



# Summit T28 PCI Express Multi-Lane Protocol Analyzer User Manual



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LeCroy Protocol Solutions Group  
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# Chapter 1

## Overview

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Designed for developers and validators, the LeCroy Summit T28™ is a Gen1/Gen2 PCI Express advanced verification system.

By leveraging years of experience in protocol analysis tools for emerging markets, Summit T28 blends sophisticated functionality with practical features to speed the development of PCI Express™ IP cores, semiconductors, bridges, switches, add-in boards, and systems.

### PETracer Analyzer Hardware and Software

#### Features and Benefits

Summit T28 Analyzer has 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.
Extensive Decoding	Complete, accurate and reliable decoding of TLPs (Transaction Layer Packets), DLLPs (Data Link Layer Packets), and all PCI Express Primitives.
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 and Split 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.
4 GB Recording Capacity, 2 GB in each direction	Capture long recording sessions for analysis and problem solving.
Flexible Host Interface	USB and GIGE.

Downloadable CATC Trace Viewer	Share and annotate CATC Trace recordings within a development team. Freely distributable <i>PETracer</i> software enables collaborative analysis across sites and time zones.
Bidirectional x1-x8, 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 LeCroy website.
Flexible probing options	Supports a variety of probing options including slot interposers, MidBus probes and speciality probes. Gen2 MidBus probe Gen2 multi-lead probe Gen2 active 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.

## CATC Trace Software

Summit T28 utilizes the CATC Trace™ to assist users in analyzing how PCI Express components work together, diagnose problems, and test for interoperability and standards compliance.

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

## Summit T28 Analyzer

The LeCroy Summit T28 is LeCroy's high performance PCI Express analyzer for customers in server, workstation, desktop, graphics, storage and network card markets.



Figure 1.1: Summit T28 Analyzer

With advanced features such as data rates from 2.5 to 5.0 GBps, lane widths from x1 to x8, and 4 GB of memory, the Summit T28 provides unmatched capability and flexibility for developers and users of advanced PCI Express products. The Summit T28 is the most advanced and sophisticated PCI Express Analyzer available in the market today.

As with other LeCroy PCI Express analyzers, the Summit T28 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.

In addition to a full suite of advanced hardware and software features, the Summit T28 has user-convenience and analysis features, such as support for automatic “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 T28 maps the lanes back into their correct order and accurately displays the embedded bus traffic. An optional BitTracer™ 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 Summit T28 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.
- ❑ **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.
- ❑ **BitTracer 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.
- ❑ **Automatic Lane Swizzling Support:** Allows board developers to lay out lanes in a non-standard order, simplifying board design.
- ❑ **Field-upgradeable Firmware and Engine:** Positions you to receive the latest *PETracer* enhancements and future additional capabilities. Allows field upgrades of all system types.
- ❑ **4-GB Data Buffer:** Capture long time windows for in-depth analysis and identification of erratic problems.
- ❑ **USB connectivity:** Allows connection by USB cable.
- ❑ **CrossSync Application:** The CrossSync application allows you to select analyzers for synchronization and manage the recording process.

## Other Documents

For more information, refer to the following documents:

- ❑ LeCroy Analyzers File-based Decoding Manual
- ❑ PETracer/Trainer Automation Manual
- ❑ PETracer VSE Manual
- ❑ CrossSync Control Panel User Manual

# Chapter 2

## Hardware Description

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The PCI Express™ system features Summit Analyzers.

### System Components

- ❑ Summit T28™ analyzer system
- ❑ DC Power Adaptor, 12 volts, and AC power cable
- ❑ USB cable
- ❑ PETracer Software program CD-ROM
- ❑ (optional) probes and interposers ([see “Interposers and Probes” on page 10](#))

### Host PC Requirements

The Summit T28 connects to a Host PC. Please consult the **readme** file on the installation CD for the latest PC requirements.

## Summit T28 Front Panel Description

When powered on, the Summit T28 activates the user-accessible controls and LEDs on the front panel.

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**WARNING:** Do not open the enclosure. There are no operator serviceable parts inside. Refer servicing to LeCroy.

---

The controls and LEDs are:

- ❑ **Power LED:** Lights when power is On.
- ❑ **Status LED:** Displays the connection status of the link.
- ❑ **Trigger LED:** Lights when Summit T28 triggers on an event.
- ❑ **Upstream [7:0] connector:** Connection to the probe for the capture of upstream direction of the link.
- ❑ **Speed LEDs:** Indicate speed setting the analyzer is using for Upstream direction.
- ❑ **Ref Clk In (Reference Clock In) connector:** Provides an optional alternative connection from an external reference clock source to the Summit T28 analyzer.  
**Note:** In standard configuration, the Summit T28 analyzer uses the reference clock from a probe cable from the interposer.
- ❑ **Downstream [7:0] connector:** Connection to the probe for the capture of downstream direction of the link.
- ❑ **Speed LEDs:** Indicate speed setting the analyzer is using for Downstream direction.

## Summit T28 Rear Panel Description

The Summit T28 rear panel contains:

- ❑ **Trigger In and Out connector:** Provide external trigger capabilities. You can configure Summit T28 to trigger external equipment using Trigger Out. You can use Trigger In to trigger the Analyzer from another device.
- ❑ **Sync In and Sync Out connector:** Allow multiple Summit T28 analyzers to send synchronization and control messages to one another
- ❑ **USB Type B Host Computer connector:** To connect the Analyzer to the Host PC using a USB connection.
- ❑ **DC IN connector:** 12 V, 5 A
- ❑ **Power Switch (black):** 1 = On and 0 = Off.

# Chapter 3

## Installation and Setup

---

The Summit T28™ is a standalone system.

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

### Installing the PETracer Software

PETracer software operates all of LeCroy's PCI Express protocol Analyzer and Exerciser products:

The PETracer software is installed on a Microsoft® Windows®-based PC and serves as the interface for the Exerciser and/or Analyzer.

To install the PETracer software on the Host PC:

1. Insert the CD into the CD-ROM drive of the PC that controls the Analyzer. The installation window opens and displays links to the PETracer software, user manuals, a readme file, and Acrobat Reader.
2. Select **Install Software** and follow the onscreen instructions.  
The PETracer software installs automatically on the PC hard disk. During installation, all necessary drivers are loaded automatically.
3. To start the application, launch the PETracer program from the Start menu:  
**Start > Programs > LeCroy > PETracer > LeCroy PETracer**

The *PETracer* program opens

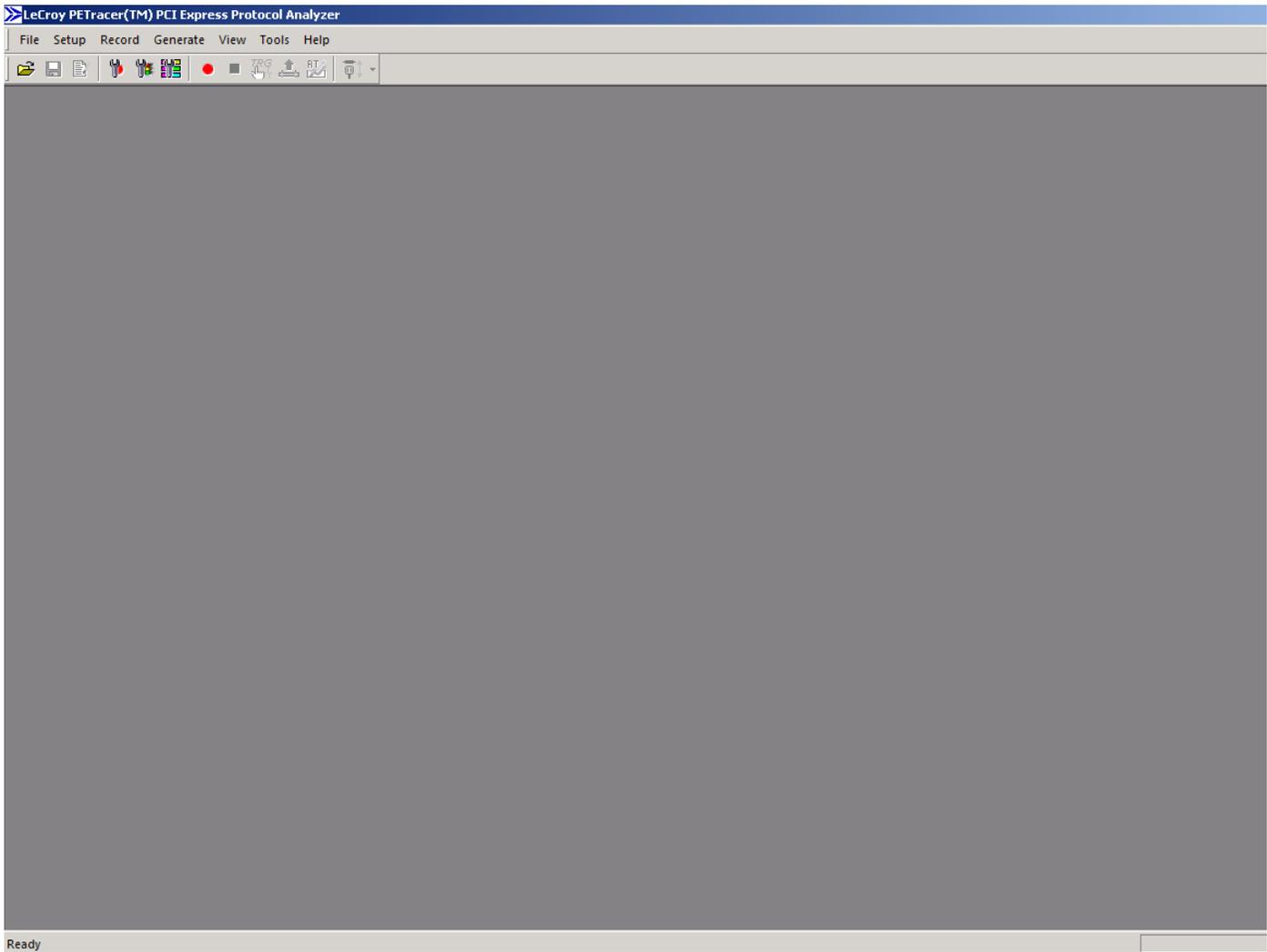


Figure 3.2: LeCroy *PETracer* Application

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

---

## Setting Up the Summit T28 Analyzer using a USB Connection

To set up the Analyzer using a USB connection:

1. Connect the Analyzer to a 100-volt to 240-volt, 50 Hz to 60 Hz, 120 W power outlet using the provided power cord.
2. Connect the USB port to a USB port on the PC using a USB cable.
3. Turn on the front power switch.

---

**Note:** At power-on, the Analyzer initializes and performs a self-diagnosis. The results are reflected by messages on the Summit T28 LCD display. If the LCD display indicates failure, call LeCroy Customer Support for assistance.

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4. Follow the Microsoft® Windows® on-screen Plug-and-Play instructions for the automatic installation of the Analyzer as a USB device on your analyzing PC. (The required USB drivers are installed on your system by the *PETracer* software installation.)

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 PC.

## Interposers and Probes

The Summit T28 works with Interposers and Probes. Some of them are listed below.

- ❑ **Gen2 MidBus Probe:** The Gen2 MidBus Probe is designed for use with the Summit T28 Analyzer and supports lane widths from x1 to x8 at data rates of 2.5 GT/s (Gen1) or 5.0 GT/s (Gen2).
- ❑ **Gen2 Multi-lead Probe:** The Gen2 Multi-lead Probe is designed for use with the Summit T28 Protocol Analyzer. The probe consists of 1 to 2 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). Each probe pod supports up to 8 Flex Tips, with each Flex Tip connected via two coax cables.
- ❑ **Gen2 Active Slot Interposer:** The Gen2 Active Slot Interposer is designed for use with the Summit T28 Analyzer and supports lane widths from x1 to x8 at data rates of 2.5 GT/s (Gen1) or 5.0 GT/s (Gen2). For lane widths up to x8, one iPass Y-cable is required.

Please refer to the *Interposers and Probes for LeCroy PCI Express Systems datasheet* at [www.LeCroy.com](http://www.LeCroy.com) for a comprehensive list.

The following sections describe how to set up probe systems.

## Using Interposers

### Gen2 Active Interposer.

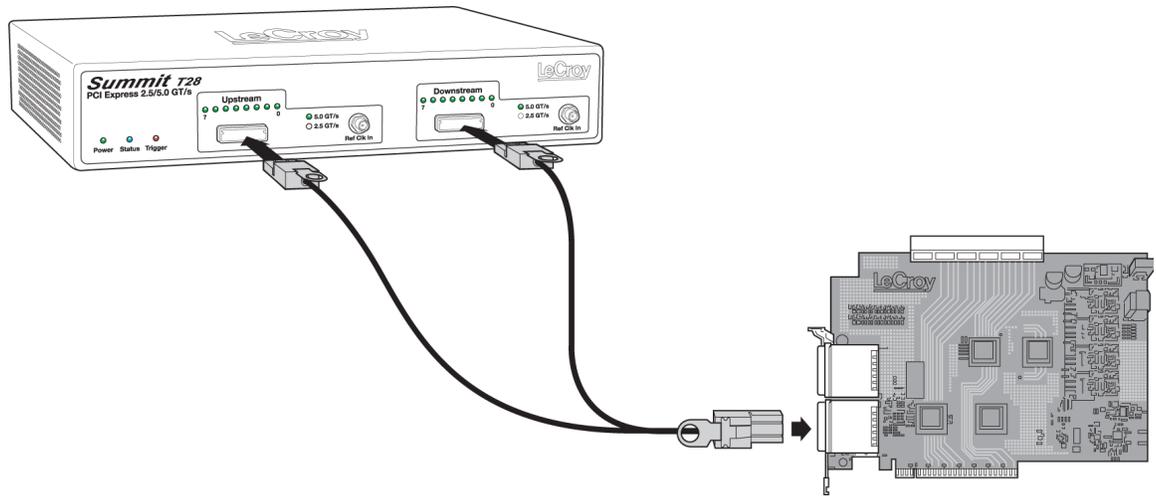


Figure 3.3: Connecting the Summit T28 Analyzer to the Device Under Test Using a Gen2 Active Interposer

### Summit T28 Components

Summit T28 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).
- ❑ **Summit T28 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 PCIe female connector that accepts a x16 PCI Express device, and two Interposer cable connectors that connect the Interposer to the Analyzer.

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

---

## Installing the Gen2 Active Interposer

To install the Interposer, perform the following steps.

1. Insert the gold male connector on the Interposer probe into a x16 PCI Express slot in the motherboard. Use edge adaptors for x1, x4, and x8 slots.
2. Insert the PCI Express DUT into the Interposer's PCIe female device connector.
3. The slot Interposer is shipped from LeCroy with a metal face plate for attachment to a PC case. If you are working with a motherboard that is not in a PC case, you may prefer to remove the metal face plate so the Interposer can sit flat with the motherboard. To remove the face plate, unscrew the two screws that hold it onto the Interposer

## Connecting the Probe Data Cable

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.

## Power On Analyzer and then DUT

1. Power on the Summit T28 Analyzer.
2. Power on the DUT.
3. Open the *PETracer* software on the PC host system. The Analyzer is now ready for PCI Express traffic recording.

## Using Probes

### Example: Connecting the Summit T28 Analyzer to the Device Under Test Using a Gen2 MidBus Probe

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**Note:** Mid-bus probes require attachment-pad and reference-clock connections. For information about how to connect the attachment pad, reference clock, and cables in your system, see the *MidBus Probe Manual*.

---

#### Components

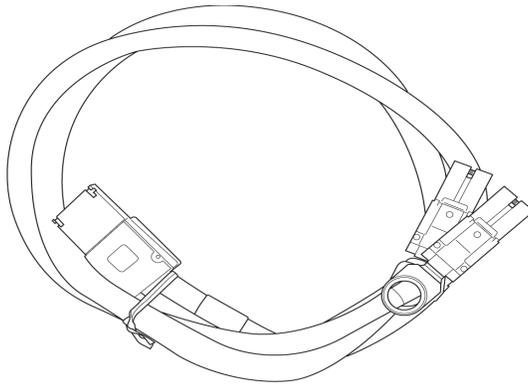


Figure 3.4: iPass Y-cable

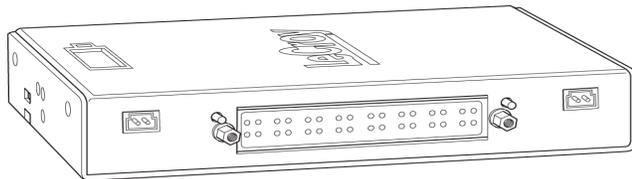


Figure 3.5: MidBus Probe pod

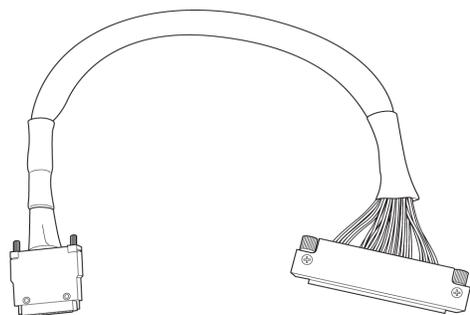


Figure 3.6: MidBus Probe Cable, Attachment Pad, and Header

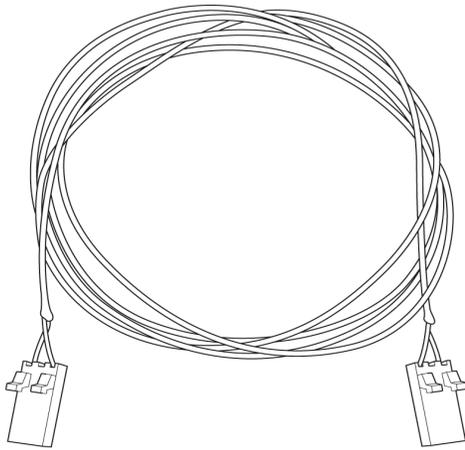


Figure 3.7: Clock Cable

### Connections Overview for Gen2 MidBus Probe

Use a 1-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.

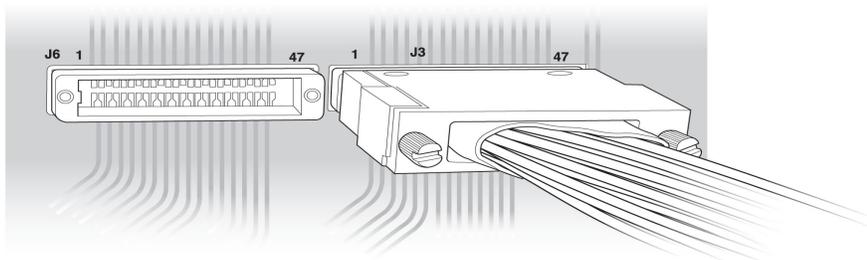


Figure 3.8: Connect MidBus Probe to MidBus Footprint

### Connection Procedure

To connect the Summit T28 to the system under test (host platform/root complex):

1. Connect the MidBus pods to the Analyzer using the iPass Y-cables.
2. Connect the MidBus probe assemblies to the MidBus pods.
3. Connect the MidBus probe assemblies to the MidBus footprints on the system under test.
4. Connect external reference clock signal to Mid-Bus External Clock In on Mid-Bus probe pod, using external reference clock cable.

## Example: Connecting the Summit T28 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 “iPass Y-cable” on page 13).
- ❑ 1 Multi-lead Probe Pod for x1 and x4

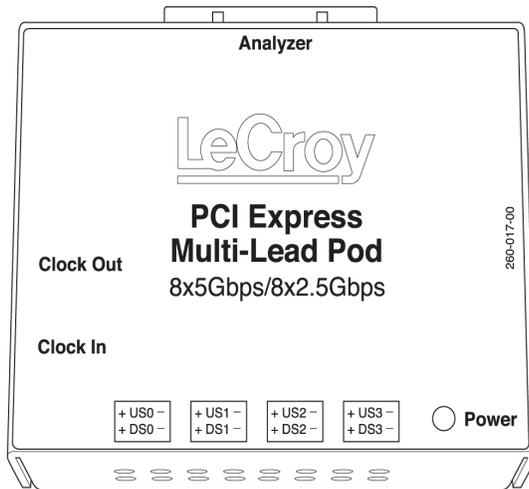


Figure 3.9: Multi-Lead Probe Pod

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



Figure 3.10: Midbus Probe SSMP Cables

- ❑ **1 Clock Cable** (see Figure 3.7 on page 14).

### Connections for Gen2 Multi-lead Probe

#### Overview

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 T28 to the system under test (host platform/root complex):

1. Connect the pods to the Analyzer using the iPass Y-cable cables.
2. Connect the flexible lead tips to the pods using the SSMP cables.
3. Connect the lead tips to the system under test by soldering to the trace.

## Example: Connecting the Summit T28 Analyzer to the Device Under Test Using a Gen2 Multi-lead Probe for x8

### Components

- ❑ 2 iPass Straight cables for x8

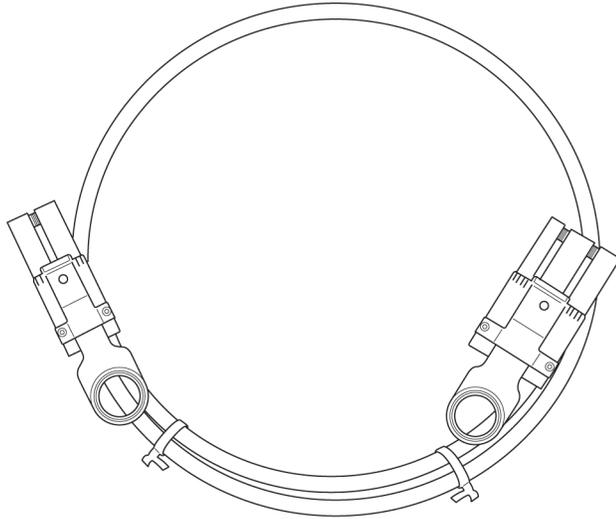


Figure 3.11: iPass Straight Cables

- ❑ 2 Multi-lead Probe pods for x8  
(See “1 Multi-lead Probe Pod for x1 and x4” on page 15).
- ❑ Up to 16 MidBus Probe SSMP Cables, and up to 8 Flexible Leads, per pod.  
(See Figure 3.9 on page 15).
- ❑ 1 Clock Cable (see Figure 3.6 on page 13).

### Connections Overview for Gen2 Multi-lead Probe

Use a 1-pod setup.

For x8, use the straight iPass 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 T28 to the system under test (host platform/root complex):

1. Connect the pods to the Analyzer using the straight iPass cables.
2. Connect the flexible lead tips to the pods using the SSMP cables.
3. Connect the lead tips to the system under test by soldering to the trace.



# Chapter 4

## Software Overview

### The PETracer Software

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

The software runs on a Windows® based PC that is attached to the Analyzer via a USB 2.0 connection (USB 1.0 is also supported). PETracer software can be used without the Analyzer as a CATC Trace viewer for viewing, analyzing and printing traces.

The PETracer software operates in Microsoft® Windows® XP, Vista, and 7 environments.

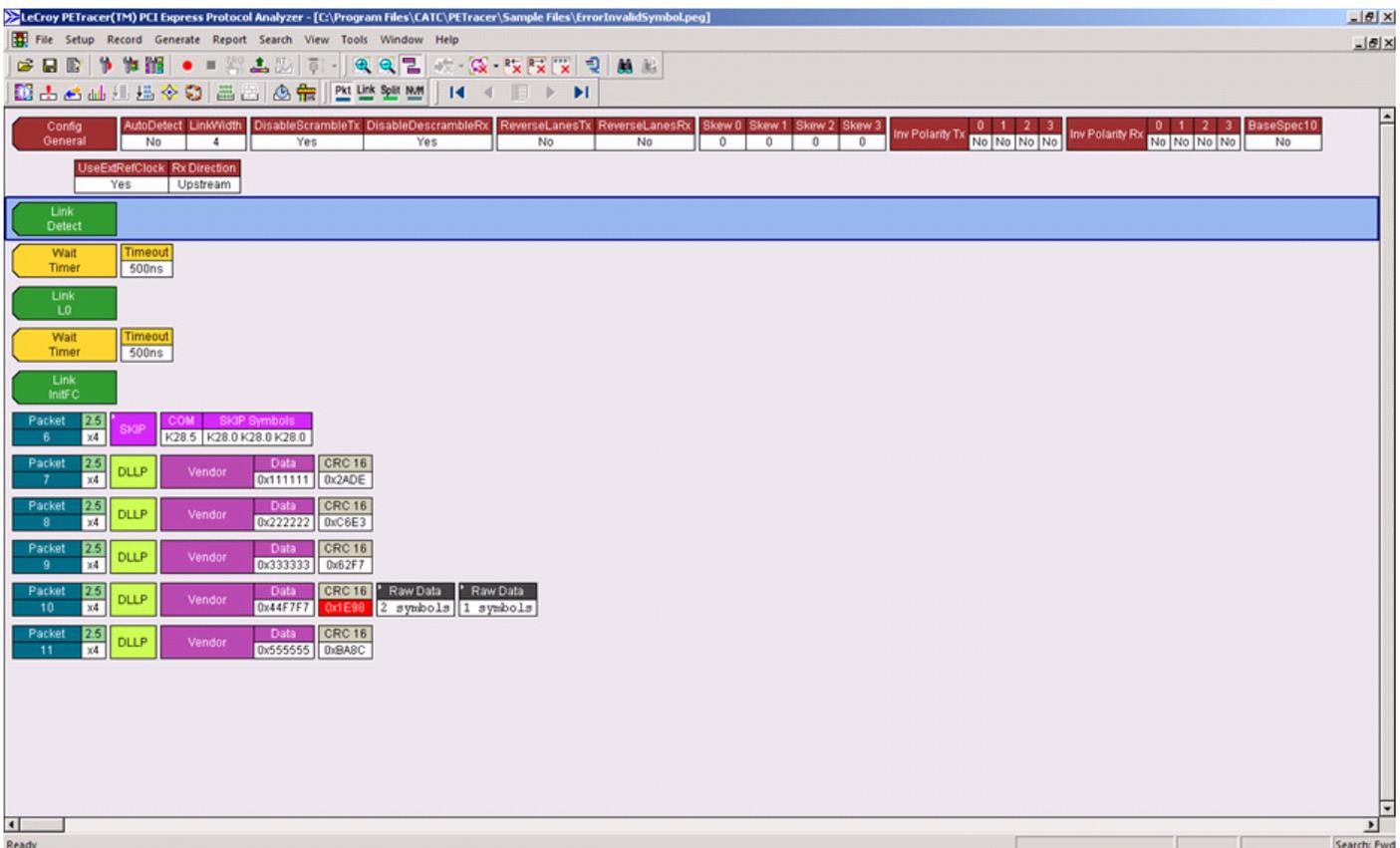


Figure 4.1: Sample of a CATC Trace

## Application Layout

The *PETracer* 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.

## Using the Toolbar

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

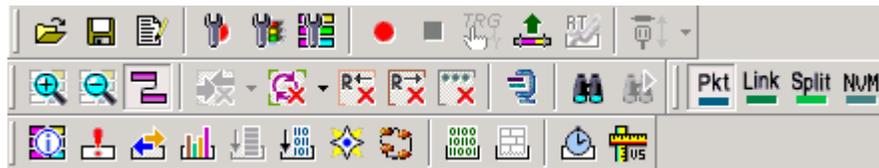


Figure 4.2: Summit T3 Toolbar

	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.		Setup Display Options Opens the Display Options dialog.
	Setup Generation Options Opens the Generation Options dialog.		

	Start 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 PC.
	Stop Recording.		Real Time Statistics monitor Opens a window that displays real-time information.
	Manual Trigger Click on this icon or press F5 to trigger manually.		Disconnect/Connect Link. Click once to break and momentarily later restore link. Open menu to select either Connect or Disconnect.

	Zoom in display.		Wraps display information.
	Zoom out display.		

	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.

	<p><b>Find</b> Opens a dialog box that allows you to select one or more items to find in the recording, then searches to that point.</p>		<p><b>Find Next.</b> Repeats last Find or Search action.</p>
---	--	---	--

	<p><b>View Packet Level data.</b></p>		<p><b>View Split Transaction Level data</b></p>
	<p><b>View Link Transaction Level data.</b></p>		<p><b>View NVM Transaction Level data</b></p>

	<p><b>File Information</b> Lists the conditions under which the recording was made.</p>		<p><b>Bus Utilization</b> Opens a window that graphically represents various information about the recording.</p>
	<p><b>Error Report</b> Opens a window that lists all errors identified in the recording.</p>		<p><b>Link Tracker</b> Opens a window that displays symbol information per lane.</p>
	<p><b>Traffic Summary</b> Opens a window that lists all events that occurred during the recording</p>		<p><b>Opens the Data Flow window.</b> Shows recorded data in a compressed tabular format.</p>
	<p><b>Navigator.</b> Shows/hides the Navigator bar - a utility that lets you easily navigate the CATC Trace.</p>		<p><b>LTSSM Flow Graph</b> Shows a state diagram of the Link Training and Status State machine.</p>

	<p><b>Displays the Data/Payload window for the current packet.</b></p>		<p><b>Displays the Packet Header bar.</b> Opens a window that displays the header information in the current packet, as it would be viewed in the specification.</p>
	<p><b>Opens the Timing and Bus Usage Calculations window.</b></p>		<p><b>Running Verification Scripts</b> Opens a dialog that allows you to select and run verification scripts.</p>

## Multi-Segment Toolbar

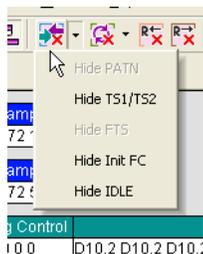
	First Segment. Open first segment in the multisegment CATC Trace.		Index file. This button becomes active if a multisegment CATC Trace file is open and displays the index file for the recording.
	Previous segment. Open previous segment in the multisegment CATC Trace.		Next Segment. Open next segment in multisegment CATC Trace.
			Last segment. Open last segment in multisegment CATC Trace.

## Toolbar Hide Buttons

The PETracer 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, Hide EDS and Update FC:** Brings up a drop-down menu that lets you hide SKIP, Update FC and hide EDS 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.

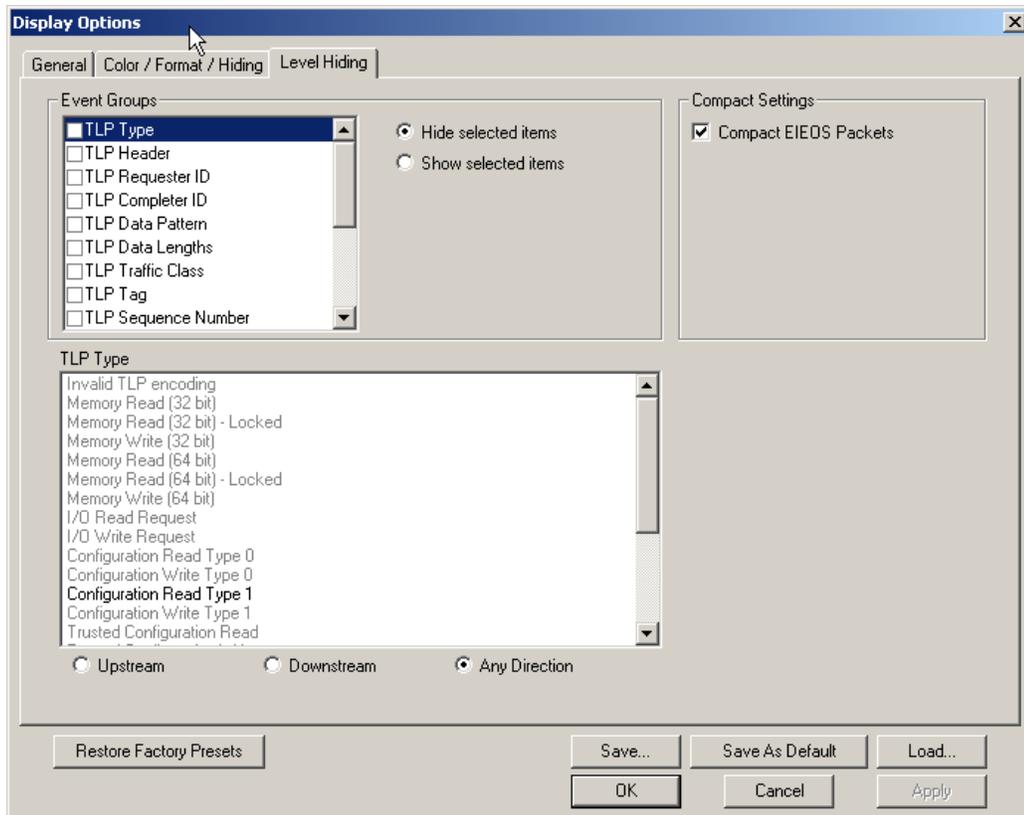


Figure 4.3: Display Options

## Using the Menus

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

File   Setup   Record   Generate   Report   Search   View   Tools   Window   Help

### File Menu

New PETrainer 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 <i>PETracer</i> to the new format for <i>PETracer</i> version 5.0 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 <i>PETracer</i> 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 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.
Launch CrossSync Control Panel	Launches the CrossSync application. The CrossSync Control Panel allows you to select analyzers for synchronization and manage the recording process. See <a href="#">“CrossSync Control Panel” on page 43</a> .
Analyzer Network	Displays the list of PCs with connected analyzers or exercisers that you want to use for recording or traffic generation.
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 PC.
Disconnect/Connect	Causes the Analyzer to momentarily break, and then establish the PCI Express link connection in both link directions.
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 viewed in the specification.
Packet 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	<p>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.</p> <p>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.</p> <p>You can search link transactions by Event Group: TLP Type, Traffic Class, Virtual Channel, Direction, Requester ID, Completer ID, Status, Tag.</p> <p>You can search split transactions by Event Group: TLP Type, Traffic Class, Virtual Channel, Direction, Requester ID, Completer ID, Status, Tag.</p> <p>Find allows you to create complex searches based on numerous criteria.</p>
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 <b>.peg</b> 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 PC 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.

## Tools Menu

Configuration Space Editor	Displays the Configuration Space Editor dialog which allows you to either create a new Configuration Space File or open an existing Configuration Space File.
Memory/IO Space Editor	Displays the Memory/IO Space Editor dialog which allows you to either create a new Address Space File or open an existing Address Space File. Select the memory size from the drop-down 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.
NVM Base Address Mapping	Presents the dialog for the NVMHCI Base Address. This dialog displays the Device ID and whether or not the device is NVM.
Run Verification Scripts	Presents a list of verification scripts, from which you can run a verification script.

## Window Menu

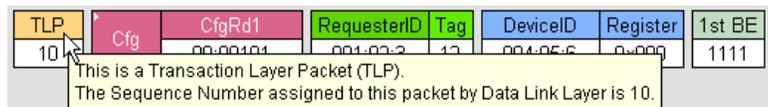
New Window	Opens a copy of the current CATC Trace window.
Cascade	Displays all open CATC Trace windows in an overlapping arrangement.
Tile	Displays all open CATC Trace windows as a series of strips across the display.
Arrange Icons	Arranges minimized CATC Trace windows at the bottom of the display.
Synchronize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

## Help Menu

User Manuals F1	Click User Manuals or press F1 to access the documentation guide for all LeCroy PCIe products.
Register Product Online	Register at the LeCroy website registration page.
Check for Updates	Check whether a new software version is available. If so, you can download from the LeCroy web site. You can select to <b>Check for updates at application startup</b>
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™.

## 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.

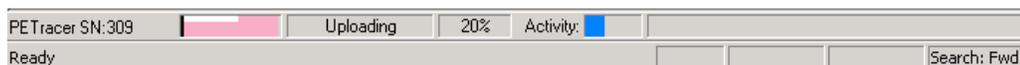
## Keyboard Shortcuts

Keystrokes	Operation
Ctrl + N	New PETracer 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

F1	Access documentation
F3	Find next
F6	Next pane
Shift+F6	Previous pane
Ctrl+B	Search backward

## Status Bar

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



From left to right:

**PETracer 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 32](#). 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 PC.

**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 PC. See [“Recording Status” on page 33](#) 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

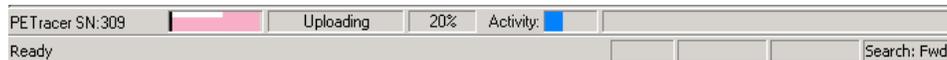
- Uploading data - x% done (where x equals the percent that has been uploaded.)

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.

## 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:

1. From the **Setup** menu, select **Recording Options**.
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, select proper speed and link width.

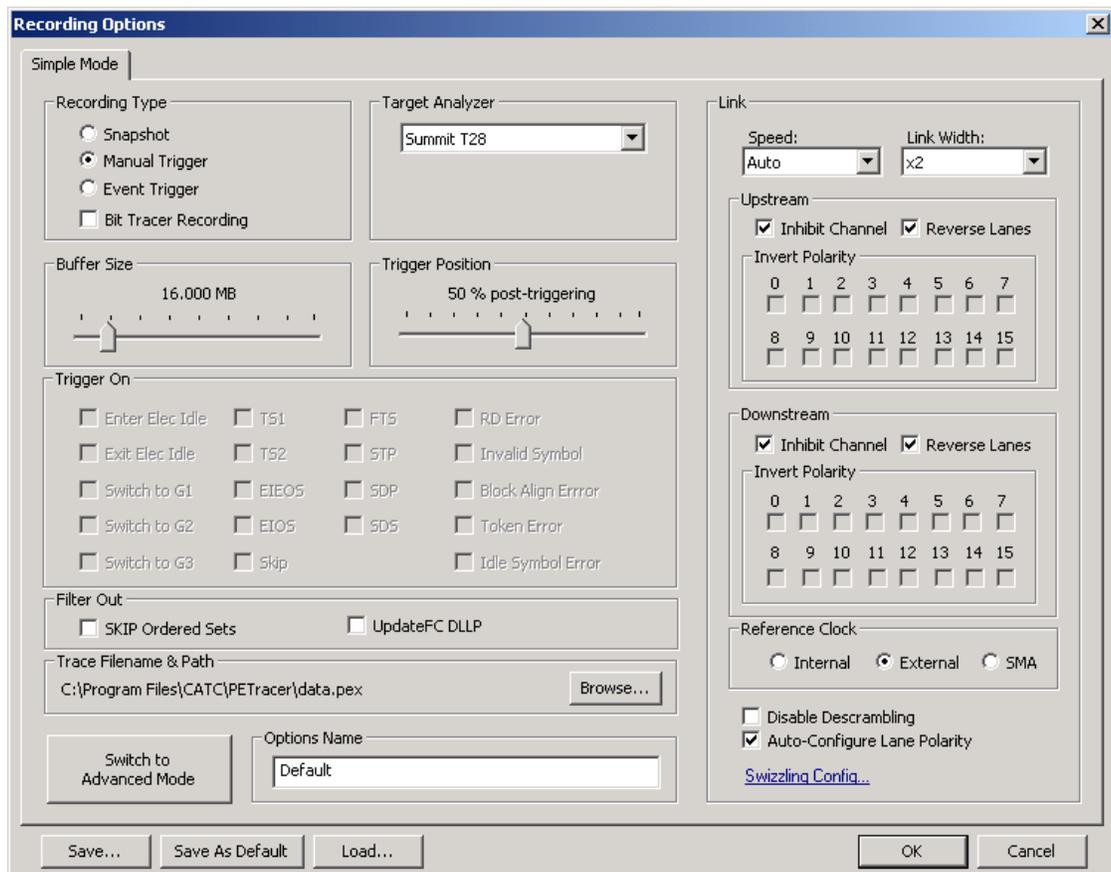


Figure 4.4: Summit T28 in Simple Recording Mode

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.
4. Click **OK** at the bottom of the Recording Options dialog to apply the Analyzer recording settings specified.
5. Click the **Record**  button.

## Stopping a Recording

You can stop the recording process at any time by pressing the **Stop** button . This causes the Analyzer to stop the recording and upload the CATC Trace to the host PC. If you press the **Stop** button again, the Analyzer temporarily halts the upload process and opens the following dialog box.

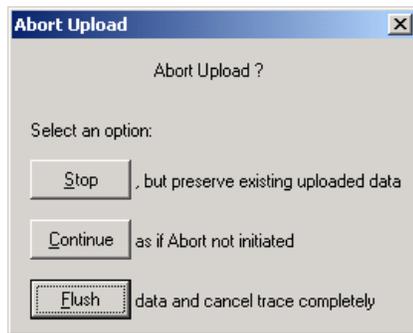


Figure 4.5: Abort Upload

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

- ❑ **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 PC'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

1. To save a current recording for future reference, select **Save As** from the File menu.
2. Give the recording a unique name, then save it to the appropriate directory.

## Recording Multi-Segmented CATC Traces

If **Save as Multisegment trace** is enabled, *PETracer* divides the CATC Trace as it records it into segments and stores them on the host's hard drive.

This option is useful for very large recordings and for host PCs with limited memory. In the latter case, multi-segmenting gives a PC with limited memory a way to open recordings that are otherwise too large to open.

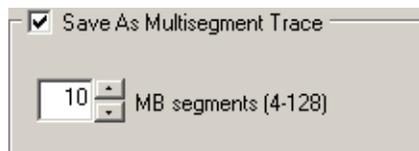
The only downside to multi-segmenting is that limits the scope of reports such as Traffic Summary, Bus Utilization, and Error Summary to each of the segments. You cannot perform summary statistics on the full recording.

The default segment size is 10 MB. Before attempting large recordings, it is recommended that you play with this number to see what value best suits your needs.

### How to Create a Multisegment Recording

To create a Multisegment recording:

1. Select **Setup > Recording Options** to open the Recording Options dialog at the General tab. Click **Switch to Advanced Mode**.



2. Check the box marked **Save as Multisegment trace**.
3. In the box marked MB Segments, enter a value of 4 to 128 MB.

### What Gets Created

Multisegmenting produces an index file and segmented CATC Trace files. The default name of the index file is **data.pem**.

The index file and the segmented CATC Trace files are stored in a directory named after the index file. The directory is named **data\_pem\_files**. Below this directory additional, sequentially numbered sub-directories (up to 100,000) hold the segmented CATC Trace files. These sub-directories bear simple numerical names: 00000 to 00999. Each of these subdirectories can hold up to 100 sequentially numbered segment files. Collectively, the entire directory structure can hold up to 10 million files.

## Example

If you create a 1010 MB recording using 10 MB segments, the following files and sub-directories are created:

```
data.pem (This is the index file.)
data_pem_files\00000\segment_00000.pex
data_pem_files\00000\segment_00001.pex
...
data_pem_files\00000\segment_00099.pex
data_pem_files\00001\segment_00100.pex
data_pem_files\00001\segment_00101.pex
```

---

**Note:** An additional index file is created called **segments.col**. This is an internal system file that users should not modify.

---

## PETracer Files

The *PETracer* 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 to configure the recording
- ❑ **Display Options Files:** Configuration file that contains the options selected in the Display Options dialog to configure how traffic is displayed

## CATC Trace Files

*PETracer* 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.

When Multisegment CATC Traces are created, a special index file is also created called **<filename>.pem**. This index file provides a high level view of the CATC Trace segments created in the recording session.

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.

## 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 *PETracer*, the application presents the Convert dialog.

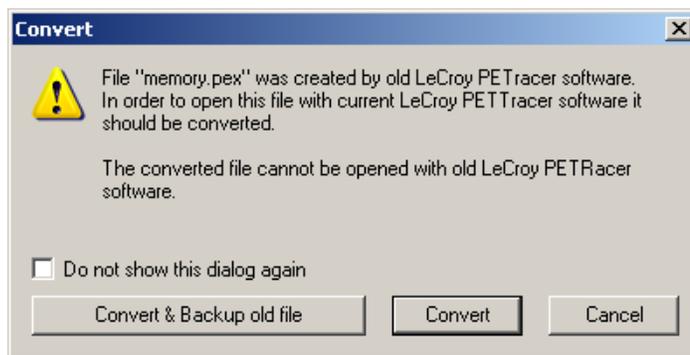


Figure 4.6: Convert Dialog

You must convert CATC Trace files made in previous versions of *PETracer* for them to open in *PETracer* version 5.0 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 *PETracer* version 5.0 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 *PETracer* version 5.0 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 *PETracer* version.

---

## Saving CATC Trace Files

This section describes how to save a CATC trace file.

### 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.

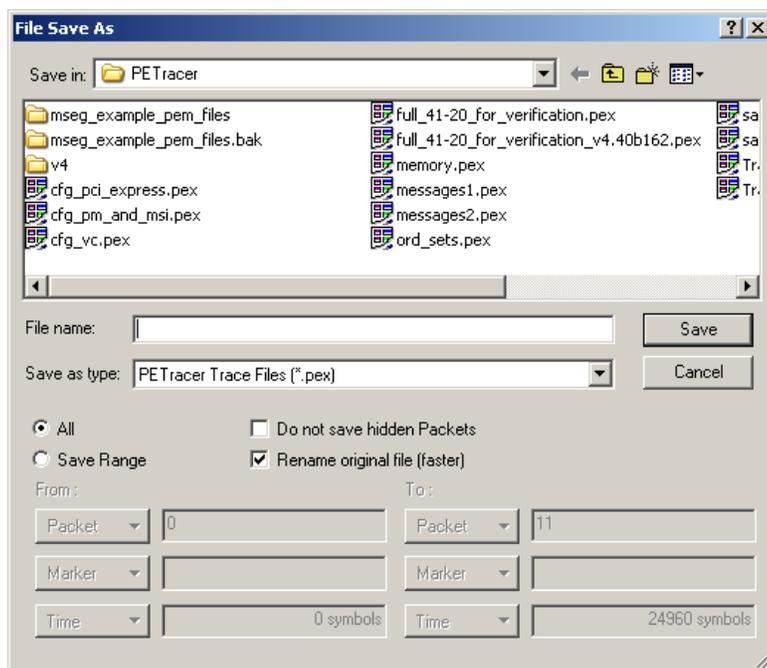


Figure 4.7: File Save As Dialog

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.

## Exporting a CATC Trace File

By default, *PETracer* 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**

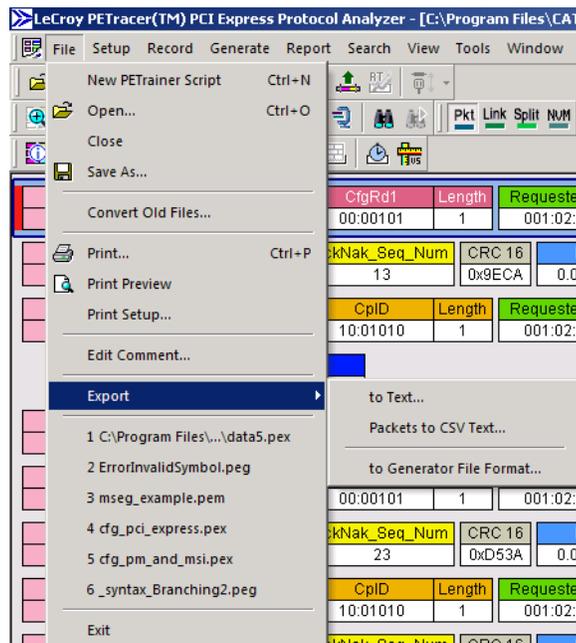


Figure 4.8: Exporting a File

## Printing Data Files

To print all or part of the open CATC Trace:

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

click the **Printer**  button on the toolbar.  
The Print Packets dialog opens

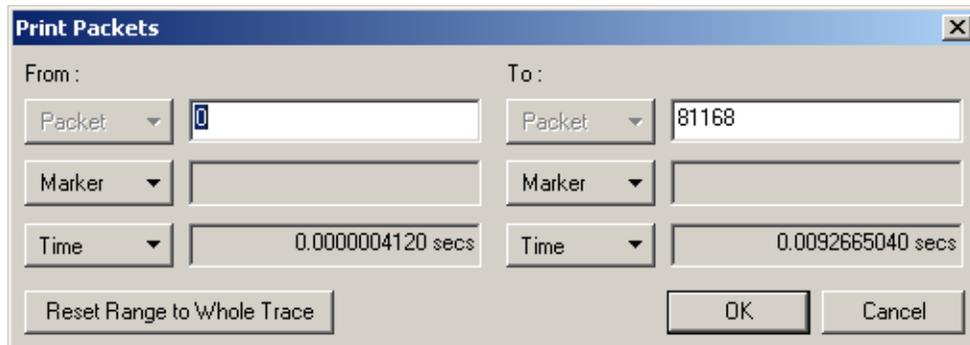


Figure 4.9: Print Packets Dialog

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

---

## Analyzer Chat Window

PETracer has a Chat window that allows you to communicate with users on remote PCs. For Chat to work, two conditions must be met:

- ❑ The PC hosts must have PETracer software installed and running.
- ❑ The hosts must be listed in each other's Network Browse list. This means that your PC must have the remote PC listed in its Network Browse window and the remote PC must have your PC listed in its Network Browse window.

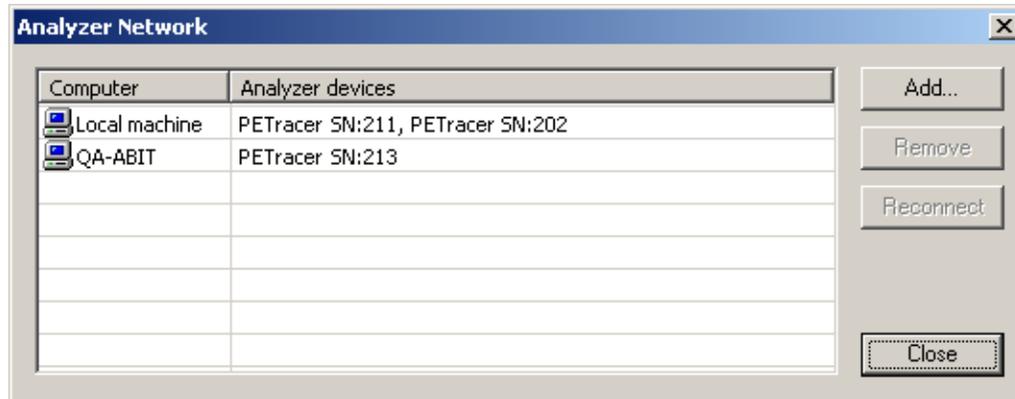


Figure 4.10: Analyzer Network Dialog

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

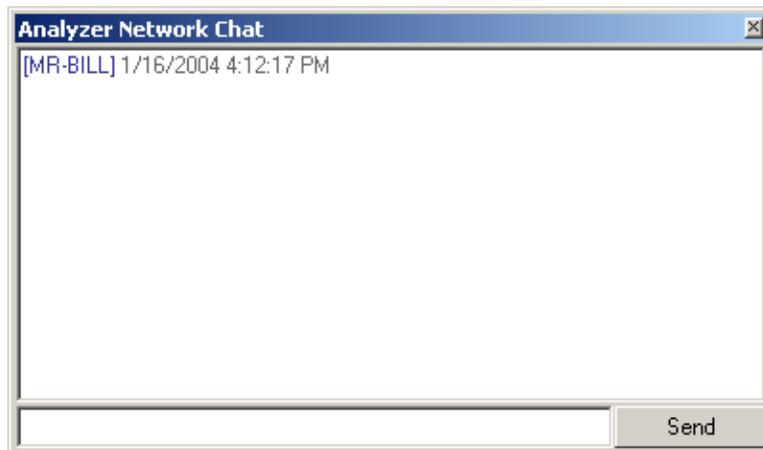


Figure 4.11: Analyzer Network Chat Dialog

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

## CrossSync Control Panel

The CrossSync Control Panel allows you to select analyzers for synchronization and manage the recording process.

### Launching the CrossSync Control Panel

To launch CrossSync from the PETracer PCI Express Protocol Analyzer software application, select the '**Launch CrossSync Control Panel**' entry in the 'Setup' menu (see the screen below). Or, you can launch CrossSync from the '**Start**' menu.

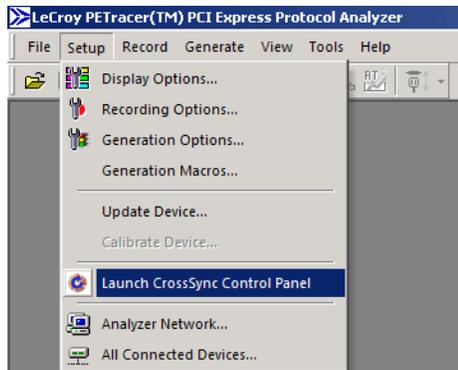


Figure 4.12: Launching CrossSync from the PETracer PCI Express Protocol Analyzer Application

Please refer to the *CrossSync Control Panel User Manual* for more information.



## Recording Options

---

### Recording Overview

After installing the software recording options should be set prior to recording. The recording options define the behavior of the Summit T28 during recording. You can create, save and load previously saved recordings. This section explains how to define recording options on the Summit T28 Analyzer.

### General Tab

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 tab of the Recording Options.

---

The General tab displays options that affect all recordings ([see Figure 5.1 on page 46](#)).

## Recording Options-General Tab

This section describes the General Tab recording options.

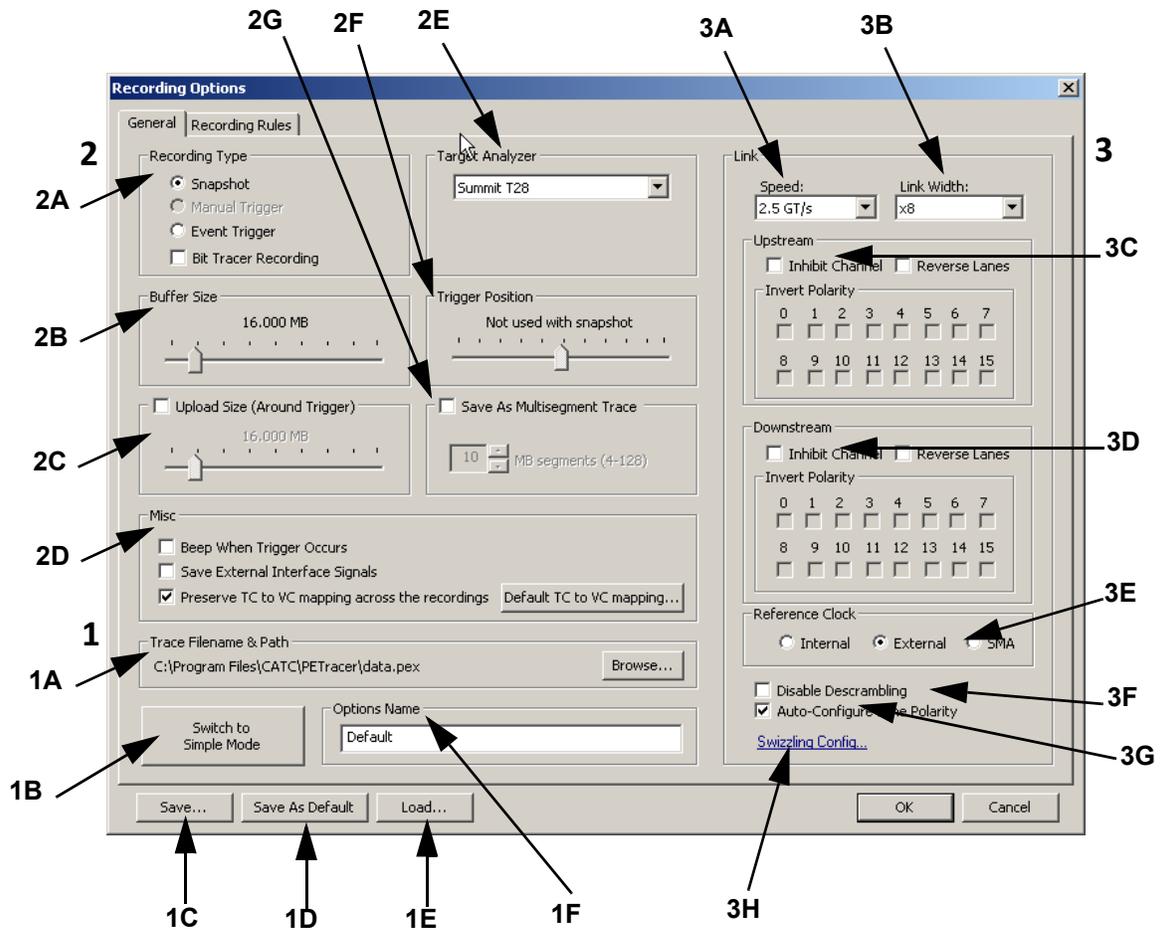


Figure 5.1: Summit T28 in Recording Options

**Note:** Please refer to the figure callout numbers in each of the sections below to co-relate to Figure 5.1 shown above. For instance, for Simple and Advanced Mode, see Figure 5.1: 1B.

## Simple and Advanced Mode

The recording options can be defined in Simple or Advanced modes. The Simple Recording and Advanced Recording options are the same in functionality, only the interface displayed is different. The Simple Mode allows quick access to commonly used options. The recording options are the same in both modes (See Figure 5.1: 1B).

Clicking on the **Switch to Simple Mode** toggles you between Simple and Advanced Mode (see Figure 5.2 on page 47).

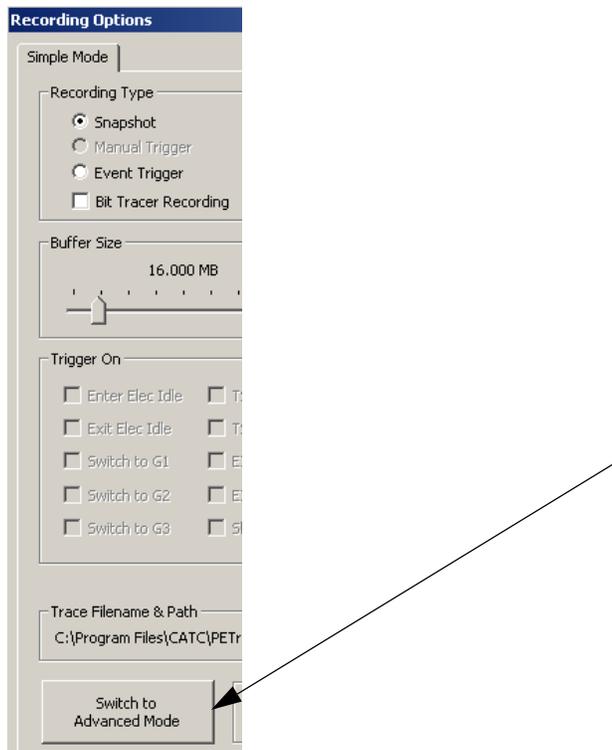


Figure 5.2: Switch to Simple Mode Button

## Trace Filename and Path

The Trace Filename and Path button sets the path and CATC Trace name for the recording. It allows you to change the default file name and path for the recorded CATC Trace file. The pre-defined name is **data.pex**. See Figure 5.1: 1A

1. Select the **Recording File Name** button.
2. The Specify Trace File Name dialog opens to navigate to the directory you want.
3. Enter the new file name in the File name field.
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.

## Saving and Loading Previously Saved Recording Options

You can save a recording or load previously saved recordings. In the general tab the following Save options are available (see [Figure 5.1](#)).

### 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 *PETracer* software begins execution, it automatically loads the **default.rec** file, if one exists.

**Options Name:** See Figure 5.1: 1F

The Options Name is a descriptive, supplemental label that you can assign to a Recording Options file so you can easily recall what settings are in the 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**.

**Save:** See Figure 5.1: 1C

Saves the current options to whatever file name you provide.

**Save As Default:** See Figure 5.1: 1D

Saves the current options into the default options file. This file is called **default.rec** or any other name you have assigned to the default options file. Whenever the LeCroy *PETracer* software begins execution, it automatically loads the default file, if one exists.

**Load:** See Figure 5.1: 1E

Loads a previously saved set of recording options.

**OK**

Applies changes and closes the Recording Options dialog.

**Cancel**

Cancels changes and closes the Recording Options dialog.

### Loading Recording Options

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

To load Recording Options:

1. Select **Setup > Recording Options** from the menu.
2. Click the **Load** button from the Recording Options dialog. The Load dialog opens and lists previously saved options files (\*.rec).
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.

1. Open the Recording Options dialog by selecting **Setup > Recording Options**.
2. Set your options, then click **Save**.
3. Enter a unique file name. The .rec extension is added by default.(optional) To add a descriptive label to this file to help you remember what options were set, use the **Options Name** box.

## Recording Type

Recording Type allows you to specify the type of recording you want to make (See Figure 5.1: 2A). They are

- Snapshot
- Manual Trigger
- Event Trigger
- Bit Tracer Recording

### 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 a **Trigger** is received. Recording begins when you select **Start** in the application. 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.)

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.

## BitTracer Recording

See the next chapter, [“BitTracer Recording” on page 111](#).

## Buffer Size

The Buffer Size allows the Analyzer to record traffic to its buffer and then upload the CATC Trace to the host PC. Recordings are limited in size to the size of the Analyzer's buffer, see Figure 5.1: 2B (2 GB per direction, Upstream and Downstream).

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



Figure 5.3: Buffer Size Slide Bar

The 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.

---

## Upload Size

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 (See Figure 5.1: 2C).

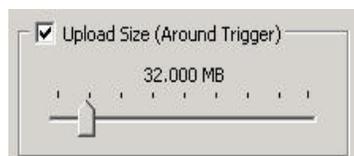


Figure 5.4: Upload Size Slide Bar

## Misc

Turns on trigger beep, 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. Click on the Default TC to VC mapping to manually map the Traffic Classes to Virtual Channels (See Figure 5.1: 2D).

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

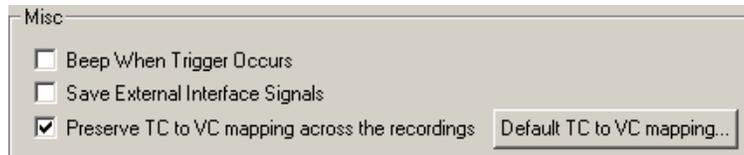


Figure 5.5: Misc Section in Recording Options

- ❑ **Beep When Trigger Occurs:** Causes the host PC 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 (Traffic Classes) to VC (Virtual Channel) mapping it established in the last recording (to re-use previously discovered Configuration Space data) in all future recordings.
- ❑ **Default TC to VC mapping button:** Lets users manually configure the default mapping.

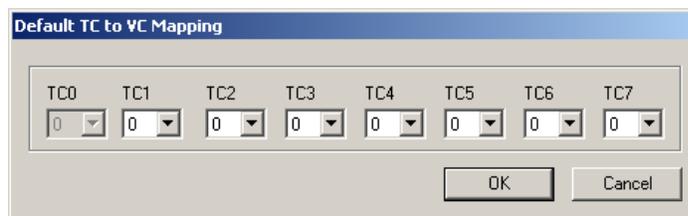


Figure 5.6: Default TC to VC Mapping

## Target Analyzer

The recording options available on each analyzer are different and you should select the correct Target Analyzer to define it for the specific analyzer. As shown in [Figure 5.1 on page 46](#) the Summit T28 Analyzer is selected and the recording options available for it are displayed (See Figure 5.1: 2E).

Target Analyzer presents a menu with these choices:

- Edge T1-4**: Displays the options for the Edge T1-4 Analyzer.
- PETracer ML**: Displays the options for the PETracer ML Analyzer.
- PETracer ML (2 Units)**: Displays the same options as PETracer ML 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.
- PETracer EML**: Displays the options for the PETracer EML Analyzer.
- PETracer Summit**: Displays the options for the PETracer Summit Analyzer.
- Summit T3-8**: Displays the options for the Summit T3-8 Analyzer.
- Summit T28**: Displays the options for the Summit T28 Analyzer.

## Trigger Position

This Trigger Position slide-bar lets you adjust the amount of recording buffer allocated to recording pre-trigger and post-trigger traffic (See Figure 5.1: 2F).

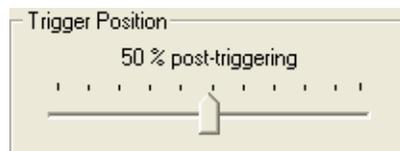


Figure 5.7: Trigger Position Slide Bar

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.

## Save As MultiSegment Trace

Divides the recording into segments so as to allow very large recordings to easily upload and view. If you are planning to create a large recording, you might want to test this option to see how it affects performance. Large CATC Trace files are easier to navigate but slower to open (See Figure 5.1: 2G).

In Advanced Mode this option allows the Analyzer to segment the CATC Trace into 4 MB to 128 MB files and to create an index file that summarizes the starting and finishing frame for each segment.

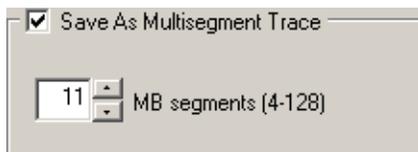


Figure 5.8: Save As MultiSegment Trace

The index file has a default name of **data.pem**.

The index file and segmented CATC Trace files are stored in a directory named **data\_pem\_files**. The directory is named after the index file. Below this directory additional, sequentially numbered sub-directories (up to 10,000) hold the segmented CATC Trace files. These sub-directories bear simple numerical names: 00000 to 00999. Each of these subdirectories can hold up to 100 sequentially numbered segment files.

### Example

A 1010 MB recording using the default file names creates the following sub-directories and files:

```
data.pem (This is the index file.)
data_pem_files\00000\segment_00000.pex
data_pem_files\00000\segment_00001.pex
...
data_pem_files\00000\segment_00099.pex
data_pem_files\00001\segment_00100.pex
data_pem_files\00001\segment_00101.pex
```

The index file looks something like a CATC Trace file but contains packet-like entities that summarize each segment.

## Viewing Multisegmented Files

If Save As MultiSegment Trace is enabled in the General tab of the Recording Options, the *PETracer* divides the CATC Trace into segments and stores them on the host's hard drive. Segment size is set in the MB Segments box. Enter a value from 4 MB to 128 MB.

*PETracer* also creates an index file that provides a brief summary of each segment and hyperlinks to each of the segments. Double-clicking a segment summary in the index file causes *PETracer* to open that segment.

You can also navigate through the segments by clicking the buttons on the Multisegment toolbar.

## Link Settings

The Link options panel allows you to manage links. You can define the basic link parameters or leave it on Auto detect. The various link settings are described in this section (See Figure 5.1: 3).

The screenshot shows the 'Link' configuration window. At the top, 'Speed' is set to '2.5 GT/s' and 'Link Width' is set to 'x8'. Below this are two sections: 'Upstream' and 'Downstream'. Each section has checkboxes for 'Inhibit Channel' and 'Reverse Lanes', and a sub-section 'Invert Polarity' with a grid of checkboxes for lanes 0 through 15. The 'Reference Clock' section has radio buttons for 'Internal', 'External' (selected), and 'SMA'. At the bottom, there are checkboxes for 'Disable Descrambling' and 'Auto-Configure Lane Polarity' (checked), and a link for 'Swizzling Config...'.

Figure 5.9: Link Options for Summit T28

## Speed

The Speed can be set at Auto, 5.0 GT/s, or 2.5 GT/s from the drop-down menu. The default is Auto (See Figure 5.1: 3A).

**Auto:** When set to Auto, the hardware auto-determines the speed.

**5.0 GT/s or 2.5 GT/s:** When set to a specific speed, LeCroy's software forces the hardware to record at that speed.

## Link Width

The Link Width sets the physical width of the link. Select the Link Width or select **Auto** (See Figure 5.1: 3B).

## 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 (See Figure 5.1: 3C and 3D).

- Inhibit Channel: Do not record/upload this channel**
- Reverse Lanes: If Swizzling Config is set, the Reverse Lanes will not work if Auto is checked.**
- Invert Polarity**

## Reference Clock

If the PCI Express link under analysis uses spread-spectrum clocking, then the Analyzer must use the external reference clock from the system. If the Device Under Test does not supply a reference clock, the internal reference clock in the Analyzer module can be used instead (See Figure 5.1: 3E).

## SMA Clock

For SMA Clock, both inputs must be connected to a clock.

## 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 (See Figure 5.1: 3F).

## Auto-Configure Lane Polarity

Lets the Analyzer determine lane polarity (See Figure 5.1: 3G).

### Swizzling Config...

The Swizzling Config dialog allows you to reconfigure the order of the US (UpStream) and DS (DownStream) lanes.

Check the box to Auto-Configure Lane Swizzle (See Figure 5.1: 3H). **Note:** Autoswizzle works only when the analyzer sees LTSSM Configuration state link training sequence.

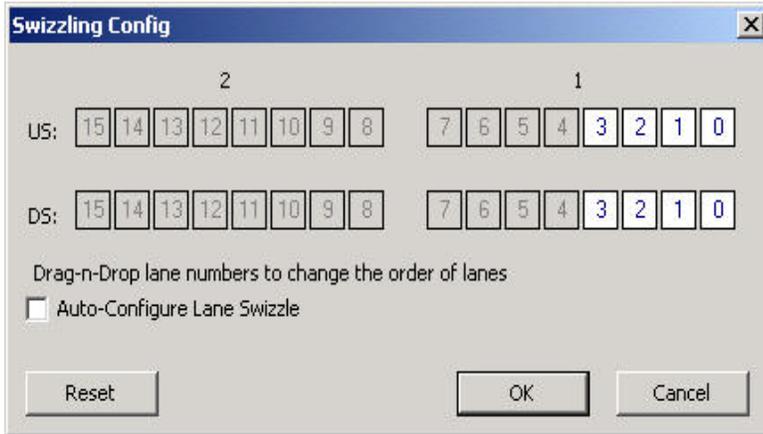


Figure 5.10: Swizzling Config Dialog

When the Auto-Configure Lane Swizzle is checked, it is important to configure Lane 0. You can do so by manually dragging Lane 0 to the required position. See Figure 5.11.

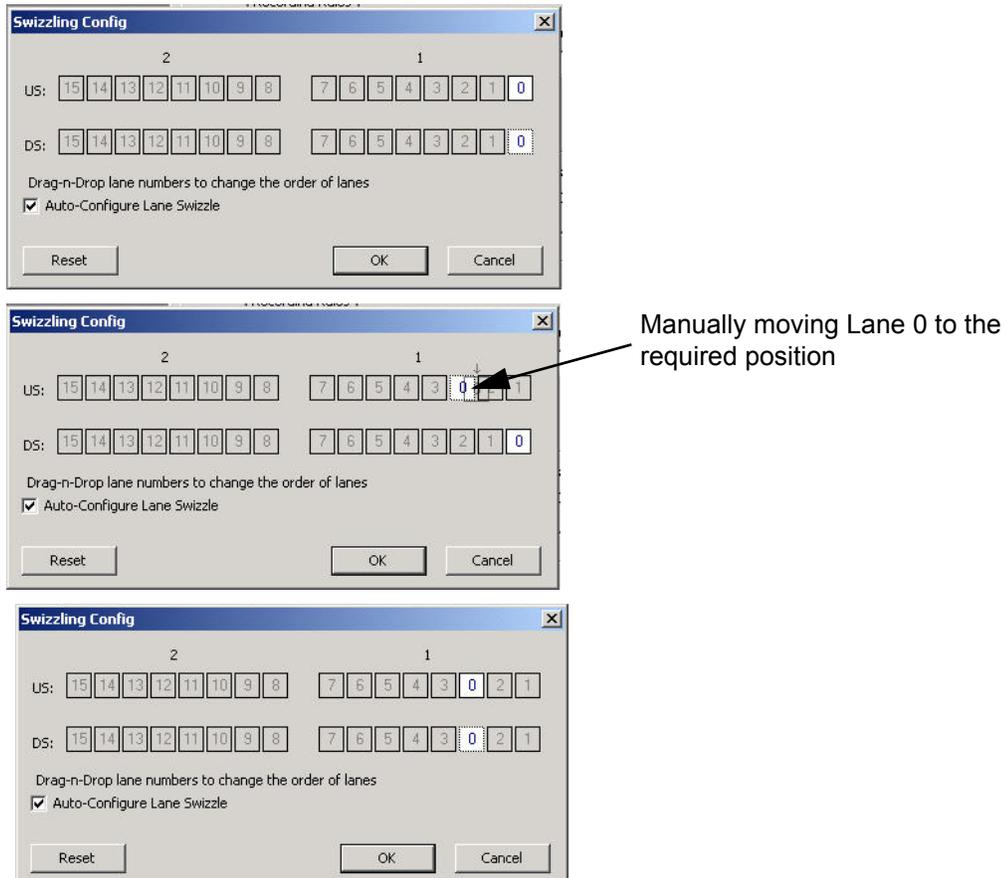


Figure 5.11: Manually Configuring Lane 0 when Auto-Configure Lane Swizzle is Checked

## Triggering

Triggering Options can be set in both Simple and Advanced Modes. The options in both modes are the same, only the GUI is different where shortcuts for the events are displayed in the Simple Mode for easy access (see [Figure 5.2 on page 47](#)).

In the Advanced Mode triggering is set up via the recording rules which allow greater flexibility to create advanced sequences you would like the analyzer to look for. These recording rules are not available in the Simple Mode. The Simple Mode allows you to simply define triggering by checking the boxes.

---

**Note:** Ensure that the correct analyzer is selected for the right options.

---

### Triggering On (Simple Mode)

You can check any of the boxes shown in [Table 5.1](#) for Trigger On in Simple Mode (see [Figure 5.12 on page 58](#)).

TABLE 5.1: Simple Mode Trigger On Events

Enter Elec Idle	AnyTLP
Exit Elec Idle	Config
Switch to G1	Memory
Switch to G2	IO
Switch to G3	Message
TS1	RD Error
TS2	Invalid Symbol
InitFC1	Block Align Error
NAK	Token Error
PM	Idle Symbol Error

Trigger Position is only available when Event Trigger or Bit Tracer Recording is selected.

---

**Note:** If you check 2 boxes or more the triggering will occur based on an OR condition, not AND condition.

---

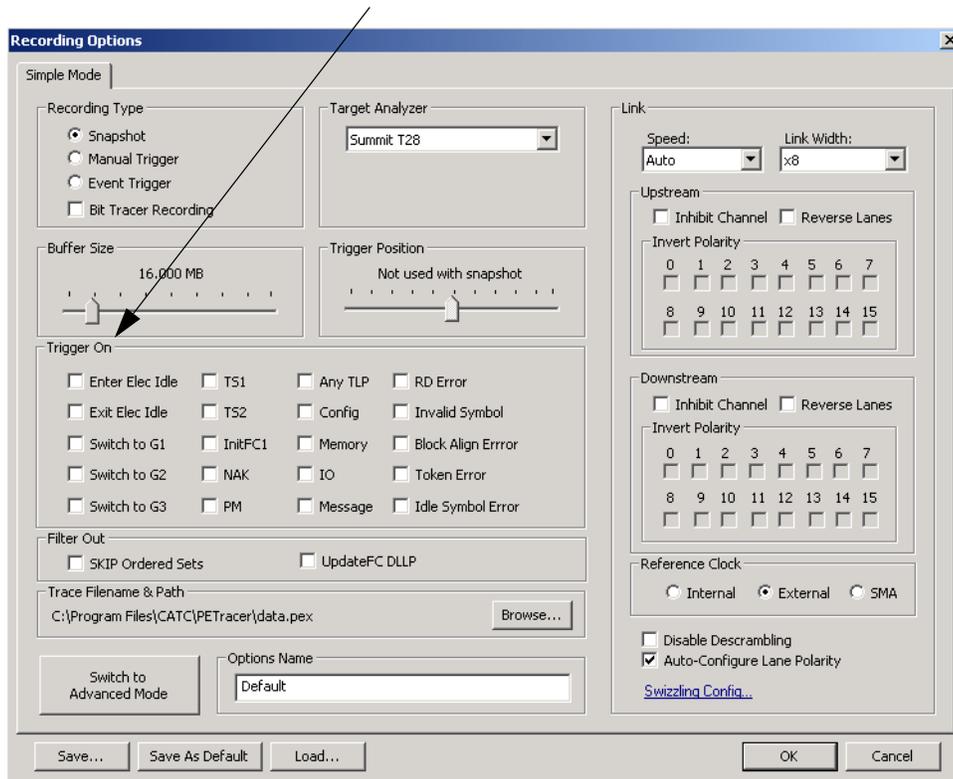


Figure 5.12: Simple Mode Triggering Options

## Triggering On (Advanced Mode)

The same triggering options are available in the Advanced Mode as in the Simple Mode. The Advanced Mode gives you additional flexibility to drill down and configure these options in greater detail via the Recording Rules dialog.

In the Advanced mode click on the Recording Rules tab to configure the settings. As shown in Figure 5.13, the Recording Rules tab allows you to create New Events. For each event you can create Actions. A detailed explanation of the Recording Rules is given in the following sections.

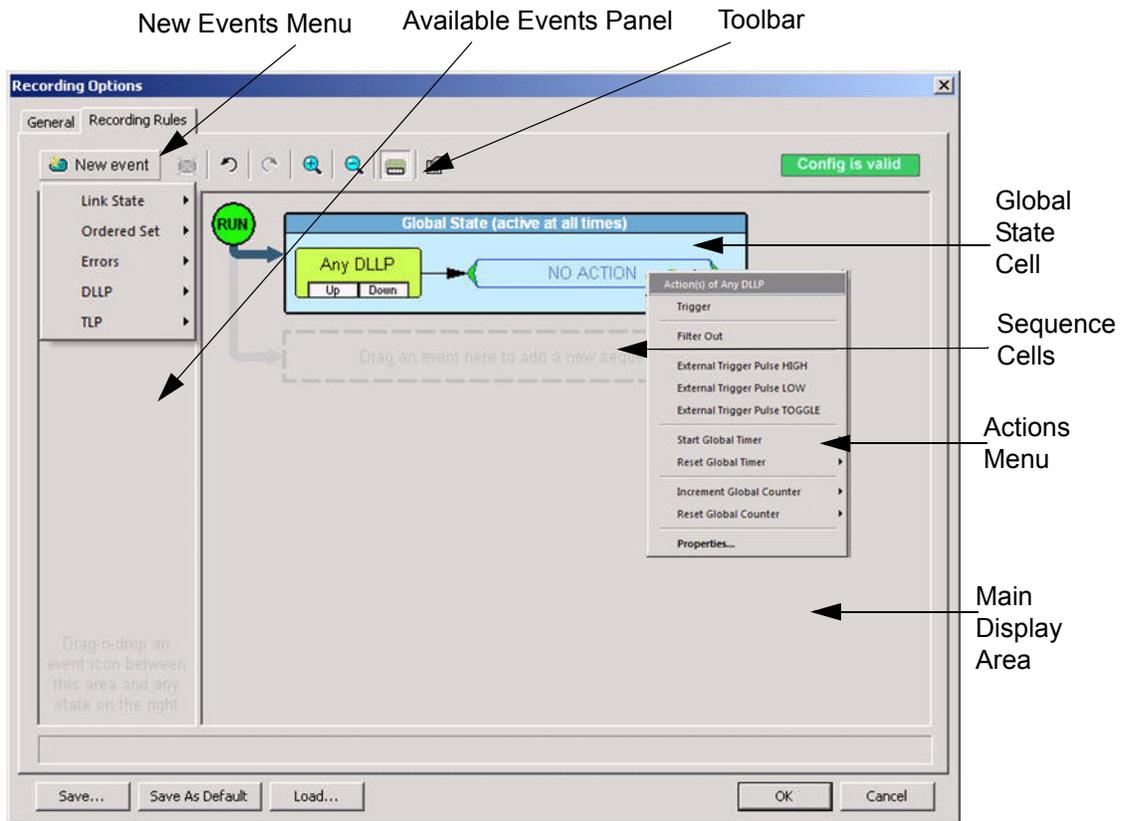


Figure 5.13: Recording Rules Tab

## Recording Rules Overview

The Recording Rules allows you to specify complex triggering and filtering options. The Summit T28 monitors incoming traffic and looks for specified events. It performs actions like triggering and filtering. Complex options can be created by putting Events in a sequence.

Events are based on Resources. Resources are explained in the next section.

## Resources

Events in Recording Rules are based on Resources. There are two types of Resources. They are Packet Match Resources and Basic Resources.

### Packet Match Resource

Packet Match Resources are for the DLLP and TLP events. A Packet Match Resource allows you to define not only packets but it also allows you to define each specific bit in a packet. In the Packet Match resource you can define the exact layout to the bit level so that the Analyzer can match the exact pattern that applies to a DLLP or TLP event.

To set a Packet Match Resource, click on the **New Event** button and select any of the options. In this case we have selected **DLLP: InitFC1**. The **DLLP: InitFC1** displays in the

**Available Events** panel. Double-click on the **DLLP: InitFC1** to select the specific fields and go to the Layout tab to change the pre-defined bits (see Figure 5.14).

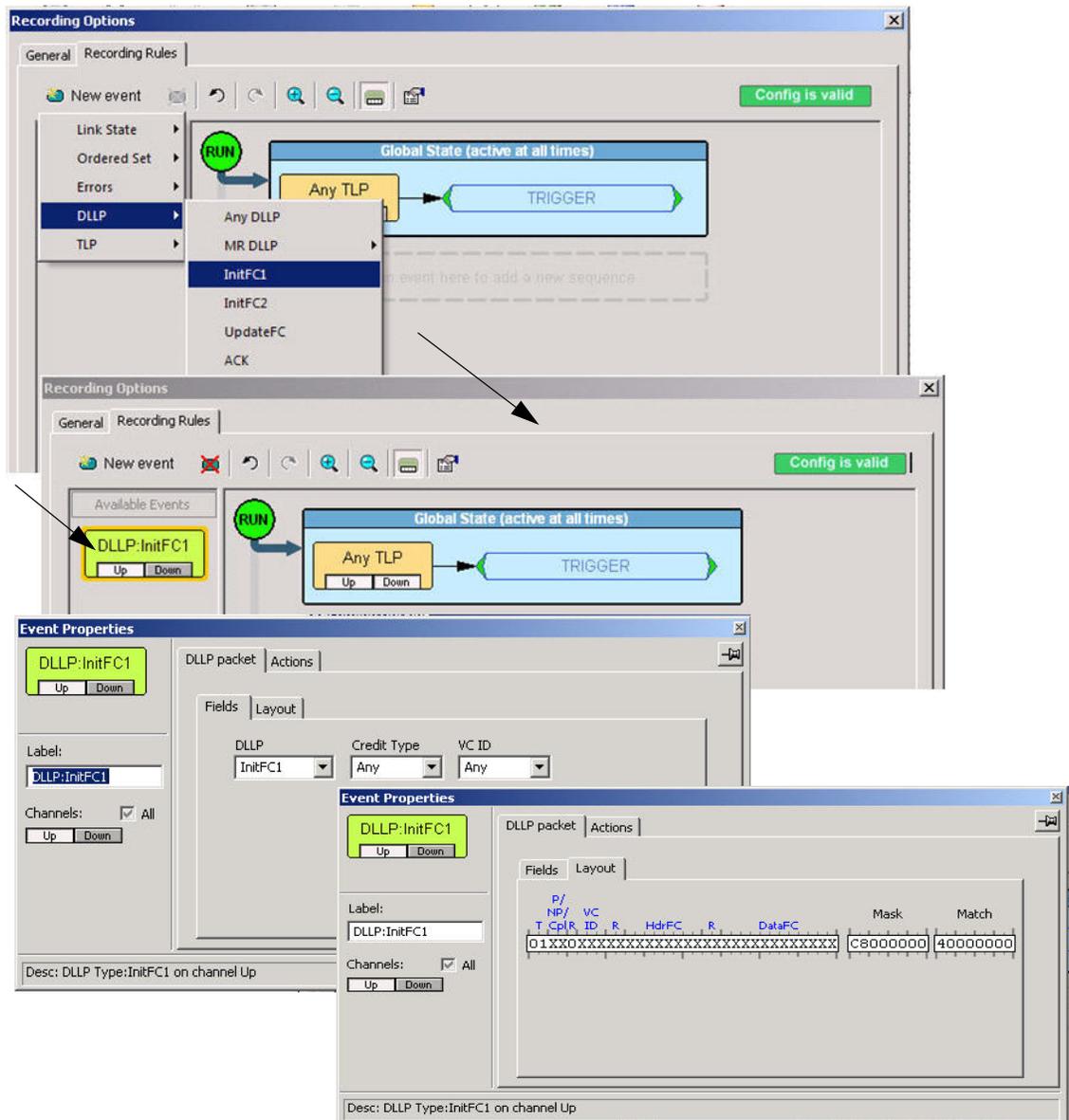


Figure 5.14: Setting Up a Packet Match Resource

## Basic Resource

Basic Resources are for the Link States, Ordered Sets and Errors. A Basic Resource does not allow you to define patterns to the bit level. It just matches events that have been predefined.

To set a Basic Resource, click on the **New Event** button and select any of the options. In this case we have selected **Ordered Set: TS1**. The **TS1** displays in the **Available Events** panel. Double-click on the **TS1** to select other Ordered Set events and go to the Actions tab to configure specific Actions (see Figure 5.15).

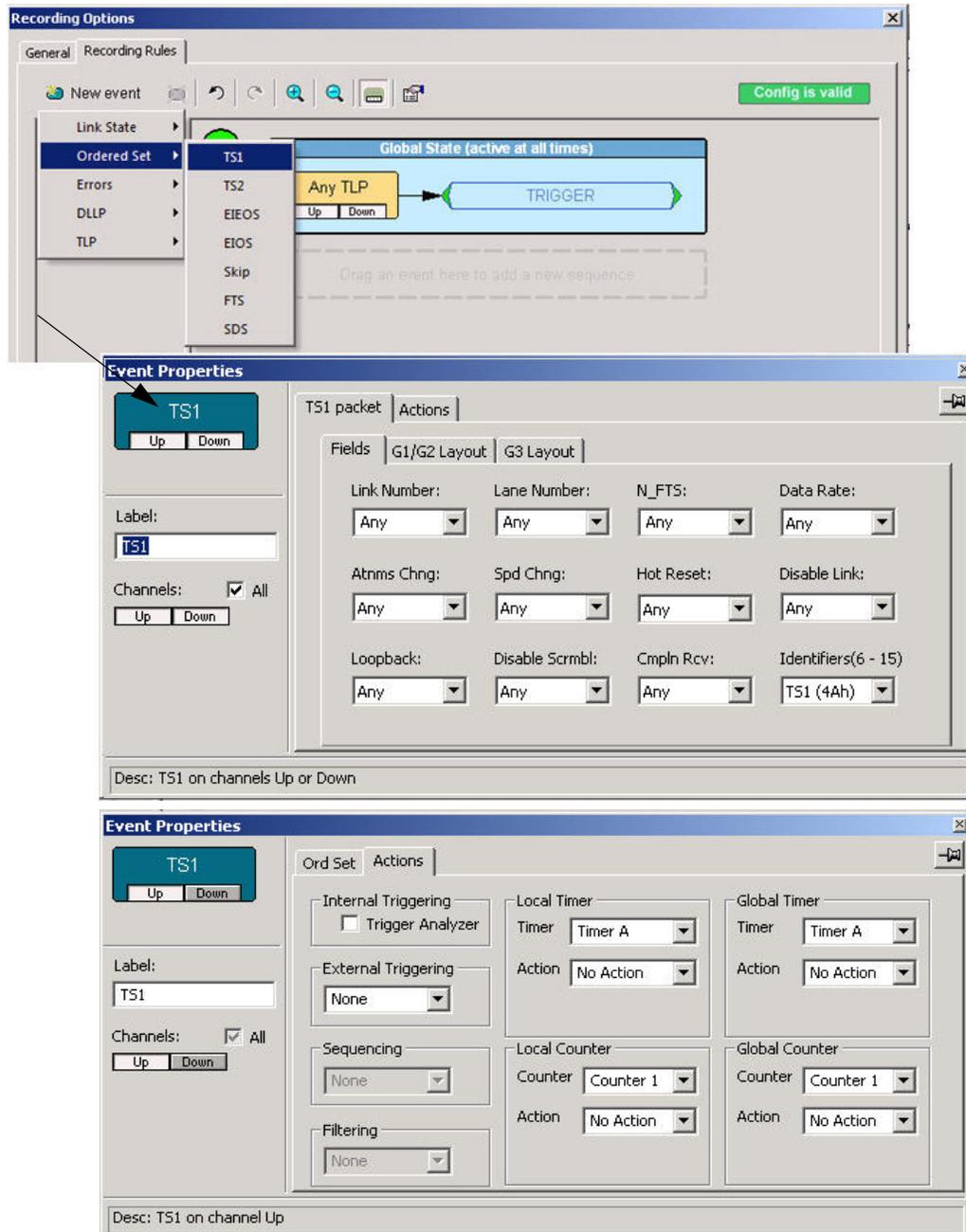


Figure 5.15: Setting Up a Basic Resource

## Global State and Sequence States

The Main Display area in the center of the Recording Rules window has two cells that affect events differently, they are the Global State and Sequence State.



Figure 5.16: Global State Cell and Sequence State Cell

In the Global and Sequence State you can add events by clicking on the New Event button and after the event is in the State you can right-click to Specify Actions, Move, Copy or Delete the event. You can view the Properties dialog to make additional changes to the Property of the event (see Figure 5.13). The description of these actions are given in Table 5.4 on page 74.

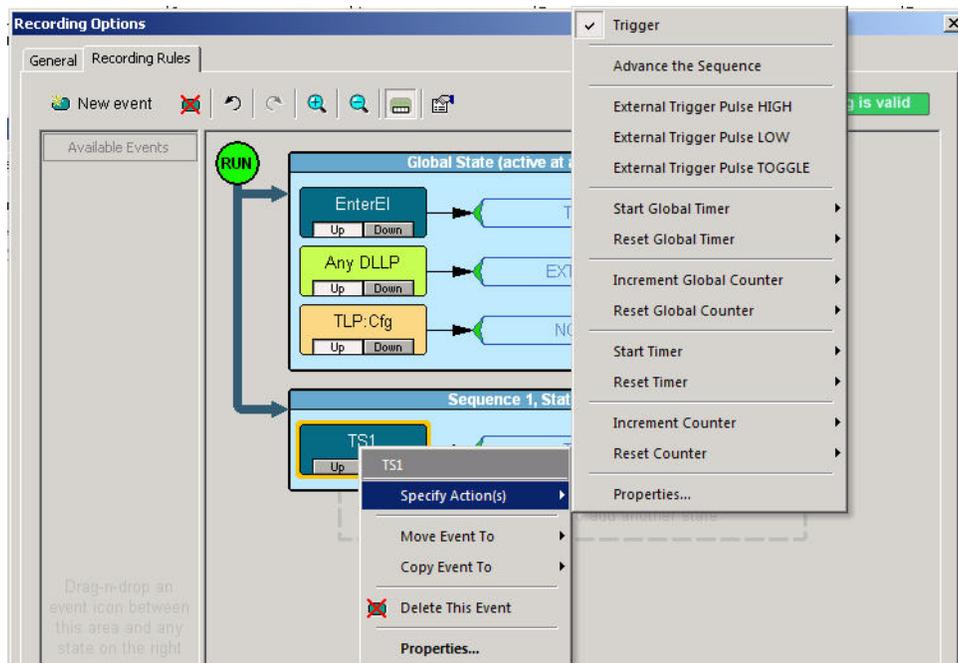


Figure 5.17: Global State Menu

## Global State

The Global State is active all the time. The Summit T3-16 Analyzer tracks all the Events and Actions defined in the Global State throughout the recording. In the Global State the Link State, Ordered Set, Errors, Counter and the Timer use Basic Resources while DLLP and TLP use Packet Match Resources. The Global State has two Timers and two Counters.

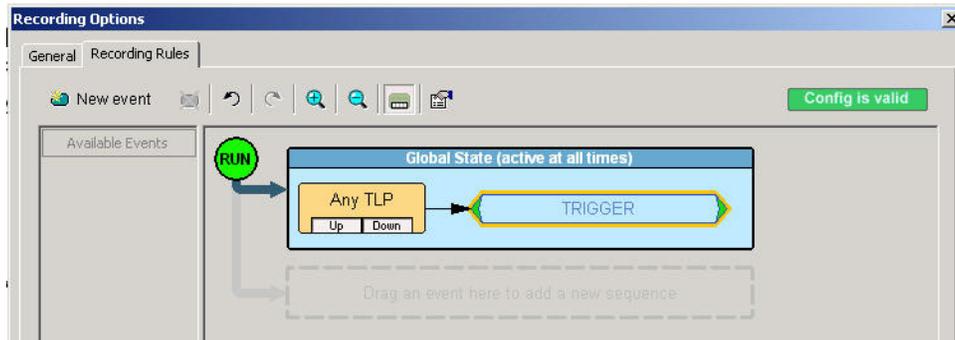


Figure 5.18: Global State

For the Global State there are only 2 Basic Resources for each Channel. Some optimization is done internally to accommodate additional resources. You can keep adding resources to the Global state so long as the **Config is valid** button stays green. If you add a new event which is not valid a window appears with a message prompting **Invalid Recording Rules Configuration** and the **Config is valid** button will turn red (see [Figure 5.19 on page 65](#)).

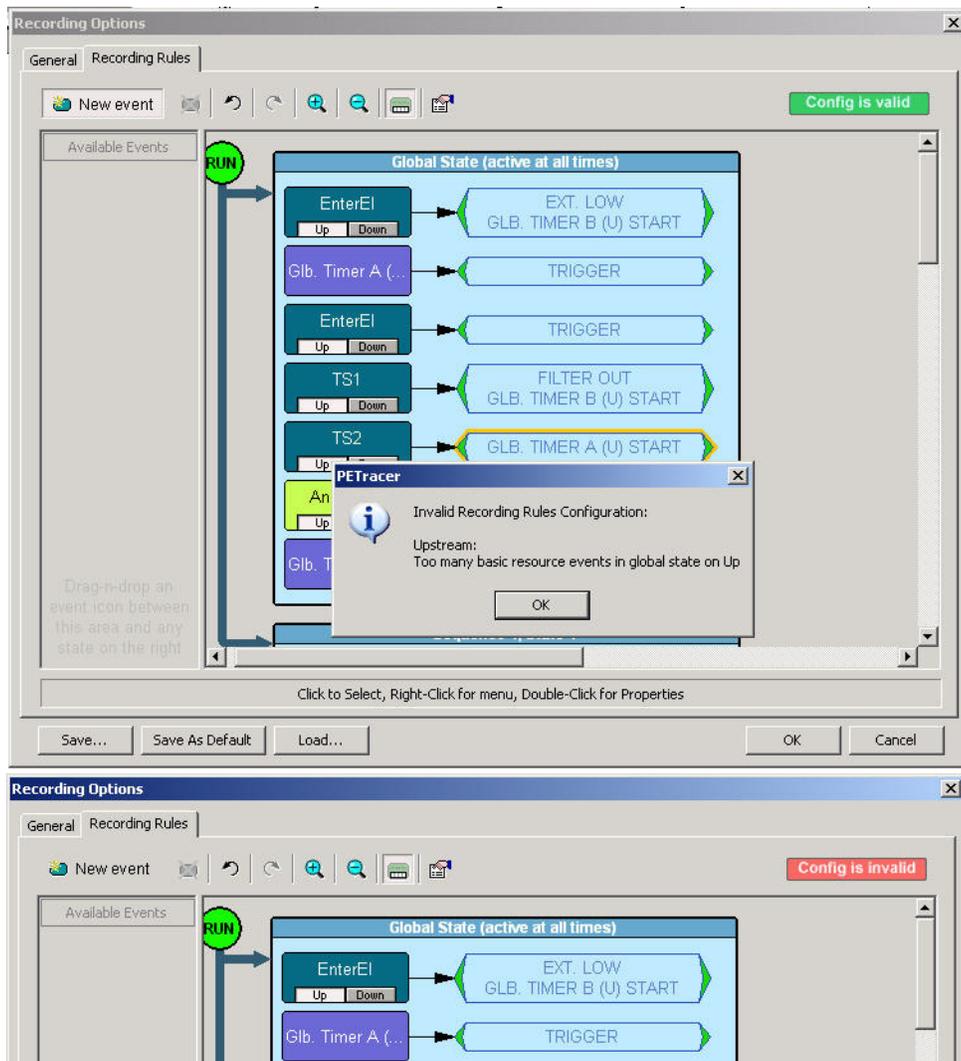


Figure 5.19: Valid and Invalid Recording Rules Configuration Dialogs

## Sequence State

The cell marked **Drag an event here to add another sequence** is the Sequence State. In the Sequence State you can define a sequence of Events and Actions which the Summit T3-16 Analyzer looks for at pre-determined times. Sequences are chains of events culminating in a trigger or any other action. A sequence which is a separate chain of events can be created with up to 16 states. A state is an event condition with an action within a sequence. Once a Sequence State is added the cell marked will read **Drag an event here to add another state**.

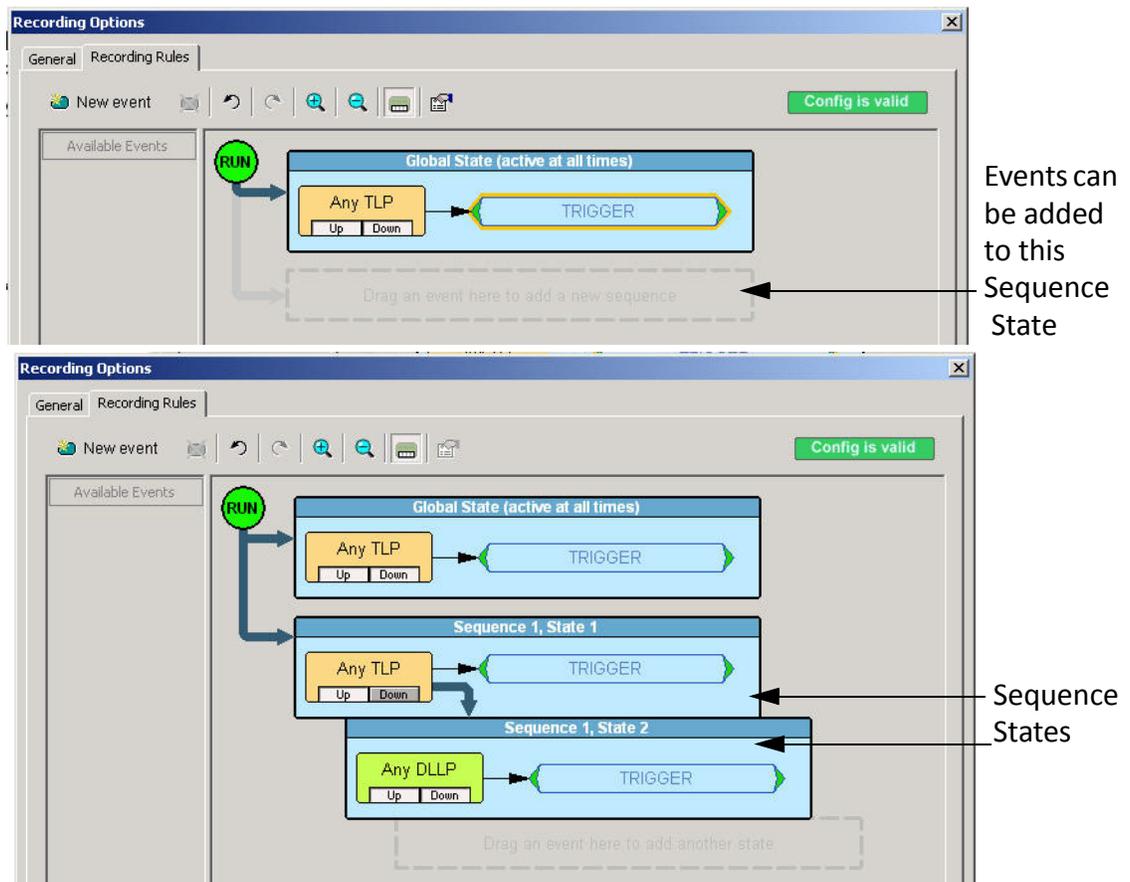


Figure 5.20: Sequence State Events

In the Sequence State the Link State, Ordered Set, Errors, Counter and the Timer use Basic Resources while DLLP and TLP use Packet Match Resources. There are four Timers and four Counters in the Sequence State.

---

**Note:** Each Sequence State has four Basic Resources and four Packet Match Resources.

---

## Navigating Recording Rules

The Recording Rules window has three main areas, the Toolbar, Available Events panel and the Main Display panel (see [Figure 5.13 on page 59](#)).

### Toolbar

The toolbar contains buttons such as the New Events button for issuing commands, Delete Current Event, Undo, Redo, Zoom in and out, Show/Hide Channels and Properties.

### Available Events Area

The Available Events area is in the left repository panel where you can park buttons that you intend to use in the Main display area. The events in this panel do not affect the recording. You can drag and drop events in the Main Display panel.

### Main Display Area

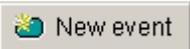
The Main Display area is the right panel where you create trigger and filter conditions. You create conditions by dragging buttons onto the Main display area from the Available Events area. You then create additional conditions by right-clicking a button and selecting options from a pop-up menu. See [Creating Recording Rules](#).

### Recording Rules Buttons

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



TABLE 5.2: Recording Rules Toolbar Buttons

	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 for the selected item.

## Recording Rules Events

There are five sets of Events that can be configured and actions can be set for every Event.

TABLE 5.3: Events and Event Actions

<b>Event</b>	<b>Pre-Defined Event Actions</b>
Link State	
	Enter Electrical Idle
	Exit Electrical Idle
	Speed Change to 2.5Gb/s
	Speed Change to 5.0Gb/s
	Speed Change to 8.0Gb/s
Ordered Set	
	TS1
	TS2
	EIEOS
	EIOS
	Skip
	FTS
	SDS
Errors	
	Idle Error
	Disparity Error
	Symbol Error
	Token Error
	Block Align Error
DLLP	
	Generic (User-definable)
	Any DLLP
	MR DLLP
	InitFC1
	InitFC2
	UpdateFC
	ACK
	NAK
	Power Management
	Vendor

TABLE 5.3: Events and Event Actions

TLP	
	Generic (User-definable)
	Any TLP
	Config Rd
	Config Wr
	IO Rd
	IO Wr
	Mem Rd
	Mem Wr
	Message
	Completion

## Properties Dialog Boxes for Events

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

### Event Properties Dialog Box Features

The following features are displayed in the any Event Properties dialog box ([see Figure 5.21 on page 70](#)).

#### 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.

## Pin Button

The Pin Button on the top right corner of the dialog allows you to **pin** the Properties dialog 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. The settings in this area vary for different events. Some events do not have any additional settings.

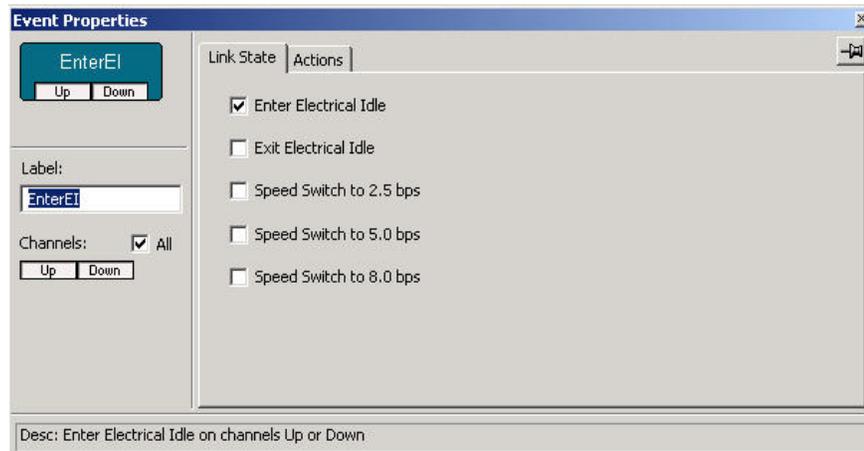


Figure 5.21: Properties Dialog Box

## Link State Dialog

The Link Properties dialog lets you select the link state.

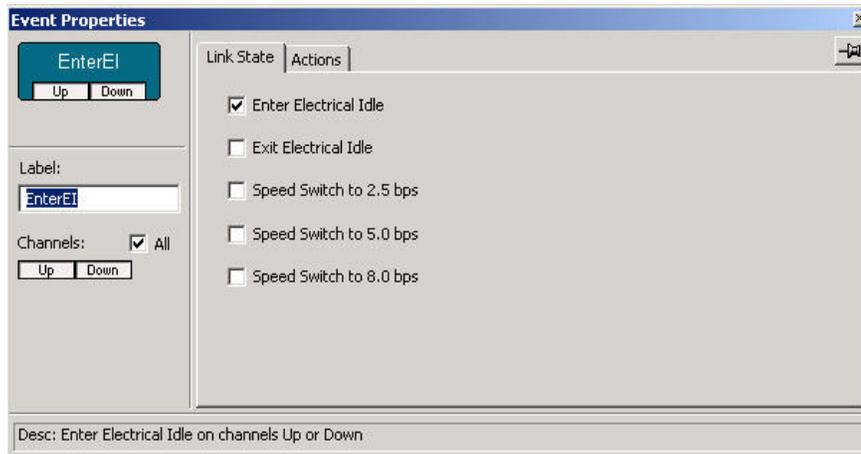


Figure 5.22: Link State Properties Dialog

## Ordered Set Properties Dialog

An Ordered Set cannot be filtered in a Global State, but can be filtered in a Sequence State.

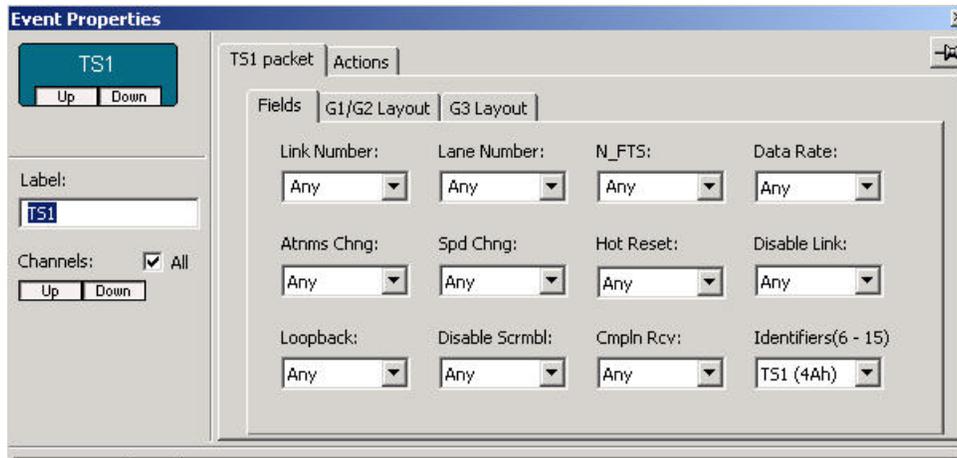


Figure 5.23: Ordered Set Properties Dialog

## Error Properties Dialog

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

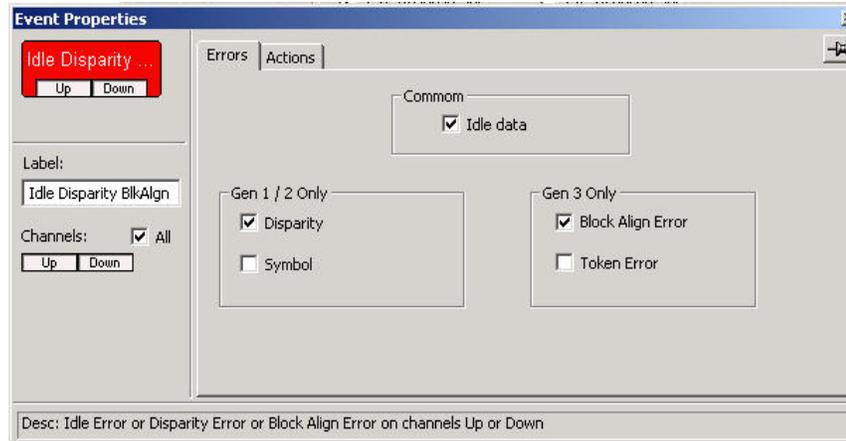


Figure 5.24: Error Properties Dialog

## DLLP Packet Properties Dialog

The DLLP Packet Properties dialog allows you to specify any DLLP field as shown below.

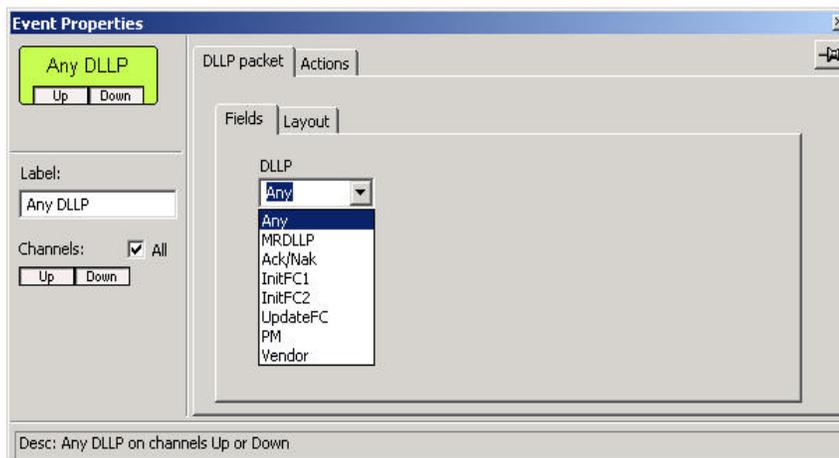


Figure 5.25: DLLP Packet Properties Dialog





TABLE 5.4: Event Actions

Global Timer	Set the Global Timer, there are two options available.
Global Timer Action	You can set the Action of the timer to Start or Reset. When you reset the timer it resets to it's initial value. The default is No Action.
Global Counter	Set the Global Counter, there are two options available.
Global Counter Action	You can set the Action of the Counter to Increment or Reset. The Counter increments by one and resets to its initial value. The default is No Action.

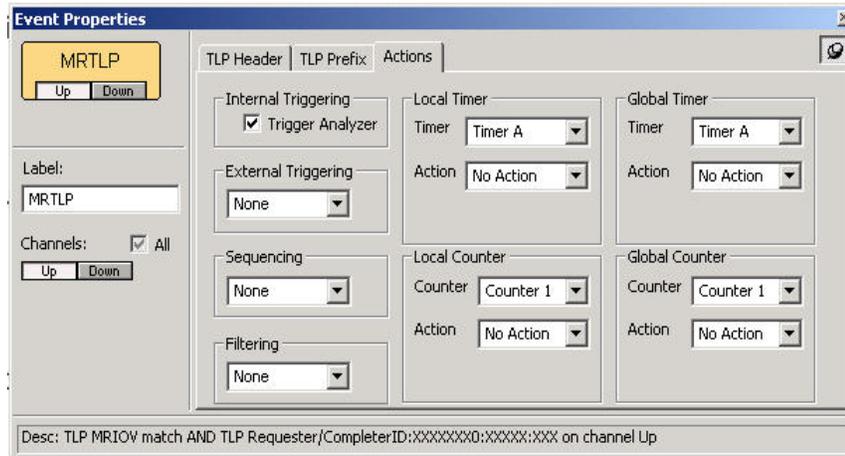


Figure 5.29: Actions Properties Dialog

## Counter

Counters can be created for any specific event or for multiple events. Counters function similar to an event and are independent of the event, thus allowing greater flexibility. You can select a counter for any event and if both channels are selected you can set the counter to count upstream and downstream. Counters can be reset providing further flexibility. The counter once set lives in the State. In an Advance to Sequence state once the action proceeds from one sequence state to the next, the counter in the preceding state will stop and the counter in the current state will start.

There are two Counters for the Global State and four Counters for the Sequence State.

---

**Note:** It is an invalid configuration for some events when you try and set a counter and timer when both channels are selected.

---

The counters have different colors for the Global State and Sequence State. Each color signifies a different meaning in the Global and Sequence states.

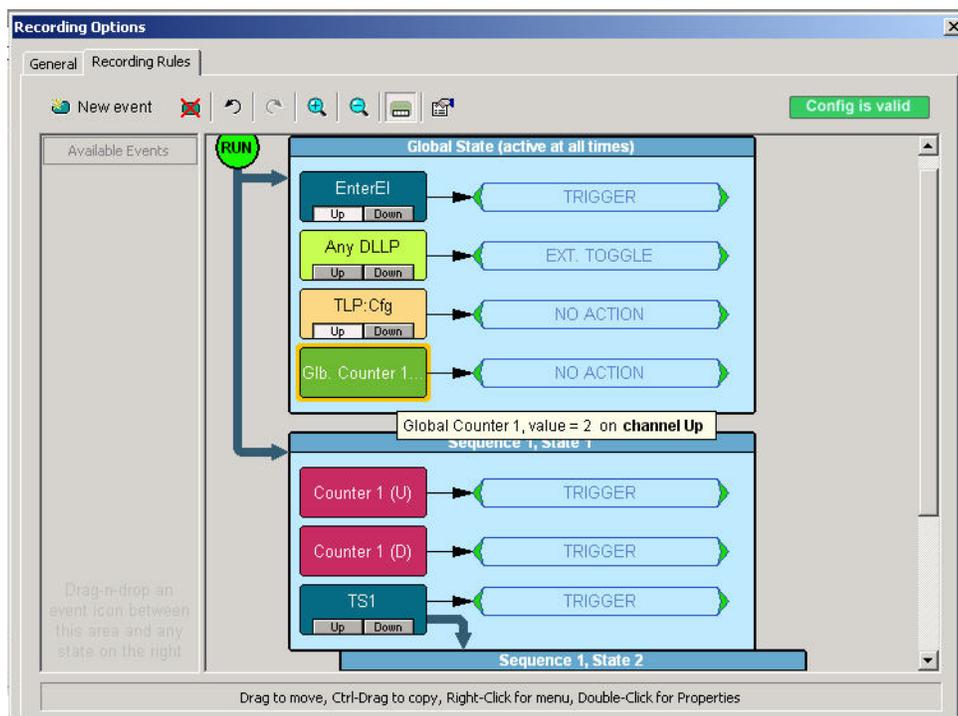


Figure 5.30: Global and Sequence State Counters

As shown in [Figure 5.30](#) there is a Global Counter 1, set to the value of 2 on channel up displayed in green in the Global State and there are two counter 1s, set to the value of 2, one counting upstream and the other counting downstream displayed in pink in the Sequence State.

## How to Set a Counter

Counters are events and you can add a counter to the Global State or the Sequence State as an event by doing the following:

Right-click in the blue space in the Global or Sequence State and **New Event > Counter > UpStream or DownStream**. See Figure 5.31 on page 77.

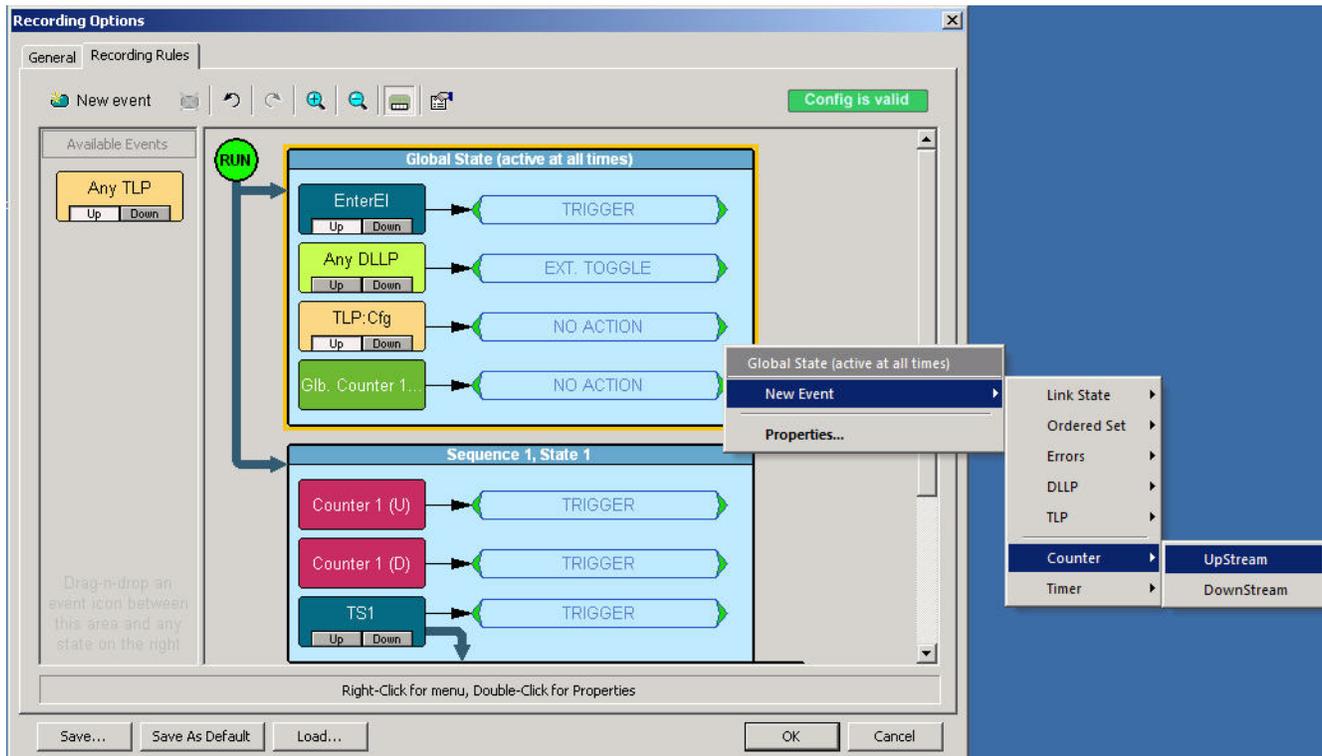


Figure 5.31: Setting Global and Sequence State Counter Events

## How to Increment or Reset a Counter

You can Increment or Reset counters in the Global State and in the Sequence State by performing the following steps:

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 “Defining Recording Rules” on page 84).
2. Right-click on an event and select **Specify Actions > Increment Global Counter > Global Counter 1** from the menu. See the figure below.

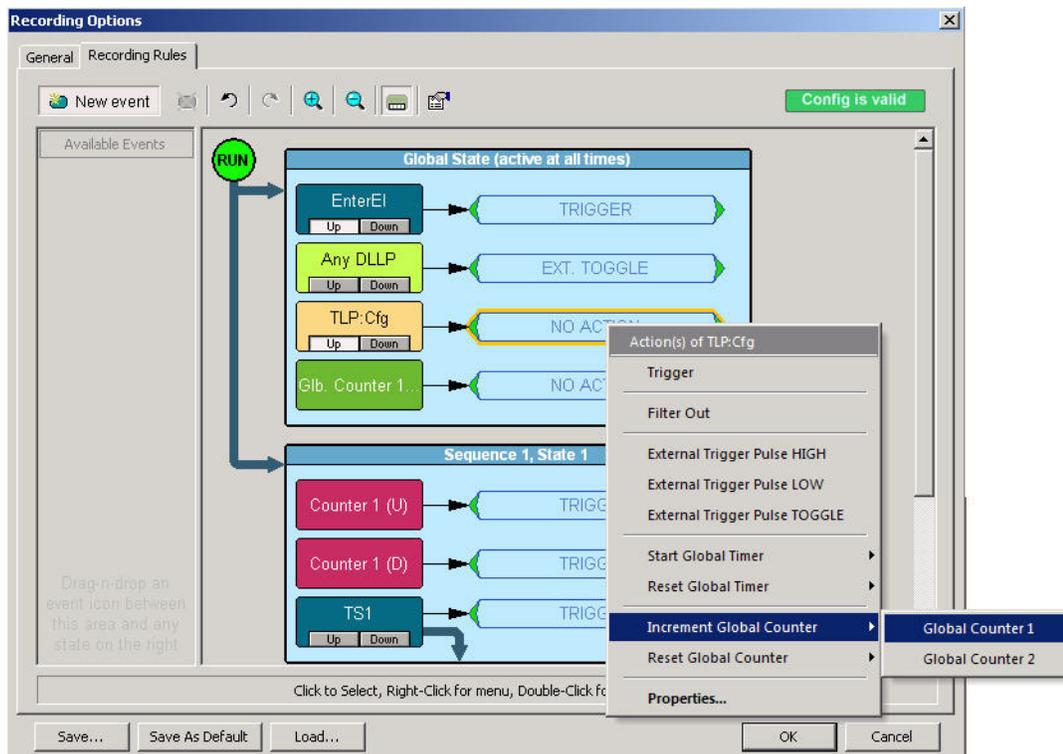


Figure 5.32: Incrementing and Resetting Global and Sequence State Counters

## Changing the Value of the Counter

To change the value of the counter:

1. Double-click on the Counter.
2. Enter a new value in the pop-up dialog. This causes the new value to appear in the counter button.

## Deleting a Counter

To delete a counter

1. Right-click on the Counter.
2. Select **Delete This Event**. The counter will disappear from the event.

## Timer

The Timer has two options which are Start and Reset. When set to Start it starts the timer and when set to Reset it resets the timer to its initial value. When the timer count is down to 0 the action is triggered.

The Global State timer can trigger, start an action. It can also affect some other timers and counters.

**Note:** It is an invalid configuration for some events when you try and set a counter and timer when both channels are selected.

The timers have different colors for the Global State and Sequence State. Each color signifies a different meaning in the Global and Sequence states.

There are two Timers for the Global State and four Timers for the Sequence State.

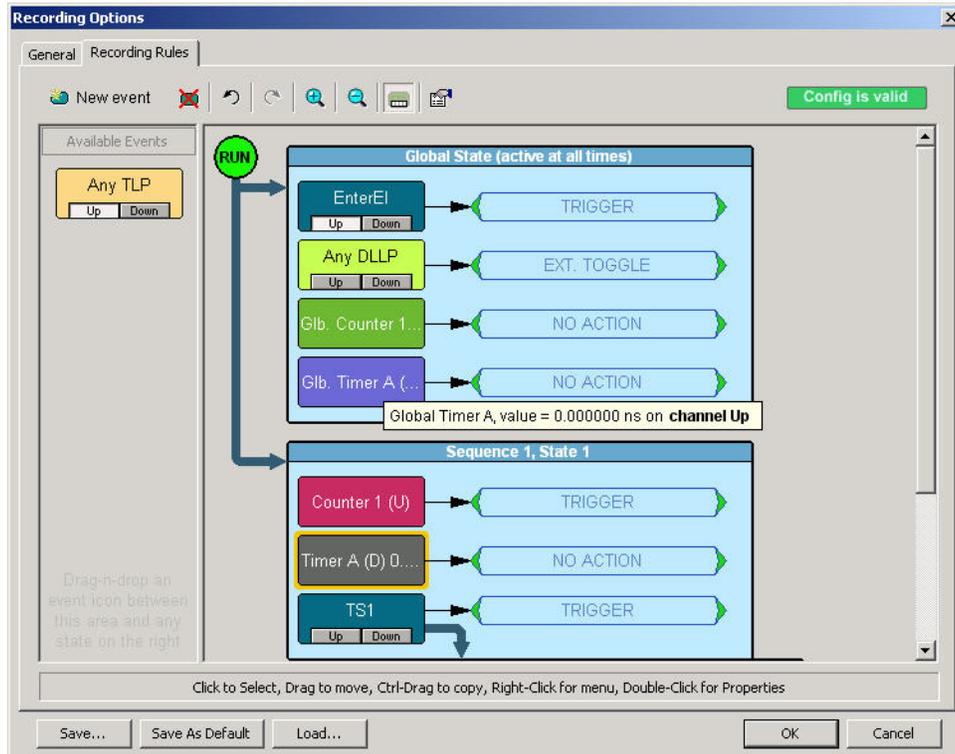


Figure 5.33: Global and Sequence State Timers

As shown in [Figure 5.33](#) there is a Global Timer A, set to the value of 0.000000 ns on channel Up displayed in blue in the Global State and there is one timer A, set to the value of 0.000000 ns on channel Down displayed in brown in the Sequence State.

## How to Set a Timer

Timers are events and you can add a timer to the Global State or the Sequence State as an event by doing the following:

Right-click in the blue space in the Global or Sequence State and **New Event > Timer > UpStream or DownStream**. See Figure 5.34 on page 80.

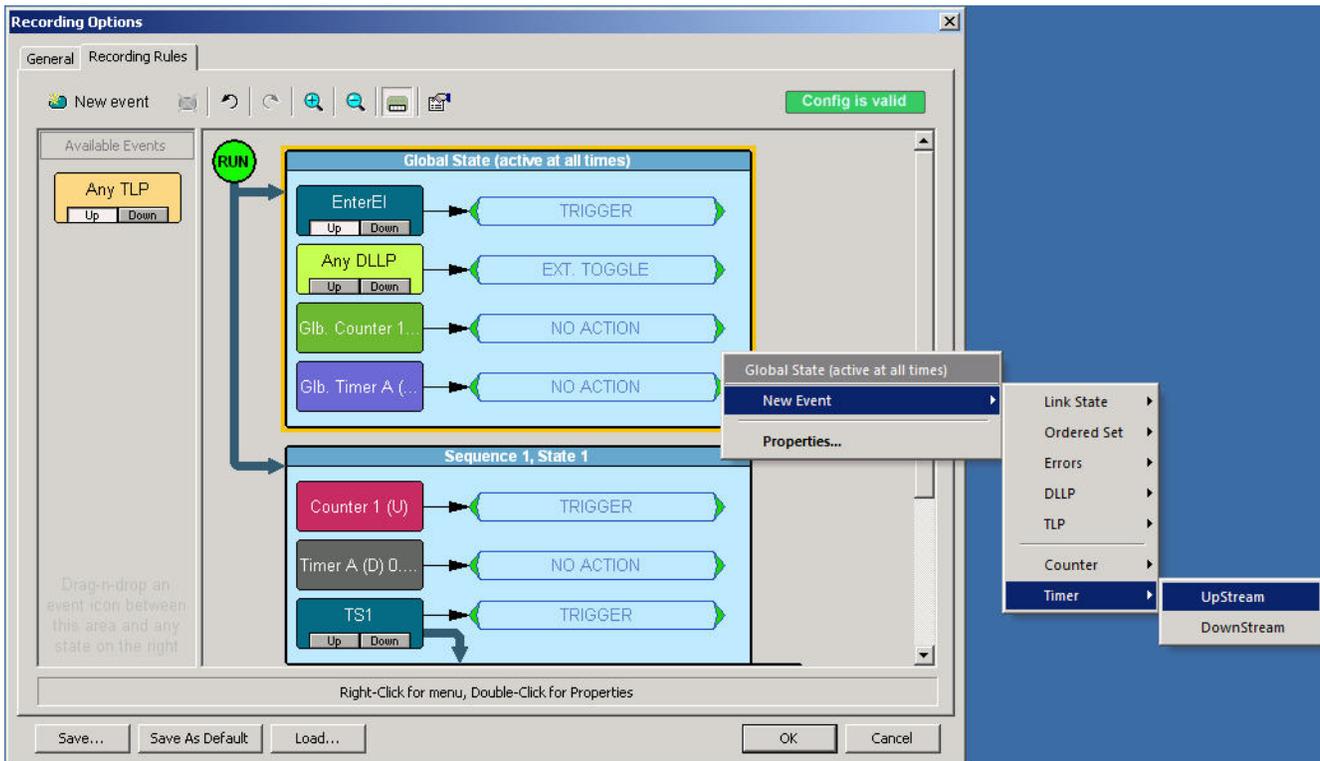


Figure 5.34: Setting Global and Sequence State Timer Events

## How to Start or Reset a Timer

You can Start or Reset the Timer in the Global State and in the Sequence State by performing the following steps:

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 “Defining Recording Rules” on page 84).
2. Right-click on an event and select **Specify Actions > Start Global Timer > Global Timer A** or **Timer B** from the menu. See the figure below.

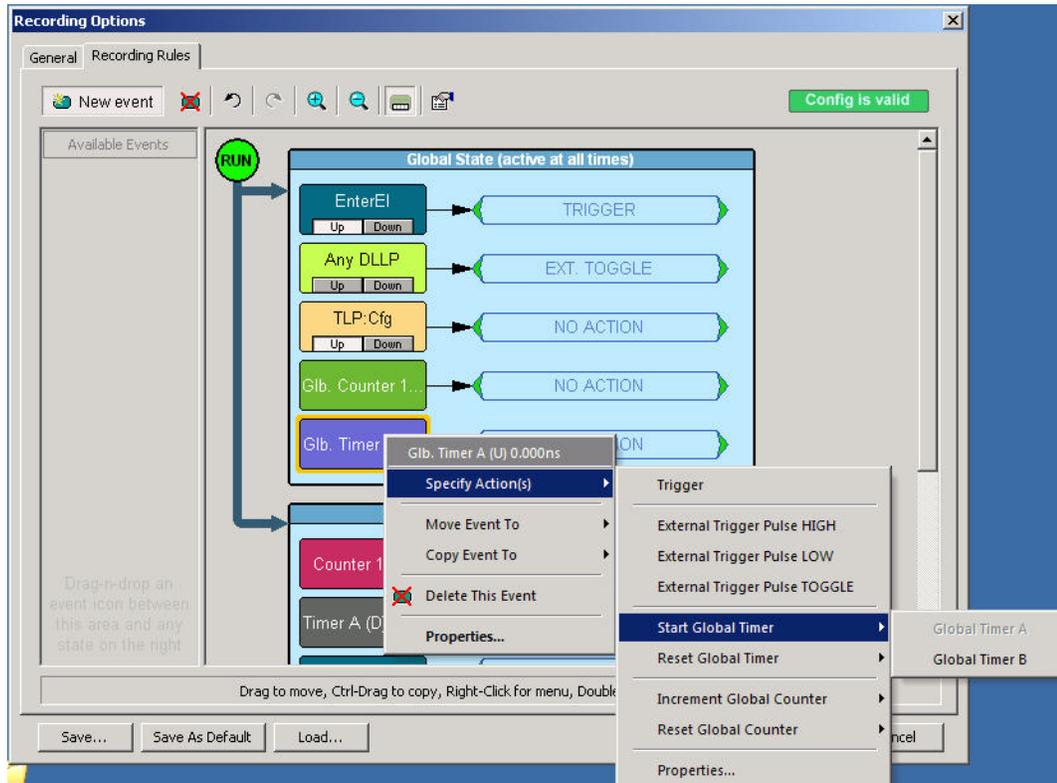


Figure 5.35: Starting and Resetting Global and Sequence State Timers

## Changing the Value of the Timer

To change the value of the timer:

1. Right-click on the Timer.
2. Select **Properties**
3. Enter in values for the Timer in the fields provides in Secs, Millisecs, Microsecs and Nanosecs on the Timer tab.

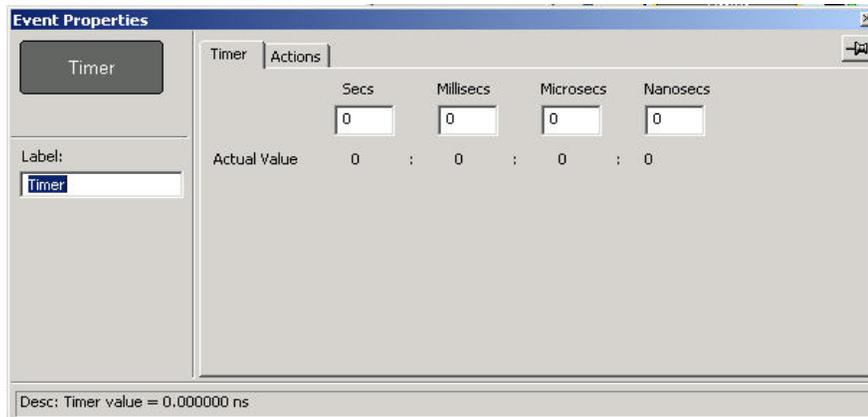


Figure 5.36: Setting the Timer Values

4. Click on the Actions tab and set the External and Internal Triggering, Sequencing and Filtering options. You can label the timer.

## Deleting a Timer

To delete a Timer

1. Right-click on the Timer.
2. Select **Delete This Event**. The Timer will disappear from the event.

## Channel

Every event has two channels, one upstream and the other downstream. You can use both channels with any event. The channels are independent of each other. If both channels are selected it is valid but no action occurs, and thus no timer and counter is created. [Figure 5.37](#) shows three events in the Global State, the first event is on Channel Up and the 3rd event is on Channel Down.

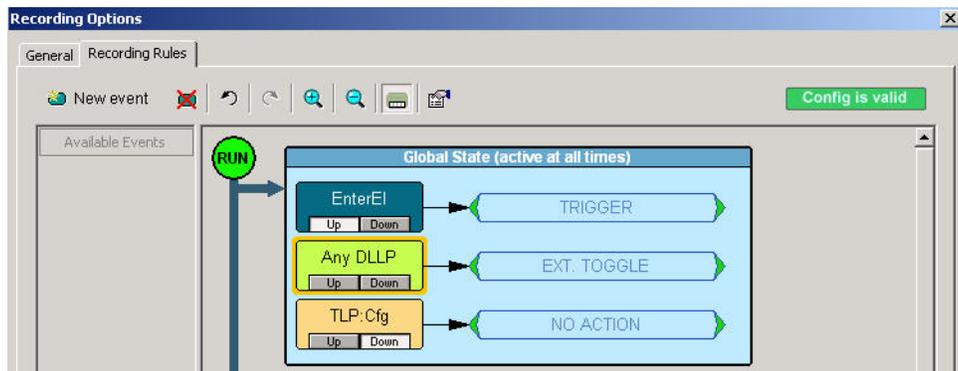


Figure 5.37: Events with Channels

## Defining Recording Rules

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

You can also access the New Event menu by right-clicking in the blue space in the Global State or in the Sequence State (see Figure 5.38 on page 84).

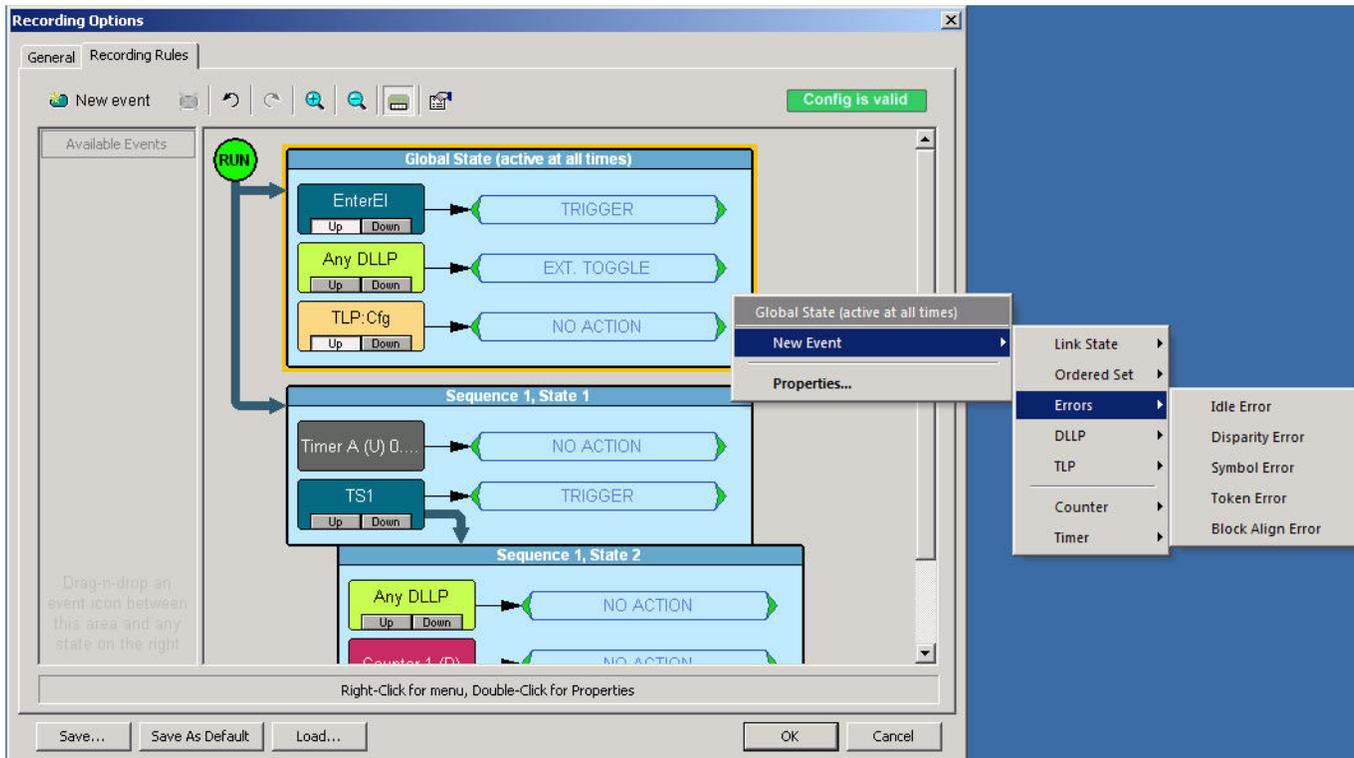


Figure 5.38: Defining New Events

There are three steps to creating a recording rule:

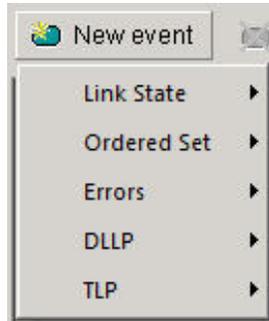
1. Select events.
2. Place the events in the Global State or Sequence cells.
3. Assign actions to the events.

---

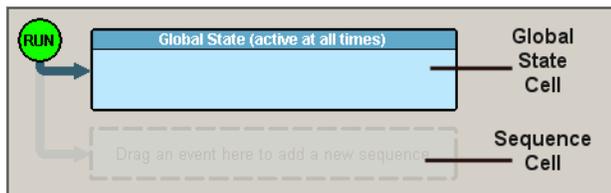
**Note:** There are limits to the types of rules that can be created.

---

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



2. Drag the selected events from the Available Events area into either the Global State Cell or the Sequence Cell (see ["Recording Rules Overview" on page 60](#)).



### 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 add a new sequence**. At this point, the selected events have no effect because an action has not been assigned.

3. To select a sub-set of your selected event, right-click it and choose **Properties**. A Properties dialog 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.

- 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).

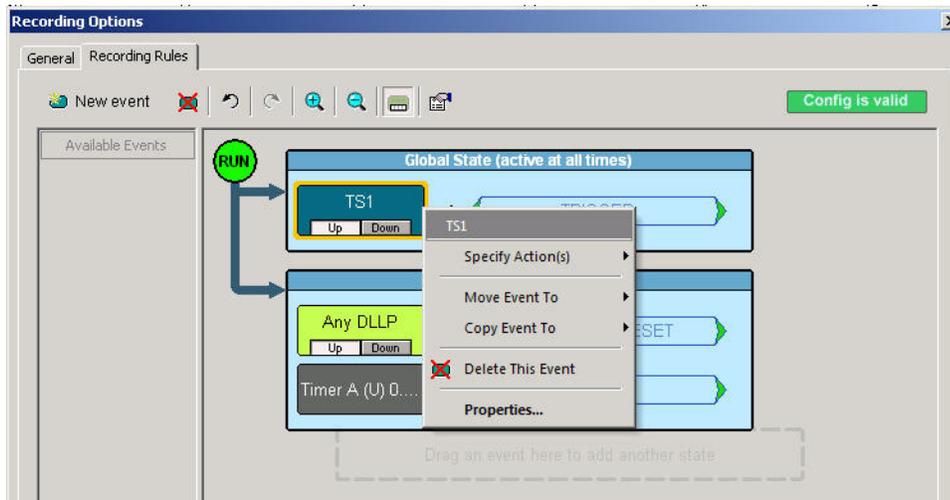


Figure 5.39: Assigning an Action

---

**Note:** You can also assign actions to events by double-clicking the event or action and selecting the Actions page when the Properties dialog opens (see “Event Properties Dialog Box Features” on page 69).

---

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

Start **Recording**  button.

## Filter Out

A filter causes the Analyzer to filter 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 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 Out**.

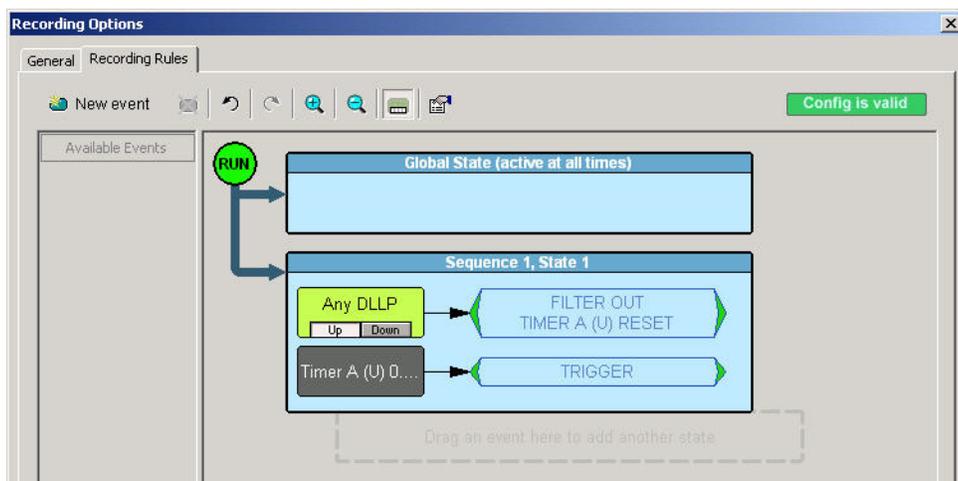


Figure 5.40: Filter Out Option

---

**Note:** The Filter Out option is only available in the DLLP, TLP, and Ordered Sets TS1 and TS2.

---



## Reading CATC Traces

### Viewing PCI Express CATC Traces

PETracer™ displays traffic as labeled, color-coded, and time-stamped rows.

Packet	R→	G1	TLP	Mem	MW(64)	RequesterID	Tag	Address	1st BE	Last BE
0		x1	1		11:00000	000:01:2	3	781F33AB:12340000	1111	1000
Data				ECRC	LCRC	Idle	Time Stamp			
1023 dwords				0x0D632C96	0x36214D17	0.000 ns	0000 . 000 000 000 s			

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.

### 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.

Packet	R→	G1	TLP	Mem	MW(64)	TC	TD	EP	Attributes	Length	RequesterID	Tag	Address	1st BE	Last BE	
0		x1	1		11:00000	0	1	0	00	1023	000:01:2	3	781F33AB:12340000	1111	1000	
Data																
0:	7F234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	7E234567	89ABCDEF	01234567	89ABCDEF
12:	01234567	89ABCDEF	01234567	89ABCDEF	7D234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF
24:	7C234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	7B234567	89ABCDEF	01234567	89ABCDEF
36:	01234567	89ABCDEF	01234567	89ABCDEF	7A234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF
48:	79234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	78234567	89ABCDEF	01234567	89ABCDEF
60:	01234567	89ABCDEF	01234567	89ABCDEF	77234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF
72:	76234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	75234567	89ABCDEF	01234567	89ABCDEF
84:	01234567	89ABCDEF	01234567	89ABCDEF	74234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF
96:	73234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	72234567	89ABCDEF	01234567	89ABCDEF
108:	01234567	89ABCDEF	01234567	89ABCDEF	71234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF
120:	70234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	...			
Data				ECRC	LCRC	Idle	Time Stamp									
0x0D632C96				0x36214D17	0.000 ns	0000 . 000 000 000 s										

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

## 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.

## 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 dialogs that contain detailed information about cells within the CATC Trace, for example, the Show Configuration Space dialog.

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.

## 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

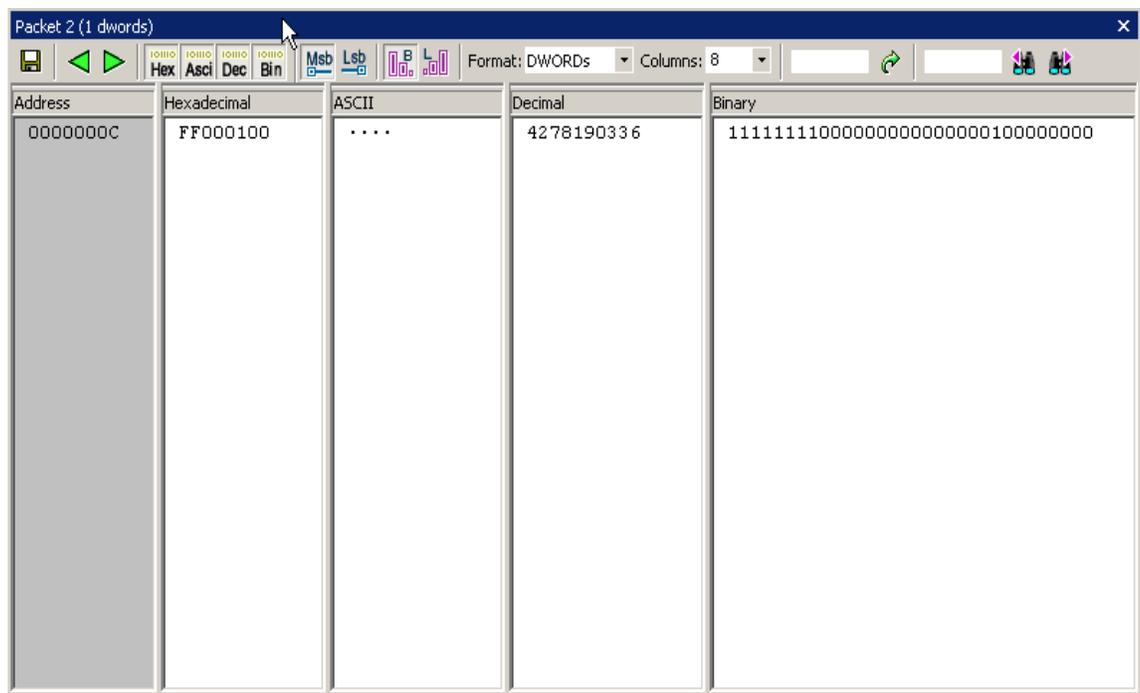


Figure 6.1: Viewing a Data Block

You can display data in Hexadecimal, 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 hexadecimal offset values.

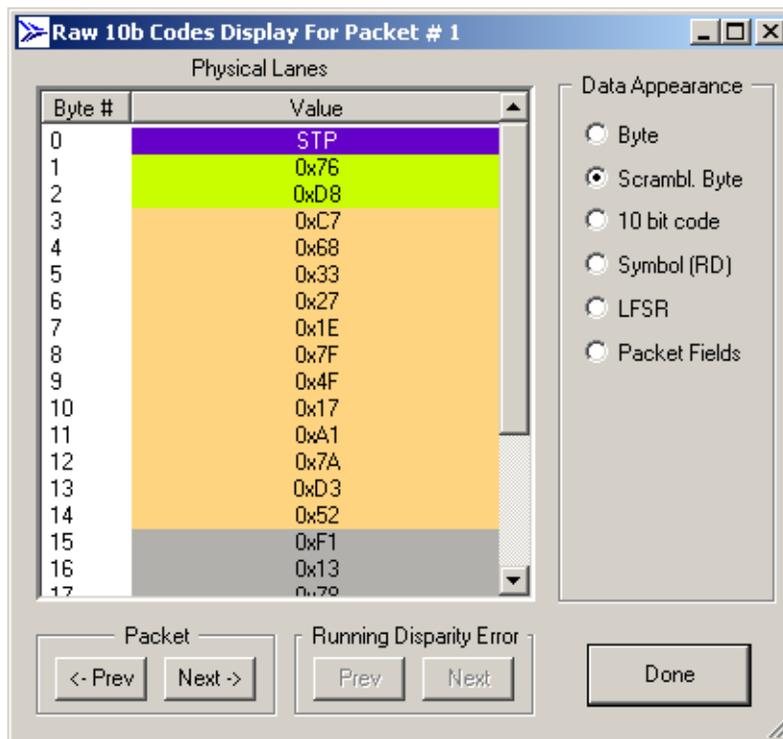
You can go to or search Previous or Next.

## 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:

1. Left-click the **first cell** in a packet.
2. Select **Show Raw 10b Codes** from the pop-up menu to display the Raw 10b Codes window

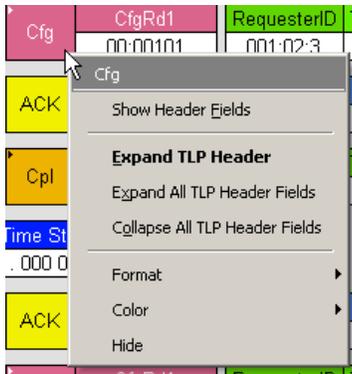


3. To change the format of the data, use the options along the right side of the dialog.
4. To navigate the CATC Trace, use the **Prev** and **Next** buttons.

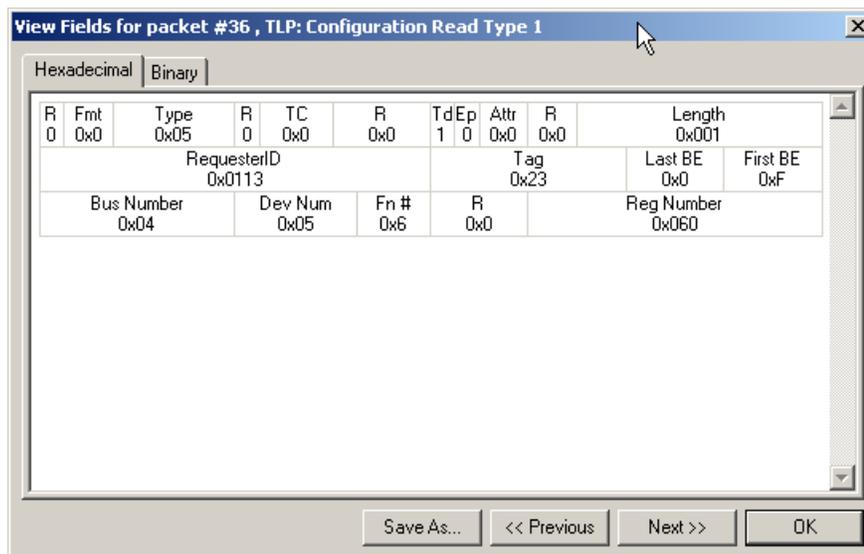
## Show Header Fields

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

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



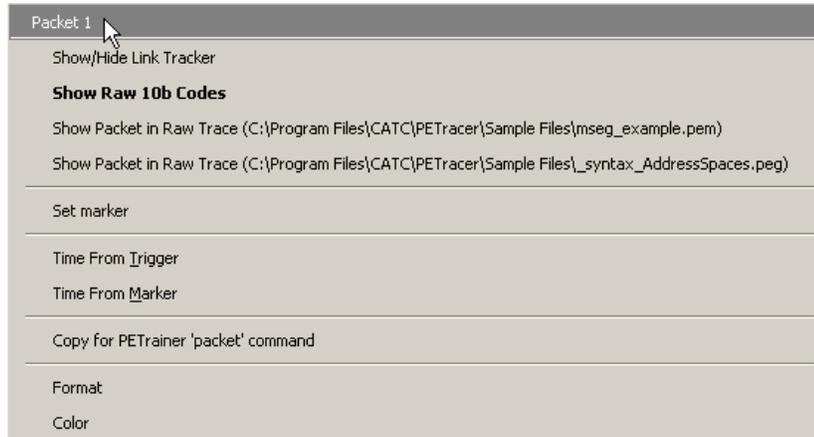
2. Select **Show Header Fields**. The following dialog opens.



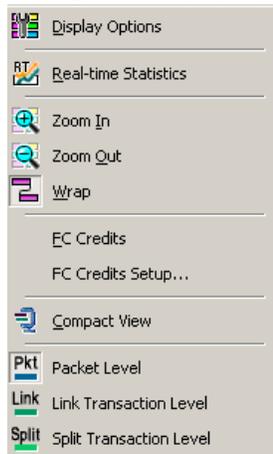
3. Use the **Prev** and **Next** buttons to navigate to other headers.

## Packet Cell Popup Menus

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

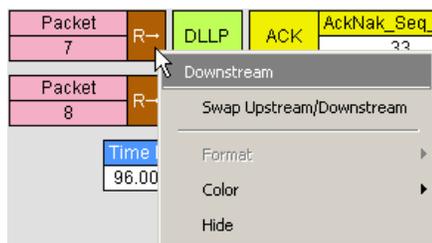


The right-click pop-up menu from Packet cell is displayed below:



## 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 92), which exposes a detailed view of the selected Header field.

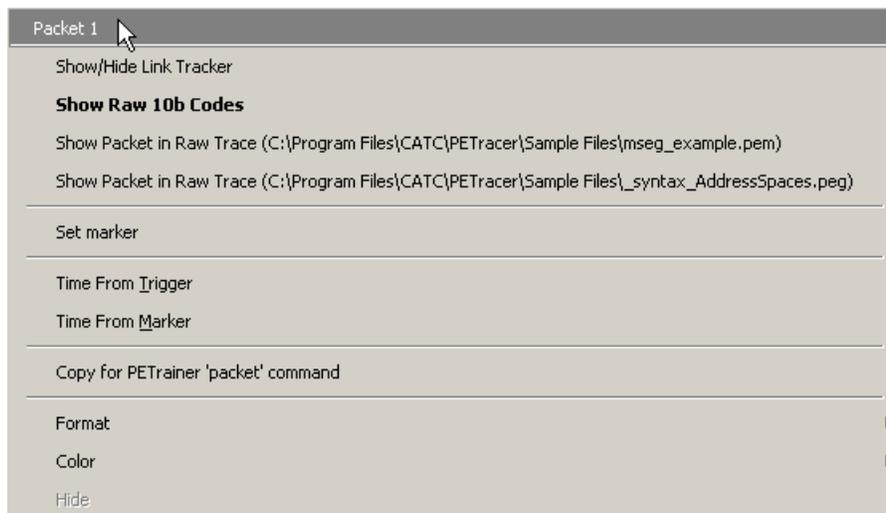


## Set Marker

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.

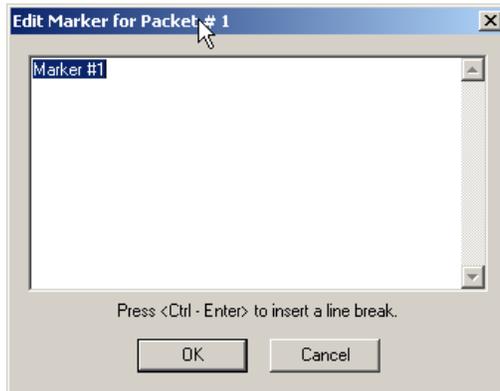
To set a marker, perform the following steps:

1. Left-click the **Packet** field of the packet you want to mark.



2. Click **Set Marker**.

3. When the Edit Marker for Packet # pop-up appears, enter a unique identifier for the packet in the Comment field.

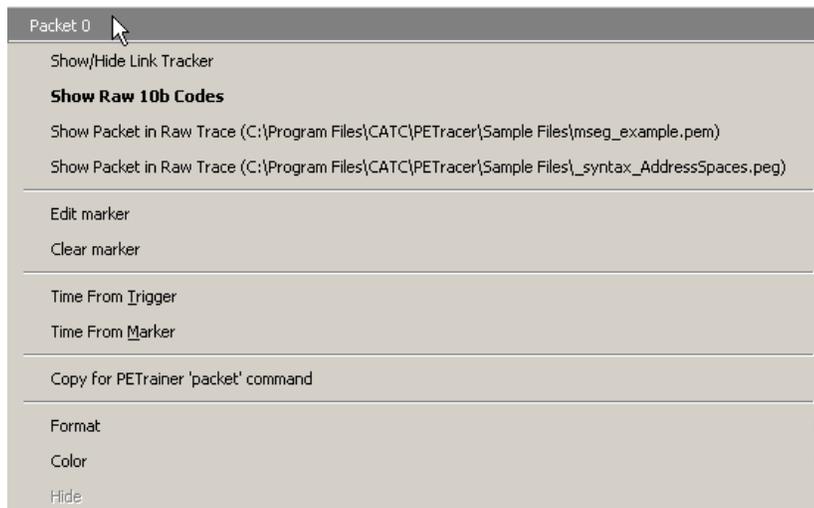


Later, you can go directly to this packet using the Go To Marker operation in the Search Menu.

## Edit or Clear Marker

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

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



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.

## Decoding Traffic

The PETracer software has three decode levels:

### Packet

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

Packet	R→	G1	TLP	Mem	MWVr(64)	RequesterID	Tag	Address	1st BE	
0		x1	1	Mem	11:00000	000:01:2	3	781F33AB:12340000	1111	
		Last BE	Data		ECRC	LCRC	Idle	Time Stamp		
		1000	1023 dwords		0x0D632C96	0x36214D17	0.000 ns	0000 . 000 000 000 s		
Packet	R→	G1	TLP	Mem	MRd(32)	RequesterID	Tag	Address	1st BE	Last BE
1		x1	2	Mem	00:00000	000:01:2	4	00010000	1111	1111
		ECRC	LCRC	Time Delta	Time Stamp					
		0x0A83F0CE	0xA3AD0991	96.000 ns	0000 . 000 016 480 s					

### Link

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

Link Tra	R→	G1	TLP	Mem	MWVr(64)	RequesterID	Tag	Address	1st BE	Last BE	
0		x1	1	Mem	11:00000	000:01:2	3	781F33AB:12340000	1111	1000	
		Data	ECRC	VC ID	Explicit NAK	Packet #2	Metrics	# Packets	Time Delta		
		1023 dwords	0x0D632C96	0				2	16.480 µs		
		Time Stamp	0000 . 000 000 000 s								
Link Tra	R→	G1	TLP	Mem	MRd(32)	RequesterID	Tag	Address	1st BE	Last BE	
1		x1	2	Mem	00:00000	000:01:2	4	00010000	1111	1111	
		ECRC	VC ID	Explicit ACK	Packet #4	Metrics	# Packets	Time Delta	Time Stamp		
		0x0A83F0CE	0				3	256.000 ns	0000 . 000 016 480 s		

### Split

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

Link Tra	R→	G1	TLP	Mem	MWVr(64)	RequesterID	Tag	Address	1st BE	Last BE	
0		x1	1	Mem	11:00000	000:01:2	3	781F33AB:12340000	1111	1000	
		Data	ECRC	VC ID	Explicit NAK	Packet #2	Metrics	# Packets	Time Delta		
		1023 dwords	0x0D632C96	0				2	16.480 µs		
		Time Stamp	0000 . 000 000 000 s								
Split Tra	R→	G1	Mem	MRd(32)	RequesterID	CompleterID	Tag	TC	VC ID	Address	
0		x1	Mem	00:00000	000:01:2	001:01:0	4	0	0	00010000	
		Status	Data	Metrics	# LinkTras	Time Delta	Time Stamp				
		SC	1023 dwords		3	16.848 µs	0000 . 000 016 480 s				

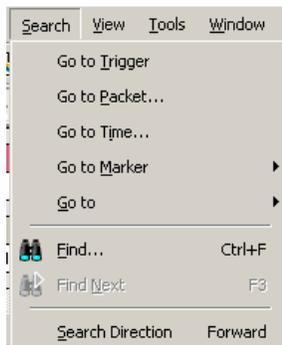
## Searching CATC Traces

This chapter describes how to search for CATC Trace events.

### 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.



### Go to Trigger

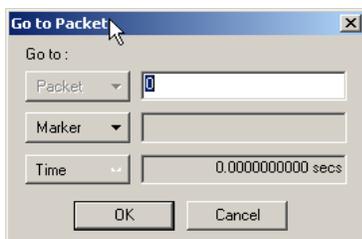
To position a trigger packet at the top of the screen:

Select **Search > Go to Trigger**.

### Go to Packet

To position a packet at the top of the screen:

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

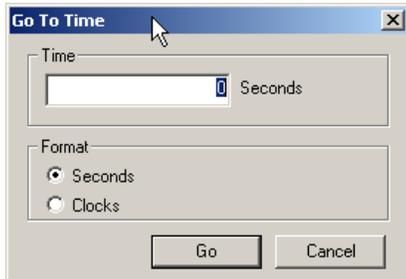


2. Enter the packet number, marker, or time.
3. Click **OK**.

## Go to Time

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

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



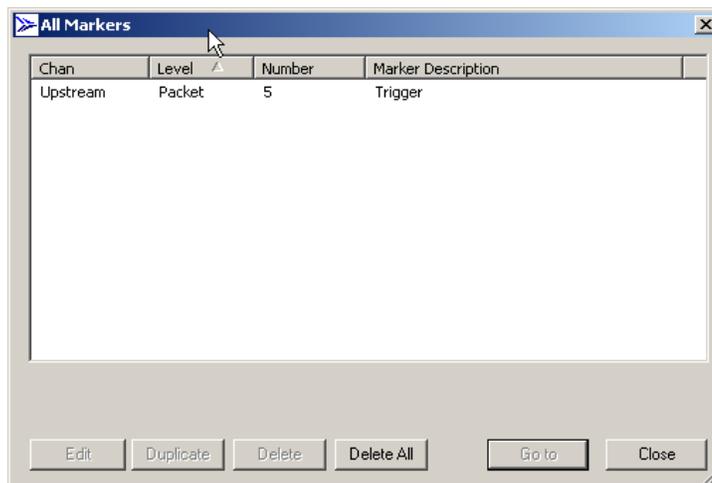
2. Enter the time and format (seconds or clocks).
3. Click **Go**.

## 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.

## 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

## 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:

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

## 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, Direction, Errors.

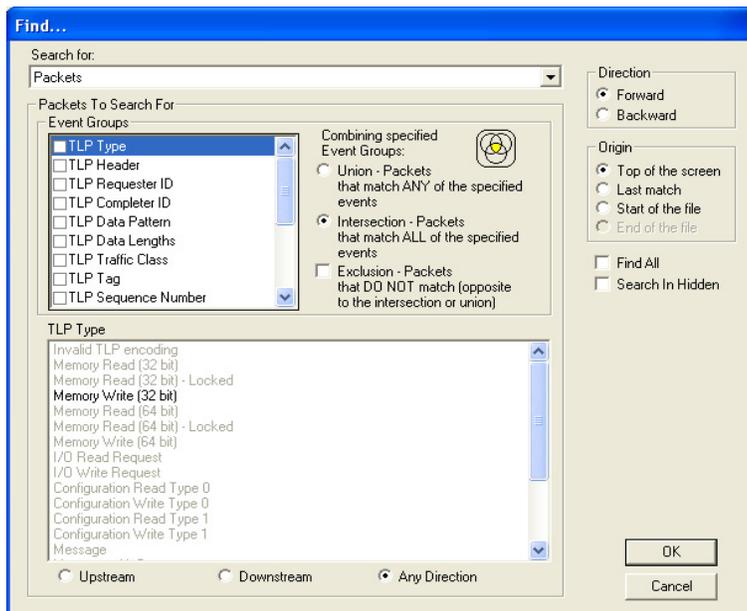
You can search link transactions by Event Group: TLP Type, Traffic Class, Virtual Channel, Direction, Requester ID, Completer ID, Status, Tag.

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

The options Union, Intersection, and Exclusion allow you to create complex searches such as “Find x OR y” or “Exclude all x or y.”

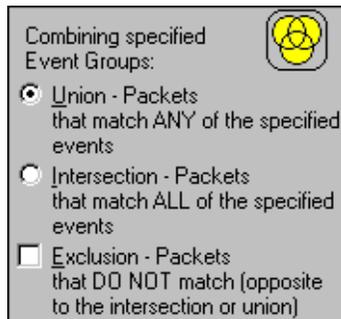
To find an item:

1. Open a CATC Trace.
2. Open Find by selecting **Search > Find** from the menu or clicking  .



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.
4. From the Event Groups menu, select an **Event Group**. The menu in the far right of the dialog is context sensitive and changes to reflect the options for that group.
5. In the menu in the far right, select one or more items.
6. Repeat Step 5 for each Event Group of interest for the selected display level.
7. Under Direction, select **Forward** or **Backward** to select a search direction.
8. Under Origin, select a starting point for the search.

9. Under **Combining Specified Event Groups**, select an option.



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 ...”
1. Repeat Steps 3 through 9 for additional display levels.
  2. **Find All** displays all matching packets or transactions in a separate view.
  3. **Search in Hidden** includes hidden packets or transactions in the search.
  4. Click **OK**.

## Event Groups

The Event Groups for Packets are:

- TLP Type
- TLP Header
- TLP Prefix
- 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

## Search for the Next Packet Type

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

## Display Options

### 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.

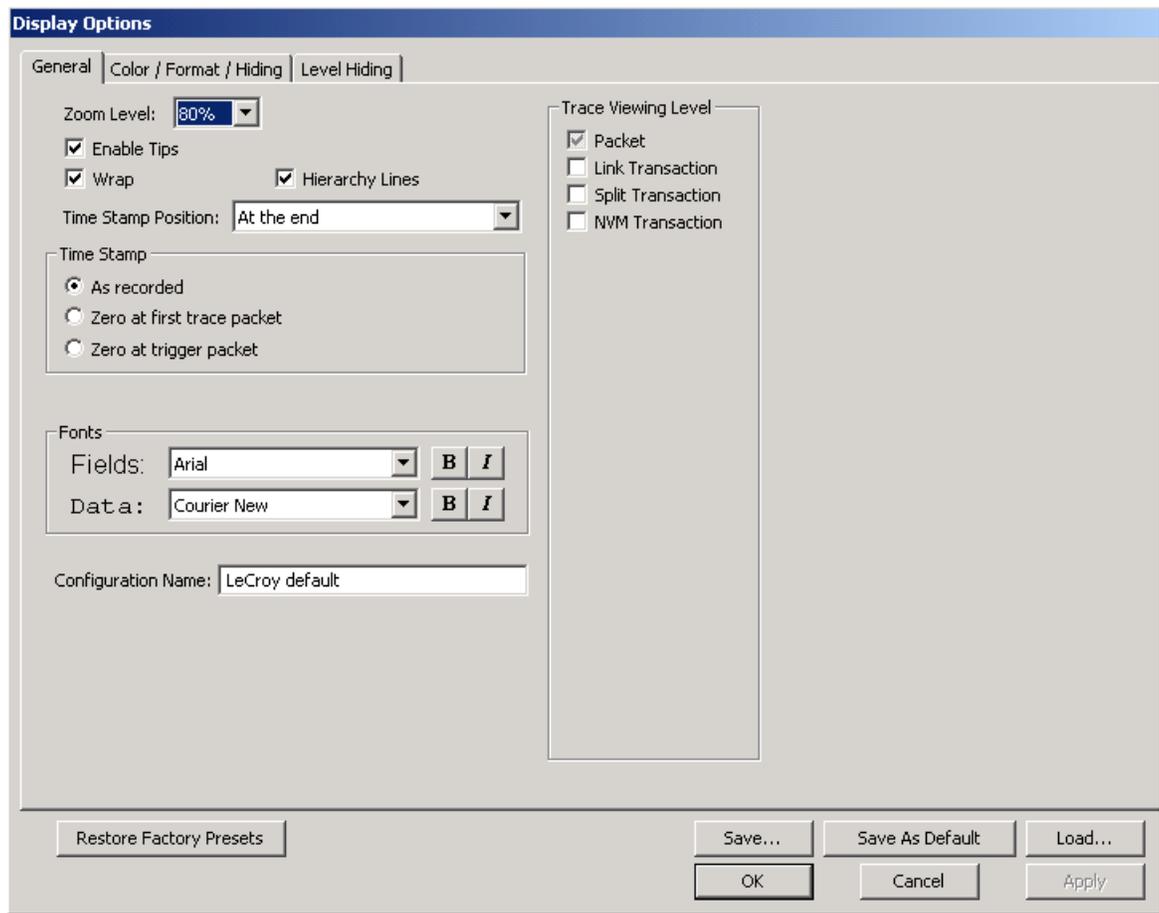


Figure 8.1: Display Options Dialog - General Tab

## 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.

**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.

**Trace Viewing Level:** Allows the CATC Trace to be displayed in different hierarchical levels: Packets, Link Transactions, Split Transactions and NVM 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.

## 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.

## 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. See the following screen capture.

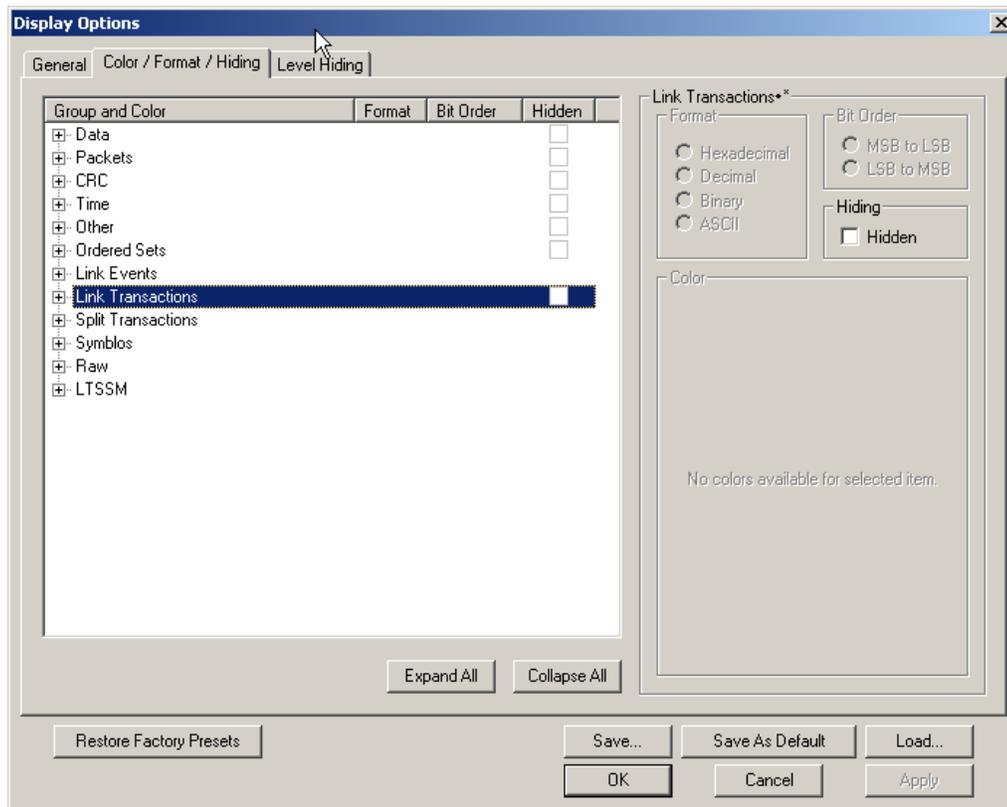


Figure 8.2: Display Options Dialog - Color/Format/Hiding Tab

## 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.

1. Click **View > Set Display Options** to open the Display Options dialog.
2. Select the **Color/Format/Hiding** property page.

- 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:

Group and Color	Format	Bit Order	Hidden
[-] Data			<input type="checkbox"/>
Packet Data	Hex	MSB to LSB	<input type="checkbox"/>
Data Length	Dec		<input type="checkbox"/>
External Data	Bin		<input type="checkbox"/>
Cfg Data	Hex		<input type="checkbox"/>
Invalid packet	Hex	MSB to LSB	<input type="checkbox"/>
Raw Data			<input type="checkbox"/>
[+] Packets			<input type="checkbox"/>
[+] CRC			<input type="checkbox"/>

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

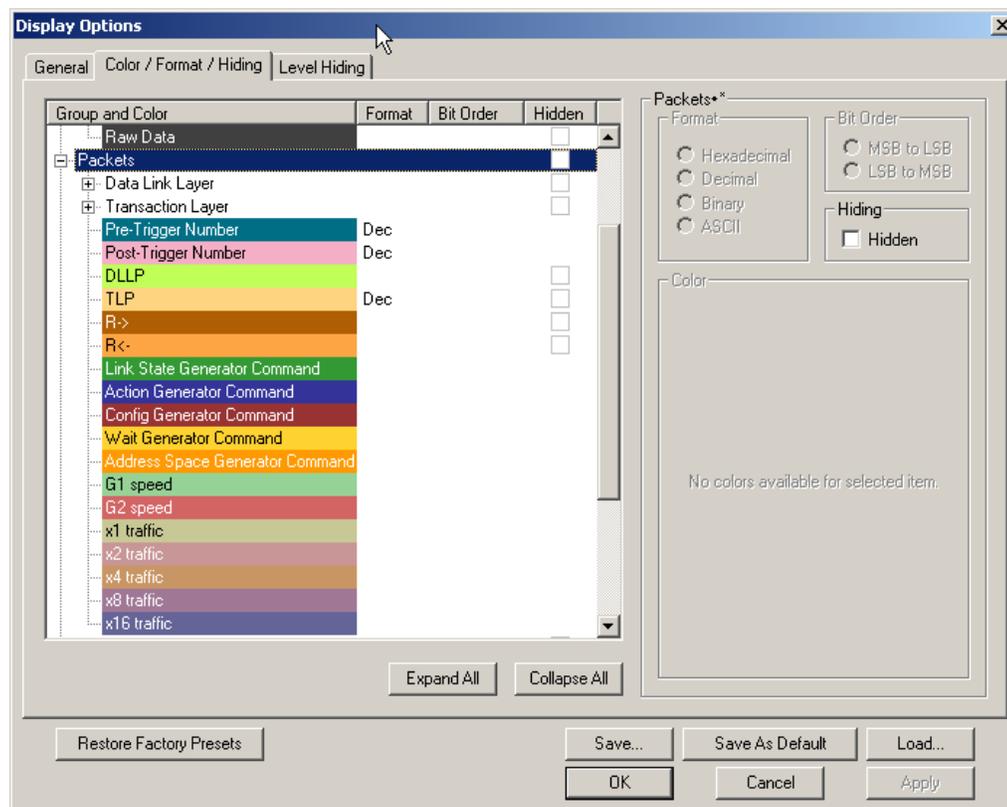


Figure 8.3: Display Options Dialog Color/Format/Hiding Tab

## 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.

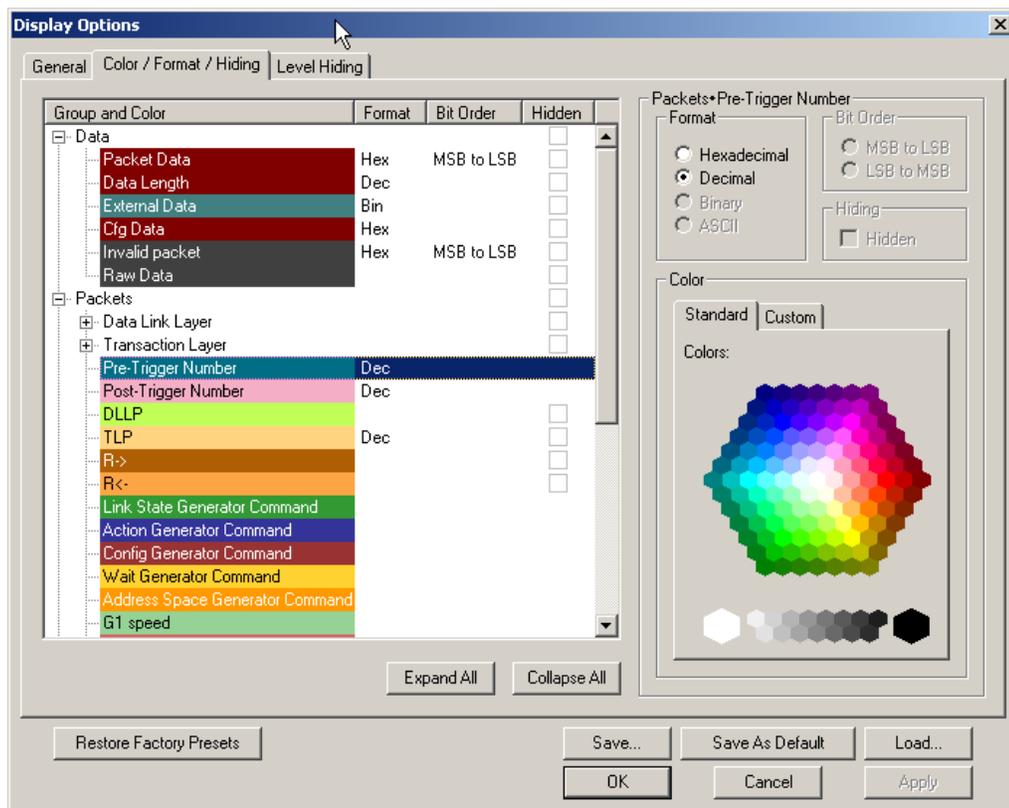


Figure 8.4: Display Options Dialog Color/Format/Hiding Tab

To change the format of alphanumeric characters in a field:

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).
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 become active, as shown below:



3. Select a **format**.
4. Specify the bit order in the displayed fields by checking/unchecking the **MSB > LSB** checkboxes.
5. Click **Apply** or **OK**.

## Hiding Fields

To hide a field:

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

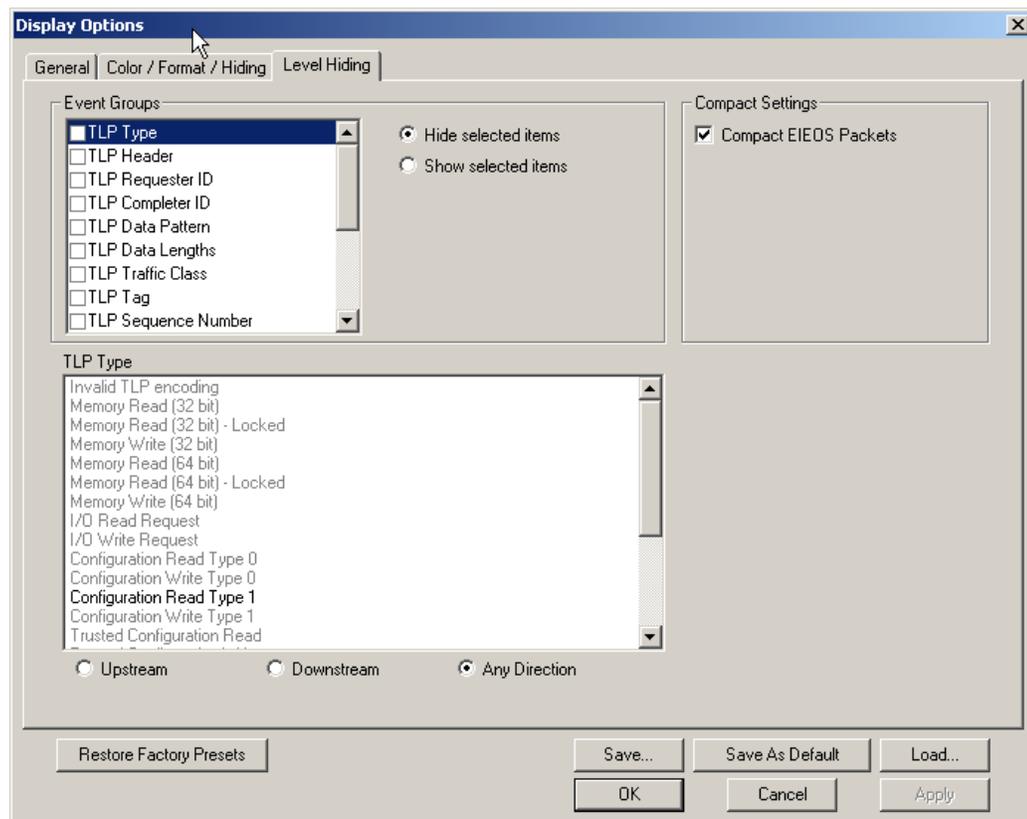


Figure 8.5: Display Options Dialog - Level Hiding Tab

To hide a level:

1. Select an Event Group.
2. Select whether to **Hide** or **Show selected items**.
3. Select **Upstream**, **Downstream**, or **Any Direction**.
4. (Optional) Select **Compact EIEOS packets**.
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

## 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 opens to let you load a previously saved display options file.

1. Click **Load** to use a previously defined display options file.
2. When you see the Open File pop-up window, enter the name of the file you want to load and click **Open**.
3. When the *PETracer*<sup>™</sup> software returns you to the Recording Options menu, click **OK** to activate the display options you selected.

## 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.

## BitTracer Recording

**Note:** BitTracer Recording is an optional feature.

The Summit T28 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.

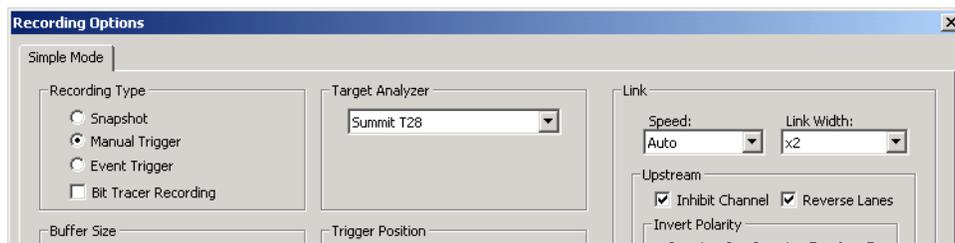
You can export BitTracer recordings for viewing in CATC Trace format.

**Note:** BitTracer Mode recording is only available in the LeCroy Summit T28 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 LeCroy.

### Enabling BitTracer Recording

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

In the Target Analyzer section of the General tab, select **Summit T28**.



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

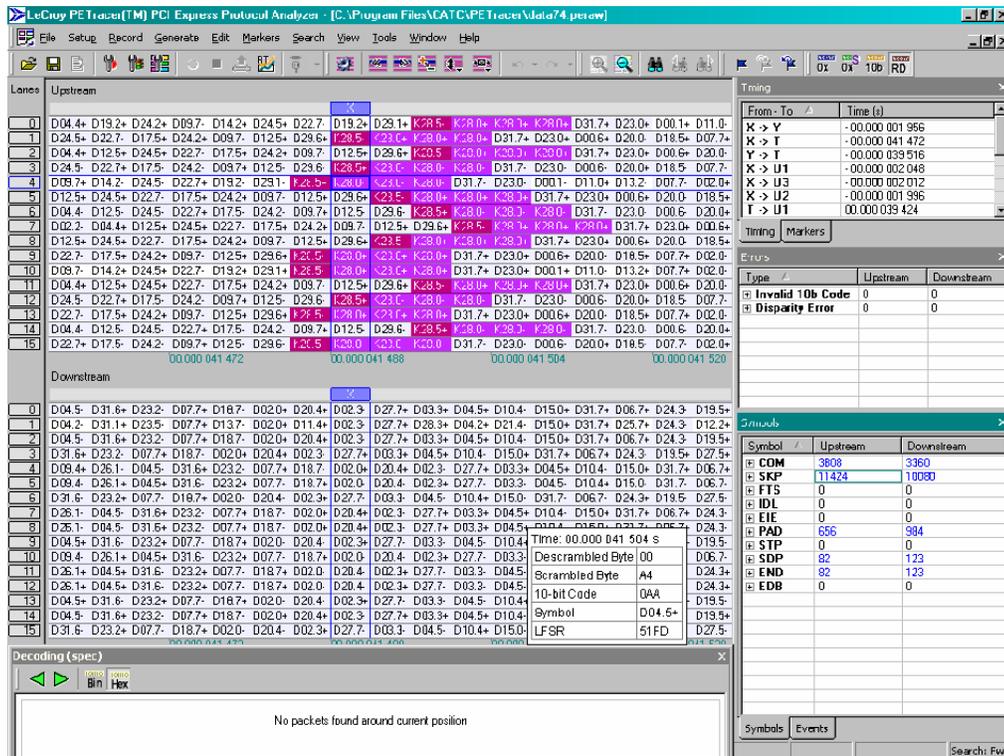


In Bit Tracer Recording, you can use the Snapshot, Manual Trigger, and Event Trigger recording types.

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

## 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.

## 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 PETracer 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.

## 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.

---

## 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 115) (color coded according to traffic speed).
- All symbols of a TS1/TS2 ordered set

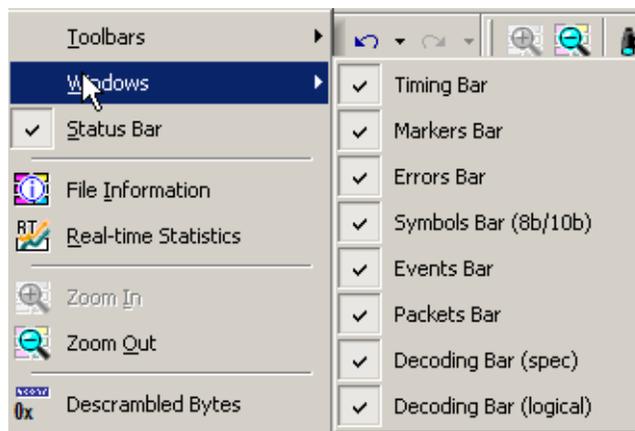
By default, these color selections match the standard color selections used in the CATC Trace format. You can modify them in the Display Options menu, accessible from the Main toolbar or the Setup menu.

## 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.

## 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

Lanes	Upstream														
	T	X										Y			
0	232	2A9	1A6	1D9	14E	1C6	305	0F4	0F4	0F4	2B1	3A4	276	0B4	13A
1		2A9	1A6	229	2B1	1C6	0FA	30B	30B	30B	14E	05B	186	0BB	13A
2			1A6	1D9	14E	1C6	305	0F4	0F4	0F4	2B1	3A4	276	0B4	13A
3		2A9	1A6	229	2B1	1C6	0FA	30B	30B	30B	14E	05B	186	0BB	13A
4		2A9	1A6	1D9	14E	1C6	305	0F4	0F4	0F4	2B1	3A4	276	0B4	13A
5	23D	2A9	1A6	229	2B1	1C6	0FA	30B	30B	30B	14E	05B	186	0BB	13A
6		2A9	1A6	1D9	14E	1C6	305	0F4	0F4	0F4	2B1	3A4	276	0B4	13A
7		2A9	1A6	1D9	14E	1C6	305	0F4	0F4	0F4	2B1	3A4	276	0B4	13A
8															

## Markers Bar

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

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

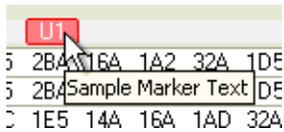
To define a marker, select the **Set Marker** command in the Markers menu or use the **Toggle Marker** icons in the toolbar. You can also use the Jump to Next or Previous marker icons in the toolbar.



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

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

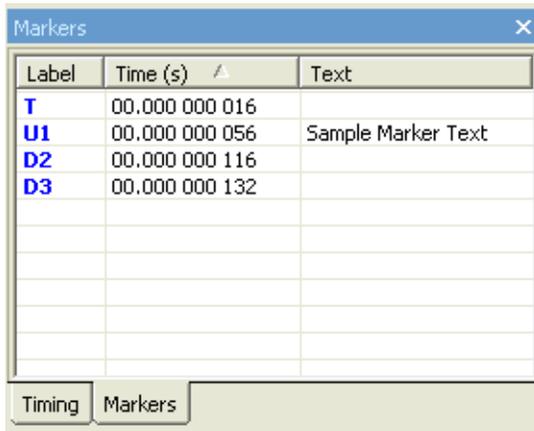


Figure 9.1: Markers Window

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

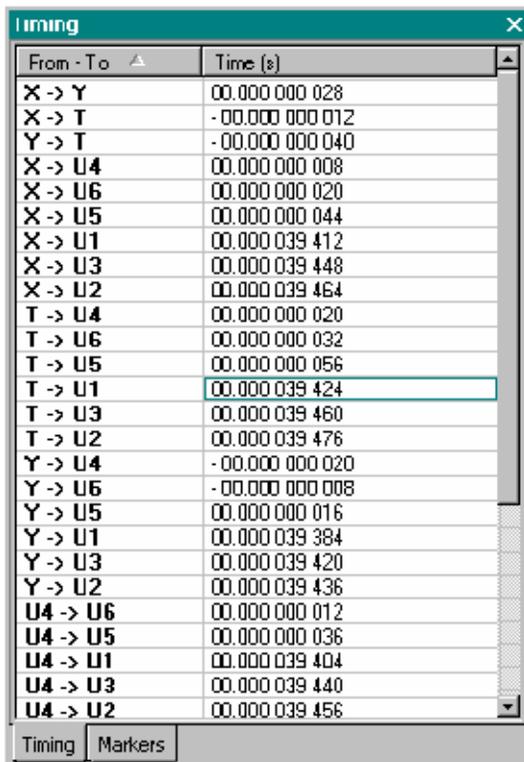


Figure 9.2: Timing Window

## 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.

Type	Upstream	Downstream
[-] Invalid 10b Code	0	0
Lane 0	0	0
Lane 1	0	0
Lane 2	0	0
Lane 3	0	0
[-] Disparity Error	0	0
Lane 0	0	0
Lane 1	0	0
Lane 2	0	0
Lane 3	0	0

Figure 9.3: Errors Window

BitTracer mode also highlights errors:

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

## Symbols Bar

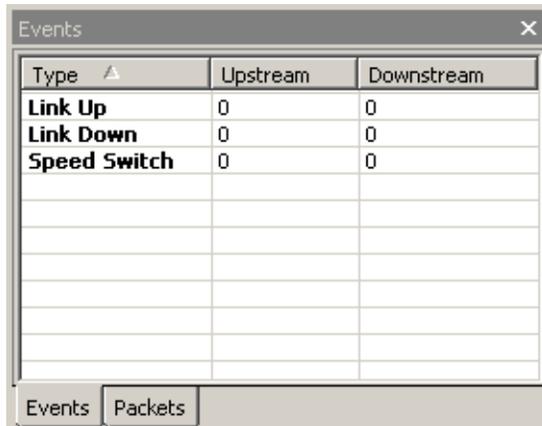
The Symbols window provides a summary of the different symbol types captured, by quantity and direction, and includes hyperlinks for jumps to selected symbols. Expanding the + sign at the left of each symbol provides a summary of symbols by lane.

Symbol	Upstream	Downstream
[+] COM	6416	7120
[+] SKP	19248	21360
[+] FTS	0	0
[+] IDL	0	0
[+] EIE	0	0
[+] PAD	0	0
[+] STP	0	0
[+] SDP	885	612
[-] END	885	612
Lane 0	0	0
Lane 1	0	0
Lane 2	0	0
Lane 3	885	612
[+] EDB	0	0

Figure 9.4: Symbols Window

## Events Bar

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



Type ▲	Upstream	Downstream
<a href="#">Link Up</a>	0	0
<a href="#">Link Down</a>	0	0
<a href="#">Speed Switch</a>	0	0

Figure 9.5: Events Window

---

**Note:** The table entries are hyperlinks.

---

## Packets Bar

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

---

**Note:** 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.  
The table entries are hyperlinks.

---

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

---

Type ▲	Upstream	Downstream
2.5 GT/s	N/A	N/A
[-] 5.0 GT/s	Analyze	24
Invalid	Analyze	0
TLP	Analyze	15
DLLP	Analyze	7
TS1	Analyze	0
TS2	Analyze	0
FTS	Analyze	0
EIOS	Analyze	0
Skip	Analyze	2
Compliance Pattern	Analyze	0
EIEOS	Analyze	0
8.0 GT/s	N/A	N/A

Symbols (8b/10b) Events Packets

Figure 9.6: Packets Window

After analysis, the Packets Bar looks like the following:

Type ▲	Upstream	Downstream
2.5 GT/s	N/A	N/A
[-] 5.0 GT/s	37	24
Invalid	0	0
TLP	5	15
DLLP	30	7
TS1	0	0
TS2	0	0
FTS	0	0
EIOS	0	0
Skip	2	2
Compliance Pattern	0	0
EIEOS	0	0
8.0 GT/s	N/A	N/A

Events Packets

## 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.

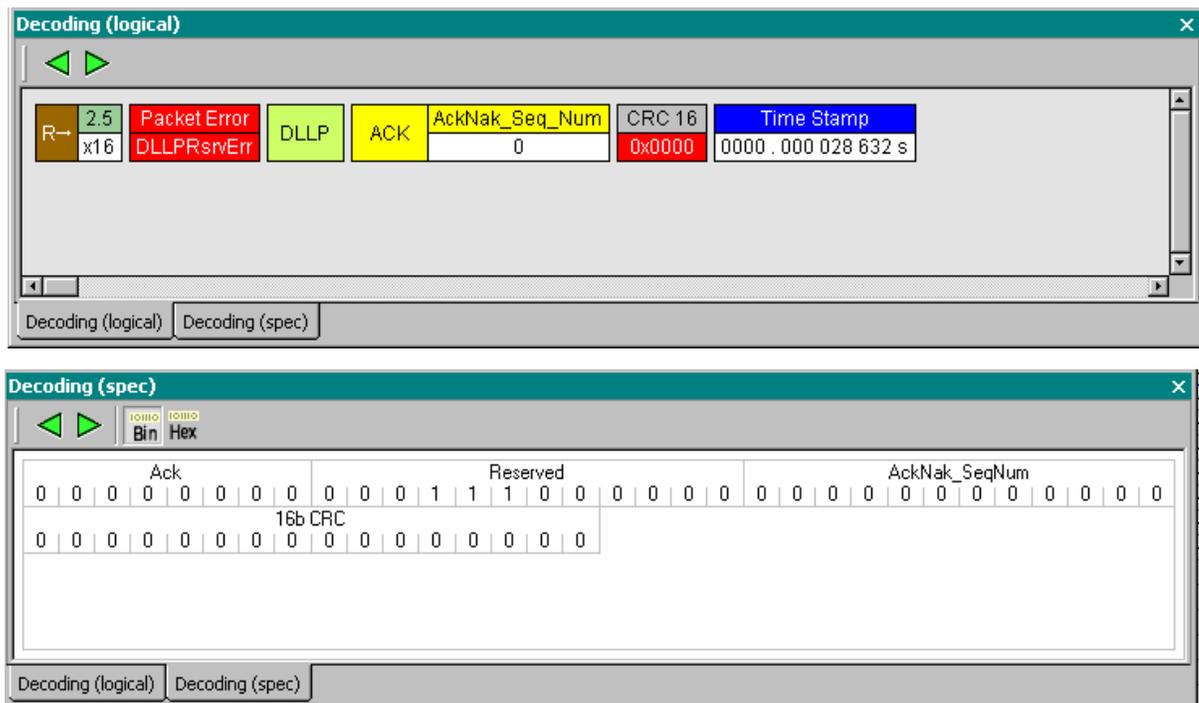


Figure 9.7: Decoding Window

## Search

To search, use the Search toolbar.



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

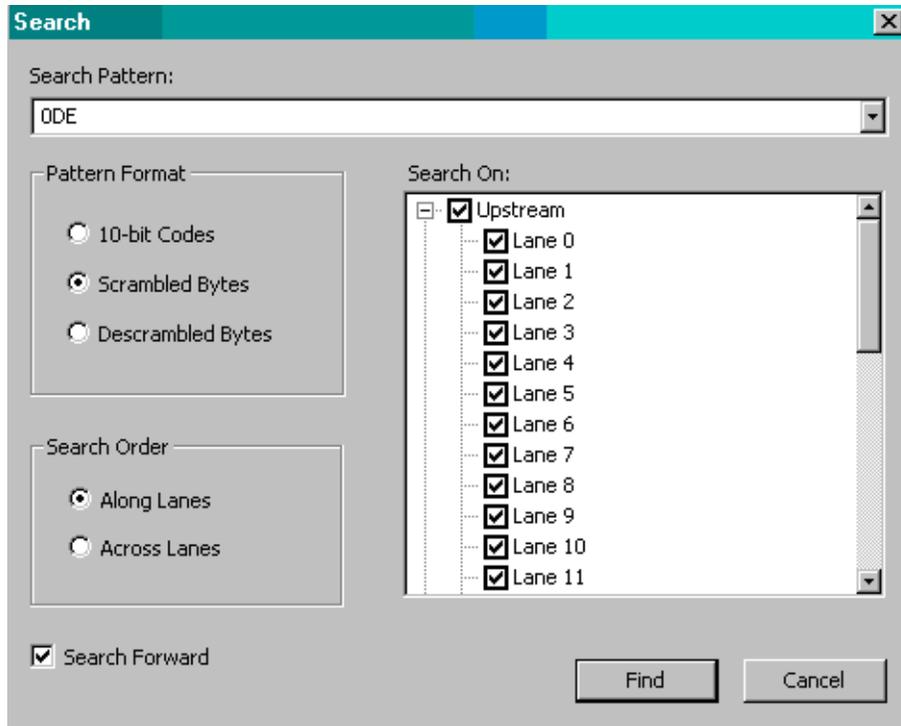


Figure 9.8: Search Window

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.

## 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.

---

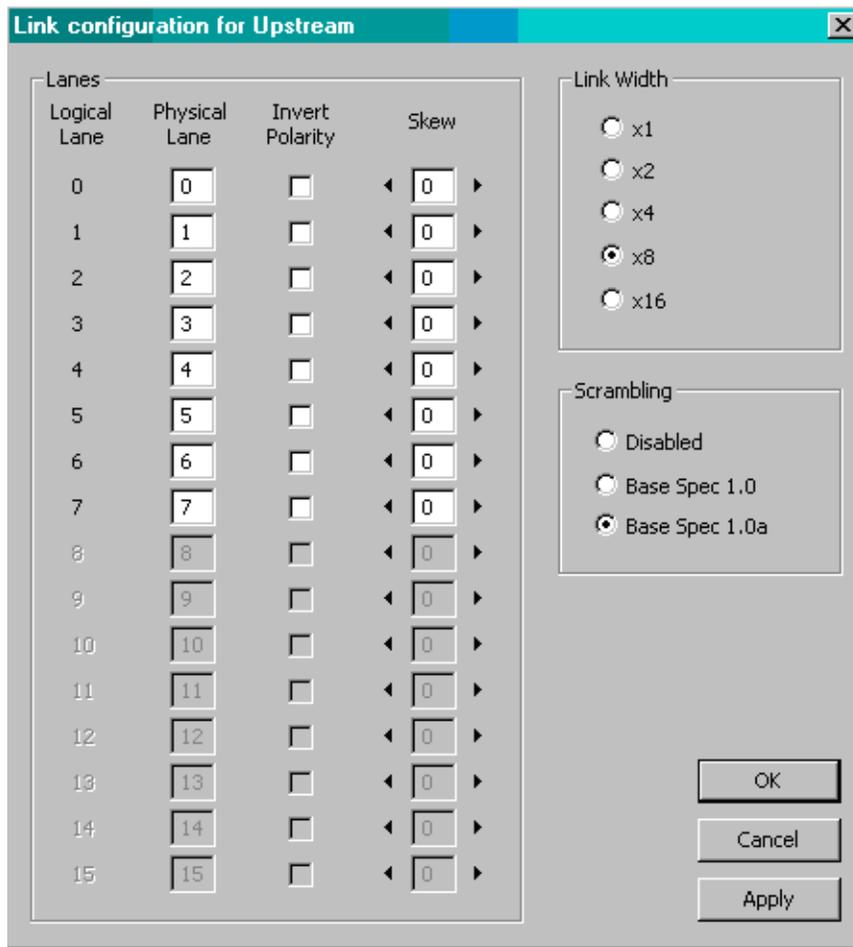
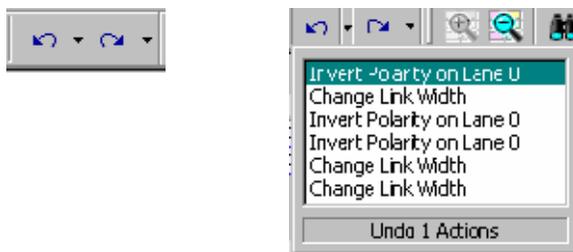


Figure 9.9: Link Configuration Dialog

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.



## 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.

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**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.

### 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.

### 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 *PETracer* application using the **File > Open** command.

# Chapter 10

## Reports and Tools

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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.
- ❑ **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.
- ❑ **NVM Base Address Mapping:** Presents the dialog for the NVMHCI Base Address. This dialog displays the Device ID and whether or not the device is NVM.
- ❑ **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.

## File Information

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

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



Figure 10.1: File Information Window

## Error Summary

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

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

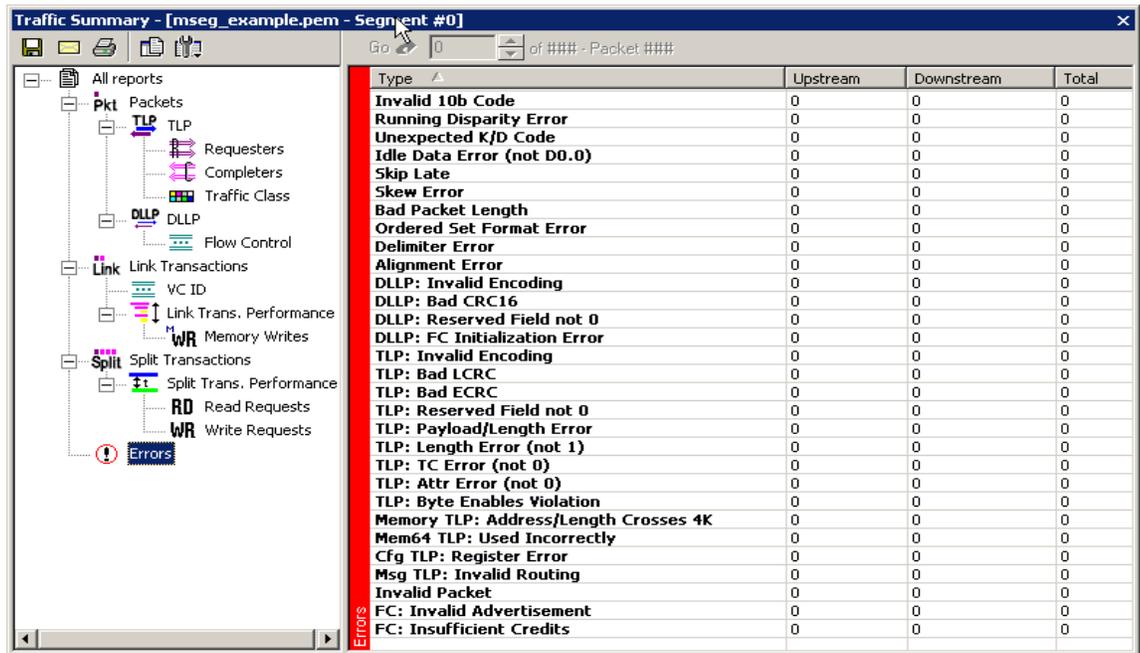
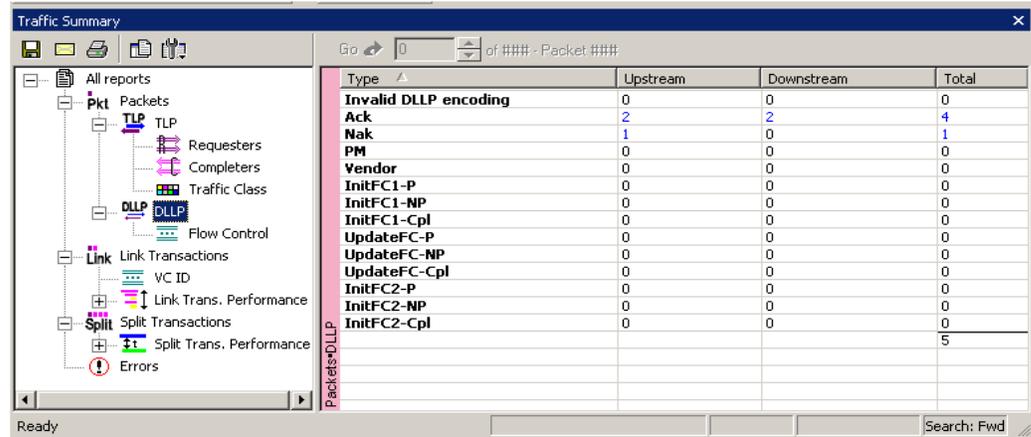


Figure 10.2: Traffic Summary Dialog

## 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

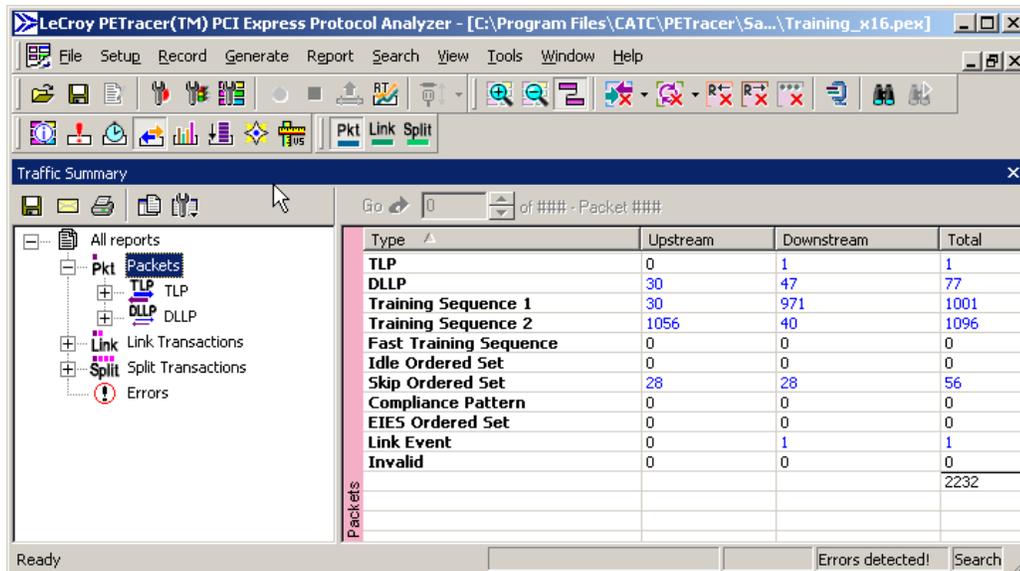


Buttons at the top of the Traffic Summary window change the display format and enable data to be exported to email, file, or the printer.

## 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:

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.



2. Click the **up** or **down** arrows  of . 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 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: <b>Grid Lines:</b> Displays/Hides grid lines <b>Row Selection:</b> Allows entire rows to be selected <b>Tight Columns:</b> Reformats column widths to match data <b>Event Navigation:</b> Skip Hidden Items Show Hidden Items Prompt each time

## Bus Utilization

Select **Report > Bus Utilization** from the menu or press  to open the Bus Utilization window.

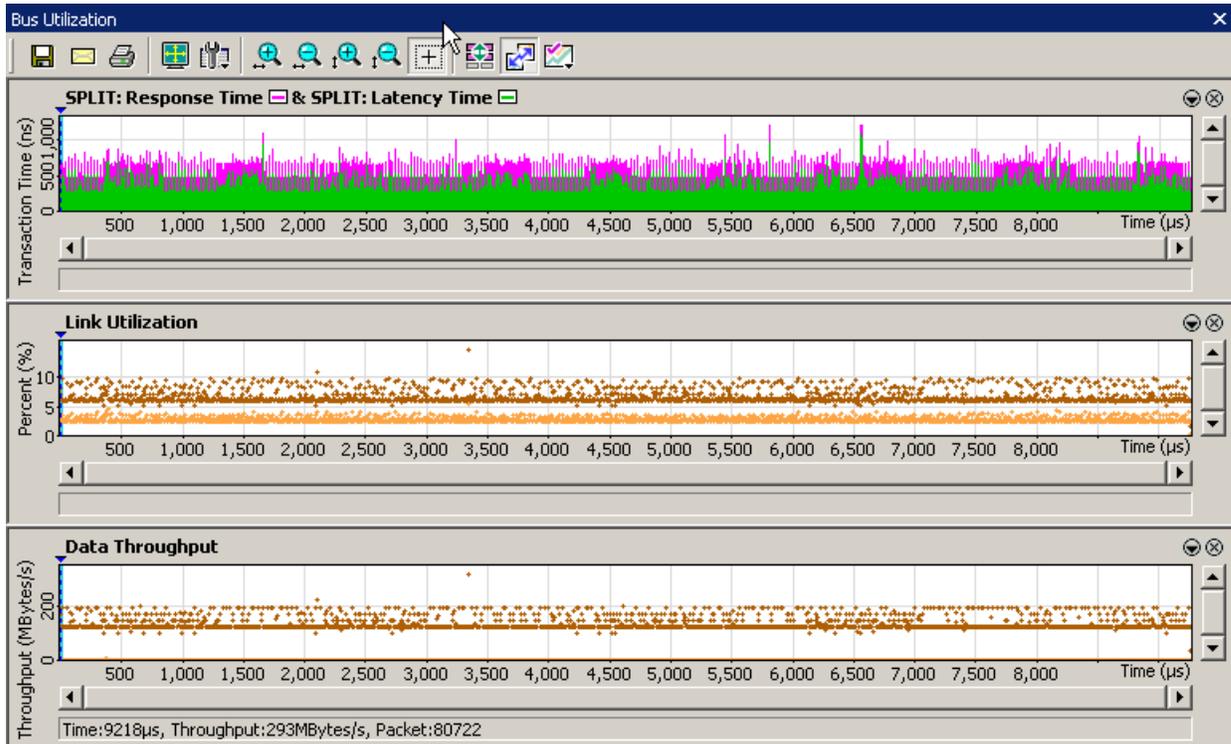
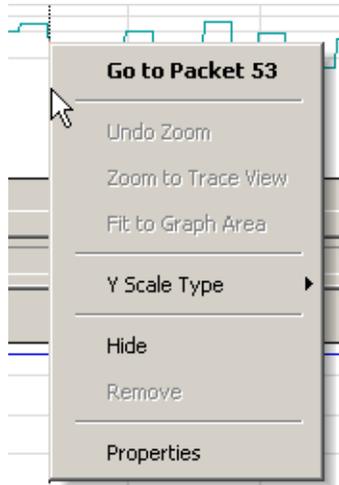


Figure 10.3: Bus Utilization Window

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 with options for changing the Title, Type, Appearance, and Color of the graphs.

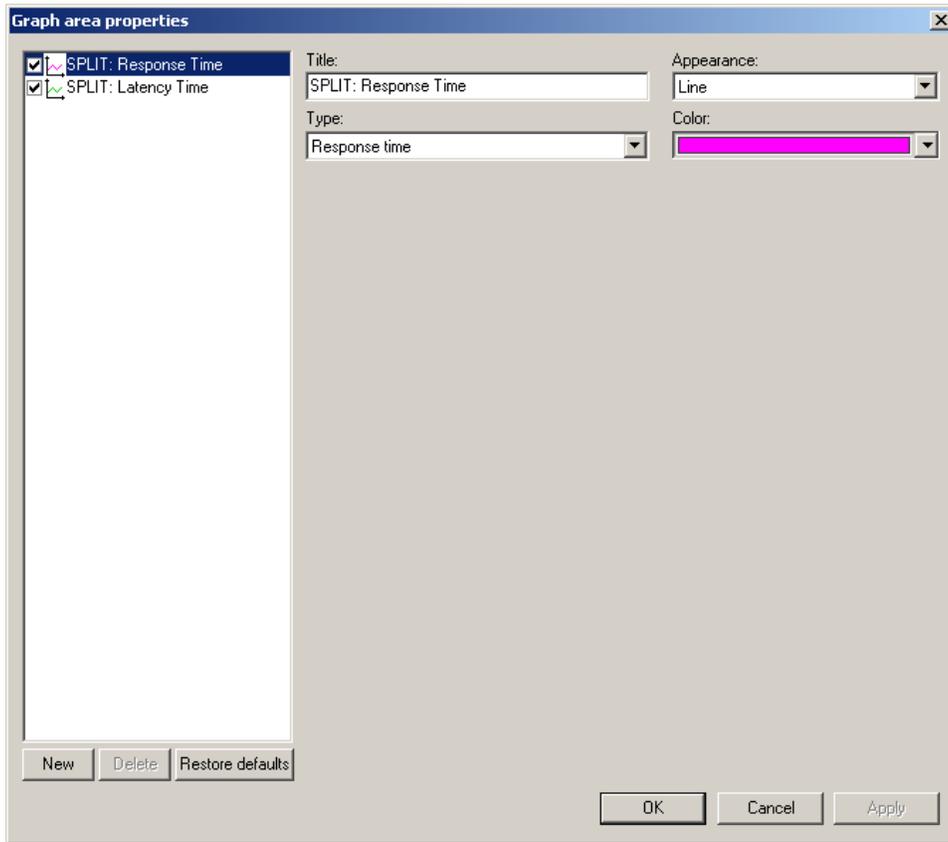


Figure 10.4: Graph Area Properties Dialog

## 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: <ul style="list-style-type: none"> <li>• Orient Horizontally</li> <li>• Tile Vertically</li> <li>• Show Markers</li> <li>• Show Plumblines</li> <li>• Status &gt;&gt;</li> <li>• Bar</li> <li>• Tool tips</li> <li>• None</li> <li>• Grid Lines &gt;&gt;</li> <li>• Both Axes</li> <li>• X Axis</li> <li>• Y Axis</li> <li>• No Grid</li> <li>• Grid on Top</li> <li>• Fonts &amp; Colors</li> </ul>
	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 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.

## 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.

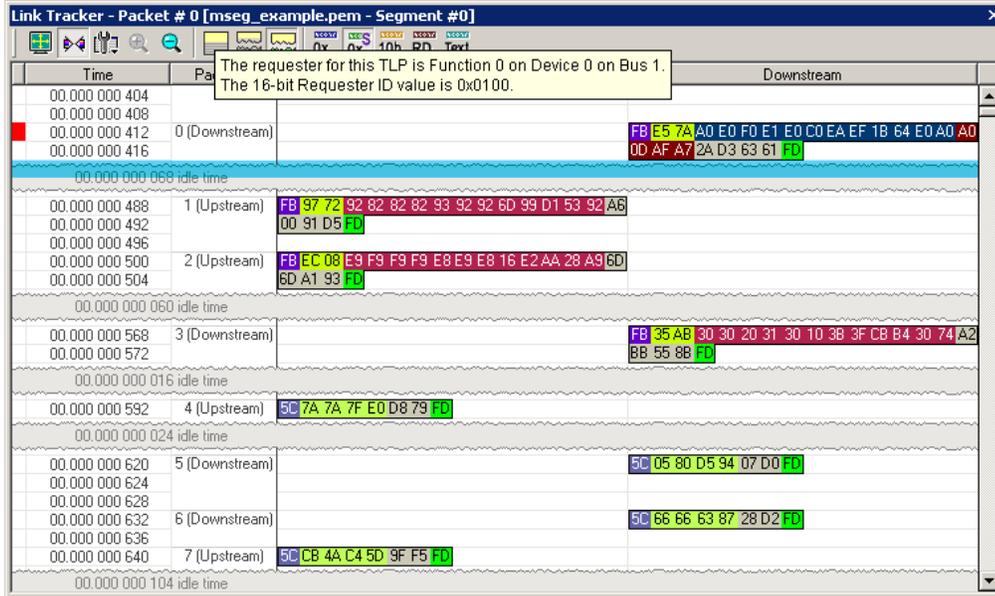
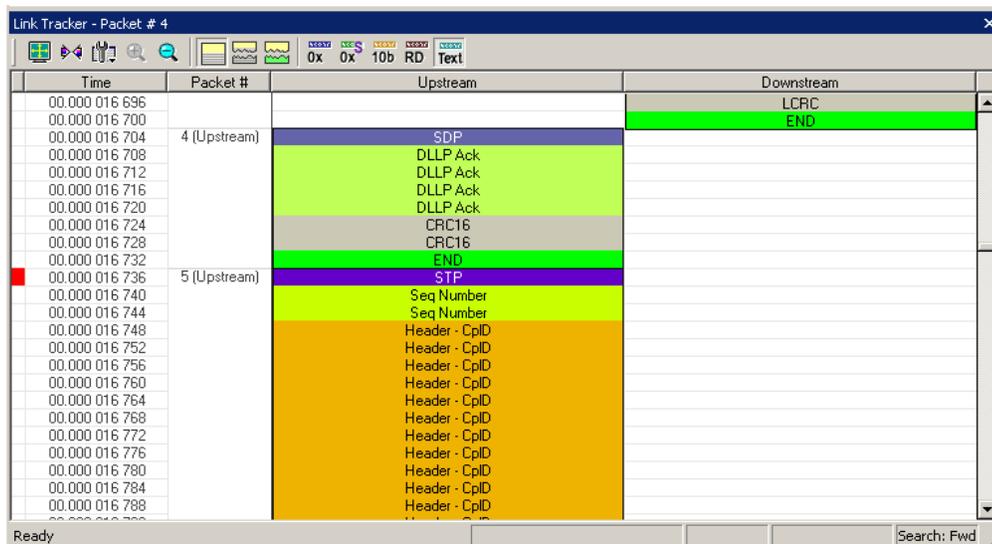


Figure 10.5: Link Tracker Window

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

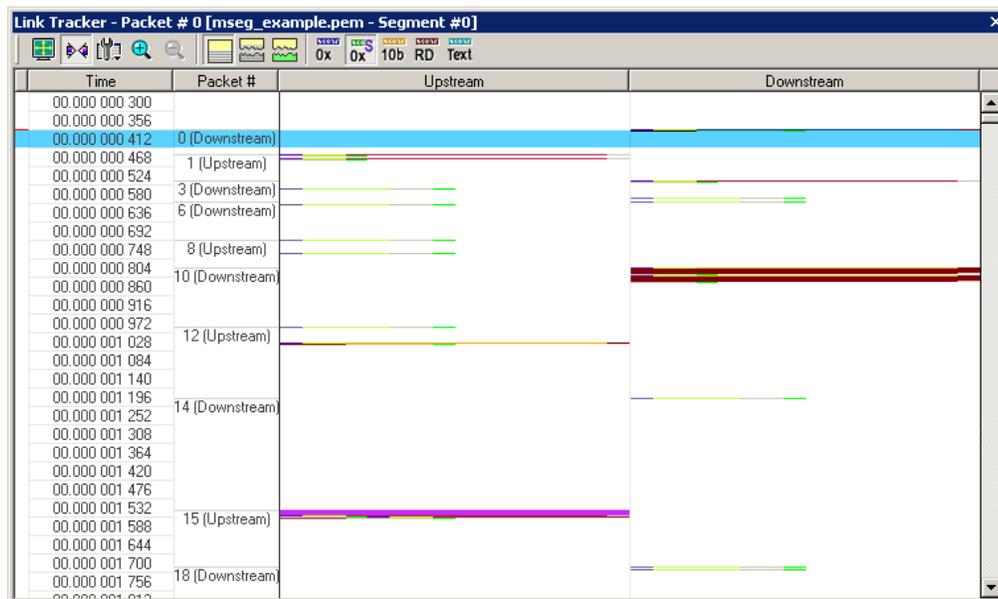
The Link Tracker window can be reformatted in several ways.

### 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.

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.

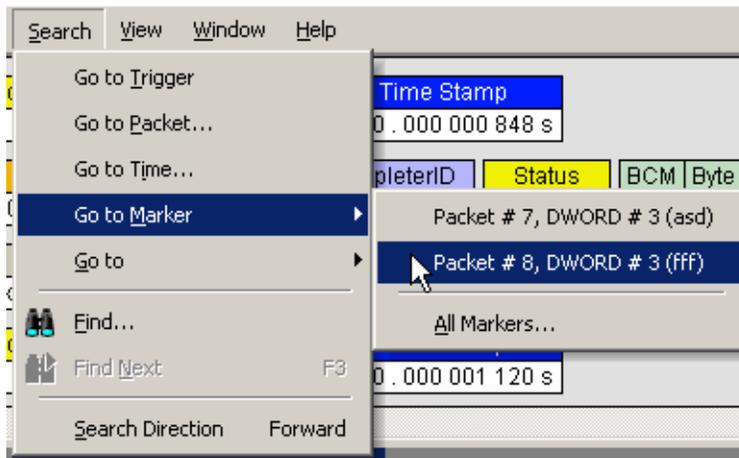
## Setting Markers

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.
	<p>View Options. Opens a menu with three options:</p> <ul style="list-style-type: none"> <li>• <b>Collapsible Idle Time</b> (Collapse Idle Bigger Than <b>n</b> nanoseconds. <b>Note:</b> Does not affect Collapse Idle Plus.)</li> <li>• <b>Tooltip Display</b> (Values, Scrambled Values, 10-bit Codes, Symbols)</li> <li>• <b>Time Format</b> (Seconds, Clock)</li> <li>• <b>Reset Columns Widths</b> (return to default widths)</li> <li>• <b>Reset Columns Order</b> (return to default column sequence)</li> </ul> <p>See <a href="#">“Using the Link Tracker Window” on page 136</a> for further details.</p>
	<p>Synchronize Trace View. Synchronizes the Trace View and Link Tracker windows so that a move in one window repositions the other.</p> <p>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.</p> <p>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.</p> <p>Scrolling in the Link Tracker window, in contrast, produces modest movements within the CATC Trace window.</p> <p>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.</p>
	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

## 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.

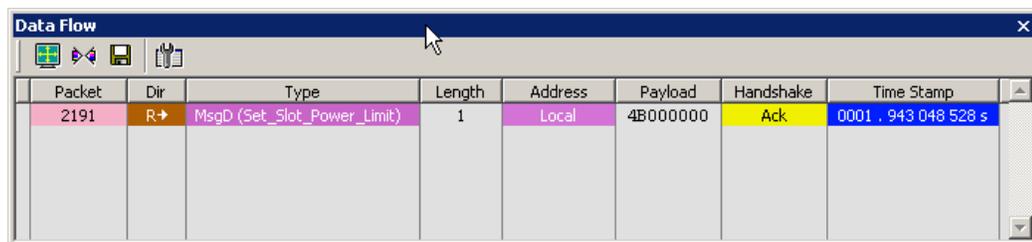
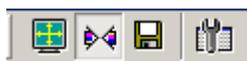


Figure 10.6: Data Flow Window



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

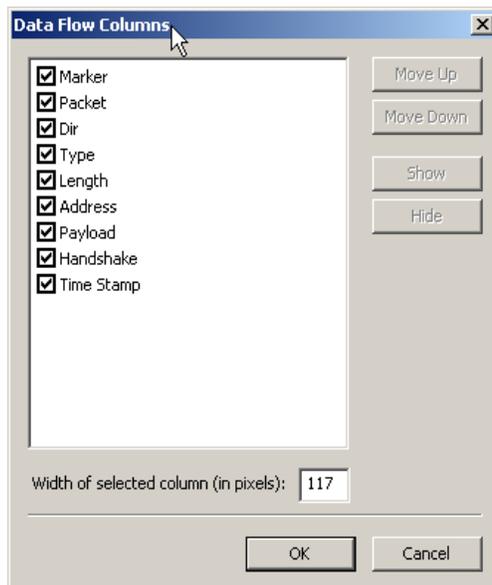


Figure 10.7: Data Flow Columns Dialog

## 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.

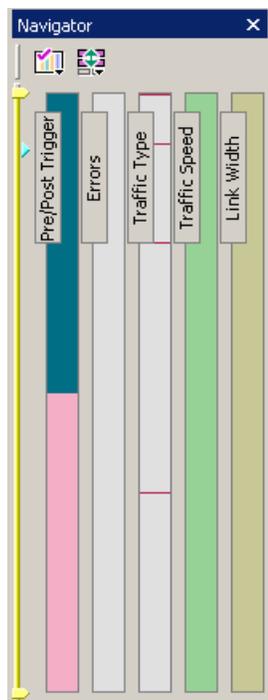


Figure 10.8: Navigator Dialog

## 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.

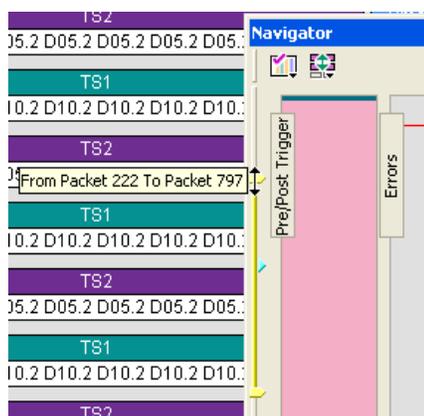


**Navigator Panes:** This button has two purposes: To select which Navigator panes appear and to bring up the Navigator legend. The legend determines how information is shown in the panes.

## 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.



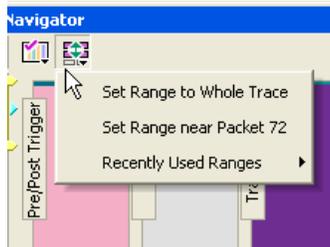
## To Determine Current Position

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.

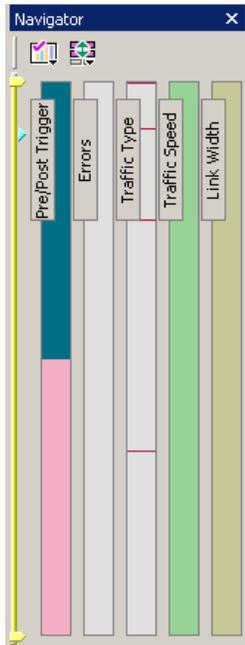


The menu has the following options:

- ❑ **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 Pane's drop-down menu. Press the toolbar **Navigator Panes** button to access the menu. Select the **Legend** option to bring up the Navigator Legend dialog.

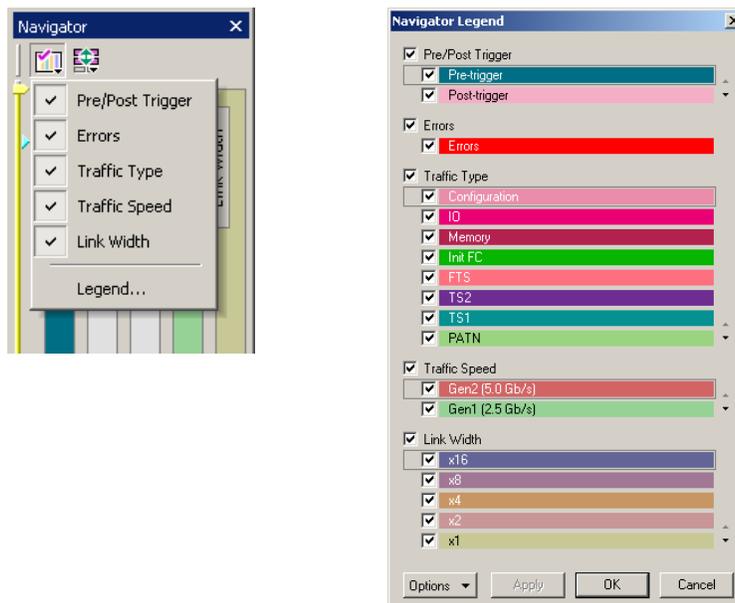


Figure 10.9: Navigator Pane and Navigator Legend Dialog

The Navigator Legend dialog 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.

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.
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 has 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.

# 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**.

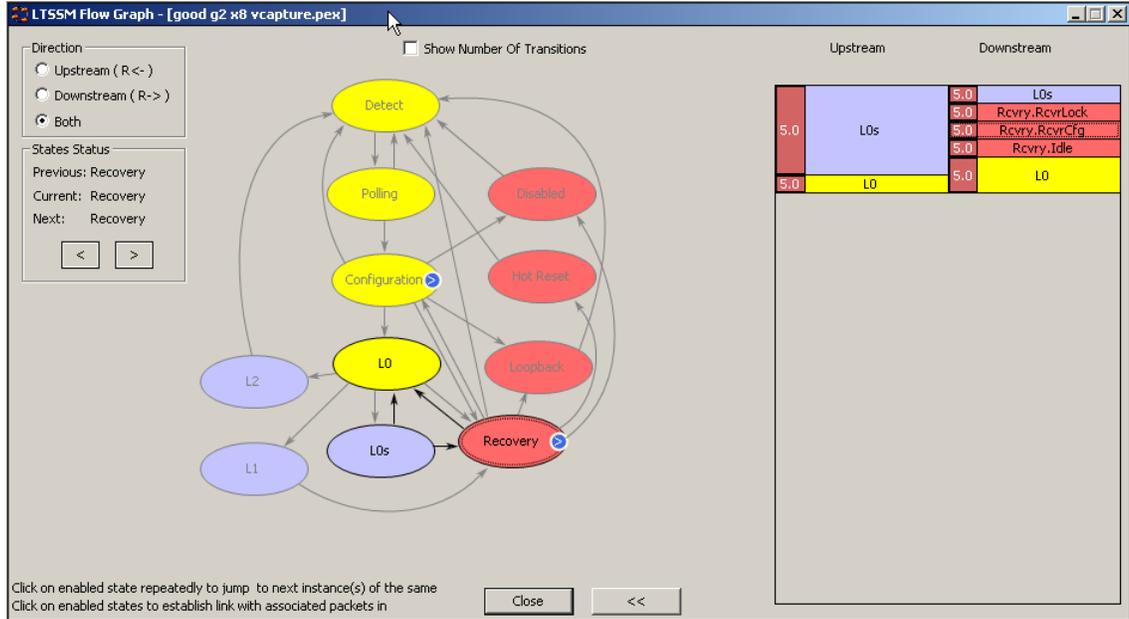


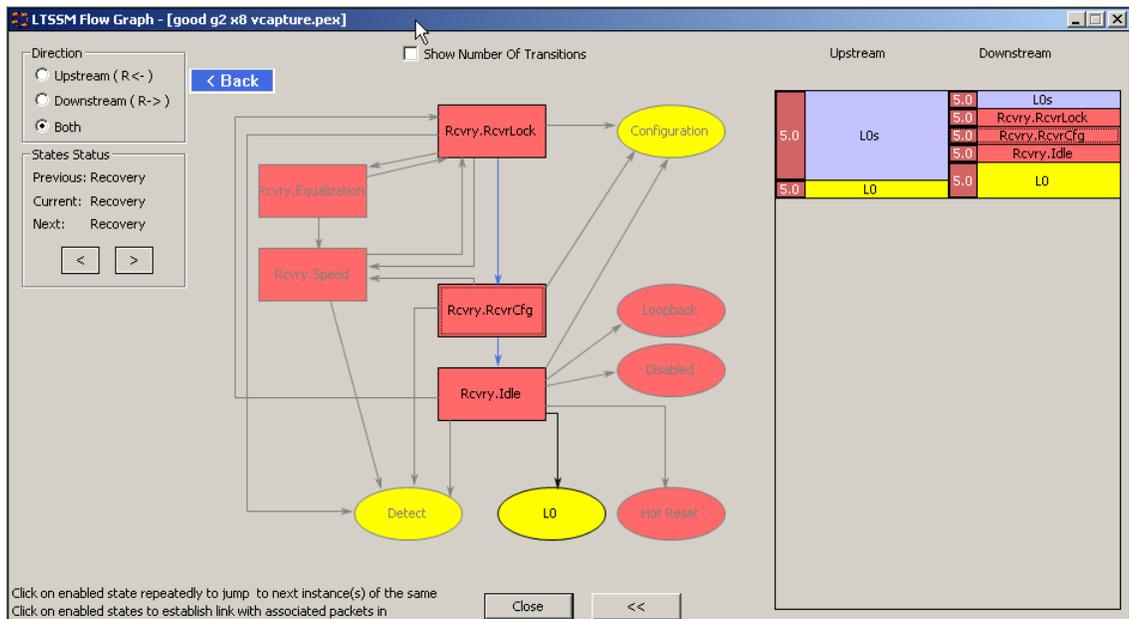
Figure 10.10: LTSSM Flow Graph Dialog

You can display the following directions:

- Upstream
- Downstream
- Both

You can **Show Number of Transitions**.

Click the blue button (on the Recovery state below) to see the substate.



## 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.



Figure 10.11: Packet Header Bar

The toolbar allows you to Save, go to Previous or Next, display Hexadecimal or Binary, and show the Packet Data window.



## 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.

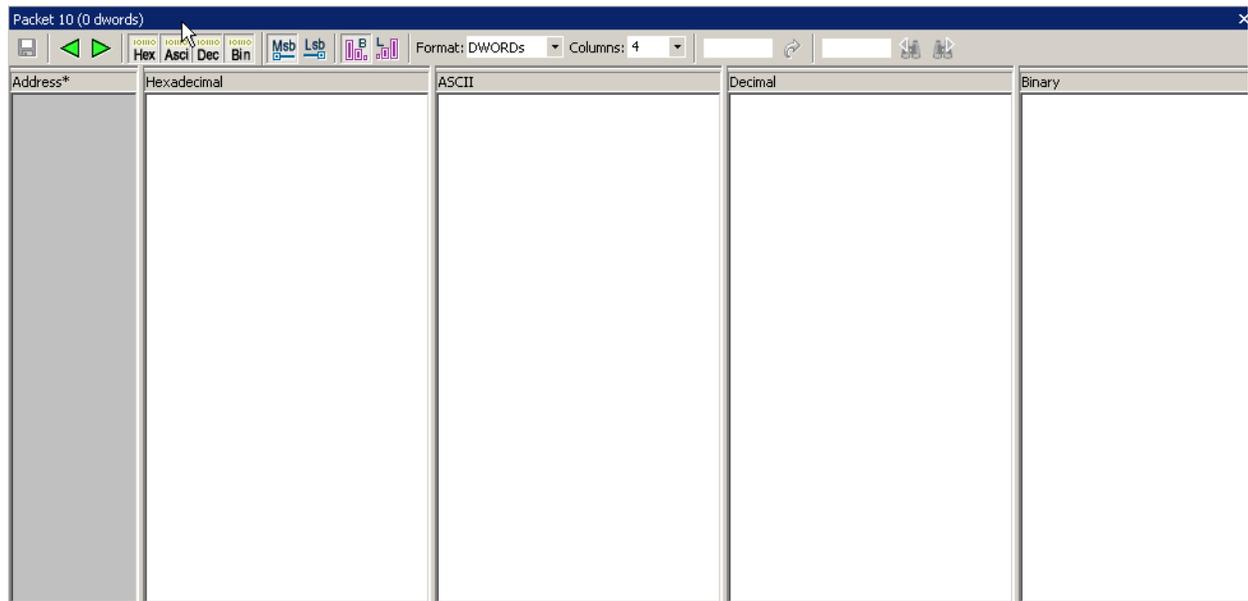


Figure 10.12: Packet Data Window

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.

## 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:

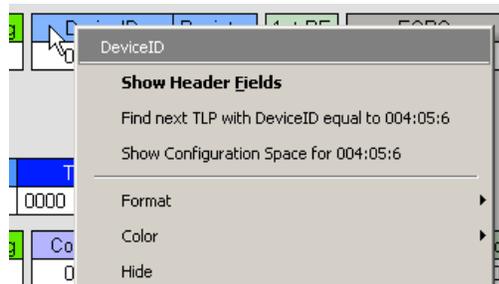
1. Open a CATC Trace, such as the sample file **cfg\_pci\_express.pex**.
2. Scroll to a packet with a Configuration header.

Packet	R→	2.5	TLP	Cfg	CfgRd1	Length	RequesterID	Tag	DeviceID	Register	1st BE	
8		x1	27		00:00101	1	001:02:3	29	004:05:6	0x044	1111	0x
Time Delta		Time Stamp										
96.000 ns		0000 . 000 000 544 s										
Packet	R←	2.5	DLLP	ACK	AckNak_Seq_Num	CRC 16	Idle	Time Stamp				
9		x1			27	0x5989	0.000 ns	0000 . 000 000 640 s				
Packet	R←	2.5	TLP	Cpl	CplID	Length	RequesterID	Tag	CompleterID	Status	BCM	Byt
10		x1	37		10:01010	1	001:02:3	29	004:05:6	SC	0	

3. Select **Report > Configuration Space > <device>** to display the Configuration Space View.

or

Click a **CompleterID** 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.

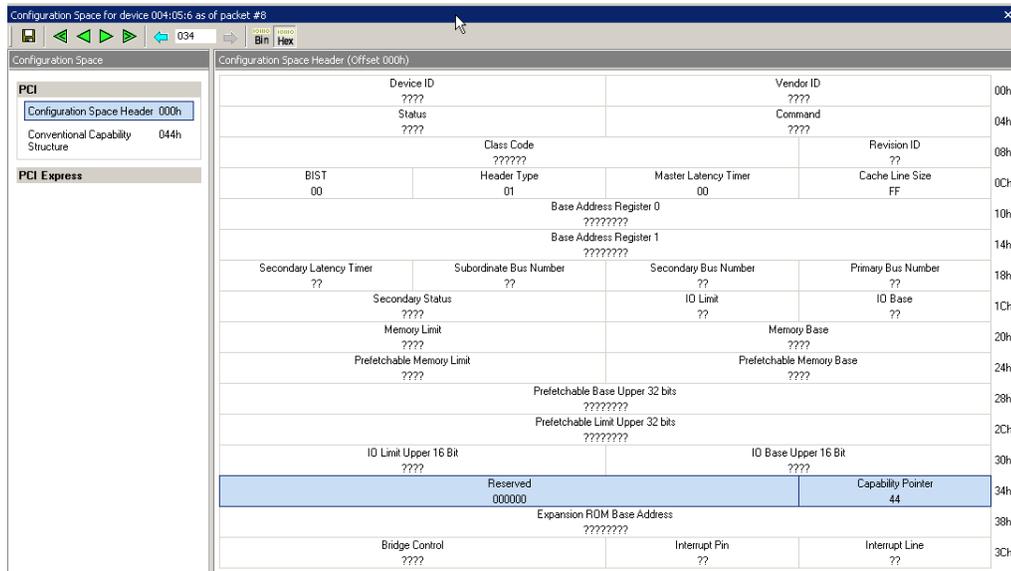


Figure 10.13: Configuration Space View

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 167.

## Using Unit Metrics

For every protocol unit at the Link or Split transaction level, *PETracer*<sup>™</sup> 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.

*PETracer* 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.

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### 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 than 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.

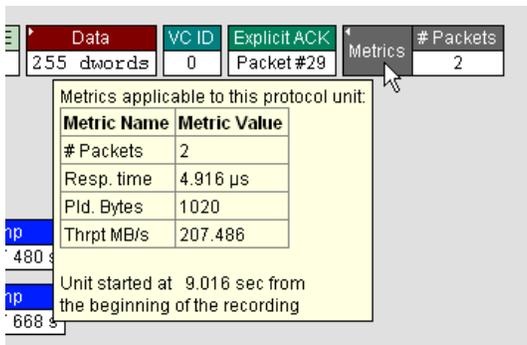
Link Tra	R→	TLP	Mem	MWrr(32)	Data	Metrics	# Packets
31250		819		10:00000	2 dwords		2

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.

Split Tra	R←	Mem	MRd(32)	Status	Data	Metrics	# LinkTras
14342			00:00000	SC	4 dwords		2

### 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:

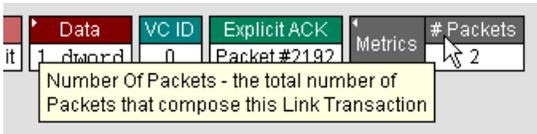
The following is the expanded Metric header for a unit in the Split Transaction view.

Metrics	# LinkTras	Resp. time	Latency	Thrpt MB/s	Pld. Bytes
	2	7.460 $\mu$ s	6.736 $\mu$ s	2.145	16

The 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.

Requester -> Completer	Total	# LinkTras (Min)	# LinkTras (Avrg)	# LinkTras (Max)	Resp. time (Min)	Resp. time (Avrg)	Resp. time (Max)
002:00:0 -> 000:04:0	188456	2	2.00	2	284.000 ns	448.040 ns	1.204 $\mu$ s
000:04:0 -> 002:00:0	54	2	2.00	2	720.000 ns	802.880 ns	1.060 $\mu$ s
	188510						

**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.

Requester -> Completer, Reads	Total	Thrpt MB/s (Min)	Thrpt MB/s (Avg)	Thrpt MB/s (Max)	Resp. time (Min)	Resp. time (Avg)	Resp. time (Max)	Latency (Min)
000:00:0 -> 001:00:0, Cfg TCO	36	14.085	14.546	15.385	260.000 ns	275.110 ns	284.000 ns	4.000 ns
000:00:0 -> 001:00:0, IO TCO	8	8.929	9.402	10.101	396.000 ns	426.000 ns	448.000 ns	156.000 ns
	44							

**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.

Requester -> Completer, Writes	Total	Thrpt MB/s (Min)	Thrpt MB/s (Avg)	Thrpt MB/s (Max)	Resp. time (Min)	Resp. time (Avg)	Resp. time (Max)	Latency (Min)	Latency (Max)
000:00:0 -> 001:00:0, Cfg TCO	5	1.420	2.717	3.145	1.272 µs	1.334 µs	1.408 µs	136.000 ns	174.000 ns
000:00:0 -> 001:00:0, IO TCO	1	3.115	3.115	3.115	1.284 µs	1.284 µs	1.284 µs	112.000 ns	112.000 ns
	6								

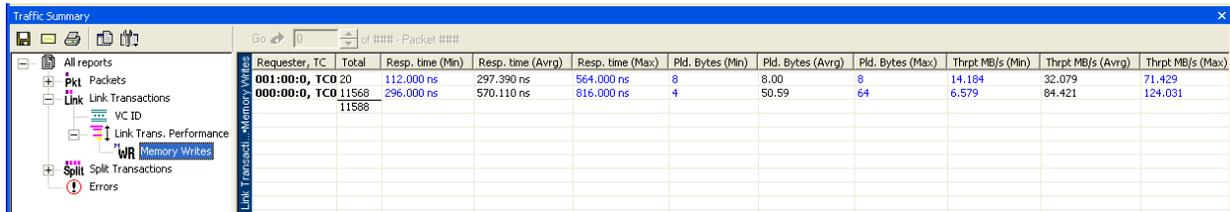
### Reports at the Link Transaction Level

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.

Transaction Type	Total	# Packets (Min)	# Packets (Avg)	# Packets (Max)	Resp. time (Min)	Resp. time (Avg)	Resp. time (Max)	Pld. Bytes (Min)	Pld. Bytes (Avg)	Pld. Bytes (Max)
MWr(32)	1469	1	1.54	2	24.000 ns	135.390 ns	328.000 ns	1	3.98	4
MRd(32)	188514	1	1.31	3	20.000 ns	50.740 ns	304.000 ns	0	0.00	0
CplD	188510	1	1.26	2	24.000 ns	80.060 ns	388.000 ns	1	31.99	32
Msg	6	1	1.83	2	24.000 ns	129.330 ns	168.000 ns	0	0.00	0
MsgD	3	1	1.67	2	26.000 ns	210.660 ns	304.000 ns	0	0.00	0
	378502									

**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.



Requester_TC	Total	Resp. time (Min)	Resp. time (Avrg)	Resp. time (Max)	Pld. Bytes (Min)	Pld. Bytes (Avrg)	Pld. Bytes (Max)	Thrpt MB/s (Min)	Thrpt MB/s (Avrg)	Thrpt MB/s (Max)
001:00:0, TCO 20	112,000	112,000 ns	297.390 ns	564,000 ns	8	8.00	8	14.184	32.079	71.429
000:00:0, TCO 11568	11568	296,000 ns	570.110 ns	816,000 ns	4	50.59	64	6.579	84.421	124.031

The 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.

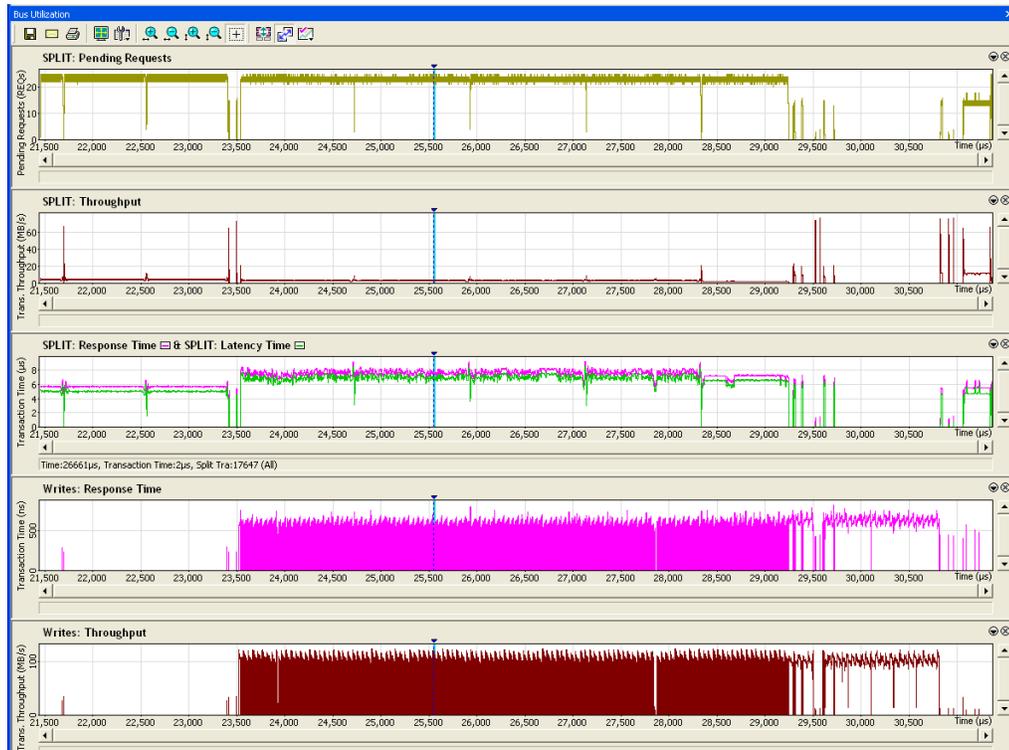
## Show Metrics in the Bus Utilization Window

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.

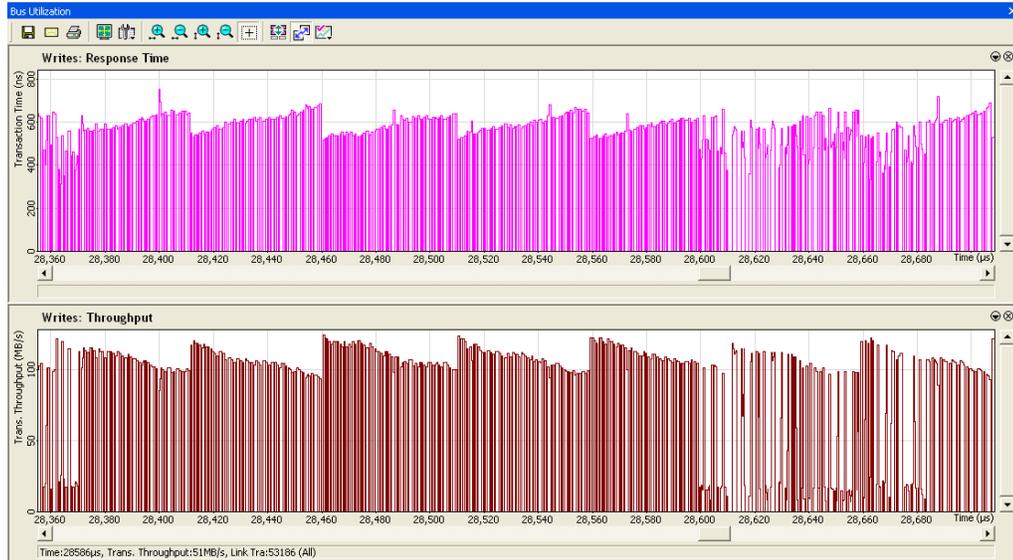
The following shows the graphs for the Split level:



**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.**



### TC to VC Mapping

**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).

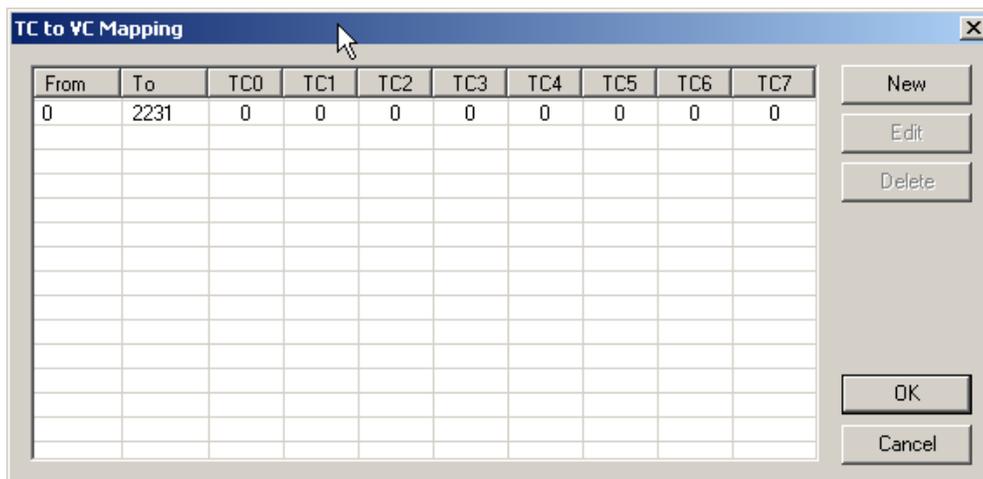


Figure 10.14: TC to VC Mapping Dialog

## 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.

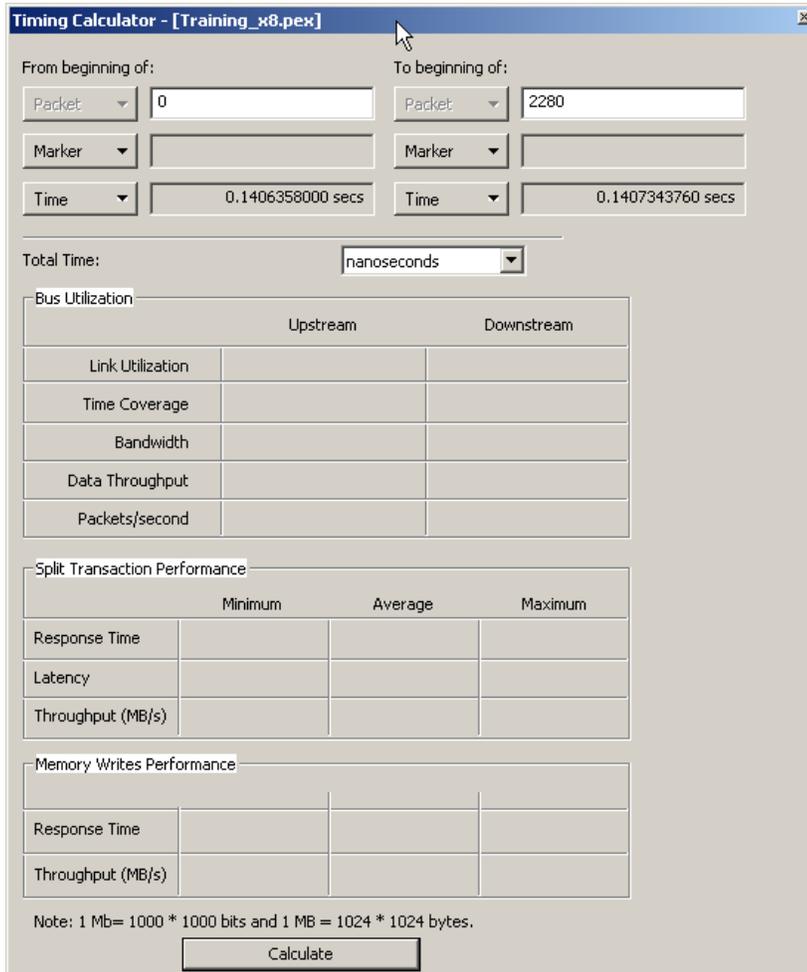


Figure 10.15: Timing Calculator Dialog

**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.

## 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, select **Tools > Run verification scripts**

or click the  icon.

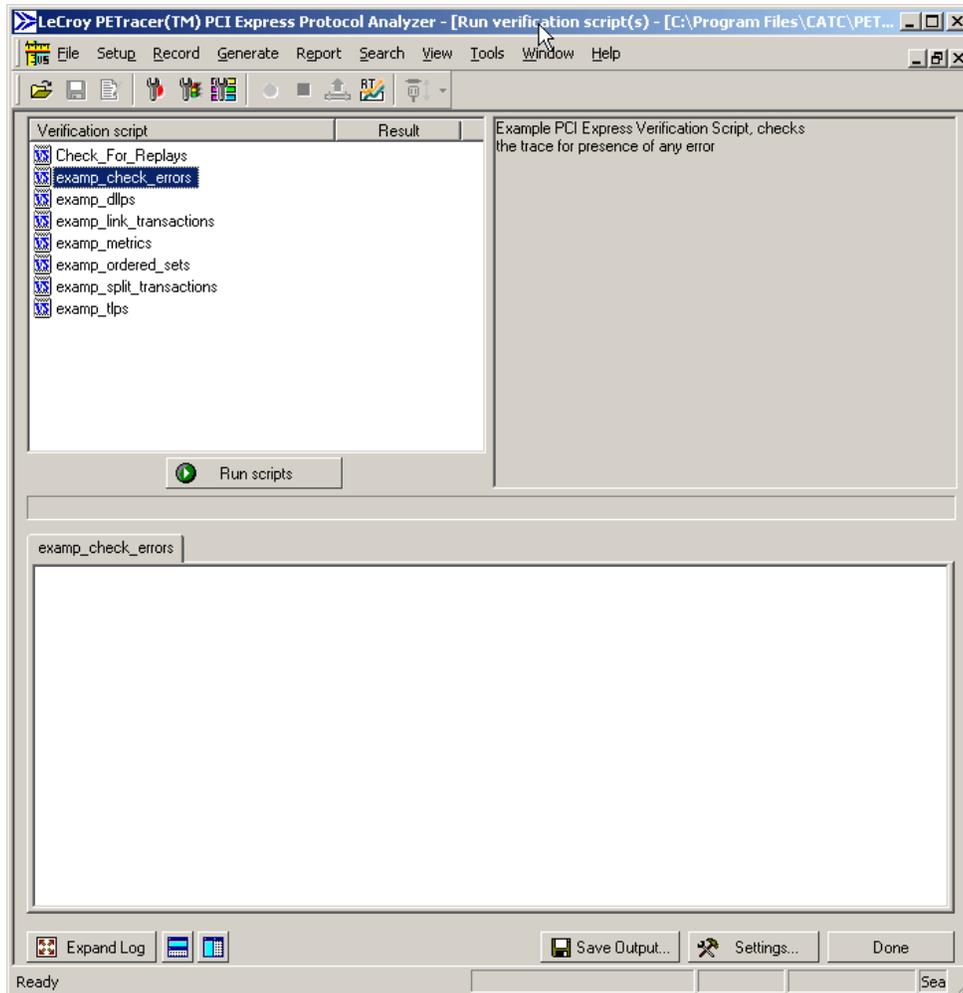
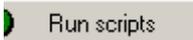


Figure 10.16: Verification Scripts Dialog

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 Dialog.

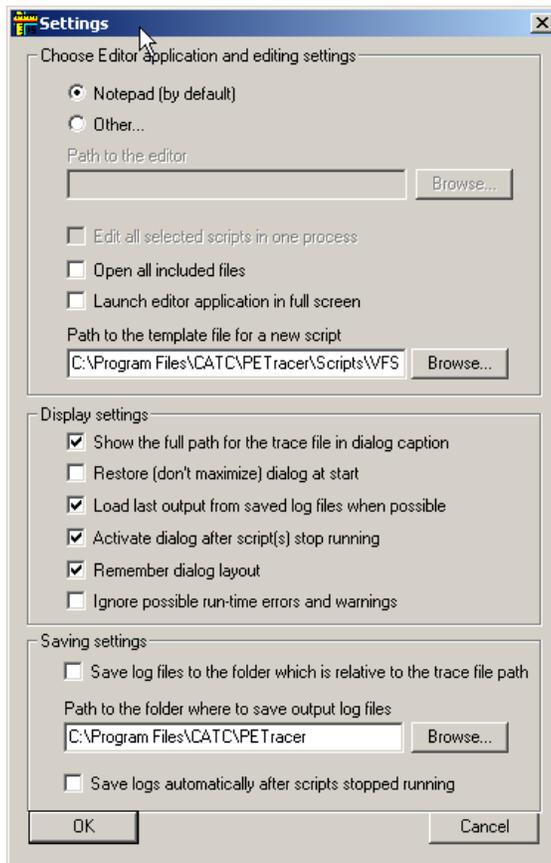


Figure 10.17: Settings Dialog

You can choose the editor, display settings, and saving settings.

## Updates and Licensing

---

### Updating the Analyzer

BusEngine™ and/or Firmware updates are now automatic processes that run anytime a new version of the PETracer™ 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:

1. Select **Setup > Update Device ...** from the menu to display the Update Analyzer dialog box for **Summit T28™**.
2. Select the appropriate file locations for the Firmware and/or BusEngine, using Browse, if necessary.
3. Check the appropriate options (if in doubt, check all options).
4. Click **Update** to initiate the updating of the Analyzer.

### 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 LeCroy for each Analyzer.

After you obtain the License Key, follow these steps to install it:

1. Select **Setup > All Connected Devices** and click the **Update License** button to display the Select License Key File dialog box.
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.
3. Select the **.lic** file, and then click **Open**.

### 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 *PETracer* 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 *LeCroy Analyzers File Based Decoding Manual* for reference.

PCI Express Configuration Space Decode Scripts have the file extension **.pecfgdec**.

### 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. Else, set to 0 for PCI.

### 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.

## 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.

---

## 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.

## Helper File

**ConfigSpaceCommon.inc** include file contains useful functions for script decoding.

## China Restriction of Hazardous Substances Table

The following tables are supplied in compliance with China's Restriction of Hazardous Substances (China RoHS) requirements:

部件名称	有毒有害物质和元素					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr <sup>6+</sup> )	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:

温度: 5摄氏度到40摄氏度

湿度: 5% - 95%最大相对湿度 (无冷凝)

高度: 最高2000米

Part Name	Toxic or Hazardous Substances and Elements					
	Lead (Pb)	Mercury (Hg)	Cadmium (Cd)	Hexavalent Chromium (Cr <sup>6+</sup> )	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:

Temperature 5C to 40C

Humidity 5% to 95% max RH (non-condensing)

Altitude Up to 2000 meters



# Appendix B

## How to Contact LeCroy

---

Type of Service	Contact
Call for technical support	US and Canada: 1 (800) 909-7112
	Worldwide: 1 (408) 653-1260
Fax your questions	Worldwide: 1 (408) 727-6622
Write a letter	LeCroy Protocol Solutions Group Customer Support 3385 Scott Blvd. Santa Clara, CA 95054-3115 USA
Send e-mail	<a href="mailto:psgsupport@lecroy.com">psgsupport@lecroy.com</a>
Visit LeCroy's web site	<a href="http://www.lecroy.com/">http://www.lecroy.com/</a>



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