

SEE THE WHOLE LINK



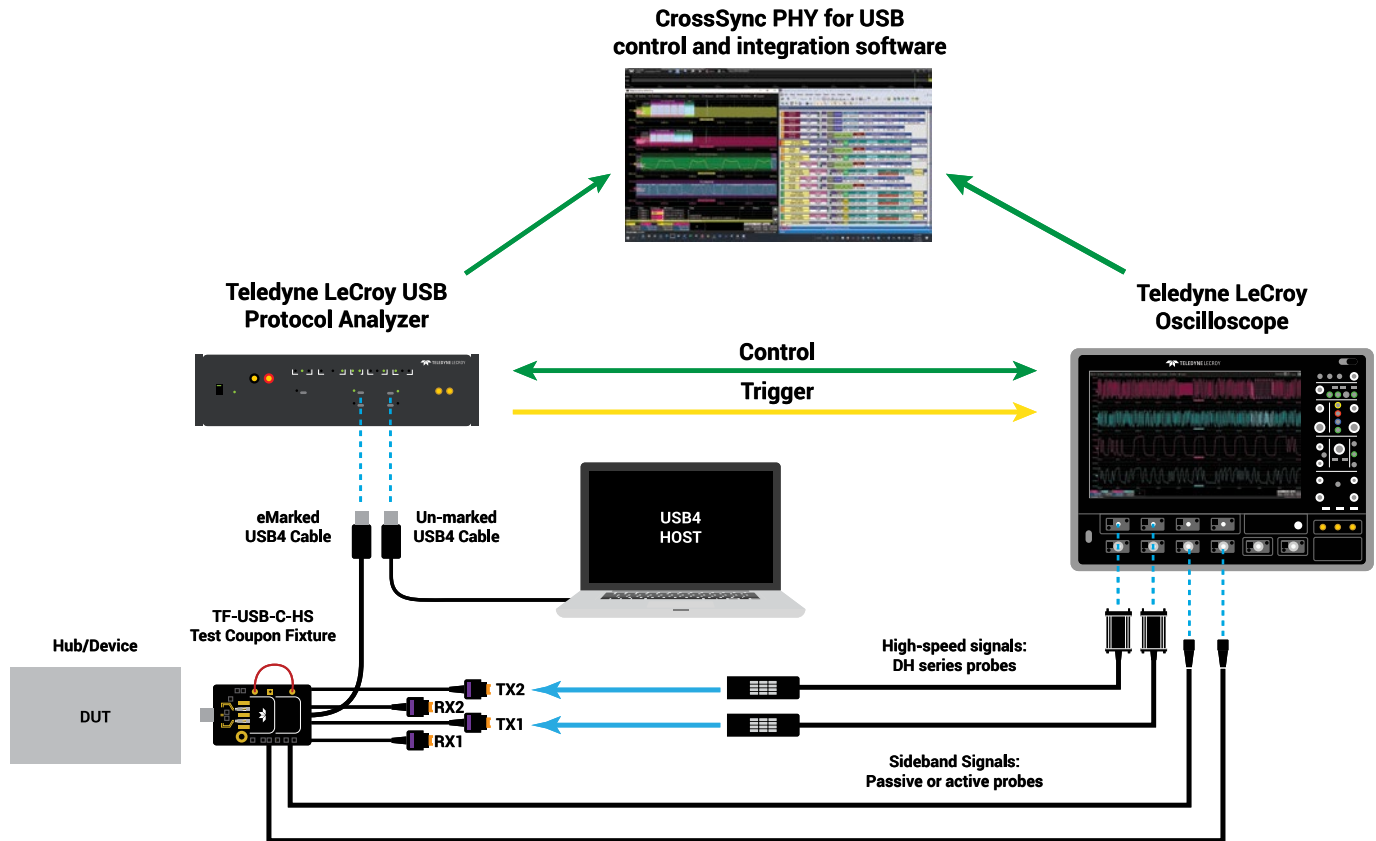
Debug and validate
active link behavior
across electrical and
protocol layers.

CrossSync™ PHY

**Cross-layer Analysis for
USB4® and Thunderbolt™**

THE CrossSync™ PHY CONCEPT

Interoperability issues can lead to finger-pointing exercises that cost money and time-to-market. Teledyne LeCroy CrossSync PHY software merges the functions of your Teledyne LeCroy protocol analyzer and oscilloscope - giving insight into link behavior that no other instrument can provide.



Validate and debug active link operation

- TF-USB-C-HS Test Coupon Fixtures enable observation of both electrical and protocol behavior without disturbing the link
- USB Type-C Sideband signals are all accessible using passive or active probes
- High-bandwidth oscilloscope probing points for USB data lanes

Quickly resolve interoperability issues by capturing the entire protocol stack

- Trigger protocol analyzer and oscilloscope captures on the same high-level event
- Easily measure timing relationships between protocol and electrical domains
- Faster root-cause analysis means fewer costly finger-pointing exercises

Analyze link training with integrated physical and protocol views

- Observe electrical-level results of protocol-level commands
- Combined navigation means always knowing which protocol and electrical behaviors happen at the same time
- No other solution can deliver this level of cross-layer insight into link training

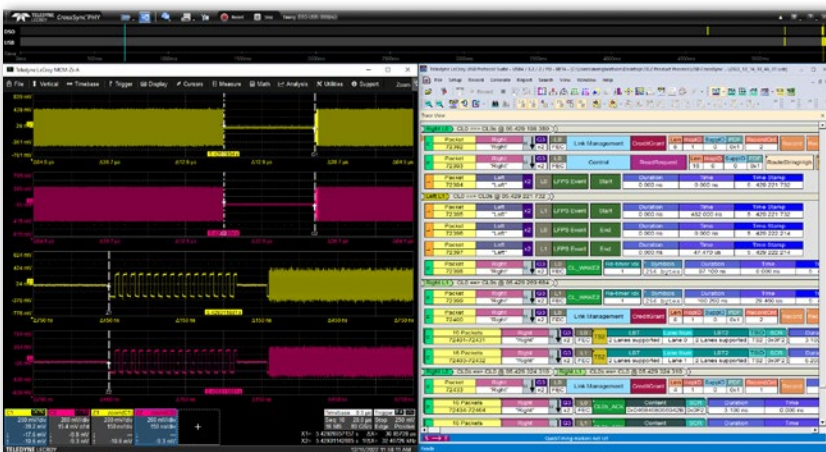
MORE VISIBILITY INTO...



Correlated electrical and protocol views of a link training sequence.

Host-Device Link Training

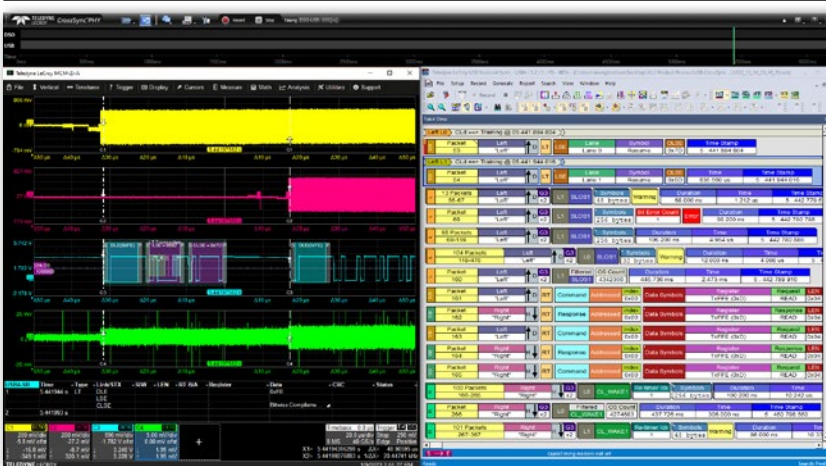
- Characterize sequence with visibility into sideband, and power delivery (CC and Vbus) signals.
- Observe speed changes in both electrical and protocol domains.
- Trigger on problematic link training behaviors and analyze their consequences through the entire protocol stack.
- Save, recall, and re-analyze linked oscilloscope and protocol analyzer traces.
- Optionally use USB4bus DME for oscilloscope based waveform decode, measurement and eye testing



Analyzing LFPS and transmitter WAKE during CL0 to CL0s state change.

Retimer Link Training

- Quick and easy triggering and capture of both protocol and electrical behavior as a retimer is enabled.
- Precise timing measurements between protocol commands and electrical behaviors during retimer link training state changes.
- Validate retimer performance and proper transmitter equalization.



Dynamic rail Vbus, USB4 SB, and Transmitter turn on during LT_Resume.

Sidebands and Power Delivery

- TF-USB-C-HS Test Coupon Fixture provides probing access to all USB-C signals including Vbus, Vbus Load Current, CC1/CC2, SBU1/2, and D+/D-.
- Time-correlate high speed Tx and Rx signal behavior with sidebands using active or passive probes.
- Compatible with ZS and ZD Series Active single ended and differential probes.
- Connect an RP4060 Active Voltage Rail probe for Vbus steady-state power integrity measurements.
- Optionally use USB4 TDMP for USB4 Sideband Decode, Measurements, and Physical Layer measurements

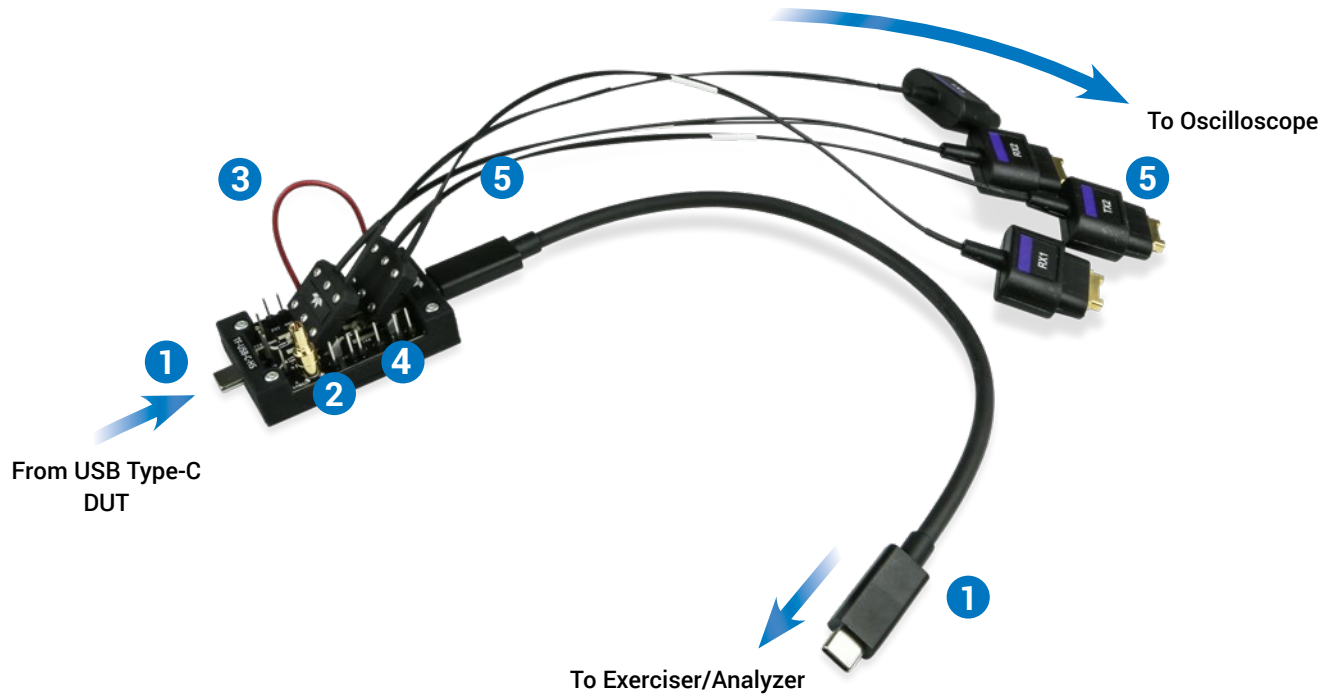
CrossSync™ PHY INTEGRATED ANALYSIS SOFTWARE

The CrossSync PHY software option for your Teledyne LeCroy oscilloscope enables precise, intuitive navigation between time-correlated protocol analyzer and oscilloscope traces.

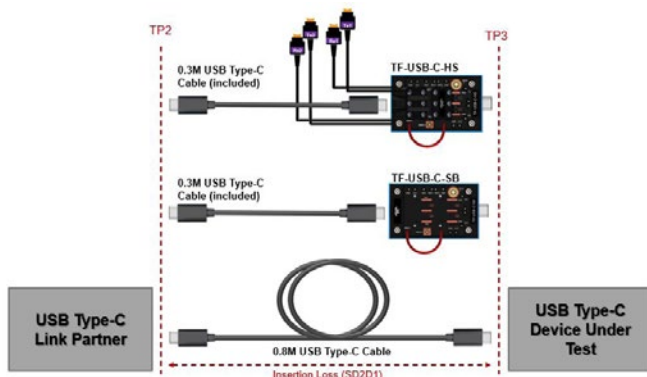


1. CrossSync PHY navigation bar makes clear the timing relationship between linked protocol analyzer and oscilloscope captures
2. One or many oscilloscope acquisition segments are represented in the navigation bar
3. Protocol analyzer trace represented in the navigation bar
4. Common trigger point ensures precise timing alignment between protocol trace, oscilloscope acquisitions, and navigation bar view
5. Oscilloscope timebase and protocol analyzer acquisition window remain synchronized while navigating through the combined acquisition, for total confidence in timing behavior
6. Selecting a packet on the protocol trace enables zoom traces on the oscilloscope to the same time window, enabling sub-packet-level measurement precision
7. Optionally use USB4bus DME and USB4-SB TDMP oscilloscope decode software to verify electrical signal quality produces the correct protocol packets during link training

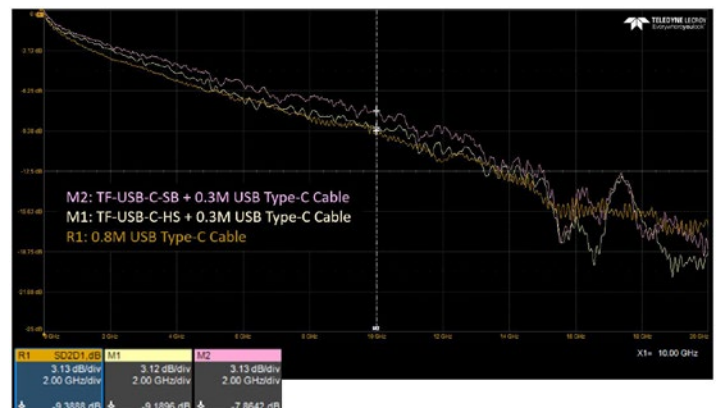
CrossSync PHY capability enhances Teledyne LeCroy's industry-leading Protocol Analyzer/Exercisers by adding high-fidelity oscilloscope probing points with simple and convenient signal access. USB Type-C Test Coupon Fixtures provide probing access to all signals at connector test points (TP2 or TP3) without impacting the performance of the system under test.



1. Transparent signal path through the test coupon fixture's USB-C Plug, Receptacle, and included 0.3M USB Type-C cable
2. Vbus access using passive oscilloscope probes or an Active Voltage Rail Probe
3. Current loop for measuring Vbus current through the test coupon fixture
4. Access SBU1/SBU2 (USB4 Sidebands and DP-AUX), CC1/CC2 (Power Delivery), and D+/D- (USB1.1/2.0) signals using square pins
5. High-speed TX1/TX2 and RX1/RX2 signals captured using a permanently attached DH-SI Series probe tips



TF-USB-C test fixture coupon replaces the 0.8M USB Type-C 'golden cable' for signal integrity transparency in a system.



Test fixture coupon S21 insertion loss compared to 0.8M 'golden cable'.

COMPATIBLE PROTOCOL & OSCILLOSCOPE EQUIPMENT

Protocol Analyzers



Voyager M4x

- The only USB-IF approved solution for testing USB4 Compliance
- Analyzes USB4®, Thunderbolt™, USB 3.2, USB PD, DisplayPort™ Aux, and Power Delivery packets
- Provides single and multiple trigger events on sideband and high-speed link training packets for USB4 (Gen2/Gen3) CrossSync PHY analysis

Oscilloscope Products



LabMaster 10 Zi-A

- Up to 65 GHz real-time bandwidth
- Supports USB measurements to USB4 Version 2.0 and beyond
- Powerful server-class PC with 20 processor cores and up to 192 GB system RAM for fast processing of long waveforms



SDA 8 Zi-B

- Up to 20 GHz real-time bandwidth
- Supports USB4 protocol debug
- Supports USB-PD and USB4 sideband triggering using USB-PD and USB4-SB TDMP software



TF-USB-C USB4 Test Coupon Fixtures

- Provides USB Type-C signal access at the connector without impacting system performance
- TF-USB-C-HS provides permanently attached DH-SI probe tips for simple Tx/Rx attachment to the DH Series probe amplifier
- TF-USB-C-SB also available for sideband-only signal access



DH Series High-bandwidth Differential Probes

- Connect directly to TF-USB-C-HS Test Coupon Fixtures with no soldering required
- Up to 30 GHz bandwidth, low noise, low loading
- Probe up to all four USB Type-C high-speed signals with a four channel oscilloscope

Oscilloscope Products – Continued



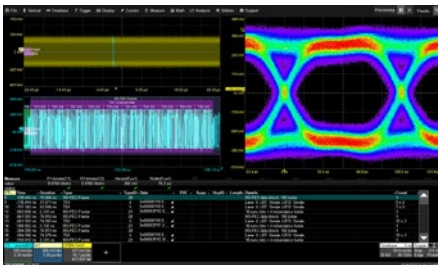
RP2060 and 4060 Active Voltage Rail Probe

- Connects directly to TF-USB-C test coupon (Vbus) with no soldering required
- Supports Vbus steady-state power integrity measurements
- 4 GHz bandwidth with $\pm 60V$ Offset Capability; Low attenuation for very low noise; 50 k Ω DC Input Impedance for low loading



Voltage and Current Probes

- Connect directly to TF-USB-C test coupon without soldering
- Connect CC1/CC2, Vconn, and Vbus (voltage and load current) for USB Power Delivery debug
- Connect SBU1/SBU2 for USB4-SB and DP-AUX for combined sideband and High-speed debug; and D+/D- for USB 2.0 debug



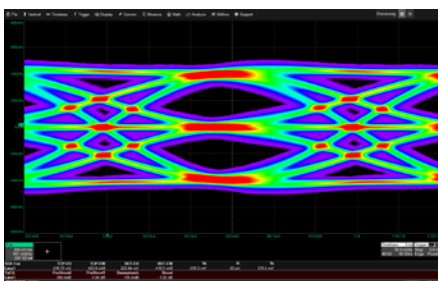
USB High Speed Data Decode Software

- Provides decoding on oscilloscope waveforms during link training
- USB4bus DME provides Decode, Measure/Graph and Eye diagrams for USB4
- USB 3.2bus D optionally provides Decode for USB 3.2 (Gen1, Gen2) and USB1.1/2.0



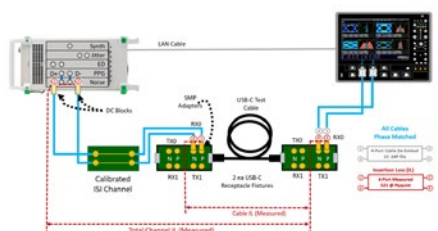
USB Type-C Sideband Trigger and Decode Software

- USB4-SB TDMP provides Trigger, Decode, Measure/Graph, and Physical layer measurements for USB4 sideband channel
- USB-PD TDMP provides Trigger, Decode, Measure/Graph, and Physical layer measurements for USB Power Delivery
- DP-AUX provides Decode, Measure/Graph, and Physical layer measurements for DisplayPort AUX sideband channel



SDA-III Serial Data Analysis Software

- Multi-lane Serial Data Analysis for USB4 and USB3.2
- SDAIII-PAMx option provides PAM3 analysis for USB4 Version 2.0
- Transmitter Equalization (Tx-FFE) measurements on NRZ and PAM3 signaling



QualiPHY USB Test Automation Software

- Automates LabMaster and WaveMaster oscilloscopes to perform USB compliance and characterization testing
- Compatible with Anritsu MP1900A Signal Quality Analyzer for complete USB4 and USB 3.2 receiver test calibration and BER testing
- Available for USB 1.1/2.0, 3.2, and USB4

ORDERING INFORMATION

Product Description

| | |
|--|--------------------------|
| USB CrossSync PHY protocol analyzer synchronization software for LabMaster 10 Zi | LM10Zi-CrossSync-PHY-USB |
| USB CrossSync PHY protocol analyzer synchronization software for WaveMaster 8 Zi | WM8Zi-CrossSync-PHY-USB |

Product Code

USB Type-C Test Coupon Fixtures

| | |
|--|-------------|
| USB4 High-speed and Sideband Test Coupon Fixture | TF-USB-C-HS |
| USB4 Sideband Test Coupon Fixture | TF-USB-C-SB |

Compatible Protocol Analyzer/Exercisers

| | |
|--|-----------------|
| Voyager M4x USB 4.0 (40 Gb/s) Analyzer Exerciser System | USB-TZP4-V08-X |
| Voyager M4x USB 4.0 (40 Gb/s) Analyzer System | USB-T0P4-V08-X |
| Voyager M4x 32 GB Memory option (Software License allows 32 GB memory upgrade for M4x platform only) | USB-MEM32-V08-A |
| Voyager USB4 Gen-3 (40 Gb/s) Compliance License | USB-AC40-V06-A |
| Medium Zero Carrying Case (for use with Summit T3-8 & Voyager M4x) | AC007XXA-X |

Recommended Oscilloscopes

| CrossSync PHY is compatible with all LabMaster 10 Zi and WaveMaster 8 Zi Oscilloscopes | LabMaster LM 10 Zi | SDA 8 Zi |
|--|------------------------------|-------------|
| USB4 CrossSync PHY and Electrical Compliance Test Capability | | |
| LabMaster Master Control Module | MCM-Zi-A | - |
| Models (25 GHz and above) supported by CrossSyncPHY-USB and required for QPHY-USB4-TX-RX compliance software | LM 10-25Zi-A to LM 10-65Zi-A | - |
| Multi-lane Tx compliance testing (80 GS/s sample rate on all channels) | Yes | No |
| USB4 CrossSync PHY Debug Only | | |
| Models supported by CrossSyncPHY-USB only (20 GHz BW, 40 GS/s sample rate adequate for USB4 decode) | LM 10-20Zi-A | SDA 820Zi-B |

Recommended Oscilloscope Probes

| | | |
|--|-------------------------------|--------------------|
| 20-30 GHz differential probe for Tx/Rx probing | DH30-2.92MM | DH20-PL |
| Power/Voltage Rail Probe, 4 or 2 GHz bandwidth, 1.2x attenuation, +/-60V offset, +/-900mV (for probing Vbus ac and transient behavior) | RP4060 or RP2060 and LPA-2.92 | RP4060 or RP2060 |
| 1 GHz, 0.9 pF, 1 MΩ Active Voltage Probe (for probing USB4-SB and other USB Type-C sideband signals) | ZS1000 and LPA-2.92 | Use Passive Probes |
| 1.5 GHz, 1.0 pF Active Differential Probe, ±8 V (for probing DisplayPort AUX differential sideband channel) | ZD1500 and LPA-2.92 | ZD1500 |
| 30A, 50 MHz Current Probe - AC/DC, 30 A rms, 50 A Peak Pulse (for probing Vbus load current) | T3CP30-50 | CP030 |

Recommended Oscilloscope Software Options

| USB and USB Type-C High-speed and Sideband Trigger and Decode Software Options | | |
|--|-------------|-------------|
| USB4 Decode, Measure/Graph, and Eye Measurements Software Option | USB4bus DME | USB4bus DME |
| USB 3.2 Decode Software Option (includes USB 2.0 Decode) | USB32bus D | USB32bus D |
| USB4-SB (USB4 Sideband) Trigger, Decode, Measure/Graph, and PHY Measurements Software Option | USB4SB DMP* | USB4SB TDMP |
| USB-PD (USB Power Delivery) Trigger, Decode, Measure/Graph, and Physical Layer Software Option | USBPD DMP* | USBPD TDMP |
| DP-AUX (DisplayPort AUX Sideband) Decode, Measure/Graph, and Physical Layer Software Option | DPAUX DMP | DPAUX DMP |

* Low speed serial triggering not available on LabMaster 10 Zi-A

USB and USB-Type-C Serial Data Electrical Validation and Compliance Test Software Options

| | |
|---|---------------------|
| Serial Data Analysis Bundle – Multi-Lane SDA LinQ Framework, incl. Eye, Jitter, Noise, Crosstalk Meas, w/EyeDrill & VirtualProbe (Includes -LINQ and -VIRTUALPROBE required options for USB4 validation and compliance) | SDAIII-CompleatLinQ |
| PAMx Serial Data Analysis, Eye, Jitter and Noise Measurements (for USB4 Version 2.0 PAM3) | SDAIII-PAMx |
| QualiPHY Enabled USB4 Transmitter and Receiver Compliance Testing | QPHY-USB4-TX-RX |
| QualiPHY Enabled USB 3.2 Transmitter and Receiver Compliance Testing | QPHY-USB32-TX-RX |
| QualiPHY Enabled USB1.1/2.0 Compliance Testing | -* QPHY-USB |
| QualiPHY Enabled DisplayPort 2 Source software (includes DisplayPort 1.4 Sink) | QPHY-DP2-SOURCE |
| QualiPHY Enabled DisplayPort 2 Sink software (includes DisplayPort 1.4 Sink) | QPHY-DP2-SINK |

* USB 1.1/2.0 QPHY compliance not available on LabMaster 10 Zi-A

Customer Service

Teledyne LeCroy oscilloscopes and probes are designed, built, and tested to ensure high reliability. In the unlikely event you experience difficulties, our digital oscilloscopes are fully warranted for three years and our probes are warranted for one year.

This warranty includes: • No charge for return shipping • Long-term 7-year support • Upgrade to latest software at no charge



1-800-5-LeCroy
teledynelecroy.com

Local sales offices are located throughout the world.
Visit our website to find the most convenient location.

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