LeCroy

Voyager™
USB Protocol Analyzer and Exerciser System

Comprehensive USB 2.0 and USB 3.0 Protocol Verification

VOYAGER USB PROTOCOL ANALYZER AND EXERCISER SYSTEM

Key Features

- **CATC Trace Analysis Software System –** Expand/Collapse transfer layer for faster interpretation of USB traffic
- **Capture/Analyze 3.0 & 2.0 Traffic Concurrently –** Record 2.0 and SuperSpeed data path to test & debug USB 3.0 host & hub operation
- **Integrated 3.0 Analyzer/Exerciser –** Multifunction system (single box) with 3.0 and 2.0 device or host traffic generation
- **ReadyLink™ and Intelliframe™ –** Host & Device emulator automatically handles USB handshaking
- **4 GB Recording Capacity –** Capture long recording sessions for analysis and problem solving
- **Raw Bit Recording/10-bit Error Detection –** view and correlate low-level 10-bit symbols to higher-level packet structures
- **Spool-to-disk Capture –** Allows longer traces, faster uploads
- **2 ns Timing Resolution –** Extremely accurate timing resolution allows precise measurement of link layer handshaking
- **External Trigger In/Out –** Use the Voyager to identify any packet and toggle a scope or logic analyzer (via SMA connectors)
- **Fully Supports SSC and Data Scrambling –** Fast Locking and Accurate capture on 5 Gb/s signals
- **Hardware Triggering –** Trigger on both 2.0 or 3.0 protocol events to isolate important traffic, specific errors or data patterns
- **Comprehensive Device Decoding –** SCSI Mass Storage, 3.0 Hub, PTP/Still Image, Printer, PictBridge, Media Transfer Protocol (MTP), OTG, and all popular USB device classes
- **Hardware Filtering –** Automatically truncate data packets or exclude redundant symbols including Idles, TS1, TS2, SKPs, and LFPS sequences.
- **Intelligent Reporting –** Automatically report event metrics and flag over 20 common USB 3.0 protocol errors
- **GbE or Hi-speed USB Upload –** High speed links for accessing captured data
- **Slow Clock/External Clock Input –** Adjustable signal frequencies for synchronizing analyzer timing with prototype devices
- **3-Year Hardware Warranty –** Protect your investment with industry leading support and warranty

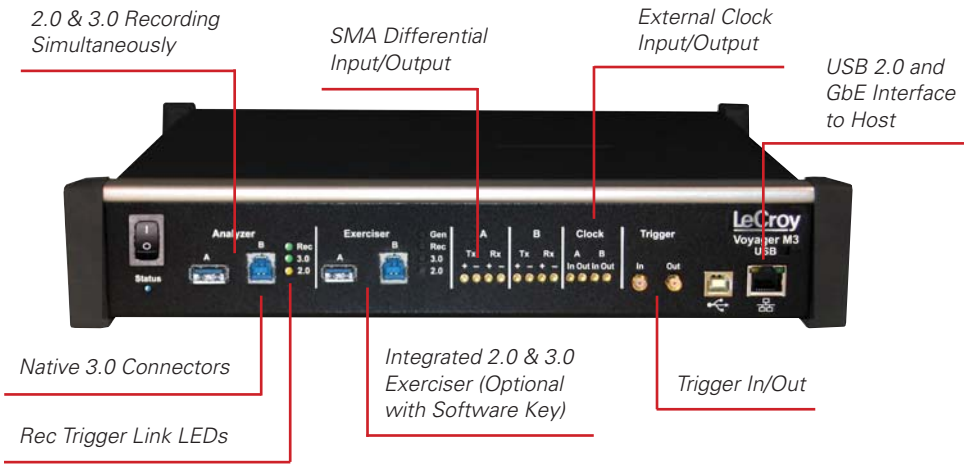
The Voyager M3 is LeCroy's 6th generation USB protocol verification system designed for the next evolution of universal serial bus known as SuperSpeed USB. Leveraging LeCroy's extensive expertise in high-speed serial data analysis, the Voyager provides traffic generation and recording of both USB 2.0 and 3.0 at data rates up to 5 Gb/s. Loaded with innovative features that help uncover elusive protocol errors, the Voyager platform is the intelligent choice for "cradle-to-grave" USB 3.0 validation.

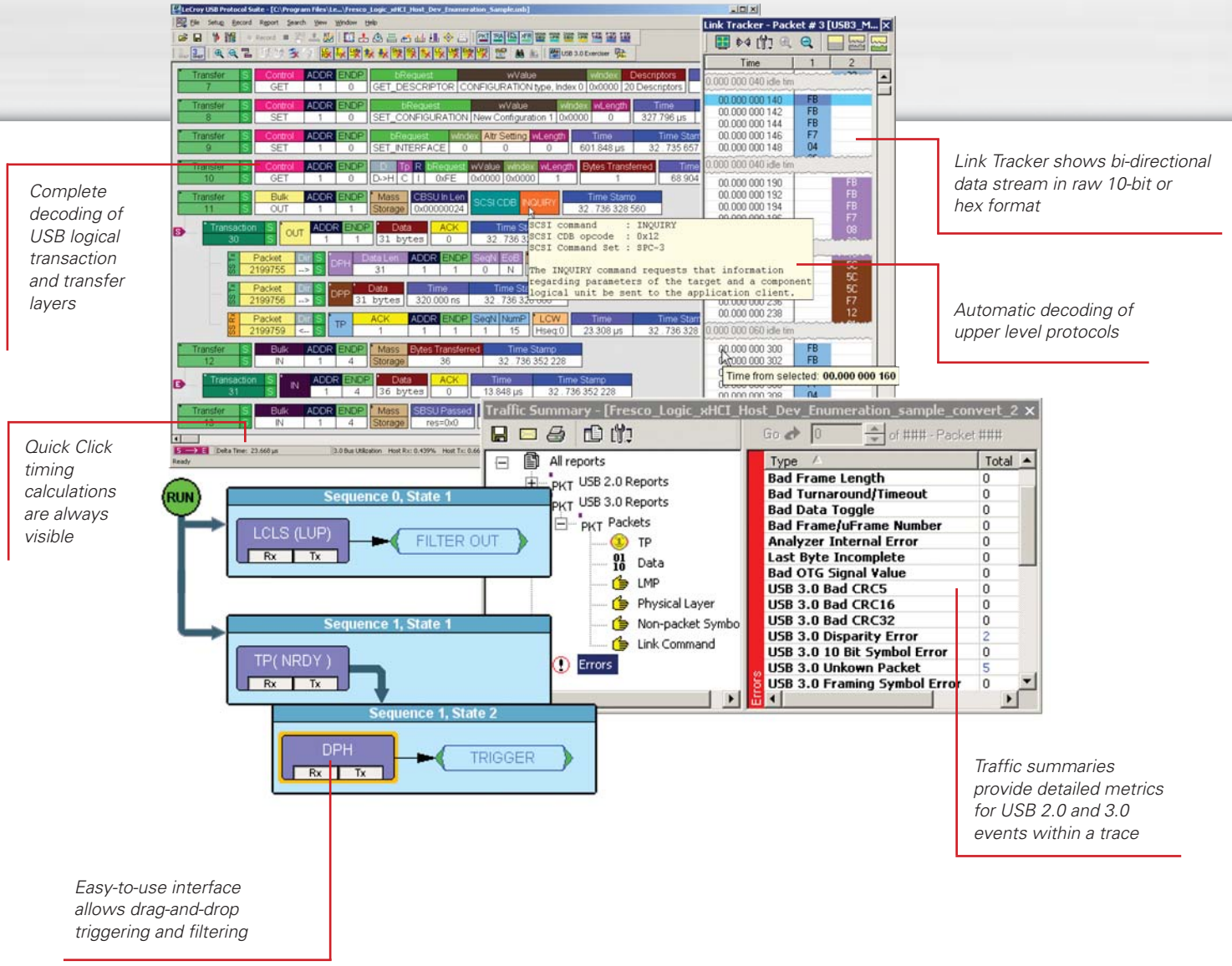
Unmatched Accuracy

The Voyager Analyzer front-end leverages custom circuitry from LeCroy's 5 Gb/s PCI Express® analyzer to provide fast-locking and uncompromised accuracy for USB 3.0 recording. While in-line, the Voyager system will detect and seamlessly recover from electrical idle while accurately showing all bus and power state transitions time-stamped within the display. It includes full support for spread spectrum clocking (SSC) and data scrambling (LFSR) which can be enabled/disabled for silicon bring-up testing.

Flexible Hardware

The Voyager is a true multifunction platform capable of both USB 2.0 and 3.0 protocol capture. It's also available in a 2.0-only configuration that is upgradeable to 3.0. There's an integrated exerciser option supporting both host and device emulation. In addition to error injection and compliance verification, the exerciser can serve as a USB 3.0 link to perform early bring-up and functional testing. The Voyager features native 3.0 connectors that bifurcate USB 2.0 and 3.0 electrical signals to provide loss-less capture of traffic from both



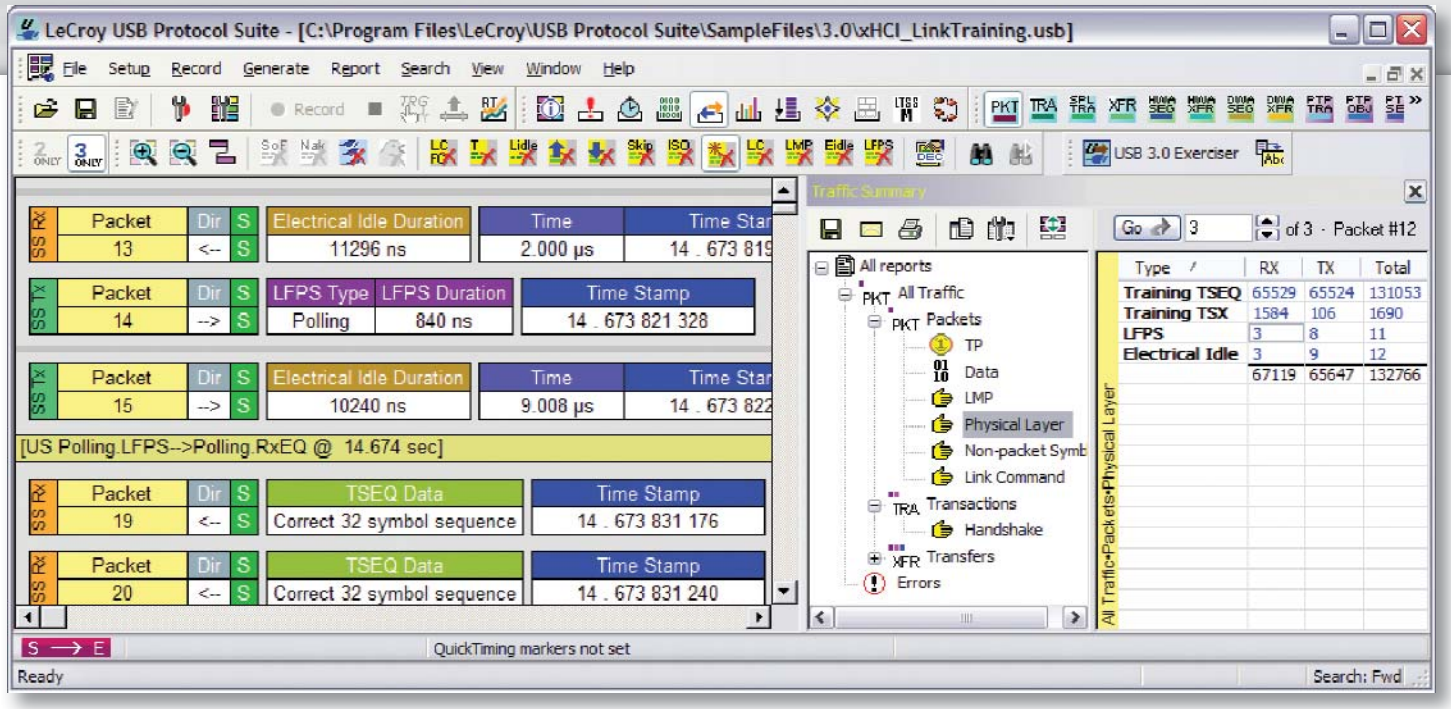


links simultaneously. Concurrent high-speed and SuperSpeed recording allows end-to-end viewing of data transfers across a USB 3.0 hub. Multi-channel recording is supported by cascading Voyagers to allow upstream/downstream hub testing.

The Voyager M3 platform includes 4 GB of recording memory plus USB and GbE links for uploading recorded traffic to the host PC. The system also offers spool-to-disk capture to allow extended recording sessions (up to the available disk space). In spooled mode, captured traffic is uploaded continuously and is displayed in real-time making it possible to see link status and state changes without stopping the recording. Both the analyzer and exerciser can utilize slow clocking (fractional) or external clock sources (as low as 1 MHz) for testing with FPGA-based prototypes or emulators that require ultra low-speed data acquisition.

The heart of the Voyager verification system is LeCroy's revolutionary BusEngine™ technology. This state-of-the-art protocol processing core incorporates a real-time recording engine and configurable tools to selectively trigger and filter on SuperSpeed USB traffic. Field upgradeable firmware allows the BusEngine to evolve and support new features or future changes to the USB specification.

Additional innovations include upgradeable hardware components. The USB connectors on the analyzer are mounted on a removable daughter-card allowing the system to be upgraded as improved connectors are available. Both the analyzer and exerciser can operate over SMA differential Input/Output lines to



LFPS signaling and state changes are shown in the trace allowing users verify link recovery timing.

provide a high-fidelity alternate interface for taping between development boards. This lets users switch between native 3.0 and SMA connectors to narrow down issues that may be related to cabling.

6th Generation Analysis Software

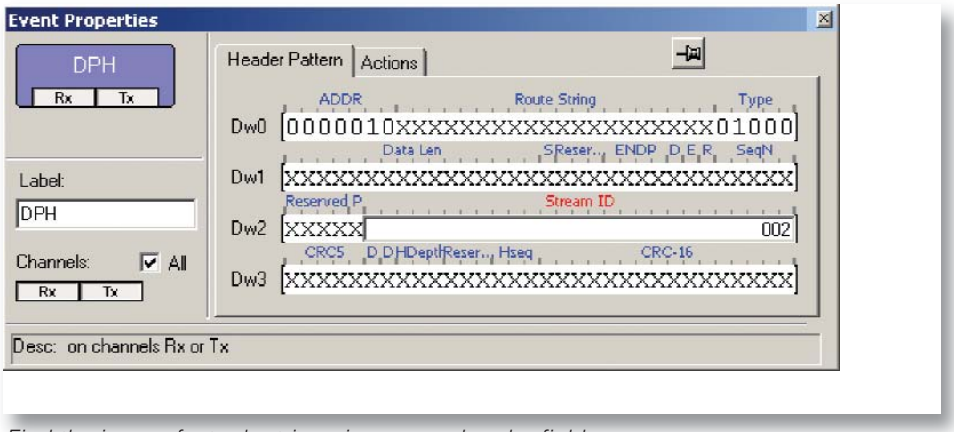
The Voyager utilizes the legendary CATC Trace™ which has become the industry's de facto standard for USB 2.0 protocol analysis. The trace viewer software uses colors and patterns to train the eye to understand information faster. When recording mixed traffic upstream from a SuperSpeed hub, Legacy 2.0 and 3.0 packets are labeled and interleaved in a single display. Traffic from the logical 2.0 & 3.0 channels can be individually filtered, searched or exported from the trace. The USB Transfer level can be expanded and collapsed to show the packet layer events including link state changes, link management packets (LMPs) and flow control symbols.

Real Time Filtering

SuperSpeed data transfers at 5 Gb/s can fill memory buffers in an instant making event filtering critical for efficient debug. The Voyager analyzer can filter unwanted traffic from the buffer in real-time by discarding redundant patterns such as SKPs, idles, LFPS, and training sequences Filtering logic can also include transaction layer packets with added criteria like direction or port number.

Intelligent Triggering

The Voyager provides hardware triggering to pinpoint protocol events of interest. Trigger events can be specified at the lowest levels including bus states and link commands (TS1/2, LBAD, ACK, EPRDY, etc..) or header fields (packet type, route strings, etc…). Users can define trigger logic that monitors multiple sequential events with counters and timers incorporated within each state.



Find the issues faster by triggering on any header field.

VOYAGER EXERCISER OPTION

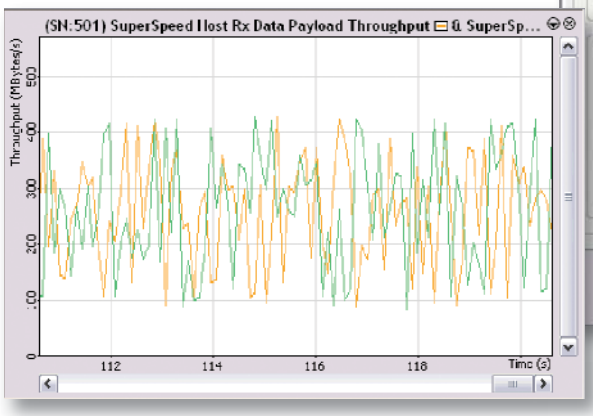
Raw Debugging Power

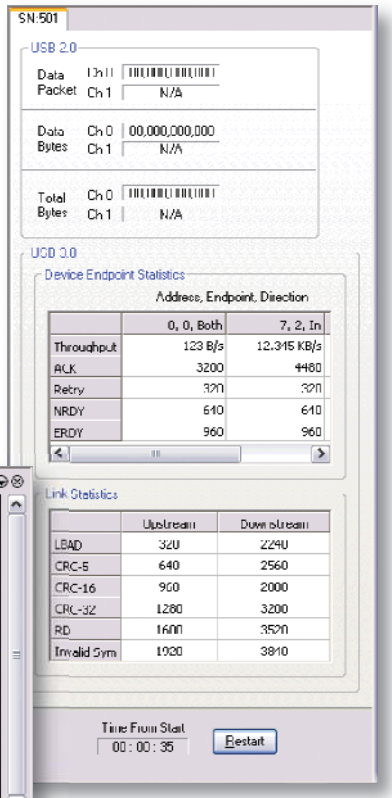
The Voyager includes a special Link Tracker mode that captures every transition and presents raw 10-bit data patterns chronologically with timing resolution of 2 ns. Designed to assist with low-level debugging, all ordered sets including training sequences and inter-packet symbols can be displayed in raw 10-bit, 8-bit, scrambled, and unscrambled Hex format. Symbol-to-symbol timing measurements are possible with a single click.

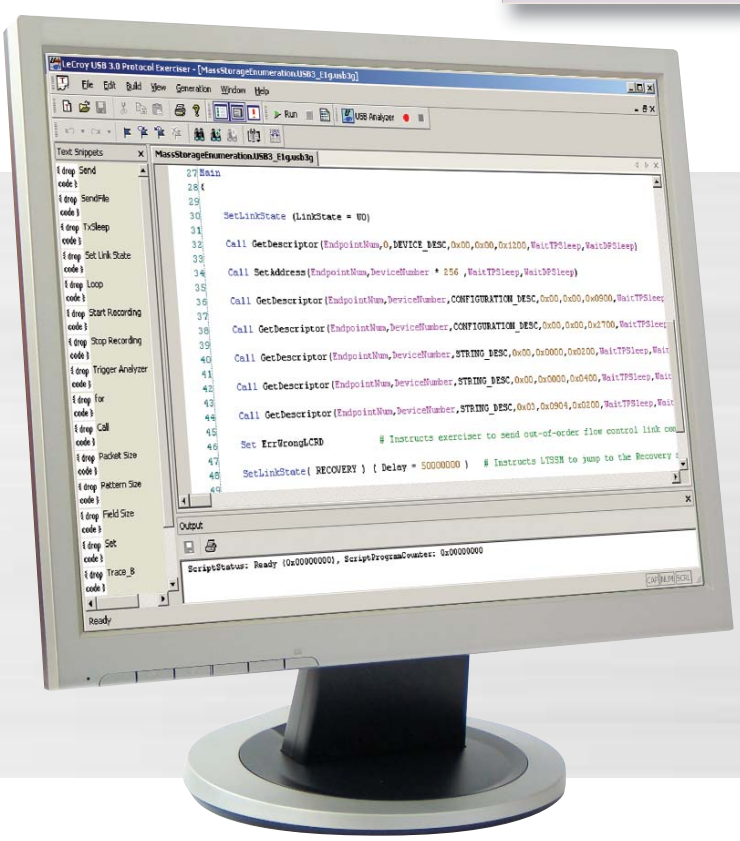
Error and Event Reporting

The Voyager can detect and flag protocol errors including logical link and timing errors. At the lower layers, training sequences and link commands are automatically verified for proper sequencing. Useful for performance analysis, the RTS view provides real time performance metrics that can be displayed graphically and in text.

USB 3.0 Real Time Statistics
Device Detected
Endpoints Detected
Throughput (MB/s)
Average Payload Size
Data Packet Count
Retried Transactions
Error Counts
ACK / NRDY / ERDY Count







A comprehensive exerciser capability with support for both USB 2.0 and 3.0 traffic generation is built in to the Voyager M3 platform. The exerciser option allows users to transmit custom packets over standard USB cables with low-level control of headers, payloads, timing, and link states. The Exerciser is seamlessly integrated with the Protocol Analyzer, making the Voyager a complete test and development solution for engineers validating USB protocol.

USB 3.0 Emulation with Voyager ReadyLink™

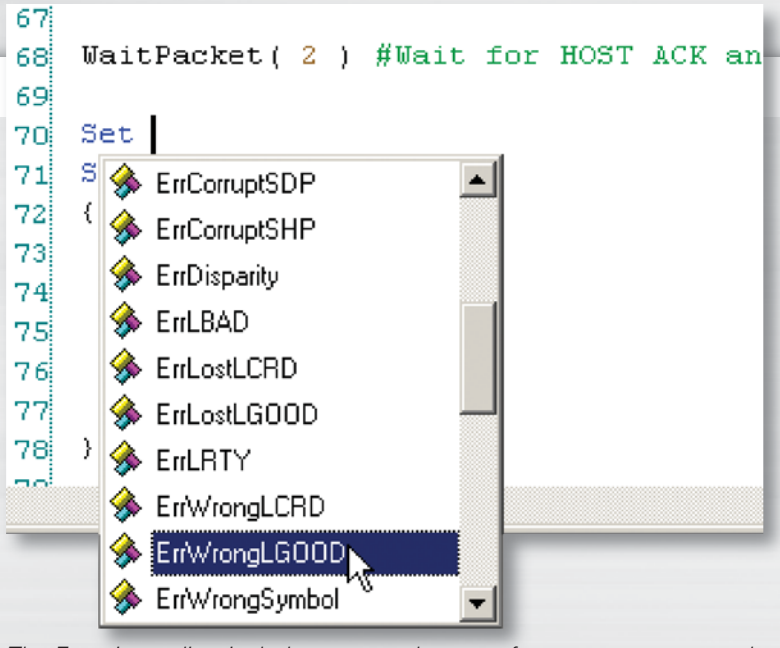
ReadyLink is a full-function link layer emulation mode built in to the exerciser. It automatically handles all USB 3.0 link training and link flow control to make development of test scenarios fast and easy. By including a complete link layer implementation resident in the exerciser hardware, the emulator operates at full line rate and correctly responds to the DUT as defined by the specification. Overrides allow ReadyLink behaviors to be altered such as shortening/lengthening the LFPS, training and recovery sequence.

Error Injection

The ReadyLink emulation can be customized per test script to include various error scenarios including:

- 8b/10b / CRC Error
- Running Disparity Error
- Corrupt Link Commands
- Corrupt Flow Control (Wrong L_CRD_x, Wrong L_GOOD_n, Drop L_Good_n, etc…)
- Corrupt Header Packet Acknowledgement (Send LBAD, LRTY)
- Corrupt Packet Framing (SHP, SDP, END)

At the packet level, users have the freedom to send customized data payloads anywhere within the stream making it easy to verify protocol behavior.



The Exerciser editor includes pop-up shortcuts for common commands.

Exerciser Control Environment

The exerciser software provides a flexible script authoring environment that supports a powerful set of parser preprocessor features. This includes pre-defined templates for all USB 3.0 packet types, random string generators, Wait_Conditions, and procedure calls within a script. A library of sample scripts is included and illustrates how these techniques can be used to create efficient, reusable generation blocks. Users can also create test scenarios by exporting the host or device traffic stream from a previously recorded analyzer trace file. These scripts can be played back using the Exerciser to recreate problems or test specific functionality.

USB 2.0 Exerciser with Intelliframe™

The Voyager 2.0 exerciser is based on LeCroy's legendary USB *Trainer*™ exerciser and is backward compatible with existing USB *Trainer* 2.0 traffic generation scripts. Capable of transmitting low-, full-, or high-speed traffic, the Voyager 2.0 exerciser also supports both host and device emulation.

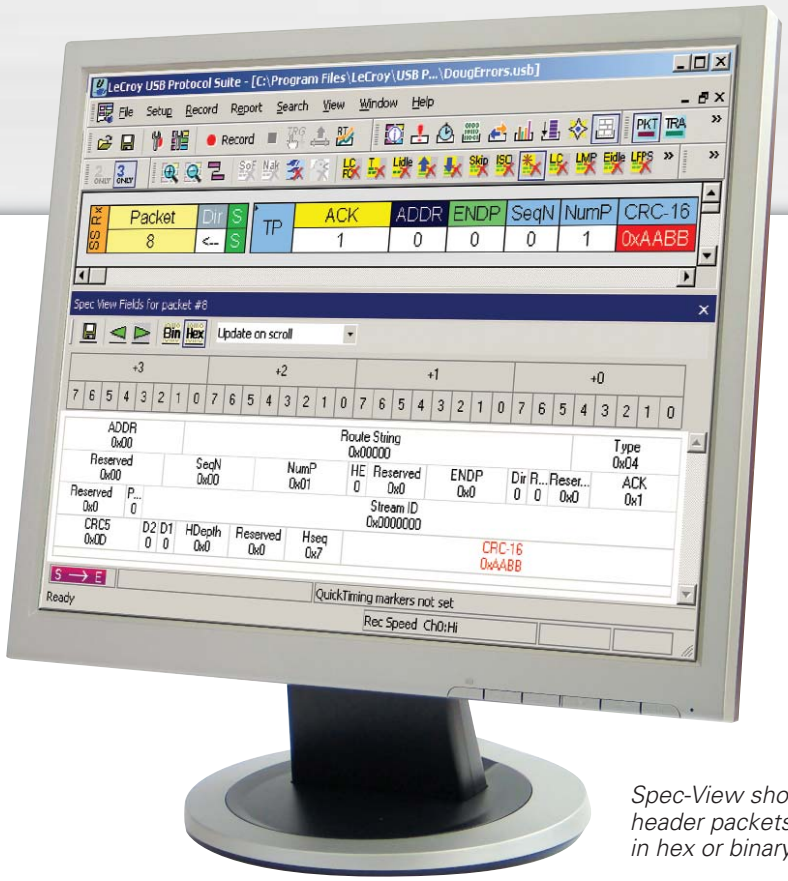
USB Device Decoding

The Voyager software performs full decoding of USB device class traffic. It allows both automatic and manual assignment of decodes to individual endpoints. It also supports vendor specific decoding for developers interested in automatically showing proprietary commands in the trace view. The Voyager offers full support for the USB OTG specification and identifies both the HNP (Host Negotiation Protocol) and SRP (Session Request Protocol) events.

Find The Issues Fast

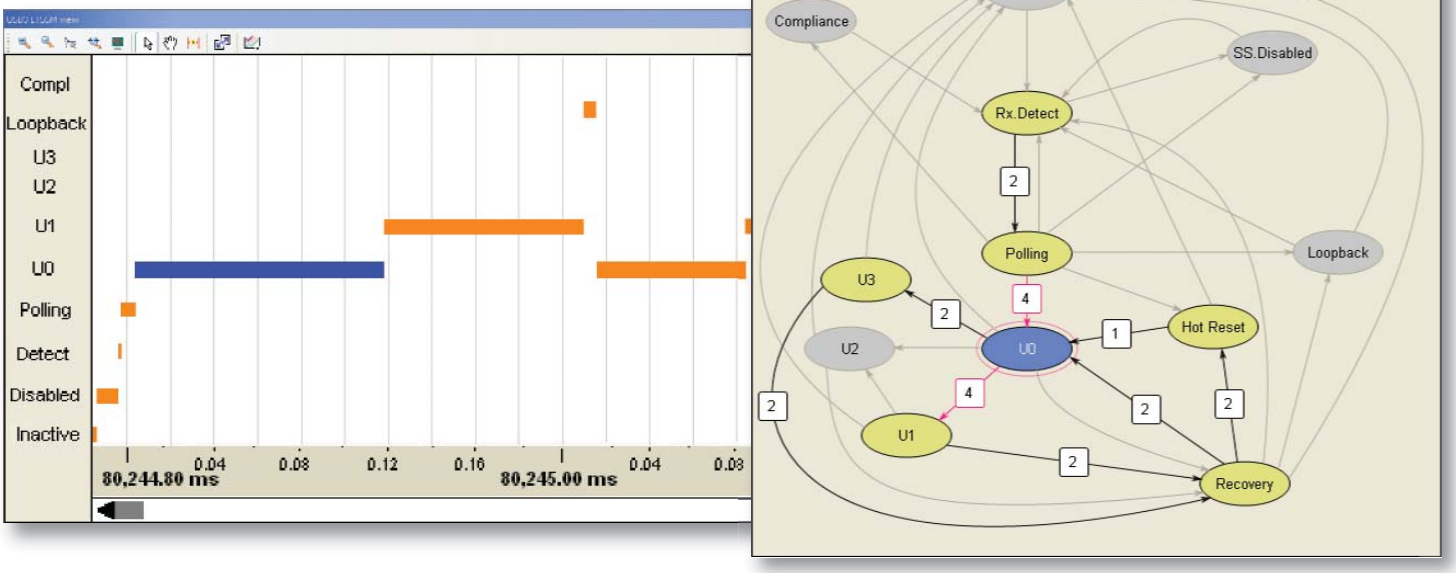
The Voyager software provides many mechanisms to measure and report on USB 2.0 and 3.0 traffic. With the Traffic Summary display, users can evaluate statistical reports at a glance or navigate to individual events. Reports are available showing link throughput and flow control metrics. The error report shows a range of protocol violations and power state transition errors.

The Bus Utilization graphs show data and packet length, bus usage by device in a histogram format. The Bandwidth calculator automatically calculates the time delta and MB per second between two points in the trace. Fast Search and Find options allow users to navigate to specific packets, errors and any data type within a trace file. The CATC Trace supports filter and hide commands, to temporarily remove irrelevant data from the display for more efficient viewing.



Spec-View shows header packets in hex or binary

Since 1996, LeCroy has been a key provider of tools for the USB ecosytem. The Voyager system leverages countless hours of research in high-speed serial data analysis to create the most reliable and accurate USB 3.0-analyzer system available. Combined with the exerciser option and the CATC Trace expert software, the Voyager platform alleviates developers from tedious byte-level analysis and lets them focus on quick resolution of protocol layer problems.



LTSSM Viewer shows link states to verify power management behavior.

SPECIFICATIONS AND ORDERING INFORMATION

Specifications

Protocol(s) Supported	USB 1.0, 1.1, 2.0 & 3.0
Host Hardware Requirements	Intel® Pentium® 4 or AMD Duron with USB 2.0 interface, 512 MB RAM (1 GB RAM recommended)
OS Requirements	Windows® XP and Vista®
Memory Size	1 or 4 GB option
Data Rates Supported	1.5 Mb/s–5.0 Gb/s
Data Bus Interface	Half duplex differential (USB 2.0) Dual simplex differential (USB 3.0)
Front Panel Connectors	Analyzer – one (1) USB 2.0 & 3.0 recording channel with USB 3.0 A & B connectors Exerciser – one (1) USB 2.0 & 3.0 generator channel with USB 3.0 A & B connectors
Front Panel Indicators	Platform LEDs: Power, Status Analyzer LEDs: Rec 2.0, 3.0 Exerciser LEDs: Gen, Rec 2.0, 3.0
Temperature: Operating	0 °C to 55 °C (32 °F to 131 °F)
Temperature: Non-Operating	-20 °C to 80 °C (-4 °F to 176 °F)
Humidity: Operating	10% to 90% RH (non-condensing)
External Clock Input	MMCX to SMA
External Clock Frequencies	1 MHz to 5 GHz
Dimensions	31.75 x 30 x 5 cm (12.5" x 11" x 2")
Weight	2.45 kg (5.4 lbs.)
Power Requirements	90–254 VAC, 47–63 Hz (universal input), 100 W maximum
Alternate Taping Interface	MMCX to SMA differential input/output (record and transmit)
External Trigger IN/OUT	SMA connectors

Ordering Information

Product Description	Product Code
Voyager M3 USB 3.0 Pro Analyzer System (includes one (1) Ch analysis USB 3.0 SuperSpeed and USB 2.0 low/full/high; 4 GB recording memory; advanced triggering; GbE and USB 2.0 host interfaces, carrying case included)	USB-T0P3-V01-X
Voyager M3 USB 3.0 Pro Analyzer Exerciser System (includes one (1) Ch analysis and one (1) Ch generation USB 3.0 SuperSpeed and USB 2.0 low/full/high; 4 GB recording memory; advanced triggering; GbE and USB 2.0 host interfaces, carrying case included)	USB-TZP3-V01-X
Voyager M3 USB 2.0 Advanced Analyzer System (includes one (1) Ch analysis USB 2.0 low/full/high; upgradeable to USB 3.0; 1 GB recording memory; advanced triggering; GbE and USB 2.0 interfaces)	USB-T0A2-V01-X
Voyager M3 USB 2.0 Advanced Analyzer Exerciser System (includes one (1) Ch analysis and one (1) Ch generation USB 2.0 low/full/high; upgradeable to USB 3.0; 1 GB recording memory; advanced triggering; GbE and USB 2.0 host interfaces)	USB-TZA2-V01-X

Product Description	Product Code
Voyager M3 USB 3.0 SMA Probe Kit (includes eight (8) MMCX to SMA cables & license key for SMA differential input tap)	USB-FE03-V01-X
Voyager M3 USB 3.0 Analysis Option (upgrades Voyager USB 2.0 analyzer to USB 3.0 analyzer)	USB-T0A3-V01-A
Voyager M3 USB 3.0 Exerciser Option (upgrades Voyager USB 3.0 analyzer system to USB 3.0 analyzer plus exerciser)	USB-ZBA3-V01-A
Voyager USB 3.0 Pro Analysis & Exerciser Option (upgrades Voyager USB 2.0 analyzer plus exerciser system to USB 3.0 analyzer plus exerciser system)	USB-ZBP3-V01-A
Voyager M3 USB 3.0 Slow Clock Kit (includes 4 MMCX to SMA adapter cables and software license to support external clock input for Voyager M3 USB 3.0 platform)	USB-AC01-V01-X
Platform Expansion CATC SYNC Card (provides synchronized recording between 2 or more Voyager M3 systems)	ACC-EXP-002-X

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