HEWLETT PACKARD

OPERATORS GUIDE

HP 3787B
DIGITAL DATA TEST SET

SERIAL NUMBERS

This manual applies directly to instruments with serial numbers prefixed 2703U.

Manual Part Number: 03787-90002
Microfiche Part Number: 03787-90027

Printed: May 1987

Getting Started 1

Introduction

This section gives a brief introduction to instrument operation and describes how to make measurements. Practical examples are used to familiarize you with the controls by demonstrating how they are used to set up and run measurements. You are shown how to read results and obtain a printout. There are some exercises to try on your own. The section is completed with a summary of what you have learned.

Introduction to Instrument Operation

Configuration and Measurement parameters are displayed in inverse video on the CRT display. These are set using the CURSOR and CHANGE keys. For ease of use the displays are arranged with the most significant parameters at the top left hand corner of the screen. When configuring the instrument it is advisable to work from top to bottom and from left to right.

Press the START/STOP key to start the measurement. It will stop automatically at the end of the preset duration but the START/STOP key can be used to override the automatic stop.

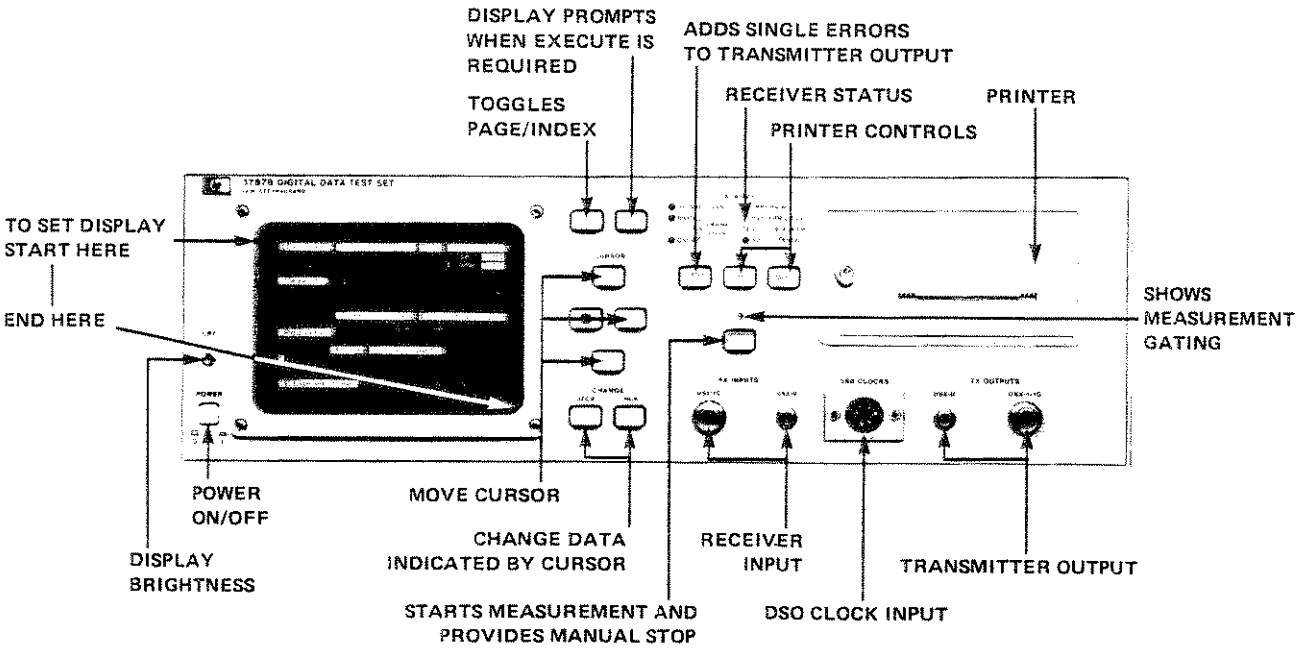
The measurement results are displayed during and after the measurement period. A printout of results can be obtained either automatically by presetting print conditions, or on demand with the PRINT key.

CURSOR keys ------ Change the position of the cursor on the screen.

CHANGE keys ------ Change the data indicated by the flashing cursor.

START/STOP key --- Starts the measurement running and stops it manually.

PRINT key -------- Prints results on the built-in printer on demand.



Start-Up

Before Switch-On

Check that the rear panel voltage selector is set for the power line voltage to be used. Refer to the installation section in the Operating Manual.

Switch-On

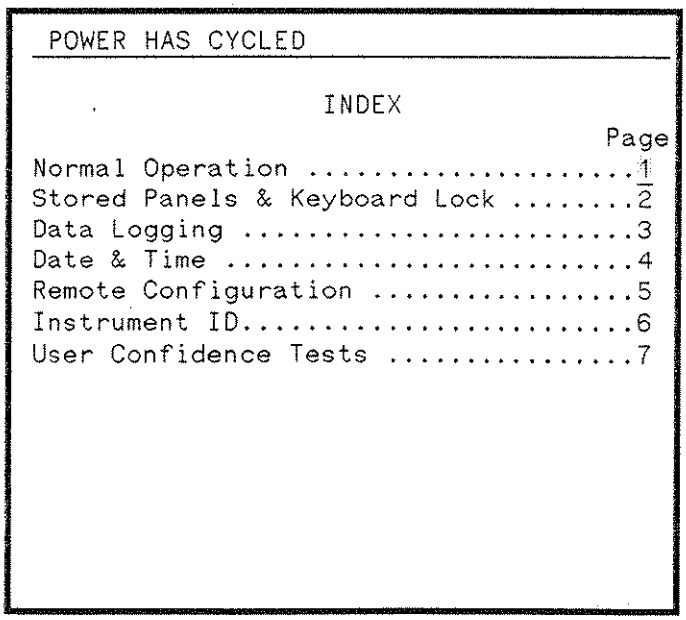
Connect the power cord and press the [POWER] switch.

The instrument will run its power-up checks automatically (this lasts approximately 12 seconds). During the power-up checks the front panel indicators will come on and the beeper will beep. When the instrument passes the power-up test, the first line of the display will show POWER HAS CYCLED. This message will be cleared when any key is pressed.

The first display will be the "INDEX" page with the flashing cursor positioned at the first item.

Normal Operation . . . 1

Check the state of the gating led above the [START/STOP] key. If it is on, press the [START/STOP] key to switch it off.



Setting the Instrument to the Default State

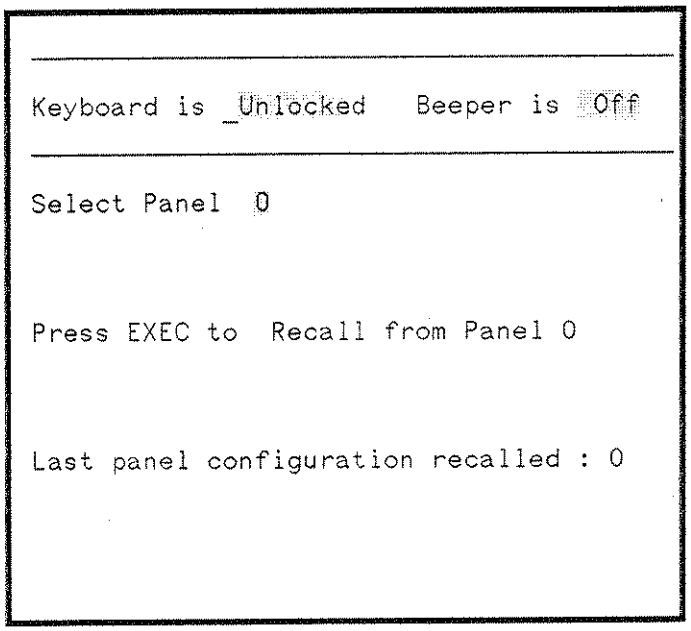
The instrument automatically starts up in the state it was in when it was last switched off. To start from a known state you may recall a fixed setup stored in the instruments memory.

Use the CURSOR [↑] and [↓] keys to move the flashing cursor to:

Stored Panels & Keyboard Lock . . . 2

then press the [PAGE/INDEX] key.

The "Stored Panels and Keyboard Lock" page is now displayed.



Use the CURSOR keys to move the cursor to Select Panel and use the CHANGE keys to select 0.

Press the [EXEC] key to recall panel 0. Panel 0 is a fixed state permanently stored in the instrument - later you will see how to store your own selections in panels 1 to 9.

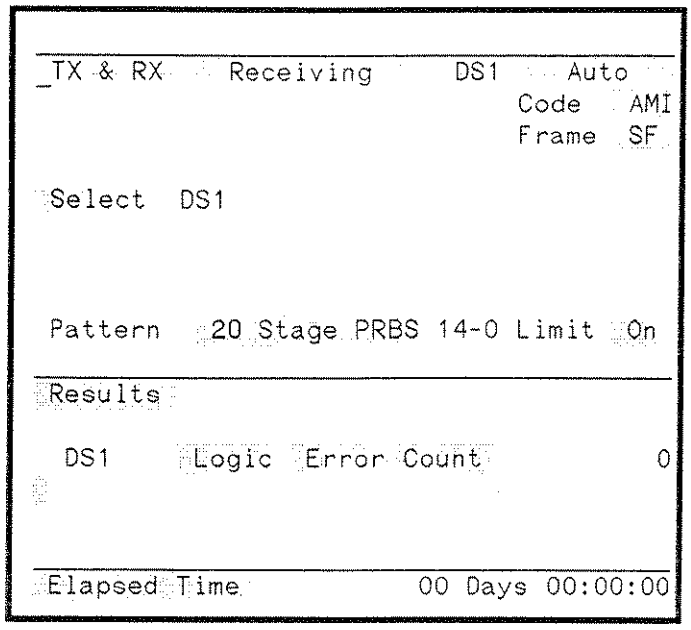
Press the [PAGE/INDEX] key to return to the "INDEX" page.

Use the CURSOR keys to move the cursor to:

Normal Operation . . . 1

Press [PAGE/INDEX] again to display the "Normal Operation" Receiving page.

Note that since measurement results are held until a new measurement is started the result of the previous measurement may be displayed at this stage. The result will be reset to 0 when you start your measurement.



- Result of previous measurement may be displayed here.

- Elapsed time of previous measurement may be displayed here.

Making a DS1 Measurement and Adding Single Errors

In the first trial run the transmitter is set to add single errors and the receiver to make logic (binary) error measurements at DS1. The transmitter and receiver are then looped to make a back-to-back measurement.

Selecting the Measurement

The measurement is selected by selecting the results required. As the default state is a logic error count measurement at DS1, you have already selected what you want by recalling panel 0. All you need to do is set a suitable gating interval and the type of error to be added.

REMEMBER:

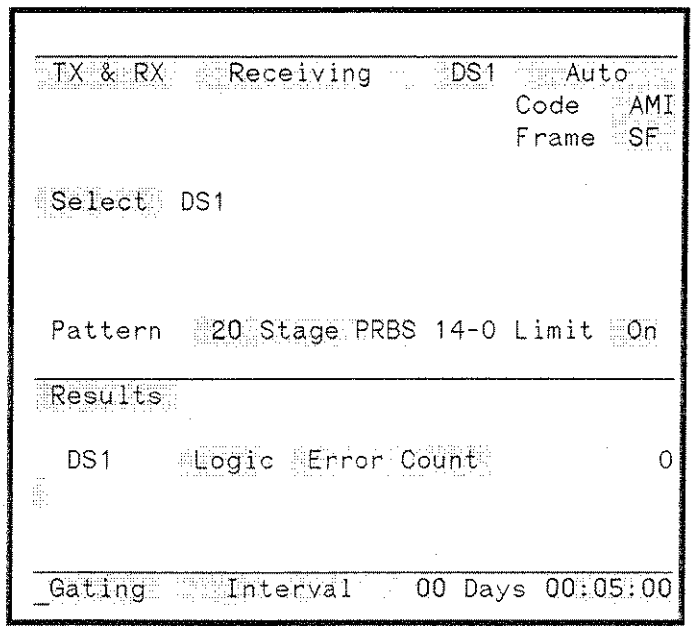
CURSOR keys ------Move the cursor in the direction of the arrow on the key.

CHANGE keys ------Change the parameter indicated by the cursor.

Set the display from top left to bottom right.

Setting the Gating Interval

Move the cursor to Elapsed Time (at the bottom of the screen) and use the NEXT key to change it to Gating. Move the cursor to Manual and use the NEXT key to change it to Interval. Additional fields will appear in the form DD days HH : MM : SS (Hours : Minutes : Seconds) to allow the interval to be set. Move the cursor to the minutes field and use the NEXT key to set 5 minutes .



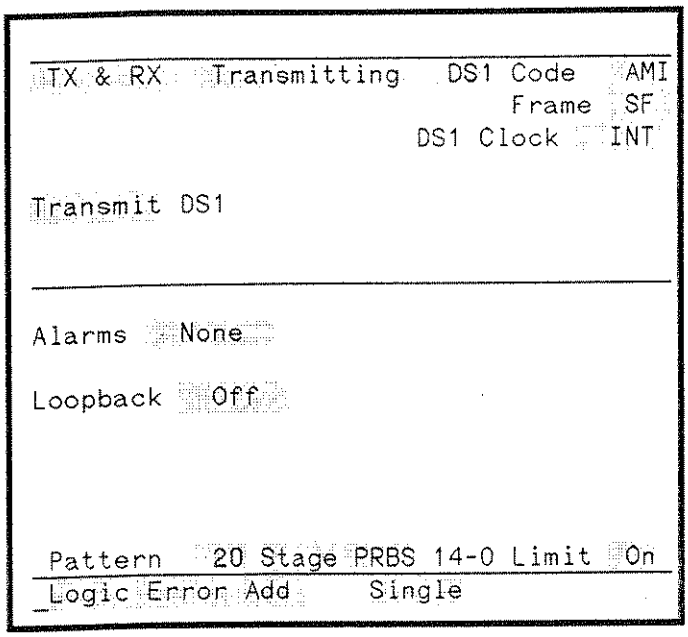
- Gating Interval set to 5 minutes.

Setting Single Error Add

Move the cursor to Receiving (at the top of the screen) and press NEXT. The Transmitting settings are now displayed.

The default state is "No Error Add".

To enable the SINGLE ERROR key for the addition of logic errors use the CURSOR and CHANGE keys to set the display as shown:



- Select Logic Error Add and then Single.

Recall the Receiving Display to See the Results

Move the cursor to Transmitting and press [NEXT]. The Receiving settings are now displayed.

Making the Measurement and Adding Single Errors

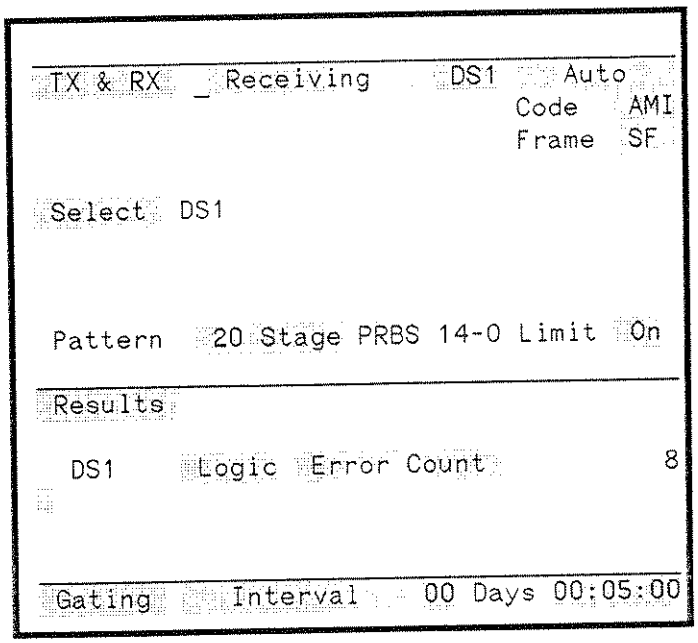
Now that both the transmitter and receiver are set to make the measurement, you are ready to run it.

As the transmitter output is active it is good practice not to connect the instrument to the system under test before this stage.

Connect the TX OUTPUT DSX-1/1C to the RX INPUT DS1/1C with a WECO 310 to WECO 310 cable.

Press the [START/STOP] key to start the measurement. The gating led above the [START/STOP] key will come on.

Press the [SINGLE ERROR] key several times to add errors to the transmitted signal. Observe these errors accumulating on the displayed Logic Error result. They will also be indicated by the ERRORS/HITS led on the front panel.



- Error Count results display.

You are now making a 5-minute DS1 error measurement. To override the selected 5 minute Gating Interval you may press the (START/STOP) key to stop the measurement.

Making a DS1 Measurement & Adding a Fixed Error Ratio

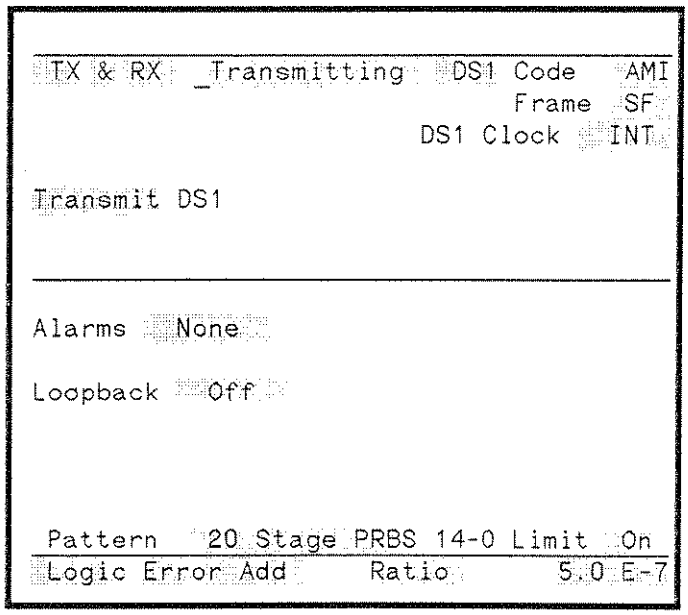
In the second trial run you add a fixed error ratio to the transmitted signal and look at error count and error ratio results during and after the measurement.

Setting the Transmitted Error Ratio

Move the cursor to Receiving and press [NEXT]. The Transmitting settings are now displayed.

Move the cursor to Logic Error Add Single and use the [NEXT] key to change it to Ratio.

A new field will appear after Ratio indicating the current setting. Move the cursor to this field and use the CHANGE keys to set the ratio to 5.0 E-7. The transmitter will now introduce 5 errors in 10^7 clock periods. You should now have the following display:



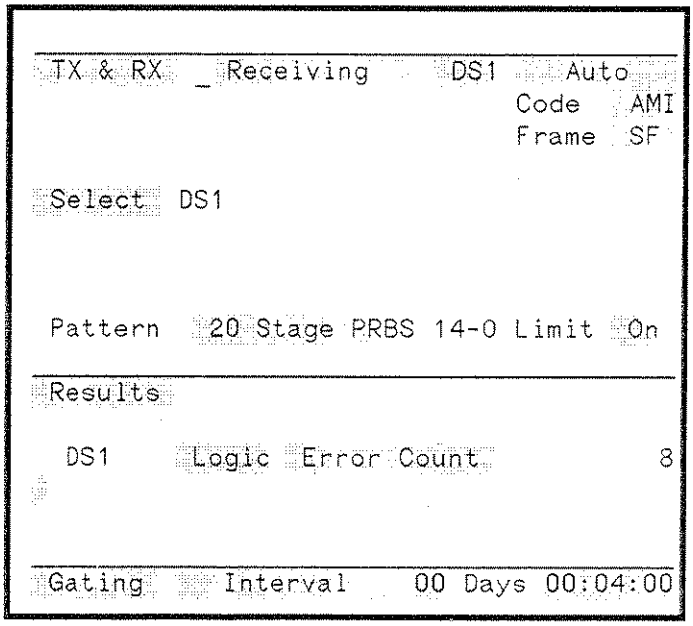
- Set Error Ratio.

Disregard the errors indicated on the ALARMS leds at this stage.

Setting the Gating Interval

Move the cursor to Transmitting and press [NEXT]. The Receiving settings are now displayed.

Use the CURSOR and [NEXT] keys to set the Gating Interval to 4 minutes as shown below:



- Result of previous measurement. This will be reset to 0 when you press [START/STOP].

- Gating Interval set to 4 minutes.

Making the Measurement and Reading the Results

Press the [START/STOP] key to start the measurement.

The ERRORS/HITS leds and the Error Count display will indicate each error received as before.

Use the CURSOR keys to move the cursor to Error Count and use the [NEXT] key to change it to Error Ratio.

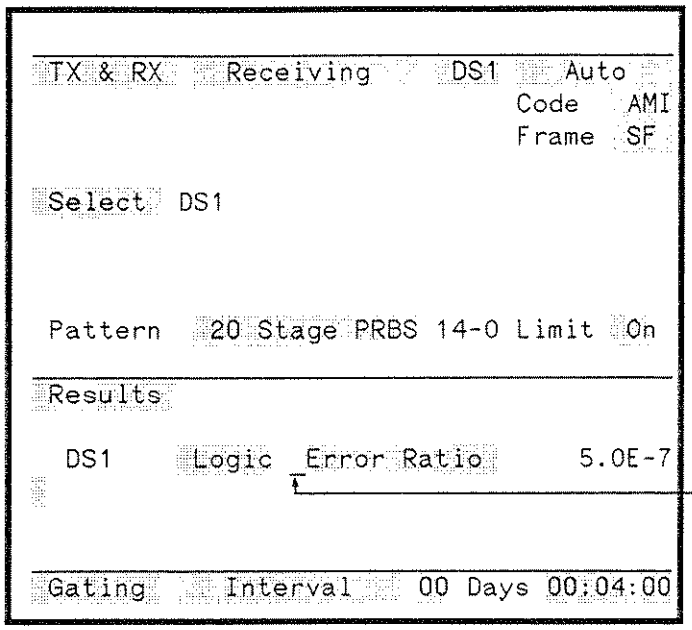
The displayed value is the currently calculated ratio and will be approaching 5.0 in 10^{-7}.

Use the [NEXT] key to display each of the logic error measurements in turn:

Synchronous Error Seconds	Sync Err Secs
Asynchronous Error Seconds	Async Err Sec
Asynchronous Error Free Seconds	Async E.F.S.
% Error Free Seconds	% E.F.S.
Error Count	Error Count
Error Ratio	Error Ratio

Use the CURSOR and [NEXT] keys to change Gating to Elapsed Time. The display will show the time that the measurement has been running. When this reaches 4 minutes the measurement will stop and the gating led will go off automatically.

You can now use the CURSOR and CHANGE keys to step through all the Logic Error Results.



- Error Ratio Result. With the cursor here the [NEXT] key is used to display each of the Logic Error Results.

- Change Gating to Elapsed Time to see how long the measurement has

Adding and Measuring Different Error Types

In this trial run you will add different error types to the transmitted signal and see their effect on the result. You also simulate power and signal loss and see their effect on the Alarm Durations display. Finally you will look at the Results Analysis.

You are going to measure two types of Error simultaneously. This is done by introducing a second Results line.

One of the points demonstrated is that only the type of error selected on the Results display is measured: logic, bipolar violations (BPV), frame, cyclic redundancy code (CRC) or, with Option 001 instruments, jitter.

As this run may take a little longer than the last one, the Gating Interval is set to 10 minutes.

Setting up a Second Simultaneous Measurement

Use the CURSOR keys to move the cursor to `Error Ratio` and use the [PREV] key to change it to `Error Count`. This gives a more immediate indication of error accumulation.

Use the CURSOR keys to move the cursor to the marker on the line below and press the [NEXT] key to display `DS1`. Move the cursor to the new fields defining this DS1 measurement and use the [NEXT] key to set them to `BPV` and `Error Count` as shown in the Figure below.

Use the CURSOR and [NEXT] keys to set the Gating Interval to 10 minutes.

```
TX & RX   Receiving   DS1   Auto
                              Code   AMI
                              Frame  SF

Select  DS1


 Pattern   20 Stage PRBS 14-0 Limit  On
Results

  DS1     Logic  Error Count          8
  DS1     BPV    Error Count          0

Gating    Interval   00 Days 00:10:00
```

- The second simultaneous measurement.

- Gating Interval set to 10 minutes.

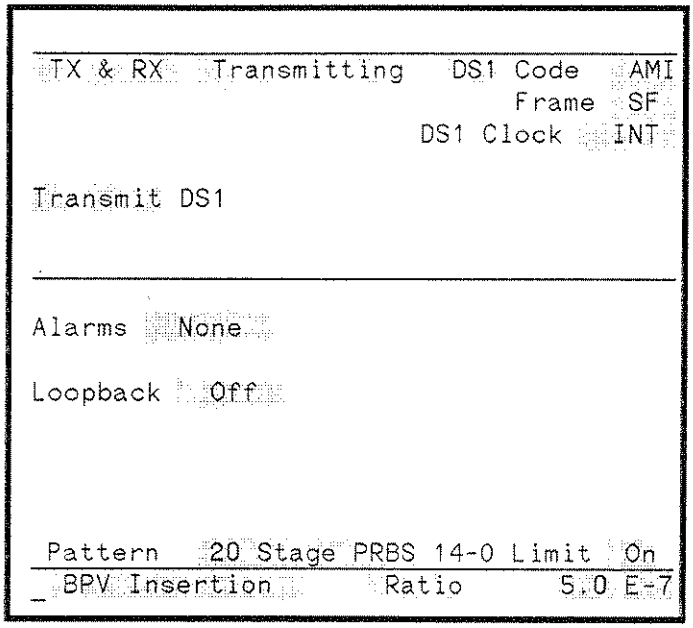
Press the [START/STOP] key to start a measurement and watch the received errors accumulate.

Note that the errors recorded are logic errors since you are inserting logic errors in the transmitted signal. No bipolar violations are recorded as you have not introduced any yet.

Changing the Type of Error Added

With the measurement still running (gating led on) use the CURSOR keys to move the cursor to Receiving and use the [NEXT] key to change it to Transmitting.

Use the CURSOR and [NEXT] keys to change Logic Error Add to BPV Insertion.

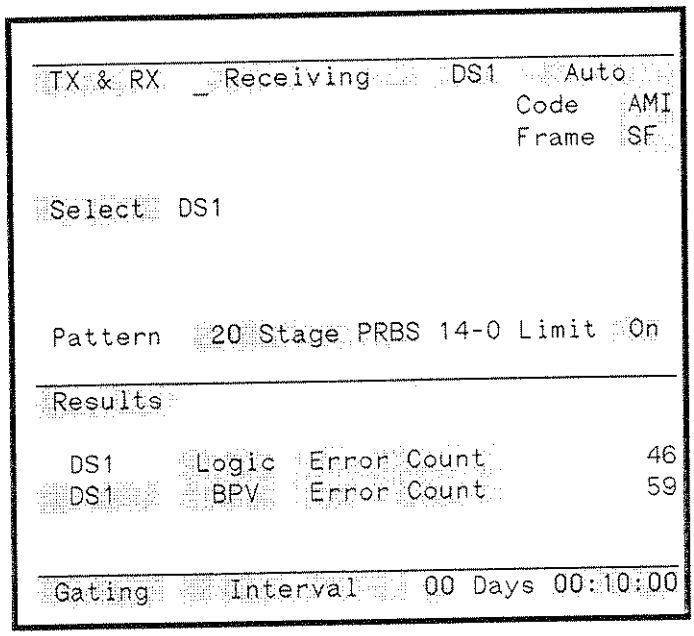


- Change to BPV Insertion.

Code errors are now being added to the transmitted signal.

Use the CURSOR keys to move the cursor to Transmitting and use the [NEXT] key to change it back to Receiving.

Note that bipolar violations are being recorded on the Results display. Logic errors are no longer being introduced because BPVs are added by changing positive marks to negative marks and negative marks to positive marks.



- BPV errors now added.

Changing the Type of Error Measured

Now try to change the type of error being measured.

Check that the gating led is still on.

Use the CURSOR keys to move the cursor to BPV and press the NEXT key. It will not change and GATING IN PROGRESS will be displayed for a few seconds at the top of the display. This is because during a measurement you cannot change the type of error being measured.

Press the START/STOP key to stop the measurement.

Now press the NEXT key and you will find that you can change the the type of error to be measured to Frame, Jitter with Option 001 instruments, and Logic.

Redisplay BPV (second result) and press START/STOP to start new measurements.

Introducing Alarms and Analysis

Now you will simulate power and signal loss to demonstrate the Alarms and Analysis displays which are alternatives to the Results display.

Move the cursor to Receiving and use the [NEXT] key to change it to Transmitting.

Use the CURSOR and [PREV] keys to change the type of error added from BPV Insertion to Logic Error Add Rate 5.0 E-7.

Move the cursor to Transmitting and use the [NEXT] key to change it to Receiving.

Note that logic errors are being accumulated .

Simulate a power failure by switching the instrument off for several seconds and then switch it back on.

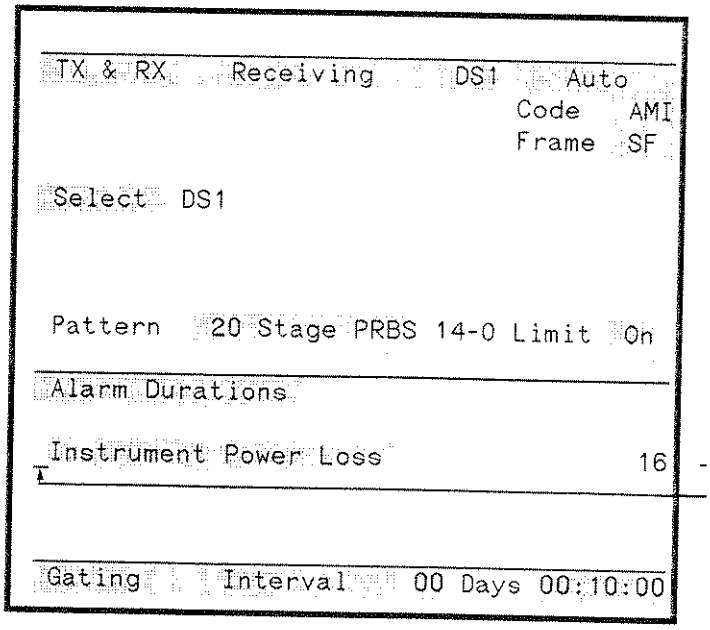
The "INDEX" page will be displayed. Press [PAGE/INDEX] to return the Receiving page to the display.

Note that your results are not lost and that the instrument is still gating.

Move the cursor to Results and use the [NEXT] key to display Alarm Durations.

Move the cursor to the alarm duration measurement and use the [NEXT] key to display each of the following in turn: DS1 Pattern Loss, DS1 Frame Loss, AIS Seconds. Use the [NEXT] key again to display Instrument Power Loss.

Instrument Power Loss will show the number of seconds the instrument was not measuring due to power loss - this includes 12 seconds for power-up self test.

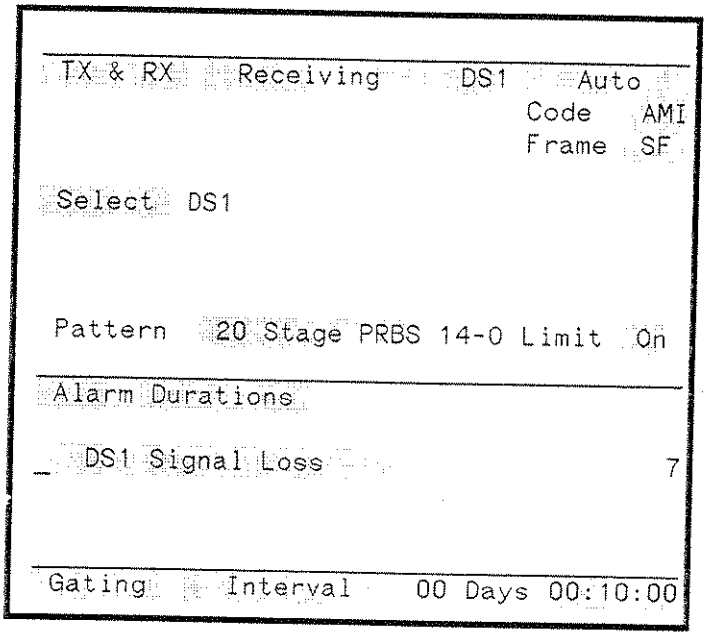


- Duration of Power Loss (seconds).
With the cursor here the [NEXT] key is used to display the Alarm Durations Results.

Use the NEXT key to set this display to DS1 Signal Loss.

Note that signal loss was not recorded during the power loss.

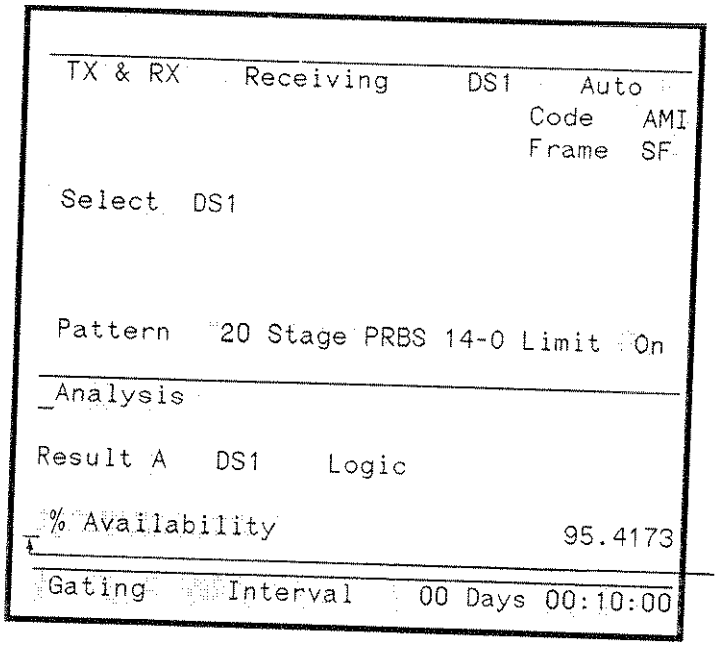
Pull out one of the Tx/Rx loop cable WECO connectors to produce signal loss. You will see the signal loss seconds accumulating on the display and being flagged by the ALARM led on the front panel. Reconnect the loop.



- Duration of Signal Loss (seconds).

Use the NEXT key to look at all the Alarm Durations measurements again.

DS1 Pattern Loss and DS1 Frame Loss may show a slightly longer time than Signal Loss because of the time required to regain alignment. Move the cursor to Alarm Durations and use the NEXT key to change it to Analysis.



With the cursor here the NEXT key is used to look at all the Analysis results.

You can look at all the Results Analysis displays while the measurement is still running:

% Availability

% Unavailability

% Severe E.S. - % Severely Errored Seconds

% Err Seconds - % Errored Seconds

% Deg. Minutes - % Degraded Minutes

Note that some of these results are triggered only with high error rates, e.g. % Availability may be 100% in this test.

Press the START/STOP key to stop the measurement. You can now repeat the operations to look at all of the results with the measurement complete. The results are held until the START/STOP key is used to start another measurement.

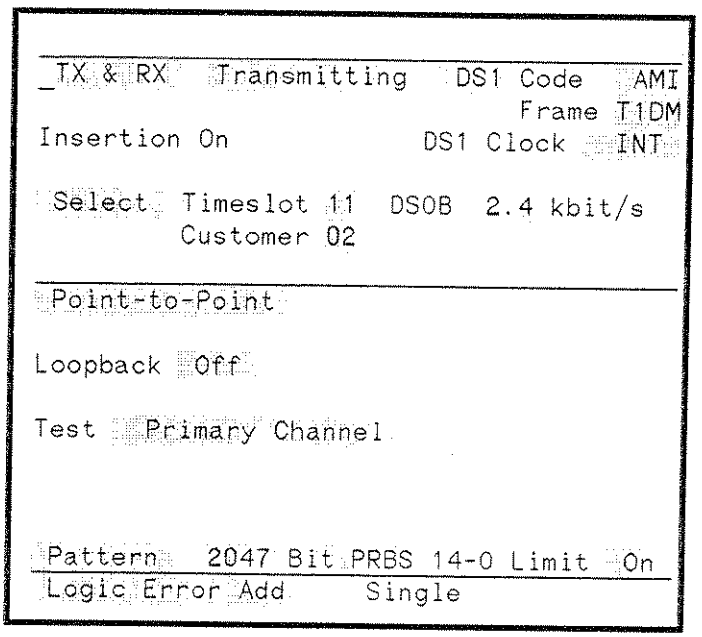
For a printout of results simply press the PRINT key. This produces a print-out on demand (only Results or Analysis fields currently displayed will be printed.) The printer can be set to produce printouts at fixed time intervals or under fixed error conditions (see the Printing/Logging Results section).

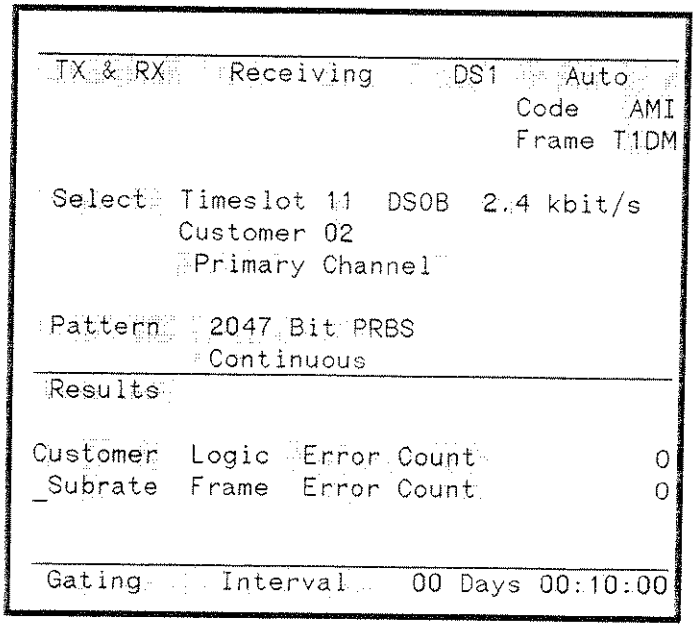
Making a DDS Measurement & Adding DS0B Frame Errors

In this trial run a test pattern is inserted into customer 2 of a DS0B signal, which is then transmitted in timeslot 11 of a multiplexed DS1 data stream. The receiver demultiplexes to the same customer 2, then measures the errors added to the test pattern. The cross connect voltage levels and path continuity are also checked.

Setting the Transmitter and Receiver for a DDS Measurement

Set the transmitter and receiver - remember, work from the top left of the display to the bottom right.



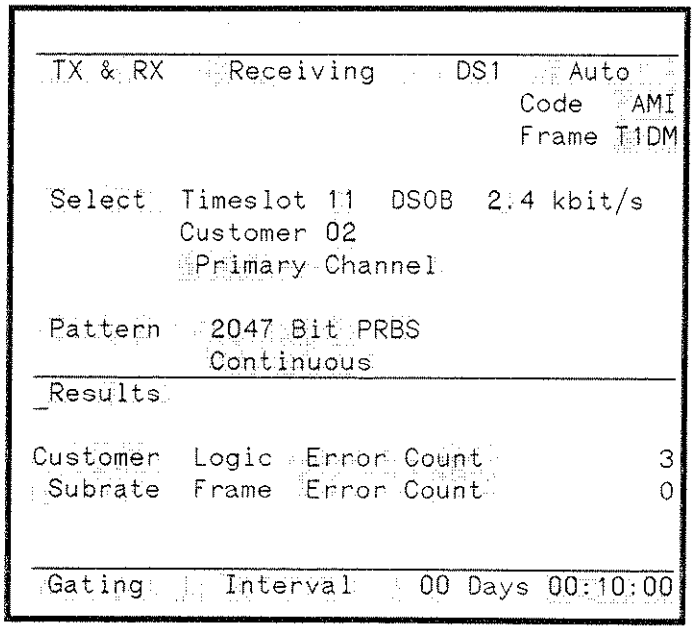


- Previous measurement results will be displayed.

Checking Path Continuity

Press the START/STOP key to start a measurement and so obtain an indication of received errors.

Press the SINGLE ERROR key and check that the logic errors inserted in the transmitted signal are measured by the receiver. This checks path continuity through the system under test.



- Single error recording checks path continuity.

Changing the Type of Error Added to Frame

With the measurement still running (gating led on) use the CURSOR keys to move the cursor to Receiving and use the NEXT key to change it to Transmitting.

Use the CURSOR and NEXT keys to change Logic Error Add to Sub Frame Err Add Single.

The SINGLE ERROR key will now add frame errors to the transmitted DS0B data.

Use the CURSOR keys to move the cursor to Transmitting and use the NEXT key to change it back to Receiving.

Press the SINGLE ERROR key to add frame errors and note that they are recorded on the Results display.

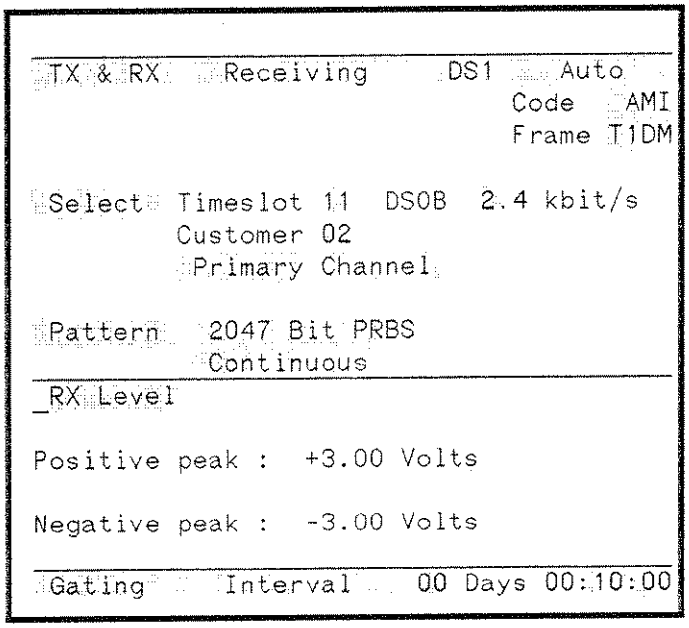
Press the START/STOP key to stop the measurement.

Checking Receiver Input Voltage Levels

Before making measurements at a DS1 cross-connect check the receiver input levels may be checked to confirm that the levels are within the recommended limits:

DSX-1 ± 2.4V to ± 3.6V
DSX-1C ± 2.8V to ± 4.5V

Move the cursor to Results and use the NEXT key to change the display to RX Level. The positive and negative peak voltages at the receiver input are displayed simultaneously but are updated alternately.



Updated alternately.

Storing and Recalling Measurement Set-ups

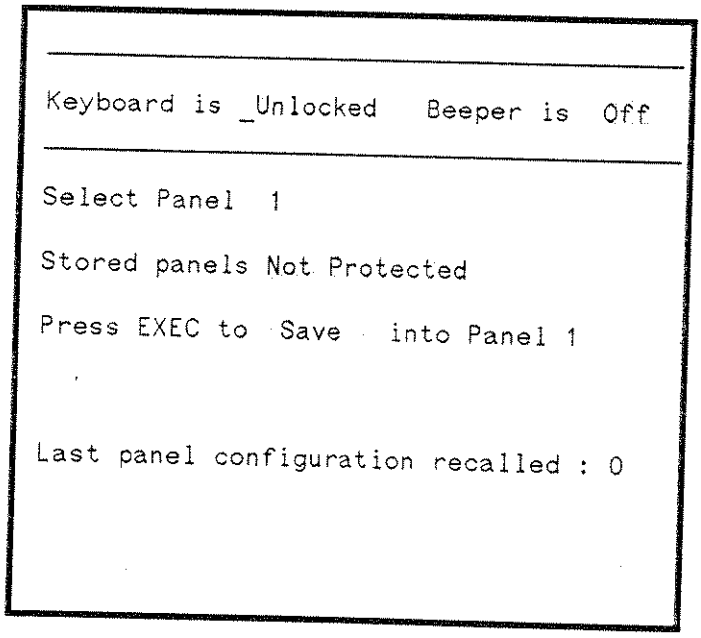
This trial run shows you how to use the "stored panels". These stored panels are preset instrument setups which are retained in the instruments memory, even after the power has been removed. One of the panels is fixed, the other 9 are selectable. In this trial run you store the current setup, recall the fixed setup (to reconfigure the instrument) and then recall the one you stored.

Storing a Panel

Use the PAGE/INDEX key to display the index and use the CURSOR keys to move the cursor to

Stored Panels & Keyboard Lock. . . 2

Press the PAGE/INDEX key again to access the Stored Panels display. Use the CURSOR and CHANGE keys to set the display as shown below:



- Current setup will be stored as Panel 1.

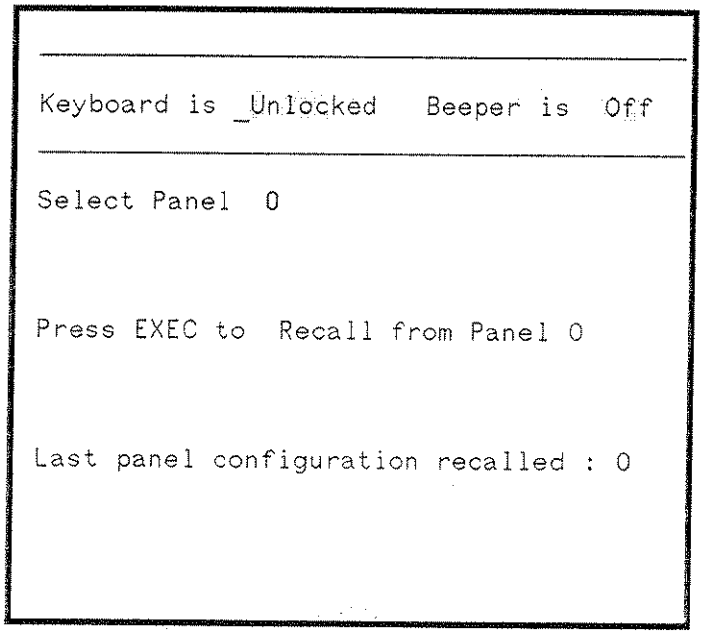
Press EXEC to store the last selected setup in "Stored Panel 1". This will be the setup (both Transmit and Receive) which you used for the DDS measurement.

The Not Protected display will automatically change to Protected. If in future, you wish to overwrite your stored panel you must first change this field from Protected to Not Protected.

Recalling the Fixed Stored Panel

Now use the CURSOR and CHANGE keys to set Select Panel 0.

Remember this is the factory default setting.



To access the selected panel press the EXEC key.

Press the PAGE/INDEX key again to return to the "INDEX" page and use the CURSOR keys to move the cursor to

Normal Operation. . . 1

Use the PAGE/INDEX key to display the "Normal Operation" page.

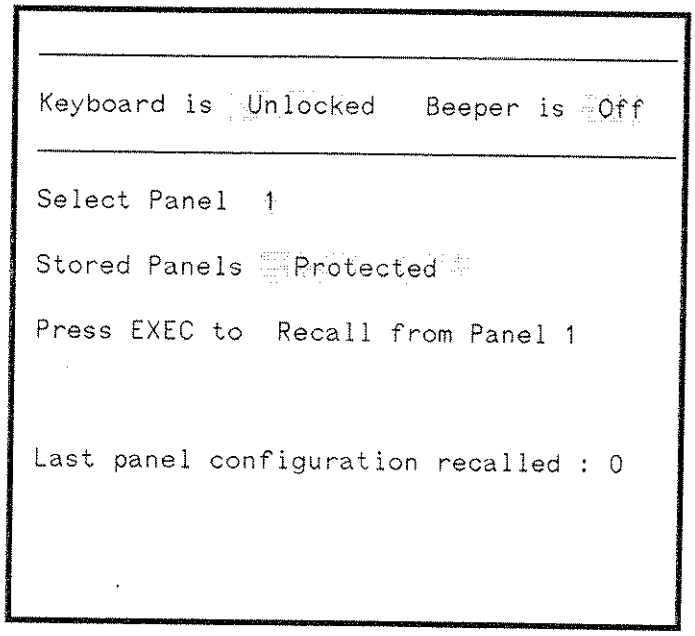
The instrument setup is now the one used for the DS1 trial run at the start of this exercise. This is permanently held in stored panel 0.

Recalling the Panel You Stored

Use the PAGE/INDEX key to display the "INDEX" and use the CURSOR keys to move the cursor to

Stored Panels & Keyboard Lock. . . 2

Press the PAGE/INDEX key again to obtain the Stored Panels display. Use the CURSOR and CHANGE keys to set the display as shown below:



Now press EXEC to recall the panel you stored in Stored Panel 1.

Press the PAGE/INDEX key again to return to the "INDEX" page and use the CURSOR keys to move the cursor to

Normal Operation. . . 1

Use the PAGE/INDEX key to display the "Normal Operation" page.

The instrument setup is now the one used for the DDS measurement and stored at the beginning of this trial run.

What You Have Learned

BEFORE YOU START

Check the transmitter parameters before connecting to the equipment under test.

The setup and operation at power loss is restored when power is restored.

SETTING-UP

The transmitter and receiver are independent.

Setup display from top left to bottom right.

Stored panels are a quick and easy way to set up the instrument.

BEFORE THE MEASUREMENT

You can check cross-connect voltage levels by selecting RX Level. (DS1 & DS1C)

You can check path continuity using single error add.

The type of measurement is selected by setting the Results display.

DURING THE MEASUREMENT

Results and result analysis can be monitored during the measurement.

Only the type of error selected in Results is recorded.

You can add errors singly or at a selectable rate.

You can change the type of error added but not the type of error measured.

During power loss only Power Loss Seconds are recorded.

START/STOP controls measurement gating; the key overrides the display setting.

AFTER THE MEASUREMENT

Results are held until the next measurement START.

The PRINT key produces results print out on demand. START/STOP key to stop the measurement.

Selected Applications 2

Introduction

This section shows how to use the network control and interface capabilities of the HP 3787B in typical applications. An example of the instrument's Normal Operation displays is given for each of these applications. This section does not tell you how to set up the display or give full details of the measurement capability in any particular application. These details are in the Operating Manual.

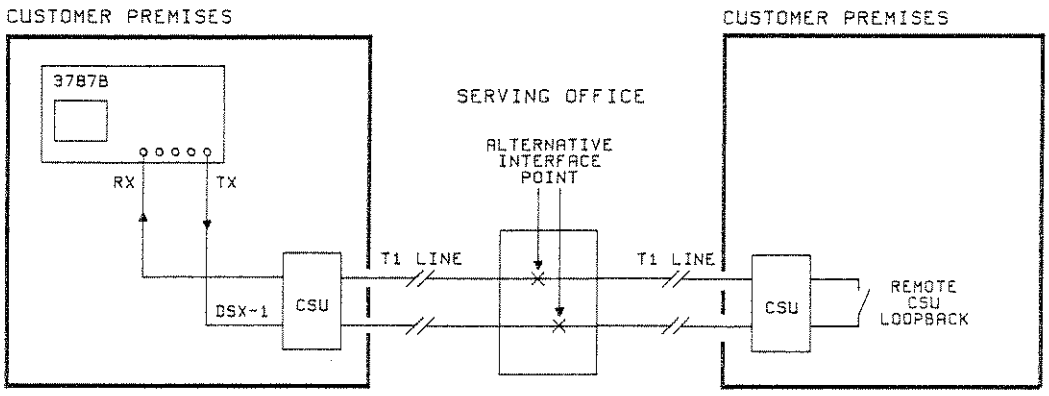
The applications covered in this section are:

DS1 In-Band Loopback

Application

In situations where DS1 Channel Service Units (CSUs) are capable of performing DS1 in-band remote loopback, the HP 3787B can loop-up a remote CSU, perform a bit error measurement and loop-down the remote CSU.

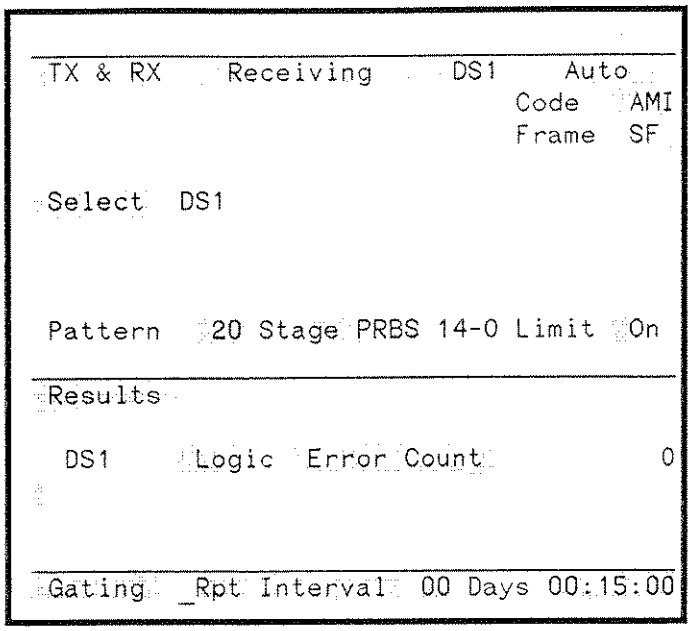
Measurement Configuration



Example: Looping a remote CSU from a customer premises to make a logic error measurement.

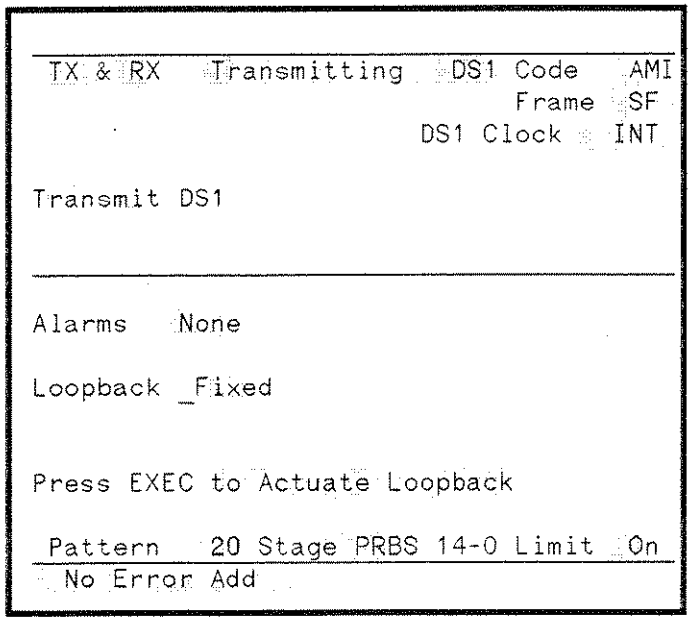
This example checks for errors in each of 3 successive 15 minute gating intervals. Typically this should be less than 20 since 14 corresponds to an error ratio of 10^{-8}. You can do this by using Repetitive Gating with a 15 minute interval, and printing an End-of-Gating Summary. See the Printing/Logging Results section for print selection information. The code and framing used in this example are AMI and SF. Set the code and framing parameters on the Receiving **and** Transmitting displays.

DS1 Loopback, Sample Receiving Display



- Set the receive interface.
- You are going to make your measurement on the complete DS1.
- Select the test Pattern.
- Select the measurement.
- Set the measurement Gating Interval.

DS1 Loopback, Sample Transmitting Display



- Set the transmit interface.
- Insert the test pattern in the complete DS1.
- Select the Fixed-format latching Loopback.

Initiate the loop-up by pressing the [EXEC] key. "Loopback operation in progress" will flash on the display while the loop is being set. This takes approximately 8 seconds after which "Press EXEC to Release Loopback" is displayed.

Confirmation of Loopback

You can check that loopback has been achieved by one of the following indicators:

An indicator on the local CSU.
Pattern sync indication on the HP 3787B ALARM indicator.
Normal levels of error count.
Adding single errors and seeing them detected on the ERRORS/HITS alarm.

Make the Measurement

Press the START/STOP key.

Remember that with Rpt Interval gating the results are not displayed until the end of each gating interval. They then remain displayed through the following gating interval.

When three results have been printed/displayed press the START/STOP key to stop the measurement.

Clear the Loopback after the Measurement

Press the EXEC key. "Loopback operation in progress" will flash on the display for approximately 8 seconds while the loop is being cleared.

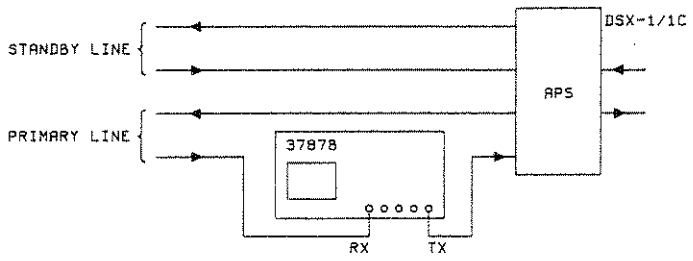
Automatic Protection Switch (APS) Testing

Application

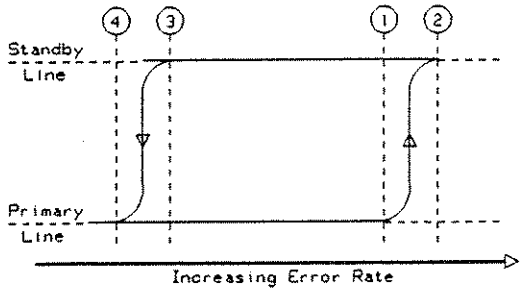
Checking the capability of an automatic protection switch (APS) to change between the primary and standby lines at specified code error rates.

Measurement Configuration

A typical APS test configuration is shown below.



Example: Code errors are introduced at four independently selectable error rates to check the APS switching characteristic. A typical switching characteristic is shown below where points 1 thru 4 correspond to the error rate thresholds set on the HP 3787B.



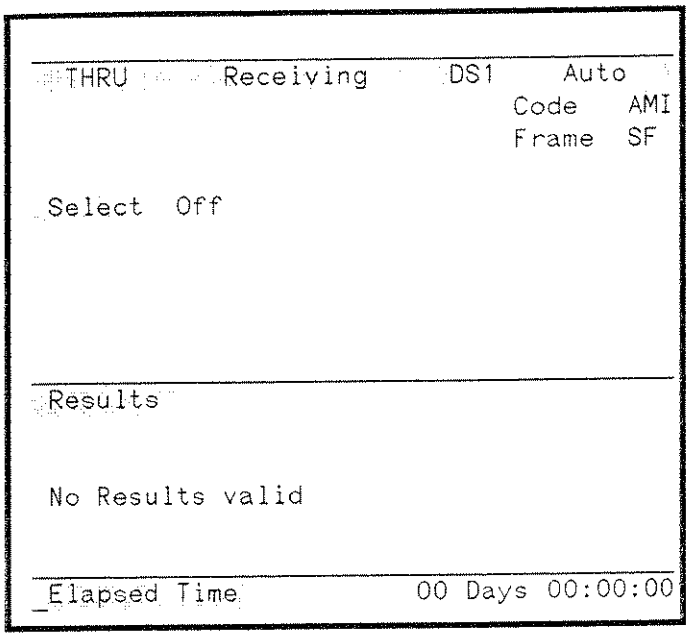
1. No Transfer - APS remains on Primary Line
2. Transfer - APS switches to Standby Line
3. No Restore - APS remains on Standby Line
4. Restore - APS returns to Primary Line

For this test the 3787B operates in the THRU mode.

The code and framing used in this example are AMI and SF framing. These must be compatible with the line and switch being tested and may be set on either the Receiving **or** Retransmitting displays.

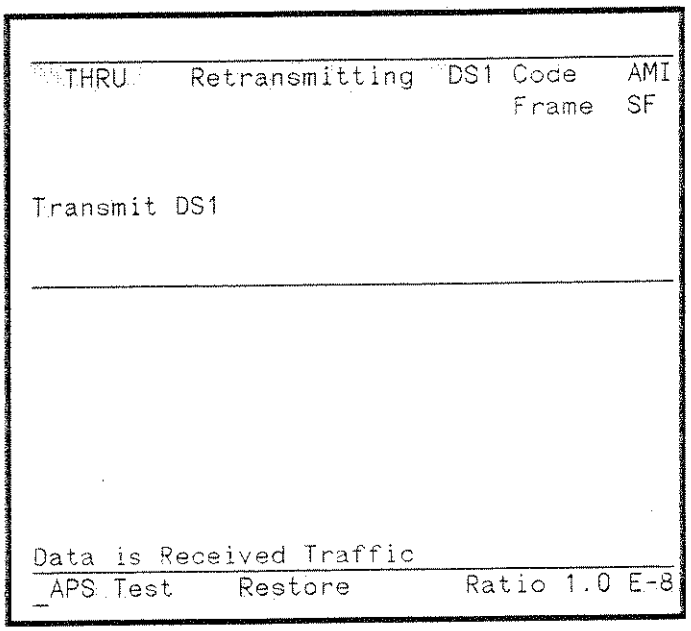
Set the No Transfer, Transfer, Restore, and No Restore ratio thresholds appropriate to the protection equipment type. An error free signal is transmitted in the Start state.

APS Test, Sample Receiving Display



- Set the receive interface.
- In Thru mode you can choose not to measure or demultiplex the received signal.

APS Test, Sample Retransmitting Display



- Transmitter interface tracks the receiver interface in THRU mode.
- Set to retransmit the received DS1.
- Set up the No Transfer, Transfer, No Restore and Restore ratio to the threshold values for the switch type to be tested.

Make the Measurement

Move the cursor to Start and check that the indicators on the APS equipment show correct operation when the [NEXT] key is used to select No Transfer, Transfer, No Restore, and Restore.

DS1 Data Multiplexer Testing

Application

The HP 3787B allows you to measure the performance of T1DM data multiplexers. This can be done from DS0A to DS0A or DS1 to DS1 by looping the multiplexer.

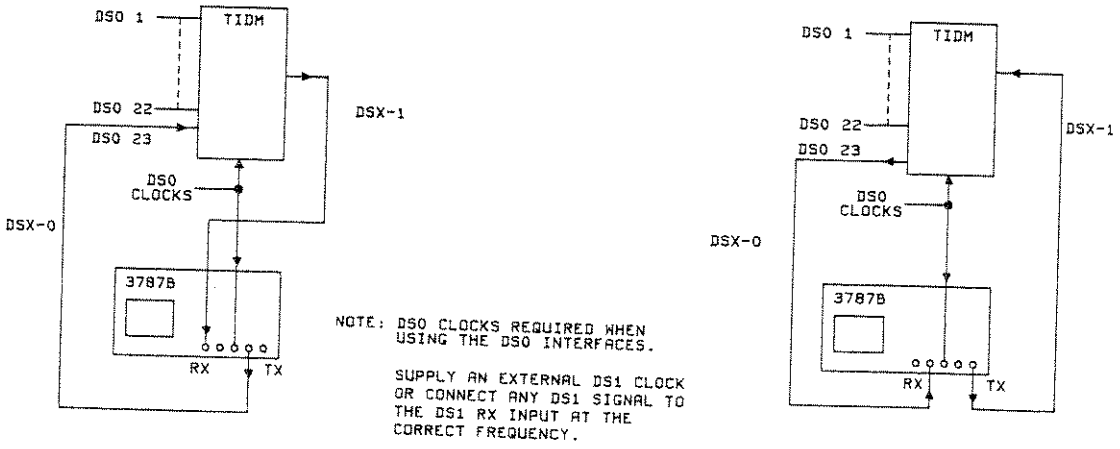
Alternately by using the multiplexing/demultiplexing capability of the HP 3787B you can make half-channel measurements (i.e. DS0 to DS1 and DS1 to DS0).

Note that this configuration is equally applicable to T1WB4 and T1WB5 testing.

Measurement Configuration

NOTE

T1WB4/5 Multiplexer testing is similar to T1DM testing.

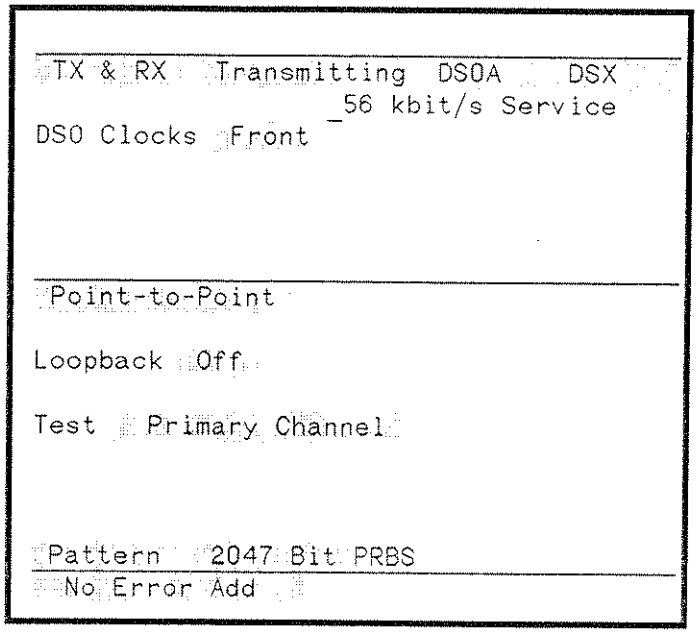


Example: Test a T1DM using the half-channel method with a timeslot assigned to a 56 kbit/s customer.

DSX-0A to DSX-1

The DS0 port to be tested is stimulated by the HP 3787B DS0 transmitter. The DSX-1 output of the T1DM is connected to the HP 3787B DS1 receiver which demultiplexes the timeslot under test and performs error measurements on it.

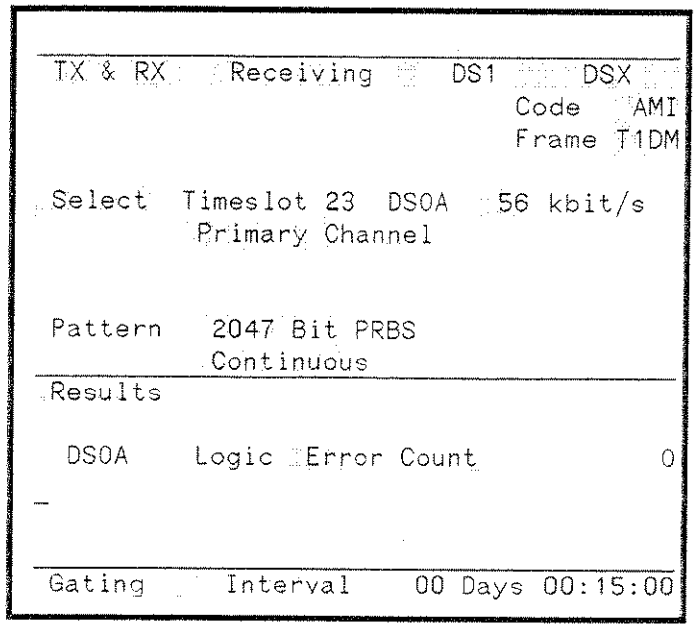
DSX-0A to DSX-1 Test, Sample Transmitting Display



- Set the transmit interface.

- Select the test Pattern.

DS0 to DS1 Test, Sample Receiving Display



- Set the receive interface.

- Demultiplex the Timeslot to be tested.

- Select the test Pattern.

- Select the measurement.

- Set the measurement Gating Interval.

Make the Measurement

Press the START/STOP key.

Remember that you can display Alarm Durations, Analysis, the Received Word and the received DS1 voltage level by changing the Results field.

DSX-1 to DSX-0A

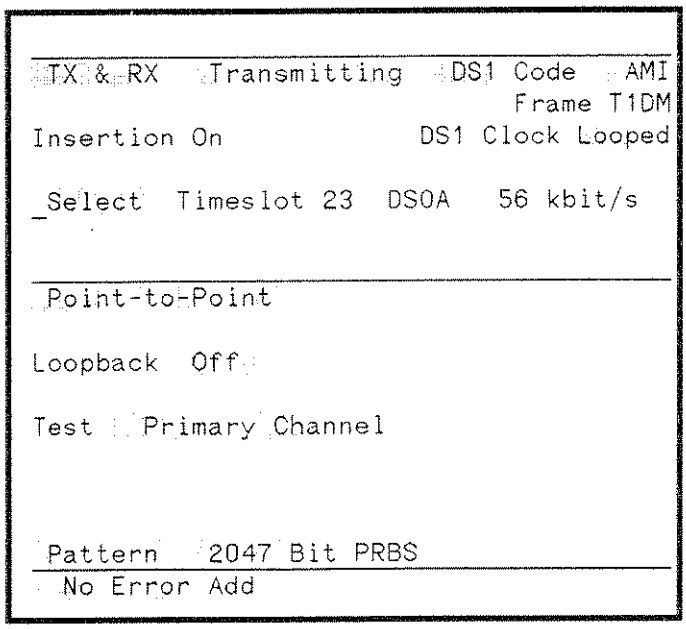
The DSX-1 input port of the T1DM is connected to the HP 3787B DS1 transmitter which stimulates the timeslot under test. The corresponding DSX-0A output of the T1DM is connected to the HP 3787B DS0 receiver which performs error measurements on it.

NOTE

For this test the HP 3787B must drive the T1DM input with a DS1 signal whose frequency is locked to the DS0 clock supplied to the T1DM and the HP 3787B. This can be achieved in two ways:

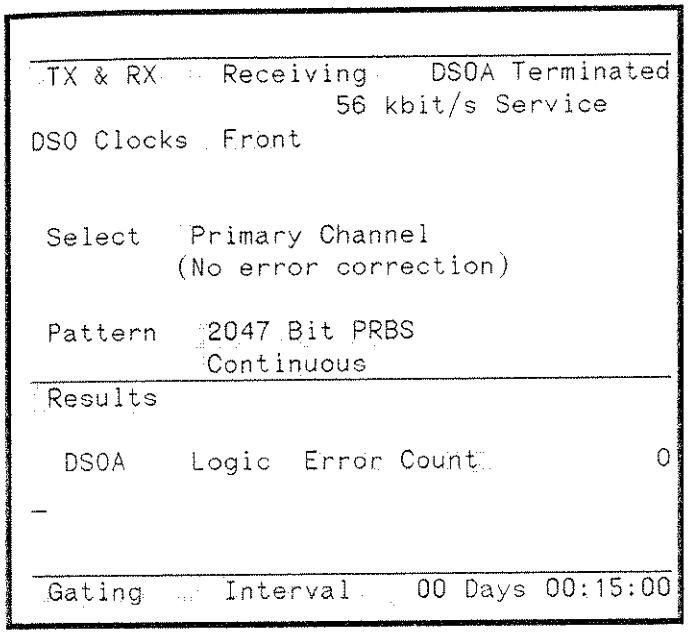
1) Supply a DS1 clock at the correct frequency to the HP 3787B rear-panel external clock input and select Ext DS1 Clock.
2) Supply any DS1 signal at the correct frequency to the DS1 receiver input and select Looped DS1 Clock. (The Receiver interface must **not** be set to DS1C).

DSX-1 to DSX-0A Test, Sample Transmitting Display



- Set the transmit interface.
- Select the DS1 Timeslot to be tested.
- Select the test Pattern.

DSX-1 to DSX-0A Test, Sample Receiving Display



- Set the receive interface.
- Select the test Pattern.
- Select the measurement.
- Set the measurement Gating Interval.

Make the Measurement

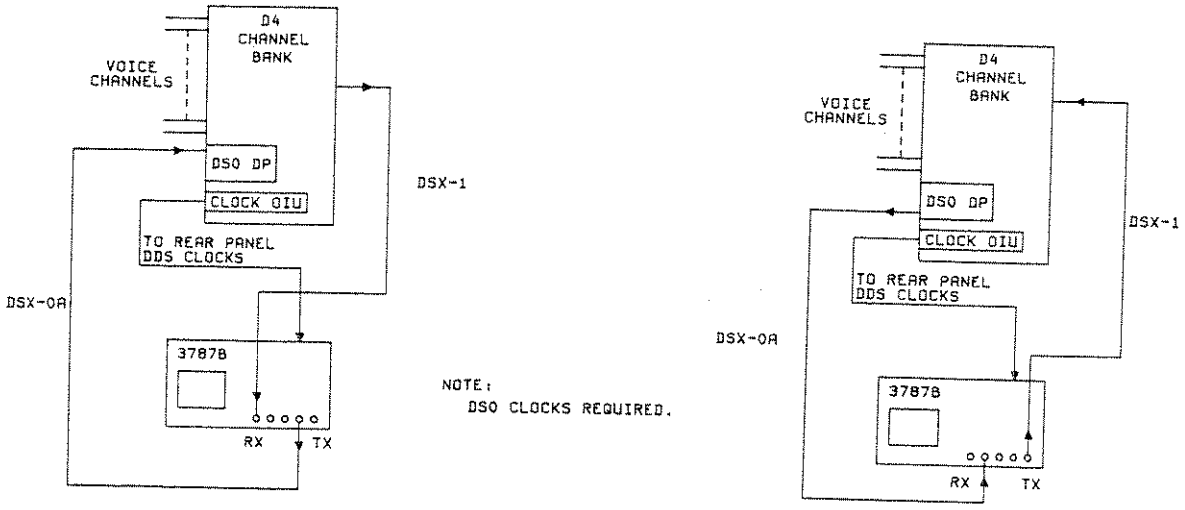
Press the START/STOP key.

Remember that you can display Alarm Durations, Analysis, the Received Word and the received DS1 voltage level by changing the Results field.

Dataport Testing

The HP 3787B allows you to measure the performance of Dataport cards installed in channel banks. This can be done from DS0A to DS0A or DS1 to DS1 by looping the channel bank. Alternatively by using the multiplexing/demultiplexing capability of the HP 3787B you can make half-channel measurements (i.e. DS0 to DS1 and DS1 to DS0).

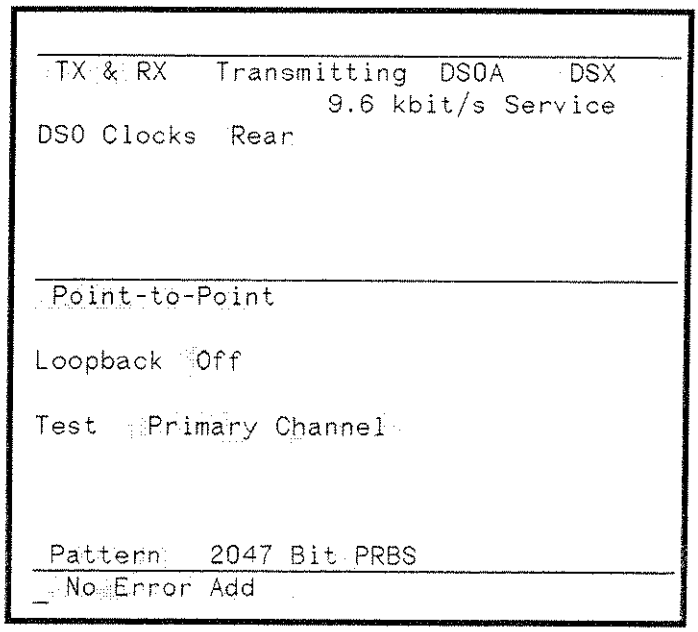
Measurement Configuration



Example: Test a DS0DP Dataport card in a D4 channel bank using the half-channel method. For this test the data rate can be 2.4, 4.8, 9.6 or 56 kbit/s. The 9.6 kbit/s rate has been chosen for this example.

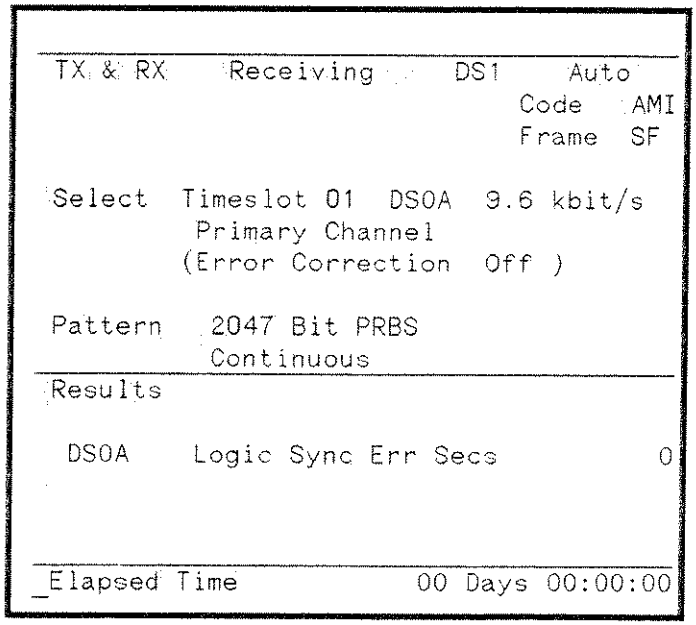
DSX-0A to DS1

Dataport DSX-0A to DS1, Sample Transmitting Display



- Set the transmit interface.
- If DS0 clocks (not complimentary bit and byte clocks) are supplied from the channel bank, use the rear panel input.
- Select the test Pattern.

Dataport DSX-0A to DS1, Sample Receiving Display



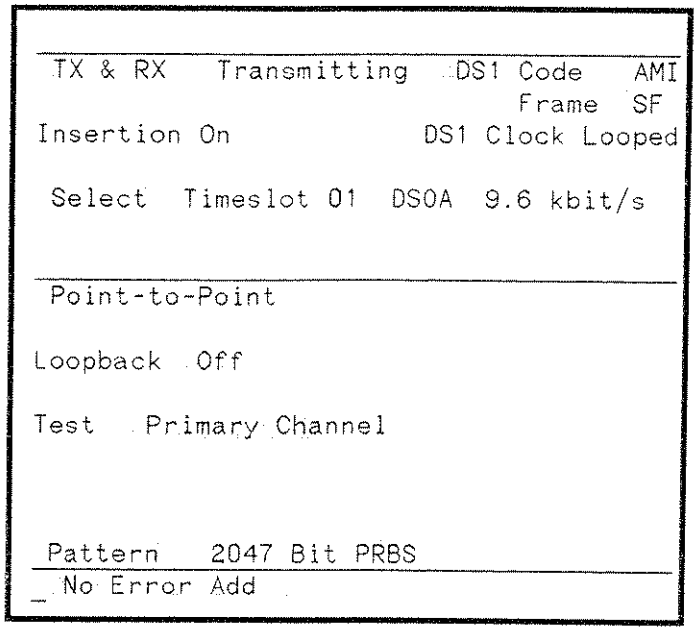
- Set the receive interface.
- Set the Timeslot number to the Dataport under test.
- Remember to select the same test Pattern as on the Transmitting display.
- Select the measurement.

Make the Measurement

Press the START/STOP key. Remember that you can display Alarm Durations, the Received Word (Monitor), RX level and Analysis by changing the Results field.

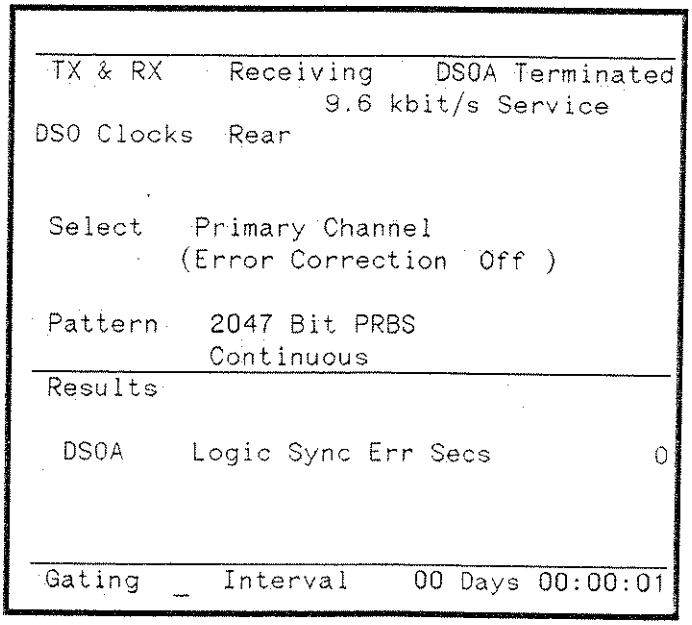
DS1 to DSX-0A

Dataport DS1 to DSX-0A, Sample Transmitting Display



- Set the transmit interface.
- Demultiplex the Timeslot to be tested.
- Select the test Pattern.

Dataport DS1 to DSX-0A, Sample Receiving Display



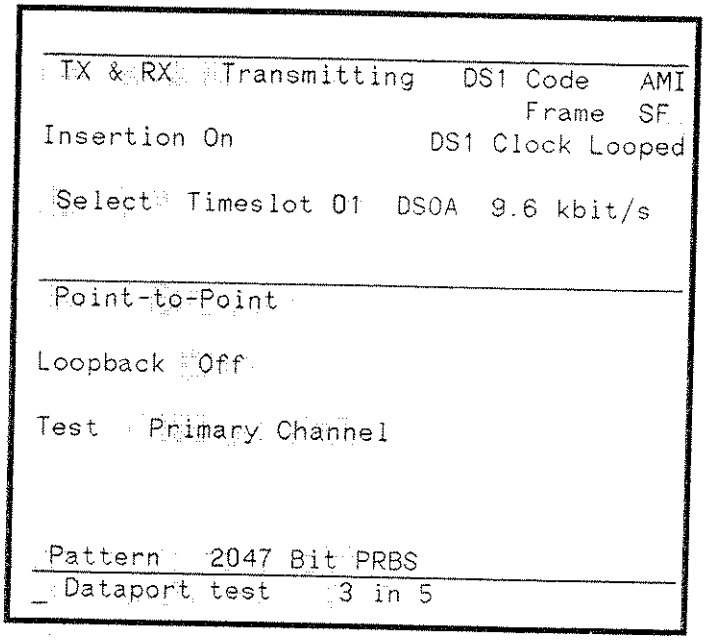
- Set the receive interface.
- If DS0 clocks (not complimentary bit and byte clocks) are supplied from the channel bank, use the rear-panel input.
- Remember to select the same test Pattern as on the transmitting display.
- Select the measurement.
- Set the measurement Gating Interval.

Make the Measurement

Press the START/STOP key.

Error Correction Testing

Dataport cards have a selectable error-correction capability in the DS1 to DS0A direction. The HP 3787B can generate errored data to test this at all subrates. With 3-in-5 selected the Dataport error correction will fail to remove the inserted errors and the HP 3787B DS0 receiver should see the added errors. With 2-in-5 selected the Dataport error correction should remove all the inserted errors and the HP 3787B DS0 receiver should see no added errors.

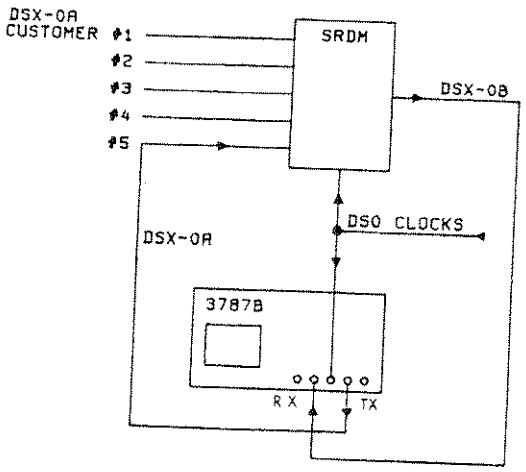


Sub-Rate Data Multiplexer (SRDM) Testing

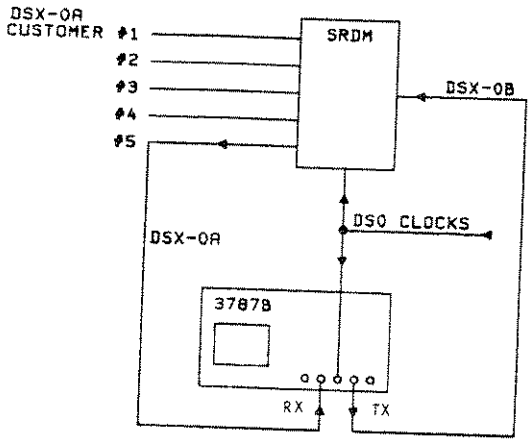
Application

You can run tests on SRDMs from DSX-0A to DSX-0B, and from DSX-0B to DSX-0A, at bit rates of 2.4, 4.8 or 9.6 kbit/s

Measurement Configuration



DSX-0A to DSX-0B



DSX-0B to DSX-0A

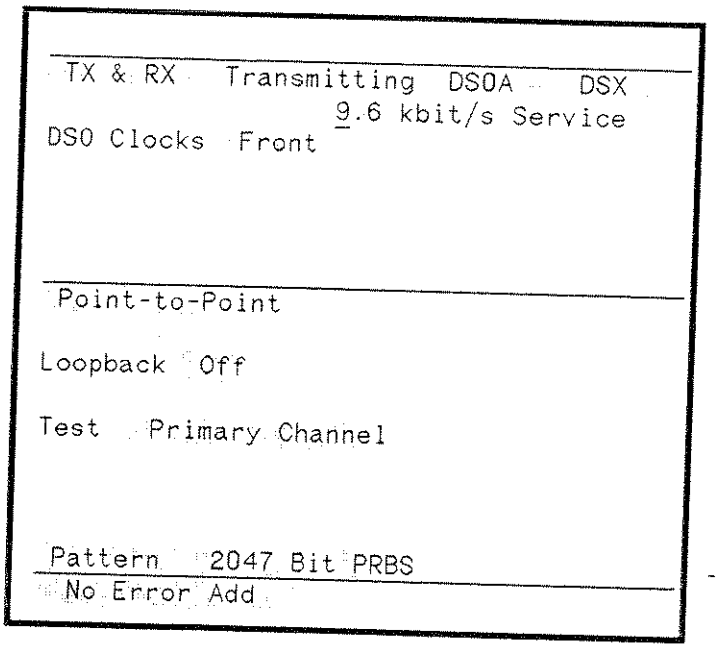
Example: DSX-0A to DSX-0B

In this example the SRDM is configured to multiplex five 9.6 kbit/s customers into a DS0B signal. 4.8 kbit/s and 2.4 kbit/s SRDMs have 10 or 20 inputs respectively. All can be tested by the HP 3787B.

NOTE

SRDMs are sometimes loaded with customers at service rates lower than the capacity of the multiplexer, eg a 2.4 kbit/s customer into a 9.6 kbit/s multiplexer. The HP 3787B can generate and test such signals.

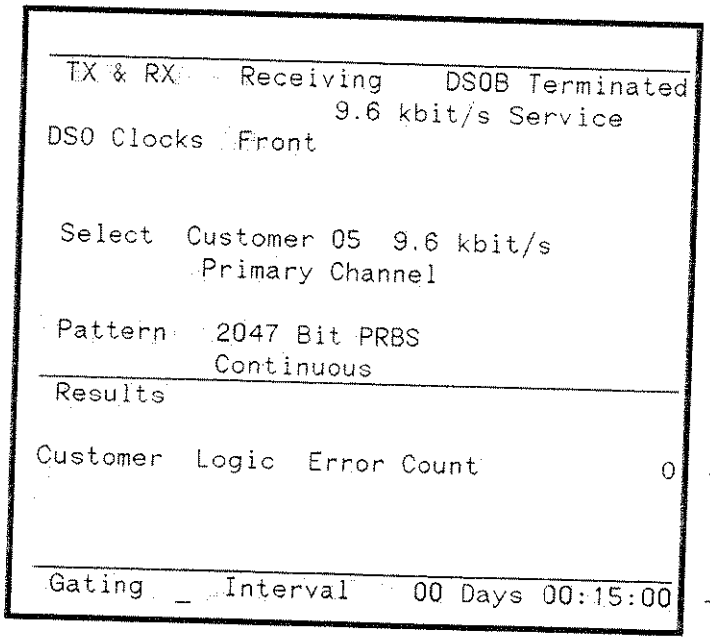
SRDM DS0A to DS0B, Sample Transmitting Display



- Set the transmit interface.

- Select the test Pattern.

SRDM DS0A to DS0B, Sample Receiving Display



- Set the receive interface.

- Select the customer under test.

- Remember to select the same test Pattern as on the Transmitting display.

- Select the measurement.

- Set the measurement Gating Interval.

Make the Measurement

Press the START/STOP key.

NOTE

If the other inputs to the SRDM are not connected, an all zero pattern may be detected in the DS0B. This will result in the SIGNAL LOSS led being illuminated. Measurements are valid in this condition.

Example: DSX-0B to DSX-0A

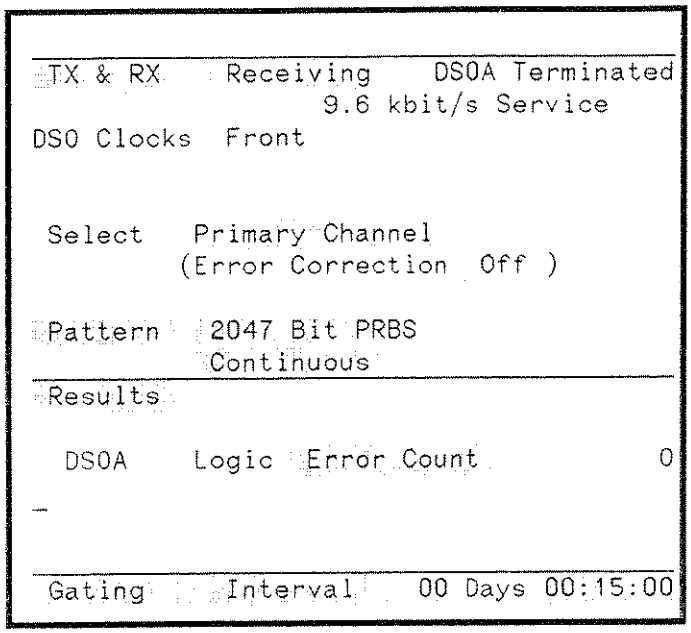
Select the DS0B Customer Number on the Transmitting display. This slot will be stimulated with the selected test Pattern; the other slots will be filled with TEST code.

SRDM DS0B to DS0A, Sample Transmitting Display

```
TX & RX   Transmitting  DS0B
                9.6 kbit/s Service
DS0 Clocks  Front


Transmit Customer 05  9.6 kbit/s
Point-to-Point

Loopback  Off

Test   Primary Channel



Pattern   2047 Bit PRBS
No Error Add
```

- Set the transmit interface.
- Select which customer to stimulate with the test Pattern.
- Select the test Pattern.

SRDM DS0B to DS0A, Sample Receiving Display



- Set the receive interface.
- Remember to select the same test Pattern as on the Transmitting display.
- Set the measurement Gating Interval.

Make the Measurement

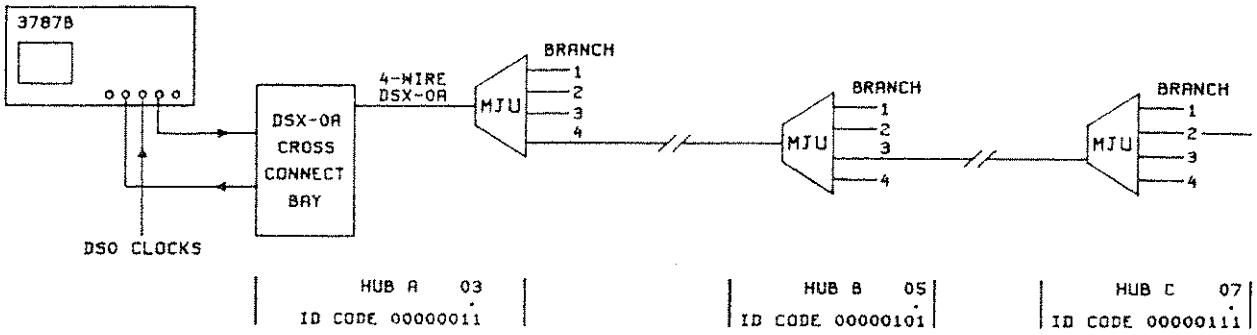
Press the START/STOP key.

Multipoint Junction Unit (MJU) Selection and Testing

Application

You can select, test, block, unblock and release all branches of a DDS Multi-point Circuit. Testing is normally performed downstream from a DSX-0A cross-connect bay by routing each Multi-point Junction Unit in turn. However, you can insert the relevant DS0A signal into a T1 stream.

Measurement Configuration



Example: Select HUB C branch 2 from the HUB A DSX-0A cross connect bay, perform a loopback, make a measurement and release the loopback.

Select Branch

The first operation is to establish the route through the system to the chosen branch. You do this by setting the transmit display for the branch of the first MJU, in this example branch 4, and pressing the EXEC key. When the branch has been selected, the Hub A ID code is returned and is displayed in the "Present" field. You then repeat the operation for branch 3 out of Hub B and branch 2 out of Hub C. This sequence is shown on the following Transmitting displays:

NOTE

The Receiver Pattern must be set to DDS Return codes for the transmitter to display the HUB-ID's.

Branch Selection, Sample Displays

```
TX & RX    Transmitting  DS0A     DSX
                      9.6 kbit/s Service
DS0 Clocks  Front
```

- Set the transmit interface.

```
_ Multipoint          Select Branch  4

                (Last branch selected X)

                      Present HUB-ID XX
                     Previous HUB-ID XX

Press EXEC to select branch
```

-Select Branch 4 out of Hub A.

- Press EXEC to select Branch 4.

```
_ Multipoint          Select Branch  4

                (Last branch selected 4)

                      Present HUB-ID 03
                     Previous HUB-ID XX

Press EXEC to select branch
```

- Branch 4 has been selected.

- Hub A ID code (03) has been returned.

```
_ Multipoint          Select Branch  3

                (Last branch selected 4)

                      Present HUB-ID 03
                     Previous HUB-ID XX
```

- Select Branch 3 out of Hub B.

Press EXEC to select Branch 3.

```
_ Multipoint          Select Branch  3

                (Last branch selected 3)

                      Present HUB-ID 05
                     Previous HUB-ID 03
```

- Branch 3 has been selected.

- Hub B ID code has been returned.

```
_ Multipoint          Select Branch  2
```

- Repeat the selection process for Hub C Branch 2.

- Press EXEC to select Branch 2.

```
                (Last branch selected 2)

                      Present HUB-ID 07
                     Previous HUB-ID 05
```

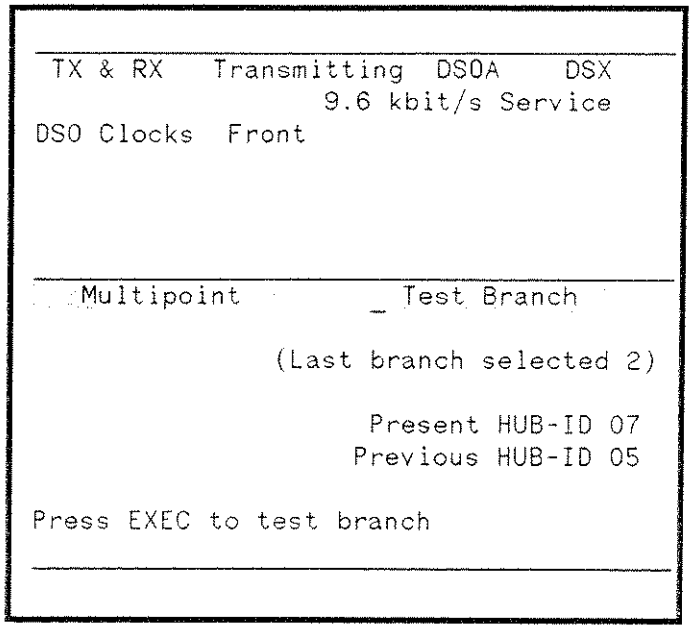
- Branch 2 has been selected.

- Hub C ID code has been returned.

NOTE

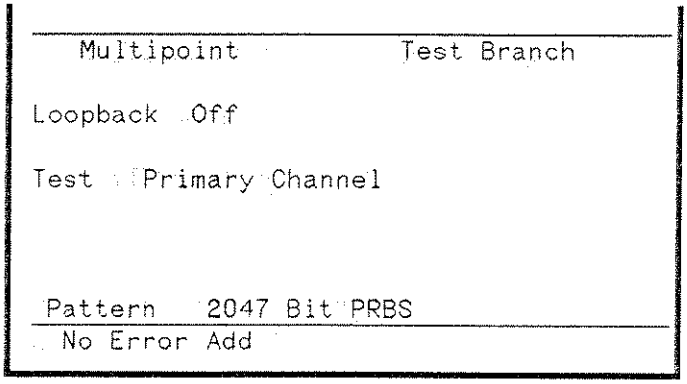
If the receiver is configured to receive routing acknowledments and fails to receive the correct acknowledgment within two seconds of EXEC the message "routing failed" is displayed and the display remains as XX and X respectively.

Test Branch



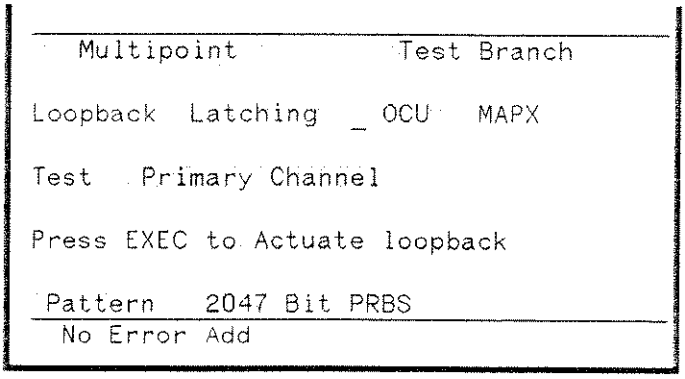
- Select Test Branch

- Press EXEC to enter the Test mode.



- At this stage the branch can be tested point-to-point but normally this is done by looping back the selected branch.

Setting Loopback and Test Pattern, Sample Display



- Select the type of Loopback.

- Select the test Pattern.

- Press EXEC to loop-up.

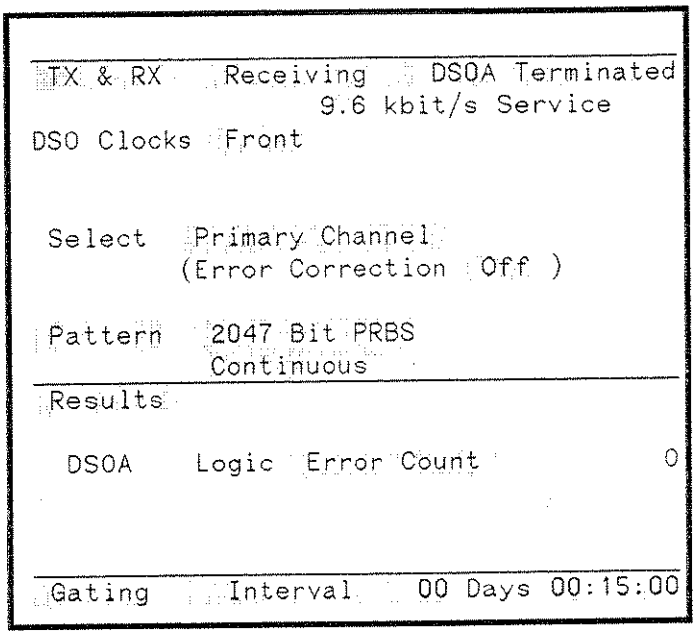
For information on Latching Loopback acknowledgment see page 2-30.

Set up the Receiver and Make the Measurement

Select the Receiving display, and set it to correspond with your transmitted test signal. Select the required Results and the Gating Interval.

Press the START/STOP key to start the measurement.

Setting Measurement, Sample Display



- Set the receive interface.

- Remember to select the same test Pattern as on the Transmitting display.

- Set the measurement Gating Interval.

After the Measurement

To release the loopback and route you have accessed select the Transmitting display. Press EXEC to release the loopback and change Test Branch to End Test. Press EXEC to release the Test route.

Releasing the Loopback, Sample Display

```
TX & RX  Transmitting  DSOA   DSX
                9.6 kbit/s Service
DSO Clocks  Front




  Multipoint          Test Branch

Loopback  Latching  _ OCU   MAP1

Test  Primary Channel

Press EXEC to Release Loopback

 Pattern  2047 Bit PRBS
  No Error Add
```

- Press EXEC to Release the Loopback.

Releasing the Route, Sample Display

```
TX & RX  Transmitting  DSOA   DSX
                9.6 kbit/s Service
DSO Clocks  Front




  Multipoint          _  End Test

              (Last branch selected 2)

                    Present HUB-ID 07
                   Previous HUB-ID 05

Press EXEC to End Test
```

- Select End Test

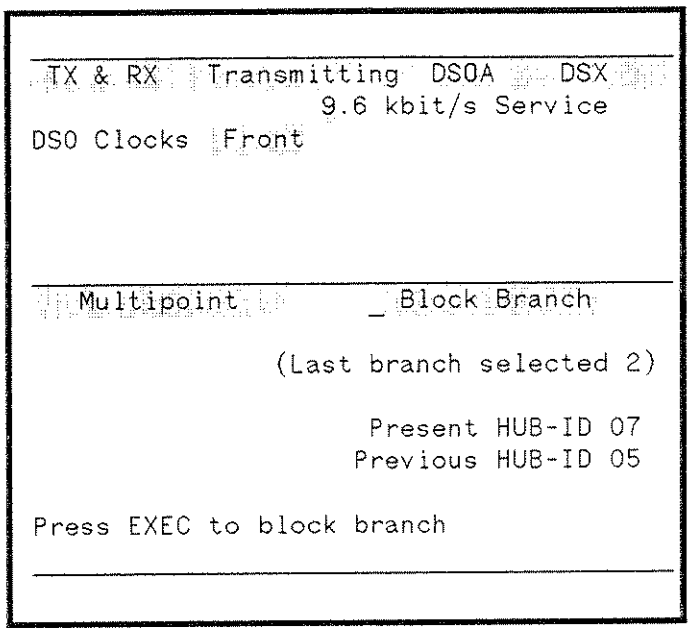
- Press EXEC to End the Test and release the route.

If after testing a branch you wish to leave it blocked simply select Block Branch instead of End Test. See the following section on Blocking and Releasing.

Blocking and Releasing

You can block or release the individual branch selected (in this example HUB C, branch 2) or release all downstream branches by selecting the appropriate Multi-point field on the Transmitting display and pressing
EXEC.

Branch Block/Release, Sample Display



- You can select Block Branch
  Unblock Branch
  Release all

- Activate your selection by pressing EXEC.

NOTE

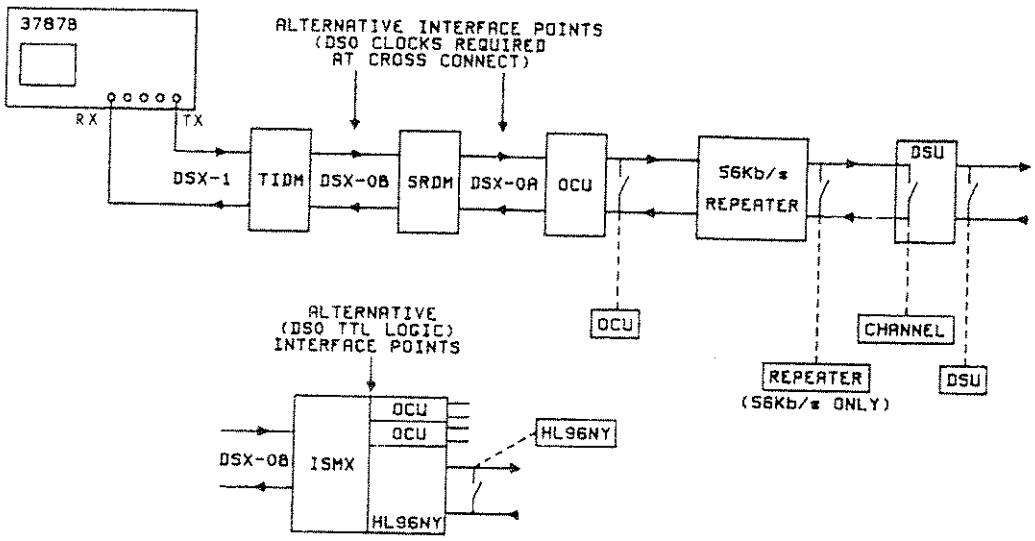
With Branch Block selected both the current and previous HUB-ID are displayed together with the selected branch number of the current MJU. Until EXEC is pressed these displays remain as confirmation of the route selected using BRANCH SELECT. If no branch selection has been attempted or a branch selection has not been acknowledged these displays default to X.

DDS Alternating (Flywheel) Loopbacks

Application

You can set an alternating (flywheel) loopback in the DDS network at any of the points shown in the measurement configuration below and then make a measurement.

Measurement Configuration

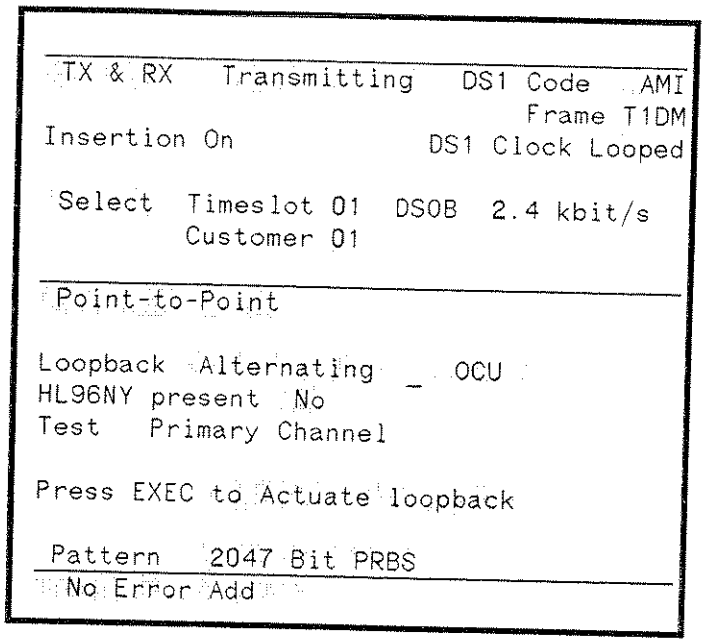


Example: From the DSX-1 cross-connect, loopback at the Office Channel Unit (OCU), make customer logic error measurements and release the loopback.

Select the Loopback details on the Transmitting page and press EXEC to initiate the Loopback.

In this example Logic errors are being measured over a 5 minute Gating Interval.

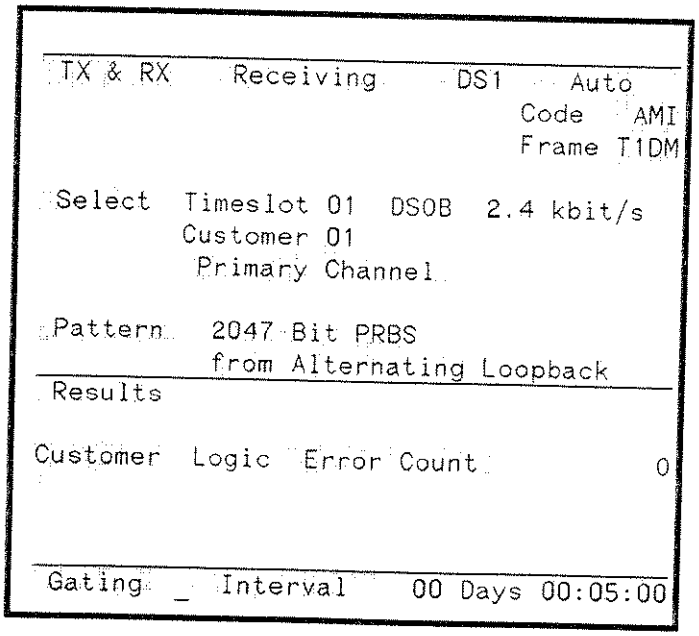
Alternating Loopback, Sample Transmitting Display



- Set the transmit interface.
- Select where in the DS1 you are going to insert your test Pattern.
- Select the loopback point.
- Select the test Pattern.

Then press EXEC to loop-up.

Alternating Loopback, Sample Receiving Display



- Set the receive interface.
- Select the timeslot parameters and customer number.
- Remember to select the same test Pattern as on the Transmitting display.
- Select your measurements.
- Set the measurement Gating Interval.

Make the Measurement

Press the START/STOP key.

Releasing the Loopback

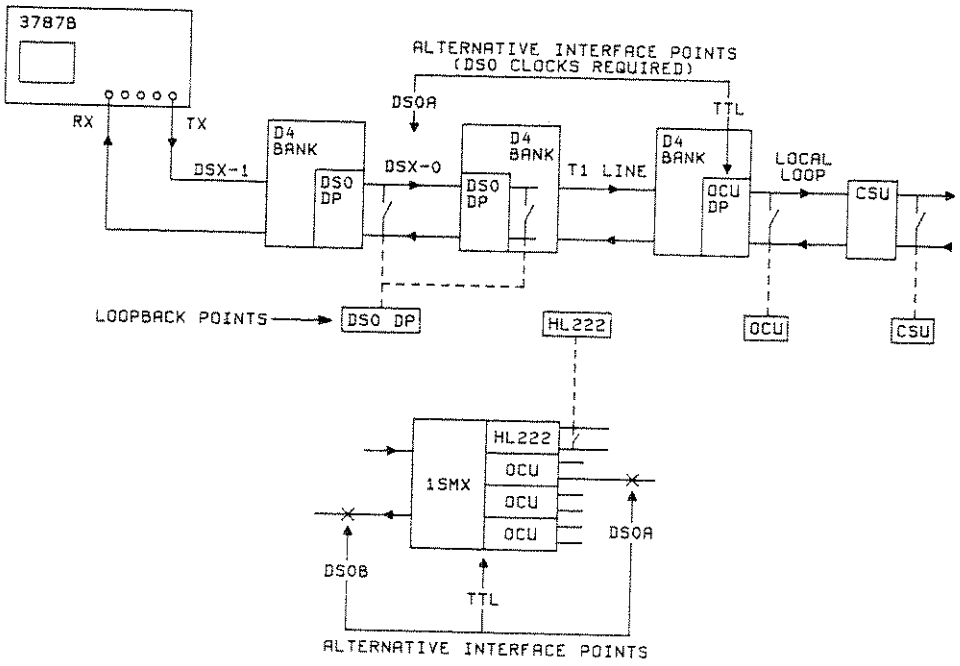
When your measurement is complete release the loopback by selecting the Transmitting display and pressing the EXEC key. (Ensure that "to Release Loopback" is displayed, before you press EXEC key).

DDS Latching Loopbacks

Application

You can set a latching loopback in the DDS system at any of the points shown in the measurement configuration below, make a measurement and release the loopback.

Measurement Configuration



Example: Access at a DSX-1 cross-connect and loopback the second DS0DP Dataport. Make logic error measurements on a 2.4 kbit/s customer circuit and release the loopback.

The HP 3787B can also access at DS0A and DS0B cross-connects and at DS0A logic access points. With DS0 access DDS clocks must be supplied.

If you wish the loopback to be acknowledged select the Receiving display and set the Pattern to Return Codes. This ensures that MAP codes returned from a successful loopback will be displayed on the Transmitting display.

Latching Loopback, Initial Receiving Display

```
TX & RX    Receiving      DS1    Auto
                                 Code   AMI
                                 Frame  T1DM

Select  Timeslot 01  DS0B  2.4 kbit/s
        Customer 01
        Primary Channel

Pattern   DDS Return Codes

Results
```

- Set the receive interface.

- Select the timeslot parameters and customer number.

- Select the Pattern to DDS Return Codes to obtain the Mapcode on the Transmitting display.

On the Transmitting display select the point at which you wish to loopback the circuit, in this case the second DS0DP unit. Press EXEC to actuate the loopback.

Latching Loopback, Sample Transmitting Display

```
TX & RX   Transmitting   DS1 Code   AMI
                                    Frame T1DM
Insertion On                DS1 Clock Looped

Select  Timeslot 01  DS0B  2.4 kbit/s
        Customer 01

Point-to-Point

Loopback  Latching  DS0DP  MAPX
Tandem Number of Unit 2
Test  Primary Channel

Press EXEC to Actuate Loopback

Pattern   2047 Bit PRBS
No Error Add
```

- Set the transmit interface.

- Select the timeslot parameters and customer number.

- Select Loopback.

- Select the test Pattern.

- Press EXEC to loop-up.

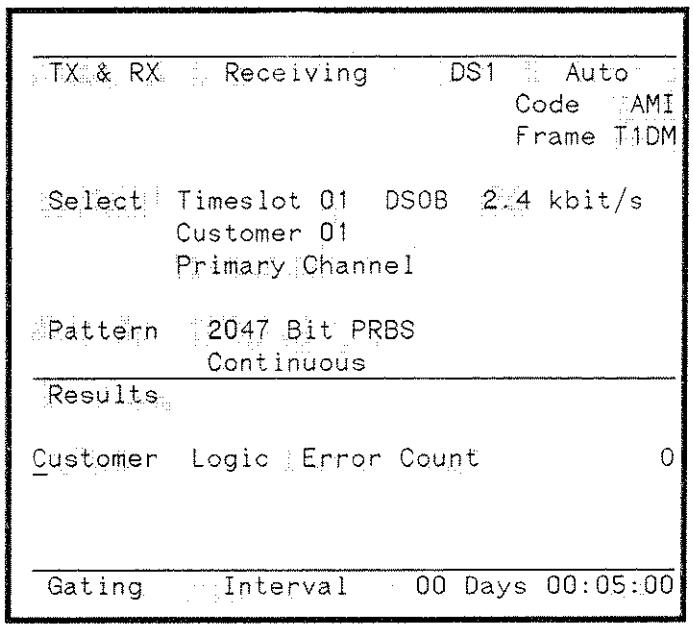
If you have selected DDS Return Codes on the Receiving page a successful loopback attempt will result in the display of "MAP0 (DS1)" indicating a lineside DS0DP loopback has been achieved.

For the various types of latching loopbacks MAP codes are returned as follows:

DS0DP (dropside), i.e. DS0 side OCU HL222	MAP1 (X110110X)
DS0DP (lineside), i.e. DS1 side CSU (channel)	MAP0 (X001001X)

If an attempt is unsuccessful or if the Receiving display has not been set for acknowledgment (DDS Return Codes) the display will remain as MAPX.

Latching Loopback, Sample Receiving Display



- Remember to select the same test Pattern as on the Transmitting display.
- Select the measurement.
- Set the measurement Gating Interval.

Make the Measurement

Press the START/STOP key

Releasing the Loopback

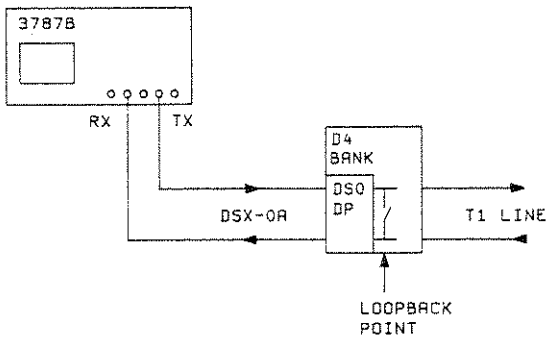
When you have completed your measurement release the loopback by selecting the Transmitting display and pressing the EXEC key. (Ensure "to Release Loopback" is displayed before you press EXEC).

DDS Secondary Channel Testing

Application

You can access and test DDS secondary channel, either end-to-end or by using latching loopbacks. The HP 3787B can access the network at the DSX-0A, DSX-0B or DSX-1 cross-connects or at DS0A logic access points.

Measurement Configuration



Example: Interface at the DSX-0A cross-connect on a 2.4 kbit/s point-to-point circuit. Loopback the first Dataport and measure secondary channel logic errors.

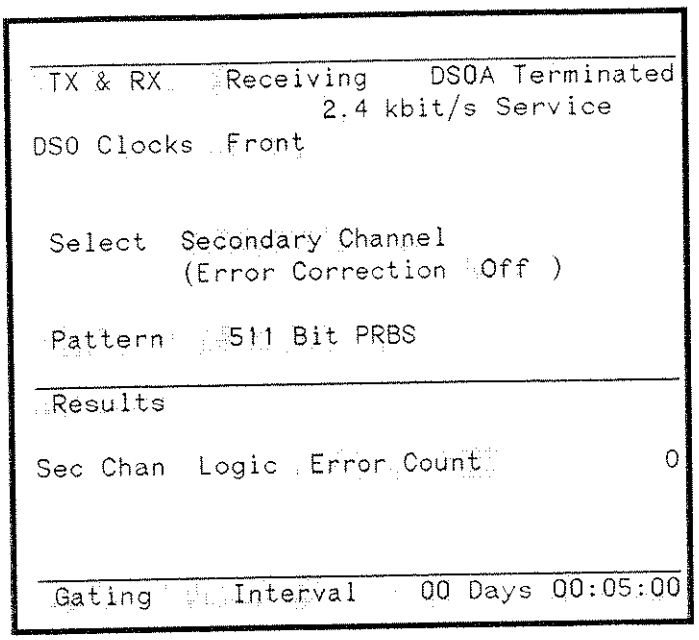
Secondary Channel Test, Sample Transmitting Display

```
TX & RX   Transmitting  DS0A   DSX
                  2.4 kbit/s Service
DS0 Clocks  Front




 Point-to-Point

Loopback  Latching   DS0DP  MAPX
Tandem Number of Unit 1
Test _Secondary Channel

Press EXEC to Actuate Loopback

 Pattern    511 Bit PRBS
  No Error Add
```

- Set the transmit interface.
- Select the Loopback.
- Select Secondary Channel.
- Select the test Pattern.
- Press [EXEC] to loop-up.

For information on Latching Loopback acknowledgment see page 2-30.

Secondary Channel Test, Sample Receiving Display



- Set the receive interface.
- Demultiplex the test data.
- Remember to select the same test Pattern as on the Transmitting display.
- Select the measurement.
- Set the measurement Gating Interval.

Practical Aspects of Secondary Channel Testing.

1. During secondary channel testing the primary channel is stimulated with random data.
2. Latching loopbacks are always used; alternating (flywheel) loopbacks are not compatible with secondary channel testing as they would corrupt the C bit modulation.

Protocol Analysis

Application

You can perform protocol analysis by using the HP 3787B as a channel access interface between the network under test and a protocol analyzer. The network can also be accessed at the DS0A and DS0B cross-connects and at DS0A logic access points.

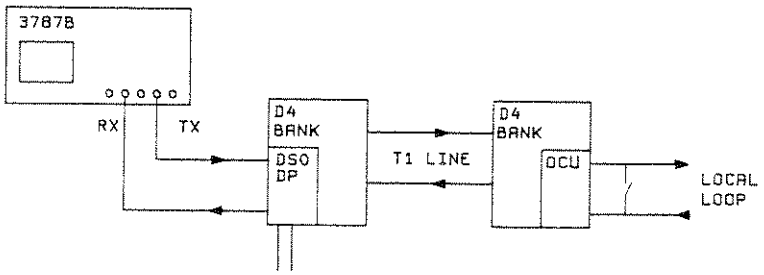
Use the protocol analyzer to produce your own pattern for stressing the system under test and make out-of-service measurements using these patterns.

The HP 3787B can provide protocol analysis access to:

1. DDS subrate primary channels at 2.4, 4.8 and 9.6 kbit/s.
2. DDS subrate secondary channels at 133 1/3, 266 2/3 and 533 1/3 bit/s.
3. DS1 standard frame (D4) 4 kbit/s Fs data link.
4. DS1 extended frame (ESF) 4 kbit/s data link.
5. DS1 TIDM frame 8 kbit/s R-Channel.

The interface between the protocol analyzer and the HP 3787B is RS232C.

Measurement Configuration

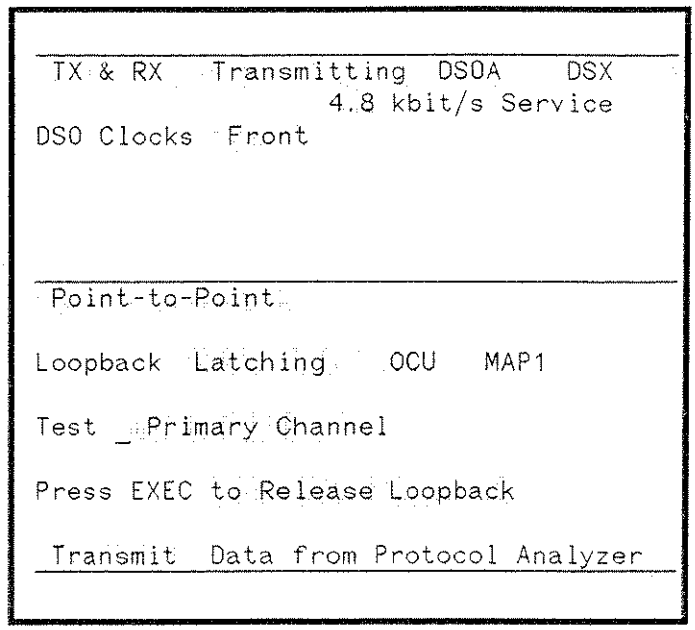


Example: Interface at the DSX-0A cross-connect on a 4.8 kbit/s point-to-point circuit. Loopback the OCU Dataport and test the circuit with data generated by a protocol analyzer.

Set up the latching OCU loopback as described on page 2-30 (selecting OCU instead of DS0DP).

Set both Transmit and Receive displays to protocol analysis as shown.

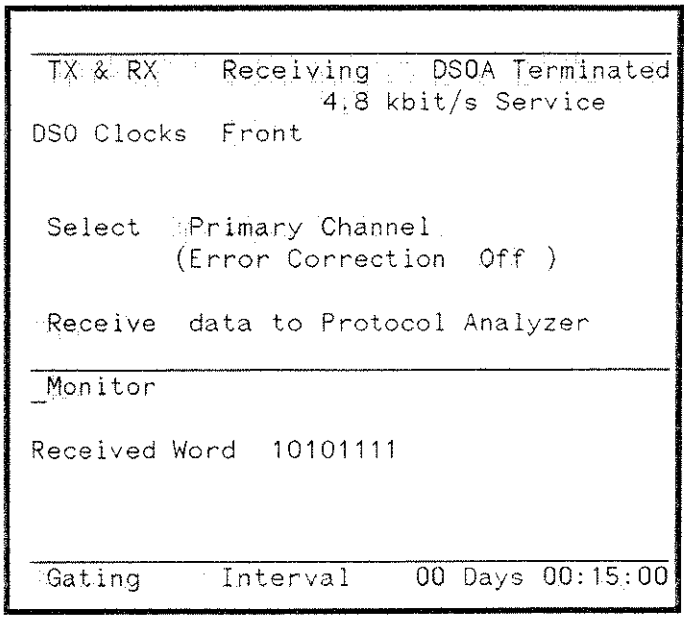
Protocol Analyzer Interface, Sample Transmitting Display



- Set the interface between the HP 3787B and the DSX-0A cross-connect.

- Select the HP 3787B/Protocol Analyzer interface. Your test pattern now comes from the protocol analyzer.

Protocol Analyzer Interface, Sample Receiving Display



- Set the interface between the DSX-0A cross connect and the HP 3787B.

- Select the HP 3787B/Protocol Analyzer interface (your receiver test pattern is now the protocol analyzer output).

- The received data can be displayed on a sampled basis.

- Select the measurement Gating Interval.

NOTE

All protocol analysis functions are also available if the network access is DS1.

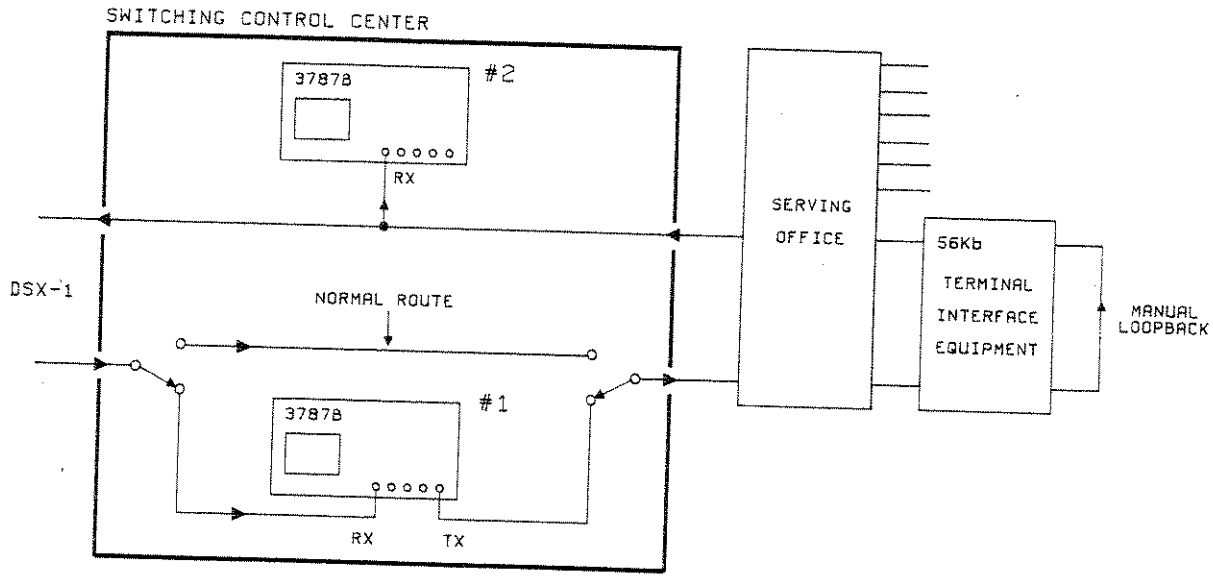
Monitoring Signaling Bits and Seizing a Free Timeslot.

Application

For testing 56 kbit/s switched services you can use the HP 3787B to monitor the standard D4 frame A and B signaling bits or the D5 extended frame A, B, C and D signaling bits. You can therefore monitor the status of live data to check if a timeslot is idle or seized. The HP 3787B can also be set to transmit selectable signaling bits which enable you to seize an idle timeslot and make a measurement on it.

Measurement Configuration

NOTE: This configuration requires hitless switch.



Example: Circuit-switched test on a D4 line which uses A=0, B=1 for idle. A=1, B=0 for seized.

Check the Timeslot is Idle Using HP 3787B #1

Select the timeslot to be tested. Check that it is idle and seize it using HP 3787B #1 without disrupting the traffic on the line. Check the logic errors on HP 3787B #2.

Before switching HP 3787B #1 into the line set the instrument up as follows.

Select THRU mode and press EXEC to initiate the mode.

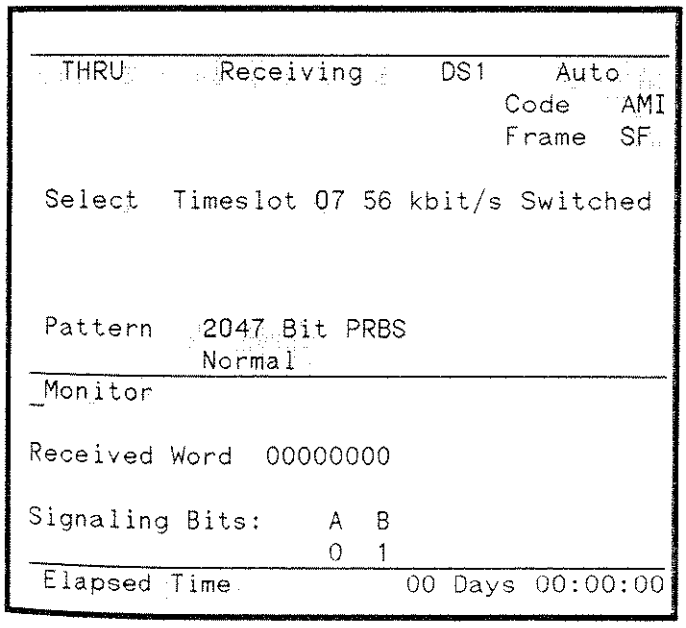
On the Receiving display set the interface parameters. The Transmitter interface will be set automatically.

Now connect the HP 3787B into the circuit using the hitless switches. Select the timeslot to be tested and use the Monitor mode to examine incoming signaling status. Proceed to test the timeslot only if the signaling bits are A=0, B=1.

NOTE

Normally there will be no test pattern in the received timeslot and the receiver will indicate Pattern Loss.

Sample Receiving Display HP 3787B #1



- Set the receiver interface.

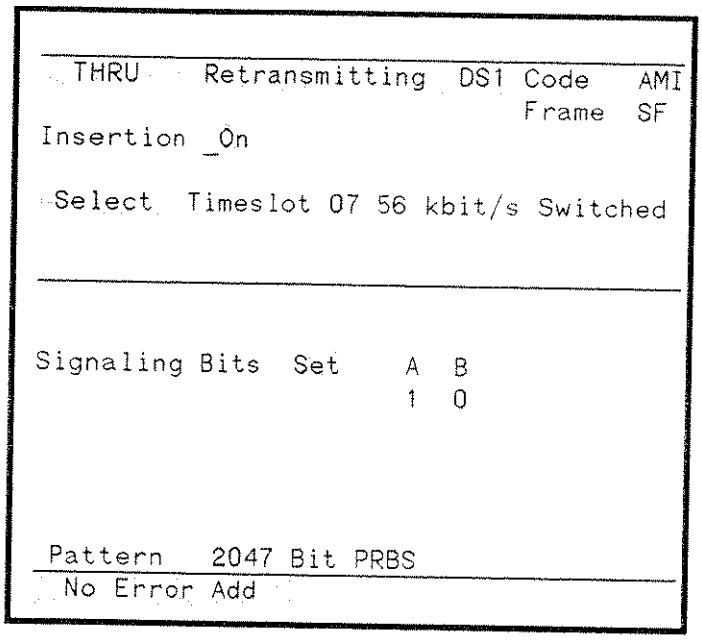
- Select Monitor

- A=0, B=1 confirms Timeslot is idle.

Seize the Idle Timeslot and Send the Test Pattern

On the Retransmitting display select the test timeslot and test pattern. Set the signaling bits to A=1, B=0 and turn Insertion On to seize the timeslot.

Seizing the Timeslot with HP 3787B #1



- Select Retransmitting
- Set to the test timeslot.
- Change to Set A=1, B=0 to seize the timeslot.
- Set insertion On.

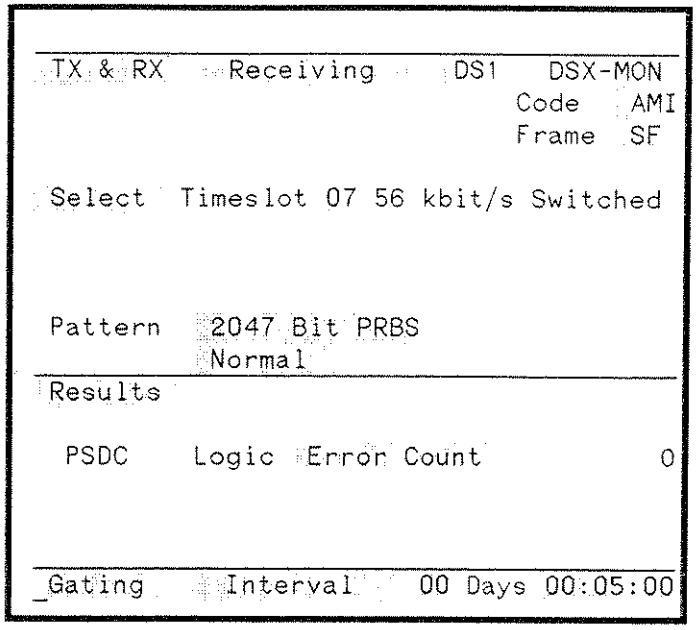
Connect HP 3787B #2 and Make the Measurement

Connect HP 3787B #2 to the return path using the monitor mode.

Set the Receiving display as shown.

Note that the return timeslot number is normally the same but need not be so.

Sample Receiving Display HP 3787B #2



- Set the receiver interface.
- Select the test timeslot.
- Remember to set the test Pattern the same as the transmitter of #1.
- Select the measurement.
- Set the measurement Gating Interval.

Press the START/STOP key on HP 3787B #1.

NOTE

If your loopback inverts the data change the Normal Pattern selection to Inverse.

Printing/Logging Results 3

Introduction

The HP 3787B can output results to its internal printer or to an external printer without using an external controller. A copy of results can be manually requested on demand or the HP 3787B can be set to automatically log results. There are two ways to log automatically:

1. Logging can be triggered by error events while the HP 3787B is gating.

2. A summary of results can be printed at the end of gating.

The type of logging selected depends on the application. For example, if events such as intermittent errors are to be traced then log during gating would be selected. If a circuits' performance is to be evaluated then end of gating summary would be selected. Both types of logging may be selected simultaneously.

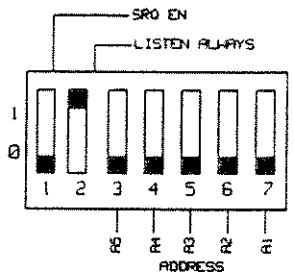
The date and time are printed at the start and stop of gating and the date is also printed at midnight. All logged results and triggers are time stamped.

Printer Selection

As previously stated results can be logged on the HP 3787B internal printer or an external printer connected to the rear panel HP-IB port.

To print results on an external printer, configure the HP 3787B as a TALK ONLY device on the "Remote Configuration" page (page 5). The external printer must be set to LISTEN ALWAYS and be the only device connected to the HP 3787B HP-IB port.

If an HP 2225A ThinkJet printer is used, set the rear panel switches as shown below.



To select your printer, display the "Data Logging" page (page 3 on the "INDEX"), then select the printer you want as the Logging Device.

```
Logging  On    Logging Device HP3787B

Set the HPIB mode on page 5 to Talk Only
to use external HPIB printer.
```

The internal printer is always selected when the instrument is configured as an addressable device.

```
Logging  On    Logging Device    HPIB
```

Logging device selection may be HP3787B or HPIB when the instrument is configured as a talk only device.

Printing Results on Demand

A time-stamped printout of results can be obtained at any time without affecting the measurement. The HP 3787B outputs the currently selected results on the receiver section of the "Normal Operation" page (page 1 on the "INDEX") when the [PRINT] key is pressed.

Results Available

The results available for display on the "Normal Operation" page are:

Results (eg Error Count and Error Ratio)
Analysis (eg % Availability and % Severe E. S.)
Alarm Duration (eg DS1 Pattern Loss Seconds and DS1 Frame Loss Seconds)
Rx Level (DS1/1C only)
Monitor

A typical printout of each is given below.

```
03:15:17              Print
RESULT A:
DS1 Logic Results
Error Count...........15

RESULT B:
DS1 Logic Results
Error Ratio......1.1E-06
```

```
00:09:29              Print
ALARM DURATIONS:
Signal loss...........0
```

```
00:10:55              Print
MONITOR WORD:
Received word...01100000
```

```
00:10:00              Print
RX LEVEL:
Positive peak.....+3.13V
Negative peak.....-3.28V
```

```
00:09:48              Print
ANALYSIS (A):
Availability.....100.00%
```

* RESULT A corresponds to the first measurement selected in the Results section. If a second measurement is selected it corresponds to RESULT B.

Logging During Gating

When the HP 3787B is set to log during gating, the printer is triggered by error events. The error events which trigger the printer are selected from either Error Seconds or an Error Ratio which exceeds a threshold set in the range 1.0E-2 to 1.0E-7. In the case of a (optional) jitter measurement the trigger is either Hit Seconds or Hit Bit Ratio.

When logging is triggered, the number of errors in the second which caused the trigger is printed.

NOTE

The source of the trigger and the Error Count printed always pertain to Result A.

The HP 3787B has a printer-squelch function which saves paper by not allowing trigger seconds to be printed when an unmanageable number of errors occur. Printing stops when the logging trigger (error seconds or error ratio) occurs on 10 consecutive seconds. Printing starts again on the next trigger-free second - the HP 3787B then outputs the time elapsed since the printout was squelched and the total number of errors (or hits for optional jitter measurements) counted since the start of the squelch. An example print is shown below.

```
------------------------
Hewlett-Packard    3787B
03:33:16  01/01/87 START
Gate Manual
DS1 Logic Results
ES Trigger : ER > 1.0E-7

03:33:21 Err Cnt.......6
03:33:22 Err Cnt.......6
03:33:23 Err Cnt.......6
03:33:24 Err Cnt.......4
03:33:25 Err Cnt.......6
03:33:26 Err Cnt.......6
03:33:27 Err Cnt.......6
03:33:28 Err Cnt.......7
03:33:29 Err Cnt.......6
03:33:30 Err Cnt.......5
03:33:30        SQUELCHED
03:33:37      UNSQUELCHED
Trigger secs..........6
Total Errors.........30
```

Procedure

1. Check that the HP 3787B clock is set to the correct time on the "Date and Time" page (page 4 on the "INDEX").

2. Select the measurement type and suitable gating on the "Normal Operation" page.

3. Display the "Data Logging" page.

4. Set Logging to On.

   Select the printer (see Page 3-1).

6. Set Log during gating to On, then select the logging Trigger; Error second or Error ratio. The Error ratio threshold can be set in the range 1.0E-2 to 1.0E-7.

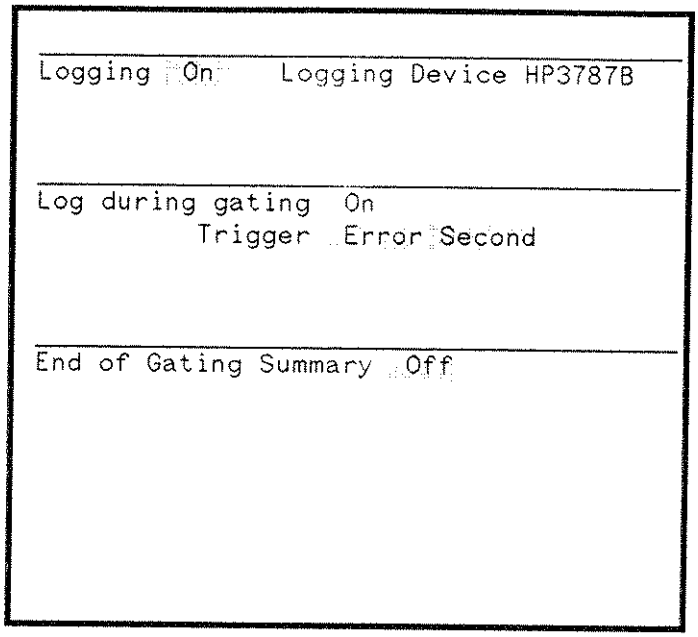
7. Start the test (gating led on), by pressing the (START/STOP) key . The instrument will automatically output the following:

   Instrument model number
   Start date and time of test
   Type of gating
   Measurement type
   Logging trigger
   Active Alarms (if any)

   Whenever the Trigger selected in step 6 occurs, the time and number of errors in the trigger second are printed.

Logging During Gating - Display & Sample Print

A typical display for Log during gating and a sample print of a DS1 measurement are shown below.




```
------------------------
Hewlett-Packard    3787B
00:07:30  01/01/87 START
Gate Manual
DS1 Logic Results
ES Trigger : Async ES

00:07:34 Err Cnt.......1
00:07:36 Err Cnt.......1
00:07:39    DS1 SIG LOSS
00:07:39    DS1 MFA LOSS
00:07:39  DS1 FRAME LOSS
00:07:39    PATTERN LOSS
00:07:39  DS1 SIG REGAIN
00:07:39    RX IMBALANCE
00:07:39    DS1 SIG LOSS
00:07:39  DS1 SIG REGAIN
00:07:39 Err Cnt..401359
00:07:39  DS1 MFA REGAIN
00:07:39  DS1 FRM REGAIN
00:07:39  PATTERN REGAIN
00:07:41     RX LEVEL OK
00:07:50 Err Cnt.......1
00:07:58      POWER LOSS
DATE           01/01/1987
00:08:11    POWER REGAIN
DATE           01/01/1987
00:08:16 Err Cnt.......1
00:08:21             STOP
```

When a power loss occurs during gating with Logging On, the power fail date and time and the power regain date and time are printed.

Whenever an alarm changes state during gating with Logging On, the new state of the alarm is printed.

Logging at the End of Gating

When the End of Gating Summary is selected, a summary of results is printed at the end of the gating interval or when you press the START/STOP key to stop the test. The log can be triggered at the end of each gating interval or after specific gating intervals in which the error ratio exceeds a threshold value set in the range 1.0E-2 to 1.0E-7. The HP 3787B outputs a summary of results under the following headings:

Results
Analysis
Alarm Durations

The HP 3787B can be set to output any combination of the above to a printer. Within each heading the instrument can be set to either:

output the results currently selected on the "Normal Operation" page
or
output all the results that are available
or
output no results under this heading

Procedure

1. Check that the HP 3787B clock is set to the correct time on the "Date and Time" page.
2. Select the measurement type and suitable gating on the "Normal Operation" page.
3. Display the "Data Logging" page.
4. Set Logging to `On`.
5. Select the printer (see Page 3-1).
6. Set End of gating summary to `On`, then select when you want a summary; `Always` or when the `Error ratio` exceeds a value set in the range 1.0E-2 to 1.0E-7.
7. For each result type, select the type of summary; `Off`, `Selected` or `All`.

   Off: no summary
   Selected: the currently selected result
   All: all valid results

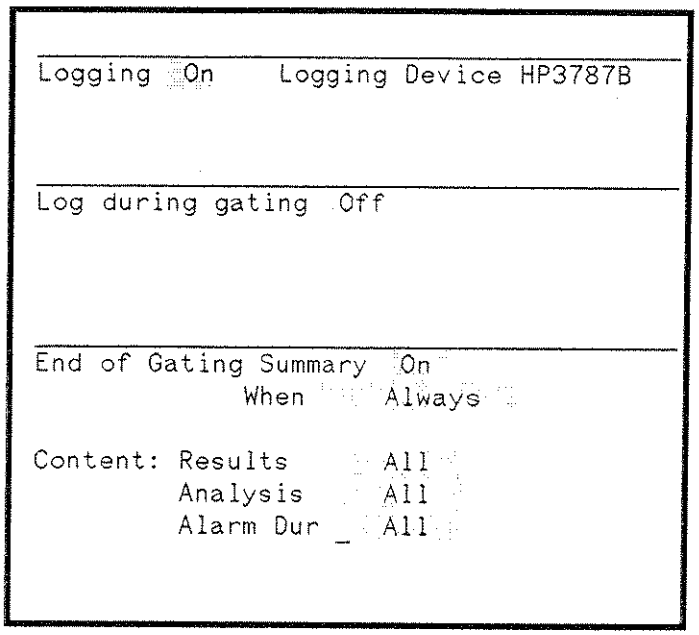
8. Start the test (gating led on), by pressing the START/STOP key. The instrument will automatically output the following:

Instrument model number	Measurement type
Start date and time of test	Logging trigger
Type of gating	Alarms (if any)

A summary is printed at the end of the gating interval or after you press the START/STOP key to stop the test.

Logging at the End of Gating - Display & Sample Print

A typical display for an End of Gating Summary and a sample print of a DS1 measurement are shown below.



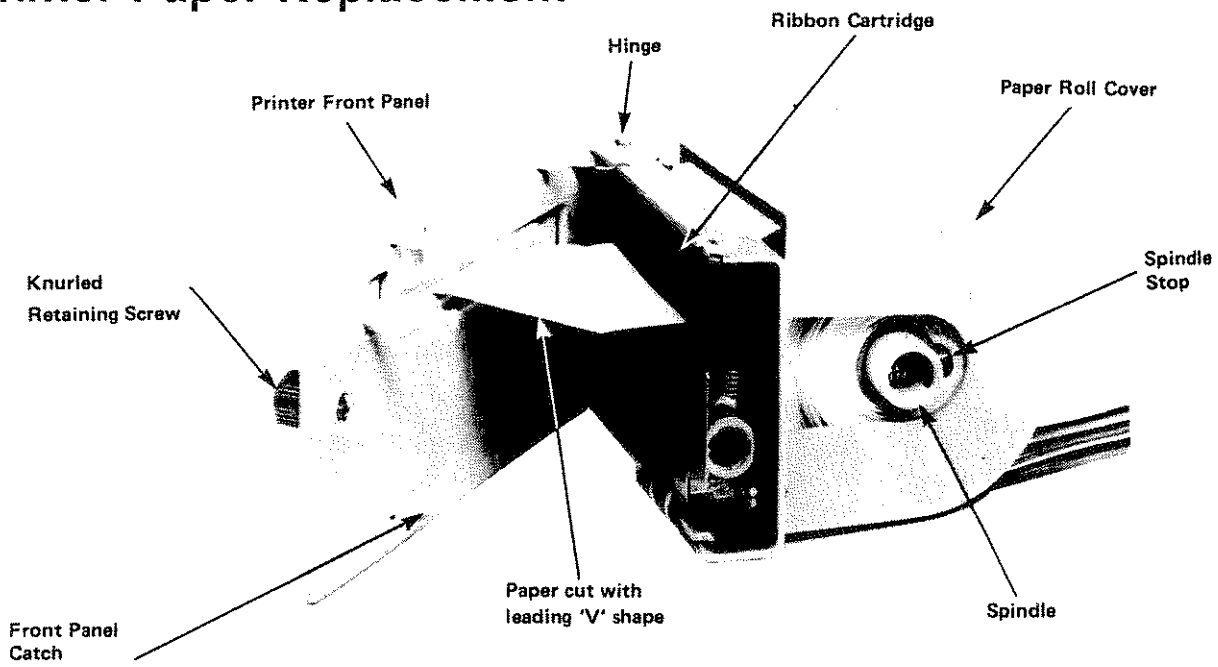
When a power loss occurs during gating with Logging On, the power fail date and time and the power regain date and time are printed.

Whenever an alarm changes state during gating with Logging On, the new state of the alarm is printed.

```
------------------------
Hewlett-Packard    3787B
00:53:21  01/01/87 START
Gate Single 00d00h02m01s
DS1 Logic Results

00:54:12    DS1 SIG LOSS
00:54:12    DS1 MFA LOSS
00:54:12  DS1 FRAME LOSS
00:54:12    PATTERN LOSS
00:54:13    RX IMBALANCE
00:54:13  DS1 SIG REGAIN
00:54:13  DS1 MFA REGAIN
00:54:13  DS1 FRM REGAIN
00:54:13  PATTERN REGAIN
00:54:15     RX LEVEL OK
00:54:33      POWER LOSS
DATE          01/01/1987
00:54:46    POWER REGAIN
DATE          01/01/1987
00:55:35            STOP
00:55:35         Summary
```

```
RESULT A:
DS1 Logic Results
Error Count.......360212
Error Ratio......1.3E-03
Sync Err Secs.........4
Asyn Err Secs.........5
Async E.F.S.........116
% E.F.S.........95.8878

(No result B)

ANALYSIS (A):
Availability.....100.00%
Unavailability...0.0000%
Severe E.S.......1.6529%
Err Seconds......4.9587%
Degraded Mins....0.0000%

ALARM DURATIONS:
Pattern loss..........2
DS1 frame loss........2
AIS Seconds...........0
Power loss...........13
Signal loss...........1
```

Printer Paper Replacement



New rolls of paper for the HP 3787B internal printer can be ordered under HP Part Number 9270-1151.

Use the following procedure to fit a new roll.

1. Switch the HP 3787B power off.
2. Unscrew the Knurled Retaining Screw on the left hand side of the printer assembly and withdraw the complete assembly from the instrument.
3. Remove the Paper Roll Cover. This is a friction fit on the printer assembly bracket.
4. Press in the Spindle Stop, remove and discard the spent paper roll.
5. Fit the new paper roll by pressing the Spindle Stop and sliding the new roll onto the Spindle.
6. Ensure that the end of the paper is cut clean and square or in a leading "V" shape.
7. Pass the end of the paper into the printer loading slot.
8. Push the paper into the slot until resistance is felt.
9. Replace the Paper Roll Cover.
10. Switch the HP 3787B on.
11. Press the HP 3787B front panel printer PAPER key until paper emerges from the printer assembly front panel slot.

NOTE

If any difficulty is experienced in feeding the paper through the printer assembly, check that the edge of the paper is cut clean and repeat steps 6 to 11.

12. When the paper has been successfully fed through the printer assembly, switch the instrument power off, replace the assembly in the instrument and secure with the Knurled Retaining Screw.

Printer Ribbon Replacement

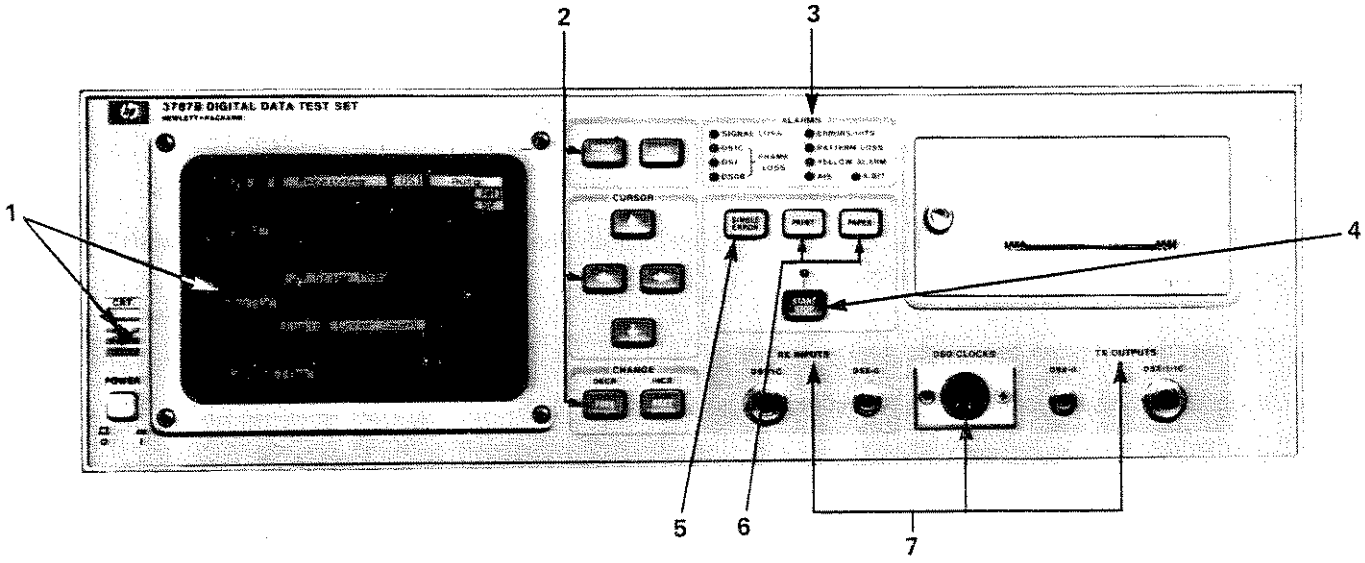
New ribbons for the HP 3787B internal printer can be ordered under HP Part Number 9282-1005.

Use the following procedure to fit a new ribbon:

1. Switch the HP 3787B power off.
2. Unscrew the Knurled Retaining Screw on the left hand side of the printer assembly and withdraw the complete assembly from the instrument.
3. Gently push back the printer Front Panel Catch and open up the printer assembly.
4. Push the Ribbon Cartridge on the edge to eject as indicated and lift it away from the printer.
5. Place the new Ribbon Cartridge onto the printer assembly and gently push into place (ensure paper is between the ribbon and the metal impact plate).
6. Close the printer assembly, replace it in the instrument and secure using the Knurled Retaining Screw.

Front and Rear Panel Features 4

Front Panel Features



1 The HP 3787B is controlled by means of a CRT display and a simple "keyboard". Information on instrument status, configuration, results, etc. is displayed to the operator in "pages" of information. These may be accessed for viewing or change via the keyboard. The information "pages" are listed in numeric order on an Index page which indicates the information content of each page. There are seven pages excluding the index page. For ease of use the HP 3787B may often be driven from the "Normal Operation" page. Page 1. When the instrument powers up the index page is always displayed. The brightness of the display may be altered using the CRT control.

```
POWER HAS CYCLED

                INDEX
                                    Page
Normal Operation ..................1
Stored Panels & Keyboard Lock .....2
Data Logging ......................3
Date & Time .......................4
Remote Configuration ..............5
Instrument ID......................6
User Confidence Tests .............7
```

2 When the Index page is displayed one of the information page numbers is highlighted by the cursor (flashing green square). The PAGE/INDEX key alternates the display between the Index page and the page being highlighted. When the information page being highlighted is displayed the cursor always appears in the top left-hand corner of the display.

Changeable items on the display are highlighted by a green background (inverse video). The highest ranked item appears at the top left-hand corner of the display, with the lower ranked items following on in order left to right and top to bottom. Changing an item may also cause lower ranked items further down the display to change automatically. To move the cursor from one changeable item to another use the CURSOR keys.

To change an item, use the CHANGE keys until the item you want is displayed. If the instrument is running a test (START/STOP gating led lit), you cannot make changes which affect the operation of the instrument Receiver set-up - if you try, the instrument emits an audible "beep" and displays "GATING IN PROGRESS".

When certain functions are selected a "Press EXEC to . . . ." instruction will appear in the display - press EXEC to execute the function.

3 The instrument monitors the incoming signal for certain alarm conditions. If any of these conditions occur the appropriate ALARMS leds are lit while the alarm conditions exist.

4 Pressing the START/STOP key (led lit) starts a new measurement and also clears old results from the display. Pressing START/STOP again stops the measurement.

5 Pressing the SINGLE ERROR key inserts a single error into the transmitted (TX OUTPUT) signal when the transmitter is configured to "add single errors".

6 To obtain a date and time stamped record of the current instrument measurement(s), press the PRINT key. A typical print out is shown below.

```
03:15:17          Print          RESULT B:
RESULT A:                        DS1 Logic Results
DS1 Logic Results                Error Ratio.....1.1E-06
Error Count.....15
```

Pressing the PAPER key causes a paper feed. If the printer is currently printing when you press the PAPER key the current line is printed before the paper feed occurs. A record of results is automatically printed when the instrument is configured for data logging (see Page 3-2).

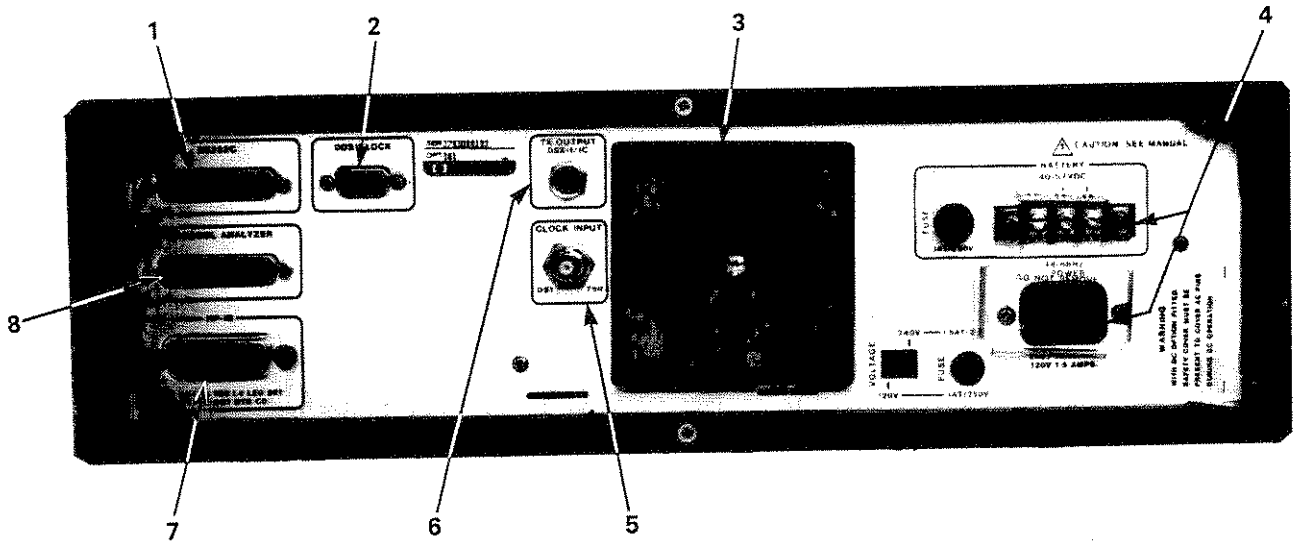
7 On the front panel there are two receiver inputs (RX INPUTS) and two transmitter outputs (TX OUPUTS). The receiver inputs provide DS1/1C and DS0 access respectively. The active input is selected via the CRT.

One transmitter output provides a DSX-1 or DSX-1C signal while the other gives a DSX-0 signal. (The DS1/1C output is duplicated on the rear panel). Either the DS1/1C outputs or the DS0 output may be active at any one time.

Select the DS1/1C ports to connect to either a DS1 (1.544 Mbit/s) or DS1C (3.152 Mbit/s) access.

Select the DSX-0 port to connect to a DS0 (64 kbit/s) level - DS0A (single customer) or DS0B. To operate at the DSX-0 digital cross connect the front panel DS0 CLOCKS input or the rear panel DDS CLOCKS input must be connected to the 8 kHz and 64 kHz DDS office clocks.

Rear Panel Features



1 To control the instrument remotely via the RS-232-C interface, connect a suitable controller to the RS232C port.

2 When interfacing at a DS0 level, the HP 3787B must be supplied with 8 kHz and 64 kHz DDS office clocks. The rear panel DDS CLOCKS input is used.

3 Fan - the fan-filter should be cleaned at regular 6-monthly intervals.

4 The standard instrument is powered from an AC power supply. An Option 002 instrument can also be powered from an office battery (-40 VDC to -57 VDC). When the AC supply is unreliable the instrument should be powered by an office battery for long-term uninterrupted measurements.

The instrument is protected by fuses: 3 Amp for 120 VAC operation, 1.5 Amp for 240 VAC operation and 3 Amp for battery operation. There is also a protective cover which ensures that only one power source can be connected (AC power supply or battery but not both).

5 The 75 Ohm DS1 CLOCK input can be used to synchronize the DS1 Transmitter to other DS1 equipment.

6 The DSX-1/1C TX OUTPUT is identical to the front panel DSX-1/1C output and is useful for testing MIC multipliers.

7 The HP-IB port has a dual function; it can be used to control the instrument remotely or it can be used to print out results on an external printer. To control the instrument remotely, connect a suitable controller and configure the instrument as an "ADDRESSABLE" device.

To print out results on an external printer connect a suitable printer (eg an HP 2225A) and configure the instrument as a "TALK ONLY" device. The printer must be configured to "LISTEN ALWAYS".

8 To perform protocol analysis, connect a suitable analyzer (eg an HP 4952A with an HP 18180A Interface Pod) to the PROTOCOL ANALYZER (RS232C) port.