



## Spirent TestCenter™ 10-GIGABIT ETHERNET XFP TEST MODULES

Convergence is creating a new generation of integrated network devices and services that are much more complex than ever before. The resulting increased complexity, scarcity of testing skills and architectural shortcomings in current test systems are hurting the ability of manufacturers to ship products on time at escalating quality levels and slowing service providers' ability to deploy networks that get Quality of Experience (QoE) right the first time.

### INCREASE PRODUCTIVITY: GET THERE FASTER WITH SPIRENT TESTCENTER

- Spirent leads the industry with the highest accuracy 10GbE latency measurement available:
  - Qualified accuracy at all Ethernet speeds
  - Measure with 10 nanosecond resolution and excellent repeatability at all Ethernet speeds
  - Measure latency in any topology and in multiple speed tests: GigE-to-10GbE
  - Unlike Spirent's competitors, Spirent's 10GbE requires no post-test results correction
- Up to 12 ports of 10GbE are supported in both 5U and 9U rackmount unit chassis and up to 2 ports are supported in the portable chassis
- Spirent supports a wide range of optical multiple source agreement (MSA) transceivers

Spirent can help you address this challenge with Spirent TestCenter 2.0 with its innovative Inspire Architecture™. Now you can create and execute more complex test cases in less time with the same resources – and scale tests higher while debugging problems faster. The results: lower CAPEX and OPEX, faster time to market, greater market share and higher profitability.

Spirent TestCenter 10-Gigabit Ethernet (10GbE) test modules provide functional, performance, system and conformance test capability from Layer 2 through Layer 7 on a single GUI and test automation platform. These modules generate realistic traffic and analyze data frame, packet, stream and protocol metrics for each layer. The test modules simultaneously manage data plane tests with control plane traffic required for metropolitan, enterprise and broadband access routing. They provide the most realistic and accurate network device performance measurements in the industry. Features such as real-time capture and decode along with the real-time event logging system allow the user to find the source of more complex multi-protocol problems.

Two 10GbE XFP test modules are offered for Spirent TestCenter. The modules are the entry level XFP-1001A and the high performance and scalable XFP-2001B. The Series 1000 and 2000 offer functional, performance, system and conformance test capability.



The entry level XFP-1001A test module provides affordable and complete Layer 2 and Layer 3 functional and LAN switching along with functional, system, conformance and performance benchmark testing for both 10GbE LAN and WAN protocols. The XFP-1001A offers complete metropolitan and enterprise routing protocol test capability. Applications for testing IPTV and broadband access are available on the Series 1000.

The high performance XFP-2001B test module provides Layer 2-7 capability for the 10GbE LAN and WAN protocols. The XFP-2001B offers high capacity LAN switching functional and performance testing with broadband access, metropolitan and enterprise routing protocol test capability. Layer 4-7 testing is supported for protocol-based tests of the upper layers.

### APPLICATIONS

- Evaluate key feature functional and performance parameters of 10GbE switches, link aggregators and routers under typical or extreme traffic load with deliberate error conditions
  - Compare and validate 10GbE network equipment for compliance to product and protocol specifications prior to deployment
  - Ensure the performance of advanced network device features, such as total host client capacities and throughput, QoS class prioritization, SLA bandwidth verification, VLAN tagging and dozens of routing protocols, scalability protocols and performance metrics
  - Verify routing controls and converged network capabilities
- Test silicon communications chips and optical transceivers
  - Measure ultra-low latency in any topology and with a high degree of realistic network traffic

### BENEFITS

- *Shorter time-to-test:* The Inspire Architecture is a real-time, multi-threaded system. Processes run concurrently and test events occur simultaneously. Communications are asynchronous and non-blocking throughout the entire Inspire

Architecture system. Processes that manage tests do not wait for one another to complete; they execute as soon as possible. Improving the efficiency of the test process translates into gaining more test plan coverage in a shorter period. This reduces total test cycle time, which increases productivity for test engineers.

- *Ease in troubleshooting of complex devices:* While testing, the rule of thumb is 80 percent of the tester's time is spent debugging 20 percent of the problems. Spirent TestCenter's unique HyperFilters™ technology saves your test engineers time on the toughest 20 percent of the problems. HyperFilters technology enables users to receive, track, inspect and accumulate statistics for up to five fields in each received frame, at wire rate, for all speeds. This breakthrough technology saves large amounts of time in defining and troubleshooting tests in today's highly-integrated networking environment. It is possible to monitor specific packet streams in real time across 65,000 Rx side streams to isolate problems quickly on a per stream basis, thus exposing the source.
- *Realistic network traffic:* The Inspire Architecture provides the most advanced traffic generation controls available in the industry for configuring voice, video, multimedia, Triple Play and converged network traffic. Today's network device tests require more than port-based traffic scheduling.
  - Priority-based scheduling guarantees the delivery, based on priority, of a mix of constant and bursty traffic streams or stream groups (i.e. stream blocks) in repeated patterns. This is required for networks that have voice, video and data on the same port where one traffic type is prioritized over another type in the presence of constant and bursty traffic.
  - Traffic loads and stream configurations can be changed on the fly to see how a device reacts in real time to unexpected changes in traffic loads.
- *Extreme Automation™:* With a single button push, the GUI-to-Script capability creates structured, ready-to-run Tcl scripts from the Spirent TestCenter GUI configurations. The

user does not have to be a Tcl scripter to create automation test cases. Other automation tools such as the Offline Configuration Mode, the Command Sequencer, the Results Reporter and Spirent ScriptMaster provide an array of productivity enhancements for test engineers.

- **Built-in test methodologies:** Spirent TestCenter's software test packages support test methodology wizards for RFC-based performance benchmarking. Additional software test packages are available for specific routing and access protocols for testing 10GbE switches and routers. The test methodology is built into the wizards, which reduces test set up times and increases test case throughput.
- **Reduce your cost:** The comprehensive feature set and processing power on the MS-1001A test module allows data plane and routing control plane testing with median scalability on a low-cost module. Spirent TestCenter reduces cost because the user may select to purchase only the level of product and capabilities required. The XFP-2001B is the right choice for achieving greater processing power or scalability to meet high-scale test requirements.
- **Product differentiation through accurate performance benchmarking:** The network equipment manufacturer and service provider markets are highly competitive. NEMs and service providers use Spirent TestCenter to produce highly accurate and reproducible latency, jitter and packet measurement statistics. These measurements characterize product and service performance metrics to differentiate their network devices from the devices of competitors.  
Spirent TestCenter is the only product in the industry that can correctly characterize forwarding latency in any test topology, with any traffic load, over all packet sizes, and in multiple speed tests.
- **Integrated testing from Layer 2-7:** The XFP-2001B supports upper layer testing with stateful TCP traffic. This allows Layer 2 and Layer 3 tests to run and produce results, all in a single test on the same

test module while running L4-7 traffic. With upper layer testing, switch and server functionality can be verified for priority-based provisioning implementation over many upper layer protocols.

## KEY FEATURES

- Support for Deficit Idle Count (DIC), Link Fault Signaling (LFS), Ethernet preamble editing, and diagnostic loopback
- High port density modules with per-port group reservation, providing multi-user capability
- Dual media test modules provide 10/100/1000 Mbps and Gigabit Ethernet fiber
- Wire-rate and beyond wire-rate traffic generation and analysis at Layers 2 and 3
- Compatible with all Spirent TestCenter software applications for comprehensive functional testing and performance analysis all in one system
- Supports all core technologies required to test Enterprise L2/L3 switches, including QoS, IPv4/v6, multicast, routing, spanning tree, VLAN and DHCP. Simultaneously runs multiple protocols per port to emulate large routed networks.
- Series 2000 GigE modules support testing of application level protocols such as HTTP, SSL, FTP, Telnet, DNS, IPv6, IPSec, Capture/ Replay for L4-7, SIP, SMTP and POP3
- Custom packet and frame editing is facilitated by a graphically driven field editor that allows the user to edit templates for a wide variety of preconfigured control and data plane packets
- Real time per stream statistics such as jitter, PRBS and minimum, maximum and average latency per stream
- Real time event log allows user to view actual protocol messaging on a per-port basis
- Hardware is field-programmable. The module can be upgraded on-site in its chassis as new features and technologies become available.

## TECHNICAL SPECIFICATIONS

### HyperFilters

- The analyzer supports a combination of 5 HyperFilters, four 16-bit and one 32-bit that may be placed anywhere in the packet for the user to select packet fields for measurement and statistical tracking analysis and will operate on the incoming traffic stream
- HyperFilters technology separates traffic into as many as 65,535 sub-streams for detailed analysis
- Automatically identifies Layer 2 (including MPLS and VLANs), Layer 3 and Layer 4 encapsulations per templates

### Analyzer – Port Measurements

- Port and rate counters are 64 bits deep and can track 65,535 uniquely trackable stream and sub-stream values with real time statistics and graphs
- Additional Spirent TestCenter Base and Test Packages add technology or protocol specific port counters. Please refer to the specific software package data sheet for additional counter information.
- Traffic Generator and Total Port Count Counters: Transmit and Receive counters report all packet statistics for counts, bytes, signature field, CRC and FCS errors, and IPv4/IPv6 checksum errors for Layer 3 and Layer 4. Protocol counters such as UDP, TCP, MPLS, VLANs, ICMP are provided. Packet size statistics are counted for Undersized, Oversized and Jumbo frames.
- Transmit and Receive CPU Port Counts are provided for: Frames, Octets, IPv4/IPv6 Frames, ARP Requests and Replies, and ICMP Echo Requests and Replies
- QoS Counters: The user can choose to count for a single IP Destination or for all traffic received on the port. For each value of the ToS/Diffserv byte the analyzer tracks Value of the byte, IPv4 Frames, IPv6 Frames and associated rates.

### Analyzer – Per Stream and Per Sub-stream Measurements

- The stream analyzer statistics are the same for sub-streams, with the exception of sequence-based statistics
- All stream counters have associated rate counters 64-bits deep, and they report real time statistics and charts
- Transmit and Receive Per-stream Counts for: Frames, Octets, IPv4, TCP and UDP Checksum Errors, PRBS Bit Errors, PRBS Filled Octets, FCS Errors, Average, Minimum and Maximum Latency, Dropped Frames, Ordered and Re-ordered Frames, Duplicate Frames, Late Frames, In and Out-of-Sequence Frames, Total Average, Minimum and Maximum Jitter, Total, Average, Minimum and Maximum Inter-arrival Time
- Per-stream Histograms: Each stream has 16 histogram bins with user-defined boundaries. Histograms are available for Inter-arrival Time, Latency, Jitter, Frame Length, Sequence Difference and Sequence Run Length.

### Analyzer – Traffic Group Measurements

- Stream blocks may be used in user-defined traffic groups for analysis of aggregated statistics. The traffic group analyzer measures Tx Frames, Rx Frames, Tx Octets and Rx octets.
- All traffic group counters have rate counters 64-bits deep, and they report real time group statistics and are charted

### Analyzer – Capture

- Eight 4-byte pattern matching filters may be positioned anywhere in the frame and combined with AND, OR and NOT logic to form a combination trigger/counter to start capture, qualify frames in the capture buffer, or stop capture
- Combination trigger can be combined with OR and NOT logic with a set of 19 different event triggers to start capture, qualify frames in the capture buffer, or stop capture. Supported events are: FCS, PRBS, Layer 1 Error, IPv4 and TCP, UDP, IGMP Checksum Errors, and Signature Sequence Error. For Frames: Undersized, Oversized, Jumbo and Signature Frames. For Packets: IPv4/IPv6, TCP, UDP, IGMP, a particular Frame Length or a particular stream ID.

- Captured packets can be filtered, decoded, examined and saved to a file
- When combined with BPK-1029A, Spirent TestCenter Enhanced Capture and Decode Base Package BPK-1001A base software package supports real time decodes of captured traffic, decode of the Spirent signature with full resolution of the timestamp, display of the captured preamble and ladder diagrams of routing protocols

### **Generator – General Stream and Stream Block Parameters**

- The BPK-1001A base software package supports up to 32,767 streams per port for the Series 2000 test module. The Series 1000 test modules support 16,384 streams per port.
- Frame lengths may be fixed, incremented, decremented or randomly-generated. An automatic setting can be used in the frame editor to set minimum frame length per protocol type.
- Traffic load per stream block may be in percent of line rate, frames per second, inter-frame gap (in bytes), bits per second, Kbps or Mbps. For bursty traffic, the user can define the inter-burst and the inter-frame gap (in bytes).
- Staggered start for stream blocks on the same port is supported via a user-defined start offset
- Stream block parameters may be changed on-the-fly (e.g. rates, PDUs, frame size) without stopping the traffic generator. Stream blocks can be created and deleted, and disabled or enabled for transmission on the fly.
- Host, router, route, interface and traffic wizards help create large test scenarios with the same effort as creating small ones. For example, using the host wizard, users can quickly create thousands of hosts across hundreds of ports in a few mouse clicks. Using the Traffic Wizard, thousands of streams can be created across a large-port test in the same amount of time required to create a single stream on one port.

### **Generator – Encapsulation Templates and Frame Editor**

- The Frame Template selector contains hundreds of pre-defined frame templates for users to rapidly create realistic traffic. Each field within the PDU (including the preamble of Ethernet frames) can be edited and field validation can be turned off to allow for negative testing.
- Each field within the PDU can be the target of a stream modifier or a hardware Variable Field Definition (a software-based VFD increments the stream ID at the same time as it modifies the target field)
- Stream modifiers and hardware VFDs support incrementing, decrementing, random, list and shuffle mode
- Stream modifiers and hardware VFDs can be chained in any combination to support complex traffic patterns

### **Generator – Schedule Modes and Port-Based Parameters**

- BPK-1001A base software package supports three scheduling modes:
  - Port-based: traffic rate and burst characteristics set per port
  - Rate-based: traffic rate and burst characteristics set per stream using a rate-based algorithm
  - Priority-based: traffic rate and burst characteristics set per stream using a user-defined priority level to govern stream scheduling
- Rate-based or Priority-based scheduling modes can mix bursty and constant rate traffic from the same port
- Traffic can be generated continuously for a burst count or for a user-defined time period
- Jumbo, undersized and oversized frame thresholds may be set per port

**Generator – Command Sequencer**

- All GUI commands in BPK-1001A base software package can be placed in the command sequencer and included as part of a test execution timeline
- Commands in the sequencer can be combined into a group. Each group can be the target of a continuous loop to be executed until the user manually terminates it, or for a fixed number of iterations.
- Each command sequencer step can be individually enabled or disabled
- Configurable time delays can be inserted between each command sequencer step
- Call an external script before, after, or at any point during the schedule to configure, monitor and/or manage the DUT/SUT during the sequence execution
- Using the custom test sequencer command, users can implement continuous tests, stepped tests, throughput tests with incrementing loads and frame sizes
- Create detailed and automated controls over Layer 2 and Layer 3 learning sequences using the command sequencer

**Generator – MDIO Registers**

- The BPK-1001A software test package on the 10GbE test modules provides an interface to MDIO registers
- Users can read the contents and write (when appropriate) new values to each register within the MDIO register space
- Users can define MDIO register templates, save these in a file and load saved templates into the application
- MDIO Register configurations may be exported to a Tcl script

**Generator/Analyzer – Error Insertion and Analysis**

- Users can inject FCS, IPv4 and IPv6, TCP and UDP checksum errors. The analyzer provides counts and rates for all injected errors.
- For negative tests, errors may be placed in most fields within a PDU by turning off field validation

10 Gigabit Ethernet Test Module Specifications		
Feature	XFP-1001A	XFP-2001B
Optical Transceiver Types	XFP MSA	
Laser Wavelengths	850nm, 1310nm, 1550nm	
10GbE IEEE 802.3ae Protocol Modes	Serial LAN, WAN	
Optical Cabling	Multi-mode fiber, single mode fiber	
Signal Rate	10Gbps LAN, 9.58464Gbps WAN	
CPU Memory	256MB	1GB
Maximum Transmit Streams	16,384 per port	32,767 per port
Total Number of Variable Fields per Stream (VFD)	4	6
Maximum Receive Streams	65,535 per port	
Minimum/Maximum Frame Size	48 – 16,367 Bytes	
Minimum/Maximum Transmit Rates	1 packet per 2.14 seconds to 103% of line rate	
Deficit Idle Count Support	LAN and WAN modes/ON or OFF selectable	
Link Fault Signaling	LAN and WAN modes/ON or OFF selectable	

## Routing Protocol Emulation and Conformance Test Suites

For specifications on all unicast, multicast, access routing protocols, conformance test suites and Layer 4 to 7 testing that are available for the 10GbE test modules, please see the separate Spirent TestCenter software package data sheets or consult your Spirent sales representative.

## REQUIREMENTS

- Pentium® or greater PC running Windows® XP Professional SP2 with mouse/color monitor required for GUI operation. See Minimum PC Requirements section.
- One Ethernet cable and one 10/100/1000 Mbps Ethernet card installed in the PC
- A SPT-2000A Spirent 2U Chassis\* and Controller, SPT-2000A-HS 2U Chassis\* (lab use only) and Controller, Spirent TestCenter 5U Chassis and Controller or SPT-9000A Spirent 9U Chassis\* and Controller
- Operating system languages supported: English, French, German, Italian, Japanese, Korean, and Chinese (traditional and simplified)
- For test automation system requirements, refer to the Spirent TestCenter Automation data sheet (P/N 79-000037)
- Layer 4 to 7 testing requires 2000 series revision B modules

\*Note: The XFP-1001A and XFP-2001B require the ACC-2090B card carrier for these chassis

## MINIMUM PC REQUIREMENTS

- Small Port System: 1-25 ports
  - 2.4GHz Pentium 4 or equivalent with 512MB of free RAM and 10GB of free disk
- Medium Port System: 26-75 ports
  - 3GHz Pentium 4 or equivalent with 2GB of RAM and 15GB of free disk space
- Large Port (75+ ports)
  - E6400 Intel® Core™ 2 Duo or equivalent with 3GB of RAM and 100GB of free disk space

## ORDERING INFORMATION

PRODUCT	PART NUMBER
Series 1000, 10GbE XFP Module, 1-Port, Single Slot	XFP-1001A
Series 2000, 10GbE XFP Module, 1-Port, Single Slot	XFP-2001B
<b>Optical Transceiver Interfaces (Optional)</b>	
850nm, Multi-Mode, 10GBASE-SR/SW	ACC-6030A
1310nm, Single Mode, 10GBASE-LR/LW	ACC-6031A
1550nm, Single Mode, 10GBASE-ER/EW	ACC-6032A

## SPIRENT GLOBAL SERVICES

Spirent Global Services optimizes your productivity with Spirent TestCenter over a broad range of technologies:

### Professional Services

- Test lab optimization: Test automation engineering services
- Service deployment and service-level optimization: Vendor acceptance testing, SLA benchmarking, infrastructure and security validation
- Device scalability optimization: POC high-scalability validation testing

### Education Services

- Web-based training: 24 x 7 hardware and software training
- Instructor-led training: Hands-on methodology and product training
- Certifications: SCPA and SCPE certifications

### Implementation Services

- Optimized new customer productivity with up to three days of on-site assistance

Visit [www.spirent.com/gs](http://www.spirent.com/gs) or contact your Spirent sales representative.

Spirent TestCenter

## 10-GIGABIT ETHERNET XFP TEST MODULES



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