FST-2310 TestPad

SONET Services Module

Key Features

- **SONET/T-carrier transmission testing from DS1 to OC-48 rates**
- **SDH transmission testing at STM-16, STM-4 and STM-1 rates**
- **Circuit-switched testing capabilities including GR-303, ISDN, signaling, voice frequency (VF), and digital data service (DDS)**
- **ATM testing capabilities including CBR/VBR traffic generation, QoS measurements, O.191 test cell generation, and support for OAM alarm and loopback cells**
- **Engineered for mobile technicians with rugged construction, lightweight design, and battery-powered operation**
- **Process oriented testing features such as test scripting and remote control operation**

The JDSU FST-2310 TestPad is an all-in-one testing solution that performs SONET, SDH, T-carrier, data, and circuit-switched testing to meet the varied testing requirements of mobile technicians. Its modular architecture protects long-term investment by providing the flexibility, scalability, and upgradeability to support evolving test needs.

Most tests performed using the FST-2310 can be done in only a few button pushes, without the need to sift through hidden setup menus. Additionally, because technicians need only minimal training to use the FST-2310, testing objectives are addressed quickly and the cost of ownership is significantly reduced.

Key features of the FST-2310 include:

Application-driven icons

Test application buttons are labeled with icons that clearly depict the way the test is performed on the circuit; for example, select the "MON/THRU" icon when performing circuit-monitoring tests – select the "TERM" icon when performing circuit-terminating tests. The icons and quick setup buttons enable technicians to use the module effectively with very little training (figure 1).

Simultaneous results analysis for different signal rates

Identify the source of problems quickly by using the FST-2310's dual results window to analyze results from different signal rates simultaneously. Simultaneous results analysis can also be performed on different signal results (for example, level and bit errors) allowing for easy results correlation and quick problem identification.

Autoconfiguration

Support for autoconfiguration is provided for all key applications. Autoconfiguration is capable of setting different test parameters, such as framing and pattern, as well as detecting the signal's multiplexed composition. This enables users to reduce the time required for test setup. Additionally, the FST-2310 has the ability to save and store up to 10 test set configurations that can be recalled for future use.

Remote control

Remotely configure tests and analyze results in detail using the remote control GUI option. This allows technicians to conveniently operate the module from a remote location using the FST-2310's graphical user interface (GUI) on a remote PC. The remote control GUI feature enables technicians to connect to the FST-2310 through the PCMCIA serial or modem card to perform tests and collect test results.

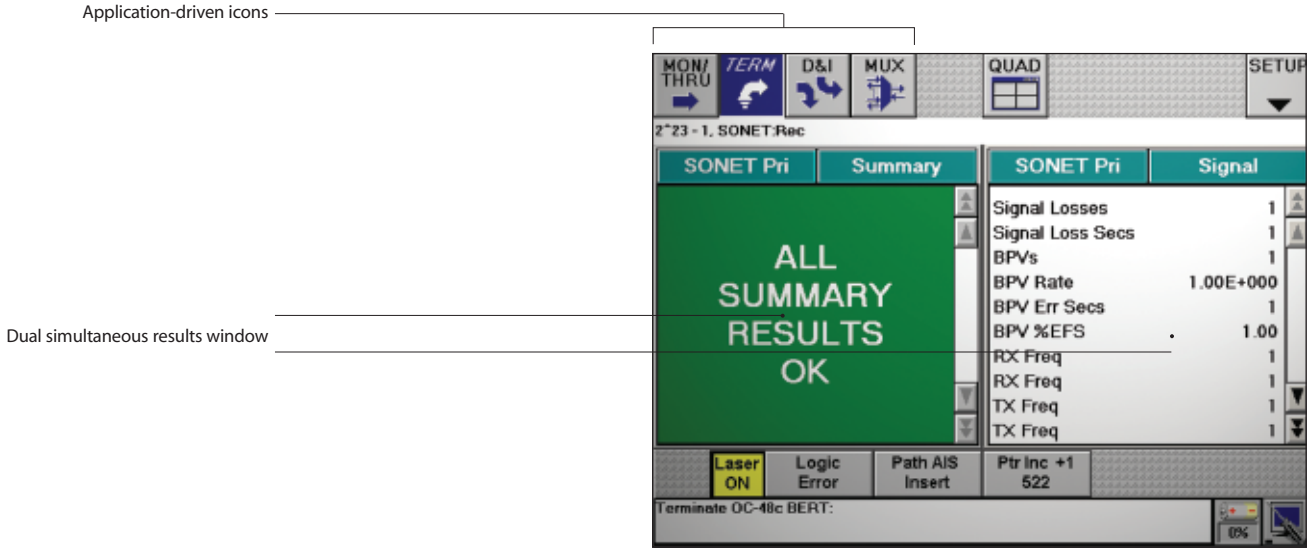

figure 1 Application-driven icons and simultaneous results

Scripting and automation
Reduce setup time and increase efficiency of tests by running preprogrammed scripts from a PCMCIA card. The DS1/DS3/SONET script libraries supported on the FST-2310 enable technicians to perform tests quickly and verify test results against specific criteria for a simple pass/fail result. Scripts can also be customized to meet the methods and procedures of any service provider (figure 2).

VT100 emulation
Perform VT100 terminal emulation to connect to network elements to configure NE parameters and monitor available statistics (figure 3).

Timed prints and error logs
Print results every few hours, at the end of a test, or at the occurrence of an error using the FST-2310's print features.

Through mode for all rates
Gain access to test circuits (DS1 through OC-48) even when no test access point is provided. The FST-2310's through-mode capability monitors test circuits by unobtrusively channeling network traffic through the test instrument.

Physical, active port, and laser active LEDs
A bright array of physical LEDs on the front panel summarizes results and clearly identifies errors detected during a test. Active port LEDs on the top panel indicate the interface(s) to use for specific tests – thus eliminating user error when connecting the FST-2310 to the network. Laser-active LEDs indicate when the transmit laser is active and when laser pulses are received.Applications

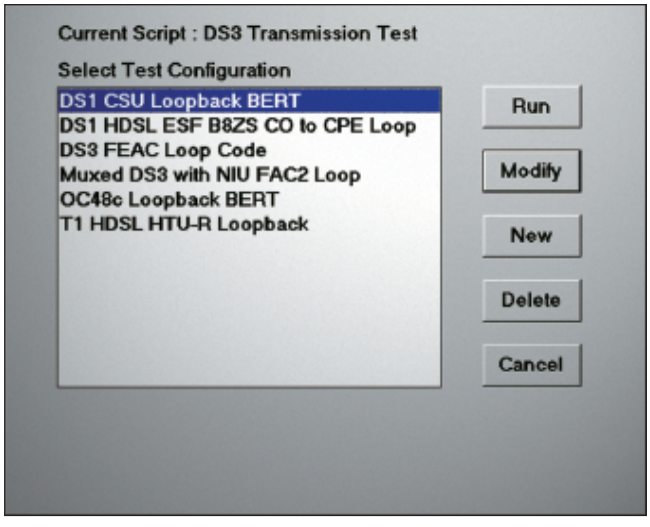

figure 2 Use automation scripts to verify network performance with the touch of a single button

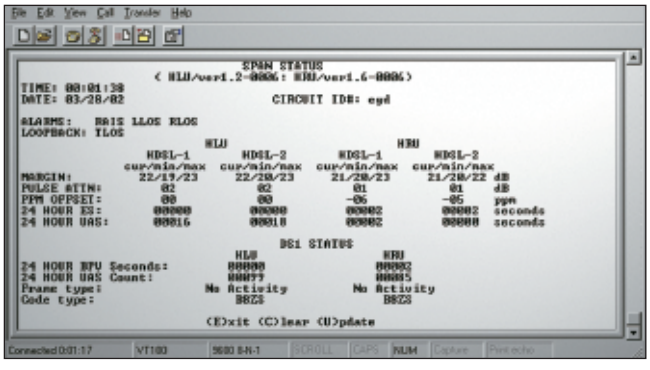

figure 3 Perform VT100 emulation to configure network elements and monitor statistics

Applications

SONET analysis

The FST-2310 can be used to verify end-to-end network performance via BER testing at SONET rates up to OC-48 as well as to analyze SONET network performance under abnormal conditions by simulating pointer justifications and inserting error and alarm conditions. Users can also manipulate and analyze all applicable SONET overhead bytes to verify network element performance (for example, pointer adjustments, alarms, DCC bytes, SONET sync messages, and K1/K2 bytes) (figure 4).

Qualify the performance of SONET networks quickly and easily with the FST-2310's intuitive GUI. By supporting various payload mappings, the FST-2310 enables testing and verification of individual payloads inside an OC-n signal (DS1, DS3, multiplexed DS3, VT1.5, OC-n subrates).

Additional functionality includes the ability to drop and insert all mappings (OC-12/3/DS3/DS1) from an OC-48 signal. Monitor individual DS1, DS3, or OC-n subrate payloads within SONET signals for analysis, and verify signal power and signal frequency of a received signal. Technicians can also name and identify trace messages and payloads by using the FST-2310's user-configurable path trace messages.

SDH analysis

The SDH functionality on the FST-2310 enables performance verification of SDH networks at the STM-16, STM-4 and STM-1 rates. The FST-2310 supports performance testing of individual payloads inside an STM-n signal (STM-16c, STM-4c, STM-1c). Ensure proper network operation with error/alarm analysis as well as the manipulation/analysis of all applicable SDH overhead bytes. Correct network timing can be monitored through pointer adjustment measurements.

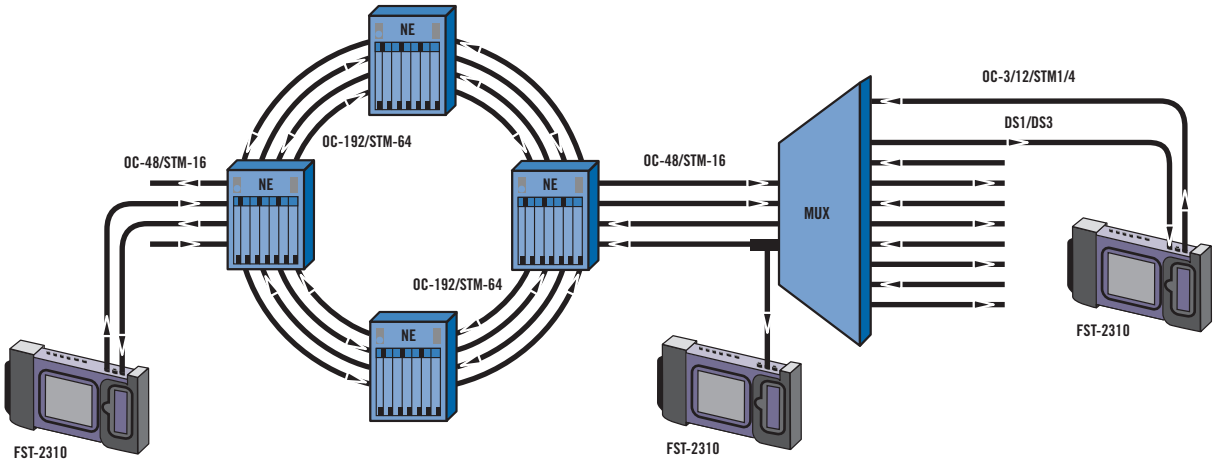

figure 4 Verify network performance at various points of a SONET/SDH network

DS3 analysis

Ensure DS3 network performance by performing end-to-end BER testing and measuring frequency and signal levels on the circuit under test. Technicians can qualify networks for accurate multiplexed operation by performing BER testing on one or all DS1 channels transmitted by a DS3 multiplexer. Access to the DS3 signal is provided from the DS3 interface or a DS3 signal embedded in an STS-1, OC-3, OC-12, or OC-48 circuit. Reduce total testing time on DS3 circuits by using the dual DS3 receivers to perform bidirectional monitoring, allowing for quick isolation of problems (figure 5).

DS1 analysis

Verify T1 network performance with the FST-2310's integrated BER, signal, alarm, and timing tests. A wide range of stress test patterns, combined with bidirectional monitoring, enables technicians to identify and sectionalize circuit problems and quickly qualify circuits for service acceptance. Users can perform VF analysis of voice trunks with the FST-2310's support of VF levels and tones measurements. The drop-and-insert test feature qualifies a DS0 channel while the T1 circuit remains in service. The FST-2310 isolates sources of timing errors by using an external bits clock input to identify network synchronization problems. Access to the DS1 signal is provided from the T1 interface or from the DS1 signal embedded in a DS3, STS-1, OC-3, OC-12, or OC-48 circuit (figure 5).

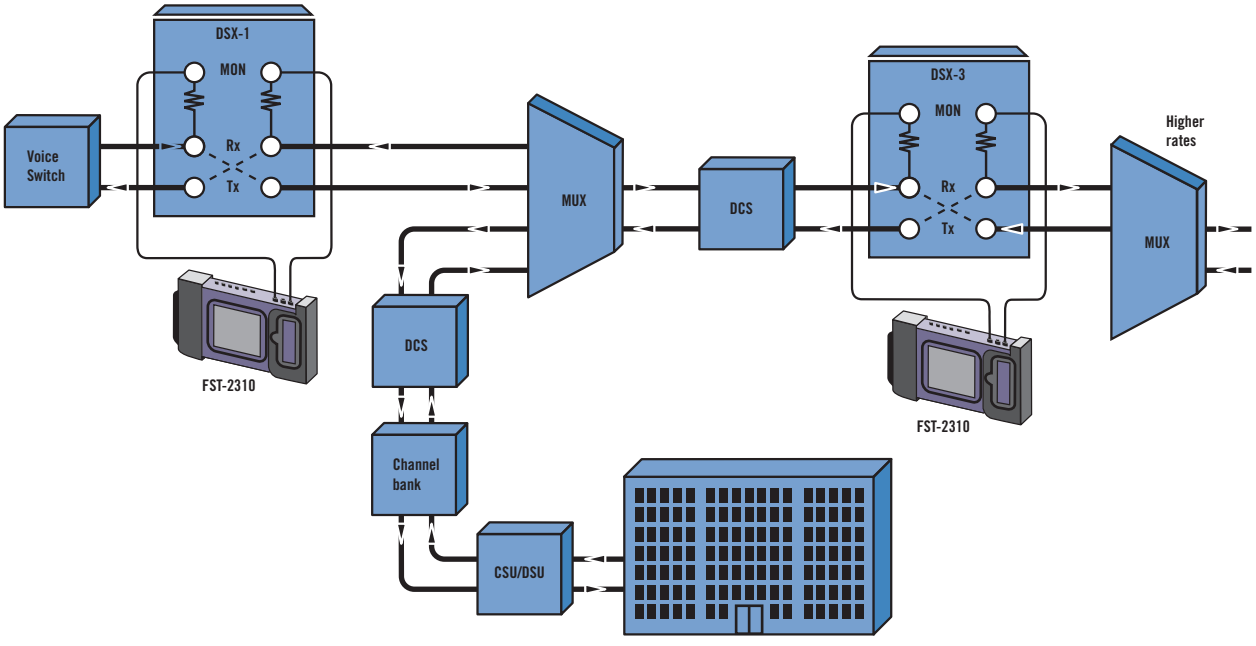

figure 5 Perform bidirectional monitoring and BER testing on DS1 and DS3 circuits

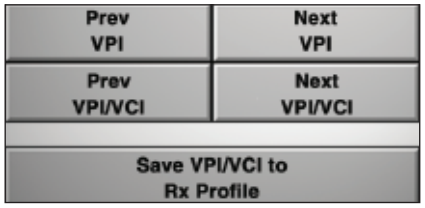

figure 6 Search for ATM traffic on DS1, DS3, OC-3, or OC-12 circuits

DS1/DS3 Jitter analysis

Verify possible timing problems encountered during installation, maintenance and troubleshooting of SONET networks by jitter testing at DS1 or DS3 tributary interfaces. Clock differences between two networks are compensated by pointer movements. Timing problems cause excessive pointer movements at SONET interfaces. However, lack of access at the high-speed SONET interfaces make it often impossible to verify timing problems at synchronous levels. Pointer movements cause jitter at plesiochronous tributary levels. The FST-2310 tests high-band and wide-band jitter at DS1 and DS3 interface. In addition, the jitter results are simultaneously available with DS1/3 bit-error-rate testing, eliminating the need for specialized test configurations and without increasing test time.

ATM analysis

Analyze ATM circuits at OC-12c, OC-3c, DS3, and DS1 rates. Generate multiple cell streams to perform key quality of service measurements (cell delay variation, cell error ratio, cell loss ratio, round-trip delay), cell statistics and bandwidth utilization. The FST-2310 supports OAM alarm (VP/VC AIS/RDI) and loopback cells as well as modification of the VPI/VCI, PTI, CLP, and GFC fields of the cell header. Also supported are the 0.191 ITU standard test cell and the ability to save up to four transmit profiles (figure 6).

GR-303 protocol link analysis

Perform basic GR-303 protocol link analysis in Monitor/Through mode at the 64-K data rate on a call processing (TMC/CSC) or operations channel (EOC).

Analysis is conducted unobtrusively to decode messages on the system's protocol links. Technicians can monitor call statistics, filter call control messages based on cause code, or monitor layer-2 packet statistics to qualify proper functioning of the GR-303 interface. The GR-303 option also provides support for tracing calls based on filter criteria (for example call reference value – CRV) established through the test setup. Once the call is traced, clicking on the appropriate call provides decodes of the protocol message that were exchanged to establish the call.

ISDN PRI testing

Emulate an ISDN TE device, such as a PBX, to place and receive voice and data calls on an ISDN PRI circuit. The FST-2310 TestPad enables users to monitor and capture signaling messages exchanged on the D-channel. Caller ID/Caller ID blocking, 21-digit dialing and DTMF digits are all supported. Call status results and progress reports provide an additional level of detail to ensure calls are successfully established (figure 7).

The FST-2310's ISDN functionality supports AT&T specific call control (5ESS, DMS-100, National ISDN-II). The FST-2310 can be used for backup D-channel testing to switch between standby and in-service D-channels, bidirectional monitoring with full text decodes for protocol messages exchanged on the D-channel, as well as testing of multiple DS1 lines with NFAS testing.

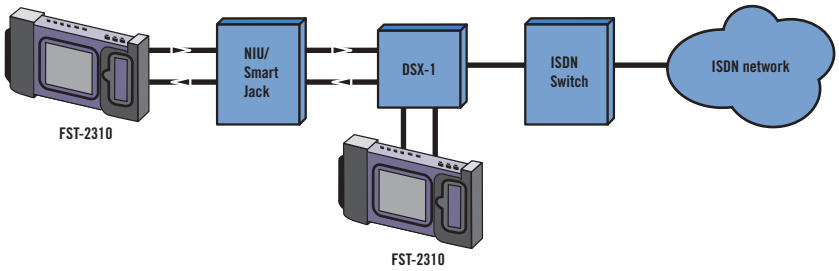

figure 7 Perform ISDN terminal emulation as well as monitor ISDN links from DS1, DS3 and STS-1 circuits

figure 8 Send loop codes to a T1 NIU/CSU

Signaling analysis

Emulate the PBX/switch for placing and receiving calls and monitor signaling digits for detailed analysis. The FST-2310 signaling features include E&M, loop start, and ground start support for placing and receiving calls. The FST-2310 provides support for DP, DTMF, and MF digit recognition. It can also perform interevent and interdigit delay measurements as well as event and digit duration measurements.

The signaling (ABCD) bits for all DS0s can be displayed in one simple result window. A speaker, microphone, and handset are provided for verifying voice integrity.

Loopback applications

Sectionalize T1/T3 circuits with the FST-2310 and its support for NIU/CSU loopback and user-programmable loop codes. The FST-2310 can sectionalize the network and verify the functionality of intelligent line-equipment and repeaters with its ability to loopback T1/T3 network elements (figure 8) .

Online help

The easy-to-use online help screens provide information on product descriptions, common applications, product specifications, cabling diagrams, and contact information (figure 9).

Software support

All JDSU products are continually being updated through software enhancements. The FST-2310 TestPad, in particular, keeps pace with advancing technologies through enhanced software revisions to add value to its users and customers. Software upgrades are done in the field in minutes through the PCMCIA card interface.

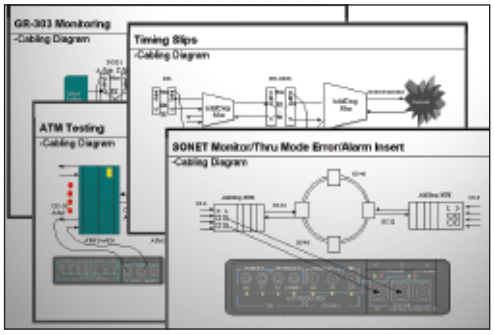

figure 9 Online help provides quick cards and cabling diagrams

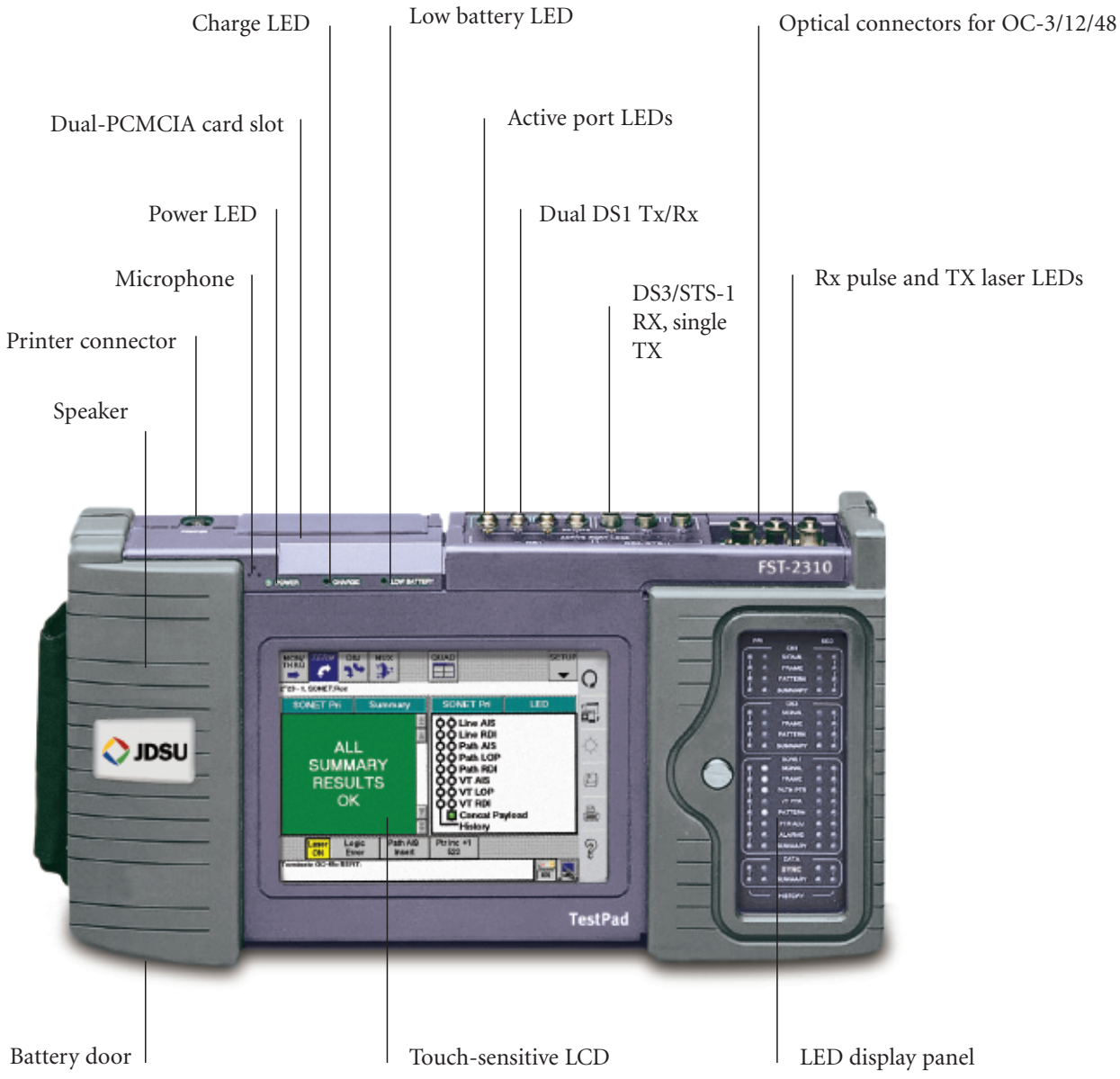

figure 10 Physical characteristics of the FST-2310

Technical specifications

Physical characteristics

Overall dimensions	7.5 x 11.5 x 2.25 in (19 x 29.2 x 5.7 cm)
Weight	5 lb (2.27 kg), with battery

Environment

Temperature range

Operating	32°F to 113°F (0°C to 45°C)
Storage	–4°F to 158°F (–20°C to 70°C)
Shock and vibration	Meets IEEE-743

Electrical

Battery type	10.8 V Nickel-Metal-Hydride (NiMH)
Operating time	Up to 1.5 hours for performing DS3/DS1 tests
Recharging period	Maximum 1.5 hours with unit off
AC adapter	19 VDC, 2.6 amps 90-240 VAC, 45-65 Hz

Optical specifications for OC-48

Optical connectors

1 OC-48 Receive – FC, SC, or ST
1 OC-48 1310 nm High-Power Transmit – FC, SC, or ST
1 OC-48 1550 nm High-Power Transmit – FC, SC, or ST (dual wavelength configurations only)

Transmitter

Single/multimode fiber compatible	
Wavelength	1310 nm/1550 nm
Clock frequency accuracy	±3 ppm
High-power TX output	+3 dBm to –2 dBm

Receiver

Single/multimode fiber compatible	
Dual wavelength	1310 nm/1550 nm
Rx clock frequency	±3 ppm
Receive level sensitivity	–8 dBm to –28 dBm
Receiver shutdown	–6 dBm or higher

Optical specifications for OC-3/12

Optical connectors

1 OC-3/12 Receive – FC, SC, or ST
1 OC-3/12 Transmit – FC, SC, or ST

Transmit signal

Single/multimode fiber compatible	
Average output power	–8 dBm to –15 dBm (+3 dBm to –2 dBm on OC-48-equipped units)
Eye diagram	Per Bell Core GR-253-C-1995
Clock frequency accuracy	±3 ppm ±1 ppm per year

Receive signal

Single/multimode fiber compatible	
Average input power receive level	–8 dBm to –28 dBm
Frequency range	±500 ppm
Clock frequency accuracy	±3 ppm ±1 ppm per year
Jitter tolerance	Per Bell Core GR-253-CORE-1995

Level measurement

Range	–5 to –45 dBm
Accuracy	±2 dB
Resolution	±0.1 dB

Input specifications for DS3 AND STS-1

Connector type	WECO 560A jack

Input level

High	Accepts nominal 1.2 Vp, 0 ft of cable from high source
DSX	Accepts nominal 0.6 Vp, 450 ft of cable from high source
Low	Accepts nominal 0.3 Vp, 900 ft of cable from high source

Maximum signal level without errors with 1.7 Vp
Minimum signal level without errors with 0.025 Vp
Maximum input signal level with 2.5 Vp

Input impedance	75 ohms nominal, unbalanced to ground
Jitter tolerance	Exceeds TR-TSY-000499

Output specifications for DS3 AND STS-1

Connector type	WECO 560A jack

Output level

High	Nominal 1.2 Vp; signal meets ANSI T1.102-1993 and ITU-T G.703 when subject to 450 ft of cable loss
DSX	Nominal 0.61 Vp; signal meets ANSI T1.102-1993 and ITU-T G.703
Low	Nominal 0.31 Vp
Output impedance	75 ohms nominal, unbalanced to ground
Jitter tolerance	Per TR-TSY-000499

Frequency

DS3	44.736 MHz ±10 ppm
STS-1	51.84 MHz ±3 ppm ±1 ppm per year

Input specifications for DS1

Connector type	Bantam jack
Frequency	1.544 MHz ±50 ppm

Impedance

BRIDGE	1000 ohms minimum
TERM	100 ohms ±5%
DSX-MON	100 ohms ±5%

Range

BRIDGE	+6 to –35.0 dBdsx
TERM	+6 to –35.0 dBdsx
DSX-MON	–10 to –26.0 dBdsx of resistive loss
Jitter tolerance	Per Bell Pub 62411-1990

Accuracy

Receive level measurement

From 6 dBdsx to –15 dBdsx, accuracy of ±1 dB
From –16 dBdsx to –30 dBdsx, accuracy of ±2 dB
From –31 dBdsx to –40 dBdsx, accuracy of ±3 dB

Simplex current measurement

±2% or ±2 mA to 60 mA
±3% or ±3 mA from 61 mA to 175 mA

Frequency measurement accuracy

±3 ppm ±1 ppm/year

Output specifications for DS1

Connector type	Bantam jack

LBO level

Line build-out of 0, –7.5, –15.0, and –22.5 dB of cable loss at 772 Hz

LBO tolerance

±2 dB for –22.5 at 772 kHz
±1 dB for 0, –7.5, and–15 at 772 kHz

Internal timing	±3 ppm ±1 ppm per year
Line codes	AMI or B8ZS
Error insert type	Logic, BPV, or Frame
Pulse shape	Per applicable specifications

Sources

Specifications/recommendations used

IEEE 743
ITU-T recommendation G.703
AT&T publications CB113, CB119, CB132, CB143
ANSI T1.403-1995
AT&T publications PUB62508, PUB62411
ITU-T recommendation G.824
TR-TSY-000499, category 1.2
ANSI T1.102-1993
Bellcore GR253-Core-1995
Bell Pub 62411-1990

Ordering information

User Interface Module

TestPad 2000 (includes soft carrying case, kickstand, AC adapter/charger, printer cable)	2000-SV3

FST-2310 Application Modules

DS1 Communications Analyzer	TB2310-DS1
DS3/DS1 Communications Analyzer	TB2310-DS3
STS-1/DS3/DS1 Communications Analyzer	TB2310-STS1
OC3/3c, STS-1/DS3/DS1 Communications Analyzer	TB2310-OC3XX*
OC12/12c, OC3/3c, STS-1/DS3/DS1 Communications Analyzer	TB2310-OC12XX*
OC48/48c, OC12/12c, OC3/3c, STS-1/DS3/DS1 Communications Analyzer	TB2310-OC48XX*
OC48/48c, OC12/12c, OC3/3c, STS-1/DS3/DS1 Communications Analyzer with 1310 nm and 1550 nm laser	TB2310-OC48DXX*

*Specify type of optical connector: FC, SC, or ST Analyzer Options

Analyzer Options

2310-PDH-JIT	2310 PDH Jitter Test
Advanced stress patterns	TB2310-ASP
ATM analysis for OC12c	TB2310-ATM-OC12
ATM analysis for OC3c	TB2310-ATM-OC3
ATM analysis for DS3	TB2310-ATM-DS3
ATM analysis for DS3 and DS1	TB2310-ATM-DSN
Digital data services (DDS) analysis	TB2310-DDS
Secondary receiver for DS3 and STS-1 interfaces	TB2310-DUALRX
Remote control GUI	TB2310-REM
SDH testing at STM-16, STM-4, and STM-1	TB2310-SDH
DS3/DS1 script library	TB2310-ELE
SONET/DS3/DS1 script library	TB2310-OPT
Fractional T1	TB2310-FT1
GR-303 analysis	TB2310-GR303
Intelligent Line equipment	TB2310-ILE
Primary rate ISDN	TB2310-PRI
Signaling	TB2310-SIG
VF PCM TIMS	TB2310-TIM
VT100 emulation	TB2310-VT100

Optional accessories

External battery charger	AC-31705
Hanging strap	AC-31891
Replacement battery	BA-014081
Carrying case, large, soft	CC-44605
Carrying case, multimodule, soft	CC-451-58
Carrying case, hard	CC-45458
Rack mount for TestPad	RM-TTC2000

Additional application modules available

FST-2510a High Speed Optical Analyzer
FST-2416 SDH Services Module
FST-2209 T1/T3 Services Module
FST-2207 T1/T3 Wireless Services Module
FST-2230 E1 Data Communications Module
FST-2109 Copper Analyzer Module
FST-2357 DSL Broadband Services Module
FST-2802 Gigabit Ethernet Services Module
BAT-2700 Base Station and Air Interface Test Module

Hardware packages

	DS1	DS3	STS-1	OC3	OC12	OC48	OC48D	UIM	VT100	Dual Rx
TB2310-P1	X	X	X					X	X	X
TB2310-P2	X	X	X	X				X	X	X
TB2310-P3	X	X	X	X	X			X	X	X
TB2310-P4	X							X	X	X
TB2310-P5	X	X						X	X	X
TB2310-P6	X	X	X	X	X	X		X	X	X
TB2310-P7	X	X	X	X	X		X	X	X	X

Software packages

	FTI	TIM	SIG	ASP	ILE	DDS	PRI	OC12 ATM	OC3 ATM	DSN ATM
TB2310-SW1	X	X	X	X						
TB2310-SW2	X	X	X	X	X	X				
TB2310-SW3	X	X	X	X			X			
TB2310-SW4	X	X	X	X	X	X	X			
TB2310-SW5								X	X	
TB2310-SW6								X	X	X

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