SUNRISE TELECOM
INCORPORATED

SunSet™ T1

User's Manual
SS114 Version 5.06

MAN-11150-US001 Rev. A

Sunrise Telecom®...a step ahead

22 Great Oaks Blvd.
San Jose, CA 95119 USA

SunSet T1 Version 5.06
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Chapter 1
Product Overview

Congratulations, you have just purchased the industry's leading hand-held T1 test set, the SunSet™ T1. This test set puts powerful test capabilities into a single, convenient, hand-held package.

Each SunSet T1 features:

- Circuit graphics to easily keep track of complicated circuit set-ups
- Software cartridges for fast and convenient feature upgrades
- Full-size display for more efficient operation and faster data correlation
- Field upgradability to Software options not purchased with the original set
- Quad signal interface (two transmits, two receives) for accessing the complete circuit
- Automated span acceptance tests
- A rich selection of stress patterns
- 32 pages of received T1 data: binary, hex, and ASCII protocol displays
- Simplex loop current and level measurement
- Talk/listen with dialing capability, 24-channel supervision bit display, tone generation, view data bits
- Receive signal sensitivity to -36 dBdsx, transmit signal build out, and preequalization
- 5 ppm accuracy clock
- Framing: unframed, SF, ESF, SLC-96*, T1DM, AUTO
- Propagation delay measurement
- Menu-driven user interface for simple and efficient operation
- Full range of LED indicators for simplicity and speedy operation
- Full range of in-service and out-of-service measurements
- Line/path/service measurements, counts and rates

Optional Software features give you even more diagnostic power:

- On-screen pulse mask analysis
- ESF datalink loopbacks, datalink read and receive. T1.403 and Pub 54016
- SLC-96* datalink transmit and receive
- Fractional T1 testing for maintaining your newest nx56 and nx64 kbps services
- Time-saving looping repeater tests for Teltrend and Westell,

including distance to loopback to verify loopback location
- In-service CSU/NI emulation
- Menu-driven remote control capability
- Westell performance monitoring NIU and maintenance switch support
- Teltrend maintenance switch support
- VF level, frequency & noise measurement
- MF/DTMF/DP dialing, decoding and analysis
- Signaling analysis
- Basic DDS capabilities
- Teleos/Northern Telecom switched 56 testing

The SunSet T1 is designed to help anyone who maintains or works with T1 circuits. Its broad range of capabilities combined with its convenient hand-held size make it the favorite of technicians in the central office, outside plant, and corporate communications center. The set helps diagnose T1 problems quickly, whether the circuit is in-service or out-of-service. Automated testing saves time for the skilled T1 technician and also enables a broader range of people to perform T1 testing.

The SunSet is useful anywhere a T1 circuit is found. At the communications center it can verify the performance of the telco-provided circuit or troubleshoot a CSU or NI that is suspected of being faulty. In the outside plant it can be used at repeater housings, digital loop carrier remote terminals, and cable splice points to troubleshoot the T1 signal. In the central office, it can be plugged into the DSX or attached to T1 equipment such as multiplexers, channel banks, digital cross-connect systems, and switches.

This manual is designed to provide you with all the information you will need concerning your SunSet T1.

For further information, or if you encounter problems, please contact Sunrise Telecom Customer Service for 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 (24 hrs)
Fax: 1 (408) 363-8313
Internet: http://www.sunrisetelecom.com
email: support@sunrsietelecom.com

Technical Support

* SLC-96 is a registered trademark of AT&T

1.0 Unpacking the Test Set

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.

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

6) Ensure the Software cartridge is fully seated in its slot. Refer to Figure 1–1.

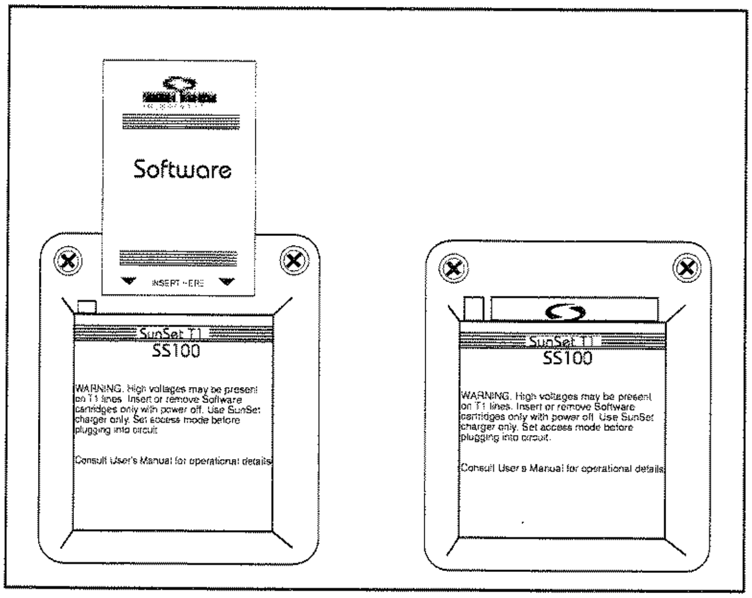


Figure 1–1 Software Cartridge Installation

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

8) If you choose to install the Instrument Stand, refer to Figure 1–2.

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

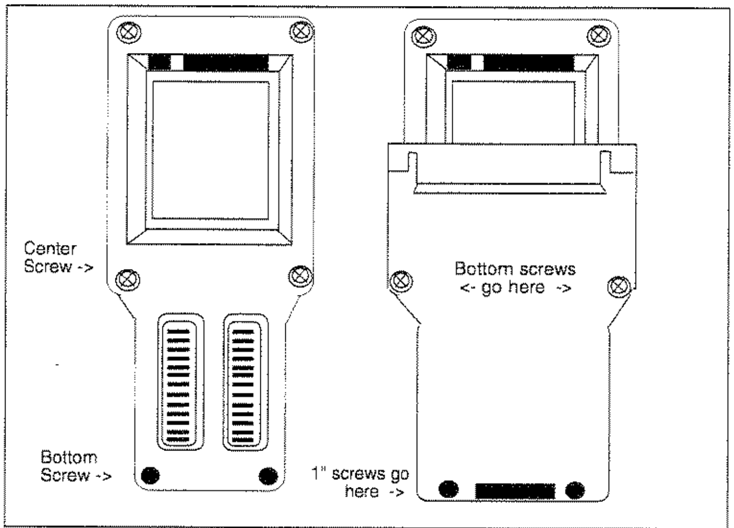


Figure 1- 2 Instrurment Stand Installation

To install the stand, use the following procedure:

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

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

c) Fit the Instrument Stand onto the back of the test set.

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

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

9) Switch the set on 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.

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

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

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

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

2.0 Check Out Procedure

1) Plug in the AC charger.

WARNING: BE SURE TO USE ONLY THE SUNSET CHARGER FOR YOUR SUNSET T1. USE ONLY THE PRINTER CHARGER FOR THE PRINTER. IMPROPER USE OF ANY CHARGER MAY DAMAGE YOUR TEST SET, THE PRINTER, OR THE CHARGERS AND WILL INVALIDATE YOUR WARRANTY.

2) Plug a single bantam to single bantam cord into the FACILITY RCV jack and the FACILITY TX jack. You will receive the signal you transmit.

3) Switch the power on. Observe the SELF TEST. Make sure it says SELF TEST COMPLETE. No errors should be listed.

4) Observe the Software configuration screen that appears immediately after the SELF TEST COMPLETE message. Verify the serial number, version number and options. Observe this screen again by turning off the power and turning it back on.

5) Study the graphic screen. The R is the test set's receiver. The T is the transmitter. FAC means that you should be plugged into the FACILITY jacks. Remember the exact way the transmitter and receiver are hooked up. Look at your LEDs - if BPV is lit, it is probably because the LINE INTERFACE is set up for BRIDGE or DSXMON instead of TERM. We will take care of this later.

6) Press the LIGHT key to turn on your backLIGHT. Adjust the screen contrast by using the contrast control on the left side of the test set.

7) Press the ESCAPE key to view the MAIN MENU. Move the cursor to the LINE INTERFACE item by pressing the appropriate arrow key. When the cursor is on LINE INTERFACE, press ENTER to set up the LINE INTERFACE. Select SINGLE (F1) for INTERFACE, TERM (F1) for MODE, ESF for FRAMING, B8ZS for CODING, Nx64 for TEST RATE (if the FT1 option is installed in your set, otherwise proceed to 8)). Notice that you are now in a fractional T1 screen. You could AUTO-configure to a received fractional T1 circuit or build up your own fractional circuit. For now, however, press ESCAPE to return to the line interface menu.

8) Cursor to the TEST RATE item and select 1.544M (F1) for TEST RATE, INTERN for REF CLOCK, and 0dB for LBO - FAC. You are done. Always set up the line interface first. Press ENTER to return to the MAIN MENU.

9) Press the GRAPHIC key and notice the changes. Press the GRAPHIC key again to return to the MAIN MENU.

10) Cursor down to the LPBK & SPAN CTRL menu and press the ENTER key. Move the cursor to CSU & NI CONTROL and press ENTER. Set TYPE to IN-BAND, CODE to NI, and MODE to LOOP-UP. Note that the operation begins the moment you press LOOP-UP (F1), so do this last if you make changes. You will get a pre-existing loop message.

11) After the set says PRE-EXISTING LOOP ONLY!...hit ENTER to continue, press the ENTER key. If you don't press the ENTER key immediately, the loop-up will be aborted.

a) After the loop-up has successfully completed, press the GRAPHIC key and notice the changes.
b) Press ESCAPE to return to the LPBK & SPAN CTRL menu.

12) If you have other choices available, cursor down and enter each of the items presented in the LPBK & SPAN CTRL menu. Observe all the functions presented to you. Press the "more" (F4) key to see any additional F-key selections available within each screen.
a) When you are finished, press ESCAPE until you have returned to the MAIN MENU.

13) Cursor down to the SEND TEST PATTERN item and ENTER it. Observe all of the stress patterns available to you. The test set will synch on any of these patterns regardless of what it is sending. Quickly cursor around the screen. The test set may lose pattern synch. The PAT LOSS light will begin to flash, indicating a "history" condition. Acknowledge this by pressing the HISTORY key. Press the RESYNCH key to regain PAT SYNC. Press the RESYNCH key whenever there should be pattern synch but the PAT SYNC light is off.
a) Cursor to the FOX pattern and press ENTER.

14) From the MAIN MENU, cursor down to BASIC MEASUREMENTS and press ENTER. NO ERRORS should display.
a) Press the ERR INJ key and observe the measurement counts. You should have one BPV and one BIT error.
b) Pull out the bantam cable and put it back in after ten seconds. Notice that the unavailable second counter continues to count for 10 seconds after you put the cable back in and then it decreases by 10. Verify that the frequency displays 1544000 +/-1. Verify that the Lpp says 0 +/- 1.0 dB.
c) Press the PAGE-DN (F2) as needed to see all the other measurements available. Press ESCAPE to return to the MAIN MENU.

15) Cursor down to OTHER MEASUREMENTS, ENTER it, and enter VIEW RECEIVED DATA (PAT SYNC turns off).
a) Press the PAUSE (F3) key.
b) Press the PAGE-DN key as necessary to observe the fox message in the ASCII column. Notice also the binary and hex protocol displays and that the data is presented by timeslot

number within consecutive frames. Verify that you can view 32 pages before the data repeats to page 1.

c) Press ESCAPE to return to the OTHER MEASUREMENTS menu.

16) Enter the PROPAGATION DELAY menu and verify that it says 0 UI.

a) Escape back to the OTHER MEASUREMENTS menu.

17) Enter the QUICK TEST - I menu.

a) Cursor up to the TICKET line.

b) Press the toggle (F3) key to get into the alphabet grid with the flashing letter A.

c) Press SELECT (F4) to select A.

d) Cursor over to B and press SELECT to choose B.

e) Cursor over to C and press SELECT.

f) Choose toggle (F3) to get out of the alphabet grid. Verify that the C is no longer flashing and that you see ABC as your TICKET.

g) Cursor down to LOOPBAK and choose NI. Observe the patterns and the times for this test. You could edit them by cursoring down. This test saves time on span acceptance tests.

h) Press ENTER to begin the test. Observe the pre-existing loopback message. Observe NO ERRORS. ESCAPE to abort the test. Observe the results. You could PAGE-DN if you had let the test finish at least one of the TEST PATs.

i) Escape to the OTHER MEASUREMENTS menu.

18) Enter and observe the BRIDGE TAP DETECT menu item.

a) Press PAGE-DN to see the test summary. Wait 30 seconds until the first pattern is finished. 0 0 30 is a perfect score.

b) ESCAPE back to the OTHER MEASUREMENTS menu.

19) If your set is configured for pulse mask analysis, enter the PULSE SHAPE ANALYSIS menu and press ENTER on START NEW ANALYSIS.

a) Observe the pulse shape. Choose T1.403 (F1) and verify that the message T1.403 PASS is displayed.

b) ESCAPE back to the MAIN MENU.

20) Enter the VF CHANNEL ACCESS menu (PAT SYNC turns off).

a) Enter VF MEASUREMENTS.

b) Use the NEXT (F1) and PREVIUS (F2) keys to set up your RCV channel and XMT channel to 01.
c) Turn up the volume on the connector panel until you hear something.
d) Blow into the microphone (located below the keypad) and verify that you hear the speaker (located on the LED panel).
e) ENABLE the 1004 TEST TONE at 0 dBm.
f) If your set has level/frequency, verify the RxFREQ/LEVEL reads 1004 Hz +/- 2 and 00.0 dBm +/- 0.3.
g) Move the cursor to Tx A/B/C/D and choose OFFHOOK (F2). Verify that the Rx bits change to all 1s.
h) Go ON-HOOK & verify Rx bits all 0s.
i) Escape to the VF CHANNEL ACCESS menu.

21) Enter the DTMF DIALING menu.
a) Press and release the SHIFT-lock key. Observe the SHIFT-lock indicator in the display.
b) Press 4083638000.
c) Press ENTER to dial the number. Verify that you hear it.

22) Enter the VIEW SUPERVISION menu (speaker turns off).
a) Verify the signaling of all channels is 1111 except for 0000 on CHNL 1. Channels 1 through 4 are on the top line.
b) Escape back to the VF CHANNEL ACCESS menu.

23) Enter and observe the DIAL/SPRVIS SETUP menu.
a) Escape back to the VF CHANNEL ACCESS menu.

24) Enter the MF/DP DIALING menu if your set is equipped with this feature.
a) Use F1 (MF) to select the dialing method.
b) Enter the numbers 123ABC and press ENTER.
c) Verify that you hear the MF dialing take place.
25) Escape back to the MAIN MENU and enter OTHER FEATURES.
a) Enter SYSTEM CONFIG.
b) Enter and escape VERSION/OPTION to see the ordering options.
c) Enter SELF TEST. If an error is listed, enter SELF TEST again and verify the error is gone. If your set lost PAT SYNC during the self test, press RESYNCH.
d) Enter ERASE NV RAM to reset the set's non volatile RAM and

erase all your programmed patterns and profiles.

e) Hit ENTER to continue.

f) Turn the set off for 5 seconds when the test is complete to reload the memory. If you ever have a problem with the set, turn it off and on, or do either of these tests.

26) Re-configure your set in the LINE INTERFACE menu as in steps 7 and 8.

a) Return to the OTHER FEATURES menu and enter SYSTEM CONFIG and SYSTEM PROFILES.

b) Press VIEW (F1). PAGE-DN to see all pages. You can store and recall up to 10 instrument configurations here. Escape back to the OTHER FEATURES menu.

27) Enter TEST PARAMETERS and ERROR INJECTION. Observe the available options.

a) Escape back to TEST PARAMETERS menu.

28) Enter OTHER PARAMETERS. If you have Software FT1, you can specify CSU or NI emulation and you can specify Westell -56 or -80 looping repeaters.

a) Escape back to the MAIN MENU.

29) If you have Software FT1, enter DATA LINK CONTROL. See all the ESF datalink functions. SLC-96 functions would be displayed if the set was SLC-96 framed.

a) Escape back to the MAIN MENU.

30) If you have Software FT1, enter CSU/NI EMULATION. A T1 circuit can pass thru the set like a CSU or NIU.

a) Press LLPBK-F and LLPBK-E. Verify loopback picture in each direction.

b) Escape back to the MAIN MENU.

31) If you have a Sunrise Telecom printer, connect the printer to its charger.

a) Turn it on and connect the printer to the SunSet using the Sunrise Telecom mini DIN 8 to RS-232C printer cable.

b) Press the PRN SCRN key to print out the current screen on the printer.

32) If you have remote control, hook it up to your PC with

ProComm plus or other VT100 emulation software.

a) Configure the Com port of your PC to 9600, 8, N, 1.

b) Plug the Null Modem Adaptor into the Sunrise Telecom DB-9 to Mini DIN 8 printer cable (SS115B).

c) Plug the Sunrise Telecom Null Modem Adaptor (SS122A) to the comm port of your PC.

d) Plug the printer cable into the test set. Type

logon

on your PC. The PC screen should display the remote control.

e) On your PC type Q and RETURN for ESCAPE and ENTER.

f) Type P to get the graphics. P, Q, and other commands are displayed at the left of the screen. The LEDs are displayed as a table of current and history conditions. The menu and graphics are just like the test set. A local user and a remote user can work on a problem together.

33) You have now finished. If you have any questions or if any of the verification steps failed, please read the User's Manual. If there is still a problem, please call Sunrise Telecom Customer Service at 1 (800) 701-5208.

Chapter 2
Test Set Description

1.0 Front View Description

See Figure 2–1 for the front view of the SunSet T1.

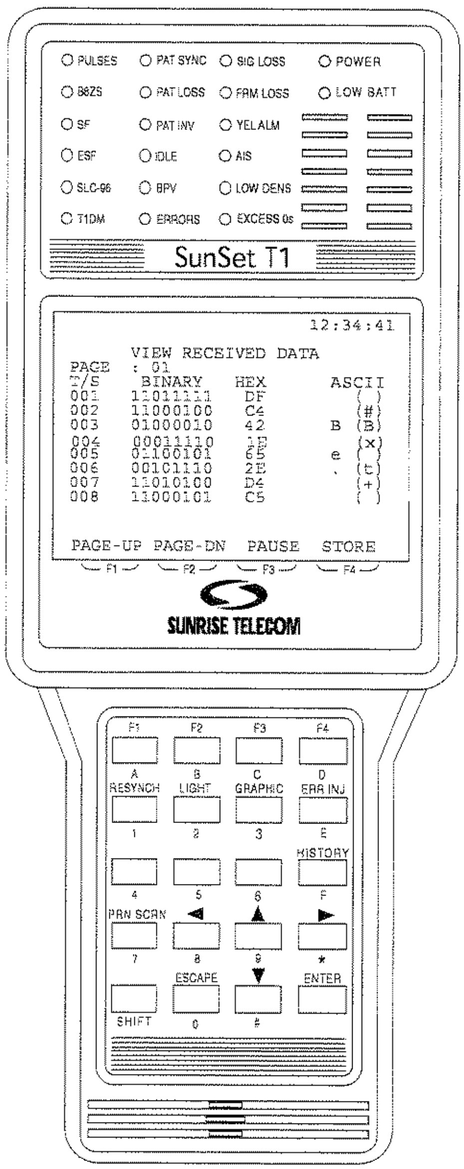


Figure 2–1 SunSet T1 Front View

1.1 Keys

See Figure 2–1 for a picture of the front panel keys and other front panel features.

There are two separate meanings for most keys. The white label above the key indicates what function will be performed if the key is pressed by itself. The orange label below the key shows what function will be performed if the SHIFT-lock key is pressed first and the SHIFT indicator is displayed in the upper left-hand corner of the screen.

Note that 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 indication will show up in the left hand corner of the screen. Then the other key should be pressed and released. The set will then perform the function indicated on the orange label.

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.

1.1.1 White Labels

F1, F2, F3, F4
These keys are used to select choices F1 through F4 shown at the bottom of the LCD display.

Using the F-Keys
When you are configuring a set-up screen, a number of options are typically available for each of the set-up items in that screen.

The available choices will appear at the bottom of the screen. The desired option may be invoked by pressing the F-key below that option. Refer to Figure 2–2.

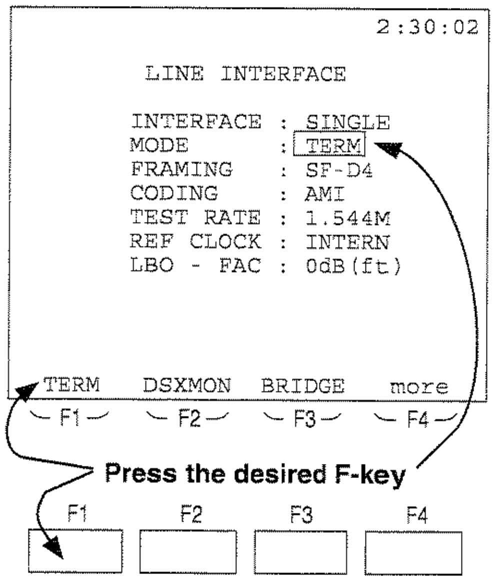


Figure 2–2 Using the F-keys

Notes:

1) In most instances, when the desired F-key is pressed, the cursor will advance to the next line of the display automatically. If you wish to change the settings of a previous line, simply press the Up Arrow key, then re-select the option using the appropriate F-key.
2) The options appearing at the bottom of the screen are associated with a particular set-up parameter within that screen. As you change the position of your cursor within the screen, the F-key options available to you will also change.

RESYNCH

The RESYNCH key allows you to manually resynchronize the test set on the line code, framing, and received test pattern. Once the test set has reported an unframed signal or live data, it will no longer look for valid framing or a test pattern. Use the RESYNCH key to force it to look for framing and pattern.

LIGHT

The backlight key is used to turn on and off the system backlight. Keeping the backlight off when it is not needed can add up to an hour to the battery life. Note that a timer can be set for the backlight in the OTHER FEATURES, SYSTEM CONFIG, GENERAL CONFIG menus. If this is done, the backLIGHT will automatically turn itself off after the specified amount of time has passed. The factory default is for a continuous backlight.

GRAPHIC

The graphic key draws a picture of the current circuit configuration. The graphic can be invoked during basic menus and basic operations such as line interface, send test pattern, basic measurements, loopback, and VF channel access.

Graphics are also included as a basic part of several advanced features such as CSU/NI emulation, looping repeater menus, and pulse mask analysis. In these advanced menus, you will not get any additional graphics if you press the GRAPHIC key.

The graphics will update according to successful operations within the test set. However, the graphic will not update if it can't be reasonably certain of just what has caused the change. For instance, after a successful NIU loopback operation, the graphic will draw an NI loopback. If you manually drop the loopback by pressing the manual loop button on the NIU, the SunSet will not undraw the NI loopback. However, if you then do a loopdown operation and it is successful, the graphic will be updated accordingly.

Using the GRAPHIC screen

Here is an explanation of the various items that are shown on the GRAPHICs screen in Figure 2–3.

FAC

This shows that the set is transmitting and receiving out of the FACILITY jacks. Be sure you are plugged in here.

T

This represents the set's Transmitter.

R

This represents the set's Receiver.

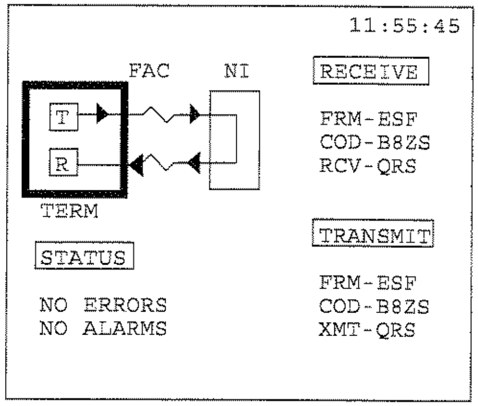


Figure 2–3 Graphic Screen, Sample

A
This is a keep alive signal (AIS)

∿
This is a 100 ohm termination.

TERM
This indicates the LINE INTERFACE MODE that has been selected

STATUS
This is where the circuit status information is displayed.

RECEIVE
This shows the characteristics of the received signal.

TRANSMIT
This shows the characteristics of the transmitted signal. AUTO means that the test set is automatically transmitting the same framing and line coding that it is receiving.

ERR INJ
The ERRor INJect key is used to inject errors on the signal being transmitted by the test set. Errors will be injected according to the current setting in OTHER FEATURES, TEST PARAMETERS, ERROR INJECTION. If the error injection MODE is RATE, then when

you press the ERR INJ key, errors will injected at the specified rate and there will be an ERINJ indicator at the top of the display.

HISTORY

The HISTORY key is used to turn off the flashing history LEDs. The LEDs flash to indicate error or alarm conditions that occurred previously but which are no longer present.

PRN SCRN

Press PRN SCRN to print the current screen. The print screen key prints any alphanumeric information on the screen. This key will not allow any screen graphics to be printed. In a graphics screen, an F-key option will typically be provided for printing.

ENTER

The ENTER key performs two functions:

1) When a menu item is highlighted and the ENTER key is pressed, the screen moves to the new screen indicated by the menu choice.
2) The ENTER key is also used in a few screens when the user is finished entering all the data in a given screen. After pressing ENTER, the test set then carries out the specified inputs. This happens in just a few cases like DTMF dialing, manual A/B(/C/D) bit entry, ESF T1.403 BOM message sending, and so on. In almost all of the high usage functions, it is not necessary to press the ENTER key to invoke the operation. If the operation you are trying to perform does not seem to be occurring, try pressing the ENTER key.

ESCAPE

The escape key has two functions:

1) It will move you back towards the main menu. Keep pressing it until you get there.
2) Secondly, if you press it while in the middle of changing settings in a few screens, it may escape from that screen to the previous menu and leave all settings in their original configuration. If some settings you just put in did not take effect, try pressing ENTER to invoke your settings. Then you can press ESCAPE if you want.

▲ **(Cursor Up)**
The Cursor up key is used to move the cursor up.

▼ **(Cursor Down)**
The Cursor Down key is used to move the cursor down.

▶ **(Cursor Right)**
The Cursor Right key is used to move the cursor right.

◀ **(Cursor Left)**
The Cursor Left key is used to move the cursor left.

1.1.2 Orange Labels

SHIFT

The SHIFT-lock (SHIFT) key is pressed to invoke any function specified by an orange label. This key is called a SHIFT-lock key because it the set will be locked in the SHIFT mode until the SHIFT -lock key is pressed again, or until the ENTER key is pressed.

Don't press the SHIFT-lock key at the same time as the other key. Instead, press and release the SHIFT-lock key first. Then press the other key.

The shift status of the test set can be observed in the upper left hand corner of the display. When the corner is blank, white-label key functions will be performed. When SHIFT is displayed, orange-label functions will be performed.

A, B, C, D, E, F
These keys are used to enter DTMF tones (A-D), special MF tones, letters in LABELs, and hexadecimal numbers.

0 through 9
These keys are used to enter user test patterns, user loopback patterns, numbers in LABELS, and telephone numbers.

*

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

#

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

1.2 LEDs

The LEDs (Light Emitting Diodes) show the status of the received signal. Often, the LEDs tell you all you need to know. An LED is lit continuously when the condition for that LED is found on the received signal.

After an alarm (red LED) or an alert (yellow LED) condition ends, the LED will begin to blink. This blinking provides a history for you in case you were absent when the condition actually occurred. Once you return and see the blinking lights, you may acknowledge the information by pressing the HISTORY key.

You can press the HISTORY key any time you want the history lights to go out. Note that the blinking will also stop automatically in some cases as you perform various operations in the test set.

PULSES
The pulses LED shows the test set is receiving a valid T1 signal.

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

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

SF, ESF, SLC-96, T1DM
These LEDs show the framing found on the received signal. Note that if the received signal is unframed, none of the LEDs will light.

If the set is configured for AUTO frame in the LINE INTERFACE menu, it will look for all types of framing when it is first plugged in and at other appropriate times (for example, when a measurement starts or when a cord is plugged in). Once the set has observed that a signal is remaining unframed, it will no longer attempt to look for valid framing on the signal. If you think that framing has returned, you can check for it by pressing the RESYNCH key.

If the set is configured for a particular type of framing in the LINE INTERFACE menu, then it will only look for that type of framing. The appropriate LED comes on if that framing is found.

If some other framing is present, the other framing LED will not come on. Whenever framing returns, the LED will come on immediately. You won't have to press the RESYNCH key.

The SLC-96 LED will always light on the A DS1 on the SLC-96 system. The B and D DS1s will always indicate SF framing. The C DS1 will show SLC-96 framing in mode II.

Although the SunSet T1 will recognize a SLC-96 signal from a SLC system, it may not recognize "SLC-96" framing from another test set. The other test set must include valid SLC-96 frame flags in its SLC-96 framing in order to be recognized as SLC-96 framing by the SunSet T1.

PAT SYNC

The pattern synchronization LED lights if the unit sees a known pattern in the received signal. The pattern is shown in the graphic screen and the basic measurement screen. The set will automatically attempt to synchronize on a pattern when it is first plugged in and at other appropriate times.

The set will synch on any known signal it receives, not just the signal it is transmitting. If it loses synch, in most cases it will look for a new pattern. If it does not find a known pattern, it will assume the signal is live and stop looking for a known pattern. If you think a pattern has returned on the received signal, but the PAT SYNC light is not lit, you can check for the pattern by pressing the RESYNCH key.

PAT LOSS

The pattern loss LED lights if pattern synchronization was first achieved but then was lost. During a BASIC MEASUREMENT, this LED will light continuously if pattern synch has been lost.

However, if you are not in a BASIC MEASUREMENT and the set loses pattern synch, the light will only be lit while the test set is looking for a new pattern. If it finds a pattern, the PAT SYNC LED will come on. If it doesn't find a pattern, it will declare a live signal and both the PAT LOSS and PAT SYNC LEDs will turn off.

PAT INV

The pattern inversion LED lights if pattern synch has been found on the received signal, but the ones and zeroes are reversed.

BPV

The BPV LED lights if a bipolar violation is observed on the received signal. B8ZS occurrences do not light the BPV LED.

ERRORS

The errors LED lights if any kind of error has been observed. This could be a framing bit error, a bit error, CRC-6 error, or other error based on these primitives.

SIG LOSS

The SIG LOSS LED lights if 175 +/- 75 consecutive zeroes are received on the active receive jack. In most cases, the active receive jack is FACILITY RCV. This corresponds to DSXMON, BRIDGE, TERM, LOOP, MON-LP, BRDG-LP, SPLT-F, SPLT-B, THRU-B, and LOOP-F line interface modes. In other line interface modes, the active receive jack is EQUIPMENT RCV.

Note that the SIG LOSS LED will light if there is AMI coding and any of the following patterns is sent: All 0s, DDS-1, DDS-2, DDS-6. Note that even though there is a loss of signal condition, the set may still be able to see the received signal. For instance, you may be able to view a signal with as few as 2 1s per frame (2 in 193). You can check for received patterns by entering OTHER MEASUREMENTS, VIEW RECEIVED DATA.

FRM LOSS

The FRM LOSS LED lights if the set has synchronized on a framing pattern and then has lost frame synchronization. Frame loss occurs when either 2-out-of-4 or 2-out-of-5 framing bits are in error. You can configure this FRM LOSS criteria in OTHER FEATURES, TEST PARAMETERS, MEASUREMENT CRITERIA, OUT OF FRAME. The light begins to blink once frame synch has been regained.

How the set looks for frame synch is determined in the LINE INTERFACE, FRAMING menu item. In ESF, SF, SLC-96, or T1DM, the set will continue to look for that kind of framing indefinitely while frame synch is lost.

In AUTO framing, two different things can happen when framing is lost. In a BASIC MEASUREMENT, the test set will continue to look for the lost frame type for the duration of the measurement. The frame type is not allowed to change during the measurement. At other times, AUTO framing will look for all frame types when frame synch is lost. If no framing is found immediately, the set will conclude the signal is unframed and will stop looking for framing. The FRM LOSS LED will stop blinking.

Note that it is possible to change received framing from one type to another without creating 2 out of 4 frame bits in error. In this case, the FRM LOSS LED will not be lit, but the ERRORS LED will be lit because of all the frame bit errors. Pressing the RESYNCH key will update all these LEDs to the exact received signal status.

YEL ALM

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

AIS

The AIS LED lights if the set detects an all ones signal without framing on its active receive jack.

LOW DENS

The LOW DENS LED lights if the set detects a signal that averages less than 12.5% ones during one second on the active receive jack.

EXCESS 0s

The EXCESS 0s LED lights if the set detects an excess number of zeroes in a row on the active receive jack. With AMI coding, this LED comes on if 16 or more zeroes are seen. In B8ZS coding, this LED comes on if 8 or more zeroes are seen.

POWER

The POWER LED lights when the test set is switched on and it has an adequate power source.

LOW BATT

The LOW BATT LED lights when the test set's power supply voltage has dropped to a low level. The test set will shut itself down approximately 10 minutes after the LOW BATT LED lights. The auto shut down helps protect the battery from a damaging total discharge.

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

1.3 Connector Panel

The SunSet T1 has a connector panel as shown in Figure 2–4.

VOLUME

The volume control determines the loudness of the speaker during talk/listen and channel monitoring. Turn the volume down if you are holding the set next to your ear and mouth and are using it like a telephone handset. Turn the volume up if you will be listening to the channel from several feet away.

EQUIPMENT

The equipment jacks are used during the dual access mode. The EQUIPMENT RCV jack is also used in the single access mode as the input for the reference clock. The reference clock allows the set to make the most accurate frequency and slip measurements.

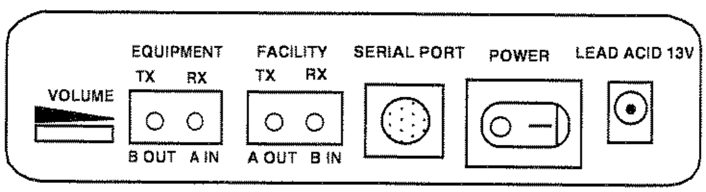


Figure 2–4 Connector Panel

FACILITY

The facility jack is used for both the single and dual access modes. This is the jack through which T1 level, pulse mask, and simplex current are measured. If the signal under test is plugged into the EQUIPMENT RCV jack, then level and simplex current measurements will be reported as N/A.

SERIAL PORT

The serial port is used for sending information to the printer. It is also used for remote control.

POWER

The power switch is used to turn the set on and off. Be sure the set is off when removing or inserting SunWare cartridges. Accidental removal or insertion while power is applied will probably not damage the cartridge, but is not recommended.

DC

The DC jack is where the SS104 Cigarette Lighter Charger, the SS113 AC Battery Charger, or the SS121 AC Battery Charger (220V) is plugged in. The set may be operated off a discharged battery if a charger is plugged in. Further, the battery will charge while it is being operated if a charger is plugged in.

1.3 Additional Controls

Contrast Control

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

Chapter 3
Menus

1.0 Introduction

The SunSet T1 operates with a menu-driven format. When the set is turned on, it will perform a self-test, show the results, show the Software configuration, and then show the GRAPHIC of the test configuration. You can exit the graphic and go into the main menu by pressing the ENTER key, the ESCAPE key, or the GRAPHIC key.

Once you are in the menus, you may refer to the graphic from most menus by pressing the GRAPHIC key. Pressing the GRAPHIC, ESCAPE, or ENTER keys returns you back to the same menu you came from.

See the following menu tree for the location of each menu item. Some menu items are only offered with certain SunWare options. These are indicated in parentheses to the right of the menu command.

MAIN MENU
LINE INTERFACE (set test parameters)
LPBK & SPAN CONTROL
    CSU & NI CONTROL
    TELTREND OFFICE REPEATER (SW1010)
    TELTREND LINE REPEATER (SW1010)
    WESTELL LINE REPEATER (SW1010)
    WESTELL OFFICE REPEATER (SW1010)
    WESTELL NIU/PM & MSS (SW120 plus SW1010)
    TELTREND MAINTENANCE SWITCH (SW120 plus SW1010)
SEND TEST PATTERN (select or define a test pattern)
BASIC MEASUREMENTS
OTHER MEASUREMENTS
    VIEW RECEIVED DATA
    PROPAGATION DELAY
    QUICK TEST - I
    QUICK TEST - II
    BRIDGE TAP DETECT
    PULSE SHAPE ANALYSIS (SW130)
        START NEW ANALYSIS
        VIEW LAST PULSE SHAPE
    DDS MEASUREMENTS (SW170)
        CONFIG & SEND PATT
        LOOP BACK ACCESS
        MEASUREMENT RESULTS

2.0 Using the LINE INTERFACE Menu

The circuit is accessed by:

1) entering the appropriate choices in the LINE INTERFACE menu,
2) connecting to the circuit as specified in the LINE INTERFACE menu.

An easy way to learn how the test set connects to the circuit is to try out each combination of INTERFACE and MODE, and use the GRAPHIC key to show you what you have done. Careful study of these diagrams will make the following explanations much easier to understand.

The choices to be made in the LINE INTERFACE menu are presented below:

2.1 INTERFACE

Here is an explanation of how the choice of interface effects the test setup. A SINGLE interface supports the DSXMON, BRIDGE, TERM, LOOP, MON-LOOP, and BRDG-LOOP MODES. A DUAL interface supports the SPLT-F, SPLT-E, SPLT-A, SPLT-B, LOOP-F, LOOP-E, THRU-A, THRU-B, MON-E, and MON-F MODES. These modes can save you time rearranging patch cords. For most applications, choose SINGLE interface.

When using the SINGLE INTERFACE, the test signals should be plugged into the FACILITY jack only. When using the DUAL INTERFACE, the test signals should be plugged into both the FACILITY and EQUIPMENT jacks.

2.1.2 MODE

Follow this procedure:

1) Be sure the cursor is at the MODE selection.
2) Press the F-key of the MODE you desire. If you do not see the desired MODE selection, press the "more" (F4) key until you see the desired MODE selection.

This is the most important part of your whole test procedure. Select the wrong MODE, and the circuit will look like it is not working.

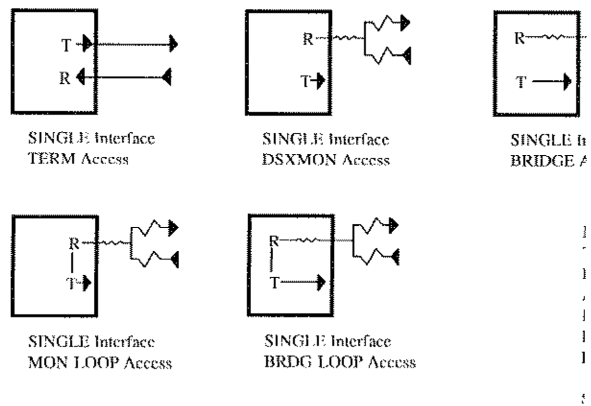


Figure 3–1 Single Interface Access Modes

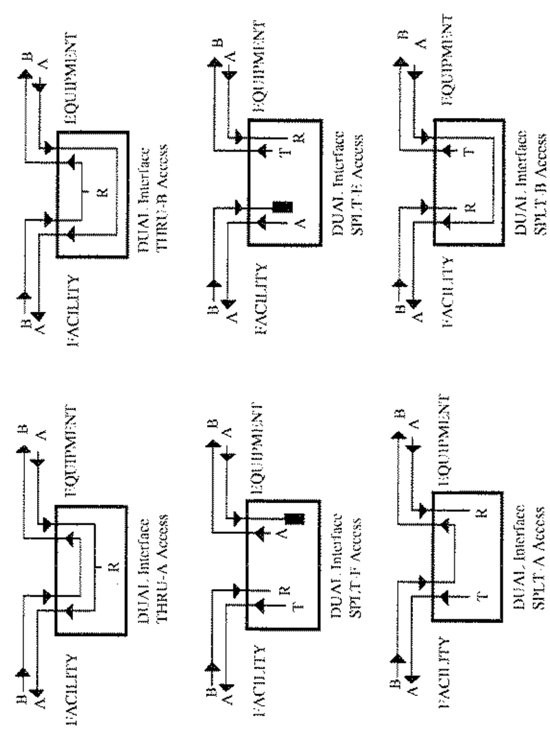


Figure 3–2 Dual Interface Access Modes

DSXMON

The DSXMON access mode is used where a monitor measurement will be made. The signal is provided from the MON jack of a DSX, DS1 plug-in card, CSU, or NI. The DSX has isolated the MON signal from the live signal with a high impedance circuit.

This mode is useful because the DSX monitor jack protects the live signal from any possible disruptions caused by the testing process. It allows the technician to observe the line while the customer is actually using it and to see if there are any problems.

If DSXMON mode is selected when a 3V signal is received, then the red BPV LED will be lit. This often happens if DSX MON is selected when the test set is plugged into an OUT jack. In this case, TERM should be selected instead of DSXMON.

In some cases, it may not be clear if the mon jack provides a bridged access or a 20 dB isolated monitor access. In this case, you should try BRIDGE first to see if this works and then try DSXMON if it doesn't.

BRIDGE

The BRIDGE monitor is similar to the DSXMON monitor. However, in BRIDGE, the test set taps into a live, in-service, terminated DS1 signal with up to 36 dB cable loss. The test set applies isolation resistors to protect the circuit from a hit.

Be sure to select BRIDGE before clipping onto the live circuit. This will put the isolation resistors in place and ensure that the test set does not place a hit on the circuit.

If you use BRIDGE mode on a DSXMON jack, there will be a total of 40 dB resistive isolation and the test set will likely report loss of signal.

In some cases, it may not be clear if the monitor jack being used provides a bridged access or a 20 dB isolation monitor access. In this case, you should try BRIDGE first to see if this works and then try DSXMON if it doesn't.

If BRIDGE mode is selected for a 3V signal from an OUT jack, then the BPV light will probably come on. Use the TERM mode instead.

TERM

The TERM mode is used when you will both send and receive a T1 signal. It requires that the circuit be disrupted for testing.

The received signal is terminated by the test set. The received signal is not obtained through a MONITOR jack. The received signal can have up to 36 dB of cable transmission loss (this is a different kind of loss than the 20 dB of resistive loss provided by a DSX MON jack).

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

LOOP

The LOOP mode is used to loop a signal at the FACILITY jacks. The test set's receiver is configured for up to 36 dB of cable loss, just like the TERM mode.

The incoming signal is regenerated and retransmitted. Note that BPVs and frame errors are eliminated in this payload loopback. This mode is useful for dropping and inserting VF channels in near-hitless fashion. The hit occurs only when the cords are plugged in. This mode is also useful for using the test set to regenerate and loop a signal back towards the direction it came from. Using MON-LOOP provides the shortest possible hit.

MON-LOOP

The MON-LOOP mode is like the LOOP mode except that the received signal is obtained from a 20 dB resistor-isolated monitor jack. To pass a signal through the set at a DSX while producing the shortest possible hit on the circuit, follow these steps in this order:

1) Set up the line interface with proper framing, mode (MON-LOOP), coding, and so on.
2) Plug into the mon jack.
3) Plug into the test set's receive jack. Verify that the proper framing and line code is received.
4) Plug into the test set's transmit jack.
5) Plug into the IN jack at the other side of the DSX or other entry point. As you plug in, the existing circuit path will be opened while the test set is being inserted. There will be a very short hit on the circuit.

WARNING: If you make any mistakes, you will bring the circuit down. Also, even a very short hit will cause a momentary loss of frame on the circuit and will disrupt service.

BRDG-LOOP

The BRDG-LOOP mode is similar to the MON-LOOP mode except that the received signal is a live, terminated source, and the test set will apply 20 dB isolation resistors to the circuit.

THRU-A and THRU-B

THRU-A and THRU-B allow the DS1 signal to pass through the test set. The set terminates and regenerates the received signal in both directions. The test receiver and drop/insert circuitry will be placed on either the side A or side B as specified. The received signals can have up to 36 dB of cable loss, like the TERM mode.

BPVs and Frame errors are eliminated during the regeneration on the specified side. BPVs and frame errors pass through unchanged on the other side.

This access mode is non-intrusive once it is established. However, while plugging and unplugging the cords, the signal will receive a momentary hit. Likewise, switching between THRU-A and THRU-B will also cause a momentary hit as the drop and insert circuitry is reconfigured.

SPLT-E and SPLT-F

The SPLT-E and SPLT-F modes are like the TERM mode, except that you can loop the non-test direction or drive it with AIS. AIS is an unframed, all ones signal. The E and F designation shows which side the test receiver and test pattern transmitter are connected. SPLT-E and SPLT-F modes are used for loopback testing.

SPLT-A and SPLT-B

The SPLT-A and SPLT-B modes allow the test set to split the specified side and place the transmitter and receiver on that side. The other side passes through the test set and is regenerated with BPVs and frame errors unchanged. The SPLT-A and SPLT-B modes are used for doing a round robin test once a loopback has been established at each end of the line.

LOOP-E and LOOP-F

The LOOP-E and LOOP-F modes are used to regenerate and loopback the received signal in the specified direction. This may be useful if a technician at a remote location requires a loopback within the SunSet T1.

Note that BPVs and frame errors are eliminated from the regenerated signal. This is called a payload loopback. The non-test direction can be driven with AIS or looped back.

MON-E and MON-F

These modes provide access to the circuit under test from monitor jacks with 20 dB resistive isolation from the line under test.

2.1.3 FRAMING

Choose the desired FRAMING using the following procedure:

1) Be sure the cursor is at the FRAMING position.
2) Press the F-key of the FRAMING type you desire. If you do not see the desired FRAMING selection, press the "more" (F4) key until you see the desired FRAMING selection.

Here is an explanation of the types of framing modes:

AUTO

AUTO framing is preferred for any monitor measurement. It is also preferred for those split measurements where the line supplies framing to the test set. AUTO framing lets the test set auto-synch on the received T1 line framing. This framing is then used on its transmitted signal. Transmit framing is unstable until the received framing is found. The received framing is displayed in the LED and screen status indicators.

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

Specific Frame Type

The user may also choose one of these specific framing types:

1) SF-D4
2) ESF
3) UNFRAME
4) SLC-96
5) T1DM

A specific framing type should be chosen when:

1) The circuit is provisioned for a specific type of framing.
2) There is no T1 signal available when the test set is plugged in.
3) The test set will be used with another test set that is already configured for auto framing.
4) The test set will control the framing that is put on the T1 line
5) The test set will provide a signal to itself without first passing through network equipment which will force a specific framing.

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

2.1.4 CODING

Choose the desired CODING using the following procedure:
1) Be sure the cursor is at the CODING selection.
2) Press the F-key of the CODING type you desire.

Here is an explanation of the of CODING types:

AUTO

AUTO coding is preferred for any monitor measurement. It is also preferred for those split measurements where the line supplies the coding to the test set. AUTO coding lets the test set auto-synch on the received T1 line code. The set uses this auto-synched coding on its transmitted signal and displays the coding in the LED and screen status indicators.

Note that it is not always possible to determine the line code of a circuit. For instance, an all 1s signal will mask the presence of B8ZS coding. The test set reports B8ZS coding if it actually sees the code, otherwise, it reports AMI coding.

AMI / B8ZS

A specific coding type should be chosen when:
1) The circuit is provisioned for a specific line code.
2) There is no T1 signal available when the test set is plugged in.
3) The test set will be used with another test set that is already configured for auto coding.
4) The test set will control the coding that is put on the T1 line.

5) The test set will provide a signal to itself without first passing through network equipment which will force a specific line coding.

2.1.5 REF CLOCK

The SunSet T1 uses the REF CLOCK for two purposes:
1) Frequency measurements. The test set measures the received signal's frequency using the clock source specified in REF CLOCK. Frequency measurements are not meaningful in the LOOP timing mode.
2) Transmitter timing. In the TERM, DSXMON, BRIDGE, SPLT-F, SPLT-E, SPLT-A, SPLT-B, MON-E, and MON-F line interface modes, the transmitter is timed off of the timing source specified in REF CLOCK.

REF CLOCK Procedure:
Choose the desired REFerence CLOCK using the following procedure:
1) Be sure the cursor is at the REF CLOCK line.
2) Press the F-key of the REF CLOCK type you desire. When in doubt, choose INTERN.

Here is an explanation of the types of REFerence CLOCK modes:

LOOP
LOOP timing should be used when:
1) The test set should use the received signal as its frequency reference.
2) The test set is configured for VF drop and insert toward a switch.
3) The test set is performing FT1 measurements towards a switch or DCS.

EX-TERM
EXternal TERMinated timing should be used when:
1) Precise frequency and frame slip measurements are required.
2) An external frequency source such as the central office clock is plugged in.
3) The frequency source is a 3V signal transmitted to the test set through up to 6000 feet of cable.

EXT-MON

EXTernal MONitor timing should be used when:

1) Precise frequency and frame slip measurements are required.
2) An external frequency source such as the central office clock is available.
3) The frequency source is obtained through a monitor jack with 20 dB isolation resistors.

INTERN

INTERNal timing should be used when:

1) an external frequency source is not available.
2) the test set will not be transmitting toward synchronized network equipment.
3) the test set will be supplying clock to the circuit to be tested such as a HiCap T1 loop, PBX, or remote terminal of a digital loop carrier.
4) the 5 ppm accuracy of the INTERNal clock is sufficient.
5) most kinds of loopback testing is performed.

2.1.6 TEST RATE

Choose the desired TEST RATE. Choose 1.544M for normal T1 and DS1 testing. Choose Nx64K for fractional T1 testing where the fractional circuit is any number of 64 kbps channels within the DS1. Choose Nx56K where the fractional circuit is any number of 56 kbps channels within the DS1. In this case, the test set will transmit a 1 in the eighth (least significant) bit of each fractional T1 channel. If you have chosen one of the fractional settings, you will see the following display, shown in Figure 3-3:

```
                                  11:41:45

              FT1 TIME SLOT

                 RECEIVE
01   02   03   04   05   06   07   08
09   10   11   12   13   14   15   16
17   18   19   20   21   22   23   24

                 TRANSMIT
01   02   03   04   05   06   07   08
09   10   11   12   13   14   15   16
17   18   19   20   21   22   23   24

 AUTO    SELECT   UN-SEL  CLR-ALL
```

Figure 3–3 Fractional T1

As shown in Figure 3–3, you have two options for selecting the desired combination of channels. You can press F1 for AUTO, and the test set will automatically configure itself for all active fractional T1 channels. The test set performs this AUTO configuration by searching for the 7F or FF idle codes on any unused channels.

If you would rather select the exact channels to be tested yourself, you may do this by pressing F2 for SELECT on each desired channel. As you select the RECEIVE timeslots, the test set will fill in the corresponding TRANSMIT side for you. If you wish to configure the TRANSMIT side differently, simply use the Down Arrow key to access these numbers and set up your selections manually. If you inadvertently select an undesired channel, simply press the UN-SEL (F4) key. Press CLR-ALL to de-select everything and start over again.

2.1.7 LB0 - FAC

Choose the desired Line Build Out in the FACility direction using the following procedure:

1) Be sure the cursor is at the LB0 - FAC selection.
2) Press the F-key of the LB0 - FAC type you desire. When in doubt, choose 0 dB(ft).

Here is an explanation of the various choices:

0 dB (ft) should be used:

1) when the set is plugged in at the front panel jack of a DSX, CSU equipment direction, NI equipment direction, channel bank, or other 3V test point, or
2) when there is 132 ft or less cabling between the test set and the DSX, or
3) under most conditions

-7.5 and -15 dB should be used:

1) when transmitting toward the T1 span from a central office or customer premises and a 7.5 dB or 15 dB attenuator is not in series with the set.
2) when the signal should be transmitted at a lower level to prevent near-end cross talk problems.
3) when the signal should be attenuated so that it arrives at the next repeater at approximately -31 dBdsx level.

133 to 533 should be used:

1) when the test set is transmitting a signal to the DSX (the test set is not at the DSX), and 2) where there is 133 feet or more cable between the test set and the DSX.

Notes:

1) 133 is used for distances of 133 to 265 ft to the DSX.
2) 266 is used for distances of 266 to 398 ft to the DSX.
3) 399 is used for distances of 399 to 532 ft to the DSX.
4) 533 is used for distances of 533 to 665 ft to the DSX.

2.1.8 LBO - EQP

Choose the desired Line Build Out in the EQuiPment direction using the following procedure:

1) Be sure the cursor is at the LBO - EQP selection.
2) Press the F-key of the LBO - EQP type you desire. When in doubt, choose 0 dB(ft).

Here is an explanation of the various types of choices:

0 dB (ft) should be used:

1) when the set is plugged in at the front panel jack of a DSX, CSU equipment direction, NI equipment direction, channel bank,

or other 3V test point, or
2) there are 132 feet or less to the DSX, or
3) under most conditions

133 to 533 should be used:
1) when the test set is transmitting a signal to the DSX (the test set is not at the DSX), and
2) where there is 133 feet or more cable between the test set and the DSX.

Notes:
1) 133 is used for distances of 133 to 265 ft to the DSX.
2) 266 is used for distances of 266 to 398 ft to the DSX.
3) 399 is used for distances of 399 to 532 ft to the DSX.
4) 533 is used for distances of 533 to 665 ft to the DSX.

2.1.9 UNTEST DIR

When using the DUAL interface, an option is provided for either terminating or looping the UNTEST DIRection. Use the following procedure:

1) Be sure the cursor is at the UNTEST DIR selection.

2) Select from TERMAIS (F1) or LOOP (F2). TERMAIS terminates the RCV signal (in the untest direction) into a 100 ohm resistor and generates a keep-alive signal for TX (in the untest direction). LOOP will loop the signal (in the untest direction) directly through the test set without regeneration.

Note: It is often useful to select the untest direction, then immediately examine the result using the GRAPHIC screen.

Once all of the LINE INTERFACE items have been selected, press the ENTER key.

2.2 Connecting the Cords

WARNING!

Plugging into a live T1 circuit may cause a loss in service for multiple customers. Be sure you are properly trained before proceeding.

WARNING!

Hazardous voltages may be present on T1 spans. When plugging in at a repeater housing, plug the cord into the set before plugging into the repeater extender or repeater housing.

WARNING!

If you want to perform a BRIDGE monitor access, do not plug into the circuit until you have selected BRIDGE in the LINE INTERFACE menu. This ensures that the isolation resistors are in place before the circuit is accessed.

Figures 3–4 through 3–7 show the various ways to plug the set into the circuit.

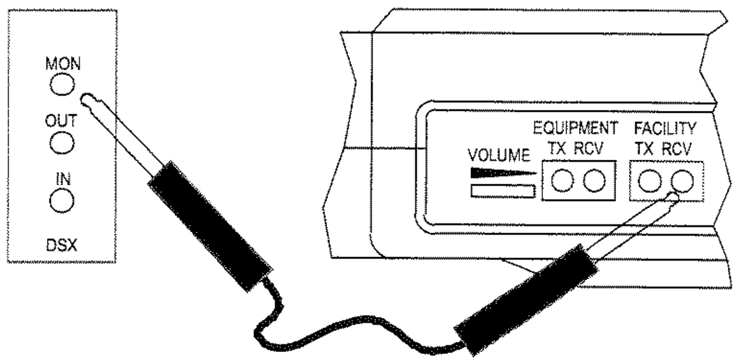


FIGURE 3-4 PLUGGING IN - DSX MON MODE

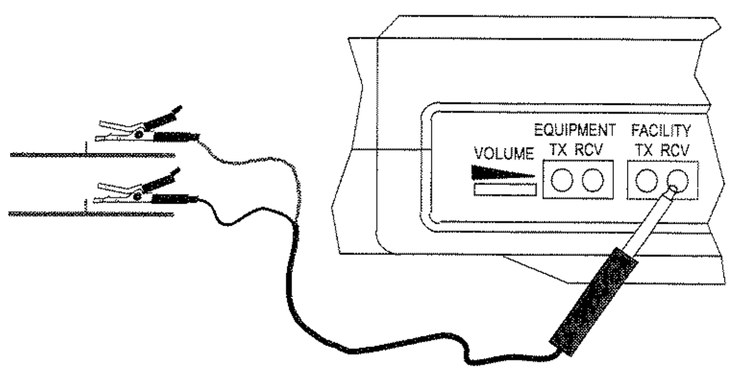


FIGURE 3-5 PLUGGING IN - BRIDGE MON MODE

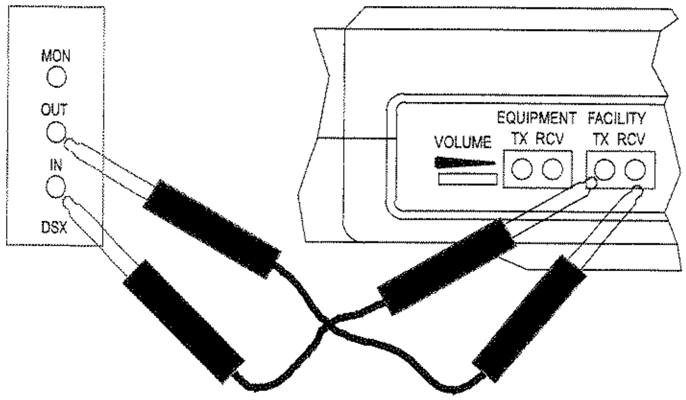


FIGURE 3-7 PLUGGING IN - TERM MODE

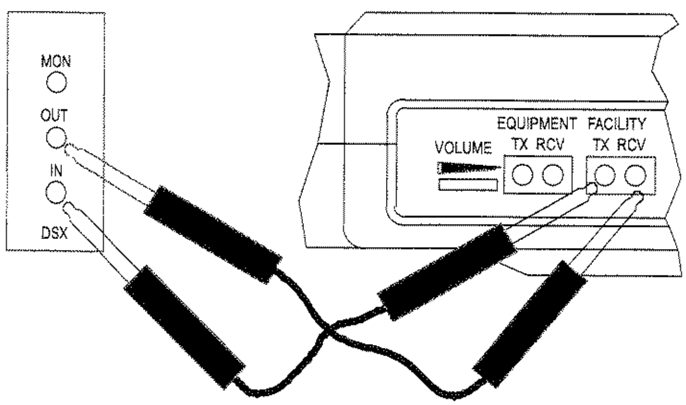
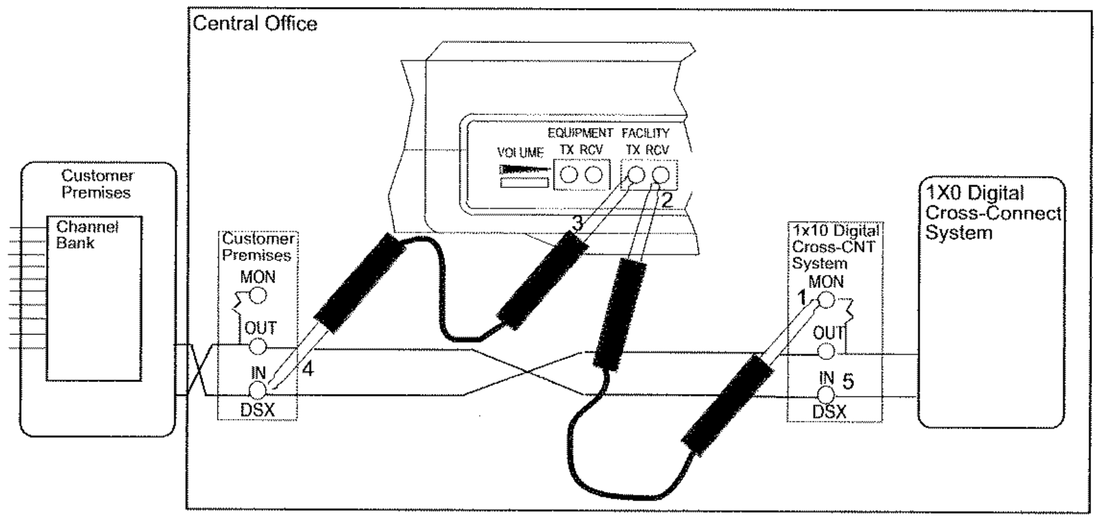


FIGURE 3-7 PLUGGING IN - LOOP MODE



Notes
1) Plug the cords in in the order shown.
2) A termination plug may be needed in the OUT jack. Otherwise, the MON signal may be unreadable. For this reason, at step #5, plug in a TERM jack into each OUT jack. Have the termination plug ready in your hand so that you can instantly insert it after the previous step.

Figure 3–8 Plugging in – MON-LP Mode

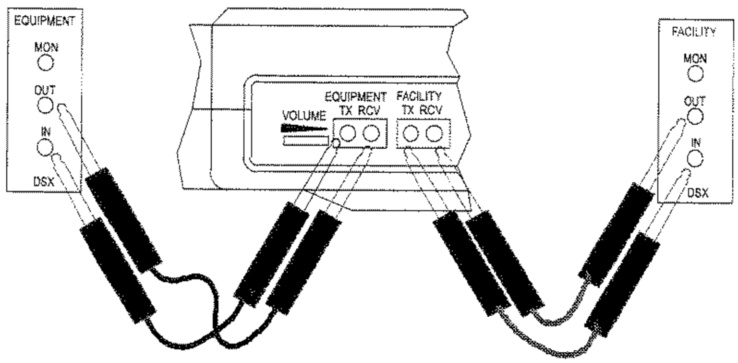


FIGURE 3-9 PLUGGING IN - ALL DUAL MODES

2.3 Using the LPBK & SPAN CONTROL menu

You may operate several different kinds of loopback devices on the T1 line using the LPBK & SPAN CONTROL menu. With the circuit looped back, you can measure transmission performance on the transmission path between your test set and the loopback device.

Figure 3–10 shows the various options that are presented in the LPBK & SPAN CONTROL menu. If you have configured your test set with Software option SW1010, then you will see the additional items for Westell and Teltrend line and office repeaters. If you have configured your test set with Software option SW120, then you will see items for the Westell performance monitoring network interface unit and the maintenance switch, and Teltrend maintenance switch.

```
                                14:07:02

         LPBK & SPAN CONTROL

         CSU & NI CONTROL
         TELTREND OFFICE RPTR
         TELTREND LINE RPTR
         WESTELL LINE RPTR
         WESTELL OFFICE RPTR
         WESTELL NIU/PM & MSS
         TELTREND MSS
```

Figure 3–10 Loopback & Span Control

Before proceeding, find out if the line to be tested has one or more loopback devices installed. If so, find out what type of loopback it is and how it is supposed to operate. Loopbacks may be operated from the TERM, SPLT-E and SPLT-F access MODEs.

2.3.1 CSU & NI CONTROL

Refer to Figure 3–11. Use the following Basic Loopback Procedure:

```
                                14:07:02

         CSU & NI CONTROL

      MODE   : LOOP-UP

      TYPE   : IN-BAND

      CODE   : NI




 LOOP-UP LOOP-DN
```

Figure 3–11 CSU and NI Control

Basic Loopback Procedure

1) From the MAIN MENU, move the cursor to LPBK & SPAN CTRL and press ENTER. Then move the cursor to CSU & NI CONTROL and press ENTER. If TYPE and CODE are correct, proceed to step 4.

2) TYPE: Move your cursor to the TYPE item. Choose either an IN-BAND (F1) or ESF-DL (F2).
   IN-BAND is the common type deployed in the network today and can be transmitted with any type of framing. ESF-DL can only be transmitted with ESF framing, and may be required for certain NIUs. When in doubt, choose IN-BAND if you are using SF framing and ESF-DL if you are using ESF framing.

3) CODE: Choose the desired CODE. The displayed CODE will depend on the TYPE of loopback selected. IN-BAND loopbacks will have a code of either CSU, NI (also known as a smart jack), 100000, or USER. ESF-DL loopbacks will have a code of either LINE, PAYLOAD, NETWORK, or USER.
   To work with USER defined loopbacks refer to the other procedures in this sub-section.
   Here is an explanation of what the in-band codes are used for. The NI code is used for an industry-standard Network Interface Unit (smart jack) if it is set to respond to in-band loopback codes. This loopback only regenerates the signal and should pass both BPVs and bit errors. The telephone company generally installs this unit at the customer premises. The CSU code is used for the customer-owned CSU. The 100000 code is used with a type of NIU (smart jack) that is standardized in some parts of the country, particularly New England.
   Here is an explanation of what the ESF-DL codes are used for. The LINE code operates a line loopback at a CSU. This loopback only regenerates the signal. Bit errors and BPVs should pass through this loopback. The PAYLOAD code operates a payload loopback at a CSU. In this loopback, the 192 channel bits are passed through but the framing bits and line code are regenerated. Only bit errors will pass through this loopback. The NETWORK CODE operates an NIU (smart jack) loopback. This loopback only regenerates the signal and should pass both BPVs and bit errors.

The codes that will be transmitted for each loopback are:

Inband:

CSU Loop Up: 10000
CSU Loop Down: 100
NI Loop Up: 11000
NI Loop Down: 11100
100000: 100000

ESF-DL (T1.403):

Line Loop Up: 11111111 01110000
Line Loop Down: 11111111 00011100
Payload Loop Up: 11111111 00101000
Payload Loop Down: 11111111 01001100
Network Loop Up: 11111111 01001000
Network Loop Down: 11111111 00100100

4) MODE. Choose LOOP-UP (F1) to loop the circuit up before testing. Choose LOOP-DN (F2) to restore the circuit to normal once your testing is complete.

5) Once the loopback operation is finished, you will see an appropriate message on the screen. You may press the GRAPHIC key for a diagram of how your circuit is now configured. Press the GRAPHIC key again to return to the previous menu.

6) Press ESCAPE as required to return to the MAIN MENU.

Select a User Loopback Code

To select your own loopback code, use the following procedure:

1) In the CSU & NI CONTROL menu, move your cursor to the CODE item and press USER (F4). Be sure to press the F4 key even if the USER item is already displayed as the selected CODE entry. This moves you into the USER LOOPBACK CODE screen.

2) Move your cursor down to the desired loopback code and press ENTER.

3) You will now see the CSU & NI CONTROL menu displayed with

your desired USER pattern displayed in the CODE position. Press ENTER to begin the loopback operation and proceed to step 4 of the basic loopback procedure.

View a User Loopback Code.

To view a preprogrammed USER loopback code, use this method:

1) In the CSU & NI CONTROL menu, move your cursor to the CODE item and select USER (F4). Be sure to press the F4 key even if the USER item is already displayed as the selected CODE entry. This moves you into the USER LOOPBACK CODE screen.

2) Move your cursor down to the desired loopback code and press VIEW (F1).

3) You will now see your selected pattern on the screen. When you are finished viewing, press ESCAPE to return to the USER LOOPBACK CODE menu.

Program a User Loopback Code

To program a USER code, use this method:

1) In the CSU & NI CONTROL menu, move your cursor to the CODE item and press USER (F4).

2) Move your cursor down to a blank position on the user pattern list. Choose CREATE (F1). The USER LOOPBACK CODE screen will now be displayed.

3) Choose toggle (F3). The letter A will begin to flash on and off within the alphabet grid. Use your cursor keys to move the flashing indicator to the desired letter. Choose SELECT (F4). You will see the desired letter appear next to the LABEL item. Continue in this fashion until you have spelled out the desired name.

4) When the name appears in the LABEL, choose toggle (F3) to move out of the alphabet grid. Press the Down Arrow key to move to the CODE item. Press the SHIFT-lock key. Enter up to 32 1s and 0s to make up the desired pattern.

5) When you are finished entering the code, press the ENTER key and you will return to the USER LOOPBACK CODE menu. Your new code will be displayed for you.

Correcting a Mistake in the Label While Entering the Label

To correct a mistake made while entering the LABEL of your USER pattern, use this procedure:

1) This procedure assumes you are starting from step 3 of the Program a User Code procedure while you are in the alphabet grid. A letter within the grid should be flashing on and off.

2) Choose toggle (F3) to move out of the alphabet grid. Press the Left Arrow key until the cursor is over the incorrect letter or number.

3) Press DELETE (F2) to remove this letter or number. Repeat this as necessary.

4) When all of the undesirable characters have been removed, move the cursor to the right of the last character. If the LABEL is now correct, press ENTER and you are done. If you need to add some more letters to the label, choose toggle (F3) to return to alphabet grid. Cursor over to the desired letter and press SELECT (F4). Repeat until the LABEL is complete. You can now press ENTER to record the new LABEL and return to the USER LOOPBACK CODE screen. Or if you prefer, you can press toggle (F3) to return to the LABEL line and continue entering or editing the pattern.

Correcting a Mistake in the Code While Entering the Code

To correct a mistake made while entering the CODE of your loopback pattern, use this procedure:

1) This procedure assumes you are starting from step 4 of the Program a User Code procedure.

2) While entering the 1s and 0s, you notice a mistaken digit. Press the ENTER key to record the pattern on the USER LOOPBACK CODE list.

3) Cursor down to the pattern you just entered and select DELETE (F2). You have now deleted the errored pattern, and you can

create a new one using the "Program a User Loopback Code" procedure.

Edit a User Loopback Code Label

Use this procedure to edit the label of a USER code that you have created:

1) From the CSU & NI CONTROL menu, move the cursor down to the CODE item and select USER (F4). Be sure to press the F4 key even if the USER item is already displayed as the selected CODE entry. This moves you into the USER LOOPBACK CODE screen.

2) Move your cursor to the code that you want to edit and select EDIT (F2).

3) Edit the code's label using the "Correcting a mistake..." procedure.

Delete a User Loopback Code

Use this procedure to delete a user loopback code that you no longer want:

1) From the CSU & NI CONTROL menu, move the cursor down to the CODE item and select USER (F4). Be sure to press the F4 key even if the USER item is already displayed as the selected CODE entry. This moves you into the USER LOOPBACK CODE screen.

2) Move your cursor to the code that you want to delete and select DELETE (F3). The code is deleted and you are finished. Press ESCAPE to return to the CSU & NI CONTROL screen.

2.3.2 TELTREND OFFICE REPEATER

Teltrend provides a variety of office repeaters which are supported in the SunSet T1. Refer to Teltrend documentation for detailed information on the operation of these various repeaters. Figure 3–12 shows the Teltrend office repeater loopback screen:

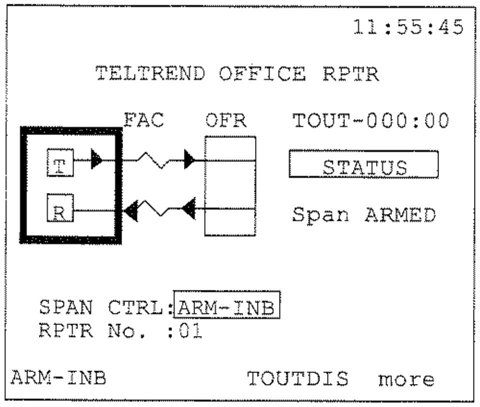


Figure 3–12 Teltrend Office Repeater

This diagram shows several aspects of the repeater control. The OFR is the office repeater. It will be shown in either a through or a loop mode.

The TIME begins counting up from 000:00 (mmm:ss) as soon as the span is armed. This gives you an indication of how much time is remaining until the repeater automatically drops its loopback, which may occur as a result of the repeater's "timout" circuitry.

The STATUS bar shows you the current looping status of the span. The SPAN CTRL line shows you what span control function is currently in process or has just been completed.

The exact F-key commands presented to you will depend on whether the test set is configured for SF-D4 framing or ESF framing. The basic difference is that in one case you will see ARM-INB (arm in-band) and in the other you will see ARM-DL (arm data link) and UNARMDL (unarm data link). In most cases, ARM-INB has the same function as ARM-DL.

Teltrend Office Repeater Procedures

To control the Teltrend office repeater using SF framing, you may perform the following functions. Some special comments are included in case you are using ESF framing:

1) Arm the office repeater and all the other repeaters on the span by pressing F1 for ARM-INB. Arming is required before the repeaters will actually loop up.

2) Disable the automatic timeout of a looped repeater on the span by pressing F3 for TOUTDIS. If you do this, be sure to loop down all the repeaters on the span when you are finished.

3) Press the more (F4 key) from the first F-key menu to show the following three F-keys:

4) Pressing F1 for LPBkQRY will query all the repeaters on the span to see which one is actually looped back.

5) Pressing F2 for POWR-DN will tell the office repeater to cut power to the span. Power will remain cut until you choose another function or escape to the main menu. Powering down the span resets all the repeaters. Be sure to arm the office repeater before selecting POWR-DN.

6) Pressing UNIVLDN (F3) will send the NIU in-band loop down code to drop one Teltrend or NIU loopback at a time.

7) Pressing the more (F4) key from the second F-key menu will provide the following three options:

8) Pressing the LOOP-UP (F1) key will loop up the office repeater. The repeater must be armed before using this function, see step 1. If the office repeater is an E-type, you can also choose office repeater number 1 through 3 in RPTR No. Do this before pressing LOOP-UP (F1).

If the E-type office repeater is configured for fractional T1 blocking, then only repeater number 1 can be looped up, and after the loop up is successful a message will be displayed showing the fractional configuration of the office repeater.

9) Pressing the LOOP-DN key will loop down the office repeater. It will not loop down the E-type office repeater when it is in NIU emulation mode.

10) Selecting the DUAL-LB (F3) key will loopback the E-type office repeater in both directions when it is configured for NIU mode and when it has already been looped up using the ARM-INB F-key.

11) Selecting more (F4) from the third F-key menu will display the following two or three options:

12) Selecting UNBLOCK (F1) will unblock the office repeater to allow NIU loop up code to pass through from the customer premises toward the DSX. This situation arises when you are testing from the customer premises and want to loop back an NIU that is on the other end of the circuit. First you have to send NIU loop up (ARM-INB) code. This arms the central office repeater but does not loop back anything. Then you can send the UNBLOCK code, which will temporarily inhibit the NIU blocking feature of the office repeater. Then you send the NIU loop up (ARM-INB) code again and the far end NIU loops up.

13) CLR-FT1 (F2) is used to temporarily reconfigure the E-type office repeater in fractional mode back to through mode. This allows you to troubleshoot the span using full 1.544 Mbps testing.

a) The first step is to send ARM-INB command (not ARM-DL) - this arms the E-type office repeater in fractional mode. It also loops back the NIU, although you will probably not see a pattern synch because the central office repeater is still blocking the unused channels.

b) The next step is to press CLR-FT1. You will now see pattern synch and no errors if the span and equipment is working properly. You can perform a variety of tests such as bridge tap and basic measurement.

c) When you are done, UNIVLDN will drop the NIU loop and return the office repeater to its fractional blocking mode.

2.3.3 TELTREND LINE REPEATER

Figure 3–13 shows the Teltrend line repeater loopback screen:

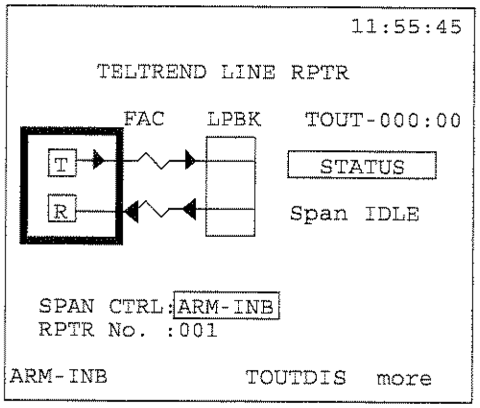


Figure 3–13 Teltrend Line Repeater

This diagram shows several aspects of the repeater control session. The LPBK is the NIU. It will be shown in either a through or a loop mode to indicate whether or not it is looped. When a repeater loops up, the LPBK will be replaced with the number of the looped repeater. The TIME counts up from 000:00 (mmm:ss) as soon as the span is armed, and gives an indication of how much time remains until the repeater will automatically drop its loopback. The STATUS bar shows you the current looping status of the span.

The SPAN CTRL line shows you :

a) what span control code will be transmitted if the ENTER key is pressed. In this case, the letters will be presented in reverse video.

b) what span control code is currently being transmitted. In this case, the letters will be blinking in normal video.

c) what span control function has just finished. In this case, the letters will be presented in reverse video.

The RPTR No. indication shows what repeater is currently being addressed.

The exact F-key commands presented to you will depend on whether the test set is configured for SF-D4 framing or ESF framing. The basic difference is that in one case you will see ARM-INB (arm in-band) and in the other you will see ARM-DL (arm data link) and UNARMDL (unarm data link). In most cases, ARM-INB has the same function as ARM-DL.

Teltrend Line Repeater Procedures

To control the Teltrend line repeater using SF-D4 framing, you may perform the following functions.

1) Arm the office repeater and all the line repeaters on the span by pressing F1 for ARM-INB. Arming is required before the repeaters will actually loop up.

2) Disable the automatic timeout of the repeaters on the span by pressing F3 for TOUTDIS. If you do this, be sure to loop down all the repeaters on the span when you are finished.

3) By pressing the more key, several new options will appear.

4) Pressing F1 for LPBkQRY will query all the repeaters on the span to see which one is actually looped back. If a repeater is found, its number will be displayed in the graphic. Otherwise, LPBK will be displayed in either the looped mode or the unlooped mode.

5) Pressing F2 for PWLPQRY will query all the repeaters on the span to see which one is looping the span simplex power. Be sure to arm the span first. You will see a special status message if the power loop query finds a repeater in power loop.

6) Pressing PWCUTTH (F3) will tell the repeater that has looped the span power to attempt to cut that power through to the other repeaters on the span.

7) Pressing the more key will yield an additional option:

8) Pressing the UNIVLDN (F1) key will cause the set to transmit universal loopdown code to loopdown any looped repeaters.

9) Pressing the more key will provide two final options.

10) Pressing the LOOP-UP key will loop up the specified line repeater. The repeater must be armed before using this function, see step 1. Also, the RPTR No. must be entered before the LOOP-UP command is selected. The display will show if the loop up was successful.

11) Pressing the LOOP-DN key will loop down any line repeater. It will not loop down the NIU.

2.3.4 WESTELL LINE & OFFICE REPEATER

Westell repeaters are looped back similarly to the Teltrend. Refer to the Teltrend sub-sections for instruction and procedures.

There are a few differences to note when using Westell repeaters. For instance, the Westell central office repeater and line repeater F-key menus also include a sequential loopback (SEQLPBK) item which allow you to quickly step through the loopbacks on a line. To use this feature, simply arm the span and then press the SEQLPBK F-key and observe which repeater loops up. You don't have to enter the repeater address. This feature is useful for tracking down misaddressed repeaters.

Also, if you want to do a span power down with the Westell office repeater, it must first be looped up.

The Westell central office repeater menus as do not have the fractional T1 blocking or NIU-mode commands of the Teltrend.

2.3.5 WESTELL PERFORMANCE MONITORING NIU, MAINTENANCE SWITCH and RAMP

Use this procedure for using the Westell Performance Monitoring NIU, Maintenance Switch, and Ramp feature:

1) Plug into the DS1 line to be tested. This will be the customers circuit if just using the PM NIU feature, or it will be the maintenance spare if you are using RAMP or the Maintenance Switch. Make sure your test set is configured for SINGLE, TERM and ESF.

2) From the main menu, enter the LPBK & SPAN CTRL menu. Then enter the WESTELL NIU/PM & MSS menu. Note: the test set will only proceed if it is able to verify a successful loopback is established.

3) Refer to Figure 3–14. Continue reading on in this section for more background information and individual procedures for each capability.

This feature set is supplied only if Software option SW120 is installed. The Westell Performance Monitoring NIU is a smart jack which constantly measures the performance of the received signals from both the network and the customer equipment. You can use your SunSet T1 to poll the smart jack to provide valuable information when troubleshooting the network.

The Westell Maintenance Switch is a 1xN protection device which is used for manually restoring service to HiCap lines upon a failure.

With the Maintenance Switch Ramp Access, you can use your SunSet T1 to non-intrusively poll the performance monitoring information from the NIU through the protection line.

All of these functions require the NIU to be looped back before you begin operations. The test set takes care of this function automatically as you enter the menu. Further, the set will automatically switch itself into the required ESF mode if you have not already done this before entering the menu.

```
                    2:30:02
WESTELL NIU/PM & MSS

RTRV/VIEW ALL PM RPT
RETRIEVE PM REPORT
RESET PM COUNTERS
RETRIEVE NIU HEADER
SET NIU TIME & DATE
MSS SWITCH CONTROL
MSS RAMP ACCESS
```

Figure 3–14 Westell NIU/PM & MSS

RTRV/VIEW ALL PM RPT

This command retrieves all the performance information from the NIU. Use the following procedure:

1) ENTER the RTRV/VIEW ALL PM RPT menu.

2) If you have performed this operation since the last time you erased the NVRAM , skip to step 3. Otherwise, press F1 (YES) to print the received data or F2 (NO) to not print the data. The set will then retrieve the data. This operation will take up to several minutes to complete. You can tell the operation is complete when the "Retrieving data ..." changes to "All PM reports retrieved." Press ENTER to return to the WESTELL NIU/PM & MSS menu. Press ENTER to reenter the RTRV/VIEW ALL PM RPT menu.

3) Refer to Figure 3-15.

```
                                  2:30:02
          RTRV/VIEW ALL PM RPT
        LAST REPORT IS AVAILABLE
        SELECT OPTION : SCRVIEW






SCRVIEW  PRINT  RMTDUMP  DELETE
```

Figure 3–15 RTRV/VIEW ALL PM RPT

4) Choose SCRVIEW (F1) if you would like to see the performance data printed on the screen. Then press PAGE-UP (F1) or PAGE-DN (F2) as desired to view all the data. If you see a STAT message that you don't understand, press STATUS (F3) to get an interpretation of the STAT code. Press ESCAPE to get out of the STATUS interpretation screen and back to the pages of performance results.

5) Press PRINT (F2) if you would like to print the status report to the printer.

6) Press RMTDUMP (F3) if you are controlling the set over the remote interface and you would like to log the data to a data file.

To do this, simply configure your remote terminal to log the data that it receives. You will have 10 seconds after pressing RMTDUMP to open your log file before the test set starts to transmit the data. You will also have 10 seconds after all the data is transmitted to close the log file before the test set starts retransmitting screen control characters.

7) Choose DELETE (F4) if you would like to delete the performance history that the test set has and you would like to poll the NIU all over again. Note that if you never print your results, when you enter this menu you will have to choose DELETE in order to delete the old results and retrieve the current results.

Here is what the data means:

PM PERIOD is the month-day-hour of the period being observed

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

DIRECT is the direction that was measured. AZ is from the central office to the customer premises and ZA is from the customer premises to the central office.

CVL is a coding violation-line (BPV).

CVP is a coding violation-path (CRC-6 or SF error).

ESL is a errored second-line.

ESP is an errored second-path.

SESL is a severely errored second-line.

SESP is a severely errored second-path.

UASL is an unavailable second-line.

UASP is an unavailable second-path.

PDVS is a pulse density violation second.

B8ZS is a second in which B8ZS was observed.

MSEC is the number of measured seconds.

STAT is the coded status message.

RETRIEVE PM REPORT

Refer to the previous procedure. This menu item allows you to retrieve the performance information from a single time period. You must specify the month, date, hour and direction of transmission that you wish to poll. Simply press the SHIFT-lock key so that the SHIFT indicator is displayed. Then type in the numbers of the day, date, and hour that you want. Then press the SHIFT-lock key again so that you can enter the desired F-keys for accumulation period and direction. When all the numbers and entries are as desired, press ENTER to retrieve and view the data.

RESET PM COUNTERS

Occasionally the data at the NIU may become corrupted. This command allows you to reset all the NIU performance registers to zero. Simply press the ENTER key when it gives you the warning message and all the counters will be reset to 0.

RETRIEVE NIU HEADER

This simple command tells you what the date and time is at the PM NIU.

SET NIU TIME & DATE

This command allows you to set the NIU time and date in year-month-day and hour-minute-second format. Note that setting the NIU time and date will cause all the registers to be reset to n/a (not available). You may wish to retrieve the available performance information before resetting the time and date.

MSS SWITCH CONTROL

This command sends the control sequence to initiate the maintenance switch. Use the following procedure:

1) Be sure you have a loopback established at the maintenance switch. Press the ERR INJ key and verify that you see your errors coming back. If you don't, ESCAPE back to the LPBK & SPAN CTRL menu. Then re-ENTER the WESTELL NIU/PM & MSS menu. This will automatically loop up the T1 Maintenance Switch card or NIU.

2) ENTER the MSS SWITCH CONTROL menu.

3) SWITCH (F1) the line if you are connected to the maintenance switch and you are ready to switch a circuit over to the spare. Or, RELEASE (F2) the line if you are connected to the customer's span and the customer is using the maintenance span.

4) If you chose RELEASE, proceed to step 5. Otherwise, choose which line to switch to the maintenance spare. Press the SHIFT-lock key to display the SHIFT indicator, then press the desired numbers, then press ENTER to begin the operation.

Once the control sequence is successful, you will get a message saying to go ahead and press the ENTER key to activate the 10 second timer at the maintenance switch. Do this. Connect the customer's span to the maintenance spare for the duration of the switch. You are now finished.

5) If you chose RELEASE in step 3, you do not need to specify which line to release - this will be taken care of automatically. Press ENTER and the control sequences will start. When the maintenance switch is ready, reposition the cables on the span, and then press ENTER to release the protection switch.

   Note that you need to have a loopback in place to perform these commands. If you go directly from a switch to a release, you will first be plugged into the control unit, and then you will be plugged into the PM NIU. The control unit will be automatically looped up when you enter the WESTELL NIU/PM & MSS menu item. However, when you plug into the PM NIU to perform the release command, then you will need to ESCAPE out of the Westell PM NIU/MSS menu and then enter back into it as described in step 1 to reestablish the loopback at the PM NIU.

   You are now finished. Consult the Westell Maintenance Switch System practices for extensive information on the operation of the switch.

MSS RAMP ACCESS

This command sends the control codes necessary to retrieve the performance information from the desired NIU. The advantage of this form of information retrieval is that the line remains in service while the information is polled. Use this procedure:

1) ENTER the MSS RAMP ACCESS menu.

2) Choose ACTIVATE (F1).

3) Choose the line that you want to read the RAMP from. Press the SHIFT-lock key to display the SHIFT indicator on the screen. Then enter the number of the line to be read. Then press ENTER.

4) When the "RAMP control has completed message" is shown, escape back to the WESTELL NIU/PM & MSS menu.

5) Press ENTER on RTRV/VIEW ALL PM REPORT. Choose F4 (DELETE). Retrieve the performance monitoring data as described in the "RTRV VIEW ALL PM RPT" procedure. View and print the data as desired.

6) When finished viewing the data, return to the MSS RAMP ACCESS menu.

7) Choose DEACTIVAT and press ENTER. When the control sequences finish, you are finished with this procedure.

2.3.6 TELTREND MAINTENANCE SWITCH

TELTREND MSS SWITCH CONTROL

Use the following procedure:

1) Verify that the settings you have specified in the LINE INTERFACE menu item are correct.

2) Upon entering the TELTREND MSS menu item, the test set will attempt to loop up the CCU (maintenance switch Common Control Unit).

3) Ensure that a successful loopback has been established at the maintenance switch by pressing the ERR INJ key. Any errors which are received should be indicated on the LED display panel.
If a successful loopback has not been established, escape to the LPBK & SPAN CTRL menu. Re-enter the TELTREND MSS menu item. This will automatically attempt to loop up the CCU or NIU.

4) Enter the TELTREND MSS CONTROL menu.

5) Select either option F1 (SWITCH) if you are connected to the maintenance switch and you are ready to switch the circuit over to the spare, or F2 (RELEASE) if you are connected to the customer's span and the customer is using the maintenance span. Using the SHIFT-lock key, enter the position of the LINE to be switched/released. Press ENTER to start the control sequences.

6) If you have chosen SWITCH, the test set will indicate that it is sending the switch code, then it will attempt to verify the switch. Once this operation has succeeded, a message will be displayed for the user to press ENTER to switch the line. After pressing ENTER, connect the customer's span to the maintenance spare for the duration of the switch. You are now finished.

7) If you have chosen RELEASE in step 5, then reposition the cables on the span. Press ENTER and wait until the control sequences have been executed. The switch has now been released.

Note the following:

1) A loopback must be in place to perform the switch/release commands. If you go directly from a switch to a release, you will first be plugged into the control unit, and then you will be plugged into the NIU.

2) The CCU will automatically loop up when the TELTREND MSS menu item is entered. However, when you plug into the NIU to perform the release command, then you will need to ESCAPE from the TELTREND MSS menu and then re-enter it (as in step 2) to re-establish a loopback at the NIU.

Consult the Teltrend Maintenance Switch System practices for more extensive information on the operation of the switch.

2.4 Using the SEND TEST PATTERN menu

Refer to Figure 3–16 Note that DDS-1, DDS-2, DDS-6, and ALL 0 should not be used as test patterns in 1.544 Mbps AMI testing. These patterns have in excess of 150 consecutive zeroes which will cause a loss of signal.

```
                                11:01:22
      SEND TEST PATTERN
QRSS  55DLY  2e23   2047
1-8   USER   2e20   511
1-16  ALL1   2e15   127
3-24  ALL0   ALT10  63
T1-5  T1-2   T1-3   T1-4
T1-5  T1-6   DDs-1  DDS-2
DDS-3 DDS-4  DDS-6  FOX
```

Figure 3–16 Test Pattern Menu

Sending a Test Pattern

Select the test pattern you wish to send by:

1) Entering SEND TEST PATTERN from the main menu.

2) Cursoring down, up, left and right as necessary until the cursor highlights your desired test pattern. The pattern will be sent as soon as the cursor highlights it. Figure 6.7A shows the available patterns.

3) Press ESCAPE to return to the main menu.

2.4.1 Standard Patterns

This section defines the various test patterns transmitted and recognized by the SunSet T1. The long patterns are written in hexadecimal, also known as "hex". You can tell if a pattern is written in hex because it will be written with pairs of numbers separated by commas. Hex is a 16-digit number system consisting of the digits 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F. The hex pattern 15 FA translates to the binary pattern 0001 0101 1111 1010, where the left-most bit is transmitted first. Here are the test patterns:

QRSS

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

55DLY

The Daly 55 Octet pattern is a special stress pattern that obeys industry standards for pulse density and maximum consecutive zeroes in both AMI and B8ZS coded circuits. Framing bits occur at octet boundaries. Note that the Daly 55 octet pattern replaced the original 55 octet pattern (see T1-6). Here is the Daly 55 octet pattern:

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

2e23

2e23 is the industry-standard $2e^{23}$-1 pseudo random bit sequence. This signal is formed from a 23-stage shift register and is not zero-constrained. This pattern contains up to 22 zeroes in a row and violates standards for consecutive zeroes in AMI-coded transmission.

2047

2047 is the industry-standard 2047 bit code used for DDS applications.

1-8

The industry-standard 1 in 8 pattern is used for stress testing AMI and B8ZS lines. The pattern is also called 1:7 in older literature. The pattern is frame aligned (f is the framing bit) as shown in its binary form:

```
f 0100 0000
```

2e20

2e20 is the industry-standard $2e^{20}$-1 pseudo random bit sequence. This signal is formed from a 20-stage shift register and is not zero-constrained. This pattern contains up to 19 zeroes in a row and violates standards for consecutive zeroes in AMI-coded transmission. This pattern is what the QRS pattern is derived from.

511
511 is the industry-standard 511-bit code used for DDS applications.

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

```
f 0100 0000 0000 0000
```

ALL 1
The industry-standard all 1s pattern is used for stress testing AMI and B8ZS lines. If the pattern is sent unframed, it will be interpreted as an AIS (Alarm Indication Signal). Here is the pattern in its binary form:

```
1111
```

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

127
127 is the industry-standard 127-bit code used for DDS applications.

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

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

ALL 0
ALL 0 is the industry-standard all zeroes pattern. This pattern is often used to make sure that clear-channel lines have been properly provisioned for B8ZS during circuit turn-up. If a portion

of the circuit is AMI, then pattern synch and/or signal will be lost. The pattern is:

```
0000
```

ALT10

ALT 10 is the industry-standard alternating ones and zeroes pattern. The pattern is frame aligned with "f" showing the location of the framing bit. The pattern is:

```
f 0101 0101
```

63

63 is the industry-standard 63-bit code used for DDS applications.

T1-1

This 72-octet pattern is used for stress testing T1 circuits and network elements. Here is the actual pattern, with "f" showing the locations of the framing bit:

```
f  01, 01, 01, 01, 80, 00, 80, 80, 80, C0, 01,
80, 01, 80, 80, 01, 80, 44, 00, 04, 44, 00, 04,
55, f  55, 55, 55, 55, AA, AA, AA, AA, 55, 55,
55, 55, AA, 55, 55, AA, AA, AA, 01, 01, FF, FF,
FF, FF, f  FF, FF, FF, 7F, FF, FF, 24, 92, 49,
11, 11, 11, 08, 42, 10, 84, 21, 04, 10, 41, 02,
04, 08, 01
```

T1-2

This 96-octet pattern is used for stress testing T1 circuits and network elements. The pattern can cause framing problems and should not be used with SF framing. Here is the actual pattern, with "f" showing the locations of the framing bit:

```
f  FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF,
FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF,
FF, f  FF, FF, FF, FF, FF, FF, FF, FF, FF, FF,
FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF,
FF, FF, f  55, 55, 55, 55, 01, 80, 01, 80, 01,
80, 01, 80, 01, 80, 01, 80, 01, 80, 01, 80, 01,
80, 01, 80, f  55, 55, 55, 55, 01, 80, 01, 80,
01, 80, 01, 80, 01, 80, 01, 80, 01, 80, 01, 80,
01, 80, 01, 80
```

T1-3

This 54-octet pattern is used for stress testing T1 circuits and network elements. The framing bit is inserted at octet boundaries. The pattern violates the 15 zeroes constraint when transmitted in a framed AMI signal. However, in unframed transmission or B8ZS transmission it meets the zeroes constraint. Here is the actual pattern:

```
80, 80, 80, 80, 80, 80, 00, 80, 80, 80, 80, 80,
80, C0, 80, 80, 80, 80, E0, 80, 80, 80, 80, AA,
AA, AA, AA, 55, 55, 55, 55, 80, 80, 80, 80, 80,
80, FF, FF, FF, FF, FF, FF, 01, 80, 01, 80, 01,
80, 01, 80, 01, 80, 01
```

T1-4

This 120-octet pattern is used for stress testing T1 circuits and network elements. Here is the actual pattern, with "f" showing the locations of the framing bit:

```
f  FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF,
FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF,
FF, f  FF, FF, FF, FF, FF, FF, FF, FF, FF, FF,
FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF,
FF, FF, f  FF, FF, FF, FF, FF, FF, FF, FF, FF,
FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF,
FF, FF, FF, f  55, 55, 55, 55, 08, 08, 08, 08,
08, 08, 08, 08, 08, 08, 08, 08, 08, 08, 08, 08,
08, 08, 08, 08, f  55, 55, 55, 55, 08, 08, 08,
08, 08, 08, 08, 08, 08, 08, 08, 08, 08, 08, 08,
08, 08, 08, 08, 08
```

T1-5

This 53-octet pattern is used for stress testing T1 circuits and network elements. The framing bit is inserted at octet boundaries. Here is the actual pattern:

```
01, 80, 01, 80, 01, 80, 01, 80, 01, 80, 01, 80,
01, 80, 01, 80, 01, 80, 01, 80, 01, 80, 01, 80,
01, 80, 01, 80, 01, 80, 80, F5, 55, F5, 80, 80,
80, 80, FF, FF, FF, FF, 80, 80, 80, 80, FF, FF,
FF, FF, FF, FF, D3
```

T1-6 (55 octet)

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

```
80, 80, 80, 80, 80 80, 00, 80, 80, 80, 80, 80,
80, C0, 80, 80, 80, 80, E0, 80, 80, 80, 80, AA,
AA, AA, AA, 55, 55, 55, 55, 80, 80, 80, 80, 80,
80, FF, FF, FF, FF, FF, FF, 01, 80, 01, 80, 01,
80, 01, 80, 01, 80, 01, 80
```

DDS pattern notes

The DDS patterns were developed specifically for DDS applications. DDS-1, DDS-2, and DDS-6 should not be used as 1.544 Mbps T1 test patterns on AMI coded lines because they have in excess of 150 consecutive zeroes which will cause a loss of signal to be recorded on a T1 line. These patterns are recommended for DDS, fractional nx56 T1 applications, and special laboratory applications.

DDS-1

```
FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF,
FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF,
FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF,
FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF,
FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF,
FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF,
FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF,
FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF,
FF, FF, FF, FF, FF, FF, FF, FF, FF, FF, FF,
FF, 00, 00, 00, 00, 00, 00, 00, 00, 00, 00,
00, 00, 00, 00, 00, 00, 00, 00, 00, 00, 00,
00, 00, 00, 00, 00, 00, 00, 00, 00, 00, 00,
00, 00, 00, 00, 00, 00, 00, 00, 00, 00, 00,
00, 00, 00, 00, 00, 00, 00, 00, 00, 00, 00,
00, 00, 00, 00, 00, 00, 00, 00, 00, 00, 00,
00, 00, 00, 00, 00, 00, 00, 00, 00, 00, 00,
00, 00, 00, 00, 00, 00, 00, 00, 00, 00, 00,
00, 00, 00, 00, 00, 00, 00, 00, 00, 00, 00,
00, 00
```

DDS-2

```
7E, 7E, 7E, 7E, 7E, 7E, 7E, 7E, 7E, 7E, 7E,
```

```
7E, 7E, 7E, 7E, 7E, 7E, 7E, 7E, 7E, 7E, 7E,
7E, 7E, 7E, 7E, 7E, 7E, 7E, 7E, 7E, 7E, 7E,
7E, 7E, 7E, 7E, 7E, 7E, 7E, 7E, 7E, 7E, 7E,
7E, 7E, 7E, 7E, 7E, 7E, 7E, 7E, 7E, 7E, 7E,
7E, 7E, 7E, 7E, 7E, 7E, 7E, 7E, 7E, 7E, 7E,
7E, 7E, 7E, 7E, 7E, 7E, 7E, 7E, 7E, 7E, 7E,
7E, 7E, 7E, 7E, 7E, 7E, 7E, 7E, 7E, 7E, 7E,
7E, 7E, 7E, 7E, 7E, 7E, 7E, 7E, 7E, 7E, 7E,
7E, 00, 00, 00, 00, 00, 00, 00, 00, 00, 00,
00, 00, 00, 00, 00, 00, 00, 00, 00, 00, 00,
00, 00, 00, 00, 00, 00, 00, 00, 00, 00, 00,
00, 00, 00, 00, 00, 00, 00, 00, 00, 00, 00,
00, 00, 00, 00, 00, 00, 00, 00, 00, 00, 00,
00, 00, 00, 00, 00, 00, 00, 00, 00, 00, 00,
00, 00, 00, 00, 00, 00, 00, 00, 00, 00, 00,
00, 00, 00, 00, 00, 00, 00, 00, 00, 00, 00,
00, 00, 00, 00, 00, 00, 00, 00, 00, 00, 00,
00, 00, 00, 00, 00, 00, 00, 00, 00, 00
```

DDS-3

```
01001100
```

DDS-4

```
00000010
```

DDS-6

```
FE, FE, FE, FE, FE, FE, FE, FF
```

FOX

The industry-standard FOX pattern is used in data communications applications. The ASCII translation of the pattern is the "Quick brown fox..." sentence. The pattern is frame aligned to ensure proper ASCII translation of the bits. It is recommended that the pattern be sent with framed signals, otherwise, ASCII translation is not possible. Here is the pattern:

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

2.4.2 User Patterns

Sending a User Pattern

1) Choose SEND TEST PATTERN from the main menu.

2) Cursor over to the USER item and press ENTER. The test set will present the list of USER patterns to you. Use the Down Arrow key to move the cursor to the desired pattern. Then, press ENTER to send the pattern. Alternatively, you may first create a new pattern to send, edit an existing pattern, or delete a pattern.

Viewing a User Test Pattern.

1) In the SEND TEST PATTERN menu, move your cursor to the USER item and press ENTER. This moves you into the USER TEST PATTERN screen.

2) Move your cursor down to the desired test pattern and press VIEW (F1).

3) You will see your selected pattern on the screen. When you are finished viewing, press ESCAPE to return to the USER TEST PATTERN menu.

Programming User-Defined Patterns

To program a user test pattern, follow this procedure:

1) In the SEND TEST PATTERN menu, move your cursor to USER and press ENTER.

2) Move your cursor down to a blank position on the user pattern list. Choose CREATE (F1).

3) Choose toggle (F3). The letter A will begin to flash on and off in the alphabet grid. Use the arrow keys to move the flashing indicator to the desired letter. Choose SELECT (F4). You will see the letter appear next to the LABEL item. Continue in this fashion until your label is spelled out.

4) Choose toggle (F3) to move out of the alphabet grid and back to the LABEL item.

Press the Down Arrow key to move to the FORMAT item. Choose BINARY (F1) or HEX (F2).

Press the Down Arrow key to move to the pattern entry area. Press the SHIFT-lock key. Enter up to 2048 binary characters or 512 hexadecimal characters to make up the desired pattern.

5) When you are finished entering the pattern, press the ENTER key to store it. Your new code will be displayed for you.

Correcting a Mistake in the Label While Entering the Label

To correct a mistake made while entering the LABEL of your USER pattern, follow this procedure:

1) This procedure assumes you are starting from step 3 of the Program a User Test Pattern procedure while you are in the alphabet grid. A letter within the grid should be flashing on and off.

2) Choose toggle (F3) to move out of the alphabet grid and back to the LABEL item. Press the Left Arrow key until the cursor is over the incorrect letter or number.

3) Press DELETE (F2) to remove the desired letter or number. Repeat this as necessary.

4) When all of the incorrect characters have been removed, move the cursor to the right of the last character. If the LABEL is now correct, press ENTER and you are done.

If you need to add some more letters to the label, choose toggle (F3) to return to alphabet grid with the flashing letter. Cursor over to the desired letter and press SELECT (F4). Repeat this until the LABEL is complete. You can now press ENTER to record the new LABEL and return to the USER TEST PATTERN screen. Or if you prefer, you can press toggle (F3) to return to the LABEL line and continue enter ing or editing the pattern.

Correcting a Mistake in the Pattern While Entering the Pattern

To correct a mistake made while entering the pattern, use this procedure:

1) This procedure assumes you are starting from step 4 of the Program a User Test Pattern procedure.

2) While entering the 1s and 0s, you notice an incorrect digit. Press the SHIFT to remove the SHIFT indicator in the screen. Cursor back to the incorrect digit and press the SHIFT key to display the SHIFT indicator.

3) Enter the correct digit. Press the SHIFT key to remove the SHIFT indicator. Cursor to the end of the line. Press the SHIFT key again to display the SHIFT indicator. Enter in the rest of the digits.

4) Press ENTER to store the pattern.

Editing a User Test Pattern Label

Use this procedure to edit the label of a test pattern that you have created:

1) From the SEND TEST PATTERN menu, move the cursor down to the USER item and press ENTER. This moves you into the USER TEST PATTERN screen.

2) Move your cursor to the code that you want to edit and select EDIT (F2).

3) Edit the code's label using the "Correcting a Mistake..." procedure.

Deleting a User Test Pattern

Use this procedure to delete a user test pattern that you no longer want:

1) From the SEND TEST PATTERN menu, move the cursor down to the USER item and press ENTER. This moves you into the USER TEST PATTERN screen.

2) Move your cursor to the test pattern that you want to delete and

select DELETE (F3). The pattern is deleted and you are finished. Press ESCAPE to return to the main menu.

2.5 Using the BASIC MEASUREMENTS menu

To perform a basic measurement use this procedure:

1) Select BASIC MEASUREMENTS from the main menu.

2) View the results on the summary screen.

3) If necessary, choose PAGE-DN (F2) to see the other measurement results available.

4) Press ESCAPE when you are finished.

Figure 3–17 shows a typical BASIC MEASUREMENTS summary screen.

```
                              17:31:55
ET- 000:00:19      RT- CONTINU
FRM-SF-D4  COD-AMI  CNFG-TERM
RCV-QRS            XMT-QRS

       RESULTS - SUMMARY
BPV - 1            RATE - 3.4e-08
BIT - 1            RATE - 3.4e-08
FBE - 0            Lpp  - -0.3 dB
CRC - N/A          FREQ - 1544000
ES  - 1            %ES  - 05.263
SES - 0            %SES - 00.000
%EFS- 19           %AS  - 100
UAS - 0            %UAS - 0

PAGE-UP PAGE-DN RESTART   more
```

Figure 3–17 Basic Measurements

Several functions are available while the measurement is in progress:

PAGE-UP, PAGE-DN
PAGE-UP and PAGE-DOWN allow you to view the pages of measurement results. Each page has a title of the form RE-

SULTS-NNNNNNN where the NNNNNNN can be SUMMARY, LOGICAL, SIGNAL, and so on.

RESTART
Pressing the RESTART (F3) key restarts the test. This function is useful if some undesired occurrence has made the current test invalid. In AUTO mode, pressing RESTART also allows the test set to resynch on the pattern, framing, and line coding.

HOLDSCR / CONTINU
HOLDSCR freezes all of the measurement counts so that they can be easily observed. The measurement still is going on, but all the counts are only updated in memory so that the user can see what the previous counts were. Once the user is finished inspecting the frozen counts, the CONTINUe (F4) key is pressed and all the counts will immediately update to their current values.

Several different items are displayed on the BASIC MEASUREMENTS screen as shown in Figure 3-17. For explanations of all of the individual measurements, refer to the measurement definitions in Section 5. In addition to the measurements, the following items are displayed on all measurement screens:

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

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

RT
The Remaining Time is the time that is left before the test is completed. The factory default condition is that the test will run continuously until you stop it. For this reason, CONTINU is normally displayed in this field. However, in the OTHER FEATURES, TEST PARAMETERS, MEASUREMENT CRITERIA, MEAS DURATION item, you may specify an exact amount of time such as 15 minutes, 1 hour, or even 999 hours. In this case, the Remaining Time will count down to zero during the measurement. When the time reaches zero, the measurement will be terminated and the results will be displayed.

FRM

The transmitted FRaMing pattern is displayed here.

COD

The transmitted line CODe is displayed here.

CNFG

The access CoNFiGuration (MODE from the LINE INTERFACE menu) is displayed here.

RCV

The ReCeiVed test pattern is displayed here. If the pattern is lost during the course of the measurement, the set will display NO SYNC. If no pattern can be found then the test set will display LIVE. LIVE means that the signal is probably live customer traffic.

XMT

The set displays the pattern it is TRANSMiTting.

2.5.1 Measurement Definitions and Usage

Available Time versus Unavailable Time

Measurement results such as AS, BPV, BPV RATE, BIT, BIT RATE, FBE, CRC, ES, %ES, SES, %SES, %EFS are dependent upon the count of "available" seconds during a test. These measurement results are counted only during "available" time. A signal is considered available until the onset of 10 consecutive Severely Errored Seconds or upon a loss of signal. When either of these two conditions occur, the remaining time is considered "unavailable".

When the service becomes unavailable, if you create an unavailable second by pulling out the receive bantam plug, you will notice that the unavailable seconds continue to be counted for 10 full seconds after you put the plug back in. Then, after the 10th second, the available seconds jump by 10 and the unavailable seconds decrease by 10. From that point on, available seconds are counted.

Note that while unavailable seconds are being counted, other measurement counts such as AS, BPV, BPV RATE, BIT, BIT RATE, FBE, CRC, ES, %ES, SES, %SES, %EFS are stopped. These counts are resumed once unavailable seconds are no longer being counted.

Note also that it may take the test set one to three seconds to gain frame synch, pattern synch, coding synch, and to stop declaring any severe errors when a signal transitions from an unavailable state to an available state. If you want to know the exact number of seconds that contained a Loss of Signal condition, see LOSS in RESULTS - SIGNAL.

RESULTS - SUMMARY Screen

The result summary screen presents the most significant measurement results. The screen contains measurement data related to specific types of impairments like bipolar violations, bit errors, framing bit errors, and CRC-6 block errors. It also reports overall service performance measures such as errored seconds and percent errored seconds.

All measurements have a count displayed on the left hand side and the corresponding rate or percent displayed on the right hand side. For instance, BPV is displayed on the left hand side of the top line, and RATE is displayed on the right hand side of the top line. BPV is the count of bipolar violations, and RATE is the bipolar violation error rate.

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

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

BPV RATE
This is the average BiPolar Violation error rate since the beginning of the
test.

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

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

Usage: The usage of this is similar to the BPV with the following differences. First, the test set is measuring a known pattern. Hence, the measurement covers transmission performance over the entire service, not just the local span or section. As a result, this is the preferred measurement for out-of-service testing and service acceptance tests. The measurement is often performed in conjunction with a loopback device at the far end.

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

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

FBE
This is a count of the number of Framing Bit Errors that have occurred since the beginning of the test. This measurement is reported as N/A when the test set is not synchronized on a known framing pattern within the received signal.

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

Lpp

Peak-to-peak LeVeL is the peak-to-peak level of negative and positive pulses being received by the test set. This measurement is only reported when the signal is plugged into the FACILITY RCV jack. LINE INTERFACE access MODEs which give a valid measurement for this signal include TERM, DSX-MON, BRIDGE, LOOP, MON-LP, BRDG-LP, SPLT-F, SPLT-B, THRU-B, and LOOP-F. Measurements are displayed in decibels (dB) variance from DSX level (3.0V).

Usage: This measurement is used to make sure the signal has the proper level. For instance, at a DSX, the level should be 0 dB at the out jack, and about -20 dB at the MON jack. At the customer premises, the received signal should be no lower than -15 dB, and the transmit signal should be about 0 dB. At a repeater, the input signals should be between -7.5 and -35 dB, and the output signals should be about 0 dB.

CRC

This is a count of the number of CRC-6 errors that have occurred since the beginning of the test. This measurement is reported as N/A when the test set is not synchronized on a received ESF signal.

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

Note that for an in-service test, both CRCs and BPVs only give information about errors on the incoming signal directions but do not give information about errors on the outgoing signals. To fully test the line with these measurements, you must take it out of service and operate a loopback at the far end.

FREQ

FREQuency is the frequency of the signal as measured against the frequency of the REF CLOCK specified in the LINE INTERFACE menu. The reference clock is assumed to be a perfectly accurate 1,544,000 Hz frequency source. This measurement is only as valid as the reference clock used. The INTERN reference clock of the set has stratum 3 accuracy. Frequency measurements are not valid for a loopback measurement. The frequency measurement is never valid when LOOP timing is selected - this is because it is meaningless to use the frequency of the received signal in order to measure the frequency of the received signal. See sections 5.4.6 and 6.7 for additional application information.

ES

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

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

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

%ES

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

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

SES

This is a count of the number of Severely Errored Seconds that have occurred since the beginning of the test. A severely errored second is a second with a 10^{-3} error rate, where error rate is measured off of bit errors, BPV errors, framing bit errors, and

CRC-6 errors. An out of frame will also generate a severely errored second. A severely errored second is not counted during an unavailable second.

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

%SES

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

Usage: This parameter is used over longer periods of time to give a uniform measure of the quality of service.

%EFS

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

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

%AS

This is the percentage of Available Seconds since the beginning of the test. An available second is any error-free, errored, or severely errored second.

Usage: This parameter can be used to distinguish between when the service is working and when it is not working. A tariff guarantee of 3 hours per year maximum service outage works out to 99.97% available seconds.

UAS

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

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

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

%UAS

This is the percentage of unavailable seconds that have occurred since the beginning of the test.

Usage: Refer to the usage of UAS. %UAS has the advantage over UAS in that it allows the comparison of measurement results over different time periods. A service guarantee of 3 hours per year maximum outage time works out to about 0.03% UAS.

RESULTS - LINE Screen

The RESULTS - LINE screen measurements are calculated from bipolar violation occurrences.

Usage: Refer to the discussion of usage under the BPV measurement in the summary screen. This will explain where BPV measurements are most useful. Also refer to the ES, SES, UAS, and AS usage notes for additional information that is relevant to the usage of the various parameters in the RESULTS - LINE screen.

You may want to use this screen if you have an unframed signal and you are performing an in-service test.

BPV

This is a count of the number of BiPolar Violations that have occurred since the beginning of the test. It is the same count referred to on the summary screen.

Usage: Refer to the discussion of usage under the BPV measurement in the summary screen.

BPV BER

This is the recent Bipolar violation Error Rate measured during the previous AVERAGING INTERVAL. The averaging interval is set in the MEASUREMENT CRITERIA screen. The factory-default averaging interval is 10 seconds. Thus BPV BER would normally be the bit error rate over the last 10 seconds. This measurement updates once every 10 seconds, or to the averaging interval that you specify in OTHER FEATURES, TEST PARAMETERS, MEASUREMENT CRITERIA, AVG INTERVAL.

Usage: Refer to the discussion of usage under the BPV BER measurement in the summary screen. Also, a measure of the current rate is useful in case you are conducting a long-term measurement. In this case, a single period of high errors can skew the average error rate quite high. It is then useful to know if the errors are still occurring, something that the BPV BER can tell you.

BPV AVBER

This is the AVerage bipolar violation Bit Error Rate since the beginning of the test.

BPV ES

BPV Errored Seconds is the count of seconds with at least one bipolar violation since the beginning of the test. BPV ESs are not counted during BPV UASs.

BPV %ES

This is the percentage of BPV ESs that has occurred since the beginning of the test. BPV %ES is not counted during BPV UASs.

BPV SES

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

BPV %SES

This is the percentage of BPV SESs that has occurred since the beginning of the test. BPV %SES are not counted during BPV UASs.

BPV AS

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

BPV %AS

This is the percentage of available BPV seconds that has occurred since the beginning of the test.

BPV UAS
This is the count of bipolar violation UnAvailable Seconds since the beginning of the test. BPV UASs are counted if there is a loss of signal. They are also counted at the onset of 10 consecutive BPV SESs. BPV UAS continue to be counted until the onset of 10 consecutive available non-SESs.

BPV %UAS
This is the percentage of BPV UASs that has occurred since the beginning of the test.

BPV DGRM
This is the number of BPV DeGRaded Minutes since the beginning of the test. A BPV DGRM is 60 consecutive non-severely errored seconds during which at least 96 BPVs occurred on a 24x64 kbps circuit.

BPV %DGRM
This is the percentage of BPV DGRMs that has occurred since the beginning of the test. BPV %DGRM s are not counted during BPV UASs and SESs.

RESULTS - SIGNAL Screen

The RESULTS - SIGNAL screen presents all those measurements that are based on the actual T1 signal itself.

Usage: You should use this screen if you are interested in the signal itself. Several of the measurements are useful in just about any application.

Signal AS
Signal Available Seconds is the number of seconds during which signal was not lost.

Usage: This measurement is not commonly used.

Signal UAS
Signal UnAvailable Seconds is the number of seconds during which signal was lost. Signal is lost during an LOS condition.

Usage: This measurement is not commonly used.

Signal LOSS
Signal Loss of Signal Seconds is a count of the number of seconds

for which signal has been lost during the test.

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

Signal LDNS

Signal Low DeNsity Seconds is a count of the number of seconds when the average ones density was less than 12.5%.

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

EXZS

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

Usage: Refer to the usage for LDNS.

AISS

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

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

Signal %AS

Signal percent Available Seconds is the percentage of seconds during which LOS did not occur since the beginning of the test.

Usage: This is a very quick way to see what percentage of the time there was a signal on the line

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

Usage: This is a very quick way to see what percentage of the time there was no signal on the line.

+LVL
Positive LeVeL is the level of positive pulses being received by the test set. This measurement is only reported when the signal being measured is plugged into the Facility Receive jack. Line Interface access MODEs which give a valid measurement for this signal include TERM, DSX-MON, BRIDGE, LOOP, MON-LP, BRDG-LP, SPLT-F, SPLT-B, THRU-B, and LOOP-F. Measurements are displayed in both Volts (V) and decibels variance from DSX level (dB).

Usage: The +LVL and -LVL measurements are useful for finding faults with the last repeater or transmitter that is generating the signal to the test set. If the value of the positive pulse is more than 1 dB different than the value of the negative pulse, you may have a problem. The level at a DSX should be about 3 volts. The level at a repeater should be between -10 dB and -35 dB.

-LVL
Negative LeVeL is the level of negative pulses being received by the test set. This measurement is only reported when the signal being measured is plugged into the Facility Receive jack. Line Interface access MODEs which give a valid measurement for this signal include TERM, DSX-MON, BRIDGE, MON-LP, BRDG-LP, SPLT-F, SPLT-B, THRU-B, and LOOP-F. Measurements are displayed in both Volts (V) and decibels variance from DSX level (dB).

Usage: The +LVL and -LVL measurements are useful for finding faults with the last repeater or transmitter that is generating the signal to the test set. If one value is different from the other by more than 1 dB, you may have a problem. The evel at a repeater should be between -10 dB and -35 dB.

Lpp

Peak-to-peak Level is the peak-to-peak level of negative and positive pulses being received by the test set. This measurement is only reported when the signal being measured is plugged into the Facility Receive jack. Line Interface access MODEs which give a valid measurement for this signal include TERM, DSX-MON, SPLT-F, SPLT-B, THRU-B, and LOOP-F. Measurements are displayed in both Volts (V) and decibels variance from DSX level (dB).

Usage: The Lpp measurement saves you the time of adding up the +LVL and -LVL values to calculate your own Lpp.

FREQ

FREQuency is the frequency of the signal as measured against the frequency of the reference REF CLOCK specified in the LINE INTERFACE menu. The reference clock is assumed to be a perfectly accurate 1,544,000 Hz frequency source. This measurement is always valid if an EXTERN REF CLOCK is selected and plugged in.

However, if INTERN REF CLOCK is selected, it is not valid for a loopback measurement. It is never valid when LOOP REF CLOCK is selected. This is because it is meaningless to use the frequency of the received signal in order to measure the frequency of the received signal.

Usage: See Sections 5.4.6 for more information.

SMPX

SiMPleX current is the simplex DC current flowing from the FACILITY TX jack to the FACILITY RX jack. Line Interface access MODEs which give a valid measurement for this signal include TERM and SPLT-F.

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

WARNING: Unplug the set immediately if the current measurement is over 150 mA, as this may damage the simplex current measuring circuit.

RESULTS - FRAME Screen

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

Usage: The RESULTS-FRAME screen is particularly useful for D4 signals where CRC-6 errors are not available. Individual measurements also have usefulness as indicated below:

FBE
This is the count of Framing Bit Errors that have occurred since the beginning of the test.

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

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

Usage: FSLIPs are useful for finding frequency synchronization problems in the network. Frequency synchronization can be the source of problems for channelized HiCap services that carry data and face a switch or 1x0 digital cross-connect system. See section 6.7 for a measurement procedure.

FBER
This is the Framing Bit Error Rate measured since the beginning of the test.

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

AFBER

This is the Framing Bit Error Rate measured during the previous AVERAGING INTERVAL. The averaging interval is set in the OTHER FEATURES, TEST PARAMETERS, MEASUREMENT CRITERIA, AVG INTERVAL menu item. The factory-default averaging interval is 10 seconds. Thus AFBER would normally be the framing bit error rate over the last 10 seconds.

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

OOFS

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

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

Once an out-of-frame condition occurs, the test set begins searching for a new framing position. The out-of-frame condition ends when framing has been reestablished. If the framing remains in the original position, then no further action takes place. If the framing moves to a new position, then a Change of Frame Alignment (COFA) is declared.

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

COFA

This is the count of Changes of Frame Alignment that have occurred since the beginning of the test. See the previous explanation for the conditions that result in the declaration of a change of frame alignment.

YELS

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

The T1 path terminating device will send a yellow alarm on its outgoing signal in response to loss of frame on its incoming signal. Thus, the yellow alarm signifies that the other side of the T1 line has failed somewhere before the end of the circuit.

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

LOFS

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

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

FRAME ES

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

FRAME %ES

This is the percentage of frame Errored Seconds that have occurred since the beginning of the test, after removing unavailable time.

FRAME SES

A frame Severely Errored Second is a second in which 4 or more frame errors have occurred, or during which at least one out-of-frame has occurred. A frame severely errored second is not counted during a frame unavailable second, after removing unavailable time.

FRAME %SES
This is the percentage of frame Severely Errored Seconds since the beginning of the test, after removing unavailable time.

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

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

FRAME UAS
A frame UnAvailable Second occurs at the onset of 3 consecutive OOFSs or 10 consecutive SESs. Frame unavailable seconds continue to be counted until the onset of 10 consecutive frame error-free seconds or frame errored seconds.

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

RESULTS - ESF CRC-6 Screen

The RESULTS - ESF CRC-6 screen shows all the results that are derived from the CRC-6 (Cyclic Redundancy Check code - 6) bits within the ESF signal. These results are only reported with an ESF signal.

Usage: Users will generally use the RESULTS-SUMMARY screen measurements instead of referring to the CRC-6 screen. However, certain lab applications make use of these results. Also, if there is a desire to see which kind of measurement primitive resulted in an errored second or other summarized measurement, this screen can give additional background information.

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

extended super frame consists of 24 frames of 193 bits each.

CER

The CER, or CRC-6 block Error Rate, is the rate at which CRC-6 block errors occurred during the previous AVERAGING INTERVAL. The averaging interval is set in the MEASUREMENT CRITERIA screen. The factory-default averaging interval is 10 seconds. Thus CER would normally be the CRC-6 block error rate over the last 10 seconds.

Note that a block error rate is not the same thing as a bit error rate. The two measures are roughly related to each other. For instance, a bit error rate of 1×10^{-6} would correspond roughly to a block error rate of 2×10^{-6}, assuming a burstiness average of 2 errors per error burst. When monitoring a live ESF signal, it will not be possible to directly measure the bit error rate, so CER is used as a substitute measurement.

AVCER

This is the AVerage CRC-6 Error Rate since the beginning of the test.

CRC-6 ES

This is a count of seconds with at least one CRC-6 since the beginning of the test. A CRC-6 errored second is not counted during a CRC-6 unavailable second.

CRC-6 %ES

This is the percentage of CRC-6 Errored Seconds since the beginning of the test.

CRC-6 SES

CRC-6 Severely Errored Seconds is a count of the seconds with at least 320 CRC-6 errors since the beginning of the test. A CRC-6 severely errored second is not counted during a CRC-6 unavailable second.

CRC-6 %SES

This is the percentage of CRC-6 Severely Errored Seconds since the beginning of the test.

CRC-6 AS

CRC-6 Available Seconds is a count of the CRC-6 error-free seconds, CRC-6 errored seconds, and CRC-6 severely errored seconds since the beginning of the test.

CRC-6 %AS
This is the percentage of CRC-6 Available Seconds since the beginning of the test.

CRC-6 UAS
This is a count of the CRC-6 UnAvailable Seconds since the beginning of the test. Also, CRC-6 unavailable seconds are counted at the onset of 10 consecutive CRC-6 severely errored seconds or immediately on LOF or LOS. CRC-6 UAS continue to be counted until the onset of 10 CRC-6 error-free or CRC-6 errored seconds.

CRC-6 %UAS
This is the percentage of CRC-6 UnAvailable Seconds since the beginning of the test.

RESULTS - LOGICAL Screen

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

Usage: most users will only refer to the bit error rate and bit error count offered on the RESULTS-SUMMARY screen. However, the bit slip measurement offered on this screen is a useful means of detecting this unusual circuit impairment.

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

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

Usage: The bit slip can be useful for finding frequency slip problems that are symptomized by a network element that periodically drops or stuffs a bit.

BER

This is the Bit Error Rate during the last AVERAGING INTERVAL. The averaging interval is set up within the MEASUREMENT PARAMETERS screen. The factory-default averaging interval is 10 seconds.

AVBER

This is the AVerage Bit Error Rate since the beginning of the test.

BIT ES

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

BIT %ES

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

BIT SES

This is a count of the bit Severely Errored Seconds that have occurred since the beginning of the test. A bit severely errored second is a second with at least 1,544 bit errors (10^{-3} error rate. Bit severely errored seconds are not counted during bit unavailable seconds.

BIT %SES

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

BIT AS

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

BIT %AS

This is the percentage of bit Available Seconds since the beginning of the test.

BIT UAS

This is a count of the bit UnAvailable Seconds since the beginning of the test. A bit unavailable second is a second during which the test pattern has lost synchronization. Bit unavailable seconds are also counted at the onset of 10 consecutive bit severely errored seconds. Bit unavailable seconds continue to be counted until the onset of 10 bit non-severely errored seconds.

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

BIT DGRM
This is a count of the bit DeGRaded Minutes that have occurred since the beginning of the test. A bit degraded minute is 60 non-severely errored seconds during which a total of at least 92 errors occurred on a 24x64 kbps circuit.

Usage: This measurement may be called out in service applications governed by ITU-T G.821 specifications.

BIT %DGRM
This is the percentage of bit DeGRaded Minutes that have occurred since the beginning of the test.

SYLS
This is a count of the number SYnchronization Lost Seconds since the beginning of the test. Note that the criteria for pattern synchronization is set in the MEASUREMENT PARAMETERS screen.

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

RESULTS - FREQUENCY Screen

The RESULTS - FREQUENCY screen shows relevant frequency and frame slip information. The screen shows a bar graph which indicates how fast the signal is slipping in relation to the LINE INTERFACE REFERENCE CLOCK. Note that the bar graph slips most rapidly at the center position and then gradually slows down as the length of the bar increases. A count of the number of clock slips is kept at the end of the bar for your reference. At 193 clock slips the graph resets itself. One clock slip occurs when the measured frequency deviates from the reference frequency by one unit interval. A unit interval is the amount of time it takes to transmit one T1 pulse.

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

MAX Hz
This is the maximum frequency measured since the beginning of the test.

CLKSLIP
This is the number of clock slips that have occurred since the beginning of the test.

MIN Hz
This is the minimum frequency measured since the beginning of the test.

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

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

FSLIP
This is the number of frame slips that has occurred since the beginning of the test.

2.6 Using the OTHER MEASUREMENTS menu

2.6.1 VIEW RECEIVED DATA

Figure 3–18 shows an example of what the VIEW RECEIVED DATA screen looks like.

```
                                   07:31:55

          VIEW RECEIVED DATA
PAGE :   01
T/S   BINARY      HEX     ASCII
001  11011111  DF (FB)      ( )
002  11000100  C4 (23)      (#)
003  01000010  42 (42)   B  (B)
004  00011110  1E (78)      (x)
005  01100101  65 (A6)   e  ( )
006  00101110  2E (74)   .  (t)
007  11010100  D4 (2B)      (+)
008  11000101  C5 (A3)      ( )

PAGE-UP  PAGE-DN  PAUSE  STORE
```

Figure 3–18 View Received Data

Basic Procedure
Follow this procedure:

1) From the main menu, ENTER the OTHER MEASUREMENTS item.

2) Enter the VIEW RECEIVED DATA item.

3) View the live presentation of T1 data.

4) Press the PAUSE key (F1) if you wish to trap the current data on the T1 line.

5) View 32 pages of data by pressing the PAGE-DN (F2) key.

6) Use the STORE (F4) key to save the screen data to memory. When this key is pressed, a message will be displayed at the bottom of the screen. A typical message would be "RCV PATTERN STORED AS RCV05". You can view, edit or delete this stored information:

a) Press ESCAPE twice to return to the main menu.
b) Enter the SEND TEST PATTERN menu.
c) Highlight the pattern "USER", then press ENTER.
d) Use the arrow keys to highlight the stored pattern of interest, then press either the VIEW (F1), EDIT (F2) or DELETE (F3) key.

Your received data pattern may also be printed. Use this procedure:
a) Press ESCAPE until you reach the main menu.
b) Enter the OTHER FEATURES menu.
c) Enter the PRINT RECORDS menu.
d) Connect your printer, switch it on, and ensure that it is configured correctly.
e) Use the arrow keys to highlight the "USER TEST PATTERN" item. Select the pattern of interest using the NEXT (F1) and PREVIUS (F2) keys. When your selection is complete, press ENTER to begin printing.

Note: for a more detailed explanation of configuring your printer and using the PRINT RECORDS menu, refer to subsequent sections.

7) When you are finished, press ESCAPE until you have returned to the main menu.

The following paragraphs explain the screen parameters:

PAGE
This entry shows what page number the display is currently showing. 32 pages of data are available.

T/S
This column shows what Time Slots are currently being viewed. The screen will display 8 time slots of data at a single time. Three consecutive pages show all 24 time slots in a frame. 10 and 2/3 frames may be viewed on the 32 pages of data.

BINARY
This column shows the binary data being received on the line. Each line represents the 8 bits of that time slot. The left-most bit is received first.
HEX

This column shows the hexadecimal representation of the 8 bits being transmitted in each time slot. Hexadecimal notation is often used to describe 8 bit channel codes. For instance, digital loop carrier idle code is usually 7F or FF. The hex number on the left side is the normal translation of the binary code. The hex number in parentheses is the hex translation of the binary code in reverse order.

ASCII

This column shows the ASCII representation of the bits being transmitted in each timeslot. Two ASCII characters are shown for each timeslot, one is created from the binary data in its normal order. The one in parentheses is created from the bits in reverse order.

2.6.2 PROPAGATION DELAY

The Propagation Delay screen shown in Figure 3.19 displays the propagation delay on a looped back signal.

```
                              11:31:05
          PROPAGATION DELAY

  RND TRIP DELAY: 28       UI
  RND TRIP TIME : 18       uS
  ONE WAY DIST  :  7       kFT

   (ASSUMING 500 ft PER U.I.)





RESTART
```

Figure 3–19 Propagation Delay

Use this procedure to measure propagation delay:

1) Be sure you have selected TERM or SPLT-F as the MODE in the LINE INTERFACE menu.

2) From the main menu, enter OTHER MEASUREMENTS, then enter PROPAGATION DELAY.

3) View the propagation delay. Refer to the following comments for an explanation.

4) When you are done, ESCAPE back to the main menu.

In the propagation delay measurement, the set measures the number of unit intervals that it takes for the signal to return. A unit interval is the amount of time it takes transmit one bit (647 nS for a T1 signal). This number is translated into an exact number of microseconds of round trip delay. It is also translated into an equivalent number of kilofeet.

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

2.6.3 QUICK TEST - I and - II

The quick test can save about a half an hour of your time each time you need to accept a new hi-cap service. If you want to use the default settings provided by the factory then you need adjust nothing. Simply press the ENTER key to begin. Check the detailed procedure that follows if you have any problems.

If you want to adjust the settings in the quick test, use the procedure shown in this section. The test set will remember the entries you made the next time you use the quick test.

Quick Test I and Quick Test II are similar; having two quick tests allows you to store two separate acceptance tests. Quick Test I has the 3 in 24 pattern and is used for AMI lines. Quick Test II has the 1 in 8 pattern and is used for B8ZS lines. You may also change the default settings and save them as System Profiles. Refer to Figure 3–20.

```
                              17:31:55

          QUICK TEST - I

   TICKET   :
   LOOPBAK  : NI
   PRINT    : NONE

      TEST PATTERN    DURATION
 1.3-24               005 min
 2.ALL1               005 min
 3.QRS                015 min
 4.QRS                015 min
 5.NONE               000 min


 YES     NONE
```

Figure 3–20 Pattern Entry

Use this procedure to adjust the default settings and run the quick test:

1) Before using the quick test, configure your line interface in the LINE INTERFACE menu to the following settings:
   - SINGLE interface
   - TERM mode
   - framing per the line specification (AUTO not allowed)
   - coding per the line specification (AUTO not allowed)
   - 1.544M test rate
   - INTERN ref clock
   - buildout as appropriate for your test access point

2) Plug your cords into the FACILITY TX and RCV jacks on the test set and also into the IN and OUT jacks on your DSX.

3) From the main menu, enter OTHER MEASUREMENTS, then enter QUICK TEST - I.

4) At the LOOPBAK item choose CSU (F1), NI (F2), or NONE (F3) as appropriate. The test set will attempt to automatically loop back the far end based on your setting.

5) At the PRINT item choose YES (F1) or NONE (F2) as appropriate.

6) Cursor down to the first pattern. Observe all of the F-key options for different patterns that you can send. Change the pattern if necessary.

7) Press the Down Arrow to access the DURATION for the first pattern. If necessary, change the time. First press the SHIFT-lock key so that the SHIFT indicator is shown in the upper left-hand corner of the screen. Then enter in any number between 001 and 999. The cursor will automatically advance to the next line. Do not press the ENTER key.

8) Repeat 6 and 7 as necessary.

9) If you don't need to store your new Quick Test configuration for future use, then proceed to step 10. Otherwise, refer to Figure 3–21.

```
                                    17:31:55

           QUICK TEST - I

   TICKET   : █
   LOOPBAK  : NI
   PRINT    : NONE



             A B C D E F G
             H I J K L M N
             O P Q R S T U
             V W X Y Z - /

 INSERT  DELETE  toggle  SELECT
```

Figure 3–21 Ticket Entry

a) Position the cursor on the TICKET line. Choose toggle (F3) to enter the alphabet grid. The letter A will flash. Cursor over to your letter of choice and choose SELECT (F4). Repeat this step until you have selected all of the letters in your ticket name. You may enter a maximum of ten characters and/or numbers. When you are finished, press toggle (F3) to get out of the alphabet grid.

If you made a mistake while entering the letters for your ticket, simply cursor over to the incorrect letter. Then press the

DELETE key (F2) to get rid of the letter. You can only use the DELETE key when you are out of the alphabet grid. When you have finished deleting letters, move the cursor back to the end of the TICKET name, press toggle (F3) to get back into the alphabet grid, and enter any additional letters. Press toggle (F3) to get back out of the alphabet grid and back to the TICKET name.

10) When you have configured the QuickTest to your liking, press ENTER to begin your testing.

11) When the QuickTest is finished, you will see summary results. You can see if the loopback operations were successful. Press the page down key to view the test results from each pattern that was transmitted. Press the ESCAPE key when you are finished.

2.6.4 BRIDGE TAP DETECT

The bridge tap detect test sends 21 different patterns down a span that you have previously looped up. Each pattern is transmitted for 30 seconds.

To run this test, use the following procedure:

1) Be sure that you have a loopback in place on the circuit to be tested and that the test set has been properly configured in the LINE INTERFACE menu.

2) Enter OTHER MEASUREMENTS from the main menu, then enter BRIDGE TAP DETECT. The testing will begin immediately.

3) You can observe the test in progress by looking at the RESULTS - LOGICAL screen.

You can PAGE-DN (F2) and see the summary results. There are 21 patterns in all. Each pattern name is listed for you as it is sent. IN PROG means that the 30 second measurement for that test pattern is still in progress. A score of 0 0 30 is perfect.

4) When the test is finished, press ESCAPE as needed to return to the main menu.

Note that only a few of the results are stored in the summary listing. The information that is listed includes the pattern number (1 to 21), the pattern name, the number of bit errors detected, the number of errored seconds detected, and the number of available seconds detected.

For perfect performance, there will be 0 errors, 0 errored seconds, and 30 available seconds. If there is a loss of signal or other unavailable service condition, then there will be less than 30 available seconds. Note that an errored second will only be triggered if there are one or more errors during an available second. Per the new ANSI and Bellcore standards, an errored second is not counted during an unavailable second.

Here are the patterns that are transmitted during the test:

#	Name	Pattern
1	All 1s	11111...
2	1-in-2	010101...
3	1-in-4	0100...
4	1-in-6	010000...
5	1-in-7	0100000...
6	1-in-8	01000000...
7	2-in-10	1100000000...
8	2-in-11	11000000000...
9	2-in-12	110000000000...
10	2-in-13	1100000000000...
11	2-in-14	11000000000000...
12	2-in-15	110000000000000...
13	2-in-16	1100000000000000...
14	3-in-18	110100000000000000...
15	3-in-19	1100100000000000000...
16	3-in-20	11000100000000000000...
17	3-in-21	010001000000000000001...
18	3-in-22	0100010000000000000010...
19	3-in-23	01000100000000000000100...
20	3-in-24	010001000000000000000100...
21	QRS	

2.6.5 PULSE SHAPE ANALYSIS (option SW130)

If you have software option SW130, Pulse Mask Analysis, you can measure the quality of the T1 pulse. Refer to Figure 3–22.

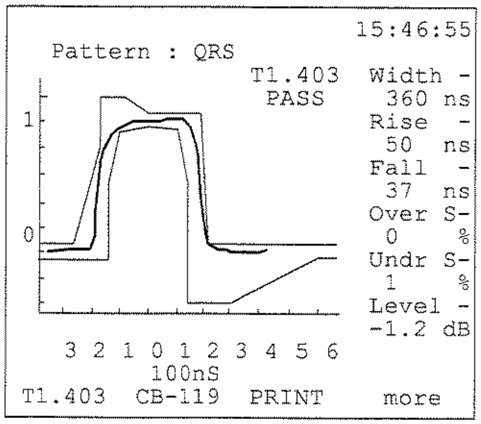


Figure 3–22 Pulse Shape Analysis

Use this procedure for performing a pulse shape analysis:

1) From the main menu, enter OTHER MEASUREMENTS, then enter PULSE SHAPE ANALYSIS.

2) Enter START NEW ANALYSIS, or enter VIEW LAST PULSE SHAPE is you wish to see the previous results.

3) After a few seconds the pulse shape will be displayed. The key pulse statistics will be displayed on the right-hand margin.

4) If you like, choose one of the industry standard masks for a pass/fail report. Choose T1.403 (F1), CB-119 (F2), or press the more (F4) key and choose Pub 62411 (F1) or T1.102 (F2). After you make a choice, you will see a message like "T1.403 PASS" displayed.

5) If you like, you can also PRINT (F3) the mask.

6) When you are finished, press ESCAPE as necessary to return to the main menu.

2.6.6 DDS MEASUREMENTS (option SW170)

The software SW170 option enables the SunSet T1 to perform basic DDS loopbacks and measurements. You configure the test set for T1 timeslot, test rate, and test pattern. Interleaved and latching loopbacks of various types are supported. Bit error and bit error rate measurements are provided. You may also send special network control codes.

CONFIG & SEND PATTERN

1) From the main menu, enter OTHER MEASUREMENTS, DDS MEASUREMENTS, CONFIG & SEND PATT.

2) Select the Time Slot on which you wish to Transmit and Receive the DDS control codes by using the NEXT (F1) and PREVIUS (F2) keys.

3) Cursor down the TEST RATE item and specify the rate at which testing is to occur. The available choices are: 2400, 4800, 9600, 19.2K, 56K and 64 Kbps.

4) Select the TEST PATTern which you wish to send. If you wish to transmit your own USER-defined test pattern, do the following, otherwise proceed to step 5:

a) At the TEST PATT line, select USER from the F-key options.

b) Press the Down Arrow key to access the USER PATT line. Using the SHIFT-lock key, define the 8-bit test pattern you wish to transmit. The pattern specified in the USER PATT line is active only if USER appears on the SEND PATT line above it.

5) Press ENTER to return to the DDS MEASUREMENTS menu.

LOOP BACK ACCESS

6) Enter the LOOP BACK ACCESS item. Refer to Figure 3–23.

7) Do not select the MODE of operation until your other screen settings are correct.

8) Select the TYPE of loopback: LATCH (F1) or NON-LATch (F2).

9) Select the loop back CODE to be transmitted: CSU, DSU,

OCU, USER, or DS0-DP.

If you have selected USER to define your own loop back code, press the down arrow key to specify your USER loop back code. Enter this 8-bit loop back code by first pressing the SHIFT-lock key, then entering the 0/1 values directly from the keypad. Press the SHIFT-lock key again when you are finished. The USER pattern which you have just entered will have no effect unless "USER" was specified for the CODE.

10) Cursor up to the MODE item. Select either LOOP-UP (F1) or LOOP-DN (F2). The looping will begin, then a loopback status message will be displayed. Press ENTER to proceed.

```
                                        12:44:56
            LOOP BACK ACCESS

            MODE   : LOOP-UP
            TYPE   : LATCH
            CODE   : CSU
            USER   : 11111111




LOOP-UP   LOOP-DN
```

Figure 3–23 Loop Back Access

MEASUREMENT RESULTS

11) Enter MEASUREMENT RESULTS and refer to Figure 3–24.

```
                                    14:07:02

ELAP TIME- 000:00:22
FRME- ESF              CODE- B8ZS
RATE- 2400             PATT- 511


              RESULTS

BIT  :  0002           BER  : 02e-06




RESTART
```

Figure 3–24 DDS Measurement Results

12) The measurement results are cumulative. All results relate to the total elapsed time of the test (ELAP TIME). Use the RESTART (F1) key to restart the measurements, if necessary. Here are the measurement definitions:

ELAP TIME
The total amount of time which has elapsed since the beginning of the measurement process (hhh:mm:ss).

FRME
The type of framing which you are transmitting.

CODE
The type of line coding which you are transmitting.

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

PATT
The test pattern which is being transmitted, as specified in the CONFIG & SEND PATT menu.

BIT
The total number of bit errors since the beginning of the test.

BER
The bit error rate since the beginning of the test.

UAS
The total number of UnAvailable Seconds since the beginning of the test.

%UAS
The percentage of UnAvailable Seconds since the beginning of the test.

13) When you are finished testing, press ESCAPE to return to the DDS MEASUREMENTS menu.

SEND/RCV CTRL CODES

14) Enter the SEND/RCV CTRL CODES menu. Here you may transmit DDS control codes to the far end. Select from: ABNORML (F1), MUX-OOS (F2), or IDLE (F3). Alternatively, you may also transmit your own code by entering it directly from the keypad using the SHIFT-lock key.
In DDS applications, the first bit being transmitted, will always be "1" and cannot be modified. This bit is displayed in brackets.
The RECEIVE portion of the screen displays the DDS control codes coming from the far end. The test set will display any control code bits it receives. If the bits correspond to a valid DDS message, then the message will also be displayed. Refer to Figure 3–25.

```
                              12:44:56
  SEND/RCV CONTROL CODE

  SEND MESG : (1) 0011010


  RECEIVE
  CODE : 10011010
  MESG : MUX-OOS




ABNORML  MUX-OOS  IDLE
```

Figure 3–25 Control Codes

15) View the DDS control code (and message) which you are currently sending and receiving.

16) When you are finished, press ESCAPE until you have returned to the main menu.

WARNING:
Careful attention should be given to the line interface mode chosen for DDS testing. See Section 6 for detailed explanation of these modes. Full duplex drop and insert hitless to the other 23 channels is not available. Loopback tests should generally be performed while the T1 line is out-of-service or while the other 23 channels are not active. DDS transmit/receive testing is usually disruptive to the other 23 channels.

2.6.7 SWITCHED 56 TESTING (option SW144)

From the main menu, enter OTHER MEASUREMENTS then enter SWITCHED 56 TESTING. The menu shown in Figure 3–26 will be displayed.

```
                                  14:07:02
              SWITCHED 56 TESTING

              TEST CONFIGURATION
              SW56 CALL SET UP
              MEASUREMENT RESULTS
              TELEOS CALL MONITOR
```

Figure 3–26 Switched 56 Testing

To perform your switched 56 testing, use this procedure:

1) From the main menu, enter LINE INTERFACE and configure the screen settings for:
INTERFACE: SINGLE
MODE: TERM
FRAMING: as appropriate
CODING: as appropriate
REF CLOCK: INTERN
TEST RATE: 1.544M
LBO - FAC: 0 dB(ft) (or, as required)

a) Press ENTER when your settings are correct.

2) Connect your test set to the circuit. Enter OTHER MEASUREMENTS, then enter SWITCHED 56 TESTING.

Test Configuration

3) Select the TEST CONFIGURATION item. Refer to Figure 3–27.
Using the F-keys choose the receive and transmit channels using the NEXT (F1) and PREVIUS (F2) keys. Moving the cursor down to the TEST PATTERN item and pressing the "more" (F4) key gives you a choice of up to 12 patterns.

```
                                    14:07:02

        TEST CONFIGURATION

       RCV CHANNEL    : 01
       XMT CHANNEL    : 01
       TEST PATTERN   : 2047
       USER PATTERN   : 11111111
       ON-HOOK ABCD   : 0 0 0 0
       OFF-HOOK ABCD  : 1 1 1 1




  NEXT    PREVIUS   SEND
```

Figure 3–27 SW56 Test Configuration

If you would like to use your own test pattern select USER for the test pattern, then move the cursor down to the USER PATTERN item. Press the SHIFT-lock key to display the SHIFT indicator in the upper left-hand corner of the screen. Next, press the 1 and 0 keys as appropriate. If you make a mistake, press the SHIFT-lock key to turn off the indicator, cursor back to the digit to be changed, press the SHIFT-lock key, then press the correct number. When your digits are correct, press the SHIFT-lock key until the SHIFT indicator is not present. The ON-HOOK and OFF-HOOK ABCD bits may now be entered directly from the keypad.

When your settings are correct, press ENTER.

```
                                    14:07:02
        SW56 CALL SET UP

      METHOD     : DP

      NUMBER     :


      Rx A/B/C/D  - 0 0
      Tx A/B/C/D  : 0 0 0 0


      Pause(,) = F

  MF      DTMF      DP
```

Figure 3–28 SW56 Call Set Up

SW56 CALL SET UP

4) Refer to Figure 3–28. Select the METHOD of dialing: MF (F1), DTMF (F2) or DP (F3).

Enter the NUMBER you wish to dial. To do this, press and release the SHIFT-lock key to display the SHIFT indicator. Enter the numbers to be dialed. The keypad A, B, etc. can be used to enter the special MF tones. For DP dialing, the Pause (,) tone is entered with the "F" key on the keypad (orange label).

If you make a mistake while entering the number, simply press and release the SHIFT-lock key to remove the SHIFT indicator. Then cursor over to the digit that needs to be changed. Press DELETE (F2) to delete a number, or enter the number over again using the process described in the previous paragraph.

Once the number is entered, apply the appropriate supervision. Do this by pressing the "more" (F4) key and then choosing ON-HOOK (F1), OFFHOOK (F2), or WINK (F3), as appropriate.

Be sure the VOLUME control is turned up to an adequate level so that you can hear the incoming signal. Dial the number by pressing ENTER.

When you are finished dialing, press ESCAPE to return to the SWITCHED 56 TESTING menu.

```
                                    14:07:02

ELAP TIME- 000:01:41
FRME- ESF             CODE- B8ZS

RATE- 56K             PATT- 2047


                RESULTS

BIT  :  0000          BER  : 00e-06

UAS  :  0             %UAS : 00.000

RESTART
```

Figure 3–29 SW56 Measurement Results

MEASUREMENT RESULTS

5) Refer to Figure 3–289. This screen displays the ELAPSED TIME at the top of the screen and gives information such as Framing type, test Rate, Code and Pattern. Also displayed are the BIT, BER (Bit Error Rate), UAS (Unavailable Seconds) and the %UAS. To RESTART the measurements press F1. Press ESCAPE when your testing is complete.

TELEOS CALL MONITOR

6) The first selection is the CALLING SIDE. This is selected from either FACility (F1) or EQuiPment (F2). Next, select the CALL DIGIT No. Using the NEXT (F1) and PREVIUS (F2) keys, select a value between 1 and 40.

2.7 Using the VF CHANNEL ACCESS Menu

The SunSet T1 provides numerous voice frequency functions. Access these items by entering the VF CHANNEL ACCESS item in the main menu. Refer to Figure 3–30.

```
                          12:44:56

      VF CHANNEL ACCESS

      VF MEASUREMENTS
      DTMF DIALING
      VIEW SUPERVISION
      DIAL/SPRVIS SETUP
      MF/DP DIALING
      NOISE MEASUREMENT
      MF/DTMF/DP ANALYSIS
      SIGNALING ANALYSIS
```

Figure 3–30 VF Channel Access

NOTE: Before attempting to use the VF CHANNEL ACCESS menu, be sure that the T1 signal under test has valid framing. It is only possible to identify channels in a framed signal.

2.7.1 VF MEASUREMENTS

Use the following procedure when accessing the VF MEASUREMENTS screen for applications such as talk/listen, generating/receiving a tone and controlling the supervision. Refer to Figure 3–31.

```
                                    08:22:56
            VF MEASUREMENTS
      RCV CHANNEL  : 01
      XMT CHANNEL  : 01
      TEST TONE    : DISABLE
      TONE FREQ    : 1004
      TONE LEVEL   : 0    dBm
      TX A/B/C/D   : 0 0 0 0

      Rx A/B/C/D   : 0 1 0 1
      Rx DATA      : 11010011
      RxFREQ/LEVEL: 1182 +04.1

NEXT    PREVIUS   SEND
```

Figure 3–31 VF MEASUREMENTS

1) From the VF CHANNEL ACCESS menu, enter the VF MEASUREMENTS item.

2) The cursor will appear at the RCV CHANNEL item. By using the NEXT (F1) and PREVIUS (F2) keys, select the channel you wish to receive on. Notice that when you adjust the RCV CHANNEL number, the XMT CHANNEL number will also change. If you wish to change the XMT CHANNEL number, then cursor down to it and again use the NEXT (F1) and PREVIUS (F2) keys.

   If you wish, you may also enter a channel number directly from the keypad. To do this, press and release the SHIFT-lock key, then enter the 2-digit channel number, then press and release the SHIFT-lock key again to remove the SHIFT indicator (upper left-hand corner of the screen).

   Your channel number settings will not take effect until you press the ENTER key or the SEND F3 key.

3) Cursor down to the TEST TONE item. If desired, transmit a tone

by selecting ENABLE (F1). If you do not need to transmit a test tone, or if you wish to perform a talk/listen application, then select DISABLE (F2).

4) If you have ENABLED your test tone, then move the cursor to the TONE FREQ item. Select the desired frequency of 404 (F1), 1004 (F2), 1804 (F3), (press the "more" (F4)), 2713 (F1) or 2804 (F2).

If your test set has Software option SW111 installed, you may also transmit any test tone from 50Hz to 3950Hz. To do this, press and release the SHIFT-lock key. Then enter your tone frequency directly from the keypad. When you are finished, press and release the SHIFT-lock key to remove the SHIFT indicator (upper left-hand corner of the screen). To begin transmitting your new tone, press the ENTER key.

5) If you are transmitting a test tone, move the cursor to the TONE LEVEL item and select the desired level of 0 dBm (F2) or -13 dBm (F3).

If your test set is equipped with the Software option SW111, you may also enter any tone level value from +3 dBm to -60 dBm. To do this, press and release the SHIFT-lock key. Then enter your tone level directly from the keypad. When you are finished, press and release the SHIFT-lock key to remove the SHIFT indicator (upper left-hand corner of the screen). If you wish to enter a tone level which is less than 0 dBm, then press the MINUS (F1) key before pressing the SHIFT-lock key.
To begin transmitting your test tone at the new level, press ENTER.

6) If you need to control the supervision you are transmitting on the channel, then cursor down to the Tx A/B/C/D item. If you are using ESF framing, A/C/C/D bits will appear. If you are using SF-D4 or SLC-96 framing, A/B bits will appear.

Use the ON-HOOK (F1), OFFHOOK (F2), or WINK (F3) to set the bit states. These bit states are determined by your settings in the VF CHANNEL ACCESS, DIAL/SPRVIS SETUP menu.

If you wish to manually enter the bits, you may do so directly from the keypad. To do this, press and release the SHIFT-lock key. Then enter your 1s and 0s from the keypad. When you are finished, press and release the SHIFT-lock key to remove the SHIFT indicator (upper left-hand corner of the screen). To begin transmitting your new supervision, press ENTER.

7) At any time, you may look at the measurements available on the screen. Rx A/B(/C/D) tells you the received channel's signaling bits. Rx DATA displays the received data bits on the channel. RxFREQ/LEVEL shows you the level and frequency on the received channel (available only with Software option SW111).

2.7.2 DTMF DIALING

You can DTMF dial a number in the DTMF DIALING menu. This can be useful if you are on an out-of-service T1 but still have access to a switch that will accept your supervision and dialing. Refer to Figure 3–32.

```
                                   12:44:56
             DTMF DIALING

  NUMBER   : 18007597243

 RX A/B/C/D - 1 1 1 1
 TX A/B/C/D : 1 1 1 1
                                 OFF-HOOK



 INSERT   DELETE   SEND   more
```

Figure 3–32 DTMF Dialing

When you dial your DTMF number, the test set uses the XMT CHANNEL selected in the VF MEASUREMENTS menu. For an explanation of how to configure this channel number, see the preceding section.

Basic Dialing Procedure

Use this simplest procedure for DTMF dialing:

1) Enter the DTMF DIALING item in the VF CHANNEL ACCESS menu.

2) Press the SHIFT-lock key to display the SHIFT indicator in the upper left-hand corner of the screen. Enter the telephone number you would like to dial directly from the keypad.
If you make a mistake while entering a number, press the SHIFT-lock key to remove the SHIFT indicator (upper left-hand corner of the screen). Then cursor over to the digit that is incorrect. Press the DELETE (F2) key to get rid of the incorrect digit. Repeat this as necessary to get rid of any other wrong digits. When all of the remaining digits are correct, cursor over to the end of the number, press the SHIFT-lock key again to display the SHIFT indicator, and enter the rest of the numbers. When you are satisfied with all of the numbers, press the SHIFT-lock key to remove the SHIFT indicator from the screen.

3) When you are finished entering the numbers, press ENTER to dial the number. A Dialing message will be displayed while the number is being dialed. The number will dial.

4) You may also control the state of the A/B(/C/D) bits which are being transmitted. To do this, press the F4 ("more") key until you see choices for ON-HOOK, OFFHOOK and WINK. Use these F-keys to control the of the state of the supervision bits which you are transmitting. Note that the state of the Received A/B(/C/D) bits is continually being updated.

Advanced dialing procedures

Heavy users of the DTMF dialing feature may also want to use these advanced dialing procedures:

1) You can insert numbers in the middle of a number by cursoring over to the point where you want to insert numbers. Then select INSERT (F1) while the SHIFT indicator is off. Then press the SHIFT-lock key to display the SHIFT indicator in the corner of the screen. Then enter the desired additional numbers.

2) After inserting numbers as in step 1, you can return to the typeover mode which changes the existing number by typing over it. Do this by pressing SHIFT to remove the SHIFT

indicator, then select TYPEOVR (F1). Press the SHIFT-lock key again to display the SHIFT indicator and enter the remaining numbers.

3) You can store the number you just entered by selecting more (F4) and STORE (F2). You enter the USER DIAL NUMBER screen where you can give the telephone number a LABEL. Press toggle (F3) to get into the alphabet grid with the flashing letter A. Here you can select the letters to be put into the LABEL. Press the cursor keys until the letter you want to enter is flashing on and off. Then press SELECT (F4). Repeat this process until the desired word is spelled in the LABEL. You may enter up to 10 characters.

   If you make a mistake entering a letter, press the toggle (F3) key to get back up to the LABEL. You can tell you're up there because the alphabet grid no longer has any letter that is flashing. Now cursor over to the letter that is wrong and press DELETE (F2) until all the wrong letters are gone. Then cursor back to where the next letter should go. Then press toggle (F3). Then repeat entering letters until the label is finished.

   When the LABEL looks right to you, press the ENTER key. You will now see your new number stored in the USER DIAL NUMBER list alongside all the other numbers. You can dial the number by cursoring down to it and pressing ENTER.

4) From the DTMF DIALING menu, you can go directly to the USER DIAL NUMBER list by pressing more (F4) and USER (F1). You can view any number in the list by cursoring down to it and selecting VIEW (F1). When you are done viewing the number you can press ESCAPE to get back to the USER DIAL NUMBER menu.

5) In the USER DIAL NUMBER menu, you can also edit a number by cursoring down to it and selecting EDIT (F2). At this point you can edit the LABEL as described in step 3). However, when the LABEL has been edited to your satisfaction, do not press ENTER. Instead select toggle (F3) to move out of the alphabet grid and back to the label (there will no longer be a letter flashing on and off in the alphabet grid).

   Then cursor down to the number. Edit the number as described in step 1). When the number is right, press ENTER and the edited number and label will be stored in the USER DIAL NUMBER list.

6) Once all your numbers are set up the way you want, you can speed dial a number at any time. From the VF CHANNEL ACCESS menu, cursor down to DTMF dialing and press ENTER. Select more (F4) and USER (F1). Cursor down to your number and press ENTER. Your number will be dialed automatically for you. You will be returned to the DTMF DIALING menu.

2.7.3 VIEW SUPERVISION

You may find it helpful to view all 24 channels of received supervision bits simultaneously. In this way, you can observe the status of all calls on the line at the same time. Note that the speaker will be turned off during VIEW SUPERVISION, so you won't be able to hear the channel you were monitoring just before you entered VIEW SUPERVISION. Refer to Figure 3–33 and use the following procedure:

```
                                       16:41:50

          VIEW SUPERVISION

   CHANL  AB     AB     AB      AB
    001   00     00     00      11
    005   11     11     00      11
    009   00     00     00      11
    013   10     00     11      11
    017   00     11     00      11
    021   00     00     00      00




HOLDSCR
```

Figure 3–33 View Supervision

1) In the VF CHANNEL ACCESS menu, cursor down to the VIEW SUPERVISION menu item and press ENTER.

2) Observe the signaling bits of all channels at the same time. Note that SF-D4 and SLC-96 framed signals will show A/B bit

signaling information, and ESF framed signals will show A/B/C/D signaling bit information.
Channels 1 through 4 are shown on the first line, 5 through 8 are shown in the second line, and so on.

3) Press ESCAPE to return to the VF CHANNEL ACCESS menu.

2.7.4 DIAL/SPRVIS SETUP

In this menu, you can vary the on and off time for the DTMF digits in DTMF DIALING and MF/DP DIALING (option SW141). You can also condition the test set to send the appropriate signaling bits for E&M, loop start, and ground start trunks with FX0 or FXS line cards. The test set will use this conditioning in VF MEASUREMENTS, Tx A/B/C/D. Refer to Figure 3–34 and use the following procedure.

```
                                        06:21:00

           DIAL/SPRVIS SETUP

         DIAL PERIOD    : 100 ms
         SILENT PERIOD : 100 ms
         TONE LEVEL DbM: -5
         SUPERVISION
         TRUNK TYPE     : G-START
         EQUIPMENT      : FXS
         DIAL PULSE (10PPS)
         %BREAK         : 60
         INTERDIGIT PRD: 500


E&M       FXS      FXO
```

Figure 3–34 Dial/Supervision Setup

1) From the VF CHANNEL ACCESS menu, cursor down to the DIAL/SPRVIS SETUP menu and press ENTER.

2) If desired, change the DIAL PERIOD and SILENT PERIOD. Make sure that the cursor is on the DIAL PERIOD entry. Then press and release the SHIFT-lock key so that the SHIFT indicator is displayed in the upper left-hand corner of the screen. Then press the desired numbers to give the desired number of milliseconds. After the first three numbers are

entered, the cursor will automatically move to the next line. If you make a mistake, press and release the SHIFT-lock key so that the SHIFT indicator is no longer displayed in the screen. Then move your cursor to the number that you want to change. Go into the SHIFT mode again and enter the desired number. When you are finished, press SHIFT again to get out of the SHIFT-lock mode.

3) At the TONE LEVEL item, choose NEXT (F1) or PREVIUS (F2) to set the tone level in dBm.

4) Next, cursor down to TRUNK TYPE. Choose E&M (F1), FXS (F2), or FXO (F3), as appropriate.

5) Cursor down to EQUIPMENT and choose G-START (F1) or L-START (F2) as appropriate.

6) Cursor down to %BREAK and, using the NEXT (F1) and PREVIUS (F2) keys, select from values of 40%, 50% or 60%.

7) Cursor down to INTERDIGITal PRD. Using the NEXT (F1) and PREVIUS (F2) keys, select from values of 200, 300, 400, 500, 600, 700, 800, and 900ms.

8) You are now finished with the dial and supervision setup process. Press ENTER to return to the VF CHANNEL ACCESS menu.

2.7.5 MF/DP DIALING (option SW141)

If your set is equipped with SW141 MF/DTMF/DP Dialing, Decoding and Analysis, you can also MF/DP dial with your SunSet T1. MF Dialing is useful in inter-switch addressing applications. Refer to Figure 3–35 and use this procedure:

```
                                    12:44:56
              MF/DP DIALING

   METHOD    : MF

   NUMBER    : 18007597243


   RX A/B/C/D - 0 1 0 1
   TX A/B/C/D : 0 1 0 1
   KP  = A   ST = B
   ST1 = C   ST2 = D
   ST3 = E   Pause(,) = F

 MF     DP
```

Figure 3–35 MF/DP Dialing

1) From the VF CHANNEL ACCESS menu, cursor down to the MF/DP DIALING item and press ENTER.

2) Select the METHOD of dialing: either MF or DP. The cursor will automatically advance to the next line.

3) Press and release the SHIFT-lock key to display the SHIFT indicator at the top of the screen. Use the keypad to enter the numbers to be dialed. Note that the keypad A, B, etc. can be used to enter the special MF tones shown on the display. For DP dialing, the Pause (,) tone is entered with the "F" key on the keypad (orange label).

   If you make a mistake while entering the number, simply press and release the SHIFT-lock key to get rid of the SHIFT indicator in the display. Then cursor over to the digit that needs to be changed. Press the DELETE (F2) key to delete the number, or enter the number over again using the process described in the previous paragraph.

4) Once the number has been entered, apply the appropriate supervision. Do this by pressing the SHIFT-lock key to remove the SHIFT indicator. Then press the "more" (F4) key and choose ON-HOOK (F1), OFFHOOK (F2), or WINK (F3), as appropriate.

5) Be sure the VOLUME control is turned up to an adequate level so that you can hear the incoming signal.

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

7) You are finished. Press ESCAPE to return to the VF CHANNEL ACCESS menu.

2.7.6 NOISE MEASUREMENT (option SW111)

Refer to the following diagram and use this procedure:

1) In the VF CHANNEL ACCESS menu, cursor down to the NOISE MEASUREMENT menu item and press ENTER

2) In the NOISE MEASUREMENTS screen, use a function key to begin one of four noise measurements: Signal to Noise S/N (F1), C-Message (F2), 3 kHz flat (F3), or C-Notch (F4).

   After the function key is pressed, the selected measurement will start. You may change the noise measurement at any time by choosing a different F-key. Measurement results previously made will not be erased. Only the measurement result for the current measurement type will be updated regularly.

3) After your desired measurement results are complete, press ESCAPE to return to the VF CHANNEL ACCESS MENU.

```
                                  12:44:56

        NOISE MEASUREMENT

    MEASURE : 3K-FLAT

              RESULTS

    Signal to Noise:          dB
    Noise C-Message:          dBrnC
    Noise 3K-Flat   :   71.6  dBrn
    Noise C-Notch   :         dBrn


 S/N    C-MESG   3K-FLAT   C-NOTCH
```

Figure 3–36 Noise Measurement

2.7.7 MF/DTMF/DP ANALYSIS (option SW141)

The SW141 MF/DTMF/DP Dialing, Decoding, and Analysis option enables the test set to send, decode, and analyze MF/DTMF/DP tones.

Use the following procedure:

1) Refer to Figure 3–37. In most instances, you will need to configure the LINE INTERFACE settings for either a DSXMON or BRDIGE access MODE. Ensure that the FRAMING and line CODING are correct, or use AUTO.

2) In the VF CHANNEL ACCESS menu, cursor down to the MF/DTMF/DP ANALYSIS item and press ENTER.

3) At the TONE TYPE selection, press the F1 key to select MF, the F2 key to select DTMF, or the F3 key to select DP.

4) After the cursor has advanced to the START SEQ, select the supervision start sequence that you must send to the far-end before the far-end begins sending you the number.
Note that this supervision can be OFF-HOOK (F1) or WINK (F2). Select LIVE to decode any digits immediately, without sending the supervision. This is only of use in a TERM configuration. For DSXMON and BRIDGE configurations use LIVE, since you are using only the test set's RCV jack. In DP decoding, the line must initially be in an off-hook state.

5) After the START SEQ has been selected, press ENTER to send any supervision start sequence and to begin receiving the digits from the far end. The MF, DTMF or DP digits will be displayed as they are received. Up to 40 digits can be displayed.

6) Press the F1 key (ANALYZE) to stop receiving digits and to analyze the digits that were received. The following information will be provided for each digit:
   - number
   - position in the digit string
   - frequency, level, and twist of high tone and low tone
   - digit time and interdigit time

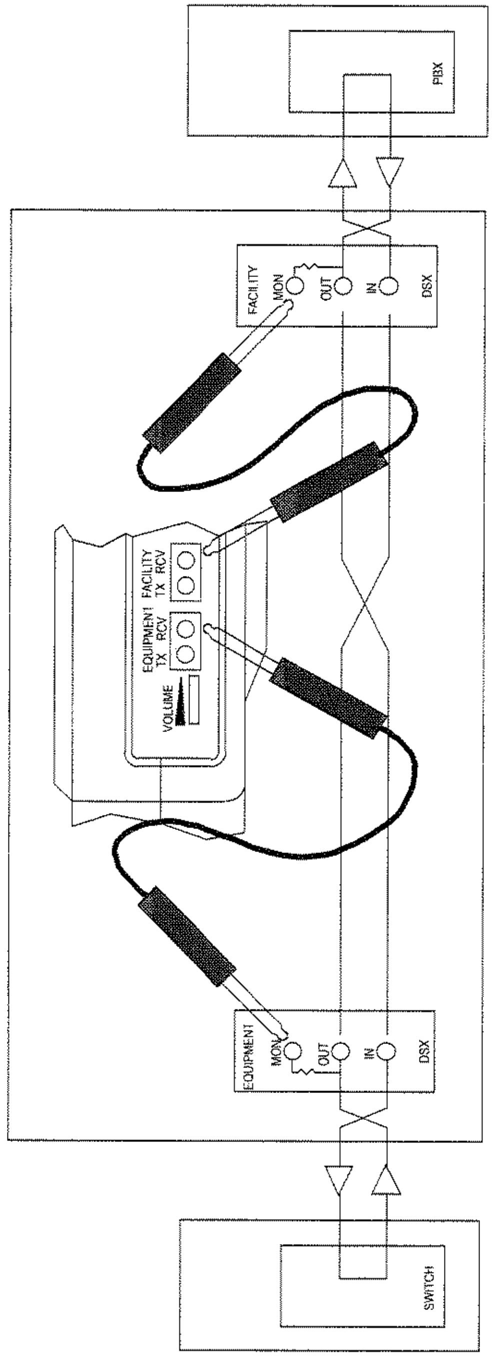


Figure 3–37 MF/DTMF/DP Analysis Configuration

7) In the ANALYZE screen, use PAGE-UP (F1) or PAGE-DN (F2) to view more digits.

8) To begin a new Decode and Analysis session, escape and then re-enter the MF/DTMF/DP ANALYSIS menu. Use the PRN SCRN key to print the test results if desired.

9) When you are finished, press ESCAPE to return to the VF CHANNEL ACCESS MENU.

2.7.8 SIGNALING ANALYSIS (option SW141)

The test set performs signaling analysis in five modes: LIVE, TRIGGER, MFR1, MFR1M and MIXTONE.

Use the following procedure:

1) Refer to Figure 3–38. In most instances, you will need to configure the LINE INTERFACE settings for either a DSXMON or BRDIGE access MODE. Ensure that the FRAMING and line CODING are correct, or use AUTO.

2) From the VF CHANNEL ACCESS menu, enter the SIGNALING ANALYSIS item.

```
                                   22:01:20

          SIGNALING ANALYSIS

   ANALYZE MODE   : LIVE
   ANALYZE CHNL   : 01
   PRINT RESULT   : NO








 LIVE    TRIGGER     MFR1      more
```

Figure 3–38 Signaling Analysis

3) Using the F-keys, select the MODE of operation you wish to use (discussed below).

A choice of five MODES is possible press the more key to view options MFR1M and MIXTONE:

LIVE MODE

In LIVE mode, an analysis is performed on the AB(CD) bits on either the FACILITY RCV or the EQUIPMENT RCV jack. Use the RCV jack which is configured to test the received signal. This will depend on the LINE INTERFACE mode which you have selected. (For example, in the DUAL, SPLIT-F mode, you would use the FAC RCV jack, because this is the one which will be tested). This can easily be confirmed by using the GRAPHIC key. Using the LIVE mode, the user can determine the elapsed time between ON-HOOK/OFF-HOOK signaling states. This information is displayed in a graphical format.

1) Select the ANALYZE MODE as LIVE.
2) Select the CHaNneL you wish to analyze.
3) Specify whether or not you wish to print your results during the analysis.
4) Press ENTER to begin the analysis. Refer to figure 3–39.

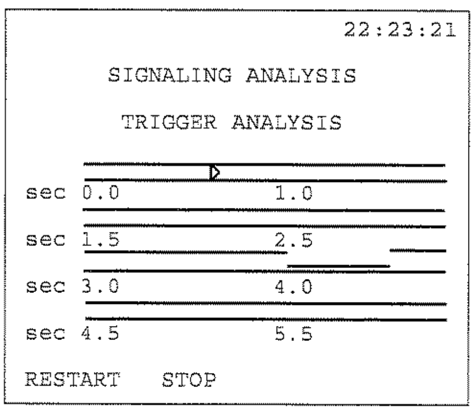


Figure 3–39 Signaling Display

In the above illustration, a signaling transition of 2.5 seconds is observed, and the transition occurs from an off-hook to an on-hook state, then back to an off-hook state (flash).

TRIGGER MODE

TRIGGER mode allows the user to examine the timing of the on-hook/off-hook signaling conditions specified by a user-defined TRIGGER STATE.

1) Select the ANALYZE MODE as TRIGGER.
2) Select the CHaNneL you wish to analyze.
3) Select whether or not you wish to print your results during the analysis.
4) Select which side is to initiate the triggering condition (FAC or EQP). Once the condition occurs, then the test set will analyze the on-hook/off-hook signaling on the other side.
5) Select the channel on which the triggering signal is to be received. Note that this need not correspond to the channel which is being analyzed.
6) Select the state of the AB(CD) bits used to initiate triggering. The triggering bit values are entered by using the SHIFT-lock key, and entering 0/1 values directly from the keypad.
7) Press ENTER to begin the analysis.

The test set will examine the state of the AB(CD) bits on the trigger side, when the triggering condition occurs, the test set will then immediately switch to the non-trigger side for the duration of the analysis.

If PRINT RESULT was selected as YES, the following information would be printed:

```
SUNRISE TELECOM Inc. 2001

SIGNALING ANALYSIS

States        TIME(MS)

OFF-HOOK      initial state

ON-HOOK       15870

OFF-HOOK      16010

ON-HOOK       16020
```

Figure 3–40 Print Result

MFR1 MODE

In MFR1 mode, the test set will examine the TRIGGER SIDE for a wink condition. When this condition occurs, the test set will immediately examine the non-trigger side for a wink response. When this wink response is received, the test set will switch back to the trigger side to receive the <KP> tone and any additional tones.

1) Select the ANALYZE MODE as MFR1.
2) Select the CHaNneL you wish to analyze.
3) Select which side is to initiate the triggering condition.
4) Select the channel on which the triggering signal is to be received. Note that this need not correspond to the channel which is being analyzed.

```
                                  12:44:56

        SIGNALING ANALYSIS
              MFR1
Side    States         Time(ms)
FAC     OFF-HOOK       0
EQP     OFF-HOOK       10
EQP     ON-HOOK        9660
FAC     DIAL-START     13830

RxDIGIT:
 (KP)564123


RESTART   STOP   ANALYZE
```

Figure 3–41 MFR1 Analysis

The SunSet will display the timing of each state change in the tabular format above. Use PRN SCRN to obtain a hard copy of the report.

MFR1M MODE

In MFR1M mode, when the TRIGGER SIDE transmits an off-hook condition, the test set will examine the non-trigger side for an off-hook condition of the AB(CD) bits. When an off-hook signal is received on the non-trigger side, the test set will switch back to the trigger side. The test set will begin to examine the <KP> tone generated from the trigger side of the circuit. When the non-trigger side of the circuit receives this <KP>tone, it will signal the trigger side with an on-hook signaling condition. Once the trigger side of the circuit receives this on-hook condition, it will begin transmitting the MF/DTMF/DP tones.

1) Select the ANALYZE MODE as MFR1M. 2) Select the CHaNneL you wish to analyze.
3) Select which side is to initiate the triggering condition.
4) Select the channel on which the triggering signal is to be received. Note that this need not correspond to the channel which is being analyzed.

```
                                12:44:56

        SIGNALING ANALYSIS
             MFR1M
Side    States          Time(ms)
EQP     OFF-HOOK        0
FAC     OFF-HOOK        10
EQP     SEND-KP         5300
FAC     ON-HOOK         63390
EQP     DIAL-START      65130
RxDIGIT:
 9654123


RESTART   STOP   ANALYZE
```

Figure 3–42 MFR1M ANALYSIS

The test set will display the timing of each state change in the tabular format above. Use PRN SCRN to obtain a hard copy of the report.

MIXTONE MODE

Refer to Figure 3–43. In mixed tone mode, a combination of MF and DTMF tones are used. Follow this procedure:

1) Select the ANALYZE MODE as MIXTONE.
2) Select the CHaNneL you wish to analyze using the NEXT (F1) and PREVIUS (F2) keys.
3) Select the STARTING TONE as either MF (F1) or DTMF (F2).
4) Select the starting digit number. Valid selections range from 1 to 32 in addition to the <ST1> digit. Select this digit using the NEXT (F1), PREVIUS (F2) or <ST1> (F3) keys.
5) Select the ENDING TONE as MF (F1) or DTMF (F2).
6) Press ENTER to begin the analysis.

```
                                   12:44:56

        SIGNALING ANALYSIS

    ANALYZE MODE    :  MIXTONE
    ANALYZE CHNL    :  01
    PRINT RESULTS   :  NO
    STARTING TONE   :  MF
       no. digit    :  01
    ENDING TONE     :  MF




MF     DTMF
```

Figure 3–43 MIXTONE Analysis

2.8 Using the OTHER FEATURES Menu

The OTHER FEATURES menu allows you to configure most of the SunSet T1's parameters. The first menu item available is SYSTEM CONFIG. Enter it to find the following confiurable items:

2.8.1 SYSTEM PROFILES

Up to 10 system profiles may be stored in the test set. These profiles can save you time in configuring the test set for your applications. The test set can store the current configuration as a system profile. You provide a name for the profile so that it can be conveniently recalled at a later time. Items that are stored in the profile are: GENERAL CONFIG settings, LINE INTERFACE, TEST PARAMETER, TEST PATTERN, LOOP BACK CONTROL, and VF CHANNEL ACCESS settings.

NOTE: The SYSTEM PROFILES menu does not operate like the user pattern menus. You may not edit an existing system profile in the SYSTEM PROFILES menu. If you wish to modify an existing profile, use the modification procedure described in this section.

To Enter a New System Profile

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

2) Press the STORE (F2) key.

3) Type in the LABEL you wish to give the profile. Do this by pressing toggle (F3) to toggle to the alphabet grid with the flashing A. Cursor to the desired letter and press SELECT (F4). Repeat this as necessary until the desired label is spelled. Then press toggle (F3) to leave the alphabet grid.

4) Observe the file number that the test set will store the new profile under. You may change the file number if you wish by pressing the Down Arrow key to access the FILE No. line. Now press the SHIFT-lock key to display the SHIFT indicator. Type in the desired number from the keypad.

5) Press ENTER to store the SYSTEM PROFILE.

Invoke a Stored System Profile

1) Enter the SYSTEM PROFILES menu.

2) Cursor down to the desired system profile.

3) Press the ENTER key.

View an Existing Profile

1) Enter the SYSTEM PROFILES menu.

2) Cursor down to the desired profile and press the VIEW (F1) key.

3) Press the PAGE-DN (F2) key repeatedly to view the profile.

Activate the Default Profile

1) Enter the SYSTEM PROFILES menu.

2) Select the DEFAULT (F4) key, then press ENTER. You will be returned to the SYSTEM CONFIG menu and the test set's configuration will be set to the factory default.

Delete a Profile

1) Enter the SYSTEM PROFILES menu.

2) Cursor down to the desired profile.

3) Press the DELETE (F2) key.

Modify an Existing Profile

1) Enter the SYSTEM PROFILES menu.

2) Cursor down to the desired system profile.

3) Press the ENTER key to invoke this profile. This will also exit you from the screen.

4) Move to the other menus within the test set where you will change the set-up items.

5) Enter the SYSTEM PROFILES menu.

6) Press the STORE (F2) key.

7) Give the profile the a new name. If you want, you can give this modified profile the same name as the original, but pay close attention to which file number it is stored under so that you will be able to tell which profile is which.

8) Press ENTER to return to the SYSTEM PROFILES menu.

9) Cursor down to the old version of the profile which you no longer need.

10) Press the DELETE (F2) key.

11) Cursor down to the new profile.

12) Press the ENTER key. You are finished.

2.8.2 GENERAL CONFIG

The GENERAL CONFIGuration screen lets you set the time and date, backlight duration, serial port, and printing characteristics. Refer to Figure 3–44.

```
                          06:44:12
        GENERAL CONFIG

   DATE  (Y-M-D): 92-08-03
   TIME  (H:M:S): 06:43:55

   BACK LIGHT   : CONTINU
   PRINTER
    BAUD RATE   : 1200
    PARITY      : NONE
    STOP BIT    : 1-BIT
    BITS/CHAR   : 8-BIT
    PRNT PERIOD: LAST
```

Figure 3–44 General Configuration

Follow this procedure:

1) From the main menu, enter OTHER FEATURES, SYSTEM CONFIG, then GENERAL CONFIG.

2) Set the DATE: press the SHIFT-lock key to display the SHIFT indicator in the upper left-hand corner of the screen. Enter the year, month and day. The test set inserts the hyphens for you. Numbers that are out of range will be rejected. Press the SHIFT-lock key to remove the SHIFT indicator from the display.

3) Set the TIME: press the SHIFT-lock key to display the SHIFT indicator in the upper left-hand corner of the screen. Enter the hour, month, and day. The test set inserts the colons for you. Numbers that are out of range will be rejected. Press the SHIFT-lock key to remove the SHIFT indicator from the display.

4) Set up the BACK LIGHT timer. This timer controls how long the backlight will stay lit when you press the LIGHT key. Choose CONTINU (F2) if you want the backlight to stay on continuously.

   Choose TIMED (F1) if you want the backlight to automatically turn itself off after the specified number of minutes. To do this, press the SHIFT-lock key. Then type in any number of minutes between 1 and 99. 1 minute is the default time. Press SHIFT again to remove the SHIFT indicator from the display.

5) If needed, change the printer port communication interface. The factory default settings work with the thermal printer supplied by the factory.

You may need a break-out box, null modem, patch-box and other RS-232C communications tools if you wish to set up your own serial communications. Here are some helpful hints. The test set is configured as a DTE. You will need a modified null modem cable if you wish to connect directly to a terminal. If you wish to connect to a modem or other brand of printer, you may find the SS122 Null Modem Adapter useful.

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

You are free to use this information to attempt to set up the SunSet T1 with another printer. However, Sunrise Telecom does not warrant the operation of the test set with any printer other than the one supplied by Sunrise Telecom.

To change the settings for your printer:

A) choose a baud rate of 1200 (F1), 2400 (F2), 9600 (F3), or 19.2K (F4).

B) choose a parity NONE (F1), EVEN (F2), or ODD (F3).

C) choose a stop bit of 1-BIT (F1) or 2-BIT (F2).

D) choose a bits per character of 7-BIT (F1) or 8-BIT (F2).

6) Set up printer's printing instructions in the PRNT PERIOD line:

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

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

B) or, choose EVENT (F2) if you would like the printer to print out a result every time an error or alarm condition is reported.

C) or, choose LAST (F3) if you would like the printer to print out a result only at the conclusion of a test.

Each result can only be printed once and then the print buffer is emptied.

2.8.3 ERASE NV RAM

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

1) Making sure that the test set is configured properly 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 of the user-storable information you have entered into the test set. All user loopback patterns, transmit patterns, telephone numbers, and system profiles will be erased.

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

1) From the main menu, enter the OTHER FEATURES menu item, then enter the SYSTEM CONFIG menu item, then enter the ERASE NV RAM menu item.

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

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

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

2.8.4 SELF TEST

Use the SELF TEST to perform a hardware and memory check within the SunSet T1. Use this procedure:

1) From the main menu, enter the OTHER FEATURES menu

item, the enter the SYSTEM CONFIG menu item, then enter the full SELF TEST menu item.

2) View the results. If you see an error code displayed, then try the NVRAM ERASE operation described in this section. Then repeat the SELF TEST again. If any error messages remain, please call Sunrise Telecom Customer Service at (800) 701-5208 for assistance.

2.8.5 CLR PRINT BUFFER

This command clears the print buffer. It saves you time by clearing out unwanted information before you turn on the printer. Use the following procedure:

1) From the main menu, enter the OTHER FEATURES menu item, then enter the SYSTEM CONFIG menu item, then press ENTER on CLR PRINT BUFFER to clear the buffer. You will see the screen flash momentarily while the buffer is cleared. You have completed the operation.

2.8.6 VERSION / OPTION

This menu item allows you to verify the Software version, type, options, and serial number. Use the following procedure:

1) From the main menu, enter the OTHER FEATURES menu item, then enter the SYSTEM CONFIG menu item, then press ENTER on VERSION / OPTION to view the software version, type, options, and serial number. You have completed the operation.

2.8.7 FACTORY DEFAULTS

This function restores all the test set settings to the factory defaults. This can be a useful troubleshooting step if someone has used the set before you and changed something that you can't find. Use this procedure:

1) From the main menu, enter the OTHER FEATURES menu item, then enter the SYSTEM CONFIG menu item, then press ENTER on FACTORY DEFAULTS to reconfigure the test set

to the factory defaults. You will see the screen flash momentarily while the operation is performed. You have completed the operation.

2.9 Using the TEST PARAMETERS menu

The next menu available in OTHER FEATURES is the TEST PARAMETERS menu. You may program several TEST PARAMETERS:

2.9.1 ERROR INJECTION

Set up the ERROR INJECTION parameters for the test set as shown in Fig 3–45 using this procedure:

1) From the main menu enter the OTHER FEATURES menu, then enter the TEST PARAMETERS menu item, then enter the ERROR INJECTION item.

2) Choose The TYPE of errors to be inserted: BPV (F1), LOGIC (F2), LOG+BPV (F3), or FBE (F4) as desired. This will cause the test set to insert BPV errors, logical errors, combined logical and BPV errors, or framing bit errors, respectively.

3) Cursor down to the MODE menu item and choose BURST (F2), or RATE (F1).

4) For BURST MODE, cursor down to COUNT and specify the COUNT of errors to be inserted. Press the SHIFT-lock key to display the SHIFT indicator. Use the keypad to type in any number between 1 and 9999.
Note that when you actually inject the errors, The errors will be inserted during a 1 second period, and will cause from 1 to 2 errored seconds.

5) For RATE MODE, cursor down to RATE and specify the error RATE number and exponent. Press the SHIFT-lock key to display the SHIFT indicator. Then enter the desired numbers from the keypad. When you have entered the desired numbers press ENTER and the operation is complete.
When the errors are actually injected, they will be inserted at

a continuous rate as specified in this entry.

Error injection is usually performed to verify presence of a loopback. Simply press the ERR INJ key and the test set will insert errors as you have specified them in the ERROR INJECTION menu. If you are looped back, the ERRORS LED will light.

```
                                         11:41:45

     ERROR INJECTION

  TYPE      : LOG+BPV

  MODE      : RATE

  RATE      : 2E-5




BPV     LOGIC      LOG+BPV     FBE
```

Figure 3–45 Error Injection

2.9.2 MEASUREMENT CRITERIA

Refer to Figure 3–46. You should only need to use this screen in rare situations. Here is an explanation of the various items:

```
                                         11:41:45

     MEASUREMENT CRITERIA

  MEAS DURATION: CONTINU

  OUT OF FRAME : 2/4

  AVG INTERVAL : 00:00:10




TIMED  CONTINU
```

Figure 3–46 Measurement Criteria

MEAS DURATION

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

2) If you choose TIMED, enter a number between 999 hr 99 min and 1 min.

OUT-OF-FRAME

You may choose either 2-in-4 or 2-in-5 frame errors as the condition for declaring an OUT-OF-FRAME. This may be useful on a corporate basis if it is desired that all test and monitoring equipment report an OUT-OF-FRAME condition under exactly the same conditions.

AVG INTERVAL

During tests that run a long time, it is useful to have measurements of current conditions as well as measurements of conditions since the beginning of the test. You may select what period of time you wish to use to report current measurements. The factory default is 10 seconds. In this way you get a report of the bit error rate and other measurements over the previous 10 second interval. The report is then updated once every 10 seconds. You may set the averaging interval between 1 second and 99 hours.

2.9.3 OTHER PARAMETERS

PATTERN INVERSION

You may enable or disable pattern inversion. When pattern inversion is enabled, it will transmit the complement of any selected test pattern. For instance, with pattern inversion selected, a 3-in-24 pattern will actually be transmitted as a 21-in-24 pattern.

IDLE CHANNEL CODE

You may set 7F-Hex (0111 1111) or FF-Hex (1111 1111) as your idle channel code. This code is then used during VF channel access operations when the line interface is set to the TERM mode. The idle code is also used in fractional T1 testing to fill up the unused channels.

EMULATION TYPE

You may choose either CSU or NI (smart jack) as the type of CSU/NI emulation you use. This setting will be used by the test set to determine what type of loopback codes it looks for in the CSU/NI emulation screen.

WESTELL REPEATER

You may choose either 31xx-80 or 31xx-56. Your choice here will be used in the WESTELL LINE RPTR and WESTELL OFFICE RPTR menus to instruct the test set which repeater codes to transmit.

2.10 Using the PRINT RECORDS Menu

The final menu in OTHER FEATURES is PRINT RECORDS. You may print out a variety of information using this feature. Use the following procedure:

1) Plug the test set into the printer. Be sure power is applied to each.
2) Press the PRNT SCRN key to make sure that the test set and printer are working together properly.

3) Set up the individual records to be printed. Choosing YES will print the record. Choosing NONE will leave the record unprinted. The individual records are:
   - TEST RESULT BUFF: The test result buffer prints all the last 10 results that are in the buffer. This function requires a lot of time to complete so don't use it until you are ready to leave the printer and test set in a printing mode for a long time.
   - VIEW DATA BUFFER: This buffer prints all 32 pages of VIEW RECEIVED DATA stored in the view data buffer.
   - SYSTEM PROFILE: This buffer prints all the parameters that

are currently set on the test set.

- USER TEST PATTERN: This buffer prints all the user-defined test patterns with their labels (names).
- USER LPBK CODE: This buffer prints all the user-defined loopback codes with their labels (names).
- USER DIAL NUMBER prints all the user-defined telephone numbers with their labels (names).

4) Each time you make a selection, press ENTER to begin printing.

2.11 Using the DATA LINK CONTROL (SLC-96)

Choose SLC-96 framing in the LINE INTERFACE menu before proceeding. Press ENTER on DATA LINK CONTROL within the main menu to see Figure 3–47. All capabilities are in conformance with TR-TSY-000008.

WARNING

Using the SLC-96 send message capability can bring down an entire SLC system. Be sure you are properly trained before proceeding. Monitoring the SLC datalink from a MON jack should not cause a problem. See Chapter 4 for additional application information.

```
                                06:44:12

   DATA LINK CONTROL SLC-96

      MONITOR DATA LINK
      SEND MESSAGE
      SWITCH PROTECT LINE
      VIEW DATA LINK
```

Figure 3–47 Data Link Control

2.11.1 MONITOR DATA LINK

The first menu choice is the data link monitor. This monitor gives you an English-language translation of the information in the SLC data link. See Figure 3–48 for a sample screen.

```
                                      06:44:12

         SLC-96 SEND MESSAGE

   MODE   : WP1    A-FELP: CLR
   MAJOR  : ALM    B-FELP: CLR
   MINOR  : CLR    C-FELP: CLR
   POWER  : CLR    D-FELP: CLR
   A SHLF: CLR     P-FELP: CLR
   B SHLF: CLR     M1  : CLR
   C SHLF: CLR     M2  : CLR
   D SHLF: CLR     M3  : CLR
   PROTECT LINE SW   : IDLE
   C BITS: 11111111111

HOLDSCR
```

Figure 3–48 SLC-96 Monitor Data Link

Here is a detailed description of each of the items:

MODE
There are three kinds of data link modes specified in TR-TSY-000008, NOTE, WP1B, and WP1. The mode will show as the NOTE, which indicates the 16-bit format of either the NOTE or the WP1B card. Alternatively, the mode can be indicated as the WP1, a 13-bit format.

MAJOR
A major alarm on the data link will be indicated here.

MINOR
A minor alarm on the data link will be indicated here.

POWER
A power alarm will be indicated here.

A SHLF
An A-shelf alarm will be indicated here.

B SHLF
An B -shelf alarm will be indicated here.

C SHLF
An C-shelf alarm will be indicated here.

D SHLF
An D-shelf alarm will be indicated here.

PROTECT LINE SW
The switch-to-protection line switch message is shown here.

C BITS
The 11 C-Bits are displayed here.

A-FELP
An A digroup far end loop will be indicated here.

B-FELP
A B digroup far end loop will be indicated here.

C-FELP
A C digroup far end loop will be indicated here.

D-FELP
A D digroup far end loop will be indicated here.

P-FELP
A Protection digroup far end loop will be indicated here.

M-BITS
The three M bits are displayed here.

2.11.2 SEND MESSAGE

The set gives you an English-language table of items that you may send on the SLC-96 data link. Before entering this menu, make sure you have a TERM or SPLT-F configuration and have both your transmit and receive cords plugged into the circuit and the test set. See Section 7 for diagrams on how to plug in the set. See Figure 3–49 for a picture of the screen that is used.

```
                                  06:44:12

        SLC-96 SEND MESSAGE

   MODE   : WP1
   MAJOR  : ALM    A-FELP: CLR
   MINOR  : CLR    B-FELP: CLR
   POWER  : CLR    C-FELP: CLR
   A SHLF: CLR     D-FELP: CLR
   B SHLF: CLR     P-FELP: CLR
   C SHLF: CLR     S-BITS: 1111
   D SHLF: CLR     M-BITS: 111
   C BITS: 11111111111

  NOTE     WP1      WP1B     SEND
```

Figure 3–49 SLC-96 Send Message

MODE
This selection allows you to control what SLC-96 element the test set will emulate as it sends the SLC-96 message. The three choices are NOTE, WP1, and WP1B.

MAJOR, MINOR, POWER, A SHLF, B SHLF, C SHLF, D SHLF
These categories allow you to set the desired alarm message.

A-FELP, B-FELP, C-FELP, D-FELP, P-FELP
These categories allow you to set a far-end loop or indicate the existence of a far-end loop.

S-BITS, M-BITS, C-BITS
These categories allow you to directly enter these SLC data link bits that are not otherwise defined.

SEND
This F4 key function allows you to send the message at any time. Alternatively, you may send a message by pressing the ENTER key. Note that no message is sent until you press either SEND or ENTER. This allows you to edit your message to your liking and only send it when it is exactly the way you wish. Once you send it, it will continue to be sent until you change it.

2.11.3 SWITCH PROTECT LINE

This menu lets you switch one of the working digroups A through D to the protection digroup.

ACTION
Choose either SWITCH (F1) or RELEASE (F2) to carry out the desired action.

LINE
Choose the desired digroup (A through D) by pressing the appropriate F-key (F1 through F4).

ENTER
When you have put your settings the way you want them, press the ENTER key to send the desired message.

2.11.4 VIEW DATA LINK SLC-96

This menu item allows you to view a live SLC-96 data link. The bits are arranged according to their place in the SLC-96 data link. This screen may be useful for those applications that do not follow TR-TSY-000008. See Figure 3–50 for an example of this screen:

```
                                   06:44:12

    SLC-96 VIEW DATA LINK
PAGE :01

DLF  C---------CsssM-MAAS--Ss
001  111111111110101110111111
002  111111111110101110111111
003  111111111110101110111111
004  111111111110101110011111
005  111111111110101110111111
006  111111111110101110111111
007  111111111110101110111111
008  111111111110101110111111

PAGE-UP PAGE-DN             PAUSE
```

Figure 3–50 View Data Link SLC-96

2.12 Using DATA LINK CONTROL (ESF)

ESF DATA LINK CONTROL is provided when you have chosen ESF framing in the LINE INTERFACE menu. See Figure 3–51, below.

```
                                17:16:17

       DATA LINK CONTROL ESF

         MONITOR T1.403 PRM
         MONITOR T1.403 BOM
         SEND T1.403 PRM
         SEND T1.403 BOM
         PRINT T1.403 RESULTS
         RTRV 54016 PM CNTR
         PRINT 54016 RESULTS
```

Figure 3–51 Data Link Control ESF

2.12.1 MONITOR T1.403 PRM

The MONITOR T1.403 PRM allows you to view the Performance Report Message (PRM) as reported on the ESF data link. This gives you real-time end-to-end performance information even when the circuit is in service. This screen also keeps a record of how many seconds payload loopback messages and yellow alarm messages appeared. The screen shows how much total time has elapsed since you began to monitor the data link, as well as how much time a valid T1.403 data link message was received. Figure 3–52 shows a sample screen:

```
                              17:16:17
      DATA LINK MONITOR
         T1.403 PRM

 ELAPS TIME - 000:02:22
 DETEC TIME - 000:00:00

 CRC-1  - 0        C=<5   - 0
 C=<10  - 0        C=<100 - 0
 C=<319- 0         C=>320 - 0
 SEFE   - 0        FSBEE  - 0
 BPV    - 0        SLIP   - 0
 PLBsec- 0         YELsec - 0
PAUSE RESTART HOLDSCR
```

Figure 3–52 MONITOR T1.403 PRM

Here are what each of the items mean:

ELAPS TIME
This is the total amount of time which has passed since the data link began to be monitored.

DETEC TIME
This is the total amount of time that the set has detected valid data link messages during the time that the set has been monitoring the data link.

CRC-1
This is the number of seconds during which exactly 1 CRC-6 error was reported.

C=<5
This is the number of seconds during which 2 to 5 CRC-6 errors were reported.

C=<10
This is the number of seconds during which 6 to 10 CRC-6 errors were reported.

C=<100

This is the number of seconds during which 11 to 100 CRC-6 errors were reported.

C=<319
This is the number of seconds during which 101 to 319 CRC-6 errors were reported.

C>320
This is the number of seconds during which 320 or more CRC-6 errors were reported.

SEFE
This is the number of severely errored framing events that were reported .

FSBEE
This is the number of FSBEEs that were reported.

BPV
This is the number of seconds in which at least one bipolar violation occurred were reported.

SLIP
This is the number of seconds during which at least one frame slip occurred.

PLBsec
This is the number of seconds in which the device is looped back.

YELsec
This is the number of seconds in which at least one yellow alarm messages were received.

PAUSE
The PAUSE (F1) key allows you to pause the measurement so that no results are recorded again until you press the RESUME (F1) key.

RESTART
The RESTART (F2) key allows you to star measurement over again.

HOLDSCR

The HOLDSCR (F3) key stops the screen from updating while you look at it. The measurement continues the background in the background. You can let the screen update again by pressing the CONTINU (F3) key.

2.12.2 MONITOR T1.403 BOM

Refer to Figure 3–53 . This screen displays the message that the test set receives over the data link. The receive status line shows MESSAGE if the test set is currently receiving a message on the data link. The message will be displayed under the LAST MESSAGE line. If the set is not receiving a message, the MESSAGE line will say IDLE, and the last message that was received will be displayed under the LAST MESSAGE line.

```
                                06:44:12

   VIEW DATA LINK T1.403 BOM

  RECEIVE STATUS: MESSAGE

  LAST MESSAGE:0000100011111111
  (left most bit received 1st)

        0000000011111111
```

Figure 3–53 MONITOR T1.403 BOM

2.12.3 SEND T1.403 PRM

You can configure the test set to send the T1.403 Performance Report Message by entering this menu item. In this mode the test set will broadcast the message on the currently selected TX jack according to the quality of the received signal on the currently selected received jack. It will display for you a count of all the various errors that have been recorded and transmitted since you entered the menu. The set sends this message continuously until you ESCAPE from this menu. Refer to Figure 3–54.

```
                              17:16:17

       DATA LINK TRANSMIT
          T1.403 PRM

ELAPS TIME - 000:02:22


CRC-1  - 0        C=<5   - 0
C=<10  - 0        C=<100 - 0
C=<319- 0         C=>320 - 0
SEFE   - 0        FSBEE  - 0
BPV    - 0        SLIP   - 0
PLBsec- 0         YELsec - 0
```

Figure 3–54 Data Link Transmit

2.12.4 SEND T1.403 BOM

You can also send a data link Bit Oriented Message if you wish. Figure 3–55 shows an example of this screen:

NOTE for ESF NIU LOOPBACKS

You can use this function to loopback a far-end NIU from the customer premises side of the near end NIU. Set the message to NLPK-UP. Set the repetition to 7 times. 7 repetitions will allow the far end NIU to loop up without letting the signal last long enough to loop up the near end.

```
                                06:44:12

   DATA LINK SEND MESSAGE
       ESF - T1.403

 MESSAGE     - 111111000000
 REPETITION  - CONTINU







YEL-ALM PLPK-UP PLPK-DN  more
```

Figure 3–55 Data Link Send Message

In this screen you select a message to send and specify a number of repetitions to send the message. Use this procedure:

1) Select the desired message. You can do this by using the F-keys for predefined messages or by typing in the desired numbers. If you type in the message, move your cursor to the desired position and enter the 1s and 0s. You are only allowed to move the cursor between the 10th and 15th bits of the message. The rest of the 16-bit message is fixed.
   Here is what each of the predefined messages does:
   YEL-ALM sends the ESF datalink yellow alarm
   PLPK-UP sends the CSU payload loop up command.
   PLPK-DN sends the CSU payload loop down command.
   LLPK-UP sends the CSU line loop up command.
   LLPK-DN sends the CSU line loop down command.
   NLPK-UP sends the NIU loop up command.
   NLPK-DN sends the NIU loop down command.

2) When you have selected your MESSAGE, cursor down to the REPETITION item. If you would like to send the message continuously, choose CONTINU (F2). If you would like to send the message for a certain number of repetitions, choose NUMBER (F1). Then press and release the SHIFT-lock key and type in the number of repetitions you desire between 01 and 99.

3) Press the ENTER key to actually send the pattern on the data link. The desired message will be sent for you. If you chose CONTINU for the number of repetitions, the message will be sent continuously while you are in the DATA LINK CONTROL ESF menu. Exiting the menu or moving into a sub-menu will cause the message to stop.

2.12.5 PRINT T1.403 RESULTS

You can print out the results of your MONITOR T1.403 PRM session after you are done. Simply connect a printer to the test set and verify it is working by pressing the PRN SCRN key. You should see the current screen printed. Then enter the PRINT T1.403 RESULTS menu item and you will see a printout of your session.

2.12.6 RTRV 54016 PM CNTR

You can retrieve the performance monitoring data in a Pub 54016 conforming CSU with this menu item. Simply press the enter key and the test set will retrieve all the data. Page down (F2) as desired to see all the available results. Refer to Figure 3–56, RTRV 54016 PM CNTR.

Note: You must take the line out of service to retrieve the information.

```
                                06:44:12
       RTRV 54016 CNTR

 CSU STATUS: NONE
       CURRENT 15-minutes
 MEASURE TIME (sec) - 602
 ES  UAS    BES    SES  CSS   LOFC
 0   584    0      0     0    0
         PAST 24-hours
 VALID INTERVAL - 96
 ES   UAS    BES    SES
 0    1      0      0
 CSS  LOFC
 0    0

PAGE-UP  PAGE-DN
```

Figure 3–56 Retrieve Counter

2.12.7 PRINT 54016 RESULTS

First connect a printer to the SunSet T1 and verify that it is working by pressing the PRN SCRN key. You can then print the results you see from RTRV 54016 PM CNTR by entering the PRINT 54016 RESULTS menu item.

2.13 Using CSU/NI EMULATION (option SW106)

CSU/NI EMULATION gives you a simple, full-duplex emulation of a CSU or an NI. With this capability, you can unplug the CSU or NI and insert the SunSet T1 in its place. The emulation screen gives you :

- a pictorial explanation of the circuit status
- measurement results
- configuration commands to perform loopbacks

Finally, while in this mode, the test set will respond to CSU and NI loop up/down codes. See Figure 3–57.

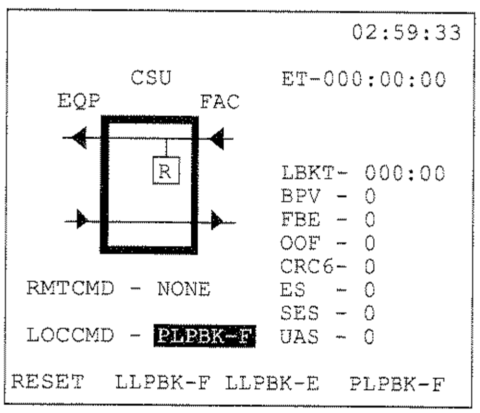


Figure 3–57 CSU/NI Emulation

To use this screen:

1) Set up your configuration in the LINE INTERFACE menu with the following settings:
   - Appropriate FRAMING for the circuit under test (not AUTO)
   - Appropriate CODING for the circuit under test (not AUTO)

- 1.544M test rate
- Appropriate LBO - FAC and LBO - EQP for the line under test.

2) Plug the cords into the test set and circuit under test. Make sure the FACILITY jacks are plugged in to the signal coming from the network. The test set will respond to loopback codes from the network.

3) Set the test set up for either NI emulation or CSU emulation. Do this by:

a) escaping to the MAIN MENU
b) entering OTHER FEATURES
c) entering TEST PARAMETERS
d) entering OTHER PARAMETERS
e) choosing CSU or NI under EMULATION TYPE

4) Return to the MAIN MENU and enter CSU/NI EMULATION. Observe the circuit error counts and see if a remote loopback command is being received. Note that the framing of the remote loopback command must be the same as the framing selected in the LINE INTERFACE menu.

5) If desired, operate any of the local commands as follows:

- RESET (F1) resets the test set to a through mode.

- LLPBK-F (F2) operates a line loopback in the facility direction. A line loopback regenerates the signal but does not reframe the signal. Hence, BPVs and frame errors will pass through the line loopback unchanged. Once the line loop back has been invoked, the LLPBK-F command will be replaced with the UNLLB-F (F2) command. In this case, pressing F2 will undo the loopback.

- LLPBK-E (F3) operates a line loopback in the equipment direction. A line loopback regenerates the signal but does not reframe the signal. Hence, BPVs and frame errors will pass through the line loopback unchanged. Once the line loop back has been invoked, the LLPBK-E command will be replaced with the UNLLB-E (F3) command. In this case, pressing F3 will undo the loopback.

- PLPBK-F (F4) operates a payload loopback in the facility direction. A payload loopback regenerates the signal, and also reframes and recodes the signal. Hence, BPVs and frame errors will be eliminated as they pass through the payload loopback. Once the payload loopback has been invoked, the PLPBK-F command will be replaced with the UNPLB-F (F4) command. In this case, pressing F4 will undo the loopback.

6) When you are finished with the session, press ESCAPE and you will return to the MAIN MENU. All loopbacks will be dropped as you exit the session, and the LINE NTERFACE settings will be reinstated.

1.0 Basic Applications

1.1 Accepting a New Span

Here is a procedure for accepting a new span. The set-up is illustrated in Figure 4–1.

1) Verify that the span is not in service. This acceptance test will disrupt service.
   Find out what kind of loopback device is installed at the end of the span, and what loopback codes operate it.

2) Switch on the test set. Press the ENTER key to advance to the MAIN MENU.

3) Enter the LINE INTERFACE item by pressing the ENTER key. Set the screen settings to:
   INTERFACE: SINGLE
   MODE: TERM
   FRAMING: as specified by your design
   CODING: as specified by your design
   TEST RATE: 1.544M
   REF CLOCK: INTERN
   LBO - FAC: 0 dB (ft)
   Press ENTER when your settings are correct.

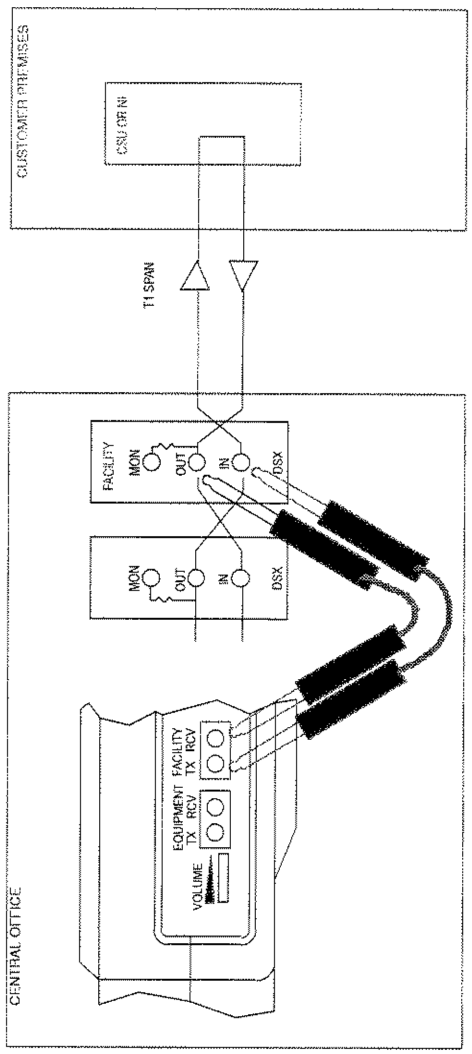


Figure 4–1 Accepting a New Span

4) Connect the test set to the circuit as shown in Figure 4–1. Press the HISTORY key to acknowledge the blinking history lights and turn them off.

5) Move the cursor to the LPBK & SPAN CONTROL menu and press ENTER. Press ENTER on CSU & NI CONTROL. For SF framing, set up the screen with:

TYPE: IN-BAND
CODE: NI or CSU, as appropriate.
Do not actually select the LOOP-UP entry until last.

For ESF framing, set up the screen with:
TYPE: ESF-DL
CODE: NETWORK (NIU) or LINE (CSU), as appropriate.
Do not actually select the LOOP-UP entry until last.

When you press the ENTER or LOOP-UP key, you will see a "LOOPING UP" message followed by a "LOOP UP SUCCEEDED" message. You may press the GRAPHIC key if you would like visual confirmation of the circuit configuration. Refer to Section 6 for additional information about the loopback capabilities.

6) Press ESCAPE until you have returned to the MAIN MENU. Move the cursor to the SEND TEST PATTERN menu item and press ENTER. Select the pattern you would like to send.

7) Enter the BASIC MEASUREMENTS menu item. Verify that the span performs to your company's requirements for the service delivered. If necessary, see Section 5 for the measurement definitions.

8) When you have finished with the BASIC MEASUREMENTS, press ESCAPE to return to the MAIN MENU. Enter the LPBK & SPAN CONTROL item. Enter the CSU & NI CONTROL item. Set the MODE to LOOP-DN to release the loopback. You should be able to leave the other settings as they were. Verify that the LOOP DOWN SUCCEEDED message is shown.

9) Disconnect your test set from the circuit.

1.2 Accept a New Service

Here is a procedure for accepting a new service. The test setup is shown in Figure 4–2.

1) Verify that the span is not in service. This acceptance test will disrupt service.

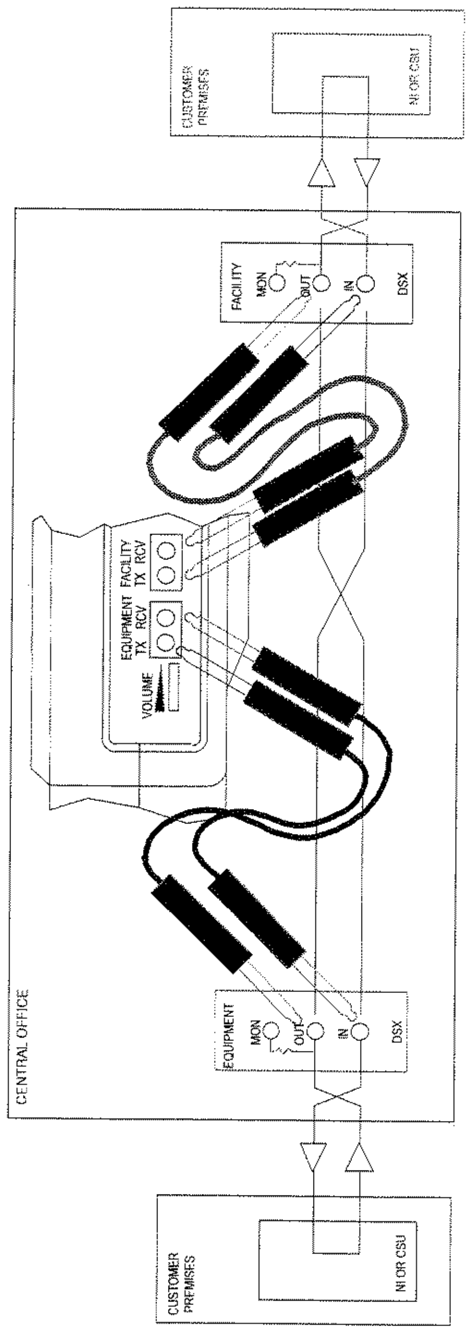


Figure 4-2 Accepting a New T1 Service

2) Switch on the test set. Wait for the graphic picture of the circuit configuration to be displayed. Press ENTER to move to the main menu.

3) Enter the LINE INTERFACE menu by pressing the ENTER key. Set the screen settings to:
   INTERFACE: DUAL
   MODE: SPLT-F
   FRAMING: as specified
   CODING: as specified
   TEST RATE: 1.544M
   REF CLOCK: INTERN
   LBO - FAC: 0 dB (ft)
   Press the ENTER key when all the settings are as desired.

4) Connect the test set to the circuit as shown in Figure 4–2.

5) Move the cursor to the LPBK & SPAN CONTROL menu; ENTER the CSU & NI CONTROL item.

   For SF framing, set up the screen with:
   MODE: LOOP-UP (Do not actually select the LOOP-UP entry until last).
   TYPE: IN-BAND
   CODE: NI or CSU, as appropriate.

   For ESF framing, set up the screen with:
   MODE: LOOP-UP (Do not actually select the LOOP-UP entry until last).
   TYPE: ESF-DL
   CODE: NETWORK (NIU) or LINE (CSU), as appropriate.

   Press ENTER when your settings are correct.

   You will see a "LOOPING UP" message followed by a "LOOP UP SUCCEEDED" message. You have now operated the loopback device on the facility side of the circuit. You may press the GRAPHIC key for a visual confirmation of the circuit configuration. Refer to Section 6 for additional loopback information.

6) Press ESCAPE as necessary to return to the MAIN MENU. Enter the LINE INTERFACE menu. Change the MODE to

SPLT-E; press ENTER.

7) Repeat step 5 for the loopback device on the equipment side of the circuit.

8) Press ESCAPE as necessary to return to the MAIN MENU. Enter the LINE INTERFACE menu. Change the MODE to SPLT-A. You will need to press the F4 ("more") key when the cursor is on the MODE line in order to do this.

Press the GRAPHIC key to confirm your set-up. You should now have the span completely looped up from end to end so that the signal transmitted by the test set will be looped around the entire span.

9) Press ESCAPE as necessary to return to the MAIN MENU. Enter the SEND TEST PATTERN menu. Cursor over to the pattern you want to transmit; press ENTER.

10) Press ESCAPE as necessary to return to the MAIN MENU. Enter the BASIC MEASUREMENTS menu. Verify that the span performs to your company's requirements for the service delivered. If necessary, see Section 6 for an additional explanation about the BASIC MEASUREMENTS.

11) When you are finished with the BASIC MEASUREMENTS, press ESCAPE to return to the MAIN MENU. Enter the LPBK & SPAN CONTROL menu. Enter the CSU & NI CONTROL item. Set the MODE to LOOP-DN in order to release the loopback. Verify that the "LOOP DOWN SUCCEEDED" message is displayed.

12) In the same manner, drop the loopback at the other end of the circuit.

13) Disconnect the test set from the circuit.

1.3 Monitor an In-service Circuit

Here is a procedure for monitoring a span that is in-service. The set-up is illustrated in Figure 4–3.

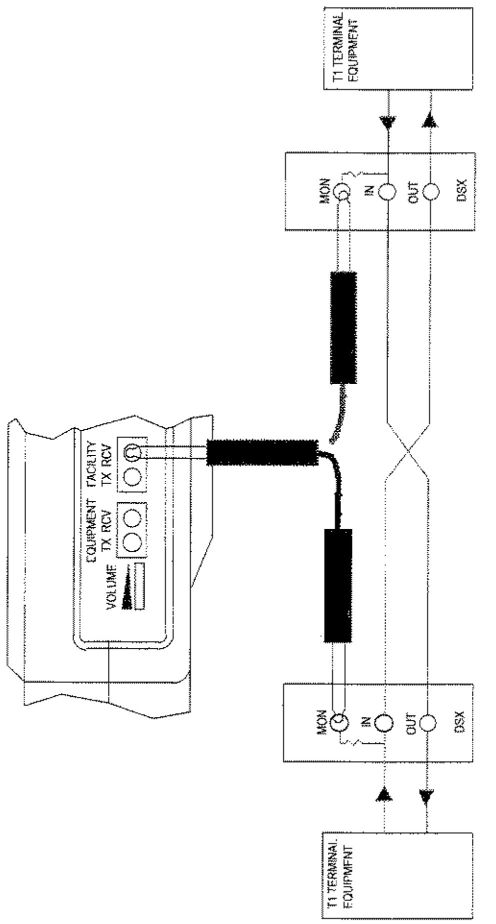


Figure 4–3 Monitoring an In-Service Circuit

1) This test may be performed while the span is carrying live customer traffic.

2) Switch on the test set.

3) From the MAIN MENU, enter the LINE INTERFACE item. Configure the test set for SINGLE, DSXMON, AUTO, AUTO, INTERN, 1.544M, 0dB(ft).

4) Connect the test set to the circuit as shown in Figure 4–3. Press the HISTORY key to acknowledge the blinking history lights and turn them off.

5) Examine the LEDs and the GRAPHIC screen for information about the circuit under test.

The pulses light should be lit, and a valid framing type should be indicated. A steady ERRORS or BPV light will tell you that the circuit is working but that it is experiencing trouble. SIG LOSS, and FRM LOSS are indications of severe problems. A YEL ALM indication will show a problem on the other side of the circuit. AIS may indicate a trouble condition where a network element transmitting to the test set has lost its incoming DS1 signal and has replaced it with the AIS signal. LOW DENS and EXCESS 0s are indications that the traffic on the DS1 is not conforming to minimum network pulse density requirements.

The graphic screen will show what kind of pattern, if any, is being received by the test set.

If you need additional information proceed to step 6. Otherwise, disconnect your test set from the circuit.

6) You may make a basic measurement by using this procedure. Press ESCAPE as necessary until you arrive at the MAIN MENU. Enter the BASIC MEASUREMENTS menu. Verify that the span performs to your company's requirements for the service delivered. If necessary, see Sections 5 and 6 for an additional explanation about the BASIC MEASUREMENTS.

7) When you are finished, disconnect your test set from the circuit.

1.4 Loop Back a CSU or NI

Here is a procedure for looping back a CSU or NI. The set-up is illustrated in Figure 4–1.

1) Verify that the span is not in service. Looping the span will disrupt service.

2) Switch on the test set. Wait for the GRAPHIC to be displayed. Press ENTER to move to the main menu.

3) Enter the LINE INTERFACE menu. Configure the settings for:

INTERFACE: SINGLE
MODE: TERM
FRAMING: as specified by your design
CODING: as specified by your design
REF CLOCK: INTERN
TEST RATE: 1.544M
LBO - FAC: 0 dB (ft)

Press ENTER when your settings are correct.

4) Connect the test set to the circuit as shown in Figure 4–1. Press the HISTORY key to acknowledge the blinking history lights and turn them off.

5) Enter the LPBK & SPAN CONTROL menu. Enter the CSU & NI CONTROL item.

For SF framing, set the screen for:

MODE: LOOP-UP (Do not select this until your other screen settings are correct).
TYPE: IN-BAND
CODE: NI or CSU, as appropriate

For ESF framing, set the screen for:

MODE: LOOP-UP (Do not select this until your other screen settings are correct).
TYPE: ESF-DL
CODE: NETWORK (NIU) or LINE (CSU), as appropriate

You will see a "LOOPING UP" message followed by a "LOOP UP SUCCEEDED" message. You may press the GRAPHIC key if you would like a visual confirmation of the loopback. If necessary, refer to *Section 6* for additional information about loopback functions.

6) When you are finished, press the ESCAPE key as required to return to the MAIN MENU. Enter the LOOPBACK CONTROL menu. Set the MODE to LOOP-DN in order to release the loopback. The other screen settings should be correct. Verify that the "LOOP DOWN SUCCEEDED" message is displayed.

7) Disconnect your test set from the circuit.

1.5 Stress a T1 Line

Follow this procedure for stress testing a T1 line:

1) Set up the span for testing as outlined in Section 1.1 or 1.2. Proceed up to the point where measurements are to be performed.

2) Before performing the BASIC MEASUREMENTS, select a stress pattern for the line. Do this by pressing ESCAPE as necessary until you arrive at the MAIN MENU. Then enter the SEND TEST PATTERN menu. Cursor over to the desired stress pattern. The test set will immediately begin transmitting the highlighted test pattern.

3) Once the pattern has been sent, see if the BPV and/or ERRORS LEDs are lit. If they are, you may have illustrated how the customer could be having a problem with the circuit. Try additional stress patterns as desired. QRS is the original stress pattern and is used as the default stress pattern in the test set. Here are some other stress patterns and their application:

55 Daly
This pattern stresses ability of regenerators to follow timing circuit phase changes. Stresses ability to pass zero patterns. Most useful on AMI lines.

3-in-24
This pattern contains maximum number of legal zeroes and minimum allowable ones density. Most useful on AMI lines.

2e23 and 2e20
These patterns are like QRS except that they are not zero-constrained. 2e23 has a maximum of 23 zeroes in a row, and 2e20 has 20 zeroes in a row. Note that AMI circuits are only specified to carry 15 zeroes in a row, so these patterns stress these circuits beyond what they are designed to carry. Despite

the long individual zero strings, the patterns average 50% ones density.

1-in-8
This pattern is like 3-in-24 except it has a maximum of 7 zeroes in a row. This is the best low density pattern for stressing B8ZS circuits.

1-in-16
This pattern puts enormous stress on AMI circuits, especially line repeaters. This pattern averages only 6% density which is far under the specified 12.5% density for AMI lines. The pattern does not cause problems for circuits with B8ZS coding.

All 1s
This pattern requires the most power from regenerating circuitry and may cause the pulse level to drop.

BRIDGE TAP DETECT patterns
This is a collection of patterns that have been known to show the presence of bridge taps. This pattern group is actually its own measurement and is found in the OTHER MEASUREMENTS menu.

Other patterns
Several additional patterns are available in the set for stress testing. See Section 5 for additional patterns and a discussion of their application.

4) When you are finished, release the loopback and disconnect your test set from the circuit.

1.6 Verify Proper B8ZS/AMI Optioning

A common fault in new circuits is a B8ZS/AMI optioning mismatch in one or more network elements. This procedure will help you determine if this problem exists in your circuit.

1) Set up the test set and circuit as described in Sections 1.1 or 1.2. If you test to one end of the circuit first, as in 1.1, be sure

to repeat the procedure to the other end of the circuit as well.

Make sure the test set's line CODING is set to the same line coding as is supposed to be present on the circuit. Get the circuit looped up and ready for testing.

2) Transmit an all 1s signal and an alternating 1s and 0s signal. Verify that there are no errors with any of these signals. If there are any errors, then you have problems that are not associated with a B8ZS/AMI mismatch.

3) Transmit a 3-in-24 signal. If any equipment in the line has optioning that disagrees with the test set, then you will see a loss of synch or excessive errors.

4) Verify the diagnosis by transmitting QRS. QRS will also cause errors when there is an AMI/B8ZS mismatch in the circuit.

5) Note that in the set-ups of Sections 1.1 and 1.2 that the customer's T1 terminating equipment is isolated from the circuit. Thus, if the customer's equipment has the optioning problem, the previous procedure will not expose it while the circuit is looped up.

If the circuit tests fine while looped up, but fails when looped down, then check if the line code monitored in one direction is not the same as the line code monitored in the other direction. If it isn't, then the customer's equipment may be at fault. If the problem still isn't evident from the central office, then a trip to the customer's premises may be required.

1.7 Checking for Frame Slips and Frequency Sync

Frequency synchronization can be a problem when:

- the customer purchases a channelized T1 circuit
- the customer's circuit passes through a synchronous network element such as a switch, PBX or a digital cross-connect system (DCS)
- the T1 circuit passes through more than one carrier

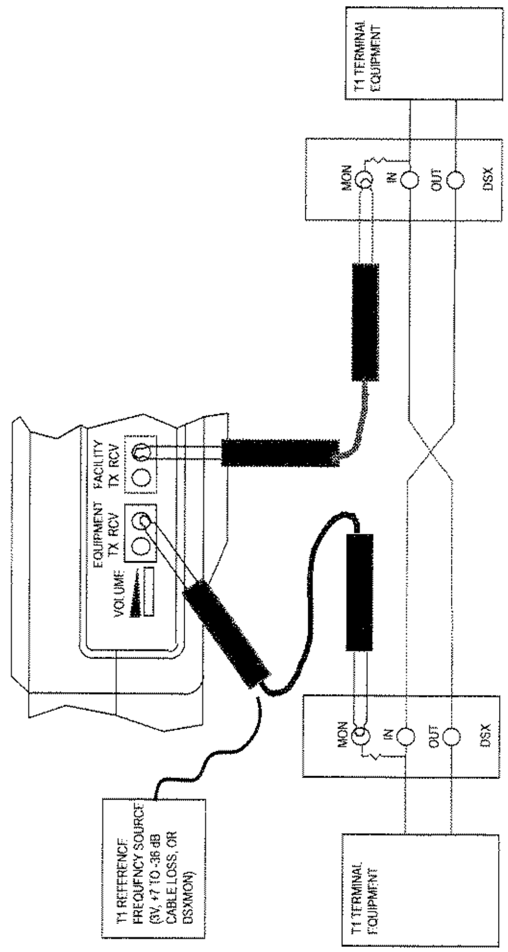


Figure 4–4 Freaquency Synchronization Problems

Frequency synchronization problems result in frame slips, a major source of service impairment. Referring to Figure 4–4, use this procedure to identify frequency synchronization problems:

1) Obtain a reference frequency source. This can be the other side of the customer's circuit or it can be a 1.544 Mbps reference signal that is traceable to a stratum 1 level clock.

2) This test may be performed while the span is carrying live customer traffic.

3) Turn the power on to the test set.

4) From the main menu, enter the LINE INTERFACE item. Configure the screen settings for:
   INTERFACE: SINGLE
   MODE: DSXMON
   FRAMING: AUTO
   CODING: AUTO
   REF CLOCK: EX-TERM (if a 3V source with up to 36 dB loss) or, EXT-MON (if a DSXMON signal is used)
   TEST RATE: 1.544M
   LBO - FAC: 0 dB (ft)

   Press ENTER when your screen settings are correct. Connect the reference T1 signal to the EQUIPMENT RCV jack on the side of the test set.

5) Plug the FACILITY RCV jack (side of test set) into the DSX MON jack or other MON jack of your circuit. Press the HISTORY key to acknowledge the blinking history lights and turn them off.

6) Press ESCAPE as necessary until you arrive at the MAIN MENU. Enter the BASIC MEASUREMENTS menu. Press the PAGE-UP (F1) key once to view the RESULTS - FREQUENCY screen. You can see if there is a problem because the frequency slip bar will be moving across the screen. If there is no bar drawn, then there is no slippage occurring.

7) If you have used an external signal source, be sure to check both sides of your circuit. If you have used one side of the circuit as your reference and the other side as the tested signal, then you are done. Disconnect your test set from the circuit.

1.8 Measure Signal Level

You can measure signal level while performing one of the other tests, or you can measure signal level just by itself.

At a DSX, the level should be between 2.7 and 3.3 volts measured from the OUT jack.

At a repeater housing, the voltage should generally be between 2.4 and 3.3 volts on either of the repeater outputs. The loss at the repeater inputs should generally be between 10 dB and 35 dB.

The signal strength at the incoming side of an office repeater bay CSU, or NI should be from 0 dB to -15 dB.

If there is a signal on the OUT jack, use the set-up shown in Figure 4–5 to measure the level. Otherwise, use the set-up shown in Figure 4–1. Here is a procedure for measuring the signal level:

1) Choose what kind of access mode you want to use. You can make the measurement in TERM, DSXMON, and BRIDGE modes. TERM and BRIDGE provide the most accurate results, but DSXMON may be the most convenient mode. TERM also will disrupt service. BRIDGE is accurate, but the result may be degraded by a low-quality termination at the network element terminating the T1 line. A DSXMON measurement should generally show a result of about -20 dB.

   For the rest of this procedure we will use the TERM mode for illustrative purposes. Verify that the span is not in service. Using the TERM mode will disrupt service.

2) Switch on the test set. From the main menu, enter the LINE INTERFACE menu and set the MODE to TERM. Now press ENTER to return to the main menu.

3) Connect the test set to the circuit as shown in Figure 4–5. Press the HISTORY key to acknowledge the blinking history lights and turn them off.

4) Enter the BASIC MEASUREMENTS menu. Press the PAGE-DN (F2) key twice to move to the RESULTS-SIGNAL screen. Read the signal level. Note that separate readings are given for the positive and negative signals so that you can get more accurate information on a faulty regenerator.

5) When you are finished, disconnect your test set from the circuit.

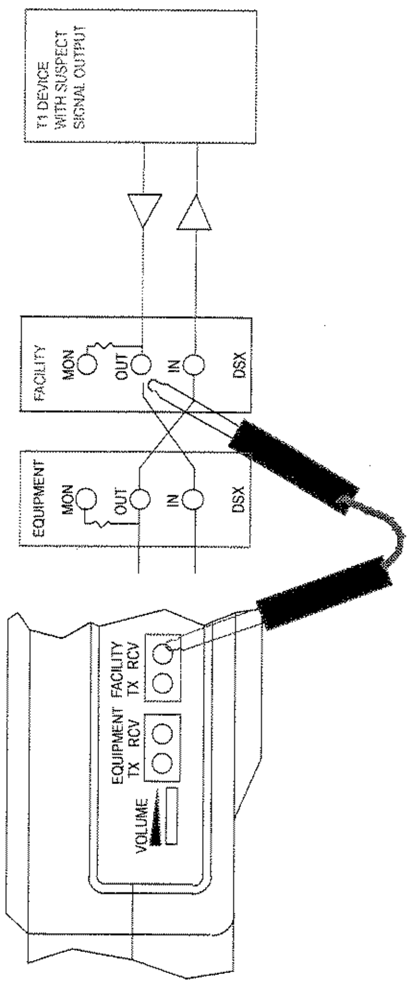


Figure 4–5 Measuring Signal Level

1.9 Run a Timed Test

Many network tests require the use of an exact time period such as 15 minutes, 1 hour, or 24 hours over which to conduct a test. In this section you will set up the timer for one of these tests. Use the following procedure:

1) Use the desired procedure from Section 1.1, 1.2, or 1.3 as the basis for your testing.

2) Switch on the test set.

3) From the MAIN MENU, enter the OTHER FEATURES item. Enter the TEST PARAMETERS item. Enter the MEASUREMENT CRITERIA item. For the MEAS DURATION, press TIMED (F1). Now press and release the SHIFT-lock key. The SHIFT indicator will appear in the upper left-hand corner of the screen. Enter the number of hours and minutes that you want the test to run. The format is (hhh:mm). Press ENTER when your setting is correct. Press ESCAPE until you arrive at the main menu.

4) Proceed with the test procedure as outlined in Section 7.1, 7.2, or 7.3. When you perform the BASIC MEASUREMENTS, the test will now be timed. You can see how much time is remaining by viewing the RT (Remaining Time) indicator in the upper right-hand corner of the screen.

1.10 Check the DSX Wiring

Occasionally, a miswired DSX can be the source of a circuit problem. Use the following procedure to verify that the DSX has been wired correctly:

1) Verify that the span is not in service. This test will disrupt service.

2) If the DSX is very large, you may need two test sets or a very long cord for this test. Switch on both of the test sets. Wait for the graphic to be displayed. Then press ENTER to move to the main menu.

3) For each test set, enter the LINE INTERFACE menu. Configure the screen settings for:
   INTERFACE: SINGLE
   MODE: TERM
   FRAMING: as specified by your design
   CODING: as specified by your design

REF CLOCK: INTERN
TEST RATE: 1.544M
LBO - FAC: 0 dB (ft)

Press the ENTER key when all the settings are as desired.

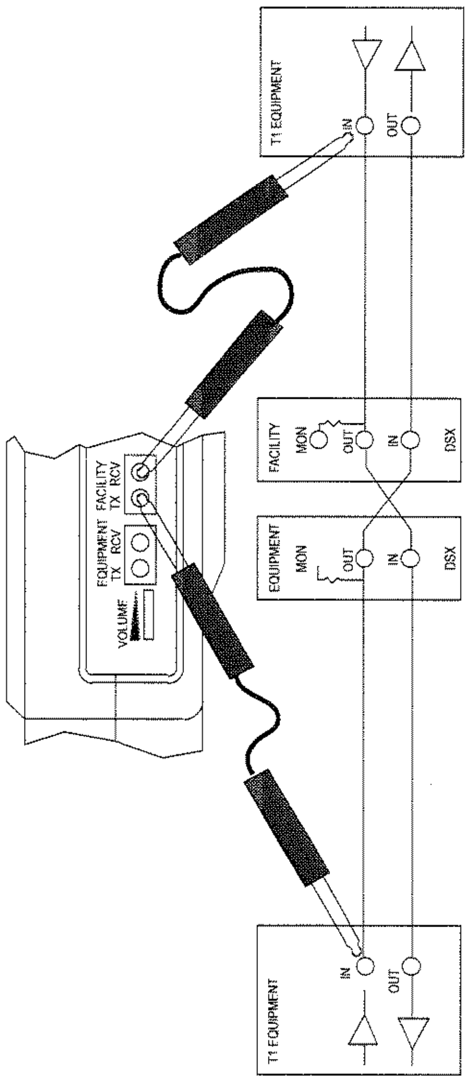


Figure 4–6 Checking the DSX Wiring

4) Connect the test set to the circuit as shown in Figure 4–6. You may use one test set as shown in the diagram or two test sets if the two pieces of equipment are not located close to each other. You will need to find a point on either side of the DSX where you can connect the test set. This point could be at test jacks on the network equipment on either side of the DSX. You will need to make sure that you have opened the circuit at each point so that the test set is not bridge-tapped onto the existing circuit. Once you have connected to the circuit, press the HISTORY key to acknowledge the blinking history lights and turn them off.

5) Verify that each test set shows the PAT SYNC LED on and the BPV and ERRORS LEDs off. This means that the circuit is wired through the DSX properly. Next, press the ERR INJ key on one of the test sets. Verify that the BPV and ERRORS lights come on and then start to blink on the other test set. This assumes that each test set is configured to inject 1 BPV and 1 BIT error. Now repeat the process by pressing the ERR INJ key on the other test set. Verify that the BPV and ERRORS lights come on and then start to blink on the first test set. This verifies that each direction is properly wired through the DSX and that the test sets didn't synch on a signal source on another circuit.

6) Repeat the procedure for the other direction of the circuit.

7) When you are finished, disconnect both test sets from the circuit. Make sure the circuit is restored to its original through condition.

1.11 Observe Network Codes or Channel Data

The SunSet T1 provides a large screen display which is useful for analyzing live circuit data. In addition to a display of the binary data, hexadecimal and ASCII translations are provided to you. This display can be used to decode T1 network control codes that are in use, and can also be used to verify the contents of DDS channels.

32 pages of data are stored at once so that you can scroll down through the information and observe changes over time.

This number of pages can also tell you whether a T1 network pattern is interleaved with the framing bit or is overwritten by the framing bit. Use this procedure:

1) This test may be performed while the span is carrying live customer traffic if a BRIDGE or DSXMON access mode is used. The test can also be performed out-of-service if the TERM mode is used.

2) Switch on the test set.

3) From the main menu, enter the LINE INTERFACE menu and specify DSXMON or BRIDGE mode if the circuit is carrying live traffic. Specify your other settings as desired. If you want to have frame alignment on the received signal, be sure the set frames up successfully.

4) Connect the test set to the circuit as shown in Figure 4–3 (DSXMON) or 3–5 (Bridge). Press the HISTORY key to acknowledge the blinking history lights and turn them off.

5) Press ESCAPE as necessary to arrive at the main menu. Enter the OTHER MEASUREMENTS menu. Enter the VIEW RECEIVED DATA item. You will now receive a display of the data.

6) Review the live data as it is displayed. When the codes that you are interested in appear, press the PAUSE (F3) key to trap 32 pages of data. Then press PAGE-DN (F2) to scroll through the data. The data is presented as it appears on the T1 bit stream. The data is broken out into timeslots for you. Use this table to convert from timeslot number to channel number:

Channel Numbering

T/S	D3/D4	D1D	D2
1	1	1	12
2	2	13	13
3	3	2	1
4	4	14	17
5	5	3	5
6	6	15	21
7	7	4	9
8	8	16	15
9	9	5	3
10	10	17	19
11	11	6	7
12	12	18	23
13	13	7	11
14	14	19	14
15	15	8	2
16	16	20	18
17	17	9	6
18	18	21	22
19	19	10	10
20	20	22	16
21	21	114	4
22	22	23	20
23	23	12	8
24	24	24	24

Channel Numbering - SLC-96

T/S	SHLF A	SHLF B	SHLF C	SHLF D
1	1	25	49	73
2	13	37	61	85
3	2	26	50	74
4	14	38	62	86
5	3	27	51	75
6	15	39	63	87
7	4	28	52	76
8	16	40	64	88
9	5	29	53	77
10	17	41	65	89
11	6	30	54	78
12	18	42	66	90
13	7	31	55	79
14	19	43	67	91
15	8	32	56	80
16	20	44	68	92
17	9	33	57	81
18	21	45	69	93
19	10	34	58	82
20	22	46	70	94
21	11	35	59	83
22	23	47	71	95
23	12	36	60	84
24	24	48	72	96

7) Figure 4.7 shows an example of the ten-bit pattern, 1011 1111 11.

```
                                09:59:33

         VIEW RECEIVED DATA
 PAGE : 01
 T/S   BINARY     HEX    ASCII
 001  10111111  BF (FD)    ( )
 002  11101111  EF (F7)    ( )
 003  11111011  FB (DF)    ( )
 004  11111110  FE (7F)    ( )
 005  11111111  FF (FF)    ( )
 006  10111111  BF (FD)    ( )
 007  11101111  EF (F7)    ( )
 008  11111011  FB (DF)    ( )

PAGE-UP PAGE-DN RESUME
```

Figure 4–7 Ten-Bit Pattern

8) When you are finished, disconnect your test set from the circuit.

1.12 Determine Round Trip Circuit Delay

Refer to Figure 4–1 and use this procedure:

1) Verify that the span is not in service. This test will disrupt service.

2) Switch on the test set.

3) From the main menu, enter the LINE INTERFACE item. Configure the screen settings for:
   INTERFACE: SINGLE
   MODE: TERM
   FRAMING: as specified by your design
   CODING: as specified by your design
   REF CLK: INTERN
   TEST RATE: 1.544M
   LBO - FAC: 0 dB (ft)
   Press the ENTER key when all the settings are as desired.

4) Connect the test set to the circuit as shown in Figure 4–1. Press the HISTORY key to acknowledge the blinking history lights and turn them off.

5) Move the cursor to the LPBK & SPAN CONTROL menu item and press ENTER. Then enter the CSU & NI CONTROL item. For SF framing, set up the screen with:
   MODE: LOOP-UP (Do not select this item until the other settings are correct)
   TYPE: IN-BAND
   CODE: NI or CSU, as appropriate

   For ESF framing, set up the screen with:
   MODE: LOOP-UP (Do not select this item until the other settings are correct)
   TYPE: ESF-DL
   CODE: Network (NIU) or LINE (CSU), as appropriate

   You will see a "LOOPING UP" message followed by a "LOOP

UP SUCCEEDED" message. You may press the GRAPHIC key if you would like a visual confirmation. Refer to Section 6 for additional information about the loopback capabilities.

6) From the main menu, enter the OTHER MEASUREMENTS item. Enter the PROPAGATION DELAY item. The set will then perform a propagation delay measurement for you on the looped-up circuit. Read the value of circuit delay reported in uS (microseconds).

7) When you are finished, ESCAPE back to the main menu. Enter the LPBK & SPAN CONTROL menu, then enter the CSU & NI CONTROL item. Set the MODE to LOOP-DN in order to release the loopback. Verify that the "LOOP DOWN SUCCEEDED" message is displayed.

8) Disconnect your test set from the circuit.

1.13 Determine Distance to Loopback

Refer to Figure 4–1 and use this procedure:

1) Verify that the span is not in service. This test will disrupt service.

2) Switch on the test set.

3) From the main menu, enter the LINE INTERFACE item. Configure the screen settings for:
   INTERFACE: SINGLE
   MODE: TERM
   FRAMING: as specified by your design
   CODING: as specified by your design
   REF CLK: INTERN
   TEST RATE: 1.544M
   LBO - FAC: 0 dB (ft)
   Press the ENTER key when all the settings are as desired.

4) Connect the test set to the circuit as shown in Figure 4–1. Press the HISTORY key to acknowledge the blinking history lights and turn them off.

5) Move the cursor to the LPBK & SPAN CONTROL menu item and press ENTER. Then enter the CSU & NI CONTROL item. For SF framing, set up the screen with:

MODE: LOOP-UP (Do not select this item until the other settings are correct)
TYPE: IN-BAND
CODE: NI or CSU, as appropriate

For ESF framing, set up the screen with:

MODE: LOOP-UP (Do not select this item until the other settings are correct)
TYPE: ESF-DL
CODE: Network (NIU) or LINE (CSU), as appropriate

You will see a "LOOPING UP" message followed by a "LOOP UP SUCCEEDED" message. You may press the GRAPHIC key if you would like a visual confirmation. Refer to Section 6 for additional information about the loopback capabilities.

Note that you could do this for any type of loopback - hardware loopback, repeater loopback, and so on.

6) From the main menu, enter the OTHER MEASUREMENTS item. Enter the PROPAGATION DELAY item. The set will then perform a propagation delay measurement for you on the looped-up circuit.

Read the value of circuit delay reported in kFt. This will tell you how many kilofeet there are between the test set and the loopback device. This measurement is accurate to about 1000 feet and is useful for making sure that the looped repeater is in the apparatus case that you expect it to be in.

This measurement is only valid if the line does not pass through any network elements and/or transmission elements that introduce appreciable delay. Line repeaters will not cause a problem. Fiber muxes, 3x1 muxes, and 3x1 digital cross-connect systems definitely will cause a problem. Office repeater bays that are equipped with dejittering circuits can cause a problem.

Even if you have devices that cause excessive delay, you can still get good data by looking at the difference in delay time between a loopback at a known location and a loopback at the unknown location.

7) When you are finished, ESCAPE back to the main menu. Enter the LPBK & SPAN CONTROL menu, then enter the CSU & NI CONTROL item. Set the MODE to LOOP-DN in order to release the loopback. Verify that the "LOOP DOWN SUCCEEDED" message is displayed.

8) Disconnect your test set from the circuit.

1.14 Monitor a Voice Frequency Channel

Here is a procedure for monitoring a voice frequency channel within a T1 circuit. The set-up is illustrated in Figure 4-3.

1) This test may be performed while the span is carrying live customer traffic.

2) Switch on the test set.

3) From the main menu, enter the LINE INTERFACE item. Set the screen settings to:
   - INTERFACE: SINGLE
   - MODE: BRIDGE (Fig 6.5B) or DSXMON (Fig 7.3A)
   - FRAMING: AUTO
   - CODING: AUTO
   - REF CLOCK: INTERN
   - TEST RATE: 1.544M
   - LBO - FAC: 0 dB (ft)

   Press ENTER when your settings are correct.

4) Connect the test set to the circuit. Press the HISTORY key to acknowledge the blinking history lights and turn them off.

5) Press ESCAPE until you arrive at the main menu.

   Enter the VF CHANNEL ACCESS menu. Enter the VF MEASUREMENTS item. Select your desired transmit and received channels. The channel number is automatically converted to a timeslot number for you on SF-D4, ESF, and SLC-96 A-digroup DS1s. The set refers to the framing type to make this conversion for you. If you are using another type of framing, refer to the channel numbering tables on pages 4-21 and 4-22 to determine which timeslot to specify within the test set.

Adjust the volume to the desired level by using the volume control on the right-hand side of the test set.

NOTE: If you are not able to monitor the channel, verify that the AUTO framing of the test set was able to synch onto a recognized framing pattern. The test set will not perform the monitor function if framing is unavailable. Press the RESYNCH key to restart the auto framer if a valid frame pattern is not shown. If this doesn't work, try unplugging and replugging the receive cord. This will positively verify that there is no recognizable framing at this moment.

6) When you are finished, disconnect your test set from the circuit.

1.15 Simple Talk/Listen

Here is the simplest procedure for talking and listening on a T1 circuit. The set-up is illustrated in Figure 4–1. However, instead of having a loopback at the far end of the circuit, your might have another test set, a channel bank, a switch, or other T1 terminating network element. Use this procedure:

1) Verify that the span is not in service. This test will disrupt service for the 23 channels that you are not using.

2) Switch on the test set. Wait for the graphic to be displayed. Then press ENTER to move to the main menu.

3) Enter the LINE INTERFACE menu. Configure the screen settings for:
   INTERFACE: SINGLE
   MODE: TERM
   FRAMING: as specified by your design
   CODING: as specified by your design
   REF CLK: INTERN
   TEST RATE: 1.544M
   LBO - FAC: 0 dB (ft)
   Press ENTER when your settings are correct.

NOTE: Beware if you select AUTO or UNFRAME for the framing type. It is not possible to perform talk and listen on an unframed signal. One of the framing LEDs must light for this procedure to work.

4) Connect the test set to the circuit as shown in Figure4–1. Press the HISTORY key to acknowledge the blinking history lights and turn them off.

5) From the main menu, enter the VF CHANNEL ACCESS item. Enter the VF MEASUREMENTS item. Select the receive (listen) and transmit (talk) channels - they are usually the same. You can now talk and listen on the channel which you have selected. Adjust the volume to the desired level by using the volume control on the right-hand side of the test set.

NOTE: The test set will automatically convert the channel number to a timeslot for you on SF-D4, ESF, and SLC-96 A digroups. For other framing formats or digroups, refer to the channel numbering tables at the end of sub-section 1.11 to determine which "channel" to specify within the test set.

6) When you are finished, disconnect the test set from the circuit.

1.16 Advanced Talk/Listen

Use the Simple Talk/Listen procedure as a reference for this one. This procedure lets you use different access modes, signaling, and other additional features.

1) Verify that the span is not in service if you will be using a disruptive access mode.

2) Switch on the test set. Press ENTER to move to the main menu.
3) Configure the set for the appropriate line interface mode:

• TERM: In the TERM mode, the test set drops and inserts on the selected channels and fills the other 23 channels with idle code. The received signal is terminated at the test set and is not retransmitted. Refer to Section 1.1 and Figure 4–1 for assistance in setting up this mode.

- LOOP, MON-LP, BRG-LP (drop and insert): In these loop modes the test set talks and listens on the selected channel. It receives and retransmits the other 23 channels without disruption. Using the loop modes will cause a momentary hit on the circuit when the test set is plugged into the circuit and when it is unplugged.

- THRU-A, THRU-B: In these modes, the talk/listen will be performed on the A- or B-side of a full-duplex circuit access. The other 23 channels of that side will be transmitted through without disruption. All 24 channels of the other side will be transmitted without disruption.
  There will be a momentary hit on both sides when the test set is plugged into the circuit and when it is unplugged. There will also be a hit if you change access modes from one side to the other side, even when the cords are already plugged in.

- LOOP-E, LOOP-F: In the LOOP-E and LOOP-F modes the test set talks and listens on the selected channels. It receives and retransmits the other 23 channels without disruption. There will be a momentary hit on the circuit when the test set is plugged in and when it is unplugged.

4) Connect the test set to the circuit according to the access mode you have selected. Press the HISTORY key to acknowledge the blinking history lights and turn them off.

5) From the main menu, enter the VF CHANNEL ACCESS menu.

6) Enter the VF MEASUREMENTS item. Select the receive (listen) and transmit (talk) channels that you want. Make sure that the TEST TONE item is DISABLED. If you need to access a D1D, D2, or SLC-96 digroups B-D, refer to the timeslot charts in the previous sections. You will now be able to talk and listen on the channel you selected. Adjust the volume to the desired level by using the volume control on the right-hand side of the test set.

7) If you need to control supervision of the circuit, enter the supervision bits you want in order to go off hook, send ringing, or other state. Send the bits by pressing the ENTER key or pressing the appropriate supervision F-key. View the super-

vision bits that are returned on this same screen. Press the ESCAPE key to exit this screen. You will still be sending the last supervision bits you sent for the remainder of the session.

For your reference, here are many of the common signaling arrangements used on D4 channel banks. TRMT refers to the signaling bits transmitted by the channel bank equipped with indicated channel card. RCV refers to the signaling bits received by the channel bank. * means that either a 1 or a 0 may appear.

Dial Pulse Originating (DPO)

VF input to DPO	TRMT A	TRMT B	RCV A	RCV B	DPO VF Output
Loop open	0	0	*	*	
Loop closure	1	1	*	*	
	*	*	0	*	Normal battery
	*	*	1	*	Reverse battery

Dial Pulse Terminating (DPT)

VF input to DPT	TRMT A	TRMT B	RCV A	RCV B	DPT VF ouput
Normal battery	0	0	*	*	
Reverse battery	1	1	*	*	
	*	*	0	*	Loop open
	*	*	1	*	Loop closure

2- or 4-wire E&M

E&M input	TRMT A	TRMT B	RCV A	RCV B	E&M output
M-lead grd or open	0	0	*	*	
M-lead battery	1	1	*	*	
	*	*	0	*	E-lead open
	*	*	1	*	E-ld grd or looped

Revertive Pulse Originating (RPO)

VF input to RPO	TRMT A	TRMT B	RCV A	RCV B	RPO VF output
Loop open	0	0	*	*	
Loop closure	1	1	*	*	
	*	*	0	1	Normal batt, no RP
	*	*	0	0	Norm batt and RP
	*	*	1	*	Reverse battery

Revertive Pulse Terminating (RPT)

VF input to RPT	TRMT A	TRMT B	RCV A	RCV B	RPT VF output
Normal battery	0	0	*	*	
Reverse battery	1	1	*	*	
	*	*	0	*	Loop open
	*	*	1	*	Loop closure

Sleeve Dial Pulse Originating (SDPO)

VF input to SDPO	TRMT		RCV		SDPO VF output
	A	B	A	B	
Loop open	0	0	*	*	No sleeve ground
Loop closure	1	1	*	*	Sleeve ground
	*	*	0	*	Normal battery
	*	*	1	*	Reverse battery

Duplex (DX) 2-wire, 900 ohm or 4-wire, 600 ohm

VF input to DX	TRMT		RCV		DX VF output
	A	B	A	B	
On-hook (idle)	0	0	*	*	
Off-hook (busy)	1	1	*	*	
	*	*	0	*	On-hook (idle)
	*	*	1	*	Off-hook (busy)

Equalized Transmission Only (ETO), or TO, 4- or 2-wire

VF input to ETO	TRMT		RCV		ETO VF output
	A	B	A	B	
No signaling	*	*	*	*	No signaling

Foreign Exchange Office End (FXO), Ground Start mode

VF input to FXO	TRMT		RCV		FXO output
	A	B	A	B	
No tip ground	1	*	*	*	
Tip ground	0	*	*	*	
No ringing	*	1	*	*	
Ringing	*	0	*	*	
	*	*	0	*	Loop open
	*	*	1	*	Loop closure
	*	*	*	1	No ring ground
	*	*	*	0	Ring ground

Foreign Exchange Office End (FXO), Loop Start mode

VF input to FXO	TRMT		RCV		FXO output
	A	B	A	B	
No ringing	0	1	*	*	
Ringing	0	0	*	*	
	*	*	0	*	Loop open
	*	*	1	*	Loop closure

Foreign Exchange Subscriber End (FXS) grd start mode

VF input to FXS	TRMT		RCV		FXS VF output
	A	B	A	B	
Loop open, no ring ground	0	1	*	*	
Ring ground	0	0	1	*	no tip ground
Loop closure, or ring ground	1	1	0	*	Tip ground
	*	*	1	*	No tip grd, no ring
	*	*	0	1	Tip grd, no ringing
Loop open	0	1	0	0	Tip grd, ringing
Loop closure	1	1	0	0	Tip grd, no ringing

Foreign Exchange Subscriber End (FXS), loop start mode

VF input to FXS	TRMT A	TRMT B	RCV A	RCV B	FXS VF output
Loop open	0	1	*	*	
Loop closure	1	1	*	*	
	*	1	*	1	No ringing
Loop open	0	1	*	0	Ringing
Loop closure	1	1	*	0	No ringing

Pulse Link Repeater (PLR)

VF input to PLR	TRMT A	TRMT B	RCV A	RCV B	PLR E&M output
E-lead open	0	0	*	*	
E-lead grd or loop	1	1	*	*	
	*	*	0	*	M-lead grd or open
	*	*	1	*	M-lead batt or loop

Ringdown (RD) 2-wire, 900 ohm or 4-wire, 600 ohm

Input to RD	TRMT A	TRMT B	RCV A	RCV B	RD output
No ring to t,r simp'x	1	1	*	*	
20Hz ring t,r simp'x	0	0	1	*	No ring to t,r pair
20Hz ring t,r simp'x	1	1	0	*	ring on t,r pair
sg lead at grd	1	1	*	*	
sg lead at -48 Vdc	0	0	1	*	Grd sens relay to sg
sg lead at -48 Vdc	1	1	0	*	48Vdc to sg lead

9) If you need to dial on the circuit, move your cursor down to the DTMF DIALING menu item and press ENTER. Enter the number you wish to dial and then press the ENTER key.

10) When you are finished, disconnect your test set from the circuit.

1.17 Send a Tone

Here is a procedure for sending a tone:

1) This is an intrusive test. Be sure the T1 line is not carrying traffic or that it will be able to withstand the hits that this procedure will introduce.

2) Configure the set for the appropriate line interface mode for sending the tone:

• TERM: In the TERM mode, the test set sends the tone on the selected channel and fills the other 23 channels with idle code. The received signal is terminated at the set and is not retransmitted. Refer to Section 1.1 and Figure 4–1 for assistance in setting up this mode.

- LOOP, BRDG-LP, MON-LP: In these LOOP modes the test set sends a tone on the selected channel. It receives and retransmits the other 23 channels without disruption. Using these LOOP modes will cause a momentary hit on the circuit when the test set is plugged in and when it is unplugged.

- THRU-A, THRU-B: In these modes, the tone will either be transmitted out the A- or B-side of a full-duplex circuit access. The other 23 channels of that side will be transmitted without disruption. All 24 channels of the other side will be transmitted without disruption. There will be a hit on both sides when the test set is plugged in and when it is unplugged. There will also be a hit on both sides if the access is changed from THRU-A to THRU-B and vice-versa

- LOOP-E, LOOP-F: In the LOOP-E and LOOP-F modes the test set sends a tone on the selected channel. It receives and retransmits the other 23 channels without disruption. There will be a momentary hit on the circuit when the test set is plugged in and when it is unplugged. The non-test direction will be terminated on the receive side, and the transmit side will be driven with an all 1s signal.

3) Once the access mode has been set up, plug the test set into the circuit. Press the HISTORY key to acknowledge the blinking history lights and turn them off.

4) From the main menu, enter the VF CHANNEL ACCESS item. Enter the VF MEASUREMENTS menu item. Use the NEXT (F1) or PREVIUS (F2) to set up the receive and transmit channels. Move the cursor to the TEST TONE menu item and press ENABLE (F1). Move the cursor to TONE FREQ and select the desired frequency, using the more (F4) key to display additional alternatives. If you wish, you may enter a tone frequency directly from the keypad using the SHIFT-lock key. Enter a value between 50 Hz and 3904 Hz. Move the cursor to the TONE LEVEL item and select either a 0 dBm level or a -13 dBm level. If you wish, you may enter your own tone level directly from the keypad. Use the F1 (MINUS) key if your entry is less

than 0 dBm. You are now transmitting a tone on the selected channel. Press ENTER when your settings are complete.

5) When you are finished, disconnect your test set from the circuit.

1.18 Fractional T1 Testing

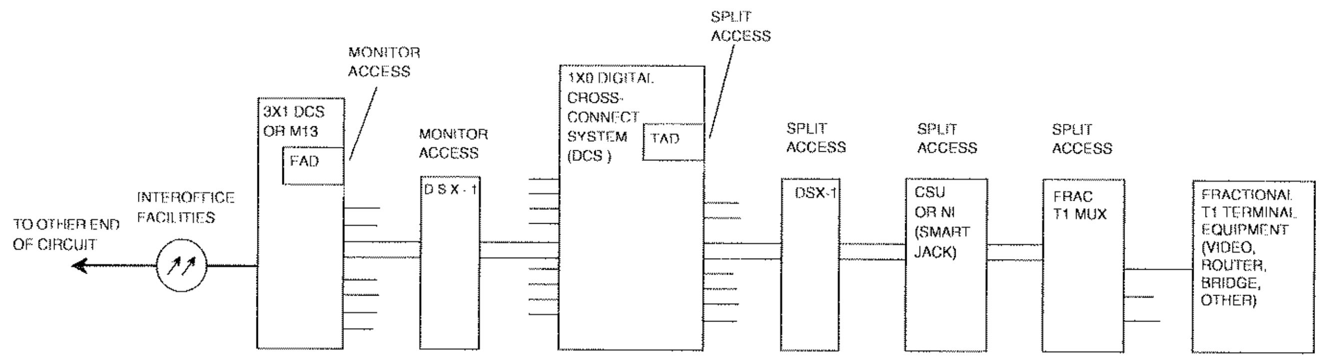
1.18.1 Fractional T1 Circuits

Fractional T1 circuits are circuits of data rate nx56 kbps or nx64 kbps, where n can be anywhere from 1 to 24 channels. N channels of the T1 line are dedicated to the fractional T1 circuit, and the remaining channels of the T1 line are either filled with an idle code or other revenue traffic.

A fractional T1 circuit typically starts out at the customer premises at a fractional T1 CSU (see Figure 7.18A). The purpose of this CSU is to convert the signal into a standard T1 signal suitable for transmission on the telephone company network. The CSU may also multiplex other fractional signals into an aggregate fractional signal within the T1.

The CSU is configured to place the data into either an nx56 or nx64 kbps format. nx56 utilizes the first 7 bits in each channel and allows the customer to transmit an unlimited number of zeroes even when the T1 line is optioned for AMI coding. The CSU places a 1 in the eighth bit to ensure 12.5% ones density even when the customer is transmitting all zeroes.

Nx64 is like nx56, except the CSU inserts no ones. This format is generally used when the T1 line is configured using B8ZS line code or alternating channel assignment. In the B8ZS case, the line code ensures adequate pulse density regardless of the number of zeroes transmitted on the circuit. In the alternating channel assignment case, the idle pattern inserted into the alternating idle channels ensures adequate ones density regardless of the customer data transmitted in the alternating active channels.



FT1 Channel Format:

Split Access Points: N FT1 channels + 24-N idle channels

Monitor Access Points: N FT1 channels + 24-N active channels from other circuits

Figure 4–8 Fractional T1 Circuit

The CSU must be configured to put the fractional T1 channels in the proper positions within the 24 T1 channels available in the T1 line. Three formats exist, sequential order, alternating order, and random order. The alternating order format was described in the previous paragraph. For example, a 384 kbps circuit (6x64) might use channels 1, 3, 5, 7, 9, and 11. Channels 2, 4, 6, 8, 10, and 12 might be filled with a 01111111 idle code. Sequential order is different from alternating order in that all the fractional channels are located contiguously within the T1 frame. For example the same 384 kbps circuit might use channels 1 through 6 of the T1 line. A randomly configured 384 kbps circuit might use channels 4, 9, 10, 17, 20, and 24.

In a fractional T1 circuit such as a video circuit, it is vital that each channel of the circuit arrive in the same order (phase) that it left. If this does not happen, then the signal becomes scrambled and the receiver cannot properly decode the information. The signal will generally only arrive in phase if the fractional T1 circuit travels as a bundle through the various network elements and transmission media. If individual channels should become split onto two different transmission paths, then the transmission delay of the two paths will probably be different, causing the problem.

We have already covered the function of the CSU in the fractional T1 circuit shown in Figure 4–7. Other elements serve different functions. For instance, the 1x0 DCS (Digital Cross-connect System) is used to cross-connect the incoming fractional T1 line onto the desired transport line. The 1x0 DCS allows many fractional T1 circuits to be combined with other channelized circuits onto more densely-packed T1s. The idle channels are simply discarded as they pass into the DCS. This reduces costs by providing highest utilization (fill) on the T1 paths in the long-haul portion of the network.

The M13 or 3x1 DCS allows the grouping of many T1s onto selected higher-speed transmission paths for long-haul transport. The fractional circuit passes through a similar group of network elements at the far end of the circuit.

1.18.2 FT1 Circuit Acceptance Test Procedure

Here is an acceptance test procedure for a fractional T1 circuit. Refer to Figure 4–8. This is an advanced test procedure which should only be attempted if users are already familiar with the T1 test procedures described earlier in this section.

1) Verify that the fractional circuit is not in service. This acceptance test will disrupt service.

2) Switch on the test set.

3) From the main menu, enter the LINE INTERFACE item. Configure the screen settings for:
INTERFACE: DUAL
MODE: SPLT-E
FRAMING: as specified by your design
CODING: as specified by your deisgn
REF CLOCK: INTERN if facing the Fractional CSU, otherwise LOOP if facing the 1x0 DCS
TEST RATE: nx56 or nx64, set up the desired channels for transmit and receive.
LBO - FAC: 0 dB (ft) (or as required)
LBO - EQP: 0 dB (ft) (or as required)

When you press nx56 or nx64, the screen will switch to the FT1 TIMESLOT screen. Manually set up the timeslots to the configuration indicated in your circuit record. If the timeslot configuration is not known, AUTO configure to the active channels.

Note that AUTO configuration may not yield the proper channels if any of the active channels are transmitting an idle code. It will also not work properly if the idle code set in the OTHER FEATURES, TEST PARAMETERS, OTHER PARAMETERS, IDLE CHANNEL CODE item is not the same as the idle code on the circuit being tested (7F = 01111111, FF = 11111111). One good way for you to observe the idle and active channels for yourself is to plug the test set in using the 1.544 Mbps test rate and then go to the VIEW RECEIVED DATA menu. This will allow you to double check what the test set comes up with in an AUTO configuration.

Press ENTER when the timeslot settings are as desired. This will return you to the LINE INTERFACE menu. When the LINE INTERFACE menu settings are as desired, press ENTER.

4) Connect the test set to the circuit at one of the split access points shown in Figure 4–9. Make sure you know which end of the circuit the EQUIPMENT jacks are facing and which end of the circuit the FACILITY jacks are facing.

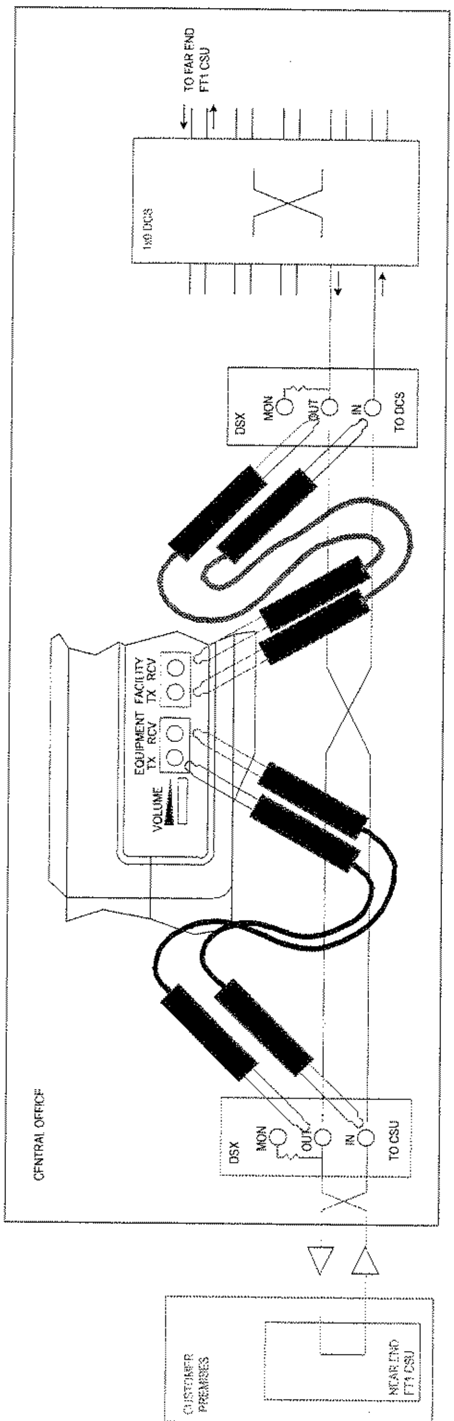


Figure 4-9 Plugging into the FT1 Circuit

5) Loop up the circuit toward the near end CSU. A standard CSU loopback code may be used from the access point described in 4–7 because the test set has access to the entire T1 terminating at the CSU.

Note that you may need to reconfigure your test set back to 1.544M TEST RATE in the LINE INTERFACE menu in order to loop up the CSU.

6) Change the access MODE to SPLT-F to look toward the far-end CSU.

7) Loop back the far-end FT1 CSU. You will need to find out what kind of loop code will activate the far-end FT1 CSU. This may possibly require assistance at the far end.

8) Change the access MODE to SPLT-A. View the graphic to verify that you have a double-loopback so that you are sending and receiving across the entire length of the span from end to end.

9) Enter the BASIC MEASUREMENTS menu and perform the acceptance test. Verify that the fractional T1 service performs to your company's requirements for the service delivered. If necessary, see Sections 5 and 6 for an additional explanation about the BASIC MEASUREMENTS.

1.19 SLC-96 Testing

Here are a few application notes on SLC-96 testing. Refer to your digital loop carrier maintenance manual for detailed information. Refer also to TR-TSY-000008 for SLC-96 reference information. Note also that SLC-96 systems come with maintenance capabilities built right into the system. These maintenance features should be used as a first step in troubleshooting SLC-96 problems. T1 test equipment should only be used where the SLC-96 maintenance features are not available.

WARNING

SLC-96 systems carry up to 96 channels of customer traffic. Do not use the test set-ups shown in Figures 4–12 and 4–13 unless you have been properly trained. Use the set-ups shown in Figures

4–12 and 4–13 only in conjunction with a SLC-96 maintenance manual. Verify through that manual that your planned maintenance activities will not cause a disruption in service.

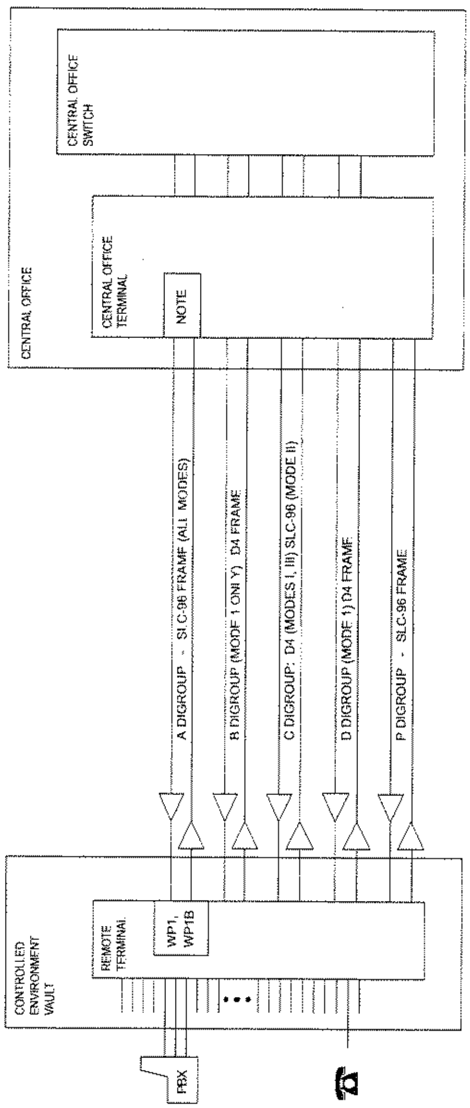


Figure 4–10 Typical SLC-96 System Configuration

Three typical SLC-96 maintenance applications are discussed in this section. The applications cover in service data link monitoring, out of service testing, and in-service digroup testing. Use Figure 4–10 as a guide for each of these applications.

Some general information about SLC-96 systems is useful before actually attempting to perform maintenance on the systems. SLC-96 systems are used to carry subscriber telephone service as well as a variety of special services. The systems provide pair gain by multiplexing up to 96 metallic loops onto 4 T1 lines. The systems have a remote terminal located near the customers and a central office terminal located in the central office. The central office terminal may have a DS1 or analog metallic interface to the switch. Conversely, newer switches may be built with a TR-TSY-000008 interface (SLC-96 interface standard) so that there is no need for a central office SLC-96 terminal.

SLC-96 systems have three modes of operation. Mode I is where all 4 digroups are used, and each channel of each digroup is reserved exclusively for a given customer. Mode II is where only 2 digroups are used for all 96 channels, and the SLC-96 system keeps track of which channels are allocated to which customers through the C bits in the SLC data link. Mode III is where the system only serves special service lines. In this mode it uses only two digroups because only 48 channel units can be plugged into the terminals.

The A digroup transmits the system's data link through the SLC-96 framing format. The data link contains alarm, protection switching, far-end looping, and other maintenance information. The B and D digroups use D4 framing. These digroups are not used in modes II and III. The C digroup also uses SLC-96 framing. The C datalink is only used in mode II. In this mode it carries channel allocation information.

The SLC-96 system uses a protection digroup for ensuring a higher level of reliability. Either the remote terminal or the central office terminal may initiate a switch to the protection digroup if a transmission failure is encountered.

1.19.1 SLC-96 Data Link Monitoring

Here is a procedure for monitoring the A data link to observe the operational status of an in-service SLC-96 system.

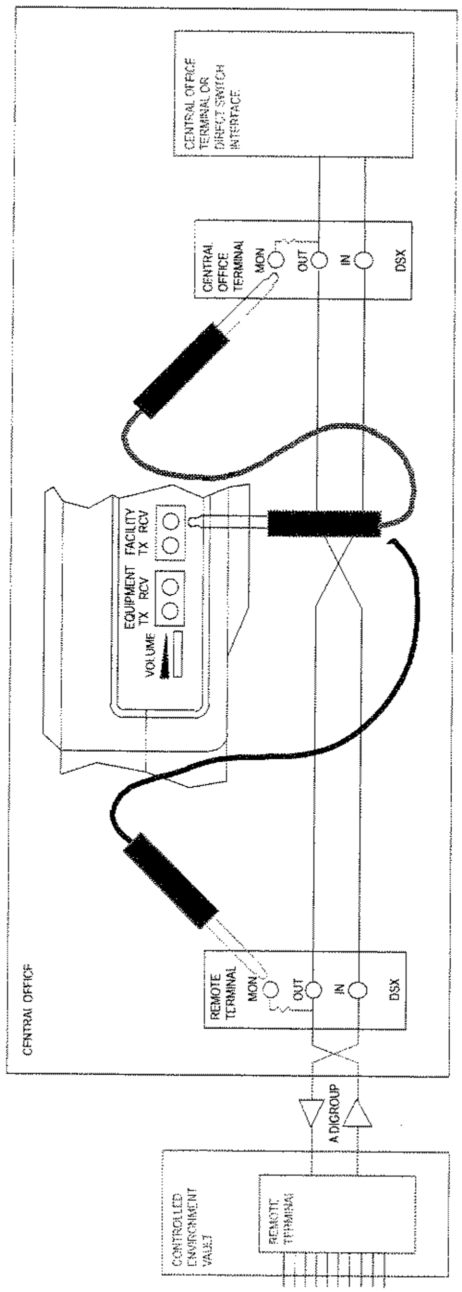


Figure 4–11 Monitoring the SLC Data Link

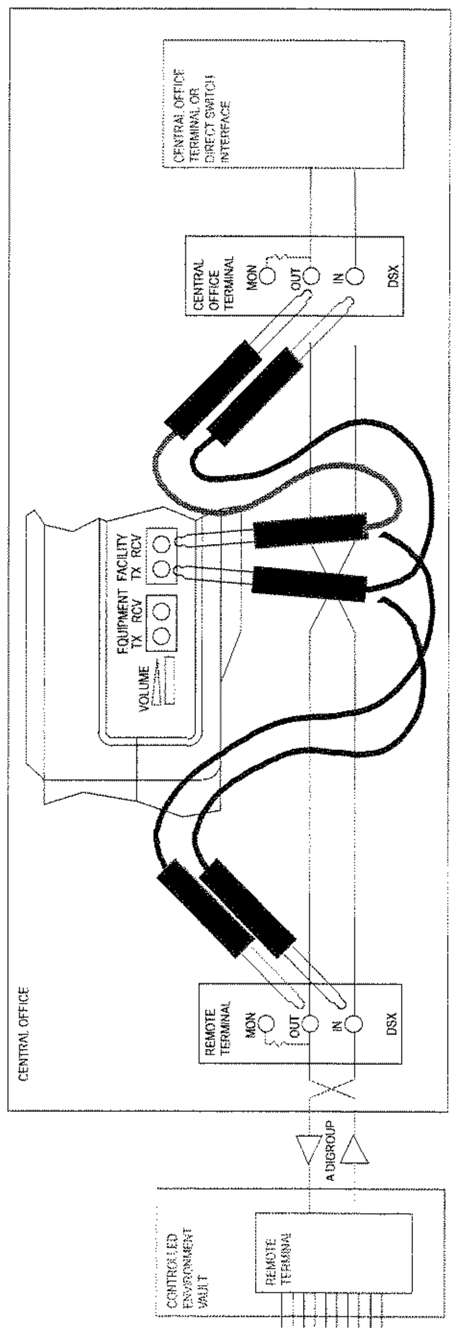


Figure 4–12 SLC-96 Out-of-Service Testing

Notes:

1) Plug the cords in in the order shown: First #1, then #2 and so on.
2) Two sets are required for this set-up.
3) A termination plug may be needed in each OUT jack. Otherwise, the MON signal may be unreadable. For this reason, for steps #5 and #10, plug in a TERM jack into each OUT jack. Have the termination plug ready in your hand so that you can instantly insert it after the previous step.

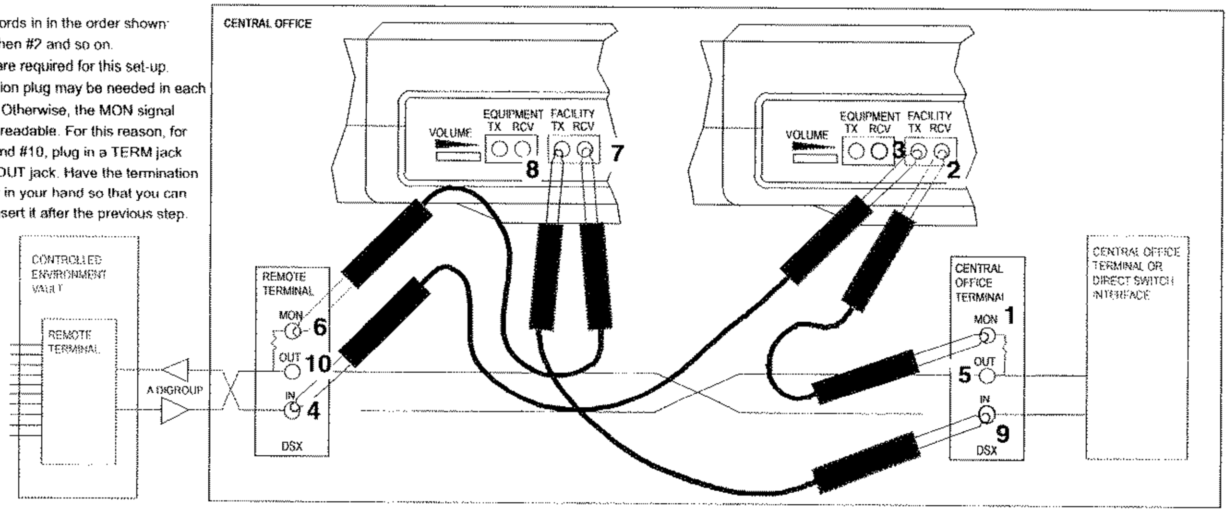


Figure 4–13 SLC-96 A Digroup Data Link Transmission

1) Switch on the test set.

2) From the main menu, enter the LINE INTERFACE item. Configure the screen settings for:
INTERFACE: SINGLE
MODE: DSXMON
FRAMING: SLC-96
CODING: AMI (or as provisioned)
REF CLOCK: INTERN
TEST RATE: 1.544M
LBO FAC: 0 dB (ft) (or as req'd)

When your LINE INTERFACE settings are correct, press ENTER.

3) Connect the test set to the circuit as shown in Figure 4–11.

4) Perform a BASIC MEASUREMENT and see if the signal itself has any BPVs or SLC-96 framing errors.

5) Escape from the BASIC MEASUREMENT and enter the DATA LINK CONTROL item. Enter the MONITOR DATA LINK item. Observe if a protection switch is in place. If there is one, note which digroup and the direction of transmission. Observe if a far-end loop is in place on any of the digroups - this will be signified by ALM next to the FELP category.

6) Reposition the plug into the remote terminal monitor jack. Observe:
- the mode of the remote card (WP1, WP1B),
- if there is a SLC-96 system alarm,
- if any of the remote shelves are in alarm,
- if there is a protection line switch in place,
- and if there is a far end loop in place.

7) Take appropriate maintenance action. When you are finished, disconnect the test set from the circuit.

1.19.2 Out-of-Service SLC-96 Testing

Here is a procedure for performing out-of-service testing on a SLC-96 system. Perform this testing only on those rare occasions when the SLC-96 system is not carrying live customer traffic.

1) Switch on the test set.

2) From the main menu, enter the LINE INTERFACE item. Configure the screen settings for:

INTERFACE: SINGLE
MODE: TERM
FRAMING: SLC-96
CODING: AMI (or as provisioned)
REF CLOCK: INTERN
TEST RATE: 1.544M
LBO FAC: 0 dB (ft) (or as required)

When your settings are correct, press ENTER.

3) Connect your test set to the circuit as required for the testing you wish to perform. Refer to Figures 4–11, 4–12 and 4–13. More than one set may be necessary because you may need to transmit and receive maintenance commands on the A digroup while you are performing bit error testing on another digroup. Possible tests you can perform include:

- Switching digroup A through D to protection
- Looping back digroup A through D and P to verify transmission performance
- Inducing the system to switch to protection by creating a loss of signal, loss of frame, or high bit error rate
- Verify transmission of proper alarm indication when a shelf or power source has gone down
- Verify that central office terminal transmits AIS (blue alarm) in downstream direction when signal has been lost in upstream direction.
- Verify that A digroup can do a half-switch when half of the A-digroup and half of the protection digroup is not working.
- Verify fast and transparent protection switching so that users do not notice a problem.
- Verify proper assignment of channels during mode II operation.

4) When you are finished, disconnect the test set from the circuit.

1.19.3 Testing a Digroup on a Working SLC-96 System

Here are some application notes for looping back and trouble-shooting a digroup on a working SLC-96 system. Note that this is not a complete discussion of in-service SLC-96 intrusive testing, and that you should not perform this testing without additional maintenance and procedural information and training beyond what is presented here. Further, you should double-check the information presented here against the maintenance procedures of your particular system.

A key requirement of in-service SLC-96 testing is that you not accidentally drop service to the people who are using the SLC-96 system. One inadvertent mistake may effect many customers.

Where possible, you should use the built-in maintenance features of your SLC-96 system to effect a protection switch and far-end loopback. The procedure presented here should only be used when the built-in features of your system are not available for some reason.

1) Verify that the protection digroup is available. Do this by using the procedure described in Section 1.19.1. Verify in the MONITOR DATA LINK menu that PROTECT LINE SW says IDLE on both directions of transmission on the A digroup. If either direction does not say idle, then the protection line is already in use and can't be used for additional switching.

   Also verify that the protection digroup is transmitting the same bit stream as the A digroup. You can do this by simultaneously using two test sets to monitor the SLC-96 data links on each digroup and by viewing the received data on each digroup.

2) Obtain three SunSet T1 test sets for general system testing. Set up the LINE INTERFACES of two of the sets to be SINGLE/LOOP/SLC-96/AMI/INTERN/1.544 Mbps /0 dB. Once these settings have been entered by pressing the ENTER key, plug the two sets in series with the two directions of transmission on the A digroup as illustrated in figure 4–13. Be sure to plug in the cords in the sequence shown in the diagram to minimize the amount of downtime for the A digroup. Before plugging the set in, obtain two termination plugs to put in the two OUT jacks shown in steps 5 and 10.

3) After making sure that the protection line is idle, also make sure that the protection line is in service. Do this by taking the set that is transmitting toward the remote terminal and requesting a far end loop for the protection line. Enter the SEND MESSAGE menu item, choosing WP1 or WP1B, as appropriate for the MODE, and then selecting ALM for P-FELP. Press the ENTER or SEND key to actually send the message. Take your third test set and plug into the protection line towards the remote terminal and verify that you can send and receive error-free towards the remote terminal. After verifying that the transmission is error-free, go back to the first test set and drop the protection line far end loop by changing P-FELP to CLR and pressing the SEND or ENTER keys.

   Repeat the procedure for the other test set towards the central office terminal. This will allow you to check the entire length of the protection line from your mid-point of test access. Note that your central office terminal may or may not support the loopback feature.

   If your protection line has tested ok, then you may proceed to switch the desired live digroup to the protection line as described in step 4).

4) If you wish to switch the B, C, or D digroups, use this procedure. If you wish to switch the A digroup, then move directly to step 8.

   Request a switch to protection by entering the SWITCH PROTECT LINE menu item on both test sets. Select SWITCH as the desired ACTION and LINE-B, C, or D as the LINE. When the menus on both sets are properly set-up, press the two ENTER keys simultaneously to get both terminals to switch to the protection line at the same time. Move to the MONITOR DATA LINK menu in each set to verify that each terminal is transmitting back that it has switched the desired line to the protection digroup. If PROTECT LINE SW says IDLE, then that terminal did not switch the desired digroup to the protection line and you may not proceed with your testing.

   Note that the test sets must continue transmitting the protection line switch command for the entire time that you want to perform your loopback test.

5) Move to the SEND MESSAGE menu and send a far end loop

message to the appropriate digroup B, C, D, or P (if you are testing the protection switch digroup). Do this by setting B-, C-, D-, or P-FELP to ALM. Move to the MONITOR DATA LINK and verify that you are receiving ALM from the terminal in the appropriate B-, C-, D-, or P-FELP message. This will verify that the far end loop has been performed.

6) Plug your third test set into the digroup B, C, D, or P to be tested. Transmit and receive QRS or other test patterns to verify transmission performance. Perform standard transmission tests. Test towards the remote terminal and the central office terminal if you were able to establish loopbacks in each direction.

7) When you have finished testing, unplug the third test set and test cords from the B, C, D, or P digroup. Enter the SEND MESSAGE menu in the two A digroup test sets and change the B-, C-, D-, or P-FELP to CLR and press ENTER or SEND. Move to the MONITOR DATA LINK menu in both sets and verify that the terminals are sending CLR in the B, C, D, or P FELPs. This will indicate that the loops have been dropped at each end.

Then move to the SWITCH PROTECT LINE menu in both sets and select RELEASE. Press the ENTER or SEND key in both sets simultaneously. This will release the protection switch at both ends at the same time. Verify that you get a SWITCH succeeded response in both sets. You have now restored the SLC-96 to a normal operating condition.

Unplug both A-digroup test sets in the exact reverse order of the way you plugged them in. Be careful to unplug the TERM plug in the OUT jack and the test cord in the IN jack at the same exact time. In other words, steps 9 & 10 happen simultaneously, and steps 4 & 5 happen simultaneously.

You are now finished with your maintenance procedure.

8) Follow a different procedure for looping back and testing the A digroup. Instead of plugging your two test sets in the A digroup as described in step 2 and as shown in figure 4–13, plug them into the P digroup in the same fashion. The P-digroup will become the control digroup while you are testing the A digroup. Set up both test sets in the SWITCH PROTECT LINE menu to request a LINE-A SWITCH. Press the ENTER or SEND keys of both sets to send this message. This message

will keep the SLC-96 system on the protection line once you actually get it switched to the protection line as described in the next step.

9) Initiate a switch to the protection line by simultaneously inserting unattached test cords into the IN and OUT jacks of the A digroup facing the remote terminal. This will cause a loss of received signal on the A digroup at both terminals. Each one should switch to the protection digroup within a few milliseconds. The quick switch is possible because an idle protection digroup carries the A digroup bit stream.

10) Request and verify an A-FELP in the SLC-96 SEND MESSAGE menu as described in step 5.

11) Use a third test set to test the A digroup as described in step 6.

12) Unplug the third test set and restore the SLC-96 system to operational condition as described in step 7. You are now finished with the procedure.

1.20 Using a T-BERD Power Lid

Using the T-Berd Power Lid is simple with the SunSet T1. Use this procedure:

1) First read your T-Berd Power Lid manual for general operation and safety instructions.

2) At the point that you would plug in a T-Berd test set, instead plug in the SunSet T1. You may use the SS111 Dual Bantam to 15-pin D-subminiature Connector Cable, Female. First plug in the cable's bantam side into the SunSet T1. The arrows should point into the RCV jack and out of the TX jack. Then plug the cable's 15-pin female connector into the 15-pin male connector attached to the spiral cord coming out of the power lid.

3) You can now test the powered span with your SunSet T1.

2.0 Using the Battery & AC Charger

The battery is designed to provide plenty of power for portable testing. The battery is charged by a custom-designed charger for optimum performance. This charger is powerful enough to run the test set continuously while keeping the battery charged.

The charger features a special fast-charge feature which recharges your discharged battery quickly so that you can get it out into the field again. This fast charging is non-damaging to the battery.

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

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

1) Leave the backLIGHT off if you don't need it. The set may run over 3 hours with a fully-charged battery when the backlight is off. However, it may only run 2 hours when the backlight is left on.

2) Switch the power off on the set when it is not in use.

3) Use the Cigarette Lighter Battery Charger when you are driving from place to place in a vehicle in between tests. This will help keep the battery charged when AC power is not available.

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

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

fully charge over night.

6) Do not use any other charger with this test set. Using another charger will void your warranty. Other 12V chargers may not supply enough power for continuous operation, or may drastically reduce the life of the battery if left plugged in continuously, or may have reverse voltage polarity, or may only provide a maximum of a 60% charge.

7) You can tell when the battery is nearly fully charged by observing the light on the charger. If the light is on solidly, then the charger is in a high-output mode and is either fast-charging the set or powering it during normal operation. When the light begins to blink, the charger is converting over to a trickle-charge mode. When the light barely flickers at all, the battery is fully charged.

3.0 Using the Serial Port

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

3.1 Serial Port Settings

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

3.2 Configuring for Printing

The test set may be ordered with an optional High Capacity Thermal Printer (SS118B or 118C). This printer operates by an 8-bit serial RS-232C method, and uses thermal paper (ie. it has no ink cartridge or ribbon which needs to be replaced). Many other serial printers are available to the user; however, not all of these printers will operate correctly with the SunSet.

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

Refer to Figure 4–13 for a diagram of the pin-to-pin assignments of the DIN to EIA-232-C cable supplied by Sunrise Telecom.

If you wish to connect to a modem or other brand of printer, you may find the SS122 Null Modem Adapter useful. Refer to Figure 4-14.

To begin printing, follow this procedure:

1) Connect the Sunrise Telecom DIN-8 to DB-9 Printer Cable (SS115B) to the SunSet T1.

2) If you are using a Sunrise Telecom printer, skip this step. Otherwise, you may need to connect the Sunrise Telecom Null Modem Adapter (SS122A) to the free end of the Printer Cable.

3) Confirm that the SunSet's serial port settings match those of your printer. The switches to configure your printer's serial port and print characteristics are usually located on the back or bottom of the printer. If you are using the Sunrise Telecom thermal printer, refer to Figure 4–15 for the correct switch settings.

The SunSet's factory default serial port settings are:

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

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

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

Figure 4–14 SS115B Printer Cable Pin Assingments

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

a) From the MAIN MENU, select the OTHER FEATURES item, then the SYSTEM CONFIG item.

b) Select the GENERAL CONFIG item.

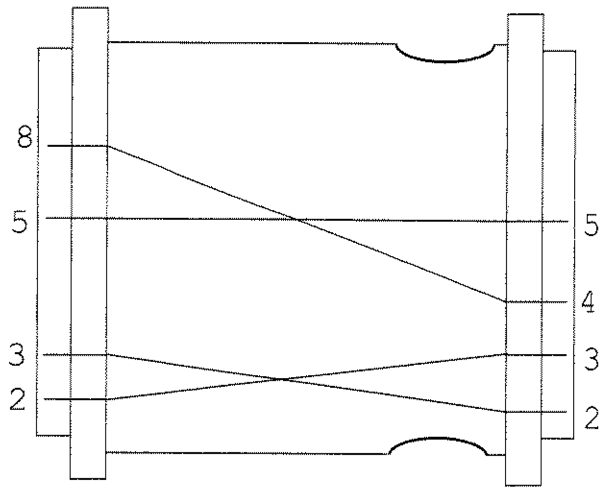
c) Use the Down Arrow key to access the BAUD RATE setting. Four selections are available: 1200 (F1), 2400 (F2), 9600 (F3) and 19.2K (F4). These settings determine the rate at which the SunSet transmits data (characters) to the printer. This setting must match the setting on your printer, otherwise random characters will appear on your printout.

d) Access the PARITY setting. Three options are available here: NONE (F1), EVEN (F2), and ODD (F3). This setting must match with the configuration of your printer.

e) Access the STOP BIT setting. Two options are available: 1-BIT (F1) and 2-BIT (F2). This setting must match with the configuration of your printer. Normally this is configured as 1-BIT.

f) Access the BITS/CHAR setting. Two options are available:

7-BIT (F1) and 8-BIT (F2). This setting must match with the configuration of your printer. Normally this is configured as 8-BIT.



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

DB-9 FEMALE PIN#	DESCRIPTION		DB-9 FEMALE PIN#	DESCRIPTION
5	SG	————	5	SG
8	CTS	————	4	DTR
3	RD	————	2	TD
2	TD	————	3	RD

Figure 4–15 SS122A Null Modem Pin Assignments

DIP SWITCH 1

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

DIP SWITCH 2

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

DIP SWITCH 3

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

Figure 4–16 SS118B/C Printer Switch Settings

4) Set up printer's printing instructions.

TIMED: Choose TIMED (F1) if you would like to have the printer print out results at a regular interval during a BASIC MEASUREMENT. The default time is 1 minute. You may enter any interval between 1 minute and 99 minutes. To change the interval, press the SHIFT-lock key to display the SHIFT indicator. Then enter the desired numbers from the keypad. Press SHIFT-lock again to remove the SHIFT indicator.

EVENT: Choose EVENT (F2) if you would like the printer to print out a result every time an error or alarm condition is reported.

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

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

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

6) Ensure that the printer is powered up and "on-line".

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

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

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

3.3 Using the Remote Control (option SW100)

The SunSet T1 comes with an optional remote control feature. Controlling the SunSet through the remote control is similar to controlling the SunSet directly.

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

Refer to Figure 4–14 for a diagram of the pin-to-pin assignments of the DIN to DB-9 cable supplied by Sunrise Telecom. Refer to Figure 4–15 for the pin-to-pin assignments of the Sunrise Telecom Null Modem Adapter.

You may need a break-out box, null modem, patch-box and other RS-232C communications tools if you wish to set up your own serial communications. Here are some helpful hints. The test set is configured as a DTE. You will need a modified null modem cable if you wish to connect directly to a terminal.

It often is successful if pin 4 (DTR) of the modem or terminal is connected to pin 8 (CTS) of the test set DB25 connector. Pin 8 of the test set DB9 connector must show green on a breakout box in order for the test set to print.

To begin remote operation, follow this procedure:

1) Connect the Sunrise Telecom DIN-8 to DB9 Printer Cable (SS115B) to the SunSet T1.

2) If you are plugging directly into a terminal, connect the Sunrise Telecom Null Modem Adapter (SS122A) to the free end of the Printer Cable.

a) Connect the Null Modem Adapter to your computer or terminal.
b) Skip steps 3, 4, 5, 6, 7.

3) Connect the printer cable's DB9 end into a modem. A 9600 baud error-correcting modem is highly recommended. Some functions such as VF MEASUREMENTS will only work properly if a 9600 baud modem is used. Refer to Figures 4–13 & 4–14 for cable pinouts. You may need a breakout box, appropriate tools, and training to make sure the test set is appropriately connected to the modem the first time you set it up.

4) If not already connected to an analog phone line, plug the modem into the telephone network (usually done with an RJ-4 cable).

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

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

If you need to **reconfigure** the SunSet's serial port settings, use the following procedure:

a) From the MAIN MENU, select OTHER FEATURES.
b) Select the GENERAL CONFIG item.
c) Use the Down Arrow key to access the BAUD RATE setting. Four selections are available: 1200 (F1), 2400 (F2), 9600 (F3), and 19.2K. These settings determine the rate at which the

SunSet transmits data (characters) to the computer or terminal. This setting must match the setting on your computer or terminal, otherwise random characters will appear on your remote screen.

d) Access the PARITY setting. Three options are available here: NONE (F1), EVEN (F2), and ODD (F3). This setting must match with the configuration of your remote control.

e) Access the STOP BIT setting. Two options are available: 1-BIT (F1) and 2-BIT (F2). This setting must match with the configuration of your remote control. Normally this is configured as 1-BIT.

f) Access the BITS/CHAR setting. Two options are available: 7-BIT (F1) and 8-BIT (F2). This setting must match with the configuration of your remote control. Normally this is configured as 8-BIT.

6) Set up a terminal to dial up the far modem and commence communications. Any terminal or personal computer with VT100 terminal emulation software should work.

7) Call up the far modem with your terminal.

8) Once communication has been established with the far modem, log on to the SunSet T1 by typing in: logon

• You do not need to press the return key after typing the letters. The test set will automatically repaint the screen with the main menu and other information. If you make a mistake while typing logon, just type it again.

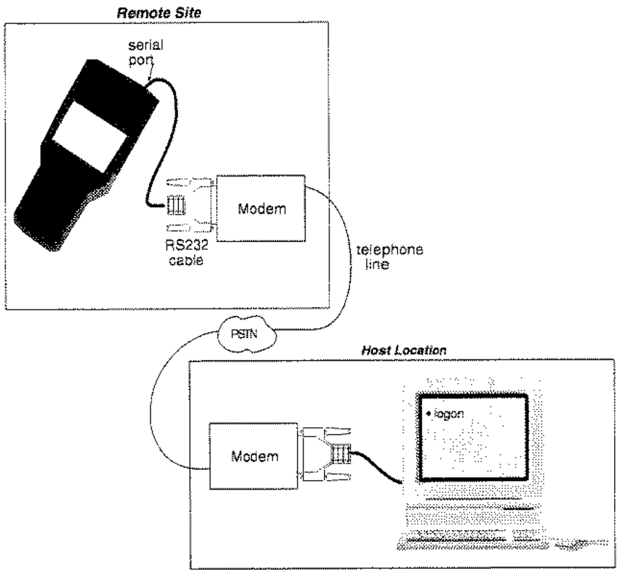


Figure 4–17 Typical Remote Control Setup

Note: If you log into the set while it is in graphic mode, the graphic may be distorted. Simply press the return key on your terminal and then P (for graphic) to see the graphic in its proper form.

9) Use the SunSet T1 just like you would use it locally. The same menus will be presented to you.
• The key options are listed under the Status Panel heading.
• The letter presented in bold is the key you push to initiate the command.

The cursor commands are: **U**p, do**W**n, lef**T** and **R**ight. In addition, you may find that the arrow keys on your computer/ terminal will work.
Refre**S**h repaints the screen.
Press **Q**uit functions as the ESCAPE key.
Other key functions are **I**nj err, **H**istory, and res**Y**nch.

Pressing the Return key on your computer/terminal is the same as pressing the ENTER key on your test set.

F-key functions are provided by the - (F1), = (F2), [(F3), and] (F4) keys.

When you wish to enter letters or numbers in a setup screen, instead of using the SHIFT key and the orange test set key labels, just type in the numbers or letters directly from your computer/ terminal keyboard.

10) When you are finished with the SunSet T1, type in: logoff

11) Then terminate the phone connection by hanging up your near-end modem.

In remote control, you have access to most of the test set's capability. However, you will notice a few differences, such as the following:

- You will not have access to the GRAPHIC screen, or the AUTO key.
- The MEASUREMENT RESULTS screen will be updated about once every 5 seconds, instead of once each second.
- Local usage of print commands is not recommended during a remote control session, beasue both the printer and the remote control use the same port. For instance, pressing the PRNTR key will log the user off.
- Talk/Listen is not supported remotely.

Note that you can use a variety of asynchronous communications in addition to modems over the public switched telephone network. Direct local connection, dedicated line, and packet are other communication alternatives.

3.4 Using Remote Control from Windows 95

Here's a brief rundown on how to get your SunSet to work by remote control, when you are operating out of Windows 95/8.

1) From the Start menu,go to Programs/Accessories/Communications, and select HyperTerminal.

a) Click the HYPERTRM icon to open the Hyper Terminal window.

2) Double click on Hypertrm.

3) At New Connection, enter "Sunrise Remote".
a) Select an icon.
b) Click on Ok.

4) On the Connect To tab, click on the down arrow of the "Connect using:" box.
a) Select the modem or com port number you are using (note: if you are connected directly to a com port, you will need to use a Null Modem Adaptor).

5) Click on the Configure button.
a) At the Port Settings, configure the settings as follows (matching those of your SunSet as set in the Serial Port Config screen):
Bits per second: 9600
Data (or Char) bits: 8
Parity:none
Stop bits: 1
Flow Control: none

b) Click Ok when done.

7) Select the Settings tab.
a) In the Emulation setting box, choose VT100 from the drop down list.
b) Click Ok.

8) In the HyperTerminal screen, click on VIEW (IMPORTANT!).
a) Highlight and click on FONT.
b) Highlight Terminal.
c) Set the Style and Size as you wish.
d) Click Ok.

9) Type "logon". Remote control should work!

Chapter 5
Troubleshooting

1.0 Troubleshooting

Here are some helpful suggestions for those occasions when your test set is not performing as expected.

Problem: Continuous BPVs show on screen even though there should be no problem with the signal
Suggestion:
1) Check the line interface:
   - do not use DSXMON for a full 3V signal
   - do not use TERM for a monitor jack
   - try both BRIDGE and DSXMON for a mon jack
   - don't BRIDGE or DSXMON onto a signal that has been opened and is no longer properly terminated

Problem: Test set performs improperly
Suggestion:
1) Perform a SELF TEST and see if the problem is resolved. If the SELF TEST shows an ERROR CODE, repeat the test to see if it was automatically able to correct the problem.
2) Try turning the set off and then on again.
3) Try ERASE NV RAM.

WARNING: This procedure will erase all of your user-programmed information, measurement results and history buffers.

Be sure to turn the power off for at least 4 seconds after completing the ERASE NV RAM operation

Problem: Test set does not power up properly
Suggestions:
1) Make sure the battery is charged or the charger is plugged in. The test set's charger is powerful enough to power the test set and recharge the battery simultaneously.
2) Make sure the software cartridge is inserted firmly and seated correctly. A flickering screen usually indicates that the software cartridge is either loose or missing. Refer to the cartridge installation procedure if necessary.

Problem: Test set shows Security Violation when switched on
Suggestion:

1) Make sure the serial number of the software cartridge matches the serial number on the back of the test set. Each Software cartridge is programmed for a specific test set. If software cartridges are swapped between test sets, the test set may not work properly.

Problem: Keys do not work properly

Suggestions:

1) Verify the SHIFT status by pressing and releasing SHIFT-lock key. Press and release the SHIFT-lock key until the SHIFT-lock status indicator in the upper left-hand corner of the screen achieves the desired condition.
2) Do not press SHIFT-lock key simultaneously with another key.
3) Press the key again. The test set may not have registered it the first time.
4) Turn the power off and then back on again.

Problem: Measurement is not working properly (loss of signal, no pattern synch)

Suggestion:

1) Verify signal INTERFACE and MODE settings in the LINE INTERFACE MENU.
2) Verify that jacks are plugged in properly according to the circuit graphic.
3) Make sure that OUT is plugged to IN and vice-a-versa.
4) Twist plugs inside of jacks and make sure that plugs are inserted all the way.

Problem: Test Patterns will not synch

Suggestions:

1) Press RESYNCH to force the test set resynchronize on the pattern, framing type, and line coding.
2) Verify that the desired pattern is sent in the SEND TEST PATTERN menu.
3) Verify that there is not an AMI/B8ZS mismatch.

Problem: Test patterns will not synch with other test equipment

Suggestions:

1) Verify that TEST PATTERN INVERSION is off in the OTHER FEATURES, TEST PARAMETERS, OTHER PARAMETERS menu.

2) Examine the pattern that the other test set is sending. Use VIEW RECEIVED DATA to look at the pattern.

Problem: Voice Frequency section does not work
Suggestions:
1) Verify that the set has a valid framing type showing in the LED indicators. If no valid framing is shown, put proper framing on the T1 signal. If the test set is generating the framing, make sure that the FRAMING item in the LINE INTERFACE menu is not set to AUTO. Instead, choose a specific framing.
2) Make sure that you have not confused the timeslot number with the channel number.
3) Make sure the received channel and the transmit channel are correct.
4) Refer to sections 6.13 - 6.15 to make sure you are performing the proper sequence of operations.

2.0 Calibration Procedure

The SunSet T1 is a self-calibrating test set. It does not require you to perform any adjustments and does not need to be returned to Sunrise Telecom for calibration.

If you are required to perform a periodic calibration on the test set, use this procedure:

1) Switch the test set on.

2) Verify that all LEDs blink in sequence and that each LED lights properly. The POWER light should always light as green and the LOW BATT light should light only when the battery is nearly fully discharged.

3) Verify that there are no errors listed at the completion of the self test.

4) Connect a single bantam to single bantam cord from FACILITY TX to RCV.
5) Enter the LINE INTERFACE item from the MAIN MENU.

6) Configure the set for:

INTERFACE: SINGLE
MODE: TERM
FRAMING: ESF
CODING: B8ZS
REF CLOCK: INTERN
TEST RATE: 1.544M
LBO - FAC: 0dB(ft)

Press ENTER when your settings are correct.

7) If necessary, press the HISTORY key to acknowledge the flashing history lights and turn them off. Verify that the green PULSES, ESF and PAT SYNC lights are on. The B8ZS light may also be on, depending on the test pattern which you are transmitting.

8) From the MAIN MENU, enter BASIC MEASUREMENTS. Using the PAGE-UP (F1) and PAGE-DN (F2) keys, access the "RESULTS - SIGNAL" screen. Verify that the +LVL is 3.00V +/- 10% and that the -LVL is 3.00V +/- 10%.

9) Verify that the FREQ is 1544000 +/- 1 Hz.

10) Press ESCAPE to return to the MAIN MENU.

11) The calibration procedure is now complete.

3.0 Customer Service

Sunrise Telecom Customer Service is available from 7:30 AM to 5:00 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

Refer to the Express Limited Warranty at the end of this manual for the warranty coverage of your SunSet T1 unit. 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 (24 hours)
Fax: 1 (408) 363 8313
internet: www.sunrisetelecom.com
email: support@sunrisetelecom.com

Chapter 6
Technology

1.0 Technology Overview

This section gives you an overview of T1 technology and equipment. It also shows you the basics of troubleshooting and sectionalizing problems with T1 circuits. Note that T1 is a general term that refers to the transmission of 1.544 Mbps digital circuits over any media. T1 can be transported over copper, fiber, or radio. DS1 is the term for the electrical signal found at the metallic interfaces for these circuits where most testing is performed.

1.1 T1 Transmission

T1 usage

T1s are used for a variety of purposes. They are widely embedded in the network distribution architecture as a convenient means of reducing cable pair counts by carrying 24 voice channels in one 4 wire circuit. End users have migrated their private networks onto leased T1s as a means of reducing their network operation costs. DS1 is a universal digital access point to traditional digital networks and newer fiber optic synchronous networks.

T1 services

Telephone companies are now selling T1 point-to-point circuits in a variety of formats. Channelized T1s are often sold as a means of connecting PBXs (Private Branch Exchanges) or ACDs (Automatic Call Distributors) to a central office switch. In this case, the telephone company may also install and maintain a channel bank for the customer at their premises. T1 "pipes" are sold to more sophisticated users who only require point-to-point connectivity of a T1 circuit from the telephone company.

DS1 Network Elements

As shown in Figure 6–1, a rich variety of equipment is available for T1 circuits.

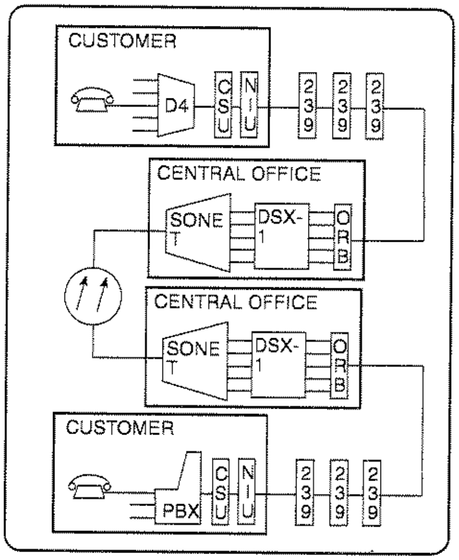


Figure 6–1 DS1 Network Elements

CSUs, or Customer Service Units, can convert a V.35 or other computer-based synchronous signal format into the DS1 format and insert the appropriate DS1 framing. CSUs also provide loopback capability, indicator lights, monitor jacks, and split access for troubleshooting and installation debugging. Network Interface Units (NIUs) are installed by the telephone company at customer premises for a variety of maintenance reasons. The NIUs also provide a loopback, but at the telephone company control. This loopback allows the telephone company to verify that the circuit works all the way to the point of interface with the customer's network. The NIUs may also be configured to loopback signal, send AIS, or send idle signal when the customer signal is unplugged. New kinds of NIUs even provide performance monitoring information and maintenance switching capability.

T1 can be transmitted over twisted pair, fiber, or digital radio. Twisted pair (normal telephone wire) is the most widely spread form of transmission and has several types of associated network elements. Regenerative repeaters, for example AT&T's 239 series, are located up to 6000 feet apart on a twisted pair span. The repeaters are housed in apparatus cases. The repeaters are located within 3000 feet of the central office and the customer premises in order to avoid cross-talk problems when the signal is carried on building wiring. Newer line repeaters offer loopback capability for faster span sectionalization. Central office repeaters provide the 60 mA span current used for powering the regenerative repeaters on the span. The repeaters may be housed in Office Repeater Bays (ORBs). Newer central office repeaters automatically adjust the supplied voltage to adapt to varying numbers of repeaters plugged into the span. They also may have fractional T1 blocking capability to allow the telephone company to sell a reduced price T1 that only carries a certain number of channels. They also may have the automated loopback capability and span power-down power-up capability.

A variety of equipment is found at the ends of DS1 lines. D4 channel banks are a traditional form of multiplexer that converts ordinary telephone wires to 64 kbps channels for multiplexing onto a DS1. Newer D4 banks offer a wide variety of channel plug-ins to handle DDS-style circuits, private line circuits, and even ISDN. AT&T SLC-96 (SLC is a registered trademark of AT&T) and SLC-5 systems are commonly found in the Bell environment and were designed as enhancements to the older D4 style.

M13 multiplexes are a traditional higher-order multiplexer for DS1s. These units take up to 28 DS1s and multiplex them into a DS3. Note that the DS1 framing and payload still exists inside the DS3 signal, but that the DS1 line coding is not passed through.

PBXs, class 5 switches (central office switches connected to local subscribers), and toll switches are often found at the end of T1 lines. These elements use DS1s as a way of concentrating their connections to local subscribers and interoffice trunks. The function of these elements is to take supervision and addressing information from subscribers, set up a call throughout the world network for the subscriber, connect the subscriber through when the path is set up, and terminate the call when the subscriber is finished.

A variety of Digital Cross-connect Switches (DCSs) connect to DS1 lines. DCSs commonly reduce the space required for achieving channel cross-connection, eliminate the manual labor associated with cross connection, and can provide amazingly fast computerized rerouting of facilities in the event of a network outage. The common DCSs are of type 1x0, 1x1, and 3x1. A 1x0 DCS has DS1 ports interfacing the network. Internally it cross-connects DS0s between the DS1s according to instructions that have been entered in through the administrative terminal. The 1x0 DCS takes the place of many racks of 1x0 multiplexes combined with a DSX-0 manual cross-connect bay. A 1x1 DCS is also called an electronic DSX-1 and is designed as a replacement for the DSX-1. A 3x1 DCS has DS3 ports and possibly also DS1 ports facing the network. It replaces a bank of M13 multiplexes and the DSX-1.

A wide variety of SONET (Synchronous Optical NETwork) equipment is now being deployed in the network. This equipment operates at higher rates and introduces a wide variety of new signal formats, both optical and electrical. Much of the SONET gear is also designed to interface to the embedded network and has DS1 and DS3 interfaces. SONET equipment replaces equipment like M13 multiplexes and 3x1 DCSs.

DS1 standards

Many standards govern various parts of DS1 transmission and network elements. The two most important standards are perhaps:

- ANSI T1.102 - 1987, Digital Hierarchy, Electrical Interfaces
- ANSI T1.403, Network-to-Customer Installation - DS1 Metallic Interface

DS1 Signal

The DS1 signal is a 1.544 Mbps 3.0 Volt signal. It uses a bipolar format and there are two line codes used in transmission, Alternate Mark Inversion (AMI) and Bipolar 8-Zero Substitution (B8ZS). AMI was the original line code used when DS1 was first introduced. However, its use is suboptimal in today's networks which mix data transmission with voice transmission and which require near error-free quality. The problem with AMI line coding is that it requires the terminal transmitting data to have at least a 12.5% average 1s density and a maximum of 15 consecutive zeroes. This data content is impossible to guarantee when computer data is being transmitted, so transmission quality can suffer. In comparison, B8ZS uses a bipolar violation substitution which guarantees the 12.5% average with maximum number of 7 consecutive 0s. Most networks are moving towards B8ZS line code usage. See Figure 6–2 for an illustration of the DS1 signal.

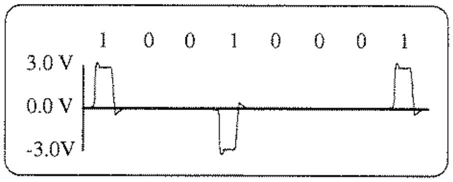


Figure 6–2 DS1 Pulse Transmission

T1 Framing

In T1, there are 192 data bits and one framing bit. With framing, you can tell where the first bit of the frame is. Most T1s are arranged with 24 channels of data, with one byte (8 bits) transmitted per channel per frame. Channel 1 is the first 8 bits after the frame bit, channel 2 is the second 8 bits after the framing bit and so on. 8000 frames are transmitted per second. Each channel provides 64 kbps bandwidth. See figure 6–3.

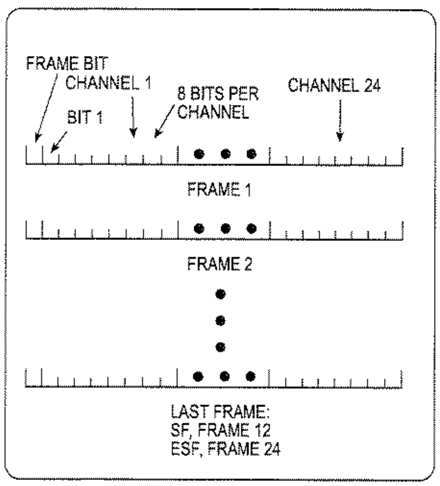


Figure 6–3 DS1 Frame Structure

There are 3 kinds of standardized T1 framing in use today, SF, ESF, and SLC-96 (SLC is a registered trade mark of AT&T).

The simplest is SF framing. In SF framing, 12 frames are grouped together as a Super Frame (SF). The 12 framing bits are transmitted in a recognizable pattern such that the super frame is organized into frame number 1, frame number 2, and so on.

ESF (Extended Super Frame) is a newer method with 24 frames grouped together. Of the 24 framing bits, only 6 are used to establish the frame position, i.e. which frame is number 1, which frame is number 2, and so on. Another 6 are used for a CRC-6 (Cyclic Redundancy Check code - 6), and 12 are used for the ESF Facility Data Link (FDL). The CRC-6 bits are the remainder from a division of the bits of the previous frame by a sixth-order polynomial. Any monitoring device along the line can do the same division process and compare its remainder to the CRC-6 bits. If the two figures are not identical, then the monitoring device can assume that a transmission error has occurred somewhere between the measurement point and the origin of the ESF-framed signal. The facility data link is a 4 kbps data channel that allows terminal to terminal communications on an in-service circuit. One example of in-service communication is the performance report message that is broadcast once per second on an in-service circuit. This message is discussed later in this section in End-to-end Performance Monitoring. The facility data link also provides a secure communication channel that the customer cannot influence. For instance, ESF NIU loopback commands are transmitted on the data link so that there is zero chance that the customer's own payload data will accidentally loop up the NIU.

SLC-96 is a framing format introduced by AT&T and later standardized by Bellcore in TR-TSY-000008, Digital Interface between the SLC 96 Digital Loop Carrier System and a Local Digital Switch. The framing is used on AT&T's old SLC-96 product line. The framing supports a broad variety of maintenance functions such as alarm transmission, automatic switching to protection line, and far end loop back. SLC-96 framing is used on the DS1 link in between the central office terminal and the remote terminal.

PCM

Pulse Code Modulation (PCM) is the technology that allows a voice conversation to be digitized and inserted on a T1 line. In a voice conversation, there is a 4 kHz analog bandwidth that is transmitted through the network. Through the Nyquist theorem, 8000 samples per second must be taken in order to achieve the 4000 kHz bandwidth requirement. As shown in figure 2.1D, the analog signal is sampled at 125 micro second intervals, 8000 times per second. Each sample is a measurement of the voltage of the analog signal. The voltage level is then converted to an 8-bit binary word. An 8-bit word provides 256 different levels, which is not very many. To produce a higher quality sound, a μ-law transformation is used which puts a constant dB level in between each voltage step. This creates a nonlinear relationship between the pulse amplitude and the level number, but it is more pleasing to the ear because it provides a more constant signal to noise ratio at a wide range of volumes. Each 8-bit word occupies one channel in one frame. Because there are 24 channels available, up to 24 conversations can be carried on the T1 signal.

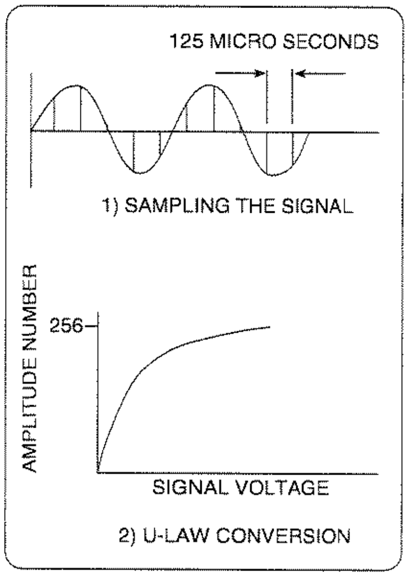


Figure 6–4 PCM Sampling and μ-Law Encoding

Switching

A basic understanding of switching is helpful when troubleshooting T1 problems. DS1, DS2, and DS3 signals are plesiochronous, that is, they are not frequency-locked with respect to each other. The DS2 and DS3 signals have stuff bits built into the framing so that all signals can be slipping with respect to each other and not cause any transmission errors at all. The frequencies are only required to be about +/- 20 ppm to +/- 50 ppm (parts per million) of center frequency for error free transmission.

Long after this digital plesiochronous (sometimes called asynchronous) transmission technology was adopted, switches also began a conversion from analog technology to a newer digital technology. Unfortunately, the original DS1 framing concept never anticipated a need to cross-connect DS0s directly from one DS1 to another DS1. Unfortunately, this is exactly what happens inside a digital switch. A call that comes in on one channel of one DS1 goes out on another channel of another DS1.

8000 times per second, a switch takes one received frame from each of the DS1s connected to it. It disassembles each frame into the 24 independent timeslots inside the frame. It looks into its call map to see where each of the received timeslot bytes should be sent. Then it sends each byte to the appropriate DS1 transmit port. Then it assembles all the bytes for each transmit DS1, inserts any idle code on timeslots that are not actively in the middle of a call, and inserts an appropriate framing bit for the frame type being used. Then it transmits each DS1 frame during 1/8000 of a second. There may be several 125 μsec periods of delay for a byte as it moves through the switch.

Not all the DS1s will have the frames ending at exactly the same moment in time. For this reason, the switch maintains a buffer for each transmitted and received DS1 signal. Each buffer provides an elastic store of bits so that the switch will always have bits available to transmit or receive at the exact moment required.

All the DS1 must be received and transmitted at exactly the same frequency, the frequency that the switch is operating at. Any received DS1 that is going too slowly will eventually run out of bits in its buffer, because the switch is taking bits out of the buffer faster than the buffer is being filled by the DS1. When the buffer becomes empty, the switch must insert extra data in each of the timeslots that are transmitted on the cross-connected channels. An error has now occurred because what is transmitted is not the same as what is received. Likewise, if any received DS1's frequency is higher than the switch, sooner or later the receive buffer will overflow because bits are coming in faster than they are being taken out. Once the buffer overflows, some bits that are received will not be transmitted on the cross-connected channel. An error has again occurred, this time because some data has been lost.

The universal deployment of digital switches has resulted in a massive effort to synchronize all DS1s so that errors will not occur in switched circuits that use DS1 for transport.

Synchronization

DS1 circuits should be synchronized to avoid the switching problems described in the previous paragraph. Minor frequency deviations will cause only pops and crackles on a voice circuit, however a data circuit can be rendered virtually useless by the regular errors resulting from frequency slippage. If a DS1 should be slipping by more than 100 to 300 bps, then a digital switch may even put the DS1 out of service and declare an alarm.

Complete synchronization is achieved only when all signals can have their frequency traced back to the same clock. When a network element is installed, its timing relationship is one of the items that needs to be engineered. The relationship is usually one of master/slave. For instance, if a PBX is connected to a central office switch via a T1 line, chances are good that the central office switch is properly synchronized to the network. Therefore, the DS1 signal received by the PBX from the central office will be synchronized to the network. Thus, the PBX should be set up to be in slave timing mode, with the DS1 signal received from the central office used as the timing source. In turn, a D4 channel bank that is connected to the PBX should be slaved to the PBX. One possible distribution of clock in the network is illustrated in Figure 6–5.

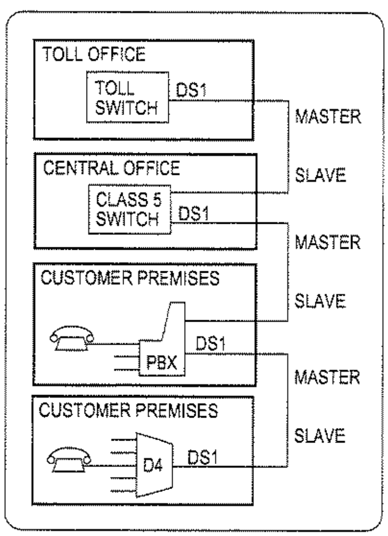


Figure 6–5 Timing Distribution

Note that a network element that is slave timed to another network element may also be the master to other network elements attached to it. Also note that slave timing is sometimes called loop timing or receive timing - loop timing because the received timing is looped out the transmitter, and receive timing because the received signal is used for the timing source.

Another way to be timed is to be internally timed. The advantage of this is that the element will always be able to generate a signal, no clock signal is required. Test sets doing acceptance testing are usually set to internal timing. Note that internal timing is not acceptable when the test set will be transmitting toward a switch for nx64 kbps testing when the switch is drawing its timing from something other than the test set. In this case the test set should be loop timed.

Supervision

Common T1 framing methods transmit supervisory information through "robbed bit" signaling. Every 6 frames, the least significant bit in the PCM byte for every channel is "robbed" and is instead used to transmit signaling information. In SF framing, bits in the sixth and twelfth frames are "robbed" to form the A and B signaling bits for each channel. These bits are interpreted according to the kind of circuit carried in the channel. For instance, on an E&M circuit A= 0, B= 0 means that the circuit is idle, (the user is on-hook). A = 1, B = 1 means that the circuit is seized (the user has taken his phone off the hook).

With ESF framing, there are 24 frames grouped together with bit 8 of each channel in frames 6, 12, 18, and 24 as the ABCD signaling bits. Most ESF signaling is identical to SF signaling - the C and D bits are copies of the A and B bits.

SLC-96 supervision is handled via the SLC-96 data link.

Addressing

Addressing is the process of sending a telephone subscriber address for the purpose of setting up a call. The oldest addressing technique in use today is pulse dialing. With pulse dialing, your phone goes on-hook and off-hook 10 times per second in order to dial a given number. For example, to dial a 7, you start out in the off-hook condition, then you go on-hook / off-hook 7 times. This is the technique that old rotary dial phones use. This addressing information is transmitted through a T1 line by toggling the A and B bits from the off-hook state to the on-hook state at a rate of 10 times per second. This sort of addressing is now commonly used in switched 56 services.

MF, Multi Frequency, is an addressing technique used for interoffice signaling in the telephone network. It uses a group of frequencies in pairs to form a single address tone. In addition to supporting the digits 0 through 9, MF offers many other control codes for specialized network applications like billing, pay phones, etc.

DTMF, Dual Tone Multi Frequency, is the commonly used addressing method on today's phones. Like MF, it uses pairs of tones to send a digit. Unlike MF, it uses two separate groups of tones. DTMF supports 16 digits, 0 through 9, #, *, and A through D.

AIS and Yellow Alarms

In DS1, an intermediate network element such as an M13 multiplex, 1x1 DCS, or SONET mux, is supposed transmit AIS downstream when it receives a loss of signal. The DS1 AIS is an all 1s unframed signal. A terminating network element like a D4 channel bank, PBX, central office switch, or 1x0 DCS should send a yellow alarm back towards the other end when it receives a loss of frame. Note that a received AIS is a loss of frame. Terminating elements also need to properly condition the DS0s that the DS1 carries when the frame is lost. For instance, A D4 channel bank is supposed to condition its channel cards to take them out of service and transmit an appropriate out-of-service signal to the low speed equipment that is attached. See Figure 6–6 for diagrams of how the AIS and yellow alarms are transmitted.

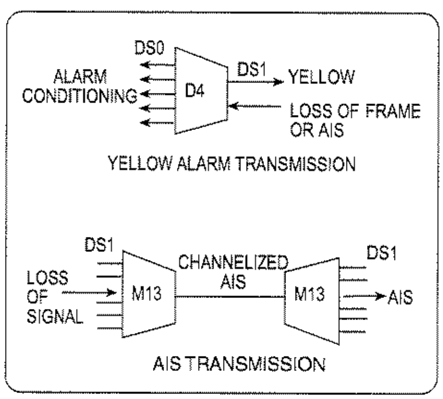


Figure 6–6 AIS and Yellow Alarms

Loopbacks

Loopback testing lets you quickly verify the performance of a new DS1 circuit. It can also greatly speed the fault sectionalization process on a circuit that is not working properly. Loopback capabilities are provided in a variety of equipment - new central office repeaters, new regenerative line repeaters, NIUs, CSUs, and M13 multiplexes. The general characteristics of these equipment have been discussed in the DS1 equipment section. Figure 6–7 shows the variety of loopback points available from the central office during a fault sectionalization process.

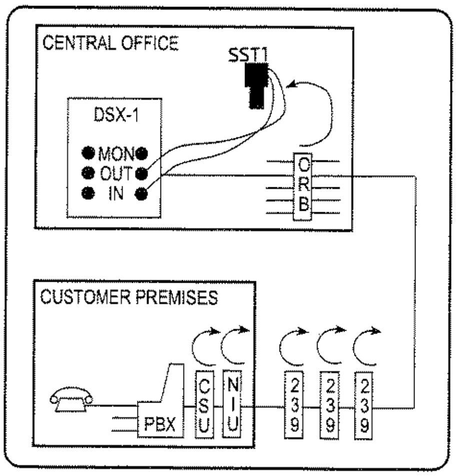


Figure 6– 7 DS1 Loopback Testing

End-to-end performance monitoring

End-to-end performance monitoring is made possible through ESF framing and CSUs that support the Performance Report Message (PRM) broadcast on the ESF Facility Data Link (FDL). This capability is specified in ANSI T1.403.

With ESF performance monitoring, any CRC-6 error or bipolar violation that is received by the CSU is transmitted out towards the other direction in the performance report message on the facility data link. In that way, the end user or the various telephone companies that provide transport service can all have equal ability to see the quality to the end-to-end transmission while the circuit is in-service. Before this capability was available, the circuit would have to be taken out of service in order to measure the end-to-end transmission performance.

This new end-to-end performance monitoring capability gives the customer a way to verify the quality of the service that the telephone company is delivering. It also allows the telephone company to set up internal monitoring systems to report on the average grade of service provided to customers. The telephone company may also receive early warning of some failures, i.e. those failures that are preceded by a gradual period of deterioration. This early warning could allow the telephone company to fix the problem before the service is lost.

End-to-end performance monitoring is illustrated in Figure 6–8. In this figure, a fault on the transmission line induces repeated errors on the service. The CSU at the end of the line sees the errors as CRC-6 errors and generates a performance report message in the other direction. The installed performance monitoring equipment in the central office and the technician using her SunSet can both see the message.

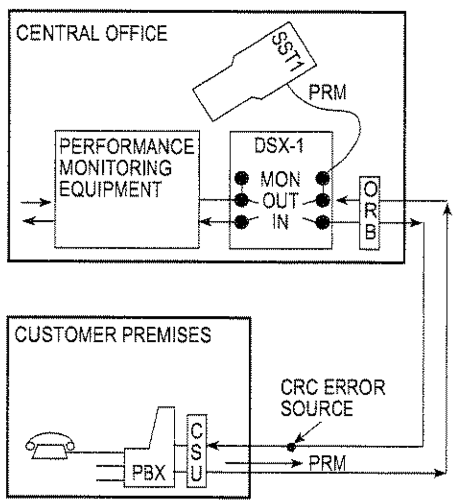


Figure 6–8 DS1 Performance Monitoring

1.2 Troubleshooting and Fault Sectionalization

This section helps you find problems on T1 circuits. First you will get a checklist on various problems that often happen with T1 circuits. Then you will see how the information you have learned about errors and alarms helps you quickly find the problem.

Here is a checklist of items to be checked on a T1 circuit:

- Is the circuit wired up properly? Check for loose wire wraps, bad splices, connections to wrong pair, etc.
- Are there any cable problems? For example, bridge taps, "wet" cable, paper insulated cable, shorts, grounds.
- Is the cable T-screened? Ideal T1 transmission cables uses a screen to separate the two directions of transmission to prevent cross talk. Are the T1s in the screened cable properly separated into Transmit and Receive binder groups?
- Has the circuit been connected through properly at all the offices along its route?
- Are Transmit and Receive backwards? A surprising number of circuits get plugged in backwards. Try the other way.
- Is there any AMI/B8ZS mismatch? AMI and B8ZS line codes are incompatible with each other. Both ends of a T1 line must use the same coding. If all ones works fine, QRS has errors, 3-in-24 will not synchronize, its probably AMI/B8ZS mismatch.
- Is there a framing mismatch? Be sure the framing is the same on both sides.
- Does the problem reappear when you drop the loopback? The problem is probably with the equipment on the far side of the loopback.
- Is the circuit connected to a switch or PBX? Look for frequency mismatch.
- Are DS1 signals used throughout? Sometimes people plug DS1 into DS1C by mistake, or other signal format incompatibility.
- Is there a double loopback? Sometimes 2 or more loopbacks of the same type get installed where only 1 is expected. In this case a double or triple loop may occur on a loopback code, and the loopdown code may have to be transmitted 2 or more times before all the loops come down.
- Is there a termination problem? All lines should have only 1 100 ohm termination. Other terminations should be high impedance. If you're not sure, try TERM, BRIDGE, and MON.
- Is the level too low? The received level should be at least -15 dBdsx for most equipment.
- Is there a frequency synchronization problem? See the discussion in this chapter.
- Is there a cross-talk problem? If the signal level is lower than -12 dB, another signal could be cross-talking onto the received T1 line.
- Are repeaters installed? Are they at the right spacing?

- Is there a span powering problem? 60 mA span power needs to be delivered to all repeaters on the span, all repeaters should have their power switches properly set to LOOP or THRU. The central office automatic span powering repeater should be delivering the proper voltage to power the span. All the repeaters before the farthest one away from the central office should be set to THRU. The farthest repeater or the NIU should be set to LOOP. Too many repeaters will overload the central office repeater.
- Is the NIU span powered? Is that span power provided?
- Is the central office repeater transmitting a 6V signal that is not being padded to 3V before it gets to the next equipment?
- Is the test cord broken or dirty? This can cause misleading test results.
- Is the test set working properly? This can also cause confusion when troubleshooting problems. A quick way to check the test set is to loop the test cord from transmit to receive, checking both the cord and the set at the same time. Common test set problems are wrong termination (TERM, BRIDGE, DSXMON), wrong clock setting (INTERNAL is right for most cases), wrong framing, wrong line code, wrong Nx64 selection, and wrong test pattern.

Fault sectionalization

Fault sectionalization techniques vary depending on whether the T1 circuit is in-service or out of service. If it is out of service, then you start from the middle and loop back the circuit in each direction to see which side has the problem. Then, you go to the middle of the side that has the problem and do another loopback in each direction. You repeat this procedure until you find the problem. See Figure 2.1G for an illustration of the loopback test. This figure shows many of the loopbacks that may be available in one direction from the central office. Note that there also may be DS3 loopbacks available if the circuit is a DS3 circuit, or DS1 channel loopbacks may be available in higher order multiplexes.

If the circuit is in service, non-disruptive performance monitoring techniques are used. Much can be learned simply by plugging into monitoring jacks and observing the information. Be sure to plug into the monitor jack for each direction and look at the results.

The following paragraphs tell you what conclusions you can make from various results at different monitor points. In the accompanying diagrams, a little SunSet T1 shows what abnormal conditions it is seeing from its monitor point. In the diagrams, a triangle indicates a line impairment that is causing steady or bursty errors. A loss of signal is indicated by a missing signal arrow. If CRC is listed in the diagram, it will only be seen if the circuit uses ESF framing.

Bipolar violations and loss of signal

DS1 bipolar violations or loss of signal show that the fault is relatively nearby. DS1 bipolar violations pass through line repeaters, office repeaters and NIUs, but are stopped by multiplexes, DCSs, switches, signal format changes (i.e. from optical to electrical, or from radio to electrical) and possibly CSUs. The DS1 electrical signal can transmitted through regenerative line repeaters for hundreds of miles. Thus a DS1 bipolar violation indicates a transmission problem between the test set and the last multiplex, DCS, or other element that stops bipolar violations.

Figure 6–9 illustrates the DS1 case.

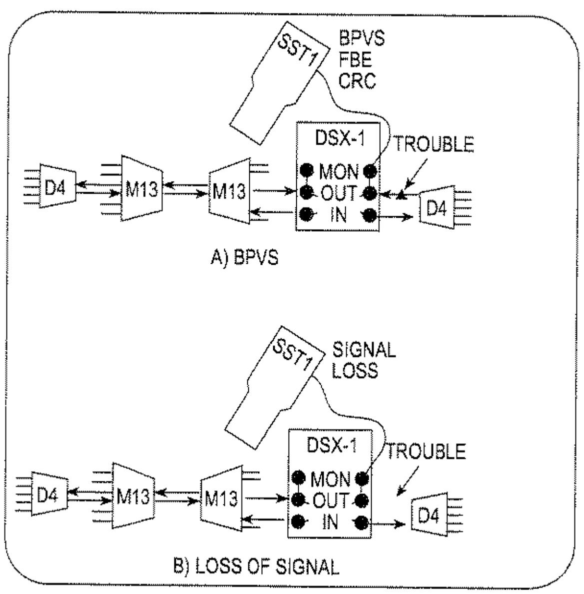


Figure 6–9 BPVs and LOS in DS1 Fault Sectionalization

Frame bit errors, bit errors, CRC-6 errors

These errors travel with the DS1 circuit for the entire length of the circuit. They pass through higher order multiplexes. They also pass through changes in line format from copper to fiber, fiber to radio, etc. If these errors are found with bipolar violations, then the problem is local. If these errors are found without bipolar violations, then the problem is behind the last format change. Figure 6–10 shows what these errors mean when they are seen without BPVs.

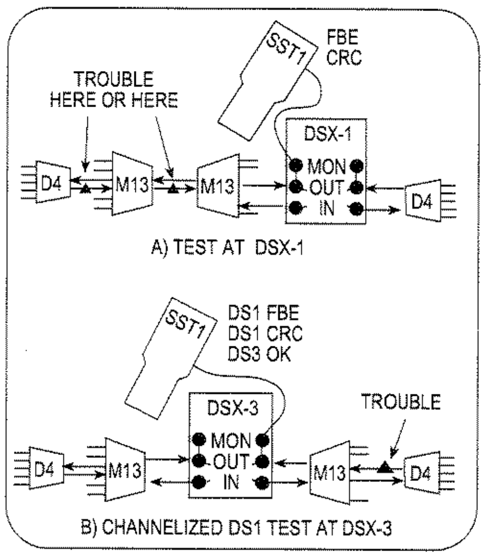


Figure 6–10 FBE and CRC in DS1 Testing

AIS and Yellow Alarm

AIS means that there is a problem on the line somewhere behind the last multiplex, DCS, fiber mux, or other device that replaces a loss of signal with AIS.

Yellow alarm means that the received signal has been lost at the end of the line that generated the signal you are monitoring. When you monitor the other direction, if the signal is framed, then the problem must exist between you and the end of the line generating the yellow. If the signal is unframed (for example AIS or loss of signal) the trouble is between you and the other end of the circuit.

Figure 6–11 shows how the AIS and Yellow alarms show up in

DS1 fault sectionalization.

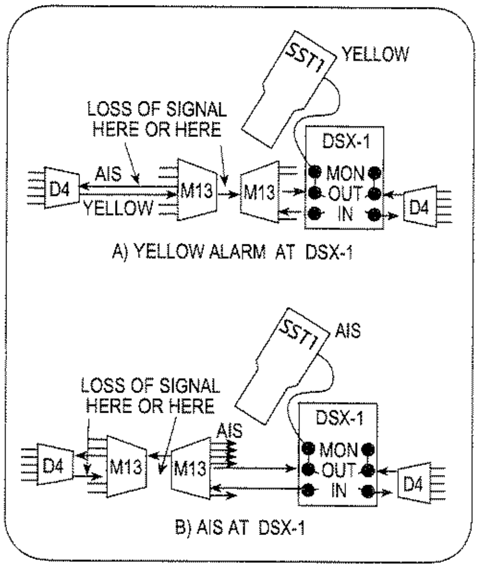


Figure 6–11 DS1 Yellow and AIS

FEBE or ESF PRM errors

Both of these indicate that errors are being received at the end of the line that is generating these messages. If you see no errors on the other direction of the line being monitored, then the problem exists between you and the end generating the FEBE or PRM error messages. If the other side shows BPVs, CRC-6, frame or other errors, then the problem exists between you and the end of the circuit that is not generating the FEBE or PRM error messages.

Figure 6–12 shows a typical example of a network fault leading to this indication.

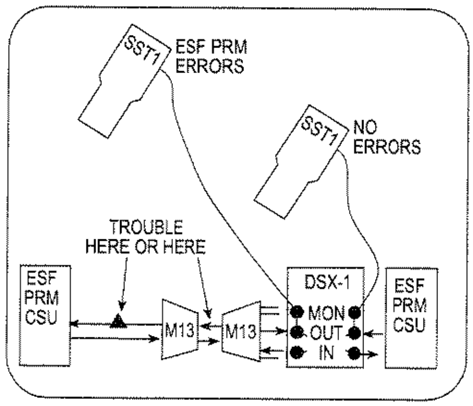


Figure 6–12 DS1 ESF PRM Errors

Chapter 7
Specifications & Configurations

1.0 Specifications

Connectors

Bantam jacks (Eq Tx, Eq Rx, Fac Tx, Fac Rx)
8-pin mini DIN RS232C serial port, DTE

Access

Single Mode

DSX Monitor :100 ohms
Bridged Monitor: > 1000 ohms
Terminated: 100 ohms
Terminated Loop:100 ohms
Bridged Loop > 1000 ohms
DSX Monitor Loop: 100 ohms

Dual Mode

Thru A/B, Split A/B, Split E/F, Loop E/F, Mon E/F: Termination
Thru, Split, Loop: 100 ohms
Mon: > 1000 ohms

Transmitter

Framing: SF-D4, ESF, SLC-96, T1DM
Coding: AMI, B8ZS
Line Build Out (LBO): 0, 7.5, 15 dB
DSX preequalization: 0 to 665 feet, 133 feet per step
Clock: internal (1.544 MHz +/- 5 ppm), looped, external
Pulse shape to TR-TSY-000499; reference: G.703,
CB113, CB119, CB132, CB143, PUB62508, PUB62411
Transmit Patterns:
Repeating: 3 in 24, 1 in 8 (1:7), all 1s, 1 in 16, 55 octet, alternating 1010, all 0s, T1-T6, DDS1-4, DDS6, FOX
User programmable pattern 1 to 2048 bits
Store up to 10 programmable patterns with alphanumeric names
Pseudo random: QRS, PRBS - n = 6, 7, 9, 11, 15, 20, 23
Test pattern inversion
Insert errors: BPV, logic, frame errors; programmable error burst 1 to 9999 counts, or error rate 2×10^{-3} to 1×10^{-9}
Idle Pattern Generation:
SF-D4, ESF payload - 00010111
ESF facility data link - 000000001111111

Receiver

Input sensitivity:

Terminate, Bridge: +6 to -36 dB cable loss

DSXMON: -15 to -30 dB, resistive

Coding: AMI, B8ZS, Auto

Framing: SF, ESF, SLC-96, T1DM, auto frame

Frequency range : 1542 kHz to 1546 kHz

Auto pattern synchronization

Received pattern synch independent of transmitted pattern

Programmable loss of frame criteria, error averaging interval

Basic Measurements

Summary Measurements

Elapsed time, remaining time, framing, line coding, transmitted pattern, received pattern, BPV count and rate, bit error count and rate, framing bit error count, pulse level (dB), CRC-6 block error count, line frequency, errored second count and percent, severely errored second count and percent, error free second percent, available second percent, unavailable second count and percent

Logical Error Measurements

Bit error count and current rate, average bit error rate since start, bit slips, bit errored seconds and percent, severely bit errored seconds and percent, available seconds and percent, unavailable seconds and percent, degraded minutes count and percent, loss of synch seconds count and percent

Signal Measurements

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

Simplex current, 1 to 150 mA, +/- 1 mA +/- 5%.

Receive bit rate, 1542 to 1546 kbps, +/- 1 bps, +/- clock source accuracy, external or internal clock

Receive level (volts and dBdsx):

Peak to peak : 60 mV to 15V, +/- 10 mV, +/- 5%

Positive pulse: 30 mV to 7.5V, +/- 10 mV, +/- 5%

Negative pulse: -30 mV to -7.5V, +/- 10 mV, +/-5%

Line Error Measurements

BPV count and rate (current and average), BPV error seconds count and percent, BPV SES count and percent, BPV AS count and percent, BPV UAS count and percent, BPV degraded minutes count and percent

Path - Frame Measurements

Frame bit error count and rate (current and average), frame slip count, OOF second count, COFA count, frame synch loss seconds, yellow alarm second count, frame error second count and percent, frame severely errored second count and rate, frame available second count and percent, frame unavailable second count and percent

Path - CRC-6 Measurements

CRC-6 block error count and rate (current and average), CRC-6 errored second count and percent, CRC-6 severely errored second count and percent, CRC-6 available second count and percent, CRC-6 unavailable second count and percent

Frequency Measurements

Moving bar graph of slip rate, received signal frequency, max frequency, min frequency, clock slips, frame slips, max positive wander, max negative wander

Other Measurements

View Received Data

View T1 data in binary, hex, ASCII
Shows data in bytes by time slot
Shows 8 time slots per display page
Captures 256 consecutive time slots as test pattern

Propagation Delay

Measure round trip propagation delay in unit intervals +/- 1 UI, with translation to microseconds and one way distance over cable

Quick Test I and II

2 programmable automated loopback tests that save time when performing standardized acceptance tests

Bridge Tap

Automated transmission and measurement of 21 different patterns to identify possible bridge taps at some point on line

Loopback Control, In-band

NIU loop up 11000
NIU loop down 11100
CSU loop up 10000
CSU loop down 100
Nonstandard loop up 100000
10 programmable user patterns, 1 to 32 bits

Loopback Control, ESF-Facility Data Link

Payload CSU loop up: 111111110 010100 0
Payload CSU loop down: 111111110 100110 0
Line CSU loop up: 111111110 111000 0
Line CSU loop down: 111111110 001110 0
Network (NIU) loop up: 111111110 100100 0
Network (NIU) loop down: 111111110 010010 0
10 programmable user patterns, 1 to 32 bits

Westell & Teltrend Looping Devices Control

Automated looping of Westell and Teltrend line and central office repeaters. Includes SF and ESF modes, arm, loop up/down, loopback query, sequential loopback, power loop query, span power down/up, unblocking. Provided in SW1010

Voice Frequency Capability

Monitor speaker with volume control
Built-in microphone for talk
View all 24 channel A,B (C,D) bits
Control A,B (C,D) bits (E&M ground/loop start, FXO, FXS, on/off hook, wink)
Generator: 404, 1004, 1804, 2713, 2804 Hz @ 0dBm and -13dBm
DTMF dialing, 32 digits, 10 sets preprogrammable speed dial number
Programmable tone and interdigital period
Companding law - u Law
Hitless drop and insert
Programmable idle channel A,B (C,D) bits
Selectable idle channel code, 7F or FF hex

VF Level, Freq & Noise Measurement (SW111)

Generator: 50 to 3950 Hz @ 1 Hz step. +3 to -60dBm @ 1dBm step
Level, Freq measurements : 50 to 3950 Hz. +3dBm to -60dBm
Noise: 3 kHz flat, C-message, C-notch, S/N

MF/DTMF/DP Dialing, Decoding and Analysis (SW141)

MF/DTMF/DP dialing
Programmable DP %break and interdigital period @ 10 pps
MF/DTMF decode up to 40 received digits. Analyze number, high/low frequencies, high/low levels, twist, tone period, interdigital time.
DP decode up to 40 digits. Analyze number, %break, PPS, interdigital time.
Signaling Analysis:
- Live - graphical display of A,B (C,D) signaling state changes
- Trigger - programmable A,B (C,D) trigger state to start analysis on the opposite side
- MFR1 - timing analysis of signaling transition states and decoding of dialed digits
- MFR1M - Modified MFR1 CO switches signaling analysis
- MIXTONE - Decode a signaling sequence that has both MF and DTMF digits

Fractional T1 (SW105, SW1010)

Error measurements, channel configuration verification
Nx64 Kbps, Nx56 Kbps, N=1 to 24
Sequential, alternating, or random channels
Auto scan and auto configure to any FT1 order
Scan for active channels
Rx and Tx do not need to be same channels
Hitless drop and insert
Programmable idle channel A,B (C,D) bits
Selectable idle channel code, 7F or FF hex

ESF Facility Data Link (SW107, SW1010)

Read and Send T1.403 message on FDL (PRM and BOM)
Automatic HDLC protocol handling
YEL ALM, LLB ACT, LLB DEA, PLB ACT, PLB DEA, NLB ACT, NLB DEA
AT&T 54016 24 hr performance report retrieval
T1.403 24 hour PRM collection per 15 min interval

SLC-96 Data Link (SW107, SW1010)

Send and receive message
WP1, WP1B, NOTE formats
Alarms, switch-to-protect, far end loop
To TR-TSY-000008 specifications
SLC-96 FEND loop

CSU/NI Emulation (SW106, SW1010)

Bidirectional (Equipment and Facility Directions)
CSU/NI replacement emulation
Responds to loopback commands - inband and datalink
Graphic indication of incoming signal status in both directions
Simultaneous display of T1 line measurements
Automatic generation of AIS
Loopbacks:
- Facility - line and payload loopback
- Equipment - line loopback
- Simultaneous loopbacks in both directions
- Local and remote loopback control

Remote Control (SW100)

VT100 emulation with same graphical interface used by test set
Circuit status table provides current and historical information on test set LEDs
Uses test set's serial port at 9600 baud, 8 pin MINI DIN
Serial port can not be connected to printer during remote control

Westell PM NIU and MSS (SW120)

Supports Westell performance monitoring network interface unit and maintenance switch system with ramp.
Set/query NIU time and date. Query performance data by hour or all. Reset performance registers. Read data over ramp line. Perform maintenance switch function for Westell and Teltrend

Pulse Mask Analysis (SW130)

Scan Period: 800 ns
Measurements: Pass/Fail, ns rise time, ns fall time, ns pulse width, % overshoot, % undershoot
Resolution: 1 ns or 1%, as applicable
Masks: ANSI T1.102, T1.403. AT&T CB119, Pub 62411
Pulse/Mask Display: test set screen and SS118B/C printer

DDS Basic Package (SW170)

Choose receive and transmit timeslots independently
Test rates: 2.4, 4.8, 9.6, 19.2, 56, 64 kbps
Patterns: 2047, 511, 127, 63, all 1s, all 0s, DDS-1, DDS-2, DDS-3, DDS-4, DDS-6, 8-bit user
Loopbacks: Latching, interleaved. CSU, DSU, OCU, DSO-DP, 8-bit user
Measurements: Bit errors, Bit error rate
Control code send/receive: abnormal, mux out of synch, idle
Access Mode: Loopback tests require intrusive access to T1

Teleos & Switched 56 Tests (SW144)

Switched 56 call set up: supervision and dialing
Send test patterns: 2047, 511, 127, 63, all 1s, all 0s, FOX, DDS1-4, DDS6, USER
Bit error, bit error rate measurement
Teleos signaling sequence timing analysis and dial digits decoding

Environmentals

Operating temperature 0 ½C to 50 ½C
Operating humidity 5% to 90%, noncondensing
Storage temperature -20 ½C to 70 ½C
Size 2.4"(max) x 4.2"(max) x 10.5"
Weight 2.7 lb (1.2 Kg)
Battery operation time 2.5hr nominal
AC operation: 110V/120V @ 60 Hz, or 220V/240V @ 50/60 Hz

2.0 Configurations

Chassis

SS100 - SunSet T1 Chassis
Includes battery charger, user's manual, instrument stand. Software Cartridge must be ordered separately
CLEI: T1TUW04HAA
CPR: 674488

Software Cartridge

SW1000 - Software T1
Includes basic measurements, loopback control, test patterns

send/rcv, bridge tap, propagation delay, quick test. Also includes VF channel capabilities: talk/listen, view/control A,B (C,D), DTMF dialing, send 5 tones at 2 levels
CLEI: T1TUW01HAA
CPR: 674485

SW1010 - Software FT1
Includes all Software T1 features and adds: Fractional T1, Teltrend/ Westell looping device control, CSU/NIU emulation, ESF/ SLC-96 data link control
CLEI: T1TUW02HAA
CPR: 674486

Software Options

SW100 - Remote Control
Graphical, menu driven VT100 emulation.
Includes SS115 & SS122
SW105 - Fractional T1
Purchased with SW1000 only
SW106 - CSU/NIU Emulation
Purchased with SW1000 only
SW107 - ESF & SLC-96 Data Link Send and Receive
Purchased with SW1000 only
SW111 - VF Level, Frequency & Noise Measurement
SW120 - Westell Maintenance Switch, PM NIU, RAMP
Purchased with SW1010 only
SW130 - Pulse Mask Analysis
SW141 - MF/DTMF/DP Dialing, Decoding, and Analysis
SW144 - Teleos/Northern Switched 56 tests
SW170 - Basic DDS Package

Accessories

SS101 - Carrying Case
SS104 - Cigarette Lighter Battery Charger
SS105 - Repeater Extender
SS106 - Single Bantam to Single Bantam Cable, 6'
SS107 - Dual Bantam to Dual Bantam Cable, 6'
SS108 - Single Bantam to Single 310 Cable, 6'
SS109 - Single Bantam to Probe Clip Cable, 6'
SS110 - Dual Bantam to 15-pin D Connector Cable, Male, 6'
SS111 - Dual Bantam to 15-pin D Connector Cable, Female, 6'
SS112 - Dual Bantam to 8-position Modular Plug Cable, 6'

SS113A - AC Battery Charger, 120VAC
SS113B - AC Battery Charger, 110VAC
SS114 - SunSet T1 User's Manual
SS115 - DIN-8 to RS232C Printer Cable
SS115B - DIN-8 to DB-9 Printer Cable
SS116 - Instrument Stand
SS117A -Printer Paper, 5 rolls, for SS118B/C
SS118B - High Capacity Thermal Printer with 110 VAC charger.
Includes SS115B
SS118C - High Capacity Thermal Printer with 220 VAC charger.
Includes SS115B
SS121A - SunSet AC Charger, 230VAC, 50/60 Cycle
European style connector
SS121B - SunSet AC Charger, 220VAC, 50/60 Cycle
3-prong IEC connector
SS121C - SunSet AC Charger, 240VAC, 50/60 Cycle
3-prong IEC connector
SS122 - Null Modem Adapter, DB-25
SS122A - Null Modem Adapter, DB-9
SS123A - SunSet Jacket
SS125 - SunSet T1 Training Tape, English
SS130A - Removable SunSet Rack Mount - 19"/23"
SS130B - Permanent SunSet Rack Mount - 19"/23"
SS132 - Two Single Bantams to 4-position Modular Plug Cable

Chapter 8
Abbreviations

Chapter 8 Abbreviations

A

AC - Alternating Current
ACK - Acknowledge
AFBER - Average Framing Bit Error Rate
AIS - Alarm Indication Signal
AISS - Alarm Indication Signal Seconds
ALM - Alarm
AMI - Alternate Mark Inversion
ARM-INB - Arm Inband
AS - Available Second
AVBER - Average Bit Error Rate
AVCER - Average CRC-6 block Error Rate
AVG - Average

B

B8ZS - Bipolar 8-Zero Substitution
BATT - Battery
BPV - Bipolar Violation
BTSLP - Bit Slip
BUFF - Buffer

C

CER - CRC-6 Error Rate
CLR - Clear
COD - Code
COFA - Change of Frame Alignment
CONFIG - Configuration
CRC-6 - Cyclic Redundancy Check Code - 6
CSU - Customer Service Unit
CTL- Control

D

dB - decibel
dBdsx - decibel referenced to dsx power level
DC - Direct Current
DCS - Digital Cross-connect System
DENS - Density

DGRM - Degraded Minute
DIG - Digital
DLF - Data Link Frame
DN - Down
DS1 - Digital Signal 1
DSX - Digital Signal Cross-connect
DSXMON - DSX Monitor signal
DTMF - Dual Tone Multi Frequency

E

E - Equipment
EQP - Equipment
ERR INJ - Error Injection
ES - Errored Second
ESF - Extended Super Frame
ET - Elapsed Time
EXTERN - External
EXZS - Excess Zeroes Seconds

F

F - Facility
F1 - Function 1
FAC - Facility
FBE - Framing Bit Error
FBER - Framing Bit Error Rate
FDL - Facility Data Link
FELP - Far End Loop
FREQ - Frequency
FRM - Frame
FSLIP - Frame Slip
ft - feet
FT1 - Fractional T1

H

HEX - hexadecimal
HOLDSCRN - Hold Screen
Hz - Hertz

I

INTERN - Internal

INV - Inverted

K

kFt - kilo Feet

L

LBO - Line Build Out
LDNS - Low Density Seconds
LED - Light Emitting Diode
LLPBK - Line Loopback
LOFS - Loss of Frame Second
LOG - Logical
LOS - Loss of Signal
LOSS - Loss of Signal Second
LPBK - Loopback
LPBKQRY - Loopback Query
Lpp - Level peak-to-peak
LVL - Level

M

Mbps - megabits per second
MON - Monitor
mW - milliwatt

N

NI - Network Interface
NOTE - Network Office Terminating Equipment
NV RAM - Non Volatile Random Access Memory

O

OOF - Out Of Frame

P

PAT - Pattern
PLPBK - Payload Loopback
ppm - parts per million
PRBS - Pseudo Random Bit Sequence
PRN SCRN - Print Screen

PRNT - Print
PRNTR - Printer
PWRLPQRY - Power Loop Query
PWCUTTH - Power Cut Through

Q

QRS - Quasi Random Signal

R

R - Receive
REF - Reference
RT - Remaining Time
RX - Receive

S

SCRN - Screen
SES - Severely Errored Second
SF - Super Frame
SIG - Signal
SHLF - Shelf
SLC-96 - Subscriber Loop Carrier - 96 channel
SMPX - Simplex
SPLT - Split
SS - SunSet
SW - Software, also Switch
SYNC - Synchronized

T

T - Transmit
T1DM - T1 Data Multiplexer
T/S - Time Slot
TERM - Terminated
TOUT - Time Out
TOUTDIS - Timeout Disable
TX - Transmit

U

UAS - Unavailable Second
UI - Unit Interval

UNIVLDN - Universal Loopdown
uS - microsecond

V

V - Volts
VAC - Volts AC
VF - Voice Frequency

Y

YEL - Yellow
YELS - Yellow Alarm Second

Index

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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.

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(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.