



Acterna ANT-5 SDH Access Tester STM-1/-4 ATM

Before operators can implement converged multimedia services on networks originally built for POTS, they must first ensure that the existing network infrastructure can support the delivery of high-speed, high-bandwidth services to an expanding base of business and residential customers. This process, however, must be completed quickly so as not to delay operators' ability to turn up new services and carry more data traffic. Compounding the pressure are corporate mandates that call for reduced expenses and the need to equip field technicians, who are tasked with installing, verifying, maintaining, and troubleshooting these high-speed, high-bandwidth network services in the access and metro networks, with the appropriate instruments and training.

Field technicians, who are tasked with installing and maintaining these networks, must learn how to test a wide variety of technologies while they strive to reach new levels of productivity. To perform these tasks, technicians need an increased amount of equipment and additional training to operate each device effectively. In addition, operators must be able to manage the conflicting demands of technicians, who need the proper equipment and training to do their jobs, and executives, who are keeping close control on capital expenses and operating costs.

The ANT-5 rises to the challenge

The rugged, battery-powered, lightweight Acterna ANT-5 SDH Access Tester contains all the powerful features and functions that technicians need to test a range of SDH/SONET/PDH and ATM digital links both on site and from a remote location. Its price/performance benefits extend to both operators and technicians by enabling more tests to be performed on multiple technologies with less equipment and lower costs.

Highlights

- Smallest and lightest test solution for DS1/E1 to 622 Mbps testing at 1310 nm and 1550 nm
- Optical layer testing at dual wavelengths at STM-1/OC-3 and STM-4/OC-12 and electrical testing at DS1/E1/E3/DS3/E4 interfaces
- Full analysis of concatenated mappings with SDH/SONET signals VC-4-4C/OC-12C
- In depth PDH analysis with Sabit generation and flexible MUX/DEMUX test configuration
- ATM analysis for service verification of ATM and 3G/UMTS networks testing new ATM services carried over PDH, SDH/SONET

The portable solution

The ANT-5's compact, robust design is ideal for field and central office applications. The convenient, built-in stand and comfortable carry strap enable hands-free testing in any location. And its extended battery life means testing can be undertaken even when AC power is not on hand.

Optional carry cases protect the ANT-5 when technicians travel between sites and provide a safe and convenient place for storing cables and accessories.

Easiest handheld to learn and use

Access technicians need a tester that can simplify their key tasks without extensive training. With its large color screen, graphical user interface, and ergonomic keypad, the ANT-5 is the easiest to learn and use handheld on the market. Other features include:

- Labelled LEDs that show current and historical alarms
- OK results summary and pass/fail results screen displays
- Autosave of test results
- Fast store and recall of key network configurations
- Automatic tests

Access technicians' tool of choice

The ANT-5 provides all the transmission test functions required in today's access network:

- Optical power measurement
- Bit error rate testing
- G.821, G.826, G.828, G.829, M.2100, M.2101 analysis
- Received signal offset measurement
- Transmit signal offset and generation
- Tabular and graphical event recording

Extensive SDH/SONET features

The ANT-5 is packed with SDH and SONET test features covering all the installation and maintenance tasks up to 622 Mbps:

- STM-1e/STS-3 interface
- STM-1/OC-3 to STM-4/OC-12 optical ports
- 1310 nm and 1550 nm wavelengths
- Anomaly and defect generation and analysis
- APS measurement
- RTD test
- SOH and POH analysis and manipulation
- Path trace generation and analysis
- Tandem connection monitoring (TCM)
- Automatic tributary scanning
- Pointer analysis

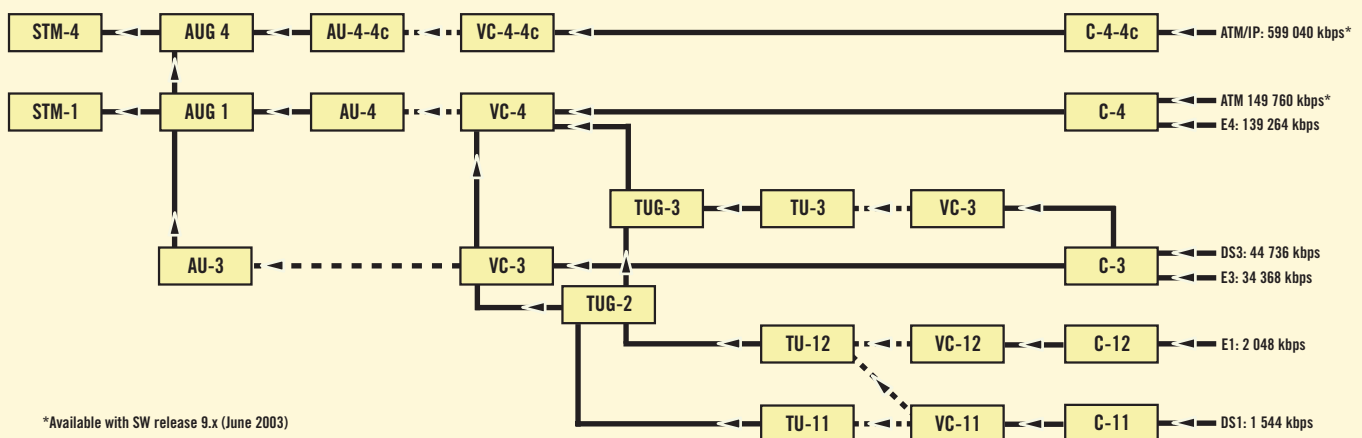


figure 1 STM mapping structure (SDH systems)

Full PDH support

From 1.5 Mbps to 140 Mbps including Nx64 Kbps, the ANT-5 can test all PDH tributaries and legacy PDH hierarchy transmission systems using high-level functions that include E1 Sa bit generation and display.

ATM service verification

UMTS network rollout and ADSL growth is increasing the use of ATM in the access network. The ANT-5 enables the installation and maintenance of ATM carried over PDH, SDH, and SONET networks that include:

- E1, E3 (G.832), DS3, E4
- VC-4/OC-12

PVC cells can be generated over UNI and NNI with CBR and VBR traffic load profiles up to STM-4c rates.

Service quality can be checked using BER or O.191 measurements. Link and channel performance can be monitored while traffic statistics are recorded.

Simple test and results management

Thanks to its built-in Ethernet port, CompactFlash memory card port, and printer port, the ANT-5 can integrate more effectively and more simply with day-to-day operations.

- Export standard test setups to other ANT-5s or PCs via the CompactFlash card
- Exchange results over LANs using Windows-based PCs
- Print test reports

Advanced remote testing capability

The ANT-5 provides out-of-the-box remote testing capability over Ethernet and dial up lines. As a result, technicians can poll instruments remotely from their offices, simplifying long-term commissioning and maintenance tests and dramatically reducing travel time and costs. Test results can be saved to any network hard disk or printed from any network printer for convenient analysis.

Flexible, cost-effective platform

The ANT-5's flexible design enables it to be adapted quickly to operators' changing requirements. And its field upgradeable capability, provided by the CompactFlash port, enables technicians in the field to install software in minutes.

Hardware upgrades can be purchased to add optical bandwidths or wavelengths. This protects the initial investment and reduces additional training expenses while allowing operators to match capital expenditures to network rollout plans.

This Acterna offering is an industry-leading access tester that sets new standards for portability, ease of use, and adaptability. The ANT-5 is the ideal device for field technicians who need to test a range of SDH, PDH, SONET, and ATM digital links both on site and from a remote location. As a result, the ANT-5 provides a significant advantage for companies that wish to optimize quality of service using a cost-effective, industry-proven solution.

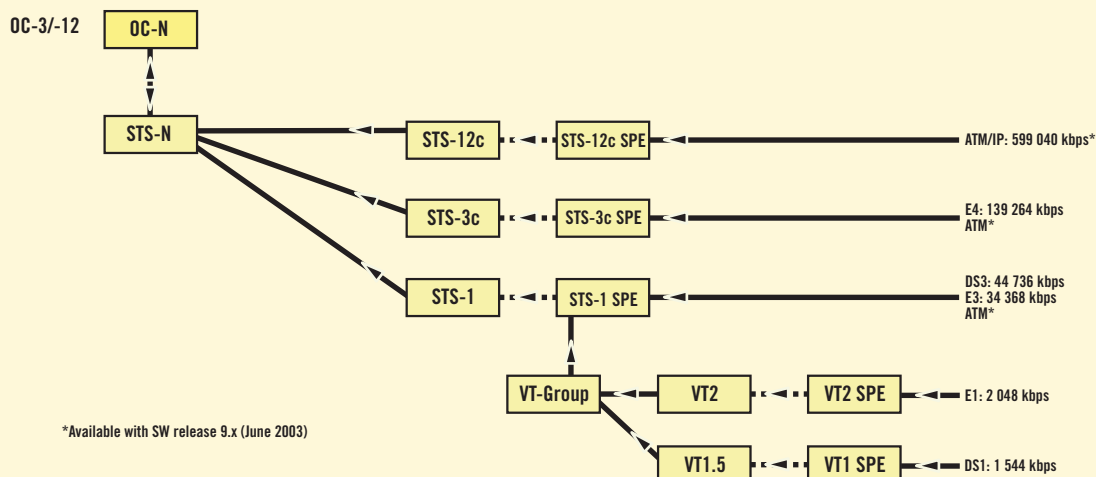


figure 2 STS mapping structure (SONET systems)

Technical specifications

G.703 transmitters

BNC 75 Ω unbalanced outputs

Bit rates and line codes

- 2048, 34368 Kbps	HDB3
- 44736 Kbps ⁽¹⁾	B3ZS
- 139264, 155520 Kbps	CMI

RJ48 120 Ω balanced output

Bit rate and line codes

- 2048 Kbps	HDB3
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G.703 receivers

BNC 75 Ω unbalanced inputs

Bit rates and line codes

- 2048, 34368 Kbps	HDB3
- 44736 Kbps ⁽¹⁾	B3ZS
- 139264, 155520 Kbps	CMI

RJ48 120 Ω balanced input

Bit rate and line codes

- 2048 Kbps	HDB3
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Clock recovery

- Pulling range as G.703

Selectable input gain

- 155520 Kbps	20 dB
- 2048, 34368, 44736, 139264 Kbps	26 dB

PDH T1 interface (requires option T1 adapter)

Connectors	Bantam
Input impedance	100 Ω
Bit rate	1544 Kbps
Line Code	B8ZS

G.957 optical transmitter and receiver (options)

- Class 1 laser product

Connectors

-FC-PC connectors

Transmitter wavelengths

-1310 nm and 1550 nm

Line bit rates

- 155.52 Mbps

- 622.08 Mbps

Line code

scrambled NRZ

Option

Output levels

Input sensitivity

BN4565/00.01 STM-1 1310 nm	-8 to -15 dBm / -	-28 dBm
BN4565/00.02 STM-1 1550 nm	- / 0 to -5 dBm	-28 dBm
BN4565/00.03 STM-1 1310+1550nm	-8 to -15 dBm / 0 to -5 dBm	-28 dBm
BN4565/00.14 STM-1/4 1310+1550nm	-8 to -15 dBm / 0 to -5 dBm	-28 dBm
BN4565/00.64 STM-1/4 1310 nm LR	+3 to -2 dBm / -	-28 dBm
Optical overload		-1 to -2 dBm
Receiver wavelength range		1100 to 1600 nm

Transmit clock synchronization

Internal stability	± 3.6 ppm
Tx Bit Rate offset	± 100 ppm
Step size	0.1 ppm

External clock (SDH transmitter)

Connector	BNC 75 Ω (120 Ω via external adapter)
Reference clock	2048 kHz
Reference signal	2048 Kbps (HDB3)



⁽¹⁾ANSI T1.101 compliant

Mappings (to ITU G.707)

The following mappings are provided as standard with the instrument

- C12 mapping (2 Mbps in STM-1, AU-4, asynchronous mode)
- C3 mapping (34 Mbps in STM-1, AU-4)
- C3 mapping (45 Mbps in STM-1, AU-4)
- C4 mapping (140 Mbps in STM-1)

SDH output signals

STM-1 signal consists of one VC-n container with

- Framed or unframed PDH test pattern
- Test pattern without stuffing bits (bulk signal to 0.181)

Content of nonselected containers

- STM-1 PRBS $2^{21}-1$ (framed/unframed as per selected container)

STM-4 signal consists of one VC-n container with

- Framed or unframed PDH test pattern or test pattern without stuffing bits (bulk signal to 0.181)
- three VC-4 containers each filled with a fixed pattern of 11100110

SOH and POH generation

The content of all bytes, with the exception of A1/A2, B1/B2/B3 and H1 to H4, is programmable with any byte.

- Selectable synchronization messages (S byte)
- Selectable signal labels (C byte)
- Trace identifier
- J0 programmable 1 byte hexadecimal or 16 byte ASCII sequence with CRC
- J1, J2 programmable 16 byte ASCII sequence with CRC or 64 byte ASCII sequence

PDH output signals

Signal structures for all bit rates

- Unframed test pattern
- Framed test pattern (to ITU-T 0.150)

– Frame types

- 1544 Kbps unframed, SF, ESF
- 2048 Kbps unframed, PCM31, PCM31CRC,
- PCM30, PCM30 CRC (to ITU G.704)
- 34368 Kbps unframed, framed G.751, framed G.832
- 44736 Kbps unframed, framed C-parity, framed M13
- 139264 Kbps unframed, framed G.751

Test patterns

Test patterns may be generated and measured for any of the provided bit rates either directly at the SDH/PDH interface or within the STM-4/STM-1 substructure. Additionally, test patterns can be generated and measured at 64 Kbps and $n \times 64$ Kbps rates within an E1 frame.

PRBS: $2^{15}-1$, $2^{20}-1$, $2^{23}-1$, $2^{31}-1$,
 $2^{15}-1$ inv., $2^{20}-1$ inv.,
 $2^{23}-1$ inv., $2^{31}-1$ inv.

Programmable word 16 bits

Anomaly and defect insertion

Defect generation

Static ON/OFF

Anomaly generation

single or at a continuous error ratio of 1×10^{-n} where the range of n is as indicated below

Payload

Bit errors (TSEs): $n=2-9$

SDH structure

Anomalies

B1, B3 $n=4-9$

MS-REI, LP-BIP (except C4), $n=3-10$

LP-REI (except C4) $n=3-9$

B2 $n=3-9$

HP-REI $n=4-10$

SDH anomaly burst generation anomalies:

B1, B2, MS-REI, B3, HP-REI, LP-BIP, LP-REI

Anomalies are injected in n consecutive frames every m frames or seconds

Defects

LOS, LOF, RS-TIM, MS-AIS, MS-RDI, AU-LOP, AU-AIS, HP-UNEQ, HP-RDI, HP-TIM, HP-PLM, TU-LOP, TU-AIS, TU-LOM, LP-UNEQ, LP-RDI, LP-TIM, LP-PLM, LP-RFI

PDH structure

Anomalies

FAS $n=3-10$

EBIT (framed 2 Mbps only) $n=3-10$

CODE (framed 2 Mbps only) $n=3-8$

CRC (framed 2 Mbps and 1.5 Mbps

ESF only) $n=3-9$

P-BIT (framed 45 Mbps only) $n=4-8$

Defects

AIS, LOF, RDI

Yellow, idle (45 Mbps only)

SDH and PDH receive signals

Signal structures as for generator unit

Error measurements

Error types

B1, B2, B3, MS-REI, HP-REI, LP-REI, TSE, LP-BIP, PDH, FAS-45, FAS-34, FAS-2, FAS-1.5, REI-45, CP-BIT, EBIT-2, CRC-2, code errors (2 Mbps), HP-IEC, LP-IEC, HP-OEI, HP-TC-DIFF, HP-TC-REI

Alarm detection

All alarms are monitored and detected simultaneously.

Alarm types

LOS, OOF, LOF, MS-AIS, MS-RDI, RS-TIM, AU-AIS, AU-LOP, AU-NDF, HP-RDI, HP-UNEQ, HP-TIM, HP-PLM, TU-AIS, TU-LOP, TU-LOM, LP-RDI, LP-PLM, LP-UNEQ, LP-TIM, LSS, LP-RFI, PDH-AIS, PDH-RDI, Idle, yellow (45 Mbps only)

Receive signal frequency measurement

Receive signal frequency is displayed and deviation from nominal shown in ppm.

Resolution 0.1ppm

OK summary display

Display of large OK for error free circuits for fast and simple installation checks. Upon detection of any anomaly or defect the OK is removed and replaced with a hierarchical list of events – allowing easy diagnosis of problems. Display of signal structure with BER or BLER displayed simultaneously.

LED event history

On screen soft LEDs and defect panel alarms can be set to display historical events. These are displayed yellow to easily distinguish them from current alarms that are displayed red.

Performance analysis

ITU-T recommendation G.821

ES, EFS, SES, DM and UAS are evaluated. Pass/fail assessment based on line length allocation of 1 to 100%. Evaluation for higher bit rates (up to 140 Mbps) is obtained using a multiplex factor as per annex D of G.821. Measurements can be made using the following events: bit errors (TSEs), FAS-2, CRC-4 and E bit and code errors (2 Mbps), FAS-34, FAS-140.

ITU-T recommendation G.826

EB, BBE, ES, EFS, SES, and UAS are evaluated. Pass/fail assessment based on line length allocation of 1 to 100%. The SES and UAS thresholds can be set by users.

In-service measurement (ISM)

Simultaneous in-service measurement of the near end and far end of a selected path:

Measurements can be made using the following events: RSOH B1, MSOH B2, HP B3, FAS-140, FAS-34, FAS-2, CRC and code errors (2 Mbps), LP-BIP.

Out-of-service measurement (OOS)

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

ITU-T recommendation G.828 Results

ES, EFS, SES, BBE, SEP, UAS

Pass/fail assessment based on path allocation of 1 to 100%.

The SES and UAS thresholds can be set by users.

Hierarchy

RSOH B1, MSOH B2, HP B3, LP-BIP, TSE.

ITU-T recommendation G.829 Results

ES, EFS, SES, BBE, UAS

The SES threshold can be set by users.

Hierarchy

RSOH B1, MSOH B2, TSE.

ITU-T recommendation M.2100

ES, EFS, SES and UAS are evaluated. Pass/fail assessment based on line length allocation of 1 to 100%. The UAS and BISO (bringing into service objectives) thresholds can be set by users.

PDH systems

Measurements can be made using the following events: TSEs, FAS-2, FAS-34, FAS-140, CRC, and code errors (2 Mbps).

ITU-T recommendation M.2101

ES, EFS, SES, BBE, SEP, and UAS are evaluated. Pass/fail assessment based on line length allocation of 1 to 100%. The UAS and BISO (bringing into service objectives) thresholds can be set by users. ISM simultaneously for near end and far end of a selected path:

Measurements can be made using the following events: TSE, LP-BIP, HP-B3, MSOH-B2, RSOH-B1.

Defect panel

On-screen hierarchical LED indication of defects.

Event log

Tabular display of time stamped events.

Anomaly count

Table of all anomalies with measured count and ratio.

Graphical display (histogram)

Display of errors and alarms as bar graphs versus time.

Zoom function allows display resolution of seconds, minutes, hours and days.

SOH and POH evaluation

Display of complete SOH and POH in hex, binary and ASCII formats.

Text decode of S and C bytes for the trace identifier.

J0 display of 16 byte ASCII sequence.

J1, J2 display of 16 or 64 byte ASCII sequence.

Tandem connection monitoring (TCM)

Analysis of N1 and N2 bytes

Monitoring/display of:

TC-IEC, TC-AIS, TC-REI, TC-OEI, TC-UNEQ, LTC,

TC-AIS, TC-RDI, TC-ODI, TC-REI

Online display of TCM access point identifier

TCM error measurement

Incoming B3/computed BIP comparison

Auto protection switching (APS)

Operates on SDH and PDH interfaces

Measurement triggers

MS-AIS, AU-AIS, TU-AIS, or bit error

Pass/fail user specified time limit

– 10 to 2000 μ s

– 1 μ s resolution

Round trip delay (RTD)

Resolution +/- 1 μ s

Except for:

E1 PDH +/- 100 μ s

E1 SDH VC12 +/- 100 μ s

E2 (when carried within PDH E3 or E4) +/- 10 μ s

VC11/12bulk +/- 10 μ s

Measurement range 10 s

Pointer analysis

Pointers analysed AU, TU

Current pointer values displayed

Displays counts of:

– pointer increments

– pointer decrements

– increments and decrements, sum and difference

– new data flags (NDFs)

Average deviation (in ppm) of AU and TU

User selectable recording of pointer events into the event log.

Repetitive BER test

BER evaluation over user definable period 1-99 seconds

Automatically repeating feature

Progress bar displays the current test period

Large character display of BER result

VC-12 tributary scan

Enables sequential BER testing of C12 channels using configured test pattern. Automatically scans selected VC-12 containers for defects and anomalies.

Concatenated mappings option (BN4565/00.59)

Enables measurements of contiguous concatenated signals:

VC-4-4c (valid only with option BN4565/00.14)

STS-12c (valid only with option BN4565/00.14 and BN4565/00.62)

PDH mux/demux option (BN4565/00.58)

For testing of legacy PDH systems. Generates structured signals from nx64 Kbps to 140 Mbps. Output signal hierarchy 2, 34, 140 Mbps. Structure depth nx64 Kbps, 2, 8, 34 Mbps. E1 Sa bit Tx generation and Rx display

SONET STS-1/STS-3c/OC12c(3) mapping option (BN4565/00.62)

Enables to generate and receive STS-3/OC3 and OC12 signals. Transmitter and receiver specifications as defined. Signal structures and measurements as defined for SDH above. The following mapping is provided:

- 599040 Kbps via STS-12c SPE
- E4 via STS-3c SPE
- DS3/E3 via STS-1 SPE

SDH AU-3/SONET VT mapping option (BN 4565/00.53)

AU-3 mapping function enables testing of DS-1, E1, E3 and DS3 tributaries mapped into STM-1 signal via VC-3/AU-3:

VC11/TU11	(1544Kbps in STM-1 via TU11, AU3)
VC11/TU12	(1544Kbps in STM-1 via TU12, AU3)
VC12	(2048Kbps in STM-1 via TU12, AU3)
VC3	(34368Kbps in STM-1 via VC3, AU3)
VC3	(44736Kbps in STM-1 via VC3, AU3)

The VT mapping function enables testing of DS-1 and E1 tributaries mapped into an STS-1 SPE via VT-1.5 and VT2 SPEs (requires option BN 4565/00.62 SONET STS-1/STS-3c/OC12c mapping)

ATM (option)

For testing of ATM services carried over PDH, SDH, and SONET

- Tests ATM over E1, E3, DS3, E4, VC-4/OC12 and VC-4c/OC12c
- CBR and VBR traffic generation
- Full cell header editing
- Cell BER tests
- 0.191 QoS measurements
- ATM link and channel statistics
- OAM cell generation and analysis for VC/VP AIS and RDI
- ATM Channel Explorer

Remote operation option (BN4565/00.60)

Enables ANT-5 to be remotely operated via V.24 or Ethernet from a s/w emulation of the instrument GUI running on a Windows PC.

Remote control option (BN4565/00.61)

Enables ANT-5 to be remotely controlled over V.24 using SCPI command set.

Measurement timers

Variable 1 second to 99 days
Measurement start manual or delayed start timer
Measurement stop manual or automatic timer
Display of elapsed time hh:mm:ss

Results memory

Resolution of error events 1 second
Alarm resolution 100 ms
Memory capacity up to 10,000 entries (approx. seven days at one entry per minute)

Alarm notification

Anomalies and defects are indicated via LEDs, on-screen graphic icons and via an audio beeper.

Printing

Setups and measurement results can be printed using printers compatible with DeskJet, Thinkjet, Epson 9, and Epson 24 print drivers.

Printer/remote interface

- Serial V.24/RS 232
- Parallel using adapter cable K1589

Result export

Results can be exported to PC in .CSV format using V.24, Ethernet (requires remote operation option BN4565/00.60) or a CompactFlash card. These can be processed using standard PC software, such as Excel™, Word™.

Result evaluation (off line)

Results (ANT-5 format) can be loaded, analyzed and printed by any Windows™-based PC using the ANT-5 Off-line Viewer SW.

Ethernet Port

Connector
RJ-45
10BaseT
TCP/IP

Display

Color TFT LCD screen
Resolution 320 x 240 pixels

Languages

The user interface can be displayed in the following languages:
English, German, French, Spanish, Portuguese, and Chinese

CompactFlash Card Slot

CompactFlash card
- Type I and II

Power outage function

In the event of an AC line power failure during a measurement, continues to perform measurements using its internal batteries.

General specifications

Power supply

AC line voltage using series specific adapter
100 to 240 V
AC line frequency
50/60 Hz
Typical operating time on batteries
3 hours
Safety class to IEC 1010-1 Part 1
(for connection to SELV only)
Pollution environment degree 2
Installation category II (indoor use)
Ambient temperature
Nominal range of use
+5° C to +45° C
Storage and transport range
–20° C to +60° C

Weight and dimensions (L x W x H)

- 275 mm x 197 mm x 76 mm
- Weight 2.2 kg

Ordering information

ANT-5 STM-1/4	BN 4565/10
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Options

STM-1 optical FC/PC 1310 nm	BN4565/00.01
STM-1 optical FC/PC 1550 nm	BN4565/00.02
STM-1 optical FC/PC 1310 and 1550 nm	BN4565/00.03
STM-1/4 optical FC/PC 1310 and 1550 nm	BN4565/00.14
STM-1/4 optical FC/PC 1310 long reach	BN4565/00.64
Concatenated mappings	BN4565/00.59
PDH mux/demux	BN4565/00.58
Remote operation	BN4565/00.60
Remote control	BN4565/00.61
SONET STS-1/STS-3c/OC-12c mapping	BN4565/00.62
SDH AU3/SONET VT mapping factory fitted	BN4565/93.53
SDH AU3/SONET VT mapping customer installed	BN4565/95.53
ATM option factory fitted	BN4565/93.54
ATM option customer installed	BN4565/95.54

Accessories

CF card (16 Mbyte) and adapter	BN4565/00.42
Printer cable	K1524
Modem cable	K1550
Serial to parallel printer cable	K1589
Hard carrying case	BN4565/00.76
Soft carrying case	BN4518/00.08
T1 adapter for ANT-5	BN 4565/00.78

Singlemode optical cables

FC-PC/FC-PC	K1605
FC-PC/SC-PC	K1606
DIN47256/FC-PC	K1607
FC-PC/E-2000	K1608
FC-PC/E-2000 APC	K1609
FC-PC/ST-PC	K1610
FC-PC/RADIALL VFO	K1611
FC-PC/FC-APC	K1612
FC-APC/FC-APC	K1613

Electrical cables

BNC/BNC (2 m)	K169
RJ-48/2 x cf	K1597
RJ-48/RJ-48	K1598
RJ-48/RJ-48 (M)/RJ-48 (F)	K1599

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From basic instrument support for your field technicians to management of complex, company-wide initiatives, Acterna's service professionals are committed to helping you maximize your return on investment. Whatever your needs – product support, system management, education services, or business planning and consulting – we offer programs that will give you the competitive edge. This is the foundation of Acterna Advantage.

Acterna is the world's largest provider of test and management solutions for optical transport, access and cable networks, and the second largest communications test company overall. Focused entirely on providing equipment, software, systems, and services, Acterna helps customers develop, install, manufacture and maintain optical transport, access, cable, data/IP, and wireless networks.

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