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LeCroy *PETracer* ML™

PCI Express Multi-Lane Protocol Analyzer

QuickStart User Manual



For Software Version 4.30
Manual Version 4.30

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1. Overview

Designed for developers, the LeCroy PETracer ML™ is a PCI Express™ Multi-Lane advanced verification system. The LeCroy PETracer ML hardware taps transparently into the fabric to capture, decode and display x1, x2, x4 and x8 bi-directional transfers of PCI Express traffic. Developers use the CATC Trace™ expert software system to define recording, triggering and filtering conditions and to view, analyze and print the trace. By leveraging years of experience in protocol analysis tools for emerging markets, PETracer ML blends sophisticated functionality with practical features to speed the development of PCI Express IP cores, semiconductors, bridges, switches and systems.

PETracer ML uses a high impedance, non-intrusive probing technology, allowing full, unaltered data pass-through. The analyzer offers a dual approach in tapping into the PCI Express fabric. Whether the design utilizes a card-edged solution, or implements the PCI Express link between circuit board components, PETracer ML provides support for both a slot interposer card and a mid-bus probe.

A single PETracer ML analyzer supports bi-directional x1, x2 and x4 links, as well as unidirectional x8 PCI Express link data capture and analysis. Combining two PETracer ML analyzer systems allows for full bi-directional decode and capture of a x8 PCI Express link.

PETracer ML has many innovative features that dramatically reduce time-to-market for PCI Express solutions, including a comprehensive set of triggering and filtering options that allow the user to capture traffic that is of most interest and relevance.

Users are provided with a list of protocol events from link conditions to error violations, which enables them to set commands to the analyzer to search, isolate and capture the essential data.

PETracer ML also provides accurate, reliable and complete decodes of Transaction Layer Packets (TLPs), Data Link Layer Packets (DLLPs) and all PCI Express primitives. For deeper analysis, you can display packet contents as raw 10-bit codes.

For complete product information, please visit www.lecroy.com.

1.1 General Description

The PETracer ML Multi-Lane PCI Express Protocol Analyzer is a hardware module that installs into the LeCroy Universal Protocol Analyzer System (UPAS) 10000. The UPAS 10000 is a base system designed to accommodate different protocol modules.

Together, PETracer ML and the UPAS connect to a PC that runs the PETracer user interface. This interface administers the analyzer, displays traces, and analyzes the performance of the devices under test.

PETracer ML supports the pairing of two UPAS/PETracer MLs. Pairing doubles the width of the PCI Express bidirectional link that can be monitored from x4 to x8.

PETracer ML uses hardware triggering to capture real-time events, and hardware filtering to filter in or out different types of packets from the recording. Filtering allows users to focus recordings on events of interest and to preserve recording memory so that the recording time can be extended. All traffic is recorded non-intrusively, meaning that PETracer ML does not adversely affect the link it is recording.

Recorded data is presented in colored graphics in a trace viewer application. This application has advanced search and viewing capabilities that allow the user to quickly locate specific data, errors, and other desired conditions, thereby focussing the user's attention on events of interest.

The PETracer ML Protocol Analyzer functions with any personal computer using the Windows 98SE, Window 2000, Windows ME, or Windows XP operating systems and equipped with a functional USB interface.

PETracer ML provides on-the-fly detection of and triggering on PCI Express events. Whether recording manually or with a specified trigger condition, PETracer ML continuously records the link data in a wrap-around fashion until manually stopped or until the Trigger Event is detected and a specified amount of post-Trigger link data is recorded.

Upon detection of a triggering event, the analyzer continues to record data up to a point specified by the user. Real-time detection of events can be individually enabled or disabled to allow triggering on events as they happen. This includes predefined exception or error conditions and a user-defined set of trigger events. The unit can also be triggered by an externally supplied signal. An external DB-25 connector provides a path for externally supplied data or timing data to be recorded along with traffic.

This DB-25 connector also provides a path for PETracer ML to transmit signals externally for purposes of probing and use by other circuitry.

The PETracer ML software provides powerful search functions that enable investigation of particular events and allow the software to identify and highlight specific events. In addition to immediate analysis, you can print any part of the data. Use the **Save As** feature to save the data on disk for later viewing. The program also provides a variety of timing information and data analysis reports.

CATC Trace Software

The PETracer ML utilizes the CATC Trace to assist users in analyzing how PCI Express components work together, diagnose problems, and test for interoperability and standards compliance.

The CATC Trace is a powerful and intuitive expert software system embedding detailed knowledge of the protocol hierarchy and intricacies, as defined in the protocol specification. The software allows the user to control the analyzer and set specific real-time triggering and filtering conditions. The CATC Trace utilizes a Windows-based graphical display that has been optimized for fast and easy navigation through a captured traffic session. Users are alerted as violations are detected at all levels of the protocol layering and can easily drill down on areas of interest or collapse and hide fields that are not relevant.

For additional information on the CATC Trace, please download the White Paper from the LeCroy website:
http://www.catc.com/support/white_papers/index.html.

1.2 Specifications

The following specifications describe a combined PETracer ML and Universal Protocol Analyzer System.

Package

Dimensions:	UPAS 10000: 12.2x12.2 x 3.5 inches (31.1 x 31.1 x 8.9 cm) PETracer ML Plug-in: 9.3 x 6.7 x 1.3 inches (23.6 x 17.0 x 3.2 cm)
Connectors:	2 Probe Data (HSSDC2 receptacle) UPAS AC power connection External trigger connection (DB-25, BNC) PC connection (USB2.0) Break-out board (type "D")
Weight:	UPAS 10000: 9.5 lbs (4.3 kg) PETracer ML Plug-in: 1.7 lb (0.77 kg)

Power Requirements

90-254 VAC, 47-63 Hz, 100W maximum (universal input)

Environmental Conditions

Operating Range:	0 to 40 °C (32 to 104°F)
Storage Range:	-20 to 80 °C (-4 to 176°F)
Humidity:	10 to 90%, non-condensing

Switches

Power:	On/Off
Manual Trigger:	When pressed forces a trigger event

Indicators (LEDs)

UPAS:	Power (PWR): Illuminated when analyzer is powered on
Status (STATUS):	Illuminated during Power-On Self Test (POST)
Recording (REC):	Illuminated when the analyzer is actively recording traffic data
Triggered (TRG):	Illuminated when the analyzer has a trigger condition
Uploading (UPLD):	Illuminated when the analyzer is uploading its recording memory to the Host PC for displaying the CATC trace and during the memory-testing step of the POST
PETracer ML Plug-in:	Illuminated when analyzer detects valid traffic for the two dual-simplex connections of the PCI Express Link

Probing Characteristics

Connection: PCI Express Slot Interposer

Recording Memory Size

2 GBytes for trace capture, timing, and control information.

Basic Trigger Events

Link Conditions	Link Alive, Electrical Idle Link Condition, TS1 Ordered Set, TS2 Ordered Set, Skip Ordered Set, Electrical Idle Ordered Set, FTS Ordered Set, Compliance Pattern Ordered Set, Comma, DLLP, TLP
TLP Headers	TLP Type: Mem, I/O, Cfg, Msg, Cpl, Any Traffic Class number
DLLP Messages Payload	Ack/Nak, InitFC1, InitFC2, UpdateFC, PM, Vendor Customizable Payload, Mask, Match
Errors	DLLP CRC, TLP LCRC, TLP ECRC, Delimiter, EDB (End-of-Bad Packet), Disparity, Symbol, Idle data, Skip late, Ordered Set Format
Breakout Board	Filter in/out capabilities

Reporting and Statistics

Transport Layer Packet	Memory Read 32-bit, Memory Read 64-bit, Memory Write 32-bit, Memory Write 64-bit, I/O Read Request, I/O Write Request, Configuration Read Type 0, Configuration Write Type 0, Configuration Read Type 1, Configuration Read Type 1, Message, Message with Data, Completion, Completion with Data, Completion for Locked Memory Read, Completion for Locked Memory Read with Data, Requesters, Completers, Traffic Class Number, Virtual Channel ID Number
Data Link Layer Packet (DLLP)	Ack, Nak, PM, Vendor, InitFC1-P, InitFC1-NP, Init-FC1-Cpl, Update FC-P, Update FC-NP, Update FC-Cpl, InitFC2-P, InitFC2-NP, Init-FC2-Cpl, Flow Control
Link Transactions Split Transaction	Implicit, Explicit, Incomplete Successful Completion, Unsupported Request, Cfg Request Retry, Completer Abort, Incomplete
Error Reports	Bad ECRCs, Bad LCRCs, Invalid 10b code, Running Disparity Error, End of Bad Packet, Delimiter Error, TS Data Error, Ordered Set Format Error, Idle Error

2. Installation

PETracer ML is a factory-installed hardware module that is sold as part of the Universal Protocol Analyzer System 10000 (UPAS 10K).

The UPAS 10K, the Analyzer module, and associated software are easily installed. You can begin making PCI Express recordings after following the steps in this chapter.

2.1 System Components/Packing List

- Factory-installed PETracer ML Analyzer module(s)
- One USB cable
- One BNC cable (if a Dual Analyzer system is purchased, then two)
- PETracer ML software program CD-ROM
- Probe data cable
- Breakout board with cable
- PCI Express Slot Interposer probe
- User Manual

2.2 Host PC Requirements

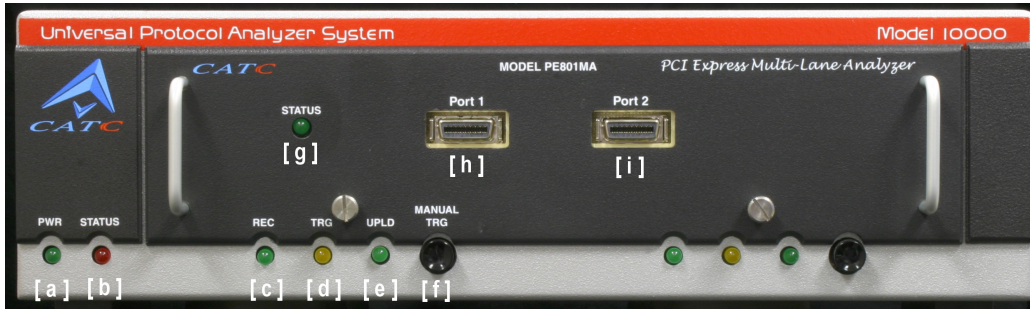
PETracer ML connects to a Host PC. Please consult the readme file on the installation CD for the latest PC requirements.

2.3 Analyzer LED Descriptions

When powered on, the PETracer ML activates the user-accessible controls and LEDs on the front and rear panels of the UPAS.

Warning Do not open the UPAS enclosure. There are no operator serviceable parts inside. Refer servicing to LeCroy.

UPAS LEDs (from left to right)



- [a] Green **PWR** (power) indicator LED for UPAS - lights when the unit power is switched on.
- [b] Red **Status** indicator LED for UPAS - lights during initialization/power up of UPAS base unit. Blinks if a self-test fails.

The following LEDs and the **Manual Trigger** button on the UPAS function in conjunction with the PETracer ML module inserted above it.

- [c] Green **REC** (recording) LED - lights when the unit is recording.
- [d] Orange **TRG** (triggered) LED - lights when the unit triggers on an event.
- [e] Green **UPLD** (Upload) - lights when unit is uploading data to PC.
- [f] The **Manual Trigger** push-button - allows a manual Trace capture.

LEDs and Connectors on the PETracer ML Module

- [g] Green **Status** LED - Illuminates when there is traffic on the link.
- [h] Probe Data Connector
- [i] Probe Data Connector

2.4 Rear Panel Description

From left to right, the UPAS rear panel contains the following components:

Figure 1: Rear Panel



USB type "B" host computer connector

This connector links the analyzer to the Host PC. for the purpose of transmitting commands from the PC to the analyzer and uploading traces from the analyzer's recording memory to the PETracer ML software for viewing and analysis.

RS-232 25 pin "Data Output" Connector

This connector links a 25 pin RS-232 cable to an external breakout board. The breakout board allows signals to be sent from the analyzer to an external device such as an oscilloscope or from an external device to the analyzer for the purpose of triggering on an external input. You configure input/output signalling through the Recording Options dialog box. Breakout board use is described at the end of this chapter.

BNC Connectors "Ext. In" and "Ext. Out"

These BNC connectors allow the analyzer to transmit or receive external signals. External signaling, in turn, can serve two functions:

Linking of analyzers - On dual analyzer systems, the BNC connectors are used to create a loop for transmitting clocking information and commands between the analyzers. This linking allows the two analyzers to function as a single, logical analyzer.

Triggering - The "Ext. In" can receive a signal from another device and use that signal to trigger the end of the recording. Conversely, the "Ext. Out" connector can be used to send an output signal from the analyzer to another device.

The "Ext. In" and "Ext. Out" connectors have the same function as the 25 pin RS-232 connector - i.e., they channel input and output signals but do not support the use of a breakout board.

Wide range AC connector module

- Power socket
- Power on/off switch
- Enclosed 5x20 mm 2.0A 250 V fast acting glass fuse

Warning For continued protection against fire, replace fuse only with the type and rating specified above.

2.5 Setting Up the Analyzer

Step 1 Remove the Analyzer/UPAS from its shipping container.

The Analyzer module will already be installed in the UPAS.

Step 2 Connect the Analyzer unit to a 100-volt to 240-volt, 50 Hz to 60 Hz, 120 W power outlet using the provided power cord.

Note The Analyzer is capable of supporting supply voltages between 100-volt and 240-volt, 50 Hz or 60 Hz, thus supporting all known supply voltages around the world.

Step 3 Turn on the power switch on the rear of the UPAS.

Note At power-on, the analyzer initializes itself in approximately five seconds and performs an exhaustive self-diagnostic that lasts about fifteen seconds. The Status LED of the UPAS base unit turns red on power up/initialization. The LED remains on approximately 20 seconds while the analyzer performs self-diagnostic testing. If the diagnostics fail, the Status LED will blink red, indicating a hardware failure. If this occurs, call LeCroy Customer Support for assistance.

Step 4 Insert the CD into the CD ROM drive of the PC that will be controlling the analyzer.

Step 5 Connect the USB cable between the USB port on the back of the analyzer and a USB port on the PC.

The host operating system detects the analyzer and begins to install the USB driver.

Step 6 Follow Windows on-screen Plug-and-Play instructions for the automatic installation of the analyzer as a USB device on the Host PC (the required USB files are included on the PETracer ML CD). Step through the Windows hardware wizard. The wizard will automatically install Analyzer as a USB device on the PC. When the wizard prompts you for driver information, point it to the CD which should be in your disk drive and install **ctcupa10.sys** and **petrcrml.sys**.

2.6 Installing the Analyzer Software

Once PETracer ML has been recognized as a USB device, install the PETracer ML software on the Host PC.

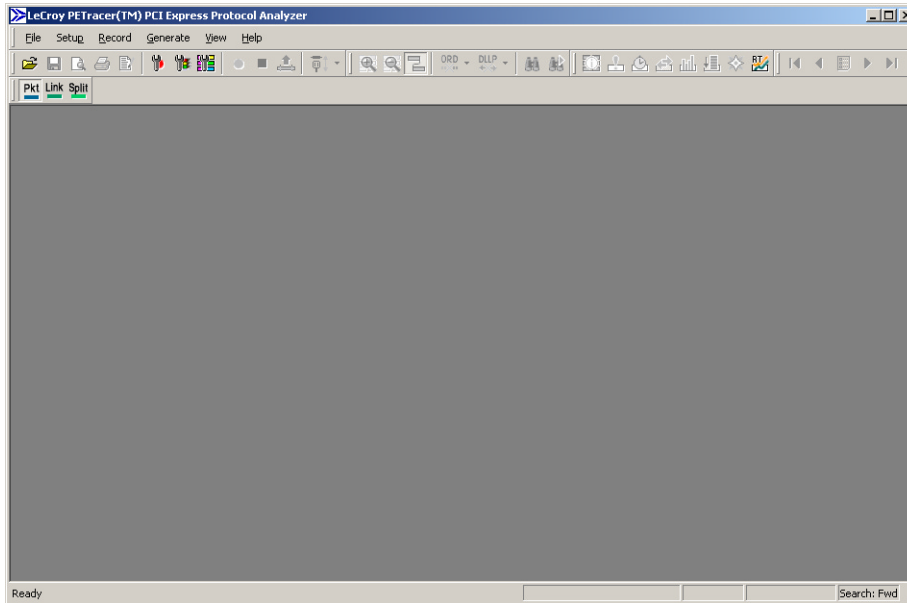
Step 1 On the PC, run **setup.exe** on the installation CD and follow the on-screen instructions.

The PETracer ML software will install on the PC hard disk.

Step 2 To start the application, launch the CATC PETracer program from the Start menu:

Start > Programs > CATC > PETracer ML.

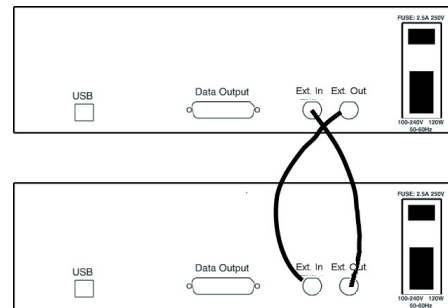
The PETracer ML program opens.



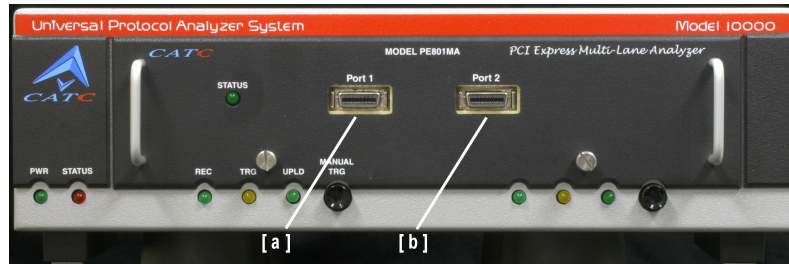
Note The software may be used with or without the analyzer. When used without an analyzer attached to the computer, the program functions as a Trace Viewer to view, analyze, and print captured traffic.

2.7 Installing a Dual Analyzer System

If you have purchased a dual analyzer system, you will need to physically link the analyzers together. You link the analyzers via their BNC connectors on the back of the two UPASs. You connect the "Ext. Out" connector of one analyzer to the "Ext. In" connector on the other analyzer, and *vice versa*, thereby creating a loop. The analyzers use this loop to transmit clocking information and commands from one analyzer to the other. From a user point of view, the interaction between the two analyzers is transparent and requires no user intervention other than the physical linking of the analyzers.



2.8 Connecting the Analyzer to the Device Under Test



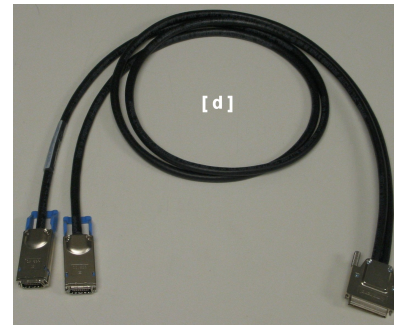
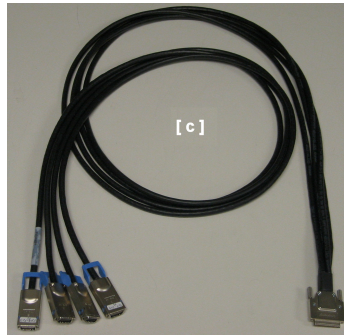
PETracer ML components

[a] - PETracer ML Probe Data connector

[b] - PETracer ML Probe Data connector

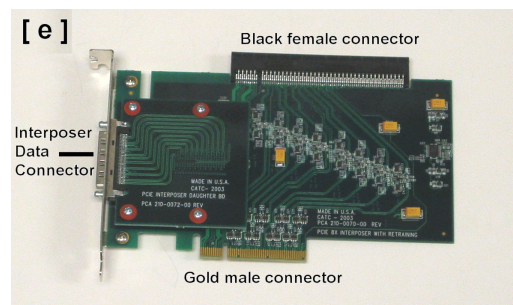
[c] and [d] - Probe Data cable. There are two versions of this cable: one with four connectors [c] and one with two connectors [d]. The small connectors connect to the front of the analyzer(s).

The four connector cable supports x8, x4, x2 and x1 links and the two connector cable supports x4, x2, and x1 links. Both cables have a large connector at the other end that connect to the interposer.



[e] - PETracer ML Slot Interposer probe. The probe has two connectors: a gold male connector that fits into a standard PCI Express slot and a black female connector that accommodates a PCI Express device.

There are two versions of the probe: a x8 probe (shown below) and a x4 probe. The gold male adapter on the x4 probe is half the length of the x8.



Installing the Interposer between the Devices Under Test (DUTs)

To install the interposer, perform the following steps.

- Step 1** If not already powered off, power off the UPAS 10000 analyzer and the DUTs.
- Step 2** Insert the gold male connector on the interposer probe [e] into a PCI Express slot in the motherboard (or whatever board you are testing). The x4 interposer is designed to fit tightly into any standard x4, x8, or x16 PCI Express slot. The x8 interposer is designed to fit into any x8 or x16 PCI Express slot.
- Step 3** Insert the PCI Express DUT into the black female device connector on the top edge of the interposer. The interposer's female device connector can accommodate any standard PCI Express device (x1, x4, x8, x16).
- Step 4** The slot interposer is shipped from LeCroy with a metal face plate for attachment to a PC case. If you are working with a motherboard that is not in a PC case, you may prefer to remove the metal face plate so the interposer can sit flat with the motherboard. To remove the face plate, unscrew the two screws that hold it onto the interposer.

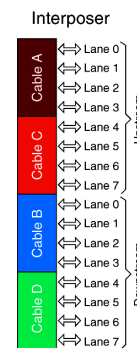
Connecting the Probe Data Cable

The next step is to connect the Probe Data cable. How you connect the cable depends on the width of your connection.

Probe Data Cable Description

The Probe Data cable consists of a single, large connector on one end and two or four smaller, 16 pin connectors on the other end. The large connector attaches to the interposer, the smaller connectors attach to the front of the analyzer.

The smaller connectors are labeled A, B, C, and D. Each transmits four physical lanes of traffic in one direction (shown in the illustration on the right). This means that to record bi-directional traffic you will need to use at least two of the



small connectors: one to capture the transmit traffic and one to capture the receive traffic (with respect to one of the devices). The various configurations of connectors and link widths are shown in the table below.

		UD - Uni-Directional		BD - Bi-Directional	
Interposer Configuration		System 1		System 2	
		Port 1	Port 2	Port 1	Port 2
1X, 2X, 4X	UD	A			
	BD	A	B		
8X	UD	A	C		
	BD	A	C	B	D
8X Lanes Reversed	UD	C	A		
	BD	C	A	D	B

Connecting the Interposer Data Cable

To connect the interposer data cable,

- Step 1** Insert the large connector of the interposer data cable [c or d] into the interposer's data connector located on the metal face plate of the interposer [e].
- Step 2** Connect the small connectors of the interposer data cable [c or d] to the analyzer probe data connectors [a and, if needed, b] on the front of the analyzer. The number of connectors you use depends on the width and direction of the link you are attempting to monitor. See foregoing table to determine the appropriate number of connectors for your test.

Connect USB Cable and Power On the Analyzer and DUTs

- Step 1** Connect the provided USB cable between the UPAS 10000 analyzer and the PC host system that will run the PETracer ML software.
- Step 2** Power on the UPAS10000 analyzer. The analyzer's green power LED will light, and the red status LED will turn on for approximately 20 seconds while the analyzer performs self-diagnostics.
- Step 3** After the analyzer's red status LED turns off, power on the PCI Express system under test.
- Step 4** Open the PETracer ML software on the PC host system. The analyzer is now ready for PCI Express traffic recording.

2.9 Making a PCI Express Recording

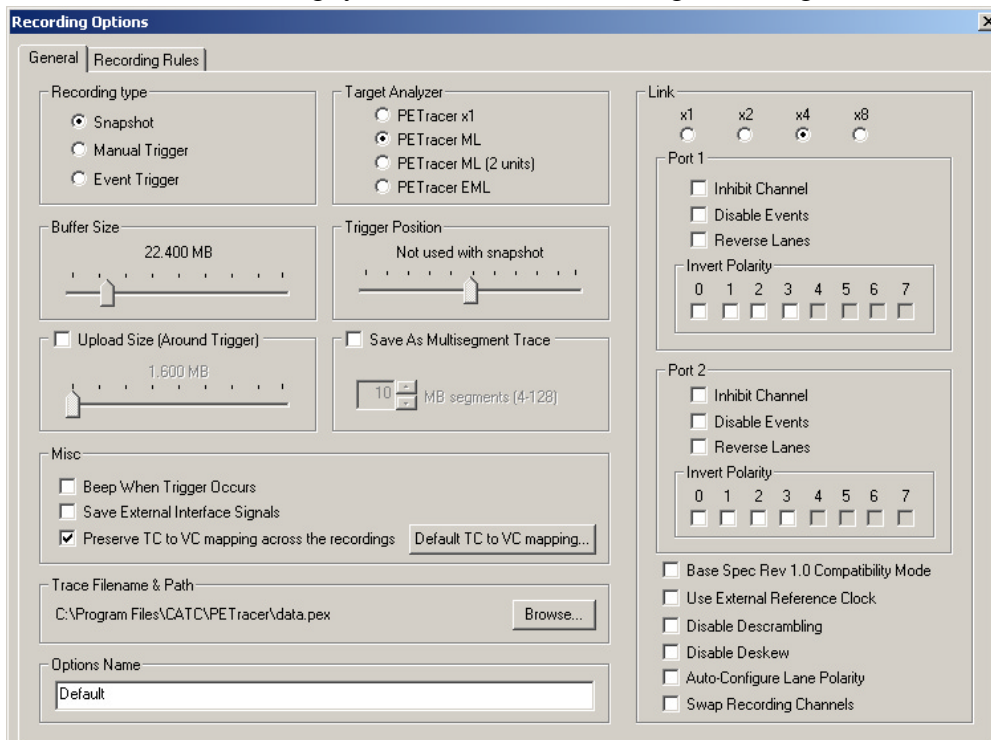
After connecting the analyzer to the device(s), you will need to configure the Recording Options. Then you can test the analyzer by creating a 16-Mbyte snapshot recording.

To make this recording, follow these steps:

Step 1 From the **Setup** menu, select **Recording Options**.

Step 2 Select the **General** tab.

The following window displays the factory default settings such as “Snapshot” and 22.4 Mbytes buffer size are displayed. For your first recording, you can leave these settings unchanged.



Step 3 In the **Link** section, specify the lane width of the PCI Express link to be analyzed. The rest of the settings in this section can be left at the factory defaults for most PCI Express systems.

Step 4 For multi-lane PCI Express links, the analyzer needs to observe link training in order to record link traffic correctly. If link training (or re-training) is not easily controllable for the devices under test, the analyzer includes the capability to force link training by disconnecting and reconnecting the PCI Express link.


Clicking the **Connect/Disconnect**  button will disconnect the PCI Express link for one second in both directions, then re-establish the link.

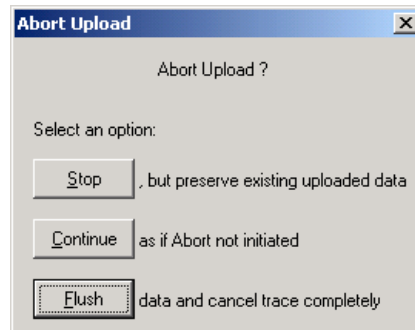
Note For x1 PCI Express links, it is not necessary for the analyzer to observe link training in order to record link traffic; this step may be skipped.

Step 5 Click **OK** at the bottom of the Recording Options dialog box to apply the analyzer recording settings specified.

Step 6 Click the **Record**  button.

Stopping a Recording

You can stop the recording process at any time by pressing the Stop button . This will cause the analyzer to stop the recording and upload the trace to the host PC. If you press the Stop button again, the analyzer will temporarily halt the upload process and open the following dialog box:



This dialog presents options for stopping, continuing, or aborting the upload:

- **Stop** - Aborts further trace upload and displays whatever trace data that has already been uploaded.
- **Continue** - Resumes the upload. This command tells the analyzer to finish uploading whatever trace data is still in its buffer.
- **Flush** - Flushes the trace without saving or displaying it.

If you allow the traffic data to be uploaded, it is automatically saved on the PC's hard drive as a file named **data<sn>.pex** (where <sn> is the serial number of the analyzer unit) or the name you assign as the default filename.

Packet	R→	TLP	Cfg	CfgRd1	RequesterID	Tag	DeviceID	Register
0		10		00:00101	001:02:3	12	004:05:6	0x000
1st BE		ECRC	LCRC	Time Delta	Time Stamp			
1111		0x47860D5E	0xAC7371D9	96 ns	0000.000000000 s			
Packet	R→	DLLP	ACK	AckNak_Seq_Num	CRC 16	Idle	Time Stamp	
1				10	0xF988	0 ns	0000.000000096 s	
Packet	R→	TLP	Cpl	CplID	RequesterID	Tag	CompleterID	Status
2		20		10:01010	001:02:3	12	004:05:6	SC

Step 7 To save a current recording for future reference, select **Save As** from the **File** menu.

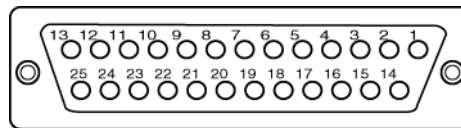
Step 8 Give the recording a unique name, and save it to the appropriate directory.

2.10 External Interface Breakout Board

With each analyzer, LeCroy includes an External Interface Breakout Board for accessing several potentially useful standard, LV TTL output and input signals. The breakout board also offers a simple way to connect logic analyzers or other tools to the PETracer ML Analyzer unit. Six ground pins and one 5-volt pin are provided.

The Breakout Board connects via a cable to the **Data In/Out** connector located on the rear of the analyzer unit. Each signaling pin is isolated by a 100Ω series resistor and a buffer inside the Analyzer unit.

Data In/Out Connector (on cable)



Pin-Outs for the Data In/Out Connector

The following table lists the pin-out and signal descriptions for the **Data In/Out** connector on a cable that connects to the Breakout board.

Data In/Out Connector – Pin-Out

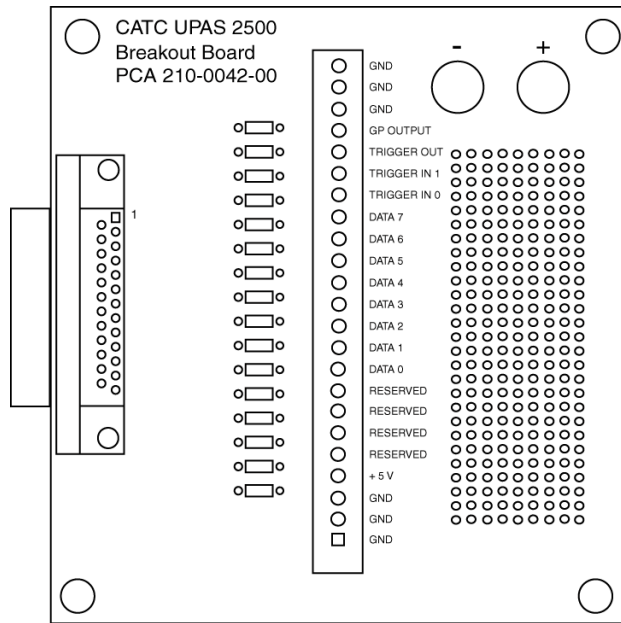
Pin	Signal Name	Signal Description
1	RSV	Reserved
2	GND	Ground
3	GP OUT	General Purpose Output
4	TRG IN 1	Trigger In 1
5	GND	Ground

Pin	Signal Name	Signal Description
6	DATA 6	Data 6
7	DATA 4	Data 4
8	DATA 3	Data 3
9	DATA 1	Data 1
10	GND	Ground
11	RSV	Reserved
12	RSV	Reserved
13	+5V	+5 Volts, 250 mA DC Source
14	RSV	Reserved
15	GND	Ground
16	TRG OUT	Trigger Out
17	TRG IN 0	Trigger In 0
18	DATA 7	Data 7
19	DATA 5	Data 5
20	GND	Ground
21	DATA 2	Data 2
22	DATA 0	Data 0
23	GND	Ground
24	RSV	Reserved
25	RSV	Reserved

Note (*) Pins 4 and 17 have the same function: they allow external signals to be used to cause triggering or recording. Pins 3 and 16 are used to transmit output signals. Pins 6, 7, 8, 9, 18, 19, 21, and 22 (data pins) are used to define data patterns for external input signals.

Note PETracer only supports Data 0 - Data 3.

External Interface Breakout Board



Prototype Rework Area

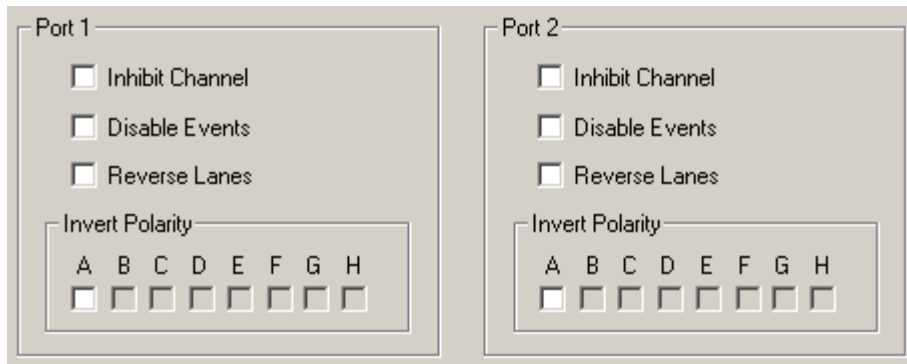
The Breakout Board contains a prototype rework area for making custom circuits for rapid development. The area consists of plated-through holes, 20 columns wide by 27 rows long. The top row of holes is connected to GND and the bottom row is connected to +5V. The remaining holes are not connected. Use the rework area to insert custom components and wire-wrap their respective signal, power, and ground pins.

PETracer ML Configuration for Lane-Reversed PCI Express Links Application Note, Rev 1.0

The PETracer™ ML protocol analyzer, when configured appropriately, supports data capture and analysis for lane-reversed PCI Express links. Lane reversal is an optional PCI Express link configuration function in which packet data is striped from physical lane N-1 down to physical lane 0 for a given link of width N (rather than from physical lane 0 up to N-1 as in standard links). Lane reversal can be used to simplify the physical routing of lane signals from component to component (or component to connector) on a PCB.

Lane Reversal: Software Configuration

To configure the PETracer™ ML protocol analyzer for lane reversal, before link recording is initiated check the 'Reverse Lanes' checkbox in the Recording Options/Link dialog box as shown below for each link direction that is reversed. Normally, both link directions will be reversed if lane reversal is implemented.



Configuring Lane Reversal in Recording Options/Link Dialog Box

Lane reversal for x4 and x2 PCI Express Links

PETracer™ ML can be configured to follow lane-reversed x4 and x2 links that include physical lane 0; this covers lane-reversed configurations for native links of x4 and x2 width but may not cover all lane-reversed situations in which the link has been negotiated down to less than its native width. For example, lane reversal of a x4 link on lanes 7-4 of a native x8 connection is not supported since the resulting link does not include physical lane 0 of the connection. **Lane reversal support does not require any changes to the physical configuration of the PETracer™ ML analyzer for x4 and x2 links.**

Lane reversal for x8 PCI Express Links

PEt be swapped for the analyzer unit(s) recording a lane-reversed x8 link. The following diagram updates the pull-out card attached to the PETracer™ ML unit, showing the special configuration required for x8 lane-reversed links.

Mid Bus Probe Configuration		System 1		System 2	
		Port 1	Port 2	Port 1	Port 2
1X, 2X, 4X	BD	A	B		
		C	D		
8X	BD	A	C	B	D
8X Lanes Reversed	BD	C	A	D	B

Interposer Configuration		System 1		System 2	
		Port 1	Port 2	Port 1	Port 2
1X, 2X, 4X	UD	A			
	BD	A	B		
8X	UD	A	C		
	BD	A	C	B	D
8X Lanes Reversed	UD	C	A		
	BD	C	A	D	B

Mid-Bus Probe and Interposer Configuration Table

PETracer™ ML software revisions prior to version 2.1 have a software problem regarding the configuration of lane reversal for x8 links that prevents correct bi-directional recording of these links. Recording of a single link direction of a lane-reversed x8 link (using a single analyzer unit) can be performed on software revisions prior to version 2.1 by checking both 'Reverse Lanes' checkboxes in the Recording Options/Link dialog box before recording begins, even though the software may indicate that the setting in the right-hand checkbox is not applicable to the current configuration.

Determining Lane Reversal

The above instructions for configuring the analyzer for recording lane-reversed PCI Express links assumes that the user knows in advance the configuration of the link. If the configuration of the link (normal or

lane-reversed) is unknown, the configuration may be determined by clearing both 'Reverse Lanes' checkboxes and recording link training with the analyzer.

If the link is not lane-reversed, the lane numbers in TS2 ordered sets during link training appear in order from 0 up to N as follows:

Packet	R-	TS2	COM	Link	Lane	N_FTS	Training Control	TS2
2133			K28.5	0	0	0	0 0 0 0	D5.2 D5.2 D5.2 D5.2 D5.2 D5.2 D5.2 D5.2
				0	1	0	0 0 0 0	D5.2 D5.2 D5.2 D5.2 D5.2 D5.2 D5.2 D5.2
				0	2	0	0 0 0 0	D5.2 D5.2 D5.2 D5.2 D5.2 D5.2 D5.2 D5.2
				0	3	0	0 0 0 0	D5.2 D5.2 D5.2 D5.2 D5.2 D5.2 D5.2 D5.2
				0	4	0	0 0 0 0	D5.2 D5.2 D5.2 D5.2 D5.2 D5.2 D5.2 D5.2
				0	5	0	0 0 0 0	D5.2 D5.2 D5.2 D5.2 D5.2 D5.2 D5.2 D5.2
				0	6	0	0 0 0 0	D5.2 D5.2 D5.2 D5.2 D5.2 D5.2 D5.2 D5.2
				0	7	0	0 0 0 0	D5.2 D5.2 D5.2 D5.2 D5.2 D5.2 D5.2 D5.2

Figure 3: Standard x8 Link

However, if the link is lane-reversed, the lane numbers in the TS2 ordered sets appear in order from N down to 0 as follows:

Packet	R-	TS2	COM	Link	Lane	N_FTS	Training Control	TS2
0			K28.5	6	7	0	0 0 0 0	D5.2 D5.2 D5.2 D5.2 D5.2 D5.2 D5.2 D5.2
				6	6	0	0 0 0 0	D5.2 D5.2 D5.2 D5.2 D5.2 D5.2 D5.2 D5.2
				6	5	0	0 0 0 0	D5.2 D5.2 D5.2 D5.2 D5.2 D5.2 D5.2 D5.2
				6	4	0	0 0 0 0	D5.2 D5.2 D5.2 D5.2 D5.2 D5.2 D5.2 D5.2
				6	3	0	0 0 0 0	D5.2 D5.2 D5.2 D5.2 D5.2 D5.2 D5.2 D5.2
				6	2	0	0 0 0 0	D5.2 D5.2 D5.2 D5.2 D5.2 D5.2 D5.2 D5.2
				6	1	0	0 0 0 0	D5.2 D5.2 D5.2 D5.2 D5.2 D5.2 D5.2 D5.2
				6	0	0	0 0 0 0	D5.2 D5.2 D5.2 D5.2 D5.2 D5.2 D5.2 D5.2

Figure 3: Lane-Reversed x8 Link

How to Contact LeCroy

Type of Service	Contact
Call for technical support...	US and Canada: 1 (800) 909-2282 Worldwide: 1 (408) 727-6600
Fax your questions...	Worldwide: 1 (408) 727-6622
Write a letter...	LeCroy Protocol Solutions Group Customer Support 3385 Scott Blvd. Santa Clara, CA 95054 USA
Send e-mail...	support@CATC.com
Visit LeCroy's web site...	http://www.lecroy.com/

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