PCI EXPRESS
PROTOCOL SOLUTIONS FOR TESTING AND VERIFICATION

PETracer™ EML Analyzer
PETrainer™ EML Exerciser
PETracer™ ML Analyzer
PETrainer™ ML Exerciser
PETracer™ Analyzer
LeCroy®, a worldwide leader in serial data test solutions, creates advanced instruments that drive product innovation by quickly measuring, analyzing, and verifying complex electronic signals. With systems available for both physical and protocol layer testing, LeCroy offers a complete solution to meet the high demands of PCI Express devices and software.

The PCI Express Solutions
Each PCI Express system is built with the CATC™ Protocol Analyzer System as its foundation for stable and reliable measurements. With interchangeable plug-ins, field upgradeable firmware, and the ability to link multiple analyzers together for higher bandwidth applications, the CATC platform can evolve, as your protocol analysis needs change.

The LeCroy PCI Express solutions are available on each CATC platform, and include both Tracer analyzers and Trainer exercisers. They support a range of lane widths from x16 to single lane.

Analyzers for every lane width
The PETracer EML analyzer is built on the CATC 100K platform, LeCroy’s highest performance platform. It provides full bi-directional support of x16, x8, x4, x2, and x1 PCI Express links. With 8 GB of trace memory, it offers enough capacity for analyzing and recording extensive PCI Express data streams. It employs high impedance, non-intrusive probing technology allowing fully unaltered data pass-through. The CATC 100k platform represents LeCroy’s third generation protocol analyzer/exerciser architecture.

Supporting up to x8 lane widths, the PETracer ML analyzer uses the CATC 10K platform as its foundation and has 2 GB of trace memory. If you are only working with x1 PCI Express lane widths, the PETracer analyzer on the CATC 2500H platform is available for validating x1 devices and software.

Exercisers for every lane width
The LeCroy PCI Express exercisers assist you with generating PCI Express transactions, observing behavior, performing stress testing and compliance testing. The PETrainer EML exerciser is the first exerciser on the market that supports up to x16 lane widths. It provides you with extensive root complex or end point emulation capabilities. Also available is the PETrainer ML exerciser for up to x8 lane widths.

As a complete solution, the PETracer/Trainer systems give you the unique ability to record (capture) live traffic, modify the traffic, and then playback the exact data stream, or “script,” using the Trainer. This saves time in setting up the Trainer operations and provides an easy way to recreate problems reported in the field.
Powerful display views allow for easy analysis of protocol traffic

LeCroy's Tracer analysis software gives you a variety of powerful tools for analyzing and displaying traffic. The Tracer software makes it easy for you to view all elements of a command, even if they are spread over several different physical links—helping you understand traffic flow and ensure devices are behaving correctly at the protocol level.

Unfiltered PCI Express traffic contains tens of thousands of packets, which can make it extremely difficult for you to analyze and discover errors within the data. Within the CATC Trace™ software display, you can preserve the detail, but also have an easy way to view the traffic hierarchically.

For instance, you can:

- Isolate the view to the Link Transaction level by clicking on the Link icon. This narrows down the display to the transaction layer and data link layer of the protocol. The data link layer packets (DLLP) and transaction layer packets (TLP) are shown along with associated information such as packet number, direction of flow, header, flow control status, time stamp, data, ACK/NAK, and other packet level information.

- Decode down to the packet level by selecting the Pkt icon, Link icon, Split icon, ORD icon, or DLLP icon. This presents the packet information and shows the detail information of the devices involved, devices ID, types of commands, and performance data.

Although the CATC Trace display is ideal for showing traffic at the logical level, it is often necessary to drill down to the byte level and see traffic across multiple lanes on a common timescale. The Link Tracker™ software display provides this view, and allows you to see the low level primitives and 32-bit data structures in hex, scrambled hex, or decoded with the field names displayed. It shows a time slice at DWORD level resolution (13 ns), and chronologically displays it on all channels synchronized to a common clock. This is helpful for analyzing propagation delay or state changes between upstream and downstream links.

Within each of these displays, Tooltips pop up to provide you with detailed descriptions of the field, including information about the PCI Express specification. At the higher layers, valuable performance metrics are calculated for each operation such as the number of packets in a sequence or the throughput (bus utilization) both upstream and downstream from a specific event. This helps you identify possible problems at the lower levels.

Optional Probes for Advanced Analysis

Analysis: The Slot Interposer Probe gives you a non-intrusive tap to capture the signals between a motherboard and an add-in card. The Mid Bus Probe allows you to capture inter-chip signaling on a PCI Express board.

Bus Exercising: LeCroy offers an add-in card for end point emulation and a host emulation platform with x16 slot. Both probing options also provide traffic capture for simultaneous analyzer operations.
Powerful Triggering and Filtering

As the protocol evolves and moves from prototypes to system level testing, triggering becomes more important since problems from linking devices is more intermittent. The Tracer software provides the ability to select simple triggers on typical events, like out of band signals, PCI Express operations, errors, link conditions, TLP Headers, DLLP Messages, Breakout Board Data, or Payload Data. Triggers can be set up on almost any sequence of events possible; it supports up to 32 levels or sequential states, with four events or actions per level. It also allows you to isolate the important part of the traffic stream, and when you open the trace, it jumps right to that portion.

The intuitive CATC Trace display decodes and displays PCI Express packets with color-coded fields. Automatically decodes TLP, DLLP’s, and primitive packets.

Packets grouped and shown in logical order.

Shows traffic direction.

The CATC Trace and Link Tracker displays can be synchronized.

Displays data in 8b, 10b, scrambled values, symbol with running disparity or field names.

Displays all lanes simultaneously.
Comprehensive Traffic Reports and Summaries

Our PCI Express solutions are more than just data recorders. The real value is in the analysis of the data. The Tracer software presents real-time statistics, including link utilization, data payload throughput, and data packet count. It also generates detailed reports that provide statistics on the occurrence of errors and packets, and counts events for the link transactions and split transactions in the trace. You can evaluate these metrics at a glance or use them to navigate through the recording. The traffic summary can be printed or saved to text with a single keystroke.

Search Results Quickly

The advanced search features in the Tracer software help you quickly find what you want. By using the Quick Search, you can select fields right from the drop-down menu, such as Go To Trigger or Event, or directly to a specific marker or timestamp in the trace. The Go To feature provides a simple way to search for PCI Express specific items within the trace, such as packets or specific link transactions. The advanced Find lets you search on specific PCI Express parameters such as the TLP Type: Memory Write (32 bit). Using the Find dialog, you can choose your selection criteria and create a new trace file that represents only the data you seek.

Advanced Trainer for PCI Express Traffic Generation

LeCroy’s PE Trainer EML and PE Trainer ML exercisers are capable of generating and responding to all types of PCI Express transactions. The powerful scripting language allows for the creation of TLPs, DLLPs, and Ordered Sets. ACK’s and NAK’s can be automatically generated under your control, or inject CRC or symbol errors, and violate flow control credits and other types of errors. You can create test scripts by exporting traffic from a trace file captured with a PETracer. The exported script can then be modified to generate different test cases, insert errors or create loop tests. The point and click capability of the script editor makes modifying or creating scripts from scratch simple. The powerful scripting language allows for a link training script to be created with just 3 simple commands.

Compliance Testing

LeCroy offers an integrated and automated compliance testing system. Used together, the PE Trainer generates traffic to test the DUT and the PE Tracer captures the ensuing exchange of communication. Programs invoked within PE Tracer using its powerful Verification Scripting Engine (VSE) review the captured trace and compare what happened against the protocol’s specifications. The automated system will report back with a pass or fail. After the tests are complete, a double-click on a test name within the application dialog will bring up the Tracer application and show the captured trace so problems can be analyzed. Tests be run repeatedly, and test logs may be automatically saved. You may create your own VSE scripts for evaluating captured traces. Provided tests include those for the link and transaction layers.
A Comprehensive Solution

LeCroy's PCI Express solutions provide you with advanced features necessary to ease the development and deployment of PCI Express devices and software. Combined with powerful Tracer analyzers and Trainer exercisers, the Tracer software makes it easy to understand what occurred in the data stream. At every level, you have the ability to drill deeper into the data, to get additional information about the traffic or even the protocol itself.

Let LeCroy's Serial Data Solutions peel back the layers of PCI Express to solve your test and verification challenges.
## Specifications

### CATC 100K PLATFORM
**PETracer/Trainer EML**
- **Host Requirements**: Windows 2000 or greater; Intel Pentium II processor or greater; USB port
- **Recording Memory Size**: 4 GB for trace capture, timing, and control information
- **Power Requirements**: 90-254 VAC, 47-63 Hz (universal input), 200W maximum
- **Connectors**: AC power connection, External trigger connection (TRIG IN/OUT BNC), USB type “B” host computer connection, Breakout Board Data Output Connection (RS232)
- **Power (PWR)**: Lights when power is on
- **Status (STATUS)**: Lights during power up of platform; Blinks if self-test fails
- **Triggered**: Lights when triggering an event
- **Slot 1 Status**: Lights when analyzer in slot 1 is recording
- **Slot 2 Status**: Lights when analyzer in slot 2 is recording
- **Power On/Off**: Manual Trigger
- **Dimensions**: 12.2” x 12.2” x 3.5” (311 mm x 311 mm x 89 mm)
- **Net Weight**: 3.4 kg (7.5 lbs.)
- **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)

### CATC 10K PLATFORM
**PETracer/Trainer ML**
- **Host Requirements**: Windows 2000 or greater; Intel Pentium II processor or greater; USB port
- **Recording Memory Size**: 2 GB for trace capture, timing, and control information
- **Power Requirements**: 90-254 VAC, 47-63 Hz (universal input), 150W maximum
- **Connectors**: AC power connection, External trigger connection (TRIG IN/OUT BNC), USB type “B” host computer connection, Breakout Board Data Output Connection (RS232)
- **Power (PWR)**: Lights when power is on
- **Status (STATUS)**: Lights during power up of platform; Blinks if self-test fails
- **Manual Trigger Switch**: Forces a trigger event when pressed
- **Dimensions**: 311 mm x 311 mm x 89 mm (12.2” x 12.2” x 3.5”)
- **Net Weight**: 3.4 kg (7.5 lbs.)
- **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)

### CATC 2500H PLATFORM
**PETracer x1**
- **Host Requirements**: Windows 2000, or greater, Intel Pentium II processor or greater; USB port
- **Recording Memory Size**: 512 MB for trace capture, timing and control information
- **Power Requirements**: 90-254 VAC, 47-63 Hz (universal input), 125W maximum
- **Connectors**: AC power connection, External trigger connection (TRIG IN/OUT BNC), USB type “B” host computer connection, Breakout Board Data Output Connection (RS232)
- **Power (PWR)**: Lights when power is on
- **Status (STATUS)**: Lights during initialization; Blinks if self-test fails
- **Manual Trigger Switch**: Forces a trigger event when pressed
- **Dimensions**: 311 mm x 311 mm x 89 mm (12.2” x 12.2” x 3.5”)
- **Net Weight**: 3.4 kg (7.5 lbs.)
- **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)

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*Note: The above specifications are from the LeCroy website.*
## Specifications

### PETracer/Trainer™ EML Plug In Module

**Basic Trigger Events**
- TLP Header, DLLP Message, Link Condition, Payload, Errors

**Reporting/Statistics**
- Transaction Layer Packet (TLP), Data Link Layer Packet, Link Transactions, Split Transactions, Error Reports

**Breakout Board**
- Pattern match on 4 bit user IO

**Connectors**
- Probe Data Connection (2), High Speed Expansion Ports (2)

**Activity LED**
- Lights when traffic is on link

**Cable Setup LED**
- Lights when cable is connected to interposer

**Dimensions (each)**
- 233 mm x 152 mm x 32 mm (9.16” x 6” x 1.25”)

**Net Weight (each)**
- 1.58 kg (3.5 lbs.)

### PETracer/Trainer™ ML Plug In Module

**Basic Trigger Events**
- TLP Header, DLLP Message, Link Condition, Payload, Errors

**Reporting/Statistics**
- Transaction Layer Packet (TLP), Data Link Layer Packet, Link Transactions, Split Transactions, Error Reports

**Breakout Board**
- Filter in/out capabilities

**Connectors**
- Module Probe Data connector, Module Probe Power connector

**REC (green)**
- Lights when actively recording

**TRG (orange)**
- Lights when triggering an event

**UPLD (green)**
- Lights when uploading data to host

**Status (Tracer) (green)**
- Lights when traffic is on the link

**Connect (Trainer)**
- Lights when cabling is correct

**Dimensions (each)**
- 236 mm x 170 mm x 32 mm (9.3” x 6.7” x 1.3”)

**Net Weight (each)**
- 0.77 kg (1.7 lbs.)

### PE Tracer Plug In Module

**Basic Trigger Events**
- TLP Header, DLLP Message, Link Condition, Payload, Errors

**Reporting/Statistics**
- Transaction Layer Packet (TLP), Data Link Layer Packet, Link Transactions, Split Transactions, Error Reports

**Connectors**
- Module Probe Data connector, Module Probe Power connector

**Activity LED**
- Lights when traffic is on link

**Dimensions**
- 113 mm x 170 mm x 32 mm (4.5” x 6.7” x 1.3”)

**Net Weight**
- 0.5 kg (1 lb.)

## Ordering Information

**PETracer/Trainer™ EML**
- PETracer/Trainer EML x8 Analyzer/Exerciser Bundle: PE009APA-X
- PETracer EML x8 Analyzer System: PE009AAA-X
- PETracer EML x8 Analyzer Module Kit: PE009MAA-X
- PETrainer EML x8 Exerciser System: PE009AGA-X
- PETrainer EML x8 Exerciser Module Kit: PE009UGA-X
- PETracer/Trainer EML x16 Analyzer/Exerciser Bundle: PE009APA-X
- PETracer EML x16 Analyzer System: PE009AAA-X
- PETracer EML x16 Exerciser System: PE009AGA-X
- PETrainer EML x16 Exerciser Module Kit: PE009UGA-X
- PETracer EML x16 Device Emulation Interposer: PE001UEA-X
- PETracer EML Host Emulation Platform: PE002UEA-X

**PETracer/Trainer™ ML**
- PETracer/Trainer ML x4 Analyzer/Exerciser Bundle: PE002APA-X
- PETracer ML x4 Analyzer System: PE002AAA-X
- PETracer ML x4 Analyzer Module: PE002MAA-X
- PETrainer ML x4 Exerciser System: PE002AGA-X
- PETrainer ML x4 Exerciser Module: PE002UGA-X
- PETracer ML x8 Analyzer System: PE003AAA-X
- PETracer Midbus Probe: PE001UIA-X
- PETracer ML x1 Slot Interposer: PE001UUA-X
- PETracer ML x4 Slot Interposer: PE001UUA-X
- PETracer ML x8 Slot Interposer: PE001UUA-X
- PETrainer ML x1 Device Emulation Interposer: PE001UEA-X
- PETrainer ML x4 Device Emulation Interposer: PE001UEA-X
- PETrainer ML Host Emulation Platform: PE002UEA-X

**PE Tracer**
- PETracer x1 Analyzer System: PE001AAC-X
- PETracer x1 Analyzer Module: PE001MAA-X
- PETracer x1 Slot Interposer: PE001UUA-X
- PETracer Midbus Probe: PE001UIA-X

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