Conquest Series, USB

Bus & Protocol Analyzers

USB 1.x
USB 2.0

CERTIFIED USB

Analyzer/Exerciser
High Speed, Full Speed, and Low speed
USB Host Exerciser
Upper Level Protocol Decodes
HWA & DWA Decodes for Wireless USB
Extensive Statistical Report
Ultimate Graphical User Interface
Ethernet or USB 2.0 Control Interface
Field upgradable FPGA design
Free lifetime software upgrades
Free Technical Support

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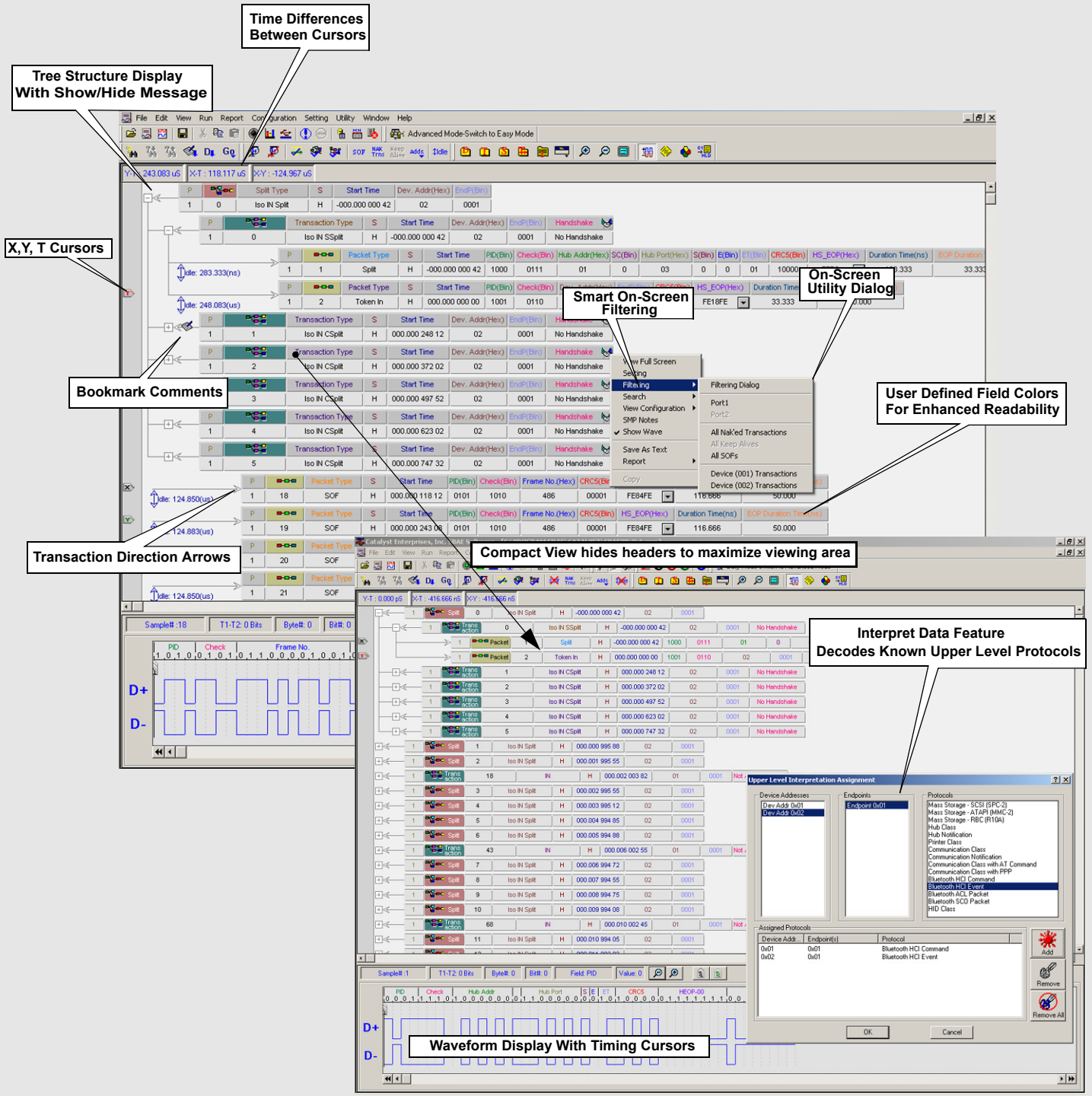
Ultimate Graphical User Interface



Features

High Performance Analyzer

The *Conquest Series, USB* is a USB 2.0 serial bus analyzer capable of analyzing data transfers of up to 480Mb/s. The *Conquest Series, USB* detects the bus speed and analyzes the protocol accordingly.

Non-Intrusive

Proprietary high impedance circuitry between the bus and the analyzer prevents any signal distortion when the analyzer is introduced between the host and the device. Not reshaping the signal allows the analyzer to see the data exactly as it appears on the bus.

Real-Time Filtering

Eight user-defined packets, representing all possible USB protocol fields, allow users to precisely define patterns for capture and triggering, up to 1024 bytes long. These packet definitions are then used in a flexible 32-state **Sequencer** that allows users to define a sequence of actions to be performed by the hardware in response to events and packets detected on the USB bus. This allows effective real-time filtering of data by excluding capture of unnecessary data.

Protocol Error detection

Conquest Series, USB detects up to 13 protocol errors in real-time and additional 20 protocol errors by post capture processing.

Interactive Analyzer/Exerciser

The Analyzer may be configured to capture and analyze data while the exerciser generates traffic on the bus.

Fully Field-Upgradable

A powerful FPGA core design allows easy field upgrades to the latest software releases. Use of an authorization code allows the activation of subsequently-purchased options without requiring a return to the factory for upgrade.

Benefits

- The *Conquest Series, USB* is a powerful tool for all phases of USB software, firmware and hardware development
- Intuitive Dual-Mode GUI reduces learning time
- Benchmarking performance
- Controlled timing and Error injection by the Exerciser for extensive device characterization and stress testing
- Versatility
  - FPGA based hardware automatically upgrades with new features
  - Field upgradable options
- Compact instrument design
  - All features in one chassis
  - No external components required
  - Integrated universal power supply
- Non restrictive software license allows sharing of captures between team members
- External I/O offers a way to interface with a variety of equipment types
- On-board memory lowers system requirements of the PC running the software

Analysis

Conquest Series, USB is capable of capturing and triggering data in 2 modes of operation, Easy and Advanced (Optional).

Easy mode allows users to use the *Conquest Series, USB* for the most common captures immediately with only three setup steps that use predefined, point and click, capture and trigger commands.

Advanced mode is designed to allow users to define custom capture and trigger commands using a flexible GUI based scripting language. A programmable sequencer permits the user to define exactly what data to capture and what to trigger on by defining a series of conditional and unconditional statements.

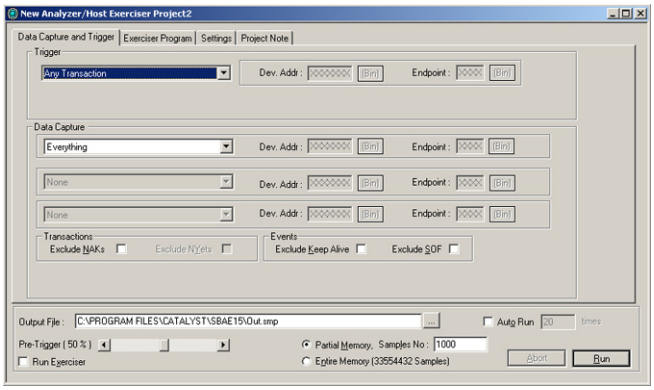
In addition a **Default Capture** feature is provided to allow you an immediate one button click capture of bus activity without any setup whatsoever.

Easy Mode (Pre-Defined)

Data Capture & Trigger

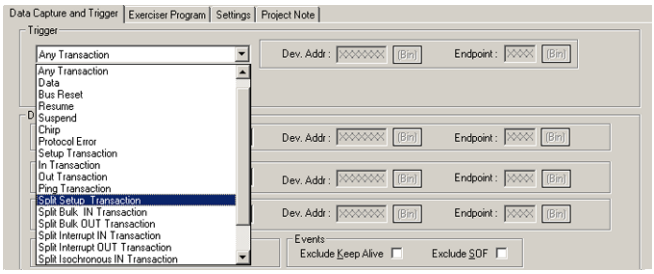
This interface allows hardware or software oriented USB debug without requiring any programming or setting of the analyzer.

A comprehensive selection of predefined setups allow capturing of several predefined data/event types and variety of trigger selections. The data to capture or to trigger on may be further narrowed by a specifying the addresses and the end points.



Pre-Defined Trigger Selections

The following are some of the commands available for High/ Full/Low speed trigger selections in the Easy mode.

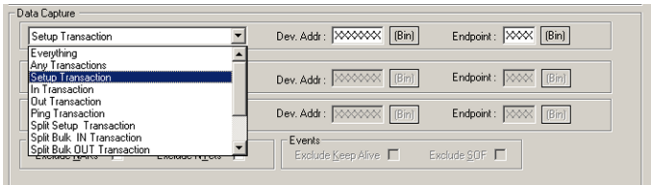


- Manual trigger - external push button
- Snapshot - trigger immediately
- Trigger on any Transaction
- Trigger on a Data Packet
- Trigger on Bus Reset
- Trigger on Chirp
- Trigger on Resume
- Trigger on Suspend
- Trigger on Protocol Error
- Trigger on Setup Transaction
- Trigger on In Transaction
- Trigger on Out Transaction
- Trigger on Ping Transaction
- Trigger on Setup with Preamble Transaction
- Trigger on Isochronous In Transaction
- Trigger on Isochronous Out Transaction
- Trigger on Setup with Preamble Transaction
- Trigger on Asynchronous In with Preamble Transaction
- Trigger on Asynchronous Out with Preamble Transaction
- Trigger on Split Setup Transaction
- Trigger on Split Bulk In Transaction
- Trigger on Split Bulk Out Transaction
- Trigger on Split Interrupt In Transaction
- Trigger on Split Interrupt Out Transaction
- Trigger on Split Isochronous In Transaction
- Trigger on Split Isochronous Out Transaction
- Trigger on Data Pattern and Length

Analysis

Pre-Defined Data Capture Selections

The following are some of the commands available for High/ Full/Low speed data/events capture selections in the Easy mode. Up to three commands may be selected simultaneously.



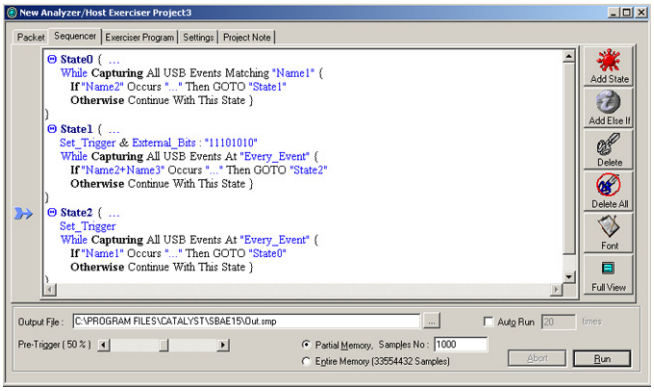
- Capture Everything
- Capture any Transaction
- Capture Setup transaction at specified address and endpoint
- Capture In Transaction at specified address and endpoint
- Capture Out Transaction at specified address and endpoint
- Capture Ping Transaction
- Capture Split Setup Transaction
- Capture Split Bulk In Transaction
- Capture Split Bulk Out Transaction
- Capture Split Interrupt In Transaction
- Capture Split Interrupt Out Transaction
- Capture Split Isochronous In Transaction
- Capture Split Isochronous Out Transaction
- Capture Isochronous In Transaction at specified address and endpoint
- Capture Isochronous Out Transaction at specified address and endpoint
- Capture Setup with Preamble Transaction at specified address and endpoint
- Capture Asynchronous In with Preamble at specified address and endpoint
- Capture Asynchronous Out with Preamble at specified address and endpoint

Analysis

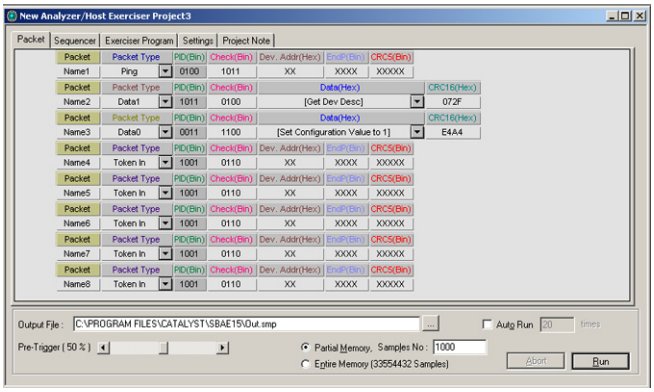
Advanced Mode (User Setup) For Debugging More Complex Problems

This mode is intended for use in applications that are not included as pre-defined setups in the Easy Mode and require more complex analysis. In this mode the user may define packets and events that are then used in the **Sequencer** for each of the available 32 linked states. The user may take advantage of two timers and two counters in the **Sequencer** to define state changes accordingly. Up to 8 different packet definitions of all possible packet types are used by a **Packet Recognizer** with pre-defined bus events to create Boolean expressions. These expressions are then used as conditions in the sequencer program for each state to define what is to be captured, tagged and discarded and to cause a transition to other states.

Sequencer Programming Dialog



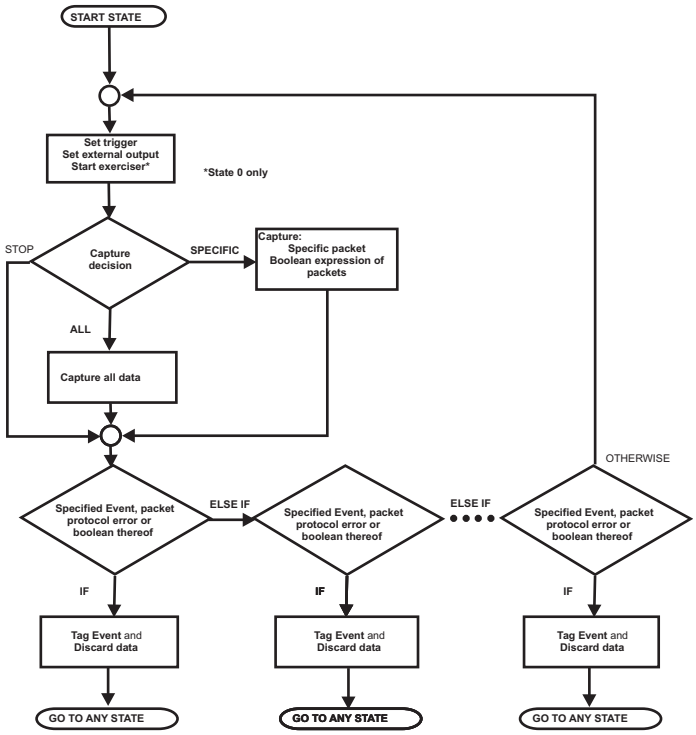
Packet Definition Dialog



Pre-defined Events

- Bus_Idle
- Resume
- Bus_Reset
- Disconnect
- Keep Alive
- Suspend
- Chirp
- Protocol Error

Sequencer Flow



Analysis

Protocol Errors

The *Conquest Series, USB* hardware monitors, detects and can trigger on up to 13 different protocol errors in real time. In addition, the software detects another 20 protocol errors by post-capture processing.

Real-time protocol Errors

Err0 Bit Stuff (Packet corrupted, stuff bit not present)

Err1 PID Err (Packet Identifier check failure)

Err2 PID Unknown (PID not defined by USB)

Err3 Synch Error

Err4 CRC5 Error (IN, OUT, SETUP Packet error)

Err5 CRC16 Error (DATA0, DATA1, DATA 2, MDATA payload error)

Err6 Frame Length (The space between SOF is not per USB specification)

Err7 Babble (Bus not idle at end of frame)

Err8 Data Toggle (Detected incorrect Data packet toggle bit)

Err9 EOP Error (Incorrect width of EOP signal or incorrect EOP occurrence)

Err10 Loss of Activity (Packet transfer followed by constant state on bus)

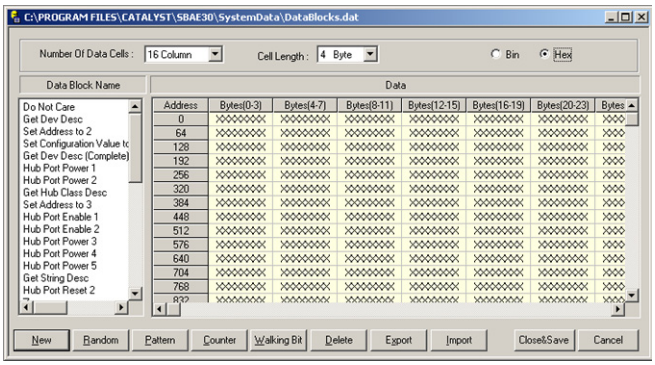
Err11 Timeout (Distance between token or data packet and corresponding response greater than USB specified)

Err12 Short Interpacket Delay

Data Blocks

The Data Blocks utility is a convenient GUI based method of creating an unlimited number of large blocks of data. These data blocks then may be included as payload data for packets used in the **Packet Recognizer** or when generating traffic with the optional **Host Exerciser**. Data block types supported are:

- User defined data pattern
- Walking bit data pattern
- Random data pattern
- Counter data pattern

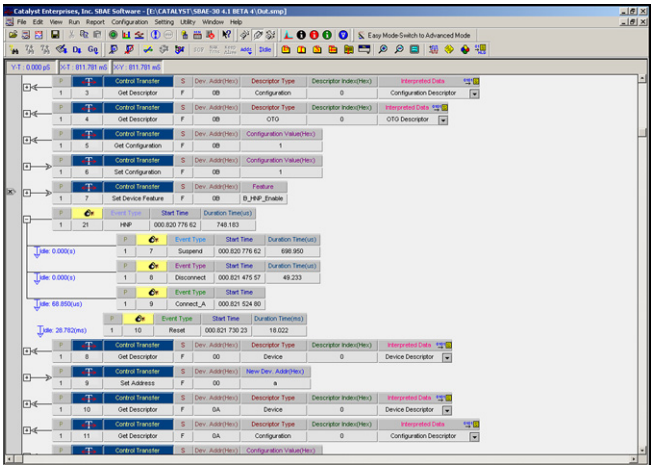


Up to 120KB/per data block may be defined with the data organized in 1, 2, 4, 8, or 16 cells per row, and 1, 2, 4, 8, or 16 bytes per cell.

The data blocks may be edited, imported and exported as text using any common text editor such as Windows Notepad.

Display Capability

The ultimate graphical user interface display offers a significant set of features to assist in analyzing results.

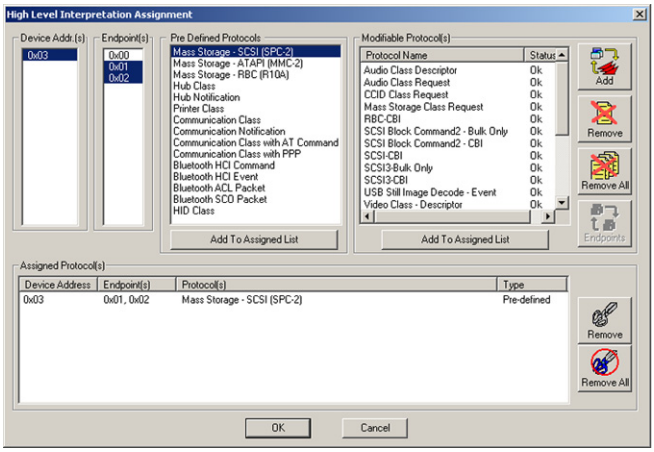


The results window provides for:

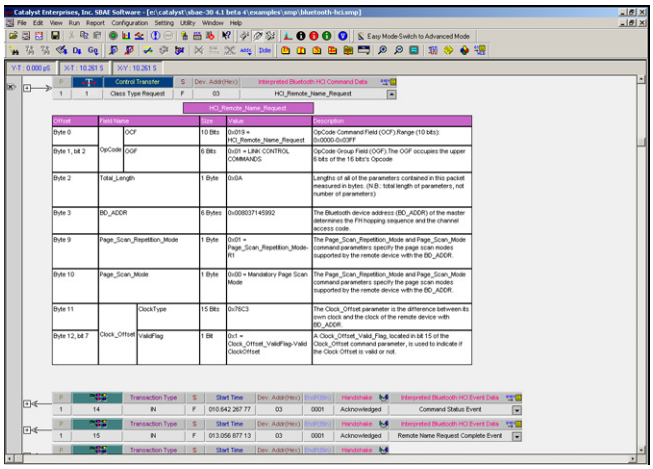
- Display of all captured transactions, packets or bus events
- **Compact View** hides headers for increased viewing area
- Interpret standard USB decodes and Upper Level Protocols
- **Smart On-Screen** filtering and utility access
- Filtering of any packet type in or out
- Hide or unhide the columns fields
- Capability to change the color of the different fields in the viewer
- Display of time difference between the positions of the X, Y, Trigger cursors
- Zoom In and Zoom Out, Full Screen capability
- Wave display of Transactions
- Format of data in Hexadecimal, Binary or ASCII
- Export in text format
- Notes and bookmarks
- Search utility
- Go to X, Y, Trigger cursors, Events, Packets, Transactions, Transfers

Upper Level Protocol Decodes

The Upper Level Protocol Decode utility is a results analysis tool that allows the decode and interpretation of upper level protocols used by a known device in a data capture result.



Protocol data is decoded and displayed in an easy to interpret tabular format.



Display Capability

Upper Level Protocols currently decoded:

- Mass Storage - SCSI (SPC-2)
- Mass Storage - ATAPI (MMC-2)
- Mass Storage - RBC (R10A)
- Hub Class
- Hub Notification
- Printer Class
- Communication Class
- Communication Notification
- Communication Class with AT Command
- Communication Class with PPP
- Bluetooth HCI Command
- Bluetooth HCI Event
- Bluetooth ACL Packet
- Bluetooth SCO Packet
- HID Class
- Audio Class Descriptor
- Audio Class Request
- CCID Class Request
- CCID - Command
- CCID - Event
- CCID - Data/Response
- CDC - HDLC - Command
- CDC - 1430 - Command
- CDC - Q931 - Command
- CDC - Q921M - Command
- CDC - Q921 - Command
- CDC - Trans - Command
- CDC - V.42bis - Command
- CDC - Event
- CDC - Class Descriptor
- CDC - Class Request
- Firmware - Class Request
- Firmware - Class Descriptor
- HID Class Descriptor
- HID Class Request
- Mass Storage Class Request
- MTP - Class Req.
- MTP - Command
- MTP - Data/Resp.
- MTP - Event
- PPP - Ethernet Receive
- PPP - Ethernet Send
- SCSI- MMC4 - Bulk Only
- SCSI - MMC4 - CBI
- SCSI - RBC - CBI
- SCSI - SBC - Bulk Only
- SCSI - SBC - CBI
- SCSI - SPC2- CBI
- SCSI - SPC3 - Bulk Only
- SCSI - SPC3 - CBI
- SCSI - SSC - Bulk Only
- SCSI - SSC - CBI
- Still Image (Cmd.Data. Resp)
- Still Image Class Req.
- Still Image Command
- Still Image Data/Response
- Still Image Event
- USBTMC - Command
- USBTMC - Response
- USBTMC - Event
- Video - Cameras Terminal - Class Req.
- Video - Video Streaming - Class Req.
- Video - Descriptor
- Video - Event
- Video Payload Descriptor
- Video Payload
- Video Processing Units - Class Request
- Video Selector Units - Class Req.
- Video Transport
- Video - Video Control Interface - Class Req.
- WUSB - DWA - Descriptor
- WUSB - HWA - Descriptor
- WUSB - HWA - DWA Request

Support of future protocol decodes is planned.

User Defined Decodes

An Advanced Script Language (ASL) extension of the Upper Level Protocol decodes allows the user to define custom upper level protocol decodes beyond those provided with the product. With the ASL the user can create custom scripts to extract and interpret arbitrary data from the USB stream. Interpretation includes any class or vendor specific requests and descriptors, protocols and any structured data transferred over the USB. Additionally the ASL allows the user to complement the pre-defined protocols to satisfy more specific custom requirements.

Post Processing Utilities

Search Utilities

The search utility offers you the capability to:

- Search for any bus transaction
- Search for any packet
- Search for any bus condition
- Search in any direction from start, end or X, Y or Trigger cursors in the viewer

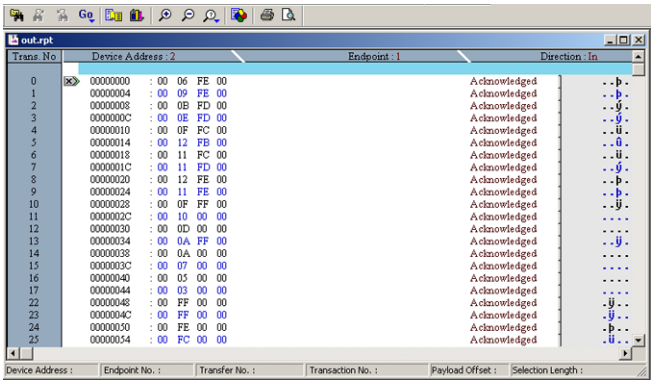
Packet Viewer Filtering

The packet viewer filter may be used to exclude user defined from the display. The filter excludes:

- Specific packets
- Specific transactions
- Specific bus events
- Specific fields

Data Report

Captured data may be displayed as a report of all of the captured data, data for selected devices or just selected lines.



Mnemonics

Up to 8 mnemonics can be defined and assigned to 8 different packets and then saved as a file. An unlimited number of mnemonics files may be defined and saved for recall and use in various applications.

Mnemonics may be used to:

- To locate and indicate certain packets in the viewer by their names
- Search for pre-defined patterns
- Filter the results in the packet viewer

Host Exerciser (Optional)

The *Conquest Series, USB* is capable of exercising a USB device as a host in 2 modes of operation, Easy and Advanced.

Easy mode is designed to provide point-and-click access to utilities which perform bus exercising and device interrogation applications such as reading the device descriptor with no requirement for programming.

Advanced mode is designed to allow users to set up a series of USB commands in a program to meet their special needs. A copy and paste feature allows the rapid creation of a powerful Host Exerciser program from a captured data file.

Easy Host Exerciser Program

There are many utilities provided to help users easily detect, configure and communicate with a device without requiring any setup.

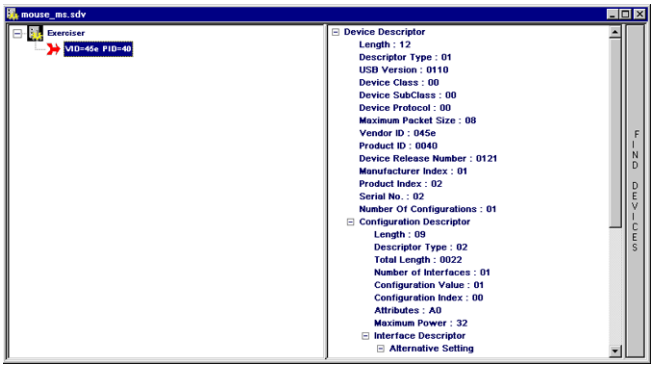
Easy Host Exerciser commands

Pre-defined commands allow immediate exercising of High/ Full/Low speed devices including hubs. The following is a sample of these commands.

- Get Configuration Descriptor
- Get Device Descriptor
- Get Interface
- Get Device Status
- Set Device Address
- Set Configuration

Scan Descriptors

The “View Scan Descriptor” utility displays detailed descriptor information about connected devices enumerating all devices at all speeds in tree form.



Advanced Host Exerciser Program

Proprietary Engine

- Generates Bus Reset, Suspend and Resume
- Generates Control and Bulk Transfers
- Generates Complete Split and Ping Transactions
- Generates Complete Asynchronous and Isochronous Transactions (In, Out and Setup)
- Inserts Bus Idle and SOF
- Allows infinite looping or finite loop of program or selected program segment
- Generates user defined bit streams on the USB bus, allowing traffic with error conditions
- All the above operations may be performed on the convenient GUI

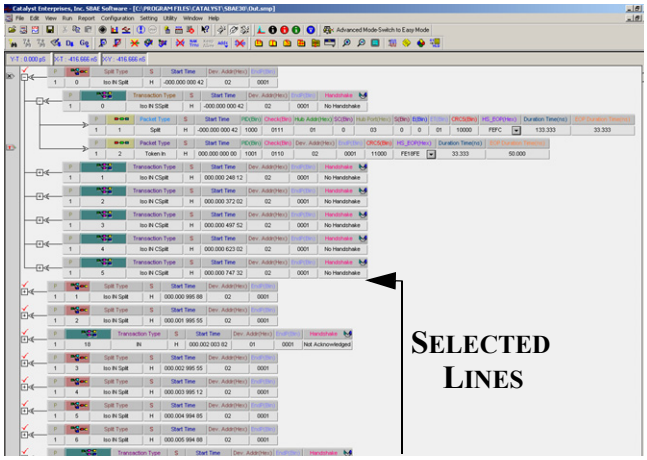
Pre-Defined Host Commands

- Start of Frame
- Split Setup Transaction
- Split Bulk In Transaction
- Split Bulk Out Transaction
- Split Iso In Transaction
- Split Iso Out Transaction
- Split Interrupt In Transaction
- Split Interrupt Out Transaction
- Ping Transaction
- Setup
- Isochronous In Transaction
- Asynchronous In Transaction
- Isochronous Out Transaction
- Asynchronous Out Transaction
- Setup with Preamble Transaction
- Asynchronous In with Preamble Transaction
- Asynchronous Out with Preamble Transaction

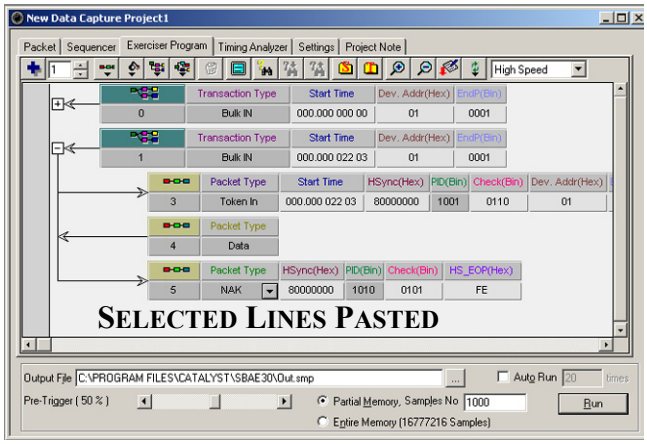
Host Exerciser (Optional)

Exerciser Programming Shortcut

A copy and paste feature allows the user to create an exerciser program from a successful analysis result.



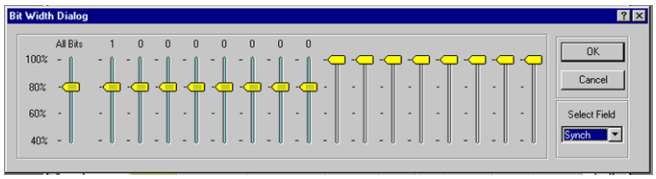
The user simply selects and copies a number of lines from the results display and pastes them into an Exerciser Program window. Only program lines are pasted with non applicable lines such as protocol errors filtered out.



Data may also be imported from a saved capture file.

Adjustable Bit Width (Full/Low speed only)

Adjustable bit width of 40, 60, 80, and 100% allows users to modify the width of the packet fields.



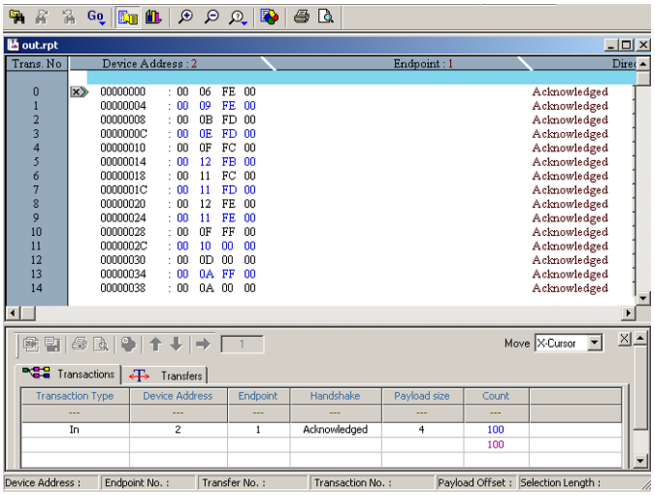
Transaction Retry

All transactions except Iso are selectable for automatic retry in response to data transfer failure. Options are available to specify the number of retries for NAK'd and failed transactions.

Extensive Statistical Report

An extensive Statistical Report may be generated for a data capture appearing in the Sample Viewer.

The Statistical Report may be generated for all samples, between user set cursors or between user designated packets.



External Signals

- External signals are used for digital pattern generation or controlling other peripherals. At each state of the sequencer user may define a unique pattern to be outputted
- External trigger input may be set to rising, falling, high or low levels for triggering the *Conquest Series, USB* from another source

Specifications

Analyzer

General

Bus Type	USB 1.x and USB 2.0 High, Full, and Low Speed
Maximum Transfer rate	480Mb/s
Analyzer memory depth Chan. 1	192 MB
Triggering	Real time hardware based in Sequencer program, Manual push button Trigger or External Trigger input

Packet Recognizer

Packet Recognizer	8 packet events maximum
Depth of packet events	1024 bytes maximum
Pre-defined packet events	All PIDs defined by USB 2.0

Sequencer

Sequencer Expressions	Using boolean operators (AND, OR, NOT) with 8 packet events, 11 bus events, and 13 Protocol Errors
Sequencer States	32 States, with Actions, Commands, Conditional Actions, and Conditional Jumps defined for each State
State Actions	Trigger, start Host Exerciser (State0 only), or output External I/O bit pattern
State Commands	Capture All, None, or Sequencer Expression
State Conditional Statements	10 per State in a form of If and Else If satisfying a Sequencer Expression, with Conditional Actions and Conditional Jumps per Conditional Statement
State Conditional Actions	Tag event for discard, or Discard tagged Events
State Conditional Jumps	To any State
Timers	Two 32-bit timers
Counters	Two 18-bit counters

Time-Tag

Width	40 bits for every eight bits of bus traffic
Recording Resolution	16.67ns (60MHz)
Recording Duration	Approx. 5 hours
Time Display	Event start time relative to Trigger point, duration times of packets/events, EOPs, and idle between packets/events in seconds or bits

Host Exerciser

Bus Type	USB 1.x and USB 2.0 High, Full, and Low Speed
Host Exerciser Memory	1MB physical dedicated to Host Exerciser, unlimited virtual with infinite looping
Program Loops Selection	All or selected segments
Program Loops Count	Infinite looping or 2 - 255 iterations
Packet Generation	All PIDs defined by USB and user defined
Event Generation	Reset, Chirp, Suspend, and Resume
User configurable event settings	All packet fields, start times, enable/disable bit-stuffing, enable/disable EOP, adjustable bit width
Adjustable Bit Width	40, 60, 80, 100% of Full/ Low speed packets

External I/O

External Trigger Input	1 input configured to trigger analyzer on rising or falling edge, or high or low levels
External Outputs	6 bit pattern set at each Sequencer State
Display Scale	Relative (adjust to largest value), Logarithmic (based on natural log of Counter and Timer values), Manual Absolute (user settable value), Auto Absolute (adjust to largest per 100 Time Intervals)

Specifications

Physical

Front Connections

Main Analyzer	USB type Std-A and Std-B
External Outputs and Trigger Input	Keyed 16-Pin
Host Exerciser	USB type Std-A

Status LEDs

Power, Triggered

Buttons

Manual Trigger Push button

Rear Connections

AC Power	Standard 3-prong
USB Host Interface	USB type
Ethernet Host Interface	Ethernet RJ45 connector

Power Supply

AC Power	(100-120V)/(200-240V) AC, 47-63Hz
Power Consumption	30W typical

Physical Characteristics

Dimensions	8.75”(22.2 cm) W x 2.9”(7.4 cm) H x 10.8”(27.5 cm) D
Weight	3Lbs (1.4Kg)
Operating Temperature	32 - 95°F(0 - 35°C)

System Requirements

Processor	Intel Pentium III 500MHz, or equivalent
Memory	128MB
Display	1024x768 resolution, 16 bit color
Operating System	Windows 2000, Windows XP
Hard Drive	100MB space on partition with SBAE software, 10MB space on Windows partition.

Ordering Information

Standard - *Conquest Series, USB*

Includes:

- Easy Mode Analyzer
- High Speed, Full Speed, and Low speed
- Upper Level Protocol Decodes
- Extensive Statistical Report
- Ultimate Graphical User Interface
- Ethernet or USB 2.0 Control Interface
- Field upgradable FPGA design
- Free lifetime software upgrades
- Free Technical Suppor

Optional:

- Advanced Mode Analyzer
- Exerciser

Note: Specifications subject to change without notice.

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