

SAS MASTER™ SATA MASTER™

SAS/SATA Analyzer/Exerciser

SATA, Advanced SATA, SAS



1.5 & 3.0 Gbps Support

Supports up to 4 Ports

Programmable Intelligent Packet Capture and Triggering

User-Defined Triggering and Real-Time Filtering

Snapshot, External or Manual Trigger Options

Protocol Error Detection in Different Protocol Layers

Dual-Mode User Interface

Device/Target Emulation with Error Injection

Host/Initiator Emulator with Error Injection

Fast Search and Filtering of Captured Samples

Performance Monitor and Statistics

Network Enabled 10/100 Ethernet Host Interface

USB 2.0 High Speed Host Interface

COM API Interface

Field Upgradable FPGA Design

Free Lifetime Software Upgrades

Free Technical Support

CATALYST
ENTERPRISES INC.

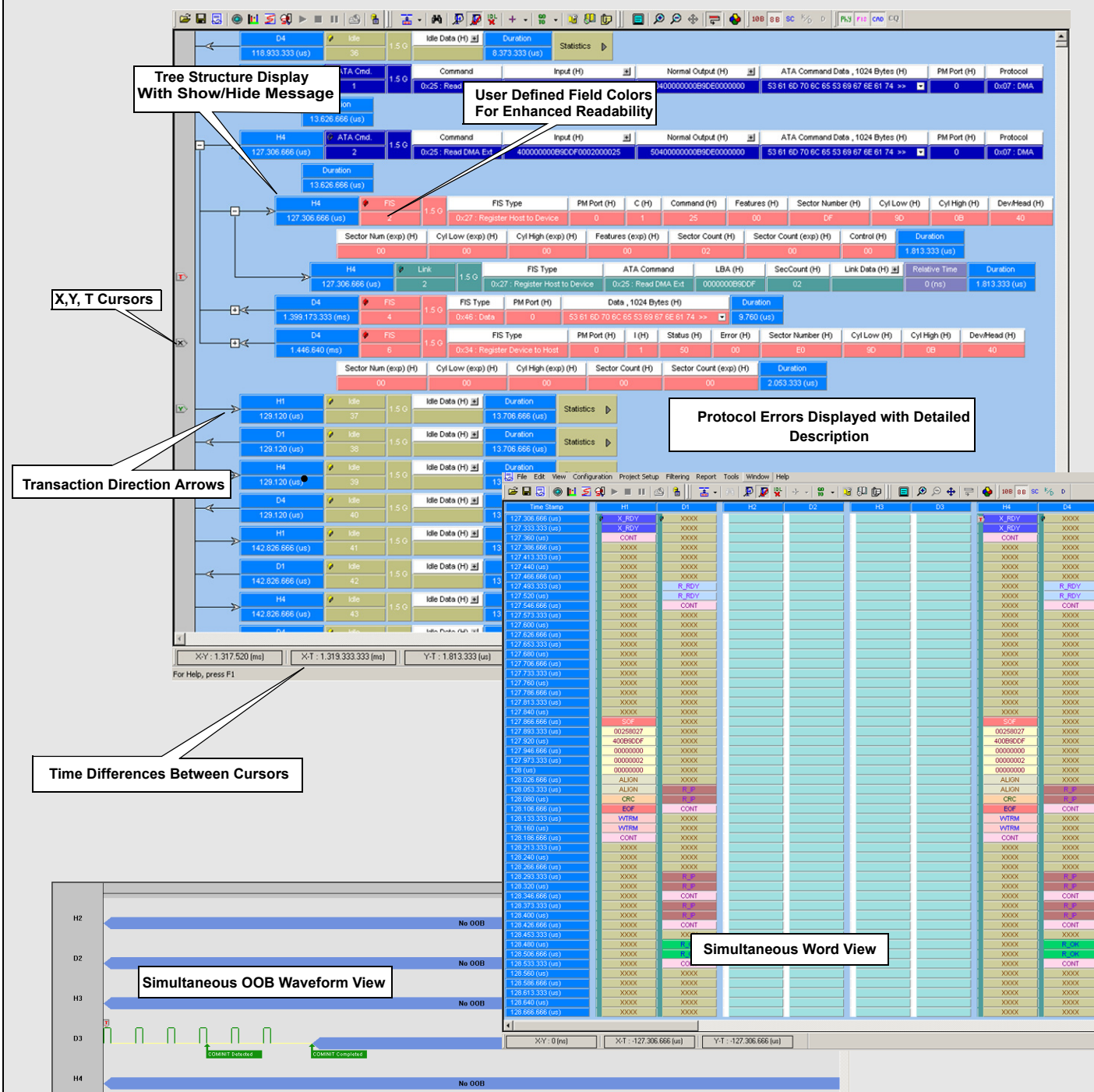
www.getcatalyst.com

PCI, PCI-X, PCI Express, USB

SAS, SATA, Fibre Channel

Certified Wireless USB

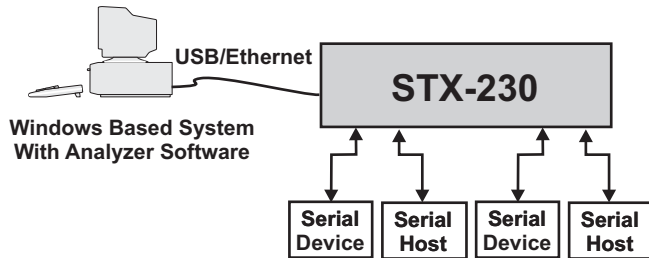
Ultimate Graphical User Interface



Example of SATA Data Capture

HIGH PERFORMANCE ANALYZER

The STX Analyzer is a serial bus analyzer that is designed to be the optimal bus analysis tool for a wide range of SATA or SAS applications. A powerful, reconfigurable hardware engine enables flexible capture and trigger of Command Layer, Transport Layer, Link Layer and Physical Layer packets, primitives, and events. Capture and triggering are user definable with a user-friendly and powerful GUI.



STX Analyzer connection

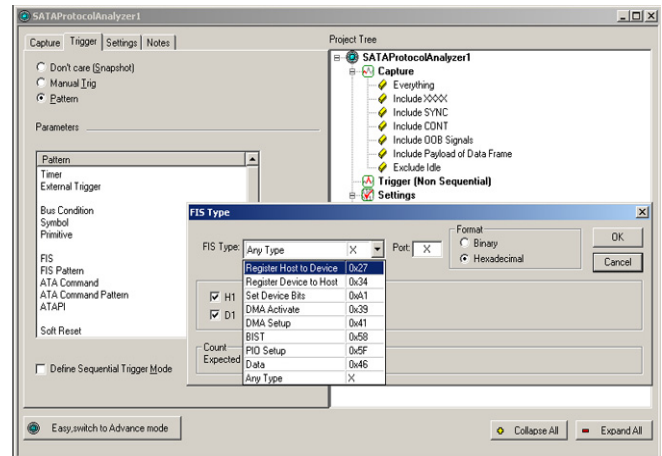
The STX Analyzer is introduced between the SATA/SAS Host and a SATA/SAS Device allowing simultaneous analysis in both directions of information flow.

STX FEATURES:

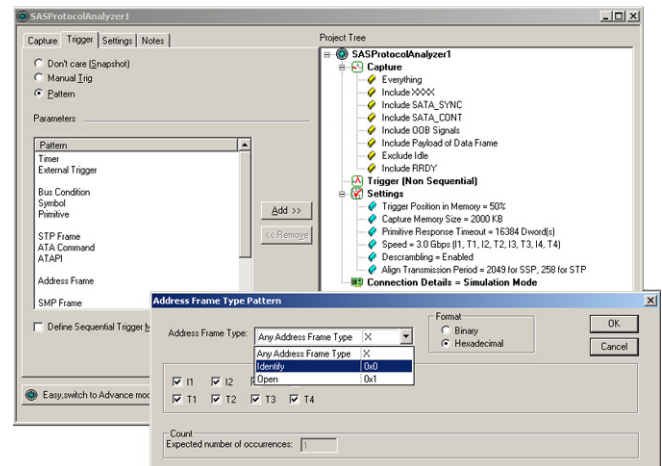
- Easy Mode Data Capture & Trigger
- Advanced Mode Data Capture & Trigger
- Real-Time Filter Selection (Pre-filtering)
- Extensive Pre-Defined Triggering
- Real-Time Protocol Error Checking
- High Capacity Trace Buffer
- Versatile Data Display
- Search Utility
- Packet Viewer Filtering (Post-Capture Filtering)
- Real-Time Performance Analysis
- Statistical Report on Captured Data
- Payload Data Report
- Self Test

EASY MODE DATA CAPTURE & TRIGGER

This interface allows hardware or software oriented SATA/SAS debug without requiring complex programming or special setup of the Analyzer. A comprehensive selection of pre-defined setups is made available for immediate analysis of the most commonly encountered scenarios. A convenient Project Tree display shows a comprehensive of selected capture and trigger choices.



FIS filter/trigger settings, SATA

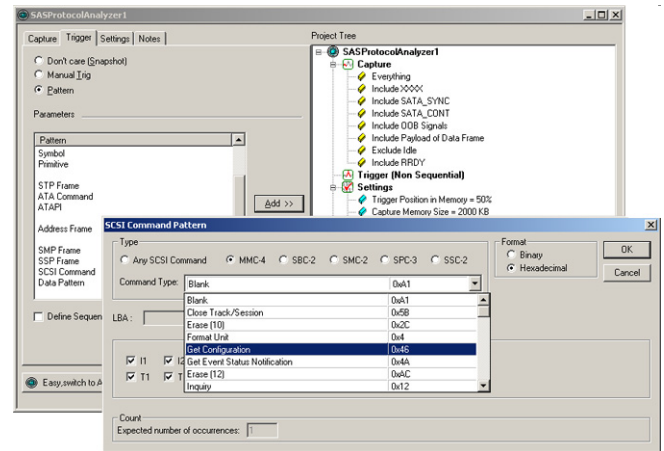


Address frame capture settings, SAS

REAL-TIME FILTER SELECTIONS

The following selections are available as pre-defined capture categories:

- Everything – Do not filter
- Exclude Align – quick exclude
- Exclude Idle – quick exclude (SATA)
- Exclude Notify – quick exclude (SAS)
- Exclude RRDY – quick exclude (SAS)
- Exclude XXXX – quick exclude
- Exclude FIS Data Payload – quick exclude (SATA)
- Exclude Payload of data Frame type – quick exclude (SAS)
- Special Symbols - trigger only
- Primitives
- Bus Conditions and OOB signals
- FIS Types (SATA)
- FIS Patterns (SATA)
- Different Address Frame Types (SAS)
- Different SSP Frame types (SAS)
- Different SMP Frame types (SAS)
- Different STP Frame types (SAS)
- Out of band signals
- Data patterns
- ATA commands
- SCSI commands (SAS)
- Vendor FIS
- Protocol Errors - Enables display of protocol errors



SCSI command trigger settings, SAS

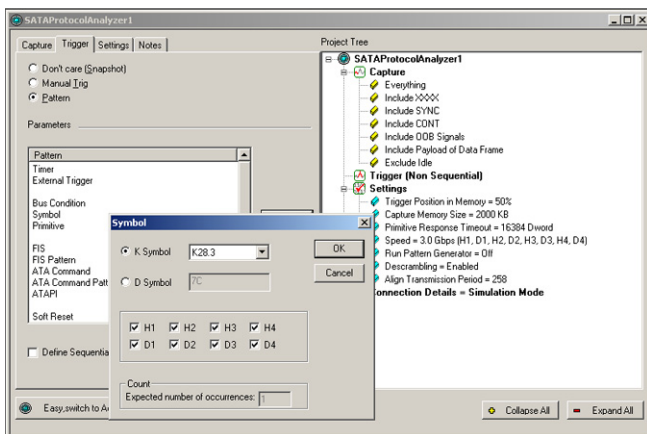
For a more specific data capture, the patterns can have additional parameters applied. Patterns from each category can be specified for Upstream, Downstream or for either direction.

Data filtering and capture may be different prior to a trigger and after a trigger.

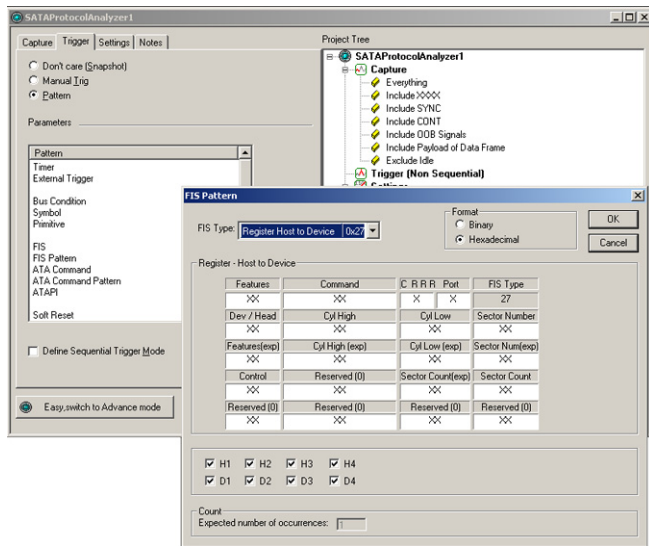
EXTENSIVE TRIGGERING

The STX Series analyzer offers the following pre-defined trigger categories:

- Snapshot – Trigger immediately
- Manual Trigger – External push button
- Timer – Trigger after timer expiration
- External Input – Synchronization with other equipment or any external event
- FIS Type (SATA)
- FIS Pattern (SATA)
- Different Address Frame Types (SAS)
- Different SSP Frame types (SAS)
- Different SMP Frame types (SAS)
- Different STP Frame types (SAS)
- ATA Command
- ATA Command Pattern
- Data Pattern
- Bus Conditions and OOB signals
- Symbol
- SCSI Command (SAS)
- Primitive
- Timer
- Protocol Errors – Trigger on all or any selected protocol errors



Symbol trigger settings, SATA



FIS Pattern trigger setting, SATA

Each of the triggering categories may be further refined for more exact triggering. The user may specify traffic direction, or further qualify a selected trigger point, such as adding a frame field qualifier to a selected command.

A **Sequential Trigger** allows the listed trigger selections to be arranged in a user defined order to define a triggering sequence, or be set to trigger on the occurrence of any selection.

PROTOCOL ERROR CHECKER

STX Series Analyzer hardware monitors, detects and can trigger on different protocol errors in real-time in all layers.

REAL-TIME PROTOCOL ERRORS (SATA)

- Code Violation
- Disparity Error
- ALIGN Error
- FIS Signaling Latency Error
- FIS Invalid State Transition (Unexpected Primitive)
- FIS Invalid State Transition (Primitive Timeout)
- Frame Type Error
- Frame Length Error
- Frame Direction Error
- CRC Error

REAL - TIME PROTOCOL ERRORS (SAS)

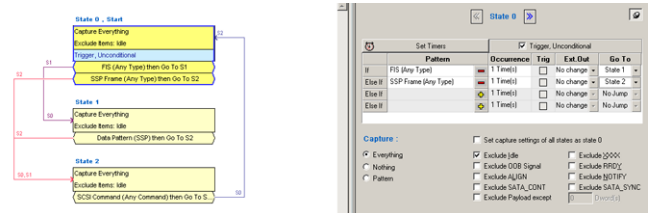
- Symbol Violation
- Running Disparity Error
- Align/Notify Error
- STP Signalling Latency Error
- STP Invalid State Transition (Unexpected Primitive)
- STP Invalid State Transition (Primitive Response Timeout)
- Frame Type Error
- Frame Length Error
- Frame Direction Error
- CRC Error
- SSP ACK/NAK Timeout

HIGH CAPACITY TRACE BUFFER

A high capacity capture buffer allows capture of data over long periods of bus activity. Coupled with the advanced triggering and filtering capability, this allows easy debug of intermittent problems.

ADVANCED MODE TRIGGER & CAPTURE

The Advanced Mode allows custom programming of complex triggering and data capture projects. This mode uses the same state terms provided in the Easy Mode (packets, data, bus events, protocol errors, etc.), but adds the usage of complex logic to precisely control the capture and trigger process. The Advanced Mode provides a 23-level state sequencer, with multiple IF/ELSE-IF conditions per state, including timers, counters, GO-TO paths, and a graphical indication of the user-built sequence.



Advanced Mode Program (SAS)

TARGET EMULATOR

The integrated STX Target Emulator provides a controllable, simulated HDD for purposes of testing and characterizing a SAS or SATA initiator. Bus traffic between the host and the target emulator is routed through the STX analyzer. Various HDD operating parameters and identifying characteristics can be defined by the user. The user can elect to pre-program the target emulator to respond to host transactions with normal or abnormal behavior.

SAS TARGET EMULATOR CAPABILITIES AND CONTROLS

Mode page definition

Error response control for received SSP and SMP commands

Generate error on:

- Data frame
- XFER RDY
- Response frame

R_RDY control

Buffer starvation selection

ALIGN Transmission control

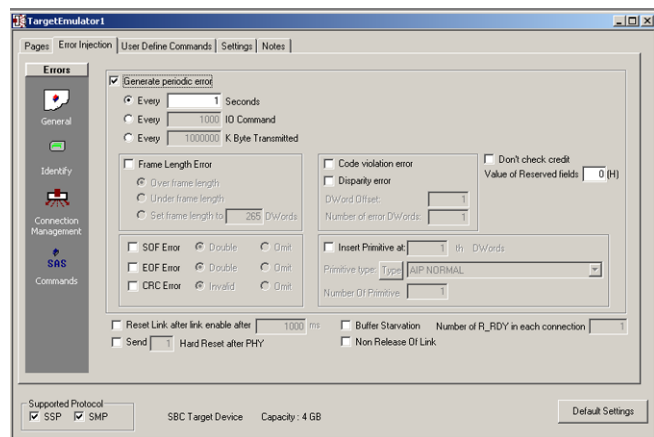
Average access time control

Frame payload size control

LBA Size

SAS TARGET EMULATOR ERROR INJECTION

- CRC errors
- Code violation errors
- EOF errors
- SOF errors
- Disparity errors



Error Injection (SAS)

SATA TARGET EMULATOR CAPABILITIES AND CONTROLS

Definition of drive identity characteristics

Error response control for received SATA commands

Generate error on:

- Data frame
- Register Device-to-Host frame
- Set Device Bits frame
- DMA Activate frame
- DMA Setup frame
- BIST frame
- PIO Setup frame

ALIGN Transmission control

Average access time control

Frame payload size control

Primitive response timeout control

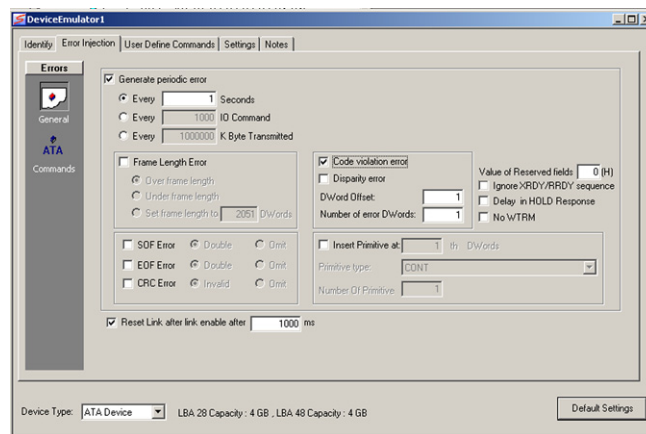
Standby timeout control

Power management accept option

CONT primitive enable/disable

SATA TARGET EMULATOR ERROR INJECTION

- CRC errors
- Code violation errors
- EOF errors
- SOF errors
- Disparity errors



Error Injection SATA

STX HOST EXERCISER

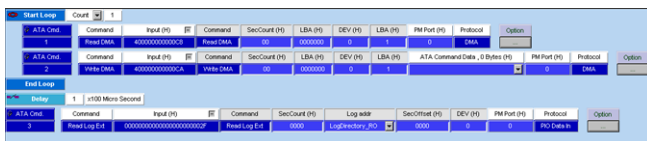
The STX provides an integrated host/initiator emulation (exerciser) capability for both SAS and SATA. Bus traffic between the exerciser and the target device is routed through the analyzer. The user can specify various command, transport, link layer, and PHY primitives for generation. Plenty of conditional logic events are available to control the execution of the exerciser, such as IF, GO-TO, STOP, WAIT, and looping. Traffic sent from the exerciser can be altered with various error injection scenarios.

SATA HOST EXERCISER CAPABILITIES AND CONTROLS:

- PIO IN Commands
- PIO OUT Commands
- DMA Commands
- Other Commands
- OOB Sequences
- Self Test
- Power Management
- Port Reset
- Command Execution Timeout
- Selective transmit of CONT primitives
- Payload size control
- Control of ALIGN primitive transmissions
- Primitive response timeout control
- Retry-on -error

SATA HOST EXERCISER ERROR INJECTION:

- CRC Errors
- SOF Errors
- EOF Errors
- Code violations
- Frame type Errors
- Frame length Errors
- Disparity Errors
- Command header field editing



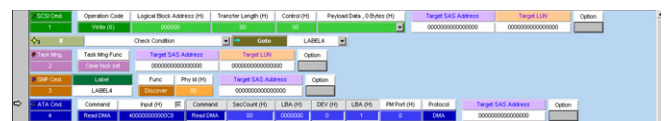
SATA Exerciser Program

SAS HOST EXERCISER CAPABILITIES AND CONTROLS:

- SCSI Commands
 - MMC4, SBC2, SMC2, SPC3, SSC2
- ATA Commands
 - PIO IN, PIO, OUT, DMA, Others
- Task Commands
- SMP Commands
- OOB Sequences
- Command Execution Timeout
- LBA size
- Payload size control
- Frame receive timeout
- First burst size
- Control of ALIGN primitive transmissions
- Connection timeout settings
- Primitive response timeout control
- Retry-on -error
- Definition of task attributes
- Enable/disable first burst
- Affiliation settings
- Rate matching enable/disable

SAS HOST EXERCISER ERROR INJECTION:

- CRC Errors
- SOAF Errors
- EOAF Errors
- Code violations
- Frame type Errors
- Frame length Errors
- Disparity Errors
- Command header field editing

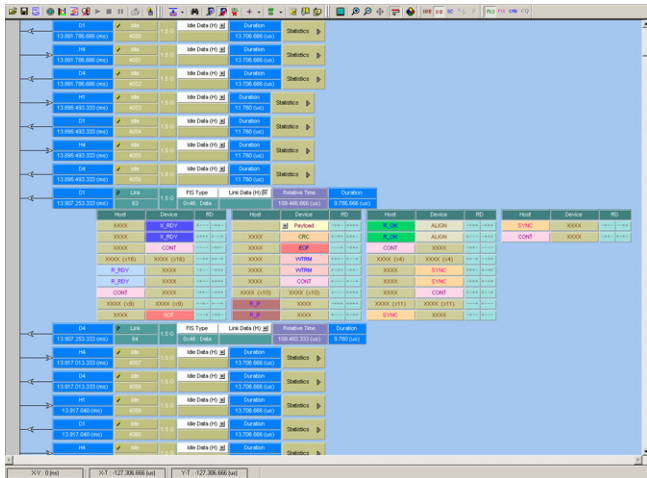


SAS Exerciser Program

DISPLAY CAPABILITY

The Ultimate Graphical User Interface display offers a significant set of features to assist in analyzing captured data. Multi-layer viewer show/hide modes are useful to view traffic for the layer of interest only.

PACKET VIEW



Decoded packet view, SATA

The results window provides for:

- Display of all Commands, Packets, and bus conditions
- Display of interpreted ATA commands in Protocol layer (SATA)
- Display of Interpreted SCSI and ATA commands in Protocol layer (SAS)
- Show/Hide layers capability to simplify results display
- Packet Wrapping to eliminate horizontal display scrolling
- Identification and description of detected Protocol Errors
- Export in Text and Microsoft® Excel Format
- Format of data in Hexadecimal, Binary, or ASCII
- Notes and Bookmarks
- Time calculation services including Packet Start Time, Bus Idle Time, and time between X, Y, Trigger Cursors
- Go to X, Y, Trigger Cursors and Packet Number
- Display zoom to magnify area of interest
- Running disparity indication for all data
- 10 bit encoded payload data display selection
- Scrambled or unscrambled payload data display selection

Host	Device	RD	S
03ca8027	ALIGN	→←→←→←→←	
e009736	Symbol: D3 0 D10 6 D0 4 D7 1	→←→←→←→←	
0309736	10nBits: 0x758CB695A	→←→←→←→←	
0000000	Scramble: 0xC118F6AA	→←→←→←→←	

Payload data description, SATA

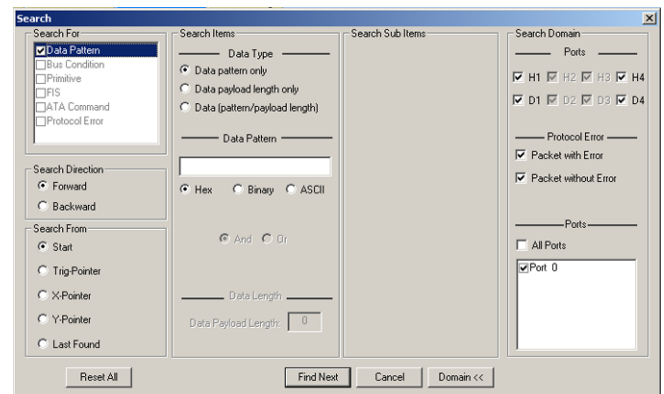
POST PROCESSING DISPLAY SERVICES

The STX Series incorporates efficient software algorithms to provide for expedient results for Search and Filtering of the data regardless of selected capture buffer size.

SEARCH UTILITY

The Packet View search utility offers you the capability to:

- Search for Data Pattern
- Search for Bus Condition
- Search for Primitive
- Search for ATA Command
- Search for Protocol Error
- Select search domain as Host to Device, Device to Host. (SATA)
- Select search domain as Initiator to Target, Target to Initiator (SAS)
- Search for FIS (SATA)
- Search for Address frames (SAS)
- Search for SSP frames (SAS)
- Search for SMP frames (SAS)
- Search for STP frames (SAS)
- Search for SCSI commands (SAS)
- Search for SMP commands (SAS)
- Search for Task management functions (SAS)
- Search from start, end, last found, X, Y or Trigger cursors in the viewer



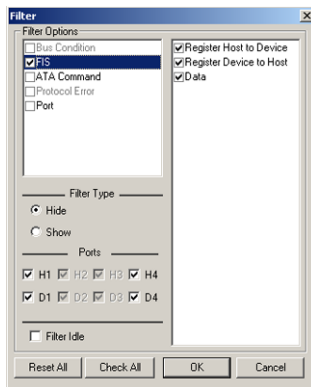
Search utility, SATA

PACKET VIEWER FILTERING

The filter may be set up to exclude unwanted items from the display. Quick Filter of Frame, ATA/SCSI Command and Idles is available by corresponding selection buttons.

The post-capture filter is used to either show or hide user-selected events, such as frame types, Idles, ATA/SCSI Commands etc. Once filtering is set, the user can elect to save either the entire capture, or just those elements of the capture that remain in the display (after filtering is set).

FILTER SELECTIONS



Filter Setup, SATA

The filter selects for exclusion/inclusion:

- Bus Condition
- FIS
- ATA Command
- Protocol Error
- Port
- Idle
- Address frames (SAS)
- SSP frames (SAS)
- SMP frames (SAS)
- STP frames (SAS)
- SCSI commands (SAS)
- SMP commands (SAS)
- Task management functions (SAS)
- Source SAS address (SAS)
- Destination SAS Address (SAS)

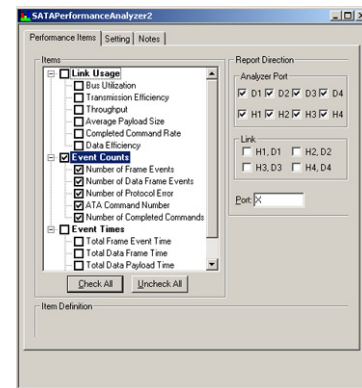
Filtering direction is selectable to limit Host/Initiator to Device/Target or Device/Target to Host/Initiator only.

A convenient button allows quick toggles between a filtered and unfiltered display.

PERFORMANCE ANALYZER

The performance analyzer measures:

- Bus Utilization
- Transmission Efficiency
- Data Efficiency
- Throughput
- Average Payload Size
- Data Efficiency
- Idle Time
- Time and Number of FIS(s)
- Time and Number of Command(s)
- Time and Number of Commands In
- Time and Number of Commands Out
- Time and Number of Commands Other
- Payload Time of Data FIS
- Number of Protocol Errors



Performance analyzer (SATA)

STATISTICAL REPORT

A complete statistical report for captured data is generated for:

- Sequence.
- Frame
- Command
- Protocol Error
- Performance (Bus Utilization Time, Efficiency %, Total Read DWords, Total Write DWords, Total Write duration, Total Read Duration and Average byte/frame)
- Sample Time, Idle Time, Idle Number and Total Payload Size.

The statistical report is available for all samples captured, user-defined range between settable cursors, or specified events, and generally includes accumulative duration time, number of occurrences, count and % of total count.

DATA REPORT

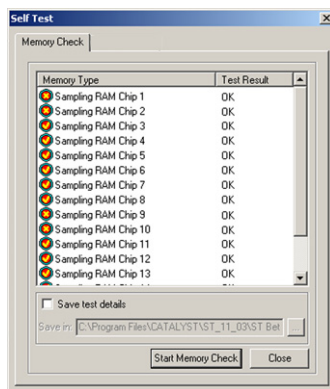
Single-click access to display a data report.

Device	Start Time	Port (H)	Command Protocol
2	13.853 (us)	0	PIO Data In
0000 : 66 77 78 D0 44 55 77 66 33 43			
000A : 54 65 56 33 55 77 32 33 44 54			
0014 : 00 10 00 30 09 07 86 40 04 D5			
0018 : C6 01 10 82 99 60 40 30 20 10			
0028 : 60 50 40 30 66 77 78 D0 44 55			
0032 : 77 66 33 43 54 65 56 33 55 77			
003C : 32 33 44 54 00 10 00 30 09 07			

SELF TEST

MEMORY CHECK

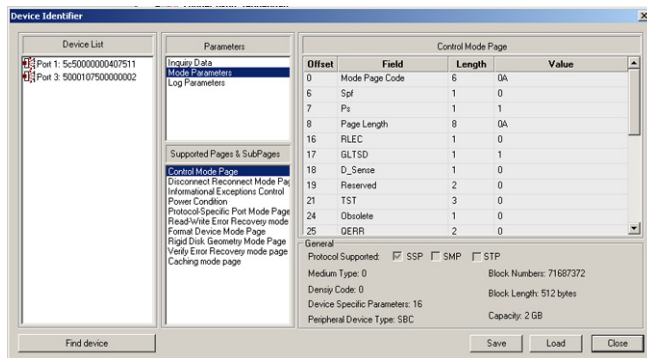
A memory check utility allows the verification of proper memory operation



Memory Check Result, SATA

FIND DEVICE

The Find Device feature provides a one-click inspection of an attached drive's mode page information, addressing, and other supported parameters.



Find Device Display (SAS)

SPECIFICATIONS

SATA/SAS PROTOCOL SUPPORT

Transfer Rate 1.5 Gb/s, 3 Gb/s

ANALYZER

GENERAL

Capture Buffer Size, STX-230	1 GByte
Capture Buffer Size, STX-430	2 GBytes
Capture Size	1KB – 512MB, 1 KB increment
STX-230 Two Ports	Four channels
STX-430 Four Ports	Eight channels
STX-430IB	Same as STX-430, but provides an alternative Front Panel 4x Port connection
Analyzer Trigger Sources	Real-time Event Based External Trigger input Manual trigger button
Sequential trigger mode Capture options	Different for Pre-trigger and Post-trigger Include or exclude patterns
40-bit Time Tag	

SEARCH

Search for	Bus conditions, Primitives, Frames, Commands, Protocol Errors and Data Patterns
Search domain	Forward or backward Port Address and SAS Address direction

FILTER

Show or Hide in Sample Viewer	Idle, Bus Conditions, Primitives, Frames, Commands and Protocol Errors
Save Filtered result	

STATISTICAL REPORT

Report of	Sequences Frames Commands Protocol Errors Performance Parameters Sample, Time Idle Time Idle Count Total Payload Size
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PERFORMANCE ANALYZER

Measures	Bus utilization, Efficiency, Throughput, Number and Time parameters
Result display	Bar graph, Pie Chart and Histogram

EXTERNAL I/O

External Trigger Output	1 output
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HOST SYSTEM CONNECTIONS

Interfaces	USB 2.0 (High & Full Speed) 10/100 Ethernet
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PHYSICAL

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)

CONNECTIONS

Ethernet Port	RJ45
USB Port	USB type Standard-B
External I/O	TBD

POWER SUPPLY

Power Requirements	110/220VAC, 50/60Hz CE compliant
Power Consumption	STX230 40w STX430 80w

STATUS LED

Power On

SYSTEM REQUIREMENTS

Processor	Intel Pentium III 500MHz, or equivalent
Memory	128MB
Display	1024x768 resolution, 16 bit color
Operating System	Windows NT 4.0® SP6, Windows 98/98SE®, Windows ME®, Windows 2000®, Windows XP®
Hard Drive	100MB space on partition with STX software, 10MB space on Windows partition

ORDERING INFORMATION

The STX Series features a flexible, field upgradable FPGA-based engine with free lifetime software updates for the product including enhancements to the product as purchased.

Note: Catalyst Enterprises, Inc. reserves the right to appoint any product enhancement as a separate purchasable option. Additional options may be purchased at a later time following your initial order.

Note 1. Purchase price includes **Free Lifetime Software Upgrades & Technical Support.**

How to Order For pricing and availability information please contact Catalyst Enterprises at (1) 408.365.3846 or e-mail: info@getcatalyst.com

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