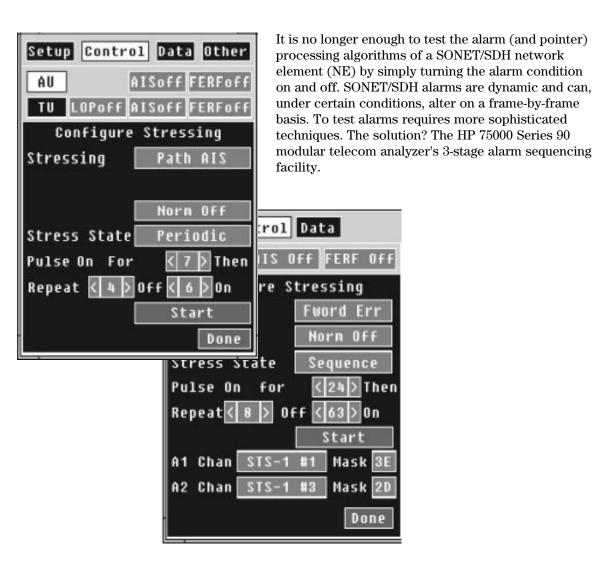


# Rigorous stressing of SONET/SDH alarms using programmable 3-stage sequences

# **Product Note**



# 3-stage frame sequencing

Rigorous stressing of SONET/SDH alarms and pointer algorithms requires a sequence of frames to be presented to the NE-under-test. This sequence of frames should consist of three parts as shown in figure 1. An error pulse followed by a 2-stage holding pattern. How this frame sequence is applied is best demonstrated using the following two path AIS threshold tests.

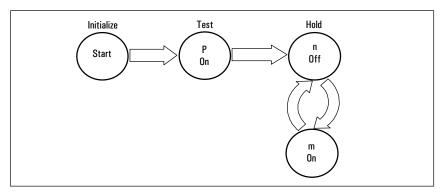


Figure 1. 3-stage alarm/error sequencer

# **Under-threshold test**

Initial state: A fully structured SDH or SONET signal with no alarms present.

A single instance of two frames of all ones in the H1H2 byte is then applied to the signal, followed by a repeating pattern of one frame with valid H1H2 bytes, and two frames with all ones in the H1H2 bytes.

This 2-1-2 repeating sequence brings the NE to the edge of the path AIS threshold (three frames of all ones) without activating the path AIS alarm condition. Under this condition the NE should not report path AIS.

# Over-threshold test

Initial state: A fully structured SDH or SONET signal with no alarms present.

A single instance of three frames of all ones in the H1H2 byte is then applied to the signal, followed by a repeating pattern of two frames with valid H1H2 bytes, and one frame with all ones in the H1H2 bytes.

The three frames of all ones in this frame sequence subjects the NE to a single instance of the minimum requirements to activate a path AIS. The following 2-1-2 holding pattern approaches the path AIS exit threshold (ie, three contiguous frames with valid H1H2 bytes) without actually exceeding it. Under these conditions, the NE should enter path AIS on receipt of the three frames, and remain in path AIS until such time as the holding pattern is discontinued.

This type of under- and over-threshold testing represents the most rigorous method of testing alarms, and can be applied to both entry and exit testing of all the major SONET/SDH alarms.

# Programming a 3-stage frame sequence

Most sophisticated SONET/SDH analyzers are capable of being programmed on a frame-by-frame basis to produce a specific sequence of events. However, they are all limited by the number of frames they can generate before repeating the holding pattern; programming depths of between 50 to 200 frames are not uncommon.

This type of programming has a major disadvantage when 3-stage sequencing of alarms is applied. Where as the simple toggling between two frame states is easily programmed in the under-threshold test, the over-threshold test involves a single instance of one frame state followed by the toggling between two states. It is the single instance of the alarm condition which causes the problem for the programmer – because, although the instance can be programmed, the limited depth means that the stimulus will repeat every N frames.

Hewlett-Packard's solution, developed for the HP 75000 Series 90 modular telecom analyzer, is a directly programmable 3-stage sequencer that allows the user to quickly set up, and if necessary alter, a sequence. The alarms and defects covered by this sequencer include:

SONET/SDH	SONET	SDH
Frameword errors Frameword loss J1 loss of message APS/RPS word stressing	Line AIS Line FERF Path AIS Path FERF AU pointer stressing VT AIS VT FERF VT pointer stressing VT C-bit stressing	MS AIS MS FERF Path AIS Path FERF AU pointer stressing TU AIS TU FERF TU pointer stressing TU C-bit stressing

# Using the Series 90's sequencer

The sequence can be quickly edited using the Series 90's graphical user interface. The subpanel shown in figure 2 shows an example test, where p = 7, n = 4 and m = 6. Note that:

- **Initial state:** Can be set to alarm/stressing on or off.
- Error pulse (p): Can be set to occur for 0 to 64 frames.
- Holding pattern (n, m): Can be programmed independently for 1 to 64 frames.

On start, the Series 90 transitions from the initial state to the error state. After the programmed number of frames (p), the Series 90 then transmits the holding pattern (n/m) until the sequence is stopped. Frame lengths for n and m can be altered in real time without causing any unnecessary alarms or errors in the transmitted serial data stream.

In addition, to stress bytes outside the normal alarm bytes, the Series 90 has an overhead sequencer that allows up to 16 sequences of TOH to be transmitted, each held for up to 64,000 frames. This can be used to test growth bytes and proprietary signals in the overhead.

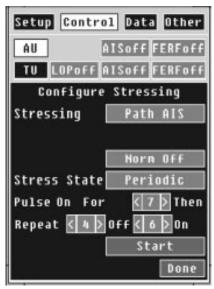


Figure 2. Series 90 alarm stressing subpanel

# **Product description**



# HP 75000 Series 90 modular telecom analyzer

The Series 90 offers a flexible approach to the testing of telecommunications network elements conforming to SONET, SDH and ATM standards. Based on industry standard VXI hardware, the analyzer consists of a series of C-sized modules, each addressing a specific aspect of SONET, SDH and ATM testing. Modules are easily added or removed to match current and changing test requirements. For further information refer to technical specifications 5964-9881E.



Hewlett-Packard manufactures the HP 75000 Series 90 modular telecom analyzer under a quality system approved to the international standard ISO 9001 plus TickIT (BSI Registration Certificate No. FM 10987).

For more information on Hewlett-Packard Test & Measurement products, applications or services please call your local Hewlett-Packard sales offices. A current listing is available via Web through AccessHP at http://www.hp.com. If you do not have access to the internet please contact one of the HP centers listed below and they will direct you to your nearest HP representative.

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