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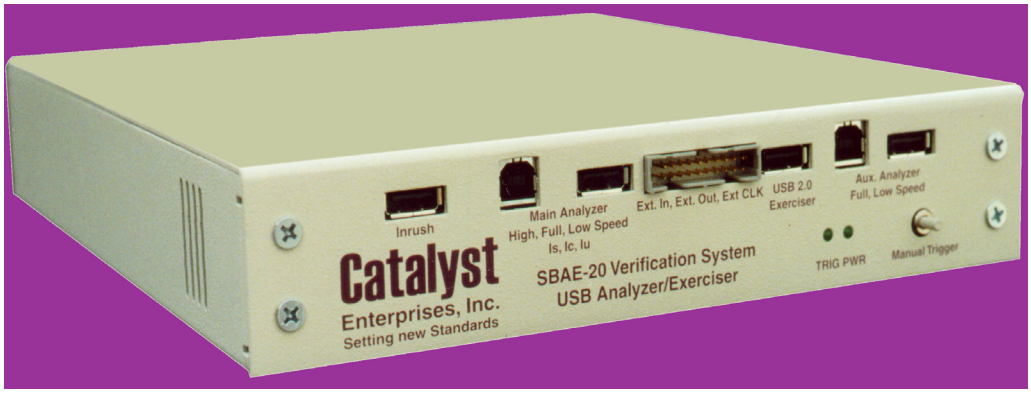
Find the *Teledyne / LeCroy / Catalyst SBAE-20* at our website: ***Click HERE***

Catalyst
Enterprises, Inc.
Setting new Standards

SBAE-20

February 6, 2001

USB 2.0 Analyzer/Exerciser/Tester



- **High-speed, Full-speed and Low-speed Analyzer**
- **High-speed, Full-speed and Low-speed Exerciser as Host**
- **Proprietary built-in repeater interface to prevent signal distortion**
- **Compliance testing for Inrush, Suspend, Configured and UN-Configured current**
- **Up to 480 M Bit/Sec real-time continuous Performance Analyzer**
- **Interactive "Linked" Exerciser analyzer operation in high-speed, full-speed and low-speed**
- **Adjustable data out for timing characterization for full & low speeds (40%, 60%, 80%)**
- **External clock input for low & full speeds**
- **Ultimate GUI interface optimized to enhance product development**
- **FPGA design automatically upgrades the product features with each software update**
- **Options (Exerciser, Inrush measurement) may be upgraded in the field**

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SBAE-20

HIGH PERFORMANCE

SBAE-20 is a USB 2.0 serial bus analyzer capable of analyzing and exercising data transfers of up to 480 M Bit/Sec. SBAE-20 detects the bus speed and analyzes the protocol accordingly.

NON-INTRUSIVE

A Proprietary repeater circuitry is design in as an interface to the analyzer to prevent signal distortion when the analyzer is introduced between the host and the device to analyze high speed protocols.

TESTING USB HUB

The auxiliary connectors for device and host on the SBAE allow for testing USB Hub input and output. These two auxiliary ports can also be used as a second channel (Full-speed and Low-speed only) for the analyzer.

PACKET RECOGNIZER

Eight user defined packets, including all USB protocol fields, are available to define patterns for capture and triggering.

SEQUENCER

A flexible 32-state sequencer allows users to define a sequence of actions to be performed by the hardware depending on the events and packets on the USB bus.

INTERACTIVE ANALYZER/EXERCISER

The Analysis and Exercising actions may be defined in the Sequencer to be conditional based on events on the bus.

PERFORMANCE ANALYSIS

Six counters and for timers to measure items as throughput of bus, efficiency of a device, bus usage by a device, data rate etc.

PROTOCOL ERROR DETECTION

SBAE-20 detects up to 12 protocol errors simultaneously with sampling.

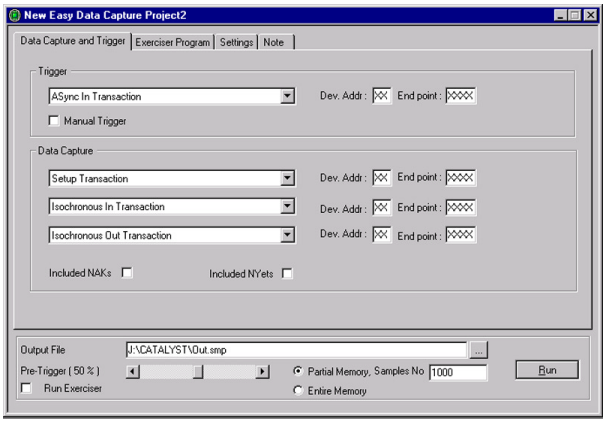
INRUSH CURRENT MEASUREMENT

The SBAE-20 samples inrush current for the initial 10 milliseconds with 0.2 µSec resolution. This measurement is then displayed on the screen with a pass/fail report.

SUSPEND, OPERATING AND UN-CONFIGURED CURRENT MEASUREMENT

SBAE-20 measures these currents with resolution of 2.7 mA for operating and un-configured current and 2.7 uA for suspend current.

Easy Mode Pre-Defined)

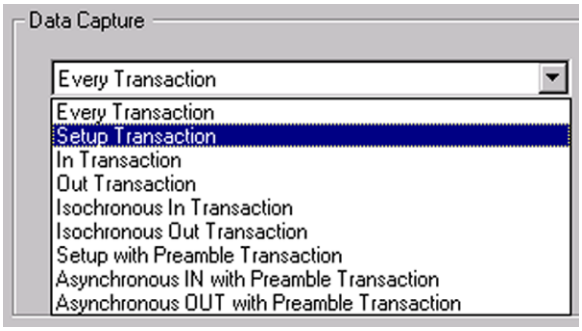


DATA CAPTURE & TRIGGER

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

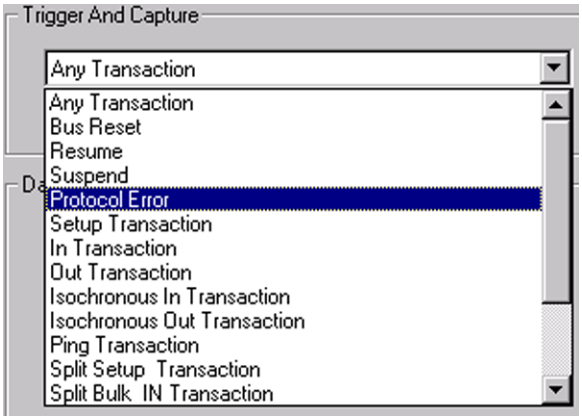
A comprehensive selection of predefined setups allow capturing of all cycles on variety of trigger selection for or just capturing different packets of the transactions. The data to capture or to trigger on may be further identified by the address and end points as well.

DATA CAPTURE SELECTIONS (HIGH SPEED)



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TRIGGER SELECTIONS (HIGH SPEED)



PRE-DEFINED DATA CAPTURE CHOICES (FULL/LOW SPEED)

- Capture Every transaction.
- Capture Setup transaction at specified address and end point.
- Capture IN transaction at specified address and end point.
- Capture Out transaction at specified address and end point.
- Capture Isochronous In transaction at specified address and end point.
- Capture Isochronous Out transaction at specified address and end point.
- Capture Setup with Preamble transaction at specified address and end point.
- Capture Asynchronous In at specified address and end point.
- Capture Asynchronous Out at specified address and end point.

EASY EXERCISER PROGRAM

This utility helps the users to easily communicate with a device without requiring more information about protocol of USB bus.

EASY EXERCISER COMMANDS FULL/LOW SPEED

- Get Configuration descriptor
- Get Device descriptor
- Get Interface
- Get Device status
- Get Device address
- Set configuration
- Clear Hub Feature
- Clear Port Feature
- Get Class Descriptor
- Get Hub Status
- Set Hub Feature
- Set Port Feature
- Clear TT Buffer
- Reset TT
- Get TT Status
- Stop TT

PRE-DEFINED TRIGGER CHOICES (FULL/LOW SPEED)

- Trigger on Any transaction.
- Trigger on Bus Reset
- Trigger on Resume.
- Trigger on Suspend.
- Trigger on Protocol Error.
- Trigger on Setup transaction.
- Trigger on In transaction.
- Trigger on Out 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.

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Advanced Mode (User Setup) For Debugging More Complex Problems.

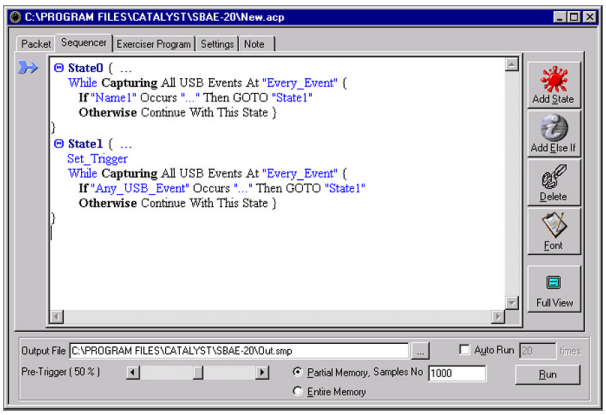
Users may define up to eight packets, covering all USB defined packet types, for data capturing and triggering.

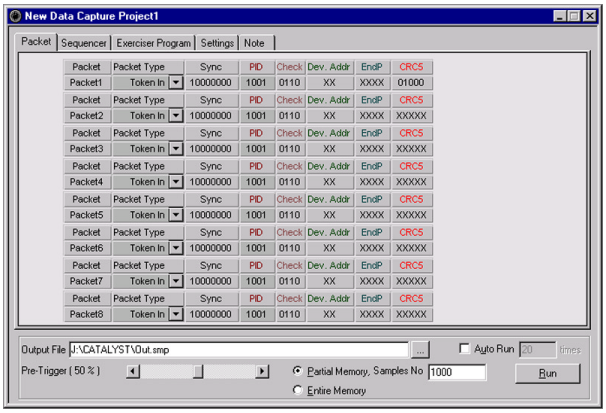
An up to 32 level state capture and trigger sequence may be defined in the Sequencer. At each state the user may define what to capture and where to jump next depending on the occurrence of a packet, event and/or a Boolean expression of packets and events or packet errors.

This mode is intended for use for applications not covered by the pre-defined setups in Data Capture & Trigger mode.

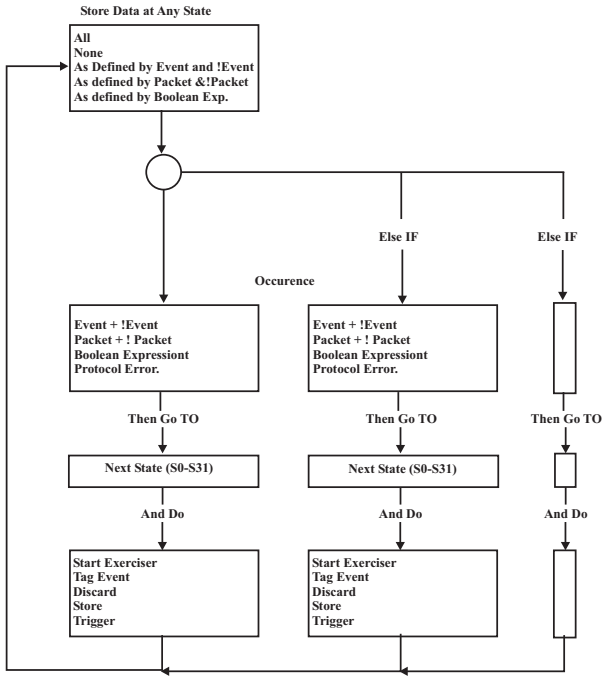
The advanced mode requires Event, Sequencer and Program files (for exerciser mode) to be defined by users.

Some samples of the Events and Sequencer features are listed below.





Packet Definition Dialog



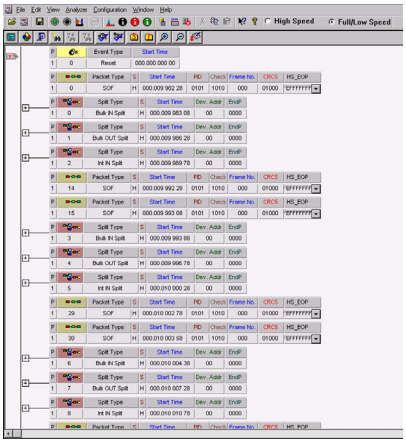
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SBAE-20

DISPLAY CAPABILITY

- List of all the transactions, packets or bus events captured.



- Ability of filter in or filter out any packet type.
- Ability of hide or unhide the columns fields.
- Ability to change the color of the different fields in the viewer.
- Two cursor on the viewer with their position.
- Zoom in and zoom out capabilities.

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 different points in the viewer.
- Search on a Boolean expression of different search condition.

PACKET FILTERING

The packet viewer may be used to filter in or out the data:

- Filter specific packets.
- Filter specific transactions.
- Filter specific bus events.
- Filter specific fields.
- Filter Specific error on the bus or packets.

MNEMONICS

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

Mnemonics may be used for:

- Locating and indicating certain packets in the viewer by their names.
- Search for pre-defined patterns.
- Filtering in the packet viewer.

PROTOCOL ERRORS

The SBAE-20 monitors and captures several different protocol errors automatically whenever a data capture occurs. User may enable all or any of the protocol errors to initiate a trigger by using a protocol error mask.

ERR0: Bad Stuff Bit (not for High-Speed devices).

ERR1: PID Error.

ERR2: Unknown PID.

ERR3: Sync Error (not for High-Speed devices)

ERR4: Bad CRC 5.

ERR5: Bad CRC 16.

ERR6: Frame Length Violation.

ERR7: Babble.

ERR8: Data toggle violation.

ERR9: EOP Error.

ERR10: Loss of Activity.

ERR11: Time Out or Turnaround Violation.

EXTERNAL SIGNALS

8 external signals are used for 60 MHz digital pattern generation.

2 external trigger inputs available.

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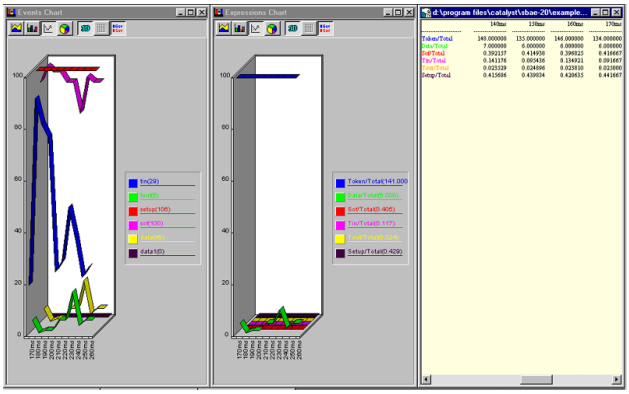
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SBAE-20

Continuous Real Time Performance Analysis

The SBAE-20 real time Performance Analyzer uses dual port FIFOs to interface between the Counters/Timer and the host system. This allows true real time measurements and provides the users with a complete and accurate event count and time measurement up to 480 M Bits/Sec.

- 6 x 24-bit event counters for packets or events defined by the user.
- 4 x 32-bit event timer for packet or event defined by the user.
- Users may use the provided setups to measure the most typical parameters or design their own.
- Report interval selectable from 500 µsec to 10 minutes.
- Eight color display
- Record the analysis in graphical format for later review or demonstration without requiring the hardware.
- Performance Analysis can work simultaneously with the exerciser to generate traffic and measure the target performance



Performance Analysis Results Display

Exerciser

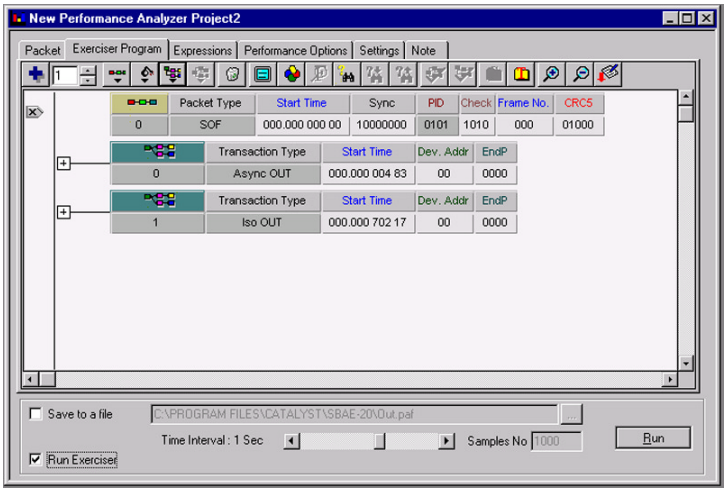
The 480, 12 and 1.5 M Bits/Sec exerciser operates as a host to communicate with any device on the Bus.

Proprietary Engine

- Emulates Bus Reset.
- Emulates complete split and ping transactions.
- Emulates Complete asynchronous and isochronous transactions (In, Out and Setup).
- Insert Bus Idle and SOF.
- Allows infinite looping on different test programs.
- Allows conditional start of the exerciser in the Sequencer.
- Generated user defined bit streams on the USB bus, allowing traffic with error conditions.
- All the above operations may be performed by 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



Exerciser Programming Window

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Current Measurement

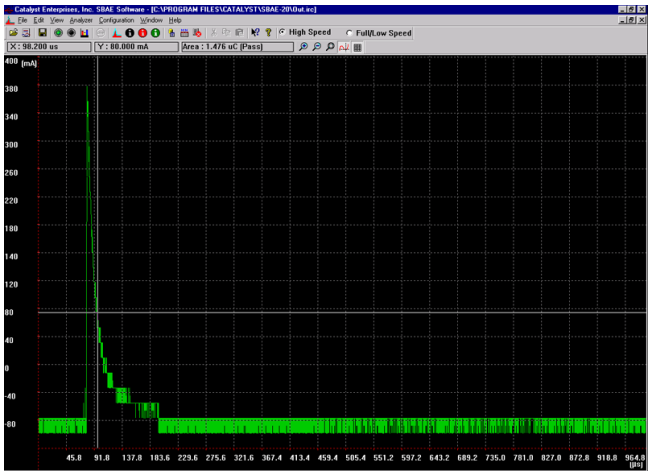
The SBAE-20 incorporates Inrush, Suspend, Un-Configured, Configured and Operating current measurement. The current of the device is measured, calculated and reported to be a Pass or a Fail according to USB-IF workshop procedures.

INRUSH CURRENT

The Inrush current measurement circuit has an automatic discharge for the device for each measurement to assure that repeatable and accurate measurements are performed according to the specifications. The source of power to the device is provided from within the SBAE-20 to eliminate the unknown from the external source and to eliminate the inductance due to the length of cable being used.

The Inrush current is measured with resolution of 20 mA for current up to 5 Amps peak or resolution of 40 mA for current up to 10 Amps peak with a 5 MHz sampling resolution.

The measured Inrush current is digitized, stored and the energy calculated for the area under the curve and displayed for the first 10 milliseconds of a device attachment. The Pass/Fail is reported based on the USB-IF specifications.

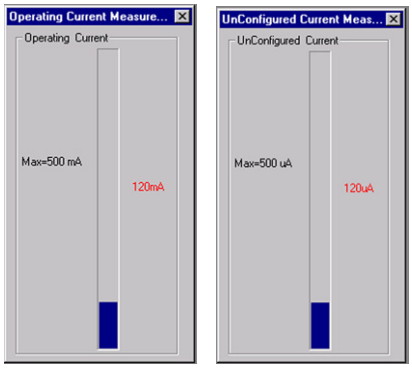


The inrush current viewer has the follow features:

- Zoom in and zoom out.
- Best Fit of the curve in the display window.
- Cursor movement on the curve with display value.
- X and Y scaling.

OPERATING & UN-CONFIGURED CURRENT

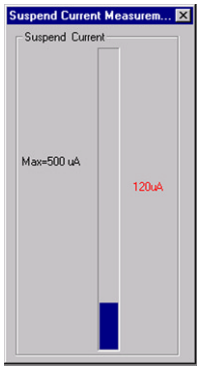
Configured and Un-Configured current are measured with a resolution of 2.7mA up to 700mA. The Pass/Fail result is recorded and reported in the display.



SUSPEND CURRENT

The suspend current is measured with a resolution of 2.7uA up to 700uA.

The Pass/Fail result is recorded and reported in the display.



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Specifications

ANALYZER

Bus Type	USB1.0 and USB 2.0
Bus Width	1
Maximum Transaction Rate	480 M Bit/Sec
External Outputs	8
External Inputs	2
Maximum memory Depth per Channel	128 M Byte
Time-Tag	(40-bit time tag for every sixteen samples)
Word Recognizer	8
Trigger Event	Any of the 8 defined packets, Boolean expression of them, 4 Bus States, Packet Error and 2 external inputs and a manual trigger
Event Counter Width	24
Event Interval Measurement	
Width and Resolution	32 / 60MHz
32 Level Sequencer	Supported at each level by Store, Set Trigger, Set Tag, Discard, If, Else IF and Start Exerciser.
Counter Use	Count accumulative. Count more than Count less than

TIME TAG

Counter	40 bits
Recording Duration	Up to 5 hours at 16.6 ns
Reported Display	Absolute time from start, relative to Trigger point, relative to each packet sampled

PERFORMANCE ANALYSIS

Event Counter	6 x 24 bits counter
Event Interval	8 x 32 bits timer
Count Mode	Reset and accumulative
Measurement reports	Normalized to largest per interval or reset to zero
Output report	Bar graph, Pie chart and histogram.
Display Mode	Color 2D and 3D
Host CPU interface	Real time FIFOs

UTILITIES

Search	On Packet, Transaction and Event, forward and backward
Filter	Filter in and out the packets, transactions and events in the viewer and save the result.
Report	Report on sampled data on: ▪ Protocol Errors ▪ Asynchronous Transactions ▪ Synchronous transactions ▪ Setup transactions ▪ Split transactions ▪ Preamble transactions ▪ Packet count ▪ Bus Events and timing

EXERCISER

Bus width	1
Max. Transaction Rate	480 M Bit/Sec
Bus speed	High, Full and Low
Link	To the analyzer, start in a defined state.
Mode	Host

DATA BLOCK GENERATION

- Data Block Generation with user defined pattern.
- Data Block Generation with Walking bit.
- Data Block Generation with Random Pattern.
- 1, 2, 4, 8, 16 and 32 bytes wide.
- Up to 1024-byte depth.
- Easily generated in GUI interface.

CURRENT MEASUREMENT

Inrush	200 ns sampling resolution, 20mA resolution 5 Amps peak or 40mA resolution and 10 Amps peak.
Operating/Un-Configured	2.7mA resolution, 700mA maximum.
Suspend	2.7uA resolution, 700uA maximum.

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