PROTOCOL SOLUTIONS GROUP
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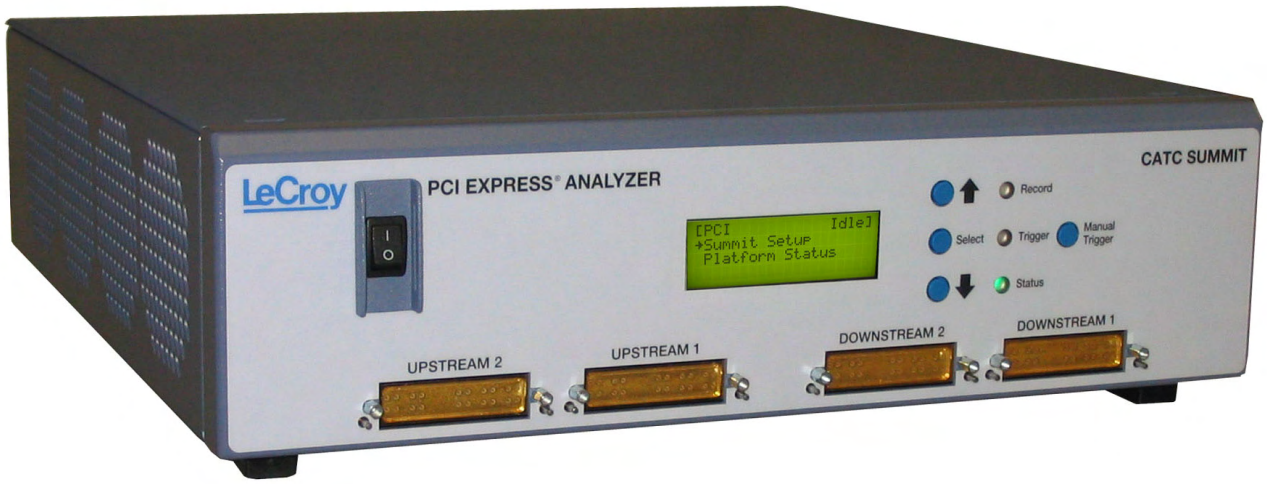
PE*Tracer* Summit™ and Summit T2-16™ PCI Express Multi-Lane Protocol Analyzer User Manual



For PCI Express Protocol Suite software version 7.30

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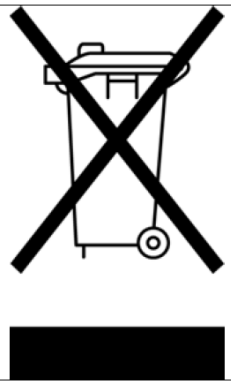

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Chapter 2: Overview

Designed for developers and validators, the Teledyne LeCroy PE*Tracer* Summit™ and Summit T2-16™ are Gen1/Gen2 PCI Express advanced verification systems.

By leveraging years of experience in protocol analysis tools for emerging markets, PE*Tracer* Summit and Summit T2-16 blend sophisticated functionality with practical features to speed the development of PCI Express™ IP cores, semiconductors, bridges, switches, add-in boards, and systems.

2.1 PE*Tracer* Analyzer Hardware and Software

Features and Benefits

PE*Tracer* Summit and Summit T2-16 Analyzers have these features and benefits:

Features	Benefits
Powerful and Intuitive CATC Trace™ Analysis Software	Faster interpretation and debug of PCI Express traffic with color-coded, clearly labeled protocol elements in a graphical display. Reduces coding and deciphering.
Extensive Decoding	Complete, accurate and reliable decoding of TLPs (Transaction Layer Packets), DLLPs (Data Link Layer Packets), NVMe, PQI, AHCI and ATA command transactions and all PCI Express Primitives.
Monitoring and Link Utilization	View link utilization and other performance measurements changing in real time.
Advanced Triggering	Isolate important traffic, specific errors, or data patterns. Trigger condition setup is made simple with drag and drop tools to link events to trigger or filter actions.
Hardware Filtering	Analyze faster and understand transactions more clearly by removing non-essential fields from the trace.
Intelligent Reporting	Quickly identify and track error rates and abnormal link or timing conditions. Display configuration space and protocol specification details.
Sophisticated Viewing	View Packet, Link, Split, NVMe, PQI, AHCI protocol and ATA command transaction levels of the PCI Express protocol. Collapsible/expandable headers with Tool tip explanations make it easy to navigate and interpret packet contents, headers, and commands. View packets, transactions of TLPs and DLLPs in classic CATC Trace™ format or in raw bit stream for deeper analysis.

8 GB Recording Capacity, 4 GB in each direction	Capture long recording sessions for analysis and problem solving
Flexible Host Interface	Summit T2-16: USB and GigE . PETracer Summit: 10/100 MBps.
Downloadable CATC Trace Viewer	Share and annotate CATC Trace recordings within a development team. Freely distributable PE*Tracer* software enables collaborative analysis across sites and time zones.
Bidirectional x1-x16, 2.5 GBps to 5.0 GBps recording support	Accurate and non-intrusive collection of PCI Express CATC Trace data
Field-upgradeable firmware and recording engine	Upgrades available for download direct from the Teledyne LeCroy website
Flexible probing options	Active and passive slot interposers MidBus probe Flying lead probe Gen1 AMC interposer Gen1 XMC interposer Gen1 SIOM interposer Gen1 Express card interposer
External interface for probing and monitoring auxiliary digital signals	Enables cross triggering between other test instruments.
Dword to Transaction Level Viewer	View Dwords, Packet, Link and Split Transaction levels of the PCI Express protocol.
CRC checking	Know that info being displayed is accurate.

2.2 CATC Trace Software

PE*Tracer* Summit and Summit T2-16 utilize 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.

2.3 Summit T2-16 Analyzer

The Teledyne LeCroy Summit T2-16 is Teledyne LeCroy's fourth-generation PCI Express analyzer for customers in server, workstation, desktop, graphics, storage and network card markets.

With advanced features such as support for PCI Express Spec 2.1, data rates of both 2.5 and 5 GBps, lane widths from x1 to x16, and a full 8 GB of trace (recording) memory, the Summit T2-16 provides unmatched capability and flexibility for developers and users of advanced PCI Express products. The Summit T2-16 is the most advanced and sophisticated PCI Express Analyzer available in the market today.

As with other Teledyne LeCroy PCI Express analyzers, the Summit T2-16 leverages the intuitive and powerful CATC Trace analysis software system, embedding a deep understanding of the PCI Express protocol hierarchy and intricacies. The colorful, intuitive and easy-to-use graphical display allows you to quickly capture and validate PCI Express product designs. All Teledyne LeCroy PCI Express protocol analyzers employ high-impedance, non-intrusive probing technology, thereby allowing fully unaltered data pass-through.

In addition to a full suite of advanced hardware and software features, the Summit T2-16 introduces new user-convenience and analysis features, such as support for "lane swizzling," which allows a board developer to lay out a mid-bus probe pad with lanes in non-standard order, simplifying the design of the board. Internally, the Summit T2-16 maps the lanes back into their correct order and accurately displays the embedded bus traffic. Other new software features include enhanced error checking for automatic identification of additional error types, more compact CATC Trace files that allow for faster analysis of data, and the choice of simplified or advanced modes for setting up recording options. An optional raw-recording mode allows bytes to be recorded as they come across the link, allowing debugging of PHY layer problems and combining the features of a logic analyzer format with a protocol analyzer format. The new auto-sense-link feature monitors negotiation between devices of different lane widths.

The Summit T2-16 supports USB and GIGE host interfaces. By connecting over GIGE, engineers can operate the system remotely (for example, install the client software on their desktop systems to control an analyzer operating in a remote lab). Also, multiple engineers working collaboratively can time-share use of a single analyzer, reducing the need for an additional analyzer for each engineer and increasing the cost effectiveness of the product.

Features

- **Powerful and Intuitive CATC Trace Analysis Software System**: The CATC Trace embeds deep understanding of the PCI Express protocol hierarchy and intricacies. This knowledge is presented in a colorful, intuitive and easy-to-use graphical display, allowing you to quickly capture and validate PCI Express product designs.
- **Protocol Hierarchical Viewing**: Displays Packet, Transaction, and Split Transaction levels of the PCI Express protocol, with increased drill-down detail for PCI Express primitives, errors, payloads or individual packets.
- **Advanced Triggering**: Allows you to trigger on various PCI Express Events such as Link Conditions, TLP Headers, DLLP Messages, and Data Payload.
- **Lane-Reversal Compatible**: Triggers, records, and displays PCI Express traffic logically, regardless of the physical configuration of the lanes.
- **Statistical and Error Reporting**: Provides a quick summary of the CATC Trace file to identify and track error rates and abnormal link or timing conditions.
- **Raw Recording Mode (optional)**: Records the bytes exactly as they come across the link, allowing debugging of PHY layer problems.
- **Auto Speed detection**: Follows link transitions through speed changes.
- **Auto Polarity detection**: Automatically detects lanes with inverted polarity.
- **Auto Sense Lane Width**: Analyzes all negotiation traffic between devices with different lane widths, eliminating the need to set up lane widths before a trace.
- **Lane Swizzling Support**: Allows board developers to lay out lanes in a non-standard order, simplifying board design.
- **Powerful Real-time BusEngine Protocol Processor Technology**: Sophisticated triggering and filtering help you focus on critical protocol data and isolate important protocol traffic, specific errors, or data patterns.
- **Field-upgradeable Firmware and Engine**: Positions you to receive the latest PE*Tracer* enhancements and future additional capabilities. Allows field upgrades of all system types.
- **8-GB Data Buffer**: Capture long time windows for in-depth analysis and identification of erratic problems.
- **GIGE Ethernet Connectivity**: Allows connection to an Ethernet network and sharing of analyzer resources by multiple engineers.
- **USB connectivity**: Allows connection by USB cable.

2.4 PETracer Gen2 Summit Analyzer

The Teledyne LeCroy PE*Tracer* Gen2 Summit is Teledyne LeCroy's first-generation high-performance PCI Express analyzer for customers in server, workstation, desktop, graphics, storage and network card markets.

With advanced features such as support for PCI Express Spec 2.0, data rates of both 2.5 and 5 GBps, lane widths from x1 to x16, and a full 8 GB of memory, the PE*Tracer* Gen2 Summit provides excellent capability and flexibility for developers and users of advanced PCI Express products.

As with other Teledyne LeCroy PCI Express analyzers, the PE*Tracer* Gen2 Summit leverages the intuitive and powerful CATC Trace analysis software system, embedding a deep understanding of the PCI Express protocol hierarchy and intricacies. The colorful, intuitive and easy-to-use graphical display allows you to quickly capture and validate PCI Express product designs. All Teledyne LeCroy PCI Express protocol analyzers employ high-impedance, non-intrusive probing technology, thereby allowing fully unaltered data pass-through.

In addition to a full suite of advanced hardware and software features, the PE*Tracer* Gen2 Summit supports "lane swizzling," which allows a board developer to lay out a mid-bus probe pad with lanes in non-standard order, simplifying the design of the board. Internally, the PE*Tracer* Gen2 Summit maps the lanes back into their correct order and accurately displays the embedded bus traffic. Other new software features include enhanced error checking for automatic identification of additional error types, more compact CATC Trace files that allow for faster analysis of data, and the choice of simplified or advanced modes for setting up recording options. An optional Bit Tracer mode allows bytes to be recorded as they come across the link, allowing debugging of PHY layer problems and combining the features of a logic analyzer format with a protocol analyzer format. The new auto-sense-link feature monitors negotiation between devices of different lane widths.

The PE*Tracer* Gen2 Summit supports both a USB and a 10/100 MBps Ethernet LAN port as standard features. By connecting over a LAN, engineers can operate the system remotely (for example, install the client software on their desktop systems to control an analyzer operating in a remote lab). Also, multiple engineers working collaboratively can time-share use of a single analyzer, reducing the need for an additional analyzer for each engineer and increasing the cost effectiveness of the product.

Features

- **Powerful and Intuitive CATC Trace Analysis Software System**: The CATC Trace embeds deep understanding of the PCI Express protocol hierarchy and intricacies. This knowledge is presented in a colorful, intuitive and easy-to-use graphical display, allowing you to quickly capture and validate PCI Express product designs.
- **Protocol Hierarchical Viewing**: Displays Packet, Transaction, and Split Transaction levels of the PCI Express protocol, with increased drill-down detail for PCI Express primitives, errors, payloads or individual packets.
- **Advanced Triggering**: Allows you to trigger on various PCI Express Events such as Link Conditions, TLP Headers, DLLP Messages, and Data Payload.
- **Lane-Reversal Compatible**: Triggers, records, and displays PCI Express traffic logically, regardless of the physical configuration of the lanes.
- **Statistical and Error Reporting**: Provides a quick summary of the CATC Trace file to identify and track error rates and abnormal link or timing conditions.
- **Raw Recording Mode (optional)**: Records the bytes exactly as they come across the link, allowing debugging of PHY layer problems.
- **Auto Speed detection**: Follows link transitions through speed changes.
- **Auto Polarity detection**: Automatically detects lanes with inverted polarity.
- **Auto Sense Lane Width**: Analyzes all negotiation traffic between devices with different lane widths, eliminating the need to set up lane widths before a trace.
- **Lane Swizzling Support**: Allows board developers to lay out lanes in a non-standard order, simplifying board design.
- **Powerful Real-time BusEngine Protocol Processor Technology**: Sophisticated triggering and filtering help you focus on critical protocol data and isolate important protocol traffic, specific errors, or data patterns.
- **Field-upgradeable Firmware and Engine**: Positions you to receive the latest PE*Tracer* enhancements and future additional capabilities. Allows field upgrades of all system types.
- **8-GB Data Buffer**: Capture long time windows for in-depth analysis and identification of erratic problems.
- **10/100 MBps Ethernet Connectivity**: Allows connection to an Ethernet network and sharing of analyzer resources by multiple engineers.

2.5 Other Documents

For more information, refer to the following documents:

- *Teledyne LeCroy Analyzers File-based Decoding Manual*
- *PETracer/Trainer Automation Manual*
- *PETracer VSE Manual*
- *PETracer Gen2 Multi Lead Probe User Manual*
- *PETrainer Scripting Language Reference Manual*
- PE*Tracer* Online Help

Chapter 3: Hardware Description

The PCI Express™ system features Summit Analyzers.

3.1 System Components

- **PE*Tracer* Summit system:**
  - PE*Tracer* Gen2 Summit™ analyzer box
  - Breakout Board with cable
  - PE*Tracer* Software program CD-ROM
  - Active or Passive interposer (optional)
    - Active or Passive interposer card with 12V power supply
    - One or two (for x8 or x16 recording) Mid Box assemblies
    - Two or four (for x8 or x16 recording) Analyzer-to-Pod cables
    - One or two (for x8 or x16 recording) iPass Y probe data cables
  - MidBus probe (optional)
    - One or two (for x8 or x16 recording) PCI Express Midbus Pods with 12-volt power supplies
    - One or two (for x8 or x16 recording) MidBus probe assemblies
    - Two or four (for x8 or x16 recording) Analyzer-to-Pod cables

- **Summit T2-16 system:**
  - Summit T2-16™ analyzer box
  - AC Power Cable
  - One or two (for x8 or x16 recording) iPass Y probe data cables
  - Breakout Board with cable
  - PE*Tracer* Software program CD-ROM
  - Active interposer with Power Supply (optional)
  - Passive interposer with Power Supply (optional)
  - MidBus probe (optional)
    - One or two (for x8 or x16 recording) MidBus probe assemblies
    - One or two (for x8 or x16 recording) T2 MidBus Pods

3.2 Host Machine Requirements

PE*Tracer* Summit and Summit T2-16 connect to a host machine. Please consult the **readme** file on the installation CD for the latest host machine requirements.

3.3 Summit T2-16 Front Panel Description

When powered on, the Summit T2-16 activates the user-accessible controls and LEDs on the front and rear panels.

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

The controls and LEDs are:

- **Power Switch (black)**: 1 = On and 0 = Off.
- **LCD Menus**: Allows you to set up the Summit T2-16 and view status. See “LCD Menus” on page 13.
- **Up Arrow (top blue button)**: Move up in the LCD menu.
- **Select (middle blue button)**: Select or change an option.
- **Down Arrow (bottom blue button)**: Move down in the LCD menu.
- **Record LED**: Lights when the Summit T2-16 is recording.
- **Trigger LED**: Lights when the Summit T2-16 triggers on an event.
- **Status LED**: Displays Analyzer status: blue = good or red = error.
- **Manual Trigger (right blue button)**: Forces a trigger.
- **UPSTREAM [15:8] and UPSTREAM [7:0] connectors**: Connection to the probe or MidBus module for the capture of upstream direction of the link.
- **DOWNSTREAM [15:8] and DOWNSTREAM [7:0] connectors**: Connection to the probe or MidBus module for the capture of downstream direction of the link.
- **REF CLK IN (Reference Clock In)**: Provides an optional alternative connection from an external reference clock source to the Summit T2-16 analyzer.
  Note: In standard configuration, the Summit T2-16 analyzer uses the reference clock from a probe cable.

LCD Menus

The Summit T2-16 has a front LCD panel that displays menus with commands for configuring the device.

Boot Sequence

The boot sequence for the analyzer takes a few seconds. As the analyzer boots, it initializes itself, beeps, and shows the status on the LCD panel. If the analyzer boots successfully, the LCD panel Root menu appears.

During initialization, the LCD panel displays boot status messages.

Booting from Boot-Code

If the analyzer does not boot successfully, or if it becomes non-responsive, you can boot from default settings called boot-code.

Boot-code is a simplified version of Summit firmware. It allows the analyzer to boot to the point where it can communicate with the Summit software application. After communication is established between the analyzer and software application, you can download a different version of firmware and BusEngine files to the analyzer.

To boot from boot-code:

Step 1 Press and hold the **Manual Trigger** button on the analyzer front panel.

Step 2 While holding the button **DOWN**, turn the box **ON**.

After you complete these steps, download the new version of BusEngine and firmware files, then reboot the analyzer from the LCD panel menu (**Summit Setup > Reboot**).

Root Menu

The Root menu appears after successful boot-up. The top line of the Root menu displays the device status with the following:

- **[PCI]**: Indicates the hardware platform.
- **Idle**: Shows analyzer status.

Submenus

The Root menu has these options:

- **Summit Setup menu**: Allows setup using submenus.
- **Platform Status menu**: Shows the results for the power-on self-diagnostics.

Note: When lists of options are presented in a menu, the current selections are indicated with an asterisk.

To navigate, use the **Up Arrow** and **Down Arrow** buttons (top and bottom blue buttons) on the front of the unit.

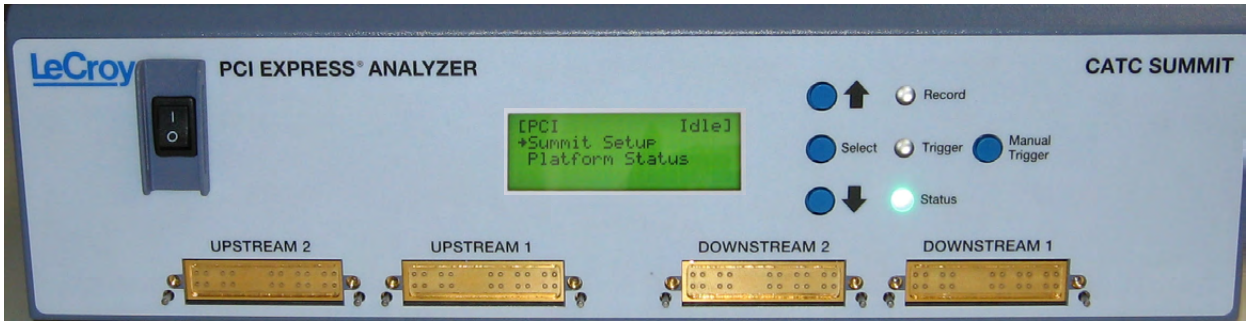
To select or change an option, use the **Select** button (middle blue button).

Summit T2-16 Setup Menu

Menu	Submenu	Command
IP Mode	Static Dynamic	Static = You assign an IP address. Dynamic = A DHCP server assigns an IP address.
IP Address		If IP Mode = Dynamic, this field is ignored.
Subnet Mask		Default is 0.0.0.0 If IP Mode = Dynamic, this field is ignored.
Default Gateway		Default is 0.0.0.0 If IP Mode = Dynamic, this field is ignored.
Reboot	Cancel Confirm	Selecting Confirm causes Summit to save the current configuration and reboot.
Shutdown	Cancel Confirm	Selecting Confirm causes Summit to save the current configuration and shut down.
About		Displays status on the following parameters: • Subnet Mask • Default Gateway • BootCode • Firmware • Bus Engine • IP Mode: Dynamic or Static **Note**: To go back to the previous menu, press the **Select** button (middle button).
[Back]		Returns to the Root menu.

3.4 PE*Tracer* Summit Front Panel Description

When powered on, the PE*Tracer* Summit activates the user-accessible controls and LEDs on the front and rear panels.



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

The controls and LEDs are:

- **Power Switch (black)**: 1 = On and 0 = Off.
- **LCD Menus**: Allows you to set up the PE*Tracer* Summit and view status. See “LCD Menus” on page 16.
- **Up Arrow (top blue button)**: Move up in the LCD menu.
- **Select (middle blue button)**: Select or change an option.
- **Down Arrow (bottom blue button)**: Move down in the LCD menu.
- **Record LED**: Lights when the PE*Tracer* Summit is recording.
- **Trigger LED**: Lights when the PE*Tracer* Summit triggers on an event.
- **Status LED**: Displays Analyzer status: blue = good or red = error.
- **Manual Trigger (right blue button)**: Forces a trigger.
- **UPSTREAM 1 (lanes [7:0]) and UPSTREAM 2 (lanes [15:8]) connectors**: Connection to the Pod for the capture of upstream direction of the link.
- **DOWNSTREAM 1 (lanes [7:0]) and DOWNSTREAM 2 (lanes [15:8]) connectors**: Connection to the Pod for the capture of downstream direction of the link.

LCD Menus

The PE*Tracer* Summit has a front LCD panel that displays menus with commands for configuring the device.

Boot Sequence

The boot sequence for the Summit box takes a few seconds. As the box boots, it initializes itself, beeps, and shows the status on the LCD panel. If the box boots successfully, the LCD panel Root menu appears.

During initialization, the LCD panel displays boot status messages.

Booting from Boot-Code

If the Summit box does not boot successfully, or if it becomes non-responsive, you can boot from default settings called boot-code.

Boot-code is a simplified version of Summit firmware. It allows the box to boot to the point where it can communicate with the Summit software application. After communication is established between the box and software application, you can download a different version of firmware and BusEngine files to the box.

To boot from boot-code:

Step 1 Press and hold the **Manual Trigger** button on the Summit box front panel.

Step 2 While holding the button **DOWN**, turn the box **ON**.

After you complete these steps, download the new version of BusEngine and firmware files, then reboot the box from the LCD panel menu (**Summit Setup > Reboot**).

Root Menu

The Root menu appears after successful boot-up. The top line of the Root menu displays the device status with the following:

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The Root menu has these options:

- **Summit Setup menu**: Allows setup using submenus.
- **Platform Status menu**: Shows the results for the power-on self-diagnostics.

Note: When lists of options are presented in a menu, the current selections are indicated with an asterisk.

To navigate, use the **Up Arrow** and **Down Arrow** buttons (top and bottom blue buttons) on the front of the unit.

To select or change an option, use the **Select** button (middle blue button).

PE*Tracer* Summit Setup Menu

Menu	Submenu	Command
IP Mode	Static Dynamic	Static = You assign an IP address. Dynamic = A DHCP server assigns an IP address.
IP Address		If IP Mode = Dynamic, this field is ignored.
Subnet Mask		Default is 0.0.0.0 If IP Mode = Dynamic, this field is ignored.
Default Gateway		Default is 0.0.0.0 If IP Mode = Dynamic, this field is ignored.
Reboot	Cancel Confirm	Selecting Confirm causes Summit to save the current configuration and reboot.
Shutdown	Cancel Confirm	Selecting Confirm causes Summit to save the current configuration and shut down.
About		Displays status on the following parameters: • Subnet Mask • Default Gateway • BootCode • Firmware • Bus Engine • IP Mode: Dynamic or Static **Note**: To go back to the previous menu, press the **Select** button (middle button).
[Back]		Returns to the Root menu.

3.5 Summit T2-16 Rear Panel Description

From left to right, the Summit T2-16 rear panel contains the following components:

Figure 3.1 Summit T2-16 Rear Panel

Wide-range AC Connector Module

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

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

Sync In and Sync Out Connectors

(not currently active) These connectors allow multiple Summit T2-16 analyzers to send synchronization and control messages to one another.

USB Type B Host Machine Computer Connector

This connector links an Analyzer to the host machine for the purpose of transmitting commands from the host machine to the Analyzer and uploading traces from the Analyzer's recording memory to the PE*Tracer* software for viewing and analysis.
Note: For each Analyzer or Exerciser, use either USB or Ethernet, not both.

Ethernet Port

GIGE Connectivity allows connection to an Ethernet network and sharing of analyzer resources by multiple engineers. **Note:** For each Analyzer or Exerciser, use either USB or Ethernet, not both.

BNC Connectors Trigger In and Trigger Out

These BNC connectors allow the Analyzer to transmit or receive trigger event signals. **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 BNC connectors are not used for the PE*Trainer* Exerciser.

RS-232 25-pin Data Input/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 Exerciser or Analyzer to an external device such as an oscilloscope or from an external device to the Exerciser or Analyzer for the purpose of triggering on an external input. You configure input/output through the Recording Options dialog box. The Breakout Board use is described at the end of this chapter.

Teledyne LeCroy Bus Connector

The Teledyne LeCroy Bus Connector is not currently active.

3.6 PETracer Summit Rear Panel Description

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

Figure 3.2 PE*Tracer* Summit Rear Panel

Wide-range AC Connector Module

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

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

RS-232 25-pin Data Input/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. The Breakout Board use is described at the end of this chapter.

USB Type B Host Machine Connector

This connector links the Analyzer to the host machine for the purpose of transmitting commands from the host machine to the Analyzer and uploading traces from the Analyzer's recording memory to the PE*Tracer* software for viewing and analysis. **Note**: May not be active on some Summit systems.

Ethernet Port

10/100 Mbps Ethernet Connectivity allows connection to an Ethernet network and sharing of analyzer resources by multiple engineers.

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.

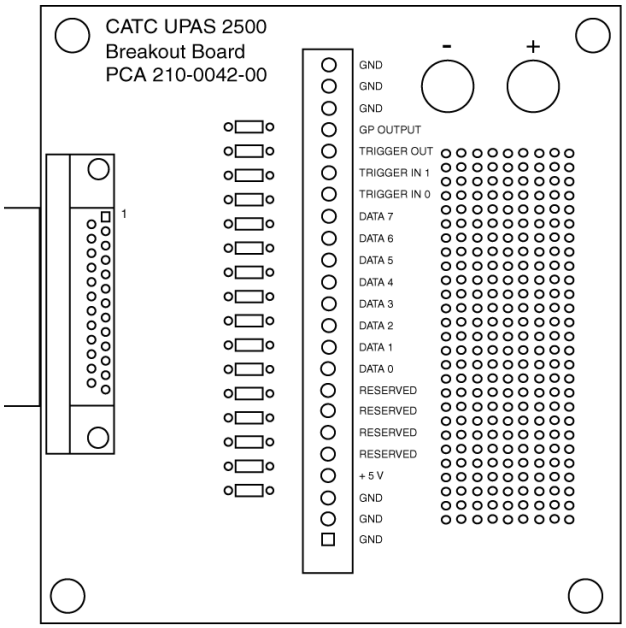
The **Ext. In** and **Ext. Out** connectors have the same function as the 25 pin RS-232 connector - i.e., they channel input and output signals but do not support the use of a Breakout Board.

VHDCI Sync In and Sync Out Connectors

These connectors allow multiple PE*Tracer* Summit or Summit T2-16 analyzers to send synchronization and control messages to one another.

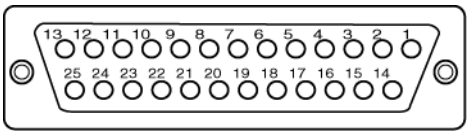
3.7 External Interface Breakout Board

With each Analyzer, Teledyne 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 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 100 Ω 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
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: All models of PE*Tracer* only support Data 0 - Data 3.

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.

Breakout Board Input and Output Signals

A Breakout Board can be used to channel input signals into the Analyzer in order to cause triggering. A Breakout Board can also be used to channel signals from the Analyzer to an external source.

Drive strength for all outputs is about 30 mA high (@2 V) and 60 mA low (@0.5 V). Inputs can handle 0 V to 5.5 V. Inputs above 2 V are detected as logic high; inputs below 0.8 V are detected as logic low.

The Breakout Board connects via a cable to the Data In/Out connector on the rear of the Summit systems.

External Recordable Signals

Breakout Board Data 0-3: These pins let you define a 4-bit Data Pattern that can be recorded in a CATC Trace file.

External Input Triggers

You can use either an external input signal or the Trigger button on the front of the UPAS to cause triggering. The following descriptions show what pins or buttons to use:

Breakout Board Data 3 - Data 0: Triggers on a 4-bit input pattern.

Breakout Board Trigger In 0: Selectable Edge triggered inputs. Triggers on any edge it detects.

Breakout Board Trigger In 1: Selectable Edge triggered inputs. Triggers on any edge it detects.

BNC Trigger (EXT IN): Selectable Edge triggered inputs. Triggers on any edge it detects. Located on the back of the chassis.

Push Button Trigger: The Trigger button on the front of the UPAS can be pressed to manually cause a trigger.

External Outputs

The Analyzer can be configured to send an external signal anytime a trigger and/or event occurs. The following descriptions show the behavior of these output signals:

Breakout Board Trigger Out: Changes from low to high when Analyzer triggers (one time per recording only)

Breakout Board G.P. Output: Programmable waveform (low or high pulse, toggle). Each event can be programmed to enable this external signal.

BNC Output (EXT OUT): Same as Breakout Board G.P. Output. Located on the back of the chassis.

Setting Recording Options to Support External Input/Output Signaling

After a Breakout Board has been connected to a Summit system, the Analyzer must be configured for external or internal input signaling.

Chapter 4: Installation and Setup

PE*Tracer* Summit™ and Summit T2-16™ are stand-alone systems.

You can begin making PCI Express™ recordings after following the steps in this chapter.

4.1 Installing the PE*Tracer* Software

PE*Tracer* software operates all of Teledyne LeCroy's PCI Express protocol Analyzer and Exerciser products:

The PE*Tracer* software is installed on a Microsoft® Windows®-based host machine and serves as the interface for the Analyzer.

To install the PE*Tracer* software on the host machine, before attaching the Analyzer to the system:

Step 1 Insert the CD into the CD ROM drive of the host machine that will control the Analyzer. The installation window opens and displays links to the PE*Tracer* software, user manuals, a readme file, and Acrobat Reader.

Step 2 Select **Install Software** and follow the on-screen instructions.

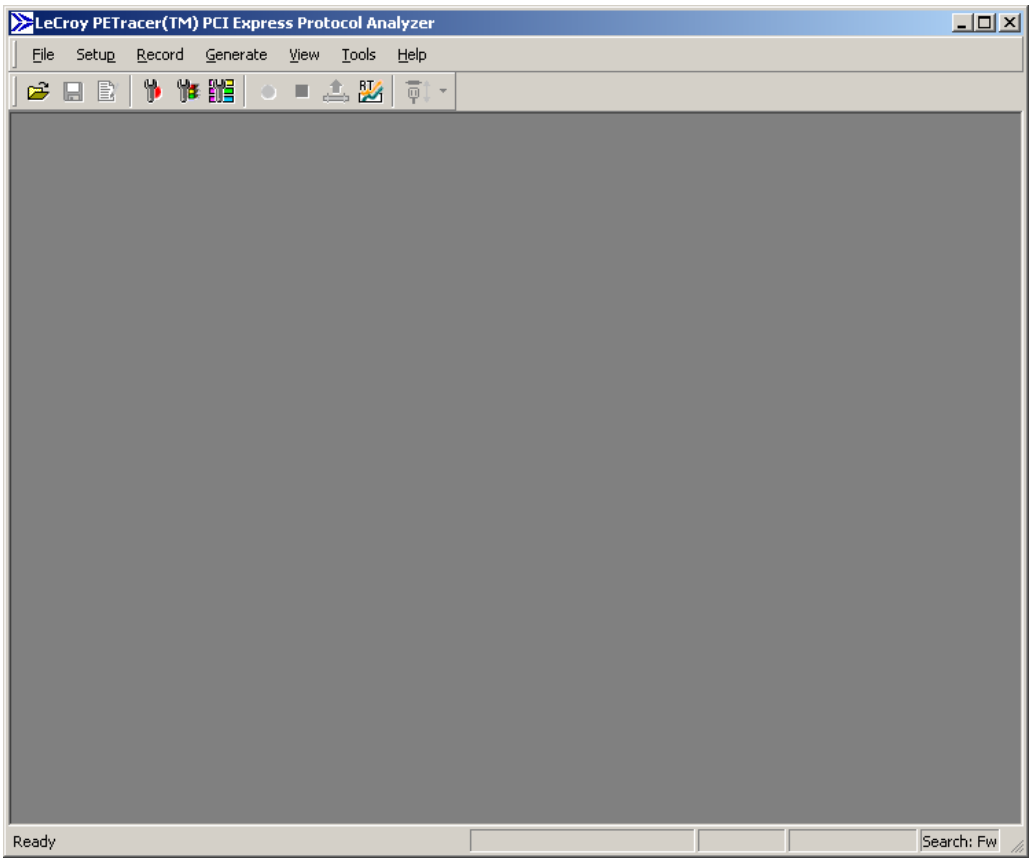
The PE*Tracer* software installs automatically on the host machine's hard disk. During installation, all necessary USB drivers are loaded automatically. Drivers included in the installation are:

- **summit.sys**: Summit T2-16 driver

Note: PE*Tracer* Summit needs no driver installation.

Step 3 To start the application, launch the PE*Tracer* program from the Start menu:
Start > Programs > LeCroy > PETracer > LeCroy PETracer

The PE*Tracer* program opens:



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

4.2 Setting Up the Summit T2-16 Analyzer using an Ethernet Connection

Step 1 Remove the Analyzer from its shipping container.

Step 2 Connect the Analyzer 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 volts and 240 volts, 50 Hz or 60 Hz, thus supporting all known supply voltages around the world.

Step 3 Connect the Ethernet cable between the Ethernet port on the back of the Analyzer and a Ethernet port (hub, switch or wall) in your local network. Continue with Step 4 below.

Note on USB: To connect using USB, see “Setting Up the Summit T2-16 Analyzer using a USB Connection” on page 30.

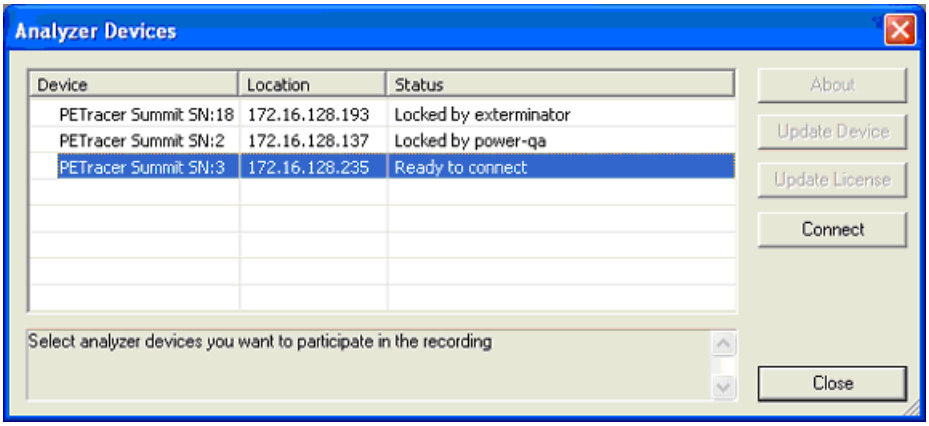
Step 4 Turn on the rear power switch and the front power switch.

Note: At power-on, the Analyzer initializes itself in approximately five seconds and performs an exhaustive self-diagnostic that lasts about forty seconds. The results are reflected by messages on the Summit T2-16 LCD display (see “Summit T2-16 Front Panel Description” on page 12). If the LCD display indicates failure, call Teledyne LeCroy Customer Support for assistance.

Connecting to a Summit T2-16 Analyzer in the Local Network

After you have installed the PE*Tracer* application software, perform the following procedure to connect to a Summit T2-16 analyzer in the local network.

Step 1 Select the **Setup > All connected devices…** menu in the PE*Tracer* application to display the Analyzer Devices dialog.



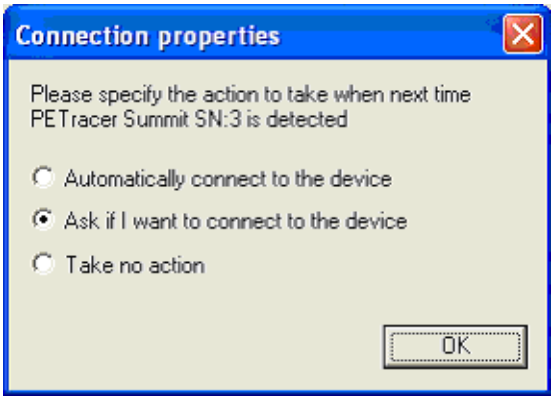
The PE*Tracer* software fills the list with devices that are connected over USB or discovered on the Ethernet network. The discovery mechanism works only within one network subnet. If a Summit is connected to the network on a different subnet, you can manually add the subnet to the list by clicking the **Add Device** button and specifying the IP address.

The Summit devices in the list are marked:

- **Locked**: Some other client on the network is already connected to that device
- **Ready to connect**: Available for connection

Step 2 If a Summit device is marked Ready to Connect, you can select that device and press the **Connect** button to execute the connection procedure.

After the connection is established, the application displays the Connection Properties dialog:



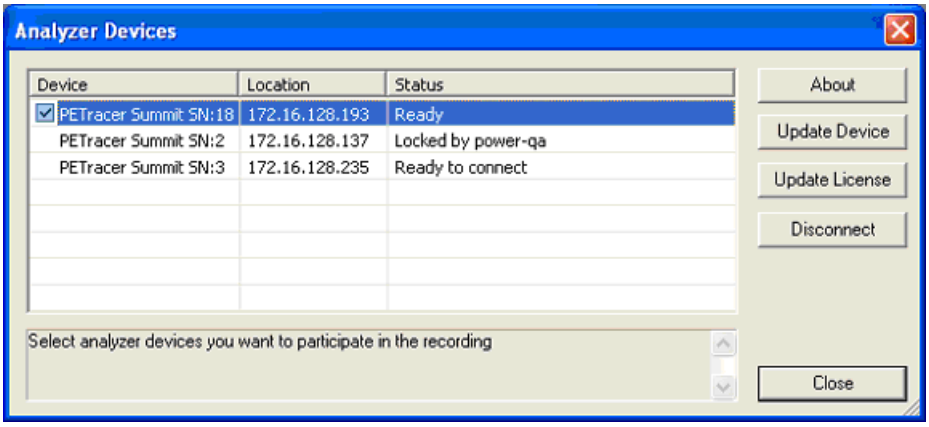
Step 3 Select an option:

- **Automatically connect to the device**: When the application is started or when the named device is added to the network while the PE*Tracer* application is running on this computer, the PE*Tracer* application will try to connect to the named device.
- **Ask if I want to connect to the device**: When the application is started or when the named device is added to the network while the PE*Tracer* application is running on this computer, the PE*Tracer* application will display a message box allowing you to connect to the named device.
- **Take no action**: When you start the application or when you add the named device to the network while the PE*Tracer* application is running on this computer, you must connect manually to use the named device.

Note: When you close the application on this computer (or you perform manual disconnect), the application disconnects from the device.

Step 4 Press **OK** in the Connection Properties dialog.

After you finish the connect procedure, the Summit device to which you have connected is marked as **Ready** and you can use it for recording:



Note: To disconnect from a device, display this dialog, select the device, and click the **Disconnect** button.

Warning! Do not change from USB to Ethernet, or back, without power cycling the analyzer.

4.3 Setting Up the Summit T2-16 Analyzer using a USB Connection

To set up the Analyzer using a USB connection:

Step 1 Remove the Analyzer from its shipping container.

Step 2 Insert and install the Installation CD.

Step 3 Connect the Analyzer 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 volts and 240 volts, 50 Hz or 60 Hz, thus supporting all known supply voltages around the world.

Step 4 Connect the USB port to a USB port on the host machine using a USB cable.

Note on Ethernet: To connect using Ethernet, see “Setting Up the Summit T2-16 Analyzer using an Ethernet Connection” on page 27.

Step 5 Turn on the rear power switch and the front power switch.

Note: At power-on, the Analyzer initializes itself in approximately five seconds and performs an exhaustive self-diagnostic that lasts about forty seconds. The results are reflected by messages on the Summit T2-16 LCD display (see “Summit T2-16 Front Panel Description” on page 12). If the LCD display indicates failure, call Teledyne LeCroy Customer Support for assistance.

Step 6 Click **Next** after you see the Add New Hardware Wizard window.

Step 7 Follow the Microsoft® Windows® on-screen Plug-and-Play instructions for the automatic installation of the Analyzer as a USB device on your analyzing host machine. (The required USB files are included on the Installation CD and were installed on your system when you installed the software CD.)

Step 8 Click **Finish** when you see the message that says “Windows has finished installing the software that your new hardware requires” and the file has been installed in your host machine.

Warning! Do not change from USB to Ethernet, or back, without power cycling the analyzer.

4.4 Setting Up the PE*Tracer* Summit Analyzer

Step 1 Remove the Analyzer from its shipping container.

Step 2 Connect the Analyzer 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 volts and 240 volts, 50 Hz or 60 Hz, thus supporting all known supply voltages around the world.

Step 3 Connect the Ethernet cable between the Ethernet port on the back of the Analyzer and a Ethernet port (hub, switch or wall) in your local network.

Step 4 Turn on the rear power switch and the front power switch.

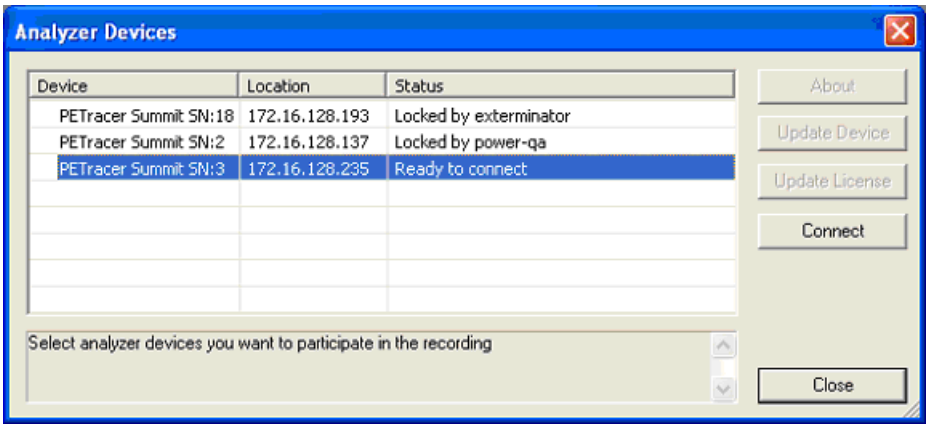
Note: At power-on, the Analyzer initializes itself in approximately five seconds and performs an exhaustive self-diagnostic that lasts about fifteen seconds. The results are reflected by messages on the PE*Tracer* Summit LCD display (see “PETracer Summit Front Panel Description” on page 15). If the LCD display indicates failure, call Teledyne LeCroy Customer Support for assistance.

Note: No driver installation is needed for the PE*Tracer* Summit device.

Connecting to a PE*Tracer* Summit Analyzer in the Local Network

After you have installed the PE*Tracer* application software, perform the following procedure to connect to a PE*Tracer* Summit analyzer in the local network.

Step 1 Select the **Setup > All connected devices…** menu in the PE*Tracer* application to display the Analyzer Devices dialog.



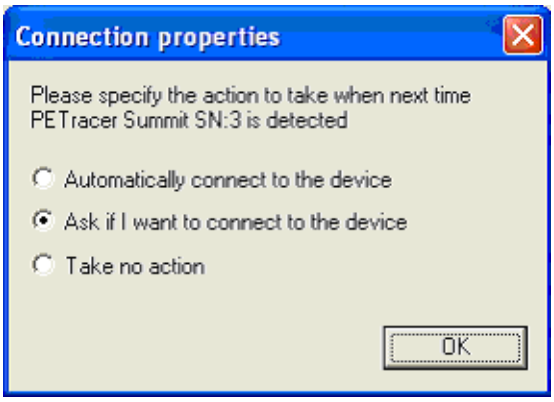
The PE*Tracer* software fills the list with devices that are connected over USB or discovered on the Ethernet network. The discovery mechanism works only within one network subnet. If a Summit is connected to the network on a different subnet, you can manually add the subnet to the list by clicking the **Add Device** button and specifying the IP address.

The Summit devices in the list are marked:

- **Locked**: Some other client on the network is already connected to that device
- **Ready to connect**: Available for connection

Step 2 If a Summit device is marked Ready To Connect, you can select that device and press the **Connect** button to execute the connection procedure.

After the connection is established, the application displays the Connection Properties dialog:



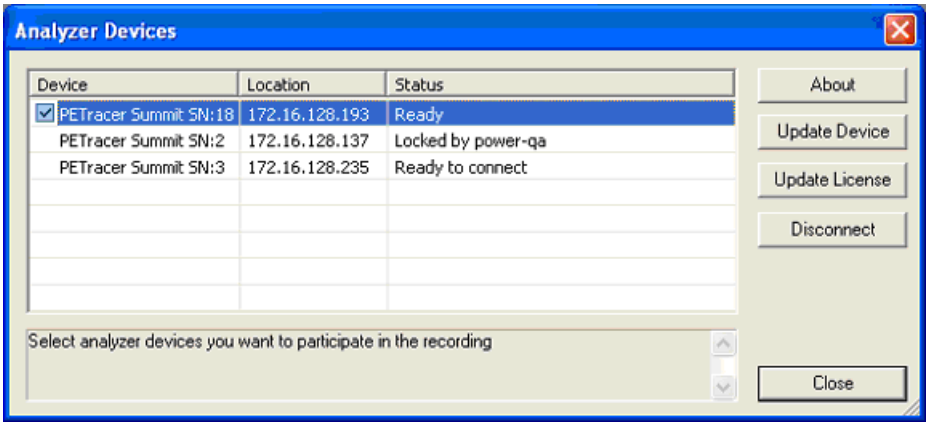
Step 3 Select an option:

- **Automatically connect to the device**: When the application is started or when the named device is added to the network while the PE*Tracer* application is running on this computer, the PE*Tracer* application will try to connect to the named device.
- **Ask if I want to connect to the device**: When the application is started or when the named device is added to the network while the PE*Tracer* application is running on this computer, the PE*Tracer* application will display a message box allowing you to connect to the named device.
- **Take no action**: When you start the application or when you want to add the named device to the network while the PE*Tracer* application is running on this computer, you must connect manually to use the named device.

Note: When you close the application on this computer (or you perform manual disconnect), the application disconnects from the device.

Step 4 Press **OK** in the Connection Properties dialog.

After you finish the connect procedure, the Summit device to which you have connected is marked as **Ready** and you can use it for recording:



Note: To disconnect from a device, display this dialog, select the device, and click the **Disconnect** button.

4.5 Interposers and Probes

PE*Tracer* Summit and Summit T2-16 work with Interposers and Probes.

- **Gen2 MidBus Probe**: The Gen2 MidBus Probe is designed for use with the Summit T2-16 Analyzer and supports lane widths from x1 to x16 at data rates of 2.5 GT/s (Gen1) or 5.0 GT/s (Gen2).
- **Gen2 Multi-lead Probe**: The Summit Multi-lead Probe is designed for use with the Summit T2-16 Protocol Analyzer. The probe consists of 1 to 4 probe pods, which are connected to the analyzer using either iPass Y-Cables (for x1 and x4) or straight x4-to-x8 iPass cables (for x8 and x16). Each probe pod supports up to 8 Flex Tips, with each Flex Tip connected via two coax cables.
- **Gen2 Passive Slot Interposer**: The Gen2 Passive Slot Interposer is designed for use with the Summit T2-16 Analyzer and supports lane widths from x1 to x16 at data rates of 2.5 GT/s (Gen1) or 5.0 GT/s (Gen2). A separate interposer is used for each lane width that you would like to probe. Lane reducers should NOT be used with the Gen2 Passive Slot Interposer. For lane widths up to x8, one iPass Y-cable is required. For x16 applications, two iPass Y-cables are required.
- **Gen2 Active Slot Interposer**: The Gen2 Active Slot Interposer is designed for use with the Summit T2-16 Analyzer and supports lane widths from x1 to x16 at data rates of 2.5 GT/s (Gen1) or 5.0 GT/s (Gen2). Lane reducers/adapters may be used with the Gen2 Active Slot Interposer. For lane widths up to x8, one iPass Y-cable is required. For x16 applications, two iPass Y-cables are required.

The following sections describe how to set up probe systems.

4.6 Using Probes

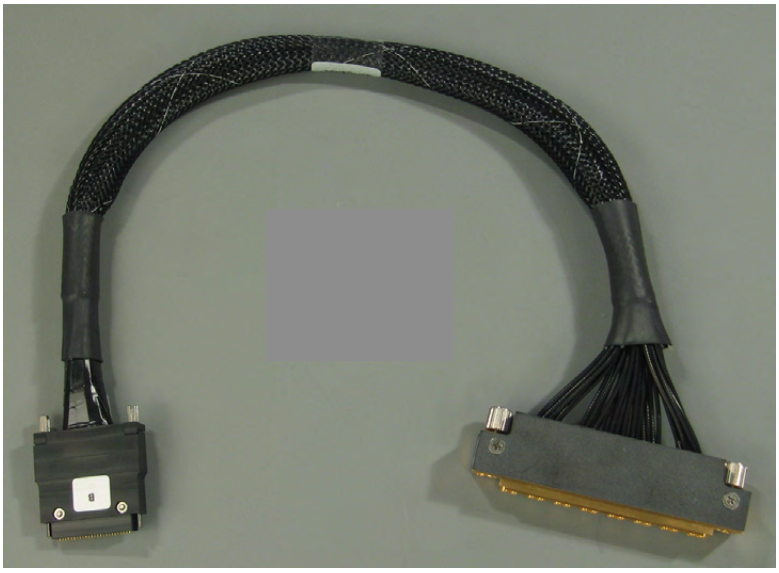
Example: Connecting the Summit T2-16 Analyzer to the Device Under Test Using a Gen2 MidBus Probe

Components

- **1 or 2 iPass Y-cable**

- **1 or 2 MidBus Probe pod**

- **1 or 2 MidBus Probe Cable, Attachment Pad, and Header**



- **1 or 2 Clock Cable**

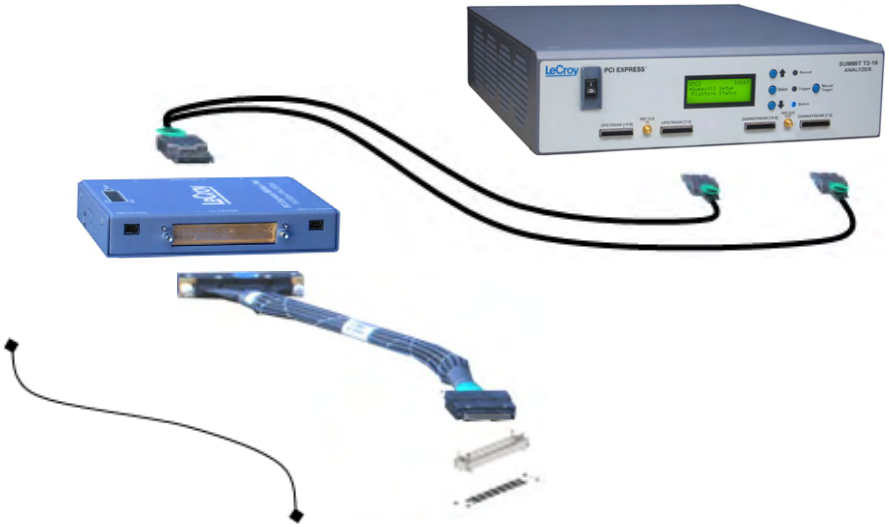
Connections Overview for Gen2 MidBus Probe

Use a 1-pod or 2-pod setup depending on the lane width of the recording:

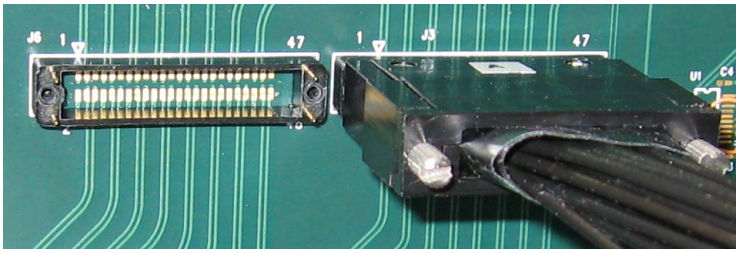
- For x16 recordings, use the 2-pod setup.
- For all other lane width recordings, use a one-pod setup.

Use the iPass Y-cables to connect the probe data connectors on the Analyzer to the MidBus pod(s).

On the other side of the pod, connect the MidBus probe assembly.



Connect the header on the MidBus probe assembly to the MidBus footprint on the System Under Test (host platform/root complex). The following picture shows two midbus footprints, with one connected to the MidBus probe assembly:



Connection Procedure

To connect the Summit T2-16 to the System Under Test (host platform/root complex):

Step 1 Connect the MidBus pods to the Analyzer using the iPass Y-cables.

Step 2 Connect the MidBus probe assemblies to the MidBus pods.

Step 3 Connect the MidBus probe assemblies to the MidBus footprints on the system under test.

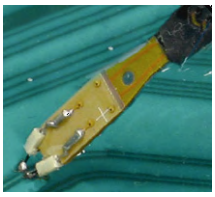
Step 4 Connect external reference clock signal to Mid-Bus External Clock In on Mid-Bus probe pod, using external reference clock cable. For x16, you need to chain the pods.

Example: Connecting the Summit T2-16 Analyzer to the Device Under Test Using a Gen2 Multi-lead Probe for x1 and x4

Components

- **1 iPass Y-cable for x1 and x4** (see “1 or 2 iPass Y-cable” on page 35)
- **1 Multi-lead Probe Pod for x1 and x4**

- **up to 16 MidBus Probe SSMP Cables, and up to 8 Flexible Leads, per pod**



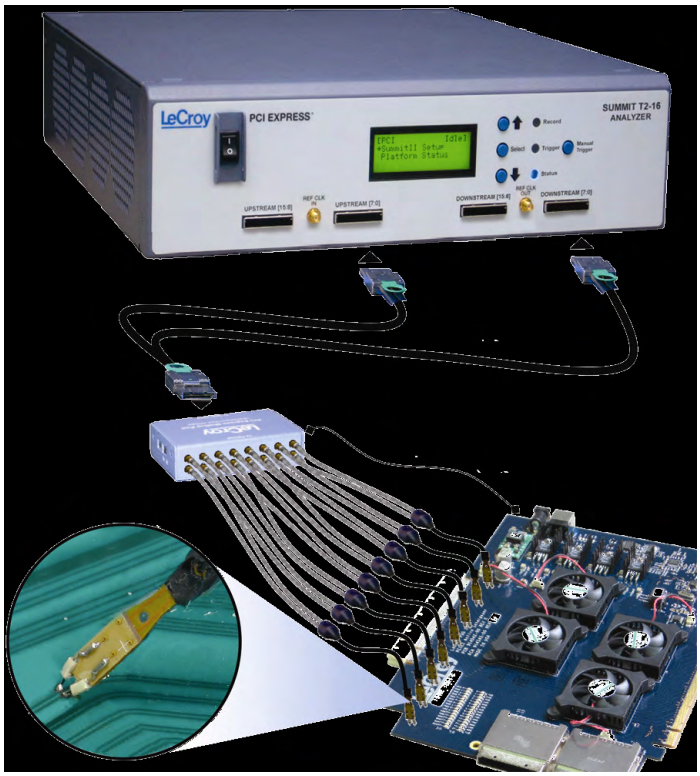
- **1 Clock Cable** (see “1 or 2 Clock Cable” on page 36)

Connections Overview for Gen2 Multi-lead Probe

Use a 1-pod setup.

For x1 or x4, use the iPass Y-cable to connect the probe data connectors on the Analyzer to the pod(s).

On the other side of the pod, connect the flexible lead tips.



Connection Procedure

To connect Summit T2-16 to the System Under Test (host platform/root complex):

Step 1 Connect the pods to the Analyzer using the iPass Y-cable cables.

Step 2 Connect the flexible lead tips to the pods using the SSMP cables.

Step 3 Connect the lead tips to the system under test by soldering to the trace.

Example: Connecting the Summit T2-16 Analyzer to the Device Under Test Using a Gen2 Multi-lead Probe for x8 and x16

Components

- **2 iPass Straight cables for x8 and 4 iPass Straight cables for x16**

- **2 Multi-lead Probe pods for x8**
  4 Multi-lead Probe pods for x16
  (see “1 Multi-lead Probe Pod for x1 and x4” on page 38)

- **up to 16 MidBus Probe SSMP Cables, and up to 8 Flexible Leads, per pod**
  (see “up to 16 MidBus Probe SSMP Cables, and up to 8 Flexible Leads, per pod” on page 38)

- **1 Clock Cable** (see “1 or 2 Clock Cable” on page 36)

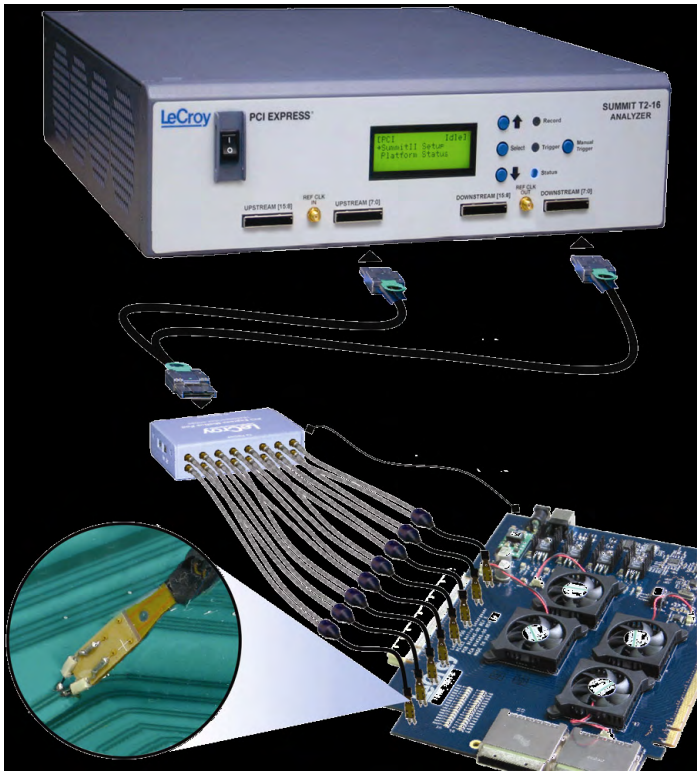
Connections Overview for Gen2 Multi-lead Probe

Use a 1-pod or 2-pod setup depending on the lane width of the recording:

- For x16 recordings, use the 2-pod setup.
- For all other lane width recordings, use a one-pod setup.

For x8 and x16, use the straight iPass cables to connect the probe data connectors on the Analyzer to the pod(s).

On the other side of the pod, connect the flexible lead tips.



Connection Procedure

To connect Summit T2-16 to the System Under Test (host platform/root complex):

Step 1 Connect the pods to the Analyzer using the straight iPass cables.

Step 2 Connect the flexible lead tips to the pods using the SSMP cables.

Step 3 Connect the lead tips to the system under test by soldering to the trace.

4.7 Using Interposers

Example: Connecting the Summit T2-16 Analyzer to the Device Under Test Using a Gen2 Passive Interposer

Summit T2-16 Components

Summit T2-16 components used in the installation are:

- **iPass Y-Cable**: The cable supports eight lanes from two directions. Side A of the probe cable connects to the Upstream port on the Analyzer (on the left in the photo above), and Side B of the probe cable connects to the Downstream port (on the right).
  Note: x16 recordings require two cables.
- **Summit T2-16 x16 Slot Gen2 Passive Interposer**: The slot Interposer provides the point of attachment for the Analyzer to the Device Under Test (DUT). The Interposer is designed to fit between a motherboard and one of its device cards - for example, a LAN card. The Interposer has three sets of connectors: a gold male connector that fits into a standard x16 PCI Express slot on a motherboard, a black female connector that accepts a x16 PCI Express device such as a graphics card, and two Interposer cable connectors that connect the Interposer to the Analyzer.

Installing the Gen2 Passive Interposer

To install the Interposer, perform the following steps.

Step 1 Insert the gold male connector on the Interposer probe into a x16 PCI Express slot in the motherboard. Use edge adapters for x1, x4, and x8 slots.

Step 2 Insert the PCI Express DUT into the Interposer's black female device connector.

Step 3 The slot Interposer is shipped from Teledyne 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

x8 recordings require one cable. To connect a single Interposer data cable, connect the probe data cable to the Interposer card at [7:0]. Connect Side A of the probe cable to the Upstream [7:0] port on the Analyzer, and connect Side B of the probe cable to the Downstream [7:0] port.

x16 recordings require two cables. Connect the second probe data cable to the Interposer card at [15:8]. Connect Side A of the second probe cable to the Upstream [15:8] port on the Analyzer, and connect Side B of the second probe cable to the Downstream [15:8] port.

Power On Analyzer and then DUT

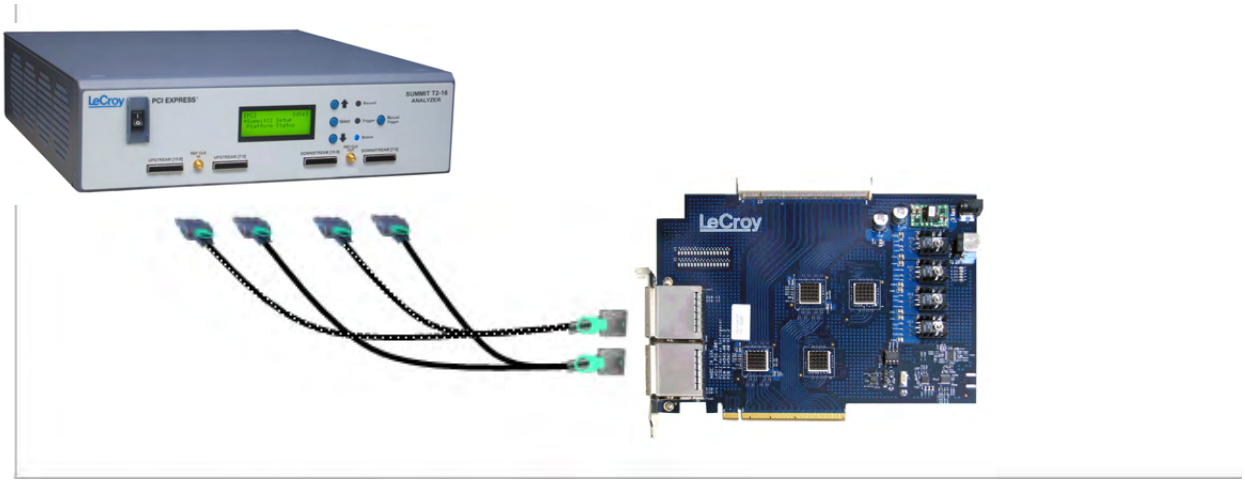
Important: Power on the Analyzer before you power on the DUT.

Step 1 Power on the Summit T2-16 Analyzer.

Step 2 Power on the DUT.

Step 3 Open the PE*Tracer* software on the host machine. The Analyzer is now ready for PCI Express traffic recording.

Example: Connecting the Summit T2-16 Analyzer to the Device Under Test Using a Gen2 Active Interposer



Summit T2-16 Components

Summit T2-16 components used in the installation are:

- **iPass Y-Cable**: The cable supports eight lanes from two directions. Side A of the probe cable connects to the Upstream port on the Analyzer (on the left in the photo above), and Side B of the probe cable connects to the Downstream port (on the right).
  Note: x16 recordings require two cables.
- **Summit T2-16 x16 Slot Gen2 Active Interposer**: The slot Interposer provides the point of attachment for the Analyzer to the Device Under Test (DUT). The Interposer is designed to fit between a motherboard and one of its device cards - for example, a LAN card. The Interposer has three sets of connectors: a gold male connector that fits into a standard x16 PCI Express slot on a motherboard, a black female connector that accepts a x16 PCI Express device such as a graphics card, and two Interposer cable connectors that connect the Interposer to the Analyzer.

Note: Edge reducers are required for lane widths less than x16.

Installing the Gen2 Active Interposer

To install the Interposer, perform the following steps.

Step 1 Insert the gold male connector on the Interposer probe into a x16 PCI Express slot in the motherboard. Use edge adapters for x1, x4, and x8 slots.

Step 2 Insert the PCI Express DUT into the Interposer's black female device connector.

Step 3 The slot Interposer is shipped from Teledyne 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

x8 recordings require one cable. To connect a single Interposer data cable, connect the probe data cable to the Interposer card at [7:0]. Connect Side A of the probe cable to the Upstream [7:0] port on the Analyzer, and connect Side B of the probe cable to the Downstream [7:0] port.

x16 recordings require two cables. Connect the second probe data cable to the Interposer card at [15:8]. Connect Side A of the second probe cable to the Upstream [15:8] port on the Analyzer, and connect Side B of the second probe cable to the Downstream [15:8] port.

Power On Analyzer and then DUT

Important: Power on the Analyzer before you power on the DUT.

Step 1 Power on the Summit T2-16 Analyzer.

Step 2 Power on the DUT.

Step 3 Open the PE*Tracer* software on the host machine. The Analyzer is now ready for PCI Express traffic recording.

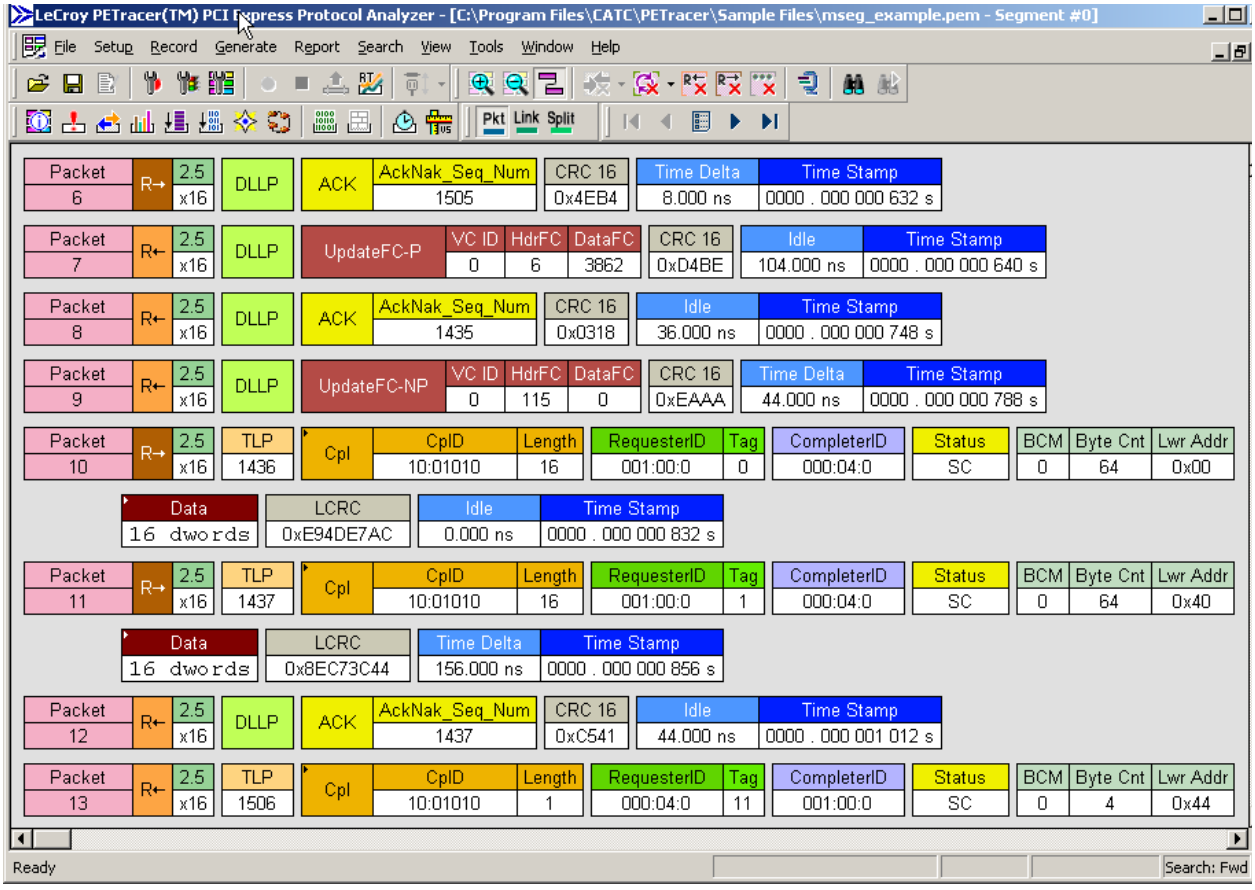
Chapter 5: Software Overview

5.1 The PE*Tracer* Software

The PE*Tracer*™ software administers Analyzer platforms and handles all CATC Trace analysis and display. The core software is thus the same for all of Teledyne LeCroy's PCI Express products.

The software runs on a Windows®-based host machine that is attached to the Analyzer via an Ethernet or USB 2.0 connection (USB 1.0 is also supported). PE*Tracer* software can be used without the Analyzer as a CATC Trace viewer for viewing, analyzing and printing traces.

The PE*Tracer* software operates in Microsoft® Windows® XP and Vista environments.



5.2 Application Layout

The PE*Tracer* application contains the following components:

Title bar: The title bar is at the top of the application window and displays the CATC Trace file name or generation script name.

Menu bar: The menu bar is located below the title bar, by default. The menu bar can be moved by clicking a blank area of the bar and then dragging the menu to a new position. It can be docked in another part of the application window or moved outside of the window to become a floating menu.

Toolbar: The toolbar is composed of buttons that represent the commonly used commands. The toolbar divides into smaller toolbars that can be moved and docked in a new position or made to float outside of the window.

Display area: The display area is the main part of the application window in which CATC Traces are displayed.

Status bar: The status bar is located at the bottom of the application window. The left end of the status bar displays descriptions of buttons and menu items when the mouse is positioned over them. The right end of the bar shows the search direction.

5.3 Using the Toolbar

You can use the PE*Tracer* application Toolbar as a shortcut to most of the operations supplied by the menus.

Opens a previously recorded CATC Trace file.

Edit as text.
Script Editor. Opens a text editor for editing traffic generation files (***.peg)**

Save As
Allows the open file to be saved with a new name.

Setup Recording Options
Opens the Recording Options dialog box.

Setup Generation Options
Opens the Generation Options dialog box.

Start Recording.

Stop Recording.

Repeat Upload.
Opens a dialog box that allows you to select a portion of memory to upload from memory, then causes the Analyzer to re-send the CATC Trace from the Analyzer buffer to the host machine

Zoom in display.

Zoom out display.

Setup Display Options
Opens the Display Options dialog box.

Real Time Statistics monitor
Opens a window that displays real-time information.

Disconnect/Connect Link.
Click once to break and momentarily later restore link. Open menu to select either Connect or Disconnect.

Wraps display information.

Hide Training Sequence.

Hide Downstream traffic/recording.

Hide SKIP and Update FC packets.

Advanced Hiding Options
Opens a dialog box that allows you to select items to hide from view.

Hide Upstream recording/traffic.

Compact View
Toggles compacting of training sequences to analyze CATC Trace data faster, or no compacting to display more data.

Find
Opens a dialog box that allows you to select one or more items to find in the recording, then searches to that point.

Find Next. Repeats last Find or Search action.

View Packet Level data.

View PQI Transaction Level data.

View Link Transaction Level data.

View AHCI Transaction Level data.

View Split Transaction Level data

View ATA Transaction Level data.

View NVM Transaction Level data.

File Information
Lists the conditions under which the recording was made.

Bus Utilization
Opens a window that graphically represents various information about the recording.

Error Report
Opens a window that lists all errors identified in the recording.

Link Tracker
Opens a window that displays symbol information per lane.

Traffic Summary
Opens a window that lists all events that occurred during the recording

Opens the Data Flow window.
Shows recorded data in a compressed tabular format.

Navigator. Shows/hides the Navigator bar - a utility that lets you easily navigate the CATC Trace.

LTSSM Flow Graph
Shows a state diagram of the LinkTraining and Status State machine.

Displays the Data/Payload window for the current packet.

Displays the Packet Header bar.
Opens a window that displays the header information in the current packet, as it would be viewed in the specification.

Opens the Timing and Bus Usage Calculations window.

Running Verification Scripts
Opens a dialog that allows you to select and run verification scripts.

5.4 Multi-Segment Toolbar

First Segment. Open first segment in the multisegment CATC Trace.

Index file. This button becomes active if a multisegment CATC Trace file is open and displays the index file for the recording.

Previous segment. Open previous segment in the multisegment CATC Trace.

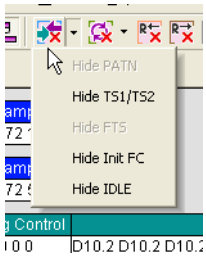
Next Segment. Open next segment in multisegment CATC Trace.

Last segment. Open last segment in multisegment CATC Trace.

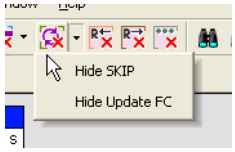
Toolbar Hide Buttons

The PE*Tracer* application toolbar has five buttons related to show/hide of CATC Trace file contents. The buttons allow you to quickly adjust the display to your needs.

Hide Training: Brings up a drop-down menu that lets you to hide all or a portion of the packets in the training portion of the CATC Trace.



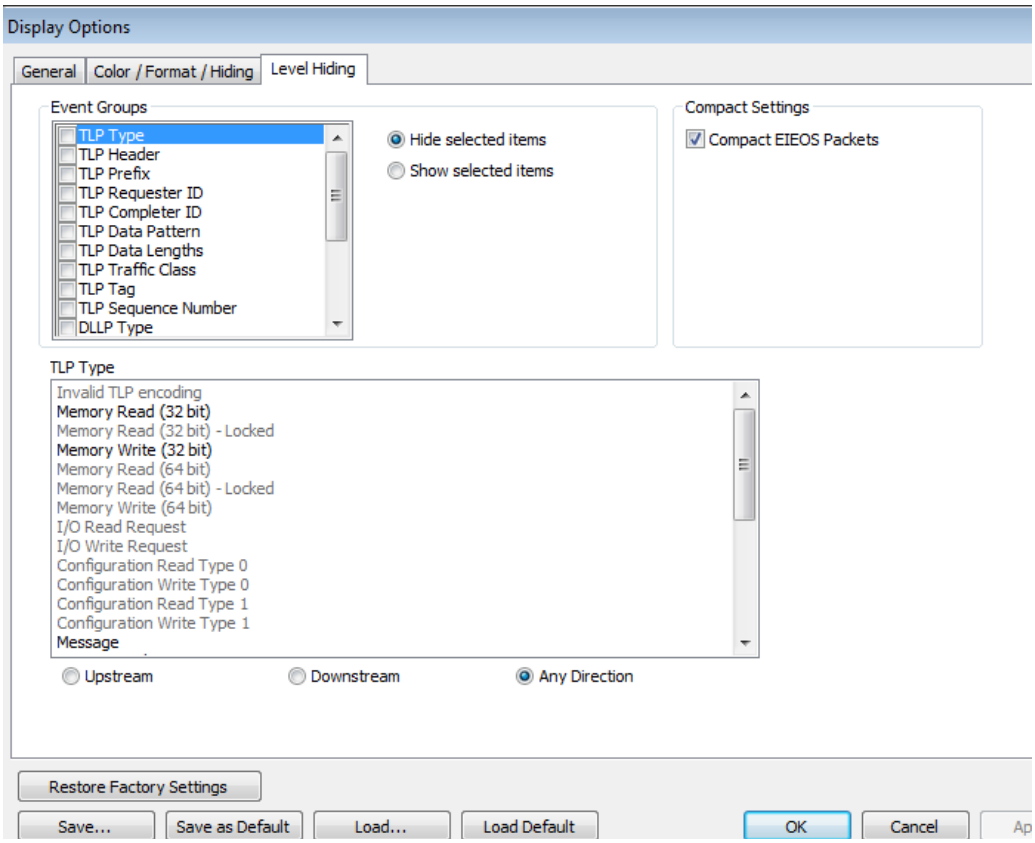
Hide SKIP and Update FC: Brings up a drop-down menu that lets you hide SKIP or Update FC packets in a CATC Trace.



Hide Upstream: Hide all traffic from endpoint devices to the root complex.

Hide Downstream: Hide all traffic from the root complex to endpoint devices.

Advanced Hiding Options: Brings up the Level Hiding pane of the Display Options window. Use this pane to tune the show/hide options within the CATC Trace display.



5.5 Using the Menus

The PE*Tracer* application main display includes the following set of pull-down menus:

File Menu

New Generator Script	Creates a new Traffic Generation file.
Open	Opens a file.
Close	Closes the current file.
Save as	Saves all or a specified range of packets to a uniquely named file.
Convert Old Files	Convert CATC Trace files made in previous versions of PE*Tracer* to the new format for PE*Tracer* version 6.5x and higher.
Print	Prints part or all of the current traffic data file.
Print Preview	Produces an on-screen preview before printing.
Print Setup	Setup your current or new printer.
Edit Comment	Create or edit the comment field in a CATC Trace file.
Export >> to Text >> Packets to CSV Text >> to Generator File Format	Saves all or part of a CATC Trace to a text file or traffic generation file. This text file summarizes the traffic in the CATC Trace. Saves the CATC Trace to a text file in Comma Separated Value (CSV) format. Saves the CATC Trace to a generation file.
Exit	Exit the PE*Tracer* application.

Setup Menu

Display Options	Allows you to customize display options such as field colors, field formats and level hiding.
Recording Options	Allows you to customize control and setup features associated with recording, triggering, and filtering recorded events.
Generation Options	The Generation Options dialog box is used to set configuration settings in a traffic generation script (*.peg). This dialog provides a convenient alternative means of editing a traffic generation file.
Generation Macros	Opens a dialog for creating buttons on the status bar that can be used to run traffic generation macros.
Update Device	Opens a dialog box that lets you update the BusEngine™ and Firmware.
Calibrate Device	Opens a dialog box that lets you calibrate the BusEngine™ and Firmware.
Analyzer Network	Opens a dialog box for browsing to local and networked analyzers. Within the dialog, click Add to browse. The dialog lists PCs that are on the LAN. If a PC has an analyzer attached to it, and if DCOM permissions have been set on the selected PC, clicking Select establishes a connection.
All Connected Devices	Opens a dialog box with a list of locally or remotely connected devices. Allows you to update the BusEngine, Firmware, and your licensing information.

Record Menu

Start	Causes the Analyzer to begin recording traffic.
Stop	Causes the Analyzer to stop recording traffic.
Reupload	Causes the Analyzer to re-send all, or selected portions, of the CATC Trace from the Analyzer buffer to the host machine.
Disconnect/Connect	Causes the Analyzer to momentarily break, and then establish the PCI Express link connection in both link directions.
Manual Trigger	Trigger command for Analyzer is generated upon clicking this button.
Reset Link Configuration	Causes the Analyzer to reset the Serdes and thereby reset the Analyzers current link configuration. This command is needed when lane width or other lane settings are changed. Otherwise, the old link configuration is used and errors are generated in the CATC Trace.

Report Menu

Report Menu operations are only available when you are working with a CATC Trace file.

File Information	Displays information about the file contents and describes the conditions of the file's recording (Recording Options, hardware information, and so on).
Error Summary	Displays an error summary of the current CATC Trace file and allows you to go to a specific packet, and save the error file to a uniquely named file.
Traffic Summary	Details the number and types of packets that were transferred during the recording. You can hide, save, send, text, print, and view.
Bus Utilization	Opens a window with graphs of bus usage for the open CATC Trace.
Link Tracker	Opens a window for displaying a detailed chronological view of traffic. The window provides view and navigation options.
Data Flow	Opens the Data Flow Window, providing a tabular view of transactions and their payload.
Trace Navigator	Shows the Navigator bar for navigating a CATC Trace. Shows a snapshot of the recording and allows you to adjust the memory area for the view.
LTSSM Flow Graph	Shows a state diagram of bus activity. Also allows you to navigate through the LTSSM, based on the current recording.
Packet Header	Opens the Packet Header bar, showing the Packet Header information as it would be veiwed in the specification.
Packet Data/View Data	Opens the Data Window for the current packet, with the options: Hide, Save, Hexadecimal, ASCII, Decimal, Binary, MSB Format, LSB Format, Big Endian, and Little Endian. Format Line allows you to enter the number of bytes, words, or dwords per line.
Configuration Space	Presents a list of Configuration Spaces. Clicking an item displays the selected Configuration Space in a Configuration Table format.

Search Menu

Search Menu operations are only available when you are working with a CATC Trace file.

Go to Trigger	Repositions the display to show the first packet following the trigger event.
Go to Packet	Repositions the display to a specific packet, Link Transaction, or Split Transaction number.
Go to Time	Repositions the display to specific timestamp.
Go to Marker	Repositions the display to a previously marked packet, Link Transaction, or Split Transaction.
Go to	Allows searching for specific link events: TLP Type, DLLP Type, .Ordered Set, Link Event, Traffic Class, DLLP Virtual Channel, TLP Virtual Channel, Direction, Speed, Link Width, Requester ID, Completer ID, Data Lengths, Errors.
Find	Displays the Find dialog to allow searching for various events within a CATC Trace. You can search by Display Level: Packets, Link Transactions, Split Transactions. You can search packets by Event Group: TLP Type, TLP Header, TLP Requester ID, TLP Completer ID, TLP Data Pattern, TLP Data Lengths, TLP Tag, TLP Sequence Number, DLLP Type, DLLP Header, DLLP Virtual Channel, ACK/NAK Seq Number, Ordered Sets, Link Event, Direction, Errors. You can search link transactions by Event Group: TLP Type, Traffic Class, Virtual Channel, Direction, Requester ID, Completer ID, Status, Tag. You can search split transactions by Event Group: TLP Type, Traffic Class, Virtual Channel, Direction, Requester ID, Completer ID, Status, Tag. Find allows you to create complex searches based on numerous criteria.
Find Next	Repeats the previous Find or Search operation.
Search Direction	Allows you to specify a forward or backward search of a CATC Trace file.

View Menu

Toolbars>>	Displays available toolbars: Standard, Frequently Used, Analysis, and Transaction Level. Use Customize to display the Windows Customize window.
Script Editor	Displays the Script Editor (only appears if a **.peg** file is open).
Analyzer Network Chat Bar	Opens a chat window for communicating with persons working with networked Analyzers. This command requires that your host machine be attached to a LAN. The Chat window broadcasts messages to whatever hosts have been connected to via the Analyzer Network command (under Setup in the menu).
Status Bar	Switches display of the Status Bar on or off.
Real Time Statistics	Opens the Real Time Statistics monitor dialog and displays a real-time graph of link activity.
Zoom In	Zoom in increases the size of the displayed elements.
Zoom Out	Zoom out decreases the size of the displayed elements.
Wrap	Allows the display to wrap.
FC Credits	Toggles a display for tracking Flow Control Credit update and consumption on a PCI Express link.
FC Credits Setup	Allows you to customize the display for tracking Flow Control Credits.
Compact View	Toggles compacting of the Link Training sequence to analyze CATC Trace data faster or no compacting to display more data.
Packet Level	View the current recording at the Packet Level.
Link Transaction Level	View the current recording at the Link Transaction Level.
Split Transaction Level	View the current recording at the Split Transaction Level.
NVM Transaction Level	View the current recording at the NVM Transaction Level.
PQI Transaction Level	View the current recording at the PQI Transaction Level.
ACHI Transaction Level	View the current recording at the ACHI Transaction Level.
ATA Transaction Level	View the current recording at the ATA Transaction Level.

Tools Menu

TC to VC Mapping	Allows Traffic Classes to be mapped to Virtual Channels for purposes of simplifying navigation (for example, Search > Go to > TLP Virtual Channel) and changing the way the CATC Trace is displayed (for example, in Split Transactions).
Timing Calculations	Starts the mode-less calculator dialog for calculating various timing and bandwidth parameters in the recording file.
Run Verification Scripts	Presents a list of verification scripts, from which you can run a verification script.

Window Menu

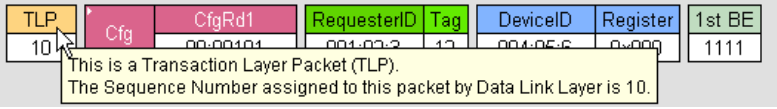
New Window	Opens a copy of the current CATC Trace window.
Cascade	Displays all open CATC Trace windows in an overlapping arrangement.
Tile	Displays all open CATC Trace windows as a series of strips across the display.
Arrange Icons	Arranges minimized CATC Trace windows at the bottom of the display.
Synchronize Traces	Synchronizes the CATC Trace View windows so that a move in one window repositions the other window of the same recording.

Help Menu

Help Topics	Accesses the PE*Tracer* application's Online Help.
Register Product Online	Register at the Teledyne LeCroy website registration page.
Check for Updates	Check whether a new software version is available. If so, you can download from the Teledyne LeCroy web site. You can select to **Check for updates at application startup**
Update License	Displays a dialog box for entering updated license information.
Display License Information	Opens an information box describing the current license information.
About	Displays version information about the attached Analyzer and its Firmware and BusEngine™.

5.6 Tool Tips

Tool tips provide details about fields within the CATC Trace. To see a tool tip, position your mouse pointer over a field within the CATC Trace.



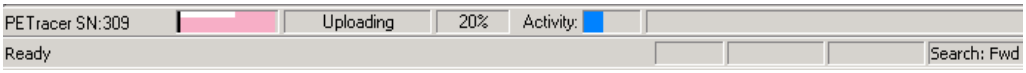
You can turn off this capability in the Display Options menu.

5.7 Keyboard Shortcuts

Keystrokes	Operation
Ctrl + N	New PE*Tracer* script
Ctrl+O	Open file
Ctrl+P	Print
Ctrl+S	Save file
Ctrl + R	Start Analyzer recording
Ctrl + T	Stop Analyzer recording
Ctrl+Home	Jump to first packet
Ctrl+End	Jump to last packet
Ctrl + G	Go to packet ...
Ctrl+F	Search forward
F3	Find next
F6	Next pane
Shift+F6	Previous pane
Ctrl+B	Search backward

5.8 Status Bar

The Status Bar is a gray bar that runs along the bottom of the application window.



From left to right:

PE*Tracer* SN:309: Analyzer Serial Number

Ready: Analyzer Status

Recording Progress Bar: The colored bar to the right of the serial number represents how much traffic has been recorded. The trigger point is indicated by the black line at the left side of the bar. In this example, the trigger occurred at the very beginning of the CATC Trace. If the trigger is set in the middle of the CATC Trace, the line is positioned in the middle of the bar. Additionally, the color of the bar is different on each side of the trigger point. For examples, see “Recording Progress Bar” on page 63. The white strip along the top edge of the color bar indicates how much traffic has been uploaded from the Analyzer buffer to the host machine.

Uploading and 20%: Indicates the Analyzer's recording status, what part of the recording process the Analyzer is now in. In this example, the Analyzer is in the upload stage and has completed 20% of the upload from the Analyzer to the host machine. See “Recording Status” on page 63 for details on other status messages.

Activity: The colored bar moves to indicate that the Analyzer is currently recording.

Search: Fwd: Indicates search direction. The direction can be toggled to **Search: Bwd** by double-clicking the search direction or by selecting **Search Direction** from the Search menu.

Recording Progress Bar

This indicator bar changes color to reflect the recording progress.

- Black vertical line is at the location of Trigger position.
- Black vertical line wiggles when Trigger Position is nearly reached.
- Field to right of Trigger Position changes color to indicate post-trigger activity.
- Upper half of progress indicator turns white when recording is complete.

Recording Status

The second segment from the left in the Status Bar indicates recording status.

During recording, this status flashes one of the following messages:

- Trigger?
- Triggered!
- Uploading

After recording stops, the message changes to

- Uploading data - x% done (where x equals the percent that has been uploaded.)

As uploading progresses, the percent increases to 100. You can abort this upload if you wish by pressing the **<escape>** button on your keyboard or

clicking  in the Tool Bar.

Recording Activity

The third segment displays recorded activity. Activity is indicated in blue:

Search Direction Indicator

The fourth segment in the status bar indicates search direction. The direction can be changed by selecting Search Direction from the Search menu.

5.9 Making a PCI Express Recording

After connecting the Analyzer to the device(s), you must configure the Recording Options. Then you can test the Analyzer by creating a 16-MB 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 in **Simple Mode**, such as Snapshot and 16-MB buffer size. 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.

Note: For PE*Tracer* Summit, 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 disconnects the PCI Express link for one second in both directions, then re-establishes 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.

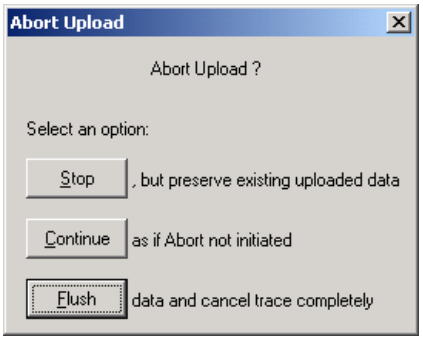
Step 5 Click **OK** at the bottom of the Recording Options dialog box to apply the Analyzer recording settings specified.

Step 6 Click the **Record** button.

Stopping a Recording

You can stop the recording process at any time by pressing the **Stop** button on the toolbar. This causes the Analyzer to stop the recording and upload the CATC Trace to the host machine.

You can interupt a session by pressing the **Escape** key. If Recording is finished and Upload has started but has not finished, a message box appears:



You can:

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

If you allow the traffic data to be uploaded, it is automatically saved on the host machine's hard drive as a file named **data.pex** or the name you assign as the default filename in the recording options.

Saving a Recording

Step 1 To save a current recording for future reference, select **Save As** from the File menu.

Step 2 Give the recording a unique name, then save it to the appropriate directory.

5.10 PE*Tracer* Files

The PE*Tracer* software creates and uses different kinds of files:

- **CATC Trace Files**: Recorded traffic
- **Recording Options Files**: Configuration file that contains the various options selected in the Recording Options dialog box to configure the recording
- **Display Options Files**: Configuration file that contains the options selected in the Display Options dialog box to configure how traffic is displayed

CATC Trace Files

PE*Tracer* records PCI Express traffic into a CATC Trace file with the default name **data.pex** or any other that you specified in the Recording Options. This file is overwritten with new data each time PCI Express traffic is recorded.

If you want to save a CATC Trace, use the **File > Save As** function. This option allows you to save the current CATC Trace to a unique file name, thereby ensuring that it is not overwritten. This option also allows you to save a range of packets in a CATC Trace file.

You can pre-define the name of the recorded CATC Trace file using the Trace Filename and Path option in Recording Options.

Recording Options Files

Recording Options files are created when you set recording options. These files use the **.rec** extension and contain recording option information.

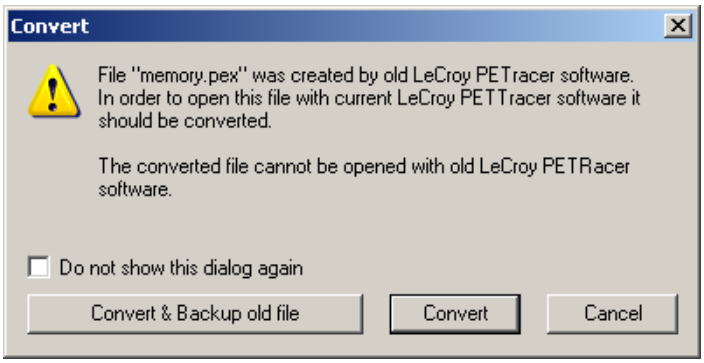
Display Options Files

Display Options files are created when you set display options. These files use the **.opt** extension and contain the display options information.

5.11 Opening CATC Trace Files

To open an existing CATC Trace file, click **File > Open** or  .

If the file was made in a previous version of PE*Tracer*, the application presents the Convert dialog box:



You must convert CATC Trace files made in previous versions of PE*Tracer* for them to open in PE*Tracer* version 6.5x or higher. The converted file has all the information that was in the original file.

You can:

- **Convert & Backup old file**: Convert the file, open it in PE*Tracer* version 6.5x or higher, and save it with the original name. Save the original file with the same name plus the extension **.bak**.
- **Convert**: Convert the file, open it in PE*Tracer* version 6.5x or higher, and save it with the original name.

Note: After you convert a CATC Trace file, you cannot open the converted file in a previous PE*Tracer* version.

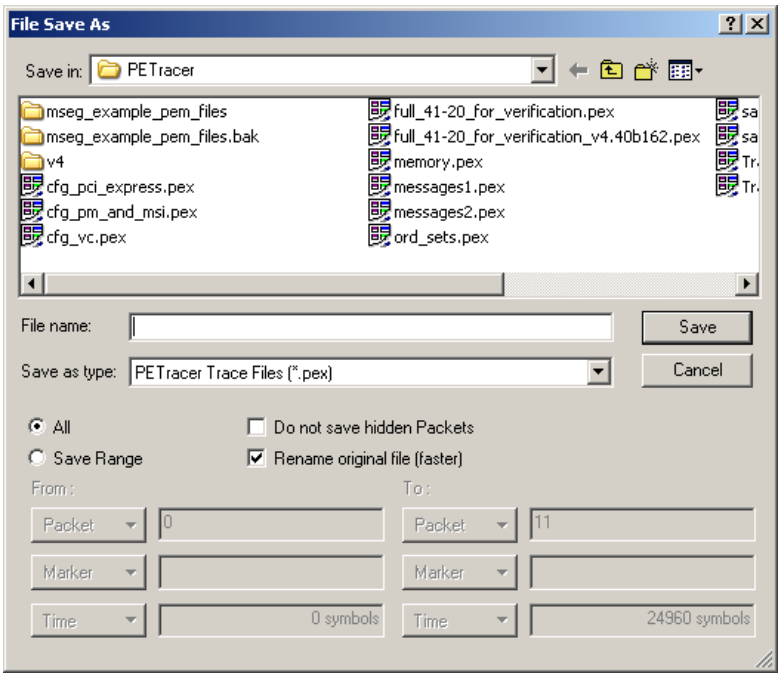
5.12 Saving CATC Trace Files

Using the Save As Function

When you record a CATC Trace file, the Analyzer software provides a pre-defined name to the CATC Trace file (**data.pex** or any other that you specified in the Recording Options). If you do consecutive recordings, each time the previous recording is overwritten. If you see a recording you want to analyze later, you need to give a unique name to the CATC Trace file, so it is not overwritten with the next recording.

Also, when you analyze a recorded CATC Trace file, you might be interested in preserving just a part of the PCI Express traffic that was recorded. If you save a portion of a CATC Trace file, it can get significantly smaller, allowing you to attach it to an e-mail.

To save a portion of a CATC Trace file or the whole file to a unique name, select **Save As** from the File menu.



If you want to give a unique name to the CATC Trace file, select the **All** option and keep **Rename original file** checked. This is the default setting for the dialog.

Saving a Portion of a CATC Trace

If you want to save a portion of a CATC Trace file, select **Save packet range**. Enter starting and ending packet numbers in the **From Packet** and **To Packet** fields. By default, it has the numbers of the first and the last packets in the file. The software is going to save all the packets in specified range to the new file, unless you have **Do not save hidden packets** checked. In this case it is going to save all packets in the range, EXCLUDING the currently hidden packets.

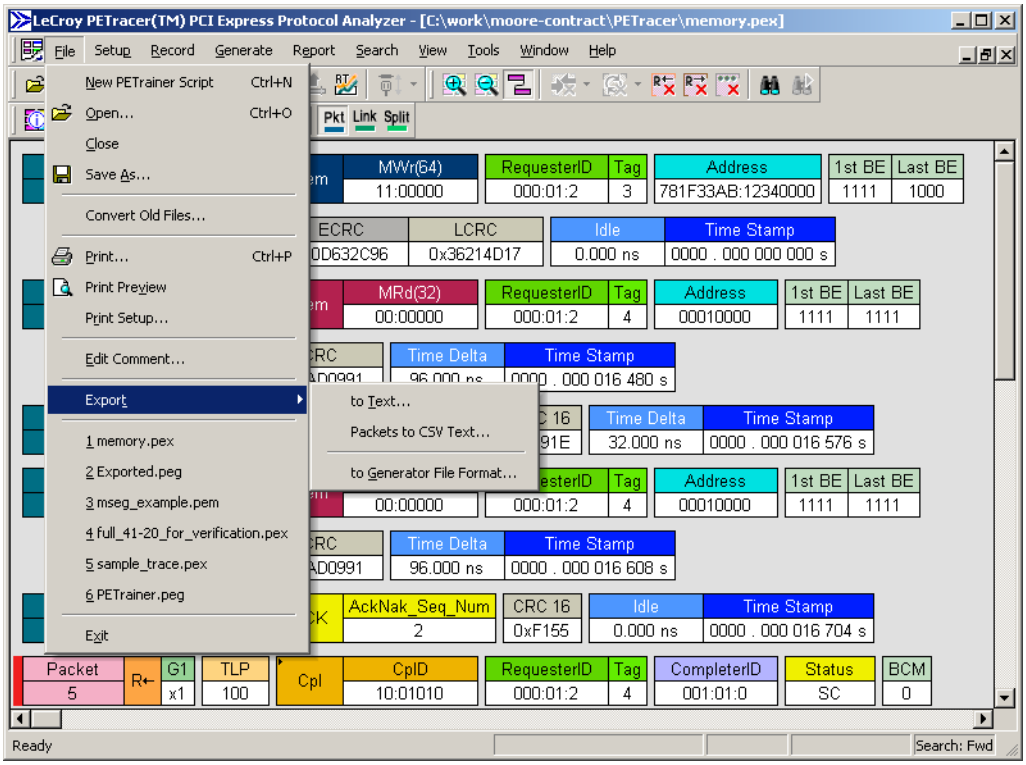
5.13 Exporting a CATC Trace File

By default, PE*Tracer* saves CATC Trace files in the **.pex** format. However, you can export a CATC Trace to a file in any of the following other formats:

- Text
- Comma Separated Value (CSV)
- Generator file format

Exporting to Generator file format is a simple way to create a script file from your CATC Trace.

To export a CATC Trace file, select **File > Export**:



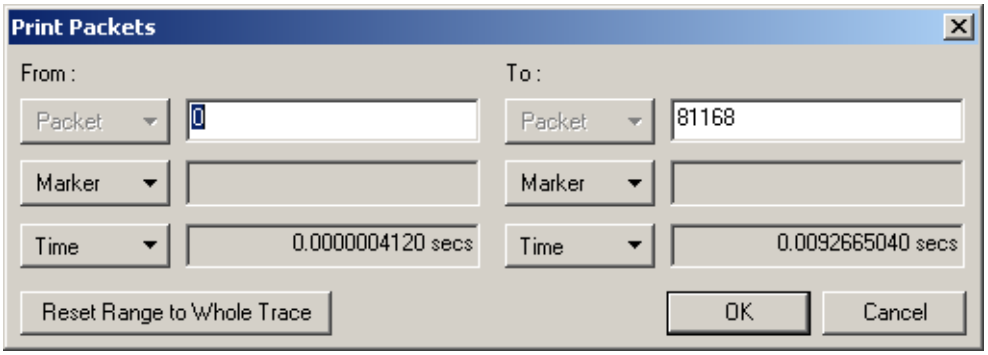
5.14 Printing Data Files

To print all or part of the open CATC Trace:

Step 1 Select **File > Print** from the menu or

click the **Printer**  button on the toolbar.

The Print Packets dialog opens:



Step 2 To select a range of packets, enter values in the **From packet #** and **To packet #** fields and click **Print**.

Step 3 To print an entire file, leave the From and To fields empty and click **Print**.

The specified traffic information is printed as currently displayed, in color or gray scale as supported by your printer. Any CATC Trace File comments you entered are printed following the current document name at the top of each page.

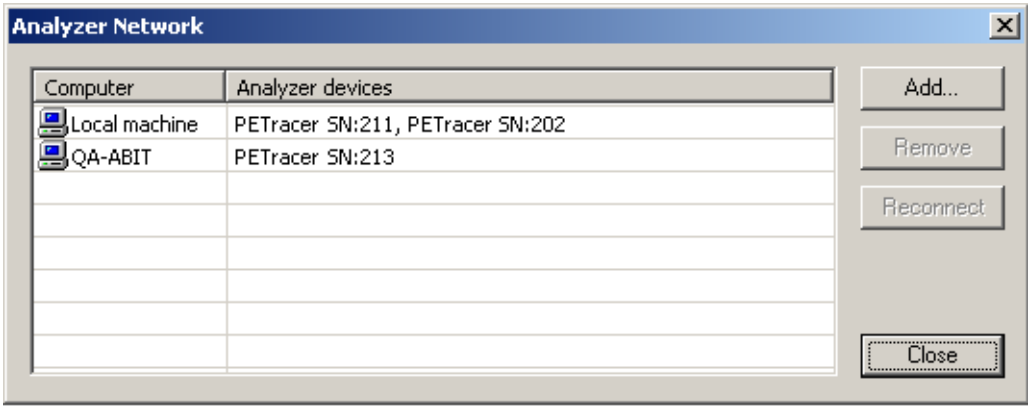
Note: CATC Trace File comments can be created by using **Edit Comment** on the File menu.

5.15 Analyzer Chat Window

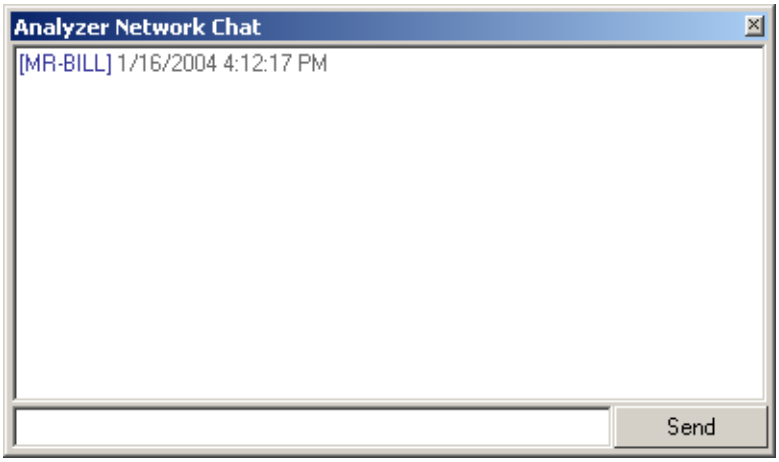
PE*Tracer* has a Chat window that allows you to communicate with users on remote host machines. For Chat to work, two conditions must be met:

1. The host machine must have PE*Tracer* software installed and running.

2. The host machines must be listed in each other's Network Browse list. This means that your host machine must have the remote host machine listed in its Network Browse window and the remote host machine must have your host machine listed in its Network Browse window.



If the above conditions are met, a Chat session is initiated by running the command: **View > Analyzer Network Chat Bar**. The following dialog opens.

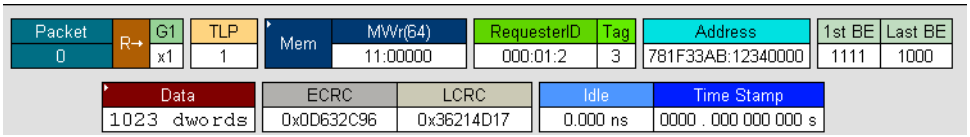


Enter some text, then press **Send**. The message is then broadcast to all host machines listed in your network browse window. If a target host machine also lists your host machine in its Network Browse window, then it can receive your message. When the message arrives, the Chat window automatically opens.

Chapter 6: Reading CATC Traces

6.1 Viewing PCI Express CATC Traces

PE*Tracer*™ displays traffic as labeled, color-coded, and time-stamped rows.



Tool tips provide details about fields within the CATC Trace. Hold the mouse cursor over a field to see a tool tip.

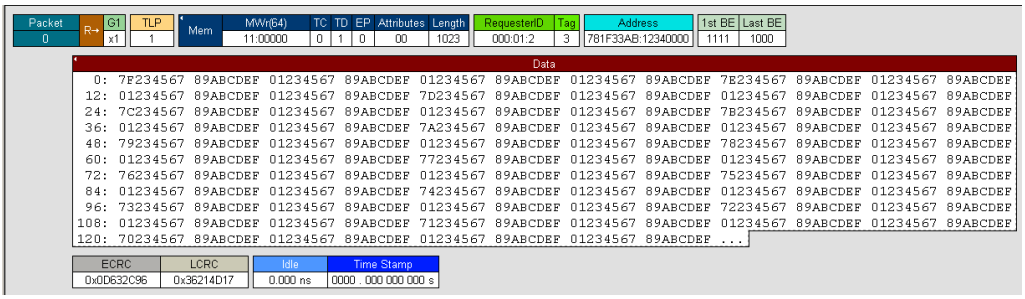
Additional information is available from pop-up menus. For example, if you click the left mouse button on the first cell in a packet a menu appears with an option to view Raw 10b Codes.

6.2 Expand and Collapse Data Fields

Packet data fields are displayed in a short format by default.

You can view a data field's long format by performing one of the following three actions:

- Click the **small triangle** in the left corner.
- Double-click anywhere in the data field.
- Click once in the Data Field with the left mouse button, then choose **Expand Data** from the pop-up menu.



A repeat of any above methods causes the display to return to a Short Data format.

6.3 Resizing Cells

Data cells can be resized by pointing the mouse pointer on the edge of a data cell, depressing and holding the left mouse button, and then repositioning the mouse pointer while keeping the mouse button depressed.

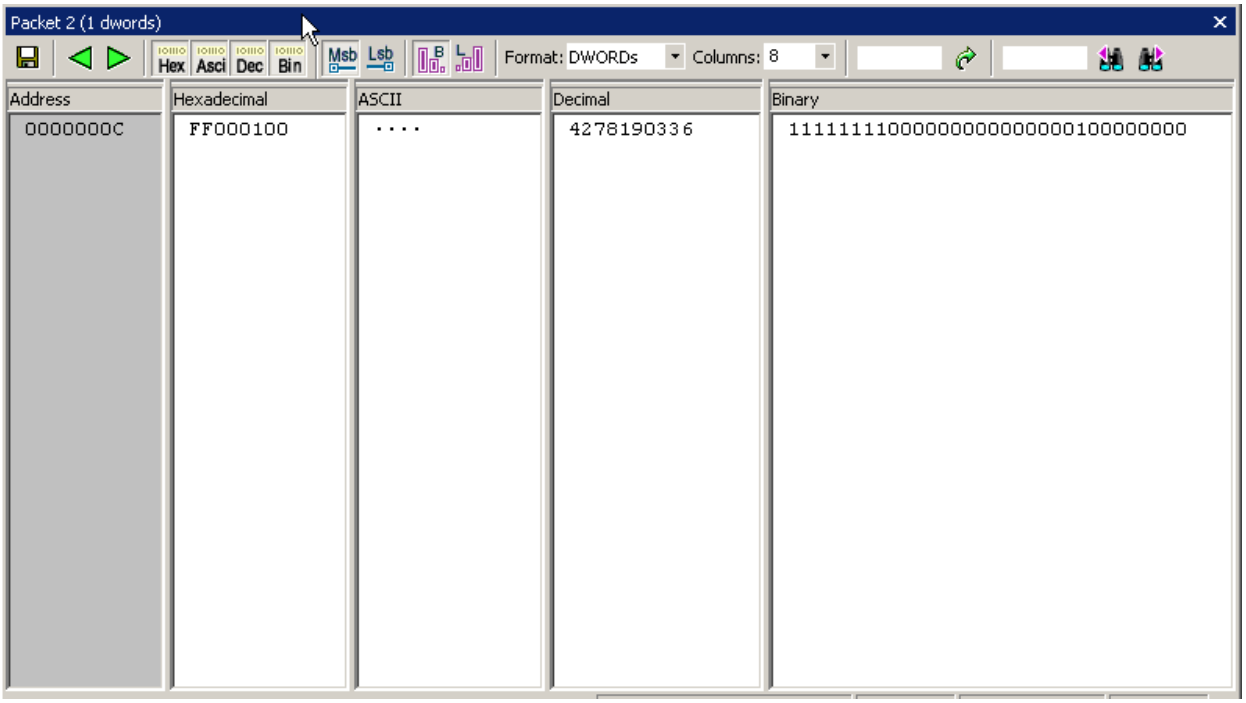
6.4 Pop-up Menus

The Analyzer software makes extensive use of pop-up menus. In some instances, pop-up menus provide the only means of accessing dialog boxes that contain detailed information about cells within the CATC Trace, for example, the Show Configuration Space dialog box.

To see a pop-up menu, left-click or right-click a **cell** within the CATC Trace. Right-click or left-click behavior depends on the Display Options setting. For default left-click, the right-click menu is not cell-dependent. For other left-click behavior, the type of menu that opens varies depending on the type of cell that is selected. Take some time to explore CATC Traces and the various pop-up menus.

6.5 View Data Block

To view the raw bits that make up the data in a data field, left-click a data field, then click  or select **View Data Block** from the pop-up menu to display the Data Block window.



You can display data in Hexidecimal, ASCII, Decimal, or Binary formats.

Bit Order is Most Significant Bit or Least Significant Bit.

You can display data in Big Endian or Little Endian.

Format lets you display data as BYTEs, WORDs, or DWORDs.

Columns lets you select the number of columns.

You can enter hexidecimal offset values.

You can go to or search Previous or Next.

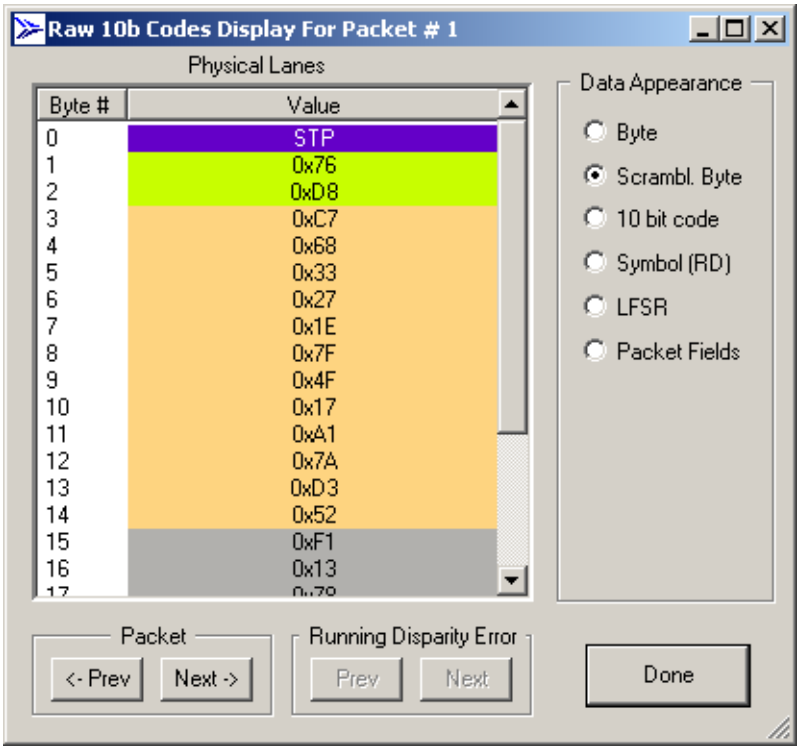
6.6 Show Raw 10b Codes

You can view the raw bits that make up the data field by left-clicking the field and selecting **View Data Block** from the pop-up menu.

To view Raw 10b Codes:

Step 1 Left-click the **first cell** in a packet.

Step 2 Select **Show Raw 10b Codes** from the pop-up menu to display the Raw 10b Codes window.



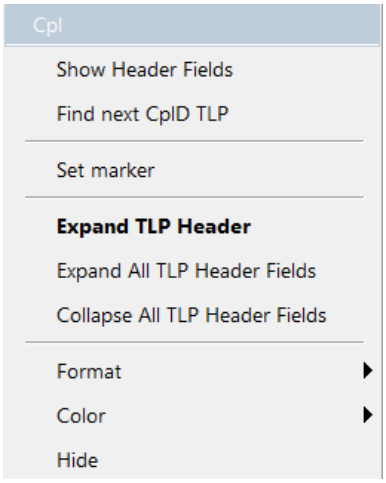
Step 3 To change the format of the data, use the options along the right side of the dialog.

Step 4 To navigate the CATC Trace, use the **Prev** and **Next** buttons.

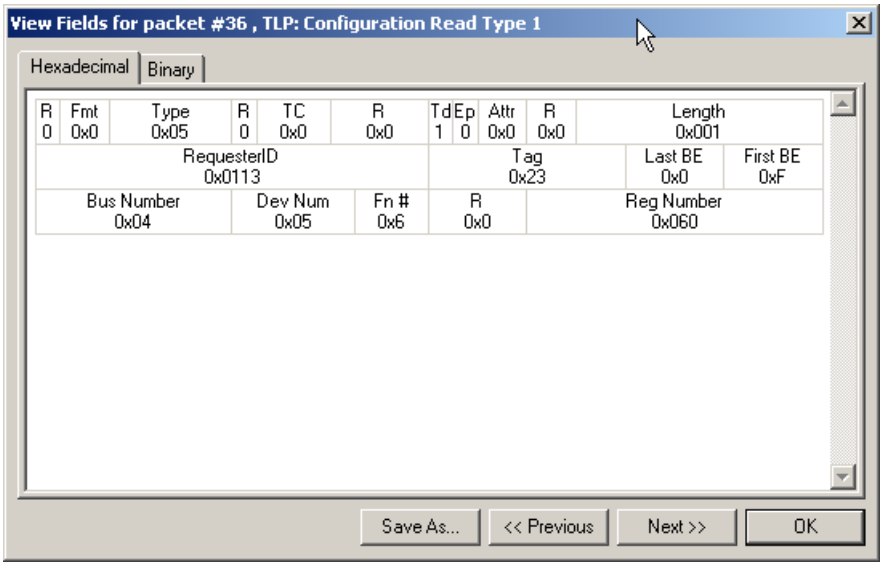
6.7 Show Header Fields

You can view details about header fields by opening the Show Header Fields dialog box.

Step 1 Click a **header.** A pop-up menu appears.



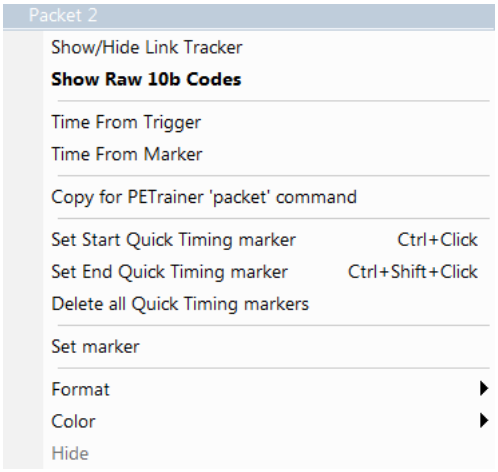
Step 2 Select **Show Header Fields**. The following dialog box opens.



Step 3 Use the **Prev** and **Next** buttons to navigate to other headers.

6.8 Packet Cell Popup Menus

The Packet cell has a left-click pop-up menu that includes the Show Raw 10b Codes command:



Set Start Quick Timing Marker

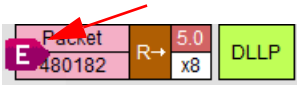
Sets the start packet for the Quick Timing marker. An S symbol is displayed at the packet.

Quick Timing provides immediate time deltas and bandwidth calculations. If the Start is placed on a packet that contains an Address and Endpoint, the bandwidth for that combination is displayed in the Status Bar below the trace data.

Quick Timing Markers are special ""Start"" and ""End"" markers used to mark the boundaries of the calculations. The results are shown in a special Quick Timing Bar at the bottom of the TraceView. The markers are set from a context sensitive menu.

Set End Quick Timing Marker

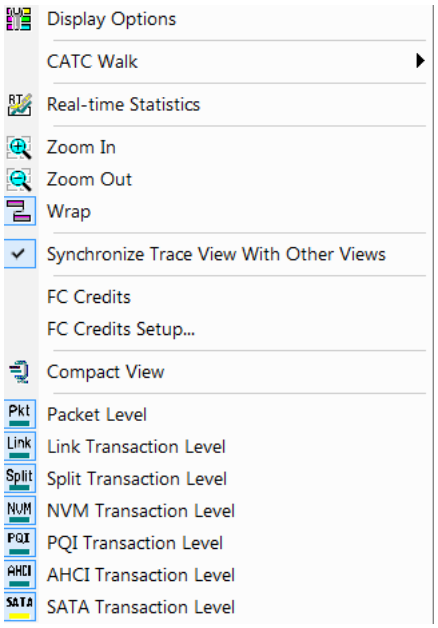
Sets the end packet for the Quick Timing marker. An E symbol is displayed at the packet.



Delete All Quick Timing Marker

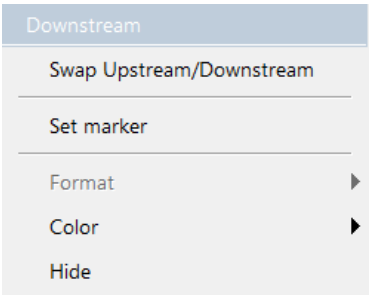
Deletes all Quick Timing markers.

The right-click pop-up menu from Packet cell is:



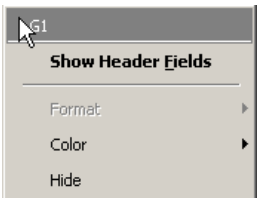
Packet Header R-> Cell Popup Menu

The Packet Header R-> cell has a pop-up menu with the Swap Upstream/Downstream command, which changes the directionality of the packets in the CATC Trace.



Packet Header G1 Cell Popup Menu

The Packet Header G1 cell has a pop-up menu with the Show Header Fields command (see “Show Header Fields” on page 75), which exposes a detailed view of the selected Header field.



6.9 Set Marker

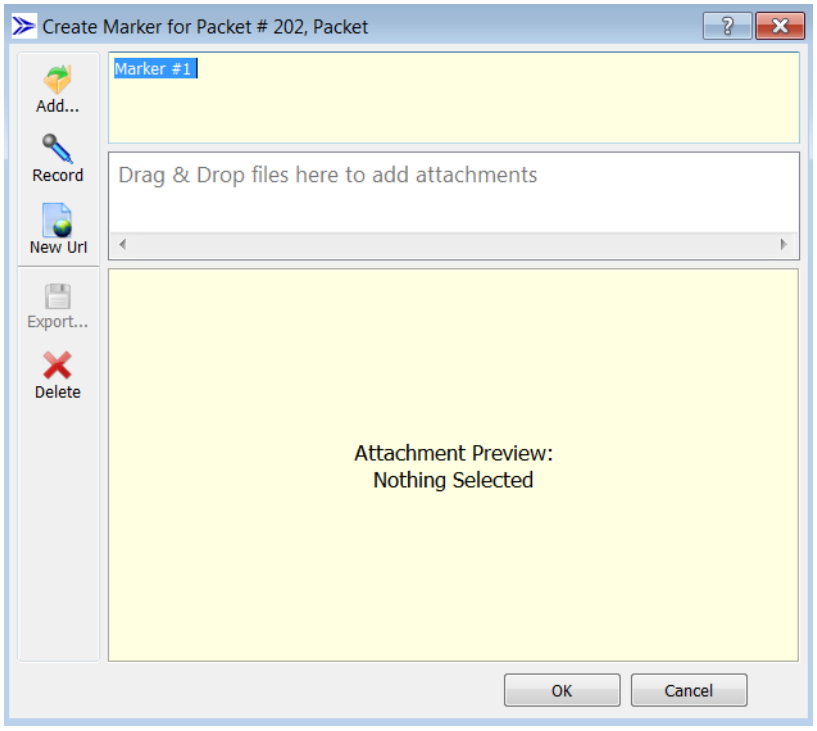
A marker is a unique label for a packet that allows you to go to that packet and also serves as a **comment string** for a specific packet. When you select a marker, the identified packet appears at the top of the screen. Packets that have been **marked** have a red bar on the left edge.

To set a marker, perform the following steps:

Step 1 Right-click the Packet field of the packet you want to mark (see figure on next page) or hover over the packet and click Ctrl+K, or select the packet and click Ctrl+L.

Step 2 Click **Set Marker**.

Step 3 When the Create Marker for Packet # pop-up appears, enter a unique identifier for the packet in the Comment field (see figure on next page).

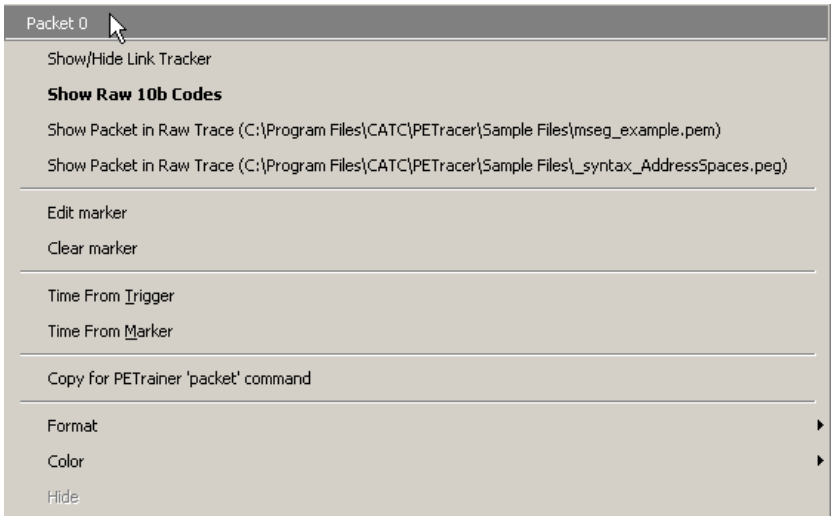


Later, you can go directly to this packet using the Go To Marker operation in the Search Menu.

6.10 Edit or Clear Marker

To change a markers identifier, or clear (delete) the marker:

Step 1 Right-click the **Packet** field of the desired packet to display a pop-up menu:



Step 2 Choose **Edit Marker** and enter a new identifier into the Edit Marker for Packer # pop-up, or
Choose **Clear Marker**. When you choose Clear Marker, the marker is removed and the red line disappears.

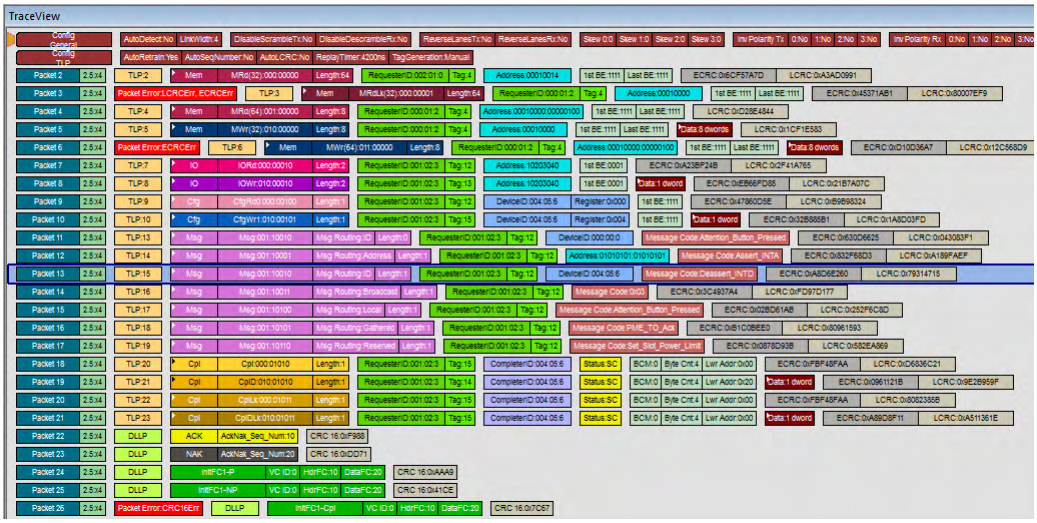
6.11 Compressed CATC Trace View

The Compressed CATC Trace view shows fields in the format “Attribute: Value”, whereas the normal CATC View shows the attribute name on top and the value below.

The Compressed CATC Trace view has almost all the information of the normal CATC View and behaves mostly the same way, while displaying more information on each window (see Figure 6.6 on page 114).

To compress the CATC Trace:

- Click  on the toolbar.



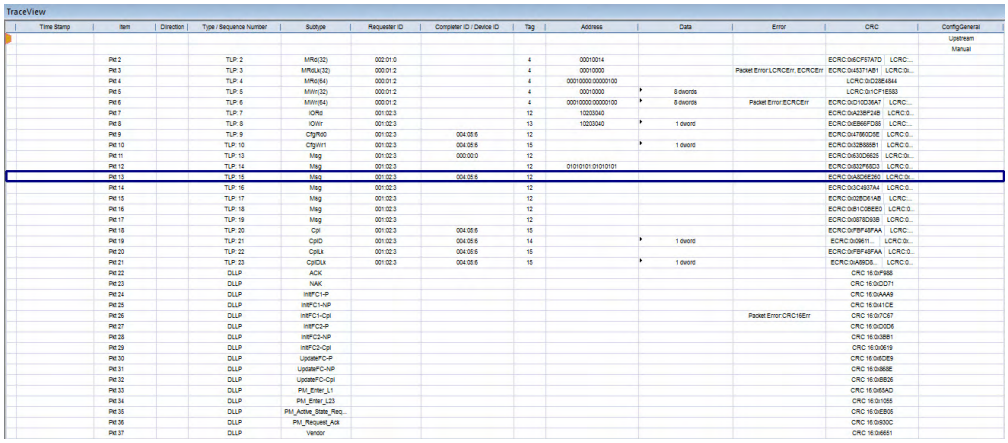
Click  on the toolbar to return to the normal CATC Trace View, or
Select **View > Trace Views > CATC Trace.**

6.12 Spreadsheet View

You can view the CATC Trace as a spreadsheet in color or black and white.

Click  on the toolbar to display the Spreadsheet View (see figure on next page).

Click  on the toolbar to display the Spreadsheet View B/W.



Columns

To add a column, right-click a column header, select **Add Column,** and then select the column name.

To delete a column, right-click a column header and then select **Remove Column**.

To reposition a column, drag the column header to the new position.

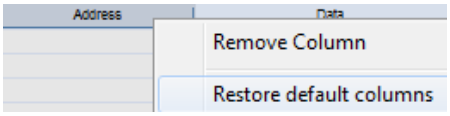
To resize columns, select the column divider and drag the divider to the right or left.

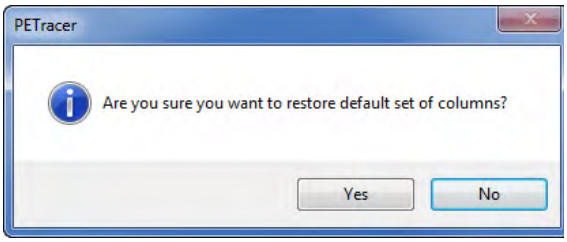
Each of the SSD options (NVMe, AHCI, ATA) can be viewed and has its own customizable column configuration. The figure below shows the NVMe transaction level. See figure on the following page

Restore Factory Default Settings

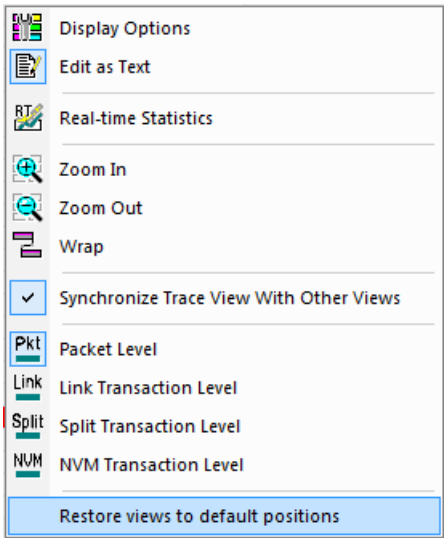
You can use one of the following three methods to restore the columns to the factory default settings:

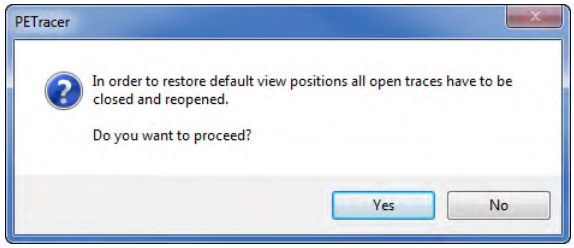
- Right-click the column header and select **Restore default columns** to display a confirmation dialog. Click **Yes** to restore for selected transaction level.



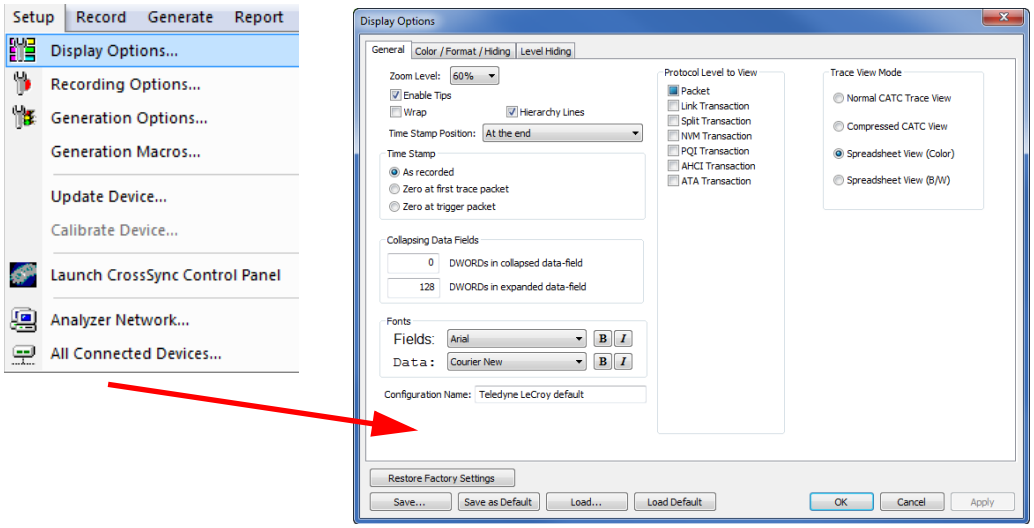


- Right-click in the empty space and select **Restore views to default positions** to display a confirmation dialog. Click **Yes** to restore for specific transaction level.





- Select **Setup > Display Options** to display the Display Options dialog. Click **Restore Factory Settings**.

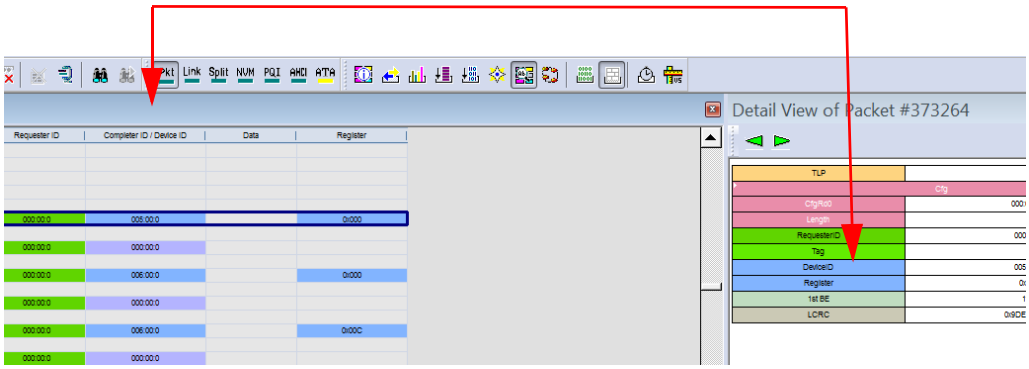


6.12.1 Detail View and Spreadsheet View

In the Spreadsheet View, double-click a packet, transaction, or transfer, or

select a field and then click  on the toolbar, to display the Detail View (see figure on next page).

To put a Detail View header as a column in the Spreadsheet View, drag the header to a column divider in the Spreadsheet View.

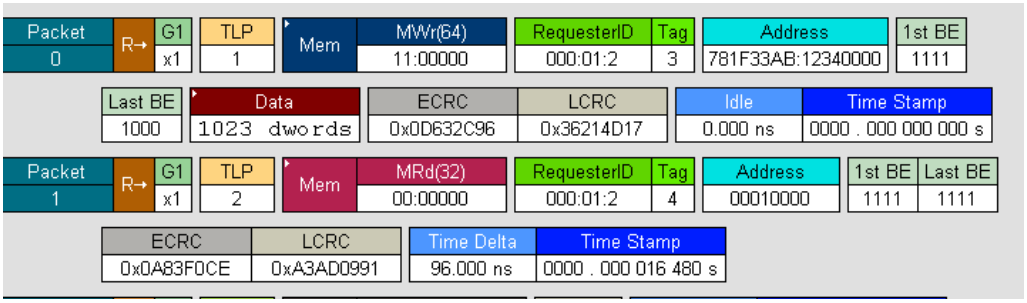


6.13 Decoding Traffic

The PE*Tracer* software has three decode levels:

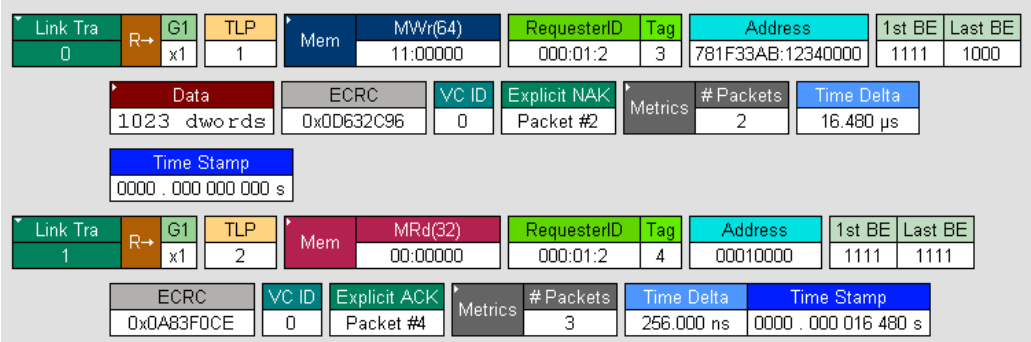
Packet

Packet level decode Pkt includes all TLP packets, DLLP packets, and all ordered sets.



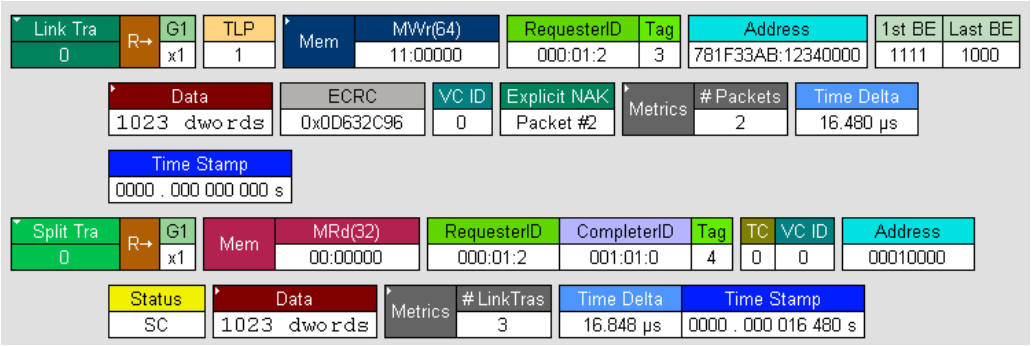
Link

Link level decode Link is composed of TLP packets matched with a corresponding ACK or NAK coming from the opposite direction.



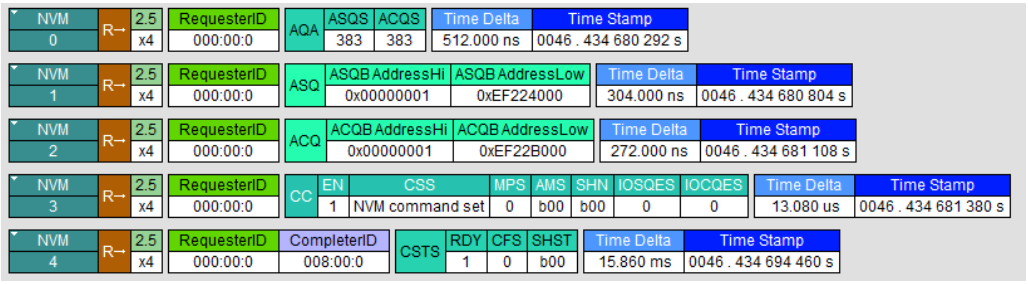
Split

Split level decode  is composed of two Link transactions, the Request TLP and the Completion TLP from the other direction.



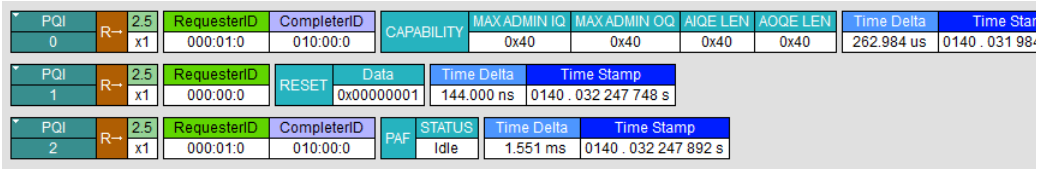
NVM

NVM level decode  displays NVMe transactions. PETracer decodes the storage commands starting from lower Transaction Layer decodes. In the case of NVMe, it will decode first the Packet Level, then the Link Transaction level, then the Split Transaction Level and finally the NVME decode level.



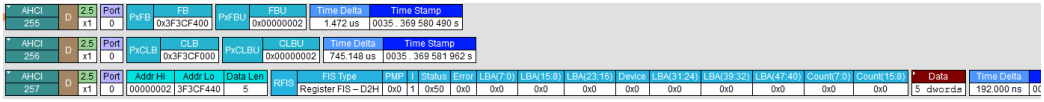
PQI

PQI level decode  displays PQI transactions. PETracer decodes the storage commands starting from lower Transaction Layer decodes. In the case of PQI, it will decode first the Packet Level, then the Link Transaction level, then the Split Transaction Level and finally the PQI decode level.



AHCI

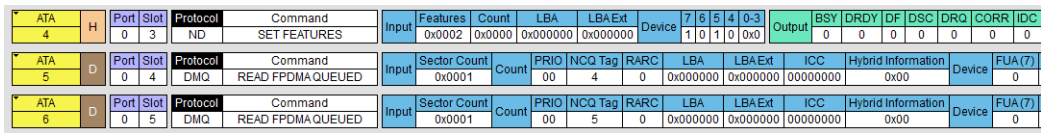
AHCI level decode  displays AHCI transactions. PETracer decodes the storage commands starting from lower Transaction Layer decodes. In the case of AHCI, it will decode first the Packet Level, then the Link Transaction level, then the Split Transaction Level and finally the AHCI decode level.



Note: The trace must contain the device enumeration sequence so the decoding picks up the associated base addresses and AHCI transactions can be properly decoded. If the enumeration sequence is not available the base addresses must be manually entered in the PCIe SSD Configuration dialog from the Tools menu.

ATA

ATA level decode  displays ATA transactions. PETracer decodes the storage commands starting from lower Transaction Layer decodes. In the case of ATA, it will decode first the Packet Level, then the Link Transaction level, then the Split Transaction Level, then AHCI level and finally the ATA decode level.



Note: The trace must contain the device enumeration sequence so the decoding picks up the associated base addresses and ATA transactions can be properly decoded. If the enumeration sequence is not available the base addresses must be manually entered in the PCIe SSD Configuration dialog from the Tools menu.

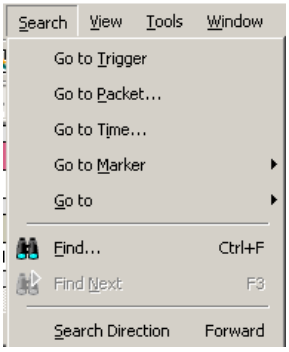
Chapter 7: Searching CATC Traces

This chapter describes how to search for CATC Trace events.

7.1 CATC Trace Search Overview

Several search commands let you navigate a CATC Trace view to search for key events, such as errors and triggers.

To view the search options, click **Search** in the Menu bar.



7.2 Go to Trigger

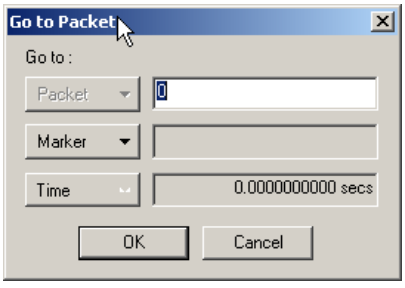
To position a trigger packet at the top of the screen:

- Select **Search > Go to Trigger**.

7.3 Go to Segment/Packet

To position a packet at the top of the screen:

Step 1 Select **Go to Segment/Packet** from the Search menu. A pop-up menu prompts you for the packet number, marker, or time.



Step 2 Enter the packet number, marker, or time.

Step 3 Click **OK**.

7.4 Go to Packet

To position a transaction at the top of the screen:

Step 1 Select **Go to Packet** from the Search menu. A pop-up menu prompts you for the packet number, marker, or time.

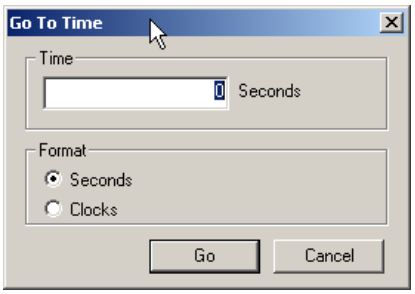
Step 2 Choose the needed transaction level from the Packet drop-down list and enter the transaction number. Please note that transaction levels is added to list if corresponding level is decoded for current trace file.

Step 3 Click **OK**.

7.5 Go to Time

To position a specific time at the top of the screen:

Step 1 Select **Go to Time** from the Search menu. A pop-up menu prompts you for the time in Seconds or Clocks.



Step 2 Enter the time and format (seconds or clocks).

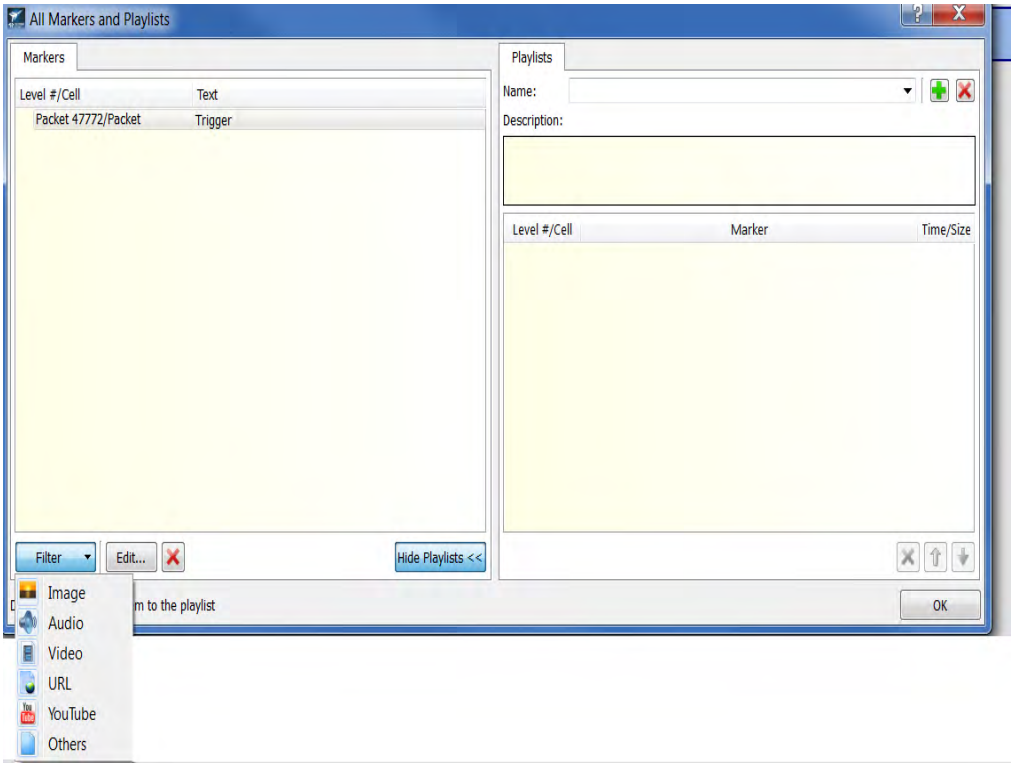
Step 3 Click **Go**.

7.6 Go to Marker

Use this operation to go directly to a specific packet that has been marked with a unique marker by the Set Marker operation.

To go to a marker:

1. Select **Go To Marker** from the Search Menu.
2. Select the marker you want from the fly-out menu. Alternatively, select **All Markers** to display the All Markers window, then select a marker and click **Goto**.



The packet you want appears at the top of the screen. Marked packets have a red bar on the left edge.

Markers

This section explains the features of Markers. A marker is an entity that flags a physical or logical item of interest within a trace file. A marker contains one or more attachments. You can add a marker to a trace file or unmark a trace file by removing the marker.

Markers are represented graphically in a different way in the application.You can not only add markers to the packets but it is granular enabling you to also add markers to individual cells.

Markers Overview

This functionality provides the user an easy way to navigate through attachments which is a discrete piece of information or data added to a marker, for example, a text description or file, an attachment of a trace file by a predefined order, video or audio files, URL links or any other files.

Functionality of Markers

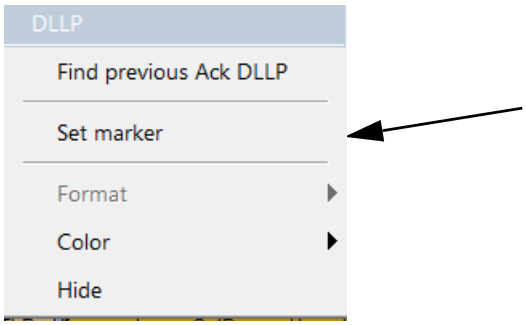
The markers functionality allows you to add markers to:

- Whole packets or frames
- Specific Cells
- Specific values within a cell: Bytes, words, etc.

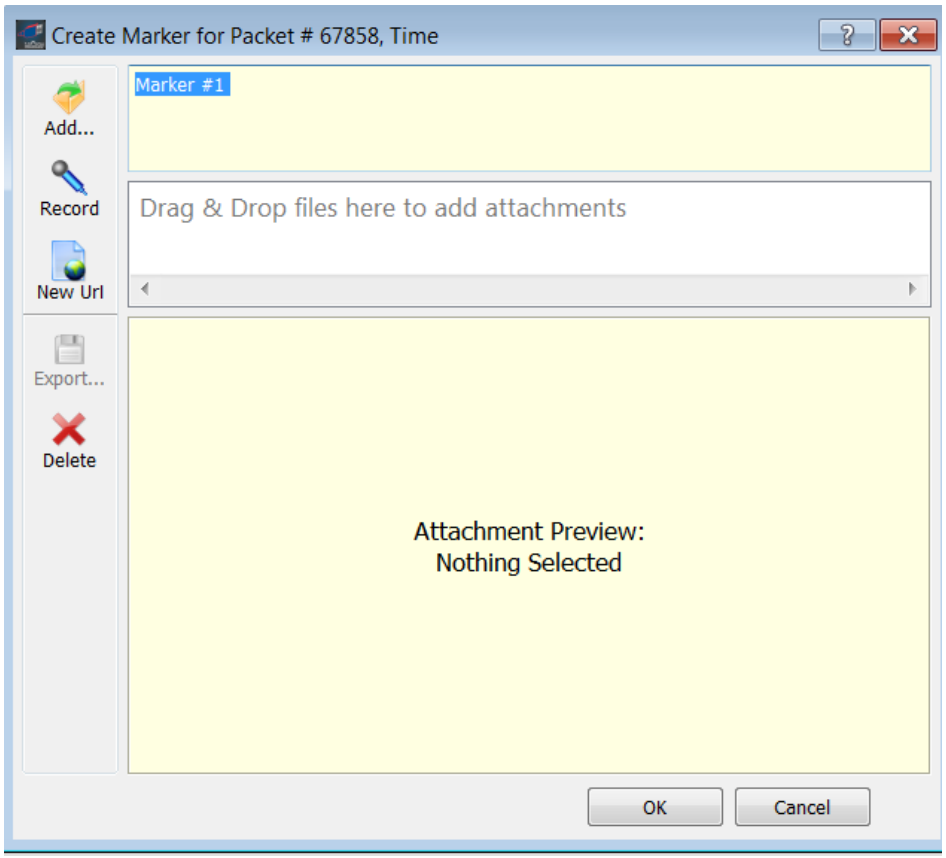
You can add attachments to markers.

Right-click on any cell of a packet and select **Set Marker** from the menu as shown below**.**

select an option.



The Create Marker dialog displays (see Figure on page 93).



Create Marker for Packet Dialog

As shown above you can:

	Add icon. Click on this icon to add any file. See "Adding an Attachment" on page 94.		Export icon. Click on this icon to export an attachment.
	Record icon. Click on this icon to record audio. See "Recording an Audio File" on page 95.		Delete icon. Click on this icon to delete an attachment
	New URL icon. Click on this icon to add any URL.		

Attaching Markers

You can attach a discrete piece of information/data to a marker, for example, a text description or file, an attachment of a trace file by a predefined order, video or audio files, URL links or any other files. You can also remove an attachment from a Marker.

Adding an Attachment

Perform the following steps to add an attachment to a marker:

1. Right-click on any cell in the trace and select **Set Marker.**

   The Create Marker window displays.

2. Click on the **Add** icon.

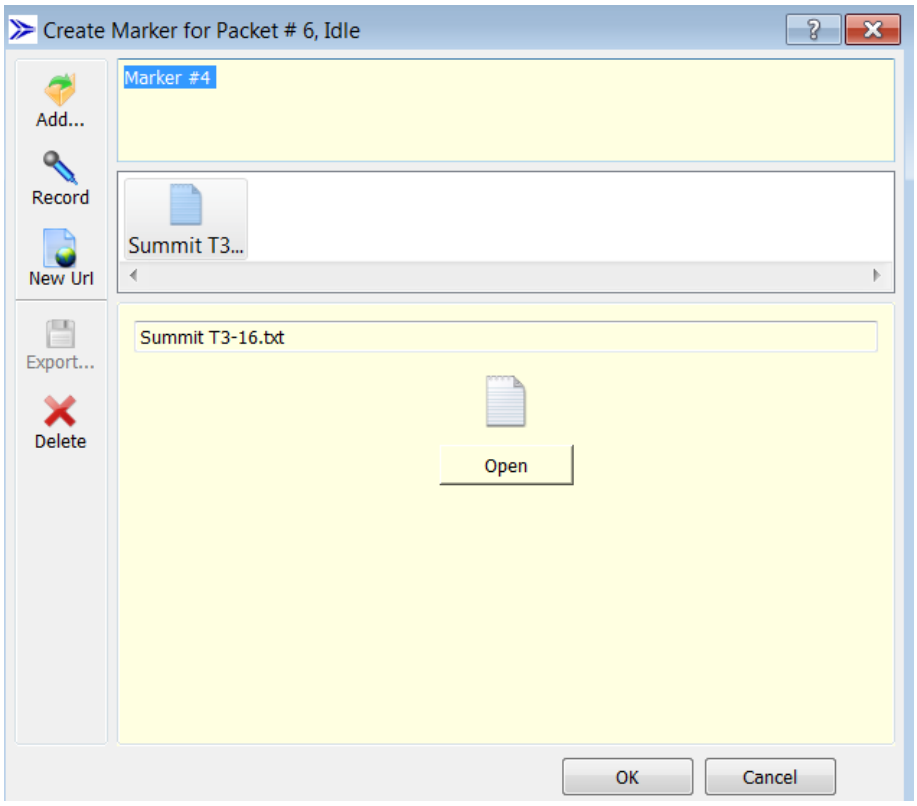
   The **Add File to the Marker** dialog displays.

3. Go to the file and select it to add it to the marker as an attachment.

4. Click **Open**.

   The file will appear in the Create Marker for Transfer... dialog as shown below. The Marker # appears in the top panel, the icons are displayed in the second panel and you can click on the icon on the third panel to view the file you are about to attach.

5. Click **OK** to add the attachments.



Create Marker for Transfer Dialog

Recording an Audio File

The audio quality supports voice attachment and is not designed for high-quality audio Playback of audio content is not limited and depends on the formats supported by the installed playback engine.

Click the record icon and speak into the microphone to record an audio file.

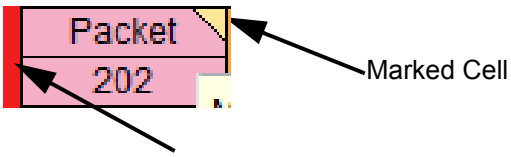
Note: This functionality is disabled if a microphone is not installed.

Video Files supported

The user can attach video clips to the trace file (“add to the marker”). The playback of the Video clips is limited to the formats that are supported by the video codecs installed in the system.

Attachment Types and Visualization

The markers are represented graphically by a yellow triangle at the top right of the marked item and a red vertical bar at the left-most cell of a packet as shown below.



A marker may comprise any number of attachments of any types.

Embedded Attachments to a Marker

Embedded files are attached to the item marked and transported with the trace. You can embed the following types of files to a marker:

- Audio Files
- Video Files
- Image Files
- YouTube Files
- Web Pages
- Text Attachments
- Other Attachments

Attachments are embedded in the marker and saved in the trace file. Once attachments are placed in a marker, the marker can then be presented to a user in a story structured form. On opening the marker the window resembles the marker editing dialog.

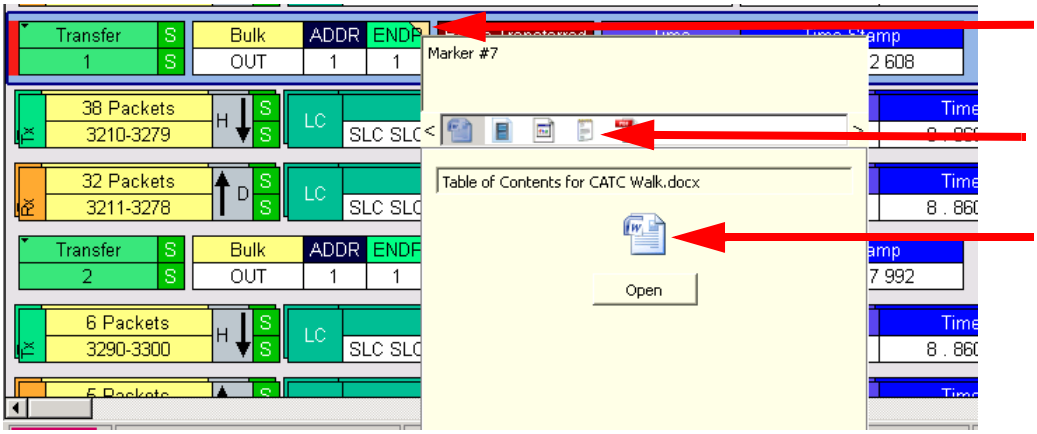
Note: The use of Audio and Video markers is limited to the file types supported on a user's system. CATC Walk has been tested with .mp3 and .wmv files, which are supported by Windows as installed. If additional codecs are installed, they should also work, but it is the user's responsibility to choose formats that will work for whomever they intend to exchange CATC trace files (no different than email attachments in this regard). Because of this dependency on installed codecs, there are situations where bugs in the codecs supplied by Microsoft or third-party applications can prevent proper operation of the Teledyne LeCroy PETracer application. See the Teledyne LeCroy PETracer Application

Read-Me file for more information if you have problems with application crashes, etc.

Viewing Attachments of a Marker

If you hover over the marked cell (yellow triangle at the top right of the marked item), refer to "Attachment Types and Visualization" on page 96, a window pops up displaying the contents of the marked cell as shown below.

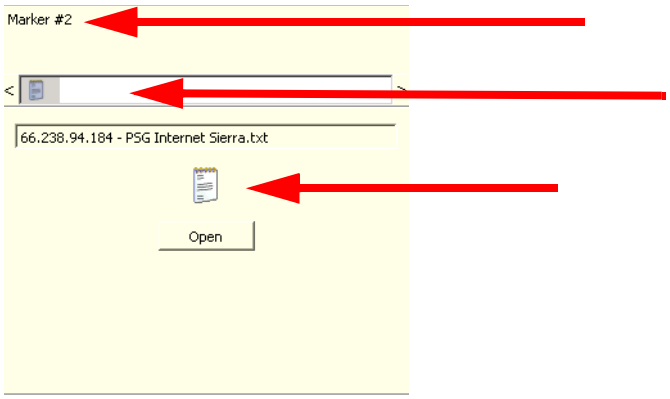
To view an attachment you can click on any of the icons in the attachment bar and or you can double-click on the icon itself to open the attachment.



Pop-up Displaying Marker Contents

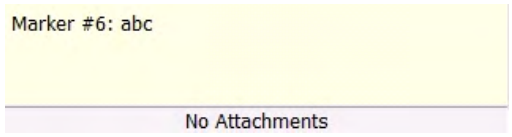
Text

The text attachment is displayed in the icon bar and in the main pop-up window. Text attachments are always shown at the top. The attachment file name is displayed in the field as shown below.



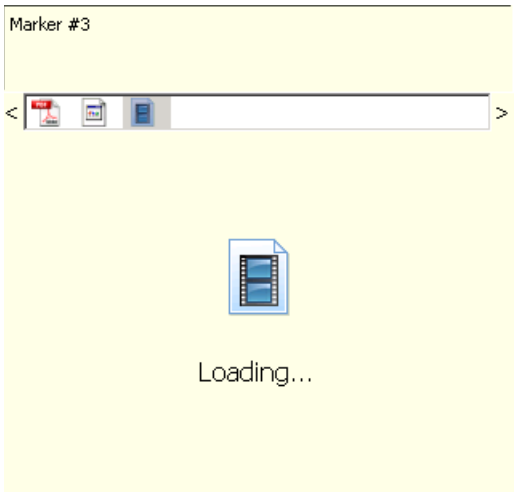
Text Attachment Pop-up Window

If there is no attachment, **No Attachments** displays in the status bar at the bottom.



No Attachments Pop-up Window

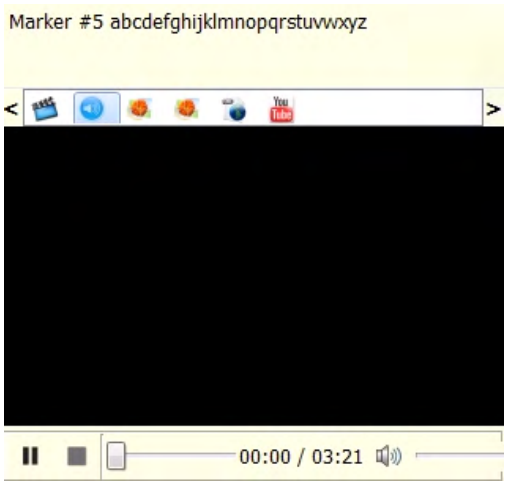
If there are attachments, the status bar is hidden. You can move the cursor to an attachment icon in the list view and a preview of the attachment starts.



Preview Attachments Pop-up Window

Audio

Audio snippets that are recorded and attached to certain point of interest in a trace can be played. The basic Play, Start, Stop, Pause buttons are displayed to listen to the audio file.



Video

Video clips that are recorded and attached to certain point of interest in a trace can be played. The video is embedded in the tooltip with simple playback controls.

File Attachment

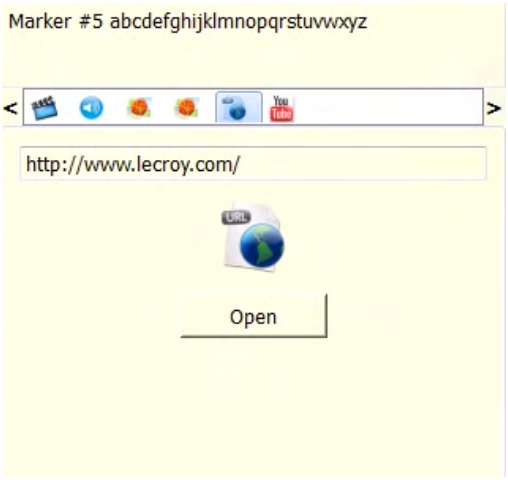
You can attach any kind of file, including images, PDFs, documents, media files, etc.

URL Link

You can specify a URL that links to a web page (i.e., YouTube), a network location, or a local file-system location.

Web Link

Due to the small size, the web page is not embedded in the callout. You can use the **Open** button to open the web link in the default web browser.



YouTube Video

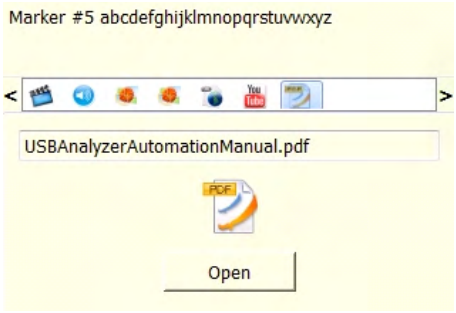
YouTube's video player is embedded for YouTube Video playback.

Images

The image is embedded in the trace.

Other Attachments

Click the **Open** button to open the attachment file with the system's default application for that file type.



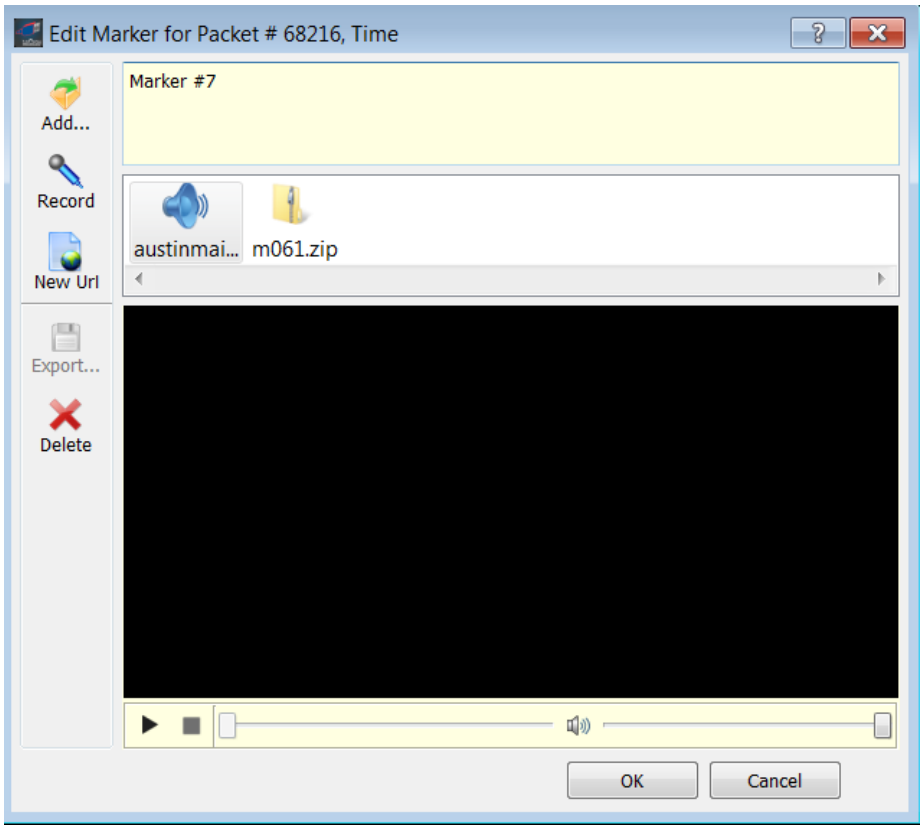
Edit Marker

To edit a marker, right-click on the marked item and select **Edit marker** from the menu. The Edit Marker dialog displays. This Edit Marker window can be used to edit one marker at a time.

You can do the following in the Edit Marker dialog:

- Edit text attachment.
- Record audio attachment.
- Add URL link attachment

- Add a file attachment. Click on **File** and click the **Open** button or drag and drop the file.
- Preview audio/video/image/URL/YouTube attachment or open other files with system default application.
- Save an attachment to a file.
- Remove attachment.



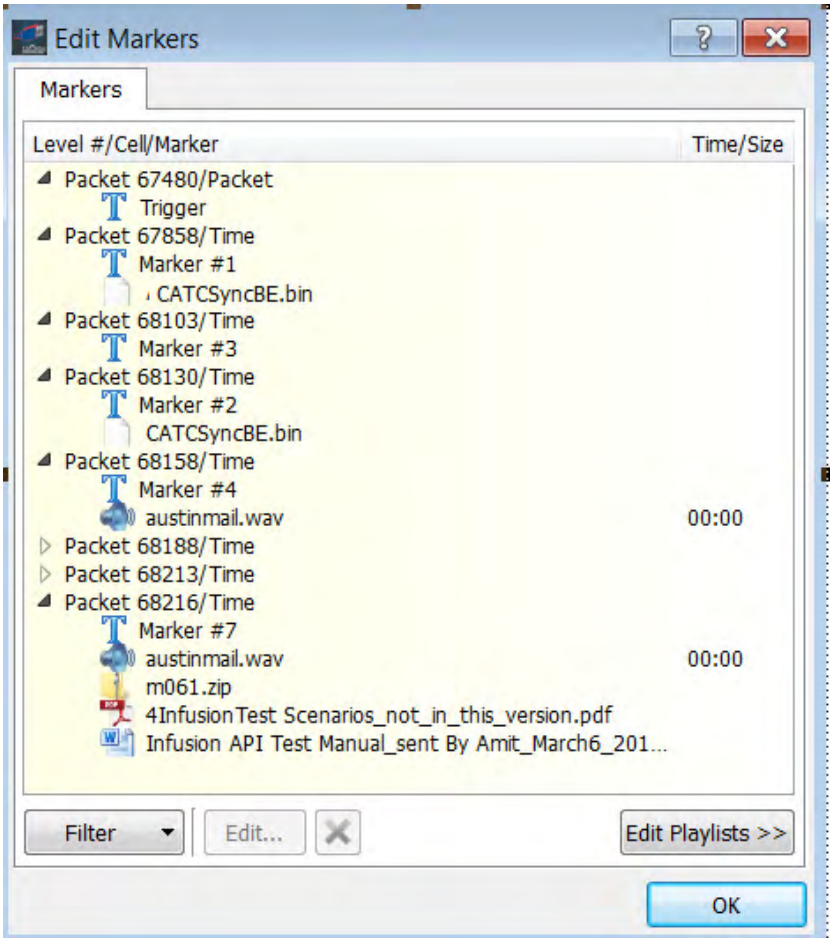
EDIT Marker for Packet Dialog

All Markers Window

Select **Search > Go to Marker > All Markers** or press **Ctrl + M** to display a list of all the markers in the file. The window uses a tree structure to show packets, fields and markers. The features of the Markers window are:

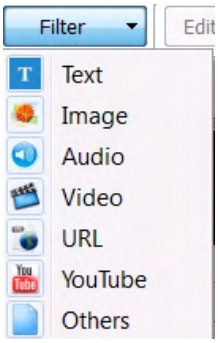
- All Markers are displayed
- All attachments within the marker are displayed
- You can collapse or expand the item marked to view the attachments
- The Time and size of audio and video files are displayed
- You can edit Playlists from this window

- You can edit or remove a marker from this location
- You can filter attachments within the marker



Edit Marker Dialog

You can filter to show or hide text, image, audio, video, URL, YouTube videos and other files.

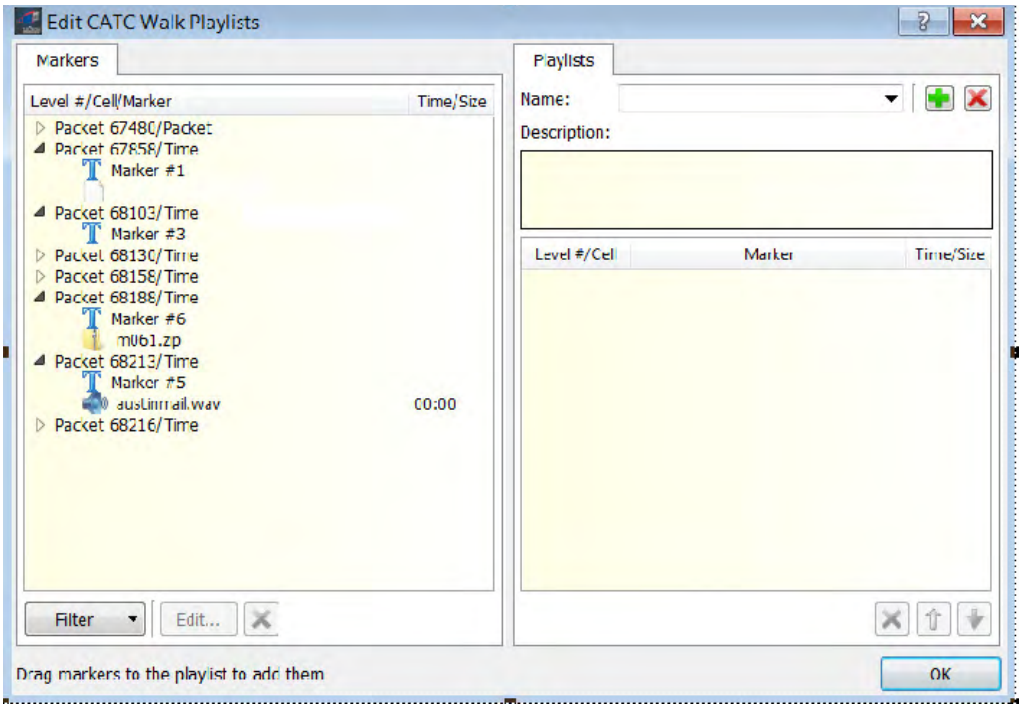


Filter Dialog

7.7 CATC Walk Playlist

This feature allows users to configure sequences of attachments into playlists. Any arbitrary order of attachments are allowed, and there are no limits on the number of playlists supported. This feature can be used for collaborating among developers as well for training, support and marketing purposes.

To access a playlist click on the **View** menu in the top toolbar of application, select **CATC Walk** and then select **Manage Playlists** as shown below.



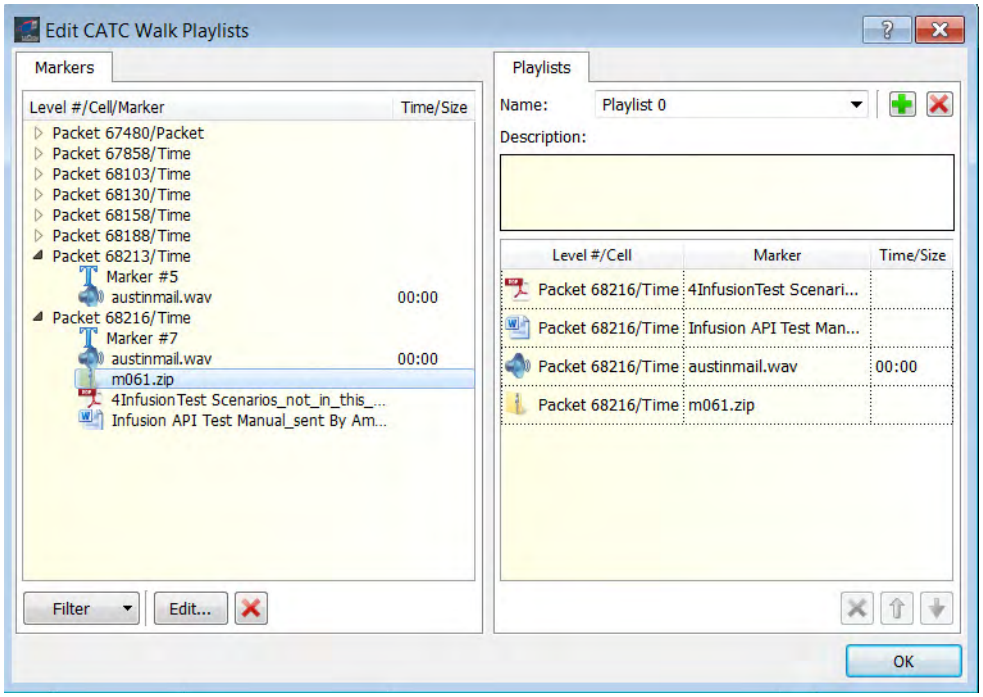
Edit CATC Walk Playlists Dialog

Playlist Functionality

You can do the following to manage playlists:

- Remove or edit current playlists
- Edit the playlist name
- Edit the playlist description
- List the sequence of attachments in current playlist
- List of all available attachments and drag/drop to a playlist.

As shown in the previous figure the Playlist window lists the markers with their attachments on the left and the playlist on the right.



Edit CATC Walk Playlists Dialog

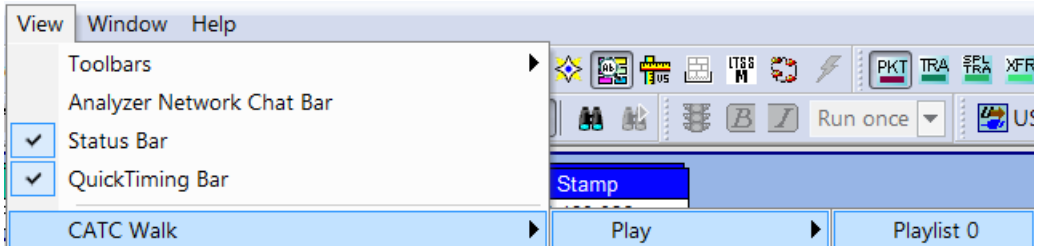
You can drag and drop and item or attachment from the **Marker** panel into the **Playlist** panel and build a story. Give a description of the playlist in the **Description** field and you can give a name to the playlist in the **Name** field.

You can add a new playlist by clicking on the green plus sign (**+**) on the right top corner of the Playlist panel, or delete a playlist by clicking the red (**x**) button.

If you have more than one playlist saved click on the Name drop-down arrow to select it. The drop-down menu lists all the available playlists

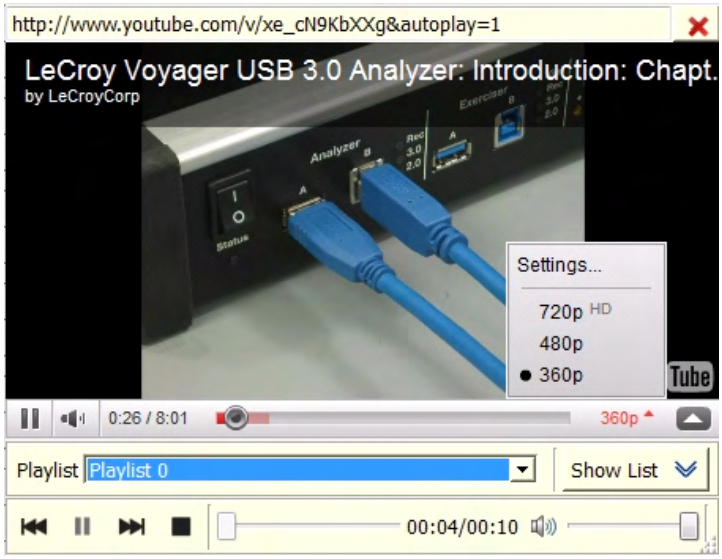
Playback Window

To playback a playlist, click on the **View** menu in the top toolbar of application, select **CATC Walk** and then select **Play > Playlist 1** as shown below.



View Dialog

The attachment item starts to play in the playback window as shown below.



Playback Window

The playback window is resizable. The close button at the top right corner and the size grip for resizing at the bottom right corner will hide automatically when moving the cursor out of the window.

Users can provide commentary to a captured trace, converting it into a script or a story and can transfer this meta-information to others. Playlist Playback Controls.

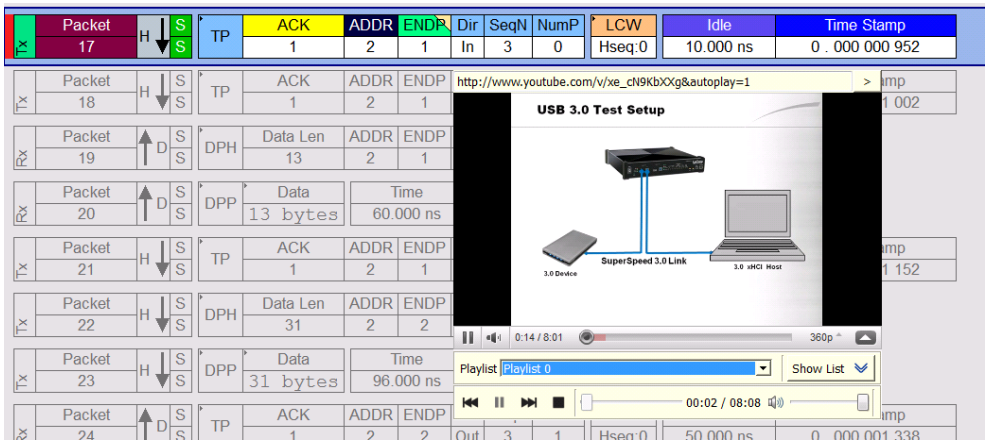
Playlist Playback Controls

The playlist playback control buttons are:

- Play/Pause
- Stop
- Jump to Next attachment
- Jump to Previous attachment
- Seek slider for seeking to positions in media streams
- Volume slider
- Playback speed slider (for text attachments)

As a playlist is played back, the playback window is displayed in close proximity to the marked area, just like a regular tooltip window.

As the playback progresses, the view jumps to the element corresponding to the current attachment being played and the marked element is highlighted. During playback the user is prevented from interacting with the trace. To reinforce this restriction, the trace view is grayed-out visually, and only the packet with the item corresponding to the current attachment is colorized.



Playback Window

7.8 Go To Menu

The **Go To menu** in the Search menu provides a quick way to search for a packet based on a simple condition. You can search for the following types of events:

- TLP Type
- DLLP Type
- Ordered Set
- Link Event
- Traffic Class
- DLLP Virtual Channel
- TLP Virtual Channel
- Direction
- Speed
- Link Width
- Requester ID
- Completer ID
- Data Lengths
- Errors

7.9 Search Direction

Search direction can be toggled back and forth by using the command under the Search menu. Search Direction controls the direction of the search. Each time Search Direction is selected, the search order is reversed. For example, if the previous search was **forward**, choosing **Search Direction** toggles the current search to **backward**.

To verify the direction of a search look at the lower right corner of the screen. **Search: Bwd** or **Search: Fwd** should appear. If a direction is not indicated, it means that the status bar is turned off.

To turn on the Status bar, select from the menu **View > Status Bar**.

Keyboard shortcuts can also be used to control search direction:

- **Alt-f** means Search Forward.
- **Alt-b** means Search Backward.

7.10 Find

Find allows you to conduct complex searches in a CATC Trace. You can search by protocol level (Packets, Link Transactions, Split Transactions).

You can search packets by Event Group: TLP Type, TLP Header, TLP Prefix, TLP Requester ID, TLP Completer ID, TLP Data Pattern, TLP Data Lengths, TLP Tag, TLP Sequence Number, DLLP Type, DLLP Header, DLLP Virtual Channel, ACK/NAK Seq Number, Ordered Sets, Link Event, OBFF Code, Direction, Errors, TS1 Data, TS2 Data.

You can search link transactions by Event Group: TLP Type, Traffic Class, Virtual Channel, Direction, Requester ID, Completer ID, Status, Tag.

You can search split transactions by Event Group: TLP Type, Traffic Class, Virtual Channel, Direction, Requester ID, Completer ID, Status, Tag.

You can seach NVM transactions by the following Event Groups: Controller Registers, Queue IDs, Command IDs, Doorbell Registers, Admin Submission Command Set, NVM Submission Command Set, Completion Queue Entry, and PRP.

You can search PQI transactions by Event Group: TLP Type, Traffic Class, Virtual Channel, Direction, Requester ID, Completer ID, Status, Tag, Address.

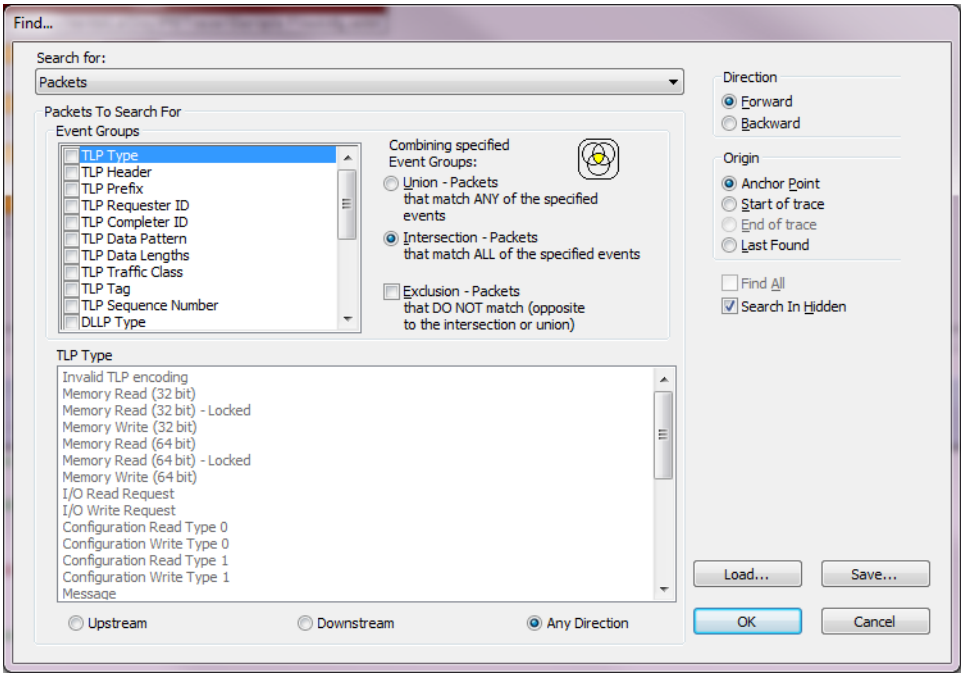
You can search AHCI transactions by Event Group: AHCI Register ID, AHCI Port Number, AHCI Slot Number, AHCI Port Multiplier Port, AHCI Raw Address AHCI Direction and, AHCI Errors.

You can search ATA transactions by Event Group: ATA Register Type, ATA Port Number, ATA Slot Number, ATA Raw Address, ATA port Multiplier Port, ATA Interruption Reason, ATA Error Type ATA Input/Output, ATA Payload Portion, ATA CFIS Fields, ATA RFIS Device to Host Fields, ATA DSFIS Fields, ATA PSFIS Fields, ATA SDBFIS Fields.

The options Union, Intersection, and Exclusion allow you to create complex searches such as "Find x OR y" or "Exclude all x or y." To find a item:

Step 1 Open a CATC Trace.

Step 2 Open Find by selecting **Search > Find** from the menu or clicking  .



Step 3 From the Search For menu, select a display level such as **Packets**. To search multiple levels, finish steps 3 to 9, and then repeat 3 to 9 for each additional display level.

Step 4 From the Event Groups menu, select an **Event Group**. The menu in the far right of the dialog box is context sensitive and changes to reflect the options for that group.

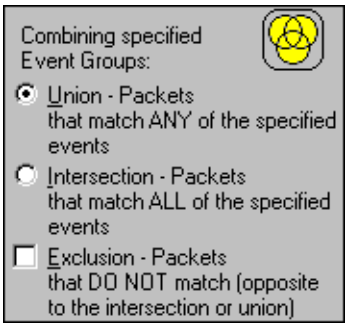
Step 5 In the menu in the far right, select one or more items.

Step 6 Repeat Step 5 for each Event Group of interest for the selected display level.

Step 7 Under Direction, select **Forward** or **Backward** to select a search direction.

Step 8 Under Origin, select a starting point for the search.

Step 9 Under **Combining Specified Event Groups**, select



The options Union, Intersection, and Exclusion let you set conditions on your searches:

- **Union**: To search for **any** of the selected criteria.
  Example: "Find packets with ANY of the following characteristics …"
- **Intersection**: To search for **all** of the selected criteria.
  Example: "Find packets with ALL of the following characteristics …"
- **Exclude**: To **exclude** items from a search. This option works in conjunction with Union and Intersection. You select Union and Exclude to exclude any of the specified traffic. You select Intersection and Exclude to exclude all of the specified traffic.
  Example: "Exclude packets with ANY of the following …" or "Exclude packets with ALL of the following …"

Step 10 Repeat Steps 3 through 9 for additional display levels.

Step 11 **Find All** displays all matching packets or transactions in a separate view.

Step 12 **Search in Hidden** includes hidden packets or transactions in the search.

Step 13 Click **OK**.

Event Groups

The Event Groups for Packets are:

- TLP Type
- TLP Header
- TLP Prefix (Summit T2-16 only)
- TLP Requester ID
- TLP Completer ID
- TLP Data Pattern
- TLP Data Lengths
- TLP Traffic Class
- TLP Tag
- TLP Sequence Number
- DLLP Type
- DLLP Header
- DLLP Virtual Channel
- ACK/NAK Seq Number
- Ordered Sets
- Link Event
- Direction
- Errors
- TS1 Data (see ““TS1 and TS2 Event Groups” on page 113)
- TS2 Data (see ““TS1 and TS2 Event Groups” on page 113)

The Event Groups for Link Transactions, Split and PQI Transactions are:

- TLP Type
- Traffic Class
- Virtual Channel
- Direction
- RequesterID
- CompleterID
- Status
- Tag

The Event Groups for NVM transactions are:

- Controller Registers
- Queue IDs
- Command IDs
- Doorbell Registers
- Admin Submission Command Set
- NVM Submission Command Set
- Completion Queue Entry
- PRP

The Event Groups for AHCI Transactions are:

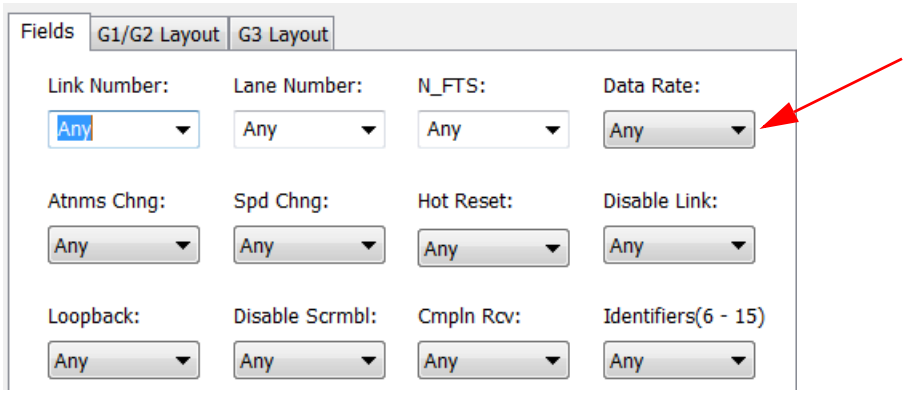
- AHCI Register ID
- AHCI Port Number
- AHCI Slot Number
- AHCI Port Multiplier Port
- AHCI Raw Address
- AHCI Direction
- AHCI Errors

The Event Groups for ATA transactions are:

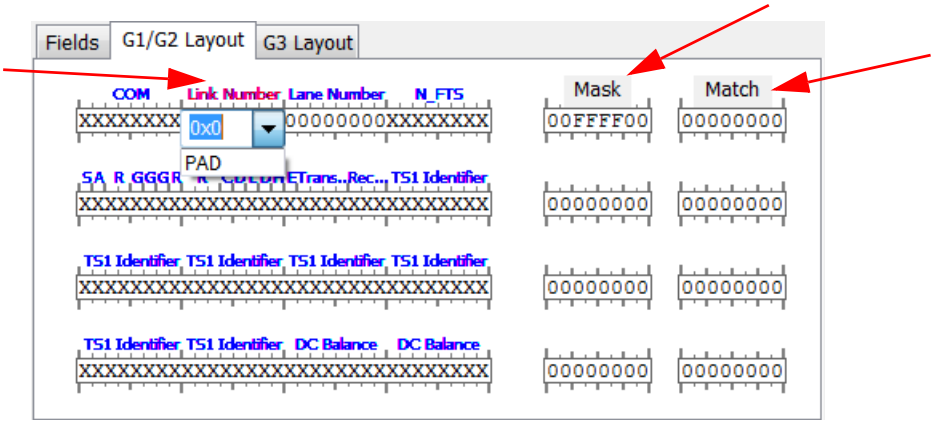
- ATA Register Type
- ATA Port Number
- ATA Slot Number
- ATA Raw Address
- ATA port Multiplier Port
- ATA Interruption Reason
- ATA Error Type ATA Input/Output
- ATA Payload Portion
- ATA CFIS Fields
- ATA RFIS Device to Host Fields
- ATA DSFIS Fields
- ATA PSFIS Fields
- ATA SDBFIS Fields.

TS1 and TS2 Event Groups

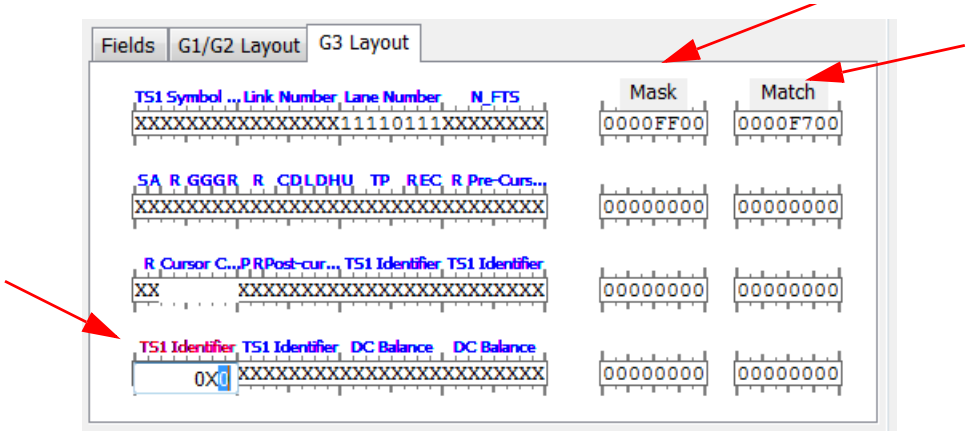
Selecting TS1 Data or TS2 Data options allows further definition of the exact field contents to match via the three dialogs show below. The search algorithm will find the specified TS ordered set on any lane.



Select parameters from the drop-down lists to use.



Select parameters from the links to use and enter the mask and match values.



7.11 Search for the Next Packet Type

Use **Find Next** or click  to search for the next packet meeting the search criteria.

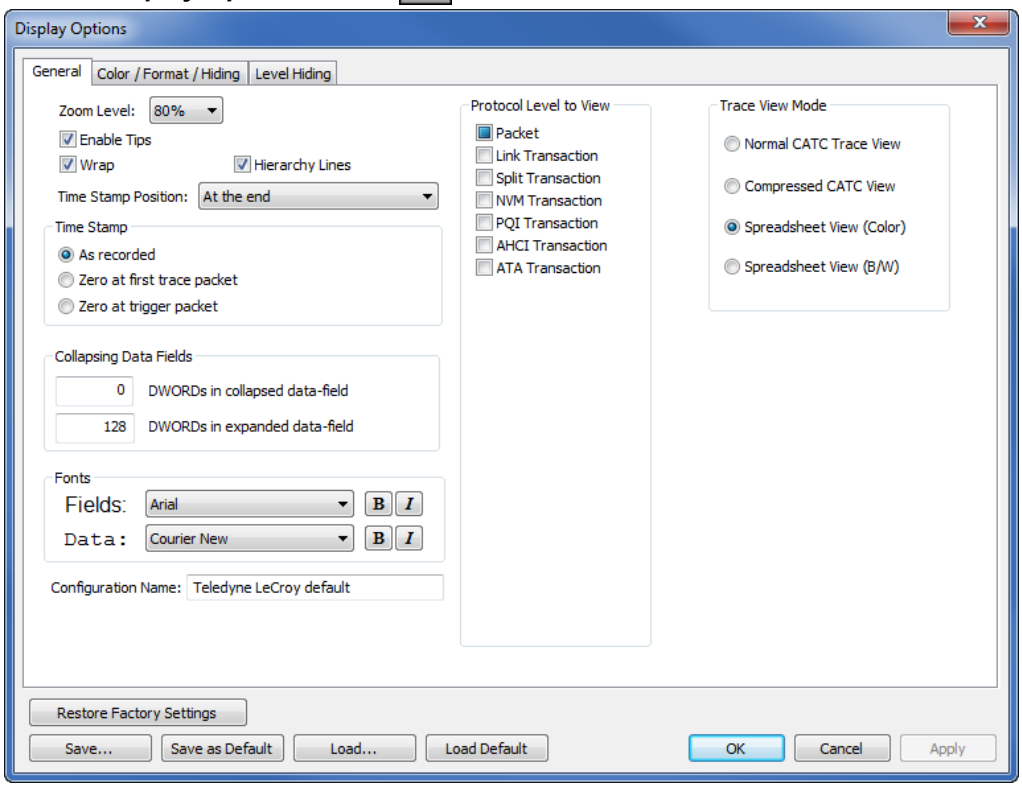
Chapter 8: Display Options

8.1 Setting Display Options

Display Options allow you to customize the colors and formats of displayed traffic.

To open the Display Options dialog at the General tab, Select **Setup > Display Options** from the menu or

click the **Display Options** button  on the toolbar.



8.2 Specifying General Display Options

The Display Options General tab allows you to specify:

Zoom Level: Defines the size of packet fields in the packet view. Zoom level is adjustable as 10, 20, 40, 60, 80, 100, 120, 140, 160, 180 and 200 percent.

Enable Tool tips: Allows information to be displayed on a packet by resting your mouse pointer over it.

Wrap: Allows packets, Link Transactions, and Split Transactions to wrap within the display.

Right click cell context menu: Swaps mouse functions.

Hierarchy Lines: Adds lines to the trace view indicating relations between packets, Link Transactions, and Split Transactions.

Timestamp position: Moves timestamp location from end of packet to beginning of packet, or merges it with the packet number.

Protocol Level to View: Allows the CATC Trace to be displayed in different hierarchical levels: Packets, Link Transactions, Split Transactions, NVM Transactions, PQI, AHCI and ATA command transactions.

Time Stamp: Gives you options for setting the timestamp to zero for either the first CATC Trace packet or the trigger packet or for leaving the stamp unchanged as it was originally recorded.

Trace View Mode: Displays Normal CATC Trace View, Compressed CATC View, Spreadsheet View (Color), and Spreadsheet View (B/W).

Fonts

Fonts: Allows the appearance of field text and/or data text to be defined.

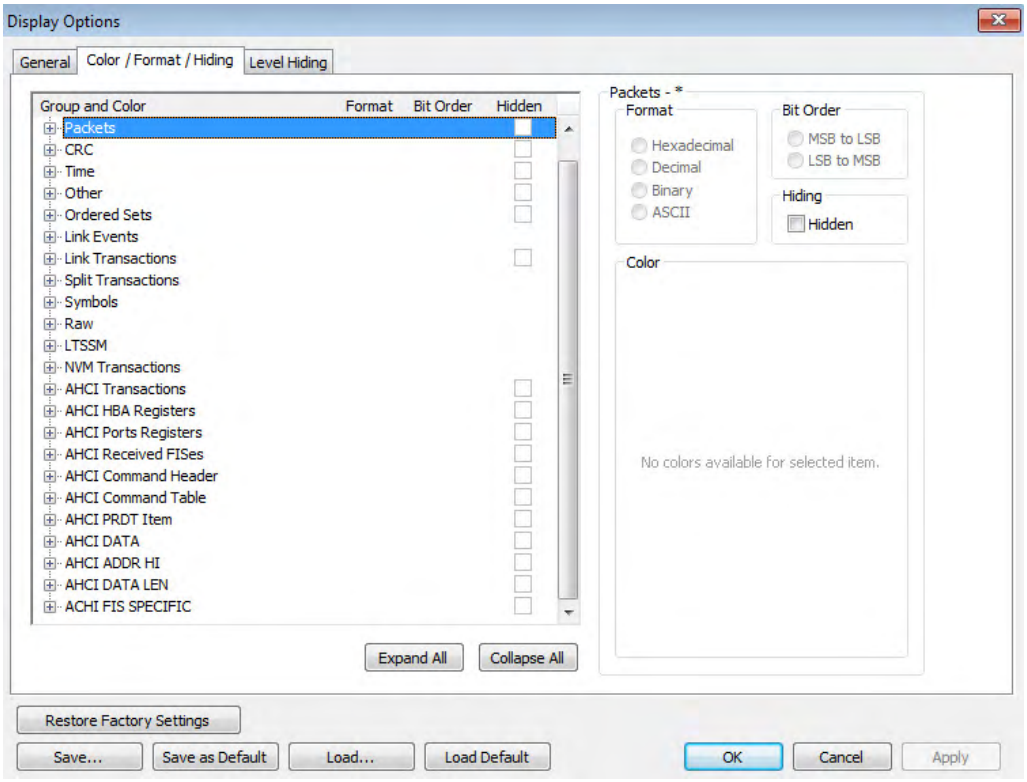
Configuration Name

Display Configuration Name: This field is used to enter a text string to be associated with the current set of Display Options. This name is saved with the Display Options file, and appears as part of the title of the packet view window that uses this set of Display Options.

8.3 Color, Format, and Hiding Options

The Color/Format/Hiding tab allows you to customize the colors and formats associated with each field in the CATC Trace and to selectively hide fields or packets. You access these display options by selecting **Setup > Display Options > Color/Format/Hiding** tab.

The Color/Format/Hiding property page lets you set how fields display in a CATC Trace. This property page lets you set field color and data format (binary, hex, decimal, ASCII), and lets you hide selected fields from the display.



Setting Field Colors

The Field Colors tab allows you to customize the colors associated with each field used in the packet view.

You may experiment with this option to achieve a color combination that suits you.

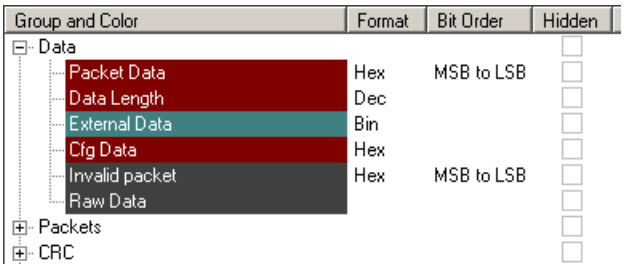
Select or change the trigger color using the color buttons labeled **- Packet #** and **+ Packet #** (before and after trigger) found under the Packet# section of the Field Colors window.

You select or change a color by clicking the appropriate color button. This action causes a color palette to pop up. Select the desired color and press OK.

Step 1 Click **View > Set Display Options** to open the Display Options dialog box.

Step 2 Select the **Color/Format/Hiding** property page.

Step 3 Under the Group and Colors column, click the **plus** symbol (**+**) next to the group you want to reformat. The group expands to show the individual fields within the group. Each field has a color, as shown below:



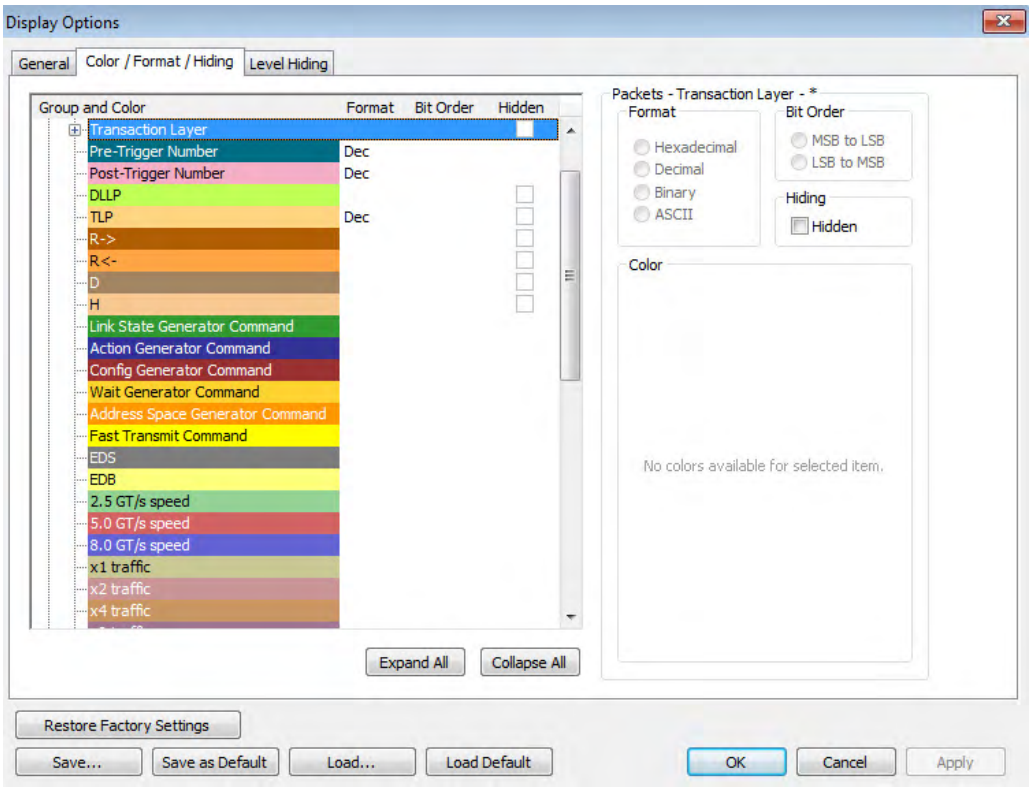
Step 4 Click the colored cell that you want to change. A color palette appears.

Step 5 Click a color in the palette, then click **Apply** or **OK**.

Note: The colors of the following Frame types cannot be changed:

- Invalid Data (frame error) field (red)
- Softbit Errors (yellow)

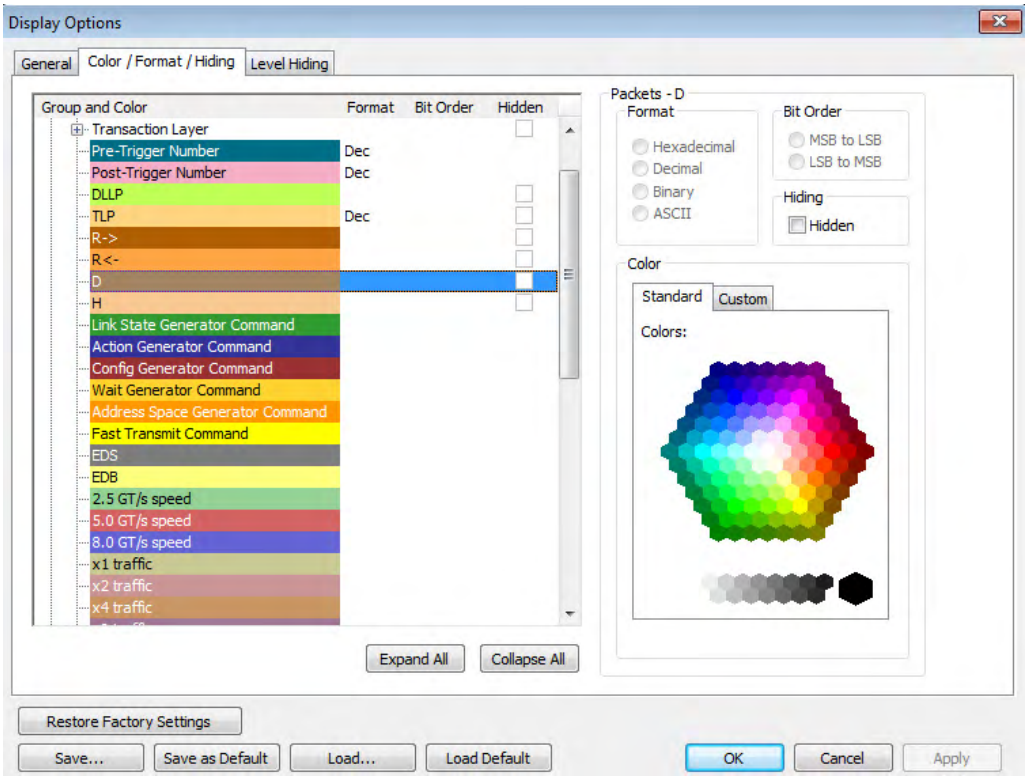
You can also change color by left-clicking a field in the CATC Trace and selecting Color from the pop-up menu.



Changing Field Formats

The Field Formats tab allows you to define the way various numeric fields are shown in the packet display. You can select Hexadecimal, Decimal, Binary, or ASCII for certain fields or groups of fields.

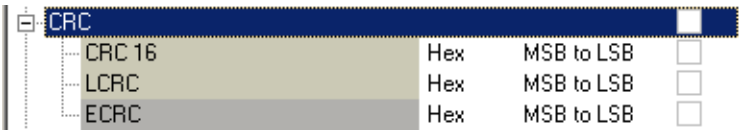
To change a field's format, click the plus sign (+) next to a field in the list. This causes the selected item to expand so you can see its constituent sub-fields. Select a sub-field, and then choose the format from the formatting choices that appear at the bottom of the window.



To change the format of alphanumeric characters in a field:

Step 1 Under the Group and Colors column, click the **plus** symbol (**+**) next to the group you want to reformat. The group expands to show the individual fields within the group (as shown above).

Step 2 Click the **row** representing the field that you want to reformat. If the field can be reformatted, the format options at the top of the dialog box become active, as shown below:



Step 3 Select a **format**.

Step 4 Specify the bit order in the displayed fields by checking/unchecking the **MSB > LSB** checkboxes.

Step 5 Click **Apply** or **OK**.

Hiding Fields

To hide a field:

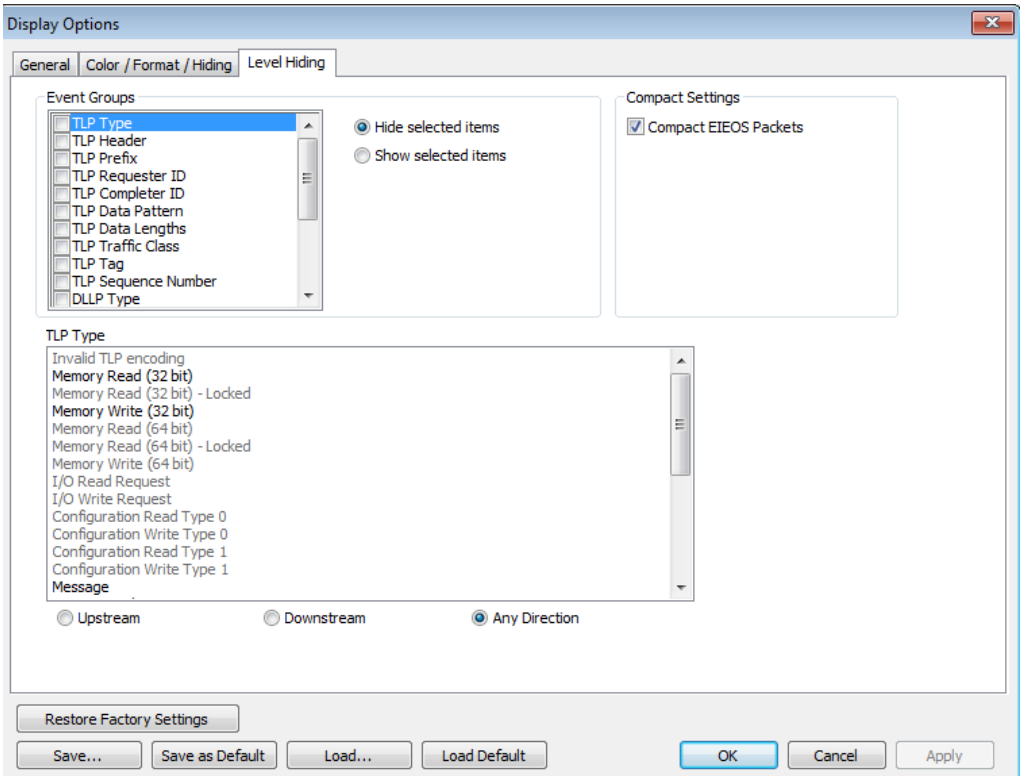
Step 1 Under the Group and Colors column, click the **plus** symbol (**+**) next to the group that has the field(s) you want to hide. The group expands to show the individual fields within the group (as shown above).

Step 2 Click the **checkbox** in the row representing the field that you want to hide.

Step 3 Click **Apply** or **OK**.

Hiding Levels

The Level Hiding page lets you hide traffic by Event Group. If you select one or more event types from the Event Group list, the selected types are hidden from the CATC Trace.



To hide a level:

Step 1 Select an Event Group.

Step 2 Select whether to **Hide** or **Show selected items**.

Step 3 Select **Upstream, Downstream**, or **Any Direction**.

Step 4 (optional) Select **Compact EIEOS packets**.

Step 5 Click **OK**.

The Event Groups for Packets are:

- TLP Type
- TLP Header
- TLP Requester ID
- TLP Completer ID
- TLP Data Pattern
- TLP Data Lengths
- TLP Traffic Class
- TLP Tag
- TLP Sequence Number
- DLLP Type
- DLLP Header
- DLLP Virtual Channel
- ACK/NAK Seq Number
- Ordered Sets
- Link Event
- Direction
- Errors

The Event Groups for Link Transactions and Split Transactions are:

- TLP Type
- Traffic Class
- Virtual Channel
- Direction
- RequesterID
- CompleterID
- Status
- Tag

The Event Groups for AHCI Transactions are:

- AHCI Register ID
- AHCI Port Number
- AHCI Slot Number
- AHCI Port Multiplier Port
- AHCI Raw Address
- AHCI Direction
- AHCI Errors

8.4 Load a Previously Saved Display Options File

If you have previously saved Display Options, you can load them by opening the Display Options dialog and clicking the **Load** button. A dialog box opens to let you load a previously saved display options file.

Step 1 Click **Load** to use a previously defined display options file.

Step 2 When you see the Open File pop-up window, enter the name of the file you want to load and click **Open**.

Step 3 When the PE*Tracer*™ software returns you to the Recording Options menu, click **OK** to activate the display options you selected.

8.5 Saving Display Options

If you have customized the Display Options and wish to save them, you can do so by clicking the **Save** button, then entering a unique file name. The **.opt** extension is added by default.

Setting the Defaults: Save the currently specified Display Options to the file name: **default.opt** by clicking **Save As Default.** When the Analyzer software begins execution, it automatically loads the **default.opt** file, if one exists.

Chapter 9: Recording Options

9.1 Setting Recording Options

The Recording Options dialog is used to configure a recording.

To open the Recording Options window, click  or select the command **Setup > Recording Options**.

Note: There are separate sets of Recording Options for each Analyzer type. To set the Analyzer type, select the appropriate platform from the Target Analyzer menu in the General page of the Recording Options.

9.2 General Tab

The General Page presents options that affect all recordings:

Figure 1: PE*Tracer* Summit or Summit T2-16 in Simple Mode:

PE*Tracer* Summit or Summit T2-16 in Advanced Mode:

Recording Type: Sets the trigger mechanism for the recording: Snapshot, Manual Trigger, Event Trigger, or Bit Tracer Recording (PE*Tracer* Summit and Summit T2-16 only).

Target Analyzer: Presents a menu with options for selecting an Analyzer platform:

- **Eclipse X34**
- **Summit T3-16**
- **Summit T3-8 (2 units)**
- **Summit T3-8**
- **Summit T34**
- **Summit (T2-16)**
- **Summit T28**
- **Summit T24**

Buffer Size: Causes the Analyzer to record traffic to its buffer and then upload the CATC Trace to the host machine. Recordings are limited in size to the size of the Analyzer's buffer (4 GB per directory).

Trigger Position: Controls the percentage of buffer allocated for pre- and post-buffer recording.

Trigger On (Simple Mode): Error, Link Up/Link Down. TS1, TS2, FTS, Any TLP, Config Rd, Config Wr, IO Rd, IO Wr, Mem Rd, Mem Wr, Message, Completion, InitFC1, InitFC2, ACK, NAK, and/or PM.

Trigger On (Bit Tracer Recording in PE*Tracer* Summit or Summit T2-16): Allows you to select the Upstream and Downstream Symbol on which to trigger from a drop-down list of bits or by typing a symbol code into the window. **Note:** Leaving a window blank results in no trigger in that direction.

Filter Out (Simple Mode): SKIP Ordered Sets and/or UpdateFC DLLP are provided.

Trace Filename & Path: Sets the path and CATC Trace name for the recording.

Options Name: Sets a descriptive label for the Recording Options so you can more easily recall what settings are in the Recording Options file.

Link: Settings: For link width, inhibiting recording, polarity, external reference clock, swapping recording channels, inverting link polarity, and descrambling.

Upload Size (Advanced Mode): Causes the Analyzer to upload a portion of the Analyzer's buffer. This option lets you look at part of the CATC Trace. Half of the uploaded CATC Trace is pre-buffer and half post-trigger.

The PETracer application forces this option when the user selects a large buffer size for recording. This is done to limit the size of individual trace files to a level that the PETracer application can efficiently work with. The maximum size of the recording buffer that can still be used for single trace recordings depends on other options selected, like link width.

Misc (Advanced Mode): Turns on trigger beep, sets external clocking (EML only), allows external interface signals to be saved into the CATC Trace, and tells the Analyzer to use whatever TC to VC mapping was used in the last recording (to re-use previously discovered Configuration Space data) in all future recordings. Also presents a button for manually mapping the Traffic Classes to Virtual Channels.

Recording Type

Recording Type lets you to specify the type of recording you want to make:

- **Snapshot**: A recording of a pre-determined length. You set the recording length in the Buffer Size box. Recording begins when you click the **Rec** button on the toolbar and ends when the selected buffer size is filled or when you press the **Stop** button.
- **Manual Trigger**: A recording that switches between the pre-trigger buffer and the post-trigger buffer when you push the **Trigger** button on the front of the Analyzer. Recording begins when you select **Start** in the application. Pressing the **Trigger** button causes the Analyzer to begin to finish recording. Recording continues until the post-trigger buffer has been filled. You can also end the recording by pressing the **Stop** button in the application.
- **Event Trigger**: A recording that switches between the pre-trigger buffer and the post-trigger buffer when it is triggered by an event in the CATC Trace. An Event Trigger begins when you select **Start** in the application and ends when the specified triggering event occurs in the CATC Trace or you press **Stop**. If an event triggers the end of the recording, the Analyzer records a predefined amount of post-trigger data (specified by Trigger Position and Buffer Size.)

  Note: You can also terminate an Event Trigger recording by pressing the Manual Trigger button on the front of the Analyzer. When the Manual Trigger button is pressed, the Analyzer continues to record until the specified post-trigger buffer has been filled.
- **Bit Tracer Recording (PE*Tracer* Summit and Summit T2-16 only)**: Allows you to trigger on an Upstream or Downstream Symbol. **Note**: This option does not have Simple Mode and Advanced Mode. Therefore, Upload Size, the Miscellaneous options, Auto-Configure Lane Polarity, Auto Speed, and Auto Link are not available. **Note:** For more information, see the next chapter, “BitTracer Recording” on page 157.

Buffer Size

The Buffer Size slide-bar allows you to set the size of the recording buffer.

Note: Size selection is per direction. For example, selecting 32 MB creates two memory areas of that size.

After you have set the Buffer Size, you must set the Recording type and Trigger position options. These options determine how the buffer is used.

Note: The Buffer Size slide-bar does not precisely portray the buffer size because of the way the packets are stored in the Analyzer’s memory.

Target Analyzer

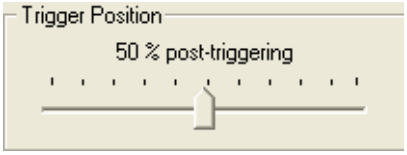
Target Analyzer presents a menu with these choices:

- **Eclipse X34:** Displays the options for the Eclipse X34 Analyzer.
- **Summit T3-16:** Displays the options for the Summit T3-16 Analyzer.
- **Summit T3-8 (2 units):** Displays the same options as the Summit T3-8 Analyzer but lists **Unit 1** and **Unit 2** in the Link Section on the right. In a two-unit setup, **Unit 1** and **Unit 2** are two separate Analyzers linked together by BNC on the back of the units to form a single, logical Analyzer.
- **Summit T3-8:** Displays the options for the Summit T3-8 Analyzer.
- **Summit T34:** Displays the options for the Summit T34 Analyzer.
- **Summit (T2-16):** Displays the options for the Summit T2-16 Analyzer.
- **Summit T28:** Displays the options for the Summit T28 Analyzer.
- **Summit T24:** Displays the options for the Summit T24 Analyzer.

Selecting an Analyzer platform changes the options presented in the Link and Events pages within the Recording Options dialog.

Trigger Position

This Trigger Position slide-bar lets you to adjust the amount of recording buffer allocated to recording pre-trigger and post-trigger traffic.

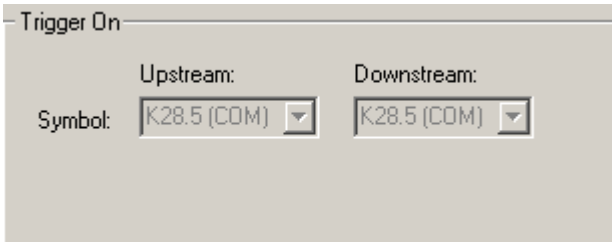


For example, if you set the Trigger Position to 90% Post-Triggering Traffic, the Analyzer records 10% pre-trigger traffic and 90% post-trigger traffic.

Trigger Position is only available when Manual Trigger or Event Trigger is selected.

Trigger On

For Bit Tracer Recording in PE*Tracer* Summit or Summit T2-16, the Trigger On section allows you to select the Upstream and Downstream Symbol on which to trigger from a drop-down list of bits.



In Simple Mode (see Figure 1), Trigger On allows you to select: Error, Link Up/Link Down. TS1, TS2, FTS, Any TLP, Config Rd, Config Wr, IO Rd, IO Wr, Mem Rd, Mem Wr, Message, Completion, InitFC1, InitFC2, ACK, NAK, and/or PM.

Trace Filename and Path

The Trace Filename and Path button on the Recording Options General panel allows you to change the default file name and path for the recorded CATC Trace file. The pre-defined name is **data.pem**.

Step 1 Select the **Recording File Name** button.

Step 2 When you see the **Save As** menu, navigate to the directory you want.

Step 3 Enter the new file name in the File name field.

Step 4 Click the **Save** button.

This action does not do any immediate save operation. It just changes the default name and uses it in subsequent recordings.

Options Name

The Options Name is a descriptive, supplemental label that you can assign to a Recording Options file.

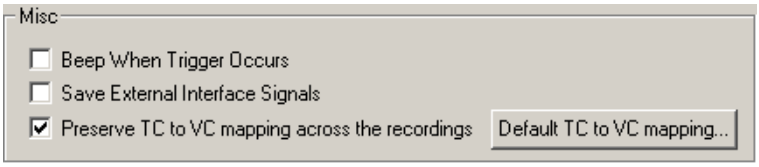
For example, if your Recording Options file were named **StandardSettings.rec**, your Options Name could be a long descriptive label such as **Standard Record Options used for all normal Recordings**.

Viewing Legacy Multisegmented CATC Traces

Current PETracer software handles traces as large as the maximum buffer size selected. It does not need to generate segmented traces but is able to open segmented traces generated with older software versions. Simply open the *.pem extension file and the trace will be converted to a new format single trace. If you are opening a *.pex file part of a segmented trace make sure not to update the file, in order for the original segmented index to work properly.

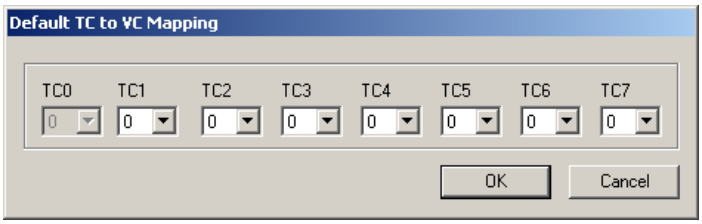
Misc

Allows you to specify the following parameters for recording and uploading traffic:



- **Beep When Trigger Occurs**: Causes the Analyzer to beep when a trigger event is detected.
- **Save External Interface Signals**: If selected, causes the Analyzer to save signals from a Breakout Board as fields in the CATC Trace.
- **Preserve TC to VC mapping across the channels**: Causes the Analyzer to use whatever TC to VC mapping it established in the last recording.

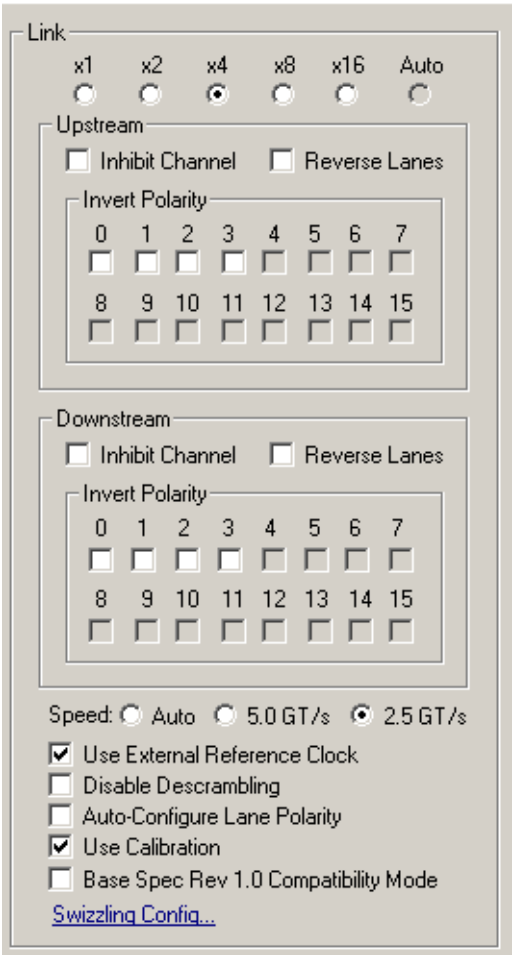
- **Default TC to VC mapping button**: Lets users manually configure the default mapping.



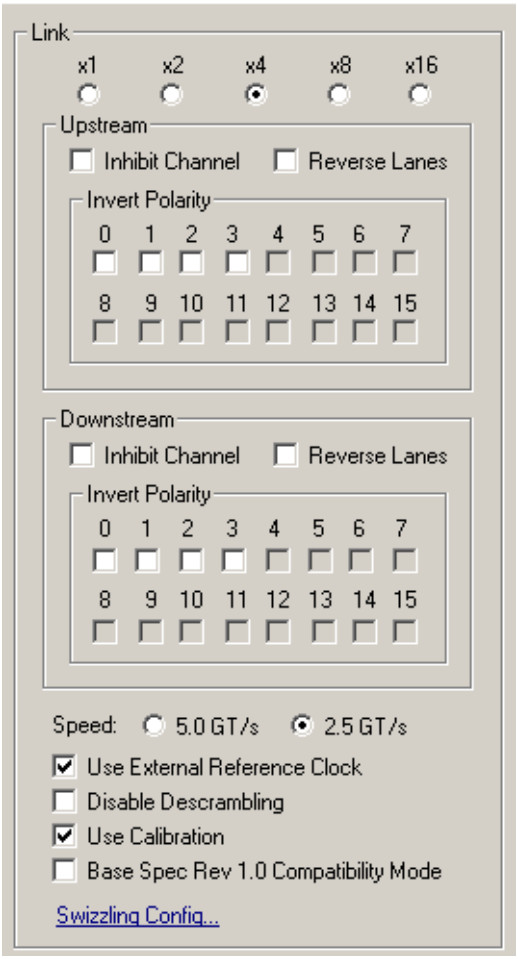
Link for Summit and Summit T2-16

The Link section allows you to manage links:

PE*Tracer* Summit and Summit T2-16



PE*Tracer* Summit or Summit T2-16 Bit Tracer Recording



Note: For more information, see BitTracer Recording “Link Configuration” on page 169.

Link Width: Sets the physical width of the link. (The **Auto** option is not available for Bit Tracer Recording.)

Upstream and Downstream: Gives you low-level control over each link direction. The heading for these boxes indicates the port and/or unit to which the following options are applied based on the current Analyzer configuration:

- **Inhibit Channel**: See above.
- **Reverse Lanes**: See above.
- **Invert Polarity**: See above.

Use External Reference Clock: If the PCI Express link under analysis uses spread-spectrum clocking, then the Analyzer must use the external reference clock from the host machine. If the host machine does not supply a reference clock, the internal reference clock in the Analyzer module is used instead for link analysis
(Not available for Bit Tracer Recording.) Only the standard PCIe reference clock is supported.

Disable Descrambling: If checked, causes the Analyzer to assume that none of the PCI Express traffic is scrambled. By default, the Analyzer determines the scrambling state of the devices under test.

Auto-Configure Lane Polarity: Lets the Analyzer determine lane polarity. (Not available for Bit Tracer Recording)

Base Spec 1.0 Rev Compatibility Mode (Advanced Mode): This option causes the Analyzer to conform to the PCI Express 1.0 Specification.

Speed: Speed can be Auto, 5.0 GT/s, or 2.5 GT/s for the Snapshot, Manual Trigger, and Event Trigger recording types, and 5.0 GT/s or 2.5 GT/s for the Bit Tracer Recording recording type.

Saving and Loading Previously Saved Recording Options

The options are:

Save: Saves the current options to whatever file name you provide.

Save As Default: Saves the current options into the default options file. This file is called **default.rec** or whatever other name you have assigned to the default options file. Whenever the Teledyne LeCroy PE*Tracer* software begins execution, it automatically loads the default file, if one exists.

Load: Loads a previously saved set of recording options.

OK: Applies changes and closes the Recording Options dialog box.

Cancel: Cancels changes and closes the Recording Options dialog box.

Loading Recording Options

In the Recording Options menu, you can load a previously saved recording options file.

To load Recording Options:

Step 1 Select **Setup > Recording Options** from the menu.

Step 2 Click the **Load** button from the Recording Options dialog box. The Load dialog opens and lists previously saved options files (***.rec**).

Step 3 Select a file and click **OK**. The options file loads.

Saving Recording Options

Recording Options settings can be saved and later reused. Recording options settings are stored in ***.rec** files.

Step 1 Open the Recording Options dialog by selecting **Setup > Recording Options.**

Step 2 Set your options, then click **Save**.

Step 3 Enter a unique file name. The **.rec** extension is added by default.

Step 4 (optional) To add a descriptive label to this file to help you remember what options were set, use the **Options Name** box.

Setting Default Recording Options

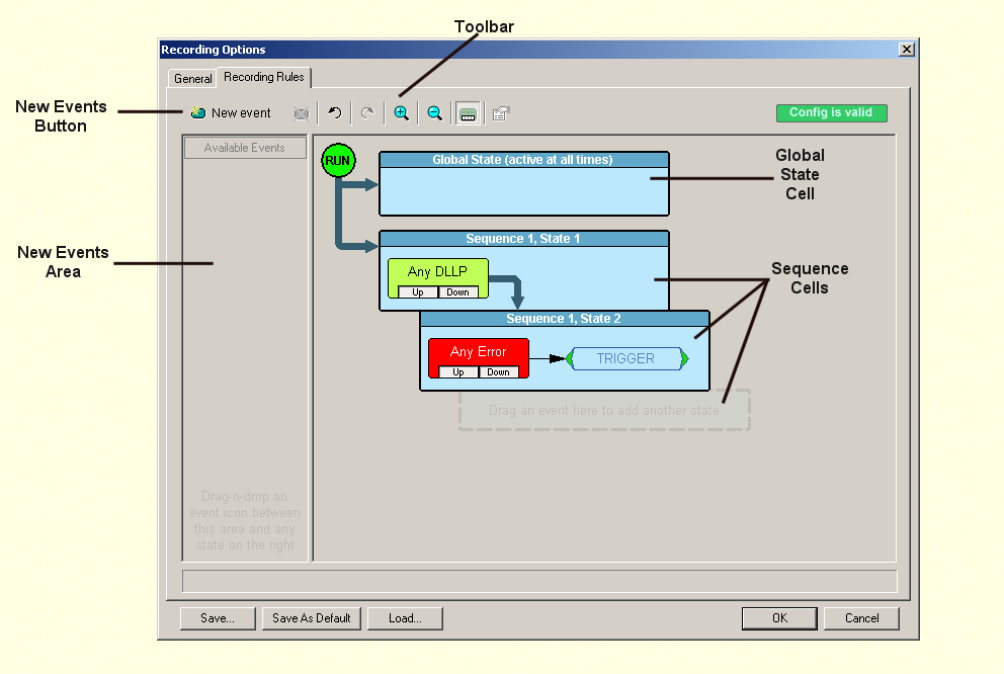
To save the current recording options into the default Recording Options file:

- Click **Save As Default**.
  The default file for the options is **default.rec**.

  When the PE*Tracer* software begins execution, it automatically loads the **default.rec** file, if one exists.

9.3 Recording Rules Overview

The Recording Rules page lets you to set triggers and filters.



The page divides into three areas:

Toolbar: Contains buttons such as the New Events button for issuing commands.

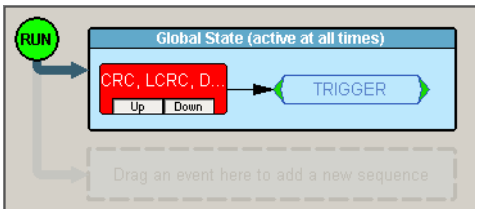
Available Events area: A part of the screen where you can park buttons that you intend to use in the Main display area.

Main display area: The part of the screen where you create trigger and filter conditions. You create conditions by dragging buttons onto the Main display area from the Available Events area. You then create additional conditions by right-clicking a button and selecting options from a pop-up menu. See Creating Recording Rules.

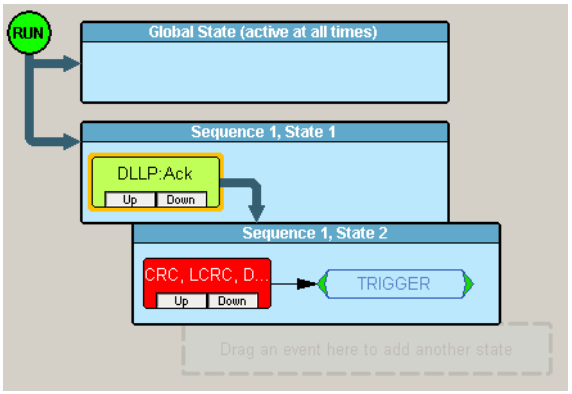
Global State vs. Sequences

The Main Display area in the center of the Recording Rules page has two cells that affect events differently.

Global State: Events dragged into the Global State cell are searched for throughout the recording. For example, if you place an Error in the Global State cell and assign a Trigger to it, the Analyzer searches for errors from the start of the recording until the end.



Sequence State: The cell marked **Drag an event here to create a new sequence** is a Sequence Cell. Sequence cells are used to event sequences, which are chains of events culminating in a trigger or other action. One sequence (i.e., a separate chains of events) can be created with up to 32 states. A state is an event condition plus some action within a sequence.



9.4 Recording Rules Buttons

The Recording Rules toolbar allows you to create and edit recording rules:

New event	New Event. Opens a drop-down menu with a list of events.		Zoom in
	Delete. Delete selected event.		Zoom out
	Undo. Undoes last action.		Show/Hide Channels. Shows/hides the channel buttons.
	Redo. Undoes last Undo command.		Show properties. Opens the Properties dialog box for the selected item.

9.5 Creating Recording Rules

The Recording Rules page is used to set triggers and filters. To access this page, select **Setup > Recording Options > Recording Rules**.

There are three steps to creating a recording rule:

1) Select events.

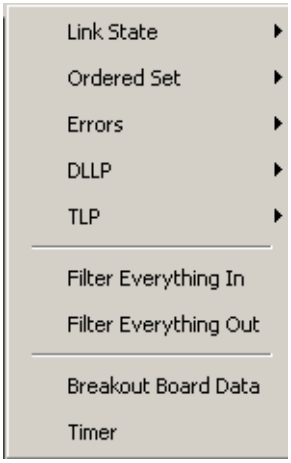
2) Place the events in the Global State or Sequence cells.

3) Assign actions to the events.

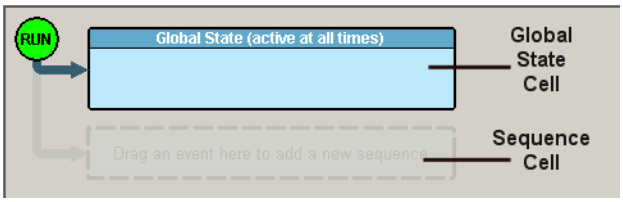
Note: There are limits to the types of rules that can be created.

Step 1 Click 

and select one or more events from the menu. Selecting an event automatically places it in the Available Events area. This area serves as a parking lot where you can place event buttons without them having any effect on the Analyzer.



Step 2 Drag the selected events from the Available Events area into one of either the Global State cell or the Sequence cell (see “Global State vs. Sequences” on page 134):

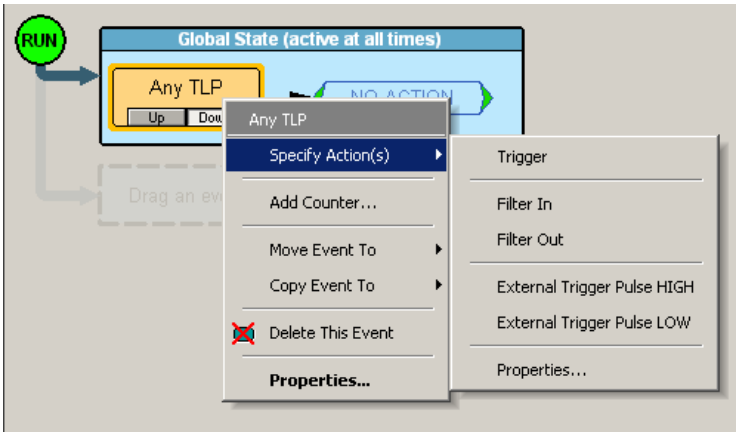


Global State Cell: If you want the Analyzer to always search for the event, place it in the cell marked **Global State**.

Sequence Cell: To create an event sequence, place two or more events in the faintly marked cell that reads **Drag an event here to create a sequence**. At this point, the selected events have no effect because an action has not been assigned.

Step 3 To select a sub-set of your selected event, right-click it and choose **Properties**. A Properties dialog box opens that presents additional options. For example, if you open the Properties dialog for Errors, you can set the specific types of errors the Analyzer should look for.

Step 4 Assign an action to the selected events by right-clicking each of the events, selecting **Specify Action** from the pop-up menu, and assigning an action such as **Trigger, Filter**, or **Count**. Be sure to click the event itself and not the **State** cell that it is sitting in (which produces a different pop-up menu.)



Note: You can also assign actions to events by double-clicking the event and selecting the Actions page when the Properties dialog box opens.

Step 5 Click **OK** to close the dialog box. At this point, assuming that the other options in the Recording Options dialog box have been set (such as the General page), you can begin the recording by pressing the

Start **Recording**  button.

9.6 Recording Rules Logic: How Contradictory Rules are Resolved

When creating rules in the Recording Rules page, it is possible to create contradictory instructions such **Filter Anything Out** and **Filter Anything In**. To resolve such conflicts, the Recording Rules page implements three internal rules that are described here:

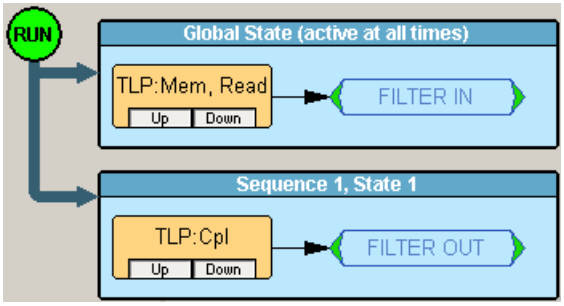
- Rules created in Sequence cells have a higher priority than rules created in the Global State cell: If a rule is placed in a Sequence cell, and a contradictory rule is placed in Global State cell, the rule in the Sequence cell applies.
- Filter-In has a higher priority than Filter-Out, so when a Filter-In rule is placed inside the same state as Filter-Out rules, only the Filter-In rule applies.
- Filter-In Anything and Filter-Out Anything have the highest priority and override any other filtering rules, so when Filter-In Anything or Filter-Out Anything are placed in the same state cell as other Filter rules, only the Filter-In Anything or Filter-Out Anything rules apply.

Recording Rules Examples

Read through the following examples to better understand how the three rules apply.

Note: In addition to these three rules, the Recording Rule Limitations define the **upper limits** of rule creation. These limitations should not affect you, but you should be aware of them.

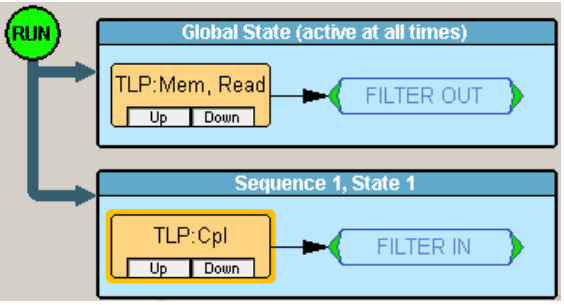
Example 1



Result: Only TLP:Mem,Read is in the CATC Trace.

Reason: The Sequence rule Filter out TLP:Completion is not contradicting the global state rule to filter in TLP:Memory. Both rules are applied.

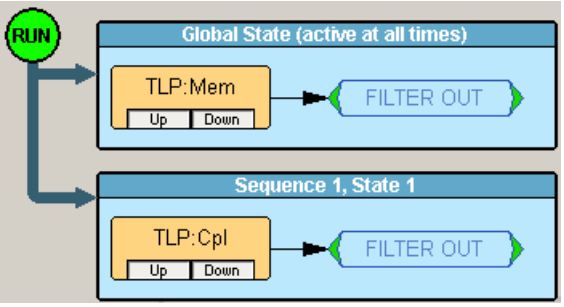
Example 2



Result: Only TLP:Completion is in the CATC Trace.

Reason: The sequence rule to filter in TLP:Completion is not contradicting the global state rule to filter out TLP:Memory. Both rules are applied.

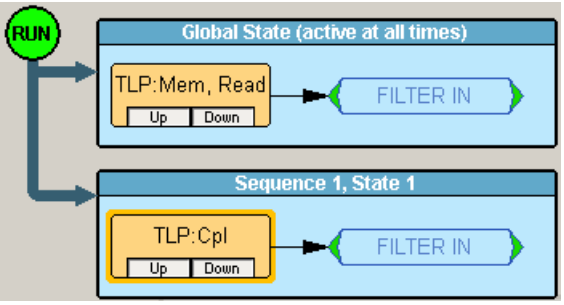
Example 3



Result: TLP:Completion and TLP:Memory are filtered out.

Reason: The Sequence rule to filter out TLP:Completion is not contradicting the global state rule to filter out TLP:Memory. Both rules are applied.

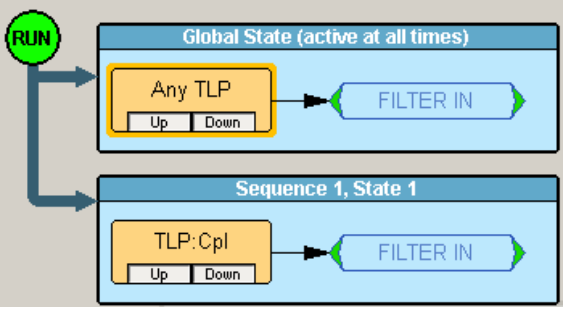
Example 4



Result: Only TLP:Completion and TLP:Memory are in the CATC Trace.

Reason: The sequence rule to filter in TLP:Completion is not contradicting the global state rule to filter in TLP:Memory. Both rules are applied.

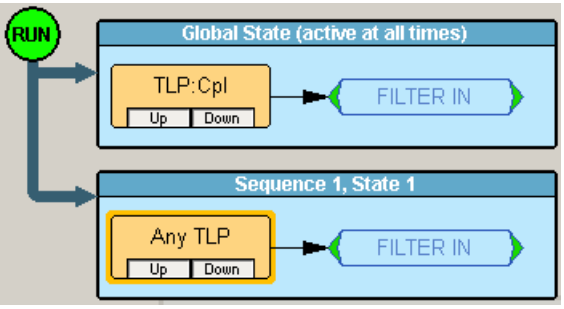
Example 5



Result: Only TLP (any type) is in the CATC Trace.

Reason: The sequence rule to filter in TLP:Completion is not contradicting the global state rule to filter in Any TLP. Both rules are applied.

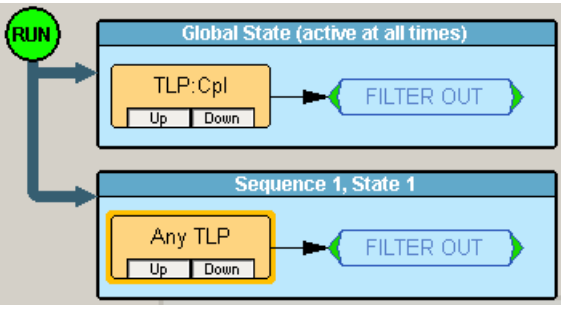
Example 6



Result: Only TLP (any type) is in the CATC Trace.

Reason: The sequence rule to filter in Any TLP is not contradicting the global state rule to filter in TLP:Completion. Both rules are applied.

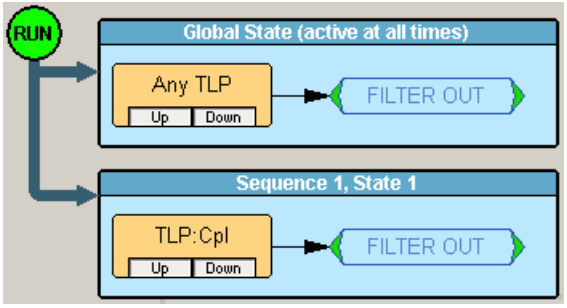
Example 7



Result: All TLP are filtered out.

Reason: The sequence rule to filter out Any TLP is not contradicting the global state rule to filter out TLP:Completion. Both rules are applied.

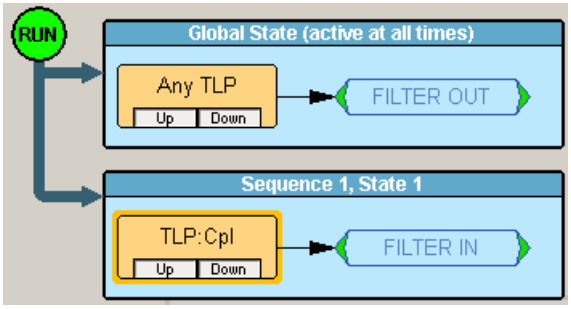
Example 8



Result: All TLP are filtered out.

Reason: The sequence rule to filter out TLP:Completion is not contradicting the global state rule to filter out Any TLP. Both rules are applied.

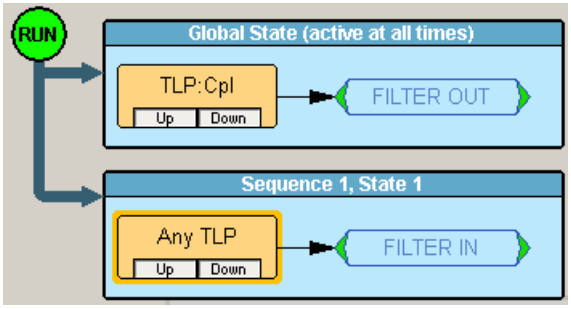
Example 9



Result: Only TLP:Completion is in the CATC Trace.

Reason: The sequence rule to filter in TLP:Completion is overwriting the global state rule to filter out Any TLP.

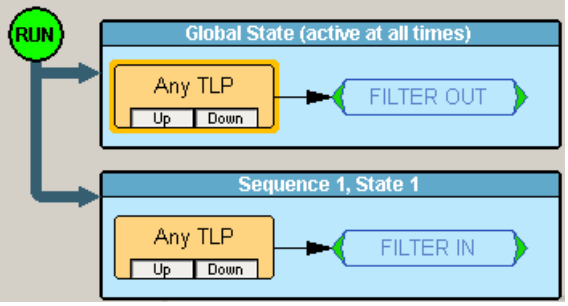
Example 10



Result: Only TLP (any type) is in the CATC Trace.

Reason: The sequence rule to filter in Any TLP is overwriting the global state rule to filter out TLP:Completion.

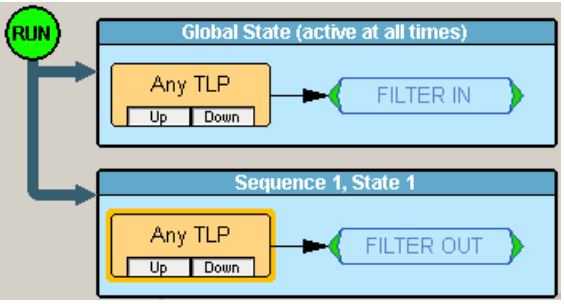
Example 11



Result: Only TLP (any type) is in the CATC Trace.

Reason: The sequence rule to filter in Any TLP is overwriting the global state rule to filter out Any TLP.

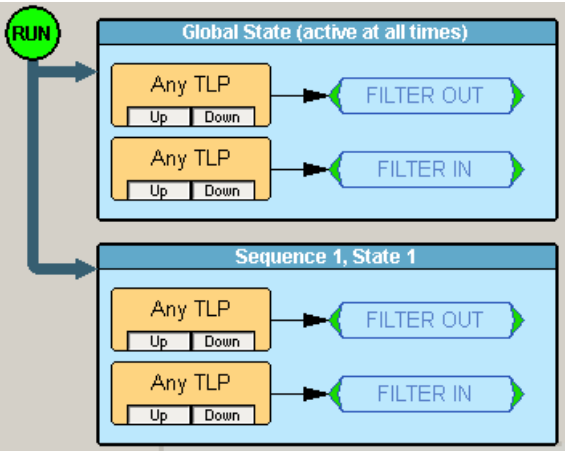
Example 12



Result: Empty CATC Trace.

Reason: The sequence rule to filter out Any TLP is not contradicting the global state rule to filter in Any TLP. Both rules are applied. (The global rule filters out DLLPs and Ordered Sets, and the sequence rule filters out TLPs.)

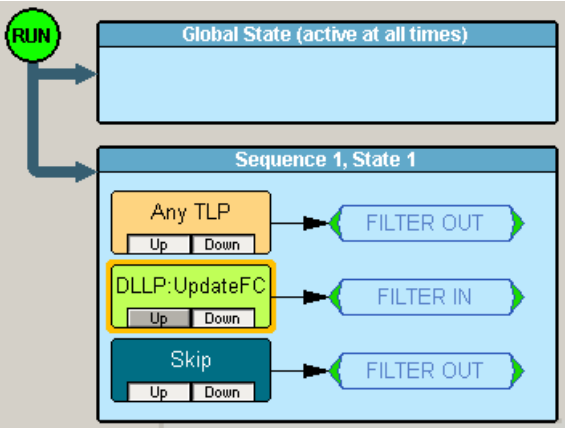
Example 13



Result: Only TLP (any type) is in the CATC Trace.

Reason: Filter out rules in the global state cell and in the sequence state cell are ignored. The Filter-In Any TLP rule is used.

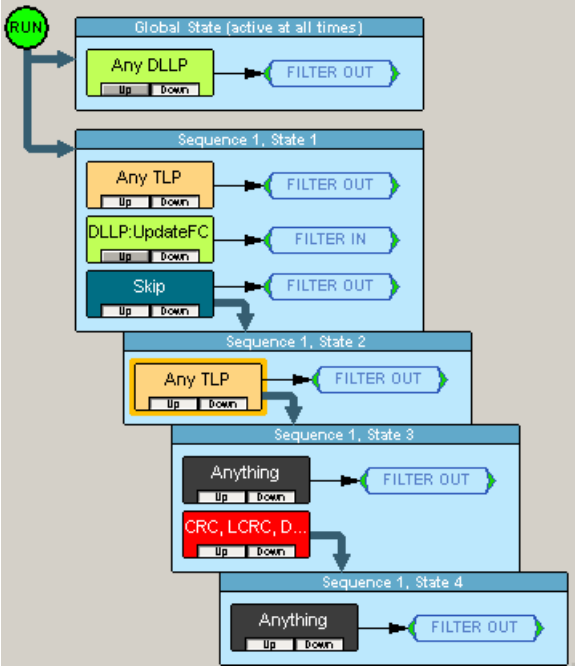
Example 14



Result: Only DLLP:UpdateFC is in the CATC Trace.

Reason: The Filter out rules are ignored. Filter in DLLP:updateFC rule is used.

Example 15



While in state 1: Only DLLP:UpdateFC is in the CATC Trace.

Reason: The Filter out rules are ignored. Filter in DLLP:updateFC rule is used.

While in state 2: Only Ordered Sets are in the CATC Trace.

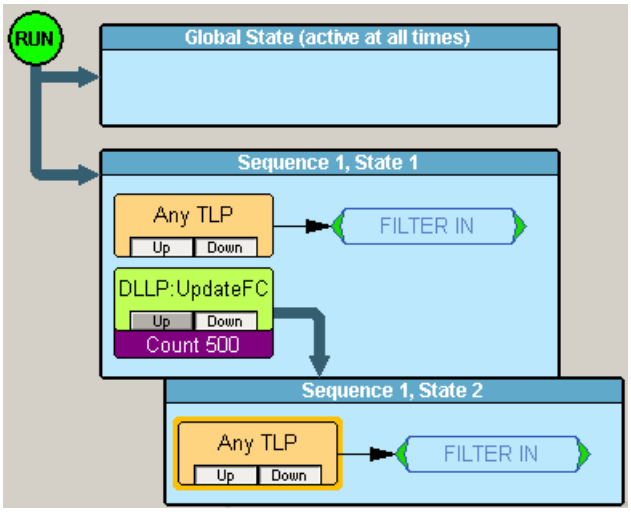
Reason: Both the sequence state and the global state rules are used, and all TLPs and DLLPs are filtered out.

While in state 3: Nothing is recorded.

While in state 4: Everything is recorded.

Reason: The sequence state rule to filter in anything overwrites global state rule.

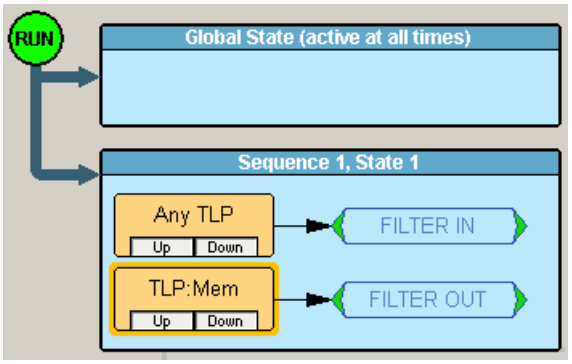
Example 16



Result: Only TLP (any type) is in the CATC Trace.

Reason: In both states, the rule is to keep only TLP.

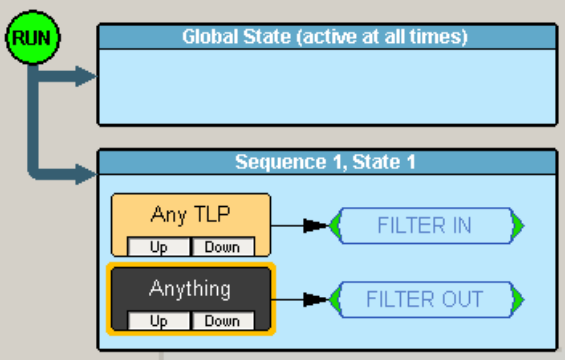
Example 17



Result: Only TLP (any type) is in the CATC Trace.

Reason: The Filter-out rule is ignored because there is a filter-in rule with a higher priority.

Example 18



Result: Empty CATC Trace.

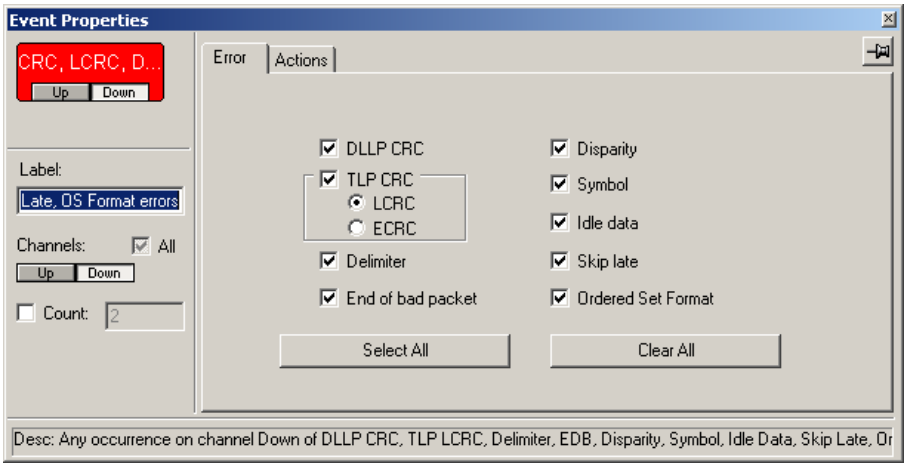
Reason: Filter Anything has the highest priority and overwrites filter-in rule.

9.7 Properties Dialog Boxes

Properties dialog boxes provide additional settings for Events, States, Actions, and other objects in the Recording Rules page. You can access a Properties dialog by double-clicking an **Event, State, Action** or other object.

9.8 Event Properties Dialog

The Event Properties dialog presents options for refining triggers and filters. For example, to set a trigger on a specific type of error, you open the Properties dialog



Accessing the Properties Dialog

To see the Properties dialog, first create an event button by clicking the **New Events** button and choosing an event from the menu. Afterwards, open the Event Properties dialog by doing one of the following:

- Double-click an event.
- Right-click an event and select **Properties** from the pop-up menu.
- Click the **Properties** button on the toolbar.

Dialog Settings and Features

Event Icon Preview: This icon shows you which event properties you are editing. The Icon Preview looks exactly like the icon in the Main Display area.

Icon Label: A text box for labeling the button. Whatever you type here appears on the button.

Channels: These controls allow you to select the channel(s) that the Analyzer should search when it is looking for the event.

Count: A counter tells the Analyzer to search for *x* instances of the selected event. For example, if you enter **10**, the Analyzer counts 10 instances of the selected event before it performs whatever action you assign. There are only two counts available in the hardware so if you try to assign more than two, you get a warning. Counters cannot be applied to events with Filter Actions. The maximum counter value is 65,535.

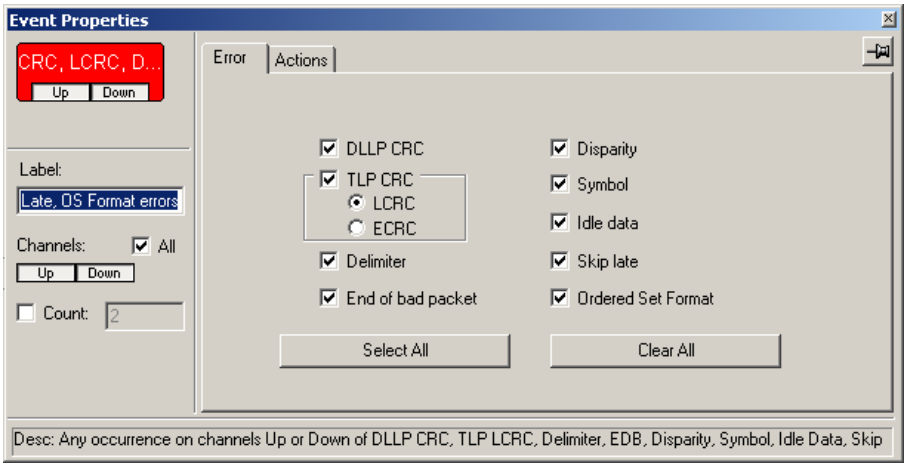
Pin Button: Allows you to **pin** the Properties dialog box to the application so that it does not go away when another object appears such as an event, state or action.

Description String: This area contains a textual description of the event.

Event-specific Settings: The largest part of the Event Properties dialog box. The settings in this area vary for different events. Some events do not have any additional settings (for example, Basic Link Services, Extended Link Services). The Events that do have settings are: Error Event, Data Frame Event, Primitive Event, Advanced Primitive Event, SCSI Command Event, Breakout Board Event, and Timer Event.

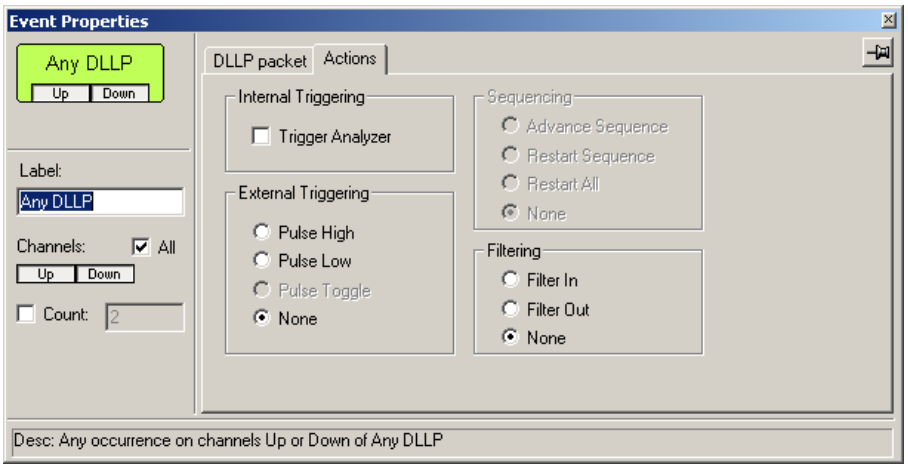
Error Properties Dialog

The Error Properties dialog box lets you select specific error types for performing an action. There are two sets of Error types: Packet Errors and Idle Errors.



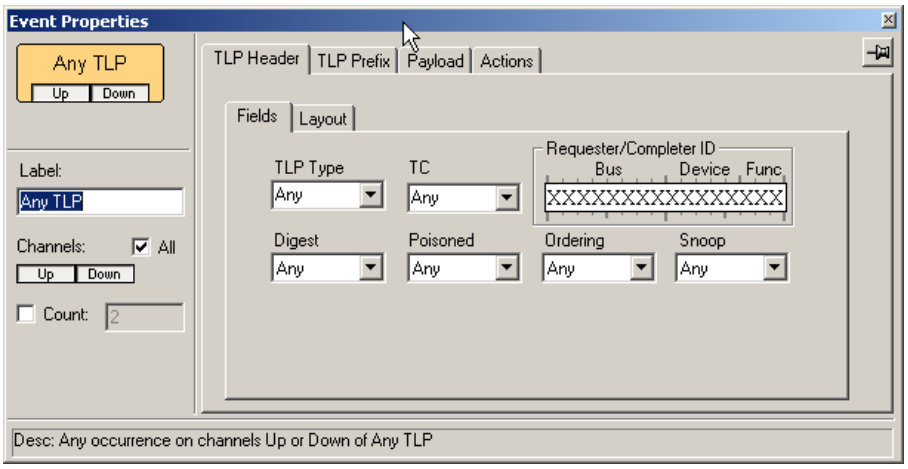
Actions Properties Dialog

The Actions Properties dialog box.



TLP Header Properties Dialog

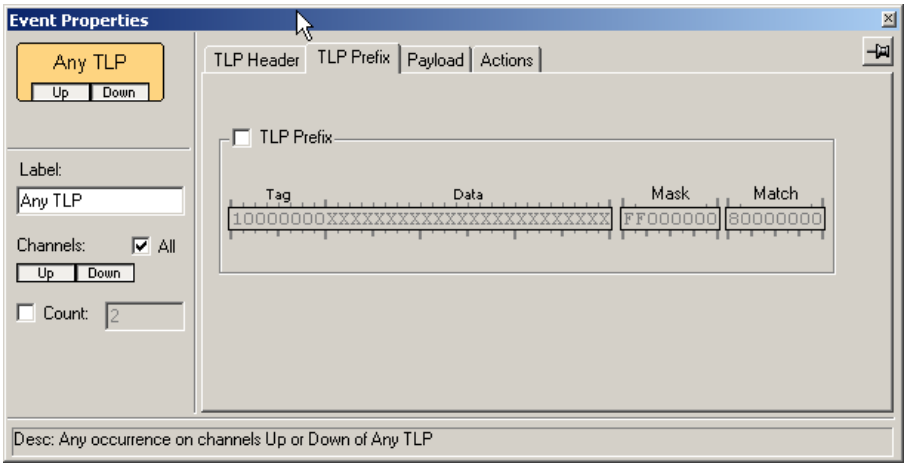
The TLP Header Properties dialog box.



Note: TLP Prefix is available only on Summit T2-16.

TLP Prefix Properties Dialog

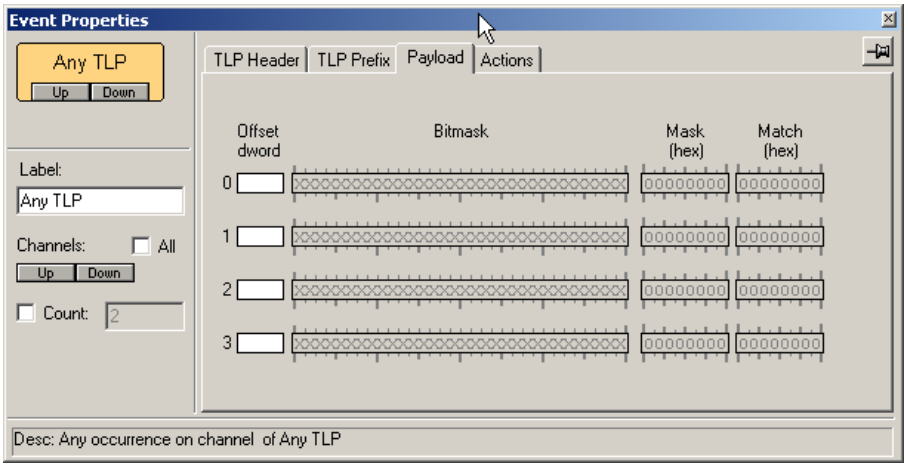
The TLP Prefix Properties dialog box.



Note: TLP Prefix is available only on Summit T2-16.

Payload Properties Dialog

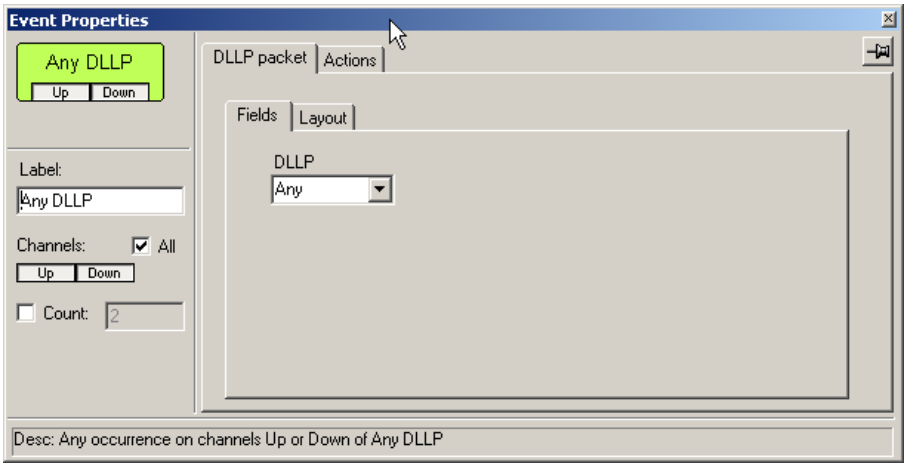
The Payload Properties dialog box.



Note: TLP Prefix is available only on Summit T2-16.

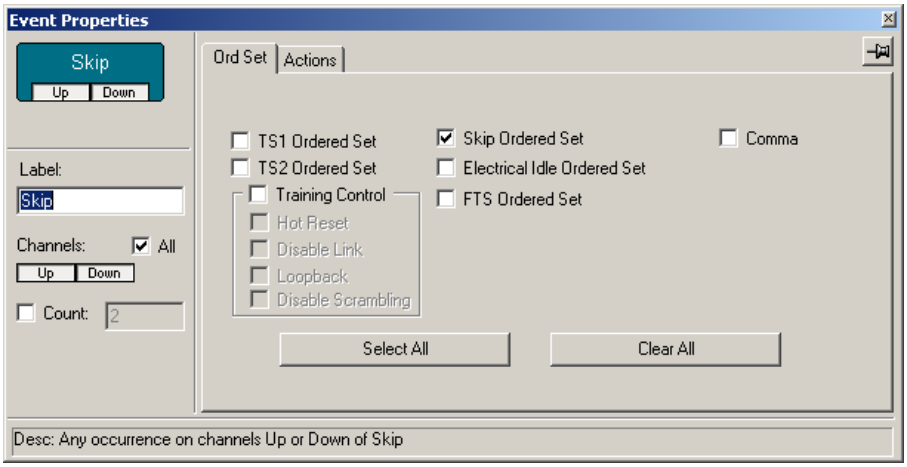
DLLP Packet Properties Dialog

The DLLP Packet Properties dialog box.



Ordered Set Properties Dialog

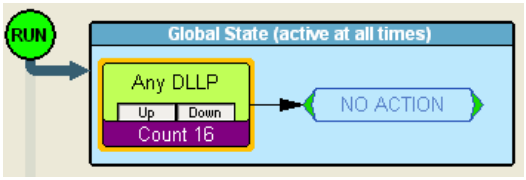
The Ordered Set Properties dialog box.



9.9 Counting Events

Triggers can be set on multiple instances of an event. For example, you can set a trigger to occur following five instances of any DLP. To configure the Analyzer to look for multiple events, you enable **Counters**. Counters tell the Analyzer how many occurrences of an event it should wait for before triggering.
For example, **Trigger following the 16th occurrence of an error**.

Counters enable triggers to be set that are based on a count of events. For example, you could use a counter to **Trigger following the 16th occurrence of a DLLP message**



To use a counter, follow these steps:

Step 1 Click an event. This causes an arrow to appear.

Step 2 Click one of the two counters (it does not matter which you use). This causes the counter to attach itself to the bottom of the event (shown above). An arrow automatically connects the counter to the Trigger button.

To change the counter value:

Step 1 Click the small blue dot in the upper-left corner of the counter button. A menu appears.

Step 2 Select **Change Counter Value**.

Step 3 Enter a new value in the pop-up dialog box. This causes the new value to appear in the counter button.

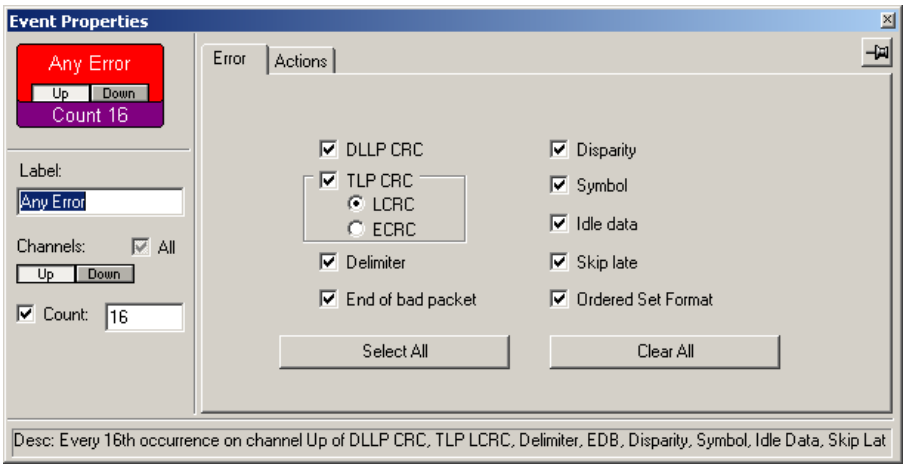
How to Set a Counter

To set a counter:

Step 1 Open the Recording Rules page, select an event, and drag it to the **Global State** or **Sequence** cells. For details on these steps, see “Creating Recording Rules” on page 135.

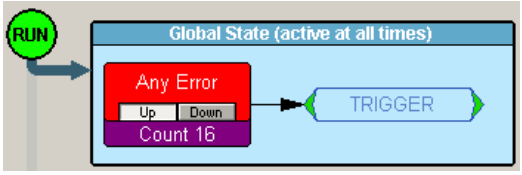
Step 2 Counts can only be set on a per channel basis, so press the **Up** or **Down** channel buttons to select the channel on which the count is performed.

Step 3 Right-click the selected event and select **Add Counter** from the menu to open the Properties dialog.



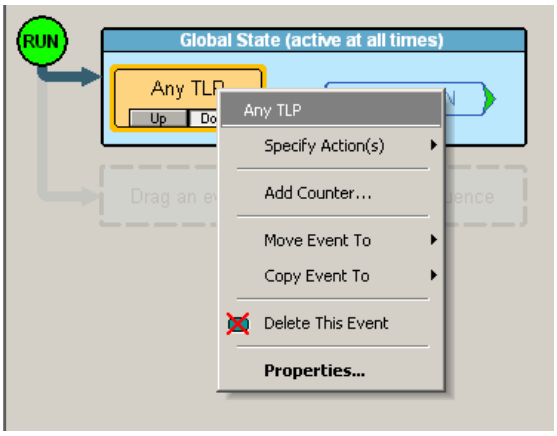
Step 4 In the text box to the right of the label Count enter a value. Make sure the checkbox to the left of the word Count is checked.

Step 5 Click the **X** in the top right corner of the dialog box to close the dialog. A counter button should appear just below your selected event.

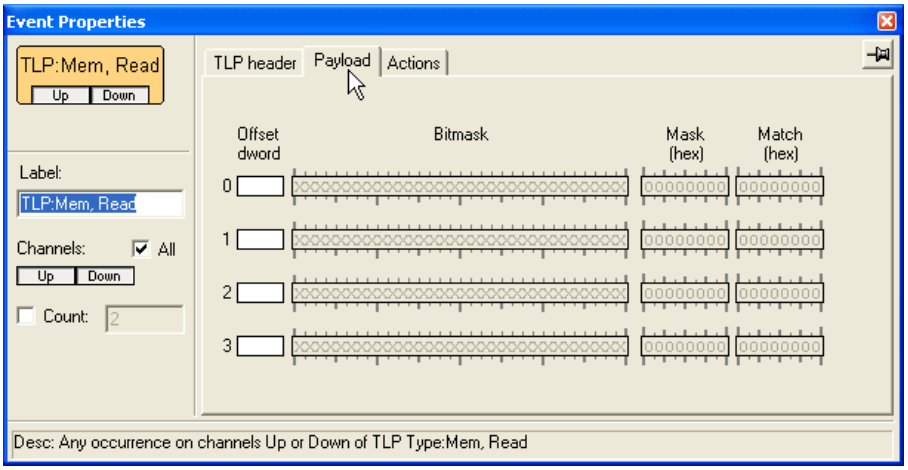


9.10 Creating a Payload Match

You can configure PE*Tracer* to trigger, count, and restart on a specific payload pattern within a Transaction Layer Packet (TLP). In Recording Rules, create a **New** event of the desired TLP type. An icon appears that represents that event type in the Available Events area. Right-click the icon and select **Properties** to bring up the Properties dialog box for the event.



Select the **Payload** tab to bring up the pane that lets you configure payload pattern. You can match up to four patterns, labeled 0 through 3.



For each pattern, you specify the following:

Offset dword: Indicates the DWORD you want to match within the payload (range is 0 through 1024). For example, if you want the Analyzer match a pattern in the first DWORD of the payload, enter 0. If you want the Analyzer to match a pattern in the thirty-fifth DWORD, enter 35.

Bitmask: Indicates which bits you want to match for the DWORD indicated. You can enter any of the following in the bitmask area:

- X (bit not relevant)
- 1 (present)
- 0 (bit not present)

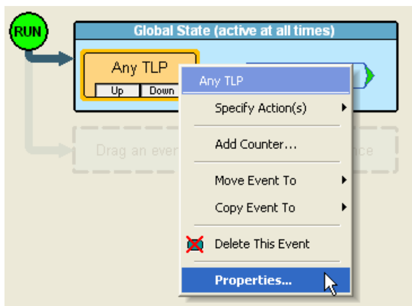
Note: The Mask (hex) and Match (hex) entries represent bitmask in hex format. As you type entries in the bitmask, corresponding values appear in fields in the hex Mask and Match. Alternately, you can type values in the hex Mask and Match, and corresponding values appear in the bitmask.

Example 1

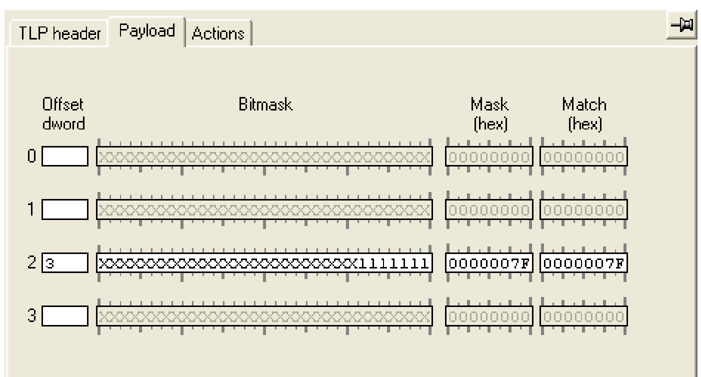
To tell the Analyzer to trigger on any payload with the binary pattern 1111111 in the third DWORD:

Step 1 Create an **Any TLP** event in the Available Events area of Recording Rules. Drag the event to the **Global State** cell.

Step 2 Open the **Properties** dialog box for the event and bring up the **Payload** pane.



Step 3 Enter **3** in the Offset dword area of any of the four patterns (0 to 3). For purposes of this example, we choose pattern 2.



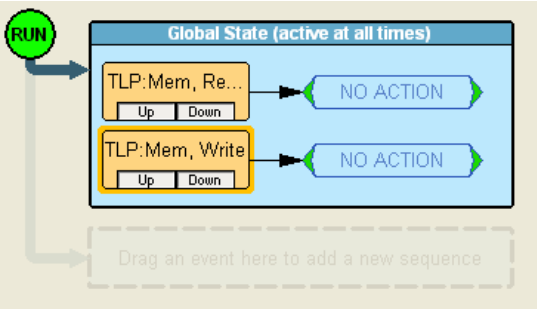
Step 4 Enter the following in pattern 2: **1111111**.

Example 2

To tell the Analyzer to trigger on any payload with the binary pattern 1111111 in the third DWORD, OR to trigger on any occurrence of Memory Write:

Step 1 To set up the first condition, do steps 1 through 4 in Example 1.

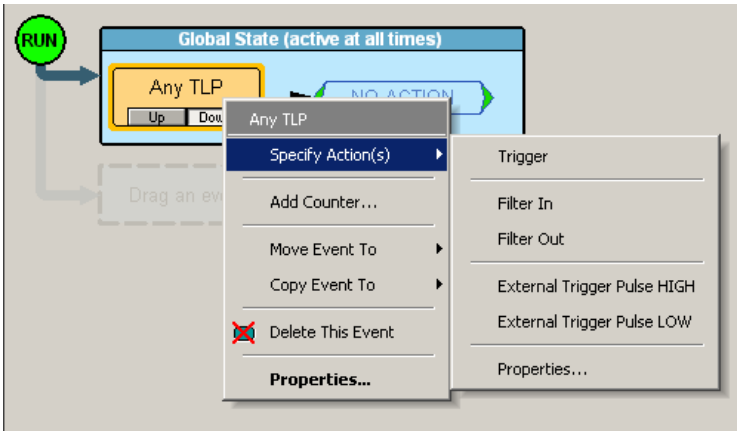
Step 2 Create a **Memory Write** event in the Available Events area of Recording Rules. Drag the **Memory Write** icon to the same cell as the **Any Event** icon from Example 1. The Analyzer now is set to trigger on either of the two conditions.



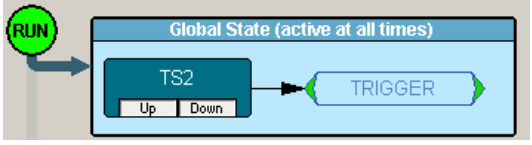
9.11 Trigger

A trigger is one of five actions that can be assigned to an event. (The other four actions are Filter In, Filter Out, Advance the Sequence, and Restart the Sequence.)

To enable a trigger, place an event button into either the **Global State** cell or the **Sequence** cell, then right-click the button and choose an **Action**.



From the sub-menu, select **Trigger**.



The exact end of the recording depends on how you have set the Trigger Position slider in the General page of the Recording Options dialog. This setting determines whether the recording terminates immediately following a trigger, or some time afterwards. See “General Tab” on page 123 for further explanation.

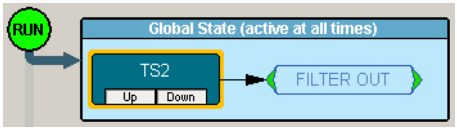
9.12 Filter In and Filter Out

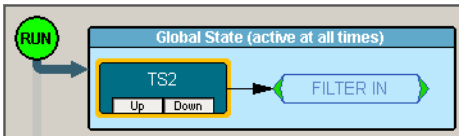
A filter causes the Analyzer to filter in or out specified events from the recording. If events are filtered out of the recording, they are excluded from the Analyzer's buffer and not simply hidden from the CATC Trace. The purpose of filtering is to preserve recording memory so you conduct longer recording sessions and exclude events that do not interest you.

A filter causes the Analyzer to filter in or out specified events from the recording so you can preserve recording memory and thereby increase the duration of your recording. Filtering also lets you exclude unwanted data so your CATC Trace displays only the traffic that interests you.

To enable or disable filtering, place an event button into either the **Global State** cell or the **Sequence** cell, then right-click the button and choose an **Action** (see previous topic).

From the sub-menu, select **Filter In** or **Filter Out**.





Chapter 10: BitTracer Recording

10.1 Overview

Note: BitTracer Recording is an optional feature.

The PE*Tracer* Summit or Summit T2-16 analyzer has an optional **BitTracer** data capture mode, which captures bi-directional link traffic in raw format. The BitTracer recording mode captures and displays traffic before lane-to-lane de-skew operations and before descrambling of 10b bytes. The BitTracer mode includes support for multiple logical links (bifurcations) on a single physical link.

The BitTracer recording mode has its own user interface, which provides characterizations of link traffic that are not available in the standard protocol analyzer mode.

You can export BitTracer recordings for viewing in CATC Trace format.

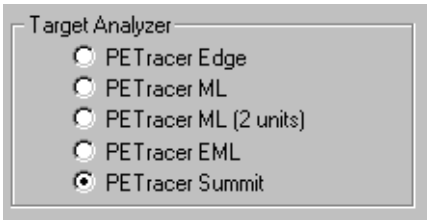
PE*Tracer* Summit and Summit T2-16 Only

Note: BitTracer Mode recording is only available in the Teledyne LeCroy PE*Tracer* Summit or Summit T2-16 PCI Express Gen2 Protocol Analyzer and is an optional feature. This feature can be included at initial purchase or added in the field with a software upgrade license. To obtain a software license key to add this feature, contact Teledyne LeCroy.

10.2 Enabling BitTracer Recording

To enable the BitTracer recording mode, open the **Recording Options** dialog box.

In the Target Analyzer section of the General tab, select **PETracer Summit** or **Summit T2-16**.



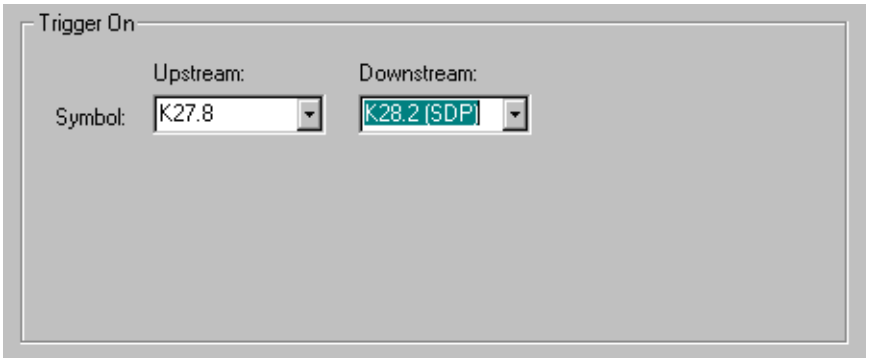
In the Recording Type section, select **Bit Tracer Recording**.

In Bit Tracer Recording, you can use the Snapshot, Manual Trigger, and Event Trigger recording types.

Note: You can also use other standard Recording Options, such as Link Width, Buffer Size, and Lane Polarity Settings, to characterize the link.

10.3 Trigger Modes

If you select Event Trigger, you may select basic trigger settings in the Trigger On box.

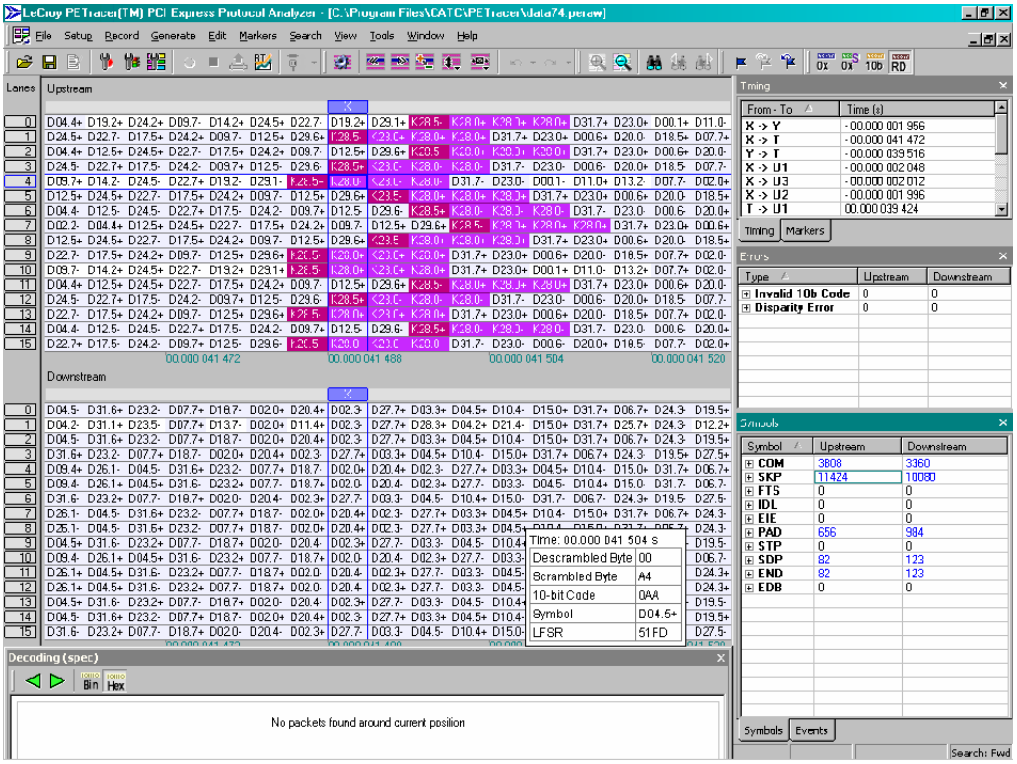


By default, these selections include standard K (command) characters for each direction (upstream and downstream). You may also manually enter a D (data) character in the upstream or downstream boxes.

To disable a K or D character in either box (and so remove a trigger condition), place the cursor in the box and delete the displayed K or D character.

10.4 Views Available for Captured Data

BitTracer mode displays captured data lane-by-lane and byte-by-byte in each direction (upstream and downstream), with the time scale progressing left to right.



Other views are provided for timing measurements, marker placement, physical layer errors, captured symbol types, packets, events, and decoding of ordered sets and packets. You can view any or all displays simultaneously, using the **Windows** selection in the View menu.

10.5 De-Skewing Data

By default, BitTracer recordings display captured data in a raw, time-skewed format, across all lanes in both directions. Individual bytes are as they were captured on the recorded link, before the receiver device on the link (or the receiver logic on the PE*Tracer* analyzer) has performed lane-to-lane de-skew operations.

You can manually skew the captured data, left or right, in increments of one symbol time, using the associated toolbar buttons.

You can automatically de-skew an entire lane direction. First, left-click on the direction in the data window. Then right-click to display a popup menu. Then select **Auto De-Skew**.

You can de-skew only one direction for each right-click operation. To automatically de-skew the opposite direction, first left-click on that direction in the data window.

Note: The skew observed in the bit tracer is the actual skew of the lanes in the link plus the skew introduced by the analyzer interface. The De-skew Bypass option is not intended for skew measurements or estimations.

10.6 Data Display Formats

To display traffic in K/D symbol (with Running Disparity indicated), scrambled, descrambled, 10-bit, and Binary code formats:

- Use the toolbar.

- Right-click to display a menu.
- Place the cursor over any given byte to display all byte formats (including an LFSR value) in pop-up list.

Time: 00.000 003 016 s

Descrambled Byte	1C
Scrambled Byte	1C
10-bit Code	30B
Symbol	K28.0+
LFSR	FFFF
Decoding	SKP

Note: Descrambled values can only be displayed after the first recorded skip ordered set. Data prior to the skip is displayed in scrambled values, due to the unknown LFSR.

Note: For Binary Data Display Format, bits are shown in order of transmission on the bus.

10.7 Color-Coding of BitTracer Contents

To increase visual understanding of BitTracer displays, different symbol types have color-coding:

- Presence or non-presence of a lane's byte-lock
- Idle data characters (D0.0)
- K codes
- Invalid 10b symbols
- Signal presence
- Background of the Markers Bar (see "Markers Bar" on page 163) (color coded according to traffic speed).
- All symbols of a TS1/TS2 ordered set

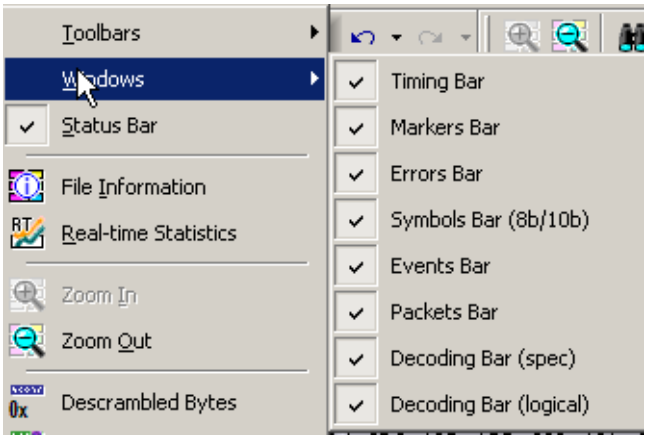
By default, these color selections match the standard color selections used in the CATC Trace format. You can modify them in the Display Options menu, accessible from the Main toolbar or the Setup menu.

10.8 Report and Analysis Windows

In the report windows, BitTracer mode provides several functions to analyze traffic:

- Statistical information
- Timing measurements
- Packet decoding

To activate/deactivate a report window, use **Views > Windows**.



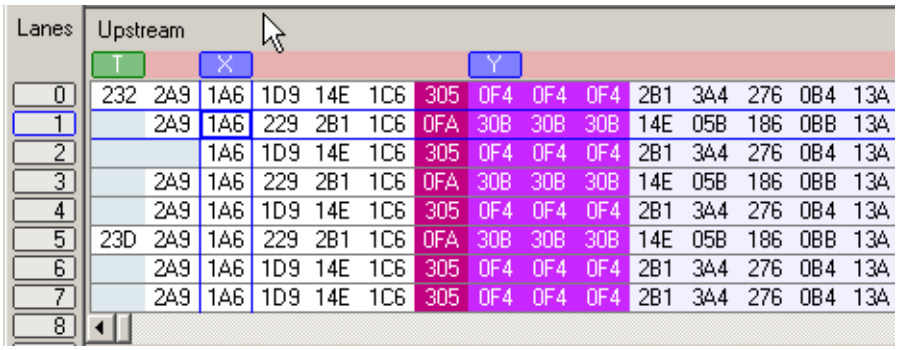
You can rearrange the report windows.

All report windows are dockable.

10.9 Timing Measurements Bar

BitTracer mode provides timing measurements on captured data:

- Measurements from the Trigger position relative to user-selected X and Y markers
- X-Y measurements
- Measurements between user-defined markers



Markers Bar

The Trigger marker T is at the point where BitTracer recognized the user-defined trigger condition.

To set an X marker X, left-click anywhere in the data display, except for the light gray bar located above the data and below the directional label.

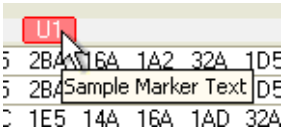
To set a Y marker Y.right-click anywhere in the data display, except for the light gray bar located above the data and below the directional label.

To define a marker, select the **Set Marker** command in the Markers menu or use the **Toggle Marker** icons in the toolbar. You can also use the Jump to Next or Previous marker icons in the toolbar.

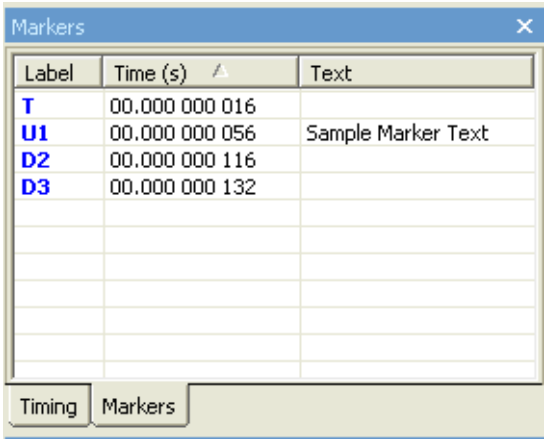
User-defined markers are numbered in order they were placed:

- U1 U1, U2, and so on in the upstream direction
- D1, D2 D2, and so on in downstream direction.

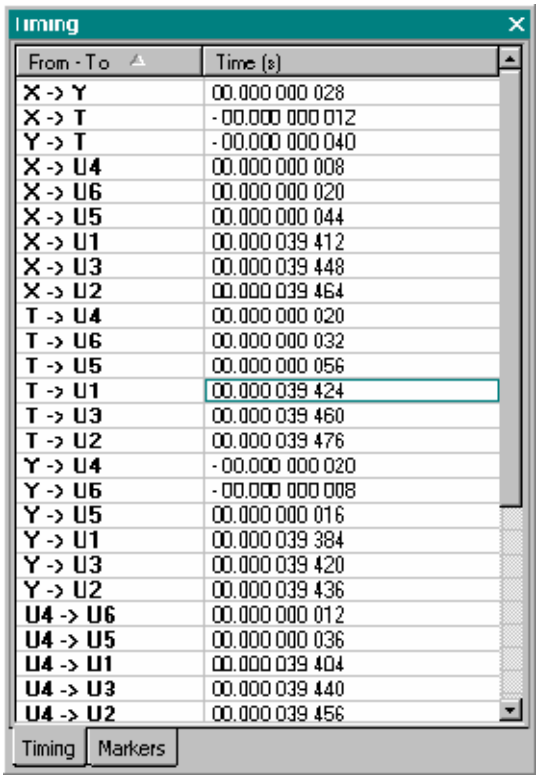
You can set a marker with text using the **Set Marker with Text…** command in the Markers menu. After setting the marker, when the mouse pointer is on the marker symbol, the marker text displays as a tooltip.



You can also display the Markers window, which lists all markers and their locations, including a hyperlink for each.

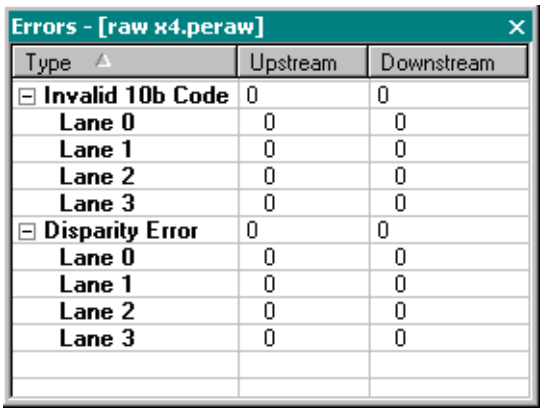


Timing measurements between all combinations of X, Y, U, and Trigger cursors are in the Timing window.



10.10 Errors Bar

BitTracer mode provides a summary of 10b errors (invalid symbols) and disparity errors in the Errors window. The window shows the total error count and errors per-lane for each error type. Hyperlinks allow jumps to selected errors.

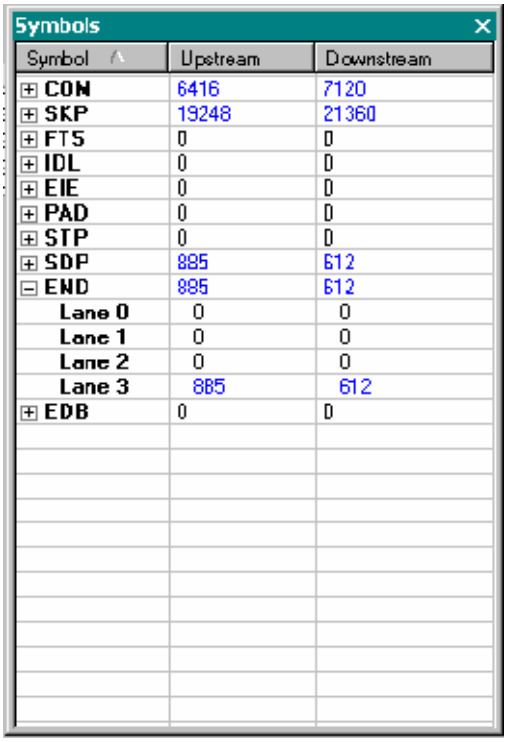


BitTracer mode also highlights errors:

- Invalid symbols have a black background.
- Bytes with incorrect running disparity have red borders.

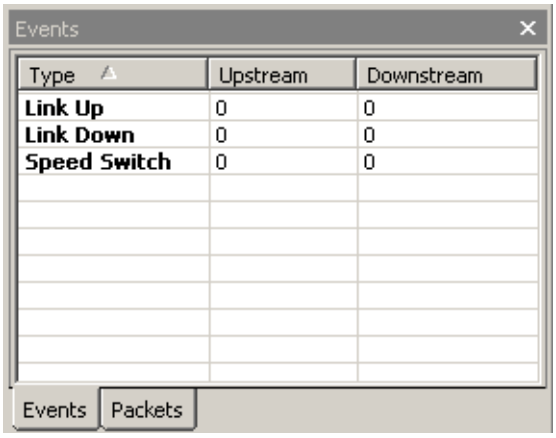
10.11 Symbols Bar

The Symbol window provides a summary of the different symbol types captured, by quantity and direction, and includes hyperlinks for jumps to selected symbols. Expanding the **+** sign at the left of each symbol provides a summary of symbols by lane.



10.12 Events Bar

The Events report window summarizes Link Up, Link Down, and Speed Switch events for Upstream and Downstream.



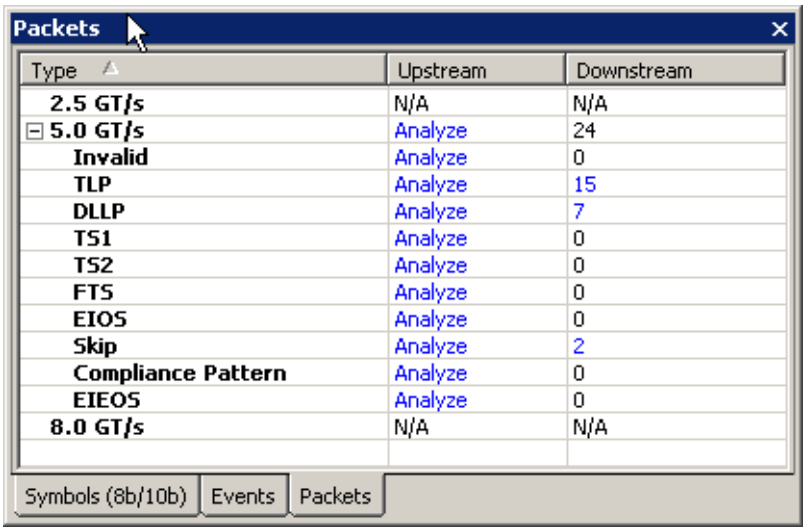
Note: The table entries are hyperlinks.

10.13 Packets Bar

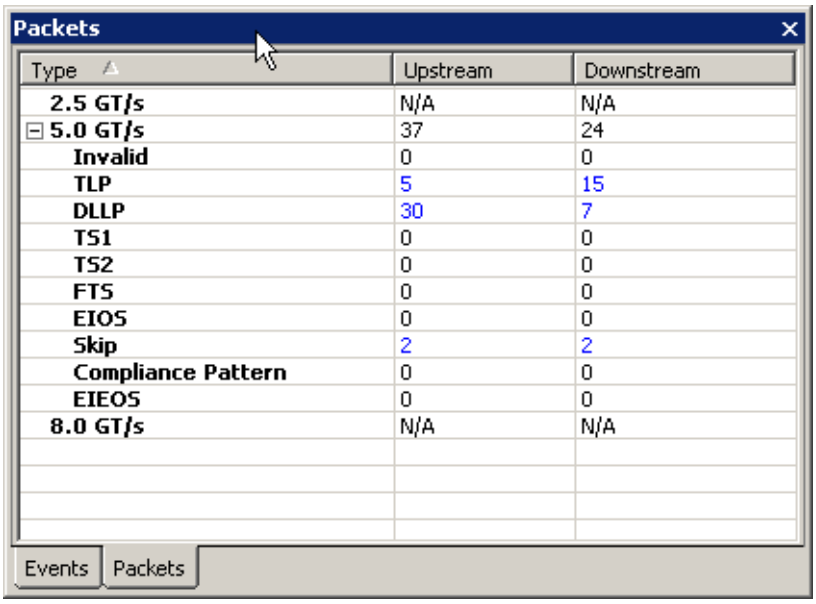
The Packets report window summarizes packet types detected in the file.

To obtain packet types, you must perform a post-capture "Analyze" step. After capture, when you open the Packets Bar for the first time, items can display the command "Analyze". To start the analysis, click the word **Analyze**. After analysis finishes, the results are saved with the file. Therefore, you do not need to click **Analyze** the next time. **Note:** The table entries are hyperlinks.

Note: If you edit anything, the results are no longer valid, and the system requires you to click **Analyze** again.



After analysis, the Packets Bar looks like the following:



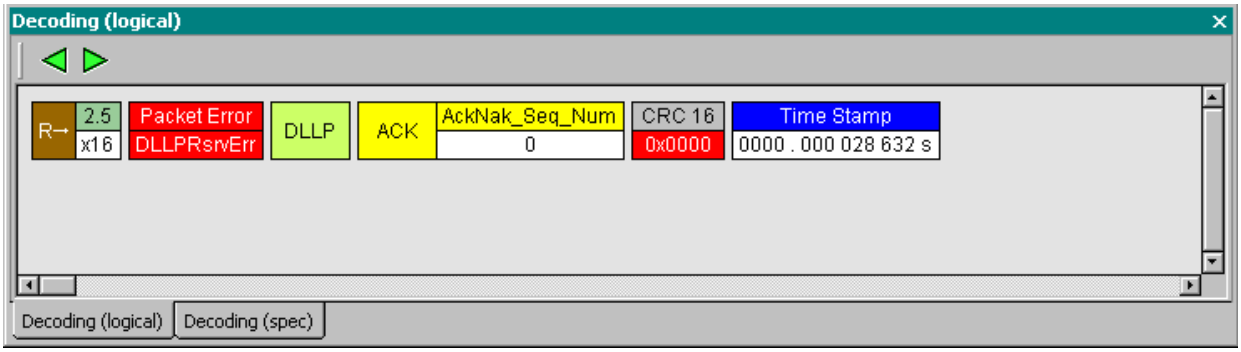
10.14 Decoding Bar

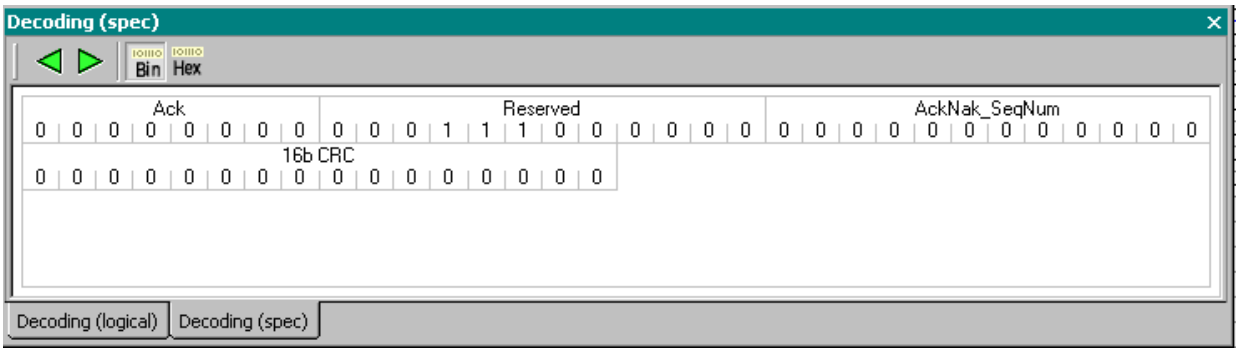
If you select them in the data view, or search or jump locates a feature, BitTracer mode displays ordered sets and packets in the Decoding window:

- **Logical view** is identical to CATC Trace format.
- **Specification view** provides a more elementary display. The Specification view includes an option to display data in hex or binary format.

Note: Packets and ordered sets translate directly to this view from data capture and use any post-capture skew manipulations you add, or use natural lane-to-lane skew present on the link if you have not added post-capture skew manipulations. Typically, you would perform an Auto De-Skew before viewing ordered sets and packets in this view.

Use the left and right arrows to search for the next or previous symbol type.

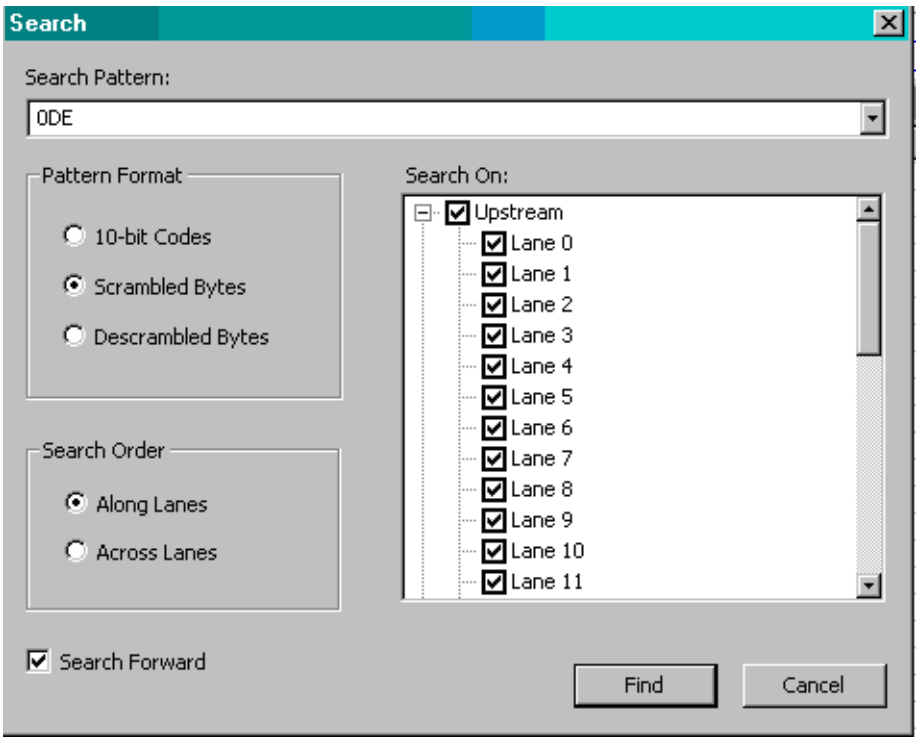




10.15 Search

To search, use the Search toolbar.

Clicking the **Search** icon displays the Search window.



You can copy data shown in the BitTracer display across a lane (horizontally) or across multiple lanes (vertically), and then paste it into the Search Pattern window.

The Search Pattern window stores previous search values, which you can recall by selecting the Search Pattern drop-down button.

In the Pattern Format section, select to search in 10-bit Codes, Scrambled Bytes, or Descrambled Bytes format.

In the Search Order section, select to search Across Lanes (multiple lanes, vertically) or Along Lanes (individual lanes, horizontally).

To define the direction (upstream or downstream) and the lanes on which to search, use the Search On section.

10.16 Link Configuration

Use the toolbar icon or right-click in the data views to display the Link Configuration dialog. This dialog allows you to associate logical lanes with physical lanes, thereby providing support for lane bifurcation (multiple logical links on the same physical link).

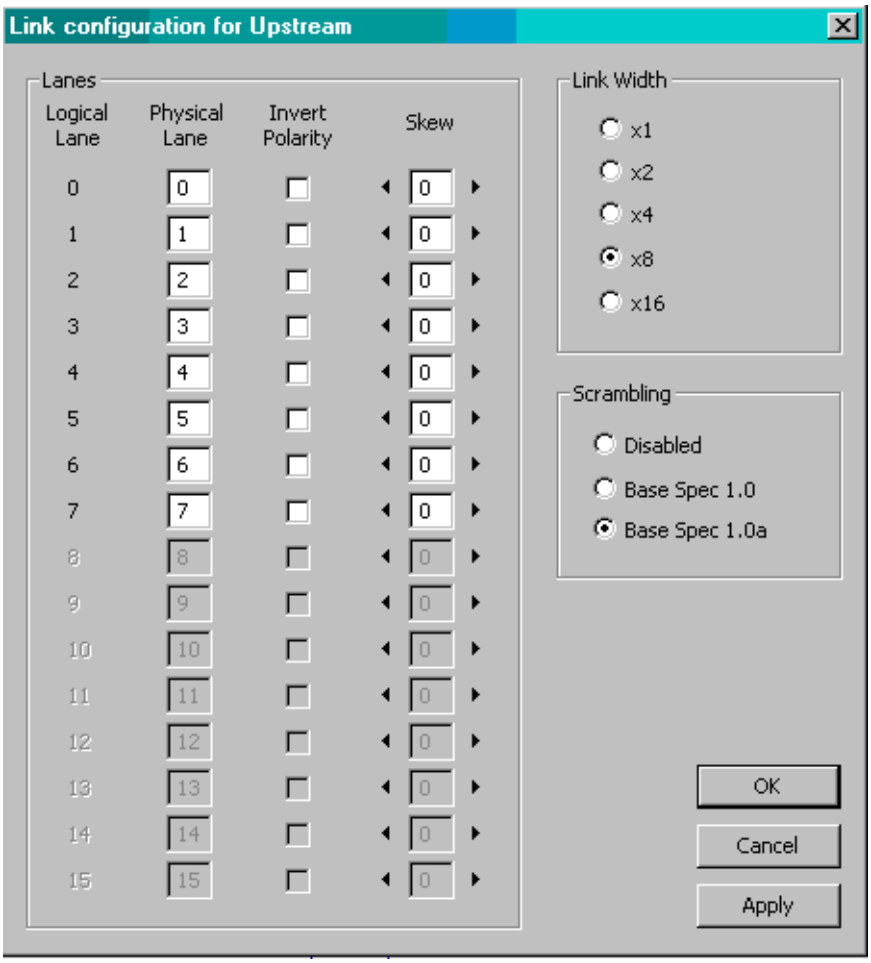
After logical lanes map to physical lanes, BitTracer mode reconfigures the display to show the selected logical link (and the logical link width, as the link width selected in the dialog).

Use the arrows to force symbol time skew on any lane.

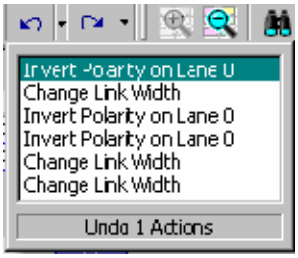
Use the polarity checkbox to invert lane polarity on the selected lane or use the **+/-** toolbar icon.

Use the scrambling option to select a scrambling algorithm, as per specification 1.0a or legacy specification 1.0.

Note: This dialog applies to one direction at a time (upstream or downstream). Left-click in the direction in the data display to edit the configuration for that direction.



As you perform operations that affect display configurations, the application records them. To undo or redo operations, use the Undo and Re-do icons on the toolbar.



10.17 Export of BitTracer Capture to CATC Trace Format

You can export BitTracer captures to standard CATC Trace file formats, selecting the **Export** option from the File menu. **Note:** You should use the Auto De-skew feature before using the export feature.

The exported CATC Trace keeps association information with the original BitTracer file. Such traces scroll synchronously when you select the **Synchronize Traces** option in the Windows menu.

You can navigate between BitTrace and CATC Trace using the **Show in Trace View/Show Packet in Raw Trace** context menu.

Exports Involving Multiple Logical Links on One Physical Link

If a single BitTrace capture contains more than one logical link, you can export each logical link to CATC Trace format. You may then cascade or tile the various BitTracer exports, which then scroll together in linked fashion, along with the original BitTracer file. The Export dialog provides options to export a limited range within the BitTrace capture and to automatically open the exported capture in CATC Trace format.

10.18 Compressing and Expanding the Data View

You can compress (zoom out) the horizontal timing of the displayed data to view higher-order link behaviors. You can expand (zoom in) to examine higher-resolution views.

To zoom in or zoom out, right-click the data view, then select a command or select a zoom icon on the toolbar.

Alternatively, to zoom in, left-click and drag across a desired range of data.

10.19 Opening and Saving BitTracer Captures

You can save BitTracer captures in various file types.

You can collate and archive these files for transport, using the **Export to Compressed Archive** feature in the File menu.

The main BitTracer files have a ***.peraw** extension.

You can open these files in the PE*Tracer* application using the **File > Open** command.

Chapter 11: Reports and Tools

Reports assist you in analyzing traffic recorded by the Analyzer. The available reports are:

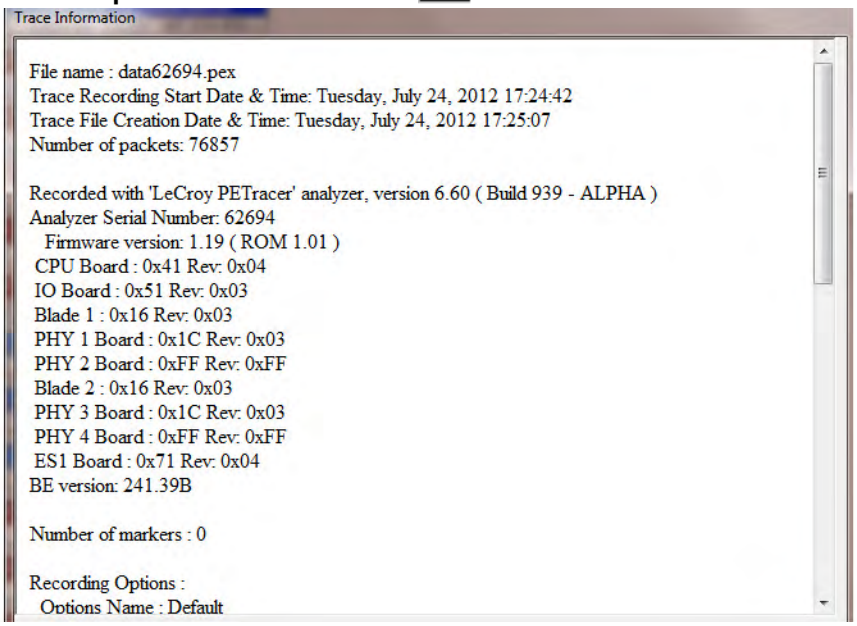
- **File Information**: To view general information about the CATC Trace file.
- **Error Summary**: To view a count of errors in a CATC Trace file.
- **Traffic Summary**: To view a summary of protocol-related information in the CATC Trace file summary information about a selected group of items in the CATC Trace file (such as a count of particular frame or packet types).
- **Bus Utilization**: To display information on bandwidth usage for the transmit and receive channels.
- **Link Tracker**: Displays a detailed chronological view of events.
- **Data Flow**: Shows marker, packet, direction, type, length, address, payload, handshake, and timestamp information.
- **Trace Navigator**: Navigates within the CATC Trace to view the location of errors and triggers, narrow the range of traffic on display, and jump to any point in the CATC Trace.
- **LTSSM Flow Graph**: Shows a state diagram of bus activity.
- **Packet Header**: Shows packet header information
- **Packet Data**: Shows packet information.
- **Configuration Space**: Displays a Configuration Space.
- **Metrics**: Measures key operating parameters.
- **Real Time Statistics**: To display statistical information for the channels.
- **TC to VC Mapping**: To display how Traffic Classes are mapped to Virtual Channels (to simplify navigation) and how the CATC Trace display was changed (for example, in Split Transactions).
- **Timing Calculations**: To view timing measured between two events set within the CATC Trace file.
- **PCIe SSD base Mapping: Displays the PCIe SSD Base Address dialog.Run Verification Scripts**: Allows you to check errors, link transactions, split transactions, metrics, ordered sets,replays, DLLPs, and TLPs.

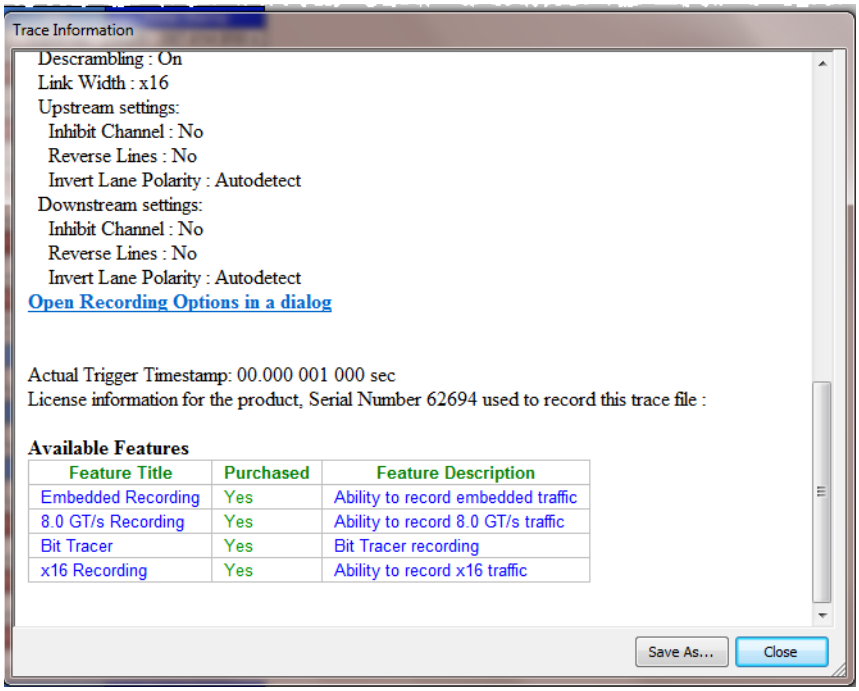
Reports are available from the Report menu and buttons on the Tool bar. Tools are available from the Tools menu.

11.1 File Information

The File Information window provides a summary on the currently displayed file.

Select **Reports > File Information**  to obtain the File Information window.

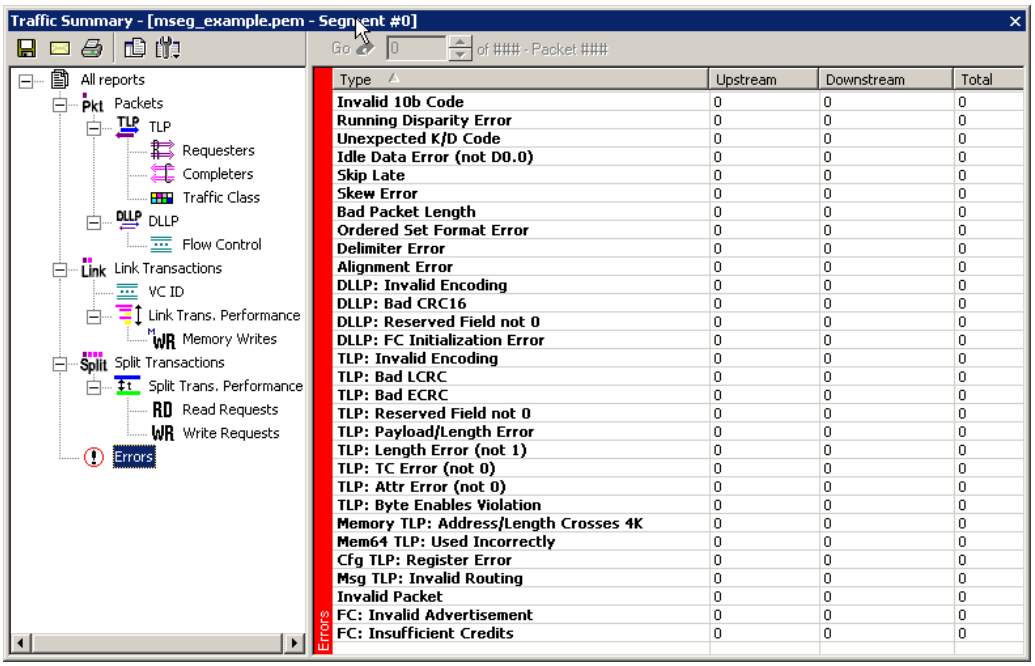




11.2 Error Summary

The Error Summary dialog box displays the number of errors for each event and the packet containing the errors.

Select **Reports > Error Summary** to obtain the Error Summary dialog box.

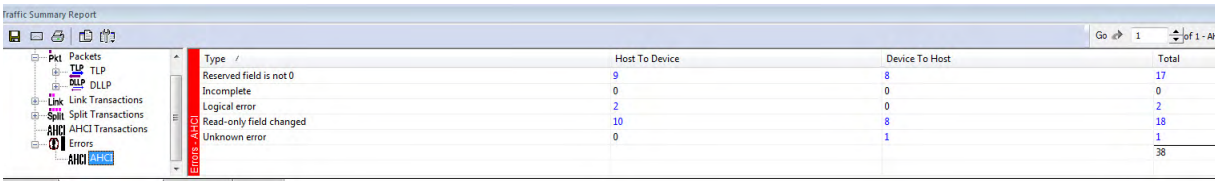


Type	Upstream	Downstream	Total
Invalid 10b Code	0	0	0
Running Disparity Error	0	0	0
Unexpected K/D Code	0	0	0
Idle Data Error (not D0.0)	0	0	0
Skip Late	0	0	0
Skew Error	0	0	0
Bad Packet Length	0	0	0
Ordered Set Format Error	0	0	0
Delimiter Error	0	0	0
Alignment Error	0	0	0
DLLP: Invalid Encoding	0	0	0
DLLP: Bad CRC16	0	0	0
DLLP: Reserved Field not 0	0	0	0
DLLP: FC Initialization Error	0	0	0
TLP: Invalid Encoding	0	0	0
TLP: Bad LCRC	0	0	0
TLP: Bad ECRC	0	0	0
TLP: Reserved Field not 0	0	0	0
TLP: Payload/Length Error	0	0	0
TLP: Length Error (not 1)	0	0	0
TLP: TC Error (not 0)	0	0	0
TLP: Attr Error (not 0)	0	0	0
TLP: Byte Enables Violation	0	0	0
Memory TLP: Address/Length Crosses 4K	0	0	0
Mem64 TLP: Used Incorrectly	0	0	0
Cfg TLP: Register Error	0	0	0
Msg TLP: Invalid Routing	0	0	0
Invalid Packet	0	0	0
FC: Invalid Advertisement	0	0	0
FC: Insufficient Credits	0	0	0

AHCI Error Summary

The AHCI Error Summary dialog is a sub-entry for the main Error Summary dialog. It displays the number of errors for each AHCI transaction containing the errors.

Select **Reports > Error Summary** to open the Error Summary dialog.

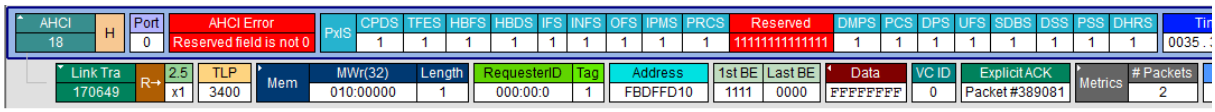


Type	Host To Device	Device To Host	Total
Reserved field is not 0	9	8	17
Incomplete	0	0	0
Logical error	2	0	2
Read-only field changed	10	8	18
Unknown error	0	1	1
			38

The five types of AHCI errors are describe below:

Reserved Field not Zeroes

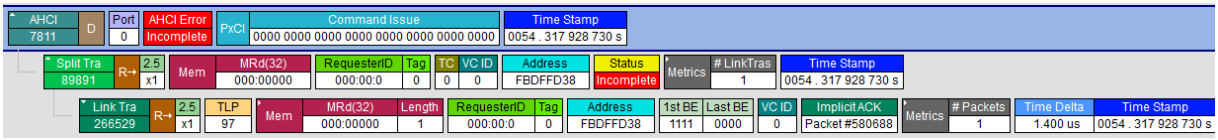
One or more fields inside the AHCI transaction are not filled with all 0s. The AHCI specification states that all reserved fields and registers must be filled with 0s.



Note: Reserved fields for AHCI level are not displayed when filled with all 0s.

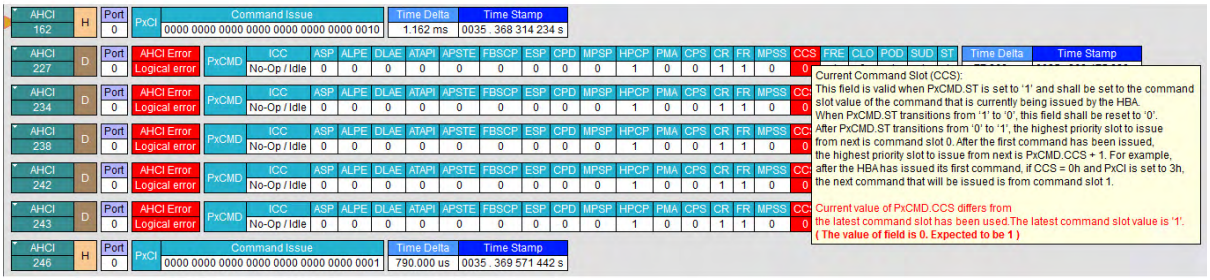
Incomplete

The AHCI transaction does not contain enough data or lower-level transactions (Link or Split) are marked as incomplete.



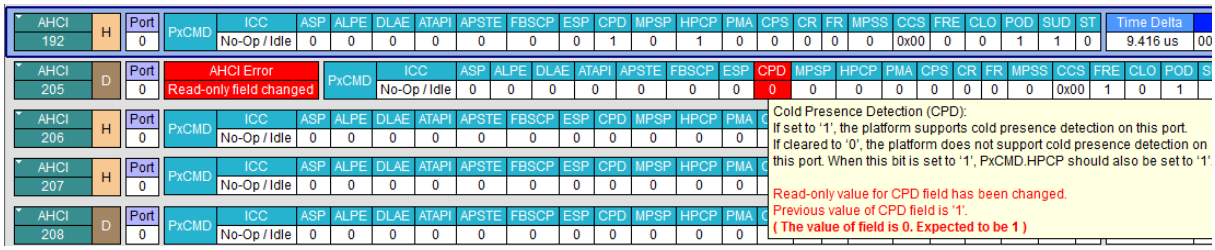
Logical Error

One or more fields are in an inconsistent state relative to the other fields in the same or other registers.



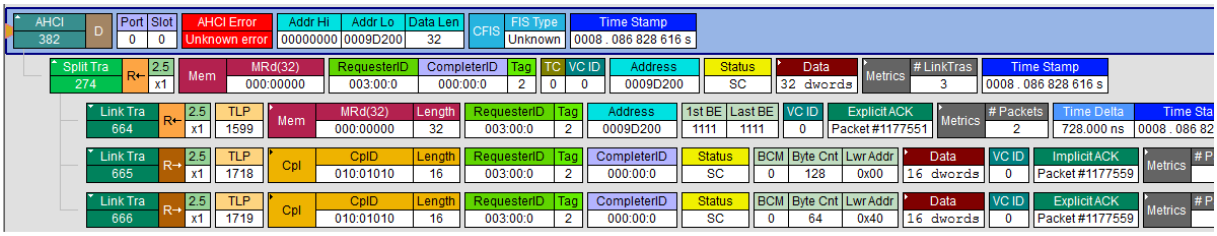
Read-only Field Changed

The value of the read-only field differs from the previous one.



Unknown

The AHCI decoder is unable to decode a particular transaction correctly. This can be caused by a distorted trace file.

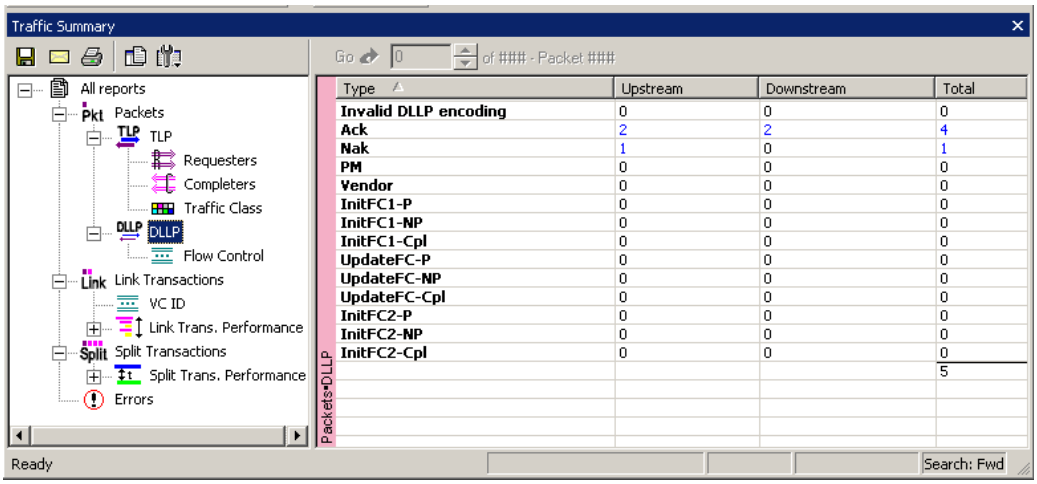


Checks for Logical error and Read-only field depending on the values obtained from previous registers. It can result in false-positive or false-negative detections in case of partially saved trace file. The AHCI transaction can be marked as incomplete in case of saving a portion.

11.3 Traffic Summary

The Traffic Summary window summarizes the traffic in the current CATC Trace. The left side of the window displays a tree of protocol levels. The right side displays a summary of traffic for the displayed levels.

Select **Reports > Traffic Summary** or click  to display the Traffic Summary window.



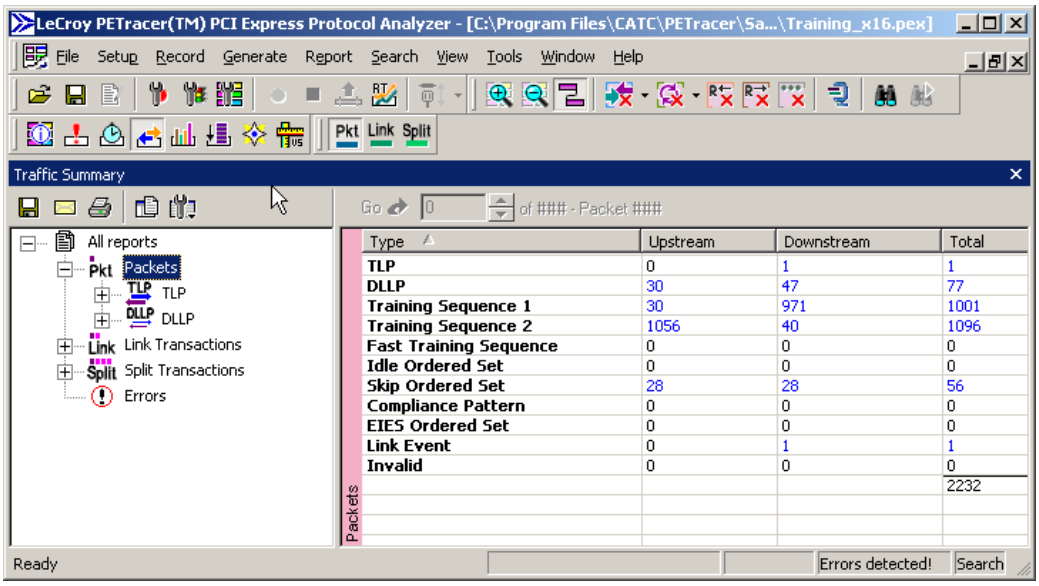
Buttons at the top of the Traffic Summary window change the display format and enable data to be exported to email, file, or the printer.

Using the Traffic Summary Window to Search the CATC Trace

You can use the Traffic Summary window to move the CATC Trace to packets of interest:

Step 1 Click one of the numbers in the right side of the Traffic Summary window.

The CATC Trace jumps to the first instance of the selected protocol.



Step 2 Click the **up** or **down** arrows  . The CATC Trace jumps forward or backward through the display to the next instance of selected protocol level.

Traffic Summary Buttons

Buttons at the top of the Traffic Summary dialog box provide options for exporting the data or formatting its appearance:

Save. Saves Traffic Summary results into an HTML format.

Email. Attaches an HTML file of the results to a new email.

Print. Prints results.

Text. Displays results in HTML format.

Options. Opens a drop-down menu with the following options:

- **Grid Lines**: Displays/Hides grid lines
- **Row Selection**: Allows entire rows to be selected
- **Tight Columns**: Reformats column widths to match data
- **Event Navigation**:

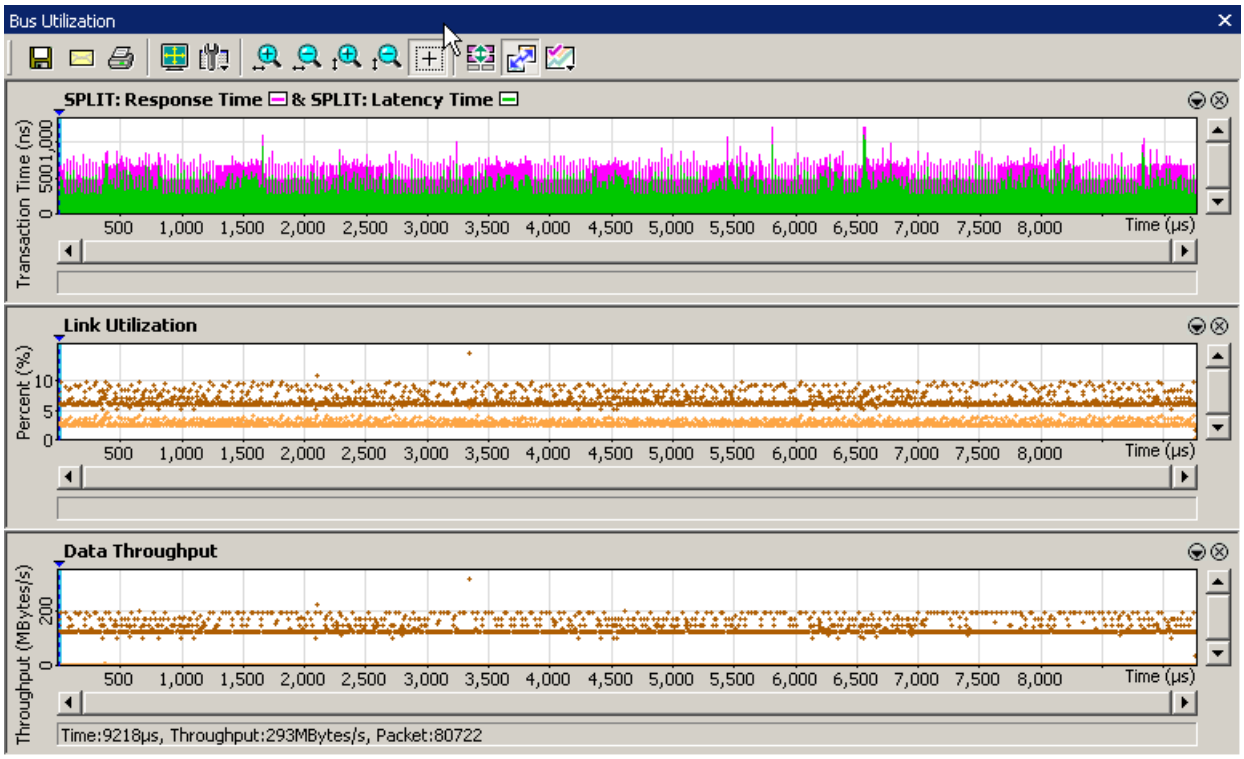
  Skip Hidden Items

  Show Hidden Items

  Prompt each time

11.4 Bus Utilization

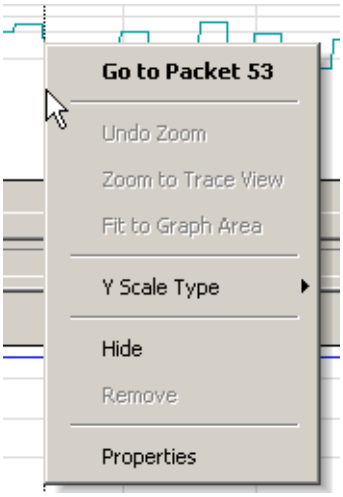
Select **Report > Bus Utilization** from the menu or press  to open the Bus Utilization window.



The Bus Utilization window displays information on bandwidth use for the transmit and receive channels.

Bus Utilization Pop-up Menu

You can reformat the display by right-clicking a graph and making a selection from the Bus Utilization pop-up menu.



Go to Packet #: Relocates the CATC Trace to the selected packet number.

Undo Zoom: If you have zoomed in, this command undoes the zoom.

Zoom to Trace View: Zooms in on graph to show traffic currently displayed in the CATC Trace screen.

Fit to Graph Area: Redisplays graph so that the entire CATC Trace fits inside graph area.

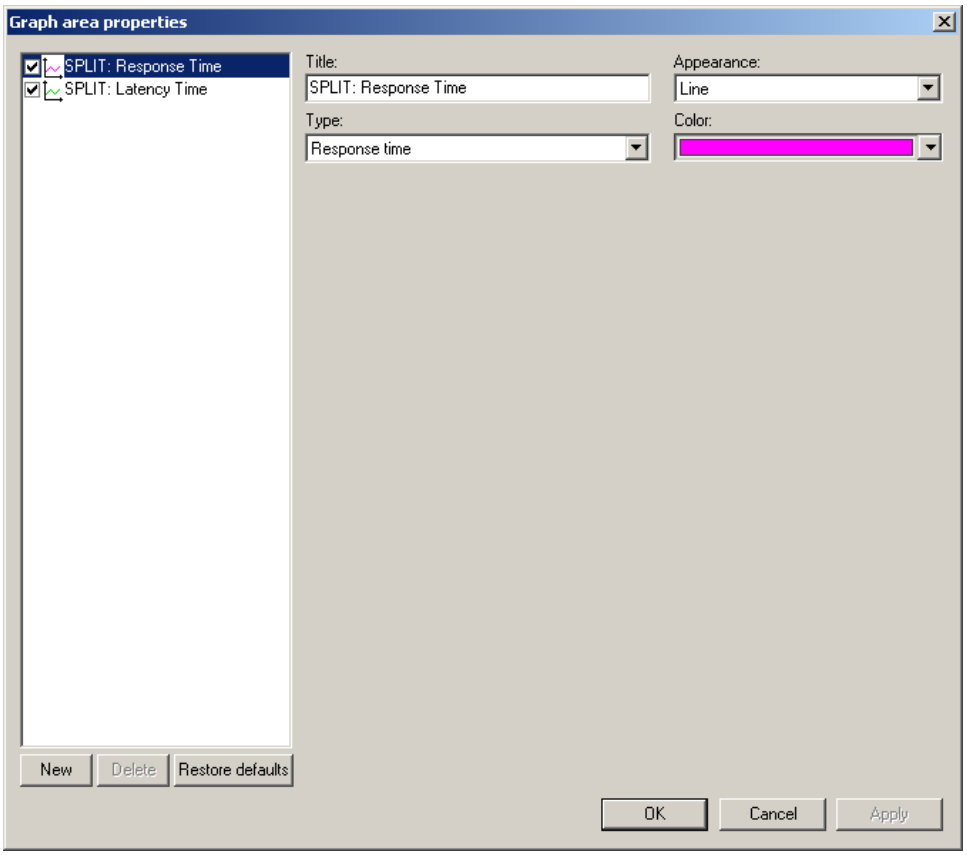
Y Scale Type:

- **Linear**: Converts display to linear format
- **Logarithmic**: Converts display to logarithmic format

Hide: Hides the selected graph

Remove: Allows you to remove any graph that you created via the **New**  command

Properties: Opens a dialog box with options for changing the Title, Type, Appearance, and Color of the graphs.



Bus Utilization Buttons

The Bus Utilization window buttons allow you to reformat the display and export data.

Button	Function
	Save. Saves Bus Utilization data to a bitmap file (***.bmp**).
	Email. Opens an email and attaches a bitmap file of the Bus Utilization data.
	Print. Prints the Bus Utilization data.
	Full Screen. Maximizes the Bus Utilization window.
	View Settings. Opens a sub-menu with the following choices: • Orient Horizontally • Tile Vertically • Show Markers • Show Plumbline • Status >> Bar Tool tips None • Grid Lines >> Both Axes X Axis Y Axis No Grid • Grid on Top • Fonts & Colors
	Horizontal zoom in
	Horizontal zoom out

Vertical zoom in

Vertical zoom out

Click and Drag zoom. Click and drag to zoom in on a part of the graph.

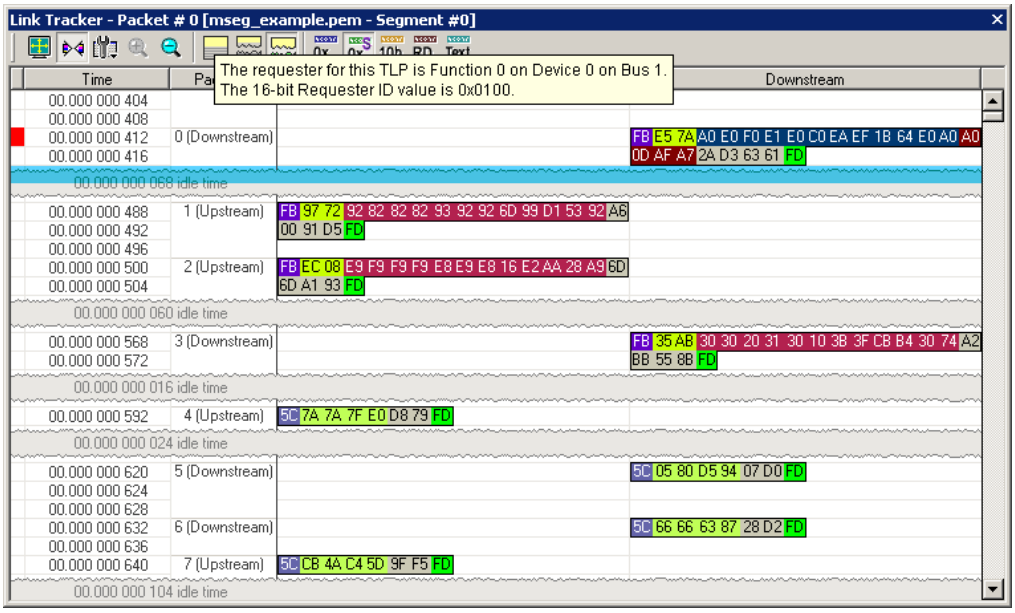
Select Range. Displays a dialog box for selecting a packet range.

Synchronize Graph Areas. If two or more graphs are displayed, this button synchronizes the graphs to one another. Once synchronized, the positioning slider of one graph moves the other graphs.

Graph Areas. Provides options for creating and displaying additional graphs of data lengths, packet lengths, and percentage of bus used.

11.5 Link Tracker

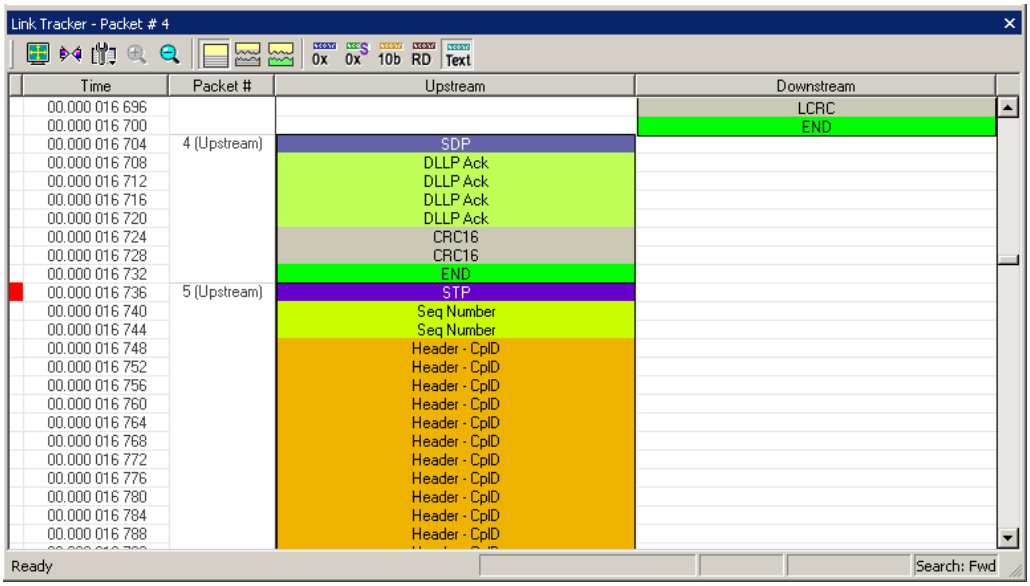
The Link Tracker window displays a detailed chronological view of events. Events are shown on a channel-by-channel basis in columns within the window.



Each time slot in the vertical axis represents the minimum time that a DWORD requires to traverse the bus.

Toolbar: Presents buttons for changing the format of the Link Tracker window.

Main Display Area: Displays traffic chronologically as it occurred in the recording. The window divides into columns: the first column shows time and traffic is shown on a channel-by-channel basis in the columns on the right.



Using the Link Tracker Window

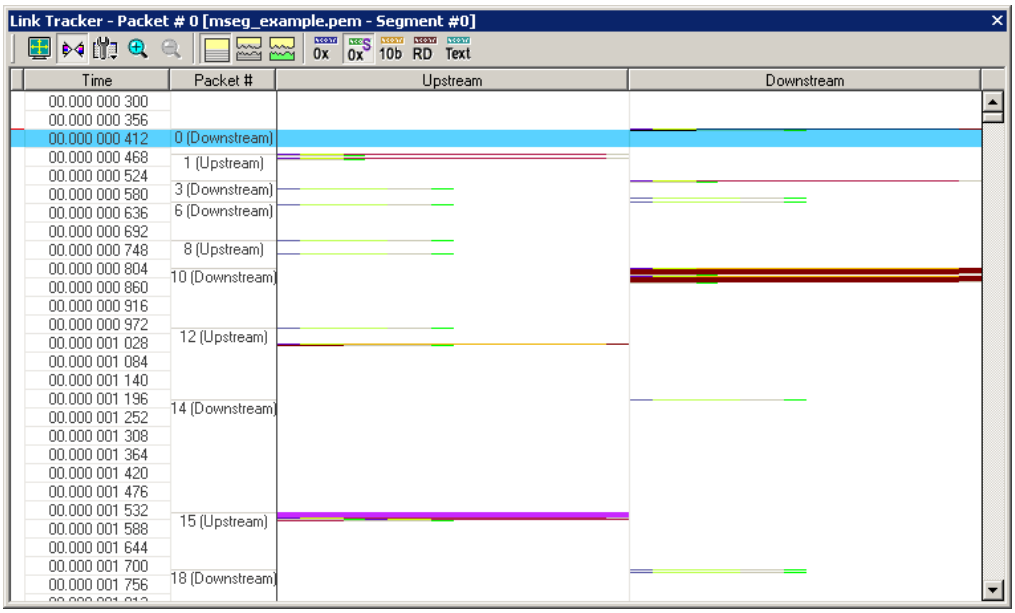
The Link Tracker window can be reformatted in several ways.

Zooming In and Out

Zooming out can give you a quick, high-level view of a CATC Trace. A fully zoomed out CATC Trace only shows columns and colored lines. Using the colors, you can see what types of traffic run through the CATC Trace.

Further information can be obtained on any point of interest in the CATC Trace by positioning your mouse pointer over it. Tool tips provide detailed description of events.

Note: When fully zoomed out, the smallest graphical unit is the DWORD, represented by a single line. Zooming out makes the CATC Trace appear smaller and increases the time scale in the first column.



Collapsing Idle Time, Enabling Tool tips, and Resetting Column Widths

Click the **View Options** button  to open a menu with options for formatting the display. Three options are presented:

Collapsible Idle Time: Opens a dialog box for setting the Idle time value. Setting a value tells the Analyzer when to collapse Idle times and display them as grayed out strips within the Bus View window.

Tooltip Display: Opens a menu with options for adding content to Tooltips. Tooltips display when you position the mouse pointer over an item in the Bus View window. The options are:

- Tooltips Display Values
- Tooltips Display Scrambled Values
- Tooltips Display 10-bit Codes
- Tooltips Display Symbols

Time Format: Seconds or Clock

Reset Column Widths: This option resets column widths to their defaults and enables columns to resize themselves automatically any time the application window is resized. Normally, columns automatically resize themselves if the application window is made larger or smaller. However, if you manually resize any columns in the Bus View window, column widths become static. Thereafter, if you resize the application window, the Bus View columns do not adjust automatically. Reset Column Widths re-enables the automatic resizing capability.

Reset Columns Order: Return to default column sequence.

Docking and Undocking the Window

You can undock the Link Tracker window by double-clicking the blue title bar along the left side of the window. Once undocked, the window can be dragged anywhere in the application. To redock, double-click again on the title bar.

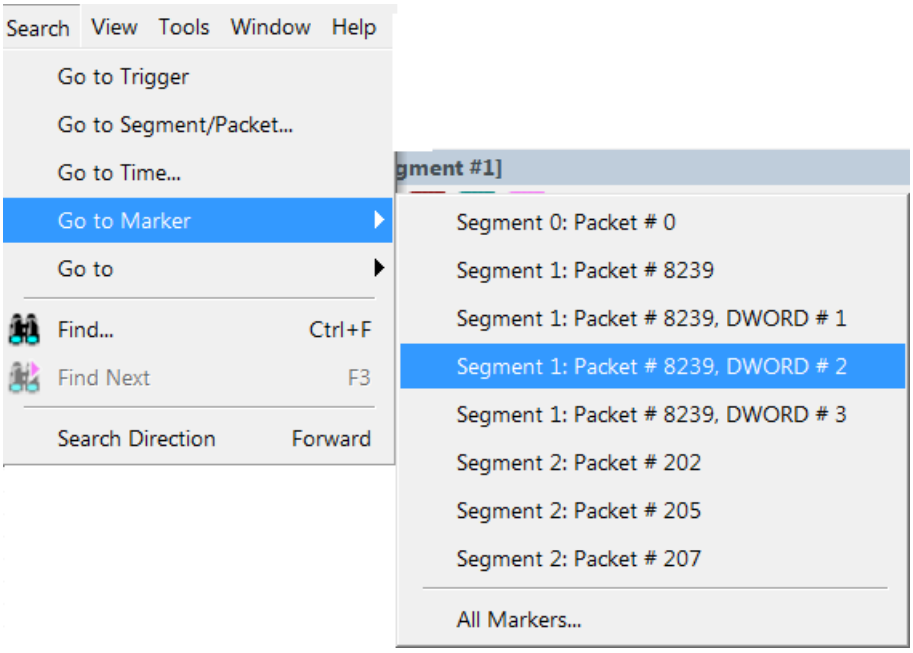
Setting Markers

Markers can be set on any event within the Link Tracker window.

To set a marker, right-click an event, then select **Set Marker** from the pop-up menu.

Once marked, you can navigate to events with the **Go to Marker** command in the Search menu.

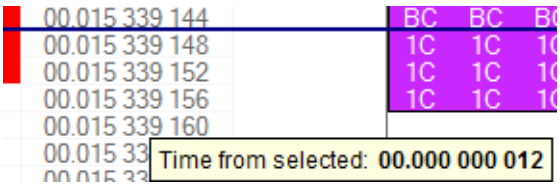
Markers set in the Link Tracker window display the packet number and DWORD number. In contrast, markers set in the CATC Trace window just show the packet number.



Calculating Time between DWORDs

You can calculate time between DWORDs by clicking an event and then positioning your mouse pointer over a second event and reading the ensuing Tool tip.

Click the **time value** for the first event. Scroll down through the CATC Trace to the second event and position the mouse pointer above its time value. A Tool tip appears showing the time interval between the first and second events.



Hiding Traffic

You can hide Idles and other data from the Link Tracker window by clicking the **Hide** buttons on the toolbar.

Link Tracker Buttons

The Link Tracker window has a row of buttons for changing the format of the displayed data and for exporting data: The buttons have the following functions:

Full Screen. Expands the Link Tracker window to fill the entire screen.

View Options. Opens a menu with three options:

- **Collapsible Idle Time** (Collapse Idle Bigger Than **n** nanoseconds. **Note:** Does not affect Collapse Idle Plus.)
- **Tooltip Display** (Values, Scrambled Values, 10-bit Codes, Symbols)
- **Time Format** (Seconds, Clock)
- **Reset Columns Widths** (return to default widths)
- **Reset Columns Order** (return to default column sequence)

See “Using the Link Tracker Window” on page 185 for further details.

Synchronize Trace View. Synchronizes the Trace View and Link Tracker windows so that a move in one window repositions the other.
Because of the differences in scale and logic between the Link Tracker and Trace view window, scrolling produces different effects depending on which window is being scrolled.
Scrolling in the CATC Trace window causes the Link Tracker window to rapidly jump from event to event. Long periods of idle time are thus skipped.
Scrolling in the Link Tracker window, in contrast, produces modest movements within the CATC Trace window.
Scrolling in the Link Tracker window causes the CATC Trace window to pause until the beginning of a packet is displayed. At that point, the CATC Trace window repositions itself. While scrolling long Idle periods or through the contents of a packet, the CATC Trace window does not move.

Zoom In

Zoom Out

Continuous Time Scale. No collapsing.

Collapse Idle. Do not show some periods of Link being idle.

Collapse Idle Plus. Do not show periods of Link being idle.

Show Values

Show Scrambled Values

Show 10b Codes

Show Symbols

Show Text

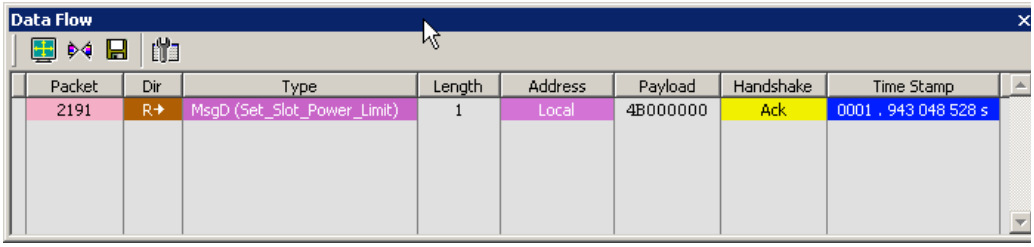
Show Binary values

11.6 Data Flow Window

The Data Flow window shows marker, packet, direction, type, length, address, payload, handshake, and timestamp information.

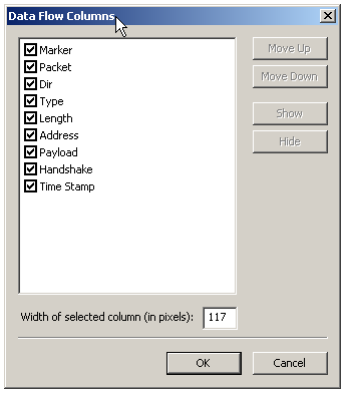
To obtain the Data Flow window, select **Report > Data Flow**

or click the  Data Flow toolbar icon.



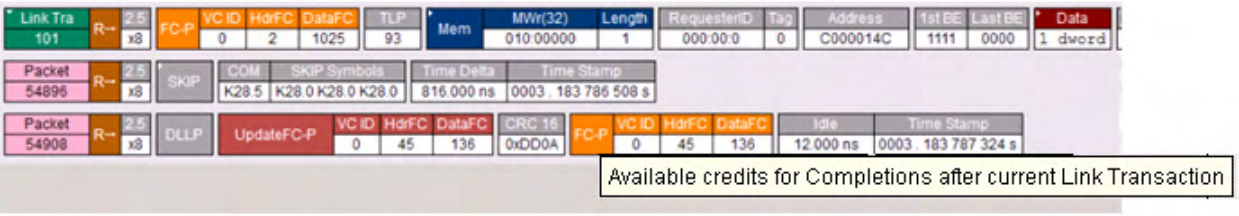
The toolbar allows you to:

- Expand the window to full screen or Collapse to a smaller window.
- Synchronize.
- Save.
- Select Data Flow columns to display and their widths:
  - Marker
  - Packet
  - Direction
  - Type
  - Length
  - Address
  - Payload
  - Handshake
  - Time Stamp



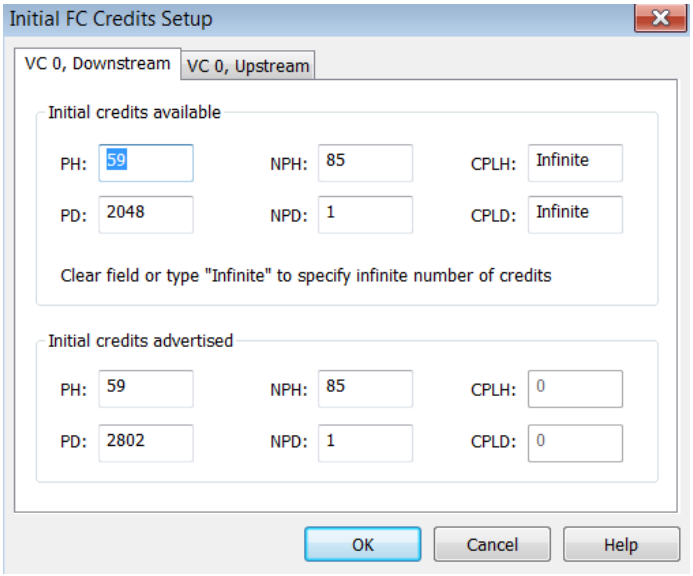
11.7 Flow Control Tracking

The Flow Control View mode highlights portions of the packets that affect flow control and displays flow control values. Flow control values shown at the beginning of Link Transaction display the credit values that were available prior to TLP transmission. Flow control values shown at the end of the Link Transaction display the credit values that were available after TLP was transmitted. Hover the mouse over the field to display tool-tips. Refer to the following screen capture.



If the trace includes Flow Control initialization, PETracer detects the amount of available credits based on the values advertised in InitFC packets. If the InitFC packets are not in the trace, the amount of available credits can be set using the FC Credit Setup dialog. Select **View > FC Credits Setup...** displays the FC Credit Setup dialog (see the following screen capture).

For each virtual channel that is present in the trace you need to specify the amount of available credits before the beginning of the trace. You can also specify the values of credit fields for UpdateFC packets before the beginning of the trace. If the values of the UpdateFC credit fields are different than the values in the first UpdateFC packet, Flow Control tracking view will show that the first UpdateFC packet is releasing appropriate amount of credits. By default, PETracer sets these values to match the first UpdateFC packets in the trace.

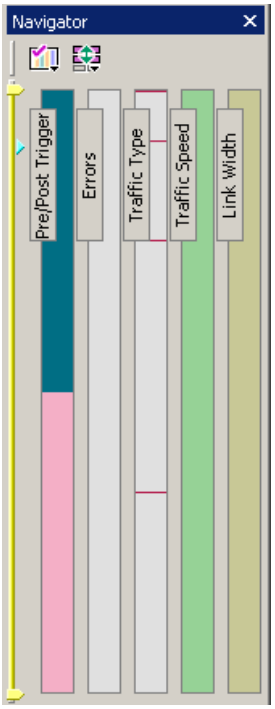


11.8 Using the CATC Trace Navigator

The CATC Trace Navigator is a tool for navigating within the CATC Trace. It allows you to view the location of errors and triggers in a CATC Trace and to narrow the range of traffic on display. It also allows you to quickly jump to any point in the CATC Trace.

Displaying the Navigator

Click  in the toolbar to display the Navigator. The Navigator appears on the right side of the Main window. It has a two-button toolbar and a vertical slider bar. It also has colored panes for navigating the CATC Trace in different ways. You set which panes are displayed through Navigator pop-up menus.



Navigator Toolbar

The Navigator toolbar lets you quickly set Navigator features. The toolbar has two buttons.

Navigator Ranges: This button brings up a pop-up menu that lets you reset the Navigator range. The range determines what packets are viewable in the CATC Trace display.

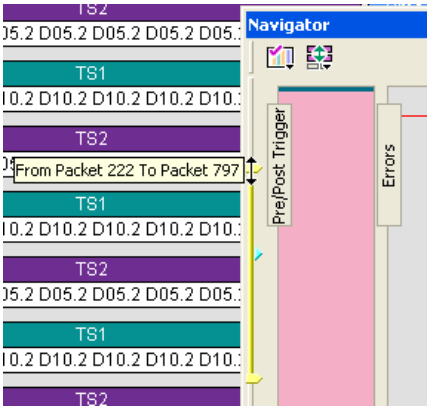
Navigator Panes: This button has two purposes: To select which Navigator panes appear and to bring up the Navigator legend. The legend determines how information is shown in the panes.

Navigator Ranges

You set the viewing range by dragging the **yellow range delimiters** along the slider.

To set the lowest packet viewable, drag the **top delimiter up**. As you do so, a tool tip appears to indicate the current range. Stop dragging when you reach the desired lowest packet.

To set the highest packet viewable, drag the **bottom delimiter down**. Stop when the tool tip indicates you are at the desired highest packet.



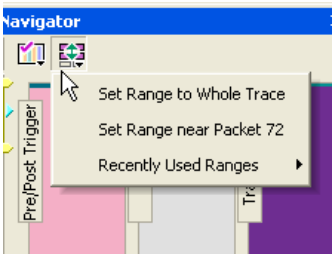
To Determine Current Position

In addition to the two range delimiters, the slider has a **blue current-position** indicator (see above). The current-position indicator shows where you are in the CATC Trace display with respect to the possible viewing range.

For example, suppose you set viewing range to packet 0 through packet 500 (the top range delimiter is at packet 0, and the bottom range delimiter is at packet 500). If you then move the current-position indicator on the slider to midway between the top and bottom delimiters, then packet 250 appears in the middle of the CATC Trace display.

To Reset Navigator Range

You can reset the Navigator range using the toolbar **Navigator Range** button. Press the button to bring up the Navigator Range drop-down menu.

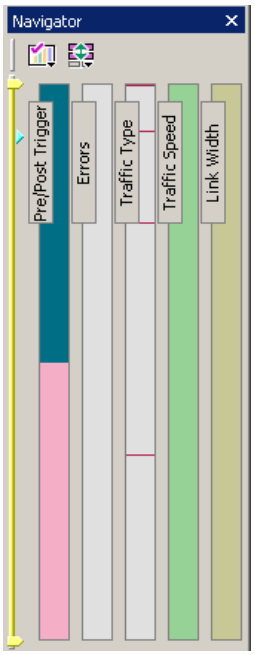


The menu has the following options:

- **Set Range to Whole Trace**: Allows you to reset the range to include the entire CATC Trace file contents. The top range delimiter is placed at the lowest packet number in the CATC Trace. The bottom range delimiter is placed at the highest packet number in the CATC Trace.
- **Set Range Near Packet xxx**: Allows you to collapse the range so that only the packets immediately above and below the xxx packet are displayed. The xxx packet is whatever packet is currently at the top in the CATC Trace display.
- **Recently Used Ranges**: Allows you to reset the range to any of a number of recently used (previously set) ranges.

Navigator Panes

You can display any combination of CATC Trace Navigator panes.



From left to right, the panes are: Pre/Post Trigger, Errors, Traffic Type, Traffic Speed, and Link Width. Each pane represents the entire CATC Trace with respect to different types of information. The top of each pane represents the start of the CATC Trace file, and the bottom represents the end of the CATC Trace file.

- **Pre/Post Trigger:** To view the trigger event in the CATC Trace and the relative size of pre-trigger and post-trigger portions of the CATC Trace. The two portions are set apart as different colors. The trigger event occurs at the point the two colors meet.
- **Errors:** To view any errors in the CATC Trace. A thin red line represents each error in the pane.
- **Traffic Type:** To view the types of packets that occur in the CATC Trace. A different color represents each packet type in the pane. The relative size of colored portions in the pane corresponds to the amounts of the various packet types in the CATC Trace. As described below, you can use the Navigator legend to change the types of packets that take precedence in the display.
- **Traffic Speed:** To view the speed that occurs in the CATC Trace.
- **Link Width:** To view the link width that occurs in the CATC Trace.

To Show/Hide Navigator Panes

You can show/hide any of the panes using pop-up menus accessible through left-click the **Navigator Panes** button or by right-click anywhere in any CATC Trace Navigator pane.

Navigator Slider

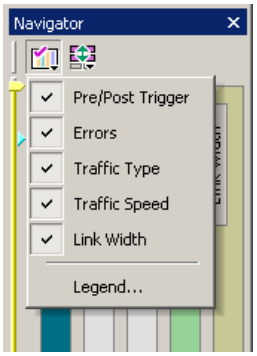
The Navigator slider appears at the left of Navigator panes. The slider has **yellow upper and lower range delimiters** and a **blue current-position** indicator.

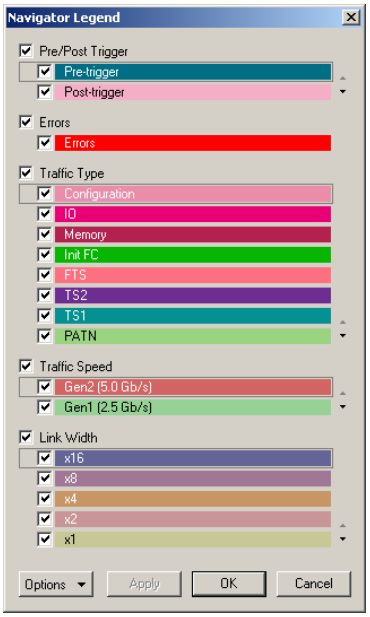
The Navigator slider lets you to set the range of packets viewable in the CATC Trace display. In other words, it sets scrolling range of the display. You can scroll the display up to the lowest packet number in the viewing range. You can scroll the display down to the highest packet number in the viewing range.

CATC Trace Navigator Legend

The Navigator legend lets you control the display of content in Navigator panes.

You bring up the legend through the Navigator Panes drop-down menu. Press the toolbar **Navigator Panes** button to access the menu. Select the **Legend** option to bring up the Navigator Legend dialog box.





The Navigator Legend dialog box has areas corresponding to each of the panes. Each area has check boxes that allow you to hide/display information in the pane. You can set the priority of information displayed in the panes using the up and down triangles on the right.

Using the Legend to Show/Hide Navigator Panes

To use the legend to show/hide an entire pane, use the **checkbox** next to the name of each pane in the legend.

In the case of the Pre/Post Trigger and Errors areas, the action of show/hide in the legend is identical to that provided by CATC Trace Navigator pop-up menus.

In the case of the Traffic Types pane, there is no equivalent show/hide available through the pop-up menus.

Using the Legend to Set the Priority of Information Display

You can use the legend to set the priority of information displayed in the Pre/Post Trigger Traffic Type panes. This is a two-step process.

Step 1 For a particular item in a pane, click the **column next to the checkbox** for the item. That labels the item as currently active.

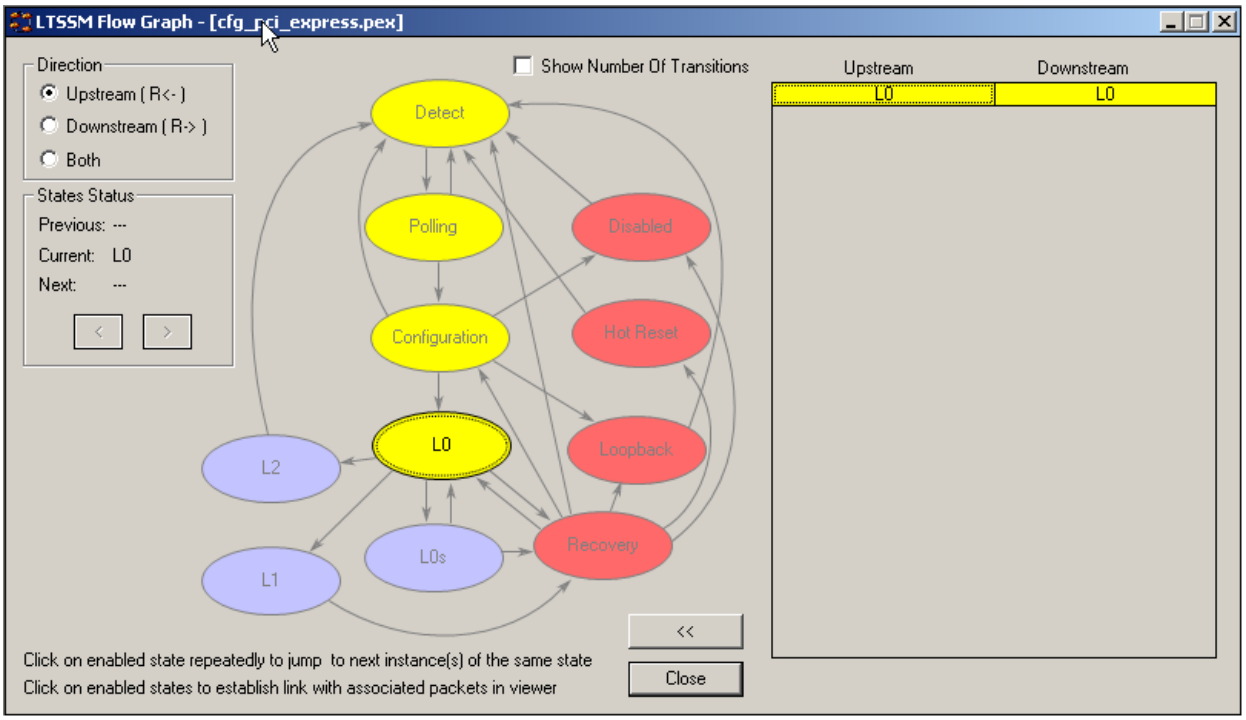
Step 2 Next, use the **up-down** at the lower-right of the area to move the item higher or lower in priority.

In the case of the Traffic Type pane, priority determines display priority of each packet type. For portions of the CATC Trace that are dominated by a particular packet type, this setting no effect: only the color corresponding to that packet type is displayed in that portion of the pane. Suppose, however, that part of the CATC Trace includes equal or near equal numbers of several types of packets. In that case, you can use the legend to select which among those types is represented in that portion of the Traffic Types pane. This allows you to view only packets of interest in crowded portions of the CATC Trace display.

11.9 LTSSM Flow Graph

The LTSSM Flow Graph shows link state transitions that the link goes through, as recorded in the CATC Trace file.

To obtain the LTSSM Flow Graph, select **View > LTSSM Flow Graph**.



You can display the following directions:

- **Upstream**
- **Downstream**
- **Both**

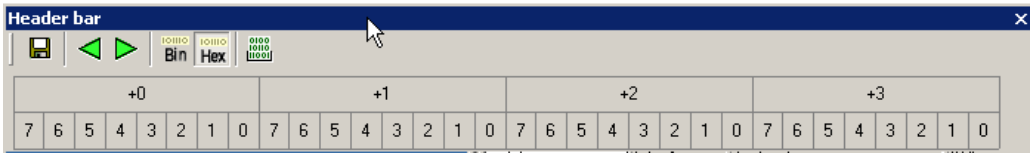
You can **Show Number of Transitions**.

11.10 Packet Header Bar

The Packet Header bar shows packet header information.

To obtain the Packet Header bar, select **Report > Packet Header**

or click the  Packet Header toolbar icon.



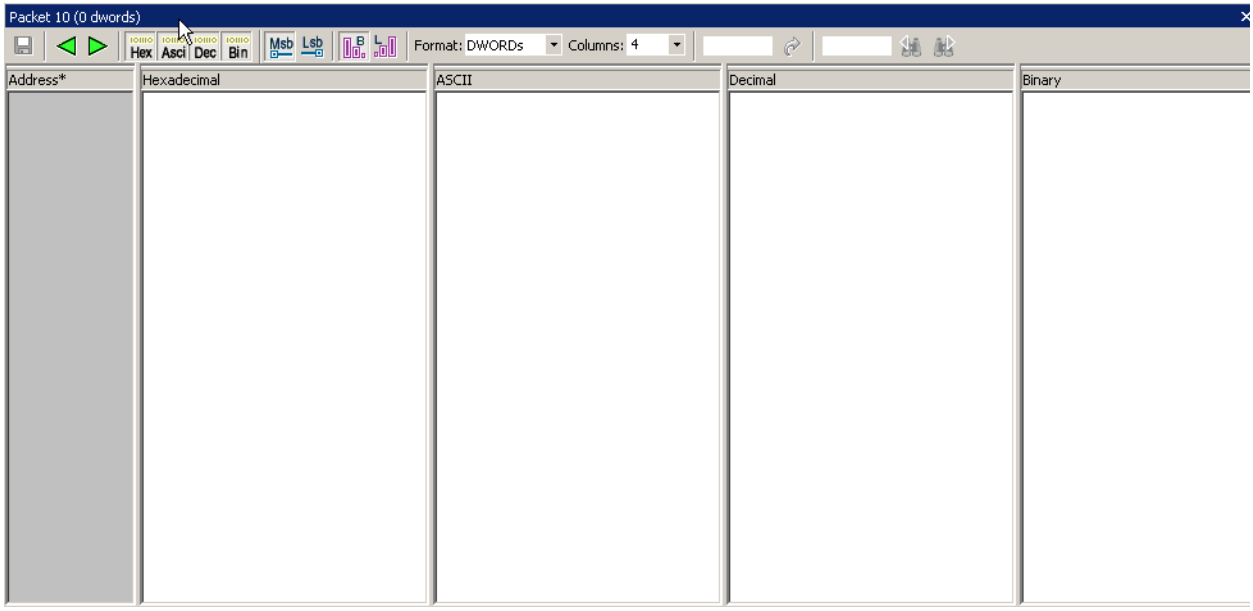
The toolbar allows you to Save, go to Previous or Next, display Hexadecimal or Binary, and show the Packet Data window.

11.11 Packet Data Window

The Packet Data window shows packet information.

To obtain the Packet Data window, select **Report > Packet Data**

or click the  toolbar icon.



The toolbar allows you to Save; go to Previous or Next; display Hexadecimal, ASCII, Decimal, or Binary; use MSB Format or LSB Format; and use Big Endian or Little Endian.

Format and Columns allows you to enter the number of bytes, words, or dwords per line.

You can enter an Offset and scroll to it.

You can enter text and Search Previous or Search Next.

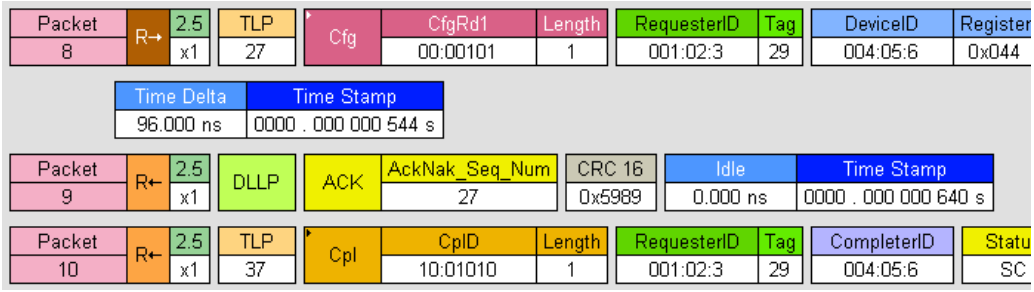
11.12 Configuration Space View

The Configuration Space View displays information about the Configuration Space state as of the current packet of the currently selected device. The view shows the Configuration Space Header and the PCI-compatible or PCI Express Capability Structures.

To display the Configuration Space View for a device at a packet:

Step 1 Open a CATC Trace, such as the sample file **cfg_pci_express.pex**.

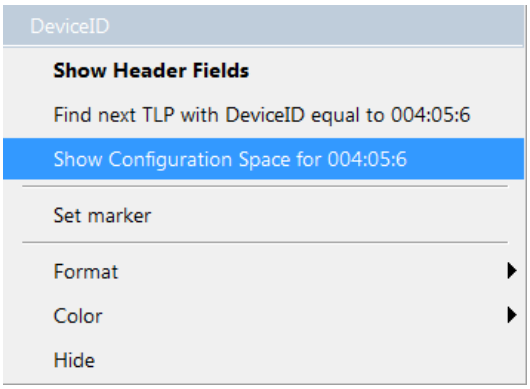
Step 2 Scroll to a packet with a Configuration header.



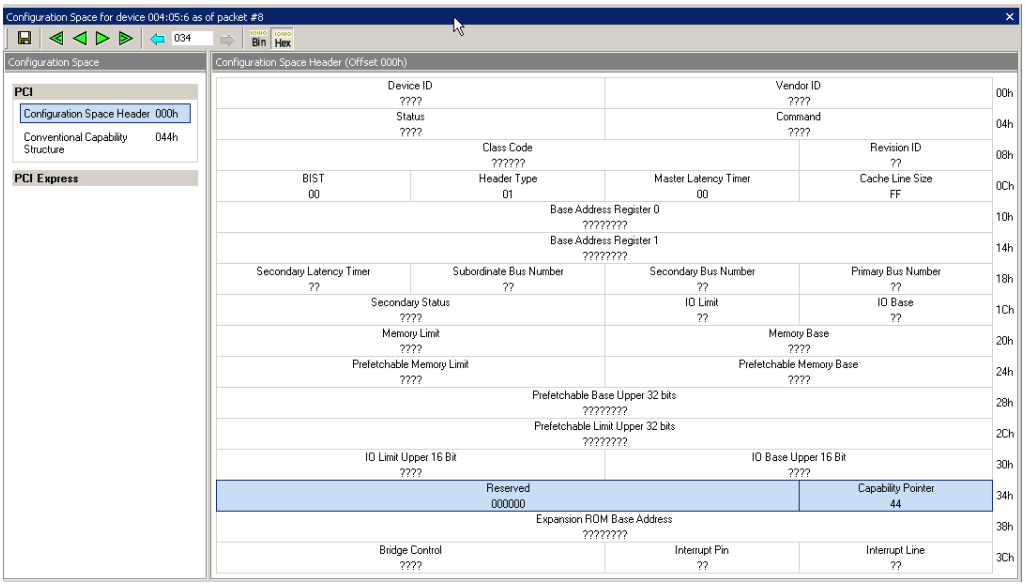
Step 3 Select **Report > Configuration Space > <device>** to display the Configuration Space View.

or

Click a **CompeterID** or **DeviceID** field. A pop-up menu opens.



Select **Show Configuration Space for xxxx** from the menu, where **xxxx** is the device number. The Configuration Space View opens.



On the left, the view displays the Configuration Space for the selected CompleterID or DeviceID at the current packet. You can select **Configuration Space Header** or a **Capability Structure.**

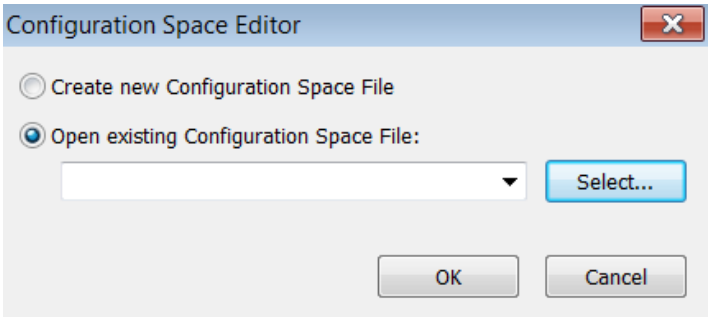
The right displays the decoded data of the selected Configuration Space Header or a Capability Structure, up to the current packet. (The decoding builds while navigating through the next packets.)

The Configuration Space View toolbar allows you to Save, go to First, go to Previous, go to Next, go to Last, go to Previous Access to Selected Configuration Space Register, go to Next Access to Selected Configuration Space Register, and display Hexadecimal or Binary.

Note: See Appendix A “Configuration Space Decoding” on page 233.

Configuration Space Editor

The Configuration Space Editor allows you to create a new Configuration space file or open an existing Configuration Space file. It is used in conjunction with Teledyne LeCroy Trainer products. Select Tools > Configuration Space Editor to display the Configuration Space Editor dialog (see figure on next page).



11.13 Using Unit Metrics

For every protocol unit at the Link or Split transaction level, PE*Tracer*™ calculates and displays a set of metrics. Metrics are measurements of key operating parameters. You can use metrics to evaluate performance of traffic in the CATC Trace stream.

You can view metrics information in the CATC Trace display, the Traffic Summary window, and the Bus Utilization window.

PE*Tracer* defines different metrics for Link and Split transactions.

Metrics Defined for Link Transactions

Number of Packets: The total number of packets that compose this Link transaction.

Payload: The number of data payload bytes this Link transaction transferred.

Response Time: The time it took to transmit this Link transaction on the PE link, from the beginning of the first packet in the transaction to the end of the last packet in the transaction.

Data Throughput: The payload divided by response time, expressed in megabytes per second.

Note: Usually, the Number of Packets metric for a link transaction is two (in case of explicit acknowledge) or one (in case of implicit acknowledge). However if Naks/link level retries are involved, this metric might be higher. As a result, the Number of Packets metric is useful in highlighting unusual link transactions.

Metrics Defined for Split Transactions

The following types of metrics currently are defined for Split transactions:

Number of Link Transactions: The total number of Link transactions that compose this Split transaction.

Payload: The number of payload bytes this Split transaction transferred.

Response Time: The time it took to transmit this Split transaction on the PE link, from the beginning of the first packet in the Split transaction to the end of the last packet in the Split transaction;

Data Throughput: The transaction payload divided by response time, expressed in megabytes per second.

Latency Time: The time measured from the end of the request transaction to the first completion transmitted in response to the request within this Split transaction.

Note: The Number Of Link Transactions metric for a Split Transaction usually is two for a Configuration or IO request. It can be bigger then two for a Memory Read request.

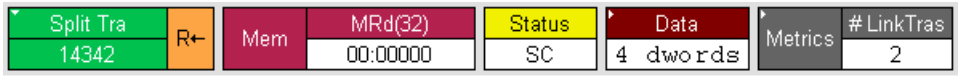
Show Metrics in the CATC Trace Display

In the CATC Trace view display of Link Transaction or Split Transaction levels, all metrics information applicable to a specific protocol unit is displayed in a Metrics header. The header is located close to the end of the unit, in front of the Time cell. You can expand and collapse the header to show or hide the metrics information.

Collapsed Metrics Header Display

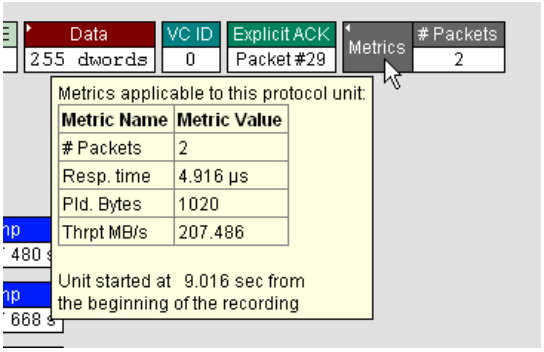
Following is a collapsed metrics display for a unit of Link Transaction. The collapsed header display shows only the metrics cell representing the Number of Packets.

Following is a collapsed metrics display for a unit of Split Transaction. The collapsed header display shows only the metrics cell representing Number of Link Transactions.



Metrics Tool Tip Display

In both CATC Trace level views, you can view the summary of all the unit metrics in the Metrics header tool tip. To view the tool tip, simply place the mouse cursor over the Metrics header. Following is the tool tip for a unit in the Link Transaction view.



Note: The tool tip also presents information for time passed from the start of the recording till the beginning of this Link or Split Transaction.

Expanded Metrics Header Display

When you expand the Metrics header, the display creates a separate cell for each applicable metric:

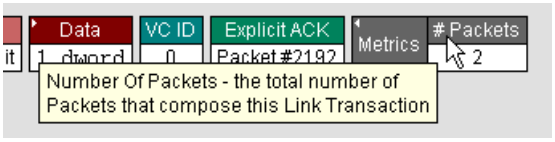
Following is the expanded Metric header for a unit in the Split Transaction view.

Metrics	# LinkTras	Resp. time	Latency	Thrpt MB/s	Pld. Bytes
	2	7.460 µs	6.736 µs	2.145	16

Following is the expanded Metric header for a unit in the Link Transaction view.

Metrics	# Packets	Resp. time	Pld. Bytes	Thrpt MB/s
	2	536.000 ns	64	119.403

Note: Each of the metric cells pops up a tool tip window with the explanation of what the metric means.

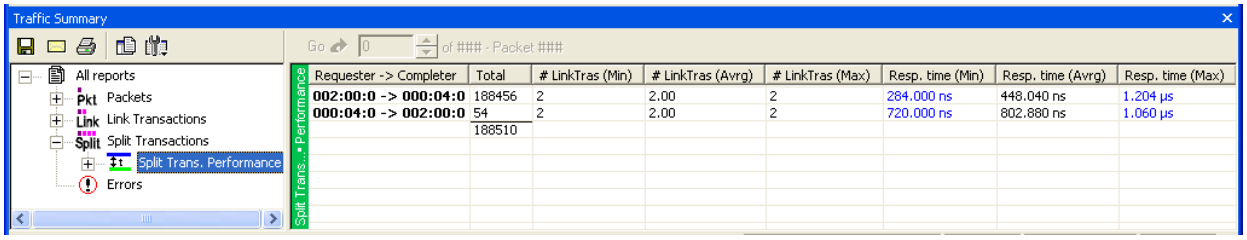


Show Metrics in the Traffic Summary Window

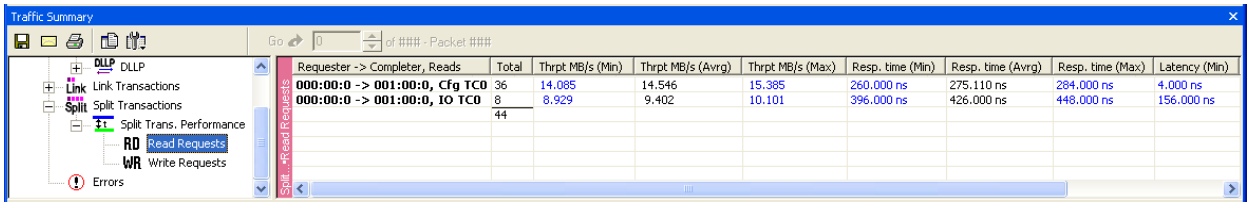
Some of the Traffic Summary reports at the Link and Split Transaction levels are based on metrics collected for the corresponding protocol units in the CATC Trace.

Reports at Split Transaction Level

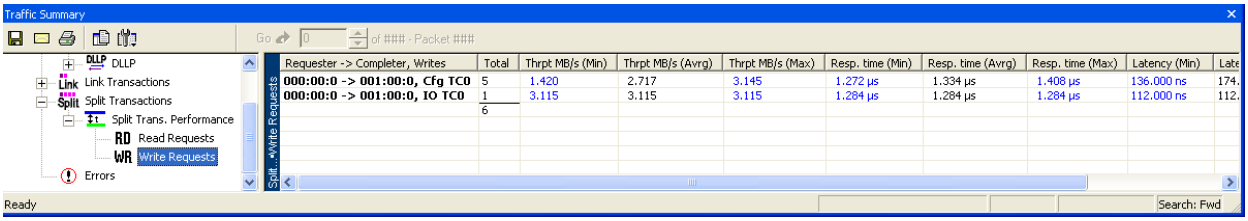
Split Transaction Performance: This report table groups the Split Transactions by Requester-Completer pair and displays Minimum/Average/Maximum data for Number Of Link Transactions and Response Time metrics.



Read Requests Performance: This report table includes only the Split Transactions that present Read Requests (Configuration, IO and Memory). It groups them by the combination of Requester-Completer pair, request type, and Traffic Class and displays Minimum/Average/Maximum data for Throughput, Response Time, and Latency metrics.



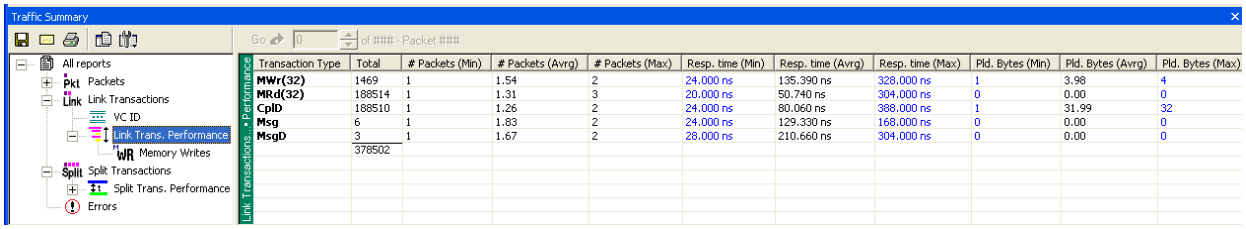
Write Requests Performance: This report table includes only the Split Transactions that present Write Requests (Configuration and IO). It groups them by the combination of Requester-Completer pair, request type, and Traffic Class and displays Minimum/Average/Maximum data for Throughput, Response Time, and Latency metrics.



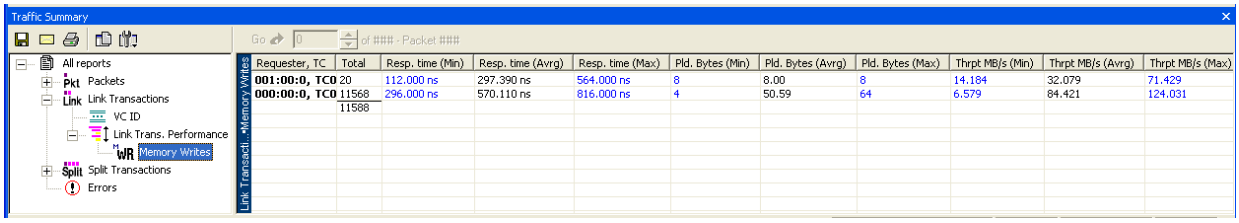
Reports at the Link Transaction Level

The following metric-based reports are displayed at the Link Transaction level:

Link Transaction Performance: This report table groups the Link Transactions by TLP Type and displays Minimum/Average/Maximum data for Number Of Packets, Response Time and Payload Bytes metrics.



Memory Writes: This report table includes only the Link Transactions that present Memory Write Requests. Memory Writes are the only (posted) requests that don't get promoted to the Split transaction level, therefore their performance should be viewed at the Link transaction level. The table groups Memory Writes by the combination of Requester ID and Traffic Class and displays Minimum/Average/Maximum data for Response Time, Payload and Throughput metrics.



Following features apply to all of the report tables described above for the Split Transaction and Link Transaction levels:

- Each report row for the defined tables contains the total number of units in this group for the CATC Trace (total number of units for Split Transaction performance, Read Requests performance, Memory Writes, and so on).
- In many cases, the Maximum and Minimum values in the report tables are navigable. By clicking table cells, you reposition the corresponding CATC Trace view to the Split or Link Transaction that has yielded this maximum or minimum

value. This can help you to find specific units in the CATC Trace, such as transactions that produced spikes in Response Time or Throughput.

Show Metrics in the Bus Utilization Window

The Bus Utilization window provides graphs for packet-level information in the CATC Trace. The window also provides graphs for information on Split and Link Transaction levels, plotted over time. The graphs for Split and Link Transaction levels are based on metrics collected for the transactions throughout the CATC Trace.

The seven graphs related to Split and Transaction levels are:

1. Pending Requests at Split Transaction level.
2. Response Time at Split Transaction level.
3. Latency Time at Split Transaction level.
4. Throughput Per Transaction at Split Transaction level.
5. Response Time and Latency Time at Split Transaction level (combined graph).
6. Response Time at Link Transaction level, for Memory Writes only.
7. Throughput at Link Transaction level, for Memory Writes only.

The following is an example of Bus Utilization window display of graph numbers 1, 4, 5, 6 and 7:

Unit-Based Averaging

The Analyzer builds metric graphs using unit-based averaging (as opposed to time-based averaging). For the total duration of a certain request (or Memory Write transaction), the graph value is assumed equal to the corresponding metric for this request (transaction). If there are overlapping operations for a certain time period, then the value is calculated as an average of metric values for all the overlapped requests (transactions).

It is important to remember that the Analyzer uses unit-based averaging rather than time-based averaging. Time-based averaging can be misleading in some situations. For example, consider the Throughput Per Transaction graph. Sometimes, while many outstanding requests are in progress, latency (and response time) grows for each of the transactions, resulting in a lower throughput per transaction over time (which is reflected in the graph). This happens even though aggregated throughput across all the transactions is constant.

Bus Utilization Window Features

For the seven Split- and Transaction-level graphs listed, all Bus Utilization window features are available, such as zooming in/out, changing scale type, scrolling, context-sensitive status, and graph synchronization. See Bus Utilization and Bus Utilization Buttons for more on these features.

Note: Clicking a certain place within a graph area repositions the CATC Trace display at the Link or Split transaction level to the transaction that was in progress at that time.

Split Transaction Level Graphs

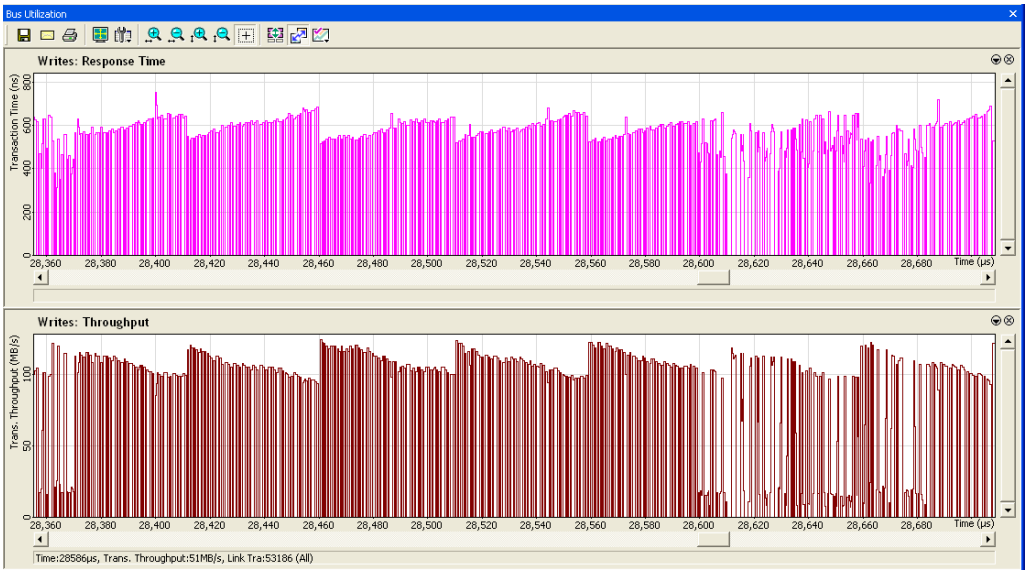
Transactions at the Split level combine all the non-posted requests with corresponding completions. This includes Configuration and IO Read and Write requests, as well as Memory Read requests.

The following shows the graphs for the Split level:

Note: The Pending Requests graph is not directly defined by metrics, but it is useful when considering metrics. The Pending Requests graph presents the unit-averaged number of requests that were pending (in progress) at any moment of time. It allows you to correlate the number of requests posted to a completer with other performance metrics.

Link Transaction Level Graphs

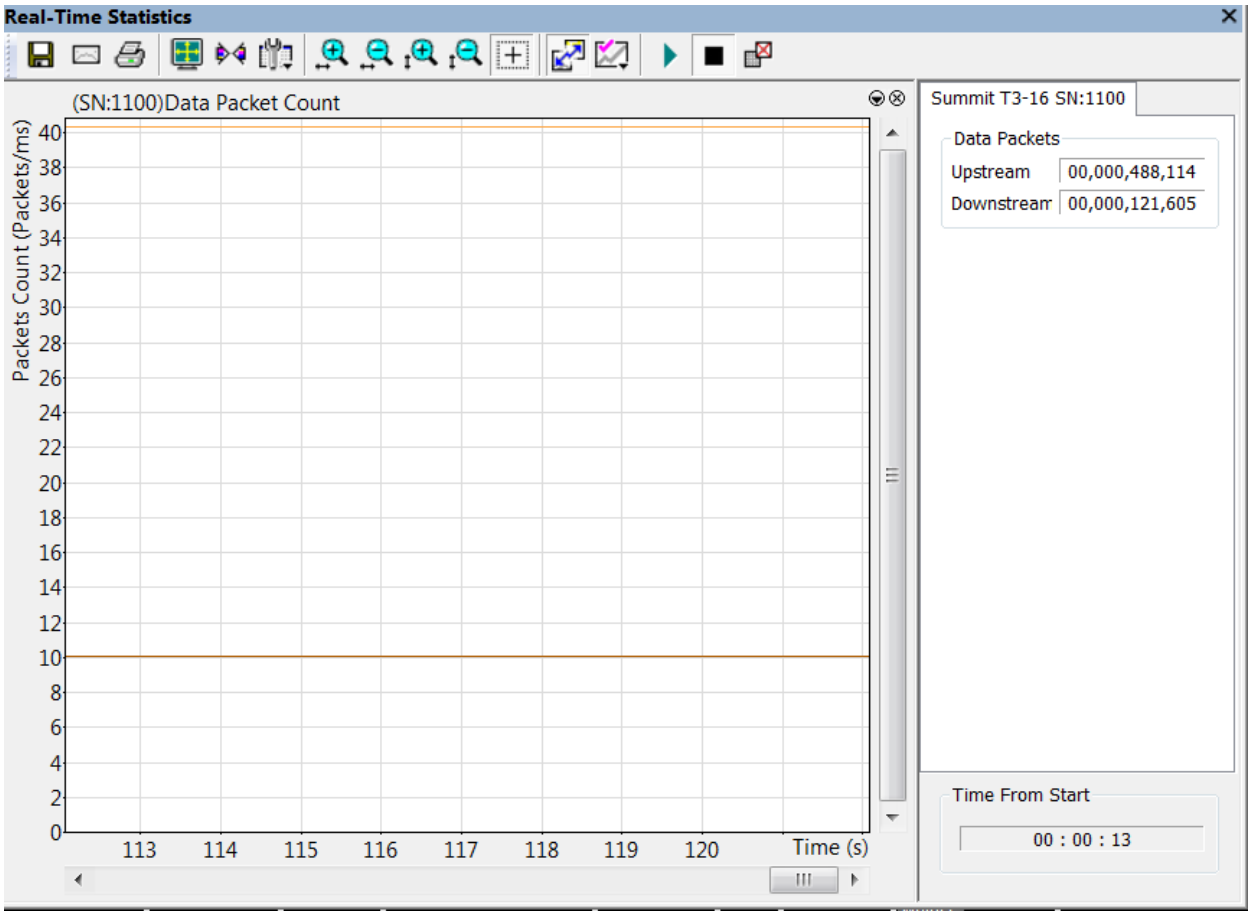
Memory Writes are the only (posted) requests that do not get promoted to the Split transaction level. Therefore, Memory Write performance should be viewed at the Link Transaction level. That is the reason graphs at the Link level only present the Memory Write-related metrics and are titled **Writes: Response Time:** and **Writes: Throughput**.



11.14 Real-Time Statistics Window

The Real-Time Statistics Window displays Link Utilization, performance measurements, and statistical values for a PCI Express link plotted in real time.

Click  to open the Real-Time Statistics window.



Start **PCI Express**™ link activity.

To start the monitor, press  .

To stop the monitor, press  .

The remaining Real-Time Statistics buttons provide options for changing the format of the display.

Additional formatting options are available through the Real-Time Statistics pop-up menu and the Real-Time Statistics toolbar.

Real-Time Statistics Buttons

Additional formatting options are available through the Real-Time Statistics toolbar.

Button	Function
	Save. Saves Real-Time Statistics data to bitmap file (*.bmp).
	Email. Opens an email and attaches a bitmap file of the Real-Time Statistics data.
	Print. Prints the Real-Time Statistics data.
	Full Screen. Maximizes the Real-Time Statistics window.
	View Settings. Opens a sub-menu with the following choices: • Orient Horizontally • Tile Vertically • Show Markers • Show Plumbline • Status >> Bar Tool tips None • Grid Lines >> Both Axes X Axis Y Axis No Grid • Grid on Top • Fonts & Colors
	Horizontal zoom in
	Horizontal zoom out

Vertical zoom in

Vertical zoom out

Click and Drag Zoom. Click and drag to zoom in on a part of the graph.

Synchronize Graph Areas. If two or more graphs are displayed, this button synchronizes the graphs to one another. Once synchronized, the positioning slider of one graph moves the other graphs.

Graph Areas. Allows you to hide or display the graphs and the counters. You can toggle Statistics Accumulation, Link Utilization, Data Payload Throughput, and Data Packet Count.

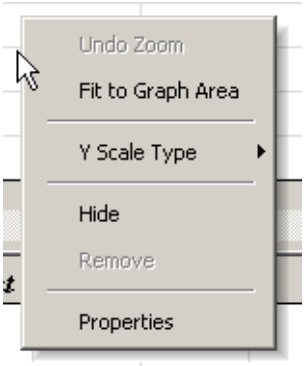
Start real-time statistics. Starts the real-time statistical monitor.

Stop real-time statistics. Stops the real-time statistical monitor.

Reset Graphs. Resets the graphs.

Real-Time Statistical Monitor Pop-up Menu

Additional formatting options are available through the Real-Time Statistics pop-up menu. Right-click a graph in the Real-Time Statistical Monitor window to display a pop-up menu with options for changing the format of the display.



Undo Zoom: If you have zoomed in, this command undoes the zoom.

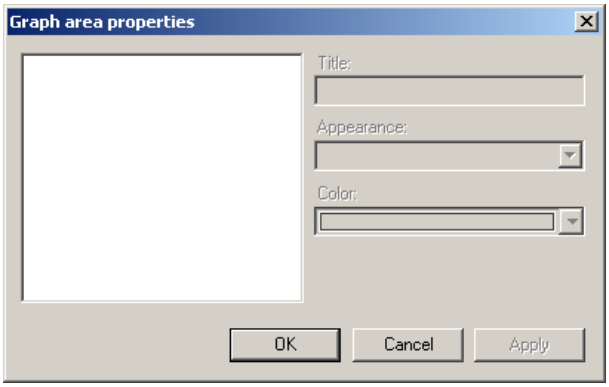
Fit to Graph Area: Redisplays graph so that the entire CATC Trace fits inside graph area.

Y Scale Type:

- **Linear**: Converts display to linear format.
- **Logarithmic**: Converts display to logarithmic format.

Hide: Hides the selected graph

Properties: Opens a dialog box with options for changing the Title, Appearance, and Color of the graph.



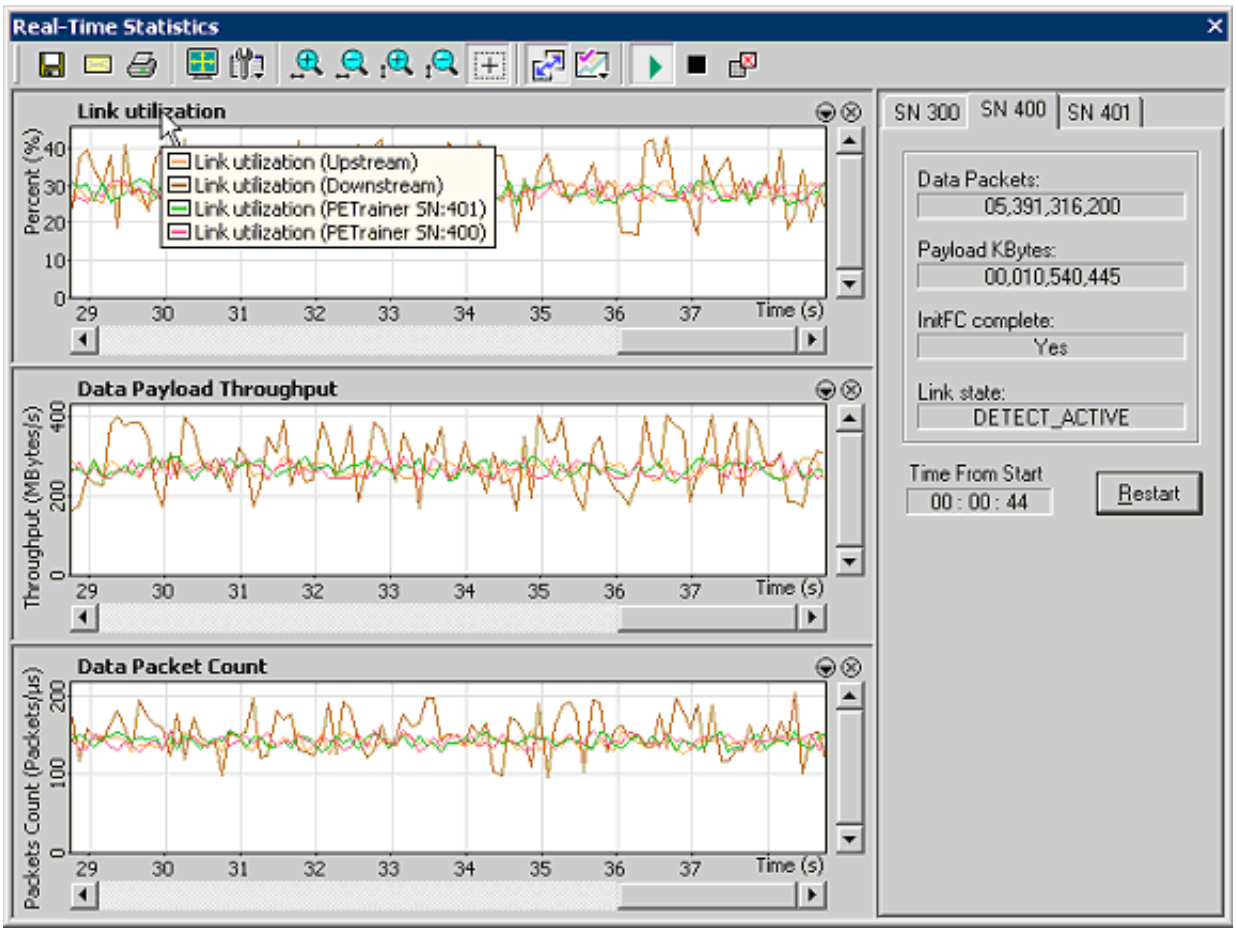
Real-Time Statistics Graph Areas

The Real-time Statistics window has three graph areas:

- Link Utilization
- Data Payload Throughput
- Data Packet Count

Each graph area has Upstream and Downstream graphs for a device (if connected to a host machine), plus as many graphs as Exerciser devices connected to the host machine.

The Statistics Accumulation area shows the PE*Tracer* statistics tab, plus as many tabs as Exerciser devices connected:

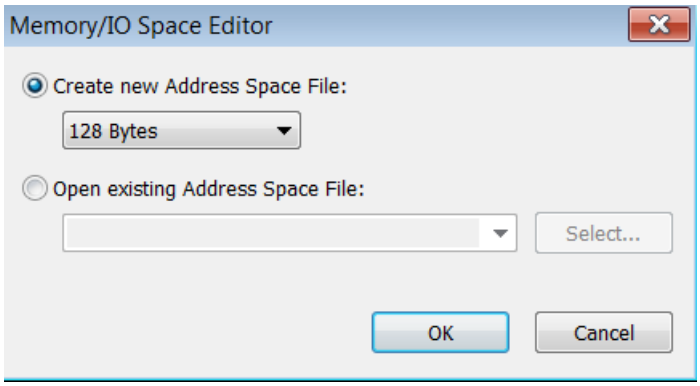


For each Exerciser device, the following information displayed:

- **Number of data packets**
- **Payload size**
- **InitFC complete status**: Yes/No
- **Link State**: Possible states are:
  - DETECT_QUIET
  - DETECT_ACTIVE
  - POLLING_ACTIVE
  - POLLING_CONFIG
  - CONFIG_LINKWIDTH_START
  - CONFIG_LINKWIDTH_ACCEPT
  - CONFIG_LANENUM_WAIT
  - CONFIG_LANENUM_ACCEPT
  - CONFIG_COMPLETE
  - CONFIG_IDLE
  - L0
  - L0S_IDLE
  - L0S_FTS
  - L1
  - RECOVERY_RCVRLOCK
  - RECOVERY_RCVRCFG
  - RECOVERY_IDLE
  - HOT_RESET
  - DISABLED

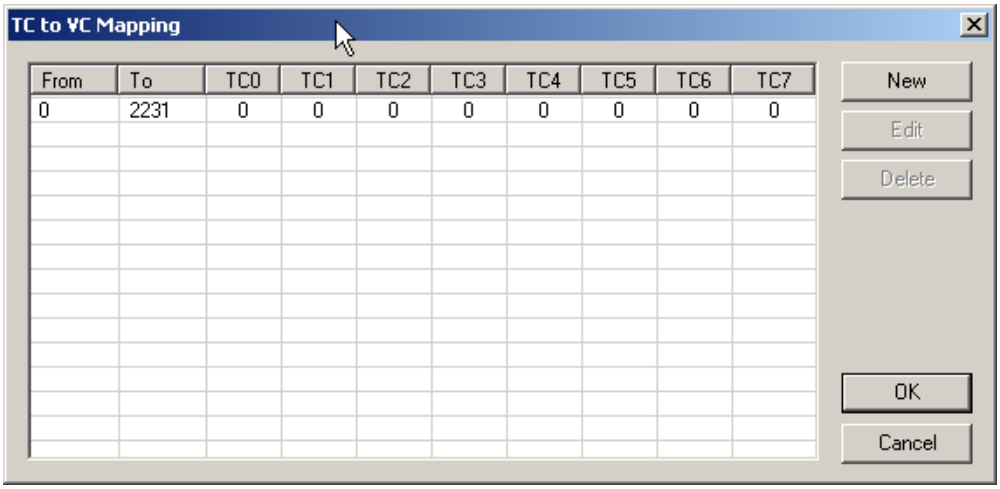
11.15 Memory I/O Space Editor

The Memory I/O Space Editor allows you to create a new Memory I/O Space file or open an existing Memory I/O Space file. It is used in conjunction with Teledyne LeCroy Trainer products. Select Tools > Memory I/O Space Editor to display the Memory Space Editor dialog.



11.16 TC to VC Mapping

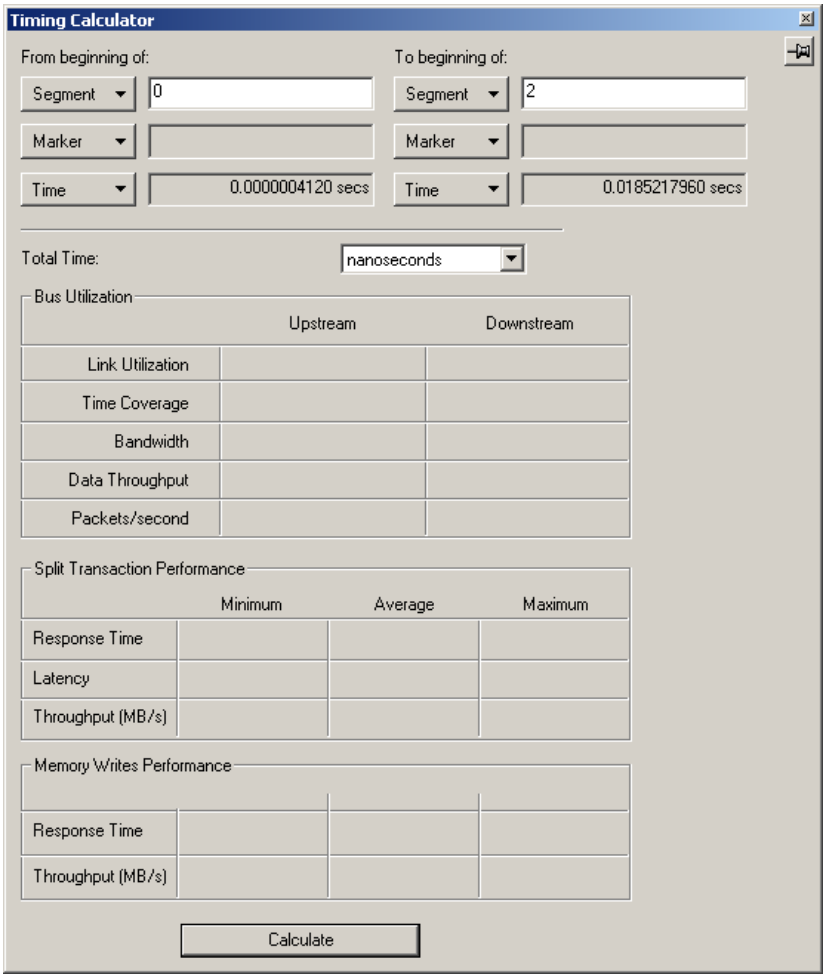
Select **Tools > TC to VC Mapping** displays how Traffic Classes are mapped to Virtual Channels (to simplify navigation) and how the CATC Trace display was changed (for example, in Split Transactions)..



11.17 Timing and Bus Usage Calculations

The Timing and Bus Usage Calculator allows you to calculate time between packets.

Select **Reports > Timing Calculations** to obtain the Timing Calculator dialog box.



Total Time: Total time from beginning of the first unit to beginning of the second unit.

Bus Utilization

This portion of the Timing Calculator window gives values that are cumulative for all packets during the timing period. For example, throughput is combined throughput of all packets during the timing period.

Upstream is from endpoint devices to the root complex. Downstream is from the root complex to endpoint devices.

Link Utilization: Percentage of non-idle symbols in total number of symbols transferred.

Time Coverage: Percentage of non-idle symbol times in total number of symbol times. (Non-idle symbol time occurs when at least on one of the lanes there were non-idle symbols transferred.)

Bandwidth: Number of non-idle symbol bits transferred per second.

Data Throughput: Number of TLP payload bytes transferred per second.

Packets/second: Number of packets transferred per second.

Split Transaction Performance

This portion of the Timing Calculator window gives minimum, maximum, and average values for all Split transactions during the timing period. For example, minimum throughput is throughput of the Split transaction that passes the least amount of data. Maximum throughput is throughput of the Split transaction that passes the most amount of data. Average throughput is the average calculated for all Split transactions during the timing period.

Response Time: The time it took to transmit this Split transaction on the PE link, from the beginning of the first packet in the Split transaction to the end of the last packet in the Split transaction.

Latency: The time measured from the end of the request transaction to the first completion transmitted in response to the request within this Split transaction.

Throughput: The transaction payload divided by response time, expressed in megabytes per second.

Memory Writes Performance

This portion of the Timing Calculator window gives minimum, maximum, and average values for all Memory Write transactions during the timing period. For example, minimum throughput is throughput of the Memory Write transaction that passes the least amount of data. Maximum throughput is throughput of the Memory Write transaction that passes the most amount of data. Average throughput is the average calculated for all Memory Write transactions during the timing period.

Response Time: The time it took to transmit this Memory Write on the PE link, from the beginning of the first packet in the Memory Write to the end of the last packet in the Memory Write.

Throughput: The Memory Write payload divided by response time, expressed in megabytes per second.

11.18 PCIe SSD Base Address Mapping

In order for NVMe, PQI, AHCI, ATA, SOP and SCSI decoding to work correctly, the PETracer software needs to know the Memory Base Address of the device. In cases when Base Address assignment is recorded in the trace, the software will determine all the values automatically. If the Base Address assignment is not present in the trace, you can specify the values manually using this dialog. You need to select the type of the device (NVMe, PQI, AHCI, ATA, SOP or SCSI) and set the value of the Base Address by selecting Tools > PCIe SSD Base Address Mapping. The PCIe SSD Configuration dialog displays (see figure on next page).

From software release 6.63 onwards, users are able to decode NVMe/PQI traces which are lacking configuration space and administration information, from release 6.70 this is applicable to AHCI traces, from release 7.00 this is applicable to ATA traces and from release 7.10 this is applicable to SOP and SCSI traces.
Follow the steps below to perform the applicable storage decoding:

Step 1 Record the trace for NVMe, PQI, AHCI, ATA, SOP or SCSI device boot and decode it. This saves the configuration space and administration information in .xml format, which is used to decode traces that do not include configuration and administration commands.

Step 2 Record the trace of the same NVMe/PQI, ATA SOP or SCSI device without rebooting and the application will decode it.

You can keep recording and decoding until rebooting. On reboot repeat steps 1 and 2 above.

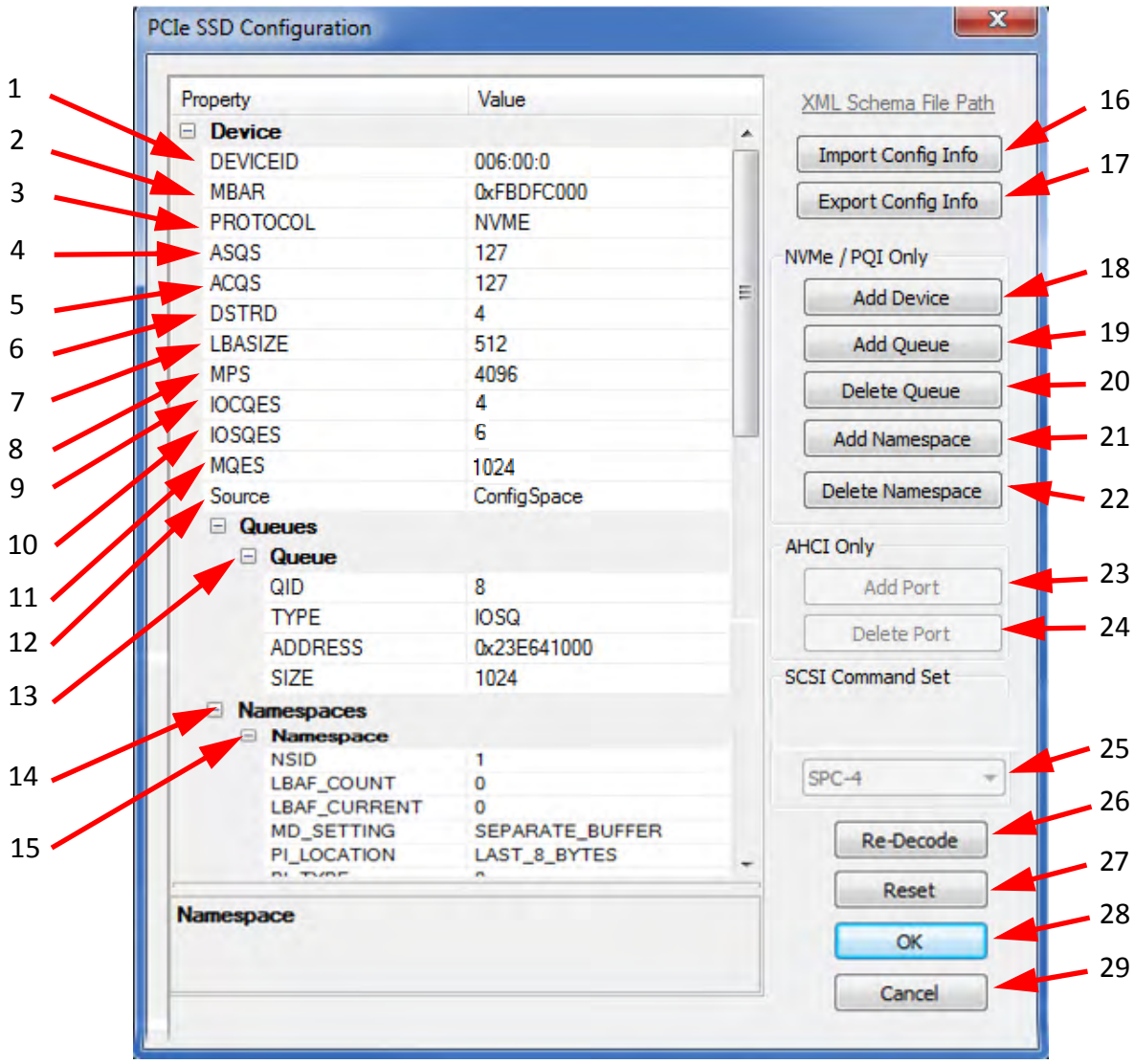
NVMe PCIe SSD Device Configuration

The PCIe SSD Configuration dialog is used to add missing information to decode the trace without the configuration space and queue administration information. See figure on page 225 for NVMe PCIe SSD Device Configuration.

Prior to decoding, if all the required information is available in Configuration Space then the Source field in the PCIe SSD Configuration will be set to "Config Space" (see figure on next page). The description for important fields and buttons are given below:

1. DEVICE ID: Represents the device ID in the bus/device/function address from the PCIe specification (ID Based routing).
2. MBAR: The MBAR field in this dialog is required and editable. Make sure that the information entered is correct. Click on any field and the description displays in the bottom read-only box. The 64-bit main address bar (i.e. BAR1:BAR0). Without this value decoding cannot be done. It should be in "0x" hex format.
3. PROTOCOL: The NVME protocol.
4. ASQS: Defines the size of the Admin Submission Queue in entries. Refer to the controller registers section of the NVMe specification. The minimum size of the Admin Submission Queue is two entries. The maximum size of the Admin Submission Queue is 4096 entries. This is a 0’s based value.
5. ACQS: Defines the size of the Admin Completion Queue in entries. Refer to the controller registers section of the NVMe specification. The minimum size of the Admin Completion Queue is two entries. The maximum size of the Admin Completion Queue is 4096 entries. This is a 0’s based value.

6. DSTRD: This register indicates the stride between doorbell registers. The stride is specified in bytes. This may be used to separate doorbells by a number of bytes in memory space. It may be useful in software emulation of an NVM Express controller. For hardware implementations of NVM Express, the expected doorbell stride value is 4.
7. LBASIZE: Size for Logical Block Addressing.
8. MPS: This field indicates the host memory page in bytes.
9. IOCQES: I/O Completion Queue Entry Size. This field defines the I/O Completion Queue entry size that is used for the selected I/O Command Set. The required and maximum values for this field are specified in the Identify Controller data structure for each I/O Command Set. The value is in bytes and is specified as a power of two (2^n).
10. IOSQES: I/O Submission Queue Entry Size. This field defines the I/O Submission Queue entry size that is used for the selected I/O Command Set. The required and maximum values for this field are specified in the Identify Controller data structure for each I/O Command Set. The value is in bytes and is specified as a power of two (2^n).
11. MQES: Maximum Queue Entries Supported. Defines the maximum individual queue size that the controller supports. This is a 0's based value. The minimum value is 1h, indicating two entries.
12. Source: Source of the data.
13. Queues: Under this node the user can add more missing nodes to decode the current trace. Click the Add Queue or Delete Queue button to add or delete a queue node. Type based on the user selection.
14. Namespaces node: A container for Namespaces configuration. Number of supported namespaces by a controller is defined in Identify Controller Data Structure, Number of Namespaces.
15. Namespace section: This entity is defined in NVMe specification and is used in several processes defined in the specification (e.g. data protection – DIF and DIX fields, command submissions, error detections). The section contains a set of fields described in the NVMe specification and the user should be familiar with it before modifying any values.
16. Import Config Info: Click to Import configuration information.
17. Export Config Info: Click to Export configuration information.
18. Add Device: Click to add device (NVMe/PQI only).
19. Add Queue: Click to add queue (NVMe/PQI only).
20. Delete Queue: Click to delete queue (NVMe/PQI only).
21. Add Namespace: Click to add a new namespace if this information is not present in a trace file (NVMe/PQI only).
22. Delete Namespace: Click to delete namespace (NVMe/PQI only).
23. Add Port: Click to add port (AHCI only).
24. Delete Port: Click to delete port (AHCI only).
25. SCSI Command Set: Select a Command Set from the drop-down list.
26. Re-Decode: Click to re-decode.
27. Reset: Click to reset.
28. OK: Click to accept the settings.
29. Cancel: Click to cancel the settings.



Click the  button to decode the trace and select **Tools > PCIe SSD Base Address Mapping** (see figure on next page).

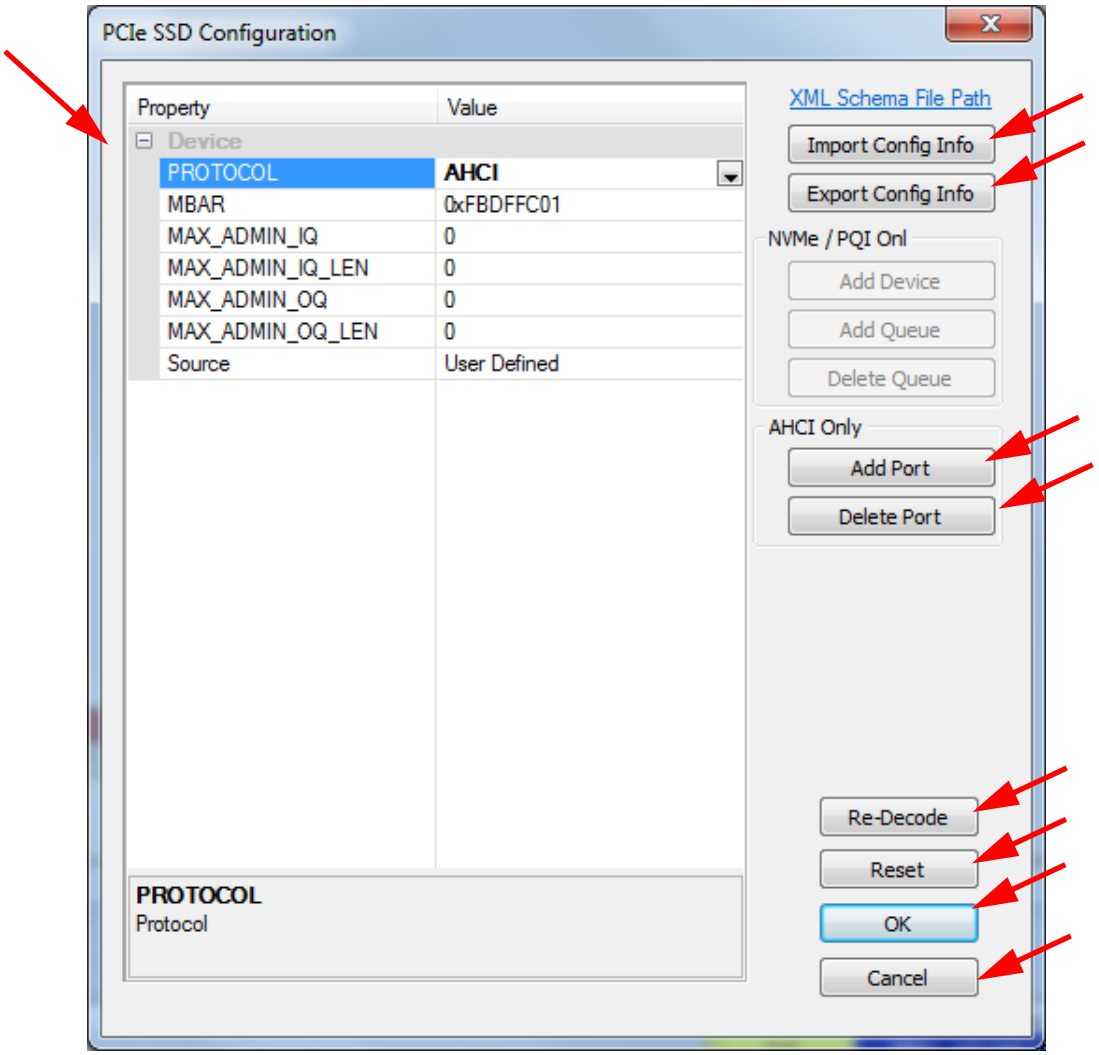
Note: When opening a trace file created with 7.0X or older versions of PETracer, these new fields are not present and the application tries to export the configuration information to XML before decoding NVMe transaction level. In this case a message box will show claiming that a value for this field is required.

Note: In case of problems when opening older traces try the following: a) Decode NVMe transaction level before exporting XML file. This will apply the default value for the new fields and export can be performed. b) Manually enter the values for the new fields. c) In case the trace contains submission entries which are not decoded, add a new Queue and set the corresponding address in the PCIe SSD Configuration dialog.

AHCI PCIe SSD Device Configuration

The PCIe SSD Configuration dialog is used to add missing information to decode the trace without the configuration space and queue administration information. See Figure 10.36 for AHCI PCIe SSD Device Configuration.

Prior to decoding if every thing is available in Configuration Space then Source equals Config Space.



The MBAR field in this dialog is required and editable. Make sure that the information entered is correct. Click on any field and the description displays in the bottom read-only box (see figure on page 231). Some important fields are described below:

- Device: There is only one device node, (support for multiple device trace decoding will be available in a later release). If there is no device node, then the user can add a device node by clicking the **Add Device** button.
    - MBAR: The 64-bit main address bar (i.e. BAR1:BAR0). Without this value decoding cannot be done. It should be in "0x" hex format.
- Ports: Under this node the user can add more missing nodes to decode the current trace. Click the **Add Port** or **Delete Port** button to add or delete a port node. Enter CLB, CLBU and FB, FBU address fields. The address is 32 bit and should be in "0x" hex format. Please use the right value for size as it is an important attribute. Consult the AHCI specifications for the correct value.

Clicking the **Re-Decode** button erases the current configuration from this dialog box and attempts to re-decode based on the information present in the open trace and/or saved on the disk with the last decode.

Click the **Import Config Info** button to import the configuration information as an .xml file, instead of adding it individually. Click the hyper-link **XML Schema File Path** to access the required format to generate the .xml file. This schema provides the detailed format for the imported file. All modern languages are equipped to generate an .xml file on a specific xml schema. The driver software accepts this schema and generates the ,xml file with all the required information.

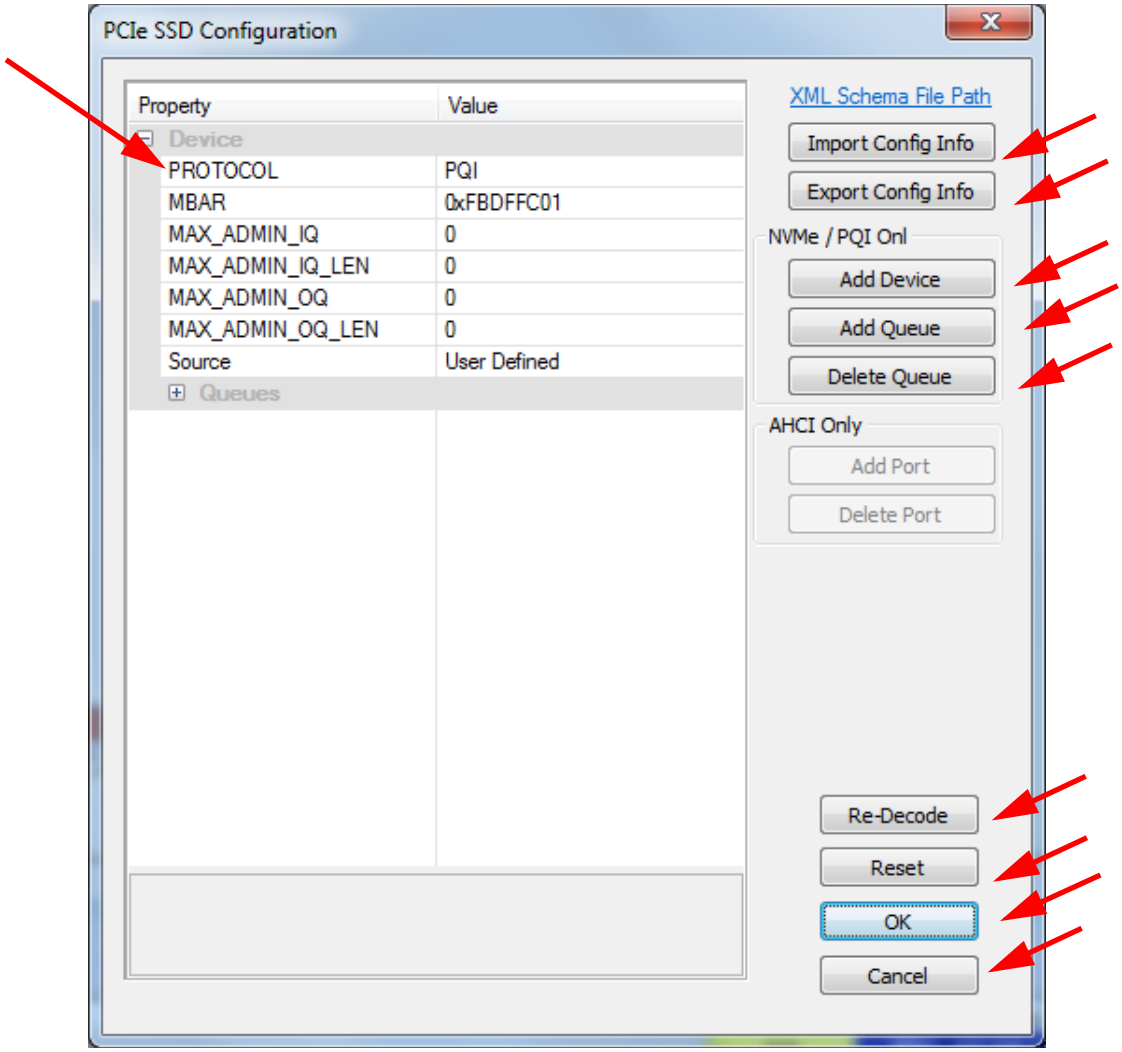
Click the **Export Config Info** button to export the configuration information as an .xml file.

Click the **Reset** button to reset the values to the original values. Press the **OK** button to save all the values.

PQI PCIe SSD Device Configuration

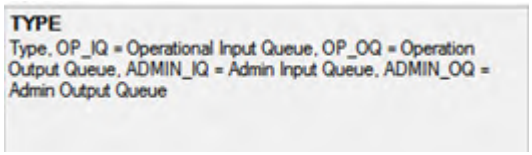
The PCIe SSD Configuration dialog is used to add missing information to decode the trace without the configuration space and queue administration information. See figure on next page for PQI PCIe SSD Device Configuration.

Prior to decoding if every thing is available in Configuration Space then Source equals Config Space (see figure on next page).



All the fields in this dialog are required and editable. Make sure that the information entered is correct. Click on any field and the description displays in the bottom read-only box (see figure on page 231). Some important fields are described below:

- **Device**: There is only one device node, (support for multiple device trace decod-ing will be available in a later release). If there is no device node, then the user can add a device node by clicking the Add Device button.
- **MBAR**: The 64-bit main address bar (i.e. BAR1:BAR0). Without this value decoding cannot be done. It should be in "0x" hex format.
- **Queues**: Under this node the user can add more missing nodes to decode the current trace. Click the Add Queue or Delete Queue button to add or delete a queue node. Type based on the user selection. The following Node types are known.



The address is 64-bit and should be in "0x" hex format. Please use the right value for each size as it is an important attribute. Consult the NVMe specifications for the correct value. Clicking the **Re-Decode** button erases the current configuration from this dialog box and attempts to re-decode based on the information present in the open trace and/or saved on the disk with the last decode.

Click 

button to decode the trace and select **Tools > PCIe SSD Base Address Mapping** (see figure on previous page).

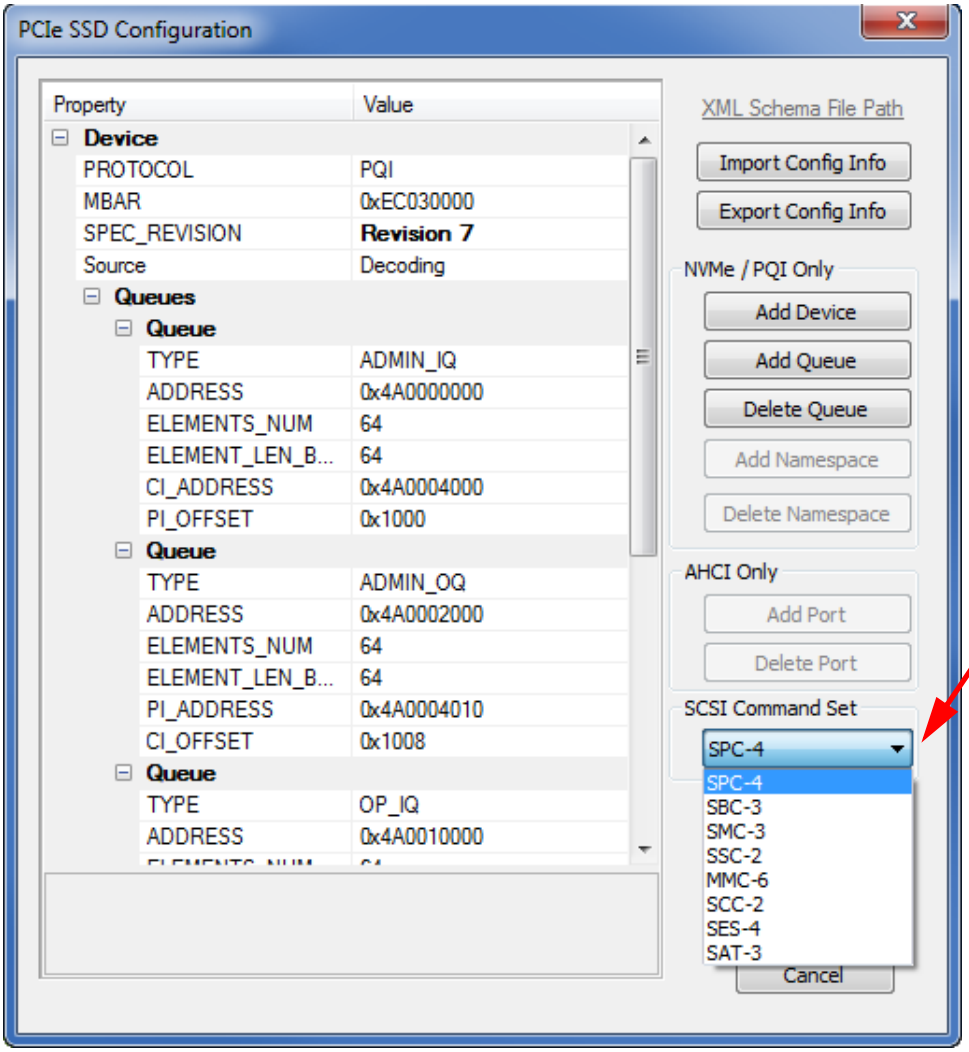
The two figures figure below show the BAR information for PQI and AHCI. If this information is present in the trace then it is not editable, otherwise it can be edited. Decoding is done only when configuration space and administration information is available.

Note: Only one device should be marked with the appropriate BAR, multiple BARs do not work.

SOP and SCSI PCIe SSD Device Configuration

The PCIe SSD Configuration dialog is used to add missing information to decode the trace without the configuration space and queue administration information. See figure on next page for SOP and SCSI PCIe SSD Device Configuration. T he base is the same as PQI Device Configuration but you can additionally choose the SCSI Command Set.

Prior to decoding if every thing is available in Configuration Space then Source equals Config Space (see figure on next page).



See“Example of XML File Format for SSD Decodes” on page 227 for a template of the XML files.

Example of XML File Format for SSD Decodes

<DEVICES XML_FORMAT_VERSION="1.0">

<DEVICE ENABLE="0x1" VENDORID="0" CLASSCODE="67586" GUID="{9C9654A1-B693-4F30-912F-125059814C42}" DEVICEID="000:00:0">

<BARS>

<MBAR ID="0" VALUE="0xF0000000"/>

<BAR ID="2" VALUE="0x00000000"/>

<BAR ID="3" VALUE="0x00000000"/>

<BAR ID="4" VALUE="0x00000000"/>

<BAR ID="5" VALUE="0x00000000"/>

</BARS>

<PROTOCOL ASQS="64" DSTRD="4" ACQS="16" LBASIZE="512" PROTOCOL="NVME" MPS="4096" ADDEDBY="DECODING"/>

<Queues>

<Queue SIZE="10" QID="2" TYPE="IOSQ" ADDRESS="0x11B210300" ADDEDBY="DECODING"/>

<Queue SIZE="10" QID="3" TYPE="IOSQ" ADDRESS="0x11B210340" ADDEDBY="DECODING"/>

<Queue SIZE="10" QID="5" TYPE="IOSQ" ADDRESS="0x11B210380" ADDEDBY="DECODING"/>

<Queue SIZE="10" QID="7" TYPE="IOSQ" ADDRESS="0x11B2103C0" ADDEDBY="DECODING"/>

<Queue SIZE="10" QID="9" TYPE="IOSQ" ADDRESS="0x11B210400" ADDEDBY="DECODING"/>

<Queue SIZE="10" QID="11" TYPE="IOSQ" ADDRESS="0x11B210E80" ADDEDBY="DECODING"/>

<Queue SIZE="10" QID="14" TYPE="IOSQ" ADDRESS="0x11B210E40" ADDEDBY="DECODING"/>

<Queue SIZE="10" QID="16" TYPE="IOSQ" ADDRESS="0x11B210E00" ADDEDBY="DECODING"/>

<Queue SIZE="10" QID="6" TYPE="IOSQ" ADDRESS="0x11B233040" ADDEDBY="DECODING"/>

<Queue SIZE="10" QID="8" TYPE="IOSQ" ADDRESS="0x11B233080" ADDEDBY="DECODING"/>

<Queue SIZE="10" QID="10" TYPE="IOSQ" ADDRESS="0x11B233B40" ADDEDBY="DECODING"/>

<Queue SIZE="10" QID="12" TYPE="IOSQ" ADDRESS="0x11B233B00" ADDEDBY="DECODING"/>

<Queue SIZE="10" QID="13" TYPE="IOSQ" ADDRESS="0x11B233AC0" ADDEDBY="DECODING"/>

<Queue SIZE="10" QID="15" TYPE="IOSQ" ADDRESS="0x11B233A80" ADDEDBY="DECODING"/>

<Queue SIZE="10" QID="17" TYPE="IOSQ" ADDRESS="0x11B233A40" ADDEDBY="DECODING"/>

<Queue SIZE="10" QID="1" TYPE="IOSQ" ADDRESS="0x11B25F080" ADDEDBY="DECODING"/>

<Queue SIZE="10" QID="4" TYPE="IOSQ" ADDRESS="0x11B28B040" ADDEDBY="DECODING"/>

<Queue SIZE="10" QID="3" TYPE="IOCQ" ADDRESS="0x11B2200C0" ADDEDBY="DECODING"/>

<Queue SIZE="10" QID="5" TYPE="IOCQ" ADDRESS="0x11B2200E0" ADDEDBY="DECODING"/>

<Queue SIZE="10" QID="7" TYPE="IOCQ" ADDRESS="0x11B2200F0" ADDEDBY="DECODING"/>

<Queue SIZE="10" QID="9" TYPE="IOCQ" ADDRESS="0x11B220100" ADDEDBY="DECODING"/>

<Queue SIZE="10" QID="11" TYPE="IOCQ" ADDRESS="0x11B2203A0" ADDEDBY="DECODING"/>

<Queue SIZE="10" QID="14" TYPE="IOCQ" ADDRESS="0x11B220390" ADDEDBY="DECODING"/>

<Queue SIZE="10" QID="16" TYPE="IOCQ" ADDRESS="0x11B220380" ADDEDBY="DECODING"/>

<Queue SIZE="10" QID="6" TYPE="IOCQ" ADDRESS="0x11B243010" ADDEDBY="DECODING"/>

<Queue SIZE="10" QID="8" TYPE="IOCQ" ADDRESS="0x11B243020" ADDEDBY="DECODING"/>

<Queue SIZE="10" QID="10" TYPE="IOCQ" ADDRESS="0x11B2432D0" ADDEDBY="DECODING"/>

<Queue SIZE="10" QID="12" TYPE="IOCQ" ADDRESS="0x11B2432C0" ADDEDBY="DECODING"/>

<Queue SIZE="10" QID="13" TYPE="IOCQ" ADDRESS="0x11B2432B0" ADDEDBY="DECODING"/>

<Queue SIZE="10" QID="15" TYPE="IOCQ" ADDRESS="0x11B2432A0" ADDEDBY="DECODING"/>

<Queue SIZE="10" QID="16" TYPE="IOCQ" ADDRESS="0x11B243290" ADDEDBY="DECODING"/>

<Queue SIZE="10" QID="1" TYPE="IOCQ" ADDRESS="0x11B26F020" ADDEDBY="DECODING"/>

<Queue SIZE="10" QID="2" TYPE="IOCQ" ADDRESS="0x11B26F030" ADDEDBY="DECODING"/>

<Queue SIZE="10" QID="4" TYPE="IOCQ" ADDRESS="0x11B29B010" ADDEDBY="DECODING"/>

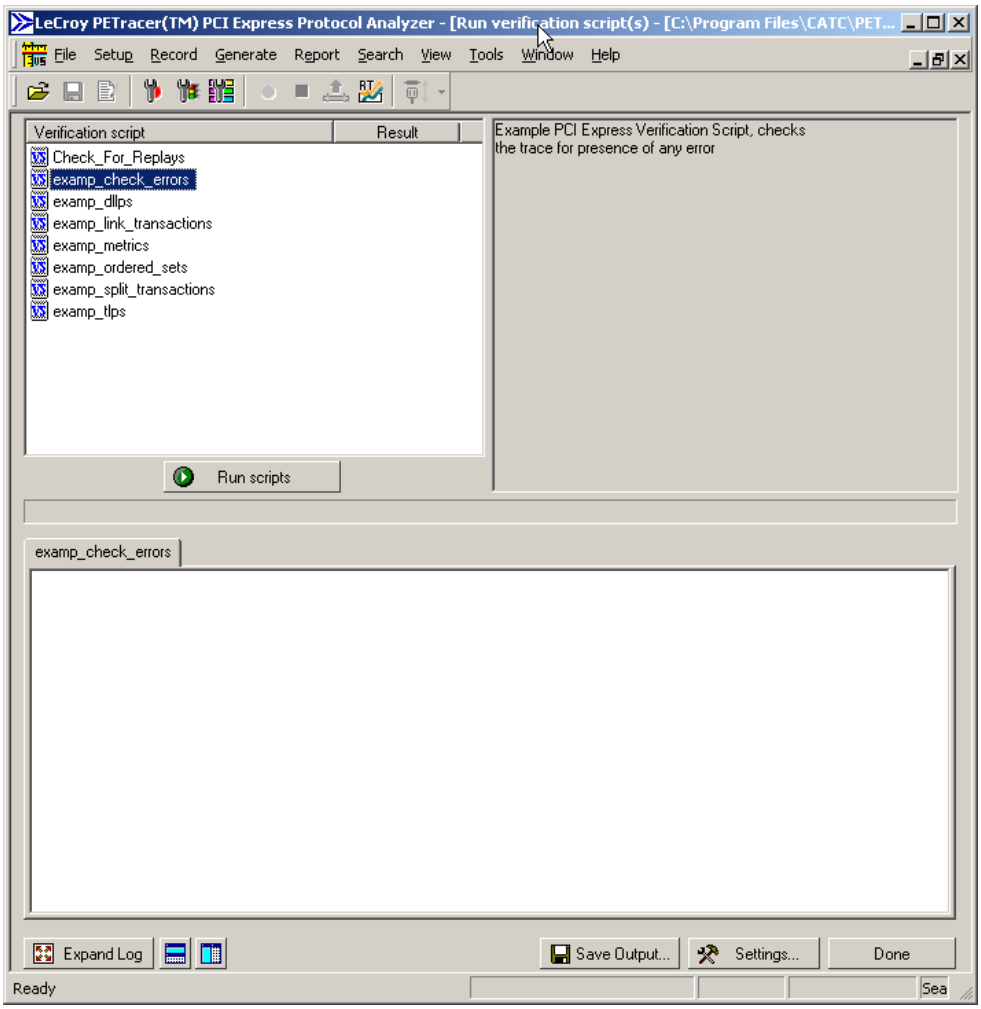
</Queues>
</DEVICE>
</DEVICES>

11.19 Running Verification Scripts

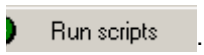
You can run verification scripts to check errors, link transactions, split transactions, metrics, ordered sets,replays, DLLPs, and TLPs.

To obtain the Verification Script dialog box, select **Tools > Run verification scripts**

or click the  icon.



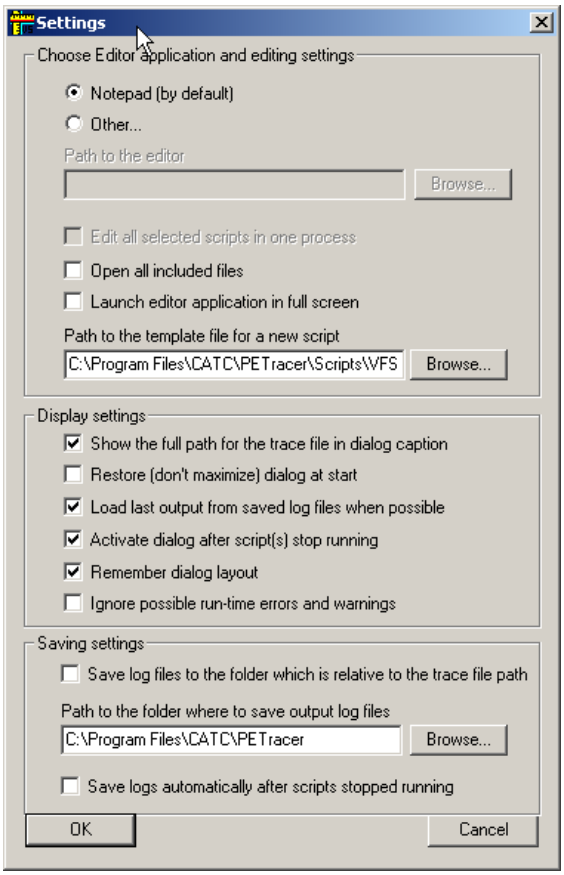
The available verification scripts are in the Verification script section.

To run a script, select it, then click the **Run Scripts** button 

.

The results appear in the bottom window. You can expand or collapse this window. You find a view related to the CATC Trace and place this window under or to the right of it. You can Save the results.

Click the **Settings** button to display the Settings window.



You can choose the editor, display settings, and saving settings.

Chapter 12: Updates and Licensing

12.1 Updating the Analyzer

BusEngine™ and/or Firmware updates are now automatic processes that run anytime a new version of the PE*Tracer*™ software is installed that is incompatible with the currently installed BusEngine or Firmware. The update process generates onscreen instructions.

If, however, you need to manually perform BusEngine or Firmware updates, follow these steps:

Step 1 Select **Setup > Update Device** … from the menu to display the Update Analyzer dialog box for **PE*Tracer* Summit™ and Summit T2-16™.**

Step 2 Select the appropriate file locations for the Firmware and/or BusEngine, using Browse, if necessary.

Step 3 Check the appropriate options (if in doubt, check all options).

Step 4 Click **Update** to initiate the updating of the Analyzer.

12.2 License Keys

A License Key is necessary to enable software maintenance. If you attempt to record with the Analyzer without an installed License Key, a message appears to indicate that a License Key is necessary in order to record traffic.

A License Key must be obtained from Teledyne LeCroy for each Analyzer.

After you obtain the License Key, follow these steps to install it:

Step 1 Select **Help > Update License**… from the menu bar. to display the Update License dialog box.

Step 2 Enter the **path** and **filename** for the License Key or use the Browse button to navigate to the directory that contains the License Key.

Step 3 Select the **.lic** file, and then click **Update Device**.

You can also update your licensing information by selecting **Setup > All Connected Devices** …, then clicking **Update License**.

12.3 License Information

You can view Licensing information for your Analyzer by selecting **Help > Display License Information**... from the menu bar. The License Information window displays data about the maintenance expiration and purchased features.

Appendix A: Configuration Space Decoding

The decoded capability structures in the Configuration Space Viewer and Editor are based on programmed definitions in the PE*Tracer* software and on Configuration Space Decode Scripts.

Configuration Space Decode Scripts are tools to define capability structures and instruct the Configuration Space Viewer or Editor how to decode them. These scripts are in the **\CfgSpaceScripts** sub-directory below the **\Scripts** directory in the application directory.

You can write Configuration Space Decode Scripts using the CATC Scripting Language (CSL). See the *Teledyne LeCroy Analyzers File Based Decoding Manual* for reference.

PCI Express Configuration Space Decode Scripts have the file extension **.pecfgdec**.

A.1 Mandatory Definitions

Configuration Space Decode Scripts must set the following reserved variables.

- **CapabilityName**: Name of the capability structure
- **CapabilityID**: ID of the capability structure
- **ExtAddSpace**: Set to 1 if Extended Configuration Space.
  Otherwise, set to 0 for PCI.

A.2 Mandatory Module Functions

Modules are collections of functions and data dedicated to decoding a specific capability structure. Each module has one primary Configuration Space Decode Script file (extension **.pecfgdec**) and optionally has include files (**.inc**).

A module function is an entry-point into a decoding module. To help display a capability structure, the application calls a module function.

The Configuration Space Editor and Viewer support only the **DecodeRegister(offset)** and **GetSize( )** functions.

DecodeRegister(offset)

The application calls this function while decoding a specific DWORD offset of the specified CapabilityID. The offset is the decoding entry point, where the decoding path starts.

The Configuration Space Editor calls this function to determine how to decode the assigned configuration space. The **offset** parameter is the DWORD to decode.
An offset of 0 indicates bytes 00h-03h, an offset of 1 indicates bytes 04h-07h, and so on.

Note: The Configuration Space Editor can only decode one DWORD at a time.

GetSize()

This function returns the size of the capability structure specified by CapabilityID.

A.3 Configuration Register Types

The following reserved variables are defined global constants.

- CFGREG_UNDEFINED
- CFGREG_HWINIT
- CFGREG_RO
- CFGREG_RW
- CFGREG_RW1C
- CFGREG_ROS
- CFGREG_RWS
- CFGREG_RW1CS
- CFGREG_RSVDP
- CFGREG_RSVDZ

Note: These reserved variables match the Configuration Register Types of Table 7-2 in Section 7.4 of the PCI Express Base Specification, Rev. 2.1.

A.4 Primitives

Decoding uses the following primitives.

GetRegisterField(dword_offset, bit_offset, field_length)

This function returns a register field of length **field_length**, starting at bit position **bit_offset** in DWORD **dword_offset**.

- **dword_offset**: DWORD offset of the register field location
- **bit_offset**: Bit offset of the register field location
- **field_length**: Length of the register field

For example, **GetRegisterField(1, 9, 2);** means: Go to DWORD 1, bit offset 9, and returns 2 bits.

AddField(field_name, field_length, configuration_reg_type, tooltip, encoding_table = NULL)

This function adds a register field to the Capability View and returns a pointer to the field, for adding subfields.

- **field_name**: Name of the register field to display in the Capability View
- **field_length**: Length of the register field
- **configuration_reg_type**: Configuration register type of the register field.
  Note: If subfields are defined, their configuration register types override this setting for their specified bits.
- **tooltip**: Tooltip displayed for the register field in the Capability View
- **encoding_table**: Optional. Displays encodings as lists for select values.
- For example, user input becomes a combo box for the field in the Field View.

As examples:
AddField("PCI Express Extended Capability ID", 16, CFGREG_RO, "");
means: Add the field "PCI Express Extended Capability ID" with length 16 and cfg register type CFGREG_RO.

capability_reg = AddField("Capability Register", 32, CFGREG_RW, "");
means: Added the field "Capability Register" with length 32 and cfg register type CFGREG_RW and stored a pointer to this field in variable capability_reg, which can be used to add subfields to this field.

AddSubField(parent_field, subfield_name, subfield_length, configuration_reg_type, tooltip, encoding_table = NULL);

This function adds a subfield to a register field in the Capability View. Subfields are modifiable and visible in the Field View and appear in the tooltips of register fields.

- **parent_field**: Pointer to a register field in the Capability View
- **subfield_name**: Name of the subfield, displayed in the Field View
- **subfield_length**: Length of the subfield
- **configuration_reg_type**: Configuration register type of the subfield field.
  Note: This overrides the configuration_reg_type of the parent field.
- **tooltip**: Tooltip displayed for the subfield in the Capability View
- **encoding_table**: Optional. Displays encodings as lists for select values.
- For example, user input becomes a combo box for the field in the Field View
  .

For example,
AddSubField(capability_reg, "Mode Supported", 4, CFGREG_RO, "Indicates the Function modes,"), ModeEncodings);
means: Add the subfield "Mode Supported" to the parent field "capability_reg" with length 4, type CFGREG_RO, a tooltip in the Capability View, and a combo box displaying "mode encodings" for input in the Field View.

A.5 Helper File

ConfigSpaceCommon.inc include file contains useful functions for script decoding.

Appendix B: China Restriction of Hazardous Substances Table

The following tables are supplied in compliance with China's Restriction of Hazardous Substances (China RoHS) requirements:

	有毒有害物质和元素					
部件名称	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr^{6+})	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
PCBAs	X	O	X	X	X	X
机械硬件	O	O	X	O	O	O
金属片	O	O	X	O	O	O
塑料部件	O	O	O	O	X	X
电源	X	X	X	O	X	X
电源线	X	O	X	O	X	X
保护外壳(如有)	O	O	O	O	X	X
电缆组件(如有)	X	O	X	O	X	X
风扇(如有)	X	O	X	O	X	X
交流滤波器和熔丝组件(如有)	X	O	X	O	O	O
外部电源(如有)	X	X	X	O	X	X
探头(如有)	X	O	X	O	X	X
O: 表明该有毒有害物质在该部件所有均质材料中的含量均在 SJ/T11363-2006 标准规定的限量要求之下。						
X: 表明该有毒有害物质至少在该部件的某一均质材料中的含量超过 SJ/T11363-2006 标准规定的限量要求。						

EFUP (对环境友好的使用时间) 使用条件：参阅本手册“规范”部分规定的环境条件。

	Toxic or Hazardous Substances and Elements					
Part Name	Lead (Pb)	Mercury (Hg)	Cadmium (Cd)	Hexavalent Chromium (Cr^{6+})	Polybrominated Biphenyls (PBB)	Polybrominated Diphenyl Ethers (PBDE)
PCBAs	X	O	X	X	X	X
Mechanical Hardware	O	O	X	O	O	O
Sheet Metal	O	O	X	O	O	O
Plastic Parts	O	O	O	O	X	X
Power Supply	X	X	X	O	X	X
Power Cord	X	O	X	O	X	X
Protective Case (if present)	O	O	O	O	X	X
Cable Assemblies (if present)	X	O	X	O	X	X
Fans (if present)	X	O	X	O	X	X
AC Filter/Fuse Assy (if present)	X	O	X	O	O	O
Ext Power Supply (if present)	X	X	X	O	X	X
Probes (if present)	X	O	X	O	X	X
O: Indicates that this toxic or hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement specified in SJ/T11363-2006.						
X: Indicates that this toxic or hazardous substance contained in at least one of the homogenous materials used for this part is above the limit requirement specified in SJ/T11363-2006.						

EFUP (Environmental Friendly Use Period) Use Conditions: refer to the environmental conditions stated in the specifications section of this Manual.

How to Contact Teledyne LeCroy

Type of Service	Contact	
Call for technical support…	US and Canada: Worldwide:	1 (800) 909-7112 1 (408) 653-1260
Fax your questions…	Worldwide:	1 (408) 727-6622
Write a letter…	Teledyne LeCroy Protocol Solutions Group Customer Support 3385 Scott Blvd. Santa Clara, CA 95054-3115 USA	
Send e-mail…	psgsupport@teledynelecroy.com	
Visit Teledyne LeCroy's web site…	teledynelecroy.com/	

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