

# STX SERIES

## SAS Serial Bus Protocol Analyzer



### User's Manual

Compatible with software version 1.x



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# Introduction

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## What's In this Manual

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This manual describes the installation and operation of your Catalyst Enterprises **SAS Analyzer: Models STX-460 (4-Port), STX-430/431 (4-Port), STX-430/431 IB\* (One x4 Wide Port SAS) or STX-230/231 (2-Port)**. Examples of some typical applications are included.

\* STX-430IB is functionally identical to STX-430 except that it provides an alternative Front Panel 4x Port connection.

**Note:** Unless stated otherwise references to STX-230 apply to STX-230 and STX-231 and references to STX-430 apply to STX-430, STX-430IB, STX-430-IBP, STX-431 and STX-431IB\*.

## Various Available Models

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STX products are available in three models, STX-230/231, STX430/431, STX-430/431IBP & STX\_460 with major differences summarized below:

### Model Major Differences

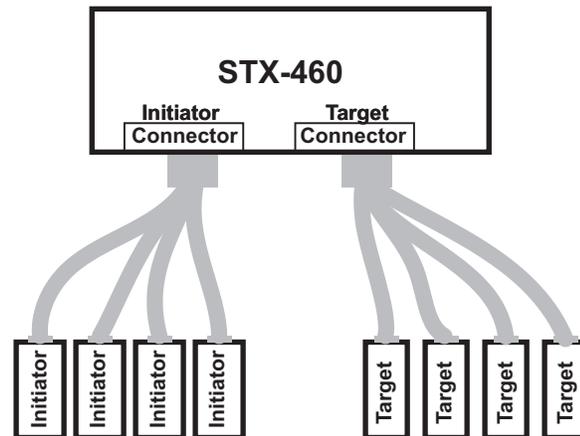
|                     | STX-230/231 | STX430/431 | STX-430IB/430IBP/431IBP | STX-460  |
|---------------------|-------------|------------|-------------------------|----------|
| Ports               | 1 or 2      | 4          | 4                       | 4        |
| Interconnect        | SAS         | SAS        | x4 SAS                  | Mini SAS |
| Analyzer            | 1 or 2      | 4          | 4                       | 4        |
| Initiator Emulation | 1           | 2          | 2                       | -        |
| Target Emulation    | 1           | 2          | 2                       | -        |

## Analyzer Overview

The **SAS Analyzer** is a serial bus analyzer that is capable of analyzing and exercising Serial Attached SCSI (SAS) and SATA, through STP data transfers. The analyzer is based on the STX hardware platform that performs serial bus analysis for SAS controlled by the SAS analyzer software.

The analyzer supports the following:

- Capture and Trigger of Serial Attached SCSI packets (SAS) + SATA through STP
- Generating SAS bus traffic with SAS Initiator Emulator while monitoring and analyzing the result
- Run a Bus Performance Analysis
- Run a Pattern Generator
- Target Emulation
- TX Vout on transmitters for test and characterization



*Figure 1. Typical SAS Test Setup of Analyzer*

The analyzer provides for bi-directional trigger and capture of commands, primitives, patterns and all bus conditions.

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## STX Interface

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- Power In
- USB Port
- Ethernet Port
- 4 SAS/SATA Ports
- External Trigger Input
- External Trigger Output
- Expansion connections
- DC Power Out

### LEDs

Each link is supported by 5 LEDs with the following functionality:

**Green** This LED is illuminated during the OOB sequence before the link is established and after link is established it indicates traffic on the bus.

**Orange** This LED is illuminated as follows:

| <b>Speed</b> | <b>Initiator</b> | <b>Target</b> |
|--------------|------------------|---------------|
| 1.5G         | Off              | Off           |
| 3.0G         | On               | Off           |
| 6.0G         | On               | On            |

**Yellow** This LED is illuminated when a link is established.

**Red** This LED illuminates when an error occurs.

**Blue** This LED is illuminated when a trigger occurs.

# Receiving Your Analyzer

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Your analyzer package includes the following components:

Carrying Case

STX unit identified in the packing list

SAS software on CD ROM

One USB 2.0 Cable 1.8 meter

x1 SATA Cable (2 for STX230, 4 for STX430), 1 Meter

Two SAS x4 Cable (Crossover) (for STX430IB and STX430IBP), 1 Meter

One Stacking cable (For STX-430 and STX-460 Units)

Two External trigger cables

Two iPass to iPass 1/2 meter cables (for STX-460)

Two iPass to IB 4X 1 meter cables (for STX-460)

One iPass to SATA 1 meter octopus cable (Straight) (for STX-460)

one iPass to SATA 1 meter octopus cable (Crossover) (for STX-460)

Ethernet Cable

User's Manual

## Unpacking Your Analyzer

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Inspect the received shipping container for any damage. Unpack the container and account for each of the system components listed on the accompanying packing list. Visually inspect each component for absence of damage. In the event of damage notify the shipper and Catalyst Enterprises. Retain all shipping materials for shipper's inspection.

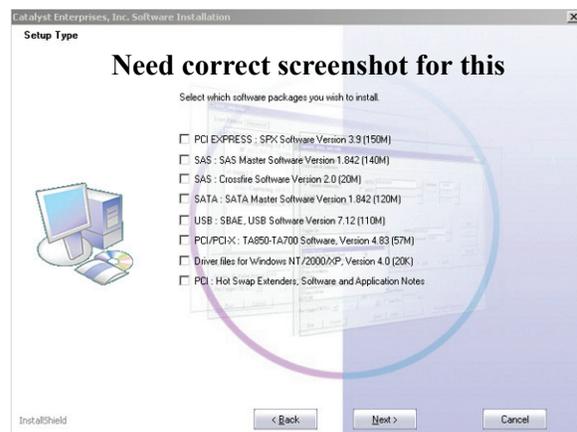
# Installing Your Analyzer

## Software Installation

On systems operating under Windows® 2000 and Windows® XP.

**Do not connect** Do not connect the STX to your host system until the software installation is complete.

1. Insert the CD ROM with the SAS software in the CD ROM drive.
2. The installation will automatically start the setup, unless the Auto Run is turned off. In this case select the CD ROM from “My Computer” and click on setup.
3. After the warning to close all other programs and before starting the installation, the Install component selection will open as shown below.



4. Select the desired components for installation.
5. Click **N**ext to complete the installation.

**System restart** You must restart your computer before you can use your Analyzer software.

**Error Message** If you get an error message during installation of the drivers for Windows 2000 or XP consult your system administrator. Your system may be setup to only allow an administrator level to copy such driver files.

## Hardware Setup

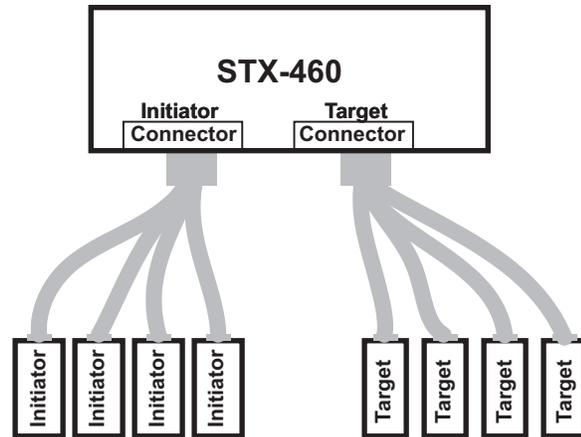
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### Separate Systems

When using the SAS analyzer, it is recommended to use a system to generate bus traffic and a second system to run the SAS software in order to avoid characterization of analyzer traffic.

### Connecting the STX

Connect the STX as shown in Figure 2.



*Figure 2. Analyzer Connections*

### What Cables to Use

When making a SAS 4x to SAS 4x connection, use Crossover x4 cables. When using Octopus (4x SAS to 4 SATA cables to connect to DHH, use Straight cables.

# Connecting the STX-430 IB

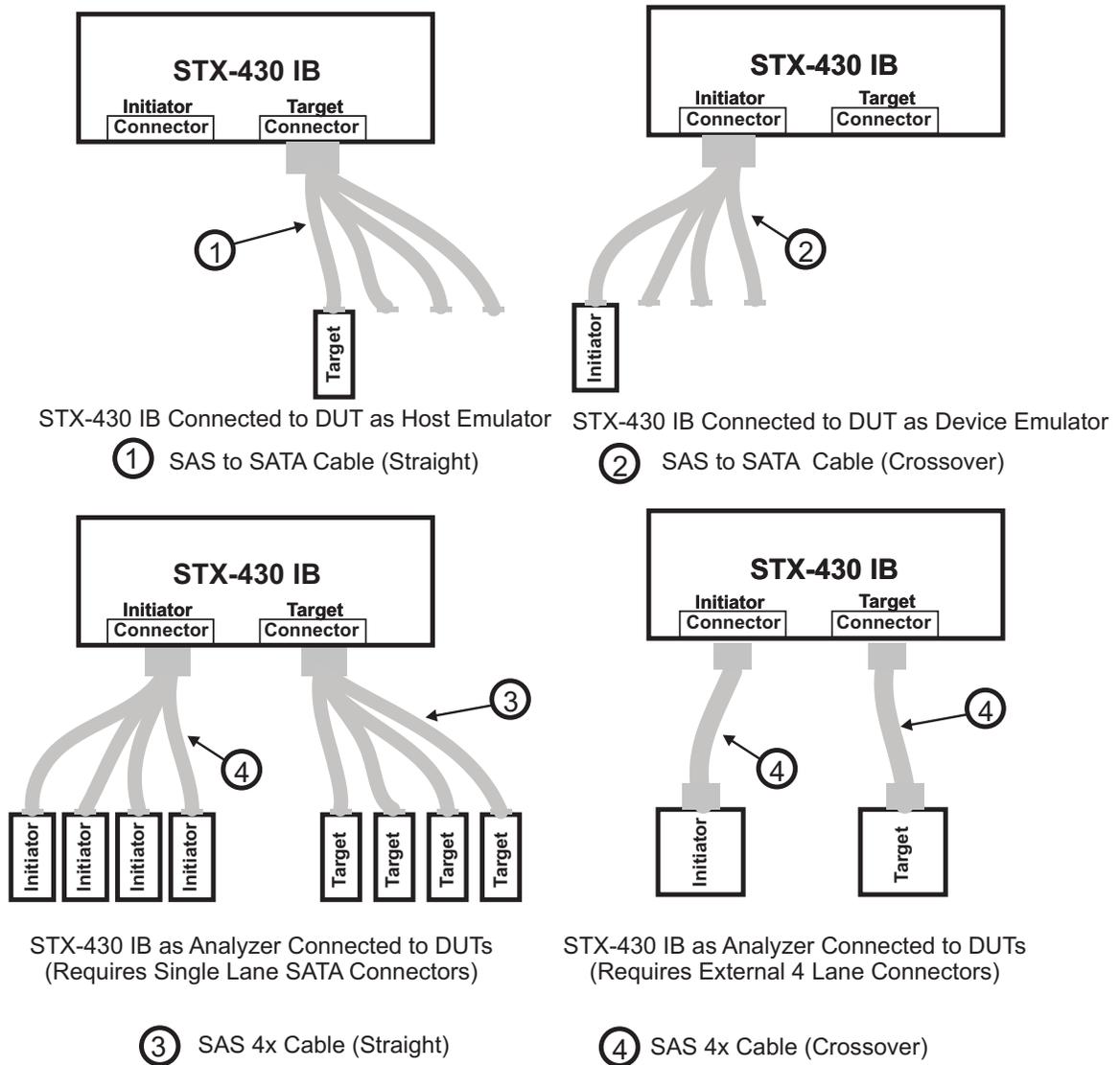


Figure 3 The STX-430 IB Connected to the STX-430 as an Analyzer

# Connecting the STX-430 IBP

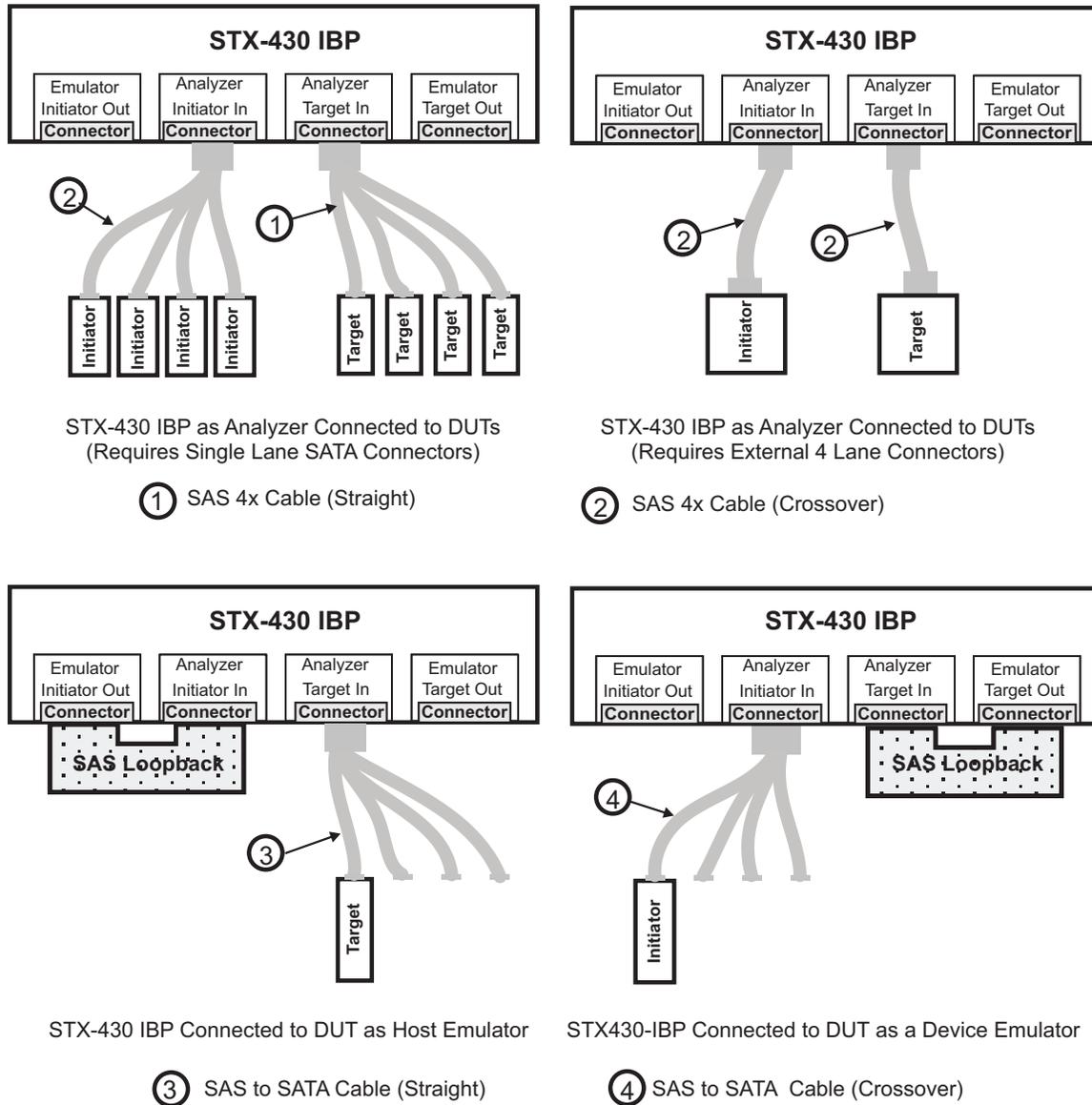


Figure 4. Connecting the STX-430 IBP

## Expandability

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STX units may be expanded for wider lane analysis. This may be accomplished by daisy chaining the units through the provided interface in the back. The “Out” connectors should be connected to the “In” connectors of the next unit in the chain for both, the signal and the clock interfaces.

The user needs to provide external hubs for connecting the host USB or Ethernet to these units.

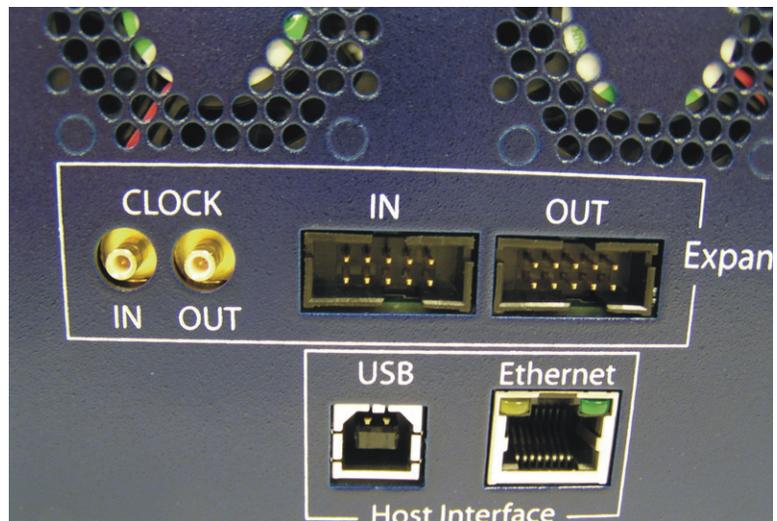
## Cascading STX-430's and STX-460's

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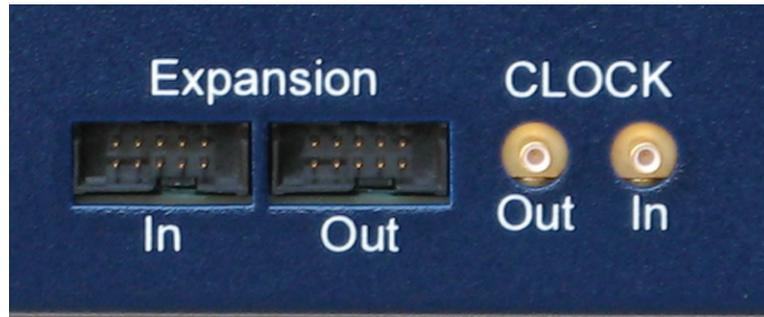
Up to 8 STX-430 and STX-460 units may be cascaded and connected to a Host PC using USB or Ethernet cables.

To set up the STX units in a cascade:

1. Connect all of the units to be cascaded to the PC using either a USB cable or an Ethernet cable. You may use hubs (USB or Ethernet) to connect up to 8 units to a single PC.
2. Locate the Expansion ports on the back of each unit.

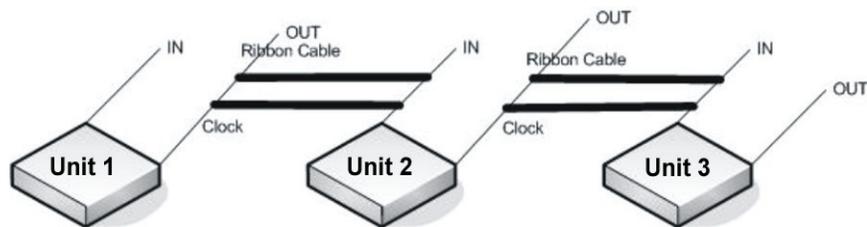


*Figure 5. STX-430 Expansion Ports*



*Figure 6. STX-460 Expansion Ports*

3. Connect the OUT clock connector of Unit 1 to the IN clock connector of Unit 2 using the supplied BNC Coax SMA to SMA cable.
4. Connect the OUT 10 pin connector of Unit 1 to the IN 10 pin connector of Unit 2 using the supplied 10 pin Ribbon Cable.
5. Similarly connect additional units up to a total of 8.
6. Arbitrarily designate one of the units as Unit 1.

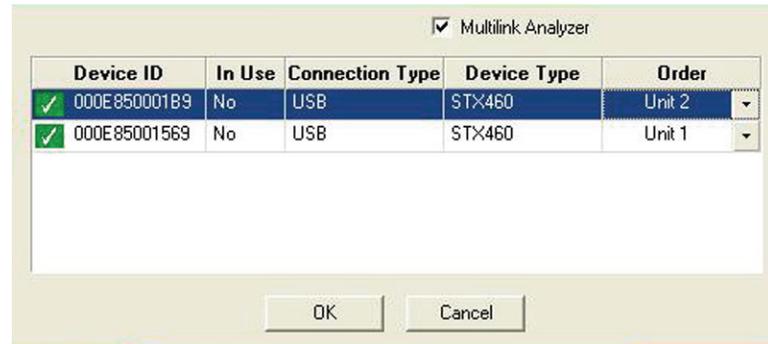


7. Make a note of the last 4 digits of the MAC address of the unit designated as Unit 1 and the last 4 digits of the other units in the order of connection.



8. Make sure that all of the units are powered up and start the STX software.
9. The software will search for and display all of the connected units.

**Note:** Be sure to check the Multilink Analyzer check box.



10. Compare the MAC addresses, which are displayed in the field titled Device ID to those noted as they were connected, then click on the pull down tab under the heading "Order" on the right side of the menu and select the Unit numbers i.e. 1 for Unit 1, 2 for Unit 2 making sure your pre determined sequence for the Units matches with the MAC address for each Unit.
  11. Click **OK** and let the STX software initialize so you can start capturing traces.
- The units are now cascaded together.

## Connecting via Ethernet

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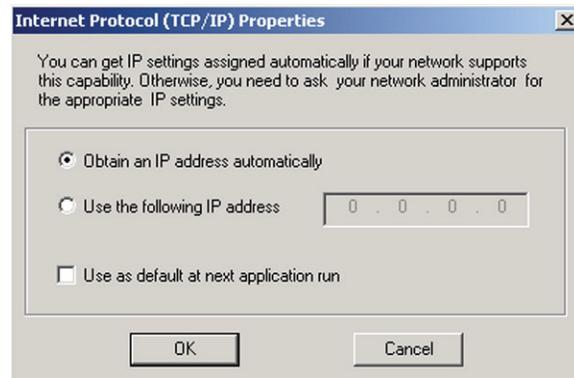
You may use the ethernet connection using any one of the following 3 supported configurations:

1. The STX connected to a network via a hub, switch, or similar device.
2. The STX connected to the host computer (machine running the application software), via a hub, switch or similar device.
3. The STX connected directly to the host computer using a crossover cable.

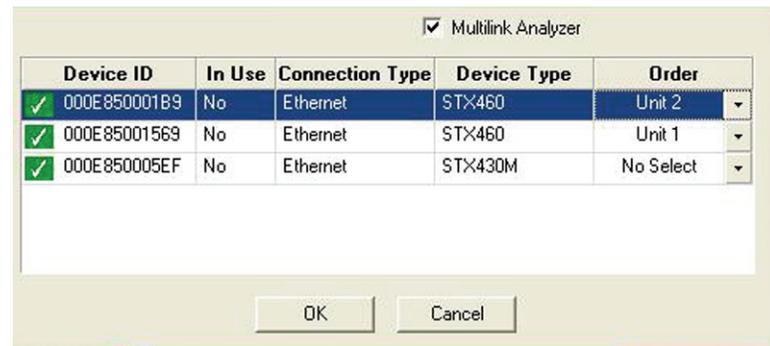
### Connecting to a Network

When connected to a network the STX must communicate with the DHCP server to establish a connection. The DHCP server will continually send the next available IP address to the STX until the STX software is started.

When the user starts the software, the user may be prompted if they wish the software to automatically use the offered IP address or if they wish to assign a specific IP address (the assigned IP address needs to be on the same network segment as the host computer). The menu also allows the user to save the selected option (automatic or specific address). If the assigned IP address is not available, the OS will notify the user of an IP address conflict.



After the user clicks 'OK' the software will search for all STX units connected to the network, and will display a list of available STX units. After the user selects the desired STX unit, the software will assign the IP address to the selected unit, completing the connection and will launch the software.



## Connecting via Hub, Switch or Similar device

When connected to the host machine via a hub, switch or other similar device or directly using a crossover cable the Catalyst board must communicate with the host computer to establish a connection. The host computer will continually broadcast the next available IP address to the Catalyst Board until the Catalyst software is started.

When the software starts, the user may be prompted if they wish the software to automatically use the offered IP address or if they wish to assign a specific IP address (the assigned IP address needs to be on the same network segment as the host computer). The menu also allows the user to save the selected option (automatic or specific address). If the assigned IP address is not available, the OS will notify the user of an IP address conflict.

After the user clicks 'OK' the software will search for all Catalyst boards connected to the network, and will display a list of available Catalyst boards, after the user selects the desired Catalyst board, the software will assign the IP address to the selected board, completing the connection and will launch the software.

## Remote Operation

In order to operate your STX remotely you must install the Remote WAN Feature as described in Appendix B.

- Note 1.** When using the remote option, the software cannot detect the power cycle on the board.
- Note 2.** In the event that the software cannot connect to the server with an error message, you must exit and re-run the software.

---

# Launching Your Analyzer

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The first time you run your software it will search for a default host interface and if it is found, the software will launch. If no interface is found the software will display the interface selection dialog.



To launch the **SAS Analyzer** software, double-click the SAS Icon in the Program Manager Window.

## Establish Interface

If no interface is detected initially, then establish an available interface and relaunch the software.



Click **OK** and the Analyzer will launch and display the Analyzer Tool bar.

## SAS Software Launched

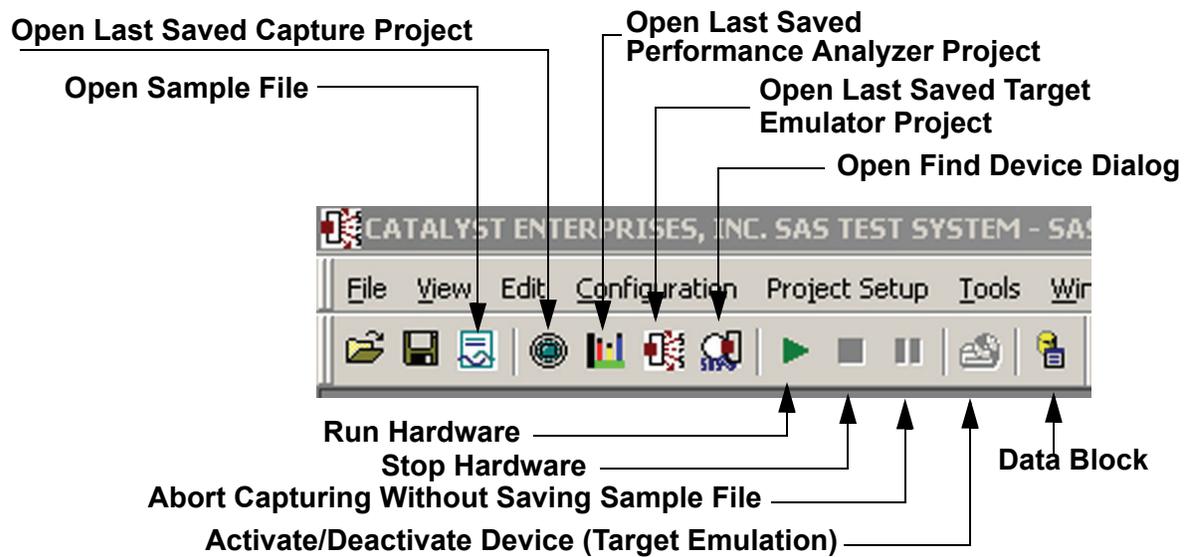


Figure 7. Analyzer Toolbar

To start working with your SAS analyzer go to “Protocol Analysis” on page 17.

## Operating in Simulation Mode

Your system will operate in the Simulation Mode by default if the hardware is not detected, however, you may operate in Simulation Mode directly without installing the Analyzer hardware. To operate without hardware, select **Hardware Not Installed (Simulation Mode)** in the Port Setting dialog box and click **OK**.

The Analyzer software will launch and display the appropriate tool bar, but with the limitation that the Analyzer will operate only on static, previously captured, bus data.

### Limitations

The Simulation mode lets you try all of the available functions, but keep in mind that **the system is not capturing any real data and is displaying only pre-captured results.**



# Protocol Analysis

Protocol Analysis is performed by defining and running an analysis project. An analysis project definition includes: defining what will be captured, what the analyzer will trigger on and capture memory settings. Defined projects may be saved as project \*.sac files for later use.

## Easy Mode (Pre-Defined Setups)

This mode allows you to operate the STX with a minimum of setup. In this mode you may perform a Trigger and Data capture only or program the Initiator Emulator to generate bus traffic for triggering and data capture.

### Quick Start

To get a comprehensive overview of your analyzer’s capabilities:

1. Install the SAS Analyzer software. See "Software Installation" on page 5.
2. Set up your STX. See "Hardware Setup" on page 6.
3. Launch your Analyzer software. See "Launching Your Analyzer" on page 14 for launching instructions.
4. On the Analyzer Menu Bar click **File, New** and then **Protocol Analyzer** to open a SAS Protocol Analyzer dialog.

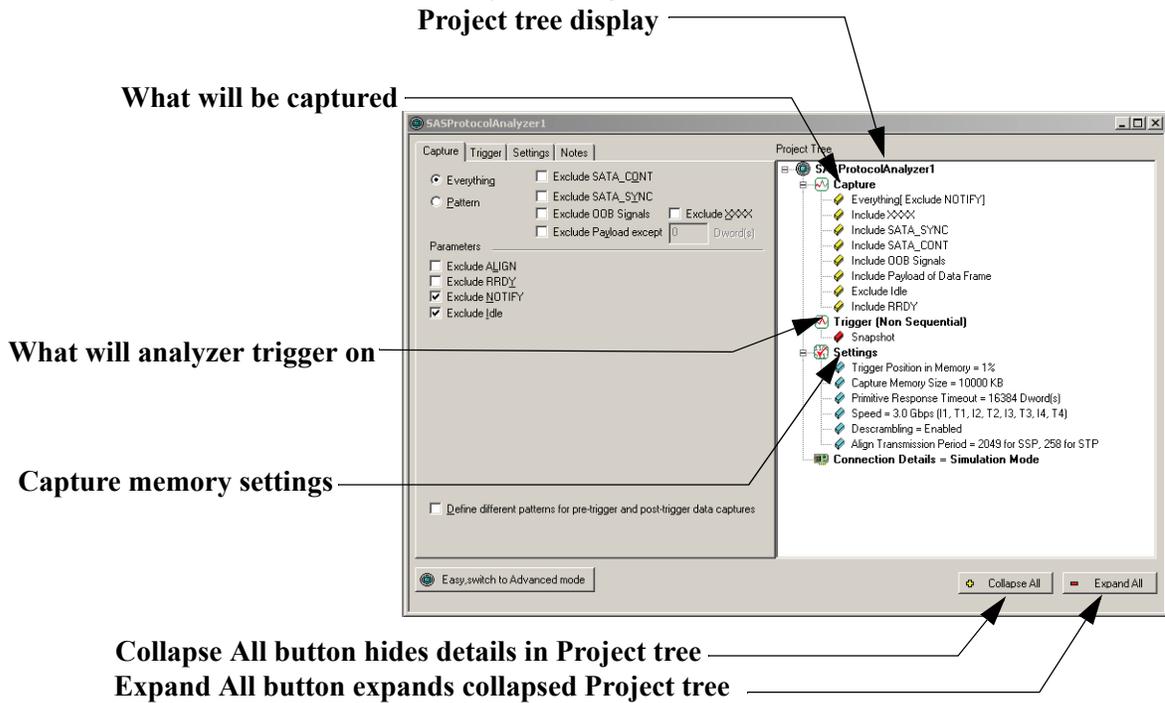


Figure 8. New Analysis Project Dialog

The New Project dialog opens with default settings to capture **Everything** on the bus and to **Trigger On on Snapshot**. (Meaning that the analyzer captures everything immediately without triggering on anything in particular).

**Project Overview**

A comprehensive tree structured overview of the project is displayed in the **Project Tree display**. The project tree shows what is to be captured, what the analyzer will trigger on and capture memory settings.

- To get an immediate overview of the bus traffic to and from your Analyzer,

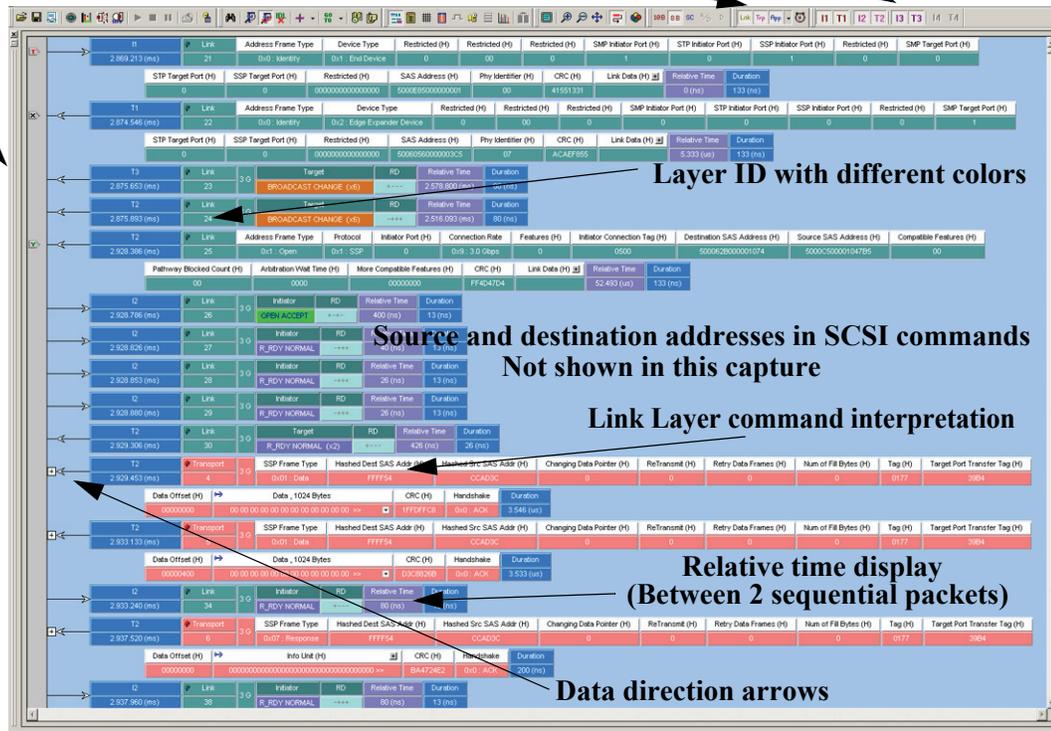
click the  **Run Hardware** button.

- After a short time a Packet view display opens. Packet view is the default display, however, you may view the result in a column view by clicking **View** and choosing **Column View** on the menu bar.

**Show/Hide Layers buttons**

**Show/Hide Port Data**

**X,Y,T Cursors**



**Time differences between cursors**

*Figure 9. Typical Packet View Results Display*

In cases of an STP interface, the expander displays STP addresses provided to the SATA drive and the SAS software integrates the STP addresses in the ATA command.

The results display shows each transaction for every layer identified in a different color and the data direction identified with data direction arrows. Upstream traffic is identified with the arrow from right to left. This arrow direction  $\Leftarrow$  indicates upstream traffic. Downstream traffic is identified with the arrow left to right. This arrow direction  $\Rightarrow$  indicates downstream traffic.

You may hide any layer by clicking the corresponding **Show/Hide** button on the menu bar. All captured data is retained, but the display is limited to the layer data of interest for simpler viewing.

You may configure the viewer display for your individual test and viewing preferences. See “Viewer Display” on page 101 for details about configuring the viewer display.

The Analysis Project dialog offers you a comprehensive set of choices to create a trigger and capture project satisfying some specific need. You may set the Analyzer to:

- Capture specific patterns. (See "Data Capture Setup" on page 24)
- Capture different patterns pre and post trigger.
- Exclude parameters from capture.
- Trigger on a Pattern or sequence of patterns. (See "Triggering Setup" on page 30)
- Configure trace capture memory. (Settings)
- Select file to save trace capture in memory. (Settings)
- Include a Project Note.

### **Run a Sample Project**

Before setting up your own custom project you may wish to run one or more of the sample projects included with your analyzer software. See "Example Projects" on page 20.

## Example Projects

---

Your SAS Analyzer includes a number of pre-defined example projects that you may use to perform an immediate analysis without any setup.

The SAS Analyzer system software comes with a pre-defined folder (Directory) structure for storing all files. All pre-defined example files are stored in the following Folder:

c:\program files\catalyst\SAS1.xx\examples

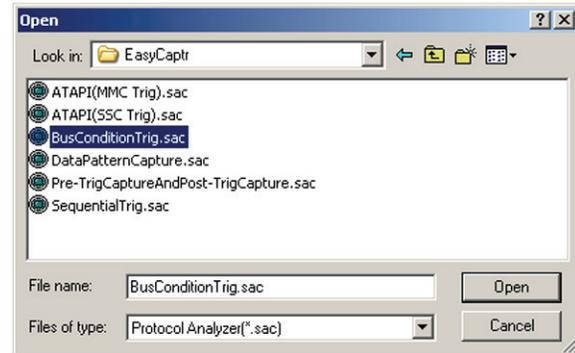
It is strongly recommended that you open some of these files to get an introduction to the types of projects that can be created for the SAS Analyzer.

### Project file type definition

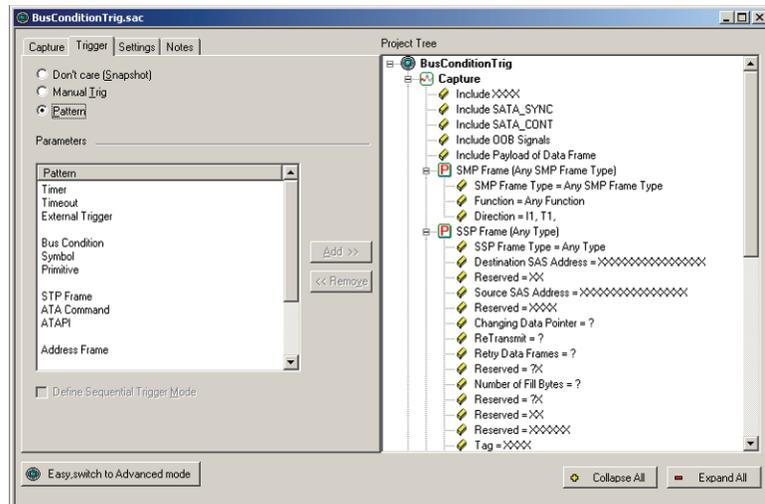
|       |                                  |
|-------|----------------------------------|
| *.asl | Decoding script file             |
| *.sac | Protocol Analyzer file           |
| *.saf | Device Identifier file           |
| *.scs | Sample file                      |
| *.sfl | Filter file                      |
| *.spg | Pattern Generator file           |
| *.ssh | Search File                      |
| *.ssp | Performance Analyzer Output file |
| *.std | Target Emulator file             |
| *.paf | Performance Analyzer Review file |

## Run an Example Analysis Project

1. Click **File** on the main menu bar and then choose **Open**.



2. Locate available example analysis projects by looking in:  
c:\program files\catalyst\sas1.xx\examples
3. Choose an example \*.sac file and click **Open** to display the example project dialog.



*Figure 10. Sample Protocol Analysis Project*

4. Click the **Run Hardware** button to execute the pre-defined example.
5. Once the project runs you will see an analyzer trace capture display similar to the one shown in Figure 11.

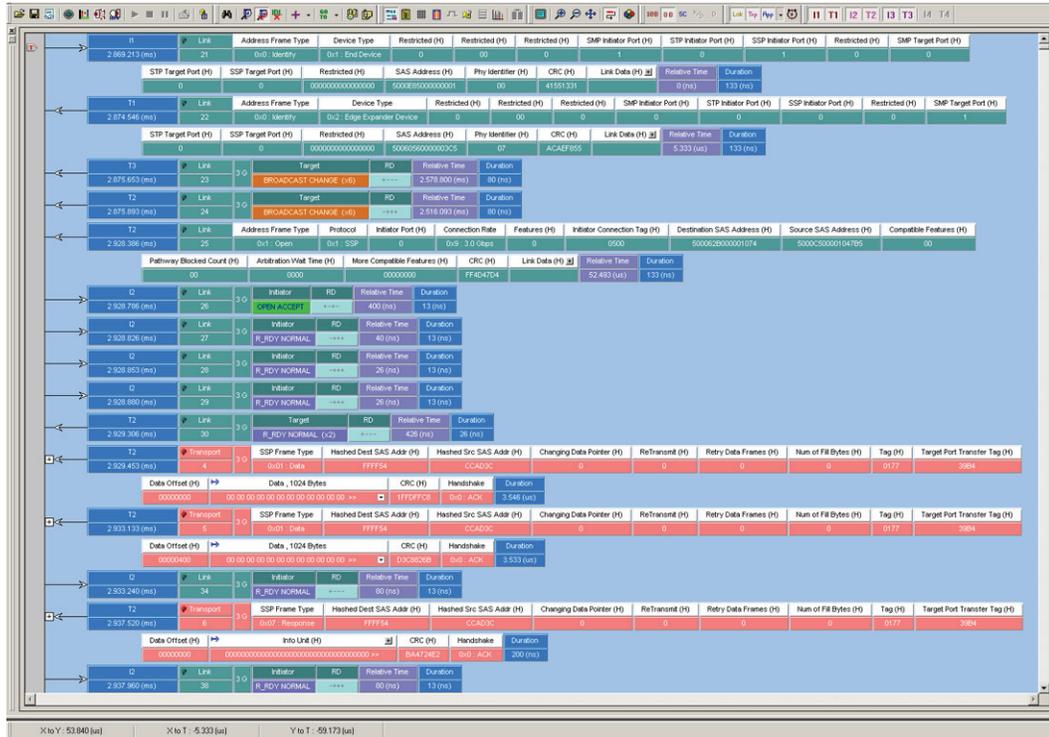


Figure 11. Analyzer Trace Capture Display

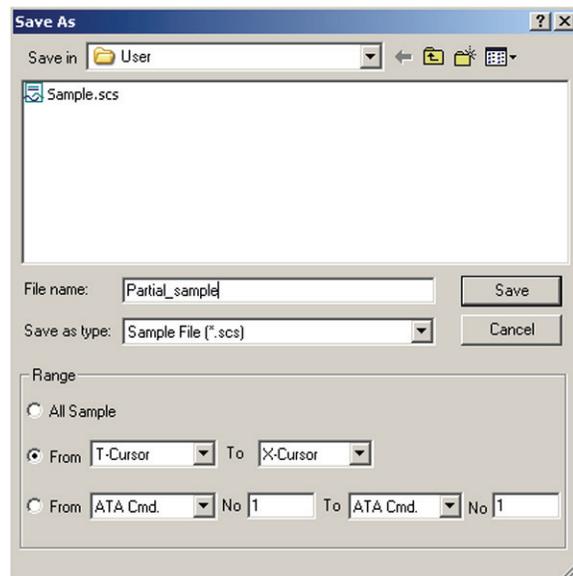
See "Data Display Manipulation" on page 101 and "Display Configuration" on page 131 for details about the results display.

## Saving a Trace Capture

You may save a Trace Capture for review at a later time.

The **Save As** dialog offers you the ability to limit the range of the saved file.

You may save All Samples, a range between selected cursors or a range between selected commands.



## Analysis Project Setup

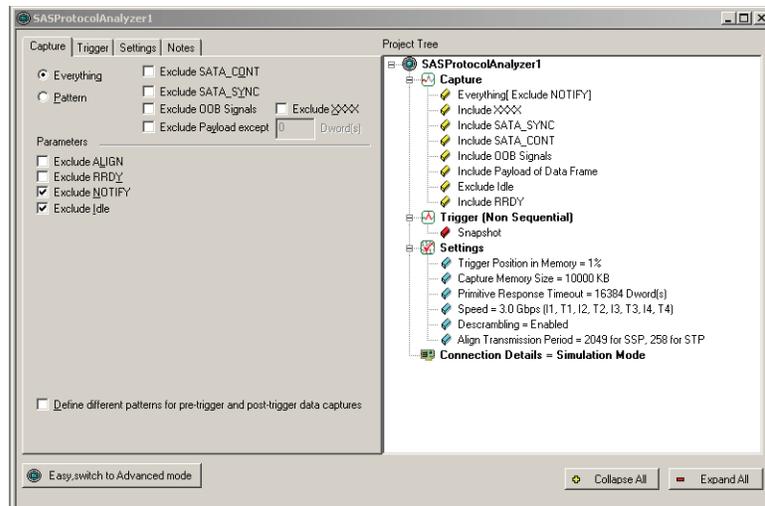
You may define a new project starting with the default project definition, or modify the settings for the last project run.

- Default Project** Clicking **New** and choosing **Protocol Analyzer** opens a new project with default settings that you can modify as required.
- Last Project** Clicking the **Green** button opens the last project run. You may modify this project as required.



Click the **Green** button on the main menu bar to open the last project run dialog.

- New Project** To start a **New** project, click **File** on the main menu bar, choose **New**, and select **Protocol Analyzer**.

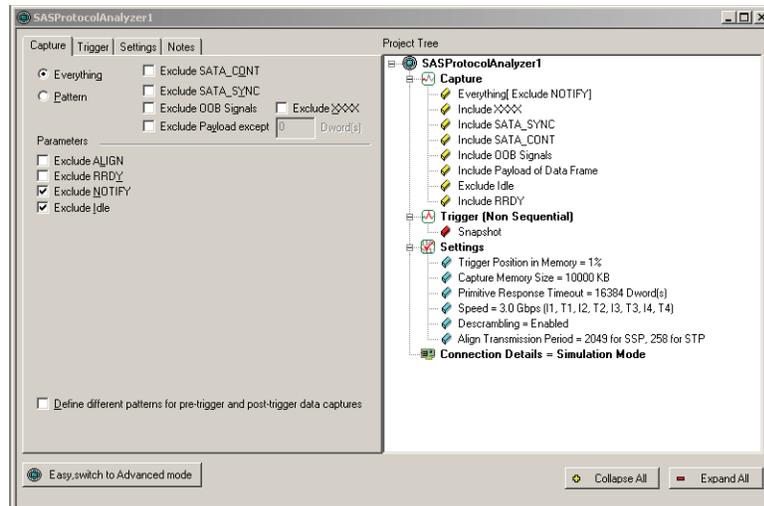


*Figure 12. New Trigger and Capture Project Dialog*

## Data Capture Setup

### Capture Everything

The default Capture Tab opens with capture **Everything** selected and the corresponding default Trigger On tab with **Don't care (Snapshot)** selected. Clicking run with these default settings will immediately start a data capture to give the user a quick view of bus activity.



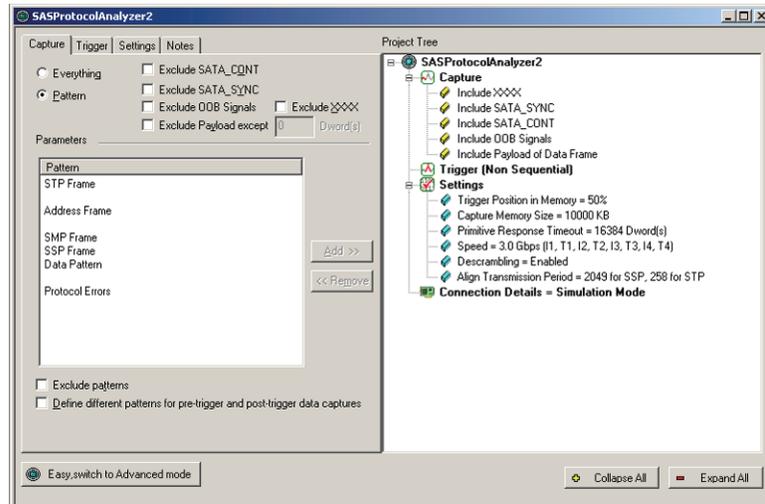
*Figure 13. Capture Everything (Default)*

|                               |   |
|-------------------------------|---|
| <b>Exclude SATA_CONT</b>      | Check this to exclude SATA_CONT Primitive from the data capture.  |
| <b>Exclude SATA_SYNC</b>      | Check this to exclude SATA_SYNC Primitive from the data capture.  |
| <b>Exclude OOB Signals</b>    | Check this to exclude OOB Signals from the capture.   |
| <b>Exclude XXXX</b>           | Check this to exclude XXXX patterns from the data capture.  |
| <b>Exclude Payload except</b> | Check this to exclude Payload of Data Frames from the data capture. (You may set except the # of Dword(s)). |
| <b>Exclude Align</b>          | Check this to exclude Align Primitive from the data capture.  |
| <b>Exclude RRDY</b>           | Check this to exclude RRDY Primitive from the data capture.   |
| <b>Exclude NOT FY</b>         | Check this to exclude Notify Primitive from the data capture.   |
| <b>Exclude Idle</b>           | Check this to exclude idles from the data capture.  |

The data capture may be refined by choosing **Pattern** and then selecting a specific pattern(s) for capture. Additionally you may define a different set of patterns to capture after trigger.

## Capture Pattern

To define specific patterns for capture, click the **Pattern** button.



*Figure 14. Choosing Capture Patterns*

The **Parameters** window displays the following pattern capture choice categories:

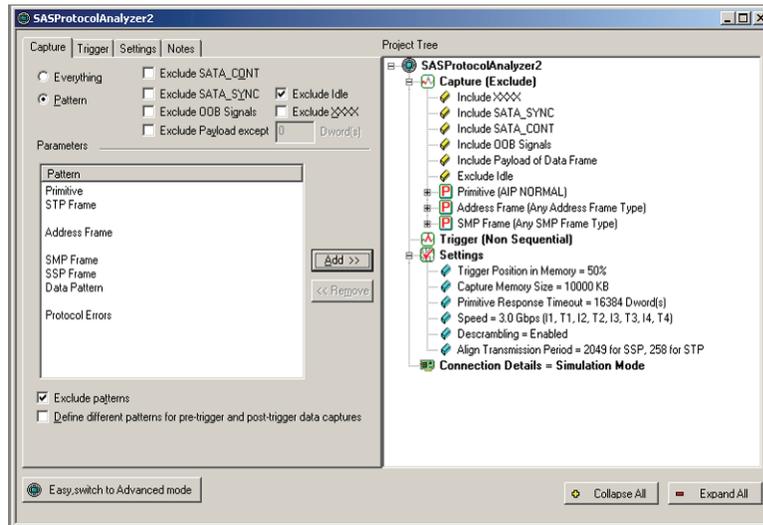
- STP Frame
- Address Frame
- SMP Frame
- SSP Frame
- Data Pattern
- Protocol Errors

### Choose a parameter

To choose a parameter for capture from any of these categories, highlight the category in the parameter window and click the **Add>>** button. This will open selection dialogs for each of the categories displaying all of the parameters for that category. All of the patterns added will appear in the project tree.

### Exclude patterns

Check this box to allow for the capture of everything **except** the patterns that have been added to the Project Tree. When this box is checked, the **Primitive** category is added to the parameter window and Exclude Idle choice is enabled.

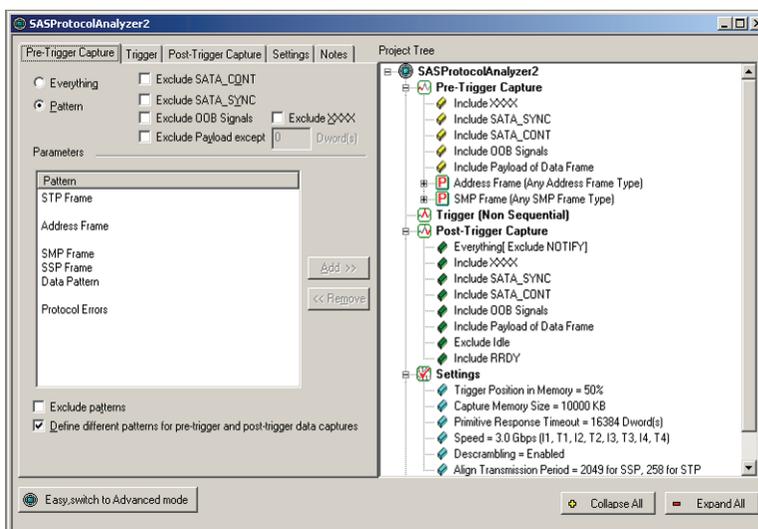


*Figure 15. Exclude Patterns Checked*

To remove an item from capture, highlight it in the Project tree and click the <<**Remove** button.

## Pre and Post Trigger Data Capture

You may define one set of patterns for capture prior to the occurrence of a trigger and another set of patterns for capture after the occurrence of a trigger. The selections and setup procedure is the same for both, the Pre-Trigger capture and the Post-Trigger capture. Check Define different patterns for pre-trigger and post-trigger data capture to enable the **Post-Trigger Capture** tab.



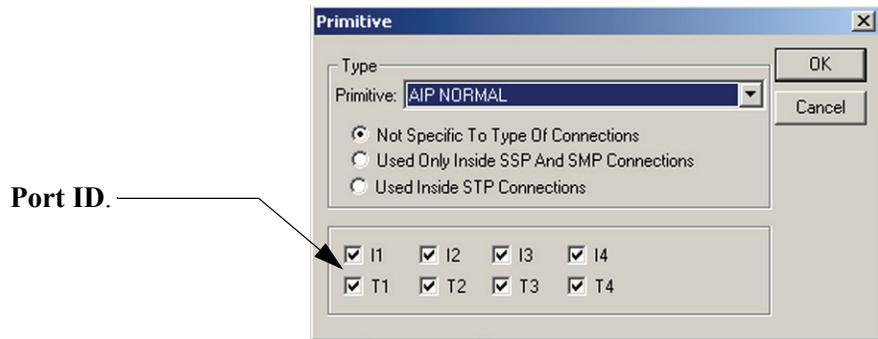
*Figure 16. Post-trigger Capture Dialog Enabled*

## Defining Patterns

To select an item for capture, either highlight the category and click the **Add>>** button or simply double-click the category to open a corresponding definition dialog. Patterns may be defined for specific ports by checking or unchecking the Port ID.

### Primitive

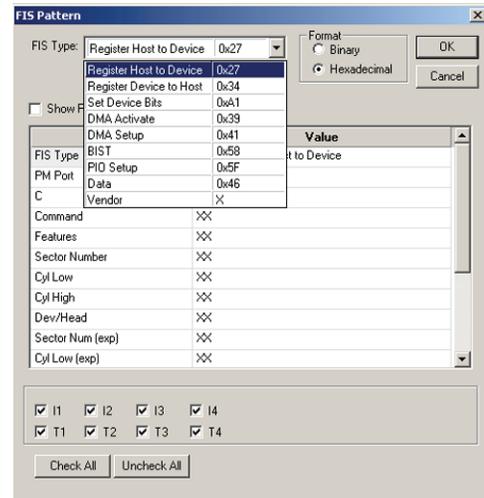
Double-click **Primitive** (Available only if Exclude Patterns is checked) to open the Primitive selection dialog.



Click the down arrow next to the Primitive drop-down list box, choose a Primitive to exclude and click **OK**. Repeat for additional Primitives.

### STP Frame

Double-click STP Frame to open the FIS Type dialog.



Click the down arrow next to the Type drop-down list box, choose an FIS type to capture or exclude and click **OK**. Repeat for additional types.

#### Available FIS Types:

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

**Address Frame**

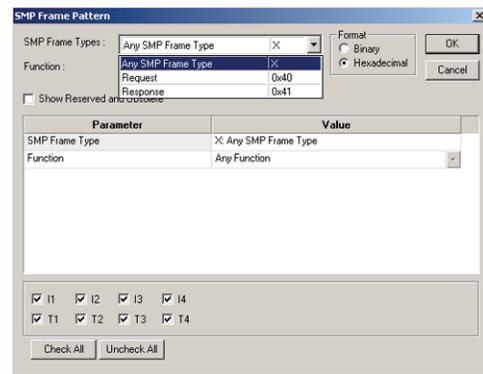
Double-click **Address Frame** to open the Address Frame Type Pattern dialog.



Click the down arrow next to the Address Frame Types list box and choose an address frame type.

**SMP Frame**

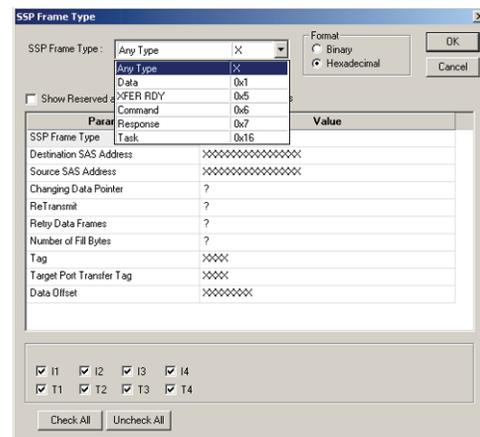
Double-click **SMP Frame** to open the SMP Frame Pattern dialog.



Click the down arrow next to the SMP Frame Type list box and choose a frame type. Assign a specific function to the frame by clicking the down arrow next to the Function list box and choose a function.

**SSP Frame**

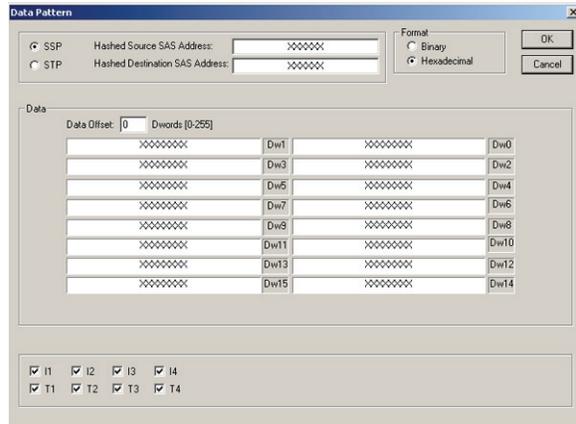
Double-click **SSP Frame** to open the SSP Frame Pattern dialog.



Click the down arrow next to the SSP Frame Type list box and choose an SSP Frame type.

**Data Pattern**

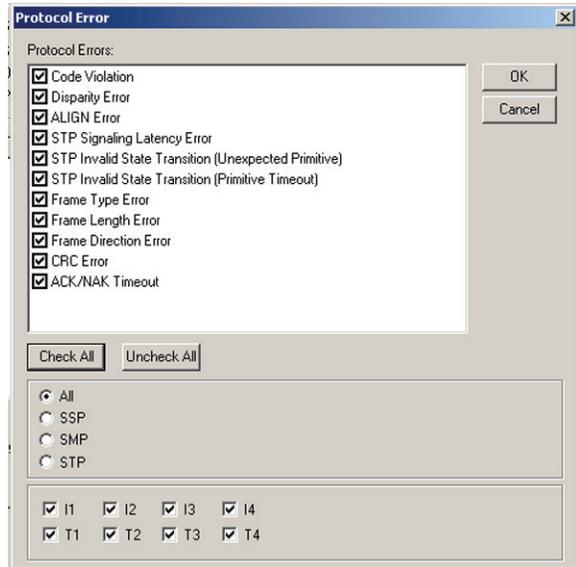
Double-click **Data Pattern** to open the Data Pattern definition dialog



Define the data pattern for capture or exclusion from capture and click **OK**.

**Protocol Errors**

Double-click **Protocol Errors** to open the Protocol Errors selection dialog.



Check the desired Protocol Error(s) for capture and click **OK**.

## Triggering Setup

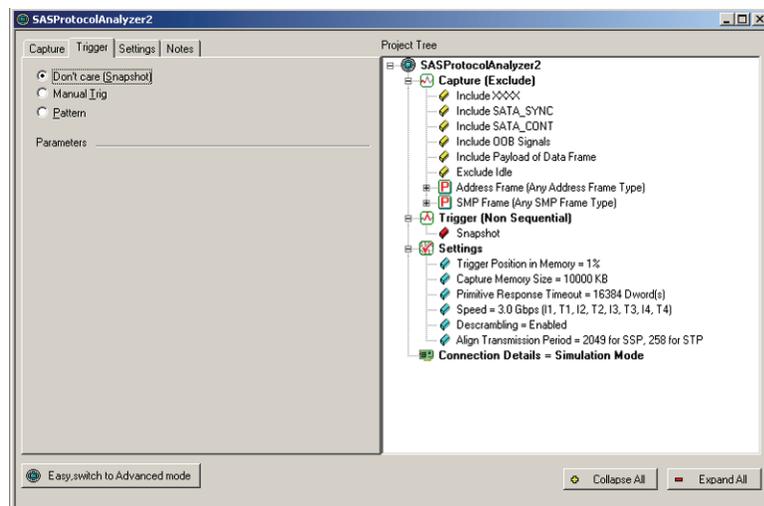
The **Trigger-on** tab, in the analysis project dialog, allows the user to specify when the analyzer will complete a data capture. Three trigger modes are available: The default **Don't care (Snapshot)**, **Manual Trig** and **Pattern**.

When a data capture is started with **Don't care (Snapshot)** selected, the analyzer will trigger on the first data pattern on the bus. Starting a data capture with **Pattern** selected the analyzer will trigger when specific pattern(s) are detected in the captured data stream. The following are three ways to trigger the analyzer with **Pattern** selected.

- Trigger on any pattern (Any Trigger Mode)
- External Trigger
- Trigger on a sequence of patterns (Sequential Trigger Mode)

## Snapshot Mode

To trigger immediately on any pattern, check the **Don't care (Snapshot)** button.



*Figure 17. Default Trigger Selected*

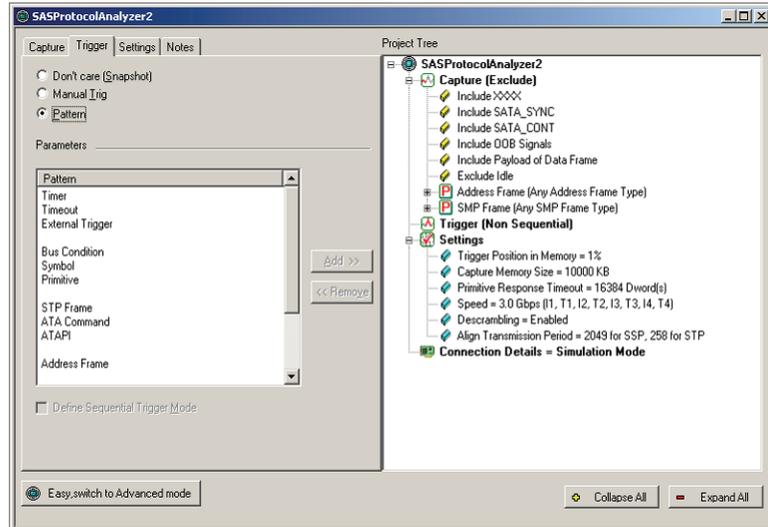
## Manual Trigger Mode

In the **Manual Trigger** mode the analyzer captures bus traffic continually until you click the **Stop Hardware** button on the analyzer toolbar which triggers the analyzer. To perform a manual trigger, check the **Manual Trig** button.

## Any Trigger Mode

In **Any Trigger** mode the Analyzer will trigger whenever any one of the patterns selected for triggering occurs. The procedure for selecting trigger parameters is identical to that for selecting capture parameters. All items selected for triggering will appear in the Project Tree.

To define patterns for triggering check the **Pattern** button in the Trigger On dialog.



*Figure 18. Select Patterns for Trigger*

The **Parameters** window displays the following trigger pattern choice categories:

- Timer
- External Trigger
- Bus Condition
- Symbol
- Primitive
- STP Frame
- ATA Command
- ATAPI
- Address Frame
- SMP Frame
- SSP Frame
- SCSI Command
- Data Pattern
- Protocol Errors

**Choose a parameter**

Either highlight the category and click the **Add>>** button or simply double-click the category to open a corresponding definition dialog.

To remove an item from trigger, highlight it in the Project tree and click the **<<Remove** button.

## Triggering on a Timer

Selecting a timer for a trigger in the **Any Trigger Mode** limits the time that the analyzer looks for selected triggering conditions before triggering. The timer is activated when the Project is run. If none of the selected triggering conditions occurs during the timer's active time the Analyzer will trigger at the end of the time set for the timer.

A timer may be set independently of any other trigger selection to cause an unconditional trigger after a set time.

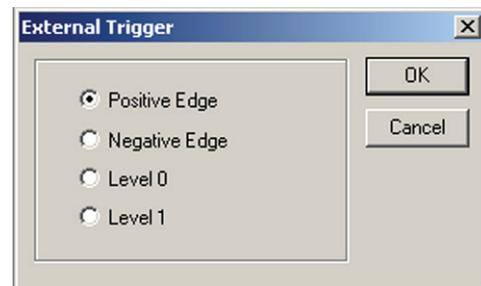
To set the timer value, double-click **Timer** in the Patterns window of the Capture Project dialog to open the Timer dialog.



Check the Time unit desired, enter the Timer Value and click **OK**.

## External Trigger

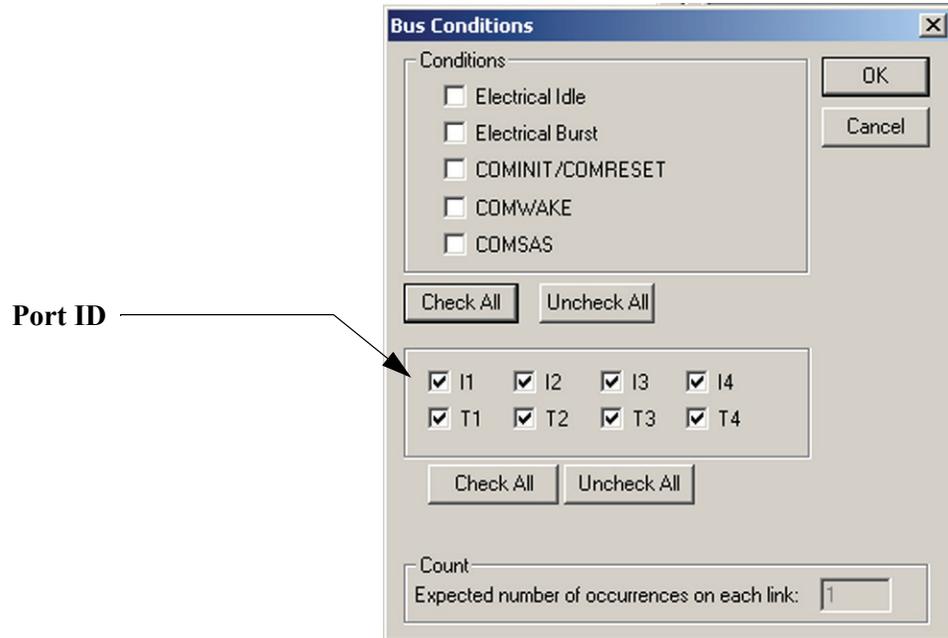
You may trigger on an external trigger. To set up the trigger click the **External Trigger** category.



Click a desired triggering condition option button and click **OK**.

## Bus Condition

Double-click **Bus Condition** in the Patterns window of the Capture Project dialog to open the Bus Conditions dialog.

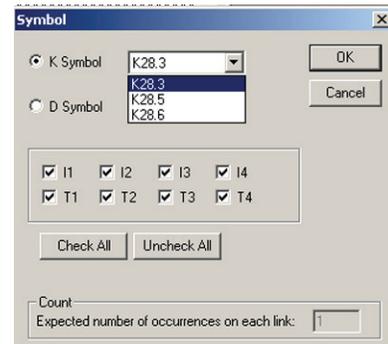


Check the desired Conditions to trigger on and click **OK**.

**Note:** Triggering may be defined for specific ports by checking or unchecking the Port ID.

## Symbol

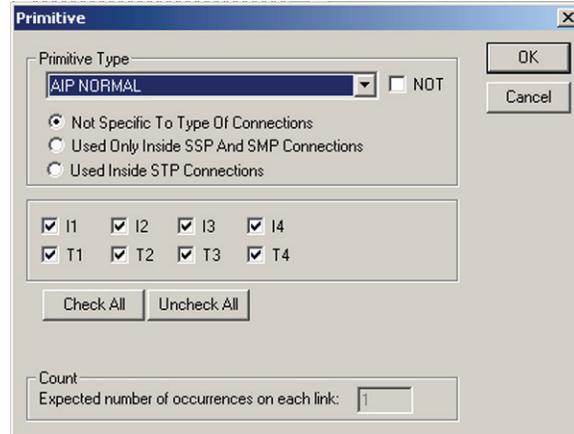
Double-click **Symbol** in the Patterns window of the Capture Project dialog to open the Symbol dialog.



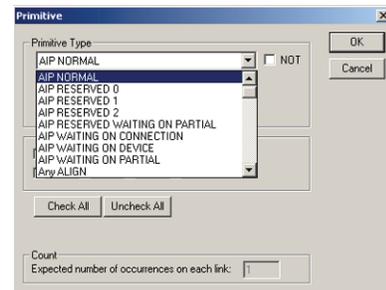
Choose a symbol type by checking either the K Symbol or D Symbol option, then click the down arrow in the Symbol dropdown list, choose a symbol to trigger on and click **OK**. Note that the D Symbol choice does not have a down arrow.

**Primitive**

Double-click Primitive in the Patterns window of the Capture Project dialog to open the Primitive dialog.



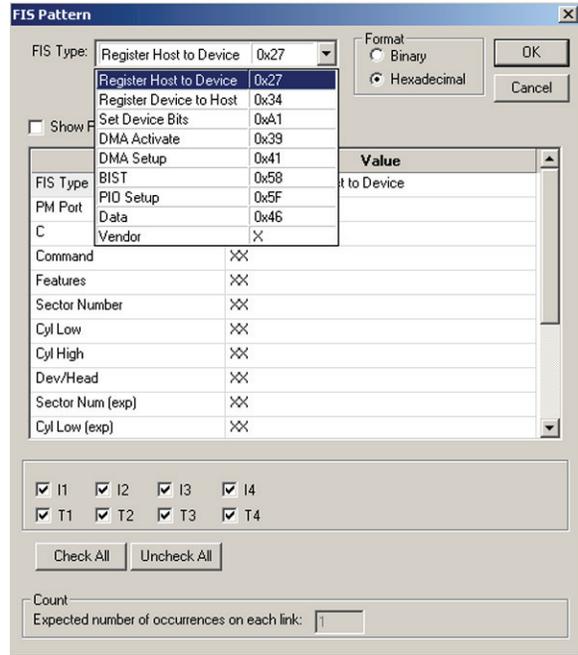
Click the down arrow next to the Primitive dropdown list, scroll the list to choose a primitive to trigger on and click **OK**. Note: Check the box to the right of the Primitive Type to use the logical NOT.



*Figure 19. Primitive Selection Choices*

**STP Frame**

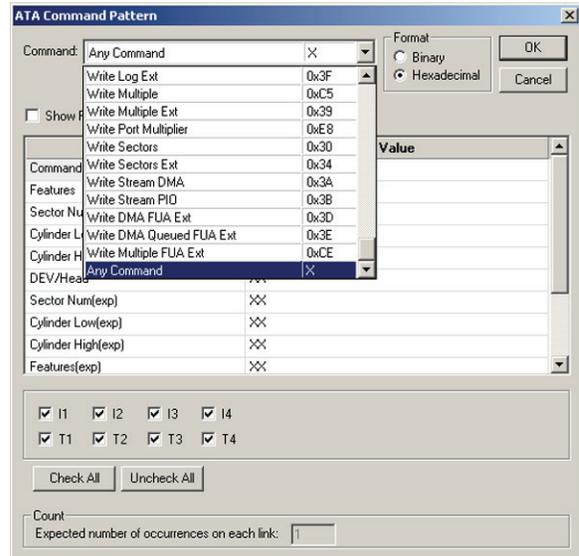
Double-click **STP Frame** in the Patterns window of the Capture Project dialog to open the FIS Type dialog.



Click the down arrow next to the FIS type dropdown list, scroll the list to choose an FIS type to trigger on and click **OK**.

**ATA Command**

Double-click **ATA Command** in the Patterns window of the Capture Project dialog to open the ATA Command dialog.

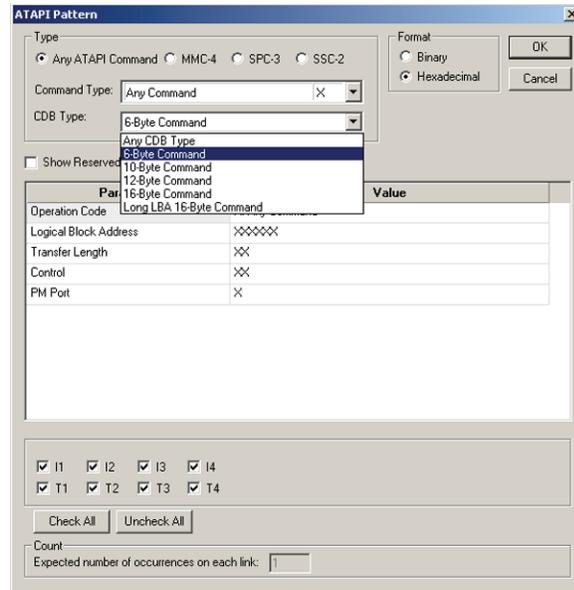


Click the down arrow next to the Command dropdown list, scroll the list to choose a command to trigger on and click **OK**.

A powerful triggering choice is **Any Command** that will cause the analyzer to trigger on any ATA command.

**ATAPI**

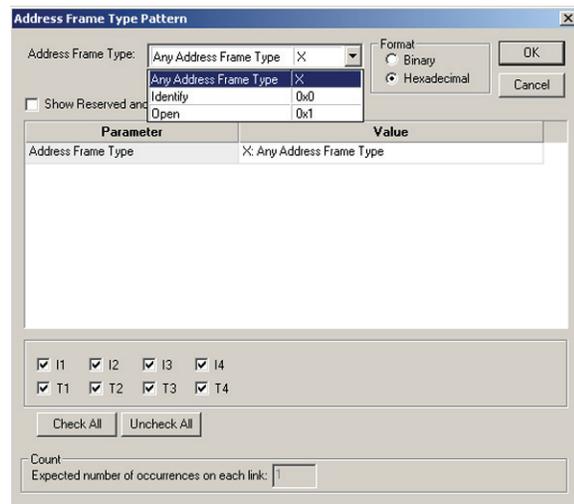
Double-click **ATAPI** in the Patterns window of the Capture Project dialog to open the ATAPI Patterns dialog.



Click the down arrow next to the CDB dropdown list, scroll the list to choose a CDB Type and click **OK**.

**Address Frame**

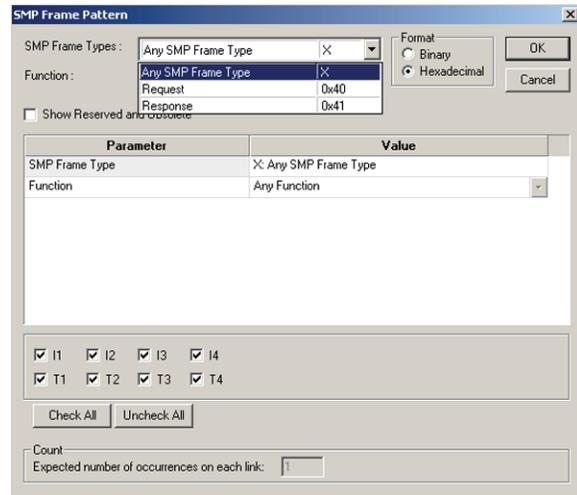
Double-click **Address Frame** in the Patterns window of the Capture Project dialog to open the Address Frame Type Pattern dialog.



Click the down arrow next to the Address Frame Type dropdown list, scroll the list to choose an address frame type to trigger on and click **OK**.

**SMP Frame**

Double-click **SMP Frame** in the Patterns window of the Capture Project dialog to open the SMP Frame Pattern dialog.

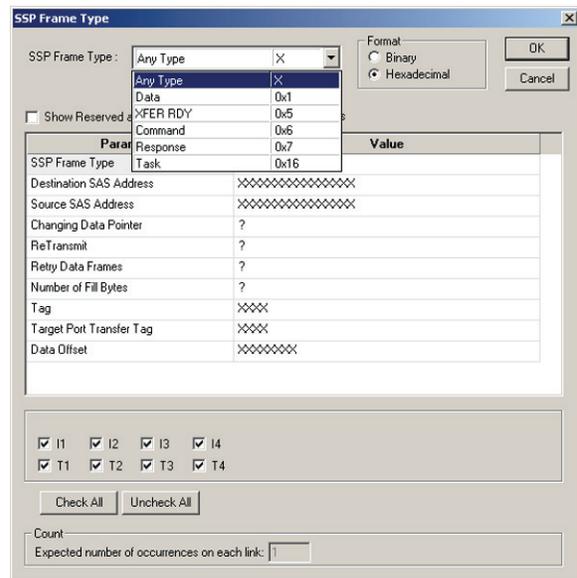


Click the down arrow next to the SMP Frame Types dropdown list, scroll the list to choose an SMP frame type to trigger on.

Then click the down arrow next to the Function dropdown list, choose a function and click **OK**.

**SSP Frame**

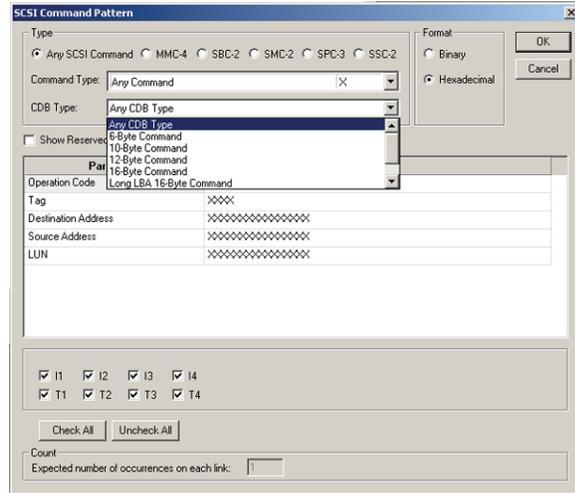
Double-click **SSP Frame** in the Patterns window of the Capture Project dialog to open the SSP Frame Pattern dialog.



Click the down arrow next to the SSP Frame Type dropdown list, scroll the list to choose an SSP frame type to trigger on and click **OK**.

**SCSI Command**

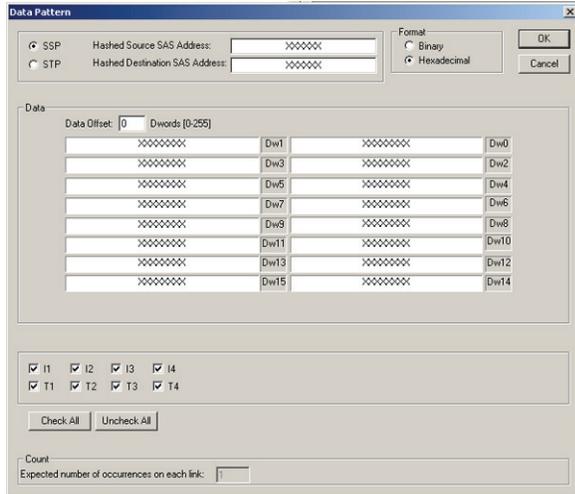
Double-click **SCSI Command** in the Patterns window of the Capture Project dialog to open the SCSI Command Pattern dialog.



Click the down arrow next to the CDB dropdown list, scroll the list to choose a CDB Type and click **OK**.

**Data Pattern**

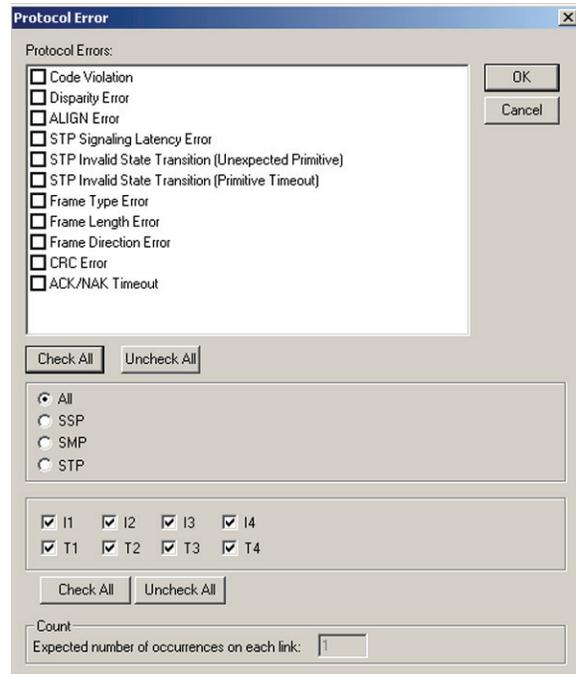
Double-click **Data Pattern** in the Patterns window of the Capture Project dialog to open the Data Pattern dialog.



Define the data pattern for triggering and click **OK**.

**Protocol Errors**

Double-click Protocol Errors in the Patterns window of the Capture Project dialog to open the Protocol Errors dialog.



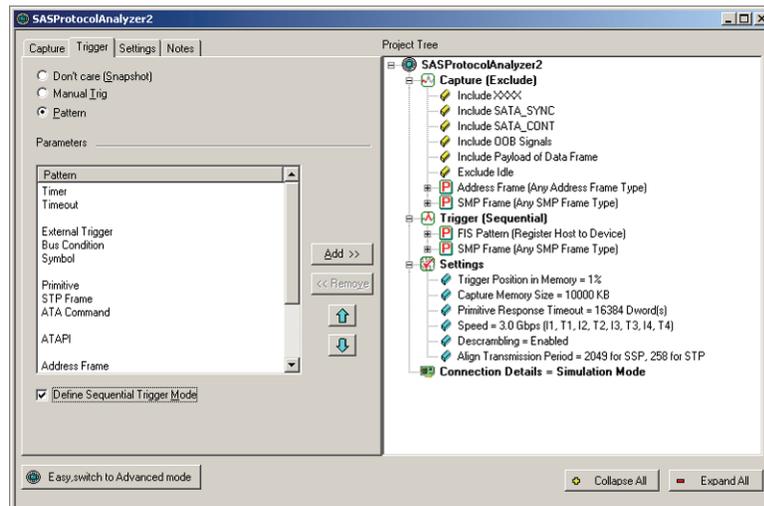
Check the protocol error(s) that you wish to trigger on and click **OK**.

## Sequential Trigger Mode

In the Sequential Trigger mode, triggering occurs whenever a specific sequence of patterns are detected. The sequence is established by the order in which the triggering patterns are defined. You must define at least two patterns to enable the selection of the sequential trigger mode.

**Note:** Patterns such as Primitives and Symbols or Frames occurring very close together on different ports will cause an error in triggering.

To define a triggering sequence, check the **Define Sequential Trigger Mode** check box.



*Figure 20. Select Sequential Trigger Mode*

## Timer

The sequential triggering mode offers the option of triggering on a timer or inserting a timer in the triggering sequence to delay detection of the next pattern in the sequence. To insert a timer in the trigger list Double-click **Timer** to open the timer definition dialog.



Enter the desired **Time Value**, choose the **Time Unit** and click **OK**.

## Defining Patterns

The definition of patterns for the sequential trigger mode is identical to the Any Trigger mode with the following exception: In the sequential triggering mode the definition dialogs for these triggering patterns enable the setting, to count the number of occurrences. This allows the user to specify the number of times that the pattern must occur before triggering or proceeding in the trigger sequence.



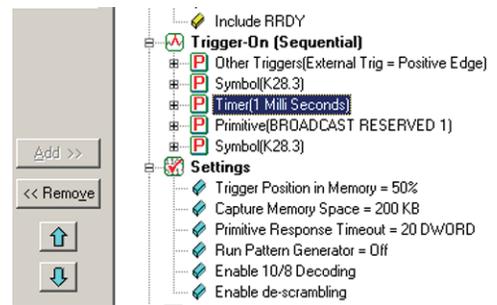
**Figure 21. Number of Occurrences**

**Note:** The events on each link are counted independently causing a trigger whenever the number of occurrences on any link equals the specified value.

**Triggering order**

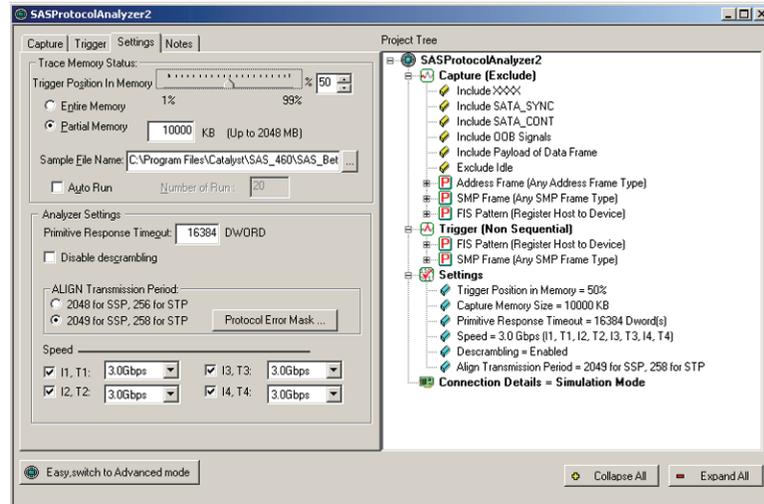
As triggering patterns are defined and added they are displayed in the Project Tree sequentially in the order that they were entered under the Trigger On category. When the project is run, the analyzer will detect the occurrence of each pattern in order and trigger on the last one.

The sequence of triggering patterns can be re ordered if desired. To change the sequence order, highlight a trigger pattern and use the Up or Down arrow to move it to a new position.



# Project Settings

To set project options click the **Settings** tab.



*Figure 22. Setting Project Options*

## Memory Settings

### Memory Size

To reduce the capture memory size, check **Partial Memory** and enter the desired buffer size or, check **entire memory** to allow capture for the entire memory (1 GB) if you want to capture the maximum amount of trace data.

**Note:** In cases where the size of a data packet exceeds the set buffer memory allocation, the project will run, but no capture will result. In such cases you must increase the buffer memory size to a value greater than the packet size.

### Trigger Position

Pre-Trigger is set by default at 50%, which defines the percentage of data to be captured before and after the triggering event. You may change this percentage by dragging the slider to the desired value.

The capture of the specified percentage of the data prior to the triggering event cannot be guaranteed and may in some cases be 0. This can occur in cases where the triggering event occurs before the required number of pre-trigger event data can be stored. In these cases the data display will show fewer than the specified data points prior to the triggering event. For more detail see "Pre-Trigger" on page 44.

### Sample File Name

Click the ellipses next to the Sample File Name text box and choose a file name and location for the results of your current project.

### Auto Run

To repeat the current capture and trigger setup automatically, check the **Auto Run** checkbox and enter the number of times in the **Number to Run** text box. The capture and trigger will repeat automatically for the specified number of times and the results saved in consecutively numbered **Sample.scs** files.

## Analyzer Settings

**Choose Port Speed** The default speed selection is **Autospeed**, however, if your unit does not support autospeed, click the down arrow next to the port speed box and choose a port speed.

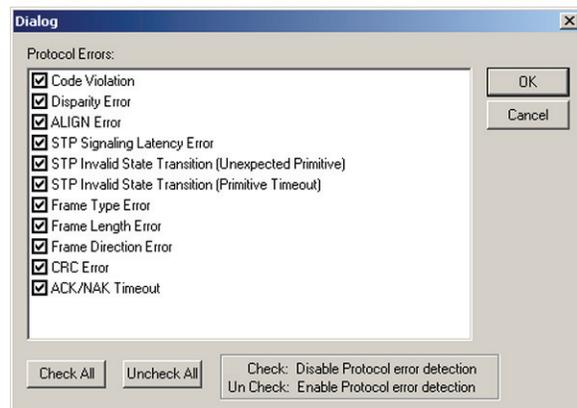
**Note:** If a Port check box is unchecked the analyzer will not capture any patterns for that Port. The trace memory for that port will be allocated to it's adjacent Port. e.g. I1, T1 <-> I2, T2 or I3, T3 <-> I4, T4

**Disable Scrambling** Check this option to disable scrambling.

**Primitive Response Timeout** Enter a value for the Primitive Response Timeout.

**Align Transmission Period** Choose the Align Transmission Period by clicking the corresponding option button.

**Protocol Error Mask** Click the **Protocol Error Mask** button to open the Protocol Error Mask dialog.



Check the Protocol Errors that you wish to not display in the sample view.

**Add a Project Note** To enter and save information about the current project click the **Notes** tab and enter the data about the project.

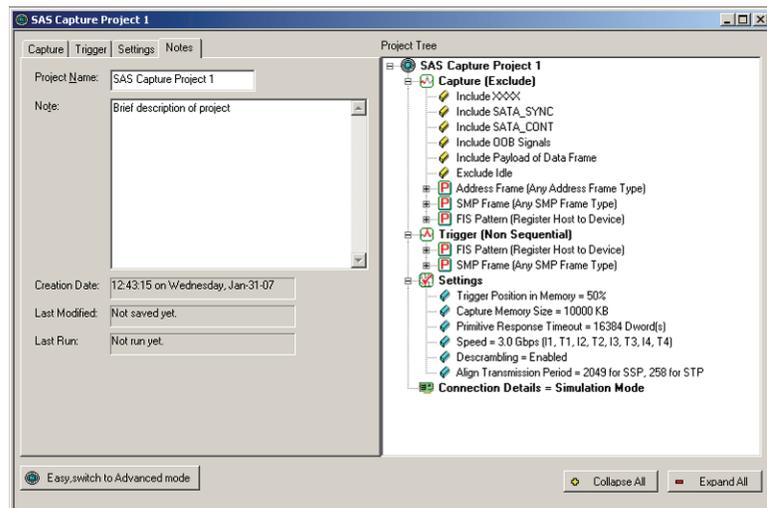
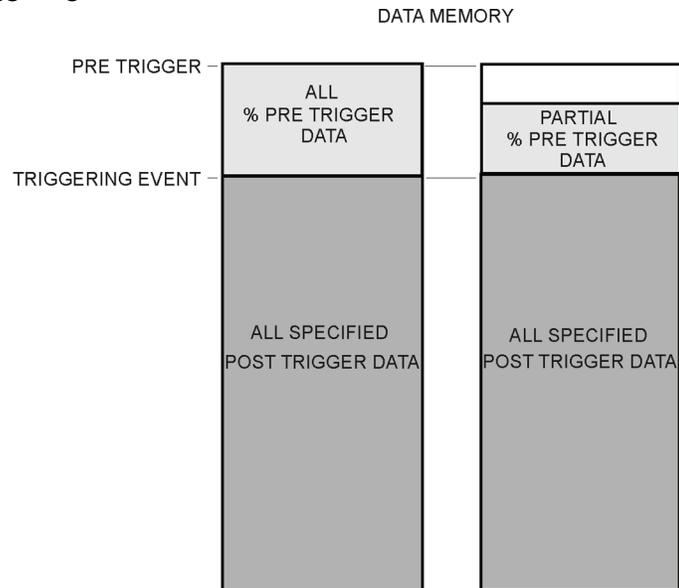


Figure 23. Project Note

## Pre-Trigger

The amount of data to be captured before and after the trigger may be set as a percentage of pre-trigger, between 1% and 99%. This may be done by positioning the pre-trigger slider to the desired percentage. This feature allows the evaluation of bus activity leading up to and after the triggering event. The operation of the pre-trigger in the data memory is conceptually illustrated in Figure 24.

Pre-trigger Data is the capture of the specified percentage of the data prior to the triggering event cannot be guaranteed and may in some cases be 0. This can occur in cases where the triggering event occurs before the required number pre-trigger event data can be stored. In these cases the data display will show fewer than the specified data points prior to the triggering event.



*Figure 24. Pre-Trigger Example, 20% Pre-Trigger*

# Advanced Mode (User Defined)

This mode expands your Analysis capability by allowing you to program complex triggering and data capture projects.

The Advanced Mode is implemented as a state machine with up to 23 different states. Each state may be individually programmed to:

- Trigger on a different event or trigger unconditionally.
- Capture Everything, Nothing or a user defined pattern.
- Include up to 3 ELSE IF statements allowing a jump to any other state based on user definition.
- Use up to 3 timers that can be set to a maximum value of 42949 ms. A timer may be set in the state or continue the one set in the previous state.
- Output an external trigger High or Low.

## Working in the Advanced Mode

To start working in the Advanced Mode, click the **Easy, Switch to Advanced Mode** button in an open Analyzer window.

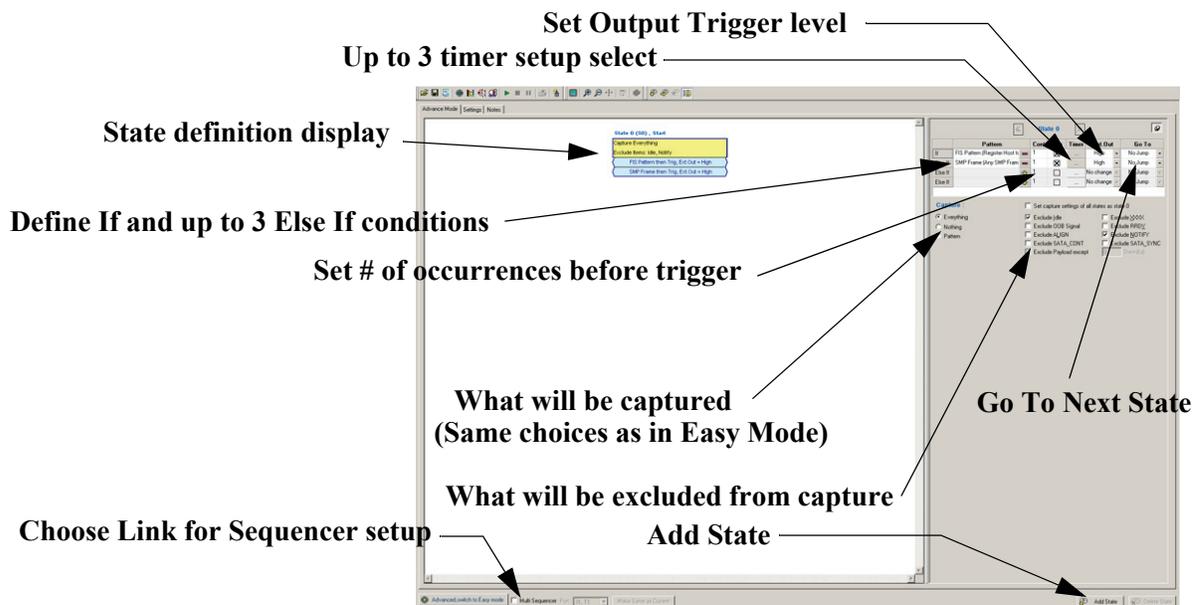
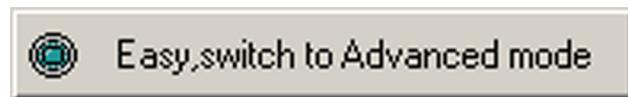
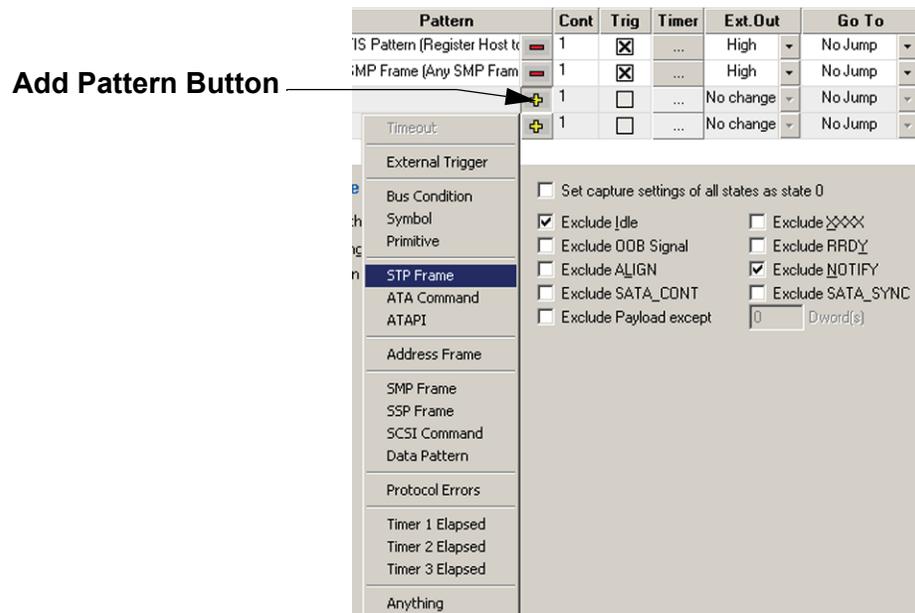


Figure 25. State Programming Dialog

## Setting Trigger Conditions

To set the If and Else If trigger condition:

1. Click in the Add Pattern Button for a Pattern Field and choose a trigger condition from the open drop down list.

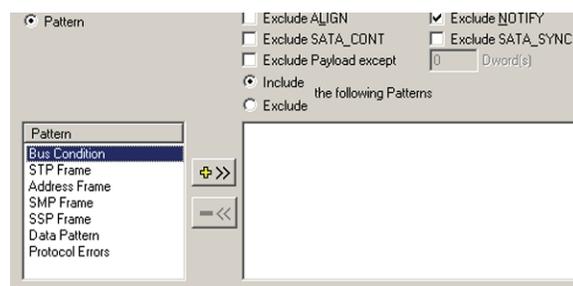


*Figure 26. Choosing a Trigger Condition*

2. Define each selected pattern in the same way as in the Easy Mode as described starting on page 27. If you wish to use a timer you must define it first.

**Note:** A timer may be set for whenever an if or elseif condition is met.

3. Enter a value for the number of occurrences before trigger in the **Cont** field. Up to a maximum of 65535 occurrences.
4. Choose a capture option: **Everything**, **Nothing** or **Pattern**.
5. If you chose Pattern, you may select patterns for inclusion or exclusion. Clicking the **Pattern** option enables a pattern definition dialog.

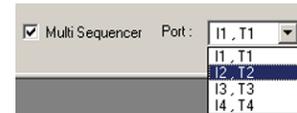


6. Choose a pattern(s) and click the +>> button to add it for capture or exclusion. Each pattern selected is defined in the same way as in Easy mode. See see "Defining Patterns" on page 27.

7. If an output trigger is required, click the down arrow in the **Ext. Out** field and choose an output trigger level.
8. To go to another state, click the down arrow in the **Go To** field and select a state to go to next. If no other state has been defined choose **New State** to add a state to go to.

## Multi - Link Triggering

You may set up different triggering for each link. To set up different trigger conditions for a link, check the Multi Sequencer check box and select the link for setup from the Port drop down list.



*Figure 27. Multi - Link Triggering Setup*

## Set Timers

You may set and use up to 3 timers for triggering. Each timer may be set for each state or set to continue from one set in the previous state. The timer defined for a particular state is started when that state is entered. To set up the timers, click the **ellipses** in the **Timer** field in each state and define each of the timers in the Set Timers dialog.



*Figure 28. Set Timers Dialog*

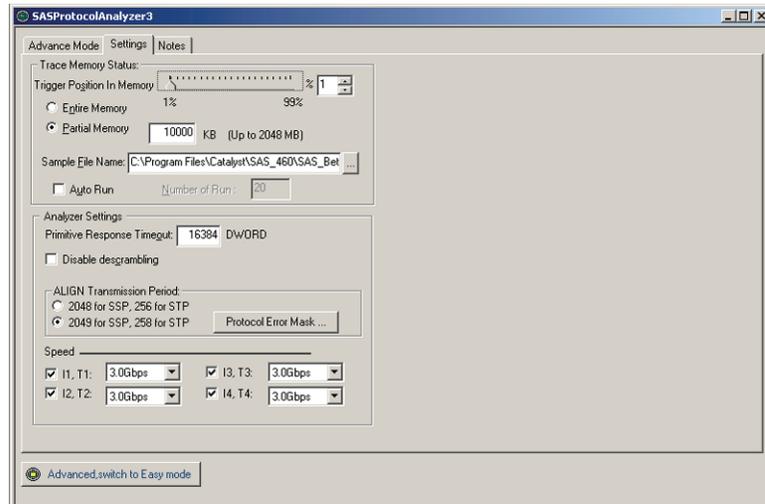
## Useful Key Sequences

The following key sequences are active to assist you in navigating a defined state machine:

|                    |                                |
|--------------------|--------------------------------|
| Ctrl+a             | Add State                      |
| Insert             | Insert State                   |
| Del                | Delete State                   |
| Ctrl+c/Ctrl+Ins    | Copy                           |
| Ctrl+v/Shift+Ins   | Paste                          |
| Up/Down arrow keys | Moves selection between states |
| Page Up/Page Down  | Page Up and Page Down states   |
| Home               | Go to first page               |
| End                | Go to end page                 |

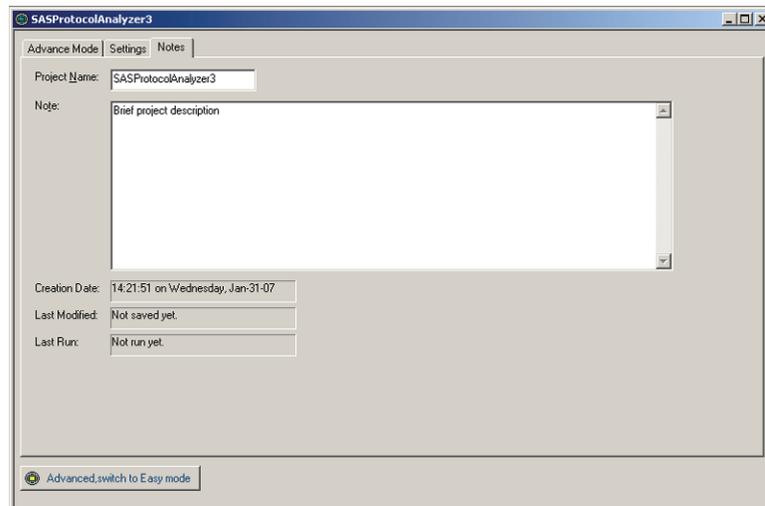
## Project Settings

Prior to running the Advanced mode project, click the **Settings** tab. The options in the Settings dialog are the same as for the Easy Mode and are described starting on page 42.



*Figure 29. Project Settings Page*

To include some descriptive information about the project, click on the **Notes** tab and enter a brief descriptive note.

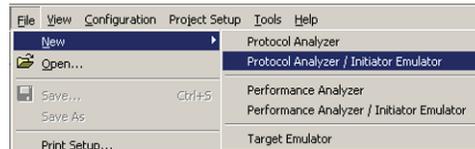


*Figure 30. Project Note*

# Exercise and Capture

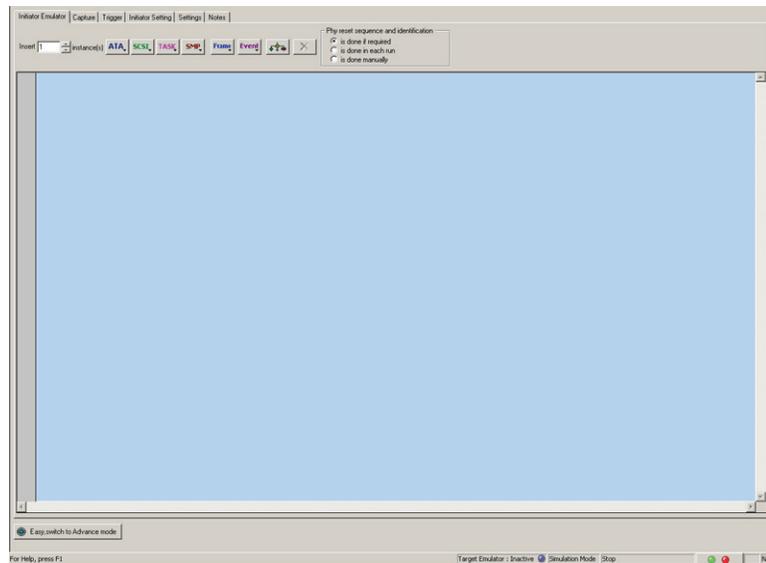
To perform a capture with Initiator Emulator generated bus traffic, click **File, New** and choose **Protocol Analyzer (Initiator Emulator)**. Program the Initiator Emulator and then set up a capture as described in “**Protocol Analysis**” on page 17.

Not in current version for STX-460.



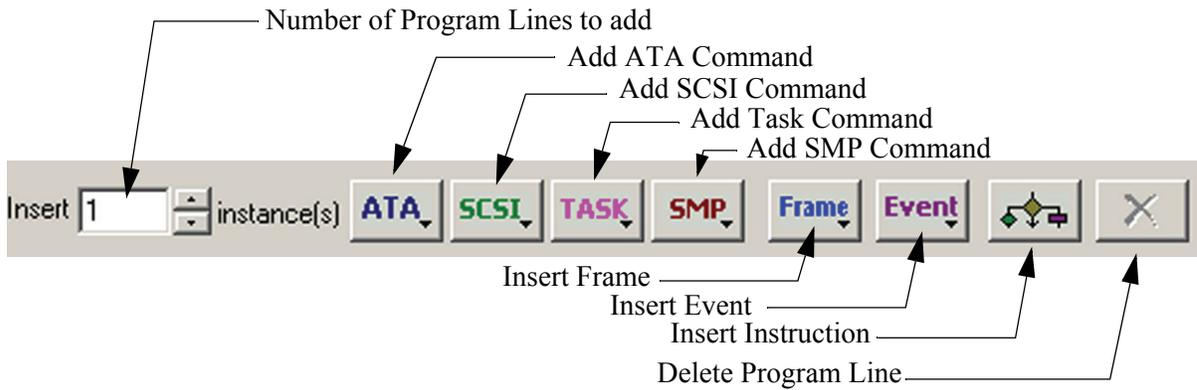
## Programming the Initiator

Click the Initiator Emulator tab to open the Initiator Emulator program dialog.



**Figure 31. Initiator Emulator Program Dialog**

An Initiator program may be created using ATA, SCSI, Task, SMP commands, Frames and Events. These commands may be executed in a program loop or subject to user specified conditions



**Add Program Lines**

To add program lines, enter the number of lines to be added and click the desired command button.

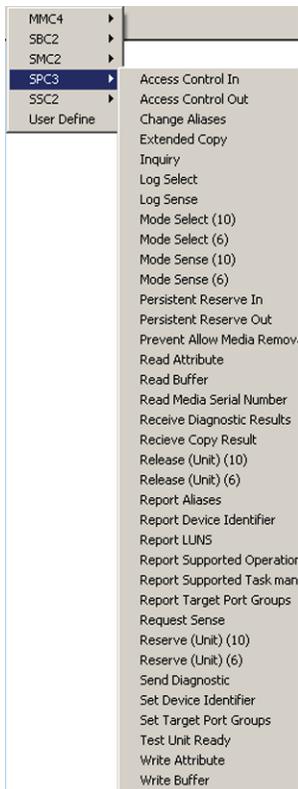
## Adding Initiator Commands

### Adding an ATA Command



Click on the **Insert ATA Command** button, click on one of the 7 command categories and choose a command.

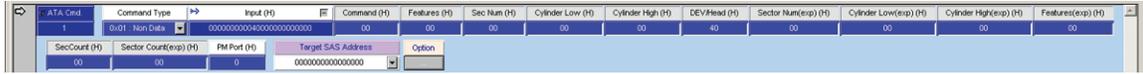
### Adding a SCSI Command



Click on the **Insert SCSI Command** button, click on one of the 5 command categories and choose a command.

### Adding a User Defined ATA Command

Click on the **Insert ATA Command** button and choose User Define. This enters an ATA command line with editable fields to define your own custom command.

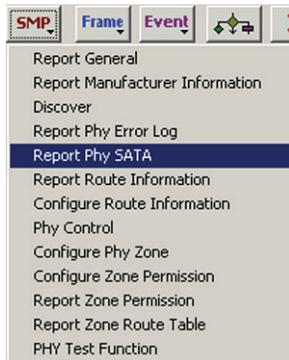


### Adding a Task Command



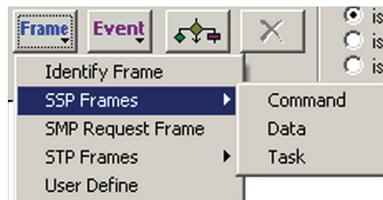
Click on the **Insert Task Command** button and choose the command to be inserted.

### Adding an SMP Command



Click on the **Insert SMP Command** button and choose the command to be inserted.

### Adding a Frame



Click on the **Insert Frame** button and choose the frame type to be inserted

Note that SSP and STP frames offer additional options.

## Adding an Event

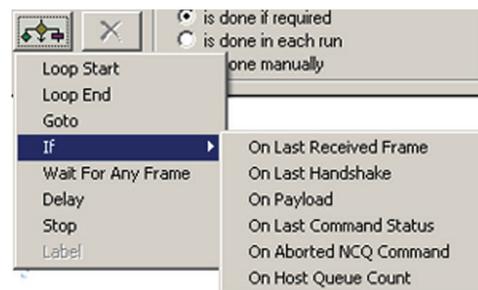


Click on the **Insert Event** button and choose the event to be inserted.

## Inserting Instructions

Instructions are logical program elements that allow the definition of how the Initiator Emulator program is executed. Using instructions you may define program loops, make conditional jumps, insert delays and stops.

To insert an instruction, click on a command in the Initiator Emulator program where you want the instruction inserted and then click the **Insert Instruction** button and choose the instruction to insert.



### Start Loop

Click on the command where you would like to start the loop and then insert the **Loop Start** instruction.

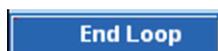


### Loop Count

Enter the number of times to run the loop in the number text box or click the down arrow on the Count Drop-down combo box and choose **Infinite**.

### End Loop

Click on the command where you would like to stop the loop and then insert the **Loop End** instruction.



### Instruction insert

You may set the instruction to be inserted before or after a command by setting the insertion mode. To set the insertion mode, right click in the

initiator page and choose **Insert before current position** or **Insert after current position**.

|                                  |        |
|----------------------------------|--------|
| Select All                       | Ctrl+A |
| Deselect All                     | Ctrl+D |
| Delete Selected Item             | Del    |
| Cut Selected Item                | Ctrl+X |
| Copy Selected Item               | Ctrl+C |
| Paste                            | Ctrl+V |
| Insert after current position    |        |
| ● Insert before current position |        |

**Add a Label**

Add a label to any command such that it may be used for conditional and unconditional jumps. Click on the command you wish to label and insert the **Label** instruction. You may also insert a label by right clicking on a command and choosing **Add Label**.



Labels are automatically labeled as Label# sequentially as they are added, however, you may assign them meaningful names such as STOP and START.

**Add a Goto**

To insert an unconditional jump to a previously labeled command, insert a **Goto** instruction. Then click the down arrow on the Drop-down combo box and choose the label to designate the destination command.



**Add an If**

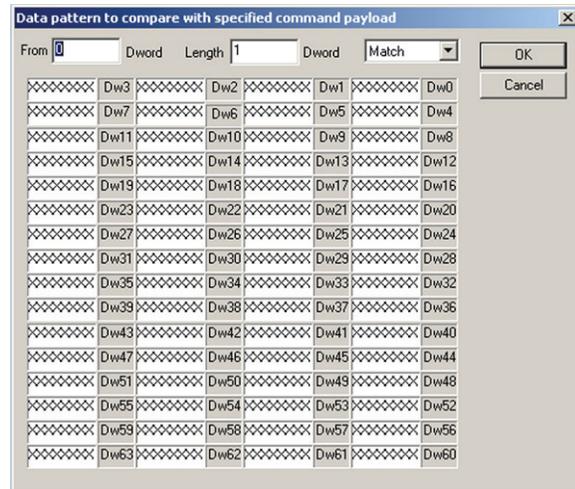
To insert a conditional jump to a previously labeled command, insert an **If** instruction. Choose a specialized condition for the **If** from the If flyout.



Then click the down arrow on the **If** Drop-down combo box and choose the condition for the jump and then the down arrow on the **Goto** Drop-down combo box and choose the label to designate the destination of the jump.



For commands with incoming payloads you may specify patterns for a condition by clicking the options button on a payload instruction and defining the required pattern(s).



### Insert Delay

To delay program execution insert a **Delay** instruction. Enter the delay value (In microseconds) in the number text box to define the desired delay.



**Add Wait for Any Frame** Insert this instruction and set an expiration time and a label for the Goto. This instruction will cause the Initiator program to go to the specified label if any frame occurs prior to the expiration time. If the expiration time occurs first the Initiator program will go to the next step.



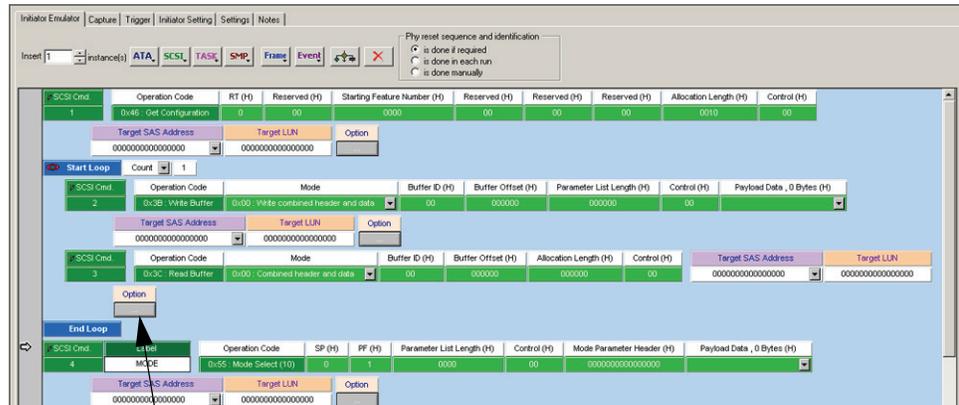
### Add Stop

To define the end of the Initiator Emulator program, insert the **Stop Initiator Exerciser** instruction.



## Sample Initiator Emulator Program

Figure 32. shows a simple completed Initiator Emulator program.



Option button

Figure 32. Sample Initiator Emulator Program

### Data

For commands requiring data blocks, click the down arrow of the **Payload Data** Drop-down combo box and choose from a set of pre-defined data blocks. If you need a new data block, click the Data Block icon on the tool bar to open a data block definition dialog. See page 73 for instructions on creating data blocks.

**Phy reset sequence and initiation** Will be performed when required by default, but you may choose to perform it on each run or manually.

## Exercising Specific SAS Addresses

Since more than one SAS device may be active at any given time you may specify specific commands to be sent to a SAS address. To assign commands to a SAS address:

1. click the down arrow on a **Target SAS Address** block in a completed Initiator Emulator program and choose **Find New Device**.

### Find New Device

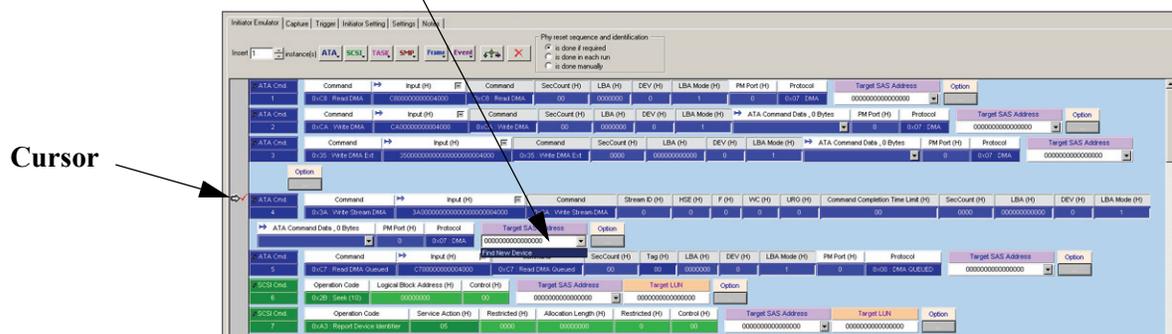
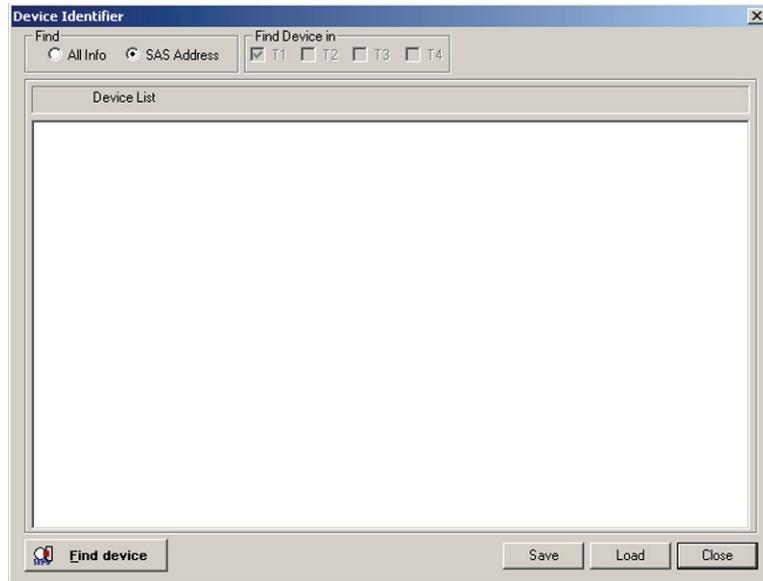


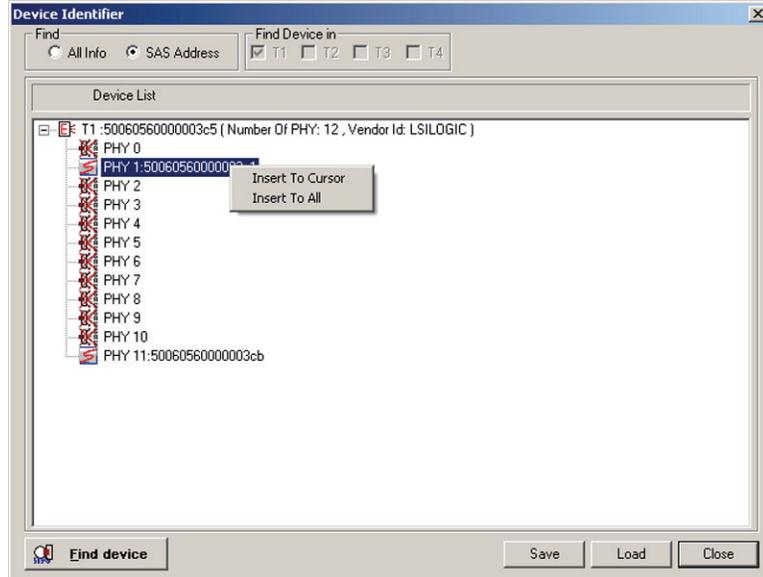
Figure 33. Find SAS Devices Select

Choosing Find New Device opens the **Device Identifier** dialog. (default Find option is SAS address)



*Figure 34. Device Identifier Dialog*

2. Click the **Find device** button to display all active SAS addresses.



*Figure 35. Active SAS Addresses*

3. To assign commands to an active SAS address, right click an address and choose either **Insert: To Cursor** or **Insert: To All**. **Insert: To Cursor** will assign all the commands up to the cursor to the chosen address and **Insert: To All** will assign all of the commands to the chosen address.

## Record and Play

This feature allows the selection of a range of commands in a trace and export them to a previously saved \*.sac file for execution by the Initiator Emulator. You may choose to export commands from all available samples, between X, Y cursors or between designated commands.

To perform this action:

1. Run a capture project or open a previously run and saved captured trace file.
2. Set X and Y cursors if export between cursors is to be chosen.

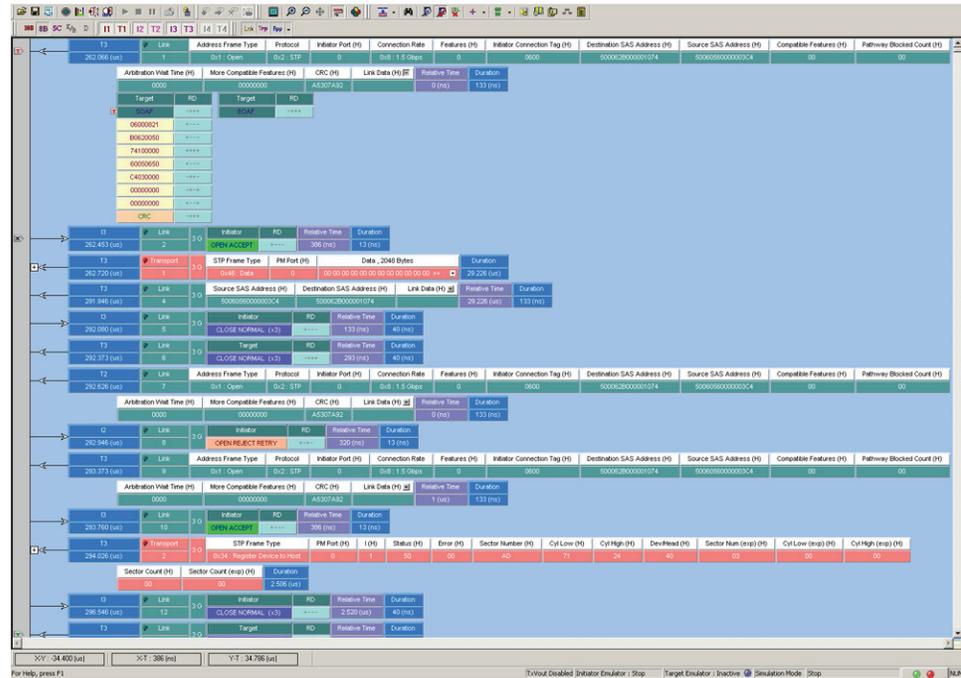
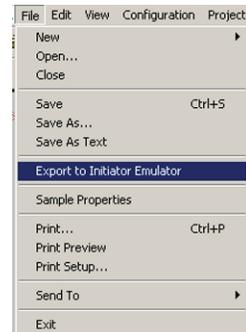


Figure 36. Captured Trace Display With Cursors Set

3. Click **File** and then choose **Export to Initiator Emulator**.

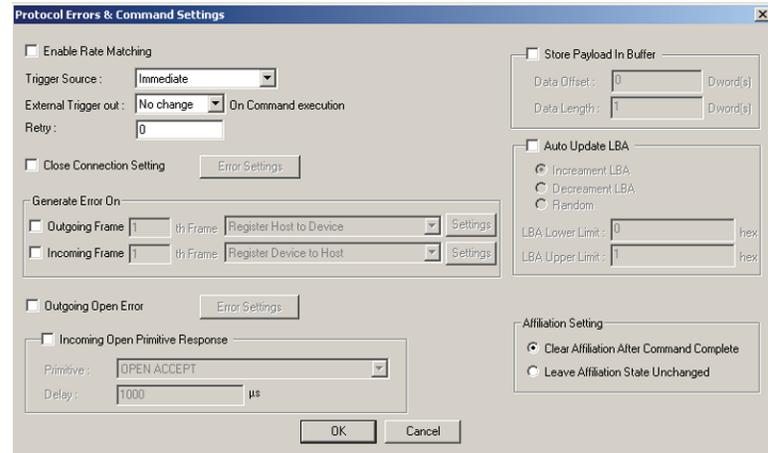




## Error and Command Settings

Each command type offers the user the ability to set a variety of command settings and to introduce errors. Click the **Option** button on a command line to display the corresponding Error and command setting dialog.

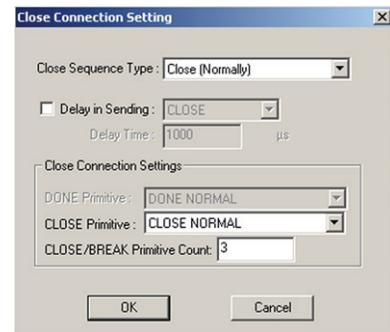
### ATA Error and Command Settings



*Figure 39. Protocol Error and Command Settings for ATA Dialog*

- |                                |  |
|--------------------------------|--|
| <b>Enable Rate Matching</b>    | Check the Enable Rate Matching box to allow a higher speed port to communicate with a lower speed port.  |
| <b>Choose Trigger Source</b>   | Click the down arrow on the <b>Trigger Source</b> combo box choose trigger type and click <b>OK</b> .  |
| <b>External Trigger Out</b>    | Click the down arrow on the <b>External Trigger out</b> combo box choose the external trigger level and click <b>OK</b> .                        |
| <b>Retry</b>                   | Enter a value for the number of command retries when a command failed in the Retry text box.   |
| <b>Store Payload in Buffer</b> | Check the <b>Store Payload in Buffer</b> check box and enter values for <b>Data Offset</b> and <b>Data length</b> in the corresponding text box. |
| <b>Auto Update LBA</b>         | Check the <b>Auto Update LBA</b> check box and check the desired auto update option button.  |

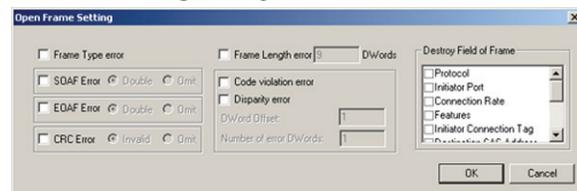
**Close Connection Setting** Checking **Close Connection Setting** enables the **Error Settings** button. Click this button to display the **Close Connection Dialog**,



*Figure 40. Close Connection Dialog*

Click the down arrow for **Close Sequence Type** and **Close Connection Settings** in turn to select the desired close sequence and connection.

**Outgoing Open Error** Check **Outgoing Open Error** and then the enabled **Error Settings** button to display **Open Frame Setting** dialog.



*Figure 41. Open Frame Setting Dialog*

Check the desired errors to be introduced and click **OK**.

**Incoming Open Primitive Response** Check this box, then click the down arrow next to the **Primitive** list box and choose a response type. Enter a **Delay** value and click **OK**.

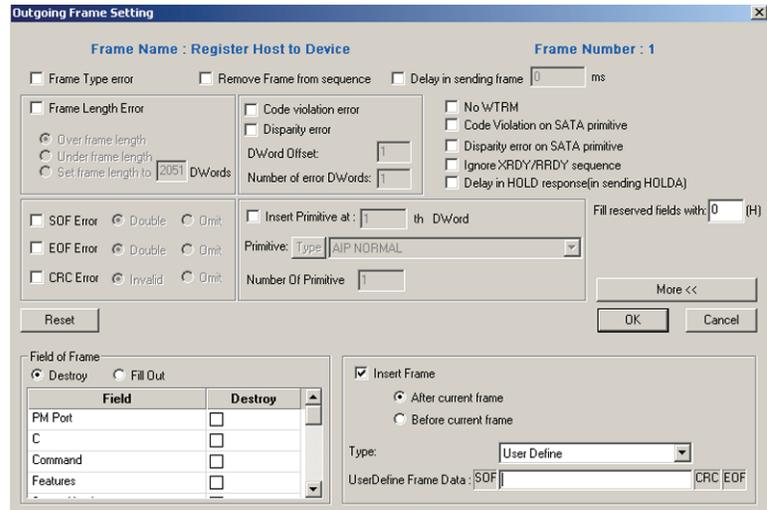


*Figure 42. Incoming Open Primitive Response Dialog*

**Affiliation Setting** Check **Clear Affiliation After Command Complete** to release device to commands from other sources or check **Leave Affiliation State Unchanged** to retain control of device.

## Outgoing ATA Frame Settings

Check **Outgoing Frame** in the **Generate Error On** area and then the enabled **Settings** button to display the Outgoing Frame Settings dialog.



*Figure 43. Outgoing Frame Settings*

**Frame Type Error** Check this to introduce a frame type error.

**Remove Frame from sequence** Check this to remove frame from sequence.

**Delay in sending frame** Check this to delay sending frame and enter a value for the desired delay.

Additionally check as required:

- No WTRM
- Code Violation on SATA primitive
- Disparity error on SATA primitive
- Ignore XRDY/RRDY sequence
- Delay in HOLD response (in sending HOLDA)

**Frame Length Error** Check **Frame Length Error**, choose the type of error to introduce and click **OK**.

**Code violation and Disparity error**

Check these if required and specify DWord offset and the number of error DWords.

**SOF, EOF and CRC errors** Check these as required and specify **Double** or **Omit** by checking the corresponding option button.

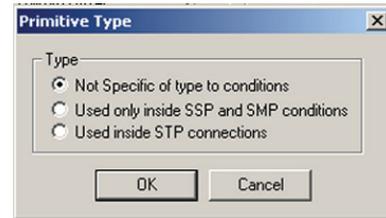
**Insert Frame**

Check **Insert Frame** and then click the down arrow on the **Type** combo box and choose the frame type. Then choose if it should be inserted before or after an outgoing frame command. Make sure that you have clicked **More**.

**Note:** In addition to the pre-defined frame types you may scroll down the list to **User Defined** and enter your own frame data between SOF and EOF.

**Insert Primitive**

Check **Insert Primitive** and then click the **Type** button to open the **Primitive Type** dialog and select the primitive type.



Click the down arrow on the **Primitive** combo box and choose a primitive and click **OK**.

**Fill reserved bits with:**

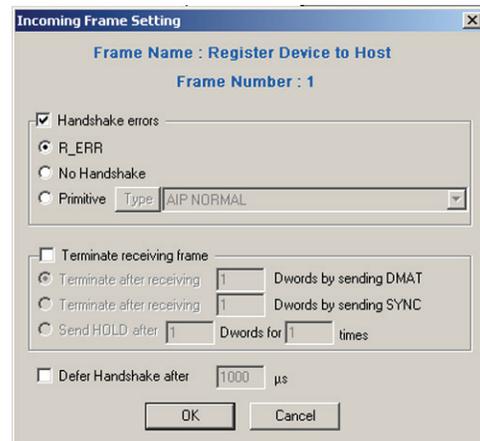
Enter a value to which reserved bits should be changed if other than 0.

**Destroy Field of Frame**

Scroll through the available choices in the Destroy Field of Frame list box and check the frame type to destroy field.

**Incoming ATA Frame Settings**

Check **Incoming Frame** in the **Generate Error On** area and then the enabled **Settings** button to display the Incoming Frame Settings dialog.



*Figure 44. Incoming Frame Setting Dialog ATI*

**Handshake Error**

Check **Handshake Errors** to enable selection of errors and primitives. Check **R\_ERR**, or select **Primitive** to be sent as an incoming frame response. Check **No Handshake** if no response is to be sent.

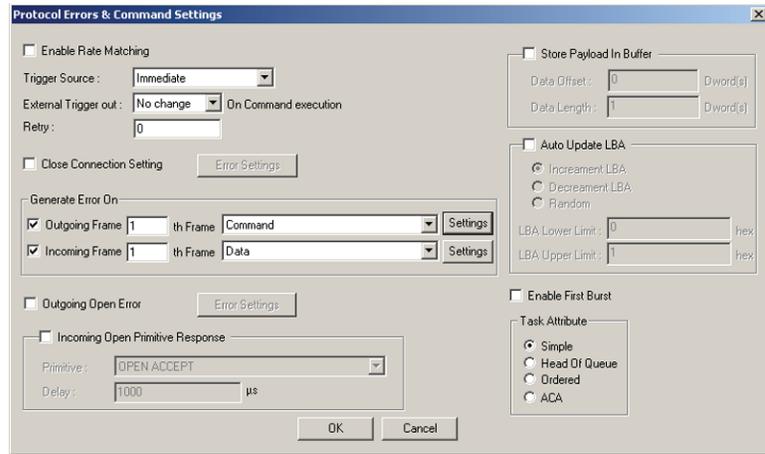
**Terminate Receiving Frame**

Check **Terminate Receiving Frame**, choose the termination type and click **OK**.

**Defer Handshake**

Check the **Defer Handshake after** check box and enter a value for the time to defer the handshake.

## SCSI Error and Command Settings



*Figure 45. Protocol Error and Command Settings for SCSI Dialog*

### Enable Rate Matching

Check the Enable Rate Matching box to allow a higher speed port to communicate with a lower speed port.

### Store Payload in Buffer

This option is enabled for read type commands. Choose and specify **Data Offset** and **Data Length**.

### Choose Trigger Source

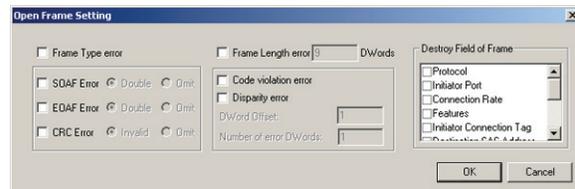
Click the down arrow on the **Trigger Source** combo box, choose trigger type and click **OK**.

### External Trigger Out

Click the down arrow on the **External Trigger out** combo box, choose the external trigger level and click **OK**.

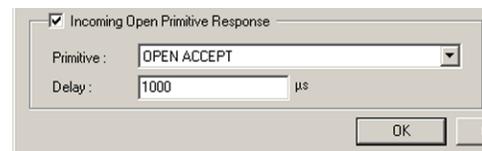
### Outgoing Open Error

Check **Outgoing Open Error** and then the enabled **Error Settings** button to display **Open Frame Setting** dialog.



Check the desired errors to be introduced and click **OK**.

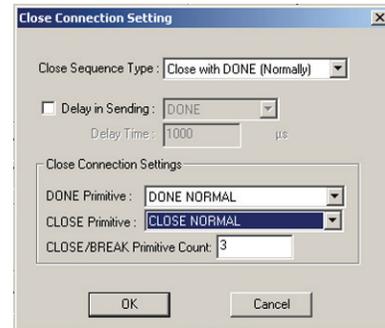
**Incoming Open Frame Response** To set a response to an incoming Open frame, check **Incoming Open Frame Response** select a primitive and enter a value for Delay.



### Retry

Enter a value for the number of command retries for failed commands in the Retry text box.

- Auto Update LBA** Check this to enable Auto Update of LBA and specify the update by checking the desired option button.
- Close Connection Setting** Checking **Close Connection Settings** enables the **Error Settings** button. Click this button to display the **Close Connection Dialog**.

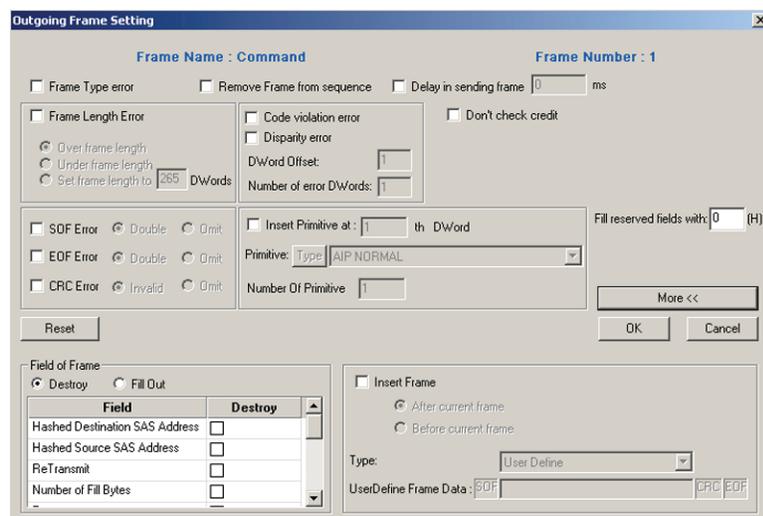


Click the down arrow for **Close Sequence Type** and **Close Connection Settings** in turn to select the desired close sequence and connection.

- Delay in Sending** Check this to specify delay in sending **Done**, **Close** or **Break** and enter a value for the time to delay.
- Enable First Burst** Check the Enable First Burst box to specify that the first burst data shall be transferred as defined by the First Burst Size field in the Advanced Initiator Setting dialog. See Figure 49. on page 68.
- Task Attribute** Choose a task attribute of **Simple**, **Head of Queue**, **Ordered** or **ACA** by checking the corresponding option button.

## Outgoing SCSI Frame Settings

Check **Outgoing Frame** in the **Generate Error On** area and then the enabled **Settings** button to display the Outgoing Frame Setting dialog.



*Figure 46. Outgoing Frame Setting Dialog SCSI*

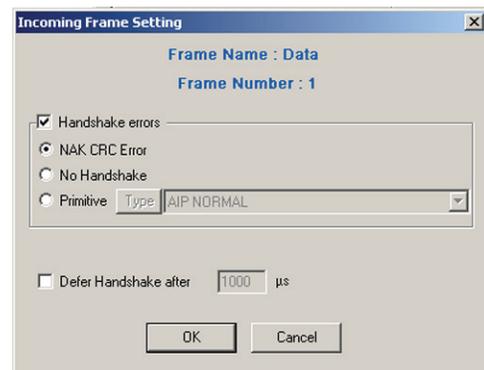
- Frame Type Error** Check this to introduce a frame type error.

- Remove Frame from sequence** Check this to remove frame from sequence.
- Delay in sending frame** Check this to delay sending frame and enter a value for the desired delay.
- Frame Length Error** Check **Frame Length Error**, choose the type of error to introduce and click **OK**.
- Code violation and Disparity error:**  
Check these if required and specify DWord offset and the number of error DWords.
- Dont check credit** Check this to disable credit checking.
- SOF, EOF and CRC errors** Check these as required and specify **Double** or **Omit** by checking the corresponding option button.
- Insert Primitive** Check **Insert Primitive** and then click the **Type** button to open the **Primitive Type** dialog, select the primitive type and click **OK**.
- Destroy Field of Frame** Scroll through the available choices in the Destroy Field of Frame list box and check the destroy field.
- Insert Frame** You may insert a frame After or before the current frame. To insert a frame, check **Insert Frame** check the option button where you would like the frame inserted and choose a Frame **Type**.



## Incoming SCSI Frame Settings

Check **Incoming Frame** in the **Generate Error On** area and then the enabled **Settings** button to display the Incoming Frame Settings dialog.

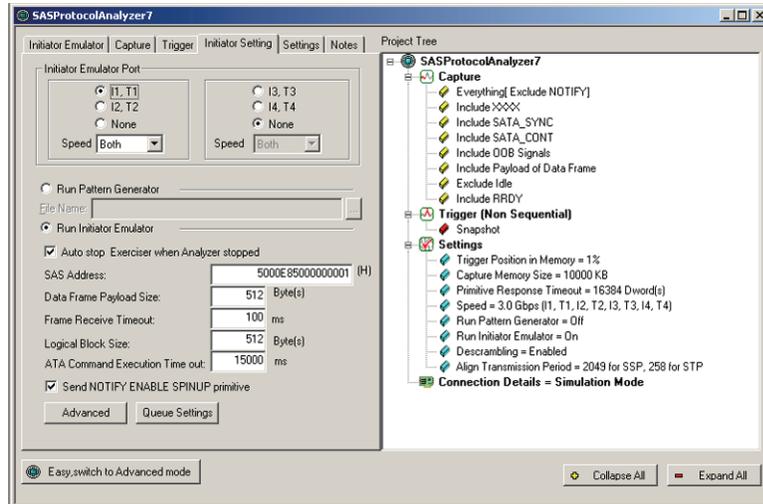


*Figure 47. Incoming Frame Setting Dialog (SCSI)*

- Handshake Error** Check **Handshake Error** and select **NAK CRC Error**, **No Handshake** or **Primitive** and a Primitive **Type**.
- Defer Handshake** Check the **Defer Handshake after** check box and enter a value for the time to defer the handshake.

## Initiator Settings

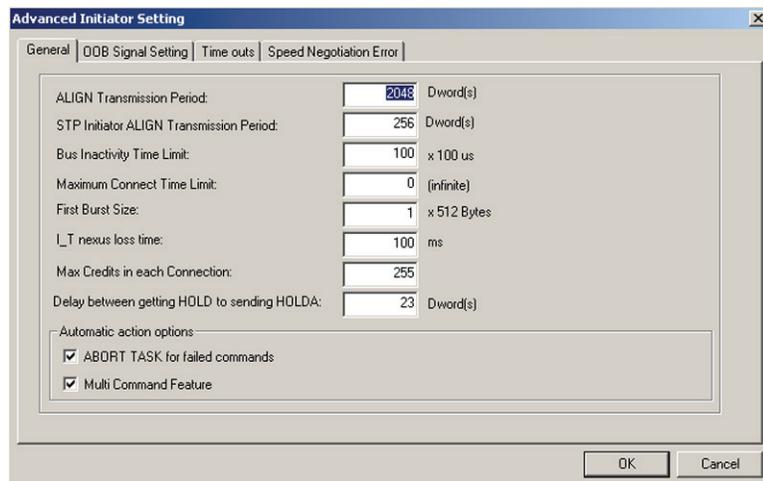
The Initiator Settings dialog allows you to select the Port(s) for generating SAS traffic and specify SAS Address, Data Frame Payload size, Frame Receive Timeout, Logical Block size and ATA Command Execution Time out. You may also elect to run a Pattern Generator. To run the Pattern generator check the **Run Pattern Generator** option button and select a Pattern Generator **File**. You may create Pattern Generator Files as described in Appendix A.



*Figure 48. Initiator Settings Dialog*

Click the **Advanced** button to display additional settable options.

## Advanced Initiator Settings



*Figure 49. Advanced Initiator Settings Dialog*

Click the **Queue Settings** button to display additional settable options.

Queue Settings

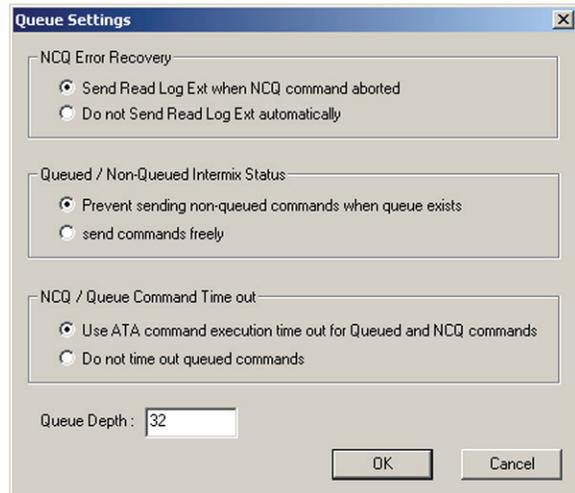


Figure 50. Queue Setting Dialog

OOB Signal Settings

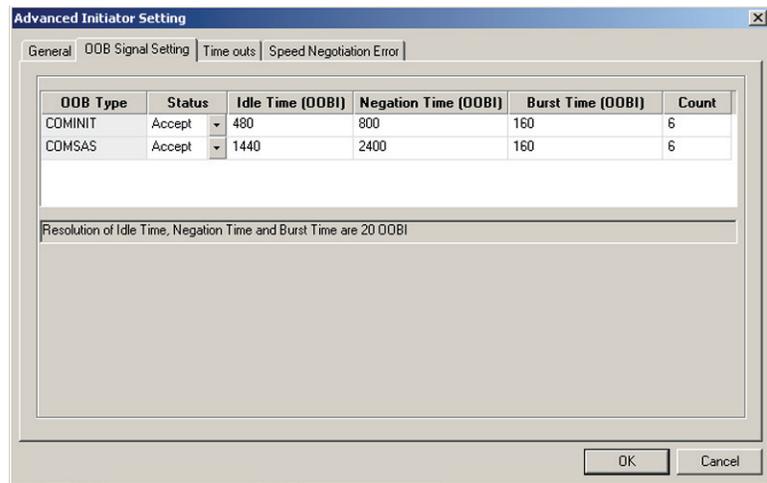


Figure 51. OOB Signal Settings Dialog

Timeouts

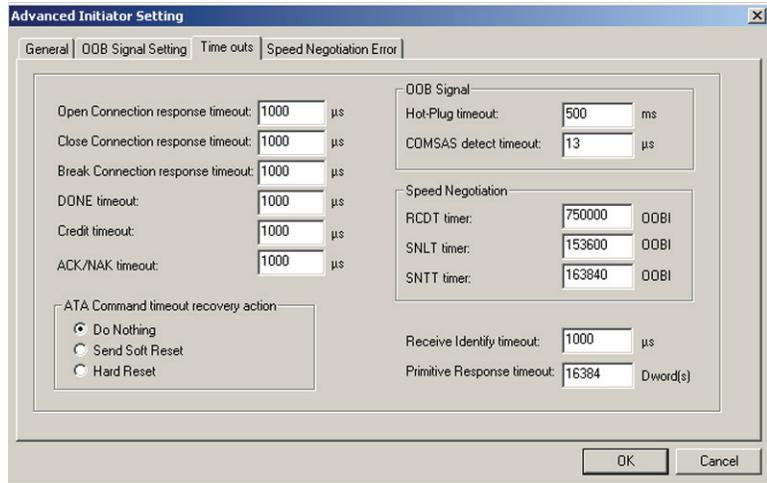


Figure 52. Timeout Setting Dialog

Speed Negotiating Error

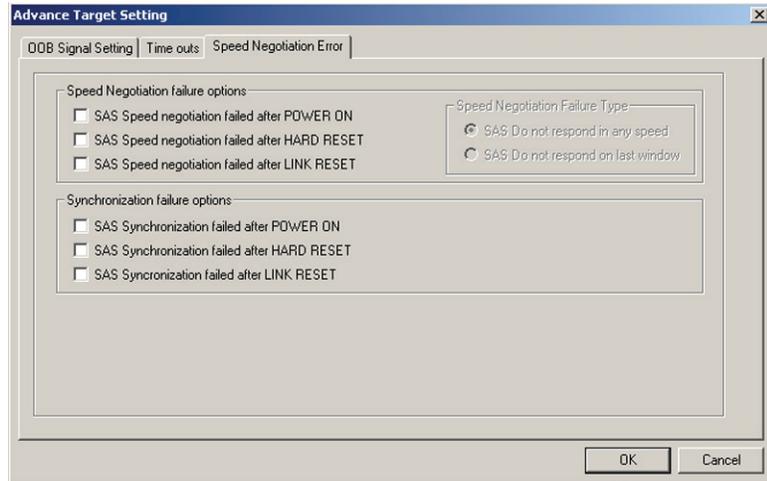


Figure 53. Speed Negotiating Error Setting Dialog

## Project Settings

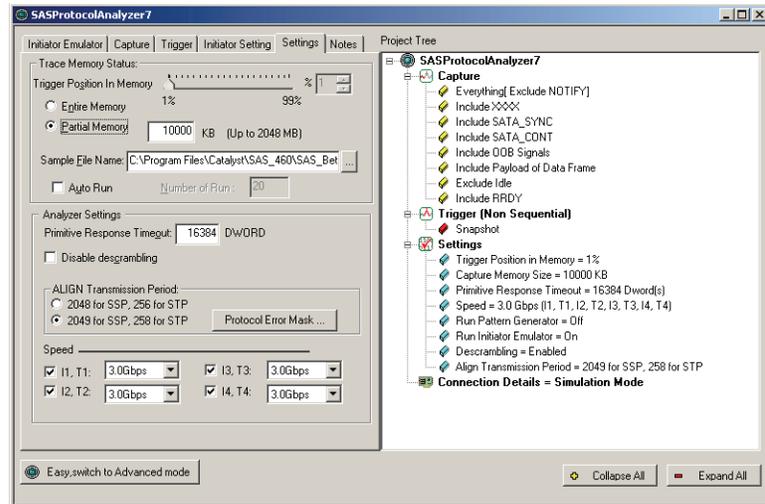


Figure 54. Project Settings

## Memory Settings

### Memory Size

To reduce the capture memory size, check Partial Memory and enter the desired buffer size or, check entire memory to allow capture for the entire memory (1 GB) if you want to capture the maximum amount of trace data.

### Trigger Position

Pre-Trigger is set by default at 50%, which defines the percentage of data to be captured before and after the triggering event. You may change this percentage by dragging the slider to the desired value.

The capture of the specified percentage of the data prior to the triggering event cannot be guaranteed and may in some cases be 0. This can occur in cases where the triggering event occurs before the required number of pre-trigger event data can be stored. In these cases the data display will show fewer than the specified data points prior to the triggering event. For more detail see "Pre-Trigger" on page 44.

### Sample File Name

Click the ellipses next to the Sample File Name text box and choose a file name and location for the results of your current project.

### Auto Run

To repeat the current capture and trigger setup automatically, check the **Auto Run** checkbox and enter the number of times in the **Number to Run** text box. The capture and trigger will repeat automatically for the specified number of times and the results saved in consecutively numbered **Sample.scs** files.

## Analyzer Settings

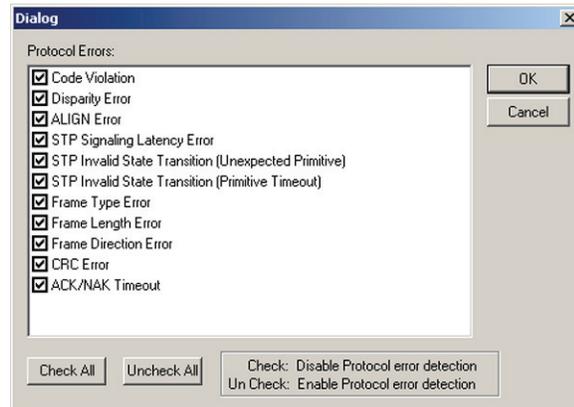
**Choose Port Speed** Click the down arrow next to the port speed box and choose a port speed.

**Disable Scrambling** Check this option to disable scrambling.

**Primitive Response Timeout** Enter a value for the Primitive Response Timeout.

**Align Transmission Period** Choose the Align Transmission Period by clicking the corresponding option button.

**Protocol Error Mask** Click the **Protocol Error Mask** button to open the Protocol Error Mask dialog.



Check the Protocol Errors that you wish to not display in the sample view.

## Creating a Data Block

You may create the following four types of data blocks for use wherever data fields are used:

1. Random data pattern
2. Custom data pattern specifically for your application
3. Counter data pattern
4. Walking bit pattern



To create a data block, click the **Default Data Block** Button on the Main toolbar to open the Data Block dialog box as shown in Figure 55.

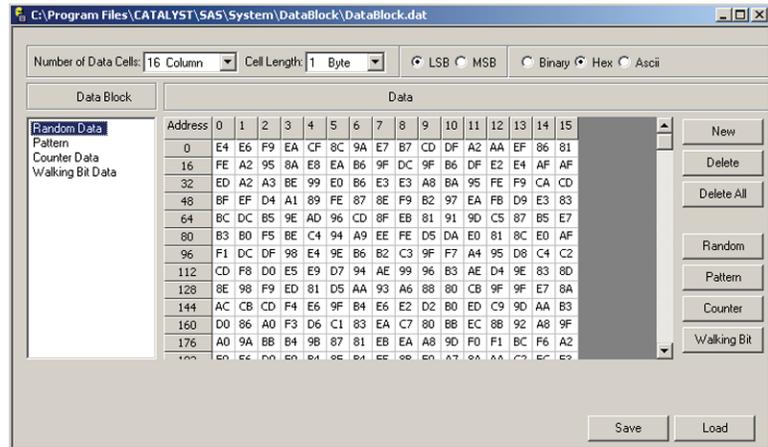


Figure 55. Default Data Block Dialog Box

1. To add another data block, click the **New** button in the Data Block dialog box.

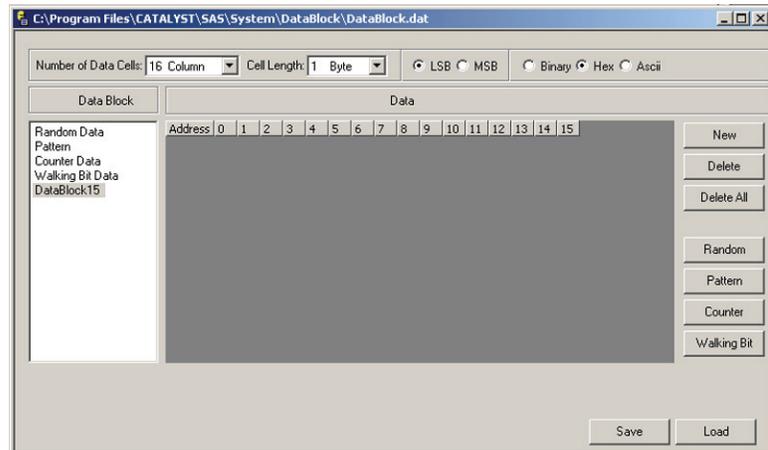
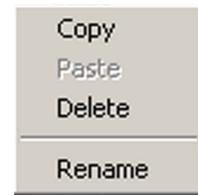


Figure 56. New Data Block Dialog Box

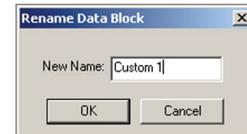
2. Choose the number of data columns (Up to 16 Data Cells/Row) and the Cell length (Up to 16 Bytes/Cell). This is a display function only.
3. Click either the Bin, Hex or Ascii option button to choose a desired number format.
4. Click either the LSB or MSB option button to choose a desired bit order.

## Naming a Data Block

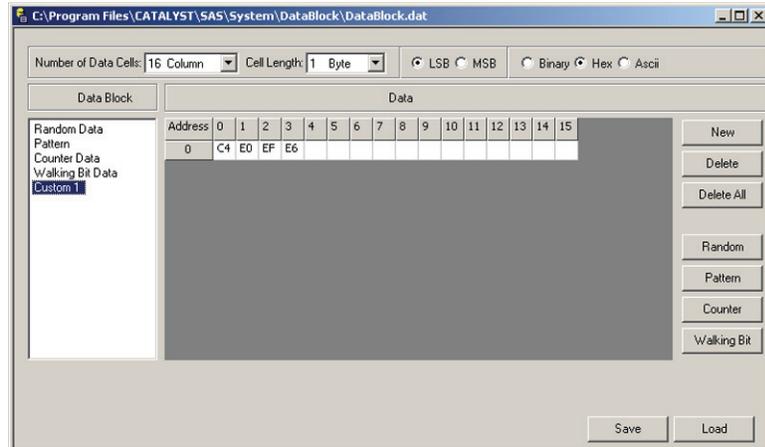
Each new data block is automatically assigned a sequential data block number as it is created. To assign a unique descriptive name to a data block, right click the data block name to open the data block edit menu.



Choose **Rename**.



Enter a descriptive name in the **New Name** edit box and click **OK**.

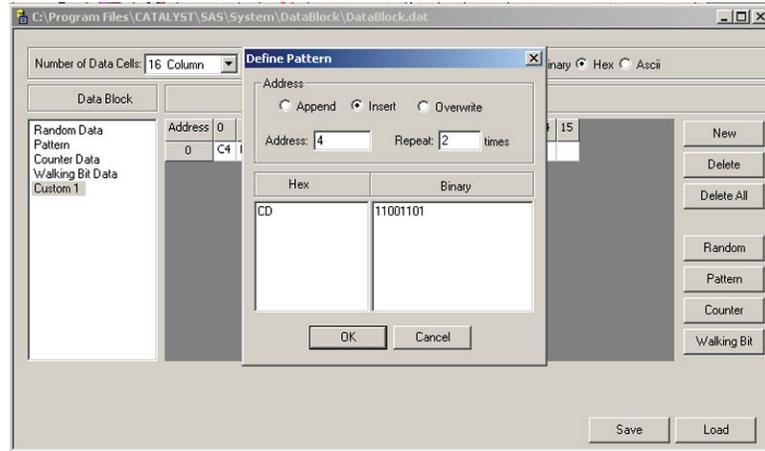


*Figure 57. Sample Active Data Block Custom 1*

You may enter data in the defined cell structure by choosing one of the four available methods. Define your own pattern, set a counter, choose a Random Pattern or choose a Walking Bit Pattern.

### Define Your Own Pattern

1. Click **Pattern** to open the Define Pattern dialog box as shown in Figure 58.
2. Enter the desired data pattern in the Data Pattern edit box.
3. Choose the number of times that you would like that pattern to be repeated and click **OK**.



*Figure 58. Define Your Own Data Pattern*

### Address

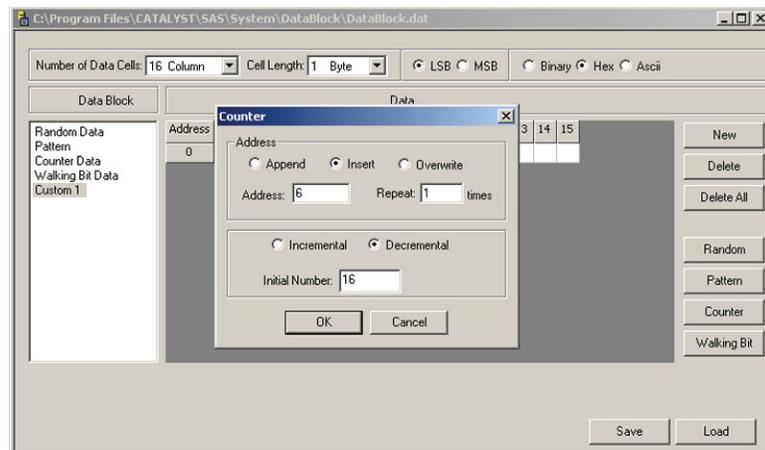
The cell address starts at 0 for the first data entry and automatically increments to the next available address as data is written. You may set it back to a previously defined address to modify its content or insert additional data at that point.

### Insert/Overwrite Data

To define if the data in a previously defined cell will be overwritten or new data inserted after that cell click the **Insert/Overwrite** button to toggle to the desired operation.

### Counter

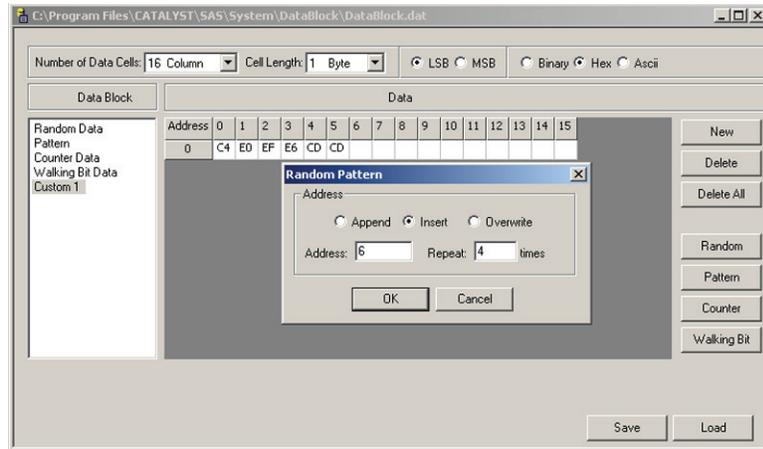
To use a counter as data click the **Counter** button, enter a Starting Number for the counter and the data address that you wish to count to and click **OK**.



*Figure 59. Set Counter as Data*

**Random Data Pattern**

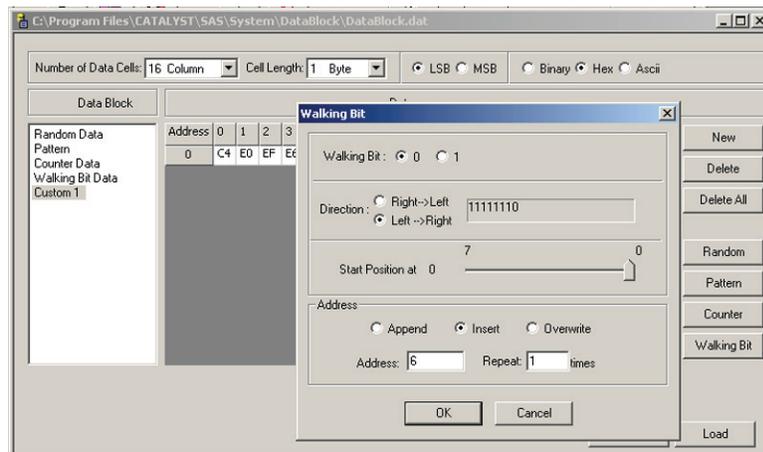
To use a random data pattern, click the **Random** button and enter the number of times that you wish the pattern repeated and click **OK**.



*Figure 60. Choose a Random Pattern*

**Walking Bit Pattern**

To use a walking bit pattern, click the **Walking Bit** button and choose either a walking bit of “0” or “1”, the walk direction, the start position and the number of times the pattern is to be repeated.



*Figure 61. Define a Walking Bit Pattern*

**Save**

When you have completed a data block definition click the **Save** button to save the newly created data block.

## Creating and Editing Data Blocks as Text

You may create and edit data blocks using a text editor such as Windows Notepad. To create a data block in Notepad. Launch notepad. Enter a header consisting of [Item1, Item2, Item3, Item4, Item5] where:

Item1 is the name of the Data Block'

Item2 is Size of the Data Block or the number of bytes in the format

Item3 is Format of the data (HEX, BIN, ASCII)

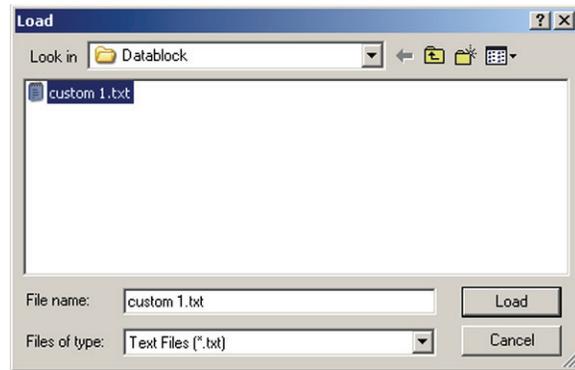
Item4 is the group of bytes defined (1, 2, 4, 8 or 16)'

Item5 is the direction (LSB or MSB)

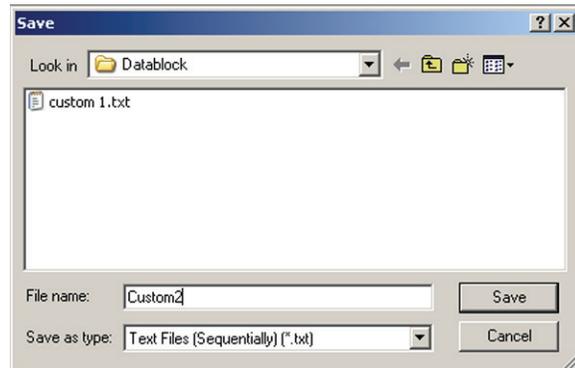
Then enter the data in space delimited Hex format and save as a \*.txt text file.

### Load data

To import Text Editor created data click the **Load** button in the data block definition dialog to open the **Load** dialog.



Choose the desired file and click **Load**. **Modify existing data** To create a new data block from an existing data block using a text editor: Select the data block to be edited from the Data Block Name list and click **Save As** to open the **Save As** dialog.



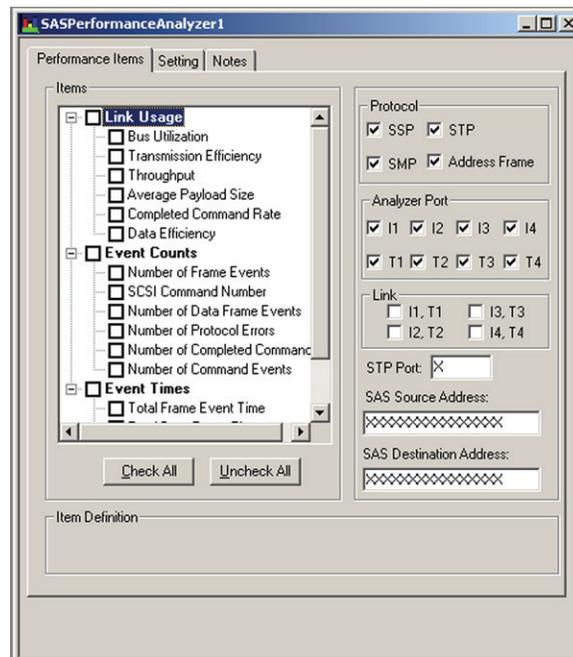
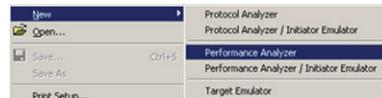
Assign a name to the new data block text file and click **Save**.

You may now edit the newly created text file using Notepad or any other text editor and then import it into the data block definition as described above.

# Performance Analysis

## Performance Analysis with Analyzer Only

To perform a Performance Analysis on bus traffic click **File, New** and choose **Performance Analyzer (Analyzer Only)**.



**Figure 62. Performance Analysis Definition Dialog**

### Choose Protocol(s)

Check the protocol check box(es) to select the protocol category:

- SSP for SCSI Commands
- STP for SATA Commands
- SMP for Management Commands
- Address Frame for Open and Identify

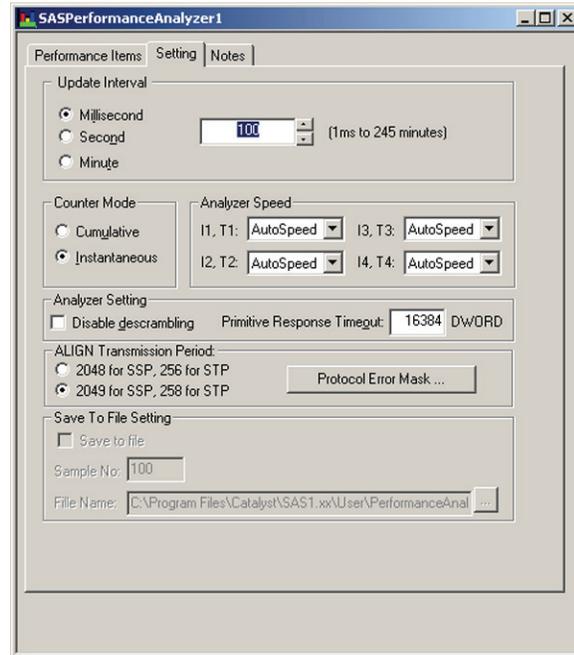
### Define Performance

Click the corresponding Performance Item check box in the Items area. Performance may be measured in the following categories:

1. Link Usage including:
  - Bus Utilization (Ratio of frame time to update interval)

- Transmission Efficiency (Ratio of payload time to frame time)
  - Throughput (Quantity of payload or useful data transferred during update interval)
  - Average Payload Size (Ratio of overall payload size to number of data frame)
  - Completed Command Rate (Ratio of completed commands to total commands)
  - Data Efficiency (Ratio of data payload time to data frame time)
2. Event Counts including:
- Number of Frame Events
  - SCSI Command Number
  - Number of Data Frame Events
  - Number of Protocol Errors
  - Number of Completed Commands
  - Number of Command Events
3. Event Times including:
- Total Frame Event Time
  - Total Data Frame Time
  - Total Data Payload Time
  - Total Idle Time

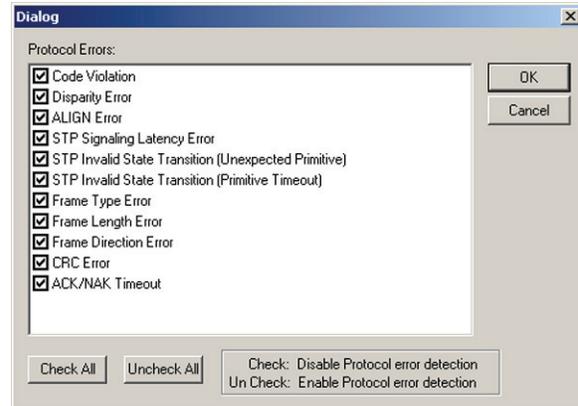
|                                |   |
|--------------------------------|---|
| <b>Analyzer Port</b>           | Check the Analyzer Port(s) to be included in the performance calculation.                 |
| <b>Link</b>                    | Check the Link(s) to be included in the performance calculation.                          |
| <b>STP Port</b>                | Enter the STP port number for the STP port to be included in the performance calculation. |
| <b>SAS Source Address</b>      | Enter a SAS Source Address to be included in the performance calculation.                 |
| <b>SAS Destination Address</b> | Enter a SAS Destination Address to be include in the performance calculation.             |
| <b>Settings</b>                | Click the <b>Setting</b> tab to display the settings dialog.                              |



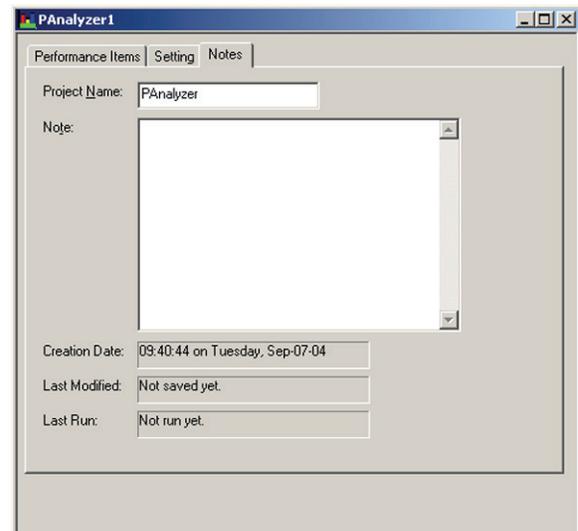
*Figure 63. Settings Dialog*

1. Choose the **Update Interval** in the range of 1 ms to 245 minutes.
2. Set the **Counter Mode** to either Cumulative or Instantaneous (Cumulative causes the measurement counters to continually increment and Instantaneous causes the measurement counters to be reset for each Update interval).
3. Set the **Analyzer Speed** for each port used.
4. To disable descrambling, check the **Disable Descrambling** check box.
5. Enter a value for **Primitive Response Timeout**.
6. Choose the **Align Transmission Period** by checking the corresponding option button.

- To select **Protocol Errors** from the analysis click the **Protocol Error Mask** button and check any or all of the protocol errors to be excluded from the analysis.



- To save the analysis result for later review, check **Save to file** and enter the path where you would like to save the result.
- To include a descriptive note about the project click the **Notes** tab and enter the desired information.

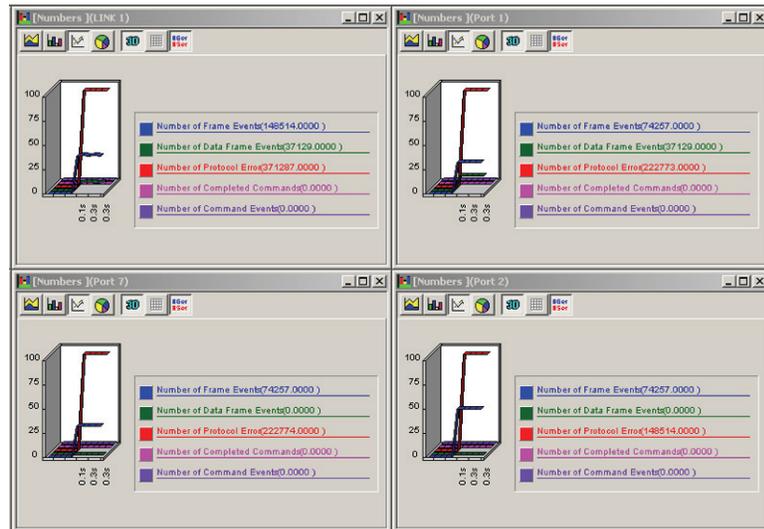


To perform the Performance Analysis click the



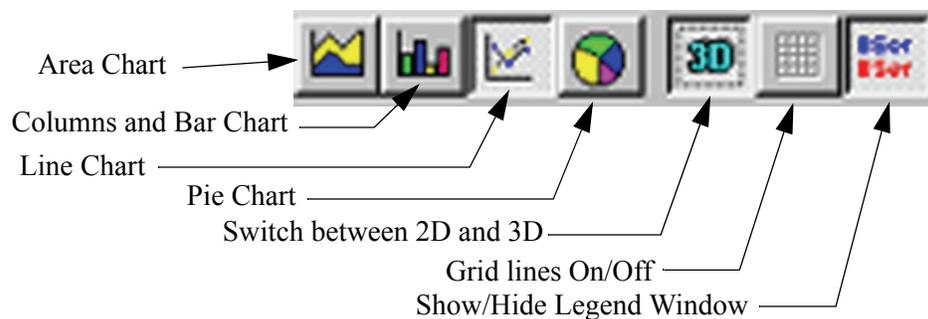
Run Hardware button.

After a brief time a real time analysis for the selected items will display.



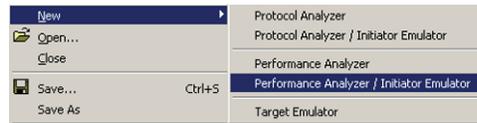
**Figure 64. Performance Analysis Real Time Display**

**Alternate Display Format** You may choose to display the result as 2D, 3D, etc. by clicking the corresponding “Graphics Setting” on the Performance Analysis display toolbar.

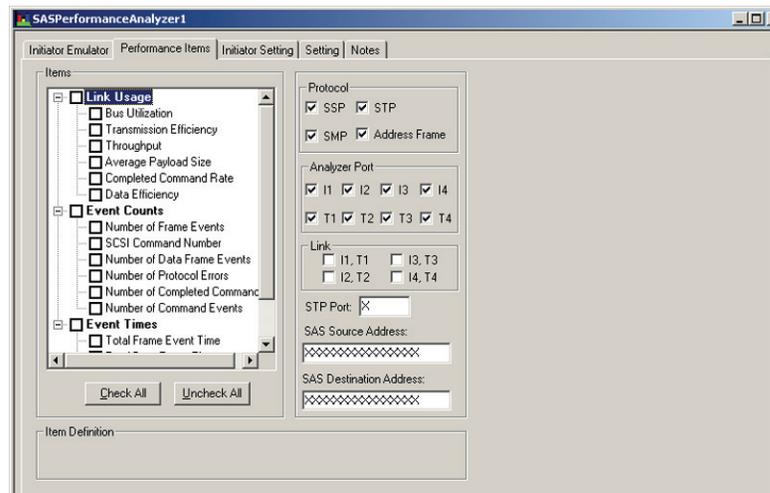


# Performance Analysis with Initiator Emulator

To perform a Performance Analysis with Initiator Emulator generated bus traffic, click **File, New** and choose **Performance Monitor/Initiator Emulator**.



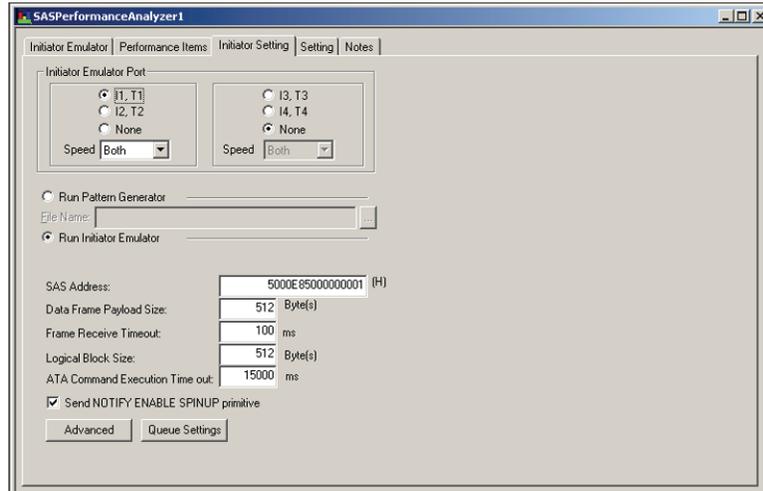
1. Click the Initiator Emulator tab and program the Initiator Emulator as described in “Programming the Initiator” on page 50.
2. Click the Performance Items tab and set up the Performance Analysis as described in “Performance Analysis with Analyzer Only” on page 78.



*Figure 65. Performance Analysis Definition with Initiator Emulator*

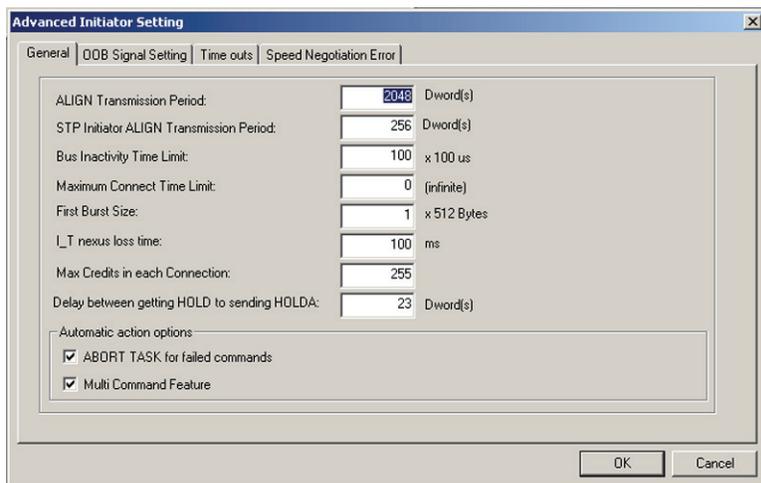
## Initiator Settings

1. Click the Initiator Settings tab to:
  - Chose the **Emulator Port(s)**.
  - Specify **SAS Address, Data Frame Payload Size, Frame Receive Timeout, Logical Block Size** and **ATA Command Execution Timeout**.



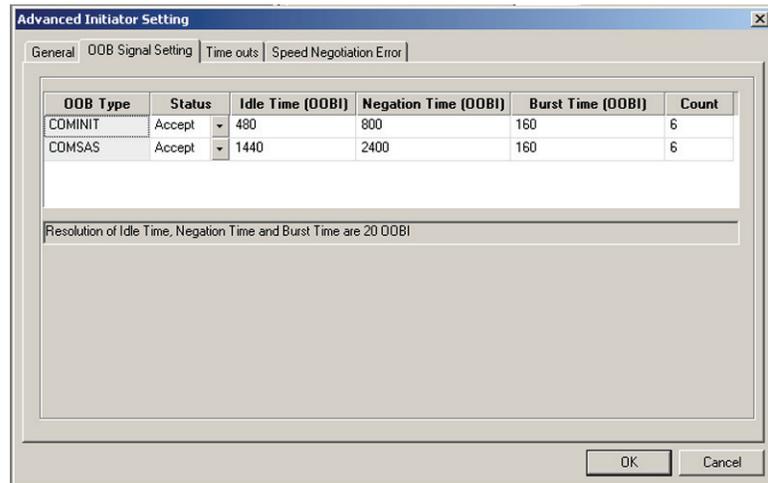
*Figure 66. Initiator Setting Dialog*

2. Click the **Advanced** button in the Setting dialog to:
  - Set **Align Transmission Period, STP Initiator Align Transmission Period, Bus Inactivity Time Limit, Maximum Connect Time Limit, First Burst Size, I\_T nexus loss time, Max Credits in each Connection, and Delay between getting HOLD and Sending HOLDA.**
  - Choose **Automatic action options** from: **Abort Task for Failed Commands** and **Multi Command feature.**



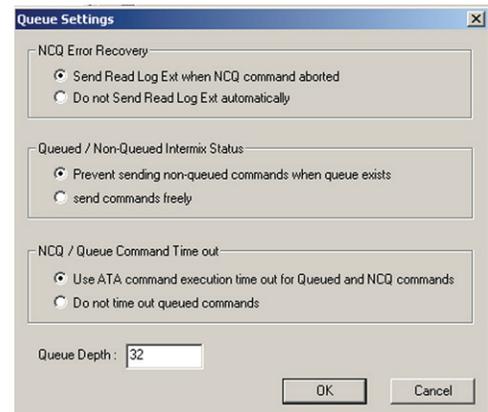
*Figure 67. General Settings Dialog*

3. Click the **OOB Signal Setting** tab in the General dialog to specify OOB parameters.



*Figure 68. OOB Signal Setting Dialog*

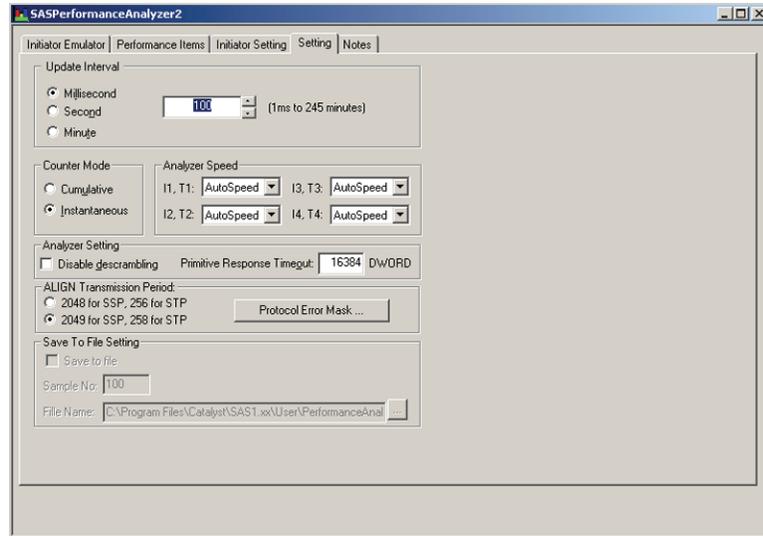
4. Return to the **Host Setting** dialog (Figure 66.) and click the **Queue Settings** button to display the Queue Settings dialog and specify:
  - NCQ Error Recovery
  - Queued/Non-Queued Intermix Status
  - NCQ/Queue Command Timeout
  - Queue Depth.



*Figure 69. Queue Settings Dialog*

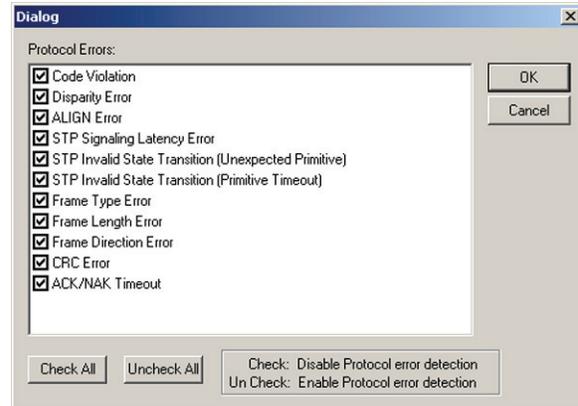
## Performance Analysis Project Settings

Click the **Setting** tab in the Performance Analysis definition dialog (Figure 65.) to display the Performance Analyzer Project Setting dialog.



1. Choose the **Update Interval** in the range of 1 ms to 245 minutes.
2. Set the **Counter Mode** to either Cumulative or Instantaneous (Cumulative causes the measurement counters to continually increment and Instantaneous causes the measurement counters to be reset for each Update interval).
3. Set the **Analyzer Speed** for each port used.
4. To disable descrambling, check the **Disable Scrambling** check box.
5. Enter a value for **Primitive Response Timeout**.
6. Choose the **Align Transmission Period** by checking the corresponding option button.

7. To select **Protocol Errors** from the analysis click the **Protocol Error Mask** button and check any or all of the protocol errors to be excluded from the analysis.



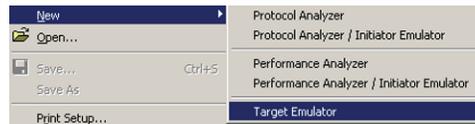
8. To save the analysis result for later review, check **Save to file** and enter the path where you would like to save the result.

To include a descriptive note about the project click the **Notes** tab and enter the desired information.

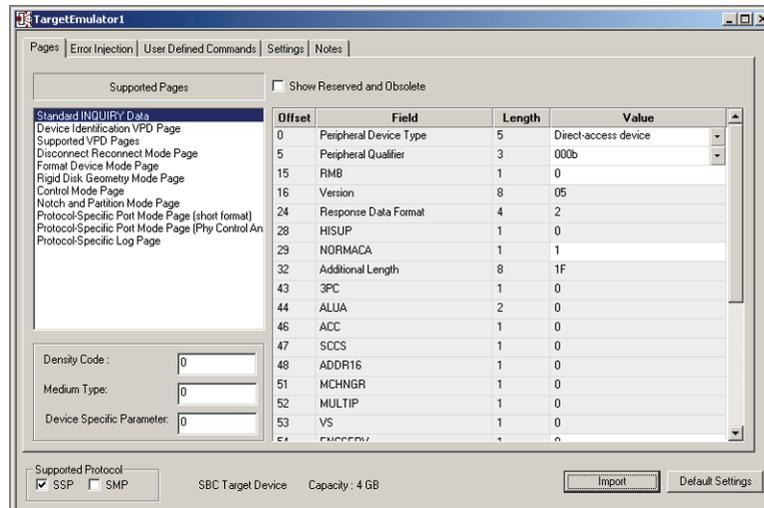
# Target Emulation

Not in current version for STX-460.

To set up a Target Emulation, click **File, New** and choose **Target Emulator**.



The target emulator opens with the Pages tab selected.



**Figure 70. Target Emulation Project Pages Tab**

The Target Emulator pages open with default settings for each page. To change settings for your application:

1. Select a page in the Supported Pages box and set required values for each of the enabled (White) Value fields.
2. Enter values for Density Code, Medium Type and Device Specific Parameter for the target emulator.
3. Check **SSP** or **SMP** to specify the protocol to support.
4. To reset the pages to the default settings, click the **Default Settings** button.
5. To use a previously defined Target click the **Import** button and choose a previously defined Device Identifier \*.saf file.

**Note** Clicking the Import button on any of the Target Emulation dialogs will set all the parameters for the current emulation, including User Defined Commands.

## Error Injection

Clicking the Error Injection tab opens the **General Errors** dialog. In addition to specifying general errors you may also set errors for **Identify**, **Connection Management** and **SAS Commands** by clicking the corresponding Icon in the Errors window.

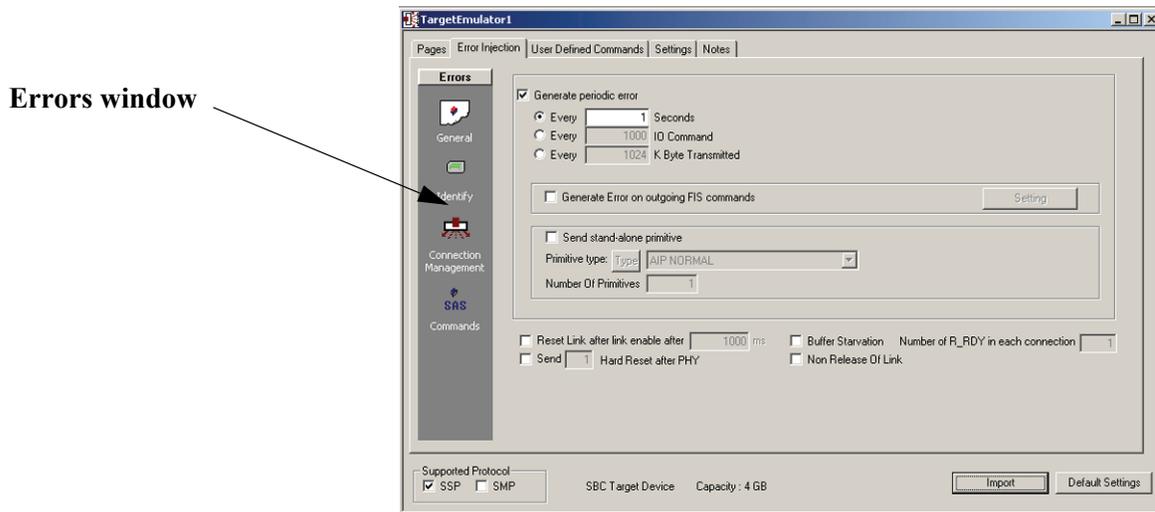
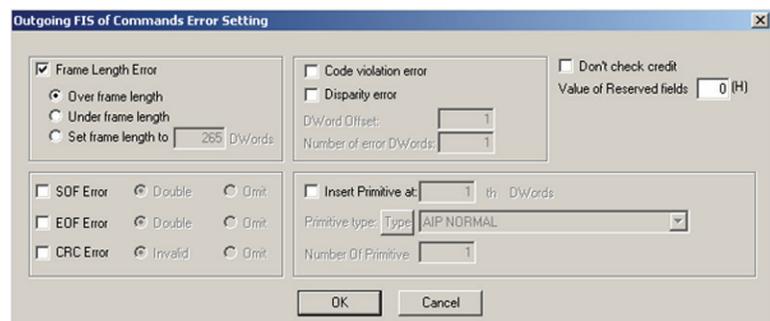


Figure 71. Setting General Errors

### Setting General Errors

**Generate Periodic Error** Check **Generate Periodic Error** and select the period unit of time, number of IO commands or number of Kbytes transferred by checking the corresponding option button.

**Outgoing FIS Command Error** Check **Generate Error on outgoing FIS commands** and then click the **Setting** button to open the error setting dialog.



**Frame Length Error** Check **Frame Length Error** and choose the type of error to introduce.

**SOF, EOF & CRC Errors** Check any or all as required and choose the criteria for introduction.

**Code violation and Disparity errors** Check these as required and specify the DWord offset and the number of error DWords.

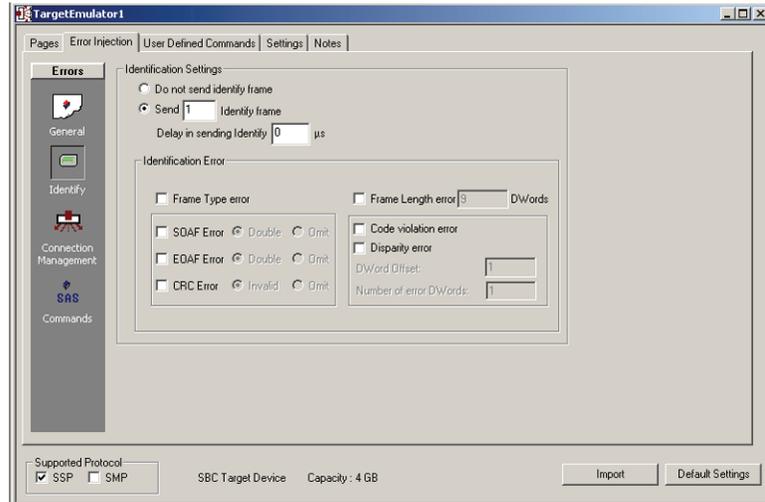
- Don't check credit** Check this to disable credit checking.
- Insert Primitive** Check **Insert Primitive** and then click the **Type** button to open the **Primitive Type** dialog, select the primitive type and click **OK**.
- Send Primitive** Check **Send stand-alone primitive** and then click the **Type** button to open the **Primitive Type** dialog, select the primitive type and click **OK**.



- Click the down arrow on the **Primitive** list box, choose a primitive, enter a value for the number of primitives to be sent and click **OK**.
- Reset Link** Check **Reset Link after link enable after** and enter time value after which to reset the link.
- Send Hard Reset** Check **Send [#of] Hard Reset after PHY** and specify #of resets to be sent.
- Generate Link Errors** To introduce link errors, check **Non release of link** to prevent release of link even if link connection time is exceeded and/or **Buffer starvation** with a value in the **Number of R\_RDY in each connection** text box to simulate a busy link.

## Identify Errors

Click the **Identify** icon in the Errors window to display the Identify Error Setting Dialog.

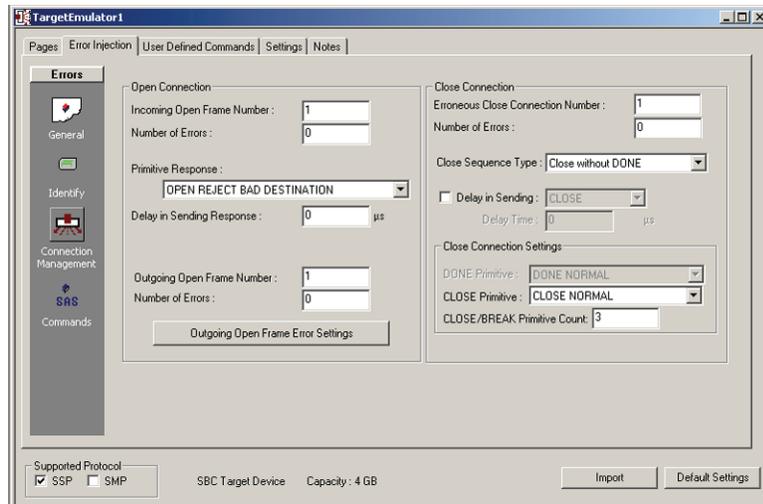


*Figure 72. Identify Error Setting Dialog*

- Sending Identify Frame** Check the **Send** option button and specify the number of Identify frames to be sent and a delay if desired. To not send Identify frames check the **Do not send identify frames** option button.
- Frame Type Error** Check this to send a **Frame Type** error.
- Frame Length Error** Check **Frame Length error** and enter the number of DWords in the corresponding text box.
- SOAF, EOAF and CRC** Check any or all as required and check the criteria for introduction.
- Code violation and Disparity** Check either or both and specify **DWord offset** and **Number of DWords** in the corresponding text boxes.

## Connection Management

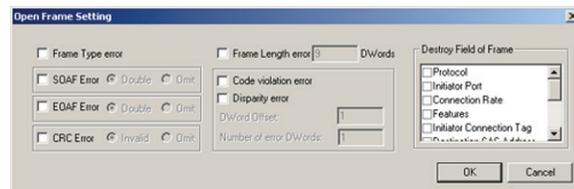
Click the **Connection Management** icon in the Errors window to display the Connection Management Setting Dialog.



*Figure 73. Connection Management Setting Dialog*

### Open Connection Definition

1. In the **Open Connection** dialog, enter a value for the **Incoming Open Frame Number** and the **Number of Error** in the corresponding text box.
2. Click the down arrow next to the **Primitive Response:** drop down list box, choose a primitive response and enter a value for **Delay in Sending Response** text box.
3. Enter a value for **Outgoing Open Frame Number** and **Number of Error** in the corresponding text box.
4. Click the **Outgoing Open Frame Error Settings** button display the **Open Frame Setting** dialog.

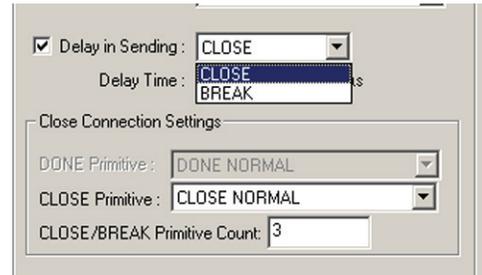


Check the desired errors to be introduced and click **OK**.

### Close Connection Definition

1. In the **Close Connection** dialog, enter a value for the **Erroneous Close Connection Number** and the **Number of Error** in the corresponding text box.

2. Click the down arrow next to the **Close Sequence Type** drop down list box, choose a closing sequence.
3. If a delay in sending is required, click in the **Delay in Sending** check box then click the down arrow on the associated drop down list box and choose what is to be delayed and enter a value for the **Delay Time**.

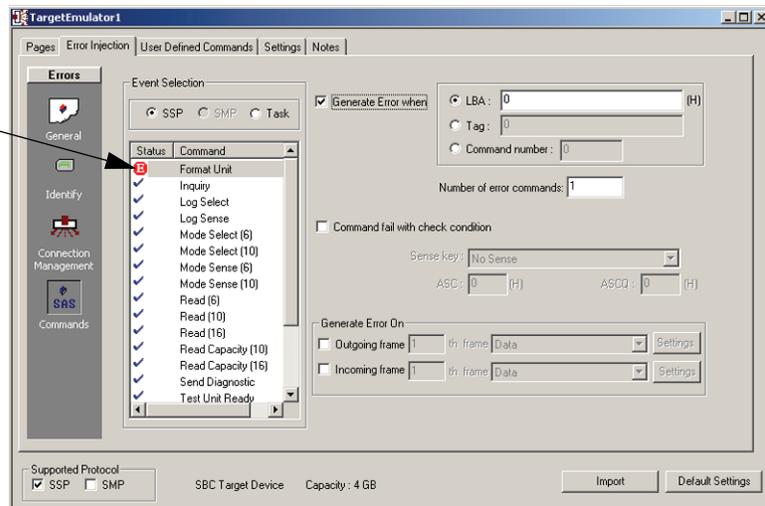


4. Click the down arrow on the **CLOSE Primitive** or **Done Primitive** dropdown list box in the **Close Connection Settings** dialog and choose a Close or Done Primitive.
5. Enter a value in the **CLOSE/BREAK Primitive Count** text box.

## SAS Commands Errors

Click the **SAS Commands** icon in the Errors window to display the Commands Error Setting Dialog

Status Indication



**Figure 74. SAS Commands Error Setting Dialog**

1. Click **SSP**, **SMP** or the **Task** option button to display the commands available for each of these categories in the Event Selection window.
2. Click on a command for which you wish to set an error and then check the **Generate Error when:** check box and enter values for **LBA**, **TAG** or **Command number** in the corresponding text box.

**Note:** Once you check the **Generate Error On:** check box for a command, a red status indication appears next to the command selected indicating an error condition.

3. Repeat for every command for which you wish to set an error.
4. Click in the **Command fail with check condition** check box and then click the down arrow on the **Sense Key** drop down list box, choose an error type and then enter values for **ASC** and **ASCQ** in the corresponding text boxes.
5. Set up Outgoing and Incoming frame errors

**Outgoing Frame Settings** Check **Outgoing Frame** in the **Generate Error On** area and then the enabled **Settings** button to display the Outgoing Frame Setting dialog.

*Figure 75. Outgoing Frame Setting Dialog*

**Frame Type Error** Check this to introduce a frame type error.

**Remove Frame from sequence** Check this to remove frame from sequence.

**Delay in sending frame** Check this to delay sending frame and enter a value for the desired delay.

**Frame Length Error** Check **Frame Length Error**, choose the type of error to introduce and click **OK**.

**Code violation and Disparity error:**

Check these if required and specify DWord offset and the number of error DWords.

**Dont check credit** Check this to disable credit checking.

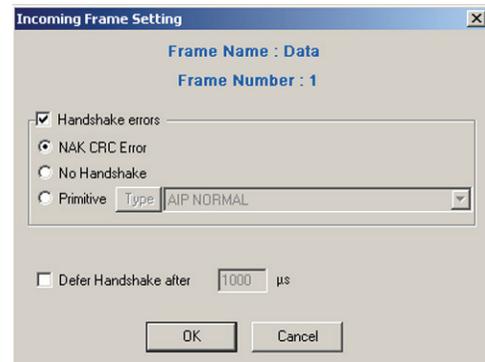
**SOF, EOF and CRC errors** Check these as required and specify **Double** or **Omit** by checking the corresponding option button.

**Insert Primitive** Check **Insert Primitive** and then click the **Type** button to open the **Primitive Type** dialog, select the primitive type and click **OK**.

**Destroy Field of Frame** Make sure to click the **More** button and then check the field to destroy.

**Insert Frame** Check **Insert Frame** and then click the down arrow on the **Type** combo box and choose the frame type. Make sure that you have clicked **More**.

**Incoming Frame Settings** Check **Incoming Frame** in the **Generate Error On** area and then the enabled **Settings** button to display the Incoming Frame Settings dialog.



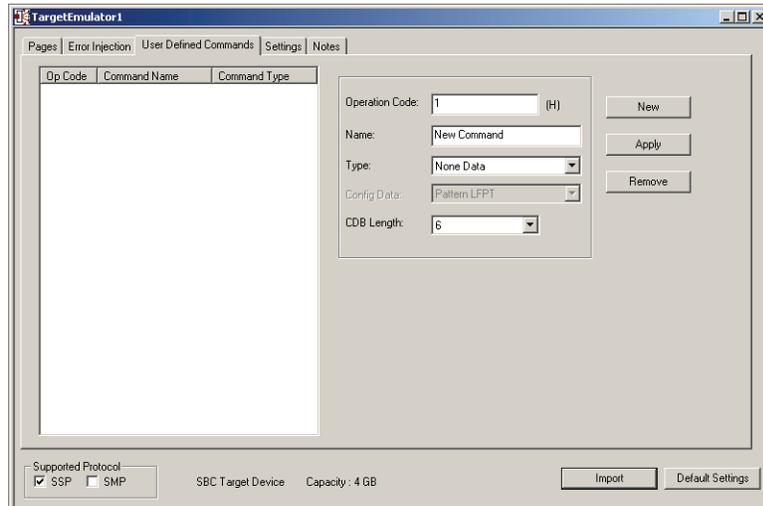
*Figure 76. Incoming Frame Setting Dialog*

### Handshake Error

Check **Handshake Errors** to enable selection of error on handshake. Check **R\_OK**, **R\_Error** or select any other **Primitive** to be sent as an incoming frame response. Check **No Handshake** if no response is to be sent.

## User Defined Commands

To create a command(s) specifically for your application Click the **User Defined Commands** tab to display the command definition dialog.



*Figure 77. Command Definition Dialog*

To define a command:

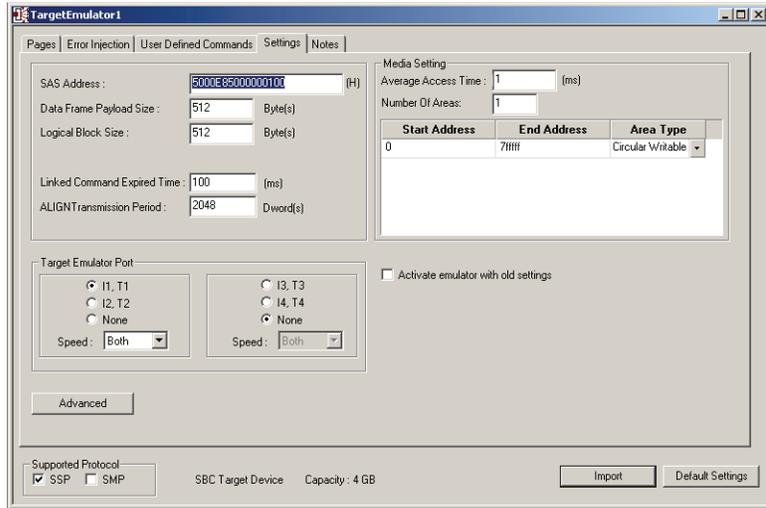
1. Enter an **OP Code** and a **Name** in the corresponding text box.
2. Click the down arrow on the **Type combo box** and choose a command type.
3. For command types requiring configuration data click the down arrow on the enabled **Config data:** combo box and choose appropriate configuration data.
4. When done click the **New** button.
5. The defined command appears in the command name window.
6. To make changes to a previously defined command, highlight the command, make necessary changes and click **Apply**.

**Note:** After creation the User Defined commands will appear in the Event Selection dialog.

## Target Emulator Settings

Click the **Settings** tab to display the target emulator settings dialog.

The Settings page opens with a default set of values which you may modify for your specific application as required. To return to these values at any time click the **Default Settings** button.



**Define the Target**

Enter a **SAS Address**, **Data Frame Payload Size**, **Logical Block Size**, **Average Access Time**, **Linked Command Expired Time** and **Align Transmission Period** in the corresponding text box.

**Media Settings**

Enter a value for **Average Access time** and **Number of Writable Area**. Define a **Start** and an **End** address, click the down arrow under the **Area Type** and choose **Normal Writable**, **Circular Writable** or **Non Writable**.

**Choose Target Emulator Port** Click a desired port option button and click the down arrow next to the **Speed** list box and choose a port speed.

**Advanced Settings**

Click on the **Advanced Button** to display additional setting options. The dialog opens displaying the **OOB Signal Setting** tab.

**OOB Signal Setting**

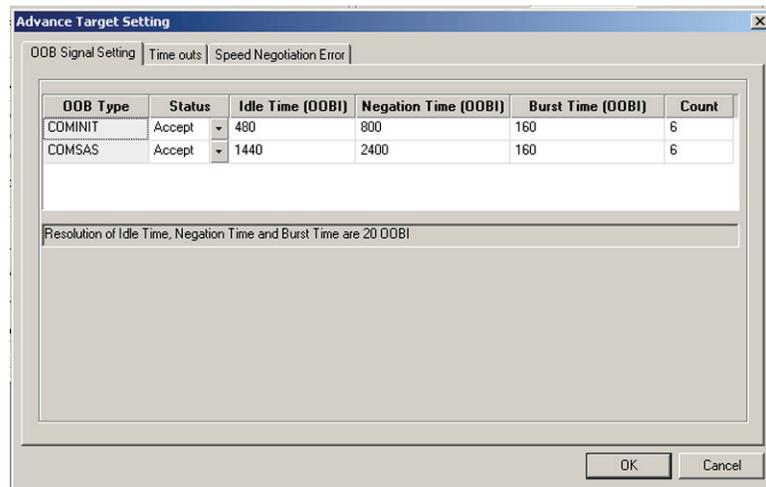
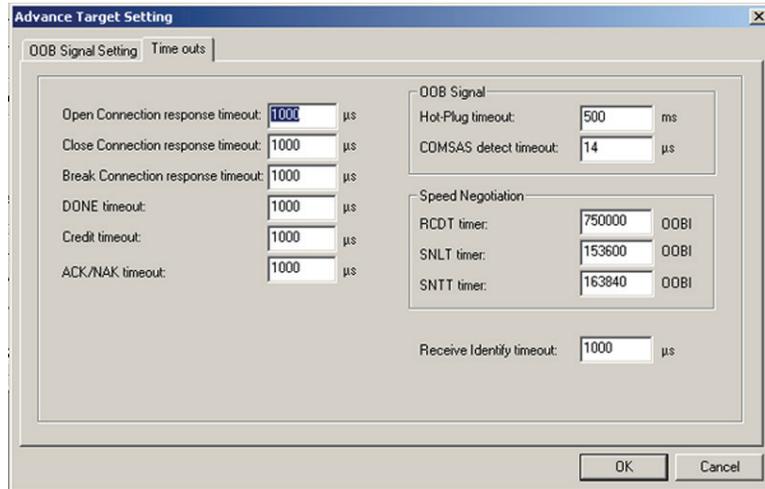


Figure 78. OOB Signal Setting Dialog

Make the necessary edits to the default values displayed in the white editable fields.

### Set Timeouts

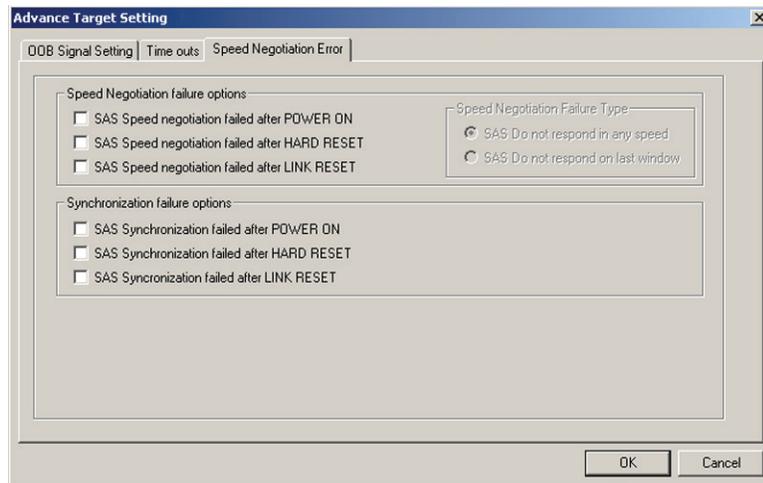
Click the **Timeouts** tab to display the Timeouts setting dialog.



*Figure 79. Timeout Setting Dialog*

Make the necessary edits to the default values displayed in the white editable fields and click **OK**.

**Set Speed Negotiating error** Click the **Speed Negotiating error** tab to display Speed Negotiating Error dialog.

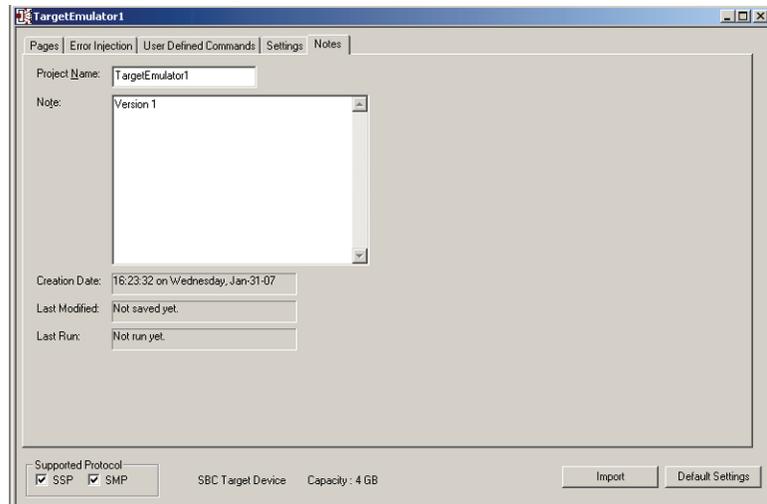


*Figure 80. Speed Negotiating Error Setting Dialog*

Check a **Speed Negotiation failure option** check box and choose a failure type by checking a corresponding option button. Additionally you may choose a **Synchronization failure option**.

**Project Note**

Click the **Notes** tab and enter a **Project Name** and a brief description of the Target Emulation project.



*Figure 81. Project Note*

**Run Target Emulation**

Click the



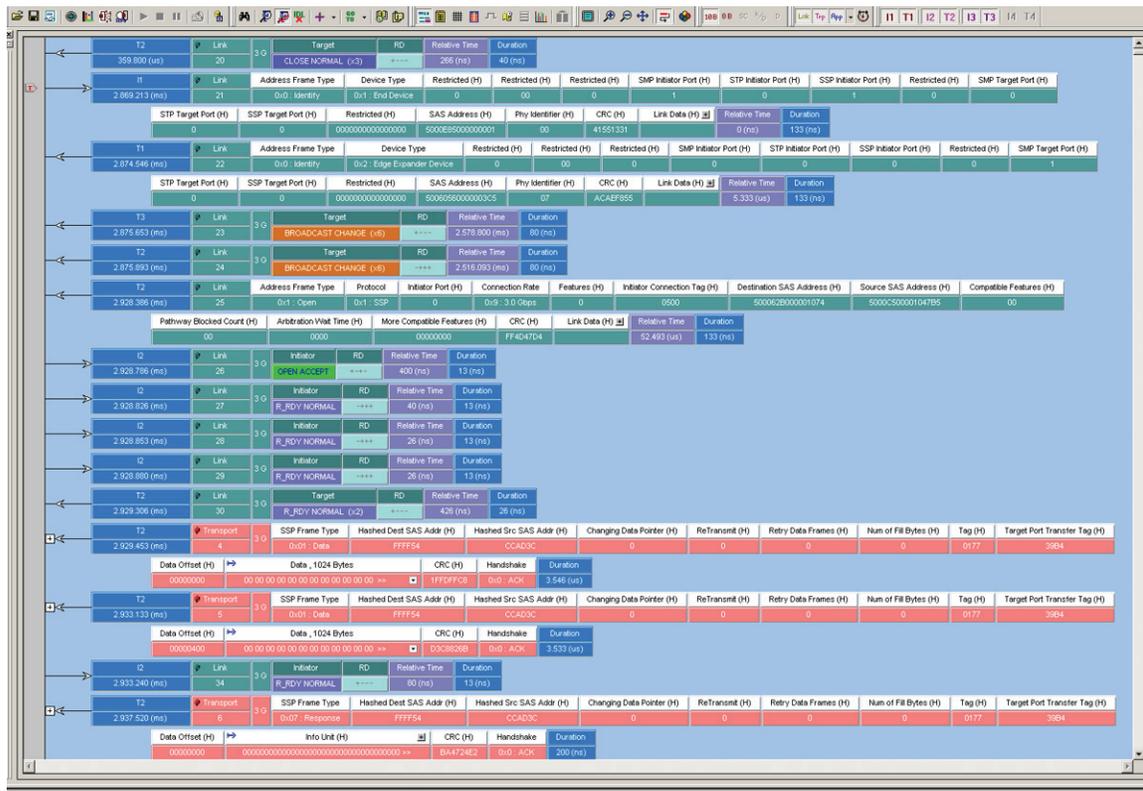
**Run Hardware** button to start emulation.



# Data Display Manipulation

## Viewer Display

The data viewer display may be configured to meet your individual test and viewing preference needs. Toolbars are available for quick access to data viewer display features.

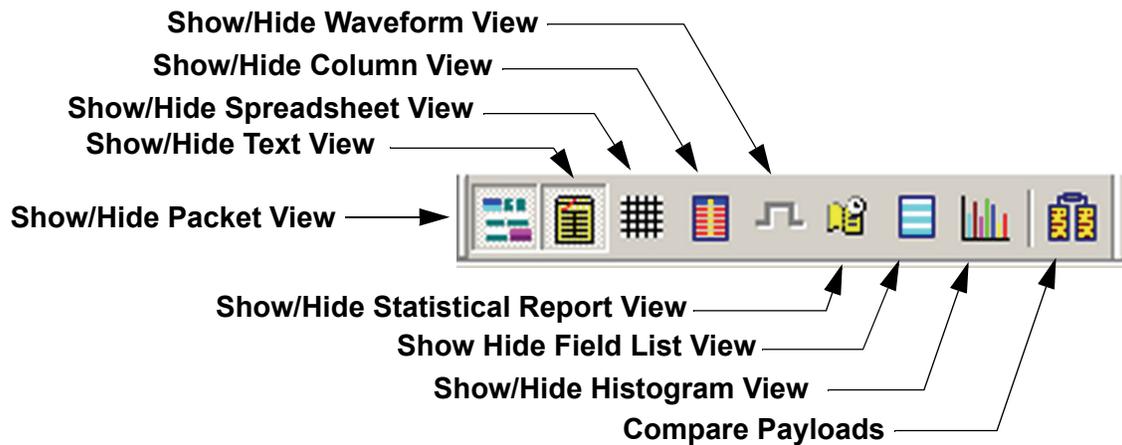


**Figure 82. Viewer Data Packet View Display**

Whenever a data capture is made it is displayed, by default, as a Packet View. You may, however display the same data in a Column View with transactions grouped for each active Port, a Text View similarly grouped for each active Port, a Spreadsheet view and a Histogram view.

## Switching Views

To display the capture in any of the other available views you can make the selection on the View Type toolbar.



*Figure 83. View Type Toolbar*

Whenever you make a View selection, the selected view appears in a split window view with the packet view. To maximize the selected view display area click the **Show/Hide Packet View** button.

When scrolling through either display using the scroll bar, the corresponding display in the other view scrolls with it.

You may rearrange the tiling by clicking **Window** and choosing the tiling as **Vertical** or **Horizontal** according to your preference.

## Text View

Text View displays the captured data interpreted as transaction frames grouped in columns by Port.

To display Text View of the current capture click **View** on the main tool bar and

choose **Text View** or click the  button.

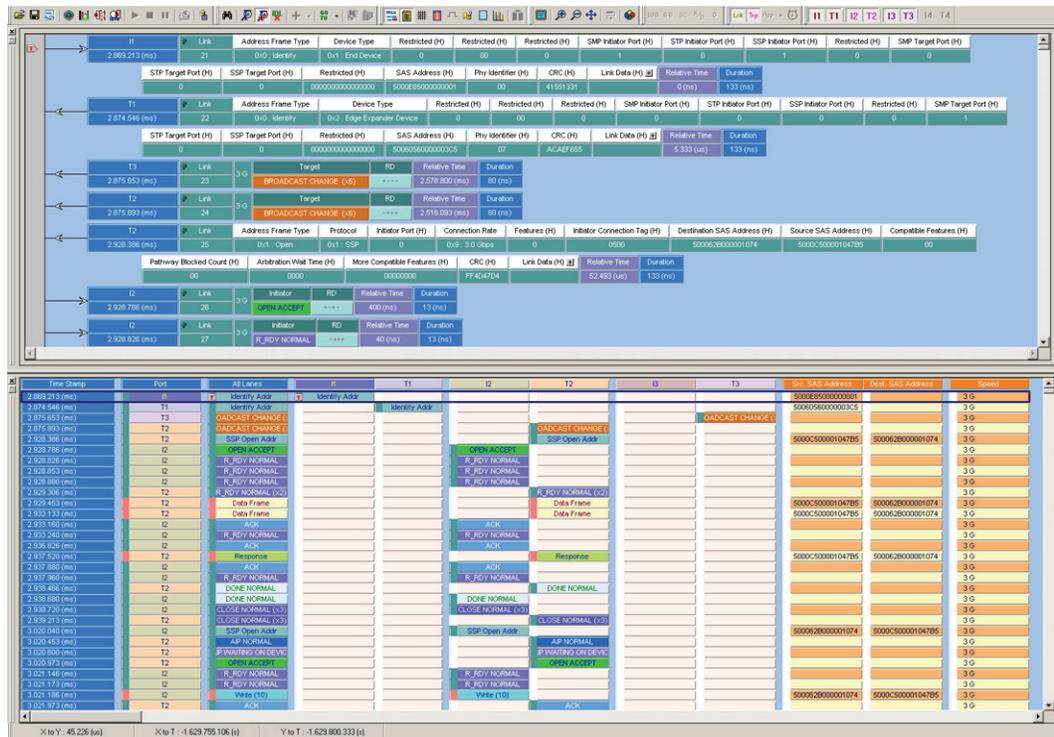


Figure 84. Simultaneous Packet View and Text View





## Spreadsheet View

Spreadsheet View displays all of the Packet View fields in a time sequential spreadsheet format.

To display the Spreadsheet View of the current capture click **View** on the main tool

bar and choose **Spreadsheet View** or click the



button.

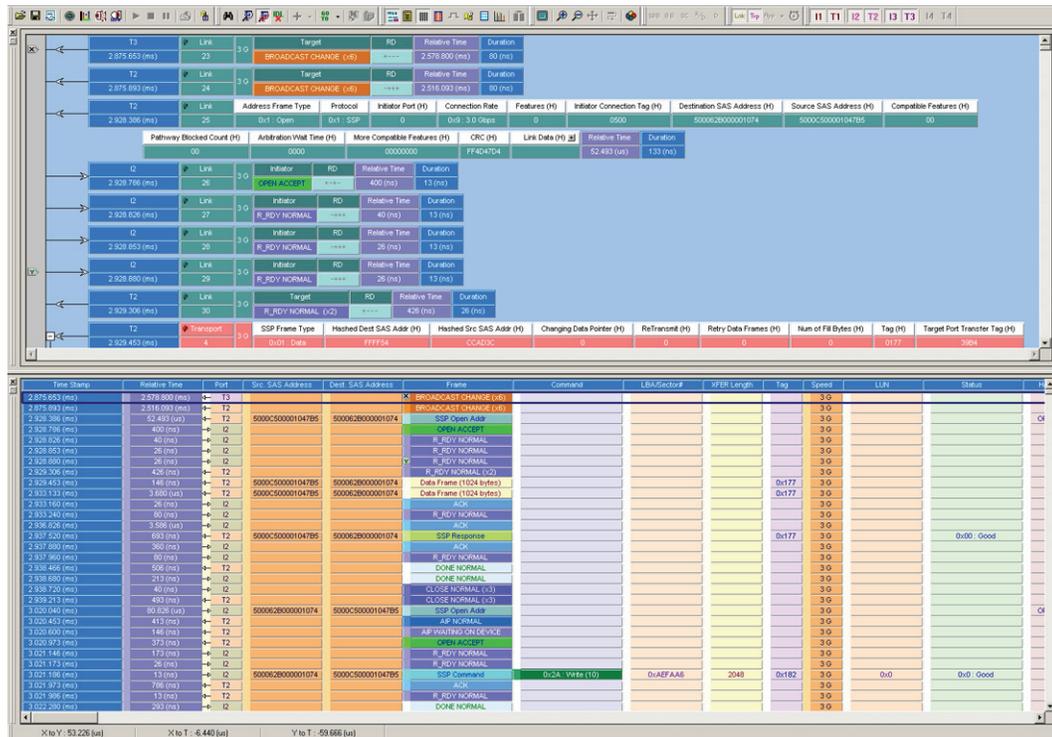


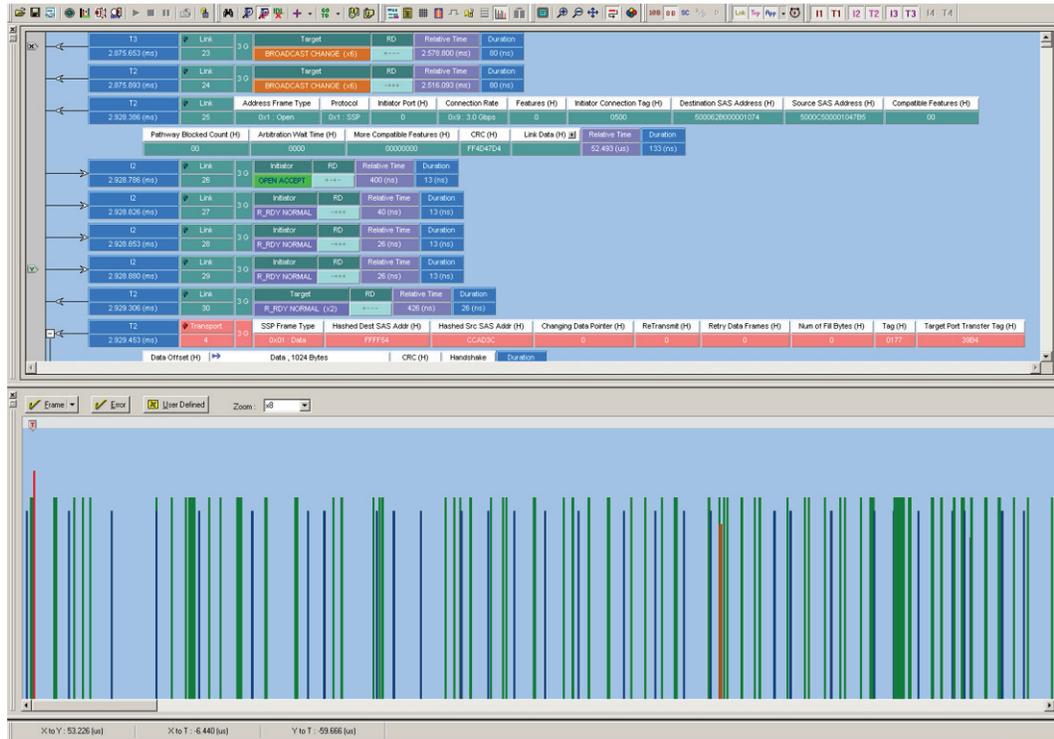
Figure 87. Simultaneous Packet View and Spreadsheet View

## Histogram View

The Histogram View displays a histogram of Frame type transfers.

To display the Histogram View of the current capture click **View** on the main tool bar

and choose **Histogram View** or click the  button.

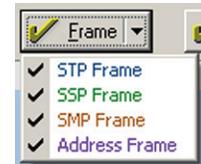


*Figure 88. Simultaneous Packet View and Histogram View*

### Hide Frames

You may customize the histogram by including only the frame types of interest.

To choose the frame types to be included in the display, click the down arrow on the Frame button on the Histogram toolbar and check the frame types to be included in the histogram.



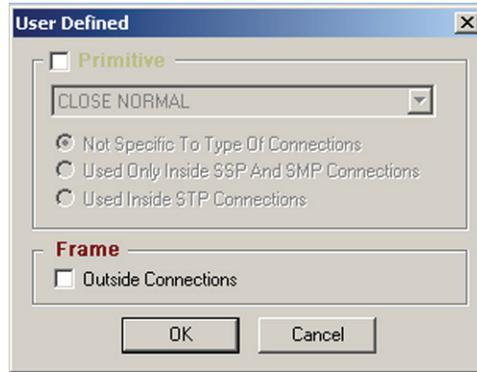
### Hide Error Frames

Frames with errors are displayed as red. To hide error frames from the

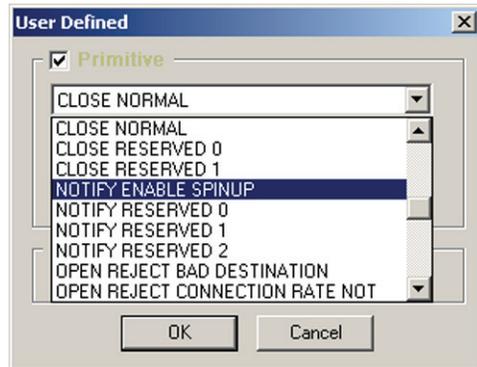
histogram click the  button.

**User Defined**

You may define additional items for inclusion in the Histogram by clicking the  button to open the User Defined dialog.



You may choose to include Primitives and/or outside connections Frames. To include Primitives check the **Primitive** check box click the down arrow on the Primitive list box and choose a Primitive.



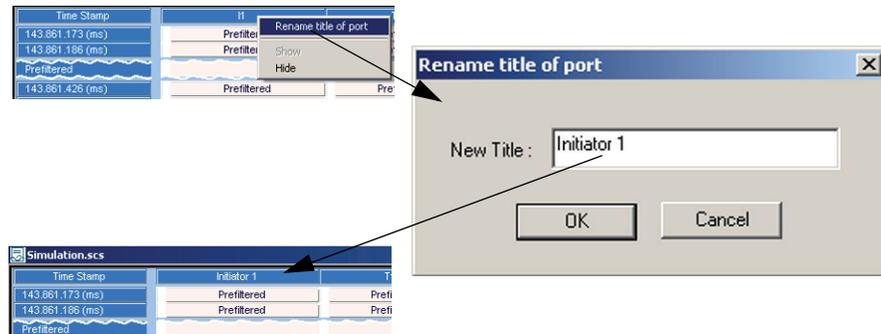
*Figure 89. Choosing a Primitive*

Then check the desired Connection Type option button.

## Customize Display

### Rename Port

You may rename each port for easy identification. To rename a port, right click the port ID in Text View or Column View and choose **Rename title of port** to open the **Rename Port** dialog.



*Figure 90. Rename Port*

### Resize Columns

You may resize the columns in column view by clicking in the column boundary and dragging the boundary to a new position.

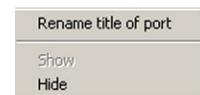
### Show/Hide Port

You may simplify the Viewer display by hiding the captures of Ports that are not of current interest. All active ports are highlighted on the Show/Hide Ports toolbar. Click the desired port button to hide the capture for that port.



*Figure 91. Show/Hide Ports Toolbar*

You may also show/hide a port by right clicking the Port name in column view and choosing **Hide**.



To show the port, right click in the column view port title area and choose a port to unhide.



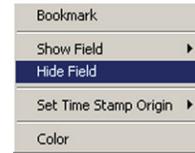
### Rearrange Columns

You may rearrange columns by clicking and holding the left mouse button in the column title and then dragging the drag and drop icon  to a new position.

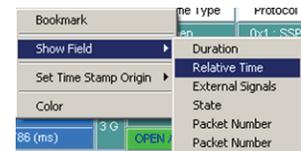
### Show/Hide Field

You may simplify the Viewer display by hiding some of the fields that are of no current interest. You may hide the **Duration**, **Relative Time**,

**External Signals** and **Packet number** fields by right clicking on the corresponding field title and choosing **Hide Field**.



To restore a field to the display, right click in the Port number title field and choose the hidden field to be restored.



**Note:** Only the fields previously hidden will appear in the restore list.

### Related Frames

Right click on a Command frame for SSP Frames or Register Device to Host for STP frames to open a short-cut menu and choose **Goto Response** to jump to the corresponding Response frame in the viewer.

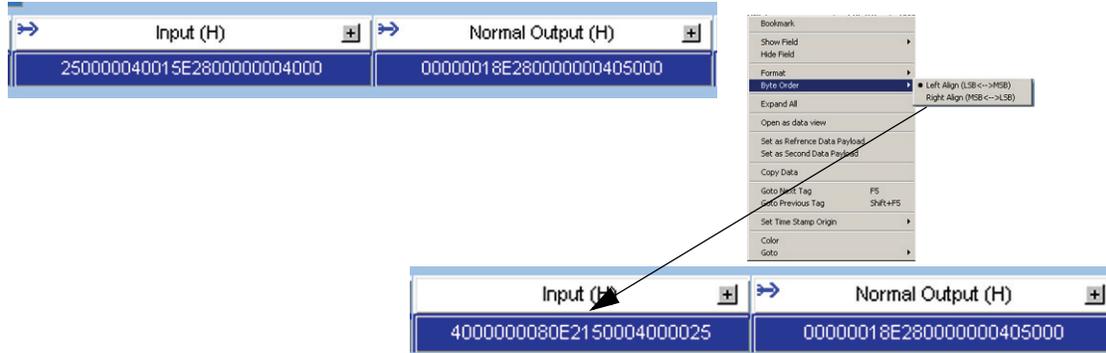


Similarly right click on a Response frame SSP Frames or Register Device to Host for STP frames to open a short-cut menu and choose **Goto Command** to jump to the corresponding Command frame in the viewer.



## Byte Order

For reviewing enhancement you may change the byte order in fields marked by an arrow. Right click in the field Select **Byte Order** and choose the ordering.



## Data View

To display data transactions in a data view, right click in the data area and choose **Open as Data View**.

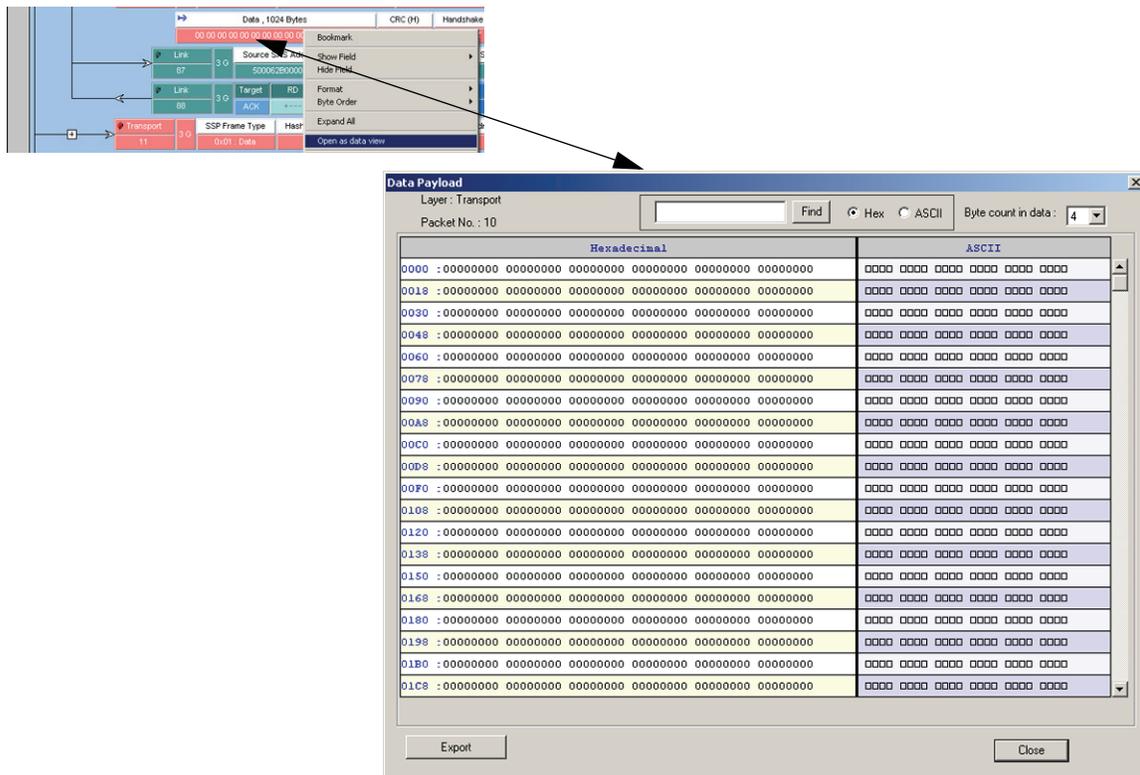


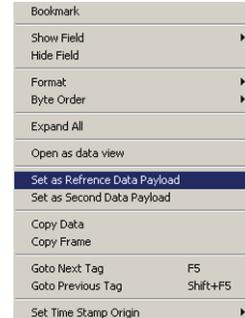
Figure 92. Selecting Open as Data View

## Find Data Pattern

To quickly locate a data pattern in the current frame enter the pattern in the Text Box and click the **Find** button.

## Compare Payloads

To compare two payloads, locate the first transaction with a payload and right click in the data field and choose **Set as Reference Data Payload**.



Then scroll to the transaction with a payload that you wish to compare and right click in the data field and choose **Set as Second Data Payload**.



Click the **Compare Payloads** button on the Viewer Toolbar to perform the comparison.

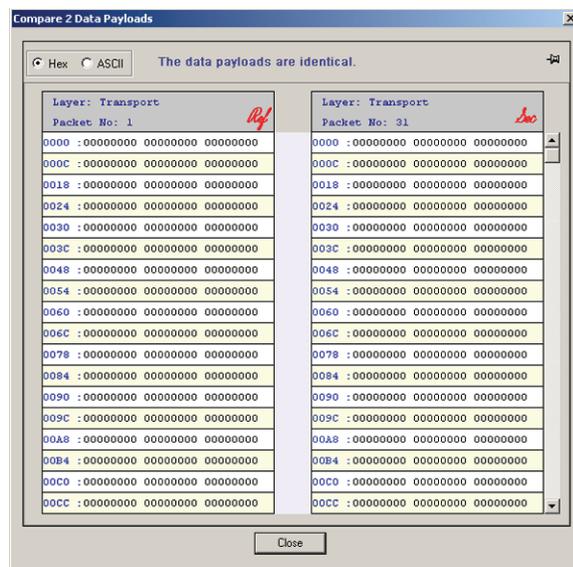


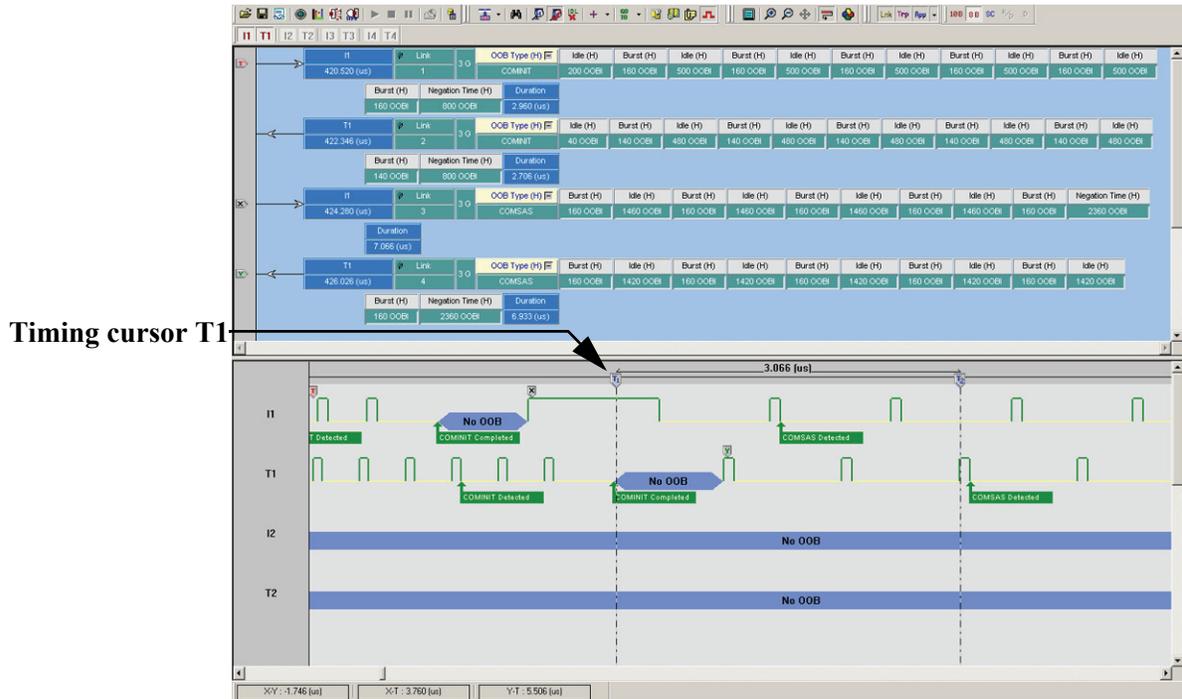
Figure 93. Payloads Compared

## Waveform Display

You may enable a waveform display for all active ports and perform timing measurements by positioning timing cursors within the waveform display.



Click the **Show/Hide Waveform** button to enable the waveform display.



Timing cursor T1

Figure 94. Waveform Display with Timing Cursors

### timing measurement

Timing measurements are made with two timing cursors T1 and T2. Click the left mouse button in the gray bar on the top of the waveform display at a point where you wish to put the T1 cursor and the right mouse button where you wish to place the T2 cursor. The time difference between the cursors is displayed on a line connecting the two cursors.

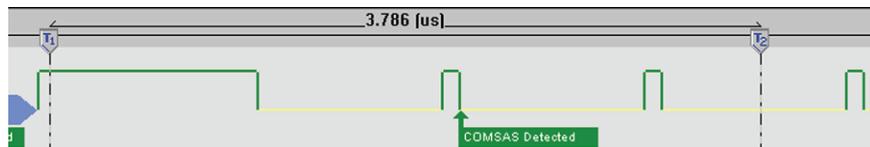


Figure 95. Timing Cursors Enabled

**Compact Waveform View** To see the OOB Sequence with speed negotiation (Hardware version 4 or later) and to see a 10x time scale expansion of the Waveform, check the **Compact View** checkbox in the Waveform View window.

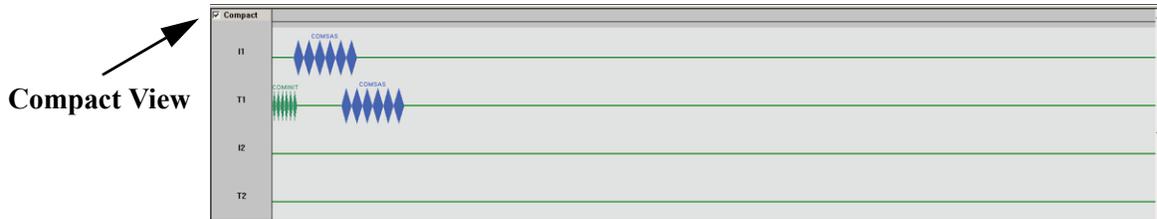
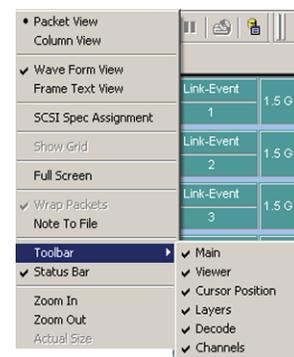


Figure 96 Compact Waveform View

**Enabling Tool Bars**

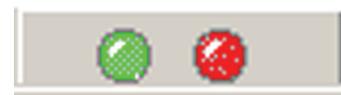
To customize your Viewer Display workspace, you can enable and reposition the available toolbars. To display or hide toolbars from the **View** menu, select **Toolbars** and check or uncheck the appropriate toolbar.

Once enabled, the toolbars can be docked to the Viewer Display window or allowed to float on the windows desktop.



**Port Status**

You may get an overview of the active Ports by clicking the Port Status button at the bottom of the screen



| Port status           |      |       |          |     |      |       |       |
|-----------------------|------|-------|----------|-----|------|-------|-------|
|                       | Port | Speed | Function | OOB | Link | Frame | Error |
| R<br>E<br>S<br>E<br>T | I1   | 1.5 G | Analyzer |     |      |       |       |
|                       | T1   | 1.5 G | Analyzer |     |      |       |       |
|                       | I2   | 1.5 G | Analyzer |     |      |       |       |
|                       | T2   | 1.5 G | Analyzer |     |      |       |       |
|                       | I3   | 1.5 G | Analyzer |     |      |       |       |
|                       | T3   | 1.5 G | Analyzer |     |      |       |       |
|                       | I4   | 1.5 G | Analyzer |     |      |       |       |
|                       | T4   | 1.5 G | Analyzer |     |      |       |       |

Figure 97. Port Status Display

In addition to displaying OOB, Link Frame or Error a display showing the % buffer full will open whenever a trigger occurs.

**Note:** If samples are taken with more than one unit active, additional Port status windows will display.

## Viewer Setting Toolbar

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Click the **Full Screen** button to increase the data display area to full on the screen.



Click the **Zoom In** button to magnify the data display area of interest on the screen. In column and frame text view it increases the column width only.



Click the **Zoom Out** button to scale the data display area to display more data lines on the screen. In column and frame text view it decreases the column width only.



Click the **Normal Zoom** button to reset the zoom to default normal on the screen and in column and frame text view.



Click the **Wrap Packets** button to wrap the packet data in the display to eliminate the need for horizontal scrolling.



Click the **View Setting** button to set the display configuration.

## Viewer Toolbar

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**Search** button opens the search dialog.



**Filtering Setup** button opens the Filter dialog that allows you to specify the criteria for filtering the result.



**Enable/Disable Filtering** button toggles the result between a filtered and unfiltered view.



**Filter Idle** button toggles the display to show/hide idle packets.



**Expand/Collapse all Layers** button expands or collapses layers to simplify the results display.



**GOTO** button locates cursors in the results display.



**Data Report** button displays the data report.



**SCSI Spec Assignment** button displays the SCSI spec assignment dialog.

## Layers Toolbar

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Click the **Show/Hide Link Packet** button on the Layers Toolbar to “ON” to display only the Link layer.



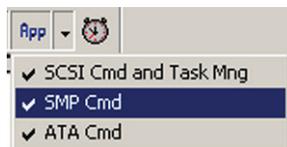
Click the **Show/Hide Transport Packet** button on the Layers Toolbar to “ON” to display the Transport layer only and below. Clicking the button “OFF” hides the Transport layer.



Click the **Show/Hide All Commands Packet** button on the Layers Toolbar to “ON” to show the Command layer only and all layers below. Clicking it “OFF” hides the Command layer.



Clicking the **Order/Reorder** toggles the time order of packets.

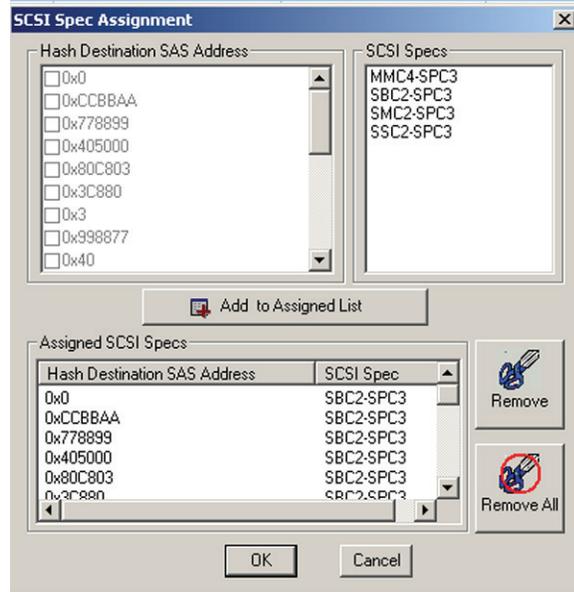


Click the down arrow on the **Show/Hide All Commands Packet** button to choose command types to show/hide.

## SCSI Spec Assignment



Click the **SCSI Spec Assignment** button on the Layers Toolbar to open the SCSI Spec Assignment dialog.



## Decode Toolbar

---



The **Decode Toolbar** allows the control of the following encoding and scrambling features.



Clicking the **10B** button displays the payload data as 10 bit encoded data.



Clicking the **8B** button displays the payload as 8 bit scrambled or unscrambled data depending on the Scrambled setting.



Clicking the **SC** button selects scramble/unscramble for the 8 bit payload data.



Clicking the **Symbol Notation** button decodes the 8 bit or 10 bit encoded data in List View.



Clicking the **Show Data** button displays the payload data values in Column View.

To view corresponding Unscrambled and Scrambled payload data values instantaneously, position the mouse pointer over the data field in column view.

## Filter

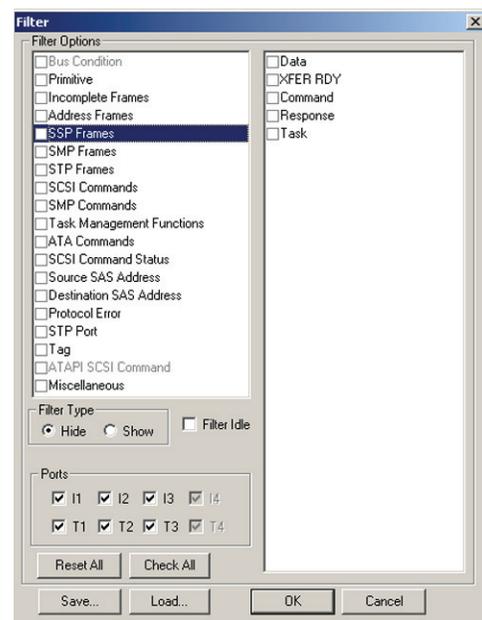
The Filtering patterns option allows you to modify data in the Viewer display to exclude Packets with a set of user defined patterns.

In order to set up filtering, you must have a viewer display open.

### Filter Setup



To display the Filter setup dialog, click the **Filter** button on the Viewer toolbar or, choose Filtering from the Filtering menu.



**Figure 98. Filter Setup Dialog**

Each of the items shown in the Filter Options window can be selected or deselected for filtering by checking or unchecking a corresponding check box. Items not in the current Sample are grayed out.

Note 1 When a group is selected, all of its child items are also selected.

Note 2 Only packets captured at run time are available to be selected for filtering.

Items selected for filtering may be designated as Show or Hide by selecting the **Filter Type**.

#### Filter Idle

When selected on the Filter Type, depending on Hide/Show selection Idle packets in the Sample Viewer will be shown or hidden.



You may quickly filter idles by clicking the **Filter Idle** button. Note that this button toggles between Show and Hide Items.



Click the **Filter Enable** button on the display menu bar to toggle between a Filtered and unfiltered display.

### Filter Type

You may choose to show or hide the items selected for filtering by checking the **Show** or **Hide** option buttons as appropriate.

### Filtering Ports

Items may be selected for filtering for a specific port or ports. Click the appropriate check boxes to designate the port(s) for filtering.

### Selectable Filter Options

- Bus Condition
- Primitive
- Incomplete Frames
- Address Frames
- SSP Frames
- SMP Frames
- STP Frames
- SCSI Commands
- Task Management Functions
- ATA Commands
- SCSI Command Status
- Source SAS Address
- Destination SAS Address
- Protocol Error
- STP Port
- Tag
- ATAPI SCSI Command
- Miscellaneous

**Filter by Tag Number**      Checking the **Tag** check box displays the tags available for filtering. Check the corresponding check box for the tags you wish to filter.

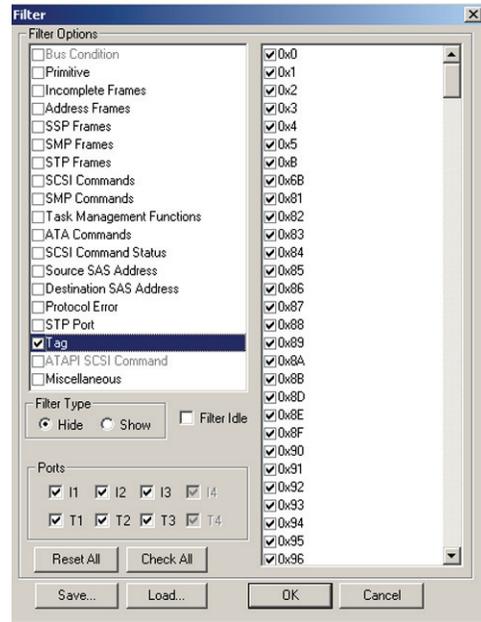


Figure 99. Filter by Tag Number

Filter Check Condition

Checking the SCSI Command Status check box enables Check Condition for filtering.

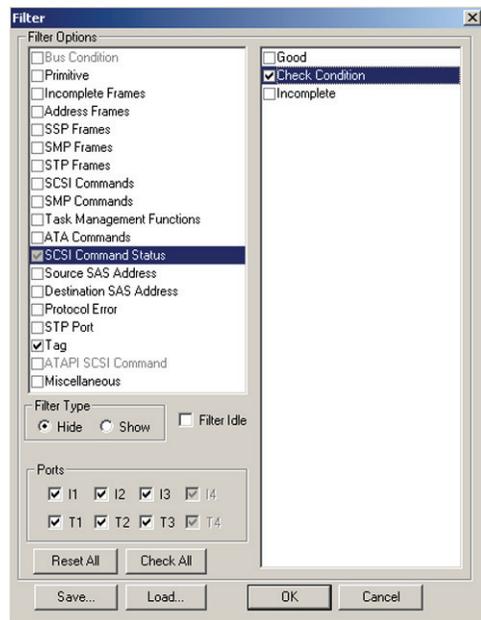
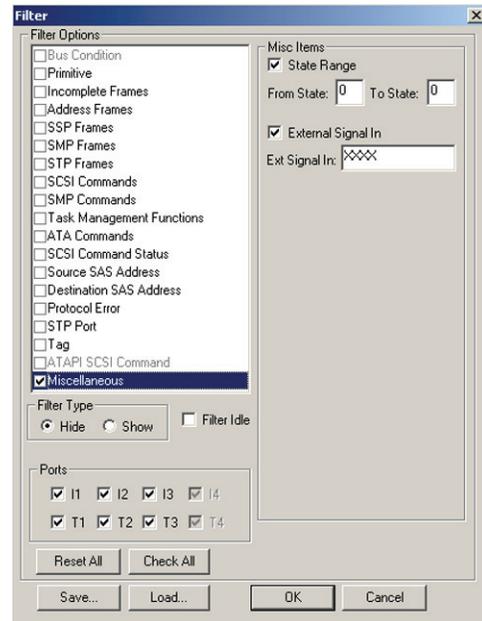


Figure 100. Filter Check Condition

## Filter Miscellaneous



*Figure 101. Filter State and/or External Signals*

## Save Filter Setup

Once you have set up a Filter configuration you may save it as a Filter file (\*.sfl) by clicking **Save**. You may then use it on a different capture by clicking **Load** in the Filter dialog.

## Using the Cursors and Bookmarks

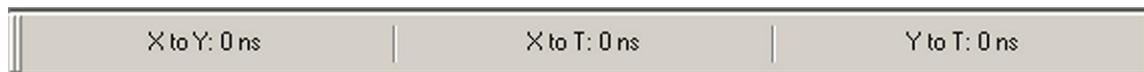
**Cursors** The data viewer display incorporates three cursors labeled **X**, **Y** and **T**. The X,Y cursors are initially overlaid and positioned at location 0. The Trigger, or **T**, cursor shows the trigger point in the captured sample and is the measurement reference. It is always locked at location 0 in the display.

**Positioning the X Cursor** To position the X-Cursor within the viewer data display, click the left mouse button in the gray bar on the left side of the sample viewer next to the line where you wish to see the cursor.

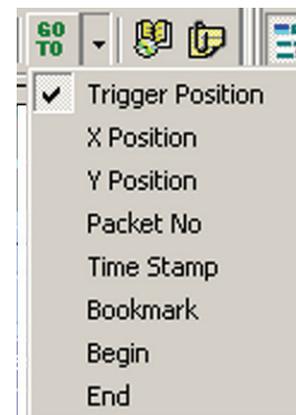
**Positioning the Y Cursor** To position the Y-cursor within the viewer data display, click the right mouse button in the gray bar on the left side of the sample viewer next to the line where you wish to see the cursor.

**Note:** You may also left click to set the X-cursor and right click to set the Y cursor in the frame and the column view by clicking in the narrow strip on the very left side of a cell. Similarly you may set the cursors in the Waveform view by left and right clicking at the beginning of a waveform.

Time differences between the cursors are displayed in the cursor position toolbar. To display the cursor position toolbar, select Toolbar from the view menu and choose Cursor Position.

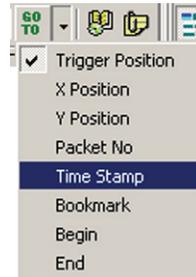


**Locate Cursors** To quickly locate any of the cursors within the data viewer display, click the **Go To** button and choose the cursor to locate. You may also locate the cursors by selecting Go To from the Edit menu and choosing the cursor to locate.

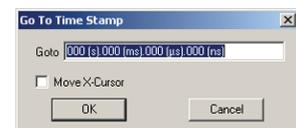


**Go to timestamp**

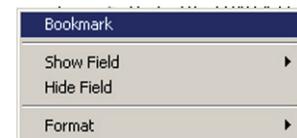
When the column view is displayed, the **Timestamp** option is enabled. To locate a timestamp click the **Go To** button and choose Timestamp.



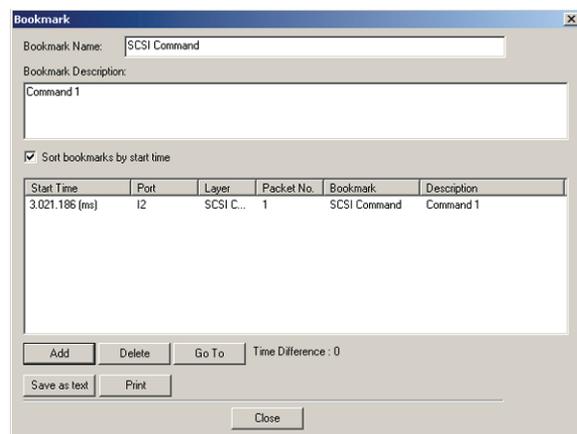
Enter a time stamp value in the Go To Timestamp dialog and click **OK**.

**Bookmarks**

Bookmarks is a convenient way to mark a point in the data viewer display by name, such that you can rapidly return to that point. To create a bookmark, right click the mouse in the data viewer area on a packet where you wish to place the bookmark.



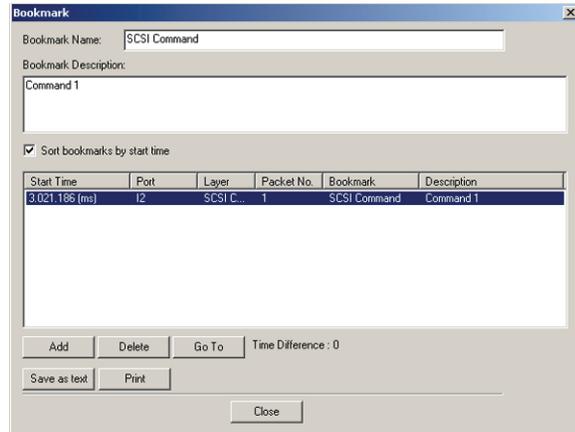
Click **Bookmark** from the shortcut menu to open the Bookmark Comment Dialog.



Choose a name for the bookmark. enter a description for the bookmark and click the **Add** button. Repeat for additional bookmarks.

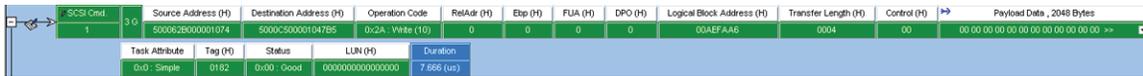
**Finding a Bookmark**

To find a bookmark in the data viewer display right click the mouse in the sample viewer and click bookmark.



*Figure 102. Go To Bookmark Dialog Box*

Highlight the bookmark that you wish to go to and click the **Go To** button, or double-click on the selection.



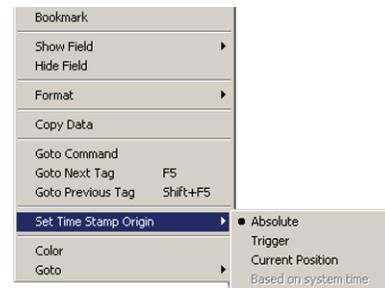
*Figure 103. Bookmark Found in Sample Viewer*

**Bookmark description**

To get a quick description of a displayed bookmark, position the tool tip over a bookmark. The name and description of the bookmark will display.

**Set Time Stamp Origin**

Right click in the sample viewer to open the fly out menu.



Click **Set Time Stamp Origin** and then choose either Absolute, Trigger or Current Position or based on System Time.

## Search

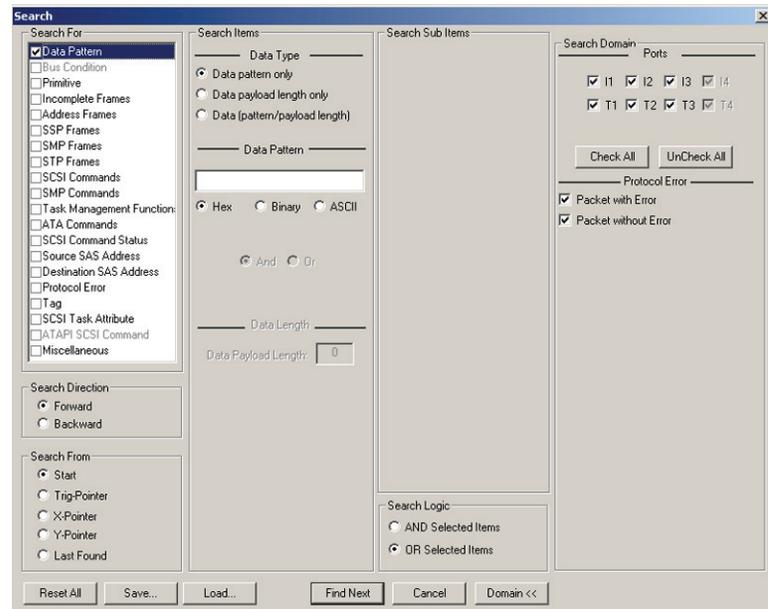
The search option permits you to examine any data capture file to quickly locate packets or bus conditions.

Whenever an initial sample file is displayed, the **Search**, button is enabled on the Viewer toolbar.



To perform a search, click the **Search** button to open the search setup dialog as shown in Figure 104. You may also perform the search by selecting Search from the Edit menu.

**Note:** Only items captured in the sample file are enabled for search.



*Figure 104. Search Parameter Definition Dialog Box*

### Search For

Choose a pattern to search for in the Search For window.

Each of the search categories offers additional choices in the **Search Items window** to refine the search. Check the desired items for the selected category.

### Search Logic

The default setting is **Or Selected Items**. With this setting clicking **Find Next** will locate all of the selected items in turn. Choosing **And Selected Items** you may set a logical And combination of items to find. Both of these options allow setting of Advanced search features.

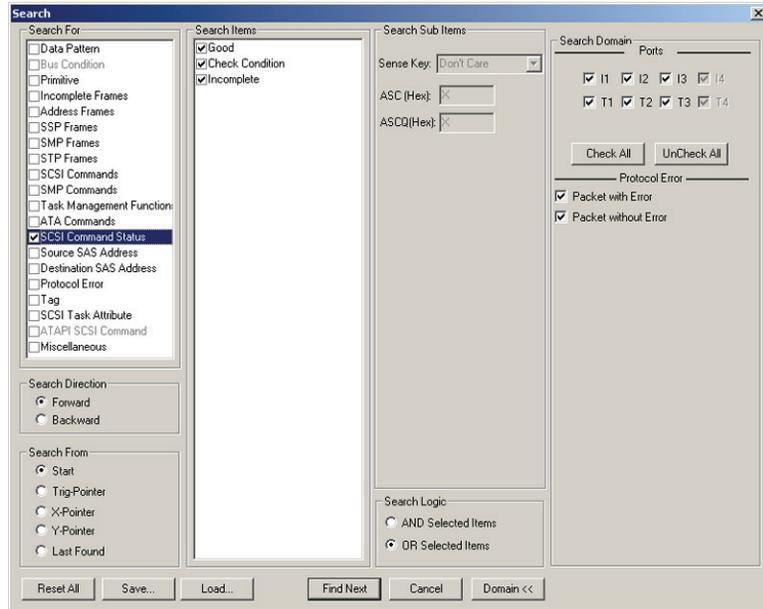
### Search Domain

Make sure to click the **Search Domain** button to display port selection for specializing the search.

**Search Sub Items**

When searching SCSI Command Status you may refine the search by selecting from a list of Sub Items.

**Note:** Some of the search categories allow you to refine the search by specifying specific SAS addresses and STP ports to be searched.

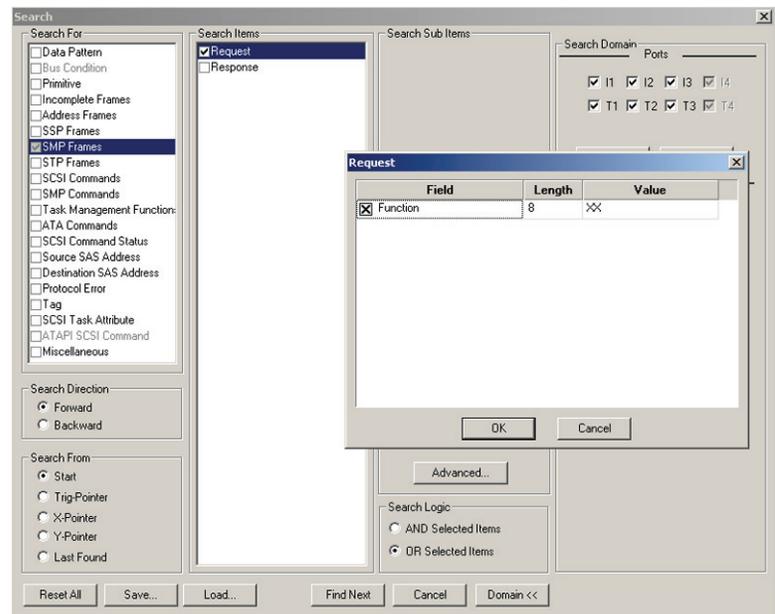


*Figure 105. Search Sub Items*

When you check the **SCSI Command Status** the **Check Condition** item appears in the Search Items Window if a check condition has occurred. Clicking on this enables **Search Sub Items** allowing you to refine the search by specifying **Sense Key**, **ASC** and **ASCQ**.

**Advanced Sub Items**

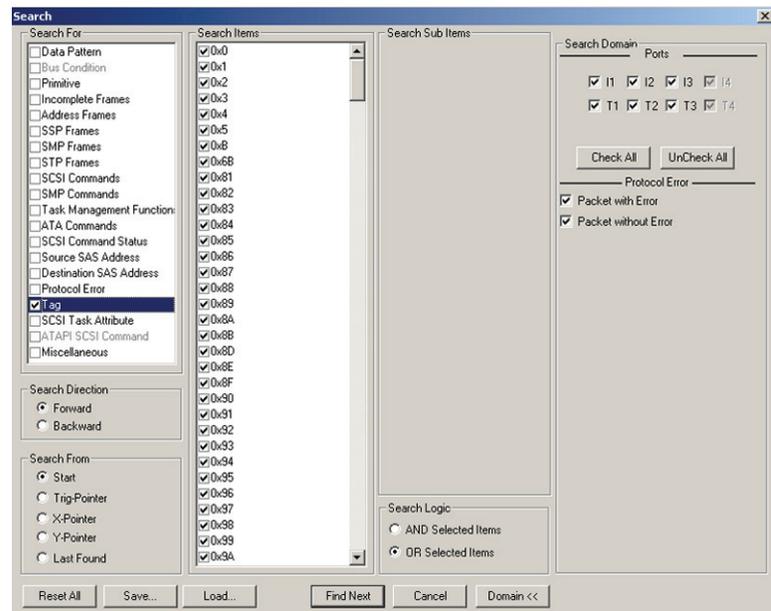
Some of the Sub item categories offer some Advanced search options by enabling the **Advanced** button. Click this to display the available options



*Figure 106. Advanced Sub Items*

**Search by Tag Number**

To search by Tag Number, check the **Tags** box in the **Search For** window and then check the **Tag(s)** that you wish to search for in the **Search Items** window.

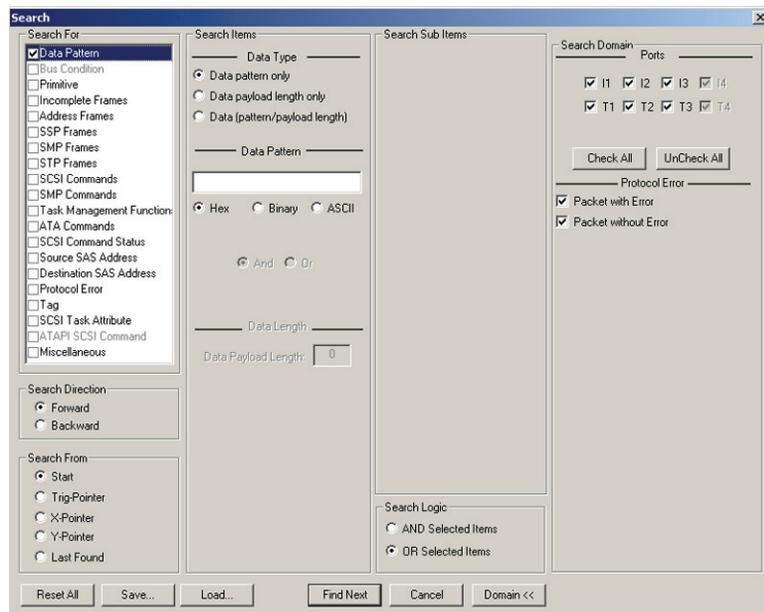


*Figure 107. Search by Tag Number*

**Data Pattern**

Search for Data Pattern allows you to search for a specific Data, Pattern and Length.

- Data Pattern
- Data Payload Length
- Data Pattern and Data Payload Length



*Figure 108. Search for Data Pattern*

- Search direction** Choose either Forward or Backward direction in which to perform the search.
- Packets With or Without Error** You may refine the search to locate packets with an error or without an error.
- Search From** Choose a starting to begin or continue a search.
- Start of the sample file
  - Trigger Pointer
  - X Cursor
  - Y Cursor
  - Last Found

Click the **Find Next** button to perform the specified search.

You may continue to search the output file for the same pattern by clicking the **Find Next** button until you redefine the data capture search parameters.

**Note:** When searching for Protocol Errors in column view, you cannot search for a specific Protocol Error type. Search will return any protocol error.

- Save Search Setup** Once you have set up a Search configuration you may save it as a Search file (\*.ssh) by clicking **Save**. You may then use it on a different capture by clicking **Load** in the Search dialog.

# Display Configuration

The Analyzer ships with a default display configuration of field and viewer settings. You may, however, define your own field and viewer settings for a particular testing scenario. The Sample Viewer Configuration dialog allows the user to change the following display settings:

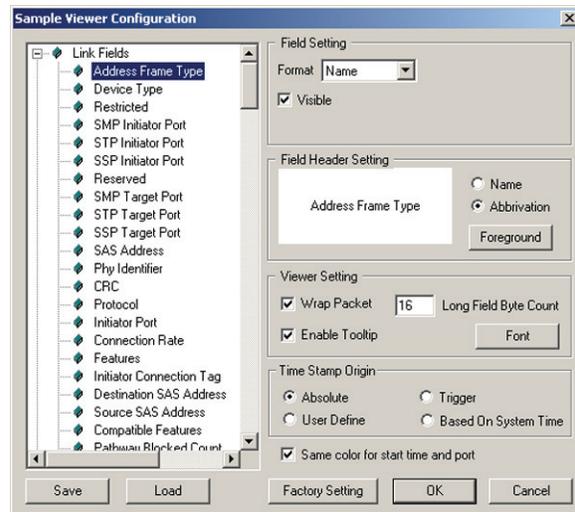
- Field settings
  - Data format
  - Field header text color
  - Hide/Show field (Check/uncheck Visible)
- Viewer Settings
  - Change fonts
  - Wrap packets
  - Enable/Disable tool tip
  - Factory Setting (Restores Default Settings)
- Save Display Configurations in a file.
- Load Display Configuration settings from a file.



## Field Settings

To customize your display, click the **Configuration** button on the Viewer toolbar, or select **Sample Viewer Configuration** from the Configuration menu to open the Sample Viewer Configuration dialog.

To view a packet field, select a field from the packet field tree and check the Visible box. Uncheck it to hide the field. To change the data format of a packet field, select the field and choose a data format from the Format drop-down list.



*Figure 109. Sample Viewer Configuration*

**Text Color** To change the color of the text in a packet field header, select a field from the packet field tree and click the **Foreground** button. Choose an appropriate color and click **OK**.

**Display Fonts** To change display fonts, click the **Font** button to open the Font dialog box. Choose the desired font, font style, size and click **OK**.

**Viewer Settings** Check the **Wrap Packet** box to enable the wrapping of packets in the display.

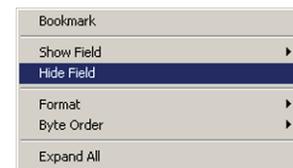
Check the **Enable Tooltip** box to enable tool tips for packet fields.

To change the length of long byte fields displayed, enter a number of bytes to display in the **Long Field Byte Count** text box.

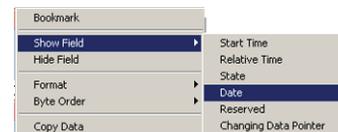
Choose **Time Stamp Origin** by checking **Absolute**, **Trigger**, **Current Position** or **System time** option button.

When finished, click **OK** to save changes and close the Display Configuration dialog.

**Show/Hide Field** You may temporarily hide a field type to simplify the sample view. To hide a field type in a sample view position the cursor over that field type, right click the mouse and choose **Hide Field**. You may hide more than one field type by repeating this step.



To redisplay that field type, right click in a line, choose **Show Field** and then choose the field type for display.



**Choose Data Format** You may display data values either in hexadecimal (default) or binary. To choose data format right click the mouse over a data field, choose **Format** and then the desired radix.

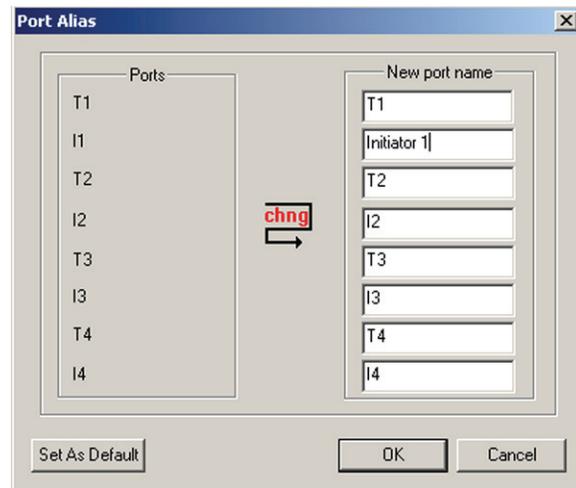


**Save/Load Settings** You may save the customized configuration settings in a \*.cfg file by clicking the **Save** button and completing the Save As procedure. To load a previously saved configuration file click **Load** and choose an appropriate file.

## Set Port Alias

Port Alias allows you to assign a meaningful name to each port to assist in interpreting the results displayed in the sample view.

To assign port names in an open sample view, click **Configuration** on the tool bar and choose **Set Port Alias**.



*Figure 110. Assign Port Name*

Assign a meaningful name to each port in use and click **OK**. The assigned names replace the port numbers in the sample view.

| Time Stamp        | Initiator 1 | T1 |
|-------------------|-------------|----|
| 6.872.097.653 (s) |             |    |

If you elect to save the capture sample file, the assigned port names will be saved together with the result so that when you open the sample file later, the assigned names will be retained.

## Software Settings

Software settings allows you to define template files for new Analyzer projects, to specify how sample files will appear when opened and to set ATAPI and SCSI Spec Assignments.

To perform software settings in an open sample view, click **Configuration** on the tool bar and choose **Software Settings**.

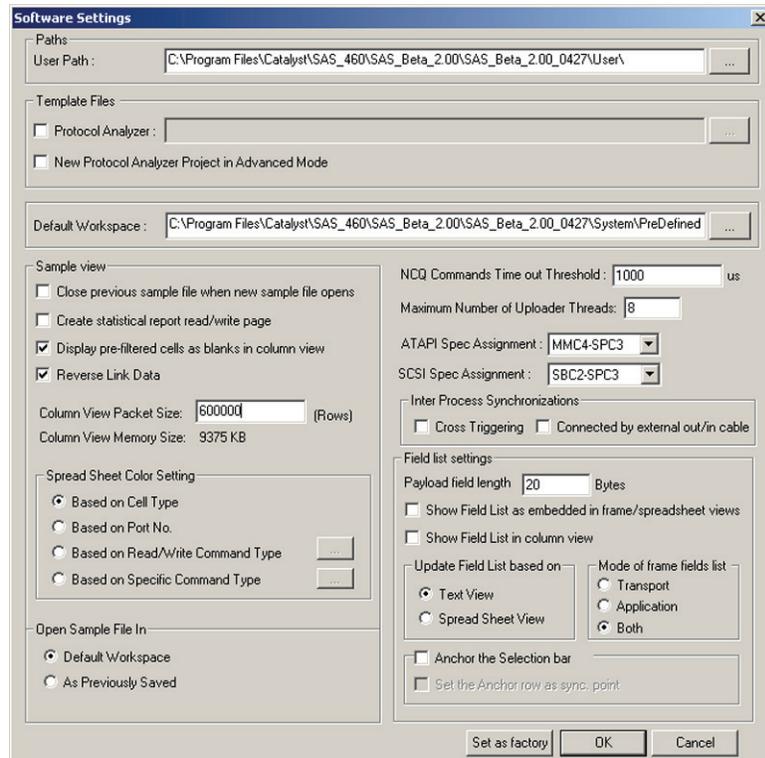
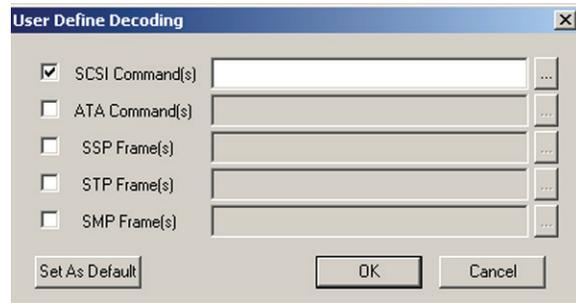


Figure 111. Software Settings Dialog

## User Defined Decoding

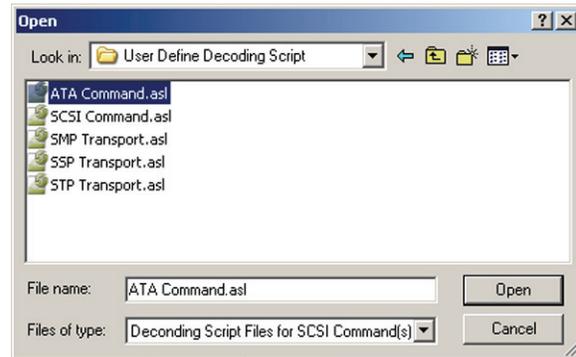
User defined decoding allows you to create a definition file to interpret commands and frames that are not in the standard set recognized by the software

Click **Configuration** on the viewer toolbar and choose **User Defined Decoding** to open the User Defined Decoding dialog.



*Figure 112. User Defined Decoding*

Check the command or frame type for which to specify user defined decoding and click the ellipses for the selection to display the **Open** dialog.



*Figure 113. Selecting Script*

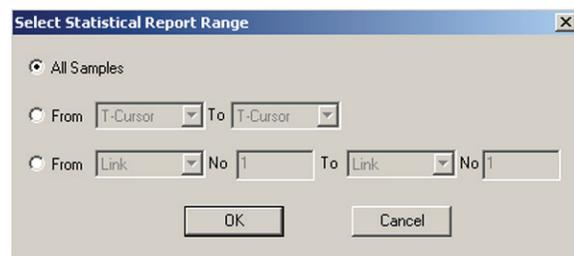
Choose an appropriate script file and click **Open**.

# Statistical Report

Whenever a captured sample is displayed in the sample viewer, the **Statistical Report** selection in the **Report** menu and a **Statistical Report Button** on the viewer toolbar are enabled. You may create a Statistical Report for the entire capture or a select portion of it as desired.



To display a Statistical Report, click the **Statistical Report** button on the viewer toolbar, or select **Statistical Report** from the **Report** menu.



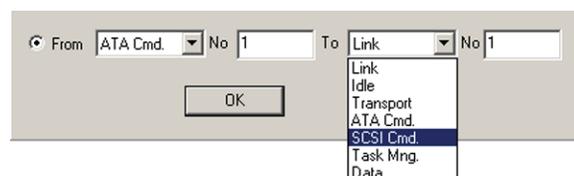
*Figure 114. Statistical Report Range Dialog*

The default statistical report is generated using all samples. You may, however, set a specific Statistic report range between defined cursor positions or events.

**Report Between Cursors** Click the option button next to the **From** cursor selection drop down list. Then click the **From** down arrow and choose the 1st. cursor, click the **To** down arrow to choose the 2nd cursor and click **OK**. The resulting report is limited to the capture between the cursors.



**Report Between Events** Click the option button next to the **From** the event selection dropdown list. Then click the **From** down arrow to choose the 1st event and enter the number of its occurrence. Next click the **To** down arrow to choose the 2nd event, and enter the number of its occurrence.



Click **OK**. The resulting report will be limited to the capture between the defined events.

# Statistical Report Content

A complete statistical report consists of the following reports a that are accessed by clicking on the corresponding report tab in the dialog:

- General
- Primitive
- SSP Transport
- SMP Transport
- STP Transport
- ATA Command
- SCSI Command
- SMP Command
- Task Command
- Read/Write Commands
- SAS Address
- Protocol Error
- Performance
- Lanes
- Others

Note: Results are displayed only for items that have been captured in the sample.

## Report Options

Some report categories offer options to display only items of interest. These report categories incorporate drop-down list boxes offering pre-defined and custom options. For details see “Formatting the Statistical Report View” on page 148.

## General Report

To display the General report view, click the **General** Tab. The General report displays the report data in columns with the following information:

- Type
- Direction
- Duration
- Count
- % of count

| Type                   | Direction | Duration          | Count | %     |
|------------------------|-----------|-------------------|-------|-------|
| All                    | All       | All               | All   | ---   |
| STP Frame              | I->T      | 2.418 253 42 ms   | 396   | 5.35  |
| STP Frame              | T->I      | 7.058 199 88 ms   | 602   | 8.13  |
| Open Address Frame     | I->T      | 181.133 331 30 us | 1358  | 18.35 |
| Open Address Frame     | T->I      | 235.360 000 61 us | 1765  | 23.84 |
| SSP Frame              | I->T      | 1.782 413 36 ms   | 1166  | 15.75 |
| SSP Frame              | T->I      | 3.355 160 00 ms   | 1857  | 25.09 |
| Identify Address Frame | I->T      | 133.333 328 25 ns | 1     | 0.01  |
| Identify Address Frame | T->I      | 133.333 328 25 ns | 1     | 0.01  |

Figure 115. Sample SAS Statistical Report

## Primitive Report

To display the Primitive report view, click the **Primitive** tab. The Primitive report displays the report data in columns with the following information:

- Primitive
- Direction
- Count
- % of count

| Primitive | Direction | Count | %    |
|-----------|-----------|-------|------|
| All       | All       | All   | ---  |
| SATA_CONT | I->T      | 396   | 0.74 |
| SATA_CONT | T->I      | 808   | 1.51 |
| SATA_EOF  | I->T      | 396   | 0.74 |
| SATA_EOF  | T->I      | 602   | 1.13 |

## SSP Transport Report

To display the SSP Transport Report, click the **SSP Transport** tab. The SSP Transport report displays the report data in columns with the following information:

- Type
- Direction
- Duration
- Count
- % of count

| Type     | Direction | Duration          | Count | %     |
|----------|-----------|-------------------|-------|-------|
| All      | All       | All               | All   | ---   |
| Data     | I->T      | 765.000 000 00 us | 458   | 15.15 |
| Data     | T->I      | 1.515 053 39 ms   | 921   | 30.47 |
| XFER_RDY | T->I      | 17.280 000 69 us  | 229   | 7.58  |

## SMP Transport Report

To display the SMP Transport Report, click the **SMP Transport** tab. The SMP Transport report displays the report data in columns with the following information:

- Type
- Direction
- Duration
- Count
- % of count

| Type     | Direction | Duration        | Count | %      |
|----------|-----------|-----------------|-------|--------|
| All      | All       | All             | ---   | ---    |
| Request  | I->T      | 1.973 333 36 us | 25    | 50.00  |
| Response | T->I      | 4.293 333 53 us | 25    | 50.00  |
|          |           | 0.00000627      | 50    | 100.00 |

## STP Transport Report

To display the STP Transport Report, click the **STP Transport** tab. The STP Transport report displays the report data in columns with the following information:

- FIS Type
- PM Port
- Direction
- Duration
- Count
- % of count

| General                 | Primitive | SSP Transport | SMP Transport | STP Transport     | ATA Command | SCSI Command | SMP Command | Task Command | SAS Address | Protocol Error | Performance | Lanes | Others |
|-------------------------|-----------|---------------|---------------|-------------------|-------------|--------------|-------------|--------------|-------------|----------------|-------------|-------|--------|
| FIS Type                |           | PM Port       | Direction     | Duration          | Count       | %            |             |              |             |                |             |       |        |
| All                     |           | ---           | All           | All               | All         | ---          |             |              |             |                |             |       |        |
| Register Host to Device |           | 0             | I->T          | 340,293 334 96 us | 301         | 30.16        |             |              |             |                |             |       |        |
| Register Device to Host |           | 0             | T->I          | 352,640 014 65 us | 300         | 30.06        |             |              |             |                |             |       |        |
| DMA Activate            |           | 0             | T->I          | 102,239 997 86 us | 95          | 9.52         |             |              |             |                |             |       |        |

## ATA Command Report

To display the ATA Command Report, click the **ATA Command** tab. The ATA Command report displays the report data in columns with the following information:

- Command
- PM Port
- Direction
- Number of FIS
- Payload Size
- Status
- Timeout
- Duration
- Count
- % of count

| General         | Primitive | SSP Transport | SMP Transport | STP Transport | ATA Command  | SCSI Command  | SMP Command | Task Command     | SAS Address | Protocol Error | Performance | Lanes | Others |
|-----------------|-----------|---------------|---------------|---------------|--------------|---------------|-------------|------------------|-------------|----------------|-------------|-------|--------|
| Command         |           | PM Port       | Direction     | Number of FIS | Payload Size | Status        | Time out    | Duration         | Count       | %              |             |       |        |
| All             |           | ---           | ---           | All           | All          | All           | ---         | All              | All         | ---            |             |       |        |
| Read DMA Ext    |           | 0             | I->T          | 3             | 2048         | Normal Output | N/A         | 7,019 613 27 ms  | 202         | 67.11          |             |       |        |
| Write DMA Ext   |           | 0             | I->T          | 4             | 2048         | Normal Output | N/A         | 2,389 519 93 ms  | 95          | 31.56          |             |       |        |
| Identify Device |           | 0             | I->T          | 3             | 512          | Normal Output | N/A         | 10,493 332 86 us | 1           | 0.33           |             |       |        |

## SCSI Command Report

To display the SCSI Command Report, click the **SCSI Command** tab. The SCSI Command report displays the report data in columns with the following information:

- Command
- Direction
- Number of Transport
- Payload Size
- Status
- Task Attribute
- Duration
- Count
- % of count

| General | Primitive | SSP Transport | SMP Transport       | STP Transport | ATA Command | SCSI Command   | SMP Command       | Task Command | SAS Address | Protocol Error | Performance | Lanes | Others |
|---------|-----------|---------------|---------------------|---------------|-------------|----------------|-------------------|--------------|-------------|----------------|-------------|-------|--------|
| Command |           | Direction     | Number Of Transport | Payload Size  | Status      | Task Attribute | Duration          | Count        | %           |                |             |       |        |
| All     |           | ---           | All                 | All           | All         | ---            | All               | All          | ---         |                |             |       |        |
| Write10 |           | I->T          | 5                   | 2048          | Good        | Simple         | 1,756 386 64 ms   | 229          | 34.24       |                |             |       |        |
| Inquiry |           | I->T          | 3                   | 128           | Good        | Simple         | 960,000 000 00 ns | 1            | 0.02        |                |             |       |        |
| Read10  |           | I->T          | 4                   | 2048          | Good        | Simple         | 3,351 399 90 ns   | 447          | 65.33       |                |             |       |        |

## SMP Command Report

To display the SMP Command Report, click the **SMP Command** tab. The SMP Command report displays the report data in columns with the following information:

- Function
- Function Result
- Direction
- Duration
- Count
- % of count

| Function             | Function Result       | Direction | Duration          | Count | %      |
|----------------------|-----------------------|-----------|-------------------|-------|--------|
| All                  | ---                   | ---       | All               | All   | ---    |
| Report General       | SMP Function Accepted | I->T      | 186.666 671 75 ns | 1     | 4.00   |
| Discover             | SMP Function Accepted | I->T      | 3.519 999 98 us   | 12    | 48.00  |
| Report Phy Error Log | SMP Function Accepted | I->T      | 2.559 999 94 us   | 12    | 48.00  |
|                      |                       |           | 0.00000627        | 25    | 100.00 |

## TASK Command Report

To display the TASK Command Report, click the **TASK Command** tab. The TASK Command report displays the report data in columns with the following information:

- Function
- Status
- Direction
- Duration
- Count
- % of count

| Function   | Status | Direction | Duration          | Count | %      |
|------------|--------|-----------|-------------------|-------|--------|
| ---        | ---    | ---       | ---               | ---   | ---    |
| Abort Task | Good   | I->T      | 426.666 656 49 ns | 1     | 100.00 |
|            |        |           | 0.00000043        | 1     | 100.00 |

## Read/Write Command Report

To display the Read/Write Command Report, click the **Read/Write Command** tab. The creation of this page can be enabled or disabled under Software Settings, see page 134. The Read/Write Command report displays the report data in columns with the following information:

- Source SAS Address
- Destination SAS Address
- Protocol Type
- OpCode/Command
- Tag
- LBA
- Sector Count
- Xfer Length
- Payload Size
- Status
- Completion Time
- Performance
- Standard Deviation
- Count

| Source SAS Address | Destination SAS Address | Protocol Type | OpCode / Command | Tag   | LBA       | Sector Count | Xfer Length | Payload size | Status        | Completion T   |
|--------------------|-------------------------|---------------|------------------|-------|-----------|--------------|-------------|--------------|---------------|----------------|
| ---                | All                     | All           | All              | ---   | All       | All          | All         | All          | All           | All            |
| 5000628000001074   | 50060560000003C4        | STP           | Read DMA Ext     |       | 0x80e215  | 0x4          |             | 2048         | Normal Output | 26.891 679 76  |
| 5000628000001074   | 5000C500001047B5        | SSP           | Write10          | 0x182 | 0xaeFa6   |              | 0x4         | 2048         | Good          | 352.266 662 61 |
| 5000628000001074   | 5000C500001047B5        | SSP           | Read10           | 0x17C | 0x1e65352 |              | 0x4         | 2048         | Good          | 14.481 987 00  |
| 5000628000001074   | 5000C500001047B5        | SSP           | Write10          | 0x17B | 0x2a206a5 |              | 0x4         | 2048         | Good          | 968.693 359 31 |

## SAS Address Report

To display the SAS Address Report, click the **SAS Address** tab. The SAS Address report displays the report data in columns with the following information:

- Source SAS Address
- Destination SAS Address
- Protocol Type
- Frame Type
- Count

| Source SAS Address | Destination SAS Address | Protocol Type | Frame Type              | Count |
|--------------------|-------------------------|---------------|-------------------------|-------|
| 5006056000003C4    | 50062B000001074         | STP           | Data                    | 206   |
| 5006056000003C4    | 50062B000001074         | STP           | Register Device to Host | 300   |
| 50062B000001074    | 5006056000003C4         | STP           | Register Host to Device | 301   |

## Protocol Error Report

To display the Protocol Error Report, click the **Protocol Error** tab. The Protocol Error report displays the report data in columns with the following information:

- Protocol Error
- Direction
- Count
- % of count

| Protocol Error | Direction | Count | %      |
|----------------|-----------|-------|--------|
| Code Violation | I->T      | 1     | 50.00  |
| CRC Error      | I->T      | 1     | 50.00  |
|                |           | 2     | 100.00 |

## Performance Report

To display the Performance Report, click the **Performance** tab. The Performance report displays the report data in columns with the following information:

- Min. Compl. Time
- Avg. Compl. Time
- Max. Compl. Time
- Init. Bus Utilization
- Target Bus Utilization
- Efficiency
- Total Read CMD
- Total Read Duration
- Cmd Min. Read (MB/S)
- Cmd Avg. Read (MB/S)
- Cmd Max. Read (MB/S)
- Total Write Cmd
- Total Write (Bytes)
- Total Write Dur.
- Cmd Min. Write (MB/S)
- Cmd Avg. Write (MB/S)
- Cmd Max. Write (MB/S)
- Total Write Duration
- Avg. Byte per SSP Frame
- Avg. Byte Per STP Frame

| General          | Primitive        | SSP Transport    | SMP Transport  | STP Transport   | ATA Command | SCSI Command   | SMP Command       | Task Command | SAS Address | Protocol Error | Performance | Lanes | Others |
|------------------|------------------|------------------|----------------|-----------------|-------------|----------------|-------------------|--------------|-------------|----------------|-------------|-------|--------|
| Min. Compl. Time | Avg. Compl. Time | Max. Compl. Time | Init. Bus Util | Target Bus Util | Efficiency  | Total Read Cmd | Total Read(Bytes) |              |             |                |             |       |        |
| ---              | ---              | ---              | ---            | ---             | ---         | ---            | ---               |              |             |                |             |       |        |
| 69.293 334 96 us | 10.442 747 12 ms | 50.291 065 22 ms | 4.66 ms        | 10.97 ms        | 43.57       | 659            | 1331728           |              |             |                |             |       |        |

## SAS Lanes Report

To display the SAS Lanes Report, click the **Lanes** tab. The Lanes report displays the report data in columns with the following information:

- Port
- Open Accept
- Open Reject
- AIP Waiting on Con.
- Break
- SCSI Command
- SMP Command
- Out Standing Command
- Transfer Bytes
- Link Utilization
- Link Utilization %

| General | Primitive   | SSP Transport | SMP Transport       | STP Transport | ATA Command  | SCSI Command | SMP Command | Task Command     | SAS Address    | Protocol Error   | Performance | Lanes | Others |
|---------|-------------|---------------|---------------------|---------------|--------------|--------------|-------------|------------------|----------------|------------------|-------------|-------|--------|
| Port    | Open Accept | Open Reject   | AIP Waiting on Con. | Break         | SCSI Command | ATA Command  | SMP Command | Out Standing Cmd | Transfer Bytes | Link Utilization | Link Utiliz |       |        |
| All     | All         | All           | ---                 | ---           | All          | All          | All         | All              | All            | ---              | ---         |       |        |
| I1      | 9           | 0             | 0                   | 0             | 6            | 0            | 0           | 1                | 0              | 4.293 334 us     | 0.03        |       |        |
| T1      | 7           | 0             | 0                   | 0             | 0            | 0            | 0           | 0                | 172            | 5.360 000 us     | 0.03        |       |        |
| I2      | 776         | 102           | 0                   | 0             | 700          | 300          | 25          | 2                | 661504         | 4.552 893 ms     | 29.1        |       |        |

## Others Report

To display the Others Report, click the **Others** tab. The Others report displays the report data in columns with the following information:

- Items
  - Idle No
  - Payload Size
  - Sample Time
  - Idle (Initiator)
  - Idle (Target)
  - SSP Bus Utilization
  - SMP Bus Utilization
  - STP Bus Utilization
- Report
  - Count/Time

| General      |              | Primitive |  | SSP Transport |  | SMP Transport |  | STP Transport |  | ATA Command |  | SCSI Command |  | SMP Command |  | Task Command |  | SAS Address |  | Protocol Error |  | Performance |  | Lanes |  | Others |  |
|--------------|--------------|-----------|--|---------------|--|---------------|--|---------------|--|-------------|--|--------------|--|-------------|--|--------------|--|-------------|--|----------------|--|-------------|--|-------|--|--------|--|
| Items        | Report       |           |  |               |  |               |  |               |  |             |  |              |  |             |  |              |  |             |  |                |  |             |  |       |  |        |  |
| ---          | ---          |           |  |               |  |               |  |               |  |             |  |              |  |             |  |              |  |             |  |                |  |             |  |       |  |        |  |
| Idle No      | 0            |           |  |               |  |               |  |               |  |             |  |              |  |             |  |              |  |             |  |                |  |             |  |       |  |        |  |
| Payload Size | 5988180      |           |  |               |  |               |  |               |  |             |  |              |  |             |  |              |  |             |  |                |  |             |  |       |  |        |  |
| Sample Time  | 5.252 485 75 |           |  |               |  |               |  |               |  |             |  |              |  |             |  |              |  |             |  |                |  |             |  |       |  |        |  |
| Idle         | 0.000 000 00 |           |  |               |  |               |  |               |  |             |  |              |  |             |  |              |  |             |  |                |  |             |  |       |  |        |  |
| Idle         | 0.000 000 00 |           |  |               |  |               |  |               |  |             |  |              |  |             |  |              |  |             |  |                |  |             |  |       |  |        |  |
| SSP Bus      | 5.137 573 24 |           |  |               |  |               |  |               |  |             |  |              |  |             |  |              |  |             |  |                |  |             |  |       |  |        |  |
| SMP Bus      | 6.266 666 89 |           |  |               |  |               |  |               |  |             |  |              |  |             |  |              |  |             |  |                |  |             |  |       |  |        |  |
| STP Bus      | 9.476 453 78 |           |  |               |  |               |  |               |  |             |  |              |  |             |  |              |  |             |  |                |  |             |  |       |  |        |  |

## Statistical Report Toolbar

---



The Statistical report toolbar provides the following functions accessible by buttons on the toolbar:

- Export to Excel
- Save as Text
- Print Report
- Print Preview
- Report Display Settings

### Export as Microsoft® Excel file



Click the **Export to Excel** Button on the Statistical Report Toolbar to open the Export to Excel dialog.

Choose a folder to save the Excel file in and an appropriate file name and click **Save**.

### Save as Text



Click the **Save as Text** Button on the Statistical Report Toolbar to open the Export to Text dialog.

Choose a folder to save the Text file in and an appropriate file name and click Save.

### Print Statistical Report



Click the **Print** Button on the Statistical Report Toolbar to open the select printer dialog. Choose an available printer and click **OK**.

## Print Preview



Click the **Print Preview** Button on the Statistical Report Toolbar to display a preview of the report to be printed.

| Catalyst Enterprises Inc. |           | Serial SCSI Analyzer/Exerciser |       | Apr 11, 2004 |  |
|---------------------------|-----------|--------------------------------|-------|--------------|--|
| General:                  |           |                                |       |              |  |
| Type                      | Direction | Duration                       | Count | %            |  |
| STP Frame                 | I->T      | 7.03999996 us                  | 17    | 7.02         |  |
| STP Frame                 | T->I      | 85.89333344 us                 | 34    | 14.05        |  |
| Open Address Frame        | I->T      | 18.39999962 us                 | 69    | 26.51        |  |
| SSP Frame                 | I->T      | 14.48000050 us                 | 95    | 14.46        |  |
| SSP Frame                 | T->I      | 23.12000084 us                 | 53    | 21.90        |  |
| SMP Frame                 | I->T      | 1.81333339 us                  | 17    | 7.02         |  |
| SMP Frame                 | T->I      | 4.53333330 us                  | 17    | 7.02         |  |
|                           |           | 0.00015528                     | 242   | 100.00       |  |
| Primitive:                |           |                                |       |              |  |
| Primitive                 | Direction | Count                          | %     |              |  |
| SATA CONT                 | I->T      | 17                             | 1.56  |              |  |
| SATA CONT                 | T->I      | 34                             | 3.13  |              |  |
| SATA EOF                  | I->T      | 17                             | 1.56  |              |  |
| SATA EOF                  | T->I      | 34                             | 3.13  |              |  |
| SATA HOLD                 | T->I      | 17                             | 1.56  |              |  |
| SATA HOLDA                | T->I      | 17                             | 1.56  |              |  |
| SATA R IP                 | I->T      | 17                             | 1.56  |              |  |
| SATA R IP                 | T->I      | 17                             | 1.56  |              |  |
| SATA SOF                  | I->T      | 17                             | 1.56  |              |  |
| SATA SOF                  | T->I      | 34                             | 3.13  |              |  |
| SATA SYNC                 | I->T      | 17                             | 1.56  |              |  |
| SATA SYNC                 | T->I      | 34                             | 3.13  |              |  |
| SATA X RDY                | I->T      | 17                             | 1.56  |              |  |
| SATA X RDY                | T->I      | 34                             | 3.13  |              |  |
| ACK                       | I->T      | 53                             | 4.88  |              |  |
| ACK                       | T->I      | 35                             | 3.22  |              |  |
| EOF                       | I->T      | 52                             | 4.78  |              |  |
| EOF                       | T->I      | 70                             | 6.44  |              |  |
| SOF                       | I->T      | 52                             | 4.78  |              |  |
| SOF                       | T->I      | 70                             | 6.44  |              |  |
| EOAF                      | I->T      | 69                             | 6.35  |              |  |
| SOAF                      | I->T      | 69                             | 6.35  |              |  |
| ALIGN0                    | I->T      | 70                             | 6.44  |              |  |
| ALIGN0                    | T->I      | 52                             | 4.78  |              |  |
| CLOSE NORMAL              | I->T      | 52                             | 4.78  |              |  |
| CLOSE NORMAL              | T->I      | 52                             | 4.78  |              |  |
| OPEN ACCEPT               | T->I      | 68                             | 6.26  |              |  |
|                           |           | 1087                           | 100.0 |              |  |
| Page 1                    |           |                                |       |              |  |

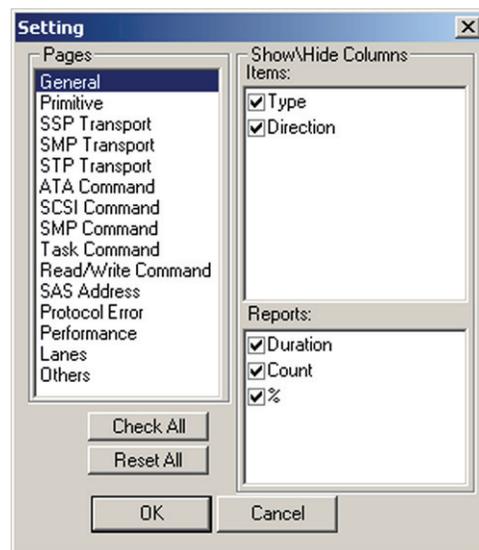
*Figure 116. Sample Print Preview of Report*

## Report Display Settings

You may set up the report columns for display to suit a particular analysis need. You may globally choose the columns for display thereby eliminating the need to show hide columns individually. Use the **Setting** dialog to configure the display for each page.



Click the **Setting** Button on the Statistical Report Toolbar to open the Setting dialog.



*Figure 117. Statistical Report Column Setting*

## Link With Sample View

Whenever a Type is selected on any page of the statistical report, a set of navigation buttons is enabled allowing you to examine each instance of that type in the sample viewer.



Click the **Jump to Previous** Button on the Statistical Report Toolbar to go to the previous instance of the selected type in the Sample Viewer.



Click the **Jump to Next** Button on the Statistical Report Toolbar to go to the next instance of the selected type in the Sample Viewer.



Click the **Jump to Specific** Button on the Statistical Report Toolbar to go to the instance specified as N of M items on the Statistical Report Toolbar.

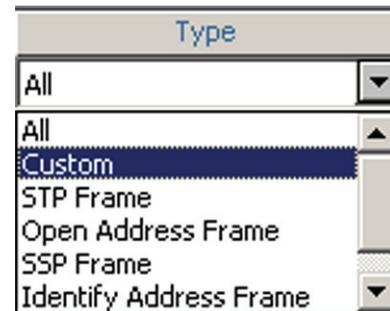
## Formatting the Statistical Report View

Initially the Statistical Report View contains all of the information in columns, but you may customize the display for your needs by:

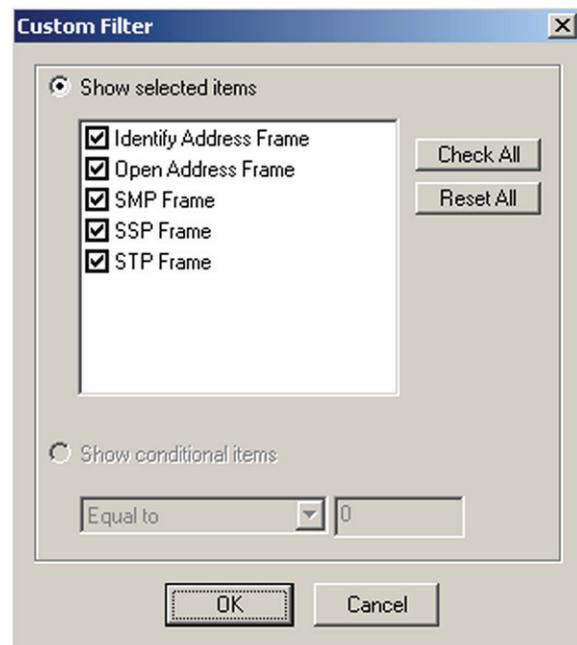
- Sorting items by column
- Filtering Columns by item
- Hiding any column on the display

### Filtering Column Content

To filter column content click the down arrow in the heading for that column and choose the items that you wish to be displayed. The default is All. By checking a specific item you exclude everything but that item for display.



Choosing **Custom** allows you to specify more than one item for display.



Check the items you wish to display and click **OK**.

## Hiding Columns

To hide a column, right click in the column and choose Hide. To unhide a column, right click on any column and choose Unhide.

## Sorting Column Content

To sort column content, click the heading for that column. Repeated clicking of the column heading will sort the column in ascending or descending order.

| Type               | Direction | Duration       | Count | %      |
|--------------------|-----------|----------------|-------|--------|
| All                | All       | All            | All   | ---    |
| Open Address Frame | I->T      | 18.39999962 us | 69    | 28.51  |
| SMP Frame          | T->I      | 4.53333330 us  | 17    | 7.02   |
| SMP Frame          | I->T      | 1.81333339 us  | 17    | 7.02   |
| SSP Frame          | T->I      | 23.12000084 us | 53    | 21.90  |
| SSP Frame          | I->T      | 14.48000050 us | 35    | 14.46  |
| STP Frame          | T->I      | 85.89333344 us | 34    | 14.05  |
| STP Frame          | I->T      | 7.03999996 us  | 17    | 7.02   |
|                    |           | 0.00015528     | 242   | 100.00 |

| Type               | Direction | Duration       | Count | %      |
|--------------------|-----------|----------------|-------|--------|
| All                | All       | All            | All   | ---    |
| STP Frame          | I->T      | 7.03999996 us  | 17    | 7.02   |
| STP Frame          | T->I      | 85.89333344 us | 34    | 14.05  |
| SSP Frame          | I->T      | 14.48000050 us | 35    | 14.46  |
| SSP Frame          | T->I      | 23.12000084 us | 53    | 21.90  |
| SMP Frame          | I->T      | 1.81333339 us  | 17    | 7.02   |
| SMP Frame          | T->I      | 4.53333330 us  | 17    | 7.02   |
| Open Address Frame | I->T      | 18.39999962 us | 69    | 28.51  |
|                    |           | 0.00015528     | 242   | 100.00 |

Figure 118. Toggling Type Sort Order

# Data Report

Whenever a captured sample is displayed in the Sample Viewer, the Data Report Button is enabled on the Viewer toolbar and the Data Report selection is enabled in the Report menu.

The data report displays all of the data that is sent from the host to the device and from the device to the host. All PIO-In (read) commands are grouped as a data packet until the occurrence of A PIO-out (write) command creating a new data packet.



To display a **Data Report**, click the Data Report Button on the Viewer toolbar or choose Data Report from the Report menu.

Click the Statistics button to display data report statistics

| Command   | Number | Duration    | From LBAN | To LBAN |
|-----------|--------|-------------|-----------|---------|
| Read (10) | 4      | 23.306 (ms) | 204c14    | 204c18  |
|           |        |             | 392b59    | 392b5d  |
|           |        |             | 0a4270    | 0a427c  |
|           |        |             | 32a22d    | 32a233  |

Click the Down Arrow in a data field to display Data Report details

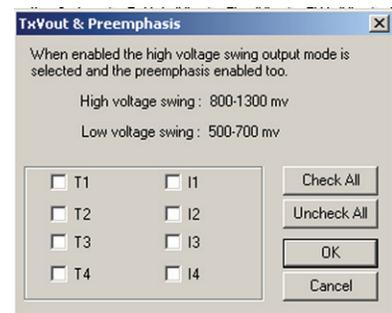
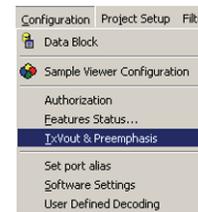
Figure 119. Data Report Display

# Utilities

## Tx Vout

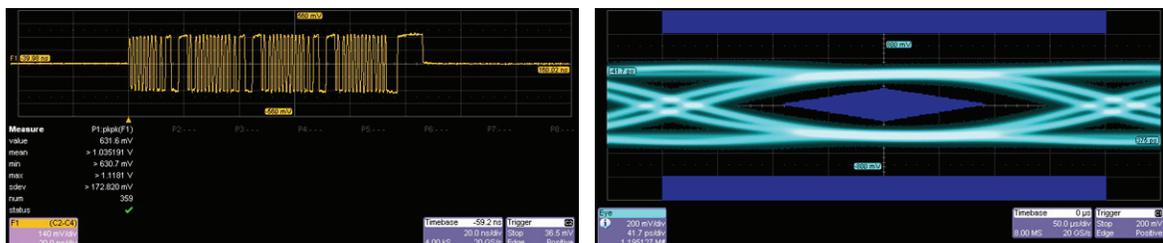
Your analyzer incorporates the ability to select Tx Vout for the transmitter on each port. Selecting Tx Vout increases the output voltage swing above the nominal value for test and characterization purposes. This feature is also useful to compensate for line loss when driving long cables. The output range without Tx Vout is 500 - 700 mv, nominally 600 mv (see Figure 121.) and 800 - 1300 mv, nominally 1100 mv (see Figure 122.) with Tx Vout selected.

To select Tx Vout click **Configuration** and then choose



**Figure 120. Choose Port for Tx Vout**

Check the Port(s) for which you wish to apply Tx Vout and click **OK**.



**Figure 121. Waveform and Eye Diagram with no Tx Vout**

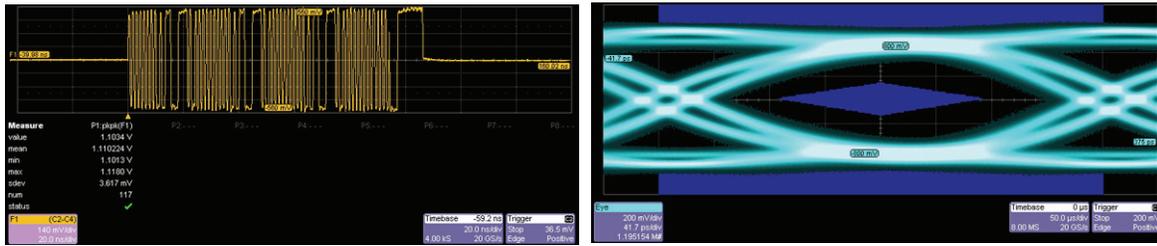


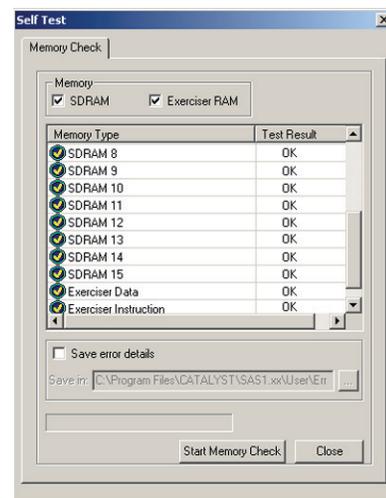
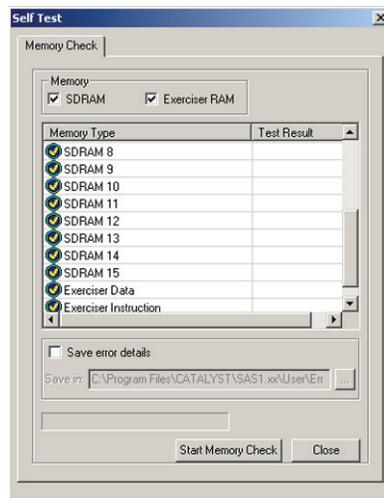
Figure 122. Waveform and Eye Diagram with Tx Vout

## Memory Check

The STX230/STX430 has a built-in RAM self test utility.



Click **Tools** on the main menu bar and choose **Self Test** to open the Self Test dialog.



Choose to test the SDRAM and/or Exerciser RAM by clicking the corresponding check box

To perform a Memory check, click the **Start Memory Check** button. After a short time the Test result status will appear.

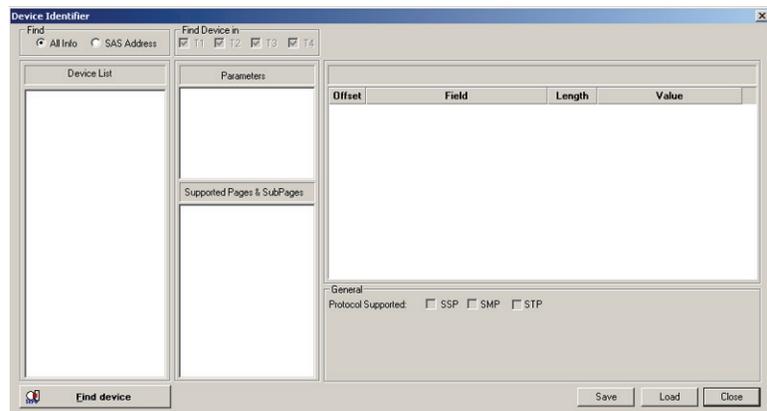
## Find Device

You may use this utility to obtain all of the vendor specific information and detailed device parameters.



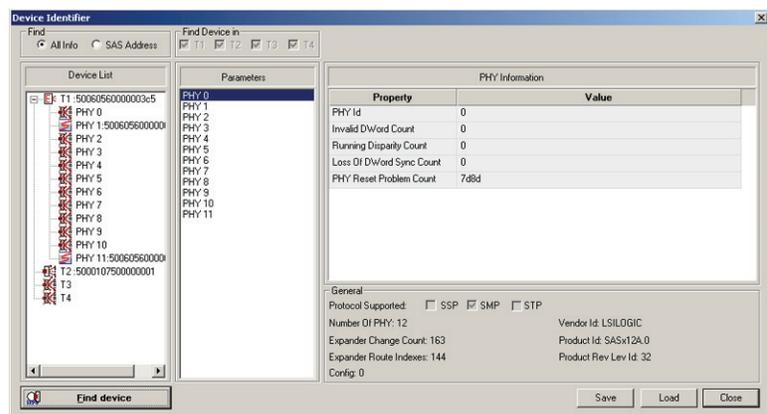
Click **Tools** on the main menu bar and choose **Find Device** to open the Device Identifier dialog.

The default dialog opens with the **All Info** option button checked.



*Figure 123. Device Identifier Dialog*

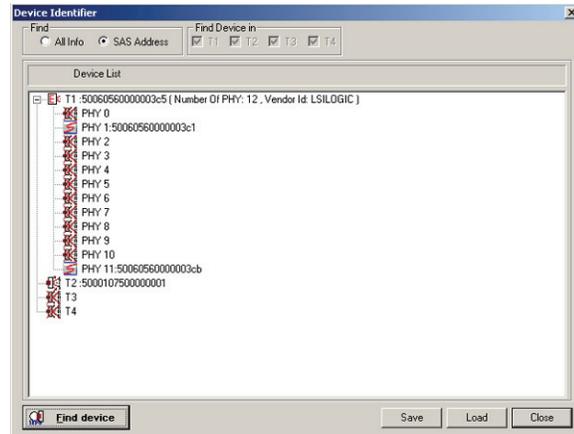
Click the **Find Device** button to search for connected devices. After a brief period the dialog will display all of the device information.



*Figure 124. Identified Devices*

Click on a device in the Device List to display information about that device.

To display the addresses for SAS devices click the **SAS Address** option button and click the **Find device** button.

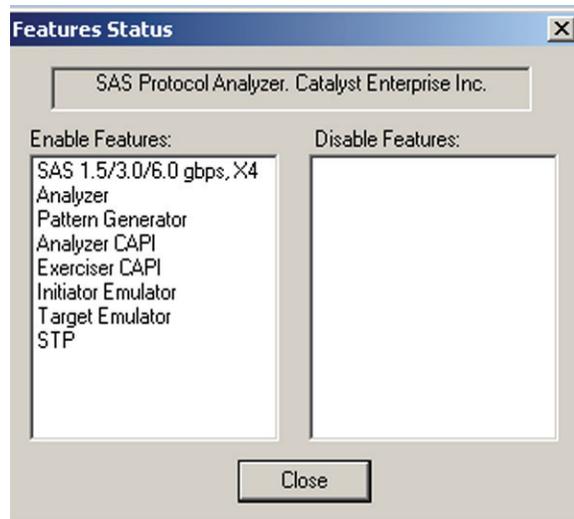


*Figure 125. Identified SAS Devices*

**Note:** This is informational only. To assign Initiator/Emulator commands to a specific address see “**Exercising Specific SAS Addresses**” on page 57.

## Configuration Features Status

To get a comprehensive overview of the current configuration feature status, click **Configuration** and choose **Features status**.



*Figure 126. Configuration Feature Status*

---

# Appendix A

---

---

## Creating a Pattern Generator File

---

You may use any text editor or word processor to create a pattern generator file (\*.spg) using the following conventions:

### Keywords

ALIGN, CONT, DMAT, EOF, HOLD, HOLDA, PMACK, PMNAK, PMREQ\_P, PMREQ\_S, R\_ERR, R\_IP, R\_OK, R\_RDY, SOF, SYNC, WTRM, X\_RDY, XXXX, LOOP, Enable, Disable, Host, Device, Scramble, Role, END\_OF\_FILE.

### Comment format

`/*Comment text*/`

### Primitive definition format

To add an ALIGN primitive, use ALIGN or 27.3 10.2 10.2 K28.5

To add a CONT primitive, use CONT or 25.4 25.4 10.5 K28.3

### Loop definition format

You may write a defined pattern into memory repeatedly by enabling a loop.

Loop definition allows either “Enable” or Disable”. To enable looping use: Loop=Enable

### Scramble definition format

Scramble definition allows either “Enable” or Disable”. To enable scramble use:

Scramble=Enable

### Role definition format

To specify SATA hardware role: Role=Host or Role=Device

### END\_OF\_FILE definition

A pattern generator file must include END\_OF\_FILE as the last statement in the file.

Figure 127 illustrates a typical Pattern Generator file.

```

DeviceRole.spg - Notepad
File Edit Format View Help
/* Target */
27.3 10.2 10.2 K28.5          /* Align */
27.3 10.2 10.2 K28.5          /* Align */
xxxx
xxxx
/* -----Open Address Frame----- */
/* -----Open SSP Connection----- */
01.4 30.0 24.0 K28.5          /* SOAF */
FF FF 08 91
44 33 22 11
88 77 66 55
cc dd ee ff
88 99 aa bb
80 01 06 00
00 00 00 00
00 00 00 00
31.4 07.3 24.0 K28.5          /* EOAF */ /* CRC */
/* -----Read DMA Command----- */
/* -----Register Host to Device----- */
xxxx
xxxx
xxxx
xxxx
xxxx
10.2 10.2 21.4 K28.3          /* R_RDY */
10.2 10.2 21.4 K28.3          /* R_RDY */
25.4 25.4 10.5 K28.3          /* CONT */
xxxx
xxxx
xxxx
27.3 10.2 10.2 K28.5          /* Align */
27.3 10.2 10.2 K28.5          /* Align */
xxxx
xxxx
/* ----- */
21.2 21.2 21.5 K28.3          /* R_IP */
21.2 21.2 21.5 K28.3          /* R_IP */
25.4 25.4 10.5 K28.3          /* CONT */
xxxx
xxxx
xxxx
21.1 21.1 21.5 K28.3          /* R_OK */
21.1 21.1 21.5 K28.3          /* R_OK */
25.4 25.4 10.5 K28.3          /* CONT */
xxxx
xxxx

```

**Figure 127 Sample Pattern Generator File \*.spg**

# **Appendix B**

---

---

## **WAN Operation**

---

WAN connected operation is supported. Contact factory for details of operation.



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---

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