JDSU TestPad 2000 FST-2802 Specs
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FST-2802 TestPad Gigabit Ethernet Services Module

Test Ethernet, Fibre Channel, and IP services using one test instrument!

Key Features

- Full line rate traffic generation to test Ethernet services at the IP layer
- IP ping and traceroute generation and response for network connectivity
- RFC 2544 benchmark testing
- TOS/DSCP and VLAN protocol verification and traffic prioritization testing
- Fibre Channel login (implicit or explicit) for subrate testing
- Test 1G/2G Fibre Channel services at 100% wire speed
- BER testing at layer 1 and layer 2 for Ethernet and Fibre Channel circuits
- Variable traffic load characteristics to measure the true performance of the link
- Dual-port capability for Ethernet and Fibre Channel traffic generation
- Loopback frame generation to automatically loop the far-end test instrument
- Easy-to-use GUI minimizes training requirements
- Enhanced PDF output during RFC 2544 testing for SLA verification
- Graphical output of link errors, throughput, and RTD

The JDSU FST-2802, a member of the TestPad family of products, is a rugged, battery-operated test instrument that enables field technicians to turn up and maintain Ethernet, IP, and Fibre Channel services. The testing capabilities of the FST-2802 range from bit error rate (BER) testing and verifying end-to-end connectivity to determining throughput, link usage, and round trip delay (RTD). The instrument's ping and traceroute capabilities enable technicians to verify both the path and the connectivity of a link over an IP-routed network. Additionally, a new login feature for Fibre Channel enables technicians to test both full rate and subrate links with BER patterns and test traffic. The easy-to-use graphical user interface (GUI) of the FST-2802 allows technicians, with limited Ethernet, IP, or Fibre Channel testing experience, to verify performance parameters and ensure that the services conform to service level agreements (SLAs). Furthermore, optional automation of RFC 2544 testing is available with improved graphical results and reporting capabilities.

With the new Version 7.0 software release, the FST-2802 now offers technicians class of service testing with the ability to specifically test individual voice, video, and data streams over a single link. With the multiple streams option for the FST-2802, technicians can:

– Generate multiple traffic streams with different VLAN IDs, user priorities, source and destination addresses, TOS/DSCPs, frame lengths, or bandwidth utilizations per stream

– Display results, such as throughput, RTD, and lost frames, for each stream independently

– Capture and display the utilizations of up to eight VLAN ID and user priority pairs

– Capture and display the utilizations of up to eight IP source and destination addresses

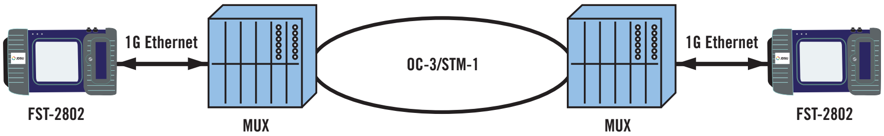


Diagram 1: Class of service testing using the Multiple Streams option for the FST-2802

Product Features

Ethernet BER and Packet Testing

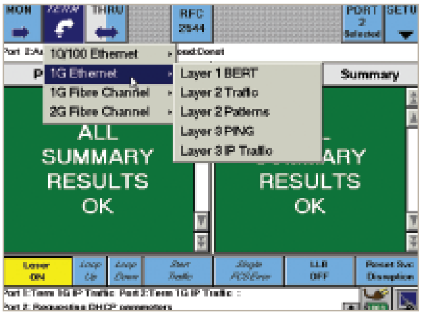
The FST-2802 provides technicians with Ethernet BER testing and layer 2 packet testing capabilities. The standard traffic generation capability of the FST-2802 allows for the generation of Ethernet frames with various configurable parameters, such as bandwidth utilization, frame length, and frame payload. By setting a user-defined sequence of 1s and 0s, technicians can transmit either a pseudorandom bit sequence (PRBS) pattern or a 32-bit fixed pattern. In either case, various traffic conditions can be simulated by defining the constant, ramp, or bursty traffic load settings. Finally, the performance of the link is analyzed via the FST-2802's easy-to-use results reporting interface.

VLAN Protocol Support

VLAN tag manipulation, supported by the FST-2802, allows for the generation of an Ethernet traffic stream with a specific VLAN ID (as per specification 802.1Q) and VLAN user priority (as per specification 801.p). This enables technicians to verify the correct transmission and prioritization of the stream through the network. In addition, VLAN filtering allows technicians to isolate a specific VLAN stream and compare its performance with the total performance of the link. VLAN protocol support is available for both layer 2 and layer 3 traffic frames.

IP Traffic Option

The IP Traffic option for the FST-2802 allows for layer 3 IP testing, enabling technicians to generate and receive packets that include a valid IP header. This header contains user-defined fields, such as TTL, TOS/DSCP, source IP address, and destination IP address. The source IP address can also be assigned by a DHCP server, if necessary, since the FST-2802 supports dynamic IP addressing. Basic domain name service (DNS) testing can be performed to ensure that the DNS server is able to resolve the name to the appropriate address. In addition, traffic load settings can be configured for constant, ramp, and bursty traffic in order to simulate different network traffic conditions and analyze the performance of the link.

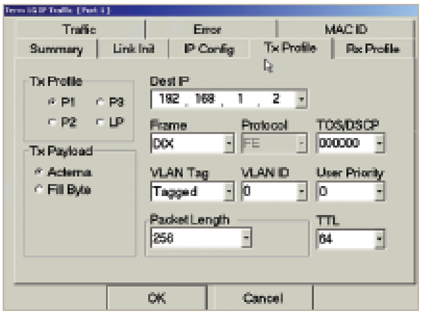

MON
THRU
RFC 2544
PORT 2 Selected
SETU
10/100 Ethernet
1G Ethernet
1G Fibre Channel
2G Fibre Channel
Layer 1 BERT
Layer 2 Traffic
Layer 2 Patterns
Layer 3 PING
Layer 3 IP Traffic
Summary
Laser ON
Loop Up
Loop Down
Start Traffic
Single FCS Error
LLB OFF
Reset Svc Disruption

ALL SUMMARY RESULTS OK

Port 1:Term 1G IP Traffic Port 2:Term 1G IP Traffic :

Port 2: Requesting DHCP parameters

Figure 1: Term application test solutions


Traffic
Error
MAC ID
Summary
Link Init
IP Config
Tx Profile
Rx Profile
OK
Cancel

Tx Profile: ● P1 ○ P3 ○ P2 ○ LP

Tx Payload: ● Acterna ○ Fill Byte

Dest IP: 192 . 168 . 1 . 2

Frame: DIX

Protocol: FE

TOS/DSCP: 000000

VLAN Tag: Tagged

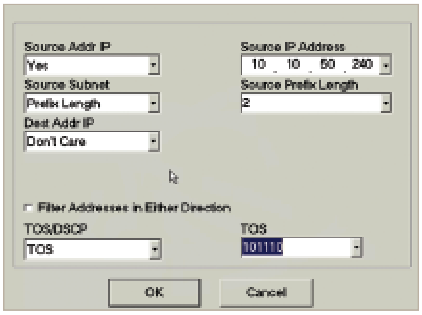
VLAN ID: 0

User Priority: 0

Packet Length: 256

TTL: 64

Figure 2: IP packet set-up page



Source Addr IP: Yes

Source IP Address: 10 . 10 . 50 . 240

Source Subnet: Prefix Length

Source Prefix Length: 2

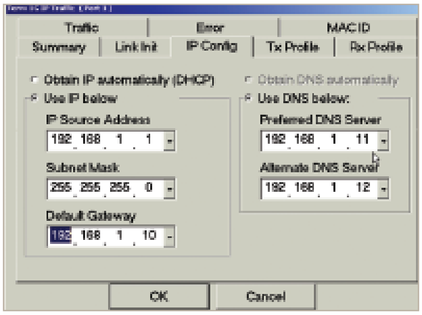
Dest Addr IP: Don't Care

☐ Filter Addresses in Either Direction

TOS/DSCP: TOS

TOS: 101110

Figure 3: Receive profile page for IP traffic


Traffic
Error
MAC ID
Summary
Link Init
IP Config
Tx Profile
Rx Profile
OK
Cancel

○ Obtain IP automatically (DHCP)

● Use IP below

IP Source Address: 192 . 168 . 1 . 1

Subnet Mask: 255 . 255 . 255 . 0

Default Gateway: 192 . 168 . 1 . 10

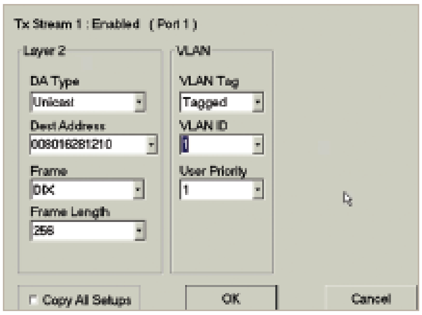
○ Obtain DNS automatically

● Use DNS below:

Preferred DNS Server: 192 . 168 . 1 . 11

Alternate DNS Server: 192 . 168 . 1 . 12

Figure 4: Configuration page for source IP address



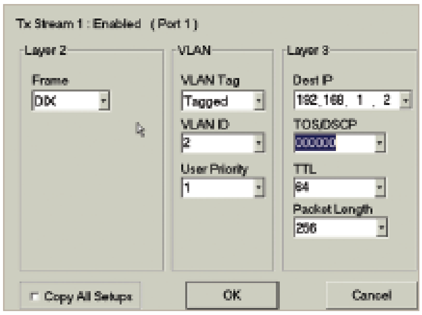
Tx Stream 1 : Enabled (Port 1)

Layer 2
DA Type: Unicast
Dest Address: 008016281210
Frame: DIX
Frame Length: 256

VLAN
VLAN Tag: Tagged
VLAN ID: 1
User Priority: 1

☐ Copy All Setups

Figure 5: Setting the destination MAC address, VLAN ID, and user priority for a traffic stream



Tx Stream 1 : Enabled (Port 1)

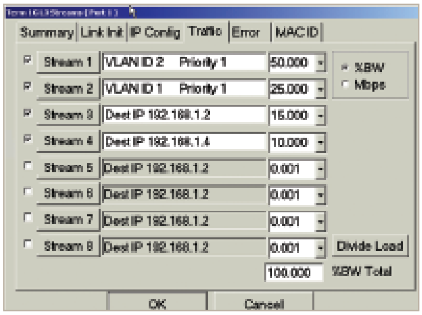
Layer 2
Frame: DIX

VLAN
VLAN Tag: Tagged
VLAN ID: 2
User Priority: 1

Layer 3
Dest IP: 192.168. 1 . 2
TOS/DSCP: 000000
TTL: 64
Packet Length: 256

☐ Copy All Setups

Figure 6: Setting the IP and TOS/DSCP addresses for a traffic stream



☑	Stream 1	VLAN ID 2 Priority 1	50.000
☑	Stream 2	VLAN ID 1 Priority 1	25.000
☑	Stream 3	Dest IP 192.168.1.2	15.000
☑	Stream 4	Dest IP 192.168.1.4	10.000
☐	Stream 5	Dest IP 192.168.1.2	0.001
☐	Stream 6	Dest IP 192.168.1.2	0.001
☐	Stream 7	Dest IP 192.168.1.2	0.001
☐	Stream 8	Dest IP 192.168.1.2	0.001

● %BW
○ Mbps

100.000 %BW Total

Figure 7: Setting the bandwidth utilization percentage for each traffic stream

Multiple Streams Option

Many service providers are beginning to offer different classes of services, whereas customers who pay more get a higher priority traffic stream and a different service level agreement than customers who pay less. This new offering leads to a new type of problem where the latency and loss may be acceptable for regular traffic, but the higher priority traffic does not meet its required SLA.

In order to test these new networks, technicians can use the new Multiple Streams option for the FST-2802 to oversubscribe the switch and determine if the various SLAs are met. This is accomplished by using two or three different traffic streams of differing priorities and sending more traffic through the switch than it can handle. For example, a technician can attempt to send 1000 Mb/s of traffic through an OC-3 SONET ring. The switch should drop the lower priority traffic, but it should allow all of the higher priority traffic to pass through to the far end where another FST-2802 (or the second port of a dual-port unit) is connected to the receiver.

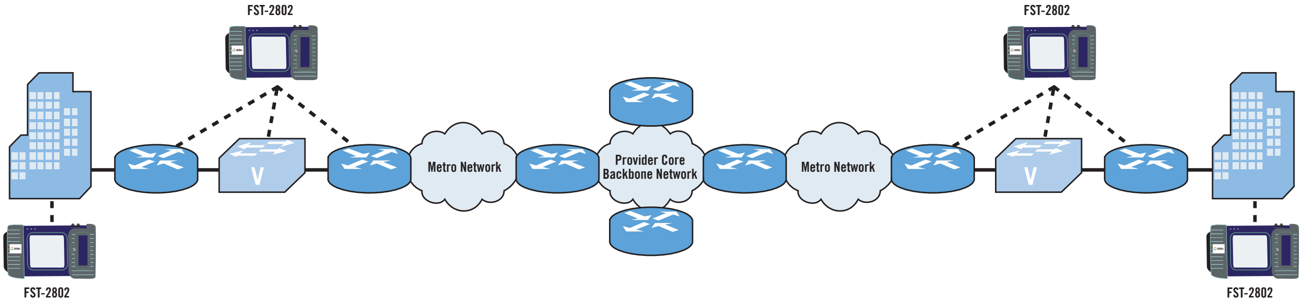
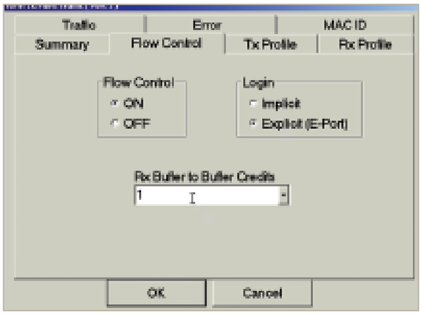


Diagram 2: IP traffic testing on a metro network

Fibre Channel Testing

The 1G and 2G Fibre Channel options (FC-100 and FC-200) allow technicians to test both FICON and Fibre Channel services with BER and Ethernet packets. Technicians can select different routing controls, destination and source identifiers, data structures, and sequence counts in each frame to further test the various elements of the Fibre Channel circuit. In addition, the FST-2802 includes a newly added feature that allows for the testing of subrate Fibre Channel links through flow control.


Traffic
Error
MAC ID
Summary
Flow Control
Tx Profile
Rx Profile
OK
Cancel

Flow Control
● ON
○ OFF

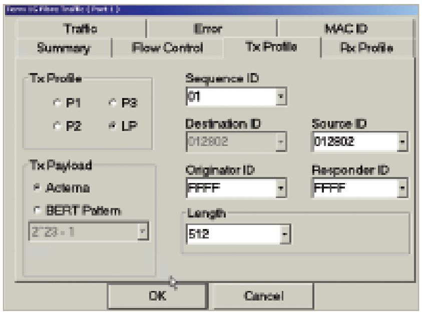
Login
○ Implicit
● Explicit (E-Port)

Rx Buffer to Buffer Credits: 1

Figure 8: Fibre Channel login set-up page

Dual-Port Testing

The dual-port testing capability of the FST-2802 allows technicians to generate traffic on two independent ports at the same time, thereby allowing them to simultaneously stress test two circuits with specific testing parameters. For example, technicians can specify different frame lengths, traffic characteristics, and filters on each port, exposing the network elements to varying traffic patterns and emulating a live network.


Traffic
Error
MAC ID
Summary
Flow Control
Tx Profile
Rx Profile
OK
Cancel

Tx Profile
○ P1 ○ P3
○ P2 ● LP

Sequence ID: 01

Destination ID: 012802

Source ID: 012802

Tx Payload
● Acterna
○ BERT Pattern
2^23 - 1

Originator ID: FFFF

Responder ID: FFFF

Length: 512

Figure 9: Fibre Channel transmit set-up page

Remote Control and Results Storage

The Version 6 UIM FST-2802 enables technicians to remotely access the FST-2802 using an analog modem and/or an Ethernet port and a standard Web browser. In addition, the FST-2802 features an FTP server that enables technicians to store and transfer files to and from other network locations.

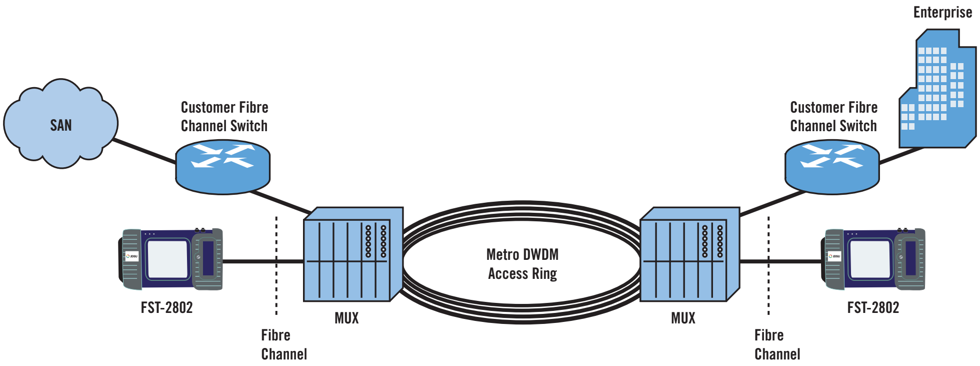

Enterprise
SAN
Customer Fibre Channel Switch
Customer Fibre Channel Switch
Metro DWDM Access Ring
FST-2802
FST-2802
MUX
MUX
Fibre Channel
Fibre Channel

Diagram 3: Fibre Channel testing on a metro DWDM network

Applications

Verifying Connectivity

Prior to testing throughput in a routed network, technicians may need to verify that the provisioned path in the network is capable of carrying the IP traffic to its destination. Using the FST-2802, technicians can verify end-to-end connectivity by performing an IP ping test.

Throughput and Round Trip Delay Measurement

In order for an Ethernet or IP service handoff to take place between a service provider and an end customer, many customers require proof that the circuit can handle the service they are paying for. Therefore, service providers are often required to measure the throughput of the network to verify that it can carry the allocated bandwidth to the end customer. Using the FST-2802, technicians can generate valid traffic at the line rate specified for the service. An additional purpose of this test is to verify that the data is error free and that no data was lost during its transit through the network. Service providers can also verify additional items in the SLA, such as the number of errored packets, the packet loss rate, and the RTD. In verifying the RTD, technicians use the loopback function of the FST-2802 to terminate the circuit and measure the network delay of a transmitted packet.

Filtering Traffic Streams

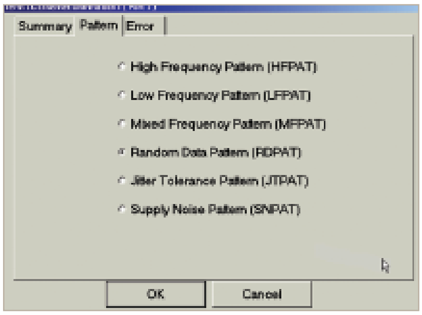
In order to perform more detailed troubleshooting on a network, technicians can use the FST-2802 to filter out a specific traffic stream. For example, a technician may be asked to verify that a particular traffic stream is being generated successfully and is being sent through the network without any errors. If the end customer utilizes both layer 2 (VLAN ID and user priority) and layer 3 (TOS or DSCP bits) prioritization schemes, the technician can use the FST-2802 to filter the customer’s traffic and thoroughly verify the network, proving that the traffic will transition the service provider's network error free.

Subrate Fibre Channel Testing

Service providers are beginning to find it lucrative to sell only part of a Fiber Channel data pipe. Software Version 6.0 for the FST-2802 supports this new endeavor. This not only allows for the sale of bandwidths less than 1G or 2G to the customer, but it also serves as a flow control mechanism using messages to regulate traffic flow and reduce errors. The FST-2802 can monitor these messages to ensure that they are properly generated and can display each step of the login process in order to troubleshoot every element of the circuit.

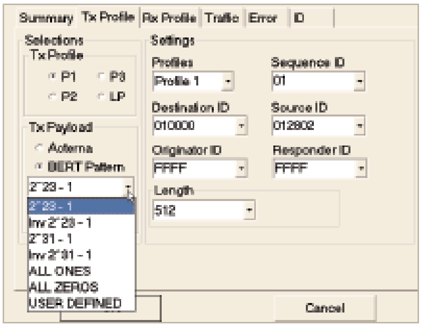
Loopback Frame Generation

The FST-2802 can generate Ethernet, IP, and Fibre Channel loopback frames to loop up and loop down the far-end test instrument. This is accomplished without requiring the FST-2802 to know the far-end test instrument’s physical address since the near-end FST-2802 is able to resolve the address of the far-end unit. This capability enables technicians to leave one test instrument at the far end and perform loopback tests for measuring bi-directional throughput and RTD of the circuit. In addition, the loopback functionality allows technicians to loopback specific Ethernet traffic based on a specified VLAN, MAC, or IP address.


Summary
Pattern
Error
OK
Cancel

○ High Frequency Pattern (HFPAT)
○ Low Frequency Pattern (LFPAT)
○ Mixed Frequency Pattern (MFPAT)
● Random Data Pattern (RDPAT)
○ Jitter Tolerance Pattern (JTPAT)
○ Supply Noise Pattern (SNPAT)

Figure 10: Layer 1 BERT patterns


Summary
Tx Profile
Rx Profile
Traffic
Error
ID
Cancel

Selections

Tx Profile: ● P1 ○ P3 ○ P2 ○ LP

Tx Payload: ○ Acterna ● BERT Pattern

2^23 - 1

2^23 - 1
Inv 2^23 - 1
2^31 - 1
Inv 2^31 - 1
ALL ONES
ALL ZEROS
USER DEFINED

Settings

Profiles: Profile 1
Sequence ID: 01
Destination ID: 010000
Source ID: 012802
Originator ID: FFFF
Responder ID: FFFF
Length: 512

Figure 11: Layer 2 BERT pattern selection

Bit Error Rate Testing

The FST-2802 allows for BER testing at both layer 1 and layer 2 of Ethernet and Fibre Channel circuits using a variety of stress test patterns designed specifically for these technologies. According to physical layer specifications, Ethernet and Fibre Channel circuits should conform to a BER of 10^{-12} or better.

Bi-directional Monitoring/Thru Mode

In addition to generating two separate traffic streams, the dual-port capability of the FST-2802 enables technicians to gain access to circuits under test to perform in-service monitoring in both directions. The FST-2802 allows for the unobtrusive monitoring of Ethernet and Fibre Channel circuits in order to verify the ability of the network elements to support reliable communications. Moreover, the test instrument's Thru mode allows for the monitoring of traffic without the use of a splitter.

Service Disruption Measurement

The FST-2802 enables service providers to measure the service disruption of their Ethernet and Fibre Channel traffic. This measurement may be used by service providers as a troubleshooting benchmark.

IP and VLAN Discovery

Using the IP discovery feature of the FST-2802, technicians can determine how much bandwidth is being used by the different elements in the network. Using the VLAN discovery feature, technicians can verify that traffic prioritization is occurring on the network according to the end customer's SLA.

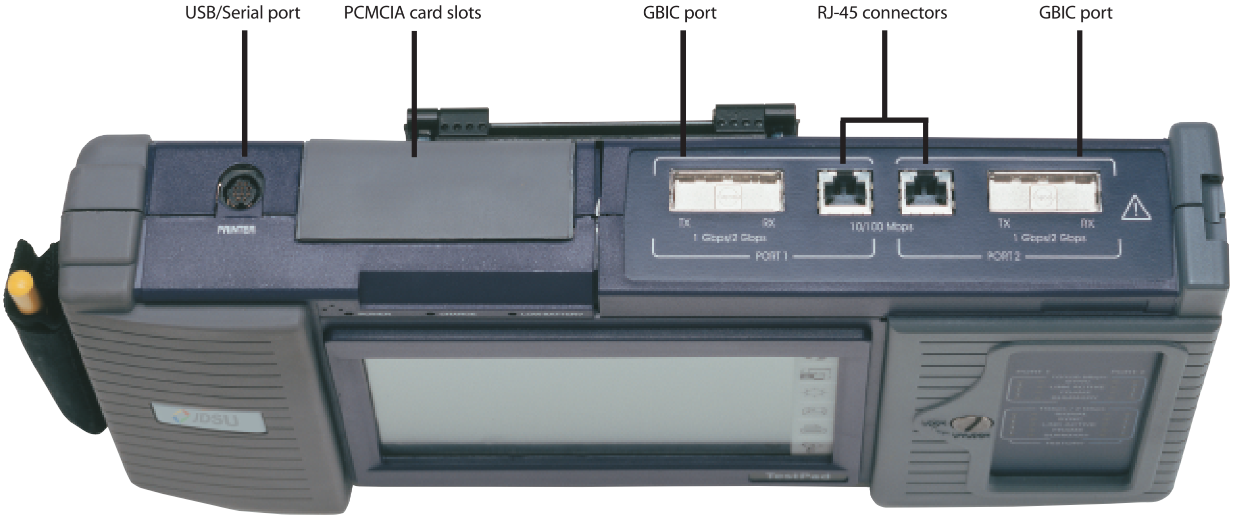

USB/Serial port
PCMCIA card slots
GBIC port
RJ-45 connectors
GBIC port
PRINTER
TX
RX
1 Gbps/2 Gbps
PORT 1
10/100 Mbps
TX
RX
1 Gbps/2 Gbps
PORT 2
JDSU
TestPad

Diagram 4: JDSU FST-2802 dual-port configuration

Specifications

General Specifications

Dimensions	7.5 x 13.5 x 2.2 in (191 x 343 x 56 mm)
Weight	5 lb (with battery) 2.26 kg (with battery)
AC adapter	19 VDC, 2.6 amps/90-240 VAC, 45-60 Hz
Menu language	English
Speaker and microphone	Built-in
PC card access	Standard dual PCMCIA interface slots

Interfaces

Ethernet	
10/100 Mb/s	RJ-45 connector
1000 Mb/s	GBIC interface (SX, LX), copper, 1550 nm
Fibre Channel	
1.0625 Gb/s	GBIC interface
2.125 Gb/s	GBIC interface

Modes

Duplex modes	Full and half
Flow control	Supported
Modes of operation	Terminate, monitor, thru

Traffic Generation

Ethernet traffic generation
- Constant, ramp, or bursty traffic
- Configurable source MAC address, destination MAC address, frame type (for DIX), frame payload, VLAN tag, VLAN ID, user priority, frame length, and % bandwidth utilization

IP traffic generation
- Constant, ramp, or bursty traffic
- Configurable source IP address and destination IP address (dynamic or static addressing)
- Configurable frame type (for DIX), TOS/DSCP prioritization bits, VLAN tag, packet length, time to live (TTL), % bandwidth utilization, and frame payload

Multiple streams traffic generation
- Eight different traffic streams
- Configurable VLAN tag (VLAN ID and user priority), % bandwidth utilization, frame length, destination MAC or IP addresses, frame type (for DIX), and TOS/DSCP prioritization bits per stream
- View throughput, round trip delay, frame counts, lost frames, and VLAN ID per stream

Fibre Channel traffic generation
- Constant, ramp, or bursty traffic
- Configurable buffer credits
- Configurable destination ID, source ID, sequence ID, originator ID, responder ID, frame length, and % bandwidth utilization

Traffic Filtering

Ethernet traffic filtering
- MAC source address, MAC destination address, frame type, frame length, VLAN ID, and user priority

IP traffic filtering
- Source IP address, destination IP address, frame type, VLAN ID, user priority, and TOS/DSCP prioritization

Fibre Channel traffic filtering
- Routing control, destination identifier, source identifier, data structure type, and sequence count

Bit Error Rate Testing Patterns

Layer 1 (unframed) bit error rate testing patterns

Per IEEE 802.3, 2000 Edition, Annex 36A
- High frequency pattern (HFPAT)
- Low frequency pattern (LFPAT)
- Mixed frequency pattern (MFPAT)

Per NCITS TR-25-1999
- Random data pattern (RDPAT)
- Jitter tolerance pattern (JTPAT)
- Supply noise sequence (SNPAT)

Layer 2 (framed) bit error rate testing patterns
- PRBS (2^{23-1}, 2^{31-1}, and inverted selections)
- All 1s
- All 0s
- User defined

Layer 2 (framed) pattern test

Per NCITS TR-25-1999
- Long continuous random pattern (CRPAT)
- Long continuous jitter pattern (CJPAT)
- Long compliant supply noise pattern (CSPAT)

Key Results

Link status
- Loss of signal
- Link active
- Frame detected
- VLAN tagged frame detected

Auto-negotiation status
- Link configuration ACK
- Link advertisement status
- Pause capable
- Remote fault

Fibre Channel login status
- Login status
- ELP TX/RX
- ACK TX/RX
- Accept TX/RX
- Reject TX/RX

Link counts
- Bandwidth utilization, frame rate, RX/TX Mb/s, round trip delay, and service disruption time
- Total received and transmitted frames/packets, pause frames, lost frames, out-of-sequence frames/packets, VLAN frames, unicast frames/multicast frames/broadcast frames, and frame length/packet length (bins)
- Symbol errors, code violations, FCS errored frames, runts, jabbers, undersized frames, IP checksum errors, and JDSU payload errors

BER testing	Bit error rate, bits received, and bit errors received
Packet testing	In conformance with IETF RFC 1242, RFC 2544, RFC 791

Ordering Information

2000-V6	FST-2000 TestPad User Interface Module (UIM)
2802-GIGE	FST-2802 1G Ethernet Single-Port Mainframe
2802-DUAL	FST-2802 1G Ethernet Dual-Port Mainframe
2802-ELEC	FST-2802 10/100 Ethernet Single-Port Mainframe
2802-ELEC-DUAL	FST-2802 10/100 Ethernet Dual-Port Mainframe
2802-FE	10/100 Mb/s Ethernet Option (only available on 2802-GIGE and 2802-DUAL)
2802-VLAN	VLAN Option
2802-IP	IP Traffic Option
2802-COS	Multiple Streams Option
2802-1G-FC	Fibre Channel 1.0625 Gb/s Option
2802-2G-FC	Fibre Channel 2.125 Gb/s Option
AC-GBIC-COPPER	Copper GBIC (1000BaseT)
AC-GBIC-ALLRATE-SX	All Rate (1G Ethernet , 1G Fibre Channel, and 2G Fibre Channel) Multimode GBIC (850 nm)
AC-GBIC-ALLRATE-LX	All Rate (1G Ethernet, 1G Fibre Channel, and 2G Fibre Channel) Singlemode GBIC (1310 nm)
AC-GBIC-LONGHAUL	Long Haul GBIC (1550 nm)

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Test & Measurement Regional Sales

NORTH AMERICA	**LATIN AMERICA**	**ASIA PACIFIC**	**EMEA**	**WEBSITE: www.jdsu.com**
TEL: 1 866 228 3762	TEL: +55 11 5503 3800	TEL: +852 2892 0990	TEL: +49 7121 86 2222	
FAX: +1 301 353 9216	FAX: +55 11 5505 1598	FAX: +852 2892 0770	FAX: +49 7121 86 1222	