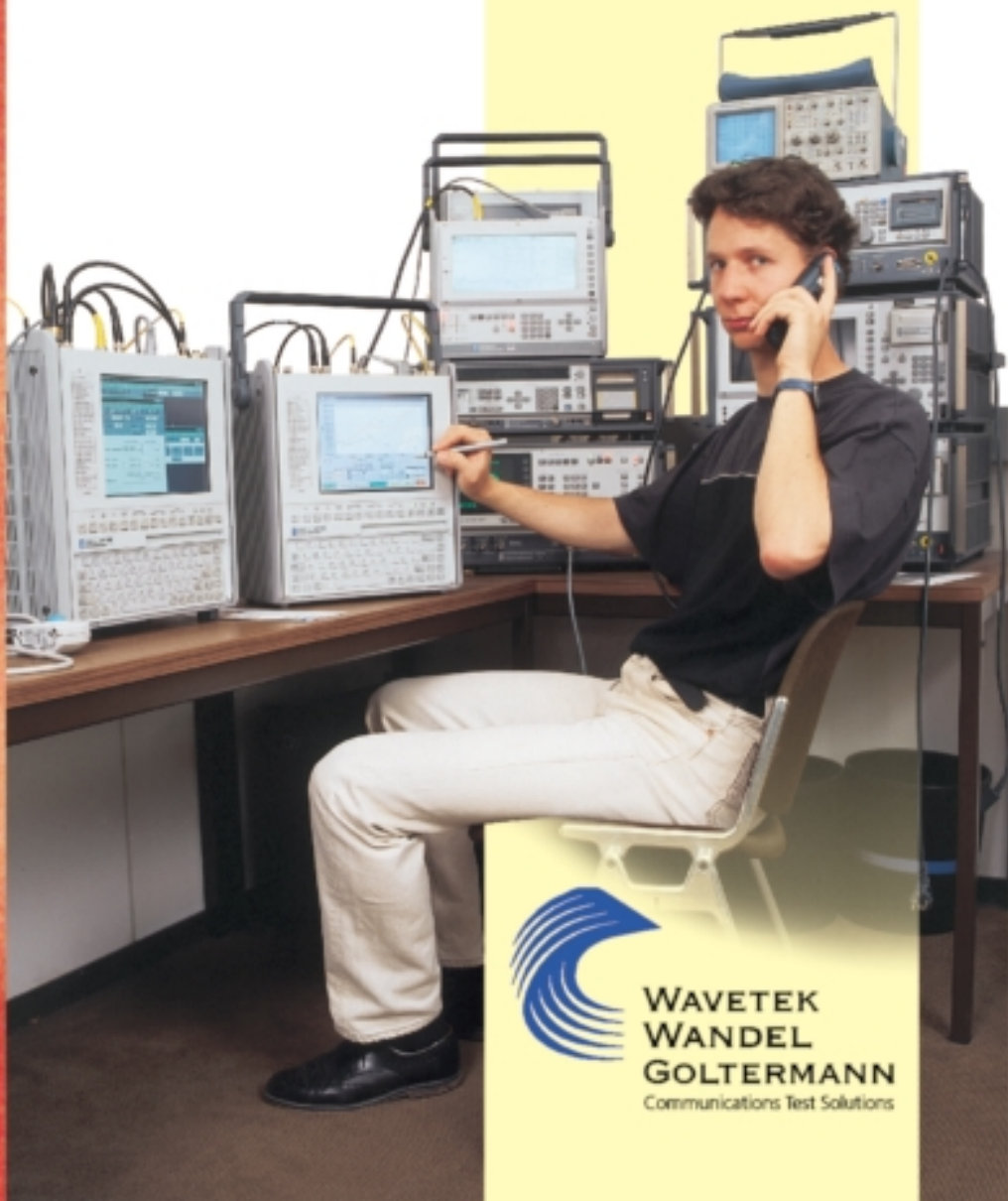
Issue Number 5

Advanced Network Testing

A new ANT-20 era

has arrived: The August Release includes new hardware for jitter and STM-16/OC-48, and the latest Version 7.0 software. This represents a big step forward; so big, in fact that the instrument should be renamed ANT-30. This popular, successful product will be developed further, of course. Available very soon: NEXT (Network Expert Tester software), the world's first expert diagnostics system for a transmission tester. This is an open, expandable system into which we will successively incorporate your experience.
More about this in the next issue of "Advanced Network Testing".



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Communications Test Solutions

Jitter/Wander Module O.172

At the start of this year, the ITU-T ratified Recommendation O.172 entitled: “Jitter and Wander Measuring Equipment for Digital Systems which are based on the Synchronous Digital Hierarchy (SDH)”. This new Recommendation supplements Recommendation O.171, which specifies Jitter and Wander measurements on PDH systems. O.172 primarily covers SDH, but the interfaces for the PDH tributaries are also included within its scope. It defines the characteristics of equipment for jitter and wander measurement and for generating jitter and wander. It should be noted that the requirements in O.172 regarding measurement accuracy have been tightened in some instances compared with O.171. The weighting filters, which are important for the measurement, are also defined precisely. New measurement applications, resulting from the use synchronous technology are additionally described (e. g. pointer jitter).

The most important feature of our new jitter test solution is that the ANT-20 now conforms to O.172. For this, the newly developed Jitter/Wander Module and Version 7.0 Software are required. ANT-20 benefits from the new Recommendation O.172 as follows:

- Extended jitter meter frequency range: now up to 20 MHz (at 2.5 Gbit/s)
- Extended measurement range for jitter amplitude (e.g. 200 UI for STM-1)
- Wander generator frequencies down to 10 µHz
- Wander generator amplitudes up to 200,000 UI
- Wander meter (TIE) with several sampling rates (e. g. 30 samples/s, 300 samples/s)
- Automatic O.172 conformance suite for pointer sequences with CATS Test Automation Software

The most noticeable changes are in *MTIE/TDEV off-line wander analysis* (BN 3035/95.21). The *TDEV* button now lets you start off-line analysis direct from the TIE view in the *O.172 Jitter Generator/Analyzer* window (upper figure). The TIE curve from the measurement now appears off-line in the *TIE Analyzer* (lower figure). Here, it can be more accurately analyzed. Zooming functions simplify the locating of critical points. This view also includes the results of new evaluation functions: *Drift Rate* (in ppm/s) and *Frequency Offset* (in ppm). These values are determined with algorithms as per ANSI T1.101. The TIE measurement curve can be corrected by the calculated frequency offset (*TIE eliminated*; the lower curve in the figure).
The curve section selected for zooming is used to calculate MTIE/TDEV. The algorithms have been optimized for speed and the existing tolerance masks for network elements have been extended to include specifications for network interfaces.

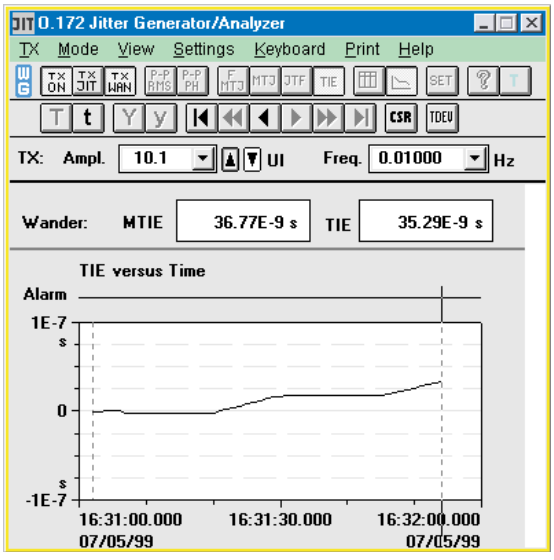
Also new in the range of jitter measurements:

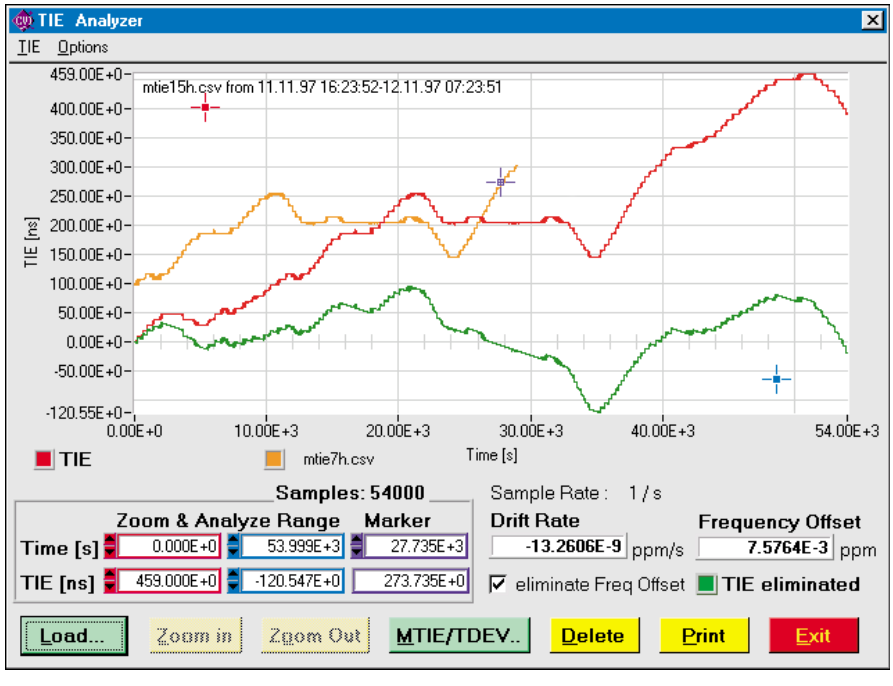
- RMS jitter measurement, including jitter versus time
- Jitter transfer function (JTF) now with selective filters

Although included from software version 6.6, the VC offset feature is little known. This allows mapping jitter to be tested by offsetting the transport bit rate of the mapped PDH tributary signals.

The CATS Test Automation Software can cycle through all the specified pointer sequences one after the other, including the *initialization* and *cool-down* phases specified in O.172. This entire sequence is, in fact, available as a pre-defined test case.

Jochen Hirschinger





Clicking on the TDEV button (upper figure) opens off-line analysis (lower figure), now with zoom function.

Our STM-16/OC-48 solution

has been revised. The result is a completely new board. This allows testing of *concatenated* bit streams, which are becoming more commonly used as the number of ATM and IP paths fed through a SDH or SONET physical layer increases. This is because *concatenation* allows the entire, common payload to be filled without gaps. Concatenation is also becoming more popular in DWDM systems.
Here are the functions of the new STM-16/OC-48 module:

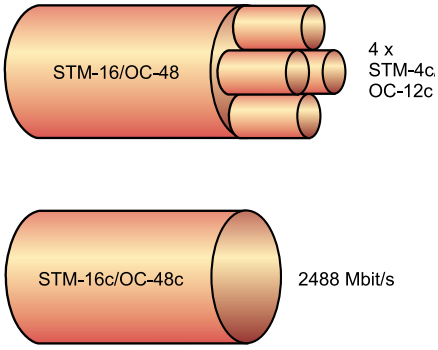
STM-16c/OC-48c BULK Bit Error Test (Option 3035/90.93).
The entire available payload of a 2.5 Gbit/s signal is filled with a pseudo-random sequence (e. g. PRBS 31) for this test.

Multiplexing and demultiplexing of **STM-4c to STM-16** or from **OC-12c to OC-48**.

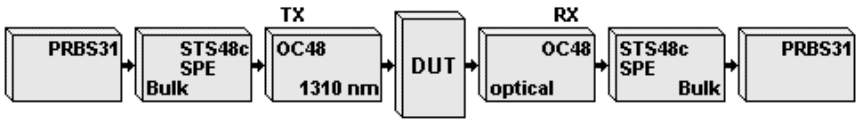
Access to **all 16 SOHs/POHs**.

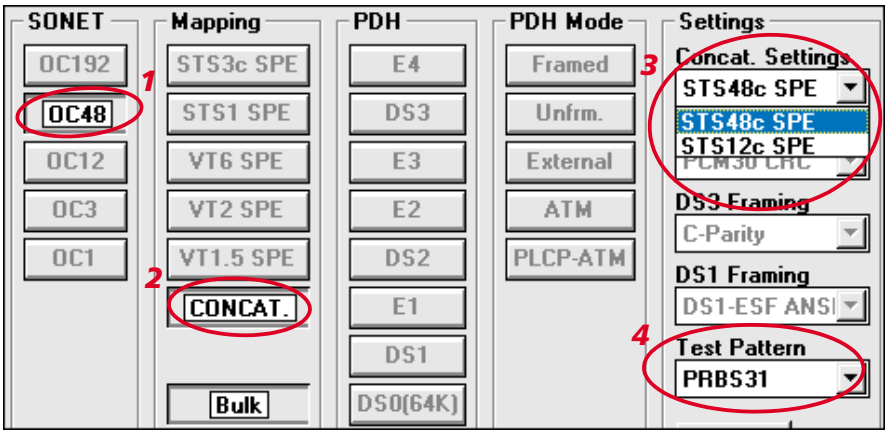
Software Version 7.0 is required for operation of the new STM-16/OC-48 module. We are offering all our existing STM-16/OC-48 users a possible upgrade. Please contact your local Sales Partner for details.

Jochen Hirschinger



Differences between STM-16/OC-48 and STM-16c/OC-48c





How do you set an OC-48c signal structure? First select OC-48 *(1)*. The *concatenated* button *(2)* can now be activated. Click on this button to select between *STS-12c* and *STS-48c* under *Settings (3)*. Now you can set the pseudo-random sequence *(4)*. The PRBS 31 has a spectral distribution that is closer to a "live" signal than shorter pseudo-random sequences.

New: Software Version 7.0

What are the advantages of the new software version?

- Supports the new Jitter Module for measurements to ITU-T Rec. O.172 (completely new hardware) with extended functions
- Supports the new STM-16/OC-48 Module (completely new hardware) with extended functions

Other new features:

- Access to the SS bits in the pointer generator
- "Extended Overhead Analysis" (BN 3035/90.15) now includes a TCM generator

The software will be available from September. Upgrading instruments already delivered requires hardware modifications. We are offering an economical upgrade concept; please contact your local Sales Partner for details.

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Which clock source for which application?

That is one of the questions that ANT-20 users are always asking. The clock source setting depends, of course, on the type of signal path: Radio link, DWDM, PDH, etc. It should be noted here that the setting always refers to the generator clock of the ANT-20. Figure 1 shows the possible settings, all of which are on the transmit side (TX). The *Internal* setting activates the built-in crystal oscillator. *Ext. Data 2M/E1 [25]* activates socket [25], into which a 2048 kbit/s HDB3 data signal must now be fed. *Ext. Clock 2M/E1 [25]* also activates socket [25], which now requires a 2048 kHz square wave or sine wave signal.
The applied signal is monitored with the appropriate *LTI* (Loss of Timing Information) LED. If it lights, the incoming signal is not recognized as a valid clock signal. The *RX [12,14,16,17,43,44]* setting activates clock derivation from the receiver (RX); the values in brackets indicate the receiver socket appropriate to the signal structure setting.
The basic test setup and possible path types are shown in figure 3.

Frank Kaplan

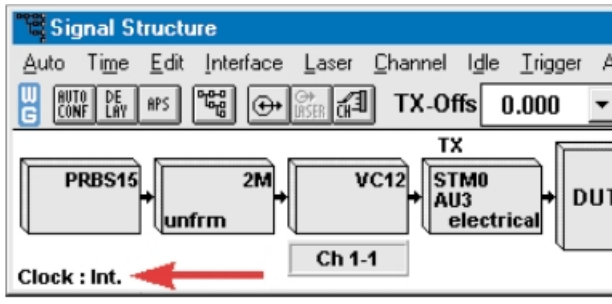


Figure 2: The clock source is shown in the *Signal Structure* window from Software-Version 6.6 onwards (in the example: *Clock: int.*

ANT-20 setting	Meaning
Internal	Clock is generated by an internal crystal oscillator
Ext.Data 2M/E1 [25]	Clock is recovered from a 2 Mbit/s data signal fed into socket [25] unbalanced
Ext.Clock 2M/E1 [25]	Clock is recovered from a 2 MHz clock signal fed into socket [25] unbalanced
RX [12,14,16,17,43,44]	Clock is recovered from the receive signal at the corresponding socket
Ext.Clock 1.5 MHz [25]	Clock is recovered from a 1.5 MHz clock signal fed into socket [25] unbalanced
Ext.Data 1.5M/DS1 [25]	Clock is recovered from a 1.5 Mbit/s data signal fed into socket [25] unbalanced

Table 1: The ANT-20 provides all these possible clock settings. The square brackets indicate the socket numbers.

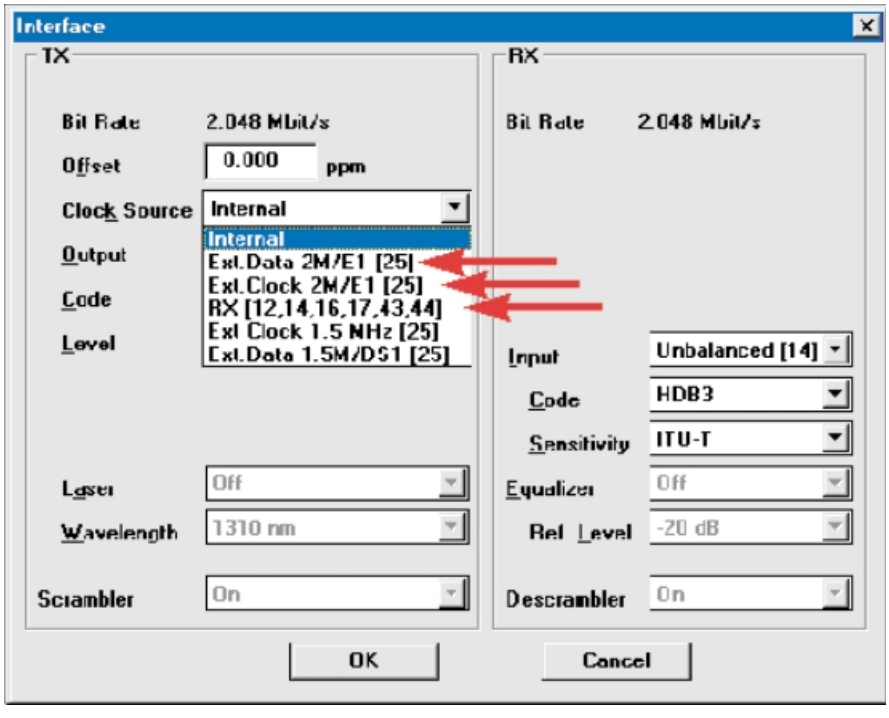


Figure 1: The possible clock sources are shown like this in the *Interface* window.

Table 2: Clock source settings for PDH/SDH end-to-end measurements from A to B. The settings for the ANT-20 at location A should be used for loop-back measurements.

Path type
PDH 2/34/140 Mbit/s (asynchronous mapping)
PDH 2 Mbit/s (asynchronous mapping) **with retiming**
PDH 2 Mbit/s (synchronous mapping)
ANSI 1.5/6/45 Mbit/s (asynchronous mapping)
SDH STM-1/4/16/64, measurement **via SDH network**
SDH STM-1/4 **stand alone** radio link system
SDH STM-1/4 radio link system **in a SDH network**
STM-1/4/16/64 **stand alone** DWDM system
STM-1/4/16/64 DWDM system **in a SDH network**
STM-1/4/16/64 glass fiber path with or without repeaters

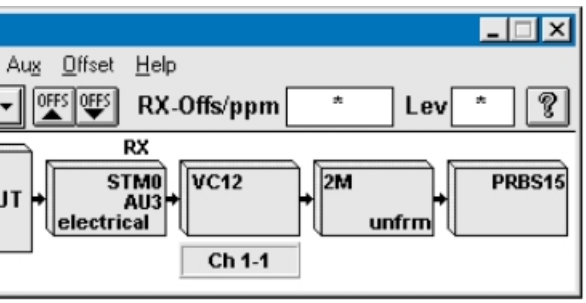
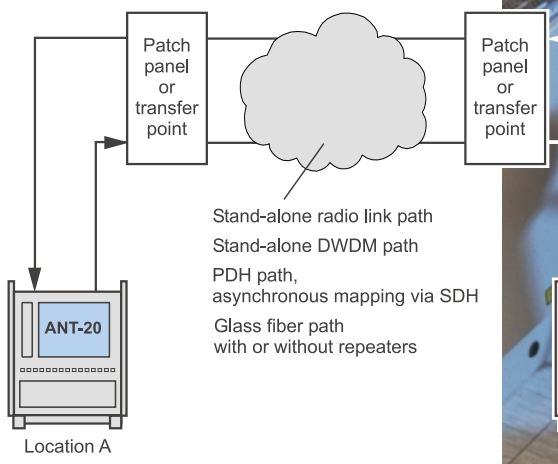


Figure 3: End-to-end measurement using two ANT-20s



	ANT-20 at location A	ANT-20 at location B	Notes
	Internal clock	Internal clock	The SDH system is transparent to clock signals, standard mode, pulling range as per G.703
	Clock from RX or external clock (T3) socket [25]	Clock from RX or external clock (T3) socket [25]	The SDH system supplies the clock to the 2 Mbit/s interface; clock from RX recommended
	Clock from RX or external clock (T3) socket [25]	Clock from RX or external clock (T3) socket [25]	The SDH system supplies the clock to the 2 Mbit/s interface, structured as per G.704; clock from RX recommended
	Internal clock	Internal clock	The SDH system is transparent to clock signals, standard mode, pulling range as per G.703
	Clock from RX or external clock (T3) socket [25]	Clock from RX or external clock (T3) socket [25]	The SDH system supplies the clock to the SDH interface, standard mode; clock from RX recommended
	Internal clock	Internal clock or clock from RX	The SDH radio link system is transparent to clock signals, it can only extract and pass on the clock signal.
	Clock from RX or external clock (T3) socket [25]	Clock from RX or external clock (T3) socket [25]	The SDH system supplies the clock to the STM-1/4 interface via the clock-transparent radio link system, standard mode, clock from RX recommended
	Internal clock	Internal clock or clock from RX	The DWDM system is transparent to clock signals, it can only extract and pass on the clock signal.
	Clock from RX or external clock (T3) socket [25]	Clock from RX or external clock (T3) socket [25]	The SDH system supplies the clock to the SDH interface via the clock-transparent DWDM system, standard mode, clock from RX recommended
	Internal clock	Internal clock or clock from RX	The glass fiber path is transparent to clock signals, it can only extract and pass on the clock signal.

Remote Control using SCPI commands

How the ANT-20 CATS Test Sequencer makes your job easy!

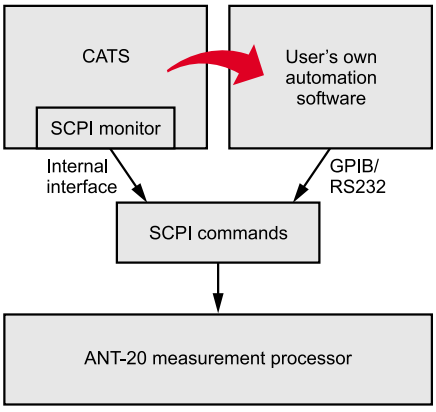
Many ANT-20 users employ the instrument in a test automation environment. Either the *CATS Test Sequencer* software option is run directly on the instrument to automate recurring measurement steps, or a customized programming environment is used for sending remote control commands (SCPI – Standard Commands for Programmable Instrumentation) to the instrument.
If a generalized environment (*not* CATS) is used, it is not always easy to select the correct SCPI commands from the large number of possible remote control commands for the ANT-20. The *CATS Test Sequencer* demonstration software package installed on every ANT-20 can be of great assistance here, since the *SCPI Monitor & Error Check* feature is also available to users even in demonstration mode. This allows you to record the command sequences that are sent to the measurement modules and the responses from the test instrument.
To use this function, all you need to do is check the *SCPI Monitor & Error Check* box in the configuration menu for the Test Sequencer. All commands will then be recorded in an I/O window automatically.

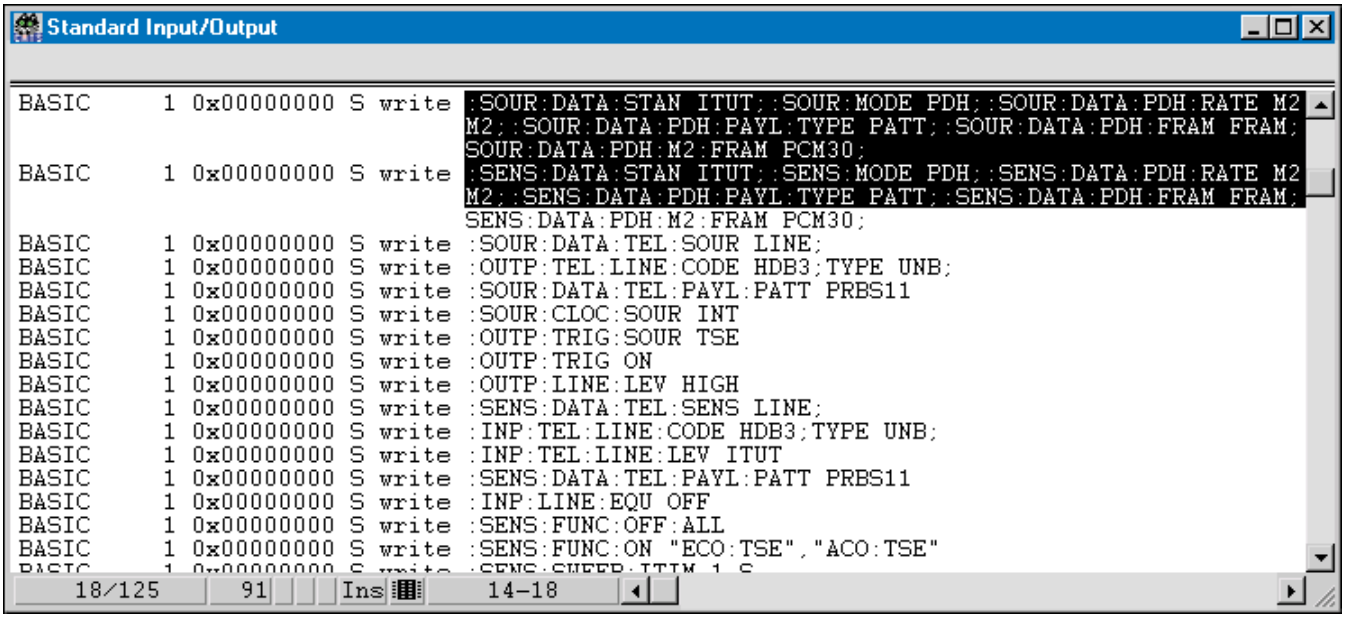
For CATS versions up to and including 3.5, the configuration menu is displayed automatically when a sequence is loaded. From CATS version 3.6 onwards, it is displayed by selecting the Sequence – Device Configuration menu item.
Now all you need to do is trigger the tests that are of interest (Run Test) in order to observe all the data traffic between the ANT-20 “Test Box” and the remote control application. Individual remote control commands can be copied from the I/O window (CTRL-C) and pasted into other applications (CTRL-V).
One more important point to note when copying SCPI commands from the I/O window:
Select the *Table* display mode; you can then suppress any unnecessary columns such as *Status* and *Mode* straight away!

Example:

In the figure below, the command sequence that the ANT-20 requires in order to generate a frames 2 Mbit/s PDH signal (framed pattern) on the TX and RX side is highlighted in black. The test cases for this are found in the sequence *_demo_e1* and are called *RX 2Mb fp* and *TX 2 Mb fp*. This test case can be adapted to any other ITU-T bit rates by the user (double-click on the test case name in the CATS main menu). A different sequence should be loaded for ANSI bit rates, e.g. *demooc3.squ*.
If you only have the CATS demonstration software available, remember that these modified sequences cannot be saved!

Walter Besse

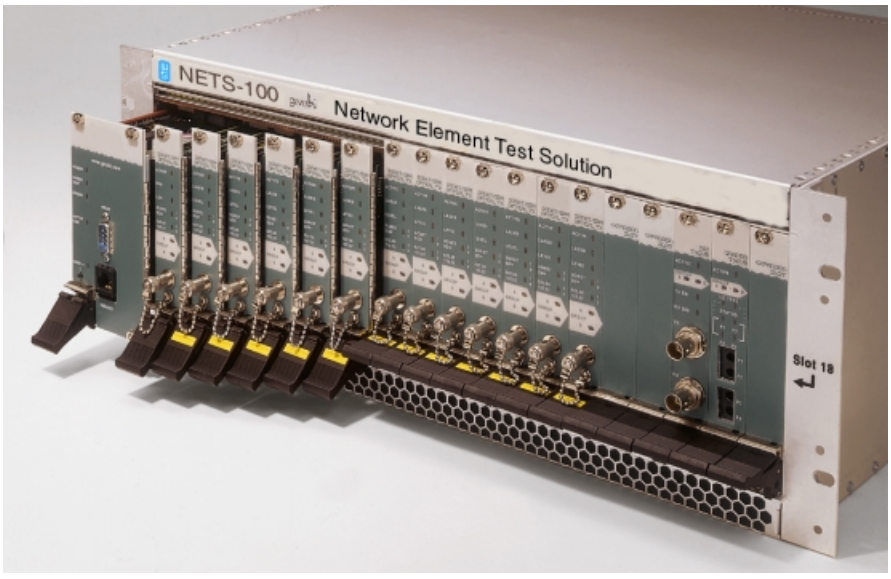




NETS-100 Network Element Test Solution

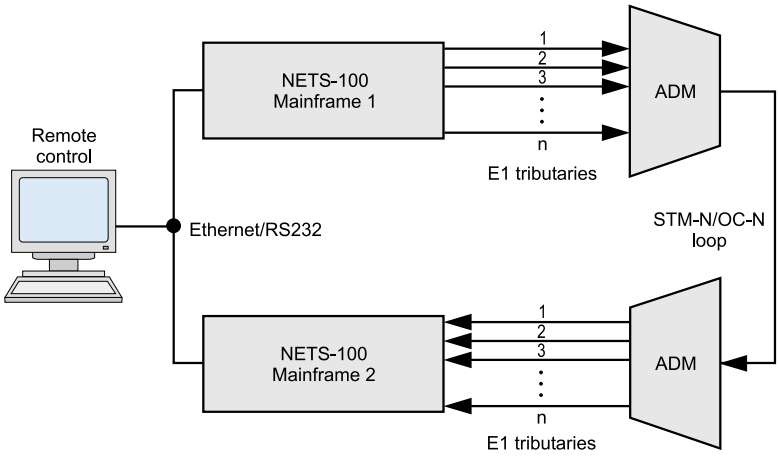
The NETS-100 product family offers a multi-channel network element test solution for analyzing digital communications network elements for applications from E1 and DS1 through STM-16 and OC-48.
The hardware is a stand-alone 17-slot mainframe with capability for plugging in different combinations of various interfaces (STM-N, OC-N, DS3, DS1, E1 etc.). The solution includes appropriate control software, i.e.: Graphical user interface (GUI), and programming interface (API).
NETS-100 is made for manufacturing and verification testing of network elements such as add/drop multiplexers (ADMs), digital cross-connects, and multi-channel optical distribution units etc. Testing these elements under worst case conditions requires the simultaneous monitoring of multiple channels and loading all interfaces with traffic. Standard SDH/SONET testers such as the ANT-20 have too many features on the one hand, which are not really required for this application. On the other hand, they can only test one channel at a time.
This is why NETS-100 is an economical solution. It provides simultaneous testing using multiple signal rates and protocols. With its modular architecture, the NETS-100 test solution supports parallel testing and is therefore ideal for both development and manufacturing test environments.

Hans-Werner Schaal



The NETS-100 mainframe can accommodate up to 17 interface plug-ins

Example: ADM full channel measurement with two NETS-100 mainframes



New Application Notes

AN 64 describes the use of trace identifiers (J0, J1, and J2 byte) in complex SDH networks and includes a concrete measurement application for the ANT-20. The special features of systems from different manufacturers are also discussed.

Automation with the aid of the CATS Test Sequencer can save much time and money. AN 66 describes just some of the many possibilities.

In-service measurements using the ANT-20 in conjunction with a test point scanner, with full remote control and automation using CATS. Sounds complicated? You'll be surprised just how easy it is. AN 68 will tell you how.

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	Very interesting	Moderately interesting	Boring	Comments
The publication in general	☐	☐	☐	_____
Jitter/Wander Module O.172	☐	☐	☐	_____
Our STM-16c/OC-48c solution	☐	☐	☐	_____
Which clock source for which application?	☐	☐	☐	_____
Remote control using SCPI commands	☐	☐	☐	_____
NETS-100 Network Element Test Solution	☐	☐	☐	_____

What topics would you like to see more of in "Advanced Network Testing"? _____

_____

Other comments: _____

_____

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