HP 37704A SONET test set
OPERATING MANUAL

SERIAL NUMBERS

This manual applies directly to instruments with serial numbers prefixed 3237U.

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1. IF THIS INSTRUMENT IS TO BE ENERGISED VIA AN AUTO-TRANSFORMER MAKE SURE THAT THE COMMON TERMINAL OF THE AUTO-TRANSFORMER IS CONNECTED TO THE NEUTRAL POLE OF THE POWER SOURCE.

2. THE INSTRUMENT MUST ONLY BE USED WITH THE MAINS CABLE PROVIDED. IF THIS IS NOT SUITABLE, CONTACT YOUR NEAREST HP SERVICE OFFICE. THE MAINS PLUG SHALL ONLY BE INSERTED IN A SOCKET OUTLET PROVIDED WITH A PROTECTIVE EARTH CONTACT. THE PROTECTIVE ACTION MUST NOT BE NEGATED BY THE USE OF AN EXTENSION CORD (POWER CABLE) WITHOUT A PROTECTIVE CONDUCTOR (GROUNDING).

3. BEFORE SWITCHING ON THIS INSTRUMENT:

    a. Ensure that all devices connected to this instrument are connected to the protective (earth) ground.

    b. Ensure that the line power (mains) plug is connected to a three-conductor line power outlet that has a protective (earth) ground. (Grounding one conductor of a two-conductor outlet is not sufficient).

    c. Check correct type and rating of the instrument fuse(s).

DECLARATION OF CONFORMITY

Manufacturer's Name: Hewlett-Packard Limited
Queensferry Telecommunications Division

Manufacturer's Address: South Queensferry
West Lothian
Scotland EH30 9TG

declares, that the product

Product Name :   SONET Test Set

Model Number(s):   HP 37704A

Product Options: This declaration covers all options of the above product.

conforms to the following Product Specifications:

Safety: IEC 348 (1978)
CSA - C22.2 No. 231 Series - M89

EMC: EN 55011 (1991) Group 1, Class A
EN 50082-1 (1991)

South Queensferry, Scotland	20 Apr 92	W R Pearson
Location	Date	W.R. Pearson/Quality Manager

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Getting Started

About this Manual

This Operating Manual describes control of the HP 37704A SONET test set using the front panel keys and is arranged in three sections :

Getting Started

Making Measurements

Reference

This Getting Started section explains the following :

- How to obtain the required display using the display select keys, (TRANSMIT); (RECEIVE); (RESULTS); (GRAPH); (AUX)

- How to modify the display information, using (⇧) (⇩) and the display softkeys

- How to use the other front panel keys

- How to interpret the status indicators

The Making Measurements section describes in detail how to test with the HP 37704A SONET test set.

The Reference section contains definitions of terminology and measurements.

About the HP 37704A

The HP 37704A SONET test set is a comprehensive field portable test set for applications at SONET rates up to 155 Mb/s (STS-3). It provides a single unit solution to network field test applications including installation test, commissioning/acceptance test and maintenance.

The standard HP 37704A SONET test set provides generation and analysis of ANSI mapped DS3 SONET signals at STS-1 (51.84 Mb/s). Errors, alarms and pointer adjustments can be added to the signals to stimulate network equipment. In addition, overhead channels can be programmed for specialized testing.

External DS3 signals may also be mapped into a SONET signal, via the rear panel STS1/DS3 Insert port, and dropped for further testing, via the rear panel STS1/DS3 Drop port.

Option 001 adds frequency offset capability. This allows the payload frequency, the line rate frequency or both to be offset from their synchronized rates. In addition it adds periodic and standard ANSI T1X1.6 pointer movement sequences to stress network desynchronizers.

Option 002 adds VT test capability. This allows generation and analysis of SONET signals carrying mapped DS1 payloads (VT 1.5) or unmapped VT6 payloads. In addition it allows generation and analysis of a framed DS1 signal.

The following plug-in interface modules add capability to the standard HP 37704A SONET test set and are easily interchanged :

HP 37771A   Provides STS-3 (155 Mb/s) electrical interface.

HP 37772A   Provides OC-1/OC-3 (52/155 Mb/s) optical interface.

HP 37776A   Provides OC-3/OC-12 (155/622 Mb/s) optical interface.

Power Requirements

The HP 37704A SONET test set requires a power source of 90 V to 253 V at a frequency between 48 Hz and 66 Hz. Power consumption is 200 VA nominal.

The fuse rating for the power source is, 3 A 250 V (Time Delay), HP part number 2110-0029.

(AUX)   Allows control of Time & Date, Keyboard Lock, Stored Settings, Printer, Remote Control, Beep On Error and Self Test. A list of Options and Plug-Ins fitted is also available on this display.

Obtaining and Modifying the HP 37704A Displays
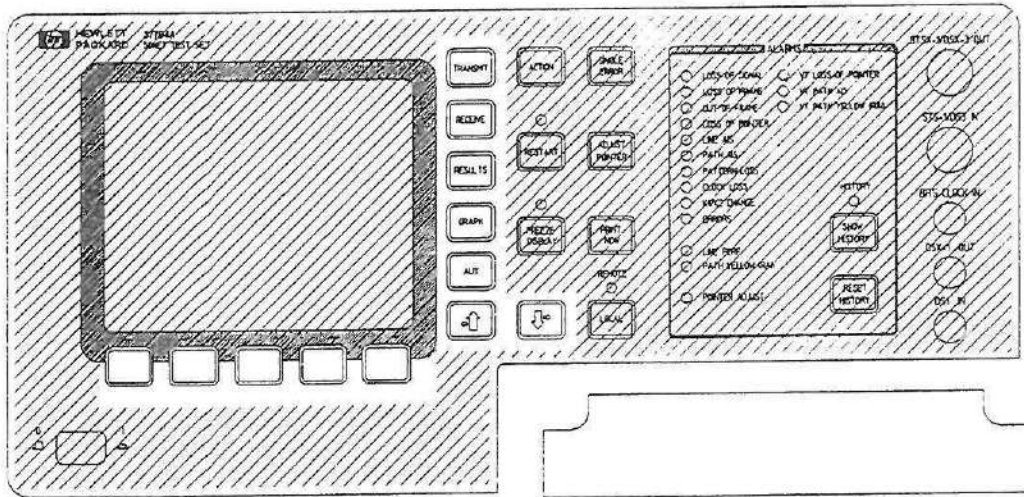
Figure 1-1. HP 37704A Front Panel

The operator interface is provided by the display and the front panel keys.

Five different display areas are obtainable using the five display keys,
(TRANSMIT) ; (RECEIVE) ; (RESULTS) ; (GRAPH) and (AUX), immediately to the right
of the display :

(TRANSMIT) Allows control of the generated Signal Rate, Signal Level,
Clock Sync Source, Payload Data, DS3 Framing, Test
Functions, Transport Overhead, and Path Overhead.

(RECEIVE) Allows selection of the received Signal Rate, Signal Level,
Payload Data, DS3 Framing and Test Functions, and provides
a monitor of the Transport Overhead and Path Overhead.

(RESULTS) Allows control of the Test Period and displays the selected
measurement results.

(GRAPH) Allows the Graphics capability to be enabled, management of
the stored graphical results and graphical results to be viewed
on the display or logged to an external printer.

Getting Started 1-3

1. In each of the display areas the field currently able to be changed is marked by a "highlighted cursor".

```
TRANSMITTER        [ SETTINGS        ]

TRANSMIT SIGNAL          [ STSX-1     ]
CLOCK SYNC              [ INTERNAL    ]


PAYLOAD                 [ DS3         ]
FRAMING                 [ UNFRAMED    ]
PATTERN                 [ 2^15-1      ]




STATUS:
SETTINGS|SETTINGS|TEST    |STATIC|STATIC
        |CONTROL |FUNCTION |T-OH  |P-OH
```
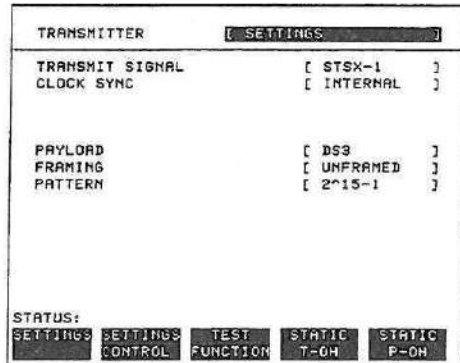
3. The menu of selections available, for the highlighted field, appears at the bottom of the display : SETTINGS ;

SETTINGS CONTROL ; TEST FUNCTION ;

STATIC T-OH ; STATIC P-OH . The choice from the menu is made using the display softkeys situated immediately below the display.

```
TRANSMITTER        [ SETTINGS        ]

TRANSMIT SIGNAL          [ DSX-3      ]
CLOCK SYNC               INTERNAL

FRAMING                 [ UNFRAMED    ]
PATTERN                 [ 2^15-1      ]

ERROR ADD TYPE           BIT
          RATE          [ OFF         ]




STATUS:
STSX-1 | DSX-3
```
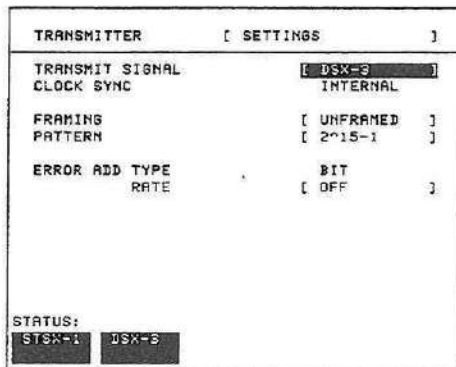
5. When the setting within a field is not enclosed in [ ] the field cannot be highlighted as no choice is available in the set up selected, as in CLOCK SYNC above.

2. The "highlighted cursor" is moved around the display using ⟨↓⟩ and ⟨↑⟩.

The "highlighted cursor" can be quickly returned to the top of the display by pressing the appropriate display key, in this example (TRANSMIT).

```
TRANSMITTER        [ SETTINGS        ]

TRANSMIT SIGNAL          [ STSX-1     ]
CLOCK SYNC              [ INTERNAL    ]


PAYLOAD                 [ DS3         ]
FRAMING                 [ UNFRAMED    ]
PATTERN                 [ 2^15-1      ]




STATUS:
2^15-1 | 2^20-1 | 2^23-1 | ALL   | MORE
       |        |        | ZEROS |
```
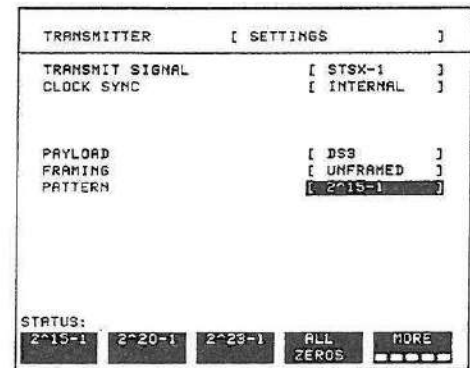
4. When a field has more than five choices, as in PATTERN above, a softkey labelled MORE is provided. When MORE is chosen the remainder of the menu is revealed as shown below.

```
TRANSMITTER        [ SETTINGS        ]

TRANSMIT SIGNAL          [ STSX-1     ]
CLOCK SYNC              [ INTERNAL    ]


PAYLOAD                 [ DS3         ]
FRAMING                 [ UNFRAMED    ]
PATTERN                 [ 2^15-1      ]




STATUS:
ALL   | USER  |       |       | MORE
ONES  | WORD  |       |       |
```
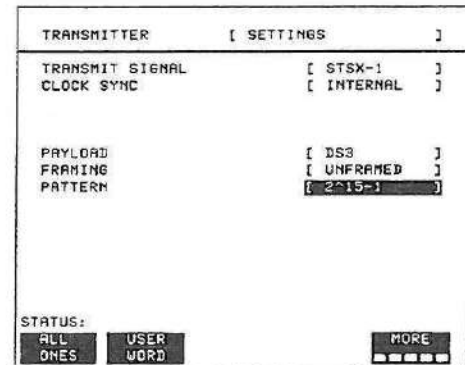
Other Front Panel Keys
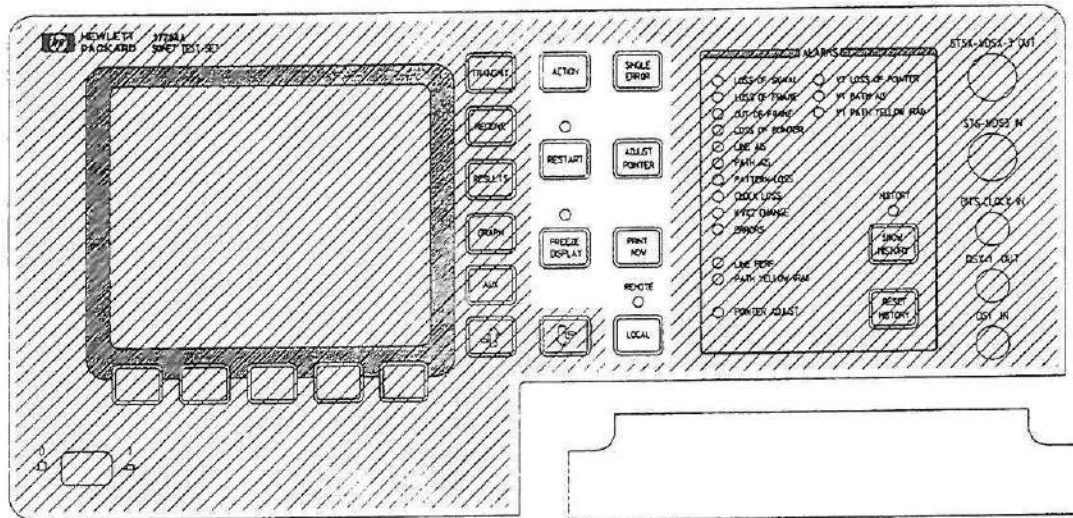
Figure 1-2. Front Panel Keys

- (ACTION) Some functions of the HP 37704A, such as Sequence generation and Save or Recall of Stored Settings, should be set up and checked before being actioned. The (ACTION) key allows a pause between set up and action.

- (RESTART) Terminates the current test period if one is in progress and starts a new test period. The indicator above the key is lit when a test period is in progress.

- (FREEZE DISPLAY) Freezes all the (RESULTS) displays. When FREEZE is active the indicator above the key is lit and none of the (RESULTS) displays will be updated, although the measurement continues. When FREEZE is deselected all of the (RESULTS) displays will be updated and the indicator above the key is not lit.

- (SINGLE ERROR) Adds a single error of the type selected under (TRANSMIT) TEST FUNCTION ERRORS & ALARMS each time the key is pressed. The type of error added is indicated on the status (bottom) line of the display.

- (ADJUST POINTER) Allows Pointer adjustments to be transmitted when the POINTER ADJUST [INCR/DECR] function is selected on the (TRANSMIT) TEST FUNCTION display.

- (PRINT NOW) The current results are logged to an external printer connected to the HP-IB or RS-232-C ports.

- (LOCAL) Returns the instrument from remote operation to Local (keyboard) operation. The indicator above the key is lit when the instrument is under Remote Control.
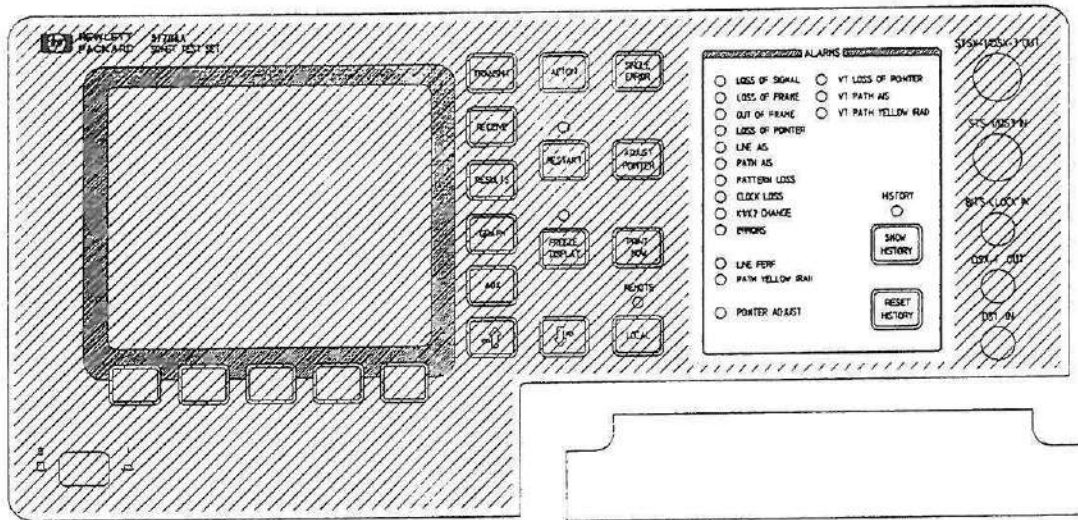
Figure 1-3. Front Panel Keys

Status Indicators

The Status indicators on the front panel convey information regarding the measurement in progress. If an alarm has occurred during the current Test Period the indicator above (SHOW HISTORY) is lit. To view which alarms have occurred press and hold (SHOW HISTORY). When (SHOW HISTORY) is released the status indicators return to displaying the current status.

(SHOW HISTORY)	When pressed and held the Status indicators display any alarms which have been set during the current Test Period. This continues until (SHOW HISTORY) is released at which time the current status is displayed. The indicator above the key is lit to signify that an alarm has occurred during the current Test Period.
(RESET HISTORY)	Resets the history store such that the historical and present status are the same. This can also be achieved by starting a new Test Period.
Loss Of Signal	Absence of data transitions for at least 100 ms at the selected electrical interface or a low received light level at the selected optical interface.

Loss Of Frame	The Out Of Frame condition has persisted for at least 3 ms.
Out Of Frame	Four or more consecutive errored framing patterns have been detected.
Loss Of Pointer	A valid STS pointer has not been detected in eight consecutive frames, or eight consecutive New Data Flags (NDF) have been detected.
Line AIS	Alarm Indication Sequence has been detected in the LINE layer.
Path AIS	Alarm Indication Sequence has been detected in the PATH layer.
Pattern Loss	The received data pattern is not in synchronization with the internally generated reference data.
Clock Loss	The transmitter clock is not synchronized to the selected EXTERNAL reference.
K1/K2 Change	A change has taken place in the K1, K2 bytes of the transport overhead.
Errors	An error has been detected. The indicator will remain lit for 100 ms.
Line FERF	A downstream Far End Receive Failure has been detected in the LINE layer.
Path Yellow (RAI)	A downstream failure indication has been detected in the PATH layer.
Pointer Adjust	Payload Pointer adjustments have taken place.
VT Loss Of Pointer	A valid VT pointer has not been detected in eight consecutive frames, or eight consecutive NDF's have been detected.
VT Path AIS	Alarm Indication Sequence has been detected in the VT PATH.
VT Path Yellow (RAI)	A downstream failure indication has been detected in the VT PATH.

Basic Error Measurement Demonstration

This simple procedure explains how to perform the following :

■ Recall the factory default settings using the STORED SETTINGS function.

■ Set up a simple back-to-back bit error measurement.

■ Start the measurement and monitor the results.

Recall Factory Default Settings

1. Set up the STORED SETTINGS function on the (AUX) display as shown opposite and select STORED SETTING NUMBER [0].

Press (ACTION) to recall the factory default settings.

```
AUXILIARY FUNCTION [ STORED SETTINGS      ]

STORED SETTING NUMBER        [ 0           ]

                    ACTION        RECALL
SETTING
  0    FACTORY DEFAULT SETTINGS
  1    [.................................]
  2    [.................................]
  3    [.................................]
  4    [.................................]
  5    [.................................]
  6    [.................................]
  7    [.................................]
  8    [.................................]
  9    [.................................]
PRESS ACTION TO RECALL INSTRUMENT SETTINGS
STATUS:
    0         1         2         3       MORE
```

The recalling of factory default settings configures the instrument in a defined state. One important feature of the factory default setting is that the Graphics Store capability is turned off. This prevents the possibility of any previously stored graphics data being discarded.

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Bit Error Measurement Setup

1. Set up the (TRANSMIT) SETTINGS
CONTROL display as shown below.

```
TRANSMITTER          [ SETTINGS CONTROL    ]

TRANSMITTER AND RECEIVER [ COUPLED          ]
     RECEIVER COUPLED TO TRANSMITTER




STATUS:
INDEP-  COUPLED
ENDENT
```

2. Set up the (TRANSMIT) SETTINGS
display as shown below.

```
TRANSMITTER          [ SETTINGS           ]
TRANSMIT SIGNAL          [ STSX-1    ]
CLOCK SYNC               [ INTERNAL  ]


PAYLOAD                  [ DS3       ]
FRAMING                  [ UNFRAMED  ]
PATTERN                  [ 2^15-1    ]



STATUS:
SETTINGS SETTINGS  TEST    STATIC  STATIC
         CONTROL FUNCTION  T-OH    P-OH
```

3. Set up the (RECEIVE) SETTINGS display
as shown below.

```
RECEIVER          [ SETTINGS         ]
RECEIVE SIGNAL        [ STS-1     ]
LEVEL                 [ STSX-1    ]


PAYLOAD               [ DS3       ]
FRAMING               [ UNFRAMED  ]
PATTERN               [ 2^15-1    ]



STATUS:
STS-1 HI  STSX-1   STS-1
                   900 FT.
```

The (LEVEL) selection is dependant on the
point at which interface is made to the
network equipment.

4. Set up the (TRANSMIT) TEST
FUNCTION display as shown below.

```
TRANSMITTER          [ TEST FUNCTION      ]
SETUP: STS-1
TEST FUNCTION             [ERROR &ALARM]

ERROR ADD TYPE            [ BIT        ]
         RATE             [ OFF        ]


ALARMS                    [ OFF        ]




STATUS:
STS-PATH  BIT                      MORE
 FEBE
```

5. Set up the (RESULTS) display as shown opposite.

Any of the other results can be viewed on the display by making a choice from the softkey menu.

```
RESULTS DISPLAYED    [ ERROR RESULTS   ]
ERROR SOURCE         [ BIT ERRORS      ]
TEST TIMING                [ MANUAL    ]

BIT ERRORS

ERROR COUNT
ERROR RATE
ERROR SECONDS
ERROR FREE SECONDS
%ERROR FREE SECONDS


ELAPSED TIME

STATUS:
ALARM    POINTER  SIGNAL              MORE
SECONDS  ACTIVITY LEVEL             ▪▪▪▪▪
```

Start the Measurement and Monitor the Results

1. Connect STS-1/DS3 In to STSX-1/DSX-3 Out.

2. Press (RESTART) to start the measurement and monitor the (RESULTS) ERROR RESULTS display.

3. Press ERROR ADD (SINGLE ERROR) and check that the Error Results change.

Making Measurements

If you are performing installation or commissioning/acceptance testing, of SONET network equipment, use a selection of the following tests to thoroughly verify the performance of your equipment.

Each measurement includes an explanation of the test, how and where to connect the HP 37704A SONET test set, how to configure it, and how to obtain the relevant results.

The following measurements are described :

■ Payload Testing

    Payload Mapping

    Payload Transmission

    Payload Demapping

■ Network Equipment Stress Testing

    Frame Synchronization

    Optical Clock Recovery circuit testing

    Desynchronizer testing

    Pointer Processor testing

■ Network Equipment Stimulus/Response Testing

    Alarm stimulus and response

    Performance Monitor stimulus and response

    Automatic Protection switching

■ In-Service Performance Monitoring

■ DCC Testing

The following HP 37704A SONET test set features/functions associated with the measurements are also described :

■ Transmit Static Overhead

■ Overhead Monitor

■ Overhead Capture

■ Pointer Graph

■ Graphics

■ Logging Results

■ Connecting an HP ThinkJet Printer

■ Storing and Recalling instrument settings

■ Enabling Keyboard Lock

■ Setting Time and Date

■ Enabling Beep On Error

■ Performing an instrument Self Test

2-2 Making Measurements

Payload Testing

DS1 and DS3 services are carried through the SONET network as payloads within a SONET signal. As they enter the network they are mapped into the Synchronous Payload Envelope (SPE) of the SONET signal and then transmitted through the network to their required destination. On leaving the SONET network, the DS1 or DS3 payload is demapped from the SONET signal.

There are therefore three tests required to verify error free transmission of the DS1 or DS3 payload through the SONET network.

- Payload Mapping
- Payload Transmission
- Payload Demapping

Payload Mapping

Application

The mapping of a DS1 or DS3 payload into the SPE should take place without introducing errors.

The mapping process is tested by applying a DS1 or DS3 payload to the low-rate side of the terminal multiplexer. On the high-rate side of the terminal multiplexer, the payload is demapped from the SONET signal by the SONET test set.

A Bit Error Rate (BER) test is performed on the recovered payload to determine whether errors have been introduced by the SONET mapping process.

The HP 37704A SONET test set, when fitted with the appropriate Optical Interface Module, can demap a DS1 or DS3 signal from a SONET signal at rates up to and including OC-12 (622 Mb/s).

Default (Known State) Settings

It is advisable to set the HP 37704A to a known state before setting up a measurement. This clears all previous settings and provides a clearly defined instrument state. For a list of Default Settings and the procedure for accessing them see *Stored Settings*.

Payload Mapping Test Setup Procedure

In this setup a framed DS3 payload is transmitted into the low-rate side of the terminal multiplexer and the framed DS3 payload is demapped from the OC-3 signal at the high-rate side of the terminal multiplexer.

A BER measurement is performed on the demapped DS3 payload.

The HP 37704A SONET test set GRAPHICS function is enabled. The graphical results can be viewed on the (GRAPH) display or logged on an external printer. If a printer is not immediately available, the results remain in storage and can be logged later. The measurement results can be viewed on the (RESULTS) display at anytime during the test.

An HP 37772A Optical Interface Module is used in this setup to provide an OC-3 optical interface in the HP 37704A SONET test set.
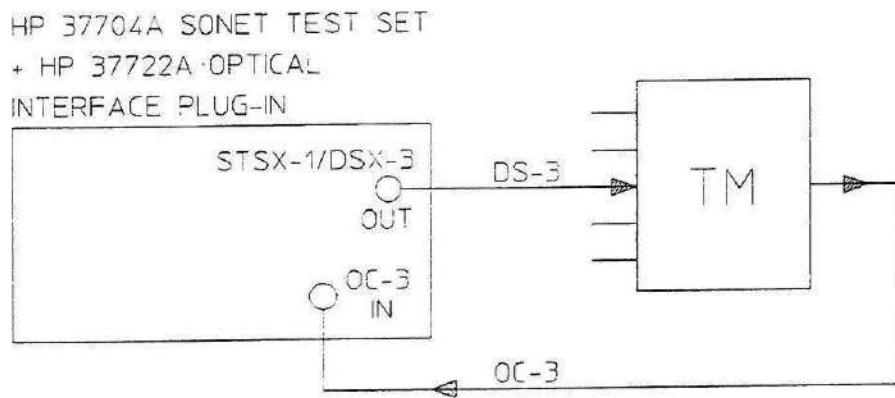
Figure 2-1. Payload Mapping

1. Connect the HP 37704A to the network equipment, as shown in Figure 2-1 and set up the (TRANSMIT) SETTINGS CONTROL display as shown below.

```
TRANSMITTER          [ SETTINGS CONTROL    ]

TRANSMITTER AND RECEIVER   [ INDEPENDENT ]


PRESS ACTION TO RETURN ALL SONET
OVERHEAD BYTES TO DEFAULT VALUES




STATUS:
INDEP-  COUPLED
ENDENT
```

2. Set up the (TRANSMIT) SETTINGS display as shown below.

```
TRANSMITTER          [ SETTINGS            ]

TRANSMIT SIGNAL           [ DSX-3           ]
CLOCK SYNC                  INTERNAL

FRAMING                   [ C-BIT           ]
PATTERN                   [ 2^15-1          ]

ERROR ADD TYPE            [ BIT             ]
          RATE            [ OFF             ]

ALARMS                    [ OFF             ]



STATUS:
UNFRAMED  M13   C-BIT
```

The Framing menu is displayed on the display softkeys.

3. Set up the (RECEIVE) SETTINGS display as shown below.

```
RECEIVER             [ SETTINGS            ]

RECEIVE SIGNAL            [ OC-3            ]


STS-1 SPE UNDER TEST     [ 1               ]
PAYLOAD                  [ DS3             ]
FRAMING                  [ C-BIT           ]
PATTERN                  [ 2^15-1          ]




STATUS:
UNFRAMED  M13   C-BIT
```

The STS-1 SPE UNDER TEST selection is dependant upon which STS-1 carries the test DS3 payload.

4. Set up the (RESULTS) display as shown below.

```
RESULTS DISPLAYED   [ ERROR RESULTS    ]
ERROR SOURCE        [ BIT ERRORS       ]
TEST TIMING              [ SINGLE       ]
     DURATION            [ 24 HOURS     ]

BIT ERRORS

ERROR COUNT
ERROR RATE
ERROR SECONDS
ERROR FREE SECONDS
%ERROR FREE SECONDS


ELAPSED TIME

STATUS:
STS-PATH  BIT                        MORE
FEBE      ERRORS
```

BIT ERROR RESULTS are displayed but any of the other results can be selected from the softkey menu without affecting the measurement.

Start the Payload Mapping Test

1. The method of starting the measurement depends on whether stored graphic results are required. If you do not require stored graphic results press (RESTART). If you wish to store the results of the measurement in graphical form set up the (GRAPH) display as shown below.

START GRAPH starts the test period and ensures that a graphical version of the measurement results is stored in non volatile memory. This allows the results to be viewed in the (GRAPH) display, or logged to an external printer, at a later time.

The measurement results are available on the (RESULTS) display during the test period.

The graphical measurement results are stored in non volatile memory for viewing later on the (GRAPH) display or logging to a printer.

Alarm occurrences are stored in graphical form in non volatile memory.

The current test period can be terminated and a new test period started, at any time by pressing (RESTART).

At the end of the test :

■ the cumulative measurement results are available on the (RESULTS) display.

■ a graphical version of the measurement results and alarms are available on the (GRAPH) display and stored in non volatile memory for viewing later or logging to a printer.

■ Results and Alarms summaries are available on the (GRAPH) display and stored in non volatile memory for viewing later or logging on a printer.

It should be noted that the total Graphics store capacity is 78 hours. The results of up to 20 measurements can be stored. If an attempt is made to store

more than 20 sets of results, then a set of results is deleted on a "first in first out" basis.

Payload Transmission

Application

The transmission of the SONET signal should not introduce any errors into the payload.

The transmission process is tested by transmitting a SONET test signal into the network equipment. The SONET test set receives the SONET signal from the network equipment and demaps the payload.

A BER measurement is performed on the recovered payload to determine whether errors have been introduced during the transmission.

The HP 37704A SONET test set, when fitted with the appropriate Optical Interface Module, can demap a DS1 or DS3 payload from the SONET signal at rates, up to and including OC-3 (155 Mb/s).

Default (Known State) Settings

It is advisable to set the HP 37704A to a known state before setting up a measurement. This clears all previous settings and provides a clearly defined instrument state. For a list of Default Settings and the procedure for accessing them see *Stored Settings*.

Payload Transmission Test Setup Procedure

In this setup an STS-1 signal carrying a framed DS1 payload is transmitted into the network equipment. At the HP 37704A SONET test set receive side the DS1 payload is demapped from the STS-1 signal.

A BER measurement is performed on the demapped DS1 payload.

The HP 37704A SONET test set GRAPHICS function is enabled. The graphical results can be viewed on the (GRAPH) display or logged on an external printer. If a printer is not immediately available, the results remain in storage and can be logged later. The measurement results can be viewed on the (RESULTS) display at anytime during the test.

Figure 2-2. Payload Transmission

1. Connect the HP 37704A to the network element, as shown in Figure 2-2, and set up the (TRANSMIT) SETTINGS CONTROL display as shown below.

```
TRANSMITTER         [ SETTINGS CONTROL    ]

TRANSMITTER AND RECEIVER  [ COUPLED         ]
    RECEIVER COUPLED TO TRANSMITTER

STATUS:
INDEP-   COUPLED
ENDENT
```

2. Set up the (TRANSMIT) SETTINGS display as shown below.

```
TRANSMITTER         [ SETTINGS          ]

TRANSMIT SIGNAL          [ STSX-1        ]
CLOCK SYNC              [ STS-1 RX      ]
    LEVEL              [ STSX-1        ]

PAYLOAD                 [ VT1.5         ]
VT MODE                 [ ASYNC         ]
SELECTED VT         GROUP [1]  VT [1]
VT PAYLOAD              [ INT - D4      ]
TEST DS1 TIMESLOT       [ FULL T1       ]
PATTERN                 [ 2^15-1        ]
SERVICE OFFSET          [    0 ppm      ]
SIGNAL LABEL            [ 001           ]
PATTERN IN OTHER VTs    [ ORSS          ]

STATUS:
STSX-1  STS-1 H1  STS-1
                  900 FT
```

The CLOCK SYNC selection determines the synchronization source of the TRANSMIT clock. In this case the received STS-1 signal provides the synchronization source.

The LEVEL selection is dependant on the point at which interface is made to the network equipment.

Making Measurements   2-9

3. Set up the (TRANSMIT) TEST

FUNCTION display as shown below.

```
TRANSMITTER          [ TEST FUNCTION        ]

SETUP: STS-1
TEST FUNCTION              [ OFF        ]




STATUS:
SETTINGS SETTINGS  TEST    STATIC  STATIC
         CONTROL  FUNCTION T-OH    P-OH
```

4. Set up the (RECEIVE) SETTINGS display as shown below.

```
RECEIVER             [ SETTINGS            ]

RECEIVE SIGNAL            [ STS-1         ]
LEVEL                     [ STSX-1          ]


PAYLOAD                   [ VT1.5         ]
VT MODE                   [ ASYNC         ]
SELECTED VT               GROUP [1]   VT [1]
VT PAYLOAD          .     [ D4            ]

TEST DS1 TIMESLOT         [ FULL T1       ]
PATTERN                   [ 2^15-1        ]

STATUS:
STS-1 MI  STSX-1  STS-1
                  900 FT
```

The LEVEL selection is dependant on the point at which interface is made to the network equipment.

5. Set up the (RESULTS) display as shown opposite.

BIT ERROR RESULTS are displayed but any of the other results can be selected from the softkey menu without affecting the measurement.

```
RESULTS DISPLAYED   [ ERROR RESULTS    ]
ERROR SOURCE        [ BIT ERRORS       ]
TEST TIMING         [ SINGLE           ]
        DURATION    [ 72 HOURS          ]

BIT ERRORS

ERROR COUNT
ERROR RATE
ERROR SECONDS
ERROR FREE SECONDS
%ERROR FREE SECONDS



ELAPSED TIME

STATUS:
1 HOUR  24 HOURS  72 HOURS  7 DAYS  USER
                                    PROGRAM
```
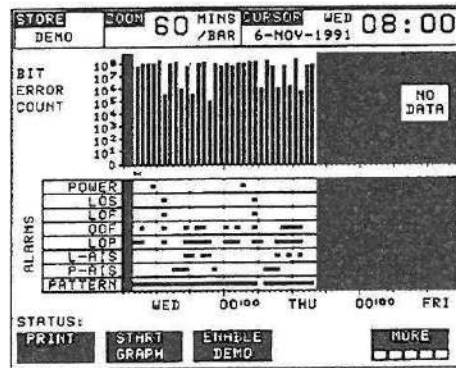
Start the Payload Transmission Test

1. The method of starting the measurement depends on whether stored
graphic results are required. If you do not require stored graphic results press
(RESTART). If you wish to store the results of the measurement in graphical
form set up the (GRAPH) display as shown below.

START GRAPH starts the test period and
ensures that a graphical version of the
measurement results is stored in non
volatile memory. This allows the results
to be viewed in the (GRAPH) display, or
logged to an external printer, at a later
time.

The measurement results are available on the (RESULTS) display during the test
period.

The graphical measurement results are stored in non volatile memory for
viewing later on the (GRAPH) display or logging to a printer.

Alarm occurrences are stored in graphical form in non volatile memory.

The current test period can be terminated and a new test period started, at
any time, by pressing (RESTART).

At the end of the test :

- the cumulative measurement results are available on the (RESULTS) display.

- a graphical version of the measurement results and alarms are available on
the (GRAPH) display and stored in non volatile memory for viewing later or
logging to a printer.

- Results and Alarms summaries are available on the (GRAPH) display and
stored in non volatile memory for viewing later or logging on a printer.

It should be noted that the total Graphics store capacity is 78 hours. The
results of up to 20 measurements can be stored. If an attempt is made to store

more than 20 sets of results, then a set of results is deleted on a "first in first out" basis.

Payload Demapping

Application

The demapping of DS1 or DS3 payloads from the SPE should take place without introducing errors.

The demapping process is tested by transmitting a SONET signal to the high-rate side of the multiplexer. On the low-rate side of the multiplexer the DS3 payload is received by the HP 37704A SONET test set.

A BER test is performed on the received payload to determine whether errors have been introduced by the SONET demapping process.

The HP 37704A SONET test set, when fitted with the appropriate Optical Interface Module, can demap a DS1 or DS3 signal from a SONET signal, at rates up to and including OC-3 (155 Mb/s).

Default (Known State) Settings

It is advisable to set the HP 37704A to a known state before setting up a measurement. This clears all previous settings and provides a clearly defined instrument state. For a list of Default Settings and the procedure for accessing them see *Stored Settings*.

Payload Demapping Test Setup procedure

In this setup an OC-3 SONET signal is transmitted into the high-rate side of the terminal multiplexer. The framed DS3 signal, on the low-rate side of the terminal multiplexer, is received by the HP 37704A SONET test set.

A BER measurement is performed on the received framed DS3 payload.

The HP 37704A SONET test set GRAPHICS function is enabled. The graphical results can be viewed on the (GRAPH) display or logged to an external printer. If a printer is not immediately available, the results remain in storage and can be logged later. The measurement results can be viewed on the (RESULTS) display at anytime during the test.

An HP 37772A Optical Interface Module is used in this example to provide an OC-3 optical interface in the HP 37704A SONET test set.
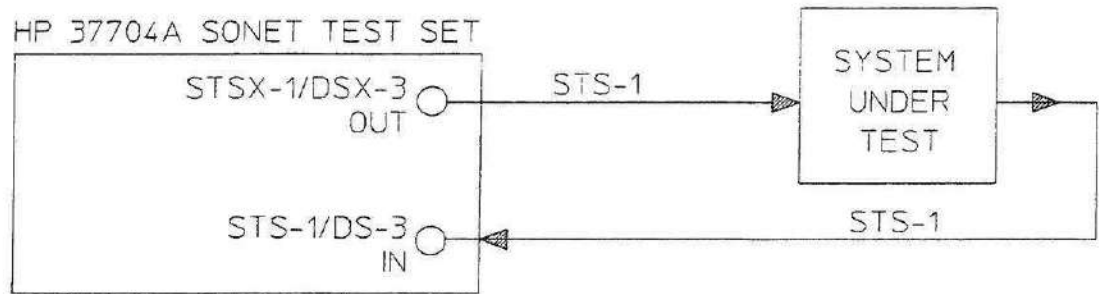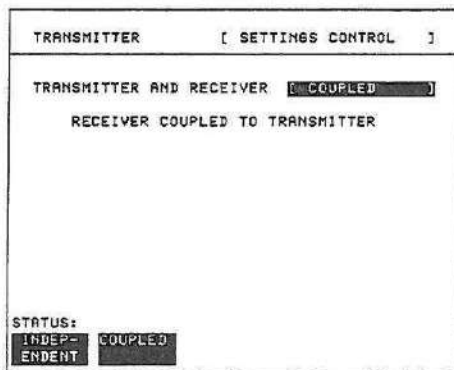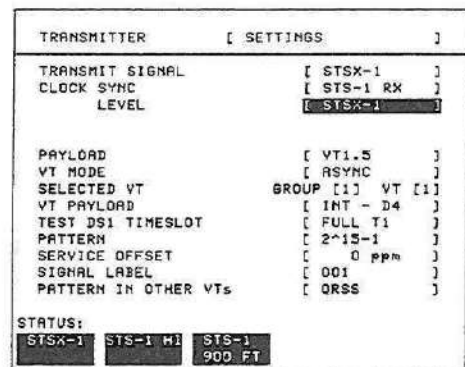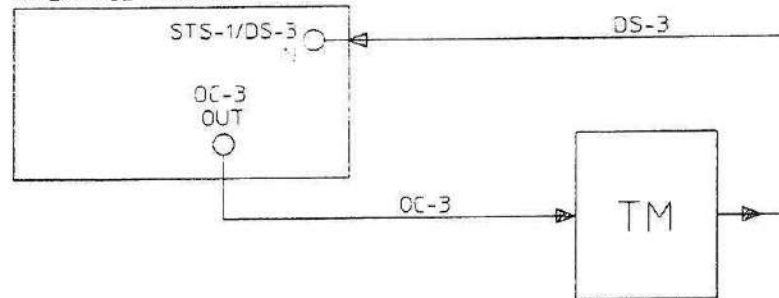
Figure 2-3. Payload Demapping

1. Connect the HP 37704A to the network equipment, as shown in Figure 2-3, and set up the (TRANSMIT) SETTINGS CONTROL display as shown below.
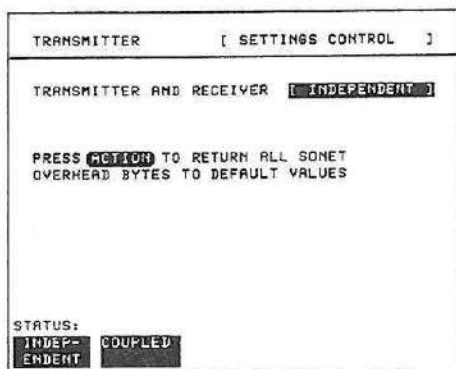
```
TRANSMITTER          [ SETTINGS CONTROL   ]

TRANSMITTER AND RECEIVER  [ INDEPENDENT ]


PRESS ACTION TO RETURN ALL SONET
OVERHEAD BYTES TO DEFAULT VALUES




STATUS:
INDEP-   COUPLED
ENDENT
```

2. Set up the (TRANSMIT) SETTINGS display as shown below.

```
TRANSMITTER          [ SETTINGS         ]

TRANSMIT SIGNAL          [ OC-3     ]
CLOCK SYNC               [ EXT BITS ]


STS-1 SPE UNDER TEST     [ 1       ]
PAYLOAD                  [ DS3      ]
FRAMING                  [ C-BIT    ]
PATTERN                  [ 2^15-1   ]




STATUS:
   1        2        3
```

The CLOCK SYNC selection determines the synchronization source for the TRANSMIT clock. If [EXT BITS] is selected a Bits Clock must be provided at the front panel, BITS CLOCK IN, port.

3. Set up the (TRANSMIT) TEST
FUNCTION display as shown below.

```
TRANSMITTER        [ TEST FUNCTION     ]

SETUP: STS-1
TEST FUNCTION               [ OFF      ]




STATUS:
SETTINGS SETTINGS  TEST    STATIC  STATIC
         CONTROL  FUNCTION  T-OH    P-OH
```

4. Set up the (RECEIVE) SETTINGS display
as shown below.

```
RECEIVER           [ SETTINGS          ]

RECEIVE SIGNAL              [ DS3       ]
LEVEL                       [ DSX-3     ]

FRAMING                     [ C-BIT     ]
PATTERN                     [ 2^15-1    ]

ERRORS DETECTED            [CODE ][BIT  ]




STATUS:
 CODE    FRAME   P-BIT   C-BIT    MORE
                 PARITY  PARITY
```
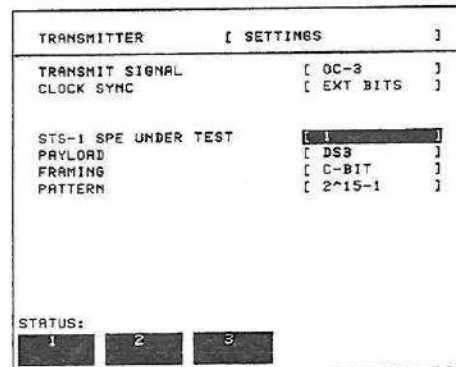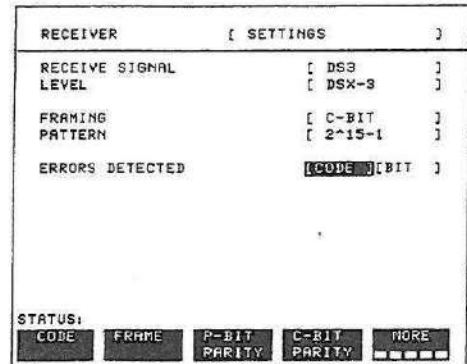
When FRAMING [C-BIT] or [M13] is
selected two types of Error Source can be
selected from the menu.

5. Set up the (RESULTS) display as shown
opposite.

BIT ERROR RESULTS are displayed but
any of the other results can be selected
from the softkey menu without affecting
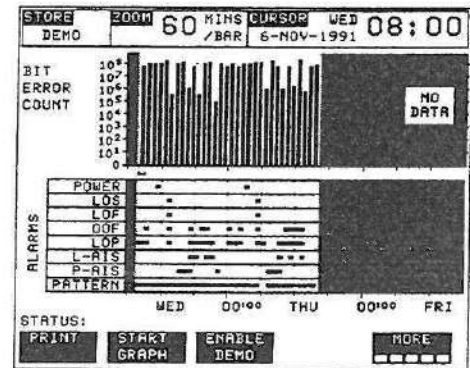the measurement.

Only the ERROR SOURCES selected on
the (RECEIVE) SETTINGS display are valid.

```
RESULTS DISPLAYED  [ ERROR RESULTS  ]
ERROR SOURCE       [ BIT ERRORS     ]
TEST TIMING               [ SINGLE    ]
     DURATION             [ 24 HOURS  ]

BIT ERRORS

ERROR COUNT
ERROR RATIO
ERROR SECONDS
ERROR FREE SECONDS
%ERROR FREE SECONDS


ELAPSED TIME

STATUS:
 CODE    FRAME   P-BIT   C-BIT    MORE
ERRORS  ERRORS  PARITY  PARITY
```
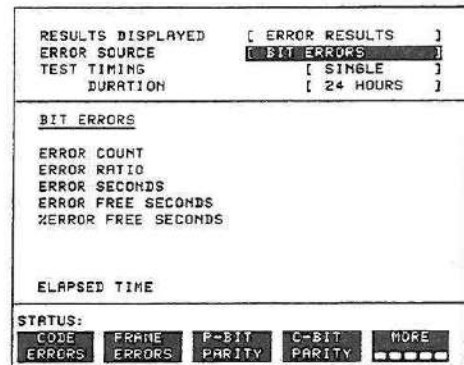
Start the Payload Demapping Test

1. The method of starting the measurement depends on whether stored
graphic results are required. If you do not require stored graphic results press
(RESTART). If you wish to store the results of the measurement in graphical
form set up the (GRAPH) display as shown below.

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START GRAPH starts the test period and ensures that a graphical version of the measurement results is stored in non volatile memory. This allows the results to be viewed in the (GRAPH) display, or logged to an external printer, at a later time.

The measurement results are available on the (RESULTS) display during the test period.

The graphical measurement results are stored in non volatile memory for viewing later on the (GRAPH) display or logging to a printer.

Alarm occurrences are stored in graphical form in non volatile memory.

The current test period can be terminated and a new test period started, at any time by pressing (RESTART).

At the end of the test :

■ the cumulative measurement results are available on the (RESULTS) display.

■ a graphical version of the measurement results and alarms are available on the (GRAPH) display and stored in non volatile memory for viewing later or logging to a printer.

■ Results and Alarms summaries are available on the (GRAPH) display and stored in non volatile memory for viewing later or logging on a printer.

It should be noted that the total Graphics store capacity is 78 hours. The results of up to 20 measurements can be stored. If an attempt is made to store more than 20 sets of results, then a set of results is deleted on a "first in first out" basis.

2-16   Making Measurements

Network Stress Testing

Network error performance may be very good under normal operating conditions. However the network is required to operate error free in less than ideal conditions. Stress testing elements of the SONET network is important to ensure the network operates error free under adverse operating conditions.

Network stress testing includes the following measurements :

- Frame synchronization stressing
- Optical clock recovery stressing
- Desynchronizer stressing
- Pointer processor stressing

Frame Synchronization

Application

A network element should maintain synchronization even in the presence of some frame errors. If the number of frame errors exceeds the specified threshold for 3 ms, the network element will lose frame synchronization causing communication to break down.

The frame synchronization process of the network element can be stressed by injecting frame errors, into the A1 and A2 framing bytes of the section overhead. As the frame error injection rate is increased to the frame synchronization threshold, the network element should indicate Out Of Frame (OOF) and Loss Of Frame (LOF) conditions. As the frame error injection rate is decreased again, the network element should regain frame synchronization.

Default (Known State) Settings

It is advisable to set the HP 37704A to a known state before setting up a measurement. This clears all previous settings and provides a clearly defined instrument state. For a list of Default Settings and the procedure for accessing them see *Stored Settings*.

Frame Synchronization Test Setup Procedure

An HP 37772A, Optical Interface Module, is used in this setup to provide an OC-1 optical interface in the SONET test set.

Frame Error Add Test Function. In this setup the SONET test set is used to insert frame errors in the A1 and A2, framing bytes of the section overhead of an OC-1 signal. The OC-1 signal is transmitted to the network equipment. The network equipment OOF and LOF alarms are monitored as the frame error add rate is increased and decreased

Sequence Generation Test Function. In this setup procedure the SONET test set generates a sequence of errored framing bytes to test the OOF and LOF alarm criteria. The upstream OC-1 SONET signal is monitored for occurrences of Line FERF. The downstream OC-1 signal can be monitored for AIS.
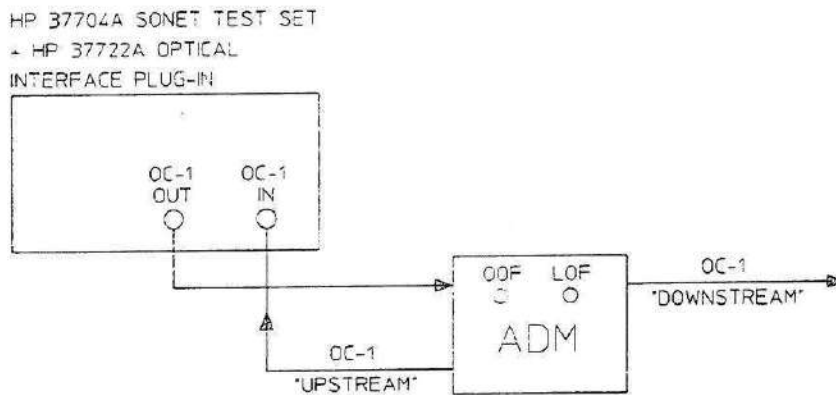
Figure 2-4. Frame Synchronization

Frame Error Add Test Function

1. Connect the HP 37704A to the network equipment, as shown in Figure 2-4, and set up the (TRANSMIT) SETTINGS CONTROL display as shown below.
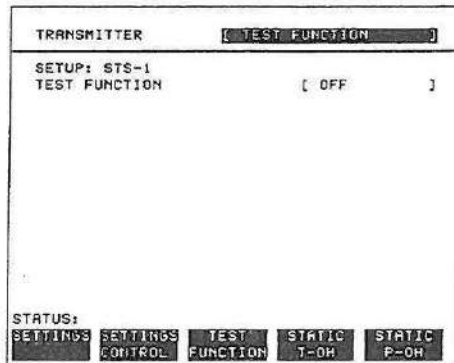
```
TRANSMITTER       [ SETTINGS CONTROL    ]

TRANSMITTER AND RECEIVER [ COUPLED    ]

        RECEIVER COUPLED TO TRANSMITTER




STATUS:
INDEP-   COUPLED
ENDENT
```

2. Set up the (TRANSMIT) SETTINGS display as shown below.

```
TRANSMITTER       [ SETTINGS          ]

TRANSMIT SIGNAL            [ OC-1      ]
CLOCK SYNC                 [ OC-1 RX   ]


PAYLOAD                    [ DS3       ]
FRAMING                    [ C-BIT     ]
PATTERN                    [ 2^15-1    ]




STATUS:
INTERNAL EXTERNAL STS-1    OC-3      MORE
         BITS   RECEIVE  RECEIVE
```

The CLOCK SYNC selection determines the synchronization source for the transmitter clock.

3. Set up the (RESULTS) display as shown below.

```
RESULTS DISPLAYED   [ ALARM SECONDS   ]

TEST TIMING         [ MANUAL          ]


POWER LOSS        LINE FERF
LOS               STS-PATH YEL
LOF
OOF
LOP
LINE AIS
STS-PATH AIS
K1/K2 CHANGE
PATTERN LOSS

ELAPSED TIME

STATUS:
TROUBLE  ERROR   ERROR   ERROR    MORE
SCAN    COUNTS  RESULTS ANALYSIS
```

4. Set up the (TRANSMIT) TEST FUNCTION display as shown below.

```
TRANSMITTER       [ TEST FUNCTION     ]

SETUP: OC-1
TEST FUNCTION            [ERROR &ALARM]

ERROR ADD TYPE           [ FRAME      ]
          RATE           [ 1 IN 4     ]


ALARMS                   [ OFF        ]




STATUS:
OFF     1 IN 4  2 IN 4  3 IN 4   4 IN 4
```

Start the Frame Synchronization Test (Frame Error Add)

1. Check that the Loss Of Frame (LOF) alarm indicator on the network element remains unlit and no occurrences of LINE FERF are recorded.

2. Increase the Frame Error Add Rate to 2 IN 4 and check that the Loss Of Frame (LOF) alarm indicator on the network element remains unlit and no occurrences of LINE FERF are recorded.

3. Increase the Frame Error Add Rate to 3 IN 4 and check that the Loss Of Frame (LOF) alarm indicator on the network element remains unlit and no occurrences of LINE FERF are recorded.

4. Increase the Frame Error Add Rate to 4 IN 4 and check that the OOF and LOF alarm indicators on the network equipment are lit and occurrences of LINE FERF are recorded.

5. Decrease the Frame Error Add Rate to 3 IN 4 and check that the OOF and LOF alarm indicators on the network equipment remain lit and occurrences of LINE FERF are still being recorded.

6. Decrease the Frame Error Add Rate to 2 IN 4 and check that the OOF and LOF alarm indicators on the network equipment go off, and no further occurrences of LINE FERF are recorded.

Sequence Generation Test Function

1. Connect the HP 37704A to the network equipment, as shown in Figure 2-4, and set up the (TRANSMIT) SETTINGS CONTROL display as shown below.

```
TRANSMITTER          [ SETTINGS CONTROL   ]

TRANSMITTER AND RECEIVER  [ COUPLED        ]

       RECEIVER COUPLED TO TRANSMITTER

STATUS:
INDEP-   COUPLED
ENDENT
```

2. Set up the (TRANSMIT) SETTINGS display as shown below.

```
TRANSMITTER          [ SETTINGS            ]

TRANSMIT SIGNAL            [ OC-1           ]
CLOCK SYNC                 [ OC-1 RX        ]


PAYLOAD                   [ DS3            ]
FRAMING                   [ C-BIT          ]
PATTERN                   [ 2^15-1         ]

STATUS:
INTERNAL EXTERNAL STS-1    OC-3     MORE
         BITS   RECEIVE  RECEIVE
```

The CLOCK SYNC selection determines the synchronization source for the transmitter clock.

3. Set up the (RESULTS) display as shown below.

```
RESULTS DISPLAYED    [ ALARM SECONDS       ]

TEST TIMING               [ MANUAL         ]

POWER LOSS           LINE FERF
LOS                  STS-PATH YEL
LOF
OOF
LOP
LINE AIS
STS-PATH AIS
K1/K2 CHANGE
PATTERN LOSS

ELAPSED TIME

STATUS:
TROUBLE  ERROR   ERROR    ERROR    MORE
SCAN    COUNTS  RESULTS  ANALYSIS
```

4. Set up the (TRANSMIT) TEST FUNCTION display as shown below.

```
TRANSMITTER          [ TEST FUNCTION       ]

SETUP: OC-1
TEST FUNCTION             [ SEQUENCES   ]
                          [ REPEAT RUN ]
OVERHEAD CHANNEL    [ S-OH ][ A1,A2      ]
         A [F628]
         B [09D7]
         C [0000]
         D [0000]
         E [0000]
SEQUENCE [15974] FRAMES OF [A] THEN
         [   26]                [B]
         [    0]                [C]
         [    0]                [D]
         [    0]                [E]
         PRESS ACTION TO START SEQUENCES
STATUS:
A1,A2     C1      E1       F1     D1 - D3
```

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Start the Frame Synchronization Test (Sequence Test)

1. Press (ACTION) to start the sequence. As a result of this sequence one OOF alarm second and one LOF alarm second should occur every two seconds.

2. Check that the network element OOF and LOF alarm indicators cycle ON and OFF and that an occurrence of LINE FERF is recorded every two seconds.

3. Press (ACTION) to stop the sequence and set up the (TRANSMIT) TEST FUNCTION display as shown opposite.

```
TRANSMITTER          [ TEST FUNCTION      ]

SETUP: OC-1
TEST FUNCTION                    [ SEQUENCES ]
                                 [ REPEAT RUN ]
OVERHEAD CHANNEL      [ S-OH ][ A1,A2      ]
          A [F628]
          B [09D7]
          C [0000]
          D [0000]
          E [0000]
SEQUENCE [15976] FRAMES OF [A] THEN
          [    24]              [B]
          [     0]              [C]
          [     0]              [D]
          [     0]              [E]
          PRESS ACTION TO START SEQUENCES
STATUS:
     A         B        C         D         E
```

4. Press (ACTION) to start the sequence. As a result of this sequence one OOF alarm second should occur every two seconds but LOF should not occur.

5. Check that the network element OOF alarm indicator cycles ON and OFF. The LOF alarm should not occur and no occurrences of LINE FERF should be recorded.

2-22 Making Measurements

Optical Clock Recovery Stress

Application

Ideally the clock recovery circuits in the network equipment optical interfaces should recover a clock even in the presence of long strings of 0's.

The optical clock recovery performance of the network equipment can be measured by increasing the length of a zero substitution block until errors occur.

Default (Known State) Settings

It is advisable to set the HP 37704A to a known state before setting up a measurement. This clears all previous settings and provides a clearly defined instrument state. For a list of Default Settings and the procedure for accessing them see *Stored Settings*.

Optical Clock Recovery Stress Test Setup Procedure

An HP 37772A Optical Interface Module is used in this test to provide an OC-3 optical interface in the HP 37704A SONET test set.

In this setup procedure the HP 37704A SONET test set transmits an OC-3 signal with zero's substituted into the payload data pattern. The length of the block of zero's is increased until the network equipment alarms are triggered.

HP 37704A SONET TEST SET
+ HP 37722A OPTICAL
INTERFACE PLUG-IN

OC-3
OUT
O

OC-3 → ADM
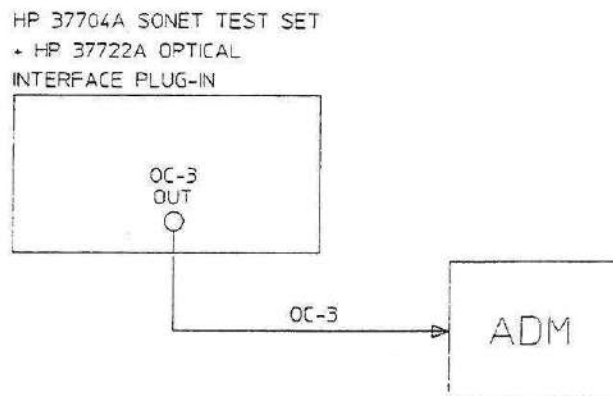
Figure 2-5. Optical Clock Recovery Stress

1. Connect the HP 37704A to the network equipment, as shown in Figure 2-5, and set up the (TRANSMIT) SETTINGS display as shown below.
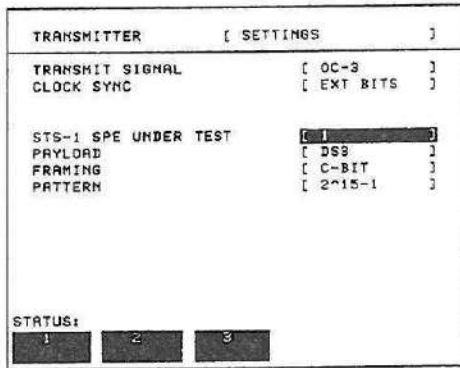
```
TRANSMITTER          [ SETTINGS              ]

TRANSMIT SIGNAL           [ OC-3        ]
CLOCK SYNC                [ EXT BITS    ]

STS-1 SPE UNDER TEST      [   ]
PAYLOAD                   [ DS3         ]
FRAMING                   [ C-BIT       ]
PATTERN                   [ 2^15-1      ]




STATUS:
   1          2          3
```

The CLOCK SYNC selection determines the synchronization source for the TRANSMIT clock. If [EXT BITS] is selected a Bits Clock must be provided at the front panel, BITS CLOCK IN, port.

2. Set up the (TRANSMIT) TEST FUNCTION display as shown below.

```
TRANSMITTER          [ TEST FUNCTION         ]

SETUP: OC-3   STS-1 #1  SELECTED FOR TEST
TEST FUNCTION              [ STRESS TEST]
STRESSING PATTERN          [ ALL ZEROS  ]
BLOCK LENGTH               [    8  ] BYTES




STATUS:
DECREASE  INCREASE
 DIGIT     DIGIT      ←       →
```
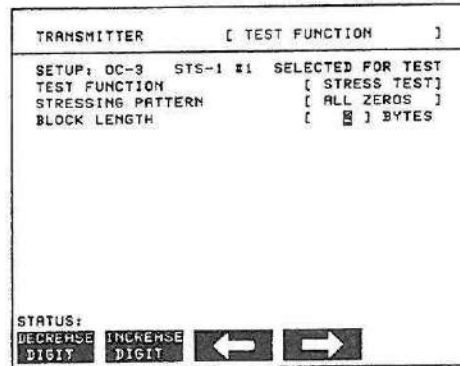
Start the Optical Clock Recovery Stress Test

Increase the Block Length until the network equipment alarms are triggered.

Desynchronizer Stress

Application

At the boundary of the SONET network the DS1 or DS3 payload is demapped from the SONET signal. Pointer adjustments in the SONET signal may cause high levels of jitter in the output payload. Excessive amounts of jitter will result in errors.

The desynchronizing phase lock loop of the network element should minimize the level of jitter in the payload.

The desynchronizing phase lock loop can be stressed by adding pointer adjustments to the SONET signal such that the test SPE moves with respect to the SONET frame, in a controlled manner.

A DS1 or DS3 jitter test set can be used to verify that the desynchronizer output jitter is within the required specification.

Default (Known State) Settings

It is advisable to set the HP 37704A to a known state before setting up a measurement. This clears all previous settings and provides a clearly defined instrument state. For a list of Default Settings and the procedure for accessing them see *Stored Settings*.

Desynchronizer Stress Test Setup Procedure

An HP 37704A SONET test set fitted with Option 001, Frequency Offsets, and an HP 3784A Digital Transmission Analyzer, fitted with Option 008, are required for this test.

An HP 37772A 52/155 Mb/s Optical Interface Module is used in this setup to provide an optical interface in the HP 37704A SONET test set.

The HP 37704A SONET test set transmits an OC-3 signal carrying DS3 payload. Pointer adjustments are added in a controlled manner.
At the output of the desynchronizer the HP 3784A, Option 008, performs a jitter measurement on the demapped DS3 signal.
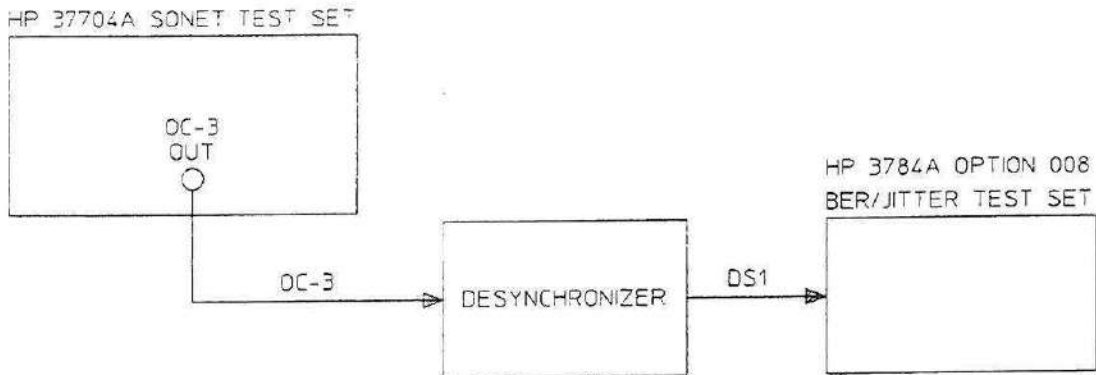
Figure 2-6. Desynchronizer Stress

1. Connect the HP 37704A and the HP 3784A to the network equipment, as shown in Figure 2-6, and set up the (TRANSMIT) SETTINGS display as shown below.

```
TRANSMITTER        [ SETTINGS          ]

TRANSMIT SIGNAL         [ OC-3      ]
CLOCK SYNC              [ EXT BITS  ]

STS-1 SPE UNDER TEST    [ 1         ]
PAYLOAD                 [ DS3       ]
FRAMING                 [ C-BIT     ]
PATTERN                 [ 2^15-1    ]




STATUS:
    1          2          3
```

The CLOCK SYNC selection determines the synchronization source for the TRANSMIT clock. If [EXT BITS] is selected a Bits Clock must be provided at the front panel, BITS CLOCK IN, port.

2. Set up the (TRANSMIT) TEST FUNCTION display as shown below.

```
TRANSMITTER        [ TEST FUNCTION     ]

SETUP: OC-3   STS-1 #1  SELECTED FOR TEST
TEST FUNCTION           [ ADJUST PTR ]

ADJUST POINTER          [ T1-X1      ]
ADJUSTMENT TYPE         [ SINGLE     ]
                        [ WITH ADDED ]
         POLARITY       [ POSITIVE   ]
         INTERVAL       [ 10 ms      ]

PRESS ACTION TO START SEQUENCE MODE


STATUS:
 INCR/    NEW     OFFSET   T1-X1
 DECR    POINTER
```

Pointer adjustments are made every 10 ms with an extra ADDED adjustment every 30 s.

Start the Desynchronizer Stress Test

1. Set up the HP 3784A, Option 008, to measure jitter amplitude at the SLOW rate, on the 10 UI range.

2. Press (ACTION) to activate the POINTER ADJUSTMENT sequence.

Pointer Processor Stress

Application

Ideally the clock frequency of an incoming STS-n signal should be synchronized to the clock frequency of the network element. If they are not synchronized, the network element compensates by moving the SPE relative to the outgoing STS-n signal. This is accompanied by pointer movements.

Some pointer movements are expected in the network during normal operation due to variations in clock frequency. Excessive pointer movements may indicate a network synchronization problem.

The Pointer processor can be exercised by transmitting an STS-n signal to the network element. The transmitted STS-n signal and the network element are synchronized and the STS-n signal rate is offset to exercise the pointer processor.

Default (Known State) Settings

It is advisable to set the HP 37704A to a known state before setting up a measurement. This clears all previous settings and provides a clearly defined instrument state. For a list of Default Settings and the procedure for accessing them see *Stored Settings*.

Pointer Processor Stress Test Setup Procedure

An HP 37704A fitted with Option 001, Frequency Offsets, is required for this test.

The HP 37704A SONET test set transmits an STS-1 signal, synchronized to the network equipment via the received STS-1 signal. The STS-1 transmit signal rate is offset by 4.6 ppm. The received offset, due to pointer processor activity, is calculated from the measured pointer movements.

HP 37704A SONET TEST SET

```
┌─────────────────────────────────┐                    ┌──────────────┐
│  STSX-1/DSX-3 ○───────STS-1──────┼──▷────────────────▶│              │
│         OUT                      │                    │     ADM      ├──▷──┐
│                                  │                    │              │     │
│   STS-1/DS-3 ○──────◁────────────┼────────STS-1───────┤    STS-1     │     │
│         IN                       │                    │              │     │
└─────────────────────────────────┘                    └──────────────┘     │
```
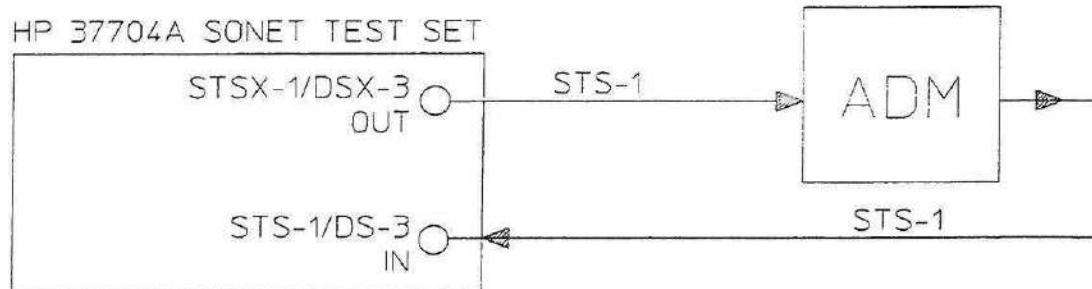
Figure 2-7. Pointer Processor Stress

1. Connect the HP 37704A to the network equipment, as shown in Figure 2-7, and set up the (TRANSMIT)

SETTINGS CONTROL display as shown below.

```
┌──────────────────────────────────────────┐
│  TRANSMITTER          [ SETTINGS CONTROL ] │
│                                            │
│  TRANSMITTER AND RECEIVER [ COUPLED      ] │
│       RECEIVER COUPLED TO TRANSMITTER      │
│                                            │
│                                            │
│                                            │
│                                            │
│                                            │
│  STATUS:                                   │
│  ┌──────┐ ┌────────┐                       │
│  │INDEP-│ │COUPLED │                       │
│  │ENDENT│ │        │                       │
│  └──────┘ └────────┘                       │
└──────────────────────────────────────────┘
```

2. Set up the (RECEIVE) SETTINGS display as shown below.

```
┌──────────────────────────────────────────┐
│  RECEIVER            [ SETTINGS          ] │
│                                            │
│  RECEIVE SIGNAL              [ STS-1     ] │
│  LEVEL                       [ STSX-1    ] │
│                                            │
│  PAYLOAD                     [ DS3       ] │
│  FRAMING                     [ UNFRAMED  ] │
│  PATTERN                     [ 2^15-1    ] │
│                                            │
│                                            │
│  STATUS:                                   │
│  ┌────────┐┌────────┐┌────────┐            │
│  │STS-1 HI││STSX-1  ││STS-1   │            │
│  │        ││        ││900 FT  │            │
│  └────────┘└────────┘└────────┘            │
└──────────────────────────────────────────┘
```
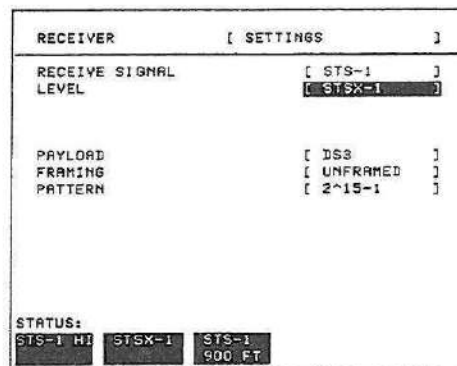
The LEVEL selection is dependant on the point at which interface is made to the network element.

3. Set up the (RESULTS) display as shown
below.

```
RESULTS DISPLAYED      [ POINTER ACTIVITY ]

TEST TIMING            [ MANUAL        ]

                       STS POINTER  VT POINTER
POINTER VALUE
NDF SECONDS
MISSING NDF SEC
POS ADJUSTMENTS
POS ADJ SECONDS
NEG ADJUSTMENTS
NEG ADJ SECONDS
IMPLIED SPE OFFSET

ELAPSED TIME

STATUS:
TROUBLE  ERROR   ERROR    ERROR      MORE
SCAN    COUNTS  RESULTS  ANALYSIS   ■■■■■
```

The IMPLIED SPE OFFSET result is
calculated from the number of received
pointer movements.

4. Set up the (TRANSMIT) SETTINGS
display as shown below.

```
TRANSMITTER       [ SETTINGS        ]

TRANSMIT SIGNAL          [ STSX-1    ]
CLOCK SYNC               [ STS-1 RX  ]
     LEVEL               [ STSX-1    ]
FREQUENCY OFFSET         [  +4.6 ppm ]

PAYLOAD                  [ DS3       ]
FRAMING                  [ UNFRAMED  ]
PATTERN                  [ 2^15-1    ]




STATUS:
DS3    INSERT  INSERT
       DS3     STS-1
```

The CLOCK SYNC selection determines
the synchronization source for the
TRANSMIT clock. STS-1 RX ensures
that the test set is synchronized to the
network element.

Start the Pointer Processor Stress Test

1. Press (RESTART) to start the measurement.

2. The IMPLIED SPE OFFSET result should be 4.6 ppm.

3. If the frequency offset is increased the IMPLIED SPE OFFSET should track
the FREQUENCY OFFSET.

At the end of the test :

■ the cumulative measurement results are available on the (RESULTS) display.

■ the current results can be retained on the display by pressing
(FREEZE DISPLAY).

Network Stimulus/Response Testing

Network equipment has built in alarms and error monitors which indicate to upstream and downstream equipment that there is a potential problem in the network :

If, for example, an upstream Loss Of Signal or Loss Of Frame condition is detected by Line Terminating Equipment (LTE), a Far End Receive Failure (FERF) is transmitted upstream and an STS Path AIS is transmitted downstream.

If a path terminating equipment error performance monitor detects a parity (BIP) error, a Far End Block Error (FEBE) is transmitted upstream and the parity error is recorded within the error performance monitor.

Network equipment may also have built in automatic protection switches. These switches automatically switch in standby equipment under certain alarm conditions or when the error ratio exceeds a preset value.

It is important that the alarms and error performance monitors are functioning correctly, to ensure that protection switches are switched into the network if required. It is also important that the protection switches react correctly to the maintenance information.

Alarm Stimulus/Response

Application

SONET network elements transmit alarms in response to certain error/alarm conditions to advise upstream and downstream equipment that these conditions exist. If these alarms are not transmitted in the proper manner, at the proper time, degradations in service will occur.

Alarm testing entails transmitting an alarm signal from the SONET test set and monitoring the network equipment alarm indicators and the upstream or downstream signal for the correct response.

Default (Known State) Settings

It is advisable to set the HP 37704A to a known state before setting up a measurement. This clears all previous settings and provides a clearly defined instrument state. For a list of Default Settings and the procedure for accessing them see *Stored Settings*.

Alarm Stimulus/Response Test Setup Procedure

In this setup the SONET test set transmits LINE AIS Alarm into the network. The network equipment alarm indicators are monitored for the appropriate alarms. The upstream signal is monitored for occurrences of LINE FERF. The downstream signal can be monitored for occurrences of STS PATH AIS.

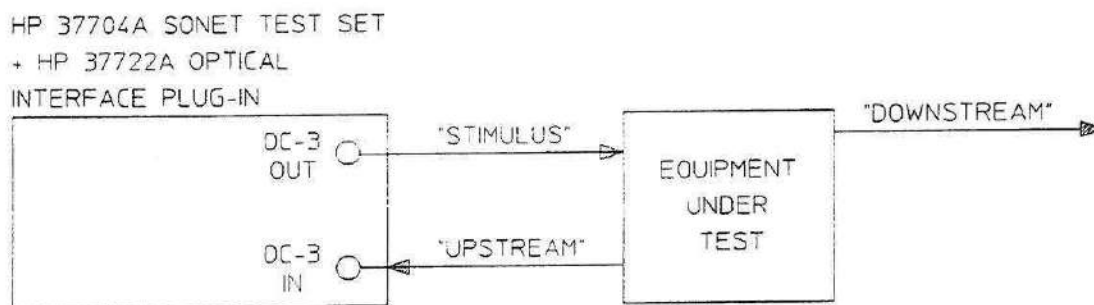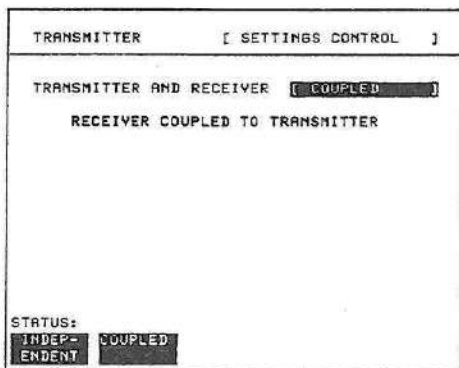A similar procedure can be used for testing all other SONET alarms. See Table 2-1.

Figure 2-8. Alarm Stimulus/Response

Table 2-1. SONET Alarms

Alarm	STE		LTE		PTE	
	Down	Up	Down	Up	Down	Up
Loss Of Signal	Line AIS	N/A	Path AIS	Line FERF	DS3 AIS	Path Yellow, Line FERF
Loss Of Frame	Line AIS	N/A	Path AIS	Line FERF	DS3 AIS	Path Yellow, Line FERF
Loss Of Pointer	N/A	N/A	Path AIS	N/A	DS3 AIS	Path Yel
Line AIS	N/A	N/A	Path AIS	Line FERF	DS3 AIS	Path Yellow, Line FERF
Line FERF	N/A	N/A	N/A	N/A	N/A	N/A
Path Yellow	N/A	N/A	N/A	N/A	N/A	N/A

1. Set up the (TRANSMIT) SETTINGS
CONTROL display as shown below.

```
TRANSMITTER        [ SETTINGS CONTROL    ]

TRANSMITTER AND RECEIVER   [ COUPLED     ]
    RECEIVER COUPLED TO TRANSMITTER




STATUS:
 INDEP-  COUPLED
 ENDENT
```

2. Set up the (TRANSMIT) SETTINGS
display as shown below.

```
TRANSMITTER        [ SETTINGS            ]

TRANSMIT SIGNAL          [ OC-3      ]
CLOCK SYNC               [ OC-3 RX   ]

STS-1 SPE UNDER TEST     [ 1         ]
PAYLOAD                  [ DS3       ]
FRAMING                  [ UNFRAMED  ]
PATTERN                  [ 2^15-1    ]



STATUS:
 INTERNAL EXTERNAL STS-1   OC-3     MORE
          BITS    RECEIVE RECEIVE  ■ ■ ■ ■
```

3. Set up the (RESULTS) display as shown below.

```
RESULTS DISPLAYED      [ ALARM SECONDS   ]

TEST TIMING            [ MANUAL          ]


POWER LOSS             LINE FERF
LOS                    STS-PATH YEL
LOF
OOF
LOP
LINE AIS
STS-PATH AIS
K1/K2 CHANGE
PATTERN LOSS

ELAPSED TIME

STATUS:
TROUBLE   ERROR    ERROR    ERROR      MORE
SCAN      COUNTS   RESULTS  ANALYSIS
```

ALARM SECONDS are displayed but any of the other results can be selected from the softkey menu without affecting the measurement.

4. Set up the (TRANSMIT) TEST FUNCTION display as shown below.

```
TRANSMITTER        [ TEST FUNCTION    ]

SETUP: OC-3   STS-1 #1  SELECTED FOR TEST
TEST FUNCTION             [ERROR &ALARM]

ERROR ADD TYPE            [ FRAME     ]
         RATE             [ OFF       ]

ALARMS                    [ LINE AIS  ]




STATUS:
OFF       LOSS OF   LINE    LINE      MORE
          FRAME     AIS     FERF
```

The ERROR ADD TYPE selected does not matter as long as RATE [OFF] is selected.

Start the Alarm Stimulus/Response Test

1. Connect the SONET test set, as shown in Figure 2-8, to the upstream port of the network equipment and press (RESTART) on the HP 37704A.

2. Check that the network equipment registers Line AIS and that LINE FERF alarm seconds are recorded on the (RESULTS) display.

Performance Monitor Stimulus/Response

Application

Performance monitors built into the SONET network equipment count
BIP errors, and communicate the results to the network controller via
the DataCommunications Channel (DCC). Performance monitors in Path
Terminating Equipment (PTE) also communicate with the upstream
equipment.

If the performance monitors are not operating correctly, degradations in
network performance will pass unnoticed and may result in a failure condition.

The performance monitors can be tested by the SONET test set transmitting
BIP (code violations) errors in the appropriate byte of the overhead and
monitoring upstream for the correct response :

SECTION - Byte B1 of transport overhead

LINE - Byte B2 of transport overhead

STS PATH - Byte B3 of path overhead

Default (Known State) Settings

It is advisable to set the HP 37704A to a known state before setting up a
measurement. This clears all previous settings and provides a clearly defined
instrument state. For a list of Default Settings and the procedure for accessing
them see *Stored Settings*.

Performance Monitor Stimulus/Response Test Setup Procedure

In this setup the HP 37704A SONET test set inserts STS PATH CV errors in
byte B3 of the path overhead of the SONET signal. The upstream signal is
monitored to provide a measure of the FEBE (Far End Block Error) count.
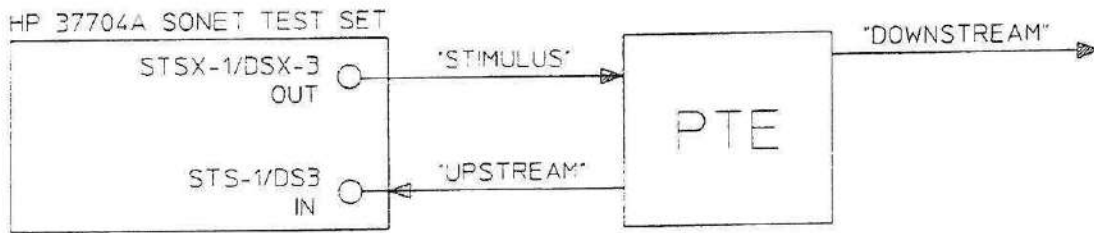
Figure 2-9. Performance Monitor Stimulus/Response

1. Connect the HP 37704A to the network equipment, as shown in Figure 2-9, and set up the (TRANSMIT) SETTINGS CONTROL display as shown below.
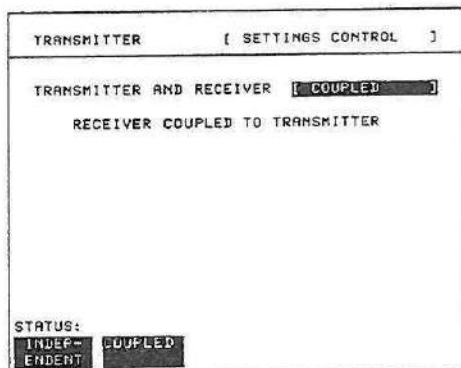
2. Set up the (TRANSMIT) SETTINGS display as shown below.

The CLOCK SYNC selection determines the synchronization source for the TRANSMIT clock. If [EXT BITS] is selected a Bits Clock must be provided at the front panel, BITS CLOCK IN, port.

3. Set up the **RECEIVE** SETTINGS display as shown below.

```
RECEIVER            [ SETTINGS          ]

RECEIVE SIGNAL               [ STS-1      ]
LEVEL                        [ STSX-1     ]


PAYLOAD                      [ DS3        ]
FRAMING                      [ UNFRAMED   ]
PATTERN                      [ 2^15-1     ]




STATUS:
STS-1 HI    STSX-1    STS-1
                      900 F.T
```

The LEVEL selection is dependant on the point at which interface is made to the network element.

4. Set up the **RESULTS** display as shown below.

```
RESULTS DISPLAYED   [ ERROR RESULTS      ]
ERROR SOURCE        [ STS-PATH FEBE      ]
TEST TIMING              [ MANUAL         ]

STS-PATH FEBE

ERROR COUNT
ERROR RATE
ERROR SECONDS
ERROR FREE SECONDS
%ERROR FREE SECONDS


ELAPSED TIME

STATUS:
CODE     FRAME    SECTION   LINE    MORE
ERRORS   ERRORS   CV        CV
```

STS PATH FEBE ERROR RESULTS are displayed but any of the other results can be selected from the softkey menu without affecting the measurement.

5. Set up the **TRANSMIT** TEST FUNCTION display as shown opposite.

The ERROR RATE required can be selected from the softkey menu.

```
TRANSMITTER         [ TEST FUNCTION      ]

SETUP: STS-1
TEST FUNCTION              [ERROR &ALARM]

ERROR ADD TYPE            [ STS-PATH CV]
         RATE            [ 1E-4         ]

ALARMS                    [ OFF         ]




STATUS:
OFF      ERROR    1E-3     1E-4     MORE
         ALL
```

Start the Performance Monitor Stimulus/Response Test

1. Press **RESTART** on the HP 37704A SONET test set.

2. Check that the STS PATH FEBE error rate is the same as the generated STS PATH CV rate.

All the measurement results are available, throughout the test, on the (RESULTS) display .

At the end of the test :

■ the cumulative measurement results are available on the (RESULTS) display.

■ the current results can be retained on the display by pressing (FREEZE DISPLAY).

APS Stimulus/Response

Application

Automatic Protection Switching (APS) is an optional feature for SONET Line Terminating Equipment (LTE). For those LTE's, in which it is provided, the APS system is standardized to ensure the interworking of APS between LTE's from different suppliers.

Standard messages, carried in the K1 and K2 bytes of the SONET signal transport overhead, indicate the state of the APS.

Switching to protection line occurs when one of the following conditions exists for a specified length of time :

■ Loss Of Signal (LOS)

■ Loss Of Frame (LOF)

■ Bit Error Ratio $> 1 \times 10^3$

■ Line AIS

If the Bit Error Ratio exceeds a lower pre-selected threshold, for a longer specified time, the APS will also switch.

The HP 37704A SONET test set can be used to test APS in two ways :

1. The switching conditions listed above can be generated using the (TRANSMIT) TEST FUNCTION ERRORS & ALARMS.

```
TRANSMITTER        [ TEST FUNCTION      ]

SETUP: STS-1
TEST FUNCTION               [ERROR &ALARM]

ERROR ADD TYPE              [ LINE CV    ]
         RATE               [APS THRESHLD]
              [    1 ] ERRORS IN [ 10 ms  ]

ALARMS                      [ OFF        ]


STATUS:
 OFF      APS      ERROR    1E-3     MORE
        THRESHLD   ALL
```

2. The K1 K2 messages can be transmitted and monitored using the
(TRANSMIT) TEST FUNCTION APS MESSAGES.

APS Messages can be inserted in the K1 and K2 bytes whatever selection is made under STS-1 SPE UNDER TEST on the (TRANSMIT) SETTINGS display.

The APS Messages are started when (ACTION) is pressed.

```
TRANSMITTER          [ TEST FUNCTION      ]

SETUP: OC-3   STS-1 #1   SELECTED FOR TEST
TEST FUNCTION              [APS MESSAGES]

NEW TX
K1 BITS 1->4  [0000:NO REQUEST          ]
   BITS 5->8  [0000:NULL CHANNEL        ]
K2 BITS 1->4  [0000] BRIDGED CHANNEL #
   BIT  5     [0   : 1+1 ARCHITECTURE   ]
   BITS 6->8  [ 000: RESERVED           ]

CURRENT TX                  CURRENT RX
K1 ........                 K1
K2 ........                 K2

PRESS ACTION TO TRANSMIT NEW K1/K2
STATUS:
 NO      DO NOT  REVERSE   NOT     MORE
REQUEST  REVERT  REQUEST   USED   ▭▭▭▭▭
```

Three displays of K1 and K2 are provided :

1. **New TX** - Allows the content of the K1 and K2 bytes to be set for future transmission.

K1 Bits 1 ->4   Selects the APS message to be transmitted. Can be set in the range 0000 to 1111 (See Table below).

K1 Bits 1 - >4

Selection	Message	Selection	Message
0000	NO REQUEST	1000	MANUAL SWITCH
0001	DO NOT REVERT	1001	NOT USED
0010	REVERSE REQUEST	1010	SD - Low Priority
0011	NOT USED	1011	SD - High Priority
0100	EXERCISE	1100	SF - Low Priority
0101	NOT USED	1101	SF - High Priority
0110	WAIT TO RESTORE	1110	FORCED SWITCH
0111	NOT USED	1111	LOCKOUT OF PROT

SD - High Priority and SF - High Priority are only available when K2 bit 5 is set to 1 - 1 : N architecture.

2-40   Making Measurements

K1 Bits 5 ->8   Selects the channel used by the APS Messages. Can be set in the range 0000 to 1111.

K1 Bits 5 - >8

Selection	Message	Selection	Message
0000	NULL CHANNEL	1000	WORKING CHANNEL #8
0001	WORKING CHANNEL #1	1001	WORKING CHANNEL #9
0010	WORKING CHANNEL #2	1010	WORKING CHANNEL #10
0011	WORKING CHANNEL #3	1011	WORKING CHANNEL #11
0100	WORKING CHANNEL #4	1100	WORKING CHANNEL #12
0101	WORKING CHANNE1 #5	1101	WORKING CHANNEL #13
0110	WORKING CHANNEL #6	1110	WORKING CHANNEL #14
0111	WORKING CHANNEL #7	1111	EXTRA TRAFFIC CHANNEL

WORKING CHANNEL #2 through WORKING CHANNEL #14 and EXTRA TRAFFIC CHANNEL are only available when K2 Bit 5 is set to 1 - 1 : N architecture. If K1 bits 1 >4 are set to 1111 LOCKOUT OF PROT then K1 bits 5 ->8 are fixed at 0000 NULL CHANNEL.

K2 bits 1 - >4   Selects the bridged channel used by the APS Messages. Can be set in the range 0000 to 1111.

K2 bit 5   Determines the automatic protection switch architecture.
                0 - 1 + 1 architecture
                1 - 1 : N architecture

K2 bits 6 ->8   Selects the reserved bits. Can be set in the range 000 to 101.

2. Current TX - Displays the values of K1 and K2 bytes which are currently being transmitted.

3. Current RX - Displays the value of K1 and K2 bytes which are currently being received.

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In-Service Performance Monitoring

Application

In-service monitoring of the network performance allows maintenance action to be taken before a degradation becomes a serious problem causing network downtime. Monitoring and analysis of the following can provide a particularly valuable indication of network performance :

BIP errors

Payload pointer movements

Default (Known State) Settings

It is advisable to set the HP 37704A to a known state before setting up a measurement. This clears all previous settings and provides a clearly defined instrument state. For a list of Default Settings and the procedure for accessing them see *Stored Settings*.

In-Service Performance Monitoring Setup Procedure

The HP 37704A SONET test set is connected to the network to monitor BIP errors (CV) and payload pointer movements.

The GRAPHICS function is enabled to provide flexibility in record keeping. The graphical results can be viewed on the (GRAPH) display or logged to an external printer. If a printer is not immediately available, the results remain in storage and can be logged later. The measurement results can be viewed on the (RESULTS) display during the test.
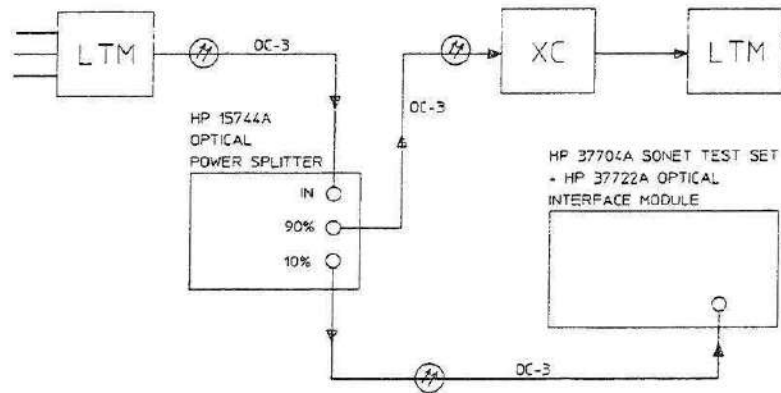
Figure 2-10. In-Service Performance Monitoring

1. Connect the HP 37704A to the
network equipment, as shown in Figure
2-10, and set up the (RECEIVE) SETTINGS
display as shown below.

```
RECEIVER          [ SETTINGS          ]

RECEIVE SIGNAL    [ OC-3              ]


STS-1 SPE UNDER TEST   [ 1            ]
PAYLOAD                [ DS3          ]
FRAMING                [ C-BIT        ]
PATTERN                [LIVE TRAFFIC]



STATUS:
| 2^15-1 | 2^20-1 | 2^23-1 | ALL    | MORE   |
|        |        |        | ZEROS  | ▭▭▭▭  |
```

2. Set up the (RESULTS) display as shown
below.

```
RESULTS DISPLAYED   [ ERROR COUNTS    ]

TEST TIMING         [ MANUAL          ]


CODE ERRORS
FRAME ERRORS
SECTION CVs
LINE CVs
STS-PATH CVs

STS-PATH FEBE

BIT ERRORS

ELAPSED TIME

STATUS:
| ALARM   | POINTER  | SIGNAL |  | MORE   |
| SECONDS | ACTIVITY | LEVEL  |  | ▭▭▭▭  |
```
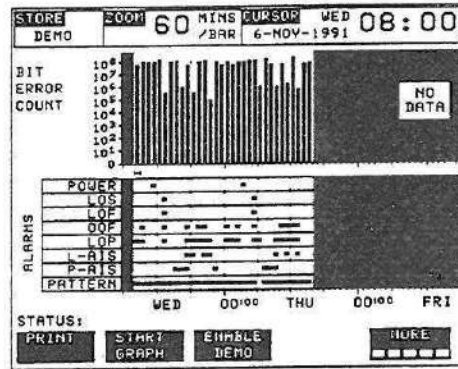
ERROR COUNTS are displayed but any
of the other results can be selected from
the softkey menu without affecting the
measurement.

Start the In-Service Monitoring Test

1. The method of starting the test period depends on the requirement for storage of graphic results. If you do not require stored graphic results, press (RESTART). If you wish to store the results of the measurement in graphical form, set up the (GRAPH) display as shown below.

START GRAPH starts the test period and ensures that a graphical version of the measurement results is stored in non volatile memory. This allows the results to be viewed in the (GRAPH) display, or logged to an external printer, at a later time.

The measurement results are available on the (RESULTS) display during the test period.

The graphical measurement results are stored in non volatile memory for viewing later on the (GRAPH) display or logging on a printer.

Alarm occurrences are stored in graphical form in non volatile memory.

The test can be halted at any time by pressing (RESTART).

At the end of the test :

- the cumulative measurement results are available on the (RESULTS) display.

- a graphical version of the measurement results and alarms are available on the (GRAPH) display and stored in non volatile memory for viewing later or logging on a printer.

- Results and Alarms summaries are available on the (GRAPH) display and stored in non volatile memory for viewing later or logging to a printer.

It should be noted that the total Graphics Store capacity is 78 hours. Up to 20 sets of graphical results can be stored. If an attempt is made to store more

than 20 sets of results, then a set of results is deleted on a "first in first out" basis.

DCC Testing

Application

The transport overhead contains two DataCommunication Channels (DCC), SECTION DCC at 192 kb/s (overhead bytes D1- D3) and LINE DCC at 576 kb/s (overhead bytes D4 - D12). The DCC communicates network management messages between network elements and the network controller via the operations support computer system.

If the DCC is not operating correctly these network management messages will be lost and degradations in network performance will pass unnoticed. This may result in a failure condition.

Full testing of the line and section DCC's can be carried out using a protocol analyzer connected via the SONET test set to the appropriate transport overhead bytes. At the far end the SONET test set can drop the selected DCC to the protocol analyzer allowing the DCC integrity to be analyzed.

If you do not have access to a protocol analyzer capable of handling SONET DCC protocol, the DCC integrity can be verified by a BER test using an HP 37711A, T1/Datacomm tester.

Default (Known State) Settings

It is advisable to set the HP 37704A to a known state prior to setting up a measurement. This clears all previous settings and provides a clearly defined instrument state. For a list of Default Settings and the procedure for accessing them see *Stored Settings*.

DCC Test Setup Procedure

In this procedure the HP 37704A SONET test set accepts a 576 kb/s test pattern via the rear panel protocol analyzer port, inserting the test pattern in bytes D4 - D12 of the transport overhead and transmitting an OC-3 SONET signal. The SONET test set receives the OC-3 SONET signal and drops the line DCC, via the rear panel protocol analyzer port, to the HP 37711A which performs the BER measurement.
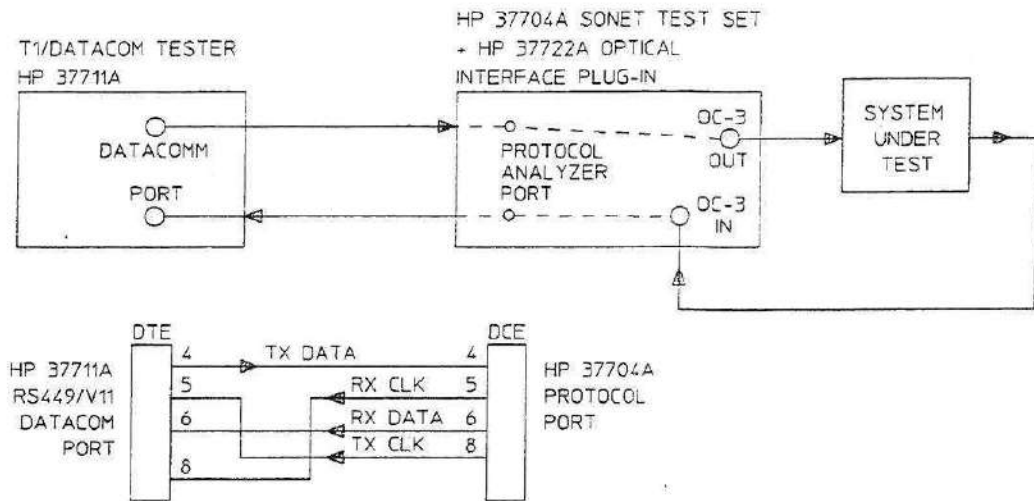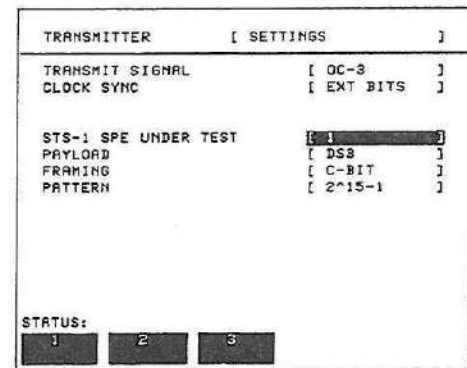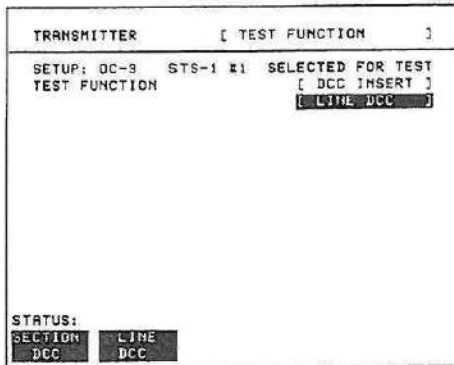
Figure 2-11. DCC Testing

1. Connect the HP 37711A and the HP 37704A to the network element, as shown in Figure 2-11, and set up the (TRANSMIT) SETTINGS CONTROL display as shown below.
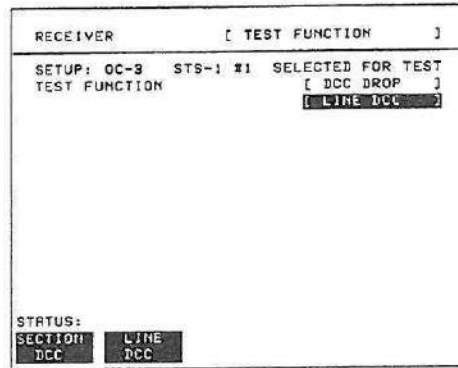
```
TRANSMITTER        [ SETTINGS CONTROL   ]

TRANSMITTER AND RECEIVER  [ COUPLED     ]

    RECEIVER COUPLED TO TRANSMITTER




STATUS:
INDEP-   COUPLED
ENDENT
```

2. Set up the (TRANSMIT) SETTINGS display as shown below.

```
TRANSMITTER        [ SETTINGS          ]

TRANSMIT SIGNAL         [ OC-3       ]
CLOCK SYNC              [ EXT BITS   ]


STS-1 SPE UNDER TEST    [ 1          ]
PAYLOAD                 [ DS3        ]
FRAMING                 [ C-BIT      ]
PATTERN                 [ 2^15-1     ]




STATUS:
    1         2         3
```

3. Set up the (TRANSMIT) TEST

FUNCTION display as shown below.

```
┌─────────────────────────────────────────┐
│ TRANSMITTER        [ TEST FUNCTION    ]  │
│                                          │
│ SETUP: OC-3  STS-1 #1 SELECTED FOR TEST  │
│ TEST FUNCTION          [ DCC INSERT ]    │
│                        [ LINE DCC    ]   │
│                                          │
│                                          │
│                                          │
│                                          │
│                                          │
│ STATUS:                                  │
│ SECTION  LINE                            │
│   DCC    DCC                             │
└─────────────────────────────────────────┘
```

4. Set up the (RECEIVE) TEST FUNCTION display as shown below.

```
┌─────────────────────────────────────────┐
│ RECEIVER           [ TEST FUNCTION    ]  │
│                                          │
│ SETUP: OC-3   STS-1 #1 SELECTED FOR TEST │
│ TEST FUNCTION          [ DCC DROP   ]    │
│                        [ LINE DCC   ]    │
│                                          │
│                                          │
│                                          │
│                                          │
│                                          │
│ STATUS:                                  │
│ SECTION  LINE                            │
│   DCC    DCC                             │
└─────────────────────────────────────────┘
```

Start the DCC Test

1. Select TEST SELECT (DATACOM) on the HP 37711A.

2. Set TX Clock Source and RX Clock Source to [INTERFACE] on the HP 37711A (Clock from HP 37704A protocol port).

3. Select the required pattern and monitor logic errors and frequency to verify the integrity of the DCC.

Transmit Static Overhead

It can be desirable to set an overhead byte to a known static state to aid in troubleshooting, for example, to quickly check for "stuck bits" in path overhead bytes. This capability is provided under (TRANSMIT) STATIC T-OH and STATIC P-OH.

Path Overhead

The value of each bit of path overhead bytes : C2, F2, G1, H4, Z3, Z4 and Z5 can be set to 0 or 1. Byte B3 cannot be set. Byte J1 can be programmed to carry a data message, thus providing a path TRACE capability.

Path Trace

The path trace capability allows a user selected data message to be inserted in the J1 byte to enable identification of the SONET STS-1 SPE under test.

1. Press (TRANSMIT); STATIC P-OH and using (⇧) ; (⇩) and the display softkeys set up the (TRANSMIT) display as shown below.

Selection of DEFAULT MESSAGE programs the J1 byte to carry 64 ASCII Null characters.

2. Selection of TEST MESSAGE programs the J1 byte to carry the displayed HP 37704A test message.

3. Selection of USER MESSAGE allows the
user to program the message content of
the J1 byte with up to 62 ASCII
characters (padded out with ASCII Null
characters if necessary) followed by CR
LF.

```
TRANSMITTER        [ STATIC P-OH      ]

SETUP: STS-1

STATIC VALUES
Other functions under TEST FUNCTION

  J1 [ USER  ]  ──→ [This is a simple]
  B3  xxxxxxxx       [ example of a us]
  C2 [00000001]      [er defined path ]
  G1 [00000000]      [trace message!▓▓]
  F2 [00000000]
  H4 [00000000]      Terminate sequence
  Z3 [00000000]      with %/%
  Z4 [00000000]
  Z5 [00000000]

STATUS:
 JUMP   PREVIOUS  NEXT   ←───   ───→
         CHAR     CHAR
```
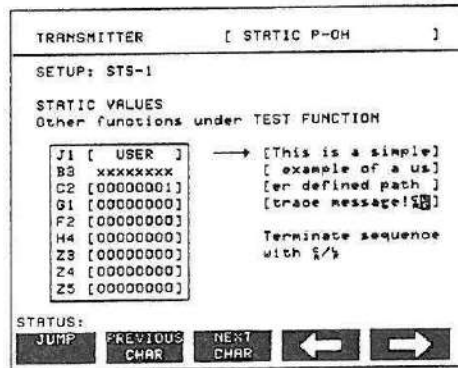
Transport Overhead

The value of each bit of transport overhead bytes : A1,A2 ; C1 ; E1 ; F1 ; D1 -
D3 ; K1,K2 ; D4 - D12 ; Z1 ; Z2 and E2 can be set to 0 or 1. Only bits 2 and 3
of byte H1 can be set to 0 or 1. Bytes B1, B2, H2 and H3 cannot be set at any
time.

If TRANSMIT SIGNAL [STS-3], [OC-3] or [OC-12] and STATIC VALUES
FOR STS-1 [2] through [12] are selected only bytes A1,A2 ; C1 ; H1 - H3 ;
B2 ; Z1 and Z2 are labelled as the other overhead functions of STS-1 [2]
through [12] have not yet been defined. The value of each bit of transport
overhead bytes : A1,A2 ; C1 ; Z1 ; Z2 and all the bits of the unlabelled
functions can be set to 0 or 1. Only bits 2 and 3 of byte H1 can be set to 0 or
1. Bytes B2, H2 and H3 cannot be set at any time.

An overhead byte cannot be set to a static value if a TEST FUNCTION is active
in that byte, for example : If the APS MESSAGES Test Function is selected
then K1,K2 value will be determined by the selections made under APS
MESSAGES.

Setting Undefined Overhead Functions

For test purposes it may be important to be able set the value of those
overhead functions which are presently undefined (Z1) or unlabelled as in
STS-1 [2] through [12].

1. Press (TRANSMIT); STATIC T-OH and using ⟨↰⟩ ; ⟨↱⟩ set up the (TRANSMIT) display as shown opposite

2. The Z1 byte can be set in the range 00000000 to 11111111 using the display softkeys.

```
TRANSMITTER           [ STATIC T-OH          ]

SETUP: STS-1

STATIC VALUES
Other functions under TEST FUNCTION

A1 [11110110] A2 [00101000] C1 [00000001]
B1   xxxxxxxx  E1 [00000000] F1 [00000000]
D1 [00000000] D2 [00000000] D3 [00000000]
H1 [xxxx00xx] H2   xxxxxxxx  H3   xxxxxxxx
B2   xxxxxxxx  K1 [00000000] K2 [00000000]
D4 [00000000] D5 [00000000] D6 [00000000]
D7 [00000000] D8 [00000000] D9 [00000000]
D10[00000000] D11[00000000] D12[00000000]
Z1 [0█000000] Z2 [00000000] E2 [00000000]

STATUS:
┌──────┬──────┬──────┬──────┬──────┐
│ SET  │ SET  │  ←   │  →   │ END  │
│  0   │  1   │      │      │ EDIT │
└──────┴──────┴──────┴──────┴──────┘
```

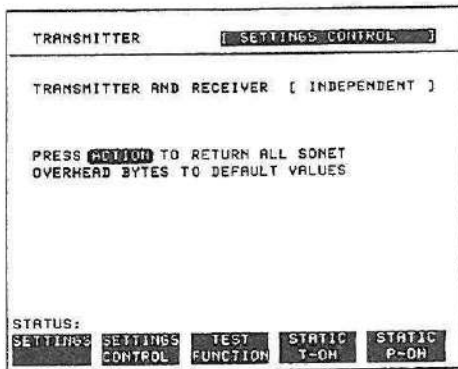## Static Overhead Known (Default) Conditions

After testing it may be desirable to return the static overhead to the known (default) state as shown below.

```
TRANSMITTER           [ STATIC T-OH          ]

SETUP: STS-1

STATIC VALUES
Other functions under TEST FUNCTION

A1 [11110110] A2 [00101000] C1 [00000001]
B1   xxxxxxxx  E1 [00000000] F1 [00000000]
D1 [00000000] D2 [00000000] D3 [00000000]
H1 [xxxx00xx] H2   xxxxxxxx  H3   xxxxxxxx
B2   xxxxxxxx  K1 [00000000] K2 [00000000]
D4 [00000000] D5 [00000000] D6 [00000000]
D7 [00000000] D8 [00000000] D9 [00000000]
D10[00000000] D11[00000000] D12[00000000]
Z1 [00000000] Z2 [00000000] E2 [00000000]

STATUS:
┌────────┬────────┬────────┬────────┬────────┐
│SETTINGS│SETTINGS│ TEST   │ STATIC │ STATIC │
│        │CONTROL │FUNCTION│ T-OH   │ P-OH   │
└────────┴────────┴────────┴────────┴────────┘
```
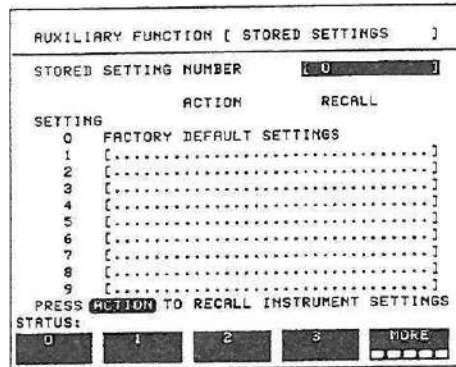
```
TRANSMITTER           [ STATIC T-OH          ]

SETUP: OC-3    STS-1 #1  SELECTED FOR TEST

STATIC VALUES FOR STS-1   [ #2              ]
Other functions under TEST FUNCTION

A1 [11110110] A2 [00101000] C1 [00000010]
   [00000000]    [00000000]    [00000000]
   [00000000]    [00000000]    [00000000]
H1 [xxxx00xx] H2   xxxxxxxx  H3   xxxxxxxx
B2   xxxxxxxx     [00000000]    [00000000]
   [00000000]    [00000000]    [00000000]
   [00000000]    [00000000]    [00000000]
   [00000000]    [00000000]    [00000000]
Z1 [00000000] Z2 [00000000]    [00000000]

STATUS:
┌────────┬────────┬────────┬────────┬────────┐
│SETTINGS│SETTINGS│ TEST   │ STATIC │ STATIC │
│        │CONTROL │FUNCTION│ T-OH   │ P-OH   │
└────────┴────────┴────────┴────────┴────────┘
```

This can be achieved in one of two ways :

1. Press TRANSMIT ; SETTINGS
CONTROL and ACTION .

```
TRANSMITTER          [ SETTINGS CONTROL ]

TRANSMITTER AND RECEIVER  [ INDEPENDENT ]


PRESS ACTION TO RETURN ALL SONET
OVERHEAD BYTES TO DEFAULT VALUES




STATUS:
SETTINGS SETTINGS  TEST    STATIC  STATIC
         CONTROL FUNCTION  T-OH    P-OH
```

2. Set up the STORED SETTINGS
function on the AUX display as shown
below and press ACTION . This method
return all settings, including overhead, to
the known (default) state.

```
AUXILIARY FUNCTION [ STORED SETTINGS     ]

STORED SETTING NUMBER        [ 0        ]

                 ACTION       RECALL
SETTING
  0    FACTORY DEFAULT SETTINGS
  1    [.................................]
  2    [.................................]
  3    [.................................]
  4    [.................................]
  5    [.................................]
  6    [.................................]
  7    [.................................]
  8    [.................................]
  9    [.................................]
PRESS ACTION TO RECALL INSTRUMENT SETTINGS
STATUS:
    0        1        2        3       MORE
```

Receive Overhead Monitor

When first connecting to a SONET network a start-up confidence check can be made by viewing the behavior of all the overhead bytes. If the SONET network shows alarm indications, some diagnosis of the problem may be gained from viewing all the overhead bytes. This facility is provided on the (RECEIVE) display under T-OH MONITOR and P-OH MONITOR.

All path overhead bytes are monitored and displayed as shown below.

The display is updated once per second (once per 8000 frames approximately).

All transport overhead bytes are monitored and displayed as shown below.

The display is updated once per second (once per 8000 frames approximately).

```
RECEIVER              [ P-OH MONITOR        ]

SETUP: STS-1

OVERHEAD MONITOR
Other functions under TEST FUNCTION

   J1  01001000   ──→ "HP37704A Field
   B3  10000000       Portable SONET
   C2  00000001       tester.
   G1  00000000       0123456789    ♪
   F2  00000000
   H4  00000000
   Z3  00000000
   Z4  00000000
   Z5  00000000

STATUS:
SETTINGS SETTINGS  TEST     T-OH     P-OH
         CONTROL  FUNCTION MONITOR  MONITOR
```

```
RECEIVER              [ T-OH MONITOR        ]

SETUP: STS-1

OVERHEAD MONITOR
Other functions under TEST FUNCTION

   A1  11110110   A2  00101000   C1  00000001
   B1  01000101   E1  00000000   F1  00000000
   D1  00000000   D2  00000000   D3  00000000
   H1  01100011   H2  00000100   H3  00000000
   B2  10001000   K1  00000000   K2  00000000
   D4  00000000   D5  00000000   D6  00000000
   D7  00000000   D8  00000000   D9  00000000
   D10 00000000   D11 00000000   D12 00000000
   Z1  00000000   Z2  00000000   E2  00000000

STATUS:
SETTINGS SETTINGS  TEST     T-OH     P-OH
         CONTROL  FUNCTION MONITOR  MONITOR
```

If any abnormal behavior is observed on a particular path or transport overhead byte, or an associated group of bytes (A1,A2 ; D1 - D3) the (RECEIVE) TEST FUNCTION display of OVERHEAD CAPTURE can be used to "zoom" in on the suspect byte, or bytes, on a frame by frame basis.

Receive Overhead Capture

Section, Line and Path overhead provide network support functions, responding dynamically to network conditions and needs. It is therefore desirable to be able to capture overhead activity on a frame by frame basis. This capability is provided under (RECEIVE) : TEST FUNCTION ; OVERHEAD CAPTURE.

Overhead Capture allows selection of the starting point of the capture by means of Trigger selection :

Trigger OFF   start immediately the capture is initiated

Trigger ON   capture activity after a specified overhead state has occurred

Trigger ON NOT   capture activity after the first occurrence of a deviation from a specified overhead state.

Trigger OFF can be used to provide a "frame by frame monitor" of the selected byte, or bytes, immediately the capture is initiated.

Trigger ON and ON NOT can be used for "transient detection" from a specified expected state.

Frame by Frame Monitor of H1,H2

The frame by frame monitor capability provides a "zoom" in version of the Receive Overhead Monitor feature using the Trigger OFF condition of overhead capture.

1. Press (RECEIVE) ; TEST FUNCTION ; OVERHEAD CAPTURE and using ⟨⬆⟩ ; ⟨⬇⟩ and the display softkeys set up the (RECEIVE) display as shown opposite.

```
RECEIVER              [ TEST FUNCTION        ]

SETUP: STS-1
TEST FUNCTION                    [ O/H CAPTURE]
CAPTURE OF CHANNEL    [L-OH][ H1,H2      ]
TRIGGER          [ OFF  ]

DATA    FRAME COUNT    DATA    FRAME COUNT
62FE        9213       62FA        12349
63AB           1       63AF            1
62FD       12343       62F9        12347
63A8           1       63AC            1
62FC       12359       62F8        12349
63A9           1       63AD            1
62FB       12346       62F7        12349
63AE           1       63A2            1
CAPTURE COMPLETE - PRESS MOTION TO CAPTURE
STATUS:
  OFF        ON        ON
                       NOT
```

Pointer Graph

If excessive pointer activity is taking place in the SONET network it is of value to know the distribution of the pointer adjustments. This capability is provided under (RECEIVE) ; TEST FUNCTION ; PTR GRAPH.

PTR GRAPH shows the distribution of net pointer adjustments, positive - negative. The measurement window size is selectable in two ranges :

1. 5 frames to 8000 frames

2. 1 second to 60 seconds (8000 frames to 480,000 frames)

To access the Pointer Graph capability press (RECEIVE) ; TEST FUNCTION ; PTR GRAPH and using (⬆) ; (⬇) and the display softkeys select the required window size.

It may be advisable to make the first measurement using a small window size and widen out for subsequent investigation.

Pointer Graph - net zero

The display shows that the number of positive pointer adjustments and negative pointer adjustments during the selected window were equal (net zero).

www.valuetronics.com
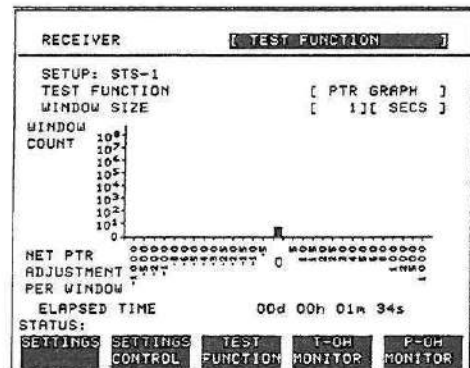
Transient Detection on A1,A2

Under normal operating conditions the A1,A2 bytes will remain in a known stable state (F628). Using the Trigger ON NOT condition of the Overhead Capture, any transient deviations from that state can be detected.

1. Press (RECEIVE) ; TEST FUNCTION ;
OVERHEAD CAPTURE and using (↑) ; (↓)
and the display softkeys set up the
(RECEIVE) display as shown opposite.

```
RECEIVER              [ TEST FUNCTION        ]

SETUP: STS-1
TEST FUNCTION                    [ O/H CAPTURE]
CAPTURE OF CHANNEL    [S-OH][ A1,A2       ]
TRIGGER         [ON NOT][F628]

DATA    FRAME COUNT    DATA    FRAME COUNT
E628              1    F628          64000
F628          64000    F628          11319
F628          38382    E628              1
E628              1    F628          64000
F628           1905    F628          64000
E628              1    F628          38952
F628          64000    E628              1
F628          64000    F628          64000
CAPTURE COMPLETE - PRESS ACTION TO CAPTURE
STATUS:
 OFF        ON        ON
                      NOT
```

The overhead capture feature provides 16 records of overhead state. Each record will represent between 1 and 64,000 frames.

Graphics

The Graphics function provides the following displays :

■ bar graph display of the results obtained during the test period.

■ display of the measurement error summary and alarm summary during the test period.

■ display of the graphics Store, content and capacity.

Each of these displays can be viewed in the (GRAPH) display. The bar graph display and the error and alarm summaries can be logged on an external HP ThinkJet printer.

Bar Graphs of Section CV; Line CV; Path CV; FEBE Count; Bit Error Count; +ve Pointer Adjust; -ve Pointer Adjust; SONET Alarms 1 and 2; DS3 Code; DS3 Frame; DS3 P-Bit; DS3 C-Bit; DS3 FEBE and DS3 Bit are available.

If Option 002, Virtual Tributary, is fitted and PAYLOAD VT1.5 is selected additional Bar graphs of VT-Path CV; VT FEBE Count; VT +ve Pointer Adjust; VT -ve Pointer Adjust and VT Alarms are available. Bar Graphs of Bit Error Count; VT +ve Pointer Adjust and -ve Pointer Adjust are not available if VT MODE LOCKED BYTE or LOCKED BIT is selected. Any two of the bar graphs can be displayed together.

If Option 002, Virtual Tributary, is fitted and RECEIVE SIGNAL DS1 is selected the only Bar Graphs available are : DS1 Bit Error Count; DS1 Code Error Count; DS1 Frame Error Count; DS1 CRC Count and DS1 Alarms.

Up to 20 sets of bar graphs, error summaries and alarm summaries, and the status of the stored results can be stored in non volatile memory. It should be noted that the total graphics store capacity is 78 hours. Up to 20 sets of graphical results can be stored. If an attempt is made to store more than 20 sets of results, then a first in first out policy is operated. If graphics are enabled and a test is run which exceeds the remaining storage capacity, then some previously stored graphical results will be discarded.

Pointer Graph - Bursts of Pointer adjustments

The display shows that a burst of positive pointer adjustments occurred during the selected window.

```
RECEIVER              [ TEST FUNCTION    ]
 _____
 SETUP: STS-1
 TEST FUNCTION              [ PTR GRAPH  ]
 WINDOW SIZE                [  50][FRAMES]
 WINDOW
 COUNT    10⁸
          10⁷
          10⁶
          10⁵
          10⁴
          10³
          10²
          10¹
            0
 NET PTR                       0
 ADJUSTMENT
 PER WINDOW
  ELAPSED TIME           00d 00h 02m 11s
 STATUS:
 SETTINGS SETTINGS  TEST    T-OH    P-OH
          CONTROL FUNCTION MONITOR MONITOR
```
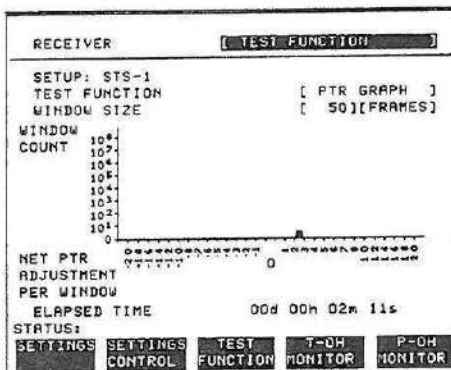
Pointer Graph - Frequency Offset

Pointer adjustments due to frequency offset will produce a regular amount of pointer adjustments.

```
RECEIVER              [ TEST FUNCTION    ]
 _____
 SETUP: STS-1
 TEST FUNCTION              [ PTR GRAPH  ]
 WINDOW SIZE                [2000][FRAMES]
 WINDOW
 COUNT    10⁸
          10⁷
          10⁶
          10⁵
          10⁴
          10³
          10²
          10¹
            0
 NET PTR                       0
 ADJUSTMENT
 PER WINDOW
  ELAPSED TIME           00d 00h 02m 04s
 STATUS:
 SETTINGS SETTINGS  TEST    T-OH    P-OH
          CONTROL FUNCTION MONITOR MONITOR
```

www.valuetronics.com
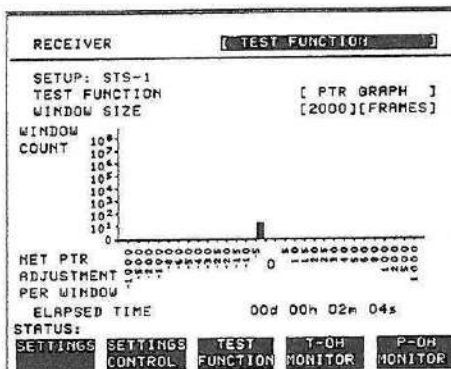
To prevent accidental loss of graphics data the graphics capability is normally disabled and must be enabled if graphical results are required. Any action causing a new test period to be started will disable the graphics capability :

Any selection on the [RECEIVE] display.

Selection of Test Timing MANUAL or SINGLE on the [RESULTS] display.

Selection of STOP GRAPH on the [GRAPHICS] display.

Changing the TIME & DATE setting on the [AUX] display.

Selection of SETTINGS CONTROL COUPLED on the [TRANSMIT] or [RECEIVE] displays if this causes a change in receive settings.

Selection of CLOCK SYNC STS-1 RX on the [TRANSMIT] display if the RECEIVE SIGNAL was previously set to [DS3] or [DS1].

Obtaining Graphics Results

To obtain graphical results enable the graphics using START GRAPH on the bar graph display.

Selecting START GRAPH enables the graphics, starts the test period, and allows storage of the measurement results.

Any action which results in the start of a new test period will disable the graphics capability until START GRAPH is reselected.
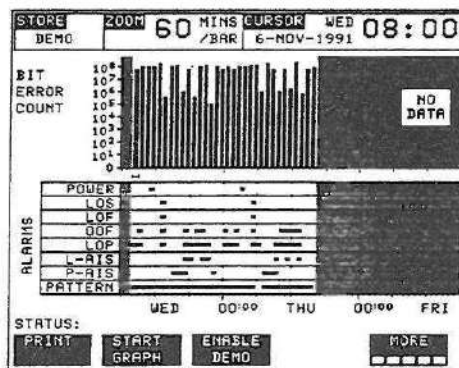
Recalling Previously Stored Results

Results stored from a previous test period can be recalled to the graphics displays for viewing and printing. If currently viewing the bar graph display, select TEXT RESULTS then STORE STATUS. If currently viewing the error or alarm summary, select STORE STATUS.

1. Using ⬆ and ⬇ move the highlighted cursor to the store location which contains the required results.

2. If you wish to view the bar graphs, select GRAPH RESULTS.

3. If you wish to view the error or alarm Summaries, select TEXT RESULTS.

Viewing the Bar Graph Display

The bar graph display can be viewed at any time.

1. To view the current bar graphs, press (GRAPH) and use CHANGE UPPER and CHANGE LOWER to obtain the bar graphs required.

2. To view a set of previously stored bar graphs, press (GRAPH); TEXT RESULTS and STORE STATUS.
Using ⬆ and ⬇ move the highlighted cursor to the store location which contains the required results, and select GRAPH RESULTS.
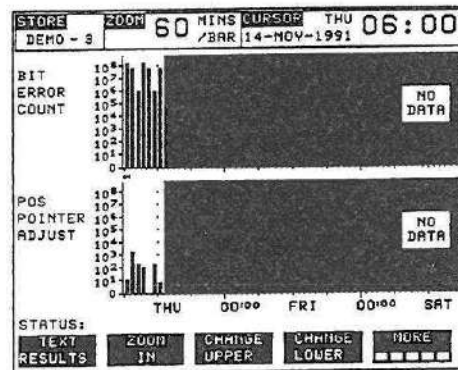
3. For more detailed inspection of the bar graph, position the cursor centrally within the area of interest using ⬆ and ⬇ and select ZOOM IN to reduce the time axis to 15 MINS/BAR.

For further reduction of the time axis, to 01 MINS/BAR, position the cursor centrally within the area of interest and select ZOOM IN once again.
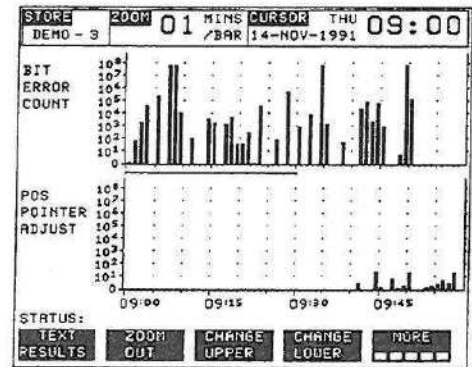
The top row of the display comprises three fields :

Store   Memory location in which the displayed bar graph data is stored. Store can only be changed when the status of stored results is displayed. Select TEXT RESULTS and then STORE STATUS and move the highlighted cursor, to the STORE location desired, using ⬆ and ⬇.

Zoom   The width, in minutes, of each "bar" in the bar graph, controlled by ZOOM IN / ZOOM OUT .

Cursor   The cursor position in terms of time and date, controlled by ⬆ and ⬇. The cursor position changes in steps of 1 minute, 15 minutes or 60 minutes dependent upon the ZOOM setting. The cursor is physically located between the two graphs.

Viewing the Error and Alarm Summaries

The error summary or alarm summary can be viewed at any time.

1. To view the error or alarm summary associated with the current bar graphs, press (GRAPH) then TEXT RESULTS .

2. To view the error or alarm summary associated with previously stored bar graphs, press (GRAPH) ; TEXT RESULTS and STORE STATUS . Using ⟨⇧⟩ and ⟨⇩⟩ move the highlighted cursor to the store location which contains the required results, and select TEXT RESULTS .

3. To view the alarms which have occurred during the measurement select ALARM SUMMARY . To view the errors that have occurred during the measurement select ERROR SUMMARY .

```
STORE   START      06:13 STOP      12:39
DEMO - 3 | THU 14-NOV-1991 | THU 14-NOV-1991

ALARM SUMMARY

POWER LOSS   .... PATTERN LOSS   ....
LOS          .... NDF            ....
LOF          .... MISSING NDF    ....
OOF          .... K1/K2 CHANGE   ....
LOP          .... LINE FERF      ....
LINE AIS     .... STS-PATH YEL   ....
PATH AIS     ....

STATUS:
STORE   GRAPH   PRINT   ERROR
STATUS  RESULTS         SUMMARY
```

The top row of the display comprises three fields :

Store   Memory location in which the bar graphs, error summary and alarm summary are stored. Store can only be changed when the status of stored results is displayed. Select STORE STATUS and move the highlighted cursor, to the STORE location desired, using ⟨⇧⟩ and ⟨⇩⟩.

Start   The start time and date of the test, which produced the displayed results.

Stop   The stop time and date of the test, which produced the displayed results.

Viewing the Stored Results Status

Select TEXT RESULTS ; STORE STATUS if viewing the bar graph display.

Select STORE STATUS if viewing the error or alarm summary.

GRAPH RESULTS displays the bar graphs from the highlighted store location.

TEXT RESULTS displays the error or alarm summary from the highlighted store location.

DELETE STORE deletes the results in the highlighted store location.

STORE	START DATE	START TIME	TEST DURATION	STORE USE
-9				
-8				
-7				
-6				
-5				
-4				
DEMO	14-NOV-1991	06:13	00d 06h 26m	7%
DEMO	13-NOV-1991	10:14	01d 03h 10m	29%
DEMO	13-NOV-1991	10:15	01d 02h 10m	28%
DEMO	13-NOV-1991	10:15	01d 07h 59m	35%

00d 00h 50m STORE FREE AT CURRENT 1 MINUTE SAMPLE PERIOD.	TOTAL	USED	99%
		FREE	1%

STATUS:
GRAPH RESULTS | TEXT RESULTS | DELETE STORE | DELETE ALL

If DELETE ALL is selected, a CONFIRM DELETE ; ABORT DELETE choice is provided to prevent accidental deletion of all the stored results.

The top row of the display comprises five fields :

Store — Memory location in which the displayed bar graph data is stored. Move the highlighted cursor, to the STORE location desired, using ⬆ and ⬇.

Start Date — The start date of the test, which produced the stored results.

Start Time — The start time of the test, which produced the stored results.

Test Duration — The duration of the test, which produced the stored results. The storage capacity of the graphics capability is expressed in days, hours and minutes. The percentage (%) of storage capacity used and the percentage still available for use is given at the bottom of the TEST DURATION column under TOTAL USED and FREE respectively.

Store Use — The percentage (%) of the overall storage capacity occupied by each set of stored results. The percentage used and the percentage still available is provided at the bottom of the STORE USE column.

Demonstration Graphs

Select ENABLE DEMO to enable the demonstration function of the graphics capability.

Select DEMO to construct a set of bar graphs. These bar graphs can be used as an operators training aid but it should be noted that the demonstration bar graphs require part of the graphics store capacity.

Select DISABLE DEMO to disable the demonstration function of the graphics capability and therefore protect any currently stored graphics data.

Demo bar graph construction takes approximately 20 seconds and uses a portion of the graphics storage capacity.
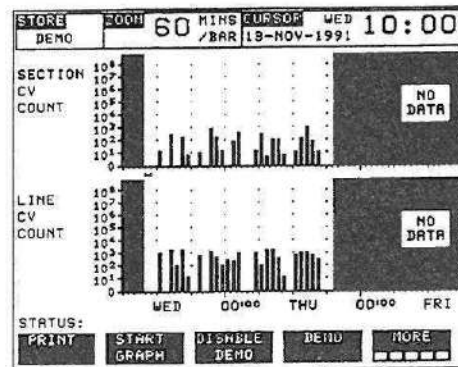
Printing Graphics Displays

The bar graphs and error and alarm summary are stored in memory and can be logged to an external HP ThinkJet printer at the end of the test period. If a printer is not immediately available the graphics results remain in memory and can be logged at a later time when a printer becomes available.

To print a graphics display on an external HP ThinkJet printer :

1. Connect an external RS-232-C HP ThinkJet printer to the HP 37704A rear panel RS232 Printer port or an external HP-IB HP ThinkJet printer to the HP 37704A rear panel HP-IB port. See *HP ThinkJet Printer*.

2. Make the required selection on the (AUX) display, FUNCTION [PRINTER]; [EXT - HPIB] or [EXT - RS232], and select PRINTING [ON].

3. Obtain the graphics display required and select PRINT.

Select PRINT on the bar graph display to
log the displayed bar graphs and the
alarm graphs to the printer.
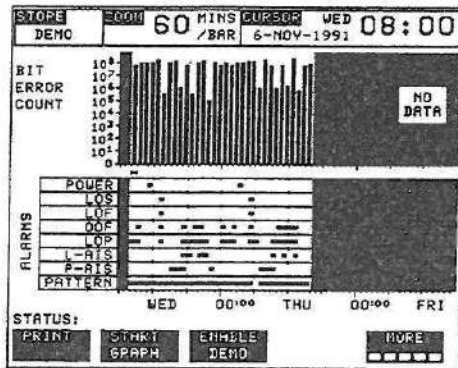
Select PRINT on the error and alarm
summary display to log the displayed
summary to the printer.
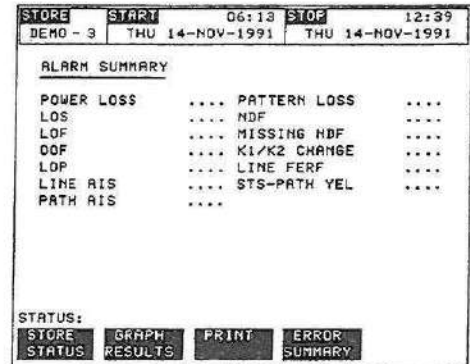
Logging Results

The results obtained during a test are retained in memory until they are overwritten by the next set of results. The results can be viewed on the (RESULTS) display at any time during the test.

Three types of results can be logged to an external HP-IB or RS-232-C HP ThinkJet printer as selected on the (AUX) PRINTER display, under PRINT ON DEMAND :

RESULTS SNAPSHOT - The cumulative measurement results are logged.

OVERHEAD SNAPSHOT - A snapshot of the received transport and path overhead is logged.

SEQUENCE CAPTURE - The received values of the last sequence capture are logged.

```
AUXILIARY FUNCTION [ PRINTER        ]

PRINTER PORT               [ RS232   ]
REMOTE CONTROL PORT          HPIB

PRINT ON DEMAND            [ RESULTS  ]
PRINTING                   [ OFF      ]


PRINTER TYPE               [ HP PRINTER ]
SPEED                      [ 9600 BAUD ]
PROTOCOL                     XON/XOFF
STATUS:
RESULTS  OVERHEAD OVERHEAD
SNAPSHOT SNAPSHOT CAPTURE
```

Note	If OVERHEAD SNAPSHOT is selected the J1 Path Trace sequence contains non printing characters (CR, LF, NU) which will be printed as ~.

Logging Instantly

The selected results can be logged during the measurement by pressing (PRINT NOW). If SEQUENCE CAPTURE is selected and a capture is in progress, (PRINT NOW) is disabled for the duration of the capture.

Logging at Intervals

The selected results can be logged at pre-determined intervals during the measurement, if PRINTING [ON] is selected on the (AUX) PRINTER display :

OFF - Selected results are not logged unless (PRINT NOW) is pressed.

15 MINUTE - Selected results are logged at 15 minute intervals during the measurement and at the end of the measurement.

2 HOURS - Selected results are logged at 2 hour intervals during the measurement and at the end of the measurement.

```
AUXILIARY FUNCTION [ PRINTER          ]

PRINTER PORT              [ RS232      ]
REMOTE CONTROL PORT         HPIB

PRINT ON DEMAND           [ RESULTS    ]
PRINTING                  [ ON         ]
PRINT PERIOD              [ 15 MINUTE  ]
PRINT ERROR SECONDS       [ OFF        ]
SQUELCH                   [ OFF        ]

PRINTER TYPE              [ HP PRINTER ]

SPEED                     [ 9600 BAUD  ]
PROTOCOL                    XON/XOFF

STATUS:
 OFF     15 MIN   2 HOURS
```

Any alarm occurrence results in a timed and dated message being logged on the printer.

Print Error Seconds

The capability to log occurrences of error seconds is enabled on the (AUX) PRINTER display under PRINT ERROR SECONDS :

OFF - Occurrences of error seconds are not logged.

ON - Each occurrence of an error second is logged. In addition, the error count for each of the error sources, which had an error count during the error second, are logged.

```
AUXILIARY FUNCTION [ PRINTER          ]

PRINTER PORT              [ RS232      ]
REMOTE CONTROL PORT         HPIB

PRINT ON DEMAND           [ RESULTS    ]
PRINTING                  [ ON         ]
PRINT PERIOD              [ 15 MINUTE  ]
PRINT ERROR SECONDS       [ ON         ]
SQUELCH                   [ OFF        ]

PRINTER TYPE              [ HP PRINTER ]

SPEED                     [ 9600 BAUD  ]
PROTOCOL                    XON/XOFF

STATUS:
 OFF      ON
```

Suppress Logging (Squelch)

During long periods of errors it may be desirable to suppress logging to prevent wastage of paper. This can be achieved by selecting SQUELCH [ON] on the (AUX) PRINTER display :

When SQUELCH [ON] is selected, logging will be suppressed if 10 consecutive error or alarm seconds occur. Logging remains suppressed until a single error or alarm free second occurs.

```
AUXILIARY FUNCTION [ PRINTER          ]

PRINTER PORT                [ RS232      ]
REMOTE CONTROL PORT           HPIB

PRINT ON DEMAND             [ RESULTS    ]
PRINTING                    [ ON         ]
PRINT PERIOD                [ 15 MINUTE  ]
PRINT ERROR SECONDS         [ ON         ]
SQUELCH                     [ ON         ]

PRINTER TYPE                [ HP PRINTER ]

SPEED                       [ 9600 BAUD  ]
PROTOCOL                      XON/XOFF

STATUS:
  OFF        ON
```

Printer Type and Speed (RS-232-C Only)

If a non HP Printer is connected to the RS-232-C printer port, this must be recorded on the (AUX) PRINTER display under PRINTER TYPE :

HP PRINTER - Results output is formatted for HP printers.

ALT PRINTER - The results output is formatted according to the selection made under PRINT MODE.

SPEED - Allows selection between 300 ; 600 ; 1200 ; 1800 ; 2400 ; 4800 and 9600 Baud.

```
AUXILIARY FUNCTION [ PRINTER          ]

PRINTER PORT                [ RS232      ]
REMOTE CONTROL PORT           HPIB

PRINT ON DEMAND             [ RESULTS    ]
PRINTING                    [ OFF        ]



PRINTER TYPE                [ ALT.PRINTER]
PRINT MODE                  [ NORMAL     ]
SPEED                       [ 9600 BAUD  ]
PROTOCOL                      DTR

STATUS:
 NORMAL   COMPRESS
```

HP ThinkJet Printer

The HP 37704A has the capability of interfacing with an RS-232-C HP ThinkJet printer via the rear panel RS232 port, or interfacing with an HP-IB HP ThinkJet printer via the rear panel HP-IB port. The choice between HPIB and RS232 printer is available on the (AUX) PRINTER display.

Connecting an RS-232-C ThinkJet Printer

1. Connect the HP 37704A rear panel RS232 port to the ThinkJet RS-232-C port.

2. Set the ThinkJet Mode switches to 0 (All switches down).

3. Set the ThinkJet RS-232-C switch to match the HP 37704A settings of PRINTER BAUD RATE, PARITY and HANDSHAKE.

ThinkJet RS-232-C Switch Settings

Handshake	Parity	Baud Rate
Bit 1=0 = Xon/Xoff	Bit 2=0 Bit 3=0 = 0's	Bit 4=0 Bit 5=0 =9600
	Bit 2=0 Bit 3=1 = ODD	
	Bit 2=1 Bit 3=0 = EVEN	Bit 4=1 Bit 5=0 = 2400
	Bit 2=1 Bit 3=1 = 1's	Bit 4=1 Bit 5=1 = 1200

Normal settings 9600 Baud, 0's Parity and Xon/Xoff is achieved when all Bits of the ThinkJet RS-232-C switch are set to 0.

Connecting an HP-IB ThinkJet Printer

1. Connect the HP 37704A rear panel HP-IB port to the ThinkJet HP-IB port.

2. Set the ThinkJet Mode switch to LISTEN ALWAYS.
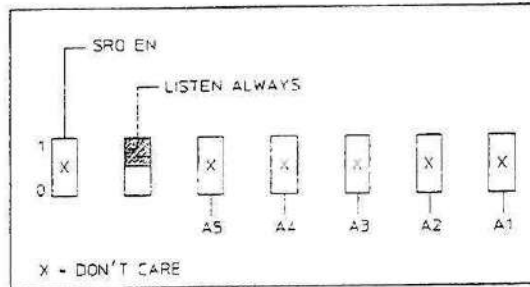
Figure 2-12. ThinkJet Listen Always

Stored Settings

It is often desirable to store measurement settings which are used regularly and be able to recall those settings at a moments notice. This capability is provided on the HP 37704A on the (AUX) STORED SETTINGS display.

One preset store is provided which cannot be overwritten, STORED SETTING NUMBER [0], and is used to set the HP 37704A to a known state. The known state is the FACTORY DEFAULT SETTINGS as listed below.

(TRANSMIT) SETTINGS CONTROL and SETTINGS displays

Settings Control	Independent	Transmit Signal	STS-1
Clock Sync	Internal	Level	Terminated
Frequency Offset	OFF, 0.0 ppm	STS-1 SPE Under Test	STS-1 #1
STS-1 Payload Source	DS3	Framing	Unframed
Payload Pattern	2^15-1	User Word Pattern	11111111
Bit Error Add	OFF		

(TRANSMIT) TEST FUNCTION display

Test Function	OFF	Error Add Type	Frame
APS Threshold Interval	10 ms	APS Threshold Errors	1
Alarm	OFF	Pointer Type	SPE
Adjust Pointer	INCR/DECR	Increment/Decrement	1 place
New Pointer Type	No NDF	Pointer Offset	SPE, 0.0 ppm
T1X1 Adjustment Type	Burst	T1X1 Polarity	Negative
T1X1 Interval	10 ms	Sequence Mode	Single Run
Overhead Channel	Section	Overhead Function	A1,A2
Sequence Data	All Zero's	Frame Count 1	1

(TRANSMIT) TEST FUNCTION **display (continued)**

Frame Count 2	0	Frame Count 3	0
Frame Count 4	0	Frame Count 5	0
Sequence Order	A,B,C,D,E	APS Message	No Request
APS Message Channel	NULL Channel	APS Bridged Channel	0
APS Architecture	1 + 1	APS Reserved Bits	000
Stress Test Pattern	All Zero's	Stress Test Block Length	2
DCC Insert	Section DCC		

(TRANSMIT) STATIC T-OH **and** STATIC P-OH **displays**

T-OH Byte A1	11110110	T-OH Byte A2	00101000
T-OH Byte C1	00000001	T-OH Byte B1	xxxxxxxx
T-OH Byte E1	00000000	T-OH Byte F1	00000000
T-OH Byte D1	00000000	T-OH Byte D2	00000000
T-OH Byte D3	00000000	T-OH Byte E1	00000000
T-OH Byte H1	xxxx00xx	T-OH Byte H2	xxxxxxxx
T-OH Byte H3	xxxxxxxx	T-OH Byte B2	xxxxxxxx
T-OH Byte K1	00000000	T-OH Byte K2	00000000
T-OH Byte D4	00000000	T-OH Byte D5	00000000
T-OH Byte D6	00000000	T-OH Byte D7	00000000
T-OH Byte D8	00000000	T-OH Byte D9	00000000
T-OH Byte D10	00000000	T-OH Byte D11	00000000
T-OH Byte D12	00000000	T-OH Byte Z1	00000000
T-OH Byte Z2	00000000	T-OH Byte E2	00000000

(TRANSMIT) STATIC T-OH and STATIC P-OH displays (continued)

P-OH Byte J1	Default	P-OH Byte B3	xxxxxxxx
P-OH Byte C2	00000001	P-OH Byte G1	00000000
P-OH Byte F2	00000000	P-OH Byte H4	00000000
P-OH Byte Z3	00000000	P-OH Byte Z4	00000000
P-OH Byte Z5	00000000		

(RECEIVE) SETTINGS CONTROL and SETTINGS displays

Settings Control	Independent	Receive Signal	STS-1
Level	STSX-1	STS-1 SPE Under Test	STS-1 #1
Payload	DS3	Framing	Unframed
Payload Pattern	2^{15}-1	User Word Pattern	11111111
Errors Detected	Code, Bit		

(RECEIVE) TEST FUNCTION display

Test Function	OFF	Capture Of Channel	Section O-H
Overhead Function	A1,A2	Trigger	OFF
Trigger Data	All Zero's	DCC Drop	Section DCC
Pointer Graph window Size	10 Frames		

(RESULTS) display

Results Displayed	Trouble Scan	Test Timing	Manual
Single Test Duration	1 Hour	Graphics	OFF

(AUX) display

Stored Setting Lock	On	Stored Setting Number	0
Printer Port	RS232	Remote Control Port	HPIB
Print On Demand	Results	Printing	Off
Print Period	OFF	Print Error Seconds	OFF
Printer Squelch	OFF	Printer Type	HP
Print Mode	Normal	Print Speed	9600 Baud
Printer Protocol	XON/XOFF	HPIB Address	5
Clock Mode	Run	Keyboard lock	OFF
Beep On Error	OFF		

Virtual Tributary Option 002

VT Mode	ASYNC	Selected VT Number	1
VT Payload	INT Unframed	Pattern	2^15-1
Service Offset	0 ppm	Signal Label	001
Pattern in Other VT1.5	QRSS	Pattern in Other VT6	Numbered
VT Concatenation	Off		

The use of the STORED SETTINGS function is illustrated by carrying out the following tasks :

- Select the settings used in the payload mapping measurement.
- TITLE the settings as payload mapping
- SAVE the settings as Stored Setting Number [1]
- RECALL the factory default settings from Stored Setting Number [0]
- RECALL the payload mapping settings from Stored Setting Number [1]

Select Settings to be Stored

1. Set up the (TRANSMIT) SETTINGS
CONTROL display as shown below.

```
TRANSMITTER       [ SETTINGS CONTROL   ]

TRANSMITTER AND RECEIVER  [ INDEPENDENT ]


PRESS ACTION TO RETURN ALL SONET
OVERHEAD BYTES TO DEFAULT VALUES




STATUS:
INDEP-  COUPLED
ENDENT
```

2. Set up the (TRANSMIT) SETTINGS
display as shown below.

```
TRANSMITTER       [ SETTINGS           ]

TRANSMIT SIGNAL        [ DSX-3          ]
CLOCK SYNC              INTERNAL

FRAMING                [ C-BIT          ]
PATTERN                [ 2^15-1         ]

ERROR ADD TYPE         [ BIT            ]
         RATE          [ OFF            ]

ALARMS                 [ OFF            ]



STATUS:
UNFRAMED   M13    C-BIT
```

3. Setup the (RECEIVE) SETTINGS display
as shown below.

```
RECEIVER          [ SETTINGS           ]

RECEIVE SIGNAL         [ OC-3           ]


STS-1 SPE UNDER TEST   [ 1              ]
PAYLOAD                [ DS3            ]
FRAMING                [ C-BIT          ]
PATTERN                [ 2^15-1         ]




STATUS:
UNFRAMED   M13    C-BIT
```

4. Setup the (RESULTS) display as shown
below.

```
RESULTS DISPLAYED   [ ERROR RESULTS    ]
ERROR SOURCE        [ BIT ERRORS       ]
TEST TIMING         [ SINGLE           ]
     DURATION       [ 24 HOURS         ]

BIT ERRORS

ERROR COUNT
ERROR RATE
ERROR SECONDS
ERROR FREE SECONDS
%ERROR FREE SECONDS


ELAPSED TIME

STATUS:
STS-PATH  BIT                    MORE
FEBE    ERRORS
```

Title the Settings

1. Select the STORED SETTINGS function on the (AUX) display.

To Title settings LOCK [OFF] must be selected.

2. Using (↲) ; JUMP ; PREVIOUS CHAR ; NEXT CHAR ; ▶ and ◀ title the settings as shown opposite.

```
AUXILIARY FUNCTION [ STORED SETTINGS    ]

STORED SETTING NUMBER       [ 1          ]
           LOCK             [ OFF        ]
           ACTION           [ SAVE       ]
SETTING
    0      FACTORY DEFAULT SETTINGS
    1      [PAYLOAD..MAPPING..█.............]
    2      [...............................]
    3      [...............................]
    4      [...............................]
    5      [...............................]
    6      [...............................]
    7      [...............................]
    8      [...............................]
    9      [...............................]
PRESS ACTION TO SAVE INSTRUMENT SETTINGS
STATUS:
 JUMP   PREVIOUS  NEXT        ←        →
          CHAR    CHAR
```

Save the Settings

1. Set up the display as shown opposite.

Press (ACTION) to save the settings.

The payload mapping settings are now stored in STORED SETTING NUMBER [1].

```
AUXILIARY FUNCTION [ STORED SETTINGS    ]

STORED SETTING NUMBER       [ 1          ]
           LOCK             [ OFF        ]
           ACTION           [ SAVE       ]
SETTING
    0      FACTORY DEFAULT SETTINGS
    1      [PAYLOAD..MAPPING...............]
    2      [...............................]
    3      [...............................]
    4      [...............................]
    5      [...............................]
    6      [...............................]
    7      [...............................]
    8      [...............................]
    9      [...............................]
PRESS ACTION TO SAVE INSTRUMENT SETTINGS
STATUS:
 RECALL    SAVE
```

Recall Default Settings

1. Set up the display as shown opposite.

Press (ACTION) to recall the settings in STORED SETTING NUMBER [0].

To verify that the instrument has adopted the factory default settings, view the (TRANSMIT); (RECEIVE); (RESULTS) and (AUX) displays.

```
AUXILIARY FUNCTION [ STORED SETTINGS    ]

STORED SETTING NUMBER       [ 0          ]

           ACTION           RECALL
SETTING
    0      FACTORY DEFAULT SETTINGS
    1      [PAYLOAD..MAPPING...............]
    2      [...............................]
    3      [...............................]
    4      [...............................]
    5      [...............................]
    6      [...............................]
    7      [...............................]
    8      [...............................]
    9      [...............................]
PRESS ACTION TO RECALL INSTRUMENT SETTINGS
STATUS:
   0        1        2        3       MORE
```

Recall Previously Stored Settings (Payload Mapping)

1. Set up the display as shown opposite and press (ACTION) to recall the settings in STORED SETTING NUMBER [1]

To verify that the instrument has adopted the payload mapping settings, view the (TRANSMIT); (RECEIVE) and (RESULTS) displays.

Settings can be recalled when LOCK [ON] is selected but to save settings or title settings LOCK [OFF] must be selected.

```
AUXILIARY FUNCTION [ STORED SETTINGS      ]

STORED SETTING NUMBER        [ 1            ]
          LOCK               [ ON           ]
          ACTION               RECALL
SETTING
   0    FACTORY DEFAULT SETTINGS
   1    .........................................
   2    .........................................
   3    .........................................
   4    .........................................
   5    .........................................
   6    .........................................
   7    .........................................
   8    .........................................
   9    .........................................
        PRESS ACTION TO RECALL INSTRUMENT SETTINGS
STATUS:
  OFF        ON
```

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Keyboard Lock

It is often desirable to protect the measurement settings from being accidentally changed during a test. This facility is provided on the HP 37704A SONET test set by the KEYBOARD LOCK function on the (AUX) display.

The following keys are not affected by keyboard lock :

■ Display keys (TRANSMIT); (RECEIVE); (RESULTS); (GRAPH); (AUX)

■ cursor keys (⇦⇧); (⇩⇨)

■ (SHOW HISTORY)

The following display functions are not affected by Keyboard Lock :

■ RESULTS DISPLAYED and ERROR SOURCE on the (RESULTS) display

■ KEYBOARD LOCK on the (AUX) display

Lock/Unlock the Keyboard

1. Set up the (AUX) display as shown opposite.

To lock the keyboard select [ON].

To unlock the keyboard select [OFF].

```
AUXILIARY FUNCTION [ KEYBOARD LOCK        ]

KEYBOARD LOCK              [ ON            ]




STATUS:
 OFF          ON
```
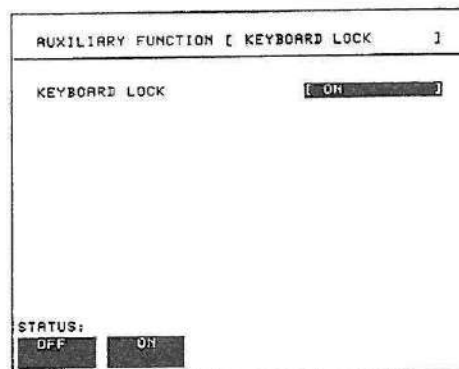
Beep On Error

It is sometimes desirable to have an audible indication of an error, particularly when the display on the test set is hidden from view. This function is provided on the HP 37704A under the heading BEEP ON ERROR on the (AUX) display.

Enable/Disable Beep On Error

1. Set up the (AUX) display as shown opposite.

To enable beep on error select ON.

To disable beep on error select OFF.

```
AUXILIARY FUNCTION [ BEEP ON ERROR          ]

BEEP ON RECEIVED ERROR          [ ON         ]




STATUS:
 OFF        ON
```
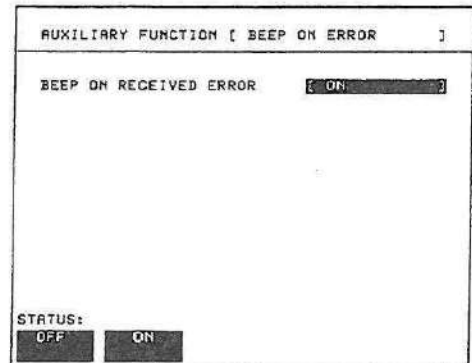
Time & Date

When making measurements and recording results it is desirable to have events timed, for example, alarms ; error seconds.

The capability to set the time and date is provided on the (AUX) display under the TIME & DATE function.

Setting Time and Date

1. Set up the (AUX) display as shown opposite.

Set the time and date as required using (⇧); (⇩); ◀; ▶; INCREASE DIGIT ; DECREASE DIGIT ; PREVIOUS MONTH ; NEXT MONTH.

```
AUXILIARY FUNCTION [ TIME & DATE        ]

   CLOCK MODE                 [ SETUP       ]
        TIME                  [ 15:10: 0    ]
        DATE                  [ 13-NOV-91   ]




STATUS:
┌────────┬────────┐ ┌──────┐ ┌──────┐
│DECREASE│INCREASE│ │  ←   │ │  →   │
│ DIGIT  │ DIGIT  │ └──────┘ └──────┘
└────────┴────────┘
```

2. Using (⇧) and (⇩) move the highlighted bar to [SETUP] as shown opposite.

Select RUN to complete the setting of time and date.

```
AUXILIARY FUNCTION [ TIME & DATE        ]

   CLOCK MODE                 [ SETUP       ]
        TIME                  [ 15:10: 0    ]
        DATE                  [ 13-NOV-91   ]




STATUS:
┌────────┬────────┐
│  RUN   │ SETUP  │
└────────┴────────┘
```

Self Test

Before using the HP 37704A to make measurements it may be desirable to run self test to ascertain the integrity of the HP 37704A. These tests take approximately 20 minutes to complete.

Before activating self test the following connections must be made :

STS-1/DS3 IN port to STSX-1/DSX-3 OUT port.

STS1/DS3 DROP port to STS1/DS3 INSERT port.

RS-232-C loopback connector (HP Part Number 5060-4462) to the rear panel RS232 port.

RS449 loopback to the rear panel PROTOCOL port.

DS1 IN port to DSX-1 OUT port (If Option 002, Virtual Tributary, is fitted).

If an Interface Module is fitted, OUT port to IN port.

Note   If any or all of these connections are not made the HP 37704A will FAIL self test.

---

1. Set up the (AUX) display as shown opposite using (AUX), MORE and SELF TEST.

2. Make the connections listed above.

```
AUXILIARY FUNCTION [ SELF-TEST          ]

TEST TYPE          [ ALL TESTS          ]
TEST NUMBER           ..
SUBTEST NUMBER        ..
TEST STATUS

PRESS THE RESTART KEY TO START TESTING

THIS SELECTION WILL RUN ALL SELF-TESTS
SEE SETUP INSTRUCTIONS UNDER EACH TEST
TYPE.

STATUS:
  ALL       CPU      DIGITAL  DIGITAL    MORE
 TESTS     TESTS    TESTS #1 TESTS #2
```

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1. Press (RESTART) to activate the self
test. TEST STATUS [RUNNING] will be
displayed. The information pertaining to
TEST TYPE, TEST NUMBER and
SUBTEST NUMBER will change as the
self test progresses.

If the HP 37704A is functioning correctly,
after approximately 25 minutes, TEST
STATUS [PASSED] is displayed.

If TEST STATUS [FAIL nnn] is
displayed, the HP 37704A should be
returned to a service office for repair.

```
AUXILIARY FUNCTION [ SELF-TEST          ]

TEST TYPE           [ DIGITAL TESTS #1   ]
TEST NUMBER           2
SUBTEST NUMBER        --
TEST STATUS           PASSED

PRESS THE (RESTART) KEY TO START TESTING


STATUS:
STORED    PRINTER   REMOTE    TIME &    MORE
SETTINGS            CONTROL   DATE      □□□□□
```

Note	FAIL Error Numbers are listed and defined in the HP 37704A Calibration Manual (HP part number 37704-90002) and are intended for use by service personnel.

Reference

This Reference section contains a detailed description of all HP 37704A keys, indicators, functions, measurement results and connectors. These are arranged in the following order :

Front Panel

Rear Panel

(TRANSMIT) Display

(RECEIVE) Display

(RESULTS) Display

(GRAPH) Display

(AUX) Display

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Front Panel

Connectors

STSX-1/DSX-3 OUT   Provides a 75 Ω BNC unbalanced, electrical, output if STS-1 or DS3 is selected as the Transmit Signal.

STS-1/DS3 IN   Allows the connection of 75 Ω, BNC unbalanced, electrical signals of STS-1 or DS3, for measurement.

BITS CLOCK IN   Allows connection of the synchronous BITS clock for timing of the HP 37704A SONET test set transmitter.

DSX-1 OUT   When Option 002, Virtual Tributary, is fitted provides a 100 Ω WECO Bantam balanced DS1 transmitter output or drops a received DS1 signal.

DS1 IN   When Option 002, Virtual Tributary, is fitted allows the connection of a 100 Ω WECO Bantam balanced DS1 signal for measurement or allows the insertion of an external DS1 signal for transmission within a SONET signal.

Keys

[TRANSMIT]   Displays the settings associated with the transmitter. ⬆ and ⬇ move the highlighted bar between fields. Selection from the menu is made using the display softkeys.

[RECEIVE]   Displays the settings associated with the receiver. ⬆ and ⬇ move the highlighted bar between fields. Selection from the menu is made using the display softkeys.

[RESULTS]   Displays the measurement results and the settings associated with the measurement results. ⬆ and ⬇ move the highlighted bar between fields. Selection from the menu is made using the display softkeys.

(GRAPH)

Displays the Bar Graphs, the Error and Alarm Summaries and the status of the stored graphics results. (⇧) and (⇩) move the cursor position, in time, on the Bar Graph display and select the Store Location on the Store Status display. Selection from the menu is made using the display softkeys.

(AUX)

Displays the settings associated with the following functions : STORED SETTINGS; PRINTER; REMOTE CONTROL; TIME & DATE; KEYBOARD LOCK; BEEP ON ERROR; OPTIONS/PLUG-INS; and SELF TEST. The desired function is selected using the display softkeys. (⇧) and (⇩) move the highlighted bar between fields.

(⇧)

Moves the highlighted bar around the display in an upward or left direction.

(⇩)

Moves the highlighted bar around the display in a downward or right direction.

Display Softkeys

Allow the settings within the highlighted bar to be changed and are situated immediately below the display. The softkey labels appear on the bottom of the display and change according to the highlighted bar position.

(ACTION)

Some functions of the HP 37704A SONET test set, such as T1.X1 pointer sequences and Save or Recall of Stored Settings, should be set up and checked before being actioned. The (ACTION) key allows a pause between set up and action.

(RESTART)

Terminates a test period, if one is in progress, and starts a new test period. The indicator above the key is lit when a test period is in progress. Some selections result in termination of the current test period and the start of a new test period :

Any selection on the [RECEIVE] display.

Selection of Test Timing MANUAL or SINGLE on the [RESULTS] display.

Selection of START GRAPH or STOP GRAPH on the [GRAPH] display.

Changing the TIME & DATE setting on the [AUX] display.

Selection of SETTINGS CONTROL COUPLED on the [TRANSMIT] or [RECEIVE] displays if this causes a change in Receive Settings.

Selection of CLOCK SYNC STS-1 RX on the [TRANSMIT] display if the RECEIVE SIGNAL was previously set to [DS3] or [DS1].

[FREEZE DISPLAY]   Freezes all the [RESULTS] displays. When FREEZE is active the indicator above the key is lit and none of the [RESULTS] displays will be updated, although updated results will be calculated. When FREEZE is inactive all the [RESULTS] displays will be updated immediately and the indicator above the key is not lit.

[SINGLE ERROR]   Adds a single error, of the type selected under [TRANSMIT] TEST FUNCTION ERRORS & ALARMS, each time the key is pressed.

[ADJUST POINTER]   Allows Payload Pointer adjustments to be transmitted when the POINTER ADJUST [INCR/DECR] function is selected on the [TRANSMIT] TEST FUNCTION display.

[PRINT NOW]   The current results are logged to an external printer connected to the rear panel HP-IB or RS-232-C ports. Selection of the port desired is made on the [AUX] PRINTER display.

<!-- LOCAL key -->
(LOCAL)

Used to return the HP 37704A SONET test set from remote HP-IB operation to Local (keyboard) operation. The indicator above the key is lit when the HP 37704A SONET test set is under remote control. Only certain display settings may be changed from the front panel whilst under Remote Control :

(RESULTS)   RESULTS DISPLAYED; ERROR
                 SOURCE

(GRAPH)   GRAPH RESULTS ; TEXT RESULTS ;
                 STORE STATUS ; ZOOM IN/ZOOM OUT ;
                 CHANGE UPPER ; CHANGE LOWER ;
                 START GRAPH/STOP GRAPH ;
                 ALARM SUMMARY ; ERROR SUMMARY .

Any of the other displays can be viewed but cannot be modified until the instrument has been returned to (LOCAL) control.

(FREEZE DISPLAY); (⬆); (⬇); (SHOW HISTORY)

Any other key sequence will result in STATUS: **Change prevented by remote lock** appearing on the display.

Alarms

Allows the, current and past alarm, status of the HP 37704A SONET test set to be viewed. The Alarms field contains 2 keys and 16 indicators.

(SHOW HISTORY)

When an alarm occurs during the test period the indicator alongside the key is lit. To determine which alarm has occurred press and hold (SHOW HISTORY). The status indicators will now display those alarms that have occurred during the test period. When (SHOW HISTORY) is released the status indicators display the current status.

(RESET HISTORY)

Resets the history store. The reset function can also be achieved by starting a new test period.

LOSS OF SIGNAL	No data transitions present at the selected input for 100 ms.
LOSS OF FRAME	The Out Of Frame condition has persisted for 3 ms at least.
OUT OF FRAME	Four or more consecutive errored framing patterns have been detected.
LOSS OF POINTER	A valid STS pointer has not been detected in eight consecutive frames, or eight consecutive New Data Flags have been detected.
LINE AIS	Alarm Indication sequence has been detected in the LINE layer.
PATH AIS	Alarm Indication sequence has been detected in the PATH layer.
PATTERN LOSS	Indicates that the received data pattern is not in synchronization with the internally generated reference data.
CLOCK LOSS	The transmitter clock is not synchronized with the selected EXTERNAL Clock Sync source.
K1/K2 CHANGE	A change has occurred in the filtered K1, K2 bytes of the transport overhead (APS Switching).
ERRORS	An error has been detected. The indicator will remain lit for 100 ms.
LINE FERF	A downstream Far End Receive Failure has occurred in the PATH layer (K2 Bits 6 - 8).
PATH YELLOW (RAI)	A downstream failure indication has occurred in the PATH layer (G1 Bit 5).
POINTER ADJUST	Payload Pointer adjustments have occurred.
VT LOSS OF POINTER	(Option 002, Virtual Tributary, Only) A valid VT pointer has not been detected in eight consecutive frames, or eight consecutive New Data Flags have been detected.

VT PATH AIS   (Option 002, Virtual Tributary, Only) Alarm Indication
                  Sequence has been detected in the VT PATH.

VT PATH   (Option 002, Virtual Tributary, Only) A downstream failure
YELLOW (RAI)   has occurred in the VT PATH.

Rear Panel

RS232 Port	Allows connection of an RS-232-C HP ThinkJet printer when PRINTER [RS232] is selected within the PRINTER function on the (AUX) display or connection of an RS-232-C controller when REMOTE CONTROL PORT [RS232] is selected within the REMOTE CONTROL function on the (AUX) display. The type of controller is selected within the REMOTE CONTROL function of the (AUX) display to be a TERMINAL or a COMPUTER.
HP-IB Port	Allows connection of an HP-IB printer to record the measurement results when PRINTER [EXT-HPIB] is selected within the PRINTER function on the (AUX) Display or connection of an HP-IB controller when REMOTE CONTROL PORT [HPIB] is selected within the REMOTE CONTROL function on the (AUX) display.
Protocol Analyzer Port	Allows the connection of a protocol analyzer for testing the Line or Section DCC.
STS/DS3 Insert Port	Allows the connection of an external 75 Ω BNC unbalanced DSX-3 or STSX-1 signal for mapping into a structured Sonet signal.
STS/DS3 Drop Port	Allows the demapped STSX-1 or DSX-3 signal to be dropped to external equipment.

⌈TRANSMIT⌋ Display

Displays the settings associated with the transmitter functions :

Settings
Settings Control
Test Function
Static T-OH
Static P-OH

Selection from the menu is made using the display softkeys. ⌈⇧⌋ and ⌈⇩⌋ move the highlighted bar between fields.

Settings

Allows the selection of the following transmitter settings :

Transmit Signal Level
Clock Synchronization Source
STS-1 Payload Source
DS3 Framing
DS3 Pattern
DS3 Bit Error Add rate
DS3 Alarms
VT Settings (Option 002 Only)

Transmit Signal   Determines the level of the transmitted signal. Selection between STSX-1 and DSX-3 is available.
If an HP 37772A, Optical Interface Module, is fitted further selections of OC-3 and OC-1 are available.
If an HP 37776A, Optical Interface Module, is fitted further selections of OC-3 and OC-12 are available.
If an HP 37771A, Electrical Interface Module. is fitted a further selection of STSX-3 is available.
If Option 002, Virtual Tributary, is fitted a further selection of DSX-1 is available.

Clock Sync   Determines the source of the transmitter clock. If
TRANSMIT SIGNAL [DSX-3] is selected only INTERNAL
is available.

INTERNAL	The transmitter clock is generated internally.
EXTERNAL BITS	The transmitter clock is synchronized to the DS1 BITS clock.
STS-1 RECEIVE	The transmitter clock is synchronized to the received STS-1 signal. This results in a choice of Level being displayed. Selection between STSX-1 STS-1 HI and STS-1 900FT is available.
OC-12 RECEIVE	The transmitter clock is synchronized to the received OC-12 signal. Only available if an HP 37776A, Optical Interface, Module is fitted.
OC-3 RECEIVE	The transmitter clock is synchronized to the received OC-3 signal. Only available if an HP 37772A or HP 37776A, Optical Interface, Module is fitted.
OC-1 RECEIVE	The transmitter clock is synchronized to the received OC-1 signal. Only available if an HP 37772A, Optical Interface, Module is fitted.
STS-3 RECEIVE	The transmitter clock is synchronized to the received STS-3 signal (HP 37771A fitted). This results in a choice of LEVEL being displayed. Selection between TERMINATE and MONITOR is available.

	`STS-1 INSERT` The transmitter clock is synchronized to the inserted STS-1 SPE.
Level	Allows selection of the interface level when CLOCK SYNC [STS-1 RECEIVE] or CLOCK SYNC [STS-3 RECEIVE] (HP 37771A fitted) is selected. [STS-1 RECEIVE] allows selection between `STSX-1` ; `STS-1 HI` and `STS-1 900FT`. [STS-3 RECEIVE] (HP 37771A fitted) allows selection between `TERMINATED` and `MONITOR`.
Frequency Offset	Only available when Option 001, Frequency Offsets, is fitted. Allows the selected TRANSMIT SIGNAL to be frequency offset, relative to the selected Clock Sync source, in the range -100 to +100 ppm (parts per million). Selection between `OFF` and `ON` is available.

`OFF`	Frequency Offset is 0 ppm.
`ON`	Frequency Offset can be adjusted in the range -100 to +100 ppm in 0.1 ppm steps.

STS-1 SPE Under Test	Determines which STS-1 SPE will carry the test payload. Selection between 1 ; 2 and 3 is available if an HP 37772A or HP 37771A is fitted and TRANSMIT SIGNAL [OC-3] or [STS-3] is selected. Selection between 1 through 12 is available if an HP 37776A is fitted and TRANSMIT SIGNAL [OC-12] is selected.
STS-1 Payload Source	Determines the source of the STS-1 payload data.

`DS3`	The STS-1 payload is constructed internally.
`INSERT DS3`	The STS-1 payload is the DS3 signal present at the rear panel STS/DS3 Insert port.

INSERT STS-1   The STS-1 frame contains the SPE of the STS-1 signal present at the rear panel STS/DS3 Insert port.

VT 1.5   28 DS1 tributaries are Mapped into the STS-1 SPE if Option 002, Virtual Tributaries, is fitted.

VT 6   7 DS2 tributaries are Mapped into the STS-1 SPE if Option 002, Virtual Tributaries, is fitted.

Framing   Determines the DS3 framing if PAYLOAD [DS3] or TRANSMIT SIGNAL [DSX-3] is selected. Selection between UNFRAMED : M13 and C-BIT is available.

Pattern   Determines the DS3 test pattern transmitted when PAYLOAD [DS3] or TRANSMIT SIGNAL [DSX-3] is selected. Selection between $2^{15}-1$; $2^{20}-1$; $2^{23}-1$; ALL ZERO's ; ALL ONES and USER WORD is available. User Word can be set in the range 00000000 to 11111111.

Error Add Type   Determines the type of errors added to the DS3 signal when TRANSMIT SIGNAL [DSX-3] is selected. The menu available depends upon the FRAMING selection :
UNFRAMED - BIT
M13 - FRAME ; P-BIT PARITY and BIT
C-BIT - FRAME ; P-BIT PARITY ; C-BIT PARITY ; FEBE and BIT
A single error, of each of the types listed, can be added by pressing (SINGLE ERROR). If BIT is selected RATE selections of OFF ; 1E-3 ; 1E-4 1E-5 and 1E-6 is available.

3-12 Reference

| Alarms | Allows the transmission of DS3 alarm conditions when TRANSMIT SIGNAL [DSX-3] and FRAMING [C-BIT] or [M13] is selected. Selection between OFF ; AIS ; IDLE and X-BIT is available. |

Transmit VT Settings (Option 002 Only)

| Payload | Determines the type of VT which forms the payload data. Selection between VT1.5 and VT6 is available. |

| VT Mode | Determines the DS1 VT mode of operation. |

ASYNC	The constructed DS1 VT is asynchronous.
FLOATING BYTE	The constructed DS1 VT is Byte synchronized within a VT SPE with VT path overhead.
LOCKED BYTE	The constructed DS1 VT is Byte synchronized and easily identified being in a fixed position within the STS-1 SPE.
LOCKED BIT	The constructed DS1 VT is Bit synchronized and easily identified being in a fixed position within the STS-1 SPE.

| VT Concatenation | Determines the DS2 VT concatenation configuration when PAYLOAD [VT6] is selected. Selection between OFF ; VT6-2C ; VT6-3C , VT6-4C ; VT6-5C and VT6-6C is available. |

| Starting At VT | Sets the starting point for DS2 VT concatenation. Selection in the range 1 to 6 is available dependant upon the VT concatenation configuration selected. If VT CONCATENATION [OFF] is selected this field is not displayed. |

| Selected VT | Determines the position of the test VT within the SPE. Selection of GROUP [1 to 7] and VT [1 to 4] if PAYLOAD [VT 1.5] is selected. (GROUP 1 - VT's 1, 8, 15 and 22; GROUP 2 - VT's 2, 9, 16 and 23; GROUP 3 - VT's 3, 10, 17 and 24; GROUP 4 - VT's 4, 11, 18 and 25; GROUP 5 - VT's 5, 12, 19 and 26; GROUP 6 - VT's 6, 13, 20 and 27; GROUP 7 - VT's 7, 14, 21 and 28). Selection in the range 1 to 7 is available if PAYLOAD [VT6] is selected depending on the VT CONCATENATION selection. |

| VT Payload | Selects the method of framing the VT payload. |

INTERNAL UNFRAMED	The VT payload is constructed without framing. Only available If PAYLOAD [VT6] or PAYLOAD [VT 1.5] and VT MODE [ASYNC] or [LOCKED BIT] is selected.
INTERNAL ESF	The DS1 VT is constructed with ESF (Extended Super Frame) framing.
INTERNAL D4	The DS1 VT is constructed with D4 framing.
EXTERNAL	The DS1 VT payload is obtained from the front panel DS1 IN port if PAYLOAD [VT 1.5] and VT MODE [ASYNC] or [LOCKED BIT] is selected.
EXTERNAL ESF	The DS1 VT payload is obtained from the front panel DS1 IN port with ESF framing, if PAYLOAD [VT 1.5] and VT MODE [FLOATING BYTE] or [LOCKED BYTE] is selected.
EXTERNAL D4	The DS1 VT payload is obtained from the front panel DS1 IN port with D4 framing, if PAYLOAD [VT 1.5] and VT MODE [FLOATING BYTE] or [LOCKED BYTE] is selected.

External DS1 Level   Matches the level of the external VT payload present at the front panel DS1 IN port. Selection between **TERM OR MONITOR** and **BRIDGED** is available. Only available if PAYLOAD [VT 1.5] and VT PAYLOAD [EXTERNAL] or [EXTERNAL ESF] or [EXTERNAL D4] is selected.

External DS1 Code   Matches the code of the external DS1 VT payload present at the front panel DS1 IN port. Selection between **AMI** and **B8ZS** is available. Only available if PAYLOAD [VT 1.5] and VT PAYLOAD [EXTERNAL] or [EXTERNAL ESF] or [EXTERNAL D4] is selected.

Test DS1 Timeslot   Determines the test DS1 timeslot when VT PAYLOAD [INTERNAL ESF] or [INTERNAL D4] is selected. Selection between **FULL T1** and **SELECT TIMESLOT** is available. Select Timeslot can be set in the range 1 to 24.

Pattern   Determines the pattern inserted in the test VT. Selections available depend on the PAYLOAD and VT PAYLOAD selections :

VT6 : $2^{15}-1$; $2^{20}-1$; $2^{23}-1$; ALL 1 ; and USER WORD . User Word can be set in the range 00000000 to 11111111.
VT1.5 - INTERNAL UNFRAMED : QRSS ; $2^{15}-1$; $2^{20}-1$; $2^{23}-1$; $2^{11}-1$; ALL 1 ; 3 IN 24 ; 1 IN 8 and **USER WORD** . User Word can be set in the range 00000000 to 11111111.
VT1.5 - INTERNAL ESF or D4 : $2^{11}-1$
VT1.5 - EXTERNAL, EXTERNAL ESF or D4 : No pattern selection is available.

Service Offset   Allows the DS1 VT selected for test to be offset in the range -150 ppm to +150 ppm. Only available if PAYLOAD [VT1.5]; VT MODE [ASYNC] and VT PAYLOAD [INTERNAL UNFRAMED] or [INT ESF] or [INT D4] are selected.

VT Signalling	Allows the foreground and background signalling to be set. Only available if VT MODE [FLOATING BYTE] or [LOCKED BYTE] is selected. Selection between OFF and ON is available. If ON is selected can be set in the range 0000 to 1111.
Signal Label	Assigns a signal label to the test VT in the range 000 to 111. Not available if VT MODE [LOCKED BIT] or [LOCKED BYTE] is selected.
Pattern In Other VT's	Determines the pattern inserted in the background (non test) VT's. Selections available depend on the PAYLOAD and VT PAYLOAD selections :

VT6 : NUMBERED
VT1.5 (ESF or D4 Framing) : QRSS or NUMBERED
(INTERNAL UNFRAMED or EXTERNAL) : QRSS

Settings Control

Allows the HP 37704A SONET test set Transmit and Receive functions to be set to operate at the same interface levels (Coupled) or at different interface levels (Independent). Press (ACTION) to return all Overhead Bytes to default values.

Transmitter and Receiver	Selection between COUPLED and INDEPENDENT is available.

Test Function

Allows access to the following dedicated test functions :

Errors and Alarms
Frame Move
Adjust Pointer
Sequence
Stress Test (Optical Interface Module fitted and OC-1 or OC-3 selected)
APS Messages
DCC Insert

Errors & Alarms

Errors - Allows the selection of the type of error to be added to the transmitted SONET signal, and determines the Rate at which the selected errors are added.

Alarms - Allows the selection of the type of alarm to be transmitted.

Error Add Type   Determines the type of Error to be added to the transmitted SONET signal.

Rate   Determines the rate of addition of the selected Error Type.

FRAME   Frame errors are added. Rate allows selection between OFF ; 1 IN 4 ; 2 IN 4 ; 3 IN 4 and 4 IN 4. If OFF is selected a single Frame Error can be added by pressing (SINGLE ERROR).

SECTION CV   Section Code Violation errors are added. Rate allows selection between OFF ; ERROR ALL ; 1E-4 ; 1E-5 1E-6 ; 1E-7 ; 1E-8 and 1E-9. If OFF is selected a single Section CV Error can be added by pressing (SINGLE ERROR).

LINE CV   Line Code Violation errors are added. Rate allows selection between OFF APS THRESHOLD ; ERROR ALL ; 1E-3 ; 1E-4 ; 1E-5 ; 1E-6 ; 1E-7 ; 1E-8 and 1E-9. If OFF is selected a single Line CV Error can be added by pressing (SINGLE ERROR).

The APS Threshold rate can be set in the range 0 to 640 per timed period if TRANSMIT SIGNAL [STS-1] or [OC-1] is selected and 0 to 1920 if TRANSMIT SIGNAL [STS-3] or [OC-3] is selected.

Timed period selections are 10 ms 100 ms ; 1 s ; 10 s ; 100 s ; 1000 s and 10000 s .

STS-PATH CV   Path Code Violation errors are added. Rate allows selection between OFF ; ERROR ALL ; 1E-3 ; 1E-4 ; 1E-5 1E-6 : 1E-7 ; 1E-8 and 1E-9 . If OFF is selected a single STS Path CV Error can be added by pressing (SINGLE ERROR).

STS-PATH FEBE   Path FEBE errors are added. Rate allows selection between OFF ; ERROR ALL ; 1E-3 ; 1E-4 ; 1E-5 1E-6 ; 1E-7 ; 1E-8 and 1E-9 . If OFF is selected a single STS Path FEBE Error can be added by pressing (SINGLE ERROR).

BIT   Bit errors are added. Rate allows selection between OFF ; 1E-3 ; 1E-4 1E-5 and 1E-6 . If OFF is selected a single Bit Error can be added by pressing (SINGLE ERROR). Bit errors are not available if PAYLOAD [INSERT DS3] or [INSERT STS-1] is selected.

VT-PATH CV | Only available if Option 002, Virtual Tributary, is fitted and PAYLOAD [VT1.5] or [VT6] is selected on the (TRANSMIT) SETTINGS display. VT Path Code Violation errors are added. Rate allows selection between OFF ; ERROR ALL ; 1E-3 ; 1E-4 ; 1E-5 1E-6 ; 1E-7 ; 1E-8 and 1E-9. If OFF is selected a single VT Path CV Error can be added by pressing (SINGLE ERROR).

VT-PATH FEBE | Only available if Option 002, Virtual Tributary, is fitted and PAYLOAD [VT1.5] or [VT6] is selected on the (TRANSMIT) SETTINGS display. VT Path FEBE errors are added. Rate allows selection between OFF ; ERROR ALL ; 1E-3 ; 1E-4 ; 1E-5 ; 1E-6 ; 1E-7 1E-8 and 1E-9. If OFF is selected a single VT Path FEBE Error can be added by pressing (SINGLE ERROR).

Alarms | Allows a selection of transmitted Alarms.

OFF | No alarms are transmitted.

LOSS OF FRAME | The Loss of Frame alarm is transmitted.

LINE AIS | The LINE Alarm Indication Sequence alarm is transmitted.

LINE FERF | The LINE Far End Receive Failure alarm is transmitted.

LOSS OF POINTER | The Loss Of Pointer alarm is transmitted.

Reference   3-19

STS-PATH AIS	The Path Alarm Indication Sequence alarm is transmitted.
STS PATH YELLOW	The Path Yellow alarm is transmitted.
STS-PATH UNEQUIPD	The Path Unequipped alarm is transmitted.
VT LOSS OF PNTR	The VT Loss Of Pointer alarm is generated. Only available if Option 002, Virtual Tributary, is fitted and PAYLOAD [VT1.5] or [VT6] is selected on the TRANSMIT SETTINGS display.
VT Path AIS	The VT Path AIS alarm is generated. Only available if Option 002, Virtual Tributary, is fitted and PAYLOAD [VT1.5] or [VT6] is selected on the TRANSMIT SETTINGS display.
VT PATH YELLOW	The VT Path Yellow alarm is generated. Only available if Option 002, Virtual Tributary, is fitted and PAYLOAD [VT1.5] or [VT6] is selected on the TRANSMIT SETTINGS display.
VT PATH UNEQIPD	The VT Path Unequipped alarm is generated. Only available if Option 002, Virtual Tributary, is fitted and PAYLOAD [VT1.5] or [VT6] is selected on the TRANSMIT SETTINGS display.

Frame Move

Allows the position of the STS-1 Frame to be moved sufficiently to cause the network equipment to reframe.
To start the Frame Movement press ACTION.

Adjust Pointer

Allows payload pointer adjustments to be added to the generated signal.

Pointer Type	Only available if Option 002, Virtual Tributary is fitted and PAYLOAD [VT6] or PAYLOAD [VT1.5] and VT MODE [ASYNC] or [FLOATING BYTE] is selected. Selection between SPE POINTER and VT POINTER is available.

SPE POINTER	The STS-1 pointer can be adjusted in Incremental or Decremental bursts. If Option 001, Frequency Offsets, is fitted Offset adjustments are available.
VT POINTER	The VT pointer can be adjusted in Incremental or Decremental bursts of 1 or 2 places or a New Pointer generated. If Option 001, Frequency Offsets, is fitted Offset adjustments are available and if PAYLOAD [VT1.5] and VT MODE [ASYNC] or [FLOATING BYTE] is selected T1.X1 PERIODIC SINGLE adjustments are available.

Adjust Pointer	Selects the type of Payload Pointer adjustment : Incremental or Decremental bursts, or A New Pointer transmitted, or Frequency Offset adjustments, or T1.X1 periodic adjustments.

INCR/DECR	Allows the payload pointer to be adjusted in incremental or decremental bursts of 1 to 6 places. Succeeding bursts are of opposite polarity. Press (ADJUST POINTER) to increment or decrement the pointer.

NEW POINTER

A New Pointer will be transmitted with or without a new data flag when (ACTION) is pressed. Selection between WITH NDF and WITHOUT NDF is available. Not available when the following selections are made : PAYLOAD [INSERT STS-1], or POINTER TYPE [SPE POINTER], or PAYLOAD [VT1.5] and VT MODE [LOCKED BYTE] or [LOCKED BIT].

OFFSET

Only available if Option 001, Frequency Offsets, is fitted and FREQUENCY OFFSET [OFF] is selected on the (TRANSMIT) SETTINGS display. Allows the Output Signal Rate or the SPE Rate or the VT Rate (Option 002 only) to be offset in the range ± 100 ppm.

T1.X1

Only available if Option 001, Frequency Offsets, is fitted. If PAYLOAD [DS3] is selected T1.X1 adjustments by Periodic Bursts of 3 places and Periodic Single with Added or Cancelled adjustments are available. If PAYLOAD [VT1.5] and VT MODE [ASYNC] or [FLOATING BYTE] and POINTER TYPE [VT POINTER] are selected T1.X1 Periodic Single with Added or Cancelled adjustments are available. Press (ACTION) to start the T1.X1 sequence. T1.X1 is not available when the following selections are made : PAYLOAD [INSERT STS-1], or PAYLOAD [VT6], or PAYLOAD [VT1.5] and POINTER TYPE [VT POINTER], or PAYLOAD [VT1.5] and VT MODE [LOCKED BYTE] or [LOCKED BIT].

Output Signal
Rate

Only available if Option 001, Frequency Offsets, is fitted and ADJUST POINTER [OFFSET] is selected.
The OUTPUT SIGNAL RATE is OFFSET and the SPE RATE is CONSTANT if PAYLOAD [INSERT STS-1] is selected.

The OUTPUT SIGNAL RATE can be selected as OFFSET or CONSTANT and the SPE RATE adopts the opposite setting when the following selections are made :
PAYLOAD [DS3], or
PAYLOAD [VT6] and POINTER TYPE [SPE POINTER], or
PAYLOAD [VT1.5] and VT MODE [ASYNC] or [FLOATING BYTE] and POINTER TYPE [SPE POINTER]

The OUTPUT SIGNAL RATE can be selected as OFFSET or CONSTANT and the VT RATE adopts the opposite setting when the following selections are made :
PAYLOAD [VT6] POINTER TYPE [VT POINTER], or
PAYLOAD [VT1.5] and VT MODE [ASYNC] or [FLOATING BYTE] and POINTER TYPE [VT POINTER]

CONSTANT   The OUTPUT SIGNAL RATE will remain constant and the SPE or VT RATE will be offset by the amount selected under ADJUST POINTER [OFFSET].

OFFSET   The OUTPUT SIGNAL RATE is offset by the amount selected under ADJUST POINTER [OFFSET] and the SPE or VT RATE remains constant.

SPE Rate/VT
Rate

Always adopts the opposite setting to Output Signal Rate.

Adjustment Type	Only available when Option 001, Frequency Offsets, is fitted and ADJUST POINTER [T1.X1] is selected. Selection between PERIODIC BURST and PERIODIC SINGLE is available if PAYLOAD DS3 is selected.
	If PAYLOAD [VT1.5] and VT MODE [ASYNC] or [FLOATING BYTE] and POINTER TYPE [VT POINTER] is selected only PERIODIC SINGLE is available.

	PERIODIC BURST	Pointer adjustments are made in bursts of 3 places at approximately 30 second intervals, in a positive or negative direction as determined by the POLARITY selection.
	PERIODIC SINGLE	Single pointer adjustments are made with ADDED or CANCELLED at time intervals determined by the INTERVAL selection. ADDED or CANCELLED adjustments can be made in a positive or negative direction as determined by the POLARITY selection.

Polarity	Determines the polarity of the PERIODIC BURST and PERIODIC SINGLE pointer adjustments. Selection between NEGATIVE and POSITIVE is available.
Interval	Determines the Time interval between PERIODIC SINGLE adjustments. Selection between 10 ms ; 20 ms 30 ms ; 40 ms ; 50 ms ; 60 ms ; 70 ms ; 80 ms ; 90 ms ; 100 ms ; 200 ms ; 300 ms ; 400 ms ; 500 ms ; 600 ms ; 700 ms ; 800 ms ; 900 ms ; 1 s ; 2 s ; 5 s and 10 s is available when PAYLOAD [DS3] is selected.
	Selection between 500 ms ; 1 s ; 2 s ; 5 s and 10 s is available when PAYLOAD [VT1.5] and VT MODE [ASYNC] or [FLOATING BYTE] and POINTER TYPE [VT POINTER] is selected.

Sequence

Allows a test sequence to be inserted into a single byte, or defined groups of bytes, of the Section, Line or Path Overhead. The sequence is derived from 5, user defined, hexadecimal blocks of data (A, B, C, D, E).

Each block of data can be transmitted in up to 64,000 frames. The sequence would typically consist of n frames of block A, n frames of block B, n frames of block C, n frames of block D, then n frames of block E.

The sequence can be set to run once only or on a repetitive basis. Selection between SINGLE RUN and REPEAT RUN is available.
To start the sequence press (ACTION).

Overhead Channel   Allows the selection of the Section, Line or Path Overhead bytes in which the sequence is to be inserted depending upon the TRANSMIT SIGNAL selection on the (TRANSMIT) SETTINGS display.

S - OH   TRANSMIT SIGNAL STS-1 or OC-1 :
Selection between A1,A2 ; C1 ; E1 ;

F1 and D1 - D3 is available.
TRANSMIT SIGNAL STS-3 or OC-3 :
Selection between 3XA1,3XA2 ; C1 #1

C1 #2 ; C1 #3 ; E1 ; F1 and D1-D3 is available. The # contained in the byte name refers to the STS-1 #.
TRANSMIT SIGNAL OC-12 :
Selection between C1 #a ; C1 #b

C1 #c ; E1 ; F1 and D1-D3 is available. a, b and c represent the STS-1's within the STS-3 in which the test STS-1 resides eg. Test STS-1 #5
C1 #4 ; C1 #5 and C1 #6 .

L - OH	TRANSMIT SIGNAL STS-1 or OC-1 : Selection between K1,K2 ; D4 - D12 ; Z1 ; Z2 and E2 is available. TRANSMIT SIGNAL STS-3 or OC-3 : Selection between K1,K2 ; D4 - D12 Z1 #1 ; Z1 #2 ; Z1 #3 ; Z2 #1 ; Z2 #2 ; Z2 #3 and E2 is available. The # contained in the byte name refers to the STS-1 #. TRANSMIT SIGNAL OC-12 : Selection between K1,K2 ; D4 - D12 Z1 #a ; Z1 #b ; Z1 #c ; Z2 #a ; Z2 #b ; Z2 #c and E2 is available. a, b and c represent the STS-1's within the STS-3 in which the test STS-1 resides eg. Test STS-1 #11 Z1 #10 ; Z1 #11 and Z1 #12.
P - OH	TRANSMIT SIGNAL STS-1, OC-1, STS-3, OC-3 or OC-12 : Selection between J1 C2 ; G1 ; F2 ; H4 ; Z3 ; Z4 and Z5 is available.
A	Allows the Hexadecimal value of block A to be set. Each byte of overhead requires two hexadecimal bits, for Example : C1 - 1 Byte - can be set in the range "00" to "FF" D4 - D12 - 9 Bytes - can be set in the range "000000000000000000" to "FFFFFFFFFFFFFFFFFF".
B	Allows the Hexadecimal value of block B to be set. Each byte of overhead requires two hexadecimal bits, for Example : E2 - 1 Byte - can be set in the range "00" to "FF" D1 - D3 - 3 Bytes - can be set in the range "000000" to "FFFFFF".

C | Allows the Hexadecimal value of block C to be set. Each byte of overhead requires two hexadecimal bits, for Example :
G1 - 1 Byte - can be set in the range "00" to "FF"
3XA1,3XA2 - 6 Bytes - can be set in the range "000000000000" to "FFFFFFFFFFFF".

D | Allows the Hexadecimal value of block D to be set. Each byte of overhead requires two hexadecimal bits, for Example :
Z2 #1 - 1 Byte - can be set in the range "00" to "FF"
K1,K2 - 2 Bytes - can be set in the range "0000" to "FFFF".

E | Allows the Hexadecimal value of block E to be set. Each byte of overhead requires two hexadecimal bits, for Example :
C1 #2 - 1 Byte - can be set in the range "00" to "FF"
K1,K2 - 2 Bytes - can be set in the range "0000" to "FFFF".

Sequence | Allows the number of frames, in which each block of data is transmitted, to be set in the range 1 to 64,000.

Frames Of | Allows the desired block of data to be selected. Selection between A ; B ; C ; D and E is available.

Stress Test

Allows a long string of 0's or 1's to be transmitted on the Optical interface, after line coding, to stress the optical clock recovery process.

This Test Function is only available if an HP 37772A or HP 37776A, Optical Interface, Module is fitted and TRANSMIT SIGNAL [OC-1] or [OC-3] is selected on the (TRANSMIT) SETTINGS display.

Stressing Pattern | Determines the pattern to be used for stressing. Selection between ALL ZERO'S and ALL ONES is available.

Block Length	Determines the length of the stressing pattern and can be set in the range 2 to 85 bytes TRANSMIT SIGNAL [OC-1] and 2 to 259 bytes TRANSMIT SIGNAL [OC-3].

APS Messages

Provides a means of testing the Automatic Protection Switch reaction to messages carried in the K1 and K2 bytes of the Transport Overhead.

The APS Messages are started when (ACTION) is pressed.

Three displays of K1 and K2 are provided :

New TX	Allows the content of the K1 and K2 bytes to be set for future transmission.
Current TX	Displays the values of K1 and K2 bytes which are currently being transmitted.
Current RX	Displays the value of K1 and K2 bytes which are currently being received.
K1 Bits 1 ->4	Selects the APS message to be transmitted. Can be set in the range 0000 to 1111 (See Table below).

K1 Bits 1 - >4

Selection	Message	Selection	Message
0000	NO REQUEST	1000	MANUAL SWITCH
0001	DO NOT REVERT	1001	NOT USED
0010	REVERSE REQUEST	1010	SD - Low Priority
0011	NOT USED	1011	SD - High Priority
0100	EXERCISE	1100	SF - Low Priority
0101	NOT USED	1101	SF - High Priority
0110	WAIT TO RESTORE	1110	FORCED SWITCH
0111	NOT USED	1111	LOCKOUT OF PROT

SD - High Priority and SF - High Priority are only available when K2 Bit 5 is set to 1 - 1 : N architecture.

K1 Bits 5 ->8   Selects the channel used by the APS Messages. Can be set in the range 0000 to 1111.

K1 Bits 5 - >8

Selection	Message	Selection	Message
0000	NULL CHANNEL	1000	WORKING CHANNEL #8
0001	WORKING CHANNEL #1	1001	WORKING CHANNEL #9
0010	WORKING CHANNEL #2	1010	WORKING CHANNEL #10
0011	WORKING CHANNEL #3	1011	WORKING CHANNEL #11
0100	WORKING CHANNEL #4	1100	WORKING CHANNEL #12
0101	WORKING CHANNEl #5	1101	WORKING CHANNEL #13
0110	WORKING CHANNEL #6	1110	WORKING CHANNEL #14
0111	WORKING CHANNEL #7	1111	EXTRA TRAFFIC CHANNEL

WORKING CHANNEL #2 through WORKING CHANNEL #14 and EXTRA TRAFFIC CHANNEL are only available when K2 Bit 5 is set to 1 - 1 : N architecture. If K1 Bits 1 >4 are set to 1111 LOCKOUT OF PROT then K1 Bits 5 ->8 are fixed at 0000 NULL CHANNEL .

K2 Bits 1 - >4   Selects the Bridged Channel used by the APS Messages. Can be set in the range 0000 to 1111.

K2 Bit 5   Determines the Automatic Protection Switch architecture.
0 - 1 + 1 Architecture
1 - 1 : N Architecture

K2 Bits 6 ->8   Selects the Reserved Bits. Can be set in the range 000 to 101 .

DCC Insert

Allows a DataCommunication Channel, connected at the Rear Panel, to be inserted in the appropriate Transport Overhead bytes of STS-1 #1.

SECTION	The DataCommunication Channel is inserted into bytes D1 - D3 of the Transport Overhead.
LINE	The DataCommunication Channel is inserted into bytes D4 - D12 of the Transport Overhead.

Static T-OH

The value of each bit of the following Transport Overhead bytes can be set to 0 or 1 : A1, A2, C1, D1, D2, D3, D4, D5, D6, D7, D8, D9, D10, D11, D12, E1, E2, F1, K1, K2, Z1 and Z2. Only available if TRANSMIT SIGNAL [STS-1] or [OC-1] or [OC-3] or [OC-12] or [STS-3] is selected under SETTINGS. Only Bits 2 and 3 of H1 can be set to 0 or 1. Bytes B1, B2, H2 and H3 cannot be set.

If STATIC VALUES FOR STS-1 #2 through #12 is selected only bytes A1, A2, C1, H1, H2, H3, B2, Z1 and Z2 are labelled, as at this time the other bytes of STS-1 #2 through #12 have not been identified. The value of each bit of bytes A1, A2, C1, Z1, Z2 and the unidentified bytes can be set to 0 or 1. Only Bits 2 and 3 of H1 can be set to 0 or 1. Bytes B2, H2 and H3 cannot be set.

Static Values For STS-1	Determines which STS-1 Transport Overhead can be set. Selection between #1 ; #2 and #3 is available if an HP 37776A or HP 37772A or HP 37771A is fitted and TRANSMIT SIGNAL [OC-3] or [STS-3] is selected under SETTINGS. Selection between #1 through #12 is available if TRANSMIT SIGNAL [OC-12] is selected

Static P-OH

Each bit of the following Path Overhead bytes can be set to 0 or 1 : C2, F2, G1, H4, Z3, Z4 and Z5. Byte J1 can be programmed to carry a data message. Byte B3 cannot be set. If TRANSMIT SIGNAL [OC-3] or [STS-3] or [OC-12] is selected under (TRANSMIT) SETTINGS only the Path Overhead bytes of the STS-1 SPE UNDER TEST can be set. The Path Overhead bytes of the STS-1 SPE's not selected for test are set to 00000001 with the exception of B3 which cannot be set.

Static Values For STS-1

Displays the STS-1 Path Overhead byte values. Allows selection between the TEST STS-1 and the other STS-1's if TRANSMIT SIGNAL [OC-12] or [OC-3] or [STS-3] is selected under (TRANSMIT) SETTINGS. Only the TEST STS-1 byte values can be set by the user.

DEFAULT MESSAGE

Byte J1 is programmed to carry the Default Message of 64 ASCII Null characters.

TEST MESSAGE

Byte J1 is programmed to carry the Test Message of " *HP37704A Field Portable SONET tester. 0123456789 CR LF*".

USER MESSAGE

Byte J1 is programmed to carry a User defined Message of up to 62 ASCII characters, (padded out by ASCII Null characters if necessary), followed by CR LF.

(RECEIVE) Display

Displays the settings associated with the receiver functions :

    Settings
    Settings Control
    Test Function
    T-OH Monitor
    P-OH Monitor

Selection from the menu is made using the display softkeys. (⇑) and (⇓) move the highlighted bar between fields.

Settings

Allows the selection of the following receiver settings :

    Receive Signal
    Receive Signal Level
    Payload
    DS3 Pattern
    DS3 Framing
    DS3 Errors Detected
    VT Settings (Option 002 Only)

Receive Signal | Determines the type of received signal. Selection between STS-1 and DS3 is available.
If an HP 37776A, Optical Interface, Module is fitted further selections of OC-12 and OC-3 are available.
If an HP 37772A, Optical Interface, Module is fitted further selections of OC-1 and OC-3 are available.
If an HP 37771A, Electrical Interface, Module is fitted a further selection of STS-3 is available.
If Option 002, Virtual Tributary, is fitted a further selection of DS1 is available.

Level | Determines the level according to the interface point from which the signal is received.

RECEIVE SIGNAL [STS-1]: selection between STS-1 HI STSX-1 and STS-1 900 FT is available.
RECEIVE SIGNAL [STS-3] : selection between TERMINATE and MONITOR is available.
RECEIVE SIGNAL [DS3] : selection between DS3 HI ; DSX-3 and DS3 900 FT is available.
RECEIVE SIGNAL [DS1] (Option 002 only) : selection between TERM OR MONITOR and BRIDGED is available.
RECEIVE SIGNAL [OC-1] ; [OC-3] or [OC-12] : LEVEL selection is not available.

STS-1 SPE Under Test

Determines which STS-1 frame will be processed. Selection between 1 ; 2 and 3 is available if RECEIVE SIGNAL [STS-3] or [OC-3] is selected. Selection between 1 through 12 is available if RECEIVE SIGNAL [OC-12] is selected.

Payload

Determines whether the payload is processed internally or Dropped to external equipment. Only available when RECEIVE SIGNAL [STS-1] ; [OC-1] ; [OC-3] : OC-12 or [STS-3] is selected.

DS3

The payload is processed internally. Pattern and Framing selections are required.

DROP DS3

The DS3 payload is dropped out to external equipment via the rear panel Drop port.

DROP STS-1

The STS-1 signal is dropped out to external equipment via the rear panel Drop port.

VT 1.5

(Option 002 Only) - The STS-1 SPE is de-mapped into 28 DS1 tributaries which are processed internally. VT selections are required.

VT 6	(Option 002 Only) - The STS-1 SPE is de-mapped into 7 DS2 tributaries which are processed internally. VT selections are required.
Framing	Determines the receiver DS3 framing if PAYLOAD [DS3] or RECEIVE SIGNAL [DS3] is selected. Selection between UNFRAMED ; M13 and C-BIT is available.
Pattern	Determines the receiver reference pattern when PAYLOAD [DS3] or RECEIVE SIGNAL [DS3] is selected. Selection between $2^{15}-1$; $2^{20}-1$; $2^{23}-1$; ALL ZEROS ; ALL ONES LIVE TRAFFIC and USER WORD is available. User Word can be set in the range 00000000 to 11111111.
Errors Detected	Determines the Error Sources for Error results when RECEIVE SIGNAL [DS3] and FRAMING [M13] or [C-BIT] is selected. Two Error Sources can be selected from the menu : M13 - CODE ; FRAME ; P-BIT PARITY and BIT C-BIT - CODE ; FRAME ; P-BIT PARITY ; C-BIT PARITY FEBE and BIT

VT Settings (Option 002 Only)

Payload	Selects the type of VT to be demapped from the payload. Selection between VT 1.5 and VT 6 is available.
VT Mode	Selects the DS1 VT mode of operation.

ASYNC	The VT's are not synchronized to the same reference.
FLOATING BYTE	The VT's are Byte synchronized within a VT SPE with VT path overhead.
LOCKED BYTE	The VT's are Byte synchronized and easily identified being at a fixed position within the STS-1 SPE.

	LOCKED BIT	The VT's are Bit synchronized and easily identified being at a fixed position within the STS-1 SPE.

VT Concatenation — Determines the DS2 VT concatenation configuration when PAYLOAD [VT6] is selected. Selection between OFF ; VT6-2C ; VT6-3C ; VT6-4C ; VT6-5C and VT6-6C is available.

Starting At VT — Sets the starting point for VT Concatenation. Selection in the range 1 to 6 is available dependant upon the VT Concatenation configuration selected. If VT CONCATENATION [OFF] is selected this field is not displayed.

Selected VT — Selects the VT on which to perform a measurement. Selection of GROUP [1 to 7] and VT [1 to 4] if PAYLOAD [VT 1.5] is selected. If PAYLOAD [VT 6] and VT CONCATENATION [OFF] is selected, range is 1 to 7.

VT Payload — Selects the method of processing the VT's.

	UNFRAMED	The VT will be treated as not having been framed before transmission. Unframed is only available if PAYLOAD [VT6] or PAYLOAD [VT 1.5] and VT MODE [ASYNC] or [LOCKED BIT] is selected.
	ESF	The DS1 VT will be processed as having ESF (Extended Super Frame) framing at the time of transmission.
	D4	The DS1 VT will be processed as having D4 framing at the time of transmission.
	DS1 DROP	The DS1 VT is dropped out via the front panel DSX-1 OUT port. DS1 Drop is only available if VT MODE [ASYNC] or [LOCKED BIT] is selected.

ESF DROP	The ESF framed DS1 VT is dropped out via the front panel DSX-1 OUT port. ESF Drop is only available if VT MODE [FLOATING BYTE] or [LOCKED BYTE] is selected.
D4 DROP	The D4 framed DS1 VT is dropped out via the front panel DSX-1 OUT port. D4 Drop is only available if VT MODE [FLOATING BYTE] or [LOCKED BYTE] is selected.
Test DS1 Timeslot	Selects the DS1 timeslot to be tested. Selection between FULL T1 and SELECT TIMESLOT is available. Select Timeslot allows selection in the range 1 to 24. Test DS1 Timeslot is only available if VT PAYLOAD [ESF] or [D4] is selected.
Pattern	Selects the internally generated test pattern with which the selected VT will be compared. Selections available depend upon the PAYLOAD selection : VT 1.5 : QRSS : $2^{15}-1$: $2^{20}-1$; $2^{23}-1$; $2^{11}-1$; ALL 1's ; 3 IN 24 ; 1 IN 8 ; LIVE and USER WORD is available. User Word can be set in the range 00000000 to 11111111. VT6 : $2^{15}-1$; $2^{20}-1$; $2^{23}-1$; ALL 1's ; LIVE and USER WORD is available. User Word can be set in the range 00000000 to 11111111. If VT PAYLOAD [DS1 DROP] or [ESF DROP] or [D4 DROP] is selected the Pattern selection is not available.
Drop Port Code	Selects the line code of the VT dropped via the front panel DSX-1 OUT port. Selection between AMI and B8ZS is available. Drop Port Code is only available if VT PAYLOAD [DS1 DROP] or [ESF DROP] or [D4 DROP] is selected.

Test Function

Allows access to the following functions :

Overhead Capture
DCC Drop
PTR Graph

OFF	All Test Functions are disabled.
OVERHEAD CAPTURE	Allows the state of the Section, Line or Path Overhead bytes to be monitored and displayed.
Capture Of Channel	Allows the selection of the Section, Line or Path Overhead bytes which are to be monitored and displayed. Press (ACTION) to start the Capture.

S - OH   Selects the Section Overhead bytes to be monitored and displayed depending upon the RECEIVE SIGNAL selection on the (RECEIVE) SETTINGS display.
RECEIVE SIGNAL STS-1 or OC-1 : Selection between A1,A2 ; C1 ; E1 ; F1 and D1-D3 is available.
RECEIVE SIGNAL STS-3 or OC-3 : Selection between 3XA1,3XA2 ; C1 #1 C1 #2 ; C1 #3 ; E1 ; F1 and D1-D3 is available. The # contained in the byte name refers to the STS-1 #.
RECEIVE SIGNAL OC-12 : Selection between 3XA1,3XA2 STS-1 # a,b,c ; C1 #a C1 #b ; C1 #c ; E1 ; F1 and D1-D3 is available.
a,b,c represent the STS-1's within the STS-3 in which the test STS-1 resides eg. Test STS-1 #8 C1 #7 ; C1 #8 and C1 #9 .

L - OH

Selects the Line Overhead bytes to be monitored and displayed depending upon the RECEIVE SIGNAL selection on the [RECEIVE] SETTINGS display.
RECEIVE SIGNAL STS-1 or OC-1 : Selection between H1,H2 ; K1,K2 D4-D12 ; Z1 ; Z2 and E2 is available.
RECEIVE SIGNAL STS-3 or OC-3 : Selection between H1,H2 #x ; K1,K2 D4-D12 ; Z1 #1 ; Z1 #2 ; Z1 #3 Z2 #1 ; Z2 #2 ; Z2 #3 and E2 is available. The # contained in the byte name refers to the STS-1 #. x represents the STS-1 selected for test.
RECEIVE SIGNAL OC-12 : Selection between H1,H2 #x ; K1,K2 ; D4-D12 Z1 #a ; Z1 #b ; Z1 #c Z2 #a ; Z2 #b : Z2 #c and E2 is available. x represents the STS-1 selected for test. a,b,c represent the STS-1's within the STS-3 in which the test STS-1 resides eg. Test STS-1 #2 Z1 #1 ; Z1 #2 and Z1 #3 .

P - OH

Selects the Path Overhead bytes to be monitored and displayed depending upon the RECEIVE SIGNAL selection on the [RECEIVE] SETTINGS display.
RECEIVE SIGNAL STS-1, OC-1, OC-3, STS-3 or OC-12 : Selection between J1 C2 ; G1 ; F2 ; H4 ; Z3 ; Z4 and Z5 is available.

Trigger	Determines the Hexadecimal value of the block of data which triggers the capture. The hexadecimal value is 00 to FF for each byte of overhead selected, for Example : F1 - 1 Byte - Can be set in the range "00" to "FF". D4-D12 - 9 Bytes - can be set in the range "000000000000000000" to "FFFFFFFFFFFFFFFFFF". The Trigger can be set to one of three states.

OFF	The capture will occur immediately (ACTION) is pressed irrespective of the state of the selected bytes.
ON	The capture will occur when (ACTION) is pressed and the value of the selected bytes matches the value set for Trigger.
ON NOT	The capture will occur when (ACTION) is pressed and the value of the selected bytes does not match the value set for Trigger.

DCC DROP	Allows the DataCommunication Channel present in the SECTION (D1-D3) or LINE (D4-D12) Transport Overhead bytes to be dropped to external equipment via the Rear Panel port.
PTR GRAPH	Displays a graph of pointer adjustments versus Window Count.
Window Size	Sets the size of the measurement window in the range 5 to 8000 frames or 1 to 60 seconds.

T-OH Monitor

The following Transport Overhead bytes are monitored and displayed : A1, A2, B1, B2, C1, D1, D2, D3, D4, D5, D6, D7, D8, D9, D10, D11, D12, E1, E2, F1, H1, H2, H3, K1, K2, Z1 and Z2. Only available if RECEIVE SIGNAL [STS-1] or [OC-1] or [OC-3] or [OC-12] or [STS-3] is selected under SETTINGS.

If Overhead Monitor Of STS-1 [2] through [12] is selected only bytes A1, A2, B2, C1, H1, H2, H3, Z1 and Z2 are labelled, as at this time the other bytes of STS-1 [2] through [12] have not been identified. The unidentified bytes are monitored and their value displayed.

Overhead Monitor Of STS-1	Only available if RECEIVE SIGNAL [OC-12] or [OC-3] or [STS-3] is selected under SETTINGS. Determines the STS-1 frame whose Transport Overhead is to be monitored. Selection between #1 ; #2 and #3 is available if an HP 37772A or HP 37771A is fitted and RECEIVE SIGNAL [OC-3] or [STS-3] is selected. Selection between #1 ; #a ; #b and #c is available if an HP 37776A is fitted and RECEIVE SIGNAL [OC-12] is selected. a,b and c represent the STS-1's within the STS-3 in which the test STS-1 resides eg. Test STS-1 #11 allows selection between #1 ; #10 ; #11 and #12. If #2 through #12 is selected only bytes A1, A2, B2, C1, H1, H2, H3, Z1 and Z2 are labelled but all bytes are monitored.

P-OH Monitor

The following Path Overhead bytes are monitored and displayed : B3, C2, F2, G1, H4, J1, Z3, Z4 and Z5. Only available if RECEIVE SIGNAL [STS-1] or [OC-1] or [OC-3] or [OC-12] or [STS-3] is selected under (RECEIVE) SETTINGS. If Option 002, Virtual Tributary, is fitted and PAYLOAD [VT1.5] and VT MODE [ASYNC] or [FLOATING BYTE] is selected, the Signal Label of the VT selected for test is displayed.

Overhead Monitor Of SPE #	Indicates the STS-1 whose Path Overhead is to be monitored. The STS-1 selected is determined by the STS-1 SPE UNDER TEST selection made under SETTINGS. Only available if RECEIVE SIGNAL [OC-12] or [OC-3] or [STS-3] is selected under SETTINGS.

⌐RESULTS⌐ Display

Displays all the measurement results. Any valid type of result may be selected during the measurement.

Results Displayed   Allows the type of result to be selected for display.

TROUBLE SCAN   All the Error counts are scanned and any which are other than 0 are displayed in large characters. If more than 4 results are other than 0 the display priority is : Section CV ; Line CV ; Path CV ; Bit ; Code ; Frame ; FEBE.

ERROR COUNTS   The Error Counts for different error sources are displayed depending upon the RECEIVE SIGNAL selection on the ⌐RECEIVE⌐ SETTINGS display :

STS-1, STS-3, OC-1, OC-3, OC-12 : Code Errors; Frame Errors, Section CV's, Line CV's, STS Path CV's, STS Path FEBE and Bit Errors.

If Option 002, Virtual Tributary, is fitted VT Path CV and VT Path FEBE are added.

DS3 : Unframed - Code Errors and Bit Errors.
M13 Framing - Code Errors; Frame Errors; P-Bit Parity Errors and Bit Errors. Results are only displayed for the two error sources selected on the ⌐RECEIVE⌐ display under ERRORS DETECTED.
C-BIT Framing - Code Errors; Frame Errors; P-Bit Parity Errors; C-Bit Parity Errors; FEBE and Bit Errors.

Results are only displayed for the two error sources selected on the (RECEIVE) display under ERRORS DETECTED.

DS-1 Code Errors, Bit Errors, Frame Errors and CRC Errors.

ERROR RESULTS — Displays results of ERROR COUNT; ERROR RATE; ERROR SECONDS ERROR FREE SECONDS ; % ERROR FREE SECONDS. The type of ERROR RESULTS is determined by the selection made under ERROR SOURCE.

ERROR ANALYSIS — The Analysis results for different error sources are displayed depending on the RECEIVE SIGNAL selection on the (RECEIVE) SETTINGS display : STS-1, STS-3, OC-1, OC-3, OC-12 Section Analysis : SEFS (Severely Errored Framing Seconds); CV (Section Code Violations/BIPS); ES an %ES (Section Error Seconds); ESA and %ESA (Section Error Seconds type A); ESB and %ESB (Section Error Seconds type B); SES and %SES (Section Severely Errored Seconds).

Line Analysis : CV (Line Code Violations/BIPS); ES and %ES (Line Error Seconds); ESA and %ESA (Line Error Seconds type A); ESB and %ESB (Line Error Seconds type B); SES and %SES (Line Severely Errored Seconds); UAS and %UAS (Line Unavailable Seconds).

STS-Path Analysis : CV (Path Code Violations/BIPS); ES and %ES (Path Error Seconds); ESA and %ESA (Path Error Seconds type A); ESB and %ESB (Path Error Seconds type B); SES and %SES (Path Severely Errored Seconds); UAS and %UAS (Path Unavailable Seconds).

STS-FEBE Analysis : CV (FEBE Code Violations/BIPS); ES and %ES (FEBE Error Seconds); ESA and %ESA (FEBE Error Seconds type A); ESB and %ESB (FEBE Error Seconds type B); SES and %SES (FEBE Severely Errored Seconds); UAS and %UAS (FEBE Unavailable Seconds).

Bit Analysis : EC (Bit Error Count); ES and %ES (Bit Error Seconds); ESA and %ESA (Bit Error Seconds type A); ESB and %ESB (Bit Error Seconds type B); SES and %SES (Bit Severely Errored Seconds); UAS and %UAS (Bit Unavailable Seconds).

If Option 002, Virtual Tributary, is fitted and PAYLOAD [VT1.5] or [VT6] is selected the following Error Analysis Results are added :

VT Path-CV Analysis : CV (VT Path Code Violations); ES and %ES (VT Path Error Seconds); ESA and %ESA (VT Path Error Seconds type A); ESB and %ESB (VT Path Error Seconds type B); SES and %SES (VT Path Severely Errored Seconds);

UAS and %UAS (VT Path Unavailable Seconds).

VT Path-FEBE Analysis : CV (VT FEBE Code Violations); ES and %ES (VT FEBE Error Seconds); ESA and %ESA (VT FEBE Error Seconds type A); ESB and %ESB (VT FEBE Error Seconds type B); SES and %SES (VT FEBE Severely Errored Seconds); UAS and %UAS (VT FEBE Unavailable Seconds).

RECEIVE SIGNAL DS3
Bit Analysis - Framed or Unframed : EC (Bit Error Count); ES and %ES (Bit Error Seconds); ESA and %ESA (Bit Error Seconds type A); ESB and %ESB (Bit Error Seconds type B); SES and %SES (Bit Severely Errored Seconds); UAS and %UAS (Bit Unavailable Seconds).

P-Bit Analysis - M13 or C-Bit Framing : EC (Bit Error Count); ES and %ES (P-Bit Error Seconds); ESA and %ESA (P-Bit Error Seconds type A); ESB and %ESB (P-Bit Error Seconds type B); SES and %SES (P-Bit Severely Errored Seconds); UAS and %UAS (P-Bit Unavailable Seconds).

C-Bit Analysis - C-Bit Framing : EC (C-Bit Error Count); ES and %ES (C-Bit Error Seconds); ESA and %ESA (C-Bit Error Seconds type A);

ESB and %ESB (C-Bit Error Seconds type B); SES and %SES (C-Bit Severely Errored Seconds); UAS and %UAS (C-Bit Unavailable Seconds).

FEBE Analysis - C-Bit Framing : EC (FEBE Error Count); ES and %ES (FEBE Error Seconds); ESA and %ESA (FEBE Error Seconds type A); ESB and %ESB (FEBE Error Seconds type B); SES and %SES (FEBE Severely Errored Seconds); UAS and %UAS (FEBE Unavailable Seconds).

RECEIVE SIGNAL DS1

Bit Analysis : EC (Bit Error Count); ES and %ES (Bit Error Seconds); ESA and %ESA (Bit Error Seconds type A); ESB and %ESB (Bit Error Seconds type B); SES and %SES (Bit Severely Errored Seconds); UAS and %UAS (Bit Unavailable Seconds).

Frame Analysis - D4 or ESF Framing : EC (Frame Error Count); ES and %ES (Frame Error Second); ESA and %ESA (Frame Error Second type A); SES and %SES (Frame Severely Errored Seconds); UAS and %UAS (Frame Unavailable Seconds).

CRC Analysis - ESF Framing : EC (CRC Error Count); ES and %ES (CRC Error Seconds); ESA and %ESA (CRC Error Seconds type A); ESB and %ESB (CRC Error Seconds type B); SES and %SES (CRC Severely Erorred Seconds); UAS and %UAS (CRC Unavailable Seconds)

ALARM SECONDS   STS-1, OC-1, STS-3, OC-3, OC-12 :
Power Loss; LOS (Loss Of Signal);
LOF (Loss Of Frame); OOF (Out Of
Frame); LOP (Loss Of Pointer); Line
AIS; STS Path AIS; K1/K2 Change;
Pattern Loss; Line FERF; STS Path
YEL.

If Option 002, Virtual Tributary, is
fitted further alarm results of VT
LOP (VT Loss Of Pointer); VT Path
AIS and VT Path YEL are displayed.

DS3 Unframed : Power Loss; Loss Of
Signal; Pattern Loss.

DS3 Framed : Power Loss; Loss Of
Signal; Pattern Loss; Loss Of Frame;
AIS; X-Bit.

DS1 : Power Loss; Loss Of Signal;
AIS; Pattern Loss; Loss Of Frame;
Yellow Alarm.

POINTER ACTIVITY   Displays results associated with STS-1
payload pointers: NDF (New Data
Flag) SECONDS; Missing NDF
SECONDS; POS ADJUSTMENTS;
POS ADJ SECONDS; NEG
ADJUSTMENTS; NEG ADJ
SECONDS; IMPLIED SPE OFFSET.
If Option 002, Virtual Tributary, is
fitted the results listed above are also
provided for VT Payload Pointers.
The Pointer Activity results are not
available if RECEIVE SIGNAL [DS1]
or [DS3] is selected on the [RECEIVE]
SETTINGS display.

SIGNAL LEVEL	Displays the voltage level of the received signal if RECEIVE SIGNAL [DS3] or [STS-1] is selected on the (RECEIVE) SETTINGS display. Selection between POSITIVE PEAK and NEGATIVE PEAK is available.
SIG/BIT Monitor	Displays the state of the Signaling Bits A B C D and the Data for the selected Timeslot if Option 002, Virtual Tributary, is fitted and PAYLOAD [VT1.5]; VT PAYLOAD [LOCKED BYTE] or [FLOATING BYTE] and VT SIGNALING [ON] is selected on the (RECEIVE) SETTINGS display. If TEST DS1 TIMESLOT [FULL T1] is selected the state of the Signaling Bits for all 24 Timeslots is displayed.
Error Source	Determines the source of the results when RESULTS DISPLAYED ERROR RESULTS or ERROR ANALYSIS is selected. The menu varies according to the RESULTS DISPLAYED and RECEIVE SIGNAL selections:

Error Results (STS-1) CODE ; FRAME ; SECTION CV ; LINE CV ; STS PATH CV ; STS PATH FEBE ; BIT.

Error Results (STS-3, OC-1, OC-3) FRAME ; SECTION CV ; LINE CV ; STS PATH CV ; STS PATH FEBE ; BIT.

Error Results (OC-12) SECTION CV ; LINE CV ; STS PATH CV ; STS PATH FEBE ; BIT.

If Option 002, Virtual Tributary, is fitted and VT MODE [ASYNC] or [FLOATING BYTE] is selected, further selections of VT-PATH CV and VT-PATH FEBE are available.

Error Results (Unframed DS3) CODE and BIT.

Error Results (M13 Framed DS3) CODE; FRAME; P-BIT PARITY and BIT.
Results are only displayed for the two error sources selected on the [RECEIVE] display under ERRORS DETECTED.

Error Results (C-Bit Framed DS3) CODE; FRAME; P-BIT PARITY; C-BIT PARITY; FEBE and BIT.
Results are only displayed for the two error sources selected on the [RECEIVE] display under ERRORS DETECTED.

Error Results (Unframed DS1) CODE and BIT.

Error Results (D4 Framed DS1) CODE; FRAME and BIT.

Error Results (ESF Framed DS1) CODE; FRAME; CRC and BIT.

Error Analysis (STS-1, STS-3, OC-1, OC-3 and OC-12 SECTION; LINE; STS PATH; STS FEBE; BIT.

If Option 002, Virtual Tributary, is fitted and VT MODE [ASYNC] or [FLOATING BYTE] is selected, further selections of VT-PATH CV and VT-PATH FEBE are available.

Error Analysis (Unframed DS3) BIT.

Error Analysis (M13 Framed DS3) P-BIT and BIT.

Error Analysis (C-Bit Framed DS3) P-BIT; C-BIT; FEBE and BIT.

Error Analysis (Unframed DS1) BIT.

Error Analysis (D4 Framed DS1) FRAME and BIT.

Error Analysis (ESF Framed DS1) FRAME; CRC and BIT.

Test Timing Determines the type of test period during which the results are calculated.

MANUAL The following selections result in termination of the current test period and the start of a new test period :

Press (RESTART)

Any selection on the (RECEIVE) display.

Selection of Test Timing MANUAL or SINGLE and DURATION on the (RESULTS) display.

Selection of START GRAPH or STOP GRAPH on the (GRAPH) display.

Changing the TIME & DATE setting on the (AUX) display.

Selection of SETTINGS CONTROL COUPLED on the (TRANSMIT) or (RECEIVE) displays if this causes a change in Receive Settings.

Selection of CLOCK SYNC STS-1 RX on the (TRANSMIT) display if the RECEIVE SIGNAL was previously set to [DS3] or [DS1].

SINGLE The test period starts when the DURATION is set by the user and terminates when the user specified DURATION is completed. The following selections which result in termination of the current test period and the start of a new test period will nullify the user specified DURATION :

Press (RESTART)

Any selection on the (RECEIVE) display.

Selection of Test Timing MANUAL or SINGLE and DURATION on the (RESULTS) display.

Selection of START GRAPH or STOP GRAPH on the (GRAPH) display.

Changing the TIME & DATE setting on the (AUX) display.

Selection of SETTINGS CONTROL COUPLED on the (TRANSMIT) or (RECEIVE) displays if this causes a change in Receive Settings.

Selection of CLOCK SYNC STS-1 RX on the (TRANSMIT) display if the RECEIVE SIGNAL was previously set to [DS3] or [DS1].

Duration   Determines the length of the test if SINGLE is selected. Selection between 1 HR; 24 HR; 72 HR; 7 DAYS and USER PROGRAM is available. USER PROGRAM allows the DURATION to be set in the range 1 to 99 Seconds; 1 to 99 Minutes; 1 to 99 Hours or 1 to 99 Days.

Elapsed Time   The current time span of the measurement is displayed.

(GRAPH) Display

Provides Bar graph displays of Section CV Count versus time; Line CV Count versus time; Path CV Count versus time; FEBE Count versus time; Bit Error Count versus time; +ve Pointer Adjust versus time; -ve Pointer Adjust versus time and 2 graphs of SONET Alarms versus time.

If RECEIVE SIGNAL DS3 is selected additional Bar graphs of DS3 Code Error Count versus time; DS3 Frame Error Count versus time; DS3 P-Bit Error Count versus time; DS3 C-Bit Error Count versus time; DS3 FEBE Count versus time; DS3 Bit Error Count versus time and a graph of DS3 Alarms versus time are provided.

If Option 002, Virtual Tributary, is fitted and PAYLOAD VT1.5 is selected additional Bar graphs of VT-Path CV Count; VT FEBE Count; VT +ve Pointer Adjust; VT -ve Pointer Adjust and VT Alarms are available. Bit Error Count; VT +ve Pointer Adjust and VT -ve Pointer Adjust are not available if VT MODE LOCKED BYTE or LOCKED BIT is selected. Any two of the Bar Graphs can be displayed at one time on the Graph Results display.

If Option 002, Virtual Tributary, is fitted and RECEIVE SIGNAL DS1 is selected the only Bar graphs available are : DS1 Bit Error Count; DS1 Code Error Count; DS1 Frame Error Count; DS1 CRC Count and DS1 Alarms.

An Error or Alarm Summary is displayed on the Text Results display.

The Store Status display allows management of the stored results.

Bar Graph Display   Displays the 2 Bar Graphs selected from the menu.

TEXT RESULTS	Changes display to an Error Summary or an Alarm Summary.
ZOOM IN/OUT	Expands or contracts the time (minutes) scale of the graph base. The cursor is moved along the graph base line to the point of interest, using (⇧) and (⇩). When the point of interest is reached, Zoom In/Out is used for more detailed examination of the area of interest.

CHANGE UPPER	Allows the upper graph type to be selected.
CHANGE LOWER	Allows the lower graph type to be selected.
PRINT	The Bar Graphs displayed, an Error Summary and an Alarm Summary, are logged on an external HP ThinkJet printer connected to the rear panel HPIB or RS232 port if PRINTING [ON] is selected on the (AUX) PRINTER display.
START GRAPH	When Start graph is selected the current test period is terminated and a new test period is started. During the new test period graphical results will be accumulated and stored. When Stop Graph is selected the current test period is terminated and a new test period is started. Graphical results will not be accumulated.
ENABLE DEMO	Enables the graphics display for generation of a set of demonstration graphs as an aid to user understanding.
DEMO	Generates a set of demonstration graphs.
DISABLE DEMO	Disables the demonstration capability of the graph display.

Text Results Display   A summary of Error results or Alarm results can be selected from the softkey menu.

STORE STATUS	Changes to a display of the status of the stored results.
GRAPH RESULTS	Returns to the Bar Graph display.

PRINT   The Summary displayed is logged
                     on an external HP ThinkJet printer
                     connected to the rear panel HPIB or
                     RS232 port if PRINTING [ON] is
                     selected on the (AUX) PRINTER display.

ERROR SUMMARY   Changes the displayed results from
                     Alarm Summary to Error Summary.

ALARM SUMMARY   Changes the displayed results from
                     Error Summary to Alarm Summary.

Store Status   Allows the storage of up to ten sets of results. The results
Display   can be recalled at a later date by moving the cursor
                     to the required store, using (⬇) and (⬆) and selecting
                     GRAPH RESULTS or TEXT RESULTS .

GRAPH RESULTS   Returns to the bar graph display. The
                     bar graphs displayed are constructed
                     from the results in the store marked by
                     the cursor.

TEXT RESULTS   Returns to the text results display. The
                     summary displayed are obtained from
                     the store marked by the cursor.

DELETE STORE   Deletes the results in the store marked
                     by the cursor.

DELETE ALL   Prepares for deletion of the results in
                     all stores. Requires a confirmation
                     [CONFIRM DELETE] before deletion
                     occurs.

CONFIRM DELETE   Completes the deletion started by
                     Delete All.

ABORT DELETE   Prevents the deletion from taking place
                     if Delete All was selected in error.

(AUX) Display

Provides access to the following auxiliary measurement functions :
Stored Settings; Printer; Remote Control; Time & Date; Keyboard Lock; Beep
On Error; Laser Interlock; Options/Plug-Ins; and Self Test.

STORED SETTINGS   Allows the storage in non-volatile memory of up to nine
sets of front panel settings (1 to 9). Setting 0 is reserved
for Factory Default Settings. Stored Settings can be
recalled from settings 0 to 9 but storage is only allowed in
settings 1 to 9.

Stored Setting   Allows selection of the settings number, 0 to 9.
Number

Lock   Prevents accidental corruption of the stored settings.
Selection between OFF and ON is available.

     OFF   Settings can be recalled, saved or titled.

     ON   Settings can be recalled only.

Action   Determines the Stored Setting action desired. Selection
between RECALL and SAVE is available. Press (ACTION) to
Save or Recall settings.

Title   Allows each set of stored settings to be titled for
easy identification using JUMP ; NEXT CHARACTER ;
PREVIOUS CHARACTER ; ◄ and ►.

PRINTER   Allows the setting of the Logging configuration to the
external printer.

Printer Port   Selects the rear panel port the printer is connected to.
Selection between HPIB and RS232 is available. If [HPIB]
is selected the Remote Control Port will be RS232. If
[RS232] is selected the Remote Control Port will be HPIB.

Remote control Port	Will always be the opposite setting to the Printer Port. If Printer Port [HPIB] is selected the Remote Control Port will be RS232. If Printer Port [RS232] is selected the Remote Control Port will be HPIB.
Print On Demand	Determines which results are logged to the external printer when (PRINT NOW) is pressed.

RESULTS SNAPSHOT	A snapshot of the measurement results is logged to the external printer when (PRINT NOW) is pressed.
OVERHEAD SNAPSHOT	A snapshot of all Overhead is logged to the external printer when (PRINT NOW) is pressed.
OVERHEAD CAPTURE	The results of the Overhead Capture are logged to the external printer when (PRINT NOW) is pressed.

Printing	Determines if the results are to be logged to the external printer. Selection between OFF and ON is available. If ON is selected this necessitates setting of Print Period; Print Error Seconds and Squelch.
Print Period	Determines the interval at which measurement results are logged to the external printer.

OFF	Results are logged to the external printer at the end of the test.
15 MIN	Results are logged to the external printer at 15 Minute intervals and at the end of the test.
2 HOURS	Results are logged to the external printer at 2 Hour intervals and at the end of the test.

Print Error Seconds	Allows the occurrence of each error second to be logged on the external printer. Selection between OFF and ON is available.

Reference 3-55

Squelch	If more than 10 consecutive error seconds or alarm seconds occur, logging is disabled until a single error or alarm free second occurs. Selection between OFF and ON is available.
Printer Type	(RS232 Only) Allows selection between an HP PRINTER and an ALT PRINTER. If ALT PRINTER is selected this entails further selection of Print Mode.
Print Mode	(RS232, ALT PRINTER Only)Selection between NORMAL and COMPRESS is available.
Speed	Determines the speed of the logging interface. Selection between 300 BAUD; 600 BAUD; 1200 BAUD; 1800 BAUD; 2400 BAUD; 4800 BAUD and 9600 BAUD is available.
Protocol	Fixed according to the selection made under Printing Type. If [HP PRINTER] is selected Protocol is Xon/Xoff. If [ALT PRINTER] is selected protocol is DTR.
REMOTE CONTROL	Provides an HP-IB remote control interface and an RS-232-C remote control interface.
Remote Control Port	Determines which port is to be used for remote control. Selection between HPIB and RS232 is available. If [HPIB] is selected the Printer Port will be RS232. If [RS232] is selected the Printer Port will be HPIB.
Printer Port	Will always be the opposite setting to the Remote Control Port. If Remote Control Port [HPIB] is selected the Printer Port will be RS232. If Remote Control Port [RS232] is selected the Printer Port will be HPIB.
Address	Allows the HP-IB address to be set in the range 0 to 30. The Address is factory preset to 05.
SRQ State	Indicates the SRQ state of the HP 37704A HP-IB interface.
Controller Type	Determines the type of controller in use on the RS-232-C interface. Selection between COMPUTER and TERMINAL is available.

ENQ/ACK	To ensure efficient transfer of data the HP 37704A setting of ENQ/ACK must be the same as the controller. ENQ/ACK forms part of the data transfer protocol. Selection between OFF and ON is available.
Xon/Xoff	To ensure efficient transfer of data the HP 37704A setting of Xon/Xoff must be the same as the RS-23-C controller setting. Xon/Xoff is part of the data transfer protocol. Selection between OFF; RX ONLY; TX ONLY and RX & TX is available.
Speed	Determines the rate at which data is transferred between the HP 37704A and the RS-232-C controller. The controller and the HP 37704A must be set to the same baud rate. Selection between 300 BAUD; 600 BAUD; 1200 BAUD; 1800 BAUD; 2400 BAUD; 4800 BAUD; 9600 BAUD is available.
Parity	Allows error detection and correction to take place on the data transferred between the HP 37704A and the RS-232-C controller. Each Byte of data contains 1 Start Bit; 7 Data Bits; and 1 or 2 Stop Bits. The Parity setting must match the setting on the RS-232-C controller. Selection between ODD; EVEN; O's and 1's; is available.
Stop Bits	Each Byte of data contains 1 Start Bit; 7 Data Bits; and 1 or 2 Stop Bits. Selection between 1 and 2 Stop Bits is available.
Error Number	If a remote control error occurs the relevant error number appears on the display. A display of +0 is normal.
TIME & DATE	The Time and Date function clock, once set, provides all the HP 37704A timing and will continue to run even if the HP 37704A line voltage is removed. Time and Date information is used in the logging of certain occurrences on the printer, for example, Start of Test; Occurrence of Errored Second; Loss Of Frame.

Clock Mode

Allows the Time and Date settings to be altered if required. Selection between RUN and SETUP is available.

Time

Displays the current time when CLOCK MODE [RUN] is selected. The displayed time is modified using the display softkeys when CLOCK MODE [SETUP] is selected and updated when [RUN] is next selected.

Date

Displays the current date when CLOCK MODE [RUN] is selected. The displayed date is modified using the display softkeys when CLOCK MODE [SETUP] is selected and updated the next time [RUN] is selected.

KEYBOARD LOCK

Disables most front panel keys to prevent unauthorized or accidental alteration of the selected settings. Selection between OFF and ON is available. The following are not affected by KEYBOARD LOCK :

(RESULTS) Display : RESULTS DISPLAYED; ERROR SOURCE selections.

(GRAPH) Display : GRAPH RESULTS ; TEXT RESULTS ; STORE STATUS ; ZOOM IN/ZOOM OUT ; CHANGE UPPER ; CHANGE LOWER ; START GRAPH/STOP GRAPH ; ALARM SUMMARY ; ERROR SUMMARY .

(AUX) Display : KEYBOARD LOCK .

Any of the other displays can be viewed but cannot be modified until Keyboard Lock has been removed.

(FREEZE DISPLAY); (⇧); (⇩); (SHOW HISTORY)

Any other key sequence will result in STATUS: **Change prevented by keyboard lock** appearing on the display.

BEEP ON ERROR

Makes an audible BEEP whenever an error is received. Selection between OFF and ON is available.

LASER INTERLOCK   Provides the capability of preventing the generation of optical power, when an Optical Interface Module is fitted. The user must set the interlock code to match the pre-programmed code, before the laser can be enabled.

Interlock Code   The code setting comprises 4 alphanumeric characters. The manufacturers setting is ABCD. The user can change the code setting via remote control for safety or security reasons. In that case the new matching code must be entered on the display and actioned by pressing (ACTION). A message is displayed indicating whether the laser is enabled or disabled.

OPTIONS/PLUG-INS   Lists the options available and indicates which, Options or Plug-Ins are fitted to the instrument.

SELF TEST   Refer to the Making Measurements section of this manual for detailed information.

Printer Messages

Headers and results are logged to the printer when :

- Results are requested using [PRINT NOW]
- Results are requested using PRINTER function on the [AUX] display
- Overhead Capture is requested
- Overhead Snapshot is requested
- Print is pressed on the Bar Graph display
- Print is pressed on the Graph Text Results display

Results Logging

When a measurement is started a header detailing the configuration of the HP 37704A is logged, as shown in Figure A-1, if PRINTING [ON] is selected on the [AUX] PRINTER display.

```
================================================================
                    Hewlett Packard HP37704A
                    Instrument Configuration
----------------------------------------------------------------
TRANSMITTER
   Transmit Signal     : STSX-1
   Clock Sync          : Internal
   STS-1 SPE Payload   : VT1.5 ASYNC    VT Number        :  1
   VT Payload          : Int Unframed
   VT Signal Label     : 001            Pattern          : 11111111
   Service Offset      :    8ppm        Bgnd VT Pattern  : QRSS

RECEIVER
   Receive Signal      : STS-1
   STS-1 SPE Payload   : VT1.5 ASYNC    VT Number        :  1
   VT Payload          : Int Unframed   Pattern          : QRSS
   Signal Level        : STSx-1

MEASUREMENT STARTED  : 03 Mar 92  05:12:00
================================================================
ERROR SEC|  Code  Frame  SCV  LCV  PCV  FEBE  VTCV VTFEBE    Bit
05:12:21 |    0     0     0    0    0     0     0    0         1
05:12:28 |    0     0     0    1    0     0     0    0         0
05:12:40 |    0     0     0    0    0     0     0    0         0
```

Figure A-1. Results Header

During the Measurement Period

If PRINT ERROR SECONDS [ON] is selected on the (AUX) PRINTER all occurrences of an error second will be logged :

- Code

- Frame

- SCV

- LCV

- PCV

- FEBE

- Bit

- P-Bit (Framed DS3 only)

- C-Bit (C-Bit Framed DS3 only)

- VT Path CV (Option 002 only)

- VT Path FEBE (Option 002 only)

A-2   Printer Messages

All alarm occurrences will be logged as SET or CLEAR :

- Loss Of Signal
- Loss Of Pointer
- Loss Of Frame
- Out Of Frame
- Pattern Loss
- Line AIS
- Line FERF
- STS Path AIS
- STS Path Yellow
- Clock Loss
- K1/K2 Change
- Pointer Adjust
- X-Bit (Framed DS3 only)
- Idle (Framed DS3 only)
- VT Pointer Loss (Option 002 only)
- VT Path AIS (Option 002 only)
- VT Path Yellow (Option 002 only)

In addition the following Events are logged :

- All Alarms Clear
- Power Failure
- Power Restored
- New Day
- Squelched - If SQUELCH [ON] is selected
- Unsquelched - If SQUELCH [ON] is selected
- Print Demand - if (PRINT NOW) pressed

- Printing Enabled

- Measurement Complete

Figures A-2 and A-3 give some examples of Error Second logging, Alarm logging and Event logging.

```
=================================================================
ERROR SEC|  Code  Frame  SCV  LCV  PCV  FEBE  VTCV VTFEBE    Bit
23:56:20 |    0     1      0    0    0           0    0        0
23:56:45 |    0     0      0    0    0           0    0        1
23:56:46 |    0     0      0    0    0           0    0        2
23:56:47 |    0     0      0    0    0           0    0        2
23:56:48 |    0     0      0    0    0           0    0        1
23:56:49 |    0     0      0    0    0           0    0        2
23:56:50 |    0     0      0    0    0           0    0        1
23:56:51 |    0     0      0    0    0           0    0        2
23:56:52 |    0     0      0    0    0           0    0        1
23:56:53 |    0     0      0    0    0           0    0        2
23:56:54 |    0     0      0    0    0           0    0        1
=================================================================
23:56:55 | SQUELCHED
=================================================================
23:57:00 | UNSQUELCHED
=================================================================
23:57:11 | Clock Loss        SET
23:57:12 |                   ALL ALARMS CLEAR
23:57:12 | Clock Loss        CLEAR
23:57:13 |                   ALL ALARMS CLEAR
23:57:32 | Loss of Frame     SET
23:57:32 | Out of Frame      SET
23:57:32 | Loss of Pointer   SET
23:57:32 | Pattern Loss      SET
23:57:32 | VT Pointer Loss   SET
   %Error Free Secs    100                              96.24060
=================================================================
ERROR SEC|  Code  Frame  SCV  LCV  PCV  FEBE  VTCV VTFEBE    Bit
23:57:33 |    0     0      0    0    0           0    0        0
=================================================================
23:57:33 | Loss of Frame     CLEAR
23:57:33 | Out of Frame      CLEAR
23:57:33 | Loss of Pointer   CLEAR
23:57:33 | Pattern Loss      CLEAR
23:57:33 | VT Pointer Loss   CLEAR
   %Error Free Secs    100                              96.00000
23:57:34 |                   ALL ALARMS CLEAR
=================================================================
ERROR SEC|  Code  Frame  SCV  LCV  PCV  FEBE  VTCV VTFEBE    Bit
23:57:34 |    0     0      0    0    0           0    0      9797
```

Figure A-2. Measurement Period Logging

A-4   Printer Messages

```
                                  CLEAR
23:59:07  | Pointer Adjust        SET
23:59:07  | Pointer Adjust        CLEAR
23:59:08  |                       ALL ALARMS CLEAR
23:59:08  | Pointer Adjust        SET
23:59:08  | Pointer Adjust        CLEAR
23:59:09  |                       ALL ALARMS CLEAR
23:59:09  | Pointer Adjust        SET
23:59:09  | Pointer Adjust        CLEAR
23:59:10  |                       ALL ALARMS CLEAR
23:59:10  | Pointer Adjust        SET
23:59:10  | Pointer Adjust        CLEAR
23:59:10  | Pointer Adjust        SET
23:59:11  | Pointer Adjust        CLEAR
23:59:11  |                       ALL ALARMS CLEAR
23:59:11  | Pointer Adjust        SET
23:59:11  | Pointer Adjust        CLEAR
23:59:12  |                       ALL ALARMS CLEAR
=================================================================================
ERROR SEC |   Code   Frame   SCV   LCV   PCV   FEBE   VTCV VTFEBE        Bit
23:59:38  |    0       0      0     0     0            0     0            1
=================================================================================
05-Mar-92| NEW DAY
± |================================================================================|
05 Mar 92 00:00:09  POWER FAILURE
05 Mar 92 00:00:15  POWER RESTORED
=================================================================================
ERROR SEC |   Code   Frame   SCV   LCV   PCV   FEBE   VTCV VTFEBE        Bit
00:00:21  |    0       0      0     0     0            0     0            0
=================================================================================
00:00:38  | K1/K2 Change         SET
00:00:38  | K1/K2 Change         CLEAR
00:00:39  |                      ALL ALARMS CLEAR
00:00:50  | K1/K2 Change         SET
00:00:50  | K1/K2 Change         CLEAR
00:00:51  |                      ALL ALARMS CLEAR
00:00:54  | K1/K2 Change         SET
00:00:54  | K1/K2 Change         CLEAR
00:00:54  | Line FERF            SET
00:00:55  | K1/K2 Change         SET
00:00:55  | K1/K2 Change         CLEAR
00:00:55  | Line FERF            CLEAR
00:00:56  |                      ALL ALARMS CLEAR
```

Figure A-3. Measurement Period Logging

At the End of the Measurement Period

A complete set of measurement results are logged as shown in Figure A-4.

```
==============================================================
MEASUREMENT COMPLETE : 04 Mar 92  00:05:42
--------------------------------------------------------------
ERROR RESULTS
--------------------------------------------------------------
                    Code    Frame  Section CV  Line CV   Path CV
Error Count           0       0         0         0         0
Error Ratio           0       0         0         0         0
Error Seconds         0       0         0         0         0
Error Free Secs     120     120       120       120       120
%Error Free Seconds 100     100       100       100       100

                    FEBE           VT-Path CV  VT-FEBE      Bit
Error Count           0               0         0           0
Error Ratio           0               0         0           0
Error Seconds         0               0         0           0
Error Free Secs     120             120       120         120
%Error Free Secs    100             100       100         100
--------------------------------------------------------------
ERROR ANALYSIS
--------------------------------------------------------------
                 Section   Line     Path      FEBE       Bit
SEFS                0                                      0
EC
CV                  0        0         0         0         0
ES                  0        0         0         0         0
ESA                 0        0         0         0         0
ESB                 0        0         0         0         0
SES                 0        0         0         0         0
URS                          0         0         0         0

%ES              0.00000  0.00000   0.00000   0.00000   0.00000
%ESA             0.00000  0.00000   0.00000   0.00000   0.00000
%ESB             0.00000  0.00000   0.00000   0.00000   0.00000
%SES             0.00000  0.00000   0.00000   0.00000   0.00000
%URS                      0.00000   0.00000   0.00000   0.00000

                                    VT-Path   VT FEBE
CV                                    0         0
ES                                    0         0
ESA                                   0         0
ESB                                   0         0
SES                                   0         0
URS                                   0         0

%ES                                 0.00000   0.00000
%ESA                                0.00000   0.00000
%ESB                                0.00000   0.00000
%SES                                0.00000   0.00000
%URS                                0.00000   0.00000
--------------------------------------------------------------
POINTER ACTIVITY
--------------------------------------------------------------
                              STS POINTER        VT POINTER
                           Count   Seconds    Count   Seconds
NDF                                   0                  0
Missing NDF                           0                  0
Positive Pointer Adjustments  0       0         0        0
Negative Pointer Adjustments  0       0         0        0
Implied SPE Offset         0.0 ppm
Pointer Value              287                  N/R
==============================================================
```

Figure A-4. Measurement Complete Logging

A-6   Printer Messages

Overhead Capture Logging

The Overhead Capture is logged when PRINT ON DEMAND [OVERHEAD CAPTURE] is selected on the (AUX) PRINTER display and (PRINT NOW) is pressed. See Figure A-5.

Overhead Snapshot Logging

The Overhead Snapshot is logged when PRINT ON DEMAND [OVERHEAD SNAPSHOT] is selected on the (AUX) PRINTER display and (PRINT NOW) is pressed. See Figure A-5.

```
=============================================================================
05:23:17 | PRINT DEMAND - OVERHEAD CAPTURE
         | Capture of channel [ A1, A2 ]  Trigger OFF
-----------------------------------------------------------------------------
           DATA      FRAME COUNT        DATA      FRAME COUNT
           F628       .. 64000          08D6        ...... 2
           F628       .. 49972          805E        ...... 2
           09D7        ..... 11         F628        .. 63699
           F628       .. 63700          09D7         ..... 11
           09D7        ...... 5         F628        .. 63700
           4997        ...... 1         09D7        ...... 7
           C816        ...... 1         F22C        ...... 4
           835D        ...... 1         F628        .. 63701
=============================================================================
05:23:36 | PRINT DEMAND - OVERHEAD SNAPSHOT
         | Setup : STSX-1
-----------------------------------------------------------------------------
  A1 F6  A2 28  C1 01 | J1     './0123456789:;<=
  B1 21  E1 00  F1 00 | B3 B3  >?~~~~~~~~~~~~~~~~
  D1 00  D2 00  D3 00 | C2 01  ~~~~~~~~~~~~~~~~~~
  H1 61  H2 1F  H3 00 | G1 00  ~~ ! "#$%&'()*+,-'
  B2 0D  K1 00  K2 00 | F2 00
  D4 00  D5 00  D6 00 | H4 CB
  D7 00  D8 00  D9 00 | 23 00
  D10 00 D11 00 D12 00| 24 00
  21 00  22 00  E2 00 | 25 00
```

Figure A-5. Overhead Capture/Snapshot Logging

Bar Graph Logging

If PRINTING [ON] is selected on the (AUX) PRINTER display and PRINT is pressed on the Bar Graph display the Upper and Lower graphs displayed and an alarm graph are logged to the printer. See Figure A-6.

```
============================================================================
                        Hewlett Packard HP37704A
                            Stored Graphics
        TEST STARTED : 04:34  3-MAR-1992
        TEST DURATION : 00d 00h 29m
============================================================================
```
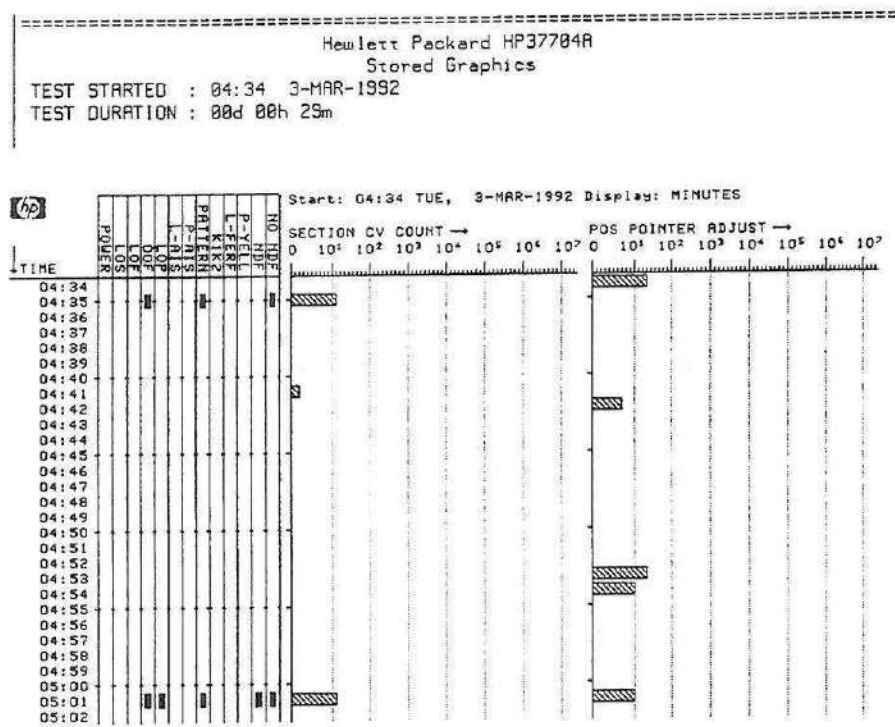

Figure A-6. Bar Graph Logging

Graphics Text Results Logging

If PRINTING [ON] is selected on the (AUX) PRINTER display and PRINT is pressed on the Text Results display the Summary displayed will be logged on the printer. See Figure A-7.

```
===============================================================================
                        Hewlett Packard HP37704A
                          Stored Text Results
TEST STARTED  : 09:50 29-MAR-1989
TEST DURATION : 00d 01h 14m

Error Summary          Count                          Ratio
  Section CV           1760                         7.742E-09
  Line CV              197121                       8.769E-07
  STS-Path CV          201681                       9.182E-07
  STS-FEBE             370230                       1.686E-06
  Bit                  0                            0
  Pos Ptr adj          143
  Neg Ptr adj          41

===============================================================================
```

```
===============================================================================
                        Hewlett Packard HP37704A
                          Stored Text Results
TEST STARTED  : 09:50 29-MAR-1989
TEST DURATION : 00d 01h 14m

Alarm Summary
  Power Loss           0        Pattern Loss       42
  LOS                  0        NDF                10
  LOF                  0        Missing NDF        14
  OOF                  46       K1/K2 Change       10
  LOP                  17       Line FERF          3
  Line AIS             1        STS-Path Yel       3
  STS-Path AIS         0
===============================================================================
```

Figure A-7. Text Results Logging

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