PROTOCOL SOLUTIONS GROUP
3385 SCOTT BLVD
SANTA CLARA, CA 95054

LeCroy USB*Mobile*HS™ Protocol Analyzer

User Manual

Manual Version 2.30

For Software Version 2.3

July 2006

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Chapter 1: Overview

The LeCroy USB*Mobile*HS™ USB Hi-Speed Analyzer is a portable, PC Card based, bus and protocol analyzer that accurately and efficiently debugs, tests and verifies Low, Full, and Hi-Speed USB semiconductors, devices, software and systems. USB*Mobile*HS features the CATC Trace software, the *de facto* standard for recording and analyzing USB protocol traffic. The CATC Trace simplifies the overall debug process by using collapsible, color-coded schemes to represent the USB Packet, Transfer and Transaction layers. Its native On-The-Go (OTG) support automatically detects, decodes, and displays the HNP and SRP protocols, including VBus pulsing. The USB*Mobile*HS builds upon LeCroy's experience and knowledge of the needs of the USB development and test communities. The result is a USB bus and protocol analyzer with unprecedented functionality, unparalleled flexibility, and uncompromising user friendliness.

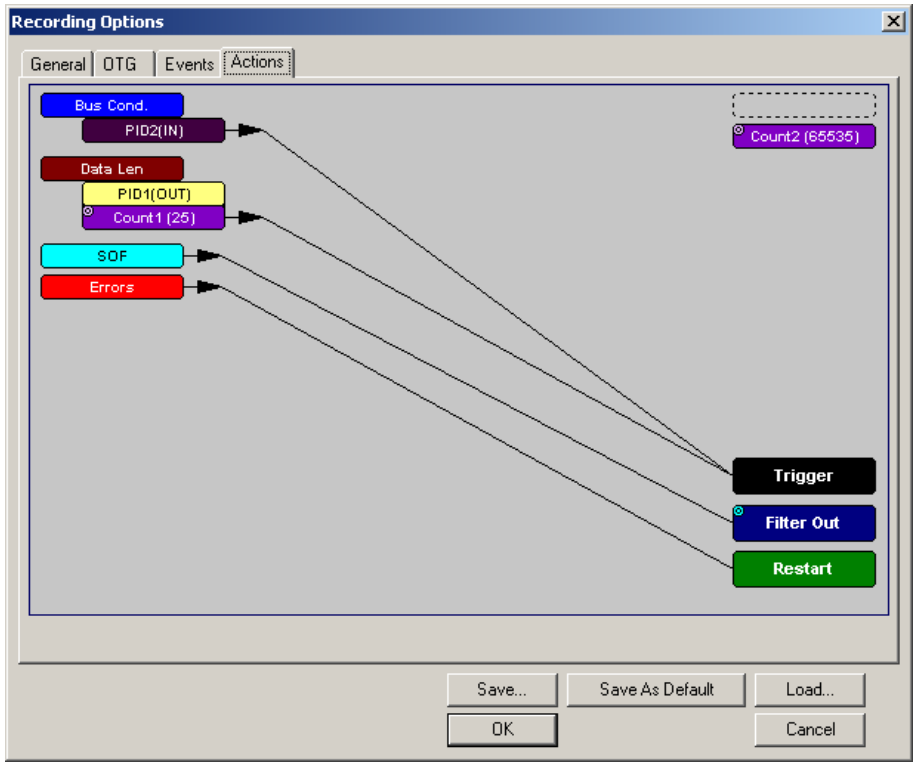
Features	**Benefits**
Low power, 16 bit, Type II PC Card Design	Personal analyzer. Portable operation with any notebook PC
CATC Trace software display	Industry standard speeds up interpretation and debug of USB traffic. Compatible with LeCroy USB*Mobile*™, Inspector™, Chief™, Advisor™, and USB*Tracer*/*Trainer*™
OTG (On-The-Go) Support	Record and analyze HNP and SRP including the capturing of VBus pulses
Trace Navigator	Define areas of interest and "shrink" the viewable Trace to areas of most importance
Advanced Triggering	Isolate important traffic, specific errors or data patterns
Hardware Filtering	Faster analysis by removing non essential fields from the trace
Intelligent Reporting	Quickly identify and track error rates, abnormal bus or timing conditions
Sophisticated Viewing	View Packet, Transaction and Transfer layers of the USB protocol
Downloadable trace viewer software	Share and annotate trace recordings within a development team

1.1 Event Triggering

For efficient development of USB systems, it is critical that users are able to extract important information from a crowded stream of bus traffic, and accurately identify and selectively record information that is of most interest. The Events and Action fields for trigger set-up is intuitive and graphical, thus making pre-recording set-up time efficient.

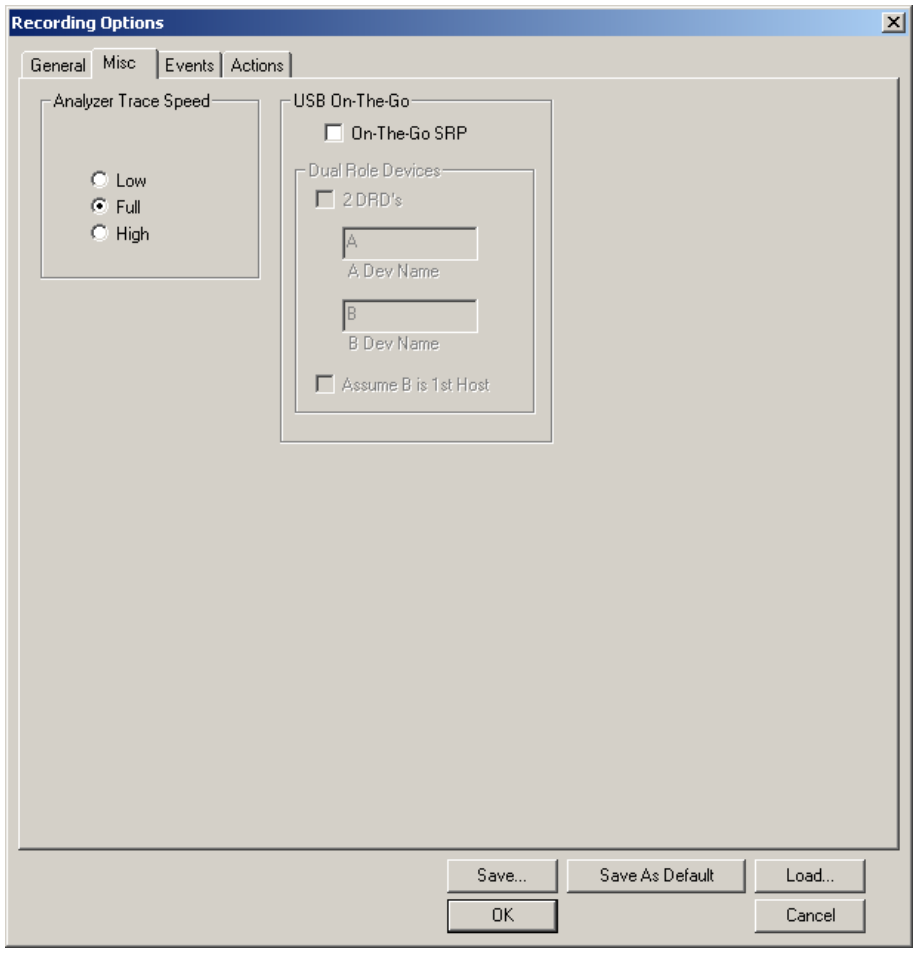
USB*Mobile*HS provides real-time hardware triggering on the critical components of USB. Users can custom-configure and control order of events selected for triggering. The count and sequence options define the rules for data recording sessions. There are two Counters, Filter Out/In and a Restart option that causes sequencing and counting to start again. Any sequence can include up to seven events of any type.

Users can adjust the depth of the recording memory - up to 64 megabytes - and determine where in the recording the trigger is located.



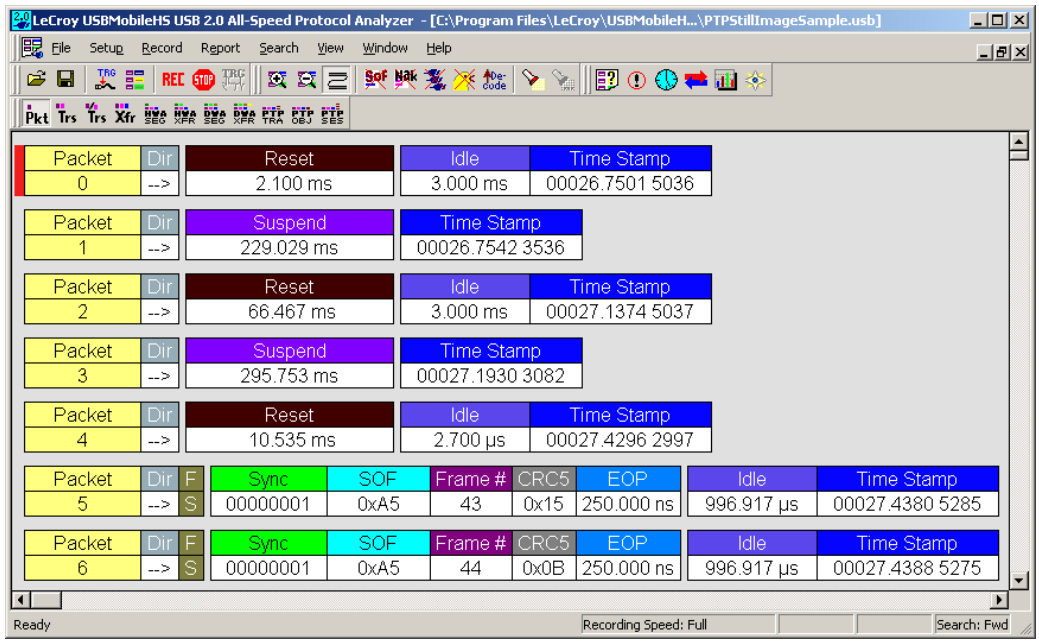
1.2 On The Go Support

The USB*Mobile*HS supports OTG (On-The-Go) capabilities. OTG is an emerging standard in the USB specifications that allows peer-to-peer connectivity among USB devices and provides a standard USB connection among portable devices. The Analyzer identifies both the HNP (Host Negotiation Protocol) and SRP (Session Request Protocol) occurrences, searches for Host A or B, and identifies timing anomalies during HNP and SRP protocols.



1.3 The CATC Trace

The CATC Trace's ability to extract critical information quickly and intuitively from a crowded stream of bus traffic is unparalleled. The ability to accurately identify and isolate very specific packets is vital to speeding debug and development time. Powerful Search and Find options allow users to quickly get to specific packets, errors and any data type within a trace file. With filter and hide commands, the CATC Trace removes irrelevant data from the Trace for efficient viewing.



1.4 Features

General

- Fully compliant with USB 2.0 specification
- Supports Full-Speed, Low-Speed, and Hi-Speed USB
- User friendly "CATC Trace™" Interface that displays bus traffic using color and graphics
- Trace Viewer available as free non-recording, view-only software
- Three year warranty and hot-line customer support

Physical Components

- PC-Card form factor: Personal analyzer. Low-power, portable operation with any notebook PC.
- Two Mini AB USB ports and cables: Designed to reduce bulk and maintain portability and compact size.
- 64MB of physical recording memory

Recording Options

- Versatile triggering - bit-wise value and mask data patterns up to sixteen bytes wide for Setup transactions and data packets.
- Triggering on new High-speed PIDs and split transaction special tokens (ERR, SPLIT, PING, NYET, DATA2, and MDATA).
- CATC Trace displays and enumerates High-speed Micro Frames.
- Three forms of triggering: Snapshot, Manual and Event.
- Transaction sequencer allows triggering on a token qualified by a data pattern and /or specific handshake or alternately transactions can be filtered (i.e., NAK'd transactions).
- Advanced triggering with event counting and sequencing.
- 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, Token, Bus Conditions, Data Length, excessive empty frames.
- Real-time traffic capture filtering and data packet truncation variable up to 256 bytes.
- Adjustable buffer size from 0.4 MB to 64 MB.

Display Options

- Utilizes the CATC Trace graphical display of bus packets, transactions, split transactions and transfers.
- Numerous packets and transactions can be grouped under a single transfer while quickly decoding all essential information.
- Decoding of split transactions up and down stream of a transaction translator is accomplished with a special hierarchical view.
- Variety of reports provided to summarize key statistics and conditions of interest with the ability to jump to the selected item in the trace display.
- Flexible input signaling can be recorded with the CATC Trace.
- Trace Viewer is backward compatible with USB*Tracer*™, USB*Mobile*™, Advisor™, 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.
- Hide start-of-frame (SOF) packets as well as any packet or transaction.
- Search for a specific PID.
- 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 disks for the latest information on features.

Chapter 2: General Description

2.1 USB*Mobile*HS System Components

The LeCroy USB*Mobile*HS 2.0 Hi-Speed Protocol Analyzer package includes the following items:

- One LeCroy USB*Mobile*HS Analyzer
- One 1-meter **A-B** cable (standard **A** plug to mini **B** plug)
- One 1-meter **A-B** cable (mini **A** plug to mini **B** plug)
- One 15-centimeter On the Go (OTG) adaptor (standard **A** receptacle to mini **A** plug)
- LeCroy USB*Mobile*HS software program installation CD
- Product Documentation

2.2 General Description

USB*Mobile*HS™ is controlled through a personal computer PCMCIA slot. It can be used with portable computers for field service and maintenance as well as with desktop units in a development environment.

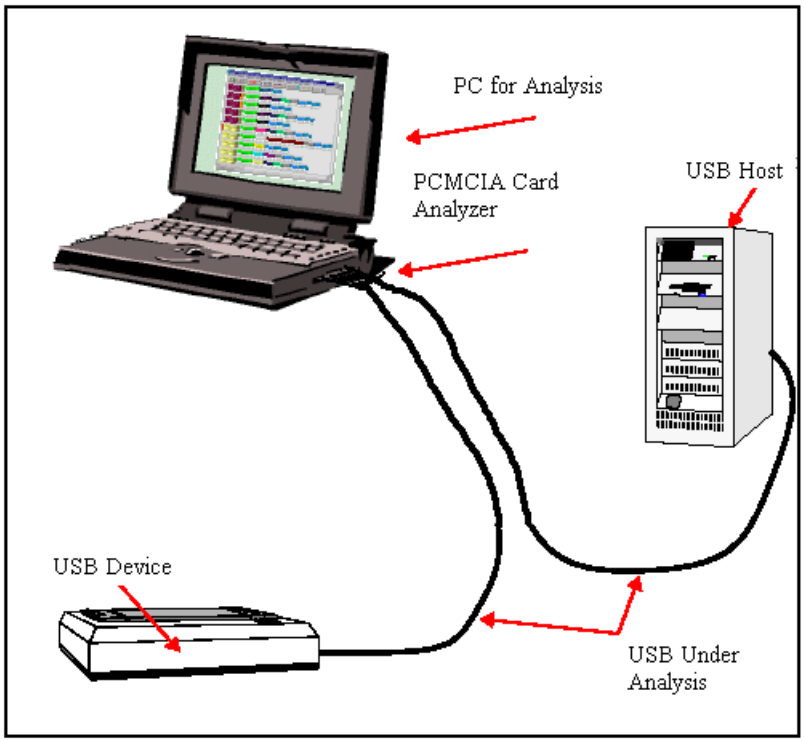


Figure 2.1 USB*Mobile*HS Connection

USB*Mobile*HS 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, USB*Mobile*HS 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 USB*Mobile*HS 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.

2.3 Analyzer PC Requirements

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

- Microsoft® Windows® 98SE, Me, 2000, or XP. The USB*Mobile*HS application can be used on machines with Windows NT 4.0 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 the AMD Athlon/Duron family, or other compatible processors with clock speed of 500mHz or higher (Processors of the Intel Pentium II/Celeron family or AMD K6 family with clock speed of 300mHz or higher are required.)
- For the best performance, it is recommended to have a minimum of 128 MB of RAM.
- At least 20 MB of free hard disk space is required for the USB*Mobile*HS installation. Additional disk space is needed for storing the recorded data in files during the recordings process (can be as much as 50 MB 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 required.)

2.4 USB Specification

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/

2.5 Specifications

Package

Dimensions	5.3 x 2.1 x 0.4 inches (135 x 54 x 5 millimeters)
Weight	1.8 ounces (51 grams)

Hardware Interface

Connectors	Standard 16-bit Type II PC Card Mini A-B Receptacles

Power Consumption

Idle	500 milliamperes (typical)
Active	560 milliamperes (typical)

Environmental Conditions

Operating Range	0 to 55°C (32 to 131°F)
Storage Range	-20 to 80°C (-4 to 176°F)
Humidity	10 to 90%, non-condensing

Recording Memory Size

64 MB

Host Compatibility

The instrument works with any PC equipped with a functioning PCMCIA slot and running the Microsoft® Windows® 98SE, Me, 2000, or XP operating systems.

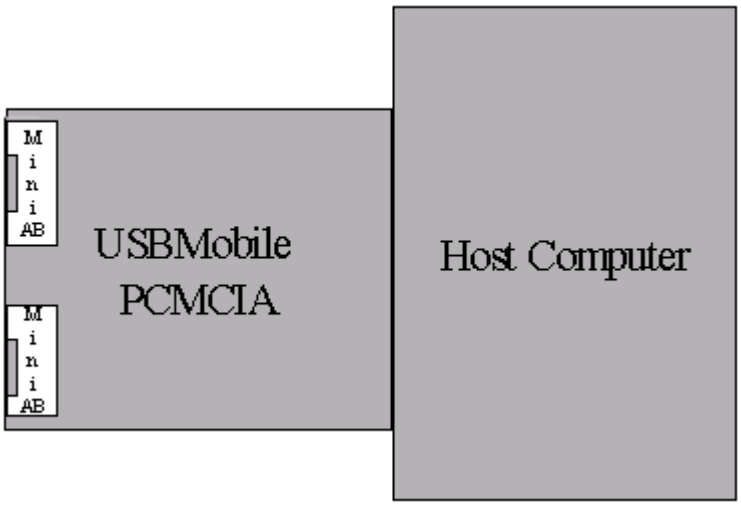
Product Warranty

LeCroy provides a three-year limited warranty on its products.

Chapter 3: Installation

3.1 USB Test Ports

Connect a host to one of the mini A-B receptacles (use an adaptor if necessary), and connect your device to the other. It does not matter which receptacle you plug into.



Note: The USB*Mobile*HS USB 2.0 Classic 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 might record incorrect data.

3.2 Software Installation

Step 1 Insert the USB*Mobile*HS CD-ROM into your computer.

Step 2 Click **Install Software** when the Auto-Run program is displayed.

Step 3 Follow the installation instructions on your screen.

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

3.3 Hardware Installation

USB*Mobile*HS components and software are easily installed and quickly ready to run on most personal computer systems. You can begin USB recordings after following these initial steps.

Step 1 Insert the CD-ROM.

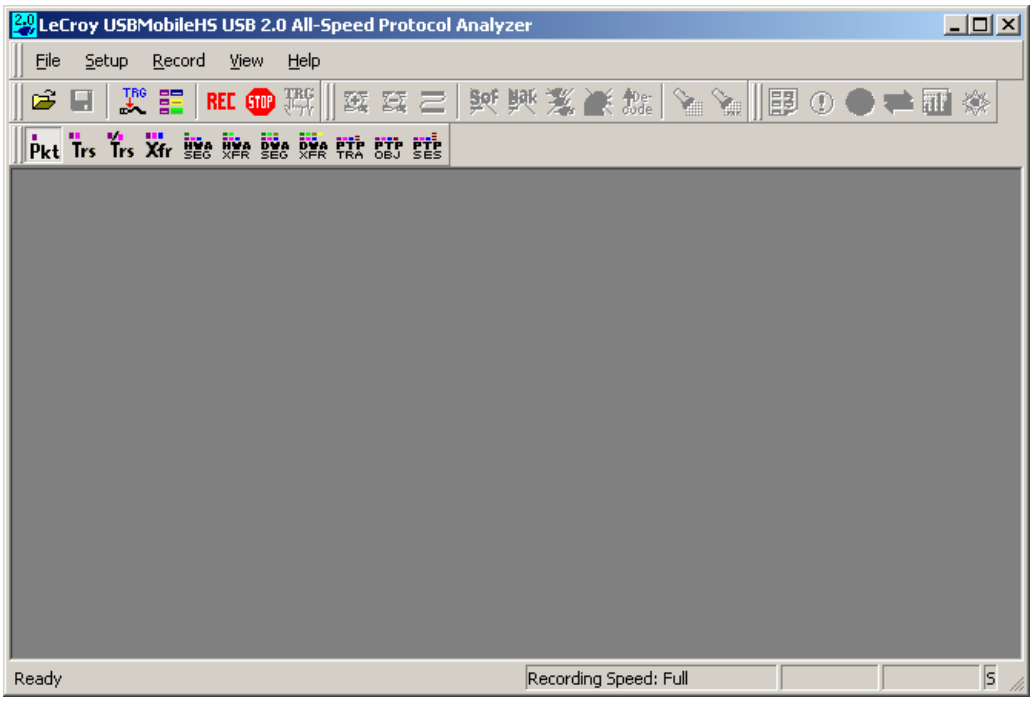
Step 2 Click **NEXT** when you see the **Add New Hardware Wizard** window.

Step 3 Follow the on-screen Plug and Play instructions.

Step 4 Click **Finish** when you see the message that says "Windows has finished installing the software that your new hardware requires" and the file **USBMobileHS.inf** has been installed on your host PC.

Step 5 Run the program **Setup** and follow the on-screen instructions.

Launch the LeCroy USB*Mobile*HS program from the LeCroy programs group. The main software screen opens:



Step 6 From the **Help** menu, select **About USBMobileHS.**

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

- USB*Mobile*HS Software Version
- USB*Mobile*HS Driver Version
- BusEngine™ Version
- Unit Serial Number

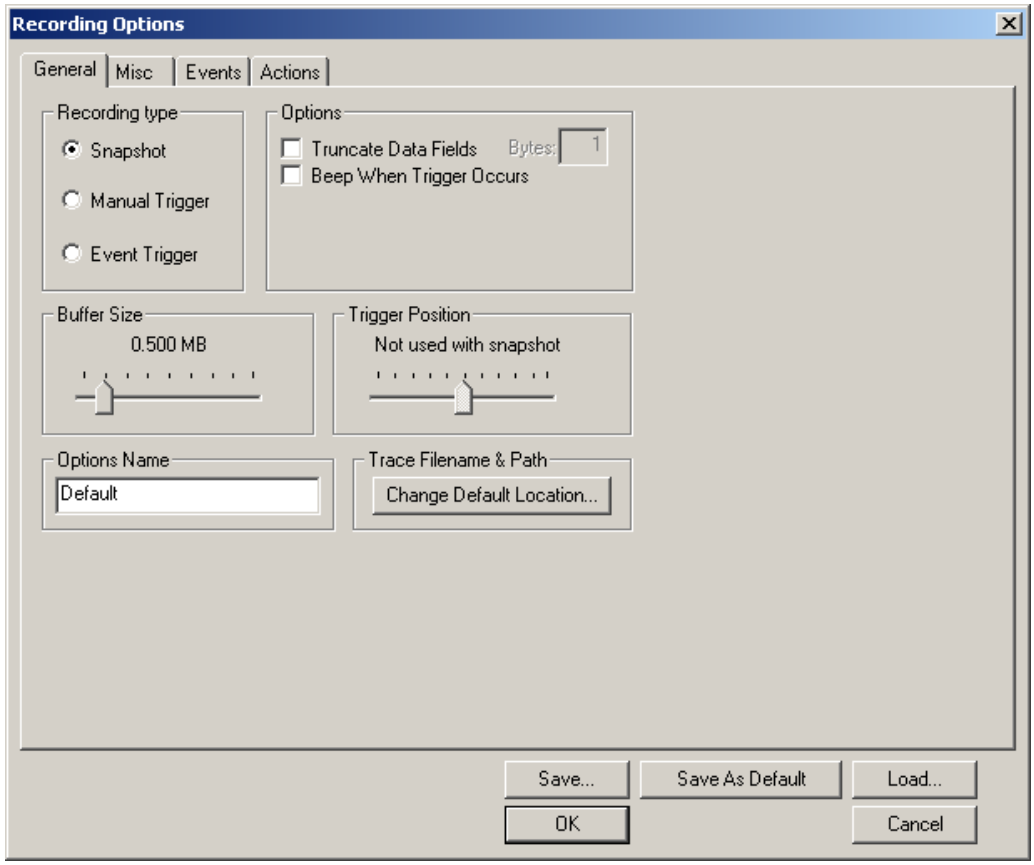
3.4 Your First USB Recording

After installing and launching the software, test USB*Mobile*HS by performing the following steps:

Step 1 Connect a USB cable to each of the two connectors on the USB*Mobile*HS module, and 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 display the default settings such as “Snapshot” and 1 Mbyte buffer size. For the first recording, leave the 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.

USB*Mobile*HS starts to record the USB traffic immediately. After 1 MB of traffic has been recorded, the Analyzer uploads the data and displays the packets in the trace window.

Step 7 To terminate the recording before the snapshot automatically completes, click 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

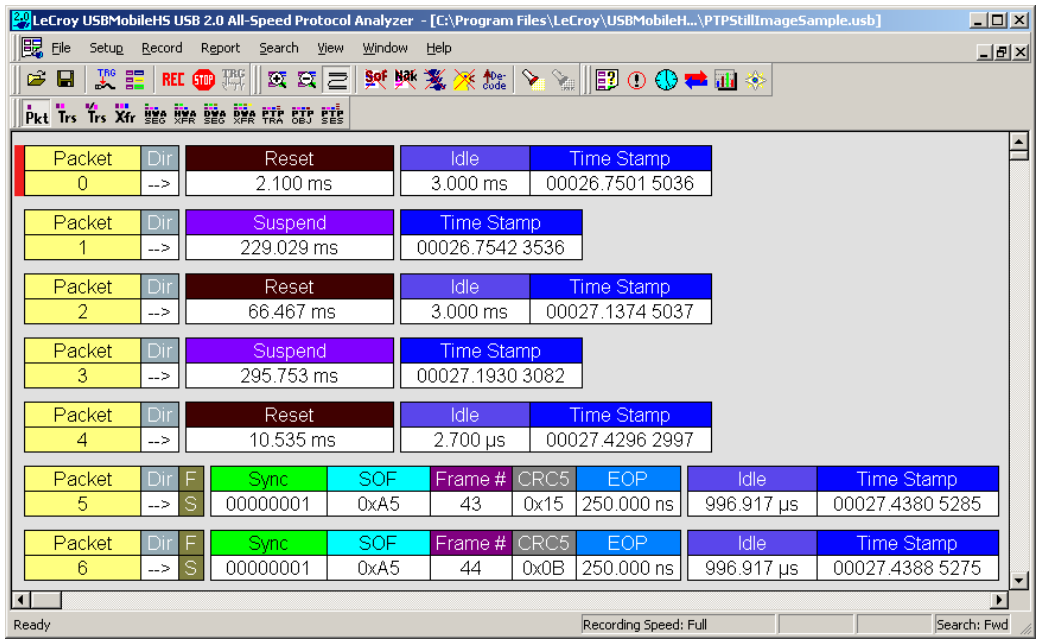
Click on the Toolbar.

The standard **Save As** screen appears.

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

Capturing Your First CATC Trace

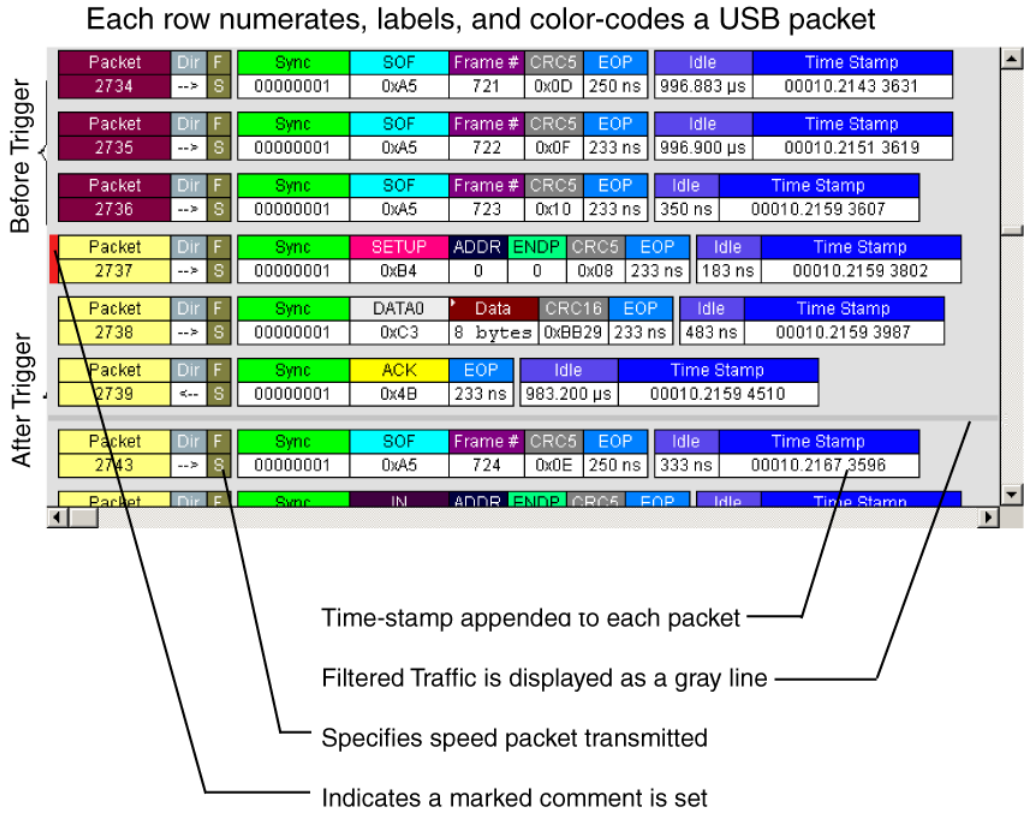
After a moment, the recording terminates and the results display.



Trace View Features

- The USB*Mobile*HS 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 or full-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: Software Overview

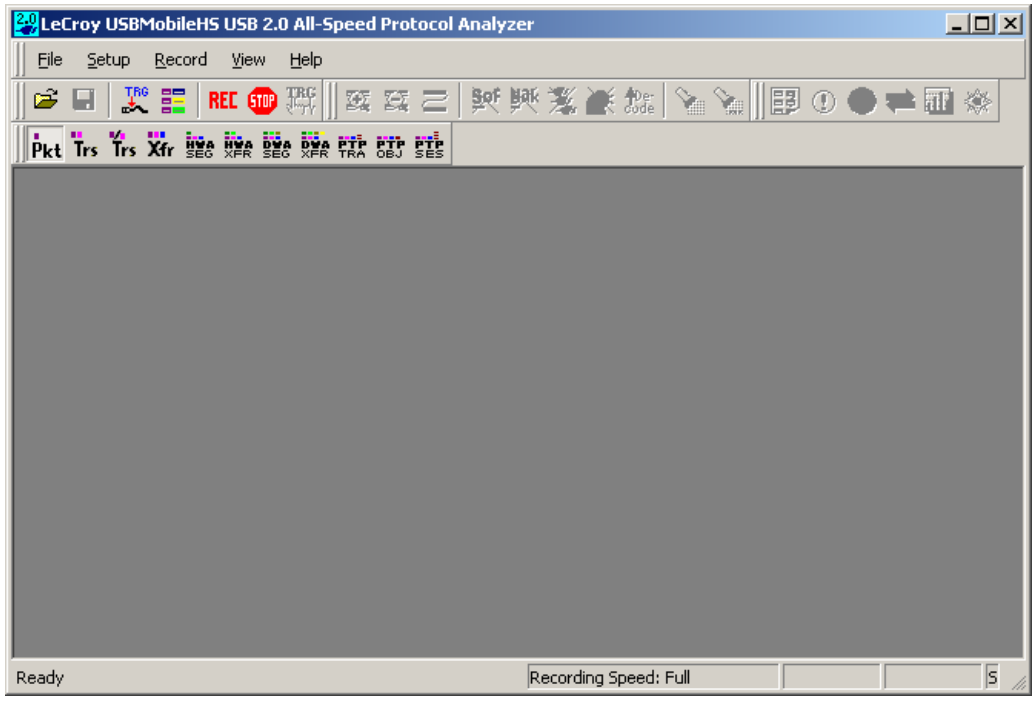
The USB*Mobile*HS™ software is an application that may be used with or without the Analyzer. When used without an Analyzer, the program functions in a Trace Viewer mode to view, analyze, and print captured protocol traffic from USB*Mobile*HS Analyzers. The software also allows you to view trace files created by the LeCroy USB*Tracer*™, USB*Mobile*™, Advisor™, 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*Mobile*HS 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.

4.1 Starting the USB*Mobile*HS Program

To start the USB*Mobile*HS program:

Step 1 Click **Start** > **Programs** > **LeCroy > LeCroy USBMobileHS**.



4.2 Tool Tips

Tool tips provide useful information about fields and buttons.

In some cases, tool tips spell out acronyms used in trace fields. In other cases, tool tips provide substantial amounts of additional information. To display a tool tip, position the mouse pointer over an item.

4.3 Menus

The following table describes the menus within the application. Note that some menus are context-sensitive.

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
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 USB*Mobile*HS program.

Menu	Function
Setup	
Display Options	Provides display options such as color, formats, and filters.
Recording Options	Provides setup options for recording, triggering events, and filtering events.
Record	
Start	Begins Analyzer recording of USB activity.
Stop	Stops Analyzer recording.
Upload Again	Allows you to upload a different portion of the captured trace if the previous upload was only partially uploaded.
Manual Trigger	Causes a trigger in a trace. Available only in Manual Trigger mode.
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 list of available toolbars.
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'ed Transactions.
Hide Devices	Hides packets belonging to specified devices by address and endpoint.
Hide Chirps	Hide the Chirp-K and Chirp-J Bus conditions. These are recorded only in USB*Mobile*HS.
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	Performs a re-analysis and re-decoding of all of the transactions in the trace
Window	
New Window	Switches display of the Tool Bar on or off.
Cascade	Displays all open windows in an overlapping arrangement.
Tile Horizontal	Arranges multiple trace windows as a series of strips across the main display area.
Tile Vertical	Displays all open windows in a side-by-side 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. You can also select F1.
Help Topics	Displays online help.
Update License	Opens a dialog box for updating your LeCroy license.
Display License Information	Displays information related to licensing.
About USB*Mobile*HS	Displays version information about USB*Mobile*HS.

4.4 View Options

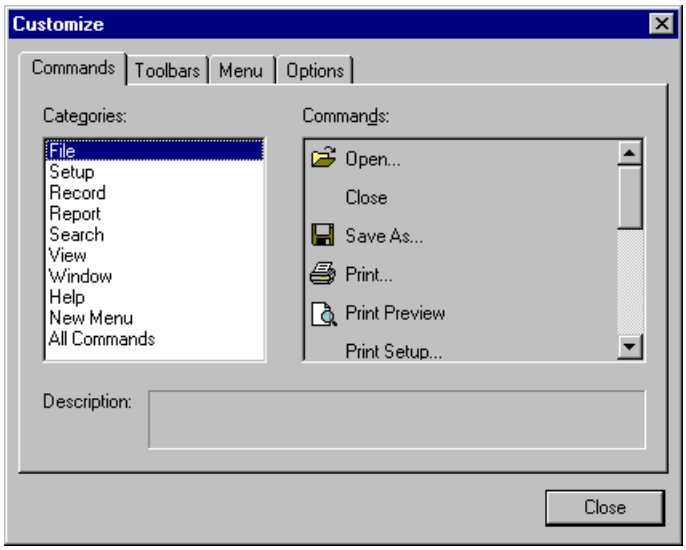
You can hide, display or reset toolbars by selecting **View > Tool bars** from the menu bar.

Resetting the Toolbars

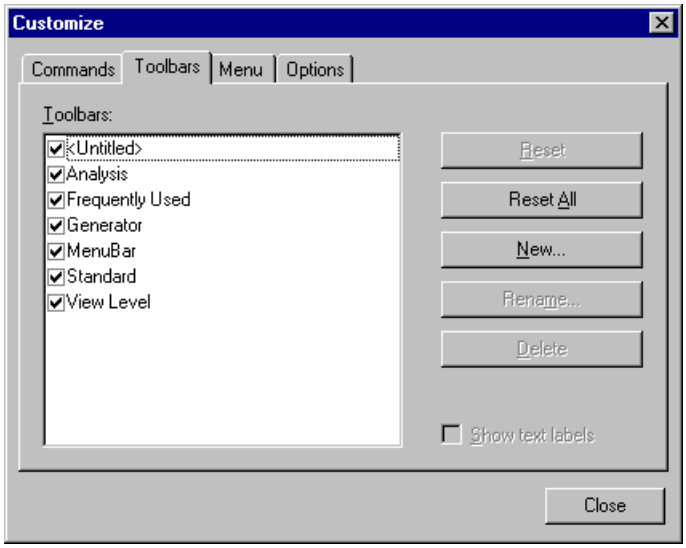
From time to time (such as following a software upgrade), it is possible for the buttons on the toolbar to not match their intended function. You can reset the toolbar by performing the following steps:

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

Step 2 Select **Customize** from the submenu to display the Customize dialog box.



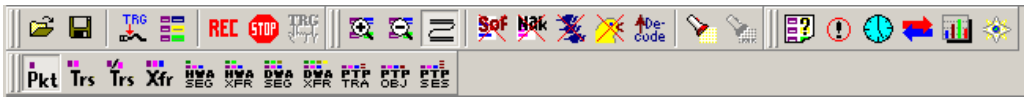
Step 3 Select the **Toolbars** tab to display the Toolbars page of the dialog box.



Step 4 Click the **Reset All** button.

The toolbar resets to the factory defaults.

Tool Bar



The Tool Bar provides quick and convenient access to the most popular program functions. Tool tips describe the functionality of each icon and menu item as the mouse arrow is moved over the icon/item.

	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
	Manual Trigger		Bus Utilization
	Zoom In		Open the Navigator bar
	Zoom Out		Display Packets
	Wrap		Display Transactions
	Hide SOFs		Display Split Transactions
	Hide NAK’ed transactions		Display Transfers
	Hide Devices		Display Host Wire Adapter Segments

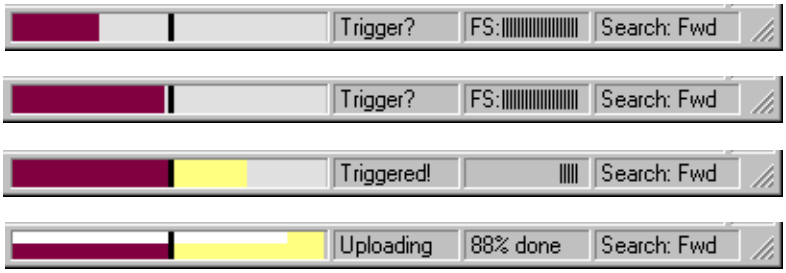
	Display PTP Transactions		Display Host Wire Adapter Transfers
	Display PTP Objects		Display Device Wire Adapter Segments
	Display PTP Sessions		Display Device Wire Adapter Transfers

4.5 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

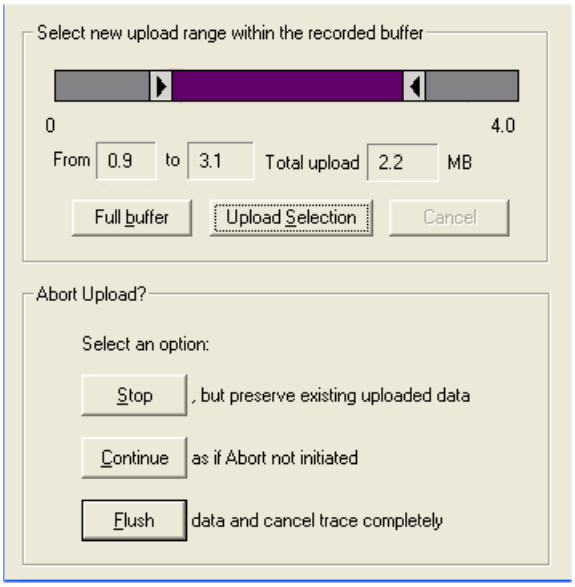
After recording stops:

- 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 into the default file **data.usb** (or whatever file name you have specified in the Recording Options dialog box).

To abort the upload process:

- Press **Esc** on your keyboard or click in the Tool Bar. You are asked if you want to keep or discard the partially uploaded data. While uploading is in progress, clicking the **Stop** button again brings up a dialog with four options:
  - **Full Buffer/Upload Selection**: Allows you to decide how much of the buffer to upload. Use the slide bar to set the range to be uploaded.
  - **Stop**: Ends the upload process and preserves whatever part of the recording has been uploaded.
  - **Continue**: Resumes the upload process.
  - **Flush**: Empties the uploaded trace from the current 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). Change the search direction from the Search Menu or double-click in the Search Status segment.

4.6 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.

4.7 USB*Mobile*HS Analyzer Keyboard Shortcuts

Several frequently-used operations are bound to keyboard shortcuts.

Table 1: 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
View Packets	CTRL-1
View Transactions	CTRL-2
View Split Transactions	CTRL-3
View Transfers	CTRL-4

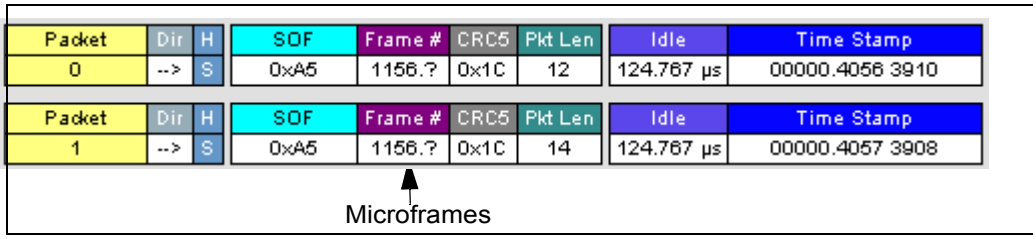
PID	
Go to ACK	Shift+A
Go to DATA0	Shift+0
Go to DATA1	Shift+1
Go to DATA2	Shift+2
Go to DATAx	Shift+D
Go to IN	Shift+I
Go to MDATA	Shift+M
Go to NAK	Shift+N
Go to NYET	Shift+Y
Go to OUT	Shift+O
Go to PING	Shift+G
Go to PRE/ERR	Shift+P
Go to SETUP	Shift+S
Go to SOF	Shift+F
Go to SPLIT	Shift+X
Go to STALL	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 5: Reading a Trace

5.1 Trace View Features

- The USB*Mobile*HS™ 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.)

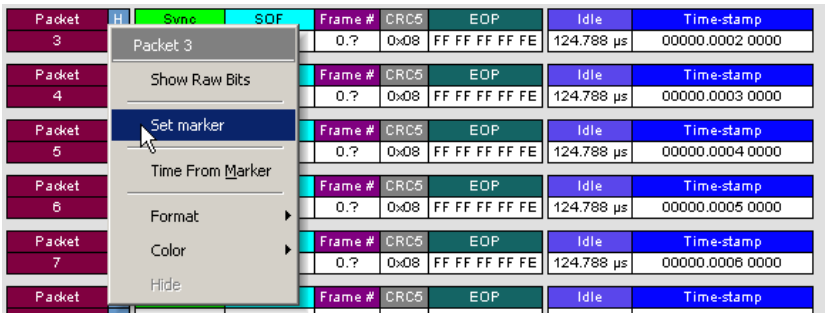


5.2 Set Marker

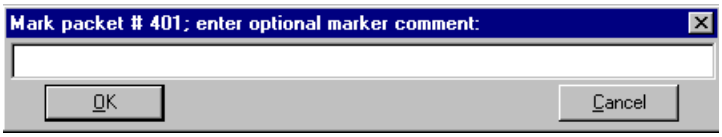
You can define a unique marker for each packet.

To place a marker on a packet:

Step 1 Left-click **Packet #** for the packet 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.

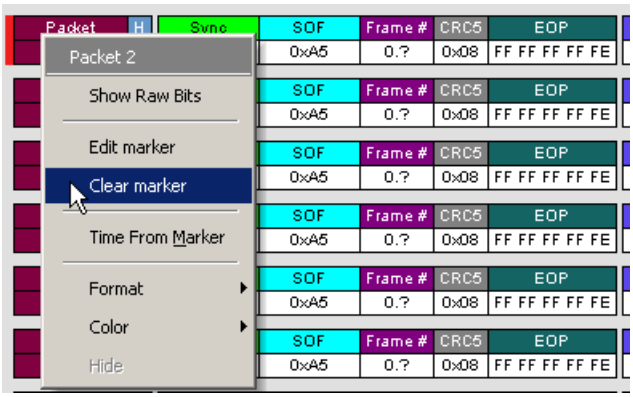
Step 4 Click **OK**.

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

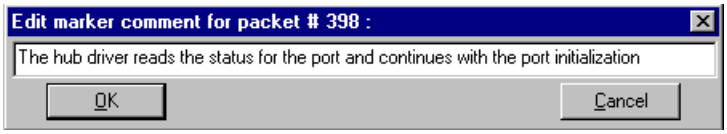
5.3 Edit or Clear Marker

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

Step 1 Left-click **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**.

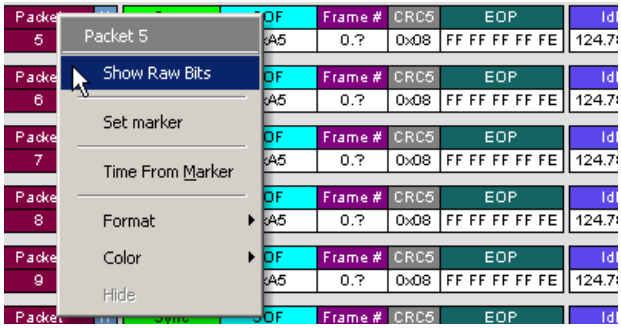
The vertical red Marker bar disappears.

5.4 View Raw Bits

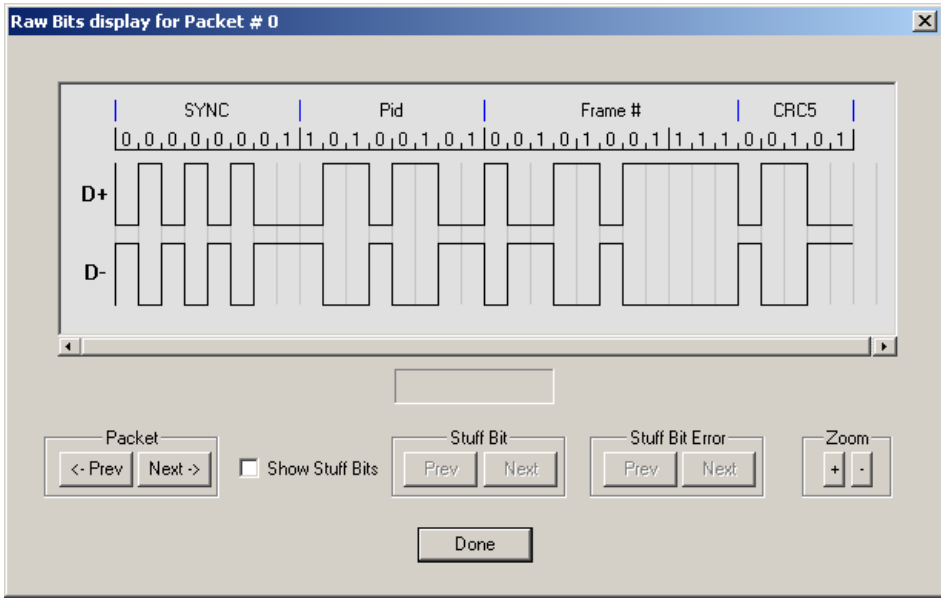
You can expand a specific packet to view the raw bits in detail.

To view the raw bits:

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



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



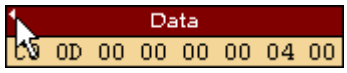
Along the top of the Raw Bits View is a linear strip of the logical bit values with corresponding field demarcations. Bit stuffing is displayed in color. Below the logical bit values is a representation of the D+/D- signaling complete with NRZ encoding. A scroll bar assists in navigation of larger packets. 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.

5.5 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.

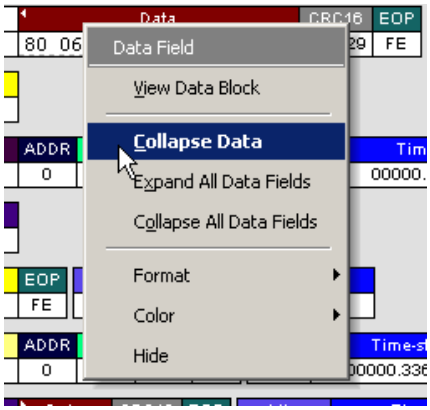
Using the Data Field Pop-up Menus

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

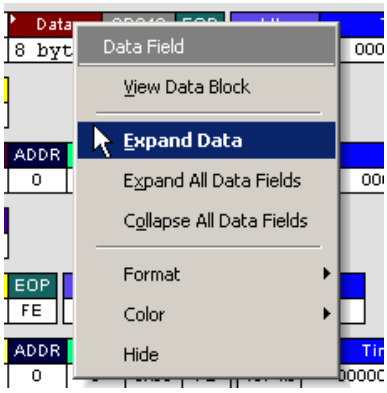
To expand and collapse data using the menu:

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.

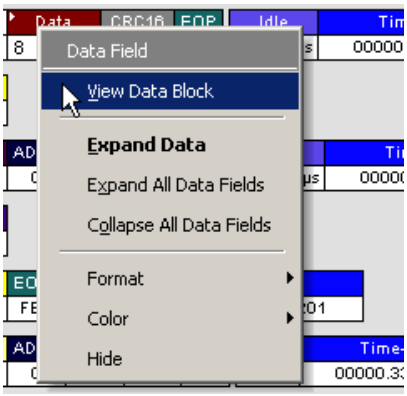
The Trace View is repositioned with the selected packet(s) adjusted in the format you have specified.

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.

5.6 View Data Block

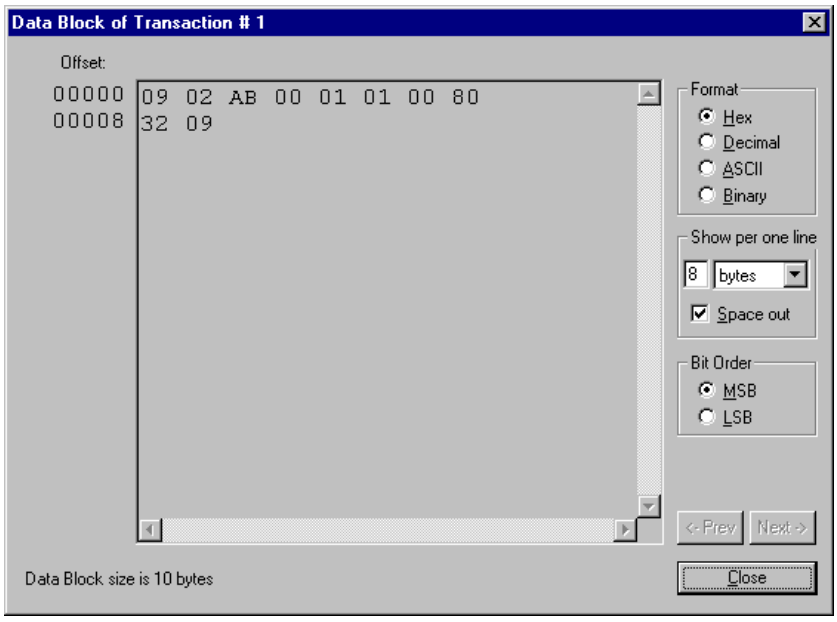
The data field pop-up menu has an option for viewing the raw bits in a data field.



To view these bits:

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

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

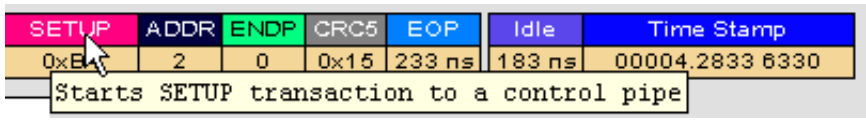


The View Data Block window has options for displaying the raw bits in different formats:

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

5.7 Pop-up Tool-tips

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



5.8 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.

Note: If you have enabled **2-Stage SOF Hiding** in the General Display Options**,** then the Hide SOF button works in two stages. Click once to hide all SOFs that begin frames with no USB traffic. Click twice to hide all SOFs.

5.9 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.

5.10 Hide Devices

Click the button to get a window that allows you to select any address/endpoint combination to be hidden.

5.11 Hide Chirps

Click the button to hide any Chirped-J or Chirped-K packets recorded in a USB trace.

5.12 Switch to Transactions View

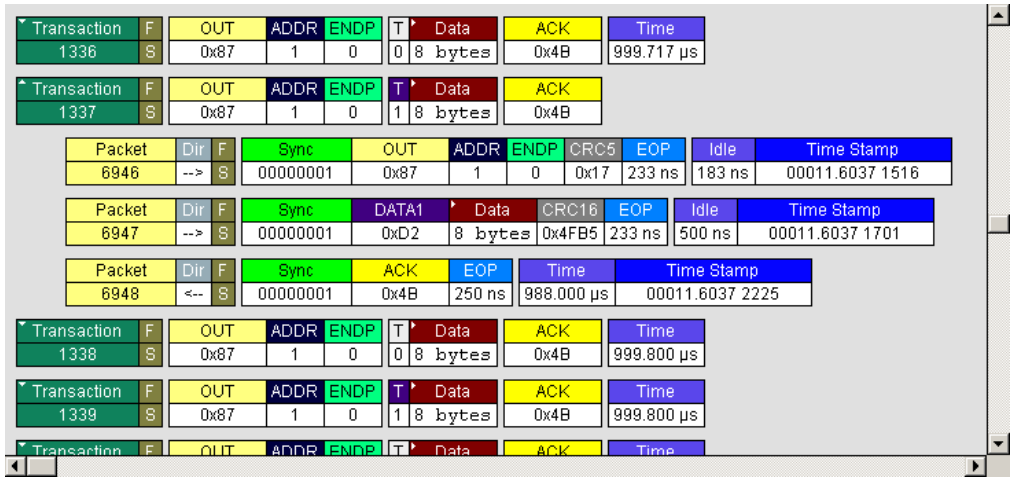
A **Transaction** is defined in the USB specification as the delivery of service to an endpoint. This consists of a token packet, an optional data packet, and an optional handshake packet. The specific packets that make up the transaction vary based upon the transaction type.

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:

- Click to on the toolbar.

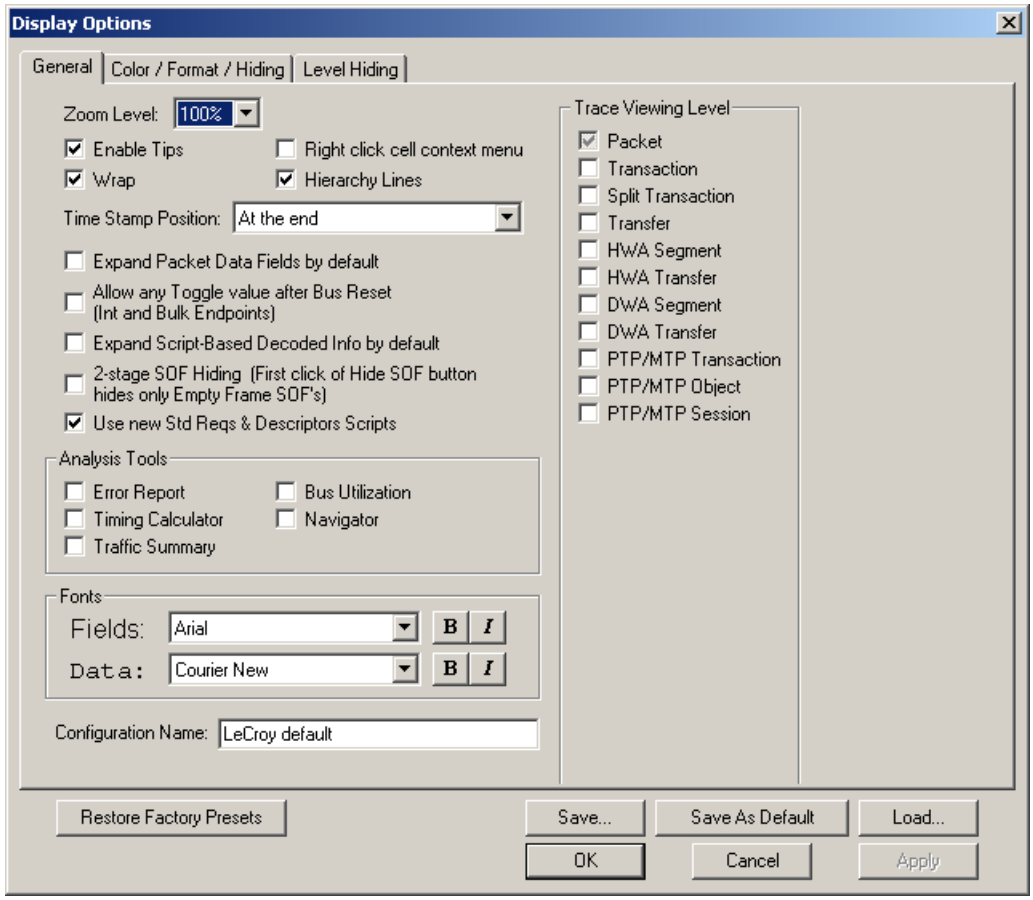
The Trace View screen is re-drawn to display Transactions.



Note: This menu selection displays a check 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**.

You can also switch to Transaction View from the Menu Bar:

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

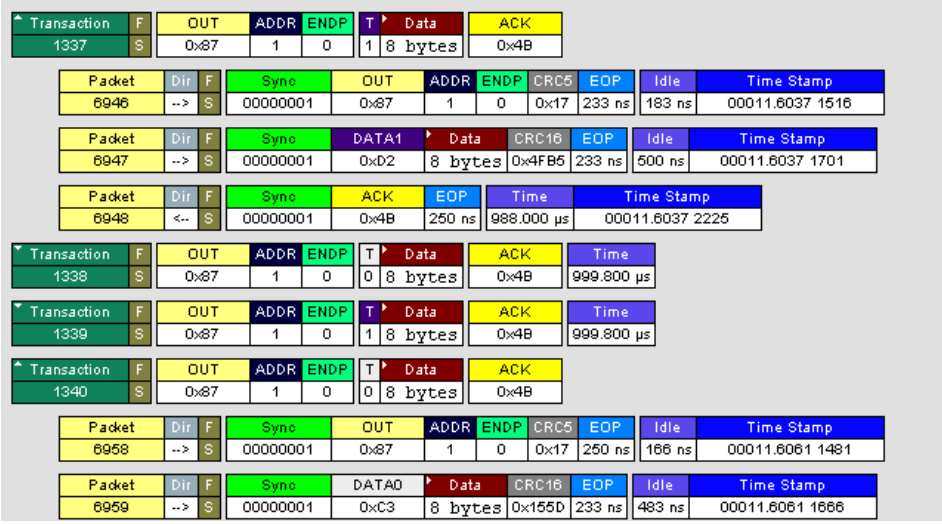


Step 2 Check **Transactions.**

Step 3 Click **OK.**

5.13 View Decoded Transactions

Once 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.

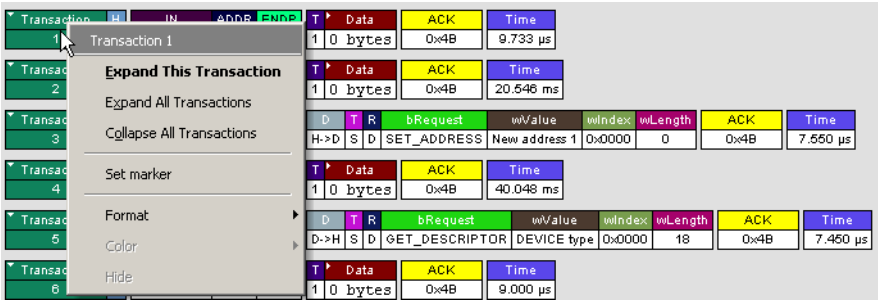
Expanded and Collapsed Transactions

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.

You see 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:

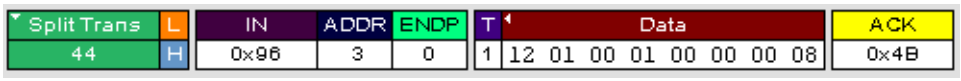
- Double-click in the Transaction number field to toggle back and forth between collapsed and expanded views.

5.14 Switch to Split Transaction View

To select Split Transaction View:

Step 1 Click the Trs button on the toolbar.

The Trace View screen is re-drawn to display Split Transactions.



You can also 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.**

5.15 Switch to Transfer View

A Tr**ansfer** 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. USB*Mobile*HS 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.

The Trace View screen is re-drawn 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.**

5.16 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.

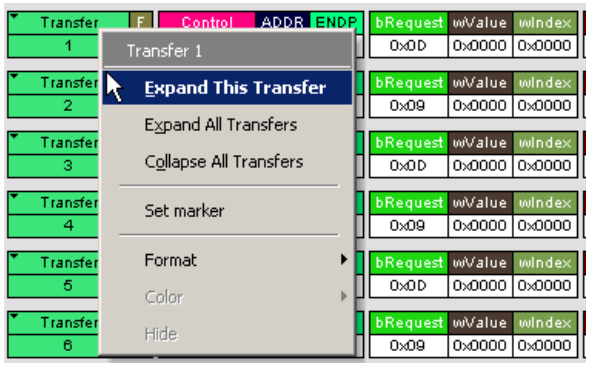
Expanded and Collapsed Transfers

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

To expand a transfer:

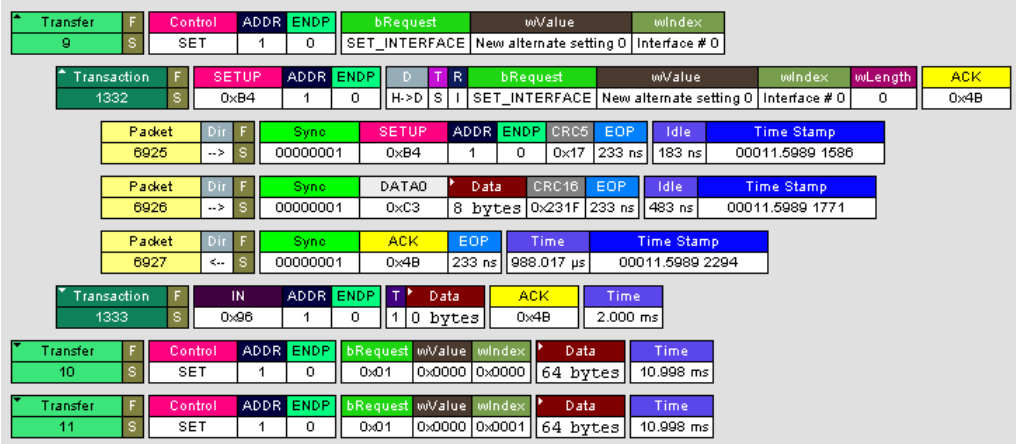
Step 1 Left-click the transfer number you wish to view.

You see the **Expand Transfer** menu:



Step 2 Select **Expand This USB Transfer**.

The screen displays 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.

5.17 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.

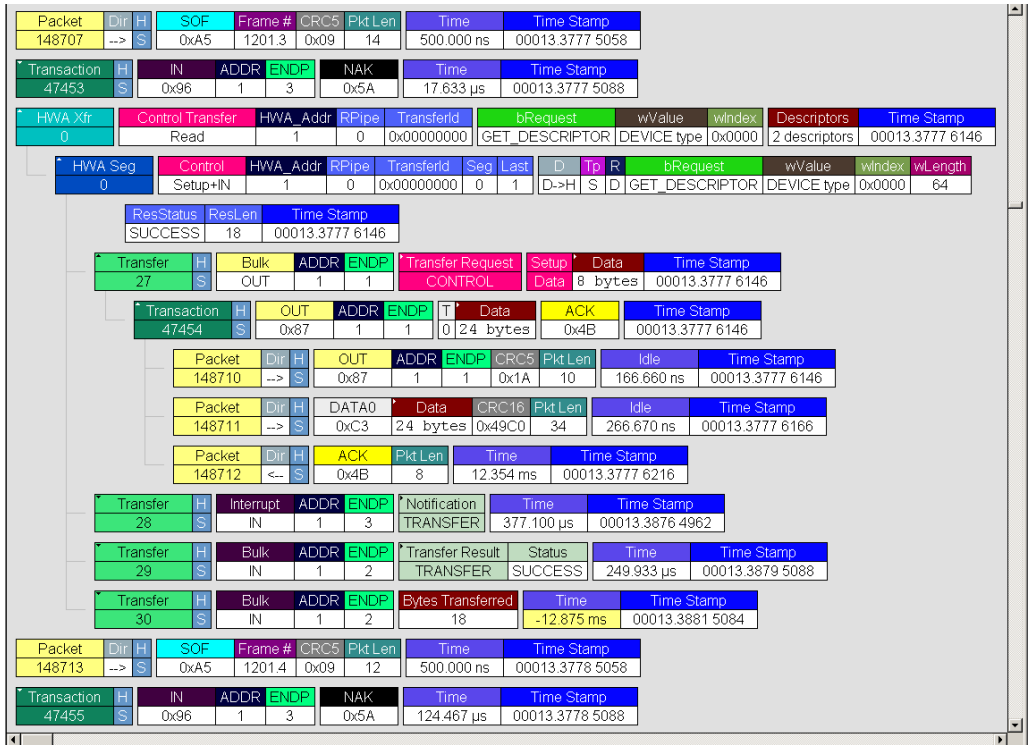
5.18 Switch to Host Wire Adapter Segment View

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.



5.19 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.**

5.20 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.**

5.21 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.**

5.22 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.**

5.23 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.**

5.24 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.

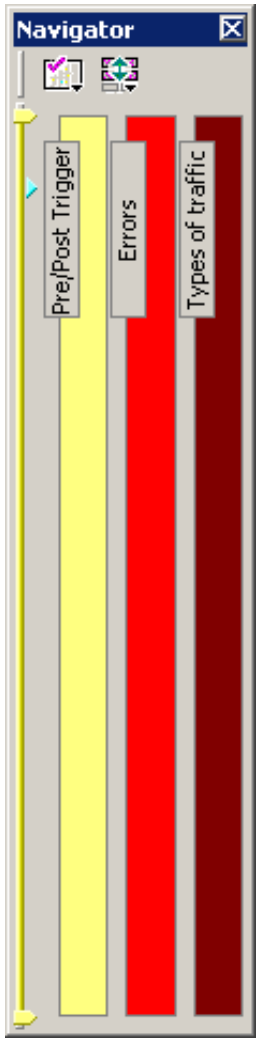
A session contains all object transfers (and their transactions), plus all transactions that do not belong to object transfers, between an OpenSession operation and a CloseSession operation. For PTP, all PTP Object Transfers and all PTP Transactions that occur from the OpenSession operation to the CloseSession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

5.25 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, thereby refining 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 or select the Navigation Bar checkbox in the Display Options General window.

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.

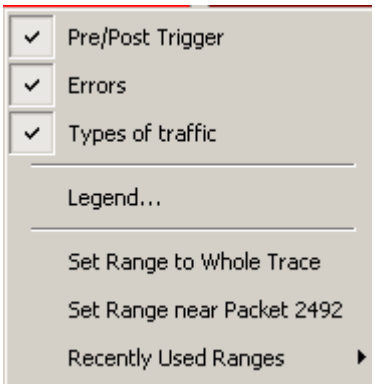
The Navigator bar represents different types of trace information in the order of the packets. The top of each bar corresponds to the first packet in the trace, and the bottom corresponds to the last packet. The Navigator bar is made up of three parts: Pre and Post-Trigger traffic, Errors, and Types 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 52.

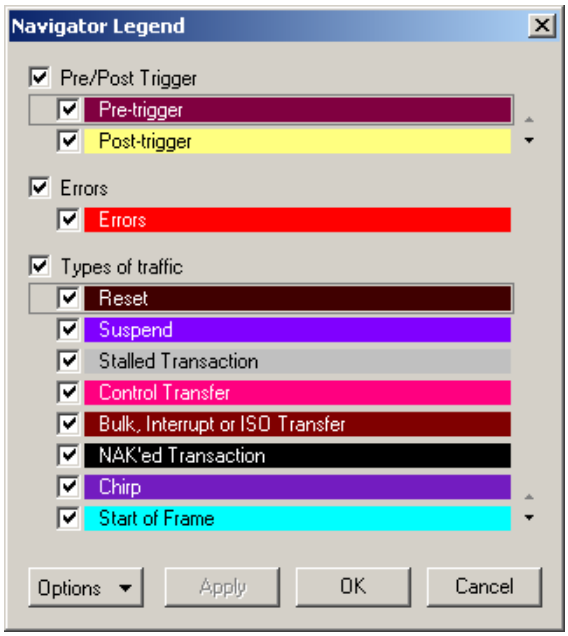
Drag the yellow caret, at the top or bottom, to set the packet range. When you move the caret, a message shows the packet range.

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

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

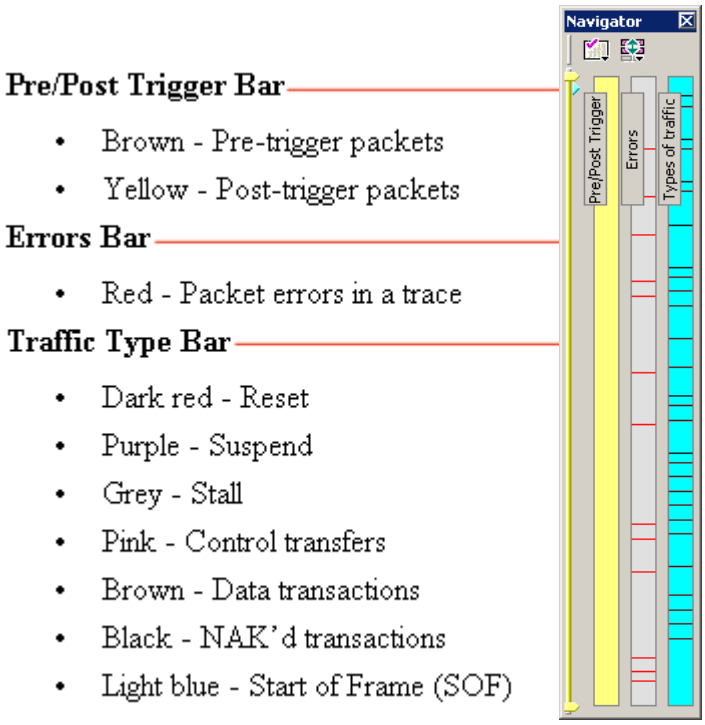


- **Pre/Post Trigger, Errors, Types of Traffic**: Shows or hides traffic information in the Navigator.
- **Legend**: Shows or hides Trigger, Error, and Traffic Type categories in the Navigator.



- **Set Range to Whole Trace**: Resets 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.
- **Recently Used Ranges**: Displays a history of ranges that were previously selected.

Navigator Bar Attributes

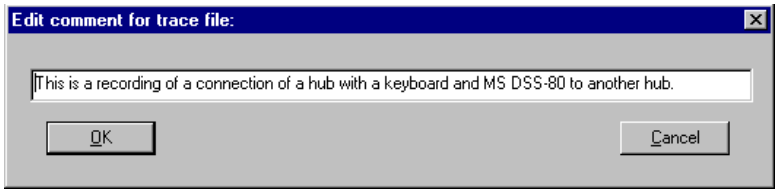


The traffic types are shown in order of importance. For example, if a NAK'd transaction occurred in the same sample area as a SOF, the NAK would take precedence, and the Navigator would show the black bar.

5.26 Edit Comment

You can create, view, or edit the 100-character comment field associated with each Trace file. These 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.

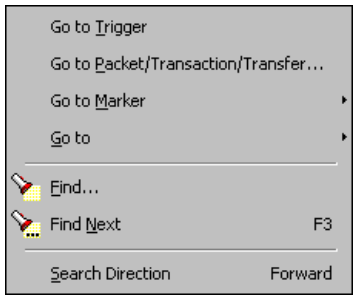
Step 3 Click **OK**.

You can view comments in Windows Explorer by selecting the Comments attribute.

Chapter 6: Searching Traces

The Search feature provides methods 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 ti display the Search drop-down menu:

6.1 Go to Trigger

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

To display a Trigger Event:

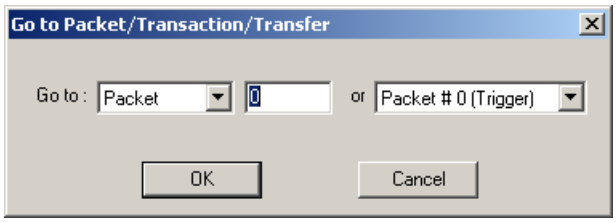
- Select **Go to Trigger** under **Search** on the Menu Bar.

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

6.2 Go to Packet/Transaction/Transfer

To display a specific packet:

Step 1 From the menu bar, select **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 you want to display.

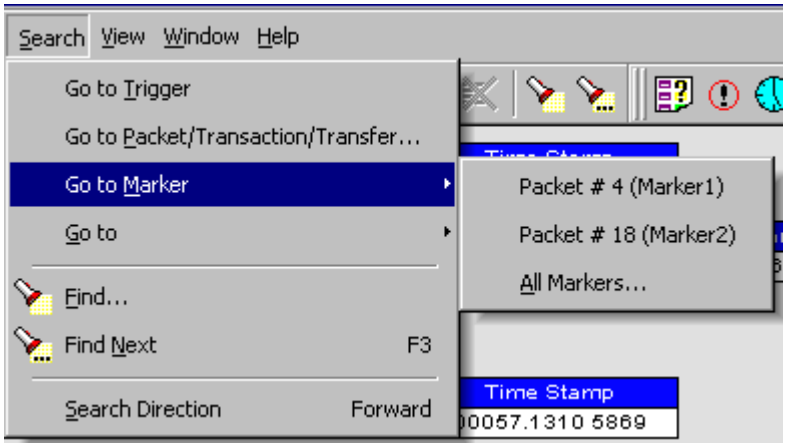
Step 4 Click **OK.**

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

6.3 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 the 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 your screen.

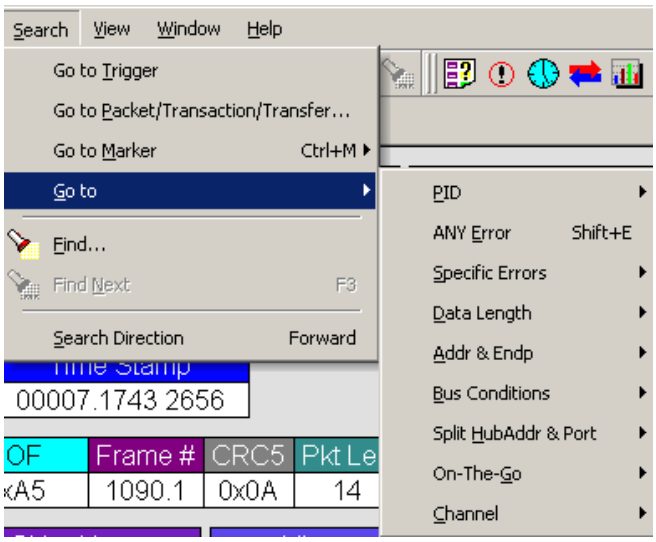
Note: The **Go to Marker** feature functions in conjunction with the **Set Marker** feature. The comments within the parentheses following each marked packet are added or edited with the **Set Marker** feature. Please refer to **Set Marker** in **Reading a CATC Trace**.

You can use **Ctrl+M** to go immediately to the All Markers dialog.

6.4 Go To

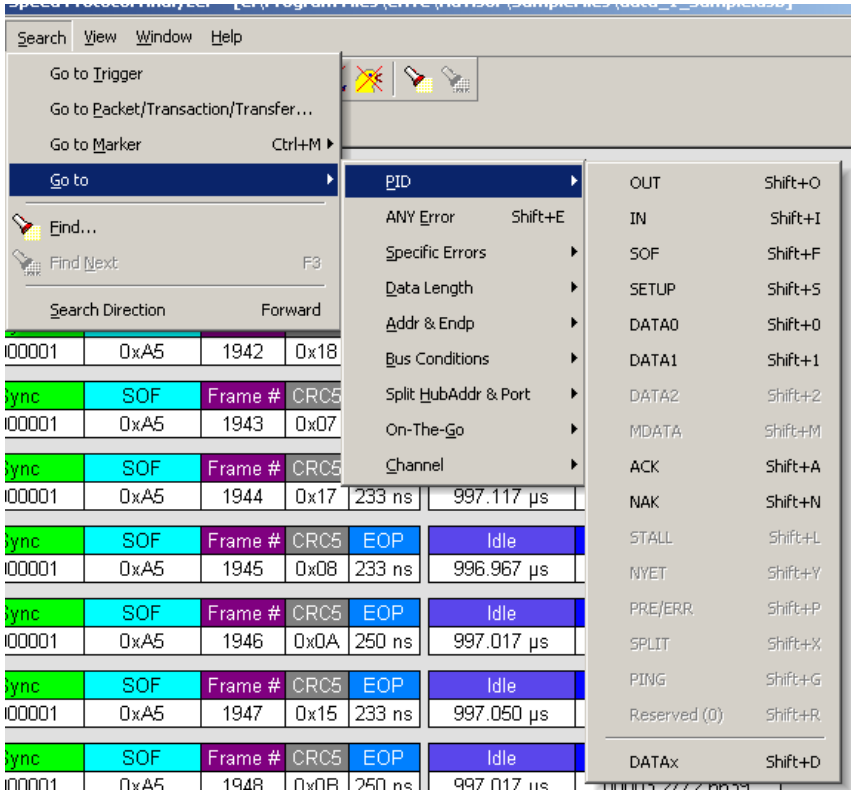
The **Go To** feature takes you directly to an event in a Trace.

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



Step 2 Select the event you want to go to and enter the necessary information.

Packet IDs (PIDs)



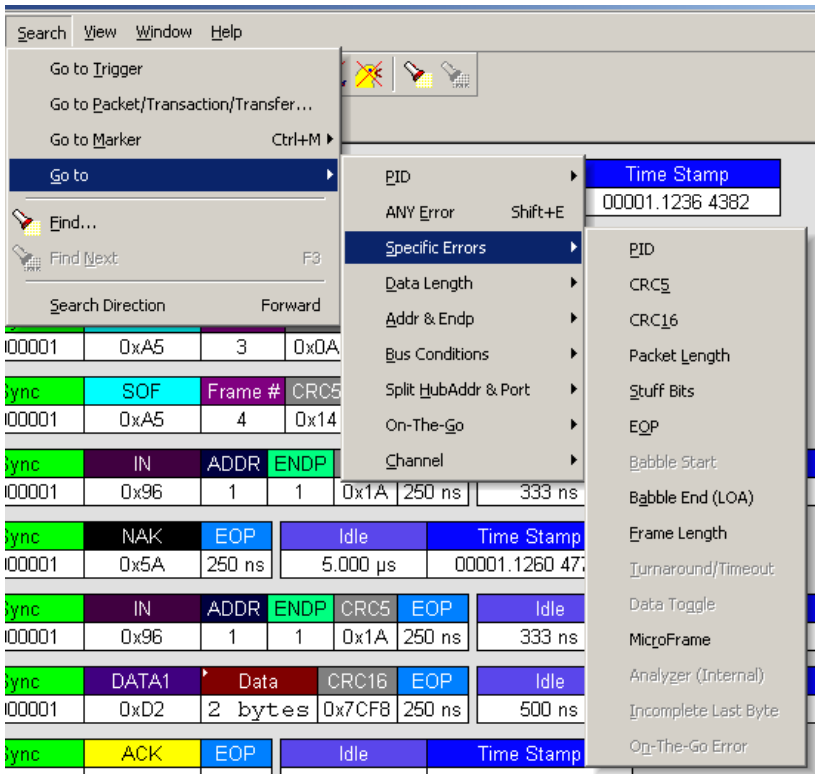
Select the type of packet to which you want to go.

ANY Error

Repositions the trace to show the next instance of any error.

Errors

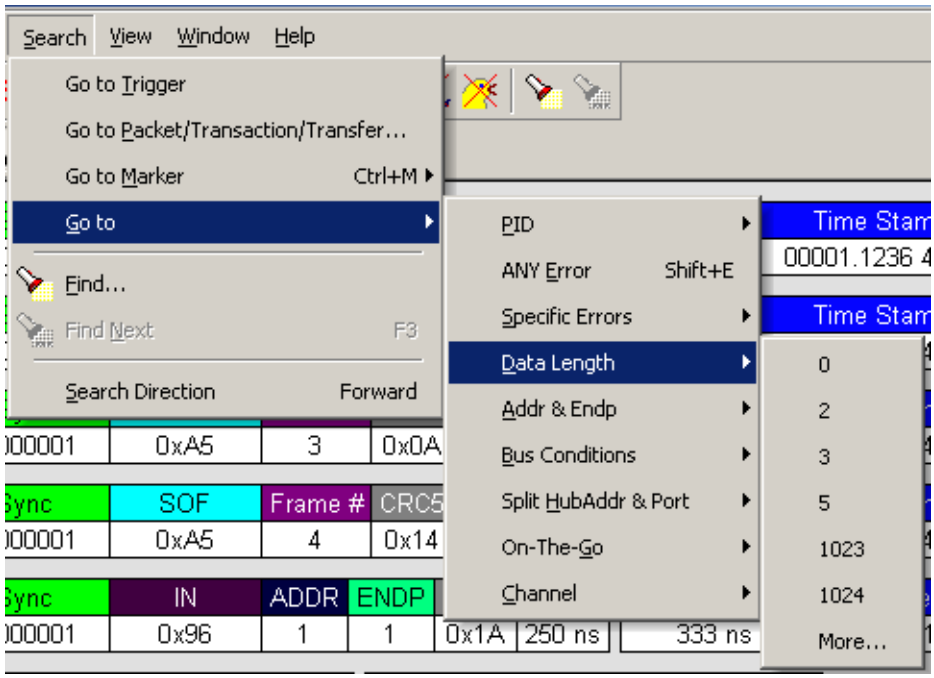
The Errors menu allows you to search for five different types of error: PID, CRC5, CRC16, Packet Length, and Stuff Bits. Menu items appear in bold if they are present in the trace or are grayed out if not present in the trace, as shown in the example below.



You can press **Shift+E** to go to the first error of any type.

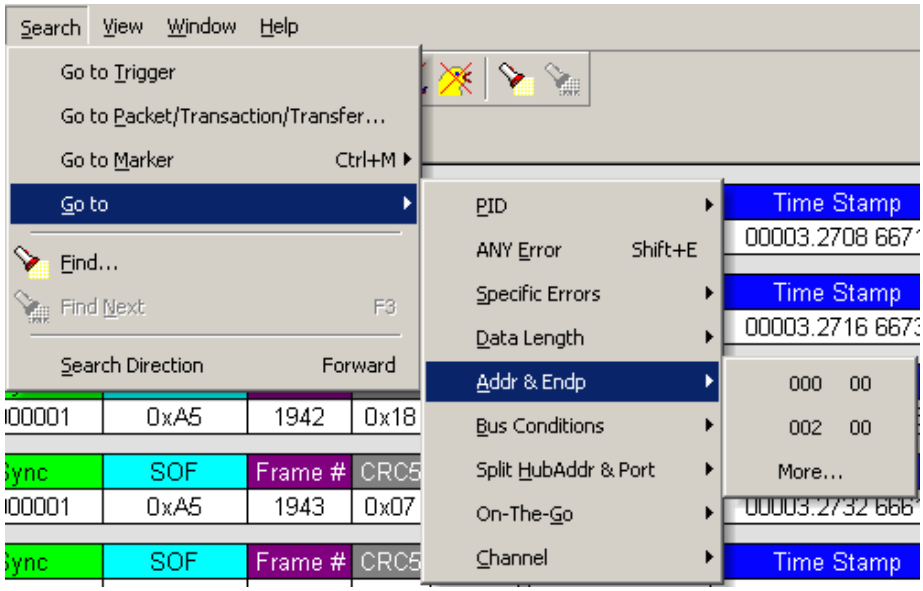
Data Length

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 causes the display to move to the next instance of that packet length.



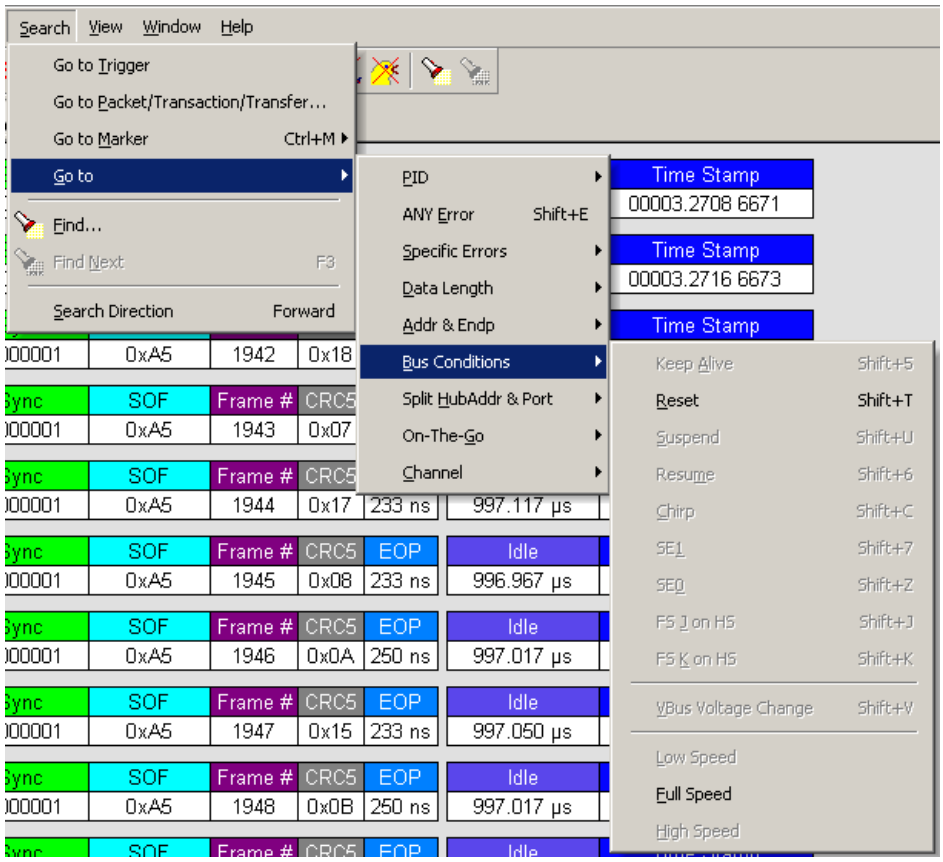
Addr & Endp

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.



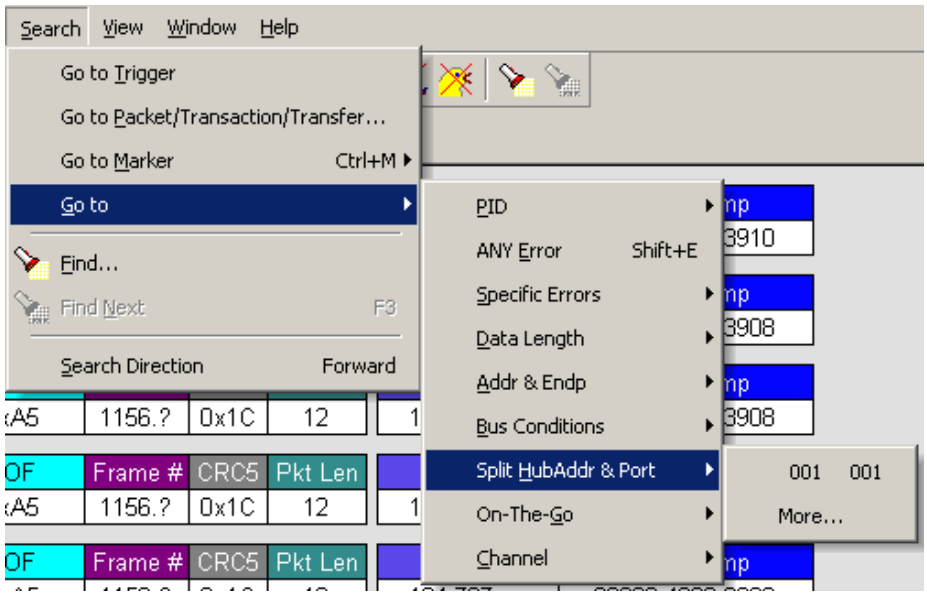
Bus Conditions

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.



Split HubAddr & Port

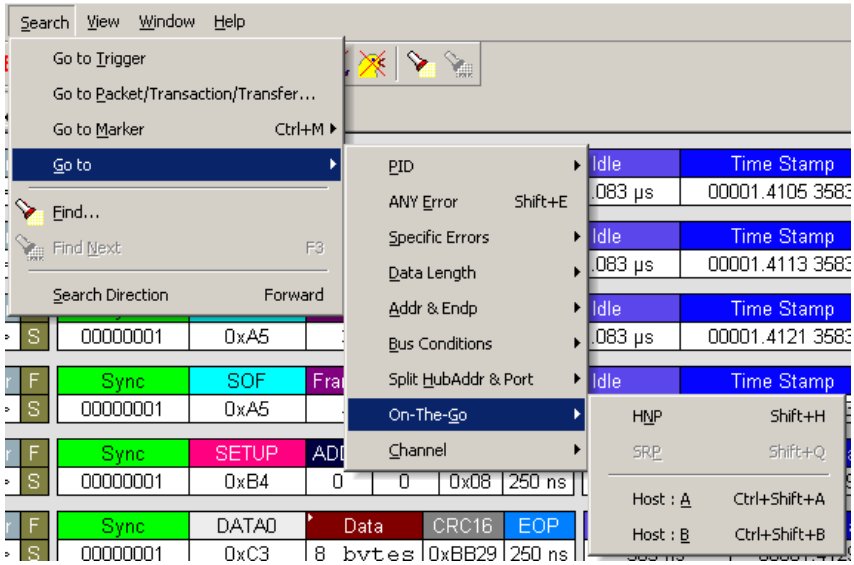
Allows you to search by Hub Address and port. If present, the option **More** opens a dialog box with a list of addresses and ports.



On-the-Go

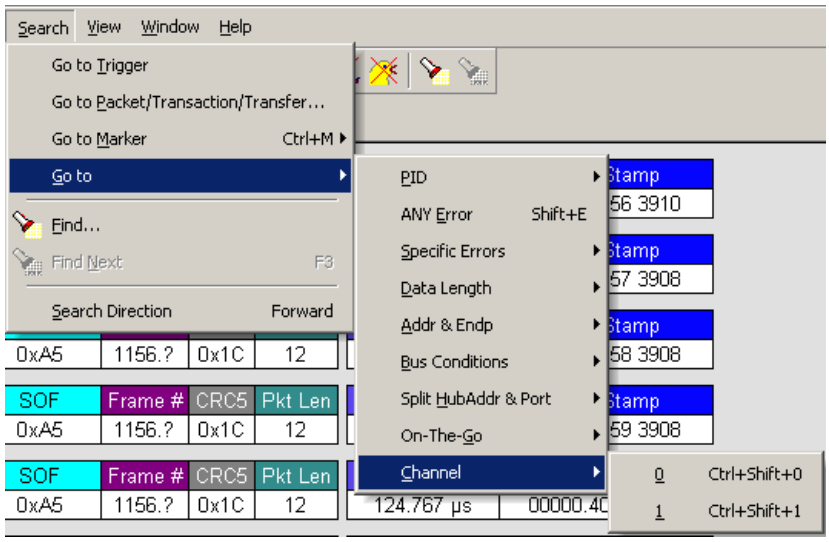
Allows you to search for On-the-go attributes. The On-the-Go menu contains entries for:

- **HNP** - Host Negotiation Protocol
- **SRP** - Session Request Protocol
- Host : A - Hosts with an A plug
- Host: B - Hosts with a B plug



Channel

Allows you to search for traffic by 1 (Classic-Speed) or 0 (Hi-Speed).



6.5 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*."

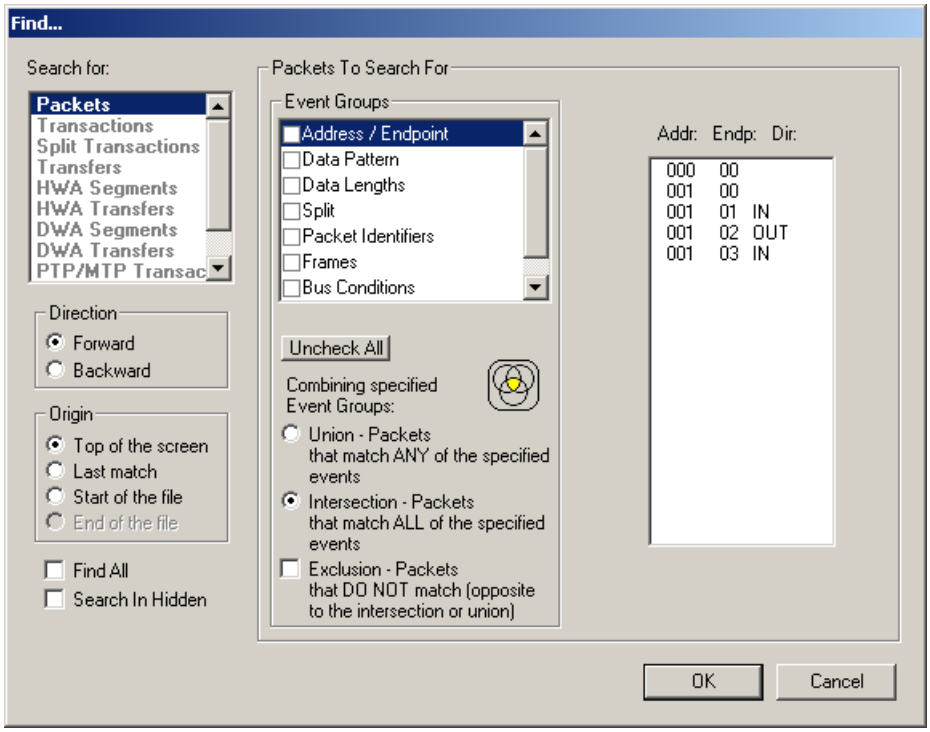
You can also perform searches whereby packets or events are excluded from a trace. The **Exclusion** allows searches to be conducted.

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:



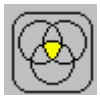
Step 2 Select **Packets, Transactions**, **Split Transactions**, **Transfers, HWA Segments, HWA Transfers, DWA Segments, DWA Transfers, PTP/MTP Transactions, PTP/MTP Objects**, or **PTP/MTP Sessions** from the top left list box to list that type of event in the Events Group box.

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 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 program displays the packets meeting the search criteria.

6.6 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.

6.7 Search Direction

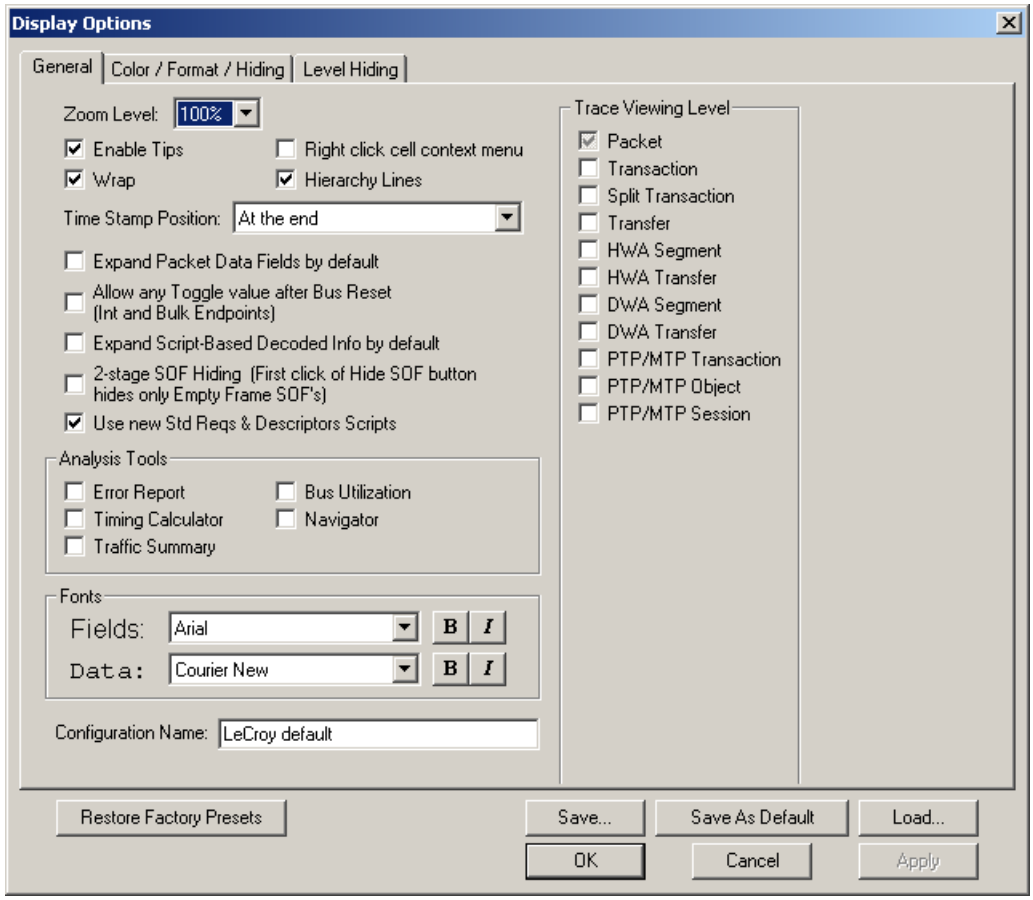
Toggles the search forward or backwards. The current direction is indicated in the menu.

Chapter 7: 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.

7.1 General Display Options

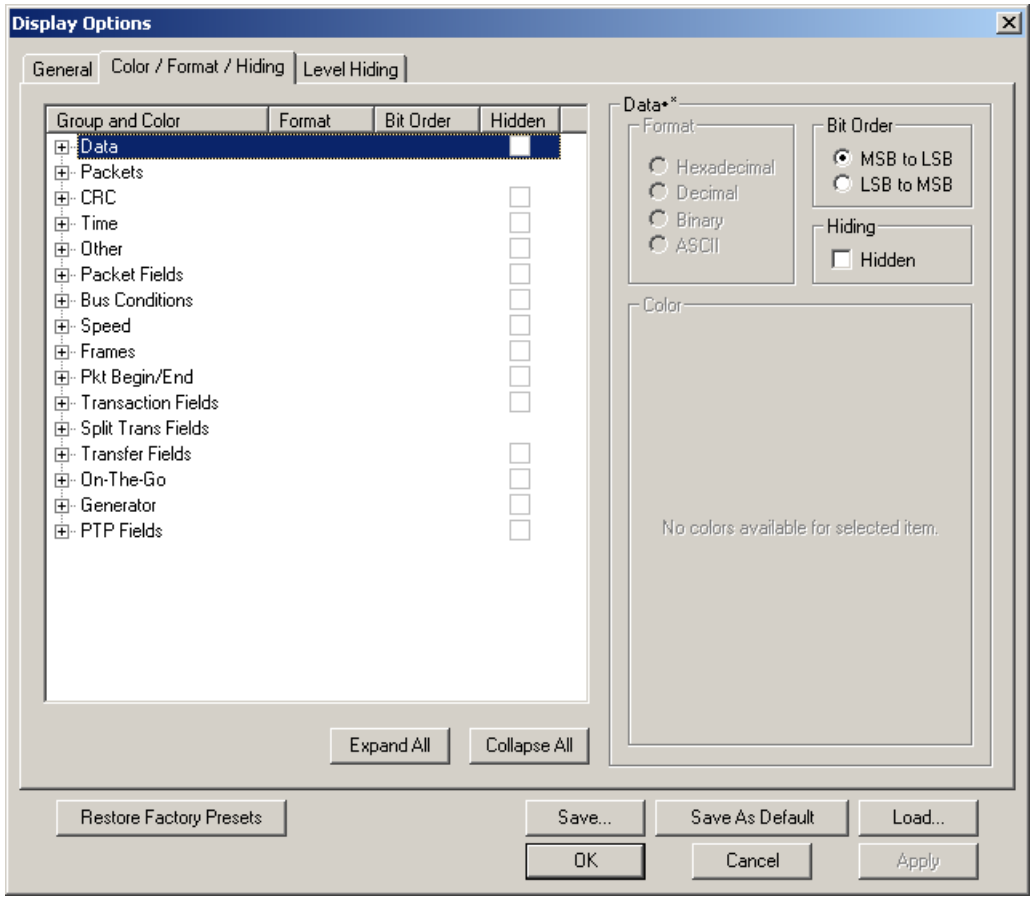
You specify the main Trace View information types and settings using General Display Options (see figure on previous page):

- **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/MTP Transactions, PTP/MTP Objects, and PTP/MTP 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.

7.2 Color/Format/Hiding Display Options

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

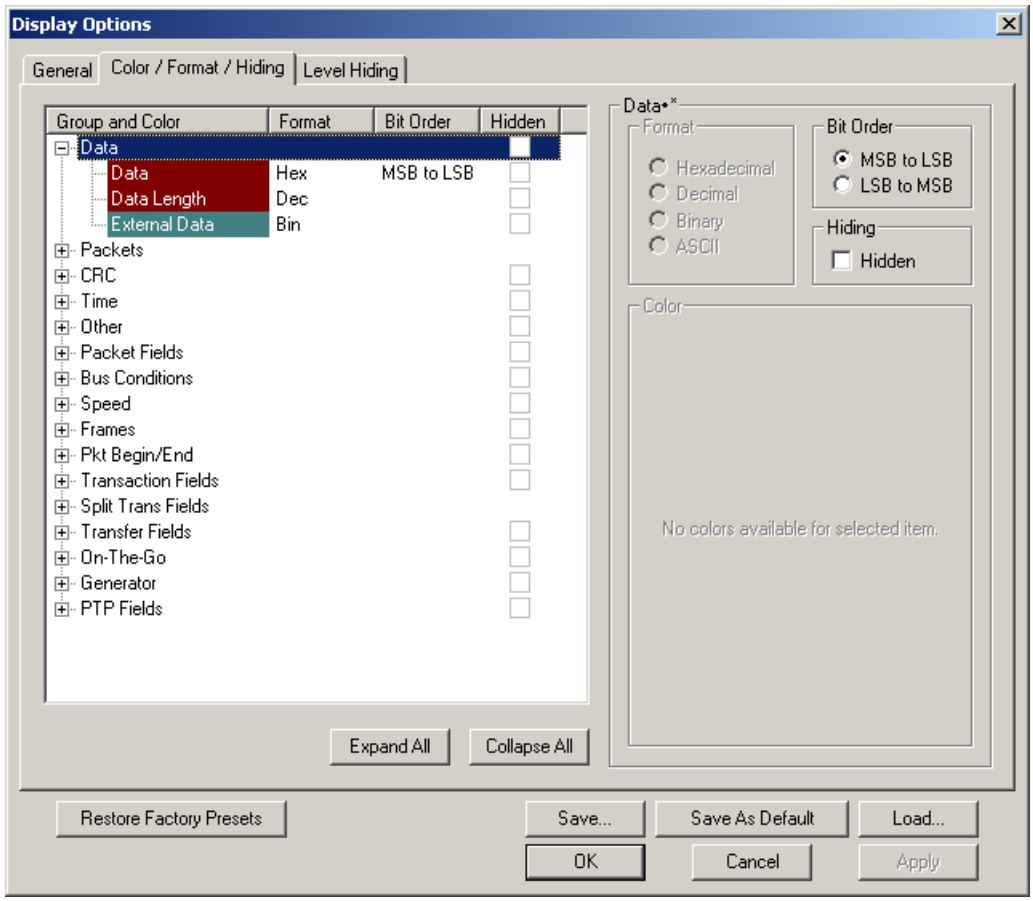


Color Display Options

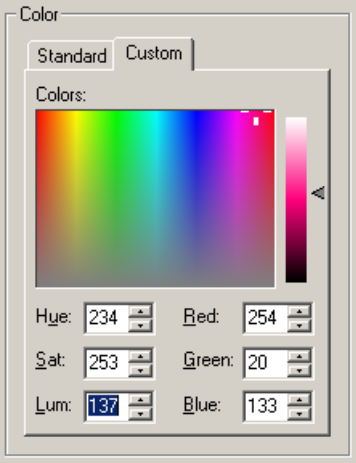
The program uses a default set of colors for each type of data in each group of data. The colors and color combinations are appropriate for most graphic systems. You can alter any color.

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.



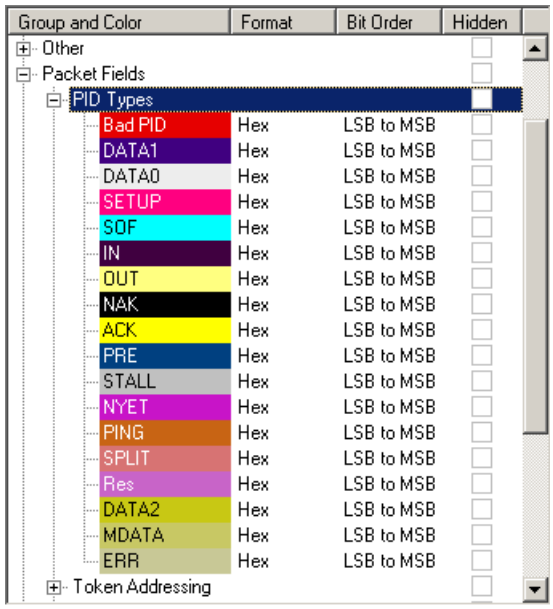
Note: You cannot change the color of an Invalid Data (packet error) field. It is permanently set to red.

Formats Display Options

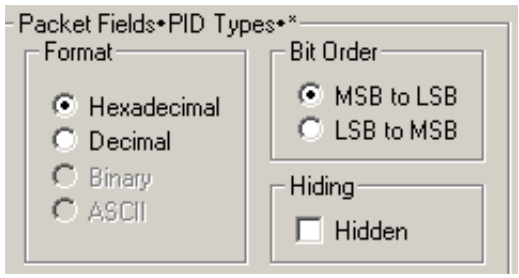
For each type of data in each group of data, the program has a default data format. Examples of number data formats are Bin (binary), Dec (decimal), and Hex (hexadecimal). Examples of date and time data formats are Hex uFrame, Dec uFrame, Date & Time, Time, Bit Time, seconds, microseconds, and nanoseconds. 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:

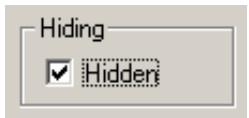


If available, select Bit Order in the Bit Order section. The options are MSB to LSB or LSB to MSB.

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.

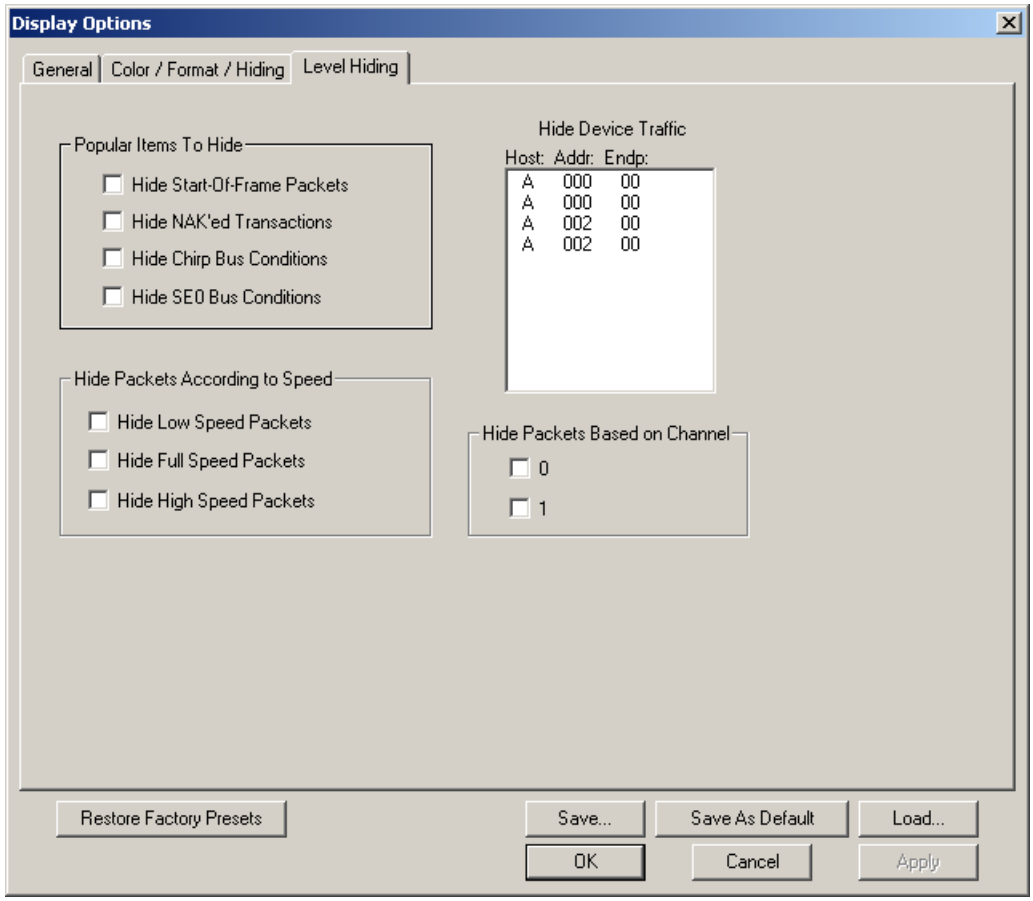


7.3 Level Hiding Display Options

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.



7.4 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 8: Decode Requests

8.1 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. Once read, the Analyzer then 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. The .**DEC** files are in the **Scripts** directory under the application directory. 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 123.

The following **.dec** files are provided:

USB Decode	USB Decoder Name	USB-IF Codes		
		Base Class	**Sub Class**	**Protocol ID**
Audio	Audio	**01h**		
Communications and CDC Control				
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	
Communication Device Subclass/EEM	CCID	**02h**	0Ch	

USB Decode	USB Decoder Name	USB-IF Codes		
		Base Class	**Sub Class**	**Protocol ID**
HID (Human Interface Device)		**03h**		
HUT (HID extension)	HID	Extension		
Monitor (HID extension)	HID	Extension		
Physical Interface (force-feedback extension to HID)	HID	Extension		
Point of Sale Devices (HID extension)	HID	Extension		
Power (HID extension)	HID	Extension		
Physical	HID	**05h**		
Still Imaging Class	Still Image/PTP/MTP/PictBridge	**06h**	01h	01h
Printer	Printer	**07h**	01h	xxh
Mass Storage				
SCSI/Bulk Protocol	Mass Storage SCSI Bulk	**08h**		
UFI(floppy)/CBI Protocol	MassStrg Class UFI CBI	**08h**		
Hub support	Hub Class	**09h**		
Picture Transfer Protocol (**PTP)** [Photographic and Imaging Manufacturers Association (PIMA) 15740 and ISO 15740]	Still Image/PTP/MTP/PictBridge	Extension		
Media Transfer Protocol (MTP) Class Decoding Extension	Still Image/PTP/MTP/PictBridge	Extension		
Video Class decoding 1.1 [currently at 1.0]				
Video CONTROL	Video	**0Eh**	01h	00h
Video STREAMING	Video	**0Eh**	02h	00h
Video INTERFACE COLLECTION	Video	**0Eh**	03h	00h

USB Decode	USB Decoder Name	USB-IF Codes		
		Base Class	**Sub Class**	**Protocol ID**
Pict Bridge (Camera and Imaging Products)	Still Image/PTP/MTP/PictBridge			
Wireless Controller				
BT	HCI	**E0h**	01h	01h
UWB	WA Radio Control	**E0h**	01h	02h
Host Wire Adapter	Wire Adapter Class	**E0h**	02h	01h
Device Wire Adapter	Wire Adapter Class	**E0h**	02h	02h
Miscellaneous				
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	Standard, so no decoder method needed	**EFh**	03h	01h

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***.

8.2 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

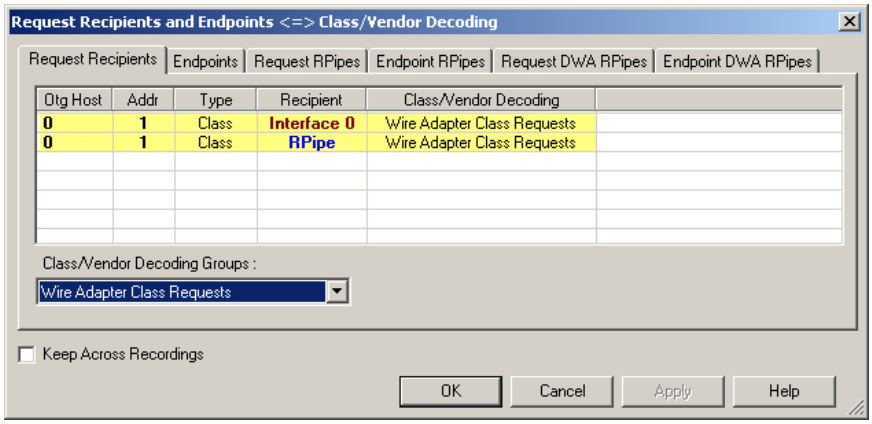
To assign a decoding group to a request recipient,

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:

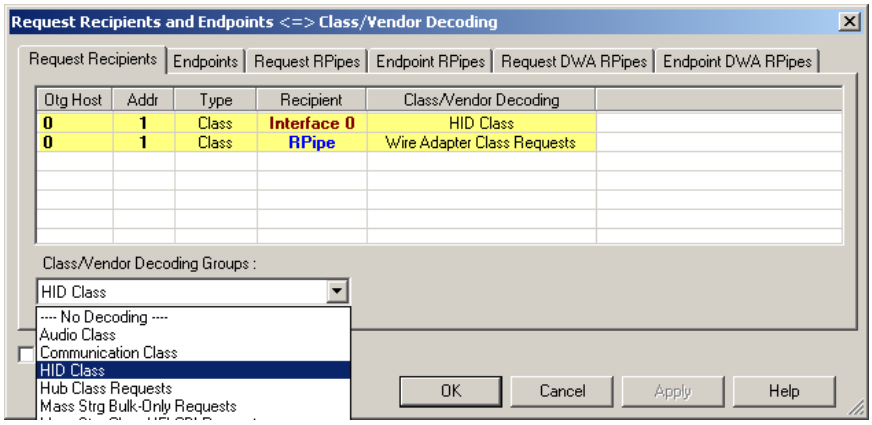
Step 2 Select **Map Request Recipients to Class/Vendor Decoding** to display the Request Recipient and Endpoints dialog box:



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
- Communication Class
- HID Class
- HUB Class Requests
- Mass-Strg Bulk-only Requests
- Mass-Strg Class UFI CBI Requests
- Printer Class
- Standard Requests
- StillImg/PTP/MTP/PictBrg 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,

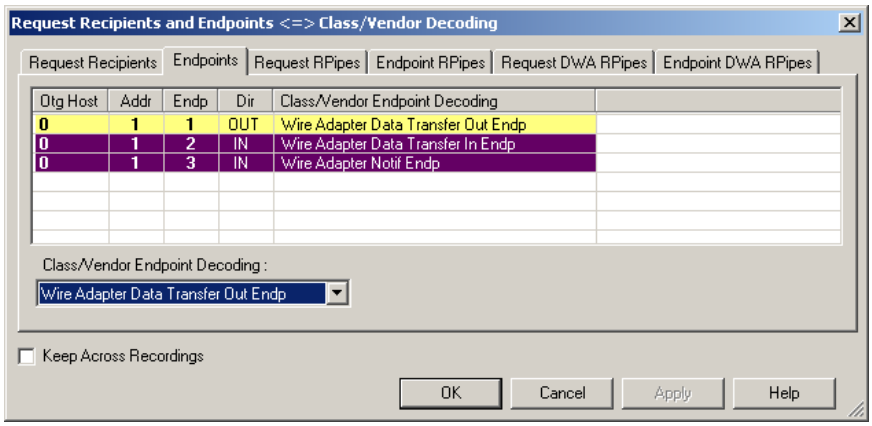
Step 1 Click the **Apply Decoding Scripts** button on the Toolbar.

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.

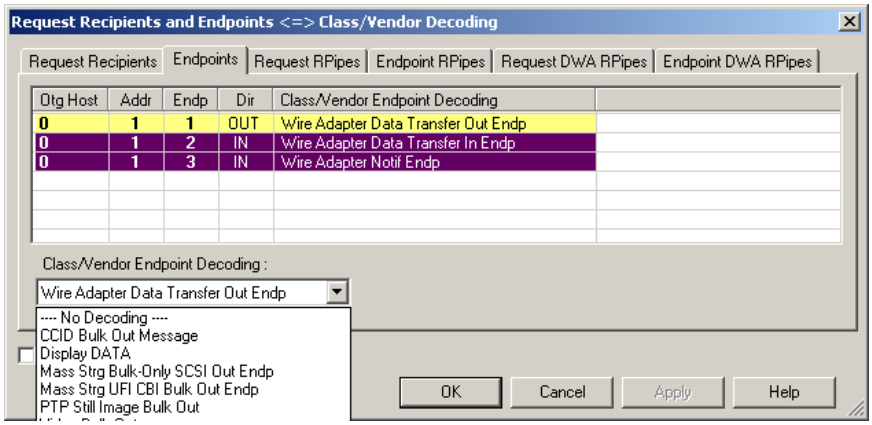
Step 3 Click the **Endpoints** tab to display the **Endpoints** dialog box.



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
- Mass Strg Bulk-Only SCSI Out Endp
- Mass Strg UFI_CBI Bulk Out Endp
- StillImg/PTP/MTP/PictBrg 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 Notification
- Display DATA
- 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
- StillImg/PTP/MTP/PictBrg Bulk In
- StillImg/PTP/MTP/PictBrg 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:

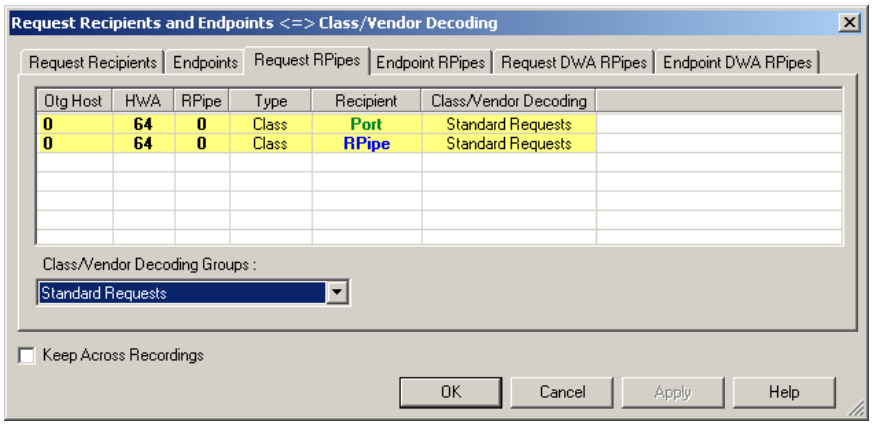
Step 1 Click the **Apply Decoding Scripts** button on the Toolbar.

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:

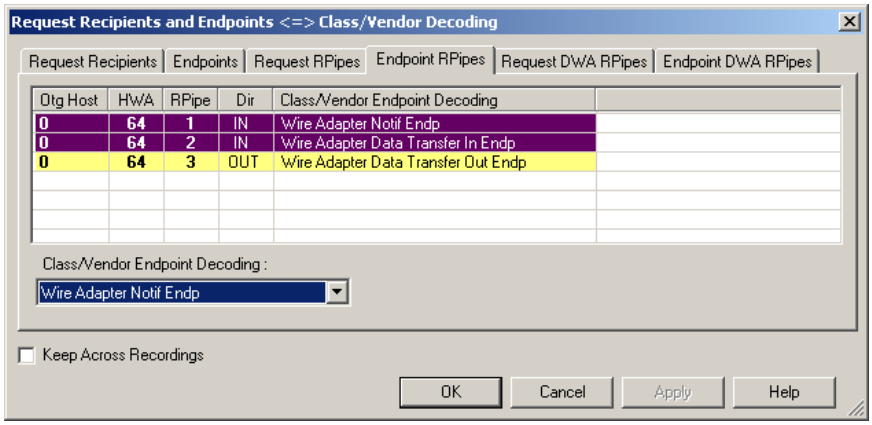
Step 1 Click the **Apply Decoding Scripts** button on the Toolbar.

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:

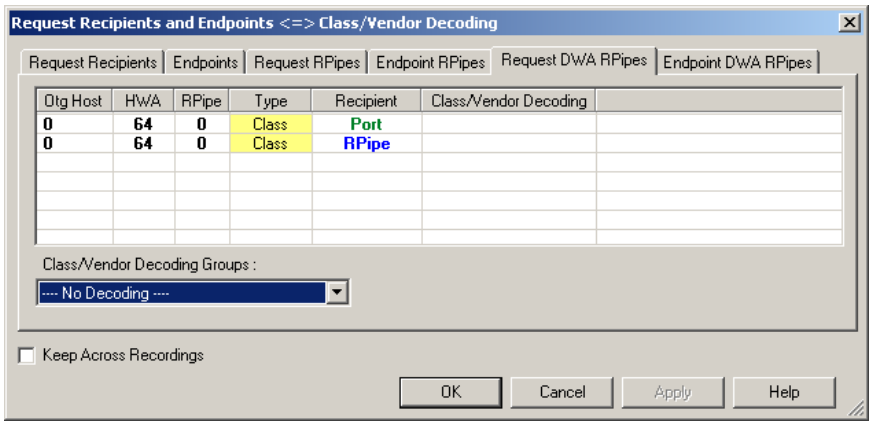
Step 1 Click the **Apply Decoding Scripts** button on the Toolbar.

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:

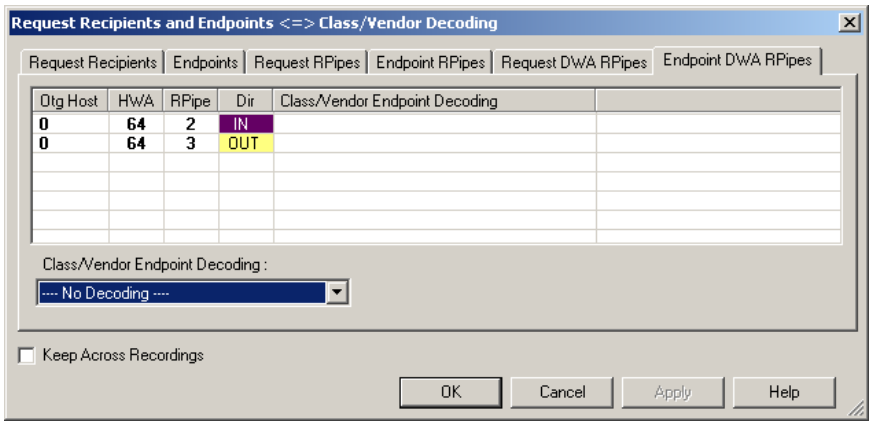
Step 1 Click the **Apply Decoding Scripts** button on the Toolbar.

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**.

8.3 General Options

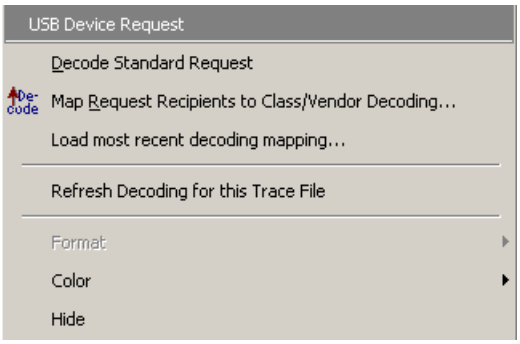
Commands are transferred on USB using special control transfers called USB Device Requests. The Analyzer can decode Device Requests as they are defined in the USB specifications and various Device Class and Vendor specifications.

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.

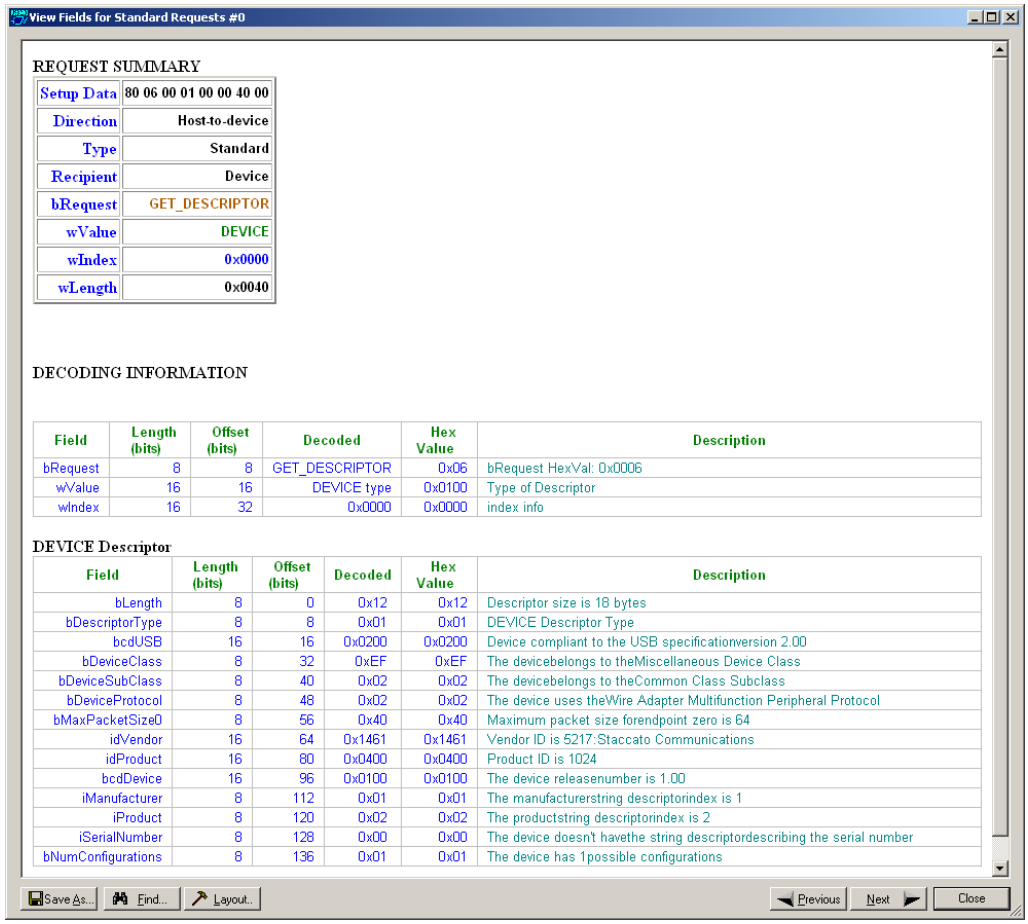
The ability to retain the mapping from trace to trace DURING an application session already exists: the Keep Across Recordings button in the endpoint map dialog. This new feature simplifies the process when the application has been re-started.

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/

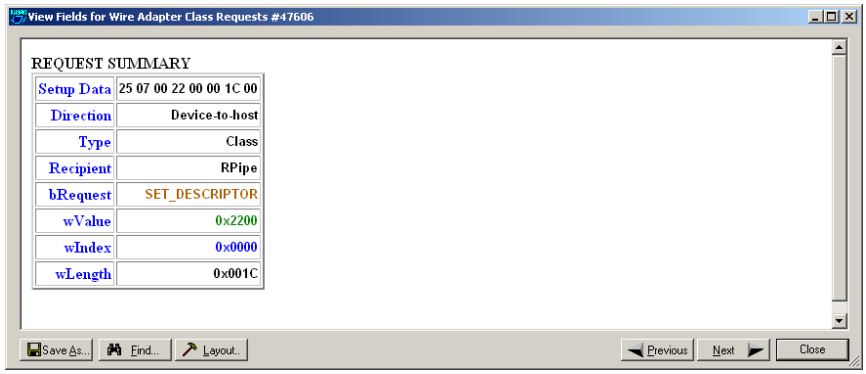
Decoding Class Requests

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:

Step 1 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*Mobile*HS™ 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).

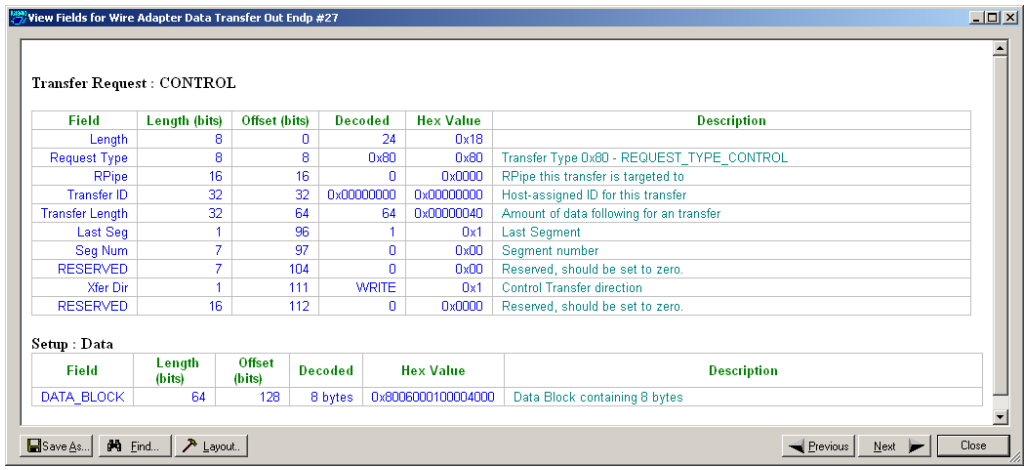
Decoding using Endpoint Information

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:

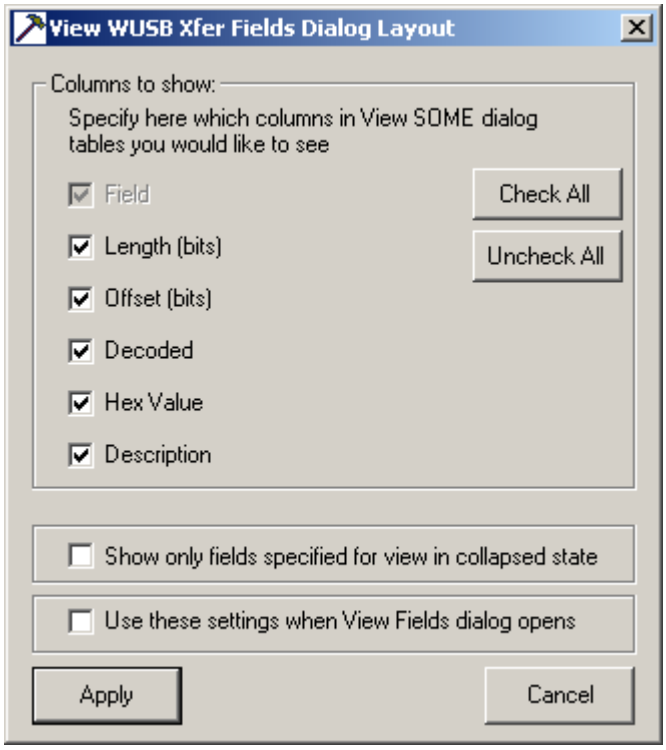


Figure 8.1 View WUSB Xfer Fields Dialog Layout Dialog Box

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

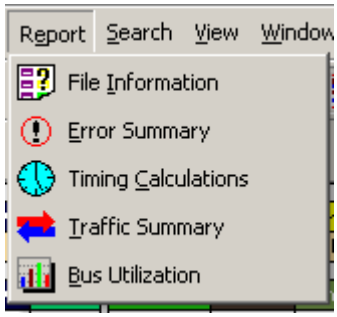
You can **Check All** or **Uncheck All**.

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 9: Reports

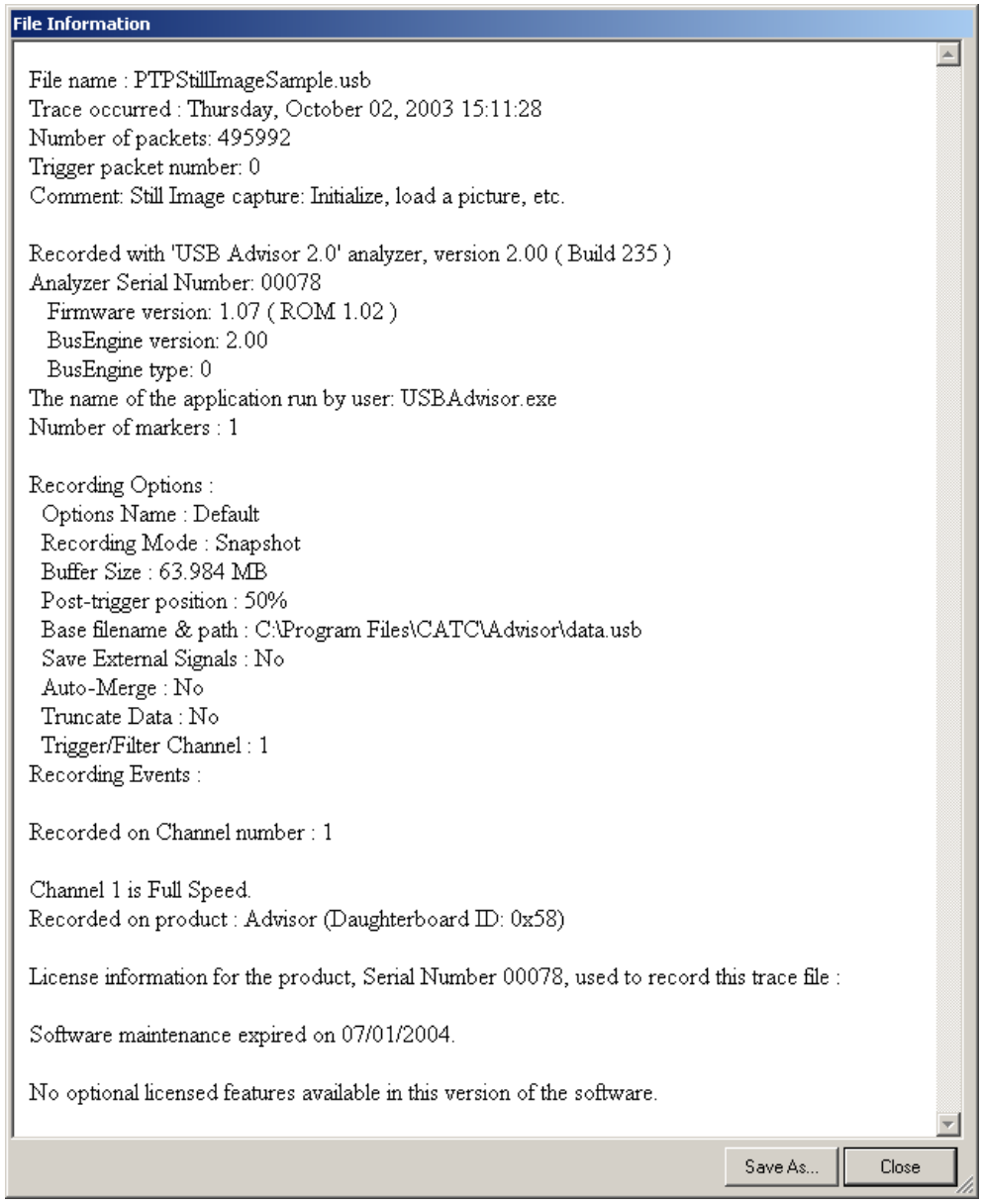
The Report menu provides several reports to assist you in analyzing USB traffic recorded by the Analyzer.



9.1 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:

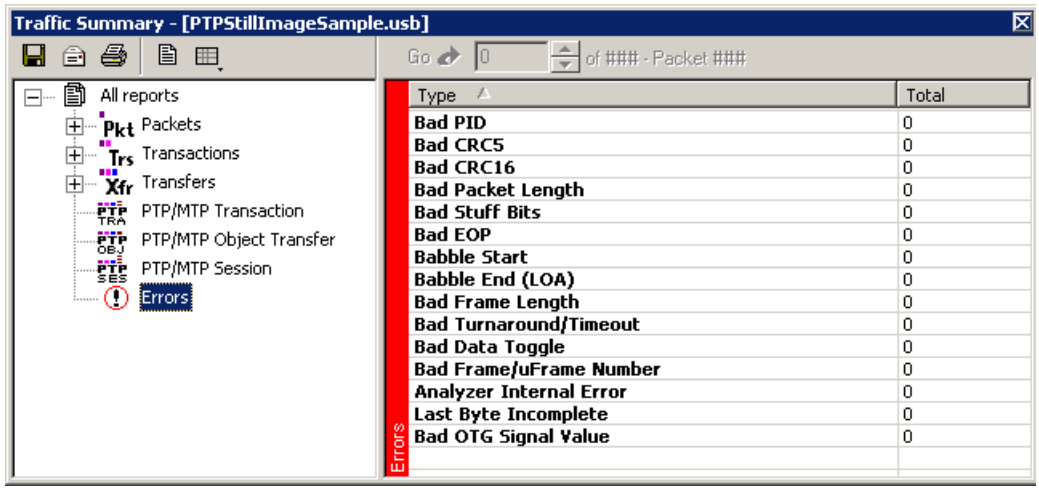


The File Information report provides information about how the recording was made, what the buffer settings were, what the trigger options were, and what version of all the Analyzer hardware was used to make the recording.

9.2 Error Summary

The Error Summary details all errors analyzed throughout the recording.

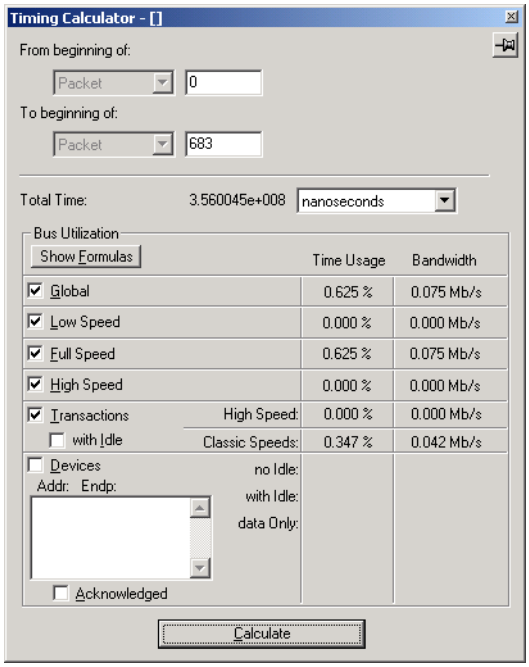
- Select **Error Summary** under **Report** in the Menu Bar.
  OR
- Click in the Tool Bar to display the Error screen below the Trace View:



9.3 Timing Calculations

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

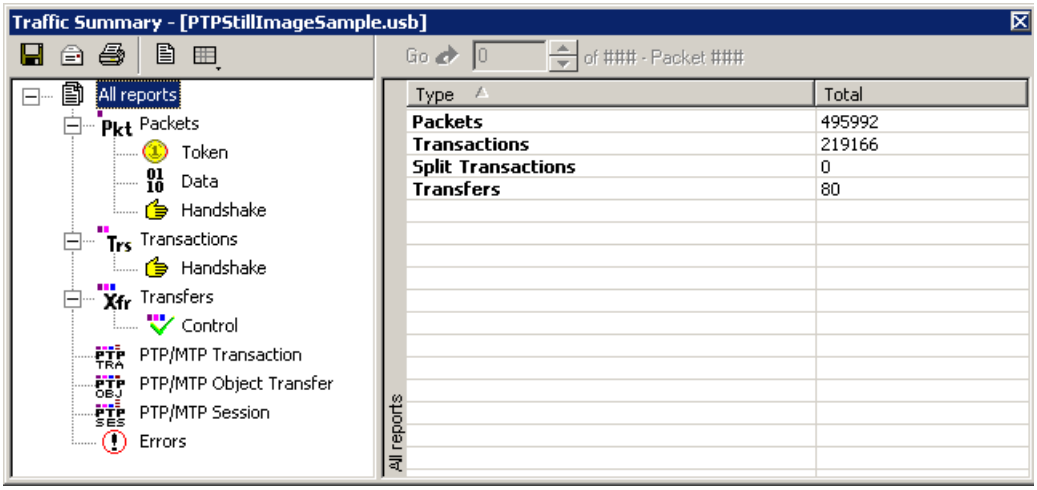
- Select **Reports** > **Timing Calculations** in the Menu or click to display the Timing and Bus Usage Calculator screen:



9.4 Traffic Summary

Traffic Summary summarizes the numbers and types of packets, transactions etc. 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:

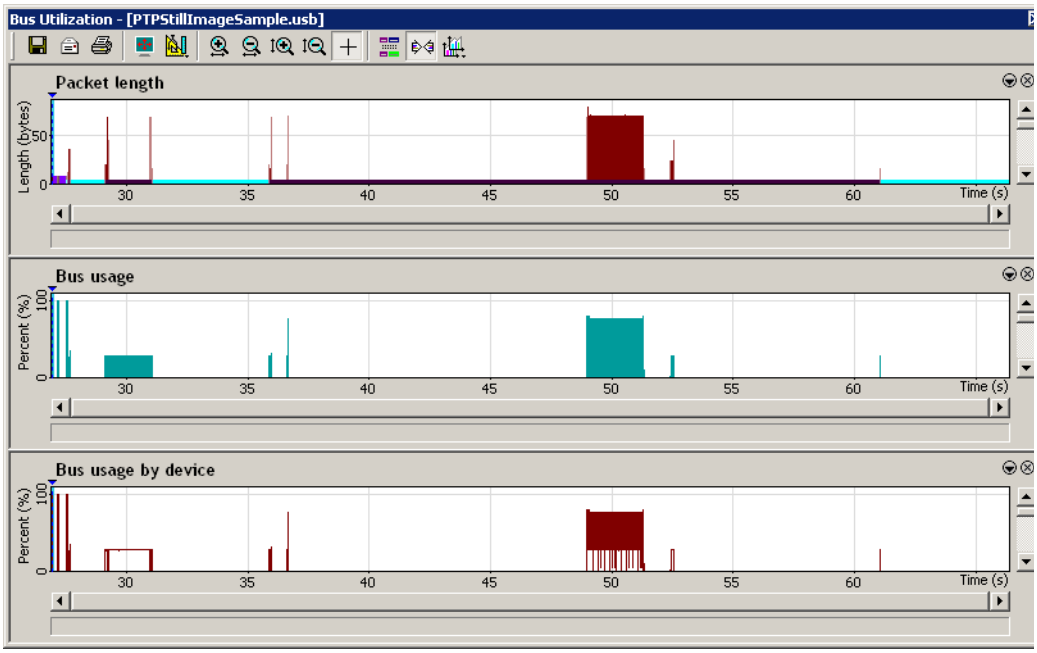


9.5 Bus Utilization

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

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

or click the button marked . A window opens with graph areas:



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 “Clicking the View Settings button opens 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

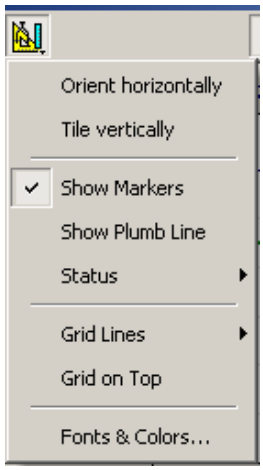
Select Range

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.

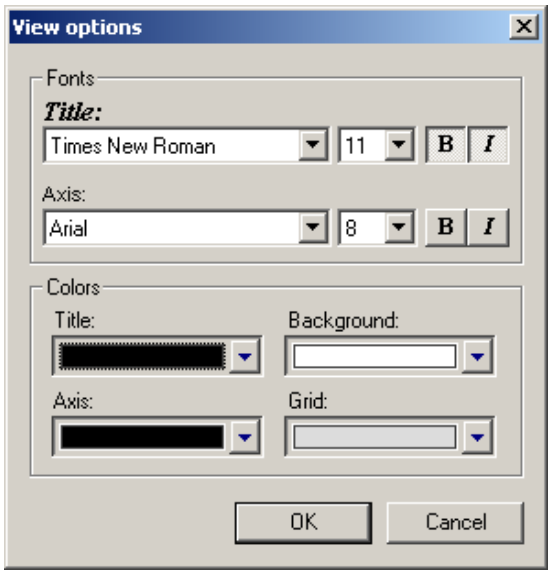
View Settings Menu

Clicking the View Settings button opens a menu with options for formatting the display.



- **Orient Horizontally**: Changes the orientation of bus usage to horizontal. After selecting this option, the menu has Orient Vertically.
- **Tile Vertically**: Tiles the two graphs vertically (i.e., side by side). After selecting this option, the menu has Tile Horizontally.
- **Show Markers**: Places tick marks along the x axis of each graph.
- Show Plumb Line
- **Status**: Opens a sub-menu with the following options:
  - Bar: Displays a status bar at bottom of graph.
  - Tooltip: Causes a tooltip to appear if you position your mouse pointer over part of the graph and leave it there for a couple of seconds.
  - None: Turns off tooltips and the status bar.
- **Grid Lines**: Opens a sub-menu 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.

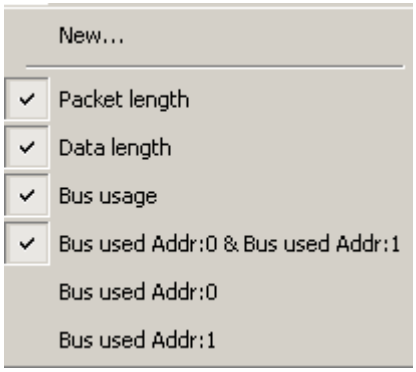
- **Fonts and Colors**: Opens a dialog box for setting the colors and fonts used in the graphs:



Graph Areas Menu

The Graph Areas menu allows you to view different information in the Bus Utilization window.

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

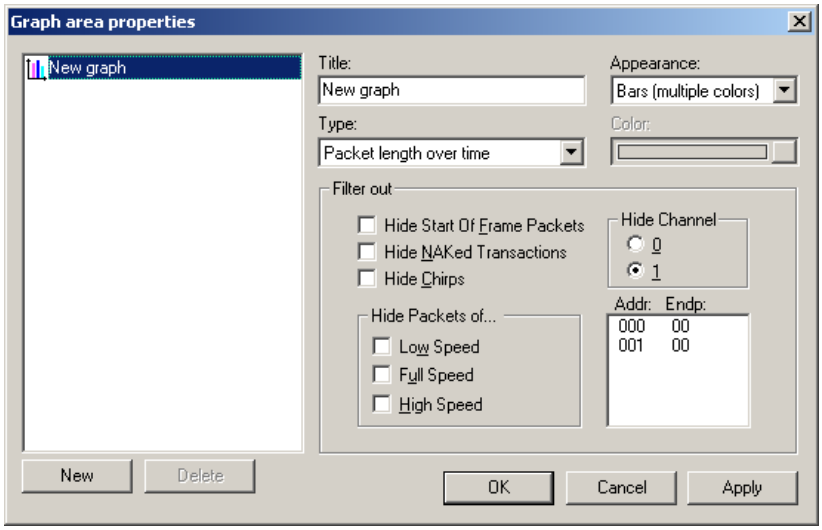


Step 2 Select the data to appear in the Graph Areas window.

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

To change the 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 10: Recording Options

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

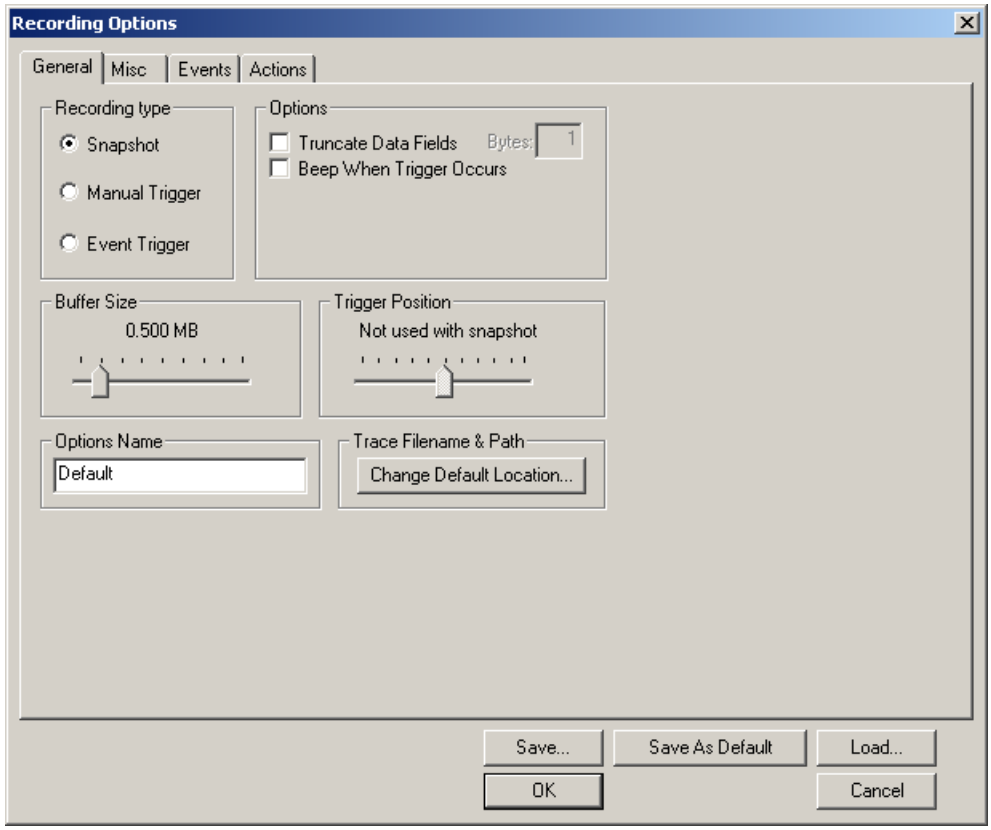
To open the **Recording Options** menu:

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

  OR

- Click on the Tool Bar.

You see the **Recording Options** window at the **General** tab:



10.1 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 USB*Mobile*HS 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.

Recording begins when is clicked and ends when the buffer is full.

You can stop recording by clicking the Stop button.

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 minimum data length value in the Bytes box. USB*Mobile*HS 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 causes the computer connected to the USB*Mobile*HS to beep three times when a trigger condition is first detected.

Buffer Size

You can adjust the size of the recording buffer from 0.4 megabytes to 64 megabytes.

The **Recording type** option determines how this buffer is used. Although there are 64 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."

Creating a New Recording Options File

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**.

You see the **Save As** window.

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

Step 4 Click **Save.**

Loading a Recording Options File

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.

The options settings for that name then display.

Trace File Name & Path

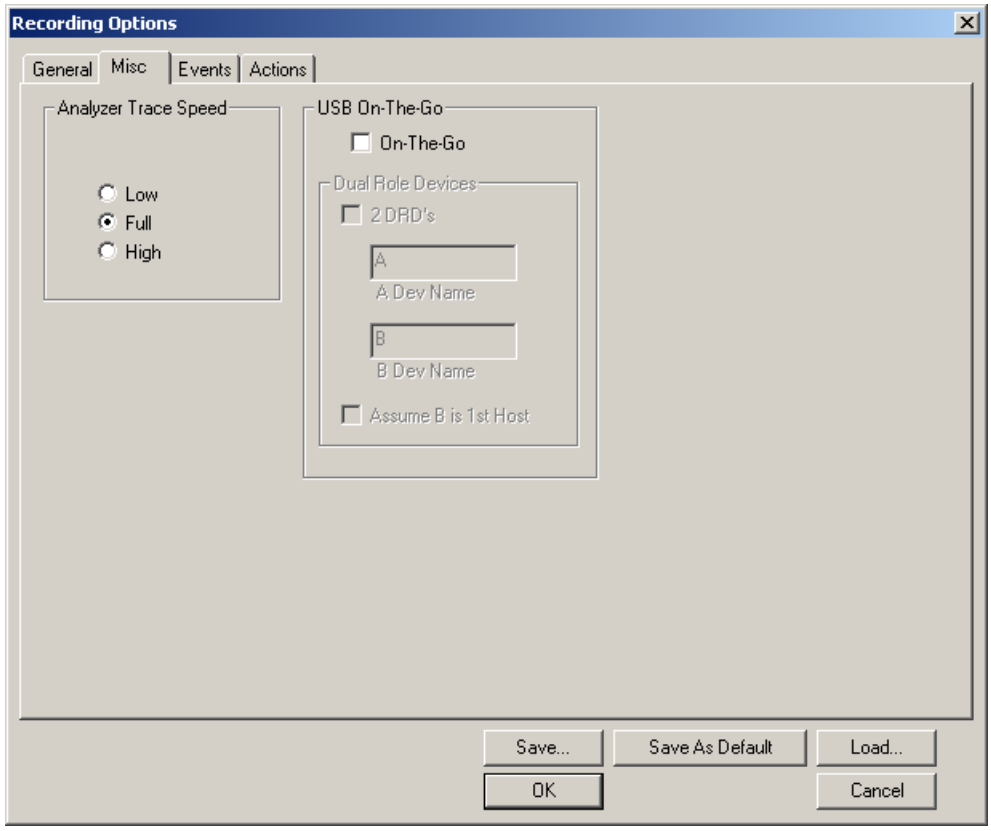
Trace File Name & Path opens a **Save As** dialog box for saving your trace file. The default recording file name is **data.usb** for Low, Full, and High Speed recordings.

- Click **Trace File Name & Path.**

You see a **Save As** window in which to enter the recording file name ***.usb** for all subsequent recordings.

10.2 Recording Speed

The **Misc** tab settings allow you to set the speed of traffic and to configure the Analyzer to record On-The-Go traffic.

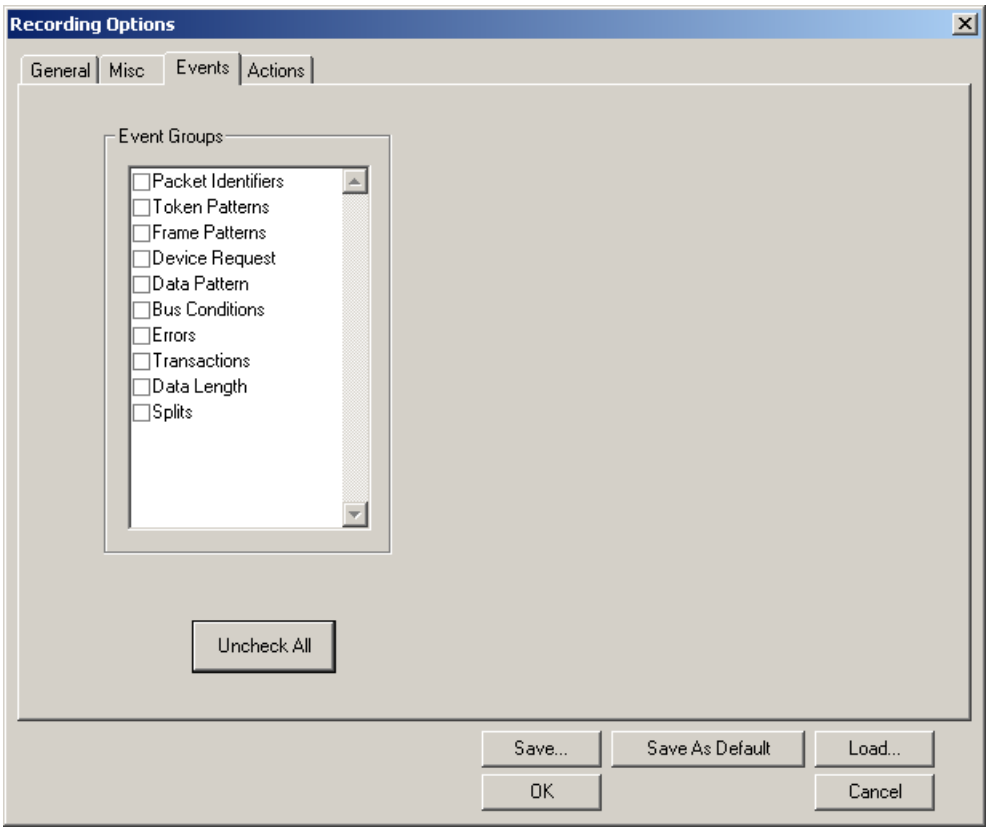


- **On the Go**: Check this if you are tracing an On the Go device. This allows session request protocol detection.
- **Dual Role Devices**:
  - **2DRD**: If both devices are Dual-Role devices, check this box to enable Host Negotiation Protocol (HNP) detection.
  - **A Dev Name**: Enter a name of your choice to refer to the device that receives the mini-**a** plug.
  - **B Dev Name**: Enter a name for the device that receives the mini-**b** plug.
- **Assume B is 1st Host**: Check this box if your scenario is one where the B device is acting as host when the trace is started. If the trace incorrectly identifies the wrong host, you can change it when viewing it by clicking on the host field of a packet and selecting a switch to the other host ID.

10.3 Events Recording Options

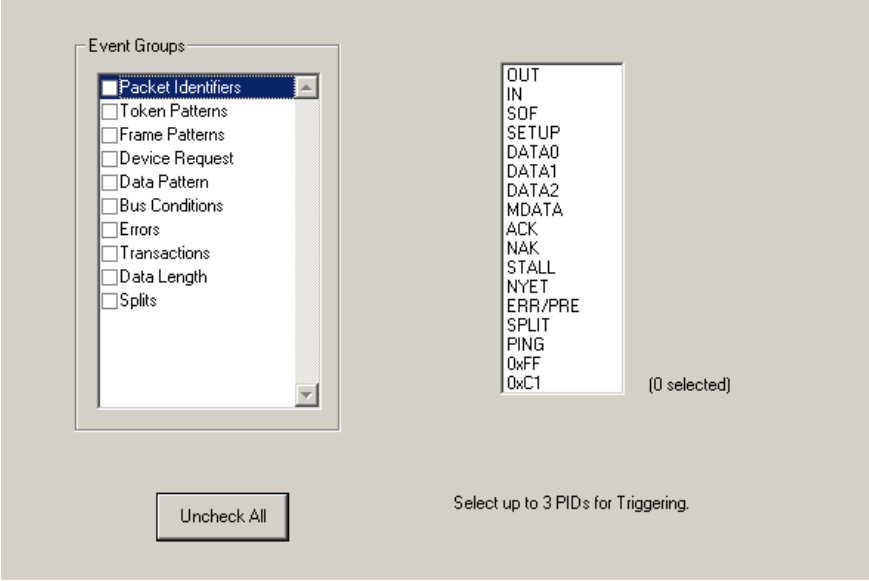
The Event triggering and filtering options allow you to set specific parameters for each Event Group. When an Event Group is selected, a field appears that allows you to select specific conditions within the corresponding Event Group. As details are selected, other Event Group details may become "grayed 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

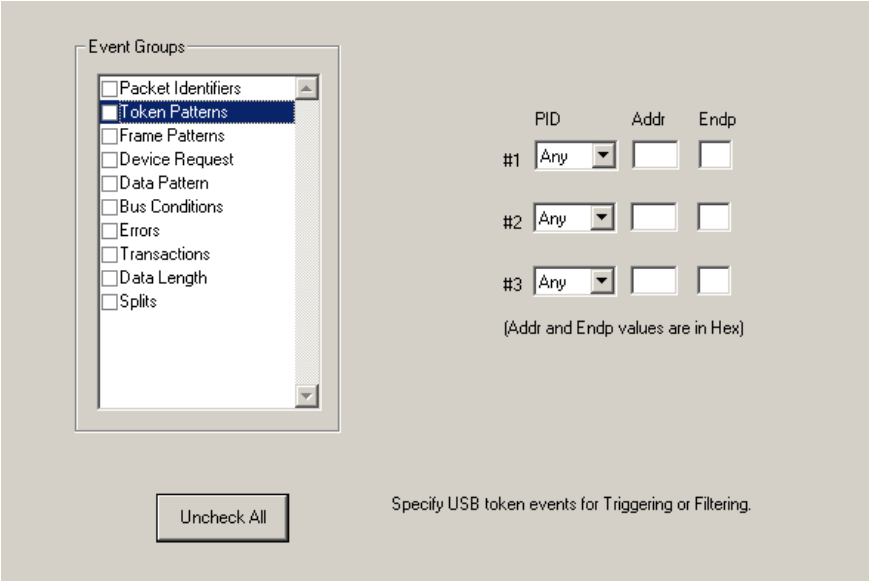
- Select **Packet Identifiers** under **Event Groups** to display the **Packet Identifiers** window:



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

Token Patterns

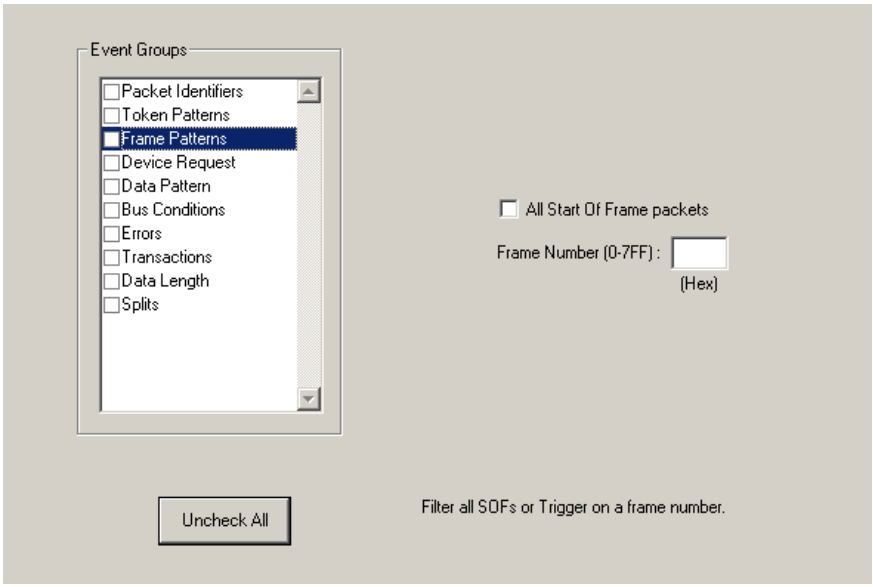
- Select **Token Patterns** under **Event Groups** to display the **Token Patterns** window:



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

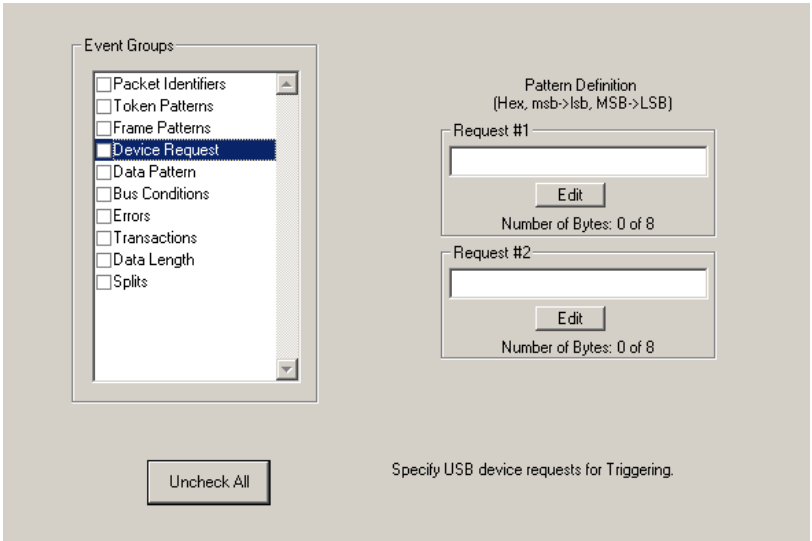
- Select **Frame Patterns** under **Event Groups** to display the **Frame Patterns** window:



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

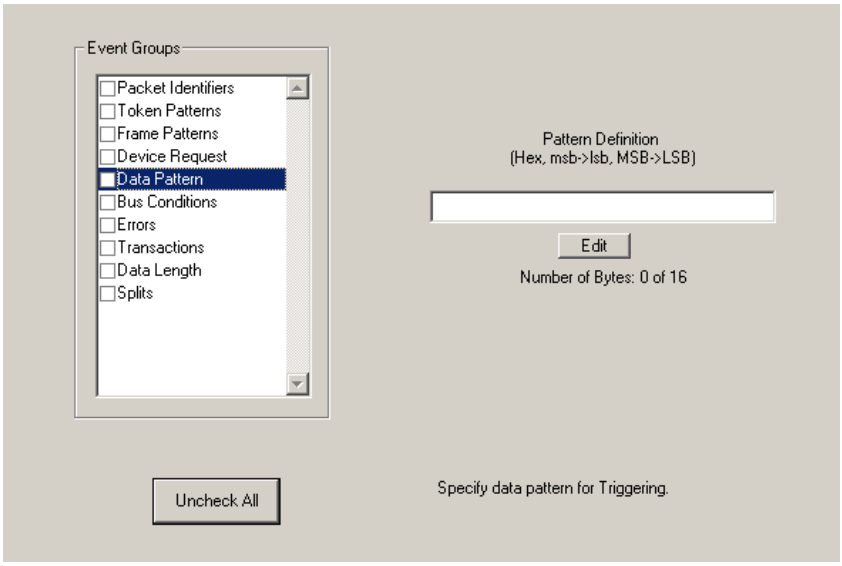
- Select **Device Requests** under **Event Groups** to display the **Device Requests** window:



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

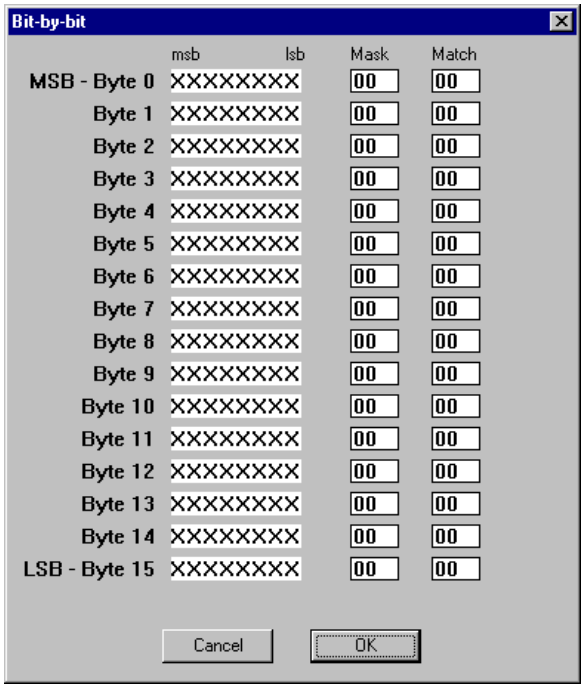
Data Pattern

- 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 1 Press the **Edit** button. to display a **Bit-by-Bit** window:

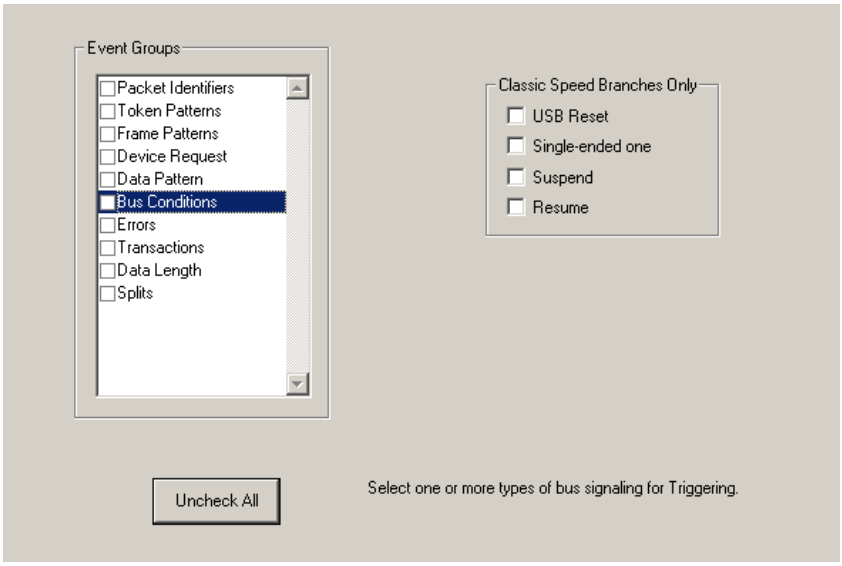


Step 2 Click your mouse on the bits within each byte that you wish to edit and enter in the appropriate text.

The Mask and Match fields change to reflect your changes.

Bus Conditions

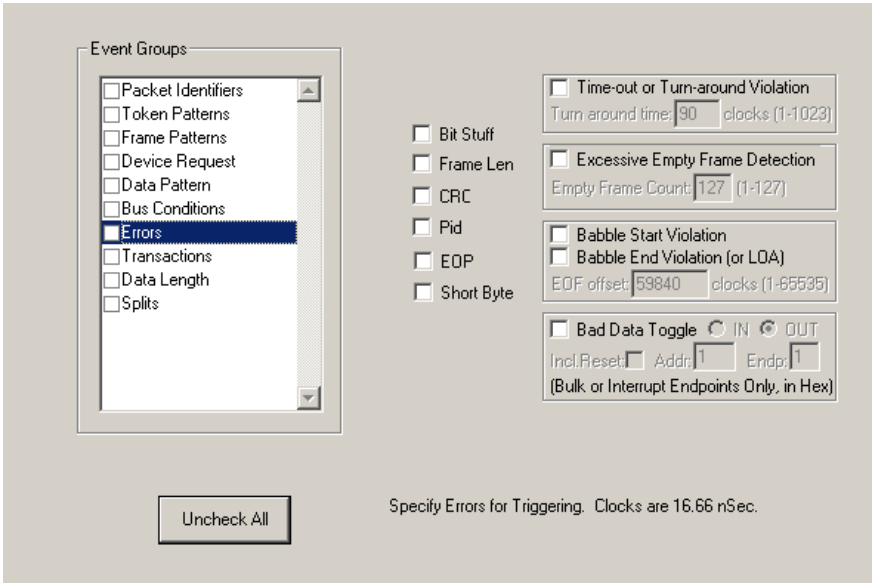
- Select **Data Pattern** under **Event Groups** to display the **Bus Conditions** window:



Use any combination of the listed errors as a Trigger.

Errors

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

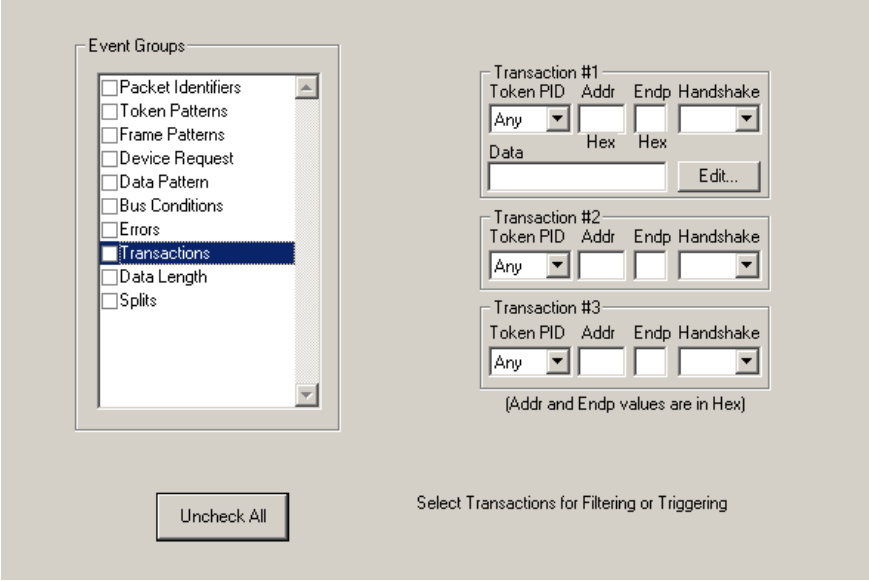


Use any combination of the listed errors as a Trigger.

- **Bit Stuffing, Frame-Length, CRC, Pid, EOP, Short Byte checkboxes** - Select one or more of these errors to set these as the basis for triggering or filtering. A Short Byte is a condition where EOP begins on a non-byte boundary.
- **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.

Transactions

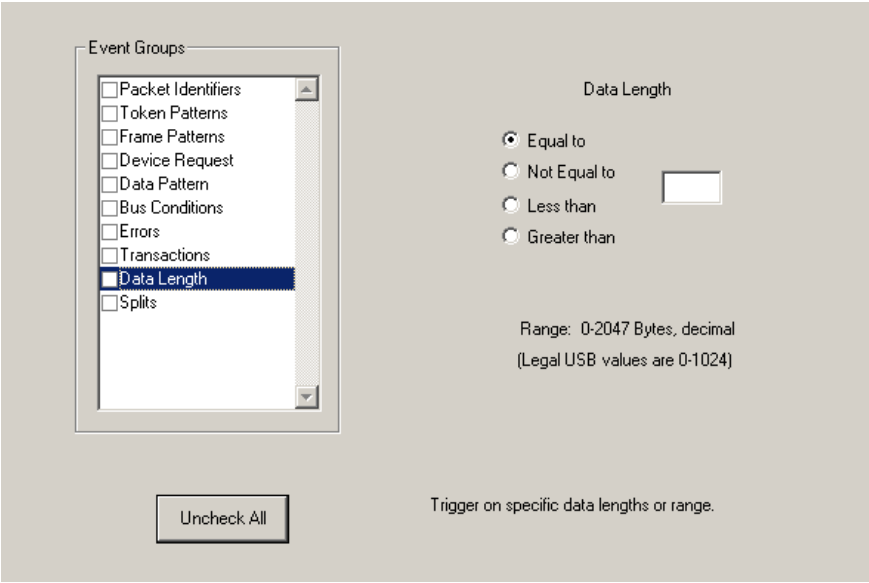
- Select **Transactions** under **Event Groups** to display the **Transactions** window:



Use any combination of the listed errors as a Trigger.

Data Length

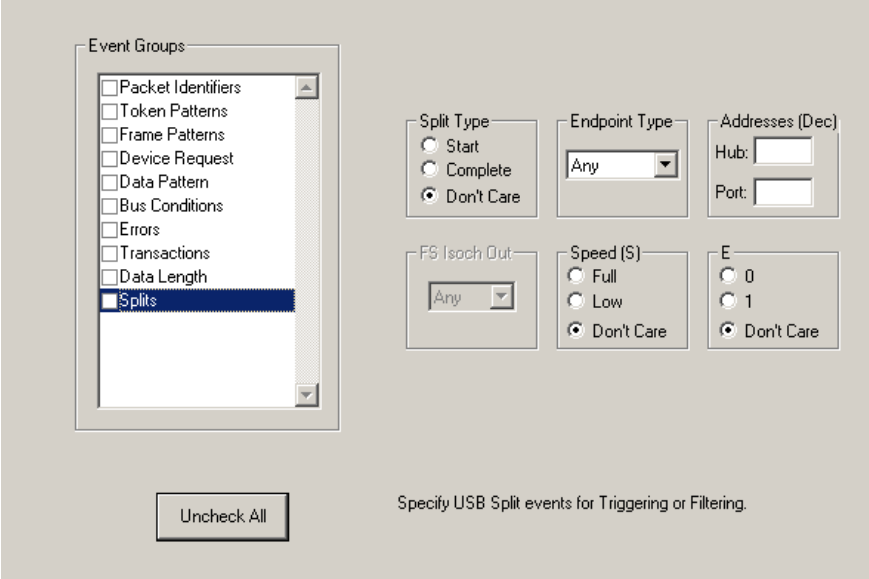
- Select **Data Length** under **Event Groups** to display the **Data Length** window:



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.



To trigger on splits, select a split type, and endpoint type, and an address. You can also select FS Isoch Out when you select the Isoch endpoint type.

10.4 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.

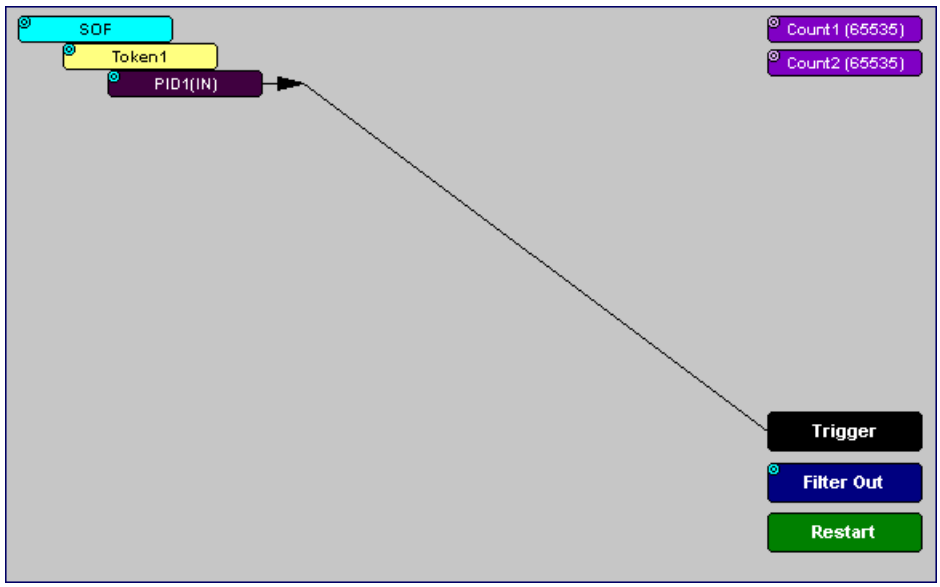
Actions Window Layout

The Actions window divides into three sections: left, center, and right.

The left section displays buttons for the events selected in the **Events** window. Events buttons tell USB*Mobile*HS 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 were selected, no Event buttons are displayed.

The right side 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 appears below the event on the left side of the screen.

The right section displays three Action buttons: **Trigger**, **Filter Out**, and **Restart**. Action buttons controls USB*Mobile*HS's response to Event conditions. For example, if an Error button is linked to a Trigger button, the Action button tells USB*Mobile*HS to trigger when the error condition occurs.



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

10.5 Connecting Events to Actions

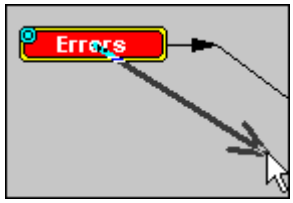
To create or edit links between Event buttons, Counters, and Action buttons, you click an Event button and then click a Counter or Action. By clicking an Event, an arrow connects the Event button to the cursor. When you click a Counter or Action button, the arrow becomes anchored to the selected button.

To make an event 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 your mouse at the desired Action button.

The elastic arrow moves with the mouse pointer.

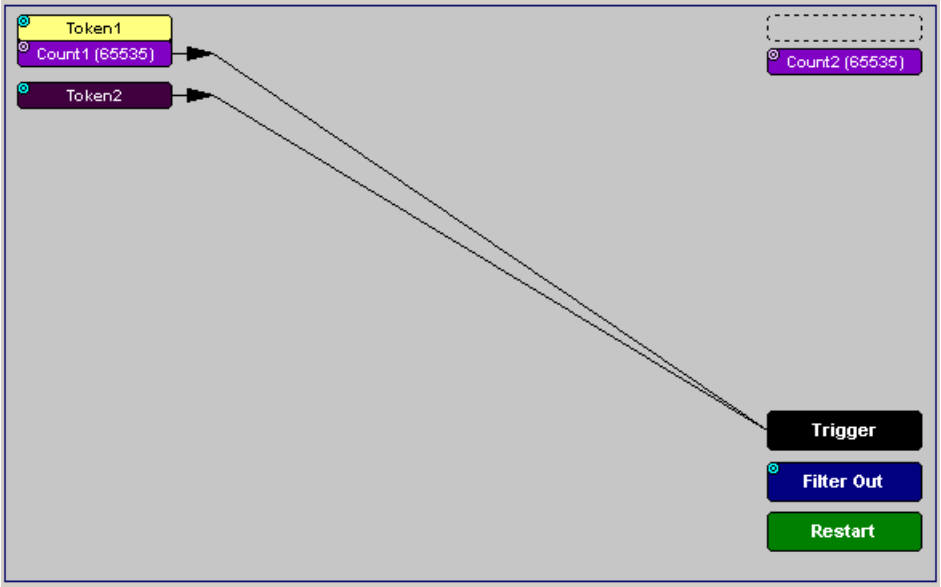
Step 5 With the pointer over an Actions button, click again the left mouse button again.

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

10.6 Connecting Counters to Events

The right side of the Actions window contains two Counter buttons marked **Count1** and **Count2**.

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



When an event is linked to a counter, the counter appears under that event on the left side of the Actions window. 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.

An Event button appears 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.

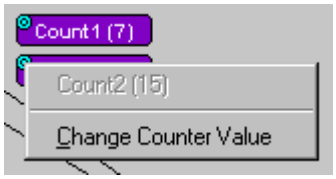
Step 3 Click the Event button.

An arrow connects the Event button to the 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 your selected counter.

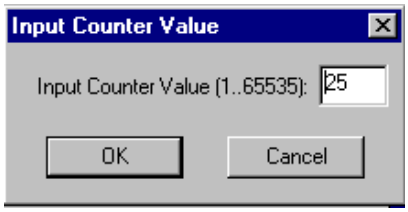


A pop-up menu opens to allow you to configure the counter.

Step 6 Choose **Change Counter Value**.

The Input Counter Value dialog box opens.

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



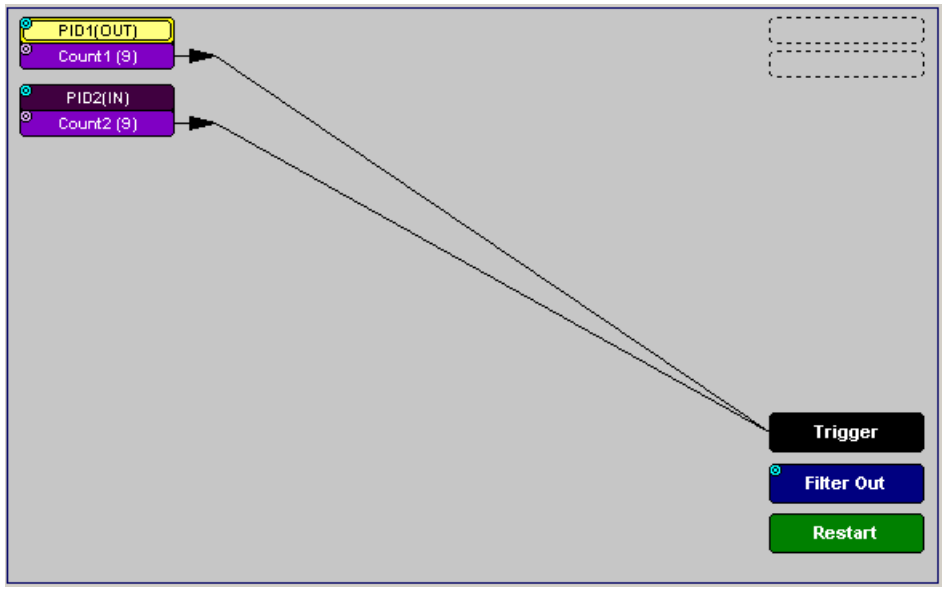
The dialog box closes, and the Counter button displays your selection.

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."

This example reads "Trigger when Count1 has counted nine Out packets or Count2 has counted nine In packets."



10.7 Using Action Buttons

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

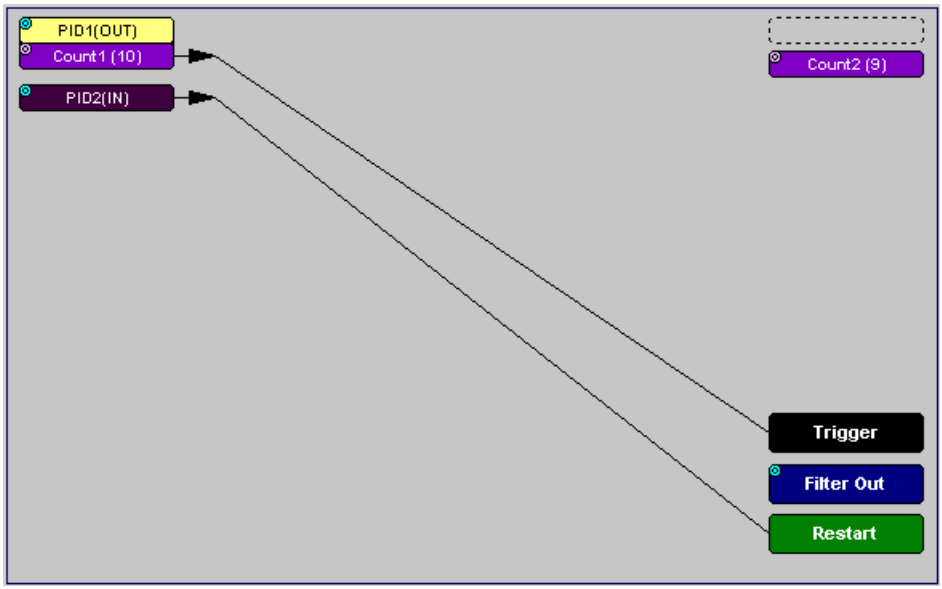
Trigger

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:

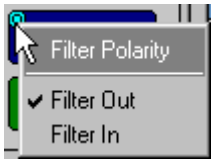
- **Filter In** records ONLY those packets related to the specified event.
- **Filter Out** records all packets EXCEPT those related to the specified event.

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**. (Note: the button may say **Filter In** depending on the last action specified.)

You see the **Filter Polarity** menu:



Step 2 Select **Filter In**.

The button changes to read Filter In.

10.8 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.

10.9 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 the appropriate Recording Options have been set:

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 1 Select **Stop** under **Record** on the Menu Bar.

OR

Click on the Tool Bar.

Click again during the uploading to upload only a portion of the recorded memory.

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.

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 1 Select **Save As** under **File** on the Menu Bar.

OR

Click on the Tool Bar.

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

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

Chapter 11: Updates

From time to time as modifications are made to the USB*Mobile*HS™ Hi-Speed USB Analyzer, it is necessary to update the Analyzer for optimal performance.

11.1 Software, Driver, and BusEngine Revisions

The **Readme.txt** file on the first installation disk and in the installed directory gives last-minute updates about the current release.

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 USB*Mobile*HS…** from the **Help** menu.

About USB*Mobile*HS details revisions of the following software and hardware:

- USB*Mobile*HS Software Version
- USB*Mobile*HS Driver Version
- BusEngine Version
- Unit Serial Number

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

11.2 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 USB*Mobile***HS screen, verify which version of USB*Mobile*HS 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 file for important information on changes in the release.

11.3 BusEngine and Driver Updates

The Bus Engine and driver updates are done automatically during software installation. No user interaction is necessary or possible.

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 75.

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.

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/	

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