

ST2400 STM-16 2.4 Gbit/s

This product is no longer available. Please see the [ST2400A](#) instead.



Features

- Compact and light weight for portability
- Cost-effective STM-16 testing
- Upgrade any SDH test set to STM-16
- Flexibility of configurations
- 155 electrical / 155/622 optical add/drop payload capability
- Dual wavelength available with option for hybrid networks
- Easily switchable to SONET OC-48
- Special 1550 ±10 nm optics for WDM applications
- Standalone mode provides STM-16 signal testing without additional test equipment
- Payload independent
- Active through mode to simulate fault conditions on installed networks

The ST2400 STM-16 Test Set allows you to upgrade your existing SDH test capabilities to 2.4 Gbit/s. It's the first truly compact, lightweight, and cost-effective STM-16 test set available. The ST2400 is payload-independent; VC-3, VC-4, VC-4-4c, VT-12, and any other mapping are all supported from an external SDH test set.

The ST2400 Transceiver features three operating modes to provide the flexibility you need to test today's advanced STM-16 and Wavelength Division Multiplexing (WDM) systems. The ST2400 also provides very cost-effective testing for STM-64 systems and is switchable for SONET capabilities.

Three Test Modes

Active Through Mode. Allows overhead bytes to be overwritten while regenerating the received STM-16 payload. Defects and errors can also be added to the received signal prior to retransmission. You can set defects and errors continuously, single-shot, or repetitively with variable duration and repetition interval. This mode is especially valuable for testing framing synchronisation and protection switching, and for diagnosing system interoperability problems.

Terminal (External) Mode. Allows out-of-service tests to be performed. Using any external STM-1 or STM-4 SDH test set, the ST2400 performs STM-16 level testing while the external test set analyses the dropped tributaries. Previous investment in test equipment is preserved.

Standalone (Internal) Mode. Where payload testing is not required, or an external STM-16 signal is not available, the ST2400 can operate independently. An internally-generated 2.4 Gbit/s test signal provides full error performance analysis and reporting at the STM-16 level.

Three Configurations

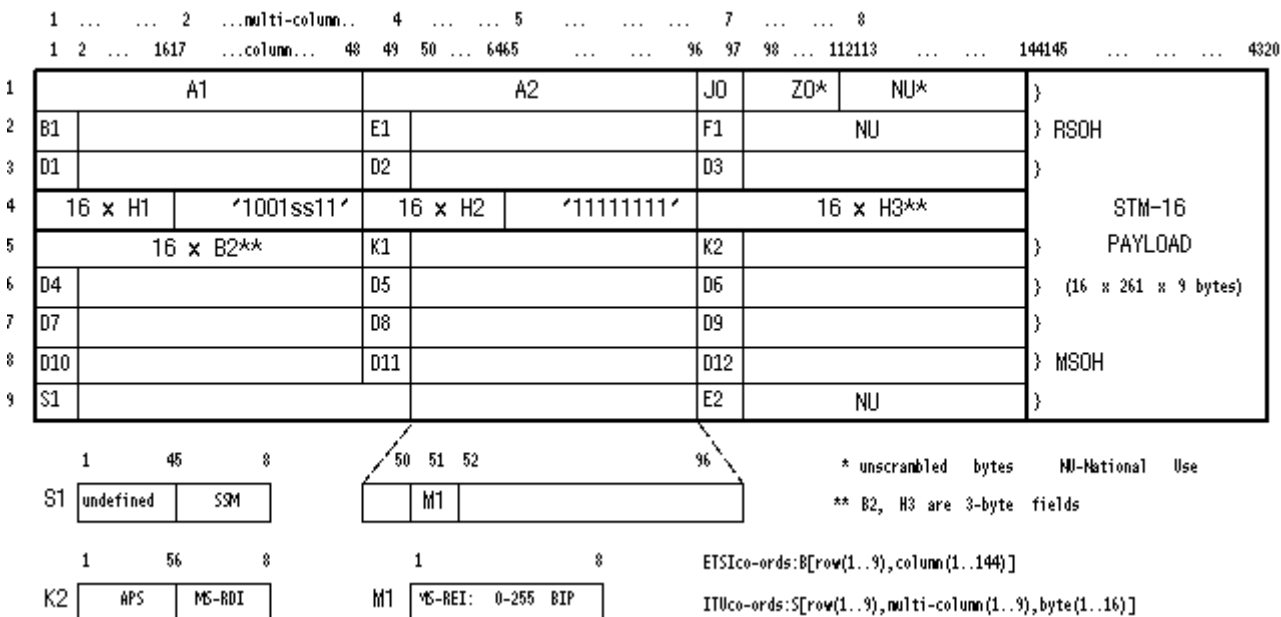
In addition to the full Transceiver version, the ST2400 can be ordered as a Receive-Only or Transmit-Only unit. The Receive-Only unit provides highly cost-effective network monitoring and system measurement. The Transmit-Only unit is ideal for economical signal generation in the lab, on the production floor, or in the network.

High Performance WDM Optics Option. For manufacturers and installers of Wavelength Division Multiplexing (WDM) equipment, the ST2400 offers a low-dispersion, long reach 1550 nm optics option that provides the enhanced performance critical for those applications.

Dual Wavelength Optics Option. Taking enhanced performance one step further, the ST2400 provides a dual wavelength version of its high performance optics. The 1310 or 1550 nm optics are chosen via a software menu item, thus providing installers and manufacturers of hybrid networks maximum flexibility.

Adheres To The Latest Standards

The ST2400 complies with the latest ITU-T recommendations, ETSI, ANSI, and Bellcore standards. New error performance analysis based on ITU-T Rec. G.826, B.827, M.2101, and B.EPMS (draft) means that network operators can properly verify their networks and ensure the highest quality of service.



STM-16 overhead structure.

Test Set Characteristics

Transmitter Specifications

Laser Options:

- Wavelength:** 1310 nm (1300 to 1320 nm) / 1550 nm (1540 to 1560 nm).
- Power:** 0 dBm (typical).
- Category:** LR-1/LR-2 respectively.
- Dispersion:** 1310 nm (N/A) / 1550 nm (1800 ps/nm).

Payload Generation: STM-16 framing and multiplexing format to meet ITU-T G.707.

Output Timing:

Internal clock: INT mode, 2,488,320 kbit/s ±20 ppm: THRU mode, recovered from STM-16 input:

EXT mode, recovered from STM-1/4 add input.

Active THRU (Through) Mode:

Output payload: Regenerated unaltered or with added defects or added errors from the received STM-16 input signal using the recovered STM-16 clock. Jitter transfer from STM-16 input to output is filtered by a 1 MHz (nominal) bandwidth PLL (typical 0.3 dB jitter transfer).

EXT (Terminal) Mode: Tributaries are added from an external SDH test set (STM-1e/1/4/4c add interfaces). STM-16 is generated using clock recovered from the add input. Tributary signals added into any 1 of 16 (STM-1e/1) or any 1 of 4 (STM-4/4c) payload locations or duplicated to fill all payload locations. Unused payload locations are bulk-filled with fixed 00H data.

INT (Standalone) Mode: All tributaries are bulk filled with fixed 00H data.

Overhead Generation: Section overhead bytes (multi-columns 1, 4, 7) can be set as hex values in the range 00 to FF.

Settable bytes: J0, E1, F1, D1-D3, K1, K2, D4-D12, S1, M1, E2.

Following bytes may not be directly edited: A1, A2, B1, B2, H1, H2, H3.

Mnemonic coding and dedicated menus for S1 (Synchronization Status Byte) and K1/K2 (Automatic Protection Switching).

Active THRU (Through) Mode: Overhead bytes are regenerated from the STM-16 input and can be selectively overwritten. B1 is recalculated prior to transmission.

EXT (Terminal) Mode: All bytes except for B1 are inserted from the tributary. Settable bytes can be selectively overwritten.

INT (Standalone) Mode: All bytes are generated internally. Settable bytes can be selectively overwritten.

Defect and Alarm Generation: LOS, LOF, MS-AIS, MS-RDI.

Single Event:

LOS: 1 to 127 μ s (1 μ s resolution)

LOF MS-AIS MS-RDI: 1 to 127 frames (1 frame resolution).

All: 0.1 to 9.9 s (0.1 s resolution).

Continuous or off.

Repeat Event Control:

Injection time: 0.1 to 9.9 s.

Idle time: 1.0 to 30 s.

Resolution: 0.1 s.

Error Generation: B1, MS-REI, STM-1 Bit, STM-16 Bit.

Error Control:

B1 (BIP-8): Single error or continuous error rate, 2.5×10^5 to 0.1×10^9 ; Decade resolution, 0.1.

MS-REI: 1 to 255 errors per frame inserted in a single frame or continuously.

Bit errors in selected STM-1 tributary or across STM-16 frame: Single error or continuous error rate 1.0×10^3 to 0.1×10^9 ; Decade resolution, 0.1.

Gated Error Control:

Injection time: 0.1 to 9.9 sec.

Idle time: 1.0 to 30 s.

Resolution: 0.1 s.

Tributary Add Interfaces: Inputs monitored for LOS and LOF, status displayed on front-panel LEDs.

STM-1e/1: 155,520 kbit/s (nominal) ± 100 ppm input tolerance.

STM-4: 622,080 kbit/s (nominal) ± 100 ppm input tolerance.

STM-1e:

Interface: 75 ohm BNC CMI G.703.

Sensitivity: -5 dB ($>0.2 V_{pp}$).

STM-1/4:

Optical interface: G.957.

Wavelength: 1310 nm.

Sensitivity: -28 dBm.

Overload: -8 dBm.

Other Interfaces:

Frame Sync Output:

Level: ECL.

Termination: 50 ohm.

Pulse width: 25 ns.

Event Trigger Output: Pulse transmitted for each alarm, error, or overhead change.

Level: TTL.

Pulse width: 25 ns.

Receiver Specifications

STM-16 Physical Interface: 2,488,320 kbit/s (nominal) G.957 optical input.

Input tolerance: ± 20 ppm.

Wavelength: 1310 nm (1300 to 1320 nm) or 1550 nm (1540 to 1560 nm).

Sensitivity: 29 dBm.

Overload: -9 dBm.

Input reflectance: Better than -27 dBm.

Jitter tolerance: Meets ITU-T G.813.

Payload Access: A selected tributary (1 of 16 STM-1e/1 or 1 of 4 STM-4/4c) is dropped to an external SDH test set, using the clock recovered from the STM-16 input.

Jitter transfer from STM-16 Receiver interface to drop interface is filtered by a 1 MHz (nominal) bandwidth PLL, and divided down to the drop rate.

Overhead Display: STM-16 (multi-columns 1, 4, 7) section overhead bytes can be displayed as hex values.

Available bytes: A1, A2, J0, B1, E1, F1, D1-D3, H1-H3, B2, K1, K2, D4-D12, S1, M1, E2.

Mnemonic decoding (for easy interpretation of G.707 message codes): S1 (SSMB), K1/K2 (APS) bytes.

Defect and Alarm Measurement: LOS, LOF, OOF, MS-AIS, MS-RDI.

Monitoring: Simultaneously during test period.

Status: Displayed as front-panel LEDs with 'history' button.

Error Measurement: B1, B2, MS-REI: Total block error count.

Monitoring: Simultaneously during test period.

Status: Displayed as front-panel LEDs with 'history' button.

Errors integrated over 1 s period.

Error Reporting:

Test Period: Manual start/stop, timed start/stop, and repeated gate.

Duration: 1 s to 99 days.

Resolution: 1 s.

Report Printout:

Comprehensive printout of defects, errors, performance analysis, test start/stop time.

Print on error, at end of test, both, or on demand.

Error Log:

Previous tests held in memory for subsequent printing.

Defects and errors logged per second, output to printer or PC via RS-232.

Tributary Drop Interfaces:

STM-1e:

Interface: 155,520 kbit/s, 75 ohm BNC CMI G.703.

STM-1/4:

Optical interface: G.957.

Wavelength: 1310 nm (1300 to 1320 nm).

Typical power: -8 dBm.

Type: Class 1 laser.

Performance Analysis:

According to G.826, G.827, M.2101, and B.EPMS (draft).

Errors Monitored:

B1, B2, MS-REI.

G.826/G.EPMS Events Computed:

EB (Errored Block).

ES (Errored Second).

SES (Severely Errored Second).
BBE (Background Block Error).

G.826/G.EPMS Parameters Computed During Available Time:

ESR (Errored Second Ratio).
SESR (Severely Errored Second Ratio).
BBER (Background Block Errored Ratio).

G.827 Parameters Computed:

UR (Unavailability Ratio).

M.2101 Parameters Computed:

ES (Errored Second).
SES (Severely Errored Second).
UAS (Unavailable Second).

Other Parameters Computed:

AEB (Available Errored Block).
ABBE (Available Background Block Error).

Remote Control**Interfaces:**

IEEE-488.2 (GPIB) and RS-232.

Command Set:

High-level ASCII.

Printer:

Interface: DB-25 translation of Centronics.

Signal: TTL.

Description: Byte serial ASCII printer interface. Follows industry standard.

Connector: DB-25.

General Characteristics**Environmental****Temperature:**

Operating: 0 to +40° C.

Non-operating: 0 to +60° C.

Electromagnetic Compatibility

FCC CFR47, Part 15, Subpart B, Class A for radiated and conducted emissions.

EC Council Directive 89/336/EEC (EC-92), as specified in the Generic Emissions Standard

EN50081-1: Class A for radiated and conducted emissions.

Laser Safety

Laser output keyswitch interlock, remote interlock, and front-panel LED indication ensure operator safety.

Power**Source Power:**

Voltage Requirements (auto-ranging): 110 (90 to 135) VAC or 220 (180 to 270) VAC.

Line Frequency: 47 to 63 Hz.

Power Consumption: 250 Watts maximum.

Connectors

Optical Connectors: FC/PC standard.

Other: 75 \pm ohm BNC unless noted otherwise.

Physical

Dimensions	mm	in.
Height	89	2.5
Width	369	14.5
Depth	420	16.5
Weight	kg	lb.
Net	11.3	25

Recommended Calibration Interval

1 year.

Standard Warranty

1 year.

Related SDH Test Products**CTS 750 SDH/PDH Test Set:** Portable test set for 52 Mbit/s, 155 Mbit/s, and 622 Mbit/s.**SJ300E SDH/SONET Jitter Analyzer:** Portable jitter analyzer for 52 Mbit/s, 155 Mbit/s, and 622 Mbit/s.**CSA 803A Communications Signal Analyser:** Eye pattern analyser offering DC to 50 GHz bandwidth.**Ordering Information****ST2400 STM-16 2.4 Gbit/s SDH/SONET Test Set****Includes:** STM-16 Transmitter and Receiver, FC Optical Connectors, Power Cord, User Manual.**Options****Opt. 11:** Receive only with 2.4 Gbit/s wideband optics.**Opt. 12:** Transmit only with 1310 nm intermediate-reach 2.4 Gbit/s transmit optics.**Opt. 13:** Transceiver with wideband receive optics and 1310 nm intermediate-reach 2.4 Gbit/s transmit optics.**Opt. 14:** Transmit only with 1550 nm long-reach 2.4 Gbit/s transmit optics.**Opt. 15:** Transceiver with wideband receive optics and 1550 nm long-reach 2.4 Gbit/s transmit optics.**Opt. 16:** Transmit only with switchable 1310 nm intermediate-reach transmit optics and 1550 nm long-reach 2.4 Gbit/s transmit optics.**Opt. 17:** Transceiver with wideband receive optics and switchable 1310 nm intermediate-reach transmit optics and 1550 nm long-reach 2.4 Gbit/s transmit optics.**Opt. 1A:** 15 dBm FC-PC attenuator for 2.4 Gbit/s receiver.**Opt. 1M:** Rackmount.**Opt. 3C:** Replace FC fiber-optic connectors with SC connectors.**Opt. 4C:** Replace FC fiber-optic connectors with ST connectors.**Recommended Accessories****1 m BNC-to-BNC 75 ohm Coaxial Cable:** Order 012-1338-00.**Adaptor Plug, BNC-1.6/5.6:** Order 013-0300-00.**2 m FC-PC to FC-PC Optical Patchcord:** Order 174-1387-00.**9 ft. 25-pin DB25 Male to 9-pin DB9 Female RS-232 Cable:** Order 012-1298-00.**AMP 06-0033 FC Style Build Out Attenuator, 15 dB Fixed Value:** Order 119-5610-00.**Rackmount Kit:** Order 016-1407-00.**Hardside Transit Case:** Order 016-1494-00.

International Power Plug Options

Option A1 - Option A5.



Tektronix Measurement products are manufactured in ISO registered facilities.



2.4 Gbit/s Laser

10/96 TD/XBS 2RW-11123-0



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