Advanced Network Tester SDH version

ANT-20

WIN '95 ®

NEW

- Jitter O.172
- OC-48c/STM-16c
- BERT

ANT-20

For analyzing digital communications systems

- **Modular concept for SDH, SONET, PDH and ATM offers flexibility with sure future viability**
- **Application-oriented options for cost-effective, flexible solutions**
- **Graphical user interface (MS Windows™) for superior ease of use**
- **Additional operating comfort with "point & shoot" touchscreen**
- **Handy design for field applications**
- **Automatic Test Sequencer saves time during testing**
- **Built-in PC**

As digital communications networks expand, network operators are increasingly utilizing network elements (NEs) from the synchronous digital hierarchy (SDH). International-scale internetworking requires flexible gateways that can process signals which conform to a diversity of different standards. In the consumer access area, the use of ATM network elements makes for even more flexibility.

ANT-20: Flexibility with sure future viability
The ANT-20 Advanced Network Tester can be individually adapted to the latest test requirements and still leave room for handling possible future needs. The instrument thus meets the ever-changing requirements of the operators and manufacturers of modern communications networks. The modular hardware and software concept means that the ANT-20 test functions are easily adapted to cover a new scenario.
It is increasingly common that signals based on different standards converge at international gateways. The ANT-20 is ideal in this situation, as it combines both SDH and SONET mapping in one handy instrument. This can be coupled with real-time ATM analysis on SDH/SONET/PDH interfaces, still using just the one compact tester.

Superior ease of use
The ANT-20 is built around the standard Microsoft® Windows™ graphical user interface and a large display screen, combining comprehensive test facilities with superior ease of use. The instrument is operated right on screen using a trackball or the optional touchscreen. A mouse can also be connected if preferred. The graphical user interface facilitates rapid, application-oriented instrument settings together with simultaneous display of major parameters and test results, adapted to the current measurement.

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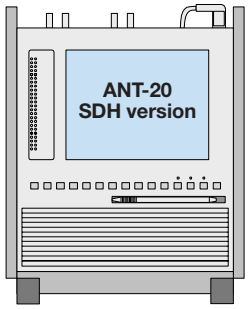
Handy design for field applications
Despite its extraordinary flexibility and functionality, ANT-20 is one of the most compact instruments in its class. Low volume combined with a large display screen (a high-contrast TFT version is also available) makes it ideal for field operations.

ANT-20 SDH version expandability



TFT color display
Touchscreen

PDH functions
64k/140M Demux
64k/140M Mux / Demux

STM-0-Mappings
STM-0 (1.5 Mbit/s)
STM-0 (45/34 Mbit/s)
STM-0 (2 Mbit/s)

OC-12c/STM-4c
BERT, ATM Testing
Virtual Concatenation
OC-48c/STM-16c BERT

STM-1 mappings
for ETSI tributaries
C12 (2 Mbit/s in STM-1)
C3 (34 Mbit/s in STM-1)
C4 (140 Mbit/s in STM-1)
for ANSI tributaries
C11 (1.5 Mbit/s in STM-1)
C2 (6 Mbit/s in STM-1)
C3 (45 Mbit/s in STM-1)
Drop & Insert
(Through, Block & Replace)
Extended Overhead Analysis
(APS, Capture, TCM)

ATM functions
ATM module
(with STM-1/STS-3c mapping)
Additional ATM mappings:
E4 (140 Mbit/s)
E3 (34 Mbit/s)
E1 (2 Mbit/s)
STM-1/VC-3

ATM Broadband* Analyzer/Generator
QoS Tester for SVC and PVC
* Expansion slot module

Optical interfaces
OC-1/3, STM-1, 1310 nm
OC-1/3, STM-1, 1550 nm
OC-1/3, STM-1, 1310 & 1550 nm
OC-1/3/12, STM-1/4, 1310 nm
OC-1/3/12, STM-1/4, 1550 nm
OC-1/3/12, STM-1/4, 1310 & 1550 nm
OC-48, STM-16, 15xy nm G.692*
OC-48, STM-16, 1550 nm*
OC-48, STM-16, 1310 nm*
OC-48, STM-16, 1310/1550 nm switchable*
* Expansion slot module

Jitter and Wander* to O.172
O.172 Jitter/Wander generator
up to 155/622 Mbit/s
O.172 Jitter/Wander analyzer
up to 155/622 Mbit/s
O.172 Jitter/Wander generator/analyzer
2488 Mbit/s**
O.172 MTIE/TDEV analysis
* Expansion slot module
** in version ANT-20E

SONET / ANSI
STS-1 mappings
for ANSI tributaries:
VT1.5 SPE (1.5 Mbit/s in STS-1)
VT6 SPE (6 Mbit/s in STS-1)
STS-1 SPE (45 Mbit/s in STS-1)

for ETSI tributaries:
VT2 SPE (2 Mbit/s in STS-1)

M13 Mux/Demux chain

BERT 1.5/6/45 Mbit/s

ATM mappings
DS1 (1.5 Mbit/s)
DS3 (45 Mbit/s)
STS-1

Other features
V.24 remote control
GPIB remote control
LabWindows/CVI driver
Remote operation via modem
Remote operation via LAN
Test sequencer for
SDH/SONET/ATM

The SDH version includes:
- Generator and analyzer for electrical STM-1 signals allowing simulation and evaluation in the SOH
- One selectable STM-1 mapping allowing simulation and evaluation in the POH and in the test pattern (included in price)
- Generator and analyzer for PDH bit error rate tests (BERT) at 2, 8, 34 and 140 Mbit/s with framed (ITU-T O.150) and unframed test patterns

Other ANT-20 versions:

ANT-20E with three additional slots to provide even more functions than the ANT-20. The combination of multiplex/demultiplex functions and jitter generation and analysis up to STM-16/OC-48 in one portable instrument is unique. Refer to the ANT-20E data sheet for more details.

DominoCOM ANT-20 is the "black box" version of the ANT-20 and is ideal for use in automated test systems. Remote-control interfaces are fitted as standard and the unit can be rack mounted.
Refer to the DominoCOM ANT-20 data sheet for more details.

Generator unit

Digital outputs
Interfaces to ITU-T Recommendation G.703
75 Ω unbalanced output, adapter jack selectable from Versacon 9 adapter system
Bit rates and line codes
2048, 8448 and 34368 kbit/s ..... HDB3, CMI
139264 and 155520 kbit/s ..... CMI

120 Ω balanced output, Lemosa jack
Bit rate and line codes
2048 kbit/s ..... HDB3, CMI

Bit rate offset ..... ±500 ppm
Step size ..... 0.001 ppm

Clock

Internal clock generation
at all of the bit rates listed above.
Clock stability ..... ±2 ppm

Synchronisation to external signals
via 75 Ω unbalanced input, BNC jack:
- Reference clock ..... 2048 kHz and 1544 kHz
- 2048 kbit/s (HDB3), 1544 kbit/s (B8ZS) or
- Receive signal

Clock outputs
- Clock output at frequency of generator signal, approx. 400 mV (when terminated into 75 Ω), BNC jack.

2048 kHz reference clock output via trigger output

STM-1 output signal
Generation of a STM-1 signal conforming to ITU-T Recommendation G.707

Mappings
One selectable STM-1 mapping is included in the basic instrument. Other mappings can be added as needed.
Content of the selected container:
- Framed or unframed PDH test pattern

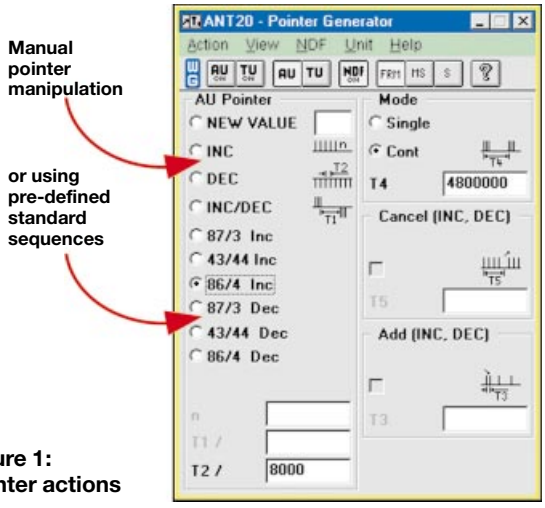


Figure 1:
Pointer actions

- PDH multiplex signal (with 64k/140M Mux/Demux chain option)
- External PDH signal (with D&I option)
- Test pattern without stuffing bits (bulk signal to O.181)

Content of non-selected containers ..... framed PRBS 2^{11}-1

The various mappings are described along with the options.

Generation of Pointer actions (figure 1)
Generation of pointer actions at the AU and TU levels simultaneously.
- Pointer sequences to G.783 with programmable spacing
- Pointer increment/decrement (continuously repeated)
- Single pointer
- Pointer value setting with or without NDF

Trigger types: Single or continuous repeat

Content of SOH and POH bytes
The content of all bytes with the exception of B1/B2/B3 and H1 to H4 is programmable with any byte or a user defined byte-sequence p in m in n (p frames in m frames and the entire sequence repeated n times) can be inserted.
Bytes E1, E2, F1, F2, and byte groups D1 to D3 and D4 to D12:
- Transmission of a PRBS test pattern with bit error insertion (see test patterns)
- Insertion of an external data signal via V.11 interface (also for K1, K2 and K3)

Trace identifier
J0, J1, J2 ..... programmable 16 byte ASCII sequence with CRC
J1, J2, additionally .. programmable 64 byte ASCII sequence
H4 byte ..... 4 or 48 byte sequence

Error insertion
Error types ..... B1, B2, B3 parity errors
frame alignment signal errors, MS-REI, HP-REI,
bit errors in test pattern, code errors (single errors)
Triggering
Single error or error ratio ..... 2×10^{-3} to 1×10^{-10}
for B1, B3, HP-REI ..... 2×10^{-4} to 1×10^{-10}
for bit errors ..... 1×10^{-2} to 1×10^{-9}
Step size for mantissa and exponent 1

Burst error: m anomalies in n periods
For FAS, B1, B2, B3, MS-REI, HP-REI ..... m = 1 to 4.8×10^6 and n = 2 to 8001 frames or 0.2 s to 600 s

Alarm generation, dynamic
Alarm types..... LOF, MS-AIS, MS-RDI, AU-LOP, AU-AIS, HP-UNEQ, HP-RDI, HP-RDIEP, HP-RDIES, HP-RDIEC
m alarms in n frames ..... m = 1 to n–1, n_{max} = 8000
or
t1 alarm active,
t2 alarm passive..... t1 = 0 to 60 s, t2 = 0 to 600 s

Alarm generation, static (on/off)
Alarm types ..... LOS, LOF, MS-AIS, RS-TIM, MS-RDI, AU-LOP, AU-AIS, HP-UNEQU, HP-PLM, HP-TIM, HP-RDI, HP-RDIEP, HP-RDIES, HP-RDIEC

PDH output signals
Signal structures for all bit rates:
– Unframed test pattern
– Framed test pattern (to ITU-T O.150); CRC-4 selectable for 2 Mbit/s

Error insertion
Error types ..... bit errors, FAS errors, code errors (single errors)
Trigger types: Single error or
error rate..... 2×10^{-3} to 1×10^{-8}
Step size for mantissa and exponent 1

Alarm generation, dynamic
Alarm types ..... LOF, RDI
m alarms in n frames ..... m = 1 to n–1, n_{max} = 1000

Alarm generation, static (on/off)
Alarm types ..... LOS, LOF, AIS, RDI

Test patterns

Pseudo-random bit sequences
PRBS: 2^{11}–1, 2^{15}–1, 2^{20}–1, 2^{23}–1, 2^{11}–1 inv., 2^{15}–1 inv., 2^{20}–1 inv., 2^{23}–1 inv.

Programmable word
Length ..... 16 bits

Receiver unit

Digital inputs
Interfaces to ITU-T Recommendation G.703

75 Ω unbalanced input; adapter jack selectable from Versacon 9 adapter system
Bit rates and line codes
2048, 8448 and 34368 kbit/s..... HDB3, CMI
139264 and 155520 kbit/s..... CMI

120 Ω balanced input, Lemosa jack
Bit rate and line codes
2048 kbit/s ..... HDB3, CMI
Clock recovery pulling range ..... ±500 ppm

Selectable input gain
CMI coded ..... 15 to 23 dB
B3ZS, B8ZS, HDB3, AMI coded ..... 15 to 26 dB

Selectable adaptive equalizers for 1544, 2048, 34368, 44736, 51840, 139264 and 155520 kbit/s

Monitor input for STM-1 and STM-4 NRZ signals
See ANT-20 Optical Interfaces data sheet for details.

STM-1 and PDH receive signals
Signal structures as for generator unit

Trigger output
75 Ω BNC connector, HCMOS signal level
Pulse output for received bit errors, transmit frame trigger, transmit pattern trigger or 2048 kHz reference clock

Automatic modes

Autoconfiguration
Automatically sets the ANT-20 to the input signal.
The routine searches at the electrical and optical interfaces for the presence of standard PDH and STM-N signals (G.703, G.707, O.151, O.181) and the payload contents in channel 1.

Automatic SCAN function
The SCAN function permits sequential testing of all C11 or C12 channels via AU-3 or AU-4 in a SDH signal.
The ANT-20 receiver checks for alarms in the receive signal, the SDH structure and all channels, and for synchronization of the selected test pattern in all channels. The results (OK / not OK) for each channel are entered in a matrix.
The generator runs simultaneously and can be used to stimulate the device under test.

Automatic TROUBLE SCAN function (figure 2)
The TROUBLE SCAN function permits sequential testing of all C11 or C12 channels via AU-3 or AU-4 in a SDH signal.
The ANT-20 receiver checks for alarms in the receive signal, the SDH structure and all channels. The results (OK / not OK) for each channel are entered in a matrix.
A detailed alarm history can be displayed by selecting a channel from the matrix.
The alarm status of individual channels can be displayed following the measurement.
Only the receive channels are altered during a TROUBLE SCAN.

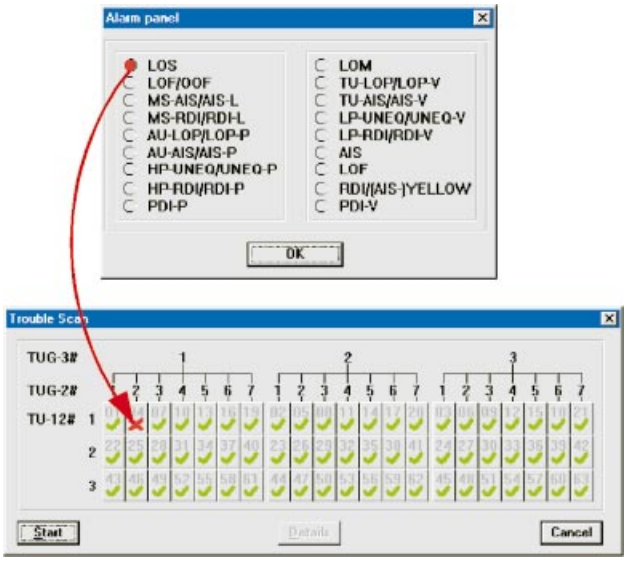


Figure 2: Trouble scan

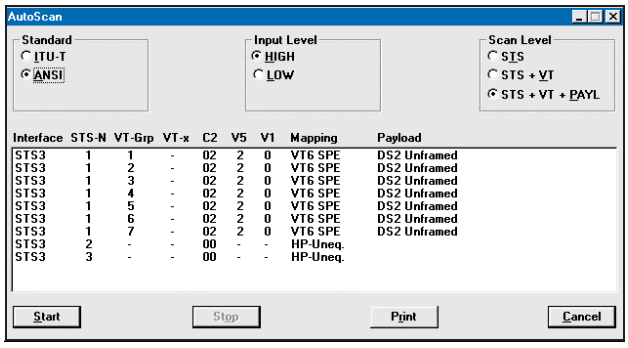


Figure 3: AutoScan

AutoScan function (figure 3)
This automatic "AutoScan" function allows you to rapidly check the signal structure, the mapping used and the payload – even with mixed mapped signals.
The ANT-20 receiver analyzes the incoming received signal and provides a clear overview of all the signals present in the composite receive signal. The variable scan depth setting allows even complex signal structures to be resolved and displayed clearly. All the displayed results can be printed out.

Automatic SEARCH function
Channel shifts in the payload may occur when measuring complex network elements, depending on the configuration of the device under test. The SEARCH function permits rapid automatic location of the test channel (C11 or C12 with defined PRBS) in the payload of a SDH signal.
The ANT-20 receiver checks for alarms in the receive signal, the SDH structure and all channels, and for synchronization of the selected test pattern in all channels. The results (OK / not OK) for each channel are entered in a matrix.
An OK result indicates that the corresponding channel contains the signal searched for. Only the receive channels are altered during a SEARCH.

Measurement types

Error measurements
Error types . . . . . B1, B2, B3 parity errors
MS-REI, HP-REI, bit errors in test pattern, code errors

Analysis of AU and TU pointer actions (figure 4)
Display of
– Number of pointer operations:
Increment, Decrement, Sum (Increment + Decrement), Difference (Increment – Decrement)
– Pointer value

Clock frequency measurement
The deviation of the input signal clock frequency from the nominal frequency is displayed in ppm.

Alarm detection
All alarms are evaluated and displayed in parallel
Alarm types. . . . . LOS, OOF, LOF, MS-AIS, MS-RDI, RS-TIM, LTI, AU-AIS, AU-LOP, AU-NDF, HP-RDI, HP-UNEQ, HP-TIM, HP-PLM, AIS, RDI, LSS

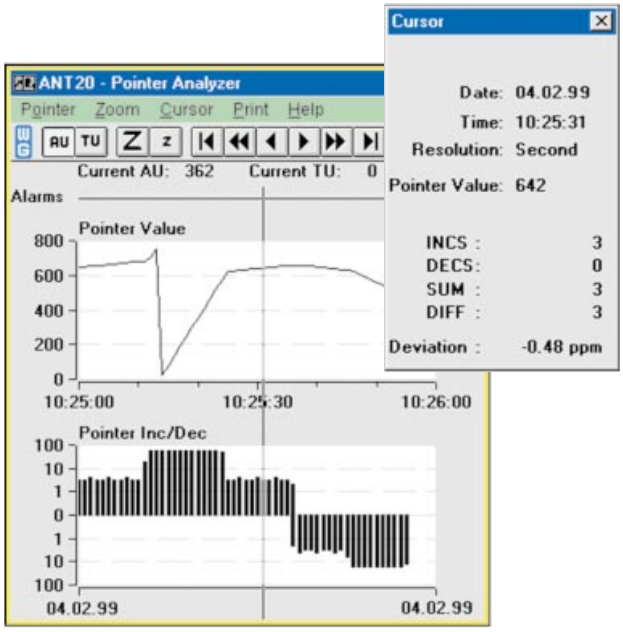


Figure 4: Graphic pointers. Display showing additional evaluation of cursor position

SOH and POH evaluation
– Display of complete SOH and POH, e.g. interpretation of APS information in K1 and K2

For the bytes E1, E2, F1, F2 and byte groups D1 to D3 and D4 to D12:
– BERT using test pattern from the generator unit
– Output of the data signal via the V.11 interface (also for K1, K2 and K3)

For the Trace Identifier
– J0 . . . . . display of 16 byte ASCII sequence
– J1, J2 . . . . . display of 16 or 64 byte ASCII sequence

Measurement interval
Variable . . . . . 1 second to 99 days
Measurement start . . . . . manual or automatic timer (user setting)
Measurement stop . . . . . manual or automatic timer (user setting)

Memory for errors, pointer operations and alarms
Resolution of error events and pointers . . . . . 1 s
Alarm resolution . . . . . 100 ms
Memory capacity . . . . . up to 1 million entries (approx. 100 days at 7 entries per minute)

Evaluation to ITU-T Recommendation G.826 (figure 5)
EB, BBE, ES, EFS, SES and UAS are evaluated.
Pass / fail assessment based on line length allocation of 0.1 to 100%.
The SES and UAS thresholds are user-settable.

In-service measurement (ISM)
Simultaneous in-service measurement of near end and far end of a selected path:
– Near end: B1, B2, HP-B3, LP-B3, BIP2, FAS at 140/34/8 or 2 Mbit/s, CRC-4
– Far end: HP-REI, LP-REI, E bit at 2 Mbit/s

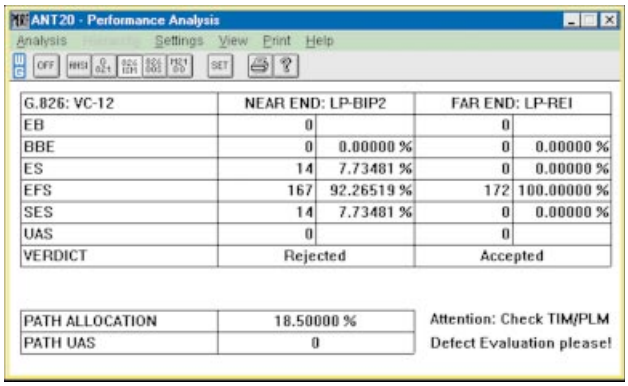


Figure 5: Performance analysis to ITU-T G.826

Out of service measurement (OOS)
Out of service measurement using bit errors in the test pattern (for PDH and SDH).

Evaluation of PDH and SDH systems to ITU-T Recommendation G.821
ES, EFS, SES, DM and UAS are evaluated.
Pass / fail assessment based on line length allocation of 0.1 to 100%.
The SES and DM thresholds are user-settable.
Evaluation for higher bit rates (up to 140 Mbit/s) is obtained using a multiplex factor as per G.821, Annex D.

Measurements can be made using the following events:
PDH systems . . . . . bit errors, FAS2, FAS8, FAS34 FAS140, CRC and E bit errors
SDH systems . . . . . payload bit errors (PDH and bulk), overhead bytes E1, E2, F2, D1 to D3, D4 to D12

Evaluation of PDH and SDH systems to ITU-T Recommendation M.2100
This recommendation describes requirements during line-up and maintenance (in-service)
ES, EFS, SES and UAS are evaluated.
Pass / fail assessment based on line length allocation of 0.1 to 100%.
The UAS and BISO (bringing into service objectives) thresholds are user-settable.
ISM simultaneously for near end and far end of a selected path:
PDH systems, near end . . . . . bit errors, FAS2, FAS8, FAS34, FAS140, CRC-4
far end . . . . . E bit at 2 Mbit/s
SDH systems . . . . . payload bit errors (PDH and bulk), overhead bytes E1, E2, F2, D1 to D3, D4 to D12
This operating mode allows application of the "Bringing into Service" procedures as per ITU-T Rec. **M.2110** and the determination of "Performance Information" as per ITU-T Rec. **M.2120.**

Delay measurement
A delay measurement is used to line-up satellite hops, to test the maximum permitted latency in storage exchanges and cross-connect systems and to check the loop circuits of regenerators. The ANT-20 measures the time taken for the test pattern to be transmitted from the generator back to the receiver via the path under test.

The measurement is made on the test patterns in the selected channel, in the containers (bulk or PDH) for SDH or in the selected channel at the lowest hierarchy level of PDH multiplex systems.
To avoid ambiguities in the measurement, two measurement times are provided.

Measurement range
Bit rates from 8 to 155 Mbit/s . . . . . 1 µs to 1 s
Bit rate 2 Mbit/s . . . . . 10 µs to 5 s
Bit rate 64 kbit/s . . . . . 100 µs to 16 s

Off-line analysis software
The software runs on standard PCs and permits comprehensive analysis of stored ANT-20 results.
After loading the results, the ANT-20 settings during the measurement and the stored results can be accessed.
Zoom and filter functions allow detailed evaluations.
The processed results can be exported in CSV format for importing into other programs such as MS Excel or MS Word for Windows for producing documentation.

Results display and instrument operation

Numerical display
Display of absolute and relative values for all error types
Intermediate results . . . . . every 1 s to 99 min

Graphical display (histogram) (figure 6)
Display of errors, pointer operations / values and alarms as bargraphs vs. time
Units, time axis . . . . . seconds, minutes, 15 minutes, hours, days

Tabular display
Display of all alarm and error events with time stamp

Result printout
ANT-20 supports a variety of dot-matrix, inkjet and laser printers (Windows Print Manager)

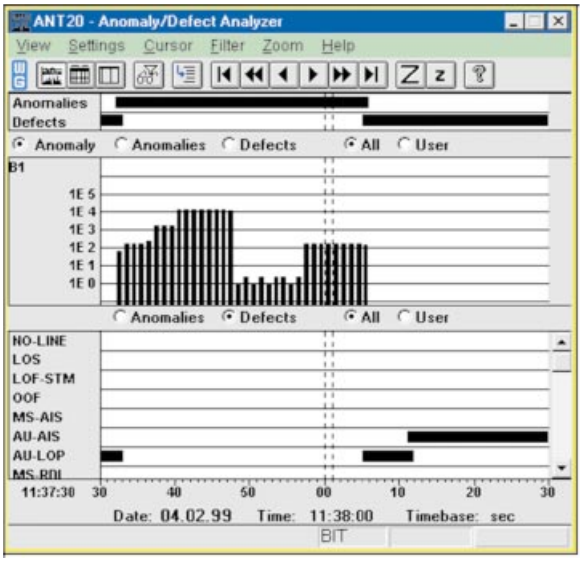


Figure 6: Histogram results display

Printer interfaces
Serial ..... V.24 / RS 232
Parallel ..... Centronics / EPP / IEEE P 1284

Result export
Results are stored in a database and can be processed using standard PC software

Instrument operation
ANT-20 is operated using the standard Microsoft® Windows™ graphical user interface.
Operation is menu-controlled using the trackball or optional touchscreen.
A mouse can also be connected if desired.

Application selection and storage
ANT-20 includes an applications library to which customer-specific applications can be added.
All applications are stored internally on the built-in hard disk drive and can be copied to any other ANT-20 via floppy disk.
Easy to use filter functions allow quick selection of the desired application.

Display
Two large display screens are available for the ANT-20: Monochrome LCD or color TFT.
Monochrome LCD ..... 9.5″, 16 gray scales
Resolution..... 640 × 480 pixels (VGA standard)
Color TFT screen ..... 9.5″, 256 colors
Resolution.....640 × 480 pixels (VGA standard

Built-in PC
ANT-20 uses a Pentium PC as internal controller so that standard PC applications can also be run on the instrument.
RAM capacity..... 16 MB
Floppy drive ..... 3.5″, 1.44 MB
Hard disk drive ..... 1 GB (minimum)

Keyboard
Full keyboard for text input, extended PC applications and future requirements. The keyboard is protected by a fold back cover.
An additional connector is provided for a standard PC keyboard.

External display connector
Simultaneous display with built-in screen
Interface ..... VGA standard

PCMCIA interface
Type ..... PCMCIA 2.1 types I, II and III
The PCMCIA interface provides access to GPIB, LANs, etc., via adapter cards.

Power outage function
In the event of an AC line power failure during a measurement, ANT-20 saves all data.
As soon as the AC line voltage is reestablished, the measurement is resumed. Previous results are retained and the time of the power failure is recorded along with other events.

General specifications

Power supply
AC line voltage,
automatic switching .....100 to 127 V and 220 to 240 V
AC line frequency..... 50 / 60 Hz
Power consumption (all options fitted) ..... max. 230 VA
Safety class to IEC 1010-1 ..... Class I

Ambient temeprature
Nominal range of use ..... +5 °C to +40 °C
Storage and transport range..... –20 °C to +70 °C

Dimensions (w × h × d) in mm .... approx. 320 × 350 × 170
in inches .... approx. 12.6 × 13.8 × 6.7

Weight ..... approx. 10 kg / 22 lb

Options

Touchscreen **BN 3035.93.11**
Upgrade for monochrome or color display screens

C12 mapping
(2 Mbit/s in STM-1, AU-3/AU-4) **BN 3035.90.01**
Modes ..... asynchronous, byte synchronous (floating)
Error insertion and measurement
Additional error types ..... BIP2 parity errors, LP-REI

Alarm generation, dynamic
Alarm types ..... TU-LOP, TU-AIS, TU-LOM, LP-UNEQ, LP-RDI, LP-RDIEP, LP-RDIES, LP-RDIEC, LP-RFI
m alarms in n frames ..... m = 1 to n–1, n_{max} = 8000
or
t1 alarm active,
t2 alarm passive..... t1 = 0 to 60 s, t2 = 0 to 600 s

Alarm generation, static (on/off) and evaluation
Alarm types ..... TU-LOP, TU-AIS, TU-LOM, LP-UNEQ, LP-PLM, LP-TIM, LP-RDI, LP-RDIEP, LP-RDIES, LP-RDIEC, LP-RFI
Alarm detection only .....TU-NDF

C3 mapping
(34 Mbit/s in STM-1, AU-3/AU-4) **BN 3035/90.02**
Error insertion and measurement
Additional error types ..... LP-B3, LP-REI

Alarm generation, dynamic
Alarm types.....TU-LOP, TU-AIS, LP-UNEQ, LP-RDI, LP-RDIEP, LP-RDIES, LP-RDIEC, LP-RFI
m alarms in n frames ..... m = 1 to n–1, n_{max} = 8000
or
t1 alarm active,
t2 alarm passive..... t1 = 0 to 60 s, t2 = 0 to 600 s

Alarm generation, static (on/off) and evaluation
Alarm types.....TU-LOP, TU-AIS, LP-UNEQ, LP-PLM, LP-TIM, LP-RDI, LP-RDIEP, LP-RDIES, LP-RDIEC, LP-RFI
Alarm detection only .....TU-NDF

C4 mapping
(140 Mbit/s in STM-1 and STS-3c) **BN 3035/90.03**
Errors and alarms as for mainframe instrument

C11 mapping
(1.5 Mbit/s in STM-1, AU-3/AU-4) **BN 3035/90.04**
Selectable via TU-11 or TU-12
Errors and alarms as for C12 mapping
(2 Mbit/s in STM-1)

C3 mapping
(45 Mbit/s in STM-1, AU-3/AU-4) **BN 3035/90.05**
Errors and alarms as for C3 mapping
(34 Mbit/s in STM-1)

C2 mapping
(6 Mbit/s unframed/Bulk in STM-1) **BN 3035/90.06**

STM-0 and VT2 SPE mapping
(2 Mbit/s in STM-0 and E1 in STS-1) **BN 3035/90.13**

STM-0 and VT1.5 SPE mapping
(1.5 Mbit/s in STM-0 and DS1 in STS-1) **BN 3035/90.10**

Mapping VT6 SPE
(6 Mbit/s in STS-1) **BN 3035/90.11**

STM-0 and STS-1 SPE mapping
(34/45 Mbit/s in STM-0 and DS3 in STS-1) **BN 3035/90.12**

OC-12c/STM-4c Bit Error Tester **BN 3035/90.90**
OC-12c/STM-4c ATM Testing **BN 3035/90.91**
OC-12c/STM-4c Virtual Concatenation **BN 3035/90.92**

Concatenated containers in both contiguous and virtual forms are now widely used in networks in order to meet the demands for ever higher bandwidths. The BERT option tests the performance of transmission paths.
The ATM testing option extends the applications of the ATM module (BN 3035/90.70). The Virtual Concatenation option provides the facilities for dealing with these new multiplexing techniques. Refer to the OC-12c/STM-4c data sheet for details.

OC-48c/STM-16c Error Test (Bulk) **BN 3035/90.93**
requires one of the following Optics Modules:
BN 3035/91.53 to /91.59 or /90.38

The quality of a 2.5 Gbit/s path can be determined very simply using a bit error rate test across the concatenated container. This is used for connectivity tests when lining up new paths between ATM switches and terabit routers via OC-192/STM-64 systems. This measurement is also used when commissioning DWDM tributaries.
The test signal fills the entire STS-48c SPE or VC-4-16c.

Extended Overhead Analysis **BN 3035/90.15**

Byte capture SOH and POH
To analyze the SOH/POH functions, it is necessary to capture individual bytes vs. time, allowing detection of errors or short-term changes with frame level precision.
The Capture function is started by a selectable trigger.
Values for a selected byte are stored and can be accessed subsequently in a table of values.
Particularly in capturing the **APS sequences,** the bytes (K1, K2) are displayed as an abbreviation of the standard commands.
The function also allows recording of the N1 or N2 bytes for evaluation of **"Tandem Connection"** information.
H4 sequences can also be analyzed very easily.
The results can be printed or exported.

Capture bytes for STM-0/1, el. & opt. . . . . all SOH/POH bytes
STM-N el. & opt. . . . . all SOH/POH bytes, channel 1 except A1, A2, B1
Storage depth for a byte 266
K1, K2 200
Trigger events . . . . . MS-AIS, AU-AIS, MS-RDI, AU-LOP, editable value in trigger byte
Capture resolution . . . . . frame precision

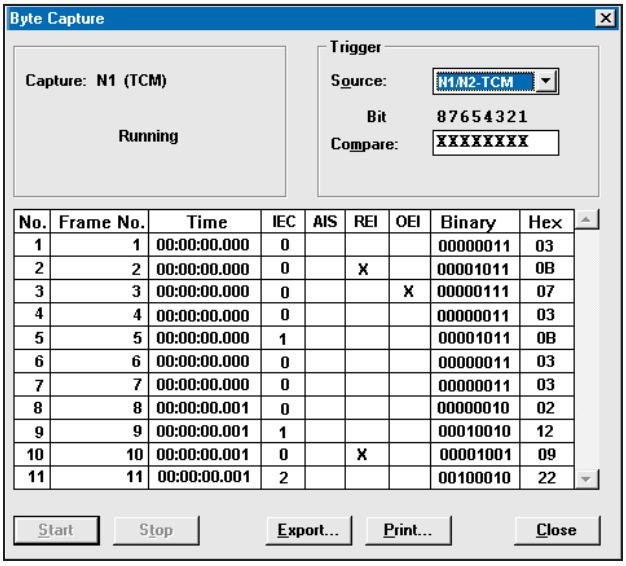
Tandem Connection Monitoring (TCM) (figure 7)
TCM is a method used to monitor the performance of a subsection of a SDH path via the N1/N2 bytes. This is particularly useful when the path is routed via different network providers. If errors occur on an end-to-end connection, you can use TCM to determine which subnetwork the errors occurred in.
The ANT-20 helps to monitor the content of the N1/N2 bytes and provides users with easy interpretation of the detailed events.

Capture TCM frames . . . . . all N1/N2 bytes, TC-IEC, TC-AIS, TC-REI, TC-OEI
Trigger events . . . . . Start of TCM frame (TCM FAS word)
Storage depth . . . . . 266 bytes (3.5 TCM frames)

On-line monitoring of alarms and trace identifier.
Display of actual and history values . . . . . .TC-UNEQ, LTC, TC-AIS , TC-RDI, TC-ODI, TC-REI, TC-OEI
On-line display of TCM Access Point Identifier

TCM error measurement
Error types . . . . . TC-IEC, TC-DIFF, TC-REI, TC-OEI

Figure 7: Capture with TCM trigger and interpretation



No.	Frame No.	Time	IEC	AIS	REI	OEI	Binary	Hex
1	1	00:00:00.000	0				00000011	03
2	2	00:00:00.000	0		X		00001011	0B
3	3	00:00:00.000	0			X	00000111	07
4	4	00:00:00.000	0				00000011	03
5	5	00:00:00.000	1				00001011	0B
6	6	00:00:00.000	0				00000011	03
7	7	00:00:00.000	0				00000011	03
8	8	00:00:00.001	0				00000010	02
9	9	00:00:00.001	1				00010010	12
10	10	00:00:00.001	0		X		00001001	09
11	11	00:00:00.001	2				00100010	22

Overhead Sequencer
This serves to test a sequential TCM process (Tandem Connection Monitoring) in the N1/N2 bytes. A sequence of 76 bytes simulating a TCM frame (equivalent frame) is generated. Individual values can be edited as binary or hexadecimal values to simulate various events for TCM evaluations.

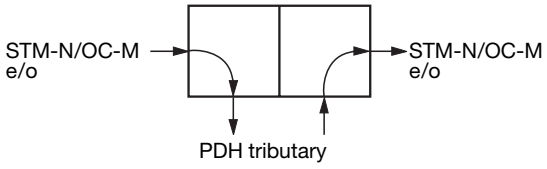
APS time measurement
In synchronous networks, a defined maximum switch-over time is necessary for the traffic in case of a fault.
To verify compliance with this requirement, the ANT-20 measures the switch-over time with 1 ms resolution.
The result can be printed.

Criteria for the time measurement . . . . . TU-AIS, MS-AIS, AU-AIS, bit error
Max. measurable switch-over time . . . . . 2 s
Resolution . . . . . 1 ms
Allowable error rate for user signal . . . . . $<2 \times 10^{-4}$

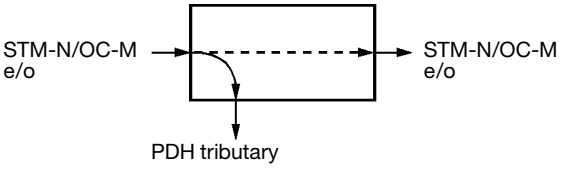
Drop & Insert **BN 3035/90.20**

This option provides the following functions:

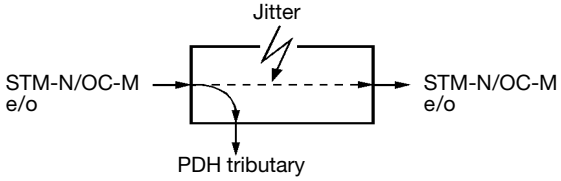
1. Generator and receiver operate independently
as mapper and demapper. The PDH signal from a selected channel is dropped from the receive signal and output to a connector. An external or internal PDH signal is inserted into the transmit signal.



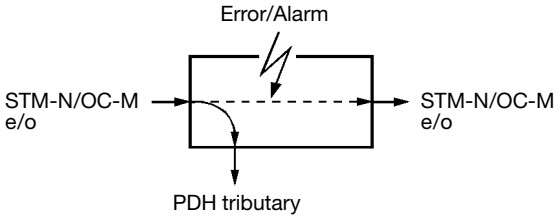
2. Through mode:
The received signal is looped through the ANT-20 and re-transmitted (generator and receiver coupled).
The PDH signal from a selected channel may be dropped from the receive signal and output to a connector.
An internal PDH signal may be inserted into the transmit signal. The ANT-20 can operate here as an active signal monitor without affecting the signal.



3. Through mode jittering:
The looped-through PDH or SDH signal can also be jittered using the Jitter Generator option. This applies to all jitter frequencies up to 622 Mbit/s depending on the jitter option fitted.



4. Error insertion in through mode:
The looped-through synchronous signal can be manipulated if required:
– Overwriting bytes in the SOH (except B1, B2, H1 to H3)
– Anomaly insertion
– Defect generation by programming the SOH



5. Block and Replace (B&R)
For this function, the ANT-20 is looped into the working fiber of a ring. B&R allows replacement of a synchronous tributary (e.g. STS-1 including SOH, POH and payload) in a STM-N signal. This can then be measured by the ANT-20 from the ring. By inserting specific errors, the error thresholds of the APS mechanism in the system can be tested.

Additional input and output for tributary signals
75 Ω, coaxial BNC; line codes as for mainframe instrument

Input and output for balanced tributary signals: Use balanced connectors on mainframe

For D&I functions with Mux/Demux signals,
see 64k/140M and M13 Multiplex/Demultiplex data sheets.

64k/140M MUX/DEMUX chain **BN 3035/90.30**
This option provides n × 64 kbit/s to 140 Mbit/s multiplex and demultiplex functions. The output signal is fed to the electrical interface and is available as payload in mappings (requires options BN 3035/90.01 to 90.03 or BN 3035/90.13). Alarms and errors can be generated and analyzed.

For further details, refer to the 64k/140M Multiplex/ Demultiplex data sheet.

M13 MUX/DEMUX chain **BN 3035/90.32**
M13 multiplexers are used in North America in hybrid networks and synchronous system cross-connects.
This option provides n × DS0 to DS3 multiplex and demultiplex functions. The output signal is fed to the electrical interface (requires option BN 3035/90.34) and is available as payload in mappings (requires option BN 3035/90.12 or BN 3035/90.05).
Alarms and errors can be generated and analyzed.

For further details, refer to the M13 Multiplex/Demultiplex data sheet.

BERT (1.5/6/45 Mbit/s) **BN 3035/90.34**
Signal structure and interfaces for generator and receiver: Framed and unframed test patterns (6 Mbit/s unframed)

Additional test pattern . . . . . QRSS 20

Additionally, for unbalanced digital signal input/output
Bit rate, line code . . . . . 1544 kbit/s, 6312 kbit/s, B8ZS, AMI
Bit rate, line code . . . . . 44736 kbit/s, B3ZS

Additionally, for balanced digital signal input/output
Bit rate, code . . . . . 1544 kbit/s, B8ZS

ANT-20 applications in the remote controlled production environment

V.24 remote control **BN 3035/91.01**
Remote control of instrument functions using SCPI command structure

Interface . . . . . V.24 / RS232

GPIB (PCMCIA) remote control **BN 3035/92.10**
Remote control of instrument functions using SCPI command structure. A GPIB adapter card for the ANT-20 PCMCIA interface is supplied with this option

Interface . . . . . GPIB

LabWindows drivers **BN 3038/95.99**
Simplifies creation of remote-control programs for automated testing using LabWindows.
The drivers can be used with options BN 3035/91.01 and BN 3035/92.10.

Simplified test automation (figure 8)

Test Sequencer (CATS) and Test Case Library **BN 3035/95.90**
The Test Sequencer is the ideal tool for rapid, simple adaptation and automatic performance of complete test sequences on the ANT-20 (CATS = CVI Application Test Sequence). This saves time where repetitive tests are required in the production, installation and monitoring of SDH, SONET and ATM network elements. The comprehensive test case library includes solutions for various applications, such as BERTs, alarm sensor tests, jitter, offset and pointer tests and monitoring ATM quality of service (QoS) parameters.
Once created, test sequences are started with a single mouse click. A report in ASCII format for documentation purposes is compiled during the measurement. All test cases are pre-defined and ready to run. They can also be easily customized.
The Test Sequencer is part of the WG CATS range.
More information is found in the CATS data sheet.

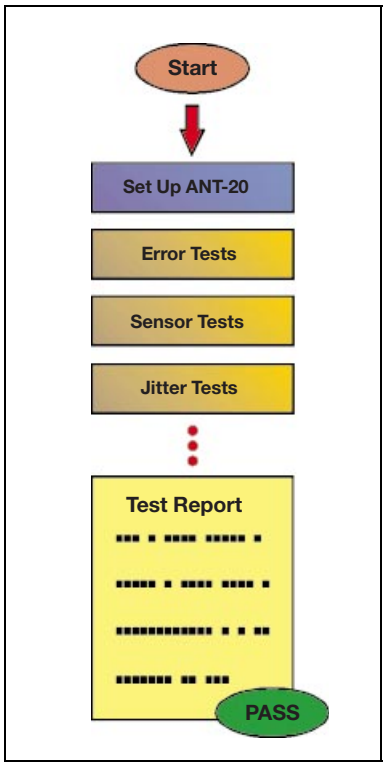
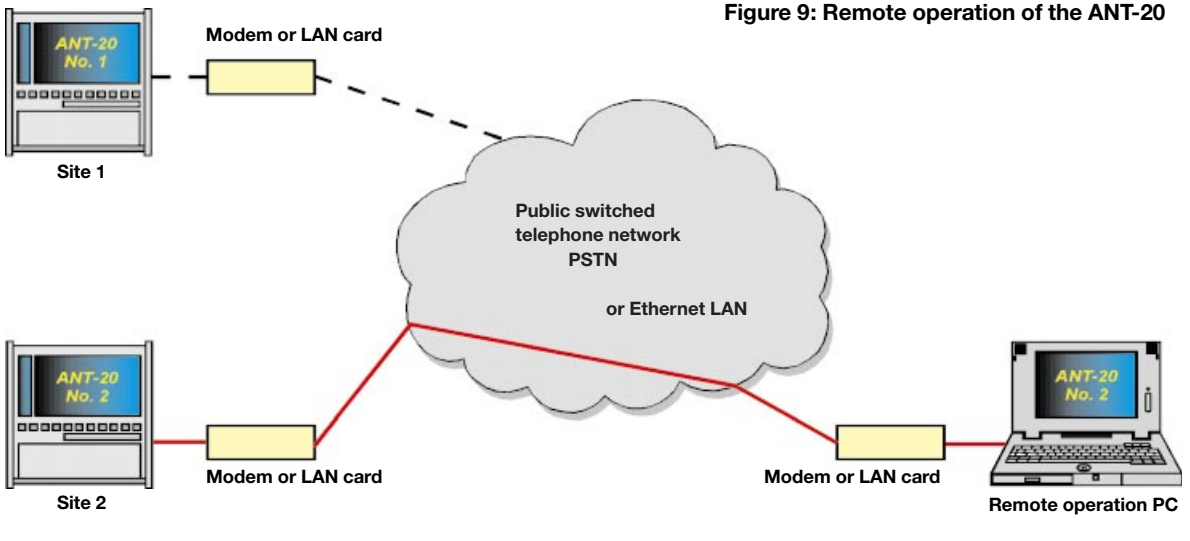


Figure 8: Automatic test sequences with the ANT-20

Remote ANT-20 operation (figure 9)

These options allow operation of the ANT-20 from a Windows® PC. The complete ANT-20 user interface is transferred to the PC screen via modem or LAN link.
This means that all the functions of the instrument can be used from any remote location. The results are simply transferred to the controlling PC for further processing.
Applications include troubleshooting networks or centralized operation of test instrumentation and devices in the production and system test environment.

Figure 9: Remote operation of the ANT-20



Remote Operation via Modem **BN 3035/95.30**
Provides remote operation via a PCMCIA or external modem (V.24) which must be purchased separately.

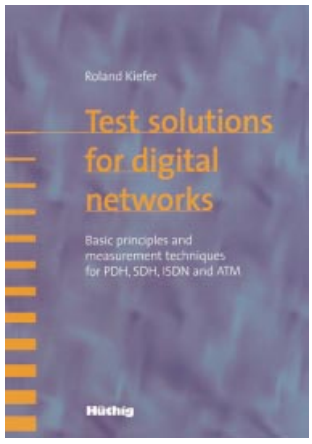
Remote Operation via LAN (TCP/IP) **BN 3035/95.31**
Provides remote operation via a PCMCIA Ethernet card (included).

Calibration

Calibration report **BN 3035/94.01**
Calibration is carried out in accordance with a quality management system certified to ISO 9001.

Recommended confirmation interval . . . . . 24 months

Specialized book
R. Kiefer: Test solutions for digital networks
BN 6390/98.21
Basic principles and measurement techniques for PDH, SDH, ISDN und ATM



Training courses

ANT-20 Training

"SDH/SONET Troubleshooting" BN 3035/89.01
(Two-day interactive workshop on SDH/SONET basics in connection with important measurement applications and presentation of WG test solutions).

"Synchronization" BN 3035/89.02
(Half-day interactive workshop on aspects of synchronization and typical measurement applications).

"Solving Jitter Problems" BN 3035/89.03
(Half-day interactive workshop on jitter problems and presentation of WG test solutions).

"SDH/SONET Quality of Service" BN 3035/89.04
(Half-day interactive workshop on performance measurements to G.821, G.826 and M.2100).

"Optimizing Your SDH/SONET Network" BN 3035/89.05
(One-day interactive workshop on measurement applications and operation of the ANT-20).

ABT-20/ANT-20 Training

"Turning up ATM Services" BN 3035/89.30
(One-day interactive workshop on ATM basics in connection with fundamental measurements in ATM networks and presentation of WG test solutions).

"ATM Traffic Management" BN 3035/89.31
(Half-day interactive workshop on traffic management measurements and fundamentals of traffic management in ATM networks).

"ATM Quality of Service" BN 3035/89.32
(Half-day interactive workshop on performance measurements to ITU-T O.191).

Information via Internet
http://www.ant-20.wg.com

Ordering information

ANT-20 Advanced Network Tester, SDH version
(Includes one STM-1 mapping; please indicate your choice. Menu in English and German.)
With color TFT display screen **BN 3035/41**

ANT-20 Advanced Network Tester SONET version
(Includes one STS-1 mapping; please indicate your choice. Menu in English. See SONET version data sheet.)
With color TFT display screen **BN 3035/42**

Options

Touchscreen BN 3035/93.11
CPU RAM expansion to 32 MB BN 3035/92.15

STM-1 mappings
C12 (2 Mbit/s in STM-1, AU-3/AU-4) BN 3035/90.01
C3 (34 Mbit/s in STM-1, AU-3/AU-4) BN 3035/90.02
C4 (140 Mbit/s in STM-1 and STS-3c) BN 3035/90.03
C11 (1.5 Mbit/s in STM-1, AU-3/4, TU-11/12) BN 3035/90.04
C3 (45 Mbit/s in STM-1, AU-3/AU-4) BN 3035/90.05
C2 (6 Mbit/s in STM-1, AU-3/AU-4) BN 3035/90.06

STM-0 mappings
STM-0 (1.5 Mbit/s) BN 3035/90.10
STM-0 (2 Mbit/s) BN 3035/90.13
STM-0 (34/45 Mbit/s) BN 3035/90.12

Extended Overhead Analysis BN 3035/90.15

Drop & Insert BN 3035/90.20

PDH functions
PDH 64k/140M MUX/DEMUX chain BN 3035/90.30
PDH 64k/140M DEMUX chain BN 3035/90.31

Optical interfaces
The following options, BN 3035/90.43 to /90.48, are alternatives.
Optical STM-0/1, OC-1/3, 1310 nm BN 3035/90.43
Optical STM-0/1, OC-1/3, 1550 nm BN 3035/90.44
Optical STM-0/1, OC-1/3, 1310 & 1550 nm BN 3035/90.45
Optical STM-0/1/4, OC-1/3/12, 1310 nm BN 3035/90.46
Optical STM-0/1/4, OC-1/3/12, 1550 nm BN 3035/90.47
Optical STM-0/1/4, OC-1/3/12, 1310 & 1550 nm BN 3035/90.48

OC-12c/STM-4c Options
OC-12c/STM-4c Bit Error Tester BN 3035/90.90
requires Optical Module BN 3035/90.46, /90.47 or /90.48
OC-12c/STM-4c ATM Testing BN 3035/90.91
requires Optical Module BN 3035/90.46, /90.47 or /90.48 and ATM Module BN 3035/90.70
OC-12c/STM-4c Virtual Concatenation BN 3035/90.92
requires BN 3035/90.90 or /90.91

The options BN 3035/90.38, /91.53, /91.54, /91.59 are alternatives.
Optical STM-16, OC-48, 15xy nm BN 3035/90.38
Select a wavelength between 1530.33 nm and 1560.61 nm to G.692.
Optical STM-16, OC-48, 1310 nm BN 3035/91.54
Optical STM-16, OC-48, 1550 nm BN 3035/91.53
Optical STM-16, OC-48, 1310/1550 nm switchable BN 3035/91.59
OC-48c/STM-16c Bit Error Tester (Bulk) BN 3035/90.93

Optical Packages
include optical interfaces from 52 Mbit/s to 2488 Mbit/s and four optical adapters – please select; not included STM-16c/OC-48c, STM-4c/OC-12c

Optics STM-0/1/4/16, OC-1/3/12/48, 1310 nm includes BN 3035/90.46, /91.54	BN 3035/91.17
Optics STM-0/1/4/16, OC-1/3/12/48, 1550 nm includes BN 3035/90.47, /91.53	BN 3035/91.18
Optics STM-0/1/4/16, OC-1/3/12/48, 1310&1550 nm includes BN 3035/90.48, /91.59	BN 3035/91.19
Optical power splitter (90/10%)	BN 3035/90.49
Optical Attenuator (plug-in) SC-PC, 1310 nm, 15 dB	BN 2060/00.61

Optical test adapters

ST type (AT&T)	BN 2060/00.32
HMS-10/A, HFS-13/A (Diamond)	BN 2060/00.34
HMS-10, HFS-13 (Diamond)	BN 2060/00.35
"Keyed Biconic" Twist-Proof (AT&T)	BN 2060/00.37
D4 (NEC)	BN 2060/00.40
DIN 47256	BN 2060/00.50
FC, FC-PC (NTT)	BN 2060/00.51
E 2000 (Diamond)	BN 2060/00.53
SC, SC-PC (NTT)	BN 2060/00.58

Wandel & Goltermann offers a wide range of optical power meters, sources and attenuators.
Contact your local sales representative for details.

O.172 Jitter and wander

O.172 Jitter Generator up to 155 Mbit/s	BN 3035/90.81
O.172 Jitter Meter up to 155 Mbit/s	BN 3035/90.82
O.172 Jitter Generator 622 Mbit/s requires BN 3035/90.81	BN 3035/90.83
O.172 Jitter Meter 622 Mbit/s requires BN 3035/90.82	BN 3035/90.84
O.172 Wander Generator up to 622 Mbit/s requires BN 3035/90.81 for up to 155 Mbit/s and /90.83 for 622 Mbit/s	BN 3035/90.85
O.172 Wander Analyzer up to 622 Mbit/s requires BN 3035/90.82 for up to 155 Mbit/s and /90.84 for 622 Mbit/s	BN 3035/90.86
O.172 MTIE/TDEV Off-line Analysis requires BN 3035/90.86 for up to 622 Mbit/s and /90.89 for 2488 Mbit/s	BN 3035/95.21
O.172 Wander Generator 2488 Mbit/s requires ANT-20E and BN 3035/90.81 and /90.88	BN 3035/90.87
O.172 Jitter Generator/Analyzer 2488 Mbit/s requires ANT-20E	BN 3035/90.88
O.172 Wander Analyzer 2488 Mbit/s requires ANT-20E and BN 3035/90.88	BN 3035/90.89

Jitter/Wander Packages

O.172 Jitter/Wander Packet **up to** 622 Mbit/s Includes BN 3035/90.81 to /90.86 and /95.21 options	BN 3035/91.31
O.172 Jitter/Wander Packet **up to** 2488 Mbit/s includes BN 3035/90.81 to /90.89 and /95.21 options; requires ANT-20E	BN 3035/91.32

ATM functions

ATM module for STM-1/STS-3c	BN 3035/90.70
ATM Broadband Analyzer/Generator module (see BAG data sheet for details)	BN 3035/90.80

Additional ATM mappings
(requires ATM module BN 3035/90.70 or BN 3035/90.80)

E4 (140 Mbit/s) ATM mapping [1)]	BN 3035/90.72
E3 (34 Mbit/s) ATM mapping [1)]	BN 3035/90.74
E1 (2 Mbit/s) ATM mapping [1)]	BN 3035/90.75
STS-1 (51 Mbit/s) ATM mapping	BN 3035/90.71
DS3 (45 Mbit/s) ATM mapping [2)]	BN 3035/90.73
DS1 (1.5 Mbit/s) ATM mapping [2)]	BN 3035/90.76
VC-3 ATM mapping in STM-1 (AU-3/AU-4)	BN 3035/90.77

1) For SONET versions BN 3035/02, BN 3035/22 and BN 3038/12, option BN 3035/90.33 is required
2) For SDH versions BN 3035/01, BN 3035/21 and BN 3038/11, option BN 3035/90.34 is required

SONET/ANSI functions

STS-1 mappings

VT1.5 SPE/STM-0 (1.5 Mbit/s in STS-1)	BN 3035/90.10
VT6 SPE (6 Mbit/s in STS-1)	BN 3035/90.11
STS-1 SPE/STM-0 (45 Mbit/s in STS-1)	BN 3035/90.12
VT2 SPE/STM-0 (2 Mbit/s in STS-1)	BN 3035/90.13
M13 MUX/DEMUX	BN 3035/90.32
BERT 1.5/6/45 Mbit/s	BN 3035/90.34

Remote control

V.24 remote control	BN 3035/91.01
GPIB remote control	BN 3035/92.10
LabWindows CVI driver	BN 3038/95.99

Remote operation

Remote operation via modem	BN 3035/95.30
Remote operation via LAN (TCP/IP)	BN 3035/95.31

Test automation

CATS test sequencer and test case library	BN 3035/95.90
Calibration report	BN 3035/94.01

Accessories

Soft case	BN 3035/92.02
TPK-960/32 carrying case with rollers	BN 960/00.08
External keyboard (UK/US)	BN 3035/92.04
Decoupler (-20 dB, 1.6/5.6 jack plug)	BN 3903/63
TKD-1 probe, 48 to 8500 kbit/s	BN 822/01
WG PenBERT mini PCM monitor (E1) (see WG PenBERT data sheet for details)	BN 4555/11

Retrofitting options
Any of the above options can be retrofitted by an authorized Wandel & Goltermann Service Center.

Training courses
Location: D-72800 Eningen u.A., Germany
Information about availability and other locations available on request.

ANT-20 Training "SDH/SONET Troubleshooting"	BN 3035/89.01
ANT-20 Training "Synchronization"	BN 3035/89.02
ANT-20 Training "Solving Jitter Problems"	BN 3035/89.03
ANT-20 Training "SDH/SONET Quality of Service"	BN 3035/89.04
ANT-20 Training "Optimizing Your SDH/SONET Network"	BN 3035/89.05
ABT-20/ANT-20 Training "Turning up ATM Services"	BN 3035/89.30
ABT-20/ANT-20 Training "ATM Traffic Management"	BN 3035/89.31
ABT-20/ANT-20 Training "ATM Quality of Service"	BN 3035/89.32

Specialized book

Test solutions for digital networks	BN 6390/98.21