



PROTOCOL SOLUTIONS GROUP
3385 SCOTT BLVD
SANTA CLARA, CA 95054

LeCroy USB *Tracer*[™]

USB 2.0 Design & Verification System User Manual

Manual Version 2.30



For Software Version 2.3

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TABLE OF CONTENTS

Chapter 1	Overview	1
1.1	General Description	1
1.2	Features	3
	Traffic Generation	5
	Hi-Speed Slow Clock	5
1.3	Graphical Bus Traffic Display	5
1.4	Accurate Time Management	6
1.5	Comprehensive Error Detection and Analysis	6
1.6	Real-Time Event Triggering and Capture Filtering	6
1.7	Advanced Event Counting & Sequencing	7
1.8	BusEngine Technology	7
Chapter 2	General Description	1
2.1	System Components/Packing List	1
2.2	Analyzer PC Requirements	1
2.3	The Installed USBTracer Unit	1
	LED and Button Descriptions	2
2.4	Specifications	3
	Package	3
	Connectors	3
	Weight	3
	Power Requirements	3
	Environmental Conditions	3
	Probing Characteristics	3
	Switches	3
	Indicators (LEDs)	4
	UPAS	4
	Recording Memory Size	4
2.5	External Interface Breakout Board	6
	Pin-Outs for the Data In/Out Connector	7
	Prototype Rework Area	7
Chapter 3	Quick Installation	9
3.1	Installing the Software and Starting the Program	10
3.2	Your First USB Recording	11
	Trace View Features	13
Chapter 4	Detailed Installation	15
4.1	USBTracer System Setup	15
4.2	AC Power Source	15
4.3	PC Connection	15
4.4	Setting Up the Analyzer	16
4.5	Installing the Analyzer Software on the PC	16
4.6	USBTracer Program Startup	17
4.7	Making a Recording	17

Chapter 5	Software Overview	19
5.1	Starting the USBTracer Program	19
5.2	Tooltips	19
5.3	The Main Display Windows	20
5.4	View Options	23
	Resetting the Toolbar	23
	Tool Bar	25
5.5	Status Bar	27
	Recording Progress	27
	Recording Status	28
	Recording Activity	29
	Search Status	29
5.6	Navigation Tools	30
	Zoom In	30
	Zoom Out	30
	Wrap	30
5.7	USBTracer Analyzer Keyboard Shortcuts	31
Chapter 6	Reading a Trace	33
6.1	Trace View Features	33
6.2	Set Marker	34
6.3	Edit or Clear Marker	35
6.4	View Raw Bits	36
6.5	Expanding and Collapsing Data Fields	37
	Using the Expand/Collapse Data Field Arrows	37
	Double-Clicking to Expand/Collapse Data Fields	37
	Expanding or Collapsing All Data Fields	37
	Using the Data Field Pop-up Menus	38
6.6	View Data Block	39
6.7	Pop-up Tool-tips	40
6.8	Hide SOF Packets	40
6.9	Hide NAKs	40
6.10	Hide Devices	40
6.11	Hide Chirps	40
6.12	Switch to Transactions View	41
6.13	View Decoded Transactions	43
	Expanded and Collapsed Transactions	44
6.14	Switch to Split Transaction View	45
6.15	Switch to Transfer View	45
6.16	View Decoded Transfers	46
	Expanded and Collapsed Transfers	46
6.17	Decoding Protocol-Specific Fields in Transactions and Transfers	47
	6.18 Switch to Host Wire Adapter Segment View	48
	6.19 Switch to Host Wire Adapter Transfer View	49
	6.20 Switch to Device Wire Adapter Segment View	49
	6.21 Switch to Device Wire Adapter Transfer View	49
	6.22 Switch to PTP Transactions	50
	6.23 Switch to PTP Object Transfers	50
	6.24 Switch to PTP Sessions	51

	6.25 Using the Trace Navigator	52
	Navigator Bar Attributes	54
	6.26 Edit Comment	54
Chapter 7	Searching Traces.	55
	7.1 Go to Trigger	55
	7.2 Go to Packet/Transaction/Transfer	56
	7.3 Go to Marker	56
	7.4 Go To	57
	7.5 Find	64
	7.6 Find Next	65
	7.7 Search Direction	65
Chapter 8	Display Options.	67
	8.1 General Display Options	68
	8.2 Color/Format/Hiding Display Options.	70
	Color Display Options	71
	Formats Display Options	72
	Hiding Display Options	73
	8.3 Level Hiding Display Options	74
	8.4 Saving Display Options	75
Chapter 9	Decode Requests	77
	9.1 Class and Vendor Definition Files	77
	9.2 Class/Vendor Decoding Options	80
	Mapping Request Recipient to Class/Vendor Decoding	80
	Mapping Endpoint to Class/Vendor Decoding	82
	Mapping Request RPipe to Class/Vendor Decoding	85
	Mapping Endpoint RPipe to Class/Vendor Decoding	86
	Mapping Request DWA RPipe to Class/Vendor Decoding	87
	Mapping Endpoint DWA RPipes to Class/Vendor Decoding	88
	9.3 General Options	89
	Decoding USB Device Requests	89
	Decoding Standard Requests	90
	Decoding Class Requests	91
	Decoding Vendor Requests	91
	Decoding Undefined USB/WUSB Device Requests	91
	Decoding using Endpoint Information	92
	Changing the Layout of Decode Requests	92
Chapter 10	Reports.	95
	10.1 File Information	96
	10.2 Error Summary	97
	10.3 Timing Calculations	98
	10.4 Traffic Summary	99
	10.5 Bus Utilization	100
	Bus Utilization Buttons	101
	View Settings Menu	102
	Graph Areas Menu	104

10.6 Real Time Monitoring	105
Real-Time Statistics Buttons	106
Real-Time Statistical Monitor Pop-up Menu	107
Displaying Multiple Graphs	108
Chapter 11 Recording Options	109
11.1 General Recording Options	110
Recording Type	110
Options	111
Buffer Size	111
Trigger Position	112
Options Name	112
Trace File Name & Path	113
11.2 Recording Options - Misc.	114
Analyzer Speed	115
Generator/Analyzer Clocking Overrides	116
USB On-The-Go	116
USBTrainer Generator-related Parameters	117
11.3 Slow Clock Selection	118
11.4 Events Recording Options	119
Packet Identifiers	120
Token Patterns	120
Frame Patterns	121
Device Requests	121
Data Pattern	122
Bus Conditions	124
Errors	124
External Input Signals	126
Transactions	126
Data Length	127
Splits	128
Extern Data7 - Data0 In	128
11.5 Actions Recording Options	129
Actions Window Layout	129
11.6 Connecting Events to Actions	130
11.7 Connecting Counters to Events	131
11.8 Using Action Buttons	133
Trigger	133
Restart	133
Filter Out/In	134
11.9 Other Actions: External Output Signals	135
11.10 Saving Recording Options	137
11.11 Recording Bus Data	138
11.12 Merging Trace Files	139

Chapter 12 Traffic Generation with USBTrainer	141
USBTrainer Traffic Generation Files	142
Creating Traffic Generation Files	143
12.1 Editing a Generation File	145
Toolbar	146
File Tabs	147
Error Log	147
Tooltips	147
12.2 Loading the Generation File	148
Traffic Generation Modes: Bitstream vs. Intelliframe	150
Starting Traffic Generation	150
Repeating a Generation Session	150
Stop Traffic Generation	150
12.3 Device Emulation	151
Creating a Generation File	151
Setting Generation Options	151
Run the Traffic Generation Script File	152
12.4 Format of the Traffic Generation Files	153
Chapter 13 Updates	167
13.1 Software, Firmware, and BusEngine Revisions	167
13.2 Software Updates	168
13.3 BusEngine and Firmware Updates	168
Updating the BusEngine	168
Updating the Firmware	168
Automatic Updates	169
Manual Updates to BusEngine and Firmware	171
Manually Updating the Firmware	172
13.4 Resetting the Analyzer	173
Appendix A Legacy Script Decoding	175
How to Contact LeCroy	177
Limited Hardware Warranty	177
Index	181

Chapter 1: Overview

The LeCroy USBTracer™ USB 2.0 Design & Verification System is the latest in LeCroy's broad portfolio of analysis tools. As a fifth generation product, it builds upon solid knowledge of the needs of the USB development and test communities. The result is a USB bus & protocol Analyzer with unprecedented functionality, unparalleled flexibility, and uncompromising user friendliness. The USBTracer interfaces with standard USB cables and connections to capture and display all speeds of USB bus traffic.



1.1 General Description

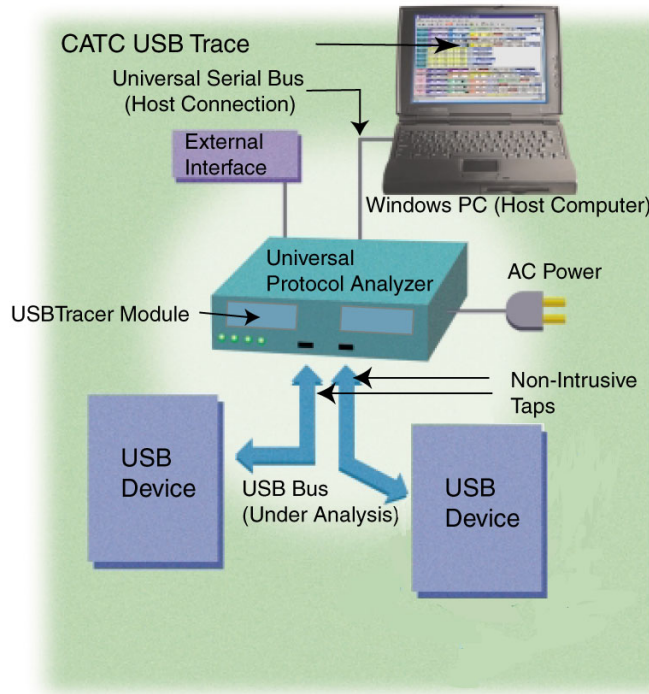
USBTracer™ is a hardware module that installs into the LeCroy Universal Protocol Analyzer System. Once installed, USBTracer can be easily configured and controlled by a portable or desktop PC connected via its USB port. USBTracer provides customers with the familiar "CATC Trace™" user interface that is the *de facto* industry standard for documenting the performance of high-speed serial protocols.

USBTracer is a non-intrusive testing tool for the USB protocol providing traffic capture and analysis. Hardware triggering allows real-time events to be captured. Hardware filtering allows the different types of packets to be filtered in or out of the recording. Filtering allows users to focus recordings on events of interest and to preserve recording memory so that the recording time can be extended.

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

USBTracer functions with any personal computer using the Microsoft® Windows® 98SE, 2000, ME, or XP operating system and equipped with a functional USB interface.

The Analyzer is a plug-in module that is installed into a LeCroy Universal Protocol Analyzer System (UPAS). Together, the Analyzer and UPAS are controlled from a personal computer USB port across a USB connection.



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

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

This DB-25 connector also provides a path for USBTracer to transmit externally the software trigger signal or a user-defined event for purposes of probing and use by other circuitry.

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

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	Tel: +1/503.296.9892
1730 SW Skyline Blvd.	Fax: +1/503.297.1090
Suite 203	Web: http://www.usb.org/
Portland, OR 97221	

1.2 Features

General

- Fully compliant with USB specification revision 2.0.
- Flexible design - reconfigurable hardware for future enhancements.
- Convenient modular system architecture with field upgradeable firmware and recording engine.
- Supports all USB speeds (480 Mb/s, 12Mb/s and 1.5 Mb/s).
- On the UPAS 2500H platform, Hi-Speed recording and generation requires an optional, separately priced key. See your LeCroy representative for more information.
- Dual recording channels aid in the development of multiple speed functions upstream and downstream of speed-matching hub or transaction translator.
- User friendly CATC Trace interface that displays bus traffic using color and graphics.
- Trace Viewer available as free non-recording, view-only software.
- Online and context-sensitive help.
- Power-on self-diagnostics.
- Three year warranty and hot-line customer support.
- Can be used in conjunction with the LeCroy USB *Trainer* USB Traffic Generator hardware module to create a fully customizable USB test platform.

Physical Components

- Hardware module for the LeCroy Universal Protocol Analyzer System.
- Operated by any desktop or portable Microsoft Windows 98, 98SE, 2000, ME, or XP computer with USB capability.
- Convenient Plug-and-Play USB installation.
- High impedance tap inserts non-intrusively in any branch of a USB system.
- 512 MB of physical data recording memory.
- Two all speed recording channels, which include Low, Full, or Hi-Speed.
- Full-Speed USB connection to desktop or portable host PC. Hi-Speed on UPAS 2500H platform.
- Internal wide-range AC power supply.
- Break-out board (included) - used to interface to external test equipment.

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.
- Dedicated trigger for recording input and output used to interface to external test equipment.
- 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 512 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 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 & alerts the user to every potential bus error, protocol violation, & 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.

Traffic Generation

- Traffic generation capability available as an add-on module for the Universal Protocol Analyzer System called USBTrainer™.

Hi-Speed Slow Clock

The ability to Trace and Generate Hi-Speed traffic at fractional (slow) clock rate is available on both USBTracer platforms (2500 and 2500H), and can be purchased via a License Key. Contact LeCroy for more information.

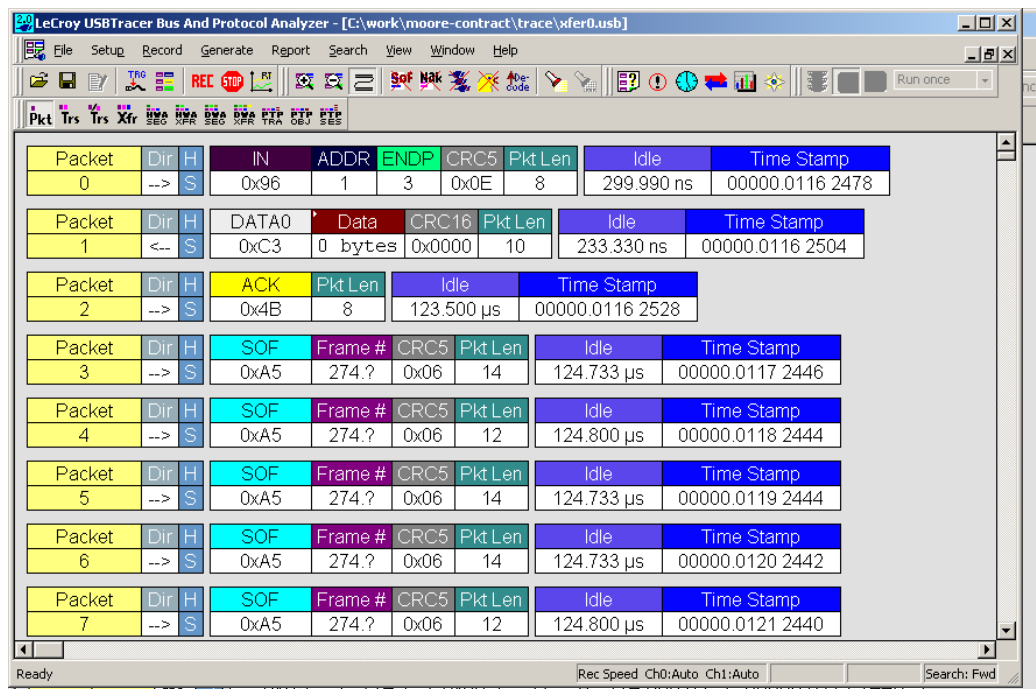
1.3 Graphical Bus Traffic Display

The USBTracer transaction displays use color and graphics to show the captured transactions in an immediate, understandable and useful format.

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

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

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



1.4 Accurate Time Management

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

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

1.5 Comprehensive Error Detection and Analysis

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

1.6 Real-Time Event Triggering and Capture Filtering

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

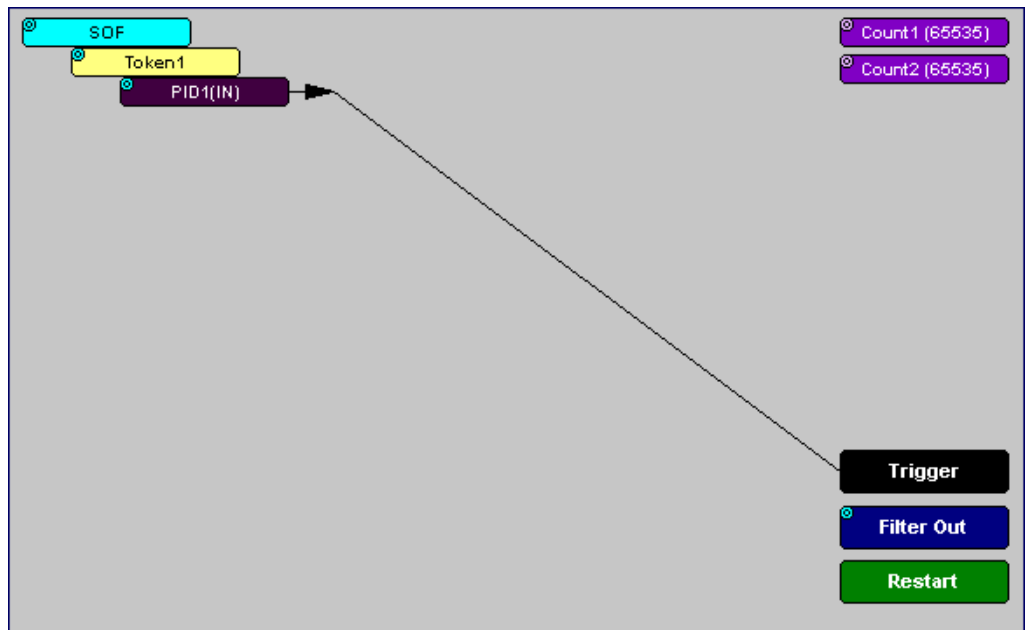
Thus, as well as triggering on basic events, such as specific bus conditions, packet identifiers (PID), etc. (see the Specifications section for a complete list), USBTracer can easily manage the most challenging requirements. For example: "trigger on the fifth occurrence of a SETUP Token device number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

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

1.7 Advanced Event Counting & Sequencing

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

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



1.8 BusEngine Technology

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

Chapter 2: General Description

2.1 System Components/Packing List

- One stand-alone USBTracer™ Analyzer module
- Five USB cables
- USBTracer software program installation diskettes
- Product documentation

2.2 Analyzer PC Requirements

Please refer to the **Readme.txt** file on the installation CD for PC and operating system requirements.

2.3 The Installed USBTracer Unit

USBTracer is a module that inserts into the left slot on the LeCroy Universal Protocol Analyzer System (UPAS). Once installed, the USBTracer Analyzer activates the user-accessible controls and LEDs on the front and rear panels of the UPAS.

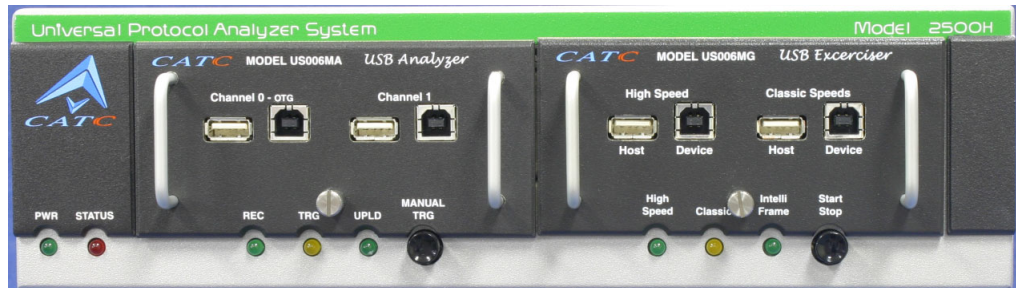


Figure 2.1 Front Panel

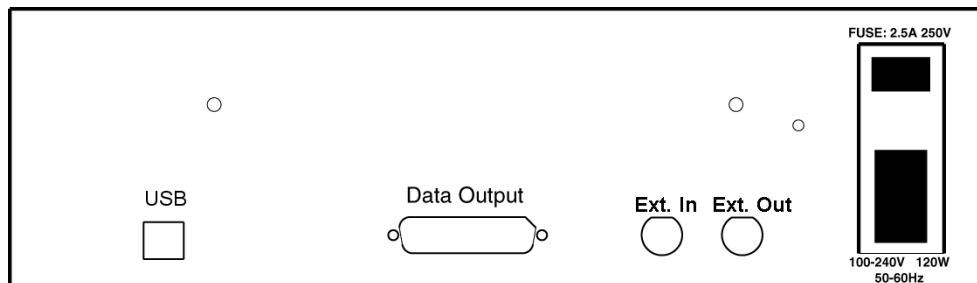


Figure 2.2 Rear Panel

LED and Button Descriptions

The following section describes the LEDs, buttons, and connectors on the module and UPAS.

LEDs on the Far Left Side of the UPAS

- Green **PWR** (Power) indicator LED for UPAS: Lights when the unit power is switched on.
- Red **Status** indicator LED for UPAS: Lights during boot up.

LEDs and Button on the UPAS under the Left Module Slot

The LEDs and button on the UPAS enclosure under the left module slot function in conjunction with the USBTracer module inserted above it:

- Green **REC** (Recording) LED: Lights when the unit is recording.
- Orange **TRG** (Triggered) LED: Lights when the unit triggers on an event.
- Green **UPLD** (Upload): Lights when unit is uploading data to PC.
- **Manual Trigger** push-button: Allows a manual Trace capture.

LEDs and Button on the UPAS under the Right Module Slot

The LEDs and button under the right module slot are reserved for LeCroy generator modules such as the USBTrainer USB Traffic Generator (described in Chapter 11: Traffic Generation with USBTrainer on page 141):

- Green **HS**: Illuminates when Hi-Speed is being generated.
- Orange **Classic**: Illuminates when Full or Low Speed is being generated. Classic also illuminates during power-on testing and is turned off at the end of the power on cycle. If the LED blinks at the end of this cycle, the hardware is faulty.
- Green **Intelliframe**: Illuminates when Intelliframe traffic is being generated using Intelliframe mode, an intelligent adaptive traffic mode. If off, the generation is in Bitstream mode. See “Traffic Generation Modes: Bitstream vs. Intelliframe” on page 150 for more information.
- **Start/Stop**: Push-button allows manual Trace capture.
- Wide range **AC connector** module:
 - Power socket
 - Power on/off switch
 - Enclosed 5x20 mm 2.0A 250 V fast acting glass fuse

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

- Two **External Ports** marked Ext. 1 and Ext. 2.
- **USB** type B host computer connector
- **Data In/Out** DB-25 (25-pin) external interface connector

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

2.4 Specifications

USBTracer is a hardware module that installs into the Universal Protocol Analyzer System. The following specifications describe a combined USBTracer/Universal Protocol Analyzer System.

Package

UPAS 12.2 x 12.2 x 3.5 inches
(31.1 x 31.1 x 8.9 cm)

USBTracer Plug-in 4.5 x 6.7 x 1.3 inches
(11.3 x 17.0 x 3.2 cm)

Connectors

UPAS AC power connection
External trigger connection
Host connection (USB, type B)

Weight

UPAS 7.5 lb. (3.4 kg)
USBTracer Plug-in 1.0 lb. (0.5 kg)

Power Requirements

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

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

Probing Characteristics

Connection High Speed USB Connectors
Standard cables

Switches

Power On/off
Manual Trigger When pressed forces a trigger event

Indicators (LEDs)

UPAS

Power (PWR):	Illuminated when the Analyzer is powered on.
Status (STATUS):	Illuminated solid during self test, blinking during failure, off when the Analyzer is functioning properly.
Recording (REC):	Illuminated when the Analyzer is actively recording traffic data.
Triggered (TRG):	Illuminated during power-on testing and when the Analyzer has detected a valid trigger condition.
Uploading (UPLD):	Illuminated when the Analyzer is uploading its recording memory to the Host PC for displaying the CATC Trace.

Recording Memory Size

512 M x 8-bit DRAM for traffic data capture, timing, state and other data.

Host Compatibility

Works with any PC equipped with a functioning USB port and running the Microsoft Windows 98SE, ME, 2000, or XP operating system.

Required Setup

Microsoft Internet Explorer, Version 5 or newer.

Hardware

Processor: For optimum performance, use processors of the Intel Pentium III/Pentium 4 family, 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 is a minimum).

Memory: For the best performance, it is recommended to have physical RAM twice the size of the recording buffer setup - 512MB or more (minimum of 128MB of RAM).

Hard Disk: At least 20MB of free hard disk space is required for the installation. Additional disk space is needed for storing the recorded data in files during the recordings process (can be as much as 500MB when recording a full buffer size).

Display: Resolution of 1024 x 768 with at least 16-bit color is recommended (resolution of 800 x 600 with 16-bit color is a minimum).

Connectivity: A USB interface is required to connect to the USBTracer Analyzer. This is not a requirement if the application is going to be used only as a viewer.

Power Cord Set

Cord Manufacturer and Models:

- 180-0005-00 Quail 5000.079 UL, CSA
- 180-0013-00 Quail 8500.098 VDE, KEMA, CEBERC, NEMDO, DEMDO, SETI, OVE, SEV
- 180-0014-00 Quail 9650.098 ASTA

USBTracer on the UPAS 2500H Platform

UPAS 2500H USBTracer is a USB 2.0 Certified Hi-Speed Device. To upload at Hi-Speed, you must have a USB 2.0 Certified Host Controller and be running Microsoft Windows 2000 SP3 or Windows XP.

The UPAS 2500H ships in one of two configurations: Classic and Hi-Speed. The Classic version can trace and generate traffic at Low and Full Speeds. The Hi-Speed version can trace and generate traffic at All speeds: Low, Full, and Hi.

The Classic model may be upgraded to a Hi-Speed model by the purchase of a License Key from LeCroy. Contact your LeCroy representative for more information.

Note: The UPAS 2500 and UPAS 2500H products include internal 1.1 and 2.0 Hubs. You might see the drivers for these generic hubs being installed upon the initial plug-in.

2.5 External Interface Breakout Board

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

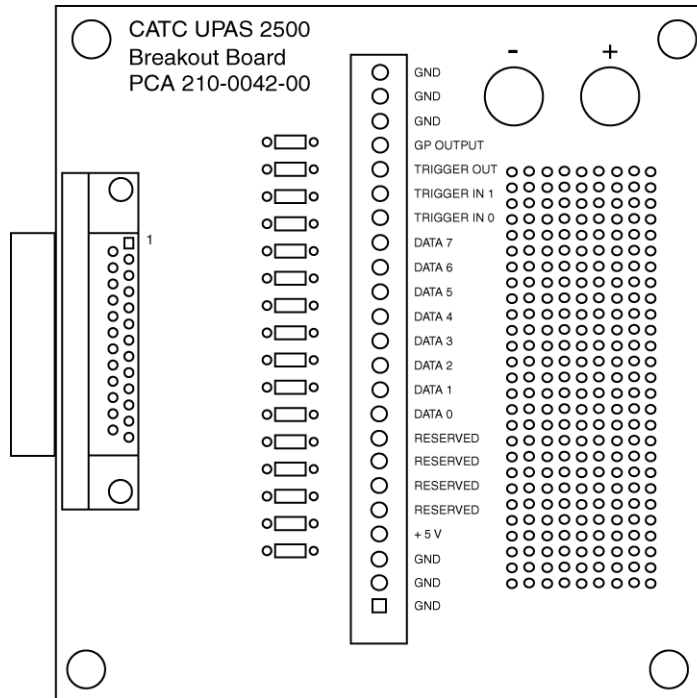


Figure 2.3 External Interface Breakout Board

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

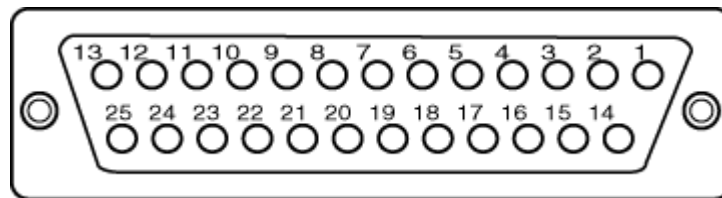


Figure 2.4 Data In/Out Connector (on cable)

Pin-Outs for the Data In/Out Connector

Table 11 lists the pin-out and signal descriptions for the **Data In/Out** connector on a cable that connects to the Breakout board.

Table 1 Data In/Out Connector – Pin-Out

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

Note: (*) Pins 4 and 17 have the same function. They allow external signals to be used to cause triggering or recording. Pins 3 and 16 are used to transmit output signals.

Prototype Rework Area

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

Chapter 3: Quick Installation

USBTracer™ is factory-installed hardware module that is sold as part of the LeCroy Universal Protocol Analyzer System.

The Universal Protocol Analyzer System (UPAS) together with the USBTracer module and associated software are easily installed on most Microsoft® Windows®-based personal computer systems. You can begin making USB recordings after following these initial steps. However, if you are new to protocol analyzers, or are unsure about what to do after reading the Quick Installation instructions, or if your Analyzer does not work after you follow these instructions, read through the subsequent sections in this manual.

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

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

Step 3 Insert the CD.

Step 4 Turn on the power switch on the rear of the Analyzer.

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

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

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

Step 8 Run the program a:\setup and follow the on-screen instructions.

Step 9 Select **About USBTracer...** from the Help menu.

If you can see all of the information listed below, you can record a trace:

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

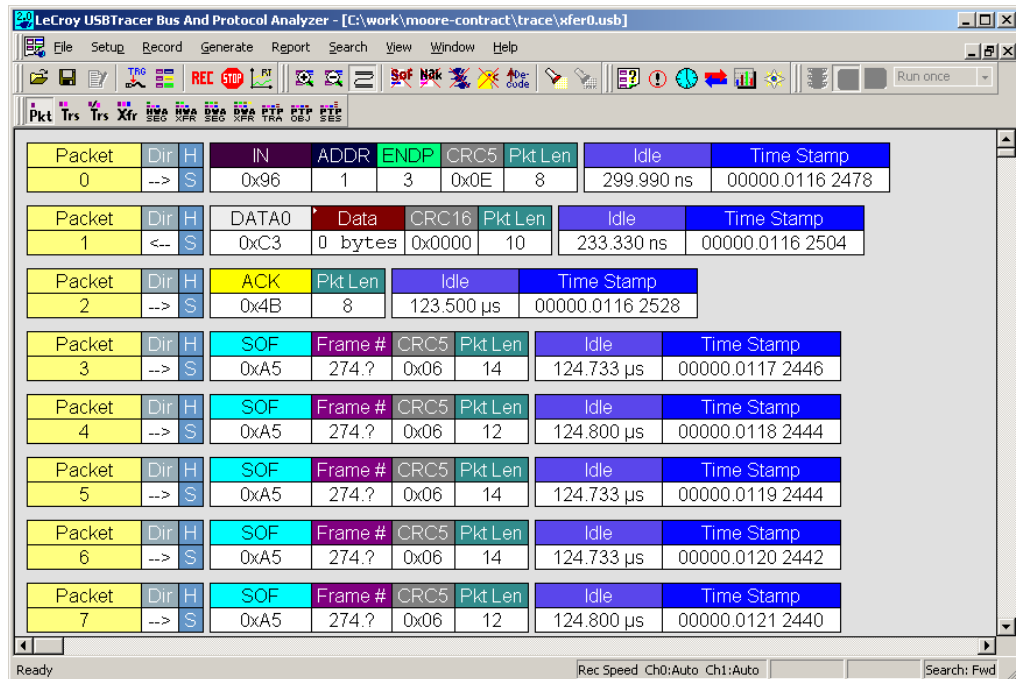
3.1 Installing the Software and Starting the Program

Step 1 Insert the USBTracer CD into the CD-ROM drive on the host PC and follow the on-screen instructions to install the USBTracer application.

Step 2 To start the application, launch the **LeCroy USBTracer** program from the **Start Menu**:

Start > Programs > LeCroy > LeCroy USBTracer

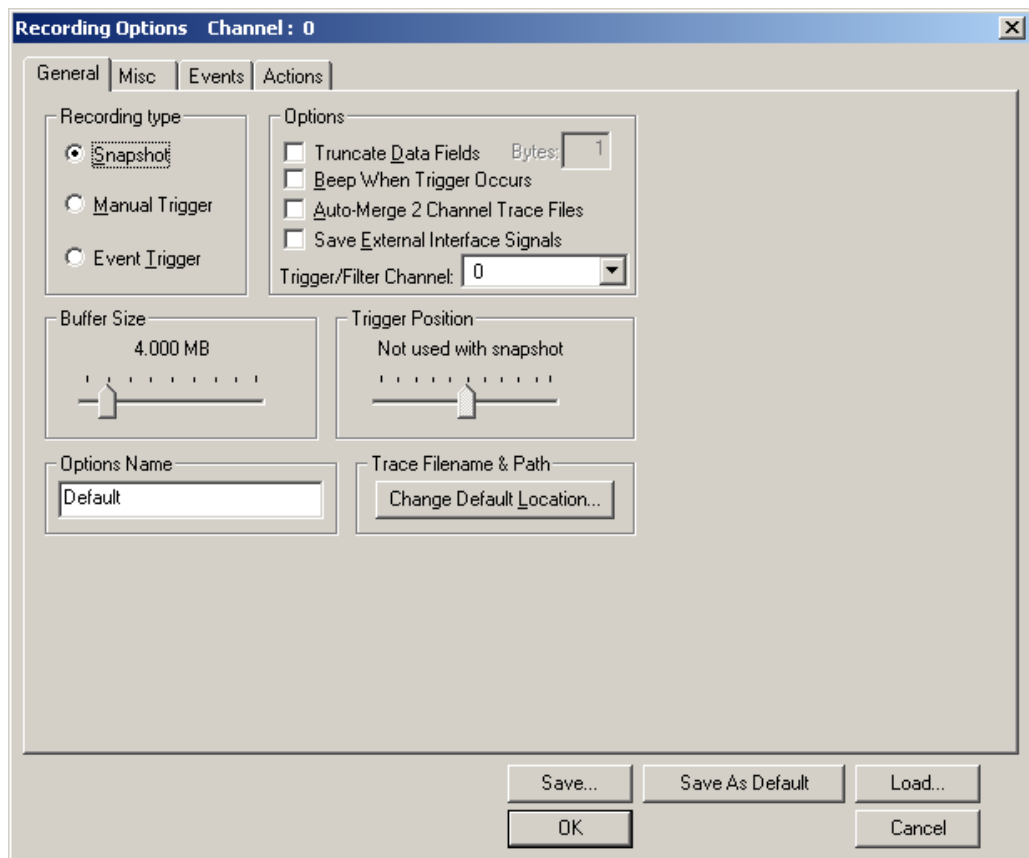
The USBTracer main window opens:




3.2 Your First USB Recording


After installing and launching the software, you can test USBTracer by performing the following steps:

- Step 1** Connect a USB cable to each of the two connectors on the USBTracer module, then connect the other ends to the USB device under test and USB host system.
- Step 2** Select **Recording Options** under **Setup** on the Menu Bar.
- Step 3** Select the **General** tab to display the following dialog box showing factory default settings such as Snapshot and 4 Mbytes buffer size. For the first recording, you can leave these settings unchanged.



- Step 4** Click **OK** to activate the recording options you selected.
- Step 5** Turn on the USB devices that are to be tested and cause them to generate USB traffic.
- Step 6** Click  on the Tool Bar.

USBTracer starts to record the USB traffic immediately. After 4 Mbytes of traffic are recorded, the Analyzer uploads the data and displays the packets in the trace window.

Step 7 To terminate 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 the 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 Tool Bar to display the standard **Save As** screen.

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

Trace View Features

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

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

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

Each row numerates, labels, and color-codes a USB packet

Packet	Dir	F	Sync	SOF	Frame #	CRC5	EOP	Idle	Time Stamp	
2734	-->	S	00000001	0xA5	721	0x0D	250 ns	996.883 µs	00010.2143 3631	
2735	-->	S	00000001	0xA5	722	0x0F	233 ns	996.900 µs	00010.2151 3619	
2736	-->	S	00000001	0xA5	723	0x10	233 ns	350 ns	00010.2159 3607	
2737	-->	S	00000001	0xB4	0	0	0x08	233 ns	183 ns	00010.2159 3802
2738	-->	S	00000001	0xC3	8 bytes	0xBB29	233 ns	483 ns	00010.2159 3987	
2739	<--	S	00000001	0x4B			233 ns	983.200 µs	00010.2159 4510	
2743	-->	S	00000001	0xA5	724	0x0E	250 ns	333 ns	00010.2167 3596	
				IN						

Time-stamp appended to each packet

Filtered Traffic is displayed as a gray line

Specifies speed packet transmitted

Indicates a marked comment is set

Chapter 4: Detailed Installation

4.1 USBTracer System Setup

The USBTracer module inserts into the Universal Protocol Analyzer System. The UPAS, in turn, is connected and controlled by a desktop or laptop PC via a USB connection.

To set up the system hardware:

- Insert the USBTracer module into the UPAS.
- Connect the Analyzer to an AC power source.
- Connect to the analyzing PC via USB.
- Connect USB cable to the device under test.

4.2 AC Power Source

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

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

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

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

4.3 PC Connection

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

4.4 Setting Up the Analyzer

Step 1 Connect the provided AC power cord to the rear of the UPAS and to a 100-volt to 240-volt, 50 Hz to 60 Hz, 100 W power outlet.

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

Step 2 Turn on the power switch on the rear of the Analyzer.

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

Step 3 Connect the USB cable between the USB port on the back of the Analyzer and a USB port on the analyzing PC.

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

4.5 Installing the Analyzer Software on the PC

Once *USBTracer* has been recognized as a USB device, install the *USBTracer* software on the PC administering the Analyzer:

Step 1 Insert the *USBTracer* CD into the CD ROM drive of the PC that administers the Analyzer.

Step 2 Follow Microsoft® Windows® on-screen Plug-and-Play instructions for the automatic installation of the *USBTracer* Analyzer as a USB device on your analyzing PC (the required USB files are included on the *USBTracer* CD).

Step 3 Select **Install Software** from the installation CD and follow the on-screen installation instructions.

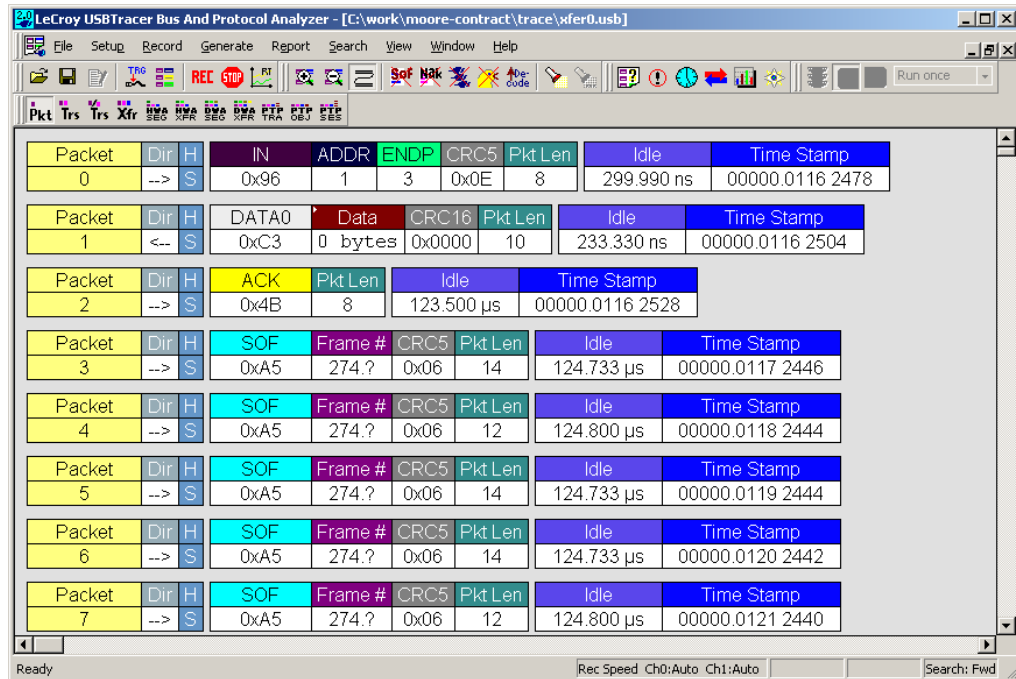
The *USBTracer* application installs on the PC hard disk.

Step 4 To start the application, launch the LeCroy *USBTracer* program from the **Start Menu**:
Start > Programs > LeCroy > LeCroy USBTracer.

The *USBTracer* program opens.

4.6 USBTracer Program Startup

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



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

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

4.7 Making a Recording

After installation, the software is configured to make a Snapshot recording of USB traffic. See Section 3.2 "Your First USB Recording" on page 11 to make your first recording of this traffic.

Chapter 5: Software Overview

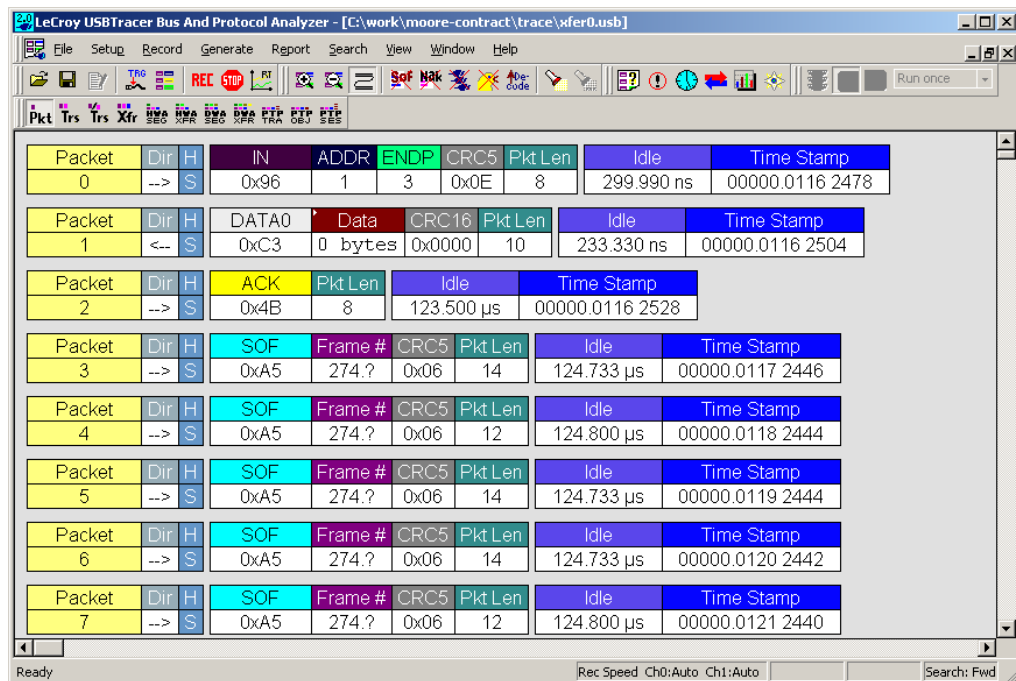
The USBTracer™ Trace Viewer is an application that may be used with or without the Analyzer box. When used without an Analyzer box, the program functions in a Trace Viewer mode to view, analyze, and print captured protocol traffic from USBTracer Analyzers. The software also allows you to view trace files created by the LeCroy Chief™, Advisor™, Detective™, and Inspector™. Opening a file created with either 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 USBTracer Analyzer attached to the computer, you can monitor and analyze the activity of your USB branch from either of the USB ports on the front of the Analyzer.

5.1 Starting the USBTracer Program

To start the USBTracer Program:

Step 1 Select **Start > Programs > LeCroy > LeCroy USBTracer**.



5.2 Tooltips

Tooltips provide useful information about cells in the trace and buttons in the application. To display a tooltip, position the mouse pointer over an item.



5.3 The Main Display Windows

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

Menu	Function
File	
<u>N</u> ew .utg file.	Creates a new, empty traffic generation file. Available only if a trace file (.usb) is open. To edit a .utg file, click the Edit as Text button in the toolbar.
<u>O</u> pen	Opens a file.
<u>C</u> lose	Closes the current file.
Sa <u>v</u> e <u>A</u> s	Saves all or a range of packets from the current file.
<u>P</u> rint	Prints part or all of the current traffic data file.
Print <u>P</u> review	Produces an on-screen preview before printing.
<u>P</u> rint Setup	Sets the options for the current or new printer.
<u>E</u> dit as Text	Opens the Script Editor. Available only when a traffic generation file (.utg) is open.
<u>E</u> dit Comment	Creates or edits the Trace file comment field.
C <u>h</u> eck Syntax of . <u>u</u> tg file	Reads open .utg file and checks syntax for errors. Available only when a traffic generation file (.utg) is open.
Export>> Packets to Text (Packet View Format)	Saves all or part of a trace to a text file or generator file. Saves trace as text file in Packet View Format.
Packets to .CSV (Comma Separated Values for Excel, etc.) Format)	Saves trace as a comma-separated-values text file for use with Microsoft® Excel.
Packets to Host Traffic Generator Text File (.utg)	Saves trace as script file that can be used by a Generator to generate a trace.
Packets to Device Emulation Traffic Generation Text File (.utg)	Exports packets to Device Emulation files. This option does not export transactions.
Data	Exports Transfer data as text or binary file.
Merge Trace Files	Merges two simultaneously recorded files into a single file. (This command does not work if the files were recorded at different times).
<u>I</u> mport	Import data from .vcd file
<u>C</u> ompare 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. Available only when a trace file (.usb) is open.
<u>E</u> xit	Exits the USBTracer program.

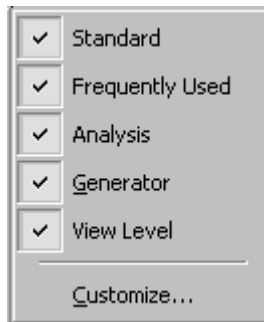
Menu	Function
Setup	
<u>D</u> isplay Options	Provides display options such as color, formats, and filters.
<u>R</u> ecording Options	Provides setup options for recording, triggering events and filtering.
Setup <u>A</u> nalyzer	Allows you to update the BusEngine™ and Firmware.
Record	
<u>S</u> tart	Causes the Analyzer to begin recording USB activity.
<u>S</u> top	Causes the Analyzer to stop recording.
<u>U</u> pload Again	Allows you to upload a different portion of the captured trace if the previous upload was only partially uploaded.
Generate	
<u>S</u> tart	Starts traffic generation. Once traffic generation has begun, the Start command becomes Stop and lets you stop traffic generation.
<u>I</u> ntelliFrame Generation Mode	Sets the mode of generation to IntelliFrame. Use before Start.
<u>B</u> itstream Generation Mode	Sets the mode of generation to bitstream. Use before Start.
<u>R</u> epeat Mode	Allows you to repeat once, a specified number of times, or an infinite number of times using the Generation Repeat Mode window.
Report	
<u>F</u> ile Information	Displays information about the recording such as the number of packets and triggering setup.
<u>E</u> rror Summary	Summarizes the errors throughout the recording. Allows for fast navigation to packet with errors.
Timing <u>C</u> alculations	Calculates timing between two packets and bus utilization.
<u>T</u> raffic Summary	Summarizes the numbers and types of errors, packets, transactions, split transactions, and transfers that occurred in the open trace.
<u>B</u> us Utilization	Displays graphs of packet length, bus usage, and bus usage by device.
Search	
Go to <u>T</u> rigger	Positions the display to show the first packet that follows the trigger event.
Go to <u>P</u> acket/ Transaction/Transfer	Positions the display to the packet/transaction/transfer number selected in the Go to <u>P</u> acket/Transaction/Transfer menu.
Go to <u>M</u> arker »	Positions the display to the selected marked packet.
<u>G</u> o to »	Positions the display to the selected event, condition, value, or type.
<u>F</u> ind	Allows complex searches on multiple criteria.
Find <u>N</u> ext	Repeats the previous Find operation.
<u>S</u> earch Direction	Allows the search direction to be changed from Forward to Backward or vice versa.

Menu	Function
View	
<u>T</u> oolbars	Displays list of available toolbars.
<u>S</u> tatus Bar	Switches display of the Status Bar on or off.
Real-t <u>i</u> me Statistics	Allows you to view traffic statistics as they occur.
Z <u>o</u> om <u>I</u> n	Increases the size of the displayed elements.
Z <u>o</u> om <u>O</u> ut	Decreases the size of the displayed elements.
<u>W</u> rap	Wraps displayed packets within the window.
Hide S <u>O</u> F's	Hides Start of Frames.
Hide N <u>A</u> K's	Hides NAK'ed Transactions.
Hide <u>D</u> evelopers	Hides packets belonging to specified devices by address and endpoint.
Hide <u>C</u> hirps	Hide the Chirp-K and Chirp-J Bus conditions. These are recorded only in USBTracer.
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.
<u>P</u> acket Level	Displays Packets.
<u>T</u> ransaction Level	Displays Transactions.
<u>S</u> plit Transaction Level	Displays Split Transactions.
<u>T</u> ransfer 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 <u>D</u> ecoding	Force the software to re-decode transactions and transfers. Useful if you have applied a decoding mapping which helps fully decode a sequence of transfers, as is the case with Mass Storage decoding.
Window	
<u>N</u> ew Window	Switches display of the Tool Bar on or off.
<u>C</u> ascade	Displays all open windows in an overlapping arrangement.
Tile <u>H</u> orizontal	Displays all open windows in a above-below arrangement.
Tile <u>V</u> ertical	Displays all open windows in a side-by-side arrangement.
<u>A</u> rrange 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 USBTracer	Displays version information about USB USBTracer.

5.4 View Options

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

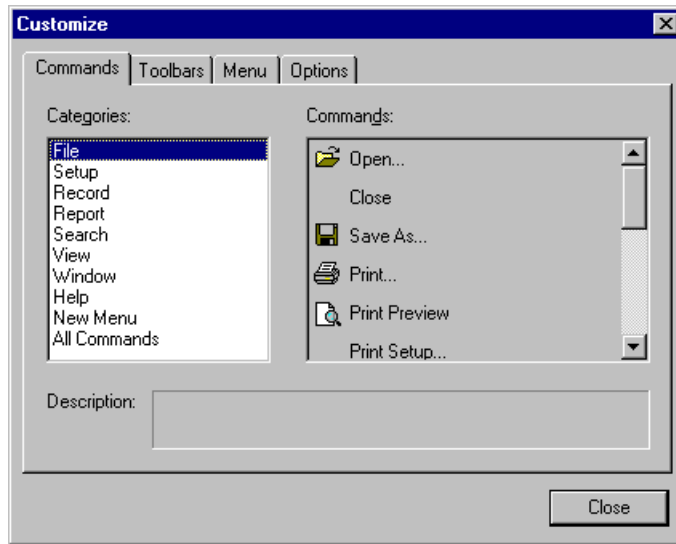


Resetting the Toolbar

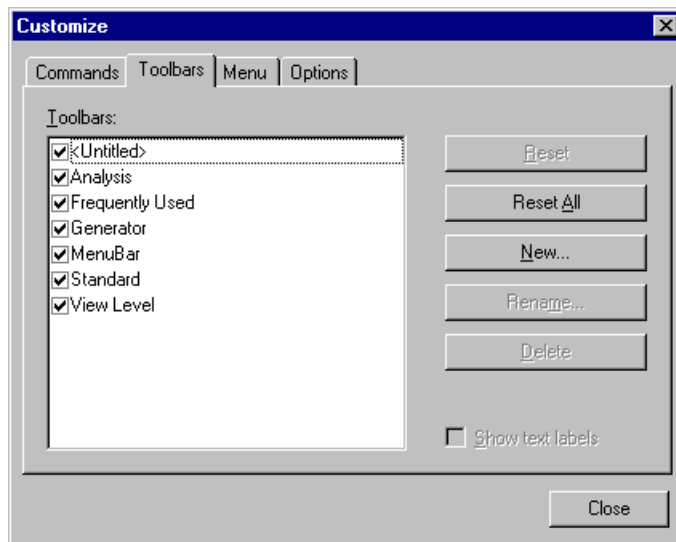
From time to time (such as following a software upgrade), it is possible for the buttons on the toolbar to not match their intended function. You can reset the toolbar by performing the following steps:

Step 1 Select **View > Tool bars** 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 Customize 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 briefly describe the functionality of each icon and menu item as the mouse arrow is moved over the icon/item.

	Open file		Find Next
	Save As		File Information Report
	Preview		Error Report
	Edit as Text		Timing and Bus Usage Calculations
	Print...		Traffic Summary
	Setup Record Options		Bus Utilization
	Setup Display Options		Open the Navigator bar
	Start Recording		Display Packets
	Stop Recording		Display Transactions
	Display Realtime Statistics.		Display Split Transactions
	Zoom In		Display Transfers
	Zoom Out		Display Host Wire Adapter Segments
	Wrap		Display Host Wire Adapter Transfers
	Hide SOFs		Display Device Wire Adapter Segments
	Hide NAK'ed transactions.		Display Device Wire Adapter Transfers



Hide Devices



Hide Chirps



Assign High Level Decodes.



Find



Repeat Upload



Display PTP Transactions



Display PTP Objects



Display PTP Sessions

Start or Stop Traffic Generation
(available if you have the
USBTrainer module).

Bitstream and Intelliframe modes

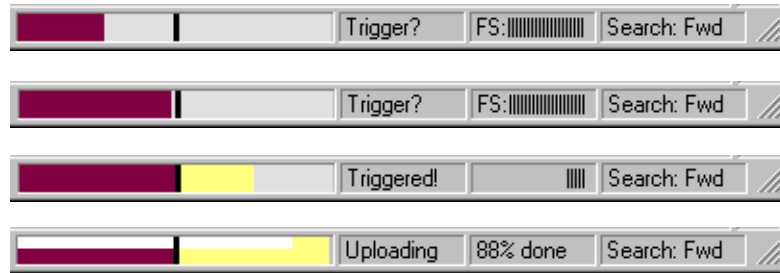
Repeat Mode. This button becomes
active when a traffic generation file
(* .utg) is open.

5.5 Status Bar

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

Recording Progress

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



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

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

You should be aware of two exceptional conditions:

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

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

Recording Status


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

- Trigger?
- Triggered!
- Uploading

After recording stops,

- The flashing message changes to **Uploading data-x% done** (x% indicates the percentage completion of the data uploading process).
- The traffic data is copied to disk (overwriting any previous version of this file) using the default file name **data.usb**. If two channels of traffic are recorded, USBTracer creates two files: **data_0.usb** and **data_1.usb**. You can also create a file name of your choice by specifying one in the Recording Options dialog box.

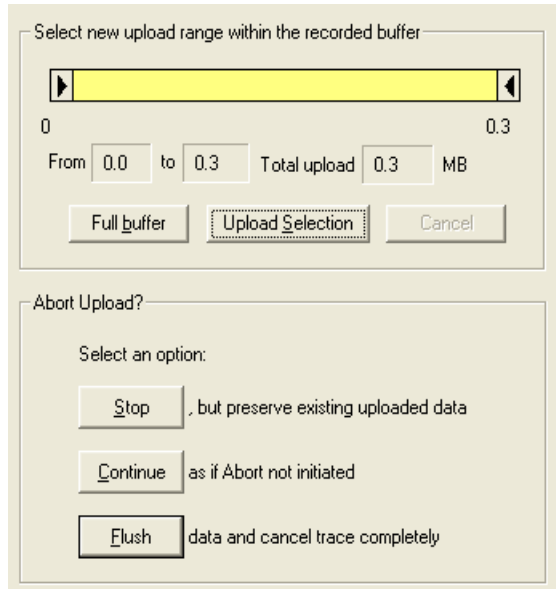
To abort the upload process:

- Press **Esc** on your keyboard
OR
- Again click  in the Tool Bar.

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

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

The Partial Upload button is enabled when you have partially uploaded data. When you click **Partial Upload**, 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.

5.6 Navigation Tools

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

Zoom In

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

- Click  on the Tool Bar.

Zoom Out

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

- Click  on the Tool Bar.

Wrap

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

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

5.7 USBTracer 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
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
Apply Decoding Scripts	Ctrl+Shift+Y

Chapter 6: Reading a Trace

6.1 Trace View Features

- The USBTracer 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.)

Packet	Dir	H	SOF	Frame #	CRC5	Pkt Len	Idle	Time Stamp
0	-->	S	0xA5	1156.?	0x1C	12	124.767 μ s	00000.4056 3910
Packet	Dir	H	SOF	Frame #	CRC5	Pkt Len	Idle	Time Stamp
1	-->	S	0xA5	1156.?	0x1C	14	124.767 μ s	00000.4057 3908

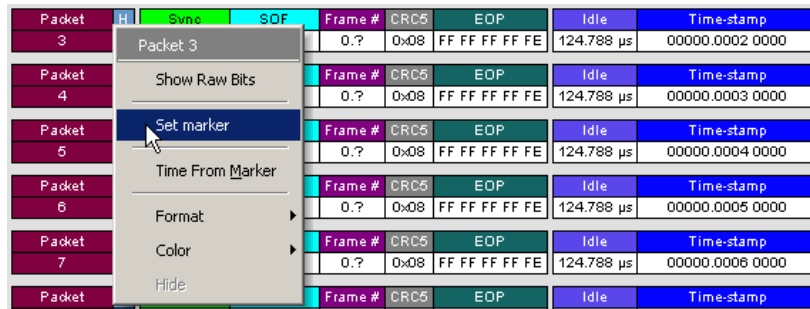
↑
Microframes

6.2 Set Marker

You can define a unique Marker for each packet.

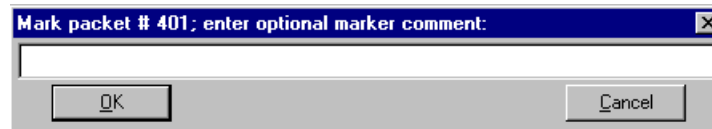
To place a marker on a packet:

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



Step 2 Select **Set Marker**.

You see the **Edit Marker Comment** window where you can enter a unique comment about this packet.:



Step 3 Enter your comment.

Step 4 Click **OK**.

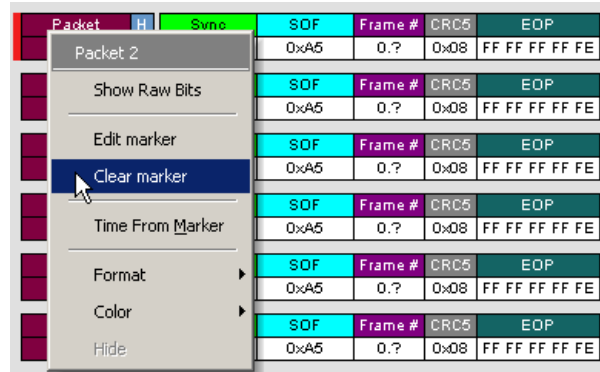
A marked packet is indicated by a vertical red bar along the left edge of the packet # block:

Packet #	F	Sync	SETUP	ADDR	ENDP	CRC5	EOP	Idle
398	S	00000001	0xB4	2	0	0x15	2.50	2

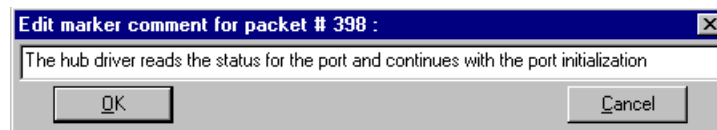
6.3 Edit or Clear Marker

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**.

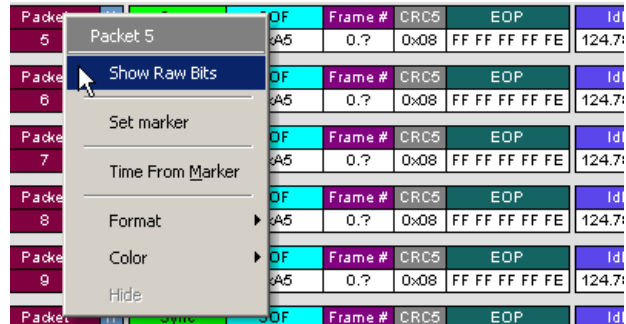
The vertical red Marker bar disappears.

6.4 View Raw Bits

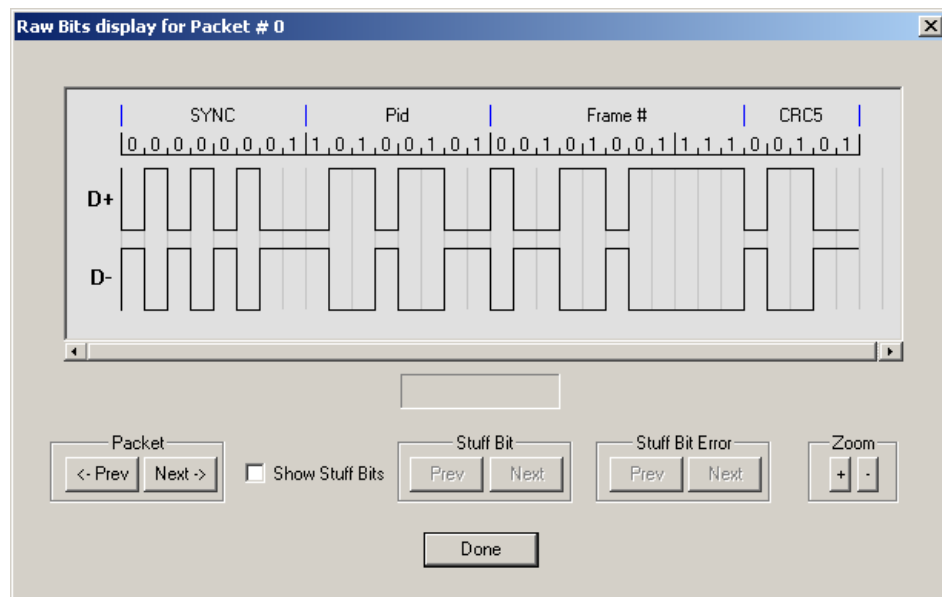
You can expand a specific packet to view the raw bits in detail.

To view the raw bits:

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



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



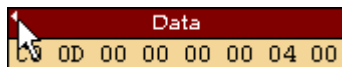
Along the top of the Raw Bits View is a linear strip of the logical bit values with corresponding field demarcations. Bit stuffing is displayed in color. Below the logical bit values is a representation of the D+/D- signaling complete with NRZ encoding. A scroll bar assists in navigation of larger packets.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

6.5 Expanding and Collapsing Data Fields

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

Using the Expand/Collapse Data Field Arrows

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



Double-Clicking to Expand/Collapse Data Fields

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

Expanding or Collapsing All Data Fields

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

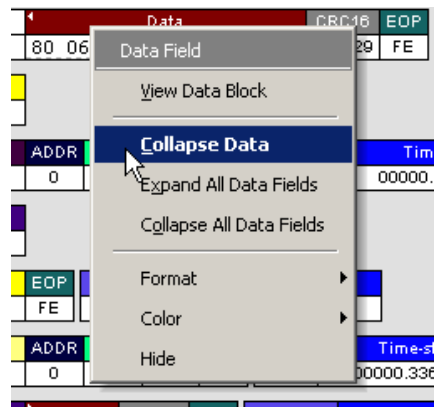
Using the Data Field Pop-up Menus

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

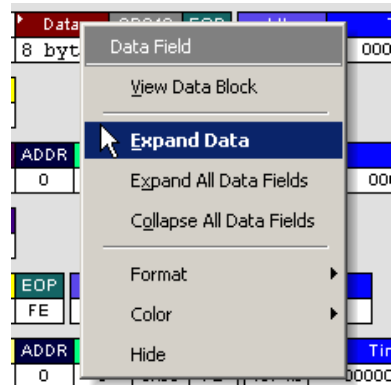
To expand and collapse data using the menu:

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

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



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



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

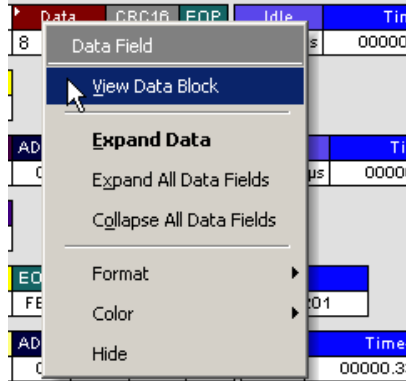
The Trace View is repositioned with the selected packet(s) adjusted in the format you have specified.

Expand or Collapse All Data Fields

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

6.6 View Data Block

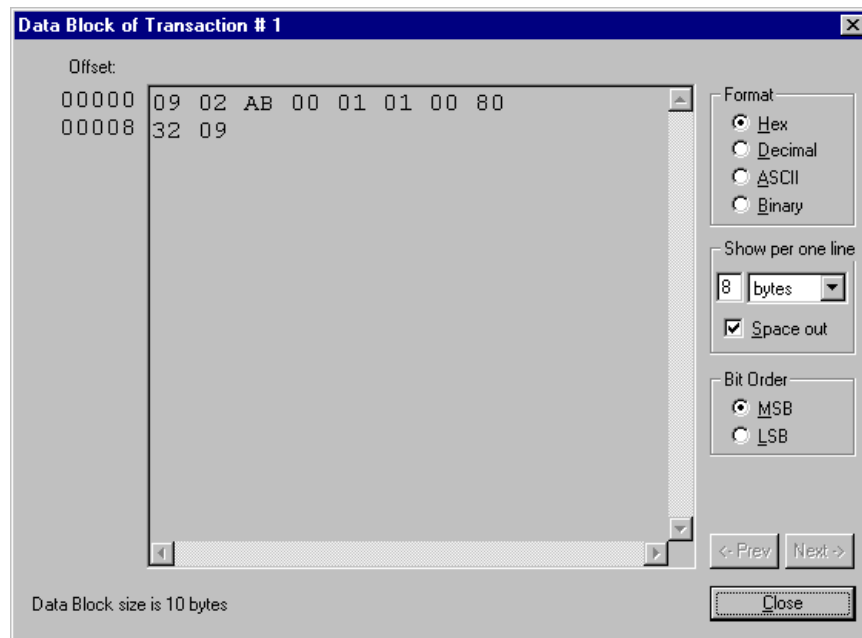
The data field pop-up menu has an option for viewing the raw bits in a data field.



To view these bits:

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

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



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

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

6.7 Pop-up Tool-tips


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

SETUP	ADDR	ENDP	CRC5	EOP	Idle	Time Stamp
0xEB	2	0	0x15	233 ns	183 ns	00004.2833 6330

Starts SETUP transaction to a control pipe


6.8 Hide SOF Packets

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


- Click  to hide all SOF packets.

6.9 Hide NAKs


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

- Click  to hide all NAK packets.

6.10 Hide Devices

Click the  button to open a menu for select any address/endpoint combination to be hidden. Hit the Control (CTRL) key to select multiple values. This menu can be moved from its default location and floated in the trace window for later use.

6.11 Hide Chirps


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

6.12 Switch to Transactions View

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

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

To select Transactions View:

Step 1 Click  to on the toolbar.

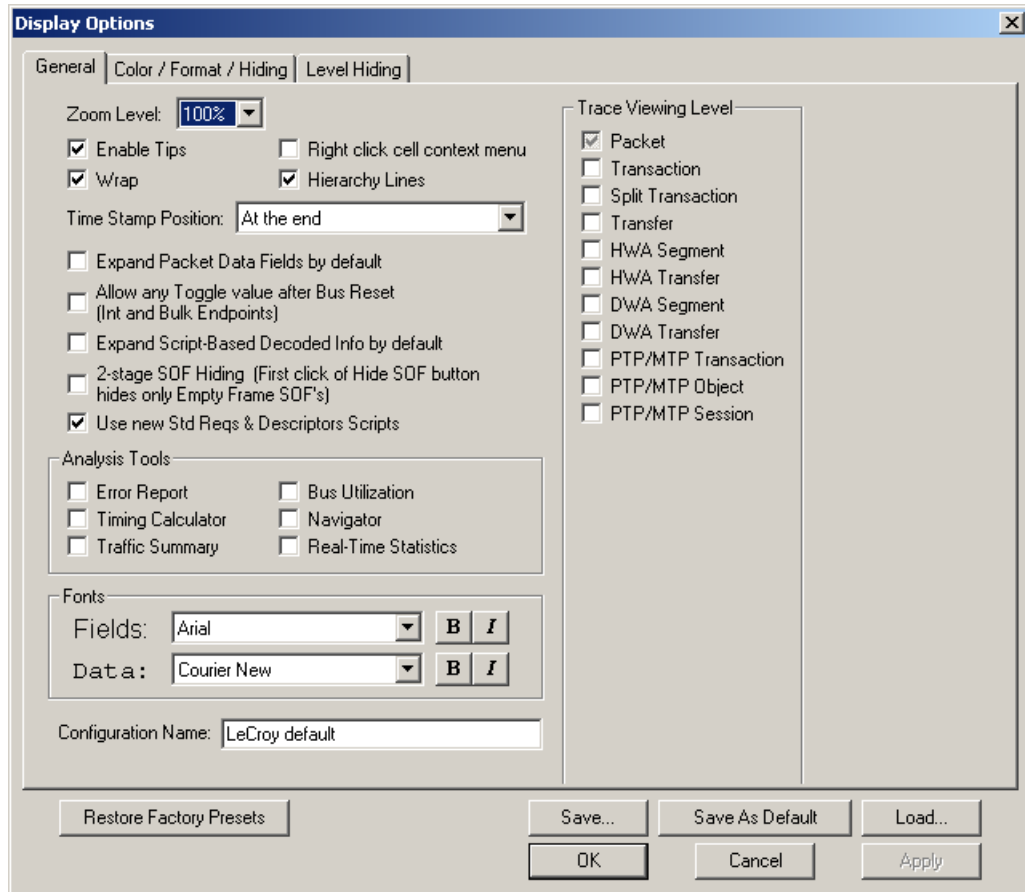
The Trace View screen is re-drawn to display Transactions.

Transaction	F	OUT	ADDR	ENDP	T	Data	ACK	Time		
1336	S	0x87	1	0	0	8 bytes	0x4B	999.717 µs		
Transaction	F	OUT	ADDR	ENDP	T	Data	ACK			
1337	S	0x87	1	0	1	8 bytes	0x4B			
Packet	Dir	F	Sync	OUT	ADDR	ENDP	CRC5	EOP	Idle	Time Stamp
6946	-->	S	00000001	0x87	1	0	0x17	233 ns	183 ns	00011.6037 1516
Packet	Dir	F	Sync	DATA1	Data	CRC16	EOP	Idle	Time Stamp	
6947	-->	S	00000001	0xD2	8 bytes	0x4FB5	233 ns	500 ns	00011.6037 1701	
Packet	Dir	F	Sync	ACK	EOP	Time	Time Stamp			
6948	<--	S	00000001	0x4B	250 ns	988.000 µs	00011.6037 2225			
Transaction	F	OUT	ADDR	ENDP	T	Data	ACK	Time		
1338	S	0x87	1	0	0	8 bytes	0x4B	999.800 µs		
Transaction	F	OUT	ADDR	ENDP	T	Data	ACK	Time		
1339	S	0x87	1	0	1	8 bytes	0x4B	999.800 µs		

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**.

6.13 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.

Transaction 1337									
F	OUT	ADDR	ENDP	T	Data	ACK			
S	0x87	1	0	1	8 bytes	0x4B			
Transaction 1338									
F	OUT	ADDR	ENDP	T	Data	ACK	Time		
S	0x87	1	0	0	8 bytes	0x4B	999.800 µs		
Transaction 1339									
F	OUT	ADDR	ENDP	T	Data	ACK	Time		
S	0x87	1	0	1	8 bytes	0x4B	999.800 µs		
Transaction 1340									
F	OUT	ADDR	ENDP	T	Data	ACK			
S	0x87	1	0	0	8 bytes	0x4B			
Transaction 6946									
Dir	F	Sync	OUT	ADDR	ENDP	CRC6	EOP	Idle	Time Stamp
-->	S	00000001	0x87	1	0	0x17	233 ns	183 ns	00011.6037 1516
Transaction 6947									
Dir	F	Sync	DATA1	Data	CRC16	EOP	Idle	Time Stamp	
-->	S	00000001	0xD2	8 bytes	0x4FB5	233 ns	500 ns	00011.6037 1701	
Transaction 6948									
Dir	F	Sync	ACK	EOP	Time	Time Stamp			
<--	S	00000001	0x4B	250 ns	988.000 µs	00011.6037 2225			
Transaction 6958									
Dir	F	Sync	OUT	ADDR	ENDP	CRC6	EOP	Idle	Time Stamp
-->	S	00000001	0x87	1	0	0x17	250 ns	166 ns	00011.6061 1481
Transaction 6959									
Dir	F	Sync	DATA0	Data	CRC16	EOP	Idle	Time Stamp	
-->	S	00000001	0xC3	8 bytes	0x155D	233 ns	483 ns	00011.6061 1666	

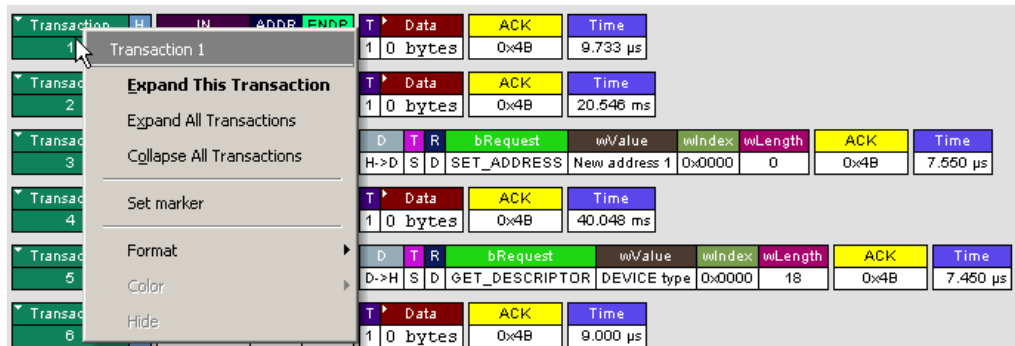
When you instruct the Analyzer to display USB transactions, the components of each transaction are collected from the current recording and are grouped and indented below each decoded transaction. Each row shows a transaction with a unique numeration, a label, and color-coded decoding of important data.

Expanded and Collapsed Transactions

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

To expand a transaction:

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



Step 2 Select **Expand This Transaction**.

The screen displays the selected transaction in expanded format.

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

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

Note that you can choose to expand or collapse

- **Only** the selected Transaction
OR
- **All** Transactions

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

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

6.14 Switch to Split Transaction View

To select Split Transaction View:

Step 1 Click the  button on the toolbar.

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

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

You can also switch to Split Transactions View from the Menu Bar:

Step 1 Select **Display Options** under **Setup**.

You see the **Display Options General** window:

Step 2 Check **Split Transactions**.

6.15 Switch to Transfer View

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

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

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

Step 2 Check **Transfers**.

Step 3 Click **OK**.

6.16 View Decoded Transfers

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

Transfer	H	Control	ADDR	ENDP	bRequest	wValue	wIndex	Descriptors																																																																																																																																																																																																																																							
1	S	GET	1	0	GET_DESCRIPTOR	CONFIGURATION type	0x0000	23 descriptors																																																																																																																																																																																																																																							
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descriptor</td> <td>1.224 sec</td> </tr> <tr> <td>3</td> <td>S</td> <td>GET</td> <td>1</td> <td>0</td> <td>GET_DESCRIPTOR</td> <td>STRING type, Index 1</td> <td>Language ID 0x001B</td> <td></td> <td>362.4</td> </tr> </tbody> </table> </td></tr></tbody></table></td></tr></tbody></table></td></tr></tbody></table>									Transaction	H	SETUP	ADDR	ENDP	D	T	R	bRequest	wValue	wIndex	wLength	A	3	S	0xB4	1	0	D->H	S	D	GET_DESCRIPTOR	CONFIGURATION type	0x0000	171	0	<table border="1"> <thead> <tr> <th>Packet</th> <th>H</th> <th>SETUP</th> <th>ADDR</th> <th>ENDP</th> <th>CRC5</th> <th>Pkt Len</th> <th>Idle</th> <th>Time Stamp</th> </tr> </thead> <tbody> <tr> <td>16495</td> <td>S</td> <td>0xB4</td> <td>1</td> <td>0</td> <td>0x17</td> <td>8</td> <td>200 ns</td> <td>00002.0675 1688</td> </tr> <tr> <td colspan="9"> <table border="1"> <thead> <tr> <th>Packet</th> <th>H</th> <th>DATA0</th> <th>Data</th> <th>CRC16</th> <th>Pkt Len</th> <th>Idle</th> <th>Time Stamp</th> </tr> </thead> <tbody> <tr> 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7	S	0x87	1	0	1		0x4B	525.027 ms																																																																																																																																																																																																																																							
2	S	GET	1	0	GET_DESCRIPTOR	DEVICE type	0x0000	DEVICE descriptor	1.224 sec																																																																																																																																																																																																																																						
3	S	GET	1	0	GET_DESCRIPTOR	STRING type, Index 1	Language ID 0x001B		362.4																																																																																																																																																																																																																																						

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 to display the **Expand Transfer** menu:

Transfer	F	Control	ADDR	ENDP	bRequest	wValue	wIndex
1					0x0D	0x0000	0x0000
2					0x09	0x0000	0x0000
3					0x0D	0x0000	0x0000
4					0x09	0x0000	0x0000
5					0x0D	0x0000	0x0000
6					0x09	0x0000	0x0000

Transfer	Menu
1	Transfer 1
2	Expand This Transfer
3	Expand All Transfers
4	Collapse All Transfers
5	Set marker
6	Format
6	Color
6	Hide

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

Transfer	F	Control	ADDR	ENDP	bRequest	wValue	wIndex
9	S	SET	1	0	SET_INTERFACE	New alternate setting 0	Interface # 0

Transaction	F	SETUP	ADDR	ENDP	D	T	R	bRequest	wValue	wIndex	wLength	ACK
1332	S	0xB4	1	0	H->D	S	I	SET_INTERFACE	New alternate setting 0	Interface # 0	0	0x4B

Packet	Dir	F	Sync	SETUP	ADDR	ENDP	CRC5	EOP	Idle	Time Stamp
6925	-->	S	00000001	0xB4	1	0	0x17	233 ns	183 ns	00011.5989 1586
6926	-->	S	00000001	DATA0	0xC3	8 bytes	0x231F	233 ns	483 ns	00011.5989 1771
6927	<--	S	00000001	ACK	0x4B	233 ns	988.017 μs	00011.5989 2294		

Transaction	F	IN	ADDR	ENDP	T	Data	ACK	Time
1333	S	0x96	1	0	1	0 bytes	0x4B	2.000 ms

Transfer	F	Control	ADDR	ENDP	bRequest	wValue	wIndex	Data	Time
10	S	SET	1	0	0x01	0x0000	0x0000	64 bytes	10.998 ms

Transfer	F	Control	ADDR	ENDP	bRequest	wValue	wIndex	Data	Time
11	S	SET	1	0	0x01	0x0000	0x0001	64 bytes	10.998 ms

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

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

Note that you can choose to expand or collapse

- **Only** the selected Transfer
OR
- **All** Transfers

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

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

6.17 Decoding Protocol-Specific Fields in Transactions and Transfers


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

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

6.18 Switch to Host Wire Adapter Segment View

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

To select the Host Wire Adapter Segment trace viewing level:

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


The program redraws the trace view.

Packet	Dir	H	SOF	Frame #	CRC5	Pkt Len	Time	Time Stamp							
149023	-->	S	0xA5	1214.5	0x19	14	500.000 ns	00013.3883 4922							
Transaction	H	IN	ADDR	ENDP	NAK	Time	Time Stamp								
47556	S	0x96	1	3	0x5A	46.900 µs	00013.3883 4952								
HWA Xfr	Control Transfer	HWA_Adr	RPipe	TransferId	bRequest	wValue	Time Stamp								
1	No Data	1	0	0x00000001	SET_ADDRESS	New address 129	00013.3884 0266								
HWA Seg	Control	HWA_Adr	RPipe	TransferId	Seg	Last	D	TP	R	bRequest	wValue	wIndex	wLength	ResStatus	ResLen
1	Setup+NoData	1	0	0x00000001	0	1	H->D	S	D	0x05	0x0081	0x0000	0	SUCCESS	0
Time Stamp 00013.3884 0266															
Transfer	H	Bulk	ADDR	ENDP	Transfer Request	Setup	Data	Time	Time Stamp						
31	S	OUT	1	1	CONTROL	Data	8 bytes	5.827 ms	00013.3884 0266						
Transfer	H	Interrupt	ADDR	ENDP	Notification	Time	Time Stamp								
32	S	IN	1	3	TRANSFER	377.133 µs	00013.3930 4892								
Transfer	H	Bulk	ADDR	ENDP	Transfer Result	Status	Time Stamp								
33	S	IN	1	2	TRANSFER	SUCCESS	00013.3933 5020								
Transaction	H	IN	ADDR	ENDP	Data	ACK	Time Stamp								
47605	S	0x96	1	2	0 16 bytes	0x4B	00013.3933 5020								
Packet	Dir	H	IN	ADDR	ENDP	CRC5	Pkt Len	Idle	Time Stamp						
149174	-->	S	0x96	1	2	0x03	8	433.330 ns	00013.3933 5020						
Packet	Dir	H	DATA0	Data	CRC16	Pkt Len	Idle	Time Stamp							
149175	<--	S	0xC3	16 bytes	0xC9ED	24	300.000 ns	00013.3933 5054							
Packet	Dir	H	ACK	Pkt Len	Time	Time Stamp									
149176	-->	S	0x4B	6	-6.128 ms	00013.3933 5096									
Packet	Dir	H	SOF	Frame #	CRC5	Pkt Len	Time	Time Stamp							
149029	-->	S	0xA5	1214.6	0x19	14	533.330 ns	00013.3884 4920							
Transaction	H	IN	ADDR	ENDP	NAK	Time	Time Stamp								
47558	S	0x96	1	3	0x5A	124.467 µs	00013.3884 4952								

6.19 Switch to Host Wire Adapter Transfer View

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


To select the Host Wire Adapter Transfer trace viewing level:

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

6.20 Switch to Device Wire Adapter Segment View

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


To select the Device Wire Adapter Segment trace viewing level:

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

6.21 Switch to Device Wire Adapter Transfer View

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

To select the Device Wire Adapter Transfer trace viewing level:

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


6.22 Switch to PTP Transactions

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

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

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

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

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


6.23 Switch to PTP Object Transfers

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

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

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

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

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


6.24 Switch to PTP Sessions

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

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

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

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

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

6.25 Using the Trace Navigator

You can use the Trace Navigator to show the structure of the entire trace from different points on the Trace view, 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.

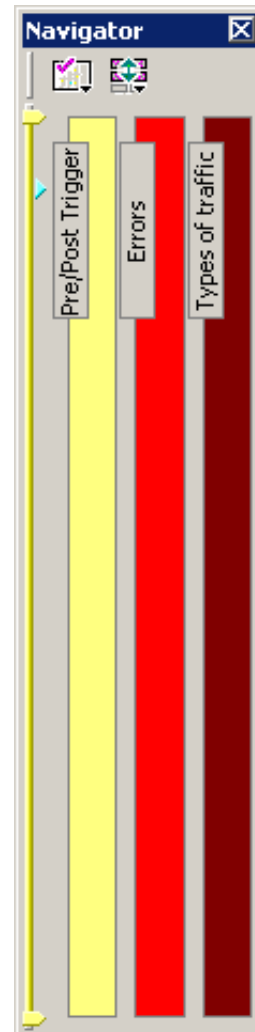
The Navigator bar can be repositioned in the trace and can be oriented horizontally or vertically, docked or undocked by dragging the parallel bars at the top or side of the Navigator bar. By default, the Navigator bar appears vertically to the right of the trace window.

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.

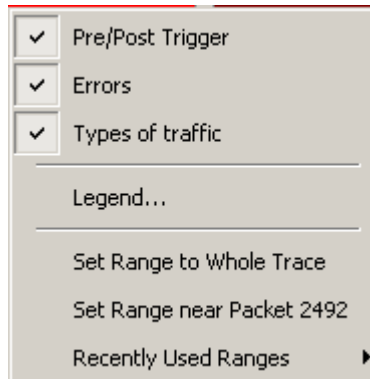
At any time, a line in the navigator bar of one pixel in height represents a fraction of the trace data. If the Navigation bar is 400 pixels high, then each bar in this example would represent 1/400 of the trace. If the trace had 4000 packets total, each bar would represent ten packets. In the Types 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 54.

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.

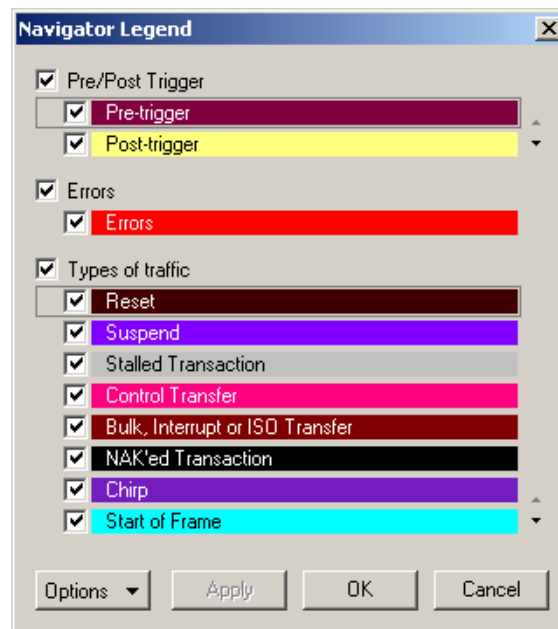
The blue caret indicates the current packet position in the trace view.



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.
- **Recent Ranges:** Displays a history of ranges that were previously selected.

Navigator Bar Attributes

Pre/Post Trigger Bar

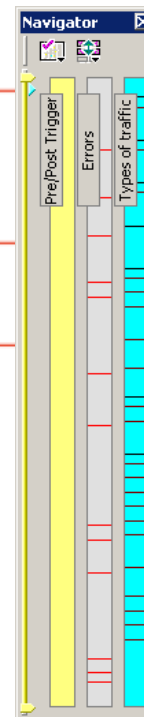
- Brown - Pre-trigger packets
- Yellow - Post-trigger packets

Errors Bar

- Red - Packet errors in a trace

Traffic Type Bar

- Dark red - Reset
- Purple - Suspend
- Grey - Stall
- Pink - Control transfers
- Brown - Data transactions
- Black - NAK'd transactions
- Light blue - Start of Frame (SOF)



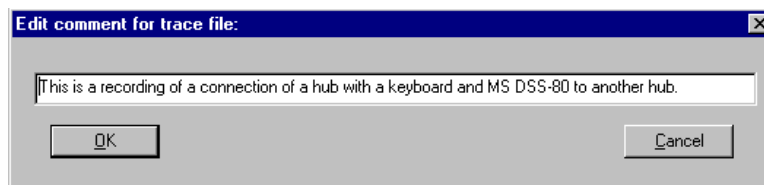
The traffic types are shown in order of importance. For example, if a NAK'd transaction occurred in the same sample area as a SOF, the NAK would take precedence, and the Navigator would show the black bar.

6.26 Edit Comment

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

You see the **Edit comment for trace file** window:



Step 2 Create, view, or edit the comment.

Step 3 Click **OK**.

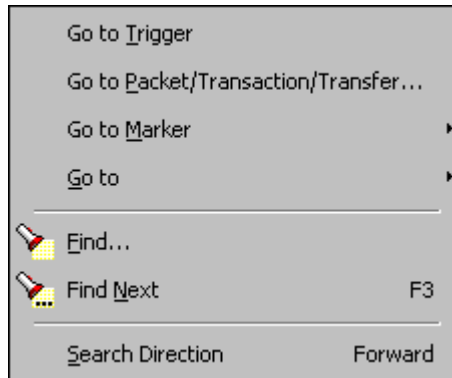
You can view comments in Windows Explorer by selecting the Comments attribute.

Chapter 7: Searching Traces

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

To view the Search options:

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



7.1 Go to Trigger

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

To display a Trigger Event:

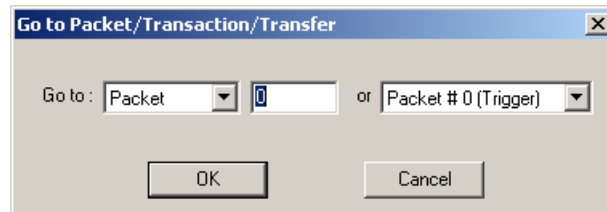
- Select **Go to Trigger** under **Search** on the Menu Bar.

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

7.2 Go to Packet/Transaction/Transfer

To display a specific packet:

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



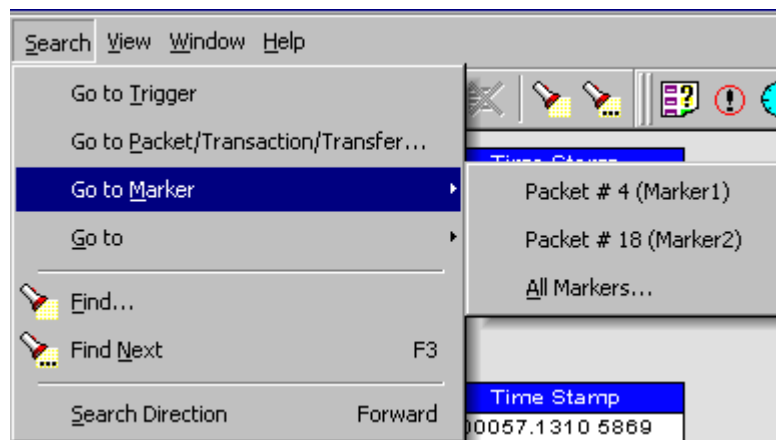
- Step 2** Select the desired viewing level (packet, transaction etc.) from the drop-down menu next to the words **Go to**.
- Step 3** Enter the number of the packet you want to display.
- Step 4** Click **OK**. The Trace View is repositioned with the selected packet at the top of your screen.

7.3 Go to Marker

To instruct the Analyzer to display a marked packet:

- Step 1** Select **Go to Marker** under **Search** on the Menu Bar.

You see a drop-down menu listing the marked packets in that Trace View:



- Step 2** Select the desired packet from the displayed list. The Trace View is repositioned with the selected packet at the top of your screen.

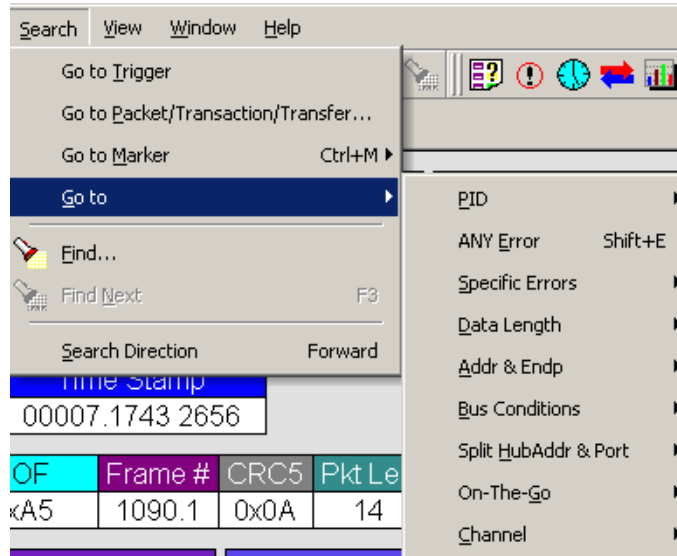
Note: The **Go to Marker** feature functions in conjunction with the **Set Marker** feature. The comments within the parentheses following each marked packet are added or edited with the **Set Marker** feature. Please refer to **Set Marker** in **Reading a Trace**.

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

7.4 Go To

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

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



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

Packet IDs (PIDs)

The screenshot shows the USBTracer software interface. The 'Go to' menu is open, and the 'PID' submenu is selected. The background shows a trace table with columns for Pkt Len, Idle, and Time Stamp.

Pkt Len	Idle	Time Stamp		
8	123.500 μs	00000		
Frame #	CRC5	Pkt Len	Idle	Time Stamp
274.?	0x06	14	124.800 μs	00000.0118
274.?	0x06	12	124.733 μs	00000.0119
274.?	0x06	14	124.733 μs	00000.0120
274.?	0x06	12	124.800 μs	00000.0121

The 'Go to' menu options are:

- Go to Trigger
- Go to Packet/Transaction/Transfer...
- Go to Marker Ctrl+M
- Go to
- Find...
- Find Next F3
- Search Direction: Forward

The 'PID' submenu options are:

- OUT Shift+O
- IN Shift+I
- SOF Shift+F
- SETUP Shift+S
- DATA0 Shift+0
- DATA1 Shift+1
- DATA2 Shift+2
- MDATA Shift+M
- ACK Shift+A
- NAK Shift+N
- STALL Shift+L
- NYET Shift+Y
- PRE/ERR. Shift+P
- SPLIT Shift+X
- PING Shift+G
- Reserved (0) Shift+R
- DATAx Shift+D

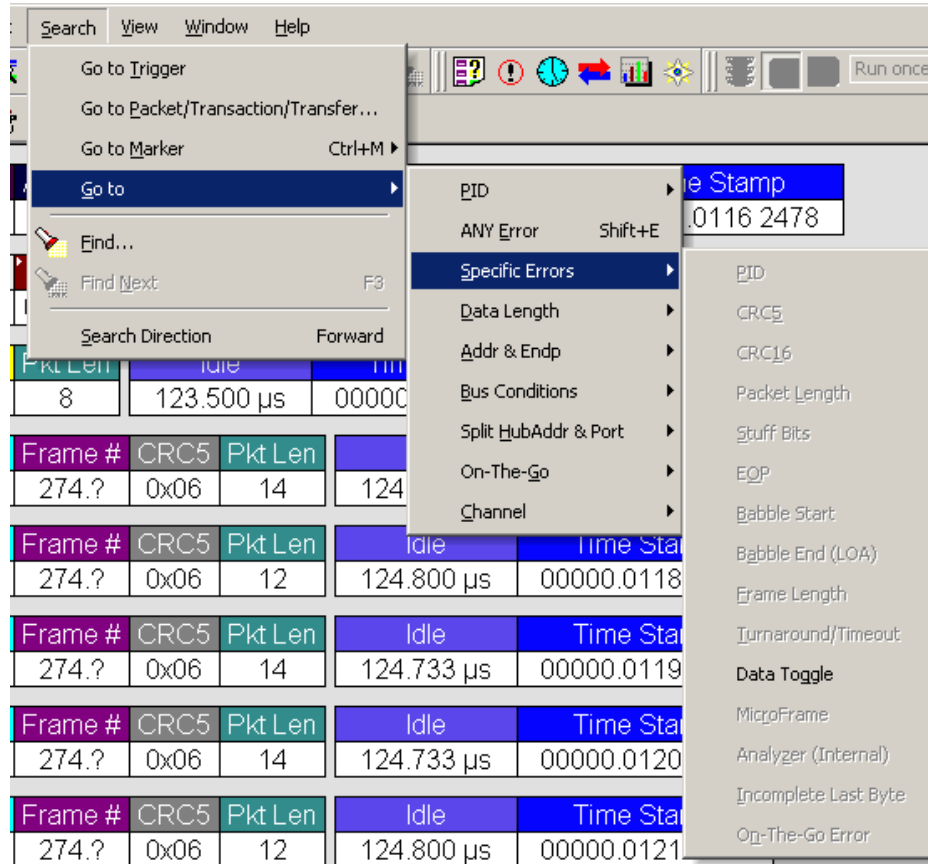
Select the type of packet to which you want to go.

ANY Error

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

Errors

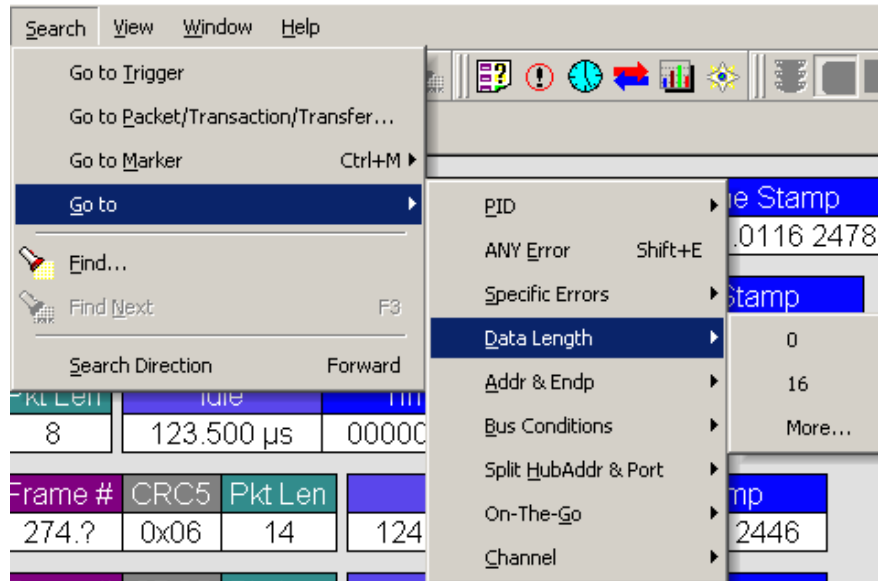
The Errors menu allows you to search for five different types of error: PID, CRC5, CRC16, Packet Length, and Stuff Bits. Menu items appear in bold if they are present in the trace or are grayed out if not present in the trace, as shown in the example below.



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

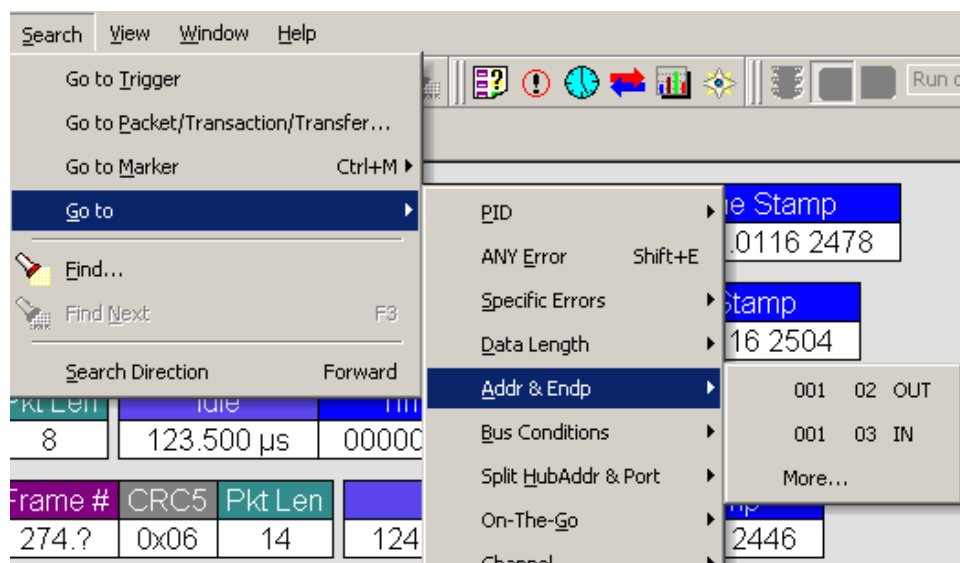
Data Length

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.



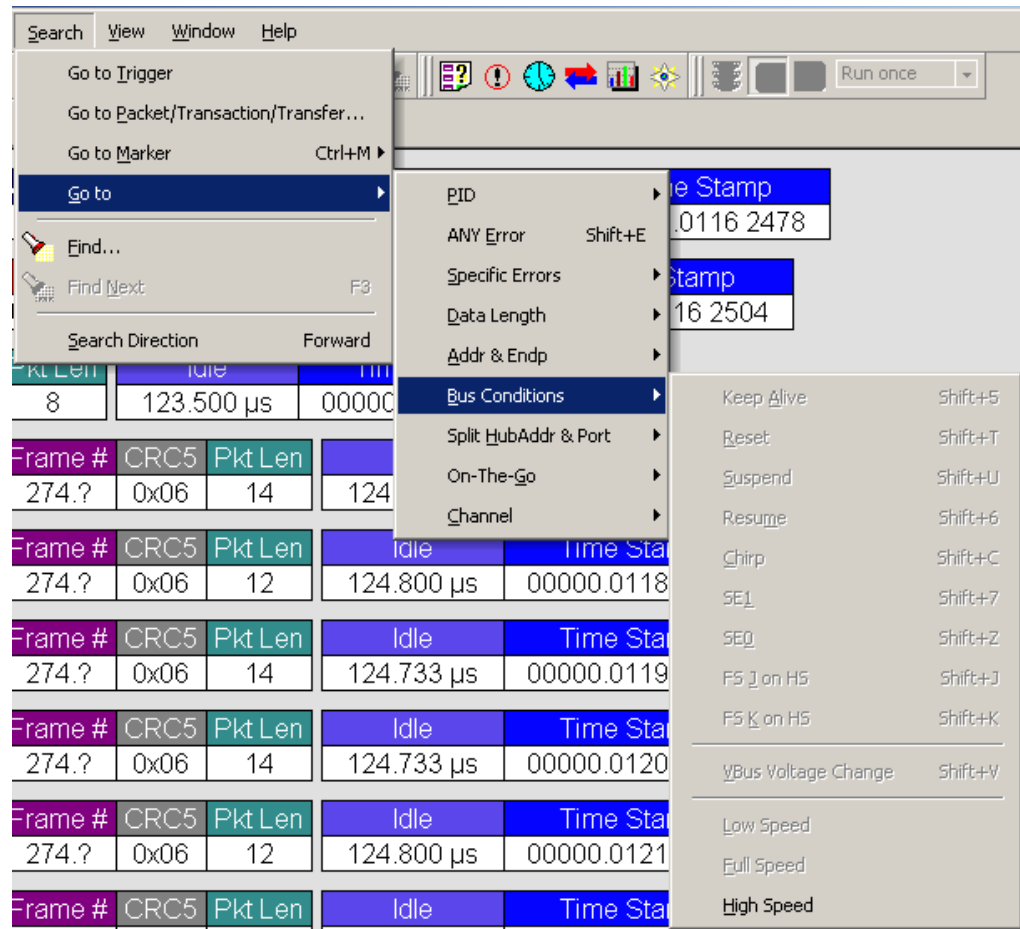
Addr & Endp

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

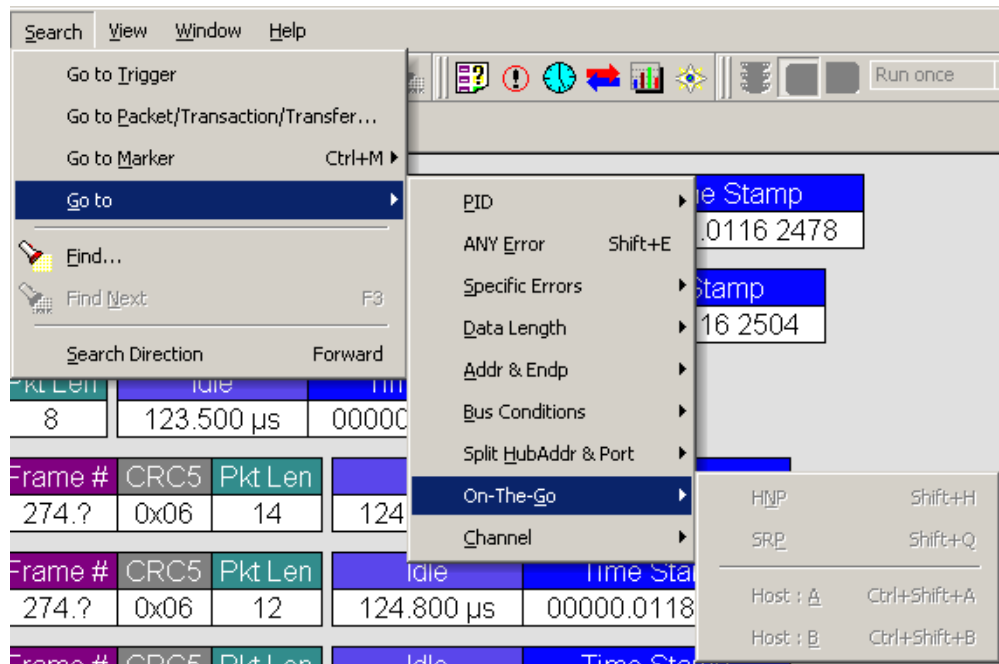
Allows you to search by bus conditions such as traffic speed, reset, and suspend. All available bus conditions are displayed in the pull down menu.



On-the-Go

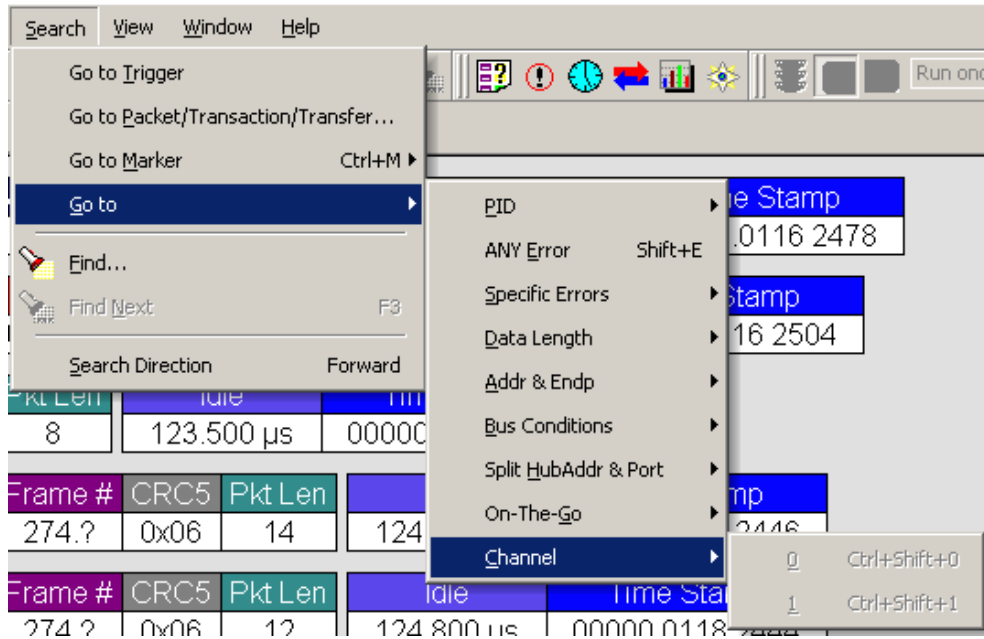
Allows you to search for On-the-go attributes. The On-the-Go submenu contains entries for:

- **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).



7.5 Find

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

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


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

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

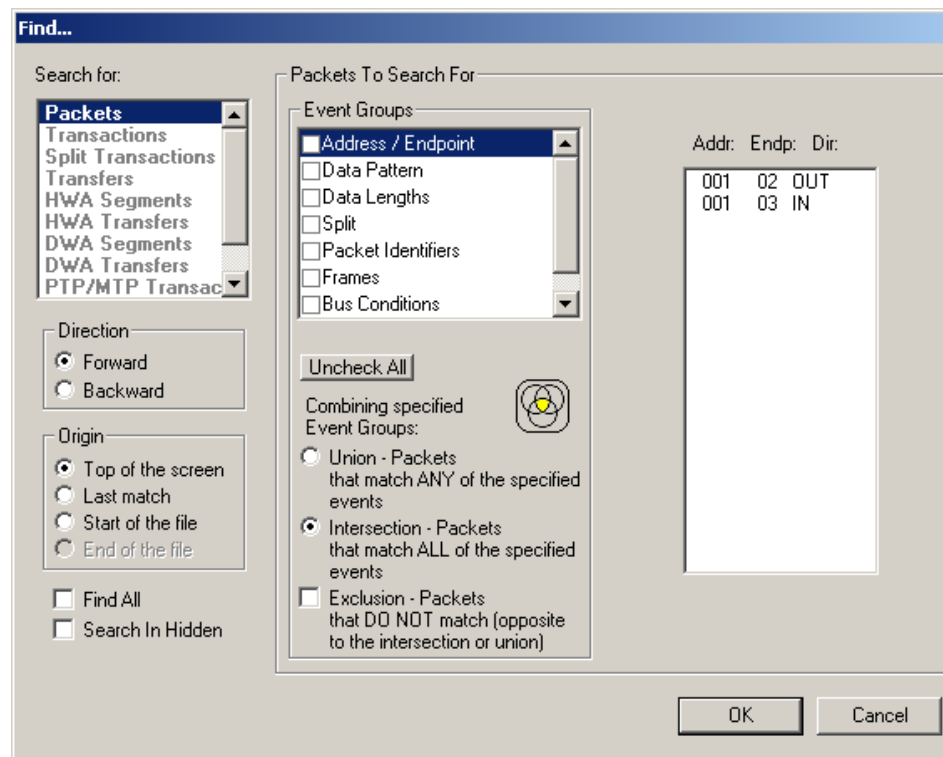
To perform a search:

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

OR

Click  in the Tool Bar.

You see 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.

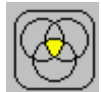
Step 3 Select one or more events from the **Events Group** box.

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.

7.6 Find Next

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

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

- Click  on the Tool Bar.


7.7 Search Direction

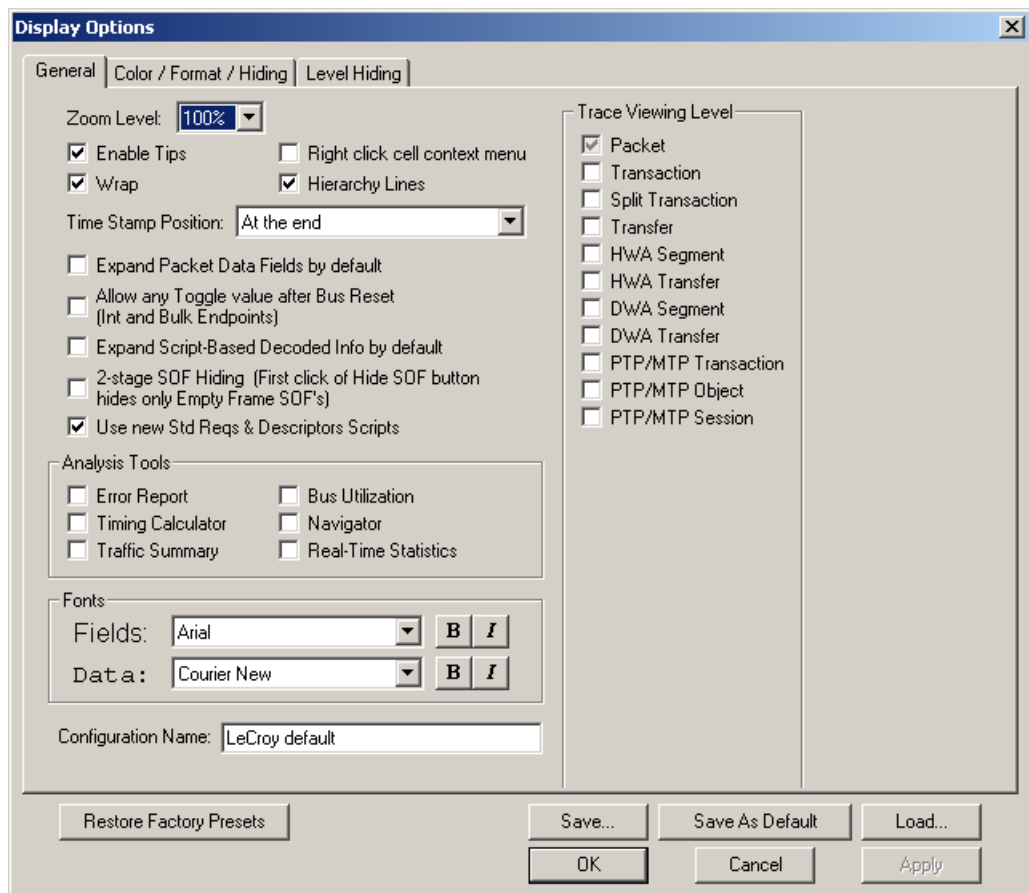
Toggles the search forward or backwards. The current direction is indicated in the menu.

Chapter 8: Display Options

You can select what information to display in Trace Views using the **Display Options** window.

To open the **Display Options** window:

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



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

8.1 General Display Options

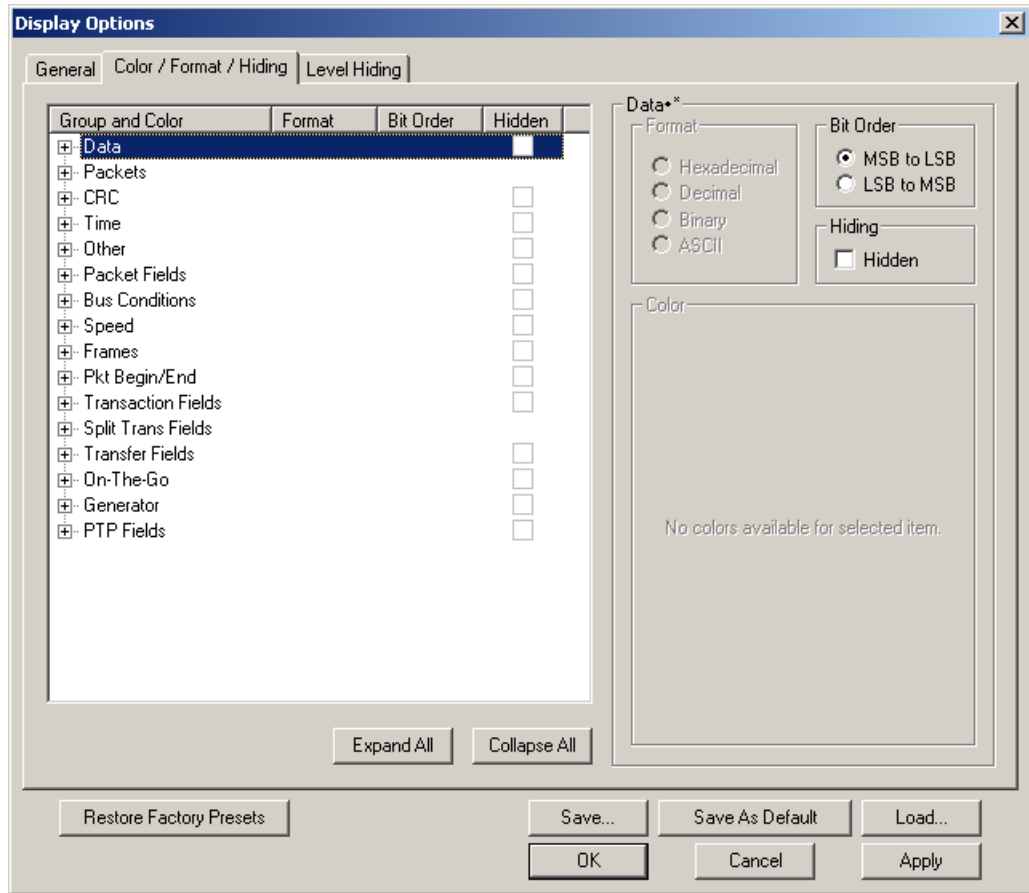
You specify the main Trace View information types and settings using General Display Options (see figure on previous page):

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

- **Analysis Tools**
 - **Error Report:** Displays the Errors section of the Traffic Summary window.
 - **Timing Calculator:** Displays the Timing Calculator window from the beginning of a packet or marker to the beginning of another packet or marker, including Total Time unit, Bus Utilization Time and Bandwidth, and selected Global, Low Speed, Full Speed, High Speed, Transactions, and Devices.
 - **Traffic Summary:** Displays the Traffic Summary window, showing all reports, including Packets, Transactions, Transfers, and Errors.
 - **Bus Utilization:** Displays the Bus Utilization window, including Packet length, Bus usage, and Bus usage by device.
 - **Navigator:** Displays the Navigation bar, including Pre/Post Triggers, Errors, and Types of Traffic.
 - **Real-Time Statistics:** Displays the Real-Time Statistics window, including Data Packet Count, Data Payload Throughput, and Bus Usage.
- **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.

8.2 Color/Format/Hiding Display Options

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

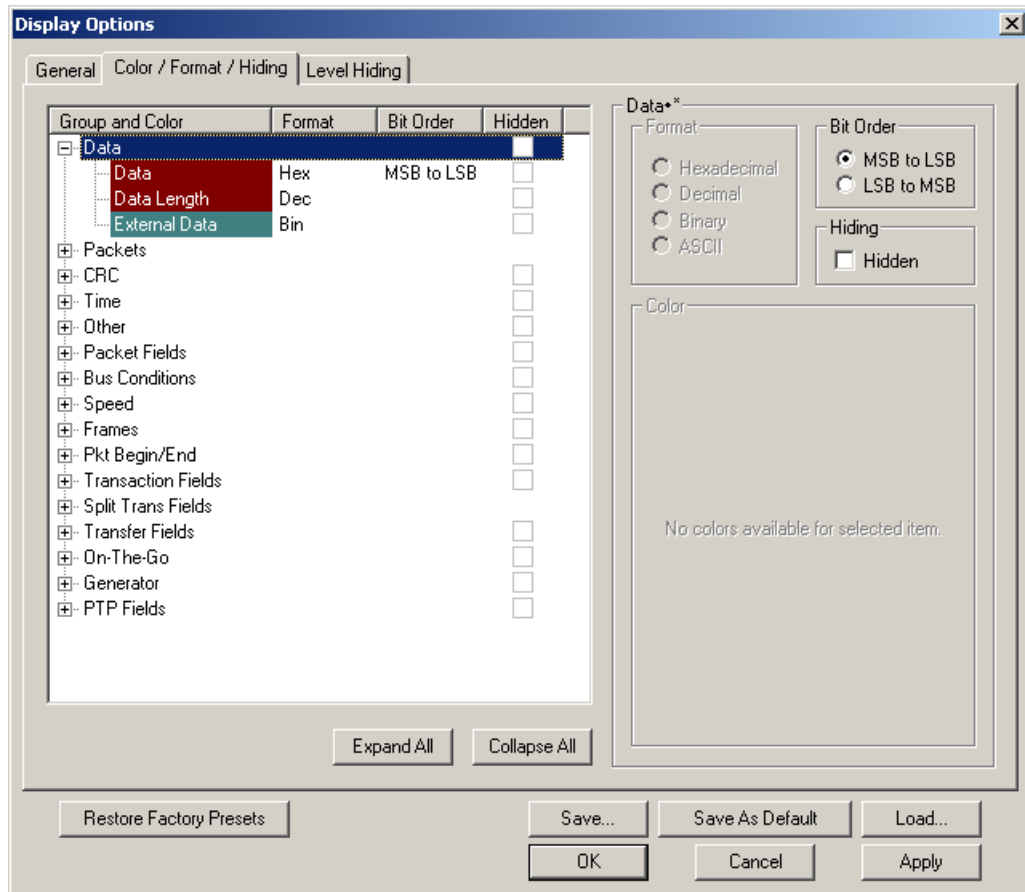


Color Display Options

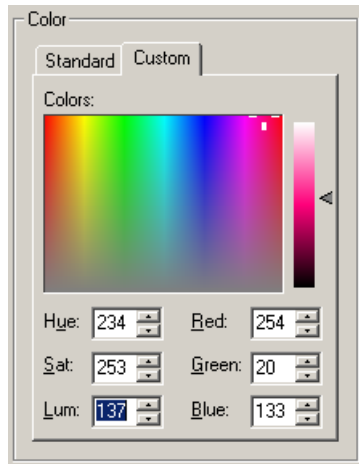
The program uses a default set of colors for each type of data in each group of data. The colors and color combinations are appropriate for most graphic systems. You can alter any color.

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

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



To customize colors, use the Custom tab.



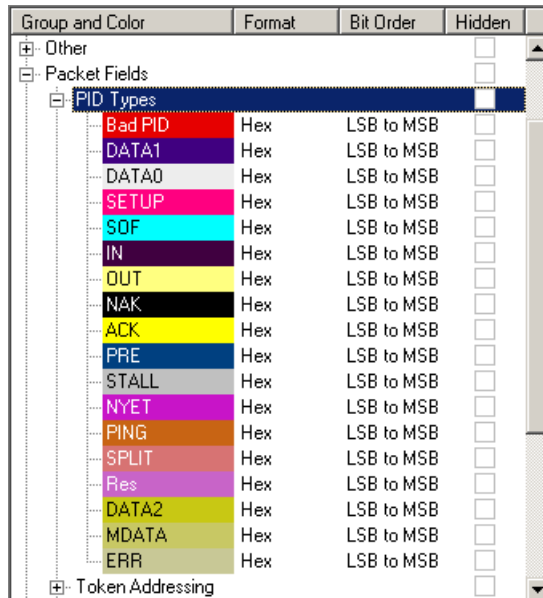
Note: You cannot change the color of an Invalid Data (packet error) field. It is permanently set to red.

Formats Display Options

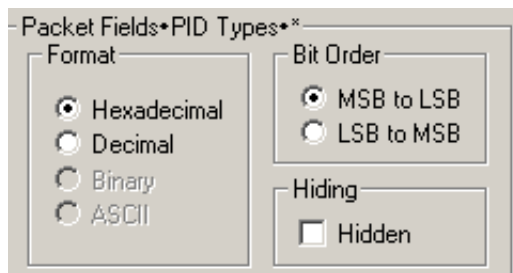
For each type of data in each group of data, the program has a default data format. Examples of number data formats are Bin (binary), Dec (decimal), and Hex (hexadecimal). Examples of date and time data formats are Hex uFrame, Dec uFrame, Date & Time, Time, Bit Time, seconds, microseconds, and nanoseconds.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

Hiding Display Options

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

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

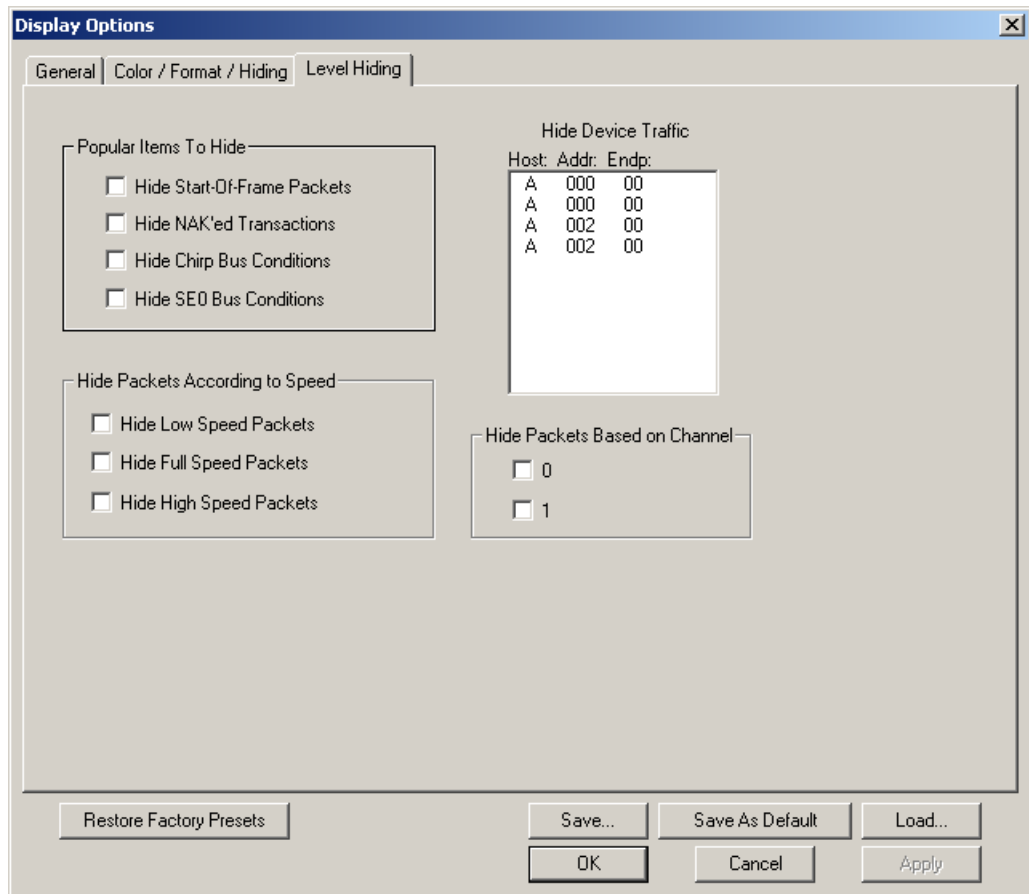


8.3 Level Hiding Display Options

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

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

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



8.4 Saving Display Options

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

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

Chapter 9: Decode Requests

9.1 Class and Vendor Definition Files

LeCroy Analyzers use script files to decode class and vendor requests. The script files are read when the application is initialized. 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 175.

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***.

9.2 Class/Vendor Decoding Options

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

Mapping Request Recipient to Class/Vendor Decoding

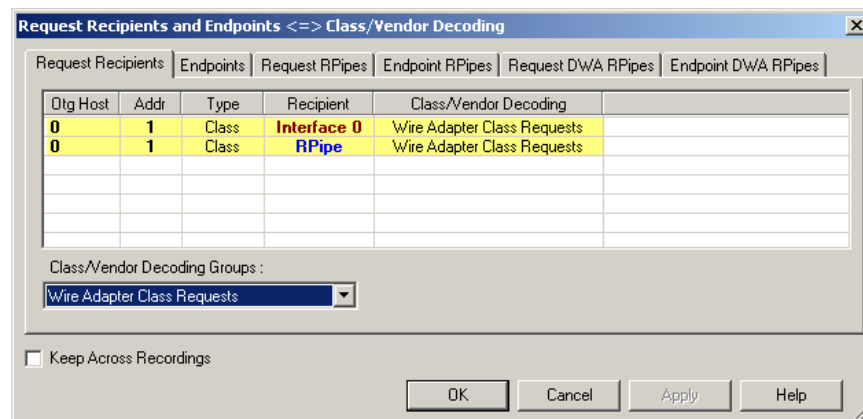
To assign a decoding group to a request recipient,

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

OR

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

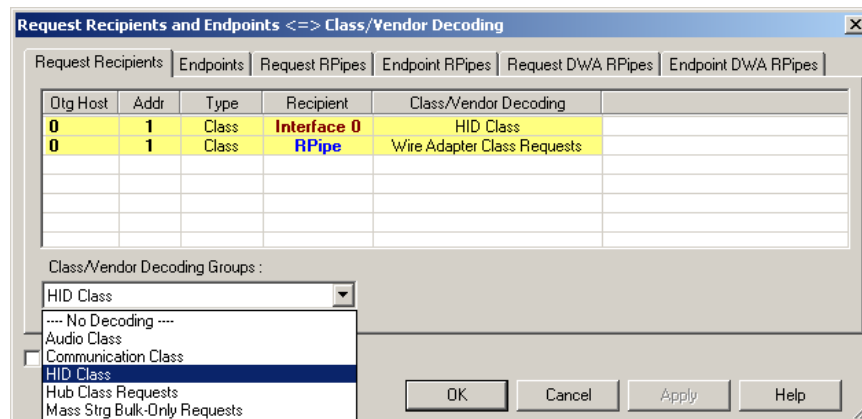
Step 2 Select **Map Request Recipients to Class/Vendor Decoding** to display the Request Recipient and Endpoints dialog box:



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

Step 3 Select a recipient.

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



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

- No Decoding
- Audio Class
- 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,

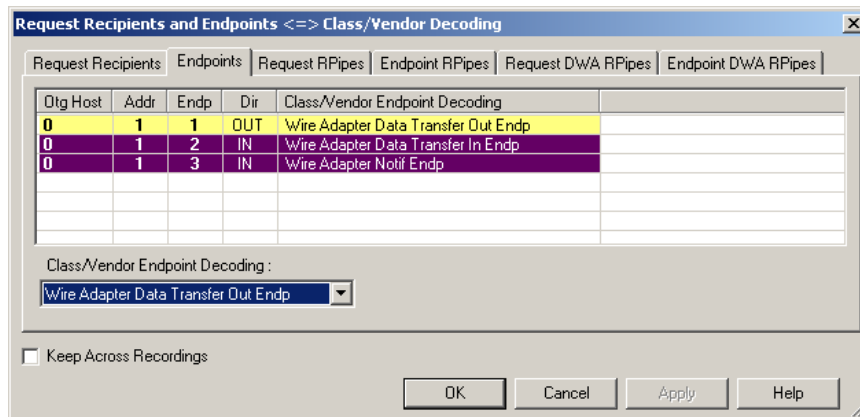
Step 1 Click the **Apply Decoding Scripts** button on the Toolbar.

OR

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

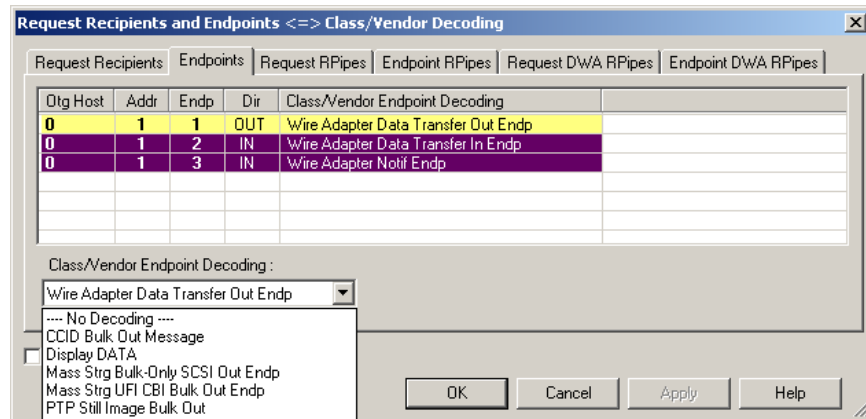
Step 2 Select **Map Endpoint to Class/Vendor Decoding** to display the Request Recipients and Endpoints dialog box.

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:

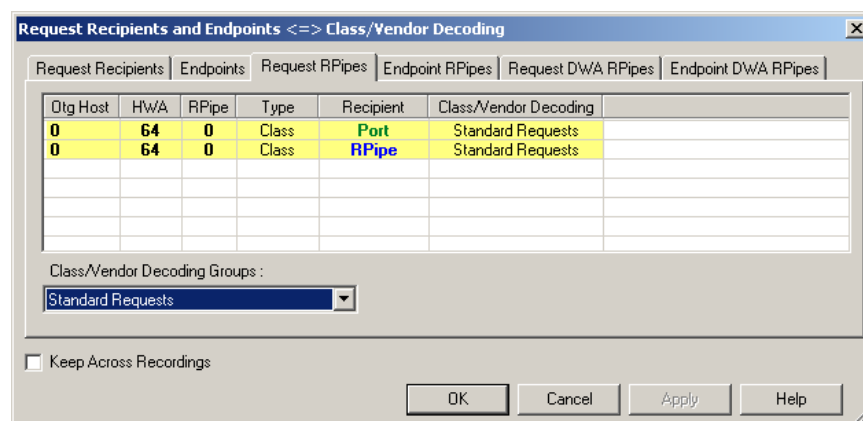
Step 1 Click the **Apply Decoding Scripts** button on the Toolbar.

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 R Pipes decoding:

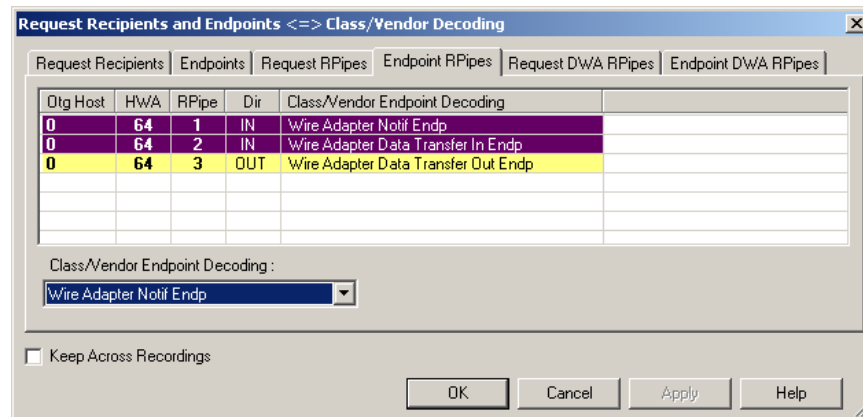
Step 1 Click the **Apply Decoding Scripts** button on the Toolbar.

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 R Pipes** tab to display the Endpoint R Pipes dialog box:



The RPipe field shows all R Pipes 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 R Pipes you would like to map.

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

Step 9 Click **OK**.

Mapping Request DWA RPipe to Class/Vendor Decoding

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

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

To assign a decoding group to a Request RPipe:

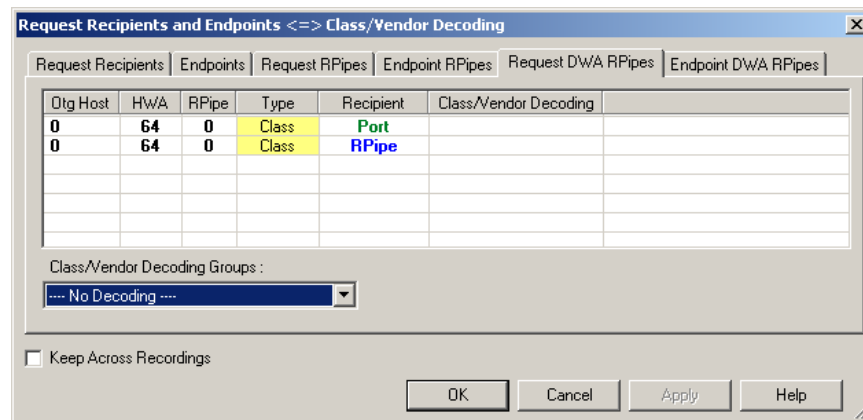
Step 1 Click the **Apply Decoding Scripts** button on the Toolbar.

OR

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

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

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



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

Step 4 Select a recipient.

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

Step 6 Select a decoding group.

OR

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

Step 7 Repeat the previous steps for additional recipients.

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

Step 9 Click **OK**.

Mapping Endpoint DWA RPipes to Class/Vendor Decoding

To assign a Class/Vendor Endpoint DWA RPipes decoding:

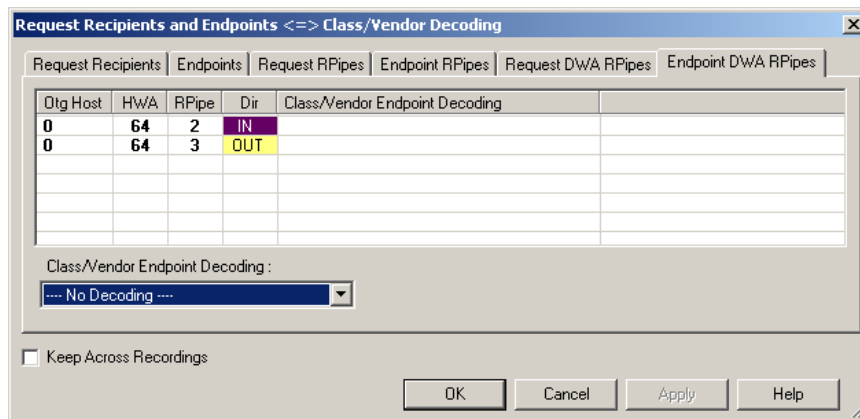
Step 1 Click the **Apply Decoding Scripts** button on the Toolbar.

OR

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

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

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



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

Step 4 Select an endpoint DWA RPipe.

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

Step 6 Select the type of decoding.

OR

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

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

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

Step 9 Click **OK**.

9.3 General Options

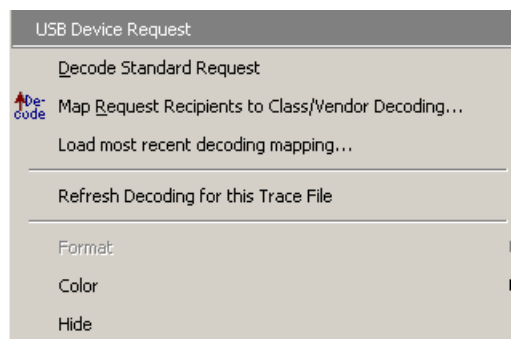
Commands are transferred on USB using special control transfers called USB Device Requests. The Analyzer can decode Device Requests as they are defined in the USB specifications and various Device Class and Vendor specifications.

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

Decoding USB Device Requests

To decode a USB Device Request:

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



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

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

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

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

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

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

Decoding Standard Requests

To decode a standard request:

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

REQUEST SUMMARY

Setup Data	80 06 00 01 00 00 40 00
Direction	Host-to-device
Type	Standard
Recipient	Device
bRequest	GET_DESCRIPTOR
wValue	DEVICE
wIndex	0x0000
wLength	0x0040

DECODING INFORMATION

Field	Length (bits)	Offset (bits)	Decoded	Hex Value	Description
bRequest	8	8	GET_DESCRIPTOR	0x06	bRequest HexVal: 0x0006
wValue	16	16	DEVICE type	0x0100	Type of Descriptor
wIndex	16	32	0x0000	0x0000	index info

DEVICE Descriptor

Field	Length (bits)	Offset (bits)	Decoded	Hex Value	Description
bLength	8	0	0x12	0x12	Descriptor size is 18 bytes
bDescriptorType	8	8	0x01	0x01	DEVICE Descriptor Type
bcdUSB	16	16	0x0200	0x0200	Device compliant to the USB specification version 2.00
bDeviceClass	8	32	0xEF	0xEF	The device belongs to the Miscellaneous Device Class
bDeviceSubClass	8	40	0x02	0x02	The device belongs to the Common Class Subclass
bDeviceProtocol	8	48	0x02	0x02	The device uses the Wire Adapter Multifunction Peripheral Protocol
bMaxPacketSize0	8	56	0x40	0x40	Maximum packet size endpoint zero is 64
idVendor	16	64	0x1461	0x1461	Vendor ID is 5217:Staccato Communications
idProduct	16	80	0x0400	0x0400	Product ID is 1024
bcdDevice	16	96	0x0100	0x0100	The device release number is 1.00
iManufacturer	8	112	0x01	0x01	The manufacturer string descriptor index is 1
iProduct	8	120	0x02	0x02	The product string descriptor index is 2
iSerialNumber	8	128	0x00	0x00	The device doesn't have the string descriptor describing the serial number
bNumConfigurations	8	136	0x01	0x01	The device has 1 possible configurations

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	Tel: +1/503.296.9892
1730 SW Skyline Blvd.	Fax: +1/503.297.1090
Suite 203	Web: http://www.usb.org/
Portland, OR 97221	

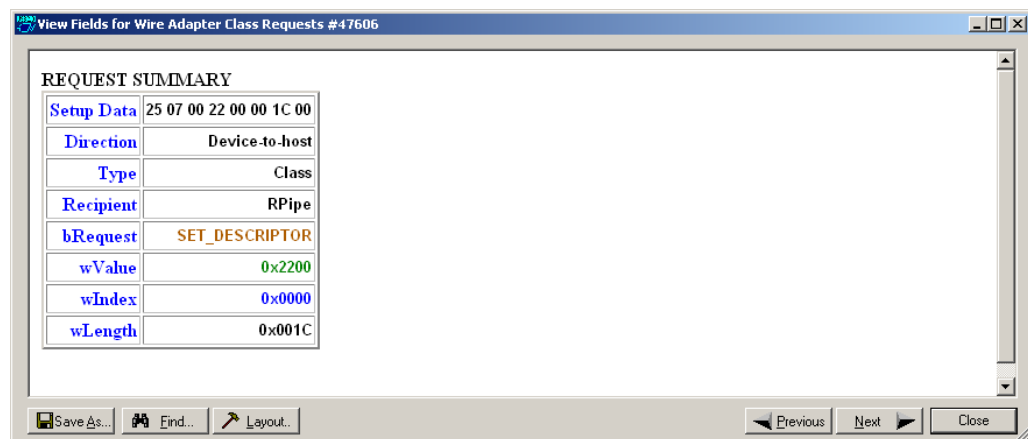
Decoding Class Requests

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 UWBTracer™ 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).

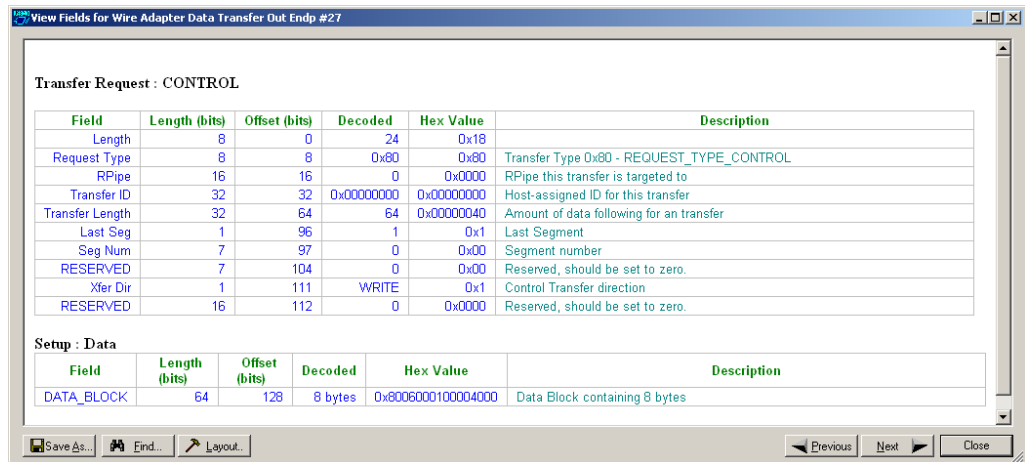
Decoding using Endpoint Information

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:



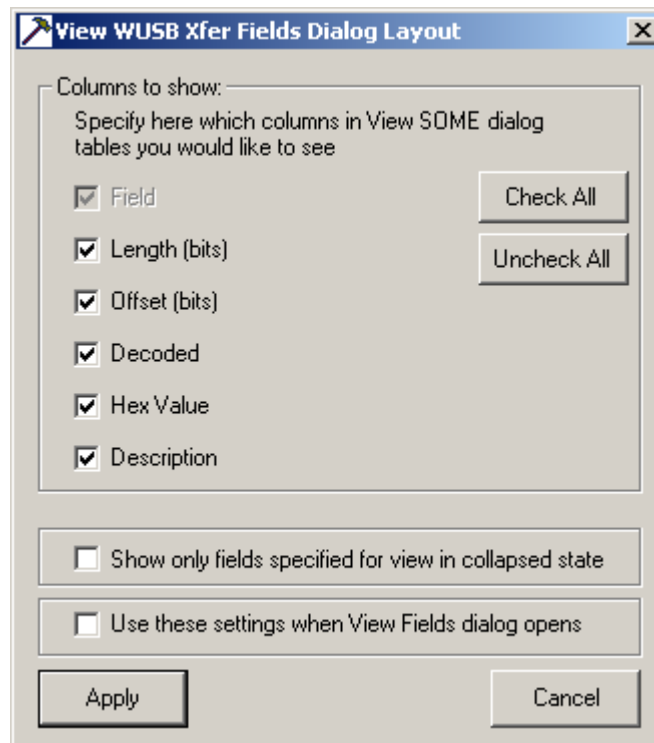
Changing the Layout of Decode Requests

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:



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

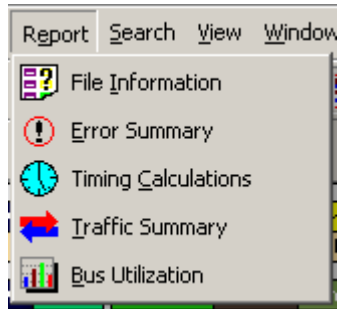
You can **Check All** or **Uncheck All**.

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

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


Chapter 10: Reports

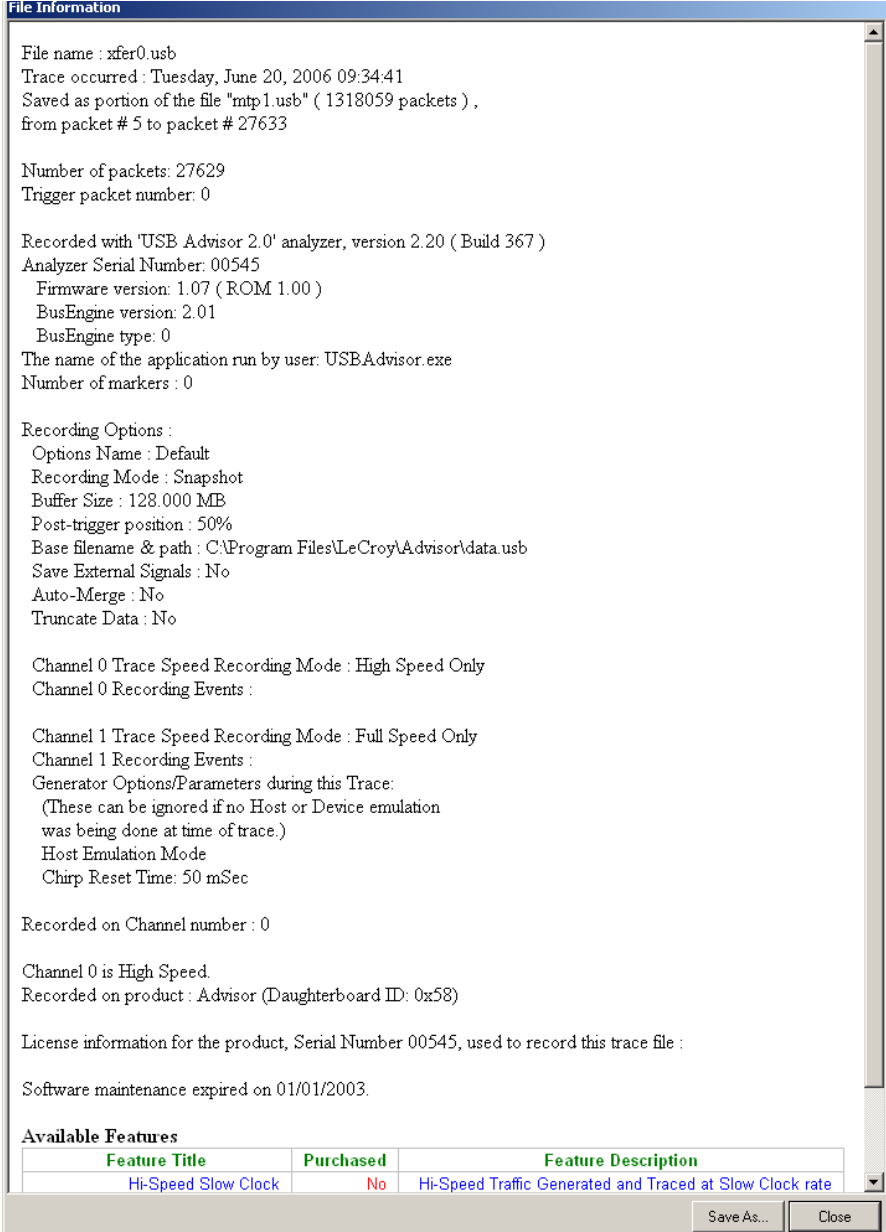
The Report menu provides several reports to assist you in analyzing USB traffic recorded by the Analyzer.



10.1 File Information

To display a File Information report:

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



File Information

File name : xfer0.usb
 Trace occurred : Tuesday, June 20, 2006 09:34:41
 Saved as portion of the file "mtp1.usb" (1318059 packets),
 from packet # 5 to packet # 27633

Number of packets: 27629
 Trigger packet number: 0

Recorded with 'USB Advisor 2.0' analyzer, version 2.20 (Build 367)
 Analyzer Serial Number: 00545
 Firmware version: 1.07 (ROM 1.00)
 BusEngine version: 2.01
 BusEngine type: 0
 The name of the application run by user: USBAdvisor.exe
 Number of markers : 0

Recording Options :
 Options Name : Default
 Recording Mode : Snapshot
 Buffer Size : 128,000 MB
 Post-trigger position : 50%
 Base filename & path : C:\Program Files\LeCroy\Advisor\data.usb
 Save External Signals : No
 Auto-Merge : No
 Truncate Data : No

Channel 0 Trace Speed Recording Mode : High Speed Only
 Channel 0 Recording Events :

Channel 1 Trace Speed Recording Mode : Full Speed Only
 Channel 1 Recording Events :

Generator Options/Parameters during this Trace:
 (These can be ignored if no Host or Device emulation
 was being done at time of trace.)
 Host Emulation Mode
 Chirp Reset Time: 50 mSec

Recorded on Channel number : 0

Channel 0 is High Speed.
 Recorded on product : Advisor (Daughterboard ID: 0x58)

License information for the product, Serial Number 00545, used to record this trace file :

Software maintenance expired on 01/01/2003.

Available Features


Feature Title	Purchased	Feature Description
Hi-Speed Slow Clock	No	Hi-Speed Traffic Generated and Traced at Slow Clock rate

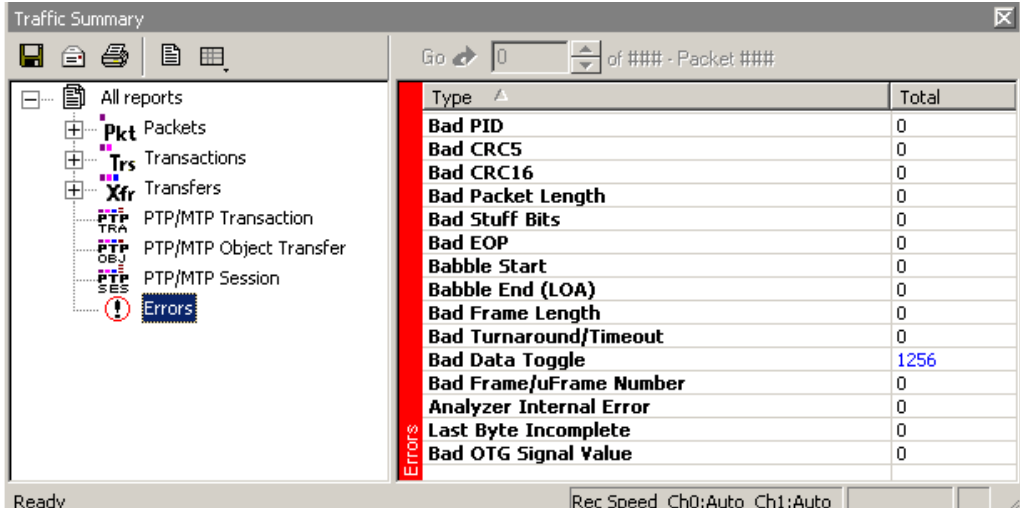
Save As... Close

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.

10.2 Error Summary

The Error Summary details all errors analyzed throughout the recording.

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




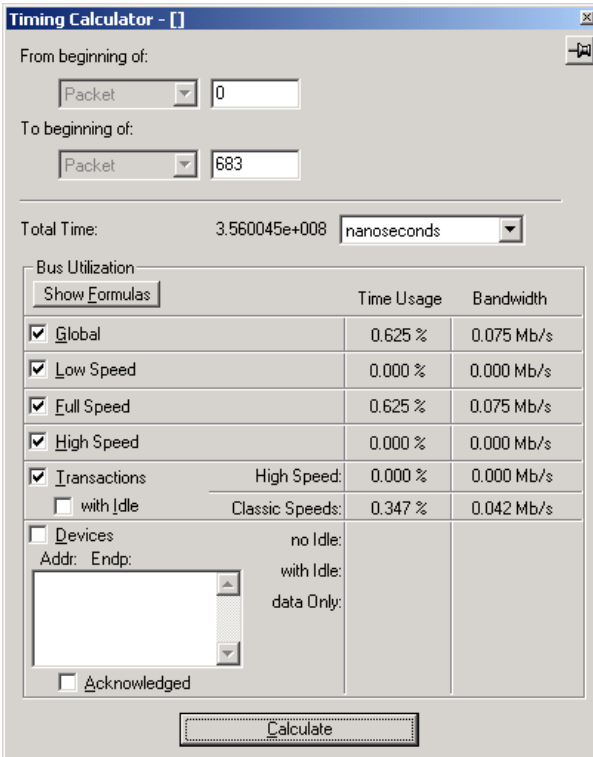
The screenshot shows the 'Traffic Summary' window with the 'Errors' report selected in the left-hand tree view. The main area displays a table of error types and their total counts. The 'Bad Data Toggle' error has a total count of 1256, while all other error types have a total count of 0.

Type	Total
Bad PID	0
Bad CRC5	0
Bad CRC16	0
Bad Packet Length	0
Bad Stuff Bits	0
Bad EOP	0
Babble Start	0
Babble End (LOA)	0
Bad Frame Length	0
Bad Turnaround/Timeout	0
Bad Data Toggle	1256
Bad Frame/uFrame Number	0
Analyzer Internal Error	0
Last Byte Incomplete	0
Bad OTG Signal Value	0

10.3 Timing Calculations

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

- Select **Timing Calculations** under **Report** in the Menu Bar
OR
- Click  in the Tool Bar to display the Timing and Bus Usage Calculator screen:



Timing Calculator - []

From beginning of:
 Packet

To beginning of:
 Packet

Total Time: 3.560045e+008 nanoseconds

Bus Utilization

Show Formulas


	Time Usage	Bandwidth
<input checked="" type="checkbox"/> Global	0.625 %	0.075 Mb/s
<input checked="" type="checkbox"/> Low Speed	0.000 %	0.000 Mb/s
<input checked="" type="checkbox"/> Full Speed	0.625 %	0.075 Mb/s
<input checked="" type="checkbox"/> High Speed	0.000 %	0.000 Mb/s
<input checked="" type="checkbox"/> Transactions	High Speed: 0.000 %	0.000 Mb/s
<input type="checkbox"/> with Idle	Classic Speeds: 0.347 %	0.042 Mb/s
<input type="checkbox"/> Devices	no Idle:	
Addr: Endp:	with Idle:	
<input type="text"/>	data Only:	
<input type="text"/>		
<input type="checkbox"/> Acknowledged		

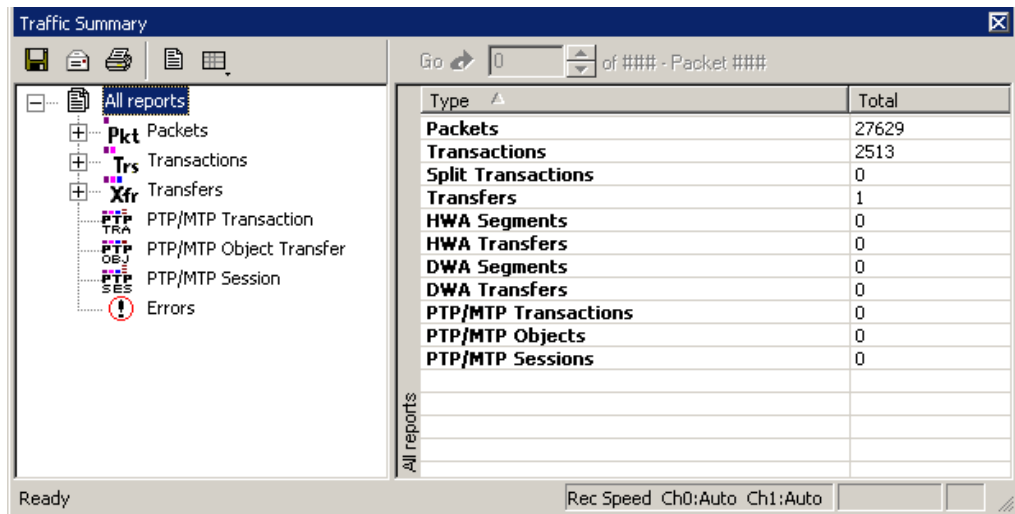
Calculate

10.4 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:



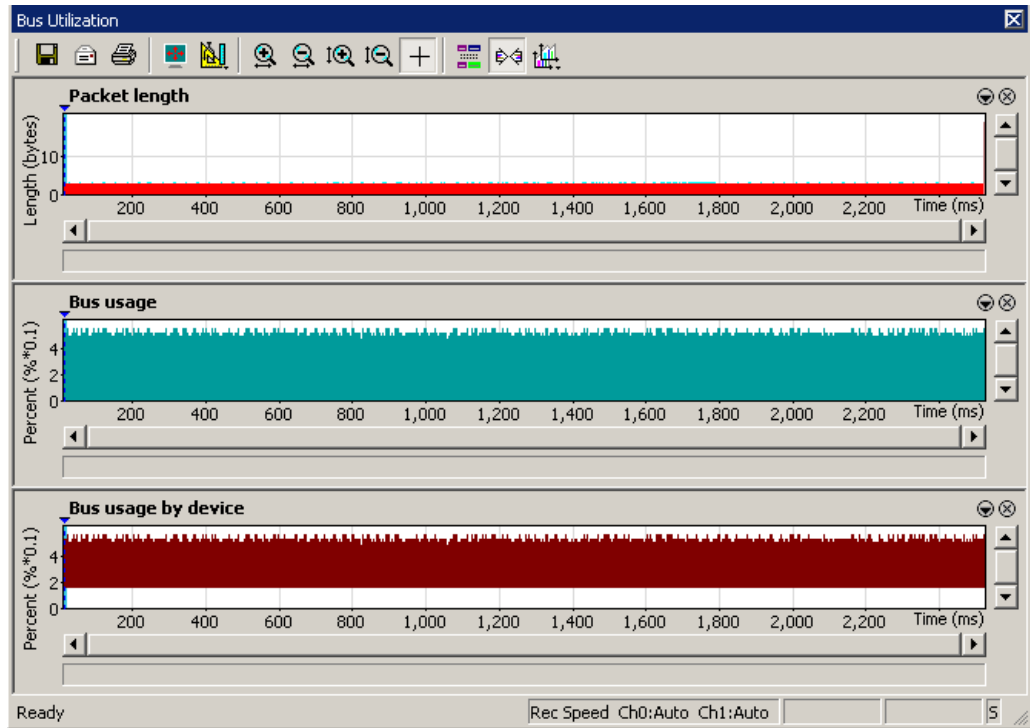
10.5 Bus Utilization

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

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

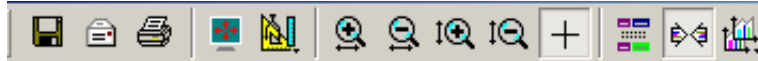
or click the button marked .

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:

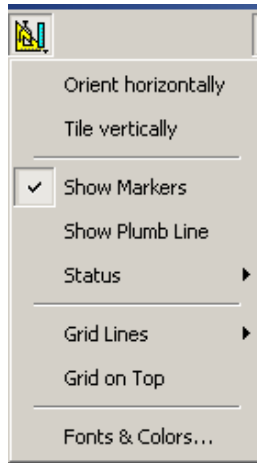


The buttons have the following functions:

- | | | | |
|---|---|---|--|
|  | Save As - Saves the graphs as a bitmap file (*.bmp) |  | Vertical zoom in |
|  | Email - Creates an email with a *.bmp file attachment of the graphs |  | Vertical zoom out |
|  | Print |  | Click and Drag zoom - Click diagonally to select and zoom in on part of the graph |
|  | Full Screen |  | Select Range |
|  | View Settings - opens a sub-menu with options for formatting the display. See "View Settings Menu" below. |  | 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. |
|  | Horizontal zoom in |  | Graph Areas - Presents options for displaying additional graphs of data lengths, packet lengths, and percentage of bus utilized. |
|  | Horizontal zoom out | | |

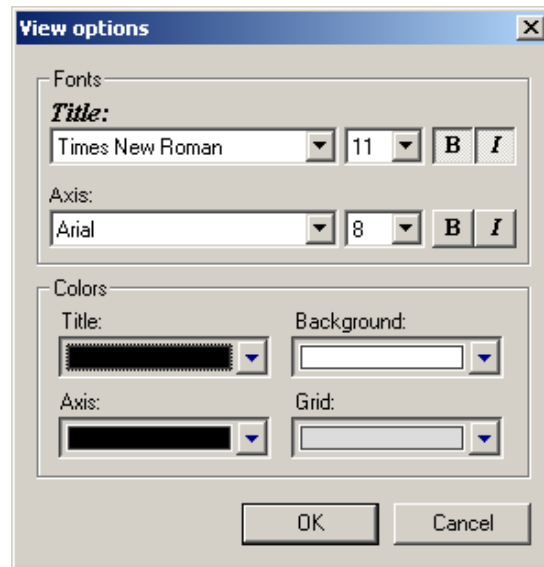
View Settings Menu

Clicking the View Settings button  causes a menu to open 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:

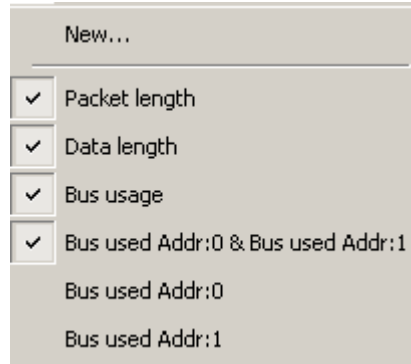


Graph Areas Menu

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

To view information:

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

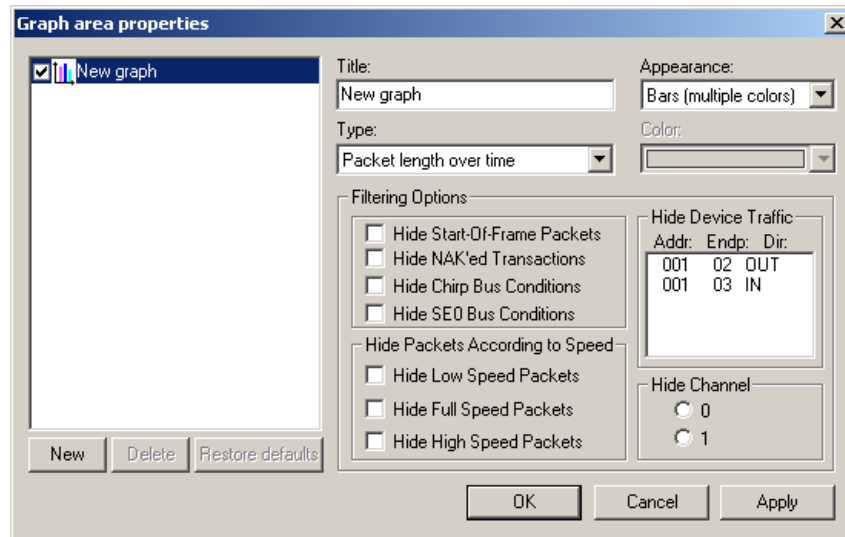


Step 2 Select the data you want to appear in the Graph Areas window.

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

To change the properties in the Bus Utilizations graph:

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




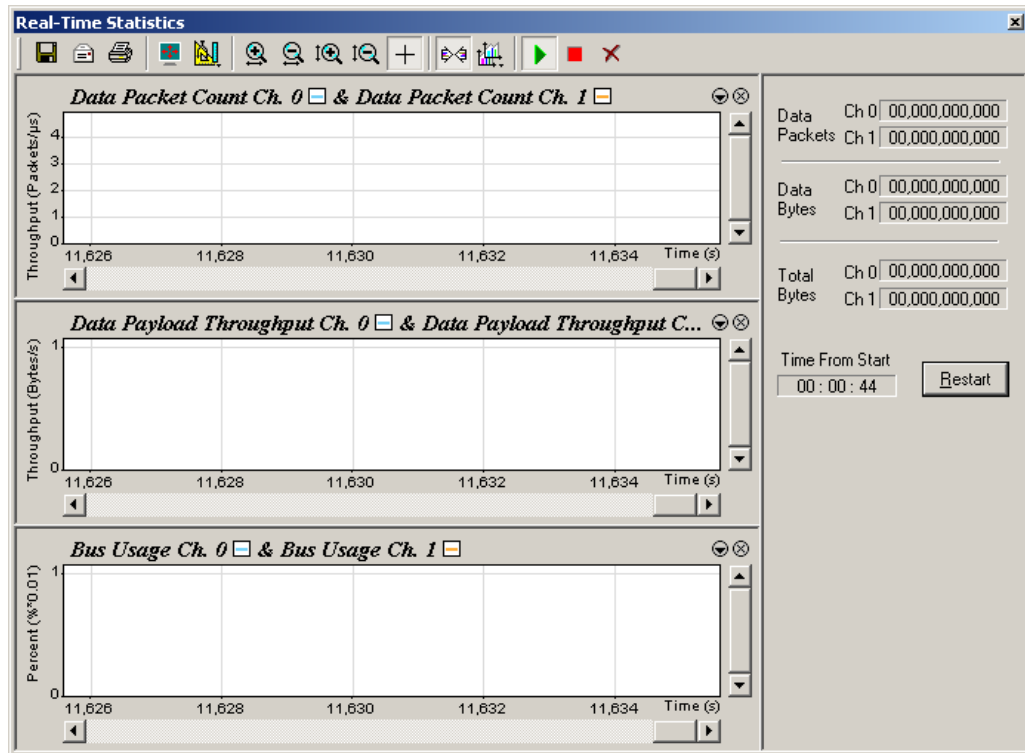
Step 2 To make a new graph, click **New**.

10.6 Real Time Monitoring


The Real-Time Statistics window displays a graph of real-time link activity.


Real Time Statistics displays a summary of the traffic currently being recorded by the Analyzer.

To display the Real-Time Statistics window, click  in the Tool Bar to open the Real Time Statistics window:



In order to see a graph of traffic, you must start recording.

After starting InfiniBand link activity, press  to start the Real-Time statistics monitor. As traffic is recorded, data is streamed in real time to this window and presented in a format of your choice.

















To stop the monitor, press .

Real-Time Statistics Buttons

The Real-Time Statistics toolbar has buttons for changing the format of the displayed data and for exporting data:

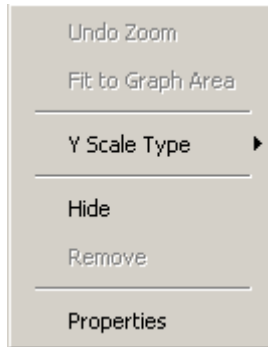


The buttons have the following functions:

	Save As - Saves Real-Time graphs as bitmap files (*.bmp)		Vertical zoom in
	Email - Creates an email with a *.bmp file attachment of the graphs		Vertical zoom out
	Print		Click and Drag zoom - Click diagonally to select and zoom in on part of the graph
	Full Screen		Select Range
	View Settings - opens a sub-menu with options for formatting the display. See "View Settings Menu" below.		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.
	Horizontal zoom in		Graph Areas - Presents options for displaying additional graphs of data lengths, packet lengths, and percentage of bus utilized.
	Horizontal zoom out		Start. Starts the Real-Time Monitor.
			Stop Real-Time Monitoring.
			Reset. Resets the graphs.

Real-Time Statistical Monitor Pop-up Menu

If you right-click a graph in the Real-Time window, a pop-up menu appears with options for changing the format of the display:



- **Undo Zoom:** If you have zoomed in, undoes the zoom.
- **Fit to Graph Area:** Displays graph so that the entire trace fits inside the graph area.
- **Y Scale Type:**
 - **Linear:** Converts display to linear format.
 - **Logarithmic:** Converts display to logarithmic format.
- **Hide:** Hides the selected graph.
- **Properties:** Opens a dialog box with options for changing the colors, titles and other features of the graphs.

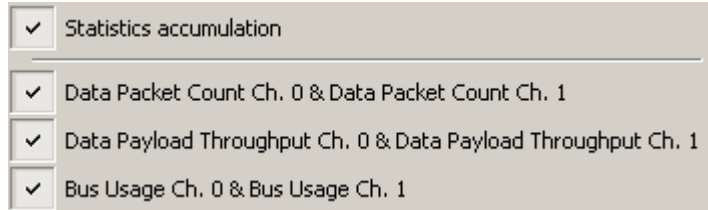
Displaying Multiple Graphs

The Real Time Statistics window gives you the ability to create up to three separate graphing windows so that you can create separate graphs of traffic and tile them vertically. Within these windows, you can format the graphs in a number of ways.

- To view two or three graphs simultaneously,

click the **Graph Areas**  button.

The following menu opens.




Selecting a checkbox displays the selected graph type:

- **Statistics Accumulation:** Plots the percentage of Link utilization by non-idle traffic for both directions of the link.
- **Data Packet Count (Packets/s):** Plots counts of Data Packets per second for both directions of the link.
- **Data Payload Throughput (MBytes):** Plots data payload throughput for both directions of the link.
- **Bus Usage:** Plots amount of Bus usage.

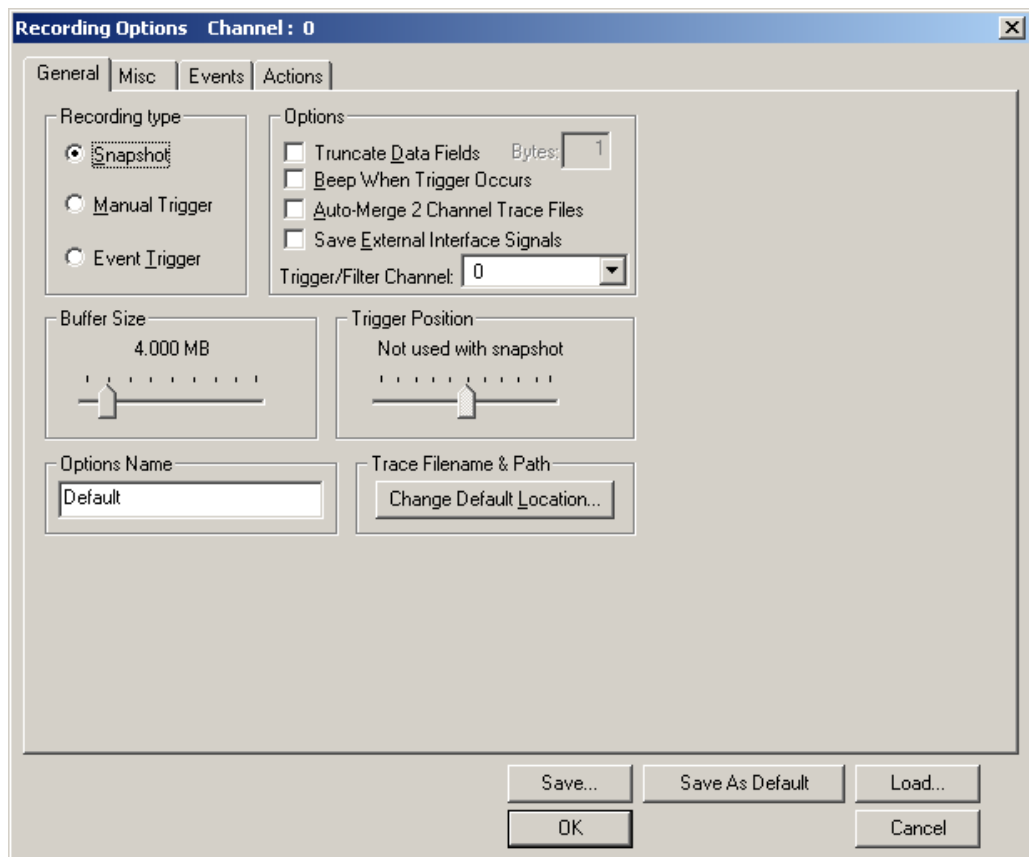
Chapter 11: Recording Options

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

To open the **Recording Options** dialog box:

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

You see the **Recording Options** dialog box:



The **Recording Options** window always opens with the **General** tab showing.

11.1 General Recording Options

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



Recording Type

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




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


Snapshot

A Snapshot is a fixed-length recording. The size of this recording is set by the Buffer Size box. Recording begins when  is clicked and ends when either the selected buffer size is filled or the  button is pressed.


Manual Trigger

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

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

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

Event Trigger

Recording begins when you click  on the Tool Bar.

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

Options

- **Truncate Data Fields:** Allows data fields to be truncated during recording in order to save Analyzer memory and allow recording of more packets. Enter a minimum data length value in the Bytes box. USBTracer 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:** The computer connected to the USBTracer beeps three times when a Trigger condition is first detected.
- **Auto-Merge 2 Channel Trace Files:** Causes USBTracer to merge traffic of the two recording channels into a file called data_merged.usb (or whatever name you wish to give it). USBTracer also makes two other files during this recording: **data_0.usb** and **data_1.usb** (or whatever names you choose to give them). If unchecked, USBTracer creates only two files: one for Classic-Speed traffic and another for Hi-Speed traffic.
- **Save External Interface Signals:** Causes USBTracer to save signals from a Break-out board (pins *Data7* - *Data0*) as fields in the trace.
- **Trigger/Filter Channel:** Presents a choice of Channel 0 or Channel 1. The selected choice tells USBTracer what channel it should use to perform its triggers/filters. If you want to set triggers/filters on *both* channels, then you must select a channel, assign trigger/filter events and actions, then select the other channel and assign trigger filter events and actions to it. In other words, you must set your events and actions *twice* - once for each channel. The channel you are currently applying the triggers/filters to is shown in the Dialog Title Bar.

Buffer Size

You can adjust the size of the recording buffer from 0.4 megabytes to 512 megabytes.

The **Recording type** option determines how this buffer is used. Although there are 512 megabytes of physical memory in the Analyzer, the efficiency of the recording is about a 2:1 ratio of physical memory to actual USB traffic. Shorter USB packets yield a slightly less efficient recording. The non-traffic portion of physical memory is utilized for control and timing information.

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

Trigger Position

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

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

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

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

Options Name

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

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

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

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

To create a new Recording Options name:

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

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

Step 3 Specify a filename (*.rec)

Step 4 Click **Save**.

To load a Recording Options name:

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

Step 2 From the list of **.rec** files, select the one that represents your Options Name.

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. If you are recording on both channels, then USBTracer creates two files: **data_0.usb** for Channel 0, and **data_1.usb** for Channel 1.

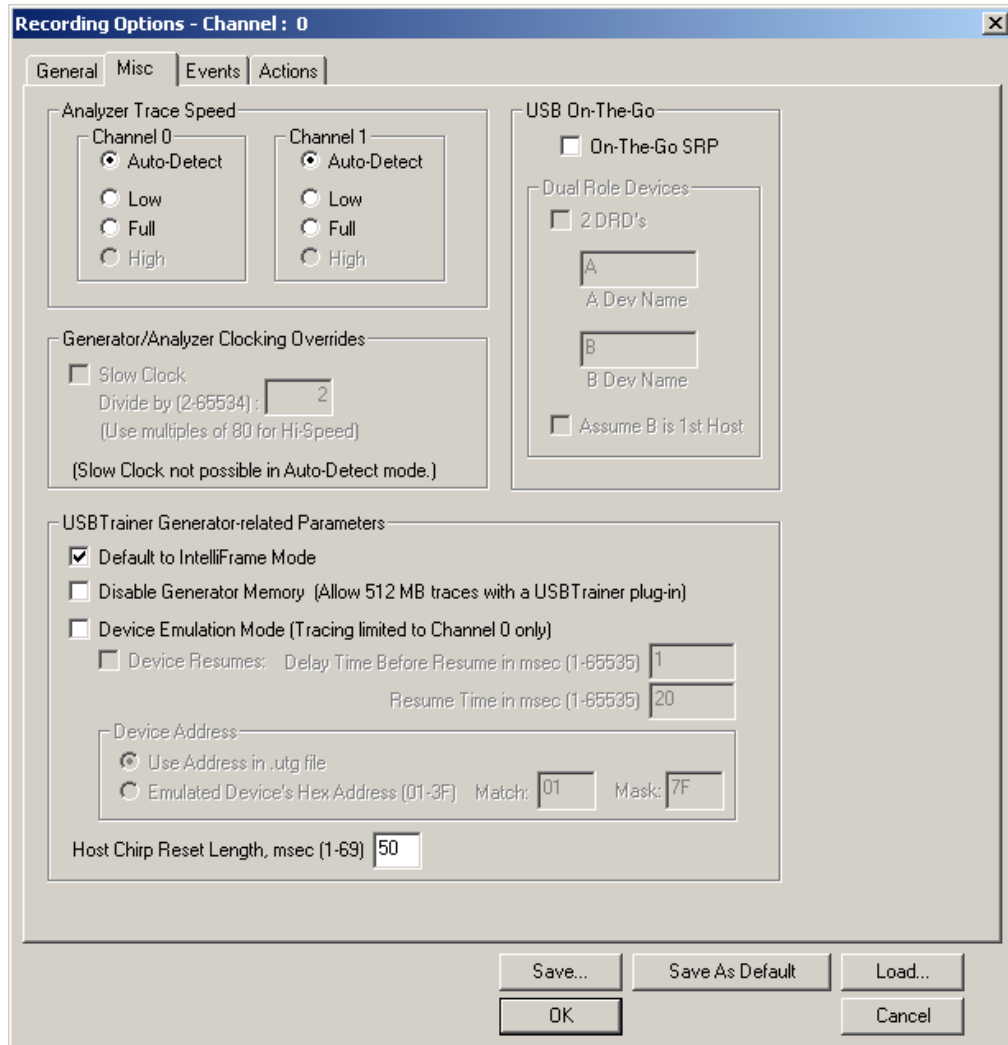
- Click **Trace File Name & Path**.

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

11.2 Recording Options - Misc

The **Misc** page presents options for setting:

- Analyzer speed
- Device emulation
- OTG
- Clocking Overrides
- Traffic Generation



Analyzer Speed

This option sets the speed of the traffic recorded by the Analyzer. The default setting is **Auto-detect**. This setting tells the Analyzer to discover what speed traffic is running and to label packets accordingly. If you are having problems with your recordings, you might try setting the traffic speed to one of the fixed values -- Low, Full, and Hi speed. These settings are used when you want to manually set the traffic speed.

In some rare cases, auto-detection circuitry causes Full Speed devices to fail to enumerate on plug-in. Changing the Analyzer speed to Full Speed can sometimes solve this problem.

Setting the speed to one of the fixed values is sometimes useful for debugging purposes. For example, if a device that is producing numerous errors at a particular speed, you may wish to set the recording to that speed in order to ensure that the Analyzer does not misread the error packets and label them the wrong speed. While it is unlikely that the Analyzer will mislabel packets in this way, manually setting the recording speed guarantees that the Analyzer always records packets at the correct speed.

You can set the speed for one or both channels.

Notes on Hi Speed Recordings

Erroneous chirp blocks can be recorded on an idle bus when the Device has its FS terminations on while the Host has HS terminations connected. This causes a small differential voltage ("tiny-J") on the USB bus that causes false Chirp detection.

This condition occurs during speed negotiation:

- On a HS bus, the condition is momentary just before the device chirps.
- On a CS bus, the condition occurs both before and after the device chirp (until the end of Reset). The user is discouraged from using **Speed=HIGH** to record signals on a classic speed bus.
- The Analyzer stops recording anything for 2.5 milliseconds following a FS_K state (which is at least 2 microseconds long). This is to avoid presenting "garbage" which is a by-product of the high-speed probe settling down.

Generator/Analyzer Clocking Overrides

Generator/Analyzer Clocking Overrides allows changes to be made to the Analyzer/generator clocking. Select **Slow Clock**, then enter a value in the box on the right. The value that is entered tells the Analyzer how much to divide the base clock by. For example, entering a 4 causes Full Speed traffic to be generated at a 3-megabit rate as opposed to the standard 12-megabit rate.

USB On-The-Go

USB On-The-Go option sets the Analyzer to record the USB On-The-Go traffic. This protocol lets you run two devices, specify one of them as the host, one of them as the device, and to assign each device a name.

USBTrainer Generator-related Parameters

Default to IntelliFrame Mode sets IntelliFrame default to ON.

In IntelliFrame mode, the generator can wait for Device responses to complete before it continues generating more host packets. For example, after issuing an IN, the generator looks for the DATAx packet issued by the device to finish, and then issues an ACK. This way, the data length can vary and does not need to be pre-calculated. Also, using the **idle=TO_EOF** statement allows the generator to calculate where the end of the frame occurs, so that a subsequent **frame=AUTO** statement creates a Start of Frame at the correct time. Moreover, the Generator can be made to retry transactions that are NAKed automatically, and to use the PING protocol where appropriate. Retries can be made to occur within the same frame or in the next frame. For further information on the flexible behavior that can be instituted during the generation, see the syntax descriptions for the generation files. An additional advantage of the IntelliFrame mode is that it creates an image in the Generator's memory that is MUCH smaller than that of the Bitstream mode, so it downloads much faster.

Disable Generator Memory [allow 512 MB traces with a USBTrainer plug-in] allows you to specify 512 MB traces on systems with a USBTrainer plug-in.

Device Emulation Mode [tracing limited to Channel 0 only]: Allows changes to the Resume time and the device address.

Device Resumes: If checked, the Device is responsible for issuing the Resume signal after waiting the specified amount of time following a suspend. If the Device Resumes option is not selected, the device waits indefinitely for the Host to resume signalling.

Delay Time: The time (in milliseconds) to wait after suspend before initiating a Resume.

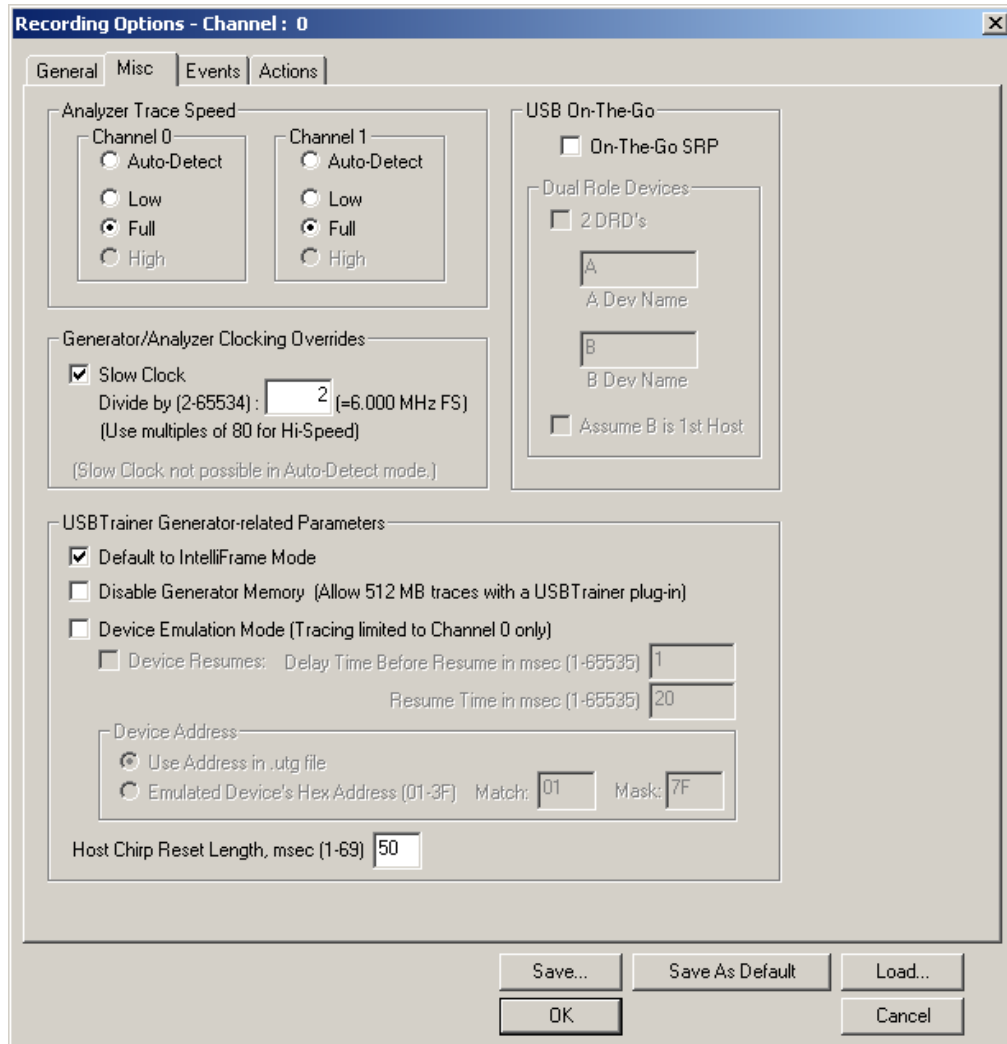
Resume Time: The Resume Time (in milliseconds) is used to configure how long a device should issue a Resume (K) signal once the delay time has occurred. Be careful to make this shorter than what the host does once it recognizes the Resume signal as a Remote Wakeup.

If the **Device Resumes** option is not selected, the device waits indefinitely for the Host to resume signalling.

- **Use Address in .utg file:** Causes the Analyzer to use whatever Device address has been specified in the .utg file.
- **Emulate Device's Hex Address:** Allows the user to specify a different address than the one specified in the .utg file. This option is useful in cases where the host does not use the same address each time.
- **Chirp Reset Length:** Allows the Reset Length for Chirps to be edited. The default is 50 milliseconds. (Host generation only).

11.3 Slow Clock Selection

You can use the slow clock selection to slow down the base clock during generation. This also changes the Analyzer's clock base to match.



Step 1 In the **Misc** tab, make sure you are out of Auto-Detect mode.

Step 2 Select the **Slow Clock** checkbox.

Step 3 In the **Divide By** field, enter a value.

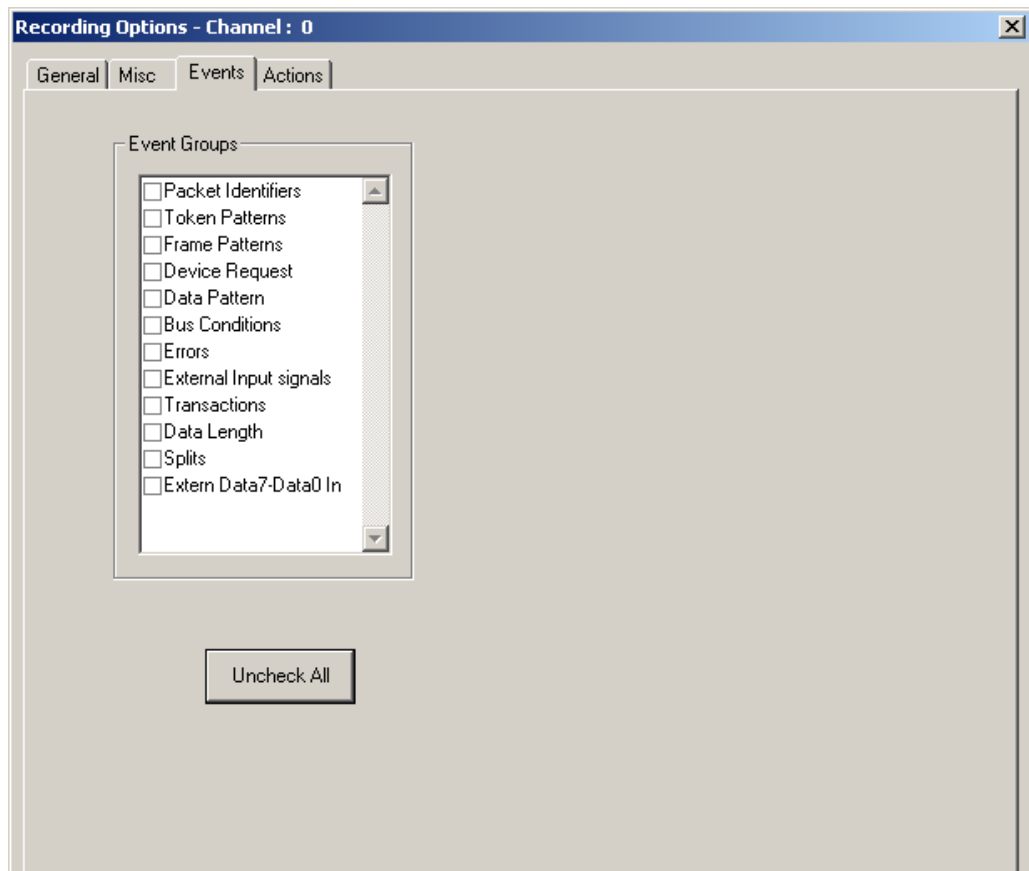
Step 4 Click **OK**.

Using this feature for Hi-Speed requires a License Key from LeCroy. Contact your LeCroy representative.

11.4 Events Recording Options

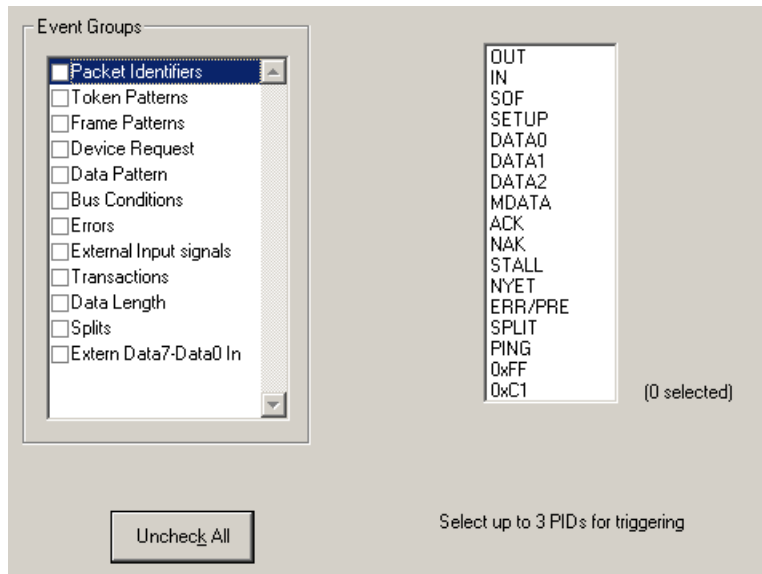
The Event triggering and filtering options allow you to set specific parameters for each Event Group. When an Event Group is selected, a field appears that allows you to select specific conditions within the corresponding Event Group. As details are selected, other Event Group details may become "grayed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



Packet Identifiers

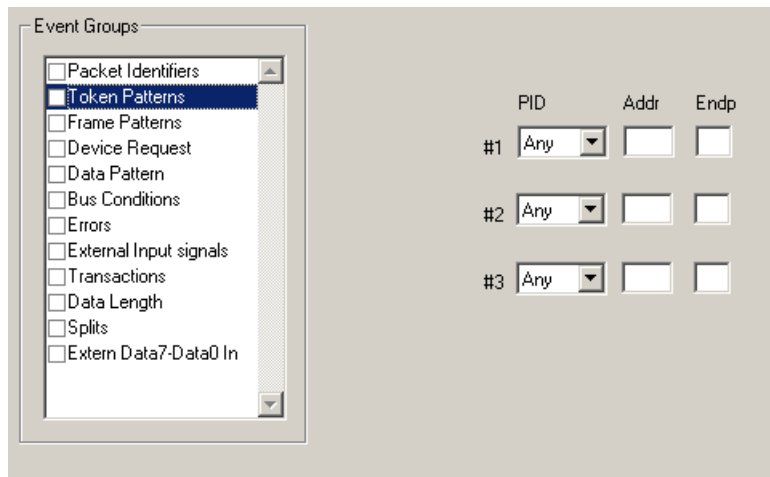
Select **Packet Identifiers** under **Event Groups**. You see the **Packet Identifiers** window:



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

Token Patterns

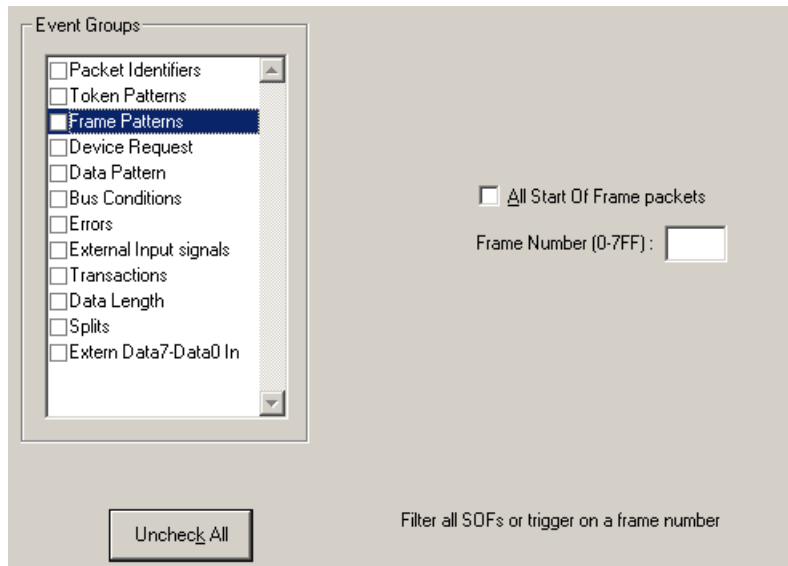
Select **Token Patterns** under **Event Groups**. You see the **Token Patterns** window:



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

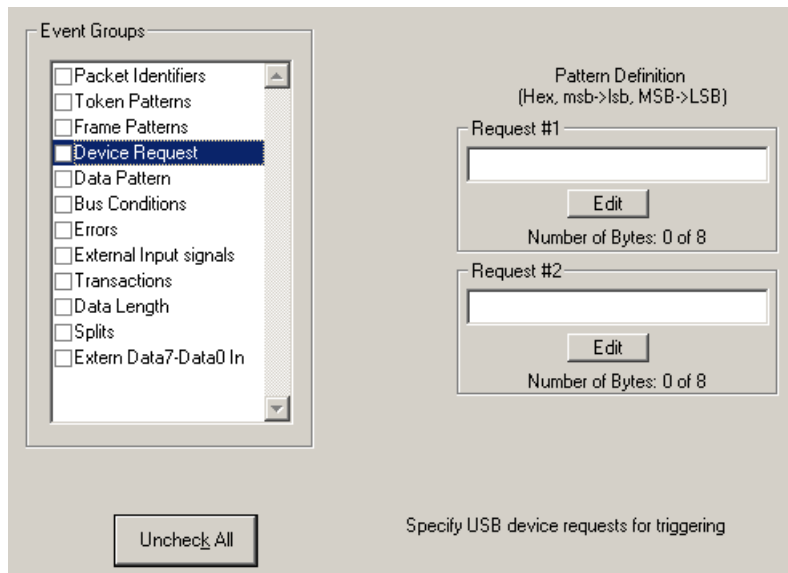
Select **Frame Patterns** under **Event Groups**. You see the **Frame Patterns** window:



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

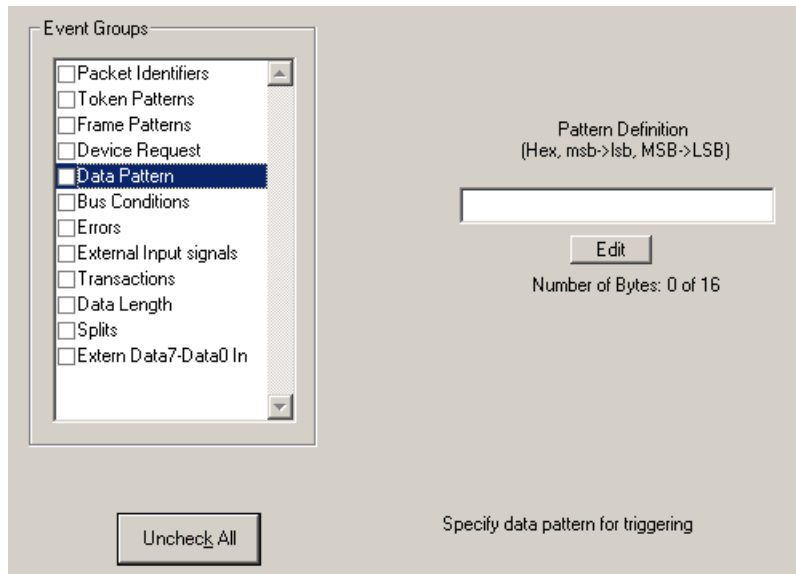
Select **Device Requests** under **Event Groups**. You see the **Device Requests** window:



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

Data Pattern

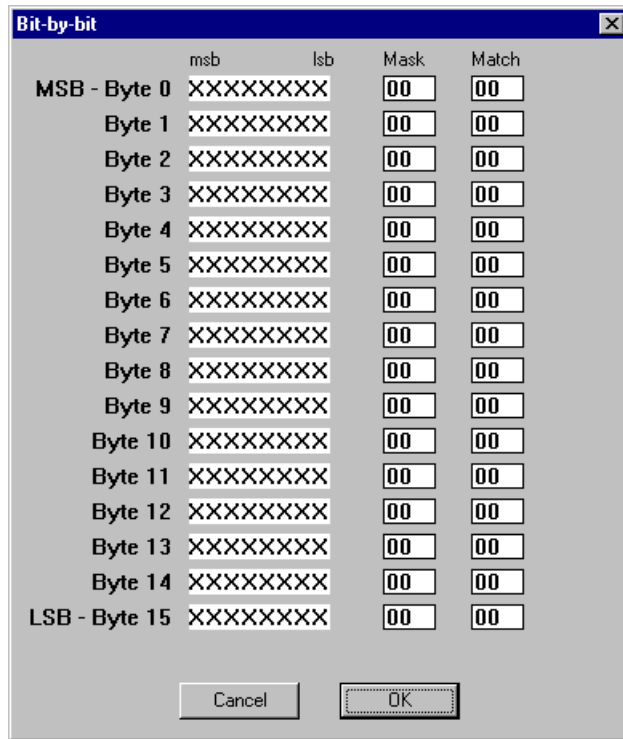
Select **Data Pattern** under **Event Groups**. You see the **Data Pattern** window:



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.

You see a **Bit-by-Bit** window:



The screenshot shows a dialog box titled "Bit-by-bit" with a close button (X) in the top right corner. The dialog contains a table with the following columns: "msb", "lsb", "Mask", and "Match". The rows are labeled from "MSB - Byte 0" to "LSB - Byte 15". Each row has a text field containing "XXXXXXXX" under the "msb" and "lsb" headers, and two small input boxes under the "Mask" and "Match" headers, both containing "00". At the bottom of the dialog are "Cancel" and "OK" buttons.

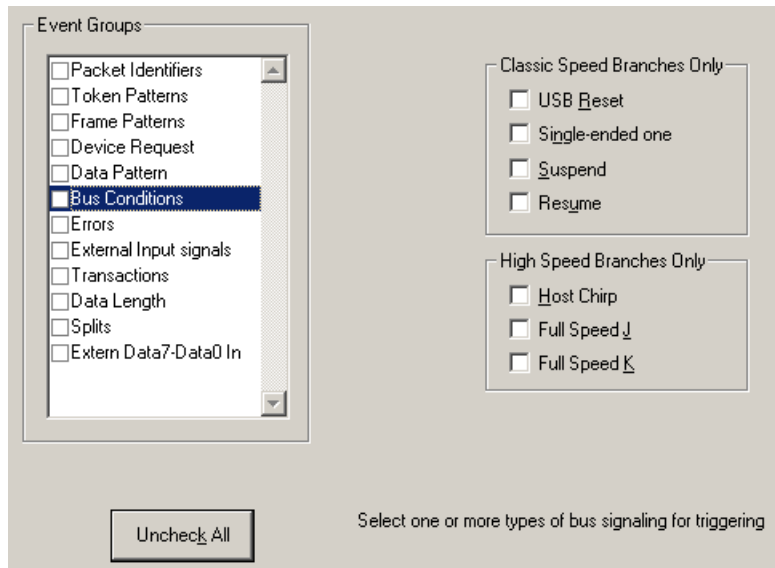
	msb	lsb	Mask	Match
MSB - Byte 0	XXXXXXXX	XXXXXXXX	00	00
Byte 1	XXXXXXXX	XXXXXXXX	00	00
Byte 2	XXXXXXXX	XXXXXXXX	00	00
Byte 3	XXXXXXXX	XXXXXXXX	00	00
Byte 4	XXXXXXXX	XXXXXXXX	00	00
Byte 5	XXXXXXXX	XXXXXXXX	00	00
Byte 6	XXXXXXXX	XXXXXXXX	00	00
Byte 7	XXXXXXXX	XXXXXXXX	00	00
Byte 8	XXXXXXXX	XXXXXXXX	00	00
Byte 9	XXXXXXXX	XXXXXXXX	00	00
Byte 10	XXXXXXXX	XXXXXXXX	00	00
Byte 11	XXXXXXXX	XXXXXXXX	00	00
Byte 12	XXXXXXXX	XXXXXXXX	00	00
Byte 13	XXXXXXXX	XXXXXXXX	00	00
Byte 14	XXXXXXXX	XXXXXXXX	00	00
LSB - Byte 15	XXXXXXXX	XXXXXXXX	00	00

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

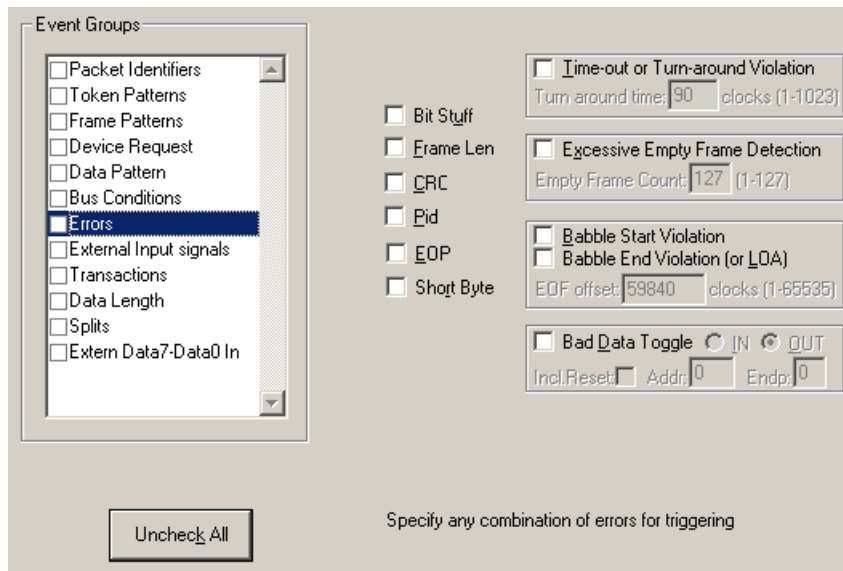
Select **Bus Conditions** under **Event Groups**. You see the **Bus Conditions** window:



Use any combination of the listed errors as a Trigger.

Errors

Select **Errors** under **Event Groups**. You see the **Errors** window:

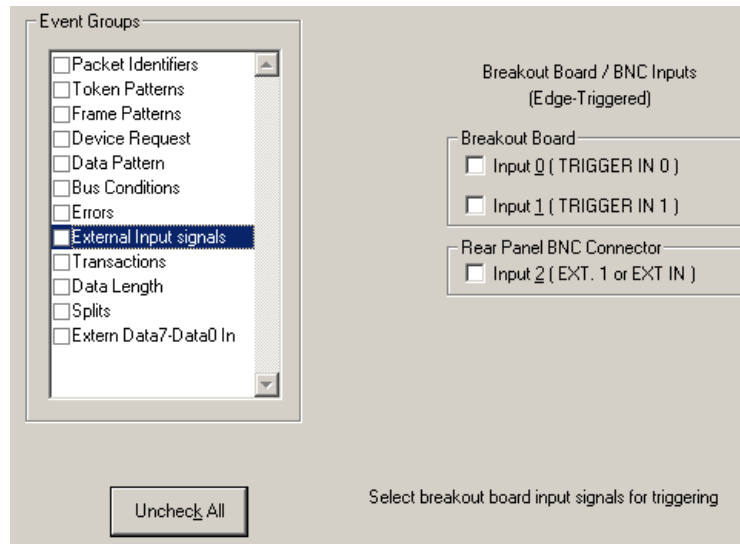


Use any combination of the listed errors as a Trigger.

- **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, the toggle state is assumed to be preserved through the reset.
- Select **Addr** and/or **Endp** to select Token Addresses and/or Endpoints.

External Input Signals

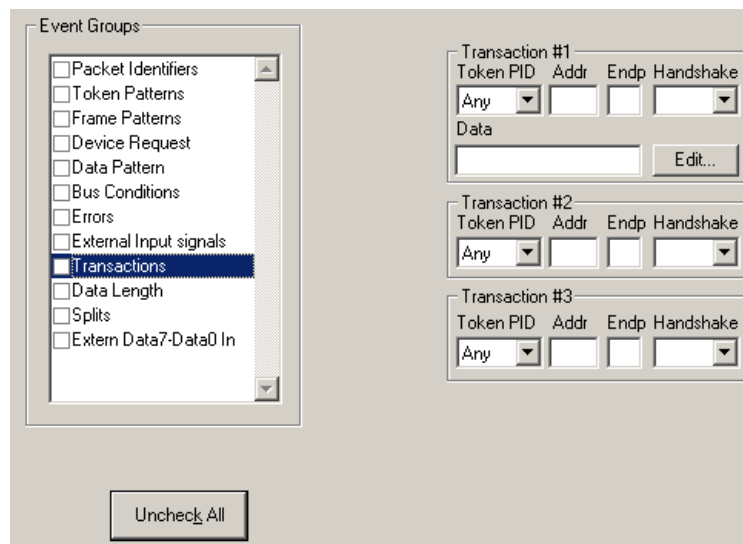
Select **External Input Signals** under **Event Groups**. You see the **External Input Signals** window:



This window has three checkboxes: **Input 0 (TRIG IN 0)**, **Input 1 (TRIGGER IN 1)**, and **Input 2 (Ext. 1 or Ext. IN)**. Use any combination of the inputs as a Trigger.

Transactions

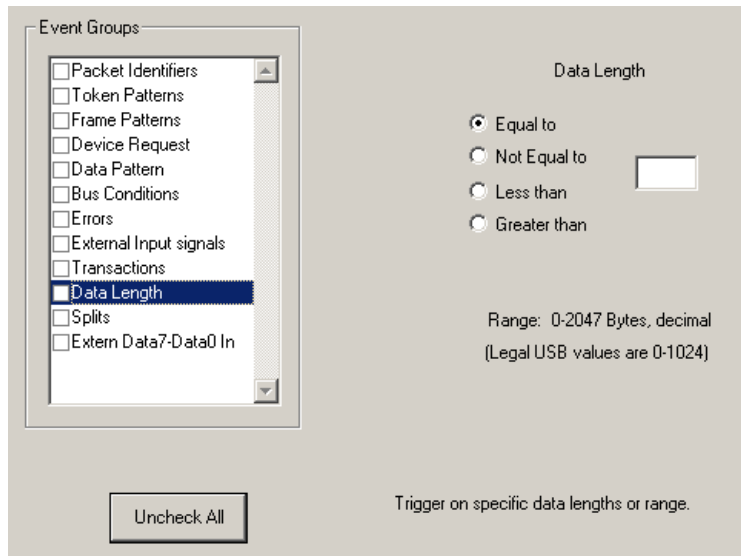
Select **Transactions** under **Event Groups**. You see the **Transactions** window:



Use any combination of the listed errors as a Trigger.

Data Length

Select **Data Length** under **Event Groups**. You see 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**. You see the following window.

The screenshot shows the 'Event Groups' dialog box. On the left, a list of event groups includes 'Splits', which is selected. On the right, there are several configuration sections: 'Split Type' with radio buttons for 'Start', 'Complete', and 'Don't Care' (selected); 'Endpoint Type' with a dropdown menu set to 'Any'; 'Addresses' with 'Hub' and 'Port' text boxes; 'FS Isoch Out' with a dropdown menu set to 'Any'; 'Speed (S)' with radio buttons for 'Full', 'Low', and 'Don't Care' (selected); and 'E' with radio buttons for '0', '1', and 'Don't Care' (selected). At the bottom, there is an 'Uncheck All' button and the text 'Specify USB Split events for triggering/filtering'.

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.

Extern Data7 - Data0 In

Select **Extern Data7 - Data0 In** under **Event Groups**.

The screenshot shows the 'Event Groups' dialog box. On the left, a list of event groups includes 'Extern Data7 - Data0 In', which is selected. On the right, there are configuration sections: 'Breakout Board Data7-Data0 (Edge-Triggered)' with 'Match' and 'Mask' text boxes, both labeled '(Hex)'. At the bottom, there is an 'Uncheck All' button and the text 'Trigger on Breakout Board Data7 - Data0 Inputs'.

To trigger on Extern Data 7 - Data0 In, enter values in the Match and Mask fields.

11.5 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.

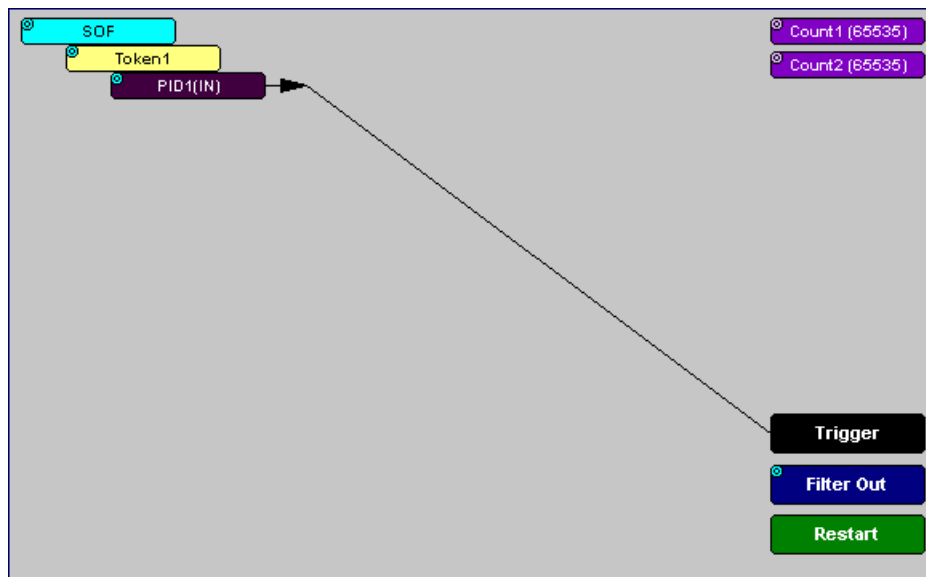
Actions Window Layout

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



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

11.6 Connecting Events to Actions

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

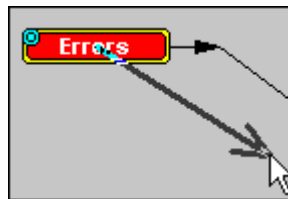
To make an association:

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

Step 2 Open the Actions window.

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

The elastic arrow appears.



Step 4 Point your mouse at the desired Action button.

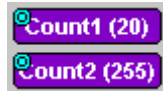
The elastic arrow moves with your mouse pointer.

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

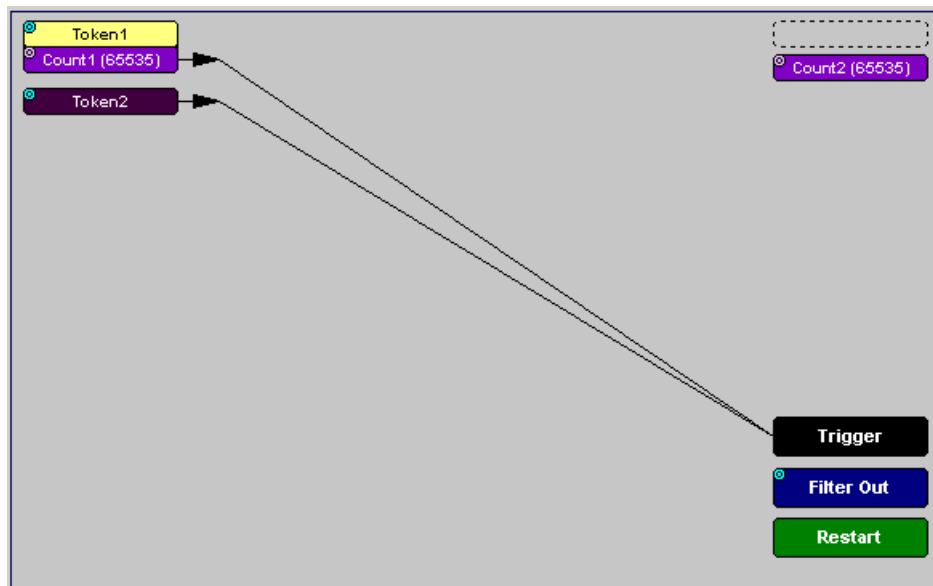
The arrow is anchored to the Action button. replaced with a black line connecting the Event button to the Action button.

11.7 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.

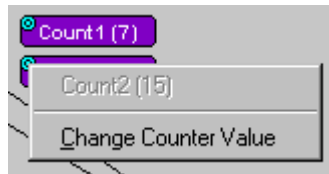
Step 3 Click the Event button.

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.

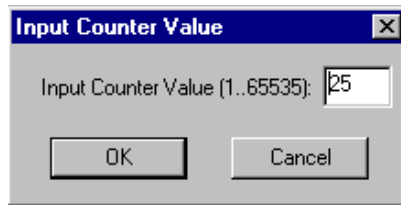
Step 5 Click the blue dot in top left corner of your selected counter.



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

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

Step 7 Set the counter to a value of your choice, then click OK.



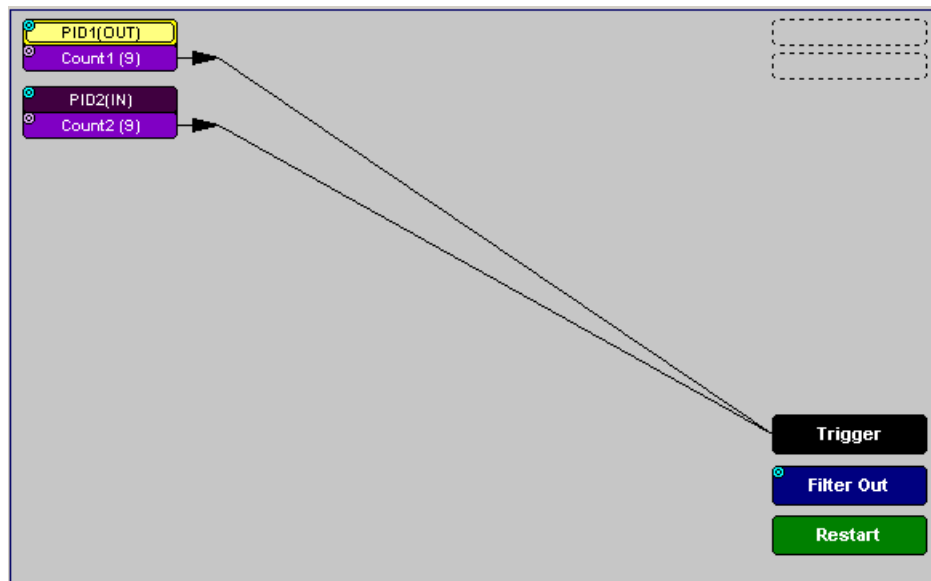
The Input Counter Value dialog box closes, and the Counter button displays your selection.

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 9 Out packets or Count2 has counted 9 In packets."



11.8 Using Action Buttons

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



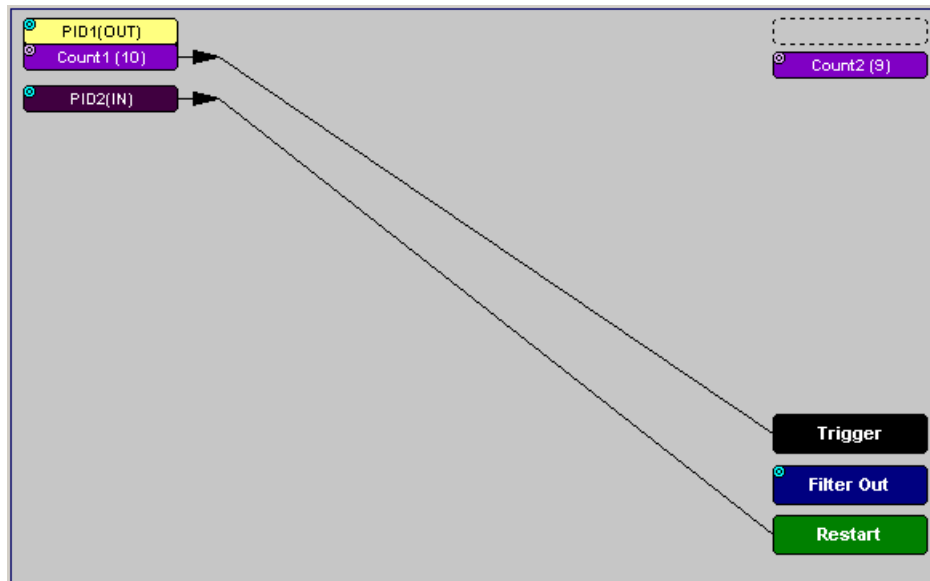
Trigger

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:

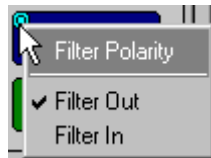
- **Filter In** records ONLY those packets related to the specified event.
- **Filter Out** records all packets EXCEPT those related to the specified event.

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:



Use this menu to toggle the selection between **Filter Out** and **Filter In**.

Step 2 Select **Filter In**.


The button changes to read Filter In.

11.9 Other Actions: External Output Signals

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

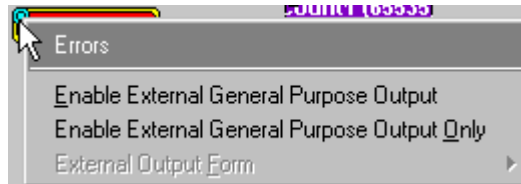
If a blue dot is present in the Event button, it means that a menu is present with three options for configuring external output signalling:

- Enable External Trigger Output
- Enable External Trigger Output only
- External Trigger Form

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

To enable or disable external trigger output:

Step 1 Click the blue dot on an Event button.



A menu similar to this one opens. Your menu may say Disable instead of Enable.

Step 2 Select **Enable External Trigger Output** (or **Disable External Trigger Output** if that is the choice presented.)

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



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

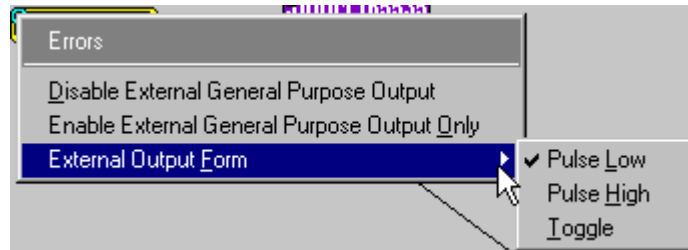
Enabling High Pulse, Low Pulse or Pulse Toggle Signal Outputs

If you chose External Trigger Output in the previous steps, then an additional choice appears in the Blue Dot Menu called **Enable External Trigger**. This option lets you control the output signal.

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

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

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



Step 3 Choose an option not currently selected.

The menu closes.

Step 4 Reopen the menu.

Note that your new selection is now checked.

11.10 Saving Recording Options

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


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

11.11 Recording Bus Data


To start recording USB traffic once the appropriate Recording Options have been set perform the following steps. Note: If you have inserted any event triggers, be sure to select *Event Trigger* under the General tab in the Recording Options dialog box.

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.

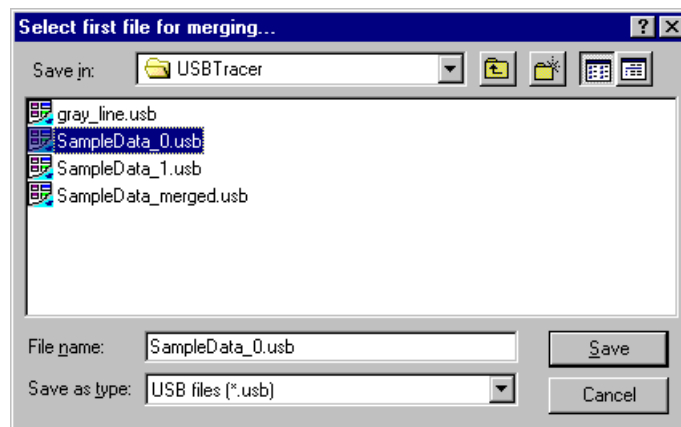
11.12 Merging Trace Files

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

Note: USBTracer is capable of merging High Speed and Classic Speeds traffic into a single merged file if the **Auto-Merge 2 Channel Trace Files** option is checked in the Recording Options dialog box. See page 111 for details.

To merge two trace files:

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

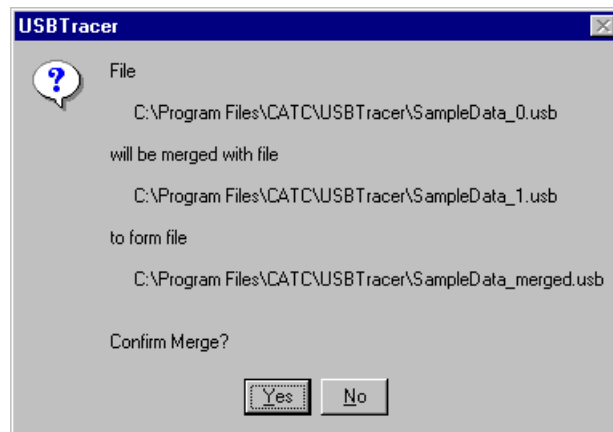


Note: The **Merge Trace Files** command can be run with or without a trace file open on the screen. The merge process ignores the open file.

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

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

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



- Step 4** Click **Yes**.

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

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



Chapter 12: Traffic Generation with USBTrainer

USBTrainer™ is a USB Traffic Generator module that plugs into the right slot of the Universal Protocol Analyzer System (UPAS).



USBTrainer is designed to generate USB traffic so that engineers can test designs under realistic conditions. Traffic Generation can also be used to transmit known bad packets, providing an opportunity for engineers to observe how a device handles specific adverse conditions.

USBTrainer Traffic Generation Files

USBTrainer generates USB traffic from traffic generation files (*.utg) which are text-based script files that instruct the Generator how to generate USB traffic. These script files can be edited with either a simple text editor such as Notepad or with the Script Editor utility provided by the USBTracer™ application. The Script Editor utility has several aids to simplify the process of writing and editing scripts: tool-tips, drop-down menus, and colored fields.

The script example below shows the beginning of a traffic generation file created through the **Export** command. This command provides an easy way to create a generation file - you open a trace file, then run the **Export** command. The trace serves as a blueprint for the traffic generation file.

The example below shows several commented lines followed by some instructions.

```
; File C:\Documents and Settings\Administrator\Desktop\enumeration\High_Hub_Sample.usb.
; Packets 0 to 24328.

; Device Side Packets were filter out during Export
; NAK'ed transactions were filtered out during Export
; Saved from Channel 0.

file_type=UPAS
file_version=2
file_speed=HIGH

chirp=here ; This needs to be added by hand, since the Export function does not export it.

frame=auto idle=T0_EOF
frame=auto idle=T0_EOF
frame=auto idle=T0_EOF
frame=auto idle=T0_EOF
frame=auto idle=T0_EOF
frame=auto idle=T0_EOF
frame=auto idle=T0_EOF
frame=auto idle=T0_EOF
```

This generation file causes USBTrainer to simulate a hub and to generate 24,320 packets. See Section 12.3, “Device Emulation” on page 151 for details about the format of traffic generation files.

Creating Traffic Generation Files

If you choose to write a script with a text editor, a good way to start is to edit the sample generation file that is provided: **HS_Hub_Sample.utg**. This file is located in the same directory as the *USBTracer* application (for example, **C:\Program Files\LeCroy\USBTrainer**). You can open this generation file with Notepad or other editor and then add or remove text as needed.

Creating a Traffic Generation File with the Export Command

The Export command on *USBTracer* offers an easy alternative method of creating a generator file. This command converts the trace to a *.**utg** file, removes all device traffic, and leaves only the traffic from the host device. You can then use this file to emulate the host and determine whether the device under test is generating the correct traffic.

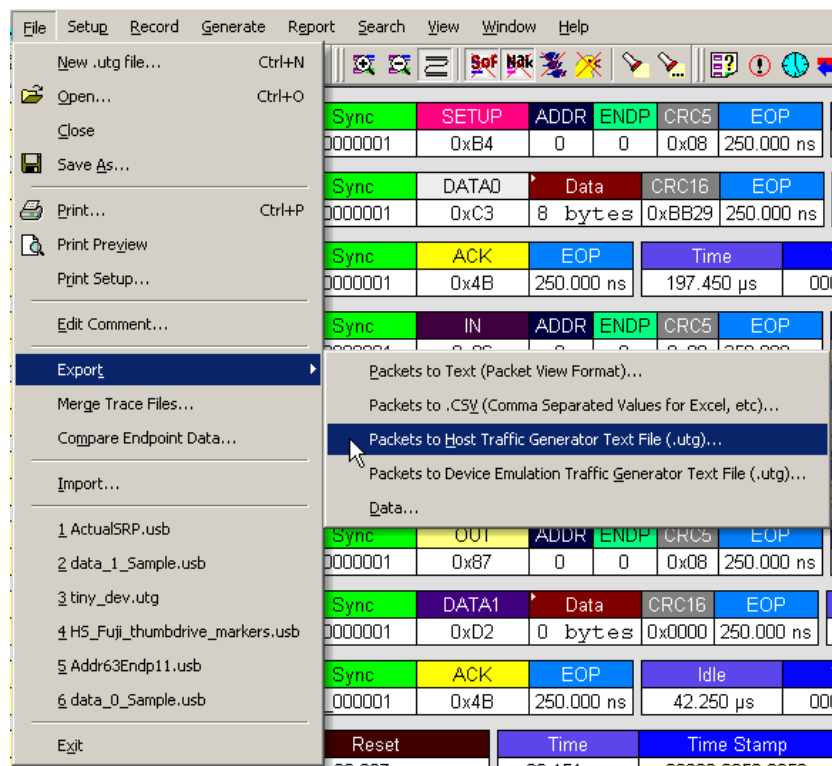
When creating a **.utg** file through the Export Packets to Text (Generator Text File Format) menu selection, it is suggested that you use the default values presented. Adding NAK transactions clutters the **.utg** file, and including the device side packets creates a **.utg** file which does not work with a real device attached.

To use the **Export** command:

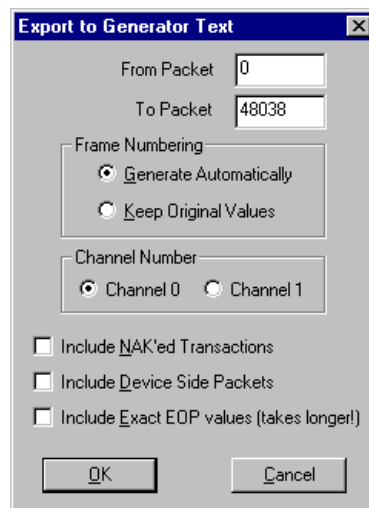
Step 1 Start *USBTracer*.

Step 2 Open a trace that has the pattern of traffic you would like to generate.

Step 3 Select **File > Export** from the menu bar to display the File Export menu:



Step 4 Select **Packets to Text (Generator Text File Format)** from the **Export** drop-down menu. You see the **Export to Generator Text** window:



Step 5 Enter the numbers of the first and last packets in the series.

Note: The device packets are removed from the exported generator text. This is essential in creating a generator text file that can be used to handshake with your device.

Step 6 You can opt to regenerate the frame numbers and remove the NAKed transactions.

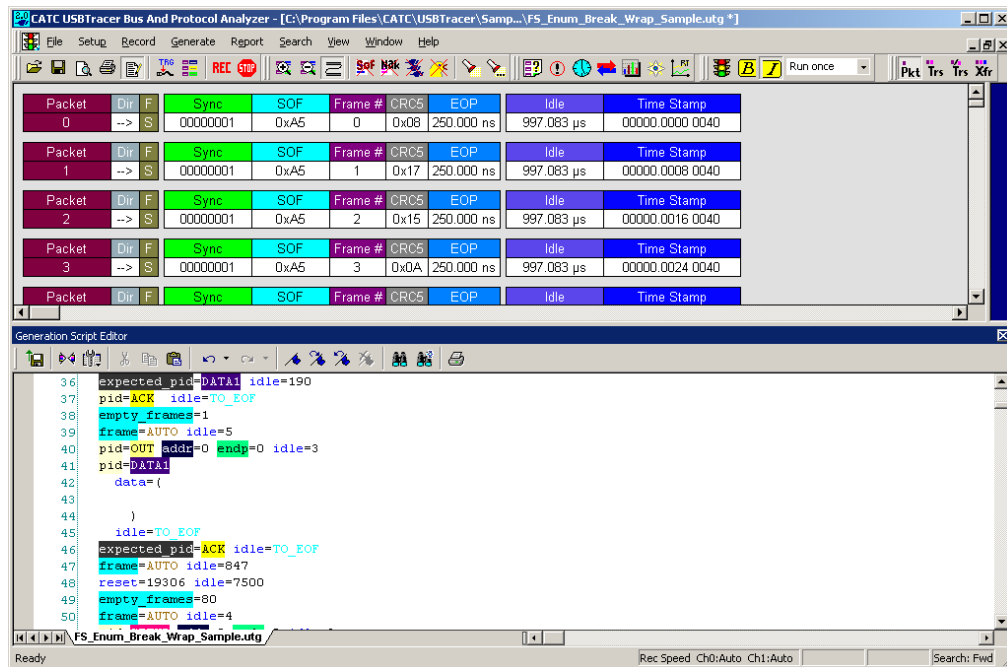
Once the generator text file is exported, you may need to edit the file and adjust idle time to properly anticipate the responses from your device.

12.1 Editing a Generation File

A **.utg** file is a text file that can be edited with any text editor such as Notepad. A better editing option, however, is Script Editor, an utility that is built into the USBTracer™ application. Script Editor provides the usual editing functions such as select, cut, copy, and paste but also adds tool-tips, colored keywords, drop-down parameter values, and expandable/collapsible packet data fields.

To launch the Script Editor, click the **Script Editor**  button on the toolbar or right-click the trace window and choose **Edit as Text**.

The Script Editor window opens in the lower portion of the trace window.

















The Script Editor divides into three areas: the toolbar, the script window, and the file tabs at the bottom of the window. If errors occur, a log opens at the bottom of the window.

Toolbar

The Script Editor toolbar contains buttons for saving your edits, navigating, searching and other functions.

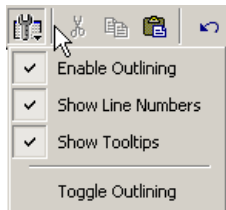


The buttons have the following functions:

	Save. Saves your edits and immediately updates the setting bars and Frames shown in the trace window.		Add/Remove bookmark. Allows markers to be set or removed to aid in navigation.
	View Options. Opens a menu with three options: Enable Outlining, Toggle Outlining, and Line Numbers. See View Options Menu below.		Go to next bookmark.
	Cut.		Go to previous bookmark.
	Copy.		Clear all bookmarks.
	Paste.		Find.
	Undo.		Find and Replace.
	Redo.		Print.

View Options Menu

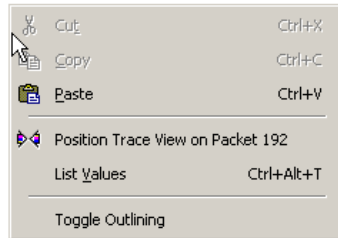
The View Options button has a menu with three options:



- **Enable Outlining:** Adds an expandable/collapsible tree structure to the left side of the Script Editor showing the hierarchical relationships of the script lines.
- **Show Line Numbers:** Adds line numbers to the left side of the Script Editor window.
- **Show Tooltips:** Enables tooltips to appear when the mouse pointer is suspended over a script item.

Pop-up Menu

Right click anywhere in the script window to open a pop-up menu with the following options:



- Cut
- Copy
- Paste
- Position Trace View on Packet xxx
- List Values
- Toggle Outlining

The List Values option displays the types of values that can be entered for a parameter in a line. To see the types of values, select the current parameter, then choose **Show Values** from the pop-up menu.

File Tabs

At the bottom of the window is a tab that shows the name of the **.utg** file. If your **.utg** file has an Include statement in it, the supporting Include files automatically open when the **.utg** file is first opened. Tabs for the opened Include files appear at the bottom of this window.



Error Log

Whenever you create a scripting error, a log opens at the bottom of the application window. When the error is corrected, the window automatically closes.

Tooltips

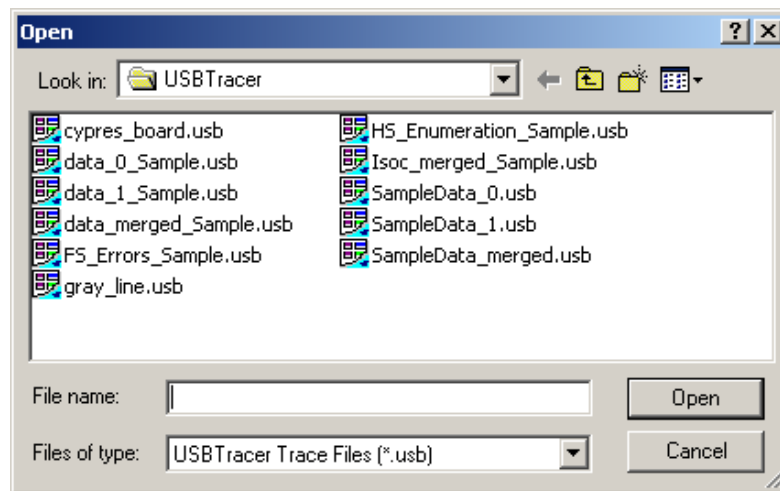
The Script Editor window includes extensive tooltips for each keyword. To see a tooltip, hold the mouse pointer over a keyword.

12.2 Loading the Generation File

The USB Traffic Generation files are scripts that instruct the Analyzer how to generate USB traffic. A traffic generation file contains text in special format and is named with a *.utg extension. These files can be created by any text editor, or using the **File > Export > Packets to Text (Generator File Format)** menu selection when viewing a Trace File. There are several examples of Traffic Generation files included with the installation of the USBTracer software.

To load a generation file:

Step 1 Select **File > Open ...** from the menu to display the Open dialog box:

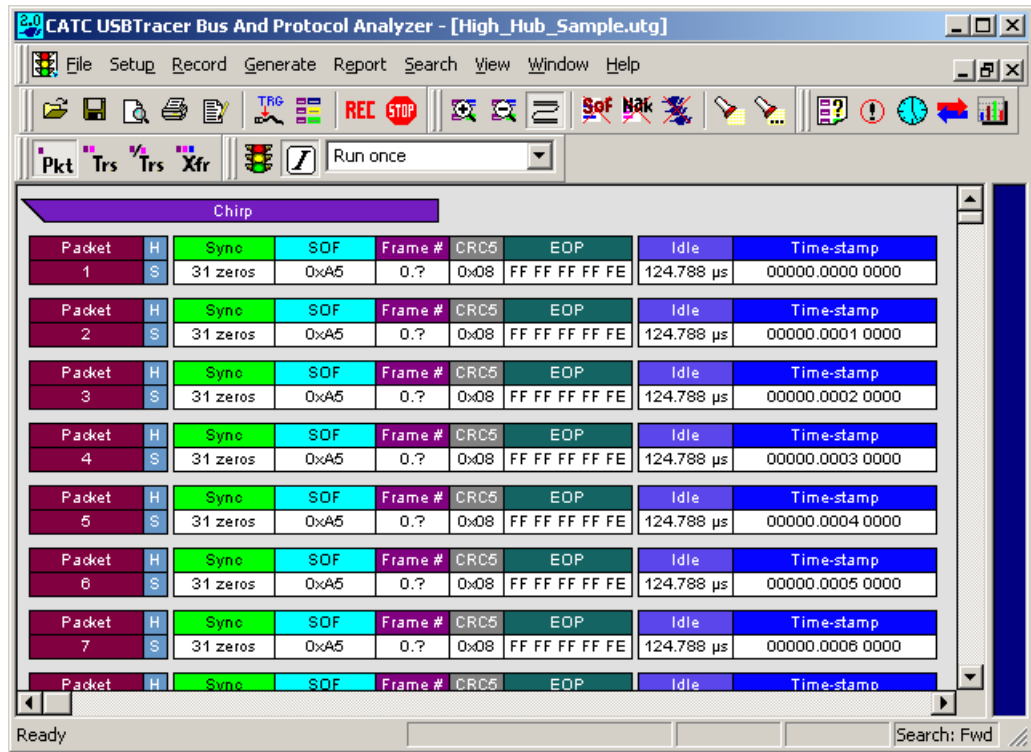


Step 2 Select **USB Tracer Generation Files (*.utg)** from the drop-down menu marked **Files of Type** to display a list of Traffic Generation files.

Step 3 Select a Traffic Generation file (*.utg).

Step 4 Click **Open**.

The file opens.



Step 5 Decide how many times you want the traffic pattern to be generated, then select a value from the **Repeat** drop-down menu.



The **Repeat mode** allows for a single pass through the generation file, looping forever, or looping 1 to 65,534 times, as desired by the user. If a **wrap=HERE** location is found in the **.utg** file, that location is where the looping portion begins. The loop end is at the end of the **.utg** file or up to the **stop=HERE** statement in the file.

Step 6 Select the **Generation mode** in which to generate traffic (see below for an explanation) by depressing or undepressing the

IntelliFrame button  on the toolbar:

- Depressed = IntelliFrame
- Undepressed = Bitstream


Traffic Generation Modes: Bitstream vs. IntelliFrame

IntelliFrame and **Bitstream** are modes that control how the generator interacts with other devices when it is generating traffic.

- **Bitstream Mode** -In Bitstream Mode, the generator constructs a bitstream of traffic based on the UTG file and assumes that packets start at pre-calculated times. For example, after an IN packet, the generator waits a calculated fixed time before presenting an ACK. The time between them is determined by the **idle=** time statement in between the IN and ACK packets in the **.utg** file. In this mode, every bit time of a generation stream (including idles and SE0's) is represented by 4 bits of data, so the file to be downloaded to the Generator can be very large.
- **IntelliFrame Mode** - In IntelliFrame mode, the generator can wait for Device responses to complete before it continues generating more host packets. For example, after issuing an IN, the generator looks for the DATAx packet issued by the device to finish, and then issues an ACK. This way, the data length can vary and does not need to be pre-calculated. Also, using the **idle=TO_EOF** statement allows the generator to calculate where the end of the frame occurs, so that a subsequent **frame=AUTO** statement creates a Start of Frame at the correct time. Moreover, the Generator can be made to retry transactions that are NAKed automatically, and to use the PING protocol where appropriate. Retries can be made to occur within the same frame or in the next frame. For further information on the flexible behavior that can be instituted during the generation, see the syntax descriptions for the generation files here. An additional advantage of the IntelliFrame mode is that it creates an image in the Generator's memory that is MUCH smaller than that of the Bitstream mode, so it downloads much faster.

Note: Device emulation only works in IntelliFrame mode.

Starting Traffic Generation

To start traffic generation, click  on the Tool Bar.

Repeating a Generation Session

If you wish to repeat a generation session, press the

Traffic Generation Start/Stop  button again. There is no need to reload the **.utg** file.

You can make an additional entry in a Generator Text File that allows you to specify a portion of the file for repetition:


- Enter **wrap=here** in the Generator Text File.

The traffic above the entry is run only once. The traffic below the entry is repeated continuously.

Note: For a usage example, see the sample file **Wrap.utg**.

Stop Traffic Generation

To instruct the Analyzer to halt traffic generation:

- Click  on the Tool Bar.

12.3 Device Emulation

Device Emulation is a licensed option that allows *USBTrainer* to generate device-side traffic. Like host traffic generation, device emulation uses text-based generation files (**.utg**) to generate traffic.

Device emulation has three steps: create a generation file, configure generation settings, and then generate traffic.

Creating a Generation File

Generation files can be created one of two ways:

- Write a generation script file using either LeCroy's context-sensitive script editor or any text editor that you choose.
OR
- Use a pre-recorded trace file that has the type of traffic that you want to generate. This file is a blueprint for the traffic generation script file.

If you decide to use a pre-recorded trace file as a generation blueprint, then verify that the trace file contains traffic for only one device. If it does not, hide all the other devices (**Setup > Level Hiding**) and save the file as a new file without the hidden traffic (**File > Save As** and check the option **Do not save hidden packets/transactions/transfers**).

Setting Generation Options

Step 1 Set the Traffic Generation options by configuring the **Misc** page in the Recording Options dialog box:

Setup > Recording Options > Misc

Step 2 In the Misc page, select **Device Emulation Mode**.

Step 3 Configure Resume settings.

- If you want the simulated device to issue Resumes, then select **Device Resumes** and enter a delay time (in milliseconds). If you do not select Device Resumes, then the emulated device waits for a Host to issue a Resume.
- If you want the simulated device to take its address from the Traffic Generation (.utg) script file, then select **Use Address in .utg file**. This option causes the *USBTrainer* to read the **.utg** file and assign a Device Address based on the device traffic that it sees in the file.


Note: In this release, the Device Emulator does not look at the Set Address in the script, so if your host controller is running more than one device, it may enumerate your device emulator incorrectly when you begin to generate traffic. The solution is to manually assign a device address. To manually configure the Device Address, select Emulated Device's Hex Address and enter an address or mask (Note: A mask allows the *USBTrainer* to respond to multiple device addresses.)

Step 4 Click **OK** to close the Recording Options dialog and apply the changes. The generation settings take effect as soon as you execute a script.

Run the Traffic Generation Script File

Step 1 Connect the USB *Trainer's* port B (either Hi Speed or Classic Speed) to the Host.

Step 2 Open the Traffic Generation .utg file.

Step 3 Begin traffic generation by clicking  .

When execution begins, USB *Trainer* reads the entire generation file and then parses the generation commands into groups according to their endpoints. Each of the parsed groups of commands are then written into dedicated memory segments in the generator. Up to eight memory segments can be created for the various endpoints. In the case of Endpoint 0 or any Control endpoints, a single memory segment is created.

Each memory segment can be thought of as a queue of the commands and responses for a particular endpoint that occur in the generation file.

Commands are stored sequentially within each memory segment as they occur in the generation file. For example, if a generation file has a sequence of command X and Y for the Endpoint 1, the commands are extracted in this order and placed in the Endpoint 1 memory segment.

When the host calls for a particular device endpoint response, the first command listed in that endpoint memory segment is then executed. With each subsequent call to the same endpoint, commands are executed sequentially down the list as they occur in the memory segments. For example, if three calls were made to Endpoint 0 IN, then the first three commands in that endpoint's memory segment would then execute.

Note: Each of the endpoint memory segments execute independently: there are no behavioral interactions between the individual endpoints.

12.4 Format of the Traffic Generation Files

Whether you create a traffic generation from scratch or use the **Export** command in *USBTracer*, there are a few rules about the format of the generation file that you should review. These are presented in this section.

Traffic is generated from a text file named ***.utg**. Within the text file:

- The data format for data fields such as Pids and Raw bits is hex.
- Each packet definition consists of this set of assignments: **key=value**.
- White space is permitted around the equal sign.
- There are no restrictions on dividing packet definition to lines nor is it necessary to define each packet in a separate line, although it is recommended.
- The maximum number of characters in a line is 250.
- The characters **#** and **;** indicate end-of-line comments (i.e. the rest of the line is ignored)
- Comments are not allowed within brackets (**()**).
- No keys or values are case-sensitive.

Each packet definition starts with one of these assignments:

- **pid=N** (where N is a string representing a valid packet identifier or an eight bit value)
OR
- **frame=N** (where N is an eleven bit value of the frame number or the strings **auto** and **keep_alive**).

A bus condition definition starts with one of these assignments:

- **reset=N** (where N is a positive integer or string)
- **suspend=N** (where N is a positive integer)
- **resume=N** (where N is a positive integer)
- **chirp=here**

Subsequent assignments after a packet's starting assignment define the values of particular fields within the packet. If a field is not defined, it is assumed to be **0**. Values are assumed to be decimal unless they are prefixed with **0x** and then are interpreted as hexadecimal. Values within a data block assignment are always assumed to be hexadecimal and should not be prefixed by **0x**.

Table 1: Support Keys for Defining Fields within a Packet

Key Code	Format	Description
File Control Keys		
file_type	UPAS CHIEF	This must be included at the beginning of the file to determine the speed of packets to be generated. Value must be file_type=UPAS to allow for High speed traffic, IntelliFrame operation, expected_pid and device_pid key support. Full and Low speed traffic, and Bitstream operation are supported on all file_type= values. If this statement does not appear in the file, the default is file_type=CHIEF , allowing backward compatibility with older USB Chief™ .usb files.
file_version	integer	This must be included after the file_type= key to determine the version of this file. Value is currently 3. Usage: file_version=3
file_mode	HOST DEVICE	Sets generation mode to host or device. For generation to work, this must match the selection found in the Recording Options > Misc dialog.
file_speed	HIGH HI FULL LOW	This must be included after the file_version= key to determine the speed of packets to be generated. Values are HIGH, HI, FULL, or LOW. Example: file_speed=FULL . Only one file_speed= is allowed per .utg file, but low speed traffic on a full speed bus can be created by adding the speed=LOW key to a low speed packet in a file defined as file_speed=FULL . No other mixing of speeds is allowed. HI is the same as HIGH and was added to conform to the USB terms.
loop_count wrap_count	0 through 16382 or "infinite"	These two terms are interchangeable. Device Emulation Only. This key defines the loop count for each memory segment. Examples: loop_count=INFINITE or wrap_count=9
wrap loop	HERE	This key marks the wrap point in the traffic. When generation is in Repeat mode, all the traffic before the wrap point is going to be sent once. All the traffic after the wrap point is going to be repeated in a loop. The usage of the keyword is wrap=HERE or loop=HERE . For Device Emulation, the value would be a memory segment number, so that the looping is associated with only that one endpoint, such as wrap=4 .

Key Code	Format	Description
skip	HERE	<p>Causes a region in the .utg file to be ignored, as if commented out.</p> <p>Can be used multiple times in the file.</p> <p>Must be used in conjunction with skip_end=HERE.</p> <p>Example:</p> <p>skip=HERE frame=auto makes this statement be ignored!</p> <p>skip_end=HERE</p>
skip_end	HERE	<p>Causes a region in the .utg file to be ignored, as if commented out.</p> <p>See above in skip=HERE.</p>
stop	string	<p>If you want to run only some first portion of the beginning of a .utg file, insert this statement where you want generation to halt. This saves having to edit a file into smaller files when testing a portion of traffic.</p> <p>The usage of the keyword is stop=HERE.</p>
break	HERE	<p>Host Generation Only.</p> <p>Enables you to generate up to a point in the .utg file, then wait for input before continuing in the file. During the breakpoint time, the traffic signal icon in the toolbar flashes yellow, indicating that a breakpoint was hit.</p> <p>When you click the traffic light icon, generation resumes.</p> <p>If you want to stop rather than continue, select Stop from the Generation menu or hit the Start/Stop button on the front of the generator module.</p> <p>Start-of-frames are issued automatically during the breakpoint duration. When you resume running, traffic begins after another start-of-frame is issued.</p> <p>The break=HERE statement must be inserted between frame=xxx statements.</p> <p>Syntax example:</p> <p>frame=AUTO break=HERE frame=AUTO</p>

Key Code	Format	Description
Endpoint Configuration		
begin_config	HERE	<p>Defines the beginning of the region in the file used to configure the endpoint types.</p> <p>The configuration is necessary to determine the default behavior of the NAK retry mechanism during IntelliFrame operation.</p> <p>Between the begin_config=HERE and the end_config=HERE statements is a series of config_endpoint=xxx statements, which define each endpoint's type and default retry behavior.</p> <p>The config region must precede any actual packet or bus condition statements.</p> <p>For Device Emulation, the config region is mandatory. It provides the mapping of the endpoints into their corresponding segments of Analyzer memory, which contain the traffic for those endpoints.</p> <p>When exporting to a .utg file from a trace file, these sections are created automatically.</p> <p>Syntax example: begin_config=HERE</p>
end_config	HERE	<p>Terminates the region in the file used for configuring the endpoints.</p> <p>See begin_config.</p> <p>Syntax example: end_config=HERE</p>
config_endpoint	CONTROL INTERRUPT ISOCHRONOUS BULK	<p>Begins a statement that defines a particular endpoint's type, default retry behavior (Host Generation only), and memory segment (Device Emulation only).</p> <p>Usage example: config_endpoint=BULK addr=1 endp=3 direction=OUT retry=TRUE retry_next_frame=FALSE</p>
endp_mem_seg	1 2 3 4 5 6 7 8	<p>Device Emulation Only.</p> <p>Separates each endpoint function into a different queue (also referred to as a Memory Segment) of commands and responses.</p> <p>There are a maximum of eight of these queues, and each has a unique address/direction combination.</p> <p>For control endpoints, one queue is shared by both directions of the endpoint.</p> <p>Traffic on the Default Endpoint (Address 0, Endpoint 0) shares the same queue as the endpoint 0 of the selected device address (the address it gets from the Host through the SetAddress request).</p> <p>These always use endp_mem_seg=1.</p> <p>These are all set automatically when exporting a trace file to a Device Emulation .utg file.</p>

Key Code	Format	Description
direction	IN OUT	<p>Defines the transfer direction of data for the specified endpoint.</p> <p>For all transfer types but CONTROL, there can be two distinct logical connections using the same address and endpoint. They would differ only in defined direction.</p> <p>Syntax example: direction=IN</p>
retry	TRUE FALSE	<p>Host Generation Only.</p> <p>Defines whether an automatic retry should be performed on packets to/from this endpoint in the case that they are NAKed (or in some cases NYETed), or if a timeout on device response occurs. RETRY only works for the Pids: Setup, In, and Out. If TRUE, the Trainer automatically retries the specified sequence if a Pid is received on the bus which does not match the expected_pid, or if a timeout occurs.</p> <p>The generator re-issues the host packet(s) after waiting either 1/10th of a frame, or until after the next start-of-frame (depending on the value set for retry_next_frame).</p> <p>The retries continue until the expected_pid is received.</p> <p>When a retry attempt finds its expected_pid, the Trainer automatically generates a new start-of-frame before continuing with the rest of the Gen File. (The start-of-frame is either an SOF packet or a keep-alive signal.)</p> <p>If FALSE, the Trainer waits for a Pid before proceeding. There is no timeout.</p> <p>If a Pid is received which does not match the expected_pid, the Trainer continues to wait for the correct Pid to appear.</p> <p>If the user stops the generation, a message states that the generator was waiting patiently for the expected_pid, and it never showed up. The user must examine the problem by viewing the trace file.</p> <p>This statement can also be used in conjunction with any pid=xxx statement in the .utg file. This can be done to override the configured or default retry behavior.</p> <p>Syntax example: retry=TRUE</p>

Key Code	Format	Description
retry_next_frame	TRUE FALSE	<p>Host Generation Only.</p> <p>Determines when a retry will be attempted after a failed match of an expected_pid.</p> <p>This statement only applies if a retry=TRUE statement also exists.</p> <p>If TRUE, the Trainer waits until the current frame completes, issues a start of frame, and then retries the transaction.</p> <p>If FALSE, the Trainer waits 1/10th of a frame before retrying the transaction.</p> <p>Before each retry attempt, the Trainer checks to see where in the frame interval it is. If it is too close to the EOF, it automatically generates the next start-of-frame before performing the retry. If it is not too close to the EOF, it performs the retry without generating a new frame.</p> <p>This statement can also be used in conjunction with any pid=xxx statement in the .utg file. This can be done to override the configured or default retry behavior.</p> <p>Syntax example: retry_next_frame=FALSE</p>
ping_on_retry	TRUE FALSE	<p>Host Generation Only.</p> <p>Determines whether an OUT transaction is retried by repeating the OUT-DATAx sequence, or whether a PING sequence should be initiated.</p> <p>If TRUE, the Trainer automatically generates PINGs (and retries) before going through a Retry Loop. PINGs are repeated until an ACK is received, and then the original OUT-DATAx transaction Sequence is attempted. During the PING retries, the Trainer automatically generates frames. When the original Retry Sequence receives its expected_pid, the Trainer generates a new frame before continuing with the Gen File.</p> <p>If FALSE, the original transaction is always retried.</p> <p>This statement can also be used in conjunction with any pid=xxx statement in the .utg file. This can be done to override the configured or default retry behavior.</p> <p>Syntax example: ping_on_retry=TRUE</p>

Key Code	Format	Description
ping_after_nyet		<p>Host Generation Only.</p> <p>If TRUE, the Trainer automatically generates PINGs (and retries) after receiving a NYET instead of the expected_pid. This feature is only used if the expected_pid is an ACK. PINGs are retried until an ACK is received. When the PING is ACKed, the Trainer generates a new frame before continuing with the Gen File.</p> <p>If FALSE, the Trainer continues as if an ACK occurred.</p> <p>This statement can also be used in conjunction with any pid=xxx statement in the .utg file. This can be done to override the configured or default retry behavior.</p> <p>Syntax example: ping_after_nyet=TRUE</p>

Key Code	Format	Description
Packet Starting Keys		
pid	8 bits (0-0xFF) or pid string	<p>Host Generation Only.</p> <p>Use this as the first key of most packets sent by the Host (Exception: Use frame= for SOF packets).</p> <p>The key should be assigned to a valid packet identifier string per the USB specification: SETUP, IN, OUT, DATA0, DATA1, ACK, PRE, PING, SPLIT, DATA2, or MDATA.</p> <p>Optionally, you may assign this key a raw eight bit value to force an error condition.</p> <p>Warning: If you specify PID=0xNN, you must use raw_data=() to specify the rest of the packet data, because the packet structure is unknown.</p>
expected_pid	pid string	<p>Host Generation Only.</p> <p>Use this as the PID key for packets which are expected to be sent by the device.</p> <p>In IntelliFrame mode, the generator waits until this PID has completed before sending the next generated packet or bus condition.</p> <p>The key should be assigned to a valid packet identifier string per the USB specification: DATA0, DATA1, ACK, NAK, STALL, NYET, DATA2, or MDATA.</p> <p>The generator engine waits forever until this expected_pid appears, so the user may have to hand edit the file to achieve the desired results.</p> <p>For example, if a NAK comes where the expected_pid was a DATA1, the user should edit the .utg file to move the pid=IN command to later in the file by inserting some frame=AUTO idle=TO_EOF pairs before it. This allows time for the device to be ready for the IN.</p> <p>If RETRY=TRUE for this address/endpoint, the NAKs are ignored and the SOF's are generated automatically until the expected PID occurs.</p>
device_pid	pid string	<p>Use this as the first key of most packets sent by a device.</p> <p>The key should be assigned to a valid packet identifier string per the USB specification: DATA0, DATA1, ACK, NAK, STALL, NYET, DATA2, or MDATA.</p> <p>Normally, the device_pid= statement is NOT present in a Host Generation .utg file, because the device responses are intended to come from real devices. By default, Host Generation files exported from Trace Files do NOT include device_pid= statements.</p> <p>Warning: If you specify PID=0xNN, you must use raw_data=() to specify the rest of the packet data, because the packet structure is unknown.</p>

Key Code	Format	Description
frame	11 bits or AUTO KEEP_ALIVE	<p>Creates a start of frame packet and generates a SOF PID as expected.</p> <p>The key should be assigned a value of the frame number, AUTO, or KEEP_ALIVE.</p> <p>AUTO instructs the generator to increment the frame number automatically.</p> <p>KEEP_ALIVE instructs the Analyzer to generate a low-speed EOP in place of a SOF packet for traffic on a low-speed branch (file_speed=LOW).</p> <p>For Device Emulation, this statement is ignored by the Device Emulator, but serves to organize the .utg file in a more readable manner.</p>
empty_frame	integer	<p>Host Generation Only.</p> <p>This key creates a sequence of start of frame packets with idle=TO_EOF values for the idle time. This results in N empty frames, where N is the integer value specified.</p> <p>If the branch speed is LOW, the frames contain only the keep-alive standalone EOP's. This key makes for an easier to manage .utg file by eliminating the need for many lines of frame=AUTO idle=TO_EOF statements.</p> <p>Usage: empty_frames=23 ; insert 23 empty frames here</p>
host_exp_pid	PID	<p>Device Emulation Only.</p> <p>Defines the PID that is expected to be received from the Host.</p> <p>The Device Emulator waits until this PID has completed before sending the next generated packet.</p> <p>The key should be assigned to a valid packet identifier string per the USB specification: SETUP, IN, OUT, DATA0, DATA1, ACK, DATA2, or MDATA.</p> <p>PRE and PING are for Hubs only and are not supported.</p> <p>Each memory segment waits forever until it receives the expected PID to its address/endpoint, so the user may have to hand edit the file to achieve the desired results.</p> <p>Each endpoint memory segment acts independently.</p>

Key Code	Format	Description
Bus Condition Keys		
reset	positive integer or LS_EOP	Host Generation Only. Indicates the number of microseconds that single-ended zeros (SE0) are driven onto the bus. Assign a positive integer to this key. This key can also be assigned the string LS_EOP to drive two low-speed bit times of SE0 followed by one bit time of J.
se0	positive integer <2500	Host Generation Only. Same SE0 signal as reset, but the range is in nanoseconds (accuracy: +/- 33 ns).
suspend	positive integer	Host Generation Only. Indicates the number of microseconds of idle and suspend after the previous packet (for example, for ten milliseconds of suspend, the key should equal 13000). Assign a positive integer to this key. Note that suspend begins after 3 milliseconds of idle.
resume	positive integer	Host Generation Only. Indicates the number of microseconds of K driven onto the bus. Assign a positive integer to this key. For a proper resume sequence, this should be followed by the condition reset=LS_EOP speed=LOW.
wait_resume	HERE	Host Generation Only. Place this immediately before a resume=<> statement to implement a device resume, also known as Remote Wakeup. This causes the host to wait for the device to issue the Resume (K) condition before the Host proceeds with its own Resume signalling. This statement MUST be followed by the resume=<> statement.
chirp	HERE	Used to create a chirp sequence for a High Speed generation. Usage: chirp=HERE
wait_vbus	VALID	Device Emulation Only. Wait for VBus to go Hi.
termination	HERE	Device Emulation Only. Set terminations now.

Key Code	Format	Description
Keys for Packet Fields		
speed	LOW	Used to cause a low speed packet on a full speed branch. The only legal value is speed=LOW .
addr	7 bits (0-127)	Assign a value for the address field.
endp	4 bits (0-15)	Assign a value for the endpoint number field.
hub_addr	7 bits (0-127)	Host Generation Only. Assign a value for the hub_address field of a SPLIT packet.
port	7 bits (0-127)	Host Generation Only. Assign a value for port field of a SPLIT packet.
data	(AB CD)	Assign data bytes for the data field. Use the following syntax: data=(12 34 56 78 90 AB CD EF DC 13 40 78 11 CA 70 65) You can wrap bytes of the data field to the next line. The bytes are in the order they come across the bus, and the bits within the bytes are in MSB to LSB order. Maximum number of bytes allowed is 1049.
crc	5 bits (0x0-0x1F) or 16 bits (0x0-0xFFFF)	Assign a value for the crc field. The default value is the correct crc calculated for the packet.
s	0 or 1	Host Generation Only. Assign a value for the s (High Speed SPLIT Start/Speed) field.
sc	0 or 1	Host Generation Only. Assign a value for the sc (High Speed SPLIT Start/Complete) field.
e	0 or 1	Host Generation Only. Assign a value for the e (High Speed SPLIT End) field.
et	0 to 3	Host Generation Only. Assign a value for the et (High Speed SPLIT Endpoint Type) field: 0 = Control 1 = Isoch 2 = bulk 3 = Interrupt
eop	positive integer	Assign a positive integer for the length of the end of packet (EOP). The default value is the correct length (2 bits of SE0, 1 bit of J). The value is reflected by <val-1> bits of SE0 plus one bit of J.

Key Code	Format	Description
hi_eop	(AB CD) Hex	Used to generate a high speed EOP pattern. The bytes are in the order they come across the bus, and the bits within the bytes are in LSB to MSB order. Maximum number of bytes allowed is 13.
idle	positive integer or TO_EOP	Defines the length of idle after the current packet. Assign a positive integer or string to this key. The positive integer indicates the number of full-speed or low-speed bit times. The default value is around 4 bits for Classic speeds and around 150 bits for High speeds. When this keyword is assigned a string TO_EOF, USB Chief automatically calculates the amount of idle remaining in the frame. When handshaking with a device, you can use this keyword to add idle where you anticipate a packet being returned from the device. The idle= key is always associated with the preceding packet or bus condition, so you should not put file control keys between the packet or bus condition statement and the idle= statement.
marker	string	Assign a string in quotation marks to be put in the marker for the defined packet.
raw_data	(aa bb)	Use to send a non-modulo 8 number of bits in a classic speed raw_data packet. It is only valid in conjunction with the raw_data statement. Normally, every bit of the array defined in a raw_data=(xx yy) type of statement would be sent. However, particularly in the case where bit_stuff=off , you need more control over the number of bits to be output on the bus. By adding the statement raw_data_bits = 11 , only the first 11 bits of the defined bytes are sent. For the following case, raw_data=(8F F0) raw_data_bits=13 the output bitstream would be: 1111 0001 0000 1 (Each byte is described in MSB to LSB format, but is output on the wire in LSB to MSB format.)

Key Code	Format	Description
raw_data_bits	integer	<p>Use to send a non-modulo 8 number of bits in a classic speed raw_data packet.</p> <p>It is only valid in conjunction with the raw_data statement.</p> <p>Normally, every bit of the array defined in a raw_data=(xx yy) type of statement would be sent. However, particularly in the case where bit_stuff=off, you need more control over the number of bits to be output on the bus. By adding the statement raw_data_bits = 11, only the first 11 bits of the defined bytes are sent.</p> <p>For the following case, raw_data=(8F F0) raw_data_bits=13 the output bitstream would be: 1111 0001 0000 1 (Each byte is described in MSB to LSB format, but is output on the wire in LSB to MSB format.)</p>
bit_stuff	OFF ON	<p>Assign the string OFF to disable bit stuffing within the current packet.</p> <p>The default value is ON.</p>
sync	integer 1-40	<p>Assign an integer from 1 to 40 to represent the sync field. The integer is the number of zeros transmitted before the one.</p> <p>For Low and Full Speed files, the default value is 7 to give a sync of 00000001.</p> <p>For High Speed files, the default value is 31 resulting in a sync of 00000000000000000000000000000001.</p>
retry ping_on_retry ping_on_nak retry_next_frame	TRUE FALSE	<p>Host Generation Only.</p> <p>These four keys may be applied to individual packets to override the behavior in a given instance.</p> <p>Normally, they are used in the config_endpoint statement.</p> <p>See their descriptions in the Endpoint Configuration section earlier.</p>
Keys for Class Decoding		
<p>These keys are populated into the .utg script file automatically whenever the menu command File > Export to .utg file is run. These keys do not need to be edited.</p>		
sd_prod		
sd_vend		
sd_bm_req_type		
sd_interface		
sd_host_id		
sd_class_code		
sd_subclass		
sd_protocol		
sd_end_sd		

Chapter 13: Updates

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

13.1 Software, Firmware, 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. Included with each release are the most recent downloadable images of the Firmware and the BusEngine™.

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



About USBTracer details revisions of the following software and hardware:

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

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

13.2 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 USBTracer** screen, verify which version of USBTracer 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.

13.3 BusEngine and Firmware Updates

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

Updating the BusEngine

The BusEngine core is the heart of the USBTracer Analyzer. Using state-of-the-art Electronically Programmable Logic Device (EPLD) technology, it incorporates both the high speed recording engine and the configurable building blocks that implement data/state/error detections, triggering, capture filtering, external signal monitoring, and event counting and sequencing. Both the BusEngine program and the Firmware that manages the internal microcontroller are fully field upgradeable.

Within a new software release, it may be necessary to update the Analyzer's BusEngine hardware for proper operation. The Readme file lets you know if this is necessary.

Updating the Firmware

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

Automatic Updates

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

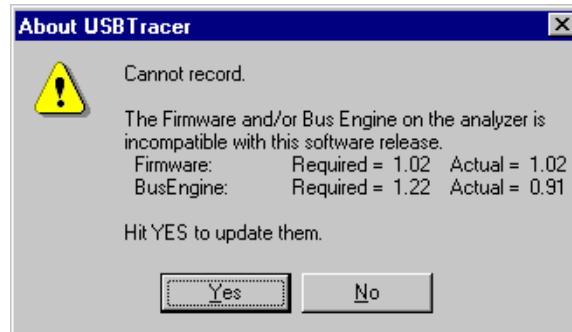
To perform an automatic BusEngine and Firmware update, follow these steps:

Step 1 If needed, update the USBTracer software using the steps outlined in "Software Updates" described above.

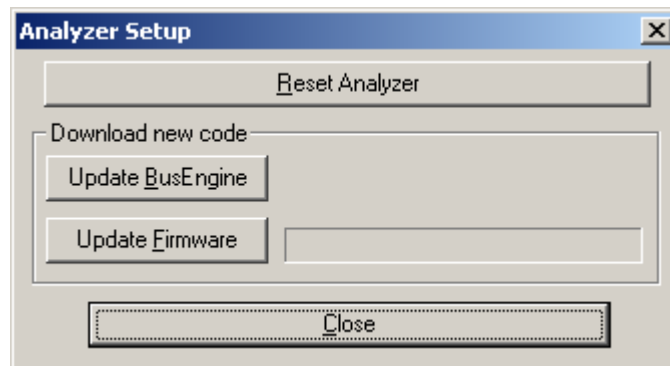
Step 1 Turn on the Analyzer.

Step 2 On the Tool Bar, click the  button.

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



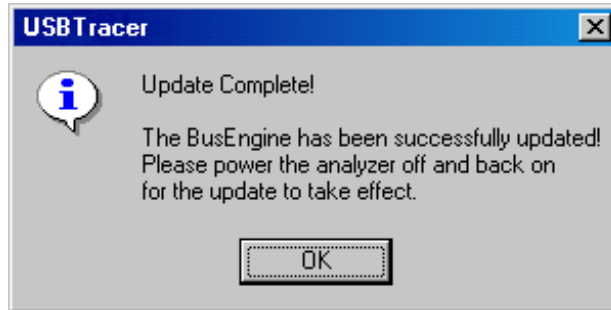
Step 3 Click **Yes** to close the window closes and open the Analyzer Setup window.



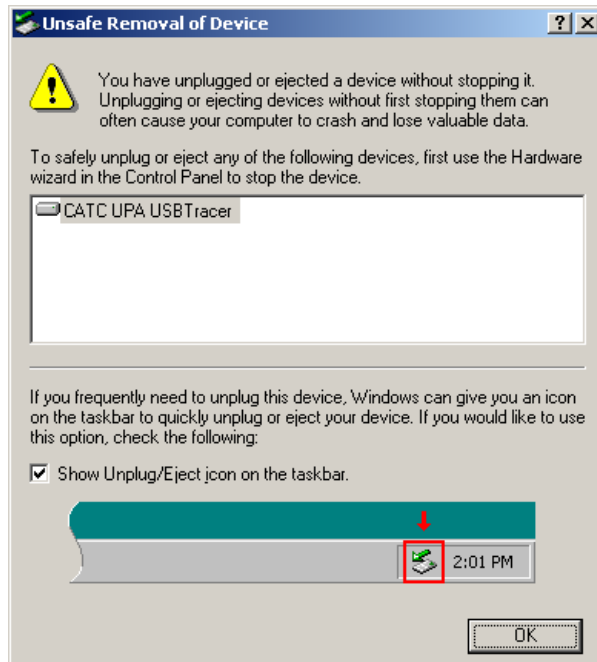
Step 4 Click **Update BusEngine** or **Update Firmware**.

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

If you are running Microsoft® Windows® 98, you get the following message when the second update is completed:

**Step 5** Power cycle *USBTracer* to complete the update.

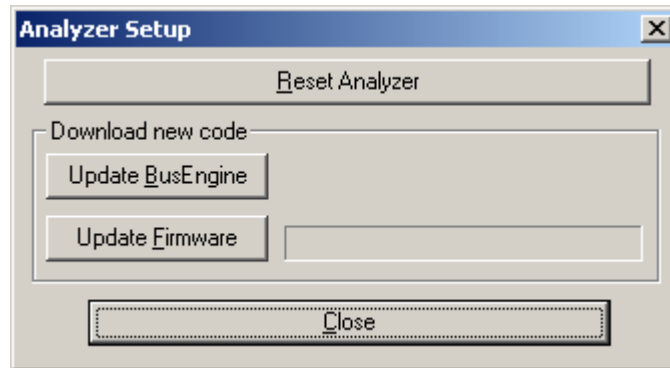
If you are running Windows 2000, the Analyzer automatically reboots and displays the following message. When this message appears, click **OK**. **You do not need to power cycle the analyzer.**



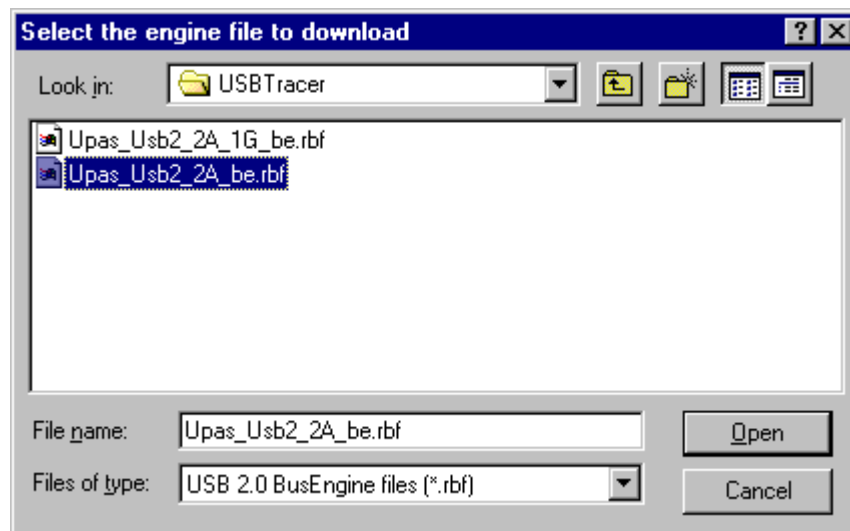
Manual Updates to BusEngine and Firmware

You can manually update the USBTracer Firmware and/or BusEngine™ by performing the following steps:

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



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



The program displays the correct file (**Upas_Usb2_2A_be.rbf**) in the **File name** field. This file is used to update the Analyzer alone (i.e., without a Traffic Generator). The other file (**Upas_Usb2_2A_1G_be.rbf**) should be selected if you upgrading a UPAS system with both an Analyzer and Traffic Generator.

If you have purchased device emulation, then the needed BusEngine file is **Upas_usb2_1A_1G-be.rbf**.

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

Step 3 Click **Open**.

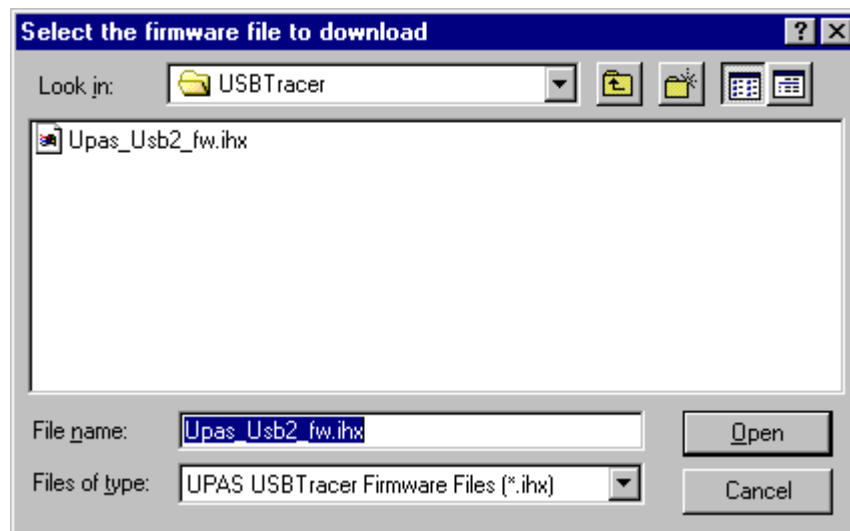
Step 4 Power cycle the Analyzer.

Re-initialization takes a couple of minutes.

Manually Updating the Firmware

To update the firmware:

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



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

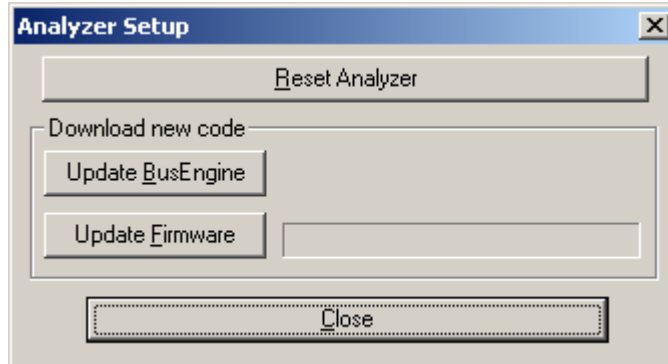
Step 2 Click **Open**.

The Analyzer updates the Firmware.

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

13.4 Resetting the Analyzer

The Analyzer Setup window contains a reset button at the top of the window. Its function is the equivalent of power cycling the Analyzer.



Appendix A: Legacy Script Decoding

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

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

This method uses fixed definitional structures.

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

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

Note: **.req** files are no longer used in LeCroy USB Analyzers. In addition, **.req** files are not compatible with the UWBTracer application. The new script decoding for LeCroy USB Analyzers uses Script Decoder version **.dec** files. **.dec** files are compatible with the UWBTracer application. It is highly recommended that you use the new Script Decoder mechanism. For information about **.dec** files and the new script decoding, see “Class and Vendor Definition Files” on page 77.

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/

Limited Hardware Warranty

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



What this Warranty Does Not Cover

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

Coverage During Warranty Period

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

How to Obtain Warranty Service

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

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

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

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

Index

Symbols

- .dec files 77
- .dsc files 175
- .rbf files 171
- .req files 175
- .usb files 28
- .utg file 20
- .utg files 142
- .vcd file 20

Numerics

- 2-stage SOF Hiding option 68
- 5-volt pin 6

A

- About USBTracer
 - command 167
 - window 167
- Abstract Control Model .dec file 77
- AC
 - connector module 2
 - power source 15
- Accurate Time Management 6
- action
 - buttons 129
- actions
 - buttons 133
 - events 130
 - linking to events 130
 - recording options 129
 - window 129
- Addr & Endp search criteria 60
- Addr checkbox 125
- Addr field 80
- alert
 - beep 111
- All Start of Frame packets option 121
- Allow any Toggle value after Bus Reset option 68

Analyzer

- bus 1
 - command 171
 - resetting 173
 - setup 16
 - traffic 1
- Analyzer Setup window 169
- Analyzer Speed options 115
- application
 - installation 16
 - startup 19
- Application startup 17
- architecture
 - network 2
- ATM Networking Control Model .dec file 77
- Audio .dec file 77
- audio.req file 175
- automatic
 - updates 169
- Auto-Merge Trace files 111

B

- Babble End Violation checkbox 125
- Babble Start Violation checkbox 125
- Bad Data Toggle checkbox 125
- Bar option 102
- Beep When Trigger Occurs option 111
- Bit Stuffing checkbox 125
- Bit-by-Bit window 123
- bits 36
- Bitstream mode 150
- Bitstream vs. Intelliframe 150
- blue dot 134
- Blue Dot Menu 136
- bluetooth.req file 175
- Breakout Board 6
- BT .dec file 79
- Buffer Size box 111
- Bulk/Int Transfer field 82

- bus
 - analyzer 1
 - condition 153
 - condition keys 162
 - usage 69
- Bus Conditions 61
- Bus Conditions event group 124
- Bus Conditions shortcuts 32
- bus data
 - recording 138
- Bus Usage option 108
- Bus Utilization
 - buttons 101
 - report 100
- Bus Utilization option 69
- BusEngine 7
 - manual updating 171
 - technology 7
 - update 168
- buttons
 - action 133
 - bus utilization 101
 - navigator 52
 - real-time statistics 106
 - Script Editor 146
 - tool bar descriptions 25
- Bytes box 111

- C**
- cable
 - connector 6
- Cable Based Association Framework .dec file 79
- Cables 15
- CAPI Control Model .dec file 77
- CATC Trace
 - recording 13
 - set marker 34
- Change Counter Value command 132
- Channel
 - search 63
- channel
 - trigger/filter 111
- Check Syntax command 20
- Chirp Reset Length option 117
- chirps
 - hiding 40
- class decoding keys 165
- class definition files 77, 175
- Class Request
 - decode 91
- Class request, decode 91
- Class/Vendor decoding 80
- Class/Vendor Decoding field 80
- Class/Vendor Decoding Groups menu 81
- Class/Vendor Endpoint Decoding
 - field 82
 - menu 83
- Class/Vendor endpoint R Pipes decoding 86, 88
- classes 175
- Classic LED 2
- Clear Marker command 35
- clock 116
 - rate 5
 - selection 118
- Collapse This USB Transfer command 47
- colors
 - Display Options 71
- comments
 - editing 54
- Communication Device Subclass/EEM .dec file 77
- communication.req file 175
- Communications and CDC Control .dec file 77
- Compare Endpoint Data command 20
- compatibility
 - host 4
- components
 - physical 3
 - system 1
- Computer connection 15
- Configuration Name option 69
- connecting
 - actions and events 130
 - cables 11, 16
 - counters to events 131
 - events to actions 130
- connector
 - cable 6
 - Data In/Out 6
 - DB-25 2
 - descriptions 7
 - module 2
- connectors 3
- context-sensitive help 19
- Control Transfer 89
- Control Transfer field 89
- convert.usb file 19
- counter 6
- counters 129
 - connect to events 131
 - events 131
 - setting multiple conditions 132

- counting 6, 7
 - restarting 133
- CRC checkbox 125
- creating
 - generation file 151
- Customize
 - command 24
 - dialog box 24
- D**
- Data Block
 - viewing 39
- Data Block dialog box 39
- data connectors
 - pin descriptions 7
- data fields
 - collapse 37
 - expand 37
 - pop-up menus 38
- Data In/Out connector 6
- data length
 - event groups 127
 - search for 60
- Data Length event group 127
- Data option 20, 69
- Data Packet Count option 108
- Data Pattern event group 122
- Data Payload Throughput option 108
- data.usb file 28
- DB-25 connector 2
- Decode
 - decoding options 80
- decode
 - class request 91
 - endpoint 82, 92
 - endpoint DWA RPipes 88
 - endpoint RPipes 86
 - general options for requests 89
 - hub status 92
 - layout 93
 - protocol-specific fields 47
 - request recipient 80
 - Request rRPipe 85, 87
 - requests 89, 90
 - standard request 90
 - vendor requests 91
- Decode ... Request command 91
- Decode as ... Endp command 92
- Decode Standard Request command 90
- decoded transactions, viewing 43
- decoded transfers 46
- decoder files 77
- decoding
 - assigning 80
 - refresh 89
- Default to IntelliFrame Mode option 117
- defining packet fields 154
- Delay Time 151
- Delay Time option 117
- description 1
- detailed installation 1
- device
 - emulation 150, 151
- Device Emulation mode 151
- Device Emulation Mode option 117
- Device Requests 89
- Device Requests event group 121
- Device Resumes option 117, 151
- Device Wire Adapter .dec file 79
- Device Wire Adapter Segment View 49
- Device Wire Adapter Transfer View 49
- devices
 - hiding 40
- diagnostics 15
- Direct Line Control Model .dec file 77
- direction
 - search 65
- Direction field 82
- Disable External Trigger Output option 135
- Disable Generator Memory option 117
- display 4
 - configuration name 69
 - format 13
 - graphs 108
 - options 4
 - windows 20
- Display Options
 - Color/Format/Hiding tab 70
 - factory settings 69
 - General 68
 - level hiding 74
 - loading 75
 - saving 75
 - values 69
 - window 67
- Divide By field 118
- dot
 - blue 134
- DWA RPipes
 - endpoints 88

E

- Edit as Text command 145
- Edit button 123
- Edit Comment command 54
- Edit comment for trace file window 54
- Edit Marker Comment
 - command 35
 - window 34
- editing
 - comment 54
 - data patterns 123
 - generation file 145
 - marker 35
- electrical
 - fuse 2
 - power switch 2
 - source 15
- Electrically Programmable Logic Device 7
- Electronically Programmable Logic Device 168
- e-mail 177
- empty frame 125
- Emulated Device's Hex Address option 117
- emulation 150, 151
- Enable External Trigger option 136
- Enable External Trigger Output option 135
- Enable Outlining command 146
- Enable Tips option 68
- Endp checkbox 125
- Endp field 82
- endpoint
 - configuration keys 156
 - decoding 82
- Endpoint RPipes
 - dialog box 86, 88
 - tab 86, 88
- Endpoints
 - tab 82
- endpoints
 - decoding 92
 - DWA RPipes 88
 - RPipes 86
- Endpoints dialog box 82
- environmental conditions 3
- EOF offset box 125
- EOP checkbox 125
- EPLD 7, 168
- error
 - detection 6
- error log 147
- Error Report option 69
- Error Summary report 97
- errors 69
 - event groups 124
 - searching for 59
 - summary 97
 - types 125
- Errors event group 124
- Errors option 53
- Ethernet Networking Control Model .dec file 77
- Event Groups dialog box 119
- Event Trigger recording 110
- events 6
 - actions 130
 - connecting to counters 131
 - connection to actions 130
 - counters 131
 - groups 119
 - linking 132
 - Recording Options 119
 - triggering 133
- Events Group box 64
- Events window 129
- Excessive Empty Frame Detection checkbox 125
- Exclusion search 65
- Expand Packet Data Fields by default option 68
- Expand Script-Based Decoded Info by default option 68
- Expand This USB Transfer command 47
- Expand Transaction menu 44
- Export command 20, 142
- Export to Generator Text window 144
- Extern Data7 - Data0 In event group 128
- external
 - external output signals 135
 - input signals 126
 - interface signals 111
- External Input Signals event group 126
- External Interface Breakout Board 6
- external interface connector 2
- external ports 2
- External Trigger Form option 136
- external trigger output
 - enable 135

F

- F1 help 19
- fax 177
- features 3
 - trace 13, 33

- fields
 - expanding 37
 - Fields option 69
 - file
 - generation format 153
 - File Control Keys 154
 - File Export menu 143
 - File Information report 96
 - File menu 20
 - files
 - .dec 77
 - .dsc 175
 - .rbf 171
 - .req 175
 - .utg 142
 - editing comment for trace 54
 - File Control Keys 154
 - file information 96
 - generation loading 148
 - information 96
 - loading generation 148
 - script 77, 175
 - tabs 147
 - trace filename 113
 - traffic generation 142
 - Files of Type field 148
 - Filter In action button 134
 - Filter Out action button 129, 134
 - Filter Polarity menu 134
 - filtering 6, 134
 - events 119
 - hardware 1
 - Find
 - command 64
 - utility 64
 - Find Next command 65
 - firmware
 - automatic updates 168
 - manual updates 172
 - manual updating 172
 - update 168
 - first recording 11
 - Fit to Graph Area option 107
 - fonts
 - changing 69
 - Fonts and Colors options 103
 - Fonts option 69
 - format
 - display 13
 - idisplay options 72
 - fractional clock rate 5
 - Frame Number field 121
 - Frame Patterns event group 121
 - Frame-Length checkbox 125
 - Full Speed
 - indicator 2
 - fuse 2
- ## G
- General tab
 - Display Options 68
 - Recording Options 110
 - Generate menu 21
 - generating
 - traffic 5
 - generation
 - file loading 148
 - formats 153
 - mode 149, 150
 - options 151
 - repeating 150
 - running 152
 - session 150
 - starting 150
 - generation file
 - creating 151
 - editing 145
 - loading 148
 - repeat 150
 - generation script file 151
 - generator
 - modules 2
 - Generator Text File 150
 - Generator/Analyzer Clocking Overrides option 116
 - glass fuse 2
 - Go to
 - drop-down menu 57
 - Marker search 56
 - Packet/Transaction/Transfer... search 56
 - Trigger search 55
 - Go to search 57
 - Graph Areas button 108
 - Graph Areas menu 104
 - graphical display 5
 - graphs
 - displaying multiple 108
 - Graph Areas menu 104
 - green LED 2
 - Grid Lines option 102
 - Grid on Top option 102
 - ground pins 6

H

- hard disk 4
- hardware
 - filtering 1
 - requirements 4
- help
 - context-sensitive 19
- Help menu 23
- Hi Speed
 - recordings 115
- HID .dec file 78
- hid.req file 175
- Hide option 107
- hiding
 - chirps 40
 - devices 40
 - display options 73
 - levels 74
 - NAKs 40
 - SOF 68
 - SOF packets 40
 - toolbars 23
- Hierarchy Lines option 68
- Hi-Speed
 - indicator 2
- Hi-Speed traffic 5
- HNP 62
- host
 - compatibility 4
- Host field 80
- Host Negotiation Protocol 62
- Host option 62
- Host Wire Adapter .dec file 79
- Host Wire Adapter Segment View 48
- Host Wire Adapter Transfer View 49
- hosts
 - Host Negotiation Protocol 62
 - with a B plug 62
 - with an A plug 62
- hot keys 31
- HS LED 2
- HS_Hub_Sample.utg file 143
- Hub .dec file 78
- hub.req file 175
- HUT .dec file 78
- HWA address field 85

I

- Import command 20

- IN checkbox 125
- Incl Reset checkbox 125
- Include statement 147
- indicators 4
 - UPAS 2
- Input Counter Value dialog box 132
- input signals
 - external 126
- Install Software command 16
- installation 16
 - basic 9
 - detailed 1
 - installed unit 1
- IntelliFrame
 - button 149
 - mode 117, 150
- Intelliframe LED 2
- Interface Association Descriptor .dec file 79
- Intersection search 65

K

- Keep Across Recordings checkbox 81
- keyboard
 - shortcuts 31
- keys
 - bus condition 162
 - class decoding 165
 - endpoint configuration 156
 - file control 154
 - packet fields 163
 - packet starting 160
 - support 154
- Keys for packet fields 165

L

- layout 93
 - Actions window 129
- Layout command 93
- LEDs 2, 4
- left module slot 2
- Legend 53
- letter 177
- line numbers 146
- Link utilization 108
- linking
 - events 132
- List Values option 147
- LOA checkbox 125
- Load command 75, 112, 137

log
 error 147
logical objects 50
Low Speed
 indicator 2
LV TTL output and input signals 6

M

Main
 screen 17
manual
 updates 172
Manual Trigger button 2
Manual Trigger recording 110
Map DWA RPipe to Class/Vendor Decoding command 87
Map Endpoint to Class/Vendor Decoding command 82
markers
 clearing 35
 defining 34
 editing 35
 setting 34
Mask field 123
Mass Storage .dec file 78
Match field 123
Media Transfer Protocol 50
Media Transfer Protocol .dec file 78
memory 4
 generator 117
 requirements 111
menus 20
 graph areas 104
 pop-up 68
 pull-down 20
 real-time statistics 107
 view settings 102
Merge Trace Files command 20, 139
merging
 trace files 139
Misc tab
 recording options 114
mode
 Bitstream 150
 collapsed 68
 device emulation 151
 expanded 68
 generation 149
 Repeat 149
 traffic generation 150

modes
 Devoce Emulation 117
 IntelliFrame 117
modules
 generator 2
Monitor .dec file 78
monitoring statistics 105
MTP 50
Multi-Channel Control Model .dec file 77

N

NAKs
 hiding 40
name of Recording Options settings 112
navigation 69
 shortcuts 31
 tools 30
Navigation Bar checkbox 52
navigator 52
Navigator bar 52
Navigator option 69
network 2
No Decoding option 81
None option 102

O

object handles 50
object transfers 50
On the Go, searching 62
opt files 75
options
 display 4
 recording 4
 search 55
options file 69
Options Name field 112
orange LED 2
Orient Horizontally option 102
Orient Vertically option 102
OTG shortcuts 32
OUT checkbox 125
output signals
 external 135
overview
 software 19

P

package 3

- Packet # field 34
 - packet fields keys 163
 - Packet Identifiers event group 120
 - Packet label 36
 - Packet menu 34
 - packet starting keys 160
 - Packet View 41
 - packets
 - defining fields 154
 - definition 153
 - display level 69
 - hiding SOF 40
 - packet identifiers 120
 - packet starting keys 160
 - searching for IDs 58
 - too late 125
 - view 13
 - Packets to .CSV option 20
 - Packets to Device Emulation Traffic Generation Text File option 20
 - Packets to Host Traffic Generator Text File option 20
 - Packets to Text (Generator Text File Format command 144
 - Packets to Text option 20
 - Packing List 1
 - Partial Upload 29
 - Partial Upload button 29
 - PC connection 15
 - PC requirements 15
 - percentages, post triggering 112
 - Physical .dec file 78
 - physical components 3
 - Physical Interface .dec file 78
 - physical memory 111
 - Pict Bridge .dec file 79
 - Picture Transfer Protocol 50
 - Picture Transfer Protocol .dec file 78
 - Pid checkbox 125
 - PID shortcuts 31
 - pin-outs 7
 - descriptions 7
 - pins 6
 - Plug-and-Play instructions 16
 - Point of Sale Devices .dec file 78
 - pop-up menu
 - Script Editor 147
 - pop-up menus 68
 - data field 38
 - pop-up tool tips 40
 - ports 2
 - position of trigger 112
 - post-triggering percentages 112
 - power 15
 - indicator 2
 - on/off switch 2
 - socket 2
 - source 15
 - switch 2
 - Power .dec file 78
 - power requirements 3
 - Pre/Post Trigger option 53
 - Printer .dec file 78
 - printer.req file 175
 - probing 3
 - product
 - description 1
 - program
 - installation 16
 - startup 10, 19
 - Progress Indicator 27
 - Properties dialog box 107
 - protocol
 - analyzer 1
 - violations 6
 - protocol-specific fields, decode 47
 - prototype rework area 7
 - PTP 50
 - PTP .dec file 78
 - PTP Object 50
 - PTP Session 51
 - PTP Transaction 50
 - pull-down menus 20
 - pulse
 - toggle 136
 - Pulse High signals 136
 - Pulse Low signals 136
 - PWR LED 2
- ## R
- raw bits 36
 - viewing 36
 - Raw Bits View 36
 - Readme.txt file 167
 - Real-Time Statistics
 - buttons 106
 - Real-time Statistics
 - pop-up menu 107
 - window 105
 - Real-Time Statistics option 69
 - REC LED 2

- Recent Ranges option 53
 - Recipient field 80
 - Record menu 21
 - recording
 - activity 29
 - bus data 138
 - first 11
 - LED 2
 - options 4
 - progress 27
 - rules 7
 - snapshot 110
 - status 28
 - type 110
 - USB traffic 17
 - Recording Options
 - actions 129
 - command 109
 - dialog box 109
 - events 119
 - General 110
 - loading 112
 - Misc page 114
 - name 112
 - options name 112
 - recording 138
 - saving 137
 - Recording Progress Indicator 27
 - Recording Type box 110
 - refresh 89
 - Refresh Decoding for this Trace File command 89
 - Remote Wakeup 117
 - Repeat
 - menu 149
 - mode 149
 - Repeating a Generation Session 150
 - Report menu 21, 95
 - reports 95
 - Request DWA RPipes
 - tab 87
 - Request Recipient and Endpoints dialog box 80
 - Request RPipes 85, 87
 - dialog box 85, 87
 - tab 85
 - request.lst file 175
 - requests 89, 175
 - requirements
 - power 3
 - Requirements for PC 15
 - Reset All button 24
 - resetting
 - Analyzer 173
 - Toolbar 23
 - Restart action button 129, 133
 - restarting
 - counting 133
 - Restore Factory Presets button 69
 - Restore Factory Presets option 69
 - Resume
 - settings 151
 - signal 117
 - time 117
 - Resume Time option 117
 - revisions
 - firmware 167
 - software 167
 - rework area 7
 - Right click cell context menu option 68
 - right module slot 2
 - RPipe field 85, 87
 - RPipes 85, 87
 - endpoints 86
 - rules
 - recording 7
- ## S
- save
 - Display Options 75
 - recording options 137
 - trace files 113
 - Save as Default command 137
 - Save External Interface Signals option 111
 - Script Decoder
 - files 79
 - Manual 79
 - Script Decoding language 79
 - Script Edito
 - utility 145
 - Script Editor
 - buttons 146
 - pop-up menu 147
 - toolbar 146
 - window 145
 - script files 77, 175
 - Scripts directory 77
 - SCSI/Bulk Protocol .dec file 78

- search
 - complex 64
 - Direction 65
 - direction 65
 - Exclusion 65
 - feature 55
 - Intersection 65
 - menu 21, 55
 - Origin 65
 - status 29
 - Union 65
 - Select engine file to download window 171
 - Select firmware file to download window 172
 - self-diagnosis 15
 - sequencing 7
 - serial number 167
 - Session Request Protocol 62
 - sessions 51
 - set
 - marker in trace 34
 - Set Marker command 34
 - Set Range near Packet number option 53
 - Set Range to Whole Trace option 53
 - setting
 - generation options 151
 - settings
 - Resume 151
 - SETUP
 - field 89
 - transaction 89
 - setup 16
 - Setup menu 21
 - Setup.exe file 168
 - Short Byte checkbox 125
 - shortcuts 31
 - Show Line Numbers command 146
 - Show Markers option 102
 - Show Plumb Line option 102
 - Show Raw Bits command 36
 - Show Tooltips command 146
 - Show Values option 147
 - signal
 - descriptions 7
 - signals
 - external input 126
 - external output 135
 - slot
 - left module 2
 - right module 2
 - Slow Clock checkbox 118
 - Slow Clock command 116
 - slow clock rate 5
 - Snapshot recording 110
 - SOF Hiding 68
 - SOF packets
 - hiding 40
 - software
 - installation 10, 16
 - release 168
 - required 4
 - updates 168
 - updating 168
 - specifications 3
 - speed 5
 - Split Transaction View 45
 - split transactions
 - event groups 128
 - Splits event group 128
 - SRP 62
 - standard.req file 175
 - Start Recording command 138
 - Start/Stop button 2
 - starting 10, 19
 - software 17, 19
 - traffic generation 150
 - statistics 69
 - monitoring 105
 - Statistics Accumulation option 108
 - status
 - indicator 2
 - Status bar 27
 - Status LED 2
 - Status option 102
 - Still Image .dec file 78
 - Stop Recording command 138
 - stopping
 - traffic generation 150
 - summary
 - error 97
 - traffic 99
 - support 177
 - support keys 154
 - Support page 168
 - suspend 117
 - switches 3
 - system
 - components 1
- T**
- tabs
 - file 147

- technical support 177
- Telephone Control Model .dec file 77
- testing 15
- Tile Horizontally option 102
- Tile Vertically option 102
- time
 - delay 117
 - resume 117
- Time-out Violation checkbox 125
- timer 6
- Timestamp At The Beginning option 68
- Timestamp field 68
- timestamps 6
- timing 69
- Timing Calculations report 98
- Timing Calculator 98
- Timing Calculator option 69
- toggle
 - pulse signals 136
 - reset 68
- Toggle pulse signals 136
- toggle violation 125
- Token Patterns event group 120
- Toolbar 23
 - button descriptions 25
 - command 23
 - icons 25
 - resetting 23
 - tab 24
- Tooltip option 102
- tooltips 19, 40, 68, 146, 147
- trace
 - auto-merge 111
 - first recording 11, 13
 - Navigator 52
 - reading 33
 - set marker in 34
 - shortcuts 31
 - view features 13, 33
 - viewing level 69
- Trace File Name & Path button 113
- trace files
 - auto-merge 111
 - edit comment 54
 - filename 113
 - merging 139
- Trace Viewer 19
- Trace Viewer mode 17
- Trace Viewing Level option 69
- traffic
 - display 5
 - generation 5
 - recording 17
 - summary 99
- traffic generation
 - file format 153
 - files 142
 - modes 150
 - options 151
 - repeating 150
 - running 152
 - starting 150
 - stopping 150
 - USBTrainer 141
- Traffic Generation Start/Stop button 150
- Traffic Summary option 69
- Traffic Summary report 99
- Transaction View 41
- transactions 50
 - decoded 43
 - decoding protocols 47
 - event groups 126
 - expanded/collapsed 44
 - split view 45
- Transactions event group 126
- Transfer View 45
- transfers
 - decode protocols 47
 - decoded 46
 - expanded/collapsed 46
- tree 146
- TRG LED 2
- trigger
 - LED 2
- Trigger action button 129, 133
- Trigger Position slider 112
- Trigger/Filter Channel option 111
- triggering 6
 - events 133
- triggers
 - Event 110
 - events 119
 - Manual 110
 - manual 2
 - Trigger/Filter Channel 111
 - using errors for 125
- Truncate Data Fields option 111
- TTL output and input signals 6
- Turn-around time 125
- type B connector 2

Type field 80
Types of Traffic option 53

U

UFI(floppy)/CBI Protocol .dec file 78
Undo Zoom option 107
Union search 65
Universal Protocol Analyzer System 2
Universal Serial Bus Specification 3, 91
UPAS 2
Upas_usb2_1A_1G-be.rbf file 171
Upas_Usb2_2A_1G_be.rbf file 171
Upas_Usb2_2A_be.rbf file 171
update
 automatic 169
 BusEngine 168
 firmware 168
 manual 171, 172
Update BusEngine command 171
Update Firmware command 172
updates
 software 168
updating 167
 automatic 169
 BusEngine manual 171
 firmware manual 172
 software 168
UPLD LED 2
upload
 LED 2
 partial 29
USB
 architecture 2
 recording traffic 17
USB Device Request menu 89
USB Device Requests 89
USB Implementers Forum 3, 91
USB On-The-Go option 116
USB Tracer Generation Files option 148
USB type B connector 2
USB-IF 3, 91
USBTracer
 main window 10
USBTrainer
 traffic generation 141
Use Address in .utg file option 117, 151
User-Defined Find Events screen 64
UWB .dec file 79

V

vendor definition files 77, 175
vendor.req file 175
versions 167
Video .dec file 78
Video CONTROL .dec file 78
Video INTERFACE COLLECTION .dec file 78
Video STREAMING .dec file 78
View
 menu 22
 options 23
view
 data block 39
 decoded transactions 43
 decoded transfers 46
 packet 41
 raw bits 36
 split transaction 45
 transaction 41
 transfer 45
 Wire Adapter Segment 48, 49
 Wire Adapter Transfer 49, 50, 51
View ... Fields Dialog Layout dialog box 93
View Data Block command 39
View Fields for ... Class Requests text box 91
View Fields for ... Endp text box 92
View Fields for Standard Request text box 90
View Options
 button 146
 menu 146
View Settings button 102
Viewing Level 69
voltages 15

W

warranty
 coverage 177
 limited 177
 period 177
 provisions 179
 service 178
 transfer 179
website 168, 177
weight 3
window
 options 20
window layout
 actions 129
Window menu 22

Wire Adapter .dec file 79
Wire Adapter Multifunction Peripheral programming
interface 79
Wireless Controller .dec file 79
Wrap command 30
Wrap option 68
Wrap.utg file 150
wrap=here line 150
wrapping lines 68

Y

Y Scale Type option 107

Z

Zip files 168
Zoom in command 30
Zoom label 36
Zoom Level option 68
Zoom out command 30

