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LeCroy Advisor™

USB 2.0 Bus and Protocol Analyzer

User Manual

Manual Version 2.5

For Software Version 2.5

July 2007

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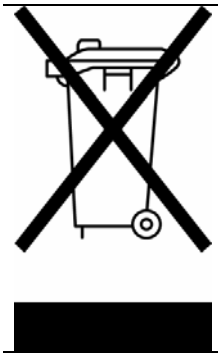

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Chapter 1: Overview

The LeCroy Advisor™ USB 2.0 Bus & Protocol Analyzer is another in LeCroy's broad portfolio of analysis tools. As a fourth generation product, it builds upon LeCroy's experience and knowledge of the needs of the USB development and test communities. The Advisor interfaces with standard USB cables and connections to capture and display Hi-Speed and Classic-Speeds USB 2.0 bus traffic.

1.1 Features

General

- Fully compliant with USB 2.0 specification
- Flexible design - reconfigurable hardware for future enhancements
- Supports all USB speeds (High-Speed, Full-Speed, and Low-Speed)
- User friendly CATC Trace Interface that displays bus traffic using color and graphics
- Trace Viewer available as free non-recording, view-only software
- Power-on self-diagnostics
- Three year warranty and hot-line customer support

Physical Components

- High impedance tap inserts non-intrusively in any branch of a USB system
- 128 MB of physical data recording memory
- Two recording channels - one for High-Speed traffic and one for Classic-Speeds traffic (either Low- or Full-Speed)
- Secondary recording channel aids in the development of multiple speed functions up-stream and down-stream of a speed-matching hub or transaction translator
- Convenient "Detach Device" switch operates with the Classic recording channel to save time and reduce USB cable/connector wear for multiple connects and disconnects to host
- Full-speed USB connection to desktop or portable host PC
- Internal wide-range AC power supply
- Break-out board (included)

Recording Options

- Triggering of new USB2.0 PIDS and split transaction special tokens (i.e. ERR, SPLIT, PING, NYET, DATA2, MDATA)
- CATC Trace displays and enumerates new USB2.0 Micro Frames
- Three forms of triggering: Snapshot, Manual and Event
- Automatically detects and captures high-, full-, and low-speed traffic
- Adjustable buffer size from 0.1MB to 128MB
- Versatile triggering-bit-wise value and mask data patterns up to sixteen bytes wide for Setup transactions and data packets
- Triggering on multiple error conditions - PID bad, bit stuffing bad, CRC bad, end-of-packet bad, babble, loss of activity, frame length violation, time-out or turn-around violation, data toggle violation
- A new transaction sequencer allows triggering or filtering on a token qualified by a data pattern and/or specific handshake, or alternately transactions can be filtered
- Advanced triggering with event counting and sequencing
- Dedicated trigger for recording input and output that is used to interface to external test equipment
- Real-time traffic capture filtering and data packet truncation variable up to 245 bytes

Display Options

- Utilizes USB industry *de facto* standard CATC Trace graphical display of bus packets, transactions, split transactions and transfers
- Trace Viewer is backward compatible with Chief™, Inspector™, and Detective™ trace files
- User-friendly trigger position indicated by different colors of pre- and post-trigger packet color
- Markers can be set to assist with navigation and time calculations. Each marker can contain unique comments.
- Hide start-of-frame (SOF) packets as well as hide any packet or transaction
- Search for a specific PID
- Change bit order for all fields except Data Length, Time, and Packet #: MSB>LSB or LSB>MSB
- Detects and alerts the user to every potential bus error, protocol violation, and combinations thereof
- High resolution, accurate time stamping of bus packets, timing measurement, and analysis functions
- Extensive search and packet hiding capabilities
- Comprehensive device class decoding plus user defined protocol decoding

Note: Refer to Readme.txt on your installation CD for the latest information on features.

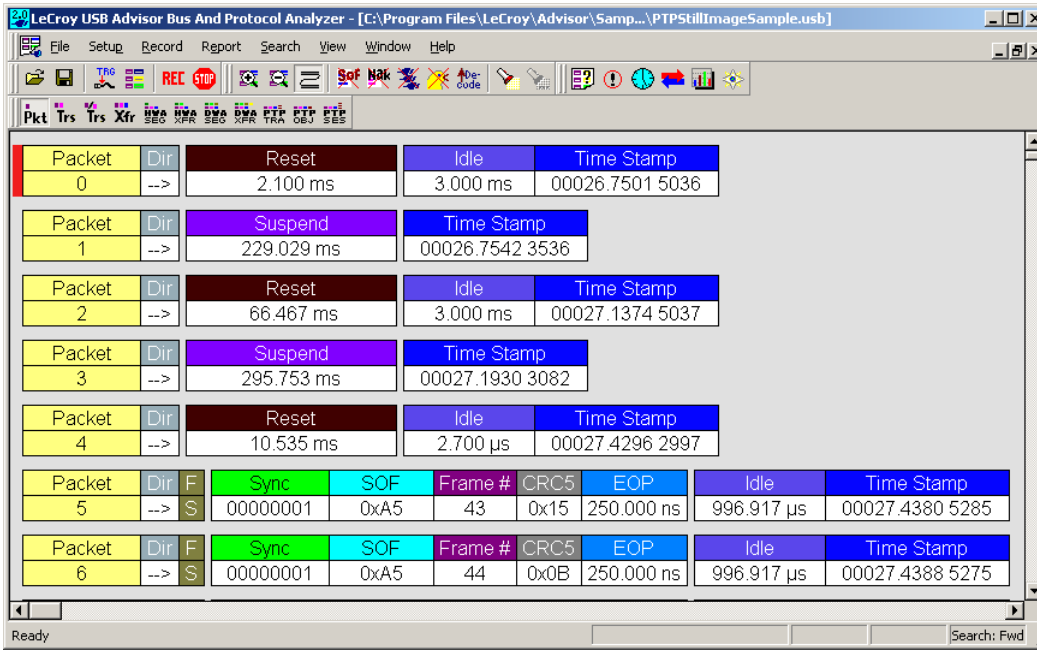
1.2 Graphical Bus Traffic Display

The Advisor USB 2.0 Analyzer transaction displays use color and graphics to present the captured transactions in an immediate, understandable and useful format.

Packets are shown on separate rows, with their individual fields both labeled and color-coded. Packets are also numbered (sequentially, as recorded), time-stamped. Protocol errors are automatically detected and highlighted in red.

The display is customizable, allowing the user to control the color scheme and the formatting of field contents. A hide feature allows users to enable the suppression of SOF packets and user defined packets or fields that may be uninteresting in a given context. Display formats can be named and saved for later use. Pop-up tooltips annotate packet fields with even more detailed information about their contents.

The display software operates independently of the hardware, allowing it to function as a stand-alone Trace Viewer that is freely distributed.



1.3 Accurate Time Management

The Advisor USB2.0 Analyzer uses internal counter/timer circuitry to enable a reliable, accurate (16.67 ns resolution) time stamping of recorded bus traffic. This timing information is available both as a component of the graphical data display and as a contribution to a variety of measurement and analysis functions. Any number of markers can be added by the user to denote specific packets, and further timing measurements can be made from one marker to another or from marker to trigger. All time fields are presented as a time stamp, idle time, bit time or in a new time delta in either decimal or hexadecimal format.

An essential feature of time management is that idle traffic does not consume the Analyzer memory. Because of this unique technology, accurate timing calculations can be made while still preserving valuable recording memory for important bus traffic.

1.4 Comprehensive Error Detection and Analysis

The Advisor USB2.0 Analyzer detects and alerts the user to every potential bus error, protocol violation and/or combination thereof. The Analyzer contains circuitry in the BusEngine™ to perform real-time triggering on multiple error conditions, such as PID bad, bit stuffing bad, header or data CRC bad, end-of-packet bad, babble, loss of activity, frame length violation, time-out or turn-around violation and data toggle violation. The Analyzer program highlights all the hardware detected errors and further examines the trace file for additional protocol errors, including wrong packet length, data payload violation, and packet termination not on a byte boundary.

1.5 Real-Time Event Triggering and Capture Filtering

No attribute of a bus and protocol Analyzer is more important than its capacity for extracting useful information from a crowded stream of bus traffic. The ability to accurately identify, and selectively record, transactions of interest is the trait most valuable to the user. The Advisor USB 2.0 Analyzer offers a unique approach to this challenge. By using a set of recording resources, more than a dozen configurable hardware building blocks can be optimized to perform a particular activity appropriate to the task. A recording resource can independently await an initialization signal, monitor its external environment (external signals, other resources) in search of a particular event and take a subsequent action (triggering, inclusive or exclusive filtering, counting, etc.). Under control of the user interface, these resources can be selected, configured and combined to both search for complex trigger conditions and selectively capture the associated transactions.

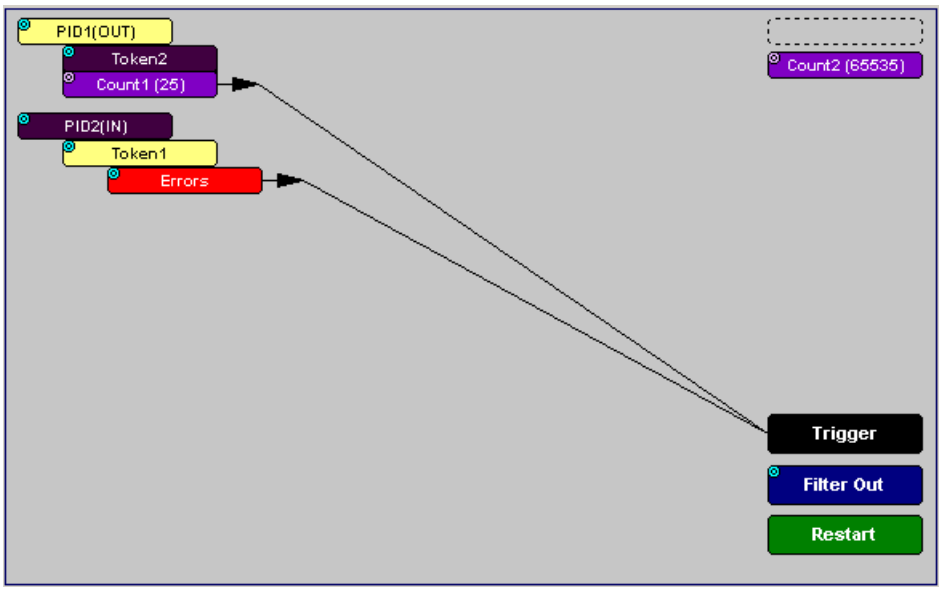
Thus, as well as triggering on basic events, such as specific bus conditions and packet identifiers (PID) (see the Specifications section for a complete list), the Advisor USB2.0 Analyzer can easily manage the most challenging requirements. For example: "trigger on the fifth occurrence of a SETUP Token device number nine", or "trigger on a SET INTERFACE request, following a specified eight-byte bulk data pattern match from this scanner, and do not capture any start-of-frame (SOF) packets."

The user can also configure the size of the recording memory, specify the pre/post-trigger capture ratio, and truncate the capture of large data packets up to the first 256 bytes.

1.6 Advanced Event Counting and Sequencing

The count and sequence options define the rules for data recording sessions. These options provide the ability to configure and control the order of events that have been selected to trigger the USB2.0 Advisor Analyzer or filter the recording. There are two counters and a restart option that causes the sequencing to start again.

By utilizing this feature a designer can specify a specific sequence of events that must occur before the Analyzer triggers and finishes capturing data. This is extremely important in allowing a designer to pinpoint certain types of events for recording. Without this feature a designers must scroll through potentially megabytes of recorded data to locate a specific sequence or occurrence of a sequence that can take hours to locate before being able to begin analyzing the data of interest.



1.7 BusEngine Technology

LeCroy's BusEngine™ Technology is at the heart of the new Advisor USB 2.0 Analyzer. The revolutionary BusEngine core uses state-of-the-art Electrically Programmable Logic Device (EPLD) technology and incorporates both the real-time recording engine and the configurable building blocks that implement data/state/error detection, triggering, capture filtering, external signal monitoring and event counting & sequencing. And like the flash-memory-based firmware that controls its operation, all BusEngine logic is fully field upgradeable, using configuration files.

Chapter 2: General Description

2.1 General Description

The LeCroy USB Advisor™ USB2.0 Protocol Analyzer is a stand-alone unit that is designed to be controlled and configured by a portable or desktop PC connected via its USB port.

The Advisor uses hardware triggering to capture real-time events and hardware filtering to preserve memory and assist in pinpointing data of interest. Recorded data is then uploaded to the attached PC and displayed on the CATC Trace graphical user interface as color-coded packets that can be searched for specific data, errors or other desired conditions.

The Advisor USB2.0 Bus & Protocol Analyzer is the ideal USB tool used in conjunction with any Microsoft® Windows® 2000, Windows XP, Windows Vista™ 32, or Windows Vista 64 desktop or portable PC in a USB development lab environment. **Note:** Support for Windows 2000 will end on January 1, 2008.

The Advisor Analyzer supports the Universal Serial Bus, version 2.0.

Please refer to the *Universal Serial Bus Specification, version 2.0* for details on the protocol. The USB specification is available from the USB Implementers Forum (USB-IF) at:

USB Implementers Forum
1730 SW Skyline Blvd. Suite 203
Portland, OR 97221

Tel: +1/503.296.9892
Fax: +1/503.297.1090
Web: http://www.usb.org/

2.2 Analyzer PC Requirements

The following is a list of recommended configuration for the host machine that runs the Advisor application and that is connected to the Advisor Analyzer:

- Microsoft Windows 2000, Windows XP, Windows Vista 32, or Windows Vista 64 operating system. **Note:** Support for Windows 2000 will end on January 1, 2008. The Advisor application can be used on machines with Windows to view trace files. Microsoft Internet Explorer, version 5 or newer.
- For optimum performance, use processors of the Intel Pentium III/Pentium 4 family or AMD Athlon/Duron family, or other compatible processors with clock speed of 500 mHz or higher. (A processor of the Intel Pentium II/Celeron family or AMD K6 family with clock speed of 300mHz is required.)
- For the best performance, it is recommended to have physical RAM twice the size of the recording buffer setup - 256 MB or more. (Minimum is 128 MB of RAM.)
- At least 20 MB of free hard disk space is required for the installation. Additional disk space is needed for storing the recorded data in files during the recordings process (can be as much as 150MB when recording a full buffer size).
- Display: Resolution of 1024 x 768 with at least 16-bit color is recommended (resolution of 800 × 600 with 16-bit color is a minimum).
- A USB interface is required to connect to the Advisor Analyzer. This is not a requirement if the application is going to be used only as a viewer.

2.3 System Components/Packing List

The LeCroy Advisor Analyzer package includes the following items:

- One stand-alone LeCroy USB Advisor™ Analyzer module
- One AC power cord with a plug appropriate to your location
- One External Interface Breakout Board with a 9-pin cable
- Five USB cables: four 3-foot (1-meter) cables and one 6-foot (2-meter) cable
- LeCroy Advisor software program installation CD
- Product documentation, including online help

2.4 Stand-Alone Unit

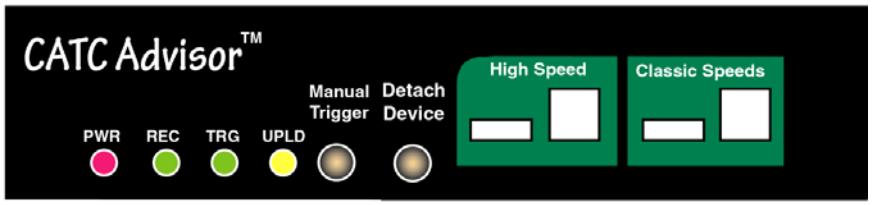


Figure 2.1 Front Panel

Figure 2.2 Rear Panel

The Advisor Analyzer has several user-accessible controls on its front and rear panels.

- **Red PWR (power) indicator LED**: Illuminates when the unit power is switched on.
- **Green REC (recording) LED**: Illuminates when the unit is recording.
- **Yellow TRG (triggered) LED**: Illuminates when the unit triggers an event. Also lights during power-on testing and blinks when the hardware is faulty.
- **Green UPLD (upload) LED**: Illuminates when unit is uploading data to host PC.
- **Manual Trigger** push-button (allows a manual Trace capture)
    - After beginning a recording session, press the **Manual Trigger** switch to force a Trigger condition. The session completes when a specified post-Trigger amount of bus data is recorded or when you manually stop a recording session.
    - **Detach Device** push-button (allows a momentary disconnection of the device from the host on the Classic Speeds port). This is especially useful when the traffic of interest occurs during device enumeration. Use the **Detach Device** switch shortly after starting recording to capture a Trace of the device's enumeration.
- Two USB ports, **High Speed** and **Classic Speed**, each with a type A and a type B connector.
    - **High Speed**: Used to record 480 MB/s High-Speed traffic only
    - **Classic Speeds**: Used to record either 12 MB/s or 1.5 MB/s Classic-Speed traffic

- Wide range AC connector module:
  - Power socket
  - Power on/off switch
  - Enclosed 5x20 mm 2.0A 250 V fast acting glass fuse

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

  - USB type B host computer connector
  - **Data In/Out** DB-9 (9-pin) external interface connector

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

2.5 Specifications

Package

Dimensions	9.2 x 8.4 x 2.5 inches (23.4 x 21.3 x 6.4 cm)
Connectors	AC power connection Trigger IN/OUT input (BNC) Host connection (USB, type B) Data connector (Data In/Out, 9-pin DB)
Weight	2.8 lbs. (1.2 kg)

Power Requirements

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

Environmental Conditions

Operating Temperature	0 to 55°C (32 to 131°F)
Storage Range	-20 to 80°C (-4 to 176°F)
Operating Humidity	10 to 90%, non-condensing
Operating Altitude	Up to 6560 feet (2000 meters)

Switches

Power	on/off
Manual Trigger	Forces trigger event.
Detach Device	Detaches the device from the classic speed connection.

LEDs

Power (PWR)	Illuminated when the Analyzer is powered on
Recording (REC)	Illuminated when the Analyzer is actively recording traffic data
Triggered (TRG)	Illuminated during power-on testing and when the Analyzer has detected a valid trigger condition
Uploading (UPLD)	Illuminated when the Analyzer is uploading its recording memory to the host PC for display

Recording Memory Size

128 Megabyte DRAM for traffic data capture, timing, state and other data

Host Compatibility

The instrument works with any PC equipped with a functioning USB port and running a Microsoft Windows 2000, Windows XP, Windows Vista 32, or Windows Vista 64 operating system. **Note:** Support for Windows 2000 will end on January 1, 2008.

2.6 External Interface Breakout Board

The External Interface Breakout Board is an accessory that allows convenient access to several potentially useful standard, fast TTL output and input signals. It also offers a simple way to connect logic Analyzers or other tools to the Advisor Analyzer unit. Four ground pins and one 5-volt pin are provided.

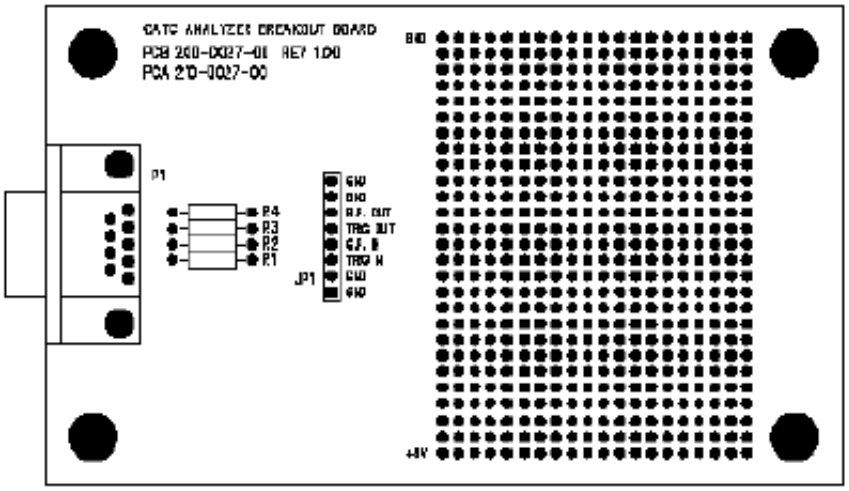


Figure 2.3 External Interface Breakout Board

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

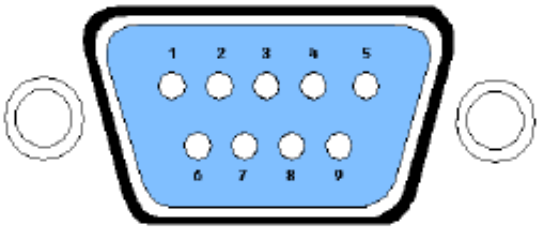


Figure 2.4 Data In/Out Connector (on cable)

Pin-Outs for the Data In/Out Connector

Table lists the pin-out and signal descriptions for the **Data In/Out** connector on a cable that connects to the Breakout Board.

Data In/Out Connector – Pin-Out

Pin	Signal Name	Signal Description
1	+5V	+5 Volts, 250mA DC source
2	TRG IN	(*) Trigger Input
3	GP IN	(*) General Purpose Input
4	TRG OUT	(*) Trigger Output
5	GP OUT	(*) General Purpose Output
6	GND	Ground
7	GND	Ground
8	GND	Ground
9	GND	Ground

Note: (*) Pins 2 and 3 have the same function: they allow external signals to be used to cause triggering or recording. Pins 4 and 5 are used to transmit output signals.

Prototype Rework Area

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

PC Connection

Use the **LONGEST (6-foot/2-meter)** of the five USB cables provided to connect the host computer to the Advisor Analyzer box.

Chapter 3: Quick Installation

The LeCroy USB2.0 Advisor™ Bus & Protocol Analyzer components and software are easily installed and quickly ready to run on most personal computer systems. You can begin making USB recordings after following these initial steps. However, if you are new to personal computers and protocol Analyzers, if you are unsure about what to do after reading the Quick Installation instructions, or if your Analyzer does not work after you follow these instructions, read through the subsequent sections in this manual.

Step 1 Connect the AC power cable to the rear of the Analyzer.

Step 2 Connect the USB port on the back of the Analyzer to the PC for analysis by using the LONG (6-foot/2-meter) USB cable.

Step 3 Insert the CD-ROM.

Step 4 Turn on the Power switch located on the rear of the Analyzer.

Step 5 Click **NEXT** when you see the **Add New Hardware Wizard** window.

Step 6 Follow the on-screen Plug and Play instructions.

Step 7 Click **Finish** when you see the message that says "Windows has finished installing the software that your new hardware requires" and the file **Advisor.inf** has been installed on your host PC.

Step 8 Click **Install Software** and follow the on-screen instructions.

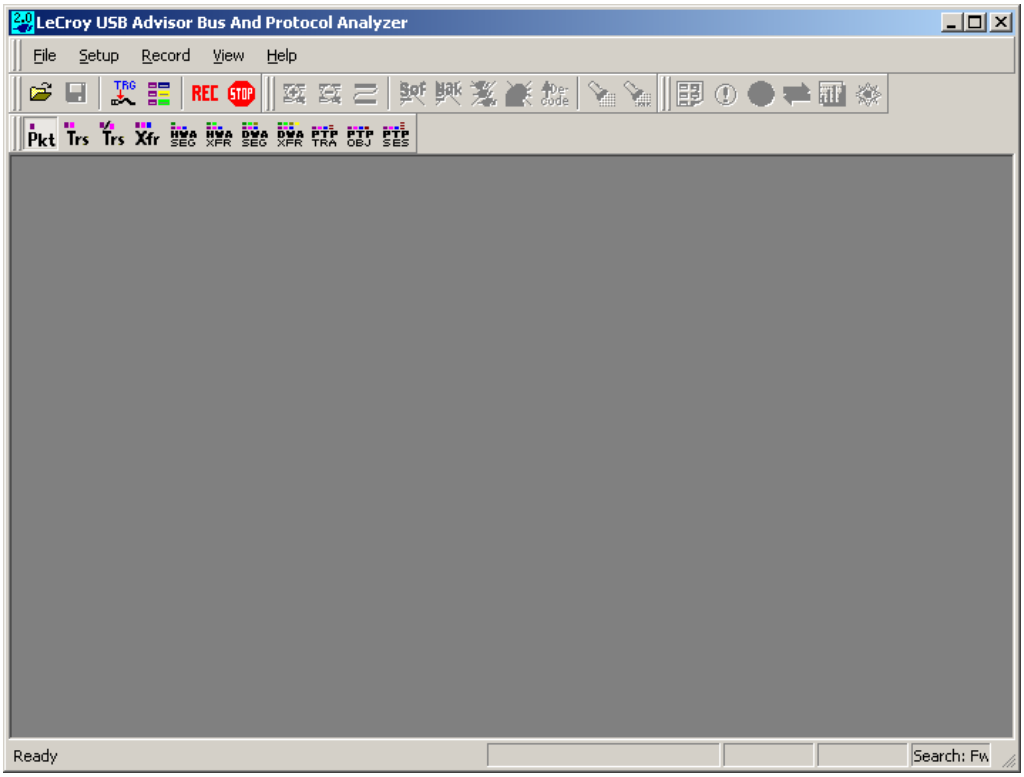
Step 9 Launch the LeCroy Advisor program from the LeCroy programs group.

Step 10 From the **Help** menu, select **About Advisor** to display the version information.

If the information below is present, you can record a trace:

- Advisor Software Version
- Advisor Firmware Version
- BusEngine™ Version
- Unit Serial Number

The following window opens:



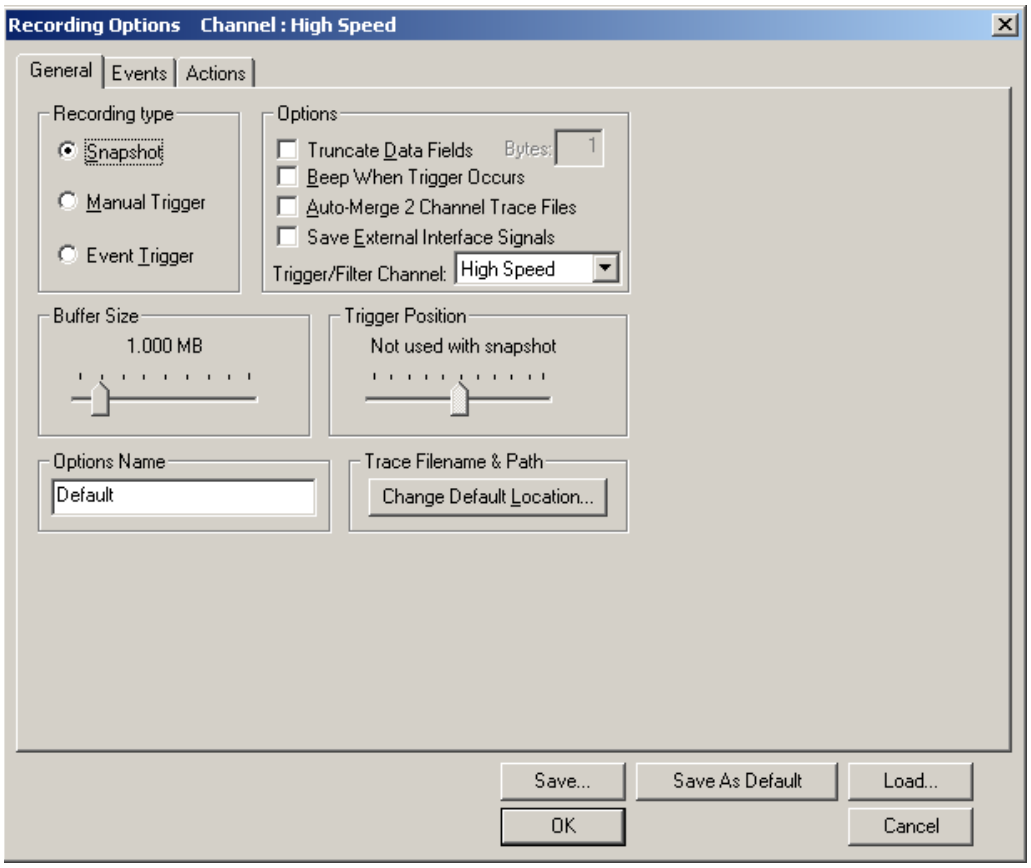
3.1 Your First USB Recording

After installing and launching the software, you can test Advisor by performing the following steps.

Step 1 Connect a USB cable to each of the two connectors on the Advisor module, then connect the other ends to the USB device under test and USB host system.

Step 2 Select **Recording Options** under **Setup** on the Menu Bar.

Step 3 Select the **General** tab to open the General page of the Recording Options dialog box, showing factory default settings such as Snapshot and 1 MB buffer size. For the first recording, leave these settings unchanged.



Step 4 Click **OK** to activate the recording options you selected.

Step 5 Turn on the USB devices that are to be tested and cause them to generate USB traffic.

Step 6 Click REC on the Tool Bar.

Advisor starts to record the USB traffic immediately. After 1 MB of traffic is recorded, the Analyzer uploads the data and displays the packets in the trace window.

Step 7 If you wish to terminate the recording before the snapshot automatically completes, click STOP on the Tool Bar.

When the recording session is finished, the traffic is uploaded from the Analyzer to the hard drive on your PC as a file named **data.usb** or whatever name you assigned as the default filename. While the file is being uploaded, you should see a brown progress bar at the bottom of the screen. When the bar disappears, it indicates that the data has been uploaded to disk.

Step 8 To save a current recording for future reference, select **Save As** under **File** on the Menu Bar.

OR

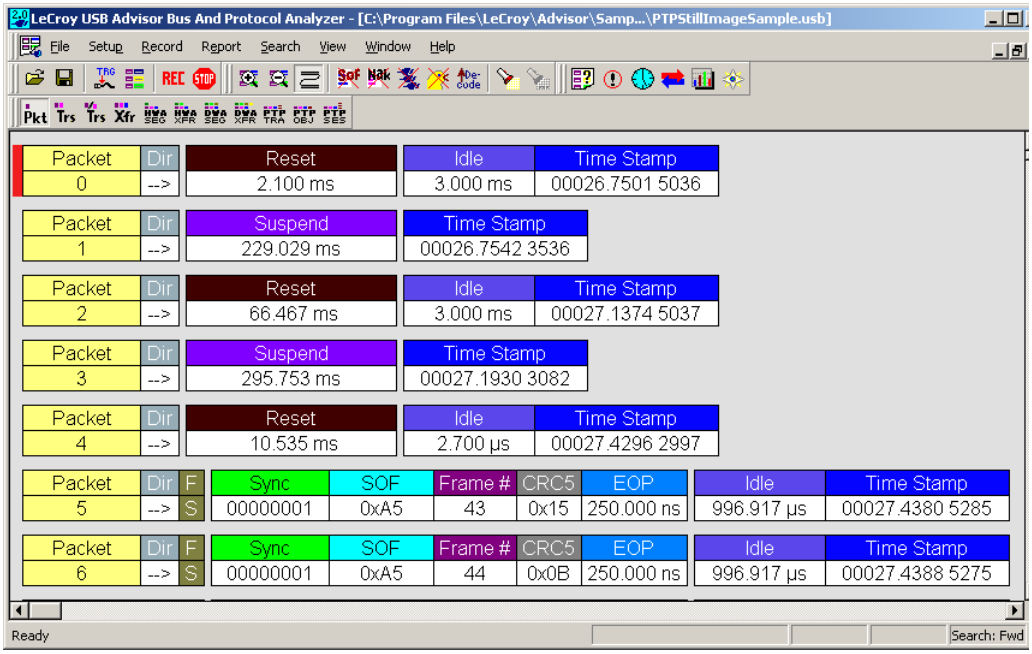
Click on the Toolbar.

You see the standard **Save As** screen.

Step 9 Give the recording a unique name and save it to the appropriate directory.

Capturing Your First CATC Trace

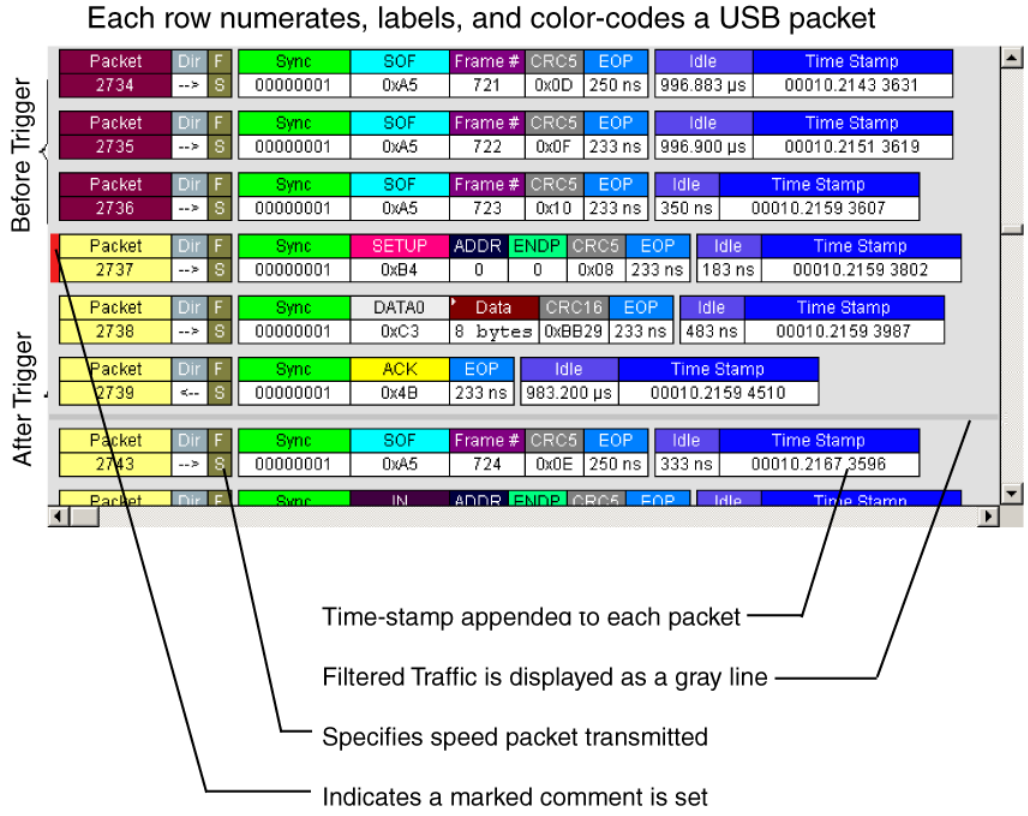
After a moment, the recording terminates and the results display.



Trace View Features

- The Advisor packet view display makes extensive use of color and graphics to fully document the captured traffic.
- Packets are shown on separate rows, with their individual fields both labeled and color coded.
- Packets are numbered (sequentially, as recorded), time-stamped (with a resolution of 16.67 ns), and highlighted to show the transmitted speed (low-speed, full-speed or high-speed).
- Display formats can be named and saved for later use.
- Pop-up Tool Tips annotate packet fields with detailed information about their contents
- Data fields can be collapsed to occupy minimal space in the display (which can in turn be zoomed in and out to optimize screen utilization).

The display software can operate independent of the hardware and so can function as a stand-alone Trace Viewer that may be freely distributed.



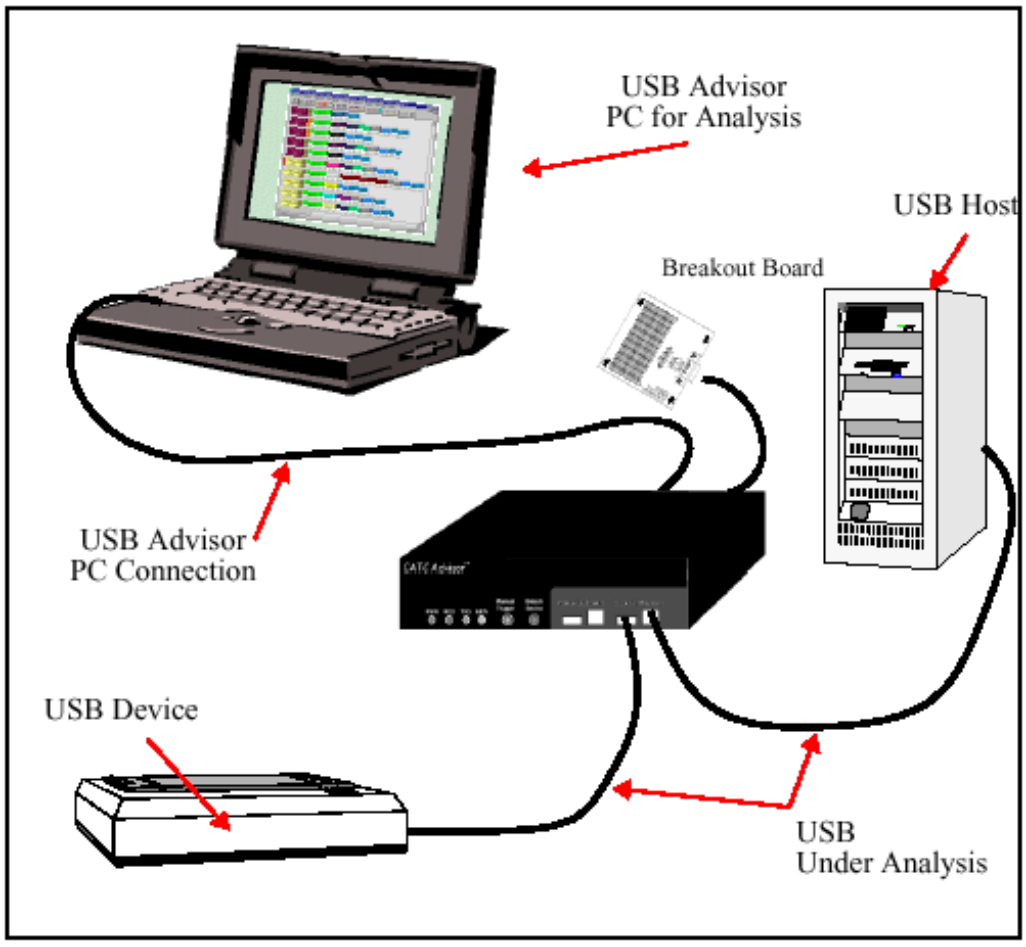
Chapter 4: Detailed Installation

4.1 Advisor System Setup

The Advisor™ Analyzer functions with any personal computer using the Microsoft® Windows® 2000, Windows XP, Windows Vista™ 32, or Windows Vista 64 operating system and equipped with a functional USB interface. **Note:** Support for Windows 2000 will end on January 1, 2008.

The Analyzer is a stand-alone unit configured and controlled through a personal computer USB port. It can be used with portable computers for field service and maintenance as well as with desktop units in a development environment. It is easily installed by connecting a cable between the computer's USB port and the Analyzer's USB port.

Figure 4.1 USB Advisor Connection



The Advisor Analyzer provides on-the-fly detection of and triggering on such events as specific user-defined bus conditions, packets matching any Packet Identifier (PID), packets matching a Token or Setup transaction, data patterns, and errors and bus

conditions. Whether recording manually or with a specified Trigger condition, the Advisor Analyzer continuously records the bus data in a wrap-around fashion until manually stopped or until the Trigger Event is detected and a specified post-Trigger amount of bus data is recorded.

Upon detection of a triggering event, the Analyzer continues to record data up to a point specified by the user. Real-time detection of events can be individually enabled or disabled to allow triggering on events as they happen. This includes predefined exception or error conditions and a user-defined set of Trigger events. The unit can also be triggered by an externally supplied signal. An external DB-9 connector provides a path for externally supplied data or timing information to be recorded along with bus traffic.

Real-time event detection information is available via an external DB-9 connector.

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

The Advisor Analyzer is designed to work with either desktop or laptop computers equipped with a functional USB interface.

To set up the system hardware, follow these steps:

Step 1 Connect the Analyzer to an AC power source.

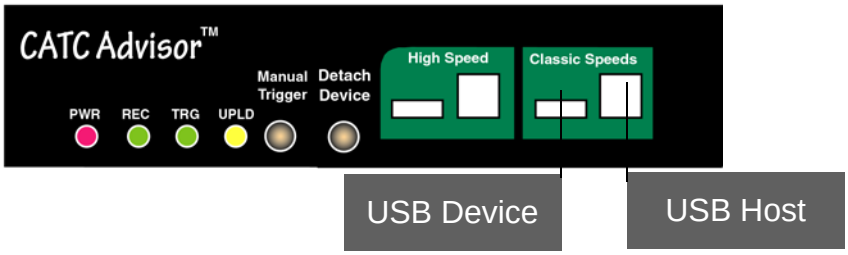
Step 2 Connect the External Interface Breakout Board to the **Data In/Out** connector (optional).

Step 3 Connect to the personal computer via USB.

Step 4 Connect the USB host and the device being analyzed to either the High-Speed or Classic-Speed USB port.

4.2 USB Test Ports

The USB Bus uses keyed connectors so that the type A connector joins a cable directed to downstream devices or to a hub and the type B connector joins a cable directed to an upstream host controller or to a hub. A USB hub is used to join multiple devices to an upstream host controller and therefore has both type A and type B connectors.



These ports have both type A and type B connectors so the Analyzer can conveniently tap a USB branch. To connect your USB branch for analysis, use the **SHORT** (3-foot/1-meter) USB cables to insert the Analyzer in place of the existing cables. Connect one cable to the type A connector and join it downstream to your device or hub. Connect the other cable to the type B connector and join it upstream to your host or hub.

Note: The Advisor Bus & Protocol Analyzer is not a hub device; it connects to a USB branch by inserting a non-intrusive, high impedance tap. Because of the poor signal quality in the middle of a USB cable, LeCroy recommends using the shortest possible cables so that the total length of both cables together is less than 6 feet. The USB cables provided with your Analyzer meet this requirement. When longer cables are used, the Analyzer may record incorrect data.

4.3 AC Power Source

To turn on the system:

Step 1 Connect the Analyzer box to a 100-volt to 240-volt, 50 Hz to 60 Hz, 120 W power outlet using the provided power cord.

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

Step 2 Use the power switch located on the rear panel to turn the Analyzer unit on and off.

Note: At power-on, the Analyzer initializes itself in approximately 25 seconds and performs an exhaustive self-diagnostic that lasts about 45 seconds. The Status LED illuminates during the power-on testing and turns off when testing is finished. If the diagnostics fail, the Status LED blinks, indicating a hardware failure. If this occurs, call LeCroy Customer Support for assistance.

4.4 Advisor Program Installation

The LeCroy Advisor software is provided on CD-ROM and requires a Microsoft Windows 2000, Windows XP, Windows Vista 32, or Windows Vista 64 operating system. **Note:** Support for Windows 2000 will end on January 1, 2008.

Loading the Advisor USB Drivers

Step 1 Insert the Advisor CD-ROM into your computer.

Step 2 Power-on the Advisor Analyzer.

Step 3 Connect the USB cable to the rear of the Analyzer and to the personal computer.

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

Step 4 When Windows prompts you for a file, browse to the CD-ROM.

Installing the Advisor Application Program

To install the Advisor program, follow these steps:

Step 1 Insert the Advisor CD-ROM into your computer.

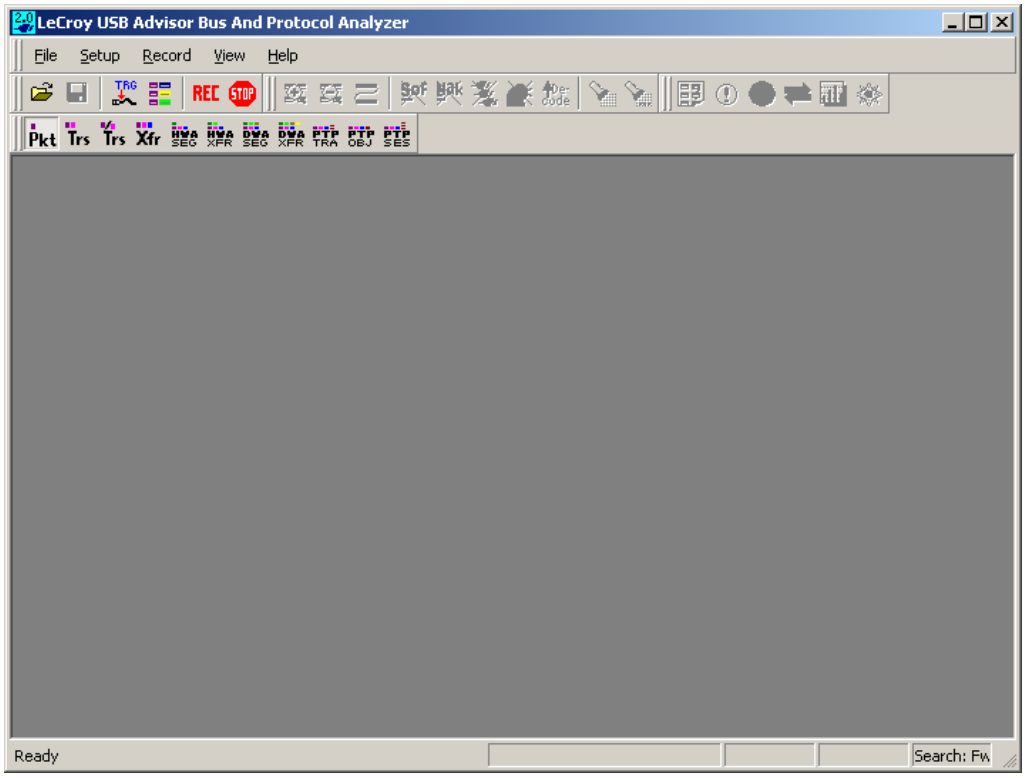
Step 2 Click **Install Software**.

Step 3 Follow the installation instructions on your screen.

The Install Wizard automatically installs the necessary files to the computer's hard drive. Advisor software is installed in the **C:\Program Files\LeCroy\Advisor** directory unless you specify otherwise. Follow the installation instructions on your screen.

4.5 Advisor Program Startup

You can start the Advisor program from the Desktop or from the installed directory. The program always begins with its main screen active:



The software may be used with or without Advisor. When used without Advisor, the program functions in a Trace Viewer mode to view, analyze, and print captured protocol traffic.

When the program is used with the Advisor Protocol Analyzer attached to the computer, you can set trigger conditions, record, monitor and analyze the activity of your USB bus.

4.6 Making a Recording

After installation, the software is configured to make a Snapshot recording of USB traffic.

To make your first recording of traffic, see “Your First USB Recording” on page 16.

Chapter 5: Software Overview

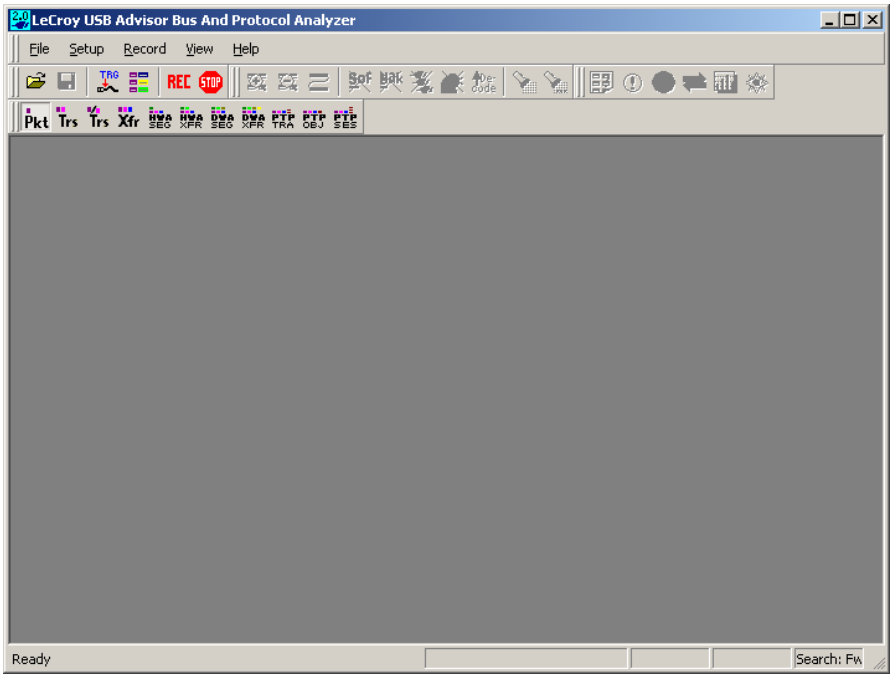
The LeCroy USB Advisor™ software may be used with or without the Analyzer hardware. When used without the Analyzer hardware, the program functions in a Trace Viewer mode to view, analyze, and print captured protocol traffic from Advisor Analyzers. The software also allows you to view trace files created by the LeCroy Chief™, Detective™, and Inspector™. Opening a file created with any of these Analyzers displays a screen asking if you want to convert the old file to the new format under the name **convert.usb**.

When the program is used with the USB Advisor Analyzer attached to the computer, you can monitor and analyze the activity of your USB branch from either of the USB ports on the front of the Analyzer.

5.1 Starting the Advisor Program

To start the USB Advisor Program:

Step 1 Click **Start** > **Programs** > **LeCroy** > **LeCroy USB Advisor**.



5.2 Tool Tips

Tool tips provide useful information about fields and buttons.

In some cases, tool tips spell out acronyms used in cells. To display a tool tip, position the mouse pointer over an item.

5.3 The Main Display Windows

While some of the Analyzer's Main Display window options are familiar, many contain options specific to the Analyzer program.

Menu	Function
File	
Open	Opens a file.
Close	Closes the current file.
Save As	Saves all or a range of packets from the current file.
Print	Prints part or all of the current traffic data file.
Print Preview	Produces an on-screen preview before printing.
Print Setup	Sets the options for the current or new printer.
Edit Comment	Creates or edits the Trace file comment field.
Export>>	Saves all or part of a trace to a text file or generator file.
Packets to Text (Packet View Format)	Saves trace as text file in Packet View Format.
Packets to .CSV (Comma Separated Values for Excel, etc.) Format)	Saves trace as a comma-separated-values text file for use with Microsoft® Excel.
Packets to Host Traffic Generator Text File (**.utg**)	Saves trace as script file that can be used by a Generator to generate a trace.
Packets to Device Emulation Traffic Generation Text File (**.utg**)	Exports packets to Device Emulation files. This option does not export transactions.
Data	Exports Transfer data as text or binary file
Merge Trace Files	Merges two simultaneously recorded files into a single file. (This command does not work if the files were recorded at different times).
Compare Endpoint Data	Allows you to select two endpoints of different directions with the same address and verify that the data OUT/IN is identical to the data IN/OUT from the other endpoint. Used when running echo-types of tests for data integrity.
Import	Imports data from a **.vcd** file.
Exit	Exits the Advisor program.
Setup	
Display Options	Provides display options such as color, formats, and filters.
Recording Options	Provides setup options for recording, triggering events, and filtering events.
Setup Analyzer	Allows you to update the BusEngine™ and Firmware.

Menu	Function
Record	
Start	Causes the Analyzer to begin recording USB activity.
Stop	Causes the Analyzer to stop recording.
Upload Again...	Allows you to upload a different portion of the captured trace if the previous upload was only partially uploaded.
Report	
File Information	Displays information about the recording such as the number of packets and triggering setup.
Error Summary	Summarizes the errors throughout the recording. Allows for fast navigation to packet with errors.
Timing Calculation	Calculates timing between two packets and bus utilization.
Traffic Summary	Summarizes the numbers and types of errors, packets, transactions, split transactions, and transfers that occurred in the open trace.
Bus Utilization	Displays graphs of packet length, bus usage, and bus usage by device.
Search	
Go to Trigger	Positions the display to show the first packet that follows the trigger event.
Go to Packet/ Transaction/Transfer	Positions the display to the packet/transaction/transfer number selected in the Go to Packet/Transaction/Transfer menu
Go to Marker »	Positions the display to the selected marked packet.
Go to »	Positions the display to the selected event, condition, value, or type
Find	Allows complex searches on multiple criteria.
Find Next	Repeats the previous Find operation.
Search Direction	Allows the search direction to be changed from Forward to Backward or vice versa.

Menu	Function
View	
Toolbars	Displays a list of available toolbar buttons.
Status Bar	Switches display of the Status Bar on or off.
Zoom In	Increases the size of the displayed elements.
Zoom Out	Decreases the size of the displayed elements.
Wrap	Wraps displayed packets within the window.
Hide SOF's	Hides Start of Frames.
Hide NAK's	Hides NAK'd Transactions.
Hide Devices	Hides packets belonging to specified devices by address and endpoint.
Hide Chirps	Hides the Chirp-K and Chirp-J Bus conditions. These are recorded only in USB*Tracer*.
Apply Decoding Scripts	Decoding scripts set the values of the display and recording options for optimum views of trace information from specific vendors or classes of data. This menu option allows you to select the vendor or class of data for the request recipients and endpoints listed in the Request Recipients and Endpoints menu. You can keep the settings across recordings.
Packet Level	Displays Packets.
Transaction Level	Displays Transactions.
Split Transaction Level	Displays Split Transactions.
Transfer Level	Displays Transfers.
HWA Segment Level	Displays Host Wire Adapter Segments
HWA Transfer Level	Displays Host Wire Adapter Transfers
DWA Segment Level	Displays Device Wire Adapter Segments
DWA Transfer Level	Displays Device Wire Adapter Transfers
PTP Transaction Level	Displays PTP Transactions
PTP Object Level	Displays PTP Objects
PTP Session Level	Displays PTP Sessions
Refresh Decoding	Forces the software to re-apply decoding to transactions and transfers. This option is useful if you have applied decoding mapping, which helps fully decode a sequence of transfers, as is the case with Mass Storage decoding.
Window	
New Window	Switches display of the Toolbar on or off.
Cascade	Displays all open windows in an overlapping arrangement.
Tile Horizontal	Displays all open windows in a side-by-side arrangement.
Tile Vertical	Displays all open windows in a top-to-bottom arrangement.
Arrange Icons	Arranges minimized windows at the bottom of the display.
Windows...	Displays a list of open windows.

Menu	Function
Help	
Help	Displays online help.
Help Topics	Displays online help. You can also select F1.
Update License	Opens a dialog box for updating your LeCroy license.
Display License Information	Displays information related to licensing.
About USB Advisor	Displays version information about USB Advisor.

5.4 View Options

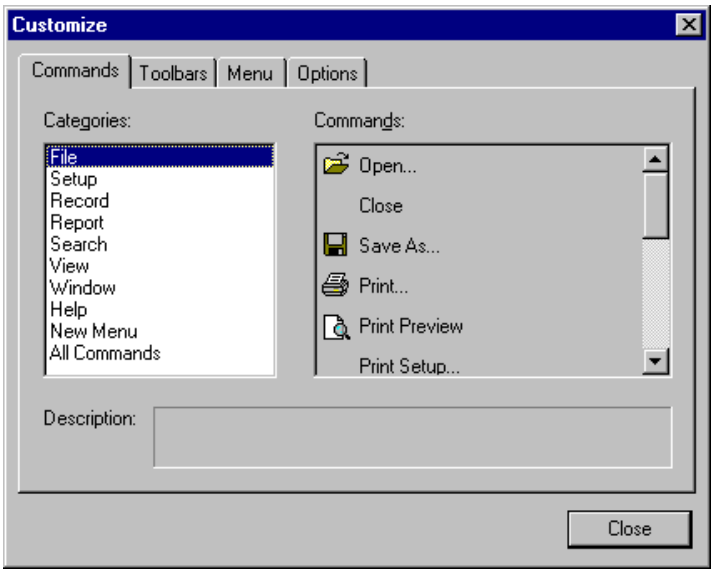
You can hide, display, or reset toolbars by selecting **View > Toolbars** from the menu bar.

Resetting the Toolbar

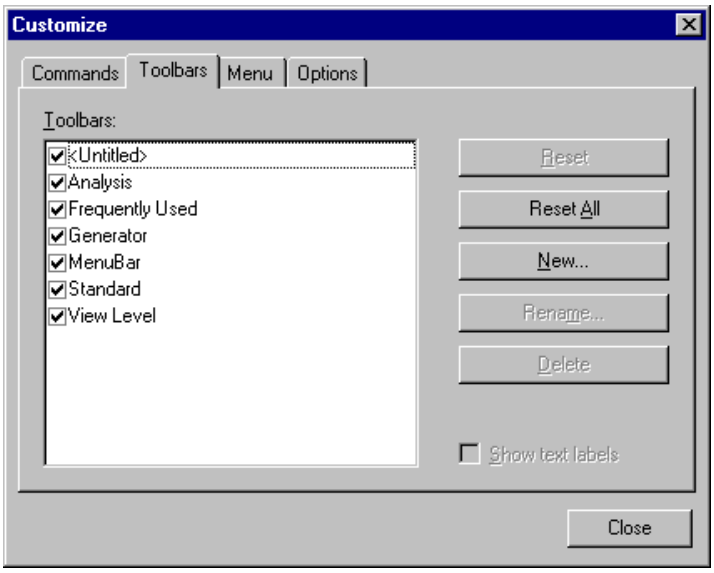
From time to time (such as following a software upgrade), it is possible for the buttons on the toolbar to not match their intended function. You can reset the toolbar by performing the following steps:

Step 1 Select **View > Toolbars** from the menu bar.

Step 2 Select **Customize** from the sub-menu to display the Customize dialog box.



Step 3 Select the **Toolbars** tab to list the toolbars.



Step 4 Click the **Reset All** button. The toolbar resets to the factory defaults.

Toolbar

The Tool Bar provides quick access to the most popular program functions. Tool tips briefly describe the functionality of each icon.

	Open file		Hide chirps
	Save As		Assign High Level Decodes
	Preview		Find
	Print…		Find Next
	Setup Record Options		File Information Report
	Setup Display Options		Error Report
	Start Recording		Timing and Bus Usage Calculations
	Stop Recording		Traffic Summary
	Zoom In		Bus Utilization
	Zoom Out		Display Packets
	Wrap		Display Transactions
	Hide SOFs		Display Split Transactions
	Starts the Trace Navigator		Display Transfers
	Partial Upload		Display Host Wire Adapter Segments
	Hide NAK’d transactions		Display Host Wire Adapter Transfers

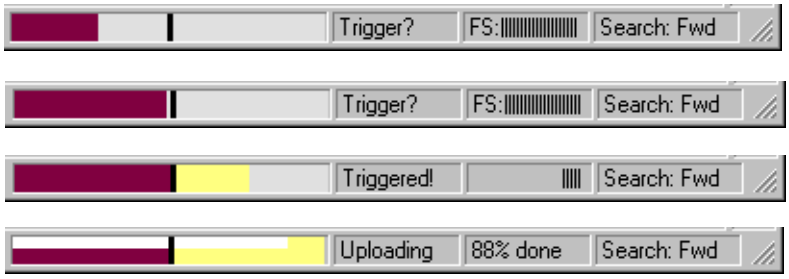
	Hide Devices		Display Device Wire Adapter Segments
	Display PTP Transactions		Display Device Wire Adapter Transfers
	Display PTP Objects		Display PTP Sessions

5.5 Status Bar

The Status Bar is located at the bottom of the main display window. Depending on the current activity, the bar can be divided into as many as four segments.

Recording Progress

When you begin recording, the left-most segment of the Status Bar displays a Recording Progress Indicator.



As recording progresses, the Progress Indicator changes to reflect the recording progress graphically:

- In the Progress Indicator, a black vertical line illustrates the location of the Trigger Position you selected in Recording Options.
- Pre-Trigger progress is displayed in the field to the left of the Trigger Position in the before-Trigger color specified in the Display Options.
- When the Trigger Position is reached, the progress indicator wiggles as it waits for the trigger.
- After the trigger occurs, the field to the right of the Trigger Position fills in the after-Trigger color specified in the Display Options.
- When recording is complete, the upper half of the progress indicator fills in white, indicating the progress of the data upload to the host computer.

You should be aware of two exceptional conditions:

- If a Trigger Event occurs during the before-Trigger recording, the before-Trigger color changes to the after-Trigger color to indicate that not all the expected data was recorded pre-Trigger.
- When you click **Stop** before or after a Trigger Event, the Progress Bar adjusts accordingly to begin uploading the most recently recorded data.

The Progress Bar fills with color in proportion to the specified size and actual rate at which the hardware is writing and reading the recording memory. However, the Progress Indicator is normalized to fill the space within the Status Bar.

Recording Status

During recording, the current Recording Status is displayed in the next segment. When you activate the **Record** function, this segment flashes one of the following messages (depending on the selected Recording Options):

- Trigger?
- Triggered!
- Uploading

After recording stops:

- The flashing message changes to **Uploading data–*x*% done** (**x%** indicates the percentage completion of the data uploading process).
- The traffic data is copied to disk (overwriting any previous version of this file) using the default file name **data.usb**. If two channels of traffic are recorded, Advisor creates two files:**data.usb** and **data_classic.usb**. You can specify a file name in the Recording Options dialog box.

To abort the upload process:

- Press **Esc** on your keyboard

  OR

- Again click in the Tool Bar.

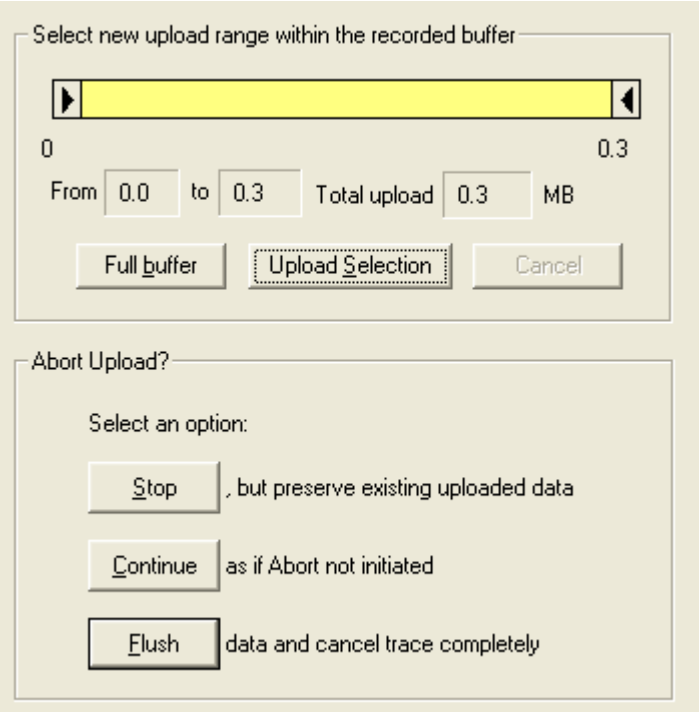
Note: While uploading is in progress, clicking the stop button again brings up a dialog opens a dialog that allows you to do a partial upload, flush the current file, keep what has uploaded at this point, and to continue uploading.

You are asked if you want to keep or discard the partially uploaded data.

When the data is saved, the Recorded Data file appears in the main display window and the Recording Status window is cleared.

- If the recording resulted from a Trigger Event, the first packet following the Trigger (or the packet that caused the Trigger) is initially positioned second from the top of the display.
- If the recording did not result from a Trigger Event, the display begins with the first packet in the traffic file.

The Partial Upload button is enabled when you have partially uploaded data. When you click this button, a dialog box appears that gives you options on what portion of data you want to upload again.



When the data is saved, the Recorded Data file appears in the main display window and the Recording Status window is cleared.

- If the recording resulted from a Trigger Event, the first packet following the Trigger (or the packet that caused the Trigger) is initially positioned second from the top of the display.
- If the recording did not result from a Trigger Event, the display begins with the first packet in the traffic file.

Recording Activity

During recording, the fourth segment from the left of the Status Bar displays Recording activity as a series of vertical bars.

The more vertical bars that are displayed, the greater the amount of activity being recorded. If there are no vertical bars, there is no recorded activity.

During uploading, the percent of the completed upload is displayed.

Note: If packets are filtered from the recording or data are truncated, the recording activity is reduced.

Search Status

The rightmost segment displays the current search direction: Fwd (forward) or Bwd (backward).

5.6 Navigation Tools

You can zoom in and out, and wrap packets/transactions/transfers to fit within the screen using the following buttons:

Zoom In

Zoom In increases the size of the displayed elements, allowing fewer (but larger) packet fields per screen.

- Click on the Tool Bar.

Zoom Out

Zoom Out decreases the size of the displayed elements, allowing more (but smaller) packet fields per screen.

- Click on the Tool Bar.

Wrap

Select **Wrap** to adjust the Trace View so that packets fit onto one line. If a packet is longer than the size of the window, the horizontal scroll bar can be used to see the hidden part of the packet.

- Click on the Tool Bar or select **Wrap** under **View** on the Menu Bar.

5.7 Advisor Analyzer Keyboard Shortcuts

Several frequently-used operations are bound to keyboard shortcuts.

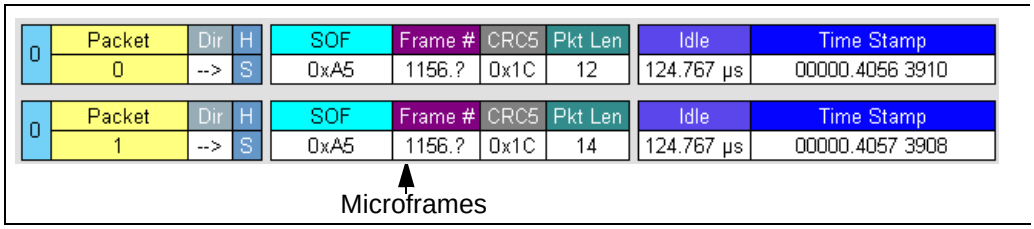
Operation	Key Combination
Trace Navigation	
Find Next	F3
Search Backwards	Ctrl+B
Search Forwards	Ctrl+F
Jump to First Packet	Ctrl+Home
Jump to Last Packet	Ctrl+End
Go to Any Error	Shift+E
Go to Channel 0	Ctrl+Shift+0
Go to Channel 1	Ctrl+Shift+1
PID	
Go to ACK	Shift+A
Go to DATA0	Shift+0
Go to DATA1	Shift+1
Go to DATA2	Shift+2
Go to DATAx	Shift+D
Go to IN	Shift+I
Go to MDATA	Shift+M
Go to NAK	Shift+N
Go to NYET	Shift+Y
Go to OUT	Shift+O
Go to PING	Shift+G
Go to PRE/ERR	Shift+P
Go to SETUP	Shift+S
Go to SOF	Shift+F
Go to SPLIT	Shift+X
Go to STALL	Shift+L

Bus Conditions	
Go to Reset	Shift+T
Go to Resume	Shift+6
Go to SE0	Shift+Z
Go to SE1	Shift+7
Go to Keep-Alive	Shift+5
Go to Suspend	Shift+U
Go to Chirp	Shift+C
Go to Full Speed J	Shift+J
Go to Full Speed K	Shift+K
OTG	
Go to SRP	Ctrl+Q
Go to HNP	Shift+H
Go to VBus Voltage Change	Shift+V
Go to OTG Host A	Ctrl+Shift+A
Go to OTG Host B	Ctrl+Shift+B
Misc.	
Marker Menu	Ctrl+M
Open File	Ctrl+O
Print…	Ctrl+P
Record	Ctrl+R
Stop Recording	Ctrl+T
Open Display Options dialog	Ctrl+Shift+D
Open Recording Options dialog	Ctrl+Shift+R
Hide SOFs	Ctrl+Shift+S
Hide NAKs	Ctrl+Shift+N
Hide Chirps	Ctrl+Shift+C

Chapter 6: Reading a Trace

6.1 Trace View Features

- The LeCroy USB Advisor™ packet view display makes extensive use of color and graphics to fully document the captured traffic.
- Packets are shown on separate rows, with their individual fields both labeled and color coded.
- Packets are numbered (sequentially, as recorded), time-stamped (with a resolution of 16.67 ns), and highlighted to show the transmitted speed (low-speed, full-speed or high-speed).
- Display formats can be named and saved for later use.
- Pop-up Tool Tips detail the contents of packet fields.
- Data fields can be collapsed to occupy minimal space in the display and you can zoom in and out to optimize screen utilization.
- The display software can operated independently of the hardware and so can function as a stand-alone Trace Viewer that may be freely distributed.
- High Speed SOFs display Microframes (shown below.)

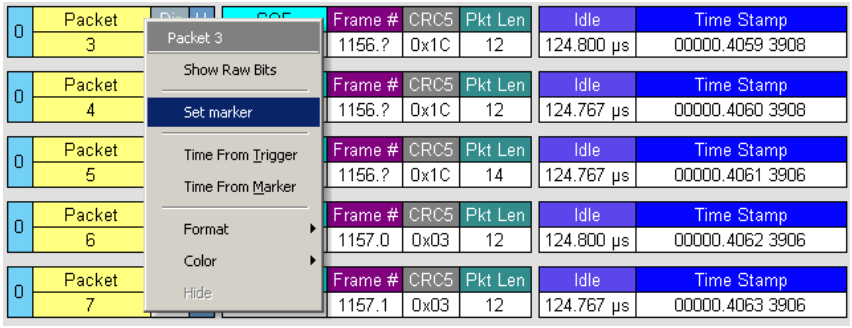


6.2 Set Marker

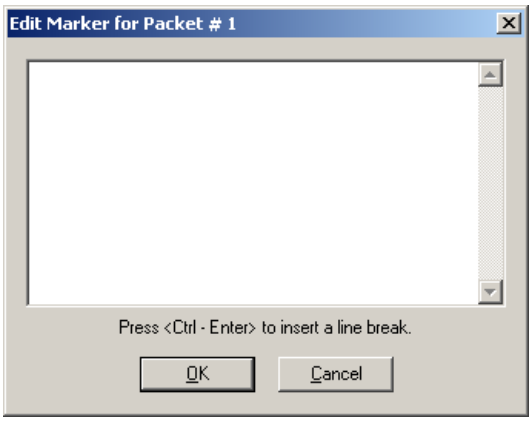
You can define a unique marker for each packet.

To place a marker on a packet:

Step 1 Left-click **Packet #** for the packet you wish to mark to display the **Packet** menu:



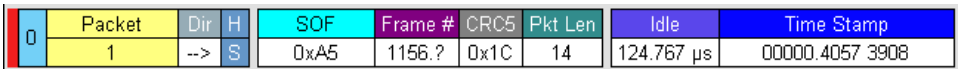
Step 2 Select **Set Marker** to display the **Edit Marker Comment** window.



Step 3 Enter a comment about the packet.

Step 4 Click **OK**.

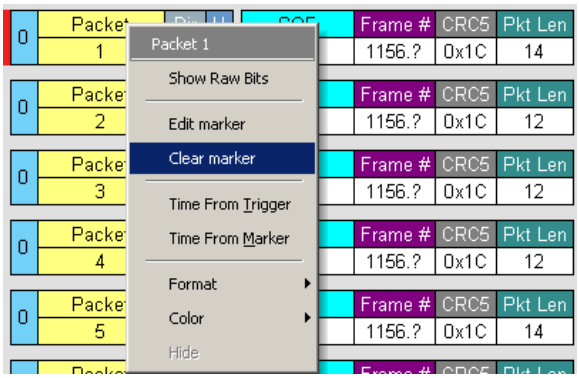
A marked packet is indicated by a vertical red bar along the left edge of the packet # block:



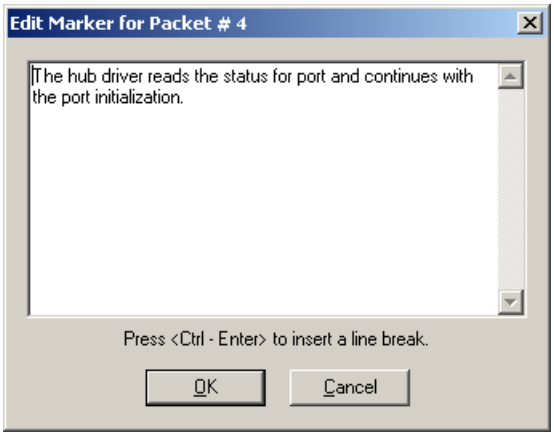
6.3 Edit or Clear Marker

To clear or edit the comments associated with a packet marker:

Step 1 Left-click **Packet #** for the chosen packet to display the **Packet** menu:



Step 2 To edit the Marker Comment, select **Edit Marker Comment** to display the **Edit Marker Comment** window. Edit the comment, then click **OK**:



Step 3 To clear a Marker, click **Clear Marker**.

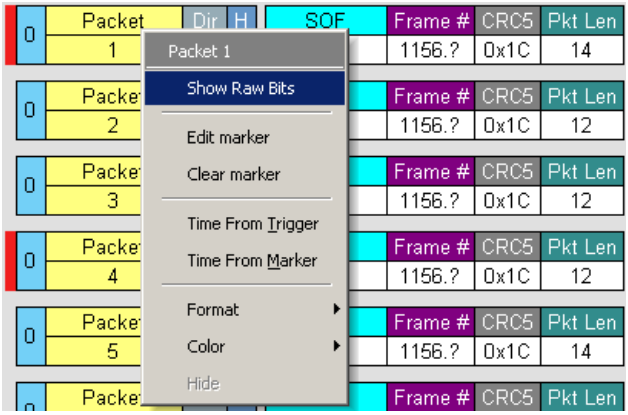
The vertical red Marker bar disappears.

6.4 View Raw Bits

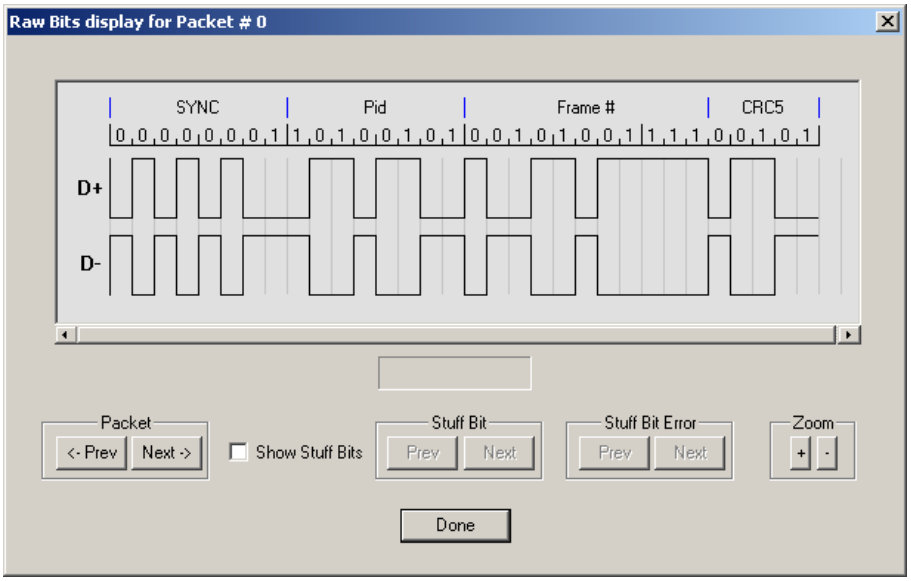
You can expand a specific packet to view the raw bits in detail.

To view the raw bits:

Step 1 Left-click **Packet #** for the packet to display the **Packet** menu:



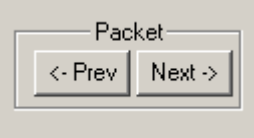
Step 2 Select **Show Raw Bits** to display the Raw Bits View for that packet:



Along the top of the Raw Bits View is a linear strip of the logical bit values with corresponding field demarcations. Bit stuffing is displayed in color. Below the logical bit values is a representation of the D+/D- signaling complete with NRZ encoding. A scroll bar assists in navigation of larger packets. Two buttons under the label **Packet** are used to view previous or next packets. Two buttons under the label **Zoom** allow you to zoom in or out on packets.

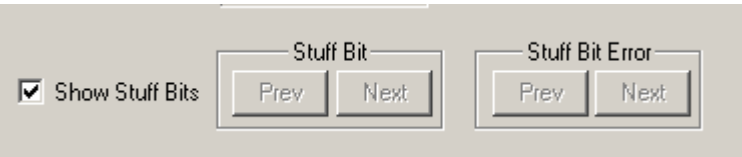
Using the Packet Buttons

The bottom left of the Raw Bits View contains buttons for navigating to different packets in the trace. Under Packet, the **Prev** and **Next** buttons allow you to show raw bits for the previous and forward packets in the trace.



Using the Stuff Bit Buttons

The bottom center of the Raw Bits View contains a checkbox and buttons for viewing Stuff Bits. Select the **Show Stuff Bits** checkbox and then click the **Prev** button to view previous stuff bits in a trace. Click the **Next** button to view show the next stuff bits in a trace. Under **Stuff Bit Error**, click the Prev button to view previous stuff bit errors in a



trace, and click Next to view stuff bits forward in a trace.

Using the Zoom Buttons

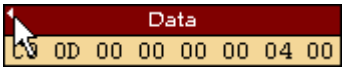
Use the buttons to view larger or smaller views of raw bits.

6.5 Expanding and Collapsing Data Fields

You can expand a data field to view it in greater detail or collapse it when you want a more compact view.

Using the Expand/Collapse Data Field Arrows

Data Fields can be easily expanded or collapsed by clicking the small triangular arrows on the left side of the data field.



Double-Clicking to Expand/Collapse Data Fields

Data fields can also be expanded or collapsed by double-clicking anywhere in the data field.

Expanding or Collapsing All Data Fields

Expand or collapse all data fields by holding down the button for more than a second.

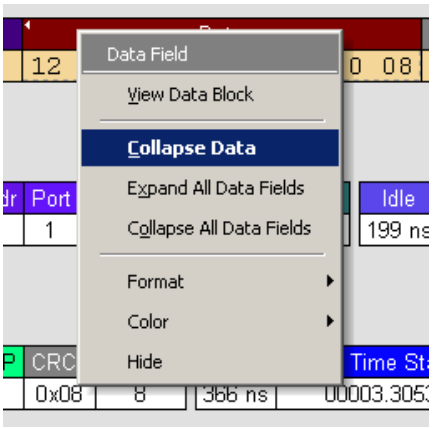
Using the Data Field Pop-up Menus

Data fields can be expanded or collapsed by clicking in a data field and selecting Expand Data or Collapse Data from the pop-up menu.

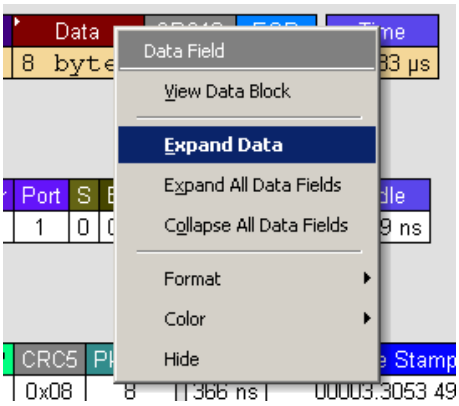
To expand and collapse data using the menu:

Step 1 Left-click **Data** in the Data packet you want to expand or collapse.

If your Data Trace View is currently expanded, you see the **Collapse Data** menu:



If your Data Trace View is currently collapsed, you see the **Expand Data** menu:



Step 2 Select the desired Expand Data or Collapse Data menu item.

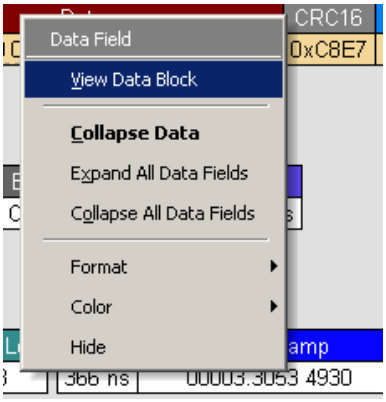
The Trace View is repositioned with the selected packet(s) adjusted in the format you have specified.

Expand or Collapse All Data Fields

All data fields can be expanded or collapsed by selecting **Expand All Data Fields** or **Collapse All Data Fields** from the data field pop-up menus.

6.6 View Data Block

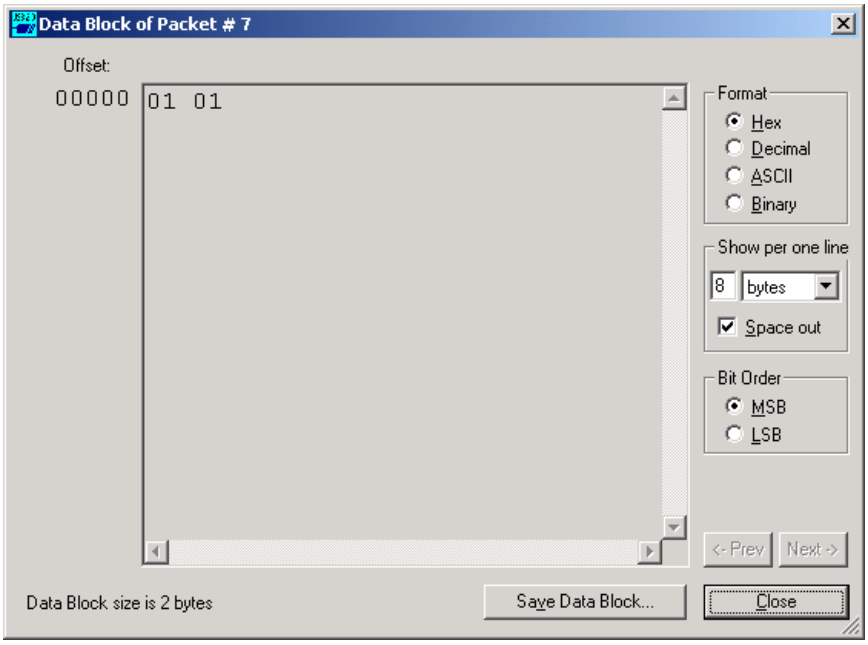
The Data Field pop-up menu has an option for viewing the raw bits in a data field.



To view these bits:

Step 1 Click in the data field to open the Data Field menu.

Step 2 Select **View Data Block** to open the Data Block dialog box.

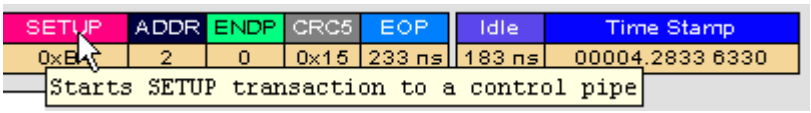


The View Data Block window has options for displaying the raw bits in different formats:

- **Format**: Lets you display data in Hex, Decimal, ASCII, or Binary format.
- **Show Per Line**: Lets you control how many bits are displayed per line.
- **Bit Order:** Most Significant Bit or Least Significant Bit

6.7 Pop-up Tool-tips

Many fields within the trace display pop-up tool-tips when the mouse pointer is suspended over them. These tips provide added details about the field.



6.8 Hide SOF Packets

You can hide Start-of-Frame (SOF) packets that may be uninteresting in a given context from a Trace View by clicking the **Hide SOF Packets** button on the Tool Bar:

- Click to hide all SOF packets.

6.9 Hide NAKs

You can hide NAKs that may be uninteresting in a given context from a Trace View by clicking the **Hide NAKs** button on the Tool Bar:

- Click to hide all NAK packets.

6.10 Hide Devices

Click the to open a tear-off window that allows you to select any address/endpoint combination that you want to hide.

6.11 Hide Chirps

Click the to hide any Chirp-J or Chirp-K packets recorded in a USB*Tracer* trace. Advisor does not record these signals.

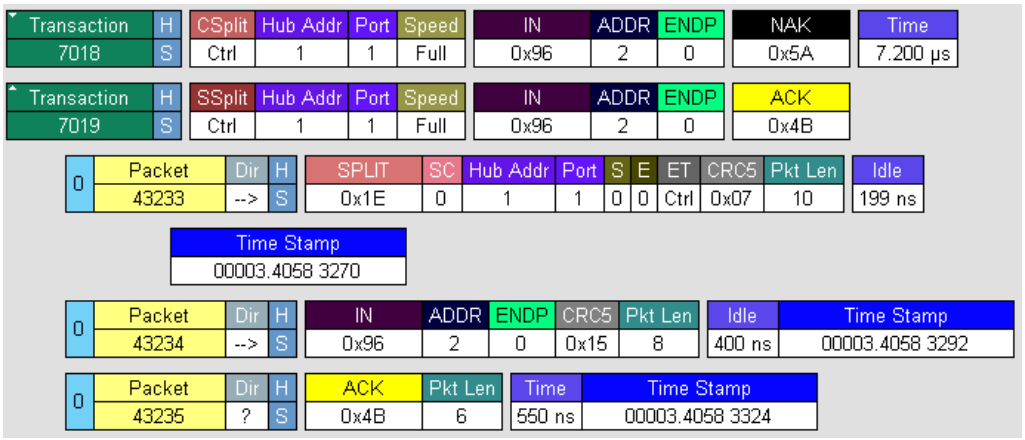
6.12 Switch to Transactions View

A **Transaction** is defined in the USB specification as the delivery of service to an endpoint. This consists of a token packet, an optional data packet, and an optional handshake packet. The specific packets that make up the transaction vary based upon the transaction type.

The program default display mode is Packet View. Before you can view decoded transactions, you must switch from Packet View to Transactions View.

To select Transactions View:

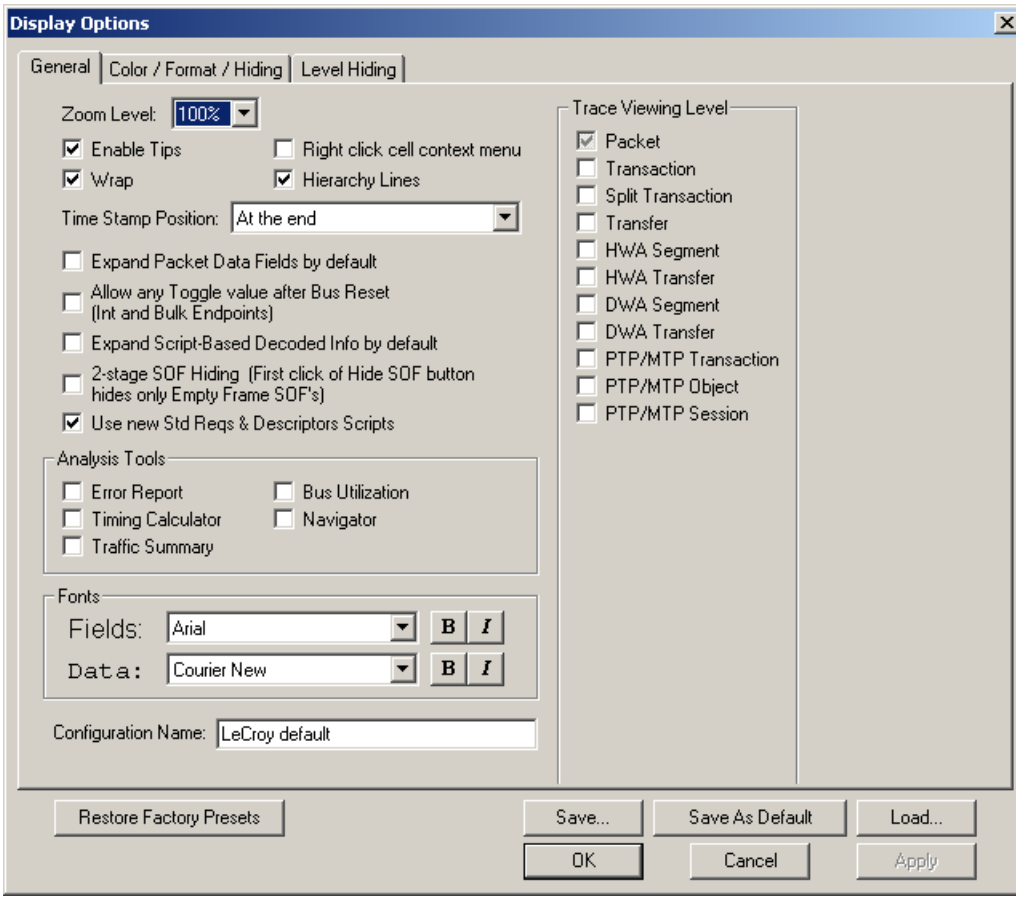
Step 1 Click on the toolbar to redraw the Trace View to display transactions.



Note: This menu selection displays a check mark next to **Show USB transactions** when you have selected it**.** When you want to switch back to Packet View mode, right-click anywhere in the trace window and then left-click **Show USB transactions**.

To switch to Transaction View from the Menu Bar:

Step 1 Select **Display Options** under **Setup** to display the **Display Options General** window:

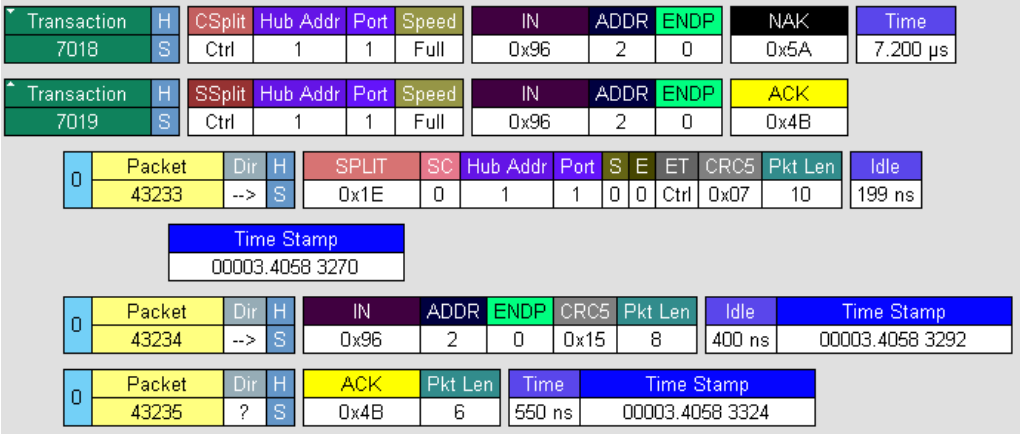


Step 2 Check **Transactions.**

Step 3 Click **OK.**

6.13 View Decoded Transactions

After you set Display Options, the Trace View screen is re-drawn to display decoded transactions in the colors and format you selected.



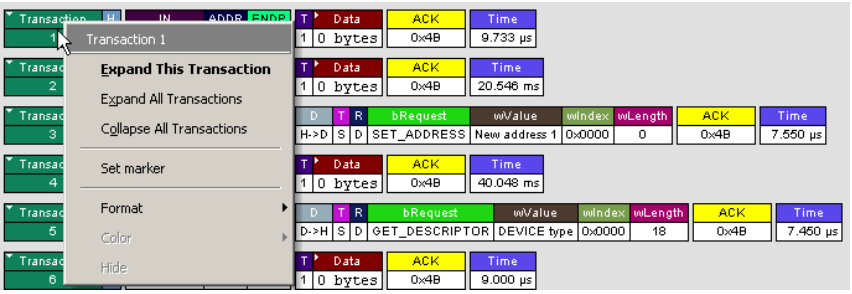
When you instruct the Analyzer to display USB transactions, the components of each transaction are collected from the current recording and are grouped and indented below each decoded transaction. Each row shows a transaction with a unique numeration, a label, and color-coded decoding of important data.

Expanded and Collapsed Transactions

You can expand a specific transaction to view its parts, which are grouped and indented below the transaction.

To expand a transaction:

Step 1 Left-click the transaction number you wish to view to display the **Expand Transaction** menu:



Step 2 Select **Expand This Transaction**.

The screen displays the selected transaction in expanded format.

Note: The Expand/Collapse transaction feature operates as a toggle: when one format is active, the other appears as an option on the Expand/Collapse drop-down menu.

To collapse a transaction, perform the same operation and select **Collapse This Transaction**.

Note that you can choose to expand or collapse:

- **Only** the selected Transaction

  OR

- **All** Transactions.

It is not necessary to use the **Expand/Collapse Transactions** menu to shift between expanded and collapsed views of a transaction:

- Double-click in the Transaction number field to toggle back and forth between collapsed and expanded views.

6.14 Switch to Split Transaction View

To select Split Transaction View:

Step 1 Click the Trs button on the toolbar to redraw the Trace View screen to display Split Transactions.

Split Trans	L	IN	ADDR	ENDP	T	Data	ACK
44	H	0x96	3	0	1	12 01 00 01 00 00 00 08	0x4B

To switch to Split Transactions View from the Menu Bar:

Step 1 Select **Display Options** under **Setup** to display the **Display Options General** window:

Step 2 Check **Split Transactions.**

6.15 Switch to Transfer View

A **Transfer** is defined in the USB specification as one or more transactions between a software client and its function. USB transfers can be one of four kinds: Control, Interrupt, Bulk, and Isochronous. Advisor is capable of displaying all four types.

The default display mode is Packet View. Before you can view decoded transfers, you must switch from Packet View (or Transaction View) to Transfer View.

To select Transfer View:

Step 1 Click Xfr on the toolbar to redraw the Trace View screen to display Transfers.

Note: Selecting **Show USB transfers** adds a check next to this menu item. If you want to return to Packet View, open the menu and reselect **Show USB transfers**. This action removes the check and returns the display to Packet View.

To switch to Transfer View from the Menu Bar:

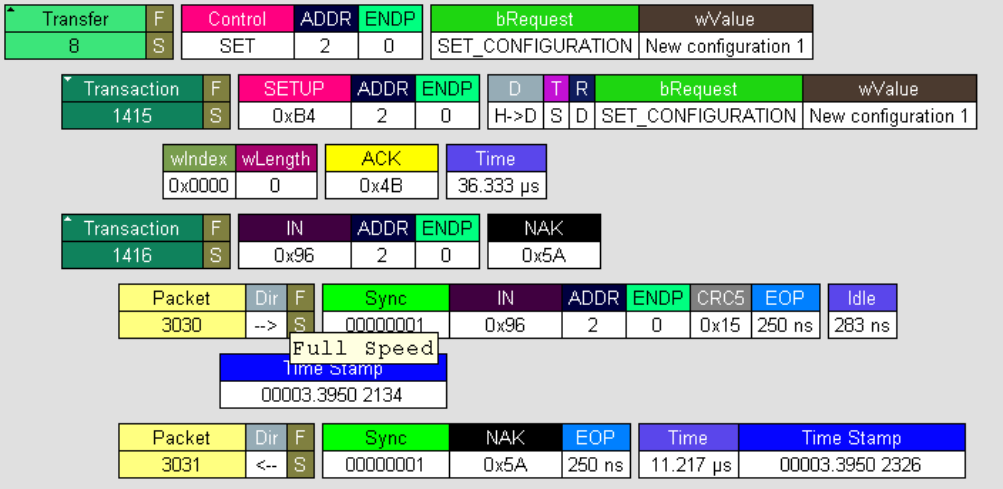
Step 1 Select **Display Options** under **Setup** to display the **Display Options General** window:

Step 2 Check **Transfers.**

Step 3 Click **OK.**

6.16 View Decoded Transfers

Once you set Display Options, the Trace View screen is re-drawn to display decoded transfers in the colors and format you selected.



When you instruct the Analyzer to display USB transfers, the components of each transfer are collected from the current recording and are grouped below each decoded transfer. Each transfer row shows a transfer with a unique numeration, a label, and color-coded decoding of important data.

To view decoded transfers, select **Transfer Level** from the **View** menu.

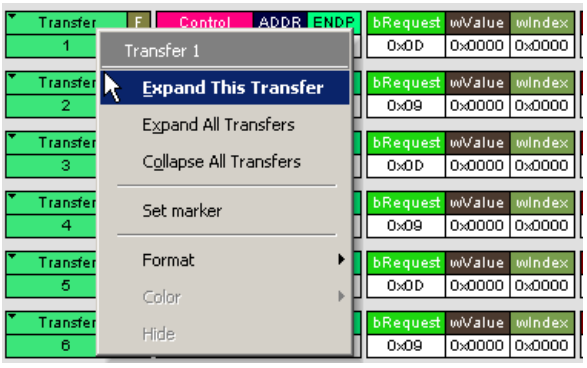
Expanded and Collapsed Transfers

You can expand a specific transfer to view its parts, which are grouped and indented below the transfer.

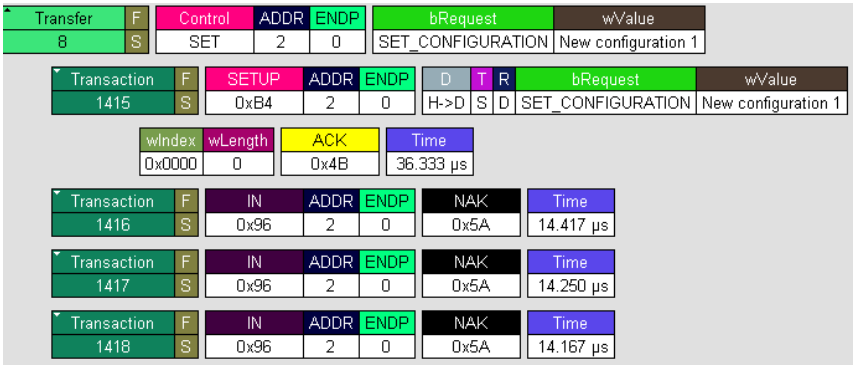
To expand a transfer:

Step 1 Left-click the transfer number you wish to view.

You see the **Expand Transfer** menu:



Step 2 Select **Expand This USB Transfer** to display the selected transfer in expanded format.



Note: The Expand/Collapse transfer feature operates as a toggle. When one format is active, the other appears as an option on the Expand/Collapse drop-down menu.

To collapse a transfer, perform the same operation and select **Collapse This USB Transfer**.

Note that you can choose to expand or collapse

- **Only** the selected Transfer

  OR

- **All** Transfers

It is not necessary to use the **Expand/Collapse Transfers** menu to shift between expanded and collapsed views of a transfers. Double-click in the Transfer number field to toggle back and forth between collapsed and expanded views.

6.17 Decoding Protocol-Specific Fields in Transactions and Transfers

When transfers or transactions are displayed, the fields in setup transactions or control, interrupt, and Bulk transfers by default do not get decoded and are shown in hexadecimal values. The exceptions are setup transactions and control transfers for standard USB device requests which are always decoded.

In order to show specific decoding for class- and vendor-specific device requests and endpoints, you have to use the decoding association mechanism that is described in Chapter 9 on decoding. When you have performed the association, you see the protocol-specific fields of transfers and transactions decoded in the trace view.

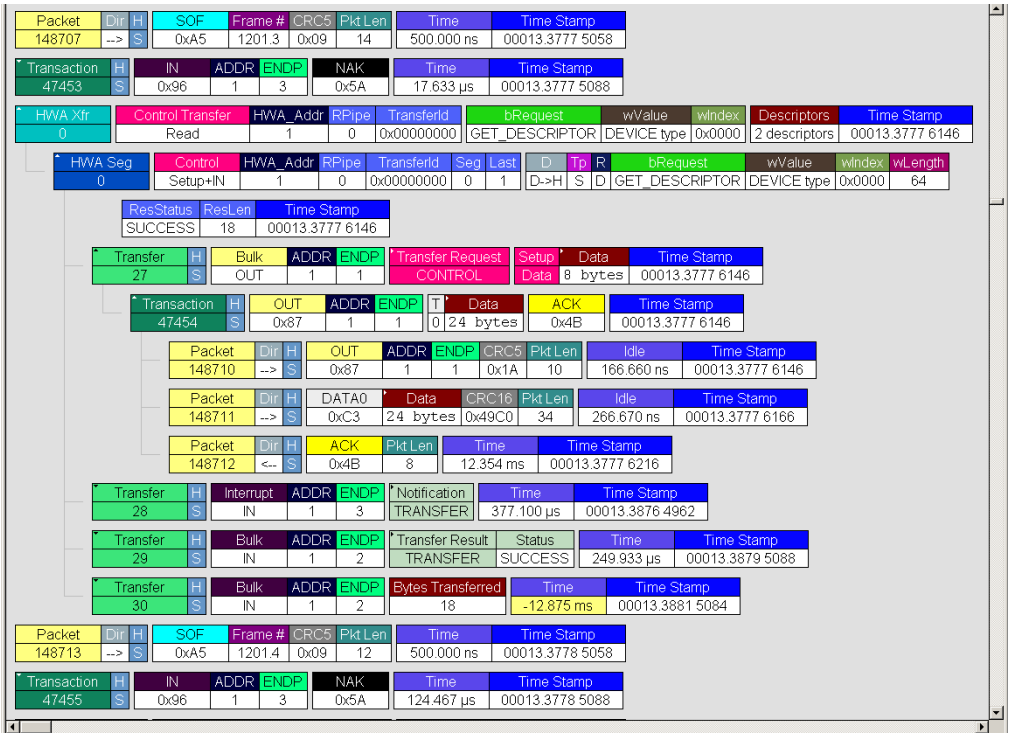
6.18 Switch to Host Wire Adapter Segment View

A **Host Wire Adapter Segment** is one or more transfers between a PC and a host wire adapter. To view host wire adapter segments, switch to the Host Wire Adapter Segment trace viewing level.

To select the Host Wire Adapter Segment trace viewing level:

- Click on the toolbar.
  OR
- Select **View > Show Host Wire Adapter Segment**.
  OR
- Select **Setup > Display Options** to display the Display Options window, check **HWA Segment**, and then click **OK.**

The program redraws the trace view.



6.19 Switch to Host Wire Adapter Transfer View

A **Host Wire Adapter Transfer** is one or more wire adapter segments or one or more transfers between a PC and a host wire adapter. To view host wire adapter transfers, switch to the Host Wire Adapter Transfer trace viewing level.

To select the Host Wire Adapter Transfer trace viewing level:

- Click on the toolbar.

  OR
- Select **View > Show Host Wire Adapter Transfer**.

  OR
- Select **Setup > Display Options** to display the Display Options window, check **HWA Transfer**, and then click **OK.**

6.20 Switch to Device Wire Adapter Segment View

A **Device Wire Adapter Segment** is one or more transfers between a PC and a device wire adapter. To view device wire adapter segments, switch to the Device Wire Adapter Segment trace viewing level.

To select the Device Wire Adapter Segment trace viewing level:

- Click on the toolbar.

  OR
- Select **View > Show Device Wire Adapter Segment**.

  OR
- Select **Setup > Display Options** to display the Display Options window, check **DWA Segment**, and then click **OK.**

6.21 Switch to Device Wire Adapter Transfer View

A **Device Wire Adapter Transfer** is one or more wire adapter segments or one or more transfers between a PC and a device wire adapter. To view device wire adapter transfers, switch to the Device Wire Adapter Transfer trace viewing level.

To select the Device Wire Adapter Transfer trace viewing level:

- Click on the toolbar.

  OR
- Select **View > Show Device Wire Adapter Transfer**.

  OR
- Select **Setup > Display Options** to display the Display Options window, check **DWA Transfer**, and then click **OK.**

The program redraws the trace view.

6.22 Switch to PTP Transactions

The Analyzer supports the Picture Transfer Protocol (PTP) and also supports the Media Transfer Protocol (MTP), which is an extension of PTP. The Analyzer can track PTP transactions, object transfers, and sessions.

A **transaction** is a standard sequence of phases for invoking an action. In PTP, an Initiator-initiated action provides input parameters, responses with parameters, and binary data exchange, and is a single **PTP Transaction**. Also, a single Asynchronous Event sent through the interrupt pipe is a single PTP Transaction.

The PTP Transaction trace viewing level is the lowest PTP level.

To view PTP transactions, switch to the PTP Transaction trace viewing level:

- Click on the toolbar.
  OR
- Select **View > Show PTP Transaction**.
  OR
- Select **Setup > Display Options** to display the Display Options window, check **PTP Transaction**, and then click **OK.**

6.23 Switch to PTP Object Transfers

A logical object on a device has a unique 32-bit identifier (**object handle**). The object handle is also unique for the session (defined below). An **object transfer** contains all the transactions for an object handle. In PTP, all of an object handle's PTP Transactions are a single **PTP Object Transfer**.

A PTP Object Transfer can include both PTP Transactions that involve an Initiator-initiated action (for example, **GetObject**, **DeleteObject**, and **GetObjectInfo** transactions) and PTP Transactions that involve a single Asynchronous Event sent through the interrupt pipe.

The PTP Object Transfer trace viewing level is the middle PTP level.

To view PTP object transfers, switch to the PTP Object Transfer trace viewing level:

- Click on the toolbar.
  OR
- Select **View > Show PTP Object**.
  OR
- Select **Setup > Display Options** to display the Display Options window, check **PTP Object**, and then click **OK.**

6.24 Switch to PTP Sessions

A **session** is a state of persisting communication between a device and a host during which the connection is continuous and the login and other communication parameters do not change. A session begins with an **OpenSession** operation, which establishes the communications connection and parameters, and ends with a **CloseSession** operation.

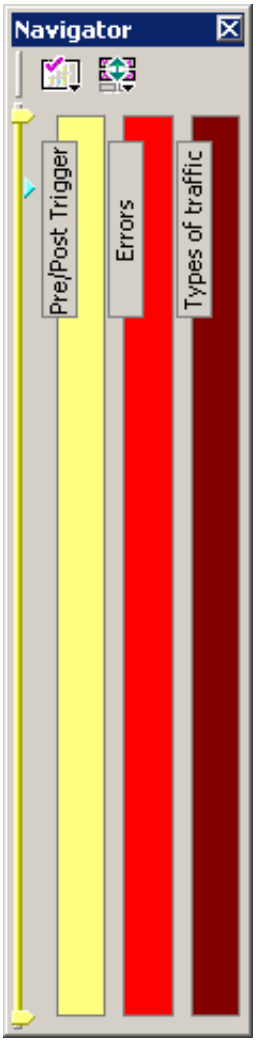
A session contains all object transfers (and their transactions), plus all transactions that do not belong to object transfers, between an OpenSession operation and a CloseSession operation. For PTP, all PTP Object Transfers and all PTP Transactions that occur from the OpenSession operation to the CloseSession operation is a single **PTP Session**.

The PTP Session trace viewing level is the highest PTP level.

To view PTP sessions, switch to the PTP Session trace viewing level:

- Click on the toolbar.
  OR
- Select **View > Show PTP Session**.
  OR
- Select **Setup > Display Options** to display the Display Options window, check **PTP Session**, and then click **OK.**

6.25 Using the Trace Navigator



You can use the Trace Navigator to show the structure of the entire trace from different points on the Trace view. This way you can refine the trace view to a packet range in the trace that is most interesting to you. This range can be set by you to show smaller parts of the trace.

To display the Navigator bar, click in the toolbar.You can also select the Navigation Bar checkbox in the Display Options General window to have the Navigator open whenever you open the Trace software.

The Navigator bar can be repositioned in the trace and can be oriented horizontally or vertically, docked or undocked by dragging the parallel bars at the top or side of the Navigator bar. By default, the Navigator bar appears vertically to the right of the trace window when opened.

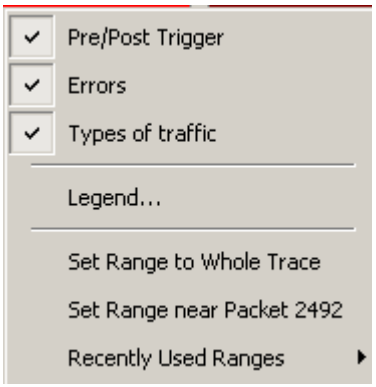
The Navigator bar represents different types of trace information in the order of the packets. The top of each bar corresponds to the first packet in the trace, and the bottom corresponds to the last packet. The Navigator bar is made up of three parts: Pre and Post-Trigger traffic, Errors, and Types of Traffic.

At any time, a line in the navigator bar of one pixel in height represents a fraction of the trace data. If the Navigation bar is 400 pixels high, then each bar in this example would represent 1/400 of the trace. If the trace had 4000 packets total, each bar would represent ten packets. In the Types of Traffic portion of the navigation bar, the color of the bar would be that of the most important item in those ten packets. See “Navigator Bar Attributes” on page 63.

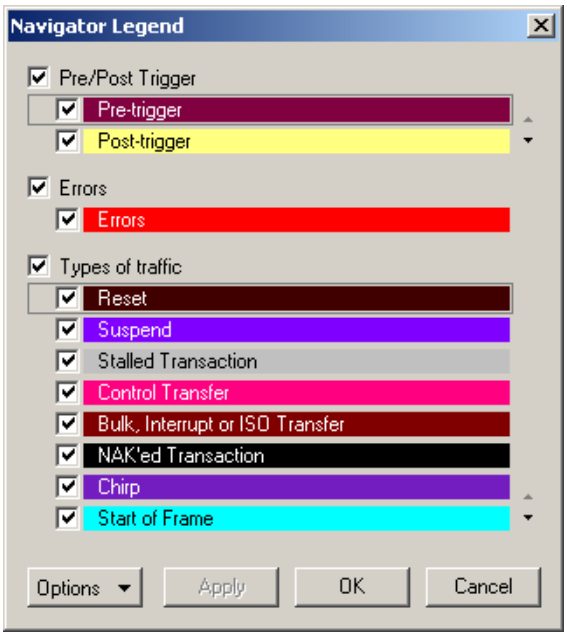
Drag the yellow caret, at the top or bottom, to set the packet range. When you move the caret, a message shows the packet range.

The blue caret indicates the current packet position in the trace view.

Right-click the Navigator to display the pop-up menu.

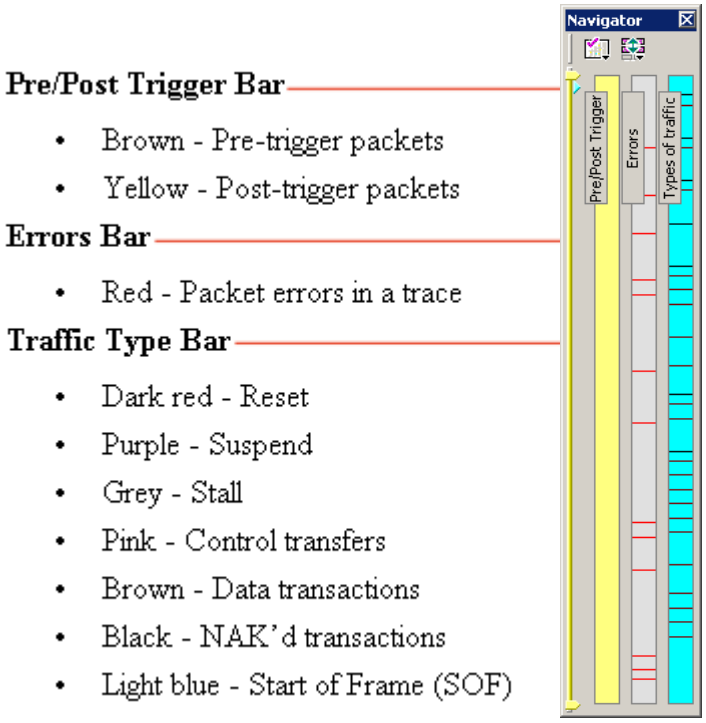


- **Pre/Post Trigger, Errors, or Types of Traffic**: Shows or hides traffic information in the Navigator.
- **Legend**: Shows or hides Trigger, Error, and Traffic Type categories in the Navigator.



- **Set Range to Whole Trace**: Sets packet range to the entire trace.
- **Set range near Packet *number***: Sets the packet range near the packet where your mouse pointer is positioned in the Navigator bar.
- **Recent Ranges**: Displays a history of ranges that were previously selected.

Navigator Bar Attributes

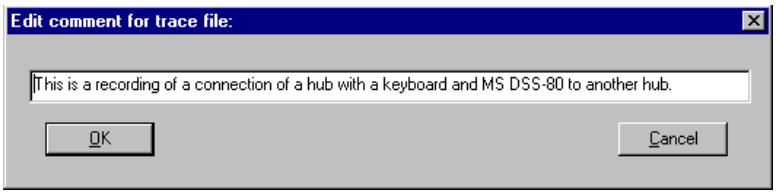


The traffic types are shown in order of importance. For example, if a NAK'd transaction occurred in the same sample area as a SOF, the NAK would take precedence, and the Navigator would show the black bar.

6.26 Edit Comment

You can create, view, or edit the 100-character comment field associated with each Trace file. The comments are visible in the Windows® Explorer if the Comments attribute is included in the Details view.

Step 1 Select **Edit Comment** under **File** on the Menu Bar to display the **Edit comment for Trace file** window:



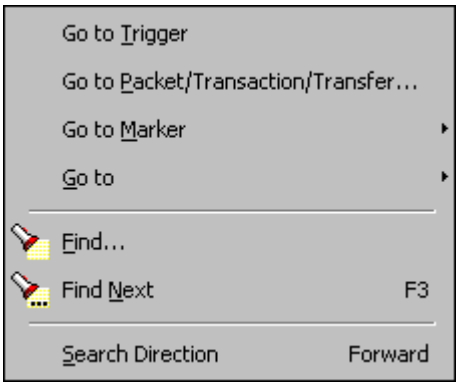
Step 2 Create, view, or edit the comment.

Step 3 Click **OK**.

Chapter 7: Searching Traces

The Search feature provides options for searching recorded traffic to find specific packets based on triggering status, packet number, marking, or content.

To view the Search options:



- Click **Search** in the Menu bar to display the Search drop-down menu.

7.1 Go to Trigger

Note: **Go to Trigger** is enabled only when a trigger has created the traffic file.

To display a Trigger Event:

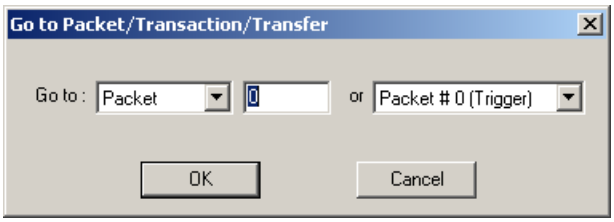
- Select **Go to Trigger** under **Search** on the Menu Bar.

The Trace View is repositioned to the first packet following the Trigger event. This packet is at the top of the screen.

7.2 Go to Packet/Transaction/Transfer

To display a specific packet:

Step 1 From the menu bar, select the command **Search > Go to Packet/Transaction/Transfer** to display the **Go to Packet** window:



Step 2 Select the desired viewing level (packet, transaction, etc.) from the drop-down menu next to the words **Go to**.

Step 3 Enter the number of the packet to display.

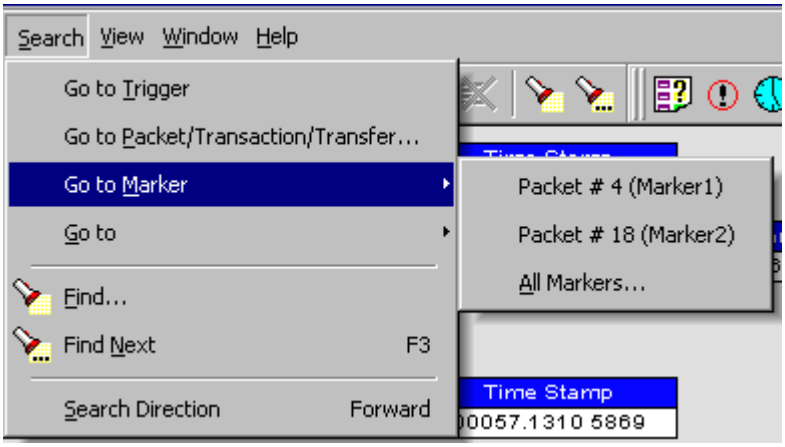
Step 4 Click **OK.**

The Trace View is repositioned with the selected packet at the top of the screen.

7.3 Go to Marker

To instruct the Analyzer to display a marked packet:

Step 1 Select **Go to Marker** under **Search** on the Menu Bar to display a drop-down menu listing the marked packets in that Trace View:



Step 2 Select the desired packet from the displayed list.

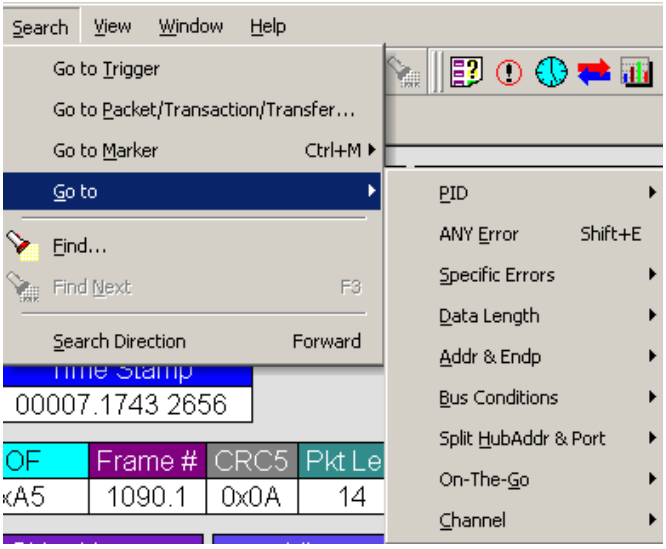
The Trace View is repositioned with the selected packet at the top of the screen.

Note: The **Go to Marker** feature functions in conjunction with the **Set Marker** feature. The comments within the parentheses following each marked packet are added or edited with the **Set Marker** feature. Please refer to **Set Marker** in **Reading a Trace**.

7.4 Go To

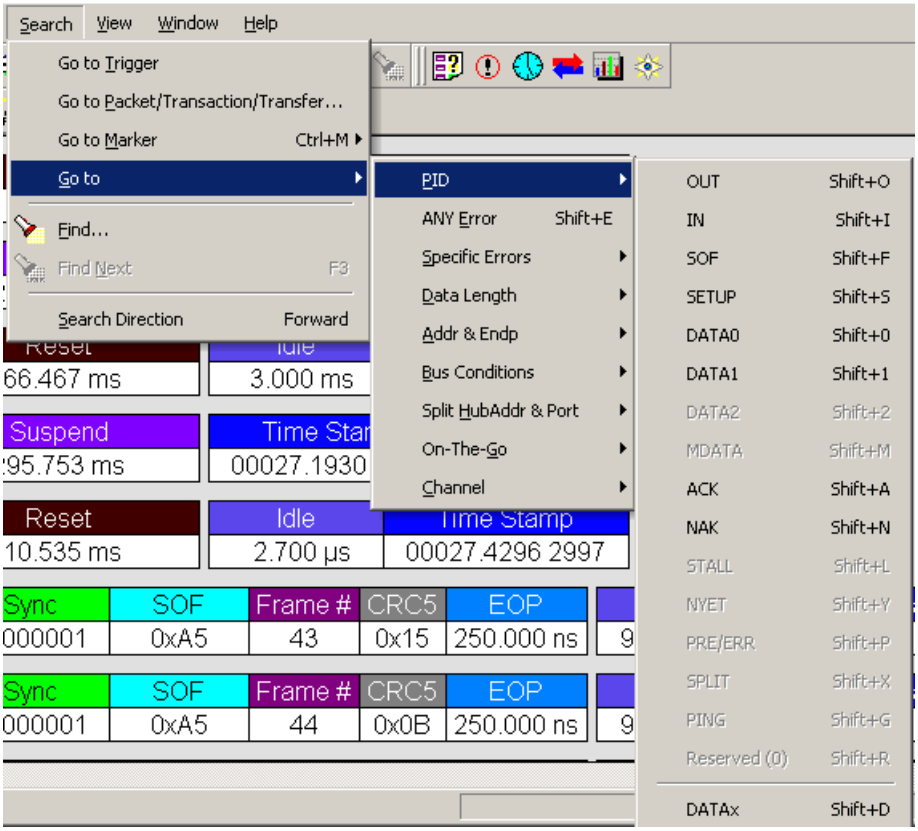
The **Go To** feature takes you directly to an event in a Trace.

Step 1 Select **Go To** under **Search** on the Menu Bar to display the **Go To** drop-down menu:



Step 2 Select an event and enter the necessary information.

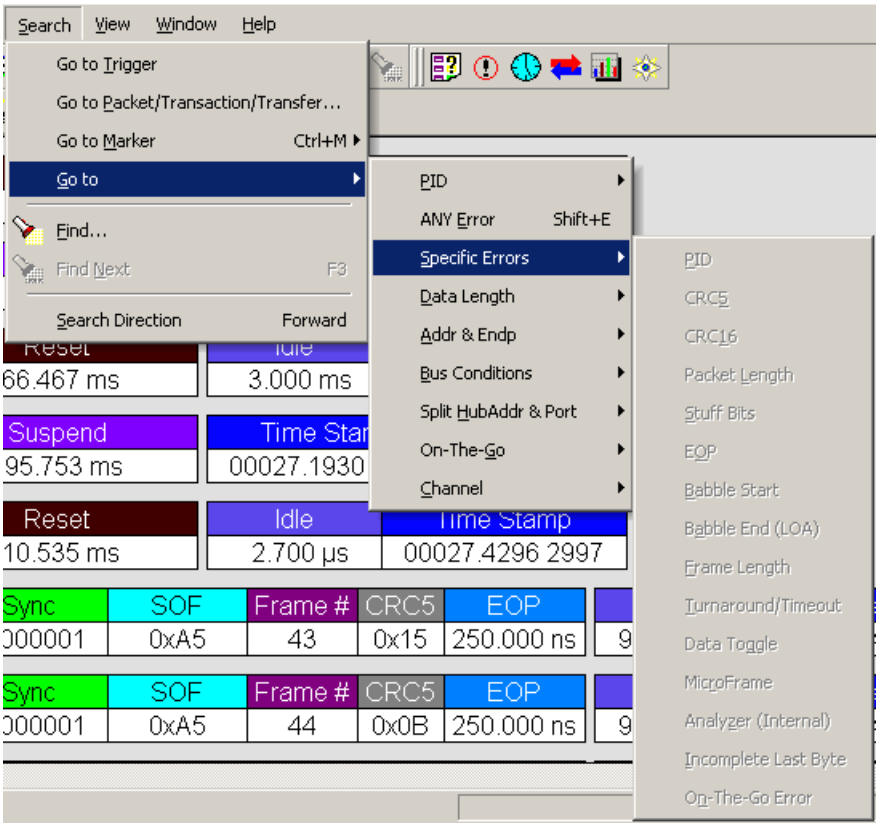
Packet IDs (PIDs)



Select the type of packet.

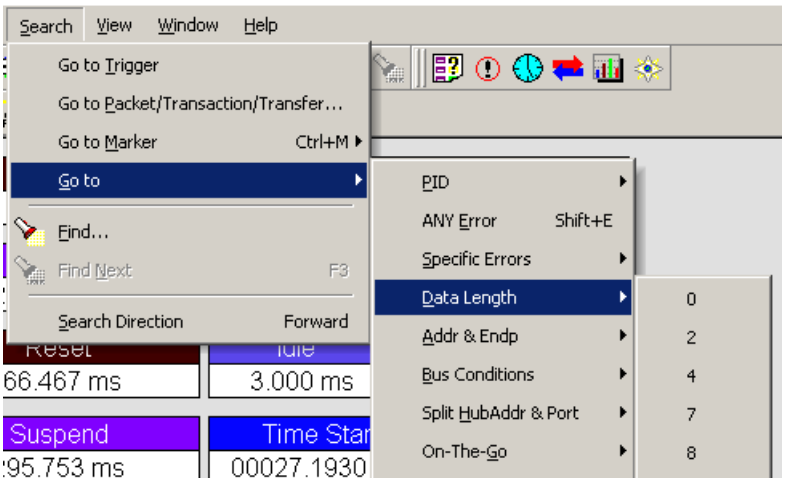
Errors

The Errors menu allows you to search for five different types of error: PID, CRC5, CRC16, Packet Length, and Stuff Bits. Menu items appear in bold if they are present in the trace or grayed out if not present in the trace, as shown in the example below.



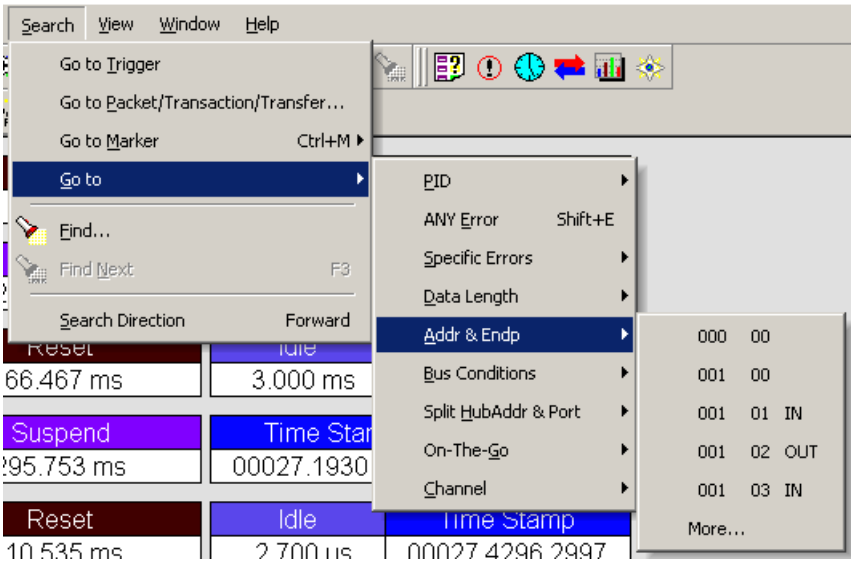
Data Length

Allows you to search for data packets of particular lengths. Lengths are displayed in Bytes in a drop down menu as shown below. Selecting a length moves the display to the next instance of that packet length.



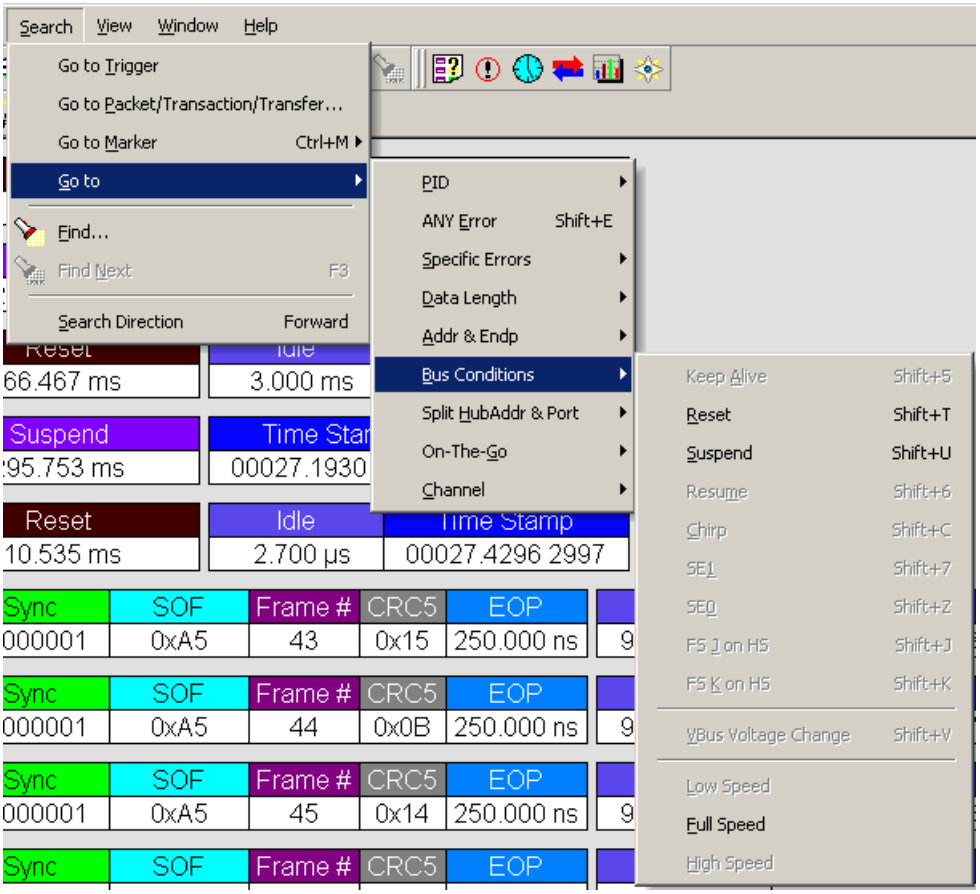
Addr & Endp

The Addr & Endp feature allows you to search for the next packet which contains a particular address and endpoint. All available address endpoint combinations are displayed in the pull down menu.



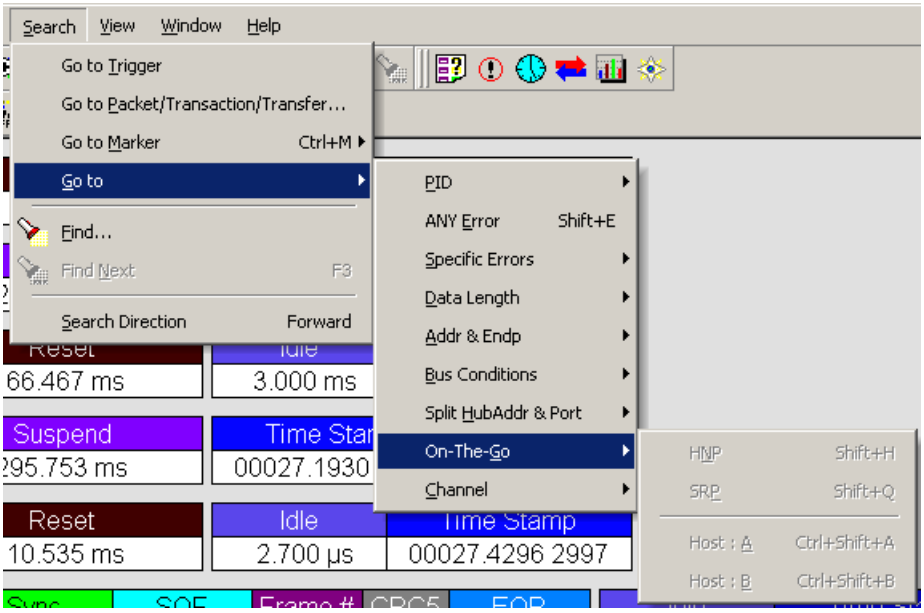
Bus Conditions

Allows you to search by bus conditions such as traffic speed, reset, and suspend. All available bus conditions are displayed in the pull down menu.



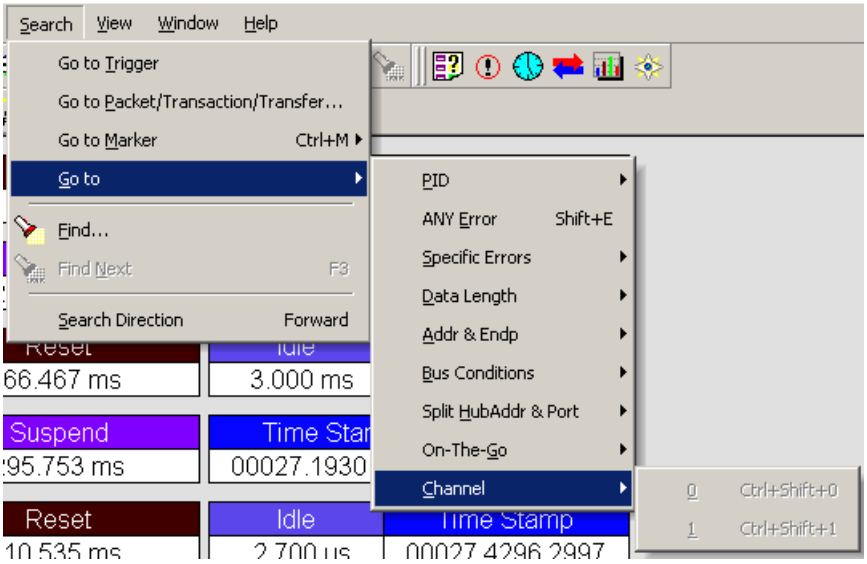
On-The-Go

Allows you to search for USB On-The-Go conditions. USB On-The-Go conditions are listed in the drop-down menu.



Channel

Allows you to search by 0(Hi-Speed) and 1(Classic-Speed).



7.5 Find

Find allows searches to be conducted on an open trace using one or more criteria. You can search by packet, transactions, split transaction, transfer, by packet type and by fields within packets.

Find is run by selecting **Search > Find** or by clicking on the toolbar.

Searches can combine criteria using the options **Intersection** and **Union**. **Intersection** creates AND statements such as "Find all packets with *x* AND *y.*" **Union** creates OR statements such as "Find all packets with *x* OR *y.*"

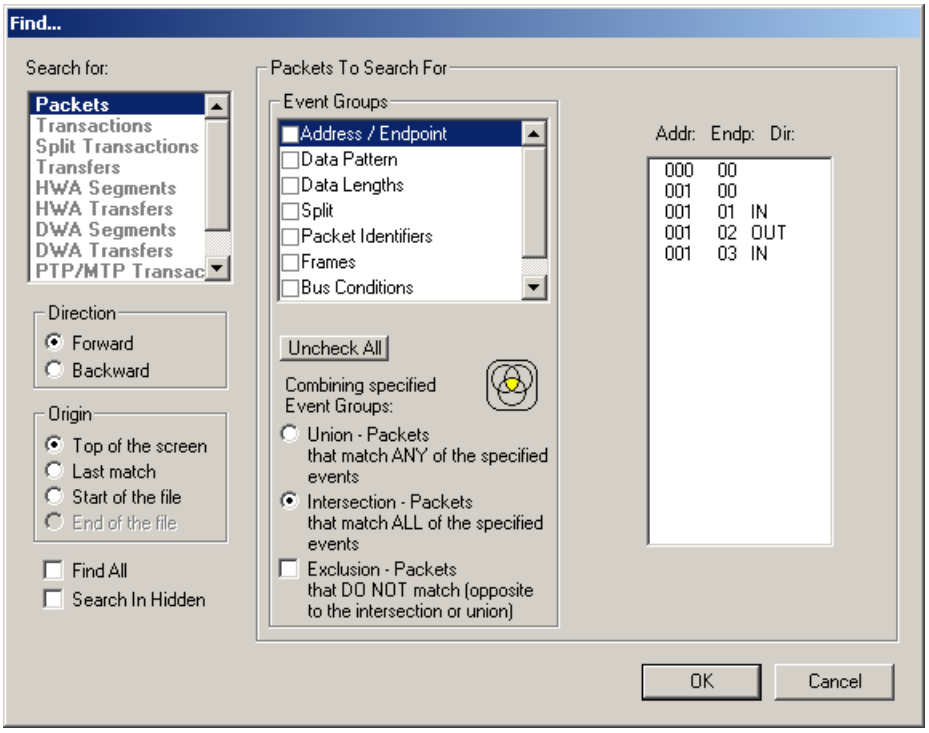
You can also perform searches whereby packets or events are excluded from a trace. The **Exclusion** allows searches to be conducted.

To perform a search:

Step 1 Select **Find...** under **Search** on the Menu Bar

OR

Click in the Tool Bar to display the **User-Defined Find Events** screen:



Step 2 Select **Packets, Transactions**, **Split Transactions**, **Transfers, HWA Segments, HWA Transfers, DWA Segments, DWA Transfers, PTP/MTP Transactions, PTP/MTP Objects**, or **PTP/MTP Sessions** from the top left list box to list that type of event in the Events Group box.

Step 3 Select one or more events from the **Events Group** box.

Step 4 Select one of the following options:

- **Union:** Find all packets matching ANY of the specified events.

- **Intersection:** Find all packets matching ALL of the specified events.

- **Exclusion:** Exclude packets matching any of the specified events.

  Exclusion works with the other two options: Select **Union** *AND* **Exclusion** (=Exclude packets with ANY of the following fields) or **Intersection** *AND* **Exclusion** (=Exclude packets with ALL of the following fields.)

Step 5 If desired, set the search **Direction** and **Origin**.

Step 6 Click **OK**.

After the search finishes, the packets meeting the search criteria are displayed.

7.6 Find Next

To apply the previous **Find** parameters to the next search:

- Select **Find Next** under **Search** on the Menu Bar.

  OR

- Click on the Tool Bar.

7.7 Search Direction

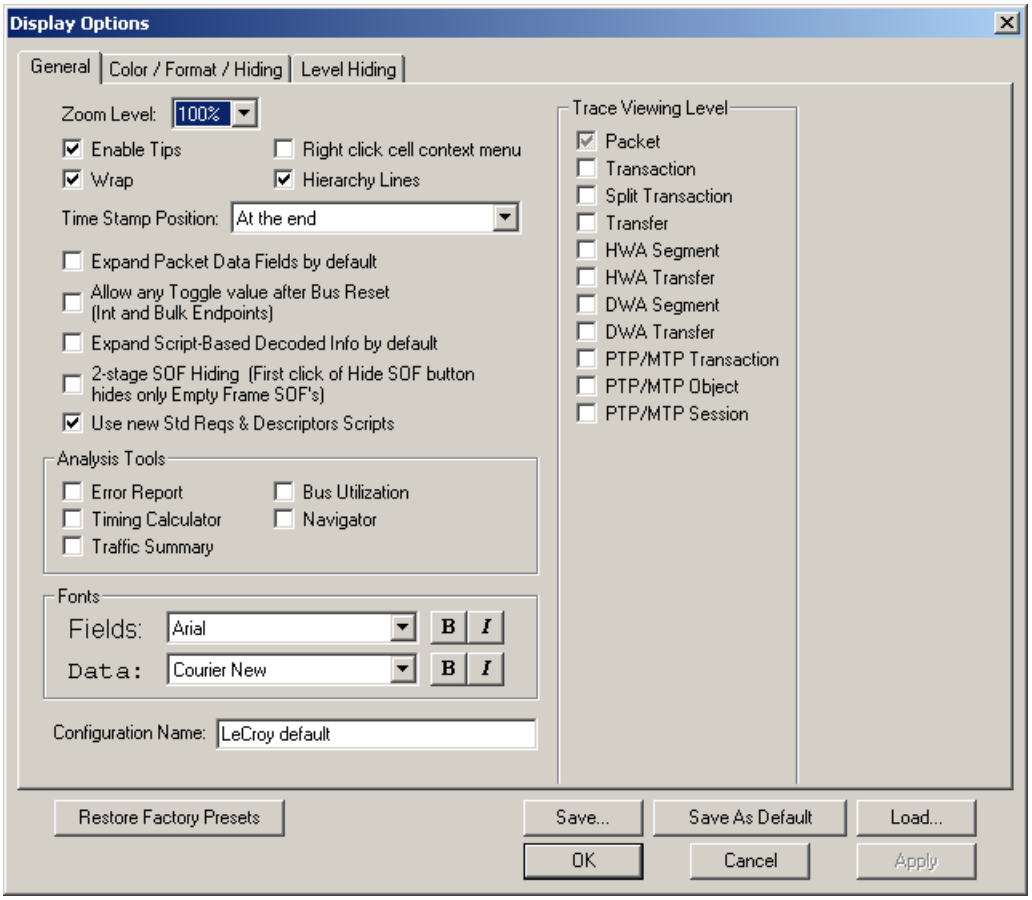
Toggles the search forward or backwards. The current direction is indicated in the menu.

Chapter 8: Display Options

You can select what information to display in CATC Traces using the **Display Options** window.

To open the **Display Options** window:

- Select **Display Options** under **Setup** on the Menu Bar.
  OR
- Click on the Tool Bar.



You can select General, Color/Format/Hiding, and Level Hiding display options. The following sections describe these display options.

8.1 General Display Options

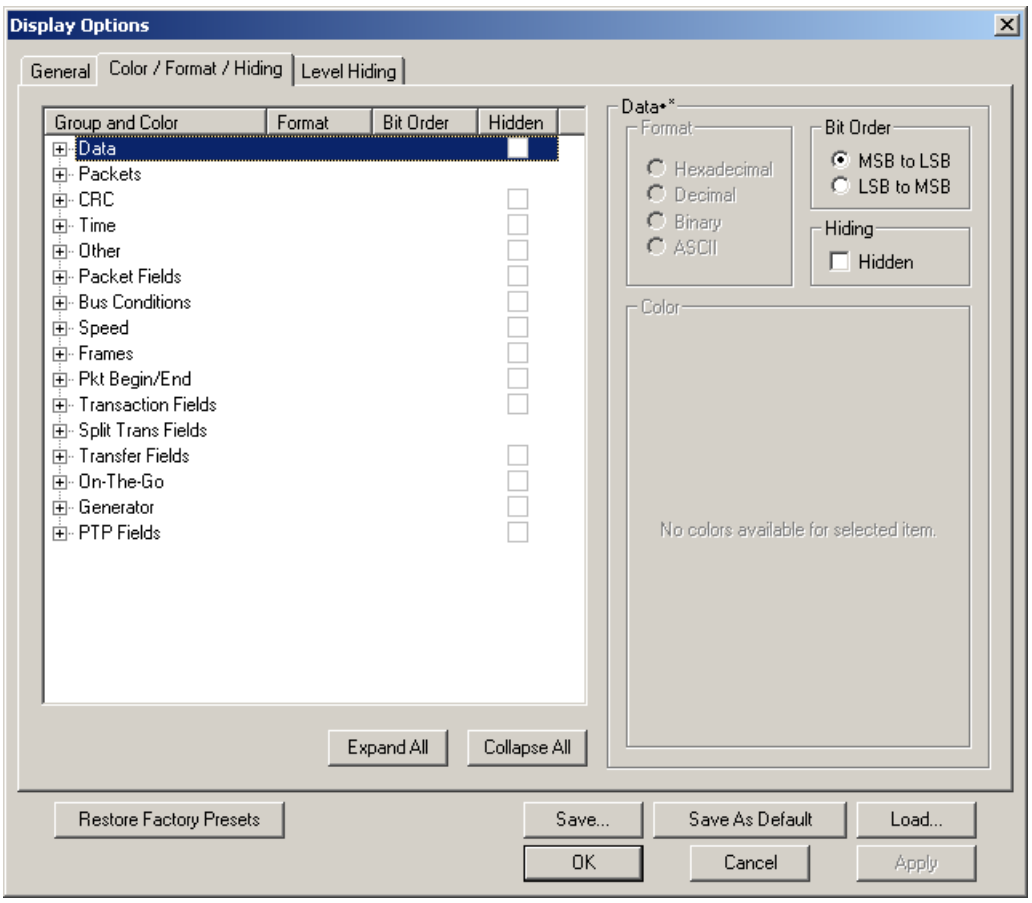
You specify the main Trace View information types and settings using General Display Options (see figure on previous page):

- **Zoom Level**: Zooms out from 100% (default) to 10% or zooms in from 100% to 200%.
- **Enable Tips**: Pops up text when you position the cursor over a field.
- **Wrap**: Wraps lines of traffic information instead of truncating lines at the right edge of the display.
- **Right click cell context menu**: By default, clicking the left mouse button on a field heading displays a context-sensitive pop-up menu providing commands about the field and clicking the right mouse button pops up a menu with display options. After selecting this option, clicking the right mouse button on a field heading displays the context-sensitive pop-up menu and clicking the left mouse button does nothing.
- **Hierarchy Lines**: Displays lines on the left side of Trace View showing the hierarchy from Packets to Transactions to Split Transactions to Transfers if you show higher-level decodes.
- **Timestamp Position**: Aligns the Timestamp field **At the beginning** (in a column on the left side of the Trace View), **At the end** (in a column on the left side of the Trace View), or **Merge with Packet/Transaction/Translation**. Selecting this option allows easier comparison with previous or following timestamps.
- **Expand Packet Data Fields by default**: Displays packet data fields in expanded mode. If this option is not selected, packet data fields display in collapsed mode, and you can expand them manually.
- **Allow any Toggle value after Bus Reset (Int and Bulk Endpoints)**: Depending on the device, after Bus Reset the endpoint toggle state might or might not be reset. Selecting this option prevents display of a toggle violation error.
- **Expand Script-Based Decoded Info by default**: Displays decoded transfer fields in expanded mode. If this option is not selected, decoded transfer fields display in collapsed mode, and you can expand them manually.
- **2-stage SOF Hiding**: You can display all SOFs, hide all SOFs, or hide empty SOFs (show only SOFs with endpoint traffic and hide empty frames). Selecting this option allows you to hide empty SOFs with one click of the Hide SOF button or hide all SOFs with two clicks of the Hide SOF button.
- **Use new Std Reqs & Descriptors Scripts**: Use dynamically loaded **.DEC** files (rather than **.REQ** and **.DSC** files) for decoding Class and Vendor requests or endpoints.

- **Analysis Tools**
  - **Error Report**: Displays the Errors section of the Traffic Summary window.
  - **Timing Calculator**: Displays the Timing Calculator window from the beginning of a packet or marker to the beginning of another packet or marker, including Total Time unit, Bus Utilization Time and Bandwidth, and selected Global, Low Speed, Full Speed, High Speed, Transactions, and Devices.
  - **Traffic Summary**: Displays the Traffic Summary window, showing all reports, including Packets, Transactions, Transfers, and Errors.
  - **Bus Utilization**: Displays the Bus Utilization window, including Packet length, Bus usage, and Bus usage by device.
  - **Navigator**: Displays the Navigation bar, including Pre/Post Triggers, Errors, and Types of Traffic.
- **Trace Viewing Level**: Displays Packets, Transactions, Split Transactions, Transfers, Host Wire Adapter Segments, Host Wire Adapter Transfers, Device Wire Adapter Segments, Device Wire Adapter Transfers, PTP Transactions, PTP Objects, and PTP Sessions.
- **Fonts**: Sets the font type and bold or italic style for Fields and Data.
- **Configuration Name**: You can name the current set of Display Options values for use with an **.opt** file. (The options file can have a different name.)
- **Restore Factory Presets**: Sets all Display Options values to the installed values.

8.2 Color/Format/Hiding Display Options

To modify the colors, formats, and hiding options, select the Color/Format/Hiding tab.

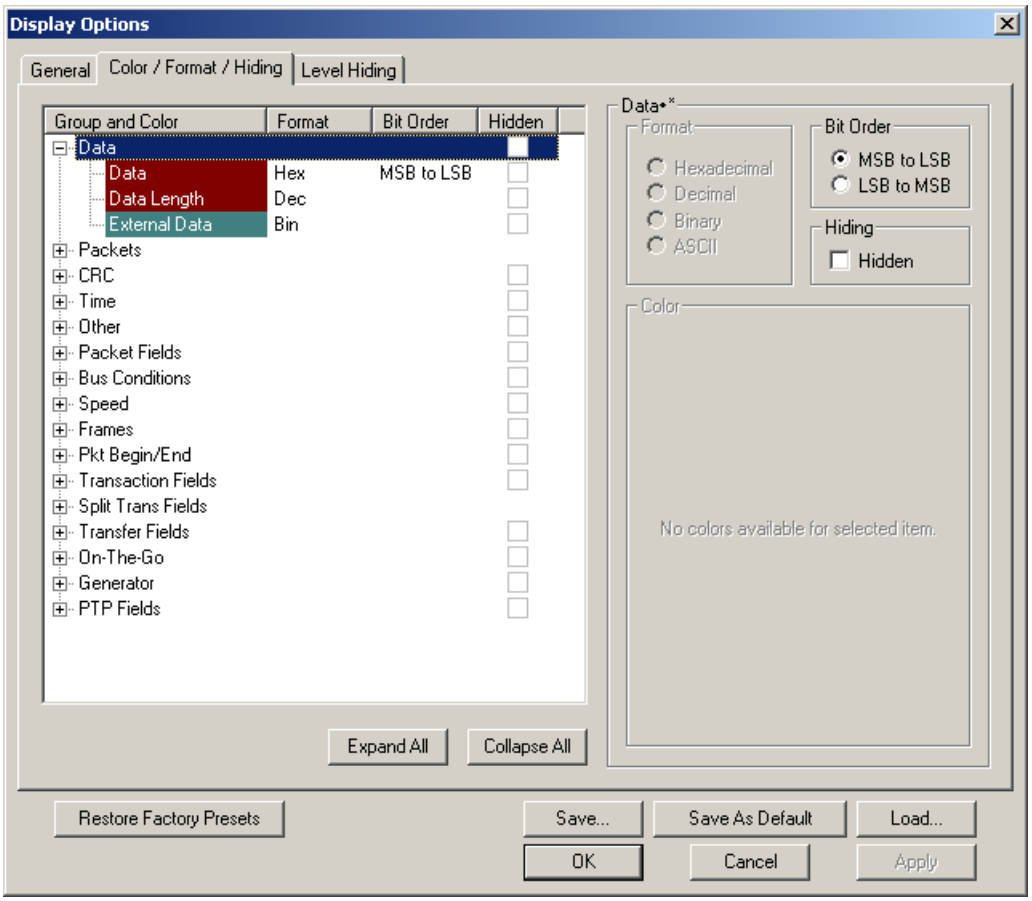


Color Display Options

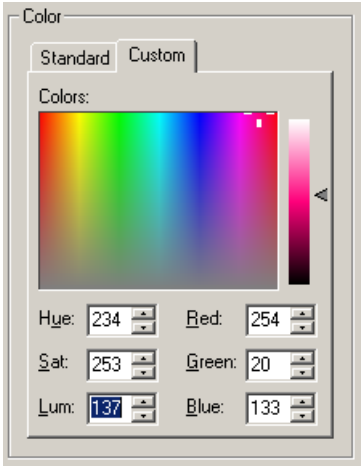
The program uses a default set of colors for each type of data in each group of data. The colors and color combinations are appropriate for most graphic systems. You can alter any color.

To specify a color for an information type, in the Color/Format/Hiding tab, select a row (such as Data) in the Group and Color column and expand it.

Select a data type (such as Data Length) in the Group, then select a color in the Color section, using Standard or Custom colors. Use a bright color for each important field.



To customize colors, use the Custom tab.



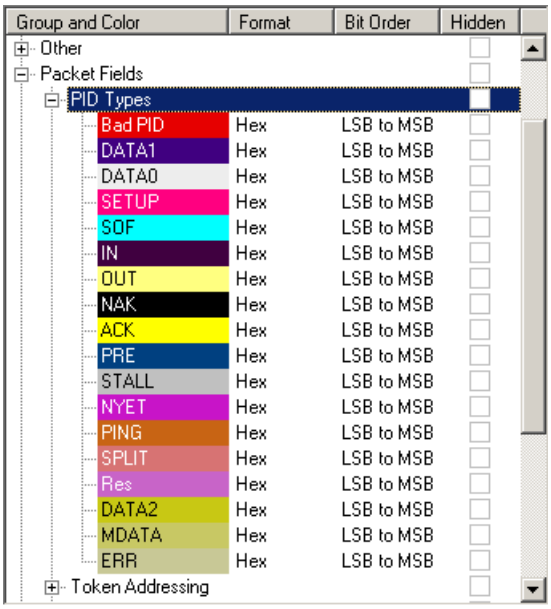
Note: You cannot change color of an Invalid Data (packet error) field. It is permanently set to red.

Formats Display Options

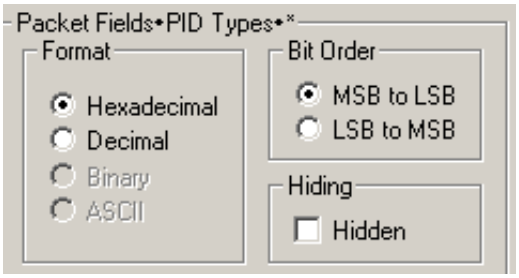
For each type of data in each group of data, the program has a default data format. Examples of number data formats are Bin (binary), Dec (decimal), and Hex (hexadecimal). Examples of date and time data formats are Hex uFrame, Dec uFrame, Date & Time, Time, Bit Time, seconds, microseconds, and nanoseconds. An example of a text data format is ASCII. You can alter some data formats.

To specify a data format for an information type, in the Color/Format/Hiding tab, select a row (such as Packet Fields) in the Group and Color column and expand it.

Select a data type (such as PID Types) in the Group:



Select a format in the Format section. The following formats are available for PID Types:



If available, select Bit Order in the Bit Order section. The options are MSB to LSB or LSB to MSB.

Hiding Display Options

By default, no data is hidden. You can hide any group of data and any type of data. You can hide transactions, SOFs; NAKs; High, Full, or Low Speed packets; traffic from one or both recording channels; and Addresses and Endpoints.

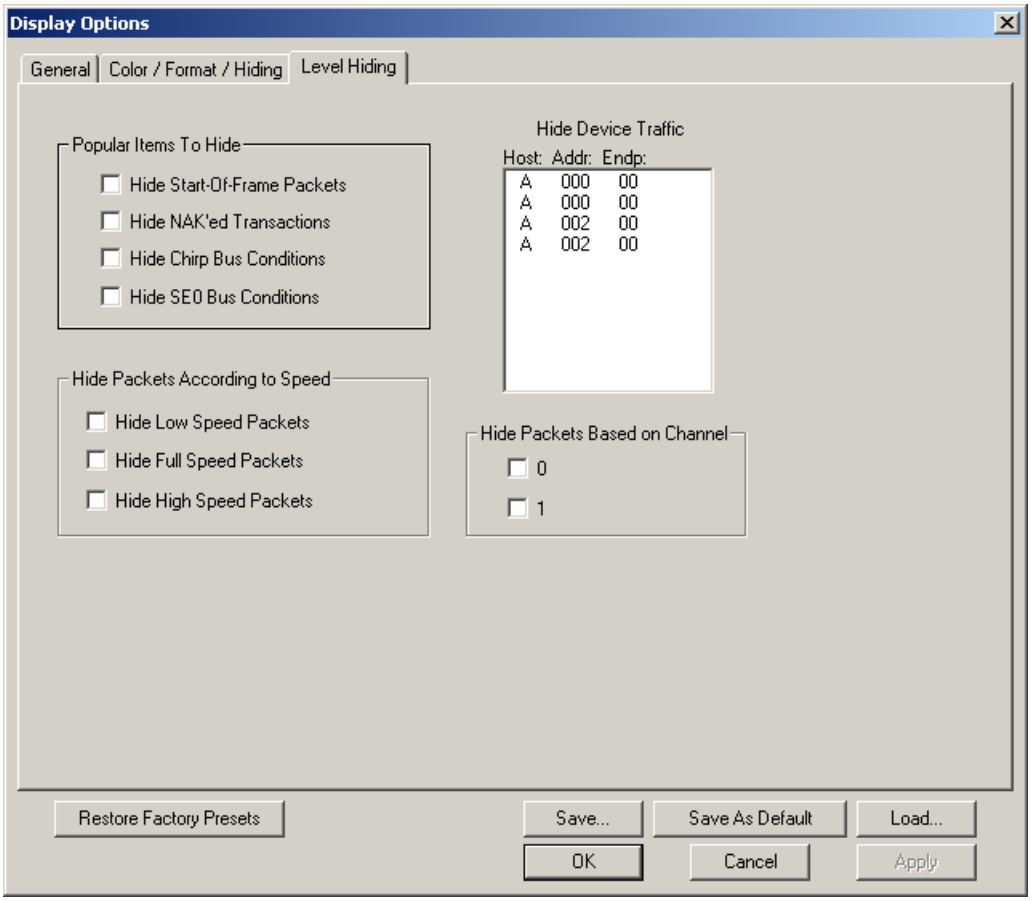
To hide one or more fields, select the Group and Data type in the Group and Color column, then click the Hidden checkbox in the display or the Hidden checkbox in the Hidden section of the Format section.

8.3 Level Hiding Display Options

By default, no data packets, transactions, or bus conditions are hidden. You can hide:

- Start of Frame packets
- NAK'ed transactions
- Chirp and SEO Bus conditions
- High, Full, or Low Speed packets
- Channel 0 or Channel 1 packets

Select the Level Hiding tab, then select the data types to hide.



8.4 Saving Display Options

You can save a set of Display Options values, make a set the default settings, or use a saved set of values with the commands at the bottom of the **Display Options** window:

- To save the current Display Options values in an options file for use in future sessions, click **Save**. Enter a file name without a file name extension. The program adds the **.opt** extension. (The file must have an **.opt** file name extension.)
- To load a previously saved **.opt** file, click **Load** and select a file name.
- To save the current Display Options values in the **default.opt** options file for use as the default display options, click **Save as Default**. (Do not delete the **default.opt** file.)
- To apply the current Display Options values, click **Apply**. The Display Options window remains open.
- To apply the current Display Options values and close the Display Options window, click **OK**.
- To cancel unsaved changes to display values and exit the Display Options window, click **Cancel**.

Chapter 9: Decode Requests

9.1 Class and Vendor Definition Files

LeCroy Analyzers use script files to decode class and vendor requests. The script files are read when the application is initialized. After reading, the Analyzer decodes class and vendor requests as instructed by the files.

.DEC files represent the new method of decoding. DEC stands for "decoder" and describes both Class and Vendor requests in a C-like language. Each **.dec** file stores an endpoint or request decode. When the application starts, these files are loaded dynamically. Subdirectories are supported.

For information about legacy script decoding, see Appendix A “Legacy Script Decoding” on page 143.

Note: The **.dec** files listed in the following table are in the **Scripts** directory under the installation directory:

USB Decode	USB Decoder Name	USB-IF Codes		
		Base Class	Sub Class	Proto-col ID
Audio Class decoding 2.0 AudioClass\Audio1.0Requests.dec AudioClass\Audio2.0Requests.dec	Audio	**01h**		
Communications and CDC Control	CCID	**02h**		
Direct Line Control Model	CCID	**02h**	01h	
Abstract Control Model	CCID	**02h**	02h	
Telephone Control Model	CCID	**02h**	03h	
Multi-Channel Control Model	CCID	**02h**	04h	
CAPI Control Model	CCID	**02h**	05h	
Ethernet Networking Control Model	CCID	**02h**	06h	
ATM Networking Control Model	CCID	**02h**	07h	
Wireless Handset Control Model	CCID	**02h**	08h	
Device Management Model	CCID	**02h**	09h	
Mobile Direct Line Model	CCID	**02h**	0Ah	
OBEX Model	CCID	**02h**	0Bh	
Communication Device Subclass/EEM Communications\CommRequests.dec Communications\CommInterrupt.dec Communications\CommCDCEEM.dec	CCID	**02h**	0Ch	

USB Decode	USB Decoder Name	USB-IF Codes		
		Base Class	Sub Class	Proto-col ID
HID (Human Interface Device) HUT (HID extension) Monitor (HID extension) Physical Interface (force-feedback extension to HID) Point of Sale Devices (HID extension) Power (HID extension) Hid\hid.dec Hid\Hid_Req.dec	HID HID HID HID HID HID	**03h** Extension Extension Extension Extension Extension		
Physical Hid\hid.dec Hid\Hid_Req.dec	HID	**05h**		
Still Imaging Class StillImageClass\PTPStillImageBulkIn.dec StillImageClass\PTPStillImageBulkOut.dec StillImageClass\PTPStillImageRequests.dec StillImageClass\PTPStillInterrupt.dec	PTP Still Image	**06h**	01h	01h
Printer Printer\Printer_req.dec	Printer	**07h**	01h	xxh
Mass Storage	Mass Storage	**08h**		
SCSI/Bulk Protocol MassStorageClass\MS_BulkOnly_Requests.dec MassStorageClass\MS_BulkOnlySCSIInEndpoint.dec MassStorageClass\MS_BulkOnlySCSIOutEndpoint.dec MassStorageClass\MS_BulkOnlySCSIOutEndpoint.dec	Mass Storage SCSI Bulk	**08h**		
UFI (floppy)/CBI Protocol MassStorageClass\MS_UFI_CBI_Requests.dec MassStorageClass\MS_UFI_CBI_BulkInEndp.dec MassStorageClass\MS_UFI_CBI_BulkOutEndp.dec MassStorageClass\MS_UFI_CBI_InterruptEndp.dec	MassStrg Class UFI CBI	**08h**		
Hub support HubClass\HubClassRequests.dec HubClass\HubClassStatusEndpoint.dec	Hub Class	**09h**		

USB Decode	USB Decoder Name	USB-IF Codes		
		Base Class	Sub Class	Protocol ID
Picture Transfer Protocol (**PTP)** [Photographic and Imaging Manufacturers Association (PIMA) 15740 and ISO 15740] StillImageClass\PTPStillImageBulkIn.dec StillImageClass\PTPStillImageBulkOut.dec StillImageClass\PTPStillImageRequests.dec StillImageClass\PTPStillInterrupt.dec	PTP Still Image	Extension		
Communications Device Class (CDC) Data Communications\CDCDataBulkIn_wCTE.dec Communications\CDCDataBulkIn_wPW.dec Communications\CDCDataBulkIn_wPW_wCTE.dec Communications\CDCDataBulkOut_wCTE.dec Communications\CDCDataBulkOut_wPW.dec Communications\CDCDataBulkOut_wPW_wCTE.dec Communications\CDCDataIsochIn_wCTE.dec Communications\CDCDataIsochIn_wPW.dec Communications\CDCDataIsochIn_wPW_wCTE.dec Communications\CDCDataIsochOut_wCTE.dec Communications\CDCDataIsochOut_wPW.dec Communications\CDCDataIsochOut_wPW_wCTE.dec		**0Ah**	00h	
Smart Card (CCID) SmartCard\CCIDBulkIn.dec SmartCard\CCIDBulkOut.dec SmartCard\CCIDInterrupt.dec SmartCard\CCID_req.dec SmartCard\ICCDBulkIn.dec SmartCard\ICCDBulkOut.dec SmartCard\ICCDInterrupt.dec SmartCard\ICCD_req_Ver.A.dec SmartCard\ICCD_req_Ver.B.dec	CCID and ICCD	**0Bh**		
Video Class (UVC) decoding 1.1 (currently at 1.0)		**0Eh**		
VIDEO CONTROL	Video	**0Eh**	01h	00h
VIDEO STREAMING	Video	**0Eh**	02h	00h
VIDEO INTERFACE COLLECTION VideoClass\VideoBulkIn.dec VideoClass\VideoBulkOut.dec VideoClass\VideoInterrupt.dec VideoClass\VideoIsochIn.dec VideoClass\VideoIsochOut.dec VideoClass\Video1.0Requests.dec VideoClass\Video1.1Requests.dec	Video	**0Eh**	03h	00h

USB Decode	USB Decoder Name	USB-IF Codes		
		Base Class	Sub Class	Protocol ID
Wireless Controller		**E0h**		
BT	HCI	**E0h**	01h	01h
UWB	WA Radio Control	**E0h**	01h	02h
Remote Network Driver Interface Specification (RNDIS)	Remote NDIS	**E0h**	01h	03h
Host Wire Adapter	Wire Adapter Class	**E0h**	02h	01h
Device Wire Adapter	Wire Adapter Class	**E0h**	02h	02h
Device Wire Adapter Isochronous interface WireAdapter\WA_DataInEndpoint.dec WireAdapter\WA_DataOutEndpoint.dec WireAdapter\WA_NotifEndpoint.dec WireAdapter\WA_Requests.dec WireAdapter\WA_Radio_Requests.dec WireAdapter\WA_RadioNotifEndpoint.dec	Wire Adapter Class	**E0h**	02h	03h
Miscellaneous Device Class		**EFh**		
Interface Association Descriptor	Standard, so no decoder method needed	**EFh**	02h	01h
Wire Adapter Multifunction Peripheral programming interface	Wire Adapter Class	**EFh**	02h	02h
Cable Based Association Framework (CBAF) Requests Standard\StandardRequests.dec IEEE\IEEECompanies.dec Virtual\VirtualDATAIn.dec Virtual\VirtualDATAOut.dec Virtual\VirtualUARTIn.dec Virtual\VirtualUARTOut.dec AssociationFrameworks\WUSB_CableBasedAssociation.dec	Association Frameworks	**EFh**	03h	01h
IrDA Bridge	IrDA Bridge	**FEh**	02h	00h
ATAPI	ATAPI	**08h**	02h	50h
IP	IP			
HTTP	HTTP			

You can create your own **.dec** file for a Class or Vendor Request. For more information on the format of these Script Decoder files and the Script Decoding language, read the ***Script Decoder Manual***.

9.2 Class/Vendor Decoding Options

You can permanently assign a class or vendor decoding for an address and/or endpoint or interface in a trace file. Once assigned, the decoding occurs automatically when you display transactions.

Mapping Request Recipient to Class/Vendor Decoding

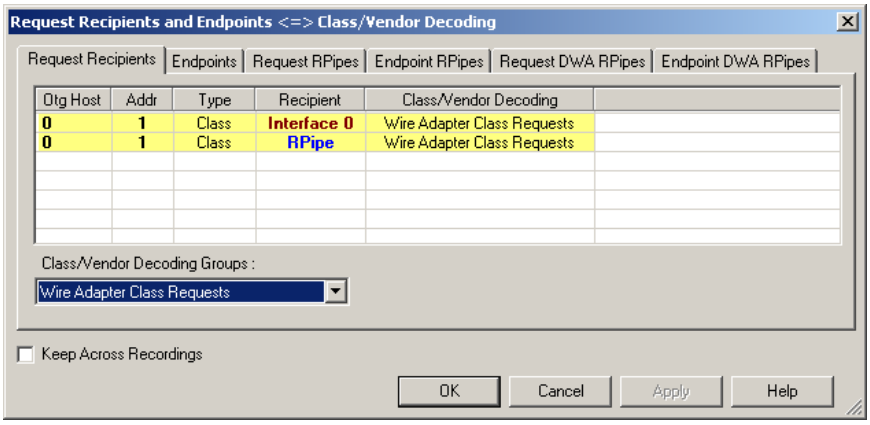
To assign a decoding group to a request recipient,

Step 1 Click the **Apply Decoding Scripts** button on the Toolbar.

OR

Left-click the **Control Transfer** field to display the USB Device Request menu:

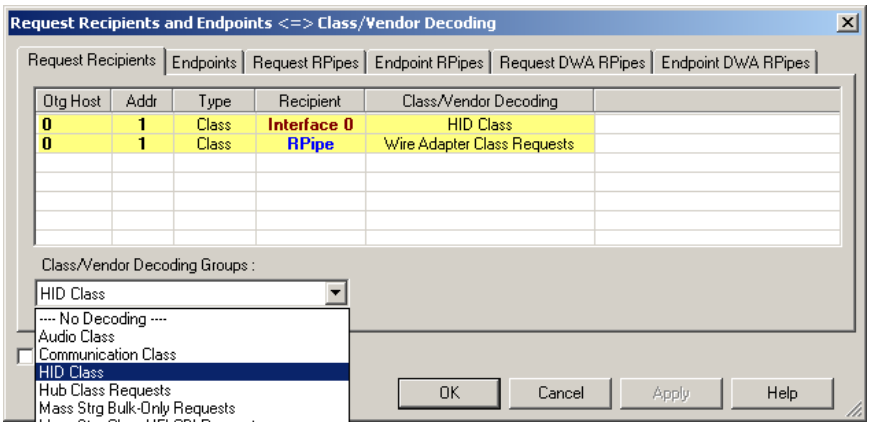
Step 2 Select **Map Request Recipients to Class/Vendor Decoding** to display the Request Recipient and Endpoints dialog box:



The Recipient field shows all Class and Vendor Request Recipients found in the trace file. The display shows the Host, Address, and Type (Class or Vendor) for the recipient. On the right are the names of Class/Vendor Decoding groups currently assigned to recipients. If blank, no decoding is assigned for a recipient.

Step 3 Select a recipient.

Step 4 Display the **Class/Vendor Decoding Groups** drop-down menu.



The drop-down menu lists the defined Class/Vendor request decoding groups. The Class/Vendor Decoding Groups are:

- No Decoding
- Audio Class Requests
- Communication Class Requests
- HCI Command
- HID Class
- HID Class Requests
- Hub Class Requests
- Mass-Strg Bulk-Only Requests
- Mass-Strg Class UFI CBI Requests
- Printer Class Requests
- Standard Requests
- Still Image/PTP/MTP/PictBridge Class Requests
- Video Class Requests
- Wire Adapter Radio Control Requests
- Wire Adapter Class Requests

Step 5 Select a decoding group.

OR

Select **No Decoding** if you do not want any specific decoding.

Step 6 Repeat the previous steps for additional recipients.

Step 7 To retain a mapping from trace to trace DURING an application session, select the **Keep Across Recordings** checkbox.

Step 8 Click **OK**.

Mapping Endpoint to Class/Vendor Decoding

To assign a Class/Vendor Endpoint decoding,

Step 1 Click the **Apply Decoding Scripts** button on the Toolbar.

OR

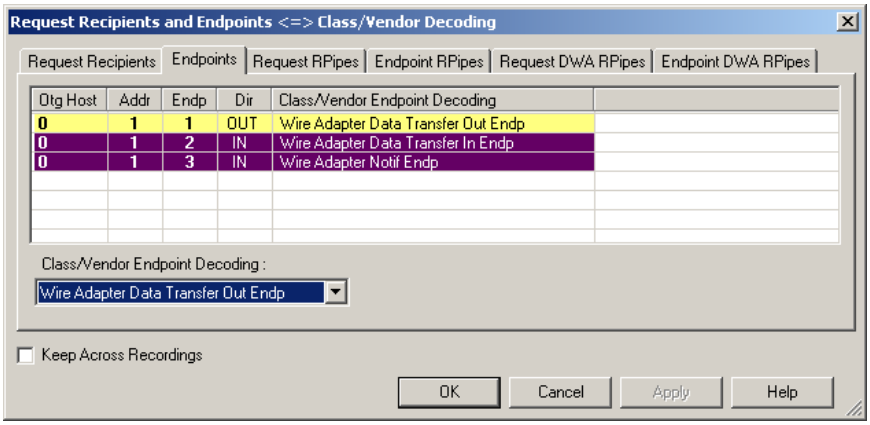
Left-click the **Bulk/Int Transfer** field to display the USB Device Request menu.

Step 2 Select **Map Endpoint to Class/Vendor Decoding** to display the Request Recipients and Endpoints dialog box.

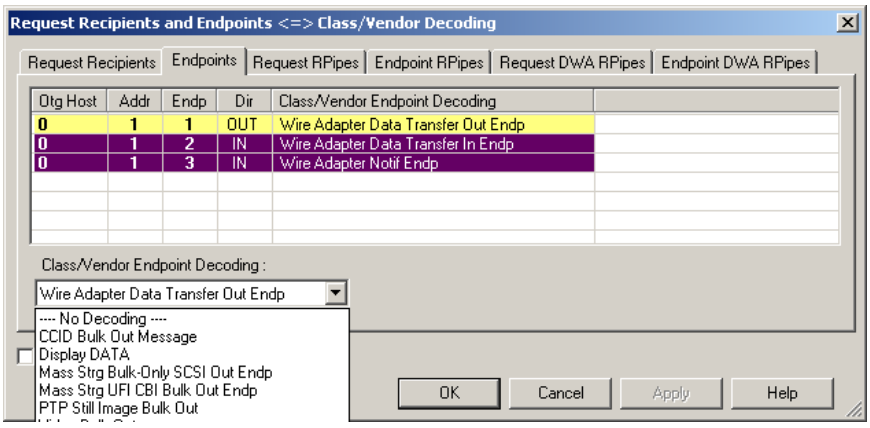
Step 3 Click the **Endpoints** tab to display the **Endpoints** dialog box.

The Endpoint field (Endp) shows all Endpoints found in the trace file. The displays shows the Host, Address, and Direction for the recipient. On the right are the names of Class/Vendor Endpoint Decoding groups currently assigned to endpoints. If blank, no decoding is assigned for a recipient.

Step 4 Select an endpoint.



Step 5 Display the **Class/Vendor Endpoint Decoding** drop-down menu:



The Class/Vendor Endpoint Decoding options for an OUT endpoint are:

- No Decoding
- CCID Bulk Out Message
- Display DATA
- HCI data out
- HCI SCO out
- Mass Strg Bulk-Only SCSI Out Endp
- Mass Strg UFI_CBI Bulk Out Endp
- Still Image/PTP/MTP/PictBridge Bulk Out
- Video Bulk Out
- Video Isoch Out
- Virtual UART
- Wire Adapter Data Transfer Out Endp

The Class/Vendor Endpoint Decoding options an IN or Interrupt endpoint are:

- No Decoding
- CCID Bulk In Message
- Communication Class Interrupt Notification
- Display DATA
- HCI data in
- HCI event
- HCI SCO in
- HID In Endp
- Hub Class Status Change Endp
- Mass Strg Bulk-Only SCSI In Endp
- Mass Strg CBI Interrupt Endp
- Mass Strg UFI_CBI Bulk In Endp
- Mass Strg UFI_CBI Interrupt Endp
- Still Image/PTP/MTP/PictBridge Bulk In
- Still Image/PTP/MTP/PictBridge Interrupt
- Video Bulk In
- Video Interrupt
- Video Isoch In
- Virtual UART
- Wire Adapter Radio Notif Endp
- Wire Adapter Data Transfer In Endp
- Wire Adapter Notif Endp

Step 6 Select the type of decoding.

OR

Select **No Decoding** if you do not want any specific decoding.

Step 7 Repeat the previous steps for any additional endpoints you would like to map.

Step 8 To retain a mapping from trace to trace DURING an application session, select the **Keep Across Recordings** checkbox.

Step 9 Click **OK**.

Mapping Request RPipe to Class/Vendor Decoding

Before mapping Request RPipes to Class/Vendor Decoding, you must first assign the following endpoint decoders:

- Wire Adapter Data Out
- Wire Adapter Data In
- Wire Adapter Notif

To assign a decoding group to a Request RPipe:

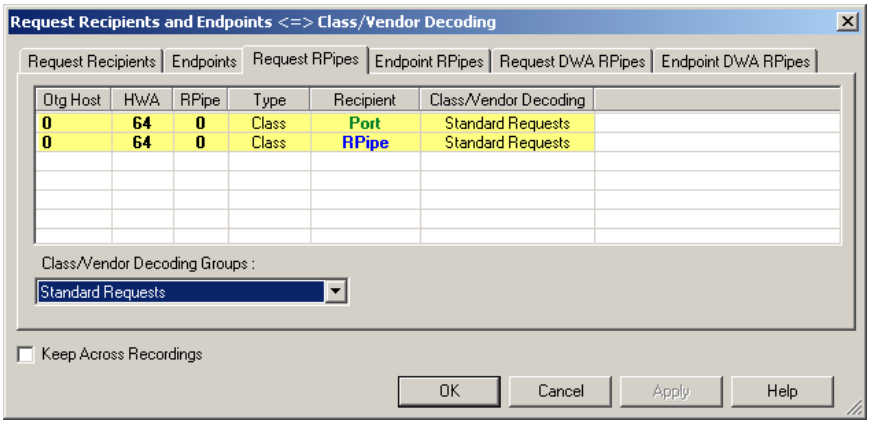
Step 1 Click the **Apply Decoding Scripts** button on the Toolbar.

OR

Left-click the **Control Transfer** field to display the USB Device Request menu.

Step 2 Select **Map RPipe to Class/Vendor Decoding** to display the Request Recipient and Endpoints dialog box.

Step 3 Click the **Request RPipes** tab to display the Request RPipes dialog box:



The Recipient field shows all Class and Vendor Request recipients found in the trace file. The RPipe field shows all Class and Vendor Request RPipes found in the trace file. The displays shows the Otg Host, HWA address, and Type (Class or Vendor) for the recipient. On the right are the names of Class/Vendor Decoding groups currently assigned to recipients. If blank, no decoding is assigned for a recipient.

Step 4 Select a recipient.

Step 5 Display the **Class/Vendor Decoding Groups** drop-down menu. The Class/Vendor Decoding Groups are the same as for Request Recipients.

Step 6 Select a decoding group.

OR

Select **No Decoding** if you do not want any specific decoding.

Step 7 Repeat the previous steps for additional recipients.

Step 8 To retain a mapping from trace to trace DURING an application session, select the **Keep Across Recordings** checkbox.

Step 9 Click **OK**.

Mapping Endpoint RPipe to Class/Vendor Decoding

To assign a Class/Vendor Endpoint RPipes decoding:

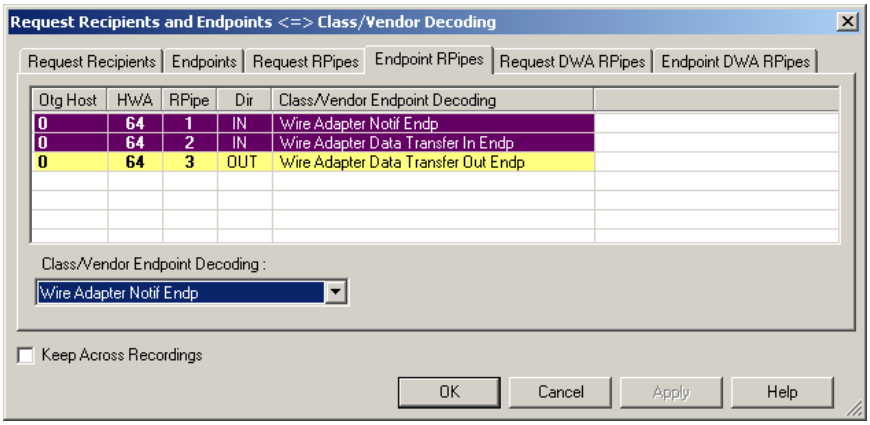
Step 1 Click the **Apply Decoding Scripts** button on the Toolbar.

OR

Left-click the **Bulk/Int Transfer** field to display the USB Device Request menu.

Step 2 Select **Map Endpoint RPipe to Class/Vendor Decoding** to display the Request Recipients and Endpoints dialog box.

Step 3 Click the **Endpoint RPipes** tab to display the Endpoint RPipes dialog box:



The RPipe field shows all RPipes found in the trace file. The displays shows the Otg Host, HWA address, and Direction for the recipient. On the right are the names of Class/Vendor Endpoint Decoding groups currently assigned to endpoints. If blank, no decoding is assigned for a recipient.

Step 4 Select an endpoint RPipe.

Step 5 Display the **Class/Vendor Endpoint Decoding** drop-down menu. The Class/Vendor Endpoint Decoding options are the same as for Endpoints.

Step 6 Select the type of decoding.

OR

Select **No Decoding** if you do not want any specific decoding.

Step 7 Repeat the previous steps for any additional RPipes you would like to map.

Step 8 To retain a mapping from trace to trace DURING an application session, select the **Keep Across Recordings** checkbox.

Step 9 Click **OK**.

Mapping Request DWA RPipe to Class/Vendor Decoding

Before mapping Request DWA RPipes to Class/Vendor Decoding, you must first assign the following endpoint decoders:

- Wire Adapter Data Out
- Wire Adapter Data In
- Wire Adapter Notif

To assign a decoding group to a Request RPipe:

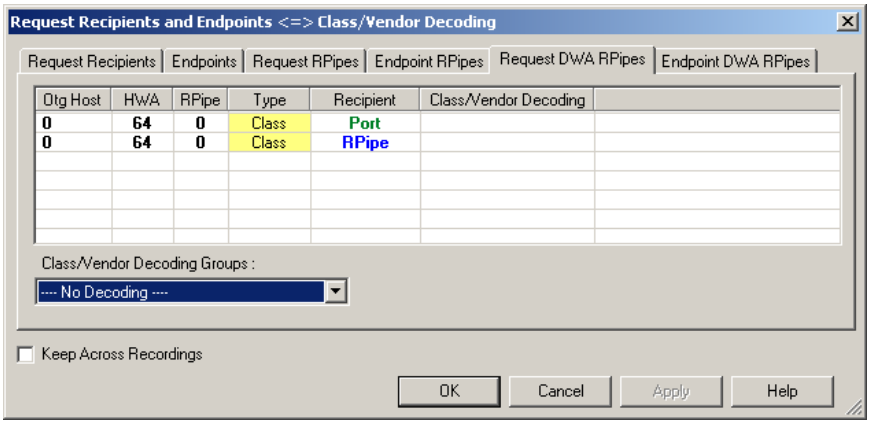
Step 1 Click the **Apply Decoding Scripts** button on the Toolbar.

OR

Left-click the **Control Transfer** field to display the USB Device Request menu.

Step 2 Select **Map DWA RPipe to Class/Vendor Decoding** to display the Request Recipient and Endpoints dialog box.

Step 3 Click the **Request DWA RPipes** tab to display the Request DWA RPipes dialog box:



The Recipient field shows all Class and Vendor Request recipients found in the trace file. The RPipe field shows all Class and Vendor Request RPipes found in the trace file. The displays shows the Otg Host, HWA address, and Type (Class or Vendor) for the recipient. On the right are the names of Class/Vendor Decoding groups currently assigned to recipients. If blank, no decoding is assigned for a recipient.

Step 4 Select a recipient.

Step 5 Display the **Class/Vendor Decoding Groups** drop-down menu. The Class/Vendor Decoding Groups are the same as for Request Recipients.

Step 6 Select a decoding group.

OR

Select **No Decoding** if you do not want any specific decoding.

Step 7 Repeat the previous steps for additional recipients.

Step 8 To retain a mapping from trace to trace DURING an application session, select the **Keep Across Recordings** checkbox.

Step 9 Click **OK**.

Mapping Endpoint DWA RPipes to Class/Vendor Decoding

To assign a Class/Vendor Endpoint DWA RPipes decoding:

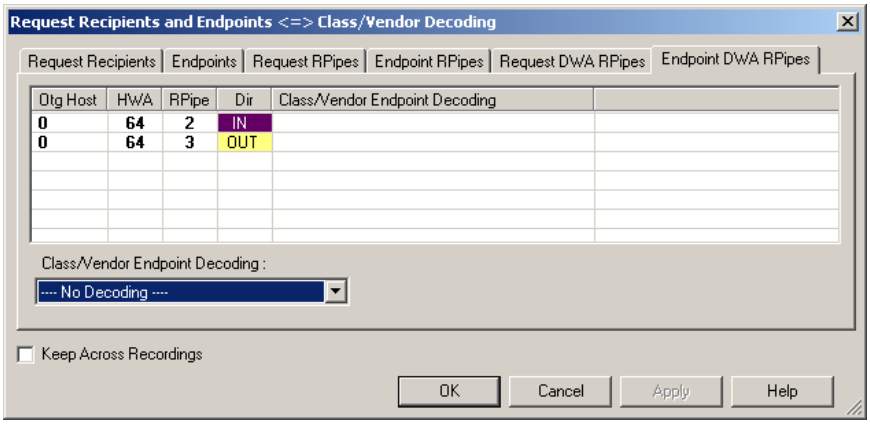
Step 1 Click the **Apply Decoding Scripts** button on the Toolbar.

OR

Left-click the **Bulk/Int Transfer** field to display the USB/WUSB Device Request menu.

Step 2 Select **Map Endpoint RPipe to Class/Vendor Decoding** to display the Request Recipients and Endpoints dialog box.

Step 3 Click the **Endpoint RPipes** tab to display the Endpoint RPipes dialog box:



The RPipe field shows all RPipes found in the trace file. The displays shows the Otg Host, HWA address, and Direction for the recipient. On the right are the names of Class/Vendor Endpoint Decoding groups currently assigned to endpoints. If blank, no decoding is assigned for a recipient.

Step 4 Select an endpoint DWA RPipe.

Step 5 Display the **Class/Vendor Endpoint Decoding** drop-down menu. The Class/Vendor Endpoint Decoding options are the same as for Endpoints.

Step 6 Select the type of decoding.

OR

Select **No Decoding** if you do not want any specific decoding.

Step 7 Repeat the previous steps for any additional RPipes you would like to map.

Step 8 To retain a mapping from trace to trace DURING an application session, select the **Keep Across Recordings** checkbox.

Step 9 Click **OK**.

9.3 General Options

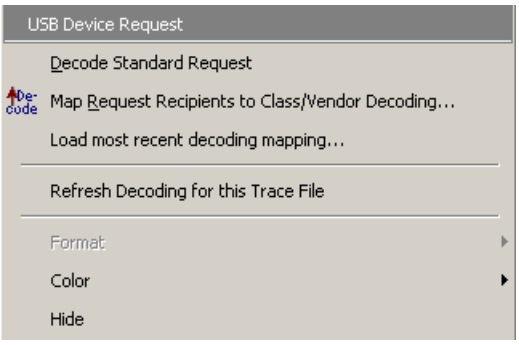
Commands are transferred on USB using special control transfers called USB Device Requests. The Analyzer can decode Device Requests as they are defined in the USB specifications and various Device Class and Vendor specifications.

Each USB Device Request is sent using a Control Transfer. Each Control Transfer starts with a SETUP transaction.

Decoding USB Device Requests

To decode a USB Device Request:

Step 1 Left-click the **Control Transfer** field or the **SETUP** field of the USB Device Request to display the USB Device Request menu:



Note: The menus shown in this section are context-sensitive. You may see slightly different menus.

Step 2 To refresh decoding, click Refresh Decoding for this Trace File. Use this option to reanalyze all transactions.

Step 3 To use the previous decoding, click **Load most recent decoding mapping**.

This option loads the most recent mapping of endpoints/requests to decoding types that was done on a previous trace. If the endpoints of the new trace are the same as the last one mapped, the mappings are applied to the current trace. This saves the user from having to constantly apply the mapping to a new trace every time the application is restarted and a new trace created.

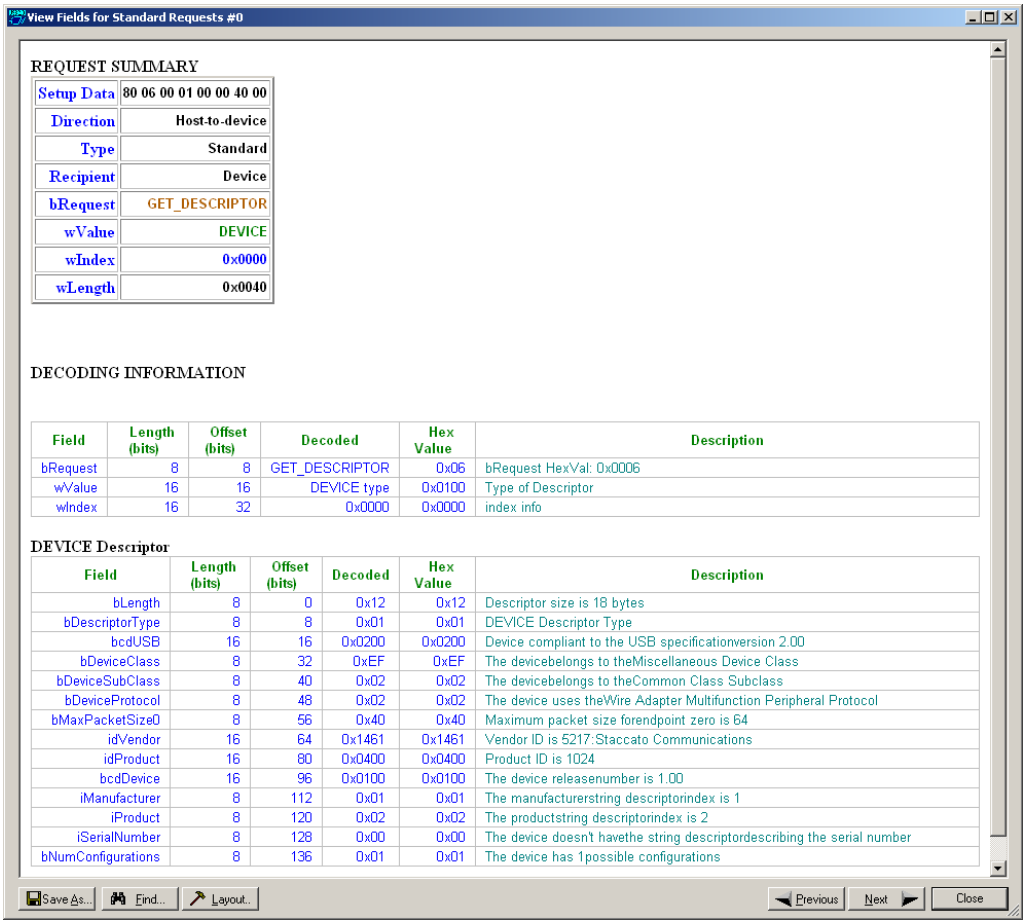
The ability to retain the mapping from trace to trace DURING an application session already exists: the Keep Across Recordings button in the endpoint map dialog. This new feature simplifies the process when the application has been re-started.

Note: You can also change the format, color, and hidden status of fields, using the same methods as in Display Options. (See Chapter 6, Display Options.)

Decoding Standard Requests

To decode a standard request:

Step 1 From the USB Device Request menu, select **Decode Standard Request** to display the View Fields for Standard Request text box:



Step 2 To find a word in the text box, click the **Find** button. Enter the word in the Find What field. To use a case-sensitive search, check **Match Case**. To find only the exact word, check **Match Whole Word Only.** You can search **Up** or **Down**. To search, click **Find Next.**

Step 3 To save the View Fields text box as an HTML file, click the **Save As** button, enter a file name in the Save As dialog box, then click **Save**.

Step 4 To view the previous or next Transfer Control field request of the same request type, click **Previous** or **Next**.

The View Fields for Standard Request dialog box displays field definitions and values of the Standard Request.

For field definitions, please refer to the *Universal Serial Bus Specification, version 2.0.* The USB specification is available from the USB Implementers Forum (USB-IF) at:

USB Implementers Forum
1730 SW Skyline Blvd.
Suite 203
Portland, OR 97221

Tel: +1/503.296.9892
Fax: +1/503.297.1090
Web: http://www.usb.org/

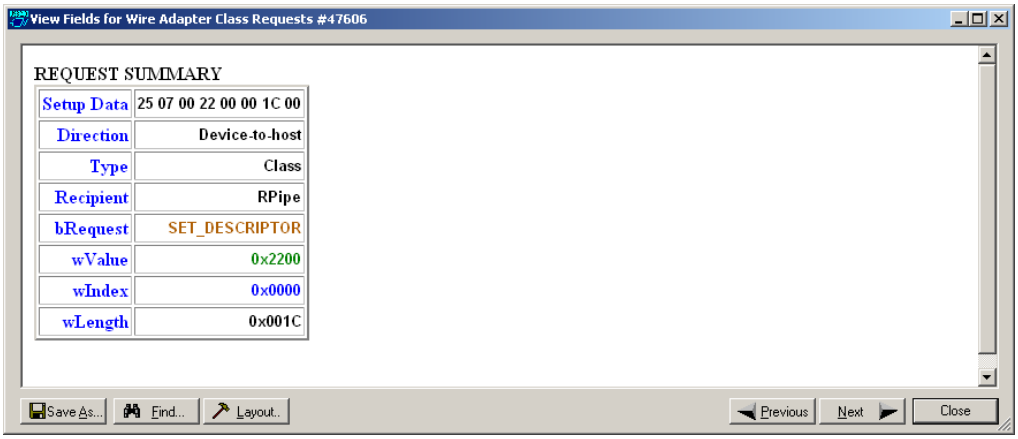
Decoding Class Requests

Examples of a class request are Mass-Strg Class UFI CBI Requests, PTP Still Image Class Requests, Video Class Requests, and Wire Adapter Class Requests.

To decode a class request:

- From the USB Device Request menu, select **Decode ... Request** to display the View Fields for ... Class Requests text box.

The following figure shows a Wire Adapter Class Requests decoding:



Decoding Vendor Requests

To decode a vendor request:

- From the USB Device Request menu, select **Decode ... Request** to display the View Fields for ... Vendor Requests text box.

An example of a vendor request is USB Advisor™ Command Set.

Decoding Undefined USB/WUSB Device Requests

A Decoding Request may not belong to any of the defined decoding groups (Standard, Class, or Vendor).

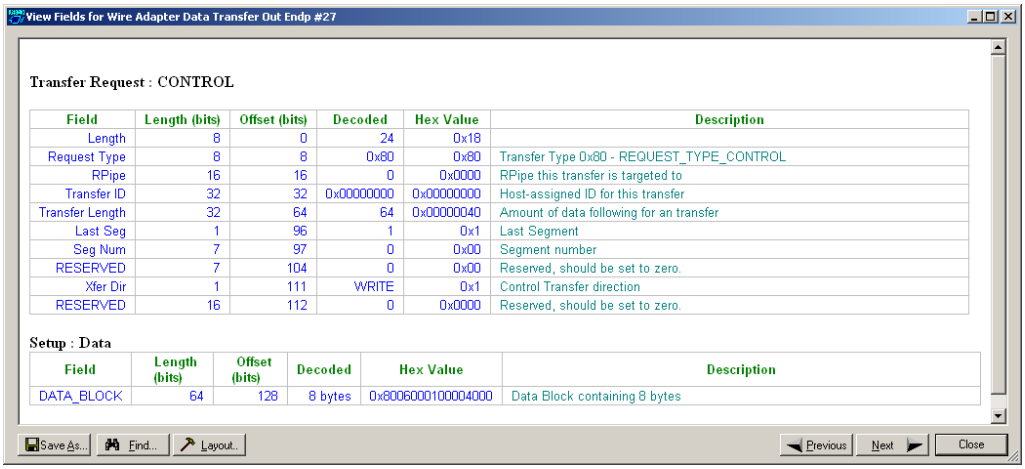
Decoding using Endpoint Information

To decode using the endpoint information:

Step 1 Left-click the **Bulk/Int Transfer** field to display the Bulk/Int Transfer (IN/OUT transaction with data) menu.

Step 2 Select **Decode as ... Endp** to open a View Fields for ... Endp text box.

The following figure shows a Wire Adapter Data Transfer Out Endp decoding:



Changing the Layout of Decode Requests

In the View ... Fields windows, the Decoding Information and the Descriptor information blocks (following the Request Summary information) have the following columns:

- **Field**: such as bRequest, wValue, wIndex, bLength, bDescriptorType, wTotalLength
- Length in bits
- Offset in bits
- **Decoded**: hex value typically equal to Hex Value
- **Hex Value**: hex value typically equal to Decoded
- **Description**: short description of field

To change the layout of decode requests display:

Step 1 Click **Layout** to display the View ... Fields Dialog Layout dialog box:

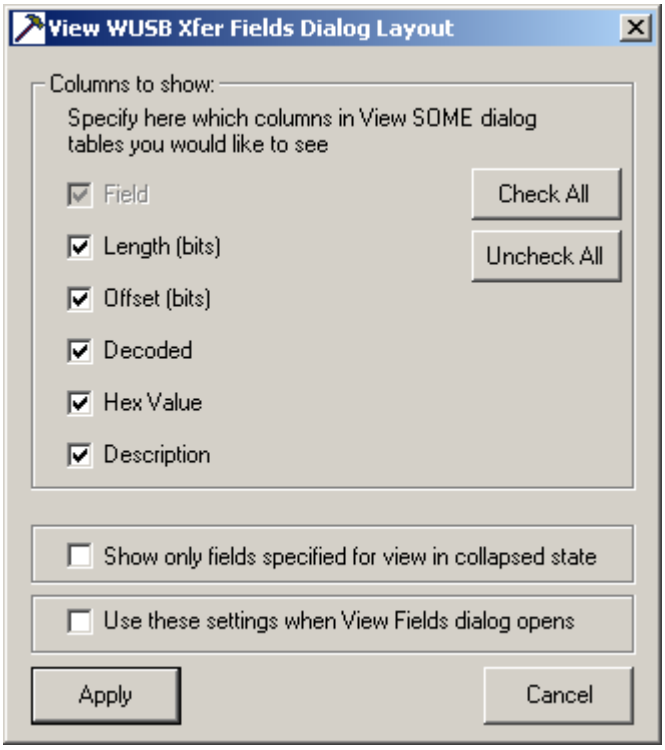


Figure 9.1 View WUSB Xfer Fields Dialog Layout Dialog Box

Step 2 To display the available columns of data, use the checkboxes for **Length, Offset, Decoded, Hex Value**, and **Description**.

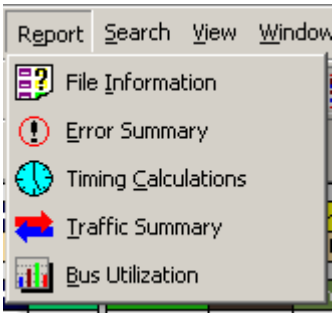
You can **Check All** or **Uncheck All**.

Step 3 To show only the fields of Collapsed mode, check **Show only fields specified for view in collapsed mode**.

Step 4 To retain settings for future viewing of Decode Request fields, check **Use these settings when View Fields dialog opens**.

Chapter 10: Reports

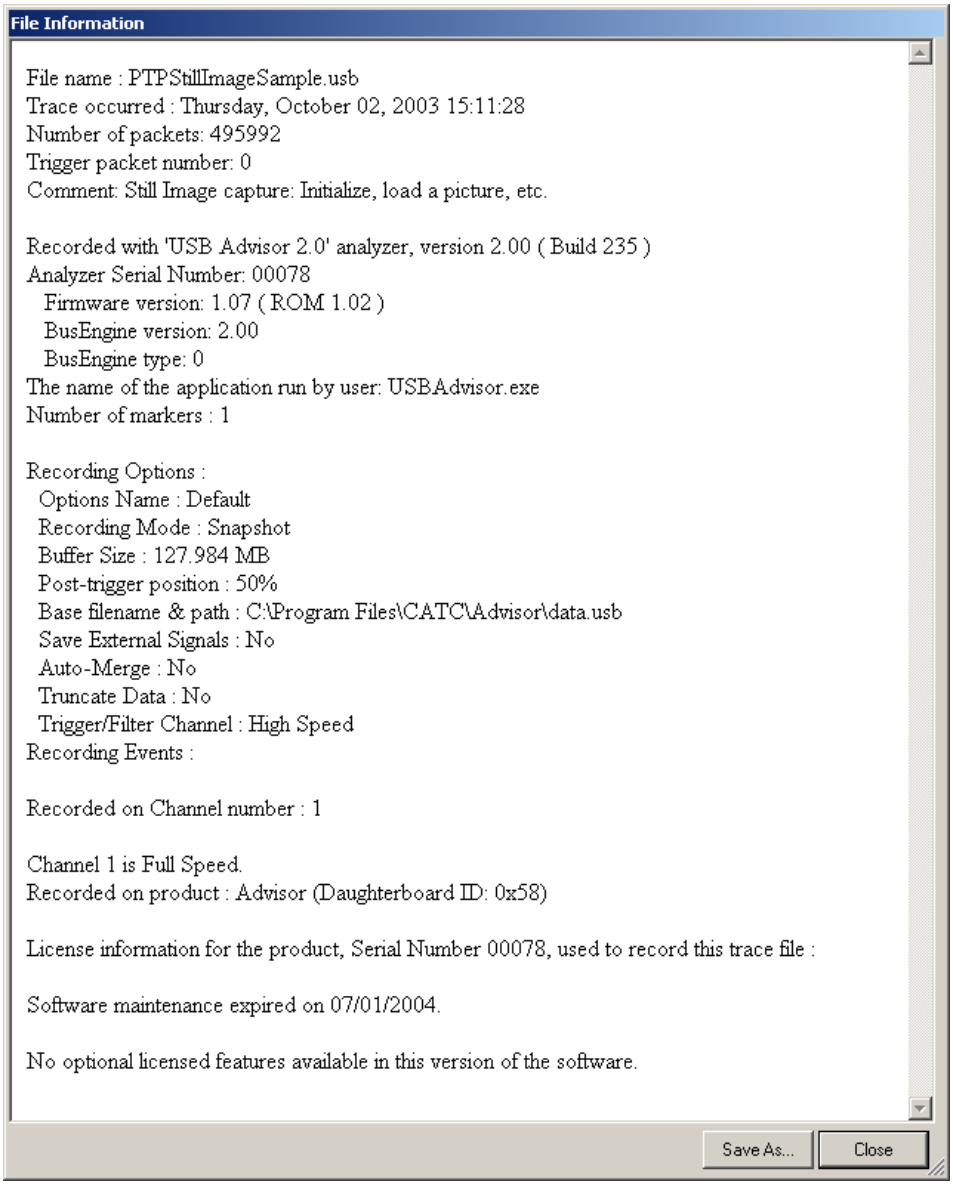
The Report menu provides several reports to assist you in analyzing USB traffic recorded by the Analyzer.



10.1 File Information

To display a File Information report:

- Select **File Information** under **Report** in the Menu Bar.
  OR
- Click in the Tool Bar to display the File Information screen:

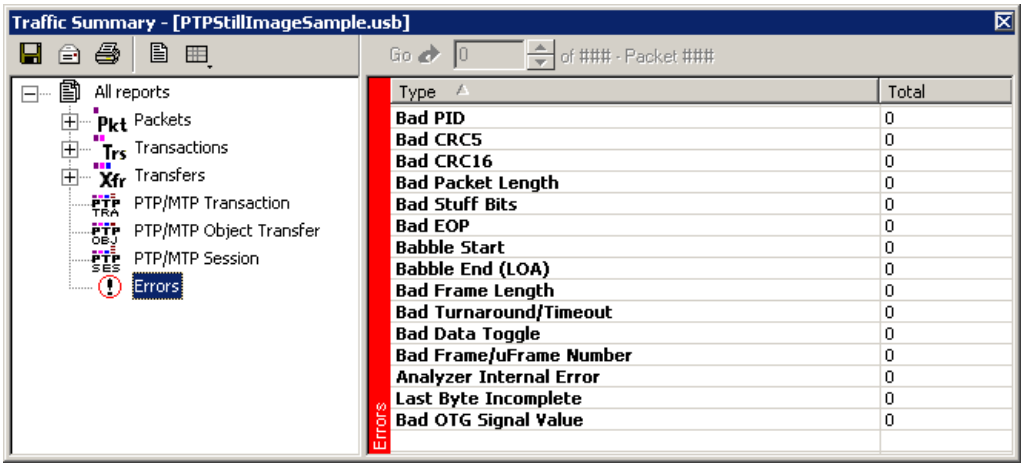


The File Information report provides information about how the recording was made, what the buffer settings were, the license number of the Analyzer that created the file, what the trigger options were, the user's license information, and what version of all the Analyzer hardware was used to make the recording.

10.2 Error Summary

The Error Summary details all errors analyzed throughout the recording.

- Select **Error Summary** under **Report** in the Menu Bar
  OR
- Click in the Tool Bar to display the Errors pane:



Navigate to an error within the recording by clicking the number of the packet containing the error.

Use the arrows to cycle though each occurrence of a particular error.

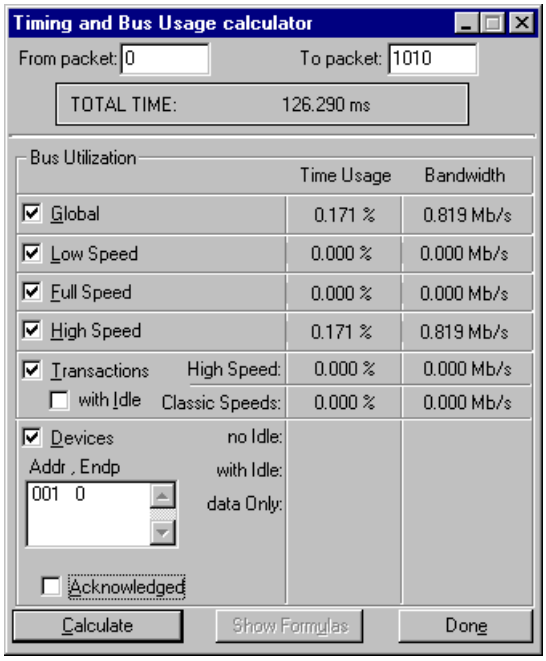
10.3 Timing Calculations

The Timing Calculator is used to measure timing between any two packets.

- Select **Timing Calculations** under **Report** in the Menu Bar.

  OR

- Click in the Tool Bar to display the Timing and Bus Usage Calculator screen:

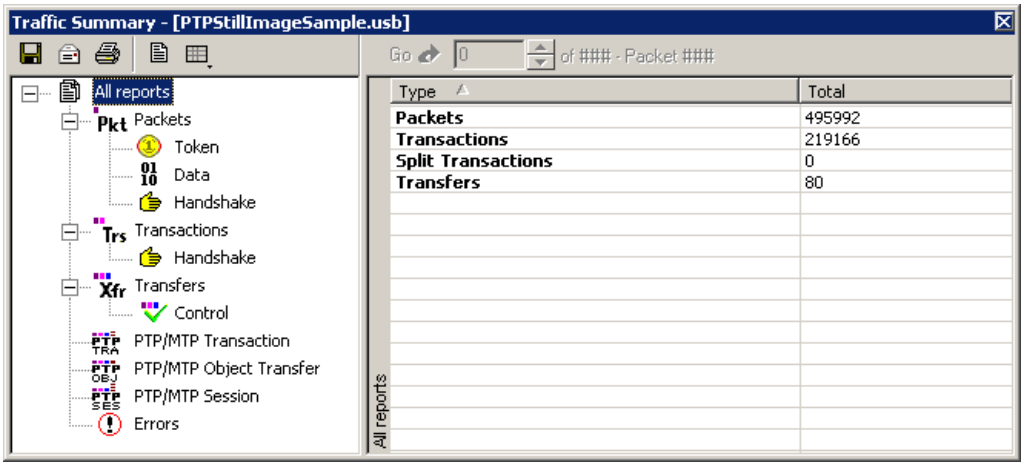


10.4 Traffic Summary

Traffic Summary summarizes the numbers and types of packets, transactions, and so on that occurred in the open trace.

To run **Traffic Summary**, select **Report > Traffic Summary,**

or click the button marked . The program prompts you to specify a range of packets, then displays the following window:

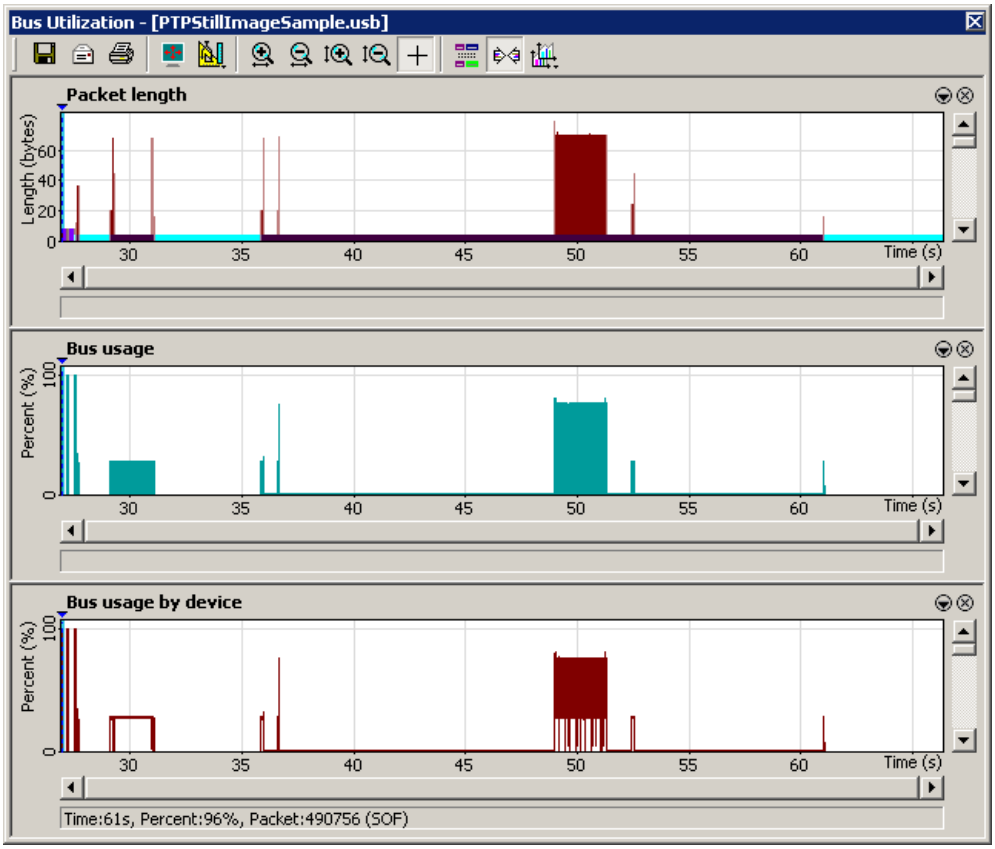


10.5 Bus Utilization

The **Bus Utilization** window displays information on bandwidth use for the two recording channels.

To open the Bus Utilization window, select **Report > Bus Utilization**

or click the button to display three graphs:



Bus Utilization Buttons

The Bus Utilization window has a row of buttons for changing the format of the displayed data and for exporting data:

The buttons have the following functions:

Save As - Saves the graphs as a bitmap file (***.bmp**)

Email - Creates an email with a *.bmp file attachment of the graphs

Print

Full Screen

View Settings - opens a sub-menu with options for formatting the display. See “Click the View Settings button to open a menu with options for formatting the display:” below.

Horizontal zoom in

Horizontal zoom out

Vertical zoom in

Vertical zoom out

Click and Drag zoom - Click diagonally to select and zoom in on part of the graph

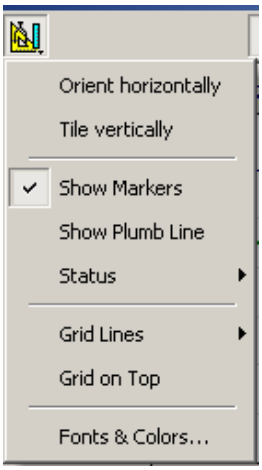
Select Range

Sync and 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 - Presents options for displaying additional graphs of data lengths, packet lengths, and percentage of bus utilized.

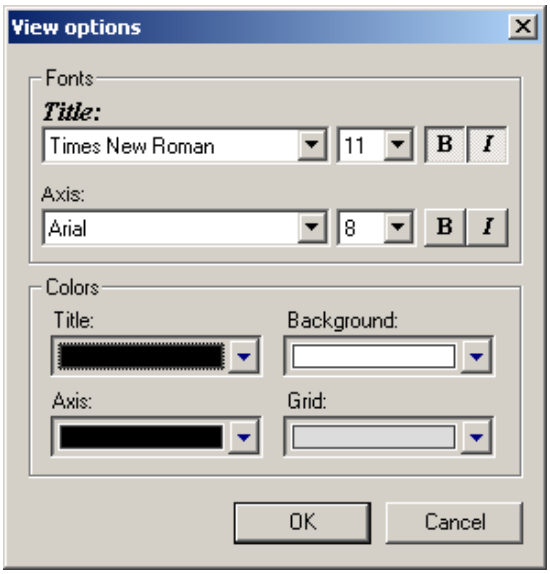
View Settings Menu

Click the View Settings button to open a menu with options for formatting the display:



- **Orient Horizontally**: Changes the orientation of bus usage to horizontal. After selecting this option, the menu option changes to Orient Vertically.
- **Tile Vertically**: Tiles the graphs vertically (i.e., side by side). After selecting this option, the menu option changes to Tile Horizontally.
- **Show Markers**: Places tick marks along the x axis of each graph.
- **Show Plumb Line**: Displays a vertical line that connects the cursor to the horizontal axis. As you move the mouse, the status bar shows the packet and time frame to which the cursor points.
- **Status**: Opens a submenu with the following options:
  - Bar: Displays a status bar at the bottom.
  - Tooltip: Displays a tooltip if you position the cursor over a field of the graphs.
  - None: Turns off tooltips and the status bar.
- **Grid Lines**: Opens a submenu with the following options:
  - Both: Displays both X and Y axis gridlines.
  - X Axis: Displays X axis gridlines.
  - Y Axis: Display Y axis gridlines.
  - None: Turns off gridlines.
- **Grid on Top**: Moves the grid lines above the graph.

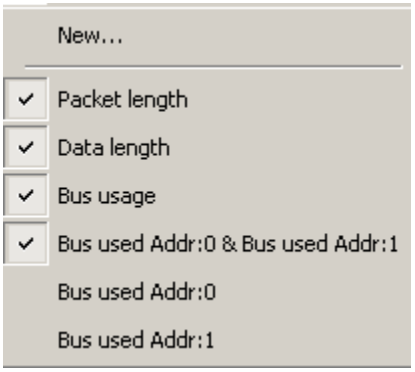
- **Fonts and Colors**: Opens the View Options dialog box for setting graph fonts and colors:



Graph Areas Menu

Use the Graph Areas menu to specify information for the Bus Utilization window.

Step 1 Click the button to open the Graph Areas menu.

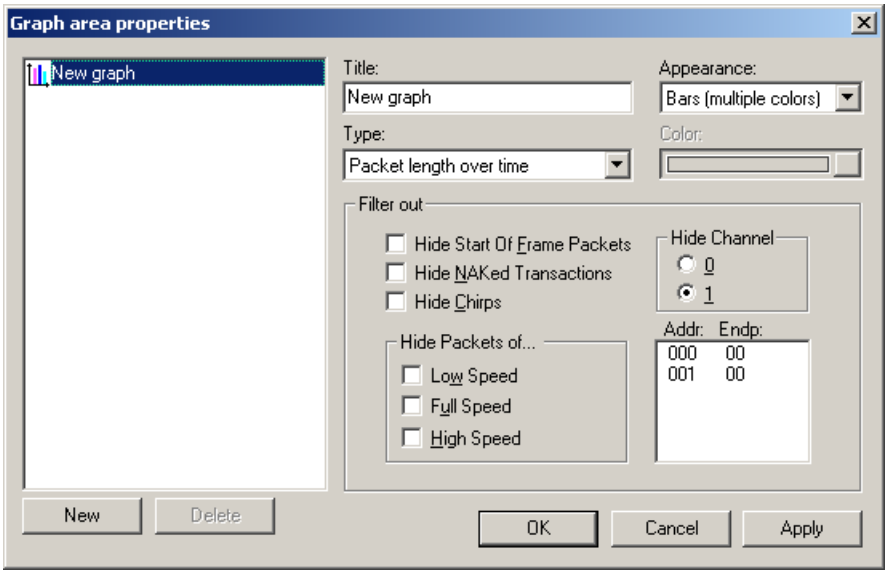


Step 2 Select the data you want to appear in the Graph Areas window.

Step 3 To make a new graph, click **New**.

To change properties in the Bus Utilizations graph:

Step 1 In the **Graph Area**s menu, select what you want your graph to display, then click **OK**.



Step 2 To make a new graph, click **New**.

Chapter 11: Recording Options

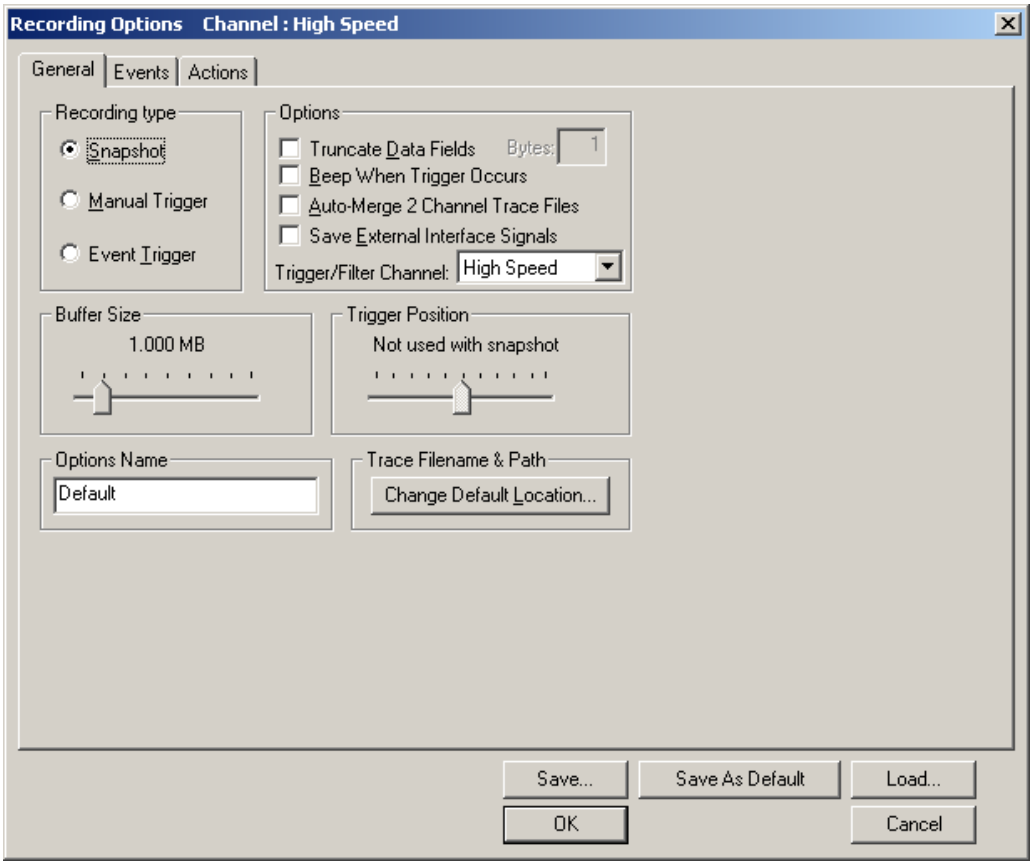
Use **Recording Options** to create and change various features that control the way information is recorded by the LeCroy USB Advisor™ Analyzer.

To open the **Recording Options** menu:

- Select **Recording Options** under **Setup** on the Menu Bar

  OR

- Click on the Tool Bar to display the **Recording Options** window at the **General** tab:



11.1 General Recording Options

The General Recording Options allow you to select or adjust the recording type, the buffer size, the amount of post-trigger recording, and the trace filename and path.

Recording Type

The **Recording Type** box presents three options that allow you to set how Advisor begins and ends a recording.

The options are: Snapshot, Manual Trigger, and Event Trigger.

Snapshot

A Snapshot is a fixed-length recording whose size is determined by the Buffer Size box in the Recording Options dialog or

by a manual click of the Stop button. Recording begins when is clicked

and ends when either the selected buffer size is filled or the button is pressed.

Manual Trigger

A Manual Trigger is a recording whose trigger point is caused by pressing the trigger button on the front panel.

Recording begins when you click on the Tool Bar. Recording continues in a circular manner within the limits set by the buffer size.

Recording ends when is clicked on the Tool Bar or after post-trigger memory has been filled following depression of the trigger button on the front panel.

Event Trigger

Recording begins when you click on the Tool Bar.

Recording continues in a circular manner within the limits set by the buffer size until an event is detected that meets the Trigger conditions specified in the Triggering Options and the defined amount of data has been recorded after the Trigger Event.

Options

Truncate Data Fields allows data fields to be truncated during recording to save Analyzer memory and allow recording of more packets. Enter a maximum data length value in the Bytes box. Advisor truncates the data to the stated value or slightly larger.

Note: Truncation of data may cause incorrect transaction or transfer decoding.

Beep When Trigger Occurs makes the computer connected to the Advisor beep three times when a Trigger condition is first detected.

Auto-Merge 2 Channel Trace Files causes Advisor to merge traffic of two recording channels into a file called data_merged.usb (or whatever name you wish to give it). Advisor also makes two other files during this recording: data.usb and data_classic.usb (or whatever names you choose to give them). If unchecked, Advisor create only two files: one for Classic-Speed traffic and another for Hi-Speed traffic.

Save External Interface Signals causes Advisor to save signals from a Breakout Board (pins *TRIG IN - G.P. IN*) as fields in the trace.

Trigger/Filter Channel allows you to choose between Hi-Speed or Classic Speed. The selected choice tells Advisor what channel it should use to perform its triggers/filters. The last channel selected here is the one to be used for Triggering/Filtering.

Buffer Size

You can adjust the size of the recording buffer from 0.1 megabytes to 128 megabytes.

The **Recording Type** option determines how this buffer is used. Although there are 128 megabytes of physical memory in the Analyzer, the efficiency of the recording is about a 2:1 ratio of physical memory to actual USB traffic. Shorter USB packets yield a slightly less efficient recording. The non-traffic portion of physical memory is utilized for control and timing information.

Note: The scale is not linear and affords more granularity in the smaller buffer sizes.

Trigger Position

You can adjust the amount of recording to be done post-Trigger or select where you want the Trigger located within the defined buffer. You can adjust the Triggering Position between 1 and 99% post-Trigger. **Trigger Position** is available only when **Manual Trigger** or **Event Trigger** is selected as **Recording type**.

As an example, if the buffer size is set to 16MB, then for the following Trigger Position settings, the amount of pre- and post-Trigger data is

- 95% post-triggering: 0.8MB pre-trigger, 15.2MB post-trigger
- 75% post-triggering: 4MB pre-trigger, 12MB post-trigger
- 50% post-triggering: 8MB pre-trigger, 8MB post-trigger
- 25% post-triggering: 12MB pre-trigger, 4MB post-trigger
- 5% post-triggering: 15.2MB pre-trigger, 0.8MB post-trigger

Note: When a Trigger occurs, recording continues until the post-Trigger amount of the buffer is filled or when **Stop** is selected.

Options Name

The **Options Name** is a descriptive label of the current Recording Options settings. Options Names are associated with files that have a **.rec** suffix.

The default option name is **default**. **Default** preserves the current Recording Options settings.

The purpose of the **Options Name** box is to give you a place to preserve different Recording Options that you use on a recurrent basis. For example, if you use two or three different Recording Options configurations, you can save these configurations and load them the next time they are needed.

Because Options Names are descriptive labels and not file names, you can enter in any text you like into the box. Your labels can be very descriptive such as "Trigger on High Speed traffic when CRC errors occur."

To create a new Recording Options name:

Step 1 Enter a comment for the new file in the **Options Name** field.

Step 2 Click **Save** to display the **Save As** window.

Step 3 Specify a filename (***.rec**)

Step 4 Click **Save.**

To load a Recording Options name:

Step 1 Click **Load** to display the Open window.

Step 2 From the list of **.rec** files, select the one that represents your Options Name to display the options settings for that name.

Trace File Name & Path

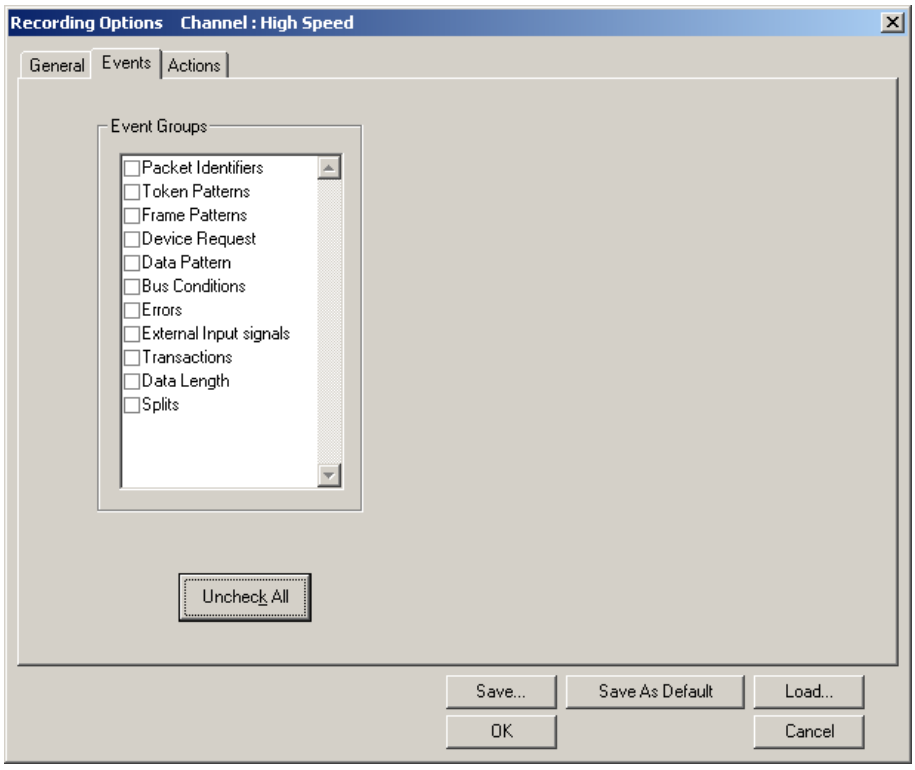
Trace File Name & Path opens a **Save As** dialog box for saving your trace file. The default recording file name is **data.usb** for Low, Full, and High Speed recordings. If you are recording on both channels, then Advisor creates two files: **data.usb** for Classic Channel, and **data_classic.usb** for High-Speed Channel.

- Click **Trace File Name & Path** to display a **Save As…** window in which to enter the recording file name ***.usb** for all subsequent recordings.

11.2 Events Recording Options

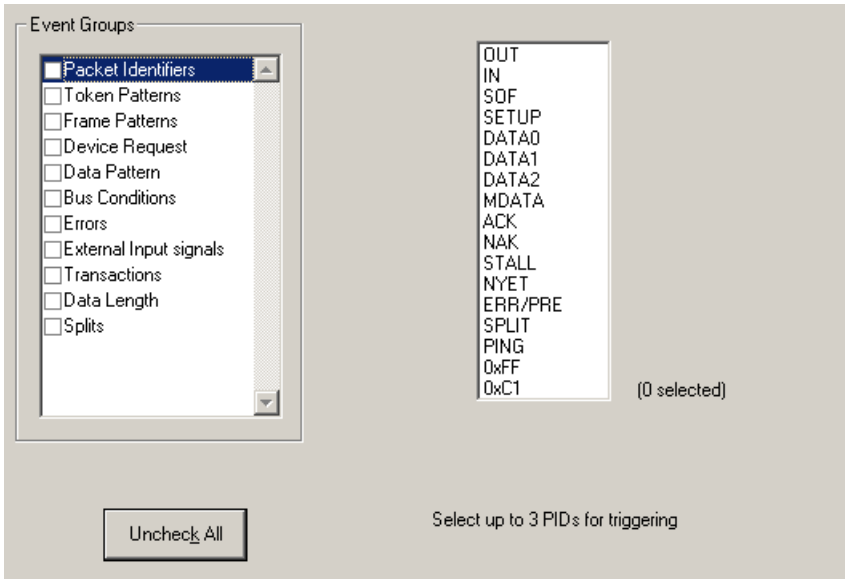
The Event triggering and filtering options allow you to set specific parameters for each Event Group. When an Event Group is selected, a field appears that allows you to select specific conditions within the corresponding Event Group. As details are selected, other Event Group details may become "grayed out" because of limited hardware resources in the Analyzer. Information about the resources available is displayed below the Event Group details. When a detail is grayed out, it is inactive and cannot be selected. If an Event Group remains inactive, the current version of the application or BusEngine™ does not support it.

- Click the **Events** tab on the **Recording Options** screen to display the **Event Groups** window:



Packet Identifiers

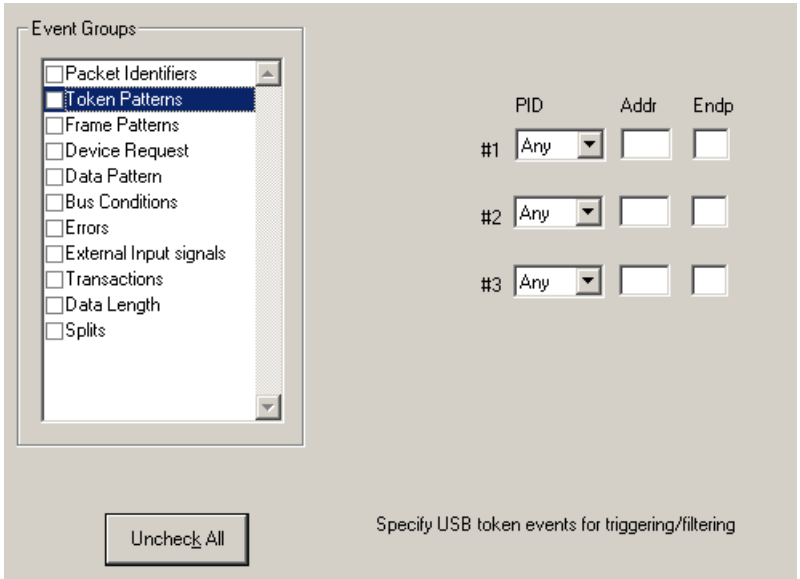
- Select **Packet Identifiers** under **Event Groups** to display the **Packet Identifiers** window:



The Packet Identifier (PID) field lists the available packet types. Select up to three packet types to use as a Recording Trigger.

Token Patterns

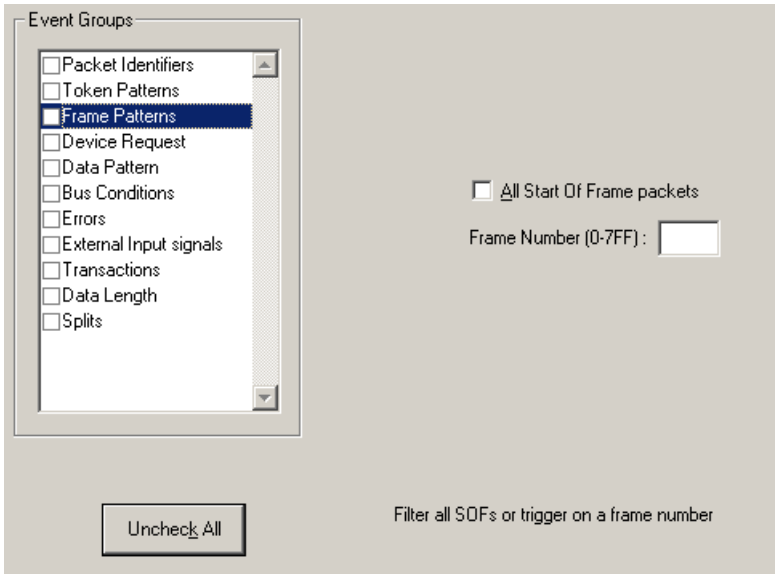
- Select **Token Patterns** under **Event Groups** to display the **Token Patterns** window:



Specify up to three combinations of Address/Endpoint with any of the token PIDs. They can be triggered on or filtered in/out.

Frame Patterns

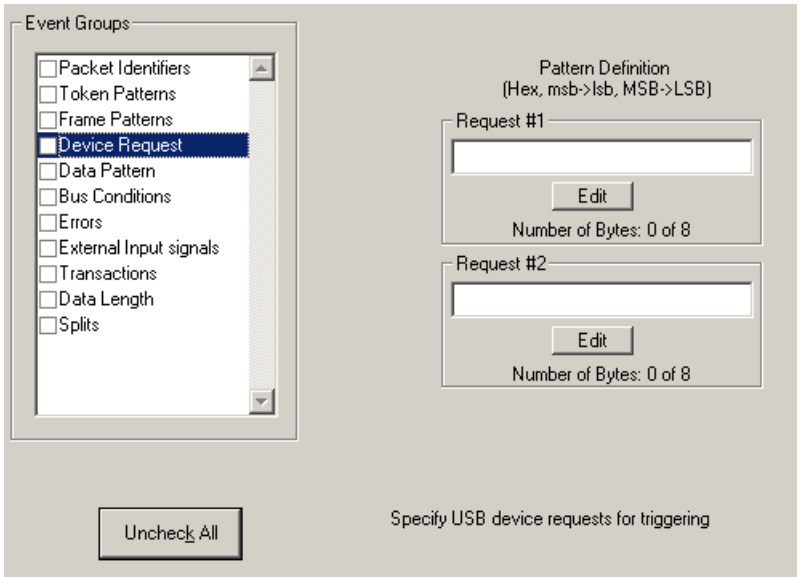
- Select **Frame Patterns** under **Event Groups** to display the **Frame Patterns** window:



Identify frame patterns you want either to filter out of a Trace View or to use as a Trigger. You can select either **All Start of Frame packets** (SOF) to be filtered out or specify the **Frame Number** of a frame to trigger on.

Device Requests

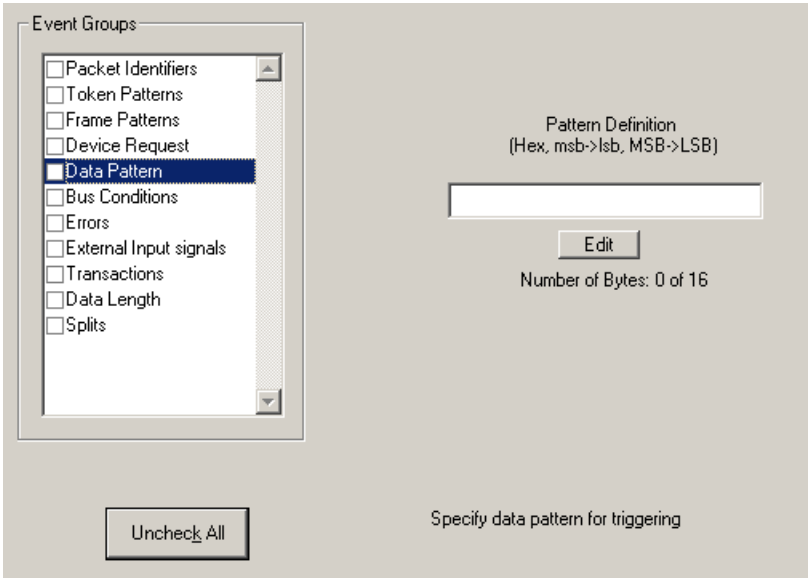
- Select **Device Requests** under **Event Groups** to display the **Device Requests** window:



You can select one or two Device Requests for triggering or filtering.

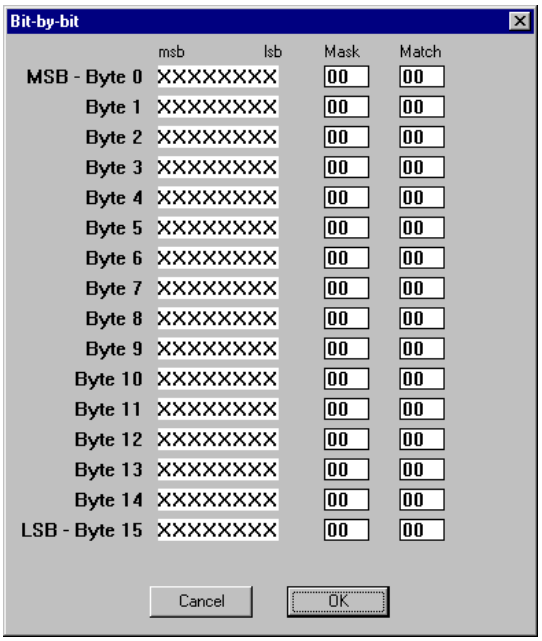
Data Pattern

Step 1 Select **Data Pattern** under **Event Groups** to display the **Data Pattern** window:



Enter a Data Pattern to be triggered upon or click **Edit** to open a pattern editor and enter data on a bit-by-bit basis.

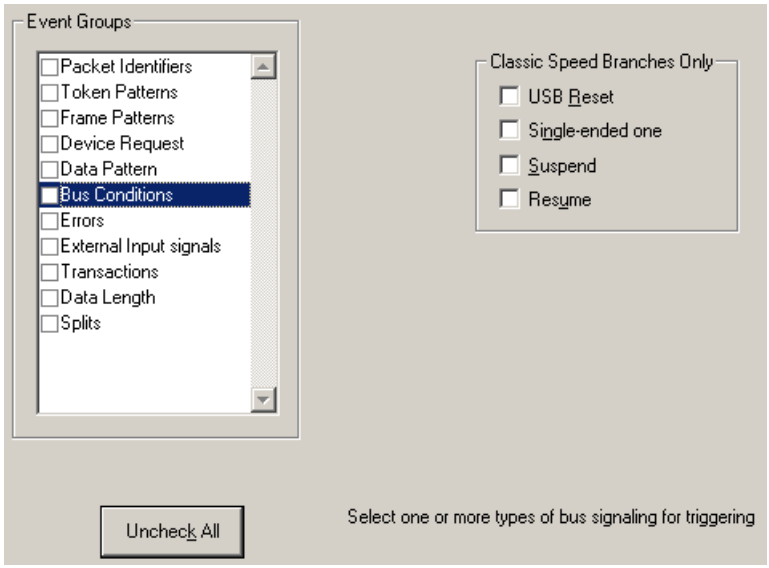
Step 2 Press the **Edit** button to display a Bit-by-Bit window:



Step 3 Click the bits within each byte that you wish to edit and enter appropriate text. The Mask and Match fields change.

Bus Conditions

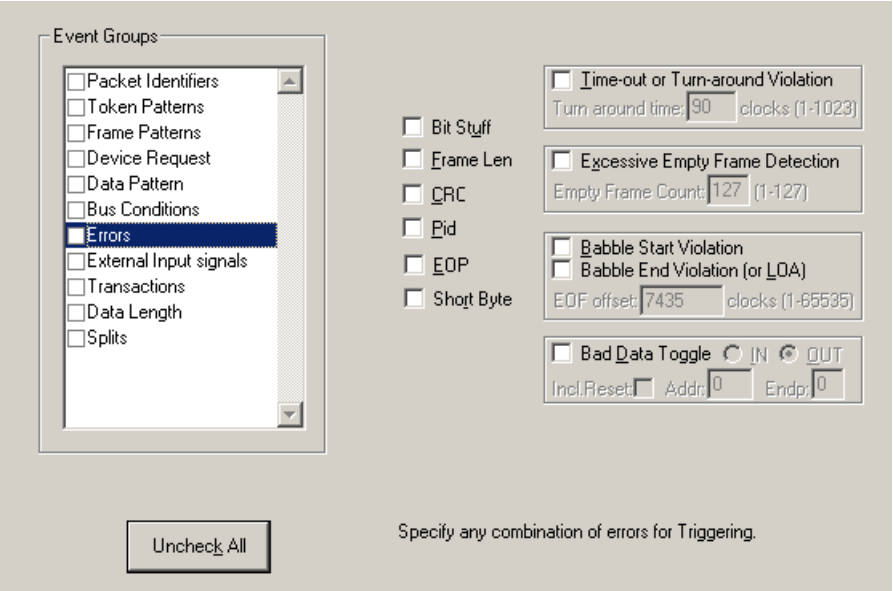
- Select **Bus Conditions** under **Event Groups** to display the **Bus Conditions** window:



Use any combination of the listed errors as a Trigger.

Errors

- Select **Errors** under **Event Groups** to display the **Errors** window:

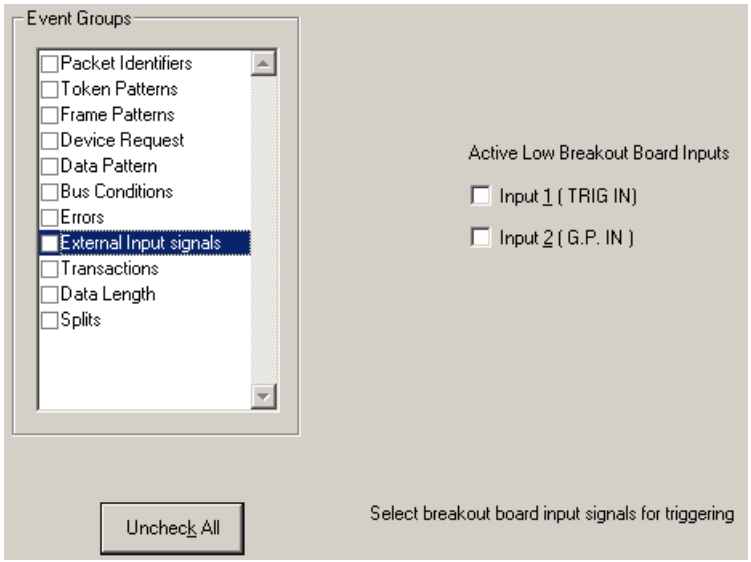


Use any combination of the listed errors as a Trigger.

- **Bit Stuffing, Frame-Length, CRC, Pid, EOP Checkboxes**: Select one or more of these errors to set these as the basis for triggering or filtering.
- **Time-out Violation**: Select this checkbox and then enter in the Turn-around time in the text box. This value tells the Analyzer how much time should elapse before triggering/filtering. Clocks are 60 MHz (with a resolution of 16.66 ns).
- **Excessive Empty Frame Detection**: Select this option and enter the empty frame count in the text box. This value tells the Analyzer how many frames should elapse before triggering/filtering.
- **Babble Start Violation**: Select this checkbox to trigger or filter whenever the start of a packet occurs too late in a Frame.
- **Babble End Violation (or LOA):** Select this to trigger/filter when the end of a packet occurs too late in a Frame. Enter a value in the **EOF offset** box from 1 to 65,535 clocks to indicate the size of the offset from start of previous SOF.
- **Bad Data Toggle**: Select this checkbox to trigger or filter whenever a Data0, Data1, Data2 toggle violation occurs.
  - Select **IN** or **OUT** if you only want triggering/filtering to occur only on IN or OUT transactions.
  - Check **Incl. Reset** if you want the first toggle value after a reset to be considered “good” regardless of the value prior to that reset. If Unchecked, toggle state is assumed to be preserved through the reset.
  - Select **Addr** and/or **Endp** to select Token Addresses and/or Endpoints.

External Input Signals

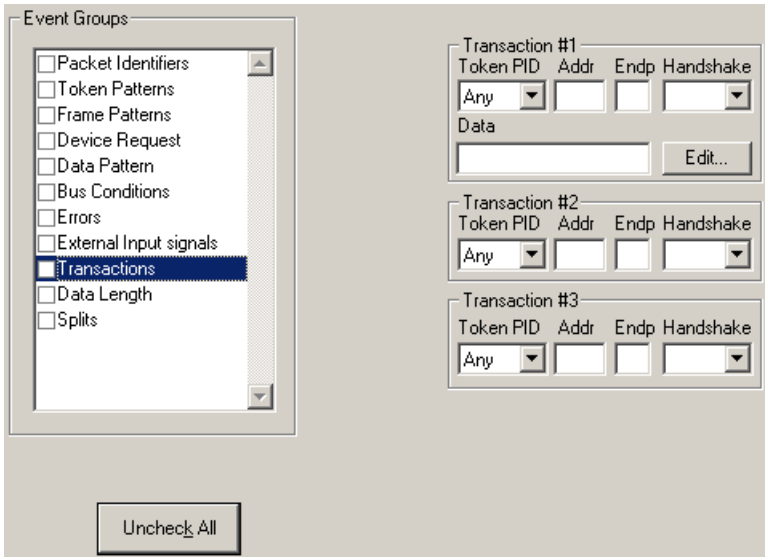
- Select **External Input Signals** under **Event Groups** to display the **External Input Signals** window:



This window has two checkboxes: **Input 1 (TRIG IN)** and **Input 2 (G.P. IN)**. Use any combination of the inputs as a Trigger.

Transactions

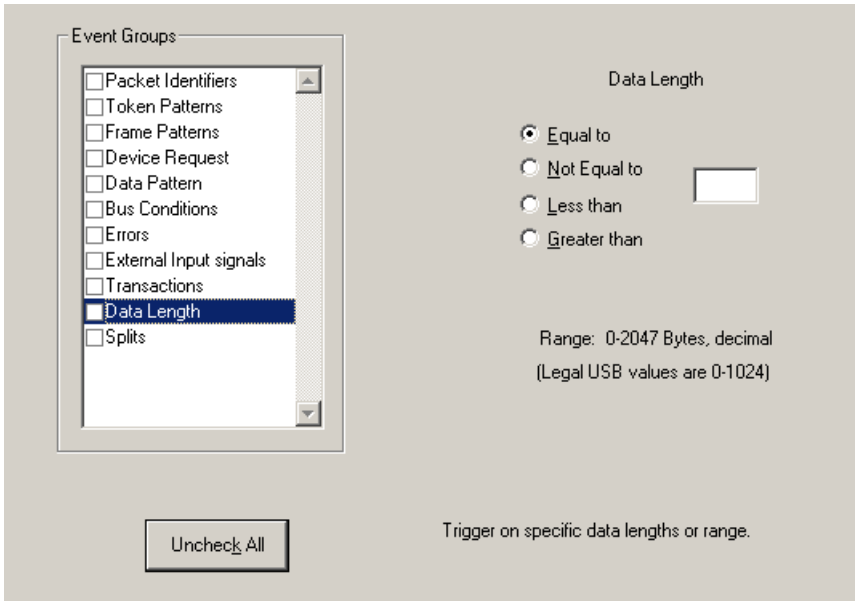
- Select **Transactions** under **Event Groups** to display the **Transactions** window:



Use any combination of the listed errors as a Trigger.

Data Length

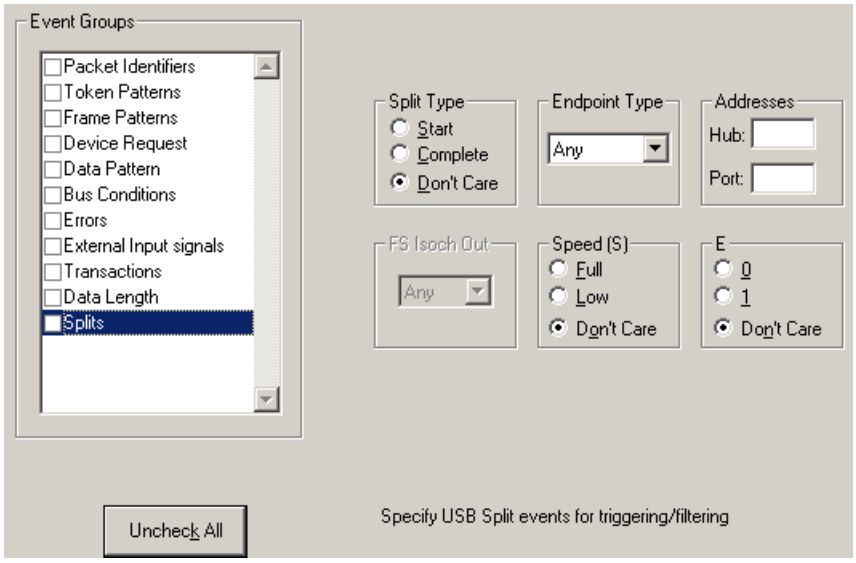
- Select **Data Length** under **Event Groups** to display the **Data Length** window:



To trigger on data length, enter a value between 0 and 1024 in the box marked **Data Length**.

Splits

- Select **Splits** under **Event Groups** to display the following window.



Selecting Splits allows you to trigger on the attributes of a Split Packet.

11.3 Actions Recording Options

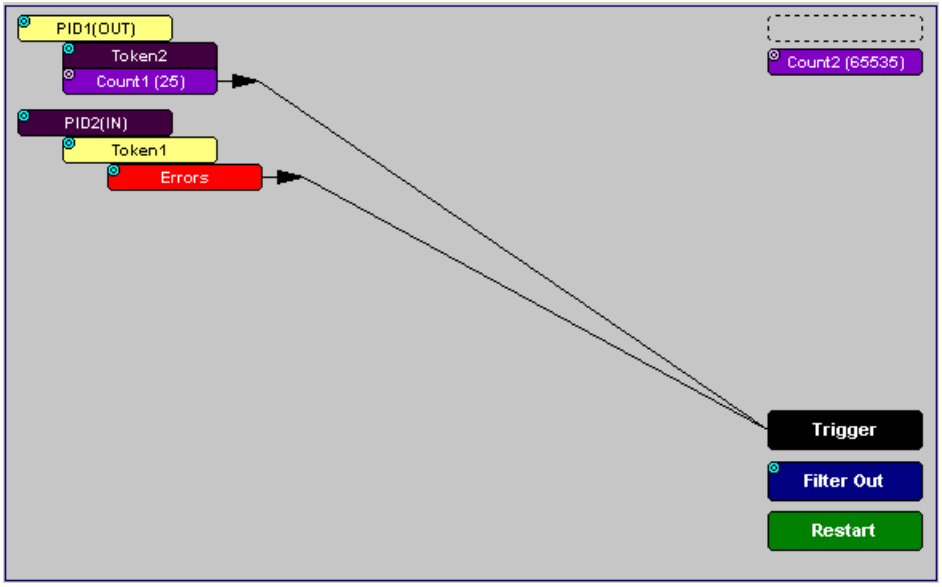
The **Actions** screen serves as a means of setting **Triggers, Filters (In or Out),** and **Counts** for the events selected in the Events window.

Actions Window Layout

The Actions window displays buttons for the events selected in the Events window. Events buttons tell Advisor what it should look for during a recording. The number of Event buttons displayed depends on the number of Events selected in the Events window. If no Events are selected, no Event buttons are displayed.

The upper right corner of the window displays a pair of counters called **Count1** and **Count2**. Counters provide a way for setting triggers based on a passage of a certain number of events. When an event is linked to a counter, the counter attaches below that event. In the following example, Advisor is set to trigger following an In Packet Identifier, then a 25 counts of a token *or* an In Packet Identifier, then a Token, then an Error.

The lower right corner displays the **Trigger**, **Filter Out**, and **Restart** buttons. Action



buttons controls the Advisor response to Event conditions. For example, if an Error button is linked to a Trigger button, the Action button tells Advisor to trigger when the error condition occurs.

The lines that join the different buttons indicate the links between Actions and Events.

11.4 Connecting Events to Actions

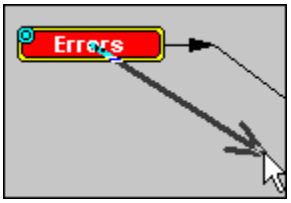
To create or edit links between Event buttons, Counters, and Action buttons, you click an Event button and then click a Counter or Action. By clicking an Event, an arrow connects the Event button to the cursor. When you click a Counter or Action button, the arrow becomes anchored to the selected button.

To make an association:

Step 1 Select one or more Events from the Events window.

Step 2 Open the Actions window.

Step 3 Click the left mouse button on an Event button such as **Errors**.



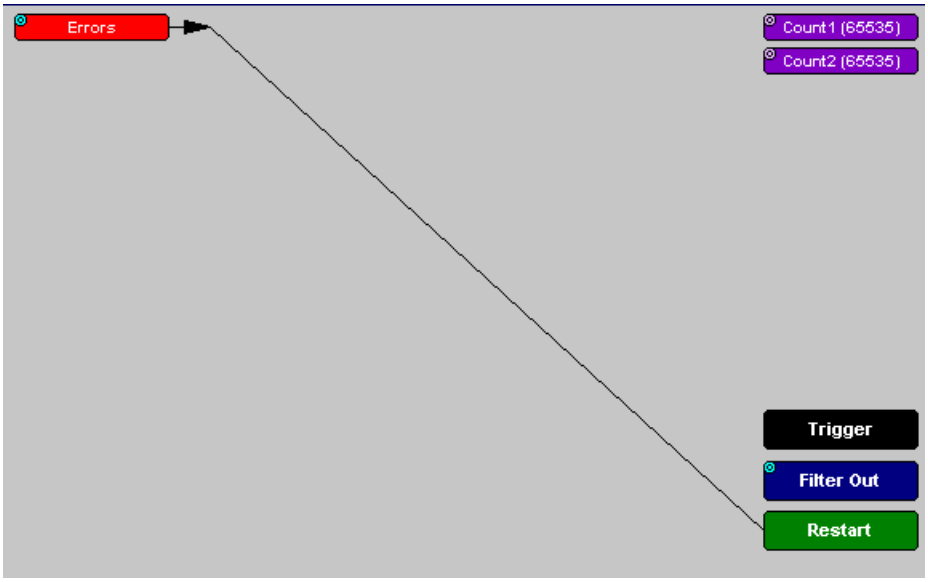
The elastic arrow appears.

Step 4 Point the mouse at the desired Action button.

The elastic arrow moves with the mouse pointer.

Step 5 With the pointer over an Actions button, click the left mouse button again.

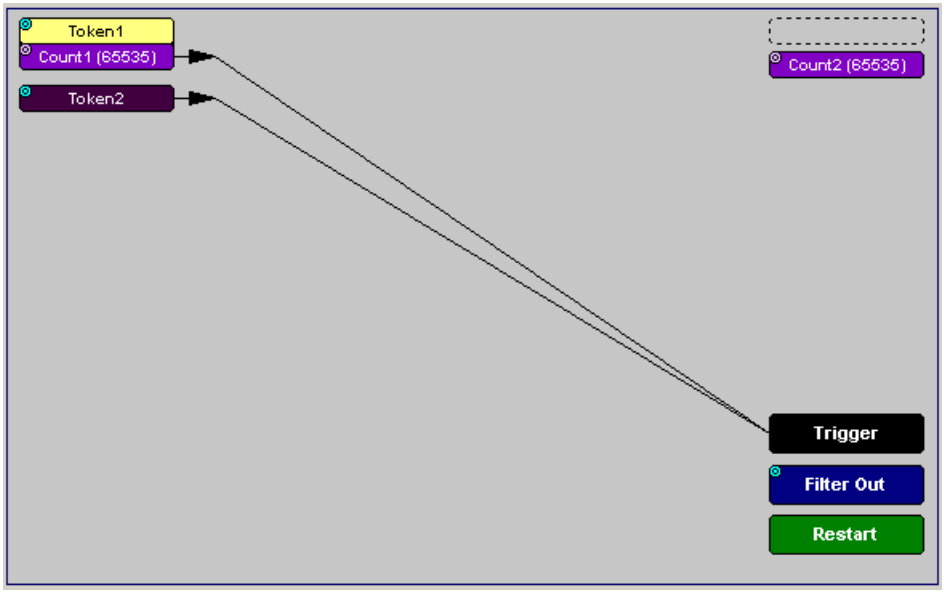
The arrow is anchored to the Action button and replaced with a black line connecting the Event button to the Action button.



11.5 Connecting Counters to Events

The center section of the Actions window displays two Counter buttons marked **Count1** and **Count2**.

Counters provide a way of triggering after a number of events have passed, such as "Trigger after the 20th IN packet."



Counters have blue dots in their top left corner that provide access to pop-up menus. The menus provide the means of setting the counter value. The counter can be set between 1 and 65,535.

To connect an event to a counter:

Step 1 Open the Event window and select an Event.

Selecting an Event causes an Event button to automatically appear in the Actions window.

Step 2 Open the Actions window.

The window displays an Event button that is connected to the Trigger button on the right via a line.

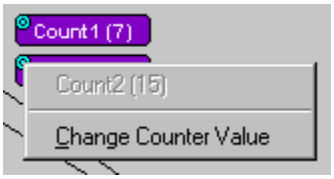
Step 3 Click the **Event** button.

An arrow appears that connects the Event button to your mouse pointer.

Step 4 Click one of the two counters.

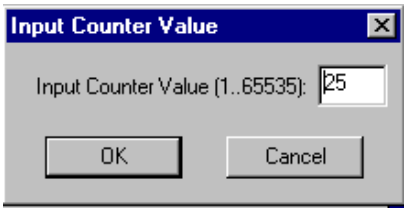
The Event automatically connects to the Counter button and then connects to the Trigger button.

Step 5 Click the **blue dot** in top left corner of the selected counter to display a pop-up menu that allows you to configure the counter.



Step 6 Choose **Change Counter Value** to open a dialog box.

Step 7 Set the counter to a value, then click **OK**.



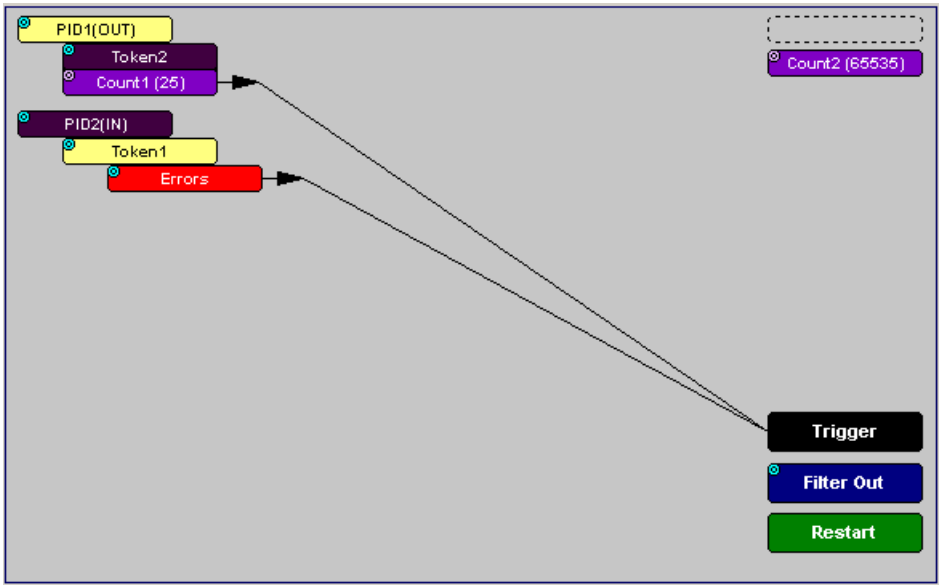
The Input Counter Value dialog box closes and the Counter button displays the selection.

Setting Multiple Conditions with Counters

You can create multiple event conditions by linking two counters to two or more events.

Linking Two Events to Two or More Counters - If an Event is linked to **Count1** and a second event is linked to **Count2**, it creates an OR statement. This statement reads "Trigger when Count1 OR Count2 has reached their specified values."

In this example, Advisor is set to trigger following an In Packet Identifier, then 25 counts of a token or an In Packet Identifier, then a Token, then an Error.



11.6 Using Action Buttons

The right section of the Actions window displays three Action buttons labeled **Trigger**, **Filter Out/In**, and Restart.

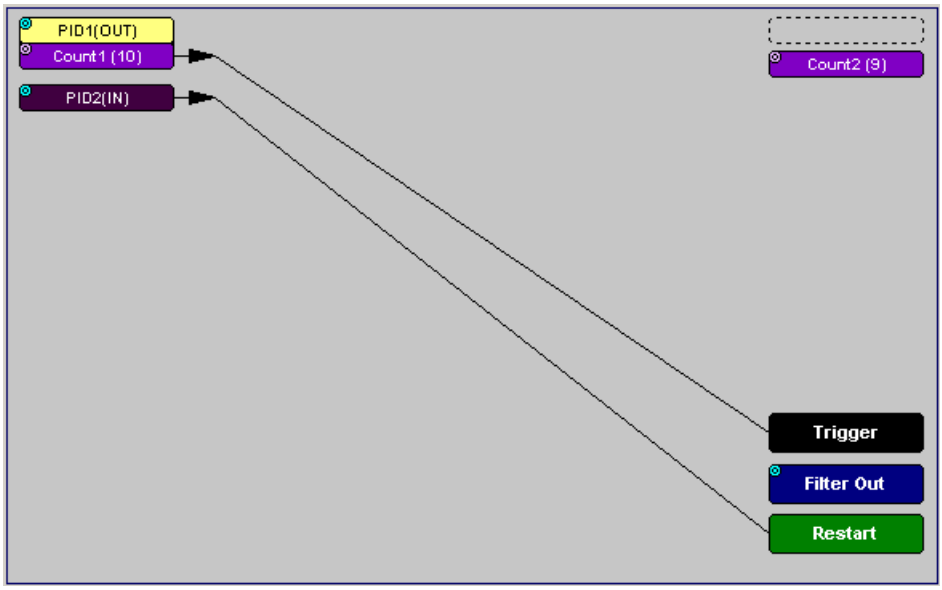
Trigger

The **Trigger** button enables event triggering.

Restart

Restart causes counters to restart counting when a certain event occurs. When Restart is used, the screen has at least two links: one between an Event and the Restart button, and a second between an Event, Counter and an Action button.

The screenshot below gives an example. The screen below reads "Look for IN and Out packets. When 10 OUT packets, trigger. However, if an IN packet occurs during the count, restart the count."



Filter Out/In

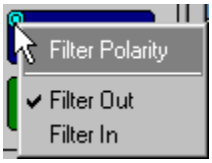
The **Filter In/Out** button causes events to be filtered in or out of the recording. **Filter Out/In** toggles between **Filter Out** and **Filter In**.

- **Filter In** records ONLY those packets related to the specified event.
- **Filter Out** records all packets EXCEPT those related to the specified event.

Note: Only events from the Token, Frame Event, Device Request, and Transaction Groups can be used to filter a recording.

To filter in or out Token, Frame Event, Device Request, and/or Transaction Group events from a recording:

Step 1 Click the blue dot on **Filter Out** (may say **Filter In** depending on the last action specified) to display the **Filter Polarity** menu:



Toggle the selection between **Filter Out** and **Filter In**.

Step 2 Select **Filter In**.

The button changes to read Filter In.

11.7 Other Actions: External Output Signals

Most Event buttons can be configured to trigger external output signals.

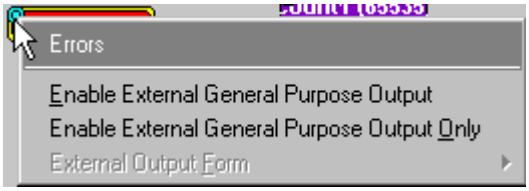
If a blue dot is present in the Event button, it means that a menu is present with three options for configuring external output signalling:

- Enable External General Purpose Output
- Enable External General Purpose Output only
- External Output Form

If you choose to enable External Output signalling, a small blue arrow projects from the Event button. This arrow is a reminder that External Signals have been set.

To enable or disable external trigger output:

Step 1 Click the blue dot on an Event button.



A menu similar to the one below opens. The menu may say Disable instead of Enable.

Step 2 Select **Enable External Trigger Output** or **Disable External Trigger Output**.

If you select **Enable External Trigger Output**, a small arrow appears on the right side of the button to indicate that a condition has been set for creating an external output signal.

Choosing **Disable External Trigger** causes the arrow to disappear.

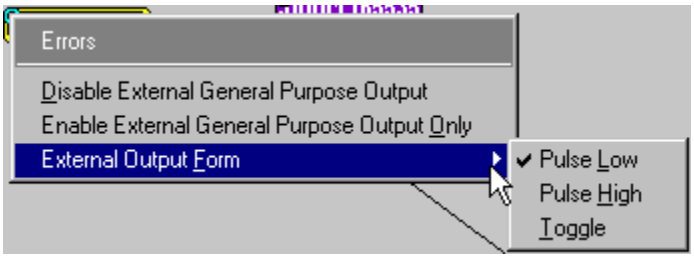
Enabling High Pulse, Low Pulse or Pulse Toggle Signal Outputs

If you chose **External Trigger Output** in the previous steps, an additional choice appears in the Blue Dot menu, **Enable External Trigger,** that lets you control the output signal.

Step 1 Click the blue dot on an event button that has a small arrow attached to it like the one shown above.

A Blue Dot menu opens. **External Trigger Form** should be an option. If it is not, choose **Enable External Trigger** and then reopen the menu.

Step 2 Choose **External Trigger Form** to display a menu with choices for **Pulse Low, Pulse High,** and **Toggle**.



Step 3 Choose an option not currently selected to close the menu.

Step 4 Reopen the menu.

Note that the new selection is now checked.

11.8 Saving Recording Options

To complete your Recording Options settings, use the features at the bottom of the **Recording Options** screen. These features remain the same no matter which of the three Recording Options screens you are working in.

- Click **Save** to save the currently specified Recording Options for use in future recording sessions. Any file name can be specified, though use of the **.rec** is recommended; if no extension is specified, **.rec** is added by default.
- Click **Load** to load a previously saved ***.rec** file, thus restoring a previous set of Recording Options.
- The **Save as Default** function is equivalent to the **Save** function, specifying the file name **default.rec.** Whenever you start up the Analyzer, it automatically loads the **default.rec** file if one exists.
- Click **OK** to apply any changes and close this dialog box.
- Click **Cancel** to cancel any immediate changes you have made and exit the Recording Options menu.

11.9 Recording Bus Data

Note: If you have inserted any event triggers, be sure to select *Event Trigger* under the General tab in the Recording Options dialog box.

To start recording USB traffic after setting the appropriate Recording Options:

Step 1 Select **Start** under **Record** on the Menu Bar.

OR

Click on the Tool Bar.

Your recording session can continue until it has finished naturally or

you may need to stop manually by clicking on the Tool Bar, depending on how you set the Recording Options.

To manually stop recording:

Step 2 Select **Stop** under **Record** on the Menu Bar.

OR

Click on the Tool Bar.

Note: The manual Stop Recording feature is primarily of use when recording low-speed traffic, which can take a long time to fill the recording buffer.

While uploading is still in progress, hitting the stop button opens a dialog that contains the following options:

- Partial Upload (loads only a portion of the trace)
- Flush current file
- Keep only what was uploaded so far
- Continue uploading

When the recording session is finished, the bus traffic is saved to the hard drive as a file named **data.usb** or whatever name you assign as the default filename.

To save a current recording for future reference:

Step 3 Select **Save As** under **File** on the Menu Bar.

OR

Click on the Tool Bar.

You see the standard **Save As** screen.

Step 4 Give the recording a unique name and save it to the appropriate directory.

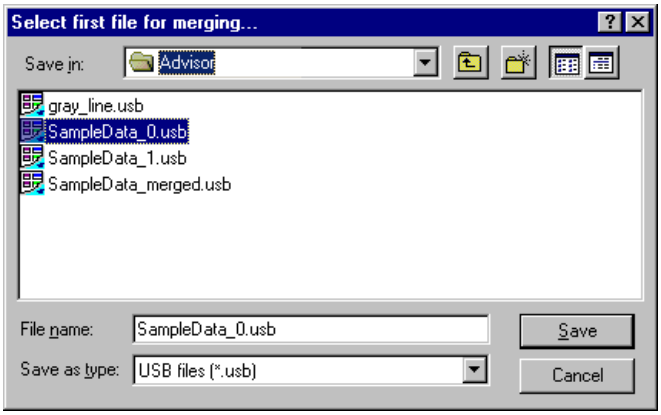
11.10 Merging Trace Files

It is possible to merge a Classic-Speed trace file with a Hi-Speed trace file using the Merge Trace File command under the File menu. This option only works with files that were created simultaneously through a single recording session. If the files were recorded during separate recording sessions, Advisor generates an error message and prevents the merge from completing.

Note: Advisor is capable of merging High Speed and Classic Speeds traffic into a single merged file if the **Auto-Merge 2 Channel Trace Files** option is checked in the Recording Options dialog box. See page 115 for details.

To merge two trace files:

Step 1 Select **File > Merge Trace Files** to open a dialog box asking for the first source file.



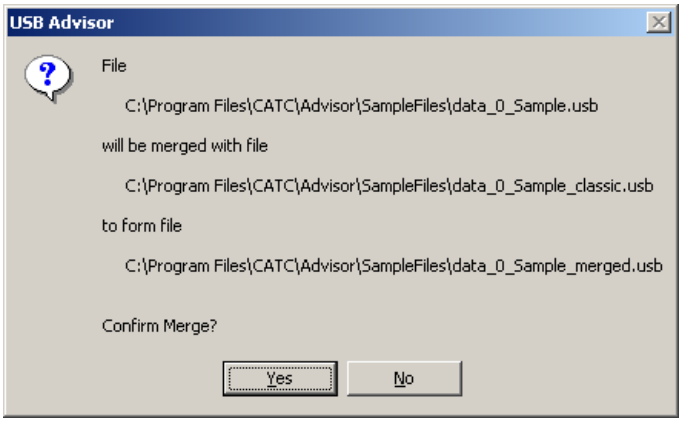
Note: The **Merge Trace Files** command can be run with or without a trace file open on the screen. The merge process ignores the open file.

Step 2 Select the first trace file to be merged, then click **Save**.

Note: It does not matter which of the two trace files is first selected, as long as both were recorded in the same session.

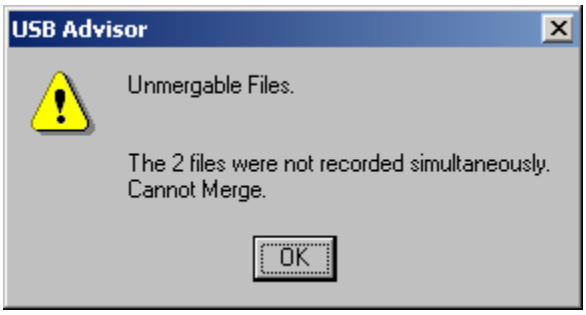
Step 3 Select the second trace file to be merged, then click **Save**.

Step 4 Click **Yes** to confirm your choices.



The two files are merged into the new file **data_merged.usb**.

Note: If you attempt to merge two files that were recorded in separate recording sessions, the following error message appears:



Chapter 12: Updates

From time to time as modifications are made to the Advisor Analyzer, it is necessary to update the Advisor for optimal performance. Updates can be performed two ways: either automatically or manually. This chapter describes both procedures.

12.1 Software, Firmware, and BusEngine Revisions

The **Readme.txt** file on the installation CD and in the installed directory gives last-minute updates about the current release. Included with each release are the most recent downloadable images of the Firmware and the BusEngine™.

Once the Analyzer has completed the self-diagnostics and is connected to the PC, you can check the latest revision of the software and BusEngine by selecting **About Advisor…** from the **Help** menu.:

About USB Advisor details revisions of the following software and hardware:

- Advisor Software Version
- Advisor Firmware Version
- BusEngine Version
- Unit Serial Number

Note: When contacting LeCroy for technical support, please have available all the revisions reported in the **About USB Advisor** window.

12.2 Software Updates

When a new software release is available, it is posted on the Support page of the LeCroy website at **www.lecroy.com/support.html**.

To update the software:

Step 1 In the **About Advisor** screen, verify which version of LeCroy USB Advisor™ Software you are currently running.

Step 2 Find the latest released software version on the LeCroy website under **Support**.

If you are running the latest version of the software, no further action is needed.

If you are **not** running the latest version, continue to Step 3.

Step 3 Download the Zip files from the website.

Step 4 Unzip the files into your choice of directory.

Step 5 Click **Start**, then **Run**, and browse to where you unzipped the files.

Step 6 Select the program named **Setup** and click **Open**.

Step 7 Click **OK** to run the Setup and begin the installation.

Step 8 Follow the on-screen instructions to complete the installation.

Step 9 Read the Readme.txt file for important information on changes in the release.

12.3 BusEngine and Firmware Updates

BusEngine and Firmware updates often need to be performed when you update the Advisor software. These updates can be performed automatically or manually. Both processes are described.

Updating the Firmware

Within a new software release, it may also be necessary to update the Analyzer's firmware for proper operation. The Readme file informs you if this is necessary.

Automatic Updates

When the Advisor software is updated, the software may become incompatible with the BusEngine and Firmware. If a recording is attempted, Advisor displays an error message and then automatically begins an update process for the BusEngine and Firmware.

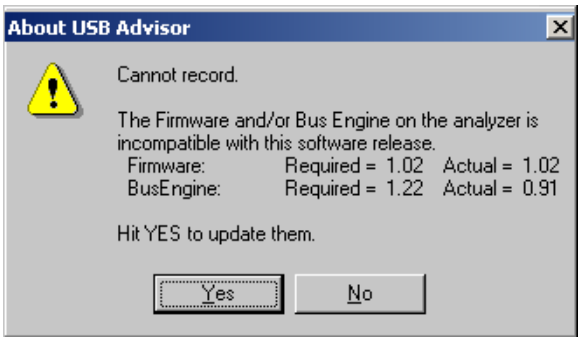
To perform an automatic BusEngine and Firmware update, follow these steps:

Step 1 If needed, update the Advisor software using the steps outlined in "Software Updates" on page 138.

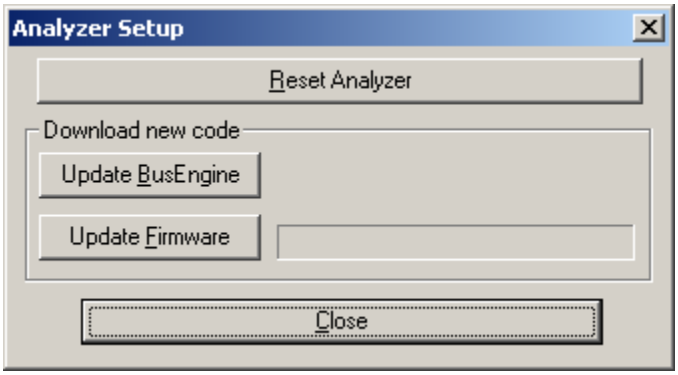
Step 2 Turn on the Analyzer.

Step 3 On the Tool Bar, click the REC button.

Since the BusEngine and/or the Firmware are incompatible with the current Advisor software version, an error message appears displaying your current versions and indicating what versions you need to install.



Step 4 Click **Yes** to close the window closes and open the Analyzer Setup window.

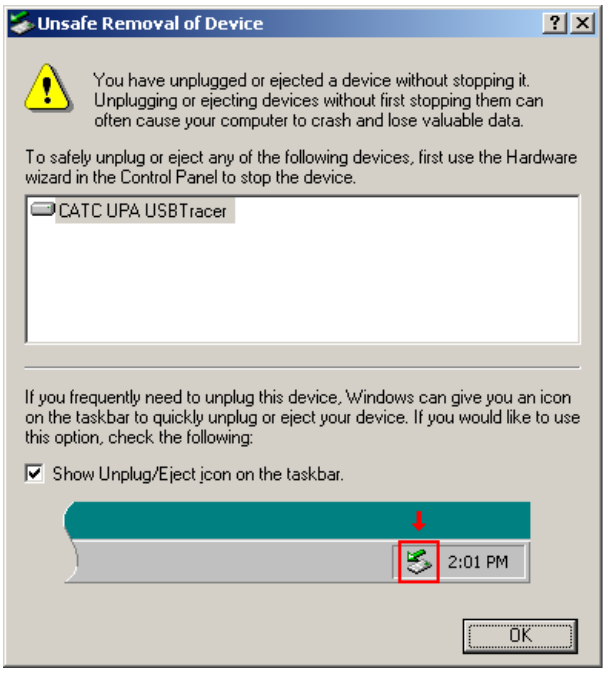


Step 5 Click **Update BusEngine** or **Update Firmware** on the **Analyzer Setup** screen.

You can select only one item at this point. If both the BusEngine and the Firmware need to be updated, the update completes the first item and then returns to the above screen so the second update can be performed.

If you are running Power cycle Advisor to complete the update.

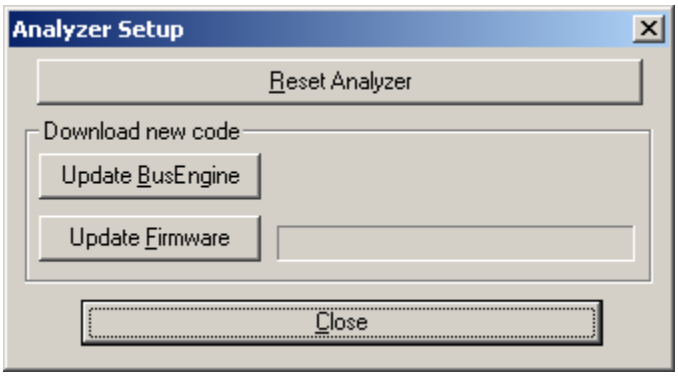
If you are running Microsoft® Windows® 2000, the Analyzer automatically reboots and causes the following message to appear. **Note:** Support for Windows 2000 will end on January 1, 2008. When this message appears, click **OK**. **You do not need to power cycle the Analyzer**.



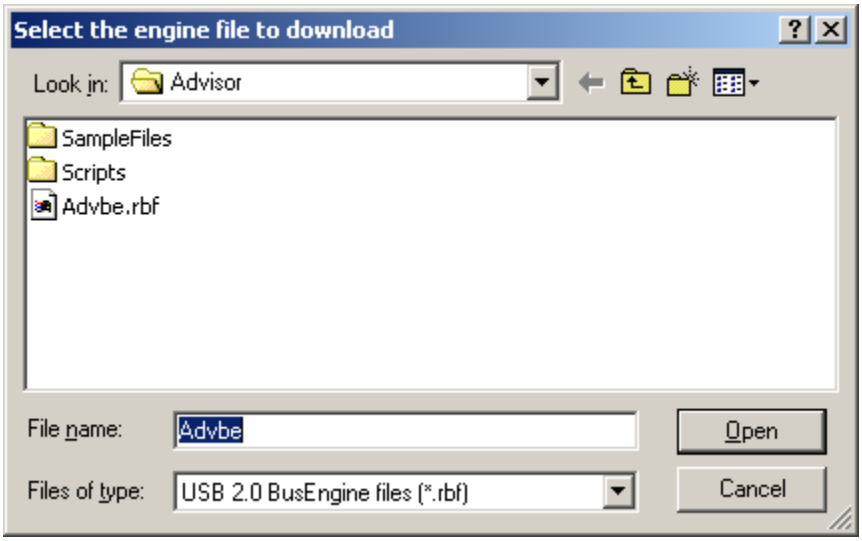
Manual Updates to BusEngine and Firmware

You can manually update the Advisor Firmware and/or BusEngine by completing the following steps:

Step 1 Select **Analyzer** under **Setup** on the Menu Bar to display the **Analyzer Setup** screen:



Step 2 To update the BusEngine, click **Update BusEngine** on the **Analyzer Setup** screen to display the **Select engine file to download** window:



The program displays the correct file (**Advbe.rbf**) in the **File name** field. This file is used to update the Analyzer alone.

Note: The most current Primary BusEngine file was copied to your **\LeCroy\Advisor** directory when you installed the program.

Step 3 Click **Open**.

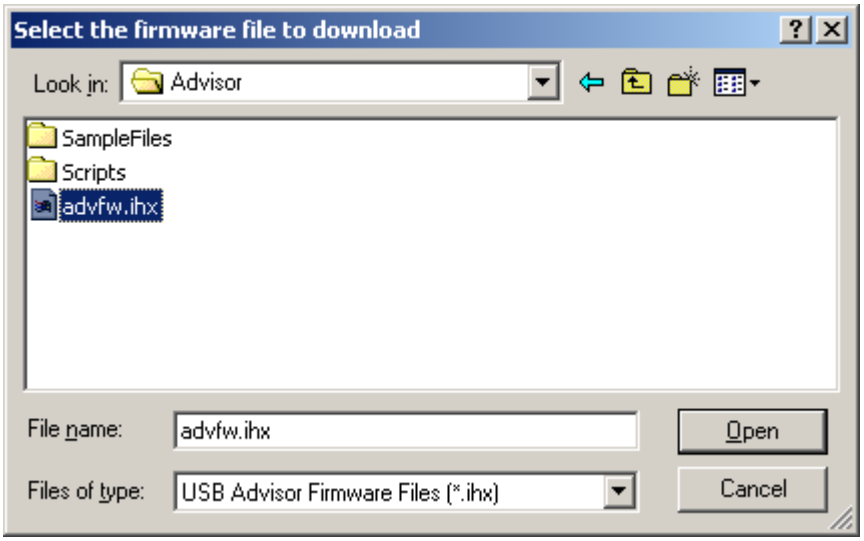
Step 4 Power cycle the Analyzer.

Re-initialization takes a couple of minutes.

Manually Upgrading the Firmware

To update the firmware:

Step 1 Click **Update Firmware** on the **Analyzer Setup** screen to display the **Select firmware file to download** window:



The program has already automatically searched for the correct file and displays it in the **File name** field.

Step 2 Click **Open**.

The Analyzer updates the Firmware.

Step 3 Unplug the USB cable from the back of the Analyzer box and then reinsert it so the new Firmware update can take effect.

Resetting the Analyzer

Clicking the **Reset Analyzer** button is equivalent to power cycling the Advisor Analyzer.

Appendix A: Legacy Script Decoding

Earlier LeCroy USB Analyzers used **.REQ** and **.DSC** script files to decode class and vendor requests.

- **.REQ** stands for Requests.
- **.DSC** stands for Descriptors.

This method uses fixed definitional structures.

For legacy script decoding, LeCroy provides **.req** files for the following requests and classes:

- Standard Requests (standard.req)
- Hub Class (hub.req)
- HID Class (hid.req)
- Printer Class (printer.req)
- Communications Class (communication.req)
- Audio Class (audio.req)
- Bluetooth USB HCI commands and events (bluetooth.req)
- Vendor Request definition file (vendor.req)

Note: .req files are no longer used in LeCroy USB Analyzers.
In addition, .req files are not compatible with the UWBTracer application.
The new script decoding for LeCroy USB Analyzers uses Script Decoder version .dec files.
.dec files are compatible with the UWBTracer application.
It is highly recommended that you use the new Script Decoder mechanism.
For information about .dec files and the new script decoding, see "Class and Vendor Definition Files" on page 85.

If you must add your own **.req** file for a Class or Vendor Request, do the following:

Step 1 Use the **Notepad** application to create and edit your own Request Definition file (for example, **my_vendor_commands.req**).

Note: To learn to write such a file, review the Request (**.req**) files provided by LeCroy.

Step 2 Add the name of your Request file to the **request.lst** file.

Step 3 Click **Setup**. The decoding menu in the Class/Vendor List appears.

Appendix B: China Restriction of Hazardous Substances Table

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

	有毒有害物质和元素					
部件名称	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr^{6+})	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
PCBAs	X	O	X	X	X	X
机械硬件	O	O	X	O	O	O
金属片	O	O	X	O	O	O
塑料部件	O	O	O	O	X	X
电源	X	X	X	O	X	X
电源线	X	O	X	O	X	X
保护外壳(如有)	O	O	O	O	X	X
电缆组件(如有)	X	O	X	O	X	X
风扇(如有)	X	O	X	O	X	X
交流滤波器和熔丝组件(如有)	X	O	X	O	O	O
外部电源(如有)	X	X	X	O	X	X
探头(如有)	X	O	X	O	X	X
O: 表明该有毒有害物质在该部件所有均质材料中的含量均在 SJ/T11363-2006 标准规定的限量要求之下。						
X: 表明该有毒有害物质至少在该部件的某一均质材料中的含量超过 SJ/T11363-2006 标准规定的限量要求。						

EFUP (对环境友好的使用时间) 使用条件：参阅本手册“规范”部分规定的环境条件。

	Toxic or Hazardous Substances and Elements					
Part Name	Lead (Pb)	Mercury (Hg)	Cadmium (Cd)	Hexavalent Chromium (Cr^{6+})	Polybrominated Biphenyls (PBB)	Polybrominated Diphenyl Ethers (PBDE)
PCBAs	X	O	X	X	X	X
Mechanical Hardware	O	O	X	O	O	O
Sheet Metal	O	O	X	O	O	O
Plastic Parts	O	O	O	O	X	X
Power Supply	X	X	X	O	X	X
Power Cord	X	O	X	O	X	X
Protective Case (if present)	O	O	O	O	X	X
Cable Assemblies (if present)	X	O	X	O	X	X
Fans (if present)	X	O	X	O	X	X
AC Filter/Fuse Assy (if present)	X	O	X	O	O	O
Ext Power Supply (if present)	X	X	X	O	X	X
Probes (if present)	X	O	X	O	X	X
O: Indicates that this toxic or hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement specified in SJ/T11363-2006.						
X: Indicates that this toxic or hazardous substance contained in at least one of the homogenous materials used for this part is above the limit requirement specified in SJ/T11363-2006.						

EFUP (Environmental Friendly Use Period) Use Conditions: refer to the environmental conditions stated in the specifications section of this Manual.

How to Contact LeCroy

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

Limited Hardware Warranty

So long as you or your authorized representative ("you" or "your"), fully complete and return the registration card provided with the applicable hardware product or peripheral hardware products (each a "Product") within fifteen days of the date of receipt from LeCroy or one of its authorized representatives, LeCroy warrants that the Product will be free from defects in materials and workmanship for a period of three years (the "Warranty Period"). You may also complete your registration form via the internet by visiting http://www.catc.com/support/register/. The Warranty Period commences on the earlier of the date of delivery by LeCroy of a Product to a common carrier for shipment to you or to LeCroy's authorized representative from whom you purchase the Product.

What this Warranty Does Not Cover

This warranty does not cover damage due to external causes including accident, damage during shipment after delivery to a common carrier by LeCroy, abuse, misuse, problems with electrical power, including power surges and outages, servicing not authorized by LeCroy, usage or operation not in accordance with Product instructions, failure to perform required preventive maintenance, software related problems (whether or not provided by LeCroy), problems caused by use of accessories, parts or components not supplied by LeCroy, Products that have been modified or altered by someone other than LeCroy, Products with missing or altered service tags or serial numbers, and Products for which LeCroy has not received payment in full.

Coverage During Warranty Period

During the Warranty Period, LeCroy or its authorized representatives will repair or replace Products, at LeCroy's sole discretion, covered under this limited warranty that are returned directly to LeCroy's facility or through LeCroy's authorized representatives.

How to Obtain Warranty Service

To request warranty service, you must complete and return the registration card or register via the internet within the fifteen day period described above and report your covered warranty claim by contacting LeCroy Technical Support or its authorized representative.

You can reach LeCroy Technical Support at 800-909-7112 or via email at support@catc.com. You may also refer to the LeCroy website at http://www.lecroy.com for more information on how to contact an authorized representative in your region. If warranty service is required, LeCroy or its authorized representative will issue a Return Material Authorization Number. You must ship the Product back to LeCroy or its authorized representative, in its original or equivalent packaging, prepay shipping charges, and insure the shipment or accept the risk of loss or damage during shipment. LeCroy must receive the Product prior to expiration of the Warranty Period for the repair(s) to be covered. LeCroy or its authorized representative will thereafter ship the repaired or replacement Product to you freight prepaid by LeCroy if you are located in the continental United States. Shipments made outside the continental United States will be sent freight collect.

Please remove any peripheral accessories or parts before you ship the Product. LeCroy does not accept liability for lost or damaged peripheral accessories, data or software.

LeCroy owns all parts removed from Products it repairs. LeCroy may use new and/or reconditioned parts, at its sole discretion, made by various manufacturers in performing warranty repairs. If LeCroy repairs or replaces a Product, the Warranty Period for the Product is not extended.

If LeCroy evaluates and determines there is "no trouble found" in any Product returned or that the returned Product is not eligible for warranty coverage, LeCroy will inform you of its determination. If you thereafter request LeCroy to repair the Product, such labor and service shall be performed under the terms and conditions of LeCroy's then current repair policy. If you chose not to have the Product repaired by LeCroy, you agree to pay LeCroy for the cost to return the Product to you and that LeCroy may require payment in advance of shipment.

General Provisions

THIS LIMITED WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS. YOU MAY HAVE ADDITIONAL RIGHTS THAT VARY BY JURISDICTION. LECROY'S RESPONSIBILITY FOR DEFECTS IN MATERIALS AND WORKMANSHIP IS LIMITED TO REPAIR AND REPLACEMENT AS SET FORTH IN THIS LIMITED WARRANTY STATEMENT. EXCEPT AS EXPRESSLY STATED IN THIS WARRANTY STATEMENT, LECROY DISCLAIMS ALL EXPRESS AND IMPLIED WARRANTIES FOR ANY PRODUCT INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTIES OF AND CONDITIONS OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, AND ANY WARRANTIES THAT MAY ARISE FROM ANY COURSE OF DEALING, COURSE OF PERFORMANCE OR TRADE USAGE. SOME JURISDICTIONS MAY NOT ALLOW LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY LASTS, SO THE PRECEDING LIMITATION MAY NOT APPLY TO YOU.

LECROY DOES NOT ACCEPT LIABILITY BEYOND THE REMEDIES SET FORTH IN THIS LIMITED WARRANTY STATEMENT OR FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES INCLUDING, WITHOUT LIMITATION, ANY LIABILITY FOR THIRD PARTY CLAIMS AGAINST YOU FOR DAMAGES, PRODUCTS NOT BEING AVAILABLE FOR USE, OR FOR LOST DATA OR SOFTWARE. LECROY'S LIABILITY TO YOU MAY NOT EXCEED THE AMOUNT YOU PAID FOR THE PRODUCT THAT IS THE SUBJECT OF A CLAIM. SOME JURISDICTIONS DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE PRECEDING EXCLUSION OR LIMITATION MAY NOT APPLY TO YOU.

The limited warranty on a Product may be transferred for the remaining term if the then current owner transfers ownership of the Product and notifies LeCroy of the transfer. You may notify LeCroy of the transfer by writing to Technical Support at LeCroy, 3385 Scott Blvd., Santa Clara, CA 95054 USA or by email at: support@catc.com. Please include the transferring owner's name and address, the name and address of the new owner, the date of transfer, and the Product serial number.

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