SierraNet™ M1288
Ethernet and Fibre Channel Protocol Test System

Analyzer Key Features

- Capture and analyze up to 128GB of Ethernet or Fibre Channel traffic at full wire transmission rate
- Deep memory buffers and pre-capture filtering for extended analysis needs
- QSFP-dd, QSFP, SFP-112, SFP-56 SFP+
- DAC, AOC, AEC and Optical module support
- Ethernet 1, 2, 4 and 8 lane support (10-800GbE)
- Fibre Channel fabrics (32/64/128GFC)
- Complete bi-directional capture of line rate traffic (800GbE)
- API for automation of test routines
  - Python scripts for popular Linux OS environments
  - Post capture, comprehensive analysis capabilities with Verification Script Engine™
- Advanced, multi-state triggering and filtering
- Comprehensive, multi-condition, multi-state Error Injection and Traffic Jamming capabilities (InFusion™)
- 2U form-factor (with available rack mount kits)
- Extensive Ethernet and Fibre Channel protocols supported, including FCoE, NVMe-oF, ORAN, PTP 1588, RoCE and iSCSI
- Multiple trace view formats
  - Summary View as a Spreadsheet or grouped by Exchanges
  - Frame Inspector View with Raw Data, Field, and Specification options
  - Traffic Summary View listing all protocols in the trace, the commands, and timing values
  - Data View for both ASCII and Hexadecimal Values
  - AN/LT and TTS Link State View including Link/State Diagram, Timeline View, and Navigation View
  - Trace Information View including the original project and settings used to capture the trace.
  - Bus Utilization View
- Seamless WireShark integration
- USB-C and Gigabit Ethernet Host Interfaces for fast upload and easy management

Probe Key Features

- 2 QSFP-DD cables to connect the DUTs or 2 OSFP cables (with field replaceable covers to support either Finned or RHS connections) to connect the DUTs
- 2QSFP-DD cables to connect to the M1288 Analyzer
- 1U form-factor (with available rack mount kits)

The Teledyne LeCroy SierraNet™ M1288 is a highly advanced, fully integrated Ethernet and Fibre Channel protocol analysis and impairment system. The SierraNet M1288 platform provides best in class traffic capture and manipulation for testing application or link characteristics. SierraNet M1288 is the latest in the line of industry leading test and measurement tools from Teledyne LeCroy, designed for today's high-speed storage and communications fabrics. SierraNet M1288 supports examination of Ethernet and Fibre Channel links utilizing both Pulse Amplitude Modulation 4 (PAM4) and legacy Non-Return to Zero (NRZ) technologies.

To achieve 100Gb Ethernet (IEEE 802.3ck) and 128Gb Fibre Channel data rates, the industry has adopted the use of PAM4 physical layer signaling technologies. PAM4 signaling offers advantages in doubling the effective data-rate, however, it has added more complexity to basic link connectivity. SierraNet M1288 leverages Teledyne LeCroy's renowned physical layer test capabilities, applying non-intrusive, high-speed probing methodologies resulting in the industry's only Layer 1 protocol capture and analysis.

Complete Coverage

The SierraNet M1288 combines the exceptional Teledyne LeCroy expertise for physical layer testing with triggering, analysis and debug functions for a wide range of current and evolving SAN and LAN specific protocols (over 100 protocols supported). The SierraNet M1288 supplies Ethernet and Fibre Channel test and validation engineers 100% complete visibility into all layers of the communication protocols.

The SierraNet M1288 supports the PAM4 signaling requirements in Ethernet and Fibre Channel communications, as well as supporting the large-scale installation of legacy NRZ based 10/25 /40/50/100 GbE and 32GFC networks and SANs. The result is the M1288 - the most versatile and capable fabric and network test and analysis platform available!

InFusion™

Teledyne LeCroy pioneered the art of "real time traffic" corruption and manipulation with the InFusion™ jamming and impairment tool software capabilities. InFusion is an integrated component of the NetProtocol Suite™ and used in conjunction with the SierraNet M1288 to provide users with intuitive and powerful tools for altering traffic and data patterns in the effort to determine the behavior of the test components. Extremely useful for problem recreation and remediation testing, the patented InFusion software may be used singularly or in automated test batch scenarios.

For example, engineers may use InFusion for the disruption of stable links to observe recovery or fail over characteristics; test the capabilities of operating system drivers, or for introduction of corner case error conditions.

Net Protocol Suite™

The Net Protocol Suite™ is a completely integrated software utility for use with the SierraNet products. It provides users with the ability to capture traffic using advanced filtering and triggering, review, examine and annotate the resulting traces either through the GUI or automation APIs. The solution also allows the traffic to be modified via the Infusion capabilities and includes many built in jamming profiles which can also be automated.

Net Protocol Suite provides the most advanced triggering and filtering state machines available. Up to 24 states, with four transitions per state, and multiple trigger, filter, and timer conditions per capture project are standard features. Advanced triggering enables state-specific filtering to eliminate the capture of unwanted traffic, providing users intuitive and easy navigation to the information and events of importance.

Post capture analysis is augmented with the Verification Script Engine (VSE), providing users with advanced data processing tools for extensive investigation of the fabric or network, and the components under observation.

Physical Layer Analysis and Error Injection

Supported	Capture / Jam	Description	Supported	Pass-through module required
Autoneg frame capture	Capture	Capture of autoneg frames between two peers: base and extended pages	✓	Yes
Link training capture	Capture	Capture of link training frames between two peers: coefficient updates, PRBS	✓	Yes
PCS symbol capture	Capture	Capture of PCS bitstream between two peers	✓	Yes
FEC codeword capture and decoding	Capture	Capture of FEC bitstream between two peers when encoded with FEC such as Reed-Solomon or Fire-Code	✓	Yes
LSS capture	Capture	Link State Signaling - Local Fault, Remote Fault capture	✓	Yes
Link down time measurement	Capture	Time measurement of link interruption (e.g., signal squelch duration)	✓	Yes
Alignment Marker capture	Capture	Capture of Alignment Markers to verify spec conformance	✓	Yes
FEC interleave / non-interleave capture	Capture	Capture of type of FEC: interleaved or non-interleaved	✓	Yes
Precoding capture	Capture	Capture of precoding	✓	Yes
PCS to PMA lane mapping	Capture	Reporting of PCS lane number mapping to PMA lane mapping	✓	Yes
Interframe Gap	Capture	Measure the Interframe Gap (IFG or IPG): smallest, largest and average	✓	Yes
Fault generation	Jam	Replace idle with Local or Remote fault	✓	No
FEC correctable error	Jam	Jam correctable FEC errors: specified BER, codeword	✓	No
FEC uncorrectable error	Jam	Jam uncorrectable FEC errors: specified BER, codeword	✓	No
PCS sync header override	Jam	Override PCS sync header: specified BER, symbol	✓	No
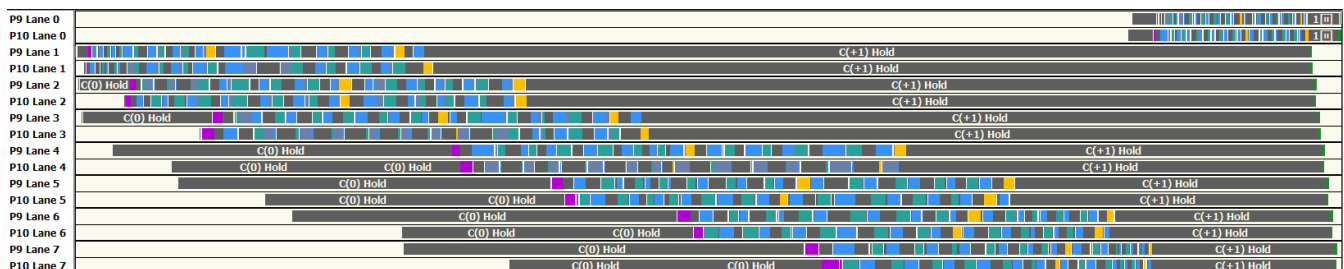
The color coded Timeline View enables users to easily see the link bring up details for all ports and lanes.
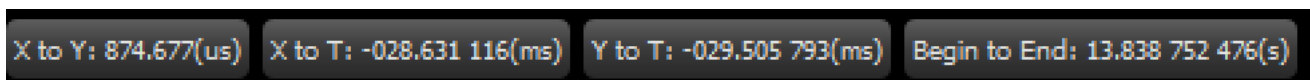
The navigation view makes it easy to track all of the attempts of the link bring up process as well as the affect of Remote / Local faults on the link bring up process.

All Layer Analysis

Traffic Summary View for most major protocols enables quick analysis of issues. Each protocol tracks which commands are used including counts and timing (min, max, average, time from first and last data to completion) for latencies. All are hyperlinked to easily navigate within the trace to important issues:

Easily track the time between any two frames:

Automation

API support enables full control for easy regression testing. The API enables full control of analysis and jamming with many example scripts included to cover common use cases such as:

- Automate regression test to ensure that performance is the same or improves with each software/firmware release
- Integrate error injection and analysis for proper error handling
- Check that all timings meet specifications

The solution supports user definable decodes to enable custom protocols to be properly decoded and included as part of the fully automated tests from capturing a trace, inserting errors using the Jammer and using the VSE abilities to analyze the captures to create pass / fail testing.
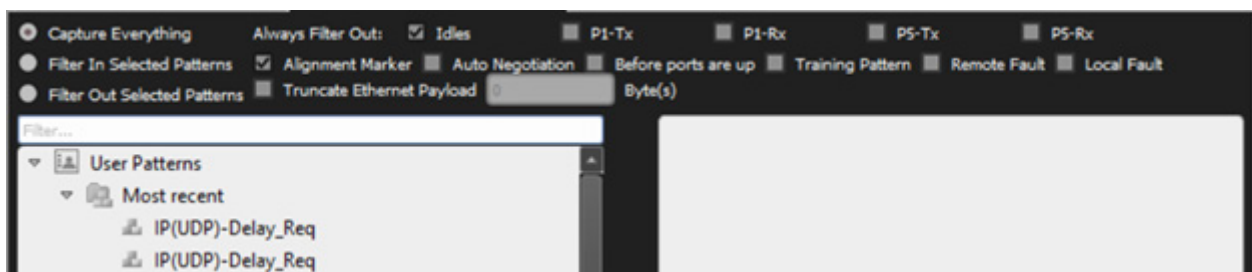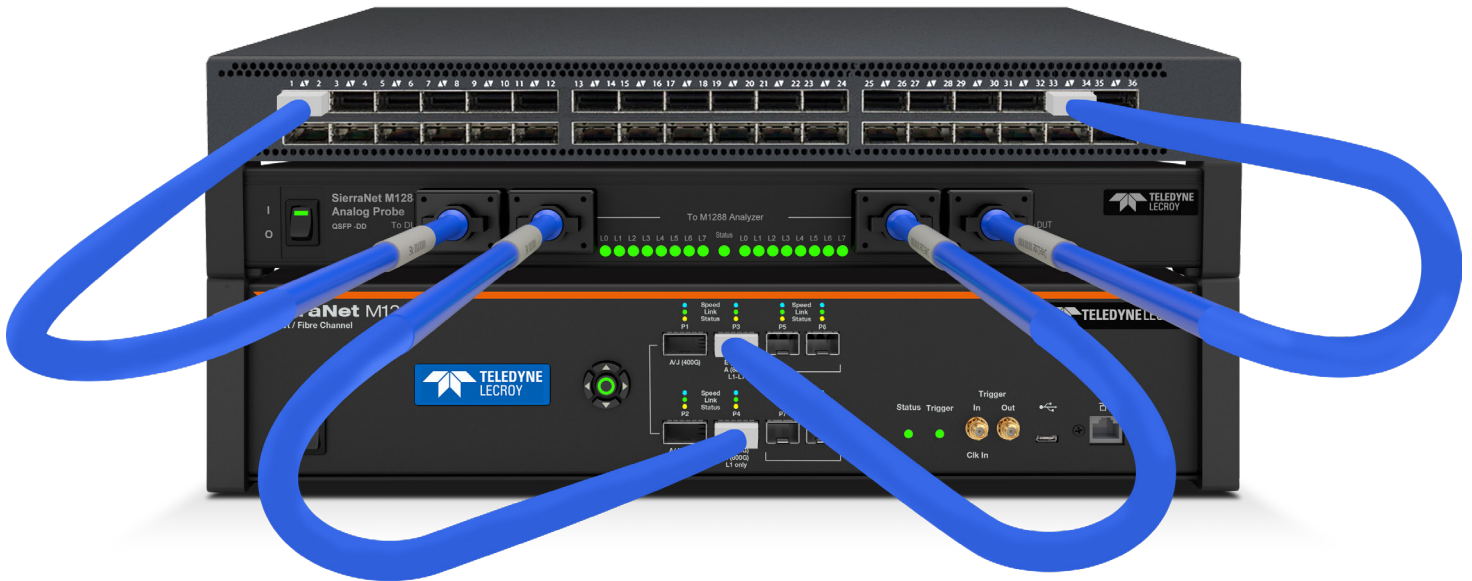
Connectivity

Networks or Fabrics under examination are connected to the M1288 through either Small Form Factor Pluggable-112 (SFP 112) connectors, or Quad-Small Form Factor Pluggable Double Density (QSFP-DD) connectors.
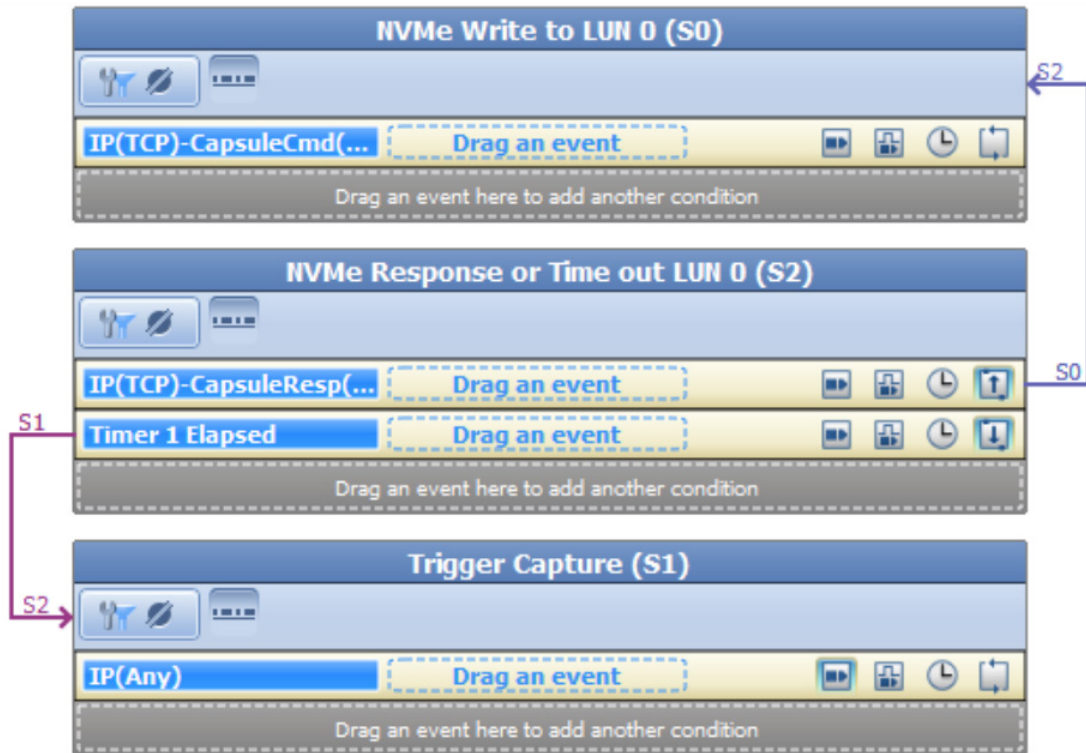
The SierraNet M1288 provides multiple options for capturing your Ethernet links effectively through Teledyne LeCroy's TAP6 technology. The TAP6 from Teledyne LeCroy allows for the most efficient method for capturing the signal without impacting the link stability. To support both enterprise and hyperscale test environments the M1288's Analog Passthrough Probes feature flexible connectivity options including QSFP-dd and OSFP endpoints. The OSFP Probes include adapters to support both OSFP RHS and OSFP cage assembly connections. Additionally, the M1288 also offers capture through digitally retimed ports. These ports allow for complete flexibility of capture, analysis, and the ability to inject errors into the stream for full system validation of copper and optical Ethernet links.

The Probes enable all lanes and all levels of traffic to pass through unchanged between the two devices as well as sending the all the traffic to the M1288 Analyzer to enable wire level capture. They support the PAM4 signaling requirements as supporting NRZ signal speeds.

Users may daisy-chain multiple SierraNet platforms to examine higher port counts and analyze captured traffic across all systems in a single, easy to understand Net Protocol Suite™ trace view. SierraNet platforms may be connected via the CrossSync™ application to other Teledyne LeCroy protocol tools to observe traffic across multiple protocol to understand how traffic, stimulus, or errors propagate across bridges or adapters.

The graphic below indicates how the M1288 Analyzer and M1288 Analog Probe will connect to Devices Under Test (DUTs):

M1288 Analyzer Specifications

Host Machine Minimum Requirements	Microsoft® Windows® 11, Windows 10, Windows Server 2016 (x64), Windows Server 2019 (x64); For improved performance of the software, it is recommended that 16GB of RAM is installed on the host machine. Memory as little as 2GB would still allow the software to function but would impair its performance; Storage with at least 4 GB of free space for the installation of the software and additional space for recorded data; display with resolution of at least 1024x768 with at least 16-bit color depth; USB 3.0 port and/or 100/1000 Mbps Ethernet network interface. For optimal performance and latest requirements, please refer to our recommended configuration in the product documentation.
Data Rates Supported	32, 64, and 128G Fibre Channel; and 10, 25, 40, 50, 100, 200, 400 and 800* Gbps Ethernet (*800Gbps - capture may not be full line rate depending on the configuration. A count of missed frames will be included if any traffic isn't captured.)
Recording Memory Size	128GB in a single M1288 platform
Host System Interface	USB C and 1Gb Ethernet
Front Panel Indicators	Three LEDs (Link, Speed, Status/ Errors) for each TX & RX pair, Status LCD Panel, Power LED
Front Panel Controls	Power ON/OFF, Menu Navigation and Selection Wheel
Front Panel Connections	Two (2) Digitally Retimed QSFP-DD cages; two (2) End Point QSFP-DD cages; four (4) Digitally Retimed QSFP-DD cages; two (2) SMA Trigger IN/OUT connectors (accepts PTP 1588 clocks); one (1) USB 3.0 compliant connector; one (1) 1Gb Ethernet connector
Rear Panel Connectors	AC Power, Sync In/Out
Cascade and Expansion Capability	Up to 8 SierraNet Systems; 10/25/50/100GbE and/or 16/32/64/128GFC: Up to 16 Links; 40/100/200/400GbE: Up to 8 Links; 800GbE: Up to 4 links (Configuration and rates under test will affect these)
Dimensions (H x W x D)	Chassis: 88 x 432 x 356mm (3.5" x 17" x 23.8") With Bumpers: 104 x 455 x 367mm (3.75" x 17.9" x 27.9")
Weight	15Kg (34lbs); Shipping 21Kg (46lbs)
Power Requirements	100-240VAC, 50-60Hz, 1000W
Environmental Requirements	Operating: 5° to 40°C (41° to 104°F); Non-operating: -20° to 60°C (-4° to 140° F); Humidity: 10 to 90% RH (non-condensing)

M1288 Analog Pass-through Probe

Data Rates Supported	10, 25, 40, 50, 100, 200, 400 and 800 Gbps Ethernet
Front Panel Indicators	One Status LED and 16 lane LEDs
Front Panel Controls	Power ON/OFF
Front Panel Connections to Analyzer	Two (2) QSFP-DD cables with internal side band for Analyzer to Probe configuration.
Front Panel Connections to DUT (HSF-M1288-QSFP)	Two (2) QSFP-DD cables (with field replaceable covers to support either Finned or RHS connections)
Front Panel Connections to DUT (HSF-M1288-OSFP)	Two (2) OSFP cables
Rear Panel Connectors	AC Power
Dimensions (H x W x D)	Chassis: 88 x 432 x 356mm (1.75" x 17" x 23.8") With Bumpers: 104 x 455 x 367mm (2" x 17.9" x 27.9")
Weight	15Kg (7lbs)
Power Requirements	100-240VAC, 50-60Hz, 100W , 2A
Environmental Requirements	Operating: 5° to 40°C (41° to 104°F); Non-operating: -20° to 60°C (-4° to 140° F); Humidity: 10 to 90% RH (non-condensing)

Ordering Information

Base Hardware Platform

Product Code

SierraNet M1288 Platform (Base HW platform with 128GB Memory) — HSF-M1288-128-X

M1288 Analysis License Option Examples

SierraNet M1288 400Gb Ethernet Protocol Analysis--License for 4-ports (1 logical link);
Fall back support to 4-ports 200Gbe (50GbEx4) PAM4 (1 logical link) OSFP/QSFP-DD Connections Only;
Enables x8 capture when two SierraNet M1288 platforms are chained via Expansion Port connections. — NET-T400-P116-A

SierraNet M1288 800G PAM4 Ethernet Phy Link Analysis License (8x100GbE) for Auto-Negotiation and Training Sequence Only
License for QSFP-DD Port Pair (1-logicial link), Applicable for SierraNet M1288 platforms only — NET-T800-P116-A

SierraNet M1288 Ethernet Protocol PAM4 Analysis Bundle License
Enables 2-links 100GbE (NET-T100-P14-A), 1-link 200GbE (NET-T200-P14-A), 1-link 800GbE ANLT(NET-T800-P116-A),
and 1-link 400GbE PAM4 Analysis (NET-T400-P18-A) — NET-TALL-P116-A

SierraNet M1288 Ethernet InFusion License for all speeds that are licensed for Analysis up to and including 4x100GbE
and 4 Lanes of 800G AN/LT. License for QSFP-DD Port Pair (1-logical link) — NET-JALL-P116-A

SierraNet M1288 128Gb Fibre Channel Protocol Analysis--License for 4-ports (2-logical links);
Fall back support to 4-ports 32/64GFC (2-logical links) — FC-T128-P14-A