

Get an Overview of Synchronous Networks!

Application Note 68



**Use in-service
measurements to
assure the best
network quality**

The ANT-20 Advanced Network Tester from Wavetek Wandel Goltermann is a very powerful test platform for SDH, SONET, PDH and ATM networks. The compact tester has a large screen to allow clear evaluation and display of measurement results. The graphical user interface makes the instrument very easy to operate. Despite its extraordinary flexibility, the ANT-20 is one of the most compact testers of its class.



Advanced Network Tester ANT-20

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Get an Overview of Synchronous Networks!

When professionally used, intelligent test equipment can reduce your operating costs on the long-term, especially in today's SDH networks. In the right combination, test equipment makes a sizable contribution to quality assurance work, speeds up troubleshooting and optimizes availability. These are all critical issues when it comes to customer satisfaction.

This Application Note contains useful suggestions on how to find a systematic approach to in-service measurements for SDH network monitoring. Due to cost and competitive constraints, today's SDH networks tend to be built under immense deadline pressure. There is little time left for extensive out-of-service (OOS) acceptance procedures.

Subsequent in-service measurements are very important as a result. Unfortunately, however, there are much greater restrictions on testing during later phases since it is difficult to interrupt customer lines.

If something goes wrong under these circumstances, there are major consequences.

For example, some customer agreements require cash payments if the service provider does not fulfill its end of the "availability" bargain. Not to mention that poor service does nothing for customer satisfaction.

A carefully planned in-service test concept has economic benefits too. This should be taken into consideration when planning the network.

As a general rule, essential operating information is accessible on the system terminals. However, this is not always easy since terminal operation is not necessarily oriented towards test needs. Many parameters are expensive to measure, and some are even impossible. For example, it is hard to assess pointers, jitter, etc, particularly when using network elements from different manufacturers.

This is why it is common to use external test equipment with more accurate and clear test and evaluation functions. Since such equipment is not built by the system manufacturer, it provides "neutral" comparison measurements.

In strategic terms, the best situated test points are at the central SDH network elements (e. g. multiplexers) where a number of links converge.



The ANT-20 is the foundation of an expandable test system (available with touchscreen).

The basic ANT-20 solution

The ANT-20 from Wavetek Wandel Goltermann is very popular in the SDH world. It provides many useful analysis functions for SDH and PDH signals. For details, see <http://www.ant-20.wwgsolutions.com>.

Fast overview

A fast overview of channels is very useful right at the start of testing. With the ANT-20, this function is known as Auto Scan and it depicts the signal structure (here, STM-1), e.g. VC-12 used/unused (Fig. 1).

Protected monitoring points

With an operational system, it is best to measure only on special protected monitoring points (PMPs) since no customer links have to be interrupted. Moreover, there are no possible negative consequences for the network. PMPs are commonly found in SDH network elements. If not, PMPs can be simulated using external circuitry.

Fig. 1: Fast channel overview (Auto Scan function)

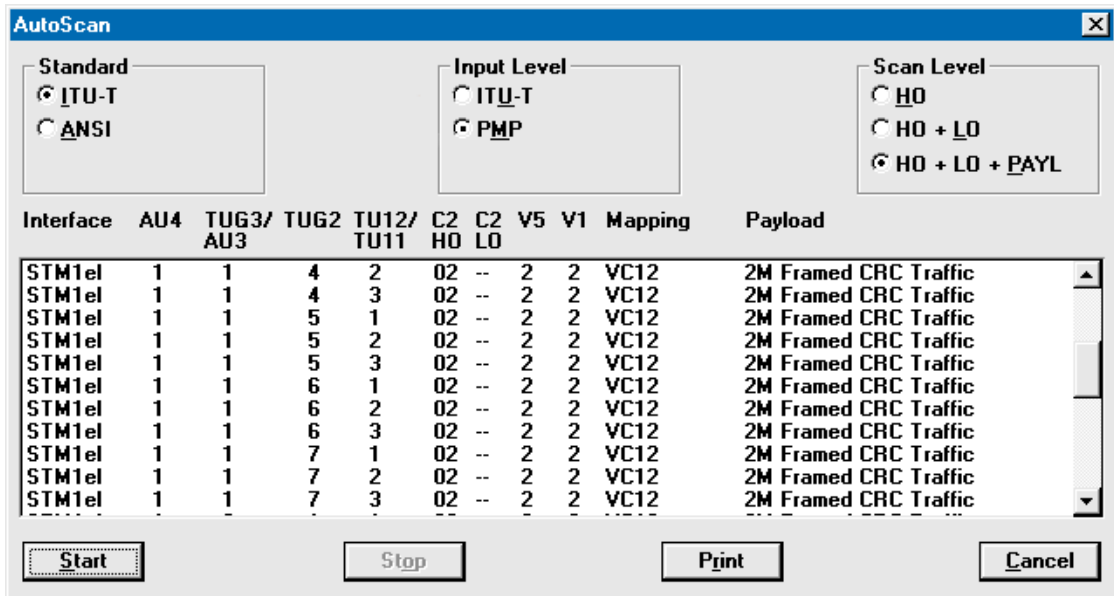
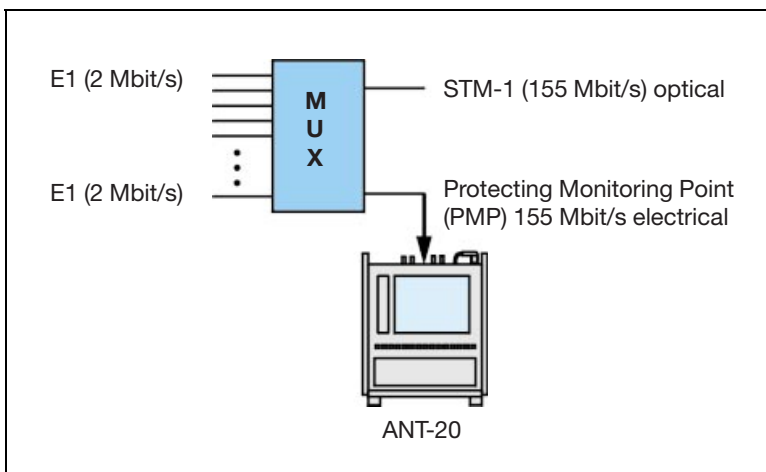


Fig. 2: ANT-20 at the protected monitoring point of a multiplexer



In the sample measurements on the following pages, the ANT-20 is set as follows:

- Signal structure, receiver (RX): 155 Mbit/s / STM-1/AU-4 with VC-12 (2 Mbit/s), i.e. STM-1 signal with 63 2 Mbit/s channels. The transmitter (TX) setting does not matter during monitoring.
- Input sensitivity "PMP", i.e. an internal preamplifier boosts the signal by 20 dB.
- Signal structure "Traffic" to prevent loss of sequence synchronization (LSS), i.e. the receiver is not expecting a PRBS.

The Trouble Scan function provides a fast overview of 2 Mbit/s tributaries in the STM-1 signal (see Fig. 3). Faulty or unoccupied channels (with LP-UNEQ) are marked in red. Double-click on the channel to open the Alarm Panel window with all major details.

Long-term monitoring

Table 1 shows the many ways of further investigating the STM-1 signal (or a 2 Mbit/s channel in it) using in-service techniques.

More information on this topic can be found in the relevant technical literature.

Many effects have to be measured statistically over a longer time interval (e.g. 24 hours). Measuring several of these effects requires multiple measurements.

The ANT-20 can be used to simultaneously observe several parameters. For instance, you can simultaneously analyze pointers, wander, G.826, anomalies/defects and overheads, thereby generating considerable time-savings.

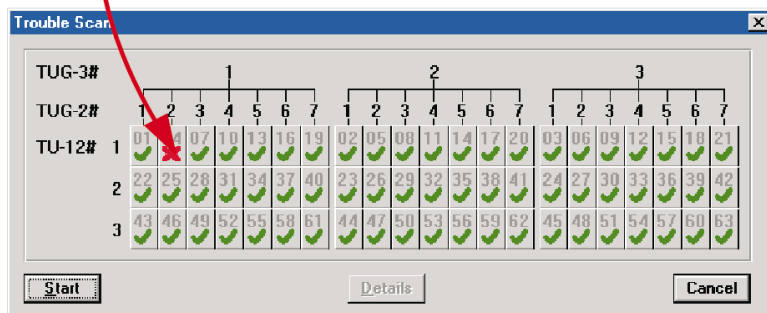
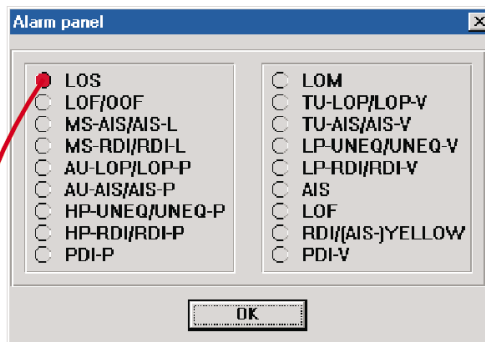


Fig. 3: Status of individual channels (Trouble Scan function)

Solutions for multiple links

The system described here is great for testing on a single protected monitor point (PMP). In real life, however, it is common to have to monitor a number of test points (links). What procedures and solutions make sense here?

One obvious approach is to simply move the test cable from test point to test point (i.e. from link to link). A simple approach, but it has some problems:

- Manual patching is time-consuming.
- Frequent patching can cause contact problems or cable breaks.
- Test points can get confused during patching, causing corrupt measurement results.
- The demands on personnel (and time) are great if the analyzer and devices under test are not at the same place.

The following section shows how to largely avoid these problems using a test point scanner.

Measurement	Purpose of the measurement
Monitoring of signals used to monitor the system	Evaluation of anomalies: Code errors, checksums (B1 to BIP2, FAS, CRC4) Evaluation of defects: e.g. loss of signal (LOS), loss of frame (LOF)
Quality analysis (performance)	G.821, e.g. frame alignment signal (FAS) at 2 Mbit/s G.826 at any hierarchy level, e.g. BIP2 at 2 Mbit/s M.2100, e.g. CRC4 checksum at 2 Mbit/s
Pointer analysis	Monitoring the clock quality in the network
Wander analysis	Assessment of the clock quality on an STM-N link
Output jitter	Checking the allowable output jitter
Overhead analysis	Monitoring and recording overhead bytes, e.g. clock indicator S1
Mapping test	Troubleshooting and testing a mapped PDH tributary signal on the STM-N side using a BERT
Path trace (trace identifier)	Checking the routing of 2 Mbit/s links during troubleshooting, after connection with 2 Mbit/s PDH tributary signals

Table 1: In-service tests with the ANT-20

Test point scanner simplifies access to multiple links

Frequent shuffling of test cables does not make sense on the long-term, as explained in the previous section. An external test point scanner is much more efficient. The time saved during measurements quickly makes up for the extra expense.

The inputs of the test point scanner are connected to the PMPs, and the output to the ANT-20's receiver (see Fig. 4).

You only need to hook up the test point scanner once. Afterwards, you can access the different PMPs as often as you like with great ease. The ANT-20 controls the switching directly via GPIB or RS232.

Facts about the "System 20" test point scanner from Pickering:

- Mainframe with room for up to 6 cards
- Power supply module
- Remote control module (RS232 and GPIB)
- 1 to 4 switching cards (1/32)
- 0 to 1 switching cards (1/16) (can also be used as "2 × 1 out 8")
- 1 to 128 channels selectable

Important specifications

Broadband (configuration 1 to 16): 2 GHz

Insertion loss:
< 3 dB at 2 GHz (without cabling)

Impedance: 75 Ω (120 Ω upon request)

Size:
19" rack-ready (approx. 450 × 270 × 250 mm)

Fig. 4: ANT-20 with test point scanner

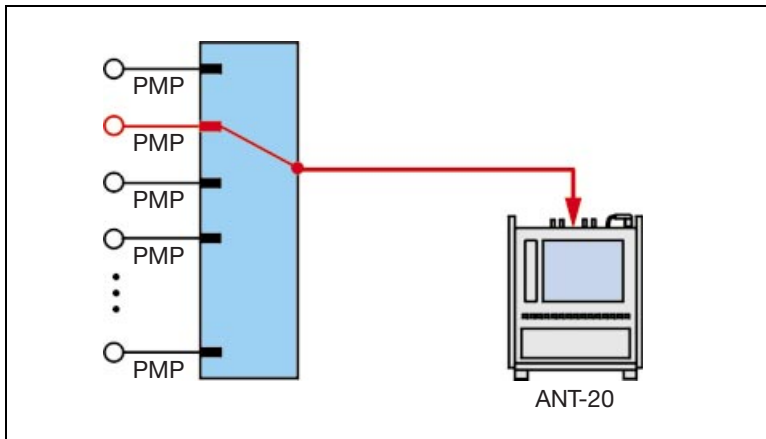
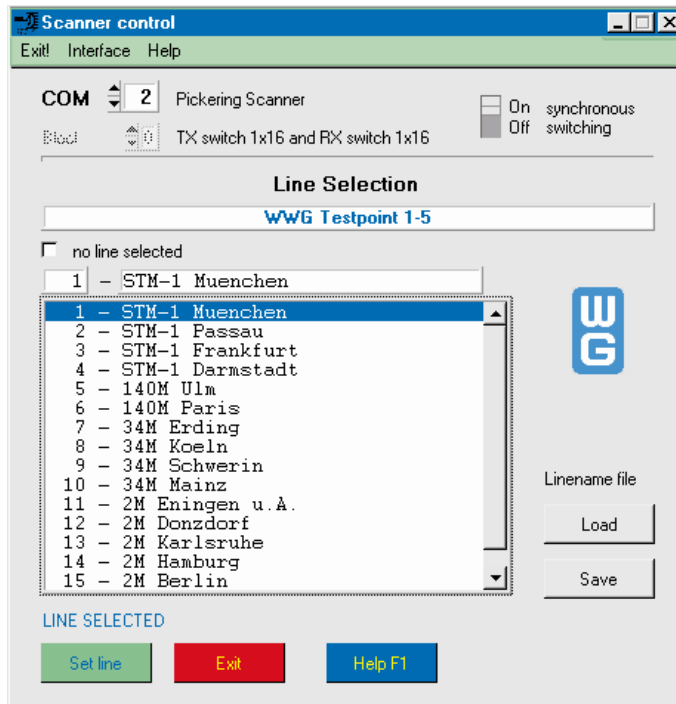


Fig. 5: The test point scanner's switching software



The ANT-20's clear *Scanner Control* menu shows the names of the PMPs in plain-text (see Fig. 5). Mix-ups involving access points (and the resultant errors) are easy to avoid in this manner.

Additional intelligent test control provides efficiency

In the test system described in the previous section (ANT-20 and test point scanner), the same procedures are always used to monitor the links and the channels within the links. For example, 63 measurements are required for bit error and TU pointer monitoring in the 63 2 Mbit/s channels in an STM-1 signal. These repetitive measurements are a burden and demand a lot of time.

Moreover, some of the measurements are very lengthy because certain phenomena require long intervals to assess statistically (e. g. bit errors, pointer movements).

The obvious choice? Automate these measurements! Fig. 6 shows how such an automated process is structured.

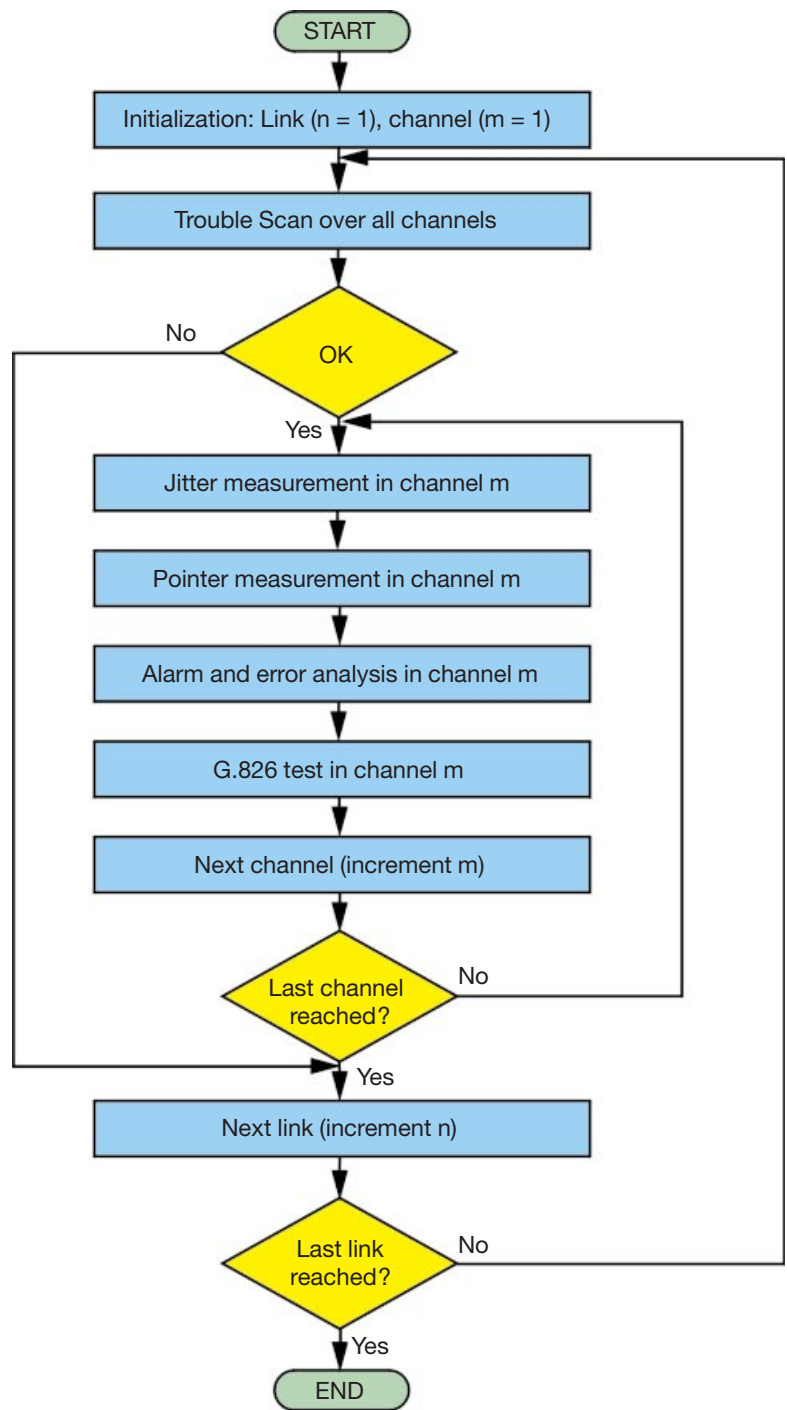


Fig. 6: Structure for automatic control of test sequences

The CATS Test Sequencer (Windows software) offers an efficient approach to automation. The software lets you control ANT-20 test procedures as well as the access to individual PMPs via the test point scanner.

The ANT-20 has a built-in, full-featured PC running Windows so the CATS Test Sequencer runs directly on the ANT-20. No external controller is required.

CATS Test Sequencer – So easy to operate

Each measurement sequence comprises a number of “test cases”. The individual test cases are listed in the sequence display. The color coding for the individual lines is as follows:

RED: Actual test cases containing concrete measurements. There must be a PASS/FAIL criterion after each test case (e.g. less than 2 bit errors = PASS).

BLUE: User dialog/information messages or configuration sequences (e.g. interface settings). These messages (or sequences) have no influence on the PASS/FAIL result.

GREEN: Commands that control the flow of the sequence (e.g. GOTO leaps). These commands have no influence on the PASS/FAIL result. If every test case gets a PASS, then the overall test sequence gets a PASS too.

Three buttons are used for operation:

Green “Run Sequence” button: Starts the selected sequence

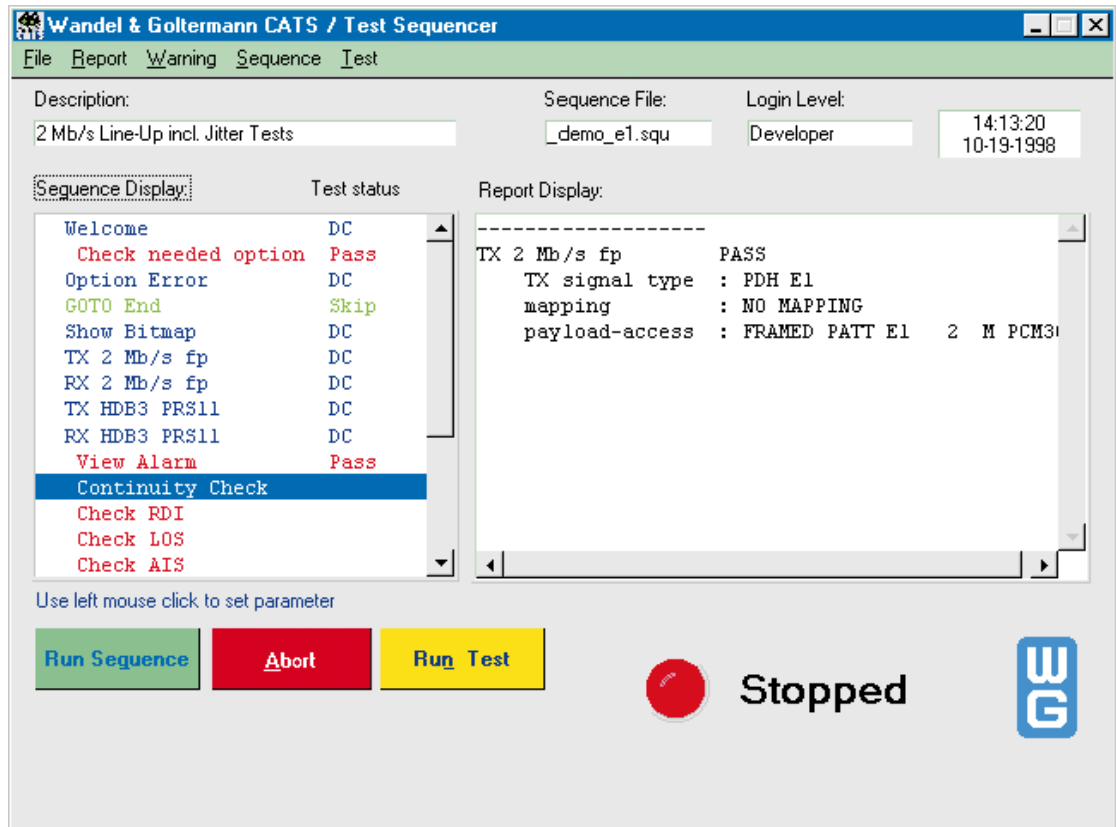
Red “Abort” button: Interrupts the sequence

Yellow “Run Test” button: Starts a single test case

The “Report Display” (right subwindow) gives details for the test case currently executing, including the results. The complete details for the sequence are saved in an ASCII file, making it easy to integrate the results into test reports.

The main window for the CATS software (Fig. 7) gives the status of the test sequence. There is also a “Sequence Editor” window for a look at the details. Here, you can modify existing sequences and create new ones.

Fig. 7: The main window of the CATS Test Sequencer



Remote operation and integration into a network management environment

The network management terminal is generally located in a central office, i. e. far removed from the actual network and test equipment.

It would be ideal to fully integrate test systems with the ANT-20, test point scanner and CATS Test Sequencer into network management environments.

The ANT-20's remote operation capability is a starting base for such a solution.

A remote control PC showing the simulated ANT-20 user interface can be situated directly in the network management center, for example. Other programs can still run concurrently on the same PC with no problems.

In case of changes in the network configuration, the response on the selected PMP can then be observed immediately.

If necessary, multiple ANT-20's can be installed at different network nodes. You can then easily switch from one ANT-20 to another while sitting at the network management center.

A test system of this sort is extremely efficient. Possibilities include:

- Fast troubleshooting and fault isolation in the entire network
- Complete test sequences can be programmed using the CATS Test Sequencer software. Once you switch to an ANT-20, you can automatically scan all channels, for example.
- Long-term monitoring of multiple links at multiple nodes.

Facts about remote operation with the ANT-20

The ANT-20 has a built-in PC with all standard interfaces. The two PCMCIA slots can be fitted with common components, e. g.:

- Modem
- Ethernet LAN card (TCP/IP)

Using a standard remote operation program that runs concurrently with the ANT-20 software, you can simulate the ANT-20's user interface on another PC via a LAN or modem link. You can then easily operate the ANT-20 from another site, almost as if you were sitting right in front of the instrument.

Special tips for TCP/IP operation:

When installing and configuring the LAN card in the ANT-20, the proper settings are critical:

- The protocol must be set to TCP-IP (Windows Control Panel → Network)
- The ANT-20 must be assigned a valid (and unused!) IP address (clarify any questions with the system operator).
- Using IP pings, you can use another LAN computer to check whether the ANT-20 can be reached in the LAN.
- Tip: First, connect the ANT-20 via the LAN cards directly to another computer and test the remote functions. Then connect the ANT-20 to the LAN.

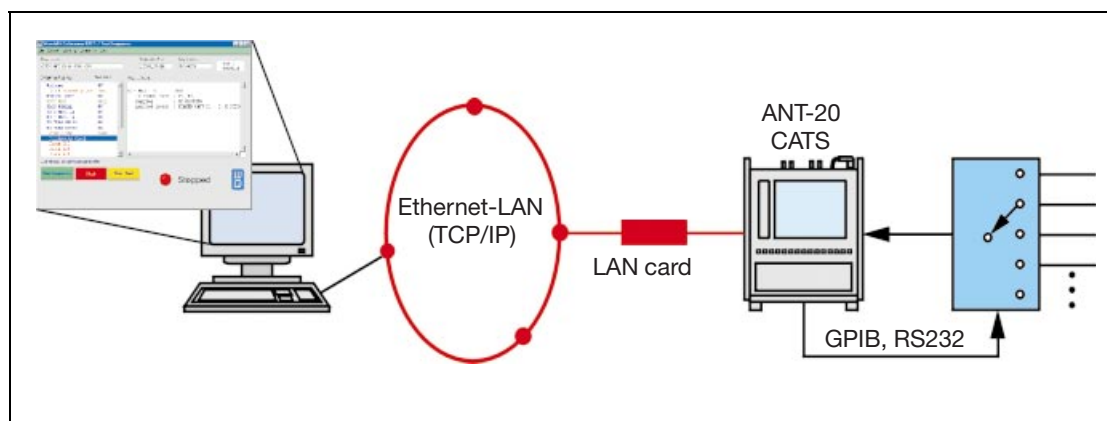


Fig. 8: ANT-20 remote operation with test point scanner and CATS

Test system expansion levels

ANT-20

- Fast overview of channel occupancy in the STM-1 signal with the Auto Scan function (used/unused/PRBS)
- Fast overview of 2 Mbit/s tributaries in the STM-1 signal with the Trouble Scan function (alarms/errors, e.g. LP-UNEQ)

ANT-20 and test point scanner

- Fast switching between a number of PMPs
- Software-controlled switching via GPIB or RS232 from the ANT-20

ANT-20, test point scanner and CATS Test Sequencer

- Time-savings by automating routine measurements.
- *CATS Test Sequencer* can run on the ANT-20. Controls ANT-20 and test point scanner.

ANT-20, test point scanner, CATS Test Sequencer and remote operation

- Remote operation via modem or LAN (TCP/IP)
- The user interface of the ANT-20 or CATS is accessible on the PC as if you were sitting right in front of the instrument.

Other possibilities

The monitoring applications described here (in-service measurements) represent only a small subset of possible uses of the ANT-20 or the monitoring system.

For example, the described system is also suitable for out-of-service (OOS) measurements on multiple links:

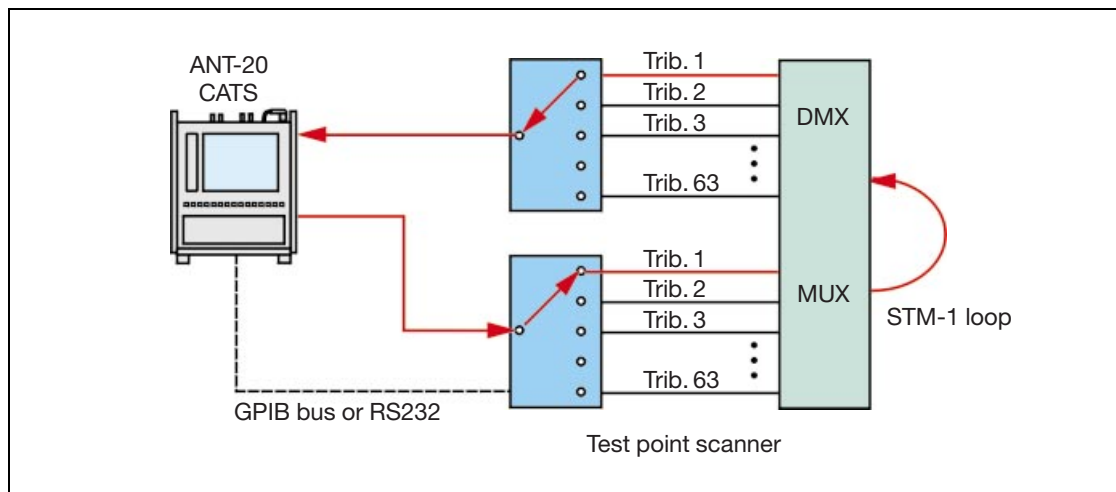
Full-channel measurements

With OOS full-channel measurements, PDH test signals are inserted into an STM-1 signal at the multiplexer. The STM-1 signal is then looped back to the test instrument via a demultiplex stage. Fig. 9 shows the basic setup:

Half-channel measurements

With half-channel measurements, a PDH test tributary is inserted into an SDH signal via the multiplexer. The SDH signal is looped back to the test instrument. The basic test setup is shown in Fig. 10.

Fig. 9: Full-channel measurements on PDH tributaries



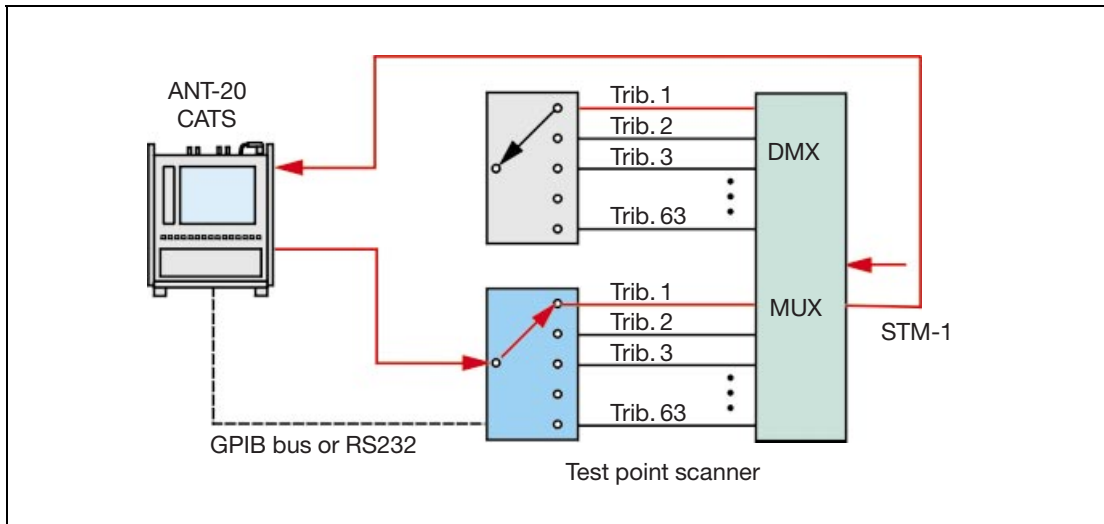


Fig. 10: Half-channel measurements (PDH tributaries, SDH signal)

Specific solutions

Combined, the ANT-20, test point scanner, CATS software and remote operation software represent an extremely versatile test package. Naturally, the solution you actually choose will vary from case to case.

If you do not have sufficient expertise to handle all of the planning, design and implementation work required for such a complex system, we suggest you contact Wavetek Wandel Goltermann's Solution Center. With the Solution Center as your partner, you can develop test solutions to fit your needs – without hiring additional personnel.

If you have specific questions about test solutions, please contact your nearest WWG sales office. If you don't know where this is, then contact our Solution Center directly:

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