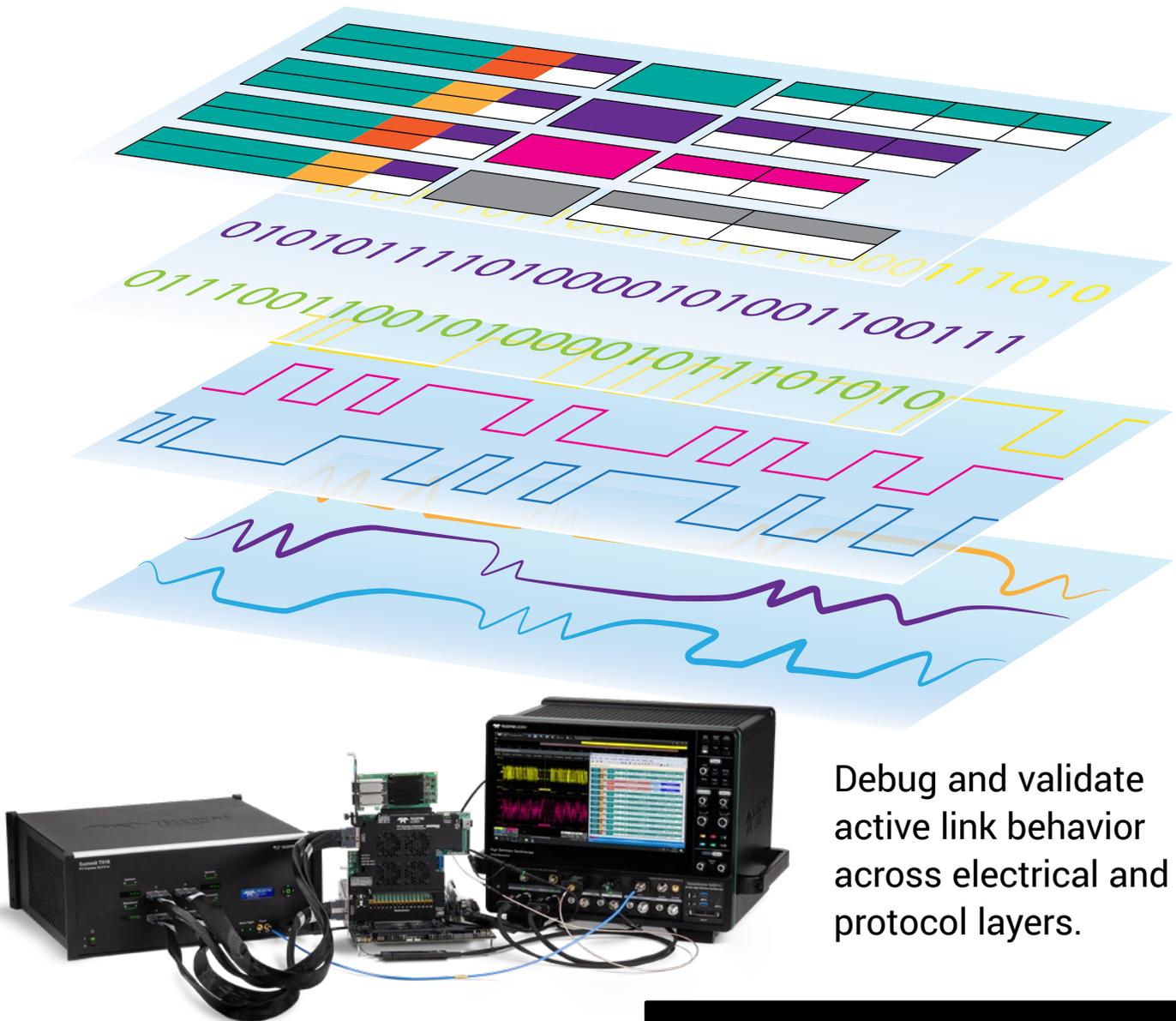# SEE THE WHOLE LINK

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

*Cross*Sync™ PHY

Cross-layer Analysis for PCI Express®

THE *Cross*Sync™ PHY CONCEPT

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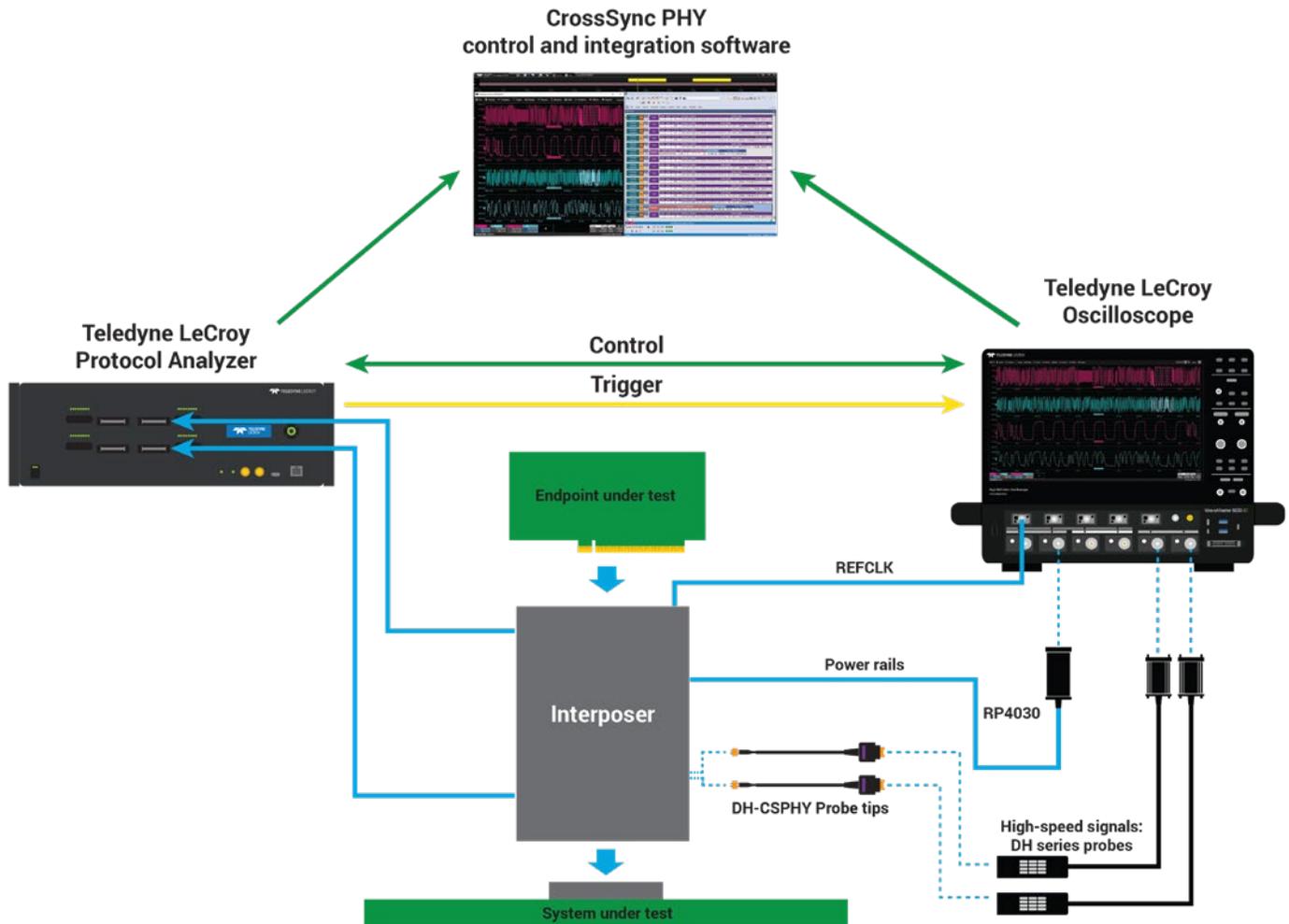
Validate and debug active link operation

- CrossSync PHY capable interposers enable observation of both electrical and protocol behavior without disturbing the link

- Sideband signals, reference clock, and power rails are all easily accessible to oscilloscope probes

- Optional high-bandwidth oscilloscope probing points for PCI Express 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 single instrument can deliver this level of cross-layer insight into link training behavior

Correlated electrical and protocol views of a link speed change from 8 to 16 GT/s.

Dynamic Link Behavior

- Characterize entire boot sequence with visibility into sideband signals, reference clock, data lanes, and power rails.

- 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.

Analyzing exit from L1.2 including reference clock and CLKREQ# behavior.

Power Management Transitions

- Quick and easy triggering and capture of both protocol and electrical behavior as a device enters or exits low-power states.

- Precise timing measurements between protocol commands and electrical behaviors of reference clock and high-speed data lines.

- Dynamic power analysis through Power Management transitions including L1 substates.

Dynamic rail voltage, current and power measurements as lane changes speed to 16 GT/s.

Dynamic Power Characterization

- CrossSync PHY interposers have built-in rail voltage and current measurement points.

- Voltage and current waveforms are synchronized and time-correlated to protocol analyzer trace.

- Oscilloscope tools enable measurement of dynamic power consumption and power integrity metrics.

- Compatible with RP4030 Active Voltage Rail probe for low-noise measurement of voltage rails with high bandwidth and low loading.

# *Cross*Sync™ 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.
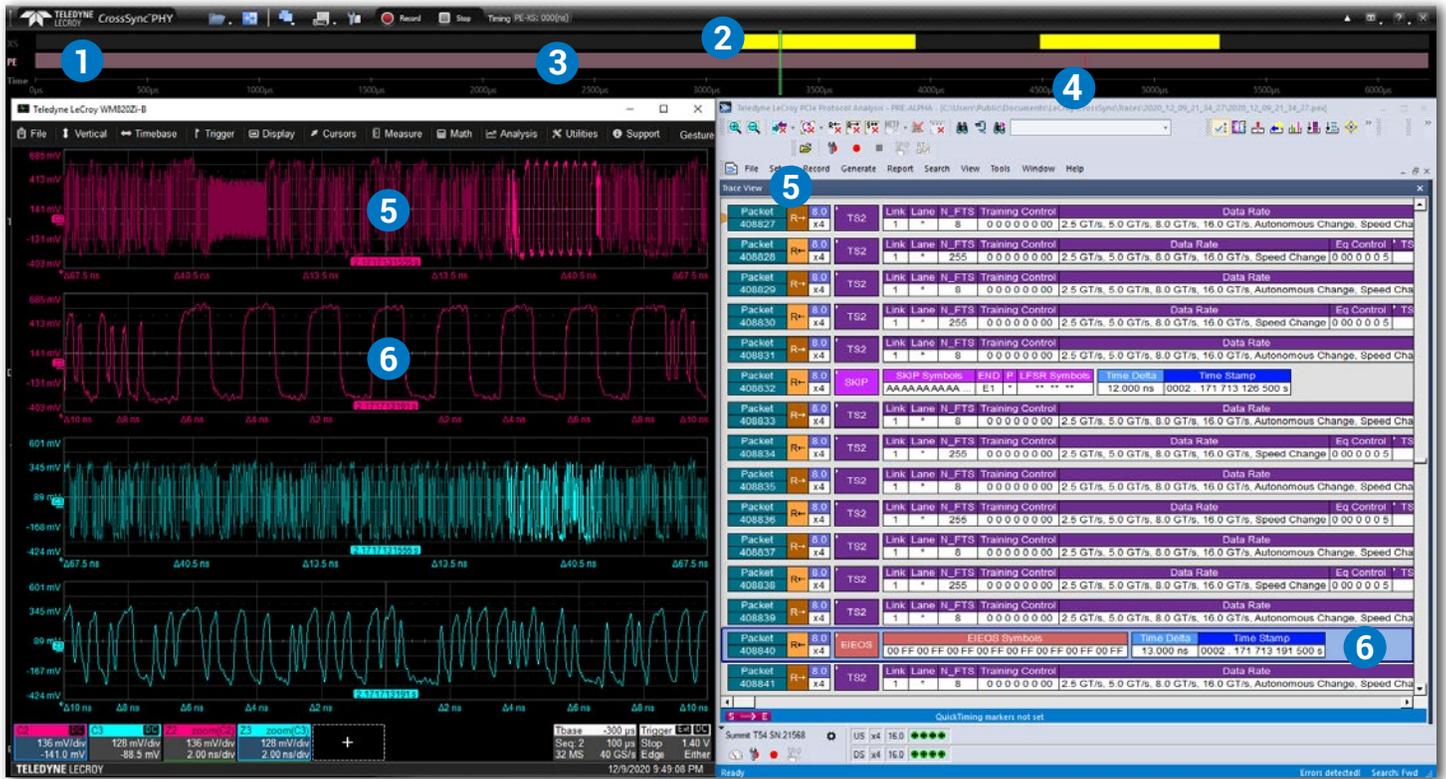
1. **CrossSync PHY navigation bar makes clear the timing relationship between linked protocol analyzer and oscilloscope captures**

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

CrossSync PHY capability enhances Teledyne LeCroy's industry-leading set of protocol analysis interposers by adding high-fidelity oscilloscope probing points with simple and convenient signal access.
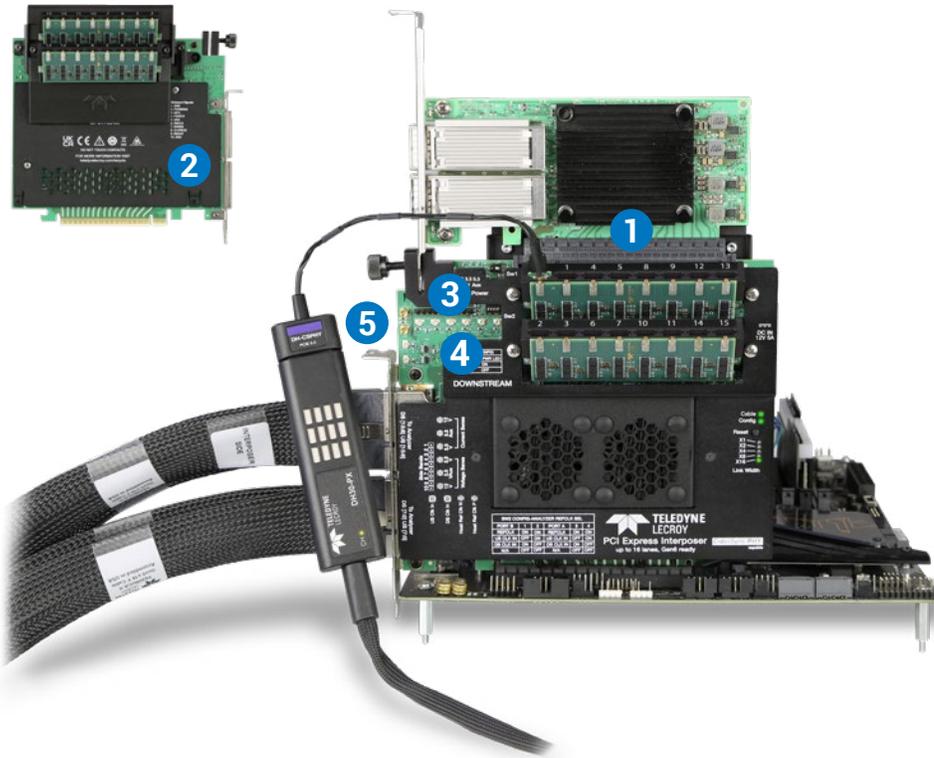
1. Transparent signal path between host and endpoint, with convenient connections to both protocol analyzer and oscilloscope

2. Simple, low-loading direct connection to high-speed lanes for Teledyne LeCroy DH series oscilloscope probes up to 30 GHz bandwidth – no soldering required

3. Easy access to all sideband signals

4. High-bandwidth voltage and current connections for monitoring dynamic power rail behavior

5. High-fidelity buffered reference clock connection for observing clock behavior during power-up and low-power states

PE6117UIA-X PCIe 6.0 CEM interposer shown with PE6817ACA-X high-speed probing upgrade

CrossSync PHY interposers for popular PCI Express form factors

See Ordering Information on page 8 for full configuration

CEM form factor

PE6817ACA-X PCIe 6.0 CEM x16 interposer

M.2 form factor

PE222UIA PCIe 5.0 M.2 M-Key Interposer

EDSFF form factor

PE243UIA-X G5x4 EDSFF E1.S Interposer
PE241UIA-X G5x8 EDSFF E1.L Interposer
PE240UIA-X G5x16 EDSFF E3.x Interposer

U.2/U.3 form factor

PE221UIA-X PCI Express 5.0 U.2/U.3 12 inch Interposer

Summit M616

- Protocol Analyzer and Exerciser for PCI Express 6.0, NVME, and CXL (Compute Express Link)
- Supports up to x16 Links at data rates of 2.5 GT/s, 5 GT/s, 8 GT/s, 16 GT/s, 32 GT/s and 64 GT/s
- Trace buffer up to 64 GB

Summit T516

- Protocol Analyzer for PCI Express 5.0, NVMe, and CXL (Compute Express Link)
- Supports up to x16 Links at data rates of 2.5 GT/s, 5 GT/s, 8 GT/s, 16 GT/s and 32 GT/s
- Trace buffer up to 256 GB

Summit M5x

- Protocol Analyzer for PCI Express 5.0, NVMe, and CXL (Compute Express Link)
- Supports up to x8 Links at data rates of 2.5 GT/s, 5 GT/s, 8 GT/s, and 16 GT/s
- Trace buffer up to 128 GB

Summit T54

- Protocol Analyzer for PCI Express 5.0, NVMe, and CXL (Compute Express Link)
- Supports x1, x2 and x4 Links at data rates of 2.5 GT/s, 5 GT/s, 8 GT/s, 16 GT/s and 32 GT/s
- Trace buffer up to 64 GB
- Can be cascaded to support x8 Link Widths with up to 128 GB of trace buffer

Summit T416

- Protocol Analyzer for PCI Express 4.0 and NVMe
- Supports up to x8 Links at data rates of 2.5 GT/s, 5 GT/s, 8 GT/s, and 16 GT/s
- Trace buffer up to 128 GB

Summit T48

- Protocol Analyzer for PCI Express 4.0 and NVMe
- Supports up to x8 Links at data rates of 2.5 GT/s, 5 GT/s, 8 GT/s, and 16 GT/s
- Trace buffer up to 64 GB

COMPATIBLE OSCILLOSCOPE PRODUCTS

WaveMaster 8000HD

- Up to 65 GHz real time bandwidth with 12-bit resolution
- Supports PCI Express measurements to PCIe 7.0 and beyond
- Class-leading PC system, so less time spent waiting for measurements to complete

DH Series High-bandwidth Differential Probes

- Connect directly to CrossSync PHY interposers with no soldering required
- Up to 30 GHz bandwidth, low noise, low loading
- Other tips available: solder-in (standard and high-sensitivity), high-temperature solder-in, handheld browser, QuickLink adapter

RP4030 Active Voltage Rail Probe

- Connects directly to CrossSync PHY interposers with no soldering required
- 4 GHz bandwidth with ±30V Offset Capability
- Low attenuation for very low noise
- 50 kΩ DC Input Impedance for low loading
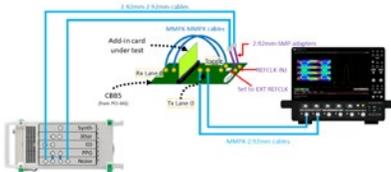
QualiPHY PCIe Test Automation Software

- Automates WaveMaster 8000HD oscilloscopes to perform PCI Express compliance and characterization testing
- Compatible with Anritsu MP1900A Signal Quality Analyzer for complete receiver test calibration and execution
- Available for PCI Express 3.0, 4.0, 5.0, and 6.0

PCI Express Decode

- Decode PCI Express signals up to data link layer directly in the oscilloscope user interface
- Intuitive, Color-Coded Overlays
- Interactive Table Summarizes Results

ORDERING INFORMATION

Product Description	Product Code
Oscilloscope Software Options (enables CrossSync PHY functionality on installed CrossSync software)	
PCIe CrossSync PHY protocol analyzer synchronization for WaveMaster/SDA 8000HD	WM8KHD-CROSSSYNC-PHY-PCIE
CrossSync PHY capable PCI Express Interposers	
PCI Express 6.0 - CEM form factor	
PCIe 6.0 CEM x16 interposer (Includes sideband, power rail and REFCLK probing points, no high-speed probing points)	PE6117UIA-X
Upgrade PE6117UIA-X to add probing points on all 32 high-speed lanes	PE6817ACA-X
Probe tip to connect DH series oscilloscope probe to PE6817ACA-X	DH-CSPHY-PCIE6
PCI Express 5.0 - CEM form factor	
PCIe 5.0 CEM x16 interposer (Includes sideband, power rail and REFCLK probing points, no high-speed probing points)	PE230UIA-X
Upgrade PE230UIA-X to add probing points on all 32 high-speed lanes	PE120ACA-X
Probe tip to connect DH series oscilloscope probe to PE120ACA-X	DH-CSPHY-PCIE5-CEMx16
PCI Express 5.0 - EDSFF form factor	
PCIe 5.0 x4 EDSFF E1.S Interposer	PE243UIA-X
PCIe 5.0 x8 EDSFF E1.L Interposer	PE241UIA-X
PCIe 5.0 x16 EDSFF E3.x Interposer (Includes sideband, power rail and REFCLK probing points, no high-speed probing points)	PE240UIA-X
Upgrade PE243UIA-X, PE241UIA-X, or PE240UIA-X to add probing points on all 32 high-speed lanes	PE135ACA-X
Probe tip to connect DH series oscilloscope probe to PE135ACA-X	DH-CSPHY-PCIE5-EDSFF
PCI Express 5.0 - U.2/U.3 form factor	
PCIe 5.0 U.2/U.3 12 inch Interposer (Includes sideband, power rail and REFCLK probing points, no high-speed probing points)	PE221UIA-X
Upgrade PE221UIA-X to add probing points on all 32 high-speed lanes	PE130ACA-X
Probe tip to connect DH series oscilloscope probe to PE130ACA-X	DH-CSPHY-PCIE5-U2U3
PCI Express 5.0 - M.2 form factor	
PCIe 5.0 M.2 M-Key Interposer - CrossSync PHY capable (Incl. sideband, power rail and REFCLK probing points, no high-speed probing points)	PE222UIA-X
PCIe 5.0 M.2 M-Key Interposer with oscilloscope probe Lane 0	PE222UIA-1PHY
PCIe 5.0 M.2 M-Key Interposer with oscilloscope probe Lane 0, 1	PE222UIA-2PHY
PCIe 5.0 M.2 M-Key Interposer with oscilloscope probe Lane 0, 1, 2, 3	PE222UIA-4PHY
PCI Express 4.0 - M.2 form factor	
PCIe 4.0 M.2 M-Key Interposer - CrossSync PHY capable (Incl. sideband, power rail and REFCLK probing points, no high-speed probing points)	PE210UIA-X
PCIe 4.0 M.2 M-Key Interposer with oscilloscope probe Lane 0	PE210UIA-1PHY
PCIe 4.0 M.2 M-Key Interposer with oscilloscope probe Lane 0, 1	PE210UIA-2PHY
PCIe 4.0 M.2 M-Key Interposer with oscilloscope probe Lane 0, 1, 2, 3	PE210UIA-4PHY
Compatible Protocol Analyzers	
Protocol Analyzer for PCIe 6.0, NVME, and CXL up to x16 link	Summit M616
Protocol Analyzer for PCIe 5.0, NVMe, and CXL up to x16 links	Summit T516
Protocol Analyzer for PCIe 5.0, NVMe, and CXL up to x8 links	Summit M5x
Protocol Analyzer for PCIe 5.0, NVMe, and CXL up to x4 links	Summit T54
Protocol Analyzer for PCIe 4.0 and NVMe up to x16 links	Summit T416
Protocol Analyzer for PCIe 4.0 and NVMe up to x8 links	Summit T48

Probes and cables not included - consult your Teledyne LeCroy sales representative for protocol analyzer configuration details.

Recommended Oscilloscopes	
CrossSync PHY is compatible with WaveMaster 8000HD series oscilloscopes.	
PCI Express 6.0 - CrossSync PHY and Compliance Test capable	
50 GHz (or higher), 320 GS/s, 400 Mpts/Ch WaveMaster 8000HD	WaveMaster 8500HD
PCI Express 5.0 - CrossSync PHY and Compliance Test capable	
50 GHz (or higher), 320 GS/s, 400 Mpts/Ch WaveMaster 8000HD	WaveMaster 8500HD
PCI Express 4.0 - CrossSync PHY and Compliance Test capable	
25 GHz (or higher), 160 GS/s, 200 Mpts/Ch WaveMaster 8000HD	WaveMaster 8250HD
PCI Express 3.0 - CrossSync PHY and Compliance Test capable	
13 GHz (or higher), 80 GS/s, 2000 Mpts/Ch WaveMaster 8000HD	WaveMaster 8130HD
Recommended Oscilloscope Probes	
13 GHz differential probe with ProLink interface	DH13-PL
20 GHz differential probe with ProLink interface	DH20-PL
25 GHz differential probe with ProAxial interface	DH25-PX
30 GHz differential probe with 2.92 mm interface	DH30-2.92MM
30 GHz differential probe with ProAxial interface	DH30-PX
Power/Voltage Rail Probe. 4 GHz bandwidth, 1.2x attenuation, ±30 V offset, ±800 mV	RP4030
Recommended Oscilloscope Software Options	
QualiPHY PCIe 6.0 Tx/Rx/LEQ Compliance Software Option (incl QPHY-PCIE5-Tx-RX, QPHY-PCIE4-Tx-RX and QPHY-PCIE3-Tx-RX)	QPHY-PCIE6-TX-RX
QualiPHY PCIe 5.0 Tx/Rx/LEQ Compliance Software Option (incl QPHY-PCIE4-Tx-RX and QPHY-PCIE3-Tx-RX)	QPHY-PCIE5-TX-RX
QualiPHY PCIe 4.0 Tx/Rx/LEQ Compliance Software Option (incl QPHY-PCIE3-Tx-RX)	QPHY-PCIE4-TX-RX
QualiPHY PCIe 3.0 Tx/Rx/LEQ Compliance Software Option	QPHY-PCIE3-TX-RX

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

TELEDYNE LECROY Everywhere**you**look™

1-800-5-LeCroy
teledynelecroy.com

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

© 2024 by Teledyne LeCroy, Inc. All rights reserved. Specifications, prices, availability, and delivery subject to change without notice.
Product or brand names are trademarks or requested trademarks of their respective holders. PCI Express® is a registered trademark and/or service mark of PCI-SIG.

cross-sync-phy-ds-19aug24