

# Voyager™ M310e

## USB Protocol Analyzer and Exerciser System



### Key Features

- **Capture / Analyze USB 2.0/3.2 and PD traffic concurrently** - Record 2.0 / 3.2 to see end-to-end host, hub and dock operation
- **Integrated 3.2 analyzer / exerciser (single box)** - Multifunction system with 2.0 & 3.2 device or host traffic generation
- **USB Type-C & PD analyzer / exerciser** - Generate and record all Type-C and Power Delivery protocol messages and state changes
- **CATC Trace Analysis Software** - Expand / Collapse transfer layer for faster interpretation of USB traffic
- **16GB 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
- **Detects over 50 USB Link & Protocol errors** - Critical link and timing errors are automatically detected and flagged in the trace
- **800ps timing resolution** - Extremely accurate timing resolution allows precise measurement of link layer handshaking
- **External Trigger In / Out** - Use the Teledyne LeCroy Voyager to identify any packet and toggle a scope or logic analyzer (via SMA connectors)
- **Hardware Triggering** - Trigger on 2.0, 3.0, and 3.2 protocol events to isolate important traffic, specific errors or data patterns
- **Comprehensive Device Decoding** - SCSI Mass Storage, Hub, PTP/Still Image, Printer, PictBridge, Media Transfer Protocol (MTP), and all popular USB device classes
- **Gbe or USB 3.0 Upload** - Sustained transfer rates of 600Mbps over Gbe provide instant access to captured data
- **Link Training State Views** - LTSSM flow diagram and chronological views linked to trace display
- **Compliance Test option** - Voyager is a certified Link Verification System (LVS) for performing Link, Hub, PD and USB Type-C compliance testing

With comprehensive support for USB Type-C™, 3.2 Gen 2x1 and Power Delivery 3.1 specifications, Teledyne LeCroy's legendary Voyager analyzer platform provides the industry's most accurate and reliable capture of SuperSpeed USB and PD protocol for fast debug, analysis and problem solving. Featuring the de facto standard CATC Trace™ display and loaded with innovative features that help uncover elusive protocol errors, the Voyager platform is the intelligent choice for any USB validation needs.

The M310e is available with an integrated exerciser capable of emulating host and endpoint behaviors for USB 2.0, 3.2, in addition to PD Source, Sink and Dual-Role devices. Highly configurable, this single platform supports the broadest range of official USB-IF Compliance tests including USB PD 3.1, USB Type-C, USB 3.2 Hub and Link Layer. Now enhanced to support Power Delivery Extended Power Range (EPR) devices, the M310e is your 'one-stop' solution for USB certification.

### Unmatched Accuracy

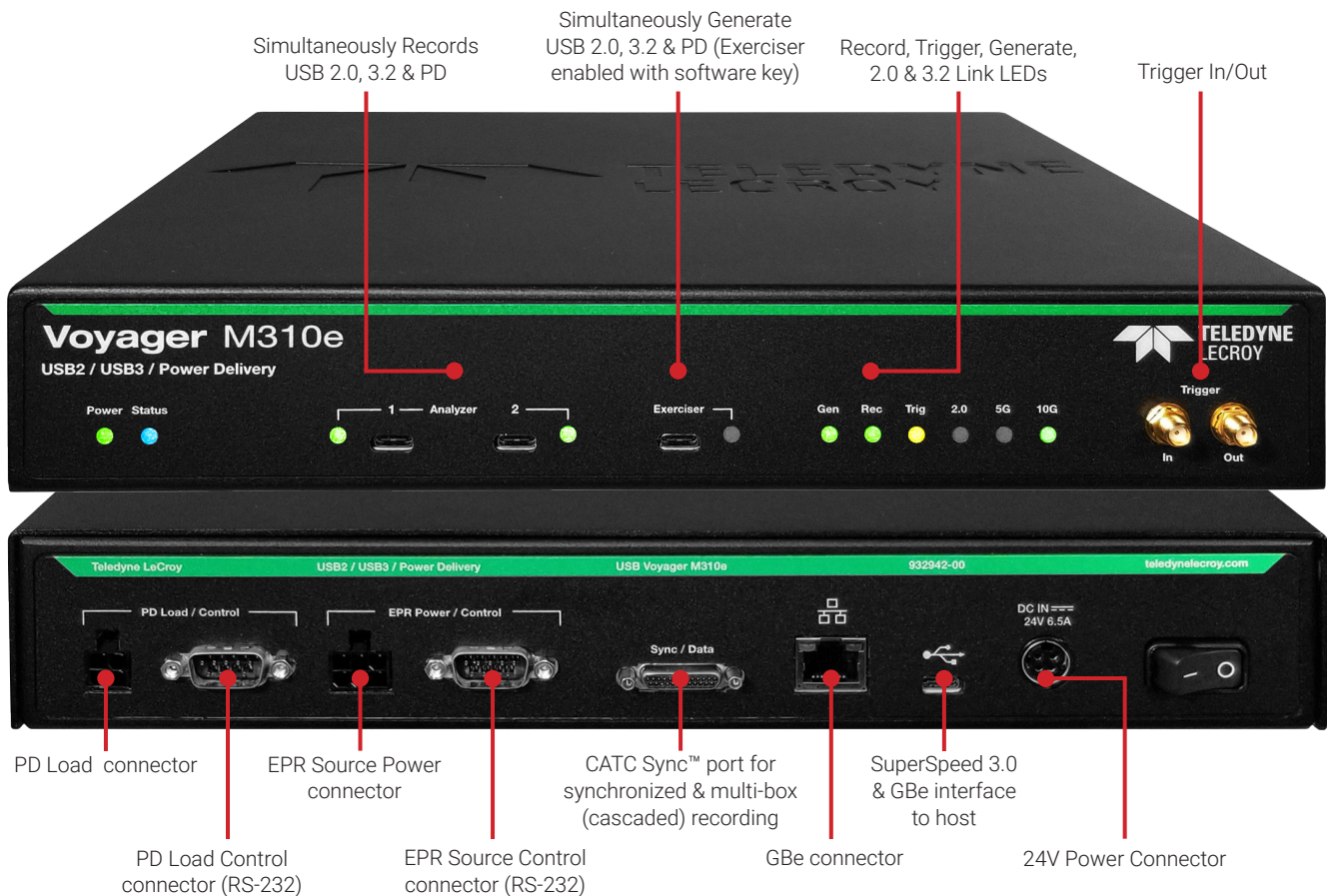
The Voyager M310e features the industry's highest fidelity probe design and provides unmatched reliability when testing devices at USB 2.0 or the latest generation USB 3.2 Gen-2x1 (10Gb/s) speeds. Designed to non-intrusively record both 5 and 10 Gbps SuperSpeed links, the analog front-end in the M310e is fully compatible with systems that use Alternate Modes including two-lane and four-lane DisplayPort.

Hot plug any combination of USB host and device and the Voyager system will transparently follow speed negotiation and lock to the established rate. While in line, it will detect and seamlessly recover from electrical idle and low power modes while accurately showing all U1/U2/U3 state transitions.

## Flexible Hardware

The front-end of the Voyager analyzer features standard USB Type-C connectors that support USB 2.0 and 3.0/3.2 signals to provide loss-less capture of traffic from all active links simultaneously. Concurrent recording of legacy USB, SuperSpeed+ and PD messages, allows end-to-end viewing of USB 3.2 Type-C bridge and dock configuration requests (legacy USB devices are fully supported using the included adapter cables). The Voyager M310e platform includes 16GB of recording memory plus USB 3.2 (Gen 1) and Gbe links for uploading recorded traffic to the host PC.

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



The built-in triggering provides unprecedented flexibility with virtually every possible frame type and state change configurable as a trigger event. In spooled recording mode, the Voyager uploads continuously and provides real-time display of captured traffic allowing fast access and extended recording sessions.

In addition to compliance verification and error injection, the exerciser can emulate a USB endpoint and intelligently respond to host enumeration or Power Delivery requests. When acting as source or sink, the system provides programmatic control of full range of VBUS voltages in both SPR and EPR modes (up to 240 watts). Any combination of PD messages and power transitions can be defined allowing corner-case testing of role swaps and power save states.

Link Tracker™ provides chronological upstream / downstream display of all ordered sets

Power Tracker™ measures VBUS and CC voltages for PD and Type-C debug

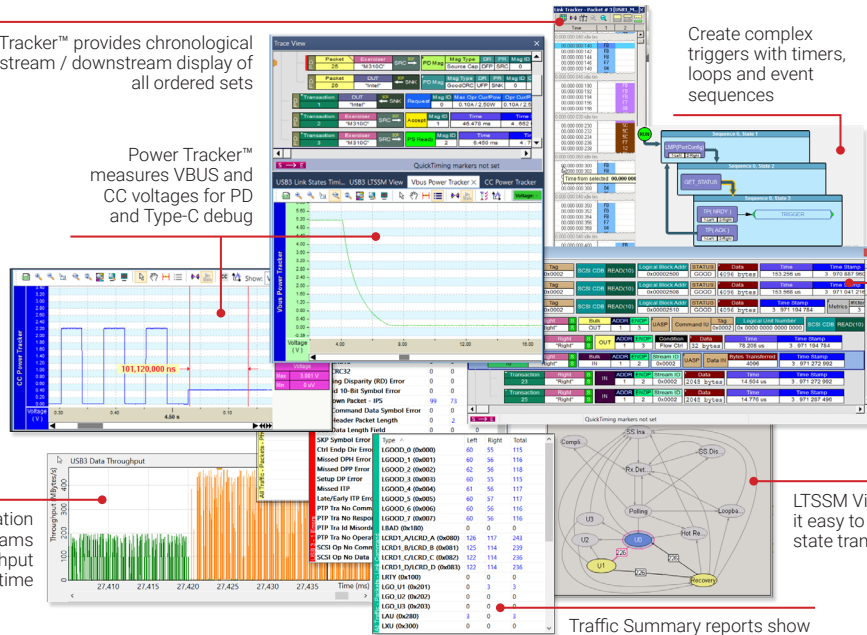
Bus Utilization histograms show throughput over time

Create complex triggers with timers, loops and event sequences

De-facto standard CATC Trace™ hierarchical display

LTSSM Viewer makes it easy to follow logical state transitions

Traffic Summary reports show event metrics for each trace



## Analysis Software

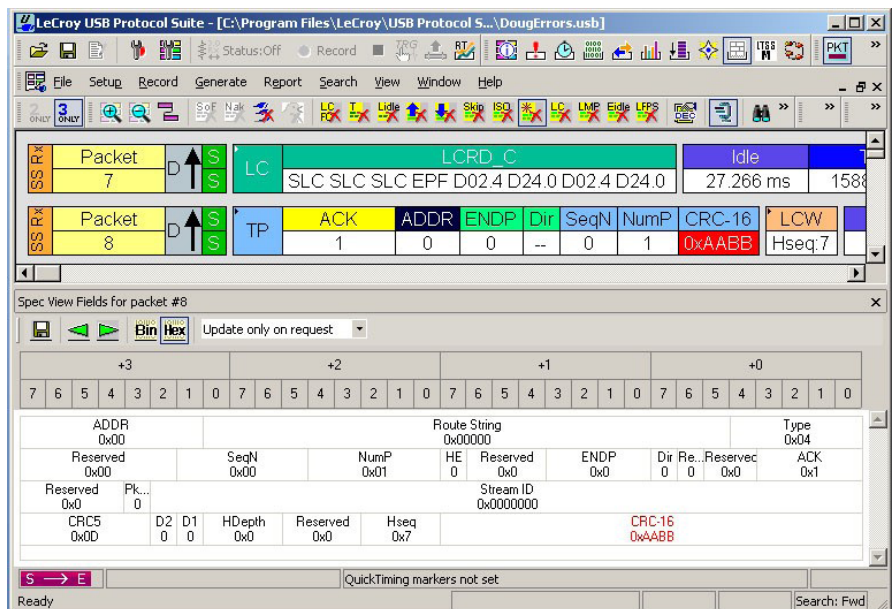
The Voyager utilizes the legendary CATC Trace - the industry's de facto standard since the inception of USB 1.0 technology. The trace viewer software uses colors and patterns to train the eye to understand information faster. When recording mixed traffic upstream from a SuperSpeed hub, Legacy 2.0 and 3.2 packets are labeled and interleaved in a single display. Each event is shown on a separate row with every field labeled and color-coded. Traffic from the logical 2.0 & 3.2 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 including all link commands and flow control primitives.

## 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 ordered sets (Link up, SKP, etc...) or header fields including address or packet types (ACK, Data, etc....). Voyager's graphical drag-and-drop interface makes setup easy. Using the Advanced mode, users can define trigger logic that monitors multiple sequential events including Control or Bulk transfers, VBUS & CC voltages, state changes or protocol errors.

## Real Time Filtering

The M310e can selectively filter unwanted traffic from the buffer in real-time by discarding redundant patterns such as SKPs, idles, and training sequences. Filtering logic can also include transaction layer packets with added criteria like direction or address.



Spec view shows header packets in hex or binary with errors in red

# Compliance Suite Options

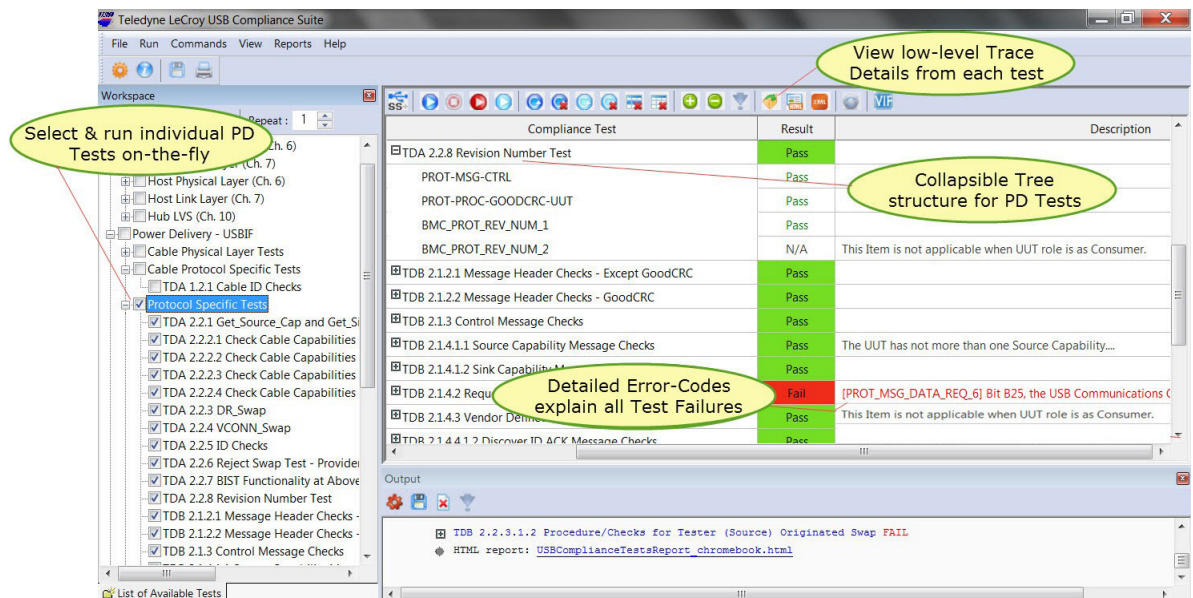
The Voyager USB Compliance Suite provides comprehensive support for Type-C, PD, Link Layer and hub compliance testing. Integrated with Teledyne LeCroy's Voyager exerciser platform, the Voyager M310e is an approved "Gold Suite" test solution approved by the USB-IF for Type-C Functional, PD, SuperSpeed Link (Ch. 6 & 7) and Hub (Ch.10) certification testing.

## One-button Testing

Fully automated, the compliance application provides point-and-pick selection of individual test cases. All tests utilize emulation scripts to mimic USB and Type-C link behaviors. The system initiates and responds to USB and PD commands like a real device while analyzing the response from the DUT. It communicates directly over Type-C cabling, records and analyzes every protocol exchange, and generates a pass/fail report.

## Power Delivery and Type-C Test Suites

Teledyne LeCroy's Power Delivery (PD) and Type-C test beds have been continuously improved since 2016 and allow developers to verify functionality, error recovery, and compliance for PD and Type-C devices. The Voyager platform offers comprehensive support for the Power Delivery Compliance Test Specification revision 1.3 and is an officially recognized "gold suite" test tool by the USB-IF. The new "merged" PD test spec provides 100% coverage of PD 2.0 & 3.1 functionality including EPR. Passing the Teledyne LeCroy test suite is required for PD and Type-C devices seeking USB-IF logo certification.



## Includes Source Code

Built on the same open architecture, all the Compliance Suite options include full source code for each test case. This represents a comprehensive library of test scripts that can be easily re-purposed for custom test development. Both the exerciser and verification scripts can be modified without recompiling. As the test specifications are revised and compliance tests are updated, customers will receive all maintenance releases at no additional cost.

## 100% Coverage

### PD Compliance:

The M310e leverages Teledyne LeCroy's robust automation framework to perform PD testing with minimal user interaction. To initiate test execution, Vendor Info Files (VIFs) are parsed and the appropriate tests are run automatically. This includes specific checks for PHY Layer (Ch-5); message and procedures (Ch-6) plus power source / sink behaviors (Ch-7). The M310e has built-in support for testing SPR power levels and fully supports EPR voltages with the addition of an external programmable power supply.

## 100% Coverage

### Type-C Compliance:

The Type-C Functional Verification test specification is fully supported by the M310e. The Type-C tests running on the M310e utilize a comprehensive library of high-level commands to emulate Type-C source, sink and DRP behaviors. Flexible control for resistor voltages (Rp / Rd / Ra), as well as programmable VCONN and vBUS settings, allow precise testing of cable orientation, initial power roles, and all Type-C source / sink operating modes. The M310e is the only reliable solution for verifying the Type-C tests that require USB 2.0 & 3.2 traffic synchronized with Type-C state changes. Many Type-C tests require generating USB 10Gbps data traffic while synchronously changing Type-C link states and this is a mandatory requirement for testing Type-C devices that also support USB data.

## 100% Coverage

### Hub and Link Layer:

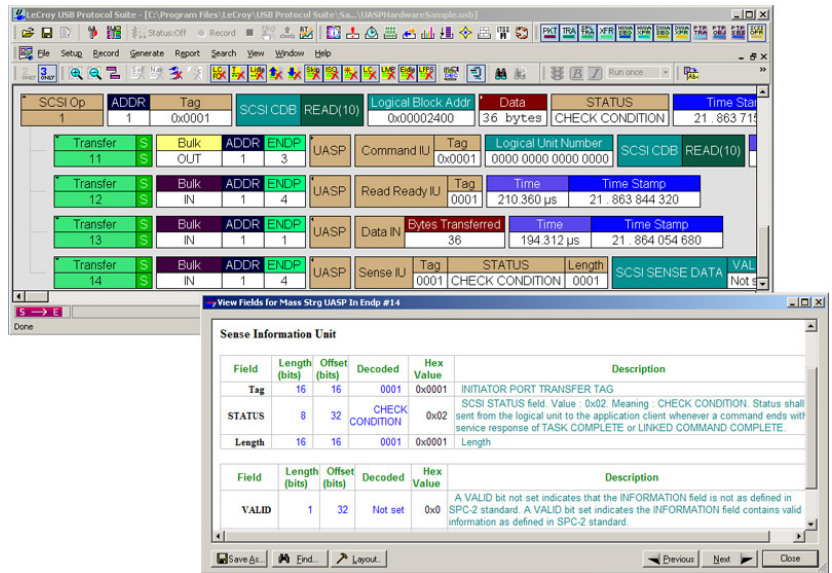
With the Hub and Link Layer compliance options, the exerciser emulates UFP or DFP traffic and verifies every aspect of the logical MAC layer for both USB 3.2 Gen1 and Gen 2. Considered one of the best ways to verify lower layer functionality, the Compliance suite covers hundreds of test points (chapter 7) including link initialization, header acknowledgement, link recovery and power management behaviors. It also addresses several PHY layer test cases (chapter 6) to verify LFPS and SKIP assertions also defined in the Link Layer Test Specification.

## Compliance Suite Configuration Guide

Compliance Spec:	Required Line Items	Description:	QTY:	Supported on Voyager models:
USB Power Delivery 2.0 & 3.1 Compliance	USB-AC16-V06-X	Voyager Power Delivery Compliance Suite option	1	Must have: Voyager M310e Models (USB-TZP3-V09-X, USB-TOP3-V09-X, USB-T0A3-V09-X, USB-TZA3-V09-X, USB-TZS3-V09-X, or USB-TZS2-V09-X) PD Compliance is no longer available for Voyager M310P.
	Includes:			
	USB25CAB-X	Cable USB4 Type C Functional Verification cable (Vconn Thru)	1	
	933534-00	Cable Voyager M310e External PD Load Cable	1	
	933535-00	Cable Voyager M310e External PD Source Cable	1	
	42488504001	Cable CATC Sync DB-9	1	
	USB-AC04-V01-A	Power Tracker option	1	
USB Type-C Functional Verification	USB-AC20-V06-X	Voyager USB Type-C Functional Verification Suite option	1	Must have: Voyager M310e Models (USB-TZP3-V09-X, USB-TOP3-V09-X, USB-T0A3-V09-X, USB-TZA3-V09-X, USB-TZS3-V09-X, USB-TZS2-V09-X); M310P Models: (USB-TZP3-V07-X, USB-TOP3-V07-X, USB-T0A3-V07-X, USB-TZA3-V07-X, USB-TZA2-V07-X, or USB-TZC2-V07-X); M310C Models: (USB-TZP3-V06-X, USB-TOP3-V06-X, USB-T0A3-V06-X; or USB-TZA3-V06-X)
	Includes:			
	USB25CAB-X	Cable USB4 Type C Functional Verification cable (Vconn Thru)	1	
	USB-AC04-V01-A	Power Tracker option	1	
USB 3.1 Gen-1 & Gen-2 Link Layer Compliance (5Gbps & 10Gbps)	USB-AC05-V01-A	Voyager USB 3.0 Compliance Suite option (Gen 1)	1	Must have: Voyager M310e Models (USB-TZP3-V09-X, USB-TOP3-V09-X, USB-T0A3-V09-X, USB-TZA3-V09-X); M310P Models: (USB-TZP3-V07-X, USB-TOP3-V07-X, USB-T0A3-V07-X, USB-TZA3-V07-X) or Voyager M310C Models: (USB-TZP3-V06-X, USB-TOP3-V06-X, USB-T0A3-V06-X)
	USB-AC15-V01-A	Voyager USB 3.1 Compliance Suite option (Gen 2)	1	
USB 3.1 Gen-1 Link Layer Compliance (5Gbps Only)	USB-AC05-V01-A	Voyager USB 3.0 Compliance Suite option (Gen 1)	1	Must have: Voyager M310e Models (USB-TZP3-V09-X, USB-TOP3-V09-X, USB-T0A3-V09-X, USB-TZA3-V09-X, USB-TZS3-V09-X); M310P Models: (USB-TZP3-V07-X, USB-TOP3-V07-X, USB-T0A3-V07-X, USB-TZA3-V07-X); or Voyager M310C Models: (USB-TZP3-V06-X, USB-TOP3-V06-X, USB-T0A3-V06-X); or Voyager M310 models: (USB-TZP3-V04-X, USB-TOP3-V04-X, USB-TZA3-V04-X, USB-T0A3-V04-X) or Voyager M3x models: (USB-TZP3-V03-X, USB-TOP3-V03-X, USB-TOS3-V03-X) or Voyager M3i models: (USB-TZP3-V02-X, USB-TOP3-V02-X, USB-TOS3-V02-X)
USB 3.0 Hub LVS Compliance Suite (5Gbps Only)	USB-AC05-V01-A	Voyager USB 3.0 Compliance Suite option (Gen 1)	2	*Hub LVS Tests only operate on "Exerciser" enabled Voyager Systems (ie: TZP3...)  Must have: Voyager M310e Models (USB-TZP3-V09-X, USB-TZA3-V09-X, USB-TZS3-V09-X); M310P Models: (USB-TZP3-V07-X, USB-TZA3-V07-X); or Voyager M310C Models: (USB-TZP3-V06-X, USB-TZA3-V06-X); or Voyager M310 models: (USB-TZP3-V04-X, USB-TZA3-V04-X); or Voyager M3x models: (USB-TZP3-V03-X) or Voyager M3i models: (USB-TZP3-V02-X)
	USB-AC08-V01-A	Voyager USB 3.0 Hub LVS Compliance Suite option	2	
	Includes Sync Cable			
	AC061XXA-X	Cable, Assy. MicroD – MicroD Sync (for M310P, M310C, M310, M3x)	1	
	USB-AC04-V01-A	Power Tracker option	2	
	ACC-EXP-002-X	Platform Expansion SYNC card*	2	*Sync card required for Voyager M3i systems only

## USB Device Decoding

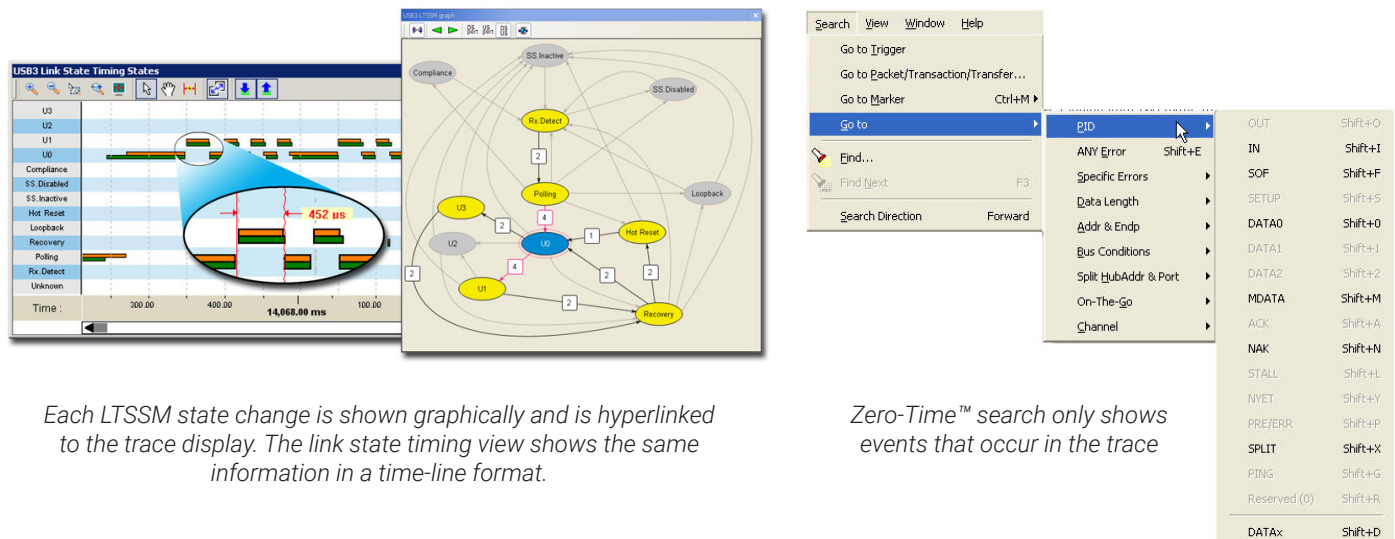
The Voyager software performs full decoding of USB device class traffic with both automatic and manual assignment of decodes to individual endpoints. From MTP, to CCD, to Video class, the Voyager provides the most comprehensive decoding available. It offers full support for the newest device types including Audio 3.0, Type-C Bridge, Content Security and USB Attached SCSI. It also supports vendor specific decoding for developers interested in automatically showing proprietary commands in the trace view.



Intelligent display shows each layer of the USB protocol including mass storage class and USB-Attached SCSI (UAS) decoding.

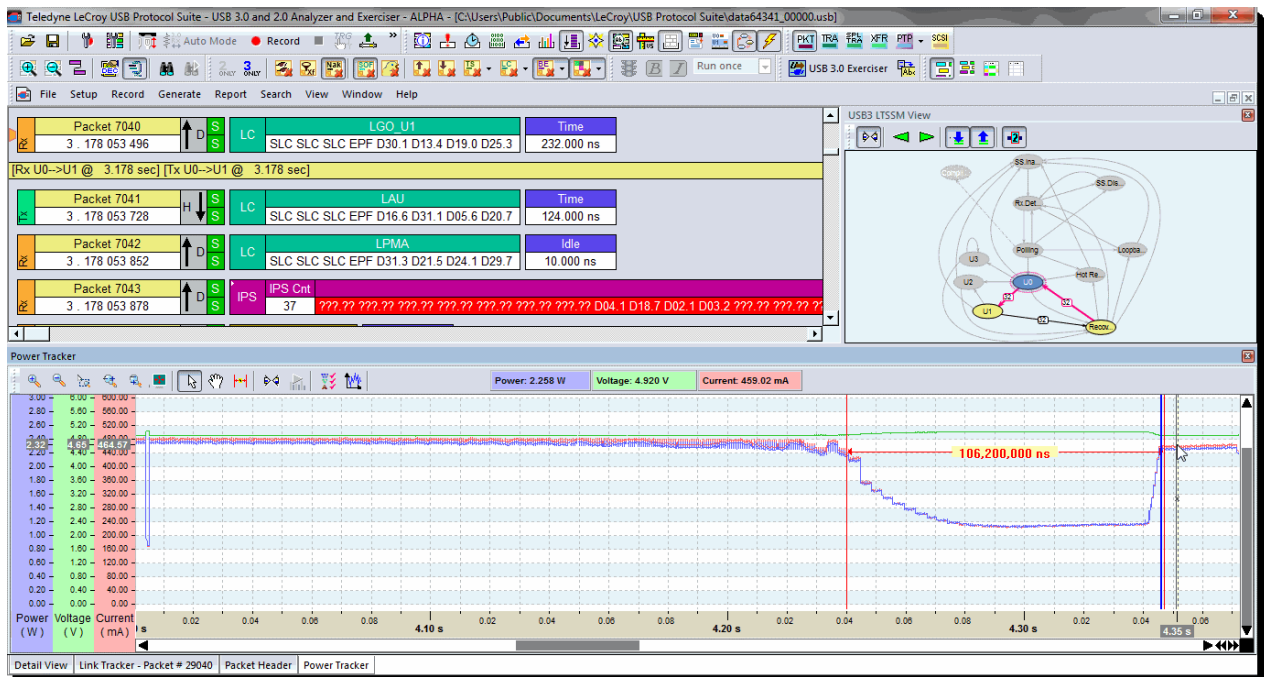
## Find the Issues Fast

The Voyager software provides many mechanisms to measure and report on PD and USB 2.0/3.2 protocol. With the Traffic Summary display, users can evaluate statistical reports at a glance or navigate to individual events. Users may select transaction packets to view ACK/NAK or Device Notification events, then jump to each occurrence with a single keystroke. Higher-level events are also tracked and reported at the logical USB Transfer level. Reports are available showing link throughput, latency and efficiency metrics. Error events are also reported showing 50 different protocol violations - from invalid CRCs to framing errors to incomplete PD contracts. The LTSSM View provides an interactive USB 3.0/3.2 state machine diagram. Bus Utilization graphs show data and packet length, bus usage by device in a histogram format. The Bandwidth calculator automatically calculates the time delta 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.



Each LTSSM state change is shown graphically and is hyperlinked to the trace display. The link state timing view shows the same information in a time-line format.

Zero-Time™ search only shows events that occur in the trace



*Voltage and current is displayed in a timeline format.*

## Measure and Verify VBUS and CC Voltages with PowerTracker

The Voyager M310e Power Tracker option offers a unique monitoring capability for vBus power and current. Power information is sampled and displayed graphically in a time-line format. The voltage and current displays are synchronized to trace events allowing users to verify power state transitions at the protocol and electrical layers. Separate power graphs are provided for CC and VCONN voltages making it easy to visualize logical Type-C state transitions. Fully compatible with the higher voltages in PD EPR devices, the Power Tracker automatically calculates the voltage change and slew rate for a selected area.

## Raw Debugging Power

The Voyager is the only analyzer on the market that captures every transition at the 5 and 10 Gbps link rates including idles, inter-packet symbols, corrupt 10-bit codes and 128-bit data blocks. The Link Tracker provides a chronological upstream / downstream display of all ordered sets with timing resolution of 800ps. Designed to assist with low-level debugging, all symbols including training sequences 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.

## Integrated Exerciser Option

A comprehensive exerciser capability with support for PD 2.0/3.2 and USB 2.0/3.1 traffic generation is built-in to the Voyager platform. The exerciser option allows users to transmit any arbitrary sequence of USB or PD packets to the device-under-test over native Type-C connectors (legacy USB devices are fully supported using the supplied adapter cables). The Exerciser is seamlessly integrated with the protocol analyzer, making the Voyager system a complete test and development solution for engineers validating USB protocol.

## Smart Emulation with ReadyLink™ and Transaction Engine™

For SuperSpeed testing, the M310e provides complete control over headers, payloads, timing, and link states. Featuring ReadyLink™ and Transaction Engine™, the exerciser includes a full-function link and transaction layer state machine that automatically handles all USB 3.2 LTSSM states and protocol handshakes for easier test script development. ReadyLink performs link synchronization, flow control and header acknowledgements in hardware. Overrides allow these behaviors to be altered such as shortening LFPS intervals, link training, or LMP handshake timing.

The Transaction Engine manages NRDY retry conditions allowing the Voyager to operate at full line-rate and correctly respond to the DUT as defined by the specification. At the packet level, users have the freedom to send customized data payloads anywhere within the stream making it easy to verify device specific behavior.

## PD Emulation

The PD exerciser supports traffic generation, including both provider and consumer device emulation. A flexible script-based authoring environment provides pre-defined templates for all Power Delivery packet types with overrides to allow low-level control of headers, payloads, timing, or logical PD protocol errors. Advanced functions including “If/Else”, “Wait”, and “Do Case” allow emulating complex PD behaviors including contract negotiation, Alt-mode entry and role swaps.



### EPR Compliance Tests:

Sinking or Sourcing Power Delivery EPR voltages (above 20V) requires

- Programmable Load with RS-232 control interface
- Programmable Power Source with RS-232 control interface

The PD exerciser also automatically handles transaction layer handshaking. The Exerciser will automatically link up as source or sink, track MessageID fields, and perform correct GoodCRC handshaking. Operating as a source, the M310e can negotiate and supply the full range of PD voltages with a single command (up to 50V). Using an attached load generator, the M310e can pull current like a real PD Sink.



## Error Injection

For validating the logical USB protocol, ReadyLink emulation can be customized per test script to include various error scenarios during link up. The Power Delivery exerciser can also override standard behaviors to insert protocol errors, marginal timing or illegal requests.

- 8B10B / CRC Error
- Running Disparity Error
- Corrupt Link Commands
- Corrupt Flow Control (Wrong L\_CRD\_x, Wrong L\_GOOD\_n, etc...)
- Corrupt Header Packet acknowledgement (Send LBAD, LRTY)
- Corrupt Packet Framing (SHP, SDP, END, SOP or SOP')
- Invalid Requests (5A current over 3A cable)

## Exerciser Control Environment

The exerciser software provides a flexible script-authoring environment that supports a powerful set of parser preprocessor features. For SuperSpeed applications, the Exerciser framework includes pre-defined templates for all USB 3.2 packet types allowing a single procedure call to complete an operation (ie: Host\_SetConfiguration). A comprehensive library of sample scripts is included and illustrates how these techniques can be used to create efficient, reusable generation blocks.

```
59: # Host sends DPH
60: MyDP_OUT( )
61: {
62:     SeqNum = out_seq_num
63:
64:     Data = { 55 53 42 43 C8 81 4F 81 24 00 00 00 80 00 06 1
65:             00 00 00 24 00 00 00 00 00 00 00 00 00 00 00 }
66: }
67: out_seq_num = (out_seq_num + 1) % 32
68: set
69:
70: # DisableLPMA
71: # DPPEndFramingErrRtryCnt
72: # DPPStartFramingErrRtryCnt
73: # ErrCorruptLinkCm
74: # ErrCorruptLMP #####
75: # ErrDisparity #####
76: # ErrLBAD
77: # ErrLostLCRD
78: # ErrLostLGOOD
79: # ErrLRTY
80: {
81:     SeqNum = in_seq_num
82:     NumP = 1
83: }
```

*Text-based editor includes pop-up shortcuts for easy adjustments to traffic generation scripts*

The USB 2.0 exerciser can create test scripts by exporting the host or device traffic stream from a captured analyzer trace file. These scripts can be played back using the Exerciser to recreate problems or test specific functionality.

## Error Detection

The Teledyne LeCroy Voyager can detect and flag real protocol errors including more than 50 different USB issues and 15 unique PD error conditions. At the lower layers, training sequences, header fields, link layer handshakes and timing parameters are automatically verified. At the SCSI and USB transaction layers, individual exchanges are checked for completeness. The Spec-View displays header fields in hex or binary and also marks errors in red.

With best-in-class features including non-intrusive probing, 16GB recording memory, and SuperSpeed Gen 1 data upload ports, the Voyager system features countless innovations in data analysis to help reduce time-to-market for USB systems and software.

Specifications	
Protocols Supported	USB 1.0, 1.1, 2.0 & 3.20; Power Delivery 3.1
Host Machine Minimum Requirements	Microsoft® Windows 11, Windows 10, Windows Server 2016, and Windows Server 2019, Intel Pentium 4 or AMD Duron with USB 2.0 interface, 512MB RAM (1GB RAM recommended)
Data Rates Supported	1.2 Mb/s–10 Gb/s
Data Bus Interface	Half duplex differential (USB 2.0) Dual simplex differential (USB 3.2)
Front Panel Connectors	Analyzer / Exerciser – one (1) USB 2.0 & 3.2 recording channel with USB 3.2 Type-C connectors
Front Panel Indicators	Platform LEDs: Power, Status, Trigger Analyzer LEDs: Rec 2.0, 5Gb/s, 10Gb/s , Exerciser LEDs: Gen, Rec 2.0, 5Gb/s, 10Gb/s
Rear Panel Connectors	Sync/Data, 1000BASE-T Ethernet, USB 3.0 (to host machine), 24V 6.67 ADC Power In, Power Switch
Dimensions (W x H x D)	304.48 x 44.45 x 345.6 mm (12" x 1.75" x 13.61")
Weight	3.1 Kg (6.8 lbs)
Environmental	Operating Temperature: 0°C to 50°C (32°F to 122°F) Non-Operating Temperature: -10°C to 80°C (14° Temperature: Operating 0 °C to 55 °C (32 °F to 131 °F) Humidity: 10% to 90% RH (non-condensing)
Power Requirements	External 24V Power Sourcing Power Delivery EPR voltages (above 20V) requires programmable Power Source
External Trigger IN/OUT	SMA connectors
Warranty	12 Month Hardware Warranty



## 绿测科技有限公司

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