Spirent Hardware Reference

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Spirent Communications, Inc.

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Copyright

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How To Contact Us

To obtain technical support for any Spirent Communications product, contact our Support Services department.

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Spirent Knowledge Base

The Spirent Customer Service Center (https://support.spirent.com) includes useful tools such as a powerful Knowledge Base. The Knowledge Base offers an easy-to-use browse mode along with an intelligent search that offers quick answers to your network analysis and measurement questions.

Information about Spirent Communications and its products and services can be found on the main company website at https://www.spirent.com.

Chapter 1
Spirent Hardware Reference

This Spirent Hardware Reference describes chassis, modules, and accessories. Information is provided on module LEDs, multiple chassis connections, cables, and chassis commands. Basic information is provided on system administration and diagnostics.

Additional Hardware Documentation

Spirent N4U, N11U, N12U and the Spirent C50 appliance:

Getting Started with Spirent TestCenter - Provides hardware set up, software installation, licensing, and software upgrade and downgrade instructions

Spirent C1 and C2 appliances:

Spirent C1 and C2 Quick Reference - Describes the Spirent C1/C2 and provides information about using the appliance for the first time

Spirent C1 and C2 Installation Instructions - Provides complete instructions on the set up and use of the Spirent C1/C2

Spirent PX3/DX3-QSFP-DD-8 appliance:

Spirent PX3/DX3-QSFP-DD-8 Installation Guide - Provides complete instructions on the set up and use of the PX3/DX3-QSFP-DD-8

Spirent PX3/DX3-QSFP-DD-8 Quick Reference - Describes the PX3/DX3-QSFP-DD-8 and provides information about using the appliance for the first time

Spirent B2-800 appliance:

Spirent B2-800 Installation Guide - Provides complete instructions on the set up and use of the appliance

Spirent A1-400-QD-16-T1P appliance:

Spirent A1-400-QD-16-T1P Installation Guide - Provides complete instructions on the set up and use of the appliance

Spirent A2-400 Appliance:

Spirent A2-400 Appliance Installation Instructions - Provides complete instructions on the set up and use of the appliance

Spirent M1 Appliance:

Spirent M1 Appliance Installation Instructions - Provides complete instructions on the set up and use of the appliance

Chapter 2
Chassis

The Spirent TestCenter network performance test systems are available in two categories: very high-density, SPT-N11U-110/SPT-N11U-220 and SPT-N12U-110/SPT-N12U-220; mobile SPT-N4U.

Specifications

This section provides specifications for all chassis types.

SPT-N4U

This table lists the specifications for the SPT-N4U chassis.

SPT-N4U Chassis Specifications

Category	Description
Front Panel Connectors	One DVI connector (for console connections) Four (4) USB connectors Ethernet connector: one RJ-45 10//1000 Base-T connector. Supports 10/100/1000Mbps and half/full duplex in 10/100 mode. Multiple chassis synchronization connectors: two RJ-45 In/Out connectors. External Time Reference connectors: one DB9 serial and two BNC connectors. 1588 connector: one RJ-45 connector.
Layout Requirements	IMPORTANT: Always use the power cord that is provided with the chassis Must have the following clearances for unimpeded airflow: Front and rear of chassis: 6 inches Left and right side of chassis: 3 inches Top of chassis: no requirement Bottom of chassis: Do not remove “feet” provided with chassis **A blank panel must be installed in every empty slot**. The SPT-N4U must be positioned to meet EMI guidelines. Local synchronization connections between chassis must be within one meter of each other.

Category	Description
Operating Temperature	59–95° F (15–35° C).
Operating Humidity	20 to 80% relative humidity, non-condensing.
Physical	Dimensions: 17.5”W x 7”H x 27.0”D (44.45 cm x 17.8 cm x 68.6 cm) 25” (63.5 cm) depth measured from front mounting flange Installation and shipping weight: 58.6 lbs. (26.6 kg) (no test modules installed) Approximate weight fully loaded: 81.6 lbs. (37 kg)
Restrictions	The SPT-N4U chassis requires two (2) power supplies (ACC-9020A) for normal operation of a fully loaded chassis.

SPT-N11U-110/SPT-N11U-220 and SPT-N12U-110/SPT-N12U-220 Chassis

This table lists the specifications for the SPT-N11U-110/SPT-N11U-220 and SPT-N12U-110/SPT-N12U-220 chassis.

SPT-N11U-110/SPT-N11U-220 Chassis and SPT-N12U-110/SPT-N12U-220 Specifications

Category	Description
Front Panel Connectors	Four (4) USB connectors
Back Panel Connectors	One DVI connector (for console connections) Two (2) USB connectors Ethernet connector: one RJ-45 10//1000 Base-T connector. Supports 10/100/1000Mbps and half/full duplex in 10/100 mode. Multiple chassis synchronization connectors: two RJ-45 In/Out connectors. External Time Reference connectors: one DB9 serial and two BNC connectors. 1588 connector: one RJ-45 connector.
Layout Requirements	IMPORTANT: Always use the power cord that is provided with the chassis Must have the following clearances for unimpeded airflow: Front and rear of chassis: 6 inches Left and right side of chassis: 3 inches Top of chassis: no requirement Bottom of chassis: Do not remove “feet” provided with chassis **A blank panel must be installed in every empty slot**. The SPT-N11U-110/SPT-N11U-220 and SPT-N12U-110/SPT-N12U-220 must be positioned to meet EMI guidelines. Local synchronization connections between chassis must be within one meter of each other.

Category	Description
Operating Temperature	59–95° F (15–35° C).
Operating Humidity	20 to 80% relative humidity, non-condensing.
Physical	SPT-N11U: Dimensions: 17.5”W x 19.25”H x 33.3”D (44.45 cm x 48.9 cm x 84.6 cm); 30” (76.2 cm) depth measured from front mounting flange Installation and shipping weight: 105 lbs. (47.6 kg) (3 system and 2 slot PSUs and fans installed, no test modules installed) Approximate weight fully loaded: 243 lbs. (110 kg) SPT-N12U: Dimensions: 17.5"W x 21"H x 33.3"D (44.45 cm x 53.34 cm x 84.6 cm). 30" (76.2 cm) depth measured from front mounting flange. Installation and shipping weight: 127 lb. (57.7 kg) (3 system and 2 slot PSUs and fans installed, no test modules installed). Approximate weight fully loaded: 234 lb. (106.1 kg)
Restrictions	The power supplies for the SPT-N11U and SPT-N12U chassis are different and are not interchangeable between the two models. SPT-N11U uses Spirent Power Supply ACC-9020A (500 Watts) SPT-N12U uses Spirent Power Supply ACC-9026A (575 Watts)

Chapter 3
Chassis Controllers

The controller board provides the main computing, processing, memory, and storage resources for each Spirent chassis. All firmware (chassis, test module, and test package) is installed on the chassis. The controller board version can be determined by looking at the manufacturing label on the board:

Controller 3 = CTL-N4U for the SPT-N4U, CTL-N11U for the SPT-N11U-110/SPT-N11U-220 and SPT-N12U-110/SPT-N12U-220 chassis

Note: Controller version 2 firmware continues to be supported, but the chassis that support controller version 2 are obsolete, and not are not included in this document.

See *Getting Started with Spirent TestCenter* for more information. Refer to the **User Documentation** section for download instructions.

Slot Context

No test package firmware or context is written to the Flash memory on the test modules (if present). Instead, it is all stored on the Controller board and is referred to as the slot context.

The slot context consists of the following information:

- The active test package (for example Spirent TestCenter or L4/L7).
- PDU files that have been downloaded.

The slot context information is retained after the following operations:

- Chassis power interruption
- Manual power down from the front panel
- Chassis reboot (either front panel or from an application)
- Module reboot from an application
- Port Group Reboot from an application
- Port Group Release from an application
- Physical removal of a test module, and then reinsertion into the same slot

The following operations cause the slot context to be lost. In these cases, the module reverts to its default state.

- The module is removed and reinserted into a different slot.
- The chassis or test module firmware is updated to a different version

Chassis Controller Limitations

- The firmware install process must be performed off line. No tests may be running on any module within the chassis while the installation is in progress.
- The firmware installation updates the chassis and modules at the same time. Installation or update of firmware for a single slot is not supported.
- When the firmware is updated on the Controller hard disk drive, any subsequent boot causes that version of the firmware to be run. The disk maintains common areas for the firmware, but does not maintain a separate area for each slot. Therefore, all modules will run with the same firmware version.
- The GUI and business layer logic (BLL) support the update of more than one chassis simultaneously.
- Refer to Knowledge Base article **FAQ11712** to verify the firmware version required for each test module.

Using Chassis Commands

The Spirent TestCenter chassis is controlled from the main controller board.

See the **Chassis Commands** section for detailed information about chassis commands.

Chapter 4
Test Modules

HyperMetrics Test Modules

Spirent FLEXE Test Modules

The Spirent FLEXE test modules include the FLEXE-100 as described in the table.

Spirent FLEXE Test Modules

Feature	FLEXE-100
Interface	QSFP28
Ports per Test Module	10 Ports at 100 Gbps 10 Ports at 50 Gbps
Speed	100 Gbps, 50 Gbps
Duplex Mode	Full
Traffic Rates	101% Wire Rate
Latency Resolution	2.5 nsec
Max. Tx Streams per Port	100G: 256 50G: 256
Max. Rx Streams per Port	100G: 512 50G: 512
Packet Length	60 to 16 Kbytes
Capture Buffer Frame Size	8 MB
Error Counters	Tx/Rx FCS Errors

Feature	FLEXE-100
	Rx PRBS Bit Errors Rx PRBS Frame Errors Each counter has an associated rate counter.
Error Generation	CRC Error
IPv6	Yes
Tx Interframe Gap range	100G: 11 bytes to 0.2 sec 50G: 11 bytes to 0.4 sec
VLAN Tagging	Yes
VLAN Stacking	Yes
Flow Control	No
Hardware-based VFDs (six, four-bytes)	Six, 4-bytes
Software VFDs Stream Modifiers	Yes
Cut-through Capture	No
Layer 4-7 Testing	No
Auto-Negotiation	Yes

Spirent PX3 Test Modules

The Spirent PX3 test modules include the PX3-100GQ-T12, PX3-QSFP-DD-2, and PX3-400GQ-P2, as described in the table.

NOTE:

- Model PX3-200GO-P2 is also available. This model includes the same features as the PX3-400GQ module, but supports only 200G mode.
- Models PX3-400GO-T2 and PX3-400GO-P2 are also available. These models include the same features as the PX3-400GQ module, but support only 400G mode.
- Model PX3-400GQ-T2 is also available. This model includes the same features as the PX3-QSFP-DD-2 module, but supports only 400G, 200G, 100G, and 50G modes.
- Model PX3-400GS-T2 is also available. This model is identical to PX3-QSFP-DD-2.

Spirent PX3 Test Modules

Feature	PX3-100GQ-T12	PX3-100GQ-T12 Performance Mode	PX3-QSFP-DD-2	PX3-400GQ-P2
Interface	QSFP28	QSFP28	QSFP-DD	CFP8

Feature	PX3-100GQ-T12	PX3-100GQ-T12 Performance Mode	PX3-QSFP-DD-2	PX3-400GQ-P2
Ports per Test Module	12 Ports in 100/40 GbE modes 24 Ports in 50 GbE mode 48 Ports in 25/10 GbE modes 12 Ports in 50GbE KP4 FEC mode	12 Ports in 100 GbE modes	2 Ports in 400 GbE PAM4 mode 4 Ports in 200 GbE PAM4 mode 8 Ports in 100 GbE PAM4 mode 16 Ports in 50 GbE PAM4 mode 2 Ports in 200 GbE NRZ mode 4 Ports in 100 GbE NRZ mode 8 Ports in 50 GbE NRZ mode 4 Ports in 40 GbE NRZ mode 16 Ports in 25 GbE NRZ mode 16 Ports in 10 GbE NRZ mode	2 Ports in 400 GbE mode 4 Ports in 200 GbE mode 8 Ports in 100 GbE mode 16 Ports in 50 GbE mode
Speed	10 GbE, 25 GbE, 40 GbE, 50 GbE, 100 GbE	100 GbE	10 GbE, 25 GbE, 40 GbE, 50 GbE, 100 GbE, 200 GbE, 400 GbE	50 GbE, 100 GbE, 200 GbE, 400 GbE
Duplex Mode	Full	Full	Full	Full
Traffic Rates	101% Wire Rate	101% Wire Rate	101% Wire Rate	101% Wire Rate
Latency Resolution	2.5 nsec	2.5 nsec	2.5 nsec	2.5 nsec
Max. Tx Streams per Port	100G: 8K 50G: 8K 40G: 8K 25G: 4K 10G: 4K	100G: 32K	32K	400G: 32K 200G: 32K 100G: 32K 50G: 32K
Max. Rx Streams per Port	100G: 16K Basic/4K Latency	100G: 32K Basic	400G: 32,400	400G: 32,400

Feature	PX3-100GQ-T12	PX3-100GQ-T12 Performance Mode	PX3-QSFP-DD-2	PX3-400GQ-P2
	50G: 8K Basic/2K Latency 40G: 8K Basic/2K Latency 25G: 4K Basic/1K Latency 10G: 4K Basic/1K Latency		200G: 32,400 100G: 32K 50G: 32K 40G: 32K 25G: 32K 10G: 32K	200G: 32,400 100G: 32K 50G: 32K
Max. Flows per Stream	Billions	Billions	Billions	Billions
Packet Length	60 to 16 Kbytes(Tx)* 60 to 16 Kbytes(Rx)* *Cut-through frames limited to 4K	60 to 16 Kbytes(Tx)* 60 to 16 Kbytes(Rx)* *Cut-through frames limited to 9K	48 to 16,004 bytes (Tx)* 48 to 16,004 bytes (Rx)* *Cut-through frames limited to 16,004	48 to 16,004 bytes (Tx)* 48 to 16,004 bytes (Rx)* *Cut-through frames limited to 16,004
Capture Buffer Frame Size	8 MB	8 MB	8 MB	8 MB
Error Counters	Tx/Rx FCS Errors Rx PRBS Bit Errors Rx PRBS Frame Errors Each counter has an associated rate counter.	Tx FCS Errors Each counter has an associated rate counter.	Tx/Rx FCS Errors Rx PRBS Bit Errors Rx PRBS Frame Errors Each counter has an associated rate counter.	Tx/Rx FCS Errors Rx PRBS Bit Errors Rx PRBS Frame Errors Each counter has an associated rate counter.
Error Generation	CRC Error	CRC Error	CRC Error	CRC Error
IPv6	Yes	Yes	Yes	Yes
Tx Interframe Gap range	10G: 11 bytes to 3.43 seconds 25G: 11 bytes to 0.8 seconds 40G: 11 bytes to 3.43 seconds 50G: 11 bytes to 0.4 seconds 100G: 11 bytes to 0.2	100G: 11 bytes to 0.2 sec (min rate is 5 frames-per-sec)	10G: 11 bytes to 3.43 seconds 25G: 11 bytes to 0.8 seconds 40G: 11 bytes to 3.43 seconds 50G: 11 bytes to 1.6 seconds 100G: 11 bytes to 0.8	50G: 11 bytes to 1.6 seconds 100G: 11 bytes to 0.8 seconds 200G: 11 bytes to 0.4 seconds 400G: 11 bytes to 0.2 seconds

Feature	PX3-100GQ-T12	PX3-100GQ-T12 Performance Mode	PX3-QSFP-DD-2	PX3-400GQ-P2
	sec (min rate is 5 frames-per-sec)		seconds 200G: 11 bytes to 0.4 seconds 400G: 11 bytes to 0.2 seconds	
VLAN Tagging	Yes	Yes	Yes	Yes
VLAN Stacking	Yes	Yes	Yes	Yes
Flow Control	Yes	Yes	Yes	Yes
Hardware-based VFDs (six, four-bytes)	Four, 4-bytes	Six, 1-4: four-bytes, 5-6: six-bytes	Six, 4-bytes	Six, 4-bytes
Software VFDs Stream Modifiers	Yes	Yes	Yes	Yes
Cut-through Capture	Yes	Yes	Yes	Yes
Layer 4-7 Testing	No	No	No	No
Auto-Negotiation	Yes	Yes	Yes	Yes

Spirent MX3 Test Modules

Spirent MX3 test modules include MX3-100GQ-T2, MX3-100GQF32-T2, MX3-25GD-S8, and MX3-QSFP28-4 as described in the table.

NOTES:

- Model MX3-100GTN-T2 is also available. This model includes the same features as the MX3-100GQ module, but support only 100G/50G/25G modes.
- Model MX3-100GD-T2 is also available. This model includes the same features as the MX3-100GQ module, but supports only 100G/25G modes.
- Model MX3-100GO-T2 is also available. This model includes the same features as the MX3-100GQ module, but supports only 100G mode.
- Model MX3-100GTL-T2 is also available. This model includes the same features as the MX3-100GQ module, but supports only 100G/40G/10G modes.
- Model MX3-25GD-T2 is also available. This model includes the same features as the MX3-100GQ module, but supports only 25G/10G modes.
- Model MX3-100GQF32-T2 can support Ethernet mode. In Ethernet mode, the model includes the same features as the MX3-100GQ-T2 module.
- Model MX3-25GO-S8 is also available. This model includes the same features as the MX3-25GD module, but supports only 25G mode.

Spirent MX3 Test Modules

Feature	MX3-100GQ-T2	MX3-100GQF32-T2	MX3-25GD-S8	MX3-QSFP28-4
Interface	QSFP28	QSFP28	SFP28	QSFP28
Ports per Test Module	Up to 2 in 100G mode Up to 4 in 50G/40G modes Up to 8 in 25G/10G modes Up to 4 Ports in 50GbE KP4 FEC mode	4 ports in Fiber Channel mode	8 ports	Up to 4 in 100G mode Up to 8 in 50G/40G modes Up to 16 in 25G/10G modes
Speed	10 Gbps, 25 Gbps, 40 Gbps, 50 Gbps, 100 Gbps	16 Gbps, 32 Gbps	10 Gbps, 25 Gbps	10 Gbps, 25 Gbps, 40 Gbps, 50 Gbps, 100 Gbps
Duplex Mode	Full	Full	Full	Full
Traffic Rates	100G/40G – 101% Wire Rate 50G/25G/10G-105%	32G/16G – 106.25%	105%	100G/40G – 101% Wire Rate 50G/25G/10G-105%
Latency Resolution	2.5 nsec	2.5 nsec	2.5 nsec	2.5 nsec
Max. Tx Streams per Port	64K	64K	64K	64K
Max. Rx Streams per Port	128K	128K	128K	128K
Max. Flows per Stream	Billions	Billions	Billions	Billions
Packet Length	32 to 16384 bytes (Tx) 40 to 16384 bytes (Rx)	36 to 2148 bytes (TX and RX)	32 to 16384 bytes (Tx) 40 to 16384 bytes (Rx)	58 to 16383 bytes (TX and RX)
Capture Buffer Frame Size	Up to 1GB per port	Up to 1GB per port	Up to 1GB per port	Total 1MB per port group: 1MB for 1 port, 512kB for 2 ports, 128kB for 4 ports
Error Counters	Tx/Rx IP Header Checksum Errors Tx/Rx CRC Tx/Rx Undersize	Tx/Rx Undersize Tx/Rx Oversize Tx/Rx FCS Errors	Tx/Rx IP Header Checksum Errors Tx/Rx CRC Tx/Rx Undersize	Tx/Rx IP Header Checksum Errors Tx/Rx CRC Tx/Rx Undersize

Feature	MX3-100GQ-T2	MX3-100GQF32-T2	MX3-25GD-S8	MX3-QSFP28-4
	Tx/Rx Oversize Tx/Rx FCS Errors Tx L3 Header Errors Tx L4 Header Errors Rx TCP Header Checksum Errors Rx TCP/UDP Checksum Errors Rx PRBS Bit Errors Rx PRBS Frame Errors Each of these counters has an associated rate counter.	Rx PRBS Bit Errors Rx PRBS Frame Errors Each of these counters has an associated rate counter.	Tx/Rx Oversize Tx/Rx FCS Error Tx L3 Header Error Tx L4 Header Error Rx TCP Header Checksum Error Rx TCP/UDP Checksum Error Rx PRBS Bit Error Rx PRBS Frame Error Each of these counters has an associated rate counter.	Tx/Rx Oversize Tx/Rx FCS Errors Tx L3 Header Errors Tx L4 Header Errors Rx TCP Header Checksum Errors Rx TCP/UDP Checksum Errors Rx PRBS Bit Errors Rx PRBS Frame Errors Each of these counters has an associated rate counter.
Error Generation	IP Checksum Error TCP Checksum Error UDP Checksum Error Frame bit error CRC Error	Frame bit error FCS error	IP Checksum Error TCP Checksum Error UDP Checksum Error Frame bit error CRC Error	IP Checksum Error TCP Checksum Error UDP Checksum Error Frame bit error CRC Error
IPv6	Yes	N/A	Yes	Yes
Tx Interframe Gap range	10G: 5 bytes to 3seconds 25G: 5 bytes to 21.9 seconds 40G: 1 byte to 13 seconds 50G: 5 bytes to 10.9 seconds 100G: 5 bytes to 5.4 seconds	24 bytes to 1.26 seconds	10G: 5 bytes to 3seconds 25G: 5 bytes to 21.9 seconds	10G: 5 bytes to 3 seconds 25G: 5 bytes to 21.9 seconds 40G: 1 byte to 13 seconds 50G: 5 bytes to 10.9 seconds 100G: 5 bytes to 5.4 seconds

Feature	MX3-100GQ-T2	MX3-100GQF32-T2	MX3-25GD-S8	MX3-QSFP28-4
VLAN Tagging	Yes	N/A	Yes	Yes
VLAN Stacking	3 Tx; 2 Rx	N/A	3 Tx; 2 Rx	3 Tx; 2 Rx
Flow Control	Yes	Yes	Yes	Yes
Hardware-based VFDs (six, four-bytes)	Yes	Yes	Yes	Yes
Software VFDs Stream Modifiers	Yes	Yes	Yes	Yes
Cut-through Capture	Yes	Yes	Yes	Yes
Layer 4-7 Testing	No	No	No	No
40G Auto-Negotiation	Yes	Yes	No	Yes

Spirent DX3 Test Modules

The Spirent DX3 test modules include the DX3-100GQ-T12, DX3-QSFP-DD-2, and DX3-400GQ-P2 as described in the table.

NOTES:

- Model DX3-25GO-T12 is also available. This model includes the same features as the DX3-100GQ-T12 modules, but supports only 25G mode.
- Model DX3-100GD-T12 is also available. This model includes the same features as the DX3-100GQ-T12 module, but supports only 100G and 25G modes.
- Model DX3-100GTN-T12 is also available. This model includes the same features as the DX3-100GQ-T12 module, but supports only 100G, 50G, and 25G modes.
- Model DX3-25GD-T12 is also available. This model includes the same features as the DX3-100GQ-T12 module, but supports only 25G and 10G modes.
- Model DX3-25GO-T12 is also available. This model includes the same features as the DX3-100GQ-T12 module, but supports only 25G mode.
- Model DX3-100GTL-T12 is also available. This model includes the same features as the DX3-100GQ-T12 module, but supports only 100G, 40G, and 10G modes.
- Model DX3-100GO-T12 is also available. This model includes the same features as the DX3-100GQ-T12 module, but supports only 100G mode.
- Models DX3-200GO-T2 and DX3-200GO-P2 are also available. These models include the same features as the DX3-400GQ module, but support only 200G mode.
- Models DX3-400GDF-T2 and DX3-400GDF-P2 are also available. These models include the same features as the DX3-400GQ module, but support only 400G/50G modes.
- Models DX3-400GD-T2 and DX3-400GD-P2 are also available. These models include the same features as the DX3-400GQ module, but support only 400G/100G modes.
- Models DX3-400GO-T2 and DX3-400GO-P2 are also available. These models include the same features as the DX3-400GQ module, but support only 400G mode.

- Model DX3-400GQ-T2 is also available. This model includes the same features as the DX3-QSFP-DD-2 module, but supports only 400G, 200G, 100G, and 50G modes.
- Model DX3-400GS-T2 is also available. This model is identical to DX3-QSFP-DD-2.

Spirent DX3 Test Modules

Feature	DX3-100GQ-T12	DX3-QSFP-DD-2	DX3-400GQ-P2
Interface	QSFP28	QSFP-DD	CFP8
Ports per Test Module	12 Ports in 100/40 GbE modes 24 Ports in 50 GbE mode 48 Ports in 25/10 GbE modes	2 Ports in 400 GbE PAM4 mode 4 Ports in 200 GbE PAM4 mode 8 Ports in 100 GbE PAM4 mode 16 Ports in 50 GbE PAM4 mode 2 Ports in 200 GbE NRZ mode 4 Ports in 100 GbE NRZ mode 8 Ports in 50 GbE NRZ mode 4 Ports in 40 GbE NRZ mode 16 Ports in 25 GbE NRZ mode 16 Ports in 10 GbE NRZ mode	2 Ports in 400 GbE mode 4 Ports in 200 GbE mode 8 Ports in 100 GbE mode 16 Ports in 50 GbE mode
Speed	10 GbE, 25 GbE, 40 GbE, 50 GbE, 100 GbE	10 GbE, 25 GbE, 40 GbE, 50 GbE, 100 GbE, 200 GbE, 400 GbE	50 GbE, 100 GbE, 200 GbE, 400 GbE
Duplex Mode	Full	Full	Full
Traffic Rates	101% Wire Rate	101% Wire Rate	101% Wire Rate
Latency Resolution	2.5 nsec	2.5 nsec	2.5 nsec
Max. Tx Streams per Port	100G: 8K 50G: 8K 40G: 8K 25G: 4K 10G: 4K	8K	400G: 8K 200G: 8K 100G: 8K 50G: 8K

Feature	DX3-100GQ-T12	DX3-QSFP-DD-2	DX3-400GQ-P2
Max. Rx Streams per Port	100G: 16K Basic/4K Latency 50G: 8K Basic/2K Latency 40G: 8K Basic/2K Latency 25G: 4K Basic/1K Latency 10G: 4K Basic/1K Latency	400G: 16,200 200G: 16,200 100G: 16K 50G: 16K 40G: 16K 25G: 16K 10G: 16K	400G: 16,200 200G: 16,200 100G: 16K 50G: 16K
Max. Flows per Stream	Billions	Billions	Billions
Packet Length	60 to 16 Kbytes(Tx)* 60 to 16 Kbytes(Rx)* *Cut-through frames limited to 4K	48 to 16,004 bytes(Tx)* 48 to 16,004 bytes(Rx)* *Cut-through frames limited to 16,004	48 to 16,004 bytes(Tx)* 48 to 16,004 bytes(Rx)* *Cut-through frames limited to 16,004
Capture Buffer Frame Size	8 MB	8 MB	8 MB
Error Counters	Tx/Rx FCS Errors Rx PRBS Bit Errors Rx PRBS Frame Errors Each counter has an associated rate counter.	Tx/Rx FCS Errors Rx PRBS Bit Errors Rx PRBS Frame Errors Each counter has an associated rate counter.	Tx/Rx FCS Errors Rx PRBS Bit Errors Rx PRBS Frame Errors Each counter has an associated rate counter.
Error Generation	CRC Error	CRC Error	CRC Error
IPv6	Yes	Yes	Yes
Tx Interframe Gap range	10G: 11 bytes to 3.43 seconds 25G: 11 bytes to 0.8 seconds 40G: 11 bytes to 3.43 seconds 50G: 11 bytes to 0.4 seconds 100G: 11 bytes to 0.2 sec (min rate is 5 frames-per-sec)	10G: 11 bytes to 3.43 seconds 25G: 11 bytes to 0.8 seconds 40G: 11 bytes to 3.43 seconds 50G: 11 bytes to 1.6 seconds 100G: 11 bytes to 0.8 seconds 200G: 11 bytes to 0.4 seconds 400G: 11 bytes 0.2 seconds	50G: 11 bytes to 1.6 seconds 100G: 11 bytes to 0.8 seconds 200G: 11 bytes to 0.4 seconds 400G: 11 bytes 0.2 seconds
VLAN Tagging	Yes	Yes	Yes

Feature	DX3-100GQ-T12	DX3-QSFP-DD-2	DX3-400GQ-P2
VLAN Stacking	Yes	Yes	Yes
Flow Control	Yes	Yes	Yes
Hardware-based VFDs (six, four-bytes)	Four, 4-bytes	Six, 4-bytes	Six, 4-bytes
Software VFDs Stream Modifiers	Yes	Yes	Yes
Cut-through Capture	Yes	Yes	Yes
Layer 4-7 Testing	No	No	No
Auto-Negotiation	Yes	Yes	Yes

Spirent FX3 Test Modules

Spirent FX3 test modules include the FX3-100GQ-T2, FX3-100GQF32-T2, FX3-25GD-S8, and FX3-QSFP28-6 as described in the table.

NOTES:

- Model FX3-100GTN-T2 is also available. This model includes the same features as the FX3-100GQ module, but support only 100G/50G/25G modes.
- Model FX3-100GD-T2 is also available. This model includes the same features as the FX3-100GQ module, but support only 100G/25G modes.
- Model FX3-100GO-T2 is also available. This model includes the same features as the FX3-100GQ module, but supports only 100G mode.
- Model FX3-100GTL-T2 is also available. This model includes the same features as the FX3-100GQ module, but supports only 100G/40G/10G modes.
- Model FX3-25GD-T2 is also available. This model includes the same features as the FX3-100GQ module, but supports only 25G/10G modes.
- Model FX3-100GQF32-T2 can support Ethernet mode. In Ethernet mode, the model includes the same features as the FX3-100GQ-T2 module.
- Model FX3-25GO-S8 is also available. This model includes the same features as the FX3-25GD module, but supports only 25G mode.
- Model FX3-QSFP28-4 is also available. This model includes the same features as the FX3-QSFP28-6, but only supports 4 ports.

Spirent FX3 Test Modules

Feature	FX3-100GQ-T2	FX3-100GQF32-T2	FX3-25GD-S8	FX3-QSFP28-6
Interface	QSFP28	QSFP28	SFP28	QSFP28
Ports per Test Module	Up to 2 in 100G mode Up to 4 in 50G/40G	4 ports in Fiber Channel mode	8 ports	Up to 6 in 100G mode Up to 12 in 50G/40G

Feature	FX3-100GQ-T2	FX3-100GQF32-T2	FX3-25GD-S8	FX3-QSFP28-6
	modes Up to 8 in 25G/10G modes Up to 4 Ports in 50GbE KP4 FEC mode			modes Up to 24 in 25G/10G modes
Speed	10 Gbps, 25 Gbps, 40 Gbps, 50 Gbps, 100 Gbps	16 Gbps, 32 Gbps	10 Gbps, 25 Gbps	10 Gbps, 25 Gbps, 40 Gbps, 50 Gbps, 100 Gbps
Duplex Mode	Full	Full	Full	Full
Traffic Rates	100G/40G – 101% Wire Rate 50G/25G/10G-105%	32G/16G – 106.25%	105%	100G/40G – 101% Wire Rate 50G/25G/10G-105%
Latency Resolution	2.5 nsec	2.5 nsec	2.5 nsec	2.5 nsec
Max. Tx Streams per Port	64k	64k	64k	64k
Max. Rx Streams per Port	128k	128k	128k	128k
Max. Flows per Stream	Billions	Billions	Billions	Billions
Packet Length	32 to 16384 bytes (Tx) 40 to 16384 bytes (Rx)	36 to 2148 bytes (TX and RX)	32 to 16384 bytes (Tx) 40 to 16384 bytes (Rx)	58 to 16383 bytes (Tx)
Capture Buffer Frame Size	Up to 1GB per port	Up to 1GB per port	Up to 1GB per port	Total 1MB per port group: 1MB for 1 port, 512kB for 2 ports, 128kB for 4 ports
Error Counters	Tx/Rx IP Header Checksum Errors Tx/Rx CRC Tx/Rx Undersize Tx/Rx Oversize Tx/Rx FCS Errors Tx L3 Header Errors	Tx/Rx Undersize Tx/Rx Oversize Tx/Rx FCS Errors Rx PRBS Bit Errors Rx PRBS Frame Errors Each of these counters has an associated rate counter.	Tx/Rx IP Header Checksum Errors Tx/Rx CRC Tx/Rx Undersize Tx/Rx Oversize Tx/Rx FCS Errors Tx L3 Header Errors	Tx/Rx IP Header Checksum Errors Tx/Rx CRC Tx/Rx Undersize Tx/Rx Oversize Tx/Rx FCS Errors Tx L3 Header Errors

Feature	FX3-100GQ-T2	FX3-100GQF32-T2	FX3-25GD-S8	FX3-QSFP28-6
	Tx L4 Header Errors Rx TCP Header Checksum Errors Rx TCP/UDP Checksum Errors Rx PRBS Bit Errors Rx PRBS Frame Errors Each of these counters has an associated rate counter.		Tx L4 Header Errors Rx TCP Header Checksum Errors Rx TCP/UDP Checksum Errors Rx PRBS Bit Errors Rx PRBS Frame Errors Each of these counters has an associated rate counter.	Tx L4 Header Errors Rx TCP Header Checksum Errors Rx TCP/UDP Checksum Errors Rx PRBS Bit Errors Rx PRBS Frame Errors Each of these counters has an associated rate counter.
Error Generation	IP Checksum Error TCP Checksum Error UDP Checksum Error Frame bit error CRC Error	Frame bit error FCS error	IP Checksum Error TCP Checksum Error UDP Checksum Error Frame bit error CRC Error	IP Checksum Error TCP Checksum Error UDP Checksum Error Frame bit error CRC Error
IPv6	Yes	N/A	Yes	Yes
Tx Interframe Gap range	10G: 5 bytes to 3seconds 25G: 5 bytes to 21.9 seconds 40G: 1 byte to 13 seconds 50G: 5 bytes to 10.9 seconds 100G: 5 bytes to 5.4 seconds	24 bytes to 1.26 seconds	10G: 5 bytes to 3seconds 25G: 5 bytes to 21.9 seconds	10G: 5 bytes to 3 seconds 25G: 5 bytes to 21.9 seconds 40G: 1 byte to 13 seconds 50G: 5 bytes to 10.9 seconds 100G: 5 bytes to 5.4 seconds
VLAN Tagging	Yes	N/A	Yes	Yes
VLAN Stacking	3 Tx; 2 Rx	N/A	3 Tx; 2 Rx	3 Tx; 2 Rx
Flow Control	Yes	Yes	Yes	Yes

Feature	FX3-100GQ-T2	FX3-100GQF32-T2	FX3-25GD-S8	FX3-QSFP28-6
Hardware-based VFDs (six, four-bytes)	Yes	Yes	Yes	Yes
Software VFDs Stream Modifiers	Yes	Yes	Yes	Yes
Cut-through Capture	Yes	Yes	Yes	Yes
Layer 4-7 Testing	No	No	No	No
40G Auto-Negotiation	Yes	Yes	No	Yes

Spirent MX2 Test Modules

Spirent MX2 test modules include the MX2-40G-Q3, MX2-100G-P4, MX2-10G-S12, MX2-1G-S16 and MX2-11AX-2, as described in the table.

NOTES: The following models are also available:

- Models MX2-40GO-Q1, MX2-40GO-Q2, and MX2-40GO-Q3. They include the same features as the MX2-40G modules, but support only 40G mode.
- Models MX2-10G-Q1, MX2-10G-Q2, MX2-10G-Q3. They include the same features as the MX2-40G modules, but support only 10G speed of operation.
- MX2-40G-Q1 and MX2-40G-Q2. They include the same features as the FX2-40G-Q5, but have fewer physical ports per module.
- MX2-10G-S4 and MX2-10G-S8. They include the same features as the MX2-10G-S12, but have fewer physical ports per module.
- MX2-1G-S8 and MX2-1G-S12. They include the same features as the MX2-1G-S16, but have fewer physical ports per module.

Spirent MX2 Test Modules

Feature	MX2-40G-Q3, 10G/40G Mode	MX2-100G-P4	MX2-10G-S12	MX2-1G-S16	MX2-11AX-2
Interface	QSFP+	CFP2	SFP+	SFP+	SMA
Ports per Test Module	Up to 3 in 40G mode Up to 12 in 10G mode	4 ports 100GbE	Up to 16 for all speeds	16 ports 1GbE	4 Ports (aka Radios) 24 Spatial Streams (aka RF I/O) 16 + 1 SMA ports (16 WiFi + 1 SDR)

Feature	MX2-40G-Q3, 10G/40G Mode	MX2-100G-P4	MX2-10G-S12	MX2-1G-S16	MX2-11AX-2
Speed	10 Gbps, 40 Gbps	100 Gbps	100 Mbps, 1 Gbps, 2.5 Gbps, 5 Gbps, 10 Gbps	Legacy 802.11 + 802.11AX: 4.8 Gbps (5 GHz 80 MHz BW @ 8 SS) + 2.4 Gbps (2.4 GHz 40 MHz BW @ 4 SS)	
Duplex Mode	Full	Full	Full	Full	Half
Traffic Rates	40G – 101% Wire Rate 10G – 105% Wire Rate	101% Wire Rate	10G – 105% Wire Rate 1G – 105% Wire Rate	104% Wire Rate	80% of PHY Rates
Latency Resolution	2.5 nsec	2.5 nsec	2.5 nsec	10 nsec	10 nsec
Max. Tx Streams per Port	65535	16383	65535	65535	16384
Max. Rx Streams per Port	131,072	16383	131,072	65535	65535
Max. Flows per Stream	Billions	Billions	Billions	Billions	Billions
Packet Length	32 to 16384 bytes (Tx) 33 to 16384 bytes (Rx)	60 to 8192 bytes (Tx) 60 to 8192 bytes (Rx)	32 to 16384 bytes (Tx) 33 to 16384 bytes (Rx)	60 to 16384 bytes	56 to 1524 bytes
Capture Buffer Frame Size	8 MB	8 MB	8 MB	8 MB	8MB Default mode 256MB (Monitor Mode)
Error Counters	Tx/Rx IP Header Checksum Errors Tx/Rx CRC Tx/Rx Undersize Tx/Rx Oversize Tx/Rx FCS Errors	Tx/Rx IP Header Checksum Errors Tx/Rx CRC Rx Undersize Rx Oversize Tx/Rx FCS	Tx/Rx IP Header Checksum Errors Tx/Rx CRC Tx/Rx Undersize	Tx/Rx IP Header Checksum Errors Tx/Rx CRC Tx/Rx Undersize Tx/Rx Oversize Tx/Rx FCS	Tx/Rx Undersize Tx/Rx Oversize Rx FCS Errors Tx L3 Header Errors

Feature	MX2-40G-Q3, 10G/40G Mode	MX2-100G-P4	MX2-10G-S12	MX2-1G-S16	MX2-11AX-2
	Tx L3 Header Errors Tx L4 Header Errors Rx TCP Header Checksum Errors Rx TCP/UDP Checksum Errors Rx PRBS Bit Errors Rx PRBS Frame Errors Each of these counters has an associated rate counter.	Errors Tx L3 Header Errors Tx L4 Header Errors Rx TCP Header Checksum Errors Rx TCP/UDP Checksum Errors Rx PRBS Bit Errors Rx PRBS Frame Errors Each of these counters has an associated rate counter.	Tx/Rx Oversize Tx/Rx FCS Errors Tx L3 Header Errors Tx L4 Header Errors Rx TCP Header Checksum Errors Rx TCP/UDP Checksum Errors Rx PRBS Bit Errors Rx PRBS Frame Errors Each of these counters has an associated rate counter.	Errors Tx L3 Header Errors Tx L4 Header Errors Rx TCP Header Checksum Errors Rx TCP/UDP Checksum Errors Rx PRBS Bit Errors Each of these counters has an associated rate counter.	Tx L4 Header Errors Rx IP Header Checksum Errors Rx TCP/UDP Checksum Errors Rx PRBS Bit Errors Rx PRBS Frame Errors Each of these counters has an associated rate counter.
Error Generation	TCP Checksum Error UDP Checksum Error CRC Error	TCP Checksum Error UDP Checksum Error CRC Error	TCP Checksum Error UDP Checksum Error CRC Error	TCP Checksum Error UDP Checksum Error CRC Error	TCP Checksum Error UDP Checksum Error
IPv6	Yes	Yes	Yes	Yes	Yes
Tx Interframe Gap range	10G: 5 bytes to 3seconds 40G: 1 byte to 13 seconds	11 bytes to 0.2 sec (min rate is 5 frames-per-sec)	1G: 5 bytes to 34 seconds 10G: 5 bytes to 3 seconds	11 bytes to 2.147 seconds	11 bytes to 3.43 seconds
VLAN Tagging	Yes	Yes	Yes	Yes	Yes
VLAN Stacking	3 Tx 2 Rx	Yes	3 Tx 2 Rx	3 Tx 2 Rx	Yes
Flow Control	Yes	Yes	Yes	Yes	No

Feature	MX2-40G-Q3, 10G/40G Mode	MX2-100G-P4	MX2-10G-S12	MX2-1G-S16	MX2-11AX-2
Hardware-based VFDs (six, four-bytes)	Yes	Yes	Yes	Yes	Yes
Software VFDs Stream Modifiers	Yes	Yes	Yes	Yes	Yes
Cut-through Capture	Yes	Yes	Yes	Yes	Yes
Layer 4-7 Testing	No	No	No	No	No
40G Auto-Negotiation	Yes	No	No	No	No

Spirent DX2 Test Modules

The Spirent DX2 test modules include the DX2-40G-Q8, DX2-100G-P4, DX2-40G-Q24, DX2-10G-Q24, DX2-100GO-T8, and DX2-10GQ-C16, as described in the table.

NOTES:

- Model DX2-40GO-Q24 is also available. This model includes the same features as the DX2-40G modules, but supports only 40G mode.
- On the DX2-40G-Q8 modules, the faceplate on the Revision B hardware shows **V.B.** in the lower-right corner.
- Model DX2-2.5GO-C16 is also available. This model includes the same features as the DX2-5GD-C16 module, but supports only 2.5G mode.
- Model DX2-5GD-C16 is also available. This model includes the same features as the DX2-10GQ module, but supports only 5G and 2.5G mode.

Spirent DX2 Test Modules

Feature	DX2-40G-Q8, 10G/40G	DX2-100G-P4	DX2-10G-Q24	DX2-40G-Q24	DX2-100GO-T8	DX2-10GQ-C16
Interface	QSFP+	CFP2	QSFP+	QSFP+	QSFP28	RJ-45
Ports per Test Module	8 in 40G mode or 32 in 10G mode	Up to 4 in 100G mode Up to 8 in 40G mode Up to 32 in 10G mode	96 ports 10GbE	24 in 40G mode or 96 in 10G mode	8 Ports 100 GbE	16
Speed	10 Gbps 40 Gbps	100 GbE	10 Gbps	10 Gbps 40 Gbps	100 GbE	10 Gbps 5 Gbps

Feature	DX2-40G-Q8, 10G/40G	DX2-100G-P4	DX2-10G-Q24	DX2-40G-Q24	DX2-100GO-T8	DX2-10GQ-C16
						2.5 Gbps 1 Gbps 100 Mbps
Duplex Mode	Full	Full	Full	Full	Full	Full
Traffic Rates	104% Wire Rate	101% Wire Rate	101% Wire Rate	101% Wire Rate	101% Wire Rate	103% Wire Rate
Latency Resolution	2.5 nsec	2.5 nsec	2.5 nsec	2.5 nsec	2.5 nsec	2.5 nsec
Max. Tx Streams per Port	64	8K	4095	4095	8K	8191
Max. Rx Streams per Port	8K	8K	8191	8191	8K	8191
Max. Flows per Stream	Billions	Billions	Billions	Billions	Billions	Billions
Packet Length	60 to 16004 bytes (Tx) 60 to 16004 bytes (Rx)	60 to 16 Kbytes(Tx)* 60 to 16 Kbytes(Rx)* *Cut-through frames limited to 4K	60 to 16004 bytes (Tx) 60 to 16004 bytes (Rx)	60 to 16004 bytes (Tx) 60 to 16004 bytes (Rx)	60 to 16 Kbytes(Tx)* 60 to 16 Kbytes(Rx)* *Cut-through frames limited to 4K	60 to 16004 bytes (Tx) 60 to 16004 bytes (Rx)
Capture Buffer Frame Size	8 MB	8 MB	8 MB	8 MB	8 MB	8 MB
Error Counters	Tx/Rx FCS Errors Each counter has an associated rate counter.	Tx/Rx FCS Errors Each counter has an associated rate counter.	Tx/Rx FCS Errors Each counter has an associated rate counter.	Tx/Rx FCS Errors Each counter has an associated rate counter.	Tx/Rx FCS Errors Each counter has an associated rate counter.	Tx/Rx FCS Errors Each counter has an associated rate counter.
Error Generation	CRC Error	CRC Error	CRC Error	CRC Error	CRC Error	CRC Error
IPv6	Yes	Yes	Yes	Yes	Yes	Yes
Tx Interframe	Minimum: 12	11 bytes to	Minimum: 11	Minimum: 11	11 bytes to	Minimum: 9

Feature	DX2-40G-Q8, 10G/40G	DX2-100G-P4	DX2-10G-Q24	DX2-40G-Q24	DX2-100GO-T8	DX2-10GQ-C16
Gap range	Bytes Maximum: 13 seconds	0.2 sec (min rate is 5 frames-per-sec)	Bytes Maximum: 3.43 secs	Bytes Maximum: 3.43 secs	0.2 sec (min rate is 5 frames-per-sec)	Bytes Maximum: 3.43 secs
VLAN Tagging	Yes	Yes	Yes	Yes	Yes	Yes
VLAN Stacking	Yes	Yes	Yes	Yes	Yes	Yes
Flow Control	Yes	Yes	Yes	Yes	Yes	Yes
Hardware-based VFDs (six, four-bytes)	Yes	Four, 4-bytes	Yes	Yes	Four, 4-bytes	Four, 4-bytes
Software VFDs Stream Modifiers	Yes	Yes	Yes	Yes	Yes	Yes
Cut-through Capture	Yes	Yes	Yes	Yes	Yes	Yes
Layer 4-7 Testing	No	No	No	No	No	No
Auto-Negotiation	Revision B(*x*) and later: Yes Revision A(*x*): No	No	No	Yes	No	Yes

Spirent FX2 Test Modules

Spirent FX2 test modules include the FX2-40G-Q5, FX2-10G-S16, FX2-100G-P4, FX2-1G-S16, and FX2-11ACN-2 as described in the table.

NOTES: The following models are also available:

- FX2-40GO-Q2, FX2-40GO-Q3, FX2-40GO-Q4 and FX2-40GO-Q5. They include the same features as the FX2-40G modules, but support only 40G mode.
- FX2-10G-Q2, FX2-10G-Q3, FX2-10G-4 and FX2-10G-Q5. They include the same features as the FX2-40G modules, but support only 10G mode.
- FX2-40G-Q2, FX2-40G-Q3, and FX2-40G-Q4. They include the same features as the FX2-40G-Q5, but have fewer physical ports per module.
- FX2-10G-S8. They include the same features as the FX2-10G-S16, but have fewer physical ports per module.
- FX2-1G-S8 and FX2-1G-S12. They include the same features as the FX2-1G-S16, but have fewer physical ports per module.
- FX2-11AC-2. This model includes the same features as the FX2-11ACN-2, but supports only 802.11AC

mode.

- FX2-11AC-WAVE2-2. This model includes the same features as the FX2-11AC-2, but has fewer physical radios per module.

Spirent FX2 Test Modules

Feature	FX2-40G-Q5 10G/40G Mode	FX2-10G-S16	FX2-100G-P4	FX2-1G-S16	FX2-11ACN-2
Interface	QSFP+	SFP+	CFP2	SFP+	SMA
Ports per Test Module	Up to 5 in 40G mode Up to 20 in 10G mode	Up to for all speeds	4 ports 100GbE	16 ports 1GbE	16 radios
Speed	10 Gbps,40 Gbps	100 Mbps, 1 Gbps, 2.5 Gbps, 5 Gbps, 10 Gbps	100 Gbps	1 Gbps	802.11N 450Mbps 802.11AC 1300Mbps
Duplex Mode	Full	Full	Full	Full	Half
Traffic Rates	40G – 101% Wire Rate 10G – 105% Wire Rate	10G – 105% Wire Rate 1G – 105% Wire Rate	101% Wire Rate	104% Wire Rate	75% of PHY Rates
Latency Resolution	2.5 nsec	2.5 nsec	2.5 nsec	10 nsec	10 nsec
Max. Tx Streams per Port	65535	65535	16383	32767	16384
Max. Rx Streams per Port	131,072	131,072	16383	65535	65535
Max. Flows per Stream	Billions	Billions	Billions	Billions	Billions
Packet Length	32 to 16384 bytes (Tx) 33 to 16384 bytes (Rx)	32 to 16384 bytes (Tx) 33 to 16384 bytes (Rx)	60 to 8192 bytes (Tx) 60 to 8192 bytes (Rx)	60 to 16384 bytes	56 to 9018 bytes
Capture Buffer Frame Size	8 MB	8 MB	8 MB	8 MB	8MB Default mode 256MB (Monitor Mode)

Feature	FX2-40G-Q5 10G/40G Mode	FX2-10G-S16	FX2-100G-P4	FX2-1G-S16	FX2-11ACN-2
Error Counters	Tx/Rx IP Header Checksum Errors Tx/Rx CRC Tx/Rx Undersize Tx/Rx Oversize Tx/Rx FCS Errors Tx L3 Header Errors Tx L4 Header Errors Rx TCP Header Checksum Errors Rx TCP/UDP Checksum Errors Rx PRBS Bit Errors Rx PRBS Frame Errors Each of these counters has an associated rate counter.	Tx/Rx IP Header Checksum Errors Tx/Rx CRC Tx/Rx Undersize Tx/Rx Oversize Tx/Rx FCS Errors Tx L3 Header Errors Tx L4 Header Errors Rx TCP Header Checksum Errors Rx TCP/UDP Checksum Errors Rx PRBS Bit Errors Rx PRBS Frame Errors Each of these counters has an associated rate counter.	Tx/Rx IP Header Checksum Errors Tx/Rx CRC Rx Undersize Rx Oversize Tx/Rx FCS Errors Tx L3 Header Errors Tx L4 Header Errors Rx TCP Header Checksum Errors Rx TCP/UDP Checksum Errors Rx PRBS Bit Errors Rx PRBS Frame Errors Each of these counters has an associated rate counter.	Tx/Rx IP Header Checksum Errors Tx/Rx CRC Tx/Rx Undersize Tx/Rx Oversize Tx/Rx FCS Errors Tx L3 Header Errors Tx L4 Header Errors Rx TCP Header Checksum Errors Rx TCP/UDP Checksum Errors Rx PRBS Bit Errors Each of these counters has an associated rate counter.	Tx/Rx Undersize Tx/Rx Oversize Rx FCS Errors Tx L3 Header Errors Tx L4 Header Errors Rx IP Header Checksum Errors Rx TCP/UDP Checksum Errors Rx PRBS Bit Errors Rx PRBS Frame Errors Each of these counters has an associated rate counter.
Error Generation	TCP Checksum Error UDP Checksum Error CRC Error	TCP Checksum Error UDP Checksum Error CRC Error	TCP Checksum Error UDP Checksum Error CRC Error	TCP Checksum Error UDP Checksum Error CRC Error	TCP Checksum Error UDP Checksum Error
IPv6	Yes	Yes	Yes	Yes	Yes
Tx Interframe Gap range	10G: 5 bytes to 3 seconds 40G: 1 byte to 13 seconds	1G: 5 bytes to 34 seconds 10G: 5 bytes to 3 seconds	11 bytes to 0.2 sec (min rate is 5 frames-per-sec)	11 bytes to 2.147 seconds	450M: 11 bytes to 76 secs 1300M: 11 bytes to 26 secs
VLAN Tagging	Yes	Yes	Yes	Yes	Yes
VLAN Stacking	3 Tx; 2 Rx	3 Tx; 2 Rx	Yes	3 Tx; 2 Rx	Yes

Feature	FX2-40G-Q5 10G/40G Mode	FX2-10G-S16	FX2-100G-P4	FX2-1G-S16	FX2-11ACN-2
Flow Control	Yes	Yes	Yes	Yes	No
Hardware-based VFDs (six, four-bytes)	Yes	Yes	Yes	Yes	Yes
Software VFDs Stream Modifiers	Yes	Yes	Yes	Yes	Yes
Cut-through Capture	Yes	Yes	Yes	Yes	Yes
Layer 4-7 Testing	No	No	No	No	No
40G Auto-Negotiation	Yes	No	No	No	No

Transceivers

Transceiver Characteristics

This table summarizes Spirent transceiver characteristics.

SFP+ MSA Form Factor Copper

Transceiver	Description
ACC-6060A	Passive Copper, SFP+ MSA, 10GbE, 1m
ACC-6061A	Passive Copper, SFP+ MSA, 10GbE, 3m
Transceiver	Description
ACC-6050A	Optical transceiver, SFP+ MSA, 10GbE, 10GBASE-SR, 850nm, MM
ACC-6051A	Optical transceiver, SFP+ MSA, 10GbE, 10GBASE-LR, 1310nm, SM
ACC-6058A	Optical transceiver, SFP+ MSA, 10GbE, 10GBASE-SR/SW, LAN/WAN, 850nm, MM
ACC-6059A	Optical transceiver, SFP+ MSA, 10GbE, 10GBASE-LR/LW, LAN/WAN, 1310nm, SM

Transceiver Support

This table shows Spirent 10GbE transceiver feature support.

10GbE Transceiver Feature Support

Transceiver	MSA Type	Wavelength	LAN	WAN	OC-192/STM-64 POS
ACC-6050A	SFP+	850 nm	Yes	No	No
ACC-6051A	SFP+	1310 nm	Yes	No	No
ACC-6058A	SFP+	850 nm	Yes	Yes	No
ACC-6059A	SFP+	1310 nm	Yes	Yes	No
ACC-6060A	SFP+	NA	Yes	Yes	NA
ACC-6061A	SFP+	NA	Yes	Yes	NA

Chapter 5
LED Indicators

The LEDs (Light-Emitting Diodes) on the Spirent chassis and test modules show the status of the system equipment.

You can also obtain status information by using the *Equipment View* window in the Spirent TestCenter Application.

LED indications also play a role in troubleshooting. Refer to the section on Troubleshooting for information on how to interpret these LED indications.

The test modules' STATUS LED is used to indicate the status of various activities, including test module hot-swapping. Refer to the section on hot-swapping for STATUS LED activity during hot swap procedures.

SPT-N4U, SPT-N11U-110/SPT-N11U-220, and SPT-N12U-110/SPT-N12U-220 Chassis LEDs

LEDs located on SPT-N4U, SPT-N11U-110/SPT-N11U-220, and SPT-N12U-110/SPT-N12U-220 chassis show the status of the chassis and the PC connection. There are LEDs on both the front panel and back panel of each chassis.

The following tables describe the front and back panel LEDs.

Chassis Front Panel LEDs

LED	Color/Status	Description
TEMP.	Solid Green	Ambient temperature inside the chassis is nominal (within limits).
	Solid Amber	Temperature has exceeded the warning level. Precautionary procedures are in process; temperature is being more closely monitored.
	Solid Red	Temperature is consistently in excess of the error level. Numerous chassis functions have been disabled to attempt to reduce the thermal load.
FAN	Solid Green	Internal chassis fans are operating properly.
	Solid Red	One or more of the fans are not working properly. The fan LED change to red is not currently supported.

LED	Color/Status	Description
LINK	Solid Green	PC and chassis and/or test modules are communicating.
	Off	PC and chassis and/or test modules are not communicating.
STATUS	Solid Green	Chassis is operational.
	Solid Amber	Chassis is initializing.
	Blinking Amber	The power down button was pressed and the chassis is shutting down.
	Solid Red	A chassis error has occurred. **Note:** During initialization, the LED state transitions will be Solid Red to Solid Amber to Solid Green. The LED will remain red if an error occurs during the initialization sequence.
POWER	Solid Green	DC power to the chassis is on.
	Off	DC power to the chassis is off.
Slot	Solid Green	The DC outlet power is within the acceptable voltage range.
	Red/ Off	The DC outlet power is not within the acceptable voltage range.

Chassis Back Panel LEDs

LED	Color/Status	Description
ETHERNET INTERFACE LINK/ACT	Blinking Green	PC is communicating with chassis; confirmed with an Ethernet link pulse.
	Off	There is no activity on the link and/or an error occurred with the link connection. **Note:** This LED describes the status of the PC Ethernet connection (the activity that occurs between the PC and the Ethernet connector). The LED is green when this link is active and off when not active.
SPT SYNC MASTER	Solid Green	Chassis is acting as a Sync Master.
	Solid Amber	Chassis Sync state is in slave mode.
	Solid Red	Chassis Sync state is in error.
	Off	Chassis power is off.
SPT SYNC STATUS	Solid Green	Sync state is operational.
	Solid Amber	Chassis Sync state is in transition.
	Solid Red	Chassis Sync state is in error.
	Off	Power is turned off.

Spirent Test Module LEDs

All Spirent test modules have similar LEDs: TX/RX (port) LEDs, a LINK LED, and the STATUS LED.

STATUS LED

The STATUS LED represents the status of the test module as a whole. In general, green indicates normal operation or "ready," amber indicates a transition state, and red indicates an error condition. This table summarizes test module STATUS LED activity.

Test Module LEDs — STATUS LED

Condition	Solid	Slow Blink	Fast Blink
Green	Test is operational.	Test module is operational. At least one port group is reserved.	A hot swap request has been accepted.
Amber	At least one port group is initializing.	At least one port group is initializing. At least one port group is reserved.	N/A
Red	An error has occurred on at least one port group.	An error has occurred on at least one port group. At least one port group is reserved.	A hot swap request has been denied.
Off	Test module is ready for removal.		
	Power is off.		

TX/RX LEDs

These LEDs have different functions when the test module is initializing and when the test module is ready to transmit and receive.

Test Module LEDs — TX/RX LEDs - During Initialization

TX LED	RX LED	Description
Off	Off	Initial state.
Solid Green	Off	Port initializing.
Solid Red	Off	Port initialization error.

Test Module LEDs — TX/RX LEDs - After Initialization

LED	Condition	Description
TX	Green	Transmitting valid frame.
	Red	Transmitting error frame.
	Off	No frame is being transmitted.

LED	Condition	Description
RX	Green	Receiving valid frame.
	Red	Receiving error frame.
	Off	No frame is being received.

LINK Status LED

The LINK Status LED on the test modules indicates the Link Status condition between the test module interface and the DUT/SUT.

This table describes the LINK status LED.

Test Module LINK Status LED

Condition	Description
Solid Green	Valid link. Normal Operation.
Solid Red	No link or link error.
Off	No link.

FRAME LEDs

The FRAME LEDs on the test modules provide information about SONET/SDH framing, as shown in the following table.

Test Module LEDs — FRAME LEDs

Condition	Description
Solid Green	Valid SONET/SDH framing.
Solid Red	SONET/SDH framing error.
Off	No receive optical signal present.

LASER LEDs

The LASER (LSR) LEDs on the test modules provide information about the state of the laser, as shown in the following table.

Test Module LEDs — LASER LEDs

Condition	Description
Solid Green	Transmit laser is on.
Off	Transmit laser is off.

LOS LEDs

The Loss of Signal (LOS) LEDs on the test modules provide information about the state of the received laser signal, as shown in the following table.

Test Module LEDs — LOS LEDs

Condition	Description
Solid Green	Receive optical laser signal detected.
Off	Receive optical laser signal not detected.

Chapter 6
Connectors and Cables

This section provides the pin assignments for the connectors on the chassis back panel, as well as the pin assignments for the cables included in the cable kit that is shipped with your chassis. Pin information for connectors located on the Spirent test modules is also provided.

Chassis Connectors and Cables

Each chassis has connectors that are used to connect the chassis to a PC (serial or Ethernet connection), to another Spirent chassis, and to External Time Reference equipment. The Spirent test modules contain connectors that are used to connect DUTs/SUTs.

Connection Types

This table summarizes the types of connections used by the chassis and shows where to find further information on how these connections are used.

Note: Spirent hardware installation information is published in *Getting Started with Spirent TestCenter*, delivered in pdf format on the installation DVD and available for download from the Spirent Communications Support Services (CSC) website. Type the title of the manual in the search box or type **DOC10032**.

Connection Types and Information References

Connection Type	For information, refer to:
Multiple chassis connections	Select **Multiple Chassis Connections** in the navigation pane in this reference.
Serial and Ethernet connections	See *Getting Started with Spirent TestCenter*
Power connections	See *Getting Started with Spirent TestCenter*
DUT/SUT connections	See *Getting Started with Spirent TestCenter*
Test module connections	See *Getting Started with Spirent TestCenter*

See the **User Documentation** section for documentation descriptions and download instructions.

Power Connector

The Power connector on the chassis connects to the 4-foot power cable that is shipped with the chassis. This cable contains a polarized connector and connects the Spirent chassis to an AC wall socket.

SPT SYNC IN and SPT SYNC OUT Connectors

These connectors are used to interconnect multiple Spirent chassis. The SPT SYNC OUT on the Sync Master is connected to the SPT SYNC IN on the Sync Slave. For longer multiple chassis chains, the SPT SYNC OUT on the Sync Slave is connected to the SPT SYNC IN of the next Sync Slave. This connection arrangement can theoretically accommodate up to 255 chassis. Each release of Spirent TestCenter is physically validated with a chain of 18 chassis synchronized.

External Time Reference (ETR) Connectors

The Spirent chassis contains these connectors that are currently supported for use with External Time Reference (ETR) equipment connections: the EXTERNAL TIME REFERENCE SERIAL DCE connector (DB9); the EXTERNAL TIME REFERENCE 10 MHz connector (BNC); and the EXTERNAL TIME REFERENCE 1 PPS connector (BNC).

NOTES:

- The BITS IN connectors are not currently enabled for use with ETR equipment
- Refer to FAQ18073 for information about External Time Reference (ETR) methods you can use to sync multiple remote chassis. Type **FAQ18073** in the CSC Search box. Press Enter.

EXTERNAL TIME REFERENCE SERIAL DCE

This table lists the pin assignments for the EXTERNAL TIME REFERENCE SERIAL DCE (DB9) connector.

EXTERNAL TIME REFERENCE SERIAL DCE Pin Assignments

Pin	Signal
1	Pin 4, 6
2	GPS TXD
3	GPS RXD
4	Pin 1, 6
5	GPS GND
6	Pin 1, 4
7	GPS CTS
8	GPS RTS
9	NC

EXTERNAL TIME REFERENCE 10MHz

This table lists the pin assignments for the EXTERNAL TIME REFERENCE 10MHz (BNC) connector.

EXTERNAL TIME REFERENCE 10MHz Pin Assignments

Pin	Signal
1	10MHz CLOCK IN
2	Shield/Signal return

EXTERNAL TIME REFERENCE 1 PPS

This table lists the pin assignments for the EXTERNAL TIME REFERENCE 1 PPS (BNC) connector.

EXTERNAL TIME REFERENCE 1PPS Pin Assignments

Pin	Signal
1	1PPS CLOCK IN
2	Shield/Signal return

BITS IN

Note: The BITS IN (RJ-45) connector is not currently enabled.

1588 (RJ-45) Connector

This table lists the pin assignments for the 1588 (RJ-45) connector.

1588 (RJ-45) Pin Assignments

Pin	Signal
1	TXRX D0+
2	TXRX D0-
3	TXRX D1+
4	TXRX D2+
5	TXRX D2-
6	TXRX D1-
7	TXRX D3+
8	TXRX D3-

Ethernet Connector and Cables

Each Spirent chassis contains an Ethernet connector that is used to connect a PC to the chassis or to a network. (See *Getting Started with Spirent TestCenter* for the location of this connector.) The cable kit shipped with your chassis includes two types of Ethernet cables to make this connection.

See the **User Documentation** section for documentation descriptions and download instructions.

This section provides the pin assignments for the chassis' Ethernet connector, and for the two Ethernet cables.

ETHERNET INTERFACE Connector

This table lists the pin assignments for the ETHERNET INTERFACE (RJ-45) connector.

ETHERNET INTERFACE Pin Assignments

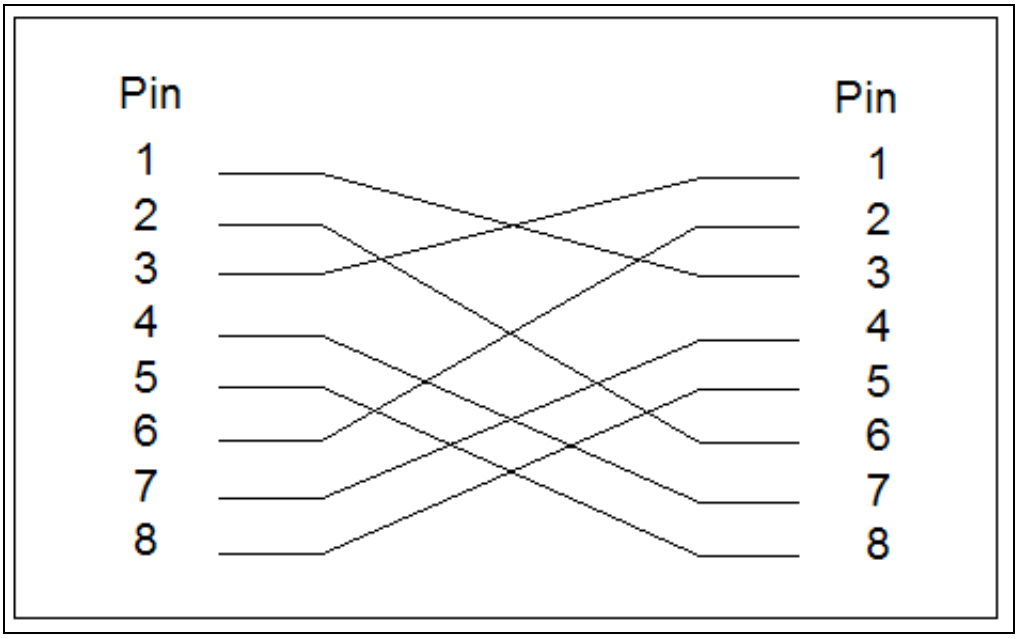
Pin	Signal
1	TXRX D0+
2	TXRX D0-
3	TXRX D1+
4	TXRX D2+
5	TXRX D2-
6	TXRX D1-
7	TXRX D3+
8	TXRX D3-

Ethernet Cables

Two Ethernet cables are shipped with the Spirent chassis. The crossover cable is used to directly connect a PC to the chassis. The straight-through cable is typically used to connect the PC to a hub or network.

Unless otherwise specified, the Ethernet cables use 4-pair, Category 5 unshielded twisted pair (UTP) cables with a patch length of one meter used between the RJ-45 connectors.

Ethernet Crossover Cable



Ethernet Straight-through Cable

Serial Connector and Cables

The chassis serial connector is used for the PC (console). Refer to *Getting Started with Spirent TestCenter* for the location of this connector on your chassis.

See the **User Documentation** section for documentation descriptions and download instructions.

CONSOLE SERIAL DCE Connector

This table lists the pin assignments for the CONSOLE SERIAL DCE (DB9p [pin]) connector.

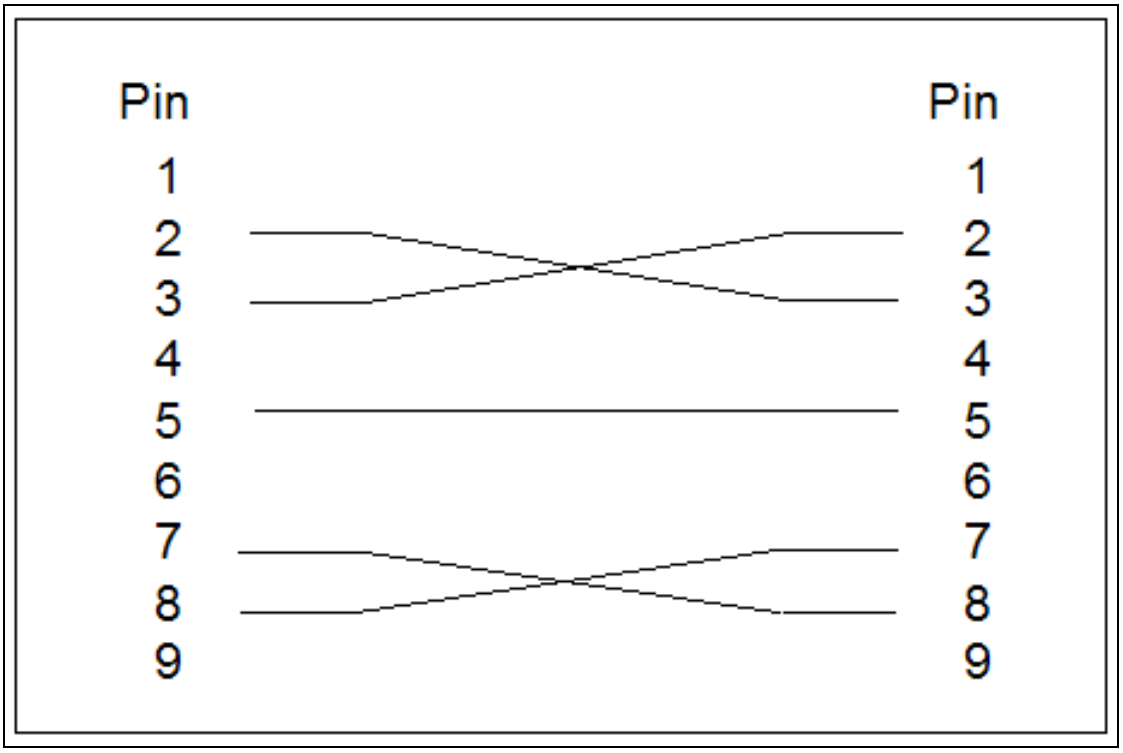
CONSOLE SERIAL DCE Pin Assignments

Pin	Signal
1	Pins 4, 6
2	CONSOLE TXD
3	CONSOLE RXD
4	Pins 1, 6
5	GND
6	Pins 1, 4
7	CONSOLE CTS
8	CONSOLE RTS
9	NC

Serial Cables

Two serial cables are included with the Spirent chassis. The null-modem cable is used to connect a PC (DCE console) to the chassis.

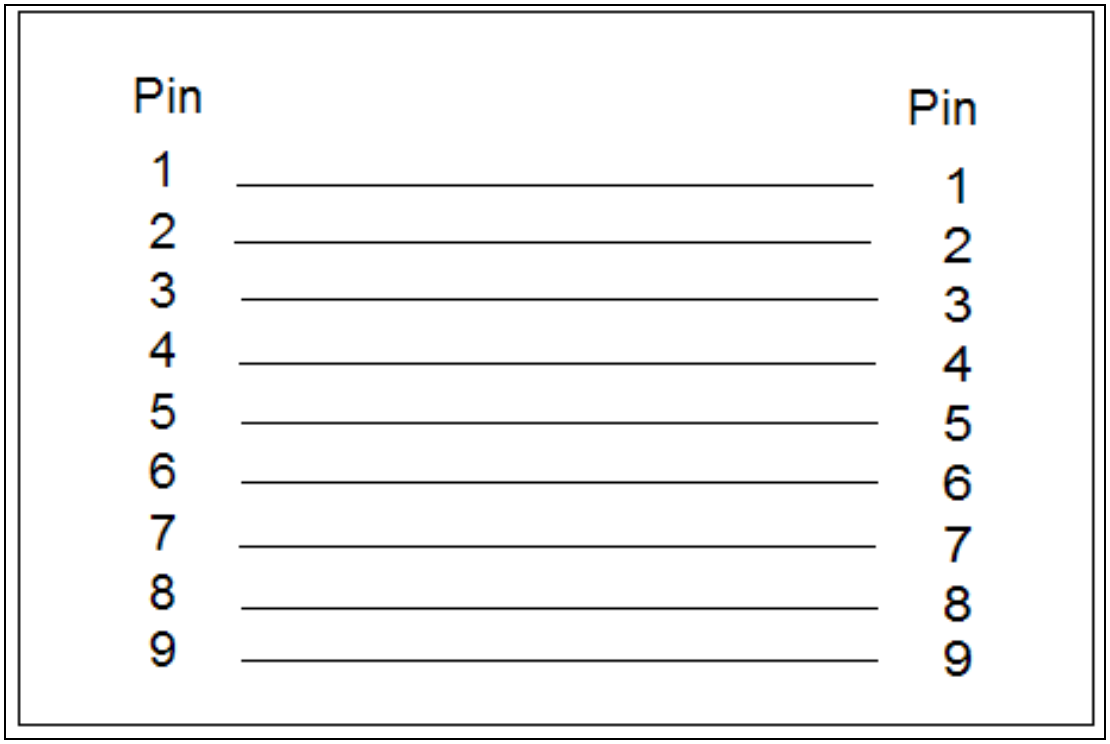
Serial Null-Modem Cable



Note: Pin 4 can connect to Pin 6, but it is ignored by the Spirent chassis.

The straight-through cable is used to connect a PC (DTE console) to the chassis.

Serial Straight-Through Cable



DB9 to DB25 Adapter Connector

Your Cable Kit contains two adapters that are used to adapt a DB25 connection to a DB9 connection. The adapter allows you to use the DB9 connector on your null-modem or straight-through serial cable that is described in the *Serial Cables* section.

Test Module Connectors

The tables in this section list the pin assignments for the port connectors on the test modules.

Copper Ports

This table lists the pin assignments for the RJ-45 connector located on the test modules.

RJ-45 Connector Pin Assignments

Pin	Signal
1	MX_ 0+
2	MX_ 0-
3	MX_ 1+
4	MX_ 2+
5	MX_ 2-

Pin	Signal
6	MX_ 1-
7	MX_ 3+
8	MX_ 3-

Fiber Ports

The fiber ports on the test modules use connectors and cables with the following specifications:

- LC Fiber, multi-mode and single mode, 850nm
- LC Fiber, single mode, 1310nm
- LC Fiber, single mode, 1550nm

TRIG OUT and TRIG IN Connector

Note: The CLOCK IN and CLOCK OUT connectors and the TRIG OUT and TRIG IN connectors are not currently supported.

CLOCK Connector

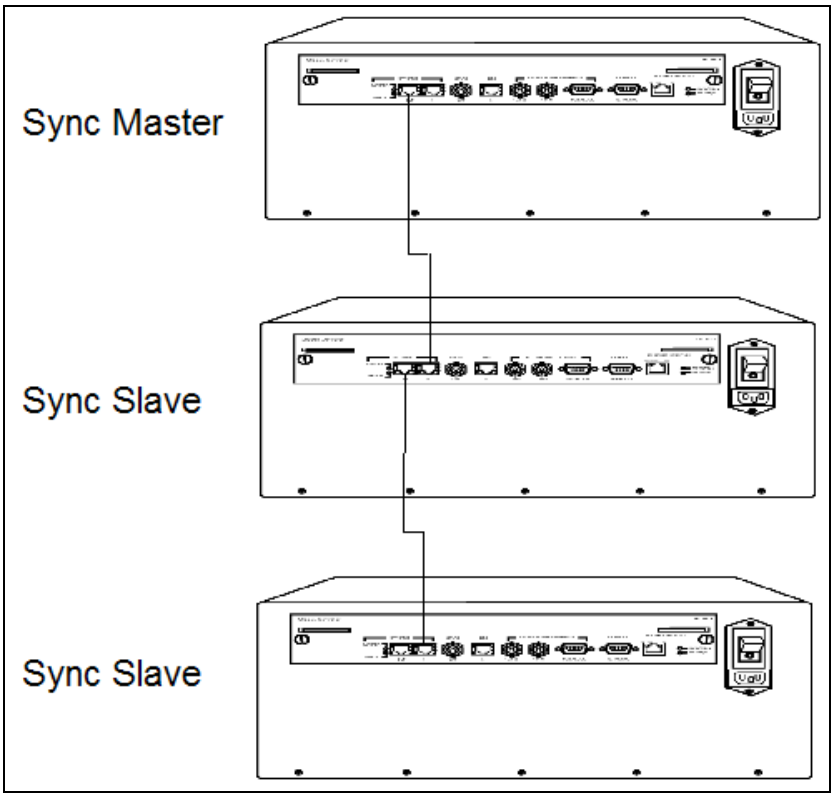
Note: The CLOCK IN and CLOCK OUT connectors and the TRIG OUT and TRIG IN connectors are not currently supported.

Chapter 7
Multiple Chassis Connections

Spirent systems can consist of a single chassis, multiple chassis, or a combination of single and multiple chassis. The maximum configuration size for any of these combinations is 255 chassis. Physical verification of Spirent TestCenter releases are conducted with a chain of 18 synchronized chassis.

For synchronization purposes, each chassis is logically considered to be a *Sync Master* or a *Sync Slave*. A single chassis defaults to Sync Master status. This occurs regardless of whether the chassis is a standalone Spirent system or part of a multiple branched, multiple chassis Spirent system.

Legacy Chassis Connection



The Sync Master and Sync Slave designations are determined by looking at the MASTER LED located on the chassis back panel, and at the associated inter-chassis sync cable connections. The MASTER LED is green if a chassis is a Sync Master and is off if the chassis is a Sync Slave. Refer to the LED Indicators section for more information on chassis front panel and back panel LEDs.

Understanding which chassis are Sync Masters and Sync Slaves is needed in order to determine which clock on which chassis is used for synchronization. Synchronization refers to the matching of clocks from each chassis so that the entire chain of chassis is synchronized to one time source. In multiple chassis configurations, a priority list of clocks is used to determine how the Spirent system is synchronized. Refer to the Determining Cable Length and Clock Priority section for detailed information.

Note: The following rules must be followed to ensure proper multiple chassis connections, synchronization, and correct test results.

- The SYNC OUT and SYNC IN connectors are only for use in interconnecting linear strings of Spirent chassis. Connecting any other device to these connectors may damage both the chassis and other equipment.
- Care should be taken to not connect the chassis into a looping topology. Although doing so should not cause permanent damage to the chassis, such a topology will inhibit the associated chassis from synchronizing.
- When using a multiple chassis configuration, you must use a synchronous Category 5 straight-through (not crossover) cable to connect the chassis. The use of the synchronous cable is required for overall test results to be accurate. This applies not just to latency test results, but to all test results.
- The maximum total aggregate cable length interconnecting all Spirent chassis is 400 feet. See the **Cable Length** section for more information on how determine the lengths of the inter-chassis sync cable(s).
- The synchronized clock and control information passing through the connected chassis do not require specific power sequencing of individual chassis. Nonetheless, it is recommended that after all chassis are powered up, you use the Spirent TestCenter Application *Equipment View* window (*Time Sync* tab) to confirm the connectivity and assignments of the Sync-Master and Sync Slave(s) before testing.
- If sync cables are moved while users are connected to the chassis, the sync status will not change until all users disconnect from the chassis. For example, if there are three chassis in a chain: chassis 1, chassis 2, and chassis 3; chassis 1 is the master and chassis 2 and 3 are the slaves. In this example, a user connects to a card/cookie on chassis 2 while the sync chain is in place. If the sync cable between chassis 1 and 2 is removed, chassis 2 will not become the master until the user (or all users) disconnects from the chassis. This is to prevent sync problems from occurring.

Terminology for Multiple Chassis Connections

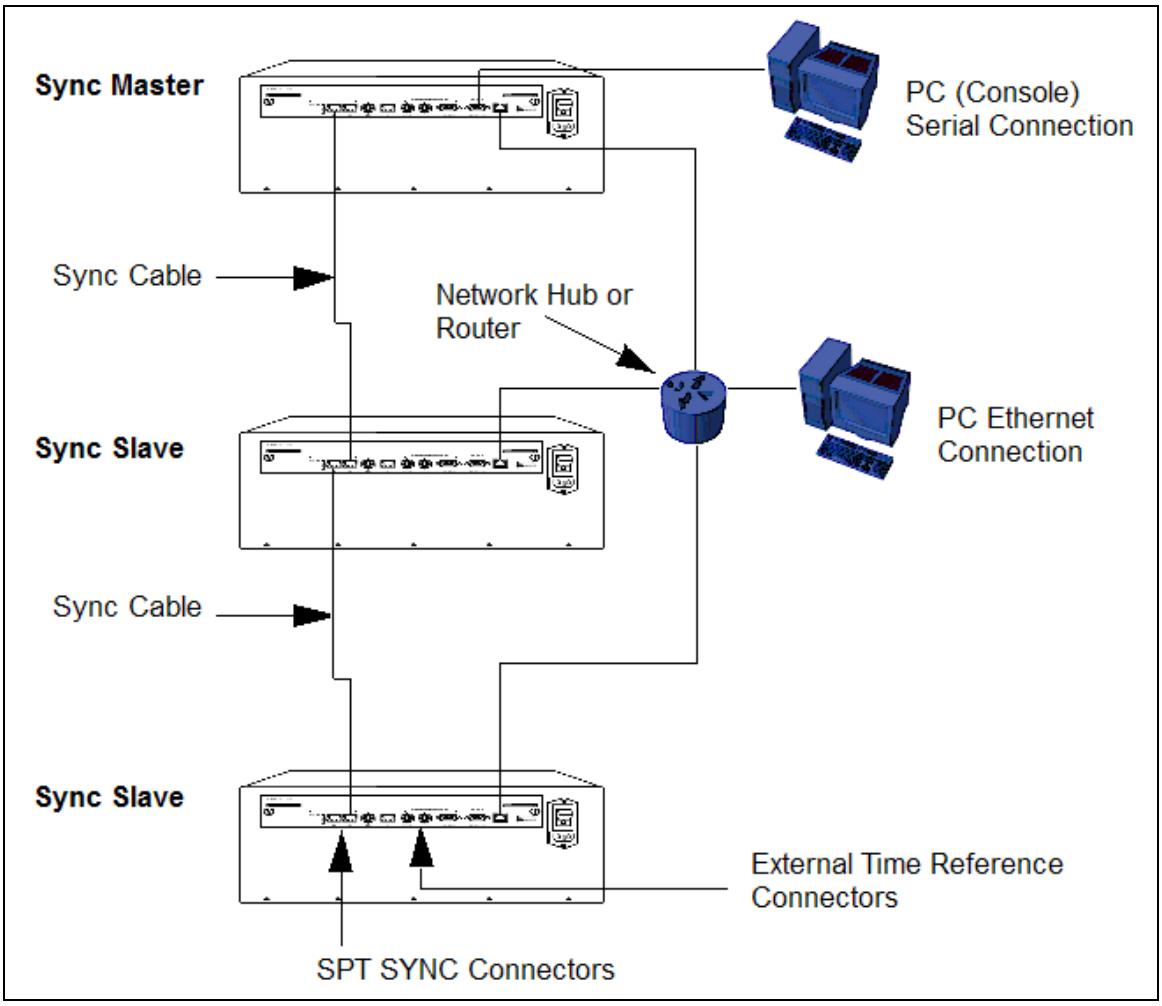
Descriptions of the terms involved in multiple chassis connections are listed below. The figure that follows the list shows a typical multiple chassis arrangement.

- Sync Master – The chassis at the head of the synchronization chain. Responsible for providing synchronization signals to all downstream Sync Slaves.
- Sync Slave – Any chassis that is downstream from the Sync Master. Receives the synchronization information from the Sync Master, often through other Sync Slaves.
- Sync cable – A cable that is used to interconnect two or more chassis. These can be Sync Master/Sync Slave or Sync Slave/Sync Slave combinations.
- SPT SYNC IN – An input connector located on the chassis back panel that is used to connect a sync cable. Any chassis connected to the SYNC IN connector is said to be upstream from the chassis. The chassis that is the furthest upstream, is the Sync Master of the chain.
- SPT SYNC OUT – An output connector located on the chassis back panel that is used to connect a sync cable. Any chassis connected to the SYNC OUT connector is said to be downstream from the chassis. All downstream chassis are Sync Slaves of the chain.
- MASTER and STATUS – Two LEDs that describe the topology and state of an individual chassis in a multiple chassis configuration. See the **LED Indicators** section for a description of these LEDs.
- PC (Console) – A personal computer or workstation connected to the serial console interface of a chassis. Refer to *Getting Started with Spirent TestCenter* for connection instructions.

- PC – A personal computer or workstation connected to the Ethernet interface of a chassis, often through a hub or a switch. Refer to *Getting Started with Spirent TestCenter* for connection instructions.
- External Time Reference (ETR) – An external clock source used for synchronization. Refer to **FAQ18073**, available on the Customer Service Center Knowledge Base.

See the **User Documentation** section for documentation descriptions and download instructions.

Typical Multiple Chassis Arrangement



Types of Multiple Chassis Configurations

There are many possible chassis arrangements in a multiple chassis system. Two of these configurations are described in this section:

- Single location with one chain of multiple chassis
- Single location with two chains of multiple chassis

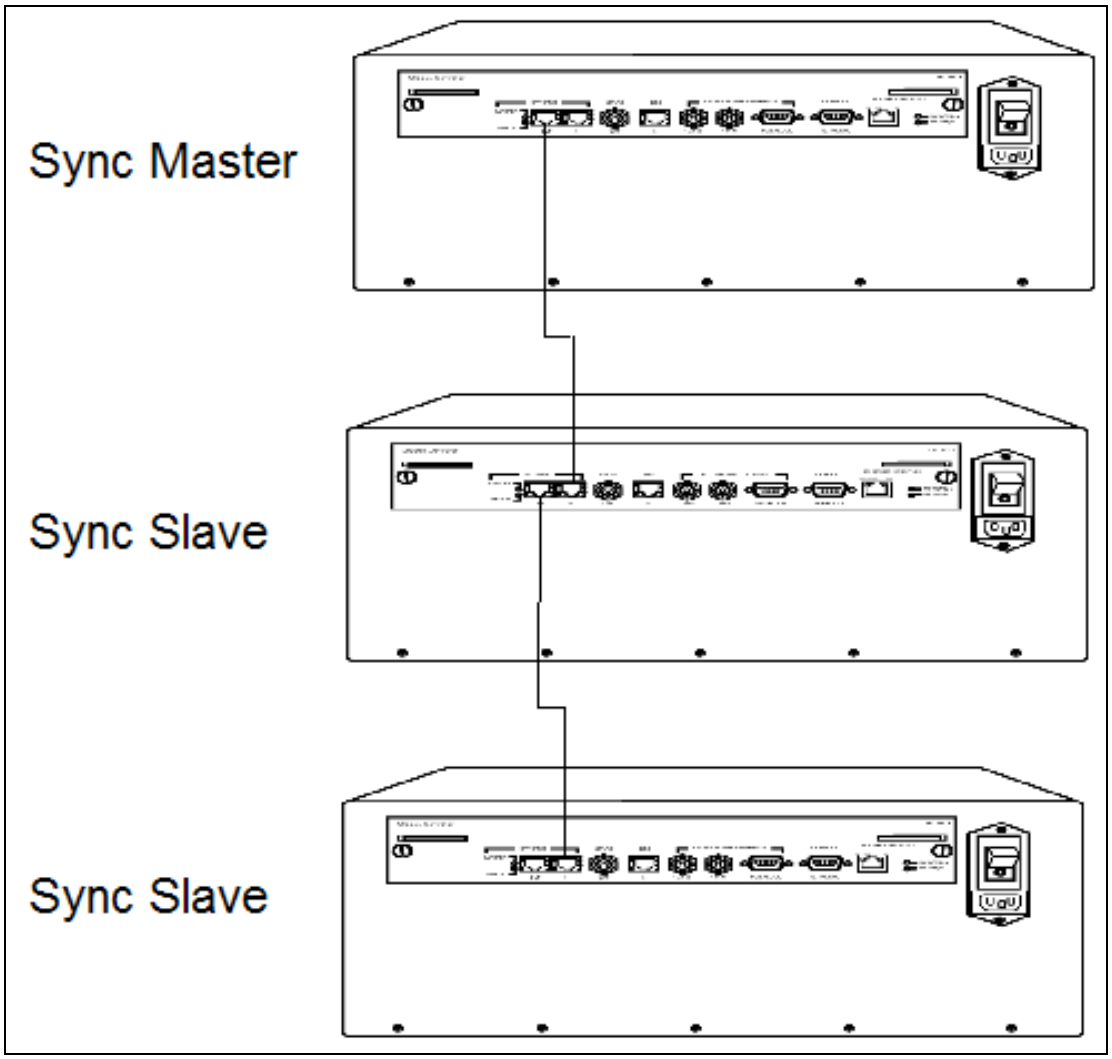
Before beginning either installation procedure, refer to the Cable Length section to determine the length of each inter-chassis sync cable and to the Clock Priority section for more information on the chassis synchronization process.

Setting Up a Single Location with One Chassis Chain

This explains how to set up a single location that contains one chassis chain.

The chassis chain consists of two Sync Slaves and a Sync Master.

One Chassis Chain: One Sync Master and Two Sync Slaves



1. Ensure that power to the chassis and PC(s) is turned off.
2. Ensure that all cables are disconnected from the chassis and PC(s).
3. Ensure that the Sync Master and Sync Slave(s) are on a stable surface.
4. Install the interconnection cable from the SPT SYNC OUT connector of the Sync Master to the SPT SYNC IN connector on the first Sync Slave.
5. Install a second interconnection cable from the previous Sync Slave SPT SYNC OUT connector to the SPT SYNC IN connector on the next Sync Slave.
6. Use either of the following options to connect a PC to each chassis. (See *Getting Started with Spirent TestCenter* for cable installation information.)
   Attach a PC to the ETHERNET INTERFACE connector of the chassis.
   Attach a PC to the CONSOLE SERIAL DCE connector of the chassis.
7. Determine if an External Time Reference (ETR) is needed for the Sync Master.

   Note: If you are using an ETR, be sure that you understand how it relates to the synchronization of the entire multiple chassis configuration. The priority of clocks in synchronizing the system is explained in the Clock

Priority section.

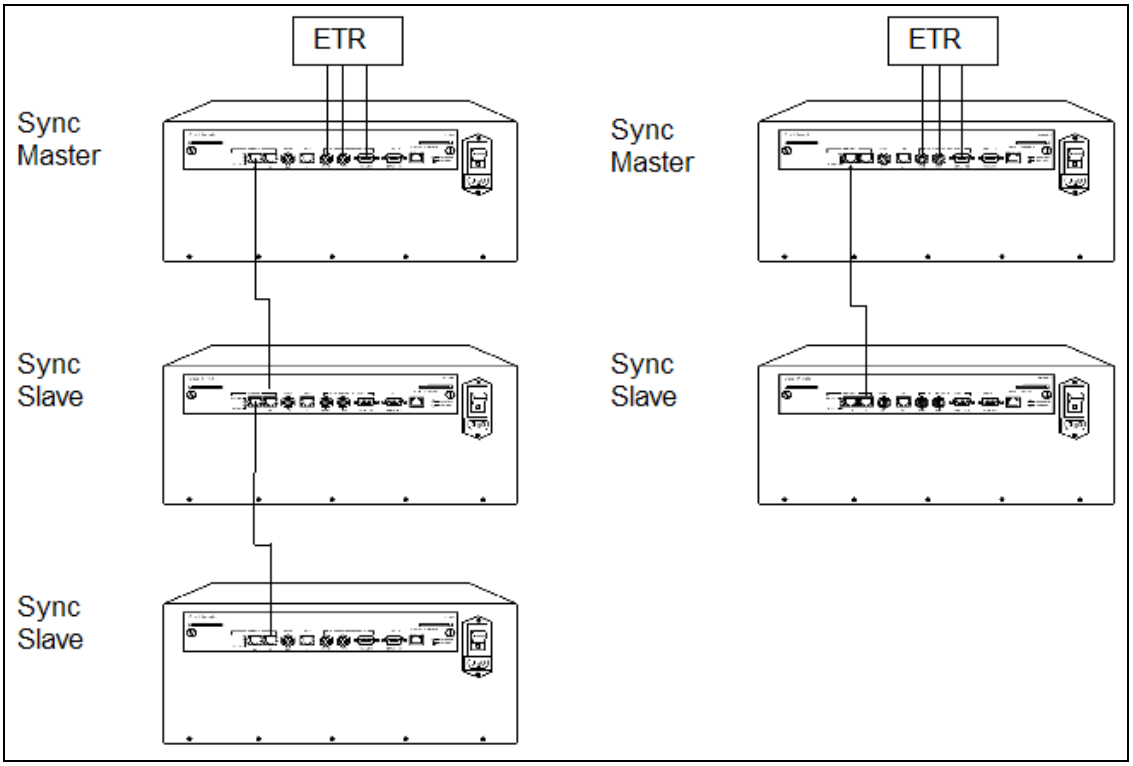
8. Install test modules into each chassis, as needed.
   See *Getting Started with Spirent TestCenter*.
9. Connect the test module(s) to a DUT/SUT.
   See *Getting Started with Spirent TestCenter*.
10. Connect and apply power to the chassis.
    See *Getting Started with Spirent TestCenter*.
11. Apply power to the PC (console or Ethernet connection) and optionally to the DUT.
12. Configure and run tests as needed.

    Refer to **FAQ18073** for information about External Time Reference (ETR) methods you can use to sync multiple remote chassis. Type FAQ18073 in the CSC Search box. Press Enter.

Setting Up a Single Location with Multiple Chassis Chains

This procedure explains how to set up a single location that contains more than one chassis chain. This typically occurs when the chains are installed at separate locations. When more that one chassis chain is used, each Sync Master must be connected to an External Time Reference (ETR) for clocking purposes.

Environment with Two Sync Master/Sync Slave Chains



1. For the first chassis chain, follow steps 1 through 6 of the procedure described under Single Location with One Chassis Chain.
2. Connect an External Time Reference (ETR) to the Sync Master chassis of the chassis chain.
   An ETR is required in this situation.
3. Perform steps 8 through 12 of the procedure described in the Single Location with One Chassis Chain section.

4. Repeat this procedure for each chassis chain.

   Refer to **FAQ18073** for information about External Time Reference (ETR) methods you can use to sync multiple remote chassis. Type FAQ18073 in the CSC Search box. Press Enter.

Cable Length and Clock Priority

The Spirent system is designed to support up to 255 chassis (Physical release validation conducted with a chain of 18 synchronized chassis). Each chassis supports several potential clock references.

Cable Type

Any standard straight-through Ethernet cable can be used for Spirent multiple chassis connections. Color coding for these cables is recommended to reduce cable confusion. Your Spirent chassis is shipped with a 3-foot purple cable for a multiple chassis connection.

Cable Length

The cable that connects two Spirent chassis is called a sync cable. One of these cables comes with your Cable Kit (see *Getting Started with Spirent TestCenter*). The maximum length of this cable is 400 feet. When synchronizing many chassis, it is recommended that you use the shortest cable length possible.

See the **User Documentation** section for documentation descriptions and download instructions.

Clock Priority

The Spirent chassis support several different types of clock references: inter-chassis sync; External Time Reference (ETR), such as GPS or CDM; Network Time Protocol (NTP), or an internal clock source.

The Spirent system provides synchronization for test data and communications within and between chassis. This synchronization is dependent upon the number of chassis connected and the optional use of an ETR device. In multiple chassis configurations, the clock used on the Sync Master is the one used for the entire multiple chassis configuration. This arrangement guarantees synchronization between the Sync Master and Sync Slaves.

Refer to **FAQ18073** for information about External Time Reference (ETR) methods you can use to sync multiple remote chassis. Type FAQ18073 in the CSC Search box. Press Enter.

Clock Priority

Priority	Sync Master Clock	Description
1	Inter-chassis	This requires that Sync Slaves always reference the clock source used by the Sync Master.
2	ETR	This requires installation of an optional External Time Reference (ETR) clock.
3	NTP	This requires that the Internet be reachable from the chassis.
4	Internal	The internal Real-Time Clock provides the initial Epoch, and an internal oscillator provides sub-second accuracy.

Chapter 8
Chassis Commands

This section describes the commands that are used to configure Spirent chassis system parameters. Refer to *Getting Started with Spirent TestCenter* for a description of how these commands are used in PC/console and Telnet connections.

About Chassis Commands

There are two levels of users of the Spirent chassis commands: guest and administrator

The commands available to each user type are listed in the following sections.

Note: The Spirent chassis is controlled from a main controller board.

- Controller 3 = CTL-N4U for the SPT-N4U, CTL-N11U for the SPT-N11U-110/SPT-N11U-220 and SPT-N12U-110/SPT-N12U-220 chassis

Controller version 2 firmware continues to be supported, but the chassis that support controller version 2 are obsolete, and not are not included in this document.

Guest User

A guest user of the Spirent TestCenter command set has read-only privileges. Guest users cannot configure chassis parameters, such as the IP address or gateway address

The login name and password for a guest user are as follows:

- Login name: guest
- Password: guest

The commands that are available to guest users are listed in the following table.

Guest Commands

Controller 2 Command	Description
agile41	Displays the chassis 41 level part number.
agile80	Displays the chassis 80 level part number.
bpagile41	Displays the chassis backplane version.

Controller 2 Command	Description
chsagile80	Displays the chassis part number.
gwaddress	Displays the chassis gateway address.
gw6address	Displays the chassis IPv6 gateway address.
help	Displays a list of available commands.
help <command name>	Displays help for a particular command.
hostname | hostnm	Displays the chassis host name.
ipaddress	Displays the IP address of the chassis host network interface.
ipv6address	Displays the IPv6 address of the chassis host network interface.
logout	Logs out and exits.
macaddress	Displays the MAC address of the chassis host network interface.
netmask	Displays the subnet mask for the chassis host network interface.
ping [option]... <IPv4 hostname or address> Options: -c <count> -s <size in bytes> -q	Send ICMP ECHO_REQUEST packets to an IPv4 network host. The default size is 56 bytes. The -q option is quiet mode. It only displays output at the start and when finished.
ping6 [option]... <IPv6 hostname or address> Options: -c <count> -s <size in bytes> -q	Send ICMPv6 ECHO_REQUEST packets to an IPv6 network host. The default size is 56 bytes. The -q option is quiet mode. It only displays output at the start and when finished.
reboot	Reboots the chassis controller and all test modules.
serialno	Displays the chassis serial number.
showall	Shows all current configuration settings.
version	Displays the version of the chassis operating system.

Administrator User

An administrator user of the Spirent TestCenter command set has read-write privileges, allowing the user to check and change chassis parameters (IP address, gateway address, subnet mask, and so on).

The login name and password for an administrator user are as follows:

- Login name: admin
- Password: spt_admin

The commands that are available to administrator users are listed in the following tables.

Administrator Commands - Controller 2

Controller 2 Command	Description
activate	Shuts down the Ethernet interface; reloads the IP address, subnet mask, gateway address, and host name; applies the settings to the running environment; and then restarts the Ethernet interface.
agile41	Displays the chassis 41 level part number
agile80	Displays the chassis 80 level part number
bpagile41	Displays the chassis backplane version.
chsagile80	Displays the chassis part number.
date <Month Day, Year hour:min:sec>	Sets the local system time. Use Universal Coordinated Time (UTC), not a date based on your local time zone. Example: date March 31, 2013 22:14:00
gwaddress	Displays the chassis IPv4 gateway address.
gwaddress <IPv4 address>	Configures the chassis IPv4 gateway address.
gw6address	Displays the chassis IPv6 gateway address.
gw6address <IPv6 address>	Configures the chassis IPv6 gateway address.
help	Displays a list of available commands.
help <command name>	Displays help for a particular command.
hostnm | hostname	Displays the chassis host name.
hostnm <host name> | hostname <host name>	Configures the chassis host name.
ipaddress	Displays the IPv4 address of the chassis' host network interface.

Controller 2 Command	Description
ipaddress <IPv4 address>	Configures the IPv4 address of the chassis' host network interface.
ipv6address	Displays the IPv6 address of the chassis' host network interface.
ipv6address <IPv6 address>	Configures the IPv6 address of the chassis' host network interface.
logout	Logs out and exits.
macaddress	Displays the MAC address of the chassis' host network interface.
macaddress <MAC address>	Configures the MAC address of the chassis host network interface.
netmask	Displays the subnet mask for the chassis host network interface.
netmask <subnet mask>	Configures the subnet mask for the chassis host network interface.
ntp client <command> ntp server <command> [address]	Network Time Protocol. There are two sets of commands: client and server. Client commands: • status - Display information on the NTP daemon and Spirent processes. • enable - Start the NTP process if it is not already running. • disable - Stop the NTP service if it is running. Server commands: • list - Display a summary of current servers. • summary - Same as list. • add <address> - Add a time server to the pool used by the NTP daemon (ntpd). • del <address> - Delete a time server from the pool used by ntpd. • status <address> - Display status information for the specified server.
ping [option]... <IPv4 hostname or address> Options: -c <count> -s <size in bytes> -q	Send ICMP ECHO_REQUEST packets to an IPv4 network host. The default size is 56 bytes. The -q option is quiet mode. It only displays output at the start and when finished.
ping6 [option]... <IPv6 hostname or address>	Send ICMPv6 ECHO_REQUEST packets to an IPv6 network host. The default size is 56 bytes. The -q option is quiet mode. It only displays output at the start and when finished.

Controller 2 Command	Description
Options: -c <count> -s <size in bytes> -q	
reboot	Reboots the chassis controller and all test modules.
serialno	Displays the chassis serial number.
showall	Shows all current configuration settings.
version	Displays the version of the chassis operating system.

Administrator Commands - Controller 3

Controller 3 Command	Description
activate [[<deviceName>] <ipaddress> <netmask> <gwaddress>] | [dhcp] | [ipv6 [<deviceName>] <ipv6address> <ipv6gwaddress>]	Save and activate the network configuration
authenticate [on | off | reset]	Enable | Disable | Reset authenticate mode
console <vm name>	Connect to a Virtual Machine's (VM) console
date [MMDDhhmm[[CC]YY][.ss]]	Show or set the date. e.g. date 01312359
dns <add> <address1> <address2> | <delete>	Set the static DNS servers
etr [command]	Query the sync status and set the learning range for ETR devices
etrsend [command]	Send a command to an external ETR device
exit	Exit
gwaddress <address>	Change the gateway address for the device
help	List all commands
hostname	Display or change the system hostname
ipaddress <address>	Change the IP address for the device
ip6address <address>	Change the address for the IPv6 device

Controller 3 Command	Description
ipv6gwaddress <address>	Change the gateway address for the IPv6 device
listvms	List the running VMs (Virtual Machines)
logout	Log out
macaddress	Display the MAC address
mode <static | dhcp>	Set the address mode to either static or dhcp
netmask <address>	Change the netmask for the device
network	Show the current network settings
ntp	Display or change the ntp settings
password	Change the password
ping <ipaddress>	Ping an IPv4 address
ping6 <ip6address>	Ping an IPv6 address
ptp	Display or change the ptp settings
reboot	Reboot the system
recovery <chassis | tm> <enable | disable>	Enable or disable Chassis or Test Module Recovery (This feature is not available on all cards.)
resetnetwork	Reset the network settings to the factory defaults
restartsysmgr	Restart the system manager
rmslot <slot number>	Remove slot context of <slot number>
securemode [on|off]	Enable or disable the secure mode setting
serialno	Display the chassis serial number
shutdown	Shut down the system
status	Show the status summary
standby_version	Displays the version of the standby partition (non-active)
switch_version	Switches to the standby partition and reboots the system
synccheck <enable|disable>	Enable or disable the sync status and chassis chain topology

Controller 3 Command	Description
	invariant check prior to any apply on the Spirent TestCenter application side
uptime <enable|disable>	Enable or disable tracking the uptime for each portgroup in the chassis
version	Display the current version

Chapter 9
Troubleshooting

This section provides troubleshooting help for common problems.

Basic Problems

This information in this table offers troubleshooting tips and solutions for basic chassis power problems.

Troubleshooting – Basic Problems

Symptom	Possible Cause	Suggested Action
Chassis power fault – POWER LED on chassis front panel is OFF	Chassis is not powered on.	Check that the power cable between the chassis and the power source is installed properly. Check that power is available from the source and is within nominal margins. Check that the AC master power switch on the chassis back panel is in the ON position. Check that the DC power button (labeled POWER) on the chassis front panel is pressed IN.

PC Connection Problems

The information in this section offers troubleshooting tips and solutions for problems with the PC connection to the chassis, including:

- PC connection to the CONSOLE SERIAL DCE connector
- PC connection to the ETHERNET INTERFACE connector.

A serial connection is typically used when setting up the chassis. As an alternative, an Ethernet connection can be used during setup, and it is also used for post-setup operations.

PC Serial Connection

This table provides information that will help you troubleshoot and fix problems related to the connection between the PC and the CONSOLE SERIAL DCE connector on the chassis back panel.

Troubleshooting – PC Serial Connection

Symptom	Possible Cause	Suggested Action
Cannot connect	Controller module is not seated properly.	Turn off power, secure controller module, and reset.
	Wrong cable	Change cable (see *Getting Started with Spirent TestCenter* and the **Connector and Cable Information** section.
	Wrong speed and data format	Make sure that the PC connection is set for RS-232, 9600 baud, 8 data bits, 1 start bit, 1 stop bit, no parity, and no flow control. (see *Getting Started with Spirent TestCenter* and the **Connector and Cable Information** section)
	Wrong COM port	Check that the serial cable is connected to the same COM port that you selected in the HyperTerminal dialog. See *Getting Started with Spirent TestCenter*.

See the **User Documentation** section for documentation descriptions and download instructions

PC Ethernet Connection

The following table provides information to help you troubleshoot and fix problems related to the connection between the PC and the ETHERNET INTERFACE connector on the chassis back panel.

The PC is used to set up the chassis and interface with the test modules. The status of the PC Ethernet connection is displayed by the 10/100 Mbps, 1000 Mbps, LINK/ACT, and FDX LEDs on the chassis back panel, as well as the STATUS and LINK LEDs on the chassis front panel (see the **LED Indicators** section for descriptions of test module LED indicators).

Troubleshooting – PC Ethernet Connection

Symptom	Possible Cause	Suggested Action
Cannot connect	Wrong cable.	Change cable and retry.
Cannot access chassis – chassis does not respond to ping	Chassis is not powered on (no LEDs on the chassis front panel are ON).	See Chassis power fault in the table titled Troubleshooting – Basic Problems.
	Chassis is not connected to the same network as the host PC.	Check network topologies and connections between the host PC and the chassis. Use PING or TRACEROUTE to verify intermediate routing and cable connectivity. If you cannot ping an chassis on another subnet, try pinging the Gateway to be sure it is alive and at the IP address you have configured. Try pinging other nodes on the other subnet. If a ping to other nodes succeeds, the chassis may be malfunctioning. If a ping to other nodes does not succeed, the PC may be malfunctioning.
	The chassis' Ethernet interface is not configured properly (the LINK LED on the chassis front panel may be	If possible, observe the LINK LED on the chassis front panel (see the **LED Indicators** section).

Symptom	Possible Cause	Suggested Action
	OFF).	Connect a terminal (or PC running a terminal emulator) to the chassis' console port. Check/configure the chassis controller's IP address, default Gateway, and IP subnet Netmask. Confirm that the chassis's Ethernet interface does not conflict with another device on the network.
Unable to reach the remote host	Wrong IP address, wrong cable	If you receive this message, try pinging the chassis. Check the IP address that you entered and make sure it is the same IP address that you set on the chassis. Check that cables are connected properly and are the correct type.
Frequent loss of connection with chassis and/or test modules	Noisy Ethernet connection	Check to ensure that the ferrite block is properly attached to the Ethernet cable connected to the controller. See *Getting Started with Spirent TestCenter.*
		Check to ensure that the Ethernet cable is of the recommended type and specification.
	The chassis' Ethernet connection is in a high-collision domain.	Consider isolating the collision domain using switches rather than hubs.

See the **User Documentation** section for documentation descriptions and download instructions.

Chassis Front and Back Panel LEDs

This table provides information that will help you troubleshoot and fix problems indicated by Spirent chassis front and back panel LEDs.

Troubleshooting – Chassis Front and Back Panel LEDs

Symptom	Possible Cause	Suggested Action
Chassis Fault Status – STATUS LED on the chassis front panel is solid red or blinking red.	Controller has detected an error condition:	
	– Duplicate IP address assignment.	Use the serial interface to check the IP address assignment, and reassign it to be unique for the subnet.
	– Fatal error on controller.	Contact Spirent Communications Support Services. Refer to *How to Contact Us* section.
	– Power fault detected by controller (for example, no 3.3V on backplane).	Contact Spirent Communications Support Services. Refer to *How to Contact Us* section.
Chassis Warning Status – STATUS LED on the chassis front panel is solid amber or	Controller is initializing (usually because of power cycle or other reset	Wait for initialization to complete.

Symptom	Possible Cause	Suggested Action
blinking amber.	condition).	
	Controller has detected an abnormal condition and is attempting recovery.	Wait for recovery to complete.
Temperature Fault – TEMP LED on the chassis front panel is red.	Ambient room temperature may be too high (should be below 15-35 degrees C).	Reduce temperature of ambient environment and/or improve air flow into the left side of the chassis and out the right side of the chassis.
	The chassis' cooling system is unable to cool chassis components sufficiently.	Check that airflow is unobstructed on both sides of the chassis. Check that all fans are operational (check the FAN LED on the chassis front panel). Check that all card slots without installed test modules are covered with blank panels.
Temperature Warning – TEMP LED on the chassis front panel is amber.	Same as for Temperature Fault, except that the temperature has not yet reached the fatal level.	Same as for Temperature Fault. Preemptive actions to reduce temperature are recommended.
Fan Fault – FAN LED on the chassis front panel is red.	One or more fans are not operating.	Check visually to see if fans are rotating.
	Improper fan connection to backplane.	Correct connection or call Spirent Communications Support Services.
Sync Topology Fault – SYNC MASTER LED on the chassis back panel is red.	Invalid sync topology (sync cable topology may be connected in a loop).	Trace sync topology and correct problem. Refer to the **Multiple Chassis Connections** section for more information.
Sync Status Fault – SYNC STATUS LED on the chassis back panel is red.	Chassis not synchronized (not aligned, not calibrated, ETR out of sync).	Use the *Equipment View* window in the Spirent TestCenter Application to check the controller's detailed synchronization status for specific fault indication, and correct.
Sync-Status Transition – SYNC STATUS LED on the chassis back panel is amber.	Chassis is synchronizing.	During chassis synchronization, the chassis' synchronization resources may be unavailable for several minutes.
		During a string synchronization, one or more of the chassis' synchronization resources may be unavailable for several minutes.

Test Modules

This table provides information that will help you troubleshoot and fix problems related to the Spirent test modules.

Troubleshooting – Test Modules

Symptom	Possible Cause	Suggested Action
Unable to access test module	The test module may have detected an error. The test module's STATUS LED will be either solid or slow blinking red.	Use the *Equipment View* window (*Test Module* tab) in the Spirent TestCenter Application to view complete test module status information.
	The test module may have been commanded to shut down for hot swap. The test module's STATUS LED will fast blink green if a hot swap request was accepted, and will be off if the test module is ready for removal.	See the **Hot Swap** section for information on hot-swap controls and indicators on the test module.
	The test module may be initializing. The test module's STATUS LED will be either solid amber or slow blinking amber.	Wait for the test module to complete initialization.
	The test module may be improperly installed.	Verify that the test module is fully inserted and that the retaining screws are fully screwed in.
The test module will not acknowledge a hot swap request.	One or more of the test module's port groups may be reserved.	Use the *Select Ports* window in the Spirent TestCenter Application to find reserved port groups. If safe, release reserved port groups. If all other measures fail, override the reservation block to force the hot swap request. See the **Hot Swap** section for information on hot swap procedures.
Audible beeping coming from test module	The test module has sensed a local over-temperature condition.	Use the *Equipment View* window (*Diagnostics* tab) in the Spirent TestCenter Application to check the chassis temperature indicators for a global concern, such as high ambient air temperature. This may be caused by blockage near the left or right side of the chassis, reducing cooling efficiency; by higher-than-desirable room temperature; or by the chassis air intake receiving exhaust air from other equipment.
Test Port Fault – TX/RX/LINK LED on the test module port is red	During test module initialization, indicates a test port initialization error.	Check the test module and/or port configuration. Reset the test module. Reload test module firmware.
	After test module initialization, indicates an error frame error.	A red TX LED means an error frame is being transmitted. Check port configuration. A red RX LED means an error frame is being received. Check port configuration. A red LINK LED means a link error occurred on the test port.

Symptom	Possible Cause	Suggested Action
		Check the cable for intermittent or improper connection. Check the port configuration.

Chapter 10
Hot Swap

This section describes the hot swap capability.

About Hot Swap

Note: To use the hot swap procedure safely for an active chassis, you must understand the sources of power used by the chassis. Refer to *Getting Started with Spirent TestCenter* for a description of AC and DC chassis power. This document is included on the Spirent TestCenter installation DVD and is included with the product download files available on the Spirent Customer Service Center website. Type **DOC10032** into the CSC Search box and press Enter.

Hot swap refers to the capability to add, remove, or exchange test modules in a powered-on chassis without affecting the operation of other test modules in the chassis.

The Spirent TestCenter administration function actively monitors the state of the chassis and will reflect any changes caused by the insertion or removal of test modules. Spirent TestCenter Base and Test Packages, however, do not recognize hot swap changes until there is a connection made to the chassis with the software. Therefore, care must be taken when performing a hot swap to make sure that “in use” test modules are not interrupted.

Test Module STATUS LED

The table below shows the activity of the STATUS LED on the test module front panel during hot swap procedures (see the front panel diagram in the **Hot Swap Procedures** section).

STATUS LED Indications for Hot Swap

Color/Status	Description
Red (Fast Blink)	Hot swap denied.
Green (Fast Blink)	Hot swap accepted.

To perform a test module hot swap, follow the instructions in the **Hot Swap Procedures** section.

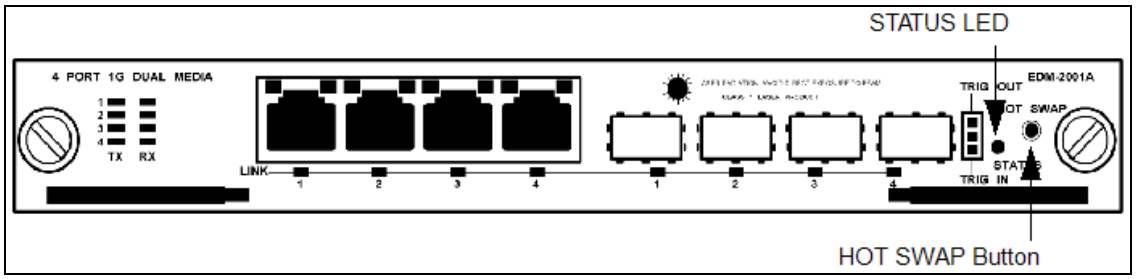
Hot Swap Procedures

The front panel of each Spirent TestCenter test module has a HOT SWAP button, located to the right of the port connectors. The button is recessed and has a spring mechanism. The button is activated by pressing it with a pointed object, such as a pen. Hot swap indications are provided by the STATUS LED, located next to the HOT SWAP button.

See the following sections for the steps to hot swap a test module under different conditions:

- Swapping a Test Module Not in Use
- Swapping a Test Module in Use
- Swapping a New Test Module

STATUS LED on Ethernet Test Modules



Hot-Swapping a Test Module Not in Use

If a test module is not in use, its available status will be indicated in the Spirent TestCenter Application *Select Ports* window. A hot swap can be easily performed on a test module.

1. Verify that the test module is not in use.
   The STATUS LED will be solid green if the test module is operational and not in use.
2. Loosen the thumb screws on the test module.
3. Press the **HOT SWAP** button on the test module for three seconds.
   The test module begins a shutdown sequence and the STATUS LED will fast blink green, indicating that the hot swap sequence has begun.
4. Wait until the STATUS LED turns off, indicating that the shutdown sequence has completed.
   It is now safe to remove the test module.
5. Remove the test module.

   Note: Once you start the hot swap sequence by pressing the HOT SWAP button, the shutdown sequence cannot be aborted. If you want to reactivate the test module, follow through with removing it, and then reinsert the test module, using the proper procedural steps

Hot-Swapping a Test Module in Use

The Spirent TestCenter Application *Select Ports* window lists the use status of each test module. The test module may be reserved for a test or performing an administrative function, such as diagnostics or firmware download. Special care must be taken when hot swapping in-use test modules, to ensure that important operations are not interrupted.

1. Verify that the test module is in use.
   The STATUS LED will slow blink green if the test module is operational and in use.
2. Before proceeding, check the in-use test module to ensure that it should be removed.
3. To remove the in-use test module, press the **HOT SWAP** button for at least three seconds.
   The STATUS LED will begin to flash red.
4. Continue to press the **HOT SWAP** button for about three seconds.
   The LED will fast blink green, indicating that the shutdown procedure has begun.

5. Wait until the shutdown procedure completes and the STATUS LED turns off.
   It is now safe to remove the test module.
6. Remove the test module.

Hot-Swapping a New Test Module

This hot swap procedure applies when inserting a test module in an existing, empty card slot.

WARNING: If fewer than the maximum number of test modules are installed in the chassis, all unused slots must be covered with the provided blank panels. This maximizes airflow inside the chassis, reduces ambient noise level, and minimizes EMI radiation.

1. Insert the test module or test module into the chassis. (Refer to *Getting Started with Spirent TestCenter* for more information.)
2. The test module begins to initialize.
   The STATUS LED will be off for about 20 seconds, and then will change to a slow amber blink while the test module is initializing.
3. When the test module finishes initializing, the STATUS LED becomes solid green. The test module is ready for use.

Forced Removal

To remove a test module without observing the proper hot swap procedure is called forced removal. The result of performing a forced removal is possible damage to the test module.

WARNING: If fewer than the maximum number of test modules are installed in the chassis, all unused slots must be covered with the provided blank panels. This maximizes airflow inside the chassis, reduces ambient noise level, and minimizes EMI radiation.

Chapter 11
User Documentation

Spirent TestCenter user documentation is available in PDF format and in online Help files:

- PDF documents are included on the Spirent TestCenter installation DVD, in the Documentation installer file (.exe) on the Customer Service Center (CSC) website *Downloads* page, and in the Knowledge Base area of the CSC website (https://support.spirent.com).
- Help files, included within Spirent TestCenter applications, provide reference and context-sensitive user support. Launch a Help file by pressing **F1** in an open application or by clicking the **Help** button in the menu bar or a dialog box.
- For your convenience, the current Help file is also available as part of the CSC Knowledge Base (DOC10335). This stand-alone Help file is fully functional.

Quick Start Guides and Installation Instructions

- *Getting Started with Spirent TestCenter*

  Provides hardware setup, software installation, and licensing instructions for Spirent customers who are receiving and installing a new Spirent TestCenter system or new hardware.

  Note: For information on the Spirent C50 appliance, refer to *Getting started with Spirent TestCenter*

- *Spirent M1 Installation Instructions*

  Provides complete instructions on the set up and use of the appliance.

- *Spirent A2-400 Installation Instructions*

  Provides complete instructions on the set up and use of the appliance.

- *Spirent B2-800 Installation Instructions*

  Provides complete instructions on the set up and use of the appliance.

- *Spirent A1-400-QD-16-T1P Installation Instructions*

  Provides complete instructions on the set up and use of the appliance.

- *Spirent A1-400-QD-16-T1P Quick Reference*

  Describes the appliance and provides information about first time use.

- *Spirent TestCenter with Spirent AION Licensing Quick Start Guide*

  Provides the steps to successfully launch Spirent TestCenter, sign in to Spirent AION, and execute a test.

- *Spirent PX3/DX3-QSFP-DD-8 Installation Guide*

  Provides complete instructions on the set up and use of the PX3/DX3-QSFP-DD-8 appliance.

- *Spirent PX3/DX3-QSFP-DD-8 Quick Reference*

  Describes the PX3/DX3-QSFP-DD-8 and provides information about using the appliance for the first time.

- *Spirent C1 Quick Reference*

  Describes the SPT-C1 and provides information about using the C1 for the first time.

- *Spirent C1 Installation Instructions*

  Provides complete instructions on the set up and use of the SPT-C1.

- *SPT-N11U/N12U Installation Instructions*

  Guides you to a safe and successful installation of the Spirent SPT-N11U/N12U chassis.

- *SPT-N11U/N12U Power Supply Installation Instructions*

  Describes the power supply installation procedure.

- Knowledge Base article *FAQ18073*

  Provides information about External Time Reference (ETR) methods you can use to sync multiple remote chassis. Go to the Customer Service Center (CSC) (https://support.spirent.com) and type **FAQ18073** in the search box. Press **Enter**.

Automation User Guides

- *Spirent TestCenter Automation Object Reference*

  Lists and describes all test configuration objects, command objects, and protocol data unit objects.

- *Spirent TestCenter Automation Overview Manual*

  Provides an overview of Spirent TestCenter Automation and how to use the Spirent TestCenter API to create a test configuration, run the test, and retrieve test results. The manual includes a description of the Spirent TestCenter software packages, the object model, and the Tcl functions in the API.

- *Spirent TestCenter Automation Programmer's Reference*

  Provides information about the Spirent TestCenter Automation API syntax and functions, how-to-use information, and examples of creating and running test configurations. Includes *API Navigator Addendum* and *TestCenter IQ Automation Addendum*.

- *Spirent TestCenter Automation HLTAPI Command Reference*

  Provides basic information about Spirent High Level Test Application Programming Interface (HLTAPI) functions. It also provides descriptions of how to use these functions and examples for creating and running test configurations.

- *Spirent TestCenter Automation HLTAPI Programmer's Reference*

  Provides installation and configuration instructions for Spirent HLTAPI. Provides information on Spirent HLTAPI features, including: Save as HLTAPI, HLTAPI Integration with Robot Framework, HLTAPI Wrapper, and Spirent TestCenter Python API Support.

- *Spirent TestCenter Automation HLTAPI Keywords*

  Provides detailed information about Spirent HLTAPI keywords for ROBOT Framework, a Python-based, extensible keyword-driven test automation framework.

Online Help Files

- Spirent TestCenter Application
- Spirent TestCenter IQ
- Spirent TestCenter Session Manager
- Spirent TestCenter Results Reporter