CMA 3000

SPECIFICATIONS

SDH, E3 and E4 test options

Testing SDH networks has never been easier

CMA 3000 is Anritsu's next-generation portable and future proof field tester for the installation and maintenance of access and core networks. The CMA 3000 covers a wide range of applications, from fast first-aid troubleshooting to comprehensive, in-depth and all-layer analysis of transmission problems.

When equipped with the SDH test option, the CMA 3000 is a powerful and easy-to-use tool for testing SDH and PDH systems. E3 testing is supported if the E3 test option is installed while E4 testing is supported with the E4 interface add-on option for the SDH option. The SDH option has a very flexible configuration, with two electrical receivers and one electrical transmitter in its basic form. It can also be equipped with one or two optical modules. With two optical modules, the instrument supports simultaneous bi-directional monitoring of SDH lines. This makes CMA 3000 the ideal instrument for both in- and out-of-service transmission-quality measurements.

The intuitive user interface, with a large color LCD display and easy-to-understand graphical symbols allows you to easily read and interpret important information from the SDH signal. For fast troubleshooting, the CMA 3000 displays alarms and transmission link status on LED indicators.

In addition, the trouble scan feature provides a fast approach to examining the SDH signal for major problems. Furthermore the user can make the CMA 3000 automatically configure to the received SDH signal, eliminating lengthy instrument setup.

The powerful 2 Mbps analysis capabilities of the basic CMA 3000 enables you to analyze a demultiplexed 2 Mbps signal embedded in an SDH signal. Additional CMA 3000 options let you carry out signaling analysis of GSM, GPRS/EDGE, SS7 and ISDN protocols and testing of ATM, Ethernet 10/100/1000, VoIP, V-series, E4 and E3 interfaces.

Key Features	Key Applications
• Simultaneous bi-directional monitoring of SDH lines • Powerful testing of SDH systems and embedded PDH systems • Mapping and de-mapping • Comprehensive error and alarm statistics • Overhead byte testing and monitoring • Trouble scan • Pointer event generation and monitoring	• Comprehensive out-of-service testing for: o Installation o Provisioning • Performance analysis • Multiplex testing • Physical line monitoring • In-service monitoring for: o Fast troubleshooting o Overhead byte analysis o Traffic monitoring o In-service error performance measurement

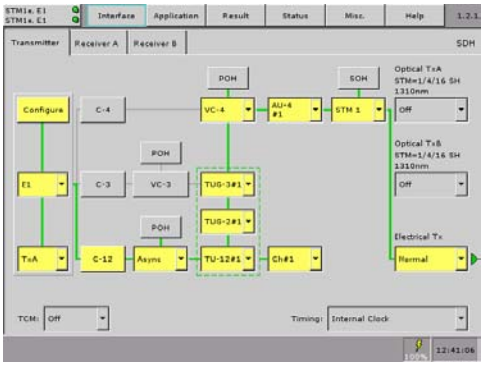

Fig.1: The intuitive user interface of CMA 3000 facilitates the SDH test setup.

Speeds SDH troubleshooting

The CMA 3000 status monitor allows you to speed troubleshooting, as the status monitor is always active providing essential information on the monitored transmission system, including:

- Line alarms on LED indicators with a trap facility
- Display of current input frequency and deviation
- Indication of optical input level
- Display of overhead bytes
- Propagation time monitor
- Traffic channel usage in an embedded 2 Mbps signal
- Audio level in a traffic channel in an embedded 2 Mbps signal
- Listen-in on a traffic channel in an embedded 2 Mbps signal

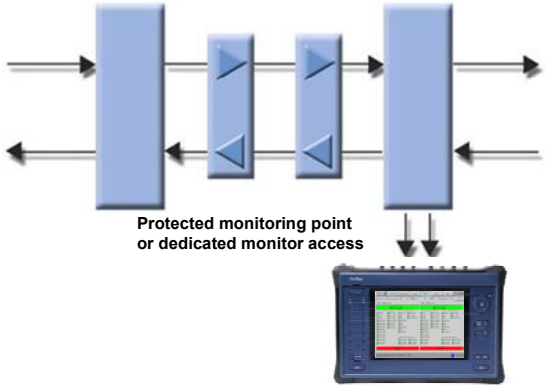

Fig.2: With the CMA 3000 you're able to perform bi-directional in-service monitoring of SDH lines.

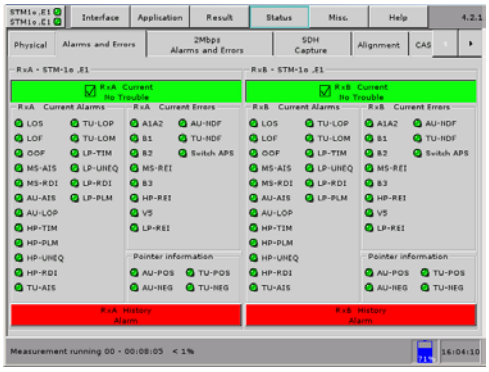

Fig.3: The CMA 3000 gives you a quick overview of errors and alarms of both sides of the SDH line.

Further troubleshooting can be done, using the CMA 3000 Trouble Scan feature. It allows you to examine the SDH signal for major problems and get them highlighted in an easy-to-understand display. In-depth trouble analysis can be done using the instruments pointer movement graph.

Fig.4: The trouble scan feature gives you a quick overview of the tributaries of the monitored line.

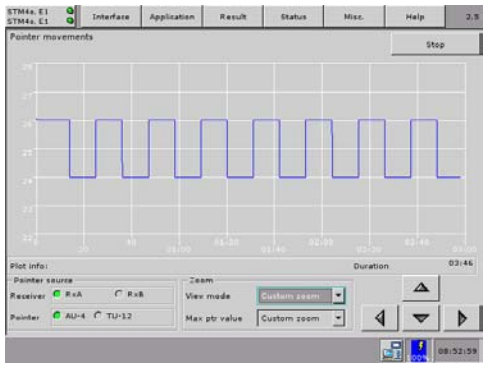

Fig.5: The pointer graph allows a detailed analysis of pointer movements in the monitored SDH signal.

For monitoring purposes you may connect the CMA 3000 using optical splitters or special test interfaces. If neither is available, you can use the CMA 3000 through-mode to access the signal.

Out-of-service or in-service SDH statistics

For installing/commissioning and out-of-service troubleshooting of SDH lines the CMA 3000 provides powerful statistical measurements for Bit Error Rate (BER) testing. Statistics are also available for in-service analysis of the transmission-error performance of a line together with information on pointer operations. G.826, G.828, G.829 or M.2100 error-performance parameters are calculated for the measurement. The result is highlighted with easy-to-understand color indications.

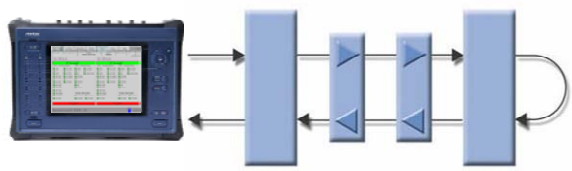

Fig.6: By looping back a test signal from the CMA 3000 at the far end, you can easily test the quality of SDH lines.

Out-of-service SDH tests

During installation/commissioning and stress testing of network elements you can control the signal transmitted by the CMA 3000. When generating an SDH signal the instrument provides you with great flexibility for injecting errors, alarms, pointer

operations and overhead byte changes into the transmitted signal. In addition, you can deviate the frequency of the transmitted signal from nominal to test a receiver's ability to handle signals that are out of specifications.

A special test feature provides easy testing of APS (Automatic Protective Switching) to allow identification of maximum switchover time during the test. Should the result be above the user-defined threshold you will receive an indication of the problem.

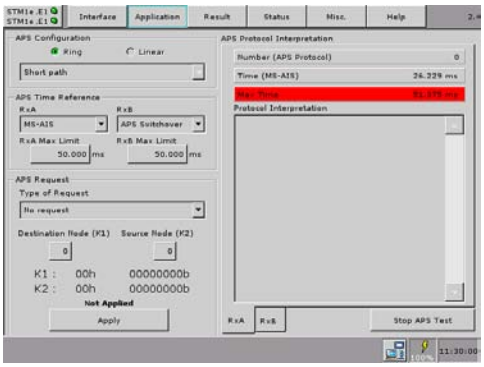

Fig.7: The dedicated APS test application makes it easy to find the maximum APS switchover time.

E4 test option

A CMA 3000 equipped with an SDH option can get an E4 option added for testing with E4 lines. The E4 signal can also be mapped into the SDH signal. Installing/commissioning and out-of-service troubleshooting of E4 lines is supported in the CMA 3000 by statistical measurements for Bit Error Rate (BER) testing. Statistics are also available for in-service analysis of the transmission-error performance of an E4 line and G.826 or M.2100 error-performance parameters are presented.

E3 test option

The instrument can be equipped with an E3 option for testing with 34 Mbps and unframed 45 Mbps bit streams. The E3 option can be installed together with the SDH option in which case the 34/45 Mbps signal can be mapped into the SDH signal. If the SDH option is not installed, installation of the E3 option makes the CMA 3000 a powerful tool for testing at 34 Mbps, 45 Mbps and 2 Mbps rates.

Installing/commissioning and out-of-service troubleshooting of E3 lines is supported in the CMA 3000 by statistical measurements for Bit Error Rate (BER) testing. Statistics are also available for in-service analysis of the transmission-error performance of a 34 Mbps line and G.826 or M.2100 error-performance parameters are calculated for the measurement.

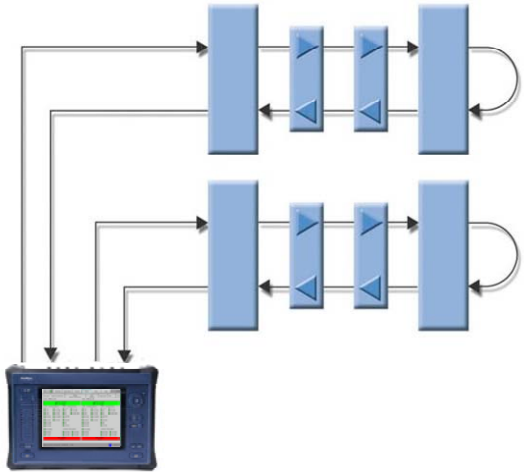

Fig.8: By looping back a CMA 3000 test signal at the far end, you can easily test the quality of E3 lines. Two lines can be tested simultaneously.

Specifications

The specifications below list the functionality for a basic CMA 3000 with SDH, E4 and/or E3 test options installed. For more information on the functionality of the basic configuration please refer to the CMA 3000 basic instrument specifications sheet.

<table>
<tr><th colspan="6">Specifications (SDH test option)</th></tr>
<tr><td>Electrical</td><td colspan="5">

Available modules:

SDH Test Option Incl. STM-1 Electrical Interface (supports optional optical STM-1 and STM-4 modules)
Enhanced SDH test option incl STM-1 Electrical Interface (supports optional optical STM-1, STM-4 and STM-16 modules)

Comply with ITU-T recommendation for electrical 155 Mbps interfaces
Interfaces: STM-1
Line Code: CMI
No. of transmitters (Tx): 1; No. of receivers (Rx): 2
Test configurations: Tx/Rx, Rx/Rx, Tx/Rx/Rx
Connectors: BNC
Impedance: 75 Ohms
The Enhanced SDH test option incl STM-1e provides an electrical level indicator for a received signal

</td></tr>
<tr><td>Attenuation and impedance modes (electrical receivers)</td><td colspan="5">
TERMINATE: Up to 12.7 dB cable attenuation, nominal impedance
MONITOR: Attenuation in accordance with ITU-T recommendations

SDH Test Option Incl. STM-1 Electrical Interface: Both modes automatically supported by the electrical receivers
Enhanced SDH test option incl STM-1e: The two modes are manually selected by the user

</td></tr>
<tr><td>Optical</td><td colspan="5">
Up to 2 optical modules can be installed.

Specification of optical modules purchased from Anritsu for the CMA 3000 (each with 1 transmitter and 1 receiver) with LC connectors (specifications may be subject to change without further noice):

<table>
<tr><th>Description</th><th colspan="2">Min. input sensitivity and wavelength</th><th colspan="2">Output power and wavelength</th></tr>
<tr><td>STM-1
short haul, 1310 nm</td><td>- 28 dBm</td><td>Min. 1260 nm
Max. 1580 nm</td><td>Between - 15 dBm and -8 dBm</td><td>Between 1261 nm and 1360 nm</td></tr>
<tr><td>STM-1/-4
short haul, 1310 nm</td><td>- 28 dBm</td><td>Min. 1260 nm
Max. 1580 nm</td><td>Between -15 dBm and -8 dBm</td><td>Between 1274 nm and 1356 nm</td></tr>
<tr><td>STM-1/-4/-16 [5]
short haul, 1310 nm</td><td>-18 dBm</td><td>Min. 1270 nm
Max. 1580 nm</td><td>Between - 5 dBm and 0 dBm</td><td>Between 1270 nm and 1360 nm</td></tr>
<tr><td>STM-1
long haul, 1310 nm</td><td>- 34 dBm</td><td>Min. 1260 nm
Max. 1580 nm</td><td>Between - 5 dBm and 0 dBm</td><td>Between 1263 nm and 1360 nm</td></tr>
<tr><td>STM-1
long haul, 1550 nm</td><td>- 34 dBm</td><td>Min. 1260 nm
Max. 1580 nm</td><td>Between - 5 dBm and 0 dBm</td><td>Between 1480 nm and 1580 nm</td></tr>
<tr><td>STM-1/-4
long haul, 1310 nm</td><td>- 28 dBm</td><td>Min. 1260 nm
Max. 1580 nm</td><td>Between - 3 dBm and 2 dBm</td><td>Between 1280 nm and 1335 nm</td></tr>
<tr><td>STM-1/-4
long haul, 1550 nm</td><td>- 28 dBm</td><td>Min. 1260 nm
Max. 1580 nm</td><td>Between - 3 dBm and 2 dBm</td><td>Between 1480 nm and 1580 nm</td></tr>
<tr><td>STM-1/-4/-16 [5]
long haul, 1310 nm</td><td>-27 dBm</td><td>Min. 1270 nm
Max. 1580 nm</td><td>Between - 2 dBm and 3 dBm</td><td>Between 1280 nm and 1335 nm</td></tr>
<tr><td>STM-1/-4/-16 [5]
long haul, 1550 nm</td><td>-28 dBm</td><td>Min. 1260 nm
Max. 1580 nm</td><td>Between - 2 dBm and 3 dBm</td><td>Between 1500 nm and 1580 nm</td></tr>
</table>

Test configurations: Tx/Rx, with two optical modules also Rx/Rx, Tx/Rx/Rx
An optical level indicator for a received optical signal is provided

</td></tr>
<tr><td>Input offset range</td><td colspan="5">± 50 ppm</td></tr>
<tr><td>Transmitter clocks</td><td colspan="5">

Internal clock accuracy: 4.6 ppm. Clock may be deviated up to 50 ppm.
Recovered from SDH input with same speed
TTL level external 2 MHz clock
Recovered from 2Mbps

</td></tr>
<tr><td>Framing</td><td colspan="5">According to ITU-T rec. G.707</td></tr>
<tr><td>Scrambling</td><td colspan="5">According to ITU-T rec. G.707</td></tr>
</table>

SDH mappings	Support of the following mappings in accordance with the ITU-T rec. G.707: VC-12/2 Mbps structure (x=1, 4^3 or 16^6): • STM-x ->AU-4 ->VC4->TUG-3 ->TUG-2 ->TU-12 ->VC-12 ->C-12->2 Mbps PDH (async./sync. mapping) VC-3/34/45 Mbps structure (x=1, 4^3 or 16^6): • STM-x->AU-4->VC4->TUG-3->TU-3->VC-3->C-3->34/45 Mbps PDH[2] VC-4/140 Mbps structure (x=1, 4^3 or 16^6): • STM-x->AU-4->VC4-> C-4->140 Mbps PDH[7] VC-4/Bulk test (x=1, 4^3 or 16^6): • STM-x->AU-4->VC-4->Bulk test pattern VC-4-4c/Bulk test (y=4^3 or 16^6): • STM-y->AU-4-4c-> VC4-4c-> C4-4c->Bulk test pattern VC-4-16c/Bulk test: • STM-16 -> AU-4-16c -> VC4-16c -> C4-16c -> Bulk test pattern[6]
SDH/ATM mappings[4]	VC-4/ATM structure (x=1, 4^3 or 16^6): • STM-x -> AU-4 -> VC-4 -> ATM VC-4-4c/ATM structure (y=4^3 or 16^6): • STM-y -> AU4-4c -> VC4-4c -> ATM
Alarms	Alarms can be detected or generated: • LOS, LOF, OOF, MS-AIS, MS-RDI, AU-AIS, AU-LOP, HP-PLM, HP-UNEQ, HP-TIM, HP-RDI, TU-LOM, TU-AIS, TU-LOP, LP-PLM, LP-UNEQ, LP-TIM, LP-RDI, LSS For 2 Mbps alarms supported please refer to the CMA 3000 basic instrument specifications sheet
Errors	Errors can be detected or generated: • B1, A1/A2, B2, MS-REI, B3, HP-REI, LP-B3, LP-REI, V5 Error insertion: • Manual: 1-8000 consecutive errors • Continuous 10^{-5}, 10^{-6}, 10^{-7}, 10^{-8}, 10^{-9}, 10^{-10} For 2 Mbps errors supported please refer to the CMA 3000 basic instrument specifications sheet
Error performance	• G.826/G.828/G.829/M.2100 analysis of the received signal based on detected errors and alarms: ES, SES, BBE (not M.2100), UAT, EFS, AT • Error performance evaluation for the total measurement: HR% allocation
BER test patterns	Pattern generation and detection for O.181 bulk test pattern: • Test patterns supported: PRBS 9, PRBS 11, PRBS 15, PRBS 20, PRBS 23, PRBS 29, PRBS 31. PRBS patterns can be inverted. All 0s, All 1s, Alternating 1/0, 1000 binary, 1010 binary, 2 in 8, 1 in 8, user-defined 2 bytes For 2 Mbps test patterns supported please refer to the CMA 3000 basic instrument specifications sheet
Pointers	• Support pointer events monitoring and generation • Pointer operations in accordance with G.783 • Events for graphical display of pointer movements
Overhead	• Generation of section and path overhead bytes • Display of current section and path overhead bytes
Round trip delay (propagation time) measurement	• Resolution: 0.1 µsec • Range at STM-1: 0 - 15 sec with PRBS 31 as test pattern • Range at STM-4: 0 - 3.5 sec with PRBS 31 as test pattern [3] • Range at STM-16: 0 - 0.85 sec with PRBS 31 as test pattern [6]
Tributary signals	For E1 signals (one per active receiver) embedded in a selected VC-12, the CMA 3000 basic instrument E1 functionality is available For E3/DS-3 signals (one per active receiver) embedded in a selected VC-3, the E3/DS-3 functionality is available if the E3 test option is installed. For E4 signals (one per active receiver) embedded in a selected VC-4, the E4 functionality is available if the E4 test option is installed.

Results (SDH test option)	
Status	Current information on: • Alarms and errors on the monitored line • Input level indication for optical signals • Input level indication for electrical signals[5] • Actual bit rate • Frequency deviation • Difference between RxA and RxB bit rate (current and accumulated) • Round trip delay
Statistics	User-defined resolution: • 1, 2, 5, 10, 15, 30s, 1, 5, 10, 15, 30 min, 1, 2, 4, 6, 12 hours Information logged: • Alarms • Errors • Pointer operations
APS	APS (Automatic Protection Switching) test and analysis: • APS switching time is measured. Switching time above a user defined threshold is highlighted ○ Trigger events (user selectable): SDH alarms and errors; APS switchover • Number of switchovers indicated by APS protocol • K1/K2 bytes can be set and displayed

Related options	
ATM-over-SDH test option[4]	Please refer to the spec. sheet on CMA 3000 ATM test options for further information
Tandem connection monitoring[1]	Please refer to the spec. sheet on Tandem Connection Monitoring for further information

Notes

[1] Requires installation of a CMA 3000 SDH test option module

[2] Requires installation of the E3 test module

[3] Requires installation of an STM1/-4 optical module

[4] Requires installation of the ATM-over-SDH option

[5] Requires installation of the Enhanced SDH test option incl STM-1e

[6] Requires installation of an STM-1/-4/-16 optical module and the Enhanced SDH test option incl STM-1e

[7] Requires installation of the E4 test option

Specifications (E4 test option – requires installation of an SDH option and the E4 test option)	
Electrical	• Comply with ITU-T rec. G.703 for139264 kbps kbps interfaces • Interfaces: E4 • Line Code: CMI • No. of Transmitters (Tx): 1; No. of Receivers (Rx): 2 • Test configurations: Tx/Rx, Tx/Rx/Rx, Rx/Rx • Connectors: BNC through the connectors also used for electrical STM-1 signals • Impedance: 75 ohms
Attenuation and impedance modes	TERMINATE: Up to 12.7 dB cable attenuation, nominal impedance MONITOR: Attenuation in accordance with ITU-T recommendations • SDH Test Option Incl. STM-1 Electrical Interface: Both modes automatically supported by the electrical receivers • Enhanced SDH test option incl STM-1e: The two modes are manually selected by the user
Transmitter clocks	• Internal. Accuracy: 4.6 ppm. Clock may be deviated up to 50 ppm from nominal. • Recovered from an E4 receiver • TTL level external 2 MHz clock
Framing	According to ITU-T rec. G.751 for E4 signals
Alarms	Alarms can be detected or generated: • No Signal, AIS, No Frame, Distant, No Sync
Errors	Errors can be detected or generated: • FAS, Pattern, Pattern slip Error insertion: • Manual: 1-255 consecutive errors • Continuous 10^{-2}, 10^{-3}, 10^{-4}, 10^{-5}, 10^{-6}, 10^{-7}, ES and SES
Error performance	• G.826/M.2100 analysis of the received signal, or based on detected errors ES, SES, ALS, UAT, AVT, EFS
BER test patterns	Pattern generation and detection. Test patterns supported: • PRBS 9, PRBS 11, PRBS 15, PRBS 20, PRBS 23, PRBS 29, PRBS 31, QRSS • All 0's, All 1's, Alternating 1:1, Alternating 1:3, Alternating 1:7, User 16bits • All patterns except “All 0” and “All 1” can be inverted
Round trip delay (propagation time) measurement	• Resolution: 0.1 µsec • Range: 0 - 15 sec with PRBS 31 as test pattern

Results (E4 test option – requires installation of an SDH option and the E4 test option)	
Status	Current information on: • Alarms and errors on the monitored line • Input level indication (requires installation of the Enhanced SDH test option incl STM-1e) • Actual bit rate • Frequency deviation • Difference between RxA and RxB bit rate (current and accumulated) • Round trip delay
Statistics	User-defined resolution: 1, 2, 5, 10, 15, 30s, 1, 5, 10, 15, 30 min, 1, 2, 4, 6, 12 hours Information logged: • Alarms • Errors • Frequency deviation

Specifications (E3 test option)	
Electrical	• Comply with ITU-T recommendation for 34 368 kbps and 44 736 kbps interfaces (ITU-T rec. G.703). • Interfaces: E3 / DS-3 • Line Code: HDB3 (E3), B3ZS (DS-3) • No. of Transmitters (Tx): 2; No. of Receivers (Rx): 2 • Test configurations: Tx/Rx, dual Tx/Rx, Rx/Rx • Connectors: BNC through the connectors also used for 2 Mbps signals • Impedance: 75 ohms
Attenuation and impedance modes	TERMINATE: Up to 12 dB cable attenuation, nominal impedance MONITOR: Attenuation in accordance with ITU-T recommendations
Transmitter clocks	• Internal. Accuracy: 2.5 ppm. Clock may be deviated up to 40 ppm from nominal. • Recovered from an E3/DS3 receiver
Framing	According to ITU-T rec. G.751 for E3 signals (DS-3 signals are unframed)
Alarms	Alarms can be detected or generated: • No Signal, AIS, No Frame (E3 only), Distant (E3 only), No Sync
Errors	Errors can be detected or generated: • FAS (E3 only), Code, Pattern, Pattern slip Error insertion: • Manual: 1-255 consecutive errors • Continuous 10^{-2}, 10^{-3}, 10^{-4}, 10^{-5}, 10^{-6}, 10^{-7}, ES and SES
Error performance	• G.826/M.2100 analysis of the received signal, or based on detected errors ES, SES, ALS, UAT, AVT, EFS
BER test patterns	Pattern generation and detection. Test patterns supported: • PRBS 7, PRBS 9, PRBS 11, PRBS 15, PRBS 20, PRBS 23, PRBS 29, PRBS 31 • Fox Pattern, All 0's, All 1's, Alternating 1:1, Alternating 1:3, Alternating 1:7, Alternating 3:24, User 16bits, User 2048bits • All patterns except “All 0”, “All 1” and “Fox” can be inverted
Round trip delay (propagation time) measurement	• Resolution: 0.1 msec • Range: 0 - 15 sec with PRBS 29 as test pattern

Results (E3 test option)	
Status	Current information on: • Alarms and errors on the monitored line • Input level indication • Actual bit rate • Frequency deviation • Difference between RxA and RxB bit rate (current and accumulated) • Round trip delay
Statistics	User-defined resolution: 1, 2, 5, 10, 15, 30s, 1, 5, 10, 15, 30 min, 1, 2, 4, 6, 12 hours Information logged: • Alarms • Errors • Frequency deviation

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