TELEDYNE LECROY
Everywhereyoulook™

Sierra M6-2
SAS/SATA Protocol Analyzer

User Manual



For software version 6.15

Generated: August 28, 2020, 11:39

Teledyne LeCroy Protocol Solutions Group

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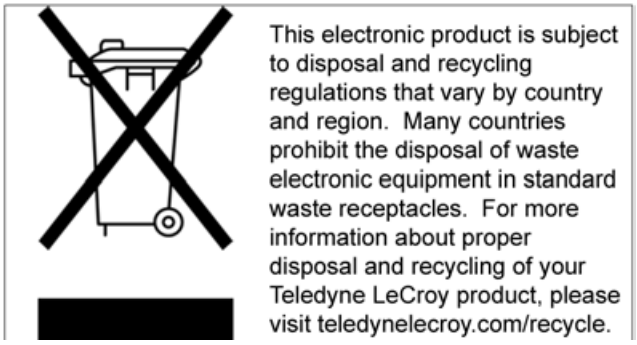
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WEEE Program



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Chapter 1

Introduction

This manual describes installation and operation of the Teledyne LeCroy Sierra M6-2™ Protocol Analyzer and includes examples of typical applications.

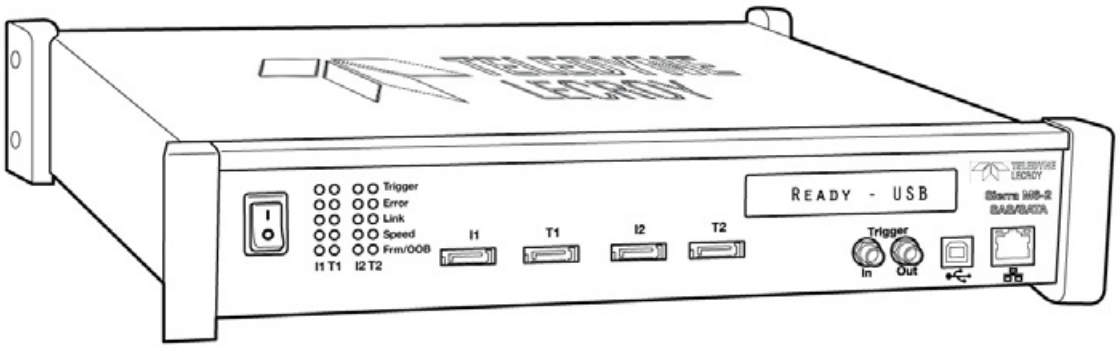


Figure 1.1: Teledyne LeCroy Sierra M6-2 Protocol Analyzer

1.1 Analyzer Overview

The Sierra M6-2 SAS/SATA Protocol Analyzer is a serial bus analyzer, supports host and device emulation, generates traffic, and provides error injection functionality. The SAS analyzer software performs serial bus analysis for Serial Attached SCSI (SAS) data transfers, as well as Serial ATA (SATA) data transfers through STP data transfers. The SATA analyzer software performs serial bus analysis for Serial ATA (SATA) data transfers.

The Sierra M6-2 Analyzer helps Hardware, Firmware, Design, and Application Engineers troubleshoot and diagnose SAS and SATA problems within their product. The analyzer supports the following:

- Capture, triggering, and filtering of Serial Attached SCSI packets or Serial ATA packets
- Generation of bus traffic as a SAS Initiator Emulator or a SATA Host Emulator, while monitoring and analyzing results
- SAS target emulation and SATA device emulation
- Running a Pattern Generator
- TX Vout on transmitters for test and characterization
- CATC API

The analyzer provides for bi-directional trigger and capture of commands, primitives, patterns and all bus conditions. You can capture all frames and/or exclude traffic.

The InFusion™ Error Injector and Traffic Modifier is an error injector and traffic modification tool that allows you to verify real-world fault handling.

The Trainer is a traffic generator that can emulate a SAS initiator/target or SATA host/device.

The Sierra M6-2 Analyzer has a USB port and an Ethernet port to connect to a computer. You can cascade analyzer units for higher port counts. The analyzer allows you to select frames to include and exclude for capture. Capturing can be triggered based on a specific event or manually.

The Sierra M6-2 Analyzer provides a full range of views and statistical reports.

1.2 Features

- 6 Gb/s SAS/SATA protocol analysis or error injection
- Native PHY for fast lock time
- Easy mode triggering
- Cascade up to 8 analyzers
- Sync with Teledyne LeCroy Sierra and STX family products
- CrossSync Control Panel
- Hardware filtering
- Automatic error detection
- Comprehensive decoding of SAS and SATA data traffic
- Logical and chronological traffic displays
- Statistical reporting
- Trace memory of 4 GB or 8 GB
- GbE & USB 2.0 host interfaces
- Capture, triggering, and filtering of Serial Attached SCSI packets or Serial ATA packets
- TX Vout on transmitters for test and characterization
- Automation API
- Error Injection Functionality (Jammer)
- Emulation support
- Trainer traffic generation

1.3 Receiving Your Analyzer

The analyzer package includes the following components:

- 1 Sierra M6-2 Analyzer identified in the packing list
- 2 SATA cables, 0.5 meter
- 1 USB A-B 2.0 cable, 1.8 meter
- 1 Ethernet cable, 10 feet
- 1 10-position ribbon cable, 6 inches
- 1 SMB RA to SMB RA cable, 6 inches
- 1 Three-Prong AC power cord
- 1 Installation DVD-ROM with software and documentation
- 1 Sierra M6-2 Getting Started manual

1.4 Unpacking the Analyzer

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 Teledyne LeCroy Corporation. Retain all shipping materials for shipper's inspection.

1.5 Analyzer Features

The Analyzer has the following features:

- Power Switch (0/1)
- Trigger, Error, Link, Speed, and Frame/OOB LEDs (see next page)
- Port 1 Initiator/Host SATA connector
- Port 1 Target/Device SATA connector
- Port 2 Initiator/Host SATA connector
- Port 2 Target/Device SATA connector
- Status and Configuration LCD Display
- External Trigger Input and Output
- USB port for host connectivity
- Gigabit Ethernet port for network connectivity
- Power In (on back)
- Expansion In/Out data ports and Clock In/Out connectors (on back)

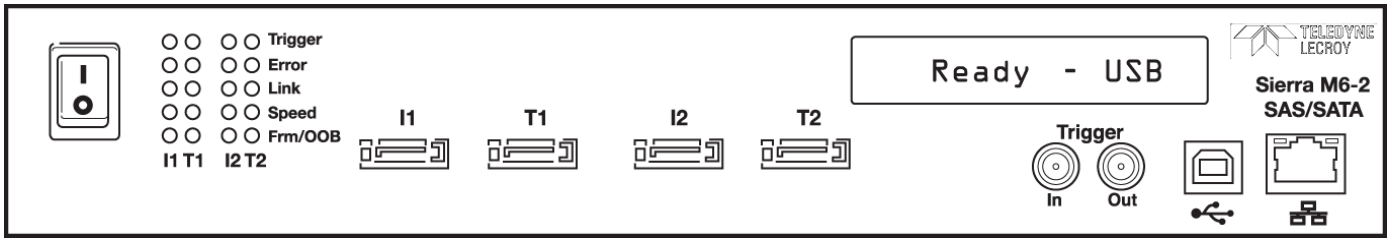


Figure 1.2: Front Panel

1.6 LEDs

Each link is supported by LEDs with the following functionality:

Green This LED is illuminated during the OOB (Out of Bound) sequence before the link is established and after link is established it indicates traffic on the bus.

Orange This LED is illuminated as follows:

Speed	Initiator	Target
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.

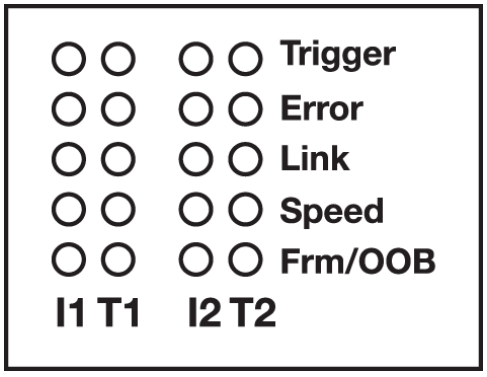


Figure 1.3: LEDs

1.6.1 Status and Configuration Display

The Analyzer front LCD display indicates the configuration and status of operations. For example, during initialization, the LCD panel displays boot status messages.

1.6.2 Temperature and Humidity

The hardware should operate flawlessly in the following temperature ranges:

- Operating 0 °C to 50 °C (32 °F to 122 °F)
- Non-Operating -20 °C to 80 °C (-4 °F to 176 °F)

The hardware should operate in the following humidity range:

- 10% to 90% RH (non-condensing)

1.7 Installing Your Analyzer

1.7.1 Software Installation

The SAS and SATA software works on systems using a Microsoft® Windows® host machine using the Windows Server 2008 R2, Windows Server 2012, Windows 7, Windows 8/8.1 and Windows 10 operating systems. 64-bit Windows OS is recommended because it allows using more RAM memory. Other Operating Systems limit the RAM to 3GB.

1. Insert the Installation DVD ROM into the DVD drive on the host machine.
2. The installation automatically starts setup, unless Auto Run is off. In that case, select the DVD ROM from “My Computer” and click **Setup**.
3. After the warning to close all other programs and before starting the installation, the Install component selection opens.
4. Select components for installation.
5. Click **Next** to complete the installation.

1.7.2 Windows Server 2012

If you are using Windows Server 2012, the Teledyne LeCroy SAS/SATA Protocol Suite Software needs to be added to the firewall exceptions to ensure that the application can find the analyzers over your Ethernet network.

To add the SAS/SATA Protocol Suite Software application to the firewall exceptions perform the following steps.

1. Open the Control Panel. See Figure 1.4.

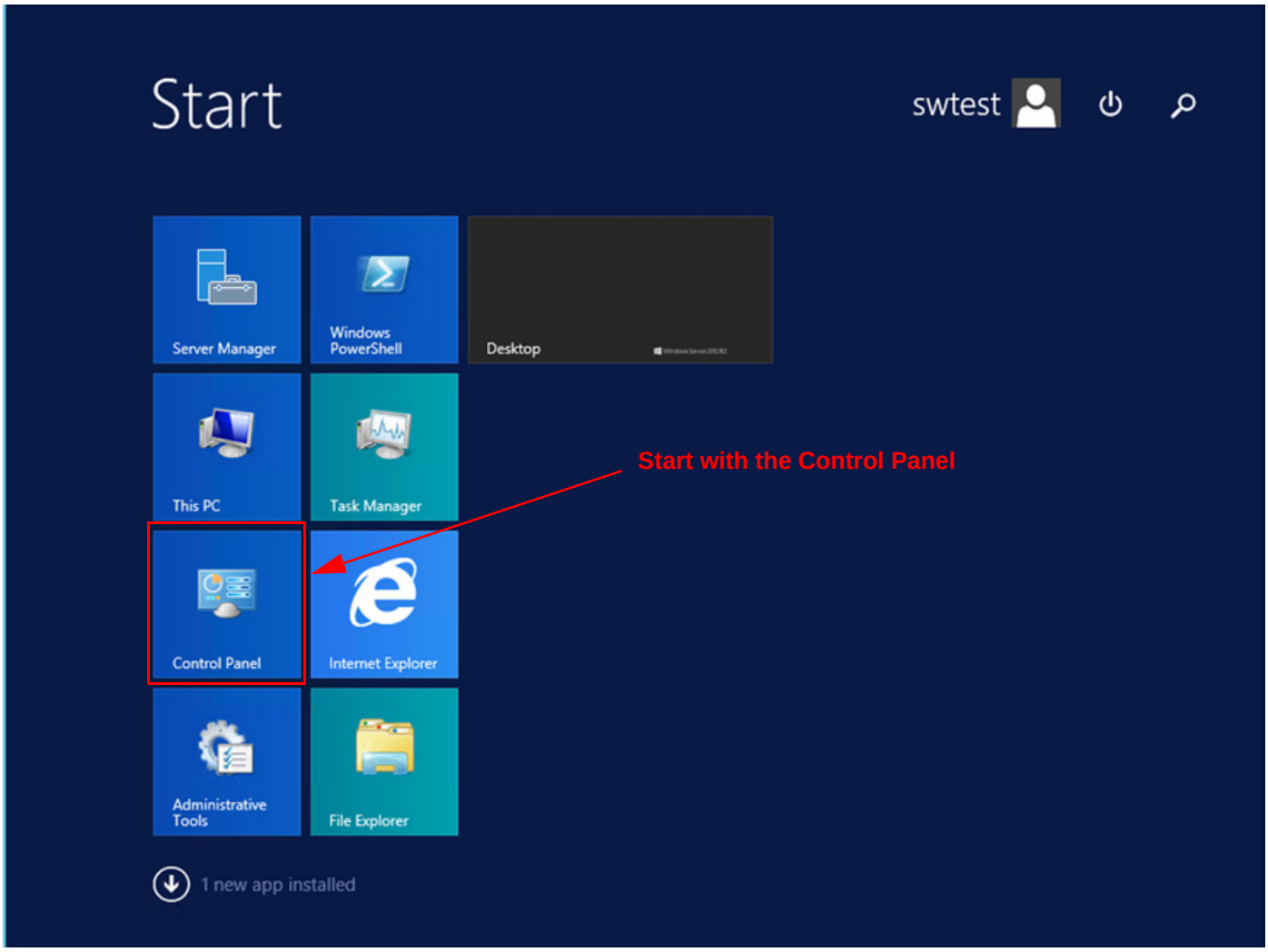


Figure 1.4: Windows Server 2012: Start Menu -> Control Panel

2. From the Control Panel. select the “Systems and Security” screen. See Figure 1.5.

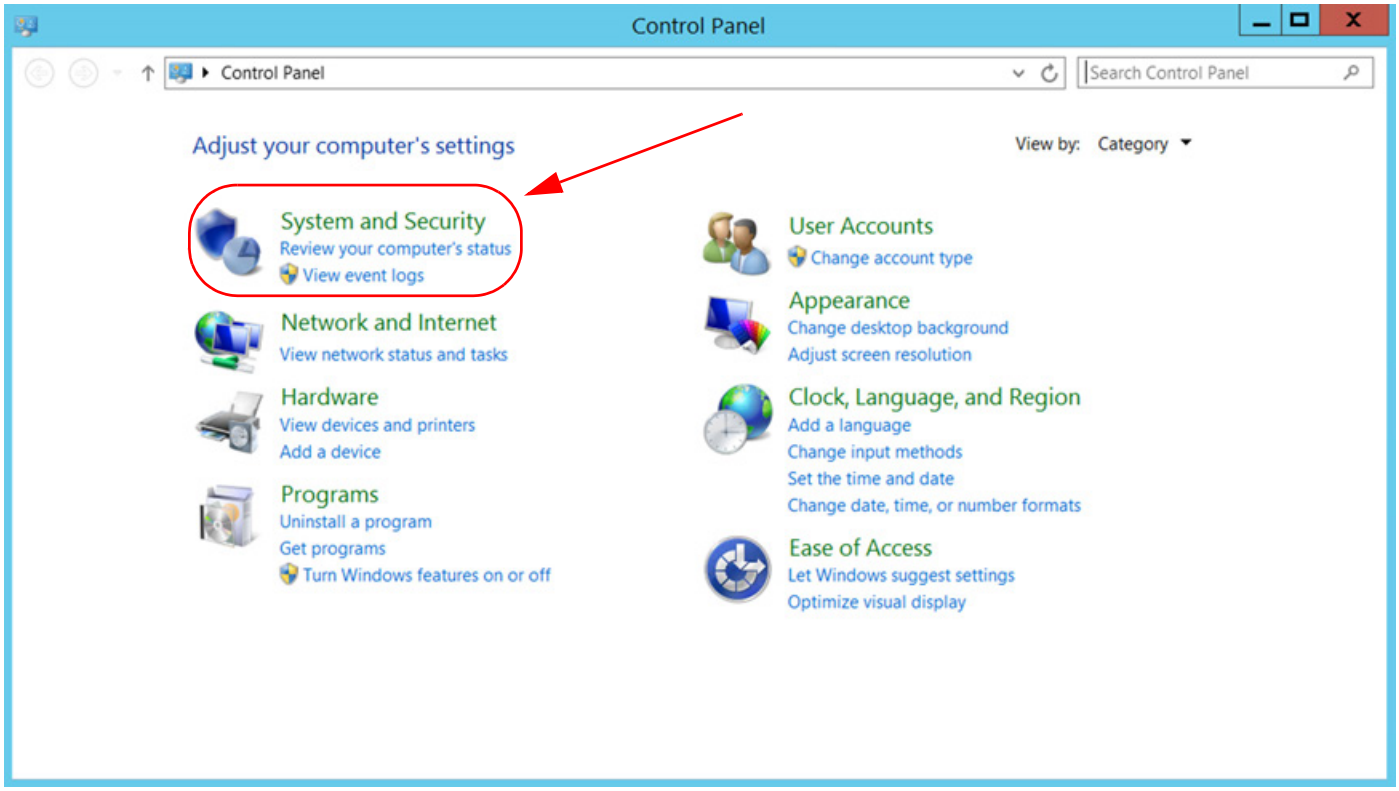


Figure 1.5: Windows Server 2012: Control Panel -> System and Security Screen

3. From the Control Panel -> System and Security Screen, select “Allow an App through Windows Firewall”. See Figure 1.6.

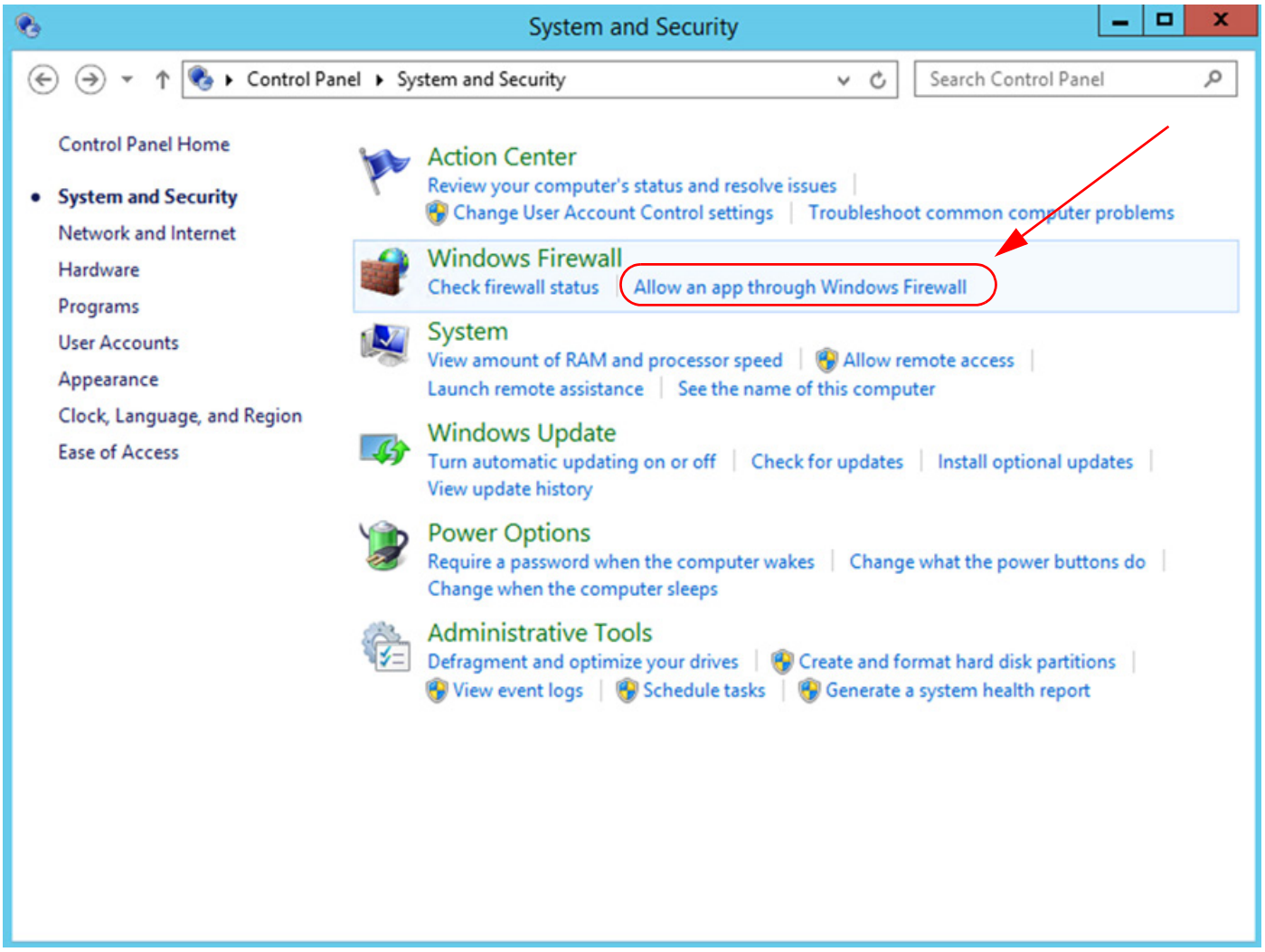


Figure 1.6: Windows Server 2012: Allow an App Through Windows Firewall

4. From the Windows Firewall screen -> Allow apps to communicate through Windows Firewall, select “Change settings”, then select “Allow another program”. See Figure 1.7.

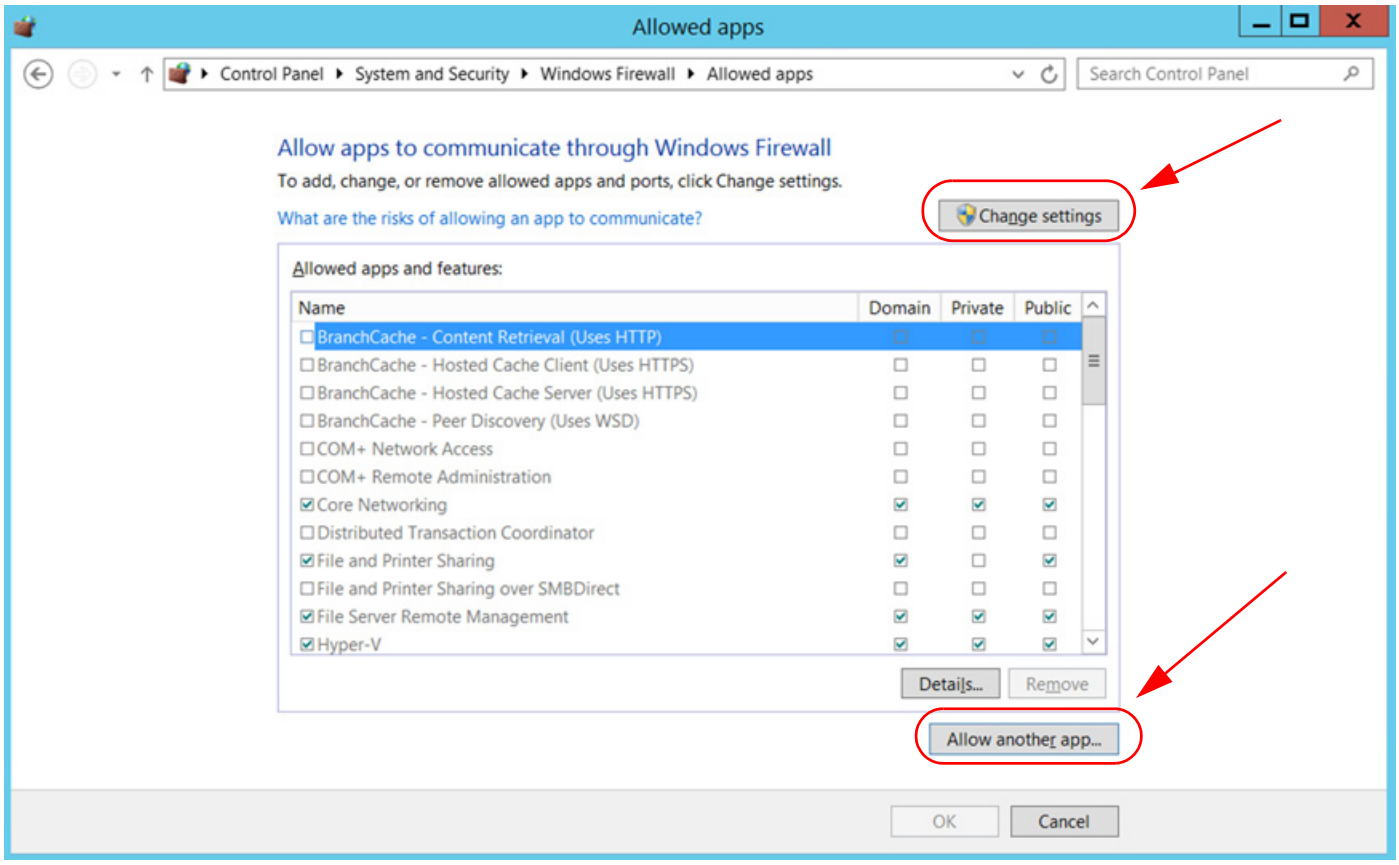


Figure 1.7: Windows Server 2012: Change Settings -> Allowed Another app

5. From the User Account Control screen, select “Yes”. Figure 1.8.

Note: This screen may be optional if you have already allowed Microsoft Windows to make changes to your computer.

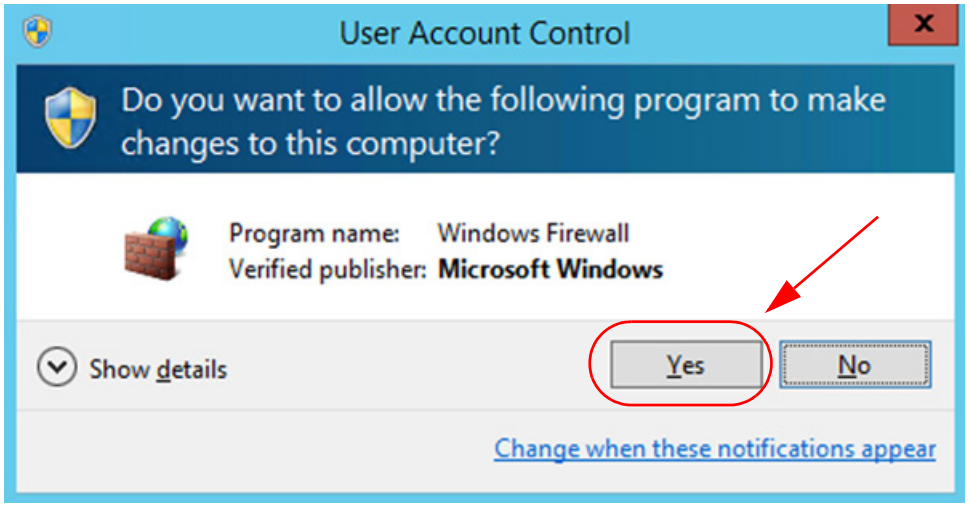


Figure 1.8: Windows Server 2012: User Account Control

6. From the “Add an app” screen, select the Browse button. See Figure 1.9.

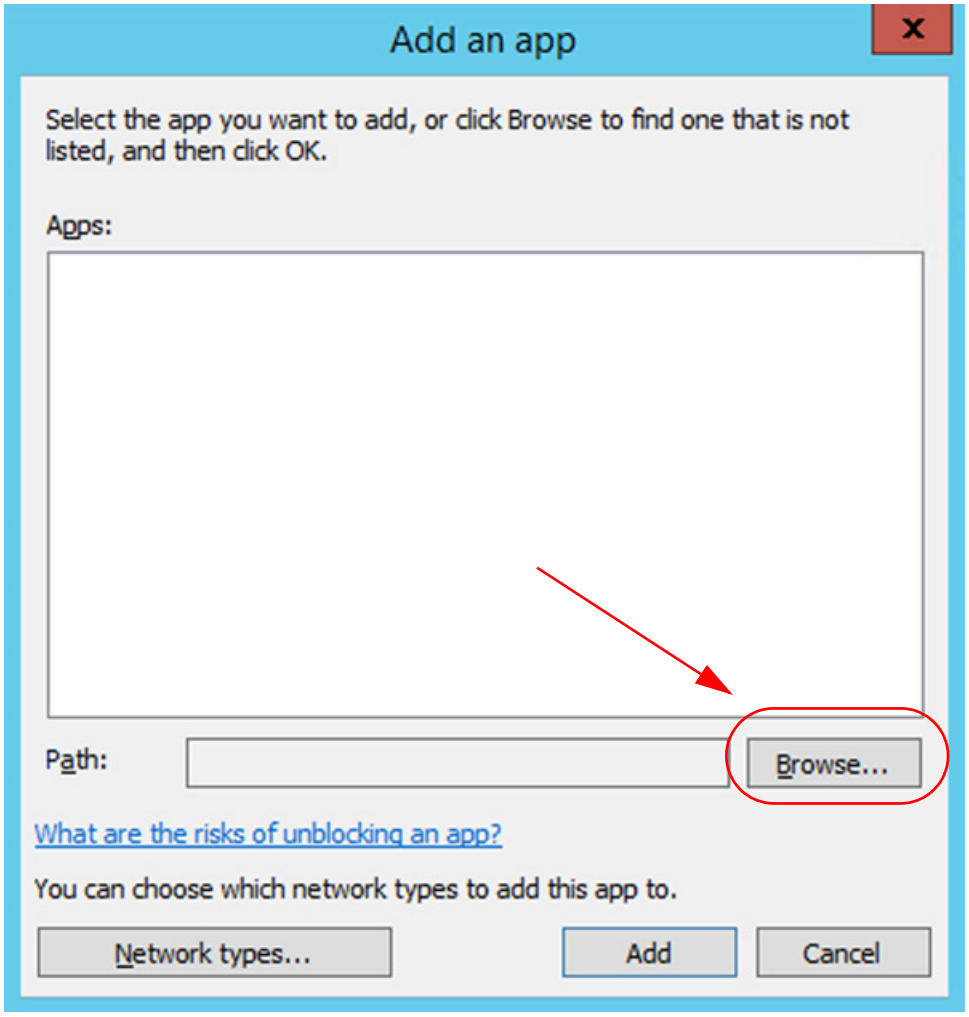


Figure 1.9: Windows Server 2012: Add an App

7. In the Browse window navigate to the location of the installation directory for the SAS/SATA Protocol Suite you are installing. The Teledyne LeCroy SAS/SATA Protocol Suite is typically installed on your machine in the C:\Program Files (x86)\LeCroy\SAS SATA Protocol Suite directory. See Figure 1.10.

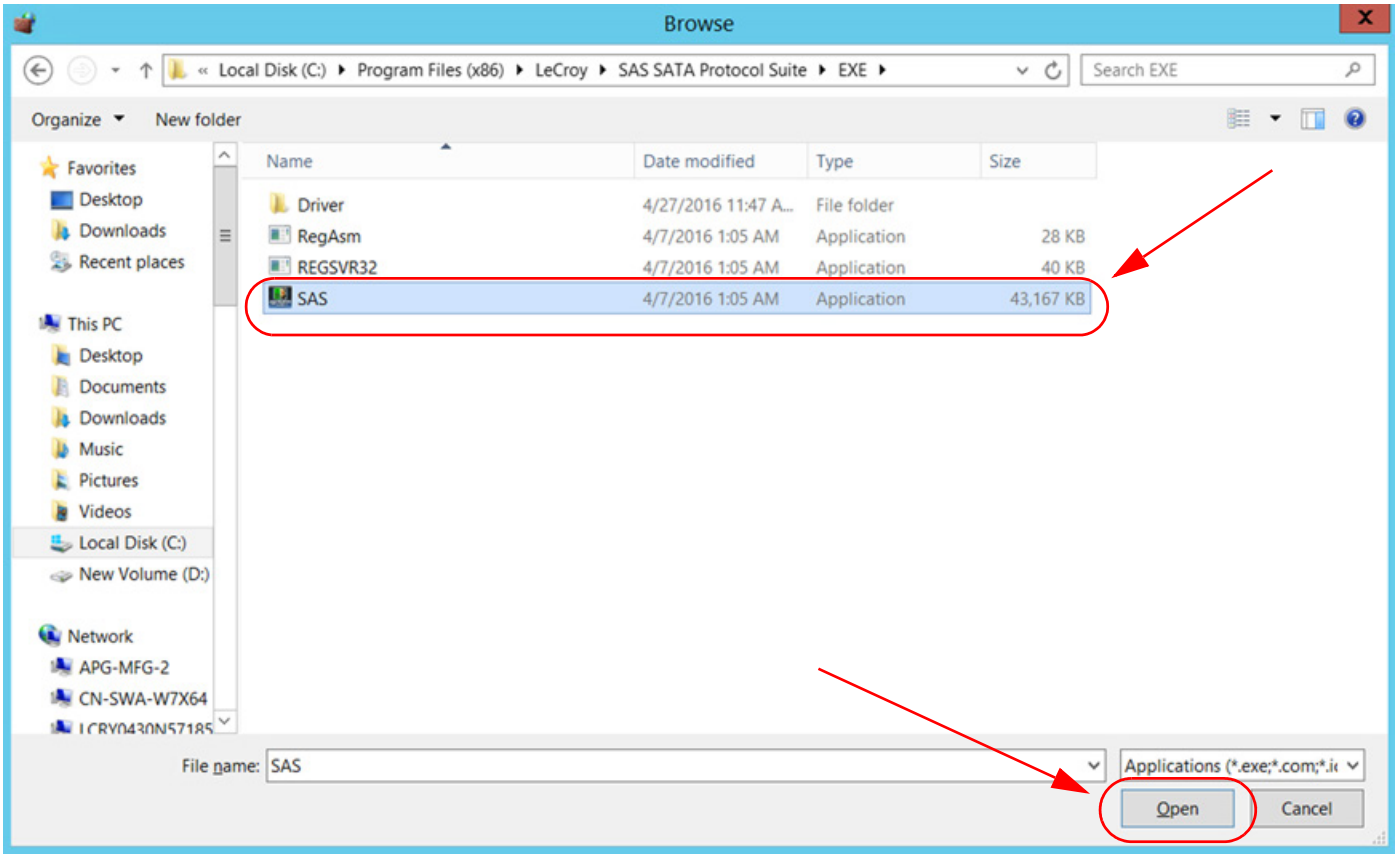


Figure 1.10: Windows Server 2012: Browse to Find Application -> SAS/SATA Protocol Suite Application

8. Select the SAS/SATA Protocol Suite executable file (with the .exe extension) and click on “Open”.

9. If necessary, select the Teledyne LeCroy SAS/SATA Protocol Suite you want to add. Then click on “ADD”, this will add the Teledyne LeCroy SAS/SATA Protocol Suite software to the Apps allowed through the Firewall. See Figure 1.11.

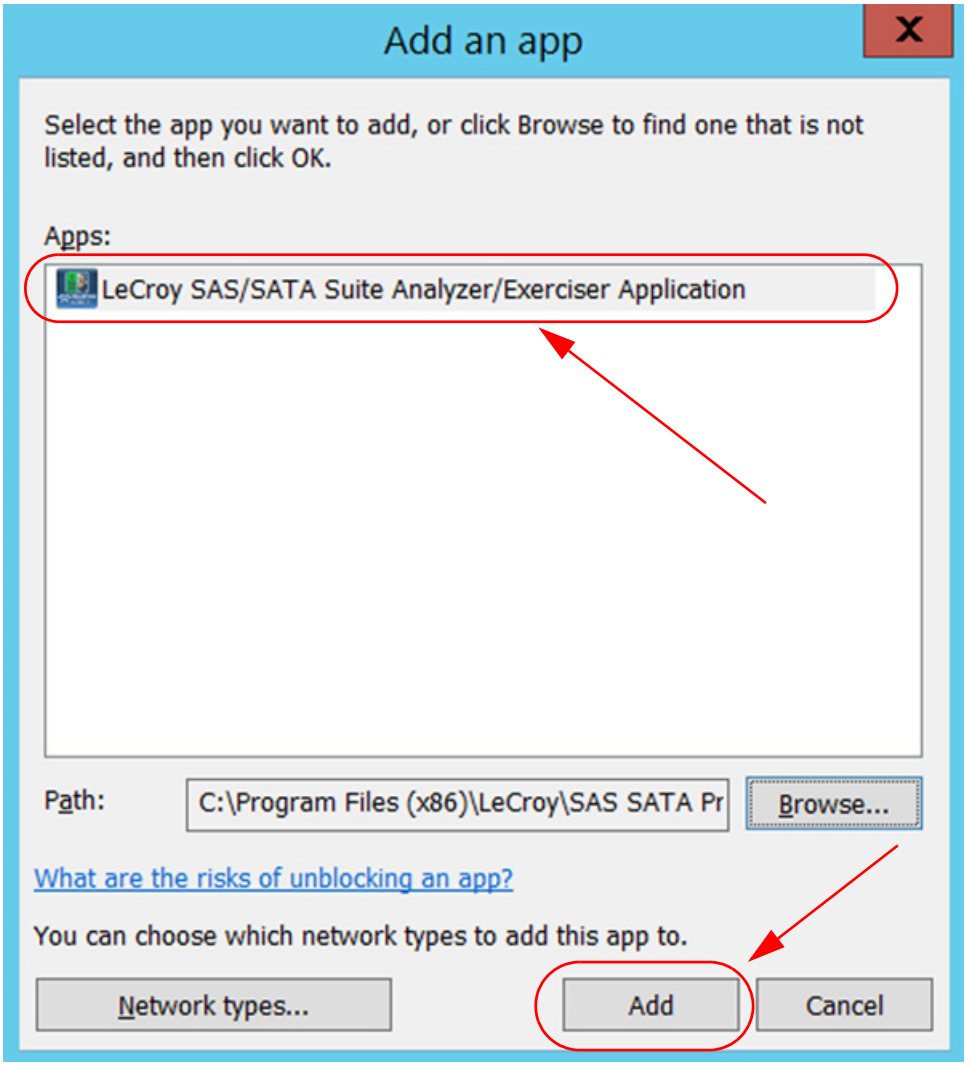


Figure 1.11: Windows Server 2012: Add an Application to the Firewall Exceptions

10. After the Application has been added, you can see it in the “Allow apps to communicate through Windows Firewall” screen. See Figure 1.12.

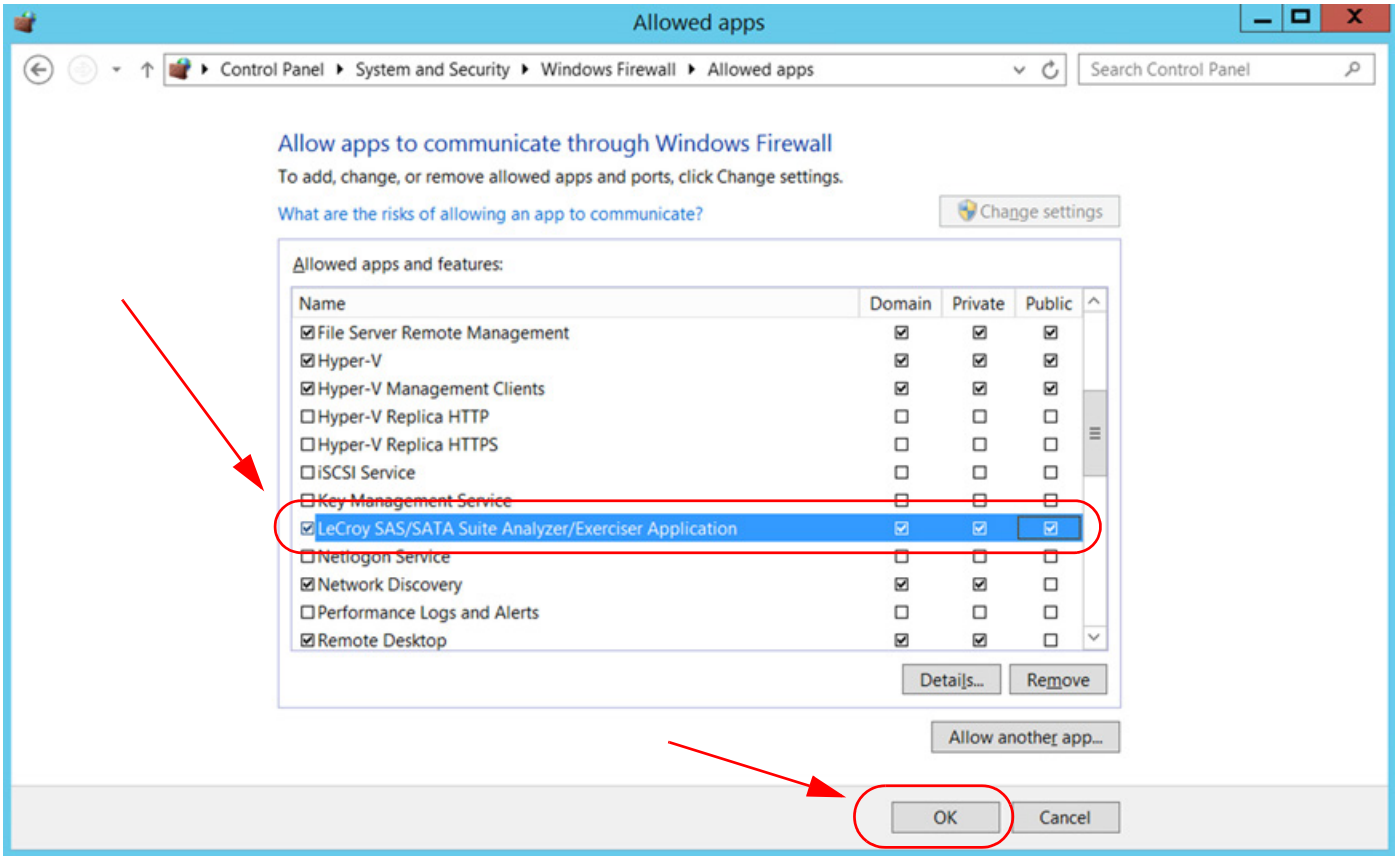


Figure 1.12: Windows Server 2012: Add Teledyne LeCroy SAS/SATA Protocol Suite to Allowed Applications

Click “**OK**” and you’re done with updating the Firewall.

1.7.3 Windows Server 2008

If you are using Windows Server 2008, the Teledyne LeCroy SAS/SATA Protocol Suite Software needs to be added to the firewall exceptions to ensure that the application can find the analyzers over your Ethernet network.

To add the SAS/SATA Protocol Suite Software application to the firewall exceptions perform the following steps.

1. Open the Control Panel. See Figure 1.13.

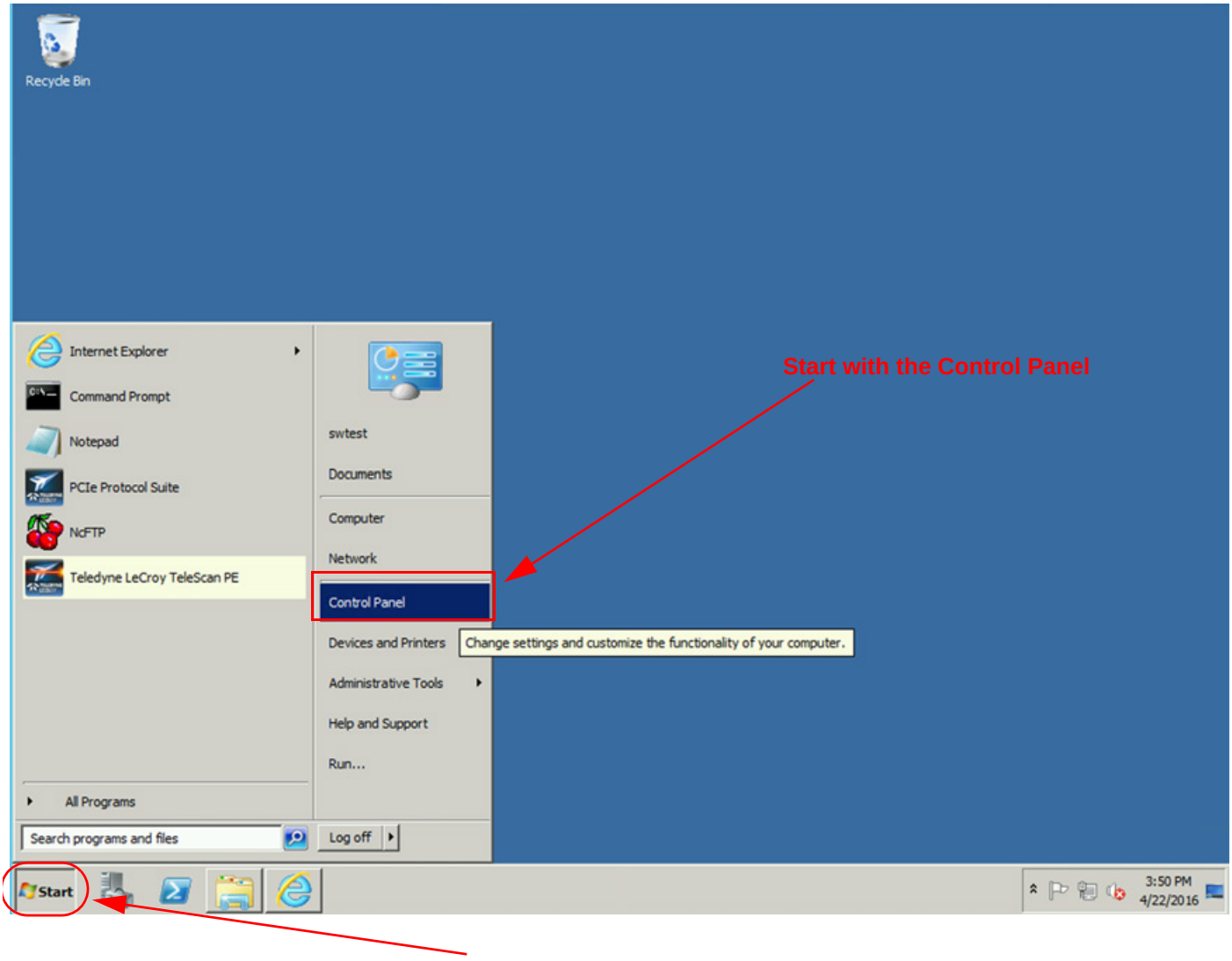


Figure 1.13: Windows Server 2008: Start Menu -> Control Panel

2. From the Control Panel, select the “System and Security” Screen. See Figure 1.14.

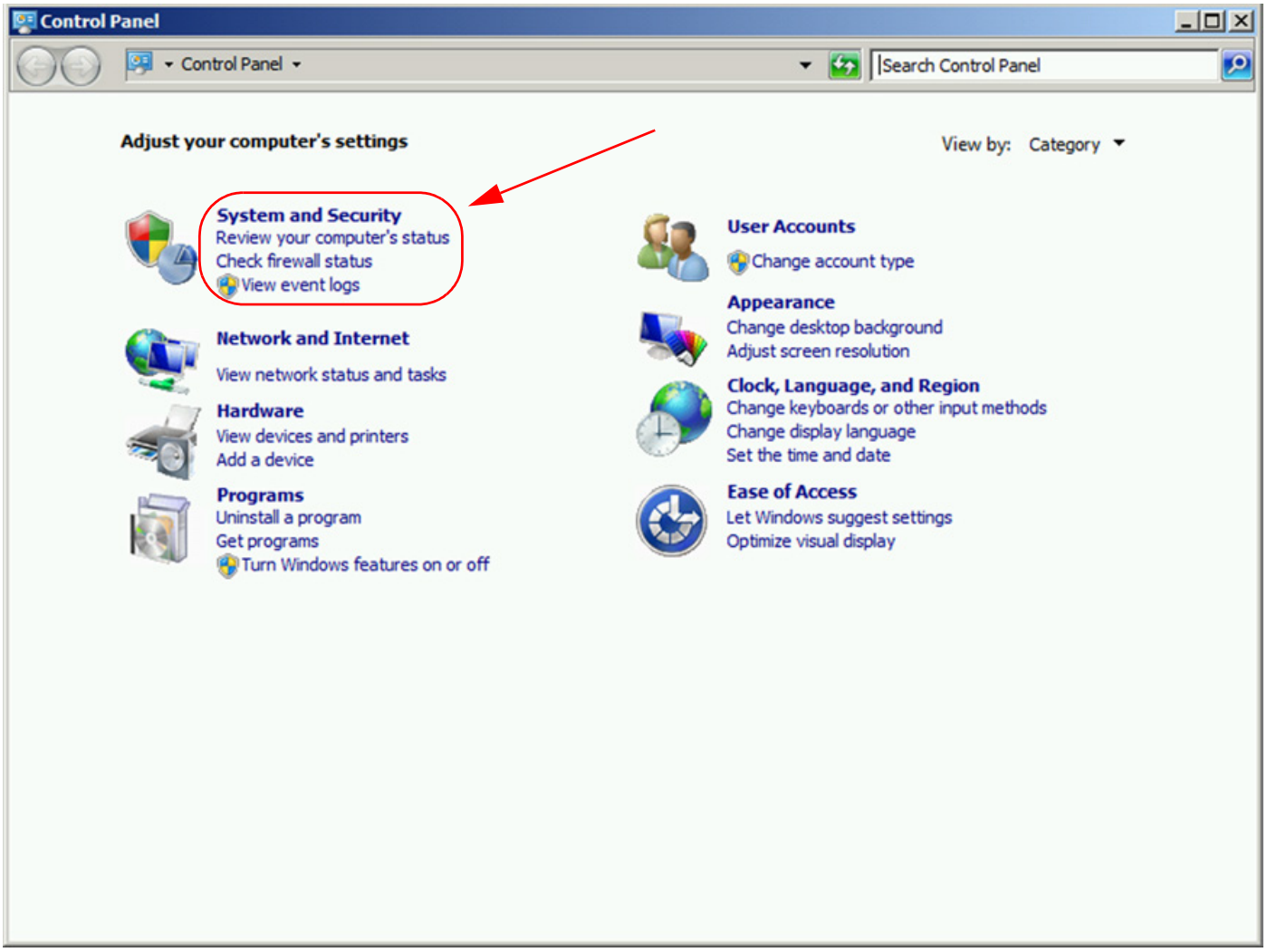


Figure 1.14: Windows Server 2008: System and Security Screen

3. From the Control Panel -> System and Security screen, select “Allow a program through Windows Firewall”. See Figure 1.15.

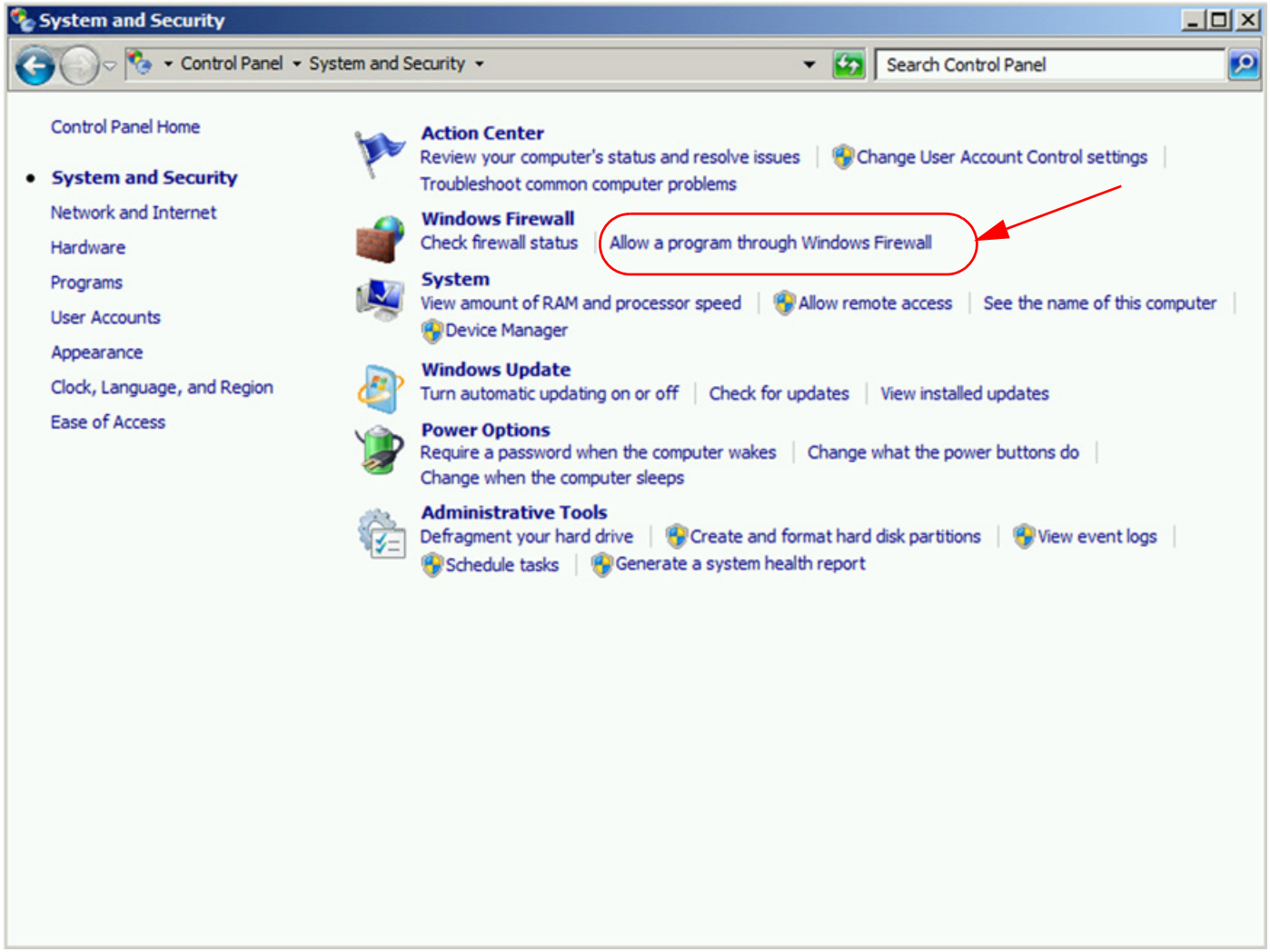


Figure 1.15: Windows Server 2008: Allowed Program through Windows Firewall

4. From the Windows Firewall screen -> Allow apps to communicate through Windows Firewall", select Change settings, then select "Allow another program". See Figure 1.16.

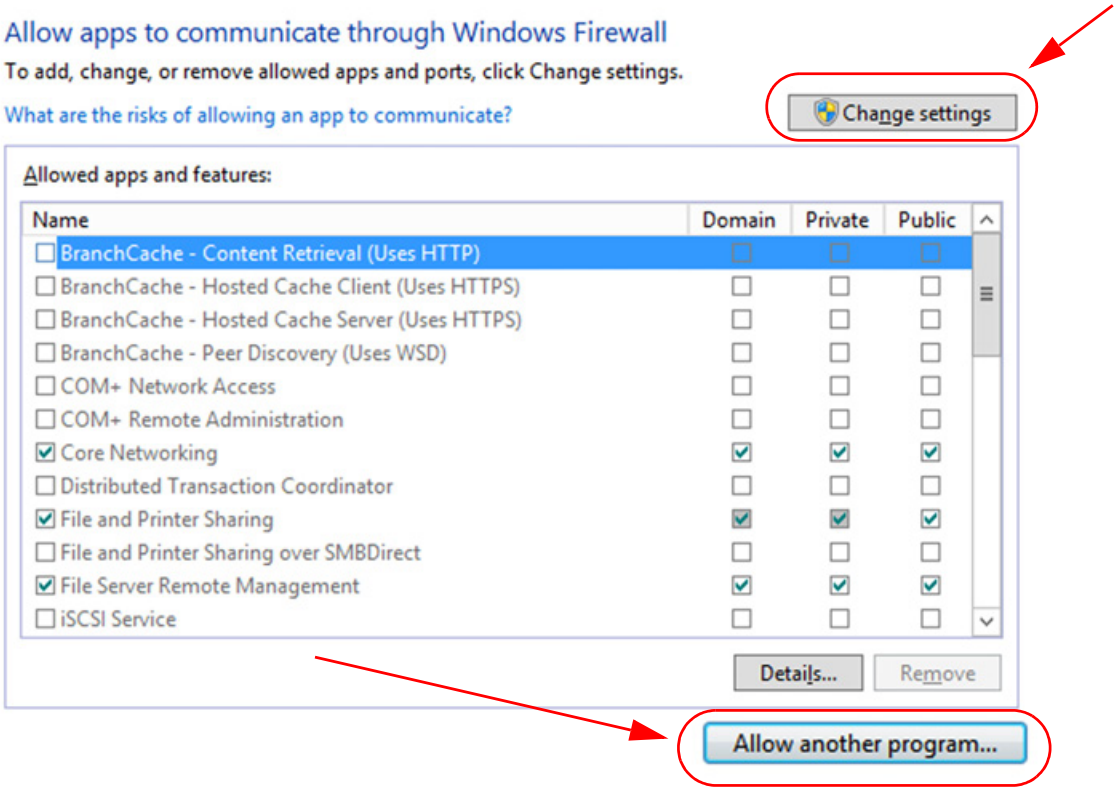


Figure 1.16: Windows Server 2008: Allowed Apps: Change settings -> Allow another program

5. In the “Add a Program” screen click on the “Browse” Button. See Figure 1.17.

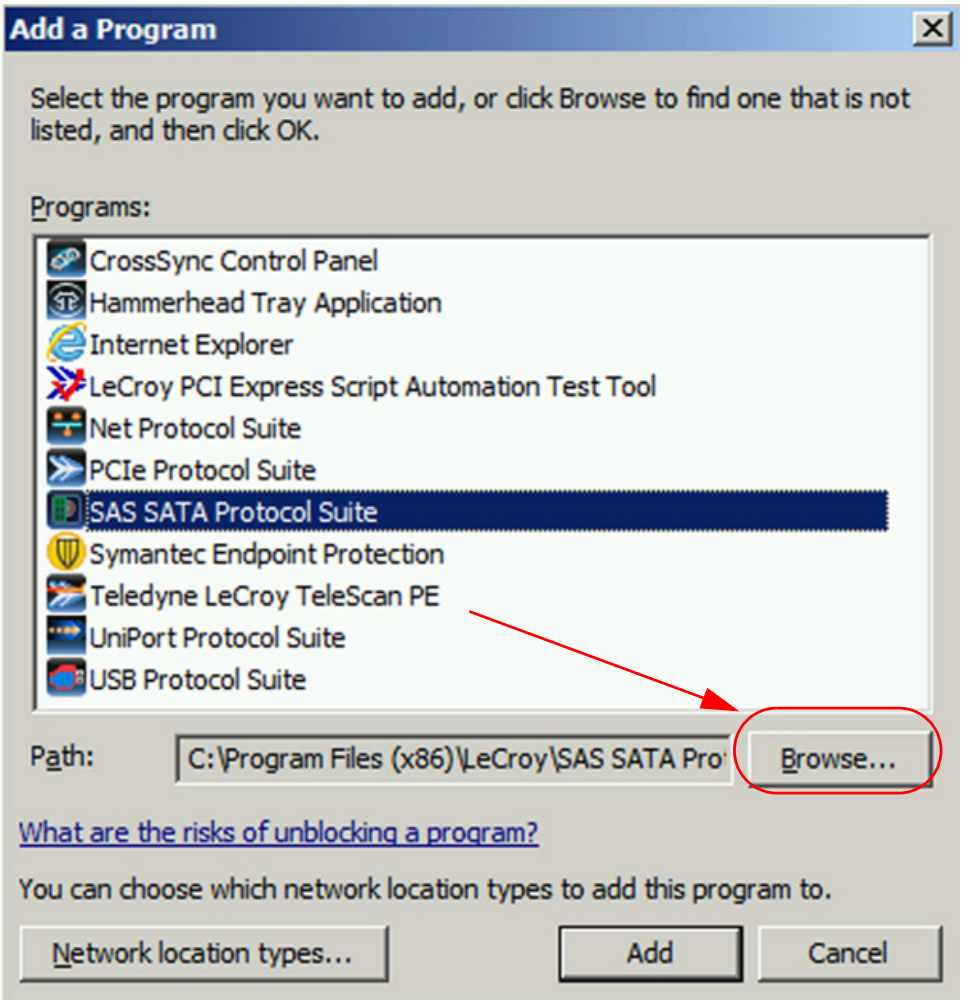


Figure 1.17: Windows Server 2008: Browse Button

6. Navigate to the location of the installation directory for the SAS/SATA Protocol Suite you have installed. The Teledyne LeCroy SAS/SATA Protocol Suite is typically installed on your machine in the C:\Program Files (x86)\LeCroy\SAS SATA Protocol Suite directory. See Figure 1.18.

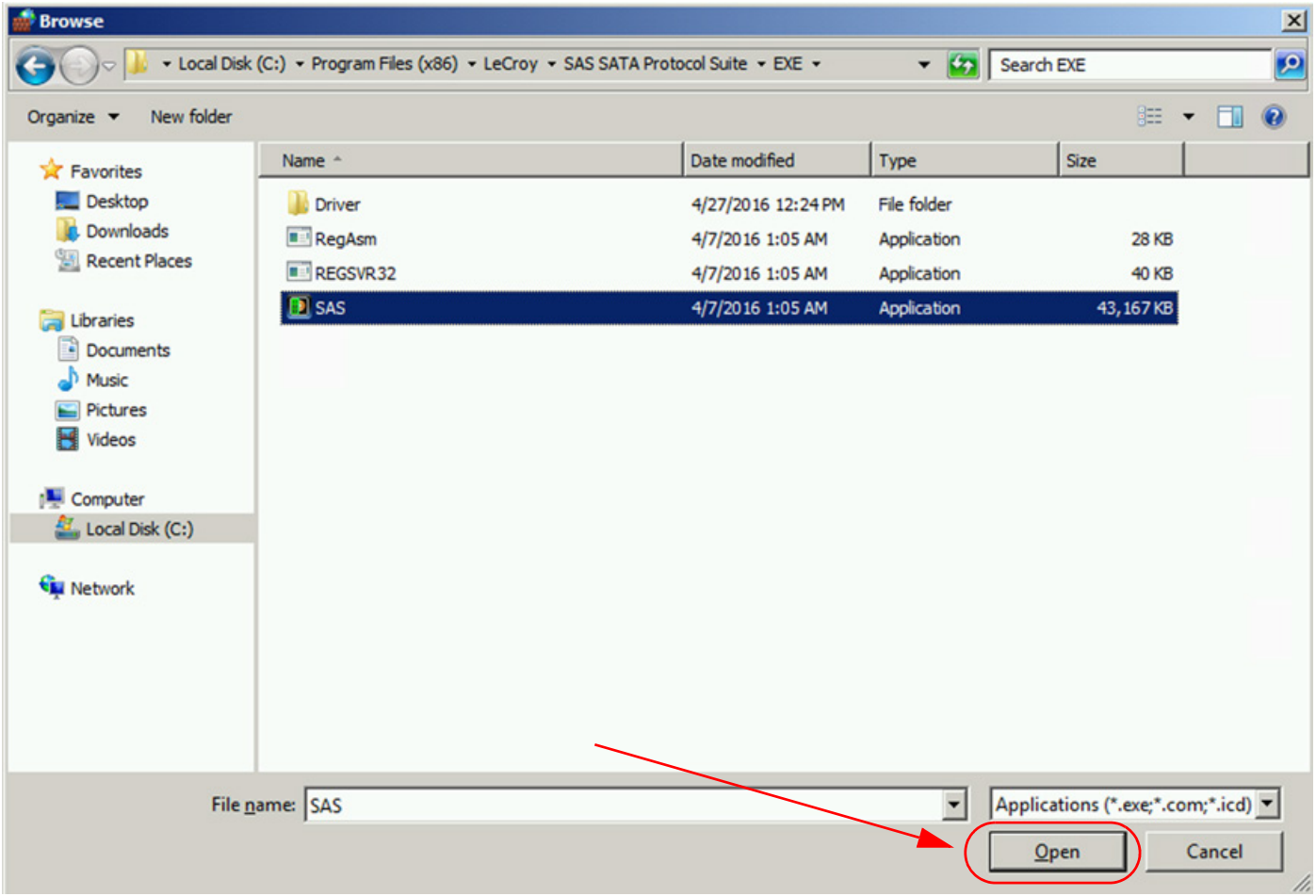


Figure 1.18: Windows 2008: Browse to Find Application -> SAS/SATA Protocol Suite

7. Select SAS and Click on “Open”.

8. In the “Add a Program” screen, click on “Add” to allow the Teledyne SAS/SATA Protocol Suite access through the Windows Firewall. See Figure 1.19.

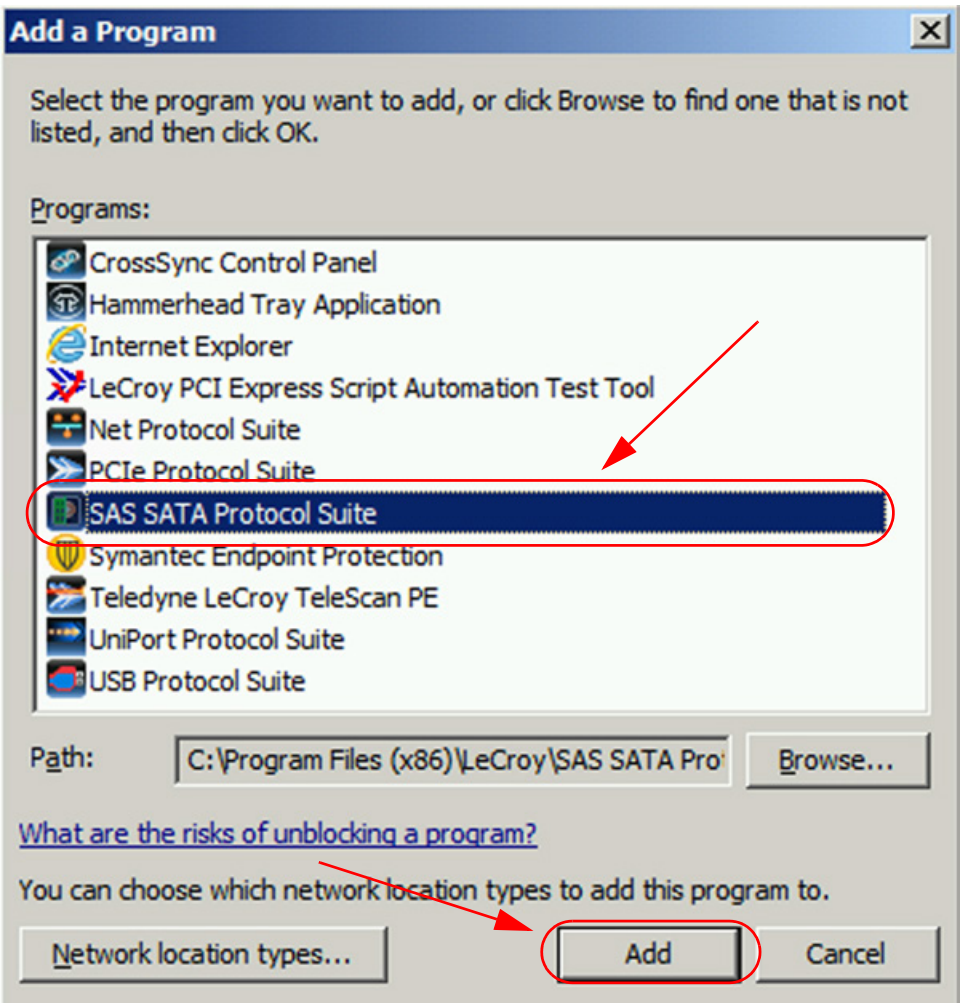


Figure 1.19: Windows Server 2008: Add a Program -> SAS/SATA Protocol Suite

9. After the Application has been added, you can see it in the “Allow programs to communicate through Windows Firewall” screen. See Figure 1.20.

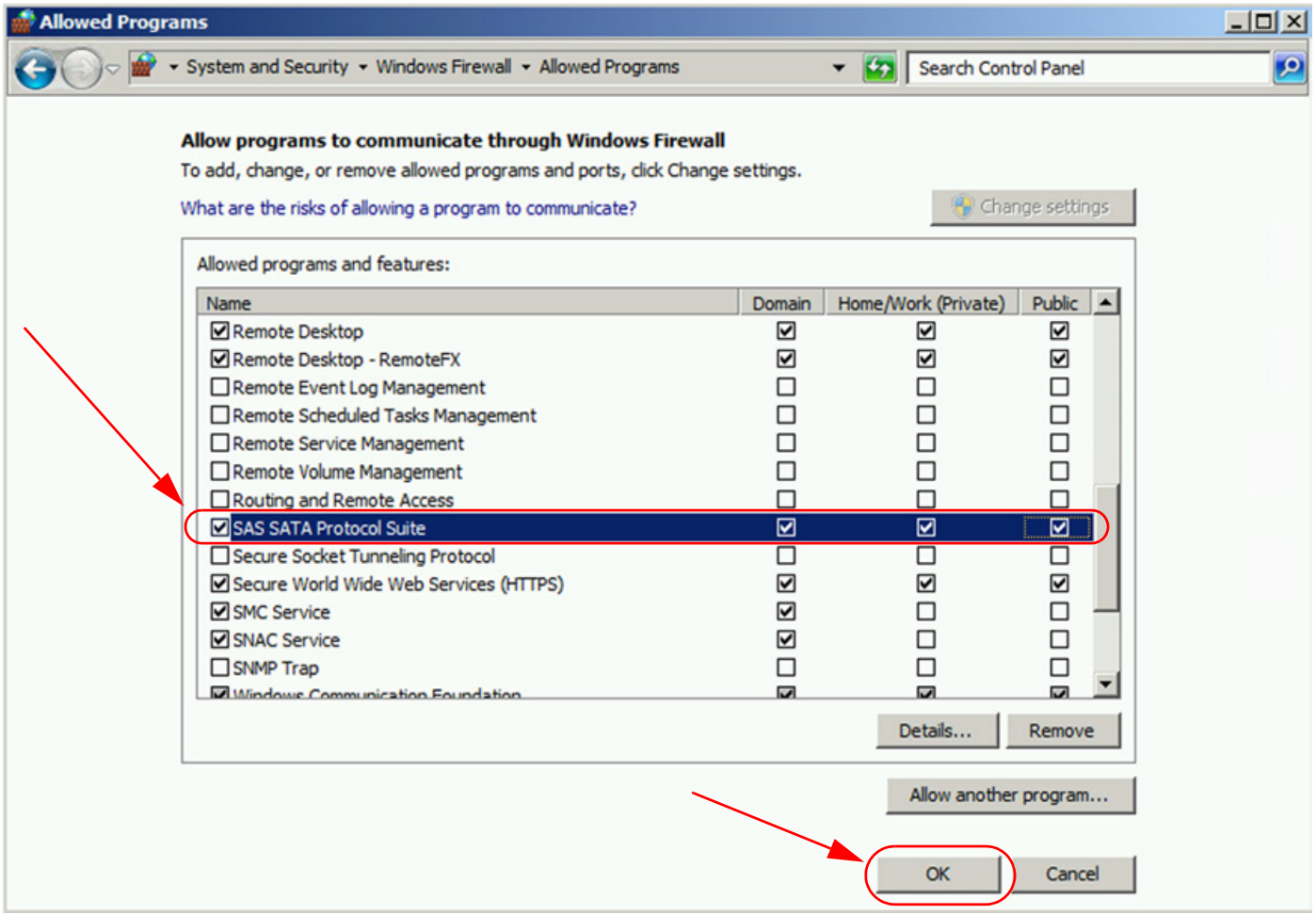


Figure 1.20: Windows Server 2008: Add Teledyne LeCroy SAS/SATA Protocol Suite to Allowed Applications

Click “**OK**” and you’re done with updating the Firewall.

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 Window, consult your system administrator. Your system may allow only administrator-level users to copy such driver files.

1.8 Hardware Setup

1.8.1 Separate Systems

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

1.8.2 Connecting in General

Note: You must install the software before connecting the analyzer to the host machine for the first time.

To set up the analyzer:

1. Plug the power adapter into the unit, and then plug the power adapter into a 100V–240V, 50Hz–60Hz, power outlet. Turn on the Power switch.
   At power on, the analyzer will go through initialization as shown on the LCD display.
2. Connect the USB cable between the Sierra M6-2 USB port and a USB port on the host machine. The host machine operating system detects the analyzer and driver files.
   (See “Connecting via Ethernet” on page 46 for Ethernet connectivity.)
3. Connect the analyzer as shown in Figure 1.21: .

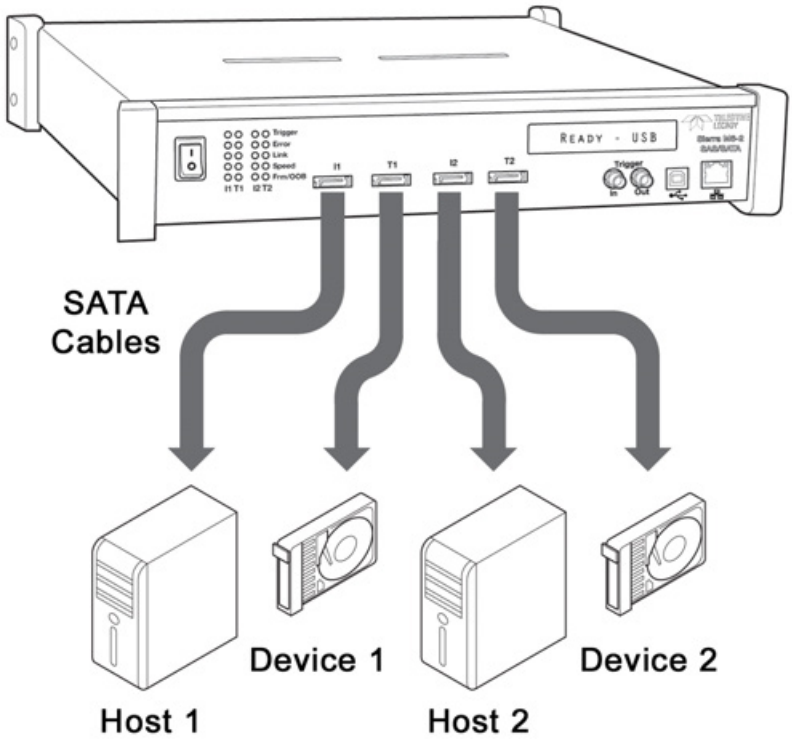


Figure 1.21: Analyzer Connections

1.8.3 Cables to Use

When using Sierra as a Host Emulator, connect from Target to hard drives using a SATA cable.

When using Sierra as a Device Emulator, connect from Initiator to HBAs using a SATA cable.

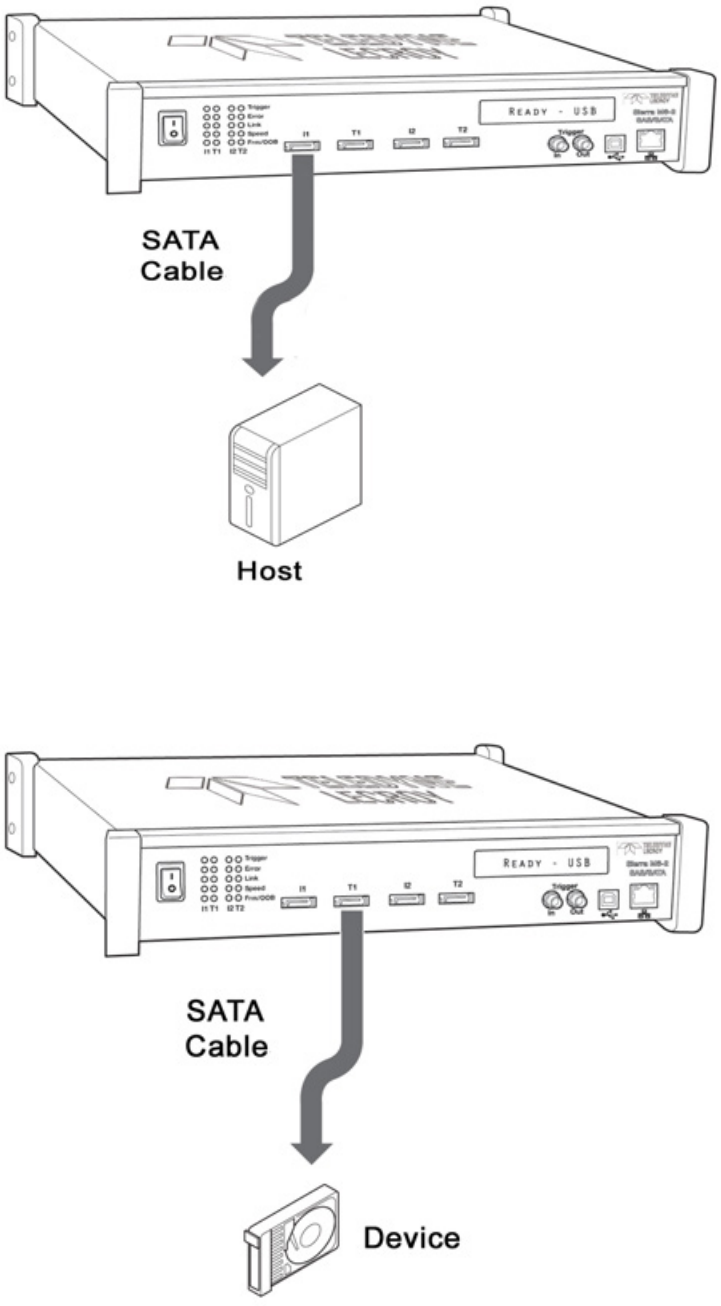


Figure 1.22: Sierra M6-2 Connected as an Analyzer

1.9 Expandability

You can expand by:

- Cascading with STX SYNC Expansion Cards
- Cascading with CATC SYNC Expansion Cards
- Using the Power Expansion Card

You can remove expansion cards with two simple tools.

Cascading and Memory Size
For example, you have two units. The first one has 2 GB memory. The second one has 4 GB memory. The system shows the entire memory as 6 GB. If you set buffer size to 6 GB, the system programs the first board for 2 GB and the second board for 4 GB. You can consider this ratio when you set buffer size to any value. For example, if you set buffer size to 2 GB, the system programs the first board for
(2*2)/6 GB and the second board for (2*4)/6 GB. Any unit that has more memory will have larger buffer size.

1.9.1 Cascading with STX SYNC Expansion Cards

You can use cascading of analyzer units for higher port count, by daisy chaining the units through the provided Expansion and Clock In/Out interfaces on the analyzer back. Connect “Out” connectors to “In” connectors of the next unit in the chain, for both Signal and Clock interfaces. You must provide external hubs for connecting the host machine to these units using USB or Ethernet. You can cascade up to eight units. Use the STX SYNC Expansion Cards to sequentially trigger the State Machine in Advanced mode.

If you mix Sierra M6-4, Sierra M6-2, and STX A6-4 analyzers/emulators, put Sierra boards first, then STX.

Note: Because chain connections for cascading boards cause delay of signals, traffic on different boards is not completely time synchronized, with about one DWORD difference between consecutive boxes.

Cascading

To set up the units in a cascade:

1. Connect all units to the host machine using either USB or Ethernet cables. You can use hubs.
2. Locate the Expansion and Clock ports on the back of each unit.

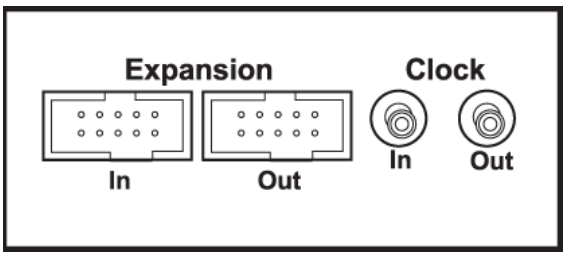


Figure 1.23: Expansion and Clock Ports

3. Connect the OUT Clock connector of Unit 1 to the IN Clock connector of Unit 2 using the supplied stacking cables. Similarly connect any additional units.
4. Connect the OUT 10-pin connector of Unit 1 to the IN 10-pin connector of Unit 2 using the supplied stacking cables. Similarly connect any additional units.

Note: Unit 1 must be the unit that has the first out connection.

Note: The Self Test, SAS Verification Test, SATA Compliance Test and Update License functions only work on unit 1 when the analyzers are set up in cascading mode.

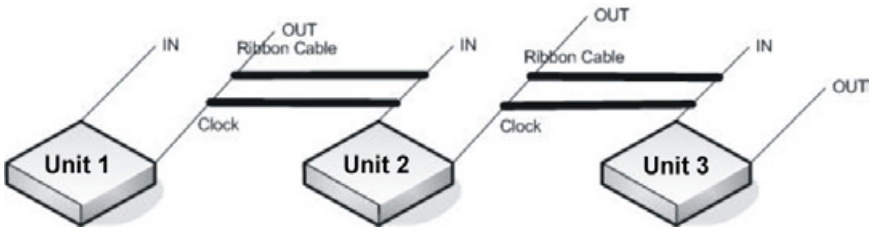
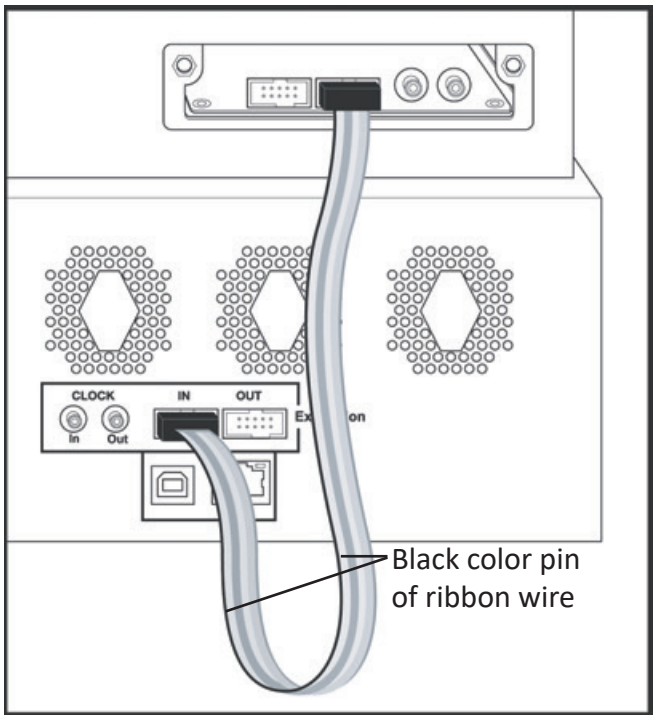


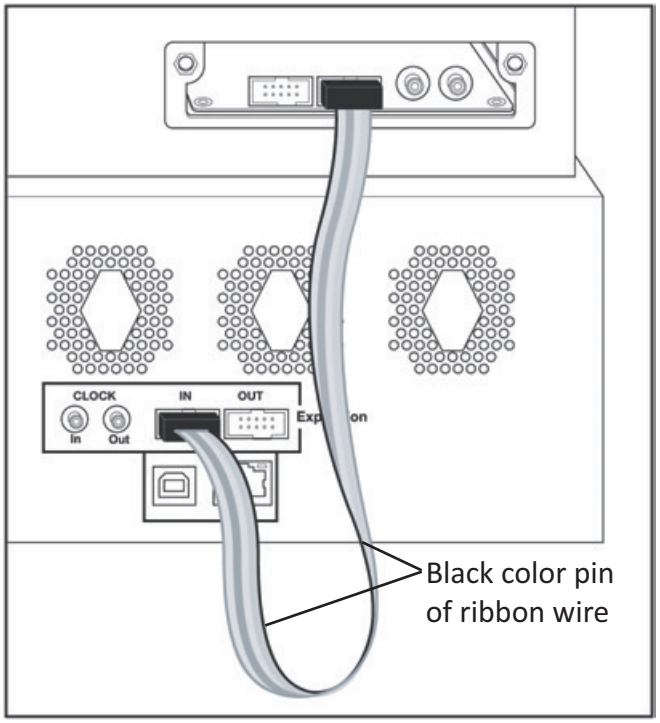
Figure 1.24: Cascading



Correct way to connect:
The black color pin of the ribbon wire is connected the same way between 2 connectors.

Cascading works correctly in this case.

Figure 1.25: Cascading Correctly



Incorrect way to connect:
The black color pin of the ribbon wire is connected in a different way between the 2 connectors.

Cascading works incorrectly in this case, the boxes are connected but no traces are captured.

Figure 1.26: Cascading Wrongly

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

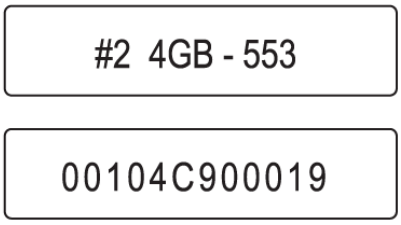


Figure 1.27: Address Digits

IMPORTANT! Power up all units before starting the software.

1.9.2 Daisy-chaining with CATC SYNC Cards

You can daisy-chain two Analyzers, if they both have a CATC SYNC ports:

You may expand the capability of the M6-2 analyzer by connecting two of them together. Also, you can time correlate different analyzers by daisy-chaining multiple Sierra M6-2 analyzers or connect to other Teledyne LeCroy protocol analyzers with the CATC SYNC Expansion Cards (ACC-EXP-002-X).

Note: More combinations of analyzers are possible, contact psgsupport@teledynelecroy.com for more details.

When purchased with the analyzer, this card is typically installed in the analyzer at the factory but it can be purchased separately. There are both extraction and insertion instructions below depending on which operation you need to perform.

The expansion slot can be located on either the front panel or the rear panel, so the first step is to find the expansion slot.

Installation and Removal of CATC SYNC Cards

If you are inserting an expansion card see “Installation of Expansion Cards” on page 32. If you are removing an expansion card continue with the steps below.

You can remove expansion cards with two simple tools.

Removal of Expansion Cards

You can remove expansion cards using two tools:

- Standard (flat blade) 3/16” screwdriver
- Teledyne LeCroy Extraction Tool (part number 230-0160-00)

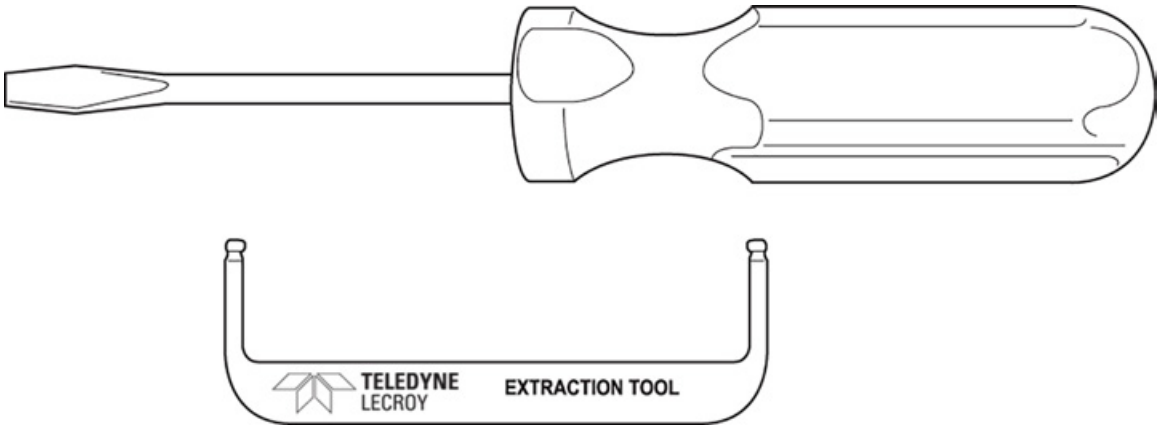


Figure 1.28: Tools needed to Remove the Expansion Cards

To remove an expansion card, follow these steps:

1. Unplug the system from AC power and turn the system so the expansion port is facing you.

Note: There are two retaining screws and the holes for the extraction tool that are located on the panel of the expansion card. See Figure 1.29.

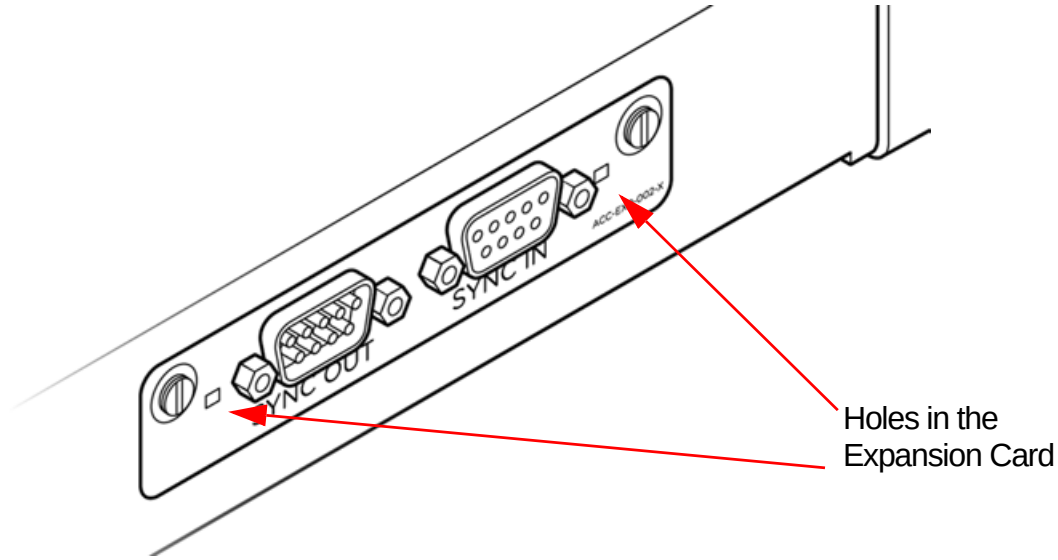


Figure 1.29: Holes in the Expansion Card Panel

2. Using the screwdriver, loosen both retaining screws by rotating them counter-clockwise approximately two full turns, until feeling slight resistance. **Do not force the retaining screws** after two turns.

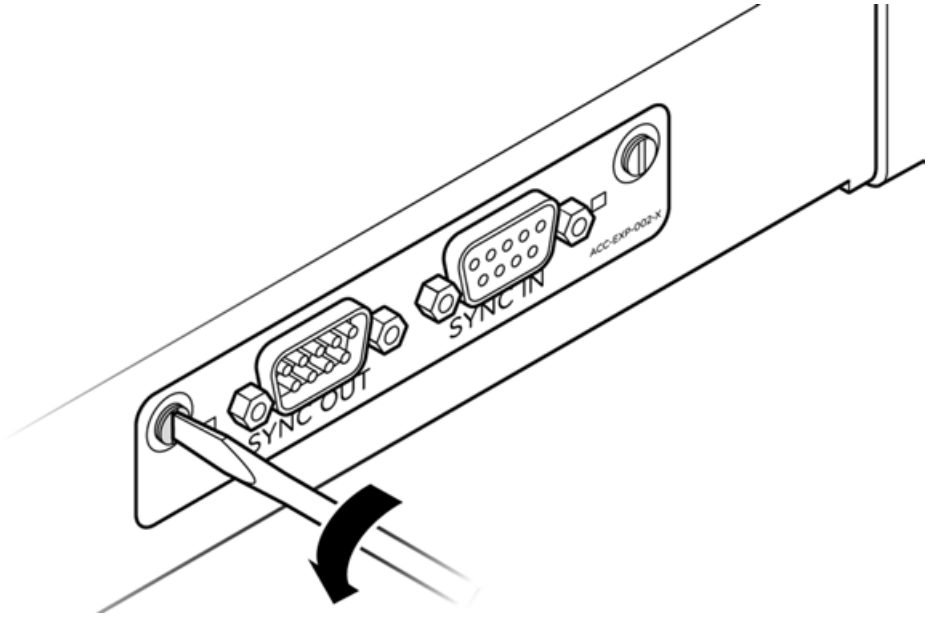


Figure 1.30: Loosen Retaining Screws on CATC Card

3. Insert the extraction-tool prongs into the holes in the expansion card panel.

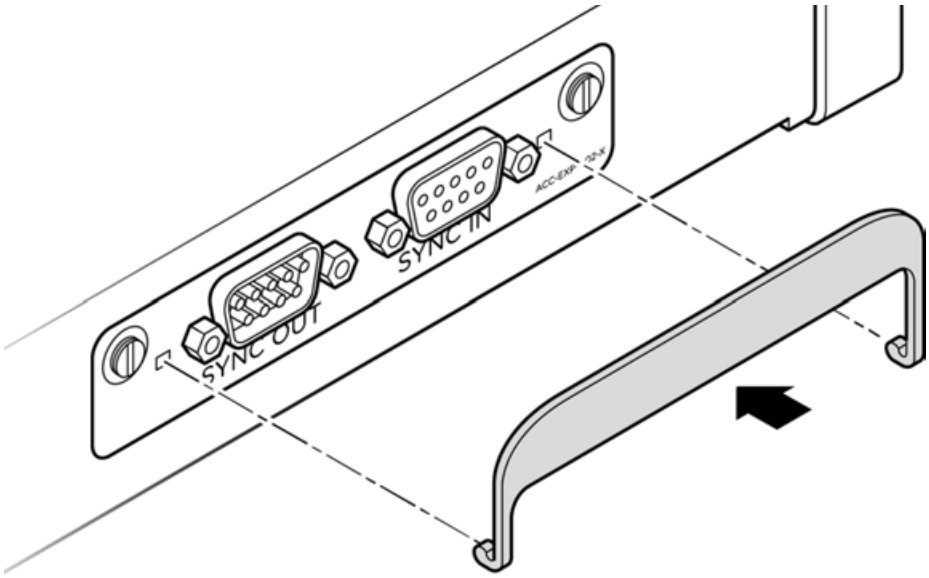


Figure 1.31: Insert Extraction Tool

Note: If the prongs do not slip easily into the holes, use a small nail file or similar device to remove paint from the prongs

4. Rotate the extraction tool to a horizontal position to lock the prongs into place and make a handle.

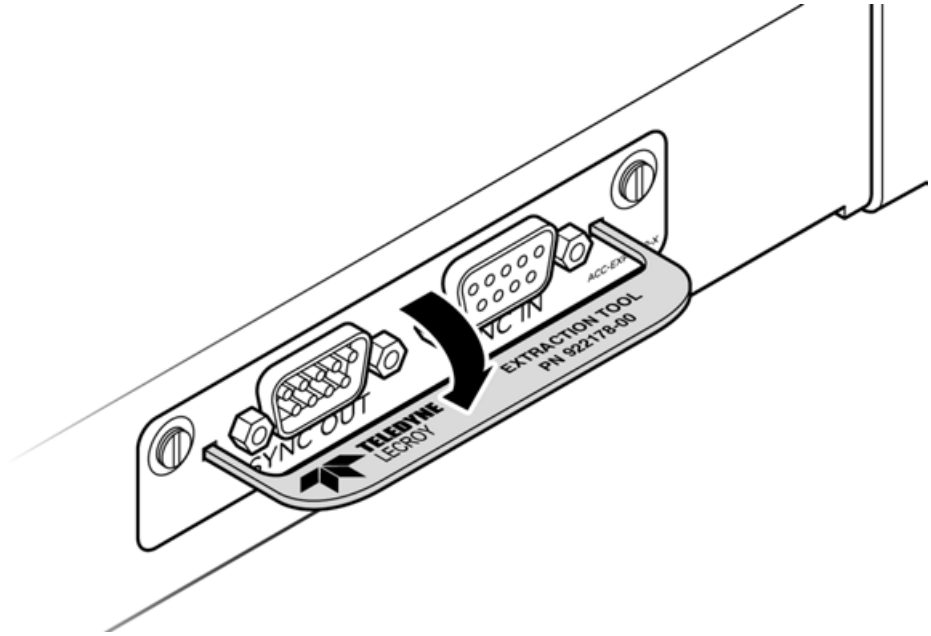


Figure 1.32: Insertion of Handle/Tool into Expansion Card Panel

5. Using the extraction tool as a handle, gently wriggle the expansion card forward about 1/8”.

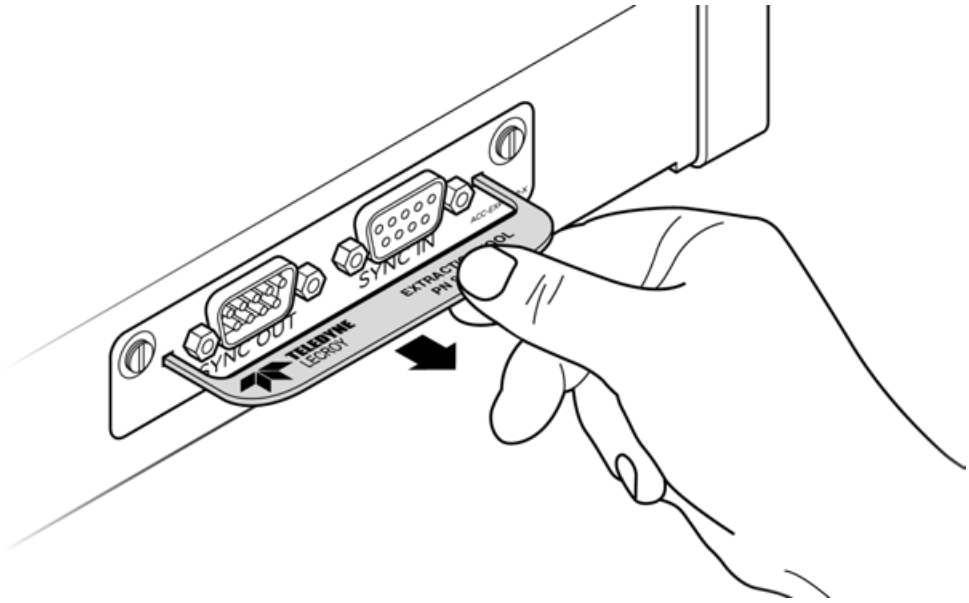


Figure 1.33: Pulling CATC Expansion Card out of Unit

6. Repeat step 5 approximately three times, until the card is free from the retaining screws and you can remove the card from the system.
7. Replace the CATC Expansion Card with a blank panel and tighten the retaining screws. See Figure 1.34.

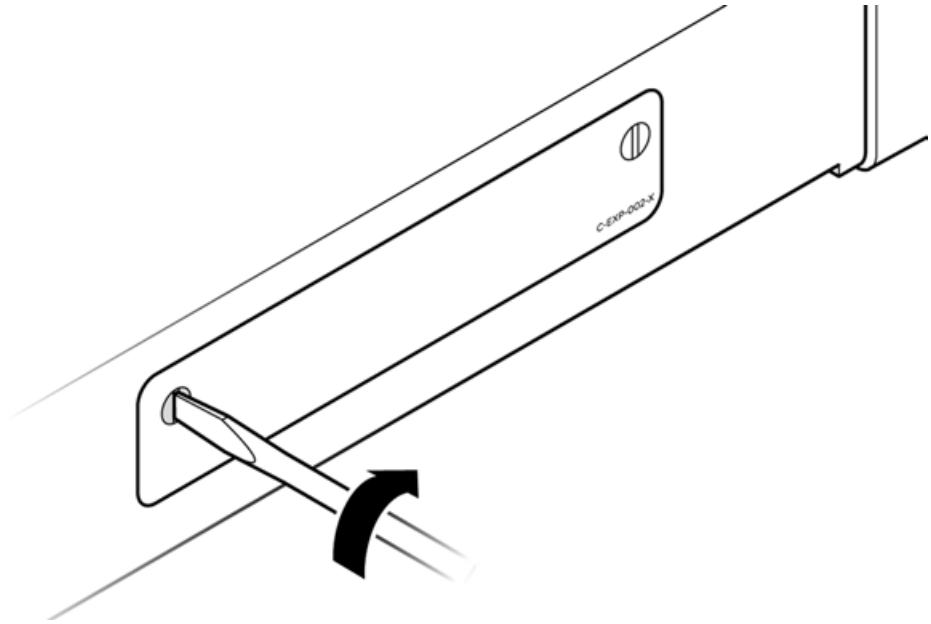


Figure 1.34: Replace Retaining Screws in Blank Panel and Tighten

Installation of Expansion Cards

1. Locate the blank expansion panel on either the front or the rear of the analyzer and then continue with the steps below.

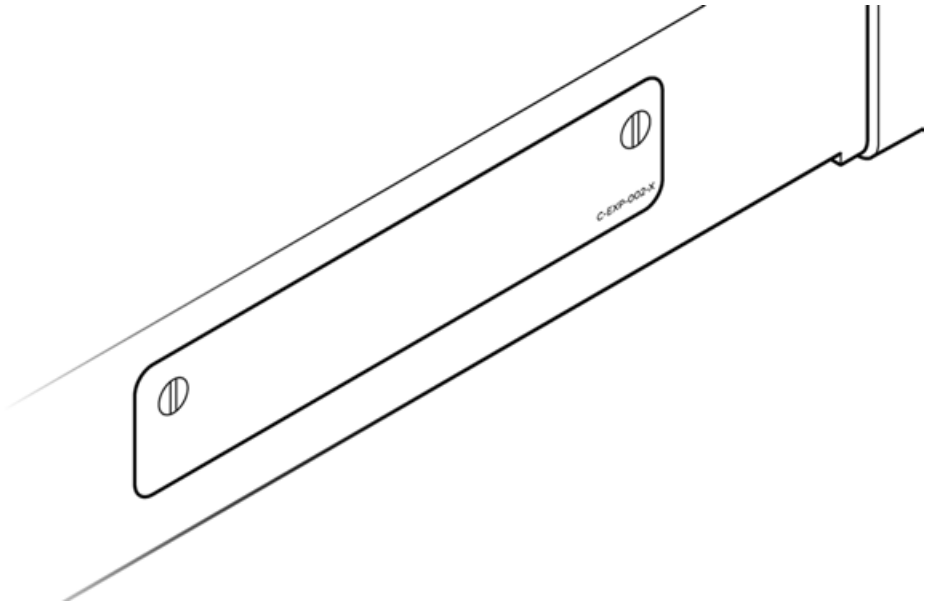


Figure 1.35: Front or Rear of Analyzer: Blank Panel

2. Using a flat bladed screw driver, loosen the two retaining screws.

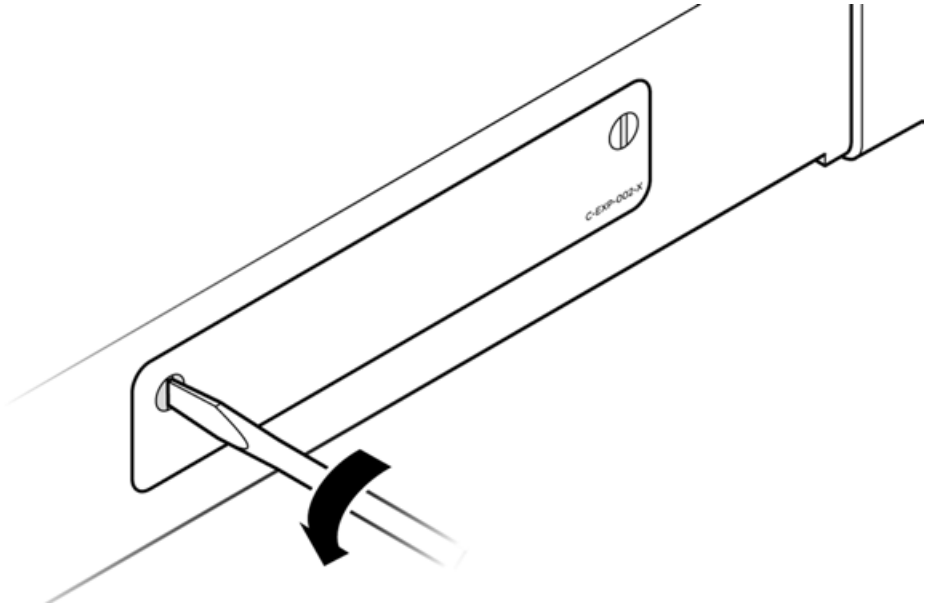


Figure 1.36: Loosen Retaining Screws from Blank Panel

3. Remove the retaining screws and blank panel, exposing the inside of the analyzer.

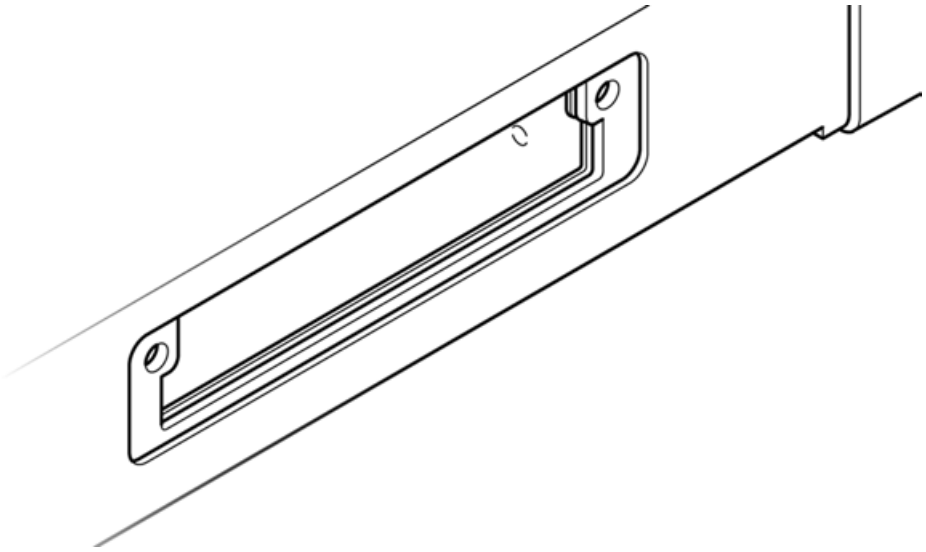


Figure 1.37: Rear of Analyzer with Blank Plate Removed

4. Insert the CATC card into the rear of the Analyzer. Gently push on the back panel of the card until you feel the card seat with the internal connector.

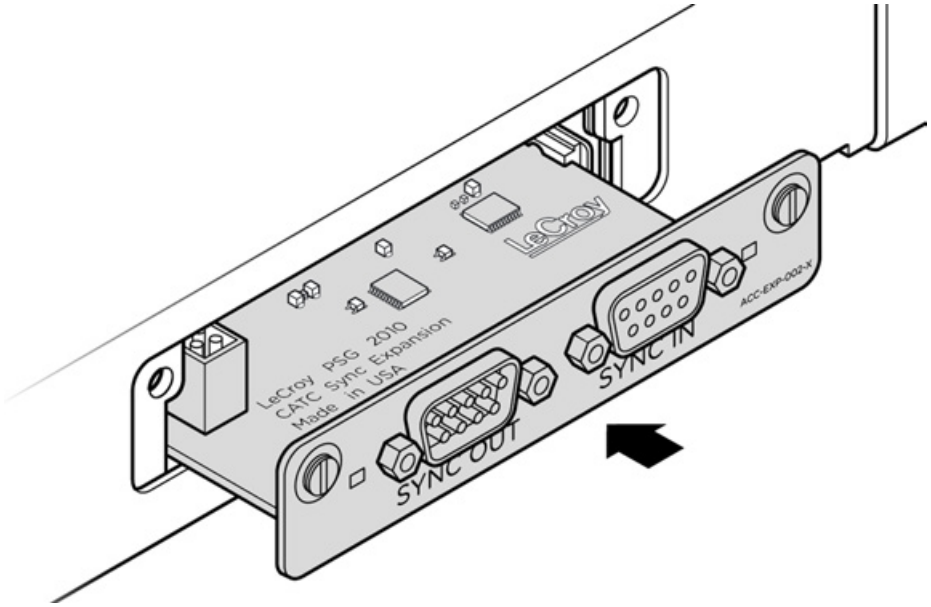


Figure 1.38: CATC Card Being Inserted into Rear of Analyzer

5. After the card is seated, tighten the retaining screws.

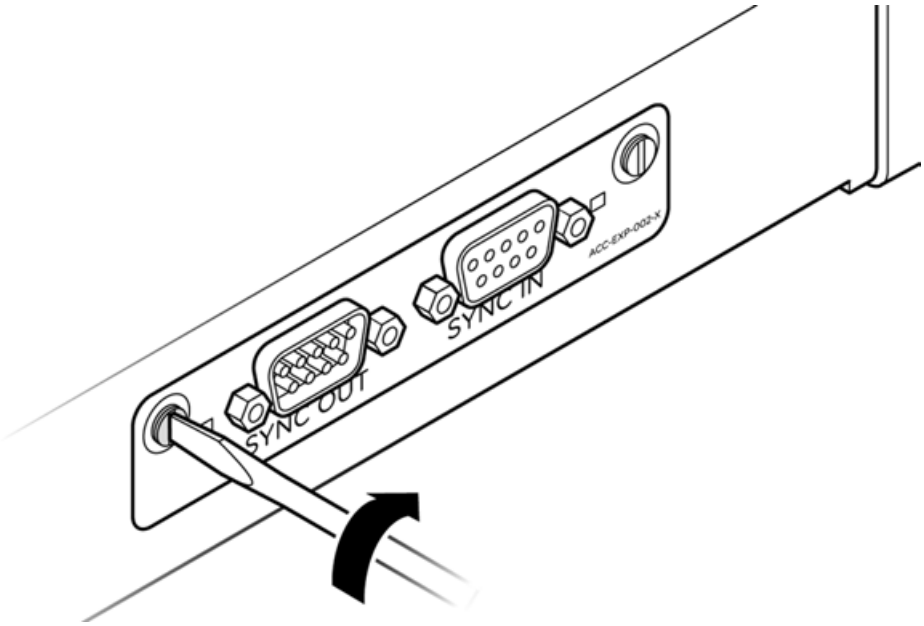


Figure 1.39: Tighten the Retaining Screws on the CATC Card

6. The CATC card can now be connected to other CATC cards in other analyzers. As described in the next section (“Connection of CATC SYNC Expansion Cards” on page 35).

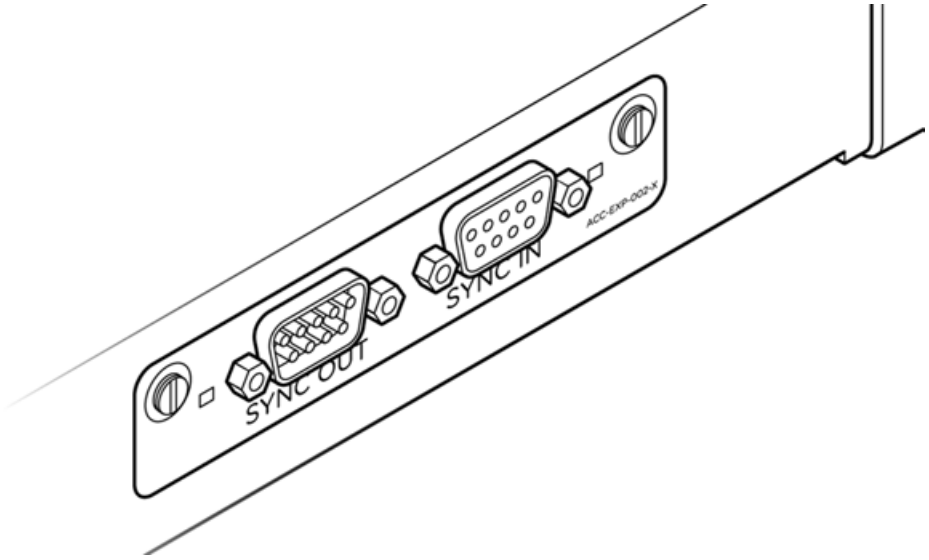


Figure 1.40: Analyzer with CATC Card Installed

Connection of CATC SYNC Expansion Cards

You may daisy-chain up to eight analyzer units by connecting the units through the optional CATC SYNC Expansion Card on the analyzer back.

Daisy-chained analyzer units will have their timestamping, recording, and triggering functions synchronized to +/- 100ns. In this example, we daisy-chain the following analyzers:

- Sierra M6-2
- Sierra M6-2

Note: More combinations of analyzers are possible, contact psgsupport@teledynelecroy.com for more details.

Note: If Sierra M6-2 has a CATC SYNC Expansion Card, you can cascade with Sierra M6-1. If Sierra M6-2 has an STX SYNC Expansion Card, you cannot cascade with Sierra M6-1.

Perform the following steps to connect the CATC Sync ports between two or more analyzers:

1. Make sure to stop any recordings in progress.

Note: You may plug/unplug the sync cable while the analyzer unit is powered on.

2. Connect the female end of the sync cable to the SYNC OUT port of one Analyzer.
3. Connect the male end of the sync cable to the SYNC IN port of the other Analyzer.
4. Repeat steps 2-3 to connect additional units (up to eight total) as needed.
5. DO NOT create a closed loop from the last unit back to the first unit.

After Analyzers are connected, recording will start simultaneously and triggers will occur simultaneously, with synchronized timestamps.

You must select both Analyzers in the Device List dialog (see Figure 1.48 on page 40).

Important: If you are using other analyzers (NOT PCIe!) in your daisy chain (this would include USB, DDR, SAS, FC and GigE) and do not wish to use the daisy chaining feature of synchronized recordings, you must UNPLUG the cable! If you do not unplug, the electrical signal prevents recording on all Analyzers.

Select Device

After starting the software, click on **Configuration a**nd select **All Connected Devices** (see the following screen capture).

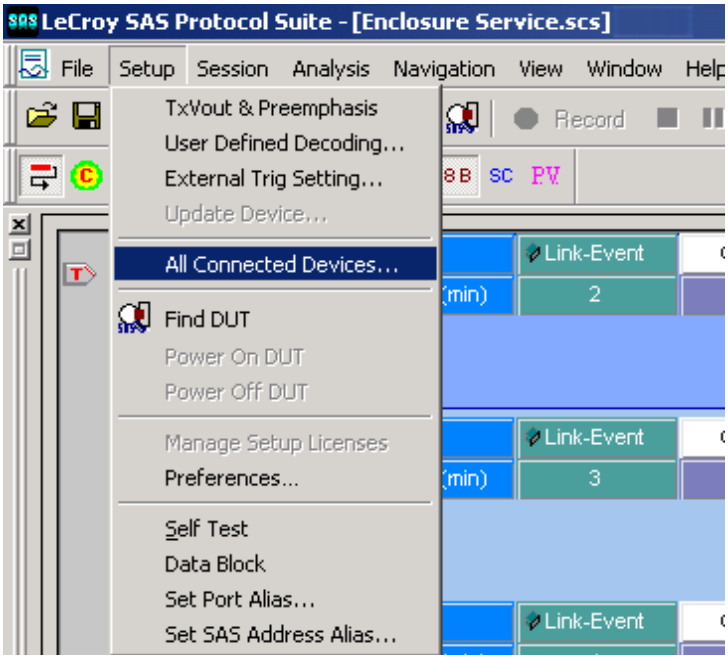


Figure 1.41: Connecting to All SAS Devices.

The **Select Device** dialog allows connecting and disconnecting analyzers on the fly, without restarting the application.

The new Device List (introduced in version 4.10) mandates using updated firmware in order to detect the analyzer over Ethernet. Thus, the analyzer must be updated over USB before it can be used remotely over Ethernet. This is applicable for any update from version 4.00 or earlier to any version from 4.10 or later.

The following **Select Device** dialog displays (see Figure 1.42 on page 37). The colors in the 'Location' column mean the following:

- Red: Firmware and/or BusEngine components need to be updated to the latest version
- Light Blue: The device is ready to be connected.
- Yellow: The device is locked.
- Green: The software is connected and ready to run.

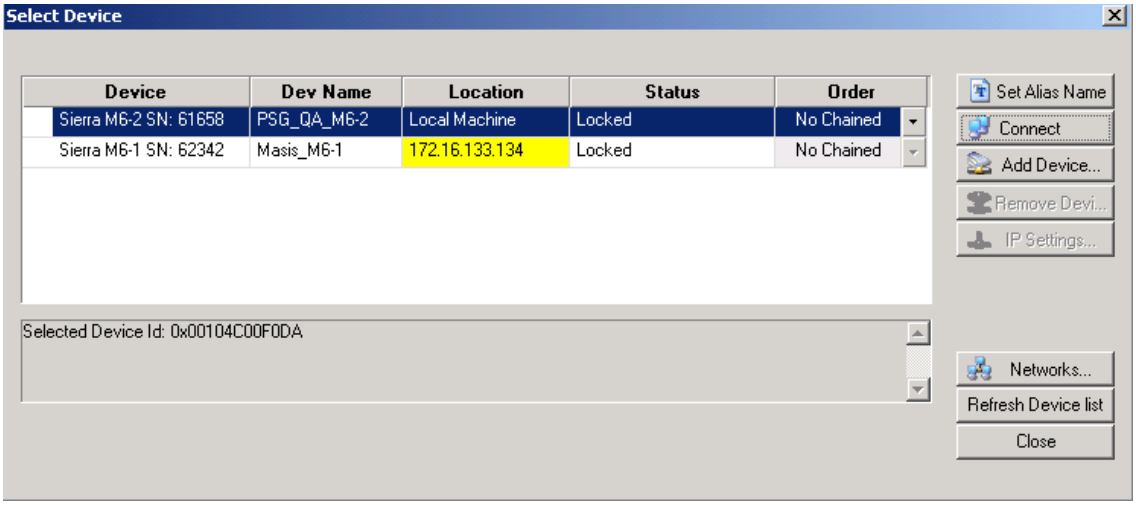


Figure 1.42: Select Device Dialog.

Note: Click **Refresh Device List** to display all the devices on the network.

The Select Device dialog displays the following buttons:

Set Alias Name

Click **Set Alias Name** to display the Set device alias name dialog as shown below.

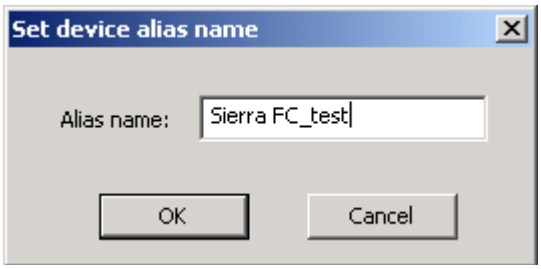


Figure 1.43: Set Device Alias Name Dialog

Disconnect

Click **Disconnect** to disconnect a device.

Add Device...

Click **Add Device** to add a device with a static IP address.



Figure 1.44: Add Device with Static IP Dialog.

Force Add/Connect Attempt

Use this option if the application's Ping function fails (the button in the upper-right corner), but you're sure the address is correct and you still want to attempt the connection. This setting is stored in the device.

Remove Device

Click **Remove Device** to remove a previously added device.

IP Settings...

Click **IP Setting** to reset IP settings of a device. The following IP Setting dialog displays.

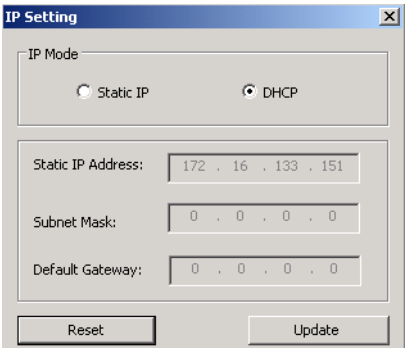


Figure 1.45: IP Setting Dialog.

Networks...

Click **Networks** to select a network adapter. The following dialog displays.

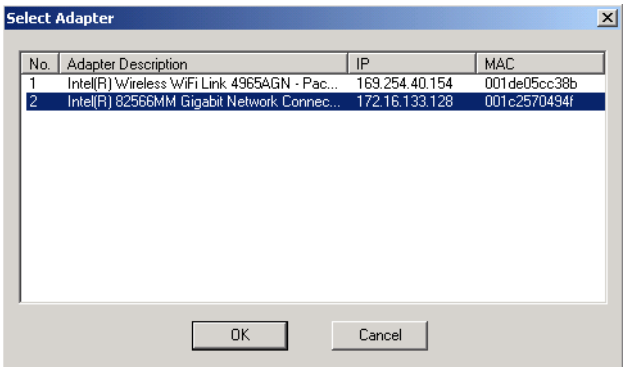


Figure 1.46: Select Adapter Dialog

Refresh Device List

Click **Refresh Device List** to refresh the device list.

To connect to a device, select a device which is Ready to Connect and click the **Connect** button on the right. The Connection Properties dialog is displayed (see the following screen capture).

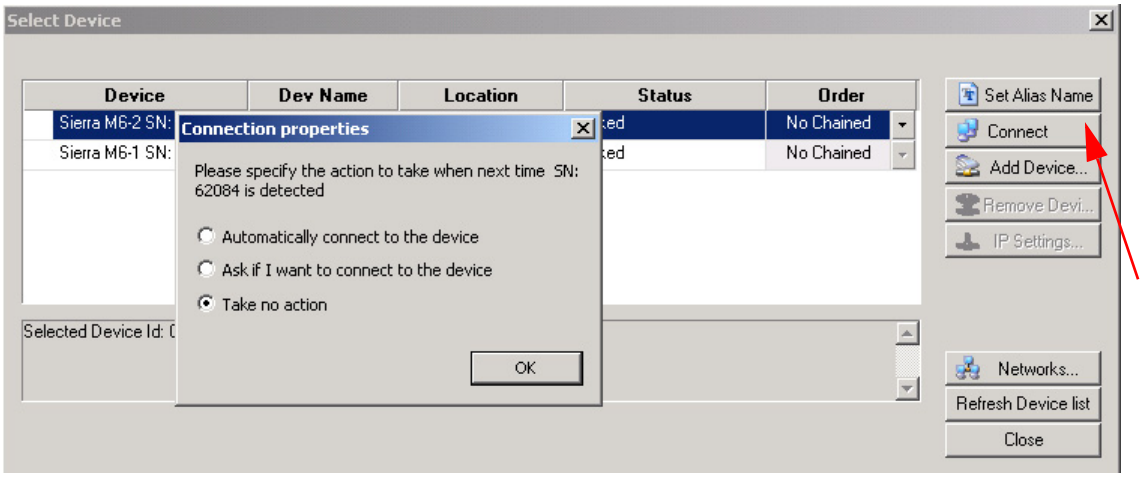


Figure 1.47: Connection Properties Dialog

Specify one of the actions from the following:

- Automatically connect to the device
- Ask if I want to connect to the device
- Take no action

If 'Automatically connect to the device' is selected, the next time the application opens the device will be automatically connected.

In the **Select Device** dialog chained or cascaded units are displayed in the **Device** column with a **[** (square bracket) icon. The sequence of the units is displayed in the **Order** column. See the following screen capture.

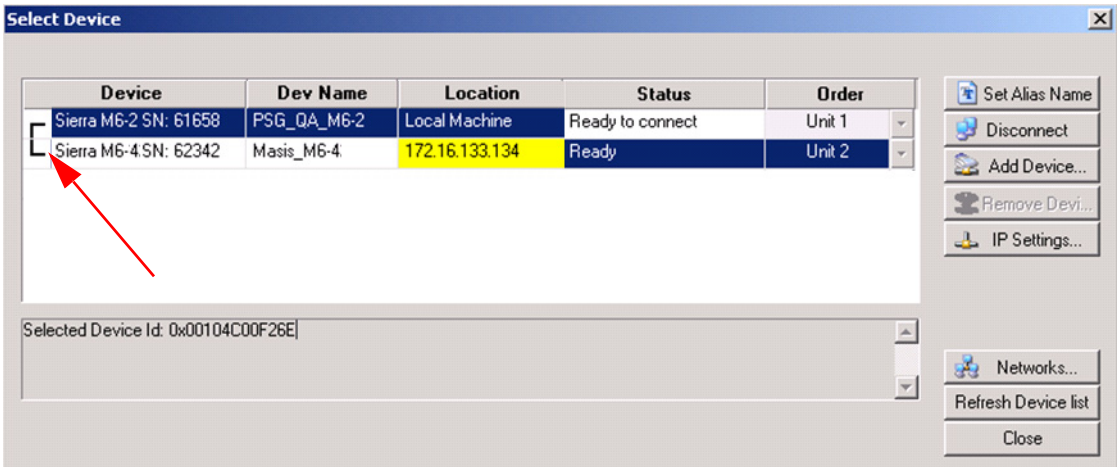


Figure 1.48: Select Device Dialog Displaying Unit 1 and Unit 2 Chained

Note: When using STX Sync cards, you need to manually specify the order of the chained units. To match your unit sequence to the address for each unit in the Select Device dialog, click the pull down tab under the Order heading (on the right side) and select unit numbers: 1 for Unit 1, 2 for Unit 2, and so on. This determines the order in which the cascaded ports appear in the trace. When using the CATC Sync cards the order is automatically detected.

IMPORTANT! Power up all units before starting the software.

VPN Connections

VPN solutions establish special network connections to primary networks and in some cases use special virtual network adapters as part of their solution.

For such VPN solutions sometimes it is necessary to select (in the Select Adapter dialog) a virtual adapter specifically created for a VPN connection in order to successfully discover and connect to devices over a VPN connection.

In most cases, this special virtual adapter will have a special IP address different from the primary network address range and have a Point-to-Point Protocol (PPP) type.

There are also VPN solutions that may require selecting an Ethernet/Wireless adapter that will be used for transferring VPN data.

So after a VPN connection to the primary network is established, please ensure that the correct network adapter suitable for your VPN solution is selected in the Select Adapter dialog.

1.9.3 Using the Power Expansion Card

Two types of Power Expansion Cards are available and the type must be specified when ordering the unit.

- Power Expansion Card (part number: ACC-EXP-004-X)
- Power Expansion Card 2 (part number: ACC-EXP-005-X)

TABLE 1.1: Analyzer Model vs. Power Expansion Cards

Analyzer Model	Power Expansion Card	
	ACC-EXP-005	ACC-EXP-004
M124A/M124	Yes	No
M122A/M122	Yes	No
M6-4	Yes	Yes
M6-2	Yes	Yes
M6-1	No	No

Power Expansion Card 2 (part number: ACC-EXP-005-X)

This card has several capabilities:

- Supplies power to devices at 12v, 5v, 3.3v, 1.5v and/or 1.2v.
- Allows monitoring in the trace of the DevSlp signal as generated by the Trainer or Host Emulator, as well as when generated directly from a Host (using a dedicated DevSlp cable). See “DevSlp” on page 542 and “Exit_DevSlp” on page 542). Also see “Device Sleep (DevSlp)” on page 244.
- Allows CATC Sync functionality to enable cascading, so there is no need to toggle between the Power Expansion Card and the Sync Expansion Card.
- Allows power measurement to monitor and record the power, current and voltage being used by the device it powers (will be supported in a future software release).

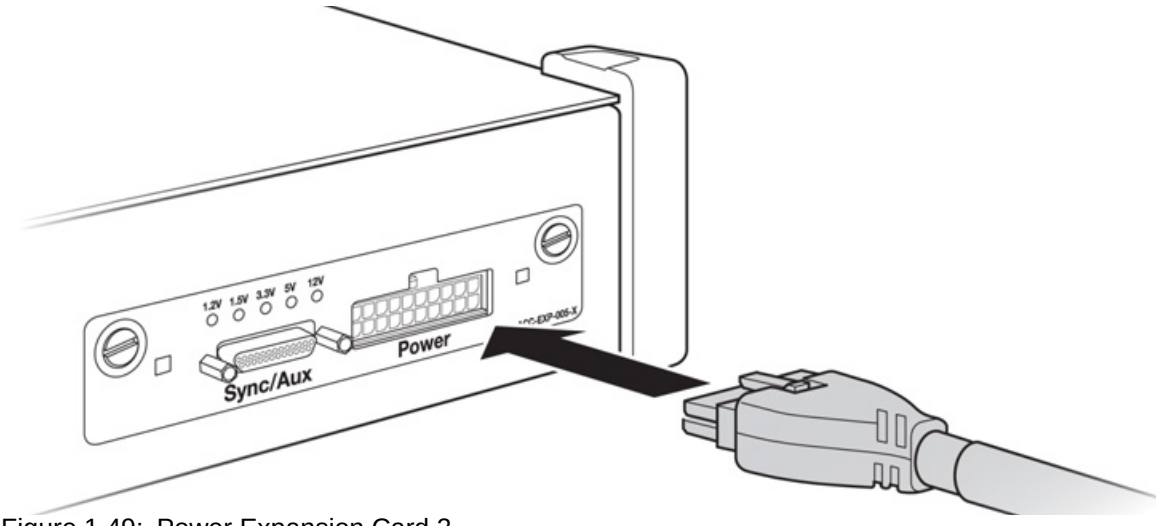


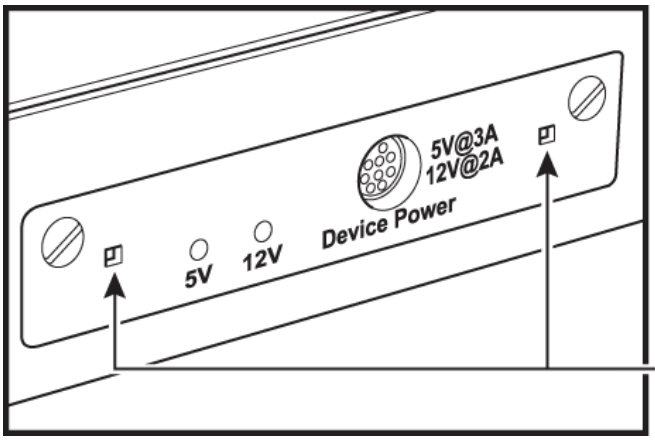
Figure 1.49: Power Expansion Card 2

It is shipped with the following three cables:

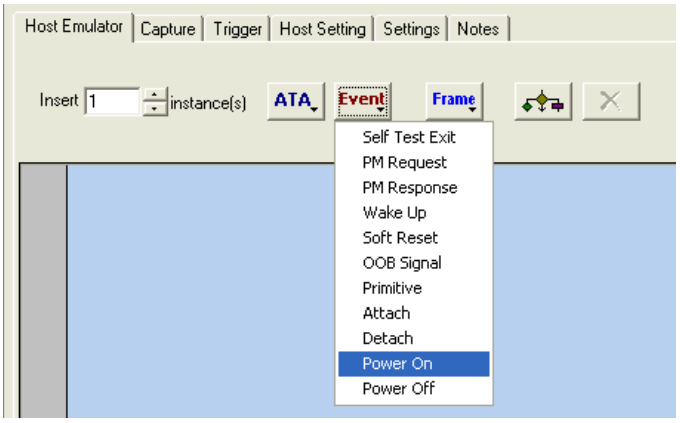
- Standard 4-pin power connector (ground, 5v, 12v only): This is a direct replacement for the existing Power Expansion Card cable.
- SATA 15-pin power segment connector: This plugs in to the power segment of the standard SATA connector, allowing to control and monitor its power and DevSlp.
- DevSlp cable: This cable is used to monitor DevSlp levels when the Device is connected directly to the Host. It is up to the user to supply a copy of the DevSlp signal coming from the Host to connect to the DevSlp wire of this cable, as well as to connect the adequate ground wire of this cable.

Power Expansion Card (part number: ACC-EXP-004-X)

You can use the Power Expansion Card to power the drives to test for Emulation, SATA Compliance, and SAS Verification. The Power Expansion Card can supply 5 V or 12 V.



You can turn the card on or off through the software during SATA Compliance or SAS Verification tests.



You can turn the card on or off through the BusEngine by user-emulation scripts during Emulation.

Activating the Power Expansion Cards

Select **Setup > Power Source Control** to display the Power Source Control dialog (see Figure 1.50 on page 43). Depending on the Power Expansion Card/s ordered the applicable device controls are enabled. Make the appropriate selections and click **Close**.

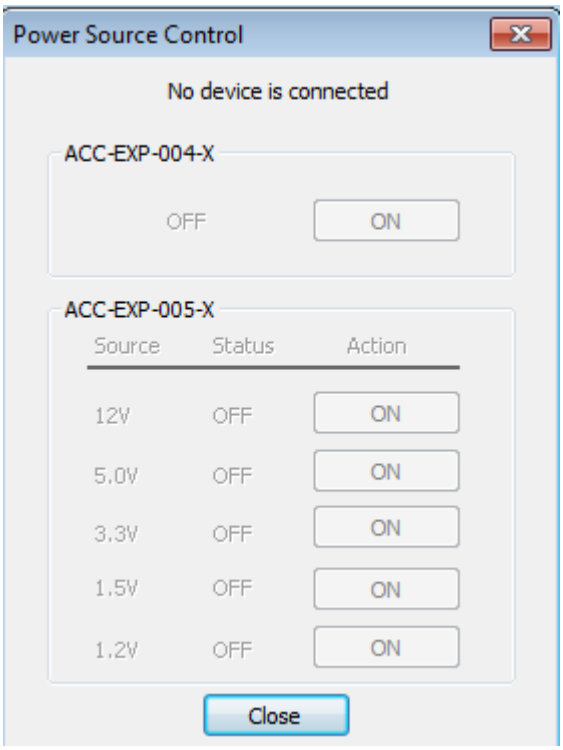
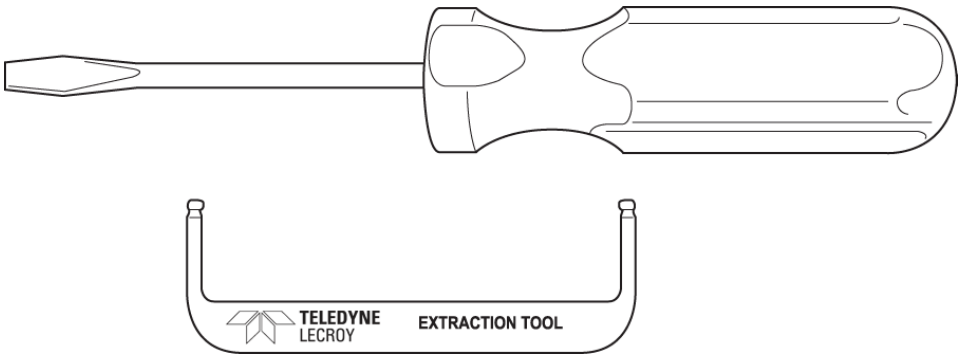


Figure 1.50: Power Source Control Dialog

Removing Power Expansion Cards

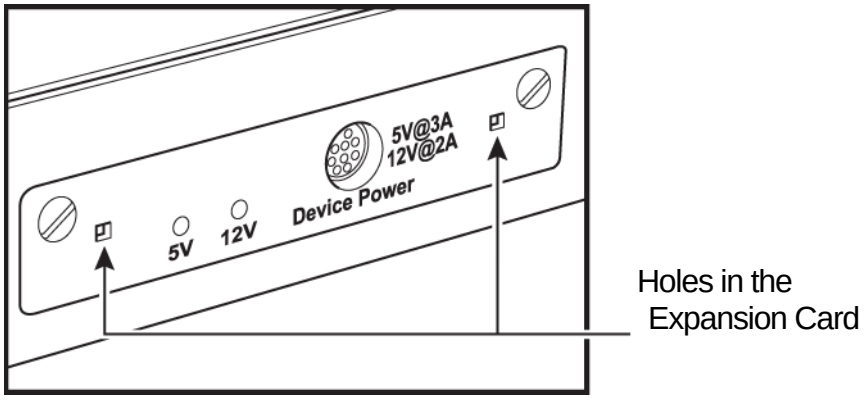
You can remove both expansion cards using two tools:

- Standard (flat blade) 3/16” screwdriver
- Teledyne LeCroy Extraction Tool (part number 230-0160-00)



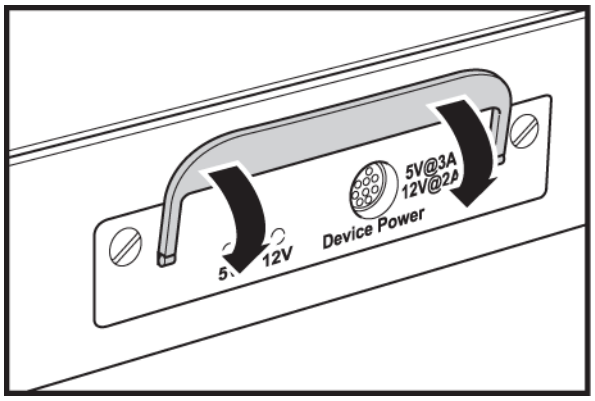
To remove an expansion card, follow these steps:

1. Unplug the system from AC power and turn the system so the expansion port is facing you. Note the two retaining screws and the holes for the extraction tool that are located on the panel of the expansion card.

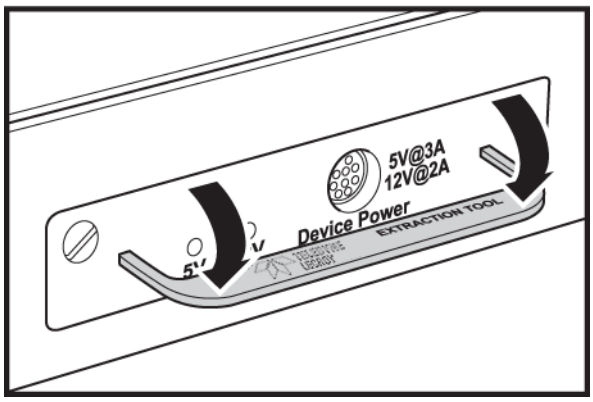


2. Insert the extraction-tool prongs into the holes in the expansion card panel.

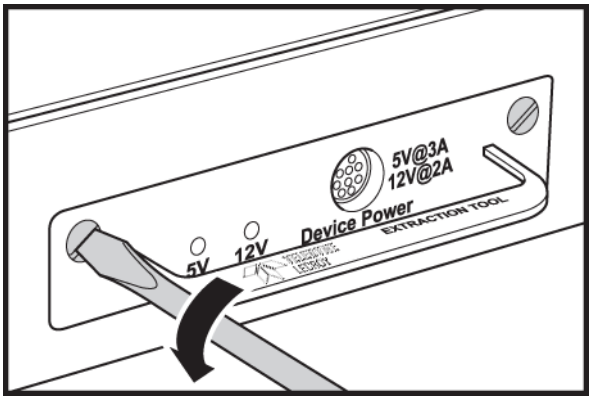
Note: If the prongs do not slip easily into the holes, use a small nail file or similar device to remove paint from the prongs.



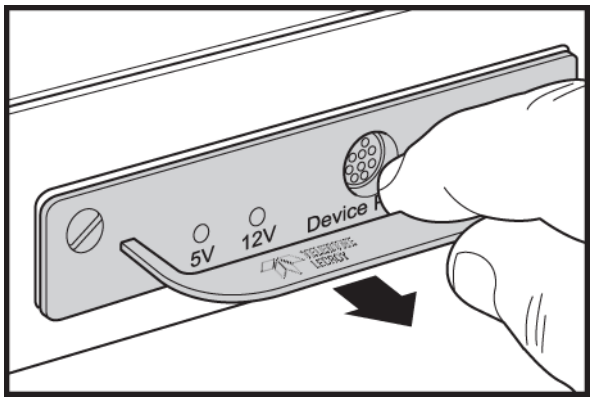
3. Rotate the extraction tool to a horizontal position to lock the prongs into place and make a handle.



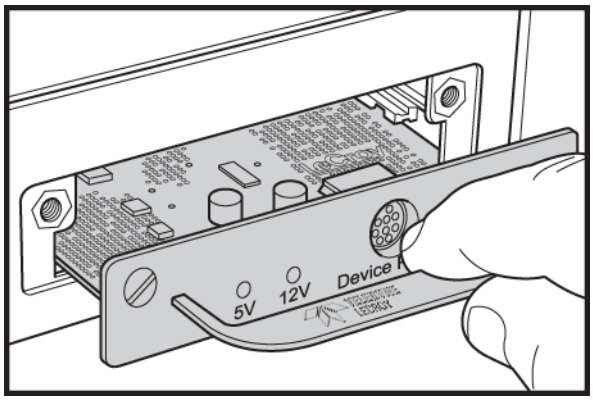
4. Using the screwdriver, loosen both retaining screws by rotating them counter-clockwise approximately two full turns, until feeling slight resistance. **Do not force the retaining screws** after two turns.



5. Using the extraction tool as a handle, gently wriggle the expansion card forward about 1/8”.



6. Repeat steps 4 and 5 approximately three times, until the card is free from the retaining screws and you can remove the card from the system.



1.10 Connecting via Ethernet

The Ethernet connection can have any of these configurations:

1. Analyzer connected to a network using a hub or switch, Gigabit Ethernet interface, or similar device.
2. Analyzer connected to the host machine (machine running the application software), using a hub or switch, Gigabit Ethernet interface, or similar device.
3. Analyzer connected directly to the host machine using a SATA cable.

1.11 Connecting to a Network

When connected to a network, the analyzer can communicate with the DHCP server to obtain IP address configuration information in order to establish a connection. Refer to "Select Device" on page 36.

1.12 Connecting over Different Subnets

If the host machine (with the Sierra software) and Sierra M6-2 are on the same subnet, they will see each other's broadcasts, and the Sierra M6-2 application will automatically appear in the Select Device dialog, from which you can select a device (as described in the previous section).

If the host machine and Sierra M6-2 do not reside on the same subnet, they will not see each other automatically. You must add the Sierra M6-2 IP address manually. To add the IP address, use the **Add Device** button (see Figure 1.44 on page 38).

1.13 TCP and UDP Ports Must Be Open to Connect over Ethernet

WARNING: Check your firewall settings before making Ethernet connections. Incorrect firewall settings can prevent Teledyne LeCroy applications from detecting analyzers on the network, though Ping works correctly. Consult your Firewall documentation to allow Teledyne LeCroy applications access to the network.

The following TCP and UDP ports must be open to connect over the Ethernet:

- **TCP Port**: 4000 to 4003
- **UDP Ports**: 4015 to 4017

1.14 Launching Your Analyzer

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

1.15 Operating in Simulation Mode

The SAS/SATA applications operate in Simulation Mode by default if the software detects no hardware.

The Analyzer software launches and displays the appropriate tool bar, but with the limitation that the Analyzer operates only on static, previously captured, bus data.

Limitations Simulation Mode lets you try all of the available functions, but the system is not capturing any real data and is displaying only pre-captured results.

1.16 Using the Software

The Sierra M6-2 application has the Teledyne LeCroy SAS/SATA Protocol Suite.

The Teledyne LeCroy SAS/SATA Protocol Suite can be a:

- **Protocol Analyzer:** Captures data, triggers on events, and saves. **Easy Mode** allows standard Trigger and Data capture. **Advanced Mode** allows you to program custom triggering in and out, capturing, state jumps, and timers (see "Protocol Analysis" on page 59).
- **Jammer:** The InFusion™ Error Injector and Traffic Modifier is an error injector and traffic modification tool that allows you to verify real-world fault handling (see "InFusion Overview" on page 417).
- **Protocol Analyzer Initiator Emulator (SAS):** Generates bus traffic for capture. It also has Easy Mode and Advanced Mode (see "Emulation" on page 137).
- **Target Emulator (SAS)**: Acts as target (see "Target and Device Emulation" on page 196).
- **Protocol Analyzer Host Emulator (SATA):** Generates bus traffic for capture. It also has Easy Mode and Advanced Mode (see "Emulation" on page 137).
- **Device Emulator (SATA)**: Acts as device (see "Target and Device Emulation" on page 196).

The SAS/SATA application now provides functionality for both protocols. Either protocol can now be accessed via the **File** menu and choosing the protocol to work with. Click **File> New** and select the desired protocol and application.

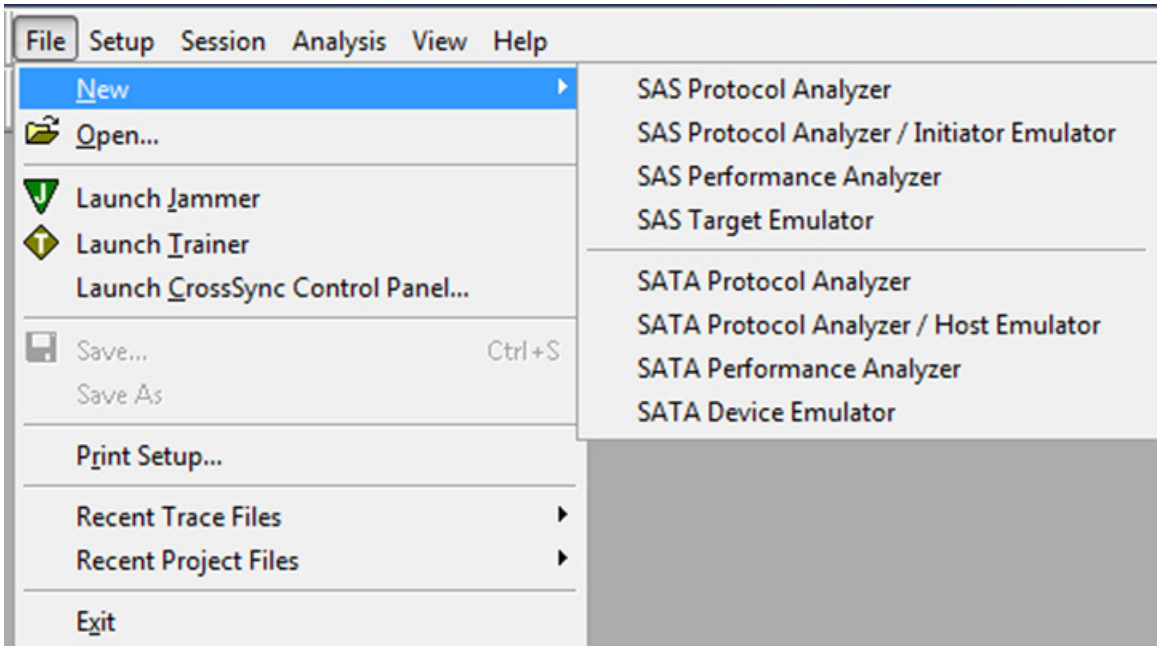


Figure 1.51: File Menu

To switch between protocols click **Window** and the select the trace or application to use.

Depending on the protocol in use, the relevant functions and menu options are available and the others are greyed out (see Figure 1.52 on page 48).

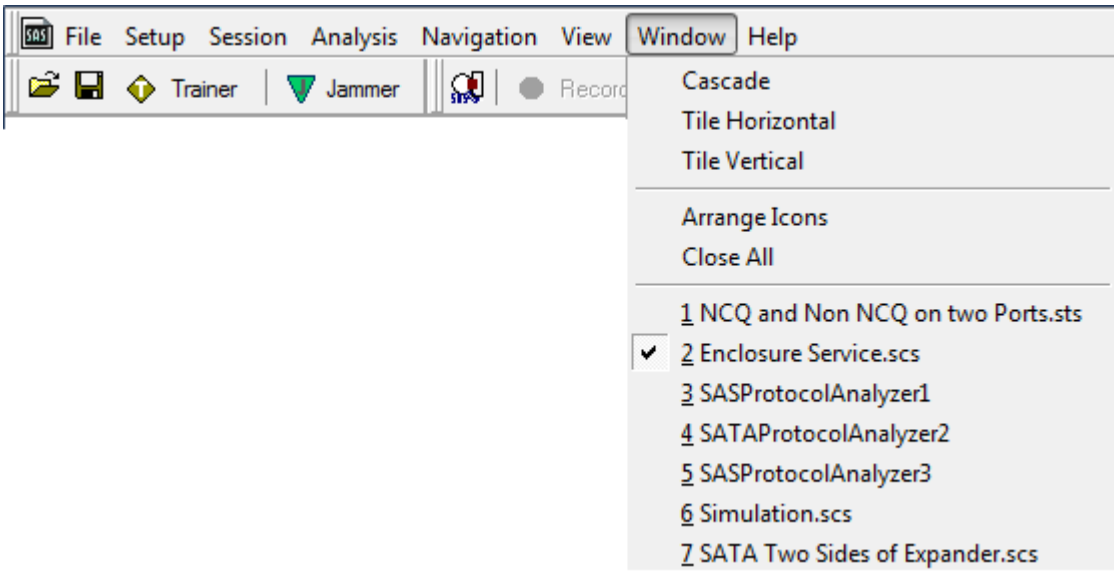


Figure 1.52: Window Dialog

1.17 Getting Started with the Protocol Analyzer

To use the software for protocol analysis, first select **File > New > SAS Protocol Analyzer** for a new SAS project, **File > New > SATA Protocol Analyzer** for a new SATA project or **File > Open** an existing protocol analysis file: **.sac** for a SAS file or **.stc** for a SATA file (see “Protocol Analysis” on

page 59). You can also open a **.scs** SAS Sample file or **.sts** SATA Sample file. Example files are in the Examples folder.

On the Capture tab, select to capture **Everything** or **Pattern**. For Pattern, select a Pattern. You can exclude patterns and frames. You can use different patterns for pre-trigger and post-trigger.

On the Trigger tab, select the trigger type. For Pattern, select the pattern.

On the Settings tab, select trigger position and memory use.

Change the Analyzer settings if necessary. Change the port Speed if necessary.

Use Advanced Mode only after you become familiar with the hardware and software and have special needs.

1.18 Protocol Analyzer Initiator Emulator or Host Emulator

To use the software for protocol analysis to generate host traffic, first select **File > New > SAS Protocol Analyzer Initiator Emulator** or **SATA Protocol Analyzer Host Emulator** for a new project or **File > Open** an existing Pattern Generator file: **.spg** for a single-role file (see “Emulation” on page 137).

In Easy Mode, on the Initiator Emulator or Host Emulator tab, insert instances of ATA, SCSI, TASK, SMP, Frame, or Event. Select the type of each from the drop-down lists. You can also loop, go to, wait, delay, if...then, and stop.

In Easy Mode, on the Capture tab, select to capture **Everything** or **Pattern**. For Pattern, select a Pattern. You can exclude patterns and frames. You can use different patterns for pre-trigger and post-trigger.

In Easy Mode, on the Trigger tab, select the trigger type. For Pattern, select the pattern.

In Easy Mode, on the Initiator Setting or Host Setting tab, select the port and speed. Select to run the Pattern Generator or Initiator Emulator or Host Emulator.

In Easy Mode, on the Settings tab, select trigger position and memory use. Also change the Analyzer settings if necessary. Specify addresses, stops, times, and sizes, if necessary.

Use Advanced Mode only after you become familiar with the hardware and software and have special needs.

1.19 Performance Analyzer

To do a Performance Analysis, select **File > New > SAS Performance Analyzer** for SAS or **File > New > SATA Performance Analyzer** for SATA**.** Choose settings in the Performance Analysis dialog. Click Run Hardware (see “Performance Analysis” on page 191.)

1.20 Target Emulator or Device Emulator

To use the software as a target or device emulator, first select **File > New > SAS Target Emulator** or **SATA Device Emulator** for a new project or **File > Open** an existing Emulator file: **.std** Target Emulator file or **.sde** Device Emulator file (see “Target and Device Emulation” on page 196). You can also use **Project Setup > Last Target Emulator** or **Last Device Emulator.**

In the Pages tab, change settings for the supported pages if necessary.

In the Error Injection tab, select General periodic errors, Identify frames, Connection Management open and close connection errors, SAS Commands and events errors, ATA Commands errors, or SATA Signature content.

Use the User-defined Commands tab only after you have become familiar with operations.

In the Settings tab, select addresses, sizes, times, and ports, if necessary.

You can capture traffic when using an Analyzer project (but not a Target Emulator project). With a Protocol Analyzer open, open a **Target Emulator.** After checking the settings, click the **Activate/ Deactivate** (Active) device button. or select **Project Setup > Active Device.** If you change Target Emulator settings, **Deactivate** and then **Activate Device**.

1.21 Teledyne LeCroy SAS/SATA Protocol Suite Menu Options and Toolbars

This section lists all the SAS/SATA Protocol Suite application menu options and the toolbars.

1.21.1 File

The File menu options allows you to perform common tasks such as open, close, save, export, print, send files and exit the application (see Figure 1.53 on page 50).

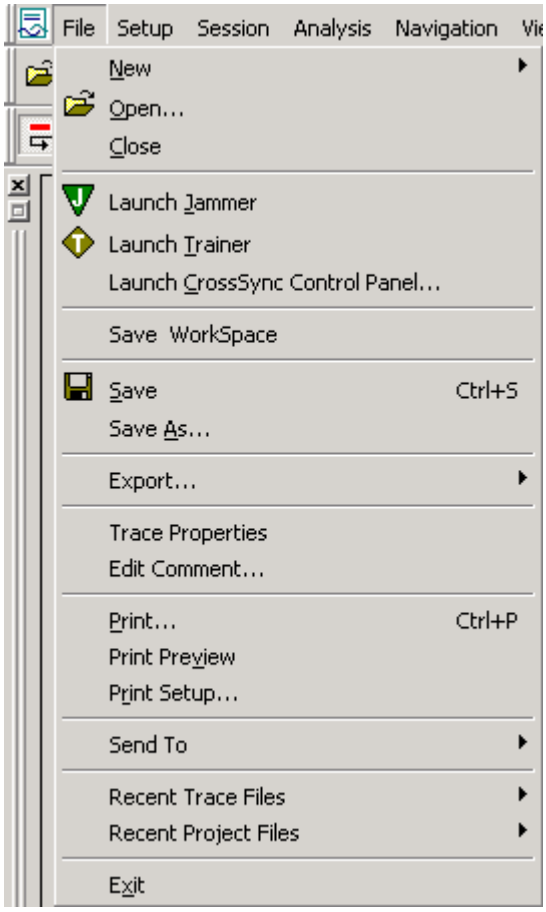


Figure 1.53: File Menu Option

1.21.2 Setup

For special work, you can use the Setup menu (see Figure 1.54 on page 51) to perform the following actions:

- TxRxVout & Pre-emphasis (see "Device Settings -> Probe Calibration Settings" on page 371)
- User Defined Decoding (see "User-Defined Decoding" on page 387)
- External Trig Setting (see "External Trig Setting" on page 384)
- Update Device (see "Update Device" on page 385)
- All Connected Devices (see "Select Device" on page 36)
- Find DUT (see "Find DUT" on page 399)
- Power Source Control (see "Power Source Control" on page 401)
- Manage Setup Licenses (see "Floating License" on page 383)
- Preferences (see "Preferences" on page 373)
- Self Test (see "Self Test" on page 391)
- Data Block (see "Data Blocks" on page 152)
- Set Port Alias (see "Set Port Alias" on page 368)
- Set SAS Address Alias (see "SAS Address Alias (SAS only)" on page 369)

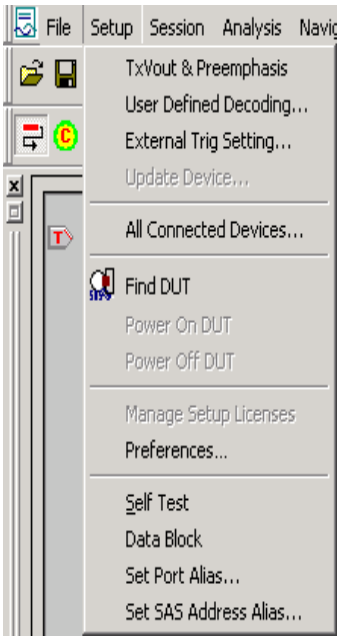


Figure 1.54: Setup Menu Option

1.21.3 Session

The Session menu has the following options:

- Start Capture/Record - Start capture or record a trace
- Pause Capture/Record - Aborts the capture without saving
- Stop Capture/Record - Stops the hardware
- Start Target Emulator - Starts the target emulator (SAS)
- Stop Target Emulator - Stops the target emulator (SAS)

- Start Device Emulator - Starts the device emulator (SATA)
- Stop Device Emulator - Stops the device emulator (SATA)

1.21.4 Analysis

The Analysis menu (see Figure 1.55 on page 52) allows you to view captured data (see the following screen capture).

Menu items and toolbar options are enabled or disabled and displayed or hidden based on the type of window open. The following types of windows can be displayed:

- No active window
- Project file open
- Trace file open

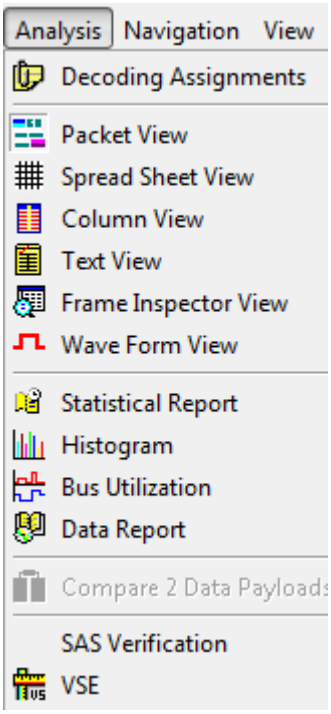


Figure 1.55: SAS/SATA Analysis Menu

1.21.5 Viewing Captured Data

Captured data can be displayed in several views. Select **Analysis** from the drop-down menu to access the different views (see "Analysis" on page 236). You can display the same data in:

- **Packet View**: Displays packets
- **Spreadsheet View**: Displays Packet View fields by time
- **Column View**: Shows DWORDs in columns by port
- **Text View**: Shows transaction frames, grouped in columns by port
- **Frame Inspector View:** Has lots of information that is available in Packet View, but not Spreadsheet View, so it is most useful in conjunction with the Spreadsheet View.
- **Waveform Display**: Shows waveform display for all active ports, on which you

can perform timing measurements

- **Statistical Report**: generate statistics for all transports, commands, primitives, bus conditions, addresses, lanes, and errors
- **Histogram View**: Shows frame-type transfers
- **Bus Utilization:** Displays the utilization of the bus
- **Data Reports**: Displays data payloads
- **Compare 2 Data Payloads:** Compares two data payloads
- **SAS Verification**: Verifies compliance with the SAS specification
- **Compliance Test**: Verifies compliance with the SATA specification
- **VSE**: Perform custom post-process analysis of the open trace by running a verification script over the trace
- **Power Tracker View**: Displays power statistics

1.21.6 Navigation

The Navigation menu has the following options to navigate through the application (see the following screen capture).

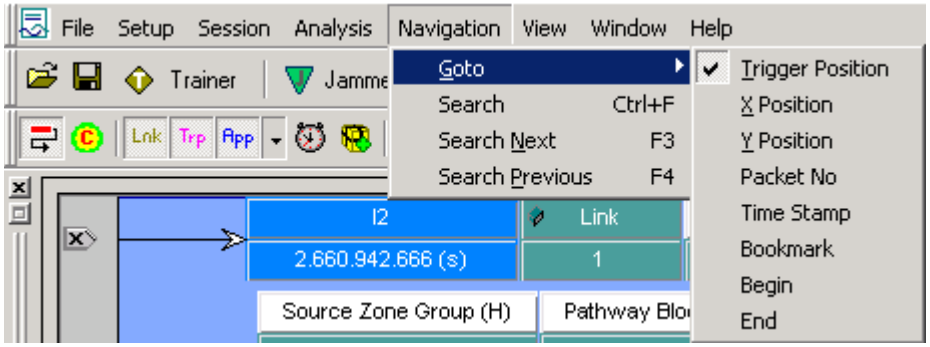


Figure 1.56: Navigation Menu Option

- Goto
  - Trigger Position
  - X Position
  - Y Position
  - Packet No
  - Time Stamp
  - Bookmark
  - Begin
  - End
- Search
- Search Next
- Search Previous

1.21.7 View

The View menu options allows the user to zoom in and out, enable/disable filtering and toolbars among other actions. It has the following options (see Figure 1.57 on page 54).

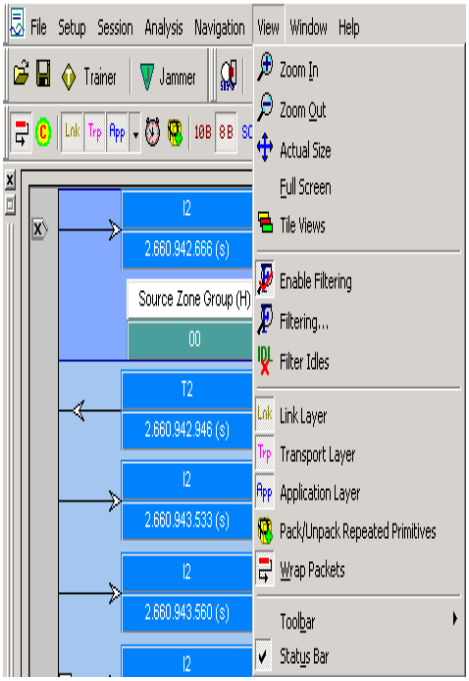


Figure 1.57: View Menu Option

- Zoom In (refer to “Navigation + View Toolbar” on page 322)
- Zoom Out (refer to “Navigation + View Toolbar” on page 322)
- Actual Size (refer to “Navigation + View Toolbar” on page 322)
- Tile Views (refer to “Navigation + View Toolbar” on page 322))
- Enable Filtering (refer to “Filter Setup” on page 329)
- Filtering (refer to “Filter Setup” on page 329)
- Filter Idles (refer to “Filter Setup” on page 329)
- Link Layer-SAS only (refer to “Packet View Toolbar” on page 351)
- Transport Layer-SAS only (refer to “Packet View Toolbar” on page 351)
- Application Layer-SAS only (refer to “Packet View Toolbar” on page 351)
- Pack/Unpack Repeated Primitives-SAS only (refer to “Packet View Toolbar” on page 351)
- Physical Layer-SATA only (refer to “Packet View Toolbar” on page 351)
- FIS Layer-SATA only (refer to “Packet View Toolbar” on page 351)
- Command Layer-SATA only (refer to “Packet View Toolbar” on page 351)
- Wrap Packets (refer to (refer to “Packet View Toolbar” on page 351)
- Tool bar (allows you to customize the toolbar with the options given below)
  - Main
  - Record+Capture
  - Analysis
  - Navigation+View
  - Column View
  - Cursor position
  - Target Emulator
- Status Bar (refer to “Cursor Position Status Bar” on page 363)

1.21.8 Window

The Window menu has the following options:

- **Cascade:** Displays all open windows in an overlapping arrangement.
- **Tile Horizontal:** Displays all open windows in a above-below arrangement.
- **Tile Vertical:** Displays all open windows in a side-by-side arrangement.
- **Arrange Icons:** Arranges minimized windows at the bottom of the display.
- **Close All:** Closes all windows.

1.21.9 Help

For more information see “Help Menu” on page 389.

1.21.10 Toolbars

The toolbars enable you to perform several actions, some of which are listed below.

- Show or hide fields and ports, change port names, and change data format.
- Show the layers and channels using their toolbars.
- Decode using the Decode toolbar.
- Search and Filter.

There are six sets of toolbars (see the following screen capture):

- Main Toolbar - For details on the Main Toolbar refer to “SAS Main Toolbar” on page 62 and “SATA Main Toolbar” on page 63.
- Record Capture Toolbar - For additional information see “SAS Main Toolbar” on page 62 and “SATA Main Toolbar” on page 63.
- Target/Device Emulator Toolbar - For additional information see “SAS Main Toolbar” on page 62 and “SATA Main Toolbar” on page 63.
- Navigation + View Toolbar - For additional information see “Navigation + View Toolbar” on page 322.
- Show Analysis Toolbar - For additional information see “Show Analysis Toolbar” on page 236.
- Packets View Toolbar - For additional information see “Packet View Toolbar” on page 351.
- Column View - For additional information see “Column View” on page 262.
- Cursor Position- For additional information see “Using the Cursors and Bookmarks” on page 363.
- Target Emulator- For additional information see “SAS/SATA Software Menus and Toolbars” on page 62.

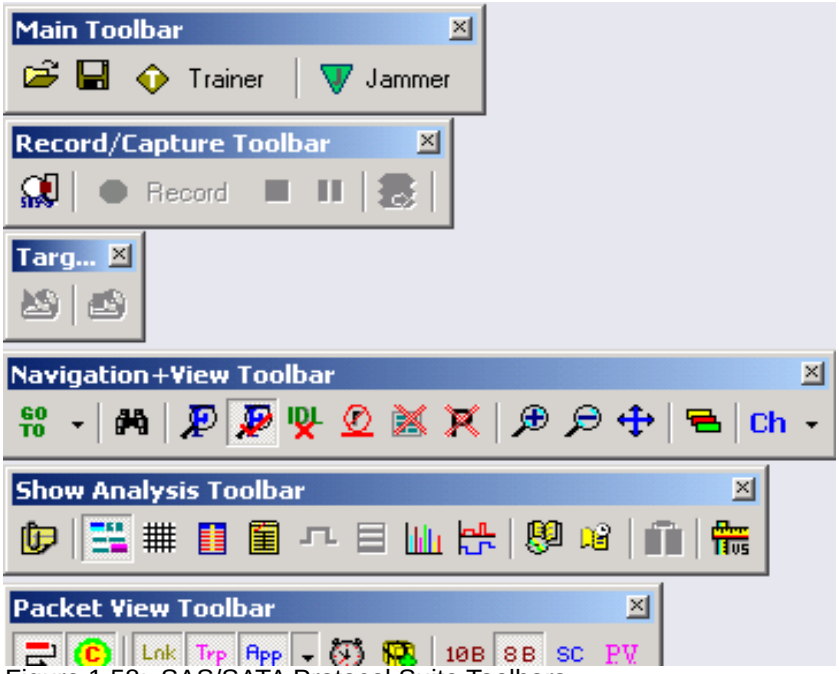


Figure 1.58: SAS/SATA Protocol Suite Toolbars

1.22 Port Status

You can display an overview of the active ports by clicking the buttons at the bottom right of the main window (see "Port Status" on page 360).

1.23 InFusion

The Teledyne LeCroy InFusion™ Error Injector and Traffic Modifier is an error injector and traffic modification tool for traffic passing through the Jammer. It allows you to verify real-world fault handling for Serial Attached SCSI (SAS) and Serial ATA (SATA) systems. Click on the Jammer icon 

to invoke the Teledyne LeCroy SAS or SATA InFusion, see "InFusion Overview" on page 417.

You can toggle between the InFusion and Analyzer panes by using the Alt+Tab keys, the Windows Task Bar or by pressing the respective toolbar button in each pane.

1.24 Trainer

The SAS *Trainer* is a traffic generator that can emulate a SAS initiator/target or SATA host/device. Traffic generation enables engineers to test designs under realistic conditions and to transmit known errors, allowing engineers to observe how devices handle faulty link conditions.

Traffic generation is performed via the execution of text-based scripts. These traffic generation files (*.**ssg**) contain statements about the types of traffic to be generated. These script files can be edited with either a simple text editor such as Notepad or with the included Script Editor utility.

Click on the Trainer icon 

to invoke the Teledyne LeCroy SAS or SATA Trainer, see "Sierra Trainer Traffic Generation" on page 503.

You can toggle between the Trainer and Analyzer panes by using the Alt+Tab keys, the Windows Task Bar or by pressing the respective toolbar button in each pane.

Chapter 2

Protocol Analysis

A default analyzer project is created automatically when the application starts. An analyzer project contains all the settings for capturing, triggering and memory usage. A project can be saved as a ***.sac** files for later use.

2.1 Easy Mode (Pre-Defined Setups)

After you install the Analyzer software (see "Software Installation" on page 5) and set up the Analyzer (see "Hardware Setup" on page 23), launch the Analyzer software (see "Launching Your Analyzer" on page 46) to display the default Protocol Analyzer in Easy Mode at the Capture tab.

The default Protocol Analyzer uses the Easy Mode which allows triggering and data capture. The Easy Mode also supports the SAS Initiator Emulator and SATA Host Emulator modes to generate bus traffic.

2.2 Main Window

Use Easy Mode to get a comprehensive overview of your analyzer's capabilities. Use the default Analyzer Project or create a new project.

For **SAS**: on the Analyzer Menu Bar, click **File > New > SAS Protocol Analyzer** to open a SAS Protocol Analyzer dialog.

SAS Capture

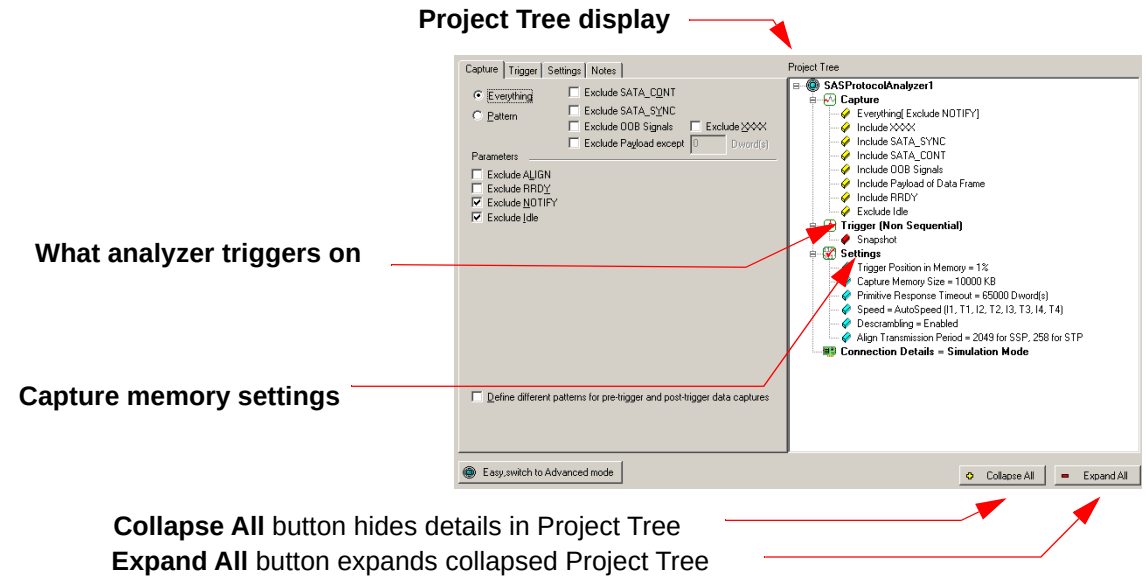


Figure 2.59: SAS: New Analysis Project Dialog

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

SATA: On the Analyzer Menu Bar, click **File > New > SATA Protocol Analyzer** to open a SATA Protocol Analyzer dialog.

SATA Capture

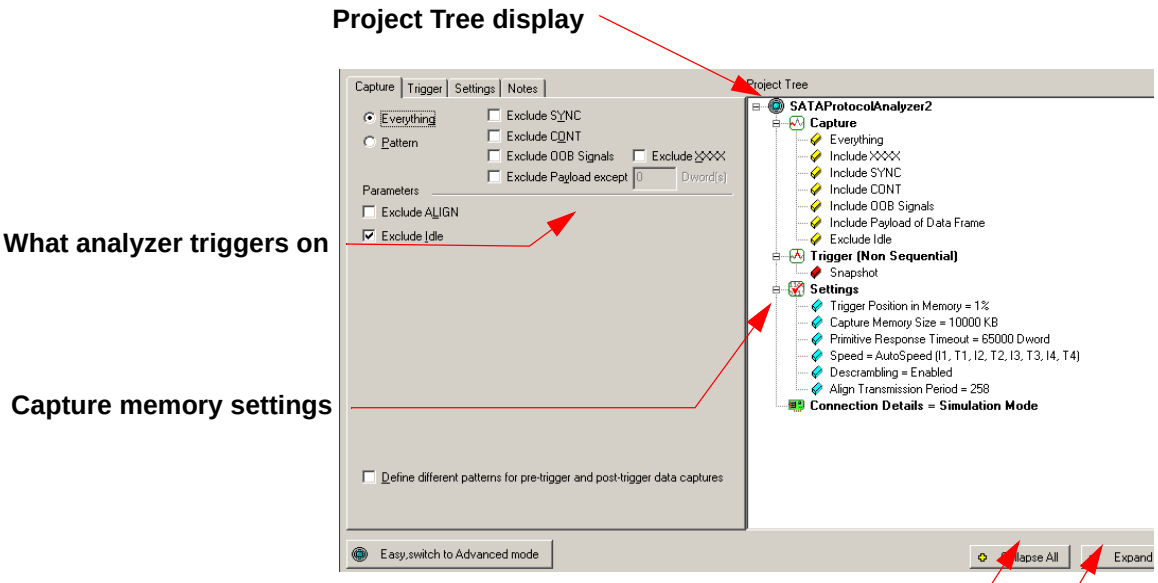


Figure 2.60: SATA: New Analysis Project Dialog

SAS vs. SATA: SATA Dialog does not show “Exclude RRDY” or “Exclude NOTIFY”.
SATA Dialog replaces “Exclude SATA_CONT” with “Exclude CONT” and “Exclude SATA_SYNC” with “Exclude SYNC”.

2.3 Project Tree

The Project Tree on the right side of the main window displays a comprehensive tree structured overview of the project. The project tree shows the capture configuration, trigger setups, and the capture memory settings.

2.3.1 Capture Tab Fields

The Capture tab has the following fields:

Exclude SATA_CONT (SAS) or Exclude CONT (SATA)

Check this to exclude SATA_CONT primitives from the data capture.

Exclude SATA_SYNC (SAS) or Exclude SYNC (SATA)

Check this to exclude SATA_SYNC primitives from the data capture.

Exclude OOB Signals

Check this to exclude OOB signals from the data capture.

Exclude XXXX

Check this to exclude XXXX patterns from the data capture.

Note: The validity of time stamps during Idles is traded off against good buffer memory utilization when using 'Exclude XXXX'.

Exclude Dev Slp Packets (SATA)

Check this to exclude Dev Slp Packets from the data capture.

Exclude Payload except

Check this to exclude Payload of Data Frames from the data capture. You can except a number of DWORD(s).

Note: The Data Report (refer to "Data Report" on page 288) does not reflect excluded Payload of Data Frames.

Note: When showing truncated data in the Data Payload View, the truncation points are marked with a separator placed between payloads. You can get more information about the data exclusion using the tooltip over the separator.

Exclude ALIGN

Check this to exclude ALIGN primitives from the data capture.

Exclude RRDY (SAS only)

Check this to exclude RRDY primitives from the data capture.

Exclude NOTIFY (SAS only)

Check this to exclude NOTIFY primitives from the data capture.

Exclude Idle

Check this to exclude Idles from the data capture.

Define different patterns for pre-trigger and post-trigger data captures

Replaces the Capture tab with a Pre-Trigger Capture tab and a Post-Trigger Capture tab.

2.4 SAS/SATA Software Menus and Toolbars

The SAS/SATA software has the following menus and toolbars.

Note: The sections "SAS Main Toolbar" and "SATA Main Toolbar" on page 63 are shown separately to indicate the different context sensitive toolbar options depending on whether SAS or SATA trace or project is open.

2.4.1 SAS Main Toolbar

The following figure displays the SAS main toolbar.

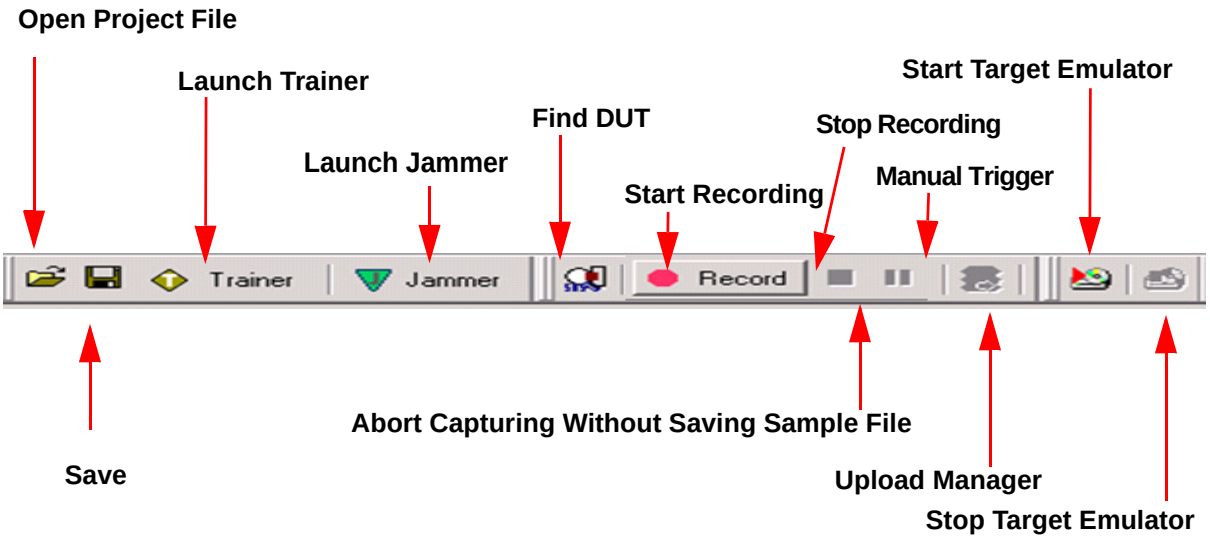


Figure 2.61: SAS: Software Menus and Toolbar

2.4.2 SATA Main Toolbar

The following figure displays the SATA main toolbar.

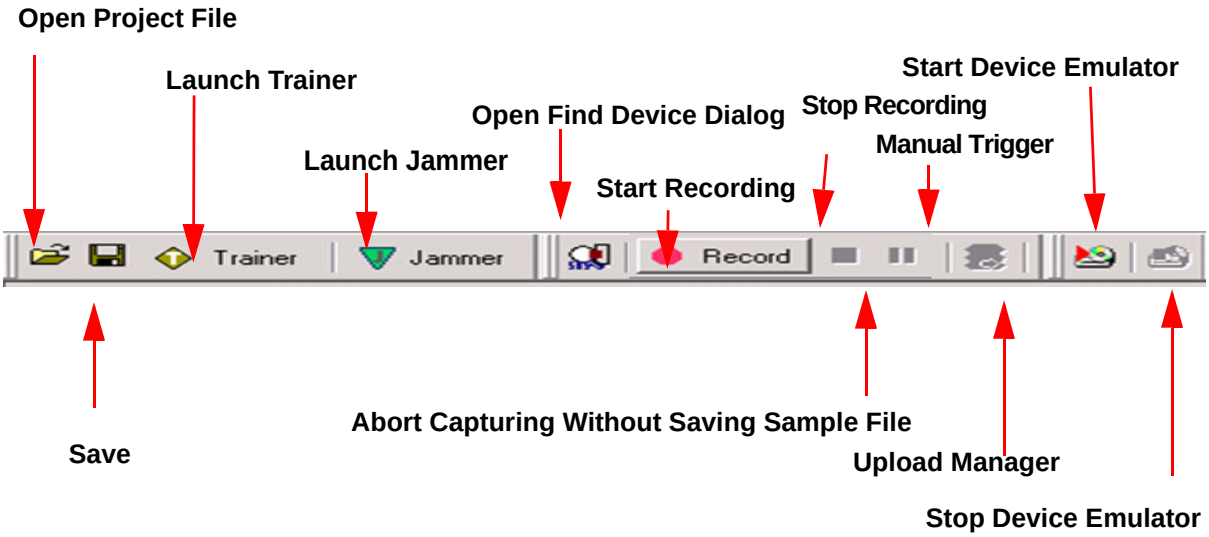


Figure 2.62: SATA: Software Menus and Toolbar

2.5 Start Recording

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

1. Click the 

Record button.
2. The analyzer begins filling the defined memory buffer with traffic captured from the bus. After the traffic fills the memory buffer, the traffic is uploaded to the viewer and the Packet View display opens. Packet View is the default display. However, more views are available by selecting **View** on the menu bar and choosing the desired View (see Figure 2.63 on page 64).

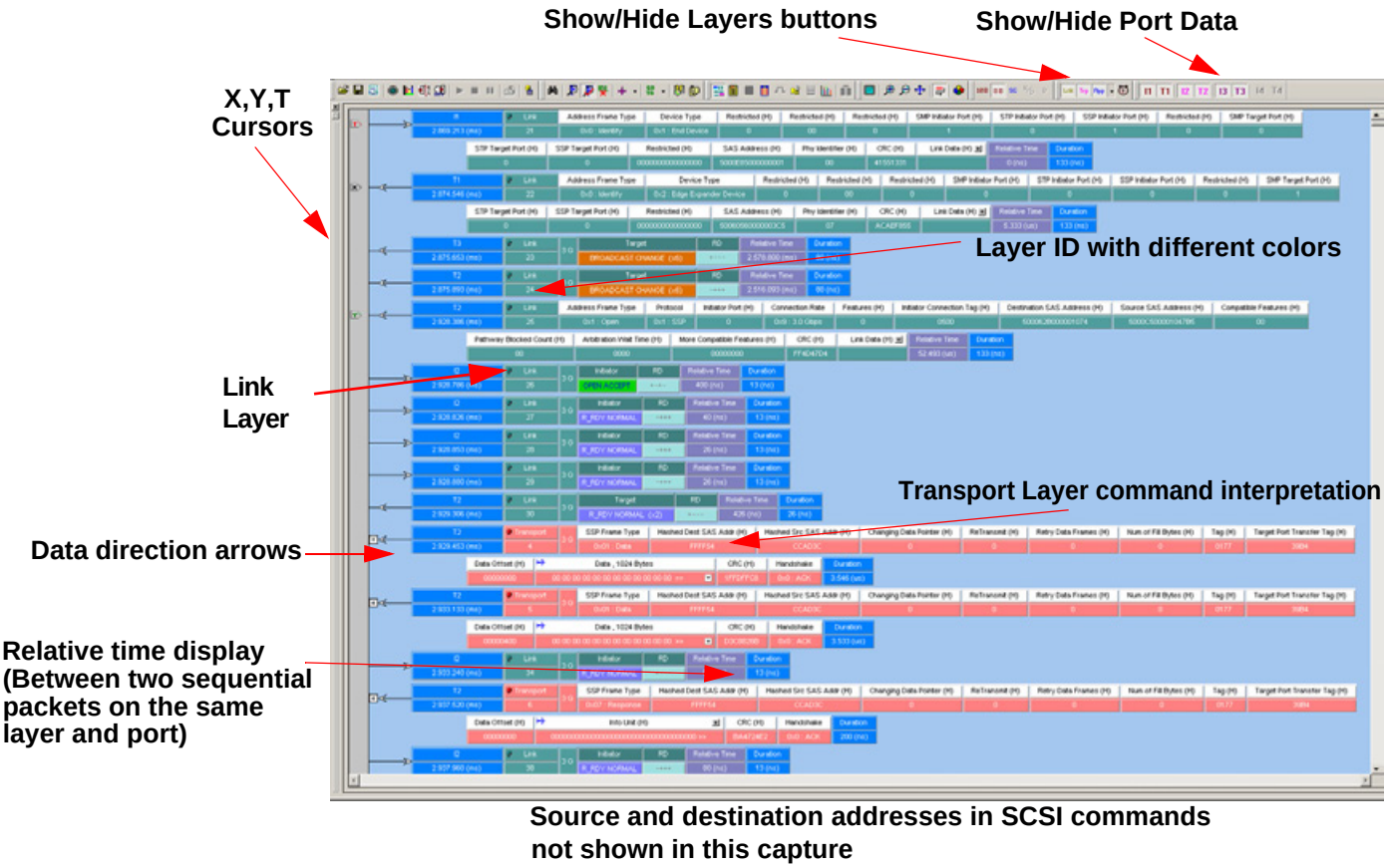


Figure 2.63: SAS: Typical Packet View.

Note: When using the Advanced Mode sequencer, the analyzer logs the state transitions in the trace, with the name the user gives to the state.

In the Packet View, right-click on any packet and select **Show->State**, to display the states and their transitions in the trace.

SAS: In case 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 has an arrow from right to left: ⇐. Downstream traffic has an arrow left to right: ⇒.

Layers can be hidden by clicking the corresponding **Show/Hide** button on the menu bar. The system retains all captured data, but the display has fewer data layers for simpler viewing.

You can configure the viewer display for test and viewing preferences (see "Viewer Display" on page 233 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 can set the Analyzer to:

- Capture specific patterns (see "Patterns and Data Capture Setup" on page 78).
- Capture different patterns pre- and post-trigger.
- Exclude parameters from capture.
- Trigger on a pattern or sequence of patterns (see "Trigger Setup" on page 93).
- Configure trace capture memory (Settings tab).
- Select file to save trace capture in memory (Settings tab).
- Include a project note (Notes tab).

2.5.1 Launch Jammer

The Launch Jammer option invokes InFusion. For more information refer to “InFusion Overview” on page 417

2.5.2 Launch Trainer

The Launch Trainer option invokes Trainer. For more information refer to “Sierra Trainer Traffic Generation” on page 503.

2.5.3 CrossSync Control Panel

The CrossSync Control Panel allows you to select analyzers for synchronization and manage the recording process. It supports a wide combination of Teledyne LeCroy’s flagship analyzers including PCI Express, USB, DDR, Serial ATA (SATA), Serial Attached SCSI (SAS), Fibre Channel (FC) and Ethernet.

CrossSync is Teledyne LeCroy’s analyzer synchronization solution that enables time-aligned display of protocol traffic from multiple daisy-chained analyzers showing packet traffic from multiple high-speed serial busses. A lightweight software control panel allows users to select analyzers for synchronization and manage the recording process. Captured traffic is displayed using the latest analyzer software (in separate windows) with all the protocol specific search and reporting features.

Captured packets are displayed in separate windows that share a common time scale. Navigating the traffic in either direction will scroll to the same timestamp in a synchronized window. When using the CrossSync option, users can access the full complement of analysis capabilities available within the individual Teledyne LeCroy software. Search, reporting, and decoding all operate normally.

This feature is available with the Teledyne LeCroy SAS/SATA Protocol Suite application.

Launching the CrossSync Control Panel

To launch CrossSync from the SAS/SATA Protocol Suite software application, click on **File** and select **Launch CrossSync Control Panel** (see the screens below). Or, you can launch CrossSync from the ‘**Start**’ menu.

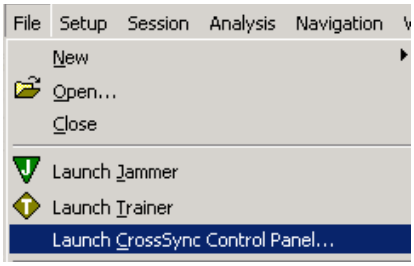


Figure 2.64: Launching CrossSync from the SAS/SATA Protocol Suite Application

Please refer to the ***CrossSync Control Panel User Manual*** for more information.

2.5.4 Save Workspace

Viewing parameters can be saved in a workspace as a **.wss** file.

After you open a trace and select views, you can save the viewing parameters in a workspace file. Select **File > Save Workspace** to open a Save As dialog. Save the current workspace as a **.wss** file.

To set a default workspace viewing parameters, select **Setup > Preferences** and select the Trace Viewer tab. In the Default Workspace field, enter the path and name of a saved workspace **.wss** file.

The workspace can be switched after opening a trace file. Select **File > Open** to open another workspace and select a **.wss** file.

2.5.5 Saving a Trace Capture

You can save a Trace Capture by selecting **Save** from the **File** menu, or select **Save As** to save as the trace capture for review at a later time using the following dialog.

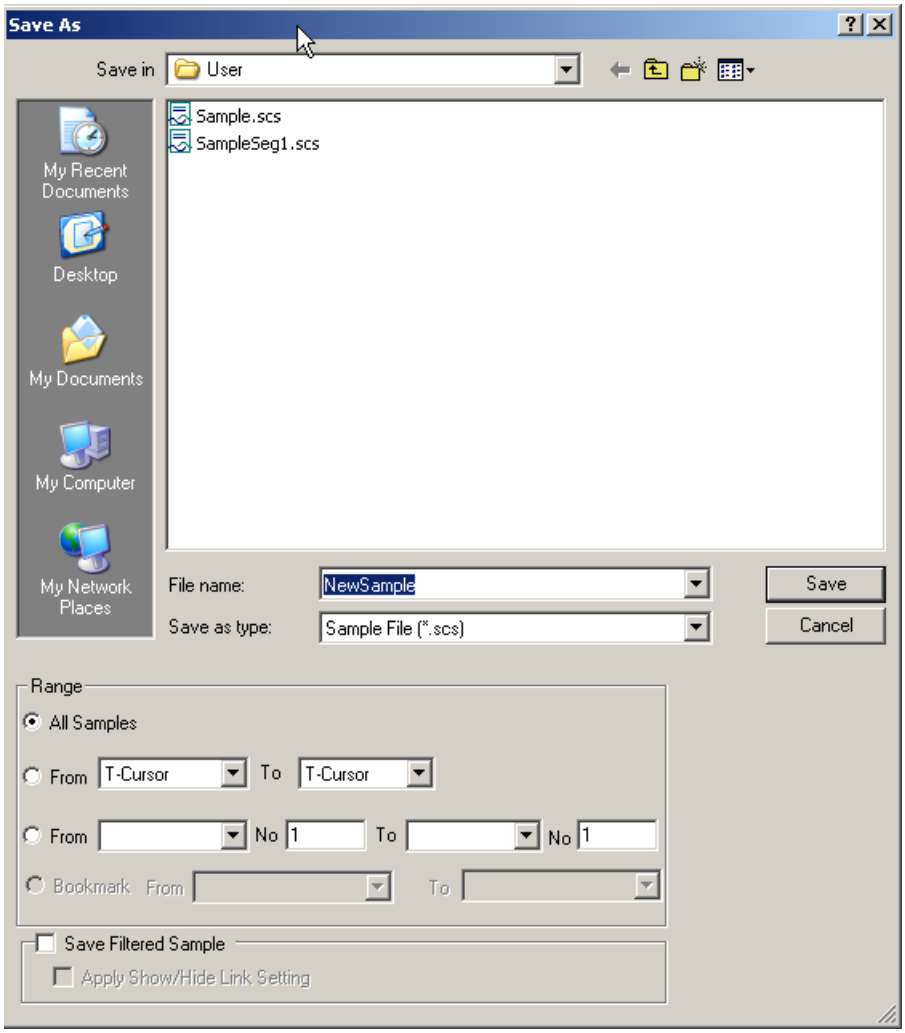


Figure 2.65: Save As Dialog

You can limit the range of the saved file. You can save:

- All Samples
- Range between selected cursors
- Range between selected Idle, link, commands
- Range between bookmarks

The **Save Filtered Sample** checkbox saves a trace file without filtered data. The **Apply Show/Hide Link Setting** checkbox filters the saved data further by also applying the current status of the port buttons of the toolbar.

2.5.6 Exporting

From the File menu, you can Export to Text/Excel, Export to Initiator Emulator, Export to Trainer, Export Read-Write Command Report, or Export Paired SAS Address Report.

Note: Export to Text/Excel is available from the Spreadsheet View, Packet View or Text View as of S/W version 5.60 or later. Export to Text/Excel is not available from Column View as of S/W version 5.60 or later.

Export to Text/Excel

From the File menu, you can export to Text/Excel, using the **Export to Text/Excel.** The **Save as Text** dialog displays.

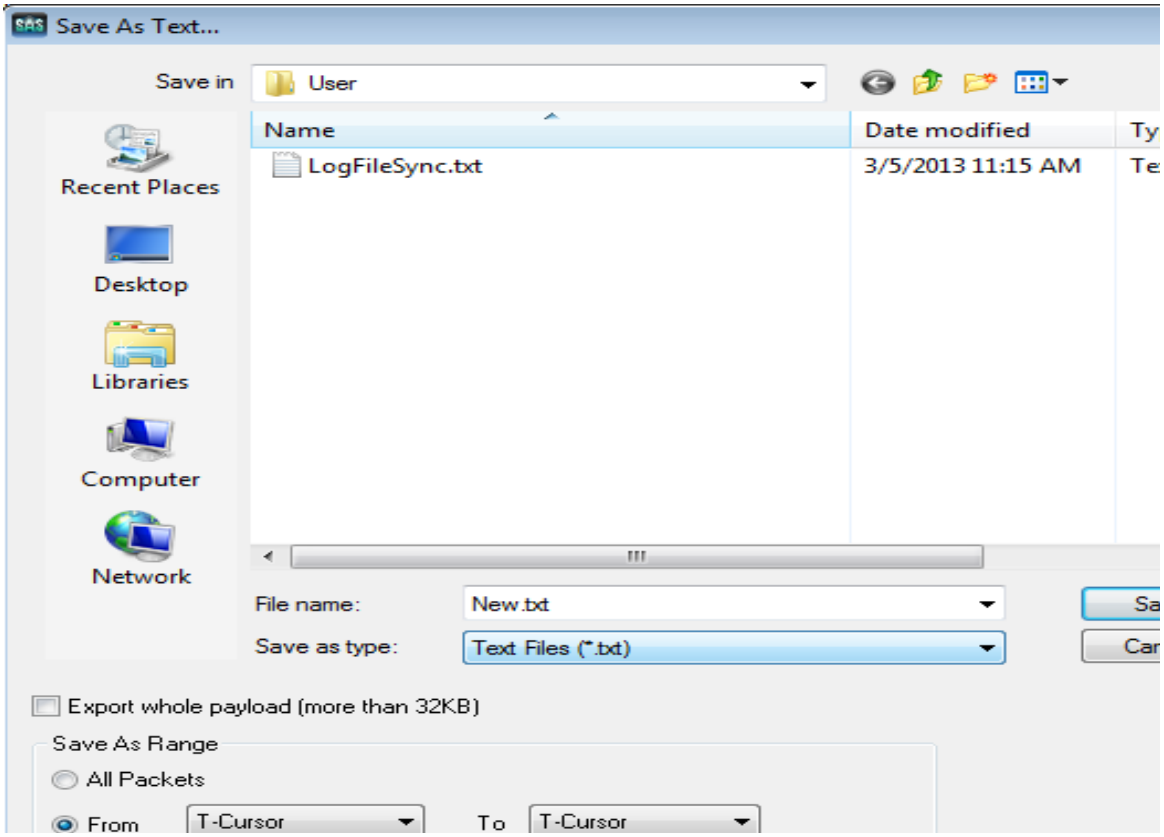


Figure 2.66: Save As Text Dialog.

- From the Save as type: drop-down select Text Files.txt or Text Files Version 1.0 .txt for text format or Excel File.csv or Excel Files Version 1.0.csv for Excel format (see "Save As Display Formats" on page 69).
- Check the box **Export the whole payload (more than 32KB)** to export the whole payload (more than 32KB).
- You can limit the range of the saved file. You can save:
  - All Packets
  - Range between selected cursors
- Range between bookmarks

Save As Display Formats

The following figure describes the four different Save As type formats:

XFER Length-Sector Count
2048 - 4

Excel File.csv format

XFER Length
2048

Excel Files Version 1.0.csv format

2048 - 4

Text Files.txt format

2048

Text Files Version 1.0.txt format

Export to Initiator Emulator (SAS) or Host Emulator (SATA)

From the File menu, you can Export to Initiator Emulator (SAS) or Export to Host Emulator (SATA), using the Extract Sample File dialog (see following figures).

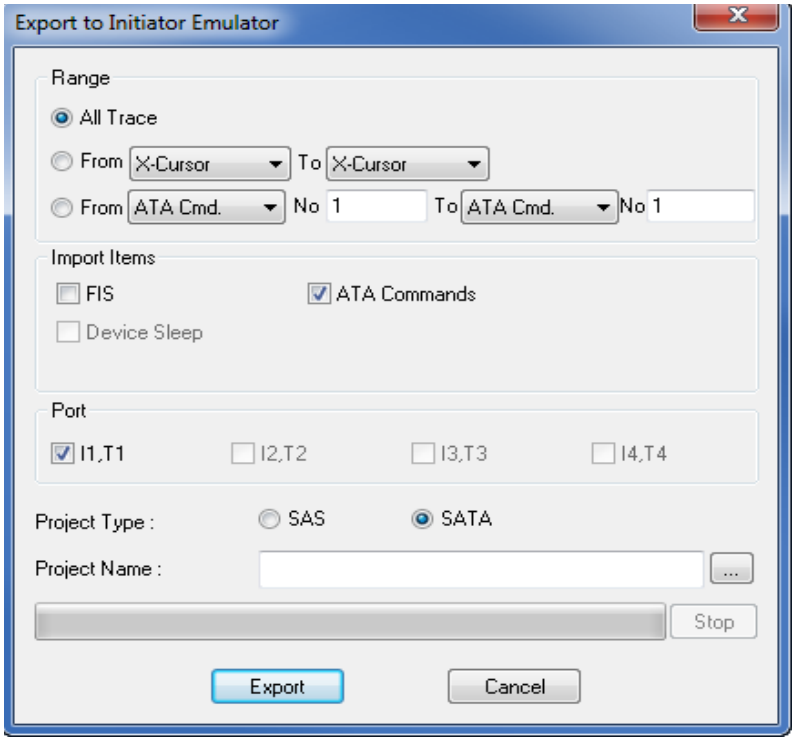


Figure 2.67: Export to Initiator Emulator (SATA) Dialog.

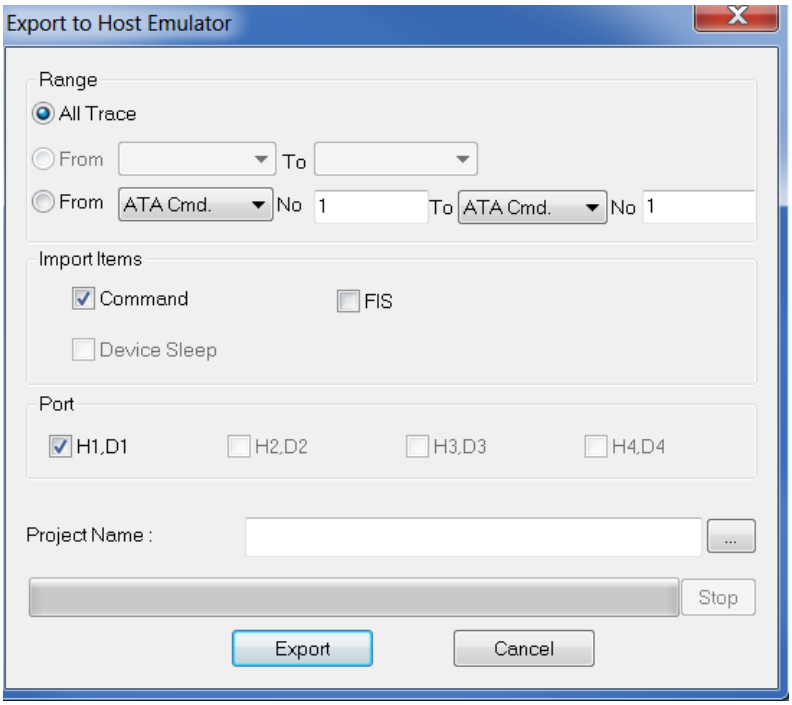


Figure 2.68: Export to Host Emulator (SATA) Dialog.

You can limit the range of the saved file. You can save:

- All Trace
- Range between selected cursors
- Range between SCSI Commands or Transport

You can export SCSI Commands, Task Management, FIS, ATA Commands, Device Sleep, SSP Frames, SMP Frames, SMP Commands, or STP Frames.

You can select the **Port**.

In the **Project Name**, enter a valid file name.

Export to Trainer

The Export to Trainer dialog, accessible from the File menu, allows exporting data to a file in a format supported by the Trainer. See Figure 2.69 and Figure 2.70 on page 71.

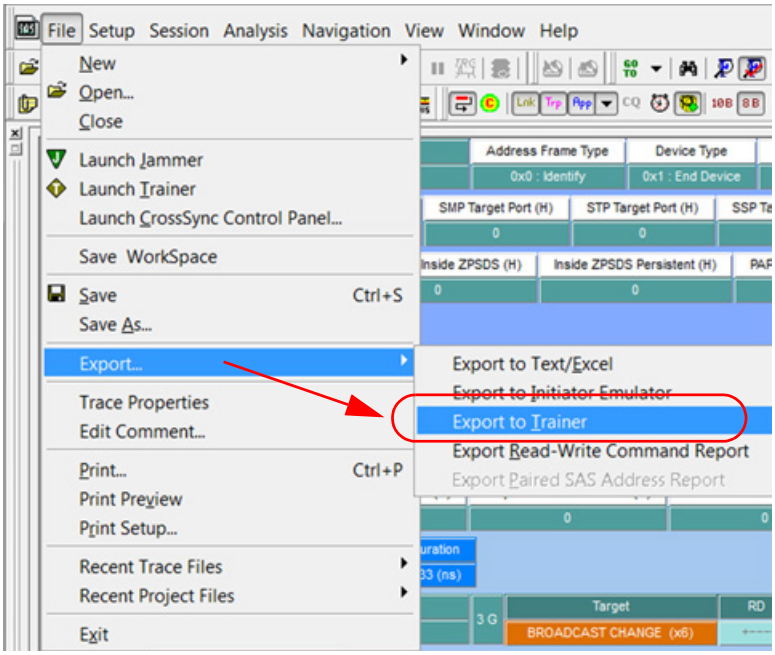


Figure 2.69: Export to Trainer Dialog (SAS)

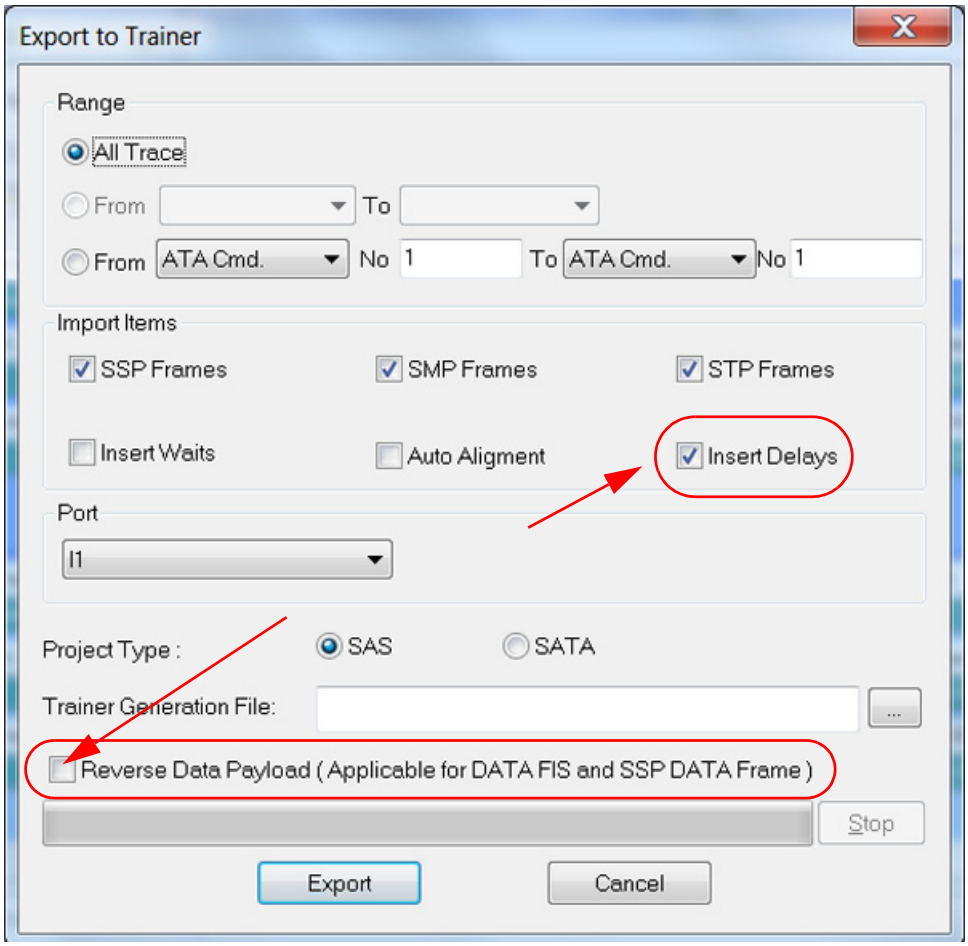


Figure 2.70: Export to Trainer Dialog

In the Export to Trainer dialog you can:

- Limit the range of the saved file. You can save:
  - All Traces
  - Range between selected cursors
  - Range between SCSI Commands, SMP Commands or Transport
- Import **SSP Frames, SMP Frames,** or **STP Frames** (see "Events and Event Properties" on page 575).
- **Reverse Data Payload:** Reverses DWORD's byte order of Data Payload in DATA FIS and SSP Data Frame
- **Insert Waits** inserts the appropriate **Wait_for** commands in the Trainer script as a function of the protocol state machine. An example would be to insert a **Wait_for open_accept** after an **open** command is exported. This allows the script to work, even if the DUT has different timing than the DUT in the original trace. See "Wait Commands" on page 548.
- **Insert Delays** inserts the exact delays as they appear in the original exported trace. This may result in the closest match in terms of timing to the original trace, but may not work with other DUTs. See Figure 2.71.

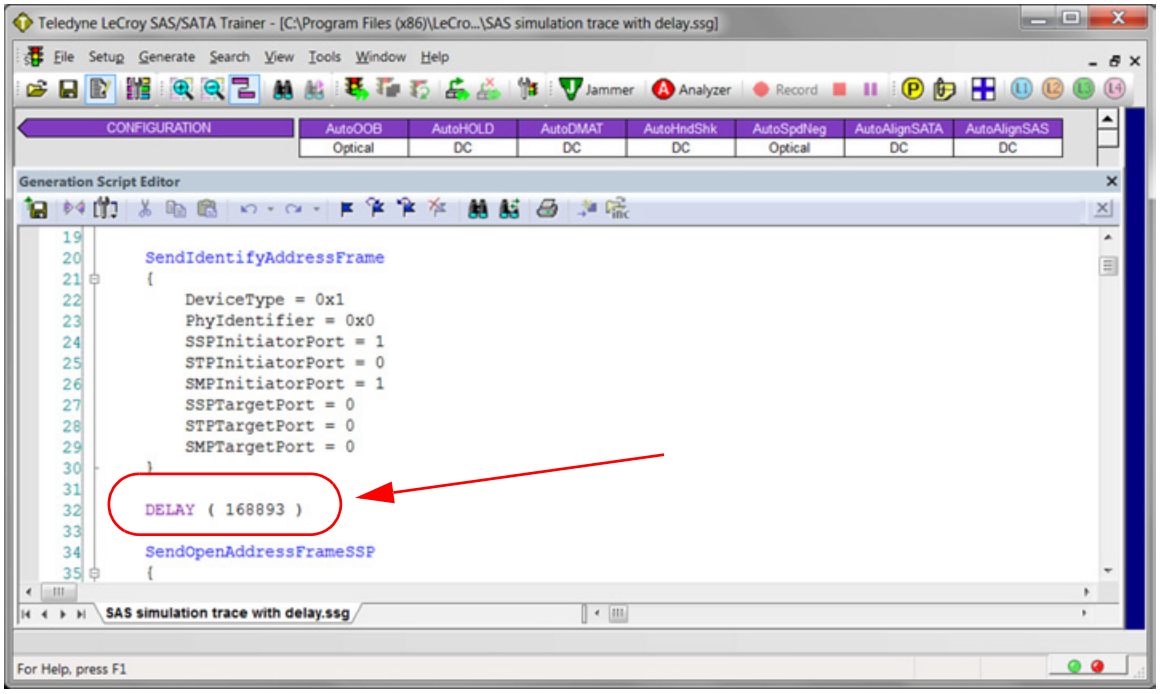


Figure 2.71: SAS Trainer Script with Delays

This option is selected by default but can be unselected by the user and no delays will be added to the Exported Trainer script. See Figure 2.72.

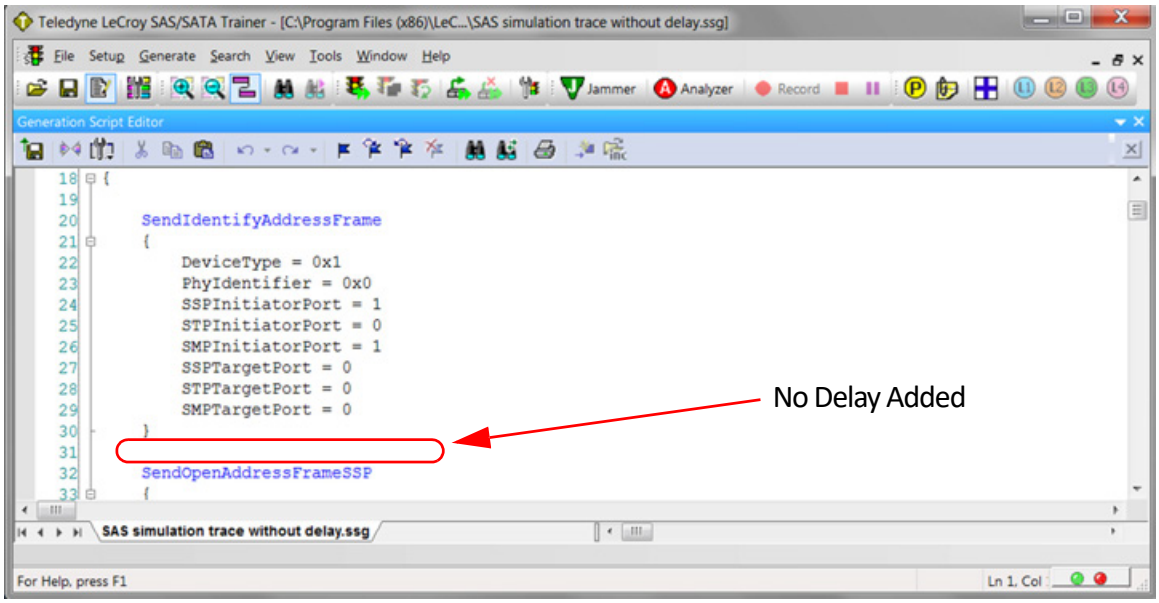


Figure 2.72: Trainer Script with No Added Delay

- You can use **Auto Alignment** (see "The Global Setting "AutoAlign"" on page 516).
- You can select the **Port** (see "Setup Menu" on page 504).
- Indicate **Trainer Generation File Name** and click **Export** to export the trainer generation file.

Note: The resulting Trainer Generation file cannot exceed 2 MB or 1,000,000 packets.

Export Read/Write Command Report

You can create an **Export Read/Write Command Report** as an Excel file (*.csv), using the **Export...** dialog from the File menu.

In **Setup > Preferences > Trace Viewer**, you must first select **Create statistical report read/write page** in order to create this report.

If this choice was not made when the trace was taken, then use **Save As** to save the trace file with this preference. This will append the **Read/Write Command Report** to the trace file, so this action need only be done once. When you re-open the trace file, you should be able to export the report as described above.

Export Paired SAS Address Report

If Text View is activated, from the File menu you can save a Paired SAS Address Report as an Excel file, using the Export Paired SAS Address Report dialog.

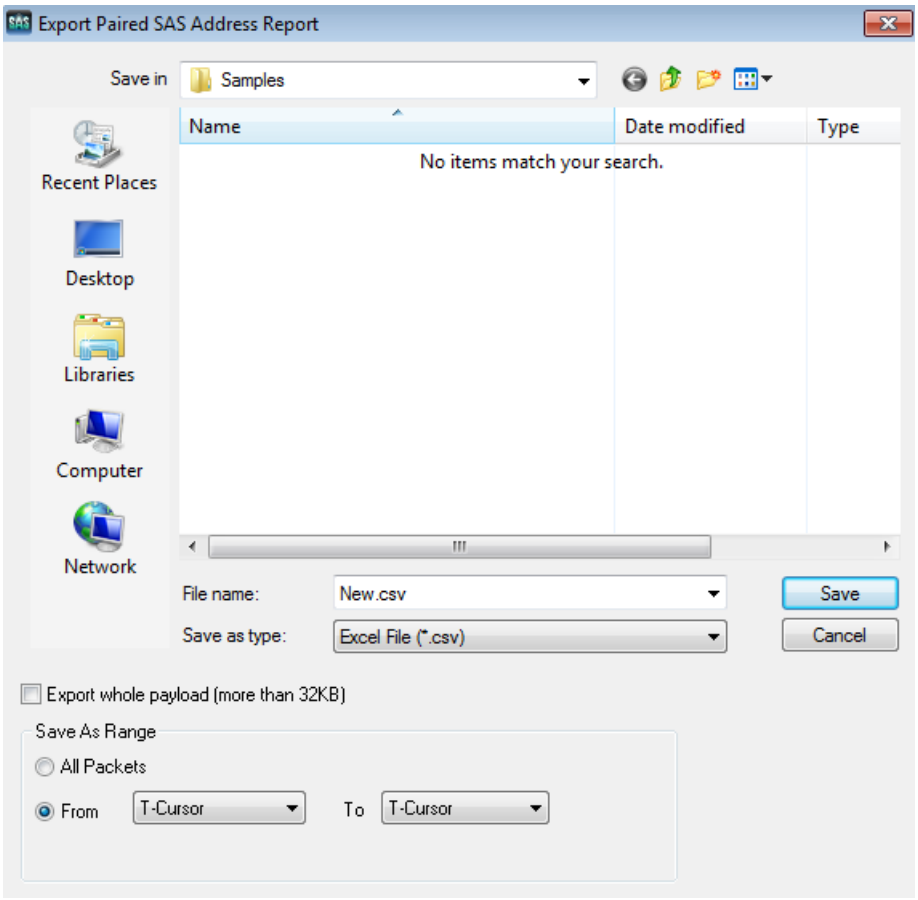


Figure 2.73: Export Paired SAS Address Report Dialog.

- Check the box **Export the whole payload (more than 32KB)** to export the whole payload (more than 32KB).
- You can limit the data range of the saved file. You can save:
  - All Packets
  - Range between selected cursors

You can view expanded traffic (particularly during discovery) in a spreadsheet format. You can use column headers with SAS Address Pairs. For example, instead of I1, T1, I2, T2, and so on, the columns are Source/Destination SAS Address pairs, such as S1:SEP or S2:EXP 0.

2.5.7 Trace Properties

Select **File > Trace Properties** to see the properties of the trace. For more information refer to "Trace Properties" on page 235.

2.5.8 Edit Comment

You can write comments and edit them for a trace for future use. Select **File > Edit Comment** to view the edit window. Key in the comments and close the window.

2.6 Projects

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

New Default Project

To start a New project, select **File > New** on the main menu bar and choose Protocol Analyzer to open a new project with default settings that you can modify (see "Main Window" on page 59).

Last Project

Clicking the Green button  opens the last project run, so you can modify it.

2.6.1 Project File Types

Projects have the following file types:

*.asl	Decoding script file (in the Examples folder "User Define Decoding Script" subfolder)
*.cfg	Display Configuration file (in the System folder "Config" subfolder)
*.dat	DataBlock file (in the System folder "DataBlock" subfolder)
*.sac	SAS Protocol Analyzer/Capture Project/Viewer file (in the Examples folder "EasyCaptr", "AdvanceCaptr", or "Exerciser" subfolders)
*.saf	Device Identifier file
*.scs	SAS Sample file (in the SAS Examples folder "Sample" subfolder)
*.sde	Device Emulator file (in the System folder "Compliance" subfolder)
*.sfl	Filter configuration file
*.spg	Single-role Pattern Generator file (in the Examples folder SAS "PatternGenerator\Single role (spg files)" subfolder and SATA "PatternGenerator\Single Role" subfolder). Single role means the file is for a Device or Host.
*.ssh	SAS Search configuration File
*.stc	SATA Protocol Analyzer/Capture Project/Viewer file (in the Examples folder "EasyCaptr", "AdvanceCaptr", or "Exerciser" subfolders)
*.std	Target Emulator file (in the Examples folder "Target Emulator" subfolder)
*.sts	SATA Sample file (in the SATA Examples folder "Sample" subfolder)
*.tsh	SATA Search configuration file
*.wss	SAS Workspace file (in the SAS System folder "Predefined\Workspace" subfolder)
*.wst	SATA Workspace file (in the SATA System folder "PreDefined\Workspace" subfolder)

2.6.2 Example Projects

The Analyzer includes example projects that you can use to perform an immediate analysis without any setup.

The Analyzer system software has a pre-defined folder (directory) structure for storing all files. All example files are in the Examples folder under the Sierra M6-2 folder.

It is strongly recommended that you open some example files to see types of projects that you can create.

2.6.3 Run an Example Analysis Project

To run an example project:

1. Select **File > Open**.
2. Locate example analysis projects by looking in the Examples folder. Examples are available for AdvanceCaptr, EasyCaptr, Exerciser, PatternGenerator, Samples, Target Emulator, and User Define Decoding Script.
3. In the EasyCaptr folder, choose an example ***.sac** file and click **Open** to display the example project dialog.

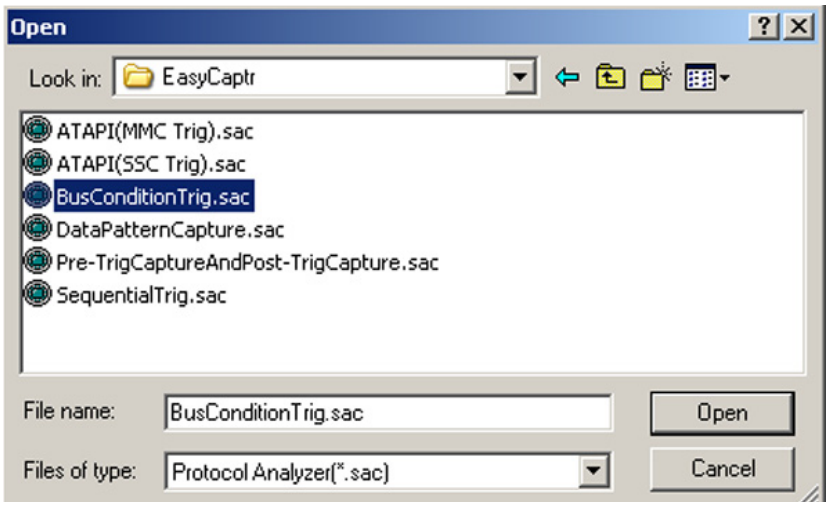


Figure 2.74: File Open Dialog

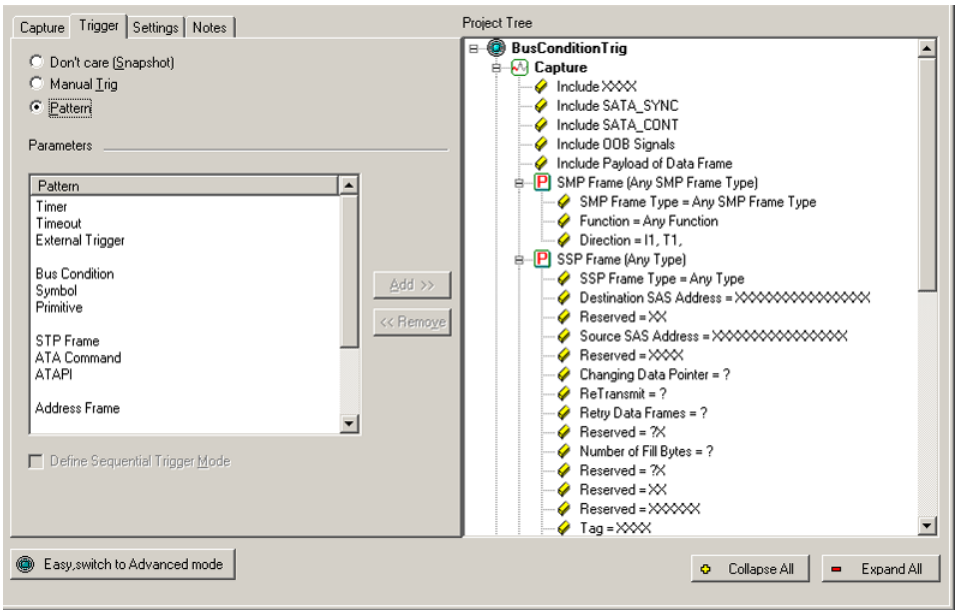


Figure 2.75: SAS: Sample Protocol Analysis Project

SAS vs. SATA: For Pattern Parameters, SATA Dialog adds FIS, FIS Pattern, and ATA Command Pattern and does not have STP Frame, SSP Frame, SMP Frame, and Address Frame.

4. Click the **Record** button to execute the pre-defined example.
5. After the project runs, you see an analyzer trace capture display similar to the one shown in (Figure 2.76 on page 78).

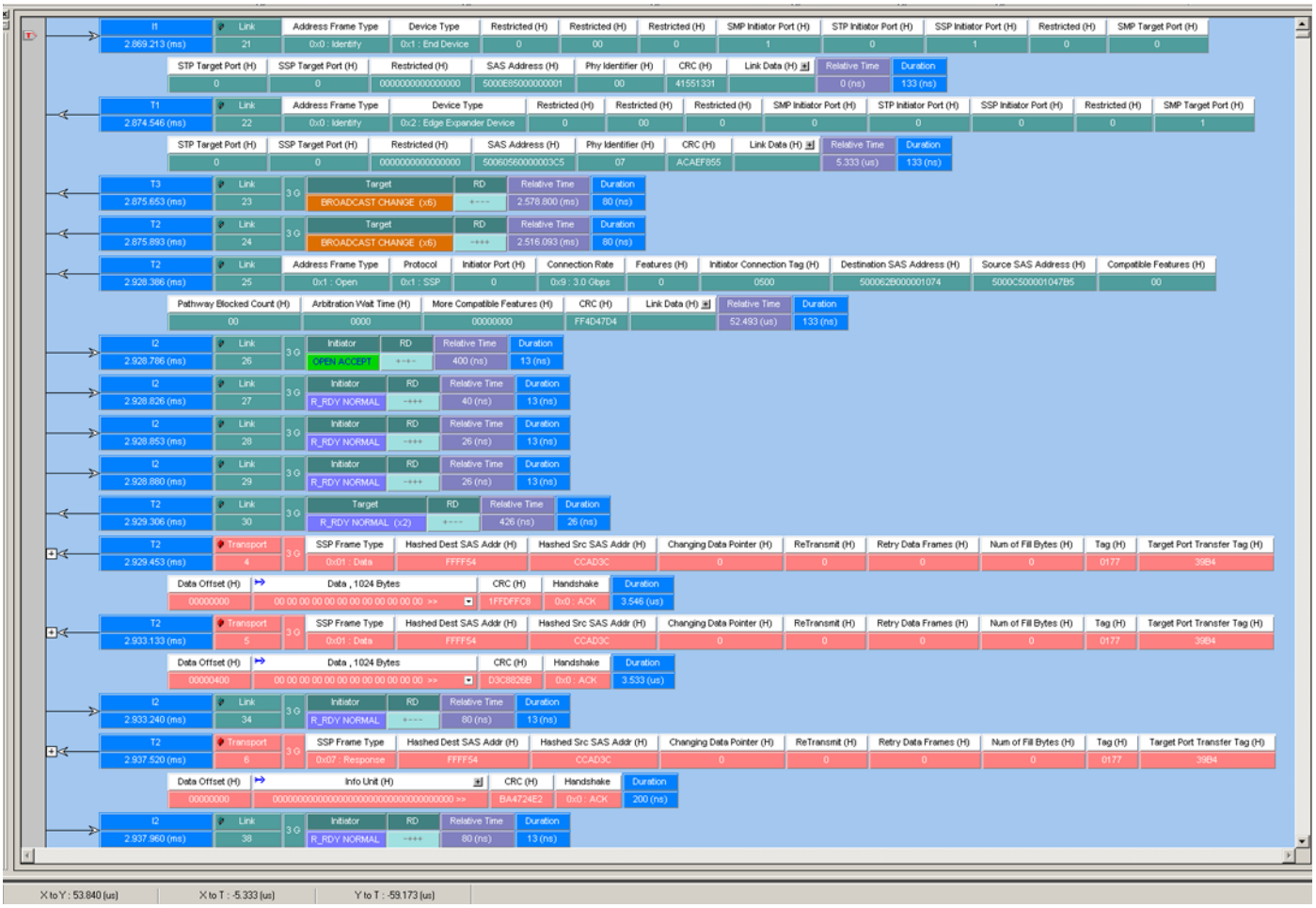


Figure 2.76: SAS: Analyzer Trace Capture Display

For details about the results display, see “Display Manipulation” on page 233 and see “Display Configuration” on page 364.

2.6.4 Patterns and Data Capture Setup

You can refine data capture by choosing **Pattern** and then selecting specific patterns for capture. Additionally, you can define a different set of patterns to capture after trigger.

To define specific patterns for capture, click the **Pattern** button to display the Capture tab for Pattern (see Figure 2.77 on page 79).

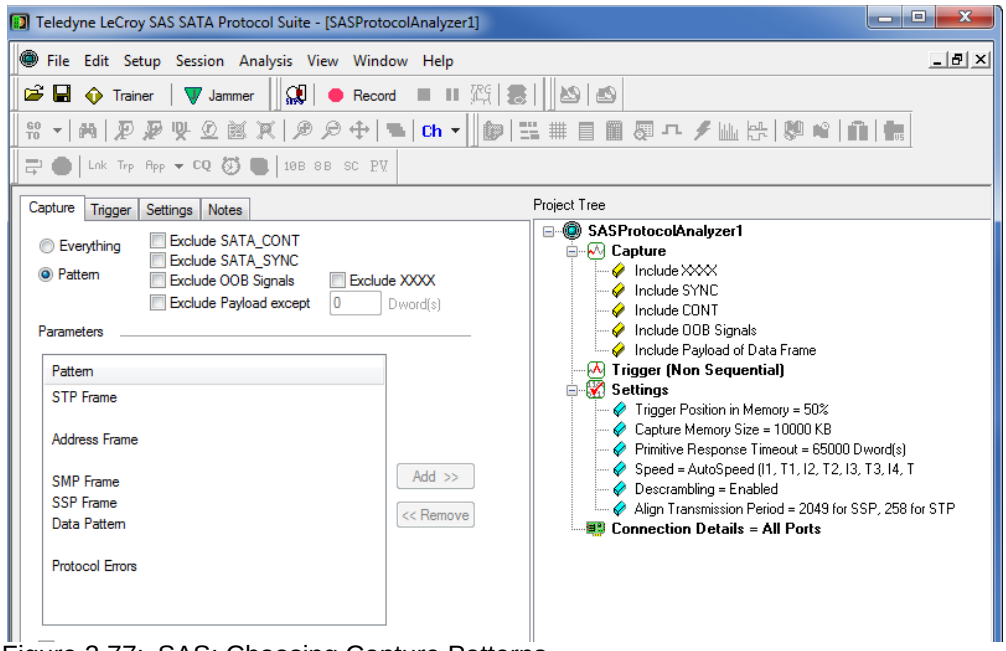


Figure 2.77: SAS: Choosing Capture Patterns

SAS vs. SATA: SATA Dialog replaces "Exclude SATA_CONT" with "Exclude CONT" and "Exclude SATA_SYNC" with "Exclude SYNC".

SAS: The SAS Parameters window displays the following pattern capture categories:

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

SATA: The SATA Parameters window displays the following pattern capture categories:

- FIS
- FIS Pattern
- Data Pattern
- Protocol Errors

2.6.5 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 opens selection dialogs for each of the categories displaying all of the parameters for that category. All patterns added appear in the Project Tree.

2.6.6 Exclude Patterns

Check this box to allow for the capture of everything except the patterns that have been added to the Project Tree.

When you check this box, the Primitive category appears in the Parameter window, and the window enables the Exclude Idle checkbox.

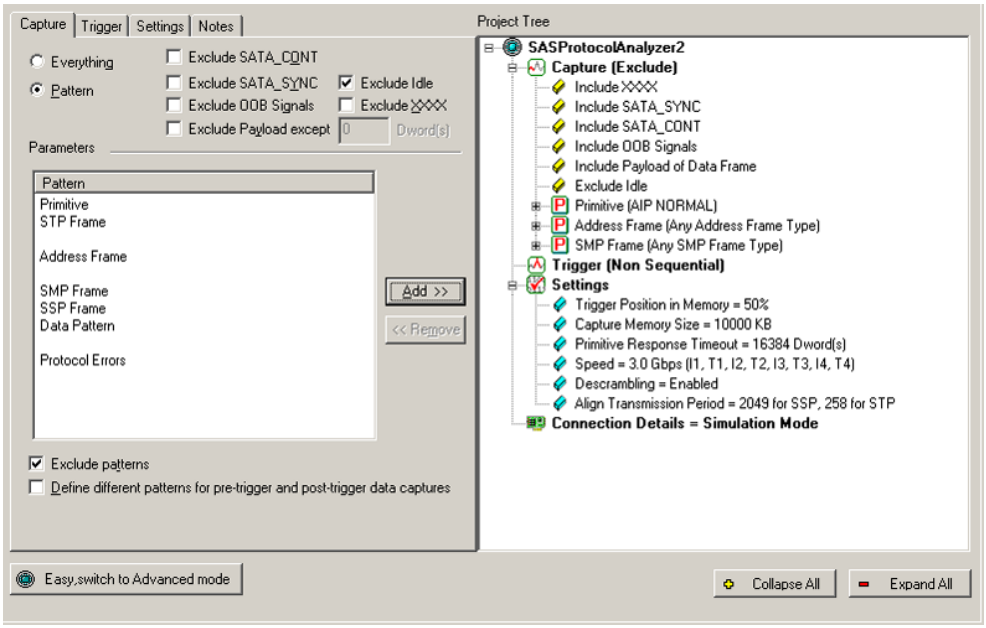


Figure 2.78: SAS: Exclude Patterns Checked

SAS vs. SATA: SATA Dialog replaces “Exclude SATA_CONT” with “Exclude CONT” and “Exclude SATA_SYNC” with “Exclude SYNC”. SATA Dialog has “ Exclude Dev Slp Packets”. SATA Dialog has different Pattern Parameters (see “Patterns and Data Capture Setup” on page 78).

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

2.6.7 Pre and Post Trigger Data Capture

You can 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 selection and setup procedure is the same for both Pre-Trigger capture and Post-Trigger capture.

Check **Define different patterns for pre-trigger and post-trigger data capture** to enable the Pre-Trigger Capture and Post-Trigger Capture tabs (instead of only the Capture tab). See the following figure.

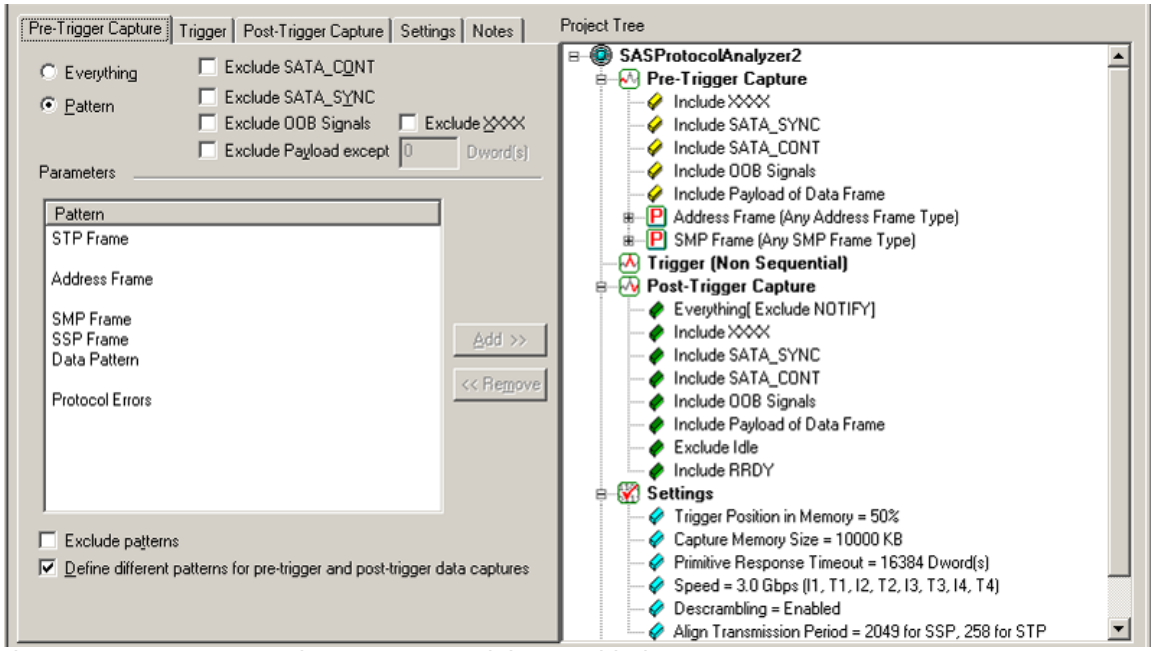


Figure 2.79: SAS: Post-trigger Capture Dialog Enabled

SAS vs. SATA: SATA Dialog replaces “Exclude SATA_CONT” with “Exclude CONT” and “Exclude SATA_SYNC” with “Exclude SYNC”. SATA Dialog has different Pattern Parameters (see “Patterns and Data Capture Setup” on page 78).

2.6.8 Defining Patterns

To select an item for capture, either highlight the category and click the **Add>>** button, or double-click the category, to open a corresponding definition dialog. You can define patterns for specific ports by checking or unchecking the Port ID (see Figure 2.80 on page 82).

Primitive

Double-click Primitive (available only if you check Exclude Patterns) to open the Primitive selection dialog.

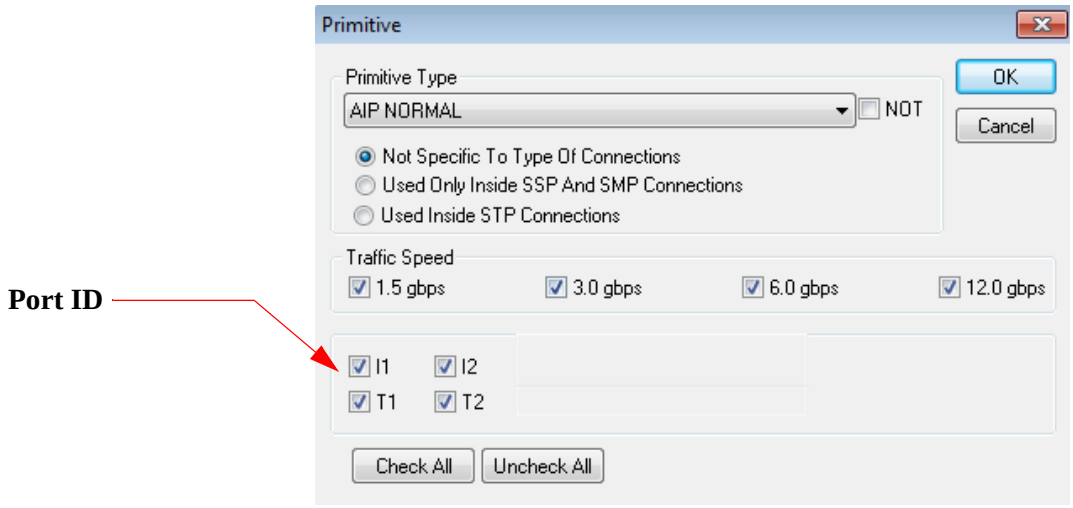


Figure 2.80: SAS: Primitive Dialog

SAS vs. SATA: SATA Dialog has no radio buttons and has different drop-down options.

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

Data Pattern

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

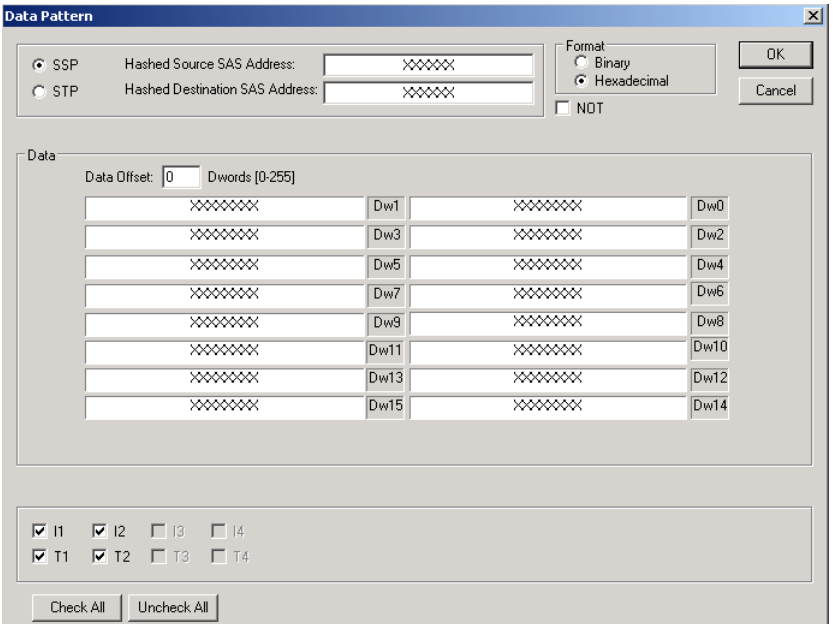


Figure 2.81: SAS: Data Pattern Dialog

SAS vs. SATA: SATA Dialog shows Port at the top and does not show SSP or STP.

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

Note: When entering the data pattern in the "Data" section of this screen, if you are reading the data pattern from a recorded trace, you must reverse the order of the bytes listed for each DWORD entered. For example, if you want to capture (or exclude) "00 01 02 03" (as displayed in the trace), you must enter this pattern as "03 02 01 00".

2.6.9 Protocol Errors Dialog

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

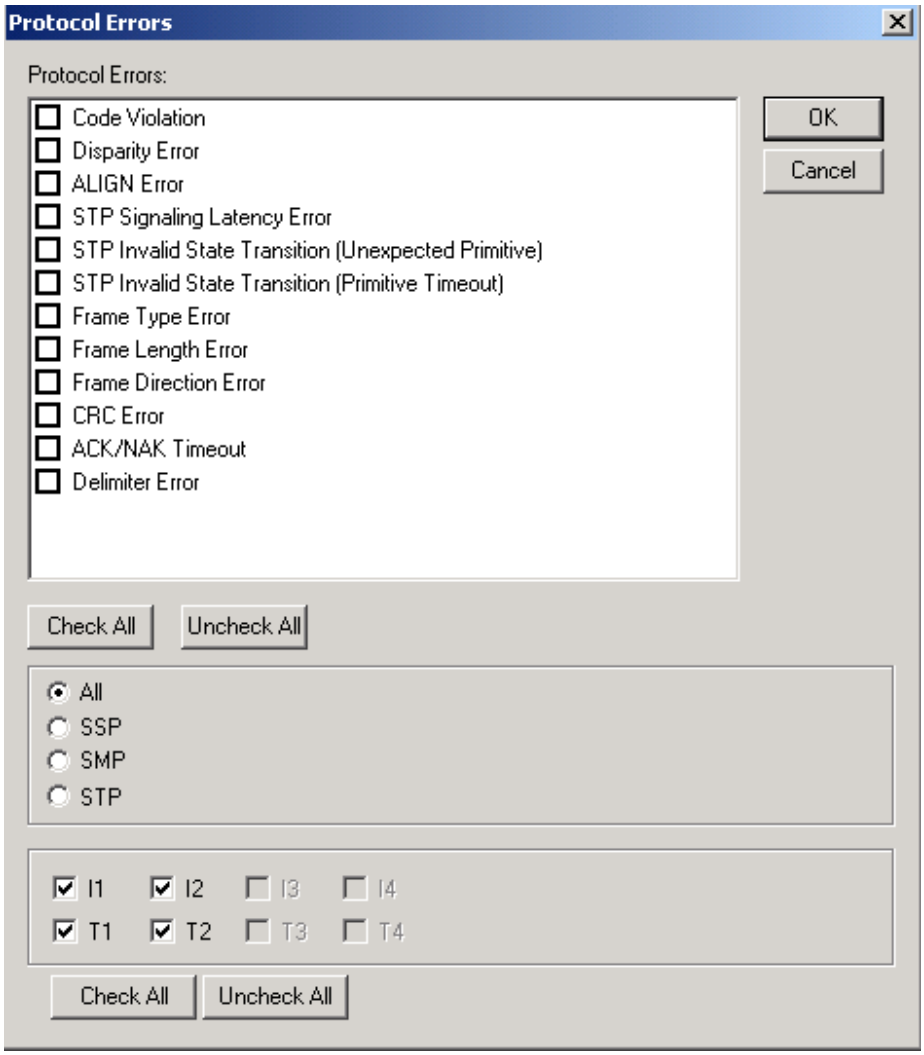


Figure 2.82: SAS: Protocol Errors Dialog

SAS vs. SATA: SATA dialog does not show ACK/NAK Timeout and has FIS signal-latency and state-transition errors, not STP ones. SATA dialog does not show ALL. SSP and SMP radio buttons.

Check protocol error(s) to omit or not capture, then click **OK**.

Protocol Error Descriptions

SMP Response Time Limit: is outside the specification requirements.

Code Violation: Wrong 10b symbol detected.

Disparity Error: Wrong disparity detected.

ALIGN Error: ALIGN primitive frequency is outside the specification requirements.

STP Signaling Latency Error: DWORD difference between HOLD and HOLDA is greater than entered value in the HOLD/HOLDA Response Timeout field.

STP Invalid State Transition (Unexpected Primitive): Second SATA_SOF is encountered before SATA_EOF, and other unexpected primitives.

STP Invalid State Transition (Primitive Timeout): Timeout between two paired primitives is above entered value. 65000 DWORDs is default. For example, it can occur between WTRM and R_OK, or X_RDY and R_RDY. It expects device (or host) to send a response, but response is not received after 65000 DWORDs. You can configure Primitive Response Timeout and HOLD/HOLDA Response Timeout in the Settings tab Analyzer Settings section.



Frame Type Error: Wrong frame type.

Frame Length Error: Reported frame length is different than actual frame length:

Frame Direction Error: Wrong frame direction. For example, Register Device to Host coming from the Host.

CRC Error: CRC error detected.

ACK/NAK Timeout [SAS only]: ACK or NAK primitive missing or encountered unexpectedly.

Delimiter Error: Detects two SOF primitives without an EOF between them. Also detects two EOF primitives without an SOF between them.

Radio Buttons: All, SSP, SMP and STP - By selecting one of these radio boxes you can specify that you want to trigger (or filter) on a specific protocol error on a specified frame type. If you check CRC error and select the SSP radio button, if a CRC error occurs on a SMP frame, the analyzer does not trigger on it.

Hashed Destination SAS Address (SSP trigger only): Specify the destination address for the analyzer to locate specific protocol errors.

Hashed Source SAS Address (SSP trigger only): Specify the source address for the analyzer to locate specific protocol errors.

2.6.10 STP Frame

Double-click STP Frame to open the STP Frame Type dialog (Figure 2.83 on page 85).

.

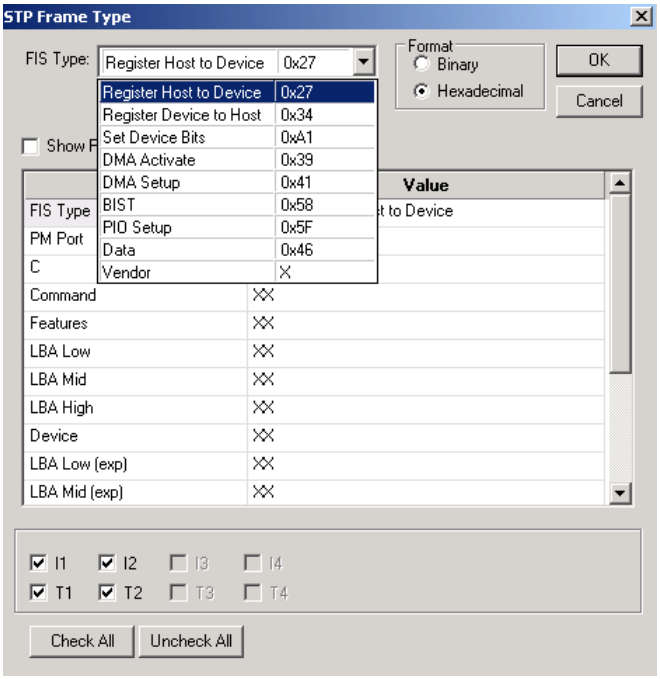


Figure 2.83: FIS Patterns Dialog

Click the down arrow next to the FIS Type drop-down list box, choose a 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

2.6.11 Address Frame (SAS only)

Double-click Address Frame to open the Address Frame Type Pattern dialog (Figure 2.84 on page 86).

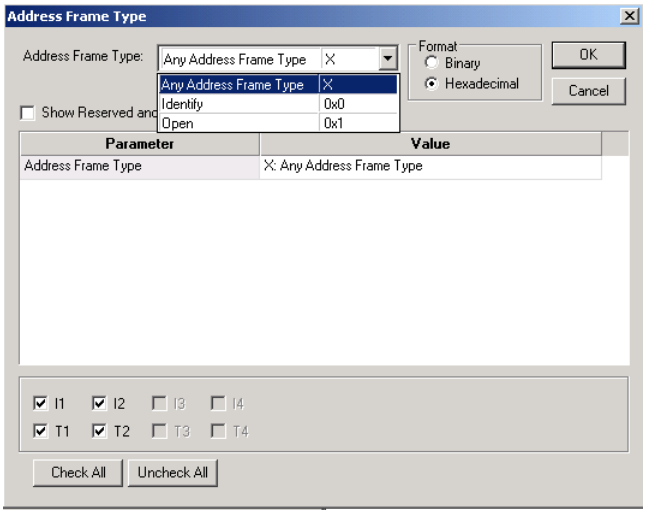


Figure 2.84: SAS: Address Frame Type Pattern Dialog

SAS vs. SATA: Not available in SATA.

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

2.6.12 SMP Frame (SAS only)

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

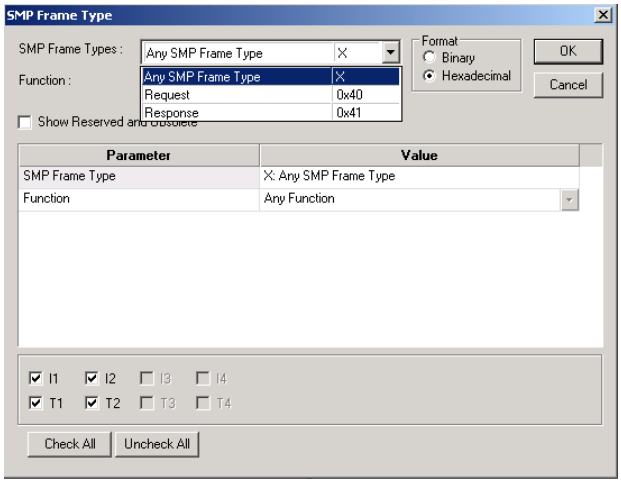


Figure 2.85: SAS: SMP Frame Pattern Dialog

SAS vs. SATA: Not available in SATA.

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.

2.6.13 SSP Frame (SAS only)

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

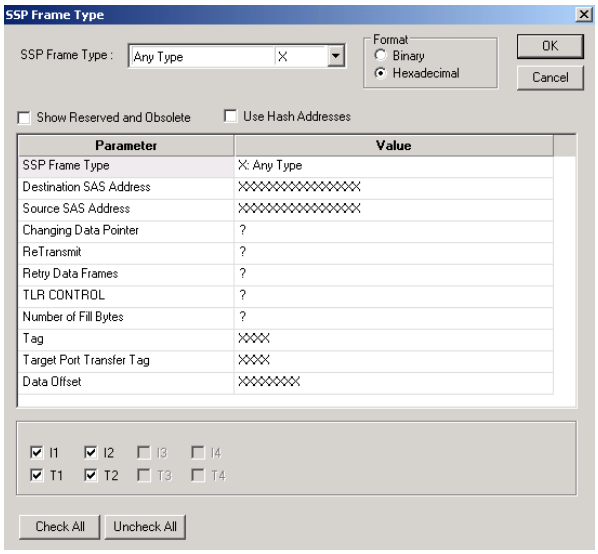


Figure 2.86: SAS: SSP Frame Type Dialog

SAS vs. SATA: Not available in SATA.

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

2.6.14 FIS Type (Frame Information Structure) (SATA only)

Double-click FIS to open the FIS Type selection dialog.

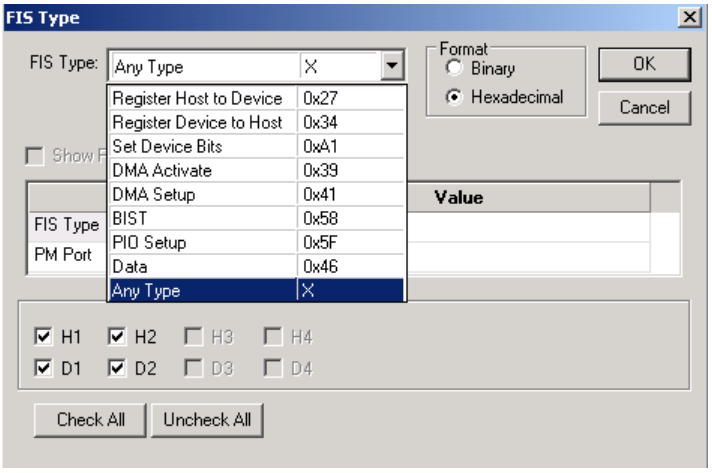


Figure 2.87: SATA: FIS Types Dialog

SAS vs. SATA: Not available in SAS.

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

Available FIS Types

- Register Host to Device
- Register Device to Host
- Set Device Bit
- DMA Activate
- DMA Setup
- BIST
- PIO Setup
- Data
- Any Type

2.6.15 STP Frame Pattern

Double-click STP Pattern to open the STP Pattern selection dialog.

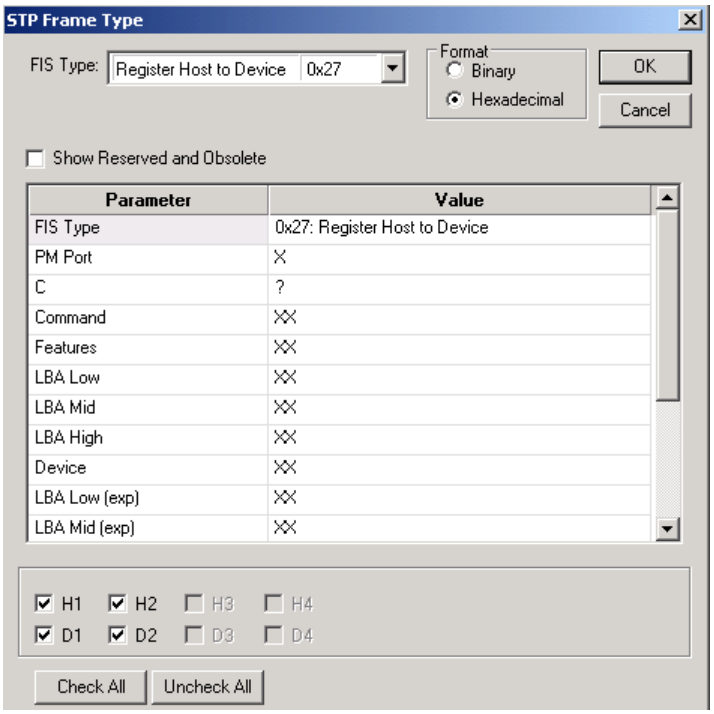


Figure 2.88: SATA: STP Pattern Dialog

The STP Pattern dialog opens with the default FIS Type as **Register Host to device.** To choose another available FIS Type, click the down arrow next to the FIS Type list box.

Choose FIS Type and complete the corresponding dialog.

Register Host to Device

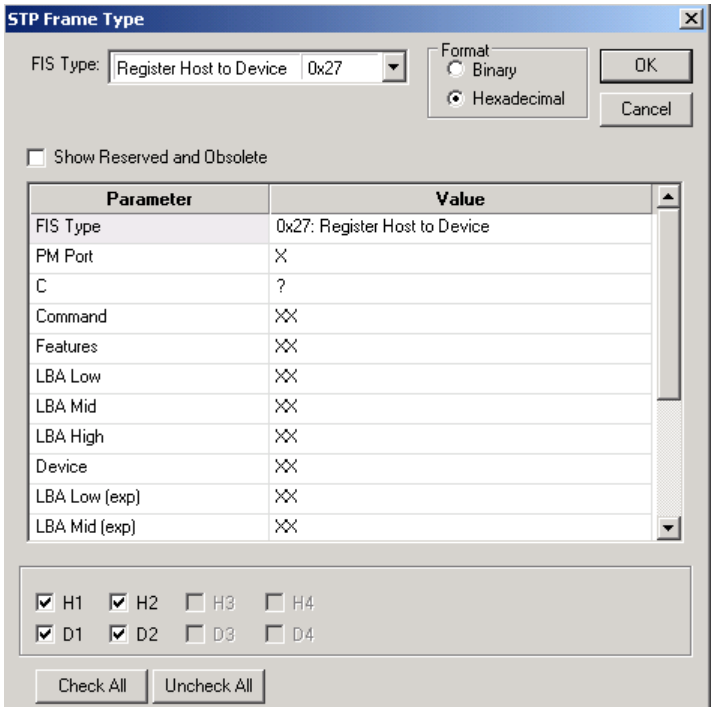


Figure 2.89: Register Host to Device

Register Device to Host

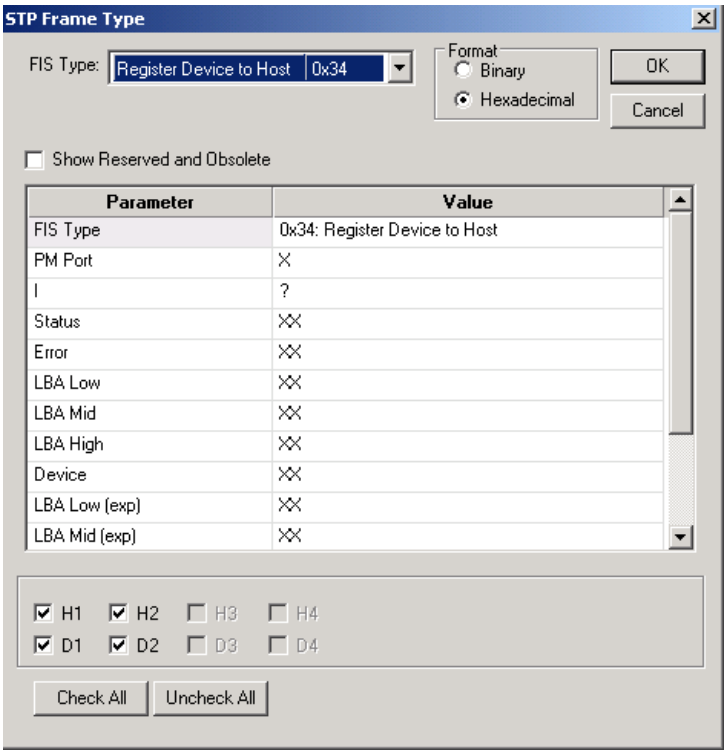


Figure 2.90: Register Device to Host

Set Device Bits

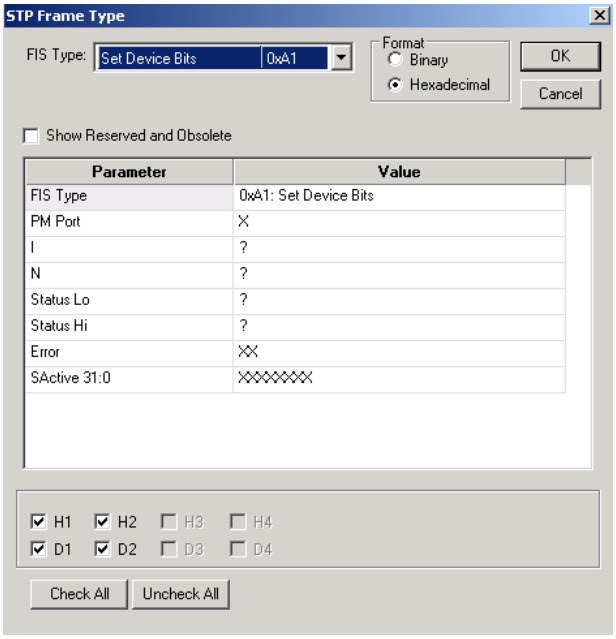


Figure 2.91: Set Device Bits

DMA Activate

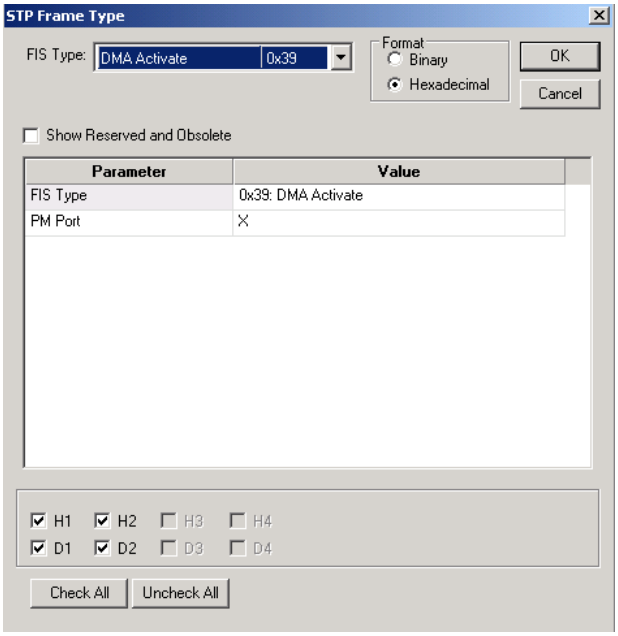


Figure 2.92: DMA Activate

DMA Setup

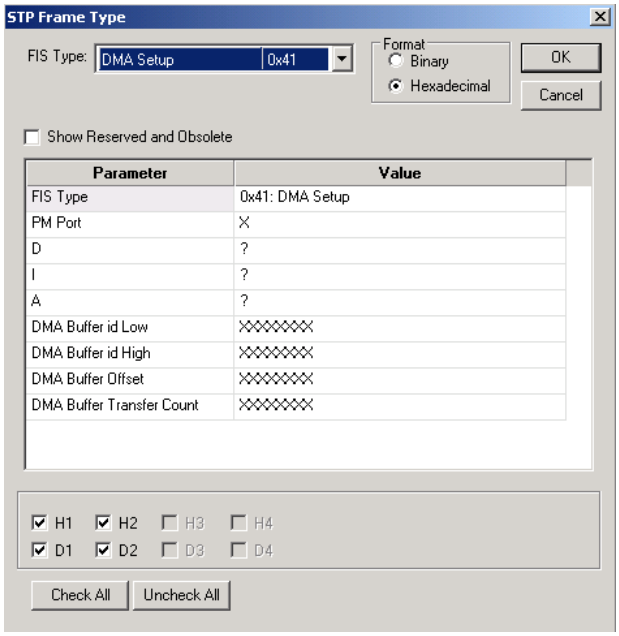


Figure 2.93: DMA Setup

BIST

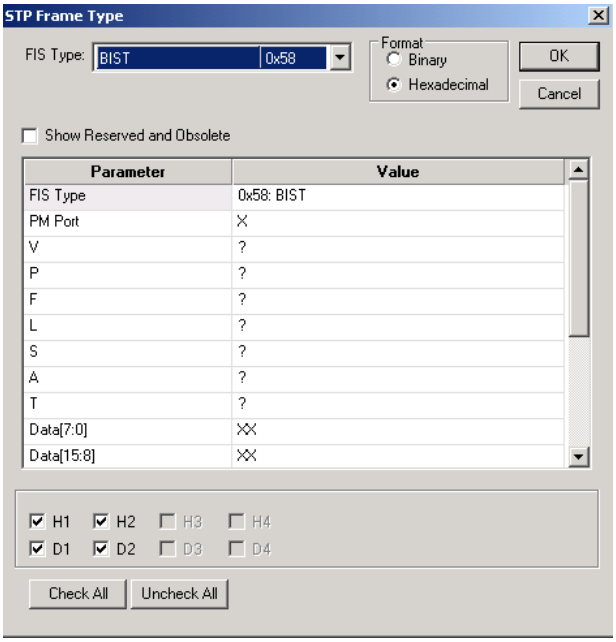


Figure 2.94: BIST

PIO Setup

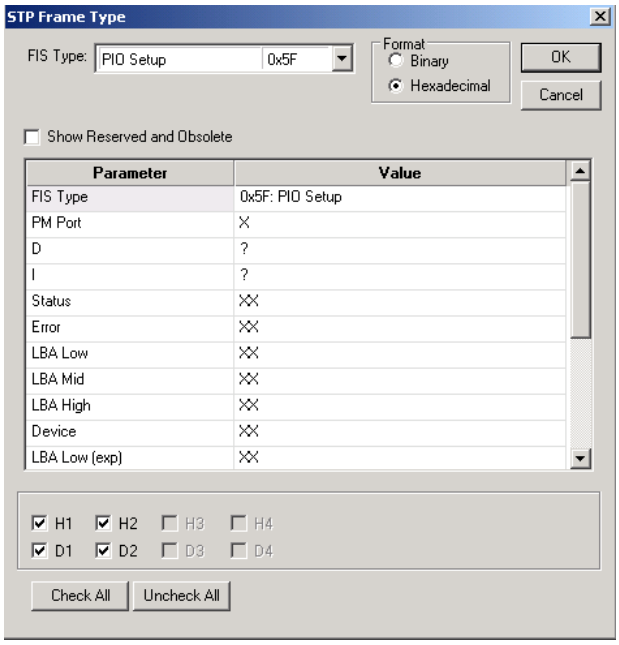


Figure 2.95: PIO Setup

Data

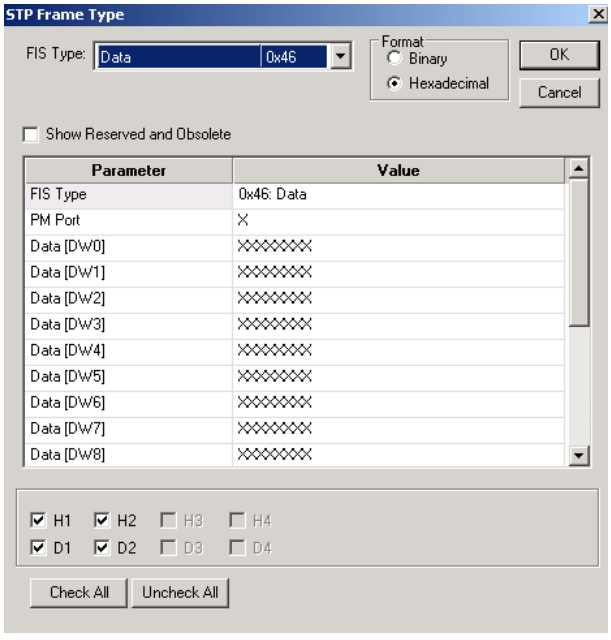


Figure 2.96: Data

Vendor

Vendor is for FIS Pattern.

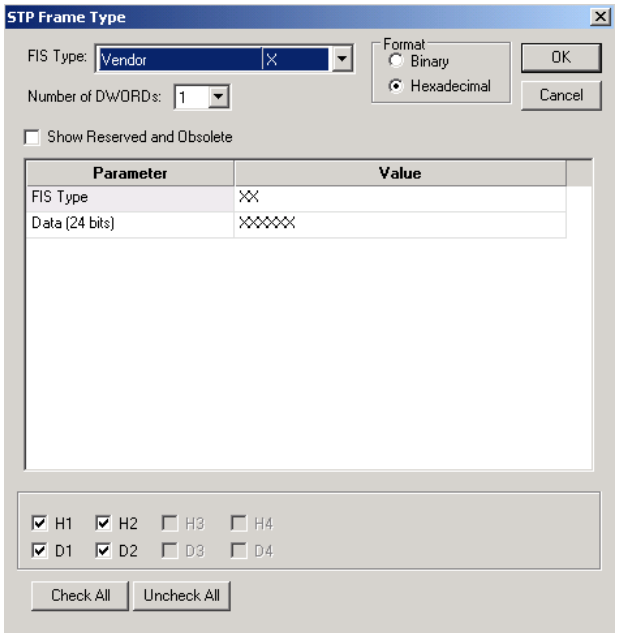


Figure 2.97: Vendor

2.6.16 Trigger Setup

The **Trigger** tab in the analysis project dialog allows you to specify when the analyzer completes a data capture. Three trigger modes are available:

- Don't care (Snapshot) is the default
- Manual Trig
- Pattern

When data capture starts with **Don't care (Snapshot)** selected, the analyzer triggers on the first data pattern on the bus.

Starting a data capture with **Pattern** selected triggers when specific pattern(s) are detected in the captured data stream. The following three ways can 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.

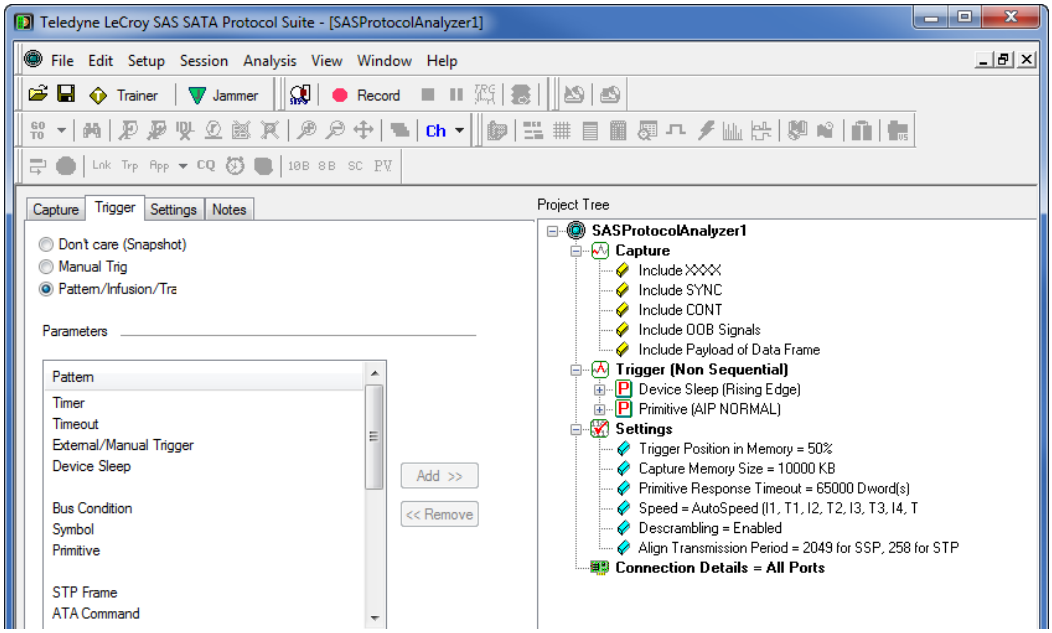


Figure 2.98: Default Trigger Selected

Manual Trigger Mode

To perform a manual trigger, check the **Manual Trig** radio button. In the **Manual Trigger** mode, the analyzer captures bus traffic continually from when you use the Manual Trigger until you click the **Stop Recording** button (on the analyzer toolbar), which triggers the analyzer. Clicking the **Manual Trigger** button on the application toolbar creates a Trigger Event and uploads the trace with the specified trigger position.

Any Trigger in Pattern Mode

In **Pattern** mode, the Analyzer triggers whenever any of the patterns selected for triggering occurs (an OR condition). The procedure for selecting trigger parameters is identical to that for selecting capture parameters. All items selected for triggering appear in the Project Tree.

To define patterns for triggering, check the **Pattern** button in the Trigger dialog (see Figure 2.99 on page 95).

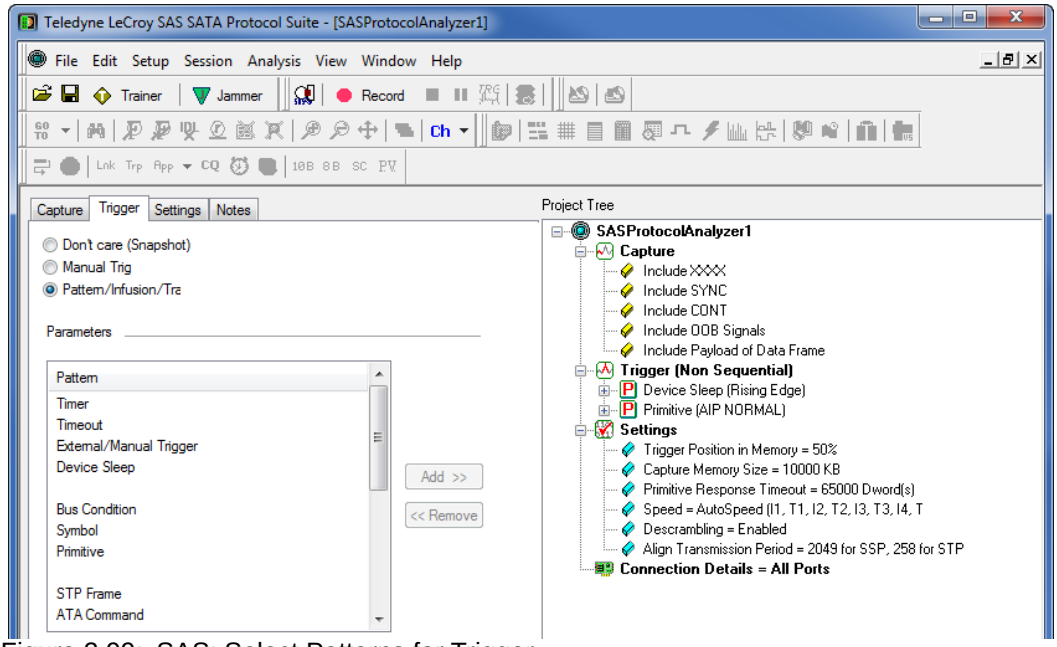


Figure 2.99: SAS: Select Patterns for Trigger

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

- Timer
- Timeout
- External/Manual Trigger
- Device Sleep
- Bus Condition
- Symbol
- Primitive
- STP Frame
- ATA Command
- ATAPI
- Address Frame
- SMP Frame
- SSP Frame
- SCSI Command
- Data Pattern
- Training Sequence
- Protocol Errors

Define Sequential Trigger Mode

This is enabled when more than one pattern is used. It allows for the use of a simple state machine of “pattern A then pattern B”. When checked, the Count field in each pattern’s dialog is enabled (see Figure 2.100 on page 96).

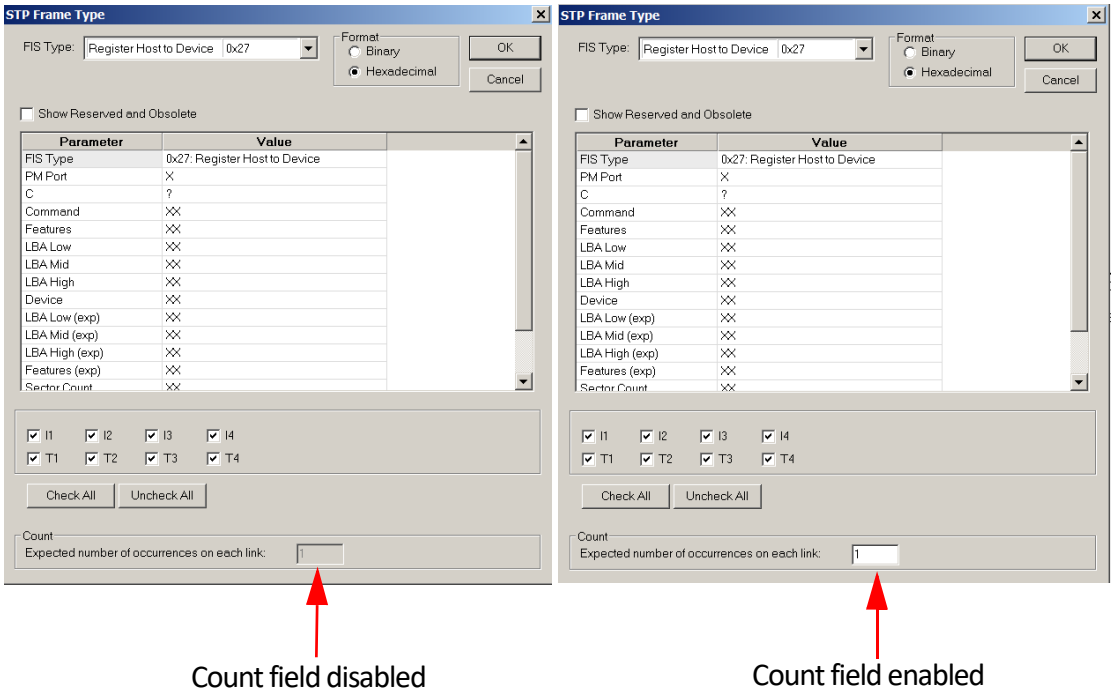


Figure 2.100: Count Field Dialog

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

- Timer
- Timeout
- External/Manual Trigger
- Device Sleep
- Bus Condition
- Symbol
- Primitive
- FIS
- FIS Pattern
- STP Frame
- ATA Command
- ATA Command Pattern
- ATAPI
- Soft Reset
- Data Pattern
- Protocol Errors

Note: In packet view, you can right-click on any frame, select **Add to Trigger**, and add the pattern to **DataPatternCapture** to make it a trigger pattern.

Choosing a Parameter

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

To remove an item, highlight it in the Project Tree, then click the **<<Remove** button.

Triggering on a Timer

Triggering based on a timer means that the trigger is activated when the timer expires. Other triggers can preempt the timed trigger while it is counting down the time. The timer starts when the project s started.

You can set a timer 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 Pattern window to open the Timer dialog.

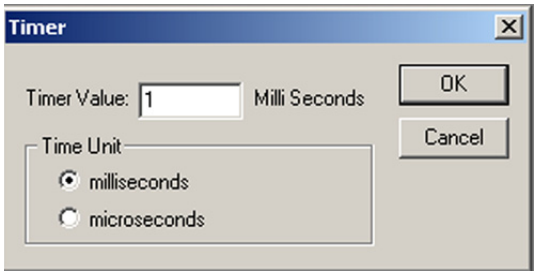


Figure 2.101: Timer Dialog

Check a Time Unit, enter the Timer Value, and click OK.

Timeout

Selecting **Timeout** for the pattern opens the Timeout Pattern dialog.

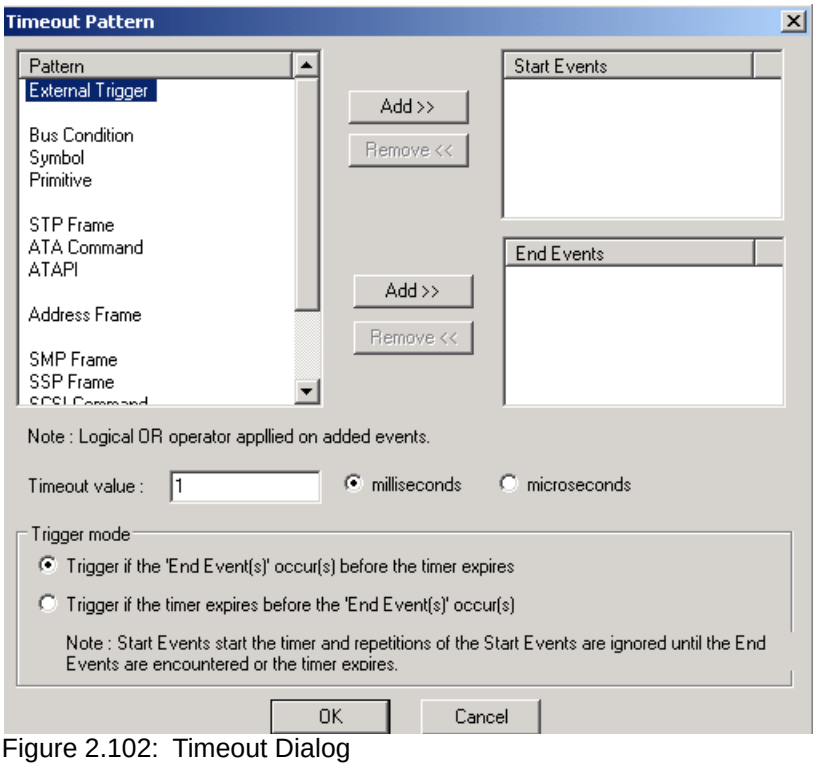


Figure 2.102: Timeout Dialog

"Start Events" starts the timer in Timeout Trigger and "End Events" triggers the analyzer (if first trigger mode is selected) or resets the trigger (if second trigger mode is selected). Repetitions of the Start Events are ignored until the End Event is encountered or the timer expires.

Select a pattern for Start Events or End Events, enter a Timeout value, then select Trigger Mode:

- If End Events occur before timer expires
- If timer expires before End Events

Note: Timeouts can only be configured from the Timeout Pattern dialog. The Timeout Pattern dialog allows configuring other patterns as triggers in combination with timeouts. Other pattern dialogs do not allow configuration of timeouts.

External/Manual Trigger

To set up an external or manual trigger. To set up the trigger, click the **External/Manual Trigger** category.

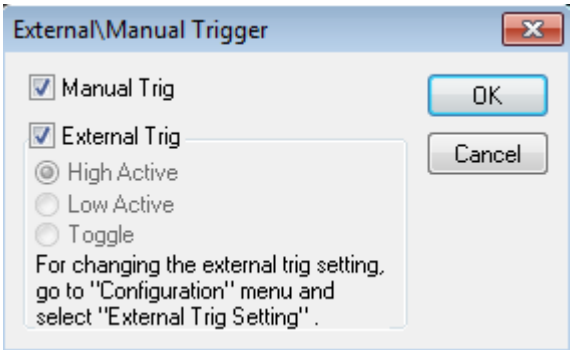


Figure 2.103: External/Manual Trigger Dialog

Device Sleep

To set up Device Sleep click the **Device Sleep** category. Select **Rising Edge** or **Falling Edge**.

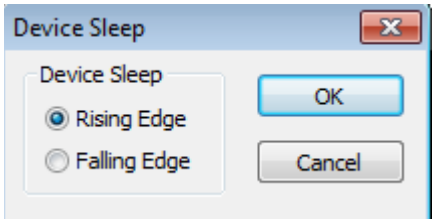


Figure 2.104: Device Sleep Dialog

Bus Condition

Double-click **Bus Condition** in the Pattern window to open the Bus Conditions dialog.

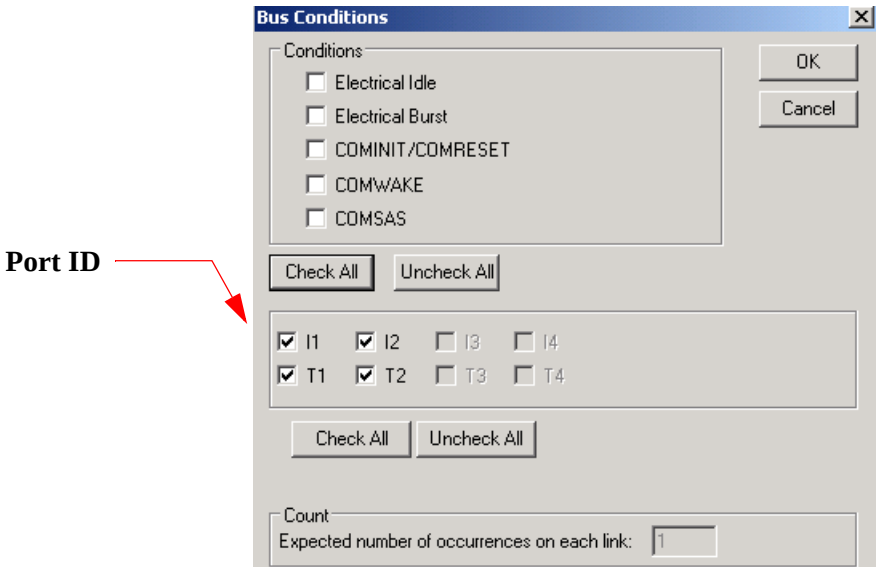


Figure 2.105: SAS: Bus Conditions Dialog

SAS vs. SATA: SATA Dialog separates the COMINIT and COMRESET check boxes and replaces COMWAKE with Host COMWAKE and COMSAS with Device COMWAKE.

Check Conditions on which to trigger, then click **OK**.

Note: You can define triggering for specific ports by checking or unchecking Port IDs.

Symbol

Double-click **Symbol** in the Pattern window to open the Symbol dialog.

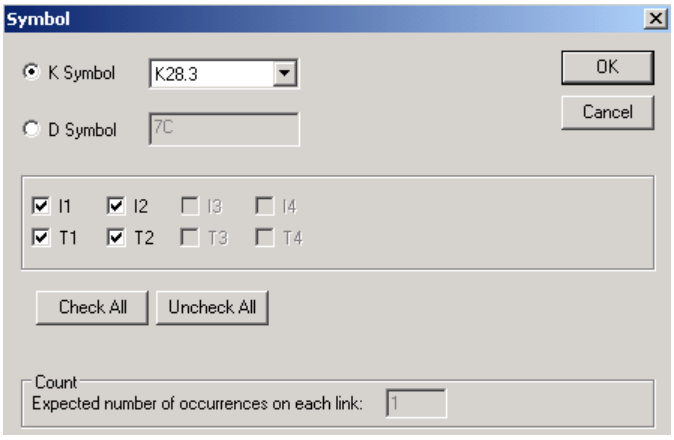


Figure 2.106: Symbol Dialog

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.

To choose a **D symbol**, click the D symbol option button and enter a Hex value.

Primitive

Double-click **Primitive** in the Patterns window of the Trigger dialog to open the Primitive dialog. The radio buttons select a different subset of primitives from an approximate total of 88 that are available. This makes it easier to find the right primitive. The Count field is enabled when the Define Sequential Trigger Mode check-box is selected (see Figure 2.100 on page 96).

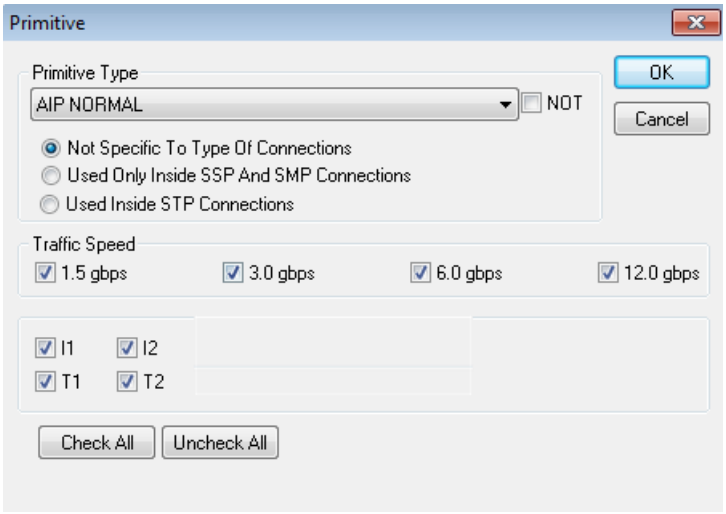


Figure 2.107: SAS: Primitive Dialog

SAS vs. SATA: SATA Dialog has no radio buttons and has different drop-down options.

Click the down arrow next to the Primitive dropdown list, scroll the list to choose a primitive on which to trigger, and click **OK**.

Note: Check the box to the right of the Primitive Type to use the logical NOT.

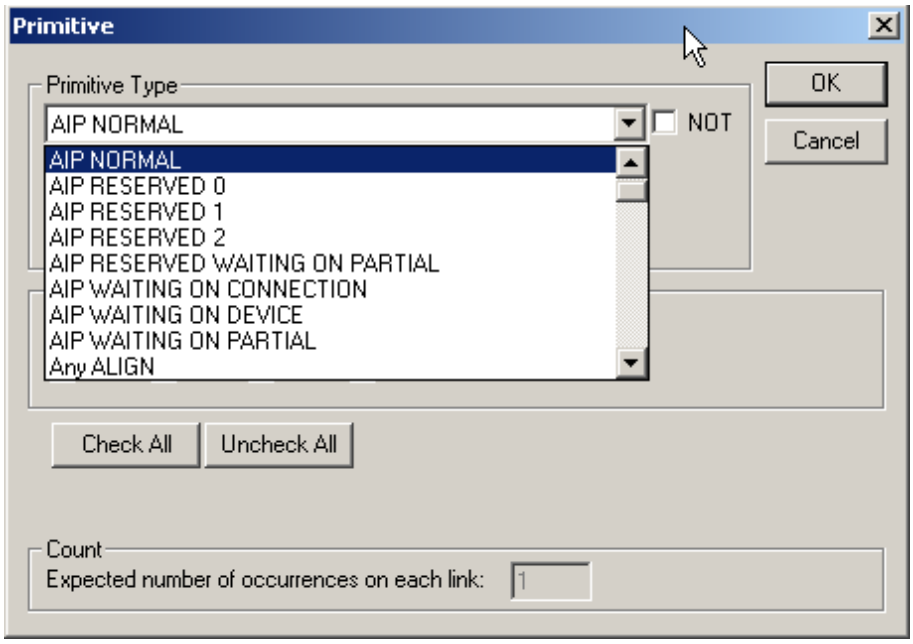


Figure 2.108: SAS: Primitive Selection Choices

SAS vs. SATA: SATA Dialog has different choices.

Primitive Traffic Speed Option (SATA only)

You can change the speed for triggering as well as search by speed for Primitives.

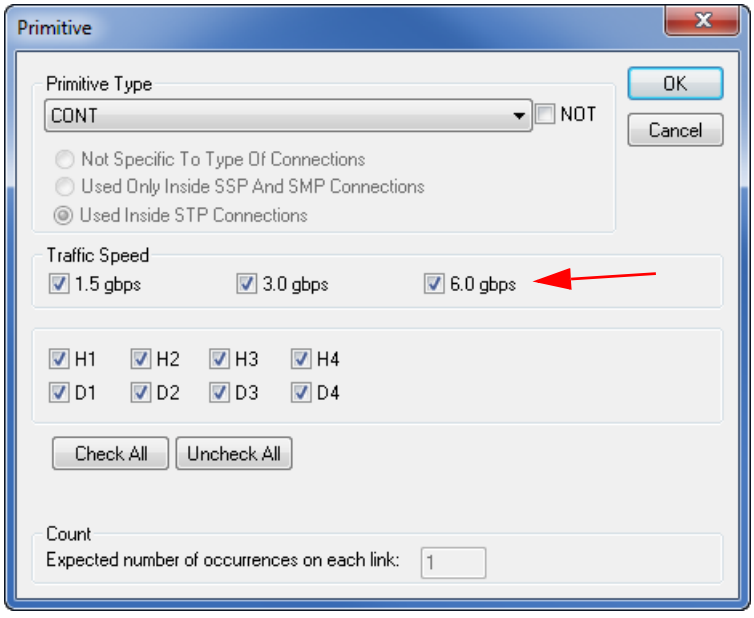


Figure 2.109: Primitive Dialog

ATA Command

Double-click **ATA Command** in the Pattern window to open the ATA Command Pattern dialog.

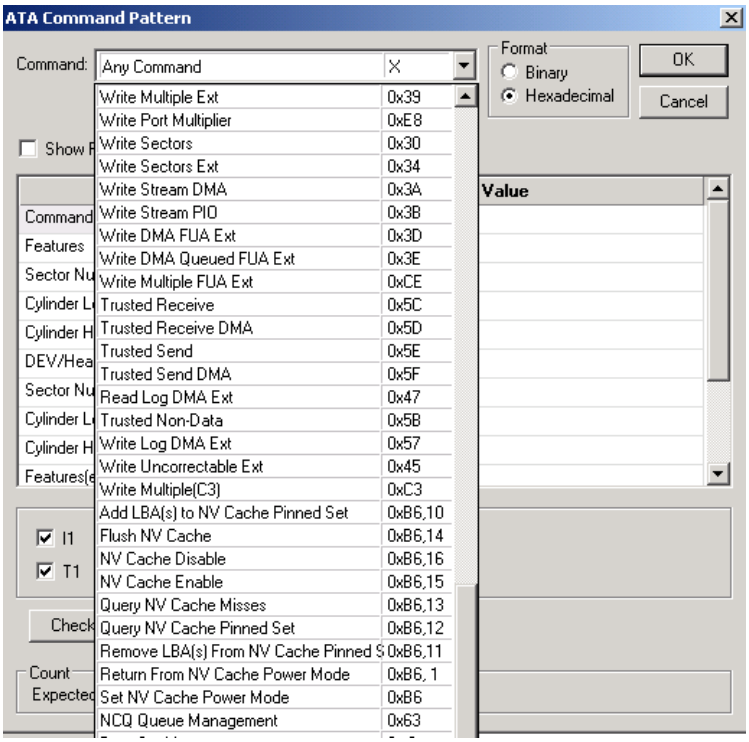


Figure 2.110: SAS: ATA Command Pattern Dialog

SAS vs. SATA: SATA Dialog has different dropdown options.

Choose a Command from the drop-down list and click **OK**.

A powerful triggering choice is **Any Command**, which causes the analyzer to trigger on any ATA command.

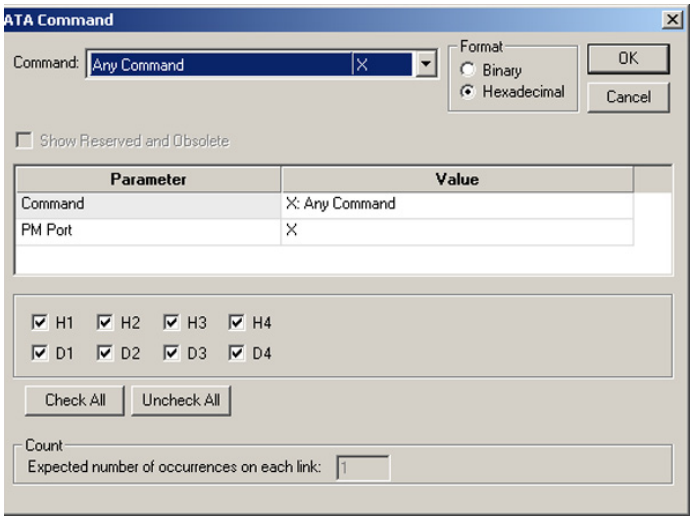


Figure 2.111: SATA: ATA Command Dialog

Choose a Command from the drop-down list and click **OK**.

Note: The command code and feature set are not the only parameters that describe an ATA command. For parameters such as LBA and sector count, use the **ATA Command Pattern** dialog.

ATAPI

Double-click **ATAPI** in the Pattern window to open the ATAPI Pattern dialog.

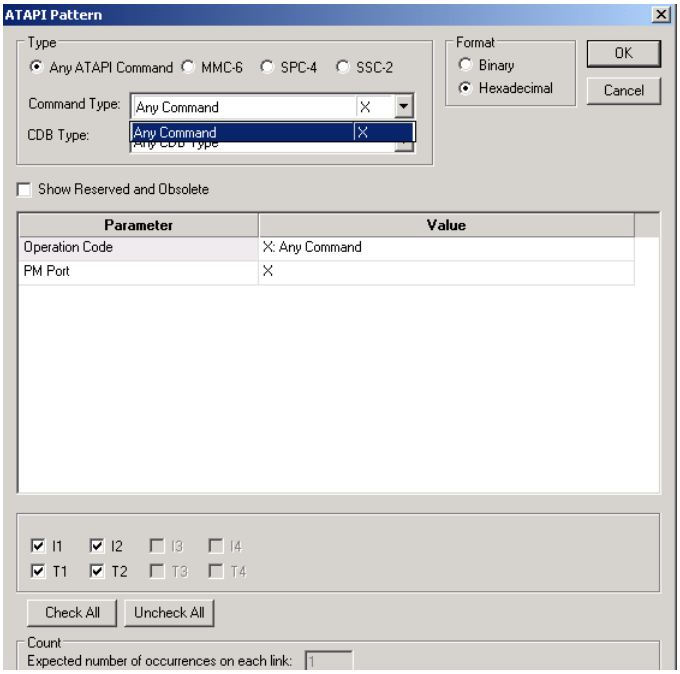


Figure 2.112: SAS: ATAPI Pattern Dialog

SAS vs. SATA: SATA Dialog has different dropdown options.

Choose a CDB from the drop-down list and click **OK**.

Data Pattern

Double-click **Data Pattern** in the Pattern window to open the Data Pattern dialog.

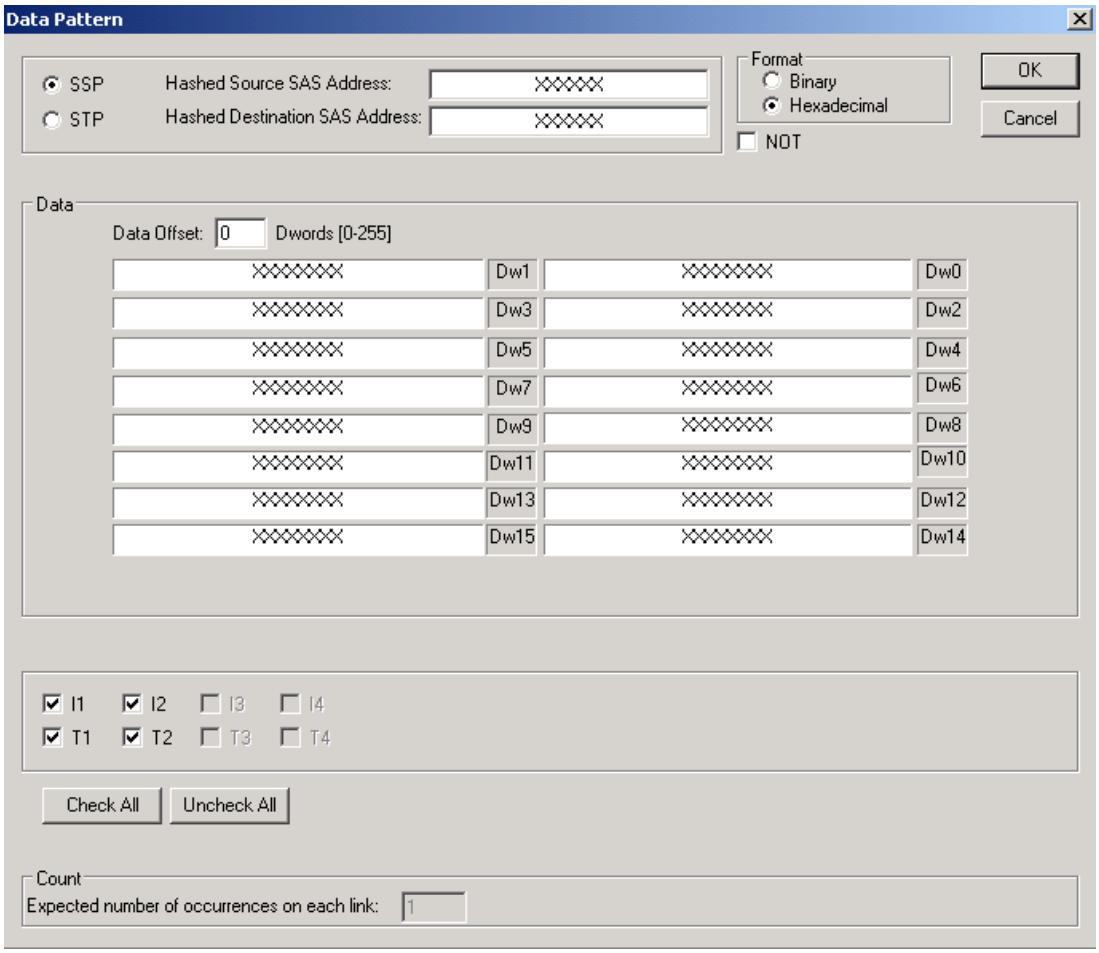


Figure 2.113: SAS: Data Pattern Dialog

SAS vs. SATA: SATA Dialog shows Port at the top and does not show SSP or STP.

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

Note: When entering the data pattern in the "Data" section of this screen, if you are reading the data pattern from a recorded trace, you must reverse the order of the bytes listed for each DWORD entered. For example, if you want to trigger on "00 01 02 03" (as displayed in the trace), you must enter this DWORD pattern as "03 02 01 00".

Training Sequence

Double-click Training Sequence in the Patterns window of the Trigger dialog to open the Training Sequence dialog.

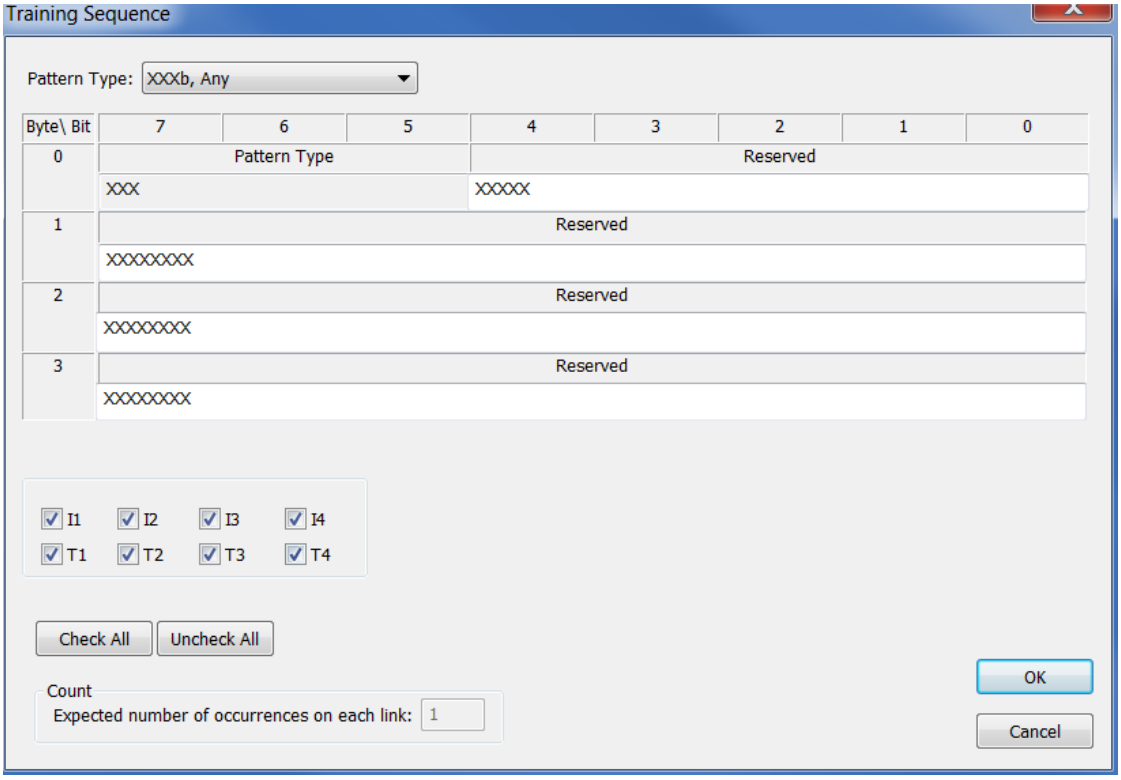


Figure 2.114: SAS: Training Sequence Dialog

SAS vs. SATA: Not available in SATA.

Define the training sequence for triggering and click **OK**.

Protocol Errors

Double-click Protocol Errors in the Pattern window to open the Protocol Errors dialog.

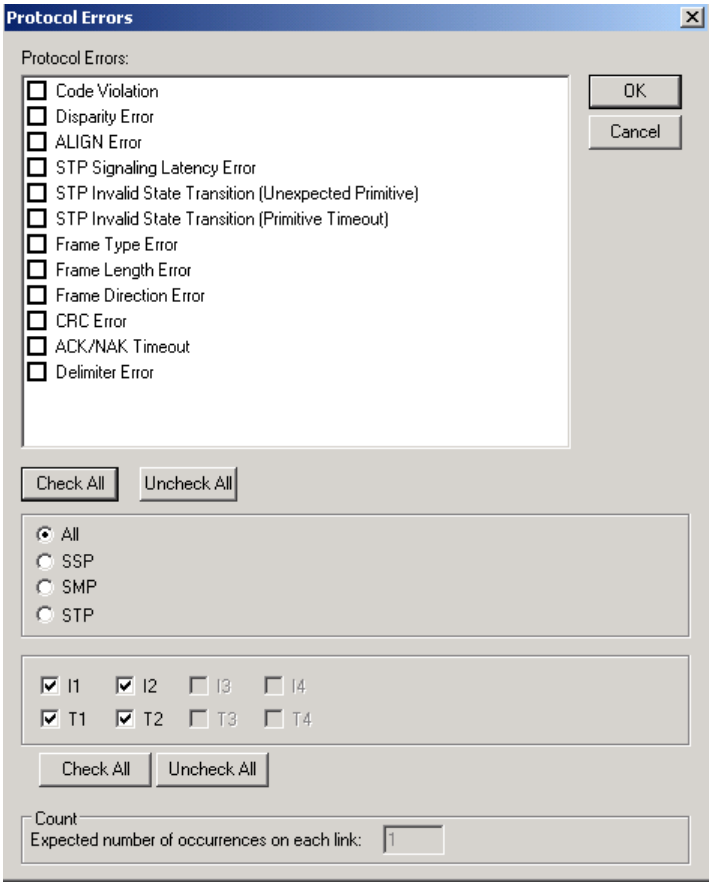


Figure 2.115: SAS: Protocol Errors Dialog

SAS vs. SATA: SATA Dialog shows Port and does not show SSP, SMP, or STP radio buttons.

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

STP Frame

Double-click **STP Frame** in the Pattern window to open the FIS Pattern dialog.

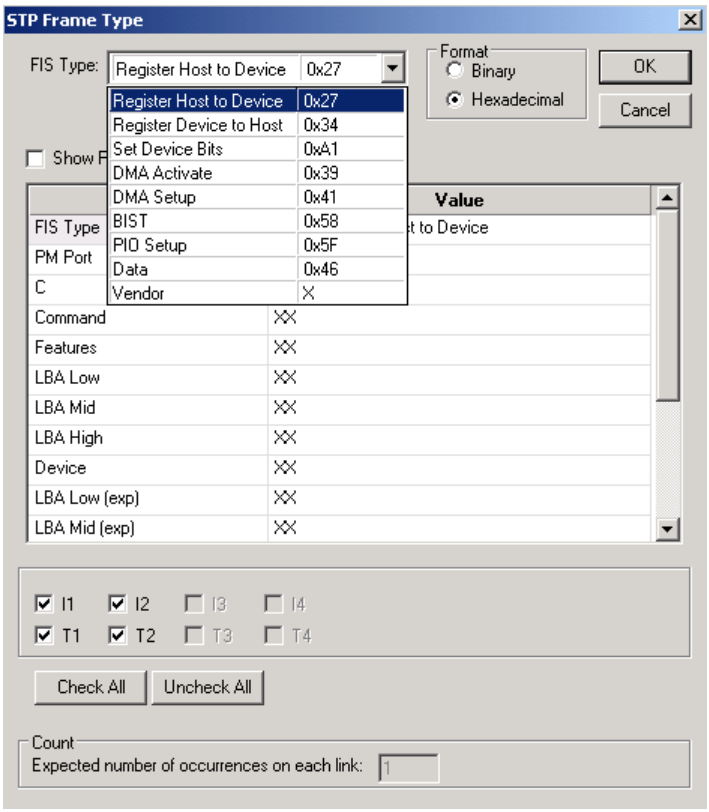


Figure 2.116: SATA: FIS Pattern Dialog

SAS vs. SATA:

Choose a FIS type from the drop-down list and click **OK**.

Address Frame (SAS only)

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

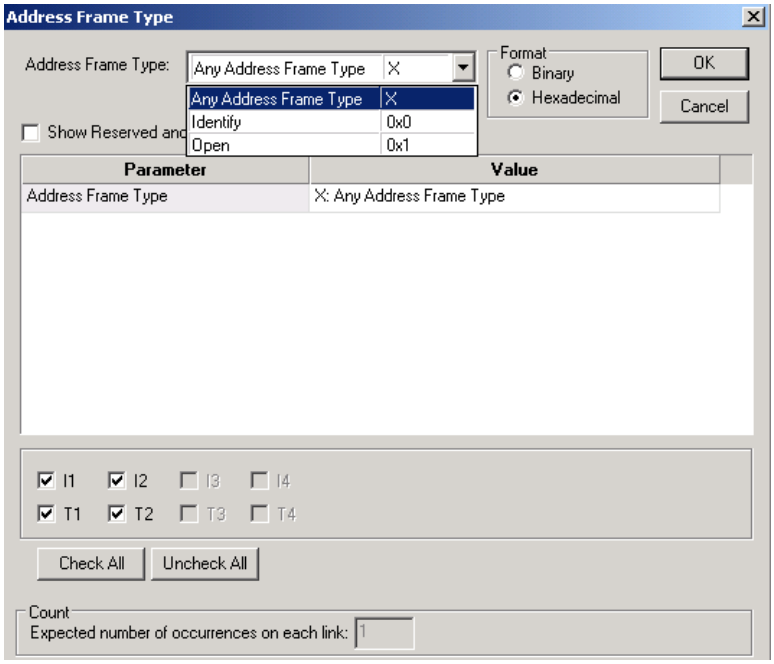


Figure 2.117: SAS: Address Frame Type Pattern Dialog

SAS vs. SATA: Not available in SATA.

Choose an Address Frame Type from the drop-down list and click **OK**.

SMP Frame (SAS only)

Double-click SMP Frame in the Pattern window to open the SMP Frame Pattern dialog.

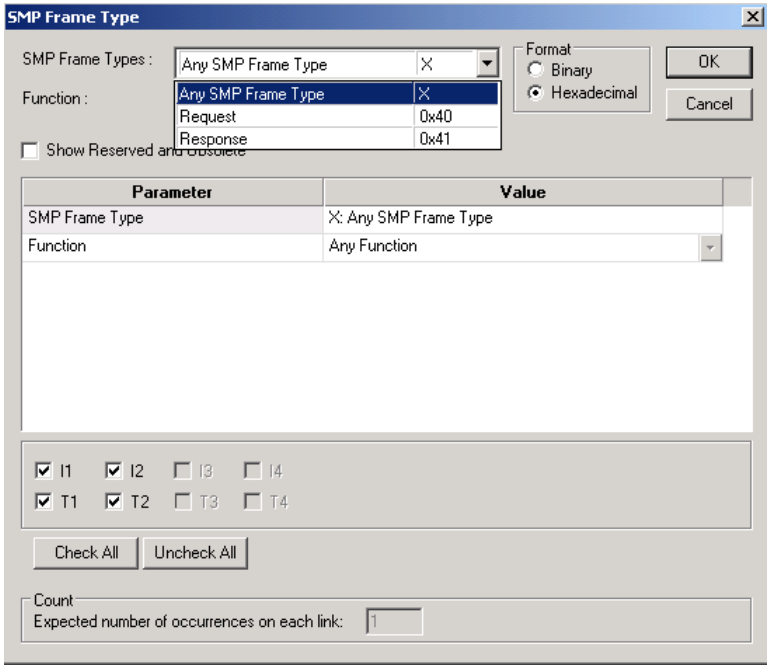


Figure 2.118: SAS: SMP Frame Pattern Dialog

SAS vs. SATA: Not available in SATA.

Choose a SMP Frame Type and Function from the drop-down list and click **OK**.

SSP Frame (SAS only)

Double-click SSP Frame in the Pattern window to open the SSP Frame Type dialog.

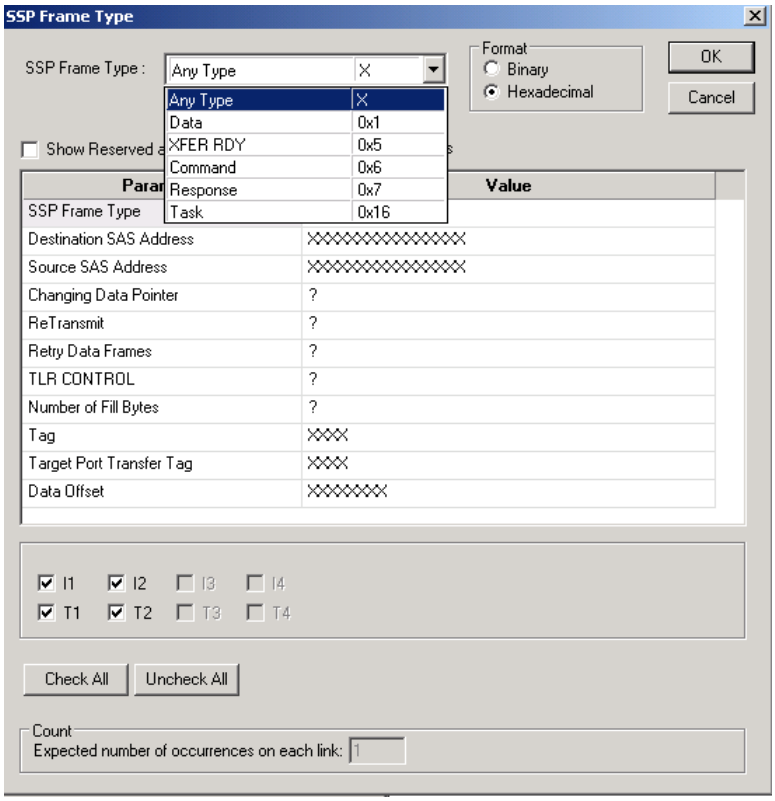


Figure 2.119: SAS: SMP Frame Type Dialog

SAS vs. SATA: Not available in SATA.

Choose a SSP Frame Type from the drop-down list and click **OK**.

SCSI Command (SAS only)

Double-click SCSI Command in the Pattern window to open the SCSI Command Pattern dialog.

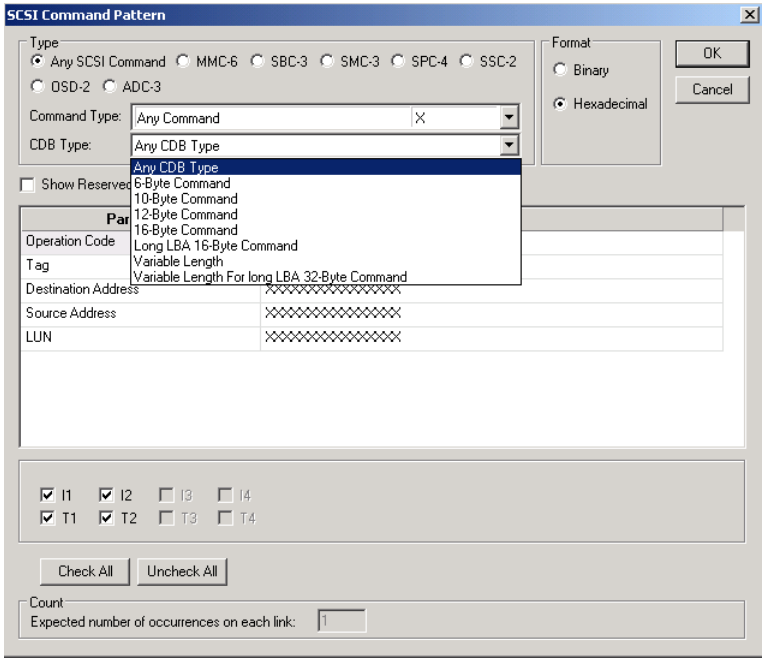


Figure 2.120: SAS: SCSI Command Pattern Dialog

SAS vs. SATA: Not available in SATA.

Choose a CDB from the drop-down list and click **OK**.

FIS (Frame Information Structure) (SATA only)

Double-click **FIS** to open the FIS Type selection dialog.

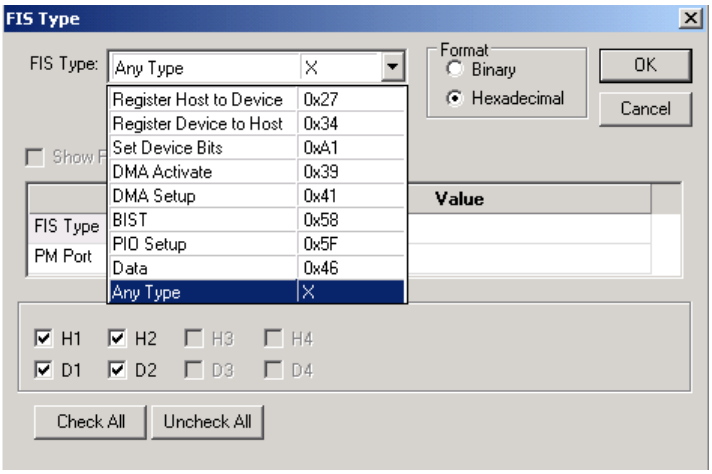


Figure 2.121: SATA: FIS Type Dialog

SAS vs. SATA: Not available in SAS.

Choose a FIS Type from the drop-down list box and click **OK.** Repeat for additional types.

Available FIS Types:

- Register Host to Device
- Register Device to Host
- Set Device Bit
- DMA Activate
- Any Type
- DMA Setup
- BIST
- PIO Setup
- Data

Note: You cannot trigger on a Vendor FIS.

FIS Pattern (SATA only)

Double-click **FIS Pattern** to open the FIS Pattern selection dialog.

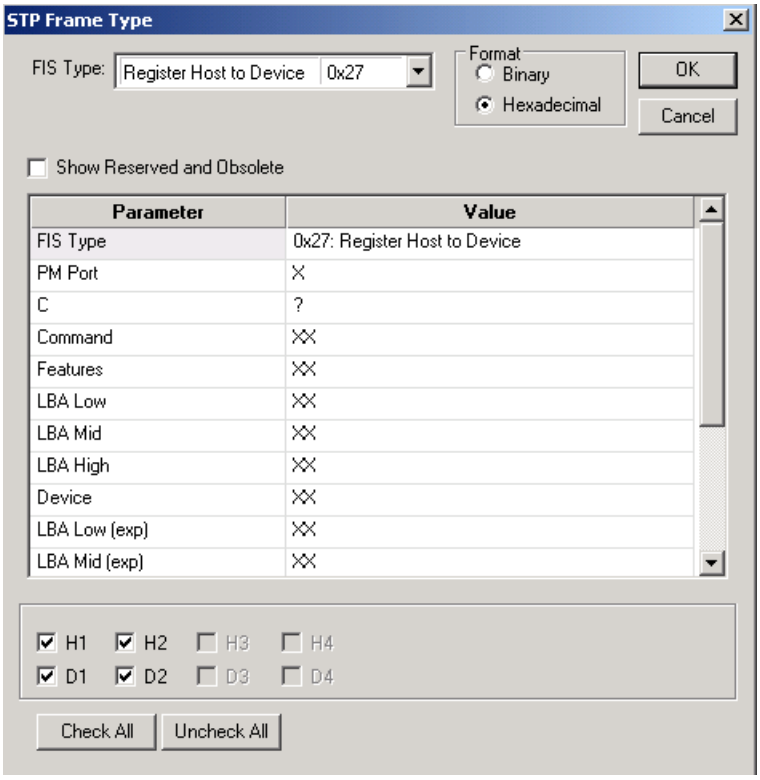


Figure 2.122: SATA: FIS Pattern Dialog

SAS vs. SATA: Not available in SAS.

The FIS Pattern dialog opens with the default FIS Type **Register Host to device.** To choose another available FIS Type, click the down arrow next to the FIS Type list box.

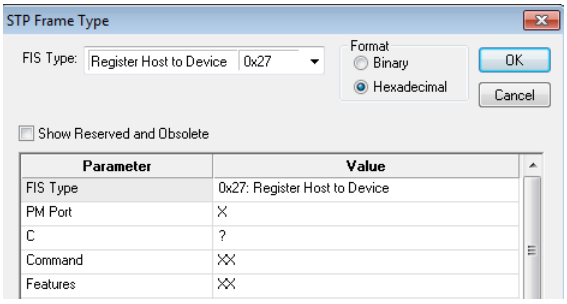


Figure 2.123: SATA: FIS Pattern Dialog Choices

SAS vs. SATA: Not available in SAS.

Choose a FIS Type and complete the corresponding dialog.

ATA Command Pattern

Double-click **ATA Command** to open the ATA Command Pattern selection dialog.

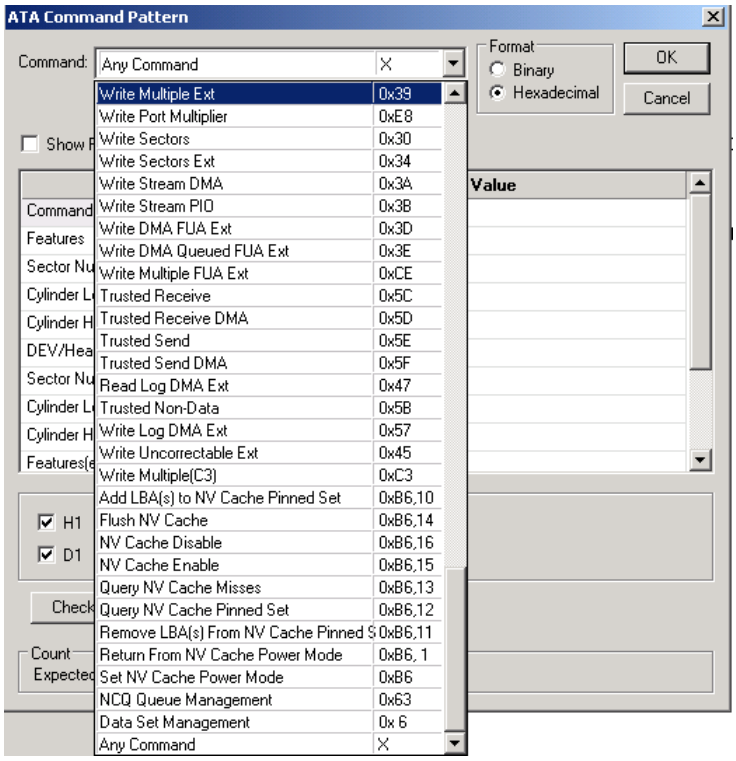


Figure 2.124: SATA: ATA Command Pattern Dialog

Choose an ATA command from the drop-down list and click **OK**.

Soft Reset (SATA only)

Double-click **Soft Reset** to open the Soft Reset dialog.

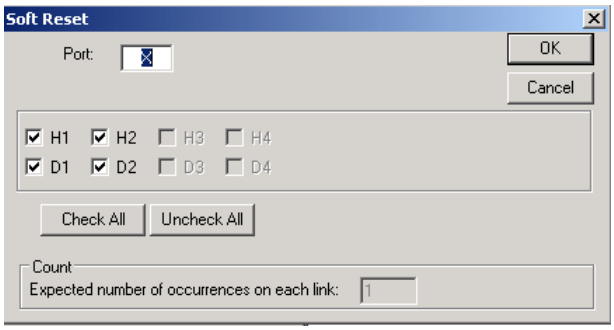


Figure 2.125: SATA: Soft Reset Dialog

SAS vs. SATA: Not available in SAS.

Sequential Trigger Mode

In Sequential Trigger mode, triggering occurs whenever the system detects a specific sequence of patterns. Defining the triggering patterns sets the sequence order. You must define at least two patterns to enable selection of Sequential Trigger mode.

Note: Patterns, such as Primitives and Symbols or Frames, occurring very close together on different ports can cause false triggers.

To define a triggering sequence, select more than one pattern, then check the **Define Sequential Trigger Mode** check box. See "Define Sequential Trigger Mode" on page 95 for more information.

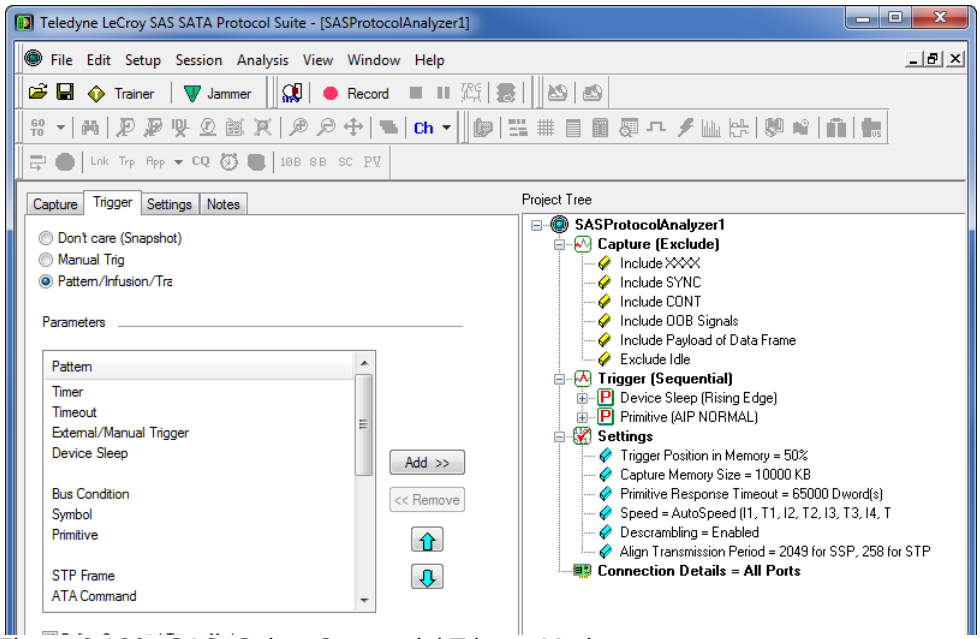


Figure 2.126: SAS: Select Sequential Trigger Mode

SAS vs. SATA: SATA Dialog has different patterns.

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 dialog.

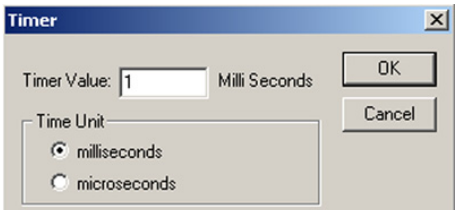


Figure 2.127: Timer Dialog

Enter a **Timer 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 sequential triggering mode, the definition dialogs for the triggering patterns enable the setting to count the number of occurrences. This allows you to specify the number of times that the pattern must occur before triggering or proceeding in the trigger sequence.



Figure 2.128: Number of Occurrences DIalog

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 you define and add triggering patterns, they display under the Trigger category in the Project Tree sequentially, in the order in which you entered them. When the project runs, the analyzer detects the occurrence of each pattern in order and triggers on the last one.

You can re-order the sequence of triggering patterns. To change the sequence order, highlight a trigger pattern and use the **Up** or **Down** arrow to move it to a new position.

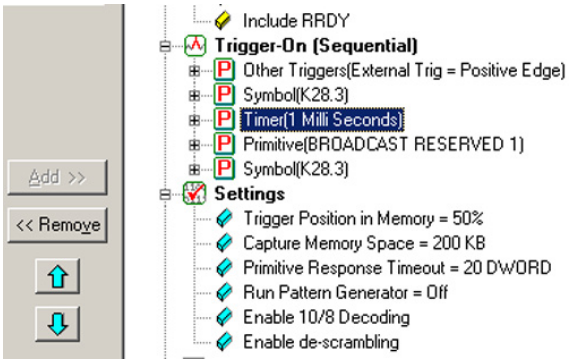


Figure 2.129: Triggering Order

Pre-Trigger

You can set the amount of data to capture before and after the trigger, as a percentage of pre-trigger, between 1% and 99%. Position the pre-trigger slider to a percentage. This feature allows the evaluation of bus activity leading up to and after the triggering event. Figure 2.130 illustrates the operation of pre-trigger in data memory.

Pre-trigger data is capture of the specified percentage of data prior to the triggering event. It cannot be guaranteed and may be 0. This can occur when the triggering event occurs before storing the required amount of pre-trigger event data. In such a case, the data display shows fewer than the specified data points prior to the triggering event.

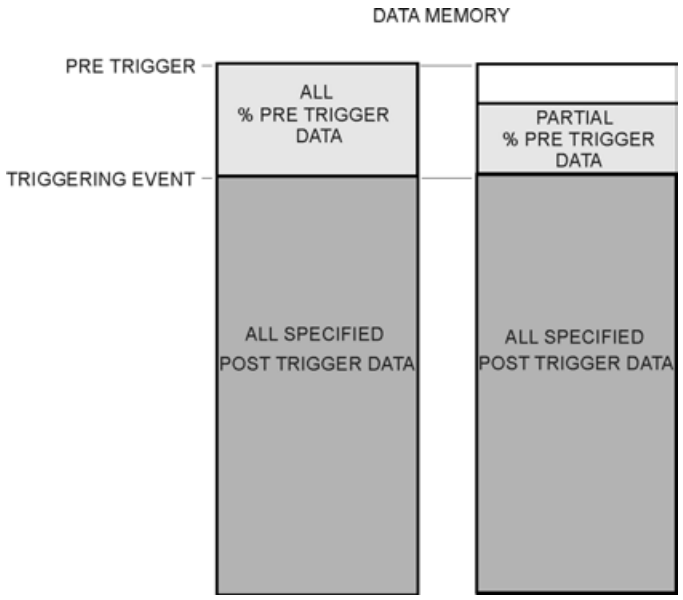


Figure 2.130: Pre-Trigger Example, 20% Pre-Trigger

2.6.17 Project Settings

To set project options, click the **Settings** tab (Figure 2.131 on page 118).

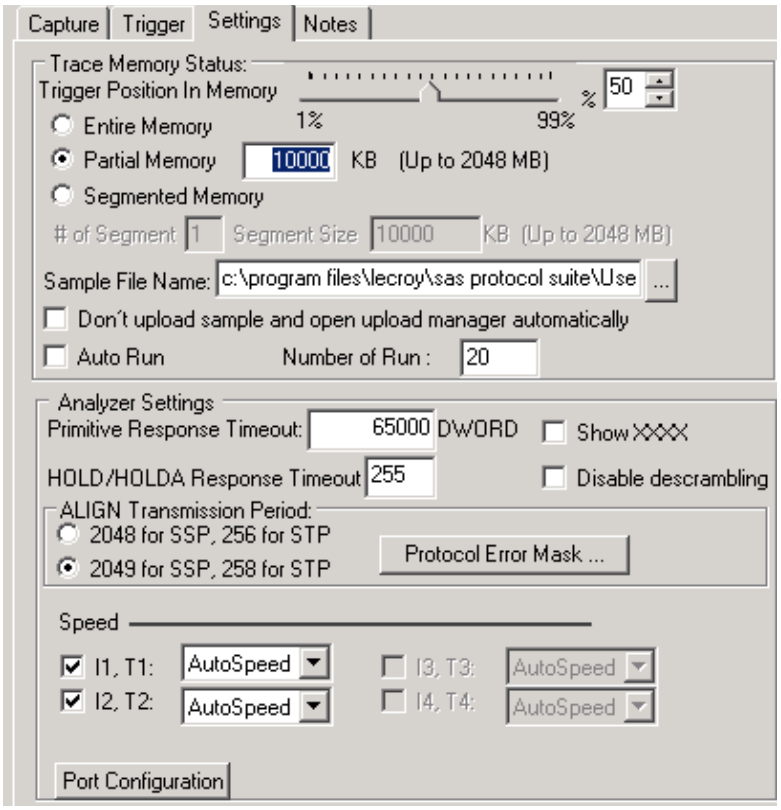


Figure 2.131: SAS: Setting Project Options

SAS vs. SATA: For the ALIGN Transmission Period section, SATA Dialog shows options 256 and 258, and does not show 2048 or 2049.
For Speed, SATA Dialog shows H1, D1 to H2, D2 and does not show I1, T1 to I2, T2.
SATA Dialog does not show MUX Setting button.

SATA dialog shows DevSlp min detection time field to enter the debouncer value.

2.6.18 Memory Settings

The Trace Memory Status section has the following fields.

Trigger Position

Pre-Trigger memory defaults to 50%, which defines the percentage of data to capture before and after the triggering event. You can change this percentage by dragging the slider.

Capture of the specified percentage of the data prior to the triggering event cannot be guaranteed and may be 0. This can occur if the triggering event occurs before storing the required amount of pre-trigger event data. In such a case, the data display shows fewer than the specified data points prior to the triggering event. For more detail, (see "Pre-Trigger" on page 117.)

Note: Trigger Position only works when the triggering option is Pattern.

In certain cases, when one port is recording traffic and filling up the memory much faster than another port, you might see traffic appearing only on one port for a while, and the other port's

traffic will only appear later. This occurs as a function of the trigger position, and is normal, expected behavior of the analyzer.

Trace 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 of Run text box. The capture and trigger repeat automatically for the specified number of times, and the results are saved in consecutively numbered Sample.scs files.

Memory Size

In the Protocol Analyzer Settings tab, you can allot memory for the trace recording. Check **Entire Memory** to allow recording to use the whole memory, to capture the maximum amount of trace data. (Minimum size of memory is 2 GB. Maximum size of memory is 16 GB.)

Partial Memory

To reduce the memory size, check **Partial Memory** and enter a buffer size in kilobytes, up to the memory size in megabytes.

Note: If the size of a data packet exceeds the buffer memory allocation, the project runs, but no data capture occurs. You must increase buffer memory size to a value greater than the packet size.

Segmented Memory

Alternatively, you can use **Segmented Memory**. Enter an integer **# of Segment**, from 1 to 32, then enter an integer **Segment Size** in kilobytes, up to the memory size in megabytes divided by the number of segments. The default segment size is 10 MB.

Each time a trigger condition occurs, the system records a new segment. You can use a Snapshot or Pattern trigger, but not Manual Trigger. As the same trigger automatically repeats, the system makes the number of segments that you entered.

Upload Manager

To upload segments manually in the Upload Manager, select the **Don't upload segments and open upload manager automatically** checkbox.
To upload segments automatically for display as the system creates them, do not select the checkbox.

To view segmented trace files, click the **Upload Manager**  button, beside the Record button, to display the Upload Manager dialog (see Figure 2.132 on page 120).

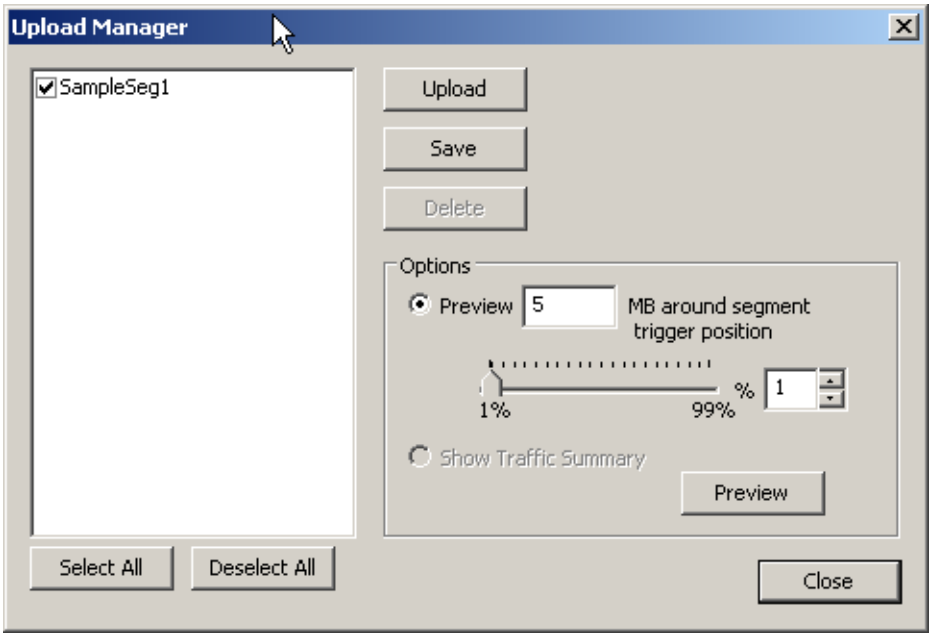


Figure 2.132: Upload Manager Dialog

The dialog displays the segments in the format Segment1, Segment2, and so on.

Select segments by clicking the checkbox. You can also **Select All** or **Deselect All** segments.

You can **Upload** segments for display, **Save** segments as sample files, and **Delete** segments.

The **Preview** radio button allows a preview of an integer number of megabytes around the trigger position. You can set the trigger position as a percentage and select the segment number. Click the radio button to **Show Traffic Summary** with the preview. To show the preview, click the **Preview** button.

2.6.19 Analyzer Settings

Primitive Response Timeout

The Primitive Response Timeout parameter specifies the number of DWORDs between two pair primitives after which the analyzer detects a protocol error. Default value is 65000. When host or device sends a primitive, such as X_RDY, HOLD, or WTRM, it expects device or host to reply with a primitive, such as R_RDY, HOLDA, or R_OK. This parameter detects FIS Signaling Latency error, between HOLD and HOLDA, and FIS State Transition error, between X_RDY and R_RDY, between SOF and EOF, or between WTRM and R_OK or R_ERR.You can set a trigger on these protocol errors.

Disable Descrambling

If checked, causes the Analyzer to assume that no traffic is scrambled. By default, the Analyzer assumes the scrambling state of the devices under test has scrambling enabled.

Show XXXX value

Check this option to display XXXX values.

Pack training sequence

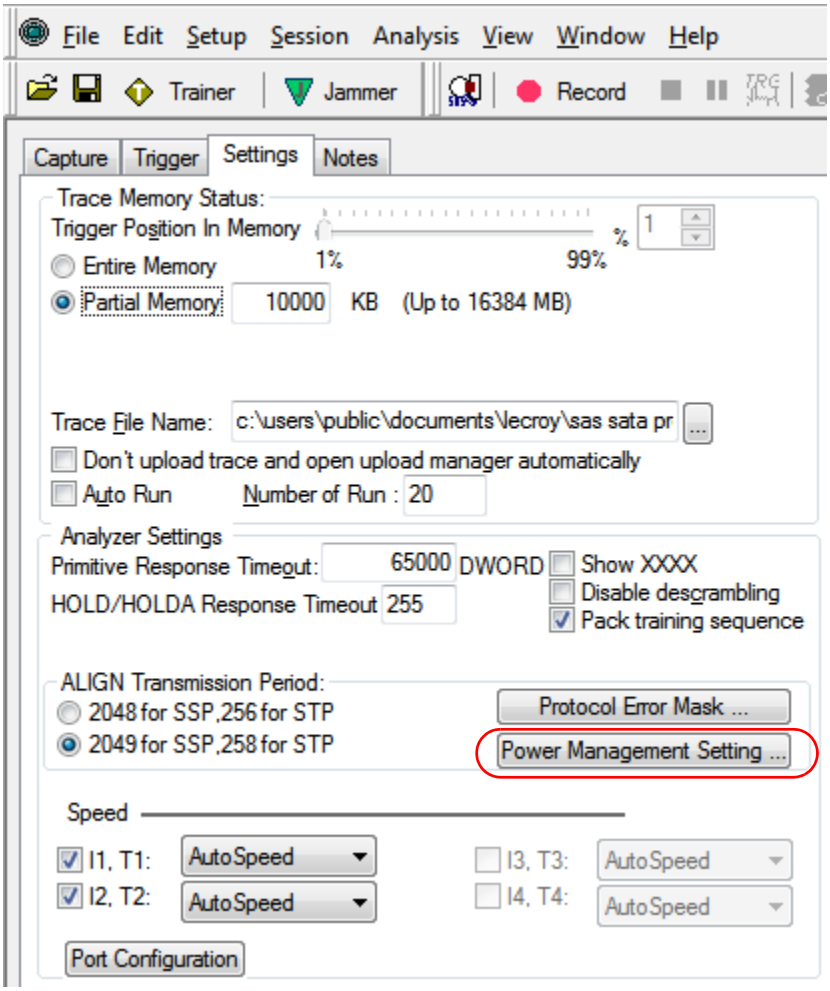
Checking this box allows hiding the details of the Training Sequence, which can take up large portions of the trace unless packed.

ALIGN Transmission Period (differs for SAS and SATA)

Choose the ALIGN Transmission Period for SSP and STP by clicking the corresponding option button, then open the Protocol Error Mask dialog.

Power Management Setting (SATA only)

Click the Power Management Setting button to open the Power Management Setting dialog.



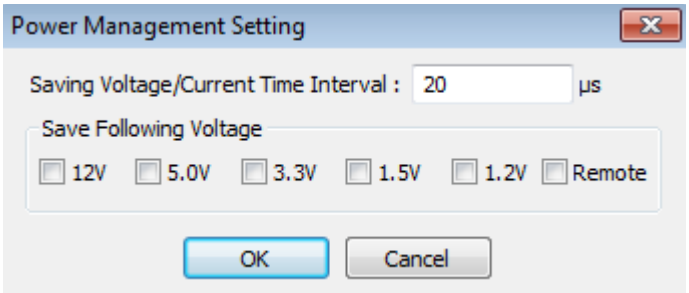


Figure 2.133: Protocol Errors Dialog

Set the Saving Voltage/Current Time Interval duration. Check the applicable Voltage value that you want the Analyzer to save. See "Power Tracker View (SATA only)" on page 299 for more information.

Protocol Error Mask

Click the Protocol Error Mask button to open the Protocol Error Mask dialog (see Figure 2.134 on page 122).

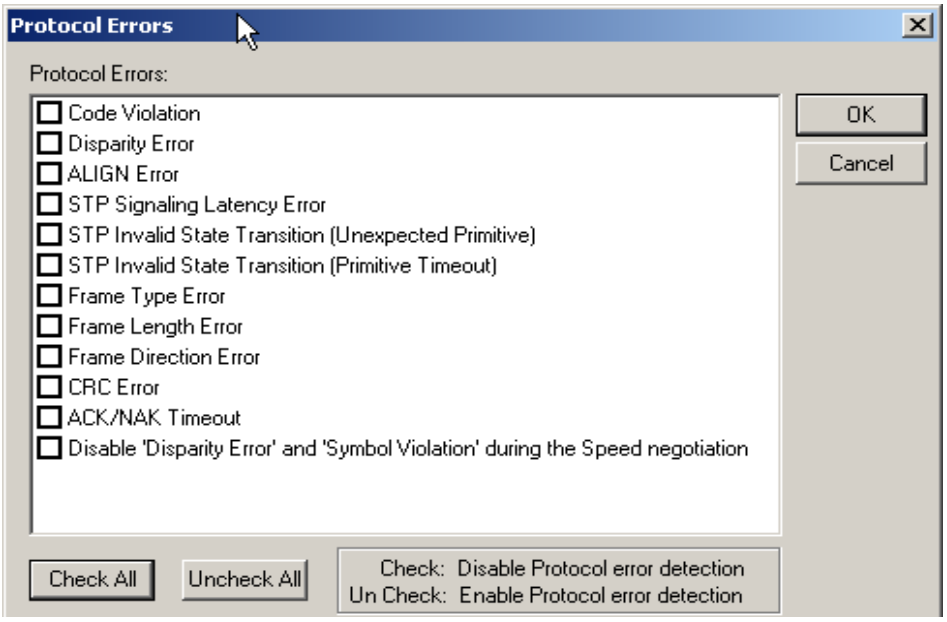


Figure 2.134: Protocol Errors Dialog

Check the Protocol Errors that you want the Analyzer to ignore.

When "RD Error" and "Code violation Error" are set as trigger events:
"RD Error" or "Code violation Error" can occur right after the OOB sequence.
"RD Error" or "Code violation Error" can occur right after the recovery from the PM state.

These errors are mainly caused by the long synchronization time of the analyzer. If these errors, caused by the Analyzer, become triggers, you cannot detect some other errors that you really need to detect. To NOT detect the above two errors, enable the software setting **Disable 'Disparity Error' and 'Symbol Violation' during Speed negotiation**. After this, the code violation is

not triggered during the speed negotiation phase, but is triggered if the violation happens after the speed negotiation phase.

External Trig Out Setting

The Analyzer can send a Low or High external signal when a trigger occurs. Under **Setup** select **External Trig Setting** to choose External Trig Out Setting: High Active, Low Active, or Toggle from High to Low or Low to High once (3.3 V output). Enter the External TrigOut pulse width.

The pulse width is programmable in the software. The Voltage level is 0 to +3.3 Volt. The trigger out is derived by NL17SZ126 buffer. The delay for OOB traffic external trigger out is 330 ns. The delays for non OOB external trigger out are:

- 6G ~ 370 ns
- 3G ~ 540 ns
- 1.5G ~ 850 ns

The delays for external trigger out with OOB traffic is 330 ns.

Note: The minimum pulse width requirement is different for "high going" pulses and "low going" pulses.
If you normally drive the Trig-IN SMA with 0V and then give it a "high going" pulse, the minimum pulse width that reliably causes the trigger is 70 ns.
If you normally drive the Trig-IN SMA with 1-3V and then give it a "low going" pulse, the minimum pulse width that reliably causes the trigger is 20 µs.

External Trig In Setting

An external Low or High input signal can cause triggering. Under **Setup** select **External Trig Setting** to choose External Trig In Setting: High Active, Low Active, or Toggle from High to Low or Low to High once (3.3 V output).

Choose Port Speed

The default speed is Autospeed. You can also select the port speed from the drop-down list: 1.5 Gbps, 3.0 Gbps, or 6.0 Gbps.

Note: If a Port ID check box has no check, the analyzer does not capture any patterns for that port. The system allocates trace memory for that port to its adjacent port, for example: I1, T1 <-> I2, T2.

Ports Configuration

Select the **Port Configuration** button to display the Set Port Configuration dialog (see Figure 2.135 on page 124).

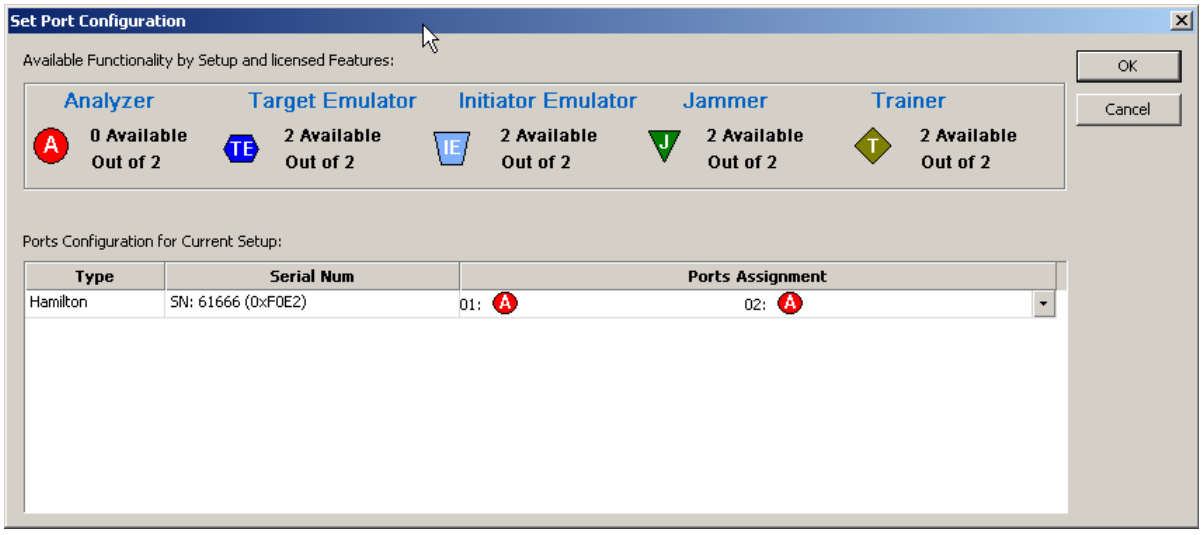


Figure 2.135: SAS: Set Port Configuration Dialog

The dialog shows the current port configuration. To select a port configuration, click the down arrow to display the Select Port Configuration dialog .

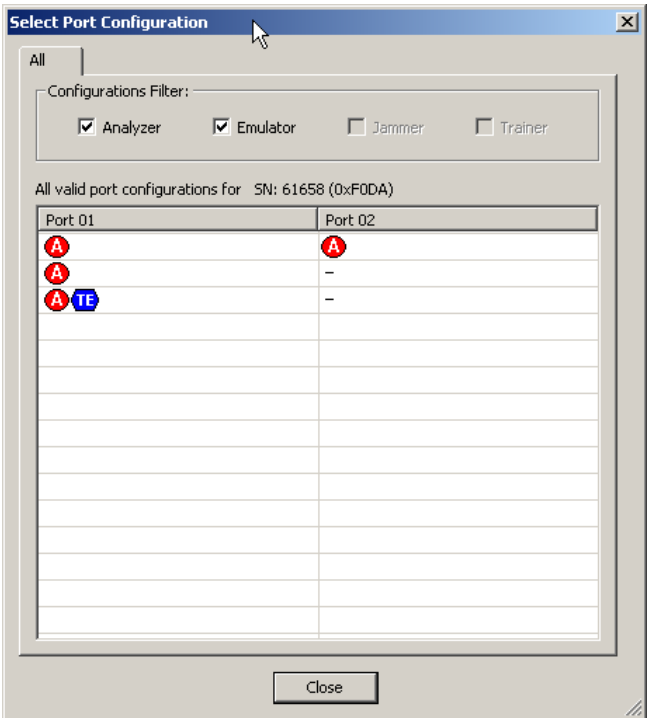


Figure 2.136: SAS: Select Port Configuration Dialog

Port configuration depends on the application you run.

- To act as Analyzer, select the  **Analyzer** port configuration.
- To activate a Target Emulator on a port, select the  **TargetEmulator** port configuration.

- To activate the Initiator Emulator on a port and run the Analyzer on the same port, select  **InitiatorEmulator/Analyzer**.
- To activate the InFusion on a port, select  **Jammer**.
- To activate the Trainer on a port, select  **Trainer**.

Sierra M6-2 can have Analyzer and Trainer or Analyzer and Jammer on same port.

Note: To display the current Port Configuration, click the green button in the lower right corner to display the Port Status window (see "Port Status" on page 360).

Port Configuration and Projects

Port Configuration depends on Project selected.

Performance Analyzer and Performance Analyzer with Initiator Emulator do not use ports.

Protocol Analyzer, Protocol Analyzer with Initiator Emulator, and Target Emulator can have the following port configurations.

Project	Number	
	One analyzer and/or one emulator	**Two analyzers and/or two emulators**
Protocol Analyzer	Port 1.	One analyzer each on 1 and 2.
Protocol Analyzer with Initiator Emulator	Port 1.	One analyzer each on Port 1 and Port 2.
	Pair on Port 1.	One emulator each on Port 1 and Port 2.
Target Emulator	Port 1.	One emulator each on Port 1 and Port 2.
	Pair on Port 1	

Analyzers work with Emulators, Jammer, and Trainer (see below).

One Initiator Emulator can work by itself or work with one Analyzer.

One Target Emulator can work by itself or work with one Analyzer.

(Note that Host Emulator and Analyzer can be on one port and Analyzer and Device Emulator can be on another port at the same time.)

Emulators do not work with Trainer.

Emulators work with Jammer (see below).

Note: Ports 1 and 2 are a pair. Put related hardware on one pair. For example, put two analyzers on ports 1 and 2.

Jammer can pair with one or two analyzers on a port.
Jammer does not work with Trainer.

Trainer can pair with one analyzer on a port.
Trainer does not work with emulators.

Trainer does not work with Jammer.

MUX Setting (SAS only)

Enable Muxing on port combinations.

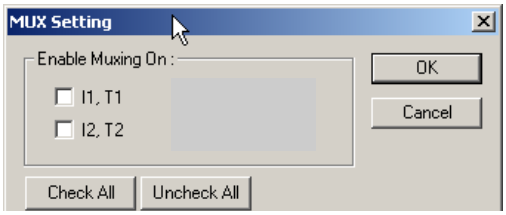


Figure 2.137: MUX Setting Dialog Box

If you enable this option on two ports, the data of both ports transfers on one physical link, whose speed is twice the speed of each link, and the data of two links multiplexes on one physical link. For example, two 3 G ports together make one 6 G port. Note the following (see Figure 2.138 on page 127):

- The muxing check boxes are usable only if two or more emulator channels are selected.
- The initiator emulator check box is greyed out if only one emulator channel is selected.

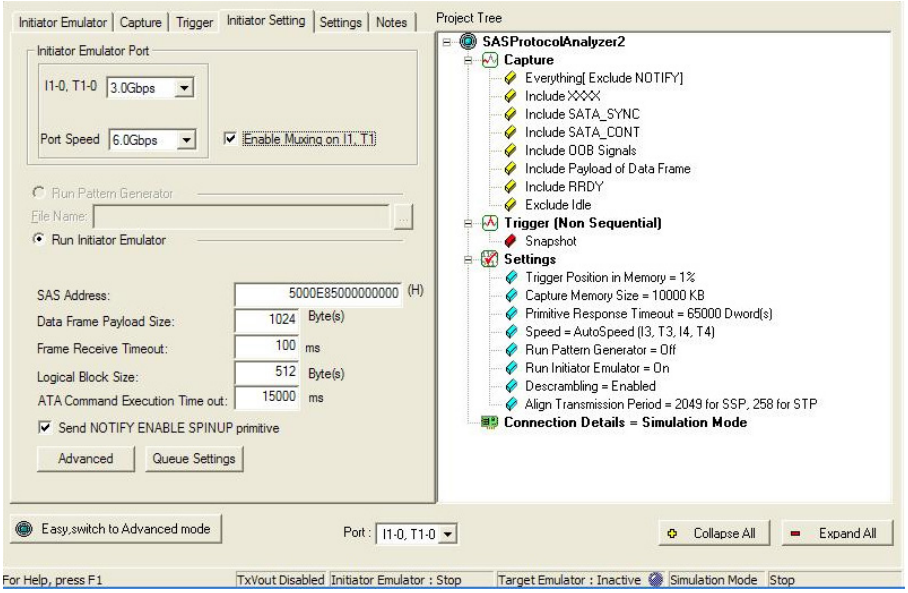


Figure 2.138: Initiator Emulator Check Box and Channel Speeds

- The target emulator check box is not displayed at all until two or more emulator channels are selected.

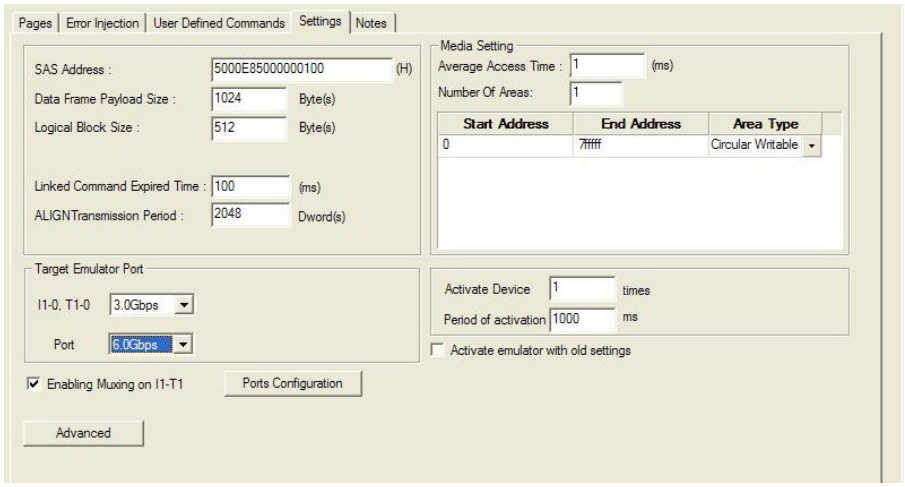


Figure 2.139: Target Emulator Check Box and Channel Speeds

Note: Analyzer must detect MUX primitives from both host and device sides to capture traffic correctly in Muxing mode.

2.6.20 Add a Project Note

To enter and save information about the current project, click the **Notes** tab and enter the data about the project.

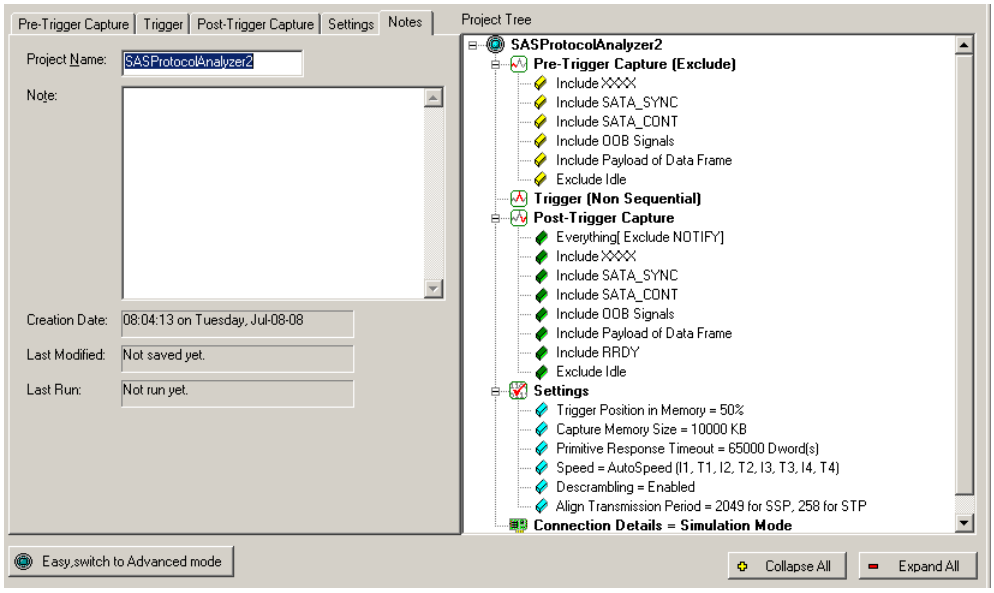


Figure 2.140: Project Notes Tab

2.7 Advanced Mode (User-Defined)

Advanced Mode expands Analysis capability by allowing you to program complex triggering and data capture projects.

The Advanced Mode is a state machine with up to 23 different states. You can program each state individually to:

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

Note: In Advanced Mode, events on each link are counted independently. A condition is met if the number of events on a link equals the defined occurrence.

2.7.1 Working in Advanced Mode

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



You can:

- Display the state definition
- Set Output Trigger level
- Select up to three timers
- Define the If condition and up to three Else If conditions
- Set number of occurrences before trigger
- Set captured data
- Set excluded data
- Go to next state
- Add state
- Choose link for Sequencer setup

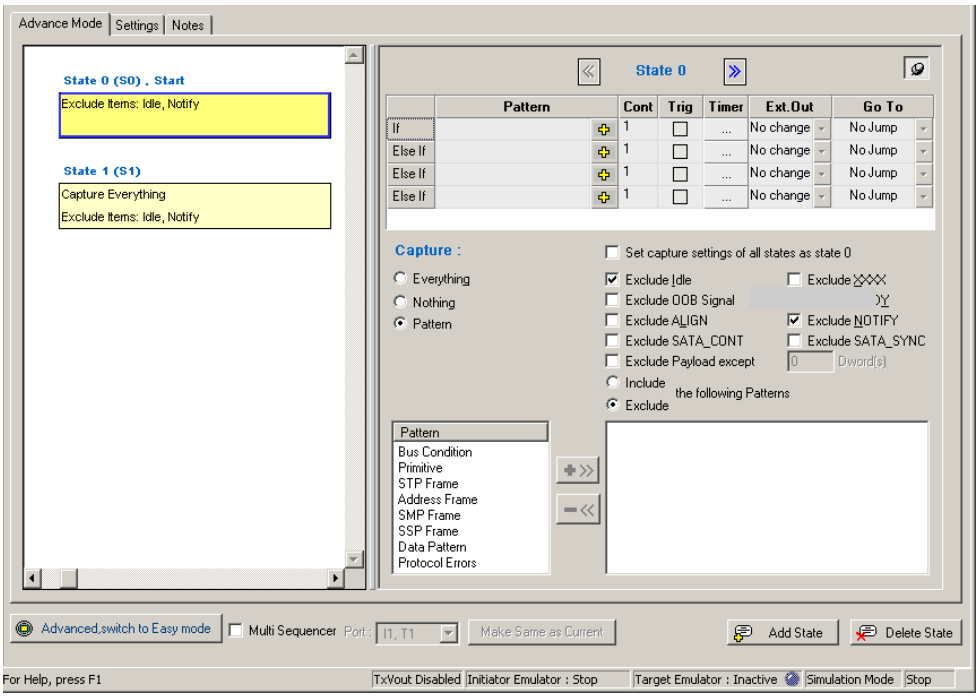


Figure 2.141: SAS: State Programming Dialog

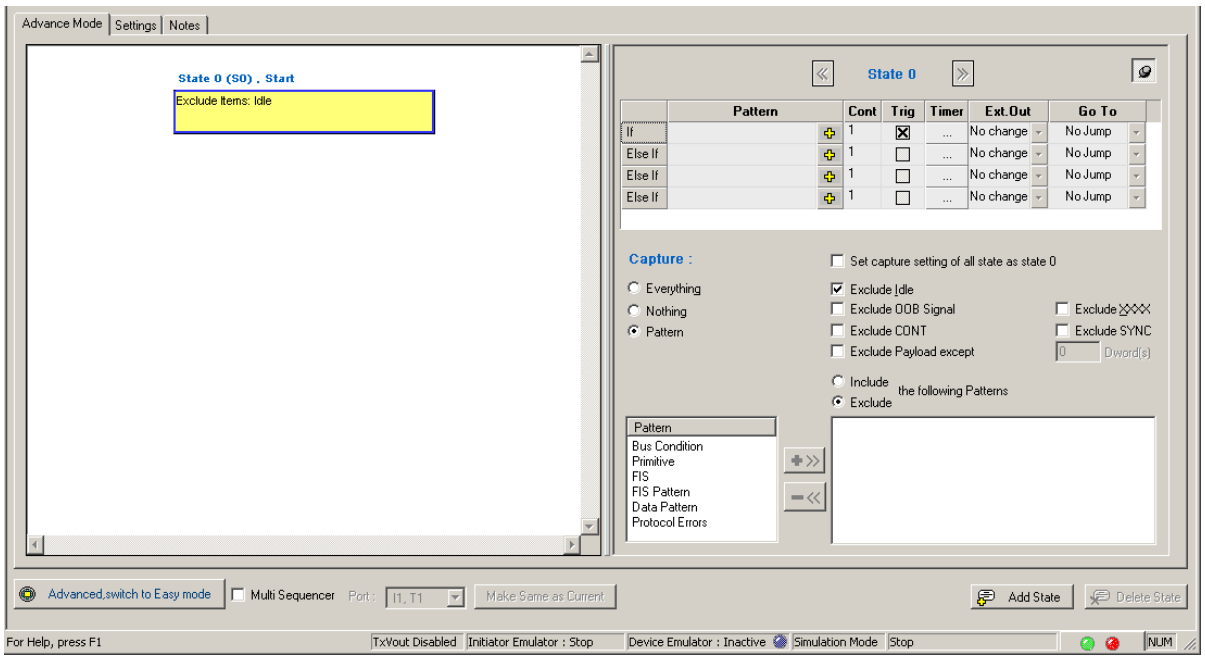


Figure 2.142: SATA: State Programming Dialog

SAS vs. SATA: SATA Dialog removes Exclude ALIGN, Exclude RRDY, and Exclude NOTIFY. SATA Dialog replaces Exclude SATA_CONT with Exclude CONT and Exclude SATA_SYNC with Exclude SYNC.

SATA Dialog has patterns Bus Condition, Primitive, FIS, FIS Pattern, Data Pattern, and Protocol Errors and does not have STP Frame, SMP Frame, STP Frame, or Address Frame.

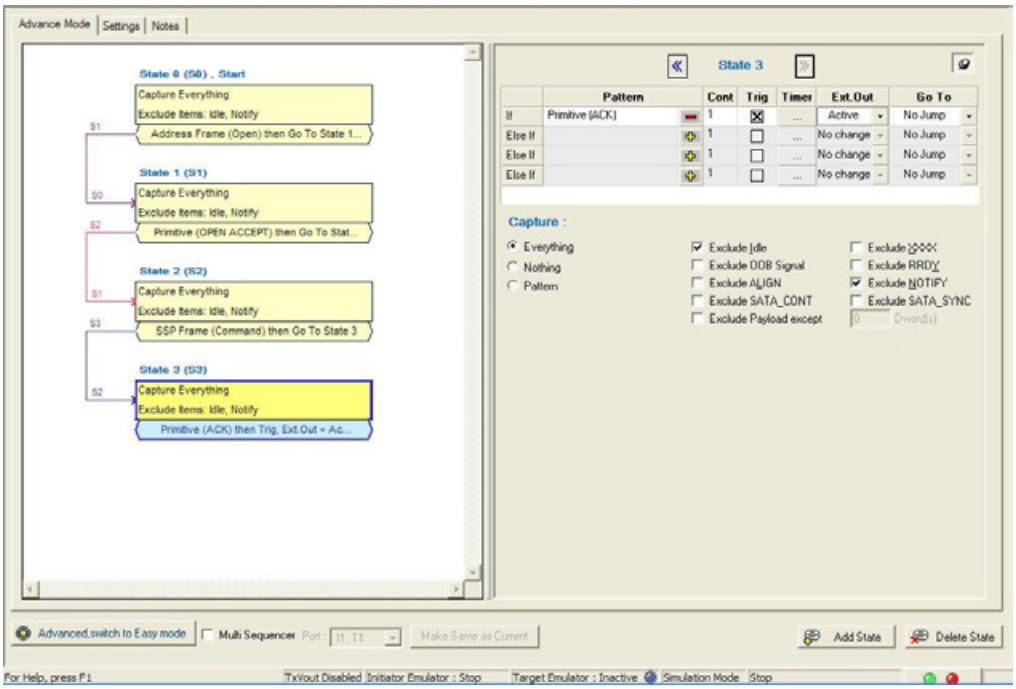


Figure 2.143: SAS: Advanced Trigger with multiple branches

State Number for Complex Trigger Sequences

To follow the path of complex trigger sequences, you can display state numbers in a trace.

To see state number, in Packet View right-click a link layer packet, show field, and select state number.

Setting Trigger Conditions

To set the If and Else If trigger condition:

1. Click the **Add Pattern** button for a Pattern field and choose a trigger condition from the drop-down list (Figure 2.144 on page 132).

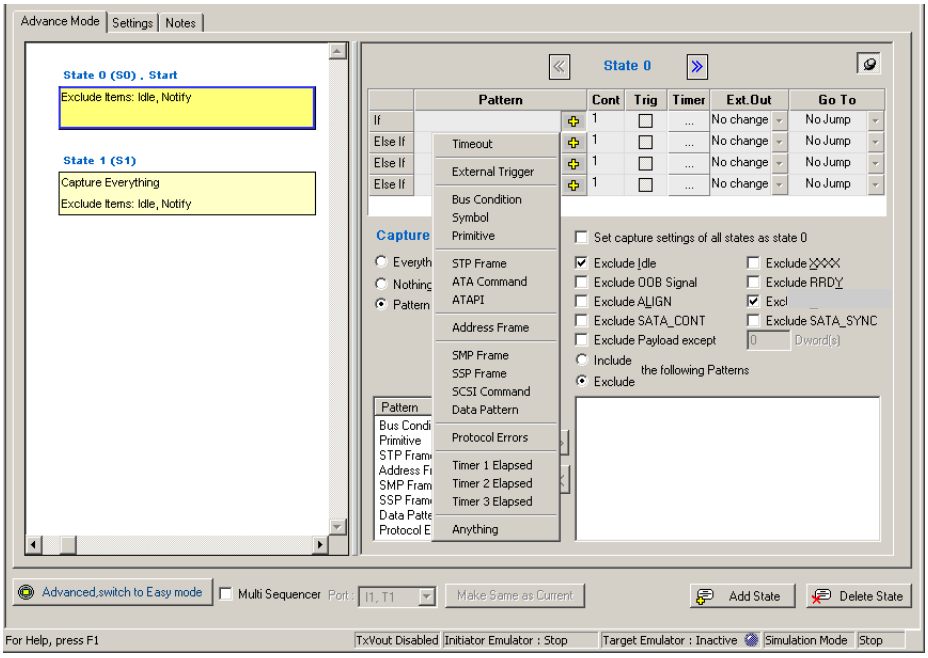


Figure 2.144: SAS: Choosing a Trigger Condition

2. Define each selected pattern in the same way as in Easy Mode, as described starting on page 81. To use a timer, define it first.

Note: You can set a timer for any If or Else If condition.

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 choose Pattern, you can select patterns for inclusion or exclusion. Clicking the **Pattern** option enables a pattern definition dialog (see Figure 2.145 on page 132).



Figure 2.145: SAS: Choosing a Pattern

6. Choose pattern(s) and click the **+>>** button to add them for capture or exclusion. You define each pattern the same way as in Easy mode (see "Defining Patterns" on page 81).
7. For an output trigger, click the down arrow in the **Ext. Out** field and choose an output trigger level. **Note:** Do not use the LOW setting in Advanced Mode.
8. To go to another state, click the down arrow in the **Go To** field and select a state. If no other state has been defined, choose **New State** to add a state.

2.7.2 Multi-Link Triggering

You can set different triggering for each link. To set different trigger conditions for a link, check the **Multi Sequencer** check box and select the link for setup from the Port drop-down list. Clicking the **Make Same as Current** button displays a warning: all sequencers will be changed to have same states as current sequencer. Click **Yes** to do so.

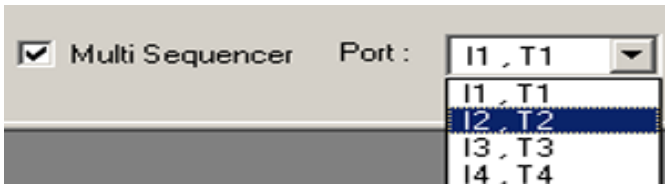


Figure 2.146: Multi-Link Triggering Setup

2.7.3 Set Timers

You can set and use up to three timers for triggering. You can set each timer for each state or continue from a timer set in the previous state. The timer defined for a particular state starts when entering that state. To set timers, click the **ellipses** in the **Timer** field in each state and define each of the timers in the Set Timers dialog.

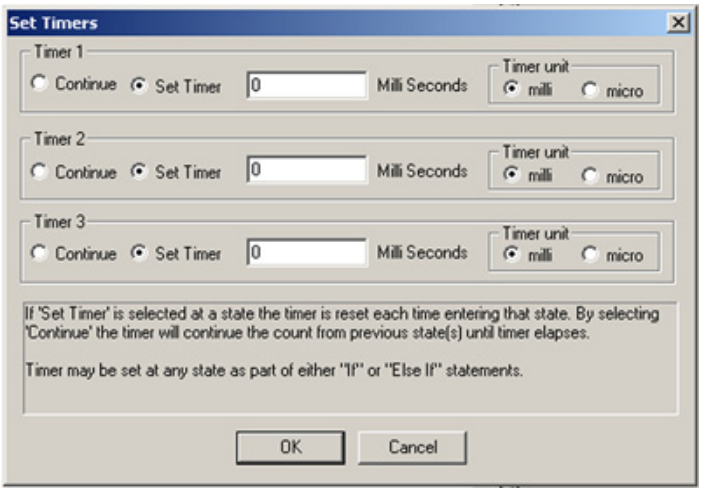


Figure 2.147: Set Timers Dialog

Note: Three timers are available. You have to set and start each timer in order to continue the next timer. For example, you have to start Timer 1, continue it, then set Timer 2 in order to continue it. It will not allow you to continue Timer 2 until you first set it.

2.7.4 Timeout

The timeout trigger allows triggering based on the occurrence or non-occurrence of two events within a pre-defined period of time. Patterns can be added to the Start Events and End Events list. An occurrence of a pattern of the Start Events list starts the timer, or resets the timer if the timer is

already running. Depending on the configurable Trigger mode, the trigger is activated when the End Event(s) occur before the timer expires, or the timer expires before the End Event(s) occurs.

- ❑ You can set a Timeout.
- ❑ Select a Pattern for the Start Event. (Start Event resets the timer.)
- ❑ Select a Pattern for the End Event.
- ❑ Enter the Timeout Value in milliseconds or microseconds.
- ❑ Select a Trigger Mode:
  - ■ If End Event occurs before timer expires.
  - ■ If timer expires before End Event occurs.

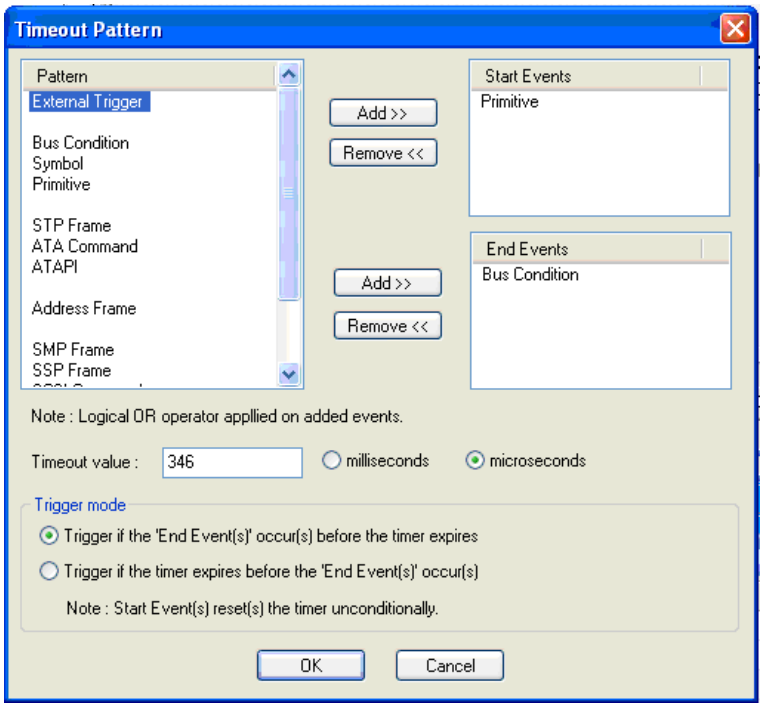


Figure 2.148: Timeout Dialog

WARNING: In Advanced Mode, Short State Jump Intervals Can Cause Hardware Queue Overflow and Corrupt Frames.

When using Advanced Mode, if too many state jumps occur in a short time, the hardware queue can overflow, which may corrupt frames. For example, an infinite loop can cause many state jumps in a short time. Hardware overflow can occur if interval between state jumps is less than 60 DWORDs.

In Advanced Mode, infinite loops are usually used to check if an event occurs before a timeout. In this case, you can use the Timeout dialog to avoid hardware queue overflow.

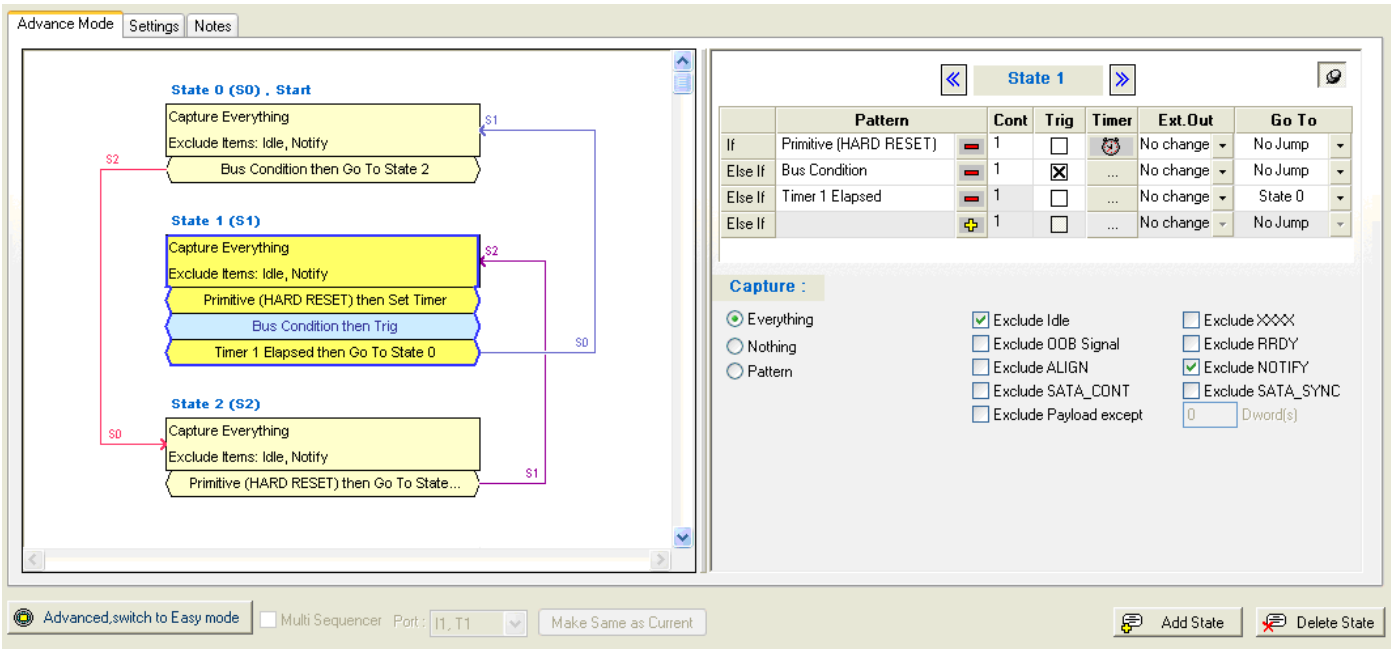


Figure 2.149: State Machine with Multiple Patterns and Timer Elapse

In Figure 2.149: , the port detects HARD_RESET, which starts the Timer. When the timer expires, it jumps to another state. If a trigger occurs between timer start and end, the captured trace will have corrupt frames because of hardware queue overflow.

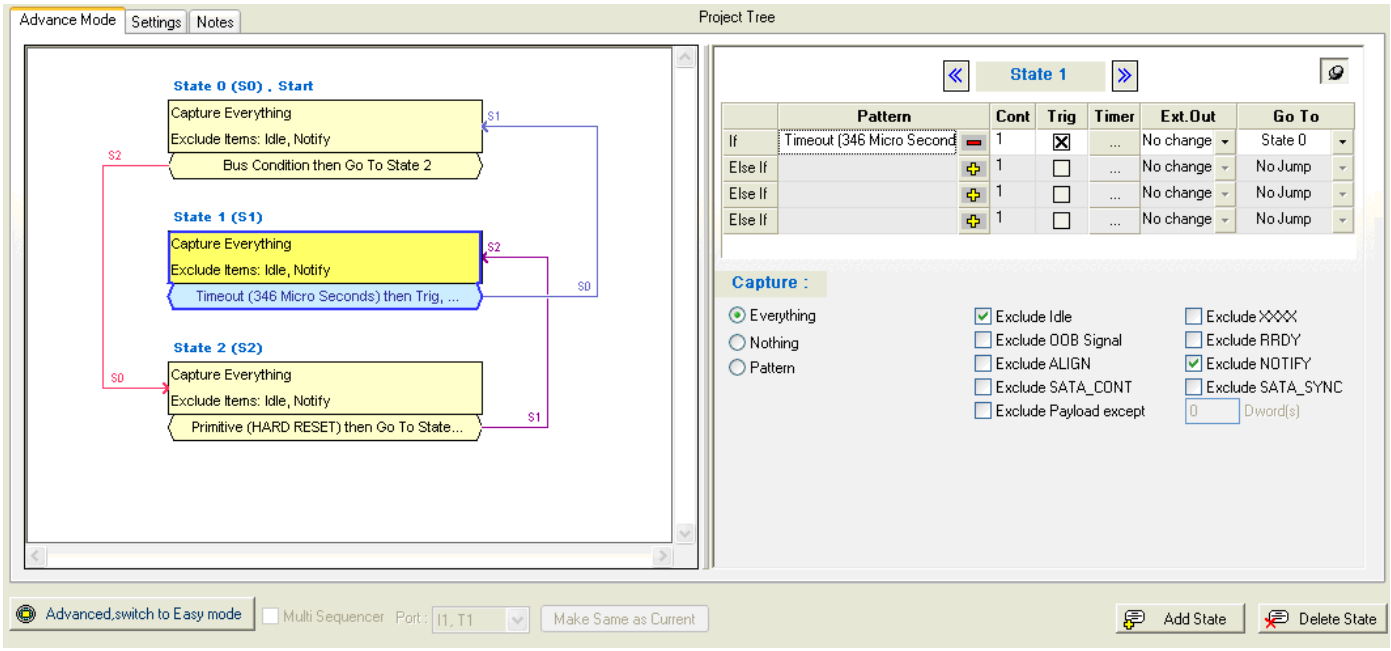


Figure 2.150: State Machine with Timeout Pattern to replace Timer

To overcome this limitation, use a Timeout Pattern instead of Timer. Figure 2.150 shows the state machine using Timeout instead of Timer.

Figure 2.151 on page 136 shows the Timeout settings.

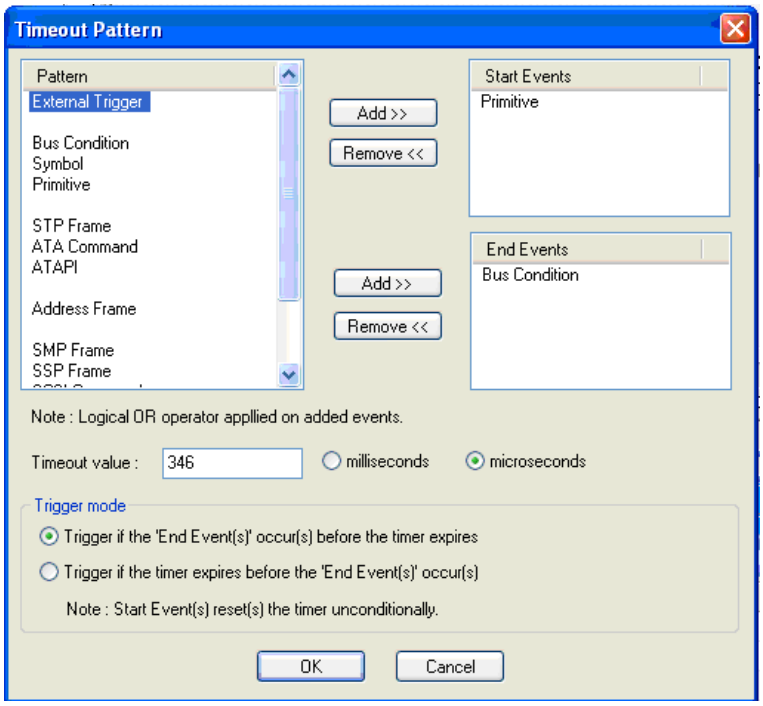


Figure 2.151: Timeout Settings

Timeout begins when the port detects the Start Event. Timer begins when the port detects the Hard RESET primitive. In the Trigger Mode window, set the Trigger to trigger when the port detects the End Event, before the Timeout occurs. In our example, this is the Bus Condition. Capture begins when the ports detects the Bus Condition before the Timeout occurs. If the port does not detect the Bus Condition until the Timeout occurs, the State Machine in Figure 2.150 on page 135 jumps to State 0.

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

2.8 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, described starting on **page 117**.

SAS vs. SATA: For the ALIGN Transmission Period section, SATA Dialog shows options 256 and 258, and does not show 2048 or 2049.
For Speed, SATA Dialog shows H1, D1 to H2, D2 and does not show I1, T1 to I2, T2.
SATA Dialog does not show MUX Setting button.

2.8.1 Notes

To include some descriptive information about the project, click the **Notes** tab and enter a brief descriptive note (see "Add a Project Note" on page 128).

2.9 Emulation

SAS: To perform a capture with SAS Initiator Emulator generated bus traffic, click **File > New > SAS Protocol Analyzer / Initiator Emulator**.

SATA: To perform a capture with SATA Host Emulator generated bus traffic, click **File > New > SATA Protocol Analyzer / Host Emulator**.

Program the Initiator Emulator or Host Emulator, then set up a capture, as described in "Protocol Analysis" on page 59.

Note: When it runs, the emulator turns on the voltage on all channels, whether they are turned on or off previously. The emulator does not execute any command until its link is established. So if the power is off on any channel, the emulator will not proceed even if the first command is a Power On command.

2.9.1 Programming the Initiator or Host Emulator

SAS: Click the **Initiator Emulator** tab to program the Initiator Emulator. See Figure 2.152.

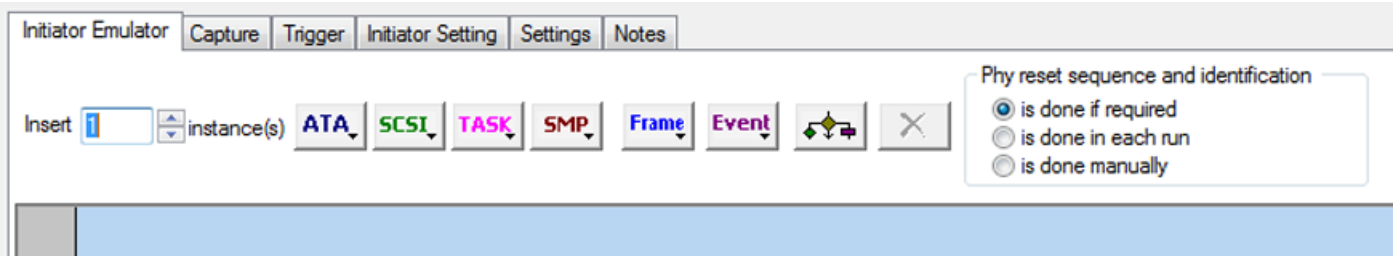


Figure 2.152: SAS: Initiator Emulator Program Dialog.

SATA: Click the **Host Emulator** tab to program the Host Emulator. See Figure 2.153 on page 138.

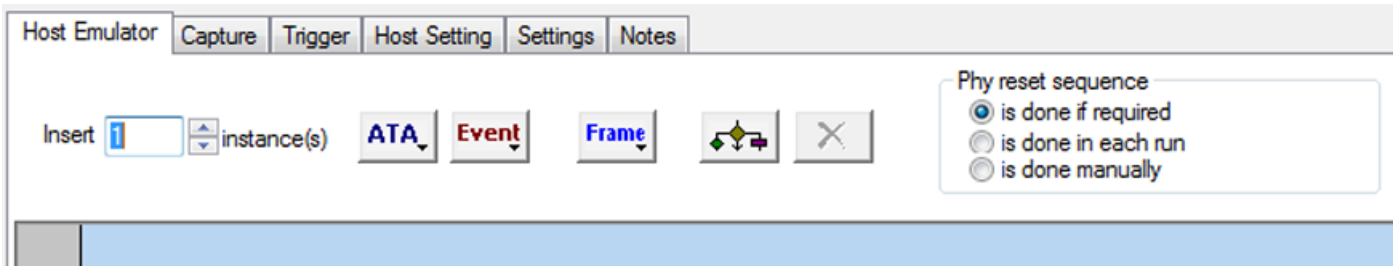


Figure 2.153: SATA: Host Emulator Program Dialog.

SAS vs. SATA: The SATA Dialog removes the SCSI, Task, and SMP buttons and replaces the Initiator Setting tab with the Host Setting tab.

SAS: You can create an Initiator program using ATA, SCSI, Task, and SMP commands; Frames; and/or Events. These commands can execute in a program loop or be subject to user-specified conditions. You can also use instructions to define program loops, make conditional jumps, and insert delays and stops.

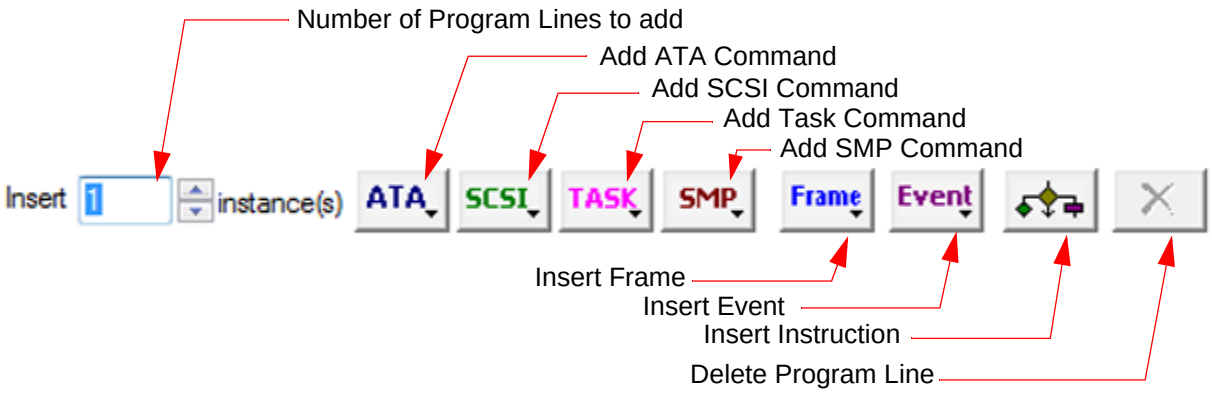


Figure 2.154: **SAS:** Initiator Emulator Program Dialog Detailed Options

SATA: You can create a Host program using ATA, Events, and/or Frames. You can also use instructions to define program loops, make conditional jumps, and insert delays and stops.

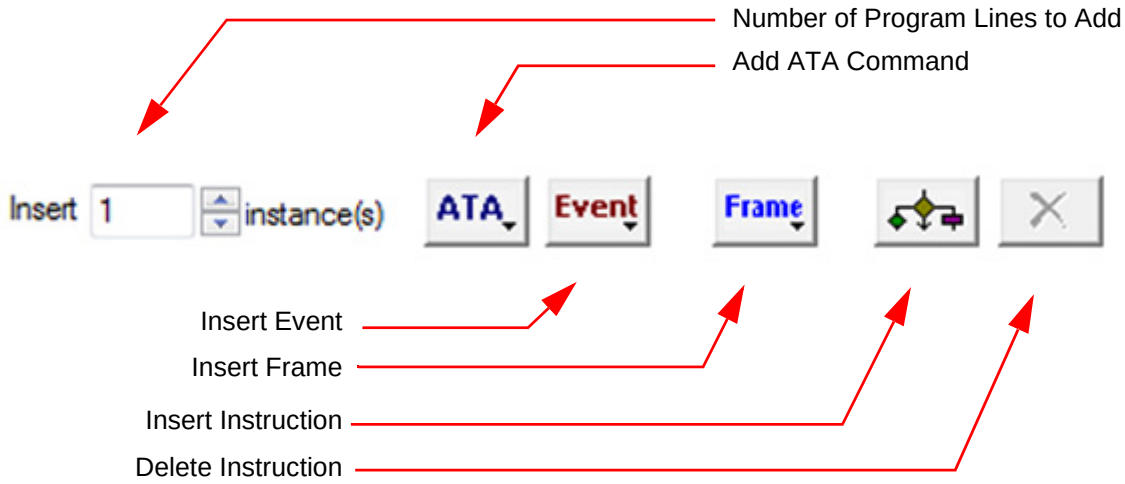


Figure 2.155: **SATA**: Host Emulator Program Dialog Detailed Options

Note: If the Sierra M6-4 analyzer is cascaded with a Sierra M124 or M122 analyzer, you cannot perform a Host Emulator or Initiator Emulator capture.

Add Program Lines

To add program lines, enter the number of lines to add in the Insert field, then click a command button: ATA, SCSI, TASK, SMP, Frame, or Event.

Note: SAS Initiator Emulator supports a queue depth of 32 commands.

2.9.2 Adding Initiator (SAS) or Host (SATA) Emulator Commands

Adding an ATA Command

Click the **Insert ATA Command** button, click one of the command categories, and choose a command. See Figure 2.156 for SAS toolbar and ATA command examples. See Figure 2.157 on page 140 for SATA toolbar and ATA command examples.

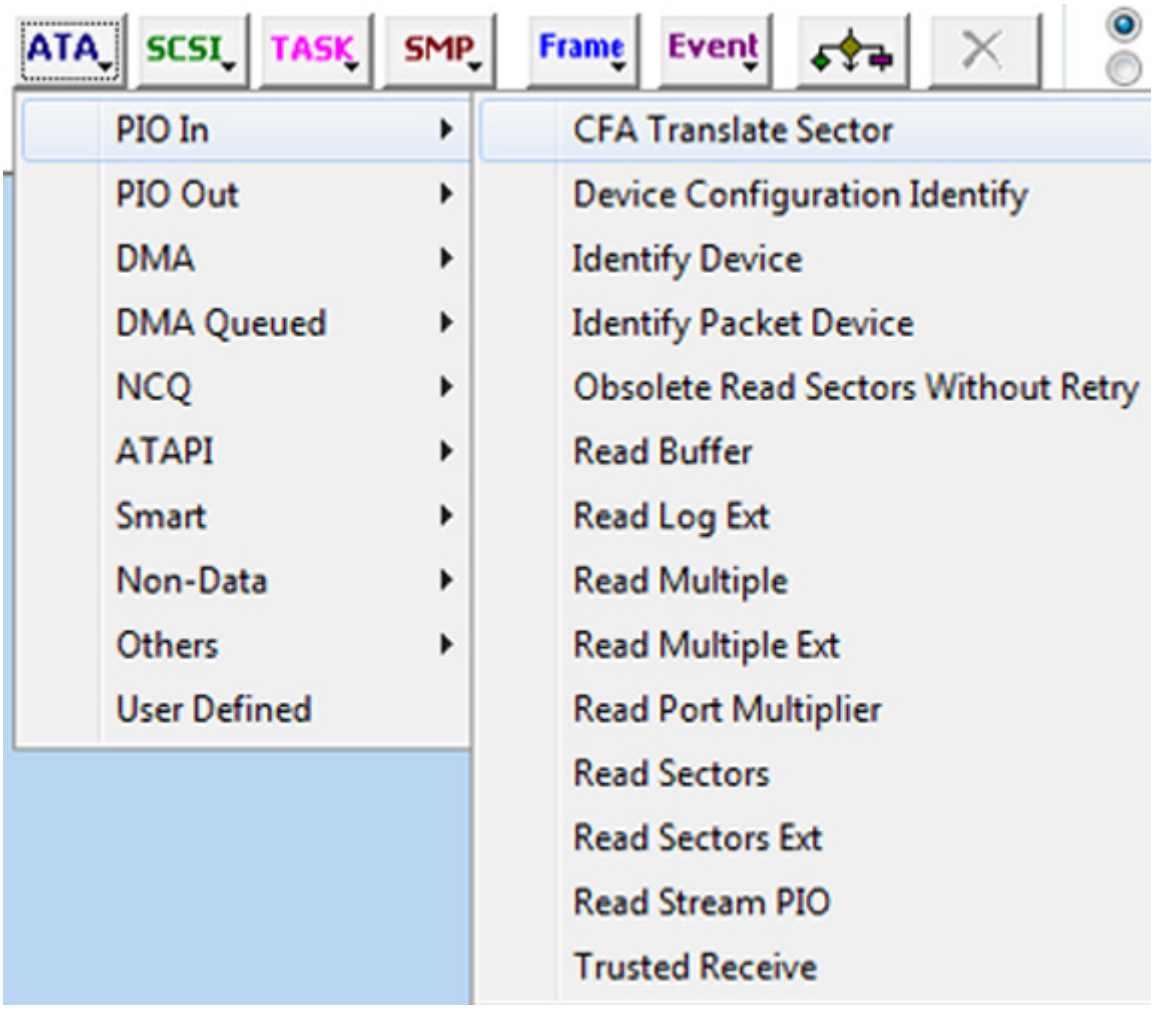


Figure 2.156: SAS: ATA PIO In Dropdown List.

ATA Commands:

- PIO In
- PIO Out
- DMA
- DMA Queued
- NCQ
- ATAPI
- Smart
- Non-Data
- Others
- User Defined

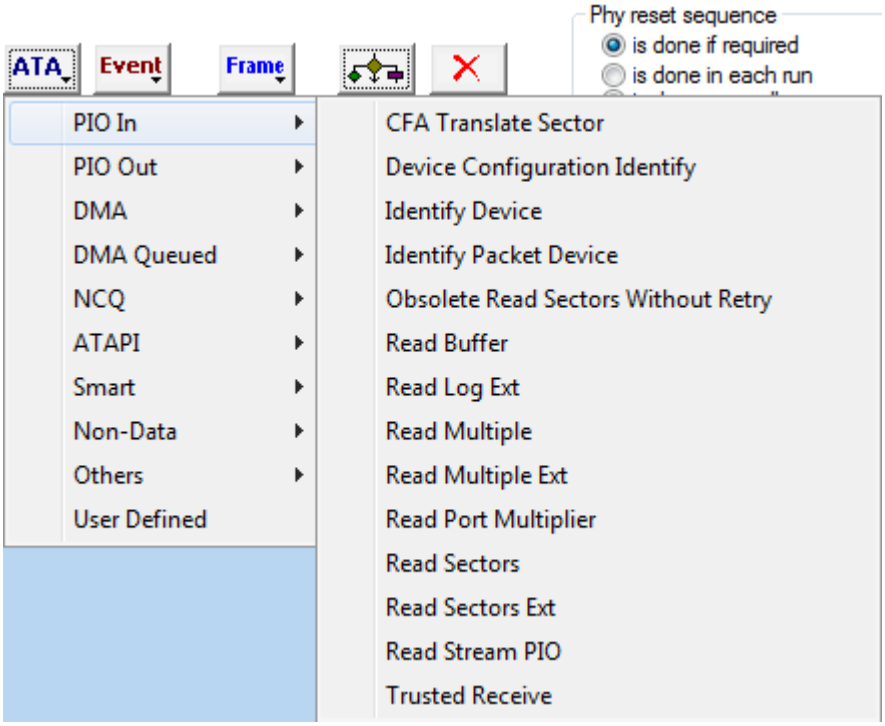


Figure 2.157: SATA: ATA PIO In Dropdown List

Adding a User-Defined ATA Command

Click the **Insert ATA Command** button and choose **User Defined**. This enters an ATA command line with editable fields to define your own custom command. See Figure 2.158

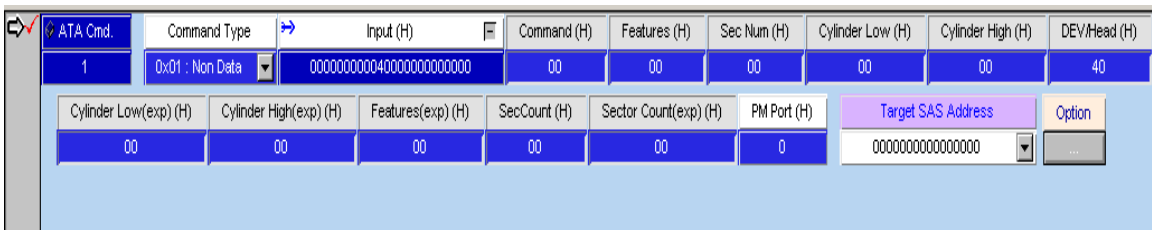


Figure 2.158: Insert ATA Command.

Adding a SCSI Command (SAS only)

The following menu options are available:

- SCSI Commands:
- MMC6
- SBC3
- SMC3
- SPC4
- SSC2
- OSD2
- ADC3
- User Defined

Click the **Insert SCSI Command** button, click one of the command categories, and choose a command (see Figure 2.159).

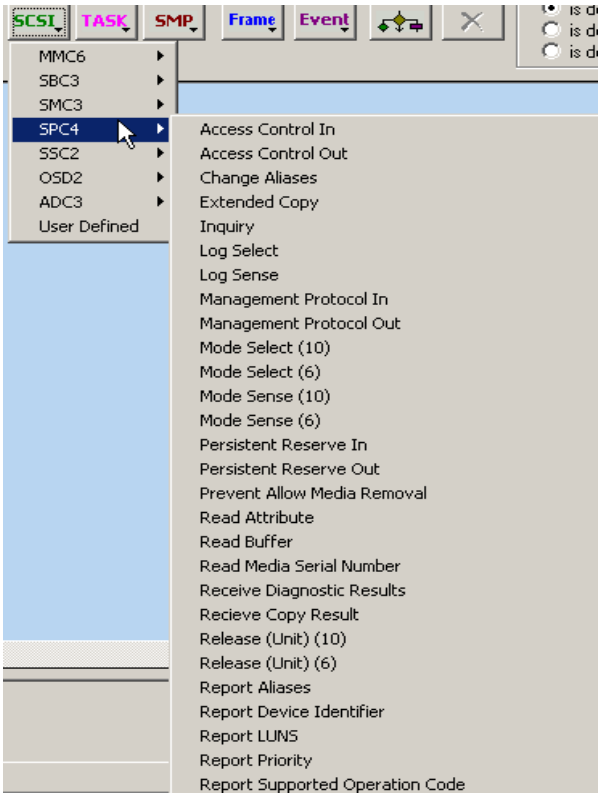


Figure 2.159: SAS: SCSI SPC4 Dropdown List.

Adding a User-Defined SCSI Command (SAS only)

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

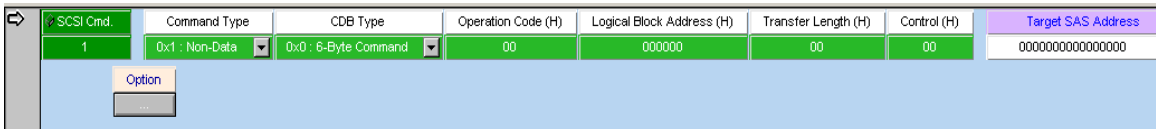


Figure 2.160: Insert SCSI Command.

User-defined SCSI commands are Non-Data, Read from Block Device, Read from Non-Block Device, Write to Block Device, Write to Non-Block Device, Bi-Directional from Block, Skip_Write, and Skip_Read.

Adding a TASK Command (SAS only)

The following menu options are available (See Figure 2.161):

- Abort Task
- Abort Task Set
- Clear Task Set
- Logical Unit Reset
- Clear ACA
- Query Task
- Query Task Set
- I T Nexus Reset
- Query Asynchronous Event

Click the **Insert Task Command** button and choose the command to insert.

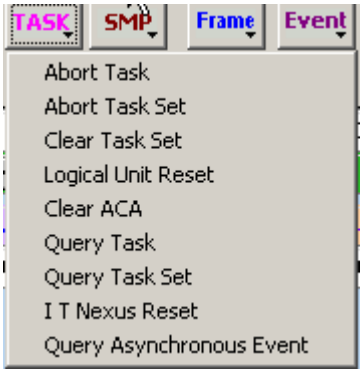


Figure 2.161: SAS: TASK Dropdown List.

Adding an SMP Command (SAS only)

The following menu options are available:

- Report General
- Report Manufacturer Information
- Read GPIO Register
- Report self-configuration status
- Report zone permission table
- Report zone manager password
- Report broadcast
- Discover
- Report Phy Error Log
- Report Phy SATA
- Report Route Information
- Report Phy event
- Discover list
- Report Phy event list
- Report expander route table list

- Configure general
- Enable disable zoning
- Write GPIO register
- Zone broadcast
- Zone lock
- Zone activate
- Zone unlock
- Configure zone manager password
- Configure zone Phy information
- Configure zone permission table
- Configure route information
- Phy control
- Phy test function
- Configure Phy event
- Configure Zone Permission

Click the **Insert SMP Command** button and choose the command to insert. (See Figure 2.162 on page 143).

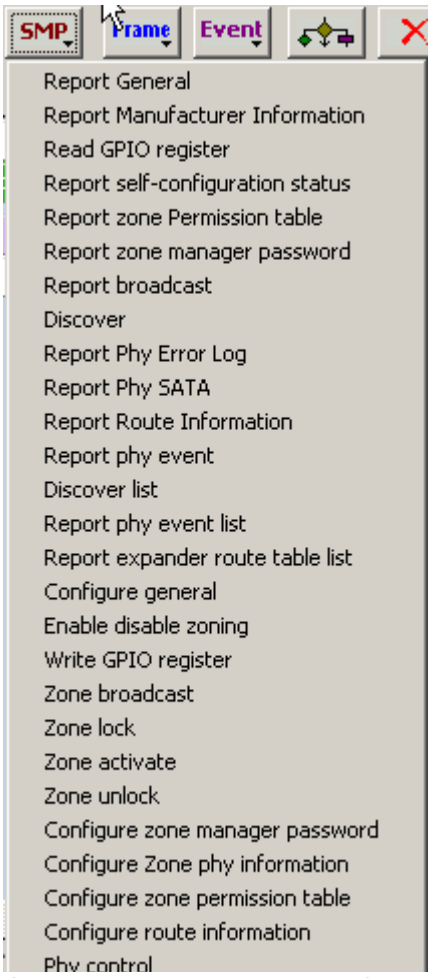


Figure 2.162: SAS: SMP Dropdown List

Adding a Frame

The following menu options are available in **SAS**:

- Identify Frame
- SSP Frames (Command, Data, Task)
- SMP Request Frame
- STP Frames (Host to Device, DMA Setup, Data)
- User Defined

SAS: Click the **Insert Frame** button and choose the frame type to insert.

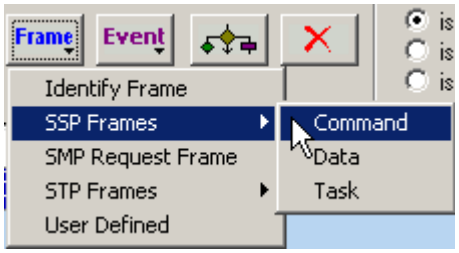


Figure 2.163: SAS: Frame Dropdown List.

Note: SSP and STP frames offer additional options.

The following menu options are available in **SATA**:

- Self Test
- Host to Device
- DMA Setup
- Data
- User Defined

SATA: Click the **Insert Frame** button and choose the frame type to insert. See Figure 2.164.



Figure 2.164: SATA: Frame Dropdown List.

Adding an Event

SAS Event Commands (see Figure 2.165 on page 145):

- PS Request
- PS Response
- Wake Up
- OOB Signal
- Primitive
- Attach
- Detach

- Power On (see “Power On” on page 146).
- Power Off
- PHY Setting & Change Speed
- Change Data Frame Size Setting

Click the **Insert Event** button and choose the event to insert.

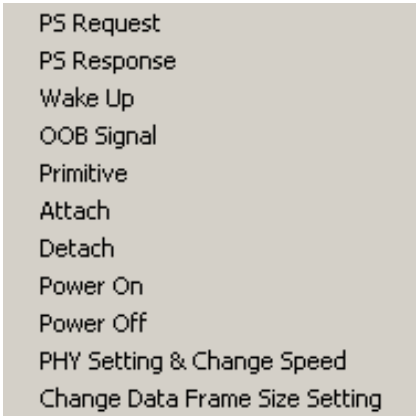


Figure 2.165: SAS: Event Dropdown List.

SATA Event Commands (see Figure 2.166 on page 146)**:**

- Self Test Exit
- PM Request
- PM Response
- Wake Up
- Soft Reset
- OOB Signal
- Primitive
- Attach
- Detach
- Power On- see “Power On” on page 146
- Power Off
- PHY Setting & Change Speed
- Change Data Frame Size Setting
- DevSlp- Toggles pin 3 of the power segment of the of the SATA connector to high setting.
- Exit DevSlp- Toggles pin 3 of the power segment of the of the SATA connector to low setting.

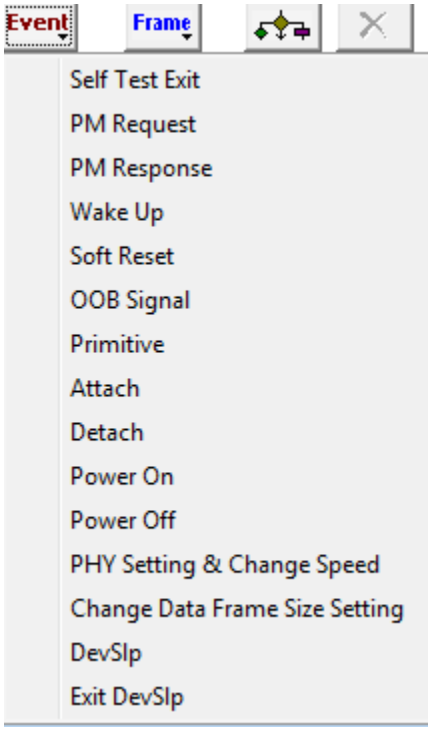


Figure 2.166: SATA: Event Dropdown List.

Power On

The Power Sources command supports 1.2, 1.5, 3.3, 5.0 and 12 Volts electricity voltage. Click the **...** button to display the Power Sources dialog (see Figure 2.167).

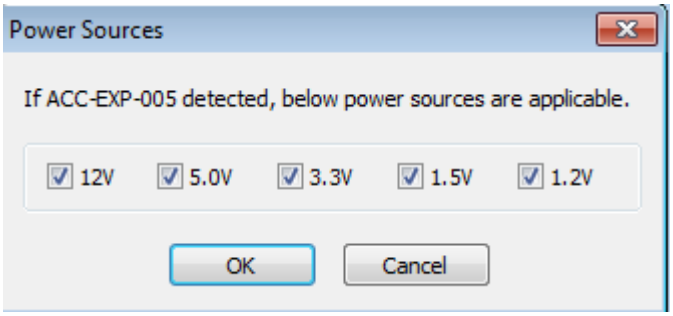


Figure 2.167: SAS/SATA: Power Sources Dialog.

2.9.3 Inserting Instructions (Same for SAS and SATA)

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

To insert an instruction, click a command in the Initiator Emulator (SAS) or Host Emulator (SATA) program where you want the instruction inserted, then click the **Insert Instruction** button, then choose the instruction to insert. See Figure 2.168 on page 147.

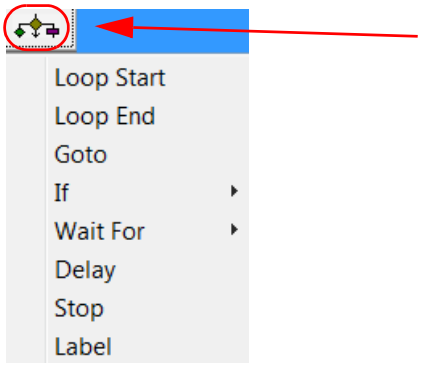


Figure 2.168: Insert Instructions Dropdown List.

Start Loop

Click the command at which to start the loop, and then insert the Loop Start instruction.



Figure 2.169: Start Loop.

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 the command at which to stop the loop, and then insert the Loop End instruction.



Figure 2.170: End Loop.

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.



Figure 2.171: Goto.

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 (SAS see Figure 2.172

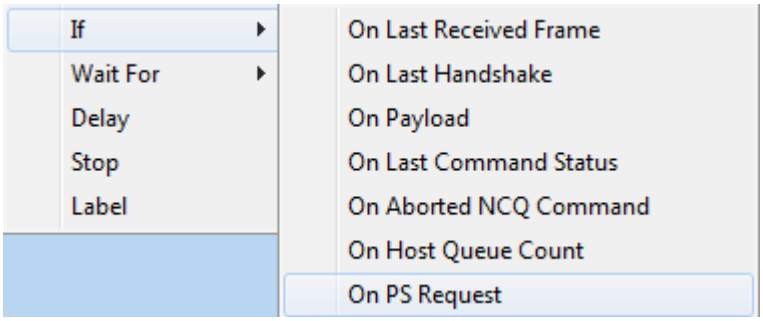


Figure 2.172: If Command Options (SAS)

Choose a specialized condition for the If from the If flyout (SATA see Figure 2.173).

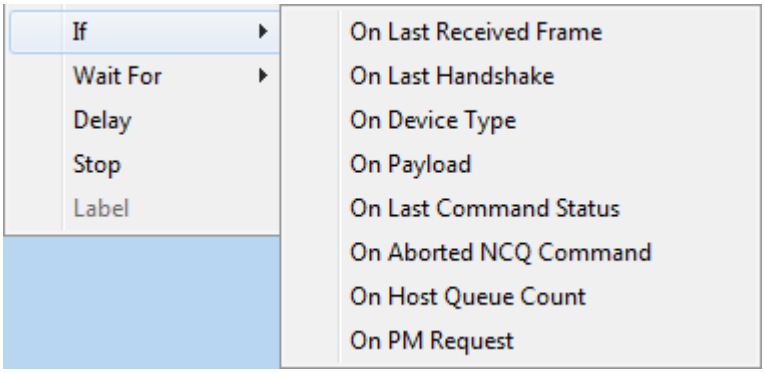


Figure 2.173: If Command Options (SATA)

Then click the down arrow on the If Drop-down combo box, 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.



Figure 2.174: If on Payload.

For commands with incoming payloads, you can specify patterns for a condition by clicking the options button on a payload instruction and defining pattern(s). Click **Load From File** to display the Select Data File dialog to load a large data pattern from a file. Select the **Store Payload in Buffer** option to use the **If on Payload** Match or Mismatch function (see "Store Payload in Buffer" on page 162).

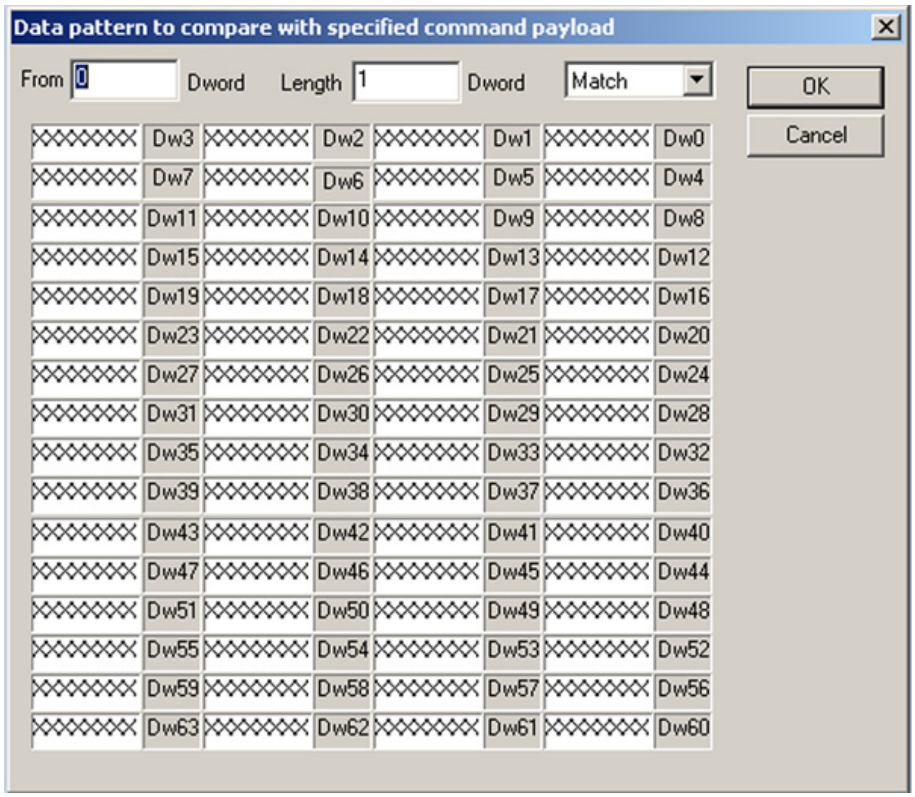


Figure 2.175: Specify Patterns.

Add Wait for Any Frame

Insert this instruction and set an expiration time and a label for the Goto. This instruction causes the emulator to go to the specified label if any frame occurs prior to the expiration time. If the expiration time occurs first, the Initiator program goes to the next step.



Figure 2.176: Wait for Any Frame.

Add Wait for PS (SAS only)

Insert this instruction and select PS_ACK or PS_NAK. Set an expiration time and a label for the Goto. This instruction causes the emulator to go to the specified label if any frame occurs prior to the expiration time. If the expiration time occurs first, the emulator goes to the next step.



Figure 2.177: SAS: Wait for PS.

Add Wait for Power Management (SATA only)

Insert this instruction and select PM_ACK or PM_NAK. Set an expiration time and a label for the Goto. This instruction causes the emulator to go to the specified label if any frame occurs prior to the expiration time. If the expiration time occurs first, the emulator goes to the next step.



Figure 2.178: SATA: Wait for Power Management.

Insert Delay

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



Figure 2.179: Delay.

Add Stop

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



Figure 2.180: Stop.

Add a Label

Add a label to any command, to use for conditional and unconditional jumps. Click the command to label, and insert the Label instruction. You can also insert a label by right-clicking a command and choosing Add Label.



Figure 2.181: Label.

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

Note: Any label that you create must begin with an alphabetic symbol, not a number. Labels that begin with numbers will be ignored.

Phy Reset Sequence and Identification (SAS)

The system performs a Phy Reset Sequence when required, by default, but you can perform it manually (by adding commands to the script) or perform the sequence on each run. See Figure 2.182.

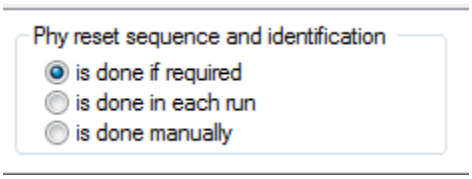


Figure 2.182: SAS: Phy Reset Sequence and Identification

Phy Reset Sequence

The system performs this when required, by default, but you can perform it manually (by adding commands to the script) or perform the sequence on each run. See Figure 2.182.

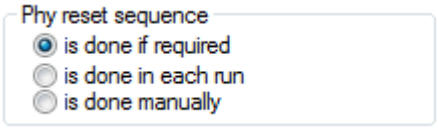


Figure 2.183: SATA: Phy Reset Sequence

Sample Initiator Emulator Program (SAS only)

Figure 2.184 shows a simple completed SAS Initiator Emulator program.

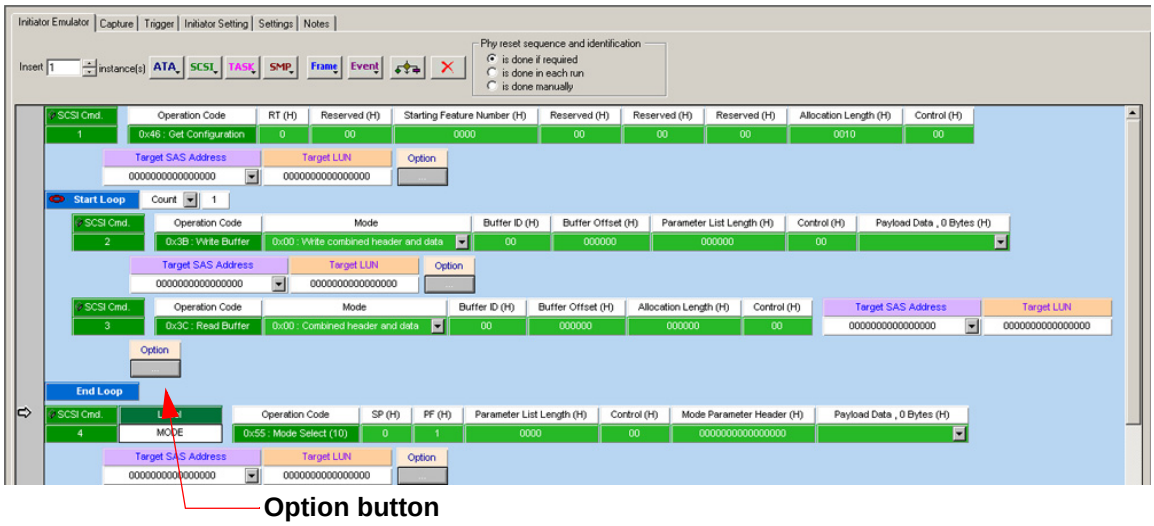


Figure 2.184: SAS: Sample Initiator Emulator Program.

Sample Host Emulator Program (SATA only)

Figure 2.185 shows a simple completed SATA Host Emulator program.

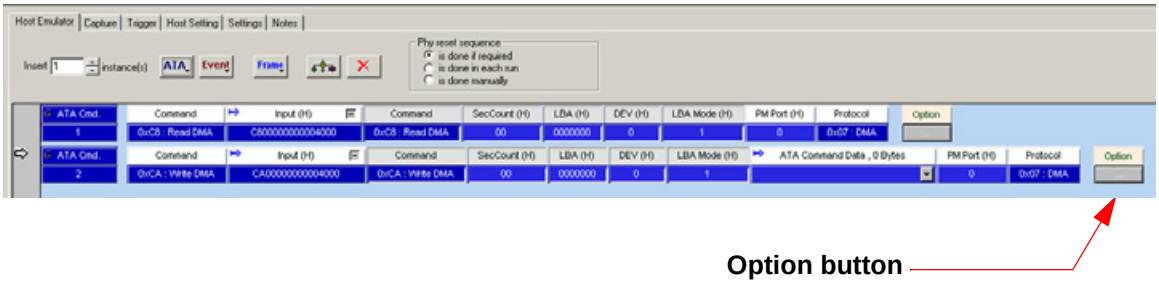


Figure 2.185: SATA: Sample Host Emulator Program.

Instruction Insertion in Script

You can 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 or host page and choose *Insert before current position* or *Insert after current position*.

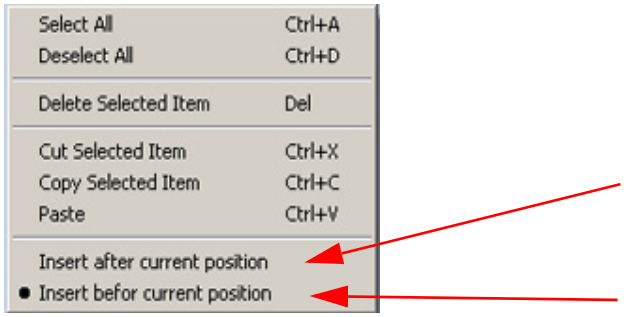


Figure 2.186: Instruction Insert.

Data Blocks

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, select **Setup > Data Block** to open a data block definition dialog (see "Creating a Data Block" on page 185 for instructions on creating data blocks).

Exercising Specific Addresses

Since more than one device can be active at any given time, you can specify specific commands to send to an address. To assign commands to an address:

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

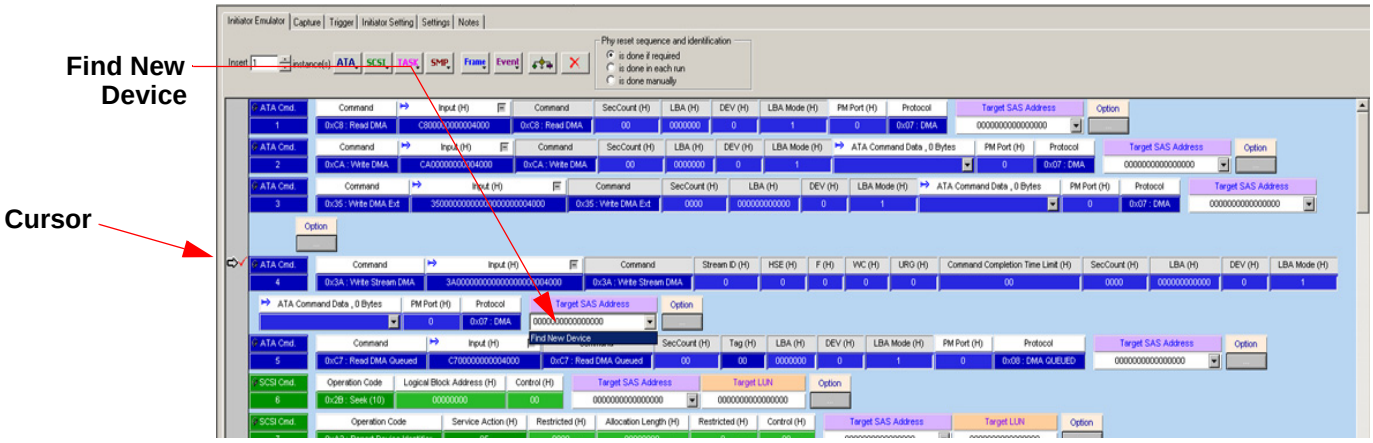


Figure 2.187: SAS: Find SAS Devices Select.

Choosing **Find New Device** opens the Device Identifier dialog.

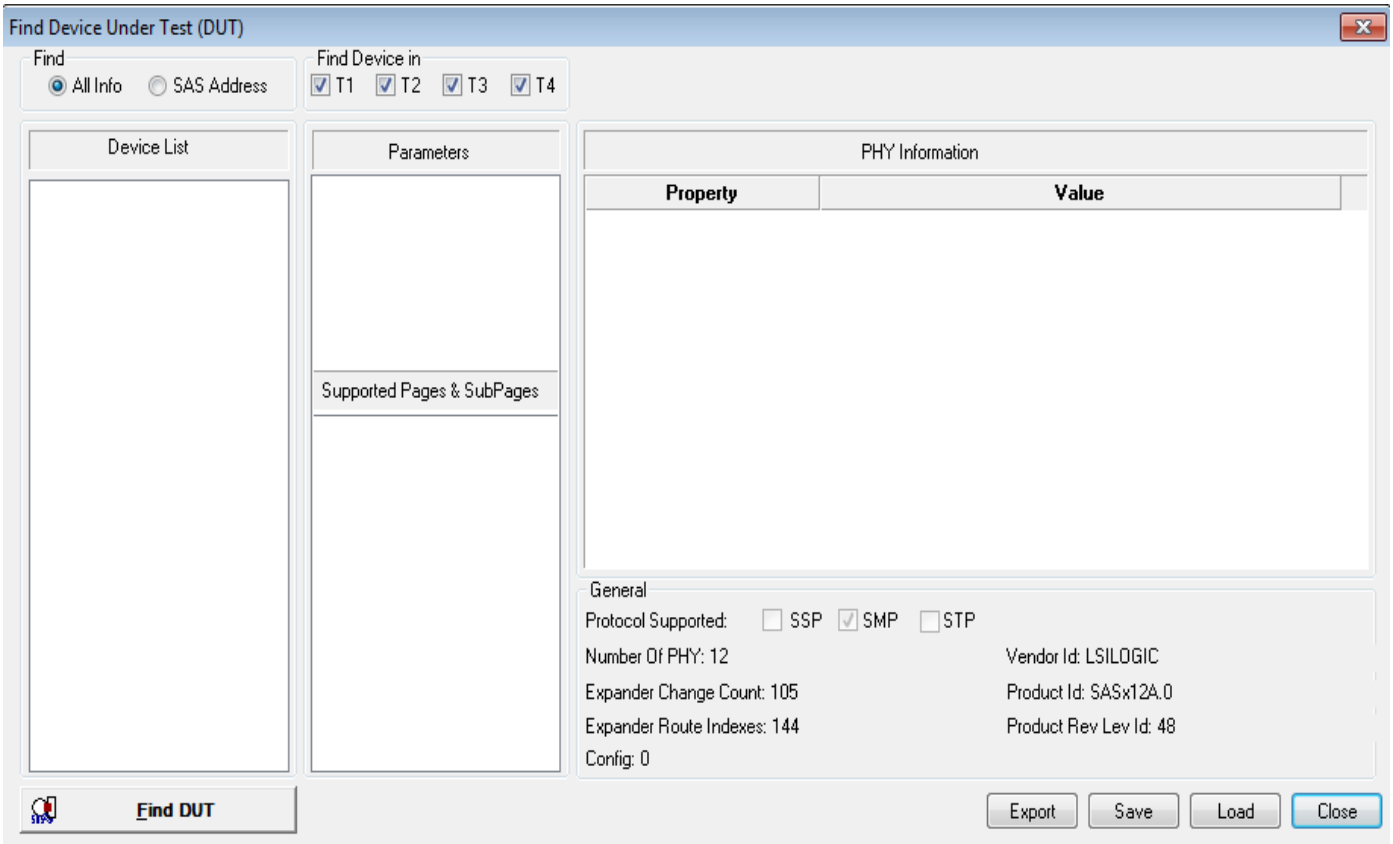


Figure 2.188: SAS: Device Identifier Dialog.

SAS vs. SATA: SATA dialog does not show Find section (All Info and SAS Address).
SATA dialog has devices D1 to D4 and does not show T1 to T4.
SATA dialog does not show Supported Pages and Sub-pages.
SATA dialog lists Word, Description and Value, not Offset, Field, Length, and Value.
SATA dialog lists Device Type, Serial Number, and Spec Version, not Protocol Supported (SSP, SMP, STP)

2. Click the **Find DUT** button to display all active addresses (see Figure 2.189 on page 154).

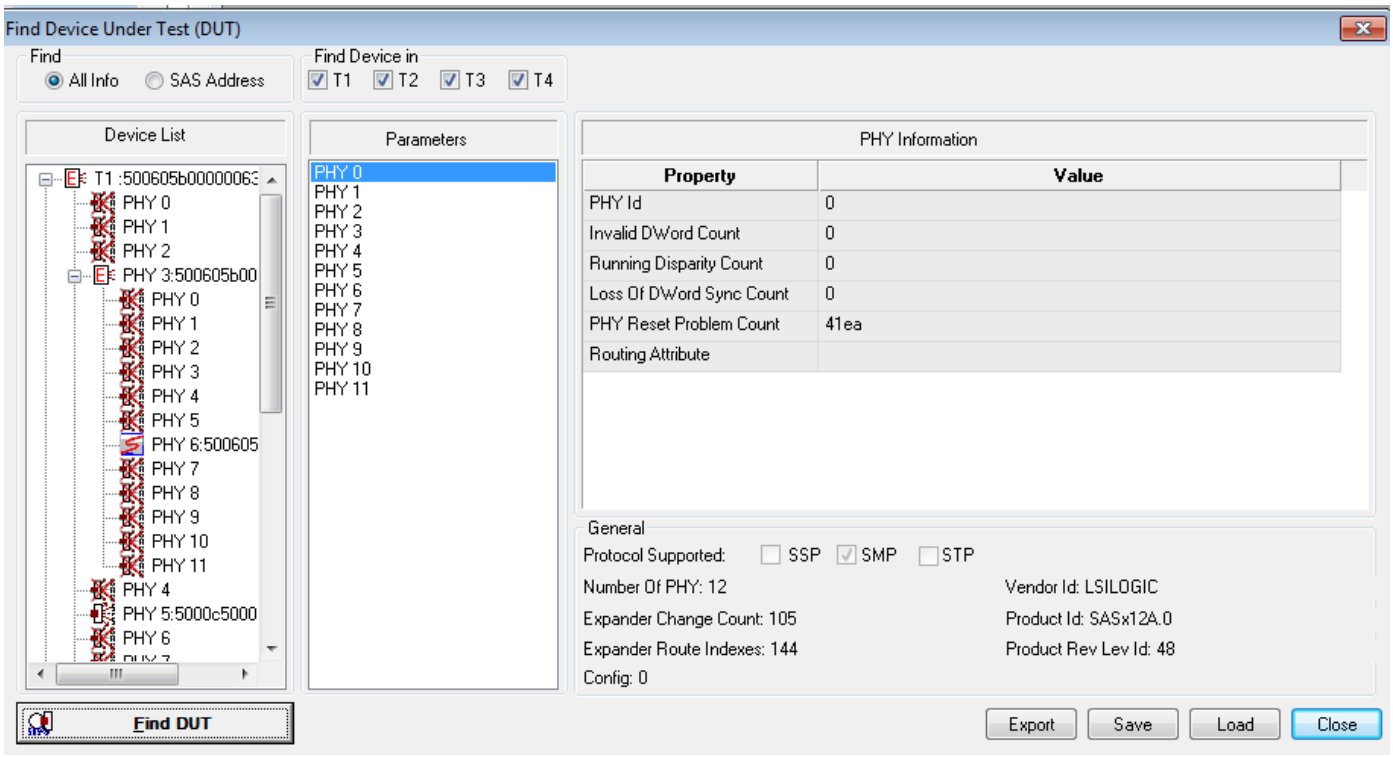


Figure 2.189: SAS: Active SAS Addresses.

3. To assign commands to an active address, right-click an address and choose:
   Insert To Cursor assigns all commands up to the cursor to the chosen address.
   Insert: To All assigns all commands to the chosen address.

Note: Selecting a SAS device and clicking **Export** allows you to export in .std format. Selecting a SATA or Expander and clicking **Export** allows you to export in .txt format.

Moving the White Insertion Arrow

To add a new item (ATA Cmd, SCSI Cmd, Task Cmd, SMP Cmd, Frame Types, Event Type, Insert Instruction or Remove selected item) in the middle of the other items, move your cursor to the colored item number block where you want to insert a new item and perform a right click. This will move the white arrow to the item of interest and a menu of actions will pop-up. See Figure 2.190.

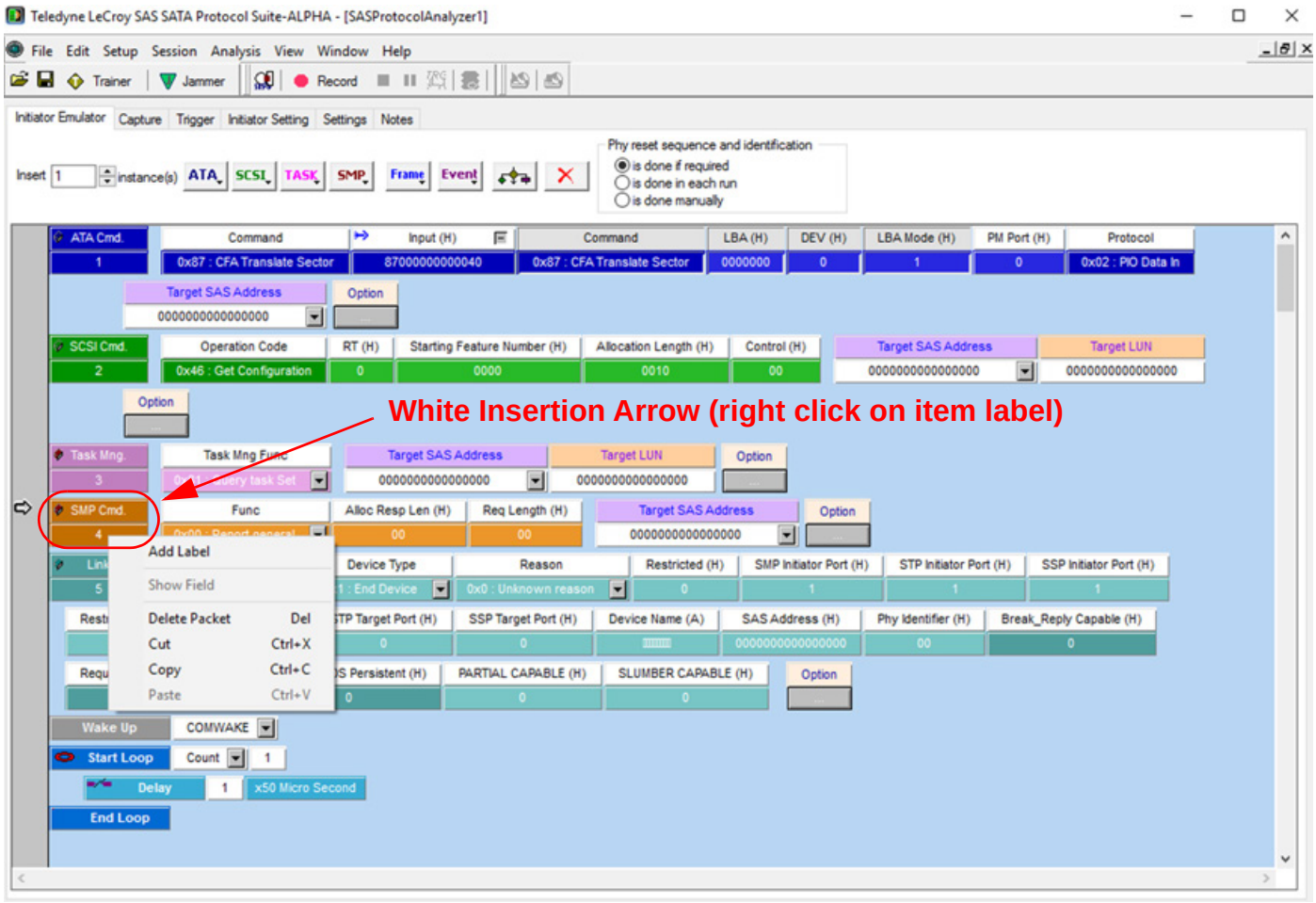


Figure 2.190: Adding a New Item

These actions include the following functions:

- Add Label
- Show Field (if applicable)
- Delete Packet
- Cut
- Copy
- Paste (if applicable)

Manipulating the Red Check Mark

If you perform a left click on the item of interest, a red check mark will pop-up next to it, along with a menu of actions that can be taken. See Figure 2.191.

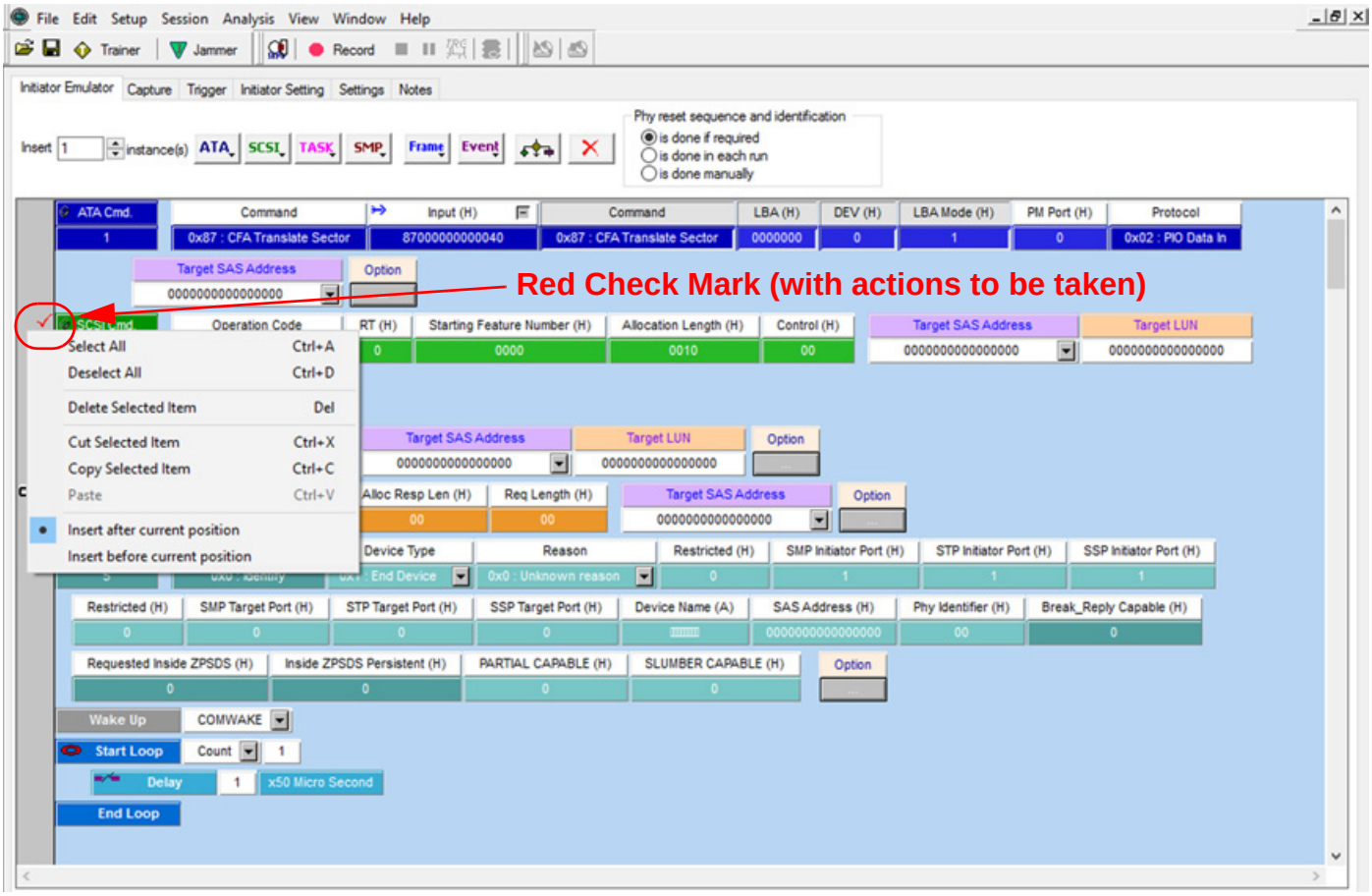


Figure 2.191: Actions That Can Be Performed After Selecting an Item

Near the item selected, a menu with the following actions will pop-up:

- Select All
- Deselect All
- Delete Selected Item
- Cut Selected Item
- Copy Selected Item
- Paste (if applicable)
- Insert (new item) after current position
- Insert (new item) before current position

2.9.4 Record and Play

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

To perform this action:

1. Run a capture project or open a previously run and saved a captured trace file.
2. Set X and Y cursors to export between cursors (see Figure 2.192 on page 157).

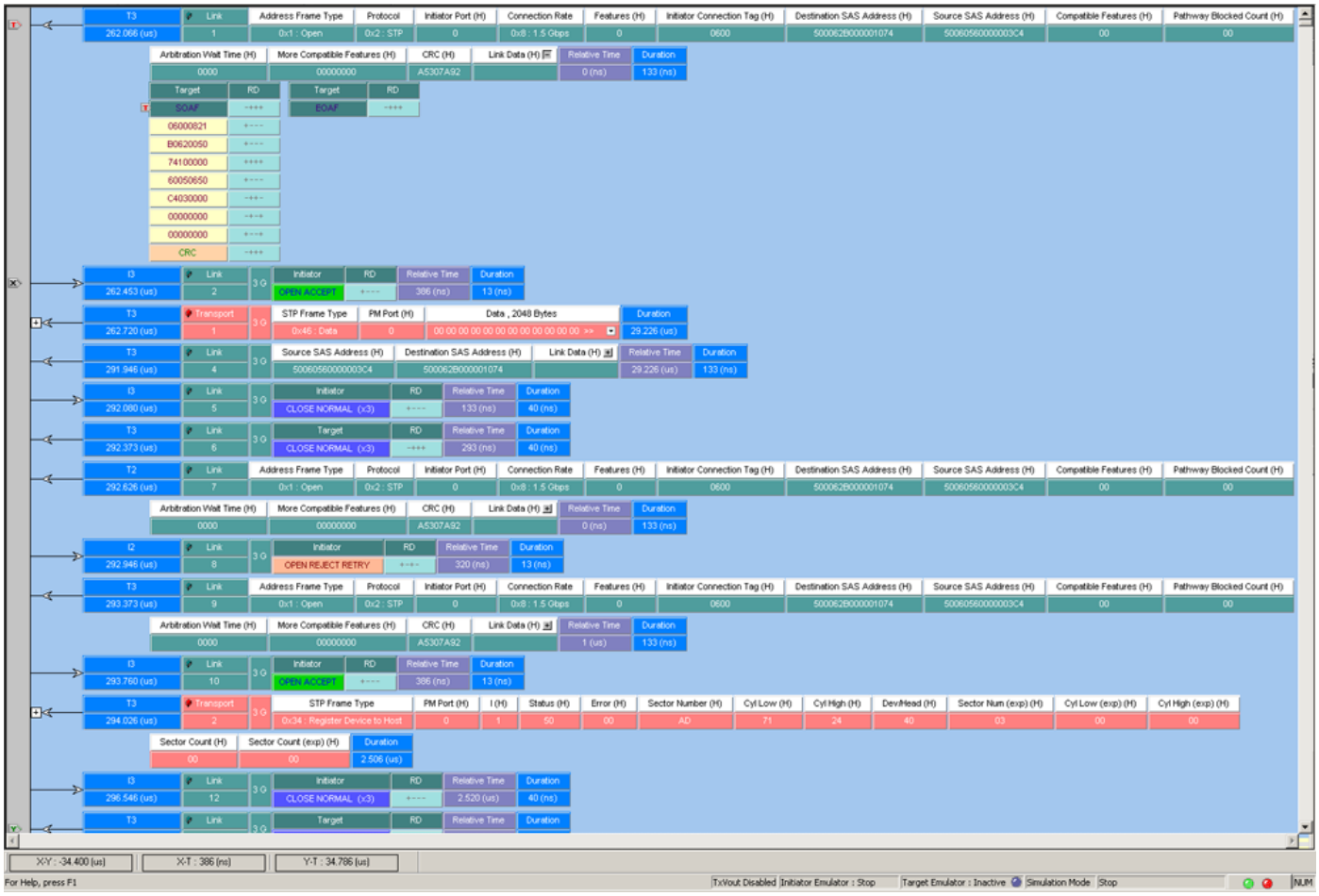


Figure 2.192: SAS: Captured Trace Display With Cursors Set.

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

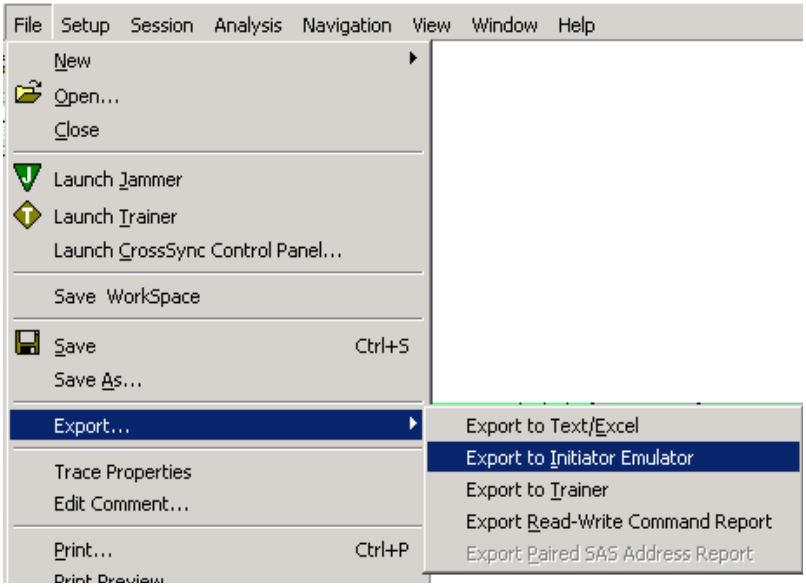


Figure 2.193: SAS: Export to Initiator Emulator.

This displays the Export to Initiator Emulator dialog.

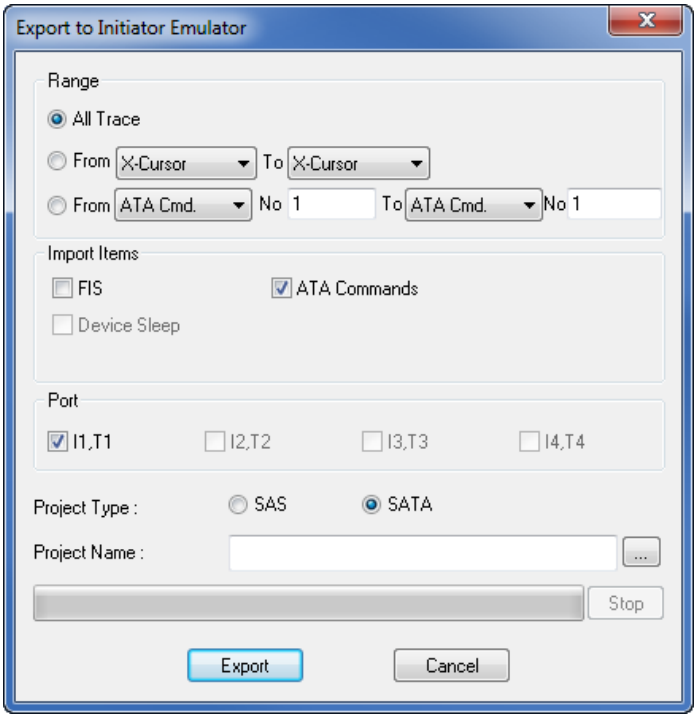


Figure 2.194: Export to Initiator Emulator Dialog.

4. Select the SAS or SATA protocol radio button.
5. Click the ellipses next to the Project Name address bar and select an existing ***.sac** or ***.stc** file.
6. Choose an export range and item, Command, or FIS, then click **Export.**
7. After the export action completes, open the exported ***.sac** or ***.stc** file.

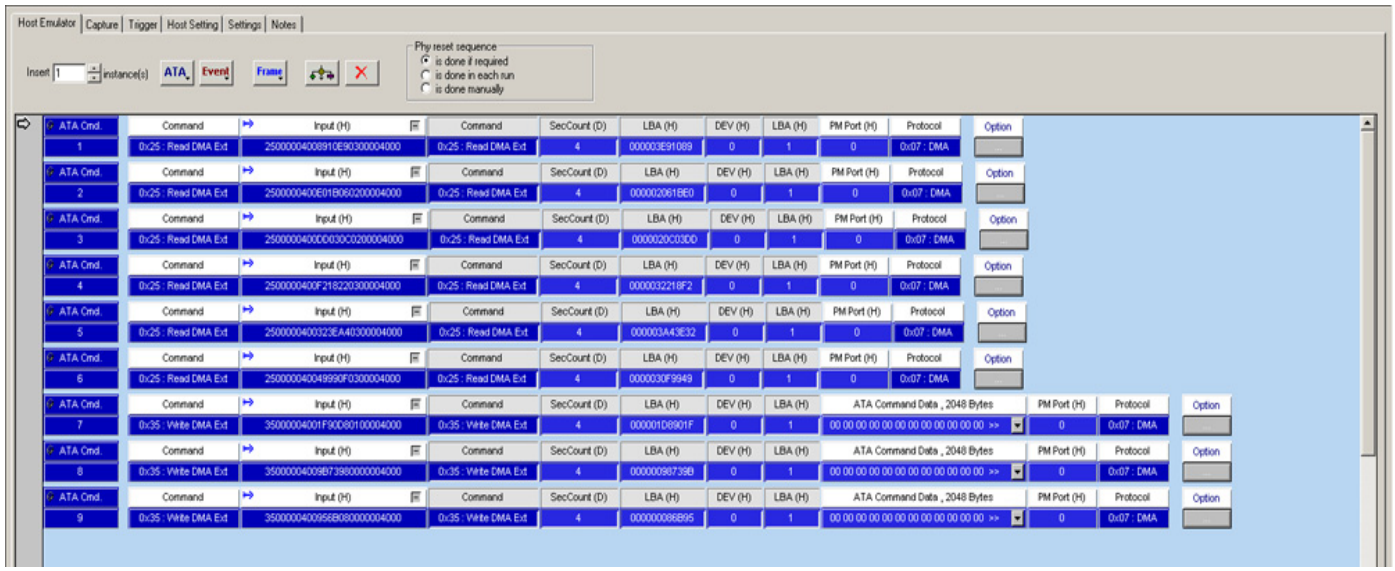


Figure 2.195: SATA: Host Emulator Program With the Exported Commands.

You can run this set of commands immediately, or you can modify it by inserting instructions and/or additional commands.

2.9.5 Error and Command Settings

Each command type allows you to set a variety of command settings and to introduce errors. Click the **Option** button on a command line to display the corresponding Protocol Error and Command Settings dialog. For SAS see Figure 2.196. For SATA see Figure 2.197.

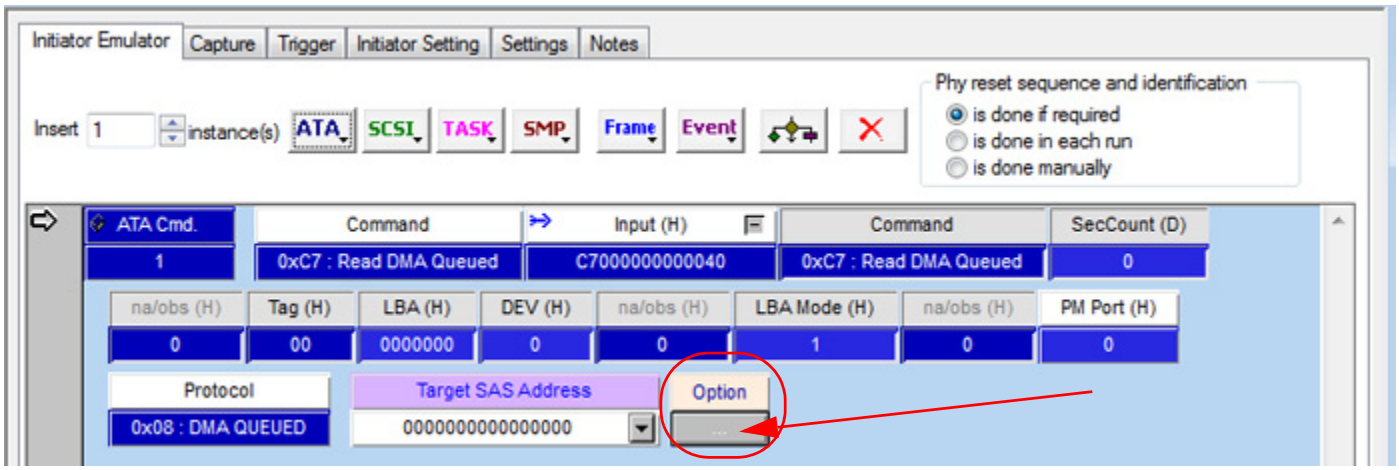


Figure 2.196: SAS: Option

Click on the gray bar below the Option label and the following dialog pops up. See Figure 2.198 on page 161.

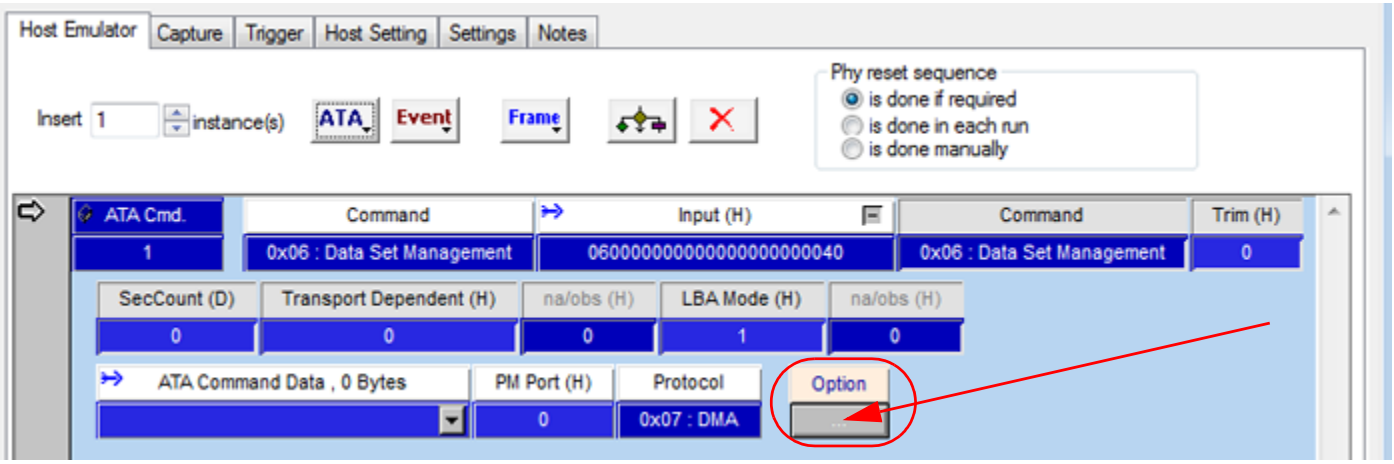


Figure 2.197: SATA: Option

Click on the gray bar below the Option label and the following dialog pops up. See Figure 2.199 on page 161.

ATA Error and Command Settings

The Protocol Errors and Command Settings screen is shown below.

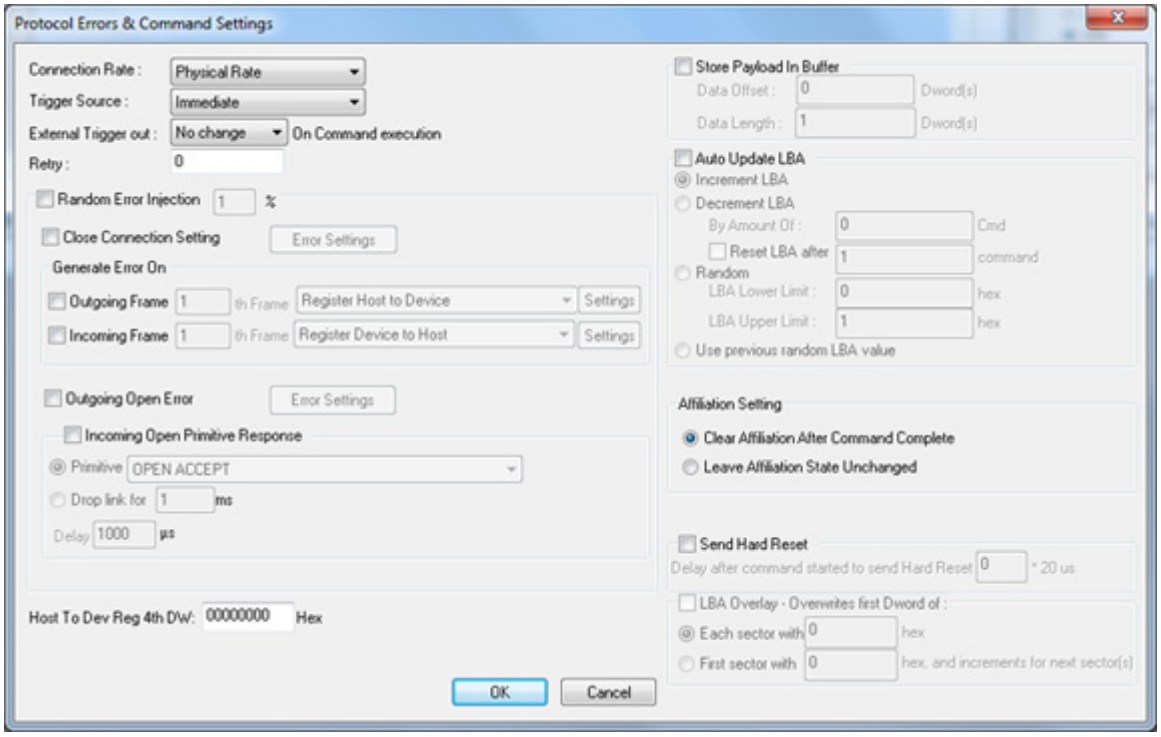


Figure 2.198: SAS: Protocol Error and Command Settings for ATA Dialog.

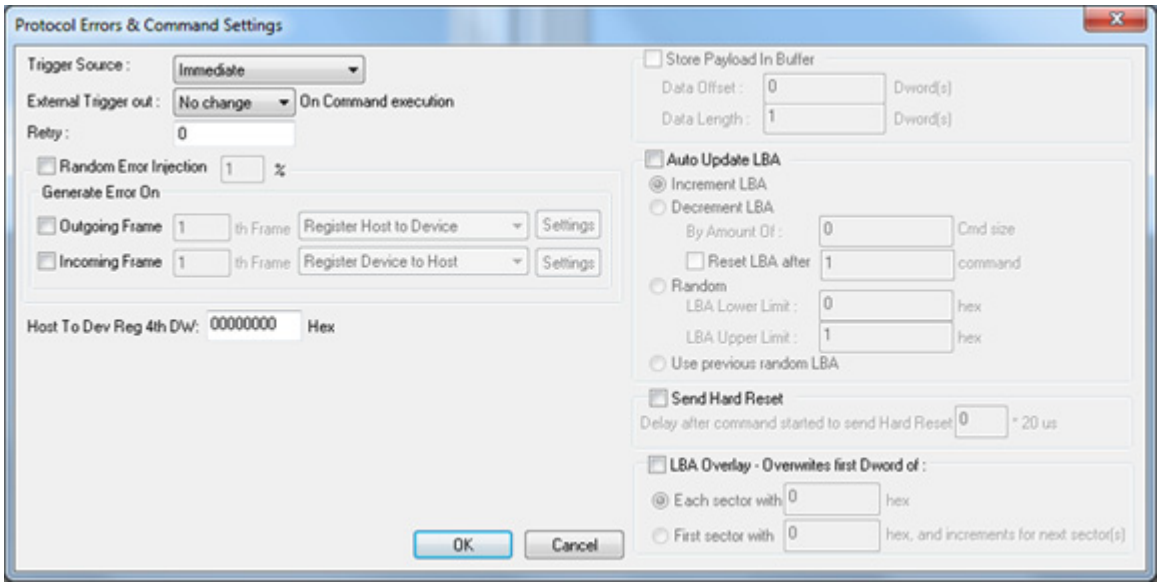


Figure 2.199: SATA: Protocol Error and Command Settings for ATA Dialog.

Connection Rate

Select the Connection Rate to allow a higher speed port to communicate with a lower speed port: Physical Rate, 1.5 G, 3, or 6.

Trigger Source

Click the down arrow on the Trigger Source combo box to choose trigger type: Immediate, Wait for external trig, or Wait for Analyzer trig.

External Trigger Out

Click the down arrow on the External Trigger out combo box to choose the external trigger level: High, Low, or No change on command execution.

Retry

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

Store Payload in Buffer

Check the Store Payload in Buffer check box and enter values for Data Offset and Data Length.

Auto Update LBA

Check the Auto Update LBA check box and check an auto update option button.

Send Hard Reset

Check the radio button and enter the delay after command restarts to send the Hard Reset.

LBA Overlay - Overwrites first Dword of:

Check the LBA Overlay - Overwrites first Dword of check box. Select one of the two options:

- Each sector with: Overwrites first Dword of each sector with given value
- First sector with: Overwrites first Dword of first sector with given value band increments for next sector(s)

Random Error Injection

Random Error Injection specifies the probability of Error Injection on the command. The probability percentage that you select applies to all Error Injection items.

Close Connection Setting

Checking Close Connection Setting enables the Error Settings button. Click this button to display the Close Connection Setting dialog (see Figure 2.200 on page 162).

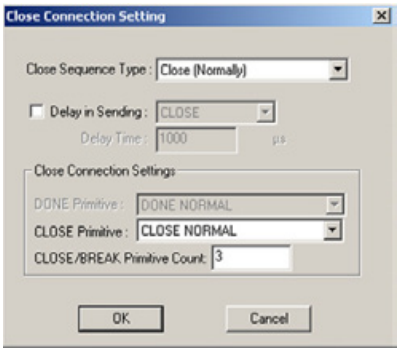


Figure 2.200: Close Connection Dialog

Select the **Close Sequence Type** from the drop-down list. Selecting **Delay in sending** allows you to specify the delay in sending Done, Close, or Break.

Select the **Close Connection Settings** from the drop-down lists.

Outgoing Open Error

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

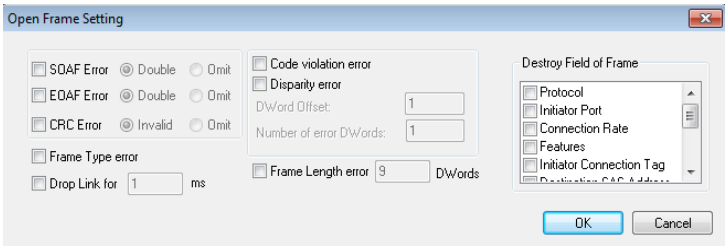


Figure 2.201: Open Frame Setting Dialog.

Check errors to introduce.

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

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.



Figure 2.202: 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.

Enable First Burst

Check Enable First Burst to allow first burst.

Task Attribute

Choose Simple, Head of Queue, Ordered, or ACA.

Outgoing ATA Frame Settings

Before selecting Outgoing Frame Settings, select the Types Of Frames and the Frame Number on which to inject an error. Then check Outgoing Frame in the Generate Error On area and then the enabled Settings button to display the Outgoing Frame Settings dialog.

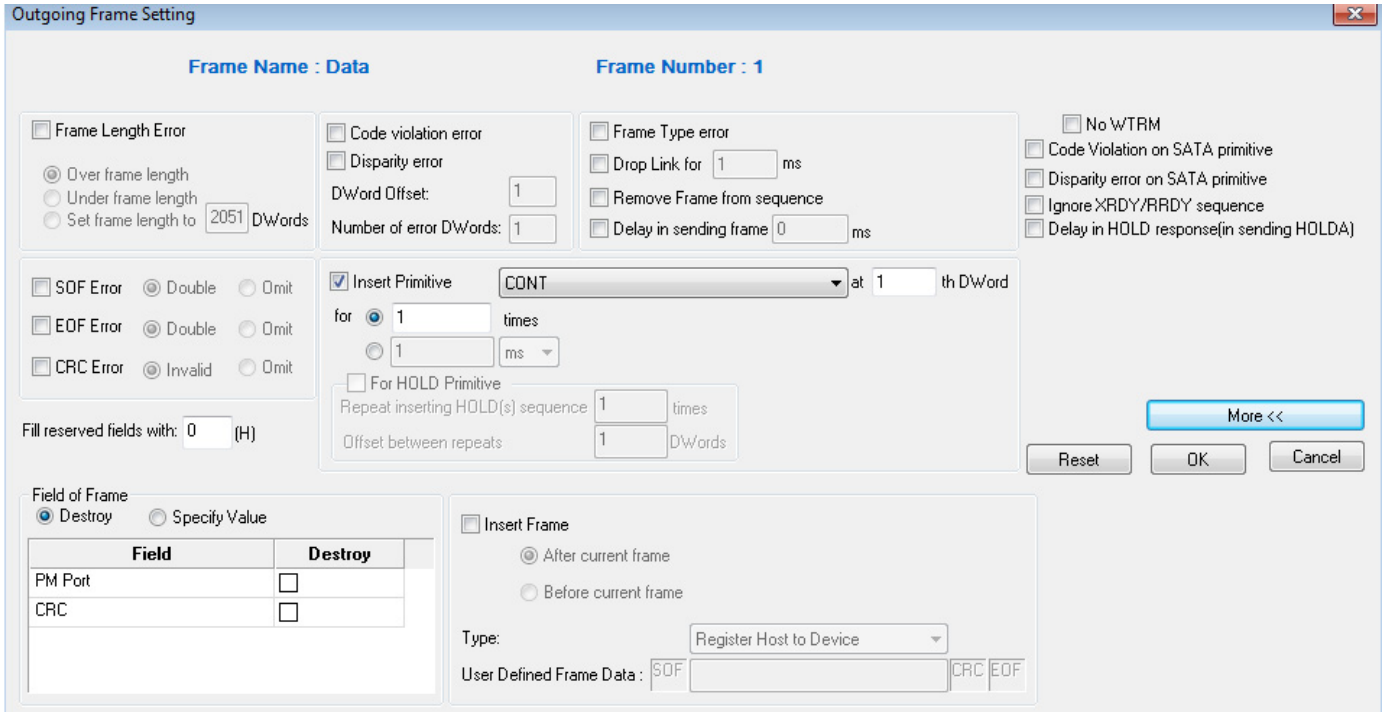


Figure 2.203: Outgoing Frame Settings.

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 delay.

Frame Length Error

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

Code violation and Disparity error

Check these and specify DWORD offset and number of error DWORDs.

Additionally check:

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

SOF, EOF and CRC errors

Check these 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 and select the primitive type.

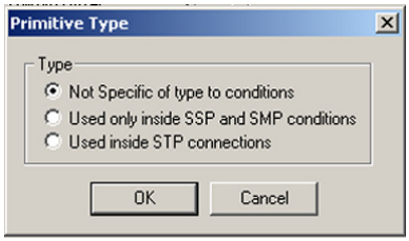


Figure 2.204: Primitive Type Dialog.

Click the down arrow on the Primitive combo box, choose a primitive, then click OK.

Fill reserved fields with

Enter a value for which reserved fields to change, if other than 0.

Field of Frame

Select Destroy, scroll through the available choices in the Field of Frame list box, and choose a field to destroy. Alternatively, select Specify Value to fill the chosen field with a pre-defined value.

Insert Frame

Check Insert Frame, click the down arrow on the Type combo box, and choose the frame type.Then choose to insert it before or after an outgoing frame command. Make sure that you have clicked More.

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

2.9.6 Incoming ATA Frame Settings

Before selecting Incoming Frame Settings, select the Types Of Frames and the Frame Number on which to inject an error. Then check Incoming Frame in the Generate Error On area and then the enabled Settings button to display the Incoming Frame Settings dialog.

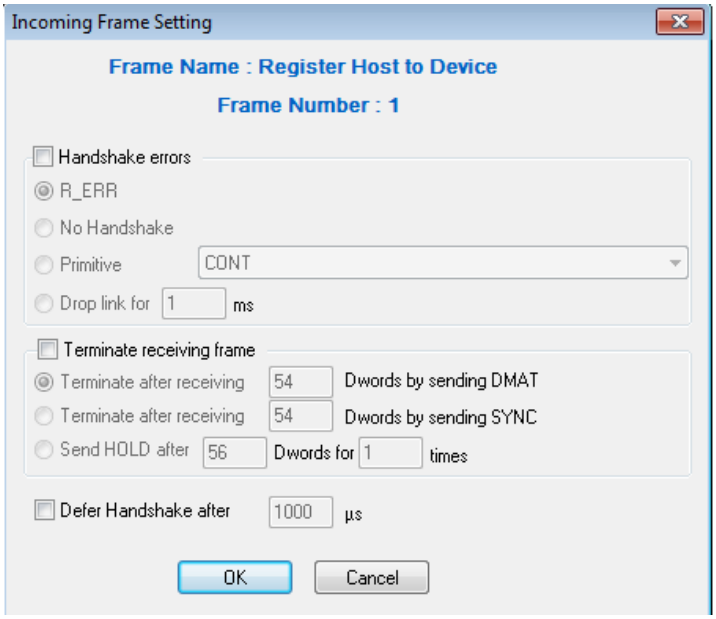


Figure 2.205: Incoming Frame Setting Dialog ATA.

Handshake Error

Check Handshake Errors to enable selection of errors and primitives. Check R_ERR or select Primitive to send as an incoming frame response. Check No Handshake to send no response.

Terminate Receiving Frame

Check **Terminate Receiving Frame**, then choose the termination type.

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 (SAS only)

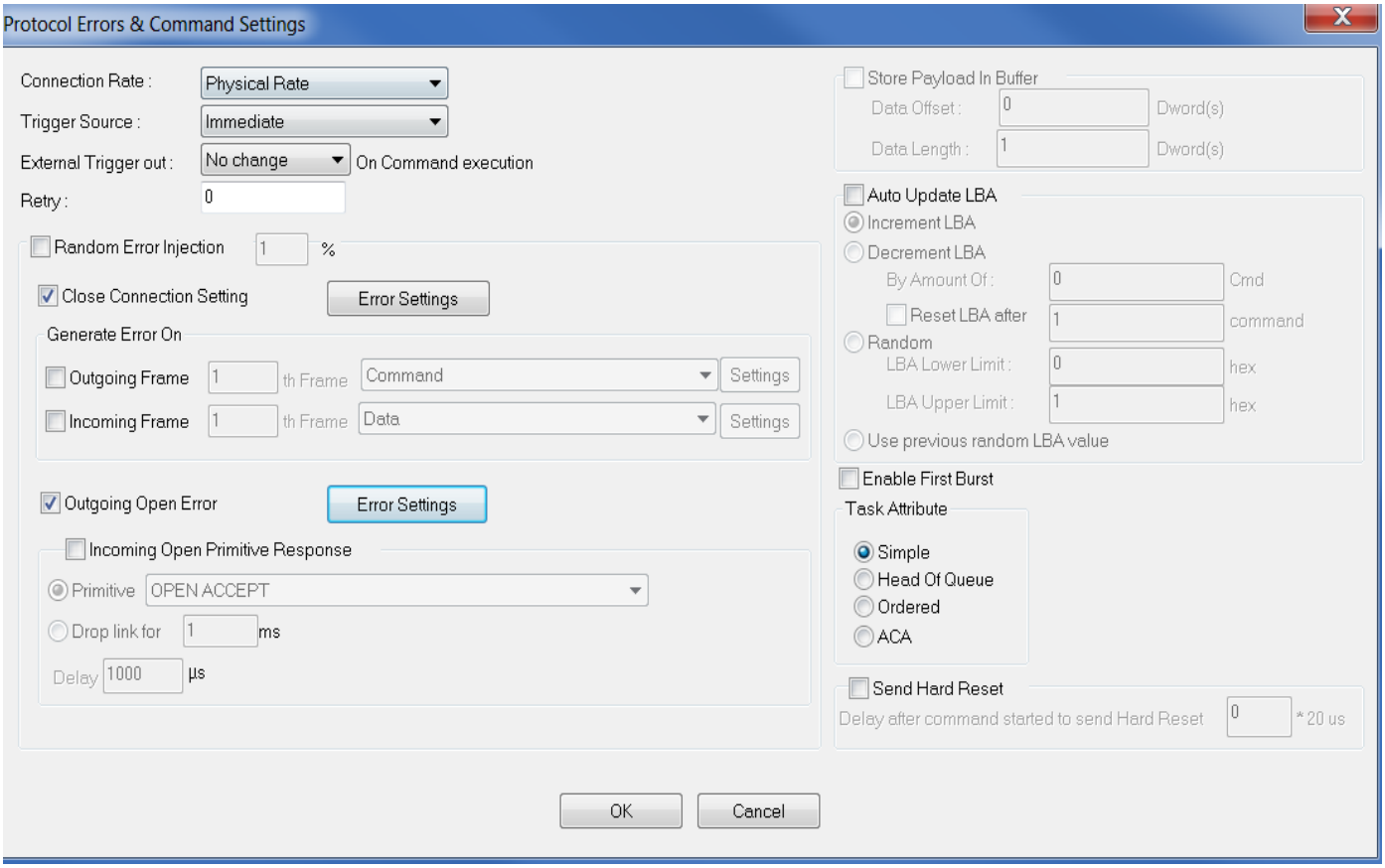


Figure 2.206: SAS: Protocol Error and Command Settings for SCSI Dialog.

Connection Rate

Select the **Connection Rate** to allow a higher speed port to communicate with a lower speed port: Physical Rate, 1.5 G, 3, or 6.

Trigger Source

Click the down arrow on the Trigger Source combo box, and choose trigger type: Immediate, Wait for external trig, or Wait for Analyzer trig.

External Trigger Out

Click the down arrow on the External Trigger out combo box to choose the external trigger level: Active or No change on command execution.

Retry

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

Random Error Injection

Random Error Injection specifies the probability of Error Injection on the command. The probability percentage that you select applies to all Error Injection items.

Close Connection Setting

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

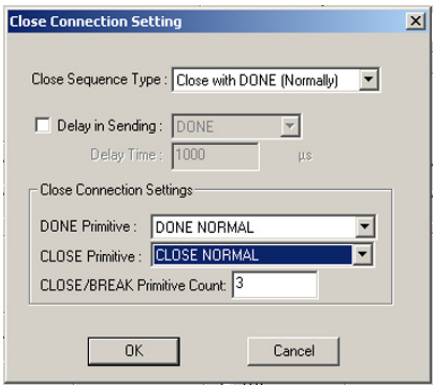


Figure 2.207: SAS: Close Connection Settings.

Select a **Close Sequence Type** from the drop-down list.

Check **Delay in Sending** to specify the delay in sending Done, Close, or Break.

Select **Close Connection Settings** from the drop-down lists.

Store Payload in Buffer

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

Auto Update LBA

Check to enable Auto Update of LBA, then specify the update by checking the options.

Outgoing Open Error

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

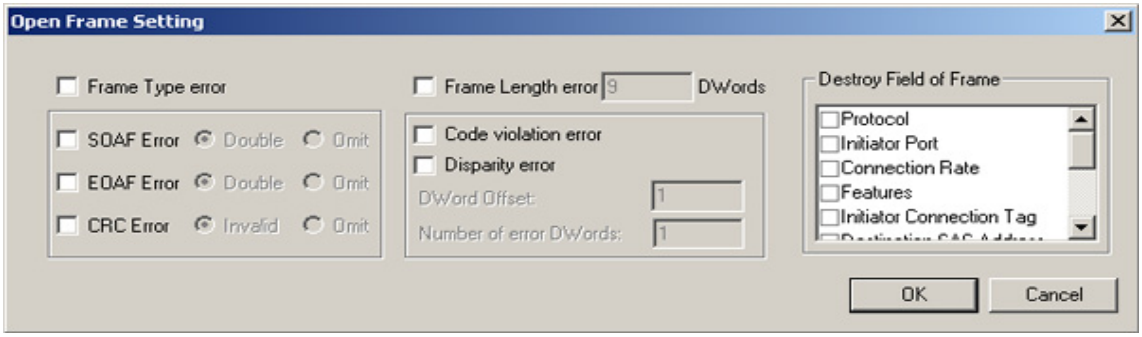


Figure 2.208: SAS: Open Frame Settings.

Check the errors to introduce.

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

Incoming Open Primitive Response

To set a response to an incoming Open frame, check **Incoming Open Frame Response**, select a Primitive from the drop-down list, check **Drop link for** to drop link for the specified milliseconds.

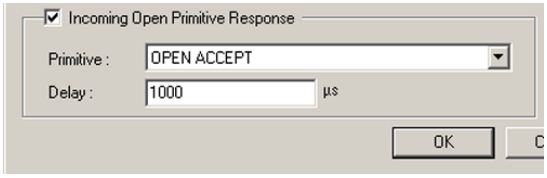


Figure 2.209: SAS: Open Primitive Response.

Enable First Burst

Check the **Enable First Burst** box to specify to transfer the first burst data as defined by the First Burst Size field in the Advanced Initiator Setting dialog. See Figure 2.217 on page 177.

Task Attribute

Choose a task attribute of Simple, Head of Queue, Ordered, or ACA by checking the corresponding option button.

Set Hard Reset

Check the radio button and enter the delay after command restarts to send the Hard Reset.

LBA Overlay - Overwrites first Dword of:

Check the LBA Overlay - Overwrites first Dword of check box. Select one of the two options:

- Each sector with: Overwrites first Dword of each sector with given value
- First sector with: Overwrites first Dword of first sector with given value band increments for next sector(s)

Outgoing SCSI Frame Settings

Before selecting Outgoing Frame Settings, select the Types Of Frames and the Frame Number on which to inject an error. Then check **Outgoing Frame** in the Generate Error On area and then the **Settings** button to display the Outgoing Frame Setting dialog (see Figure 2.210 on page 169).

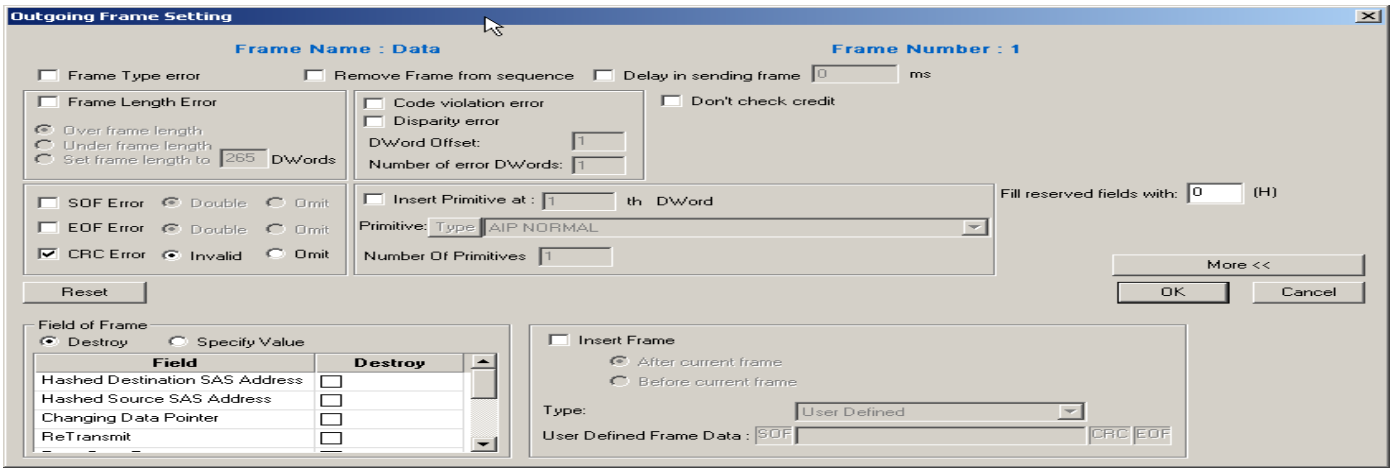


Figure 2.210: SAS: Outgoing Frame Setting Dialog SCSI.

Frame Type Error

Check this to introduce a frame type error.

Drop link for

Check this to drop link for the specified milliseconds.

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 delay.

Frame Length Error

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

Code violation and Disparity error

Check these and specify DWORD offset and the number of error DWORDs.

Don't check credit

Check this to disable credit checking.

SOF, EOF and CRC errors

Check these and specify Double or Omit by checking the corresponding option button.

Insert Primitive

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

Field of Frame

Select **Destroy**, scroll through the available choices in the Field of Frame list box, and choose a field to destroy. Alternatively, you can select **Specify Value** to fill the chosen field with a pre-defined value.

Insert Frame

You can insert a frame before or after the current frame. To insert a frame, check **Insert Frame**, check the option button at which to insert the frame, and choose a Frame Type.

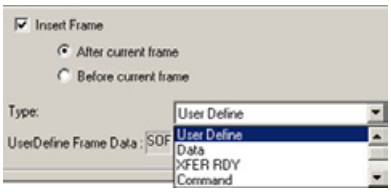


Figure 2.211: SAS: Insert Frame.

Incoming SCSI Frame Settings

Before selecting Incoming Frame Settings, select the Types Of Frames and the Frame Number on which to inject an error. Then check Incoming Frame in the Generate Error On area and then the enabled Settings button to display the Incoming Frame Setting dialog (see Figure 2.212 on page 171).

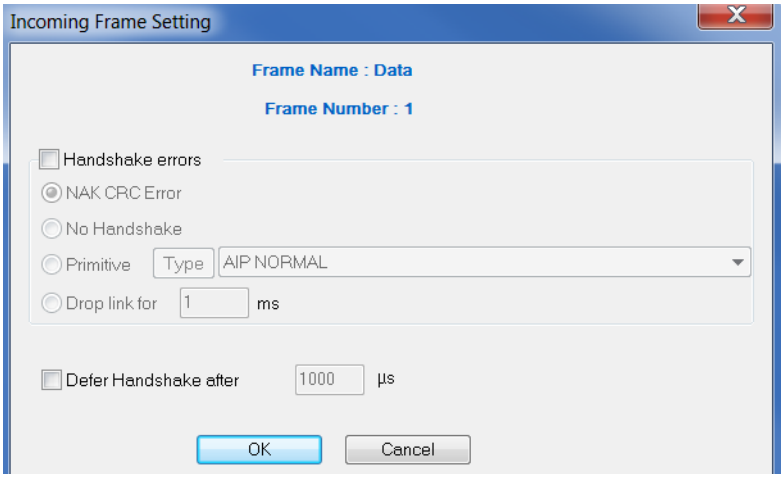


Figure 2.212: SAS: Incoming Frame Setting Dialog (SCSI).

Handshake Error

Check **Handshake Error** and select **NAK CRC Error, No Handshake**, or **Primitive** and a Primitive Type. Select **Drop link for** to drop link for the specified milliseconds

Defer Handshake

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

FIS Options (SATA only)

If you select **Frame > Host to Device**, **Frame > DMA Setup**, or **Frame > Data**, the system adds an FIS line. At the end of the line is an **Options** button that opens an Outgoing Frame Setting dialog.

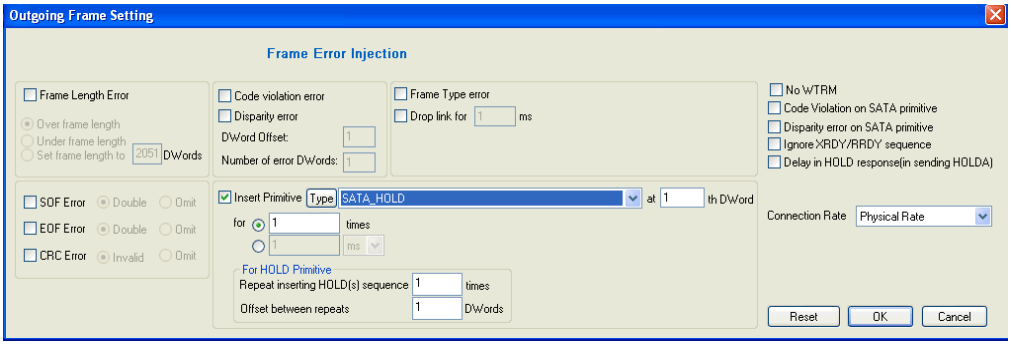


Figure 2.213: SATA: FIS Options Outgoing Frame Setting Dialog.

Frame Length Error

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

SOF, EOF and CRC errors

Check these and specify Double or Omit by checking the corresponding option button.

Code violation and Disparity error

Check these and specify DWORD offset and the number of error DWORDs.

Insert Primitive

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

The host can send multiple bursts of HOLD primitives during a single data frame. You can repeat the HOLD sequence up to 999 times. You can enter the offset between repeats, up to 99999 DWORDs.

Frame Type Error

Check this to introduce a frame type error.

Drop Link for ... ms

Check this to drop link for the specified milliseconds.

Additionally check:

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

2.9.7 Capture Tab

The Capture Tab in the Initiator Emulator Toolbar works the same way the SAS Protocol Analyzer capture feature works. See “SAS Capture” on page 60. The Capture tab in the Host Emulator works the same way the SATA Protocol Analyzer capture feature works. See “SATA Capture” on page 60.

2.9.8 Trigger Tab

The Trigger Tab in the Initiator Emulator Toolbar and the Host Emulator Toolbar both work in a very similar way to the SAS Protocol Analyzer trigger. See “Trigger Setup” on page 93.

2.9.9 Initiator Setting Tab (SAS)

The Initiator Setting tab allows you to select the Port(s) for generating SAS traffic and to specify SAS Address, Data Frame Payload size, Frame Receive Timeout, Logical Block size, and ATA Command Execution Time out (see Figure 2.214 on page 174).

You can run a Pattern Generator. To run the Pattern generator, check the **Run Pattern Generator** option button and select a **Pattern Generator File.** You can create Pattern Generator Files, see “Creating a Pattern Generator File” on page 591.

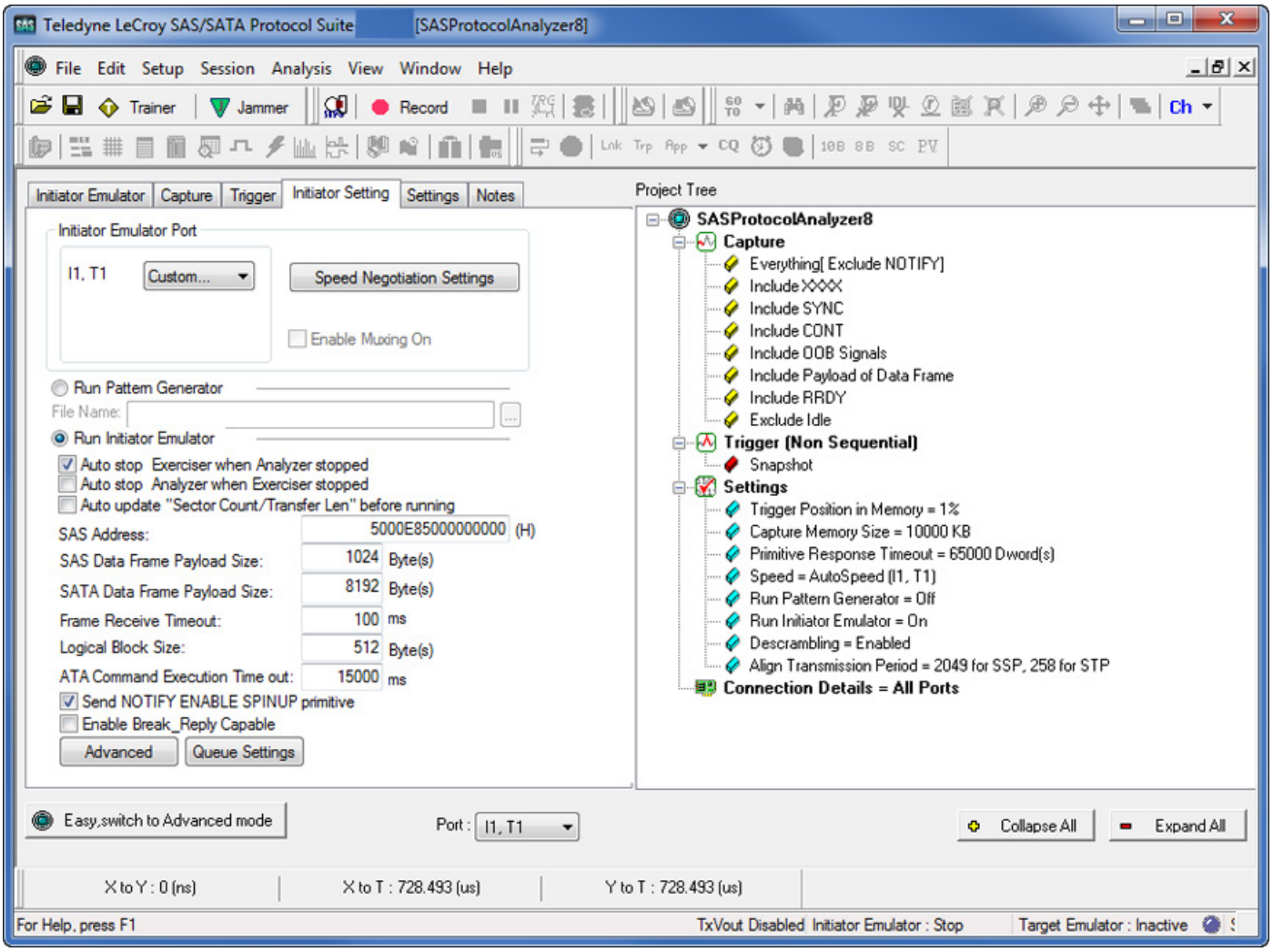


Figure 2.214: SAS: Initiator Setting Tab.

Choose Initiator Emulator Port

For each port, select a speed, then click the **Speed Negotiation Setting** button.

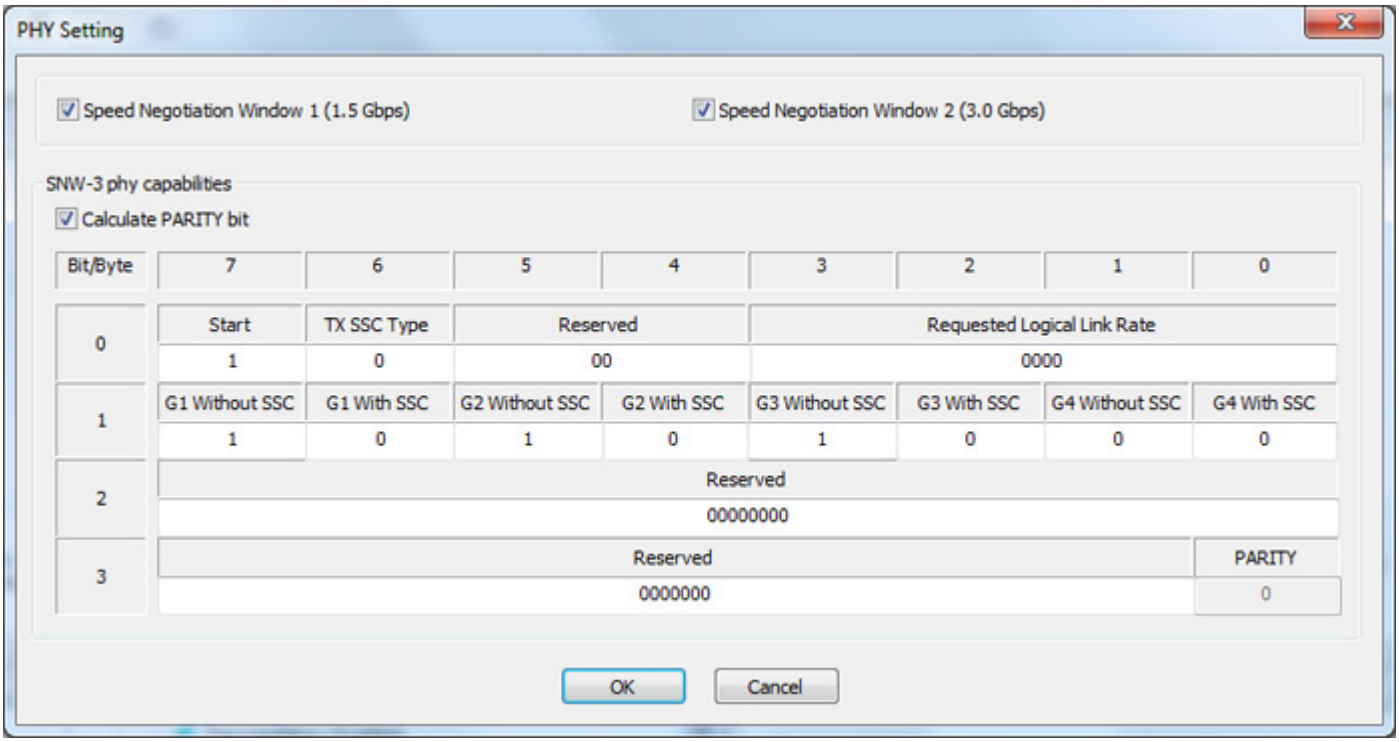


Figure 2.215: SAS: PHY Setting Dialog.

Select the port speed settings (see "Data Blocks" on page 152).

After you click **OK**, you can **Enable Muxing On**.

Pattern Generator

You can select a Pattern Generation file.

Initiator Emulator

You can run an Initiator Emulator while setting:

- Auto stop Exerciser when Analyzer stopped
- Auto stop Analyzer when Exerciser stopped
- Auto update "Sector Count/Transfer Len" before running
- SAS Address
- Data Frame Payload Size
- Frame Receive Timeout
- Logical Block Size
- ATA Command Execution Timeout
- Send NOTIFY ENABLE SPINUP primitive

Check **Autostop Exerciser when Analyzer Stopped** to halt the Initiator Emulator when the Analyzer stops. If unchecked, the Exerciser continues to run even after the Analyzer stops.

Check **Autostop Analyzer when Exerciser Stopped** to halt the Initiator Emulator when the Exerciser stops. If unchecked, the Exerciser continues to run even after the Exerciser stops.

Check **Auto update "sector Count/Transfer Len" before running -** If you want to automatically calculate the sector count and transfer length per the payload data length. Keep this unchecked to use the values entered manually in the emulation script.

Checking this option will manipulate the emulation script with the calculated values, but unchecking it afterwards will NOT revert to the previous values. It is recommended to save a copy of your script before checking this option. The message shown in Figure 2.223 on page 181 displays when you check this option.

Queue Settings

Click the **Queue Settings** button to display the Queue Settings dialog (see Figure 2.216 on page 176) and for ATA specify:

- Queue Depth
- NCQ Error Recovery
- Queued/Non-Queued Items Status
- NCQ/Queue Command Timeout

Specify the Queue Depth or SCSI.

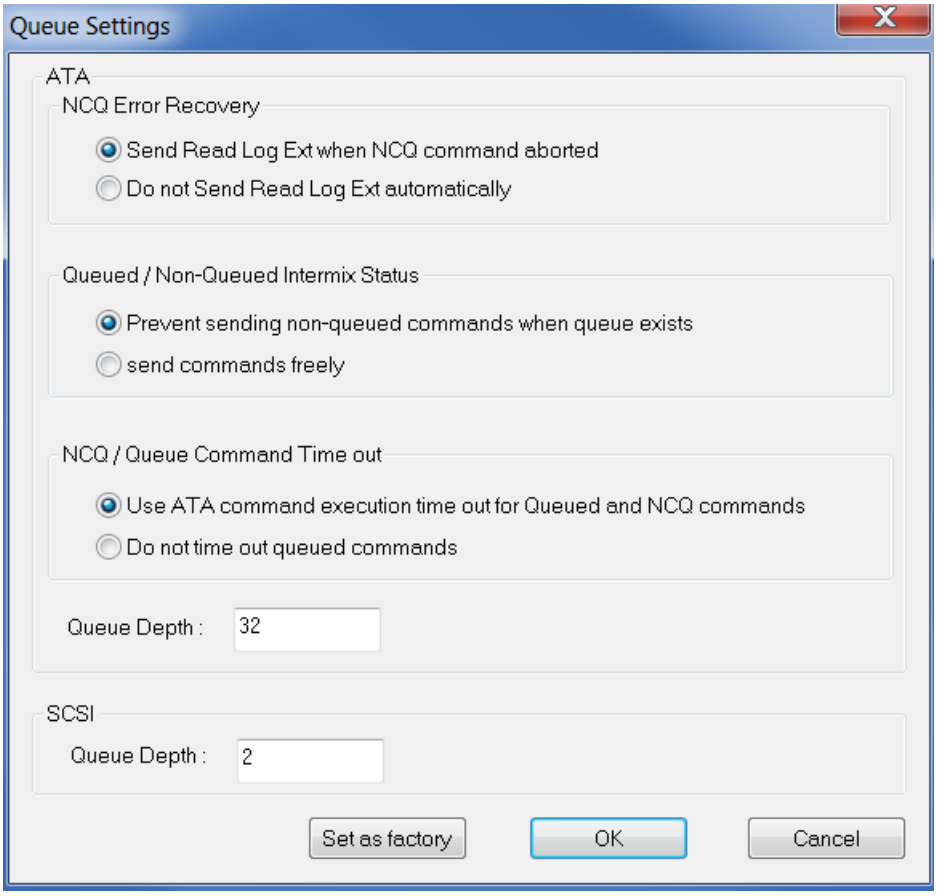


Figure 2.216: Queue Setting Dialog

Advanced Initiator Settings

- Click the **Advanced** button to display additional settable options.
- 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
- Delay between getting HOLD and Sending HOLDA

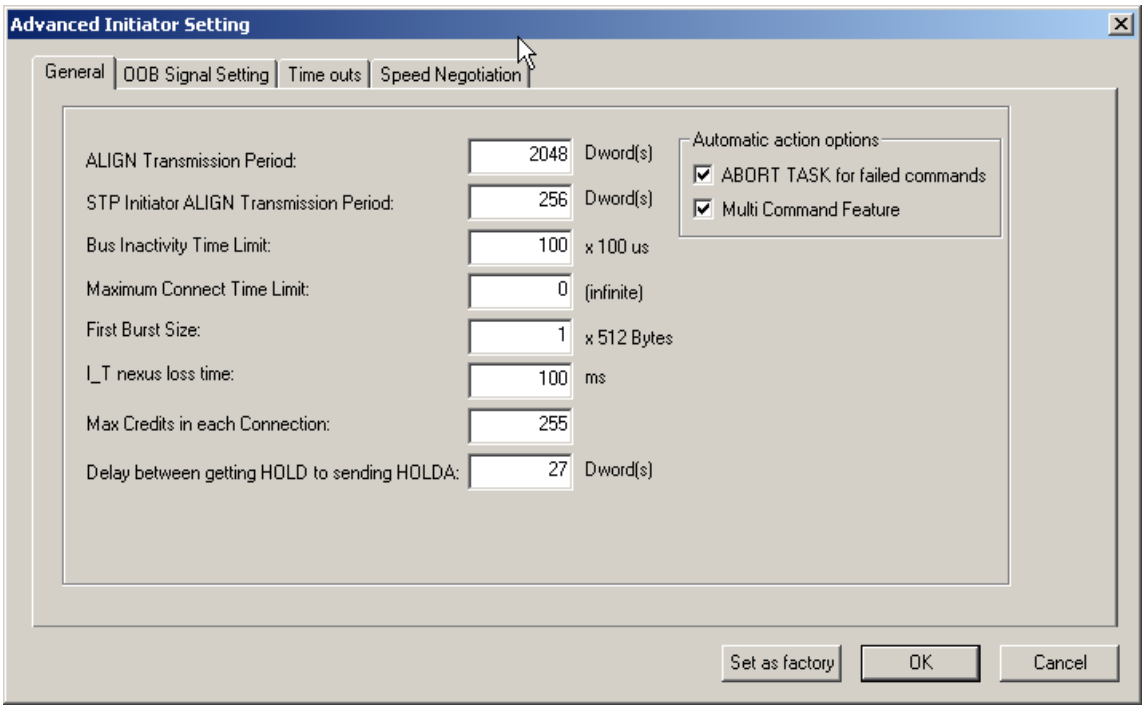


Figure 2.217: Advanced Initiator Settings Dialog General Tab

In the Advanced Initiator Setting dialog, choose **Automatic action** options from

- ABORT TASK for Failed Commands
- Multi Command feature.

OOB Signal Setting Tab

Click the **OOB Signal Setting** tab in the Advanced initiator Setting dialog to specify OOB parameters in the enabled editable fields**:**

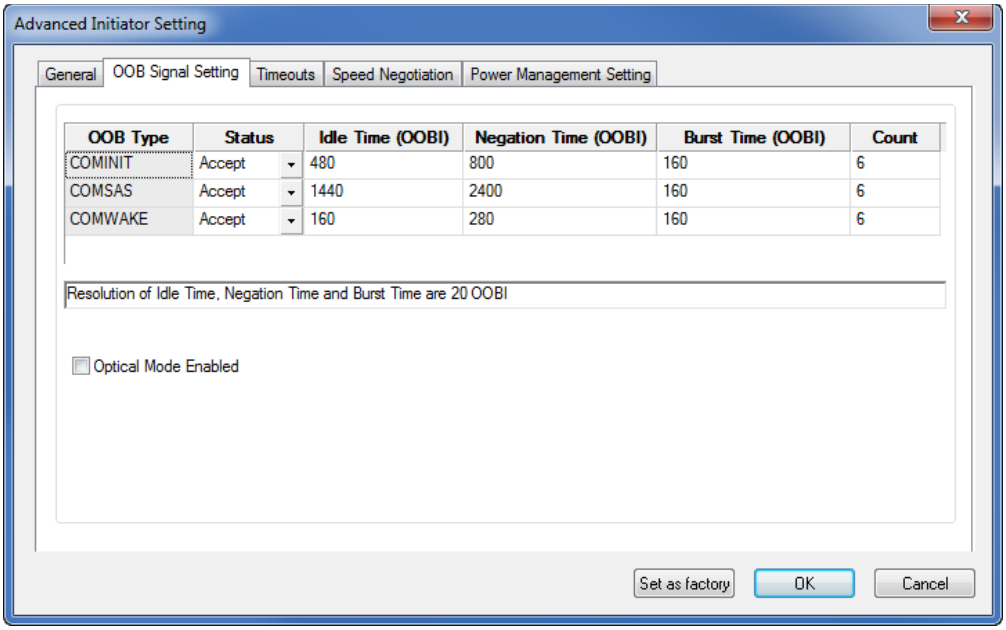


Figure 2.218: OOB Signal Setting Tab.

Timeouts Tab

Click the **Timeouts** tab in the Advanced Host Setting dialog to specify timeouts for connection, CREDIT, ACK/NAK, ATA Command, OOB Signal and Identify frame. You can also edit the speed negotiation parameters.

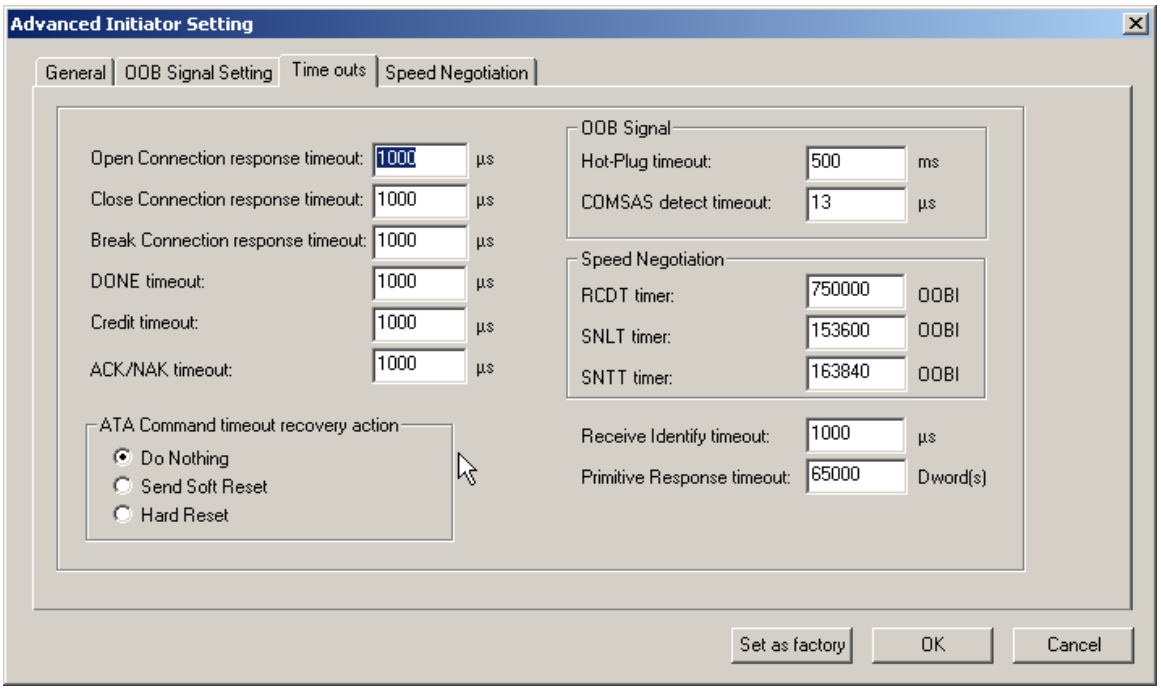


Figure 2.219: Timeouts Tab.

Speed Negotiation Tab

Use the Speed Negotiation tab to inject errors during speed negotiation.

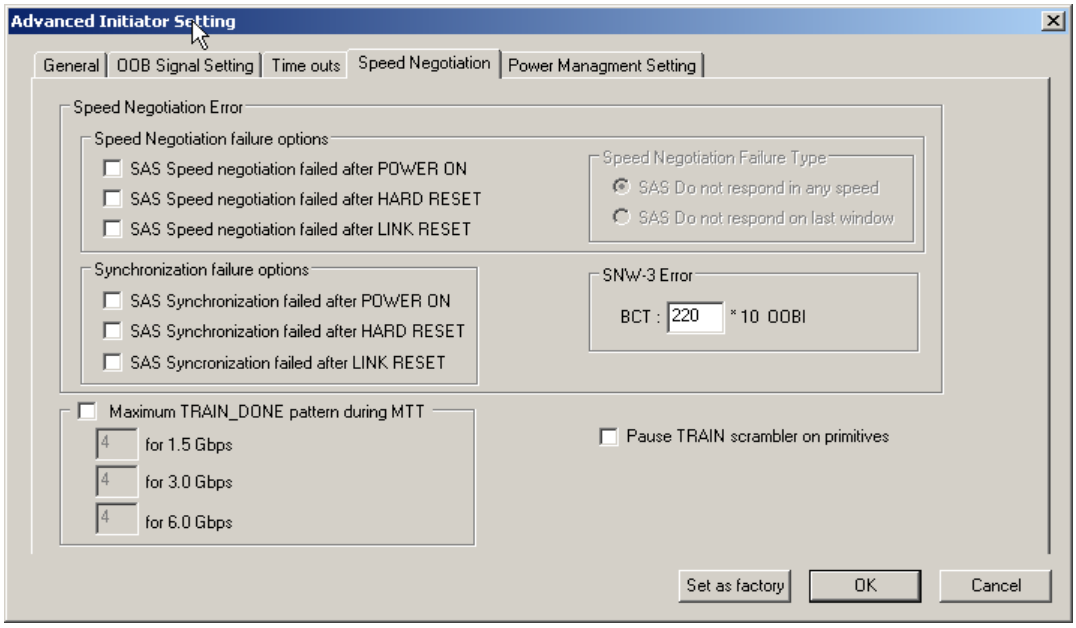


Figure 2.220: Speed Negotiation Tab.

Power Management Settings

Click the **Power Management Setting** tab in the Advanced Initiator Setting dialog to specify the settings in the editable fields.

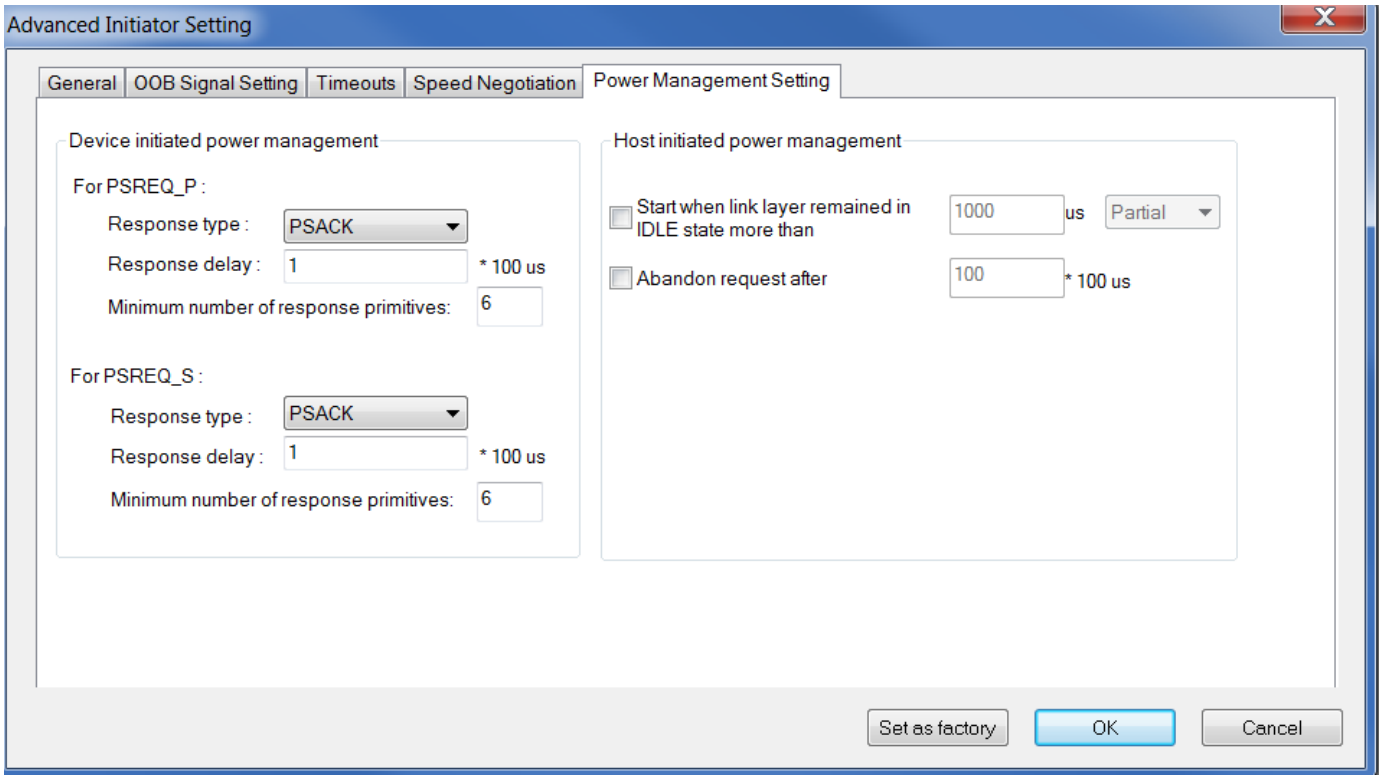


Figure 2.221: SAS: Power Management Settings.

Set parameters for Host and/or Device initiated power management.

2.9.10 Host Setting Tab (SATA)

The Host Emulator Setting dialog allows you to select the Port(s) for exercising, choose to use the Host Emulator or Pattern generator and specify Host Emulator characteristics.

Click the **Host Setting** tab (see Figure 2.222):

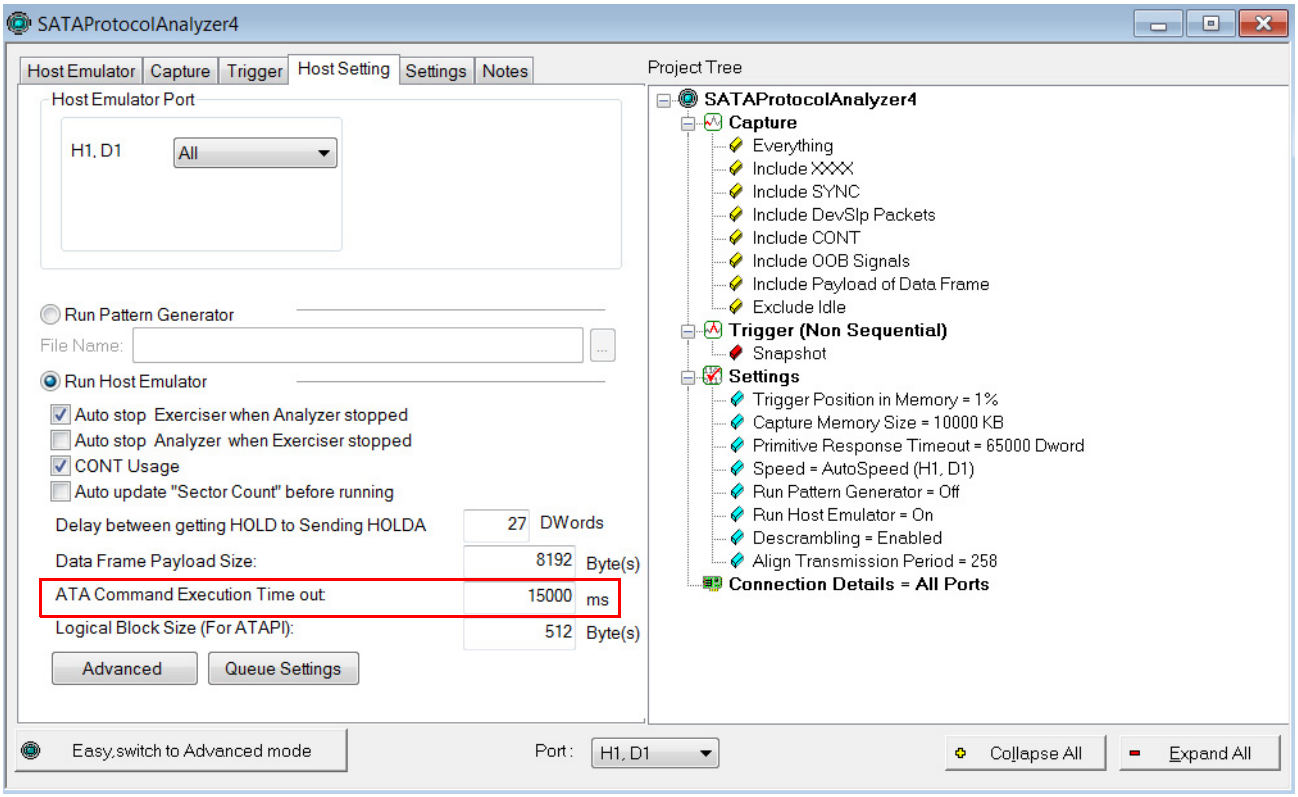


Figure 2.222: ATA Command Execution Timeout

Choose Host Emulator Port

For each port, select a speed.

Pattern Generator

You can select a Pattern Generation file. To perform a capture with a Pattern Generator, enter a path to a pattern generator ***.spg** file in the File Name dialog. See "Creating a Pattern Generator File" on page 595 for instructions how to create a Pattern Generator file.

Host Emulator

You can run an Host Emulator while setting:

- Auto stop Exerciser when Analyzer stopped
- Auto stop Analyzer when Exerciser stopped
- CONT usage

- ❑ Auto update “Sector Count” before running
- ❑ Delay between getting HOLD to Sending HOLDA
- ❑ Data Frame Payload Size
- ❑ ATA Command Execution Timeout
- ❑ Logical Block Size (for ATAPI)

Check **Autostop exerciser when Analyzer Stopped** to halt the Host Emulator when the Analyzer stops.

Check **Autostop Analyzer when Exerciser Stopped** to halt the Initiator Emulator when the Exerciser stops. If unchecked, the Exerciser continues to run even after the Exerciser stops.

Check **CONT Usage** to enable the specification of **Delay between getting HOLD to sending HOLDA**, **Data Frame Payload Size,** and **ATA Command Execution Timeout**.

Check **Auto update “Sector Count” before running -** If you want to automatically calculate the sector count and transfer length per the payload data length. Keep this unchecked to use the values entered manually in the emulation script.

Note: Checking this option will manipulate the emulation script with the calculated values, but unchecking it afterwards will NOT revert to the previous values. It is recommended to save a copy of your script before checking this option The message shown in Figure 2.223 displays when you check this option.

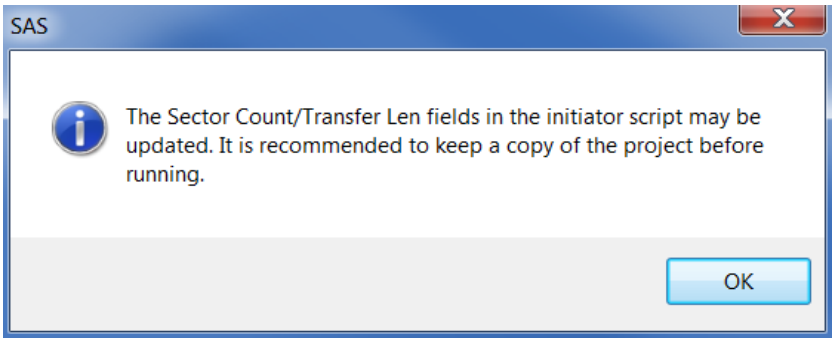


Figure 2.223: Auto Update Message

ATA Command Execution Timeout

The ATA Command Execution Timeout is a timeout for ATA commands. When the host sends an H2D frame (i.e., it issues a command) and receives an R_OK from the device, it starts this timer. If the execution of the command takes more than the timeout specified (15 seconds is the default), the host emulator performs the action specified in the Advanced/General/ ATA command timeout recovery action settings. The options are Nothing, Send Soft Reset and Hard Reset (see Figure 2.222 on page 180).

Queue Settings

Click the **Queue Settings** button to display the Queue Settings dialog (see Figure 2.224 on page 182) and specify:

- ❑ Queue Depth
- ❑ NCQ Error Recovery

- Queued/Non-Queued Items Status
- NCQ/Queue Command Timeout

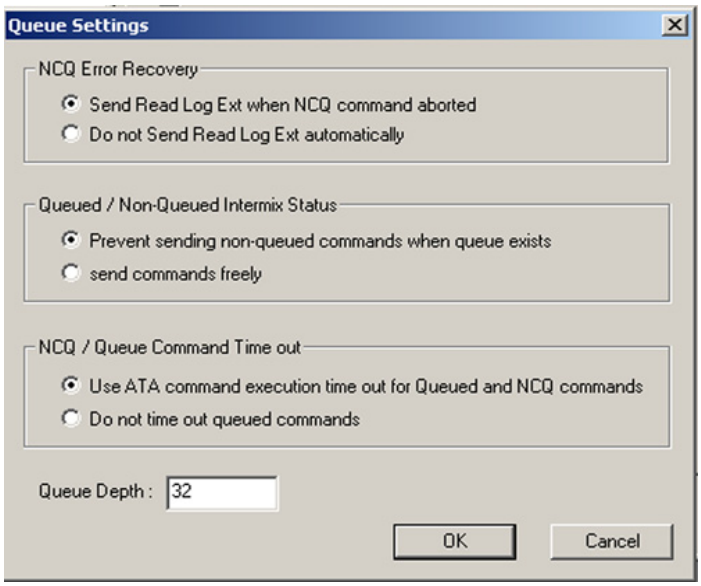


Figure 2.224: SATA: Queue Settings Dialog

Advanced Host Setting Dialog

Click the **Advanced** button to display all settable options (see Figure 2.225 on page 182).

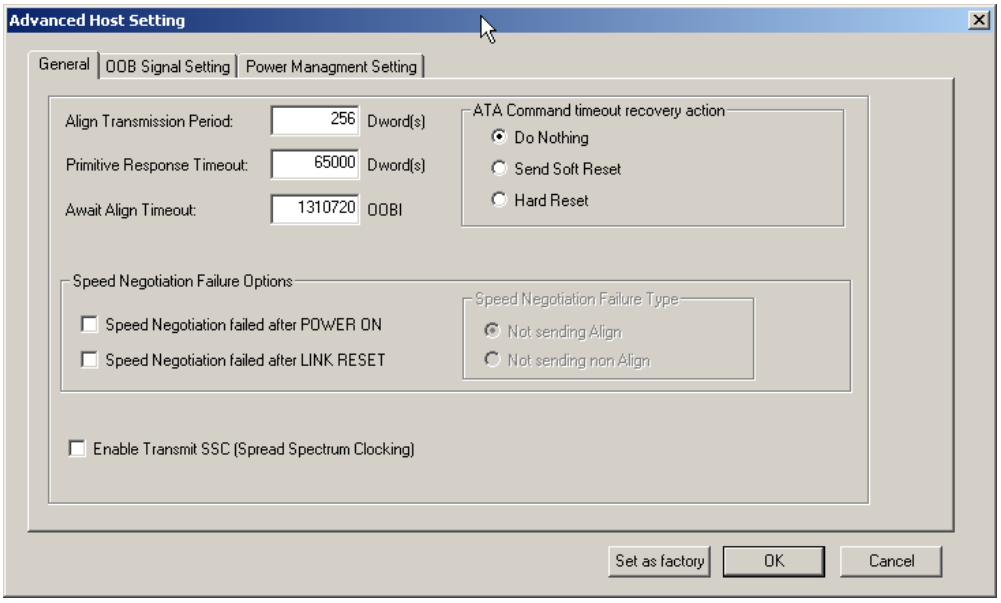


Figure 2.225: SATA: Advanced Host Setting Dialog General Tab

Settable options are:

- Set **Align Transmission Period**, **Primitive Response Timeout** and **Await Align Timeout**.
- Choose **ATA Command timeout recovery action** by checking the corresponding

option button.

- Specify **Speed Negotiating Failure Option(s)** and a **Speed Negotiation Failure Type**.

OOB Signal Setting Tab

Click the **OOB Signal Setting** tab in the Advanced Host Setting dialog to specify OOB parameters in the enabled editable fields (see Figure 2.226 on page 183).

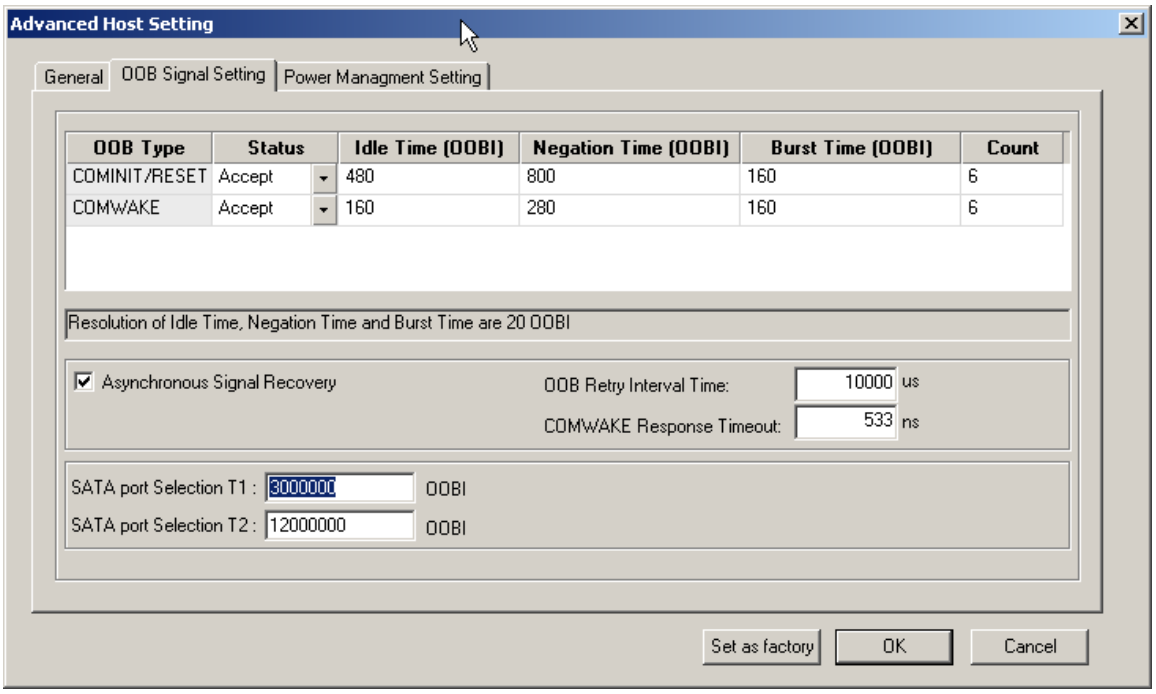


Figure 2.226: SATA: OOB Signal Setting Tab

The Device Sleep function in the Host Emulator script has an option to select **COMRESET** or **COMWAKE** commands (see Figure 2.227 on page 184).

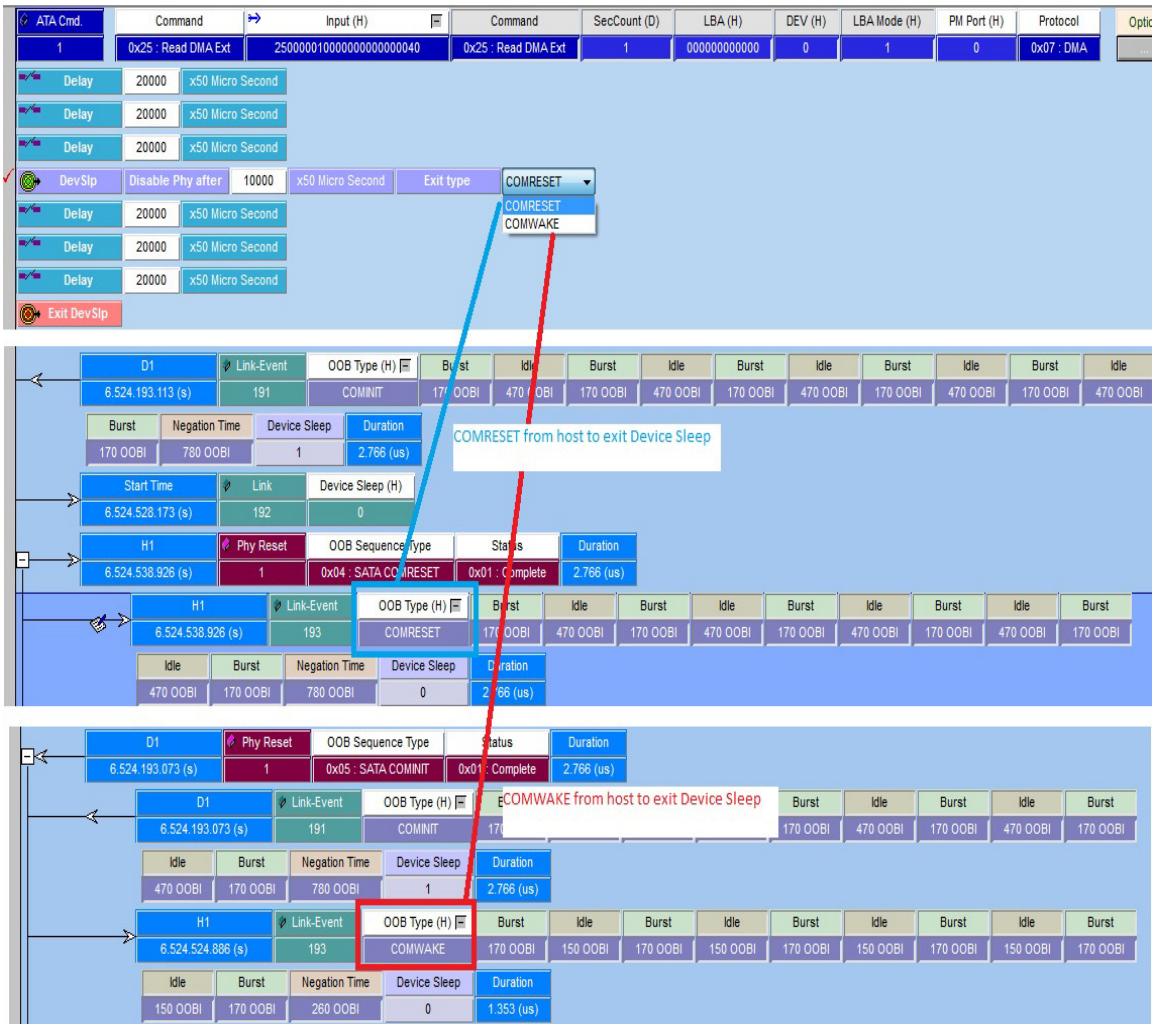


Figure 2.227: SATA: Selecting COMRESET or COMWAKE Commands

Asynchronous signal recovery

Set the OOB Retry Interval Time, check the Asynchronous signal recovery option check box and enter a value for the time.

Inter-reset Delay Settings

Enter a value for **SATA port Selection T1** to specify the inter-reset- assertion delay for the first event of the selection sequence and **SATA port Selection T2** to specify the inter-reset- assertion delay for the second event of the selection sequence.

Power Management Settings

Click the **Power Management Setting** tab in the Advanced Host Setting dialog to specify the settings in the editable fields.

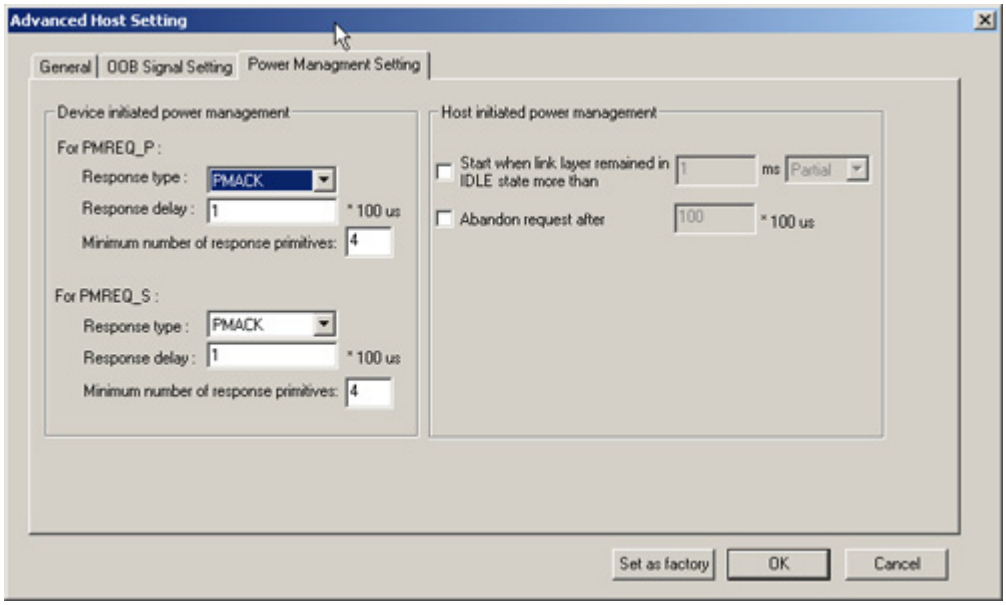


Figure 2.228: SATA: Power Management Settings

Set parameters for Host and/or Device initiated power management.

2.9.11 Project Settings

Set project settings in the Project Settings tab (see "Project Settings" on page 117).

Note: When using the Exerciser, channel 2 is not available and is grey.

2.9.12 Creating a Data Block

You can create the following types of data blocks, for use with data fields:

- Random data pattern
- Custom data pattern specifically for your application
- Counter data pattern
- Walking bit pattern

To create a data block, select **Setup > Data Block** to open the Data Block dialog box as shown in Figure 2.229 on page 186.

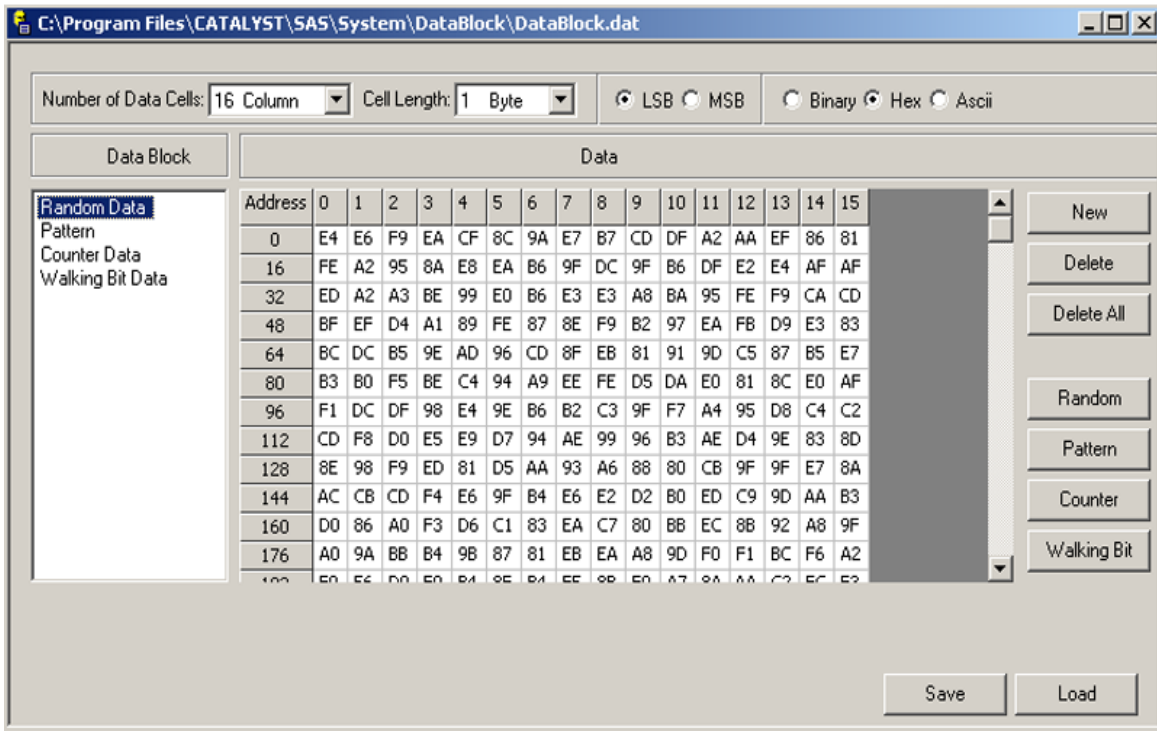


Figure 2.229: Default Data Block Dialog Box

To add another data block:

1. Click the **New** button in the Data Block dialog box.

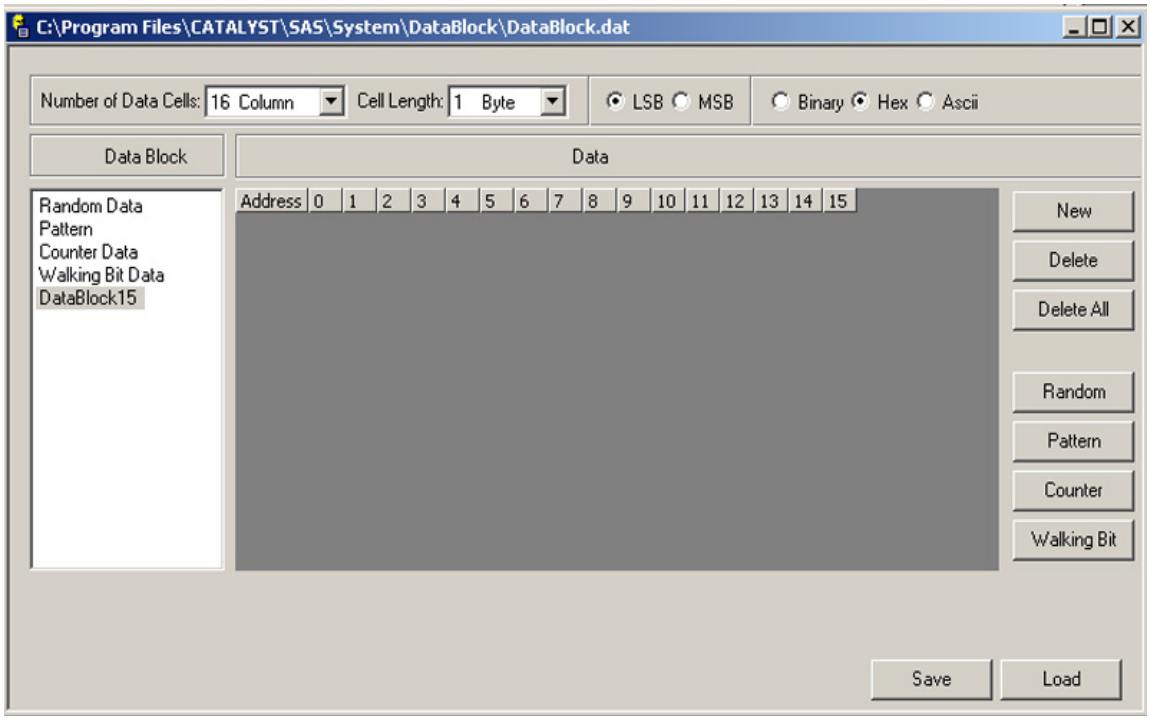


Figure 2.230: New Data Block Dialog Box

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 number format.
4. Click either the **LSB** or **MSB** option button to choose a bit order.

Naming a Data Block

Each new data block automatically receives a sequential data block number. To assign a unique descriptive name to a data block, right-click the data block name to open the Data Block Edit menu.

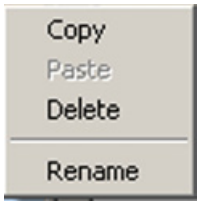


Figure 2.231: Data Block Edit

Choose **Rename.**

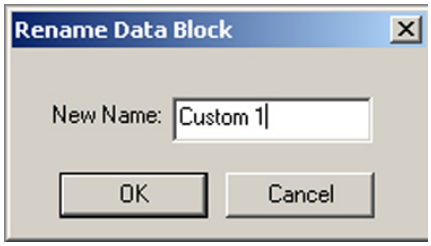


Figure 2.232: Rename Data Block

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

Editing a Data Block

You can enter data in the defined cell structure by these methods:

- Define your own pattern
- Set a counter
- Choose a Random Pattern
- Choose a Walking Bit Pattern

Define Your Own Pattern

To define a pattern:

1. Click **Pattern** to open the Define Pattern dialog box (see Figure 2.233 on page 188).
2. Enter a data pattern in the Data Pattern edit box.
3. Choose the number of times to repeat that pattern, and click **OK.**

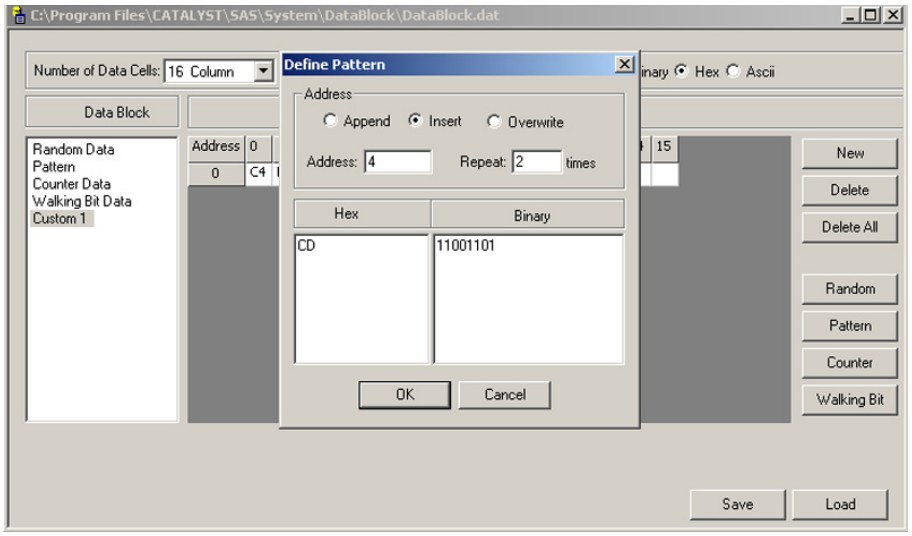


Figure 2.233: Define Your Own Data Pattern

Address

The cell address starts at 0 for the first data entry and automatically increments to the next available address. You can set it to a previously defined address to modify its content or insert additional data.

Insert/Overwrite Data

To define whether to overwrite data in a previously defined cell or insert new data after that cell, toggle the Insert/Overwrite button.

Save

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

Counter

To use a counter as data, click the **Counter** button, enter a Starting Number for the counter and the data address to count to, and click **OK** (see Figure 2.234 on page 189).

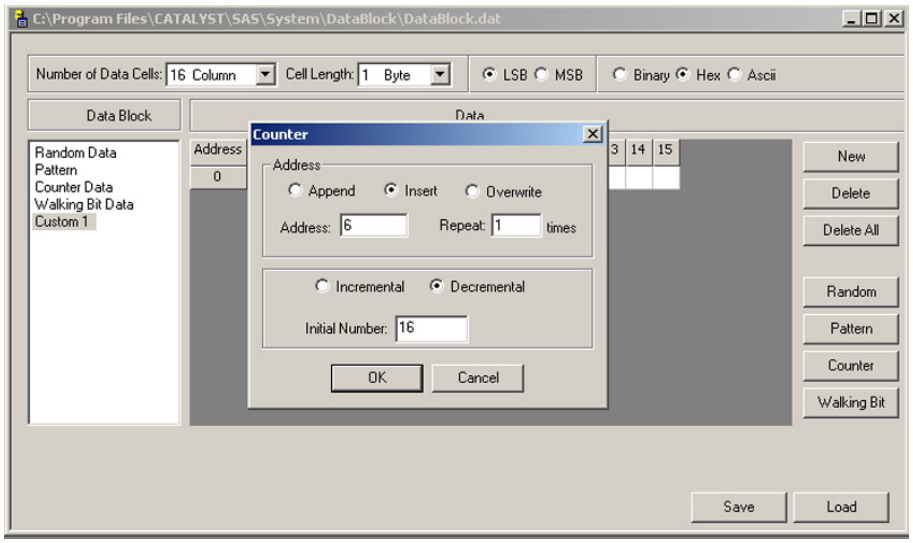


Figure 2.234: Set Counter as Data

Random Data Pattern

To use a random data pattern, click the **Random** button, enter the number of times to repeat the pattern, and click **OK**.

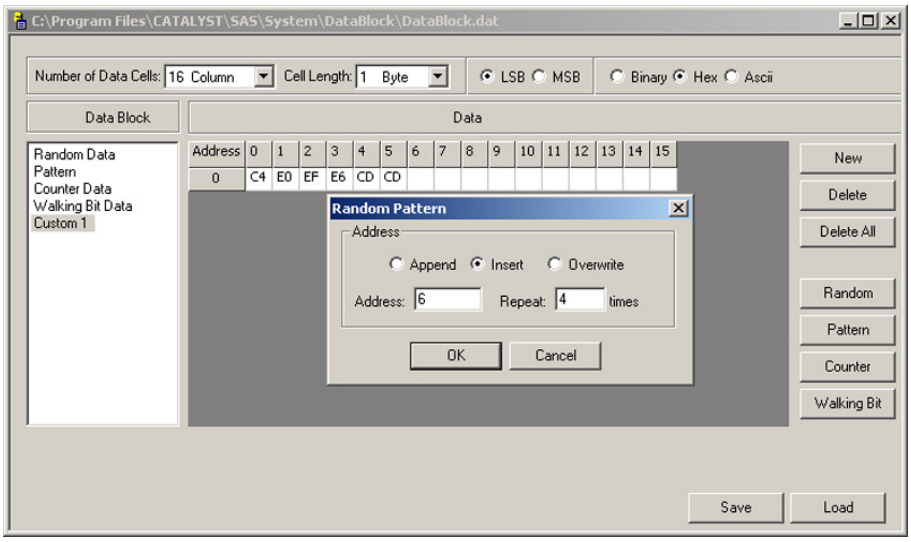


Figure 2.235: Choose a Random Pattern

Walking Bit Pattern

To use a walking bit pattern, click the **Walking Bit** button, then choose either a walking bit of "0" or "1", the walk direction, the start position, and the number of times to repeat the pattern (see Figure 2.236 on page 190).

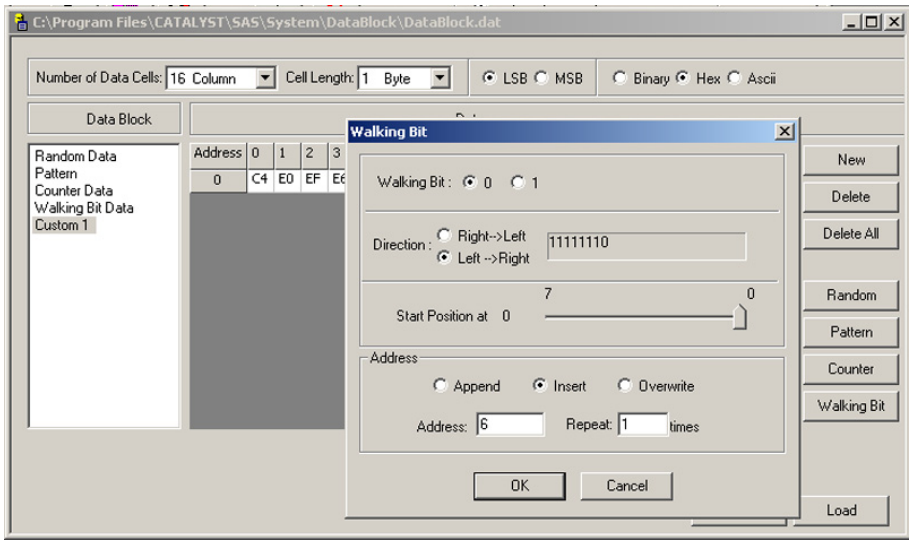


Figure 2.236: Define a Walking Bit Pattern

2.9.13 Creating and Editing Data Blocks as Text

You can 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 the size of the Data Block or the number of bytes in the format.

Item3 is the 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 a file and click **Load.** Modify existing data.

Save As

To create a new data block from an existing data block using a text editor, select the data block to edit from the **Data Block Name** list, then click **Save As** to open the Save As dialog.

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

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

2.10 Performance Analysis

An Analyzer incorporates a real-time Performance Analysis capability, to allow you to quickly measure performance parameters. You can select the format for the results display. You can set the Area and Column. You can use Bar, Line, or Pie charts with 3D and Grid enhancement options.

2.10.1 New Performance Analysis Project

Note: Only Performance Analysis is supported. Performance Analysis with Analyzer, Emulation, Trainer, or InFusion is not supported.

To perform a Performance Analysis on bus traffic and start a **New** project, click **File > New > SAS Performance Analyzer** or **File > New > SATA Performance Analyzer**.

The Performance Analyzer dialog opens.

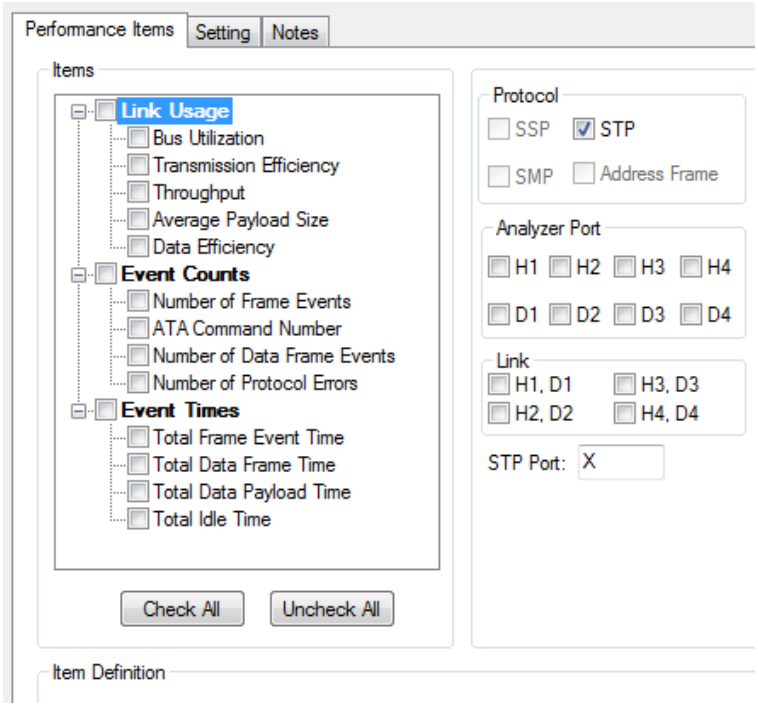


Figure 2.237: SAS/SATA: Performance Analysis Definition Dialog

Note: When you use the Exerciser, channel 2 is not usable and is greyed out.

Choose Protocol

(SAS only)

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

(SAS only)

Check the protocol check box to select the protocol category:

- STP

Analyzer Port

Check the Analyzer Port(s) to include in the performance calculation.

Link

Check the Link(s) to include in the performance calculation.

STP Port

Enter the STP port number for the STP port to include in the performance calculation.

SAS Source Address (SAS only)

Enter a SAS Source Address to include in the performance calculation.

SAS Destination Address (SAS only)

Enter a SAS Destination Address to include in the performance calculation.

Define Performance

Click the **Performance Item** check box in the Performance Items tab. Performance measurement has the following categories:

- Link Usage:
  - 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)
- Event Counts:
  - Number of Frame Events
  - SCSI Command Number
  - Number of Data Frame Events
  - Number of Protocol Errors
  - Number of Frame Errors
- Event Times:
  - Total Frame Event Time
  - Total Data Frame Time
  - Total Data Payload Time
  - Total Idle Time

Settings

Click the **Setting** tab to display the settings dialog.

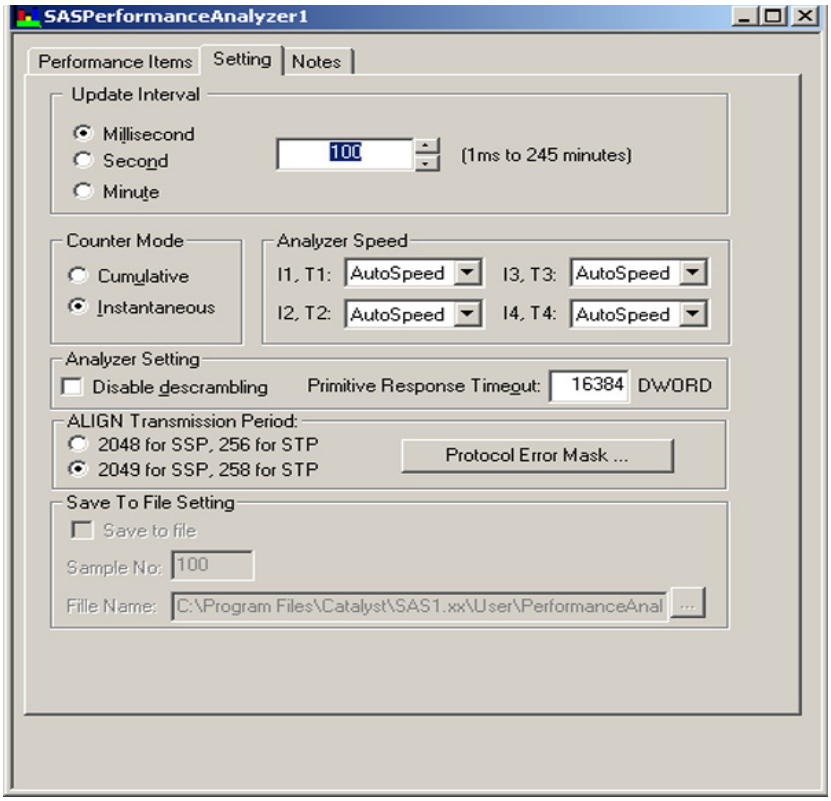


Figure 2.238: SAS: Settings Dialog

Note: When you use the Exerciser, channel 2 is not usable and is greyed out.

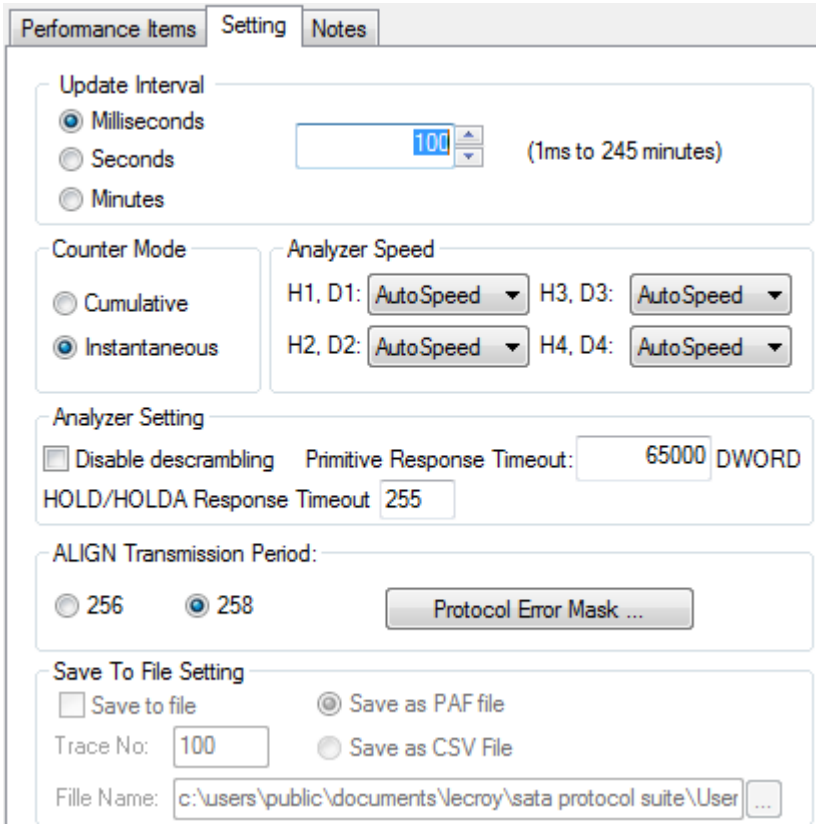


Figure 2.239: SATA: Settings Dialog

The settings dialog allows you to set the Analysis update interval and define the counter mode.

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>
   Instantaneous causes the measurement counters to 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.
7. To select **Protocol Errors** to exclude from the analysis, click the **Protocol Error Mask** button and check any or all of the protocol errors to exclude. See “Protocol Errors Dialog” on page 83.
8. To save the analysis result for later review, check **Save to file** and enter the path in which to save the result.
9. To include a descriptive note about the project, click the **Notes** tab and enter information in the **Notes** dialog. See “Add a Project Note” on page 128.

To perform the Performance Analysis, click the  **Run Hardware** button and wait for the real time analysis for the selected items to display.

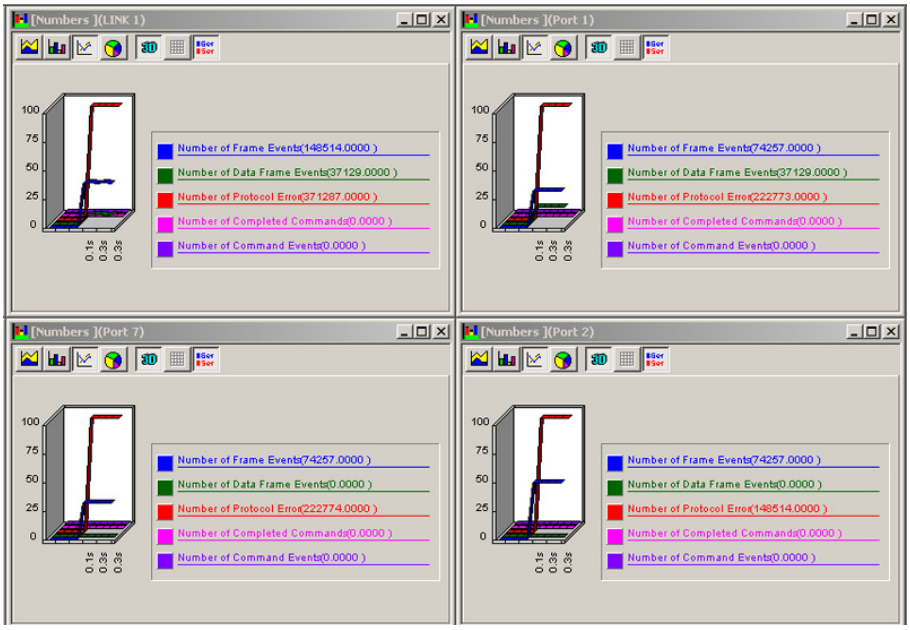


Figure 2.240: SAS: Performance Analysis Real Time Display

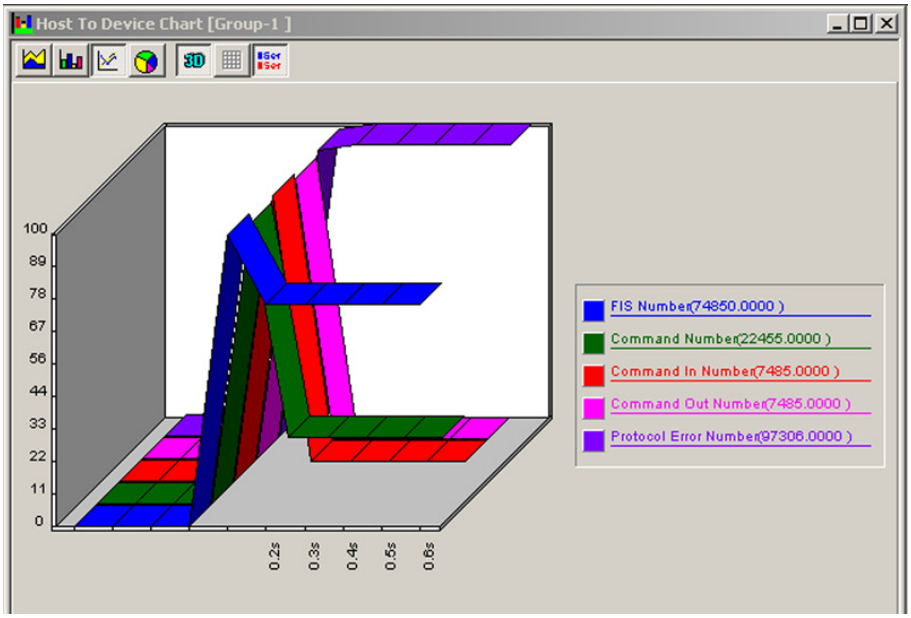
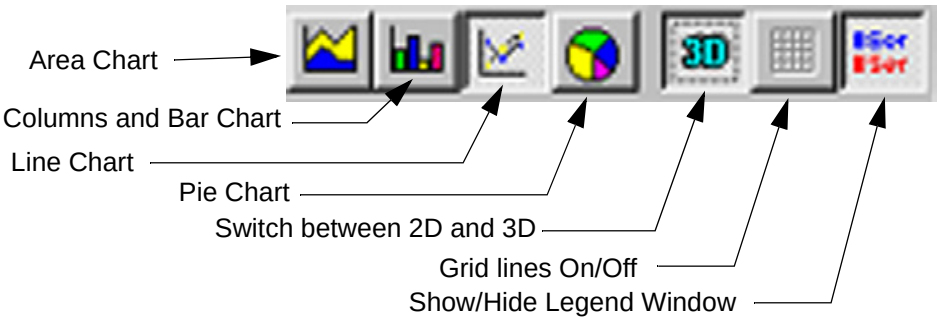


Figure 2.241: SATA: Performance Analysis Results Display

Alternate Display Format

You can display the result as 2D, 3D, and so on, by clicking the corresponding **Graphics Setting** on the Performance Analysis toolbar.



2.11 Run Hardware

To perform the defined analysis, click the  **Run Hardware** button and wait for the result to display**.**

2.12 Target and Device Emulation

You can run the analyzer while device emulation is active to monitor bus traffic.

2.12.1 Pages Tab

SAS: To set up SAS Target Emulation, click **File > New > SAS Target Emulator** to display the target emulator with the Pages tab selected (see Figure 2.242 on page 197).

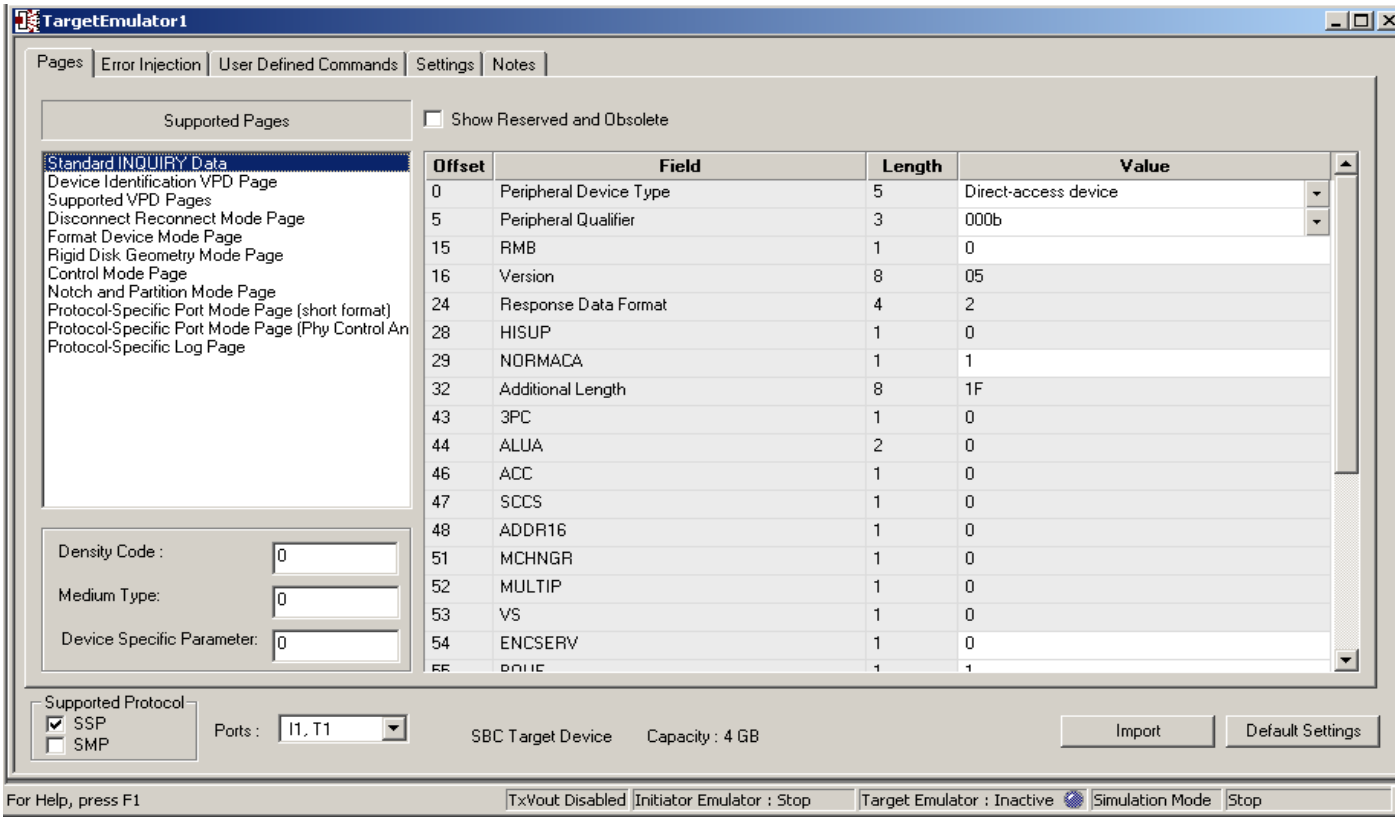


Figure 2.242: SAS: Target Emulation Project Pages Tab

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 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 sets all the parameters for the current emulation, including User-Defined Commands.

SATA: To set up a Device Emulation, click **File > New > SATA Device Emulator**. The Device Emulation project opens with the Pages tab selected.

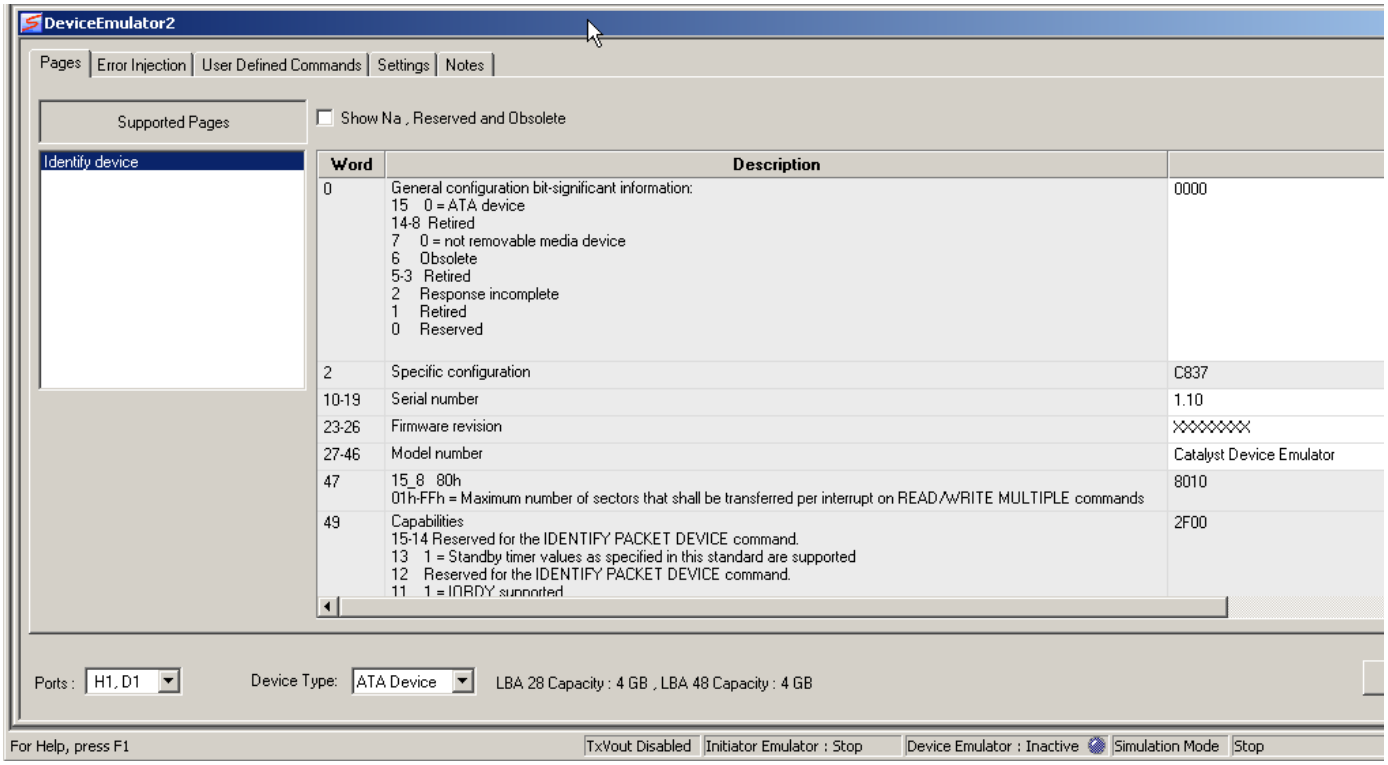


Figure 2.243: SATA: Device Emulation Project Pages Tab

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

1. Set the Device Type of either ATA or ATAPI
2. Set values for each of the enabled (White) Value fields on the Identify page.
3. To reset the pages to the default settings, click the **Default Settings** button.

To use a previously defined emulation, click the **Import** button and select an emulation.

Words with Settable Bits

The table below lists the words with settable bits.

TABLE 2.2:

Word	Bit Numbers of Settable Bits
0	All
10-19	All
23-26	All
27-46	All
48	All
75	0, 1, 2, 3 and 4

TABLE 2.2:

Word	Bit Numbers of Settable Bits
76	14, 9, 8, 3, 2 and 1
77	7
78	8, 5, 4, 3, 2 and 1
79	7, 5, 4, 3, 2 and 1
82	0
83	10, 1, 0
84	7, 6, 1, 0
86	10, 1, 0
87	7, 6, 1, 0
100-103	All
106	12
117-118	All
215-216	All
255	All

Writable Buffer Size Field

The writable buffer size field is about 3.5 GB. The buffer is cyclical in that it behaves in a Circular Writable manner in the Host Emulator. Writing 500MB at address 00000000 and 1GB starting at address 00100000 still stores the contents of address 00000000. If you start writing 2GB at address 3G, the contents of address 00000000 are overwritten after 1G.

After writing data to the Device Emulator and disconnecting/reconnecting by clicking Start/Stop the data still remains in the Device Emulator.

Error Injection Tab

Clicking the **Error Injection** tab opens the General Errors dialog (see Figure 2.244 on page 200 and see Figure 2.245 on page 200).

SAS: In addition to specifying general errors, you can also set errors for Identify, Connection Management, and SAS Commands by clicking the corresponding icon in the Errors window.

The error injection tab enables general errors or commands errors to be introduced at a fixed time after the device emulator has been activated.

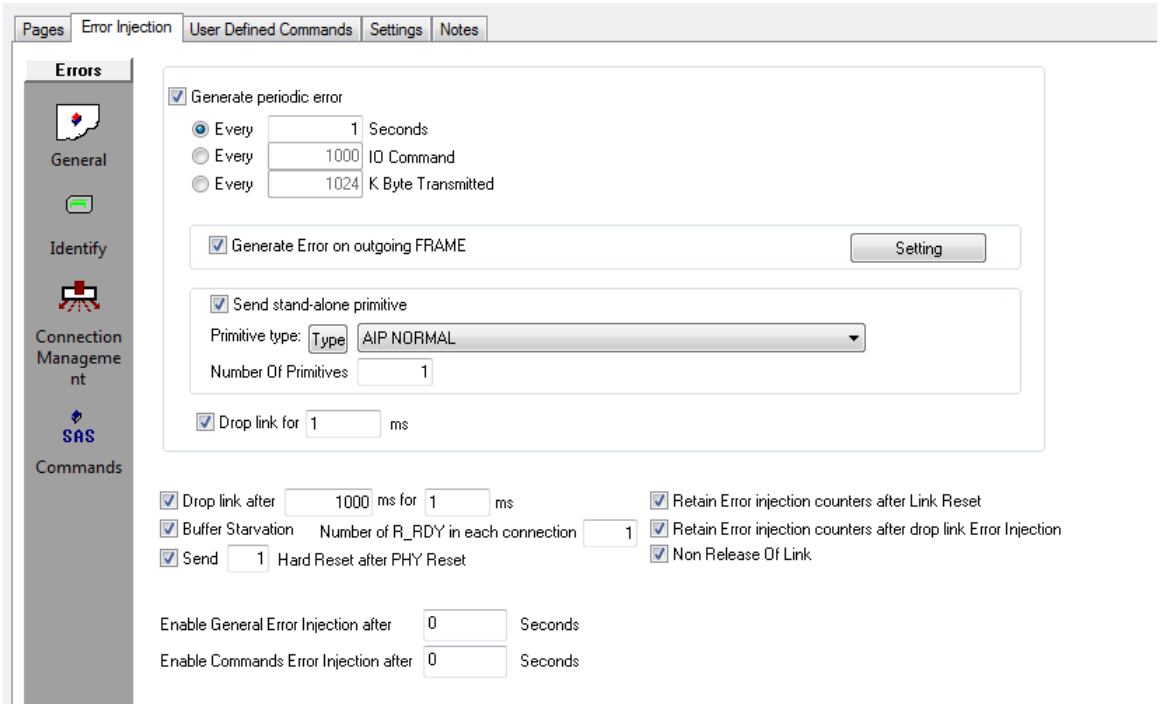


Figure 2.244: SAS: Setting General Errors

SATA: In addition to specifying general errors, you can also set errors for ATA Commands and SATA Signature by clicking the corresponding icon in the Errors window.

The error injection tab enables general errors or commands errors to be introduced at a fixed time after the device emulator has been activated.

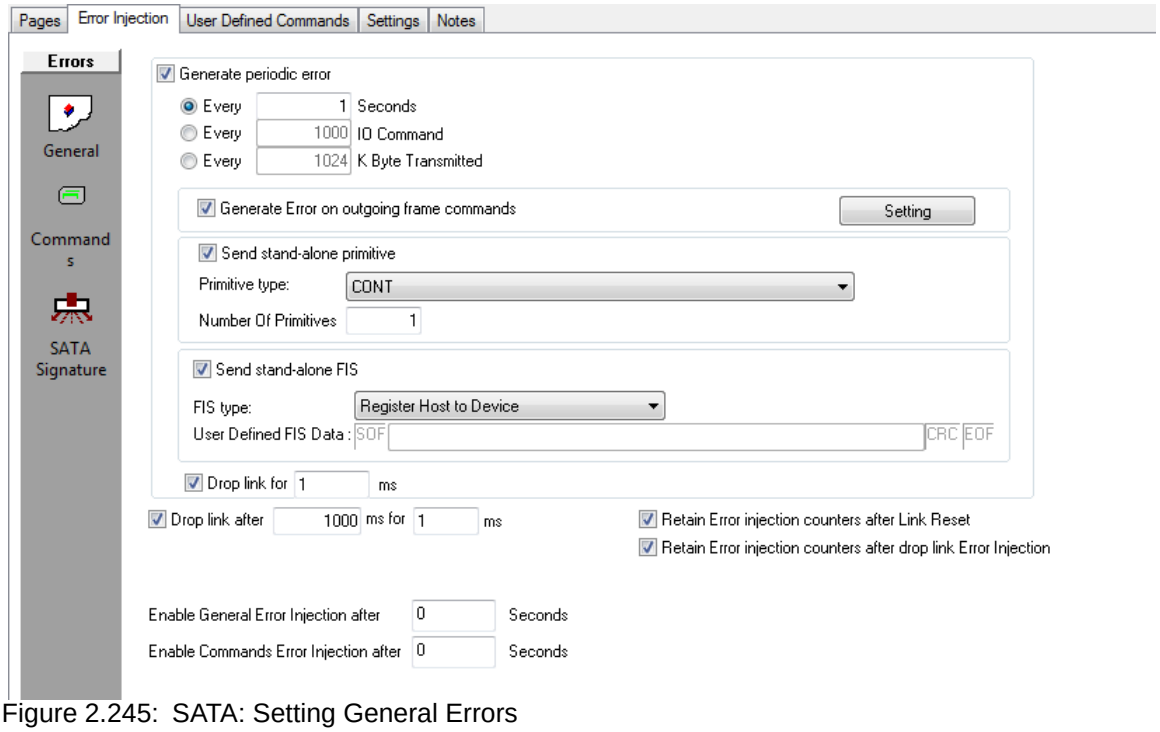


Figure 2.245: SATA: Setting General Errors

2.12.2 Setting General Errors

Generate Periodic Error

Generate Periodic Error allows you to inject periodic error on Command frame, FIS frame, stand alone primitive, and stand alone FIS. Check **Generate Periodic Error** and select the period unit of time, number of IO commands, or number of kilobytes transferred, by checking the corresponding option button.

Outgoing FIS Command Error or Outgoing FRAME Command Error

SAS: Check **Generate Error on outgoing FRAME**, then click the **Setting** button to open the error setting dialog.

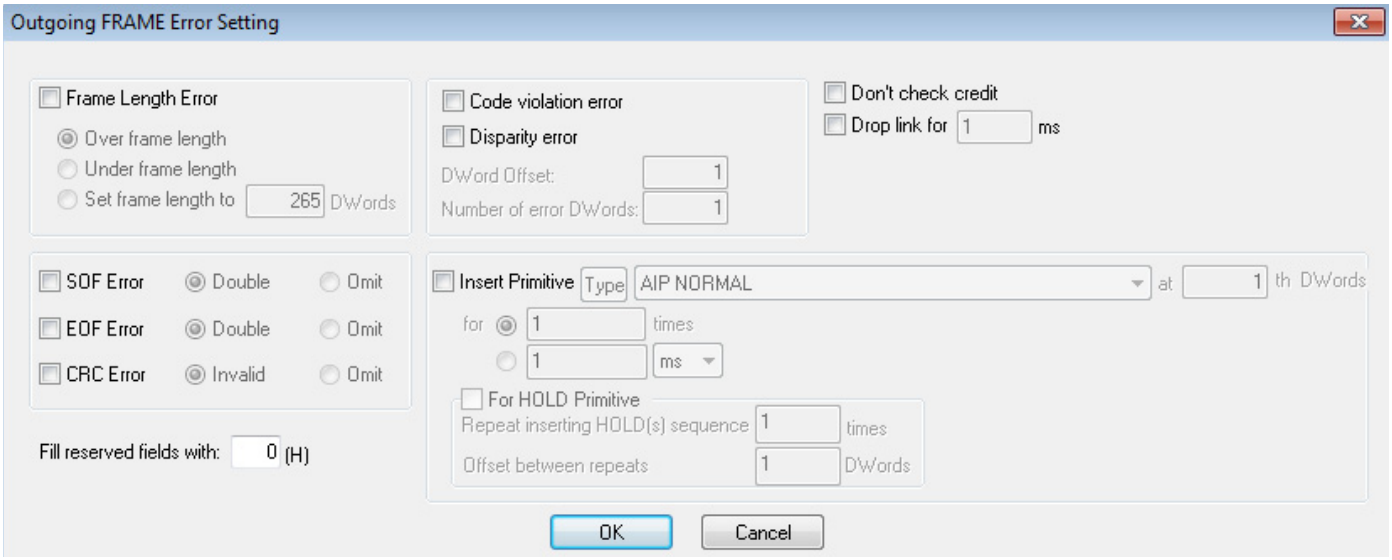


Figure 2.246: SAS: Outgoing Frame Error Setting

SATA: Check **Generate Error on outgoing frame commands**, then click the **Setting** button to open the error setting dialog.

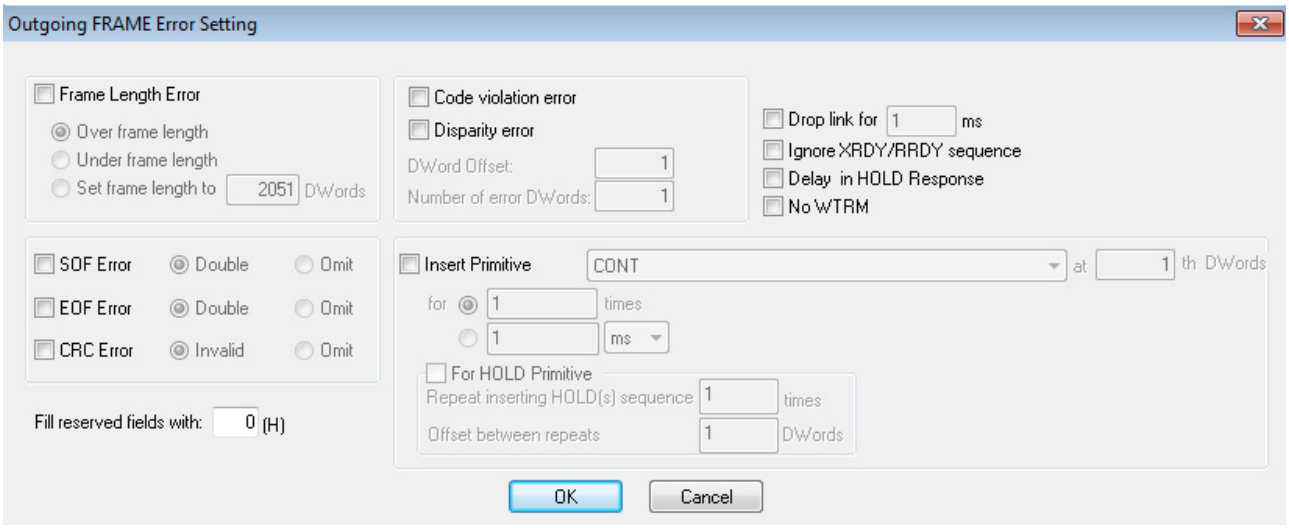


Figure 2.247: SATA: Outgoing FIS of Command Error Setting

Frame Length Error

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

- **Under frame length**: Data frame payload returned by the DE is 0 bytes.
- **Set data frame length to xxxx DWORDs**: Sets the frame length and not the payload length. You need to consider the frame header in the calculations.
- **Over frame length**: 2049 DWORD payloads are sent instead of 2048, because four 00 bytes are added to the payload.

Code violation and Disparity errors

Check these and specify the DWORD offset and the number of error DWORDs.

Don't check credit (SAS only)

Check this to disable credit checking.

Value of Reserved Fields

Enter a value.

Ignore XRDY/RRDY sequence (SATA only)

Check or not.

Delay in HOLD Response (SATA only)

Check or not.

No WTRM (SATA only)

Check or not.

SOF, EOF & CRC Errors

Check any or all and choose the criteria for introduction.

Insert Primitive

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

Send Primitive

Check **Send stand-alone primitive**, click the Type button to open the Primitive Type dialog, select the primitive type, and click **OK**.

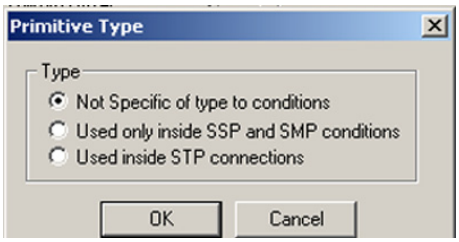


Figure 2.248: Primitive Type

Click the down arrow on the Primitive list box, choose a primitive, enter a value for the number of primitives to send, and click **OK**.

Drop link for ... ms

Check and enter time value for which to drop the link.

Drop link after ... ms for ... ms

Check and enter time value for which to wait before dropping the link and time value for which to drop the link.

Retain Error Injection Counters after Link Reset

If unchecked, after every Link Reset, the Emulator resets its internal Command Number/Counters and re-initializes the Error injection core. If checked, the Emulator keeps the state.

Retain Error Injection Counters after drop link error injection

If unchecked, after every Link Reset, the Emulator resets its internal Command Number/Counters and re-initializes the Error injection core. If checked, the Emulator keeps the state.

Buffer Starvation (SAS only)

Enter **Number of R_RND in each connection**.

Send ... Hard Reset after PHY Reset (SAS only)

Specify number of resets to send.

Send FIS (SATA only)

Check **Send stand-alone FIS**, select the FIS Type button, and optionally enter User Defined FIS Data.

Identify Errors (SAS only)

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

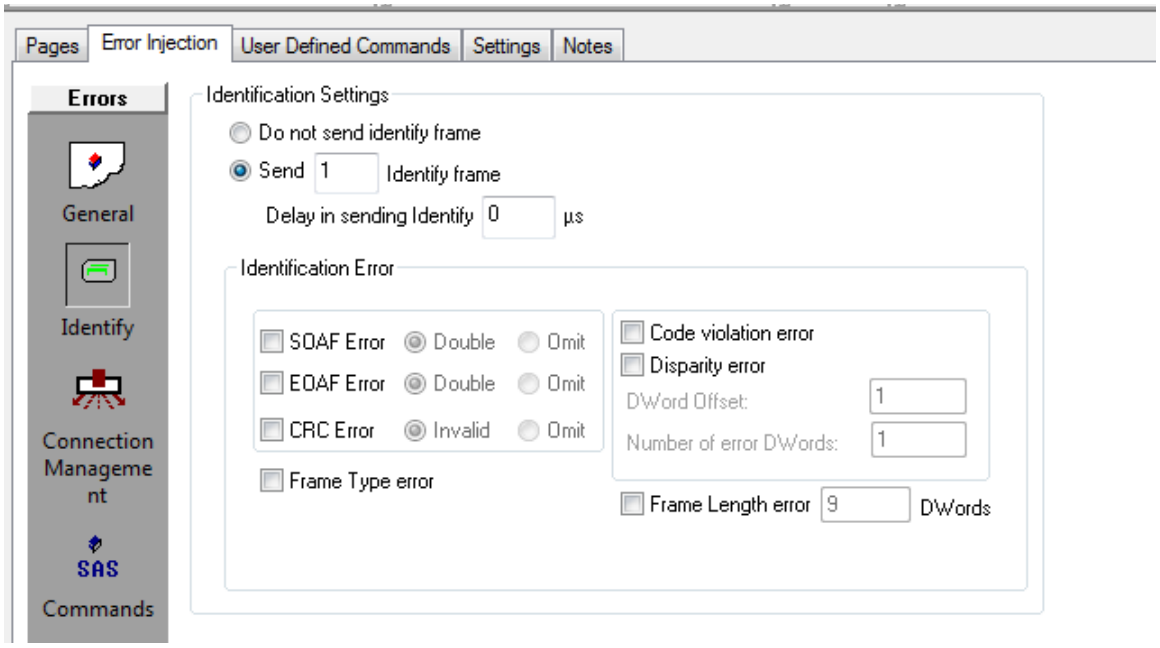


Figure 2.249: SAS: Identify Error Setting Dialog

Sending Identify Frame

Check the **Send** option button, then specify the number of Identify frames to send (and a delay, if needed).
Not to 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 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.

2.12.3 Connection Management (SAS only)

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

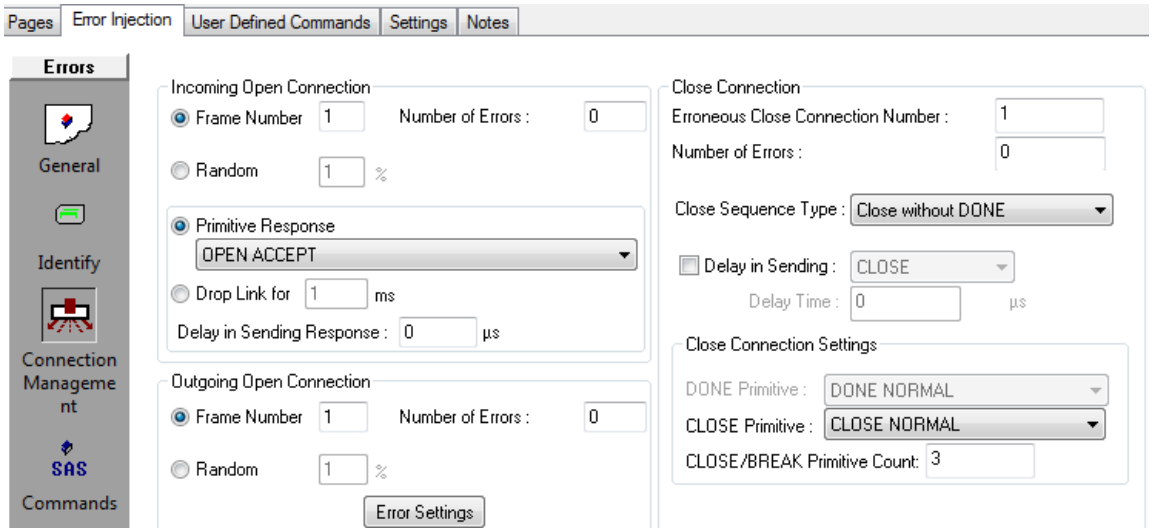


Figure 2.250: SAS: Connection Management Setting Dialog

Open Connection Definition

Incoming Frame Settings

1. In the **Open Connection** dialog, enter a value for the **Incoming Open Frame Number** and the **Number of Errors** in the corresponding text box**.**
2. Click the **Random** radio button if desired and enter a value.
3. Click the down arrow next to the **Primitive Response:** drop down list box, choose a primitive response, and enter a value for the **Delay in Sending Response** text box.
4. Click the **Drop Link for** radio button if desired and enter a value
5. Enter a value for **Outgoing Open Frame Number** and **Number of Errors** in the corresponding text box.

Outgoing Frame Settings

1. In the **Outgoing Open Connection** pane, enter a value for the **Frame Number** and the **Number of Errors** in the corresponding text box (see Figure 2.251 on page 207)**.**
2. Click the **Random** radio button if desired and enter a value
3. Click **Error Settings** to display the **Open Frame Setting** dialog. Check the errors to introduce and click **OK**.

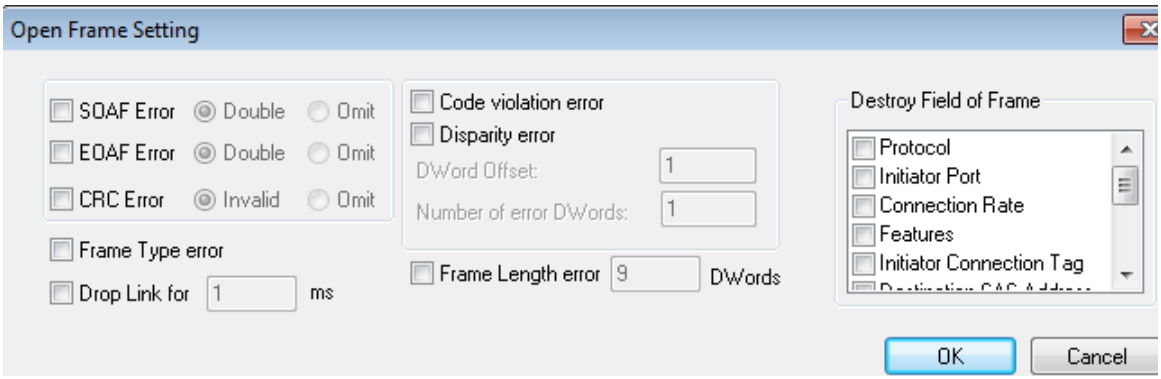


Figure 2.251: SAS: Open Frame Setting

Close Connection Definition

1. In the **Close Connection** dialog, enter a value for the **Erroneous Close Connection Number** and the **Number of Errors** in the corresponding text box.
2. Click the down arrow next to the **Close Sequence Type** drop down list box, then choose a closing sequence.
3. For a delay in sending, click the **Delay in Sending** check box, click the down arrow on the associated drop down list box, choose what to delay, and enter a value for the **Delay Time.**

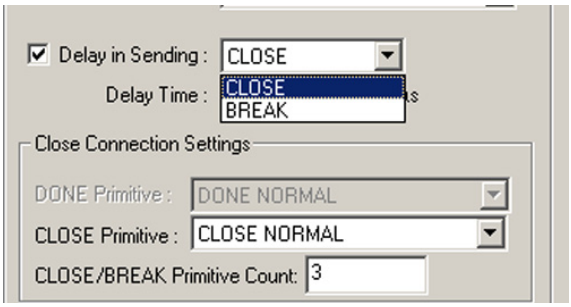


Figure 2.252: SAS: Delay in Sending

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

2.12.4 SAS Commands Errors (SAS only)

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

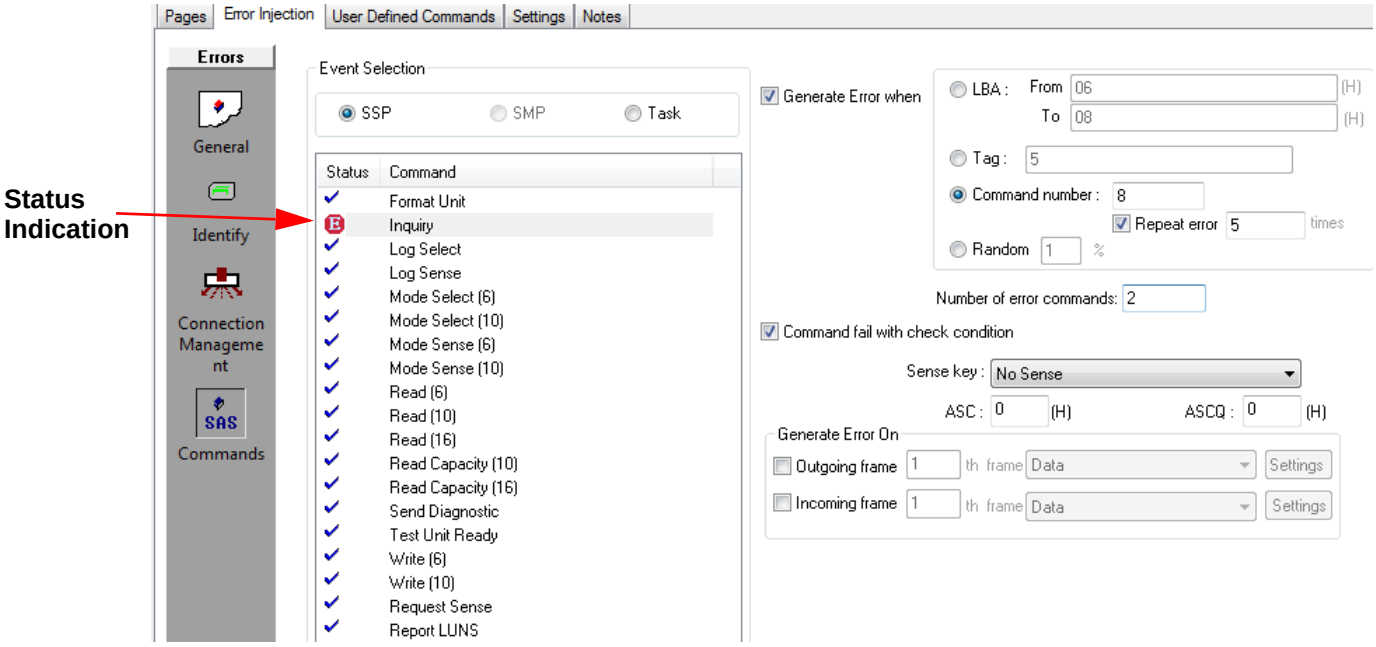


Figure 2.253: SAS: SAS Commands Error Setting Dialog

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

Command number specifies the number of the command for which you want to inject error. For example, if you select the **Inquiry** command, then enter **2** for the Command Number, you inject error on the 2nd Inquiry command.

Number of error commands specifies the number of commands for which you want to inject error. For example, if you select the **Inquiry** command, then enter **2** for the Command Number, and enter **3** for Number of Error Commands, the target emulator injects error on the 2, 3, and 4 Inquiry commands, because you want to inject on 2nd command and continue error injection as much as 3 times.

When using Command Number as the Error Injection filter, you can repeat the erring-command sets by checking **Repeat error**. The default value is 1, which injects error only once, with no repeats. In the above example, the system injects error on the 2, 3, and 4 Inquiry commands and does not inject error for other commands.
If you enter 2 for Repeat Error, the system injects error on the 2nd, 3rd, 4th, 6th, 7th, and 8th commands.
If you enter 3 for Repeat Error, target emulator injects error on the 2nd, 3rd, 4th, 6th, 7th, 8th, 10th, 11th, and 12th commands.

If you set Repeat Error to 0, it means infinity, and the system injects error on the 2nd, 3rd, 4th, 6th, 7th, 8th, 10th, 11th, 12th, 14th, 15th, 16th, 18th, 19th, 20th, 22th, 23th, 24th, and so on commands.

Note: Repeat error resets the target emulator received command counter.

In the API, use the following functions:

- **ErInjSetSCSICommandGenerateError**: Enable error injection on a command. Specify Command Number and Number of Error Commands in the 4th and 6th parameters.
  See API reference manual (section 5.5.139, page 748).
- **ErInjSetSCSICommandRepeatedErrorOnCommandNumber (int nCommand, BOOL bEnable, short iCountOfRepeatedErrorsOnCommands)**:
  nCommand specifies SCSI command. See 6.52 SCSI Command type definition in the API manual.
  bEnable: TRUE means you want repeat error as much as iCountOfRepeatedErrorsOnCommands.

3. Click the **Command fail with check condition** check box, 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.

   Some Check Condition Sense Key and ASC/ASCQ values are (see Figure 2.254 on page 210):

   - 01, 1807 (soft error, RECOVERED DATA WITH ECC - DATA REWRITTEN)
   - 0b, 1103 (aborted command, MULTIPLE READ ERRORS)
   - 0b, 4b06 (aborted command, INITIATOR RESPONSE TIMEOUT)
   - 04, 4100 (hardware errors, DATA PATH FAILURE)

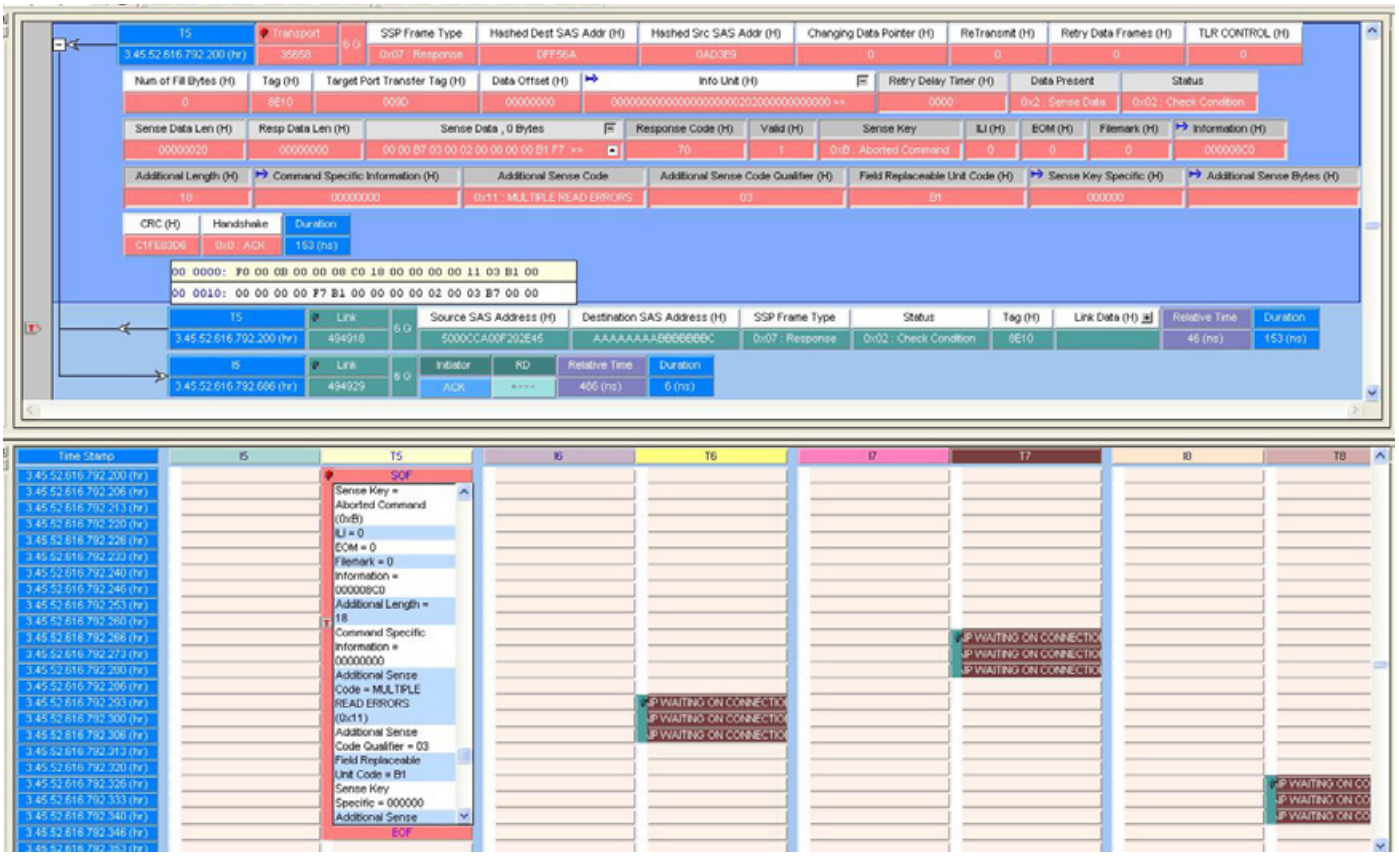


Figure 2.254: Sense Key Codes

4. Set up Outgoing and Incoming frame errors.

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

Outgoing Frame Settings

Before selecting Outgoing Frame Settings, select the Types Of Frames and the Frame Number on which to inject an error. Then check **Outgoing Frame** in the Generate Error On area and then the enabled **Settings** button to display the Outgoing Frame Setting dialog. See Figure 2.255 on page 211.

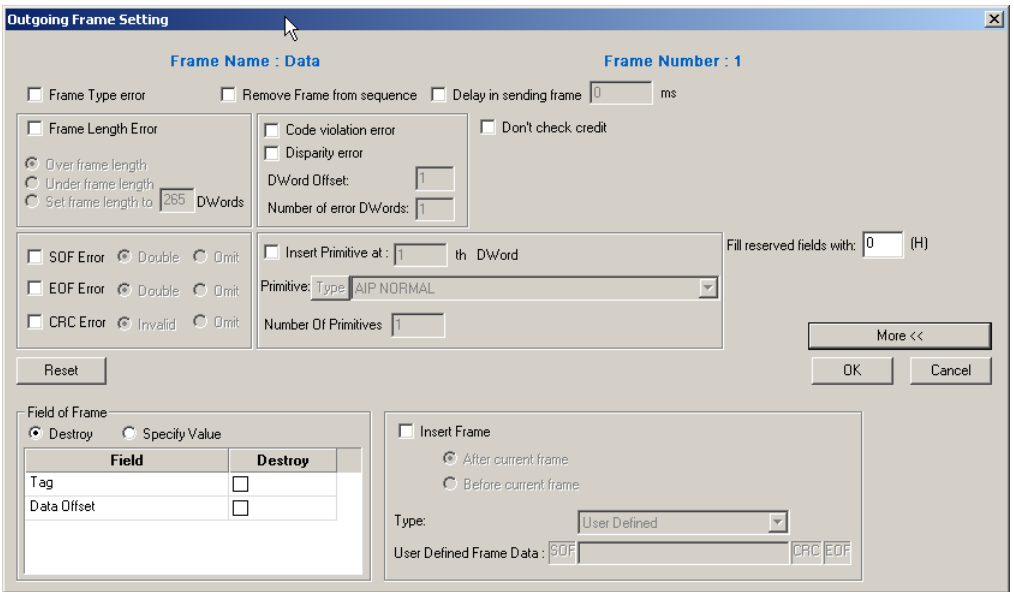


Figure 2.255: Outgoing Frame Setting Dialog

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 delay.

Frame Length Error

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

Code Violation and Disparity error

Check these and specify DWORD offset and the number of error DWORDs.

Don’t check credit

Check this to disable credit checking.

SOF, EOF, and CRC errors

Check these and specify Double or Omit by checking the corresponding option button.

Insert Primitive

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

Incoming Frame Settings

Before selecting Incoming Frame Settings, select the **Types Of Frames** and the **Frame Number** on which to inject an error. Then check **Incoming Frame** in the Generate Error On area and then the enabled **Settings** button to display the Incoming Frame Settings dialog.

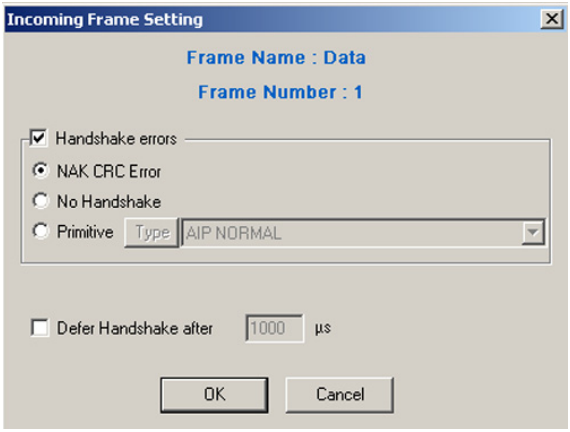


Figure 2.256: Incoming Frame Setting Dialog

Handshake Error

Check Handshake Errors to enable selection of error on handshake. Check NAK, CRC, or any other Primitive to send as an incoming frame response. Check No Handshake to send no response.

Defer Handshake Errors

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

2.12.5 ATA Commands Errors (SATA only)

Click the **ATA Commands** icon in the Errors window to display the ATA Commands Error Setting dialog.

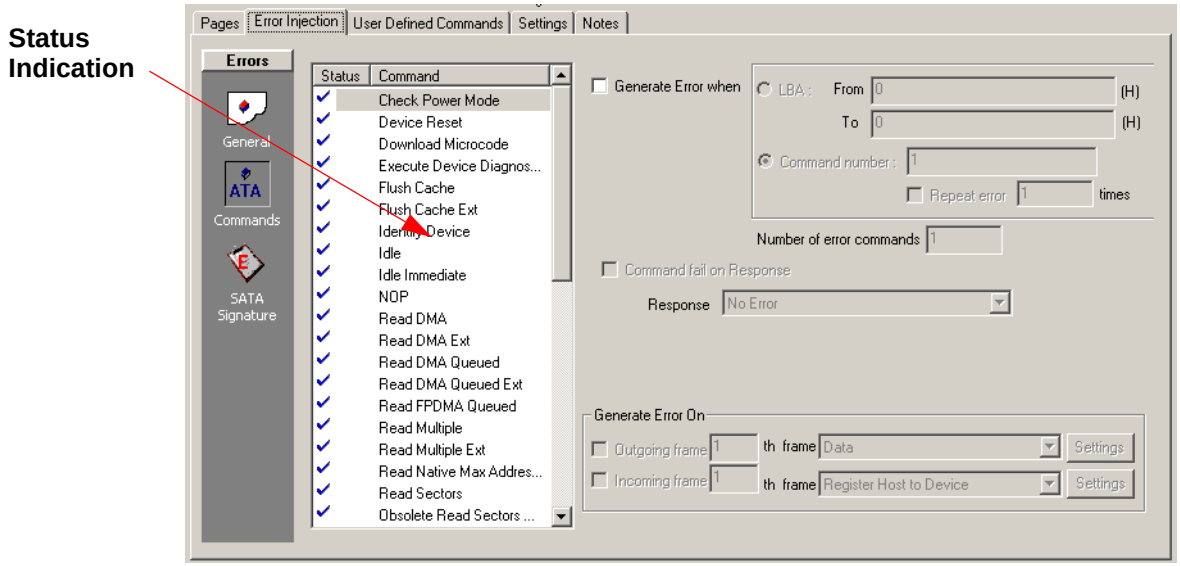


Figure 2.257: SATA: Commands Error Setting Dialog

To set errors for ATA commands:

1. Click a command for which to set an error and then check the **Generate Error when** check box and chose **LBA or Command number** with a value in the corresponding text box.

Note: Hard-drive password security commands (as described in ATA8) are Data Set Management, Write Uncorrectable Ext, Security Disable Password, Security Erase Password, Security Erase Unit, Security Freeze Lock, Security Set Password and Security Unlock.

---

2. When you choose Command Number, you can use **Repeat error** for periodic series of errors in commands. Set the number of times to repeat the error, by entering a value in the **Number of Error Commands** text box.

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

---

3. To force the system to send a defined response frame to the host, check the **Command fail on Response** check box and then choose a pre-defined response.
4. Repeat for every command for which to set an error.

2.12.6 Outgoing Frame Settings

Before selecting Outgoing Frame Settings, select the Types Of Frames and the Frame Number on which to inject an error. Then check **Outgoing Frame** in the **Generate Error On** area and then the enabled **Settings** button to display the Outgoing Frame Setting dialog.

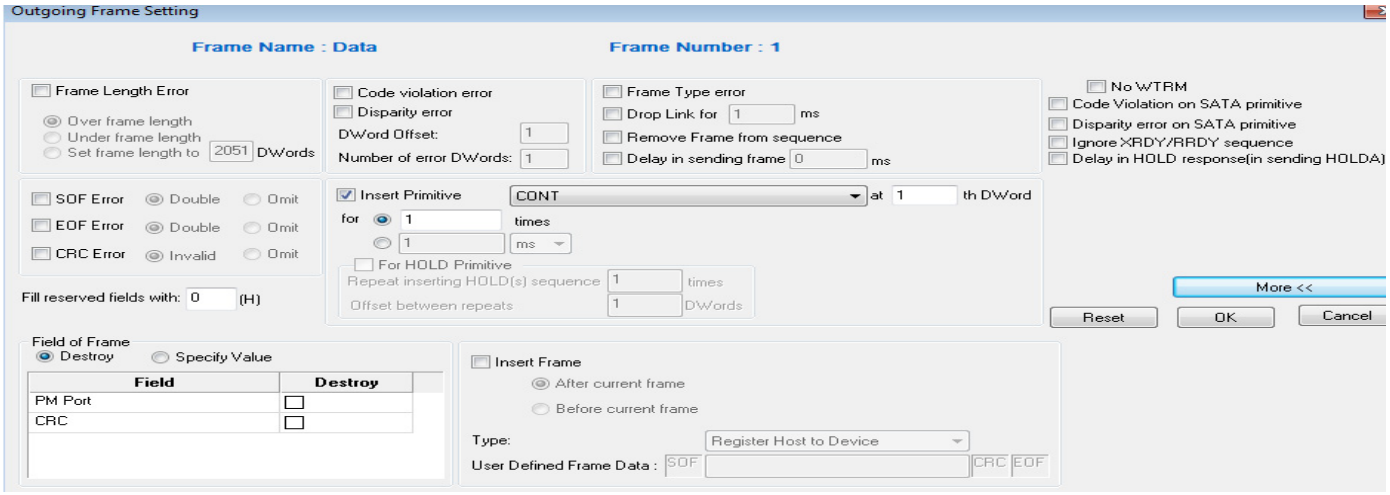


Figure 2.258: Outgoing Frame Setting Dialog

Frame Type Error

Check this to introduce a frame type error.

Drop Link for

Check this to drop link for specified duration.

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 delay.

Additionally check:

- 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 and specify DWORD offset and the number of error DWORDs.

SOF, EOF and CRC errors

Check these and specify **Double** or **Omit** by checking the corresponding option button.

Insert Primitive

Check **Insert Primitive** to enable the Primitive Type dialog, select the primitive type and number of primitives, and click **OK**.

Destroy Field of Frame

Click the **More** button to display the Field of Frame area, check **Destroy,** and check the fields to destroy. Alternatively, check **Specify Value** to choose from a predefined list of values.

Set Value of Field

Check **Fill Out** in the **Field of Frame** area and enter values for fields.

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.**

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

2.12.7 Incoming Frame Settings

Before selecting Incoming Frame Settings, select the Types Of Frames and the Frame Number on which to inject an error. Then check **Incoming Frame** in the **Generate Error On** area and then the enabled **Settings** button to display the Incoming Frame Settings dialog.

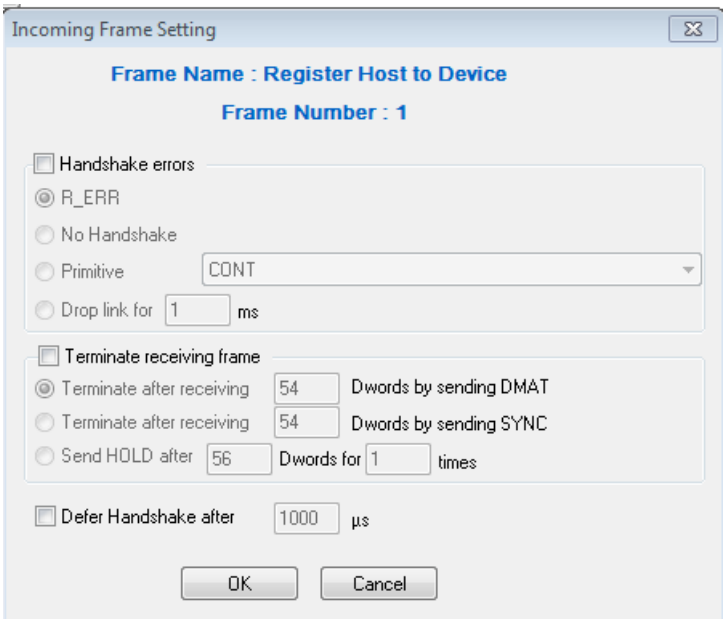


Figure 2.259: Incoming Frame Setting Dialog

Handshake Errors

Check **Handshake Errors** to enable selection of error on handshake. Check NAK, CRC, or any other **Primitive** to send as an incoming frame response. Check **No Handshake** to send no response.

Defer Handshake Errors

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

Primitive

Check **Insert Primitive** then click the down arrow on the **Primitive** drop down combo box and choose a primitive.

Terminate receiving frame

Check **Terminate receiving frame** and choose the termination condition.

2.12.8 SATA Signature (SATA only)

Click the **SATA Signature** icon in the Errors window to display the SATA Signature dialog.

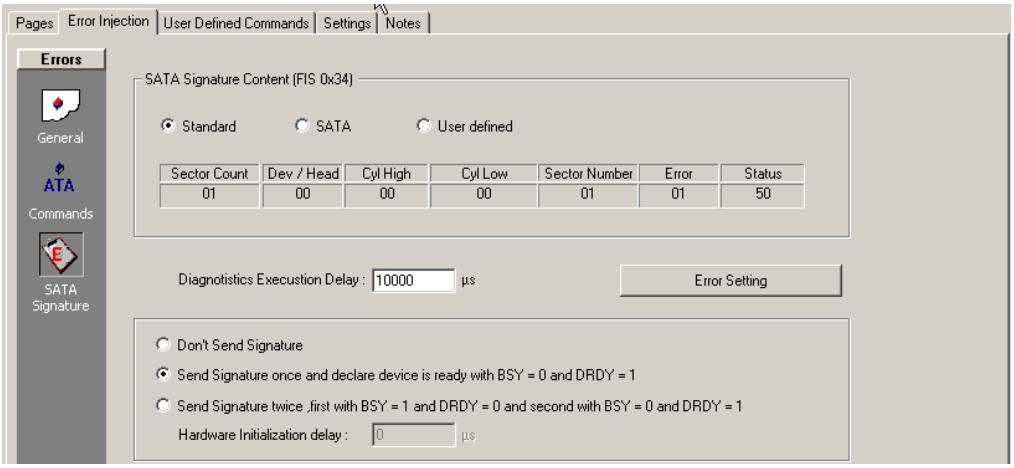


Figure 2.260: SATA: SATA Signature Dialog

Choose SATA Signature Content

Choose either the pre-defined **Standard** or **SATA**. Alternatively, you can define your own signature by checking the **User Defined** option button and then entering values in the enabled fields.

Specify when to send Signature

You can choose from **Don't Send Signature, Send Signature once** and declare device is ready with BSY=0 and DRDY=1, or **Send Signature twice**, first with BSY=1 and DRDY=0 and second with BSY=0 and DRDY=1, by checking the corresponding option button.

Note: If you choose **Send Signature twice**, first with BSY=1 and DRDY=0 and second with BSY=0 and DRDY=1, the system enables the Hardware initialization delay text box, allowing you to set the hardware initialization delay.

2.12.9 SATA Signature Errors

You can define errors to introduce when sending a SATA Signature. To define the errors, click the **Error Setting** button to open the SATA Signature Error Setting dialog.

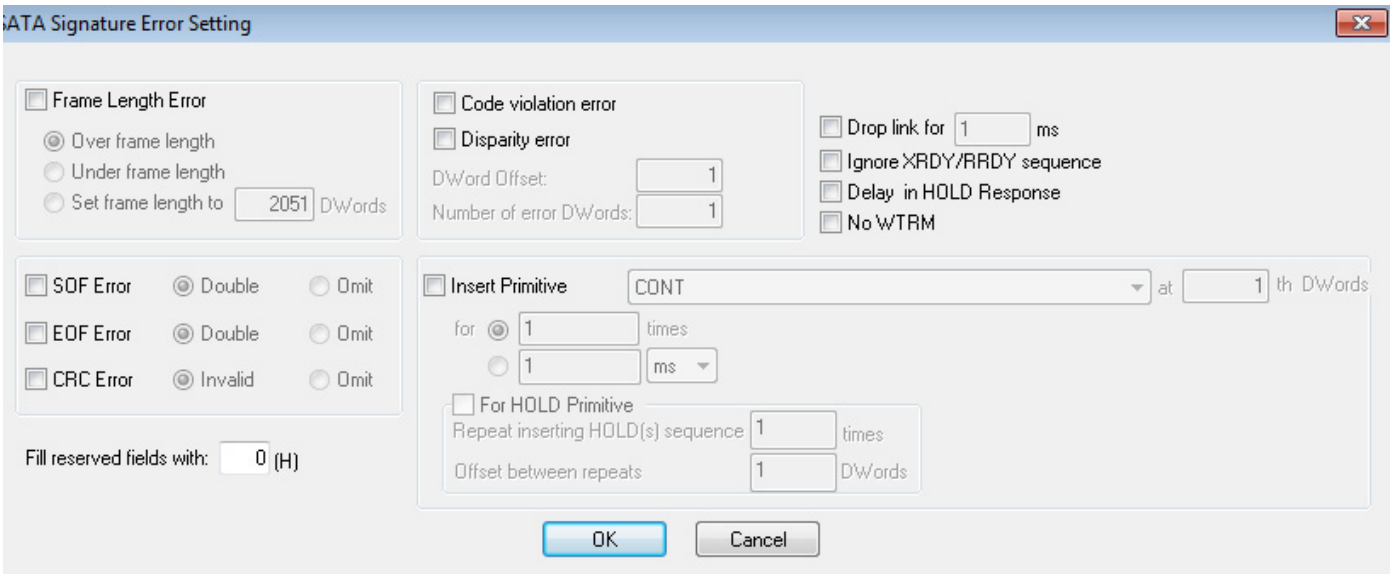


Figure 2.261: SATA: SATA Signature Error Setting

Frame Length Error

Choose the Frame Length Error type to introduce.

SOF, EOF and CRC Errors

Check any or all and check the criteria for introduction.

Code Violation and Disparity errors

Check and specify DWORD offset and Number of DWORD errors for Disparity error.

Additional Settings

Set and check:

- Value for Reserved fields
- Ignore XRDY/RRDY Sequence
- Delay in HOLD Response
- No WTRM

Insert Primitive

Check **Insert Primitive**, click the down arrow on the **Primitive** list box, choose a primitive type and enter a value for the Number of Primitive.

2.12.10 User-Defined Commands Tab

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

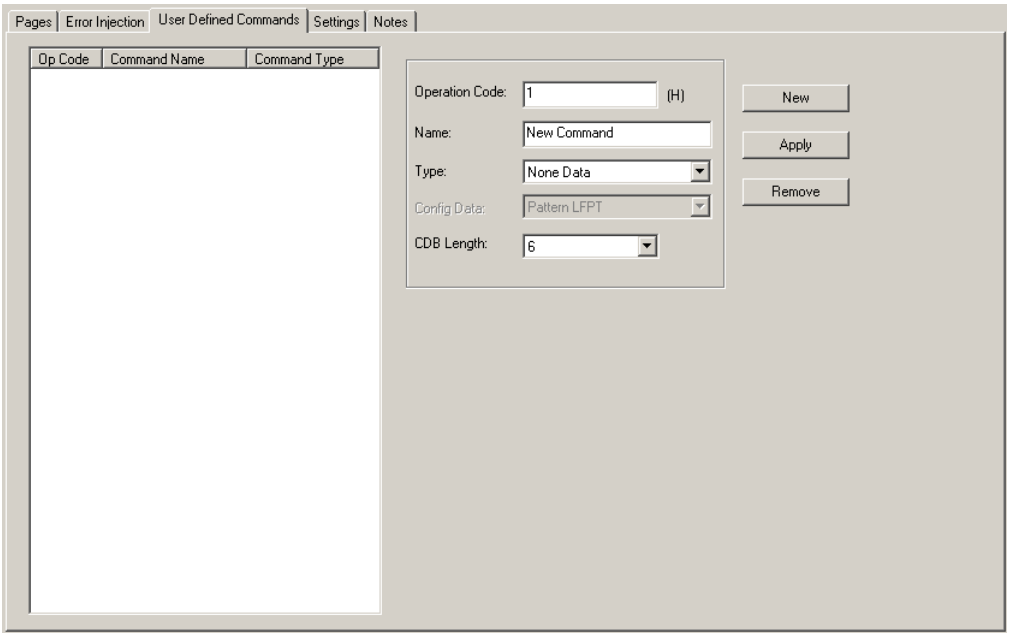


Figure 2.262: SAS: Command Definition Dialog

To define a command:

1. Enter an **Operation Code** and a **Name** in the corresponding text boxes.
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. Enter the **CDB length**: 6, 10, 12, or 16.
5. When done, click the **New** button.
6. The defined command appears in the command name window.
7. To make changes to a previously defined command, highlight the command, make the changes, and click **Apply.**

Note: After creation, the User-Defined commands appear in the Event Selection dialog.

2.12.11 Target Emulator Settings (SAS)

Click the **Settings** tab to display the Target Emulator Settings dialog.

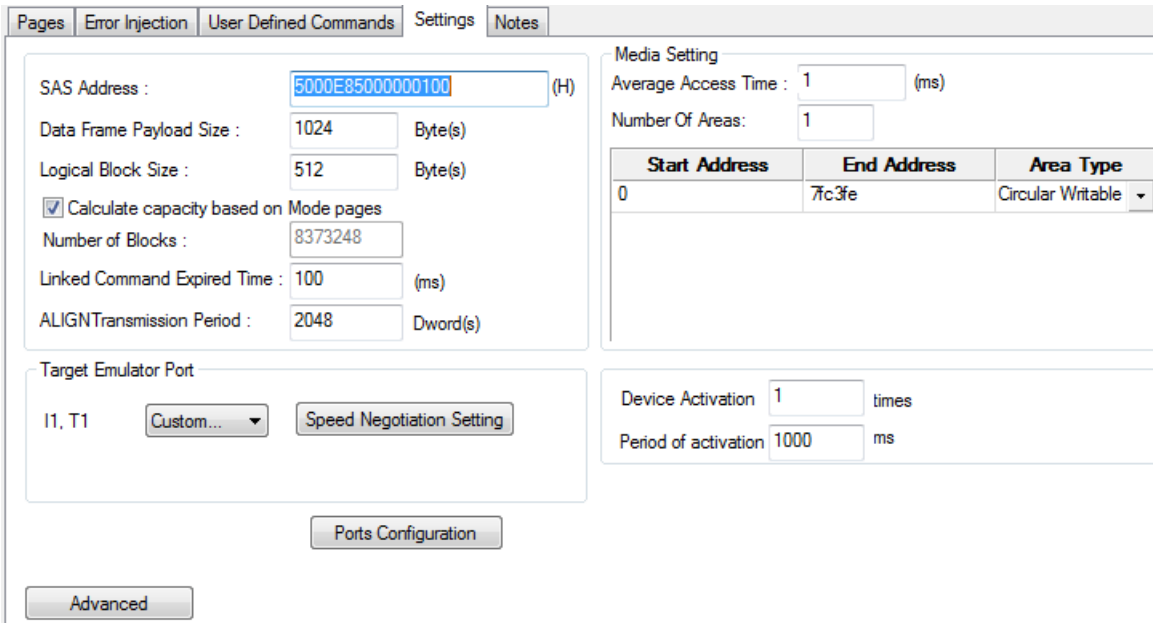


Figure 2.263: SAS: Target Emulator Settings Dialog

The Settings page opens with a default set of values, which you can modify. To return to these values, click the **Default Settings** button.

Define the Target

Enter a **SAS Address, Data Frame Payload Size, Logical Block Size, Linked Command Expired Time**, and **ALIGN Transmission Period** in the corresponding text box. Check **Calculate capacity based on Mode pages** or **enter a value for Number of Blocks**.

Media Settings

Enter a value for Average Access Time to simulate Seek/Access time delay of a real device.

Enter a Number of Writable Areas. **Define a Start** and an **End Address,** click the down arrow under the **Area Type**, and choose **Normal Writable, Circular Writable**, or **Non-Writable**.

Note: To set and get the settings of Media Settings Area Types, use these two functions:

```
SetMediaAreaAttribute(int nAreaIndex, int nStartAddress,
int nEndAddress, TrgEmulMediaAreaTypeEnum eAreaType, int* pnErrorCode)
GetMediaAreaAttribute(int nAreaIndex, int* pnStartAddress,
int* pnEndAddress, TrgEmulMediaAreaTypeEnum* peAreaType)
```

nAreaIndex: Specifies the (zero base) index of the Area.

Note: The Number of Areas should be set by the **SetNumberOfMediaArea** function prior to calling these functions.

nStartAddress: Specifies the start address of the Area.

nEndAddress: Specifies the End address of the Area.

eAreaType: Specifies the Area Type. This parameter should be in **TrgEmulMediaAreaTypeEnum** format. Its possible values are:

```
typedef enum {eNORMAL_WRITABLE = 0, eCIRCULAR_WRITABLE = 1,
eNONE_WRITABLE = 2} TrgEmulMediaAreaTypeEnum;
```

Choose Target Emulator Port

Click a port option button, then click the **Speed Negotiation Setting** button (see "Speed Negotiation Tab" on page 179). Select the port speed settings, all by default.

Ports Configuration

Click the **Port Configuration** button to display the Ports Configuration dialog (see "Ports Configuration" on page 124).

Device Activation

Enter a number of times in the **Activate Device** field. If **Activate Device** = 1, the software activates Target Emulator until you deactivate it. This is the default behavior. (**Period of Activation** has no effect.)

If **Activate Device** = n, where n > 1, the software activates and deactivates Target Emulator n times, with activation period specified in the **period of activation** field. For example, if **Activate Device** = 10 and **period of activation** = 2000 ms, the software activates Target Emulator for 2000 ms and then deactivates it, and then repeats activation and deactivation 9 times, for a total of 10 times. (You must enter **Period of Activation**.)

Advanced Settings

Click the **Advanced** button to display Advance Target Setting dialog for additional setting options. The dialog opens displaying the OOB Signal Setting tab (see Figure 2.264 on page 221).

OOB Signal Setting

Edit the default values displayed in the white editable fields.

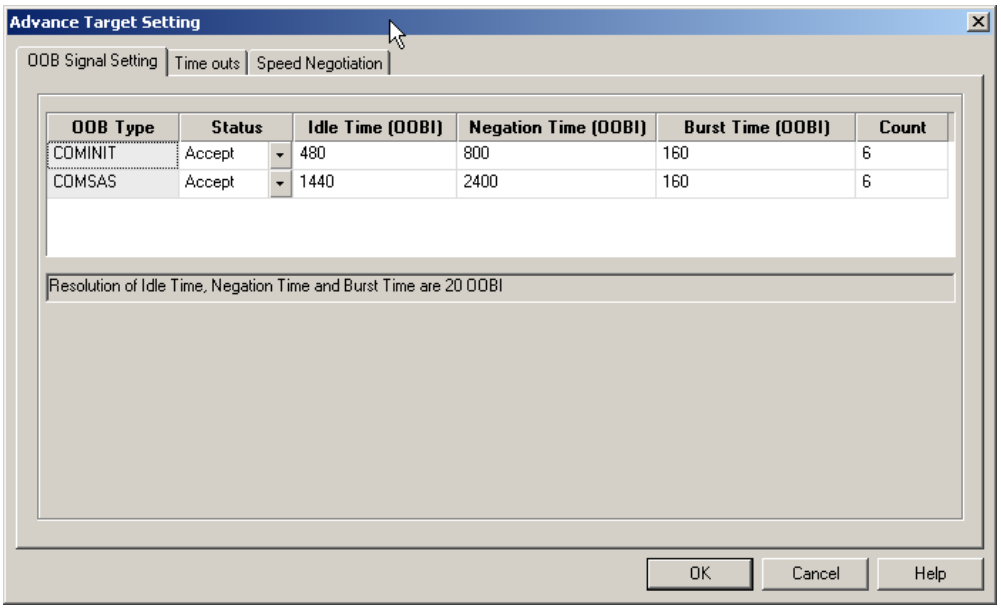


Figure 2.264: OOB Signal Setting Dialog

Set Timeouts

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

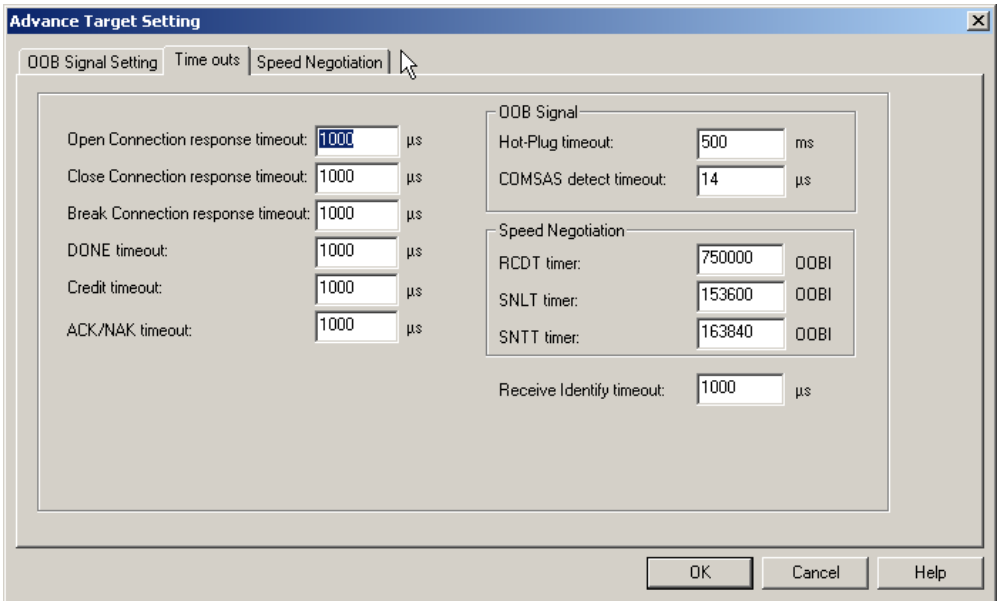


Figure 2.265: Timeout Setting Dialog

Edit the default values displayed in the white editable fields and click **OK**.

Set Speed Negotiating Error

Click the **Speed Negotiation** tab to display the Speed Negotiation dialog.

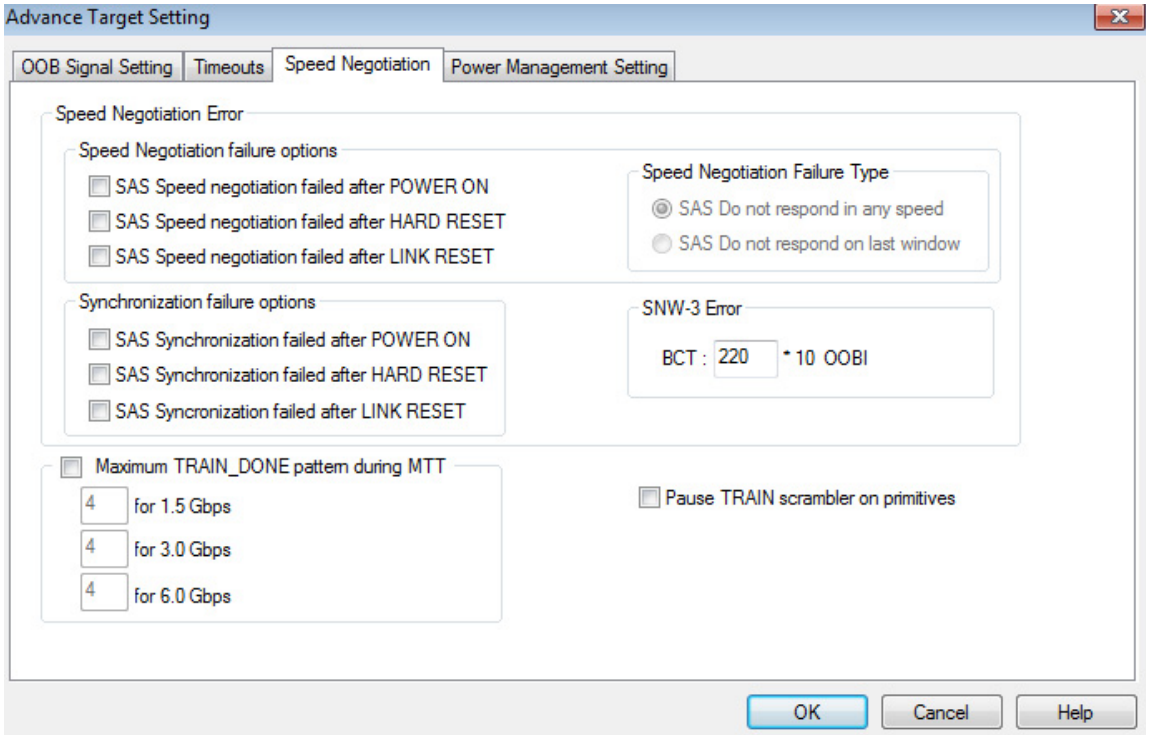


Figure 2.266: Speed Negotiating Error Setting Dialog

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

Power Management Setting

Use the Power Management tab to manage power settings. Enter the relevant information in the Host Initiated Power Management and Device Initiated Power Management panes.

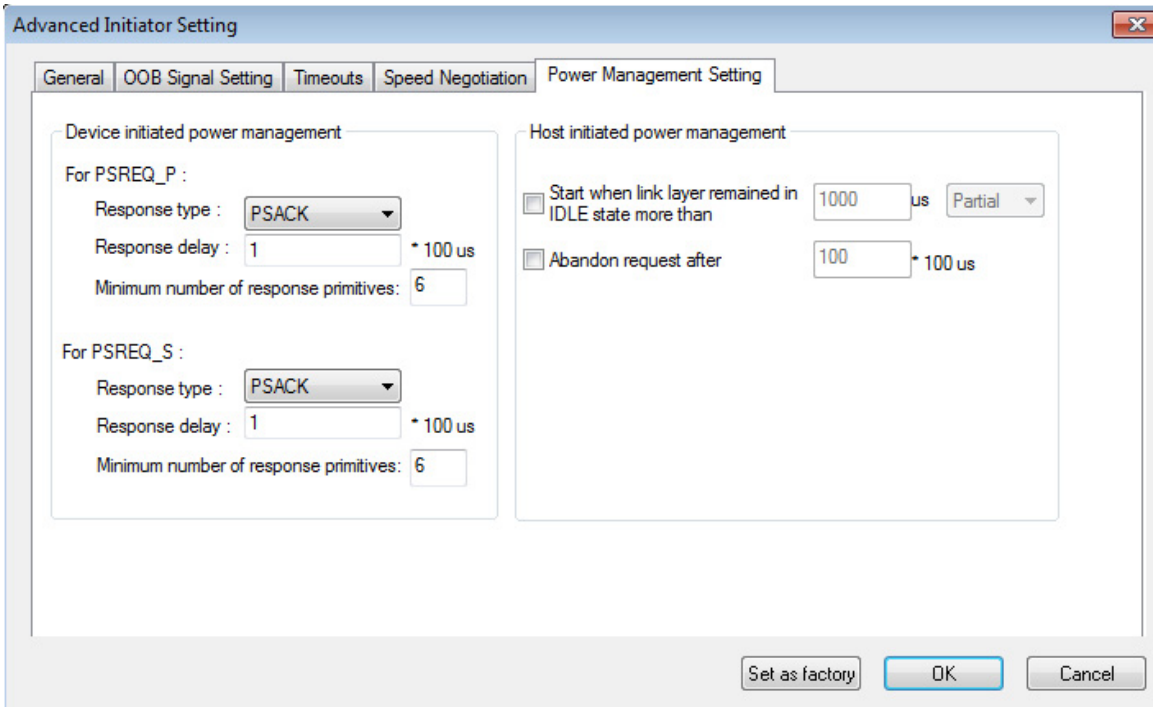


Figure 2.267: Power Management Tab

2.12.12 Notes Tab

Click the **Notes** tab and enter a Project Name and a brief description of the Target Emulation project (see "Add a Project Note" on page 128).

2.12.13 Run Target Emulation

Click the  **Start Target Emulator** button or select **Session > Start Target Emulator** to start emulation.

Note: You can run the analyzer while device emulation is active to monitor bus traffic.

2.12.14 Device Emulator Settings (SATA only)

Click the **Settings** tab to display the Device Emulator Settings dialog.

The Settings tab opens with a default set of values, which you can modify. To return to these values, click the **Default Settings** button.

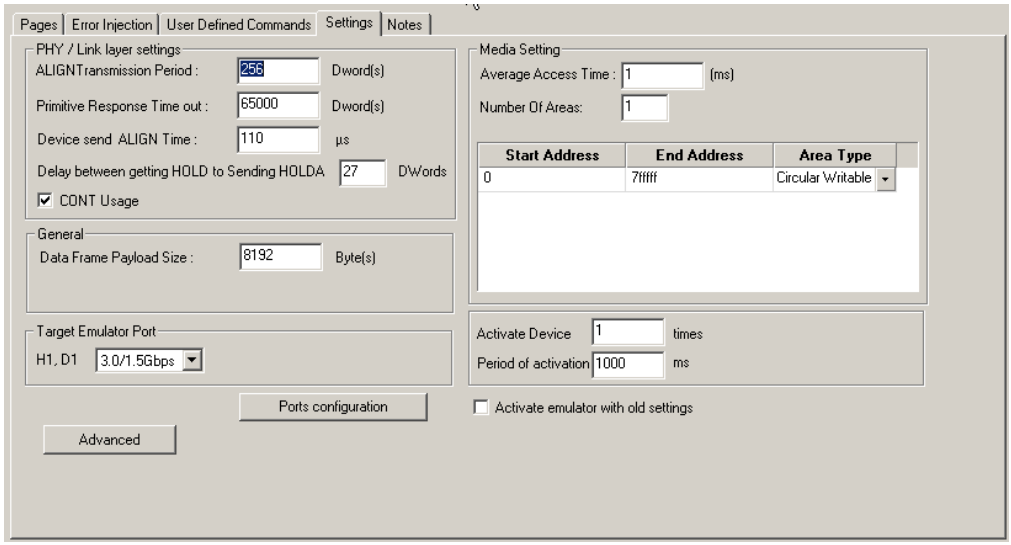


Figure 2.268: SATA: Device Emulator Settings

PHY/Link layer settings

Enter values for **Align Transmission Period**, **Primitive Response Timeout**, and **Standby Timeout**, **Device send Align Time** and **Delay between getting HOLD to Sending HOLDA** and specify a delay. Check **CONT usage**.

Delay Between Getting HOLD to Sending HOLDA

To enable the **Delay between getting HOLD to Sending HOLDA** feature perform the following steps:

1. Enter the value in the **Delay between getting HOLD to Sending HOLDA** field in the **Settings** tab as shown in the figure above.
2. Select the **Error Injection** tab.

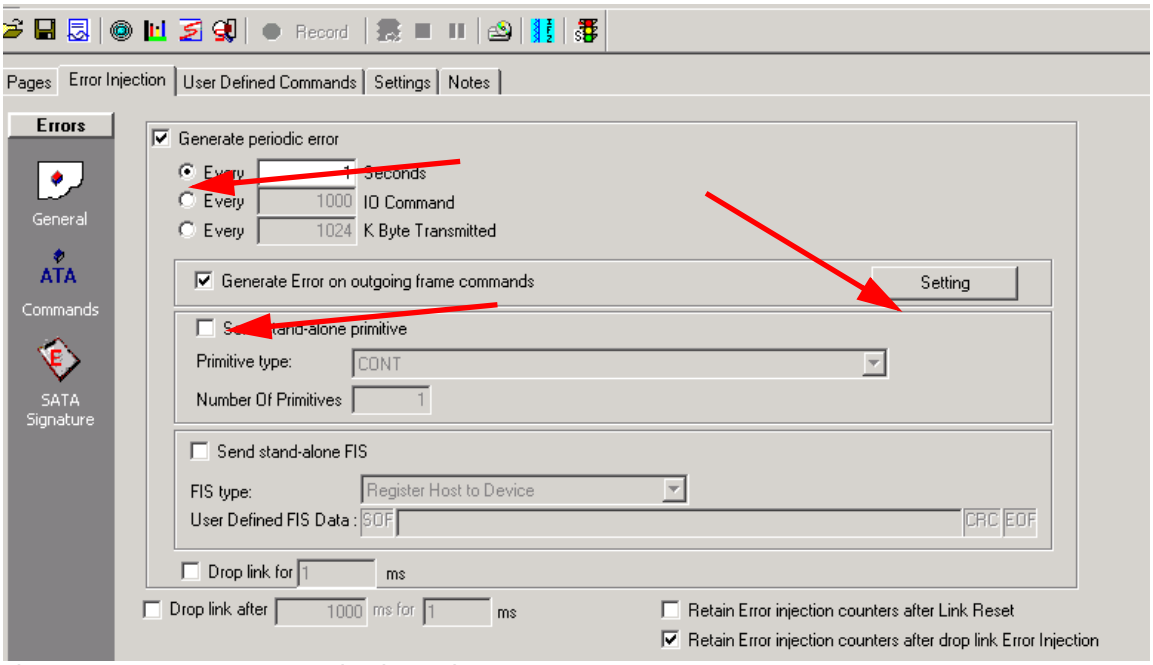


Figure 2.269: SATA: Error Injection Tab

3. Click the **Generate periodic error** check box.
4. Click the **Generate Error on outgoing frame commands** check box.
5. Click the **Settings** button.

   The Outgoing FRAME Error Setting dialog displays.

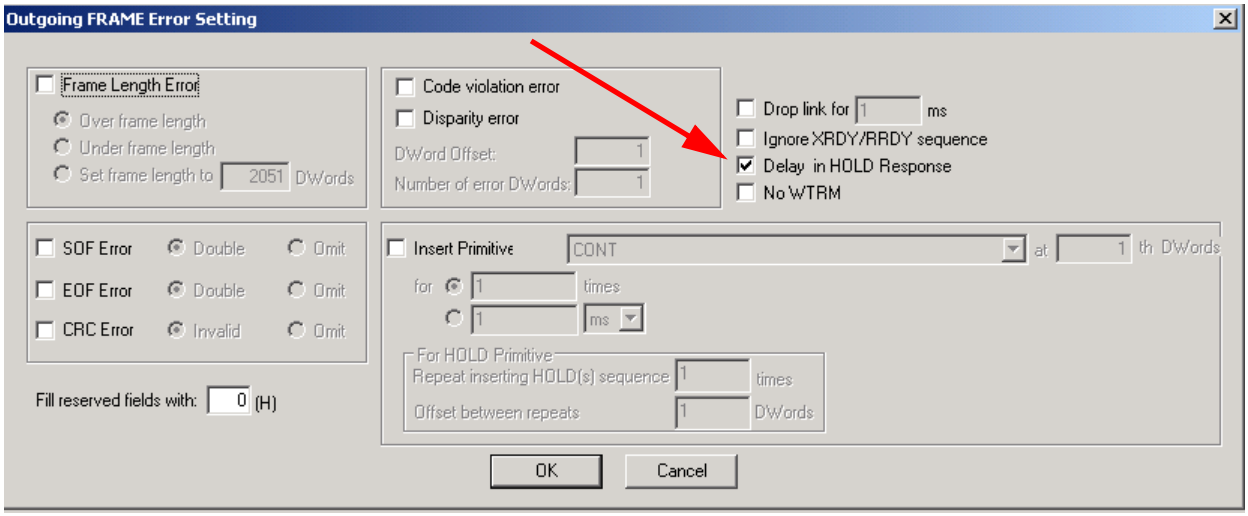


Figure 2.270: SATA: Outgoing FRAME Error Setting Tab

6. Click the **Delay in HOLD Response** check box.
7. Click **OK**.

Media Settings

Enter a value for **Average Access time** to simulate Seek/Access time delay of a real device.

Enter a **Number of Areas.** Define a **Start** and an **End Address**, click the down arrow under the **Area Type** and choose **Normal Writable**, **Circular Writable,** or **Non Writable**.

Payload Size

Enter a value for **Data Frame Payload Size** in the General area.

Choose Target Emulator Port

Click a port option button and click the down arrow next to the **Speed** list box and choose a port speed. Use the **Speed Negotiation Setting** button to open the dialog (see "Speed Negotiation Tab" on page 179).

Note: If you have made some changes to a defined emulation and want to return to the original definition, check the **Activate the emulator with old settings**.

Ports Configuration

Click the **Port Configuration** button to display the Ports Configuration dialog (see "Ports Configuration" on page 124).

Activation

Enter **number of times** and **period of activation**.

Advanced Options

Click the **Advanced** button to display the OOB Signal Setting, Power Management setting, Speed Negotiation, NCQ Command setting and Miscellaneous additional setting dialogs.

OOB Signal Setting

Edit the default values displayed in the white editable fields (see Figure 2.271 on page 227).

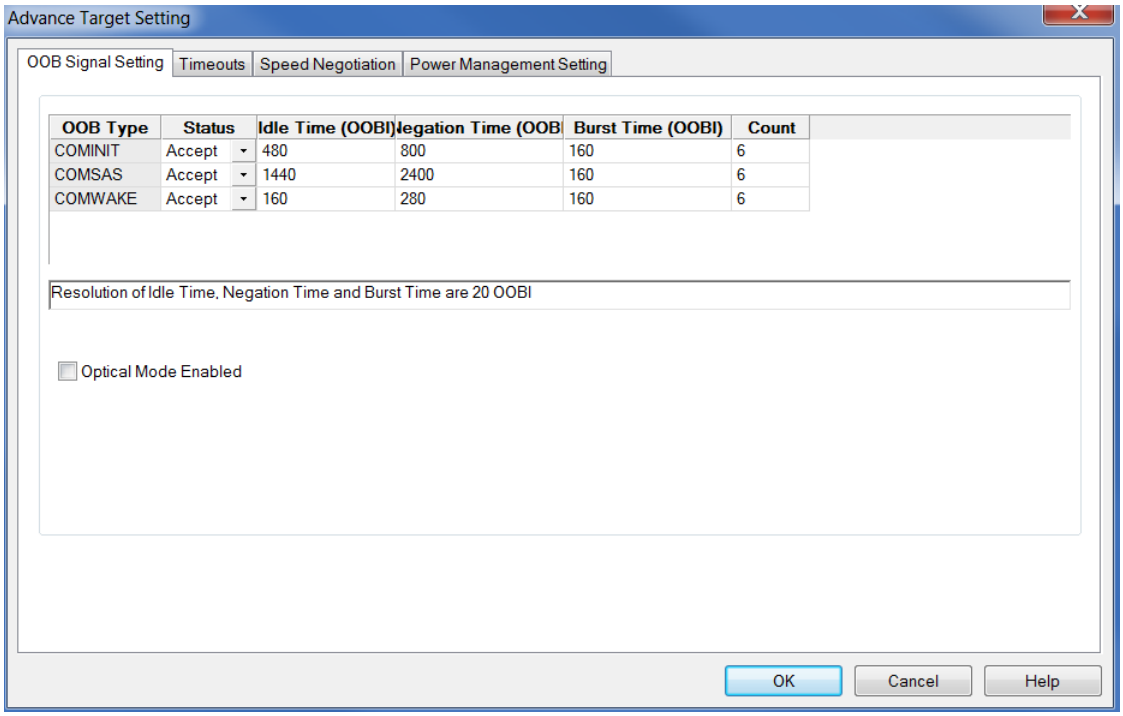


Figure 2.271: OOB Signal Setting Dialog

Timeouts

Click the **Timeouts** tab in the Advanced Host Setting dialog to specify timeouts for connection, CREDIT, ACK/NAK, ATA Command, OOB Signal and Identify frame.You can also edit the speed negotiation parameters.

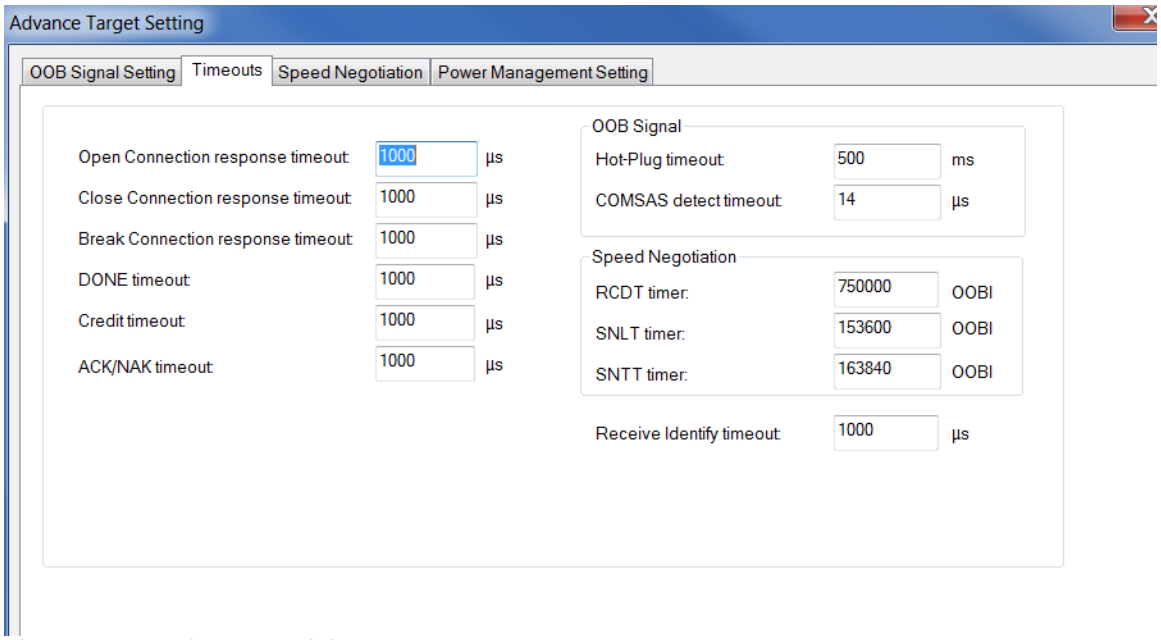


Figure 2.272: Timeouts Dialog

Speed Negotiation

Click the **Speed Negotiation** tab to display the Speed Negotiation dialog. Specify **Speed Negotiating Error Option(s), Speed Negotiating Failure Option(s), Maximum TRAIN_DONE pattern during MTT** and a **Speed Negotiation Failure Type**. Check Pause TRAIN scrambler on primitives

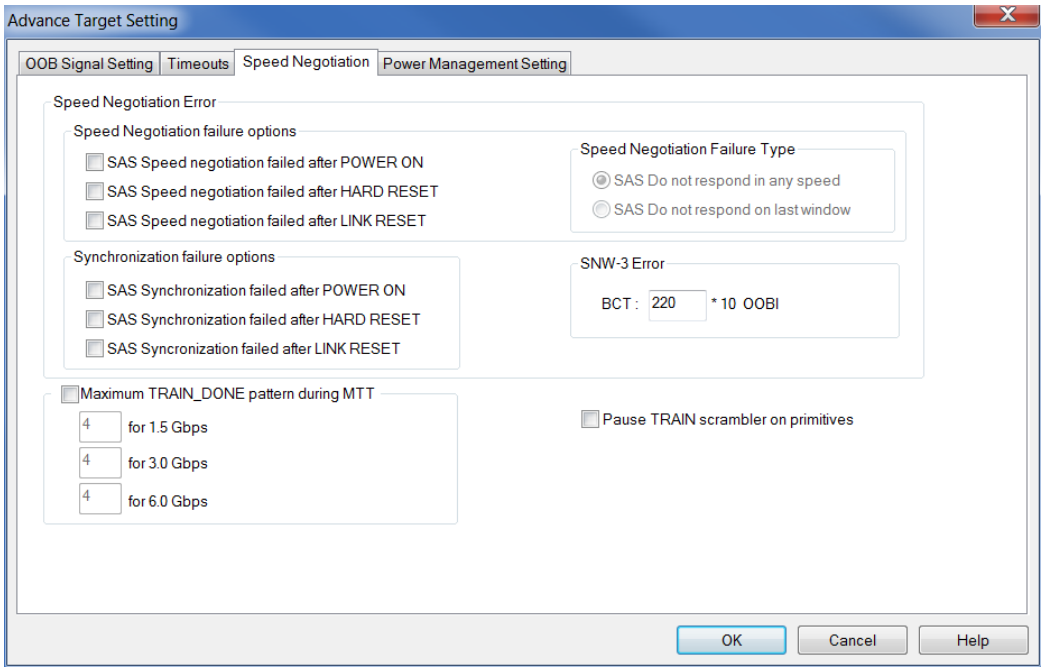


Figure 2.273: Speed Negotiation Dialog

Power Management Settings Tab

Start Target Emulator button or select **Session > Start Target Emulator** to start emulation.

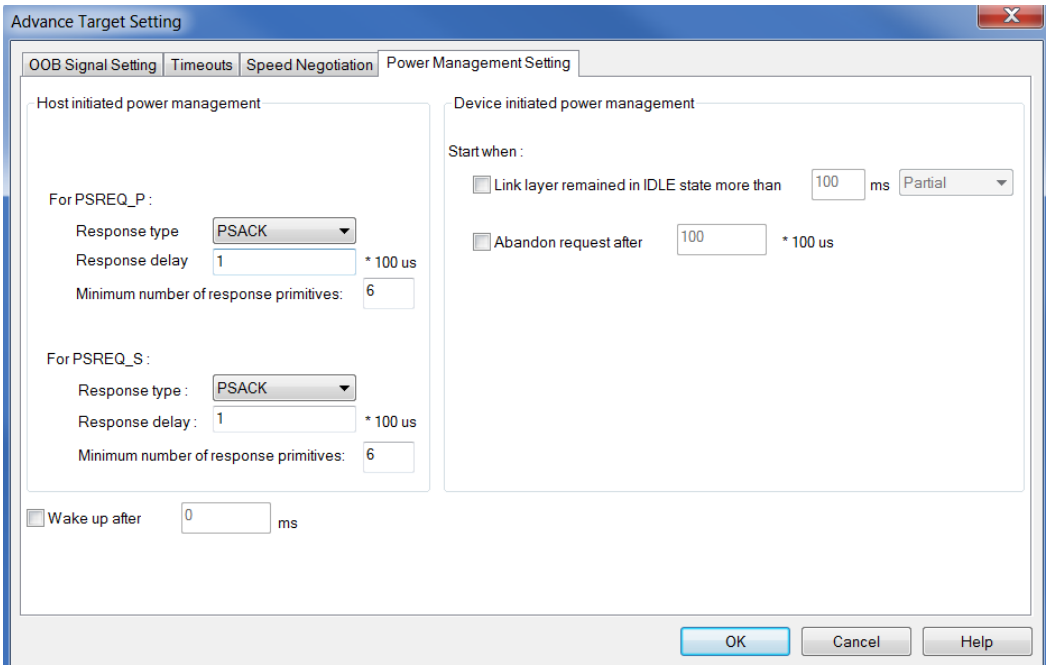


Figure 2.274: Power Management

1. In the **Host Initialized Power Management** area, choose whether to support the report in the Identify page.
2. Specify the response type for PMREQ_P and PMREQ_S, the delay, and **Minimum Number of Response Primitives**.
3. In the **Device Initiated Power Management** area choose whether to support the report in the Identify page.
4. Define start event by choosing **Standby timer expires, STANDBY command executes**, or **Link layer remains in IDLE state** more than [XXX] ms.
5. Specify time for **Abandon request** and **Wake up after** and enter the **Standby timer interval**.

NCQ Command Settings Tab

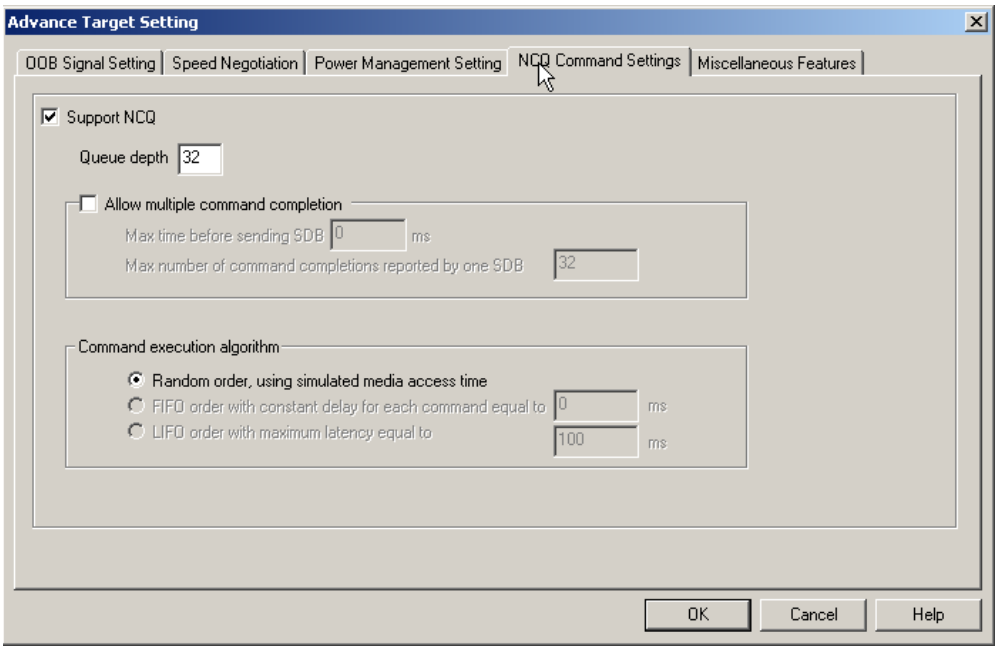


Figure 2.275: NCQ Commands

1. To enable **NCQ** commands, check **Support NCQ** and specify **Queue depth**.
2. Optionally check **Allow multiple command completion** and enter values for **Max time before sending SDP** and **Max number of command completions reported by one SDB**.

Miscellaneous Features Tab

The following screen capture shows the Miscellaneous Features tab in the Advanced Target Settings dialog.

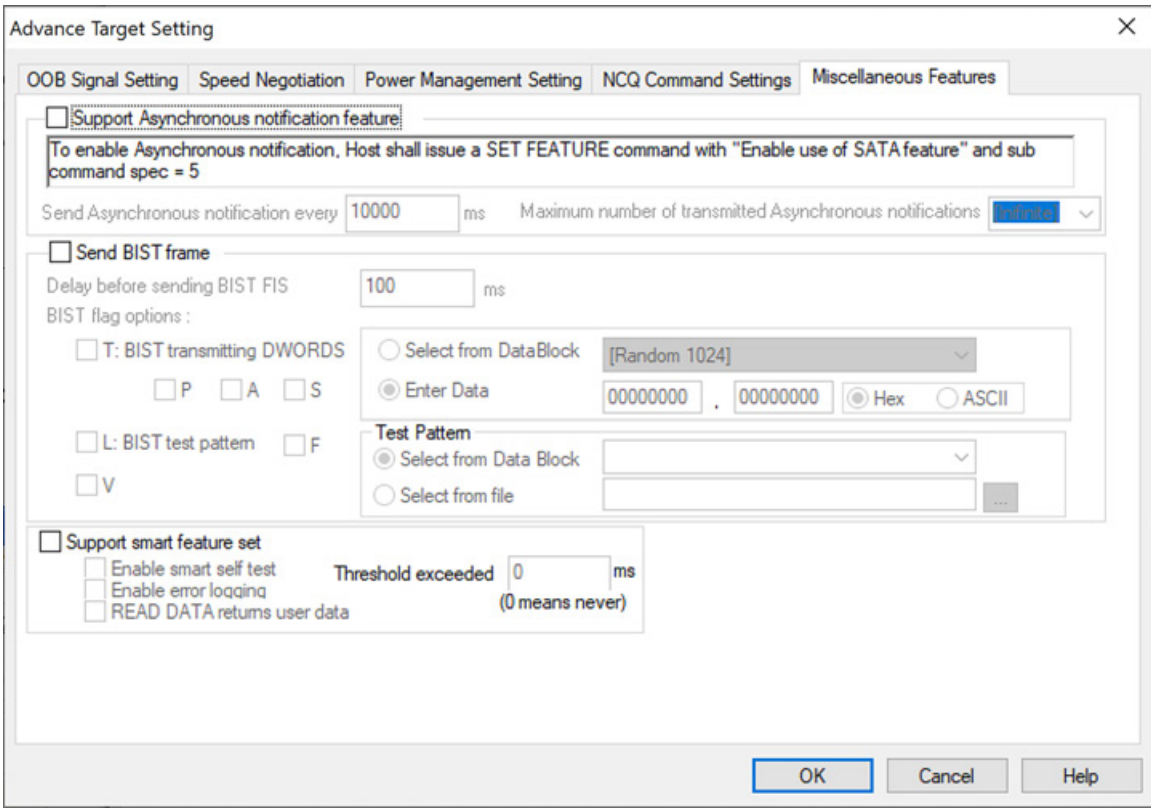


Figure 2.276: Miscellaneous Features

1. To enable Asynchronous notification, check the **Support Asynchronous notification feature,** and then specify the millisecond **Asynchronous notification interval** and the **Maximum number of transmitted Asynchronous notifications**.
2. To send a BIST frame, check **Send BIST frame** and enter a value for the millisecond **Delay before sending BIST FIS**. Choose BIST flag options and enter or select DATA or test pattern.
3. To support smart features, check **Support smart feature set**.
   For self test, check **Enable smart self test**.
   For error logging, check **Enable error logging**.
   To return user data for READ DATA, check **READ DATA returns user data**.
   To set threshold, enter an integer in **Threshold exceeded**. To never exceed threshold, enter **0**.

2.12.15 Project Note

Click the **Notes** tab and enter a **Project Name** and a brief description of the Device Emulation project (see "Add a Project Note" on page 128).

2.12.16 Using the Power Expansion Card

You can use the Power Expansion Card for Emulation. See "Using the Power Expansion Card" on page 41.

2.12.17 Run Device Emulation

Click the  **Activate Device** button to start emulation.

Note: You can run the analyzer while device emulation is active to monitor bus traffic.

Chapter 3

Display Manipulation

3.1 Viewer Display

After data is captured (Recorded), the Viewer displays a sample file (**.scs** for SAS and **.sts** for SATA) in Packet View.

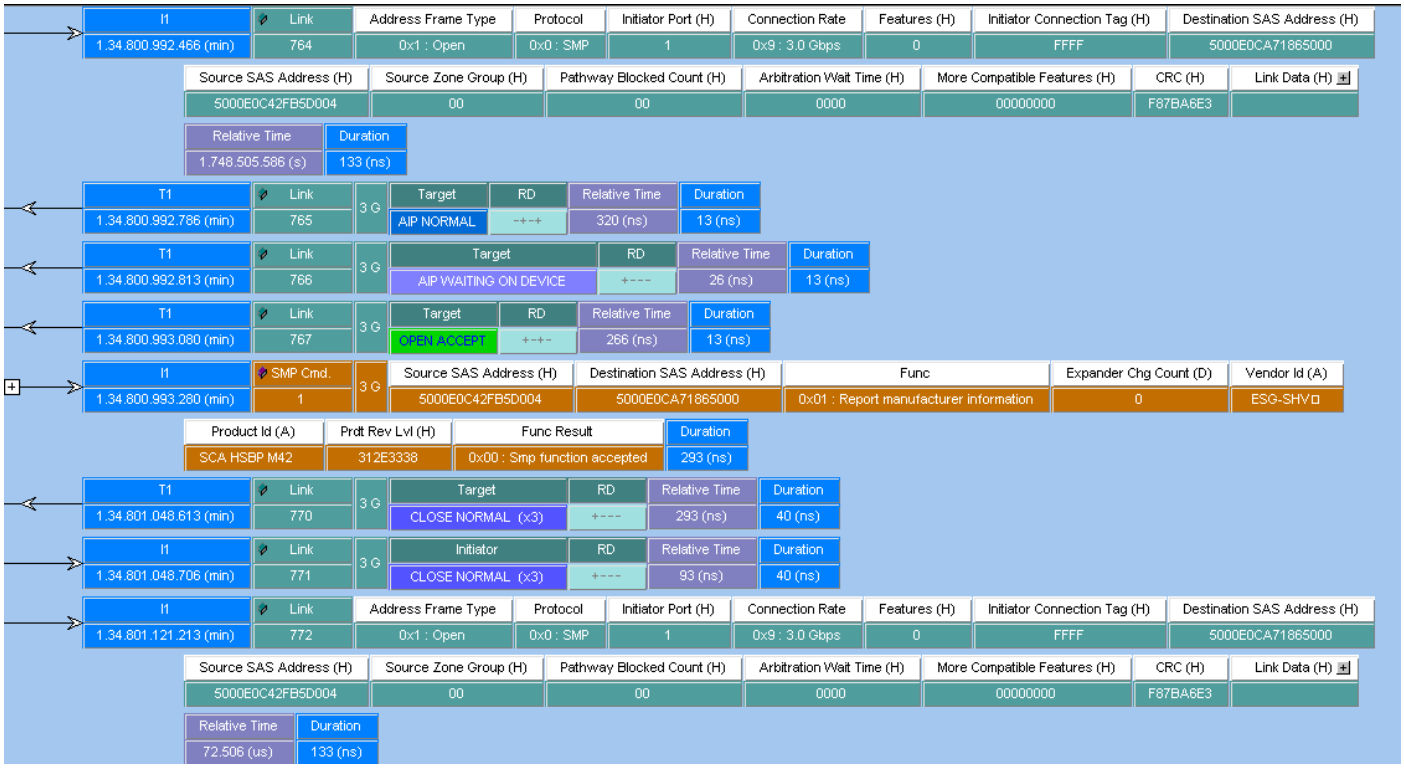


Figure 3.1: SAS: Packet View of .scs Sample File.

3.1.1 Scrolling

On Packet View / Spreadsheet View / Column View / Text View, with frame A selected:

- If you scroll with the mouse wheel or go up / down with keyboard arrow button, the software will scroll the view but the frame A remains selected.
- If you scroll with mouse wheel or go up / down with keyboard arrow button while pressing the Shift button, software will scroll to the next frame like B, C, or D.

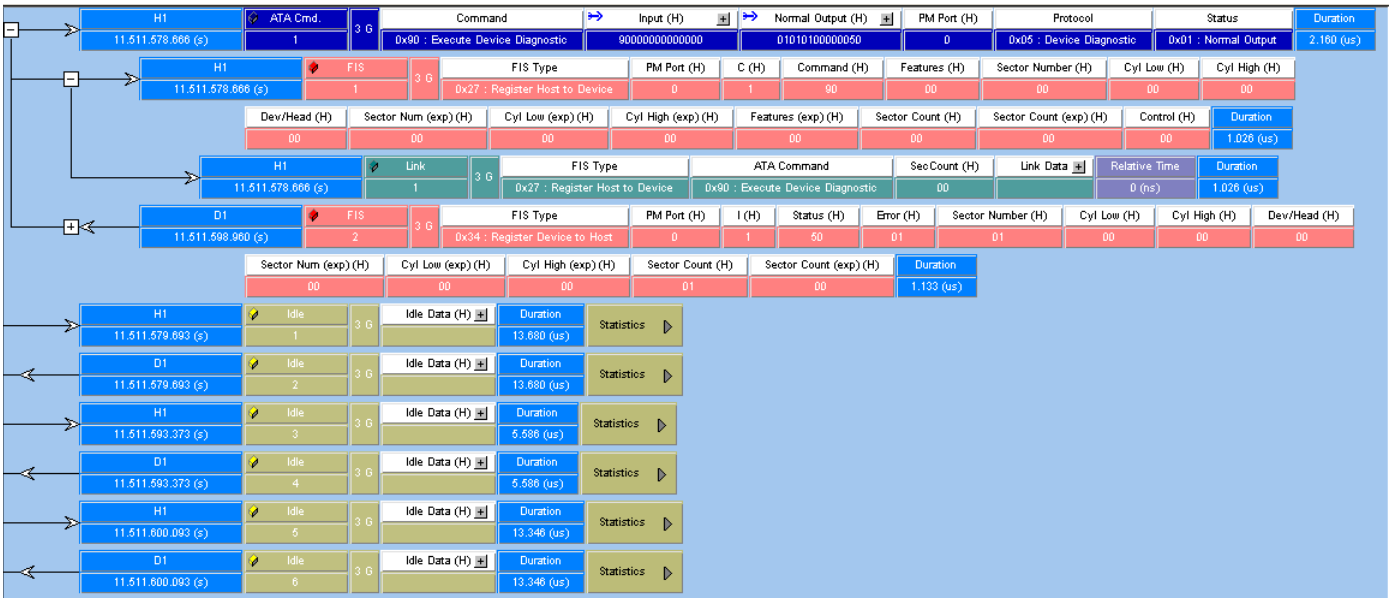


Figure 3.2: SATA: Packet View of .sts Sample File.

3.1.2 Quick View

By default, the settings in **Preferences** enable **Quick View**. Quick View allows full access to the whole trace more quickly, especially when using a Gigabit Ethernet connection. However, the trace is NOT written to the host machine's hard drive. To save the trace, you must manually click **Save**.

If you uncheck **Quick View** in the **Preferences** to disable Quick View, the trace loads more slowly, but is automatically saved to the host machine's hard drive. When Quick View is disabled, the Viewer displays successive parts of trace data as they upload. As soon as a trace part uploads, it is available in all trace views.

If you only need quick successive traces, and do not need to save them, keep the default setting to enable Quick View.

If you need to save all captured traces, unchecking the Quick View setting loads traces faster, especially for larger traces and slower connections than Gigabit Ethernet.

To refresh the viewer display with more uploaded data, scroll to the end of the trace, using scroll bars, page down, arrow down, or CTRL-End. Newly uploaded data then appears there.

Note: High-level decoding and statistics are available only after the whole trace has uploaded.

The software automatically switches to full trace view after trace uploading finishes.

Note: Users must press **CTRL Home** to go to the beginning of an uploaded trace, and **CTRL End** to go to the end of an uploaded trace.

3.1.3 Using the Viewer Display

To configure the data viewer display, use the toolbars. You can display the same data in:

- Packet view
- Spreadsheet view
- Column view, with transactions grouped for each active port
- Text view, with transactions grouped for each active port
- Waveform view
- Frame Inspector view
- Histogram view
- Bus Utilization view
- Data Report
- Statistical Report view

To change the view type when opening a trace, change the default workspace or save options in the **Preferences** dialog.

To toggle among open windows, use **CTRL - TAB**.
To reverse toggle order, use **CTRL - SHIFT - TAB**.

To make a frame a trigger pattern, in Packet View, right-click any frame, select **Add to Trigger**, and add the pattern to **DataPatternCapture**.

Viewer Display enables you to also perform the following:

- Decode Assignments (Refer to “Decoding Assignments” on page 237 for more details.)
- Compare Two Data Payloads (Refer to “Compare Two Data Payloads” on page 292 for more details.)
- Run Verification Scripts (Refer to “Running Verification Script Engine (VSE)” on page 317 for more details.)

3.2 Trace Properties

You can view the Trace Properties from the File menu. Click **File > Trace Properties**, the Trace Properties dialog displays with the following information (see Figure 3.3 on page 236):

- Software version
- Sample file version
- Grouping Type
- Hardware bin file version
- Analyzer armed at
- Analyzer triggered at
- Sample saved at
- Original Capture Project: **Open** displays the project settings used to capture the sample.
- Licensing Information
- Simpass Information

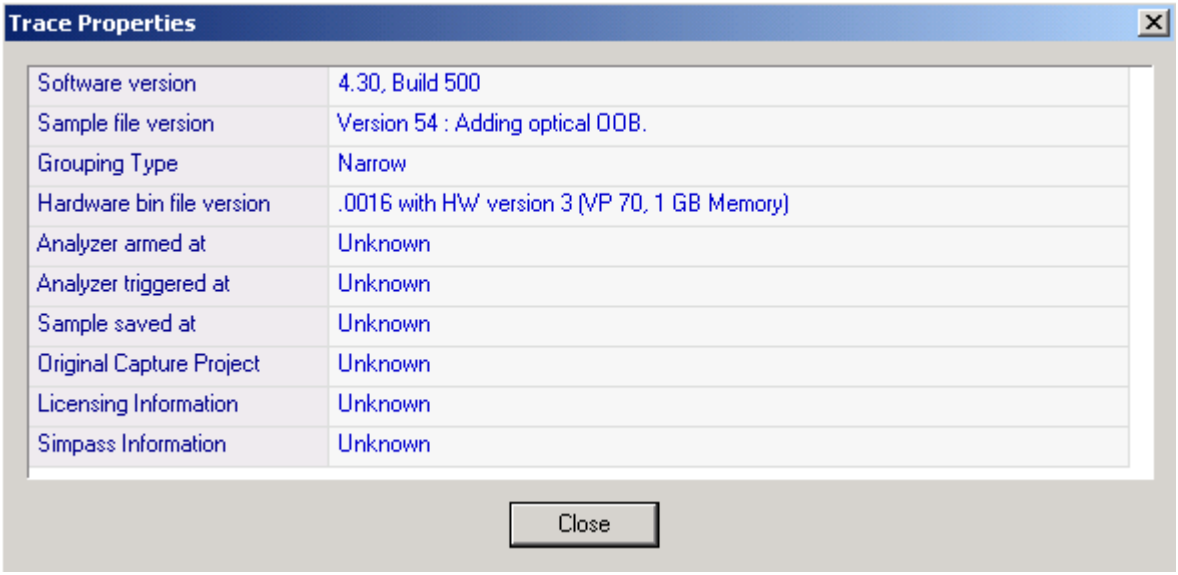


Figure 3.3: Trace Properties Dialog.

3.3 Analysis

The Analysis menu options allows you to see the trace in various views and switch views.

3.3.1 Show Analysis Toolbar

To display the capture in any of the other available views you can make the selection on the View Type toolbar as shown below or select the menu option under Analysis as shown in Figure 3.5 on page 237.

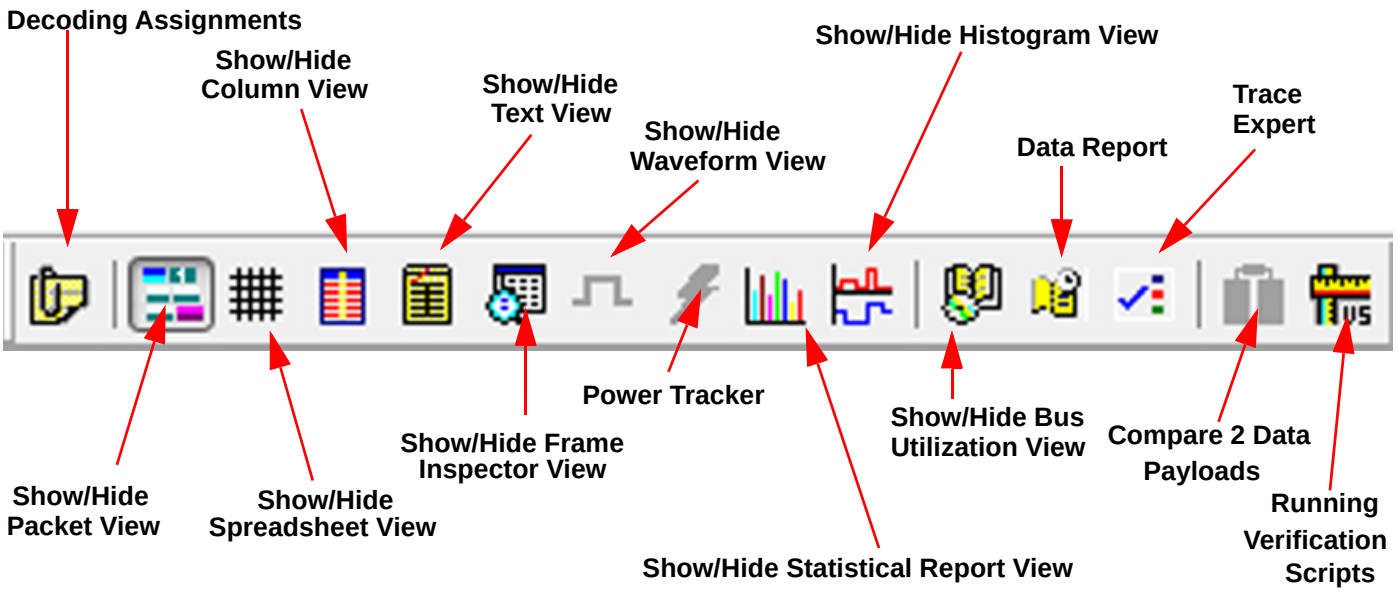


Figure 3.4: View Type Toolbar.

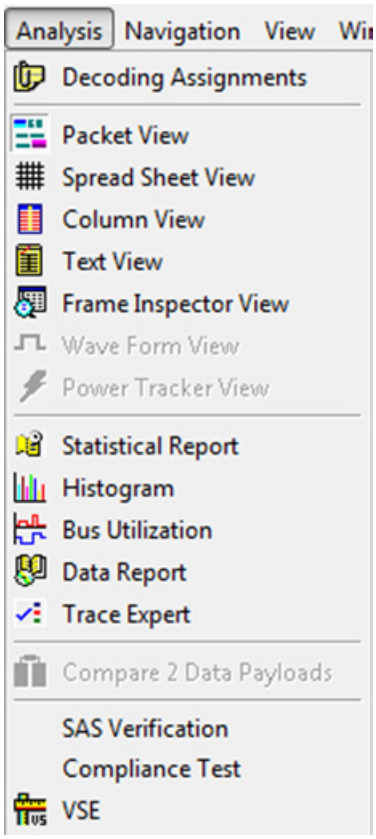


Figure 3.5: SAS/SATA Analysis Menu.

3.3.2 Decoding Assignments

The SAS/SATA Protocol Suite is designed to automatically assign SCSI decoding to a trace by using SBC3-SPC4 for SSP based transactions and MMC6-SPC4 for ATAPI/STP based transactions. To view the current decoding assignment for devices in the trace, click on the **Decoding Assignments** icon. See Figure 3.5and Figure 3.6.

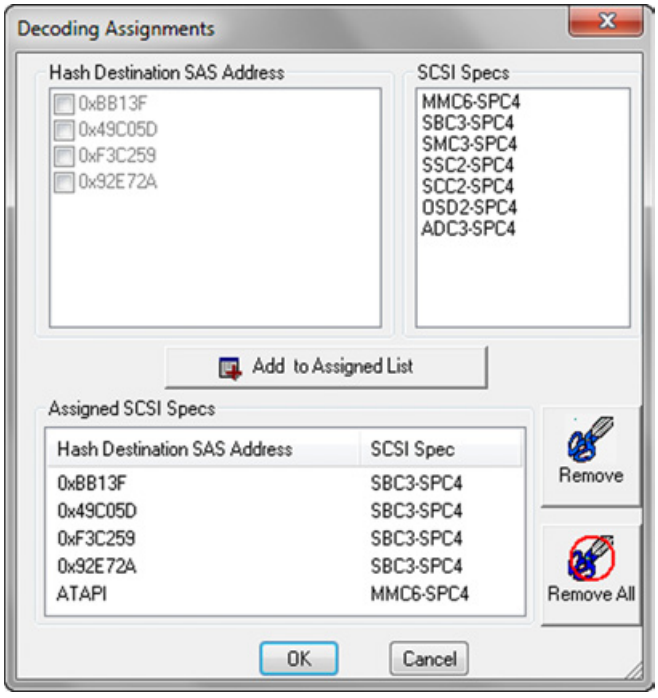


Figure 3.6: Decoding Assignments

In the **Decoding Assignments** window, the hashed address for all SCSI devices detected in the trace will appear in the **Hash Destination SAS Address** list. The supported specifications appear in the window on the right labeled **SCSI Specs**. The **Assigned SCSI Specs** scroll list displays the current assignment for each hashed address detected in the trace. This scroll list allows users to manually change the decoding assignment post capture. This may be necessary if the trace contains SAS traffic that is not SCSI Block Command 3 (SBC3) based, such as SAS tape or multimedia devices (rare).

If for any reason, the **Assigned SCSI Specs** list is displaying an incorrect spec for an individual device, select the Hash Address within this list and click the **Remove** button. To assign a different specification to the same device, reselect the device hashed address in the upper **Hash Destination SAS Address** window. Then select the correct specification in the SCSI Spec(s) window. Click the **Add to Assigned List** button to assign the individual decode. It's only possible to assign one SCSI Spec to a given hash address. Decoding changes should appear immediately but It's necessary to save the trace to keep any decoding changes.

In general SATA devices do not require manual decode assignment. Most SATA-based HDD/SSD devices use the ATA/ATAPI command set and are automatically decoded using the MMC6-SPC4 specification. Some removable SATA multimedia devices utilize the PACKET feature set (also known as ATAPI devices). These ATAPI based devices use a subset of the SCSI command set by default will be decoded using the Multi-Media Commands - 6 (MMC6-SPC4). Some SATA multimedia devices may alternately use the SCSI Streaming Command set (SSC2-SPC4). For these devices it may be necessary to manually assign the decoding to the SSC2-SPC4 spec. See Figure 3.7 on page 239.

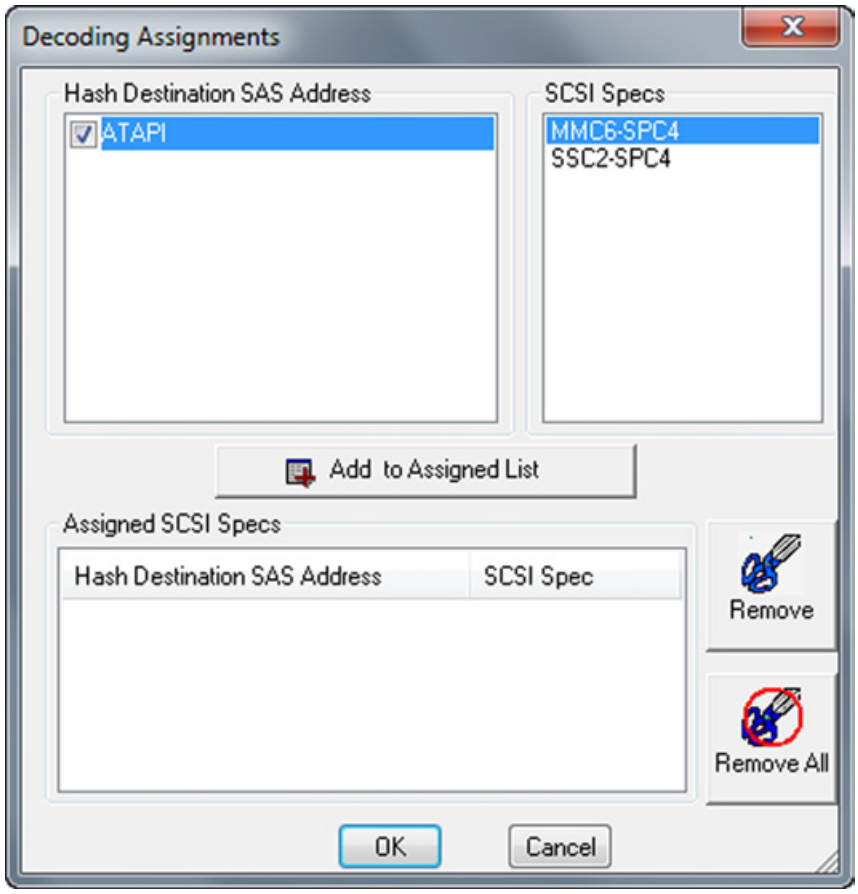


Figure 3.7: Decoding Assignments SATA

To make changes to the default decoding, use the Preferences window to assign the specific SCSI specification for all future traces. By changing the default decoding in the Preferences window, the Search and Hide options will also reflect the correct decoded fields. See Figure 3.8 on page 240.

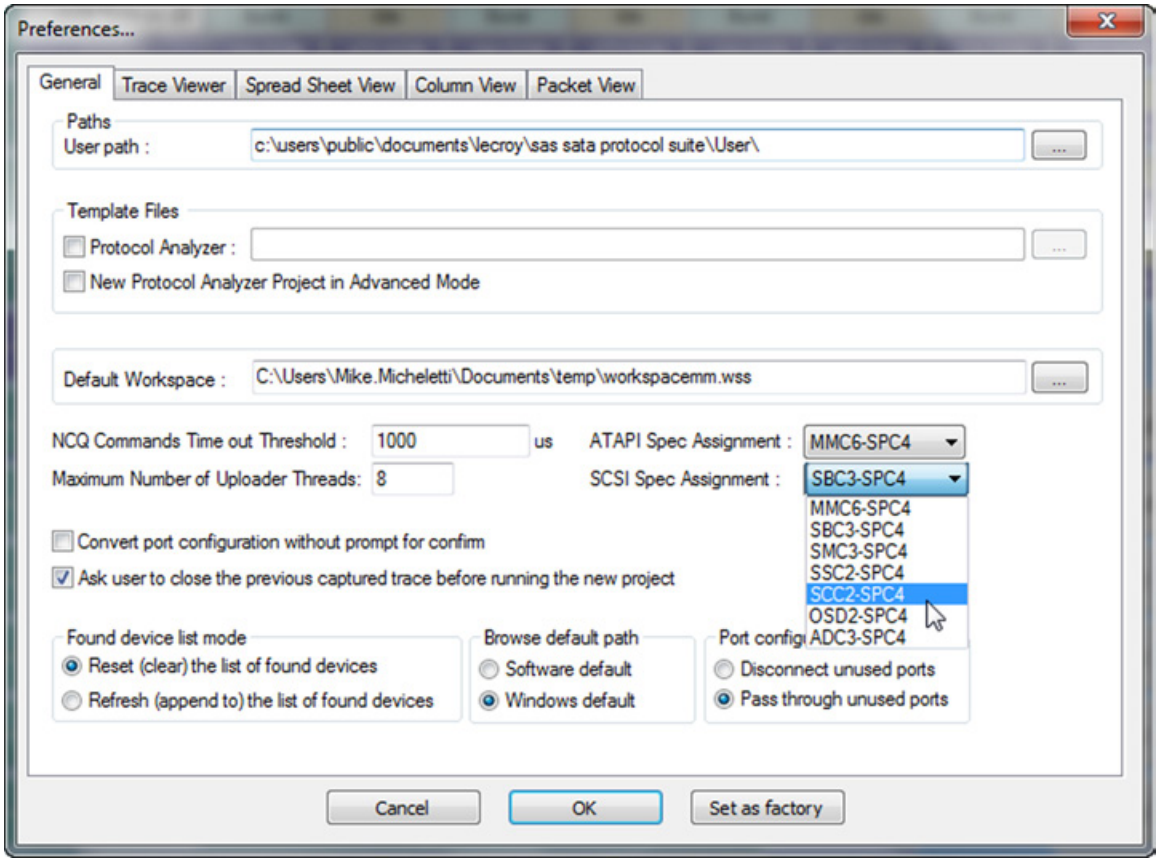


Figure 3.8: Preferences Window

If a specific SCSI Spec does not appear in the SCSI Specs window, it may not be supported by the current release of the SAS / SATA Protocol Suite. Contact Teledyne LeCroy Technical Support to request additional decode development.

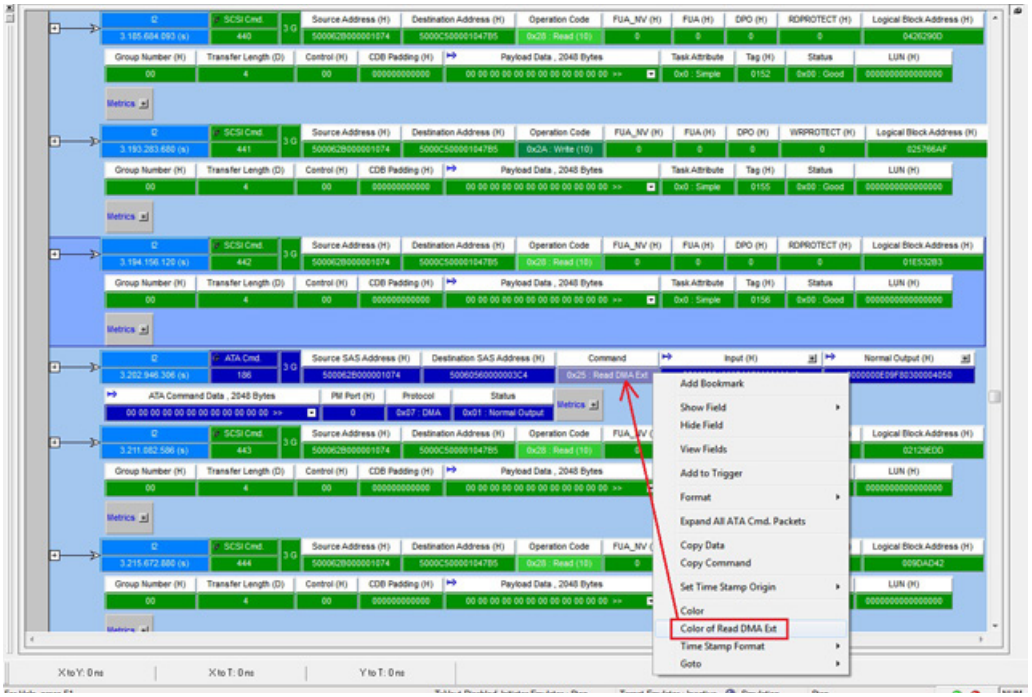
3.3.3 Packet View

After you select a view, it appears in a separate window. To increase the new window display size, select **Analysis > Packet View** or, click the  **Show/Hide Packet View** button.

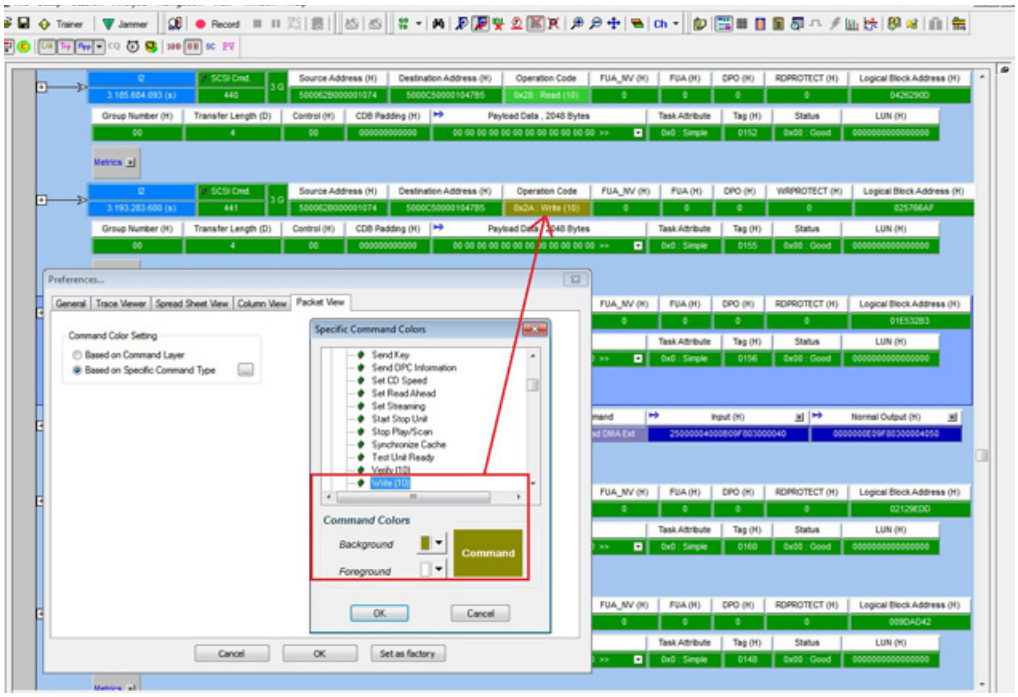
When scrolling through either display using the scroll bar, the corresponding display in the other view scrolls with it.

You can rearrange the tiling by clicking **Window** and choosing **Cascade, Tile Vertical,** or **Tile Horizontal**.

You can customize the color of any operation code field using either of the following two methods:



1. Right-click on any command field in the trace. Select "Color of ..." option to set the color for the selected operation code field.



2. In the Preferences window, select the Packet View tab. select the "Based on Specific Command Type" option. In the commands list, search for any command that you want, and change the background and foreground colors.

Packet View Metrics

The Metrics feature provides quick access to additional information about the packet data. Click the Metrics + icon as shown in Figure 3.9 to display the details.

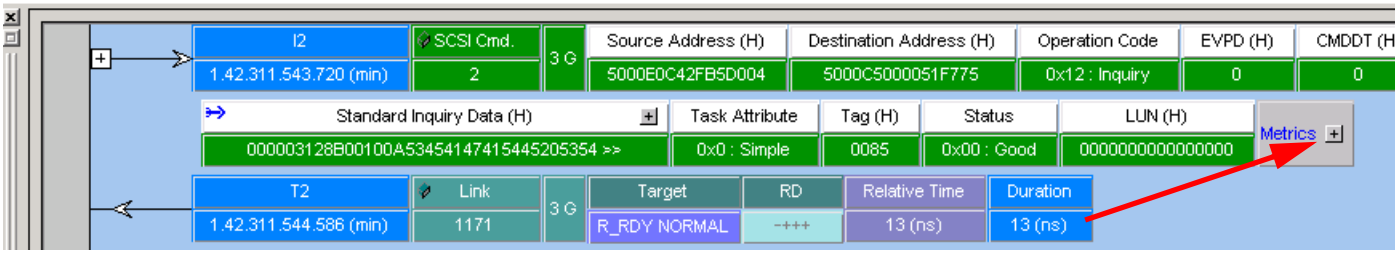


Figure 3.9: Packet View Metrics.

The following additional information of the packet is displayed when the Metrics field is expanded. Refer to Figure 3.10 on page 242.

Performance Reference Definitions

Trp. No. - Number of Transports

The total number of transports that compose this exchange.

Resp. Time - Response Time

The time taken to transmit this command on the link(s) from the beginning of the first frame in the command to the end of the last frame in the command.

Pld. Bytes - Payload Bytes

The number of payload bytes this operation transferred.

Latency Time

The time measured from the transmission of the command to the first data transmitted for this IO operation.

Data-Stat. Time - Data to Status Time

The time between the end of data transmission for this command and the Status frame.

Thrpt MB/s- Data Throughput

The payload divided by response time expressed in MB per second.

Note: In the calculation of Throughput we use MB to represent 1024x1024 bytes (or Mebibytes: MiB). 1 MiB = 2^20 bytes = 1,048.576 bytes.

Duration

The time taken from the first DWord to the last DWord in a line.

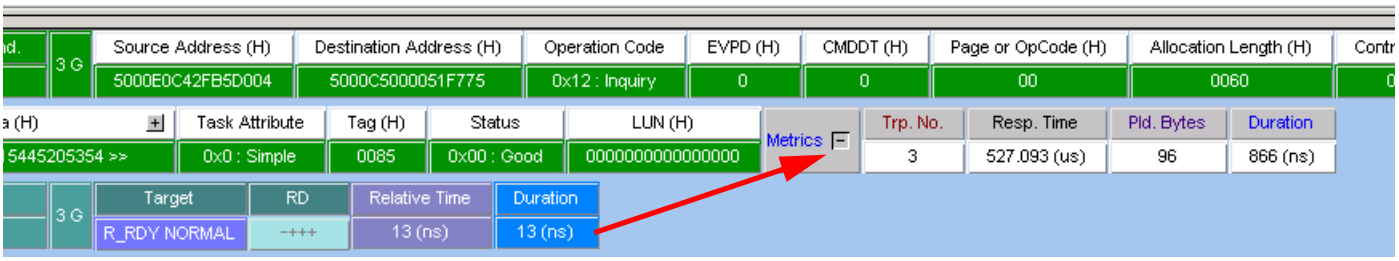


Figure 3.10: Packet View Metrics Expanded.

Copying Packets from a Trace to a Host Emulator Script

This check mark in the illustration below shows packet (s) selected to copy. You can copy packet(s) from a trace and paste it into a host emulator script. That is why you can only mark packets that we support in emulator and host side packets. You can also mark multiple packets by left-clicking and moving the mouse over multiple packets and then right-click to select them, and paste them in an emulator script.



Figure 3.11: Packets Selected to Copy.

Device Sleep (DevSlp)

The Device Sleep status is displayed throughout the trace by right-clicking and selecting **Device Sleep** in Packet View.

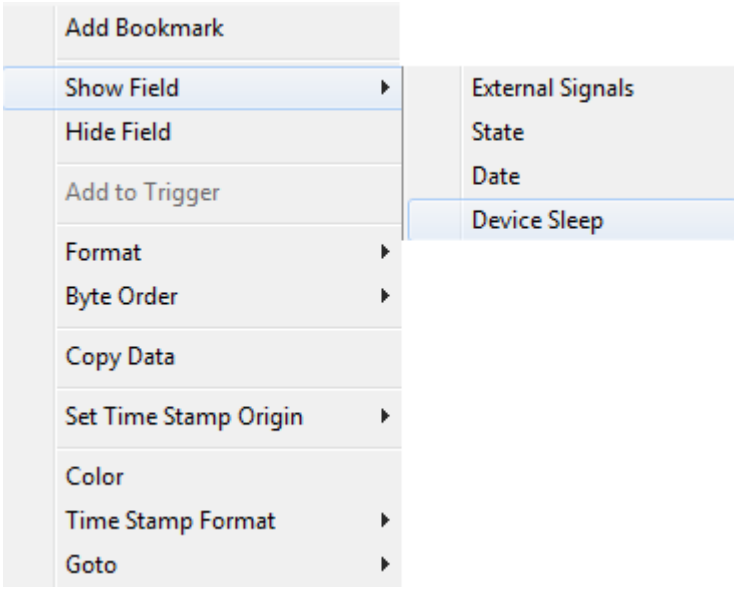


Figure 3.12: Right-click Device Sleep Menu.

The trace now displays the Device Sleep fields of all the packets (see Figure 3.13 on page 244). Current measurement accuracy is +/- 10mA for 5V and lower signals, and +/- 100mA for 12V. Voltage measurement accuracy is +/- 100mV for 5V and lower and +/- 150mV for 12V.

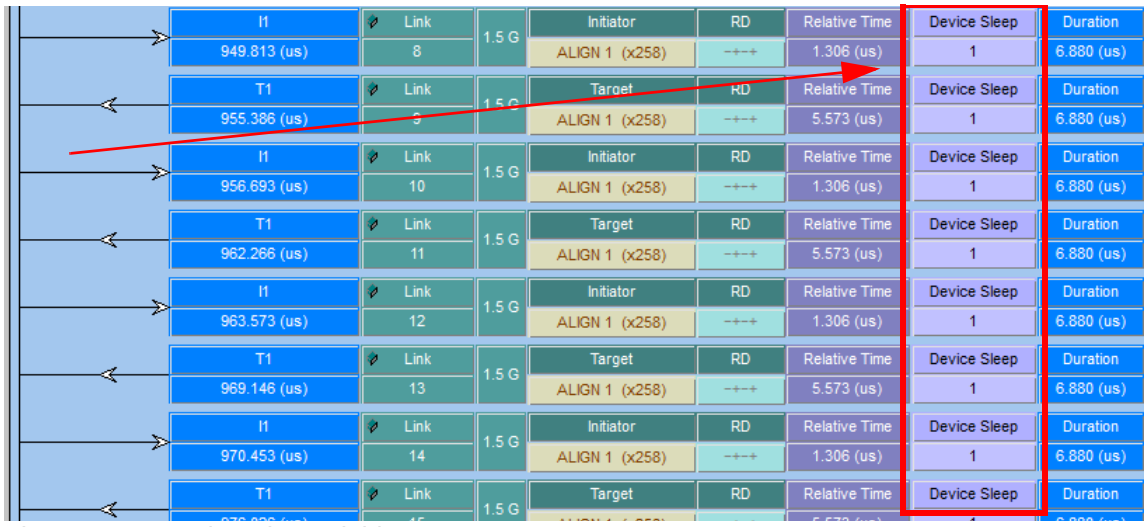


Figure 3.13: Device Sleep Fields.

Viewing Check Condition Sense Data

When a Check Condition error occurs, you can view decode data from it. This info is shown in Packet View. Under Transport layer, expand Info Unit, then expand Sense Data. In Column View, check the "show Field View in Column View" check box in SW settings, then display Field View while column View is open.

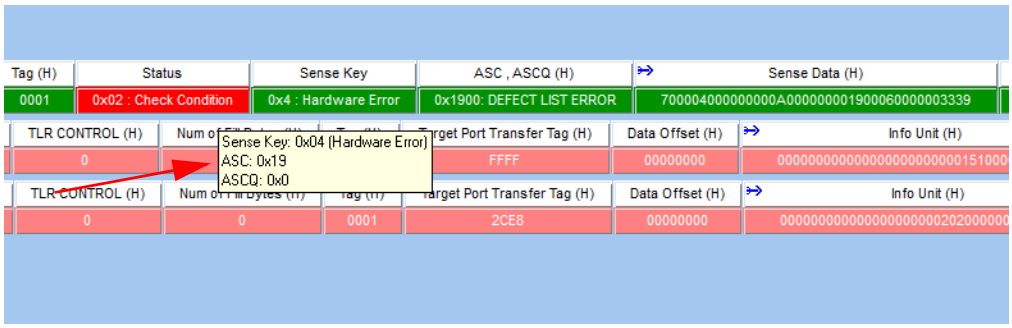


Figure 3.14: Check Condition Data.

1. Open Packet View.

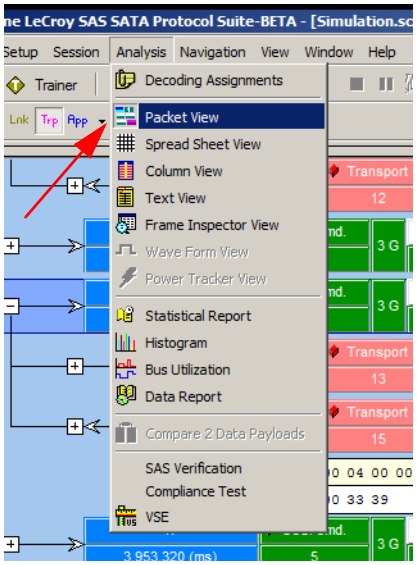


Figure 3.15: Packet view.

2. Show Transport layer.

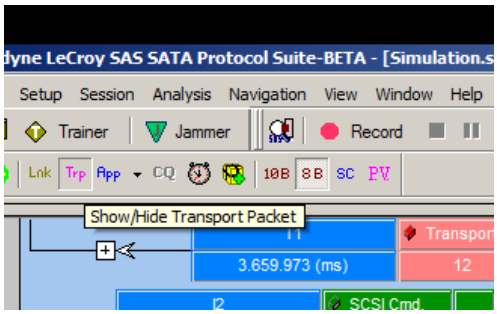


Figure 3.16: Transport layer.

3. Expand the Information Unit.

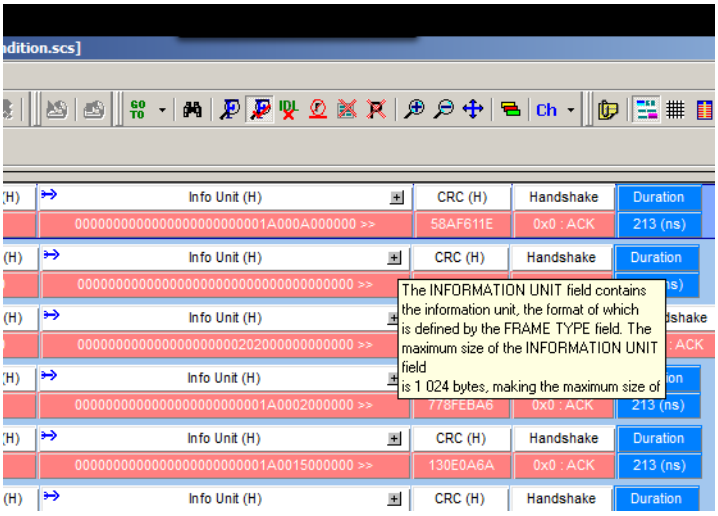


Figure 3.17: Information unit.

4. Expand Sense Data. The hidden fields are revealed.

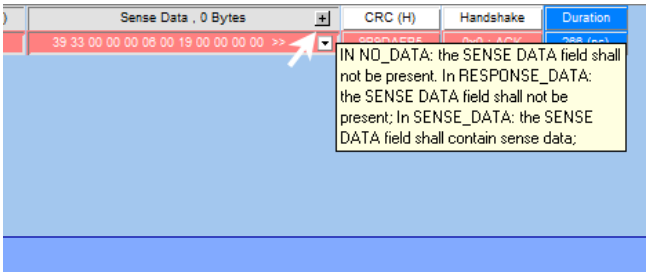


Figure 3.18: Sense data.

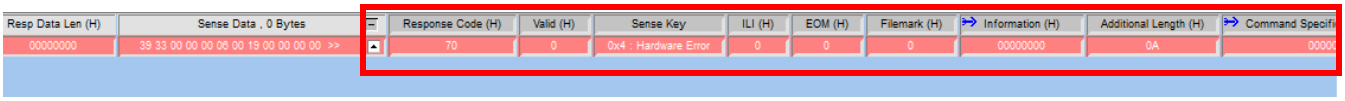


Figure 3.19: Sense data expanded.

Go to Command / Go to Response

The Go to Command / Go to Response feature can be used to scroll through a large data packet to find SCSI commands and responses.

To use the Go to Command / Go to Response feature, open a trace with a data packet and “Right Click” on the Data section of the packet (TimeStamp = 35.965 us). See Figure 3.20 on page 247.

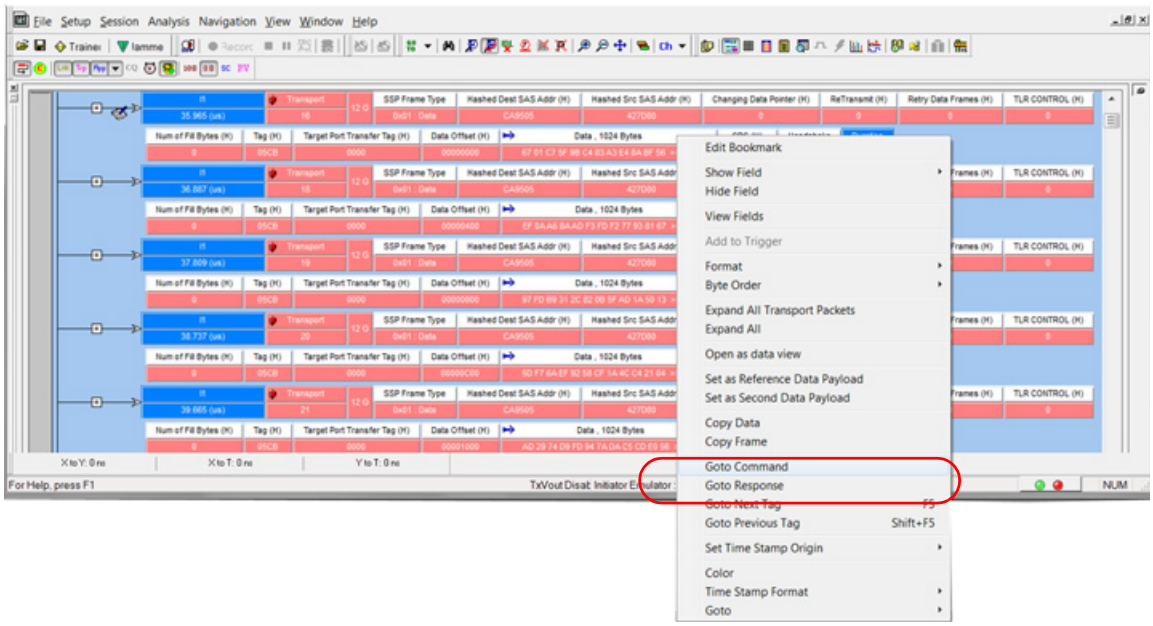


Figure 3.20: Goto Command / Goto Response Menu

Clicking on Goto Command will take you to the Command Packet 1. See Figure 3.21 on page 247.

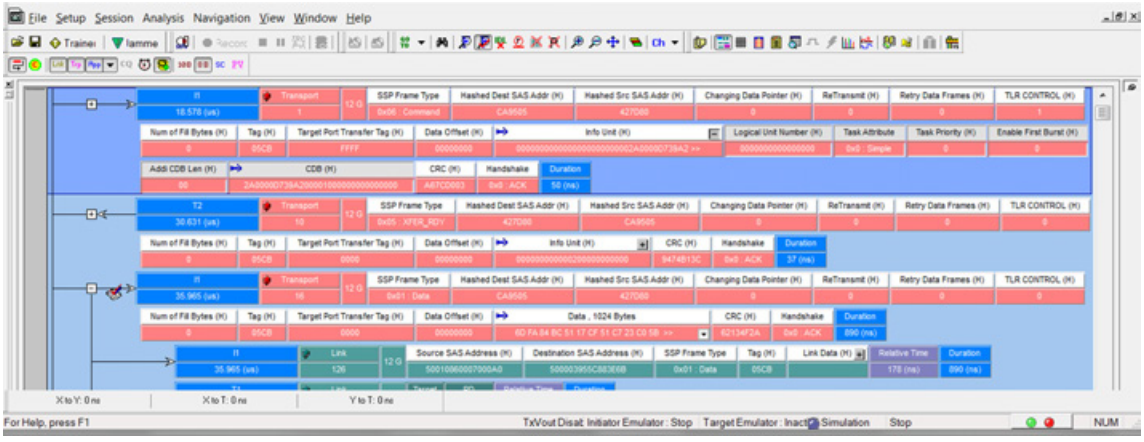


Figure 3.21: Typical Goto Command Trace

Clicking on Goto Response will take you to the Response Packet 35. See Figure 3.22 on page 248.

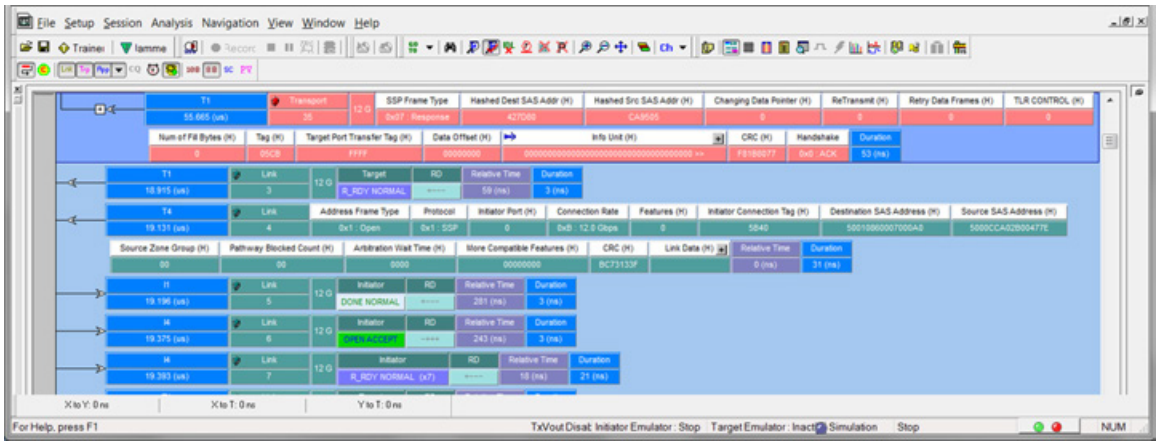


Figure 3.22: Goto Response Trace

Note: Export to Text/Excel is available from the Spreadsheet View, Packet View or Text View as of S/W version 5.60 or later. Export to Text/Excel is not available from Column View as of S/W version 5.60 or later.

3.3.4 Changing the Default View

Perform the following steps to change the default view of all trace files to Packet View:

1. Open a trace file.
2. Select the **Packet View**. Close all other views.
3. Select **File > Save Workspace** to open a Save As dialog. Save the current workspace as a **.wss** file.
4. Select **Setup > Preferences** and select the Trace Viewer tab.
5. In the Default Workspace field, enter the path and name of the workspace **.wss** file that you saved in step 3.

Because the default workspace contains only Packet View, the software opens trace files in Packet View.

3.3.5 Updating the Workspace

If you'd rather have a set of views open when you open a Trace, you can select a set you like and store that particular set of views as a *workspace_your_description.wss* file. The next time you open any Trace it will initially come up showing the Default Workspace (as shown in "Changing the Default View" on page 248), but then you can open a Workspace you have defined and the Trace will be displayed in your unique Workspace set.

Perform the following steps to define a set of views that you are interested in:

1. Open a trace file, in this case the 1.5-3.0-6.0 Trace has been opened. See Figure 3.23 on page 249.

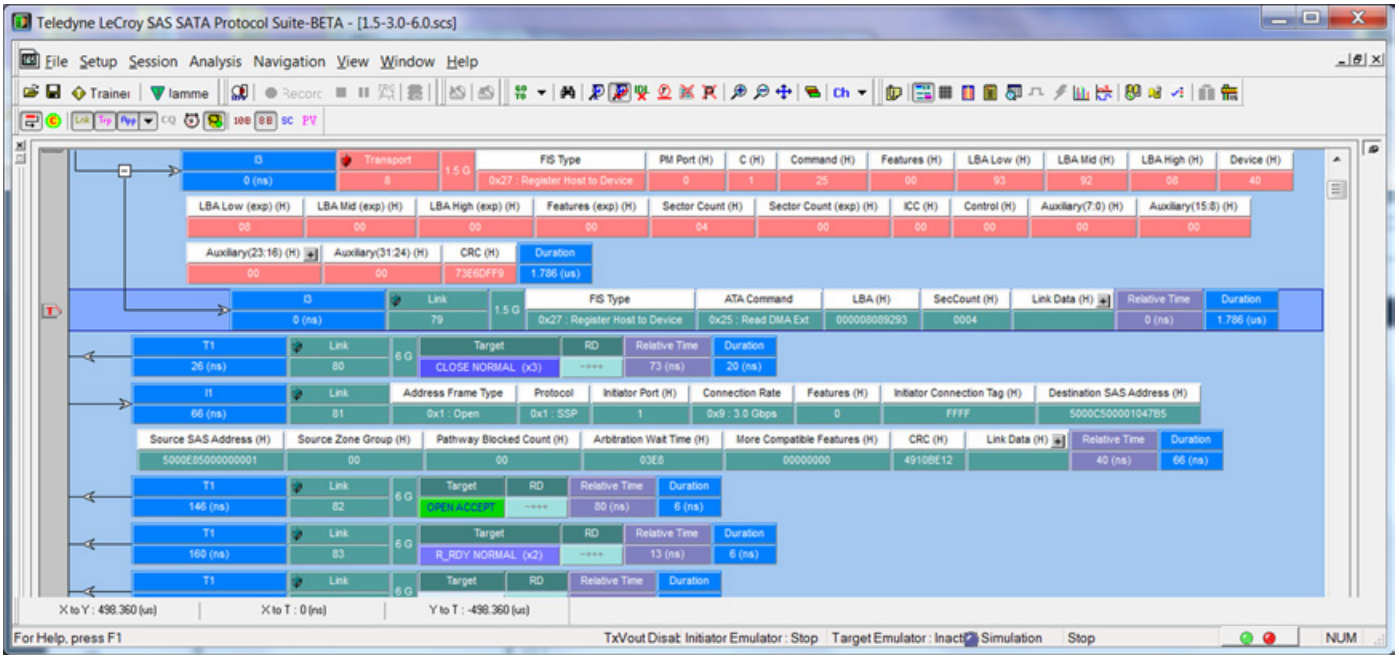


Figure 3.23: Default Workspace (Trace View)

2. Select the other views you'd like to see. In this case we have chosen Packet, Spreadsheet, Column and Bus Utilization. See Figure 3.24.

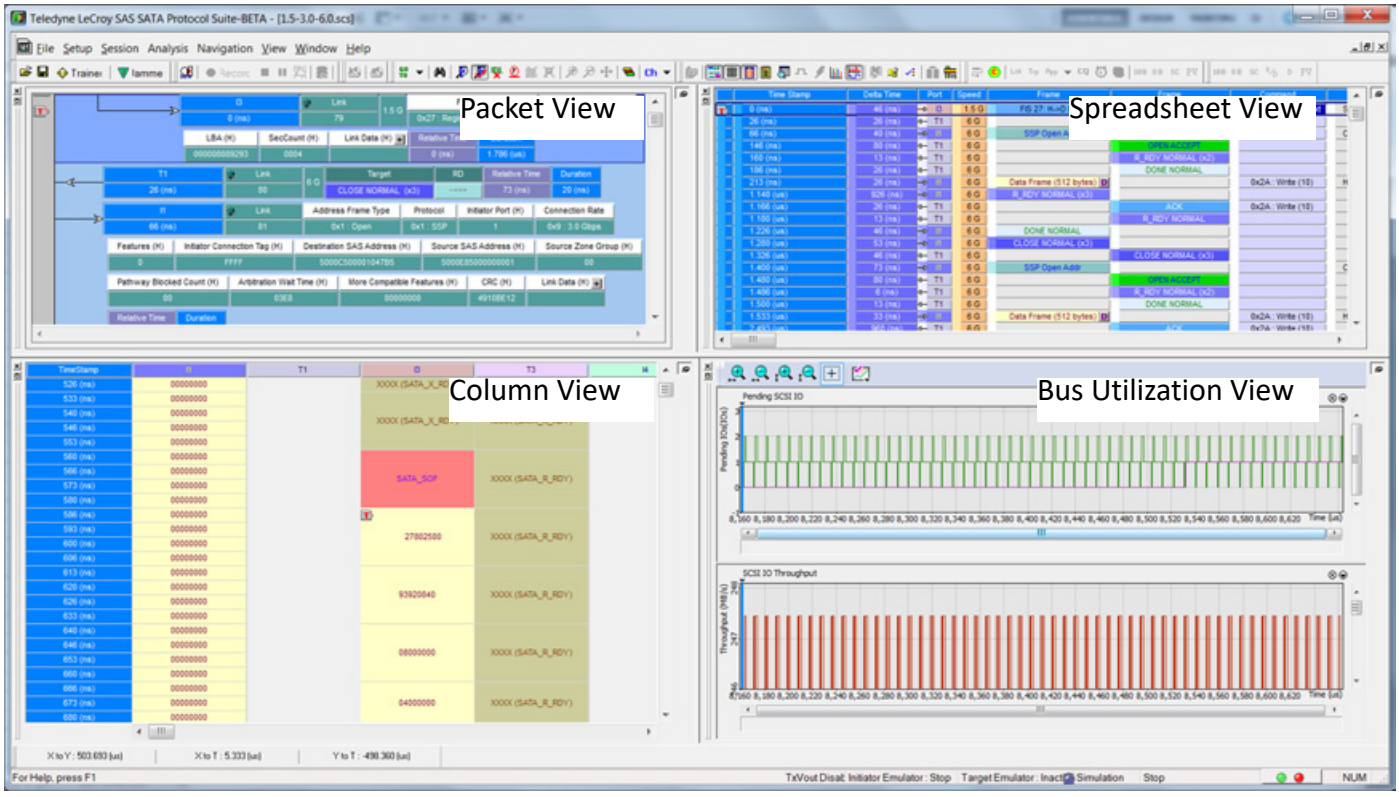


Figure 3.24: Workspace with Four Views (Packet, Spreadsheet, Column, Bus Utilization)

3. Now you can save this set of Views to be called up later or as the Default Workspace per "Changing the Default View" on page 248.

4. If you Save the Workspace with four views as the Default, the next Trace you open will have all the views you want to see. See Figure 3.25.

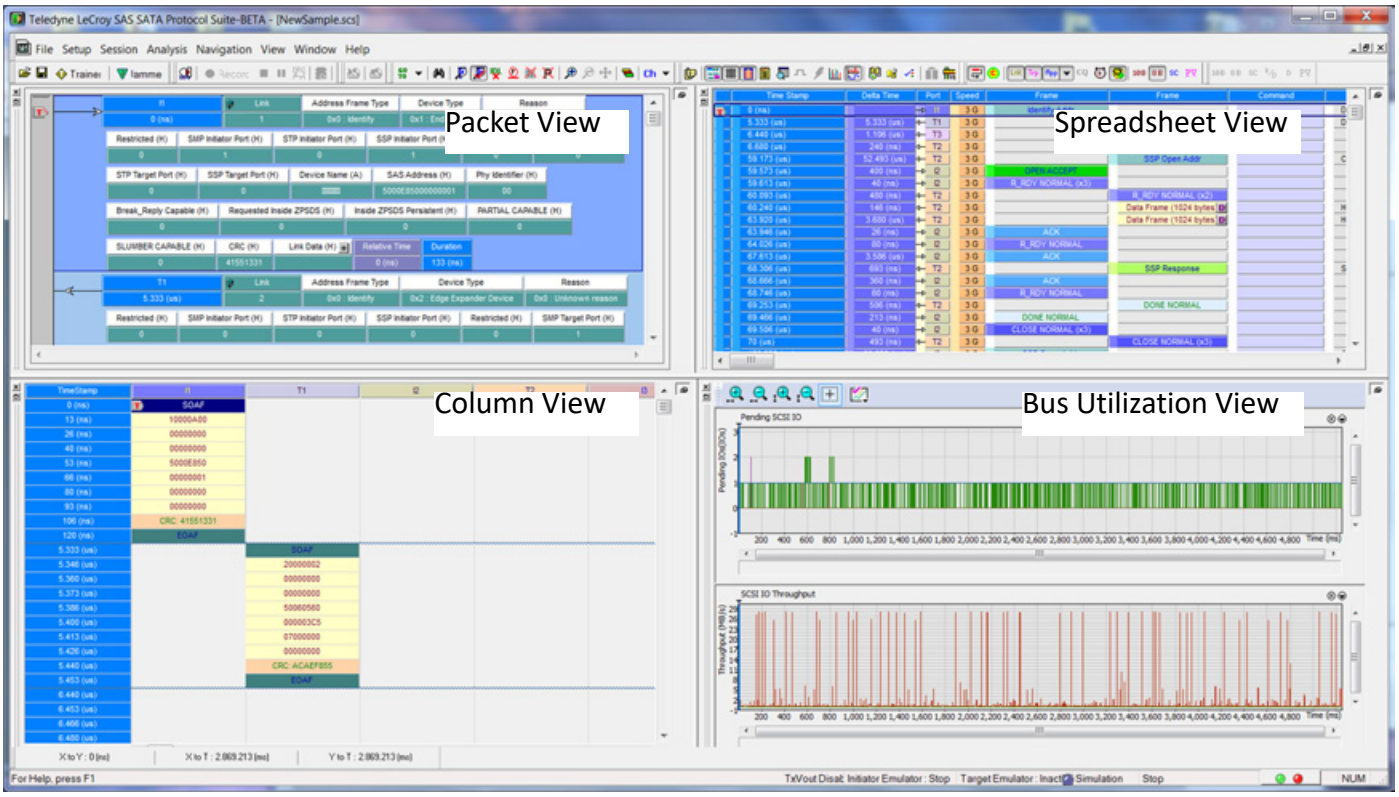


Figure 3.25: Default Workspace Contains Four Views (Trace = NewSample.scs)

5. If you want to know which Views make up the Workspace, select File -> Open -> then select the Workspace file: (workspace_w_4_views_default.wss). See Figure 3.26 on page 250.

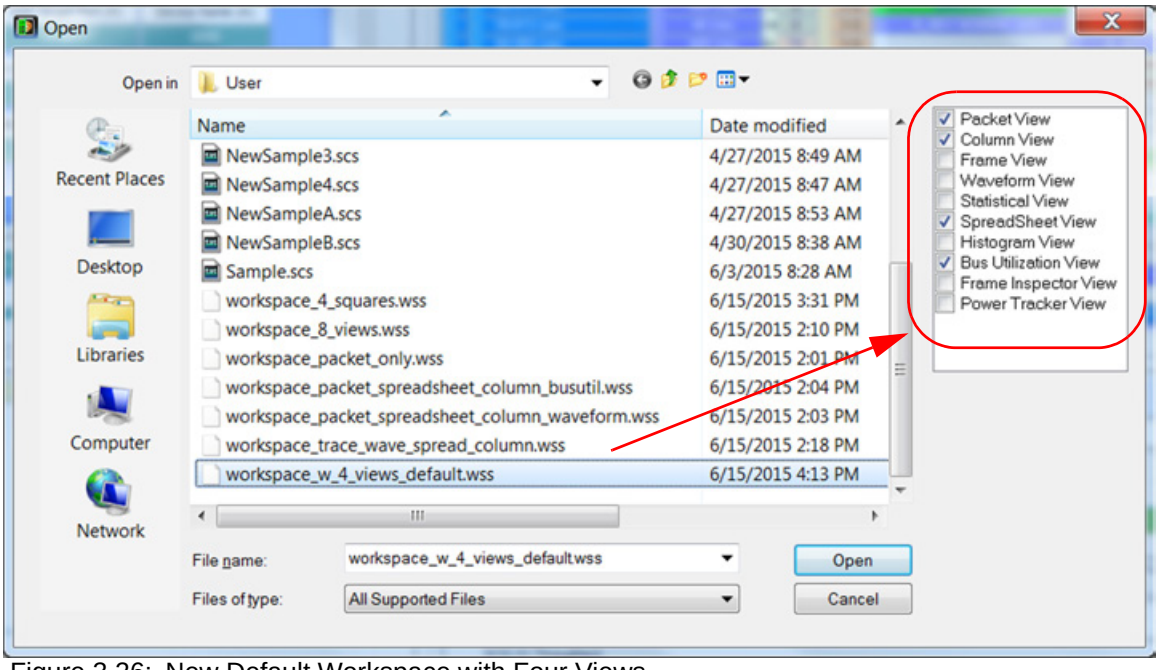
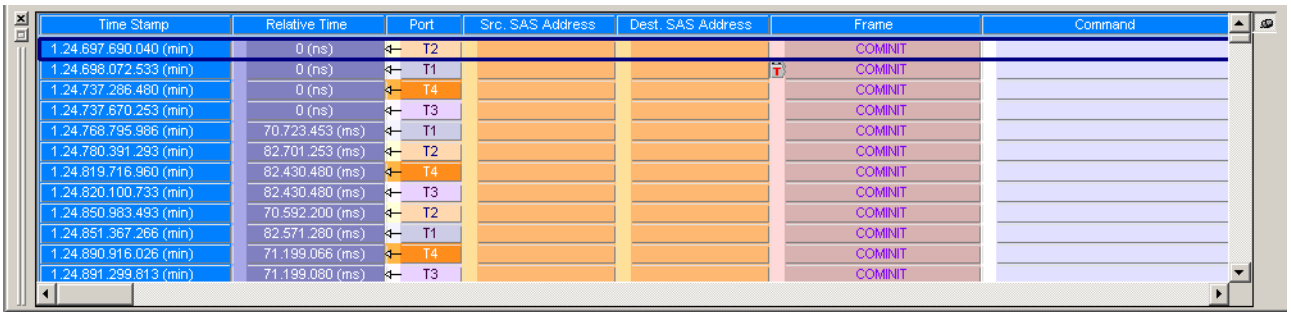


Figure 3.26: New Default Workspace with Four Views

6. To the right side of the window you can see the Packet, Column, Spreadsheet and Bus Utilization Views are selected.

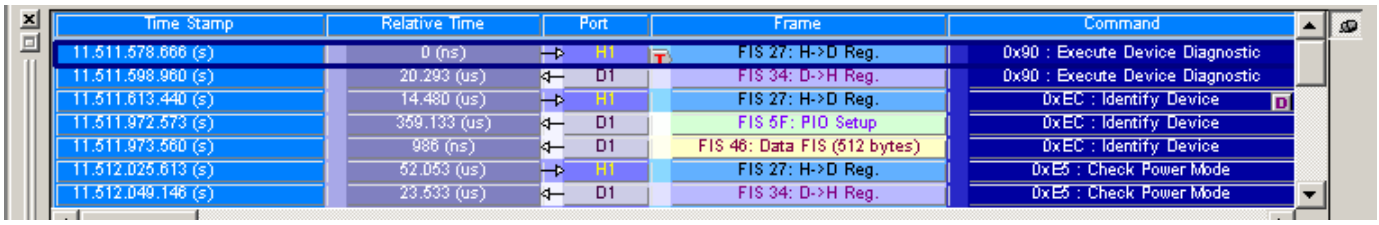
3.3.6 Spreadsheet View

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 **Analysis > Spreadsheet View** or click the  button on the toolbar.



Time Stamp	Relative Time	Port	Src. SAS Address	Dest. SAS Address	Frame	Command
1.24.697.690.040 (min)	0 (ns)	T2			COMINIT	
1.24.698.072.533 (min)	0 (ns)	T1			COMINIT	
1.24.737.286.480 (min)	0 (ns)	T4			COMINIT	
1.24.737.670.253 (min)	0 (ns)	T3			COMINIT	
1.24.768.795.986 (min)	70.723.453 (ms)	T1			COMINIT	
1.24.780.391.293 (min)	82.701.253 (ms)	T2			COMINIT	
1.24.819.716.960 (min)	82.430.480 (ms)	T4			COMINIT	
1.24.820.100.733 (min)	82.430.480 (ms)	T3			COMINIT	
1.24.850.983.493 (min)	70.592.200 (ms)	T2			COMINIT	
1.24.851.367.266 (min)	82.571.280 (ms)	T1			COMINIT	
1.24.890.916.026 (min)	71.199.066 (ms)	T4			COMINIT	
1.24.891.299.813 (min)	71.199.080 (ms)	T3			COMINIT	

Figure 3.27: SAS: Spreadsheet View.



Time Stamp	Relative Time	Port	Frame	Command
11.511.578.666 (s)	0 (ns)	H1	FIS 27: H->D Reg.	0x90 : Execute Device Diagnostic
11.511.598.960 (s)	20.293 (us)	D1	FIS 34: D->H Reg.	0x90 : Execute Device Diagnostic
11.511.613.440 (s)	14.480 (us)	H1	FIS 27: H->D Reg.	0xEC : Identify Device
11.511.972.573 (s)	359.133 (us)	D1	FIS 5F: PIO Setup	0xEC : Identify Device
11.511.973.560 (s)	986 (ns)	D1	FIS 46: Data FIS (512 bytes)	0xEC : Identify Device
11.512.025.613 (s)	52.053 (us)	H1	FIS 27: H->D Reg.	0xE5 : Check Power Mode
11.512.049.146 (s)	23.533 (us)	D1	FIS 34: D->H Reg.	0xE5 : Check Power Mode

Figure 3.28: SATA: Spreadsheet View.

Right-click a column heading to go to **Preferences**, make all columns the same width, choose **Time Stamp Format**, or **Goto** a position.

Right-click a column heading to **Hide** or **Show** the column. To show the same columns permanently, select **Setup > Preferences > Trace Viewer > As Previously Saved**.

Right-click the column to **Add Bookmark** or **Edit Bookmark**, **Set Time Stamp Origin**, go to **Preferences**, choose **Time Stamp Format**, **Change Background (or Foreground) Color**, or **Goto** a position.

Note: You can double-click a data frame to display the data payload view.
The Status column can show ABRT and UNC status.

Spreadsheet View: Column Add/Edit/Delete

Right click on the Column Heading to bring up the Options Dialog, see Figure 3.29.

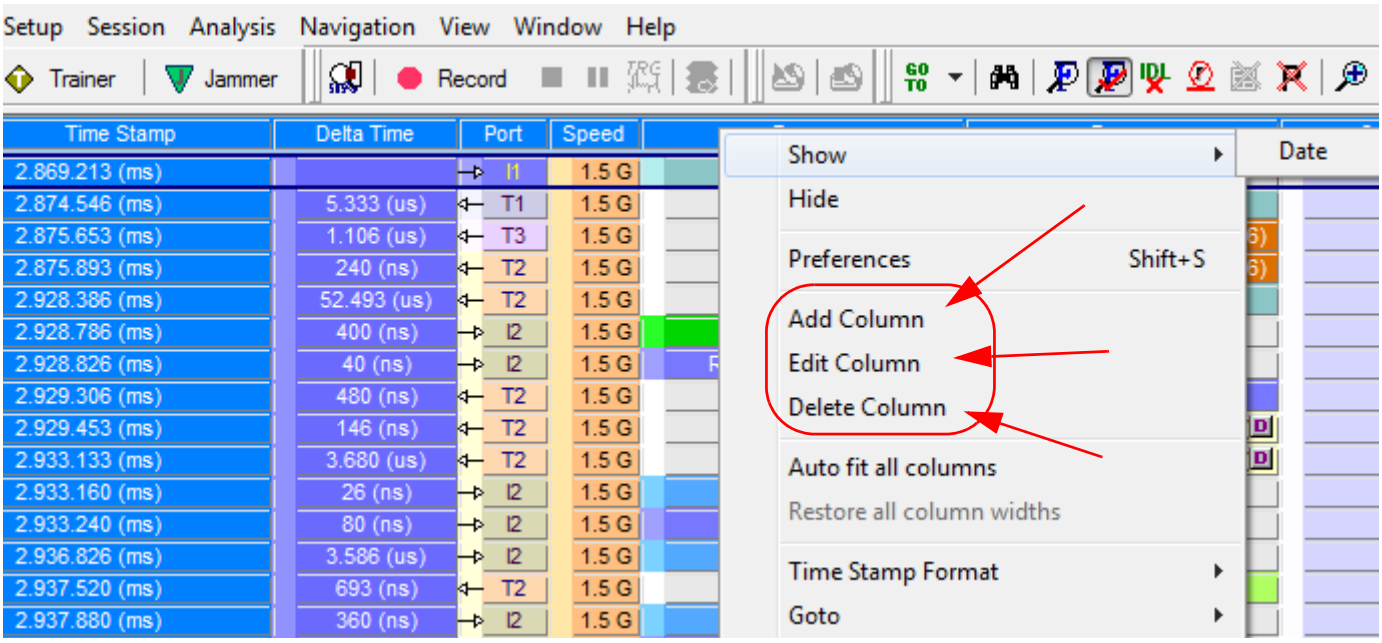


Figure 3.29: Spreadsheet View: Column Heading Options

You can Add a new column, Edit a new or existing Column or Delete a new or existing Column.

If you select Add Column the following dialog will pop up, see Figure 3.30 on page 253.

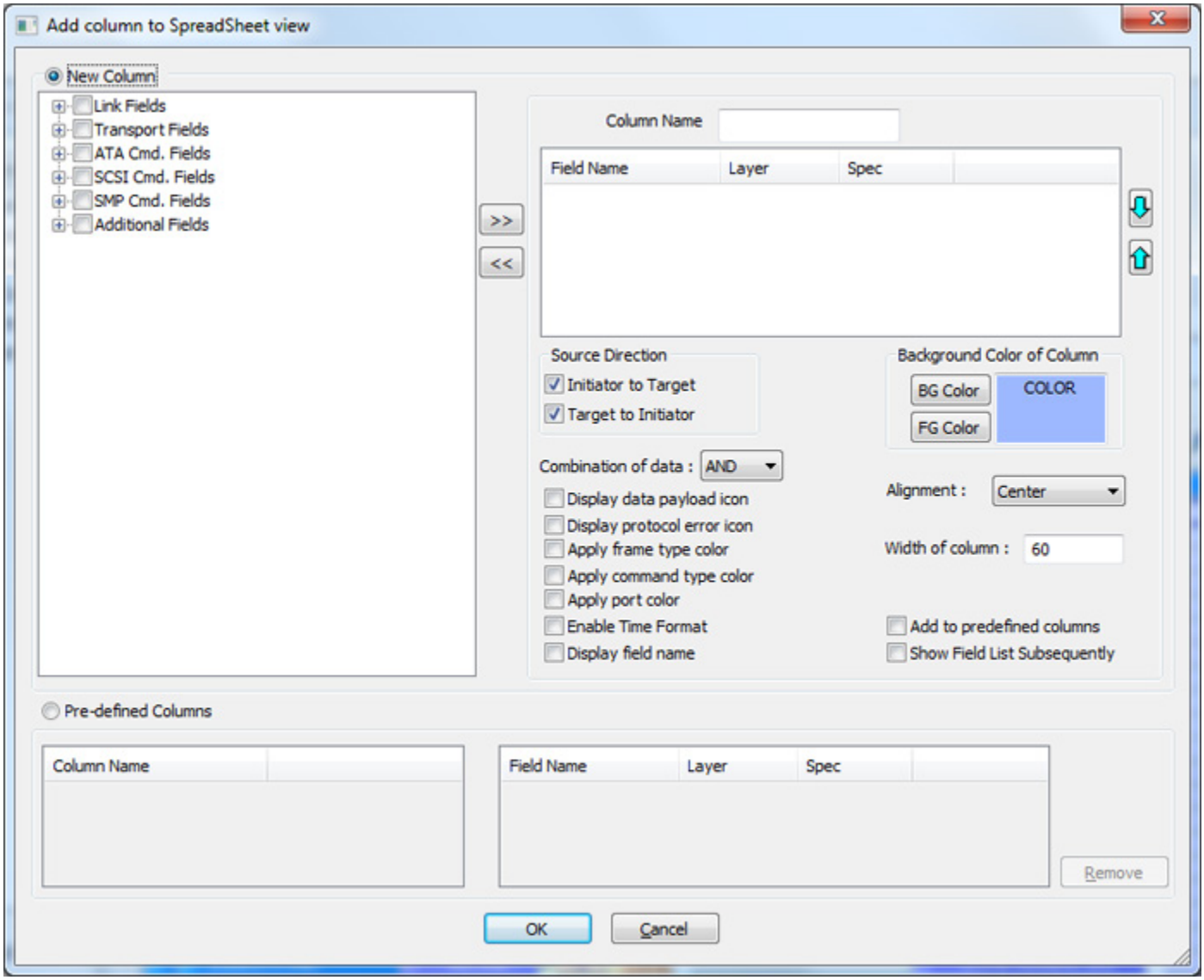


Figure 3.30: Column Header Options Dialog

From this dialog you can customize the Spreadsheet View Columns by adding:

- Link Fields
- Transport Fields
- ATA Cmd. Fields
- SCSI Cmd. Fields
- SMP Cmd. Fields
- Additional Fields

Each option will bring up a dialog with characteristics for that field which would become a new column. Select an item from the drop down, in this case Link -> Frame Information Structure (FIS) was chosen. See Figure 3.31 on page 254.

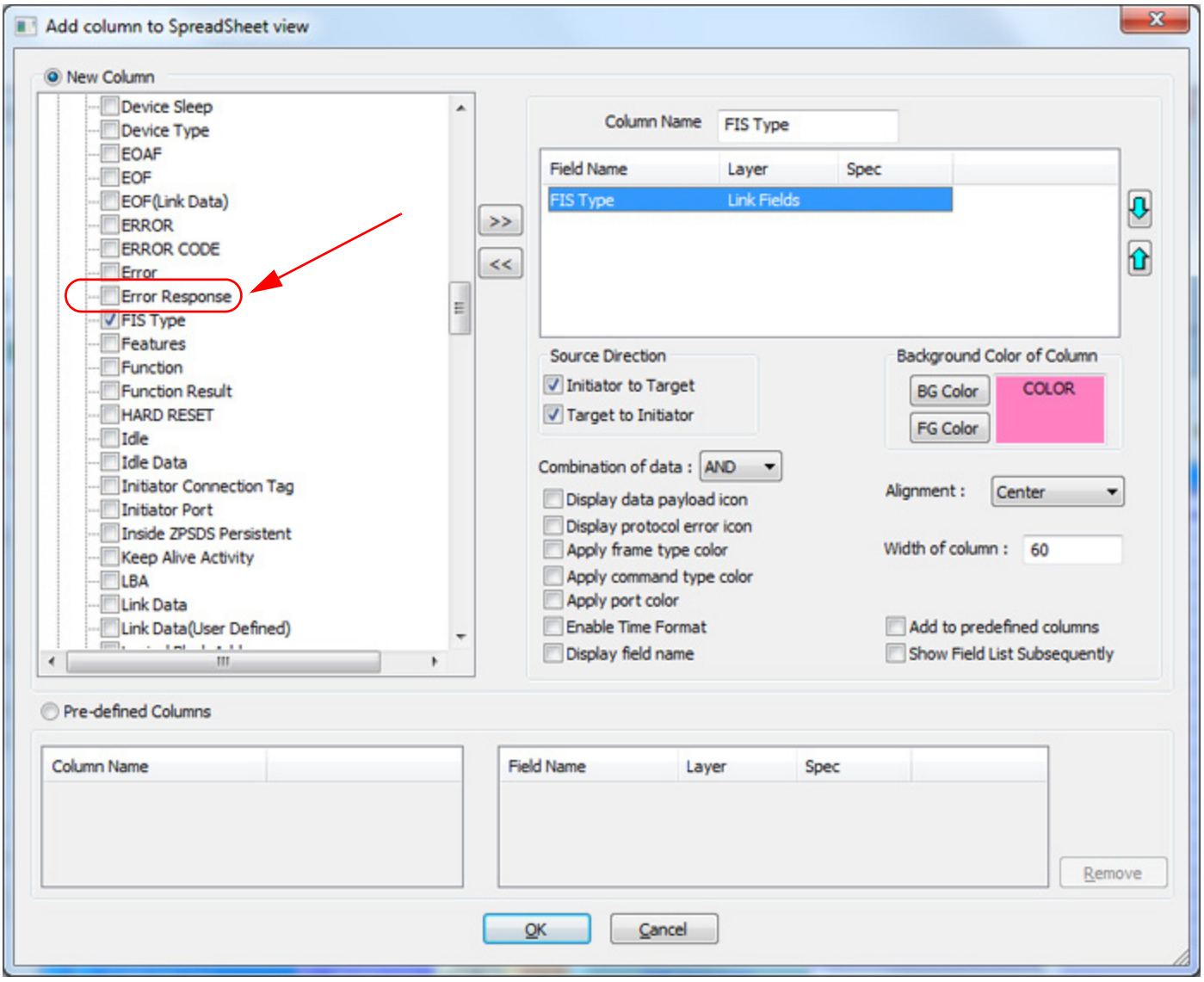


Figure 3.31: Frame Information Structure (FIS) Selected

The new Spreadsheet View with the new Column is shown in Figure 3.32 on page 255.

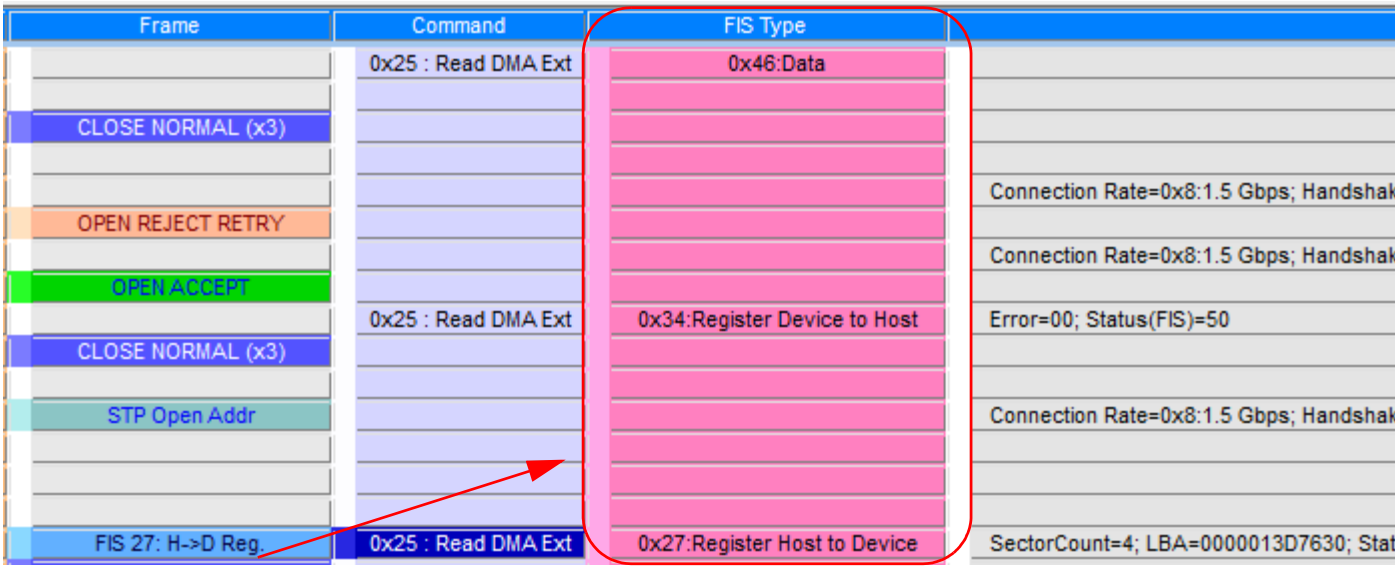


Figure 3.32: Spreadsheet View with New Column Added (FIS)

You can change any of the options shown in the "Add Column to Spreadsheet View" dialog (see Figure 3.31 on page 254) – Edit the Column or Delete the Column.

New Columns Added at Transport Fields Level

For new columns to be added to the Spreadsheet View the data for the column must come from the appropriate Field. In the case shown below, the LBA Low, LBA Mid and LBA High data will be displayed in a new column but only if the Transport Field is selected. See

Figure 3.33.

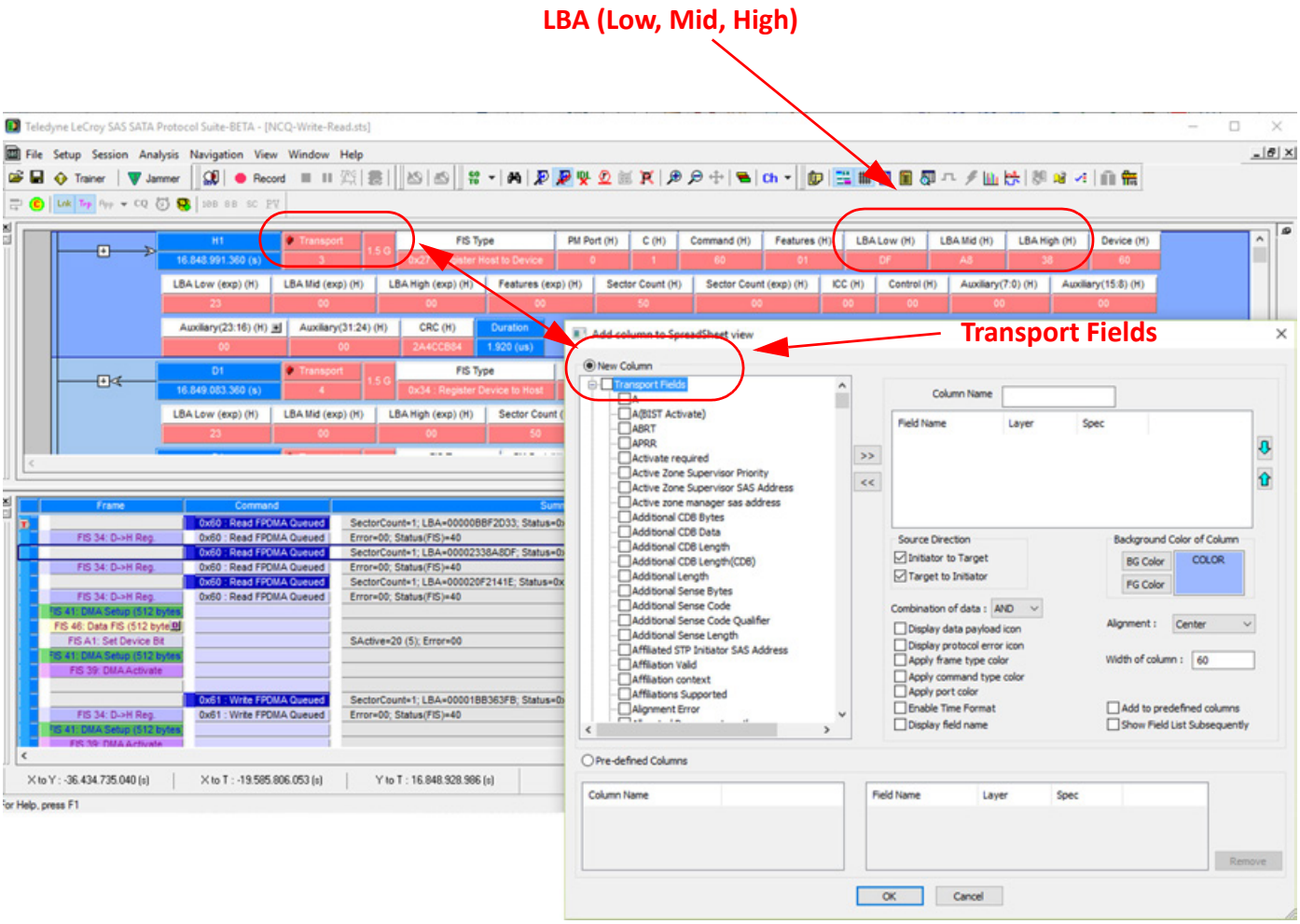


Figure 3.33: Spreadsheet View: New Columns Selected from Transport Field Packet

Scroll down through the Transport Field type to LBA and add the data you want to see displayed in a new column (see Figure 3.34 on page 257).

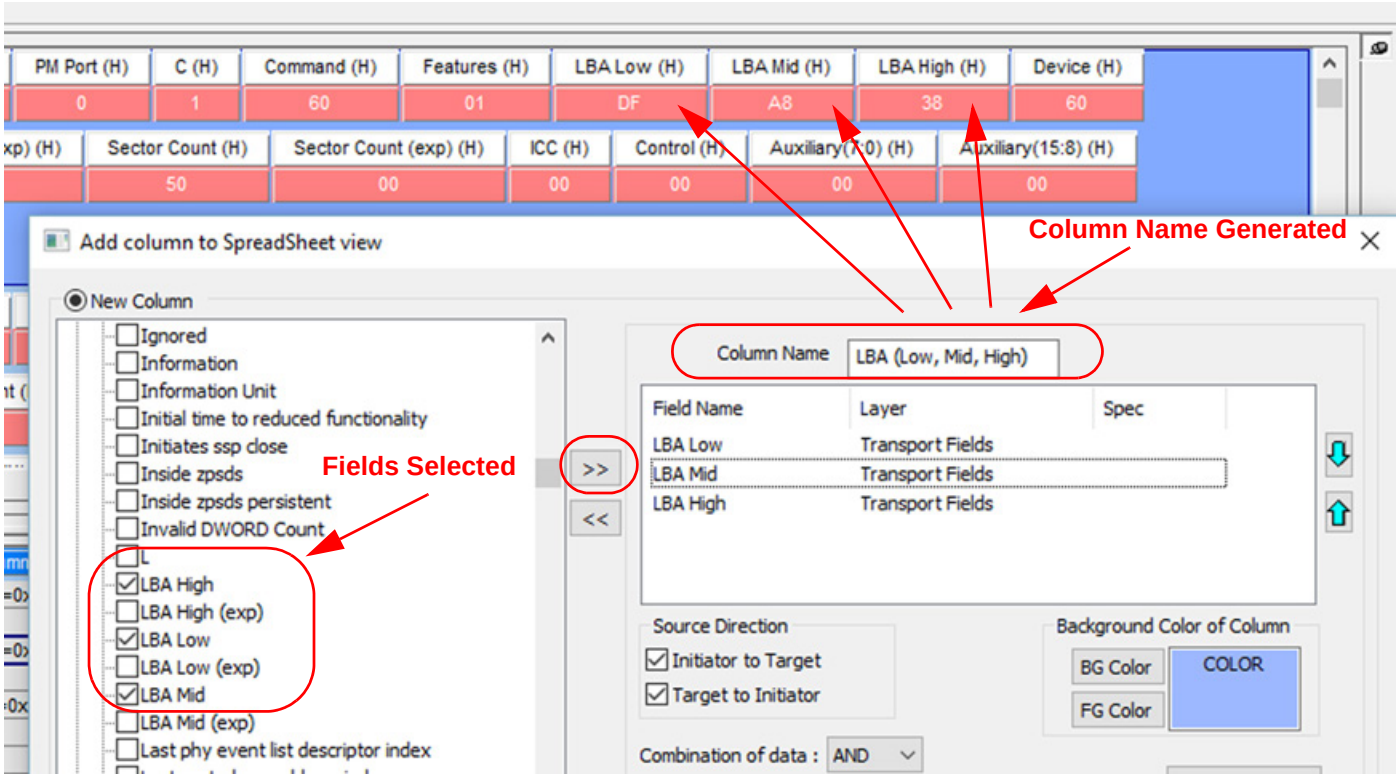


Figure 3.34: Select Fields to Add to New Column in Spreadsheet View

The new column with the LBA (Low, Mid and High) data is shown in the Spreadsheet View in Figure 3.35 on page 258.

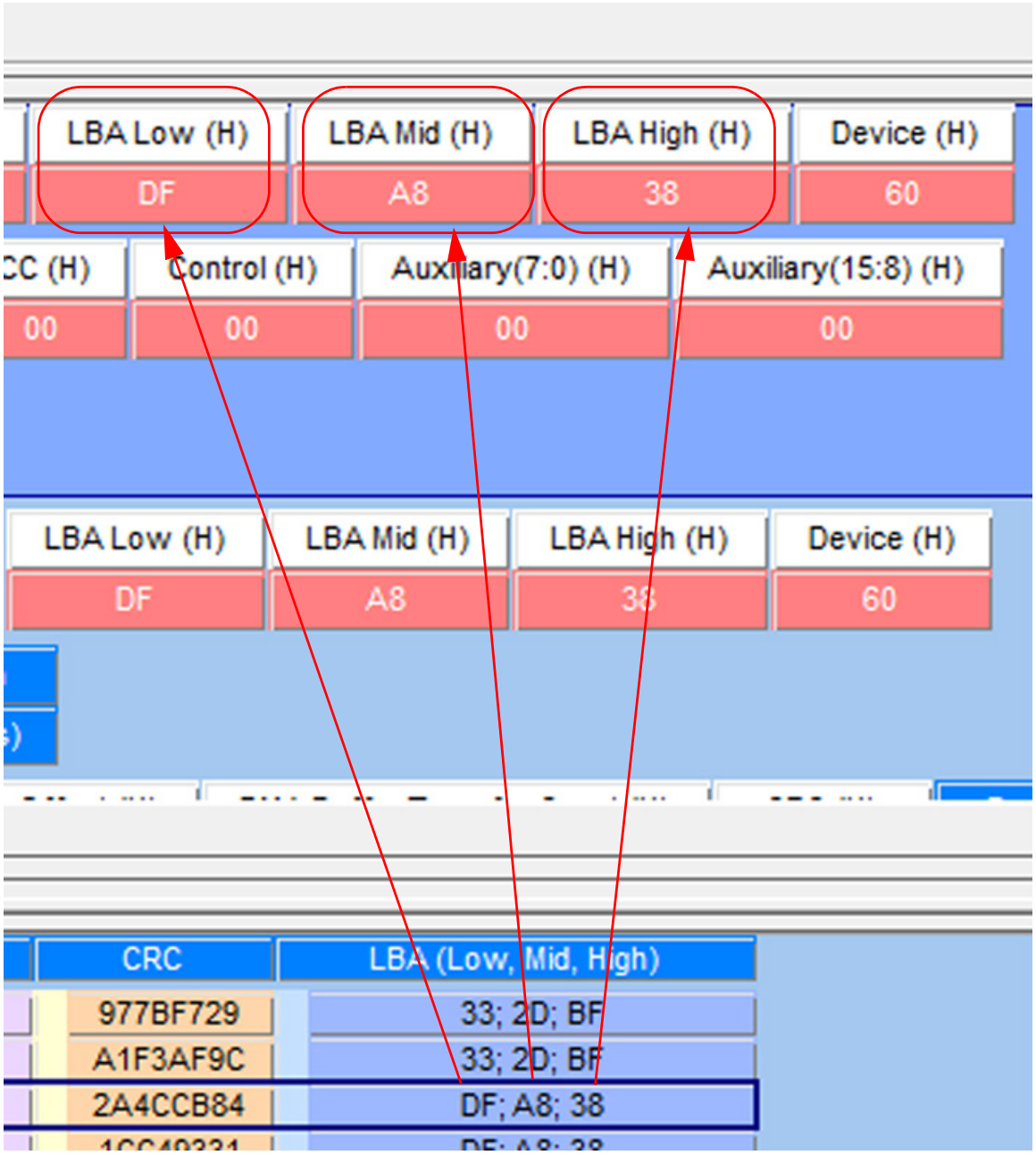


Figure 3.35: Spreadsheet View with New Column Added

Primitives Displayed in Both Spreadsheet and Packet Views

The following primitives are shown if they are inside a frame:

- RRDY_NORMAL
- ACK
- NAK_CRC_ERROR
- CREDIT_BLOCKED
- BREAK
- DONE_ACK_NAK_TIMEOUT
- DONE_CREDIT_TIMEOUT
- DONE_NORMAL
- AIP_NORMAL
- SAS_ERROR

See Figure 3.36.

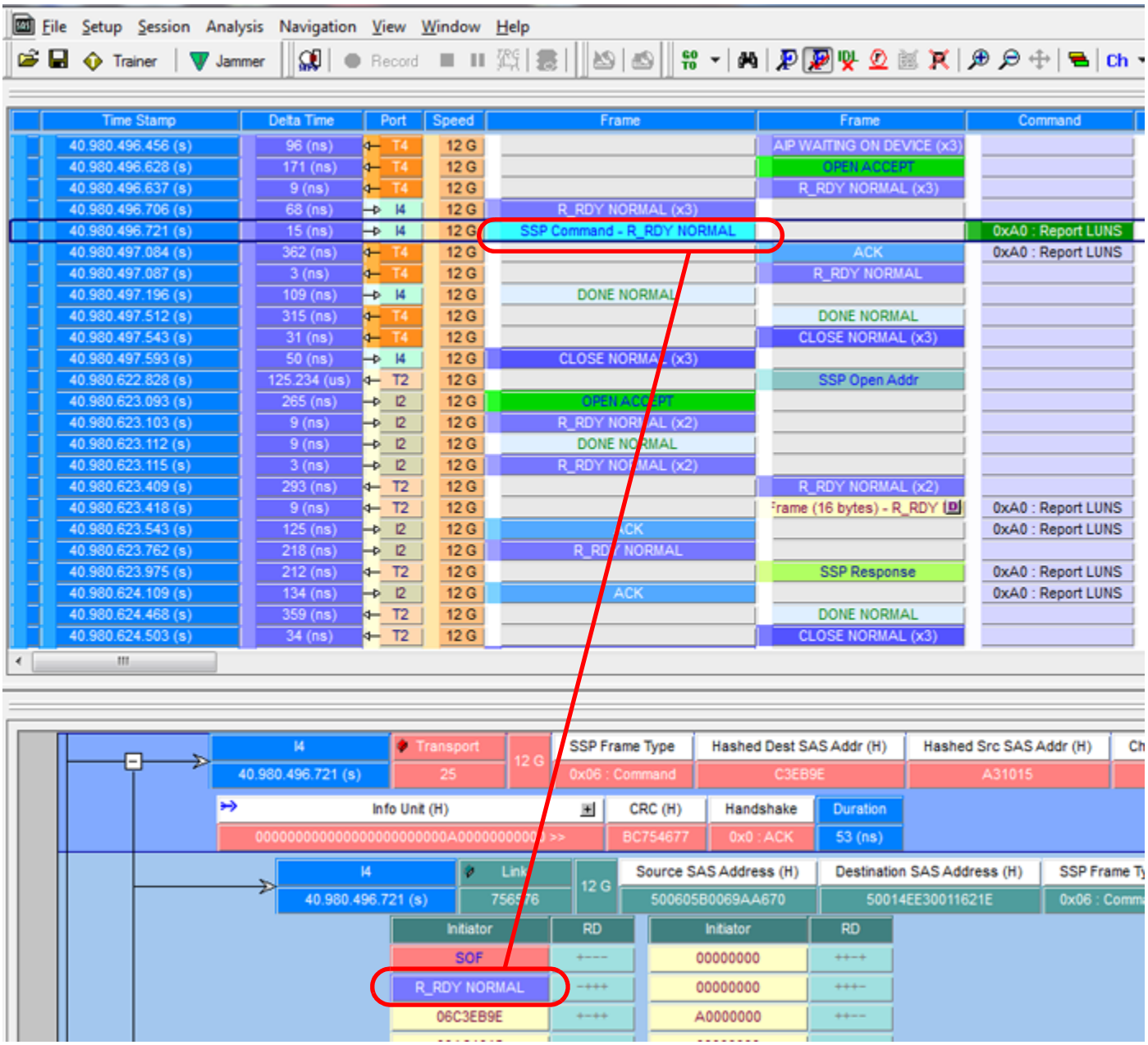


Figure 3.36: Primitives Shown in Spreadsheet and Packet Views

Export As Text/Excel

Select **File > Export > Export to Text/Excel** to open the Save As Text dialog.

For Save As Type, select **Text Files** or **Excel Files**.

Select options from With comma delimiter, Export Duration and Save in a Single CSV File.

For Save As Range, select **All Packets** or enter a cursor range.

Enter a **File Name** and click **Save**.

Note: When Spreadsheet View is exported to text, the XFER-Length field is always in hexadecimal format.

Note: Export to Text/Excel is available from the Spreadsheet View, Packet View or Text View as of S/W version 5.60 or later. Export to Text/Excel is not available from Column View as of S/W version 5.60 or later.

Change Format of Logical Block Address (LBA)

You can set different LBA formats in Packet View and Spreadsheet View. To change the LBA format, right-click the LBA column to display the popup menu, select **Format,** and change the format to **Decimal, Hexadecimal,** or **Binary**.

In Spreadsheet View, you can also Right-click on a column heading to go to **Preferences,** click the **Trace Viewer** and then the **Configuration** icon to display the **Trace Viewer Configuration** dialog. Expand the **Frame List/Spread Sheet View**, select **LBA/Sector#**, and change the **Format**. If you cannot change the format there, select the **Link Fields, Transport Fields, ATA Cmd. Fields**, or **SCSI Cmd. Fields** node, select the field (such as "LBA High"), and then change the **Format**.

Spreadsheet View Context Menu

In Spreadsheet View a Context Menu is available by performing a right click on an Frame packet. See Figure 3.37.

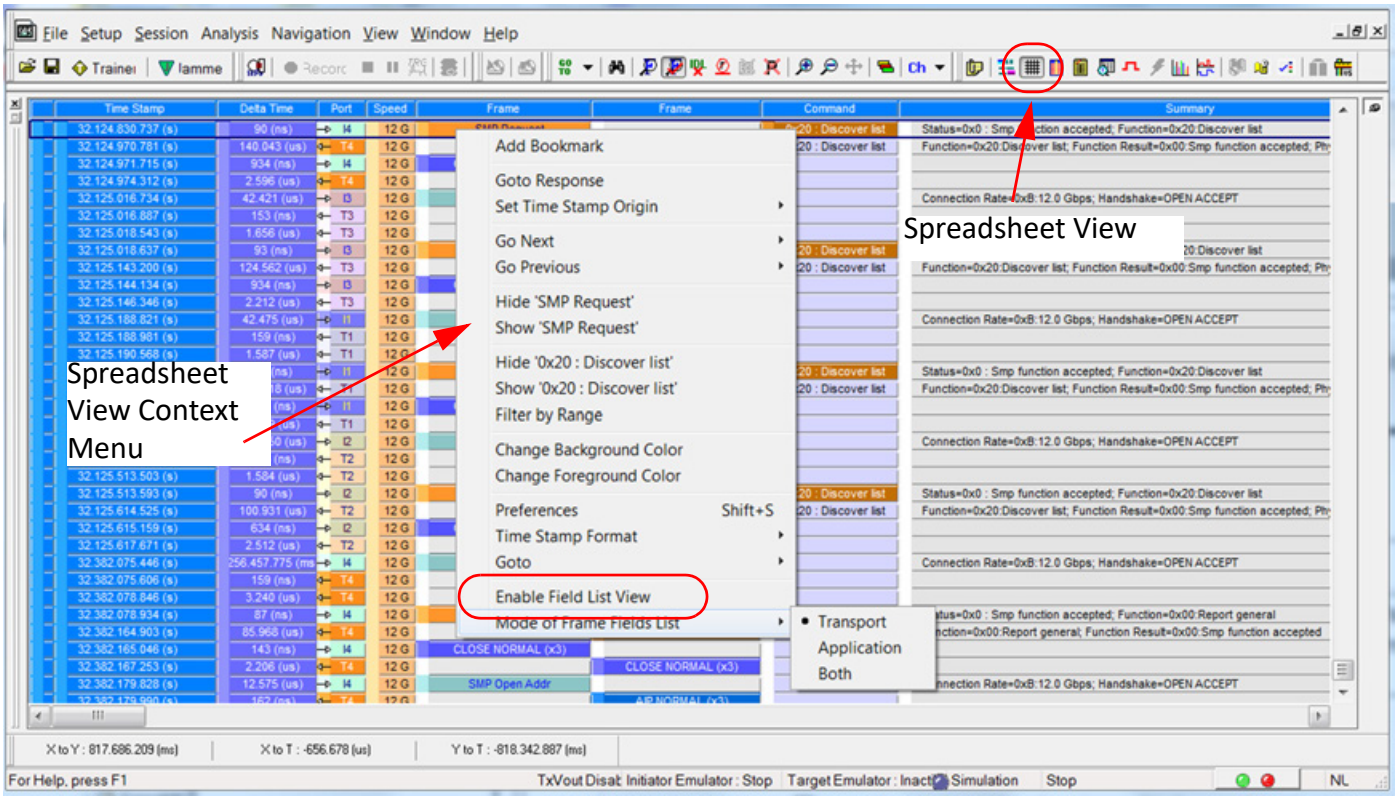


Figure 3.37: Spreadsheet View Context Menu

From this window you can select the Enable Field List View and the Field List View will pop up, see Figure 3.38 on page 262.

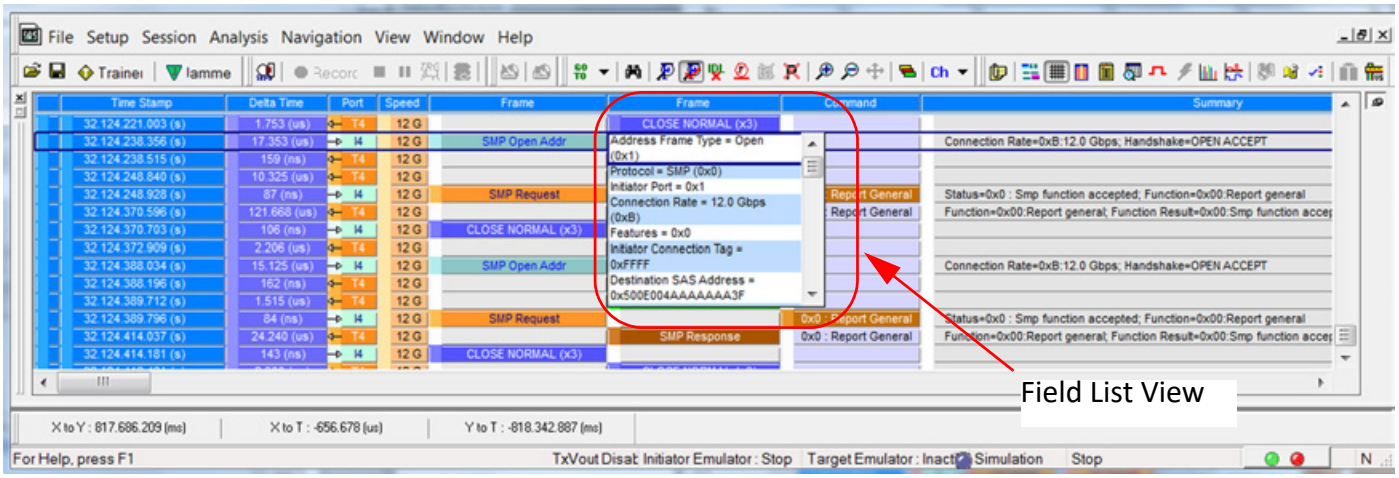


Figure 3.38: Field List View

The Field List View contains information about the selected Packet.

3.3.7 Column View

Column View displays the captured data grouped in columns by port. Each row shows captured DWORDs on different ports related to the timestamp. It also shows different speed (1.5G, 3G, 6G) DWORDs. Different DWORD cell height shows the duration of the DWORD. To display Column View of the current capture (see Figure 3.39 on page 263), click **Analysis > Column View** or click the  button on the View Type toolbar.

You can click the + sign to expand the packet and - sign to collapse the packet. Hovering over the signs displays a tooltip showing the contents of the packet (see the arrows in Figure 3.39 on page 263). Right-click a packet to change the background and foreground color.

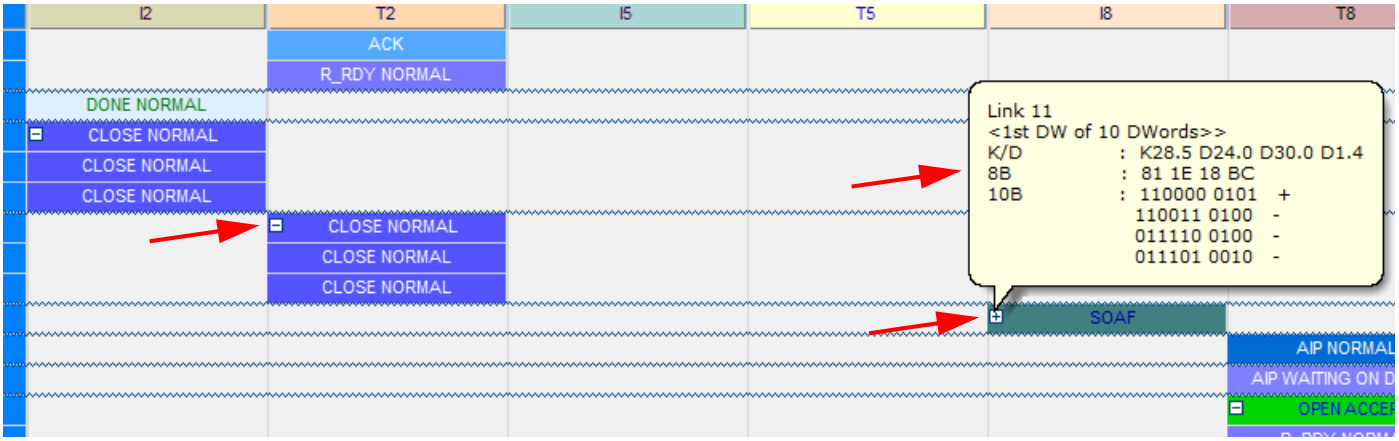


Figure 3.39: Column View

Right-click in the Column View to display commands:

Right-click in the Column View to display commands:

- Add Bookmark
- Expand All
- Preferences
- Time Stamp Format (LeCroy Format, Milli Second, Micro Second)
- Go to (Trigger Position, X Position, Y Position, Packet Number, Time Stamp, Bookmark, Begin, End)
- Goto within Packet (SOF, EOF, Next HOLD, Previous HOLD, Next HOLDA, Previous HOLDA, Next Align, Previous Align, Next R_IP, Previous R_IP)
- Set X-Pointer
- Set Y-Pointer
- Change Background Color

Note: The Column View displays the CRC value. To see different formats (10b, 8b, scrambled, and so on), select a format by clicking its Tool menu button.

Resize Columns

You can resize the columns in Column View by clicking in the column boundary and dragging the boundary to a new position.

Rearrange Columns

You can rearrange columns by left-clicking in the column title and then dragging the drag-and-drop icon  to a new position.

Note: Export to Text/Excel is available from the Spreadsheet View, Packet View or Text View as of S/W version 5.60 or later. Export to Text/Excel is not available from Column View as of S/W version 5.60 or later.

3.3.8 Text View

Text View (see Figure 3.40 on page 264) displays the captured data interpreted as transaction frames, grouped in columns by port. To display Text View, select **Analysis > Text View** or click the  button on the View Type toolbar.

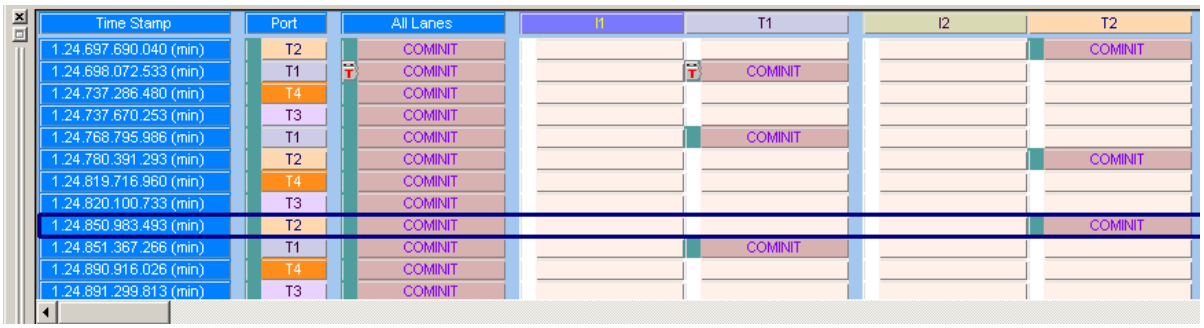


Figure 3.40: SAS: Text View

.

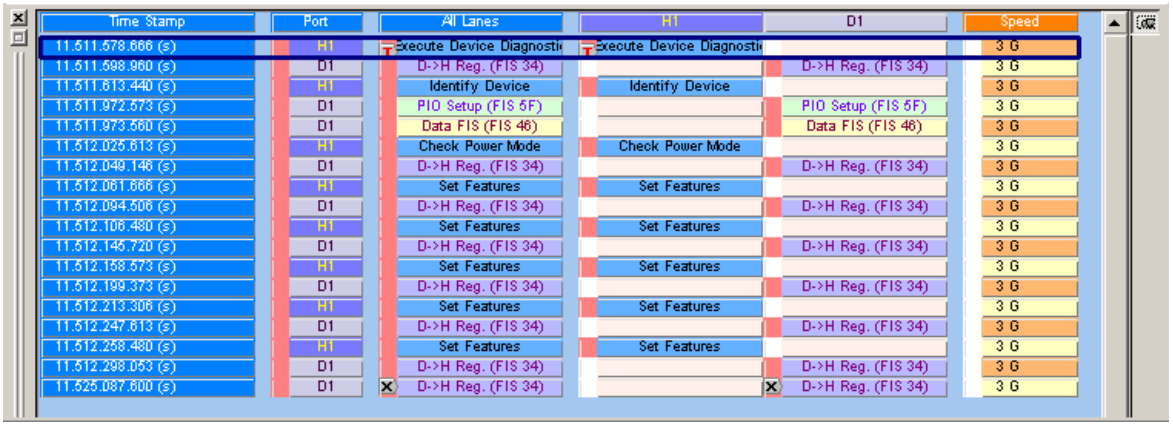


Figure 3.41: SATA: Text View

Note: The LBA and Tag Number value are shown in the All Lanes column.

Identify Device Frame

When in Text View, if a trace has an Identify Device frame (as shown in Figure 3.42 on page 265).

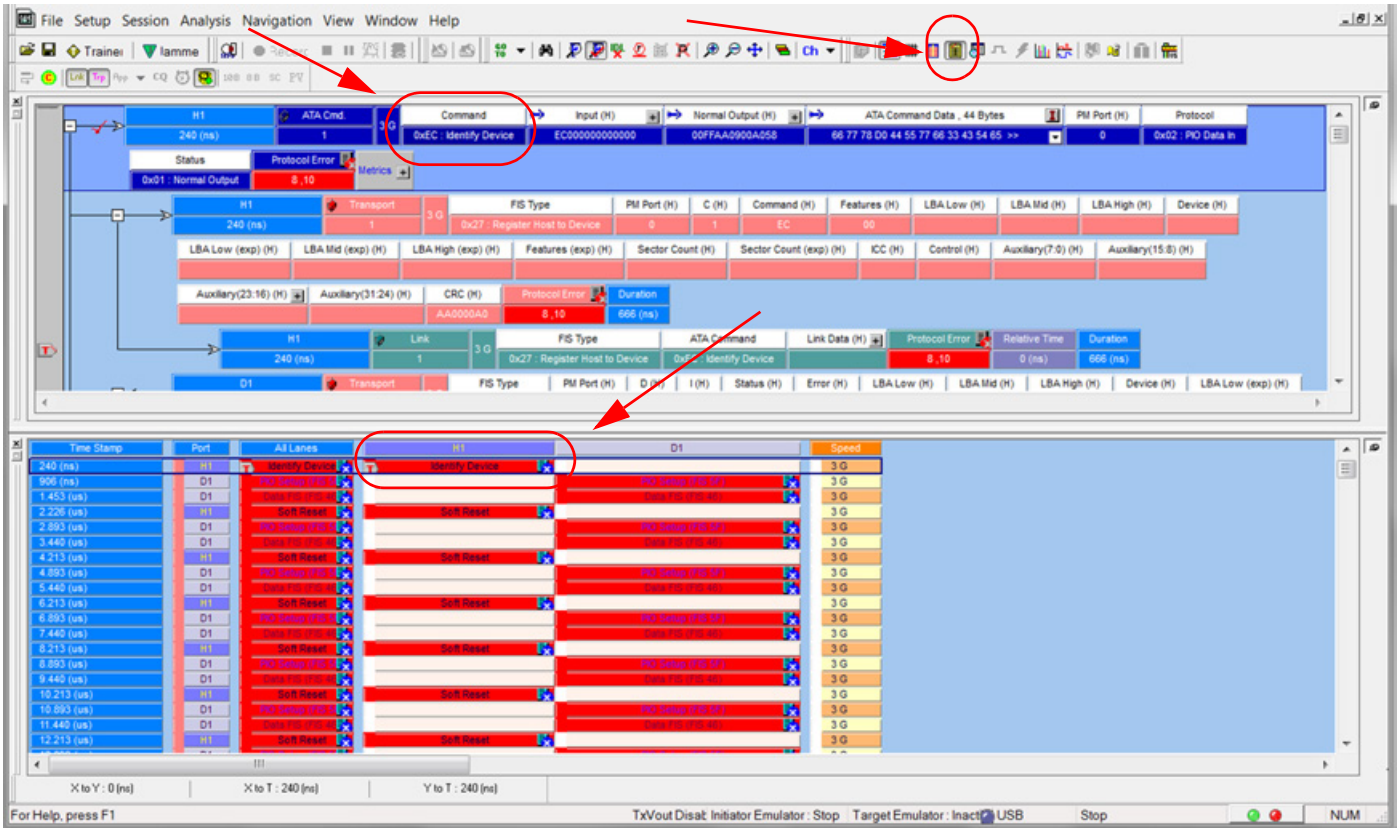


Figure 3.42: Identify Device Frame

Double clicking in the Identify Device Frame (while in Text Mode) will pop up the Data Payload View. See Figure 3.43 on page 266.

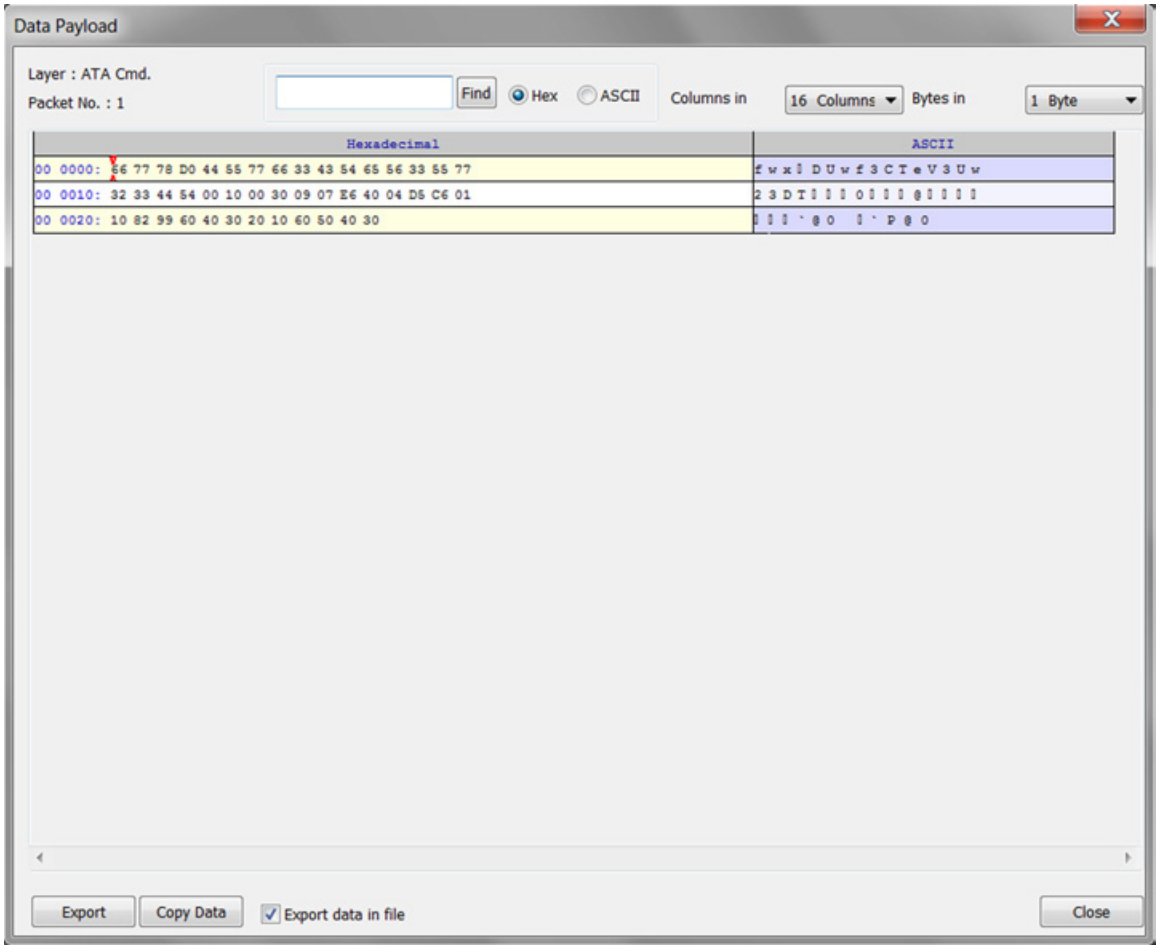


Figure 3.43: Data Payload View from Identify Device Frame in Text Mode

The data payload is valid because the Identify Device Frame includes a Data Frame Information Structure (FIS) pattern (SATA only). See Figure 3.44.

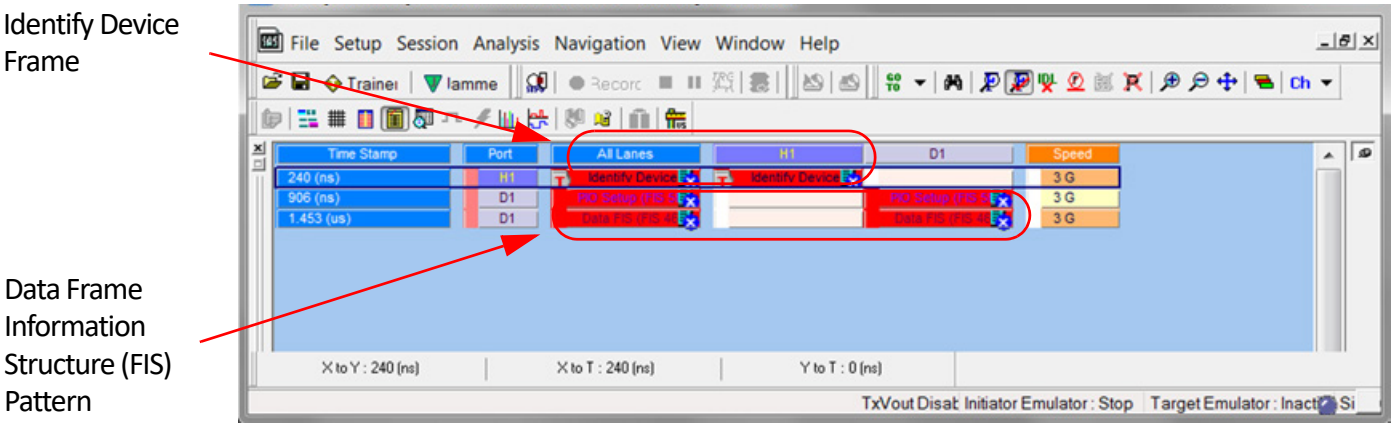


Figure 3.44: Data FIS Pattern in Identify Device Frame

Note: Export to Text/Excel is available from the Spreadsheet View, Packet View or Text View as of S/W version 5.60 or later. Export to Text/Excel is not available from Column View as of S/W version 5.60 or later.

Text View Context Menu

In Text View mode the Context Menu is available by performing a right click on a packet. See Figure 3.45.

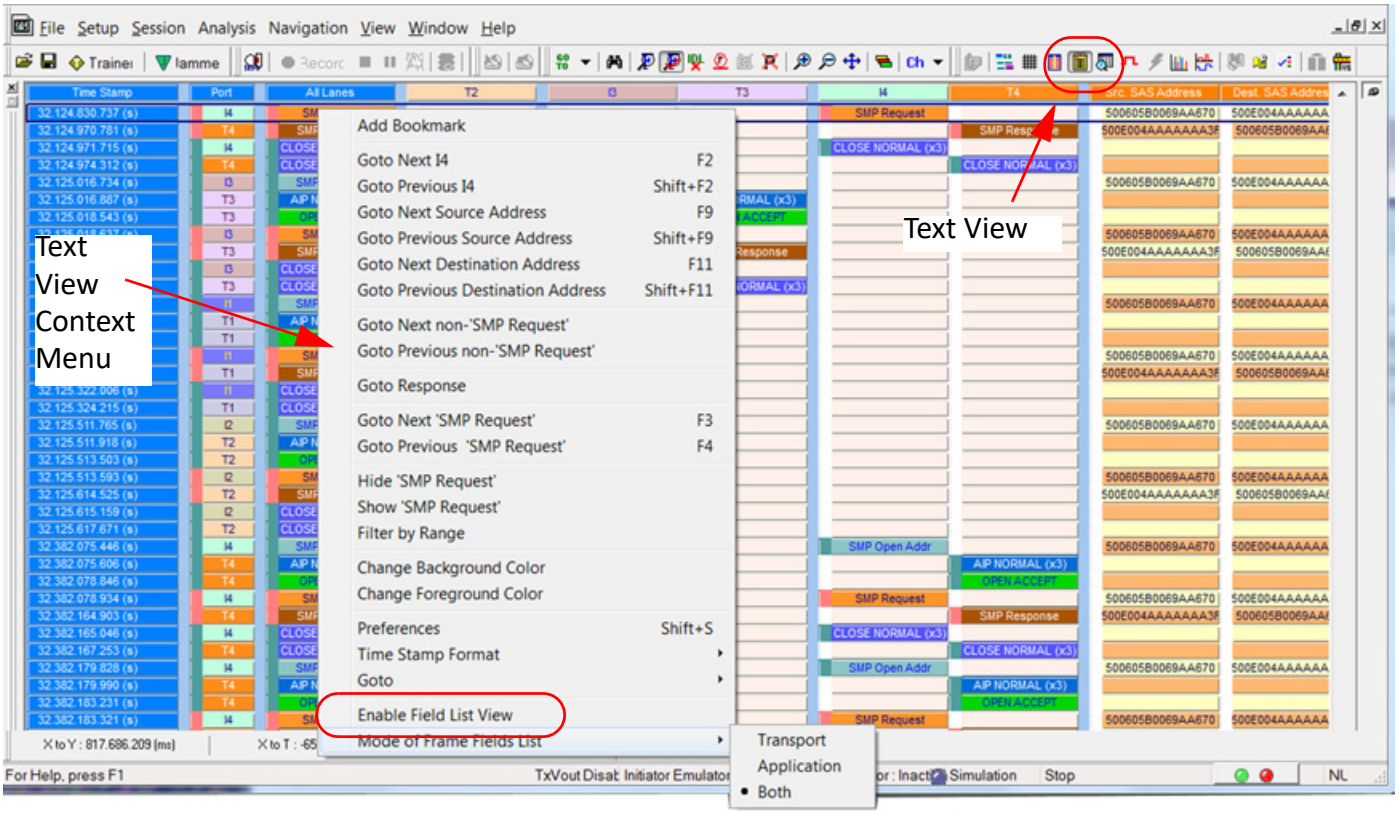


Figure 3.45: Text View Context Menu

From this window you can select the Enable Field List View and the Field List View will popup, see Figure 3.46.

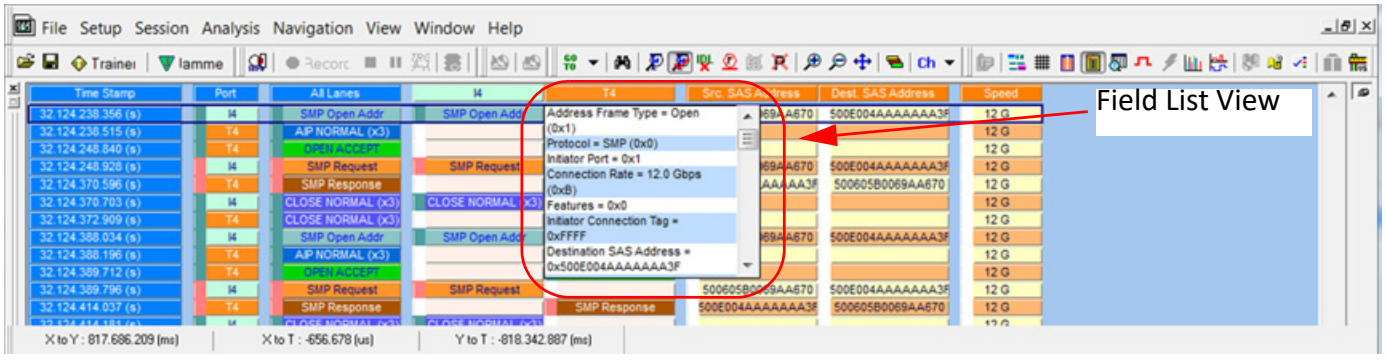


Figure 3.46: Field List View

The Field List View contains information about the selected Packet.

3.3.9 Frame Inspector View

Frame Inspector View has lots of information that is available in Packet View, but not Spreadsheet View, so it is most useful in conjunction with the Spreadsheet View.
This view has the following three tabs:

Spec View:

This view shows the Frame as it would appear in the spec, with the field names and values spelled out clearly. Fields that are too short to clearly contain the description can be viewed as tooltips by hovering the mouse over them. Some fields might have a a lowercase 'e' button at the top right corner. Pressing this button displays an 'expanded' view of the sub-fields in this field.

Field View:

This view shows, when applicable, a hierarchical display of the selected Packet, with the relevant fields in each level.

To open a Frame Inspector View of the current capture, select **View > Frame Inspector View** or click the  button on the View Type toolbar.

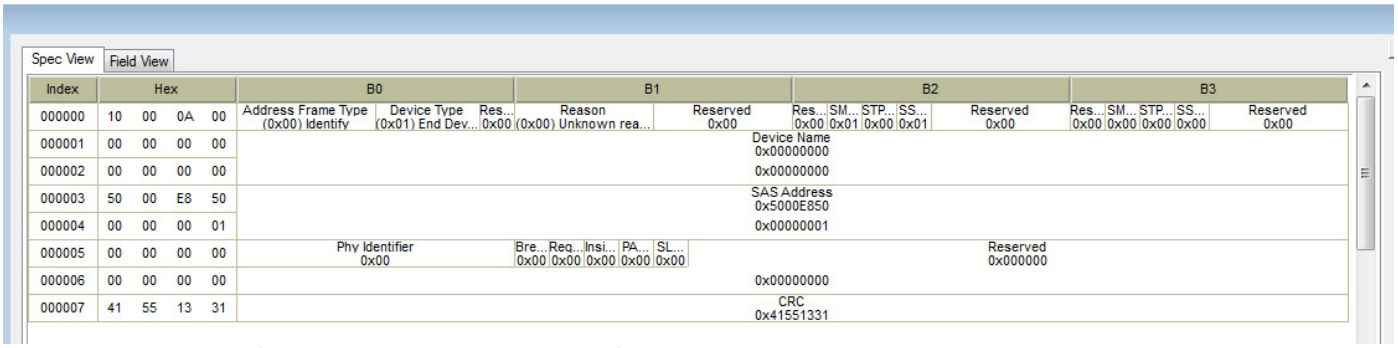


Figure 3.47: Frame Inspector View

Field View Display Manipulation

If you select Field View, each Field and it's Value for the selected Packet will be displayed (see Figure 3.48 on page 269).

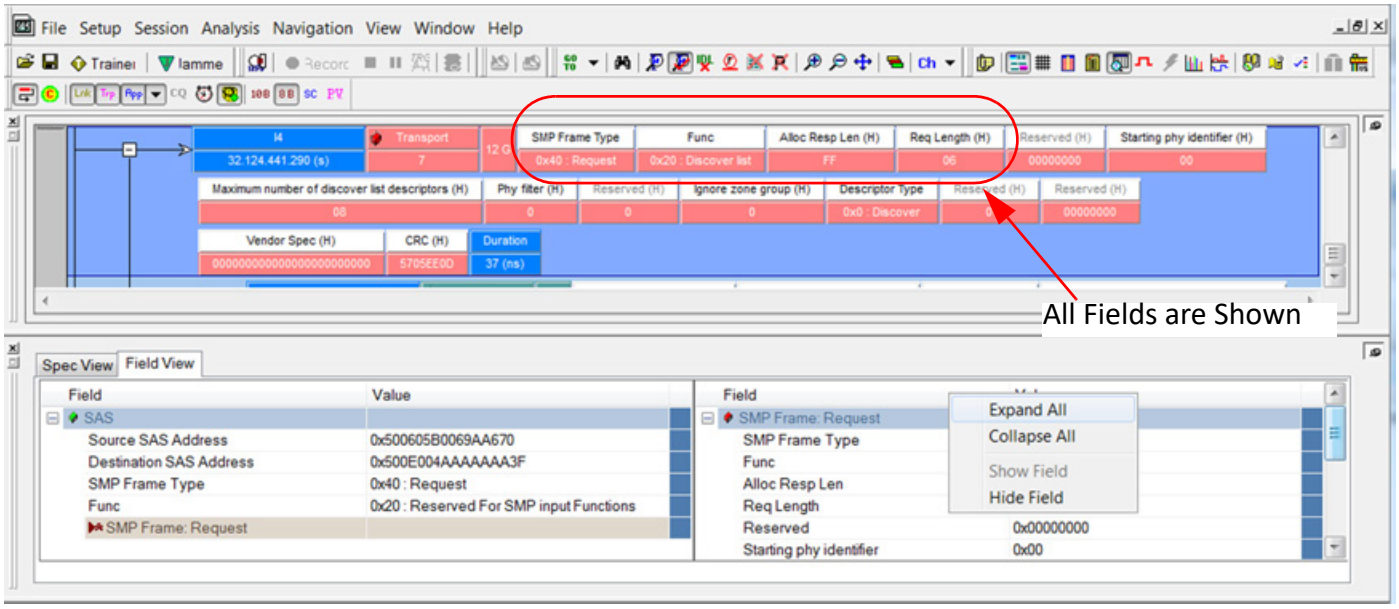


Figure 3.48: Field Inspector -- Field View Display Selected for a Specific Packet

If you want to manipulate the Field View display, you have the following options:

- Expand All (All fields will be displayed)
- Collapse All (Only the Packet type will be displayed)
- Show Field (Fields which have been hidden will show in the menu)
- Hide Field (You can select Fields to be hidden)
  You can select several Fields to Hide. This will remove them from the Field View but will also remove them from the Packet View. See Figure 3.49.

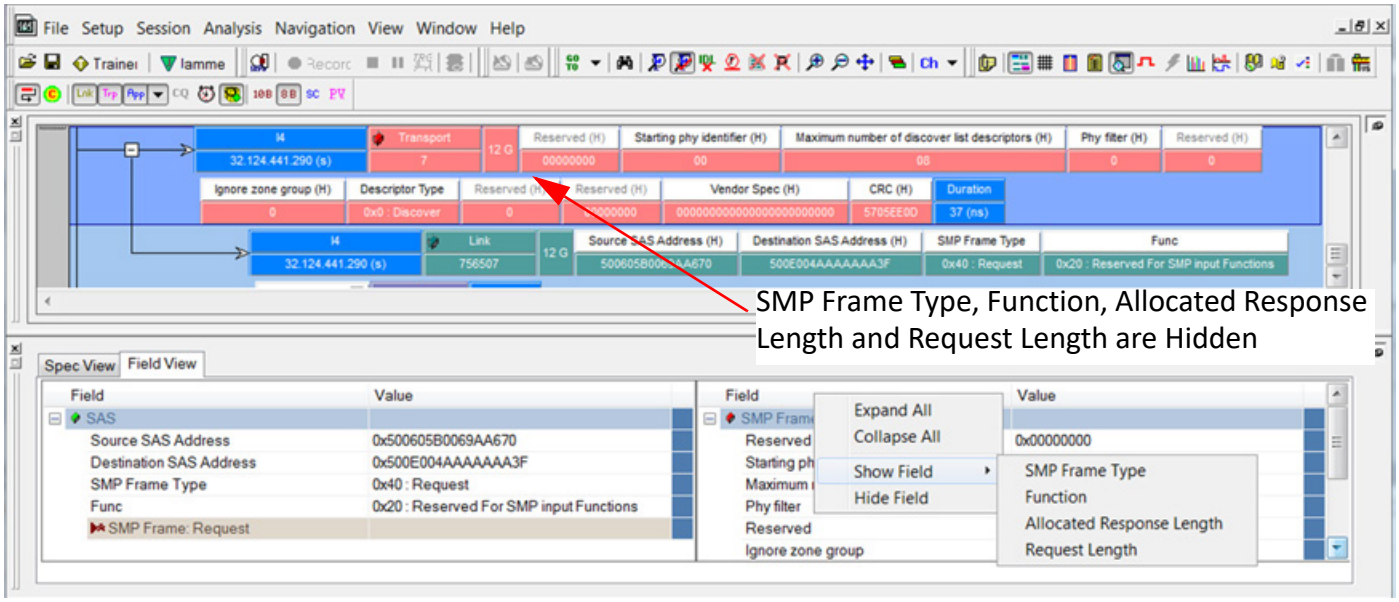


Figure 3.49: Field Inspector with Fields Hidden

To display the Hidden Fields simply select them in the Show Field box. They will then be displayed in both the Packet View and the Field View.

3.3.10 Waveform Display

You can enable a waveform display for all active ports, and perform timing measurements, by positioning timing cursors within the waveform display (see Figure 3.50 on page 270).

Select **View > Wave Form View** or click the  **Show/Hide Waveform** button on the View Type toolbar to enable the waveform display.

The Compact View shows the OOB Sequence with speed negotiation.

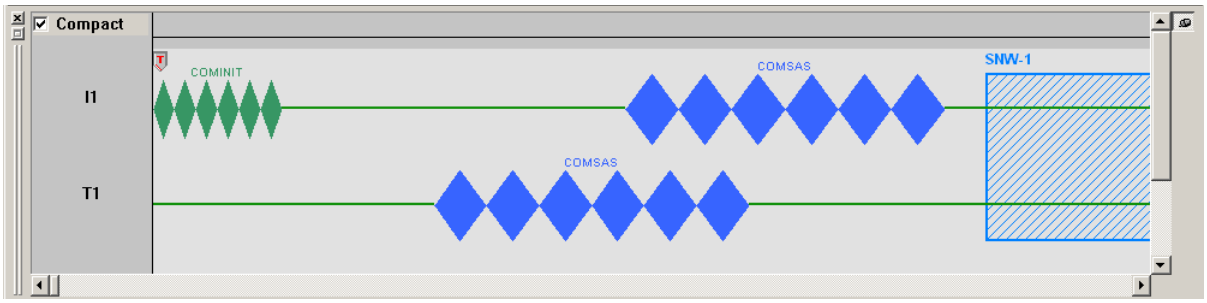


Figure 3.50: SAS: Waveform View

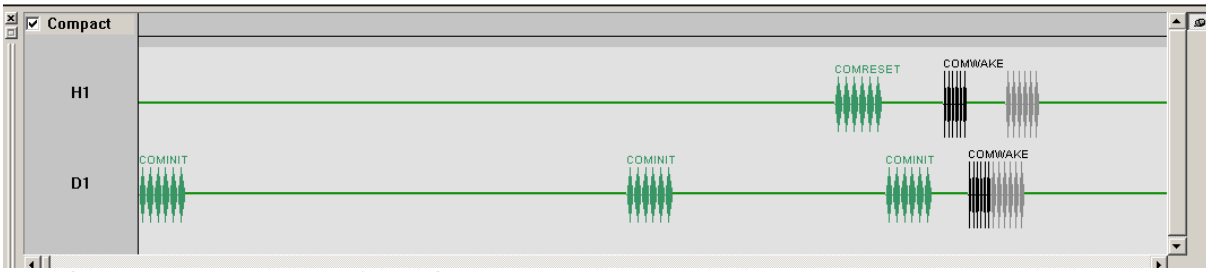


Figure 3.51: SATA: Waveform View

Making a 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 for the T1 cursor, and the right mouse button at a point for the T2 cursor. The time difference between the cursors is on a line connecting the two cursors.

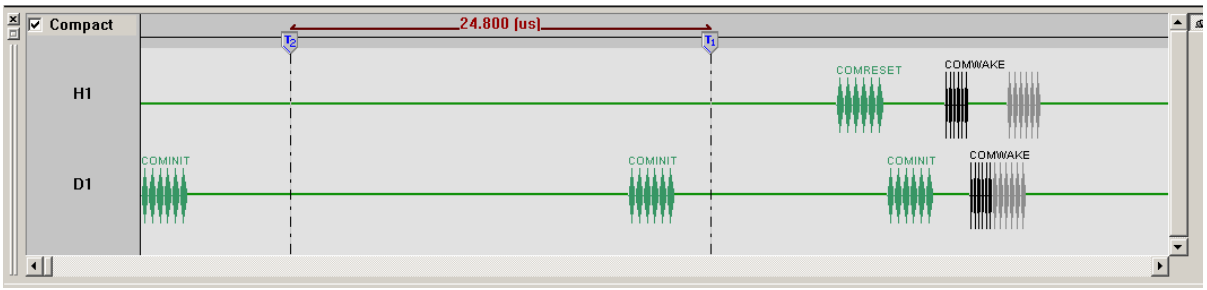


Figure 3.52: SATA: Timing Cursors Enabled

Expanded Waveform View

To see a 10x time scale expansion of the waveform, uncheck the **Compact View** checkbox in the Waveform View window. The OOB Sequence has speed negotiation (Hardware version 4 or later).

.

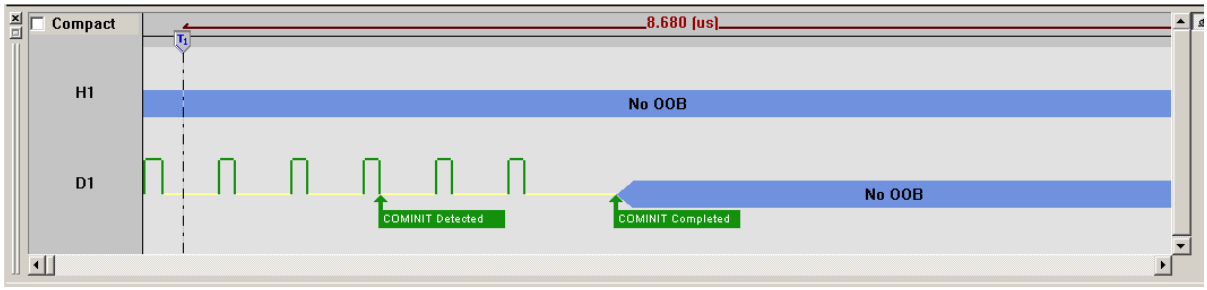


Figure 3.53: SATA: Expanded Waveform View

Performance Reference Definitions

Trp. No. - Number of Transports

The total number of transports that compose this exchange.

Resp. Time - Response Time

The time taken to transmit this command on the link(s) from the beginning of the first frame in the command to the end of the last frame in the command.

Pld. Bytes - Payload Bytes

The number of payload bytes this operation transferred.

Latency Time

The time measured from the transmission of the command to the first data transmitted for this IO operation.

Data-Stat. Time - Data to Status Time

The time between the end of data transmission for this command and the Status frame.

Thrpt MB/s- Data Throughput

The payload divided by response time expressed in MB per second.

Duration

The time taken from the first DWord to the last DWord in a line.

3.3.11 Statistical Report

Whenever a captured Trace is in the Packet Viewer, a **Statistical Report Button** on the viewer toolbar is enabled. See Figure 3.54.

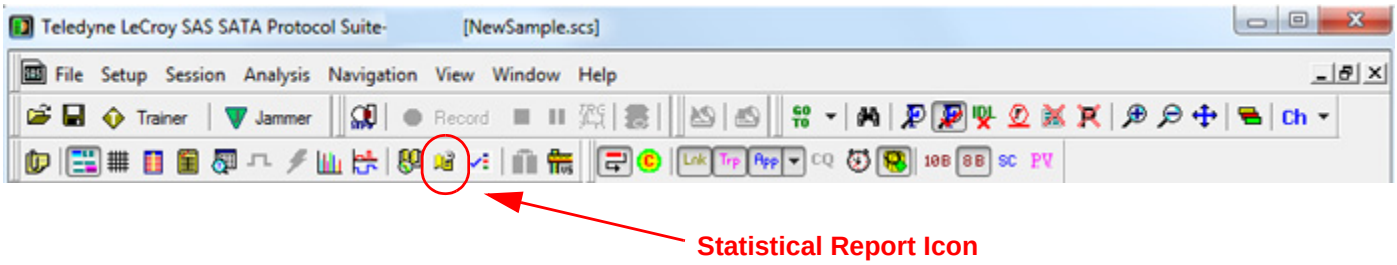
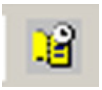


Figure 3.54: Statistical Report Icon in Toolbar

To display a Statistical Report, click the  **Statistical Report** button on the viewer toolbar. See Figure 3.55.

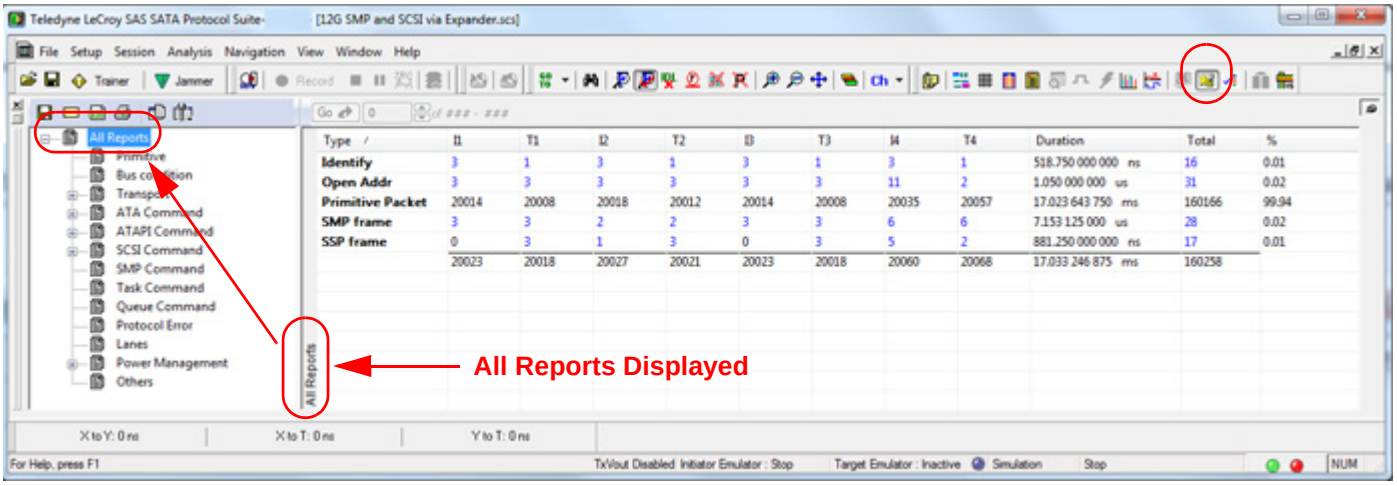


Figure 3.55: Hierarchical Statistical Report

The default statistical report has All Reports. You can select a specific Statistical report from the list on the left side of the dialog window.

Some of the Reports have levels of hierarchy, so you have to drill down to find the report you are interested in.

Statistical Report Content

A complete statistical report consists of the following reports, accessed by clicking the corresponding tab in the dialog see: Figure 3.56.

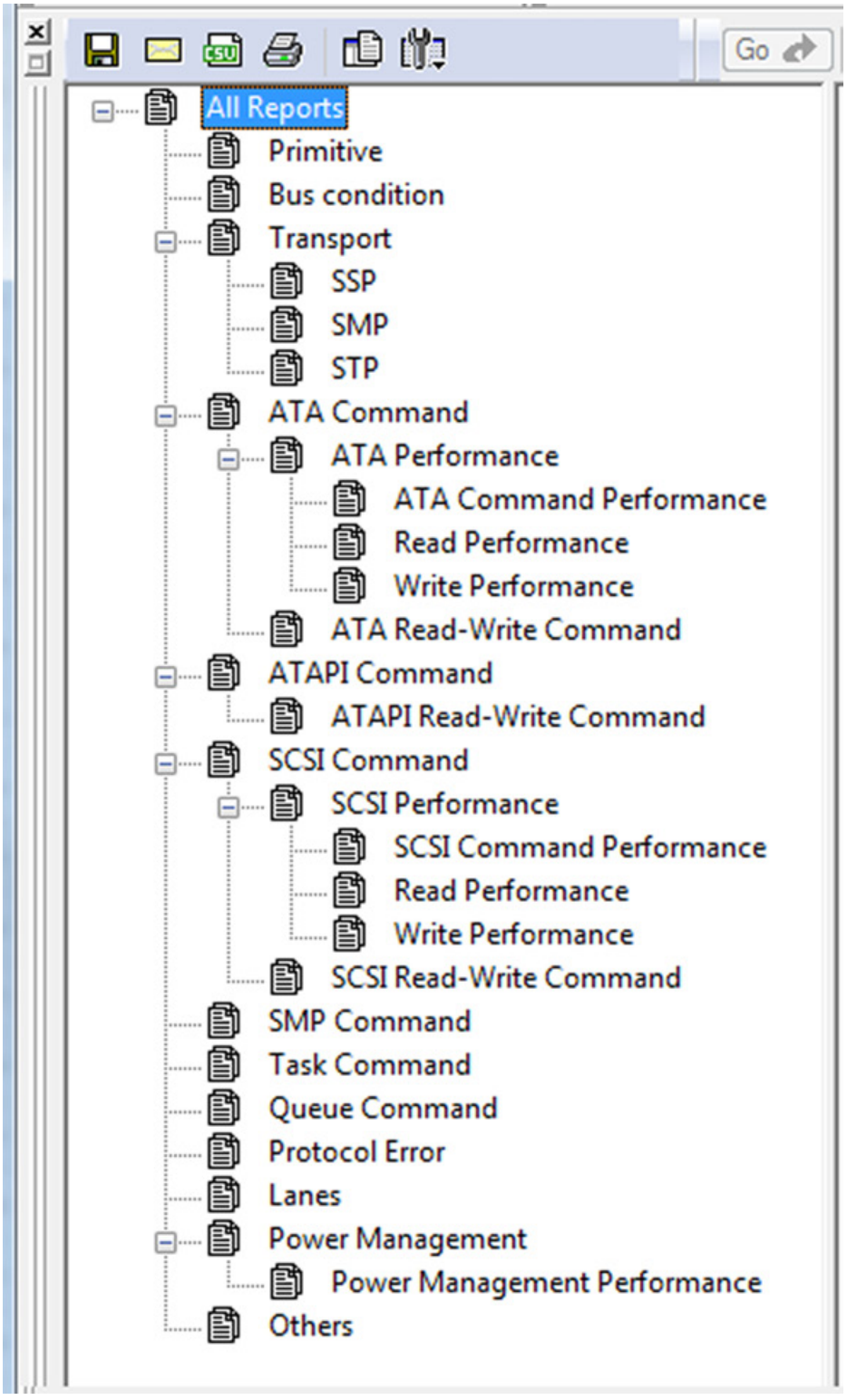


Figure 3.56: Analysis: All Statistical Reports

All Reports

- Primitive
- Bus Condition
- Transport
  - SSP
  - SMP
  - STP
- ATA Command
  - ATA Performance
    - ATA Command Performance
    - Read Performance
    - Write Performance
  - ATA Read-Write Commands
- ATAPI Command
  - ATAPI Read-Write-command
- SCSI Command
    - SCSI Command Performance
  - SCSI Performance
    - Read Performance
    - Write Performance
  - SCSI Read-Write Commands
    -
- SMP Command
- Task Command
- Queue Command
- Protocol Error
- Lanes
- Power Management
  - Power Management Performance
- Others

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

ATA Command Performance

The ATA Command Performance report in shown below in Figure 3.57, Figure 3.58 and Figure 3.59

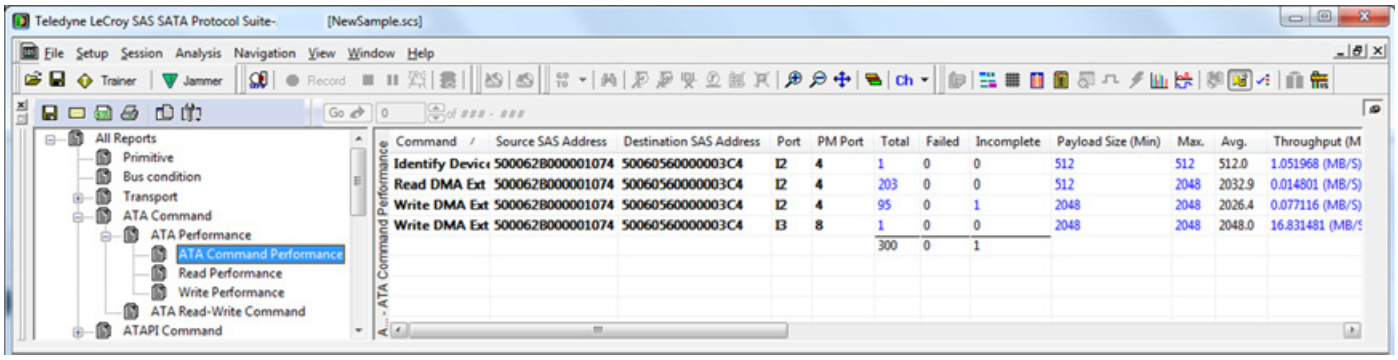


Figure 3.57: Statistical Report: ATA Command Performance (1)

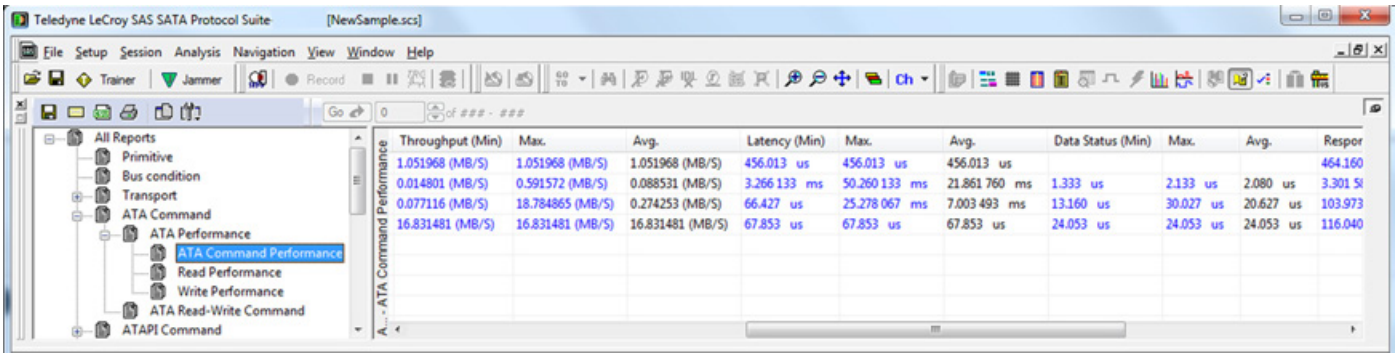


Figure 3.58: Statistical Report: ATA Command Performance (2)

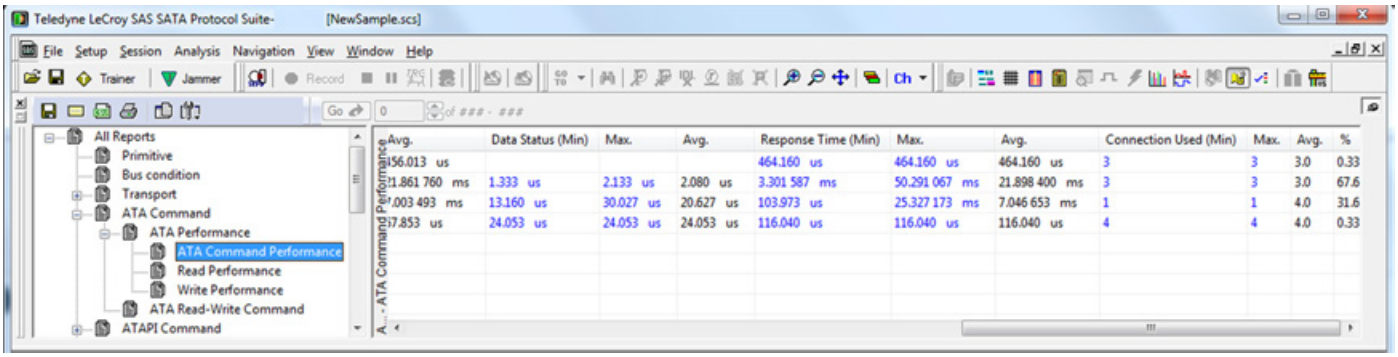


Figure 3.59: Statistical Report: ATA Command Performance (3)

SCSI Command Performance

The SCSI Command Performance report in shown below in Figure 3.60, Figure 3.61 and Figure 3.62.

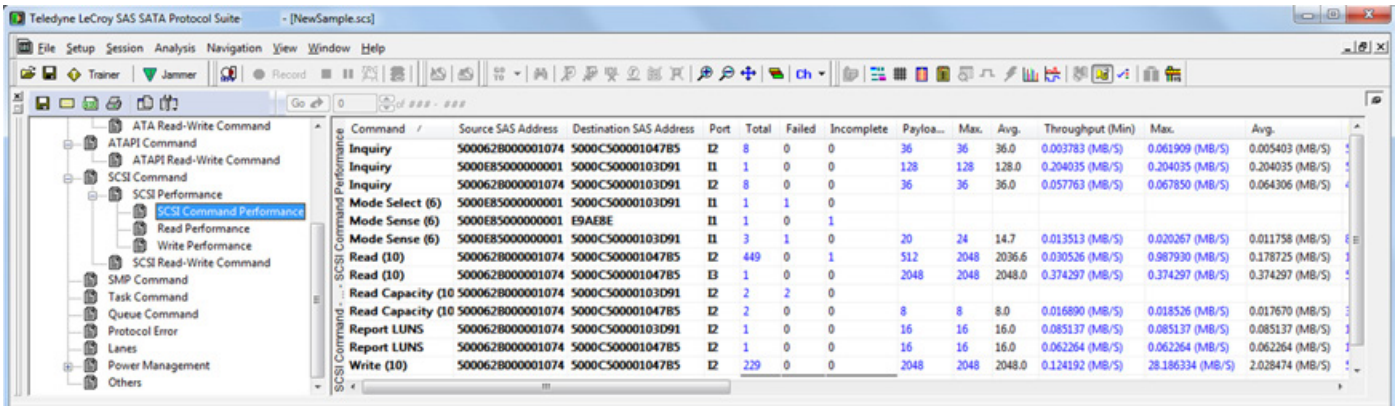


Figure 3.60: Statistical Report: SCSI Command Performance (1)

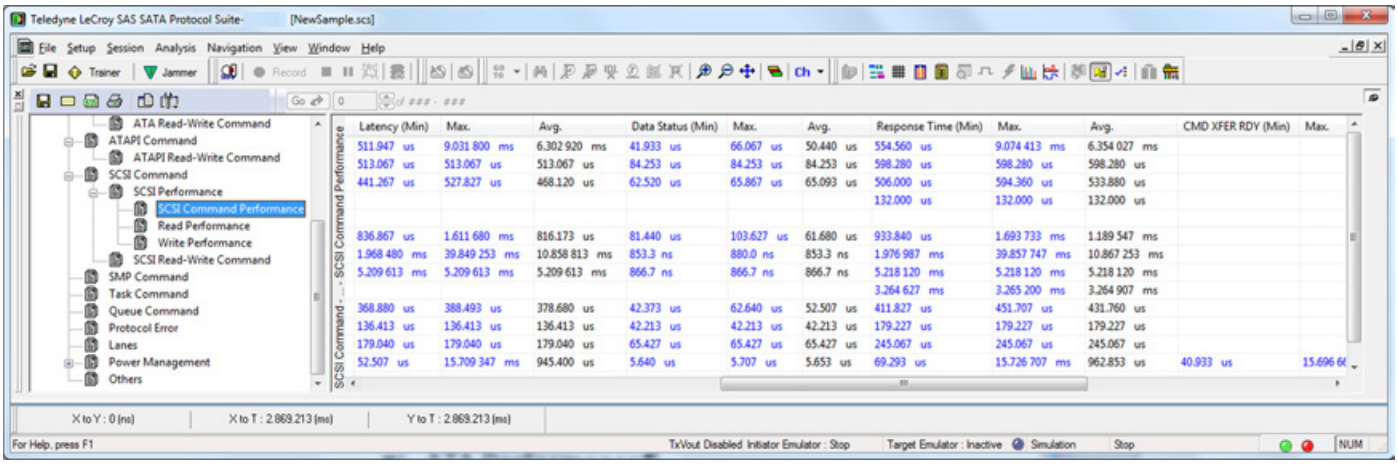


Figure 3.61: Statistical Report: SCSI Command Performance (2)

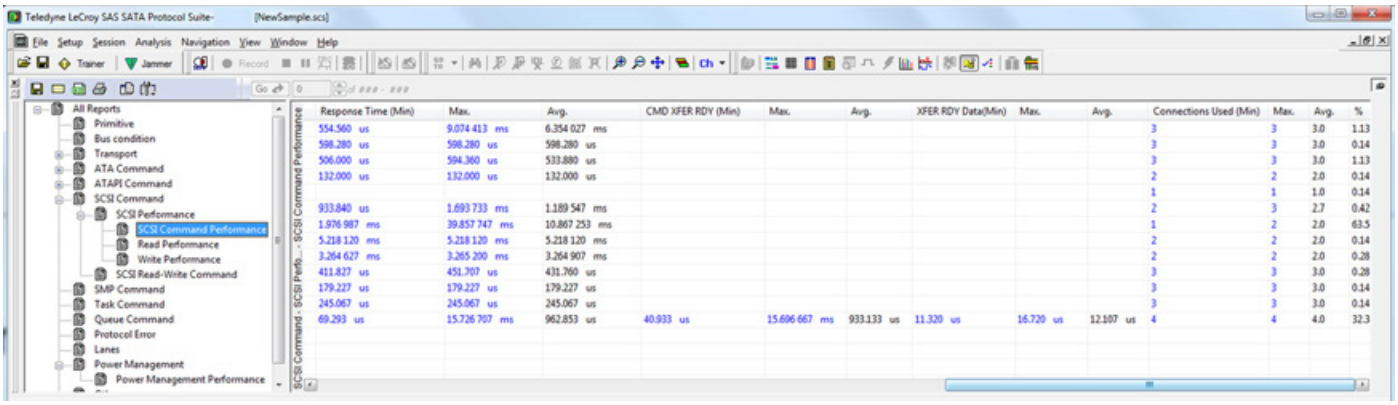


Figure 3.62: Statistical Report: SCSI Command Performance (3)

3.3.12 Statistical Report Toolbar

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

- Save Report (Brings up Windows Explorer to save file in HTML format)
- Email Report (Brings up your default email tool)
- Save as Comma Delimited File (Brings up Windows Explorer to save file in CSV format)
- Print Report (Sends Report to Printer)
- Display a Text version of the Reports
- Options
  - Show Grid Lines (Adds grid lines to report display)
  - Row Selection (Selects entire row)
  - Tight Columns (removes extra space between columns)

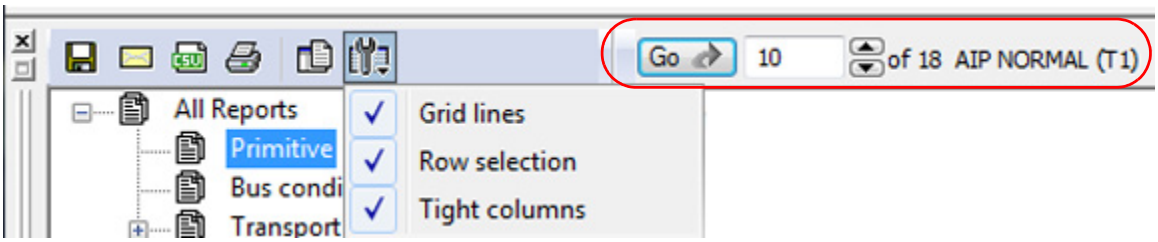
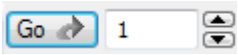


Figure 3.63: Close Up View of Report Toolbar

If you select an event within a row the Go to icon is enabled 

. This allows you to select a specific event in the report and clicking on the Go button will update the selected event in the Packet View. See Figure 3.64 on page 278.

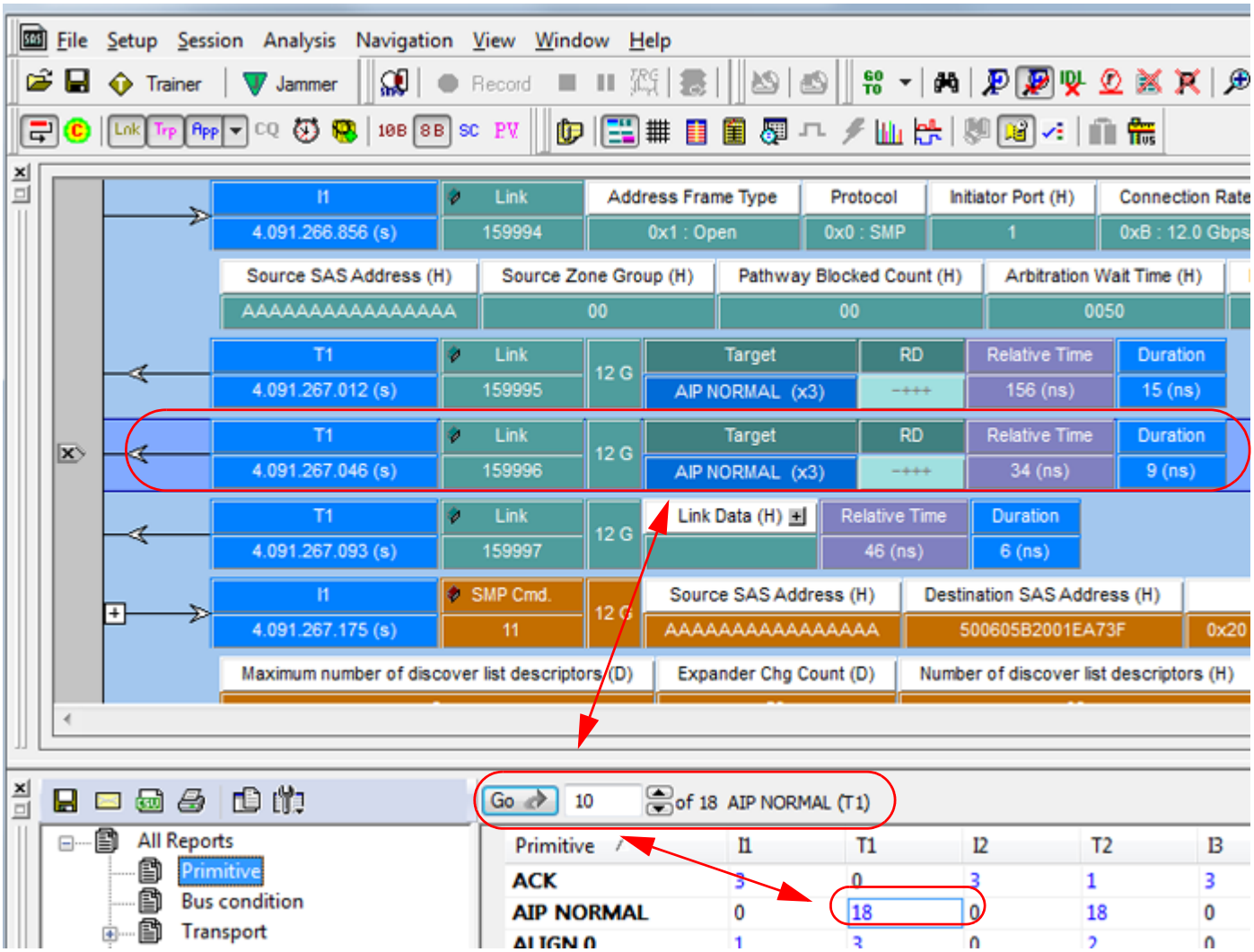


Figure 3.64: Selected Event (AIP NORMAL) Highlighted in the Packet View

Generating Statistical Read/Write Report

To create a statistical read/write page perform the following steps:

1. Click on **Setup > Preferences**.
2. Click on the **Trace Viewer** tab.
3. Check the box **Create statistical report read/write page** (see Figure 3.65.)

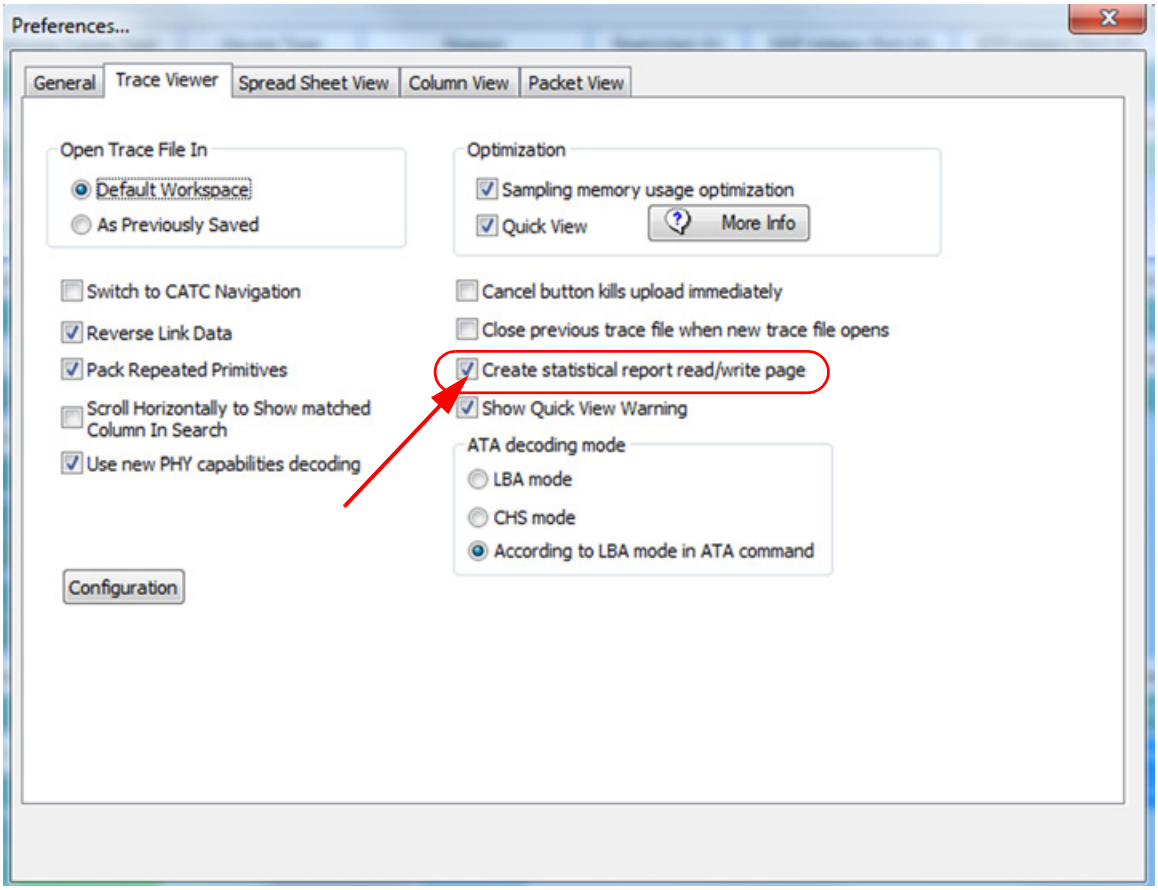


Figure 3.65: Enabling Read/Write Statistical Report.

Note: This setting should be enabled before you capture the trace file.

Note: Alternately, you can force the report creation by using Save As after this setting is selected.

3.3.13 Histogram View

The Histogram View displays a histogram of frame-type transfers.

To display the Histogram View of the current capture, click **View > Histogram View** or click the  button on the View Type toolbar.

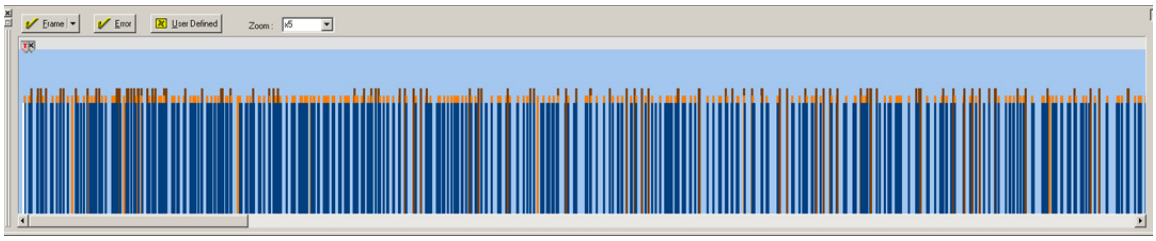


Figure 3.66: Histogram View

Hide Frames

You can customize the histogram by including only frame types that you want.

To choose frame types to include in the display, click the down arrow on the **Frame** button on the Histogram toolbar and check frame types:

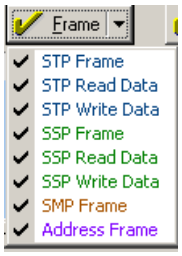


Figure 3.67: SAS: Histogram Frames

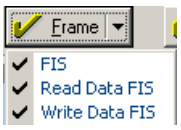
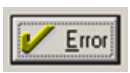


Figure 3.68: SAS: Histogram Frames

Hide Error Frames

Frames with errors are displayed in red. To hide error frames from the histogram, click the  button.

Note: To display the error code of a protocol error, click the error icon (with the red 'x').

Pending IO Graph

The Tool menu has a Pending IO Graph command, with horizontal zoom, vertical zoom, click and drag zoom, graph area zoom, synchronize with trace view, fit to graph area and graph view.

User Defined

You can define additional items for inclusion in the Histogram by clicking the



button to open the User Defined dialog. See the following screen capture:

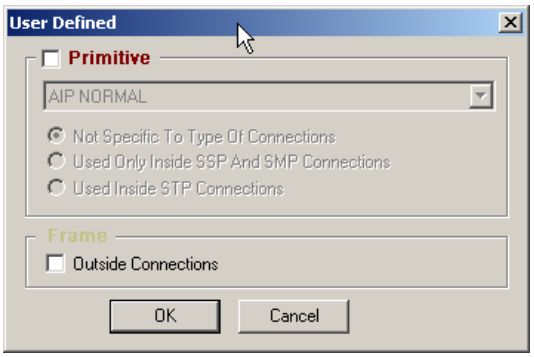


Figure 3.69: SAS: Histogram User Defined Dialog

You can include Primitive and/or Outside Connections frames.

Primitives

To include Primitives, check the **Primitive** check box, click the down arrow on the Primitive list box, and choose a Primitive.

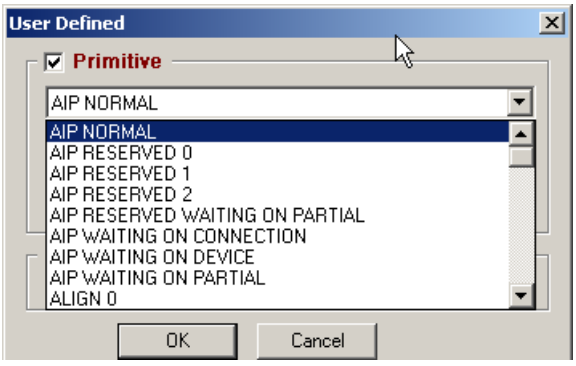


Figure 3.70: SAS: Choosing a Primitive

.



Figure 3.71: SATA: Choosing a Primitive

Check a Connection Type option radio button, if available, and click **OK**.

Zoom

You can Zoom from x1 to x256.

3.3.14 Bus Utilization View

The Bus Utilization View displays information on pending IO, IO Throughput, Latency Time and Response Time. To display the Bus Utilization View of the current capture, Select Analysis from the Main Toolbar, see Figure 3.72.

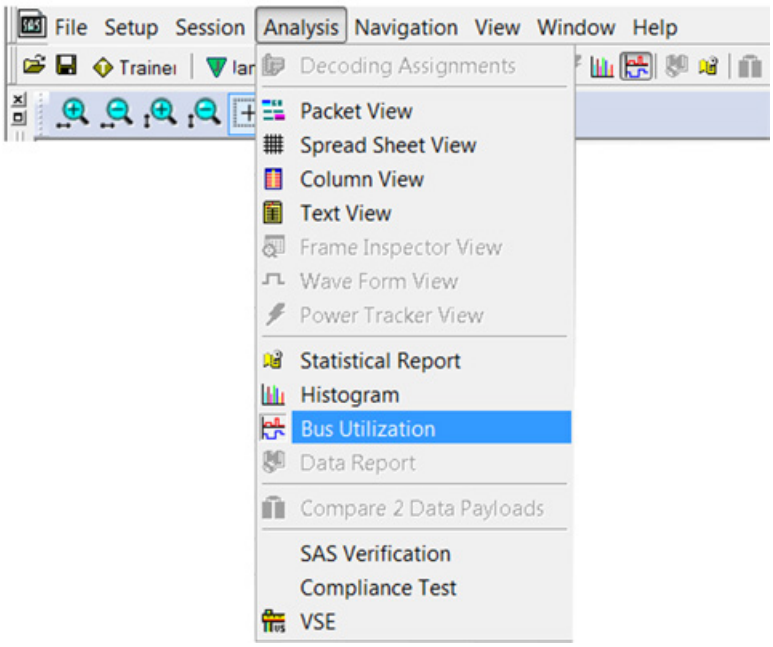


Figure 3.72: Analysis: Bus Utilization Dialog

then

select **Bus Utilization View** or click the  button on the main tool bar.

This will bring up the Bus Utilization Toolbar (see Figure 3.73), which has the following functions:

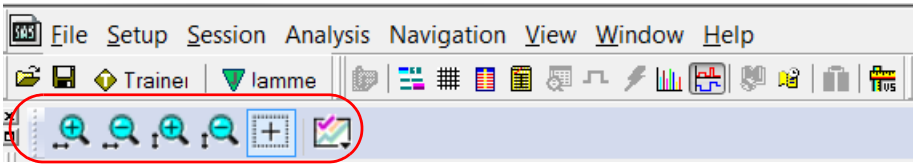


Figure 3.73: Bus Utilization Toolbar Functions

- Horizontal zoom in
- Horizontal zoom out
- Vertical zoom in
- Vertical zoom out
- Click and drag zoom mode
- Graph areas

Select functions to view from the Available Bus Utilization Views from the Graph areas icon:

- Pending SCSI IO (for SAS): Shows number of pending commands
- Pending ATA IO (for SATA): Shows number of pending commands
- SCSI IO Throughput (for SAS): The payload divided by response time expressed in MB per second.
- ATA IO Throughput (for SATA): The payload divided by response time expressed in MB per second.
- SCSI IO Latency Time (for SAS): The time measured from the transmission of the command to the first data transmitted for this IO operation.
- ATA IO Latency Time (for SATA): The time measured from the transmission of the command to the first data transmitted for this IO operation.
- SCSI IO Response Time (for SAS): The time taken to transmit this command on the link(s) from the beginning of the first frame in the command to the end of the last frame in the command.
- ATA IO Response Time (for SATA): The time taken to transmit this command on the link(s) from the beginning of the first frame in the command to the end of the last frame in the command.

See figure below (Figure 3.74 on page 284).

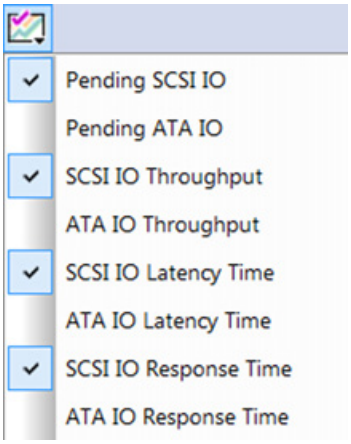


Figure 3.74: Graph Selected Functions: SCSI Functions Selected

This will bring up graphs for the Selected functions (see Figure 3.75 on page 284).

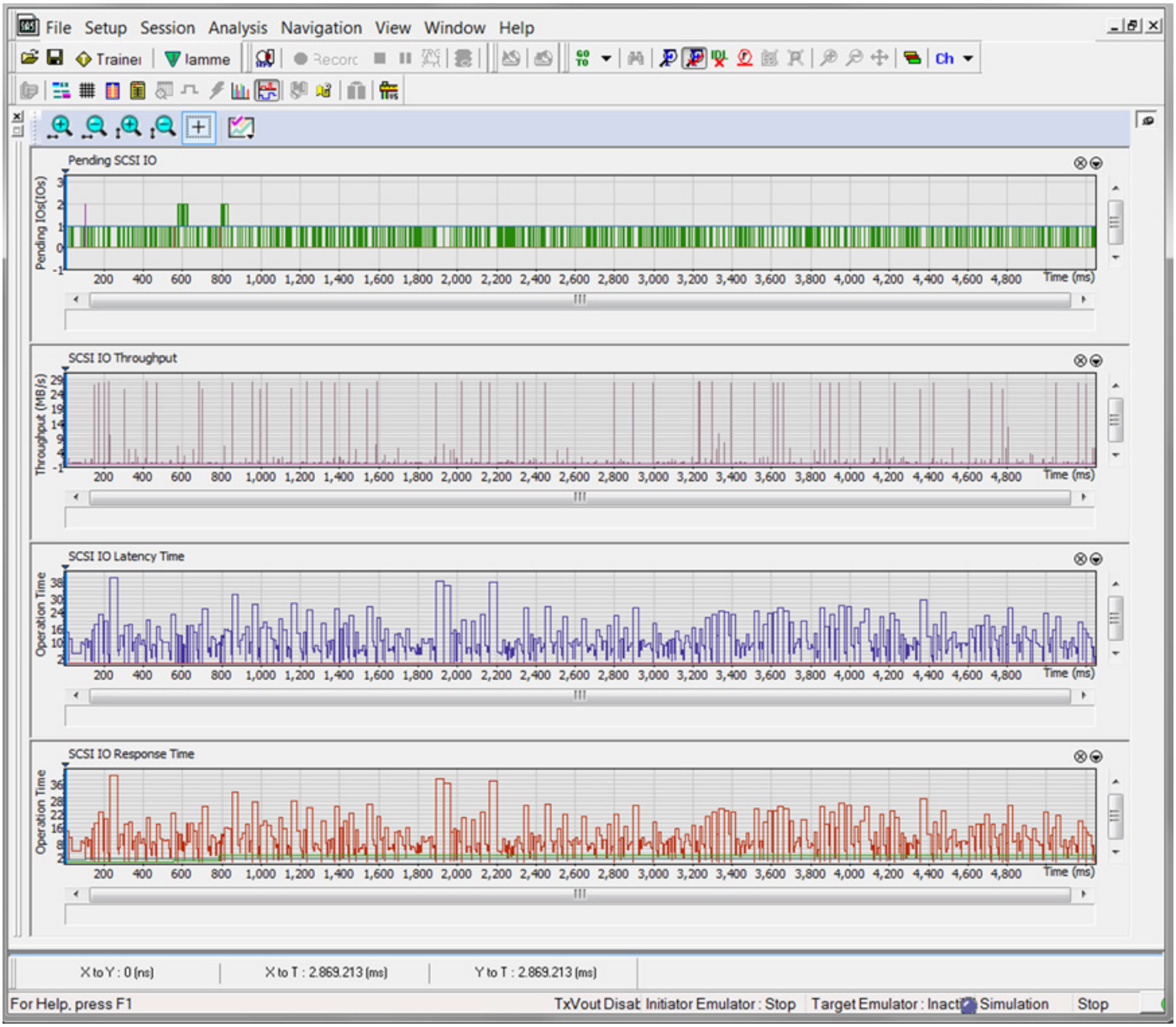


Figure 3.75: Waveform View for Full Trace

Select Packet View to see both the Packet and the Waveforms. See Figure 3.76 on page 285.

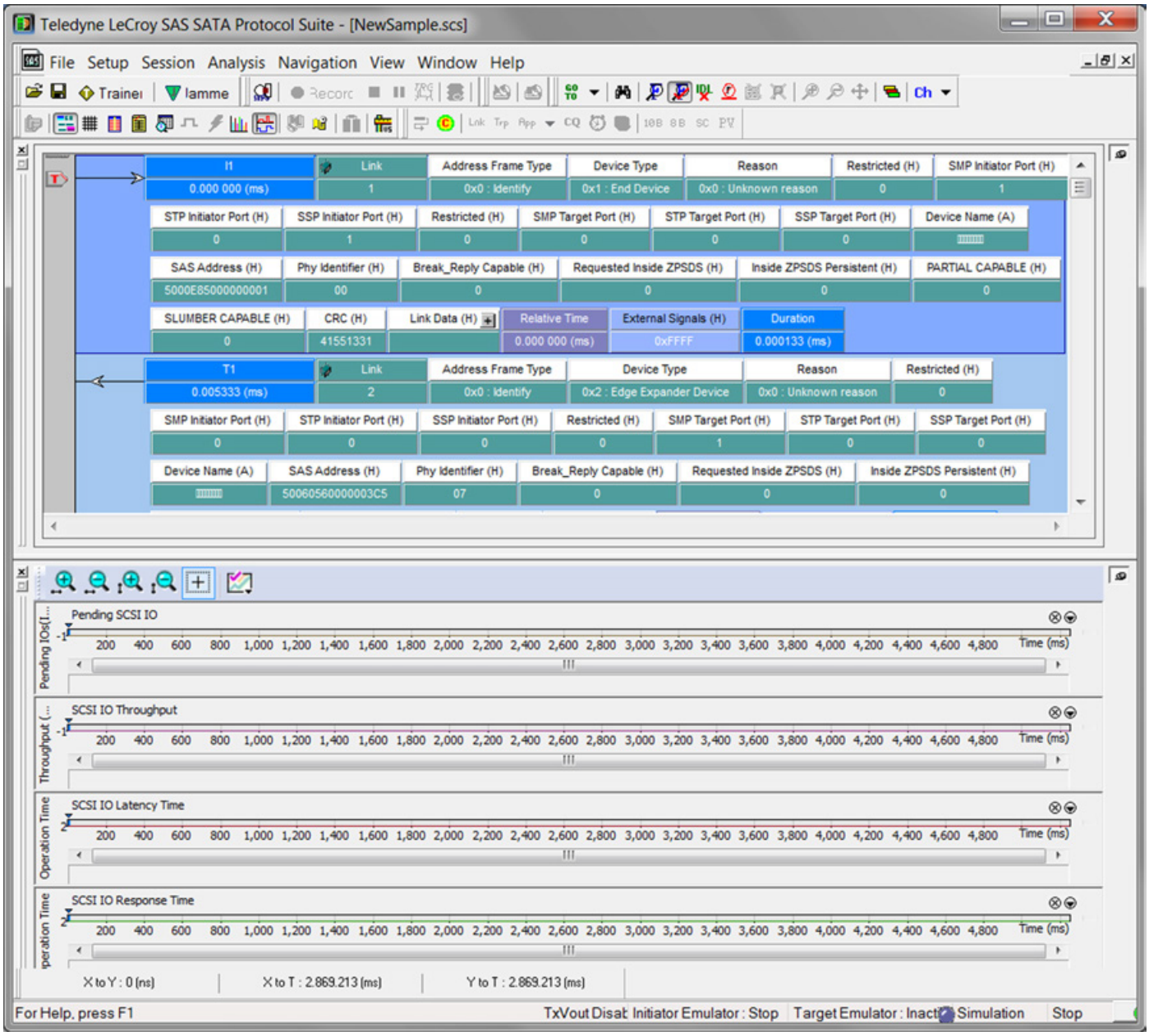


Figure 3.76: Packet and Waveform Views

Right clicking the mouse over the graph heading displays the graph legend:

- **Go to ATA/SCSI Cmd. #**: Jump to command.
- **Synchronize with Trace View**: Synchronize all open views to that location in the trace.
- **Fit to Graph Area**: Zoom to fit.
- **Hide**: Do not display the graph.

See Figure 3.77 on page 286.



Figure 3.77: Right Click on Graph Heading Dialog

Selecting Go to SCSI Cmd. 264 and Synchronize with Trace View will bring up both the Packet View and the associated Waveforms. See Figure 3.78.

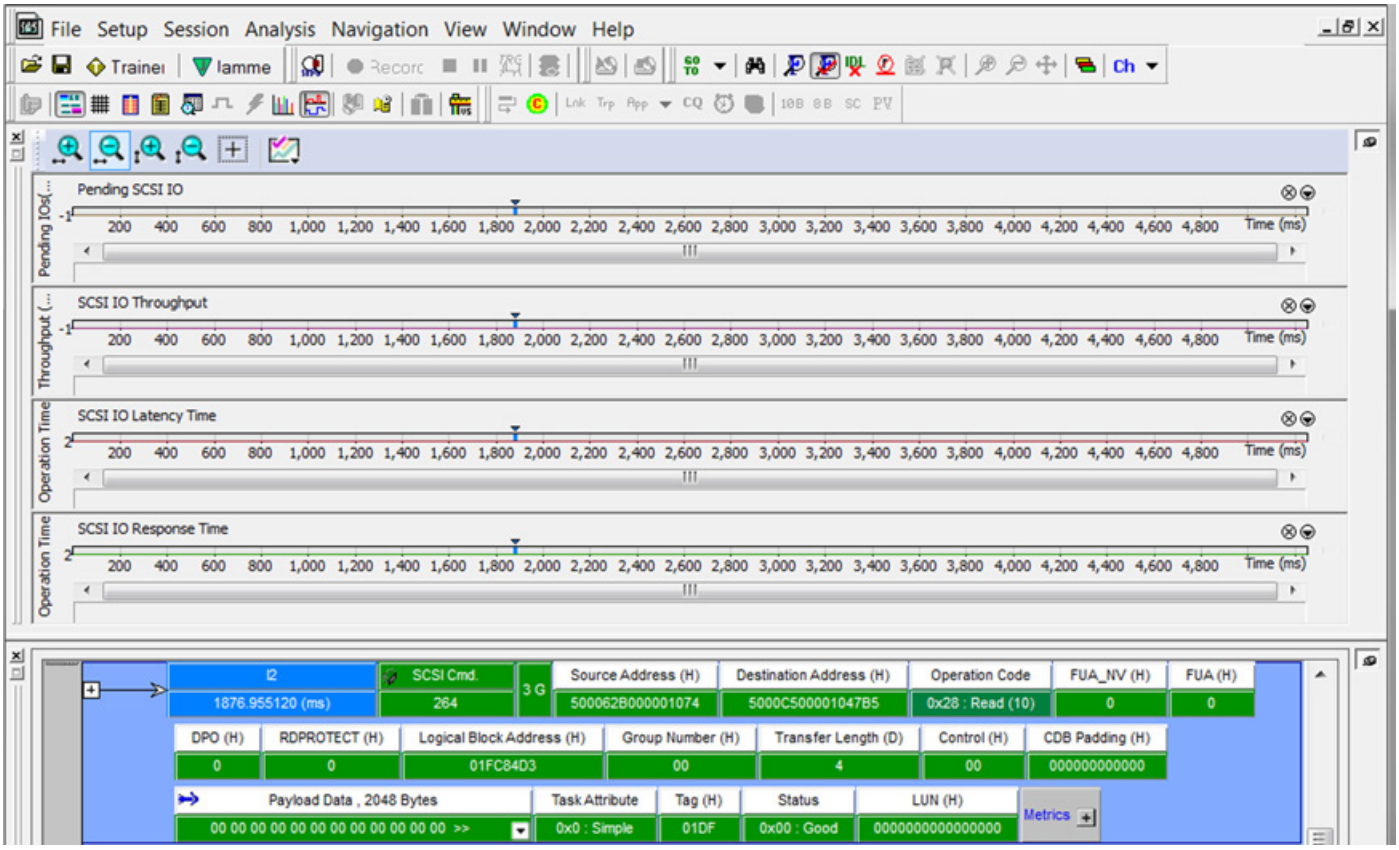


Figure 3.78: Packet View and Waveforms Synchronized

Then you can zoom in to the waveforms associated with the selected packet. See Figure 3.79 on page 287.

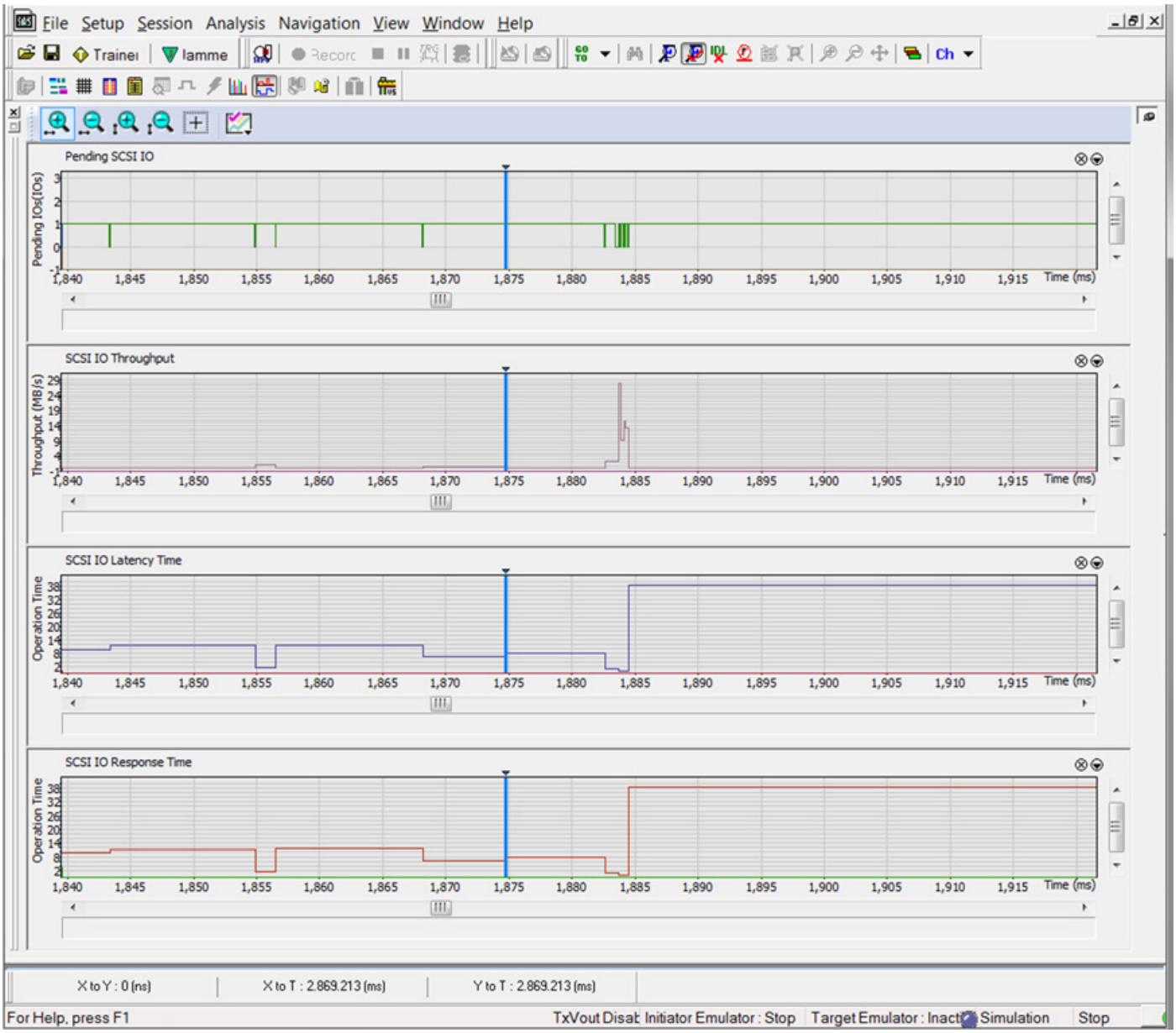


Figure 3.79: Zoom In on Waveforms near the Selected Packet

Performance Reference Definitions

Trp. No. - Number of Transports

The total number of transports that compose this exchange.

Resp. Time - Response Time

The time taken to transmit this command on the link(s) from the beginning of the first frame in the command to the end of the last frame in the command.

Pld. Bytes - Payload Bytes

The number of payload bytes this operation transferred.

Latency Time

The time measured from the transmission of the command to the first data transmitted for this IO operation.

Data-Stat. Time - Data to Status Time

The time between the end of data transmission for this command and the Status frame.

Thrpt MB/s- Data Throughput

The payload divided by response time expressed in MB per second.

Duration

The time taken from the first DWord to the last DWord in a line.

3.3.15 Bus Utilization Buttons

The Bus Utilization window has a row of buttons for changing the format of the displayed data. The buttons have the following functions:

	Horizontal zoom in		Vertical zoom in
	Horizontal zoom out		Vertical zoom out
	Graph Areas Presents options for displaying additional graphs.		Click and Drag zoom Click diagonally to select and zoom in on part of the graph.
	Hide graph.		Graph legend (see previous page)

3.3.16 Data Report

When a captured sample is in the Sample Viewer, the Data Report button is on the Viewer toolbar, and Data Report is in the Report menu.

The data report displays all the data sent from the host to the device and from the device to the host. All PIO In => In commands are grouped as a data packet until the occurrence of a PIO Out => Out command, creating a new data packet.

To display a Data Report, click the  **Data Report** button on the Viewer toolbar or select **Report > Data Report**.

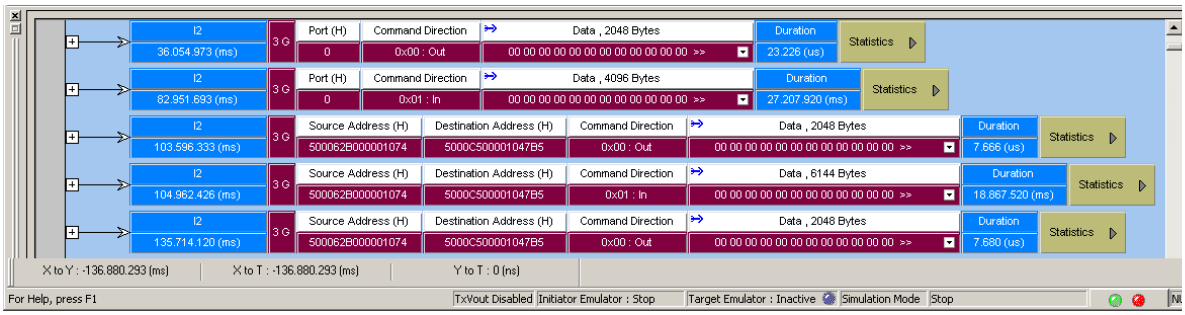


Figure 3.80: SAS: Data Report

Click the **Down Arrow** in a data field to display Data Report details (see the following screen capture.)

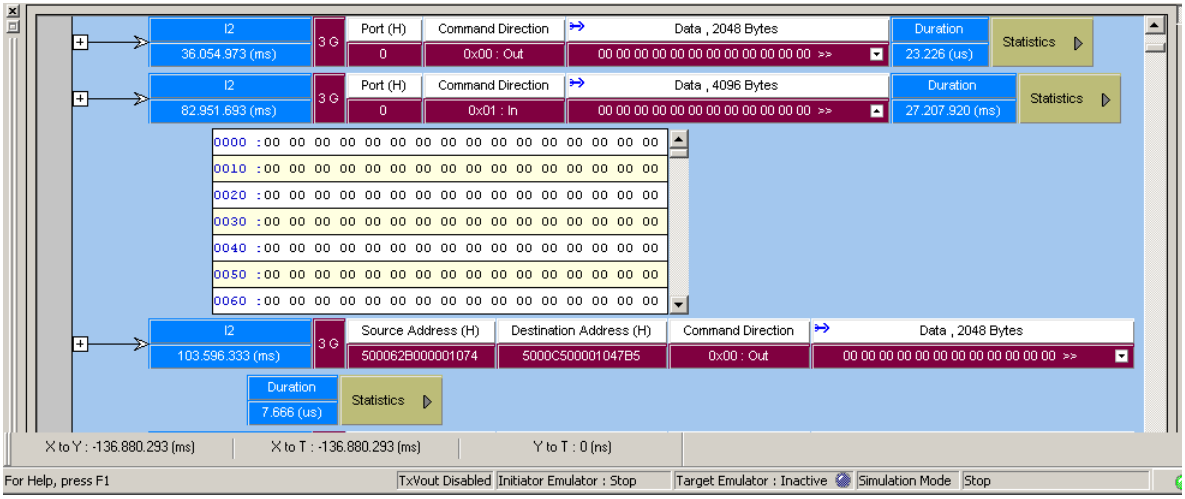


Figure 3.81: SAS: Data Report Details

Click the **Statistics** button  at the end of a row to display data report statistics.

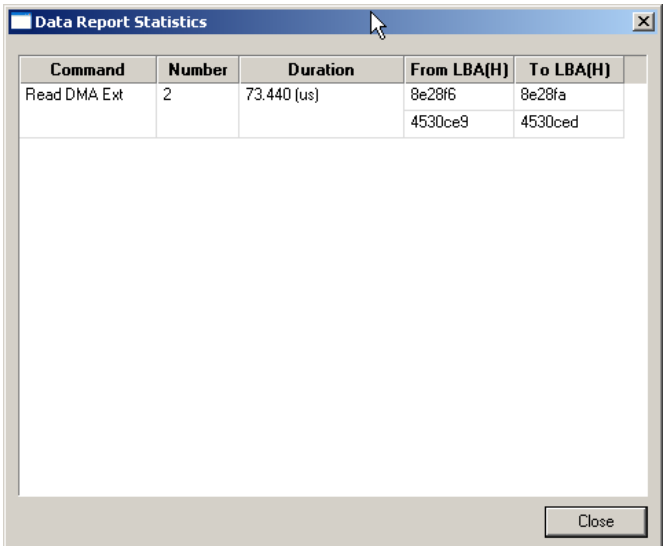


Figure 3.82: SAS: Data Report Statistics

Data Payload View

To display the Data Payload View (see Figure 3.83 on page 291), double-click a data payload field in a Packet or Spreadsheet view, or right-click a data payload field and select **Open as Data View**:

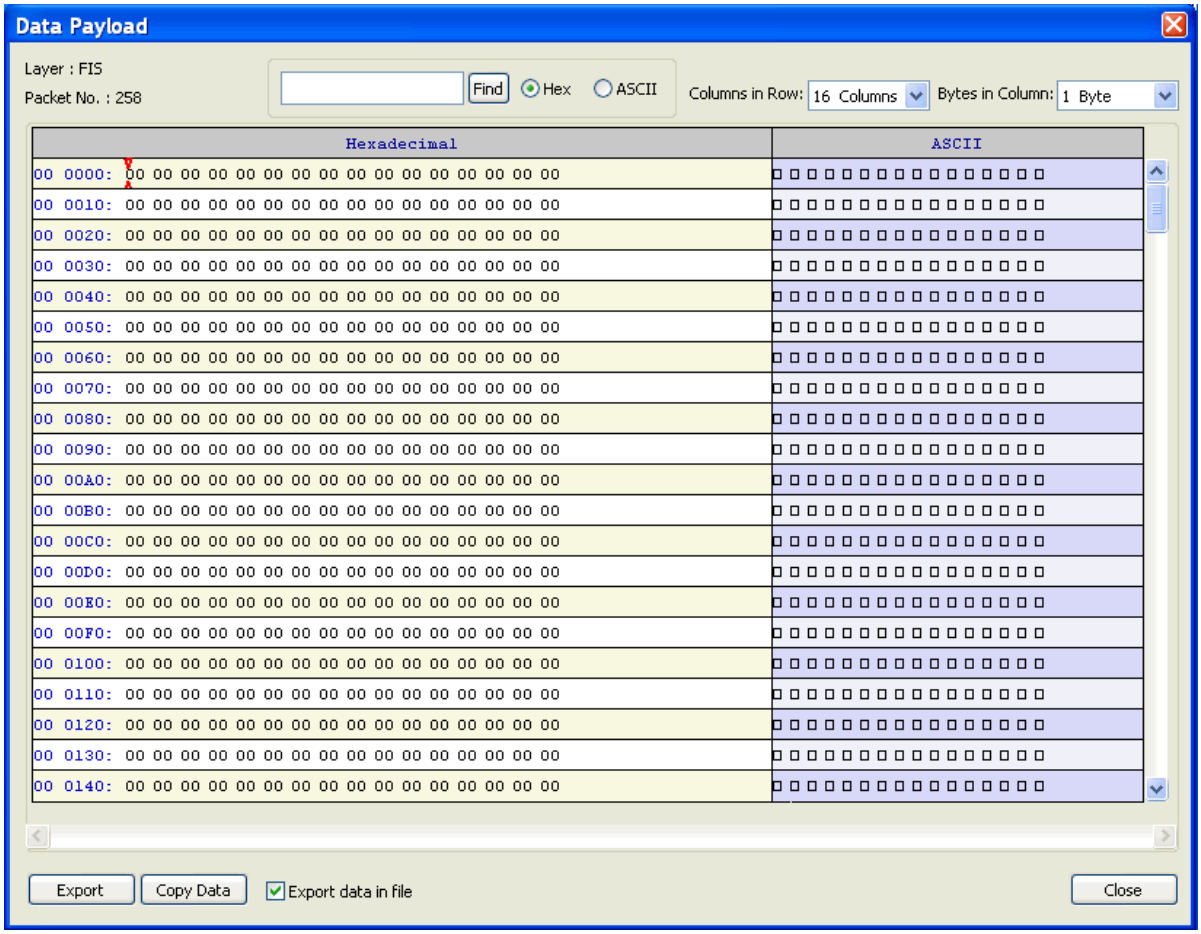


Figure 3.83: Data Payload View

Note: When showing truncated data in the Data Payload View, the truncation points are marked with a separator placed between payloads. You can get more information about the data exclusion using the tooltip over the separator.

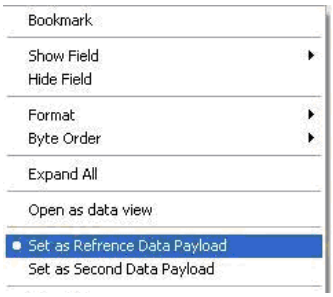
Note: You can control the number of bytes per line.

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.

3.3.17 Compare Two Data Payloads

To compare two data payloads, select two different payload packets, one as reference. Right-click a payload field in Packet View or a related frame in Text View or Spreadsheet View to display a menu, then select **Set As Reference Data Payload**.



Right-click a payload field in Packet View or a related frame in Text View or Spreadsheet View to display a menu, and choose **Set as Second Data Payload**.

To compare data payloads, click the  **Show/Hide Compare 2 Data Payloads** button on the View Type toolbar:

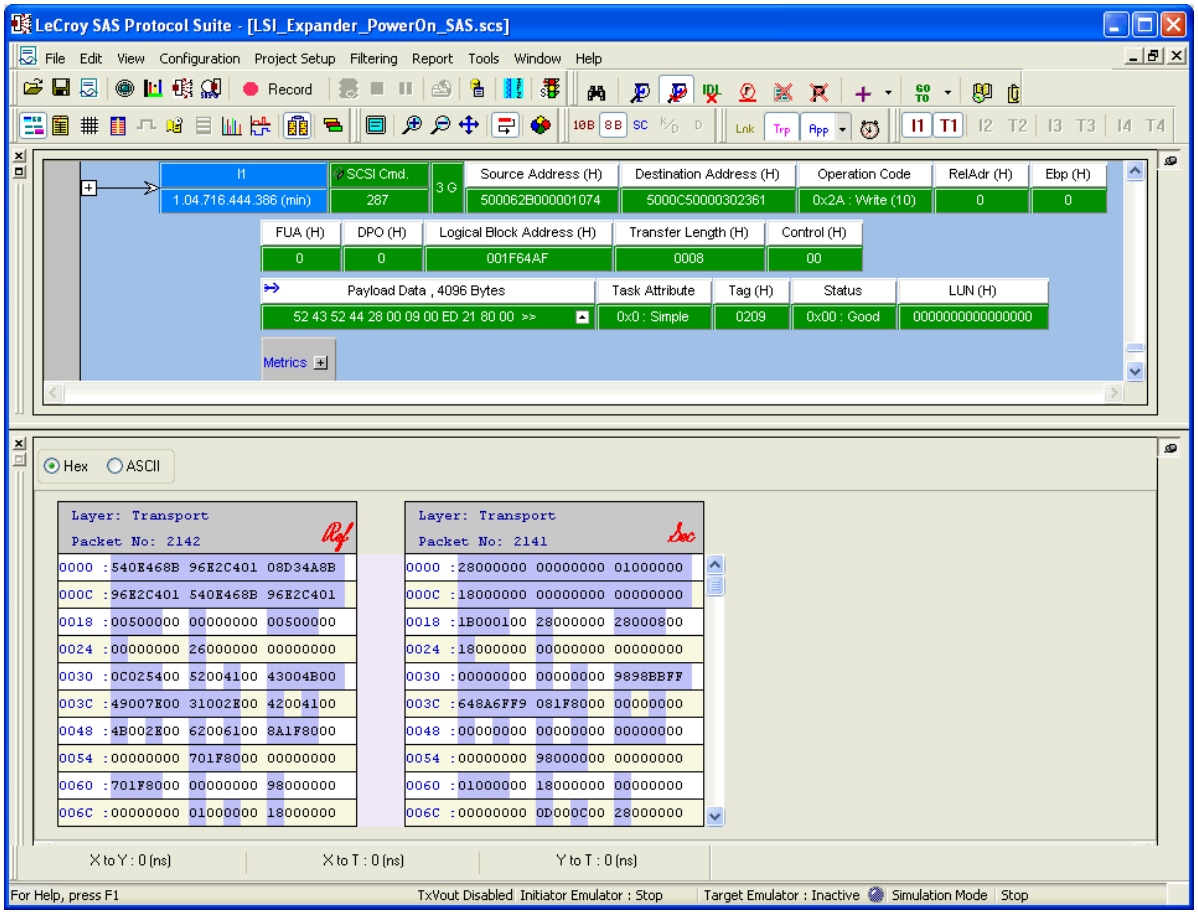


Figure 3.84: Compare Two Data Payloads

3.4 Trace Expert

Trace Expert generates the following reports and analysis for the currently loaded trace:

- Performance Analysis
- Error Reports
- Trace Analysis Statistics
- Trace Information

To use Trace Expert, load a saved Trace that you are interested in examining. In this case the Trace "SAS 12G.scs" has been loaded. This trace is used as an example and may not be suitable for all analyzers, but the basic steps are the same for any analyzer.

Next, find the Trace Expert icon which is available from the Main Toolbar as shown in Figure 3.85 or the Analysis Toolbar (shown on Figure 3.5 on page 237).

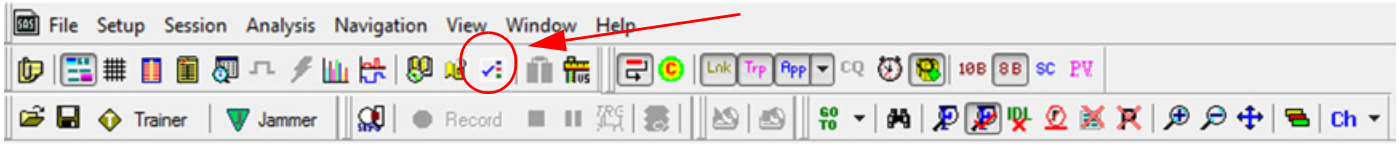


Figure 3.85: Main Toolbar: Trace Expert Icon

Click on the Trace Expert icon, which generates the following pop-up dialog (Figure 3.86) showing all the Trace HTML files which contain the previously generated reports used by Trace Expert:

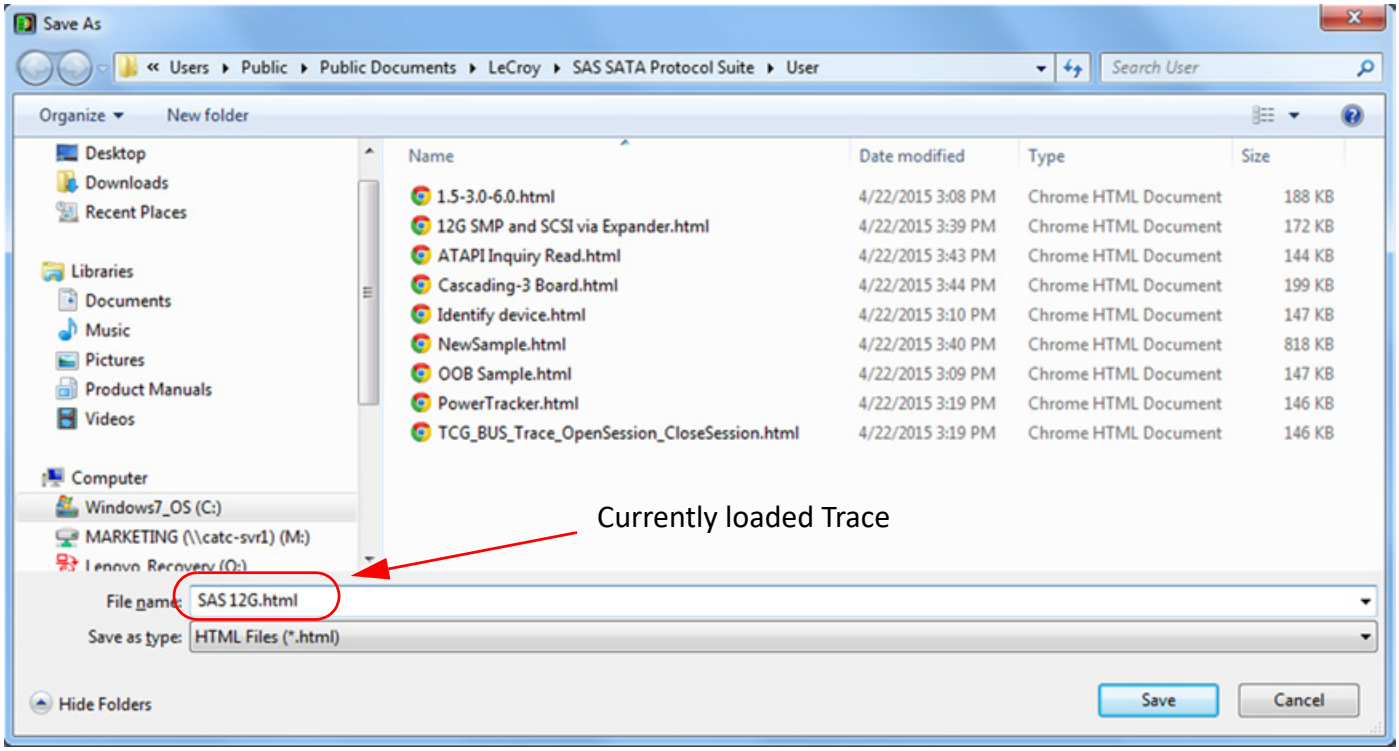


Figure 3.86: Trace Expert: Pop-Up Dialog

Click on the Save button to add the currently loaded Trace to the list of Saved Trace Expert HTML files. These HTML files can then be re-used. For example, the SAS 12G.html file (~150 KB containing all the Trace Expert reports and analysis for that Trace) could be emailed to a colleague or to Teledyne Customer Service without sending the whole Trace (~39 MB).

The Save process will also generate the SAS 12G Trace Expert HTML file with the following topics displayed for the loaded Trace (see Figure 3.87):

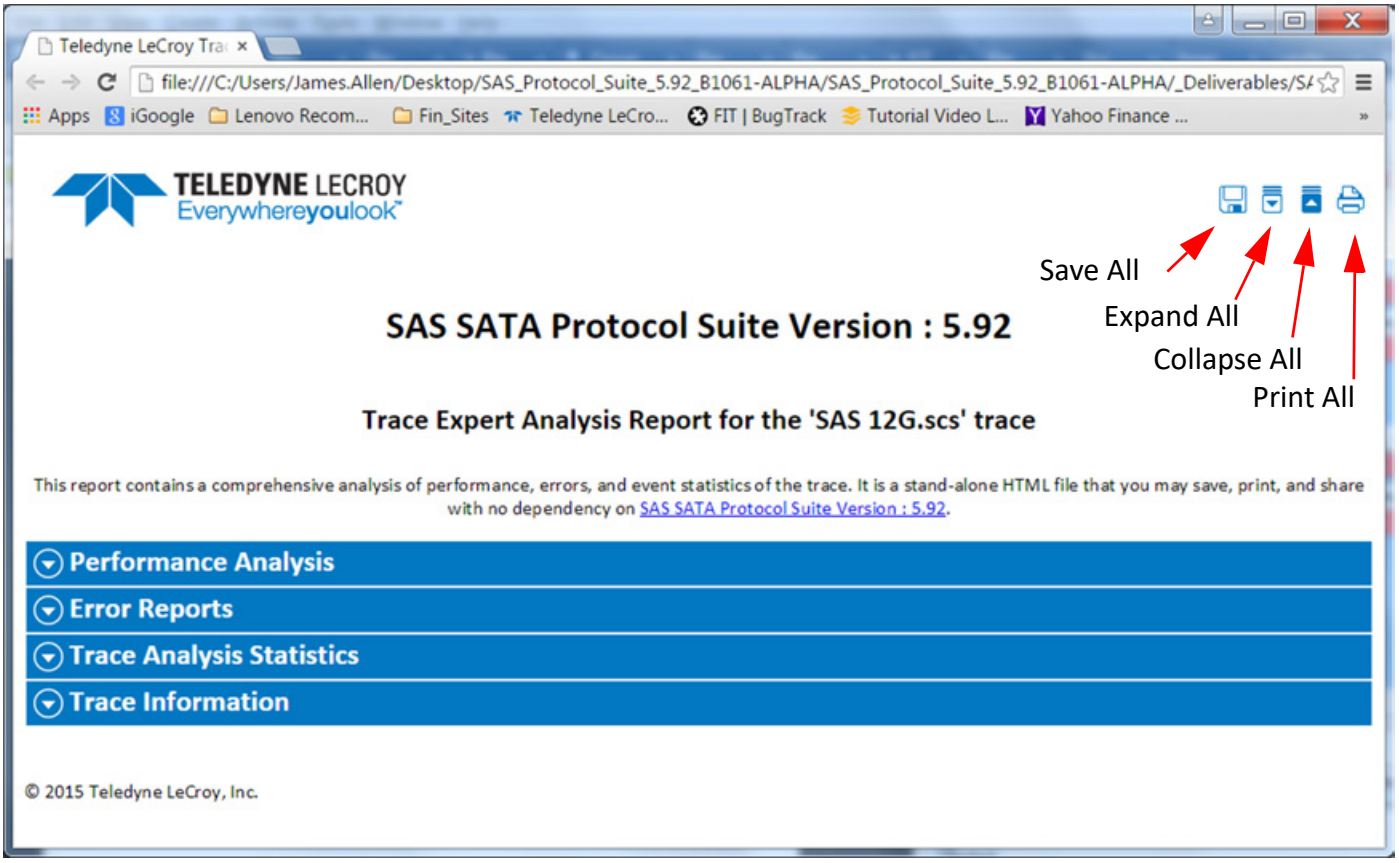


Figure 3.87: Trace Expert: Main Report Dialog

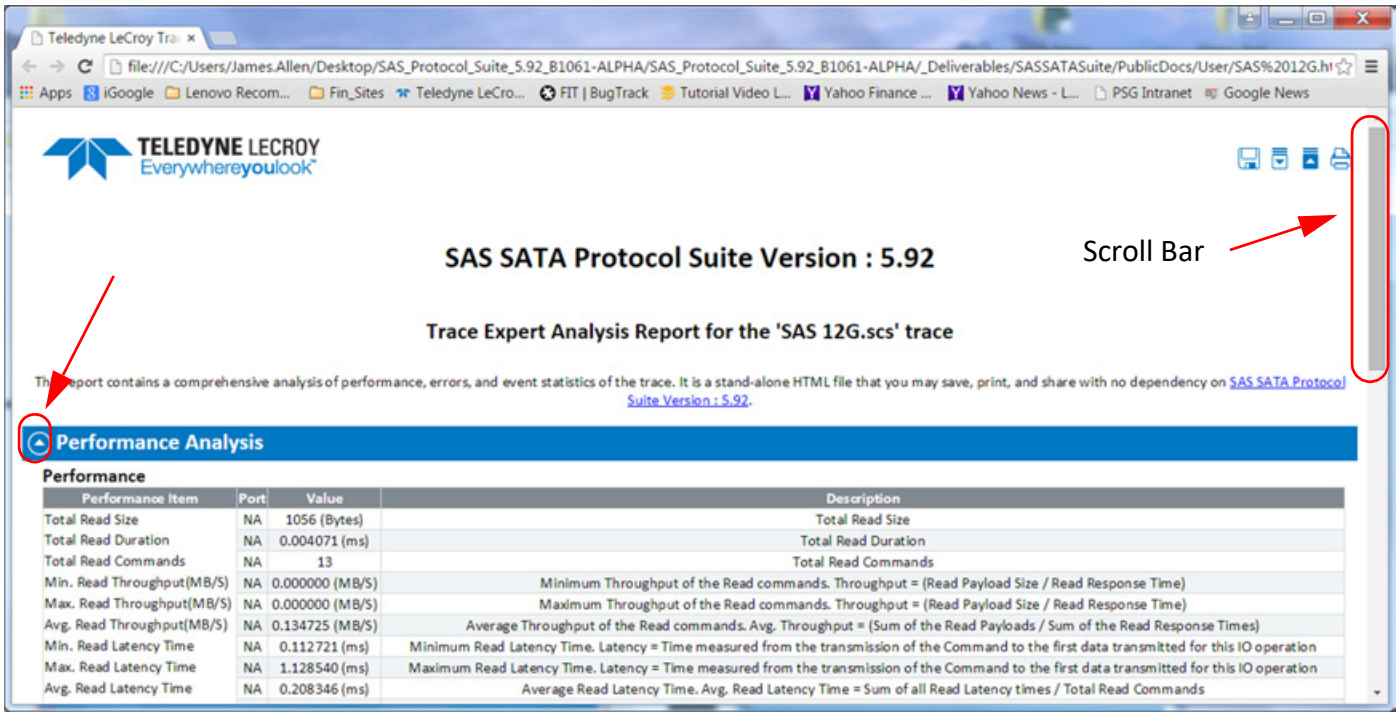
The main window has an Expand All button, a Collapse All button. a Print All button and a Save All button. The Save All button stores the Trace Expert html file to your Download folder.

You can select any of the four topics and information about that topic will be displayed.

If there is no information on any of the four topics, no report will be generated. For instance if no Errors were detected, no report would be generated and the Error Report menu option wouldn't appear.

3.4.1 Performance Analysis

To view Performance Analysis click on that button. See Figure 3.88.



Performance Item	Port	Value	Description
Total Read Size	NA	1056 (Bytes)	Total Read Size
Total Read Duration	NA	0.004071 (ms)	Total Read Duration
Total Read Commands	NA	13	Total Read Commands
Min. Read Throughput(MB/S)	NA	0.000000 (MB/S)	Minimum Throughput of the Read commands. Throughput = (Read Payload Size / Read Response Time)
Max. Read Throughput(MB/S)	NA	0.000000 (MB/S)	Maximum Throughput of the Read commands. Throughput = (Read Payload Size / Read Response Time)
Avg. Read Throughput(MB/S)	NA	0.134725 (MB/S)	Average Throughput of the Read commands. Avg. Throughput = (Sum of the Read Payloads / Sum of the Read Response Times)
Min. Read Latency Time	NA	0.112721 (ms)	Minimum Read Latency Time. Latency = Time measured from the transmission of the Command to the first data transmitted for this IO operation
Max. Read Latency Time	NA	1.128540 (ms)	Maximum Read Latency Time. Latency = Time measured from the transmission of the Command to the first data transmitted for this IO operation
Avg. Read Latency Time	NA	0.208346 (ms)	Average Read Latency Time. Avg. Read Latency Time = Sum of all Read Latency times / Total Read Commands

Figure 3.88: Trace Expert: Performance Analysis

You can use the scroll bar to see more data.

3.4.2 Error Reports

To view the Error Report, click on the that button. See Figure 3.89.

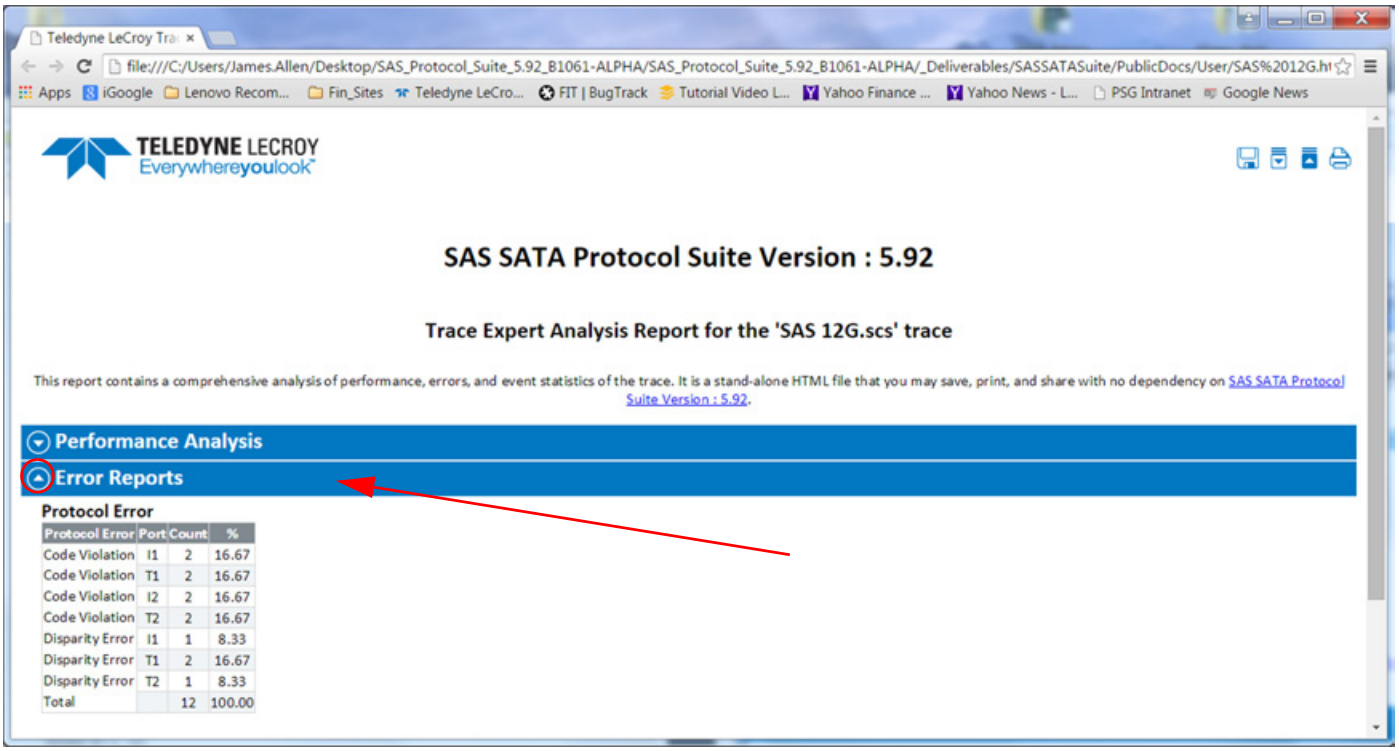
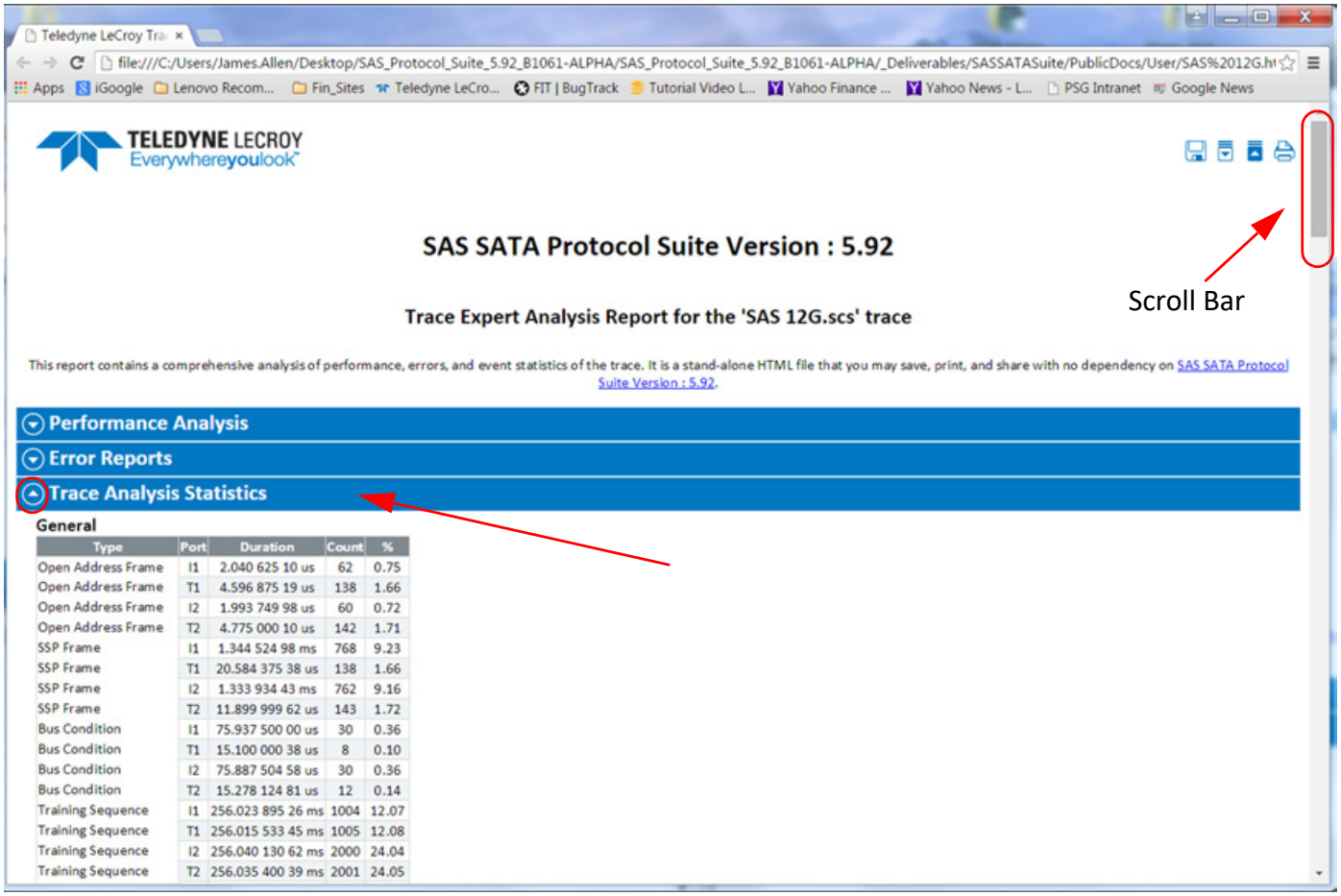


Figure 3.89: Trace Expert: Error Reports

You can use the scroll bar to see more data.

3.4.3 Trace Analysis Statistics

To view the Trace Analysis Statistics, click on the that button. See Figure 3.90.



Type	Port	Duration	Count	%
Open Address Frame	I1	2.040 625 10 us	62	0.75
Open Address Frame	T1	4.596 875 19 us	138	1.66
Open Address Frame	I2	1.993 749 98 us	60	0.72
Open Address Frame	T2	4.775 000 10 us	142	1.71
SSP Frame	I1	1.344 524 98 ms	768	9.23
SSP Frame	T1	20.584 375 38 us	138	1.66
SSP Frame	I2	1.333 934 43 ms	762	9.16
SSP Frame	T2	11.899 999 62 us	143	1.72
Bus Condition	I1	75.937 500 00 us	30	0.36
Bus Condition	T1	15.100 000 38 us	8	0.10
Bus Condition	I2	75.887 504 58 us	30	0.36
Bus Condition	T2	15.278 124 81 us	12	0.14
Training Sequence	I1	256.023 895 26 ms	1004	12.07
Training Sequence	T1	256.015 533 45 ms	1005	12.08
Training Sequence	I2	256.040 130 62 ms	2000	24.04
Training Sequence	T2	256.035 400 39 ms	2001	24.05

Figure 3.90: Trace Expert: Trace Analysis Statistics

You can use the scroll bar to see more data.

3.4.4 Trace File Information

To view the Trace File Information, click on that button. See Figure 3.91.

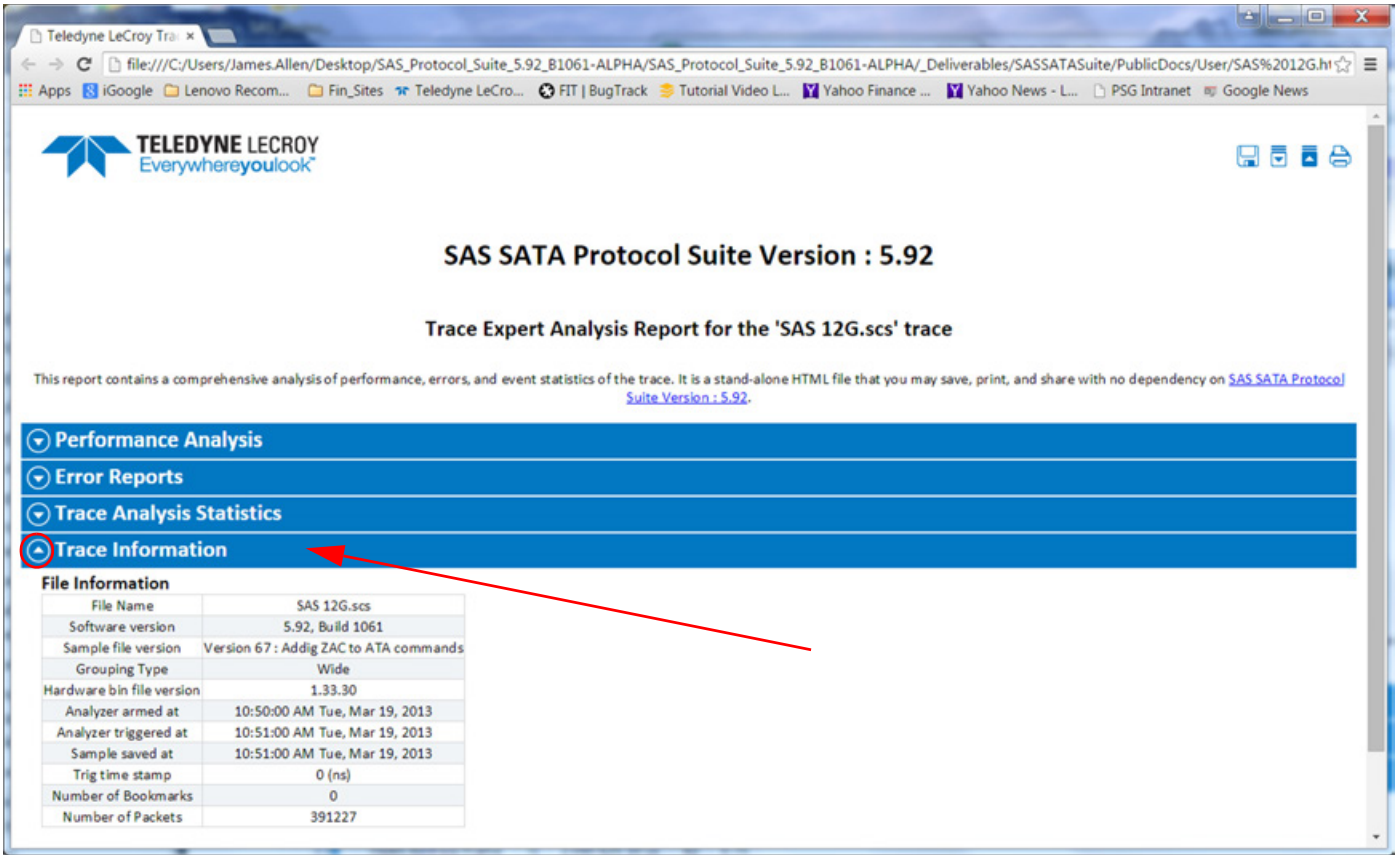


Figure 3.91: Trace Expert: Trace File Information

3.5 Power Tracker View (SATA only)

Click the **Power Tracker View** button on the Viewer toolbar or select **Analysis > Power Tracker View**. The Power Tracker View displays all the power, current and voltage information captured while recording a trace as well as the sample time. See "Power Management Setting (SATA only)" on page 121 for more information.

The power, voltage and current is displayed on the vertical axis and time on the horizontal axis. Hover anywhere over the view to display the information pop-up.

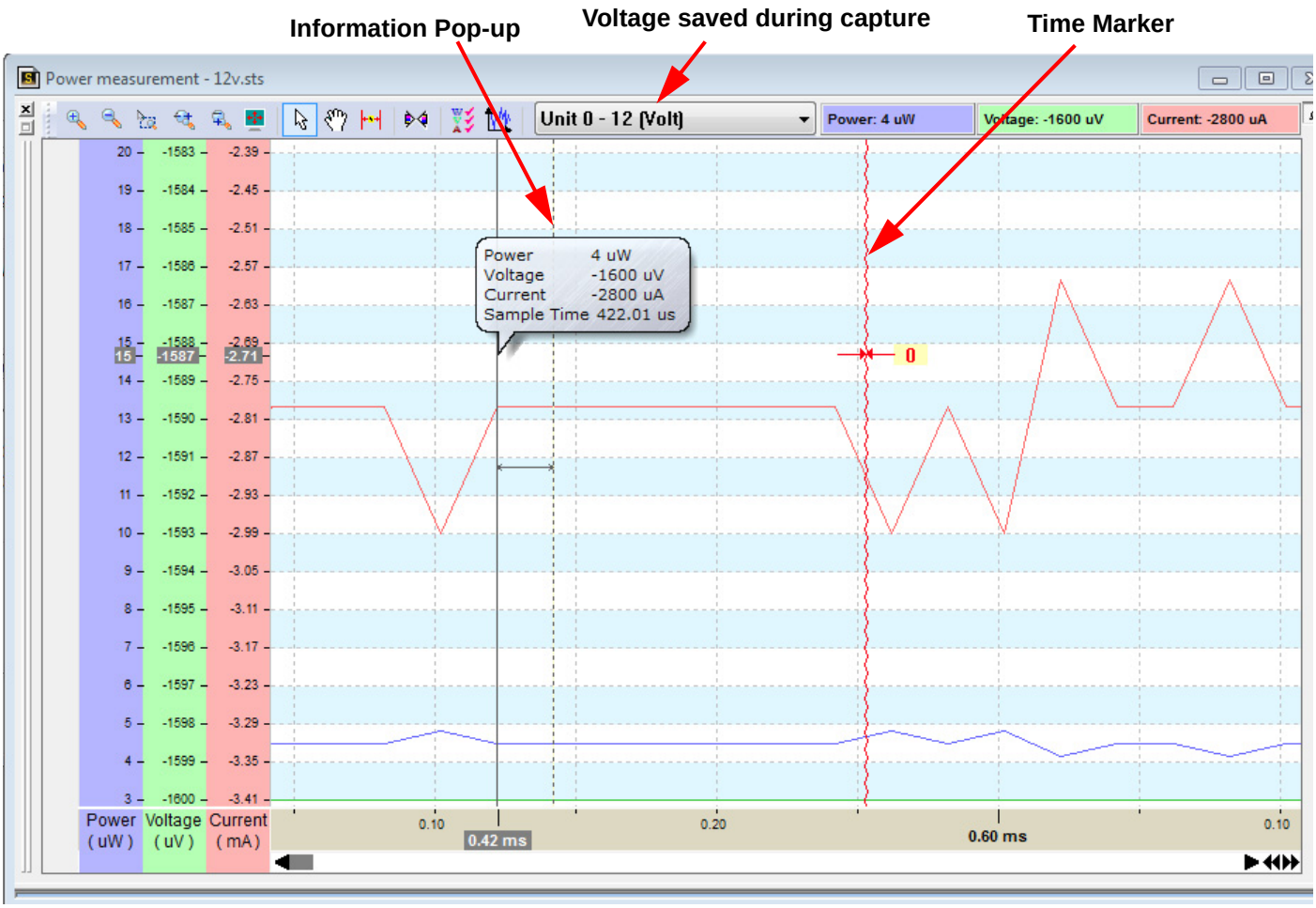
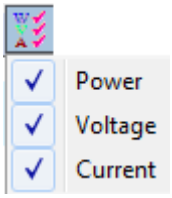
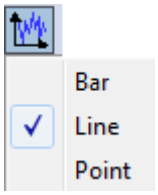


Figure 3.92: SATA: Power Tracker View

	The **Zoom In** button on the toolbar magnifies the data display area on the screen.
	The **Zoom In** button on the toolbar magnifies the data display area on the screen.
	The **Zoom By Selection** button on the toolbar magnifies the user selected area in the view.

	The **Zoom By H Drag** button on the toolbar magnifies the area selected by horizontally dragging and selecting in the view.
	The **Zoom By V Drag** button on the toolbar magnifies the area selected by vertically dragging and selecting in the view.
	The **Full Screen** button on the toolbar Toggles between normal and full screen view.
	The **Pointer Mode** button on the toolbar changes the cursor to a pointer.
	The **Hand Panning** button on the toolbar changes the cursor to a hand for panning.
	The **Insert Time Marker** button on the toolbar enables inserting a time marker at selected spot in the view (see Figure 3.92 on page 299).
	The **Sync by Time** button on the toolbar toggles between synchronizing and un-synchronizing all the views by time.
	The **Show/Hide Power Tracker types: W, V, A** button on the toolbar allows the user to select the parameters to view from the drop-down list.
	The **Change Power Tracker graph type: W, V, A** button on the toolbar allows the user to select one of the three graph types to view from the drop-down list.
	Displays the voltage saved during trace capture. This is selected in the Power Management Setting dialog (see "Power Management Setting (SATA only)" on page 121).

3.6 SAS Verification Tests

SAS Verification consists of a set of selectable tests to verify compliance with the SAS specification.

Note: Speed Negotiation and all other SAS tests are documented in the *SAS Verification Test Descriptions*.pdf. file in the installed Documents directory.

Note: Connecting to an HBA, while running in Emulation/Trainer mode, will impact test results.

To run a SAS Verification Test:

1. Select **Analysis** on the main toolbar and choose **SAS Verification** to open the SAS Verification dialog (see Figure 3.93 on page 301).

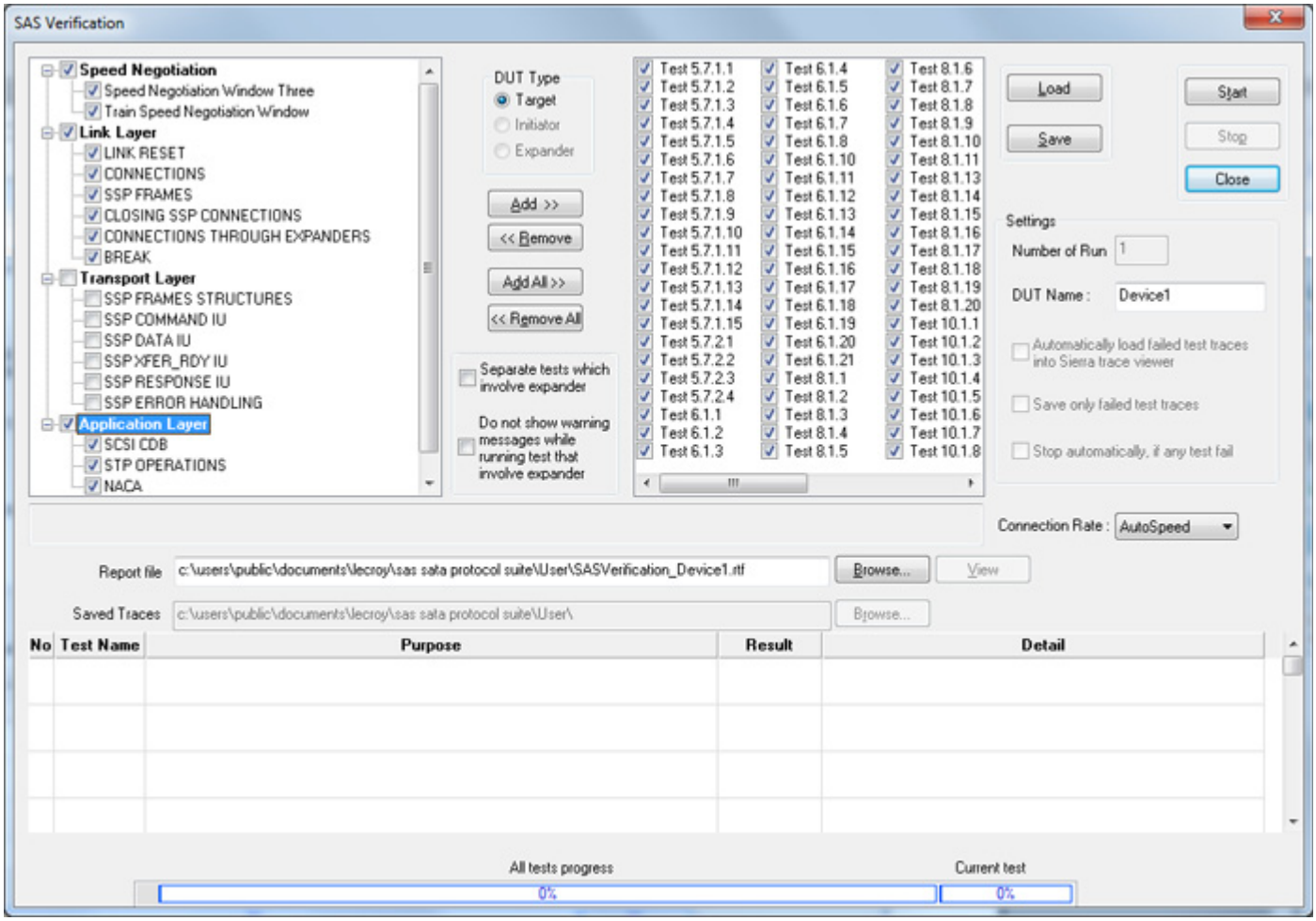


Figure 3.93: Run SAS Verification Scripts Dialog

Speed Negotiation has Speed Negotiation Window Three and Train Speed Negotiation Window.

The Link Layer has Link Reset, Connections, SSP Frames,
Closing SSP Connections, Connections through Expanders, and Break.

The Transport Layer has SSP Frames Structures, Command IU, Data IU,
XFER_RDY IU, Response IU, and Error Handling.

The Application Layer has SCSI CDB, STP and NACA Operations.

2. Choose the tests in the left pane of the dialog and click the **Add>>** button.
3. Enter a value for **DUT Type**: Target, Initiator, or Expander.
4. Enter the **DUT Name**.
5. Enter a value for the **Number of Runs** to run a particular test more than once.
6. Enter the **Connection Rate** as Autospeed or a value.
7. To view failed test traces in the trace viewer, check the **Automatically load failed test traces into Sierra trace viewer** check box.
8. To save the failed test traces only, check the **Save only failed test traces** check box.
9. Enter a path and file name for **Report file**, or use the default file name and path:

For Windows XP:

```
C:\Program Files\LeCroy\SAS SATA Protocol
Suite\User\SASVerification_Device1.rtf
```

For Windows 7:

```
C:\Users\Public\Documents\LeCroy\SAS SATA Protocol
Suite\User\SASVerification_Device1.rtf
```

10. Enter a path and file name for **Saved Traces**, or use the default folder:

For Windows XP:

```
C:\Program Files\LeCroy\SAS SATA Protocol Suite\User\
```

For Windows 7:

```
C:\Users\Public\Documents\LeCroy\SAS SATA Protocol Suite\User\
```

11. After you select tests, click **Start**.
12. The test runs and, after a brief period, displays the result.
13. To save the current compliance setup for later use, click the **Save** button to open the Save As dialog. Assign a meaningful name to the setup and save it as a ***.cst** compliance file.
14. To run a previously defined setup, click the **Load** button and choose a previously defined setup to run.

For the NACA test, both ports of the SAS device must be connected to two Host Emulation ports, I1 and I2, using two SATA cables.

Note: When you are running SAS Verification, you cannot work with Trainer and Emulator while device is connected to D connector and HBA is connected to H connector.

Note: You must use a Power Expansion Card (ACC-EXP-004-x or ACC-EXP-005-X) for the SATA Compliance Test. See “Using the Power Expansion Card” on page 41.

3.7 SATA Compliance Test

3.7.1 SATA Verification

SATA Verification consists of a set of selectable tests to verify compliance with the SATA specification.

Note: The Digital Tests and the Phy Tests are documented in the *SATA_Digital-Device_MOI_LeCroy_1.00_UTD1.4.pdf* file in the installed Documents directory.

Note: Connecting to an HBA, while running in Emulation/Trainer mode, will impact test results.

To run a SATA Compliance Test:

1. Select **Analysis** on the main toolbar and choose **Compliance Test** to open the SATA Compliance Test dialog (see Figure 3.94).

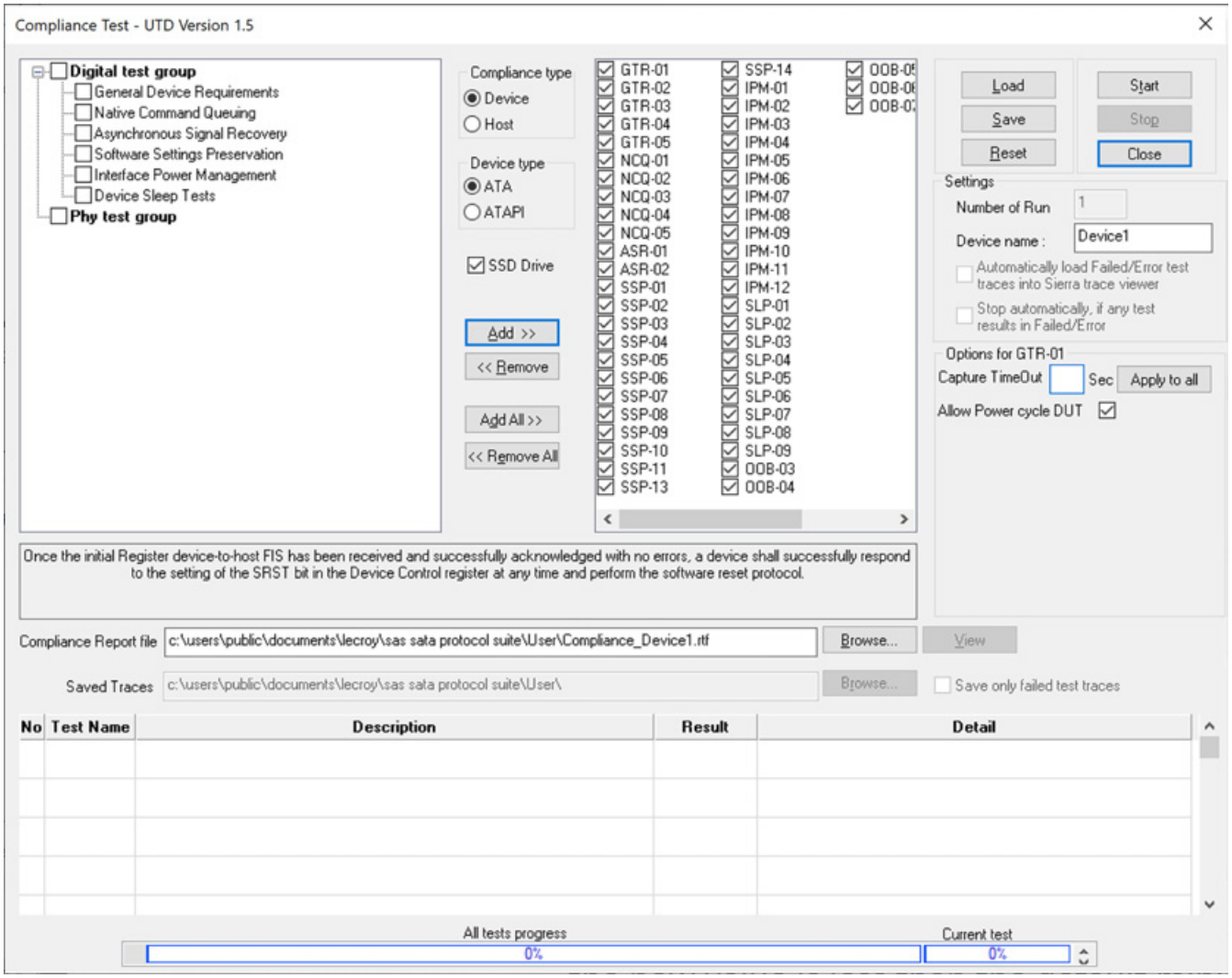


Figure 3.94: Compliance Test Dialog

Load/Save

You may load/save the current-state (all settings along with the currently selected test-cases) of the compliance test in a file.

Reset

Once reset, all the parameters of compliance dialog would go to its default value or state.

Time-out

The time-out values (in second) is specified for all tests. You may change the time-out for the individual test just by selecting the desired test from the selected list. You may also apply the same time-out to all the tests by clicking "Apply to all" button. (Note that all test's time-out would be applied to the new value, except if the new value is less than the default minimum value that are defined for few tests).

Number of Run

You may specify to run more than once. If the number of run is more than 1, the traces and report files would get saved in different folders.

Settings

These are a group of settings which are common to all tests, and can be changed.

Options

These are a group of settings which can be set based on individual test cases.

They get enabled once a test case is selected on the right pane. The current selected test-case name gets appeared in the group-box.

Note: The last recent changes are always kept and reflected back when the compliance dialog gets reopen (even after application restarts).

The Phy Test and Digital Test groups are displayed in the left column. The Digital Tests comprise of the following:

- General Device Requirements
- Native Command Queuing
- Asynchronous Signal Recovery
- Software Settings Preservation
- Interface Power Management

2. Choose the tests in the left pane of the dialog by clicking on the checkboxes and click the **Add>>** button.

   You can add all or remove all by clicking **Add All** or **Remove All**.
3. Select a Compliance Type: Device or Host
4. Select a Device Type: ATA or ATAPI
5. Enter a value for the **Number of Runs** to run a particular test more than once.

6. Enter the **Capture Timeout** value in seconds**.**
7. To view failed test traces in the sample viewer, check the **Automatically load failed test traces into Sierra trace viewer** check box.
8. To save the failed test traces only, check the **Save only failed test traces** check box.
9. Enter a path and file name for **Report file**, or use the default file name and path:

For Windows XP:

```
C:\Program Files\LeCroy\SAS/SATA Protocol
Suite\User\Compliance_Device1.rtf
```

For Windows 7:

```
C:\Users\Public\Documents\LeCroy\SAS SATA Protocol
Suite\User\Compliance_Device1.rtf
```

10. Enter a path and file name for **Saved Traces**, or use the default folder:

For Windows XP:

```
C:\Program Files\LeCroy\SAS SATA Protocol Suite\User\
```

For Windows 7:

```
C:\Users\Public\Documents\LeCroy\SAS SATA Protocol Suite\User\
```

11. After you select tests, click **Start**.
12. The test runs and, after a brief period, displays the result.
13. To save the current compliance setup for later use, click the **Save** button to open the Save As dialog. Assign a meaningful name to the setup and save it as a ***.cst** compliance file.
14. To run a previously defined setup, click the **Load** button and choose a previously defined setup to run.

Note: When you are running the Compliance Test, you cannot work with Trainer and Emulator while the device is connected to a D connector and HBA is connected to an H connector.

3.7.2 SLP (DevSleep) Test Descriptions

SLP-01: IDENTIFY DEVICE Data Log support

Purpose

To verify if the device supports Device Sleep (Word 78 bit 8 cleared to one in IDENTIFY DEVICE), the device shall support the Identify Device data log and the DEVSLP TIMING VARIABLES SUPPORTED bit shall be set to one.

Last Modification

August 27, 2015

Discussion

Host establishes a connection with the DUT and sends an IDENTIFY DEVICE command to check for the supports of Device sleep and General Purpose Logging feature. If it supports, further it continues and send Read Log Ext command to check the support of Identify Device Data Log and DEVSLP TIMING VARIABLES SUPPORTED bit.

A test project is executed via LeCroy Host trainer at the highest supported speed of the device and the resulting trace will be captured; then, the trace is post-processed to verify the complete execution of test project and to check the pass/fail criteria.

Test Project:

- **SLP_01.ssg**

1. Connect to DUT
2. An IDENTIFY DEVICE command is issued to check for the supports of Device Sleep and the GPL feature set.
3. A READ LOG EXT command with Log Address 00h is issued to get the General purpose log directory.
4. A READ LOG EXT command with Log Address 30h, Page 00h is issued to get the Identify Device data log page.
5. A READ LOG EXT command with Log Address 30h, Page 08h is issued to get the Serial ATA log page.

Post process:

o Existing and complete execution of IDENTIFY DEVICE command in the trace is checked to verify the proper execution of the test project. "ERROR" result is reported if the above command is missed and/or not executed completely. Word 78 bit 8 and Word 87 Bit 5 in IDENTIFY DEVICE command are checked. If they are set then continue to the next step, otherwise "N/A" result is reported.

o Existing and complete execution of the first Read Log Ext command in the trace is checked to verify the proper execution of test project. "ERROR" result is reported if the above commands is missed and/or not executed completely. Verify the number of Log pages at Log Address 30h is larger than 1, if not "FAILED" result is reported.

- Existing and complete execution of the second Read Log Ext command in the trace is checked to verify the proper execution of test project. "ERROR" result is reported if the above commands is missed and/or not executed completely. Verify if the Log Page 08h is supported, if not "FAILED" result is reported.
- Existing and complete execution of the third Read Log Ext command in the trace is checked to verify the proper execution of test project. "ERROR" result is reported if the above commands is missed and/or not executed completely. Verify if the Device sleep timing variables supported bit (which is Byte 37h Bit 7) is set, if not "FAILED" result is reported.

Observable Results

Click the "View" button to see a report of the test. A failing test may be viewed by going to the C:\Users\Public\Documents\LeCroy\SAS SATA Protocol Suite\LOG\ directory and double clicking on the appropriate test for analysis.

SLP-02: Default setting for Device Sleep

Purpose

To verify that as a result of processing a power on reset, the Device Sleep feature shall be disabled.

Last Modification

August 27, 2015

Discussion

Host establishes a connection with DUT and sends an SET FEATURE command to enable the device sleep and immediately power cycle the DUT. The Device Sleep enable bit is than checked to be cleared. A similar test is done again if the SSP is supported by the P.U.T by enabling the device sleep using a SET FEATURE command and immediately issuing a COMRESET and complete OOB Sequence and at this time the Device Sleep enable bit is again checked to be cleared.

Test Procedure

A test project is executed via LeCroy Host trainer at the highest supported speed of device and the resulting trace will be captured; then, the trace is post-processed to verify the complete execution of test project and to check the pass/fail criteria. The process is repeated 10 times to be certain of result persistence and signature contents are checked to be correct at every run.

Test Project:

- **SLP_02.ssg**
  1. Connect to DUT
  2. An IDENTIFY DEVICE command is issued to check for the supports of Device Sleep.
  3. A SET FEATURE command (Sector Count = 09h, Features = 10h) is issued to enable device sleep.
  4. Power cycle the DUT.

5. An IDENTIFY DEVICE is issued to check the Device Sleep enable bit. Also a Read Log Ext command is issued to read the Identify Device Data Log page to check the Device Sleep enable bit.
6. A SET FEATURE command (Sector Count = 09h, Features = 10h) is issued to enable device sleep.
7. A COMRESET is sent and complete the OOB sequence.
8. An IDENTIFY DEVICE command is issued to check the Device Sleep enable bit. Also a Read Log Ext command is issued to read the Identify Device Data Log page to check the Device Sleep enable bit.
9. The project is repeated 10 times.

Post process:

o Existing and complete execution of IDENTIFY DEVICE command in the trace is checked to verify the proper execution of test project. "ERROR" result is reported if the above commands is missed and/or not executed completely. Word 78 bit 8 in the IDENTIFY DEVICE command is checked. If it is set then continue to the next step, otherwise "N/A" result is reported.

o Existing and complete execution of the next IDENTIFY DEVICE command in the trace is checked to verify the proper execution of test project. "ERROR" result is reported if the above commands is missed and/or not executed completely. Word 79 bit 8 in IDENTIFY DEVICE is checked and "FAILED" result is reported if the bit is not cleared.

Similarly, Existing and complete execution of the next READ LOG EXT command in the trace is checked to verify the proper execution of test project. "ERROR" result is reported if the above commands is missed and/or not executed completely. BYTE 17 bit 2 in the Identify device Data Log is checked and "FAILED" result is reported if the bit is not cleared.

o Word 78 Bit 6 and Word 79 bit 6 of the IDENTIFY DEVICE command are checked here, and if they are set (i.e. SSP bit is supported and enabled) test stops here.

o Existing and complete execution of the next IDENTIFY DEVICE command in the trace is checked to verify the proper execution of test project. "ERROR" result is reported if the above commands is missed and/or not executed completely. Word 79 bit 8 in IDENTIFY DEVICE is checked and "FAILED" result is reported if the bit is not cleared.

Similarly, Existing and complete execution of the next READ LOG EXT command in the trace is checked to verify the proper execution of test project. "ERROR" result is reported if the above commands is missed and/or not executed completely. BYTE 17 bit 2 in the Identify device Data Log is checked and "FAILED" result is reported if the bit is not cleared.

Observable Results

Click the "View" button to see a report of the test. A failing test may be viewed by going to the C:\Users\Public\Documents\LeCroy\SAS SATA Protocol Suite\LOG\ directory and double clicking on the appropriate test for analysis.

SLP-03: Device Sleep Enable/Disable States

Purpose

To verify that the state of device sleep feature is reflected in the Identify Device and Identify Device Data Log.

Last Modification

August 27, 2015

Discussion

Host establishes connection with DUT and enables the device sleep feature using a SET FEATURE command, and immediately checks if it has been reflected in the Identify Device and Identify Device Data Log page. Again, disable the device sleep feature using SET FEATURE command, and check if it has been reflected in the Identify Device and Identify Device Data Log page.

Test Procedure

A test project is executed via LeCroy Host trainer at the highest supported speed of device and the resulting trace will be captured; then, the trace is post-processed to verify the complete execution of test project and to check the pass/fail criteria.

Test Project:

- **SLP_03.ssg**

1. Connect to DUT
2. An IDENTIFY PACKET DEVICE command is issued to check for the supports of Device Sleep.
3. A SET FEATURES (Sector Count = 09h, Features = 10h) is issued to enable device sleep.
4. An IDENTIFY DEVICE is issued to check the Device Sleep enable bit. Also a Read Log Ext command issued to read the Identify Device Data Log page to check the Device Sleep enable bit.
5. A SET FEATURES (Sector Count = 09h, Features = 90h) is issued to disable device sleep.
6. An IDENTIFY DEVICE is issued to check the Device Sleep enable bit. Also a Read Log Ext command issued to read the Identify Device Data Log page to check the Device Sleep enable bit.

Post process:

o Existing and complete execution of IDENTIFY DEVICE command in the trace is checked to verify the proper execution of test project. “ERROR” result is reported if the above commands is missed and/or not executed completely. Word 78 bit 8 in IDENTIFY DEVICE command is checked. If it is set to one then continue to the next step, otherwise “N/A” result is reported.

o Existing and complete execution of the next IDENTIFY DEVICE command in the trace is checked to verify the proper execution of test project. "ERROR" result is reported if the above

commands is missed and/or not executed completely. Word 79 bit 8 in IDENTIFY DEVICE is checked and "FAILED" result is reported if the bit is not set.

Similarly, Existing and complete execution of the next READ LOG EXT command in the trace is checked to verify the proper execution of test project. "ERROR" result is reported if the above commands is missed and/or not executed completely. BYTE 17 bit 2 in the Identify device Data Log is checked and "FAILED" result is reported if the bit is not set.

o Again, existing and complete execution of the next IDENTIFY DEVICE command in the trace is checked to verify the proper execution of test project. "ERROR" result is reported if the above commands is missed and/or not executed completely. Word 79 bit 8 in IDENTIFY DEVICE is checked and "FAILED" result is reported if the bit is not cleared.

Similarly, Existing and complete execution of the next READ LOG EXT command in the trace is checked to verify the proper execution of test project. "ERROR" result is reported if the above commands is missed and/or not executed completely. BYTE 17 bit 2 in the Identify device Data Log is checked and "FAILED" result is reported if the bit is not cleared.

Observable Results

Click the "View" button to see a report of the test. A failing test may be viewed by going to the C:\Users\Public\Documents\LeCroy\SAS SATA Protocol Suite\LOG\ directory and double clicking on the appropriate test for analysis.

SLP-04: Lack of Device Sleep support

Purpose

If a device does not support Device Sleep (Word 78 bit 8 cleared to zero in IDENTIFY DEVICE), Set Features to enable Device Sleep shall return command aborted.

Last Modification

December 29, 2015

Discussion

Host establishes connection with DUT and enables the device sleep feature using a SET FEATURE command, and verifies if the DUT aborts the command.

Test Project:

- **SLP_04.ssg**

1. Connect to DUT.
2. An IDENTIFY PACKET DEVICE command is issued to check for the supports of Device Sleep.
3. A SET FEATURES (Sector Count = 09h, Features = 10h) is issued to enable device sleep.
4. An IDENTIFY DEVICE is issued to check the Device Sleep enable bit.

Post process:

o Existing and complete execution of IDENTIFY DEVICE command in the trace is checked to verify the proper execution of test project. Error result is reported if the above commands is missed and/or not executed completely. Word 78 bit 8 in IDENTIFY DEVICE command is checked. If it is set to zero then continue to the next step, otherwise "N/A" result is reported since the DUT supports device sleep.

o Existing of Set feature command in the trace is checked, Error is reported if it is not found. The status of the command is checked to be aborted; if not "FAILED" result is reported.

o Existing and complete execution of IDENTIFY DEVICE command in the trace is checked, Error result is reported if the above commands is missed and/or not executed completely. Word 79 bit 8 in is checked, and if it is not cleared "FAILED" result is reported.

Observable Results

Click the "View" button to see a report of the test. A failing test may be viewed by going to the C:\Users\Public\Documents\LeCroy\SAS SATA Protocol Suite\LOG\ directory and double clicking on the appropriate test for analysis.

SLP-05: Info Consistency between IDENTIFY DEVICE and IDENTIFY DEVICE Data Log

Purpose

If a device supports Device Sleep, than word 78-Bit 8(DEVICE SLEEP SUPPORTED), word 79-bit 8(DEVICE SLEEP ENABLED), word 77-bit 7(DEVSLEEP_TO_REDUCEDPWRSTATE CAPABILITY SUPPORTED) of Identify device are copies of word11-bit 1, word11-bit 2 and word17-bit2 of the Identify device data log page.

Last Modification

December 29, 2015

Discussion

Host establishes connection with DUT and issue an identify-device command, and a Read Log Ext command to receive the Identify device data log page. Later, the above mentioned bits are compared to be consistent.

Test Project:

- **SLP_05.ssg**

1. Connect to DUT
2. An IDENTIFY PACKET DEVICE command is issued.
3. A Read Log Ext command with Log Address 30h, Page 08h is issued.

Post process:

o Existing and complete execution of IDENTIFY DEVICE command in the trace is checked to verify the proper execution of test project. Error result is reported if the above commands is missed and/or not executed completely. Word 78 bit 8 in IDENTIFY DEVICE command is checked. If it is set to one then continue to the next step, otherwise "N/A" result is reported.

o Existing and complete execution of Read Log Ext command in the trace is checked to verify the proper execution of test project. Error result is reported if the above commands is missed and/or not executed completely.

o Compare the following bits, and "FAILED" result is reported if they are not matched.

Word 78-Bit 8 (DEVICE SLEEP SUPPORTED) of Identify device with Word 11-bit 1 of Identify device page.

Word 79-bit 8(DEVICE SLEEP ENABLED) of Identify device with Word 17-bit 2 of Identify device page.

Word 77-bit 7(DEVSLEEP_TO_REDUCEDPWRSTATE CAPABILITY SUPPORTED) of Identify device with Word 11-bit 2 of Identify device page.

Observable Results

Click the "View" button to see a report of the test. A failing test may be viewed by going to the C:\Users\Public\Documents\LeCroy\SAS SATA Protocol Suite\LOG\ directory and double clicking on the appropriate test for analysis.

SLP-06: Device Sleep invoked from different power states

Purpose

If a device supports Device Sleep, it can enter to device sleep state from either Active/Partial/ slumber state.

Last Modification

December 29, 2015

Discussion

Host establishes a connection with DUT, and finds the different power-management features it supports by issuing an Identify device command. Depending on the feature it supports (HIPM/ DIPM); it makes the DUT to enter into different states like Active/Partial/Slumber, and then asserts device-sleep. The DUT is verified whether it enters to the device-sleep state by measuring the power drawing by it. The process is repeated 10 times for each state Active/Partial/Slumber.

Test Project:

- **PMFeatures.ssg**

1. Connect to DUT.
2. An IDENTIFY PACKET DEVICE command is issued to read different features that are supported by the DUT.
3. To find whether the device supports partial or Slumber or both states, issue PMREQ_P and PMREQ_S individually and check for the device response for the PM request(s).

- **SLP_PMState.ssg**

1. Connect to DUT.
2. A Set Feature command is issued to enable the device sleep feature.
3. Following steps are executed for Partial/Slumber states.
4. If the device supports HIPM.
5. Issue PMREQ (Partial or Slumber depending on the current test iteration) and wait for the device's response.
6. If the device doesn't supports HIPM, but DIPM
7. A Set Feature command is issued to enable DIPM, and wait for a PM request from the device side.
8. If PM request is not received within 10 seconds, a Standby Immediate command is issued, and waits for a PM request from the device side.
9. Assert Device Sleep after 5 seconds.
10. De-Assert Device Sleep. (Just to make the DUT ready for the next test iteration.)

Post process:

- **PMFeatures.ssg**

1. Existing and complete execution of IDENTIFY DEVICE command in the trace is checked to verify the proper execution of test project. Error result is reported if the above commands is missed and/or not executed completely.
2. Noted the different features like DeviceSleepSupported/ DevSleep_to_ReducePwrState/HIPM/DIPM etc.
3. To identify the PM states (Partial/Slumber), PMACK is looked on the trace against PMREQ_S and PMREQ_S.

- **SLP_PMState.ssg**

1. From the above noted features, "N/A" result is reported if one of the following occurs.
2. Device sleep is not supported.
3. Device supports DIPM, but doesn't accept either partial or Slumber request.
4. Following processing is done for each iteration.
5. Existing of Set feature command and its status is checked, Error is reported if it is not found or status is not good.
6. If the current checking (iteration) is for partial/slumber states, PM-Request and PMACK are checked on the trace and error is reported if they are not found.
7. Find the Device sleep assertion, error result is reported if not found.
8. Measure the power consumption (current drawing by the DUT) while the DUT is on active/partial/slumber state, and during the device sleep. These 2 current-measurements are than compared, and check that the current while the DUT is on device sleep is less than the current while the DUT is on active/partial/slumber state. If it is found to be not less "FAILED" result is reported.
9. If in any iteration (10-times for each state), there is a Failed/Error case, the final result is reported as "FAILED" or error, otherwise reported as "PASSED".

Observable Results

Click the "View" button to see a report of the test. A failing test may be viewed by going to the C:\Users\Public\Documents\LeCroy\SAS SATA Protocol Suite\LOG\ directory and double clicking on the appropriate test for analysis.

SLP-07: Device Sleep with Reduced Power State support

Purpose

If the DEVSLEEP_TO_REDUCEDPWRSTATE CAPABILITY SUPPORTED bit is set to one, then the device supports maintaining whether it was in Partial or Slumber after detection of assertion, and subsequent detection of negation, of DEVSLP.

Last Modification

December 30, 2015

Discussion

Host establishes a connection with DUT, and finds the different power-management features it supports by issuing an Identify device command. Depending on the feature it supports (HIPM/ DIPM); it makes the DUT to enter into different states like Partial/Slumber, and then asserts device-sleep and de-asserts it again. The DUT is verified whether it retains the same state that was before assertion and after de-assertion.

Test Project:

- **PMFeatures.ssg**

1. Connect to DUT.
2. An IDENTIFY PACKET DEVICE command is issued to read different features that are supported by the DUT.
3. To find whether the device supports partial or Slumber or both states, issue PMREQ_P and PMREQ_S individually and check for the device response for the PM request(s).

- **SLP_PMState.ssg**

1. Connect to DUT.
2. A Set Feature command is issued to enable the device sleep feature.
3. Following steps are executed for Partial/Slumber states.
4. If the device supports HIPM.
5. Issue PMREQ (Partial or Slumber depending on the current test iteration) and wait for the device's response.
6. If the device doesn't supports HIPM, but DIPM.
7. A Set Feature command is issued to enable DIPM, and wait for a PM request from the device side.
8. If PM request is not received within 10 seconds, a Standby Immediate command is issued, and waits for a PM request from the device side.
9. Assert Device Sleep after 5 seconds.
10. De-Assert Device Sleep after 5 seconds.

Post process:

- **PMFeatures.ssg**

1. Existing and complete execution of IDENTIFY DEVICE command in the trace is checked to verify the proper execution of test project. Error result is reported if the above commands is missed and/or not executed completely.
2. Noted the different features like DeviceSleepSupported/ DevSleep_to_ReducePwrState/HIPM/DIPM etc.
3. To identify the PM states (Partial/Slumber), PMACK is looked on the trace against PMREQ_S and PMREQ_S.

- **SLP_PMState.ssg**

1. From the above noted features, "N/A" result is reported if one of the following occurs.
2. Device sleep is not supported.
3. DevSleep_to_ReducePwrState is not supported.
4. Device supports DIPM, but doesn't accept either partial or Slumber request.
5. Following processing is done for each iteration:
6. Existing of Set feature command and its status is checked, Error is reported if it is not found or status is not good.
7. If the current checking (iteration) is for partial/slumber states, PM-Request and PMACK are checked on the trace and error is reported if they are not found.
8. Find the Device sleep Assertion, error result is reported if not found.
9. Measure the power consumption (current drawing by the DUT) while the DUT is on partial/slumber state, and during the device sleep. These 2 current-measurements are than compared, and check that the current while the DUT is on device sleep is less than the current while the DUT is on partial/slumber state. If it is found to be not less "FAILED" result is reported.
10. Find the Device sleep De-Assertion, error result is reported if not found.
11. Measure the power consumption (current drawing by the DUT) here again (i.e. considered as after device sleep negation). This measurement is than compared with the measurement that was taken while the DUT is on partial/Slumber state. If they are not equal, "FAILED" result is reported.
12. If in any iteration (10-times for each state), there is a Failed/Error case, the final result is reported as "FAILED" or error, otherwise reported as "PASSED".

Observable Results

Click the "View" button to see a report of the test. A failing test may be viewed by going to the C:\Users\Public\Documents\LeCroy\SAS SATA Protocol Suite\LOG\ directory and double clicking on the appropriate test for analysis.

3.8 Running Verification Script Engine (VSE)

You can perform custom post-process analysis of the open trace by running a verification script over the trace. A verification script instructs the application to send trace and analysis information to the script. A verification script also contains script code, written using CATC Script Language (CSL) (see the **CSL_RefManual.pdf** document in the **docs** directory of the installation), used to process trace data and output that data in different formats.

Note: You may write your own verification scripts to perform custom verification and analysis. For information on how to write a verification script, see the *Verification Script Engine Reference Manual*.

To run a verification script over a trace:

1. Select the main menu item **Analysis > VSE** or click the **Running verification scripts** button  on the main tool bar. The Run Verification Scripts dialog opens (see Figure 3.95 on page 317), from which you choose and then run one or several verification scripts:

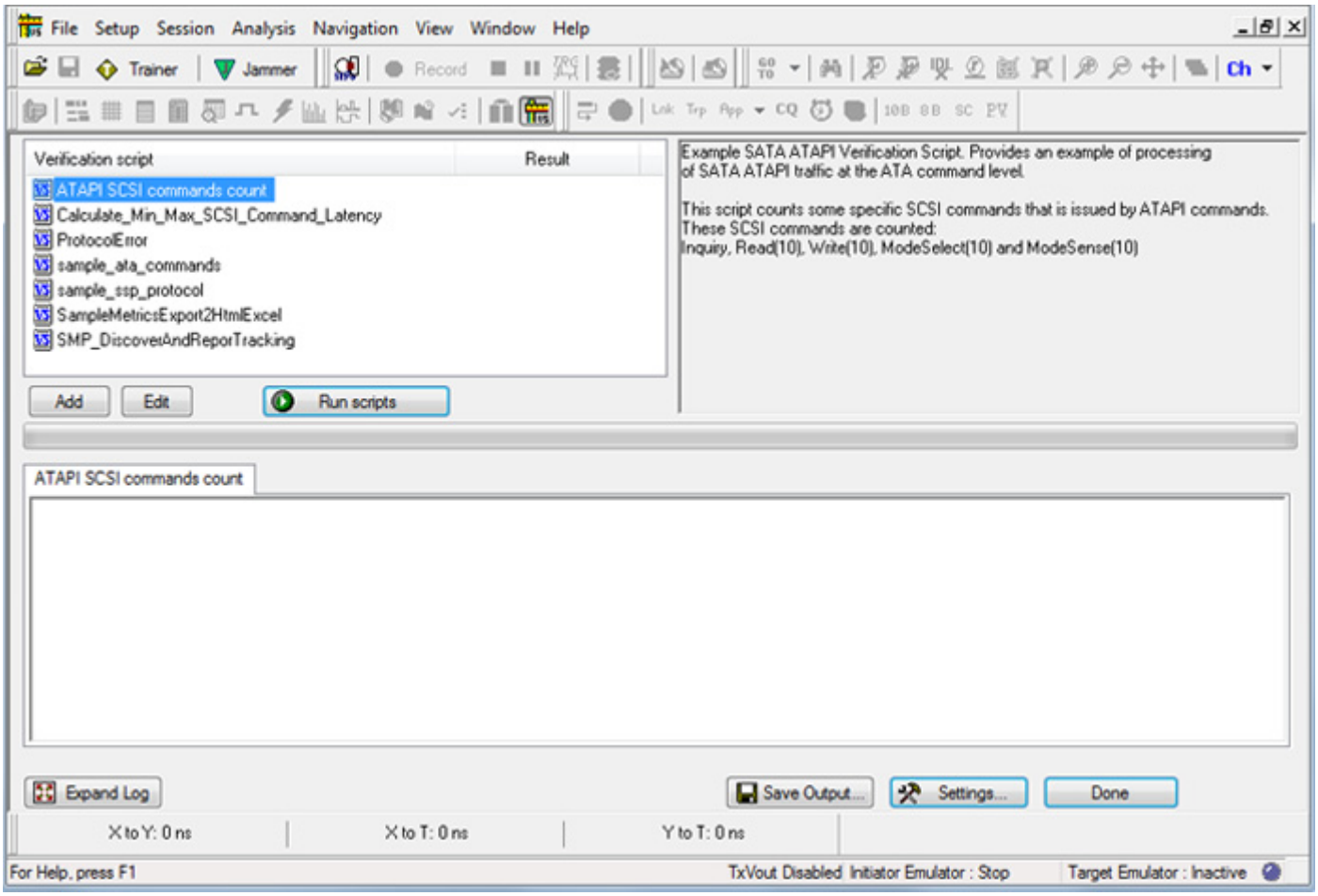


Figure 3.95: Run Verification Scripts Dialog

To expand the Log window, click the **Expand Log** button. The Log window fills the whole window. To see the Verification Scripts window again, click the Collapse Log button.

To save output, click the **Save Output** button.

2. After choosing **Settings** from the drop-down list or the button, the Settings dialog displays:

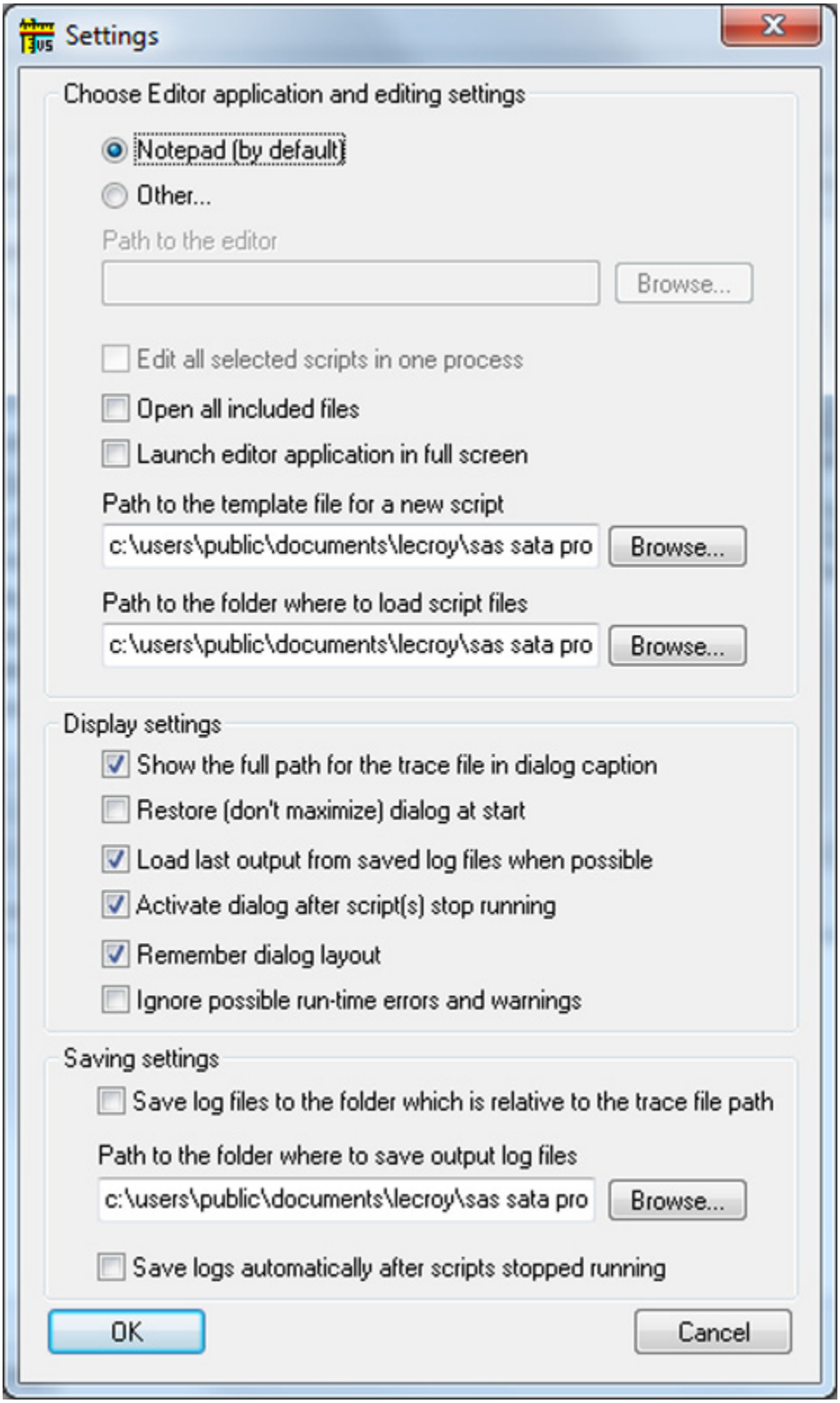


Figure 3.96: Run Verification Scripts - Settings Dialog

Choose the editor application: Notepad or other.

Edit all selected scripts in one process: If the editor supports multiple documents, you can edit all scripts in the editor.

Open all included files: You can edit included files, as well as the main script.

Launch editor application in full screen: You can use whole screen.

Path to the template file for a new script: You can use a template for the script.

Display Settings can show full trace-file path, restore dialog at start, load last output from save log files, activate dialog after scripts have run, remember dialog layout, and ignore errors and warnings.

Saving Settings can save log files to relative file folder, indicate output-log-file path, and save logs automatically.

3. Click the **Run scripts** button after you select scripts to run. VSE starts running the selected verification scripts, shows script report information in the output windows, and presents the results of verifications in the script list:

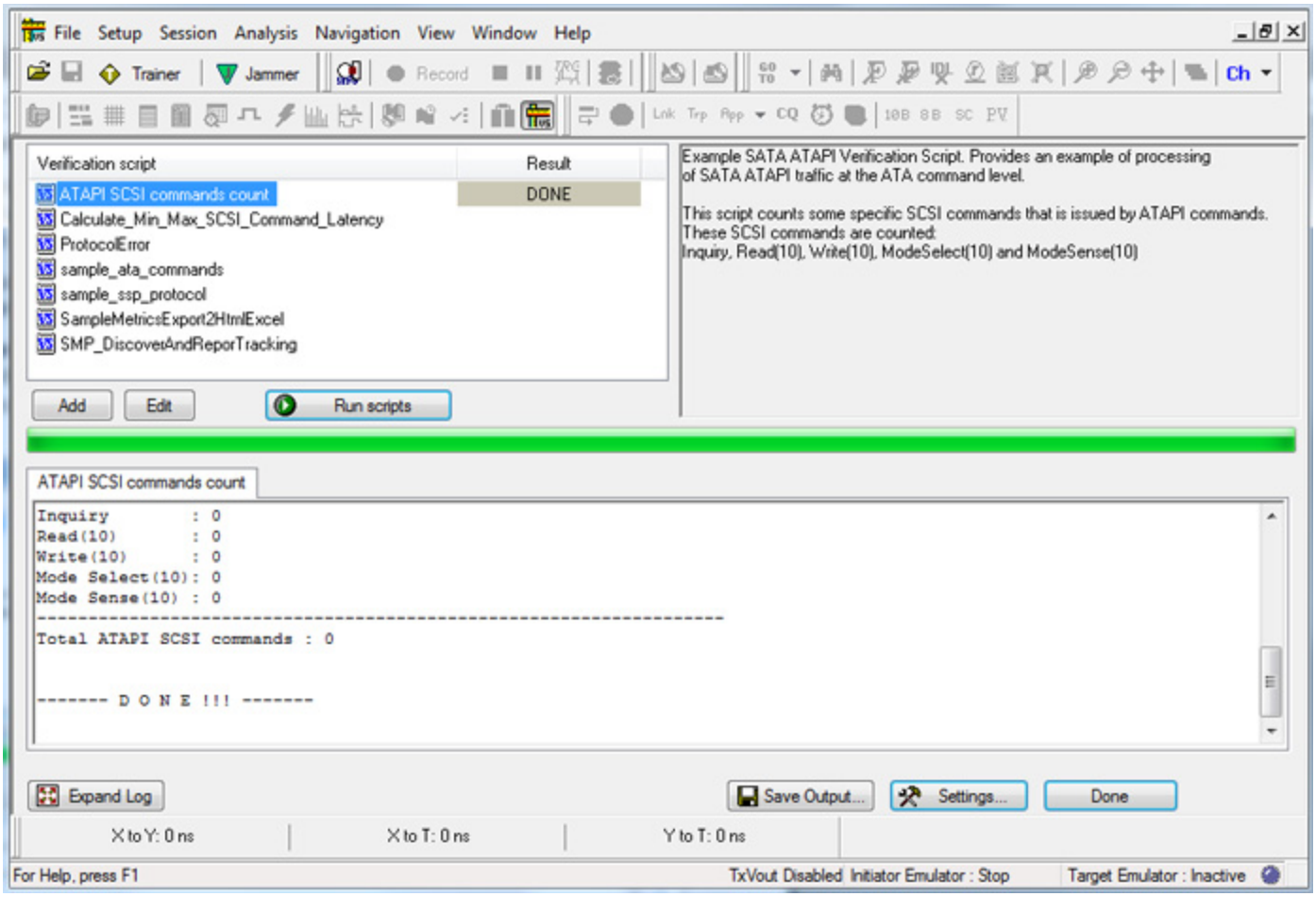


Figure 3.97: Run Verification Scripts Dialog

4. Right-clicking in the script list displays some additional operations over selected scripts:

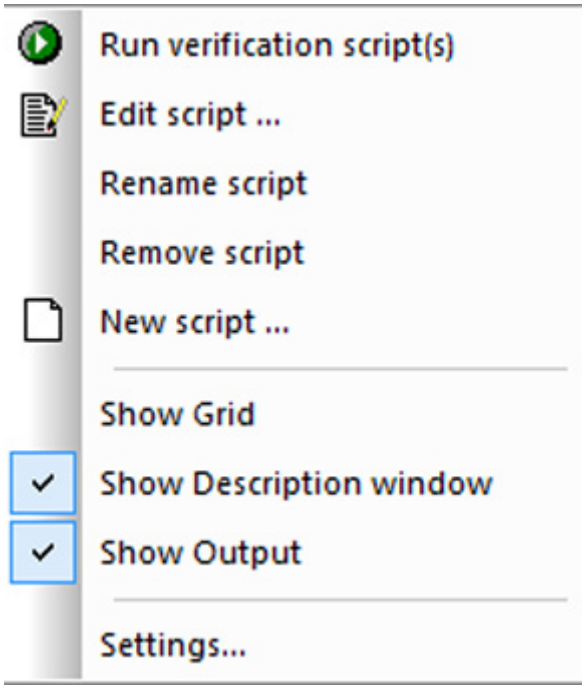


Figure 3.98: Run Verification Scripts - Menu

Run verification script(s): Start running selected script(s).

Edit script: Edit selected scripts in the editor application specified in Editor settings.

Rename script: Allows you to rename the selected script.

Remove script: Displays prompt for confirming removal of script.

New script: Create a new script file using the template specified in Editor settings.

Show Grid: Show/hide a grid in the verification script list.

Show Description window: Show/hide the script description window (Shortcut key F2).

Show Output: Show/hide the script output windows (Shortcut key F3).

Settings: Open a special Setting dialog to specify different settings for VSE.

3.9 Navigation + View Toolbar

The Navigation + View toolbar allows you to navigate, search filter, hide RRDY/all primitives and unassociated traffic, zoom, tile views and select ports.

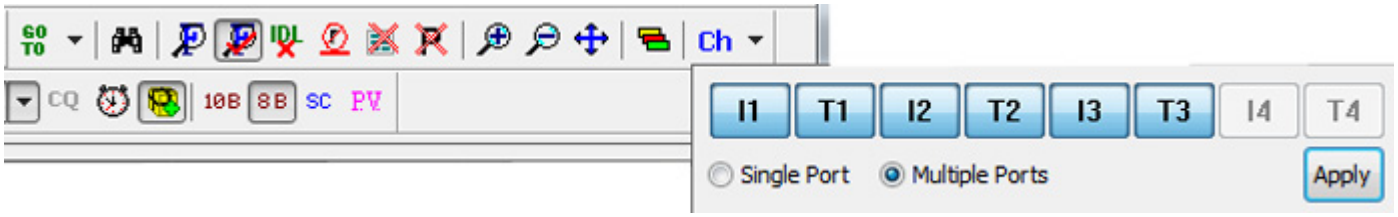


Figure 3.99: Navigation Toolbar

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	The down arrow on the **Go To** button allows location of cursors or specific packets: Trigger Position, X Position, Y Position, Packet Number, Timestamp, Bookmark, Begin, and End.
	The **Search** button opens the search dialog (see "Search" on page 343).
	The **Filtering Setup** button opens the Filter dialog (see "Filtering" on page 328) and allows you to specify the criteria for filtering the result.
	The **Enable Disable Filtering** button toggles the result between a filtered and unfiltered view (see "Filtering" on page 328).
	The **Filter Idle** button toggles the display to show/hide idle packets (see "Filtering" on page 328).
	The **Hide RRDY Primitives** button toggles the display to show/hide RRDY primitives (see "Filtering" on page 328).
	The **Hide Unassociated Traffic** button toggles the display to show/hide unassociated traffic (see "Filtering" on page 328).

	The **Hide All Primitives** button toggles the display to show/hide all primitives (see "Filtering" on page 328. **Note:** When capturing PM traces, you need the ability to filter the PM primitives so you can find commands quicker.
	The **Zoom In** button on the Viewer Setting Toolbar magnifies the data display area on the screen. Clicking this button in Column or Text View increases column width only.
	The **Zoom Out** button on the Viewer Setting Toolbar scales the data display area to display more data lines on the screen. Clicking this button in Column or Text View decreases column width only.
	The **Normal Zoom** button on the Viewer Setting Toolbar resets the zoom to default normal on the screen. Clicking this button in Column or Text View resets column width only.
	You can use **Tile Horizontally All Views icon** or select **View > Tile Views** to revert any unintended window docking or sizing, or maximize screen utilization. This function only tiles views inside a trace window. Note that there is no command to tile views vertically.
	You can use this tool to incrementally Show or Hide Ports, either one at a time, or multiple ports at the same time. For multiple ports, select the desired ports to Show or Hide, and click **Apply** (see "Show/Hide Ports" on page 351).

3.9.1 Go To Menu

Locate Cursors

To quickly locate any cursor within the data viewer display, click the **Go To** button and choose the cursor to locate. You can also locate a cursor by selecting **Go To** from the Edit menu and choosing the cursor to locate.

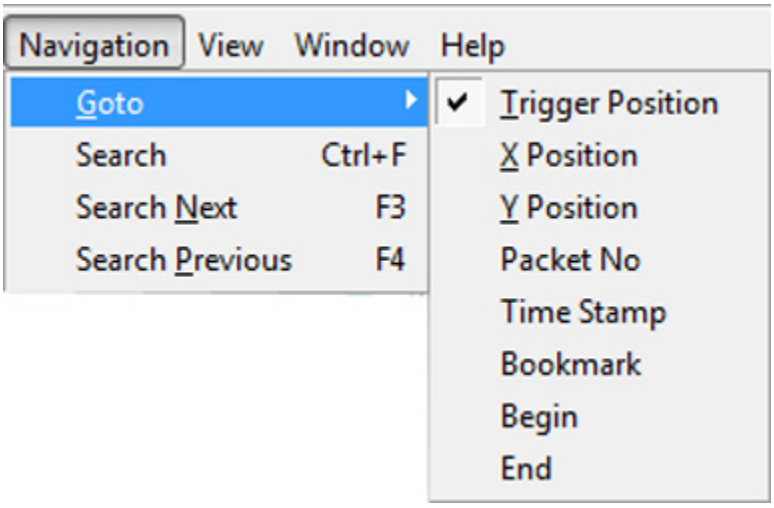


Figure 3.100: Locate Cursors

Go to Time Stamp

To locate a timestamp, click the **Go To** button and choose **Timestamp (see the following screen capture**.)

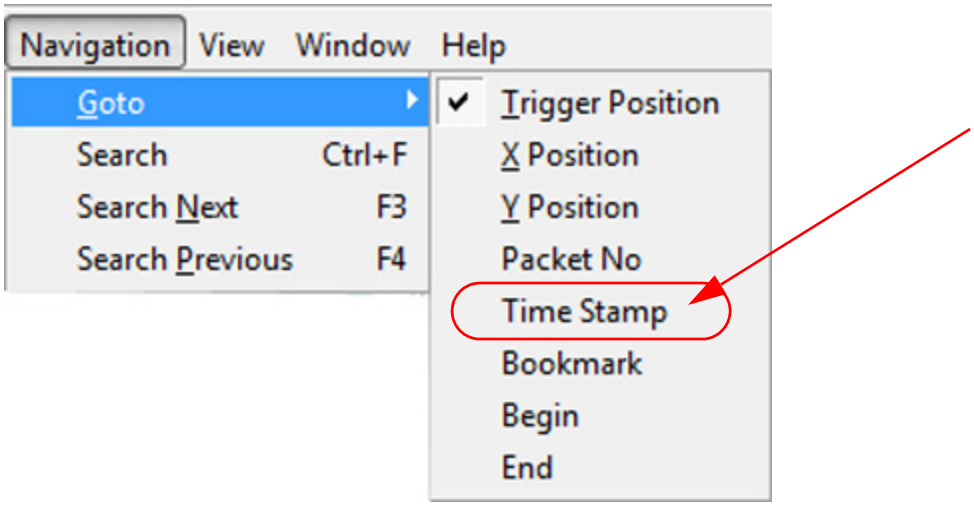


Figure 3.101: Time Stamp

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

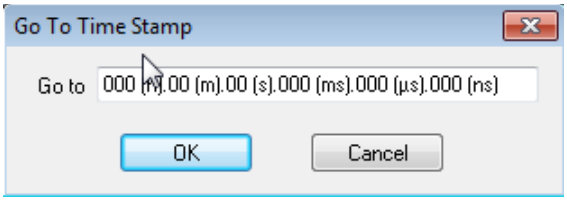


Figure 3.102: Go to Time Stamp

Bookmarks

Bookmarks are a convenient way to mark a point in the data viewer display by name, so that you can rapidly return to that point. To create a bookmark, right-click the mouse in the data viewer area on a packet in which to place the bookmark.

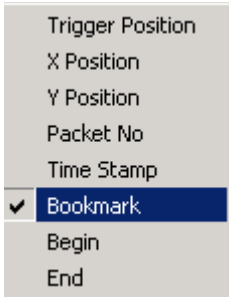


Figure 3.103: Bookmark

Click **Bookmark** from the fly out menu to open the Bookmark Comment Dialog.

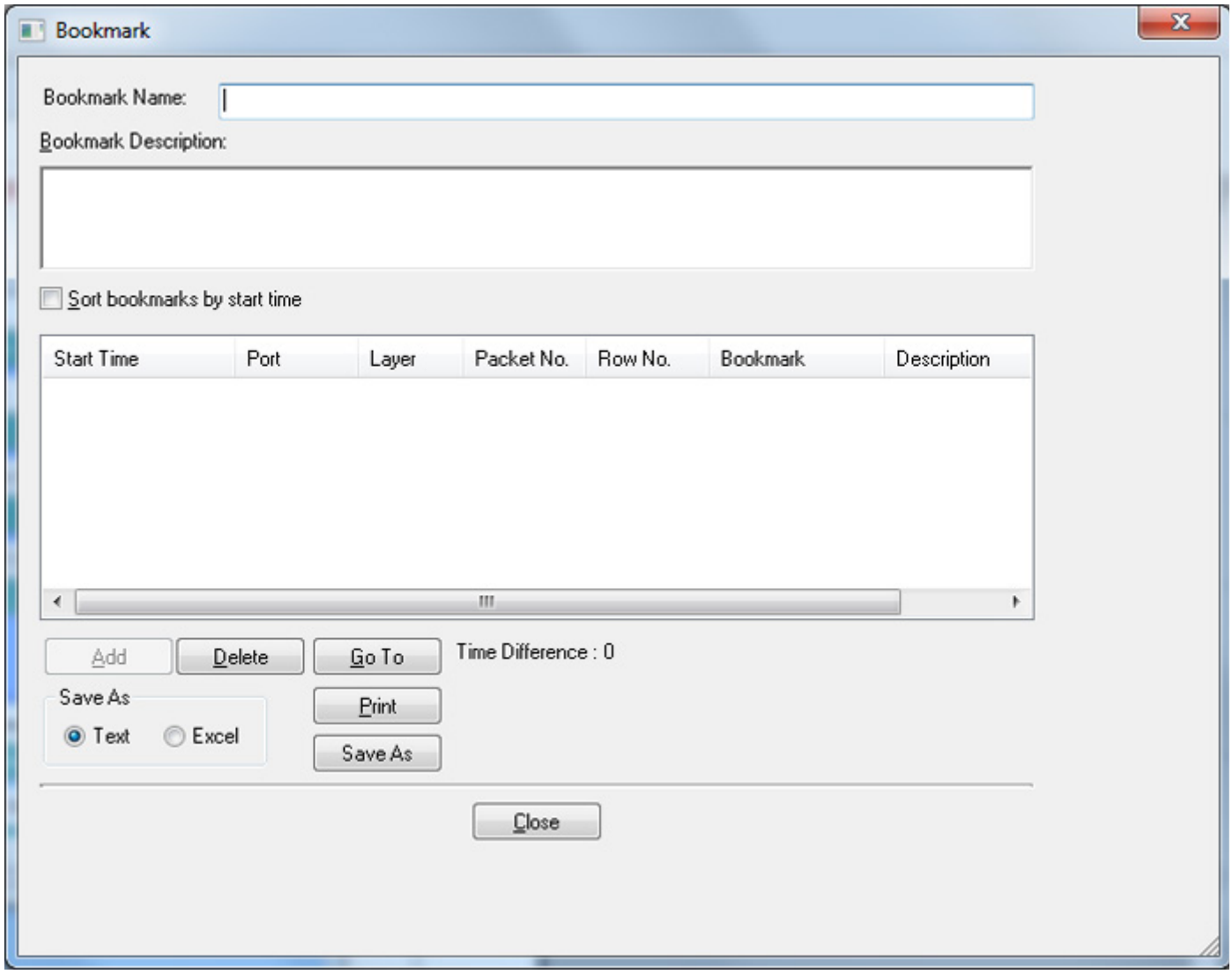


Figure 3.104: Bookmark Dialog

Enter a description for the bookmark and click the **Add** button. Repeat for additional **bookmarks.**

You can save the bookmark as a text file or Excel CSV file.

Note: Column View has a different bookmark mechanism than other views, and you can set a bookmark on each DWORD in the view. This makes Column View bookmarks unavailable in other views and vice versa.

Editing a Bookmark

If a packet has a bookmark, you can edit the bookmark by right-clicking the data viewer area of the packet, selecting the **Edit Bookmark** command from the pop-up menu, and changing the information in the Bookmark dialog (see above).

Finding a Bookmark

To find a bookmark in the data viewer display, right-click the mouse in the sample viewer and select **Bookmark** (see Figure 3.105 on page 326).

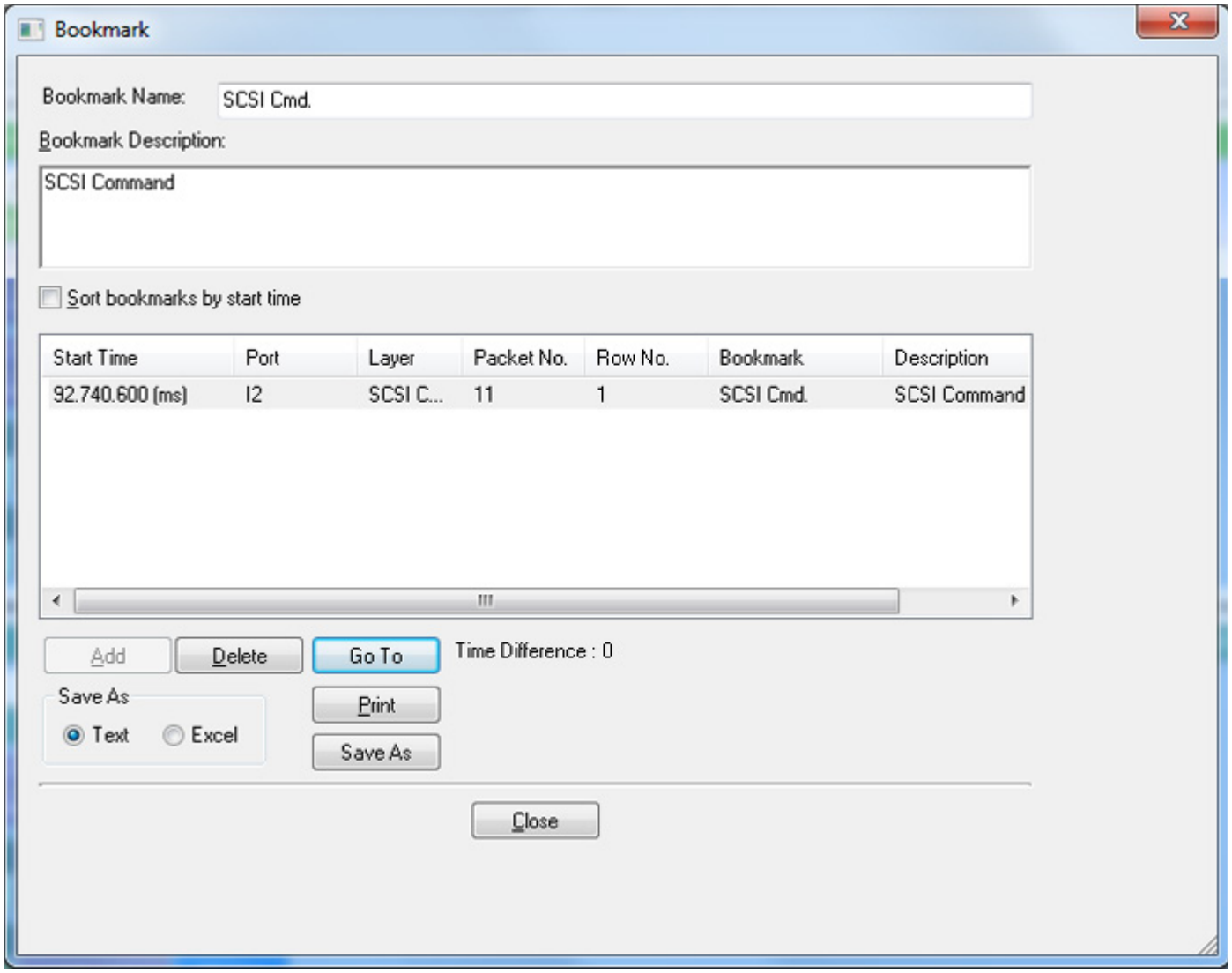


Figure 3.105: Go To Bookmark Dialog Box

Highlight the bookmark to which to go, then click the **Go To** button, or double-click the selection.

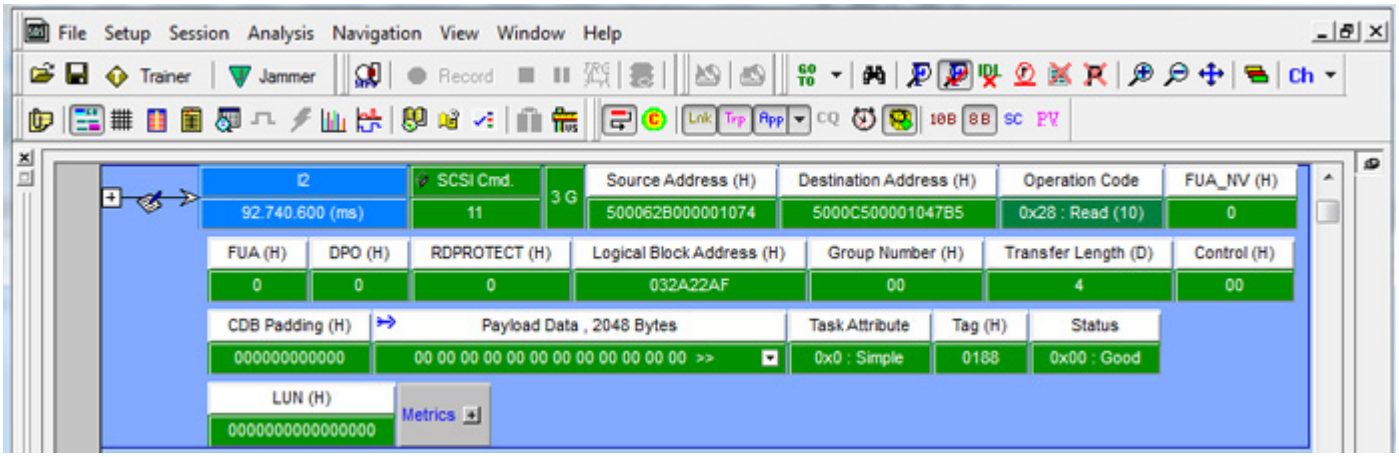


Figure 3.106: Bookmark Found Example in Data Viewer Display

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 display.

Set Time Stamp Origin

Right-click in the sample viewer to open the fly out menu (see Figure 3.107):

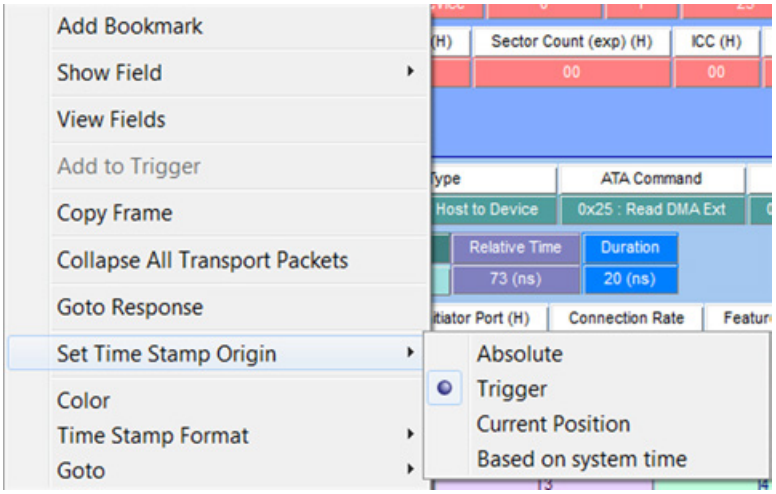


Figure 3.107: Set Time Stamp Origin: Trigger.

Highlight **Set Time Stamp Origin** and choose either Absolute, Trigger, Current Position, or Based on system time.

Example: Trigger Mode

An example Trace showing the Time Stamp set to Trigger Mode in both the Packet View and the Column View is shown below in Figure 3.108.

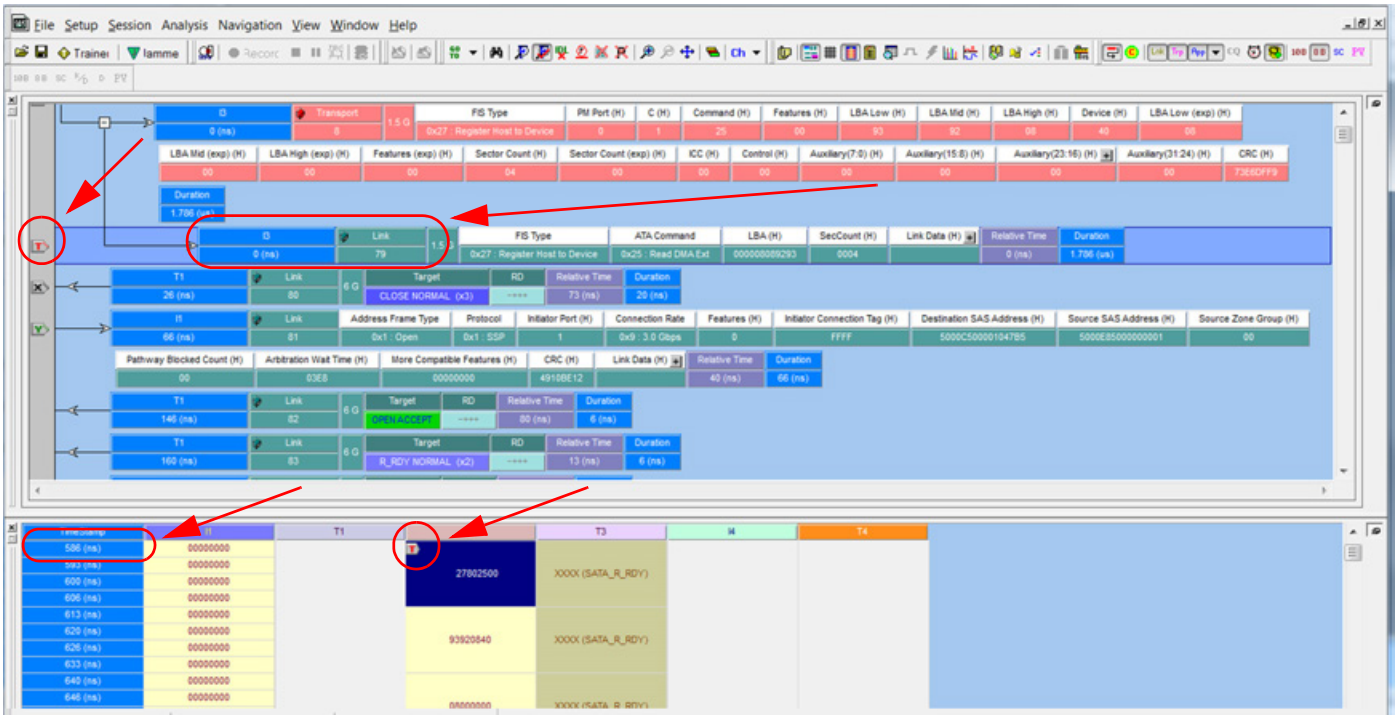


Figure 3.108: Time Stamp Set to Trigger

In the Packet View (upper pane) the Red T for Trigger shows that the trigger occurs within Packet 79 and setting the Time Stamp to Trigger shows 0 ns.

In the Column View (lower pane) the Red T for Trigger shows that the trigger occurs 566ns within Packet 79. The reason the two trigger times are different is because the Column View is more accurate. The Packet View tells you that the trigger occurs within Packet 79, but the Column View tells you that the trigger occurs 566ns after the start of the packet.

3.9.2 Filtering

The Filtering menu and options allow you to modify data in the sample viewer display to exclude packets with a set of user-defined patterns and show the results in all views.

To set up filtering, you must have a viewer display open.

The Filtering menu has the options:

- Enable Filtering (see “Enable Filter” on page 339)
- Filtering (see “Filter Setup” on page 329)
- Link Layer (SAS)
- Transport Layer (SAS)
- Application Layer (SAS)
- Physical Layer (SATA)
- FIS Layer (SATA)
- Command Layer (SATA)
- Filter Idles (see “Filter Idle” on page 343)

3.9.3 Filter Setup

To display the Filter setup dialog, click the  **Filter** button on the Viewer toolbar or select **View > Filtering**.

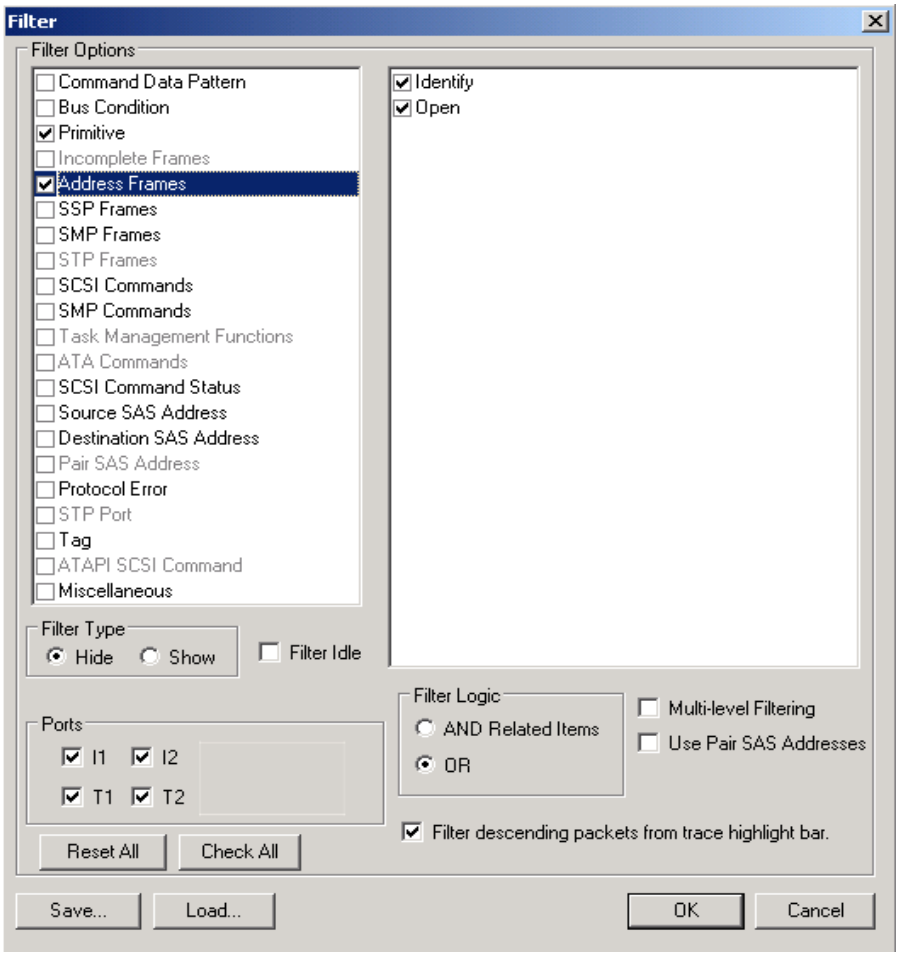


Figure 3.109: SAS/SATA: Filter Setup Dialog

You can select or deselect each of the items shown in the Filter Options window for filtering, by checking or unchecking a corresponding check box. Items not in the current sample are in shade. See "Selectable Filter Options for SAS" on page 332 and "Selectable Filter Options for SATA" on page 337.

Note: If you select a group, that also selects all child items.

Note: Only packets captured at run time are available for selection for filtering.

Filter Type

You can choose to show or hide the Filter Type items by checking the **Show** or **Hide** option button.

Note: When capturing PM traces, you need the ability to filter the PM primitives so you can find commands quicker.

Filtering Direction

You can select items for filtering in a single direction or both directions by checking the corresponding Port. By default, all ports are enabled. Uncheck the port check boxes for ports not to include in the filter.

Filter Idle

Depending on the Filter Type (Hide/Show), Idle packets in the Sample Viewer are shown or hidden.

Save Filter Setup

After you have set up a Filter configuration, you can save it as an SAS Filter file (***sfl**) or SATA Filter file (***.tfl**) by clicking **Save**. You can then use it on a different capture by clicking **Load** in the Filter dialog.

Filter Logic

After you have set up Filter options, you can set filter logic to **And Related Items** to apply "AND" logic on related selected options (for example, SCSI commands and SAS Addresses) or **OR** to apply "OR" logic on all selected options.

Filter only applies to entities in a trace. When you choose SCSI command **AND** SSP frame, for instance, Filter affects all entities in the trace that are SCSI commands, **AND** are SSP frames. Any SCSI commands that are **NOT** SSP frames, will not, in this case, be filtered.

If you choose **OR**, Filter affects all entities that are SCSI commands, as well as all SSP frames.

The AND operator is only applicable for some cases, such as:

- A SCSI command AND a Tag.
- A SCSI command AND a source/destination address.

For example, when you choose a SCSI command AND a tag = 0x1, you will filter all entities on a trace that are SCSI commands that have tags equal to "0x1" in that SCSI command.

As a general rule, it is not possible to apply AND to two packet types (frames, commands, primitives, training sequences or bus conditions). It only works when you apply AND to one packet type with other items such as source/Destination Addresses, TAG, Task attribute.

Multilevel Filtering in SAS

You can set up a filter in a sequential steps by **Multi level filtering**. In each level, you can select specific items to “AND” to the previous level. The results of all levels show in views (see following screen captures).

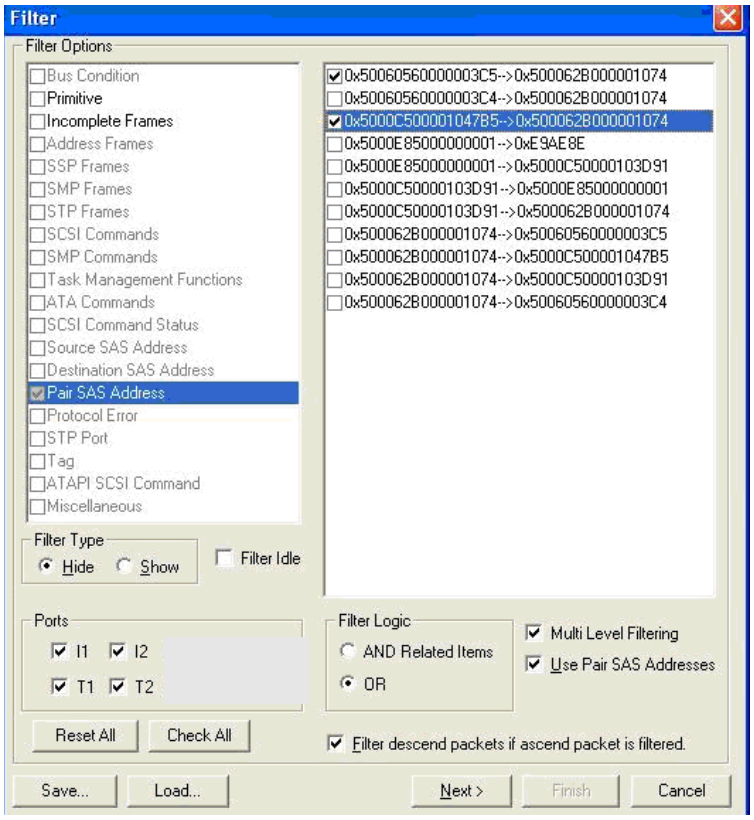


Figure 3.110: First Level of Multilevel Filtering

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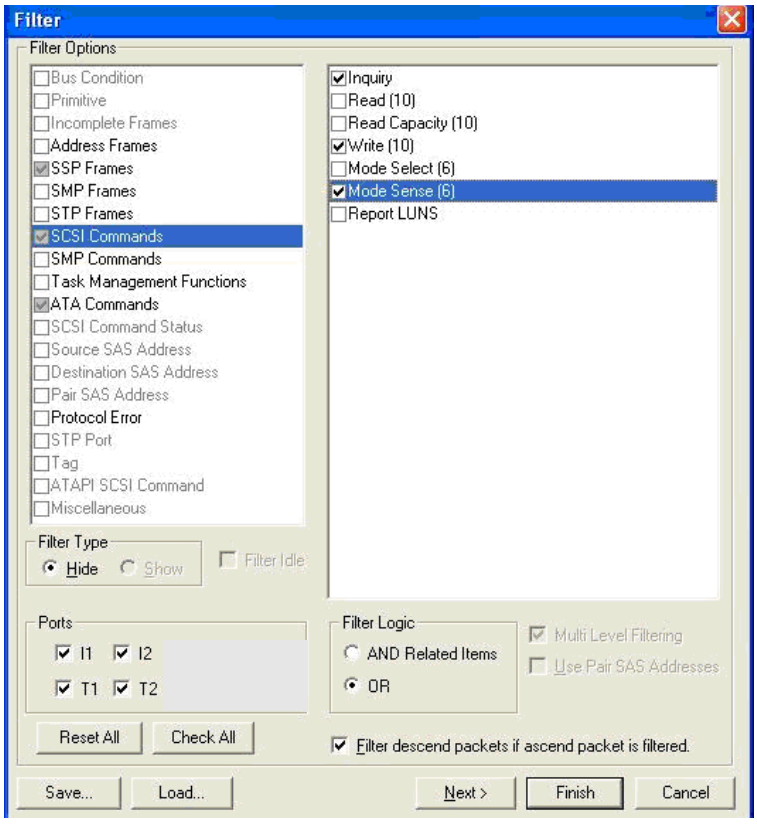


Figure 3.111: Second Level of Multilevel Filtering

.

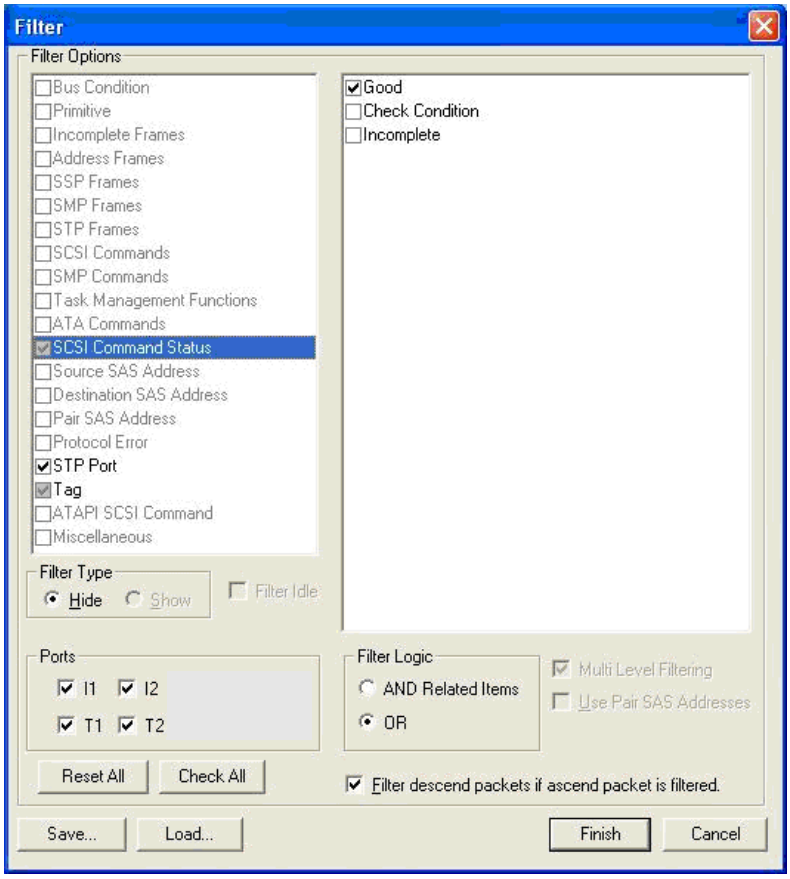


Figure 3.112: Third Level of Multilevel Filtering

Filter descending packets from trace highlight bar

If you check the **Filter descend packets if ascend packet is filtered** checkbox, the application will only filter onward from the highlighted trace selection bar.

If you uncheck this option, the software only filters the filtered packet. For example, if this option is checked and any SCSI command is selected, all transport and link packets of this command are filtered. If you unchecked this option, only selected SCSI commands are filtered.

3.9.4 Selectable Filter Options for SAS

The SAS Filter Options are:

- Command Data Pattern
- Bus Condition
- Primitive
- Incomplete Frames
- Address Frames
- SSP Frames
- SMP Frames
- STP Frames

- ❑ SCSI Commands
- ❑ SMP Commands
- ❑ Task Management Functions
- ❑ ATA Commands
- ❑ SCSI Command Status (see “Filter Check Condition” on page 333).
- ❑ Source SAS Address
- ❑ Destination SAS Address
- ❑ Pair SAS Address
- ❑ Protocol Error
- ❑ STP Port
- ❑ Tag (see “Filter by Tag Number” on page 335).
- ❑ ATAPI SCSI Command
- ❑ Device Sleep
- ❑ Miscellaneous (see “Filter Miscellaneous” on page 336).
- ❑ Training Sequence

Command Data Pattern

When selected, depending on the Filter Type, the Hide/Show selection shows or hides captured Command Data Patterns in the Sample Viewer.

Bus Condition

When selected, depending on the Filter Type, the Hide/Show selection shows or hides captured Bus Conditions in the Sample Viewer.

Incomplete Frames

When selected, depending on the Filter Type, the Hide/Show selection shows or hides Incomplete Frames in the Sample Viewer.

ATA Command

When selected, depending on the Filter Type, the Hide/Show selection shows or hides captured ATA commands in the Sample Viewer.

Protocol Error

When selected, depending on the Filter Type, the Hide/Show selection shows or hides captured packets with the specified Protocol Errors in the Sample Viewer.

ATAPI SCSI Command

When selected, depending on the Filter Type, the Show/Hide selection shows or hides ATAPI SCSI commands.

Filter Check Condition

Checking the **SCSI Command Status** check box enables Check Condition for filtering (see Figure 3.113 on page 334).

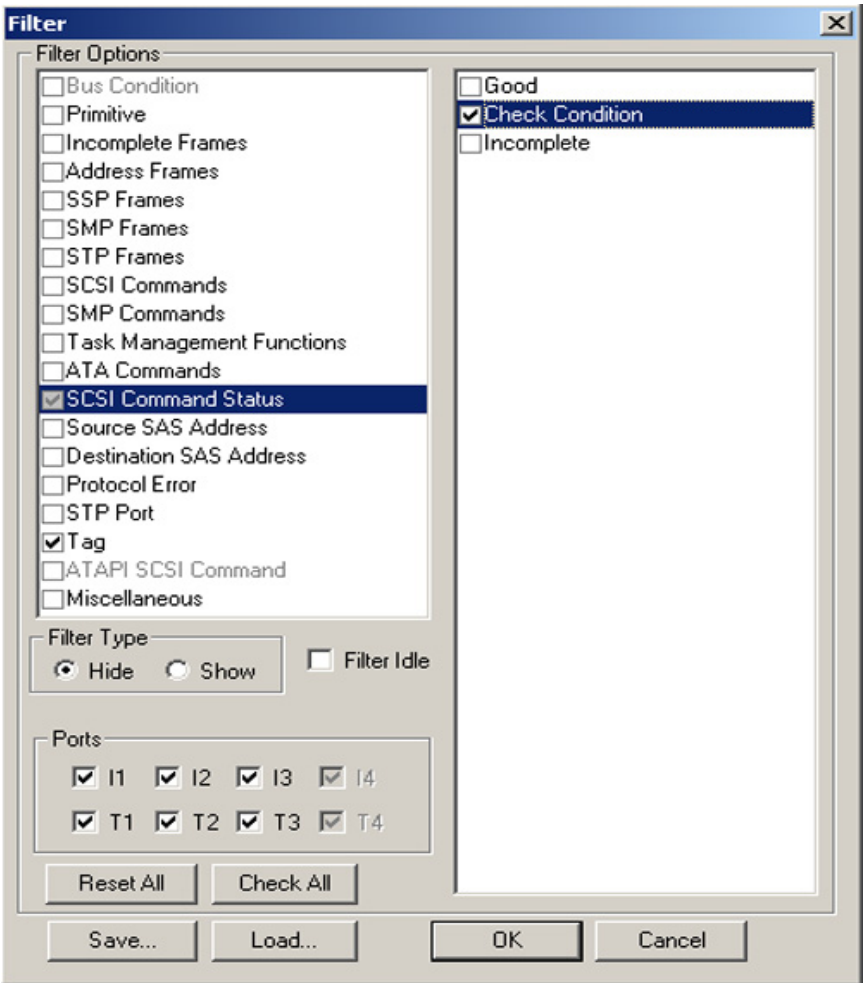


Figure 3.113: Filter Check Condition

Filter by Tag Number

Checking the **Tag** check box displays tags available for filtering. Check the corresponding check boxes for tags to filter.

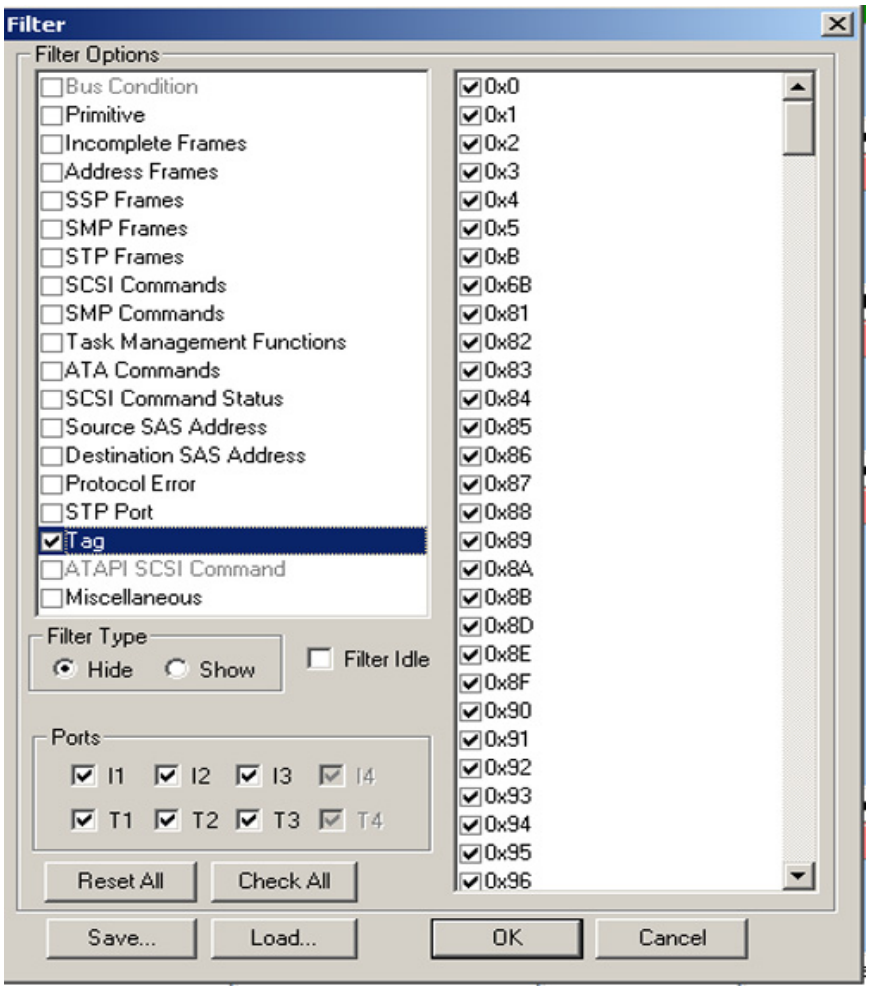


Figure 3.114: Filter by Tag Number

Filter Miscellaneous

When you choose **Miscellaneous**, an additional dialog displays, allowing you to specify the filtering of State Range and/or External Signal In.

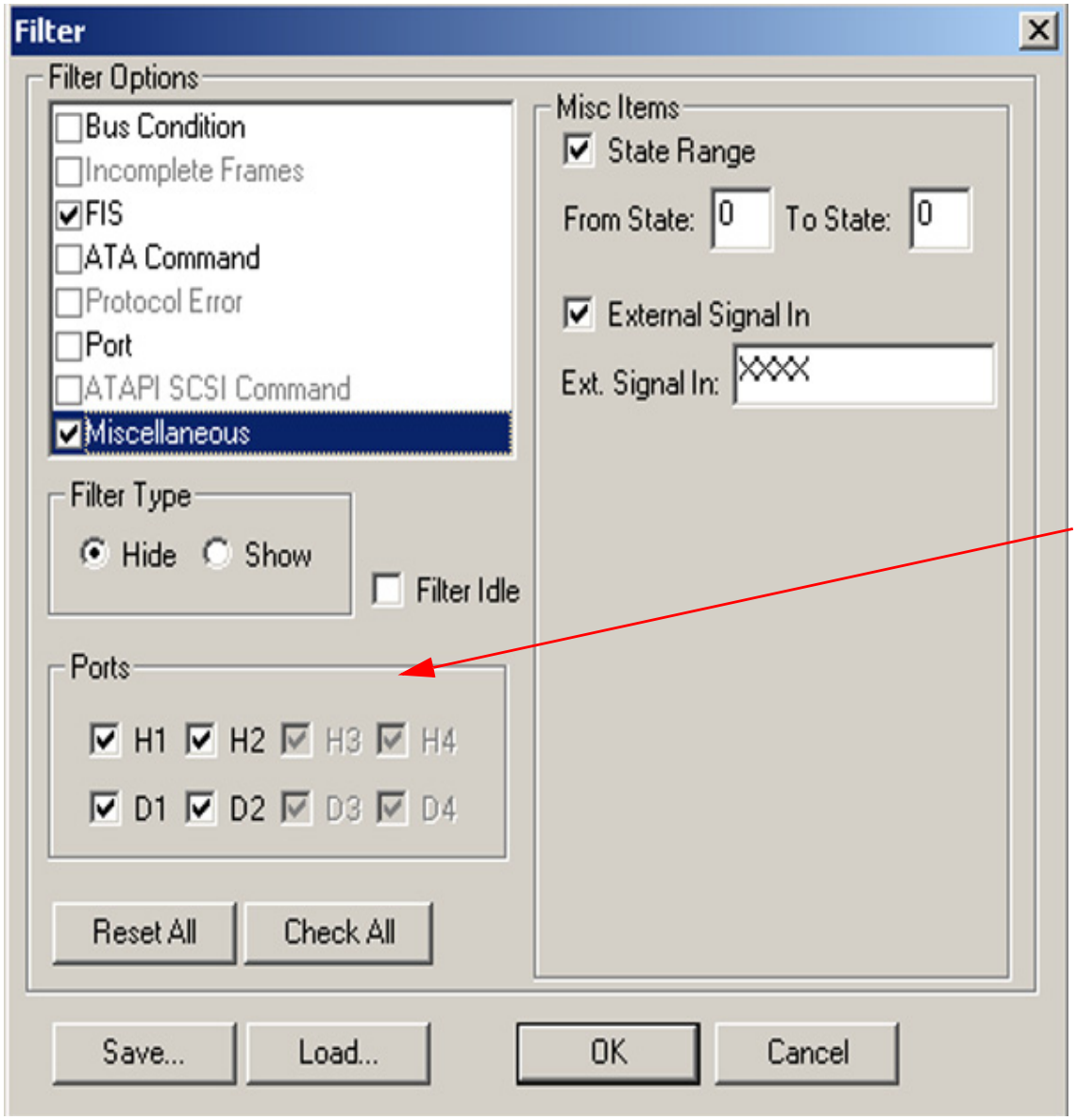


Figure 3.115: Filter State and/or Device Sleep

Use Pair SAS Addresses

You can use all available pair SAS addresses (Source -> Destination) instead of using SAS source and destination addresses. To enable the pair SAS address filter option, check **Use Pair SAS Addresses** check box in the Filter dialog.

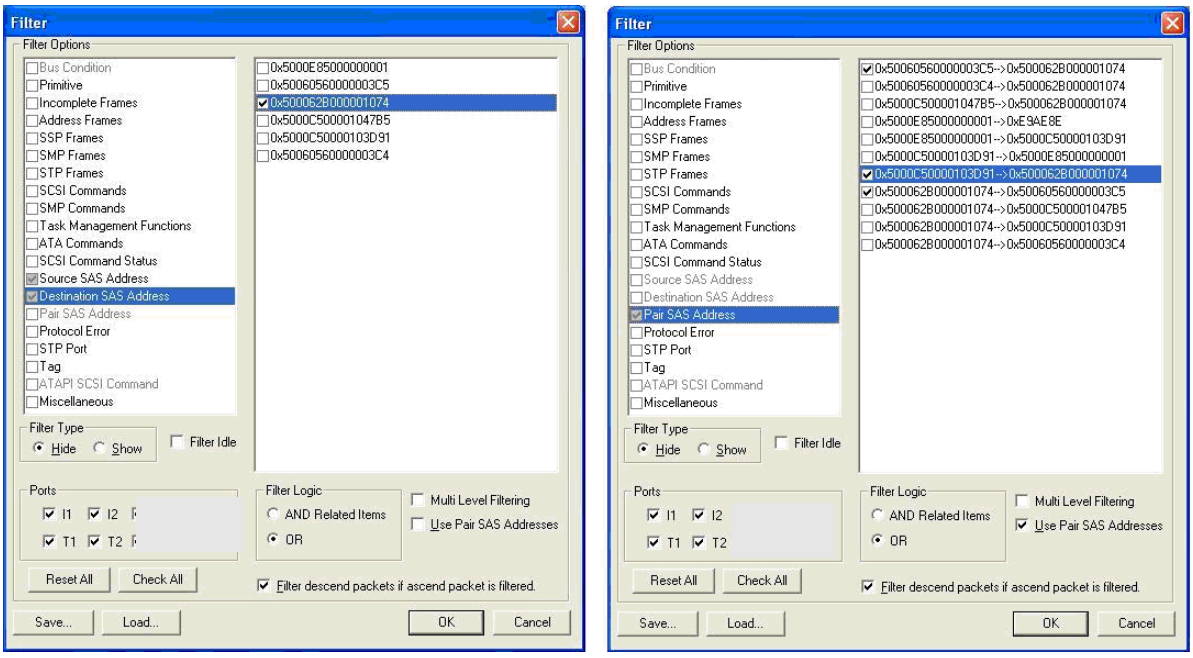


Figure 3.116: SAS: SAS Address Filtering before and after Using Pair SAS Addresses

Note: If you enable pair SAS addresses, the source/destination SAS addresses options are disabled and filtering on them is ignored at filtering time. If you disable pair SAS addresses, the pair SAS address option is disabled and filtering on it is ignored at filtering time.

Training Sequence

When selected, depending on the Filter Type, the Hide/Show selection shows or hides captured Training Sequences in the Sample Viewer.

3.9.5 Selectable Filter Options for SATA

The SATA filter options are:

- Bus Condition
- Incomplete Frames
- FIS
- ATA Command
- Protocol Error
- Port
- ATAPI SCSI Command
- Miscellaneous
- Filter Idle (see Figure 3.115 on page 336)

Bus Condition

When selected, depending on the Filter Type, the Hide/Show selection shows or hides captured Bus Conditions in the Trace Viewer.

Incomplete Frames

When selected, depending on the Filter Type, the Hide/Show selection shows or hides Incomplete Frames in the Sample Viewer.

FIS

When selected, depending on the Filter Type, the Hide/Show selection shows or hides captured FIS items in the Sample Viewer.

ATA Command

When selected, depending on the Filter Type, the Hide/Show selection shows or hides captured ATA commands in the Sample Viewer.

Protocol Error

When selected, depending on the Filter Type, the Hide/Show selection shows or hides captured packets with the specified Protocol Errors in the Sample Viewer.

Port

When selected, depending on the Filter Type, the Show/Hide selection shows or hides packet traffic for the selected port.

ATAPI SCSI Command

When selected, depending on the Filter Type, the Show/Hide selection shows or hides ATAPI SCSI commands.

Miscellaneous

When you choose Miscellaneous, an additional dialog displays, allowing you to specify the filtering of State Range and/or External Signal In (see “Filter Miscellaneous” on page 336).

3.9.6 Enable Filter

Select **Filtering > Enable Filtering** or click the  **Filter Enable** button on the display menu bar to toggle between Filtered and Unfiltered display.

Example: Filtering for an Item

If you select the “Show 0x60: Read FPDMA Queued” (see Figure 3.117) with Filtering Enabled, the result will be a Spreadsheet View with only **0x60: Read** commands shown (see Figure 3.118 on page 340).

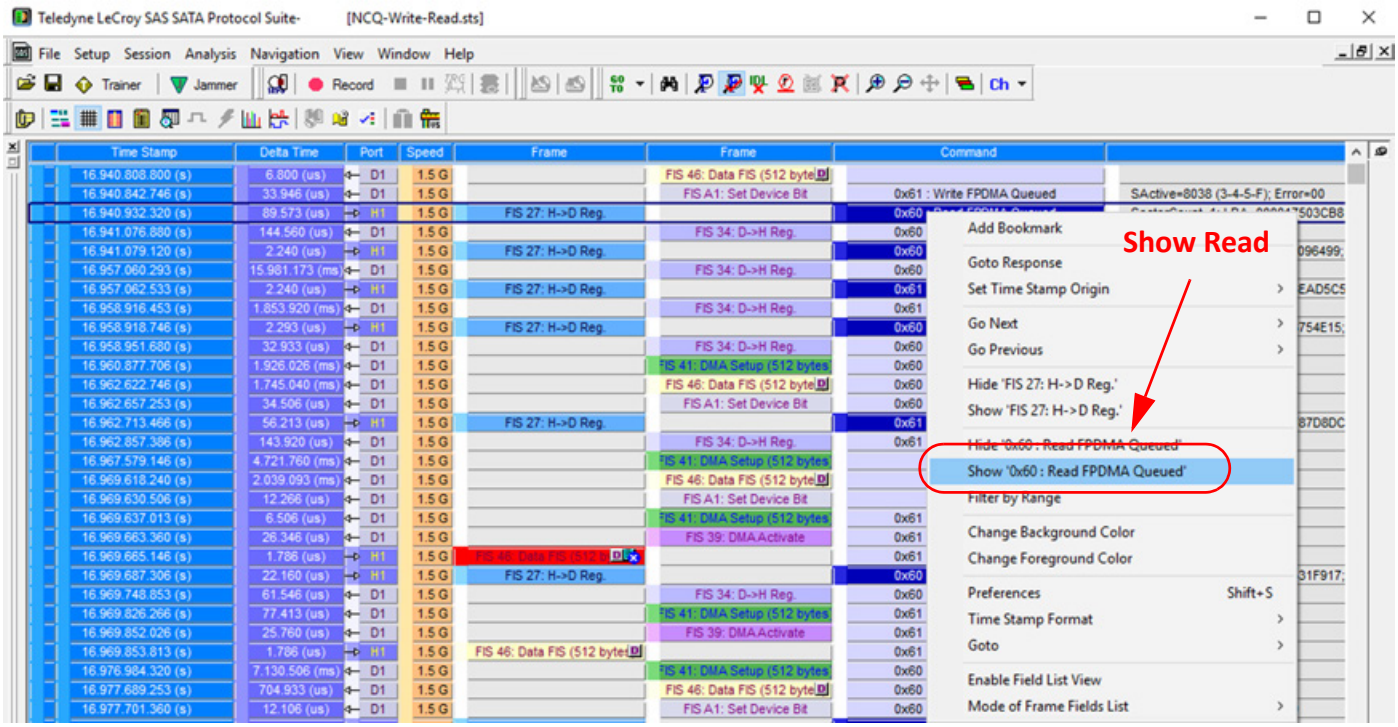


Figure 3.117: Filtering an Item Using Context Menu

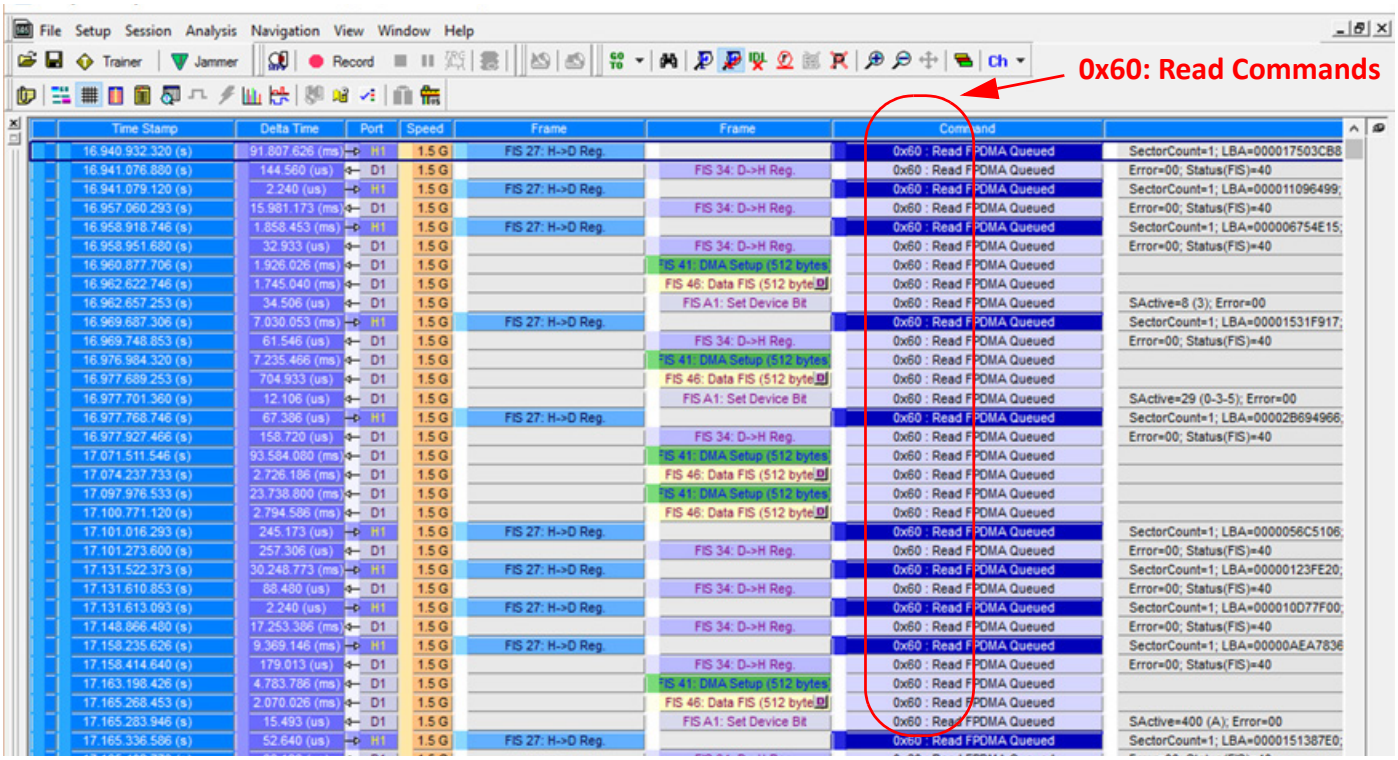


Figure 3.118: Filtered Trace: Only 0x60: Read Commands Shown

If you select the Enable/Disable Filtering Icon (see Figure 3.119)



Figure 3.119: Enable/Disable Filtering

the Spreadsheet View will toggle between the Filtered View (showing only **0x60: Read** commands see Figure 3.118) and the Unfiltered View (showing all commands) see Figure 3.120 on page 341.

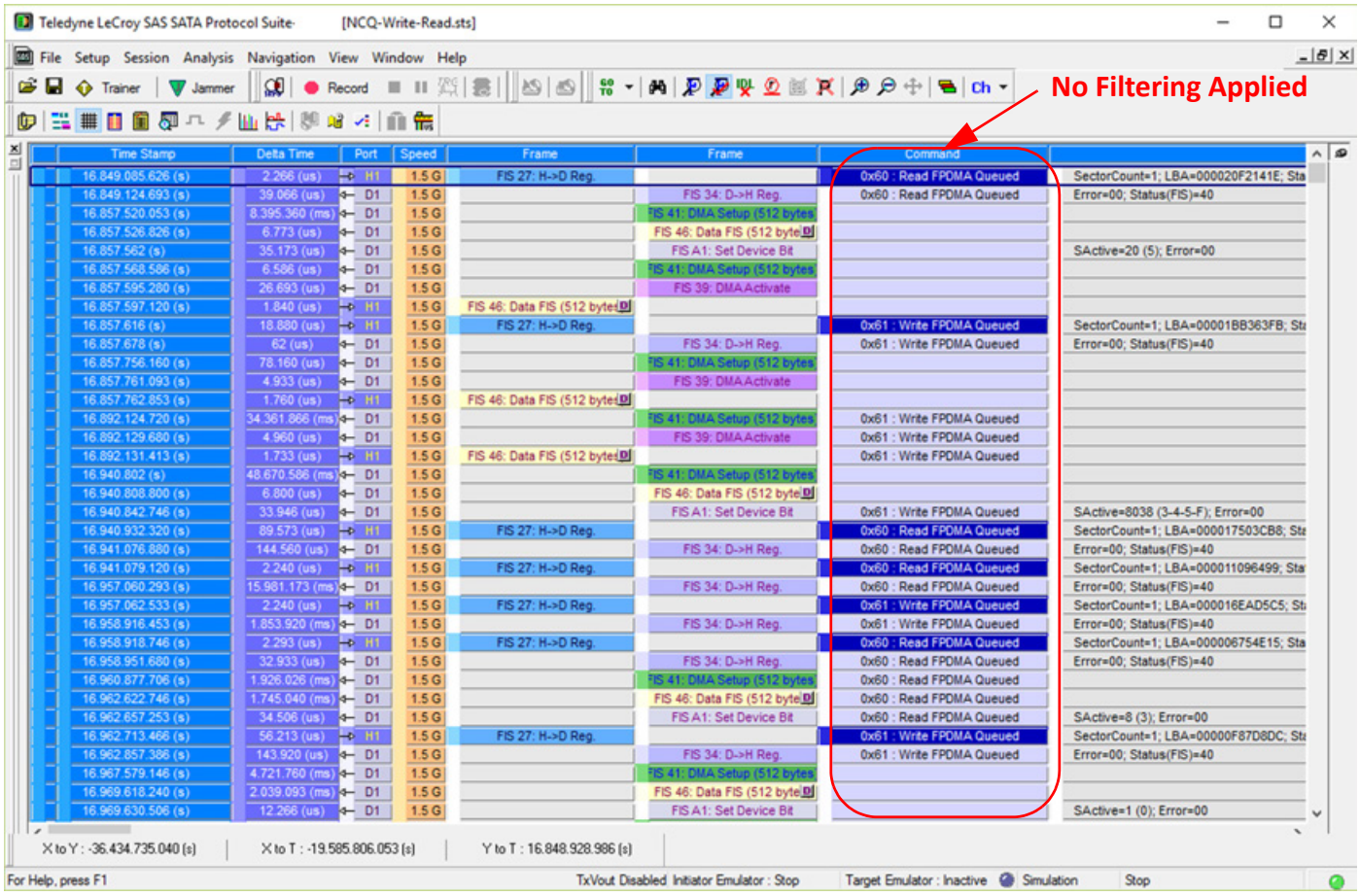


Figure 3.120: Filtered Trace: Reset -> No Filtering Applied

Example: Filtering for a New Item

To filter a different item (like the **0x61: Write** Command), you must select the "Filtering Setup" Icon (see Figure 3.121).

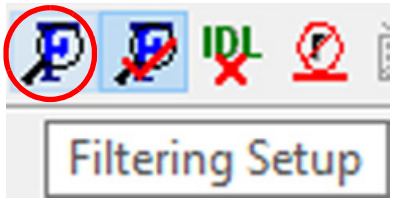


Figure 3.121: Filter Setup Icon

This will pop up the Filtering Setup dialog.

Select the "Reset All" button and then click "OK". See Figure 3.122 on page 342.

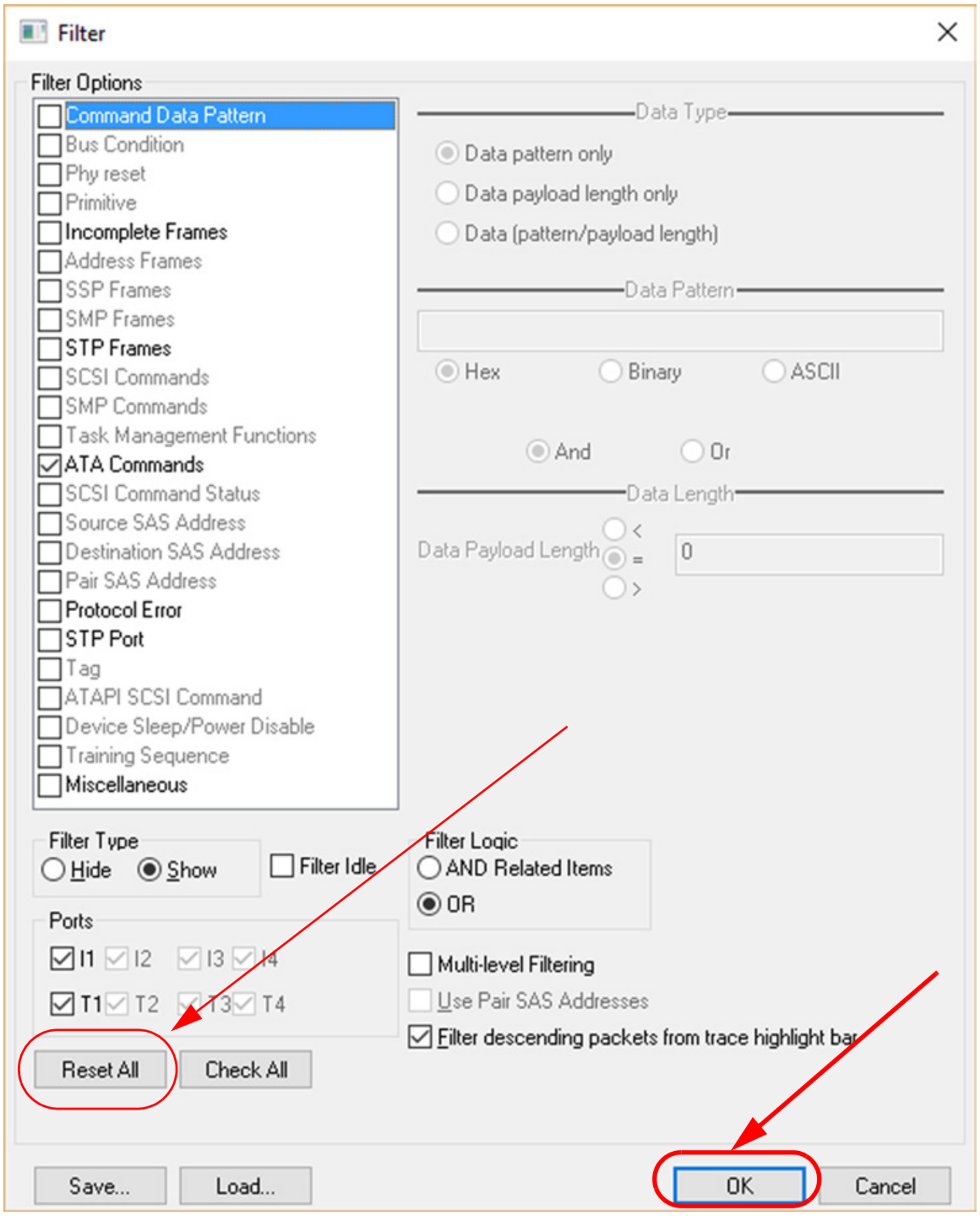


Figure 3.122: Filtering Setup Dialog

This will reset all the filtering options and allow you to filter a different item in the Spreadsheet View such as **0x61: Write**, see Figure 3.123 on page 343.

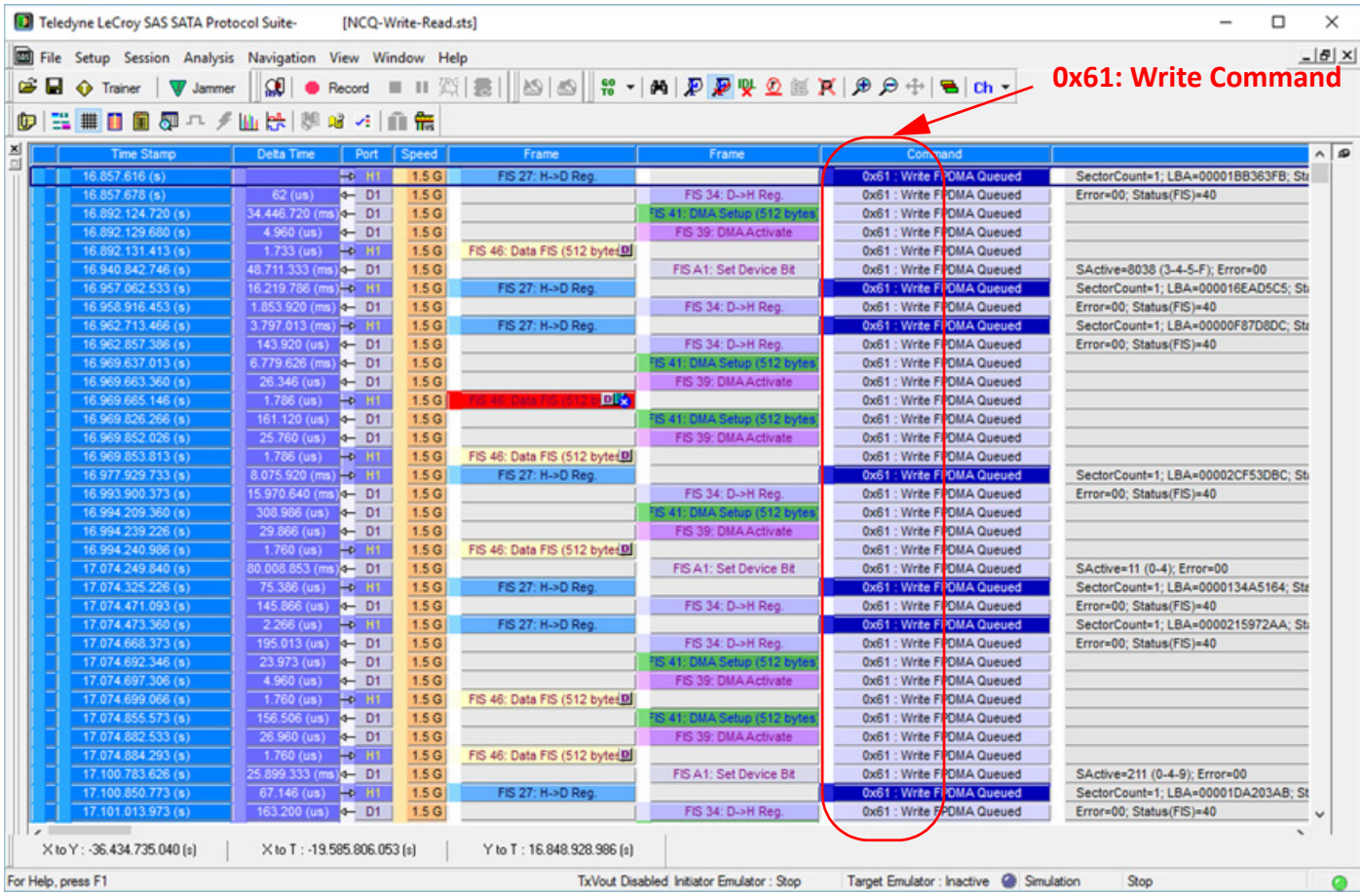


Figure 3.123: Filtered Trace: Only 0x61: Write Commands Shown

So the Filter Enable/Disable Icon only turns on or off the Filtered Item. To select a new Item to filter you must click on the Filtering Setup Icon and reset the filtering options.

3.9.7 Filter Idle

Depending on the Filter Type (Hide/Show), Idle packets in the Trace Viewer are shown or hidden.

You can quickly filter idles by clicking the 

Filter Idle button. This button toggles between Show and Hide items.

3.9.8 Search

The Search menu and toolbar options permit you to examine any data capture file to quickly locate the packet or data pattern.

To perform an initial search, select **Edit > Search** or click the  **Search** button to open the Search setup dialog (Figure 3.124).

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

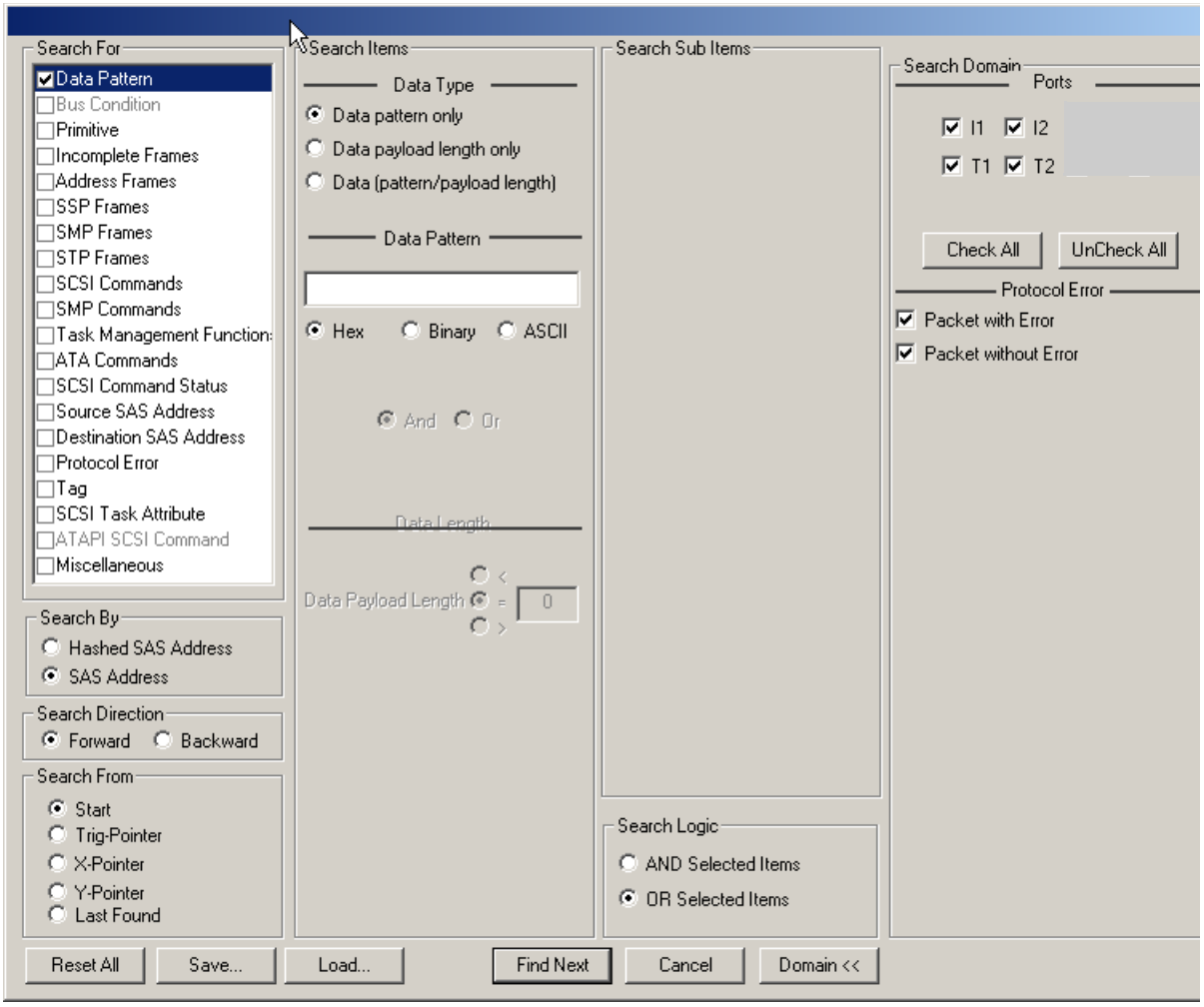


Figure 3.124: Search Data Pattern

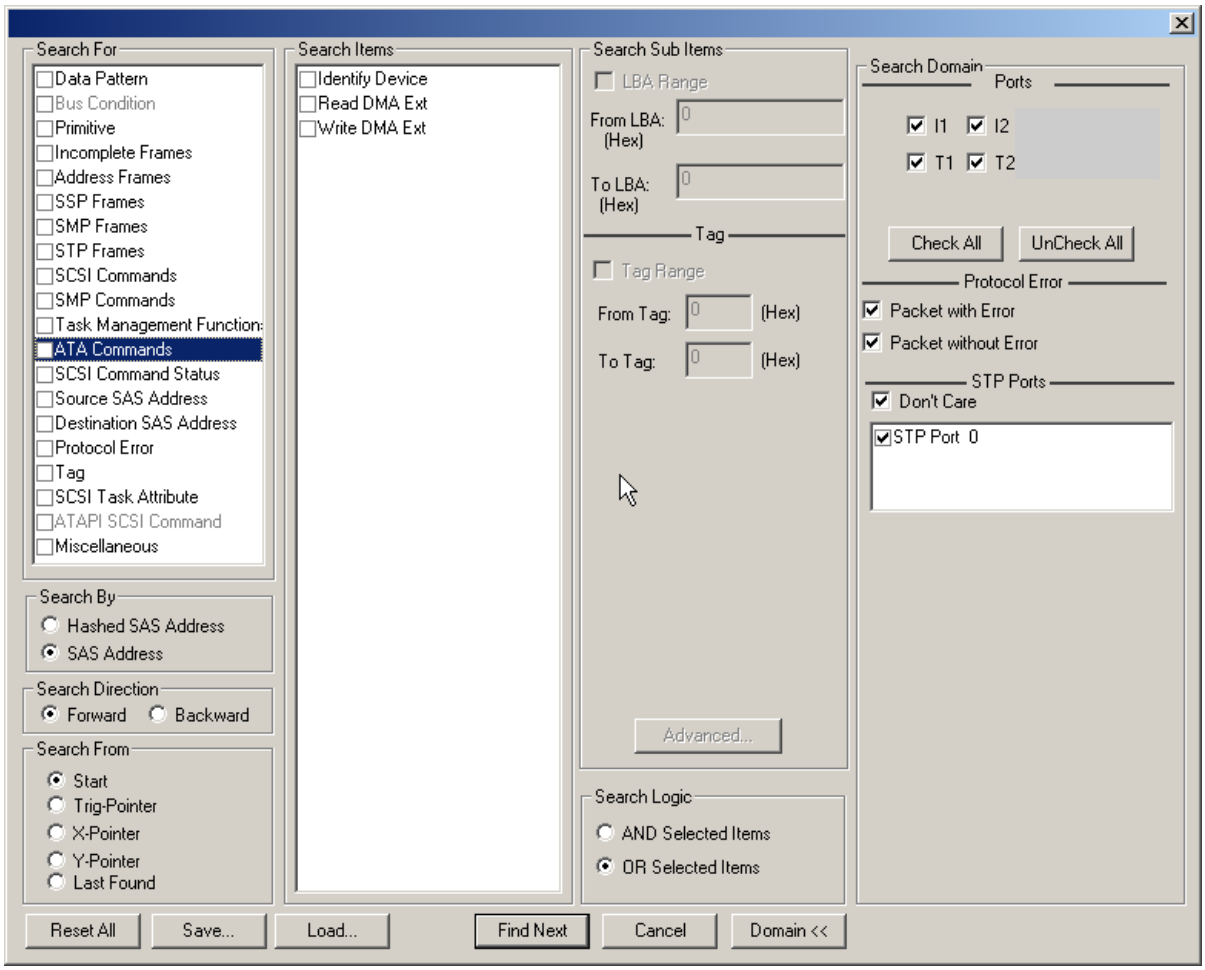


Figure 3.125: Search Parameter Definition Dialog

You can continue to search the output file using **Next Search (F3)** or **Previous Search (F4)** for the same pattern, until you redefine the data capture search parameters.

Save Search Setup

After you have set up a Search configuration, you can save it as a SAS Search configuration file (***.ssh**) or a SATA Search configuration file (***.tsh**) by clicking **Save**. You can then use it on a different capture by clicking **Load** in the Search dialog.

Search By

Choose **Hashed SAS Address** to search on hash address, or choose **SAS Address** to search for address.

Search Direction

Choose either **Forward** or **Backward** direction in which to perform the search.

Search From

Choose a starting point to begin or continue a search: Start of the sample file, Trigger Pointer, X Pointer, Y Pointer, or Last Found.

Search Logic

The default setting is **Or Selected Items**. With this setting, clicking **Find Next** locates all selected items in turn. If you choose **And Selected Items,** you can set a logical AND combination of items to find. Both options allow setting Advanced search features.

Search looks for entities in a trace. When you choose SCSI command AND SSP frame, for instance, search will return all entities in the trace that are SCSI commands, AND are SSP frames. Any SCSI commands that are NOT SSP frames, will not, in this case, be returned.

If you choose OR, search will return all entities that are SCSI commands as well as all SSP frames.

The AND operator is only applicable for some cases, such as:

- A SCSI command AND a Tag
- A SCSI command AND a source/destination address.

For example, when you choose a SCSI command AND a tag = 0x1, you will get all entities on a trace that are SCSI commands that have tags equal to "0x1" in that SCSI command.

As a general rule, it is not possible to apply AND on two packet types (frames, commands, primitives, training sequences or bus conditions). It only works when you apply AND on one packet type with other items such as source/Destination Addresses, TAG, Task attribute.

Search For

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

Data Pattern

Search for Data Pattern allows you to search for a specific Data Type, Pattern, and Length (see Figure 3.124).

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

Advanced options

Some of the Search For categories offer advanced options for search. To set these options, highlight the search item in a category and click the **Advanced** button to open the Advanced options dialog.

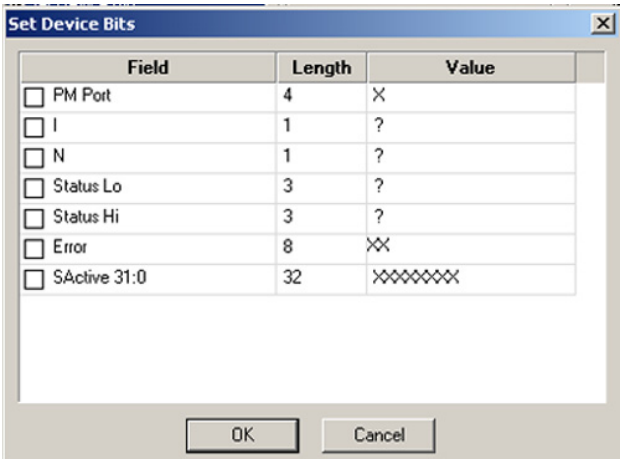


Figure 3.126: Advanced Options Dialog Example: Set Device Bits

Set the options and click **OK.**

Search Domain

Click the **Domain** button and choose a search domain from all ports or a specific port.

Protocol Error

You can refine the search to locate packets with an error or without an error.

Note: When searching for Protocol Errors in Column View, you cannot search for a specific Protocol Error type. Search returns any protocol error.

Search Sub Items

When searching SCSI Command Status, you can 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 search.

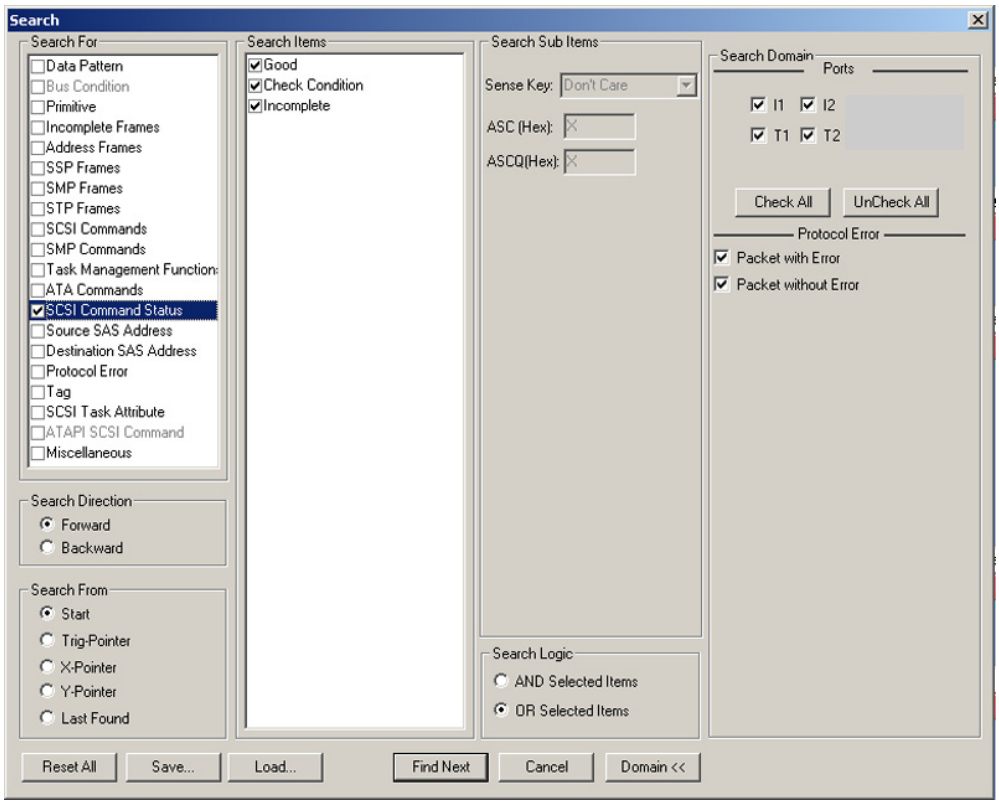


Figure 3.127: Search Sub Items

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

Search by Tag Number

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

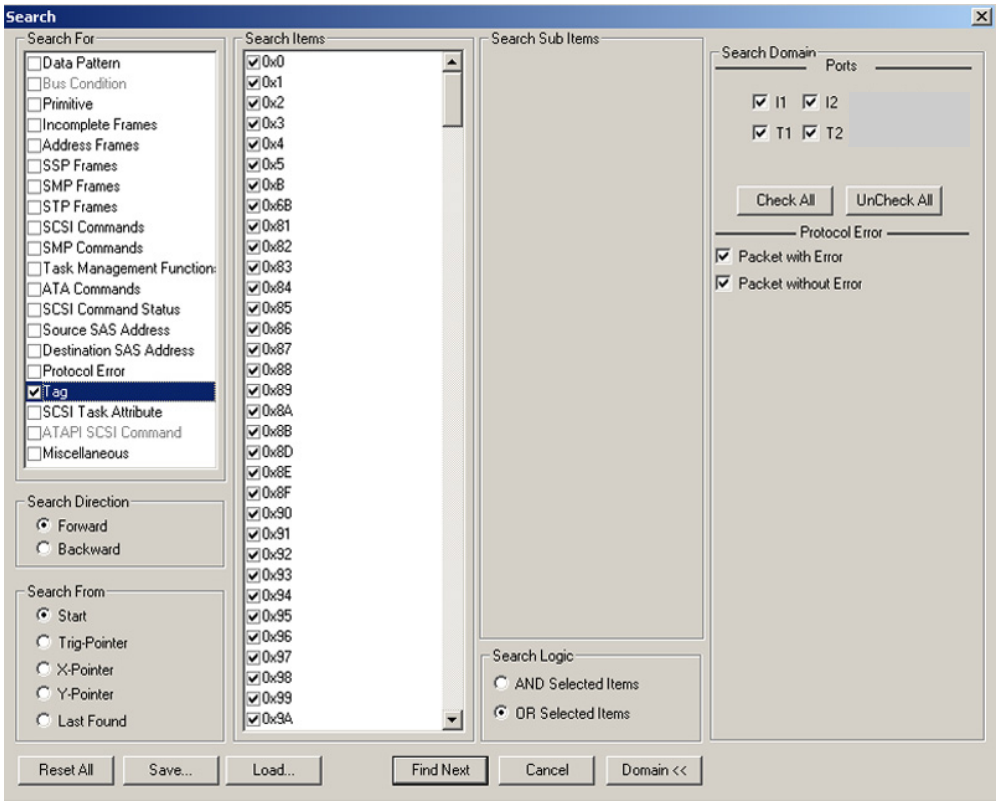


Figure 3.128: Search by Tag Number

Search by Speed

To search by **Speed**, check the **Speed** box in the Search For window to look for points where speed changes occurred in the trace.

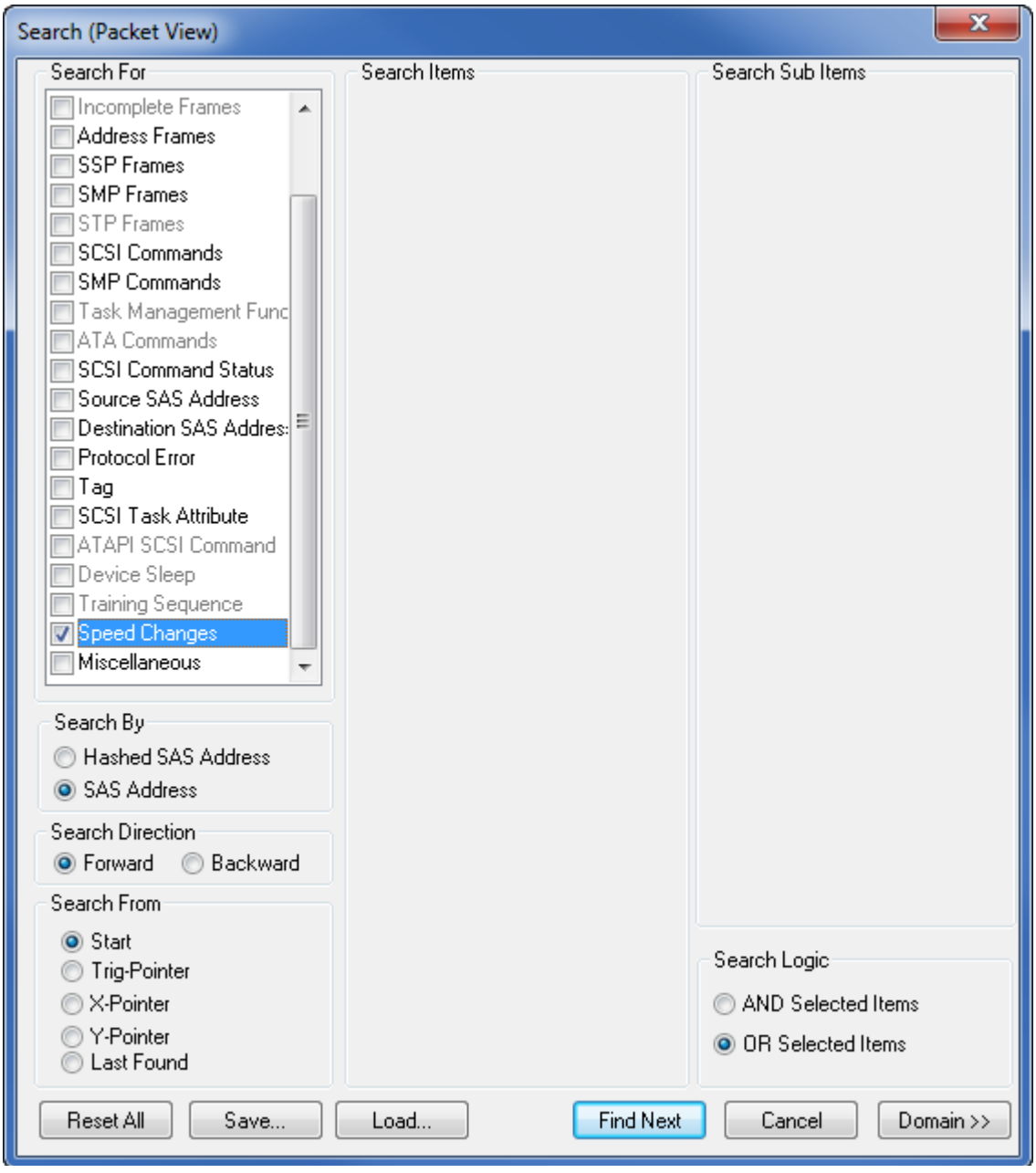


Figure 3.129: Search by Speed Changes

3.9.9 Show/Hide Ports

You can **Show/Hide a Single Port** or you can **Show/Hide Multiple Ports**. To do so click on the **Ch Down Arrow.**

Single Port

If Single Port is selected, you can click on one port button at a time to show/hide the capture for that port. Show/Hide Single Port is time consuming as it shows or hides one port at a time.

Multiple Ports

If Multiple Ports is selected, you can click on multiple ports to show or hide them. This mode is much faster. Click on multiple ports to show or hide them.

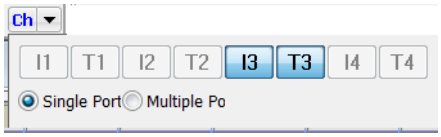


Figure 3.130: SAS: Show/Hide Ports Toolbar

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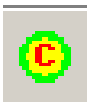
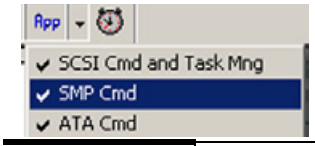
Figure 3.131: SATA: Show/Hide Ports Toolbar

You can also show or hide a port by right-clicking a **Port ID** in Text View or Column View and choosing **Show** or **Hide** (see Figure 3.135 on page 356).

3.10 Packet View Toolbar

The Packet View toolbar allows wrapping, zooming, and configuration.



	The **Wrap Packets** button on the Viewer Toolbar wraps the packet data in the display to eliminate the need for horizontal scrolling.
	Go to CATC Navigation View. Click this button to change the trace display to a CATC Trace™. You can change the colors, fonts, and so on, in the Trace Viewer Configuration (see "Trace Viewer Configuration" on page 364).
	The **Show/Hide Link Packet** button displays/hides the Link layer (SAS only).
	The **Show/Hide Transport Packet** button on the Layers Toolbar displays/hides the Transport layer and below (SAS only).
 	The **Show/Hide All Commands Packet** button shows/hides the Command layer and all layers below: SCSI Cmd and Task Mng, SMP Cmd, and ATA Cmd (SAS only). Click the down arrow on the Show/Hide All Commands Packet button to choose command types to show/hide.
	The **Show/Hide Physical Packet** button toggles the display of physical layer packets (SATA only).
	The **Show/Hide FIS packet** button toggles the display of FIS layer packets. When "OFF", the FIS layer and its links are hidden (SATA only).
	The **Show/Hide CMD packet** button toggles the display of the CMD packets. When "ON", only the command layer displays (SATA only).
	The **Show/Hide Command Queue** (CQ) button displays queued commands. SATA only. The CQ button's hierarchy only applies to **ReadDMAQueued** and **WriteDMAQueued**. The hierarchy for other queued commands is displayed as part of the regular application layer decoding.
	The **Order/Reorder** toggles the time order of packets. SATA only.

	The **Pack/Unpack Repeated Primitives** toggles packing repeated primitives in one port. SAS only.
	The **10B** button displays the payload data as 10-bit encoded data.
	The **8B** button displays the payload as 8-bit scrambled or unscrambled data, depending on the Scrambled setting.
	The **SC** button selects scramble/unscramble for the 8-bit payload data.
	The **PV** button shows/hides the primitive value.

3.10.1 CATC Navigation View

To change the trace display to a CATC Trace™ (see Figure 3.132 on page 354), click the **CATC Navigation**  button. You can change the colors, fonts, and so on, in the Trace Viewer Configuration (see “Trace Viewer Configuration” on page 364).

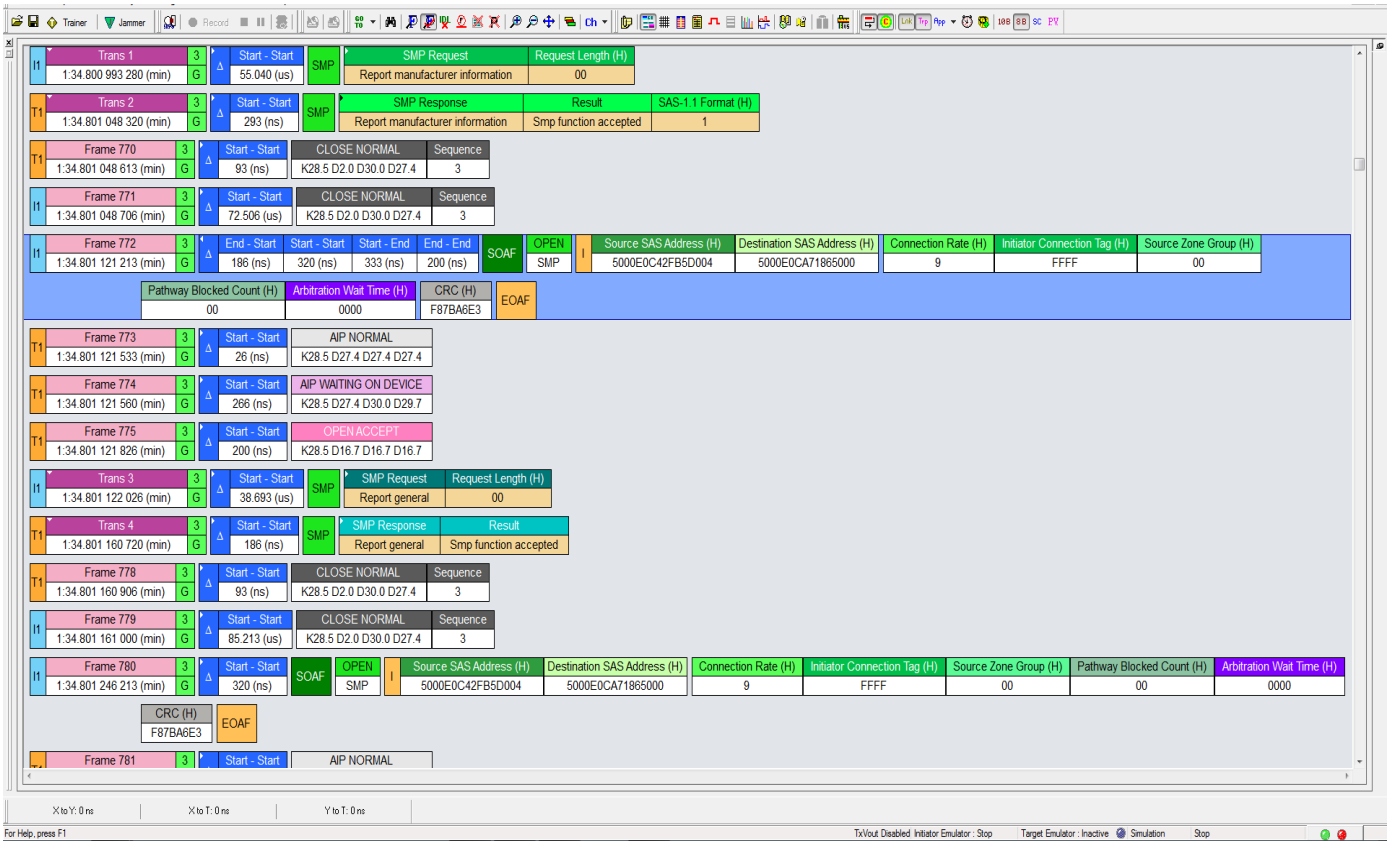


Figure 3.132: CATC Navigation View

3.10.2 Spec View

Spec View shows packet header information.

To obtain the Spec View from the CATC View, left-click to display a popup menu, then select the **View Fields** option (see Figure 3.133 on page 355.)

To obtain the Spec View from the Catalyst View, right-click to display a popup menu, then select the **View Fields** option.

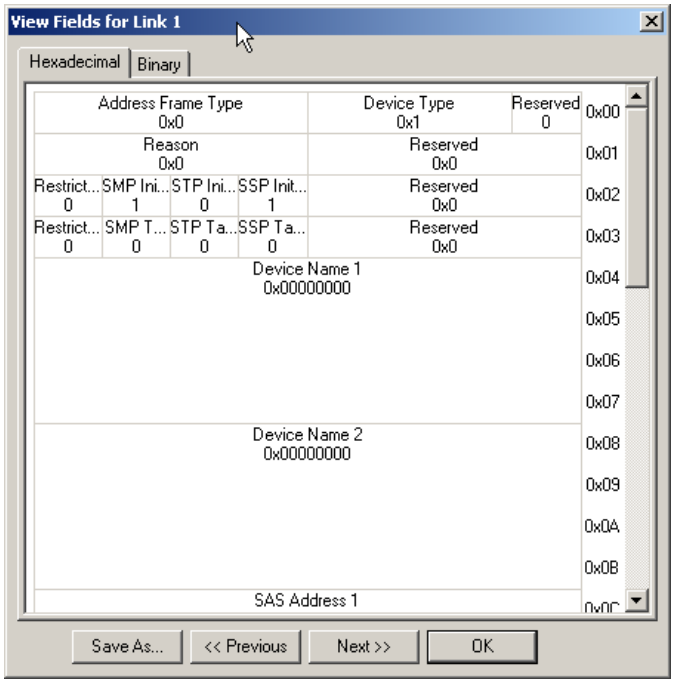


Figure 3.133: Spec View

The tabs allows you to display **Hexadecimal** or **Binary**.

The buttons allow you to go to **Previous** or **Next**.

You can **Save As** a text file.

3.10.3 Decode Icons

The **Decode Toolbar** controls encoding and scrambling features.

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

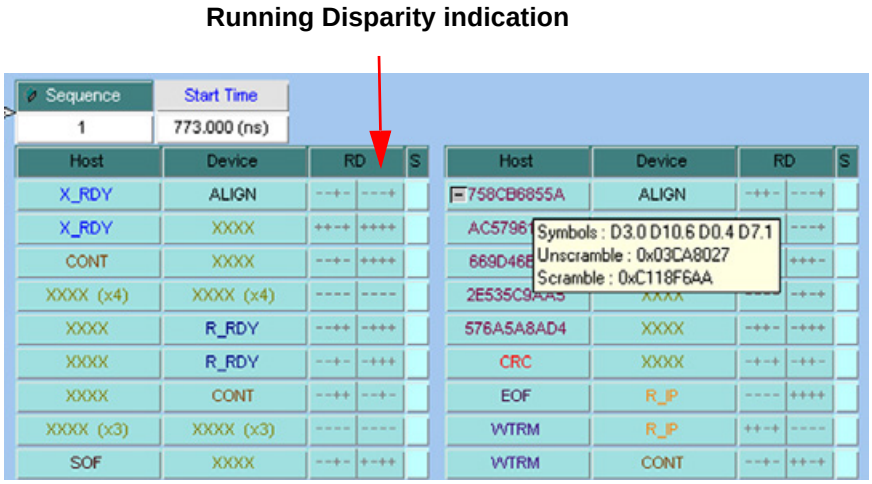


Figure 3.134: Payload Data Display

3.10.4 Customize Display

Rename Port

You can rename each port for easy identification. To rename a port, right-click the **port ID** in Text View or Column View.

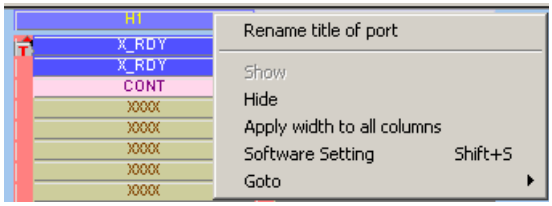


Figure 3.135: Rename Port

Choose **Rename title of port** to open the Rename Title of Port dialog.

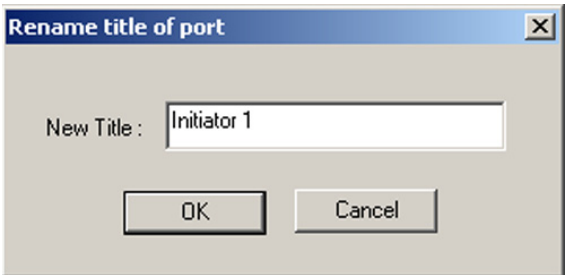


Figure 3.136: Rename Title of Port

Show/Hide Field

You can simplify the Viewer display by hiding some fields. You can hide the **Duration**, **Relative Time**, **External Signals,** and **Packet number** fields by right-clicking the corresponding field title and choosing **Hide Field** (see Figure 3.137 on page 356).



Figure 3.137: Hide Field

To restore a field to the display, right-click a **Port ID** field and choose the hidden field to restore.

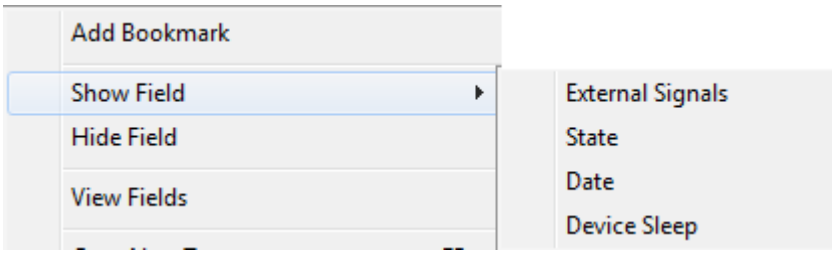


Figure 3.138: Show Field

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

Related Frames

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

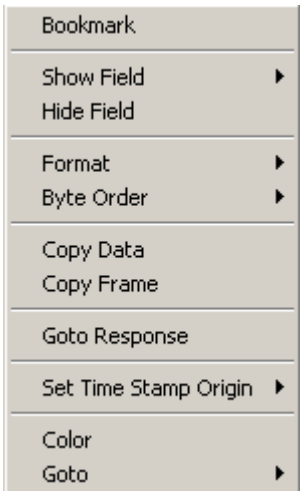


Figure 3.139: Goto Response

Similarly, right-click a **Response frame** for an SSP Frame, or **Register Device to Host** for an STP frame, to open a short-cut menu, then choose **Goto Command** to jump to the corresponding Command frame in the viewer.

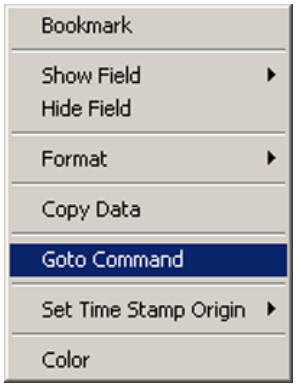


Figure 3.140: Goto Command

In Column View, you can right-click a **DWORD** inside a frame to display the **Goto Within Packet** command. You can jump to an SOF, EOF, HOLD, or R_IP.



Figure 3.141: Goto Within Packet Command

Byte Order

You can change the byte order in fields marked by an arrow and other fields.

Right-click in the field, select **Byte Order,** and choose the ordering.

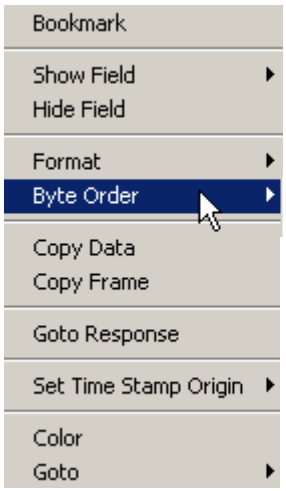


Figure 3.142: Byte Order

Note: A blue arrow in the byte order field indicates that it has been changed.

Choose Data Format

You can display data values either in hexadecimal (default) or binary. To choose data format, right-click the mouse over a data field, and choose **Format** and the format (see Figure 3.143 on page 359).

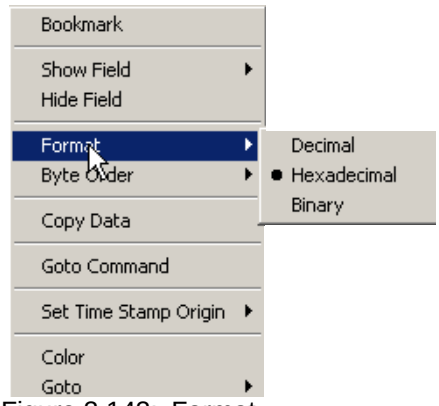


Figure 3.143: Format

Show All Data

To display all captured data, click the **data expand** toggle arrow in a data field, to examine the data in detail.

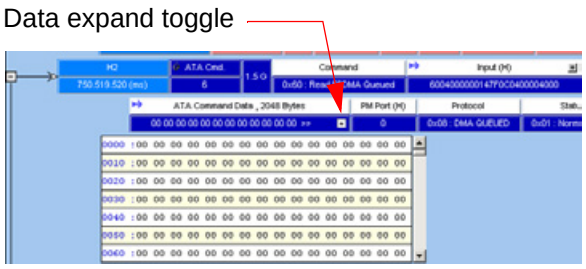


Figure 3.144: Show All Data

You can expand or collapse all data fields globally. To expand all data fields, right-click the mouse in a data field and choose **Expand All.**

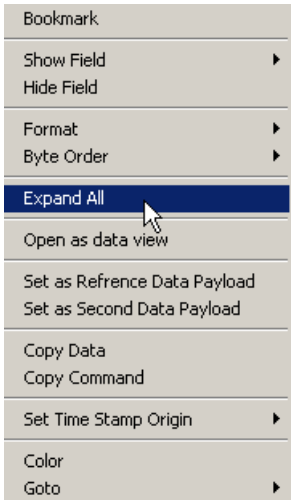


Figure 3.145: Expand All

To collapse all fields, right-click the mouse in a data field and choose **Collapse All.**

You can expand or collapse all FIS's and commands. To expand, right-click the mouse in a data field and choose **Expand All FIS's** or **Expand All ATA Cmd.s.** See Figure 3.146 on page 360.

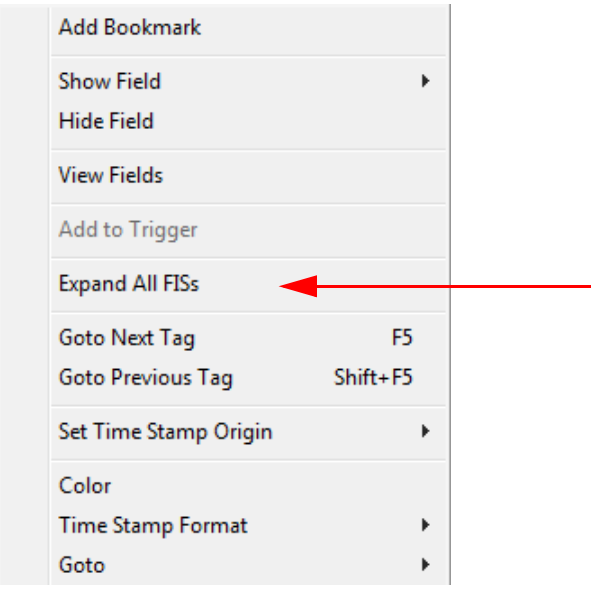


Figure 3.146: Expand All FIS's

To collapse, right-click the mouse in a data field and choose **Collapse All FIS's** or **Collapse All ATA Cmd.s.**

You can expand or collapse specific packets and commands by clicking on the + or − buttons (see Figure 3.147 on page 360).

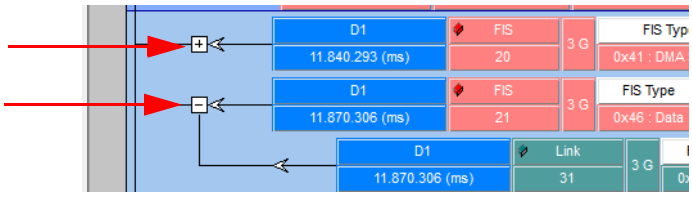
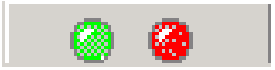


Figure 3.147: Expand/Collapse Specific Layers.

3.11 Port Status

You can get an overview of the active ports by clicking the **Port Status** button at the bottom right of the application window.



The Port Status displays the Port, Speed, and Analyzer.

In addition to displaying OOB, Link, Frame, and Error, a display showing the % buffer full opens when a trigger occurs.

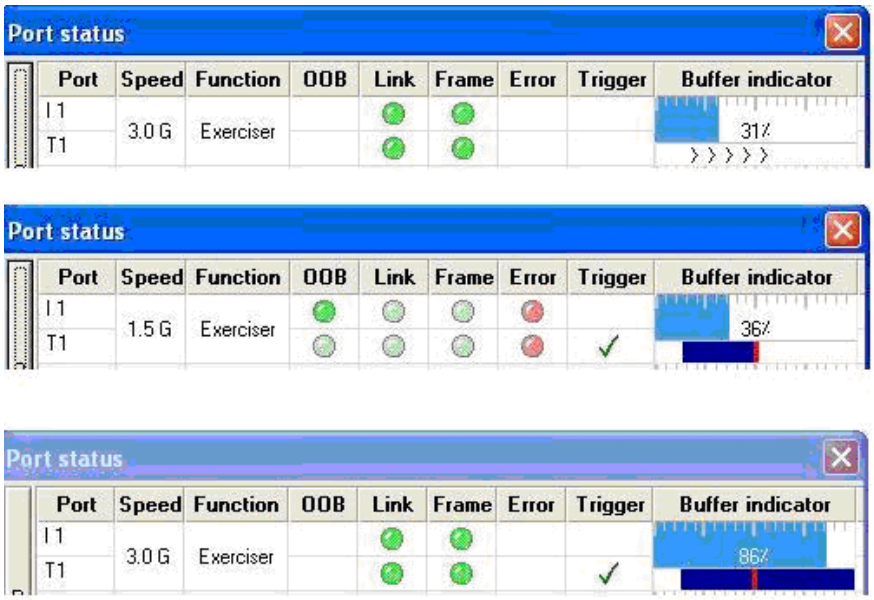
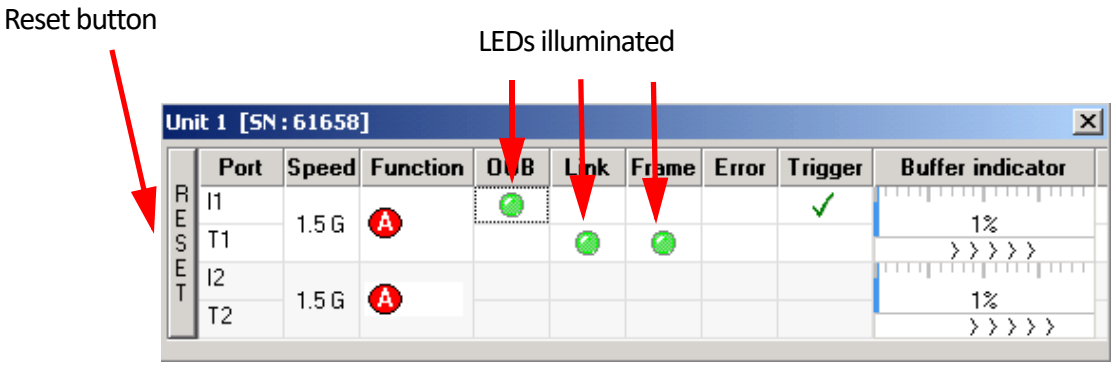


Figure 3.148: Port Status Window and Capturing Time

1. Pre-trig capturing (trig is 50%)
2. Trig point (shown by red bar; 36% pre trig was captured)
3. Post-trig capturing (50% post-trig was captured and capturing has stopped)

Note: If sample capture occurs with more than one unit active, additional Port Status windows display.

The OOB, Link, Frame and Error LEDs in the Port Status dialog mimic/follow the LEDs on the Front panel of the unit.

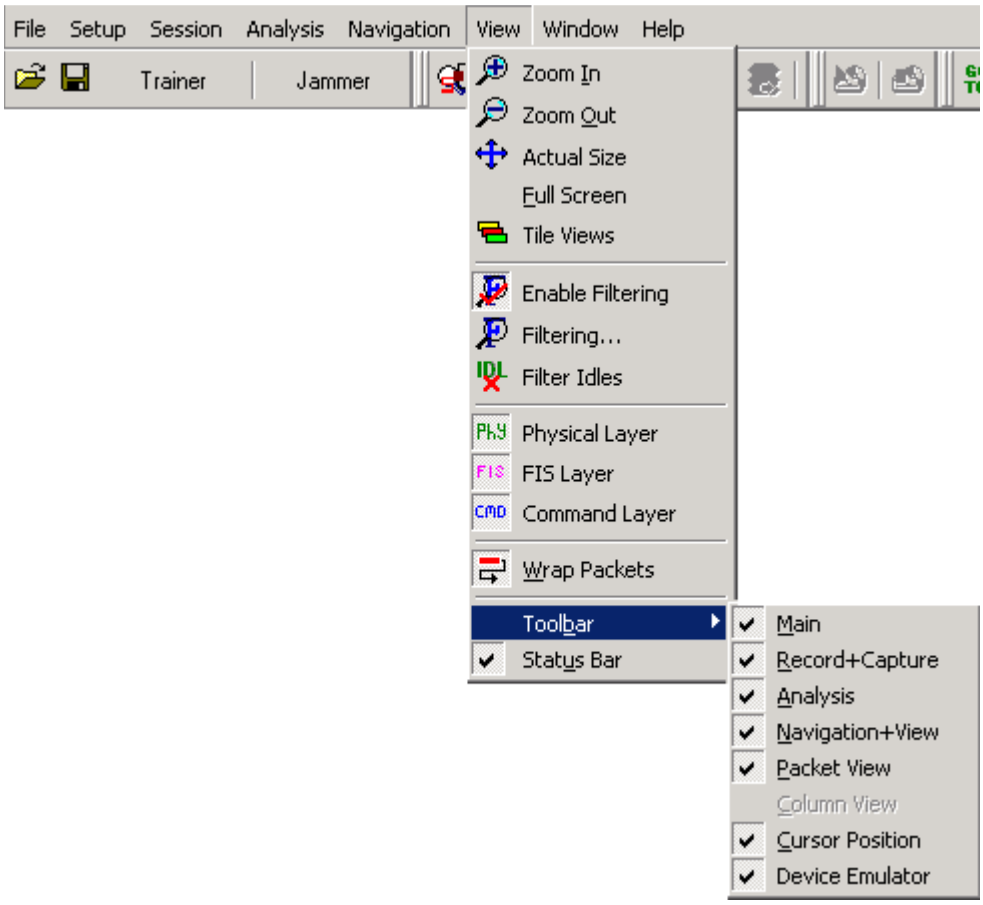


When the LEDs are dim, it indicates they were lit in the past. Pressing the Reset button erases this history and the illuminated LEDs are removed from the dialog.

3.12 Toolbars

3.12.1 Enabling Tool Bars

To customize the Viewer Display workspace, you can enable and reposition the available toolbars. To display or hide toolbars, select **View > Toolbar**, then check or uncheck toolbars**.**



Toolbars are:

- Main
- Record + Capture
- Analysis
- Navigation + View
- Packet View
- Column View
- Cursor Position
- Device/Target Emulator

Once enabled, the toolbars can dock at the Viewer Display window or float on the windows desktop.

3.12.2 Cursor Position Status Bar

To display the cursor position status bar, select **Toolbar > Cursor Position**.



Figure 3.149: Cursor Position Toolbar

See "Using the Cursors and Bookmarks" on page 363.

3.13 Status Bar

The Status bar is located at the bottom of the main display window.

3.13.1 Search Status

The right most segment displays the current search direction: **Fwd** (forward) or **Bwd** (backward). Change the search direction from the Search Menu or double-click the Search Status segment.

3.14 Using the Cursors and Bookmarks

3.14.1 Cursors

The data viewer display incorporates three cursors labeled **X, Y,** and **T.** All cursors are initially overlaid and positioned at location 0, which is the trigger position of the display. The Trigger, or **T**, cursor is the measurement reference and is always 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 in which to place 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 in which to place the cursor.

Note: You can also left-click to set the X-cursor and right-click to set the Y cursor in the Frame and Column View by clicking in the narrow strip on the very left side of a cell. Similarly, you can set the cursors in the Waveform View by left and right clicking at the beginning of a waveform.

Time

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.



Figure 3.150: Cursor Position Toolbar

3.15 Display Configuration

The Analyzer ships with a default display configuration of field and viewer settings. You can define your own field and viewer settings for a particular testing scenario. Right-click in the Packet View and select **Preferences** or select **Setup>Preferences>Trace Viewer>Configuration**. The Trace Viewer Configuration dialog displays (see Figure 3.151 on page 365).

3.15.1 Trace Viewer Configuration

The Trace Viewer Configuration dialog (see Figure 3.151 on page 365) allows you to change the following display settings:

- Field Setting
  - Format (Decimal, Hexadecimal, Binary)
  - Visible
  - Byte Order (Right Align, Left Align)
- Field Header Setting
  - Text (color)
  - Name
  - Abbreviation
  - Foreground (color)
- Viewer Setting
  - Wrap Packet
  - Enable Tooltips
- Data Payload
  - Columns in Row (1, 2, 4, 8, 16)
  - Bytes in Column (1, 2, 4, 8, 16)
- Time Stamp Origin: Absolute, Trigger, User Defined, Based on System Time
- Same color for start time and port
- Enable Packet View Condense Mode
- Time Stamp Format (LeCroy, Milli, Micro)
- Save Trace Viewer Configuration in a file
- Load Sample Viewer Configuration from a file
- Factory Setting (restores default settings)
- Font (opens Font dialog)

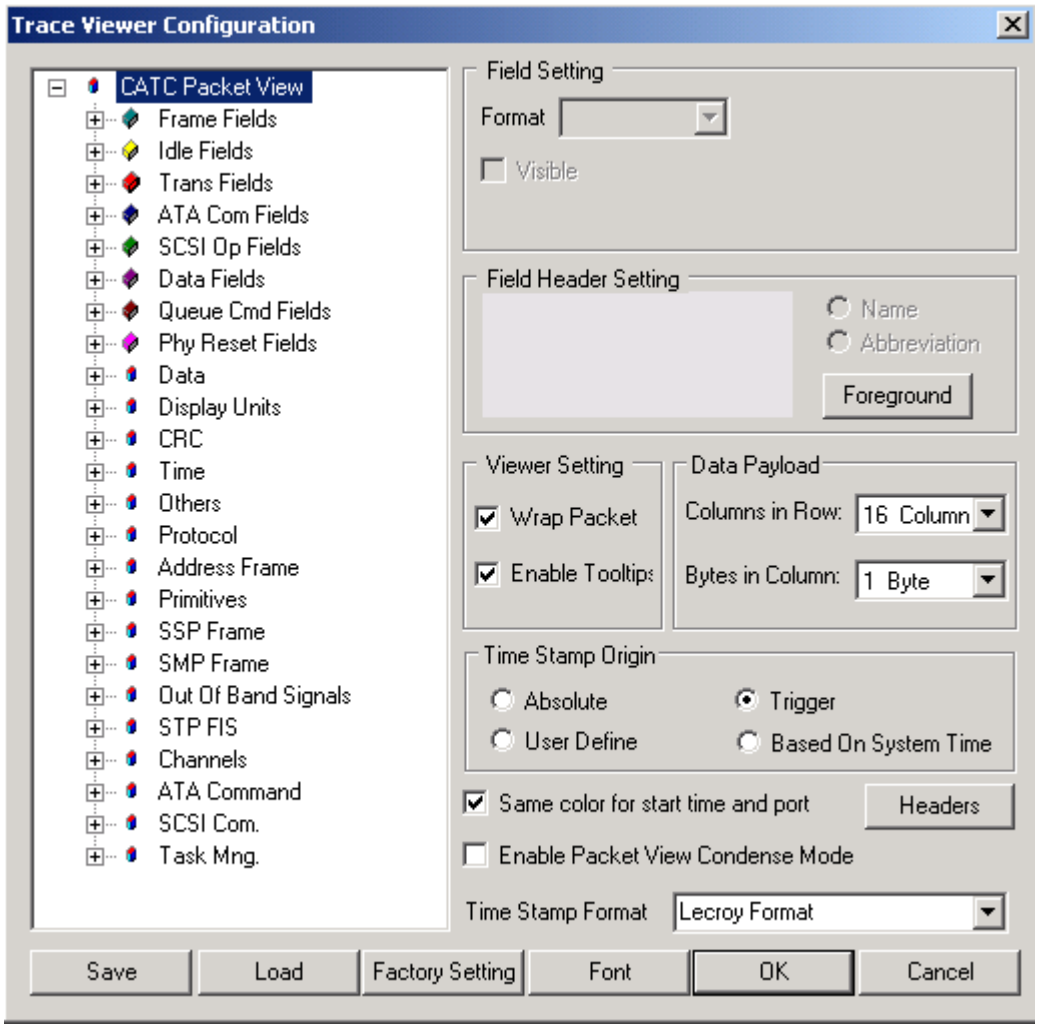


Figure 3.151: Trace Viewer Configuration

Field Settings

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.

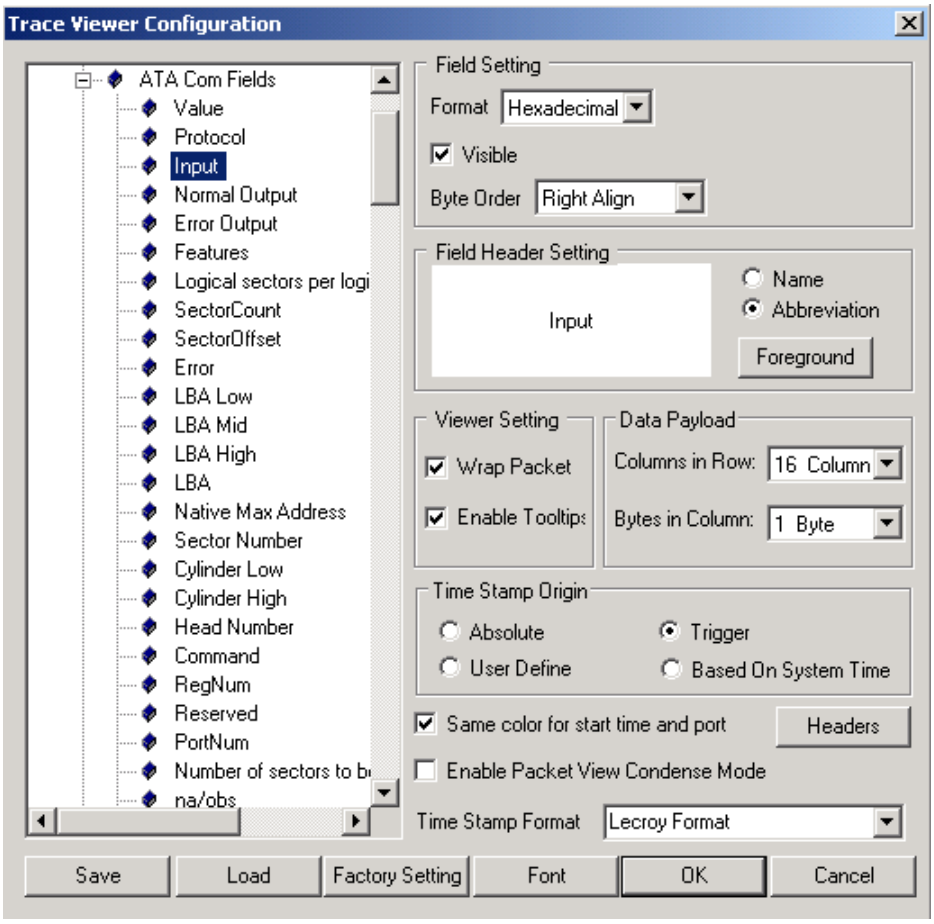


Figure 3.152: ATA Command Fields

Field Header Setting

You can use the Name or Abbreviation.

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.



Figure 3.153: Color

Choose an appropriate color and click **OK.**

Viewer Setting

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.

Data Payload

You can format the Data Payload display.

For Columns in Row, select 1, 2, 4, 8, or 16.

For Bytes in Column, select 1, 2, 4, 8, or 16.

Time Stamp Origin

Select Absolute, User Defined, Trigger, or Based on System Time.

Start Time and Port

You can use the same color for the start time and port.

Packet View Condense Mode

You can enable Packet View Condense Mode to minimize Packet View rows.

Time Stamp Format

Select Teledyne LeCroy, Milliseconds, or Microseconds.

Font

To change display fonts, click the **Font** button to open the Font dialog box.

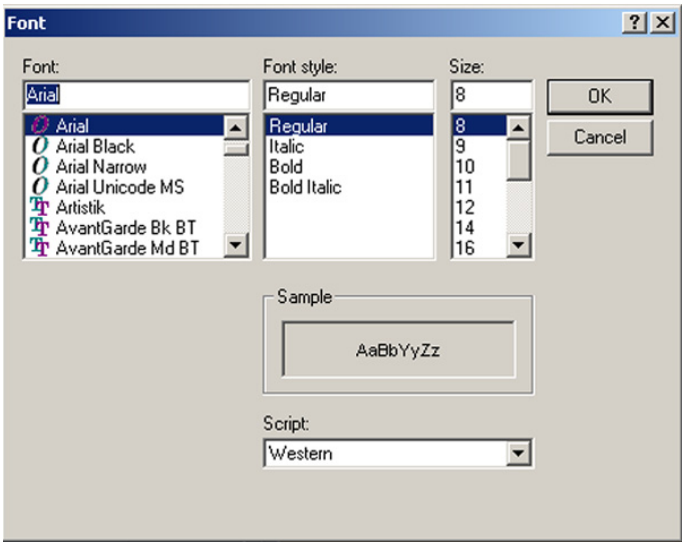


Figure 3.154: Font

Choose the font, font style, and size, and click **OK.**

Save/Load Settings

You can 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.

3.16 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 (see Figure 3.155 on page 369).

To assign port names in an open sample view, select **Setup > Set Port Alias**.

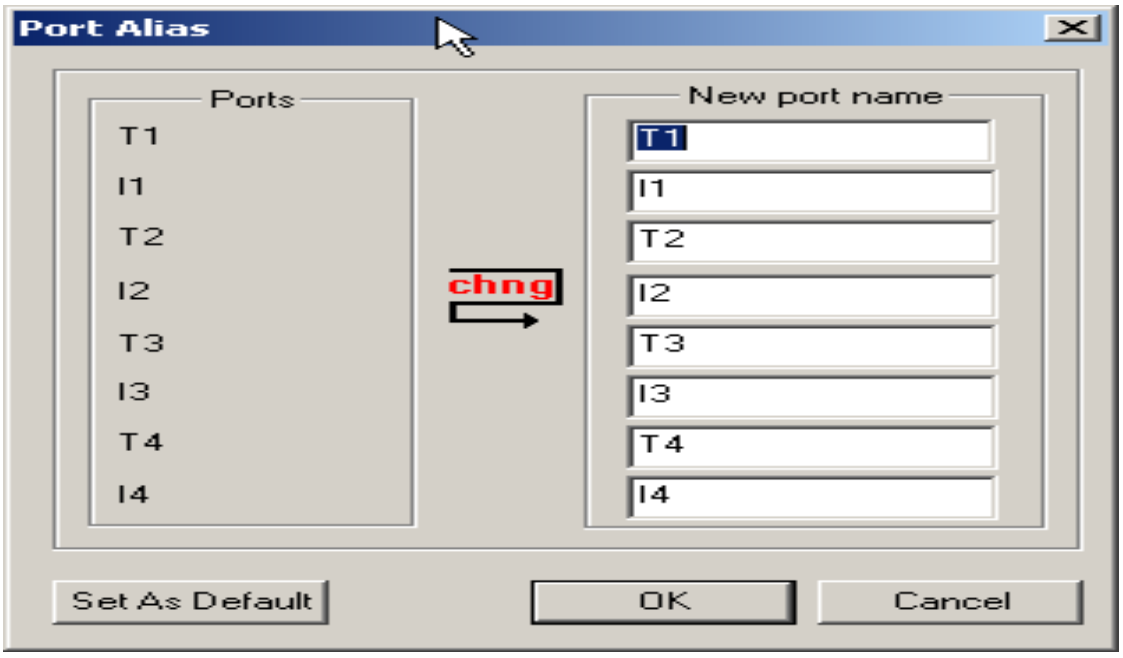
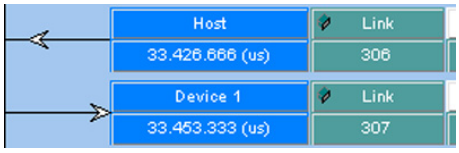


Figure 3.155: Assign Port Alias

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



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

Restore Factory Presets

Click the **Restore Factory Presets** button to restore the settings to the factory settings.

Set As Default

If you want to set these port aliases for sample files that will be captured later, you can set them as default, and new samples will be opened by these default port aliases.

3.17 SAS Address Alias (SAS only)

SAS Address Alias allows you to assign a meaningful name to each SAS address to assist in interpreting the results displayed in the sample view. To assign SAS address names in an open sample view, select **Setup > Set SAS Address Alias** (see Figure 3.156 on page 370).

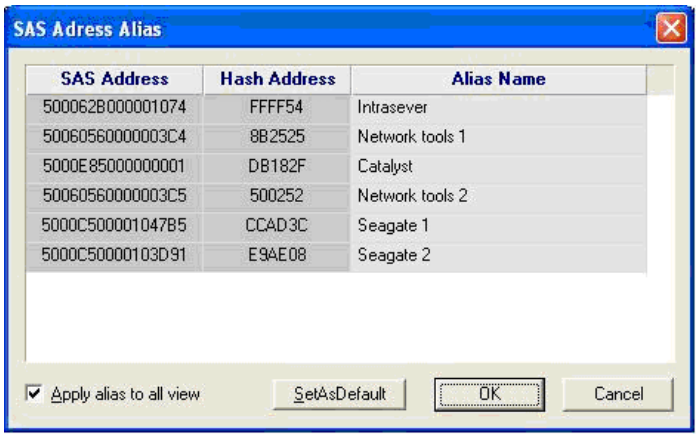


Figure 3.156: SAS: Assign SAS Address Alias

Assign a meaningful name to each SAS address in use and click **OK**. The assigned names replace the SAS address in the sample view, Search, filter, and Statistical report.

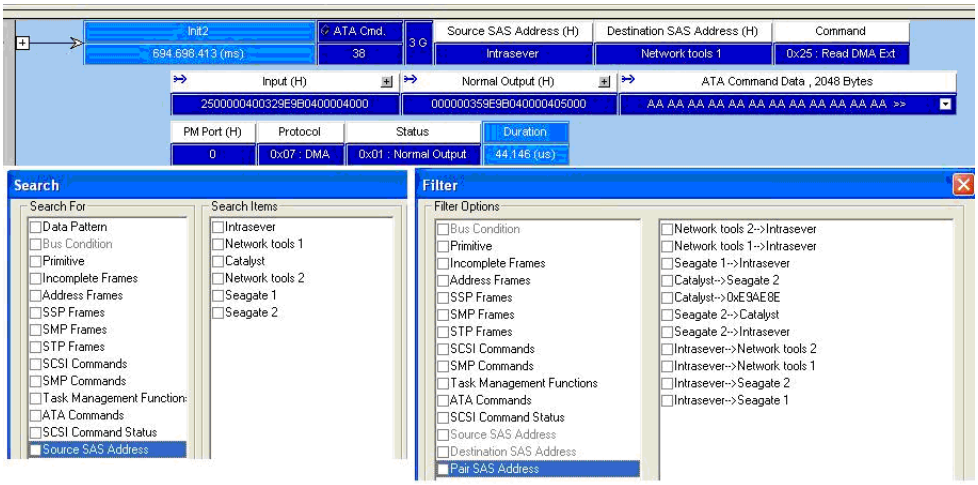


Figure 3.157: SAS: Address Alias

If you elect to save the captured sample file, the assigned SAS address names are saved together with the result, so that when you open the sample file later, the assigned names are retained.

Set As Default

If you want to set these SAS address aliases for sample files that will be captured later, you can set them as default, and new samples will be opened by these default SAS address aliases.

3.18 Device Settings -> Probe Calibration Settings

Select **Setup > Device Settings** to display the Device Settings dialog:

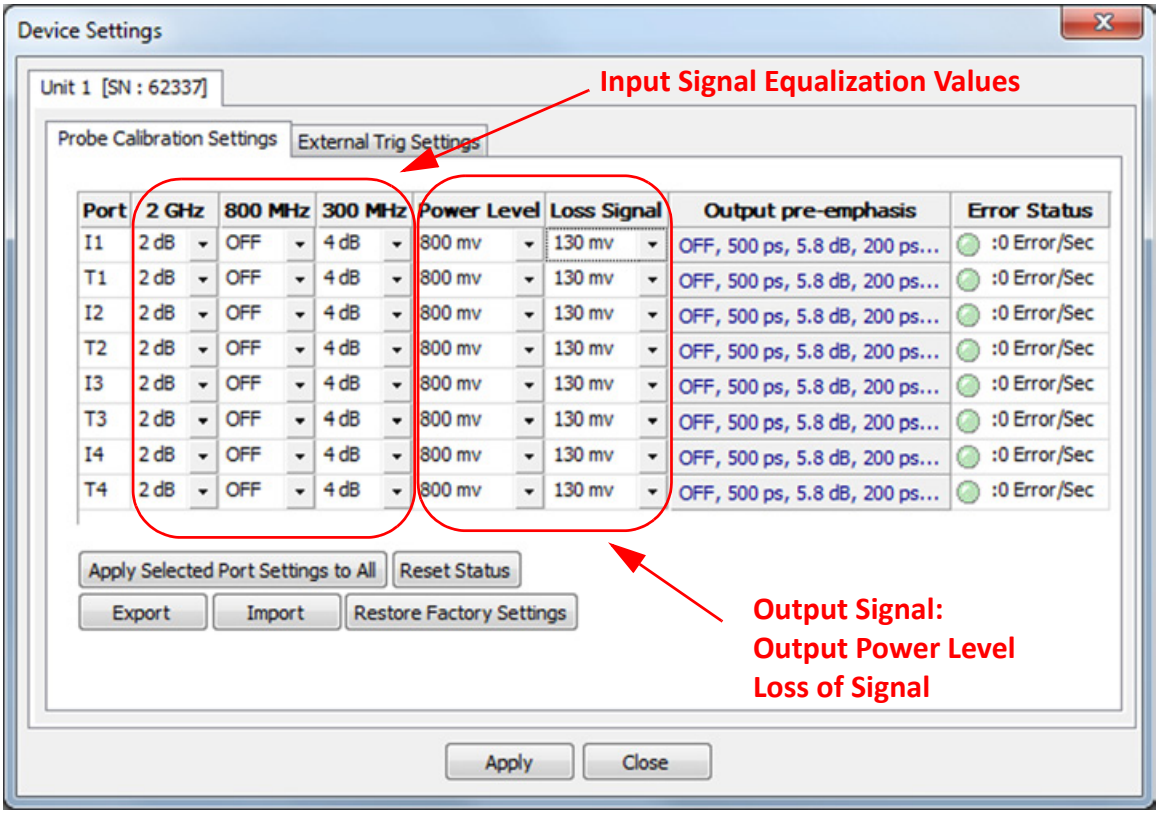


Figure 3.158: Device Settings Dialog

3.18.1 Port Selection

Port: Displays ports to select from.

3.18.2 Input Settings

Input signal equalization settings: Allows you to select values for Short time constant (**2GHz**), Medium time constant (**800 MHz**), Long time constant (**300MHz**), **Power Level** and **Loss Signal** from the drop-down menus.

3.18.3 Output Settings

Output Power Level: 1130 mv to 210 mv

Loss of Signal: 310 mv to 130 mv

3.18.4 Output Pre-Emphasis

Output pre-emphasis: See Figure 3.159.

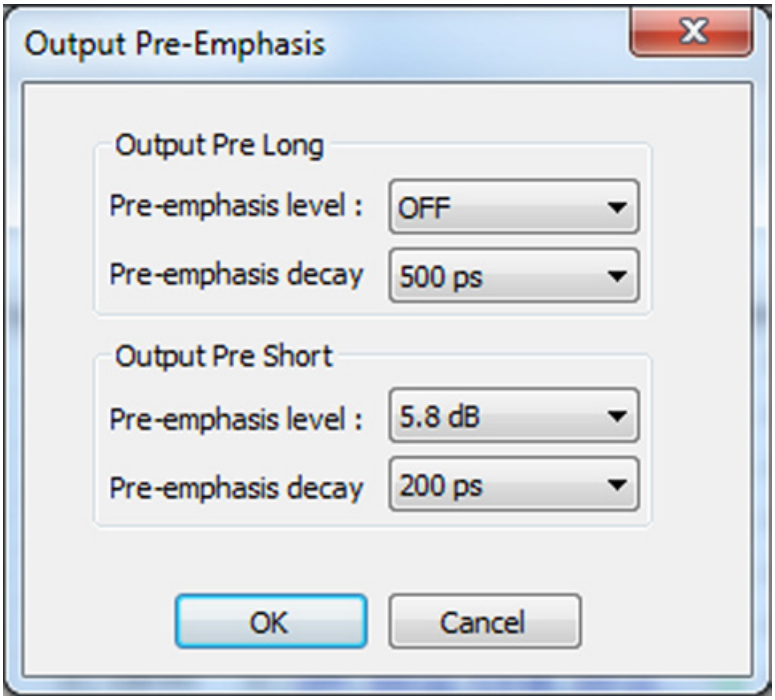


Figure 3.159: Device Settings: Output pre-emphasis

3.18.5 Other Status/Settings

Error Status: Displays number of errors per second per Port.

Apply Selected Port Settings to All Ports: Implements one port's setting into all other port settings.

Reset Status: Press the **Reset Status** button to Reset the Error Status of the selected Port.

Export: Saves the new values as a ***.sng** file.

Import: Loads back the saved ***.sng** file.

Restore Factory Settings: Restores default values.

Apply: Applies the selected settings.

Output Pre Long: Allows you to select values for Pre-emphasis level, Pre-emphasis decay, from the drop-down menu.

Output Pre Short: Allows you to select values for Pre-emphasis level, Pre-emphasis decay, from the drop-down menu.

OK: Stores the selected settings.

3.19 Preferences

Preferences allow you to define template files for new Analyzer projects, to specify how sample files appear when opened, and to set ATAPI and SCSI Spec Assignments.

To perform settings in an open trace view, select **Setup > Preferences**.

3.19.1 General Tab

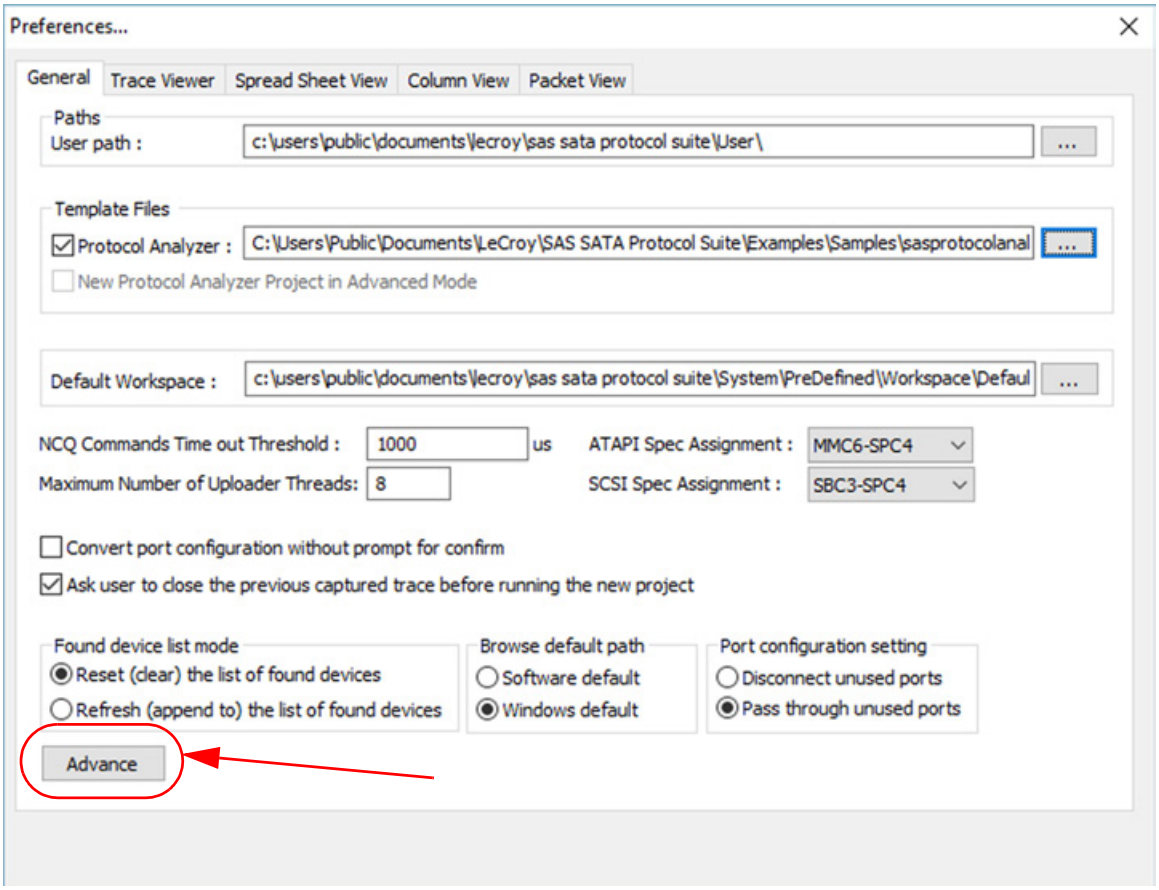


Figure 3.160: Preferences Dialog General Tab

Paths

User Path specifies the “User” folder path, used by the software after launching the Open dialog.

Template Files

Protocol Analyzer: You can use a pre-saved analyzer and/or analyzer/emulator project file as a template. Whenever you make a new project file, the software uses the template to initialize the project file.

New Protocol Analyzer Project in Advanced Mode: When you use the New menu item to create a new project file, the software switches to Advanced mode automatically.

Other

Default Workspace specifies the default workspace file for opening a sample file. You can save any viewer configuration as a workspace and then specify it as the default workspace. The software always open a trace file based on the default workspace file.

NCQ Commands Time out Threshold: The software uses this setting in the statistical ATA command page for NCQ commands. If the time out exceeds this setting, the software reports an error.

Maximum Number of Uploader Threads: If Quick View is not enabled, during cascading, specifies the number of concurrent processes for uploading a sample file.

ATAPI spec assignment: Specifies the ATAPI default spec.

SCSI spec assignment (SAS only): Specifies the SCSI default spec.

Convert port configuration without prompt for confirm: If the current attached board does not support the project file port configuration, the software converts it to a supported port configuration without asking for confirmation. If this setting is unchecked, the software asks for confirmation

Ask user to close the previous captured sample before running the new project: When you start to run a new project, the software prompts you to close the current sample.

Found Device List Mode

Reset (clear) the list of found devices: Lists only the currently found devices.

Refresh (append to) the list of found devices: Adds new devices to the list of devices found previously.

Browse Default Path

Software default: After you select **File > Open**, the Open dialog shows the default user folder.

Windows default: After you select **File > Open**, the Open dialog shows the path selected when the Open dialog was last used.

Port Configuration Setting

These options pertain to Port Configurations that have unused ports (as marked by a dash in the Port Configuration table, e.g. AA--). This allows the user to control these ports, if unused by the analyzer platform, are to be disconnected or are to be used as pass through, meaning the traffic will simply pass through them (default setting). It is sometimes useful to force disconnect on unused ports, to cause all traffic to pass through the used ports. Select the desired option:

Disconnect unused ports

Pass through unused ports

Advance Button

Clicking on the Advanced button in the **Preferences -> General tab** (see Figure 3.160 on page 373) will bring up the following options (see Figure 3.161):

- Enhanced SigDet sensitivity on M122(A)/M124(A)
- Enable Long SAS Frames on M6-X (allows trace frame duration > 60 usec)

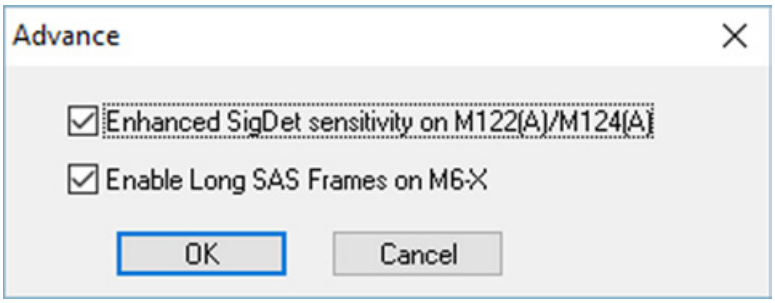


Figure 3.161: Preferences: General -> Advance

3.19.2 Trace Viewer Tab

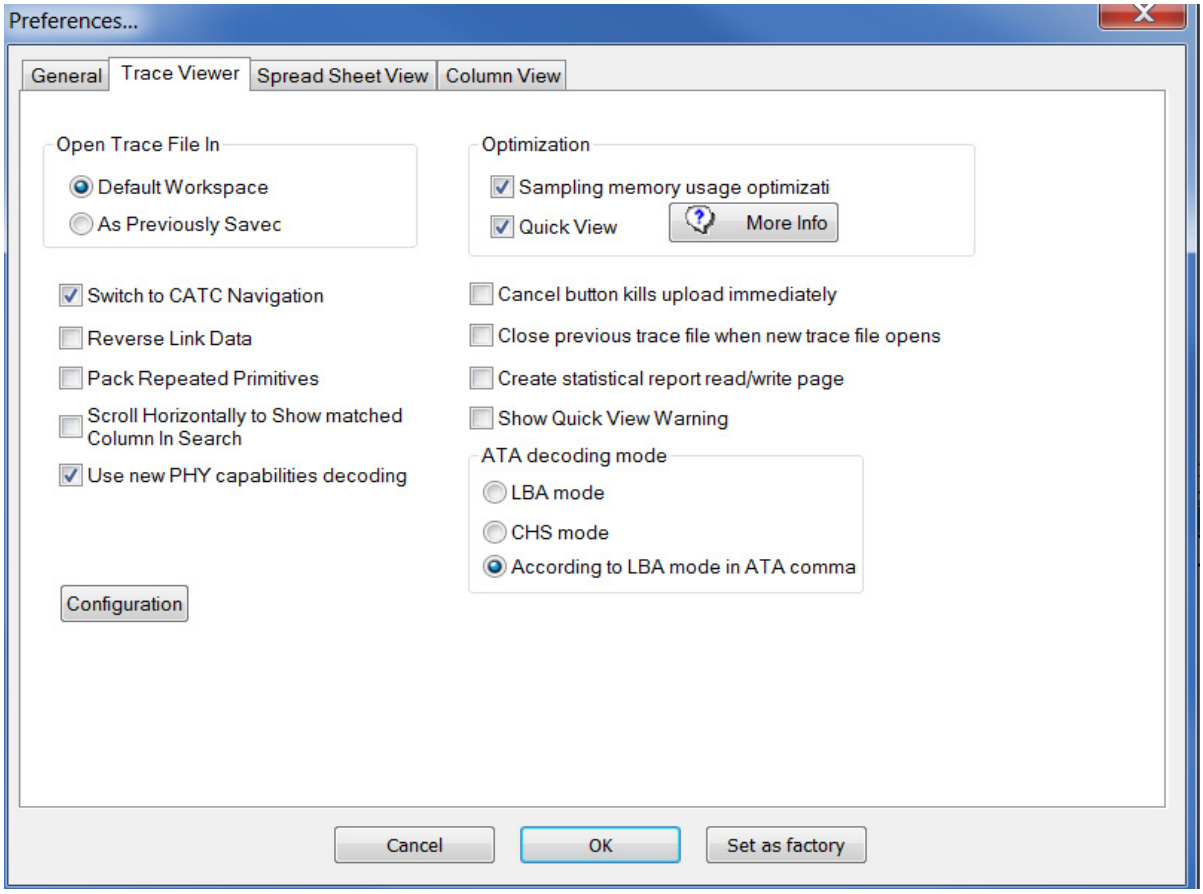


Figure 3.162: Preferences Dialog Trace Viewer Tab

The SATA Preferences dialog has the same options.

Open Trace file In

Default Workspace: The software opens a **trace** file in view(s) based on the specified default workspace.

As previously saved: The software opens a **trace** file in view (views) based on the last saved configuration for the **trace** file.

Optimization

Sampling memory usage optimization: Enables memory cascading for two ports. The analyzer will use memory of another port if there is not data on another port. (see "Sampling Memory Usage Optimization" on page 381)

Quick View: Quick View allows full access to the whole trace more quickly, especially when using a Gigabit Ethernet connection. However, the trace is NOT written to the host machine's hard drive. To save the trace, you must manually click **Save**.
If you do not check Quick View, the trace loads more slowly but is automatically saved to the host machine's hard drive.

Other

Switch to CATC Navigation: Packet view will open in CATC mode.

Reverse Link Data: The software shows DWORDs of link data as reversed.

Pack Repeated Primitives: The software packs repeated primitives just after opening a sample file.

Scroll Horizontally to Show matched Column in Search: When unchecked makes columns stationary even during search.

Use new PHY capabilities decoding: Checking this box sends the first bit as bit # 7. Leaving the box unchecked sends the first bit as bit # 0.

Cancel button kills upload immediately: The software kills the uploading process if you press **Cancel**.

Close previous sample file when new sample file opens: When you want to open a new sample file, the software closes any open sample files.

Create statistical report read/write page: The software creates a Read/Write page in the statistical report. Enabling this setting displays the **Read/Write Stream DMA** command in the Read/Write page.

Show Quick View Warning: The Quick View Warning pops up when attempting to close a trace that has not yet been saved, and is only shown in Quick View "mode". This checkbox allows to turn off this popup.

LBA mode: Checking this box enables LBA mode for ATA decoding.

CHS mode: Checking this box enables CHS mode for ATA decoding.

According to LBA mode in ATA command: Checking this box enables decoding according to LBA mode in ATA command for ATA decoding.

Configuration: Clicking **Configuration** displays the Trace Viewer Configuration dialog (see Figure 3.163 on page 377).

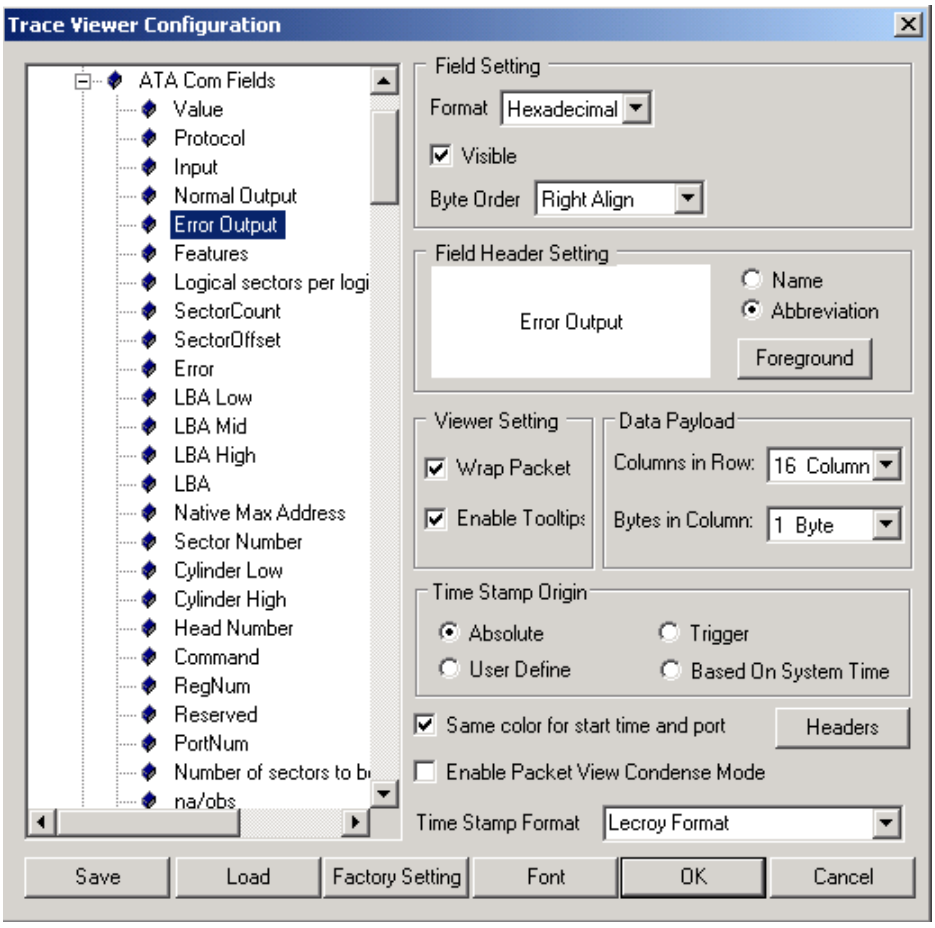


Figure 3.163: Preferences Trace Viewer Configuration Dialog

Select a view in the left pane and set the trace viewer display options in the right pane.

3.19.3 Spread Sheet View Tab

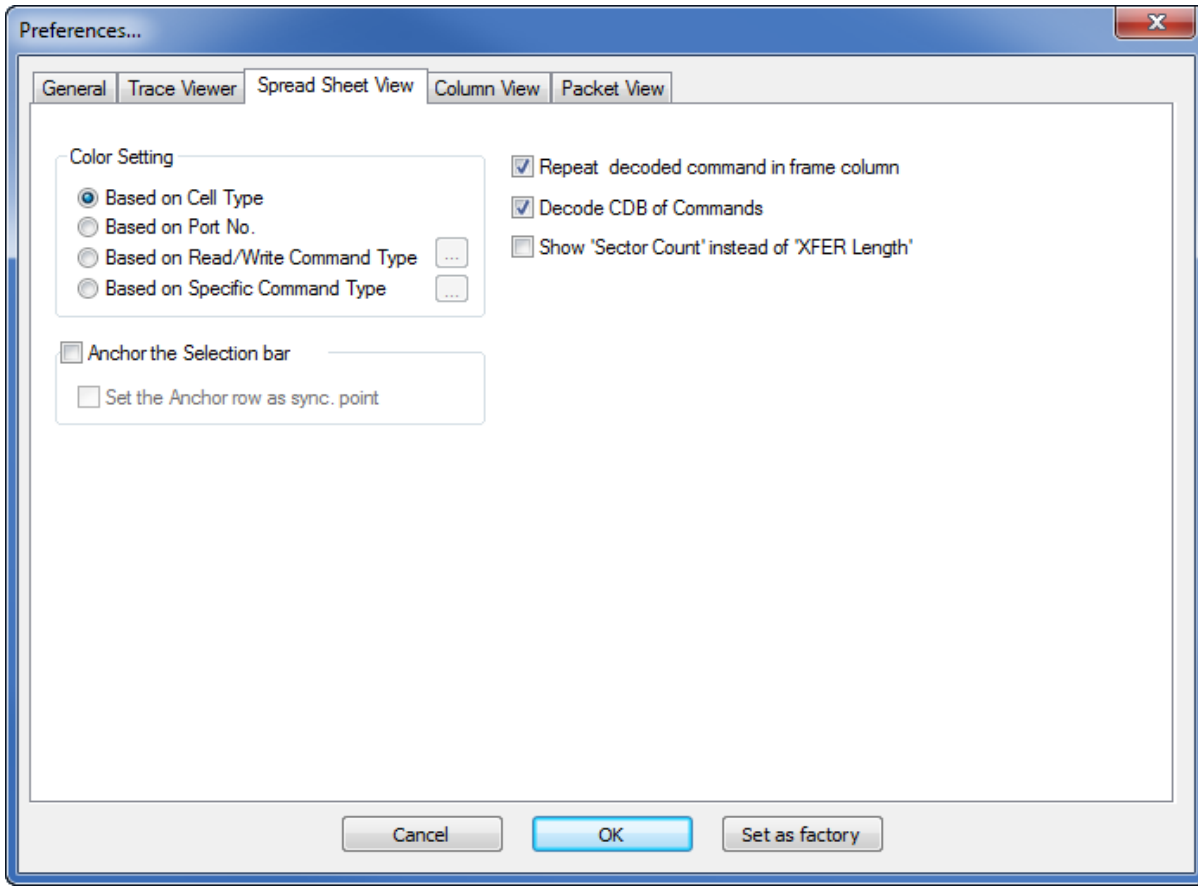


Figure 3.164: Preferences Dialog Spread Sheet View Tab

The SAS Preferences dialog has the same options, except that it does not have "Show 'Sector Count' instead of 'Xfer Length".

Color Setting

Based on Cell Type: Each column has its own color.

Based on Port No.: Data of each row are shown based on the specified color for its port. You can set the color of ports in the Viewer settings.

Based on Read/Write Command Type: You can specify a color for Read commands, another color for Write commands, and other color for other commands. The software shows each row based on the command type: Read, Write, or others.

Based on Specific Command Type: You can specify a color for each command. The software applies the setting on the Command column.

Anchor the Selection bar

You can anchor the selection bar of the Spreadsheet View.

Set the Anchor row as sync. point: Other views synchronize based on the contents of the anchor row.

Other

Repeat decoded command in frame column: The spreadsheet shows the name of the command in front of all frames in the Command column. Otherwise, it will show the name of the command only in front of the SSP command frame.

Decode CDB of Commands: The spreadsheet shows name of command in command column, otherwise shows CDB of command in command column.

Show 'Sector Count' instead of 'Xfer Length' (SATA only): Display sector count.

3.19.4 Column View Tab

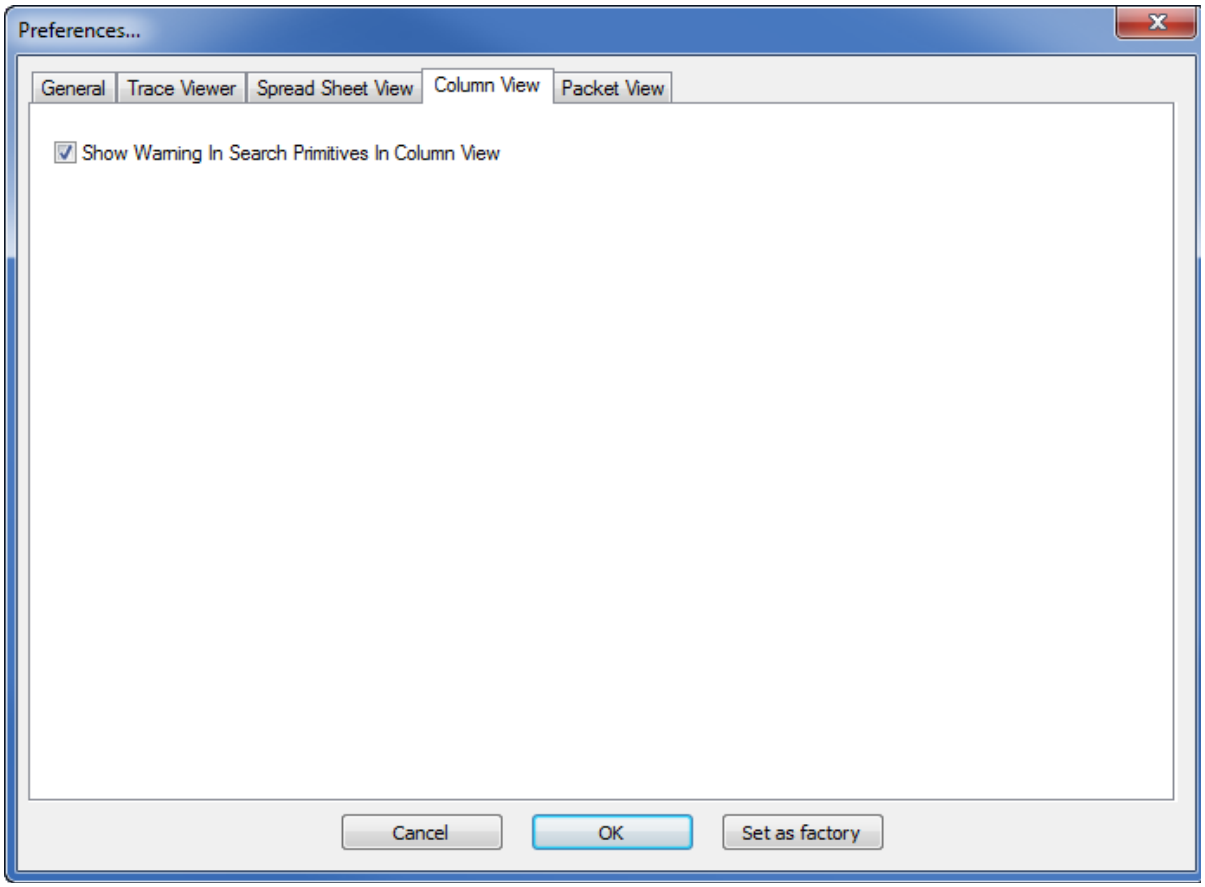


Figure 3.165: Preferences Dialog Column View Tab

Primitive In Column View: If searching in Column View takes a long time, the software asks if you want to continue search. Otherwise, the software continues searching with no pause.

3.19.5Packet View Tab

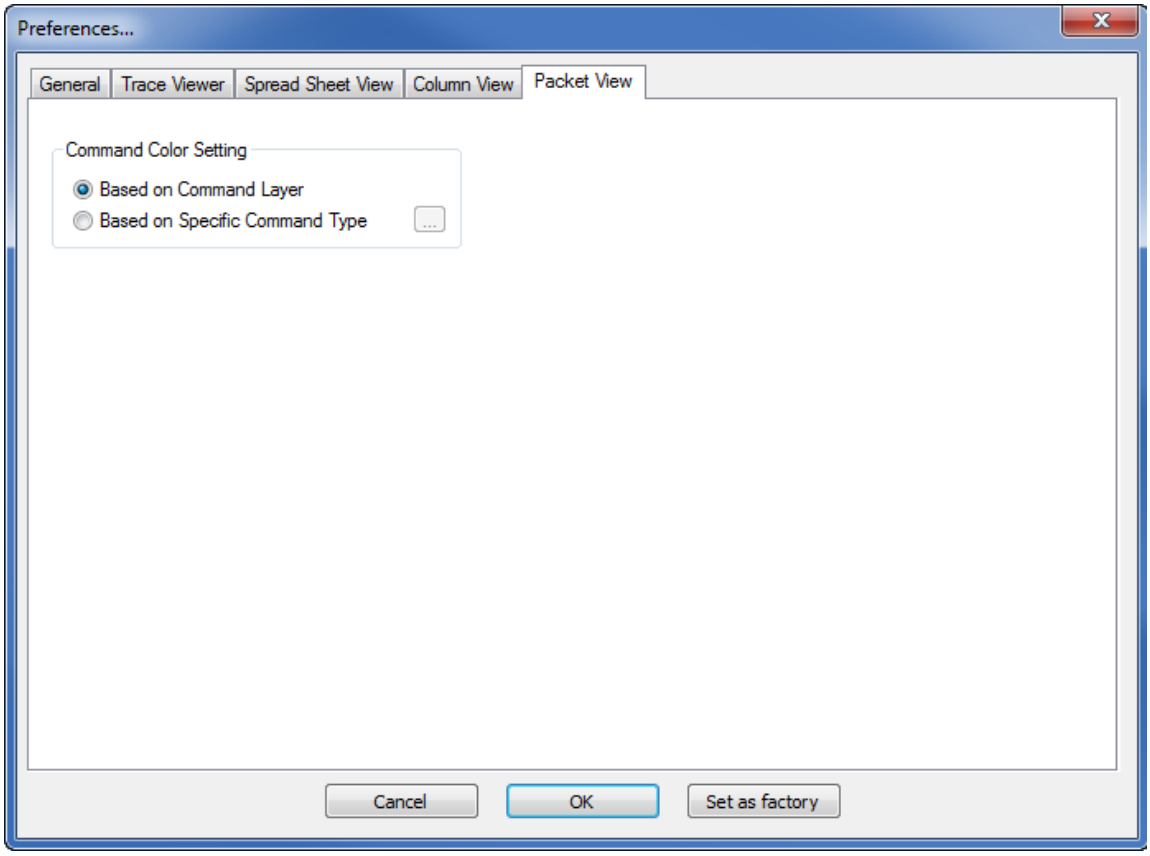


Figure 3.166: Preferences Dialog Packet View Tab

Based on Command Layer: You can specify a color for the Command Layer. The software shows each row based on the command layer.

Based on Specific Command Type: You can specify a color for each command. The software applies the setting on the Command column.

3.19.6 Sampling Memory Usage Optimization

The Preferences dialog has a Sampling Memory Usage Optimization option. This Memory Assignment (MA) feature optimizes sampling memory utilization.

If the Sampling Memory Usage Optimization Option is Checked

The system tries to use empty space in all memory banks to prevent any memory bank from filling completely. Each physical link is not necessarily assigned to a specific memory bank. The system can capture more sample data than if the MA option is unchecked, and sample file size is closer to the user-defined Sampling Memory Size.

Memory Assignment efficiency varies with Port Configuration and Trigger Position:

- **FPGA**: The Memory Assignment feature works for a pair of ports connected to one FPGA, for example ports 1 and 2 (or ports 3 and 4). Memory Assignment

does not work for two ports connected to different FPGAs, for example ports 1 and 3.

- **Triggering**: Memory Assignment only starts after the trigger point. During pre-trigger, each physical link is always assigned to a specific memory bank. Post-trigger, the system can try to use empty space in all memory banks, if you check the MA option. Therefore, Memory Assignment efficiency is maximum when Trigger Position is set to 0% (snap-shot trigger) and is minimum when Trigger Position is set to 99% or when there is no triggering (you stop recording manually).
- **MUX**: When MUX is enabled, each segment has four memory banks, limiting Memory Assignment somewhat.

Here are examples of different Port Configurations and Trigger Positions:

- **One port configuration (A - - -):** Sample size is user-specified sample size.
- **Two port configuration (AA - -)**: Ports 1 and 2 are on the same FPGA, so Memory Assignment has an effect. If you use snapshot triggering, the sample size is near specified size.
- **Two port configuration (AA - -):** If you use manual stop, Memory Assignment has no effect. Sample size depends on port traffic loads.
- **Two port configuration (AA - -)**: If trigger is set at 50%, and there is enough data to fill pre-trigger, Memory Assignment has an effect. Sample size is typically near specified size.
- **Two port configuration (AA - -)**: If trigger is set at 50%, but there is not enough data to fill pre-trigger, Memory Assignment has an effect. Sample size is typically more than half specified size, with size determined by the amount of data captured before trigger.
- **Two port configuration (A - A -)**: Ports 1 and 3 are not on the same FPGA, so Memory Assignment has no effect. If one port has heavy traffic, it may fill its memory bank and stop recording, resulting in smaller sample size than specified.

Note: Checking this option does not affect the sample. It only allows larger sample sizes.

Note: If traffic is balanced on ports, sample size is the same whether you check or uncheck the Sampling Memory Usage Optimization option.

Note: Memory Assignment depends on traffic load distribution at the time when the system tries to re-assign physical links to memory banks. Therefore, if you repeat a capture with the same Sampling Memory Size and Segment Number parameters, the resulting sample size may not be the same. However, if traffic load distribution is similar, sample size will be similar.

Note: The buffer status indicator shows buffer by FPGA, not by port.

If the Sampling Memory Usage Optimization Option is Not Checked

Each physical link (or logical link if MUX is enabled) is assigned to a specific memory space (memory bank), depending on the Sampling Memory Size and Segment Number parameters.

Important: If **any** physical link fills its memory bank, the recording process stops. Other memory banks will typically be less than full (and can be empty). The sample file might be smaller than the user-defined Sampling Memory Size. You might even think that the Analyzer malfunctioned.

3.20 Floating License

Note: License Manager is only available when in Cascading mode. For example, if one unit is licensed only for JJ and a second unit is licensed only for AA, cascading the two units and using the License Manager allows each unit to do JA.

To manage the license, select **Setup > Manage Setup Licenses**.

The Floating License dialog displays (see Figure 3.137 on page 356) the available functionality by Function, Total Ports, Assigned To ports, and Not Used. It also displays the Current License Configuration by License Type, Serial Number, Analyzer, Device Emulator, Host Emulator, and InFusion.

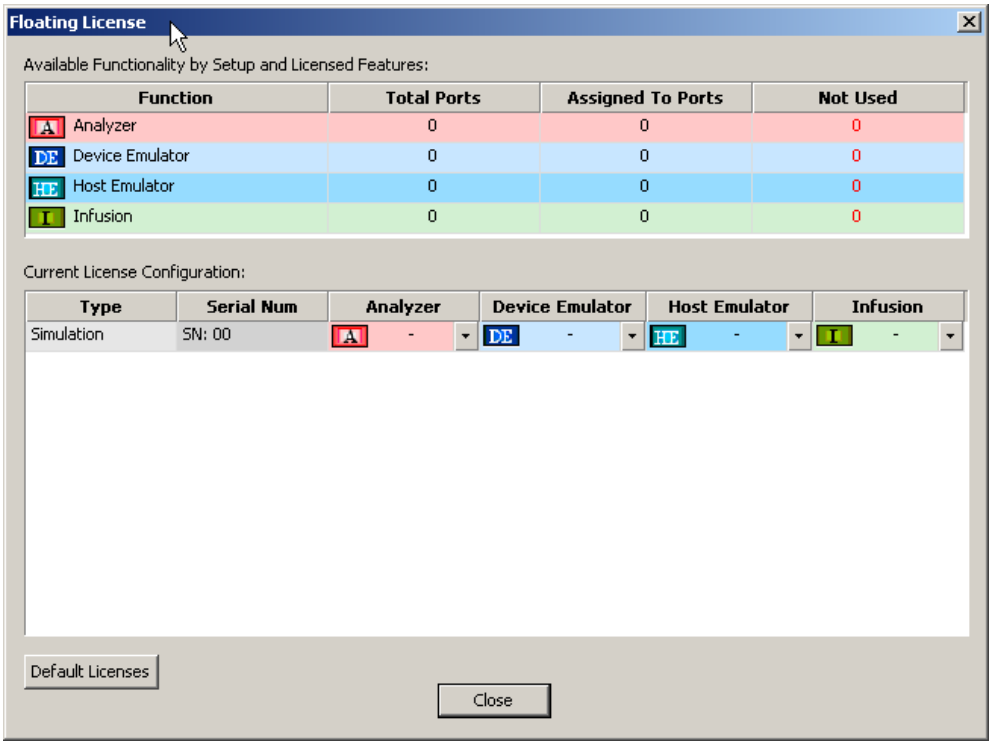


Figure 3.167: Floating License Dialog

3.21 External Trig Setting

To display the External Trig Setting dialog, select **Setup -> Device Settings -> External Trig Setting**. The External Trig Setting dialog displays the External Trig Out Setting and External Trig In Setting as High Active, Low Active or Toggle.

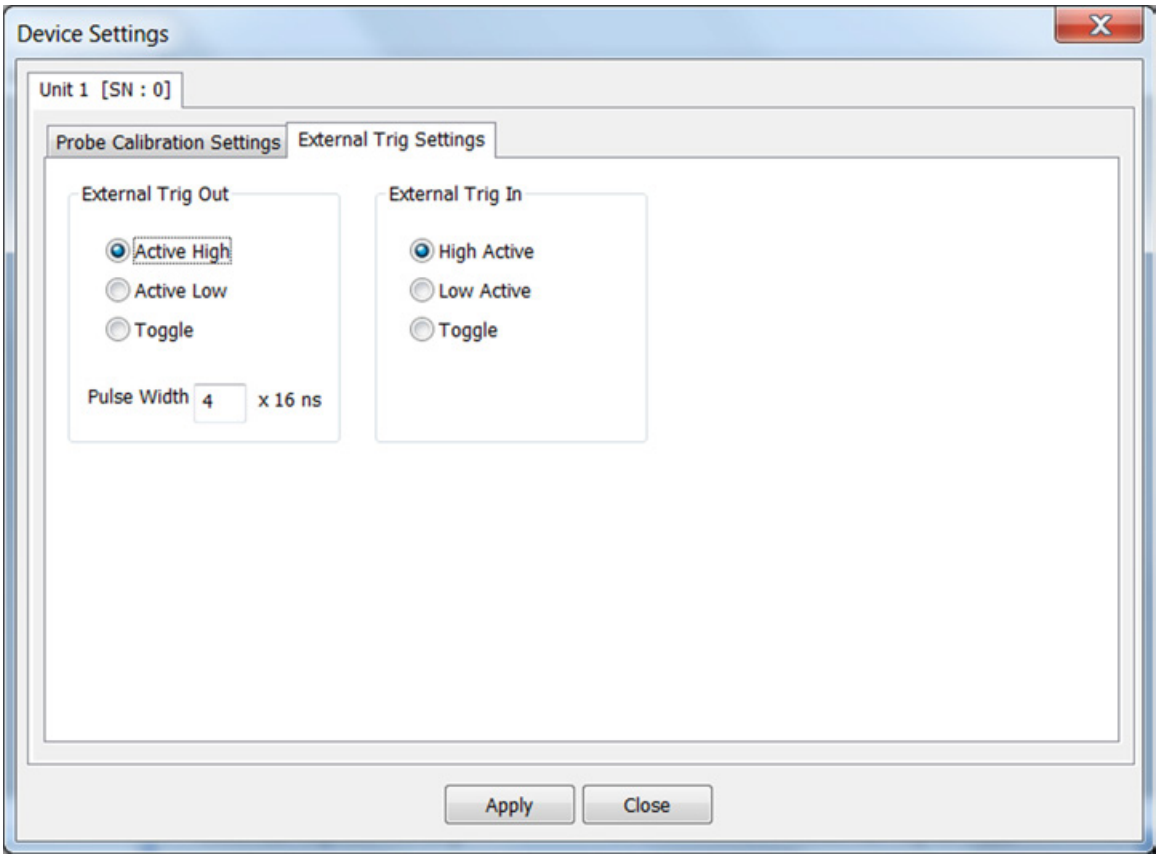


Figure 3.168: External Trigger Setting Dialog.

External Trig Out Setting

The Analyzer can send a Low or High external signal anytime a trigger occurs. Select the External Trig Out Setting: High Active, Low Active, or Toggle from High to Low or Low to High once (3.3 V output).

Enter the External TrigOut pulse width.

Note: The External TrigOut pulse width field supports increments of 16 ns, starting from 64 ns and up to 1024 ns.

External Trig In Setting

An external Low or High input signal can cause triggering. Select the External Trig In Setting: High Active, Low Active, or Toggle from High to Low or Low to High once (3.3 V output).

Note: The nominal External Trigger voltage is 0.818 volts. Trigger In can work with 1 volt to 5 volts input voltage.

3.22 Update Device

The Update Sierra Device command allows you to update a Sierra M6-2 Analyzer or CATC-Sync expansion card whose current version is incorrect.

1. Click **Setup > Update Device** to display the Device Setup dialog.

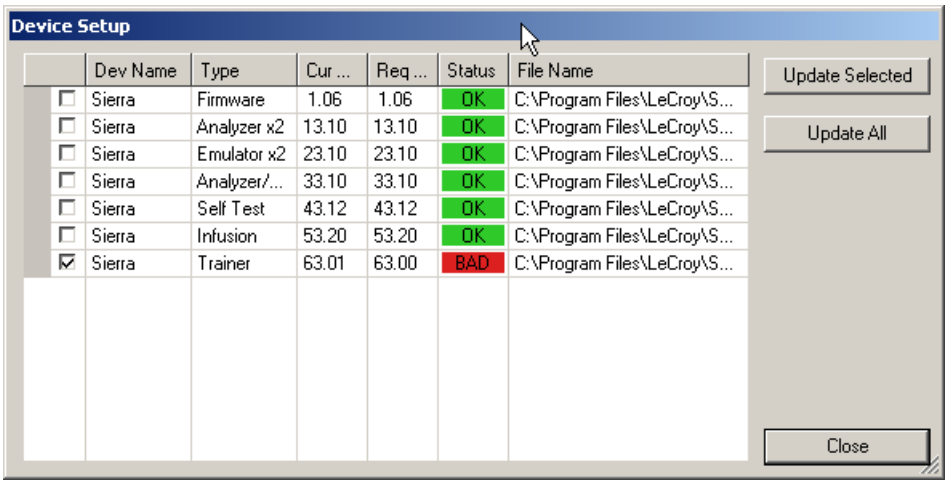


Figure 3.169: Device Setup Dialog with BAD Device Status

Devices whose version is correct have an OK status.
A device whose version is incorrect has a BAD status.

Note: You can click the ellipses (...) at the end of a file path and name to display an Open dialog, in which you can browse for files.

2. Click the checkbox to the left of a device with BAD status, then click **Update Selected** to begin the process that will make the Analyzer version correct (see Figure 3.170 on page 386).

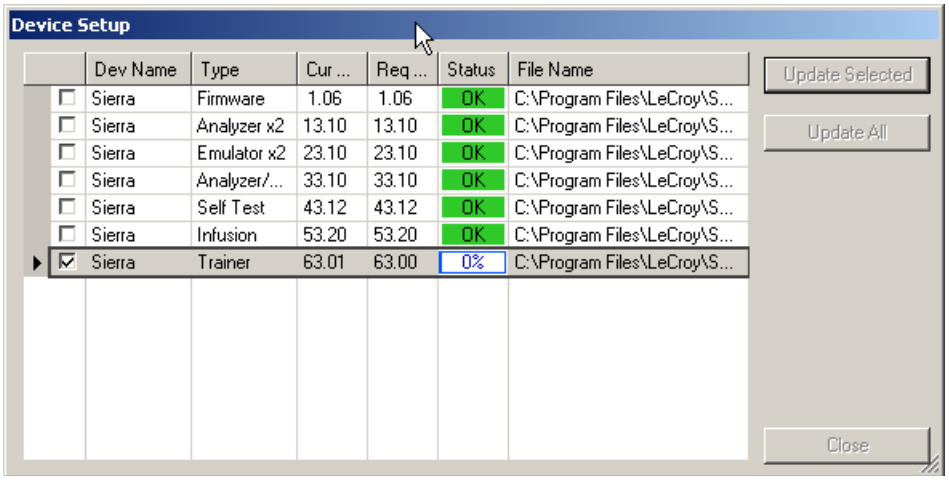


Figure 3.170: Device Setup Dialog Beginning to Update Status of a Device

After the update, the device must restart.

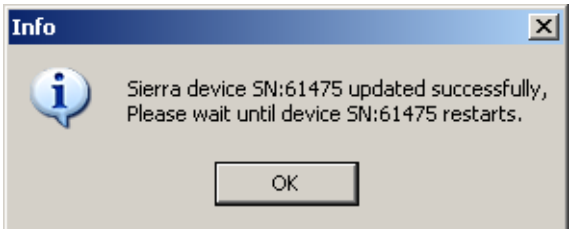


Figure 3.171: Info Dialog

Then the update is complete.

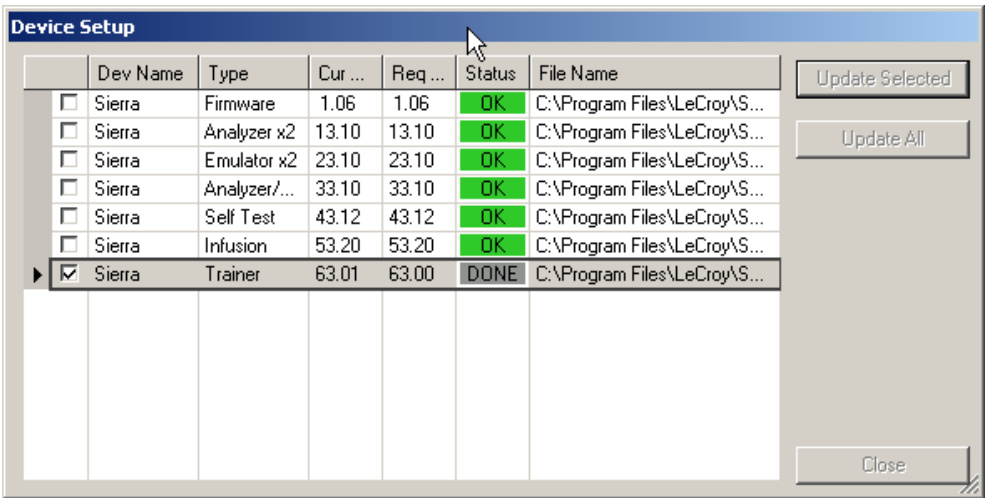


Figure 3.172: Device Setup Dialog with DONE Device Status

3.23 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.

Select **Setup > User Defined Decoding** to open the User Defined Decoding dialog. See Figure 3.173.

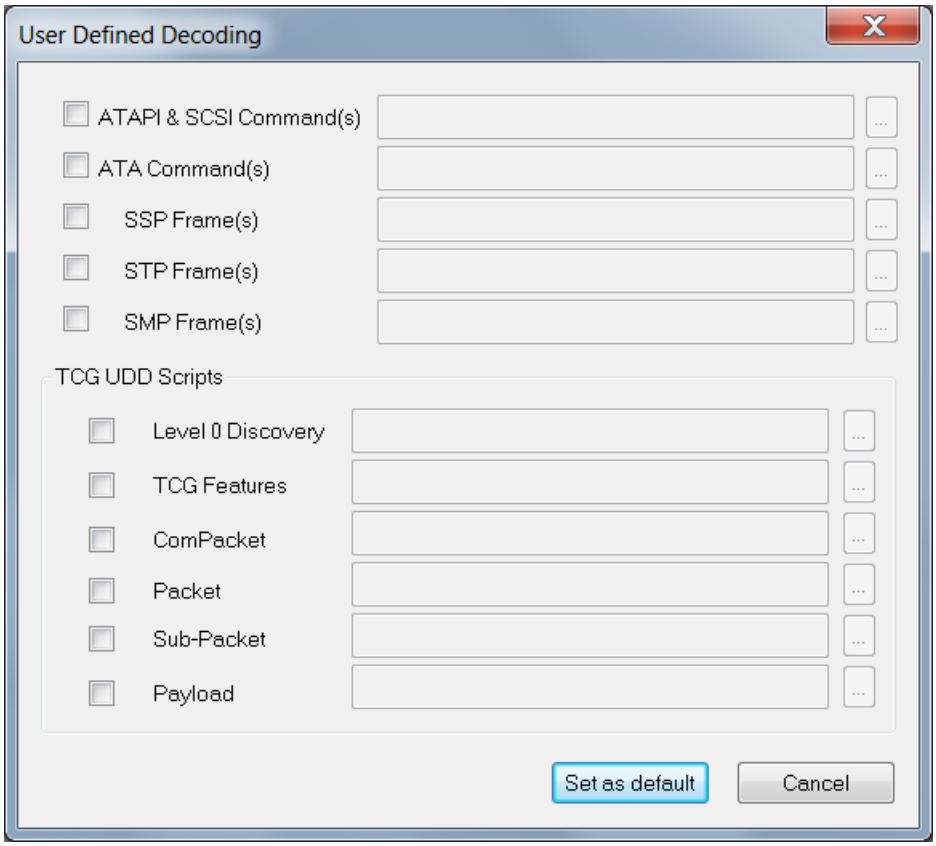


Figure 3.173: SAS/SATA: User Defined Decoding.

SAS adds SCSI Commands, SSP Frames, and SMP Frames.

Select one of the script types and click on the "..." tab. See Figure 3.174 on page 388.

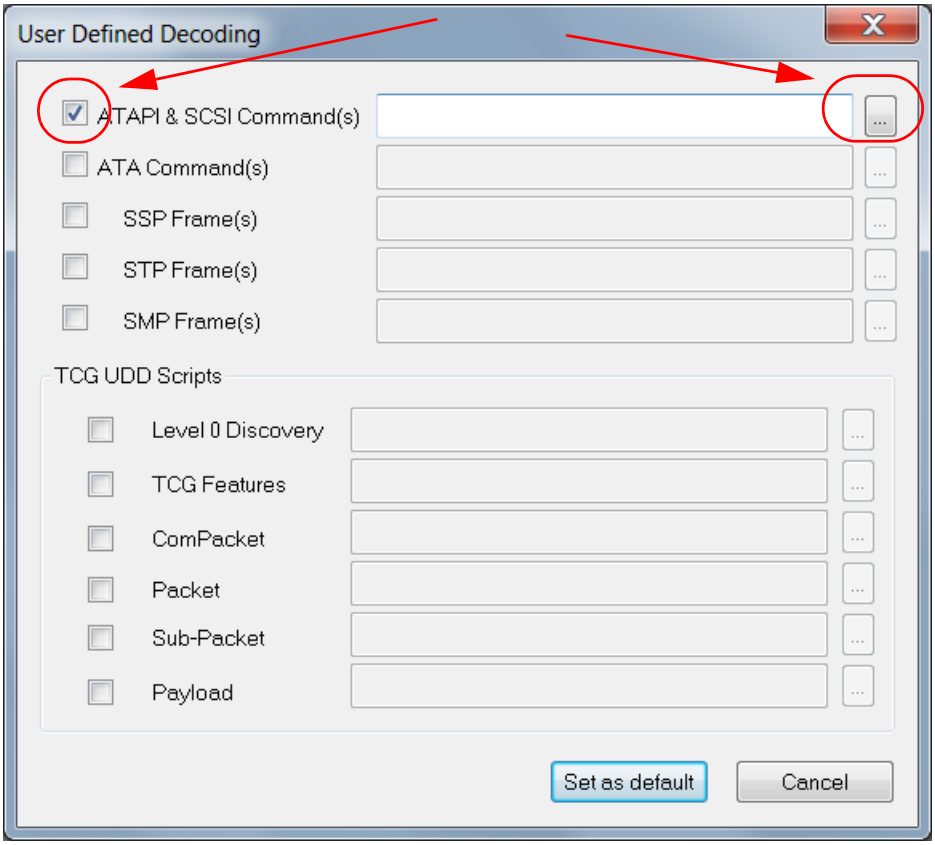


Figure 3.174: Select a Script Type

This will take you to the location of the stored script type. See Figure 3.175.

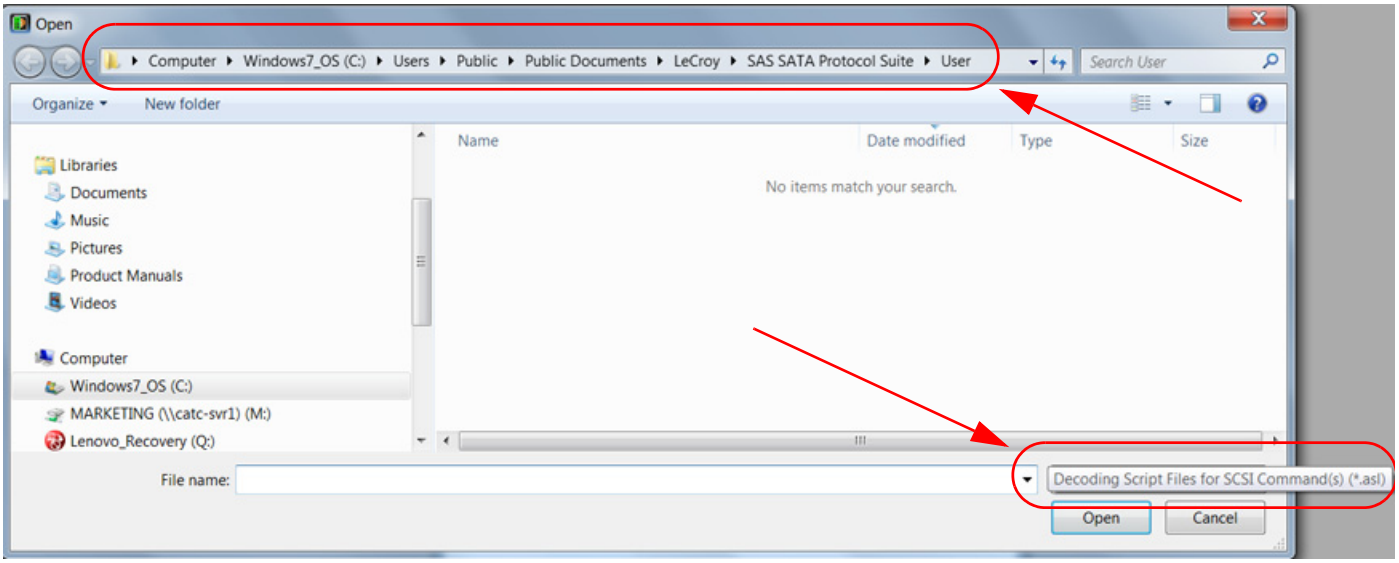


Figure 3.175: Path to Stored User Defined Scripts

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

3.24 Help Menu

3.24.1 Tell Teledyne LeCroy

Report a problem to Teledyne LeCroy Support via e-mail. This requires that an e-mail client be installed and configured on the host machine.

3.24.2 Help Topics

Displays online help. You can also select F1.

3.24.3 VSE Help Topics

Displays VSE online help. You can also select F1.

3.24.4 Update License

A current license agreement with Teledyne LeCroy entitles the Analyzer owner to continued technical support and access to software updates as they are published on the Teledyne LeCroy website. When you obtain a license key, from the Help menu select Update License to display the Select License Key File dialog box. Enter the path and filename for the license key, or browse to the directory that contains the license key and select the *.lic file. Click Open.

3.24.5 Display License Information

Open a license information dialog to display a list of named features supported by the current software version (see Figure 3.176 on page 390.). Named features that are not enabled on your system are indicated by No in the Purchased column. Whether or not named features are enabled depends on the license key stored in your analyzer. If you try to use a feature for which you do not yet have a license, the program displays the License Protection Message. To use the feature, you must purchase a license.



Figure 3.176: Licensing Dialog

3.24.6 Check for Updates

Check whether a new software version is available. If so, you can download from the Teledyne LeCroy web site.
You can select to Check for updates at application startup.

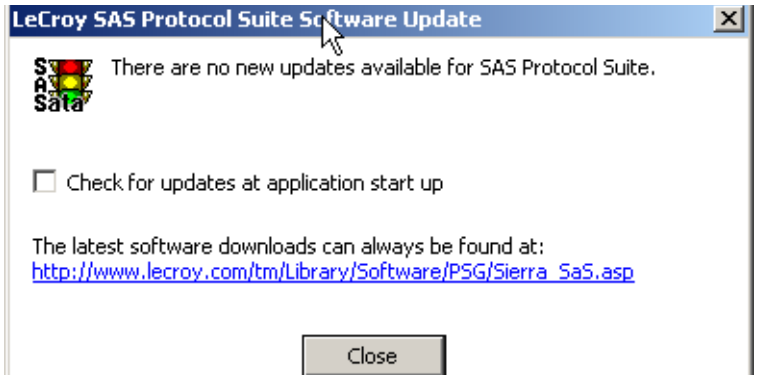


Figure 3.177: Check for Updates

3.24.7 About

Displays version information.

3.25 Setup Menu

3.25.1 Self Test

You can use the built-in RAM self-test utility. Select **Setup** on the main menu bar and choose **Self Test** to open the Self Test dialog.

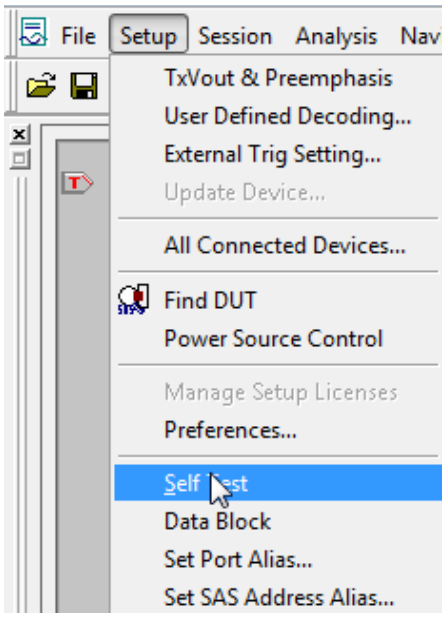


Figure 3.178: SAS: Self Test Command on Tools Menu

3.25.2 Clock Check

To perform a Clock check, choose the clock to test and click the **Start Clock Check** button. After a short time, the Test Result appears to the right of the selected line.

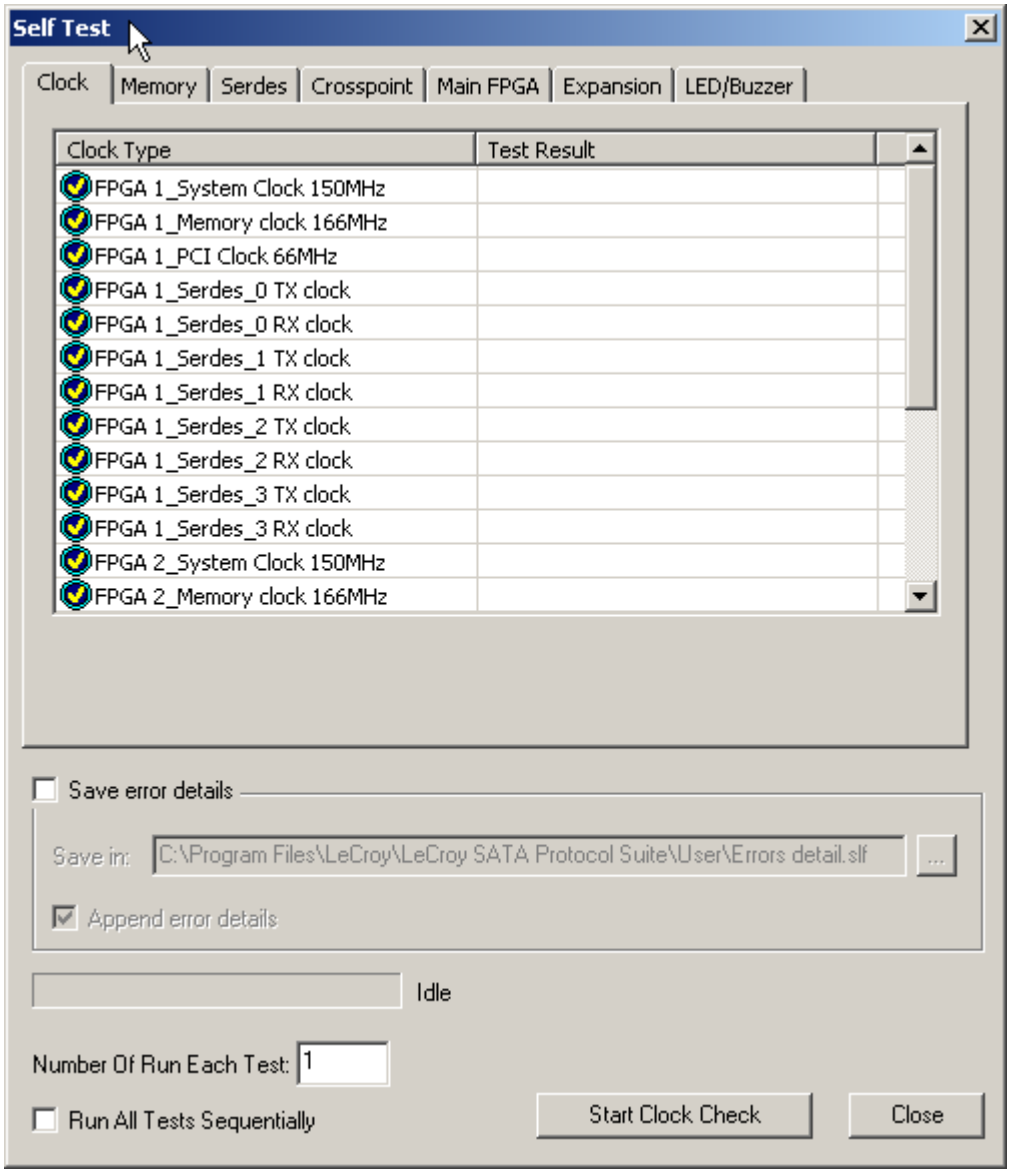


Figure 3.179: SATA: Self Test Dialog Clock Tab

Test Result: OK or Error

If a test is OK and you specified one run, the Test Result is **OK: 1 times**.

If a test has an error and you specified one run, the Test Result is **Error: 1 times**.

Saving

You can save any check result by checking the **Save error details** check box and specifying a destination file name.

Number of Runs Each Test

You can specify to run a test more than once.

Run All Tests Sequentially

This option runs all items in the Clock, Memory, Serdes, Crosspoint, Main FPGA, Expansion, and LED/Buzzer tests in order. After you check this check box, the command button becomes **Start All Tests**. You must click the **Stop Test** button on the LED/Buzzer tab to stop the check.

3.25.3 Memory Check

To perform a SDRAM or Exerciser RAM memory check, select the **Memory** tab.

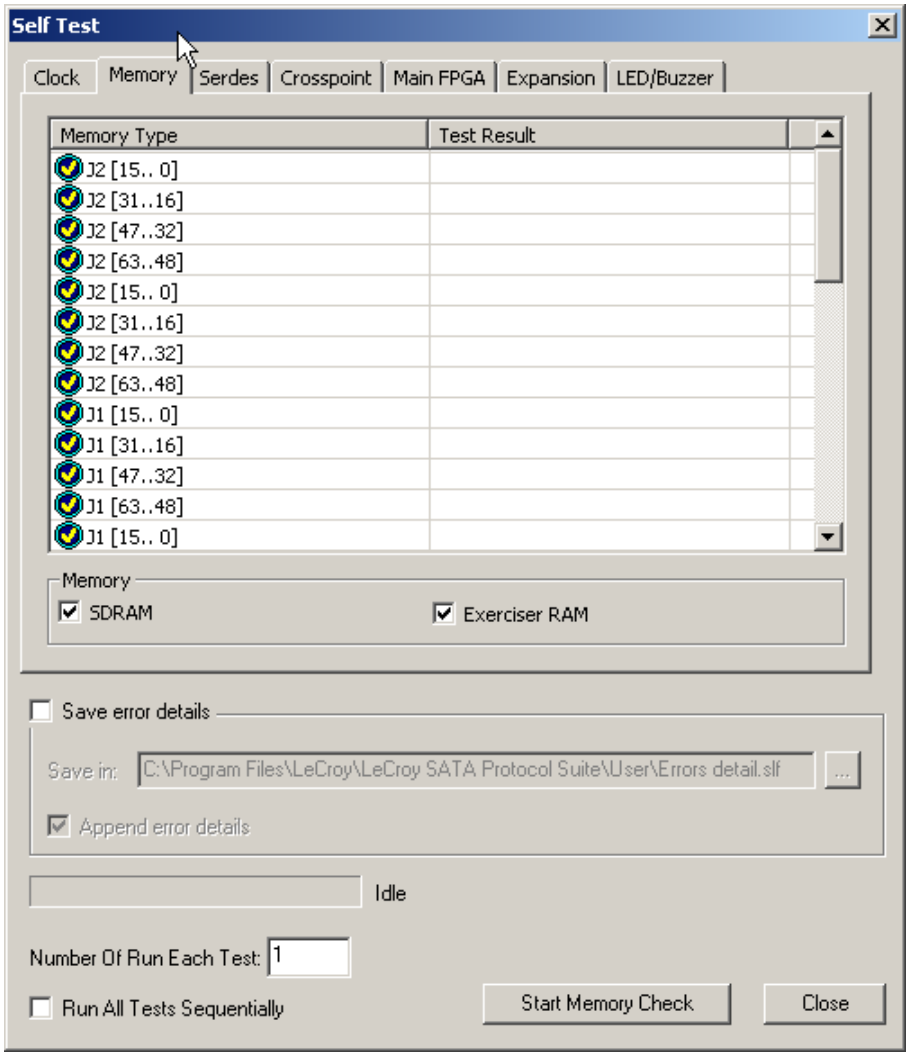


Figure 3.180: SAS: Self Test Dialog Memory Tab

Choose the SDRAM, Exerciser Data, or Exerciser Instruction to test and click the **Start Memory Check** button. After a short time, the Test Result appears to the right of the selected line.

3.25.4 Serdes Check

To perform an FPGA 1 or 2 Serdes Chip check, select the **Serdes** tab.

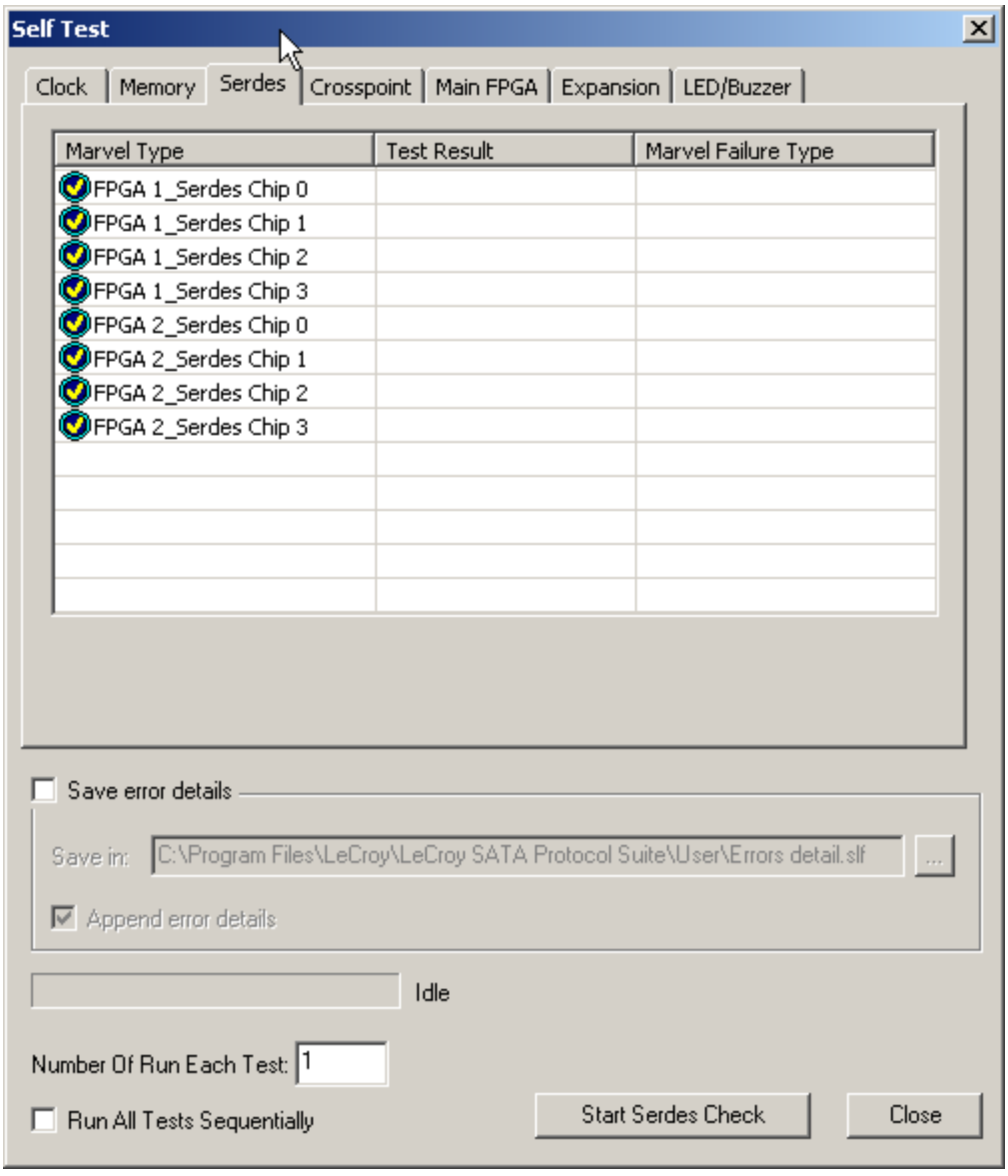


Figure 3.181: SATA: Self Test Dialog Serdes Tab

Choose the n FPGA 1 or 2 Serdes Chip to test and click the **Start Serdes Check** button. After a short time, the Test Result and Marvel Failure Type appear to the right of the selected line. Marvel Failure Type indicates the error type.

3.25.5 Crosspoint Check

To perform a Crosspoint-Crosspoint bus test or Crosspoint external loop back, select the **Crosspoint** tab.

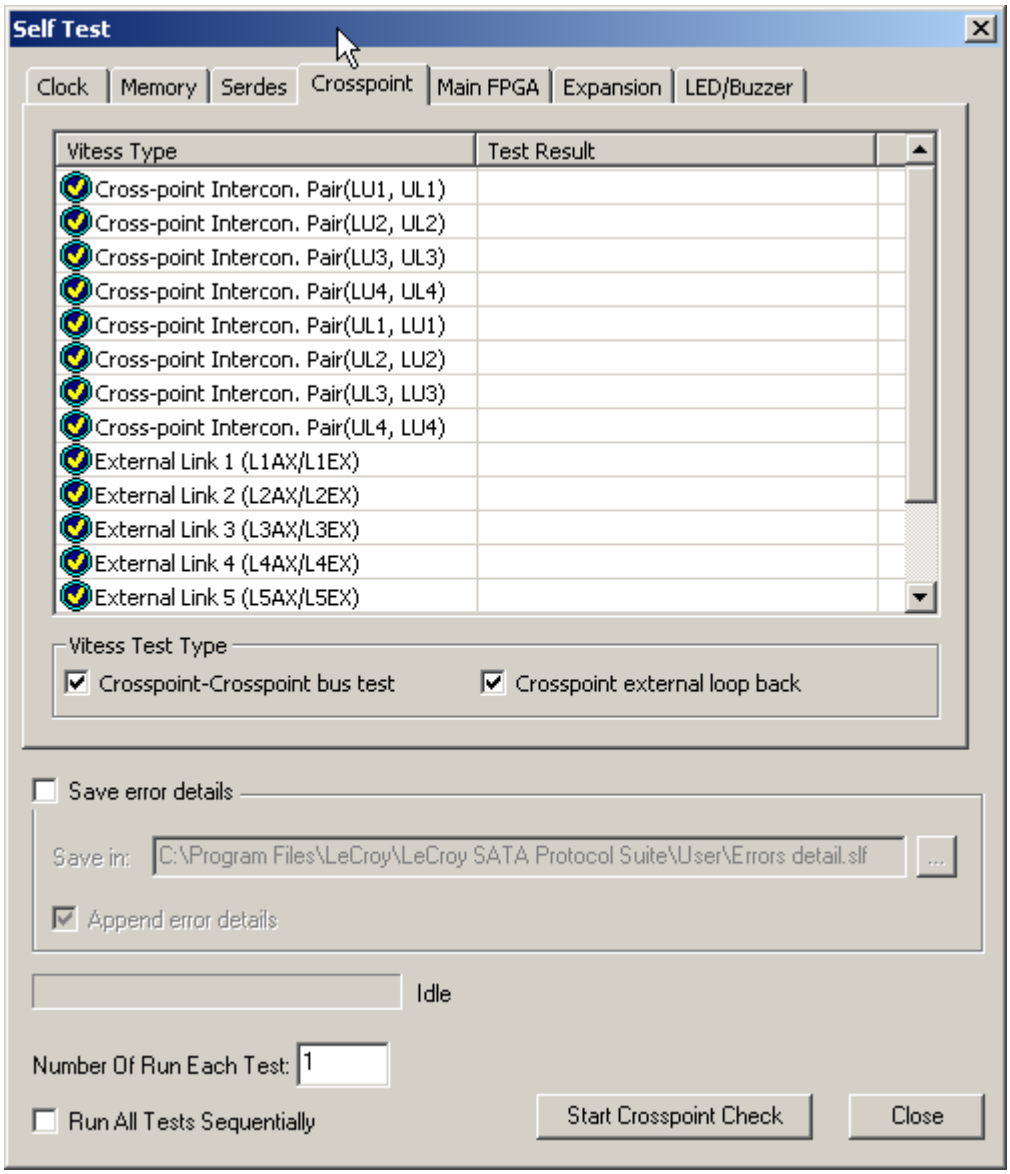


Figure 3.182: SATA: Self Test Dialog Crosspoint Tab

Choose the Crosspoint Interconnection Pair or External loop back to test and click the **Start Crosspoint Check** button. After a short time, the Test Result appears to the right of the selected line.

3.25.6 Main FPGA Check (SATA only)

To perform an Inter-FPGA Connection check, select the **Main FPGA** tab.

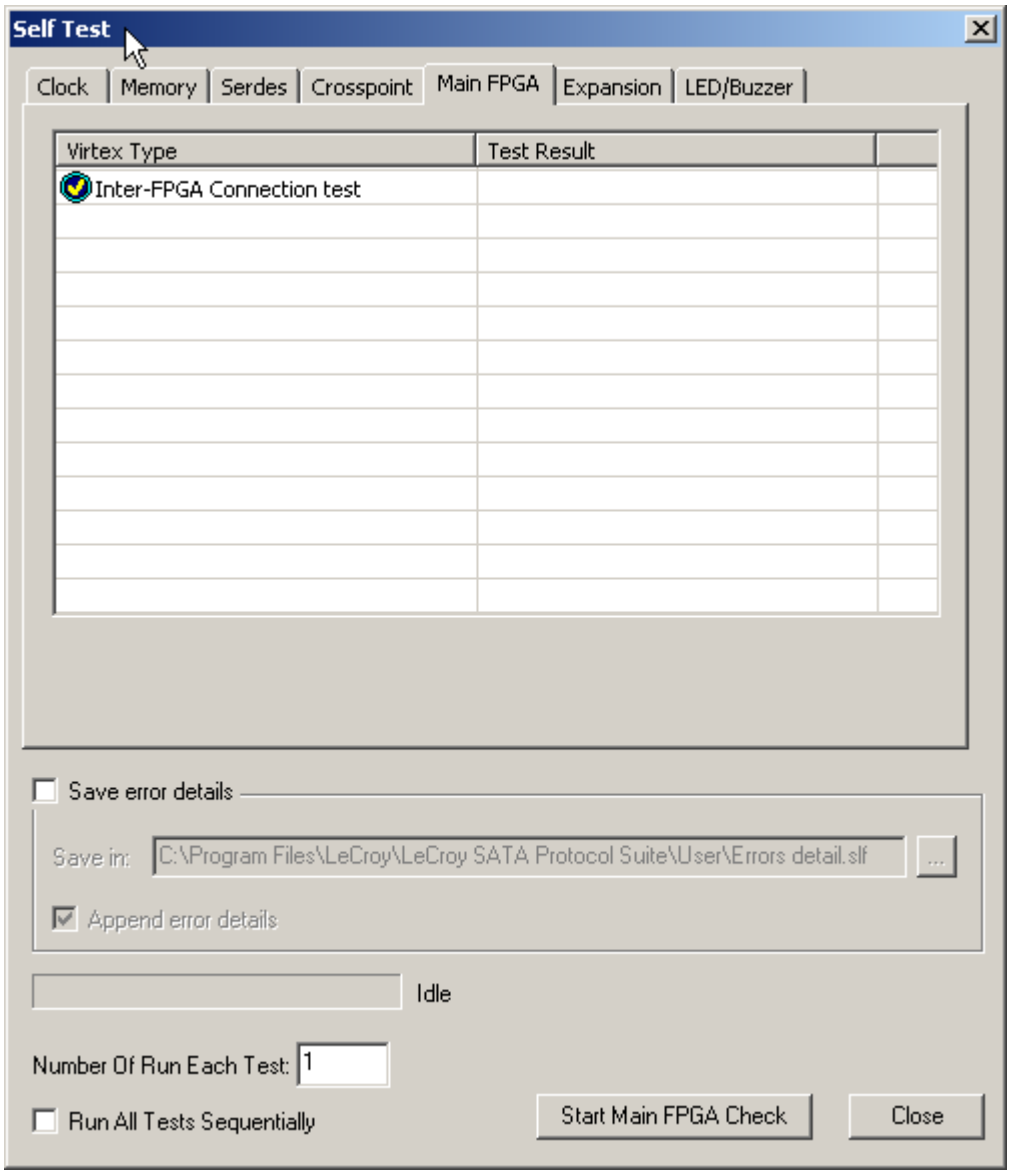


Figure 3.183: Self Test Dialog Main FPGA Tab

Choose the Inter-FPGA Connection test and click the **Start Main FPGA Check** button. After a short time, the Test Result appears to the right of the selected line.

3.25.7 Expansion Check

To perform a Expansion Card Data Status or Clock Status check, select the **Expansion** tab.

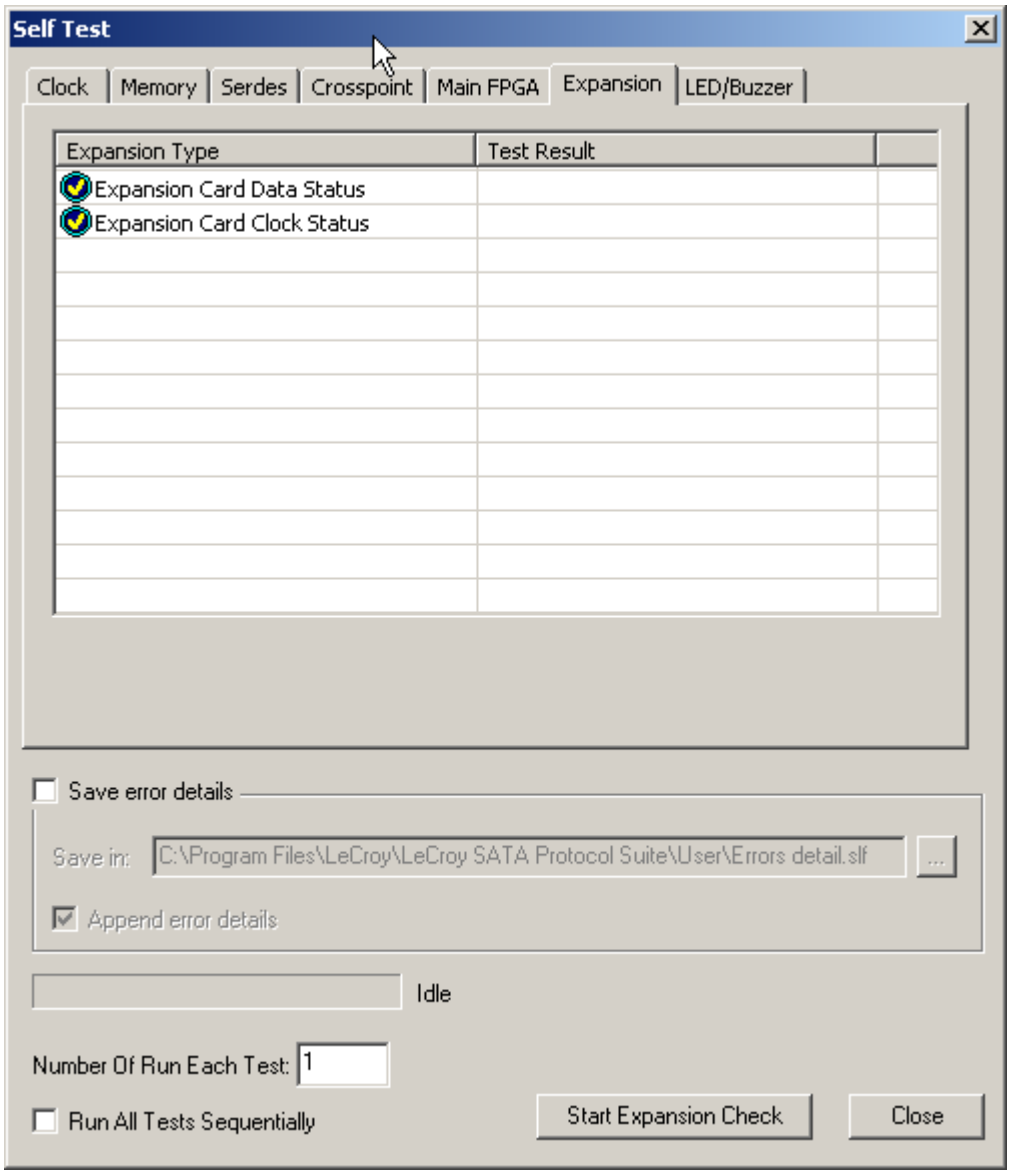


Figure 3.184: Self Test Dialog Expansion Tab

Choose the Expansion Card Data Status or Clock Status to test and click the **Start Expansion Check** button. After a short time, the Test Result appears to the right of the selected line.

3.25.8 LED/Buzzer Check

To perform a LED or Buzzer check, select the **LED/Buzzer** tab.

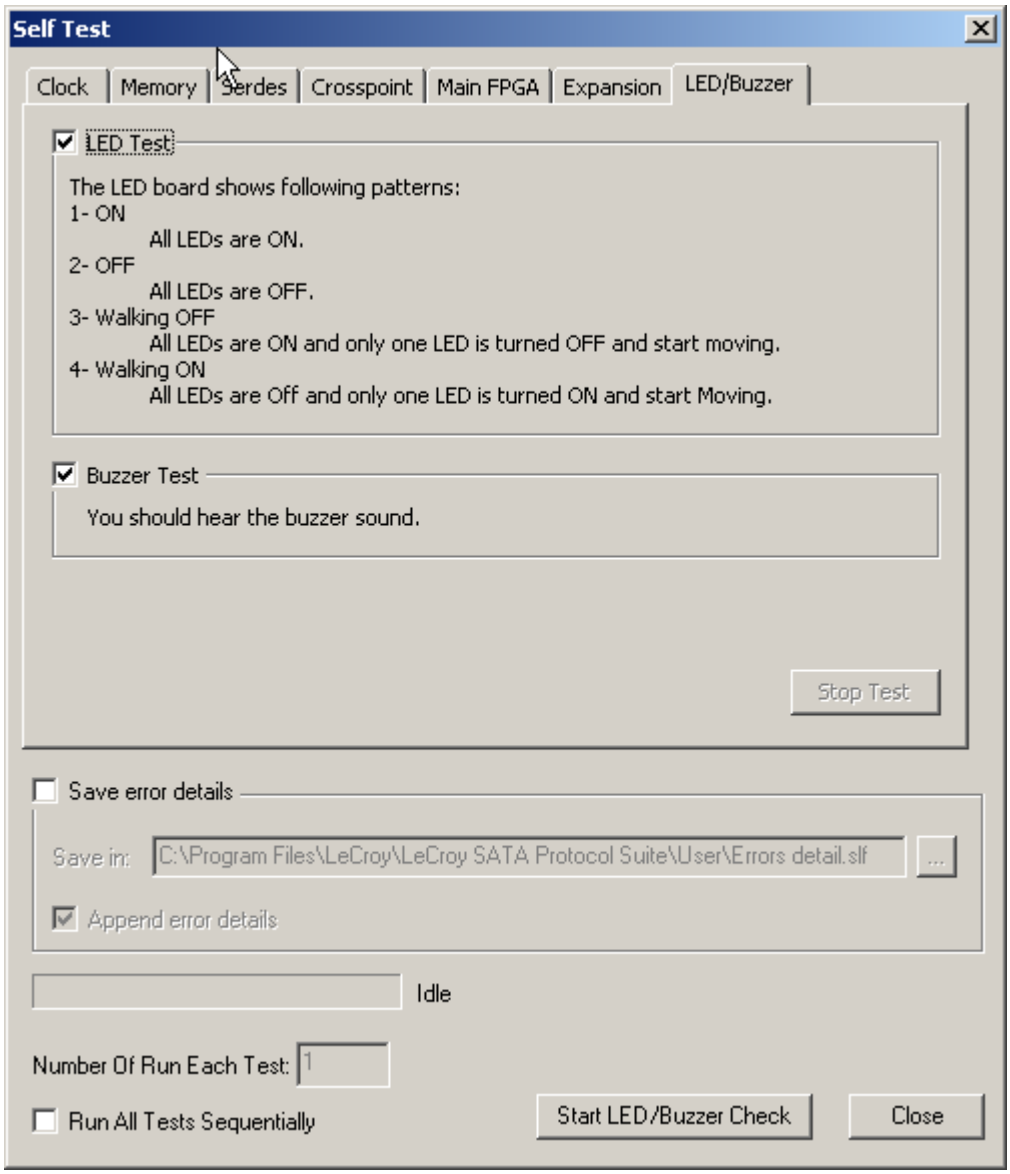


Figure 3.185: Self Test Dialog LED/Buzzer Tab

Check **LED Test** or **Buzzer Test** and click the **Start LED/Buzzer Check** button. For the LED, you should see the LED pattern. For the buzzer, you should hear it sound. You must click the **Stop Test** button to stop the check.

3.26 Find DUT

Saving device information allows you to import the specific device information into the Target/ Device emulator.

The Find DUT utility obtains all vendor-specific information and detailed device parameters.

Find device finds any devices that are attached to any port.

Select **Setup** on the main menu bar and choose **Find DUT**.

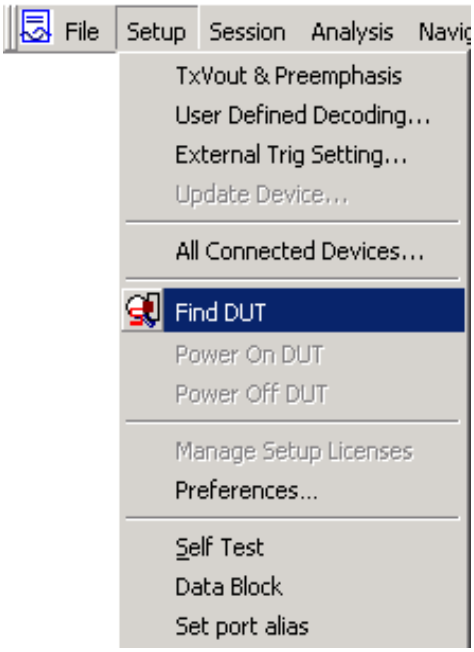


Figure 3.186: Find DUT

The Find DUT dialog displays (see Figure 3.187 on page 400).

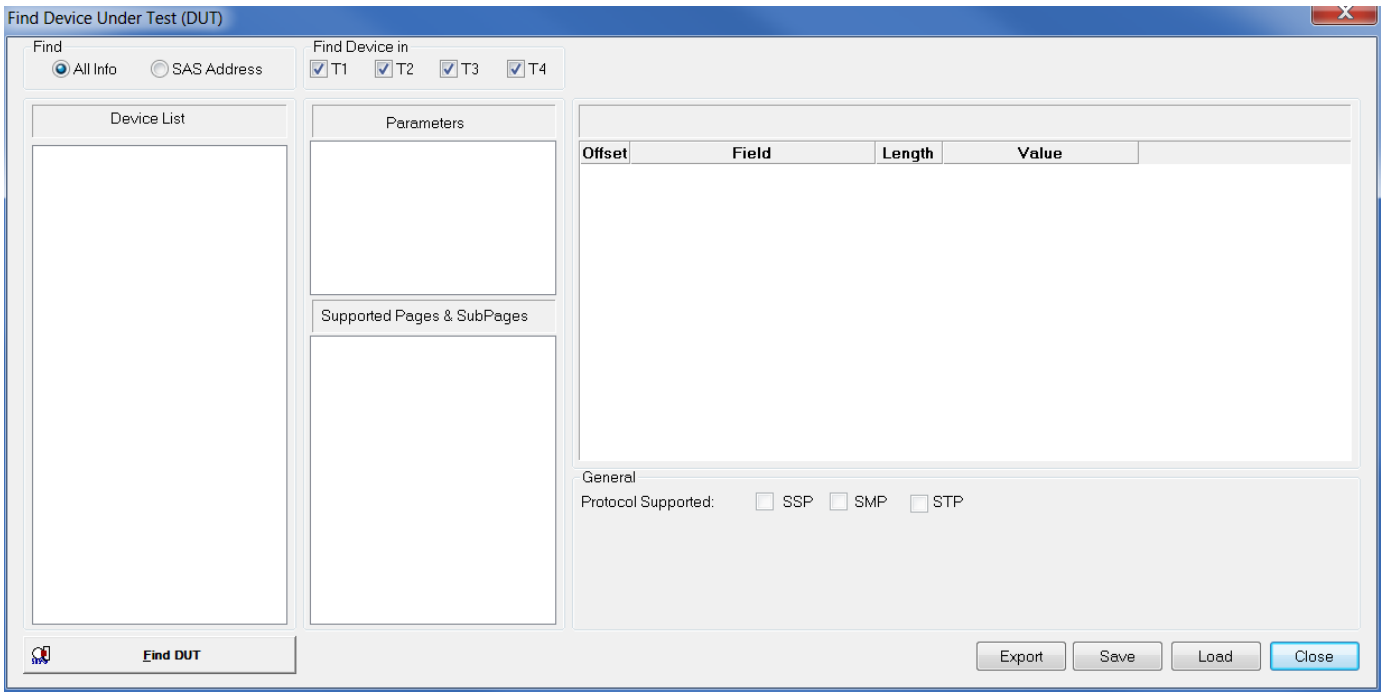


Figure 3.187: Find DUT Dialog

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

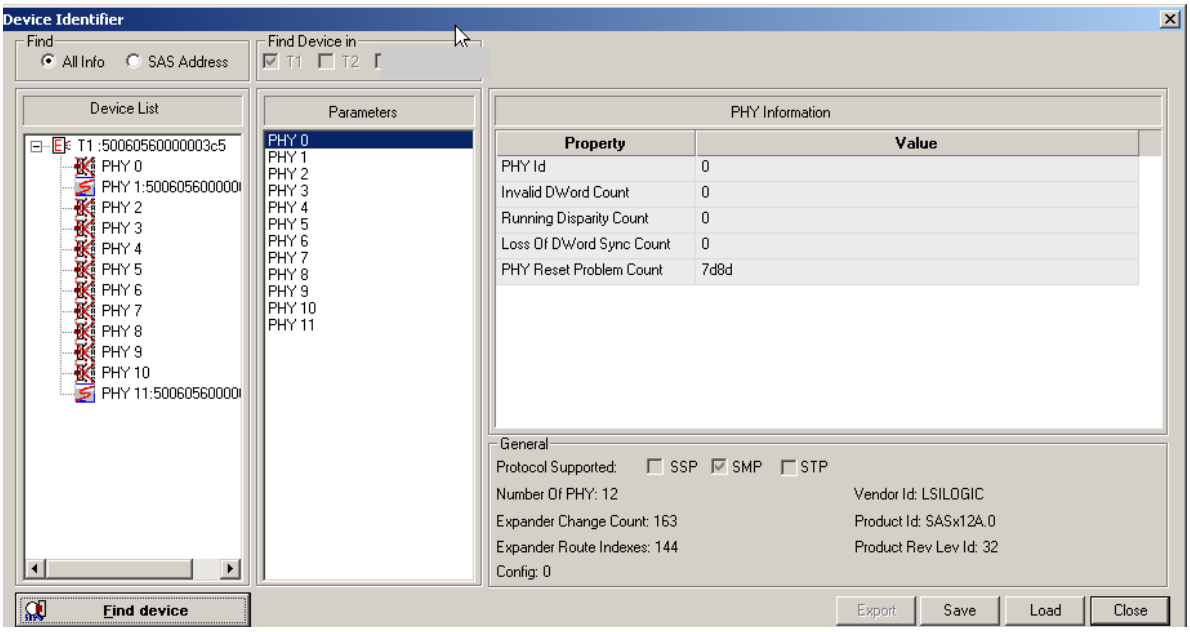


Figure 3.188: SAS: Identified Devices

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

Aliasing

You can enter a 16-character alias name for a device. In the Device List, right-click the device name and enter an alias after the colon.

The alias name appears in the Device List.

Exporting

You can export a device specification to a text file. Click the **Export** button to open the Export dialog.

3.27 Power Source Control

This function allows you to manage power for connected devices.

Select **Setup** on the main menu bar and choose **Power Source Control**.

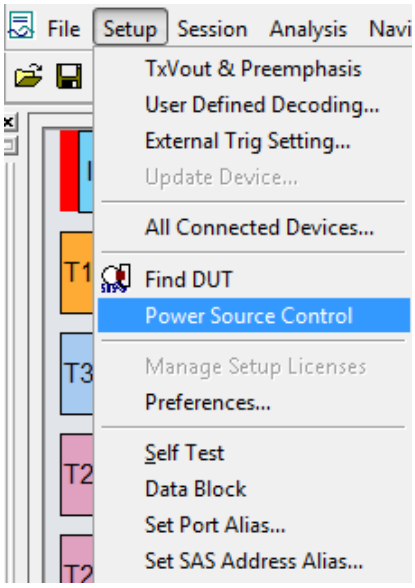


Figure 3.189: Power Source Control

The Power Source Control dialog displays (see Figure 3.190 on page 402).

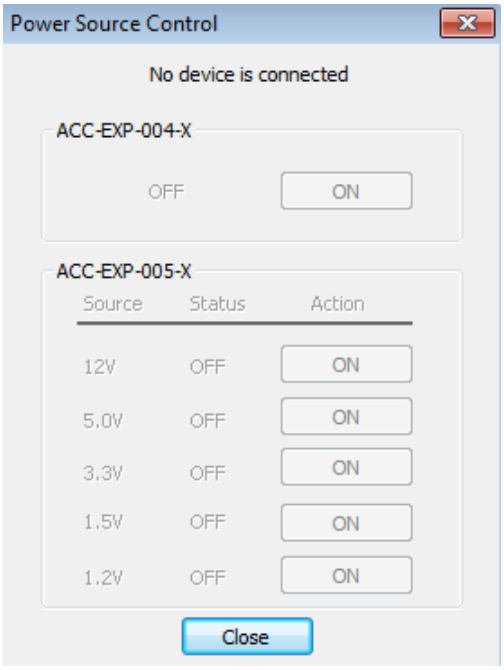


Figure 3.190: Power Source Control Dialog

3.28 Compliance Test (SATA)

The Compliance Test consists of a set of selectable tests to verify compliance with the SATA specification. SATA compliance is at UTD Rev 1.4.

Note: The tests follow the Teledyne LeCroy MOI, which is described in the **SATA_Digital-Device_MOI_LeCroy_1.00_UTD1.4.pdf** file in the installed Documents directory.

Note: You can start tests using the command line. The SAS/SATA Protocol Suite API Reference Manual, Section 2.12, starting on page 153, explains how to write VB scripts to automate compliance tests and generate results as RTF files.

To run a Compliance Test:

1. Click **Analysis** on the main toolbar and choose **Compliance Test** to open the Compliance Test dialog (see Figure 3.137 on page 356).

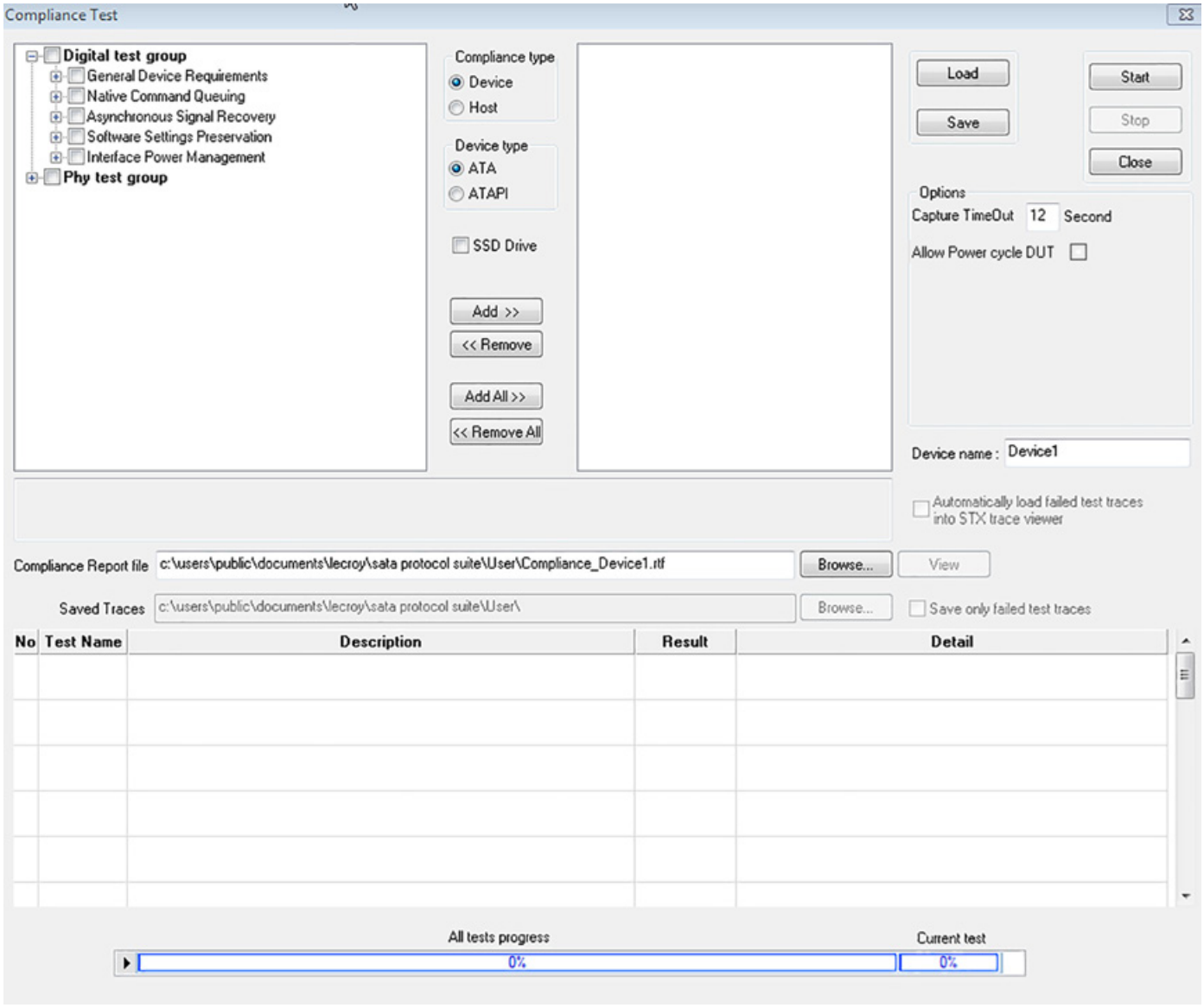


Figure 3.191: SATA: Compliance Test Selection

The Digital Test Group has:

- **General Device Requirements**: GTR-01 through GTR-05
- **Native Command Queuing**: NCQ-01 through NCQ-05
- **Asynchronous Signal Recovery**: ASR-01 and ASR-02
- **Software Settings Preservation**: SSP-01 through SSP-12
- **Interface Power Management**: IPM-01 through IPM-11
- **Digital Optional Features**: DOF-01 and DOF-02

NCQ-04 Test

To complete the NCQ04-02 test case successfully, the DUT must abort the two READ FPDMA QUEUED commands with duplicate tags sent to it in quick succession. However, certain new SSDs are so fast that they are able to complete the first command before the second command is sent. To pass the test successfully you must select the “Allow Power cycle DUT” checkbox. See Figure 3.192.

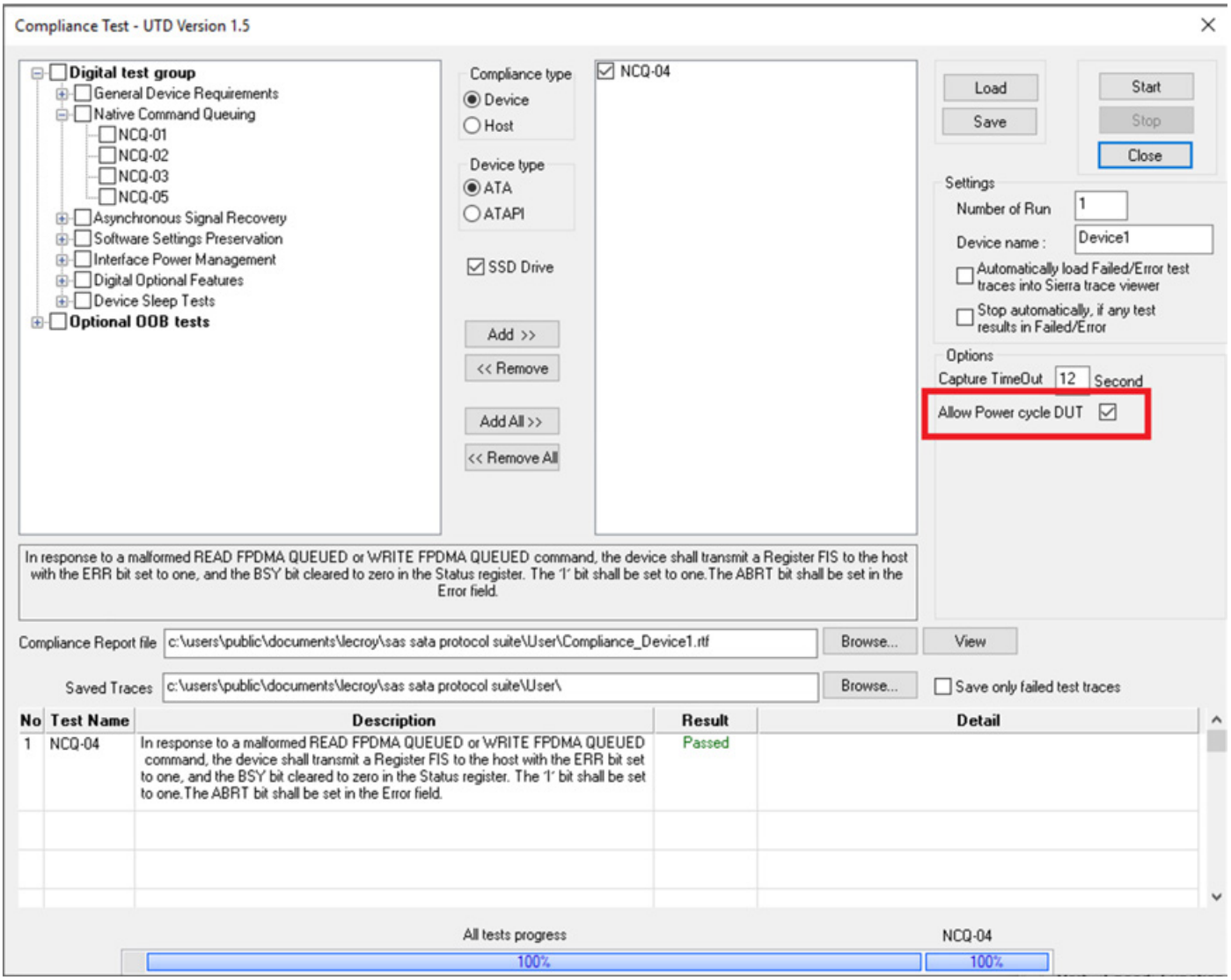


Figure 3.192: **Native Command Queuing: NCQ-04**

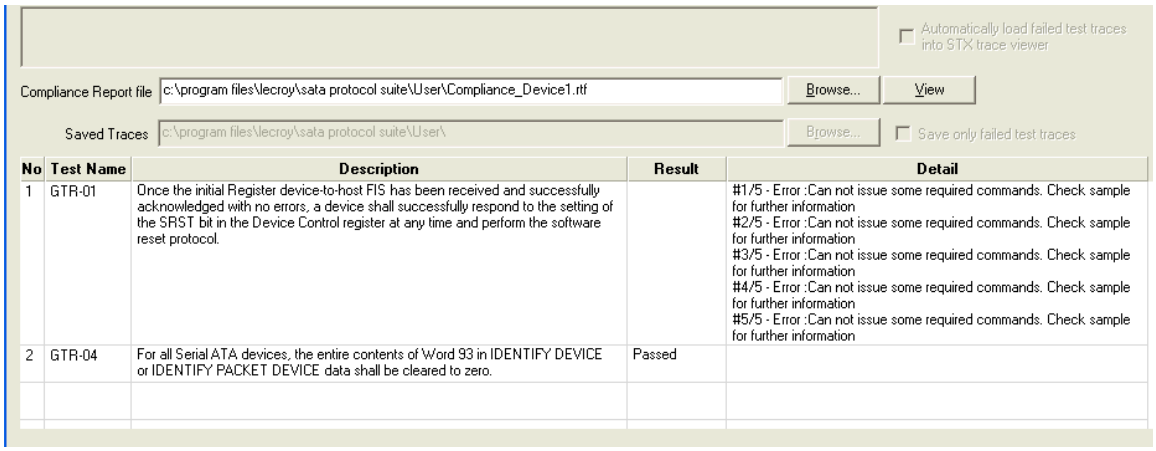
The PHY Test Group has tests OOB-03 through OOB-07.

2. Choose the tests in the left pane of the dialog and click the **Add>>** button.
3. Enter a value for **Capture Timeout**.

Note: If test running time exceeds the Capture Timeout value, the test terminates.

4. Enter the **Device Name**.

5. Select the UTD Version as **UTD 1.3** (for devices supporting up to SATA 2.6 specification) or **UTD 1.4** (for devices supporting up to SATA 3.0 specification).
6. Select the Compliance Type as **Host** or **Device**.
7. Select the Device Type as **ATA** or **ATAPI**.
8. When testing SSD devices, select the **SSD Drive** checkbox, to ensure correct test results.
9. To view failed test traces in the sample viewer, check the **Automatically load failed test traces into Sierra trace viewer** check box.
10. To save the failed test traces only, check the **Save only failed test traces** check box.
11. Enter a path and file name for the **Compliance Report file**, or use the default file name and path:
    C:\Program Files\LeCroy\SATA Protocol Suite\User\Compliance_Device1.rtf
12. Enter a path and file name for the **Saved Traces**, or use the default folder:
    C:\Program Files\LeCroy\SATA Protocol Suite\User\
13. After you select tests, click **Start**.
14. The test runs and, after a brief period, displays the result.



No	Test Name	Description	Result	Detail
1	GTR-01	Once the initial Register device-to-host FIS has been received and successfully acknowledged with no errors, a device shall successfully respond to the setting of the SRST bit in the Device Control register at any time and perform the software reset protocol.		#1/5 - Error :Can not issue some required commands. Check sample for further information #2/5 - Error :Can not issue some required commands. Check sample for further information #3/5 - Error :Can not issue some required commands. Check sample for further information #4/5 - Error :Can not issue some required commands. Check sample for further information #5/5 - Error :Can not issue some required commands. Check sample for further information
2	GTR-04	For all Serial ATA devices, the entire contents of Word 93 in IDENTIFY DEVICE or IDENTIFY PACKET DEVICE data shall be cleared to zero.	Passed	

Figure 3.193: Compliance Test Result

15. To save the current compliance setup for later use, click the **Save** button to open the Save As dialog. Assign a meaningful name to the setup and save it as a ***.cst** compliance file.
16. To run a previously defined setup, click the **Load** button and choose a previously defined setup to run.

Note: When you are running Compliance Test, do not connect the analyzer to the Host if testing a Device. Do not connect the analyzer to the Device if testing Host. Such improper connections can impact compliance-test result validity.

3.29 Discover List Descriptor Lists Decode

In a Trace that has Discover List Descriptor Lists, Click on the Discover List descriptor list.

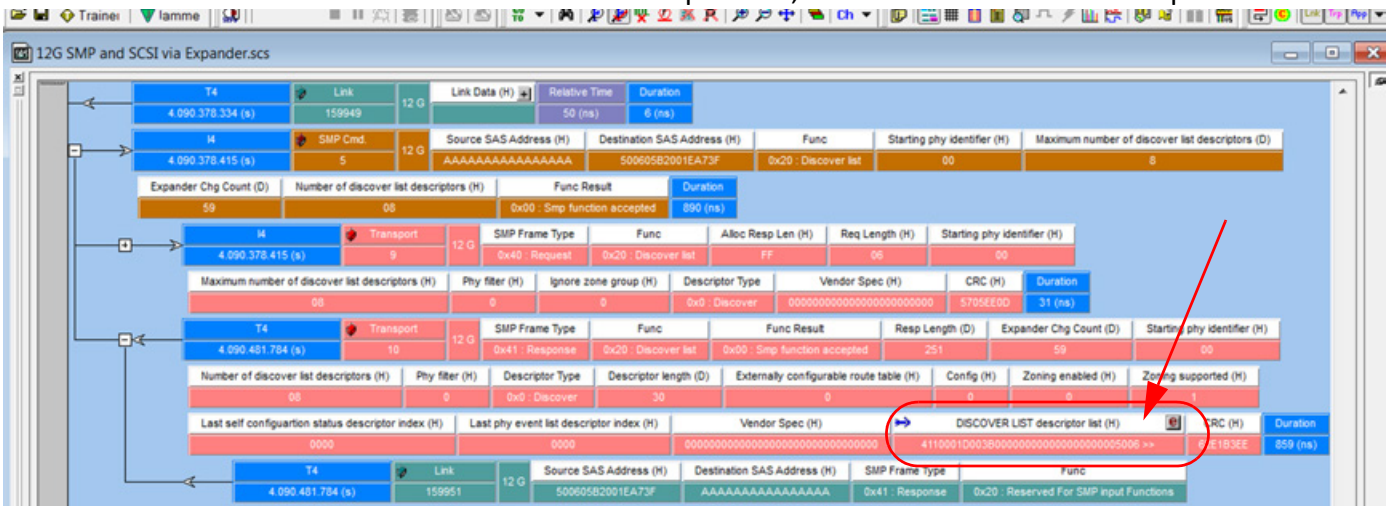


Figure 3.194: Discover List Descriptor Lists

This will bring up the Discover List descriptor list. See Figure 3.195 on page 407.

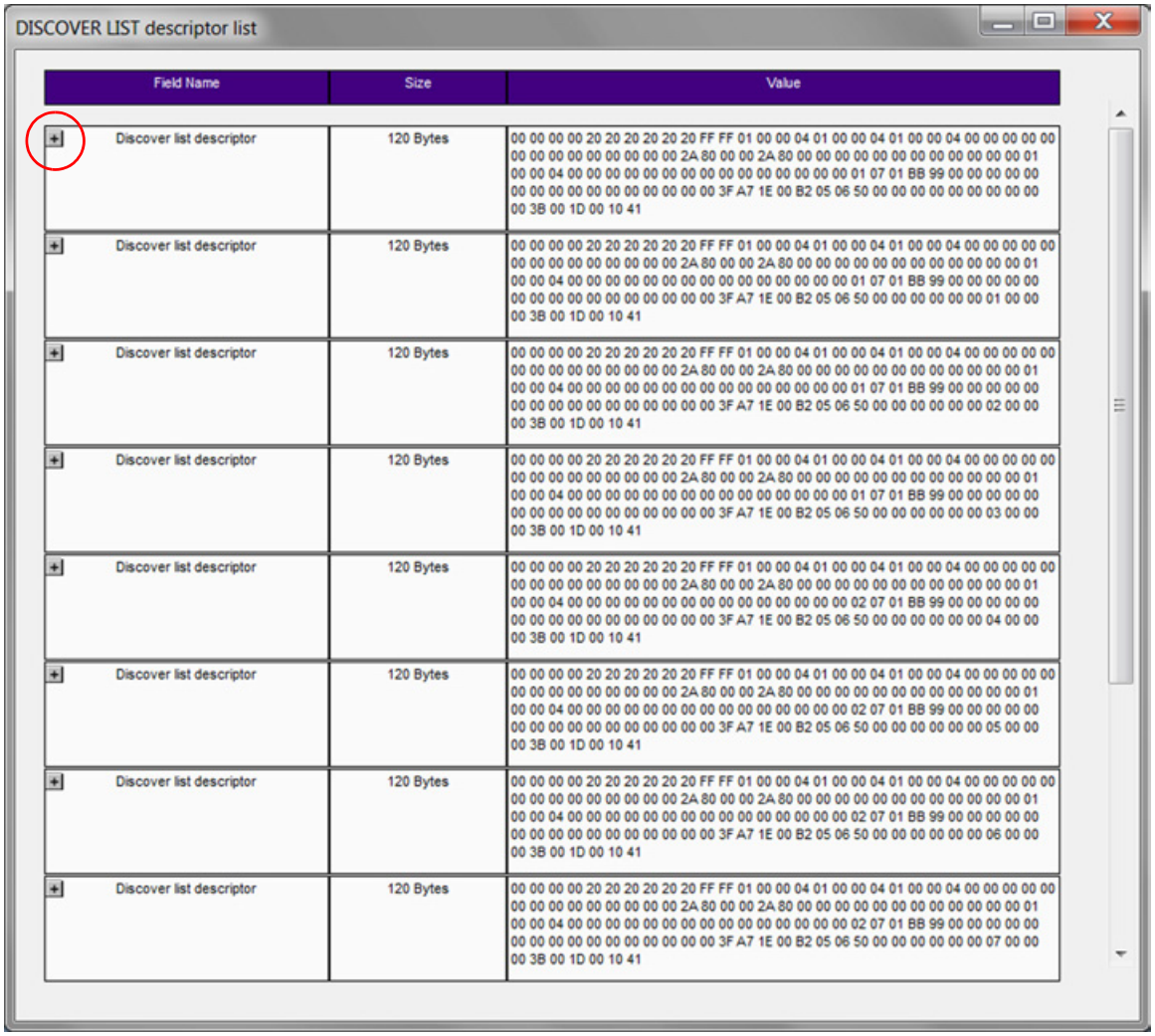


Figure 3.195: Descriptor Lists

Click on the "+" sign in the first field to bring up a menu with more information abut the Discover list descriptor. See Figure 3.196 on page 408.

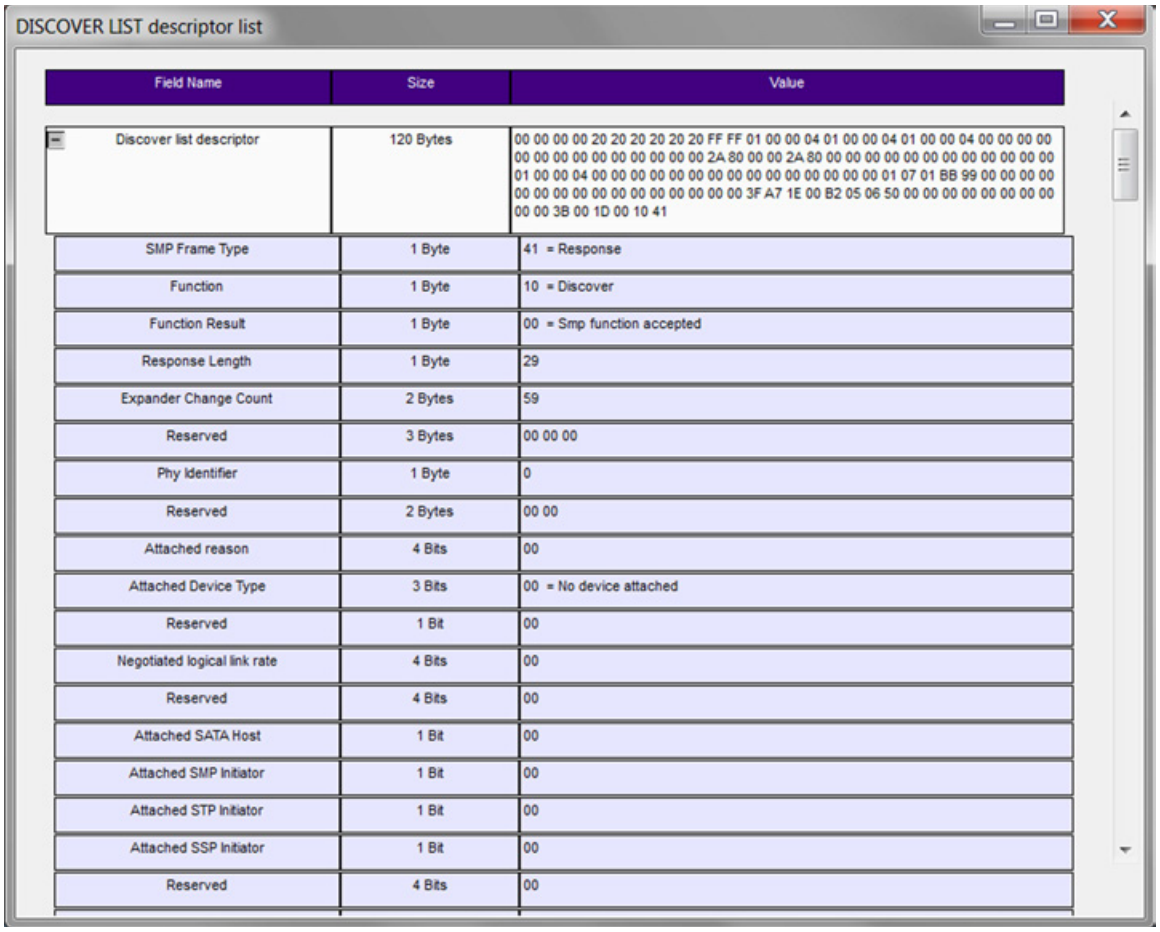


Figure 3.196: Details of a Single Discover List Descriptor

If you right click in the Value Field you can Copy text, Show First Field or Change the data format to binary, decimal or leave it in hexadecimal format. See

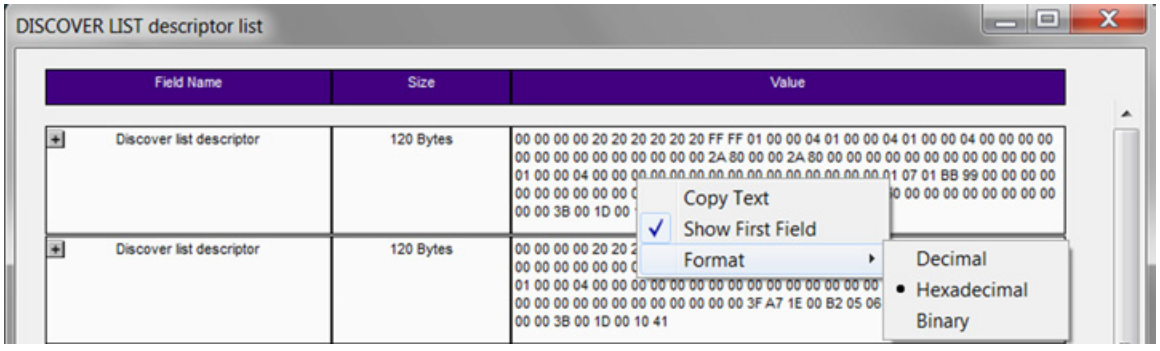
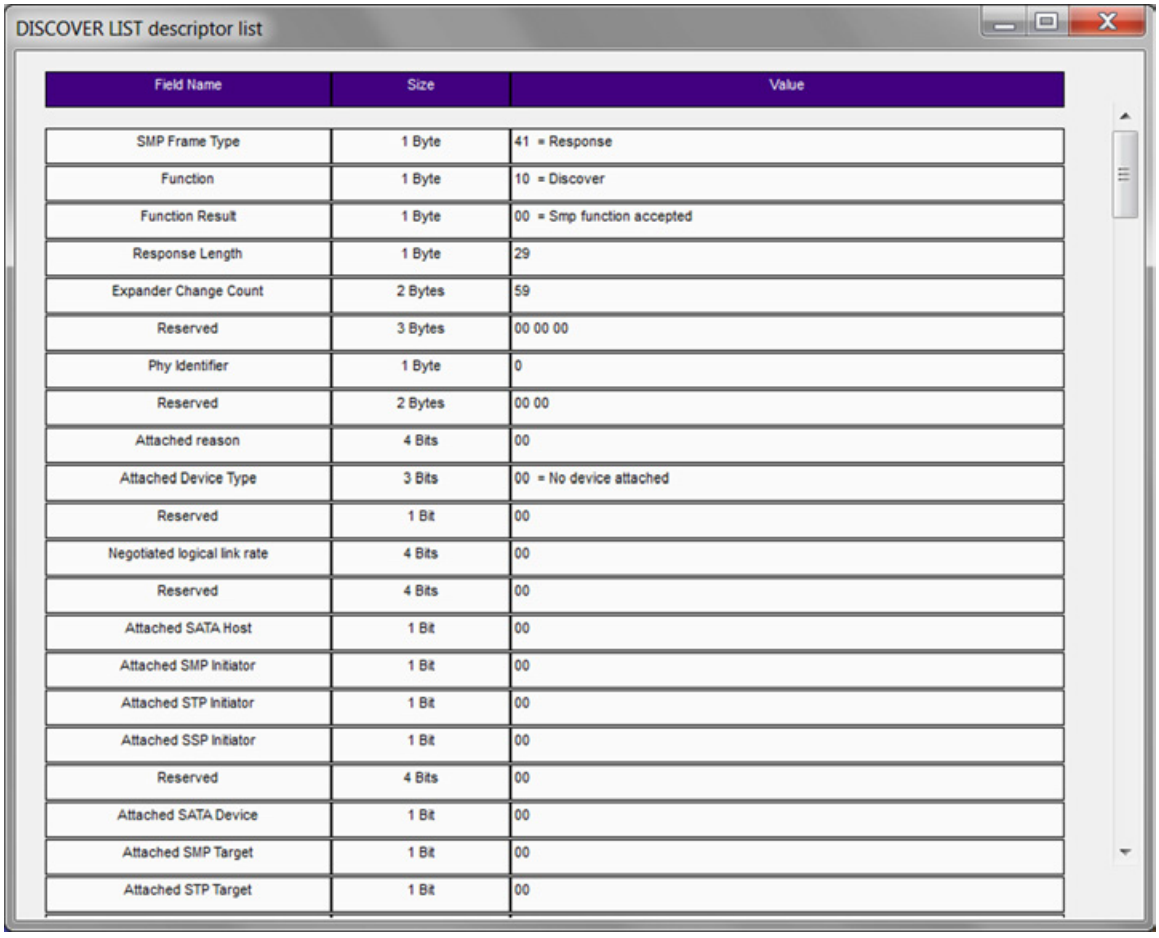


Figure 3.197: Discover List Descriptor List Showing Different Options and Formats

If you de-select Show First Field the Data will be shown as Function, Data Size and value of the data with an explanation. See Figure 3.198 on page 409.



Field Name	Size	Value
SMP Frame Type	1 Byte	41 = Response
Function	1 Byte	10 = Discover
Function Result	1 Byte	00 = Smp function accepted
Response Length	1 Byte	29
Expander Change Count	2 Bytes	59
Reserved	3 Bytes	00 00 00
Phy Identifier	1 Byte	0
Reserved	2 Bytes	00 00
Attached reason	4 Bits	00
Attached Device Type	3 Bits	00 = No device attached
Reserved	1 Bit	00
Negotiated logical link rate	4 Bits	00
Reserved	4 Bits	00
Attached SATA Host	1 Bit	00
Attached SMP Initiator	1 Bit	00
Attached STP Initiator	1 Bit	00
Attached SSP Initiator	1 Bit	00
Reserved	4 Bits	00
Attached SATA Device	1 Bit	00
Attached SMP Target	1 Bit	00
Attached STP Target	1 Bit	00

Figure 3.198: Data Shown as Function, Data Size and Value

3.30 Trusted Command Group Decodes in Spreadsheet View

Trusted Command Group (TCG) decodes are now available in the Spreadsheet View. See Figure 3.199 on page 410.

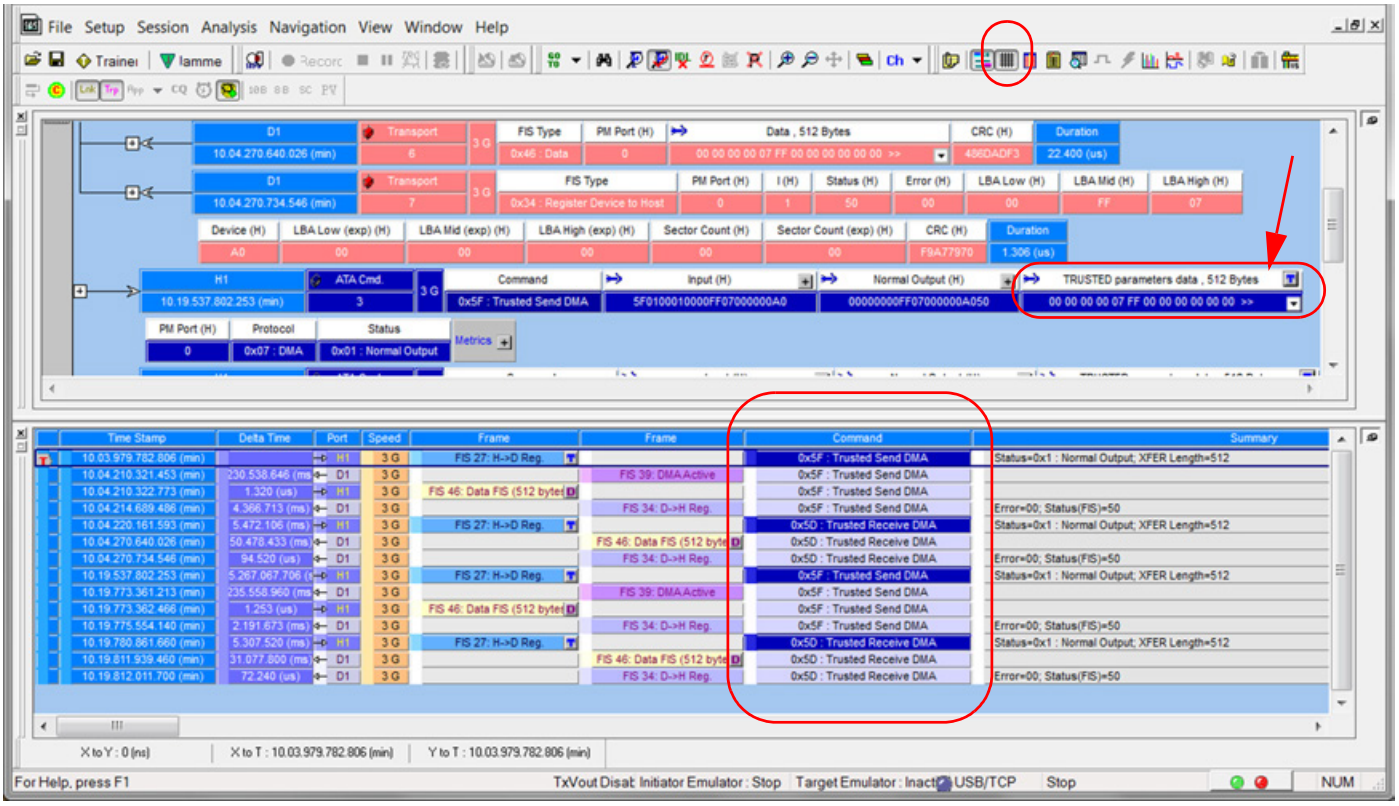


Figure 3.199: Trace Showing Trusted Command Group data in Spreadsheet View

If you click on the TCG icon in the trace a window with detailed data about the TCG packet will pop up. The different Fields shown include: Com Packet, Packet, Data Sub Packet, Data Payload and Data. See Figure 3.200 on page 410.

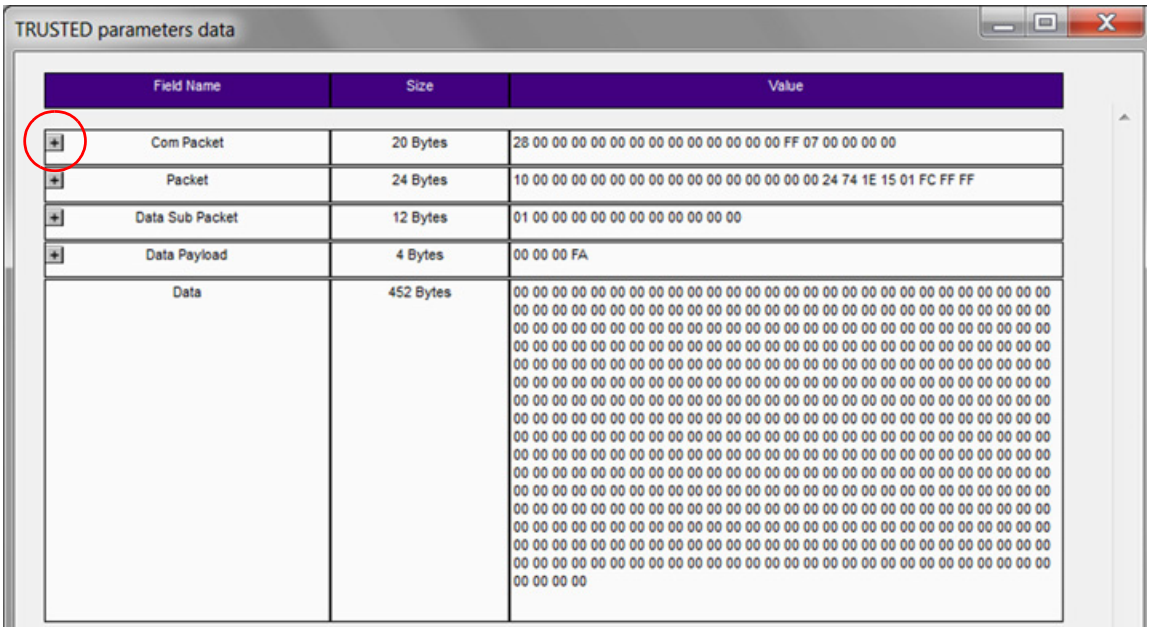
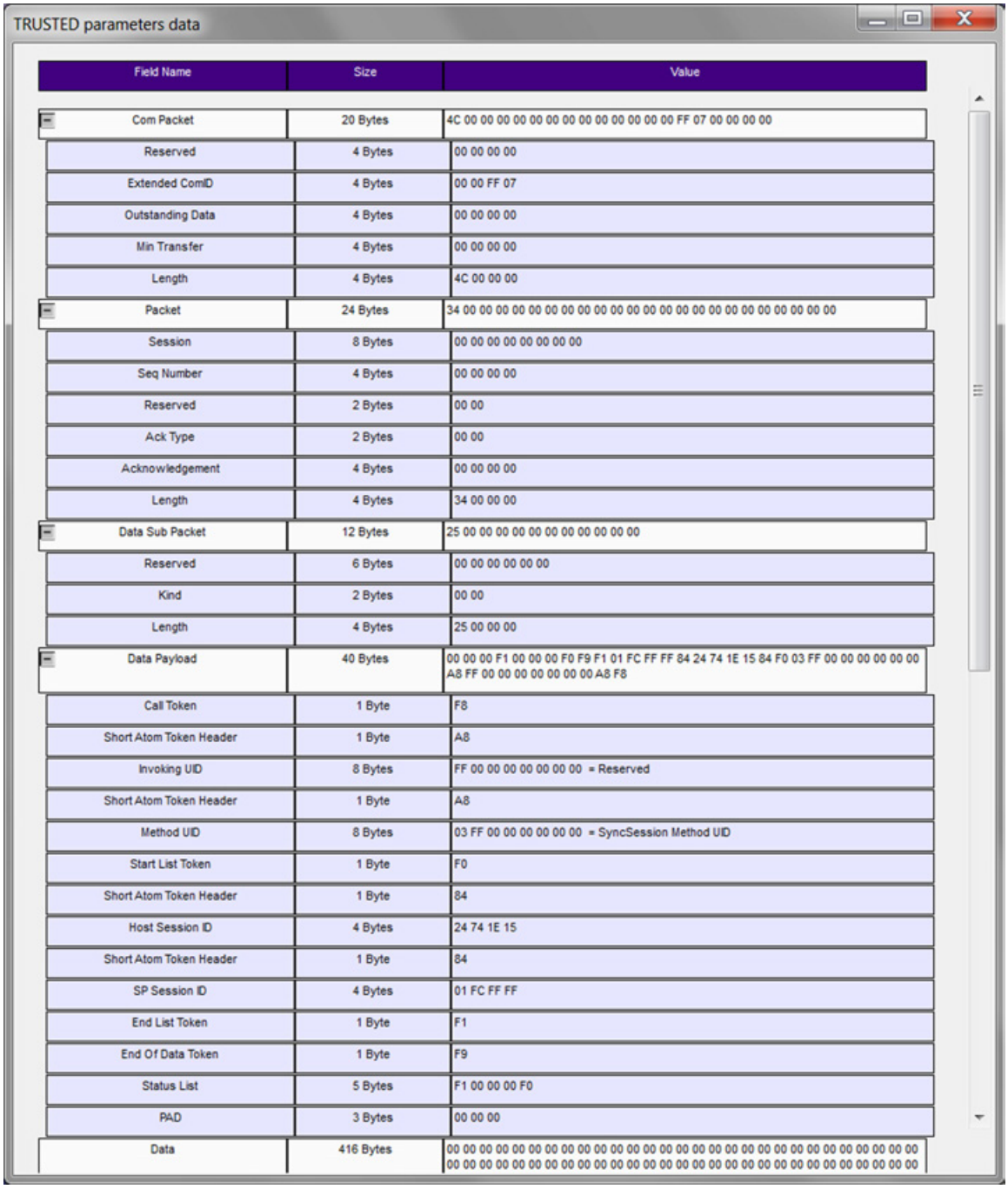


Figure 3.200: TCG Parameter Data Field Name, Size and Values

Clicking on the "+" symbol in any of the Field Name boxes will pop up a window with more detailed information about the particular Field. See Figure 3.201 on page 411.



Field Name	Size	Value
Com Packet	20 Bytes	4C 00 00 00 00 00 00 00 00 00 00 00 00 00 FF 07 00 00 00 00
Reserved	4 Bytes	00 00 00 00
Extended ComID	4 Bytes	00 00 FF 07
Outstanding Data	4 Bytes	00 00 00 00
Min Transfer	4 Bytes	00 00 00 00
Length	4 Bytes	4C 00 00 00
Packet	24 Bytes	34 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
Session	8 Bytes	00 00 00 00 00 00 00 00
Seq Number	4 Bytes	00 00 00 00
Reserved	2 Bytes	00 00
Ack Type	2 Bytes	00 00
Acknowledgement	4 Bytes	00 00 00 00
Length	4 Bytes	34 00 00 00
Data Sub Packet	12 Bytes	25 00 00 00 00 00 00 00 00 00 00 00
Reserved	6 Bytes	00 00 00 00 00 00
Kind	2 Bytes	00 00
Length	4 Bytes	25 00 00 00
Data Payload	40 Bytes	00 00 00 F1 00 00 00 F0 F9 F1 01 FC FF FF 84 24 74 1E 15 84 F0 03 FF 00 00 00 00 00 00 A8 FF 00 00 00 00 00 00 00 A8 F8
Call Token	1 Byte	F8
Short Atom Token Header	1 Byte	A8
Invoking UID	8 Bytes	FF 00 00 00 00 00 00 00 = Reserved
Short Atom Token Header	1 Byte	A8
Method UID	8 Bytes	03 FF 00 00 00 00 00 00 = SyncSession Method UID
Start List Token	1 Byte	F0
Short Atom Token Header	1 Byte	84
Host Session ID	4 Bytes	24 74 1E 15
Short Atom Token Header	1 Byte	84
SP Session ID	4 Bytes	01 FC FF FF
End List Token	1 Byte	F1
End Of Data Token	1 Byte	F9
Status List	5 Bytes	F1 00 00 00 F0
PAD	3 Bytes	00 00 00
Data	416 Bytes	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00

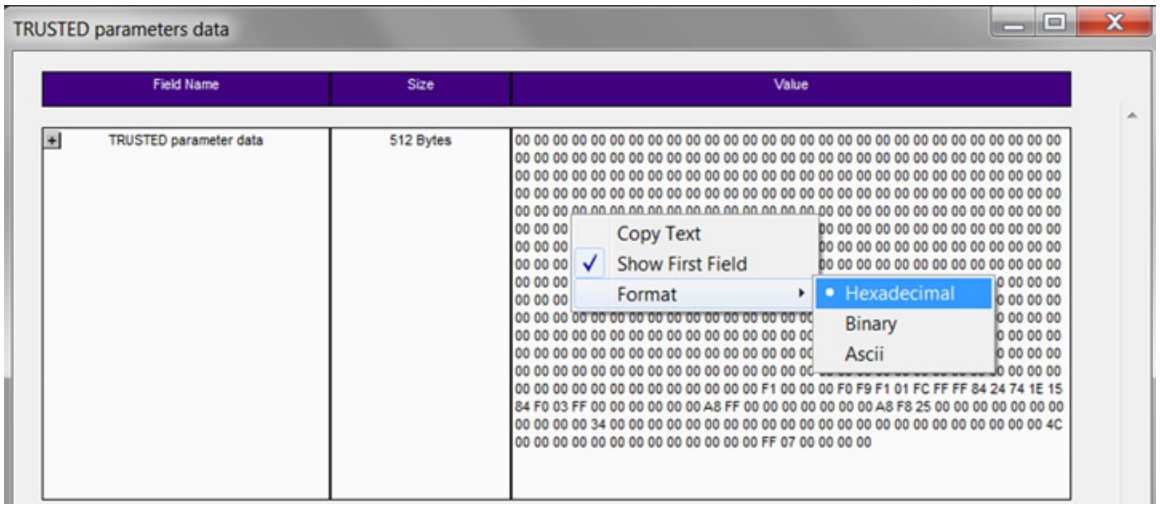


Figure 3.202: TCG showing Copy Text, Show First Field and Changing Format of Data

If you de-select Show First Field the Data will be shown as Function, Data Size and value of the data with an explanation. See Figure 3.203 on page 412.

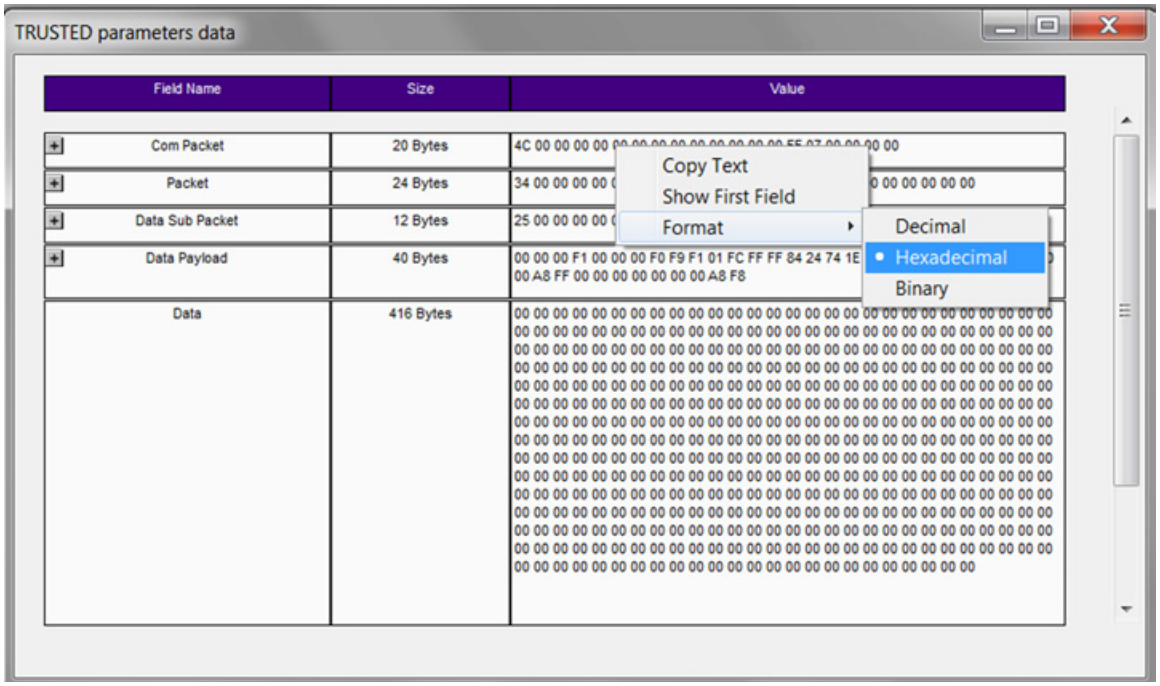


Figure 3.203: TCG showing Copy Text, No Show First Field and Changing Format of Data

3.31 Exporting LBA, XFER Length and Tag from Spreadsheet View

From an open Trace in Spreadsheet display mode, you can now Export and SaveAs LBA, Transfer Length and Tag data in different formats: Text 1.0/2.0 and Excel 1.0/2.0 as well as hexadecimal, decimal or binary. See Figure 3.204 on page 413.

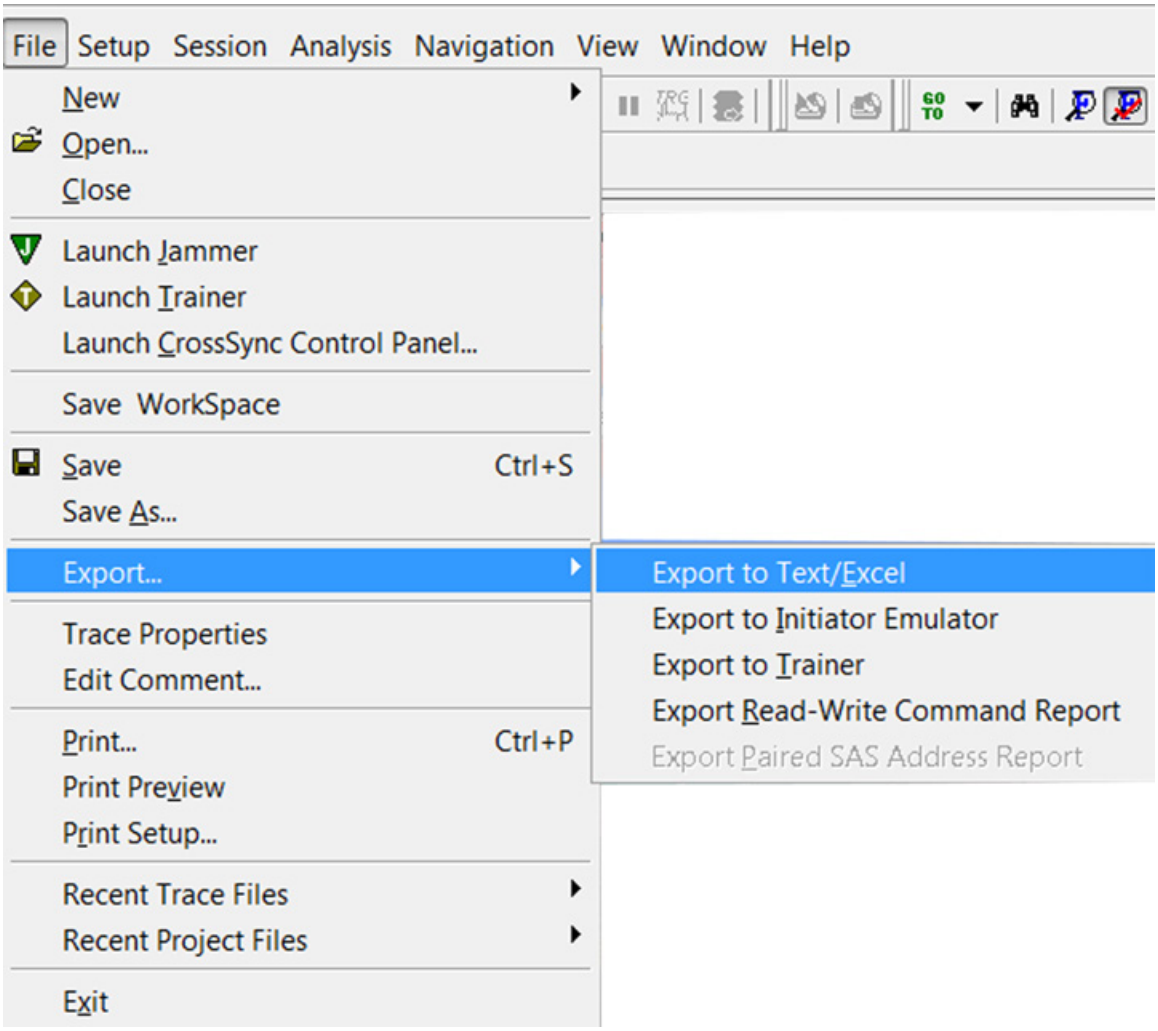


Figure 3.204: Export --> Export Text/Excel

This will bring up a SaveAs menu. See Figure 3.205 on page 414.

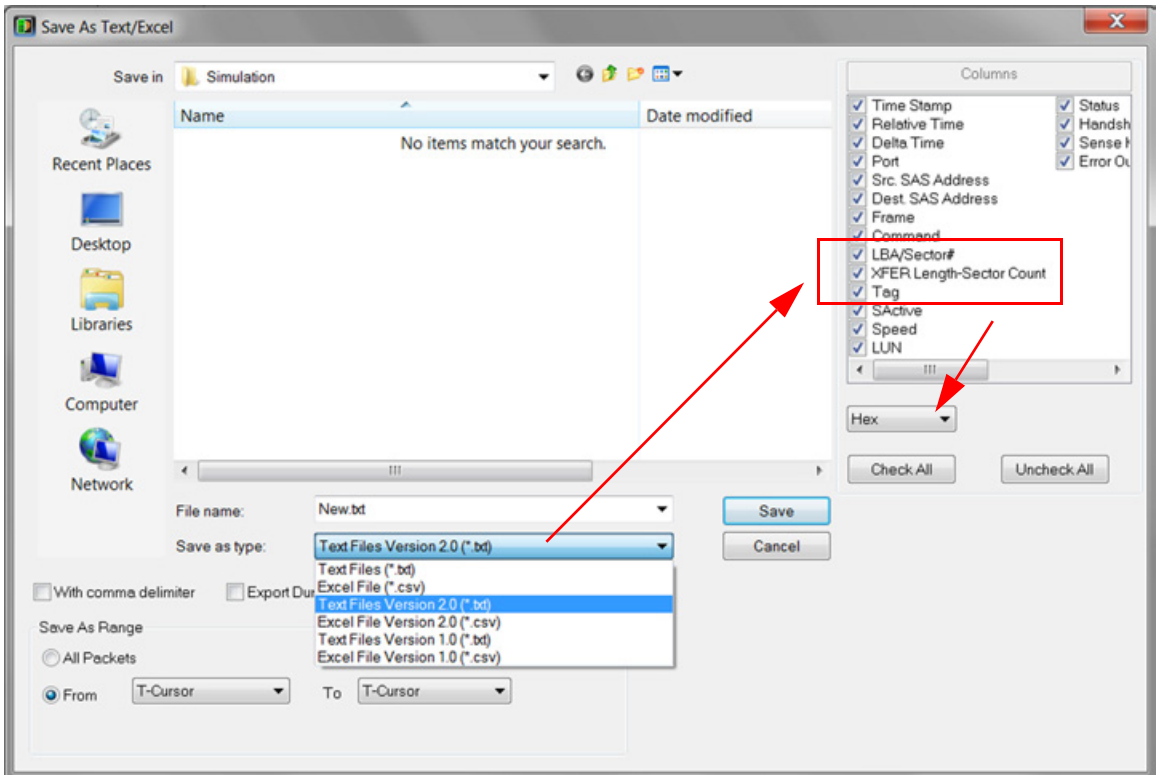


Figure 3.205: Select Text Files Version 1.0/2.0 or Excel File Version 1.0/2.0

LBA/Sector#, XFER Length-Sector Count and Tag will bring up a option to save the data in hexadecimal, decimal or binary format. See Figure 3.206 on page 415.

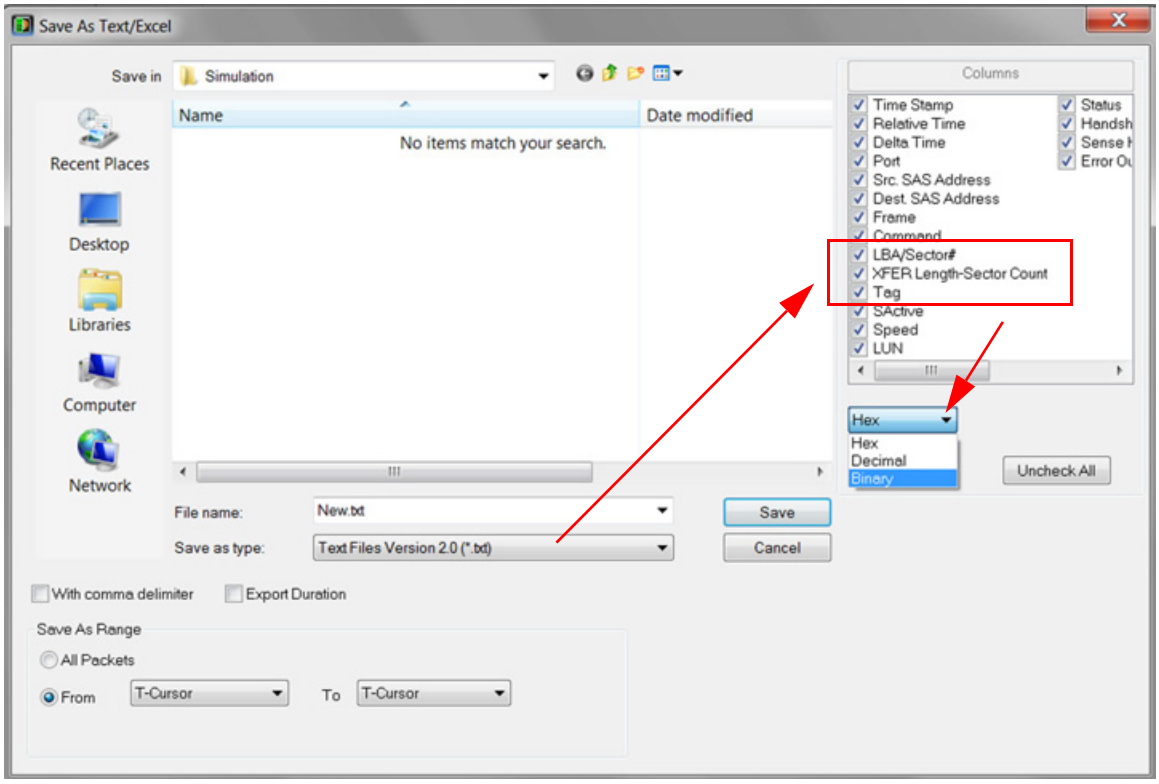


Figure 3.206: Save Data as Hex, Decimal or Binary

Chapter 4

InFusion Overview

The Teledyne LeCroy InFusion™ Error Injector and Traffic Modifier is an error injector and traffic modification tool that allows you to verify real-world fault handling for Serial Attached SCSI (SAS) and Serial ATA (SATA) systems. InFusion can sit unobtrusively in the data path on a live system to programmatically alter or corrupt traffic. InFusion is the ideal tool for stress-testing systems using actual workloads.

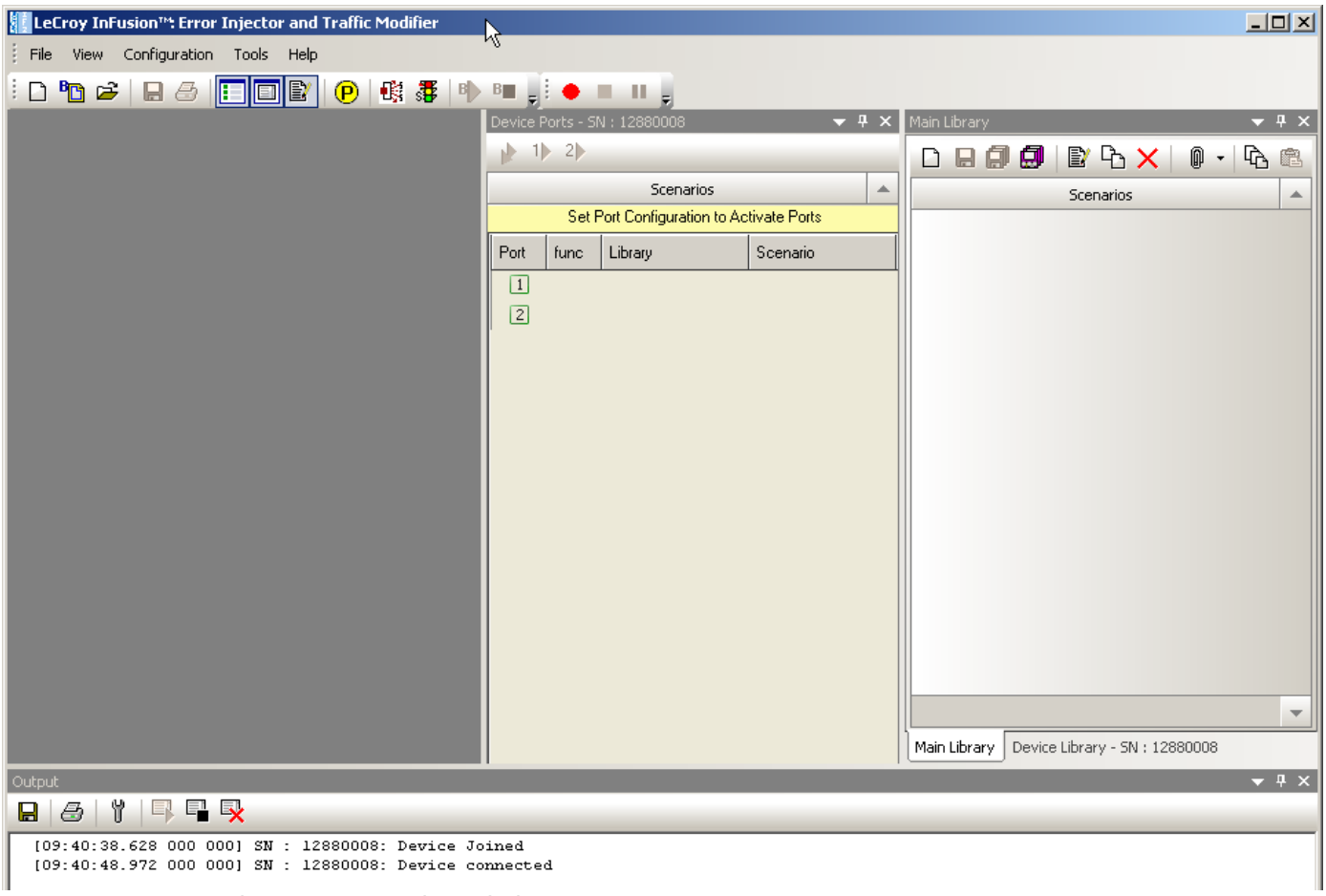


Figure 4.1: InFusion Windows.

InFusion supports SAS SSP, SMP, STP, and SATA-based protocols operating across a single SAS or SATA link up to 6 G. InFusion monitors traffic from both directions in real-time and relies on predefined rules to replace any bit, primitive, or parameter with one you specify. InFusion can change traffic when it detects a specific sequence or reaches a designated time interval, yet it requires no complicated scripts, programming, or simulation tools.

InFusion can monitor traffic in both directions and act on events occurring in either direction of the communications link. InFusion can modify traffic in only one direction within a given test scenario, but that direction can be either from the Initiator or from the Target.

InFusion is specifically designed to verify recovery characteristics within a subsystem. An easy pop-up menu interface allows you to create specific test scenarios in just minutes.

Once a InFusion session starts, the system automatically handles protocol handshaking between devices. InFusion transmits a faithful copy of the original data stream down to the CRC value which, if needed, it recalculates. InFusion allows test engineers to systematically verify error recovery in ways not possible with other test platforms.

An Infusion event can trigger an analyzer.

Infusion supports all commands in the SATA 3.0 specification.

4.1 Key Features

The key features of InFusion are:

- **Error Injection**: Injects CRC, disparity, 8b/10b encoding, framing, and coding errors.
- **Break Link Recovery**: Programmatically breaks the connection to test link recovery.
- **Value Replacement**: Monitors the link for specific values, patterns, or primitives (as low as bit level) and replace with user-defined values. You can replace values on every occurrence, after a specified number of occurrences, or after a specified time interval.
- **Packet Drop**: Removes individual primitives, address frames, or data frames from the stream to verify retry behavior.
- **Primitive Manipulation**: Replaces handshaking and flow control primitives to help validate robustness of a design.
- **Traffic Monitoring:** Operates as a traffic monitor, collecting statistical data on user-specified parameters. In this mode, data passes unchanged in both directions.
- **Menu-Driven Interface:** Allows easy set-up of test scenarios.
- **API based on C++:** Allows development of custom test applications.
- **Scenario Batch Files:** Allows scenario scripts.

With respect to traffic modification, in the Link Layer you can modify primitives, CRC, scrambled traffic, and SSP, SMP, and STP connection events. You cannot modify clock skew management and signal integrity.

InFusion consists of a hardware device that connects to the line under test and a Windows-based software application used to create and download test scripts to the device. You also can use the software application to configure and control the device across an Ethernet link.

InFusion test scripts are called scenarios. Scenarios determine how the hardware device monitors and modifies line traffic. You must use the application to create and download scenarios.

For the InFusion connections, the device is connected between the SAS/SATA host and the PHY of the test target (DUT). While jamming, the signals between ports I1 and T1 (for example) are routed through the FPGA, as opposed to being routed through the front end in the case of Analyzer mode. Both Out of Band (OOB) and data signals propagate through the FPGA.

4.2 Interface

4.2.1 Buttons

The InFusion interface has the following command buttons:



New Scenario: Begins the scenario creation process by listing Scenario Name, Direction for traffic changes, and Global Rules in the scenario window.

New Batch Script: Starts a scenario batch file in Batch Script window.

Open Library: Lists the InFusion Library Files (**.infdb**), which contain the available scenarios, in an Open dialog.

Save: Saves the current scenario in the UserData folder.

Print: Prints the current scenario.

Show Library: Displays/hides the Main Library window (on the right), which displays the available scenarios. You can create a new scenario, save a selected scenario, save the library, save a copy of the library, display the selected scenario, insert a copy of the selected item, or delete the selected scenario.

Show Output: Displays/hides the Output window (at the bottom), which displays InFusion output. Use the buttons to save output, print output, display options (automatically save the log file, with a path and size), start logging, stop logging, and clear the Output window.

Show Port Assignment: Displays/hides the port assignment.

Port Configuration: Displays the port configuration dialog. See "Port Configuration for InFusion" on page 423.

Launch Analyzer: Returns to the Protocol Analyzer or Target/Host Emulator window.

Launch Trainer: Goes to the Trainer window.

Run Batch Script: Runs a scenario batch file.

Stop Batch Script: Stops a running scenario batch file.

Record: Starts recording on the current analyzer, using the current project.

Stop: Stops recording on the current analyzer.

Abort: Aborts recording.

4.2.2 Menus

The InFusion interface has the following menus:

File

(see command descriptions in the "Buttons" section above)

- New Scenario, Open Scenario (File Library or Main Library)
- Open an InFusion database (.**infdb** file)
- Launch Analyzer
- Launch Trainer
- New Batch Script, Save Batch Script As
- New Library, Close Library (File Library or Main Library), Save Library, Save Copy of Library As
- Open Log File
- Print Setup
- Recent Trace Files
- Recent Project Files
- Close

Setup

- External Trig Setting (see "External Trig Setting" on page 384)
- Update Device (see "Update Device" on page 385)
- All Connected Devices
- Status Bar

View

- Views (Library, Output, Port Assignment, Customize - commands, Toolbars, Keyboard, Menu and Options)
- Smart Docking
- Toolbar
- Status Bar

Configuration

- Port Configuration (see "Port Configuration for InFusion" on page 423)
- Batch Script Setting (see "Scenario Batch Files" on page 493)

Tools

Browse UserData, System, or InFusion folder.

Help

Help Topics and About InFusion.

4.2.3 Main Library

You can **Show Main Library**.

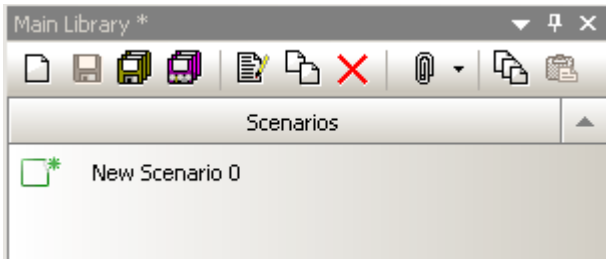


Figure 4.2: Main Library.

The Main Library has Scenarios.

Using the buttons from left to right, you can:

- Create a new scenario and save a scenario.
- Save a library and save a copy of a library.
- View/edit a scenario, insert copy of a scenario and delete scenario.
- Copy and paste.

4.2.4 File Library

You can display the File Library.

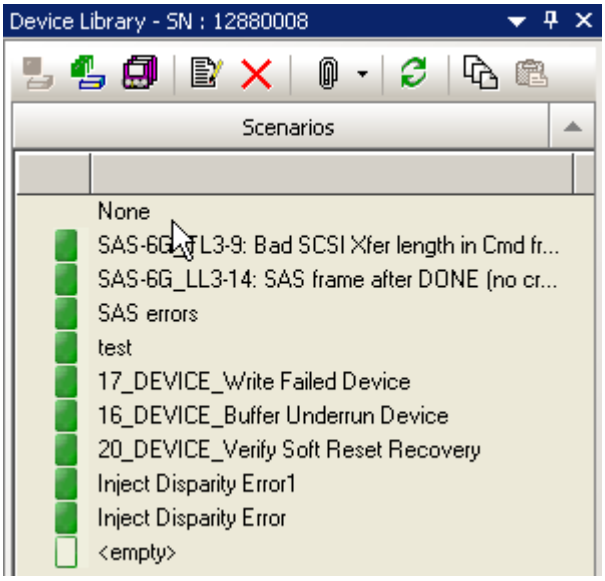


Figure 4.3: File Library.

A File Library has Scenarios currently available in the device.

Using the buttons from left to right, you can:

- New scenario.
- Save selected scenario.
- Save library.
- Save a copy of the library as.
- View/edit a selected item.
- Insert a copy.
- Delete a selected scenario.
- Copy
- Paste

4.2.5 Device Ports

If a device is connected, the software displays the Device Ports.

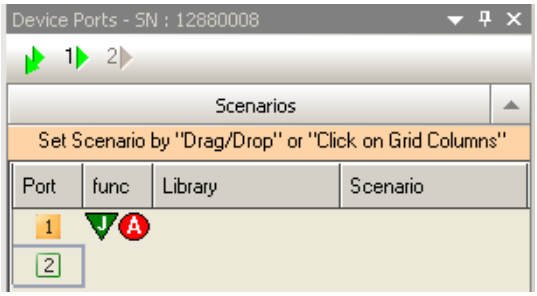


Figure 4.4: Device Ports.

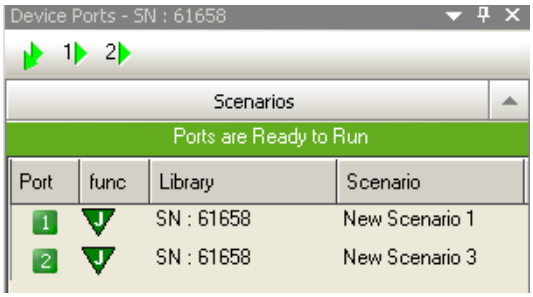
Using the first row of icons, you can Run/Stop All Ports or Run/Stop individual ports.
The columns display the Port, Function/Configuration, Library, and Scenario.
You can Float, Dock, Auto-Hide, or Hide the window.

Note: A port row is grayed out when that port has not been configured to be a Jammer in the Port Configuration dialog (see “Port Configuration for InFusion” on page 423).

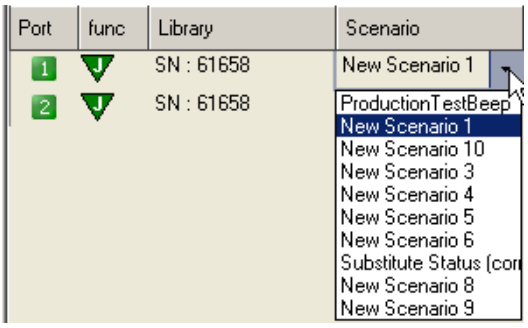
Using the Device Ports Dialog

After you have finished Port Configuration (see “Port Configuration for InFusion” on page 423), you use the Device Ports dialog to assign specific scenarios to ports, so that different scenarios can run on different ports.

To assign a scenario to a port, drag and drop the scenario from any library window to the port. The Device Ports dialog then displays the Library and Scenario on the row for that Port/Configuration.



Alternatively, assign the scenario using the Library and Scenario drop-down lists.



After you have assigned scenarios to ports, in the first row of icons, use the first green arrow icon to **Run/Stop All Ports**, or use the numbered green arrows to **Run/Stop an individual port**.

Note: A port row is grayed out when that port is running a scenario.

4.3 Port Configuration for InFusion

The InFusion (Jammer) port configurations must match the Analyzer port configurations for the infusion-analyzer to work.

Select **Configuration > Port Configuration** to display the Set Port Configuration dialog.

To record traffic, select **Jammer** on the port that you want to jam. In the following figure, there is a match on Port 1.

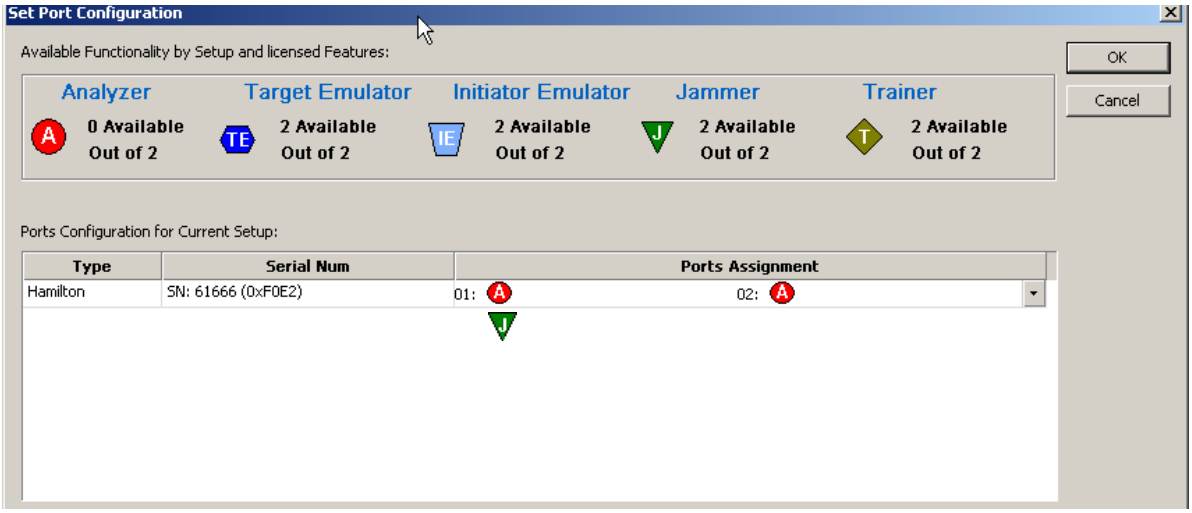


Figure 4.5: Ports Configuration Dialog with InFusion/Analyzer Port Match.

You can select only one Jammer port at a time with this configuration.

Note: To display the current Port Configuration, click **Show Analyzer** to go to the analyzer application, then click the green button in the lower right corner to display the Port Status window (see "Port Status" on page 360).

Important Information for Jammer and Analyzer

Jammer intercepts and delays traffic on both directions simultaneously, so Host sends to Jammer, Jammer delays and sends to Host, Device sends to Jammer, Jammer delays and sends to Device. However, Jammer modifies traffic in one direction only: from Host to Device, or from Device to Host.

When using Jammer and Analyzer, the Select Port Configuration dialog has options JA as shown in Figure 4.6.

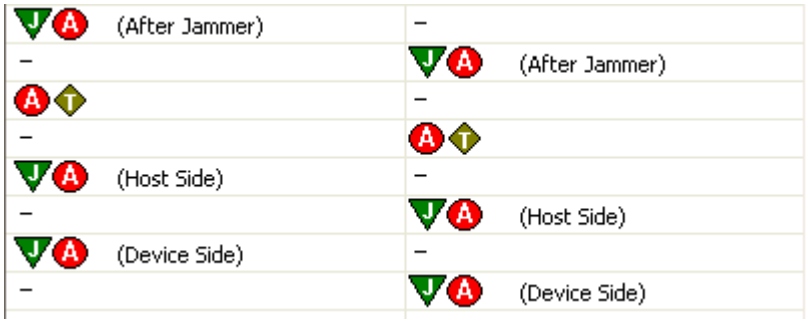


Figure 4.6: Select Port Configuration Options with Jammer and Analyzer.

The following figures illustrate the available setup options.

- **JA (After Jammer)**: Analyzer captures Jammer to Host and Jammer to Device. Analyzer is after Jammer on both paths. See Figure 4.7:

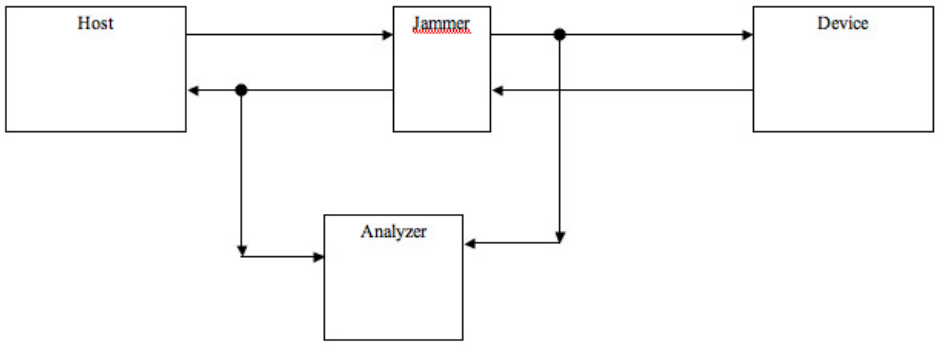


Figure 4.7: Jammer and Analyzer with Analyzer after Jammer.

- **JA (Host Side)**: Analyzer captures Host to Jammer and Jammer to Host. Analyzer is before and after Jammer on Host side. See Figure 4.8.

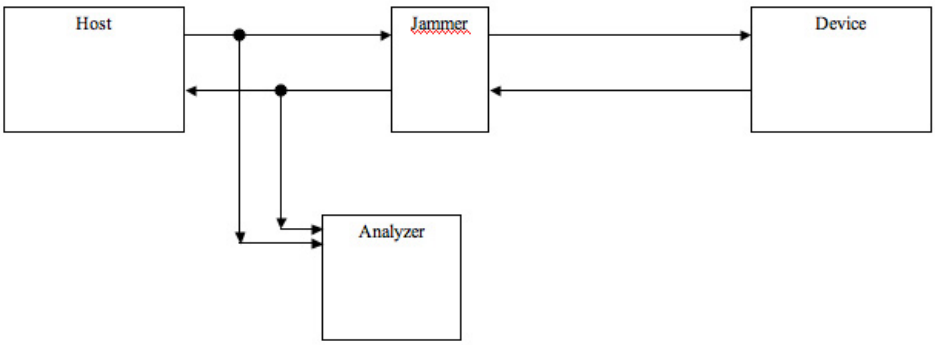


Figure 4.8: Jammer and Analyzer Host Side.

- **JA (Device Side)**: Analyzer captures Jammer to Device and Device to Jammer. Analyzer is before and after Jammer on Device side. See Figure 4.9.

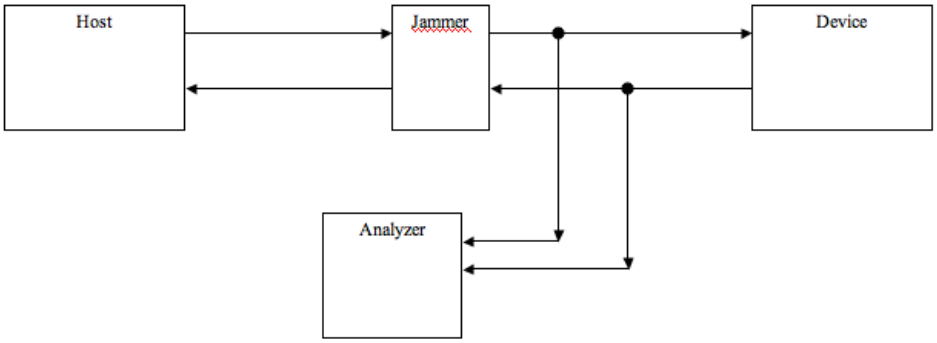


Figure 4.9: Jammer and Analyzer Device Side.

The setup options are the same whether Jammer modifies traffic from Host to Device or from Device to Host.

Note: When the Unit Under Test (UUT) is the Host, using JA (Host Side) (see Figure 4.8) will give the most accurate recordings of Host behavior, though the Jammer delays will accumulate in the round trip.

Note: When the Unit Under Test (UUT) is the Device, using JA (Device Side) (see Figure 4.9) will give the most accurate recordings of Device behavior, though the Jammer delays will accumulate in the round trip.

Note: The After Jammer configuration (see Figure 4.7) is useful when debugging a system, as the tapping points are balanced to account for Jammer delays. Note that when SATA traffic is recorded, this configuration might show out of order HOLD/HOLDA primitives, due to the special handling of these primitives by the Jammer.

Note: When running InFusion in an AJ port configuration a "FIS Signaling Latency Error" message displays due to the delay through the InFusion Jammer. This can prevented by turning off the detection of this error using the Protocol Error Mask dialog from the Settings tab.

4.4 InFusion Scenarios

You can create and execute InFusion scenarios. A scenario is a test script that defines how InFusion monitors and modifies line traffic.

4.4.1 Scenarios Overview

The InFusion application provides a menu-driven interface for building scenarios. The interface prompts you for simple decisions and choices from drop-down menus. As you make your selections, the script takes shape automatically in the scenario window. The script is in the form of simple English sentences. You need not understand any formal scripting language (see Figure 4.10 and Figure 4.11 on page 427).

To start, Select **File -> New Scenario** as shown below:

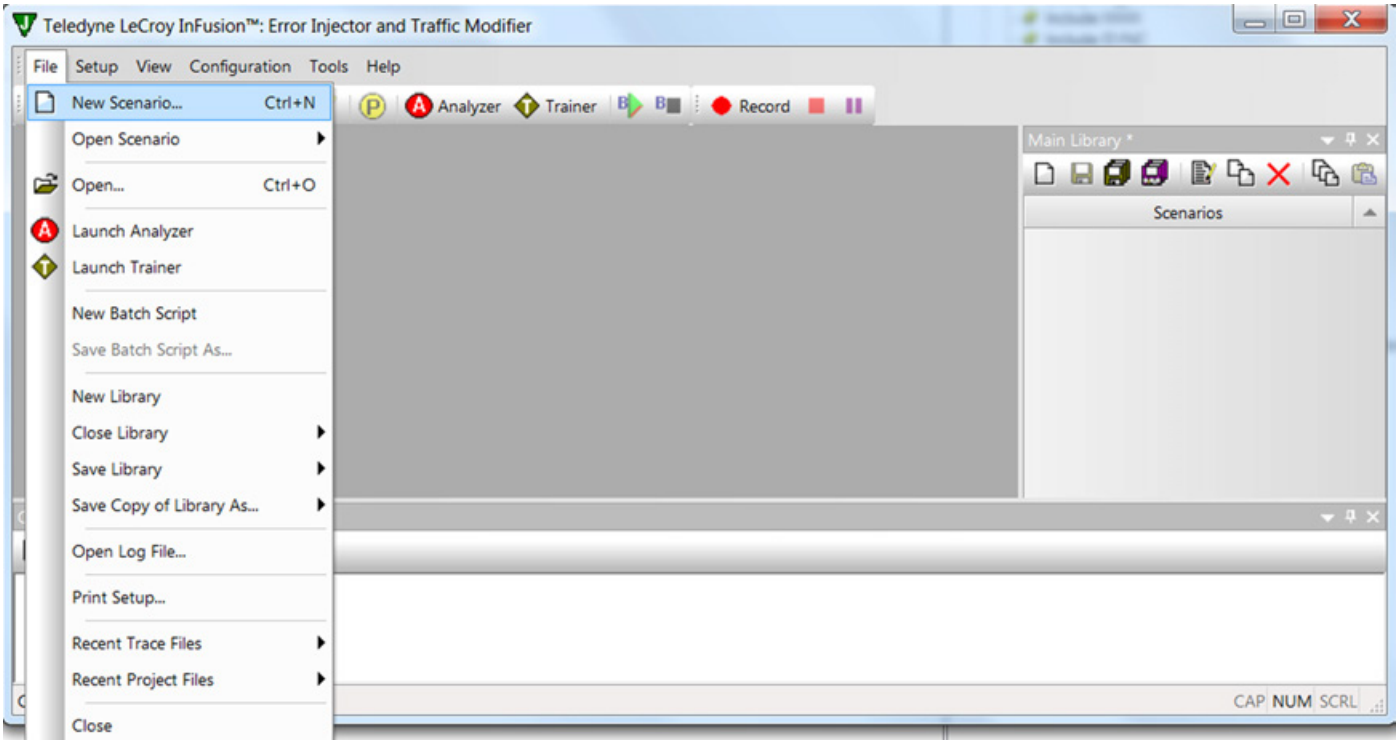


Figure 4.10: Generate a New Scenario

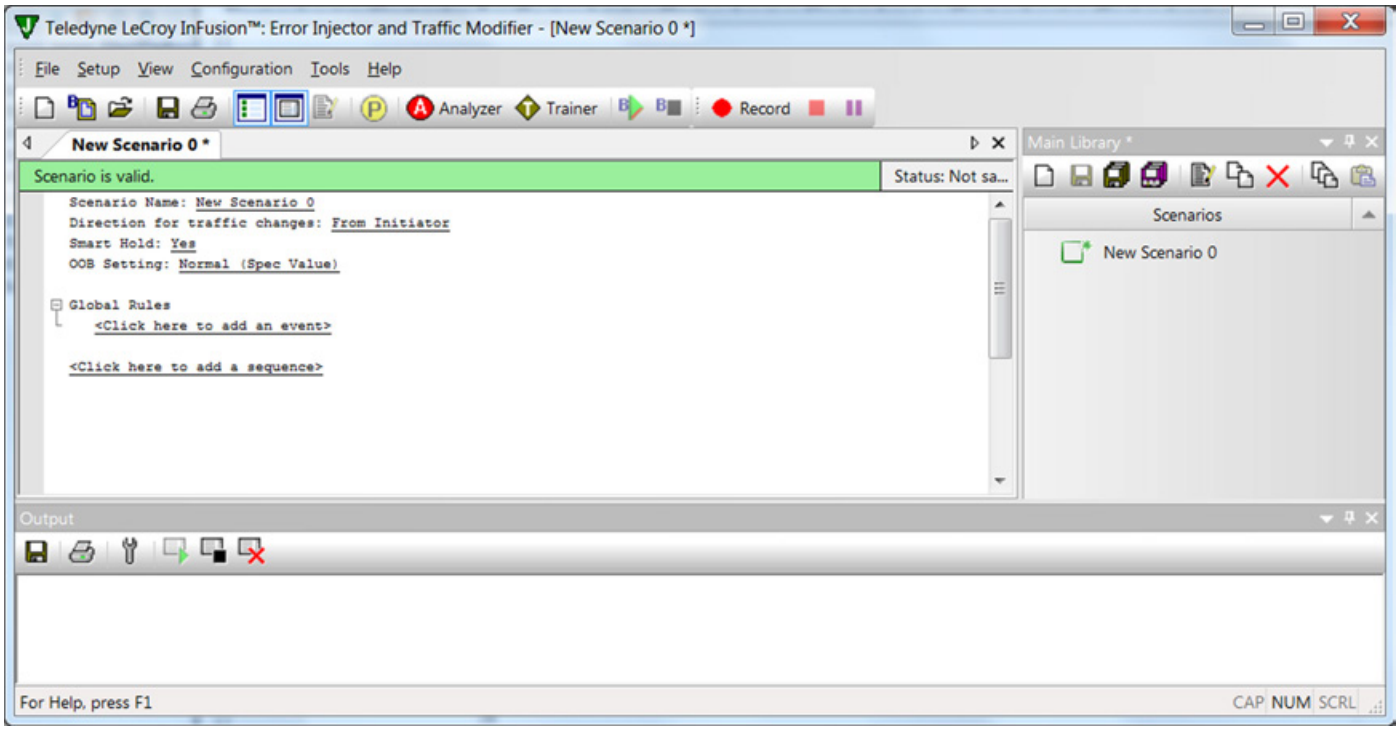


Figure 4.11: Structure of New Scenario 0

InFusion Scenario Parameters

Timers

Timers allowed per state/sequence/scenario:

2 timers per state and 6 timers per scenario are allowed.

Events

Events allowed to be used per state/sequence/scenario:

For combined events, there is virtually no limit per state/sequence/scenario.

Actions

Actions allowed per state/sequence/scenario:

A maximum of 8 actions per state, 2048 actions per sequence (8*256 state), 4104 actions per scenario (2*2048 + 8 more in the Global Rules "state").

Monitors

Monitors allowed to be used per state/sequence/scenario:

InFusion can keep an account of 8/12 Monitor/Count events per scenario.

Random change of use of count and count randomly:

In Global Rules, if a Counter is used for Event counting, 2 extra actions are consumed. 2 more actions are required for "Every Nth occurrence" option.

In Sequences, If a Counter is used for Event counting, 3 extra actions are consumed. 3 more actions are required for "Every Nth occurrence" option.

Regarding limits on any of the above mentioned connections, i.e., x timers + y monitors are allowed per state where x+y=n:

There are a lot of big/small rules checked by the scenario compiler, but as a rule of thumb:

8 actions per state are available

12 counters globally are available, each assigned permanently to a certain job

6 available timers per scenario

12 programmable multi-purpose resources for DWORD comparison/substitution/capture are available. If a pattern detector uses 3 of these resources to trigger on a specific frame on the bus, only 9 more resources are available for other tasks. Frame/FIS type detectors are excluded from this rule, because they use their own dedicated resources.

8 primitive detectors are available

If you want to trigger on a pattern (Frame/FIS) and change/capture a dword(s) before the last offset of a detected pattern (e.g., changing the Frame Type of a SAS Frame with Data Offset == 11223344), you are limited to a maximum of 9 dword offset (i.e., if you trigger on the 20th payload of a Data FIS, you can change/capture the 12th dword onwards. 11th payload dword and preceding dwords are not accessible for change/capture)

You can not change a state based on back-to-back events. At 6G speed, there should be at least one dword between the triggering event of two consecutive states. At other speeds, back-to-back dword state transitions might rarely be missed, so best practice is to never assume back-to-back dword events.

As described later in this chapter, you can create any number of scenarios and store them in libraries on the host machine's hard drive. Scenario library files names are in the following format:

`<filename>.infdb`

Creating InFusion scenarios is easy, but it requires an understanding of the following terms defined in Table 1.

TABLE 4.3: Key Scenario Terms

Term	Definition
Action	InFusion response to an event.
Event	Condition that is detectable by InFusion.
Combined Event	Logical OR association of events (for example, event A OR event B).
Global Rules	Portion of a scenario that can define a single InFusion test state. You can think of the Global Rules and each sequence as a separate test routine or program operating within the scenario. Each operates independently and in parallel with the others. The purpose of each is to detect events and then respond with the appropriate action or set of actions. In essence, you can operate up to three test states simultaneously within InFusion.
Sequence	Portion of a scenario that can define multiple InFusion test states. More flexible than the Global Rules, a sequence allows more powerful scenarios that include branching and looping between test states (Global Rules can define only a single test state, so there is no branching).
State	"Behavior" of the Global Rules or a sequence at any point in time. In terms of InFusion testing, behavior is "waiting" for a set of events and responding with a set of actions.

4.4.2 Global Rules

Global Rules are a portion of the scenario that can define only one test state. To create the Global Rules, you use the menu-driven interface to enter an event or combined event and the corresponding action or set of actions (the response of InFusion hardware to the event).

In the case of a combined event, the action is taken upon occurrence of any of the events stated for the event combination. It is a logical OR association, meaning any of the events can trigger the action.

After you enter the event or combined event, the interface prompts you for actions. An action might be, for example, injecting a particular primitive or error into the traffic stream. You can enter multiple actions, which take place simultaneously.

After defining the event and actions within the Global Rule area, you can save the scenario and download it to a InFusion device.

Note: If you want to stop the scenario after the jam, the Global Rules is not the right tool. This should be done in one of the sequencers. Please see "Stop Scenario" on page 430 for more information on this function.

Sequences

The Global Rules are all you need for simple test scenarios. However, a scenario also can contain one or two sequences, which can define multiple states and allow branching between states. With a sequence, you also can do looping, which allows you to repeat a test state or to execute a test for a specified period of time.

As with Global Rules, the menu-driven interface guides you in building a sequence. Some of the prompts are different, however, because you now are encapsulating groups of events and actions as distinct states. Recall that a state is a combination of events and actions at a specific point in time. If the event or combined event defined by a state occurs, the corresponding action or set of actions follows.

Stop Scenario

If one of the Actions is Stop Scenario, the other Actions are not carried out. To stop the Scenario after the requested Actions have been carried out, you should branch to a new state which stops the Scenario.

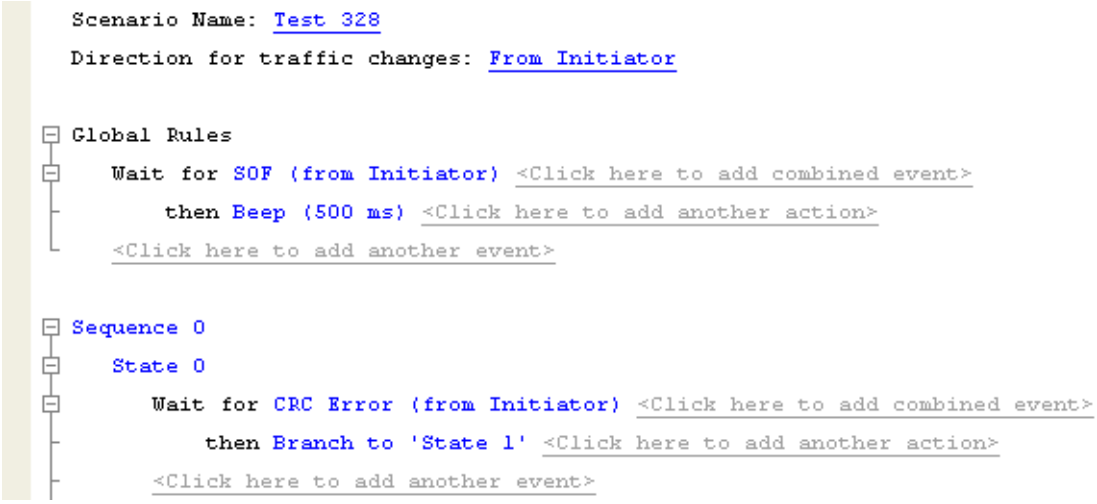


Figure 4.12: Global Rules and Sequence Areas of a Scenario

InFusion hardware provides the capacity to have up to two sequences co-existing in a scenario in addition to the Global Rules. Recall that both the Global Rules and any sequences are active at all times. Each is a separate “state machine,” having the behavior of a particular test state at any point in time. Because the Global Rules has the capacity for only one state, you can view it as a “degenerative state machine.”

4.5 Scenario Libraries

You can create any number of scenarios, which you then can archive on your host machine’s hard drive. You also can download up to ten scenarios to each InFusion device for test execution. You can think of the libraries as windows that hold scenarios.

Recall that each library is a separate ***.infdb** file.

4.5.1 Main Library

When you launch the InFusion application, it opens a window called the Main Library. The main library is the default workspace for creating and storing new scenarios. The main library corresponds with the following file in the InFusion folder on the host machine's hard drive:

```
default.infdb
```

4.5.2 File Libraries

You can save the main library with a name other than default (while still using the **.infdb** file extension). The new file becomes a file library that is functionally equivalent to the main library with the following exception: It does not open by default in the Main Library window. You can navigate to other file libraries using the File Manager of the InFusion application.

In this manual, the main library and other **.infdb** file libraries are collectively called general libraries.

If you select **Open Library,** you see a window similar to the following:

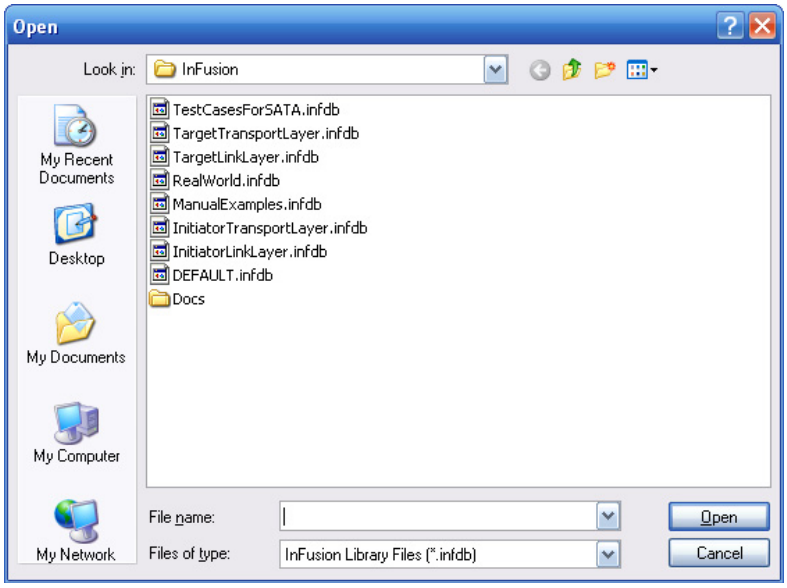


Figure 4.13: Open Library File List

By selecting the **TestCasesForSATA.infbd** file, you get an additional library window with predefined SATA test cases, similar to the following:

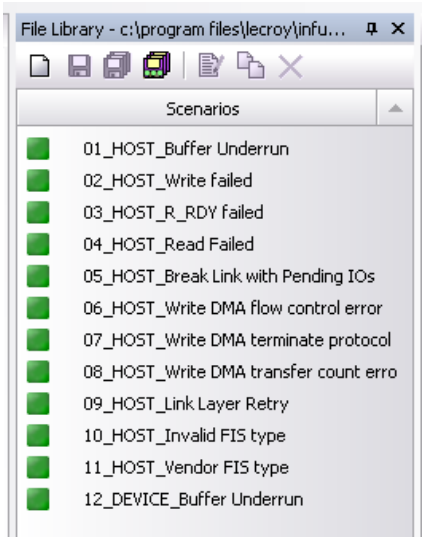


Figure 4.14: Test Cases for SATA Library

4.5.3 Device Libraries

In addition to general libraries, the application defines device libraries. Each device library is associated with a specific InFusion device. Each device library opens in a separate Device Library window and holds up to ten InFusion scenarios for the device. When you connect to the device and click the entry for that device in the Device List, the device library for the device opens automatically.

The scenarios that appear in the device library are those currently stored on the corresponding device. They were uploaded from the device to your host machine when you opened the device library. You can click any of the scenarios listed to open it for editing. When you are finished with your edits, you can use the buttons on the Device Library toolbar to download the revised scenario to the device.

The None scenario is an empty and undefined scenario to allow you to assign port(s) to None.

The Multiport feature allows you to run a scenario by more than one port in a Device Library and to assign different ports to different scenarios and run them together. Each scenario in a library can run by more than one port.

4.6 Scenario Properties

To begin the scenario creation process, you click the **New Scenario** button in a library window, the InFusion application toolbar or from the SAS SATA Protocol Suite Main Menu (see Figure 4.15) select Jammer (to get the InFusion dialog to popup see Figure 4.16).

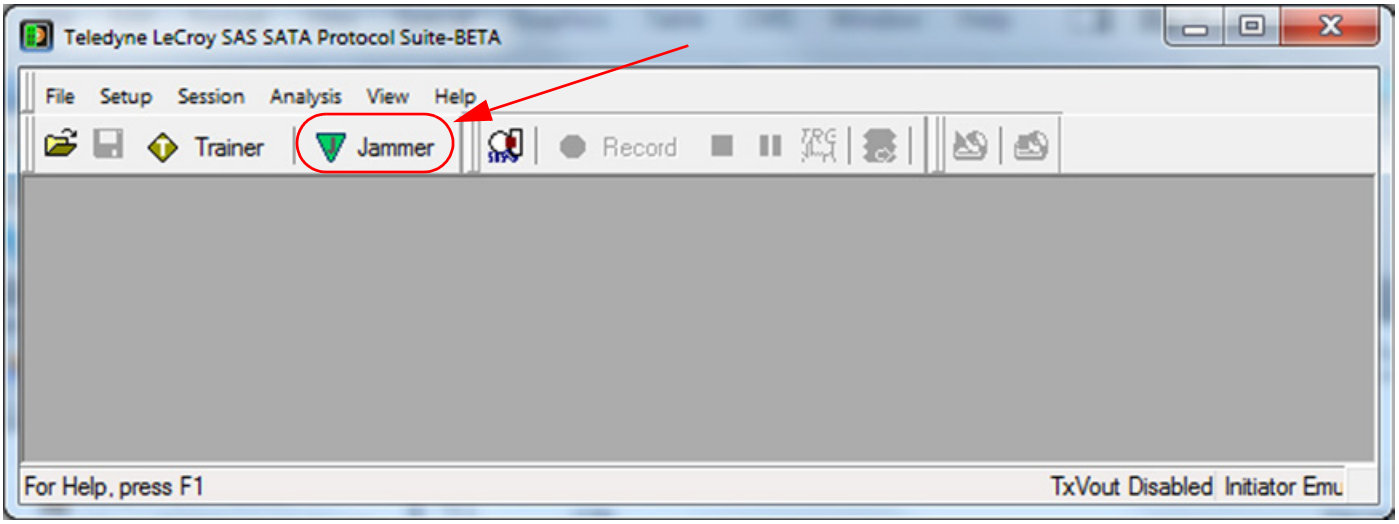


Figure 4.15: SAS SATA Protocol Suite Main Menu

From the InFusion Dialog select the Create New Scenario icon (see Figure 4.16).

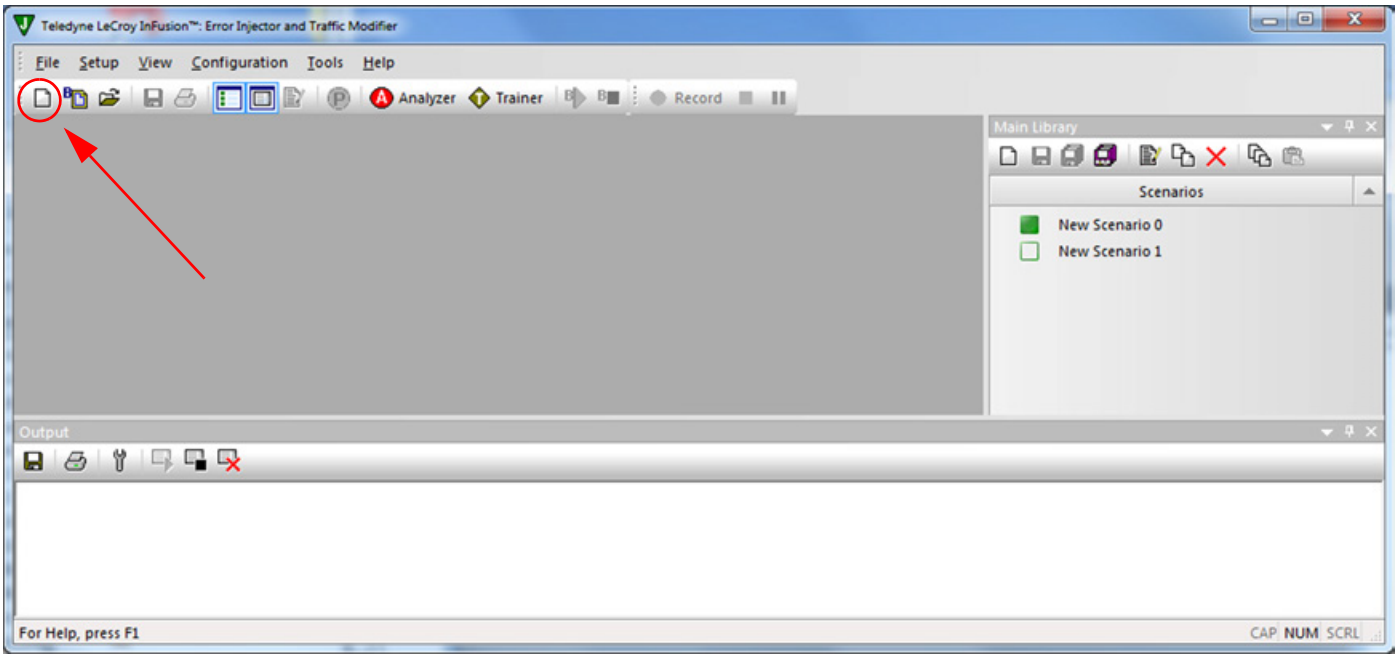


Figure 4.16: InFusion Dialog

The following New Scenario dialog pops up. See Figure 4.17 on page 434.

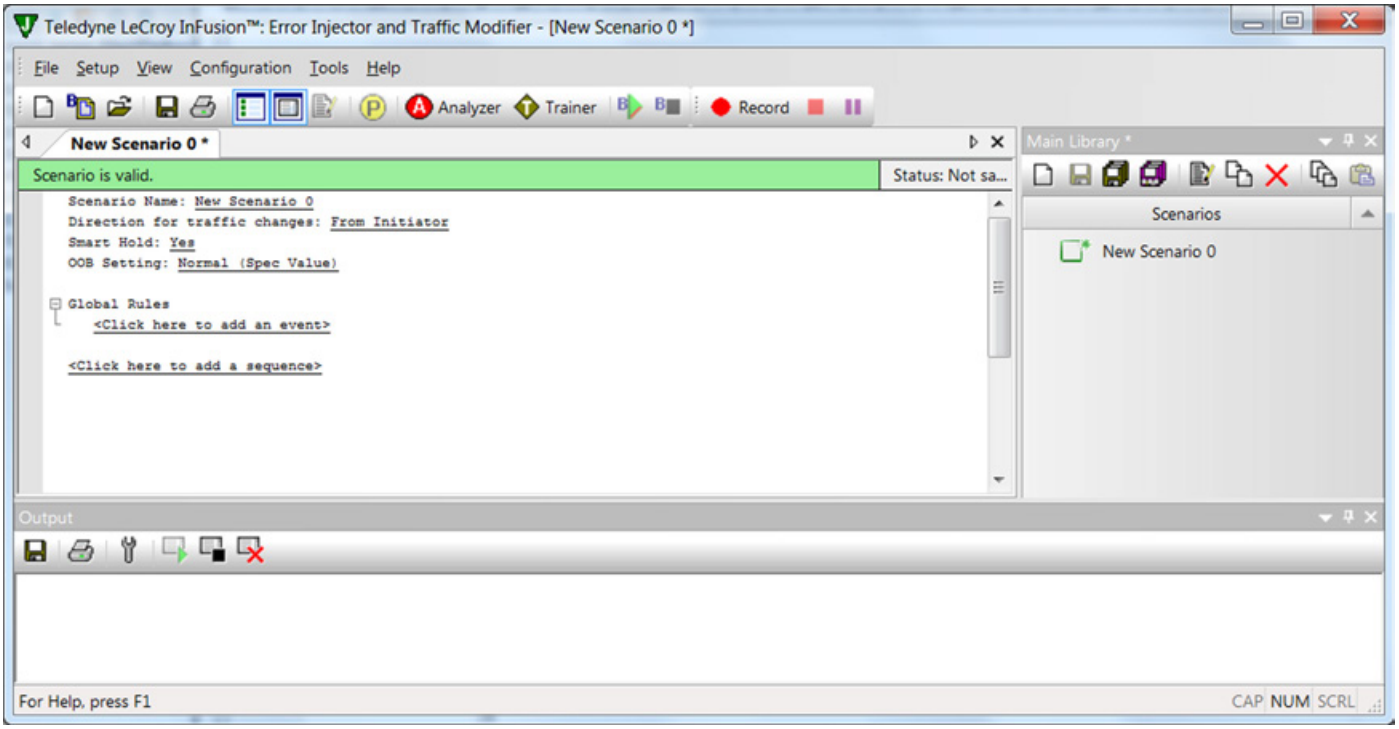


Figure 4.17: Structure of New Scenario 0

4.6.1 Scenario Generation

Your New Scenario 0 already has several Scenario Properties defined for it:

- Scenario Name: New Scenario 0
- Direction for traffic changes: From Initiator
- Smart Hold: Yes
- OOB Setting: Normal (Spec Value).

You can change any of these parameters by selecting them.

Scenario Name

Selecting Scenario Name allows you to customize it. See Figure 4.18.

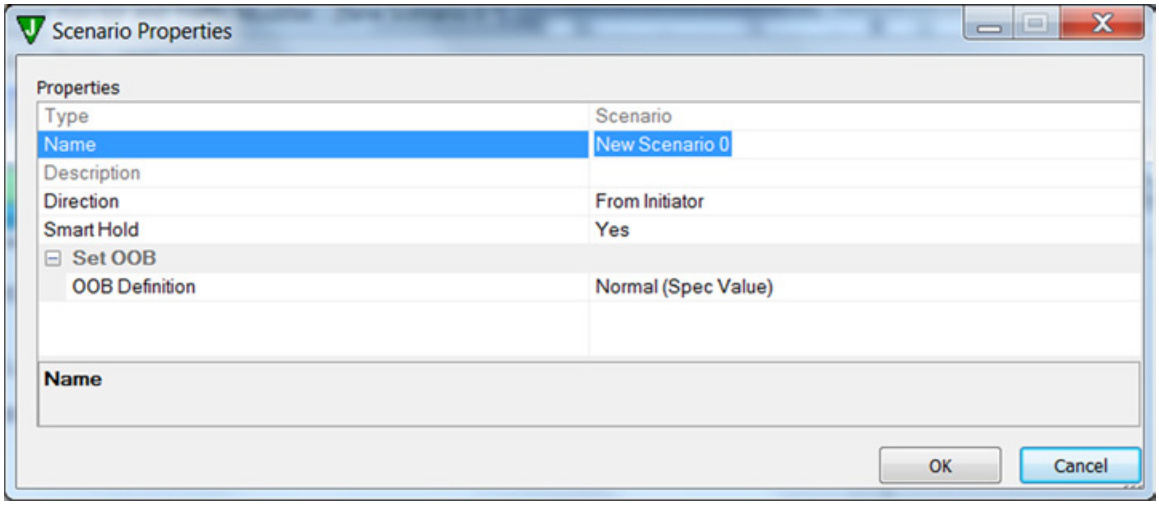


Figure 4.18: Scenario Properties: Name

Direction of Traffic

Selecting Direction allows you to change the Direction of Traffic. You identify direction of traffic change, or modification, in terms of traffic origin. The application uses the following conventions:

- **From Initiator**: Change is made to traffic coming from test host (for example, CRC error is injected into traffic stream sent from initiator to target).
- **From Target**: Modification is made to traffic coming from the target (for example, CRC error is injected into traffic stream sent from target to initiator).

The direction for traffic modification is defined on a global basis for the entire scenario. In other words, any scenario action that modifies line traffic only affects the traffic flowing in the direction established at the top of the scenario, in the Scenario Properties. Scenario events can be monitored in either direction, and therefore the parameters for events provide the ability to specify the intended direction for monitoring traffic for that event. See Figure 4.19.

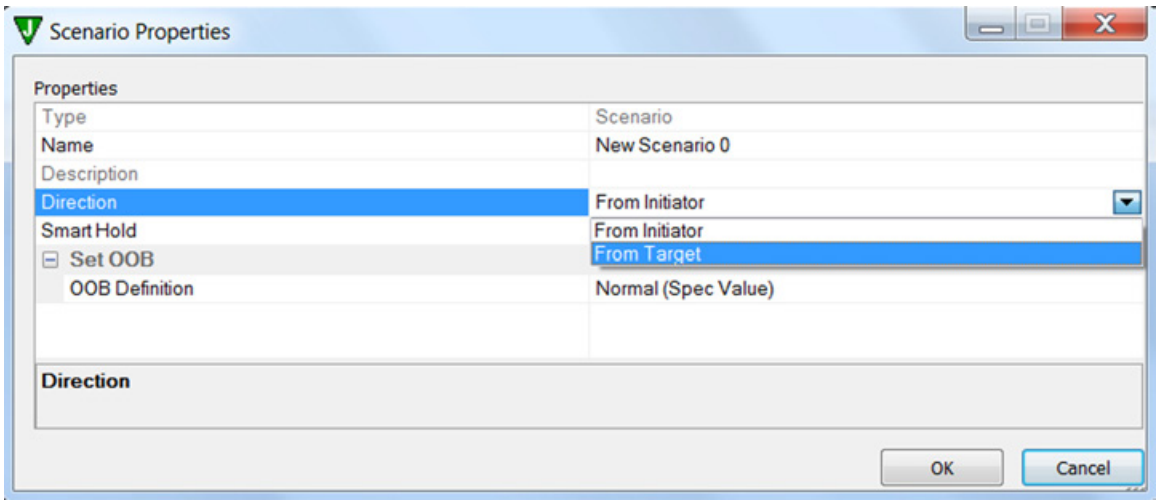


Figure 4.19: Scenario Properties: Direction of Traffic

Smart Hold

SATA Scenario Properties have a Smart Hold option, which is on by default. Figure 4.20 on page 436.

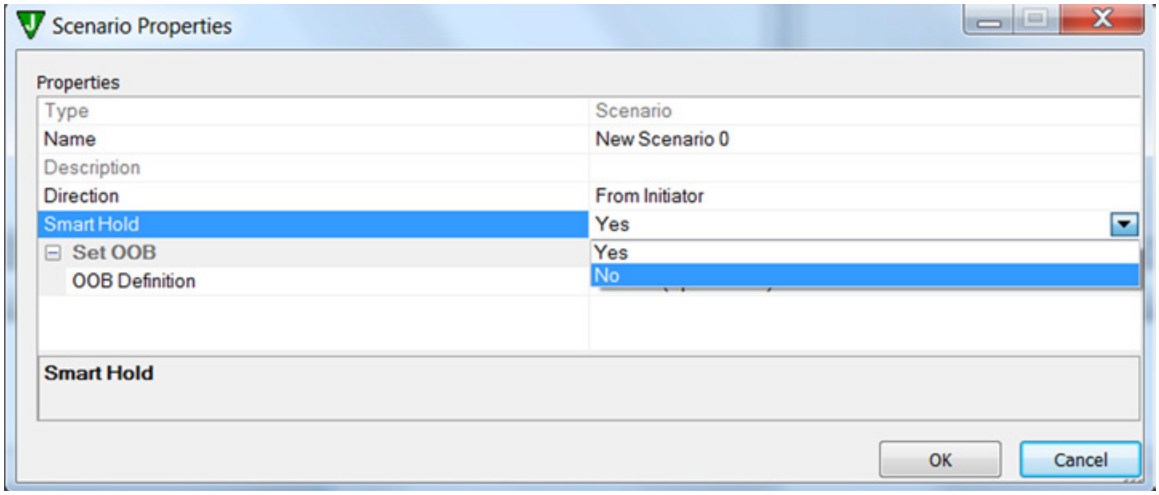


Figure 4.20: Scenario Properties: Smart Hold

Each port monitors incoming data, which originated with the other device's receiver, as close as possible to where it enters the bus engine. If a port detects a HOLD primitive during a SATA frame, the port stops reading data from the FIFO and generates HOLDA. The HOLD propagates through the bus engine and eventually goes to the other device, where the HOLD causes the other device to send HOLDA. (The bus engine FIFOs must be deep enough to hold all the traffic that the other device sends while the HOLD propagates. The port drops all incoming HOLDA conditions, so HOLDAs are never put in the FIFOs or made visible to the sequencers.)

After this, the port that had been receiving the HOLD stops sending HOLDA and attempts to read data from the FIFO. The termination of HOLD propagates through the bus engine and then causes the other device to restart transmission, which puts data into the FIFO.

Note: If both sides send HOLD primitives that overlap, the receivers drop the HOLD conditions to avoid overflowing the FIFOs. If you turn off the Smart Hold option, the port does not send HOLDA when it detects a HOLD primitive during a SATA frame.

OOB Definition

Select OOB Definition to set the Out of Band conditions. You have three choices (see Figure 4.21 on page 437):

- Normal (Spec Value)
- Violated
- Custom (User Defined)

Normal uses Spec Values for OOB conditions.

Normal (Spec Value)

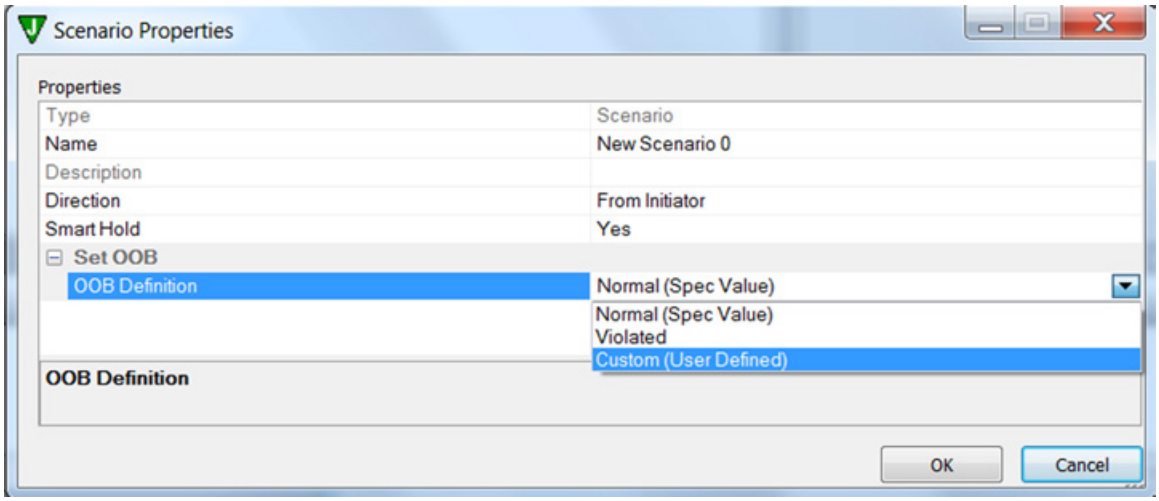


Figure 4.21: Scenario Properties: OOB Definition

Violated

You can set the COMINT, COMSAS or COMWAKE parameters that would cause an OOB condition by selecting Violated and selecting Yes or No. See Figure 4.22.

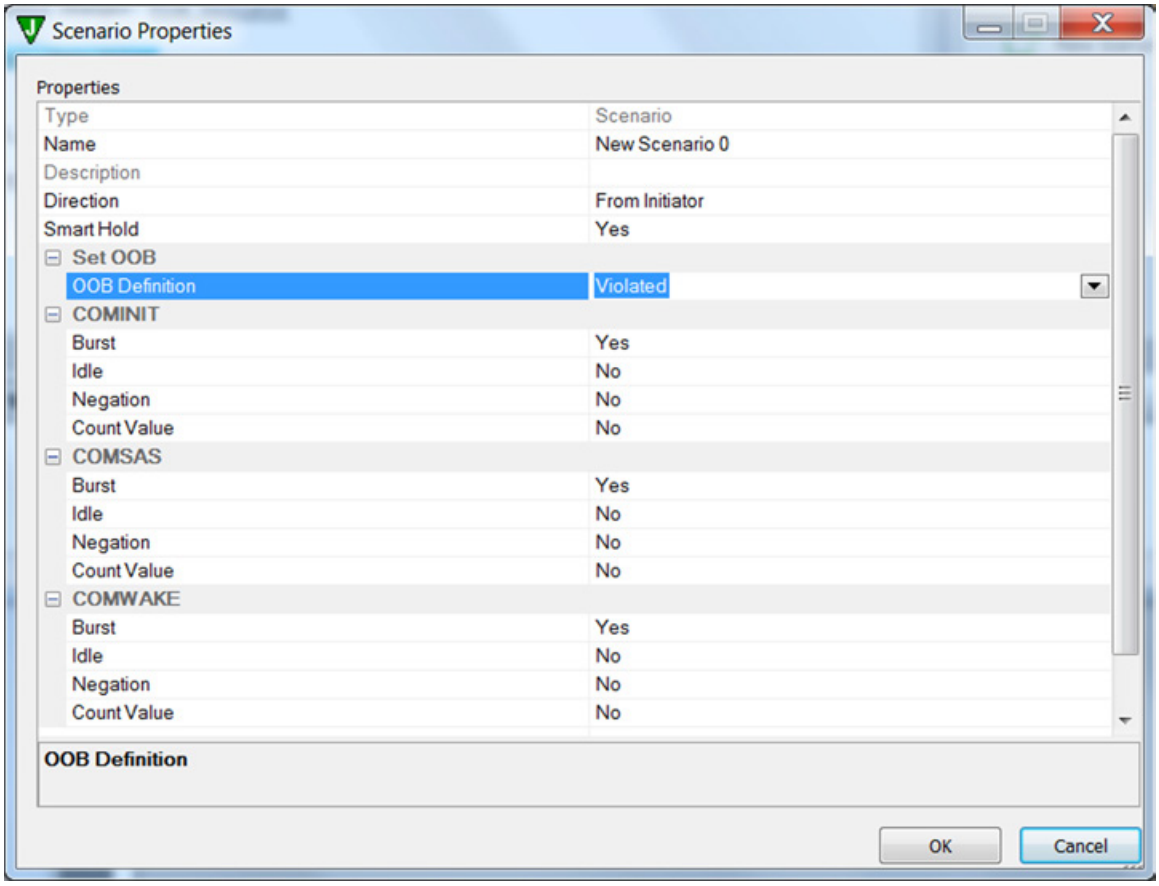


Figure 4.22: Scenario Properties: OOB Violated Conditions

Custom (User Defined)

Or you can generate your own set of Conditions for an Out of Bounds conditions: Custom (User Defined). See Figure 4.23.

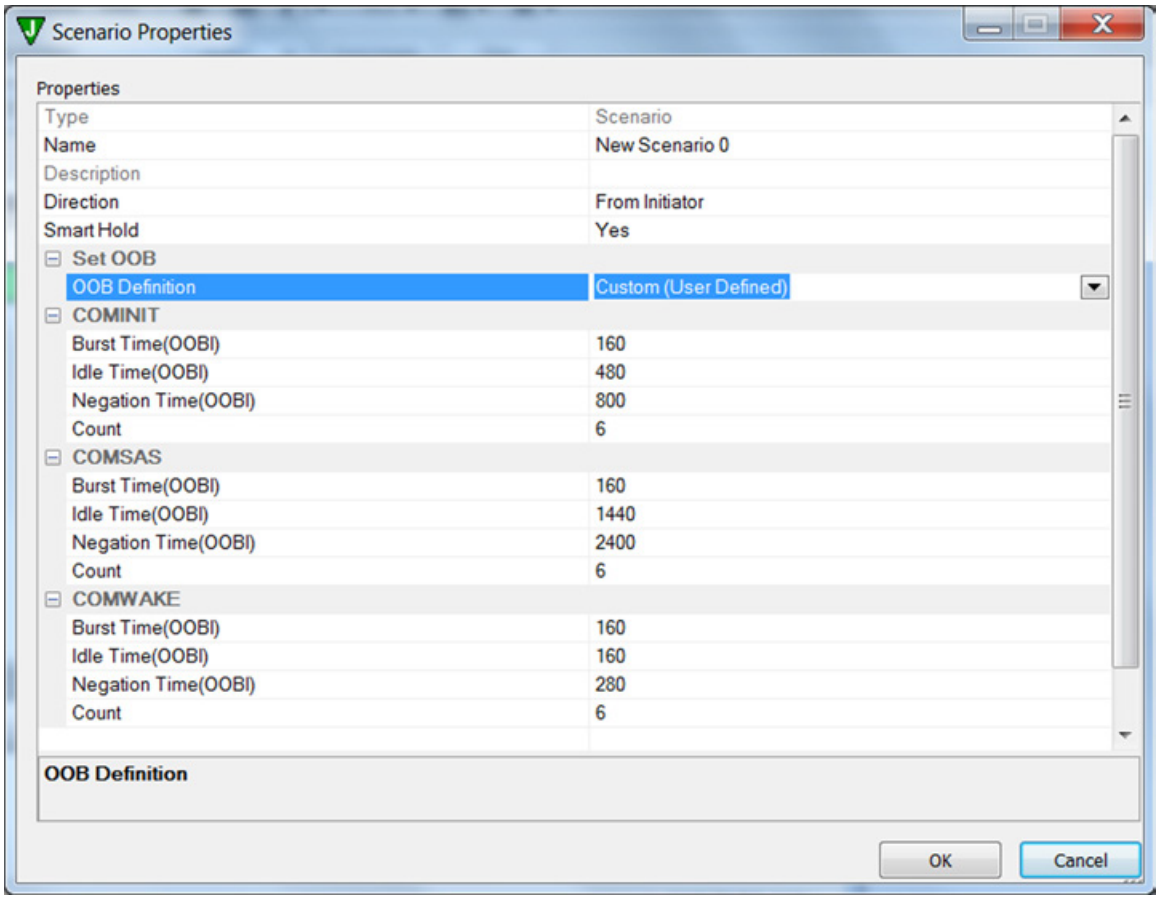


Figure 4.23: Scenario Properties: OOB Custom Conditions

This allows you to set the values for each parameter type (COMINT, COMSAS, and COMWAKE).

The next step is to define the Scenario Events and Actions.

4.7 Scenario Events

A scenario is a script you create using simple mouse clicks and text entries. As you work, the script takes shape in the scenario area of the application display. You can think of the scenario area itself as consisting of two subareas: A Global Rules area at the top, where you create the Global Rules, and a Sequence area beneath the Global Rules, where you create any sequences. Whether you are creating Global Rules or a Sequence, the menu-driven interface prompts you to specify the event(s) for which you want to trigger actions (see Figure 4.24 on page 439).

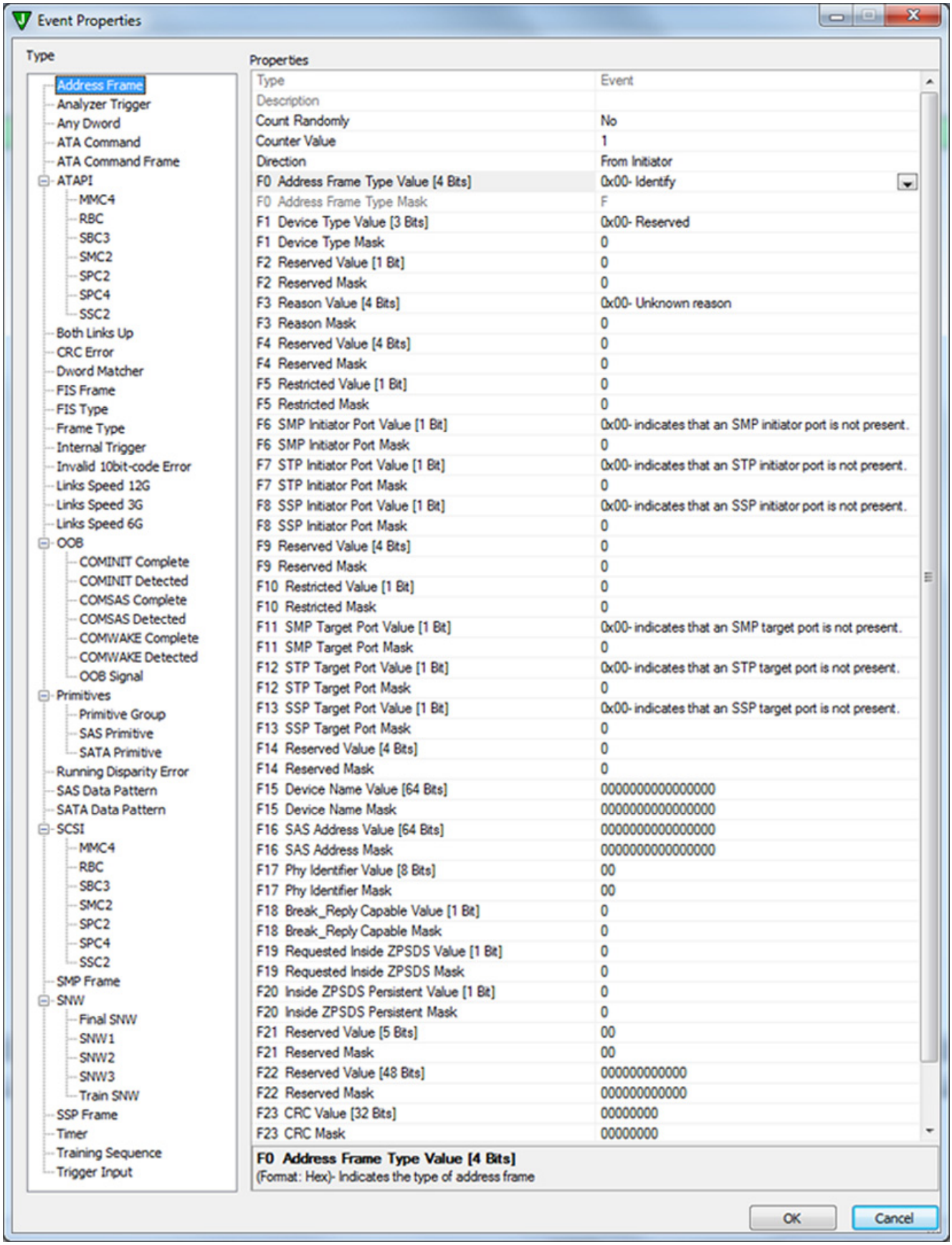


Figure 4.24: Event Properties Dialog

To copy an event or action, right-click on the event or action and select **Copy**.
Right-click **Click here to add another event** or **Click here to add an action** and then select **Paste**.

To copy a sequence or state, right-click on the sequence or state and select **Copy**.
Right-click **Click here to add another sequence** or **Click here to add another state** and then select **Paste**.

You can also cut, delete, and edit a selected sequence, state, event, or action.

While many events are line conditions, an event also can be a condition that occurs within a InFusion device (for example, detection of a trigger signal from another device).
The following table lists supported events. Note that some events are applicable only in the context of creating sequences (those events appear on the drop-down list only if you are creating a sequence). Sequences can have multiple states, and they allow branching between states.

TABLE 4.4: Events

Event	Description
Address Frame	Occurrence of a specified address frame.
Analyzer Trigger	The Analyzer Trigger feature functions when the Analyzer trigger pattern is set to "Pattern/Infusion" and is running a scenario which activates the "Trigger Analyzer" action.
Any DWORD	Occurrence of any DWORD.
ATA Command	Occurrence of a particular ATA command.
ATA Command Frame	Occurrence of a particular ATA command frame.
[+] ATAPI	Occurrence of a particular ATAPI command from the list: MMC4, RBC, SBC2, SMC2, SPC2, SPC3, or SSC2.
Both Links Up	Occurrence of both line ports active (not idling).
CRC Error	Occurrence of a CRC error.
DWORD Matcher	Occurrence of a particular DWORD.
FIS Frame	Occurrence of a particular FIS frame.
FIS Type	Occurrence of a particular SATA FIS type.
Frame Type	Occurrence of a particular frame type.
Internal Trigger	Allows user to send a trigger (notification) to other ports. See “Generating an Internal Trigger” on page 460.
Invalid 10bit-code Error	Occurrence of an invalid 10b code.
Links Speed 3G	Both lines operating at 3 Gbps.
Links Speed 6G	Both lines operating at 6 Gbps.
OOB Signal	Occurrence of OOB signal.
[+] Primitives	Occurrence of Primitive Group, SAS Primitive, or SATA Primitive. Includes NOT property (see Figure 4.25 on page 444).
Running Disparity Error	Occurrence of Running Disparity (RD) error.
SAS Data Pattern	Occurrence of a particular data pattern in a SAS frame.
SATA Data Pattern	Occurrence of a particular data pattern in a SATA frame.
{+} SCSI	Occurrence of a particular SCSI command from the list: MMC4, RBC, SBC2, SMC2, SPC2, SPC3, or SSC2.
SMP Frame	Occurrence of a particular SMP frame.
SNW	Occurrence of Final SNW, SNW1, SNW2, SNW3, Train SNW
SSP Frame	Occurrence of a particular SSP frame.
Timer	Occurrence of a particular elapsed time (time period).
Trigger Input	Occurrence of input trigger.

The following sections provide some additional details about three of the above events.

4.7.1 DWORD Matcher

DWORD Matcher is a DWORD pattern matcher that presents match and mask fields and a K-Code Mask field. K-Codes are control characters that are always used in the first byte of a four-byte

primitive. Of the K-Code masks listed in the menu, D-D-D-D is used for data bytes, and K-D-D-D is used for all primitives.

When you create a DWORD match, keep the following in mind:

- The pattern can be inside or outside of frames (it does not matter if the pattern is inside a frame or not).
- Because the pattern can be inside or outside of frames, there is no offset.
- You can make user-defined primitives. (This is the reason this feature was created.)
- You can use any K/D pattern.

4.7.2 Address Frame

With Infusion, you must enter all values in reverse MSB, LSB order.

For example: a SAS Address in the viewer "5000C50056B8C829" should be entered like this in Infusion: "29C8B85600C50050".

4.7.3 SAS Data Pattern

When you create a SAS data pattern, keep the following in mind:

- The pattern must be defined inside a frame that starts with a SOF or SOAF.
- The pattern must be data only (no K-codes/primitives).
- The pattern must be defined at a specific offset in the frame.
- The pattern and mask must be specified in the same format as specified in the SAS standard:
  0x12345678 (hex)
  where “1” is the first digit on the cable and is the MSB as given in the SAS Standard.

For example, for an SMP Request:

Pattern: 0x40000000

Mask: 0xFF000000

Offset: 0

SOF Type: SOF

4.7.4 SATA Data Pattern

When you create a SATA data pattern, keep the following in mind:

- The pattern must be defined inside a frame that starts with a SATA_SOF.
- The pattern must be data only (no K-codes/primitives).
- The pattern must be defined at a specific offset in the frame.
- The pattern and mask must be specified in the same format as specified in the SATA Standard.

For example, for Register H -> D FIS:

Pattern: 0x00000027

Mask: 0x000000FF

Offset: 0

SOF Type: SATA_SOF

4.7.5 Analyzer Trigger

Trigger the Analyzer when the Scenario event matches. You can see the trigger on the Analyzer Status Bar.

The Analyzer Trigger feature functions when an Analyzer trigger pattern is set to "Pattern/Infusion" and is running a scenario which activates the "Trigger Analyzer" action. A message "Triggered, Post-Trig Capturing" displays on the Software Status bar.

Note: This is different from the external trigger mechanism. You do not need an external trigger cable.

Note: When the analyzer triggers, it triggers on a packet before the actual trigger event occurs. The trace triggers more than 1 µs before the event actually occurs. The trigger is on the Initiator side, instead of the Target side as set in the scenario.

4.7.6 Adding NOT Property to SAS and SATA Primitives

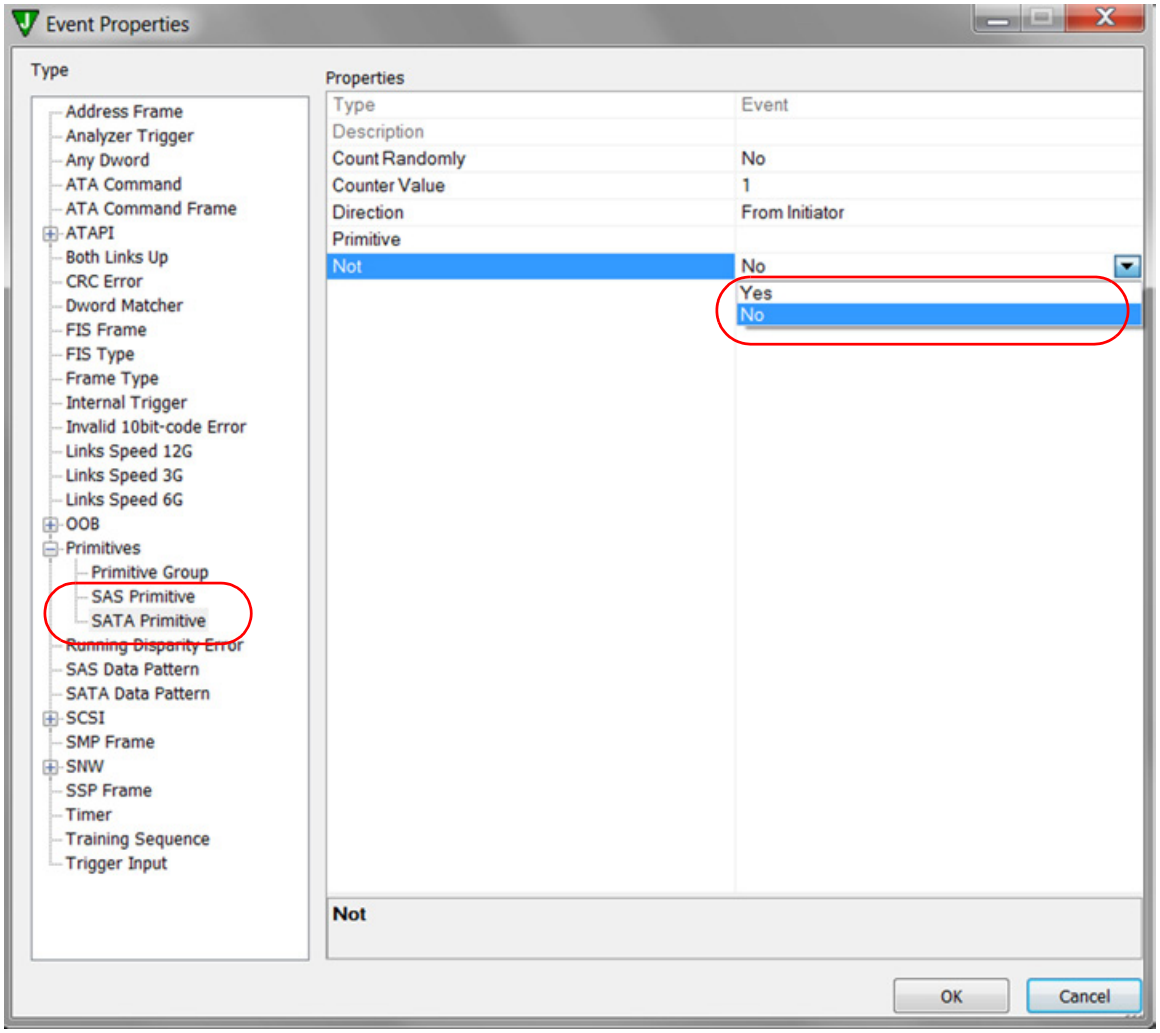


Figure 4.25: Event Properties: Not

Use the Not property to look for a de-asserted Primitive.

4.7.7 Qualifying an Event by Matching a Captured Data DWORD

Any type of frame (see Figure 4.26) can use a previously captured Data DWORD as part of qualifying the event (capturing Data DWORDs is explained in "Capturing a Data DWORD" on page 458).

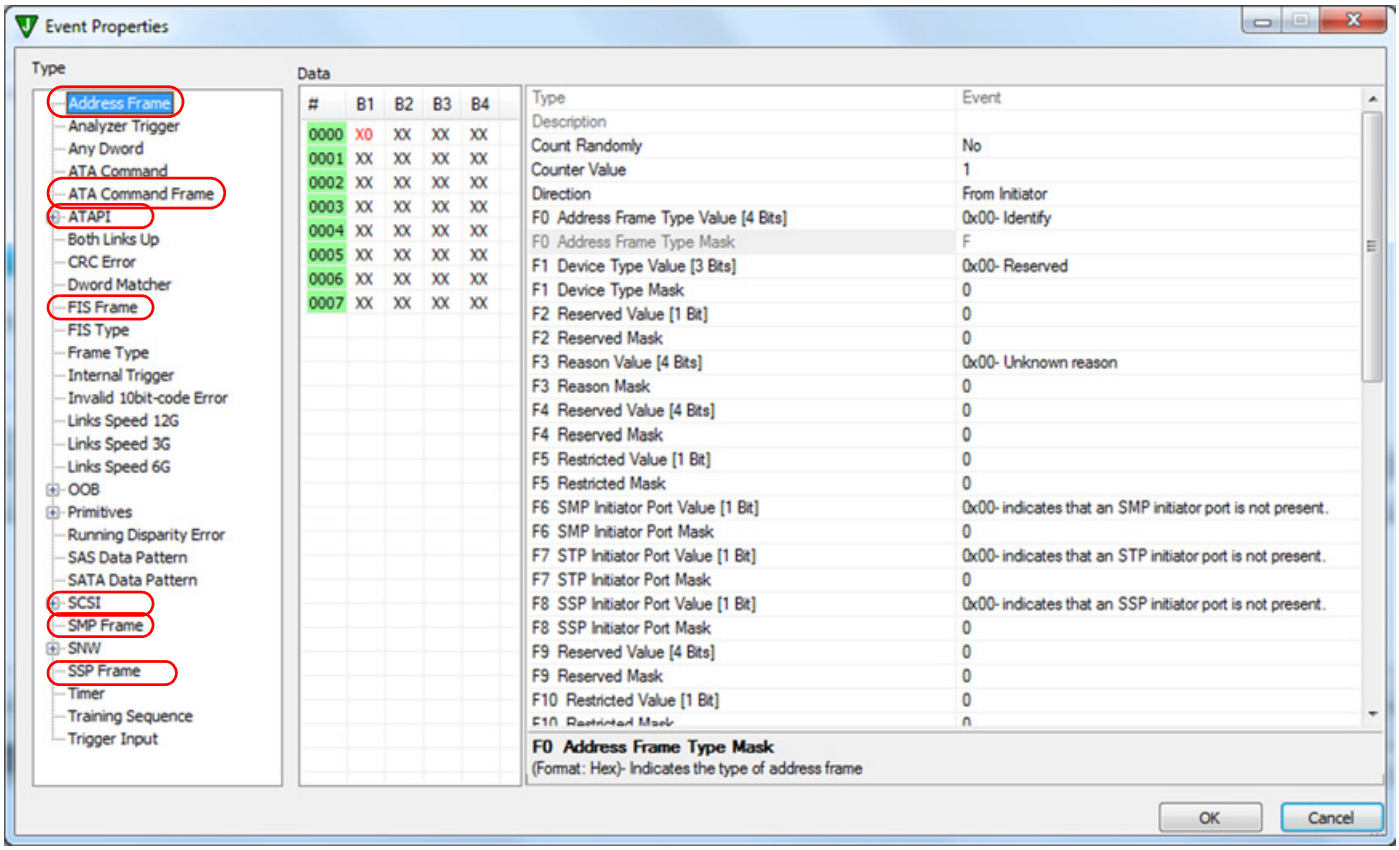


Figure 4.26: Event Properties (Frame Types) that can Qualified by Captured Data DWORDs

Frame Types

- Address
- ATA Command Frame
- ATAPI
- FIS
- SCSI
- SMP
- SSP

Any of the Data DWORDs in the selected Frame can be substituted with a Captured Data DWORD (0-3). See Figure 4.27 on page 446.

Replace with Captured Data

Any of the Data DWORDs in the selected Frame can be substituted with a Captured Data DWORD (0-3). See Figure 4.27.

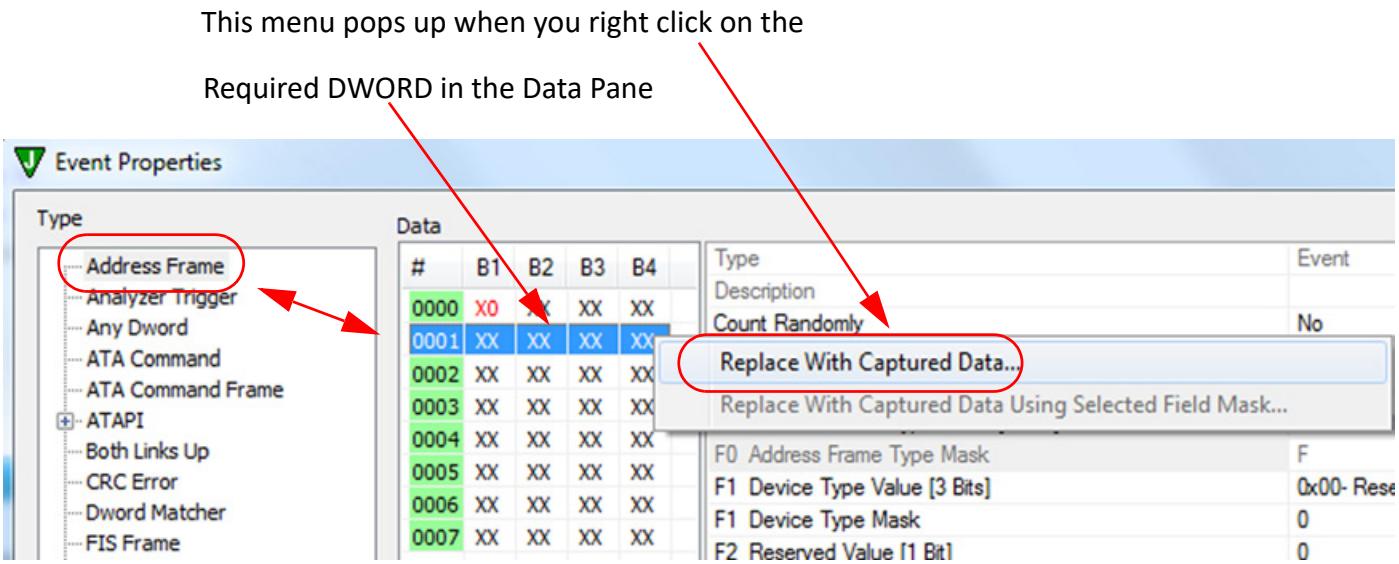


Figure 4.27: Using a Captured DWord to Qualify an Event

In this example we've chosen Captured Data DWORD 3 to be substituted for Data DWORD #001 in the Address Frame. See Figure 4.28.

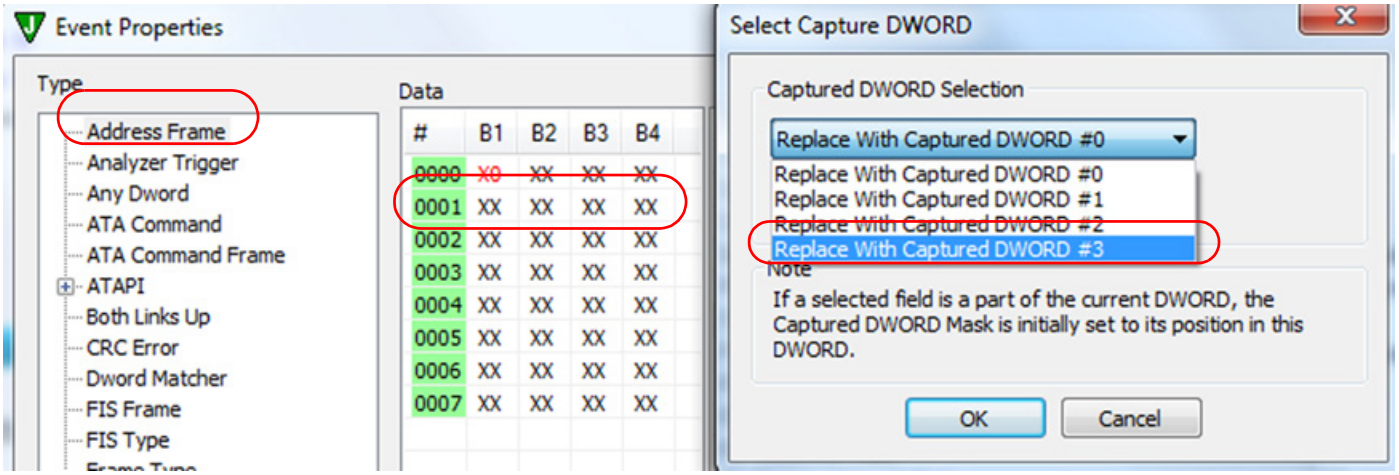


Figure 4.28: Captured Data DWORD #3 Replacing Data Word #0001 in Address Frame (1)

When you click on "**OK**" the Captured Data DWORD #3 is substituted for the Address Frame Data DWORD #0001. See Figure 4.29.

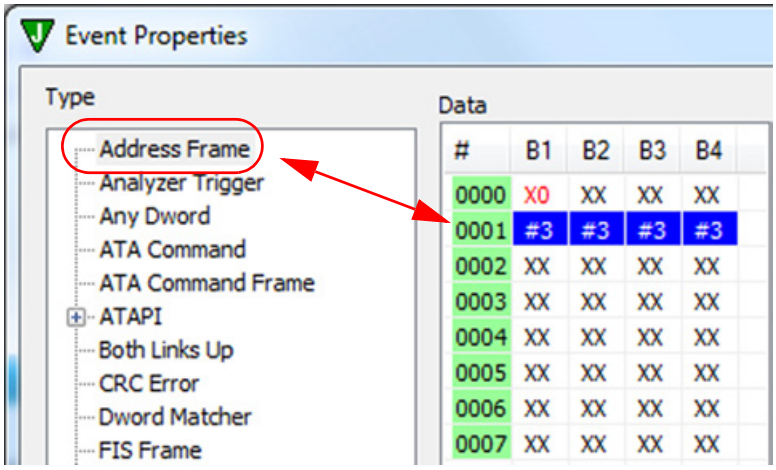


Figure 4.29: Captured Data DWORD #3 Replacing Data DWORD #0001 in Address Frame (2)

When you click on "**OK**" again, the Event has been updated with the Captured Data DWORD. See Figure 4.30.

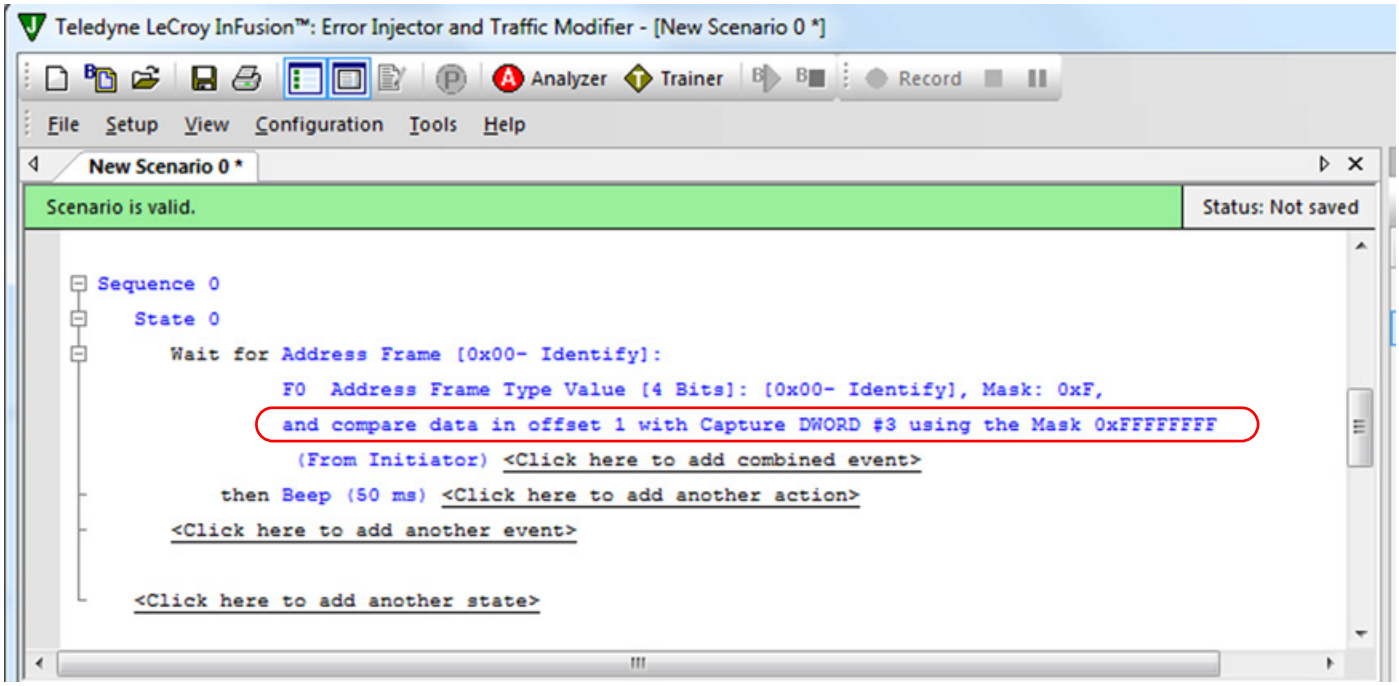


Figure 4.30: Scenario Event has been Updated with Qualifying Captured Data DWORD

Replace With Captured Data Using Selected Field Mask

A second option is available with this feature, “Replace with Captured Data using a selected field mask”. See Figure 4.31 and Figure 4.32 on page 449.

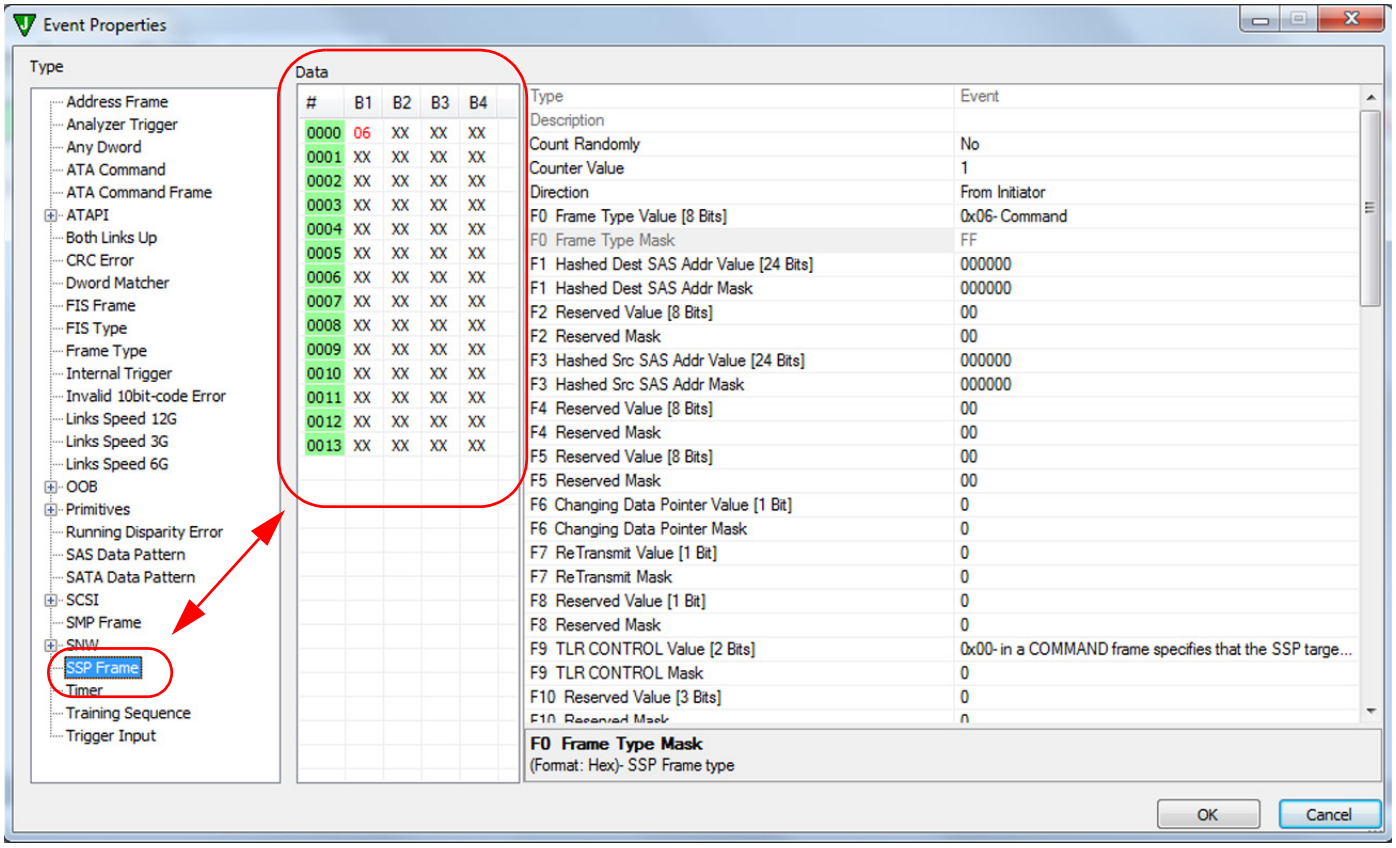


Figure 4.31: Event Properties: SSP Frame

In this case, you selected F3 Hashed Src SAS Addr Value [24 bits]. See Figure 4.32. This will highlight the selected bits in the Data Panel with a gray background.

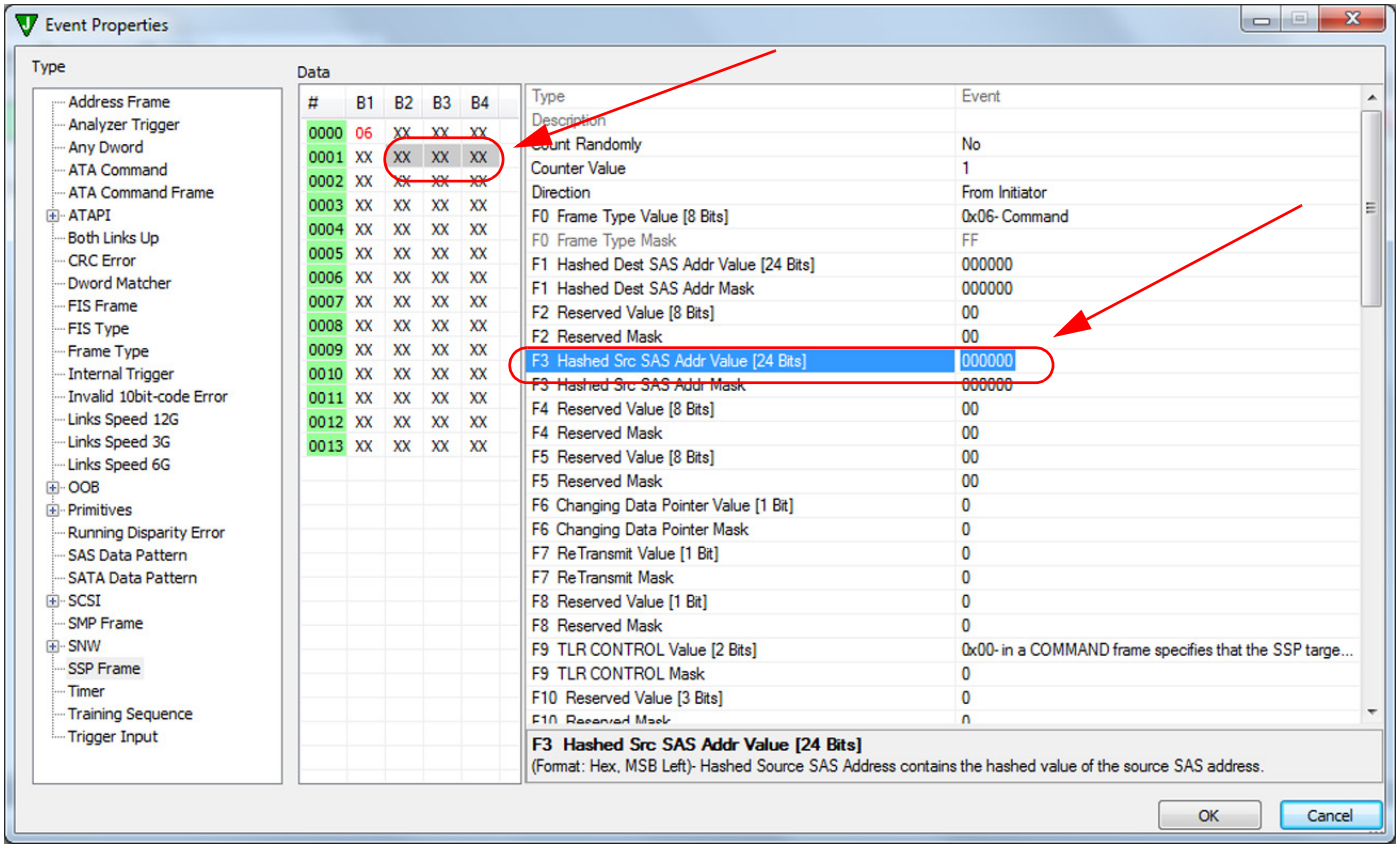


Figure 4.32: F3 Hashed Src SAS Addr Value [24 bits] Selected

Next, right click on the grayed out bits in the Data Panel (Data #0001, they will then be highlighted in blue). The Replace with Captured Data menu will pop up and the “Replace With Captured Data Using Selected Field Mask” section will be active. See Figure 4.33.

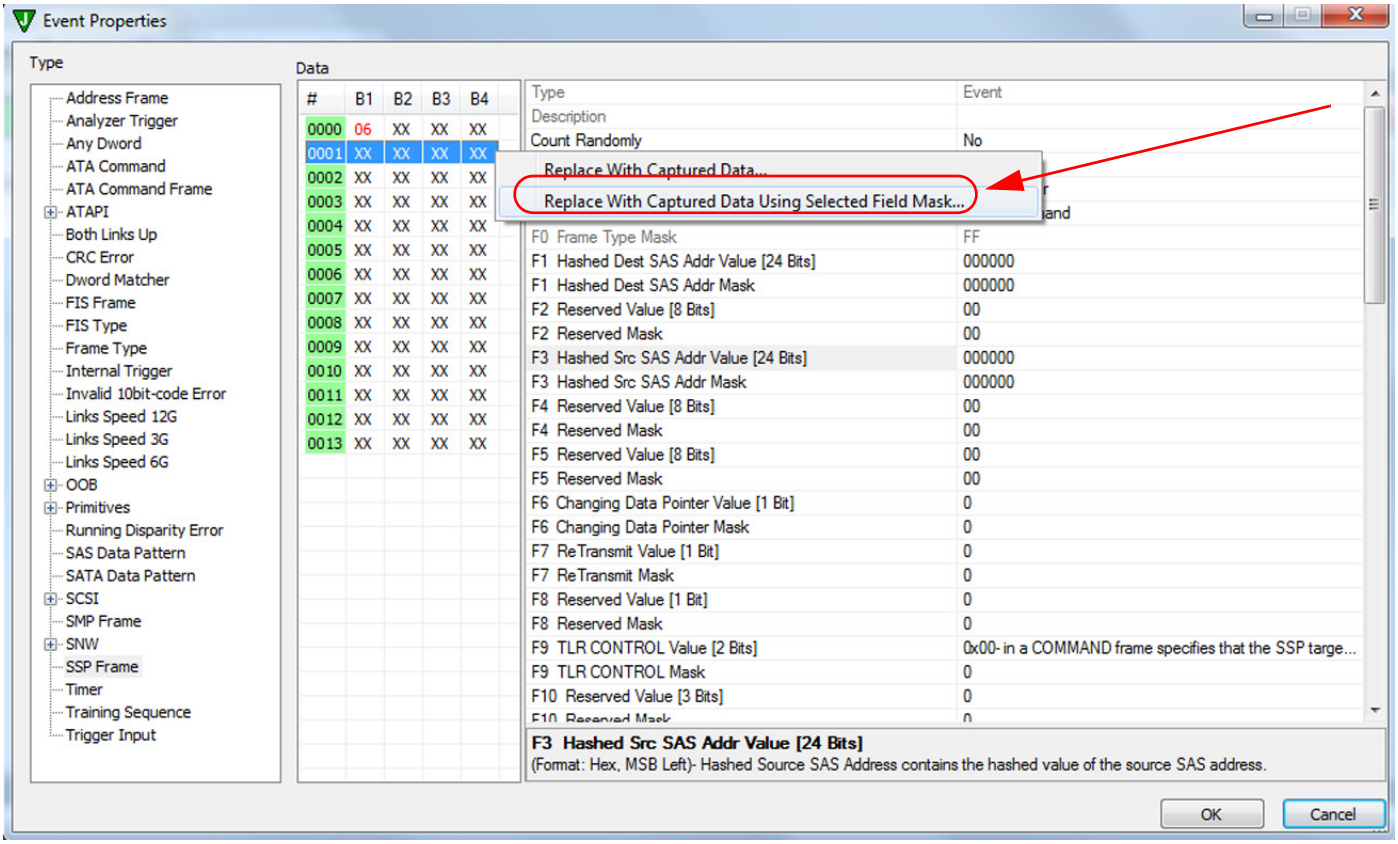


Figure 4.33: Right Click on Selected bits: Menu Pops Up

Select the “Replace With Captured Data Using Selected Field Mask” option and the menu to select the Captured DWORD to use (0-3) and the default DWORD Mask pops up. See Figure 4.34.

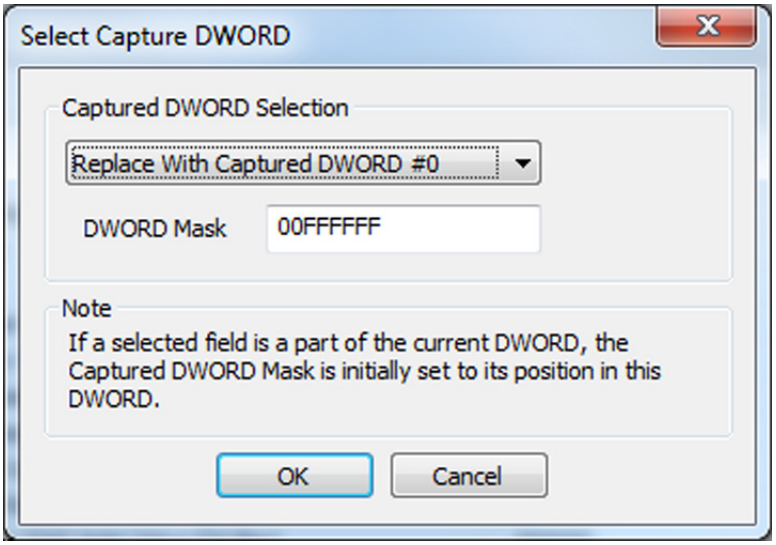


Figure 4.34: Select Capture DWORD and Default Mask

If you want to change the default Captured DWORD (from #0 to #3) and default DWORD Mask so that only selected bits will be enabled in the qualifying event, update the default values as shown in Figure 4.35.

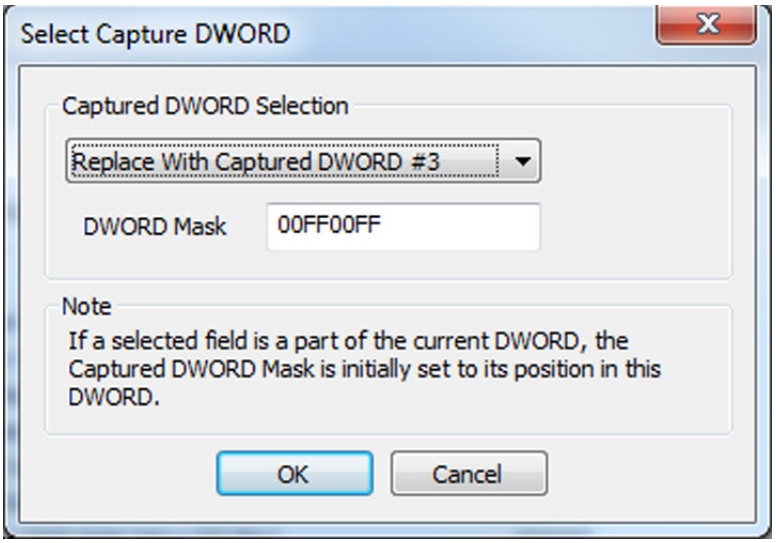


Figure 4.35: Update Default Mask Setting

Click on "**OK**" and you'll see the Captured DWORD and DWORD Mask change in the Data Panel. See Figure 4.36.

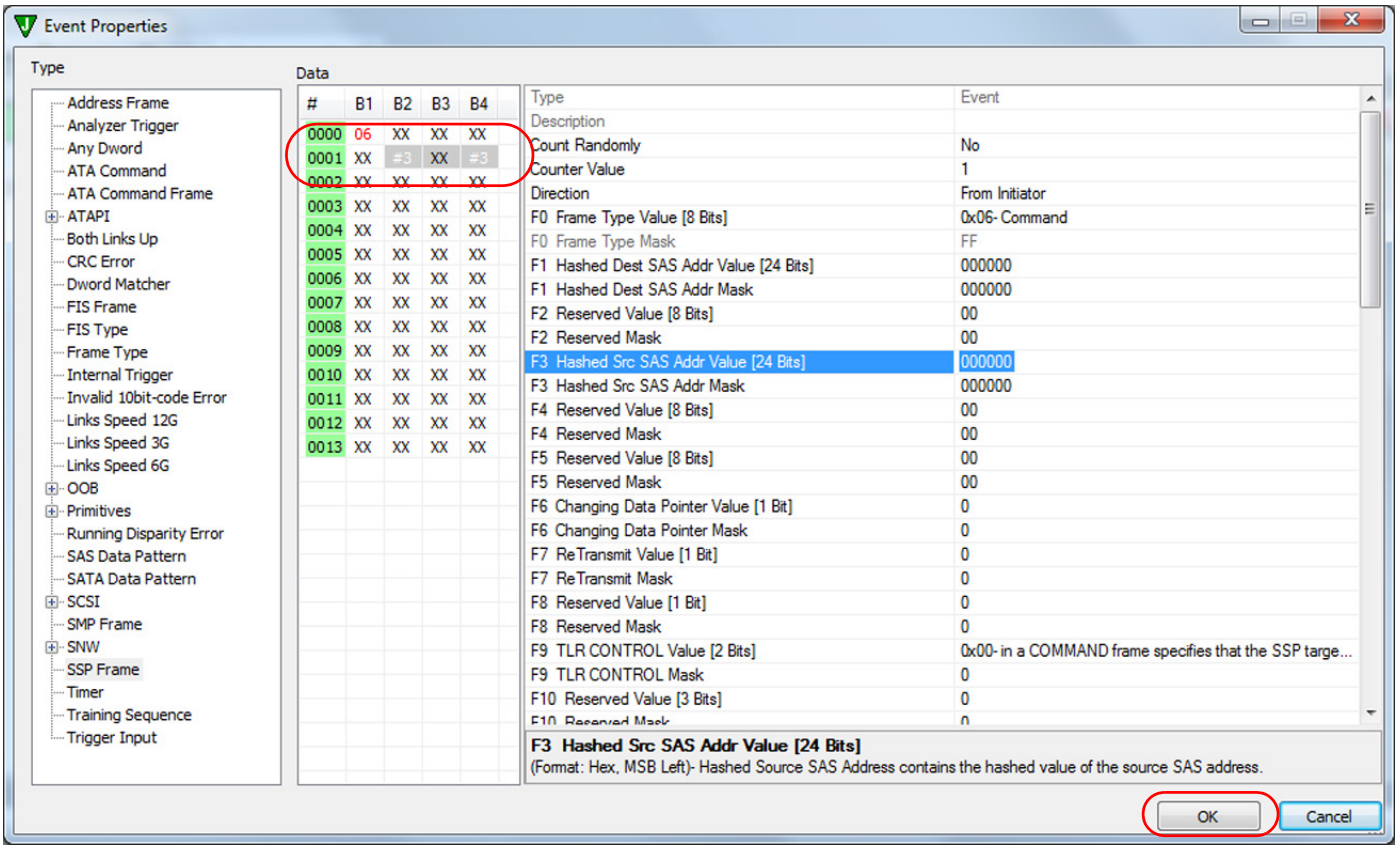


Figure 4.36: Updated Captured DWORD and DWORD Mask

Click on "**OK**" again and the Scenario will be updated. See Figure 4.37 on page 453 for the updated Scenario Event.

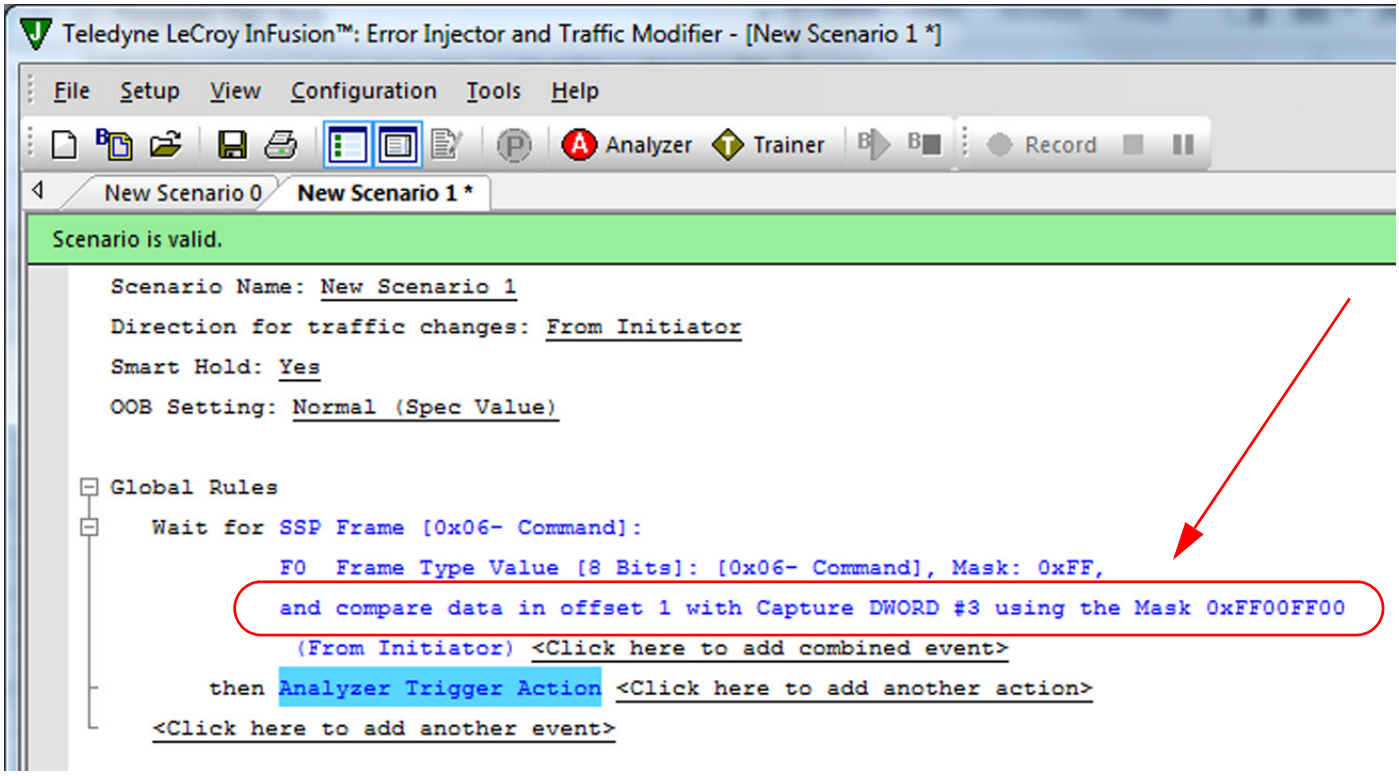


Figure 4.37: Scenario Qualified with Data DWORD #3 and DWORD Mask

Note: When using the DWORD Matcher for SATA, please remember that the SATA byte ordering is reversed.

4.8 Scenario Actions

After you enter the set of events for a test state, the menu-driven interface prompts you for the corresponding action or set of actions. If you define multiple actions, the actions occur simultaneously.

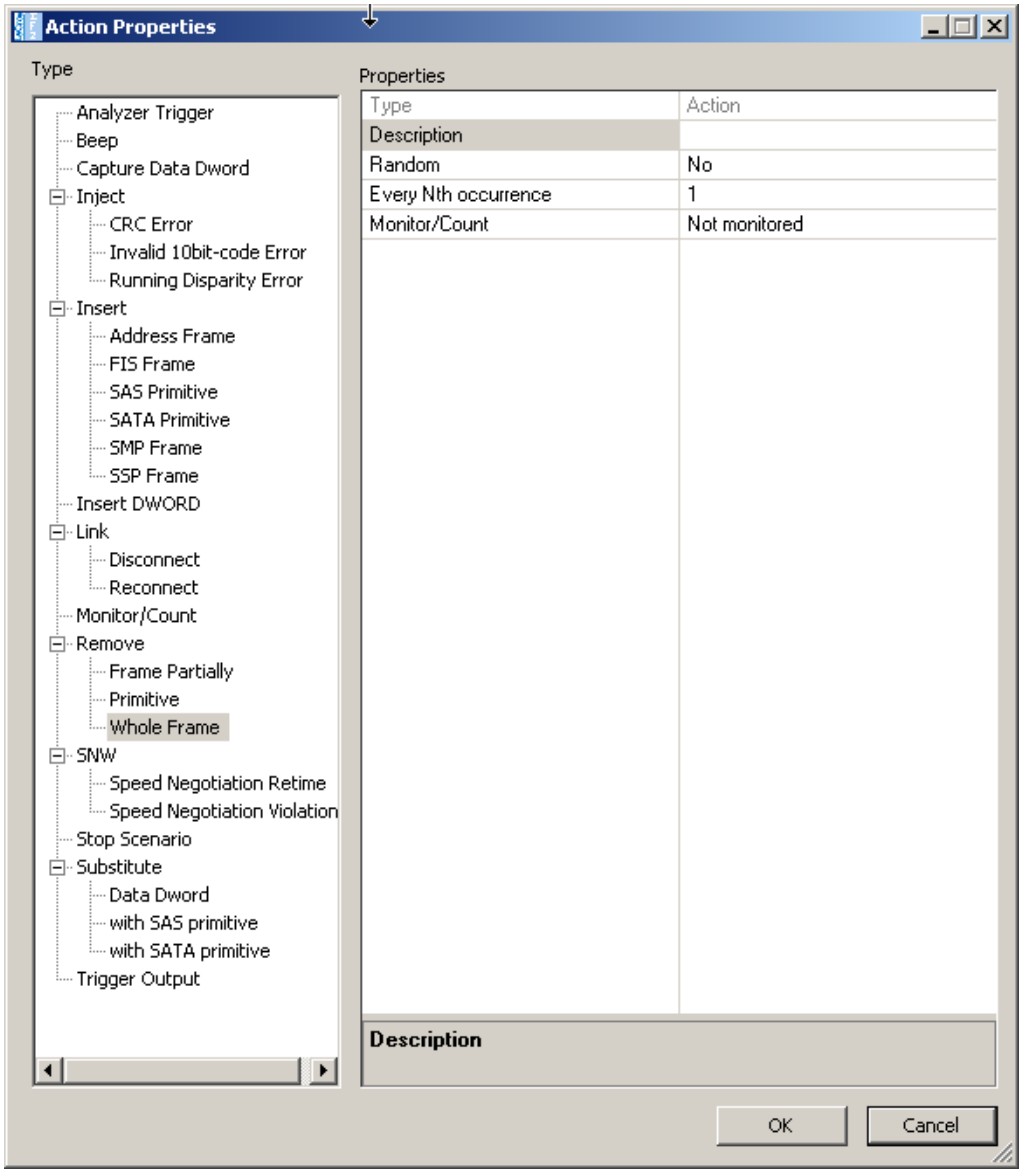


Figure 4.38: Action Properties Dialog

The following table lists supported actions. Note that some of these actions only apply to creating sequences.

TABLE 4.5: Test State Actions

Action		Description
Analyzer Trigger		The Jammer sends a trigger to the Analyzer.
Beep		Emits audible sound of duration selectable via drop-down list.
Branch to	Existing State[1]	Go to a state in this sequence that is already defined.[1]
	New State[1]	Go to a state in this sequence that is not yet defined (you need to define it).[1]
Capture Data DWORD		Captures a data DWORD into one of four registers.
Inject	CRC Error	Injects a CRC error into the line.
	Invalid 10bit-code Error	Injects invalid 10b code into the line.
	Running Disparity Error	Injects a Running Disparity (RD) error into traffic.
Insert	Address Frame FIS Frame SAS Primitive SMP Frame SSP Frame	Inserts a frame or primitive.
Insert DWORD		Inserts DWORD.
Internal Trigger		Allows user to send a trigger (notification) to other ports. See “Generating an Internal Trigger” on page 460.
Link	Disconnect	Puts both InFusion SAS ports at electrical idle immediately. This action is only in effect while the scenario is running, and the Jammer will reconnect the line when the scenario is stopped.
	Reconnect	Starts traffic pass-through immediately. This action restarts traffic after a previous disconnect command. Once traffic is passing through, the initiator and target resume OOB signaling.
Marker		The main purpose of this feature is enabling the user to mark specific parts of the captured traffic for better tracking. See “Generating a Jammer Marker” on page 462.
Monitor/Count		Opens a window to count the number of events that occur during a session. A session is a time interval during which a scenario runs.
Remove	Frame Partially Primitive Whole Frame	Removes the targeted event from the traffic.

Action		Description
Restart	All Sequences[1]	Restart all sequences in the scenario.[1]
	Current Sequence[1]	Restart the sequence that contains this action definition. [1]
SNW	Speed Negotiation Retime	Set RCDT, SNTT, ALT/TLT, TX speed, TRAIN/ TRAIN_DONE pattern, and/or PHY Capability.
	Speed Negotiation Violation	Set Violation Type.
Stop Scenario		Stops all scenario activity.
Substitute	Data DWORD	Substitutes a data DWORD in the traffic.
	with SAS Primitive	Substitutes a SAS primitive in the traffic.
	with SATA Primitive	Substitutes a SATA primitive in the traffic.
Trigger Output		Sends a signal out the trigger port to the device downstream. The trigger point in the Analyzer that caused the analyzer trigger action will not be the selected event, it will be the selected event with some offset.

[1] Only shown in Action Properties dialog box when creating a sequence.

4.8.1 Available Resources

You can specify Events, Combined Events and Actions and additional Events. The application automatically checks for the maximum number of terms (Events/Actions). When you exceed the limit, an error is flagged, prompting you to jump to the place that caused the error.

The list of available resources is given below:

- External Trigger X 1
- Analyzer Trigger X 1
- Training Detector x 4
- Primitive Detector (each has its own Embedded counter in M12x) X 8
- Pattern Detector (each has its own Embedded counter in M12x) X 8 (a total of 12 DWORD detectors are shared between all pattern detectors)
- Frame Type Detector X 24
- Counter X 12
- Timer X 8
- OOB X 1
- ComWakeDetected X 1
- ComWakeCompleted X 1
- ComInitDetected X 1
- ComInitCompleted X 1
- ComSasDetected X 1
- ComSasCompleted X 1
- Snw1 X 1
- Snw2 X 1

- Snw3 X 1
- SnwFinal X 1
- SnwTrain X 1
- DisparityError X 1
- 10B Error X 1
- CrcError X 1
- Both Links Up X 1
- Link Speed 3G X 1
- Link Speed 6G X 1
- Primitive Substitute X 12
- Insert Frame1 (Up To 1024 Dword) X 1
- Insert Dword8 (Up To 16 Dword) X 8
- SNW Manipulation X 16
- Global Action Register X 8
- State per sequencer X 256
- Action Register per state X 8

Usage of Action Register:

- Each Counter in Global Rules = 2
- Each Counter in State = 3
- Each Timer in Global Rules = 2
- Each Timer in State = 3
- Other Actions = 1

4.8.2 Using Counters in Events and Actions

Many of the events and actions supported by InFusion also support counters that can control functions.

Within events, counters determine how many times the event must occur before the associated actions are triggered. Event counters typically have two properties:

- **Count Randomly**: Can be set to “Yes” or “No” (default value is “No”).
  If set to “Yes”, the event repeats a random number of times (between 1 and the value set in the property **Max Random Count**, which replaces the property **Counter Value** when “Yes” is selected), before the action is triggered.
- **Counter Value**: Number of repeats required when **Count Randomly** is set to “No”. The default value is 1.

Within actions, counters determine how many times the system calls the action before it acts. Action counters typically have two properties:

- **Random**: Can be set to “Yes” or “No” (default value is “No”).
  If set to “Yes”, the action triggers a number of occurrences before the action takes place. That number ranges randomly between 1 and the value set in the property **At least every Nth occurrence**, which replaces the property **Every Nth occurrence** when “Yes” is selected.
- **Every Nth occurrence**: Number of times the system calls the action before it acts.

Note that there is some overlap in the way these counters can be used. For example, in the simple case of a single event leading to a single action, it makes no difference whether you specify the event to require five repeats before triggering the action, or the action to require five occurrences before it acts.

However, in the case of combined events and/or actions, the separate counters provide flexibility in designing test cases. For example, consider the case where Event_1 OR Event_2 leads to Action. If Event_1 has a counter of 5, then the Action triggers either when Event_1 has repeated five times or when Event_2 happens the first time, whichever occurs first.

But if the event counters are set to 1 and the Action counter is set to 5, then the Action happens after five occurrences of EITHER Event_1 or Event_2.

4.8.3 Capturing a Data DWORD

InFusion provides the ability to capture individual data DWORDs and provides four different registers to store captured DWORDs (DWORD #0, #1, #2 and #3).

To capture a data dword, select **Capture Data DWORD** from the Action Properties screen, as shown below. Select the register to be used to store the DWORD from the drop-down menu under the **Capture Register** property.

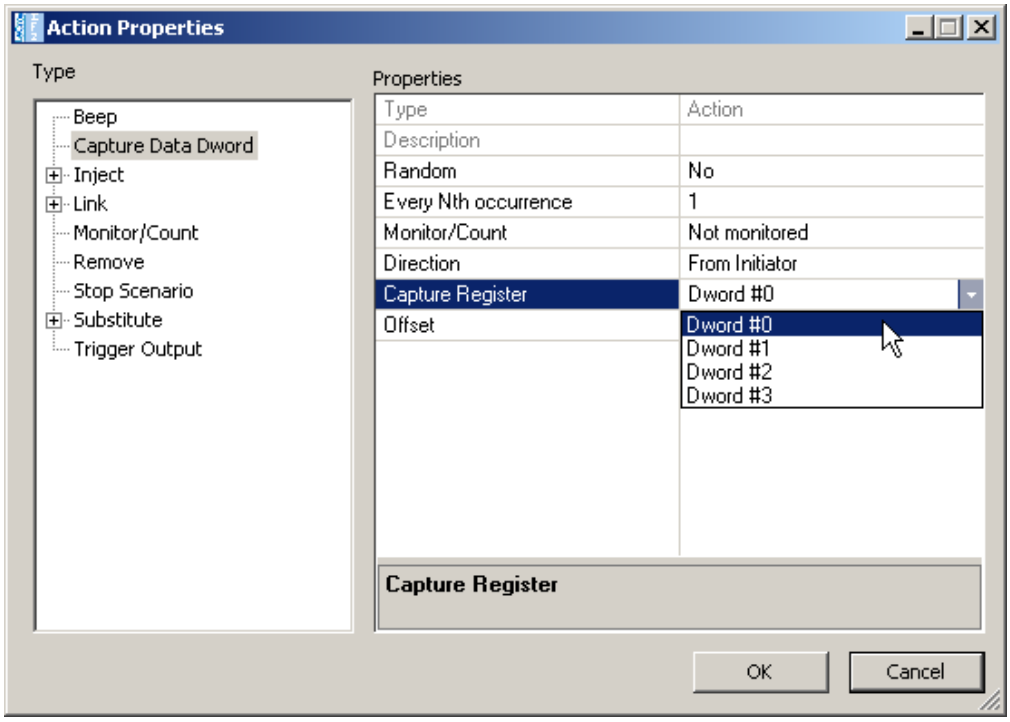


Figure 4.39: Capture Data DWORD Action

4.8.4 Using Captured Data DWORDs

Captured data DWORDs can be used in creating events for data that match the captured DWORD(s), or in creating actions to substitute the captured DWORD(s) into the data stream.

DWORD Used in Event Properties: SAS Data Pattern

To create an event using the captured DWORD, in the Event Properties menu, select **SAS Data Pattern** (or **SATA Data Pattern**), and then select any of the 12 DWORDs (**DWORD 0 Type** through **DWORD 11 Type**). The drop-down menu (see Figure 4.40 on page 459) provides the choice of a custom DWORD or any of the four captured DWORDs. If you select a captured DWORD, the **Value** field beneath this selection is hidden (the **Value** field is only used for specifying custom DWORDs). Note that choice of a mask and an offset are still available when using captured DWORDs.

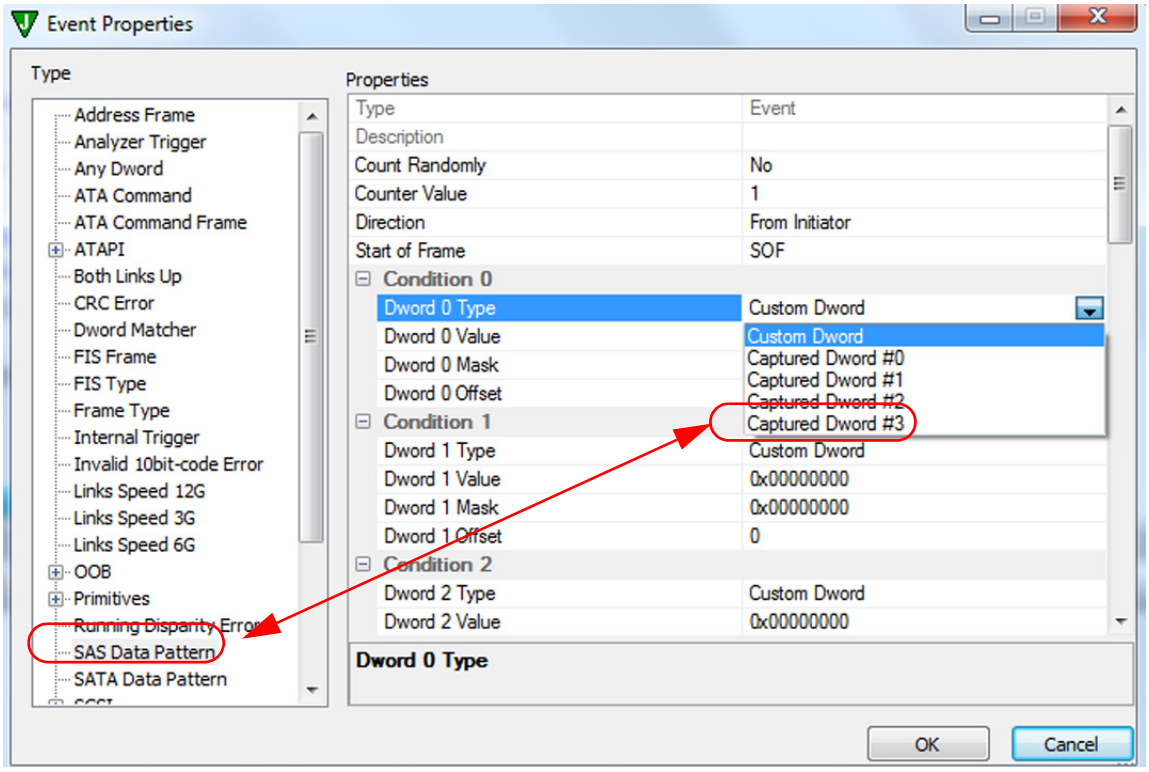


Figure 4.40: Using a Captured DWORD in a SAS Data Pattern

Captured data DWORDs may also be used in the **Substitute Data DWORD** test state action. From the Action Properties screen, choose **Substitute Data DWORD** and then select the **Substitute for** property. A drop-down menu is provided (see below) that allows the choice of a custom DWORD or any of the four captured DWORD registers.

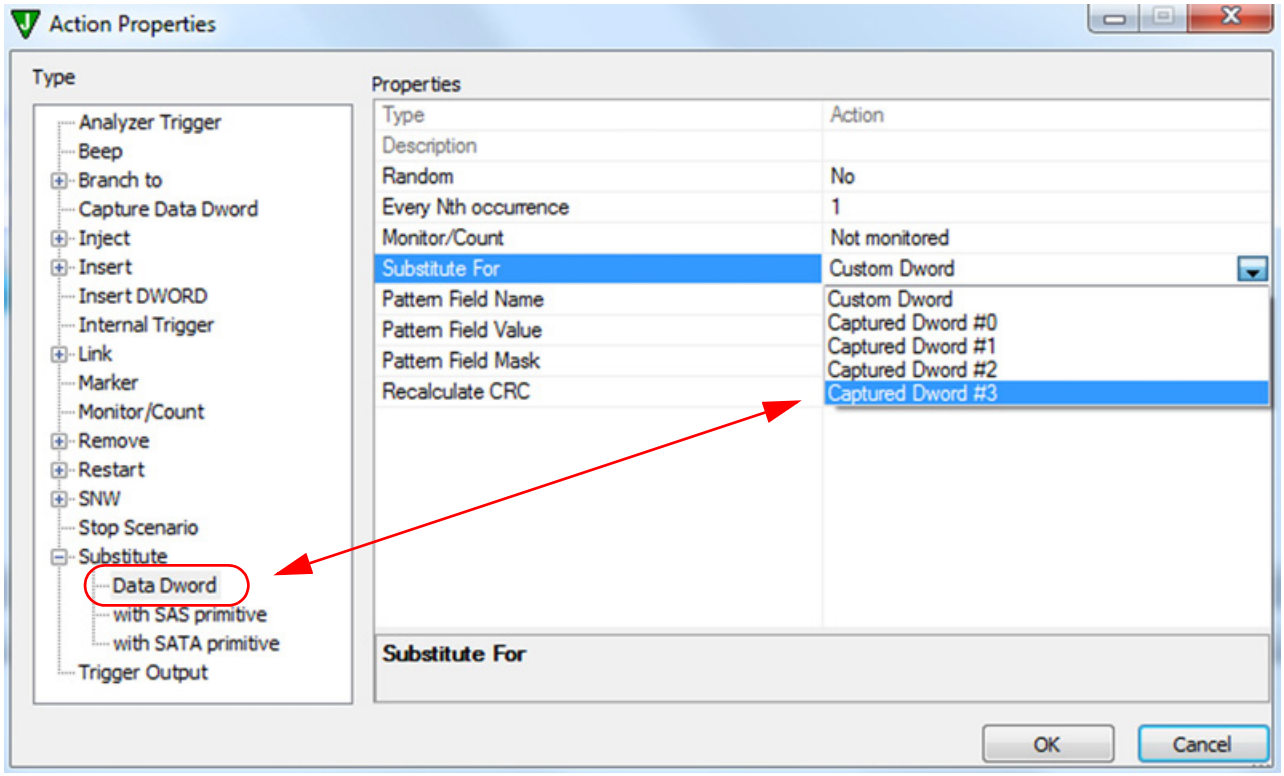


Figure 4.41: Using a Captured Data DWORD in Substitute DWORD Test Action

Captured Data DWORD Used to Qualify an Event

A captured Data DWORD can also be used to qualify a Scenario Event (see "Qualifying an Event by Matching a Captured Data DWORD" on page 445).

4.8.5 Generating an Internal Trigger

This feature has the following capabilities:

1. 'Internal Trigger' action to notify all other paths has been added, there are 4 internal trigger signals (0 to 3).
   a. Internal Trigger Action 0
   b. Internal Trigger Action 1
   c. Internal Trigger Action 2
   d. Internal Trigger Action 3
2. 'Internal Trigger' event to wait for others' notifications has been added
   a. Internal Trigger Event 0, which corresponds to Internal Trigger Action 0

b. Internal Trigger Event 1, which corresponds to Internal Trigger Action 1

c. Internal Trigger Event 2, which corresponds to Internal Trigger Action 2

d. Internal Trigger Event 3, which corresponds to Internal Trigger Action 3

The above feature can cover a few requirements like, Stop All ports, bi-directional jamming and emulate wide port jammer. See Figure 4.42 on page 461.

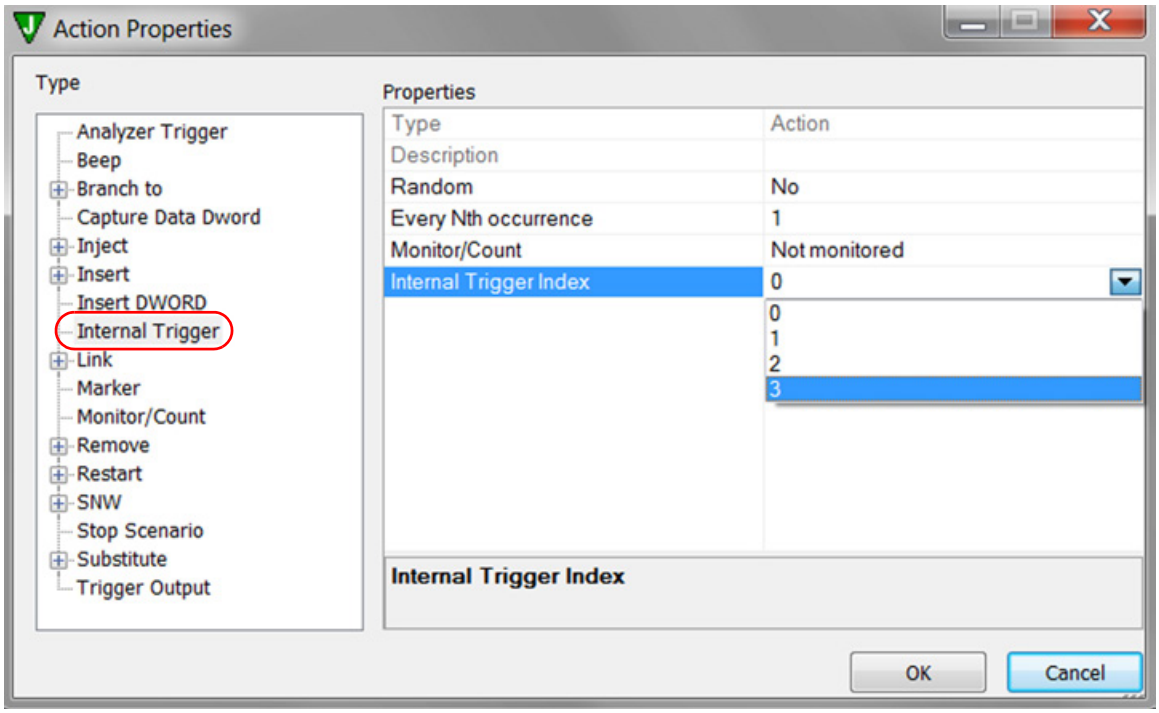


Figure 4.42: Internal Trigger Index

Example of Using Internal Triggers to Stop All Scenarios

The example scenario can be generated to use any of the internal triggers to stop all scenarios. When this scenario (New Scenario 1) is run on all ports, as soon as any port finds the 500th occurrence of SSP Command Frame, the scenario will stop on that Port and send an internal trigger signal to all other ports. This internal trigger will then cause the scenarios running on any other port to stop.

The commands used in the script are shown below:

< Global Rules - waits for Internal Trigger Event then stop scenario >

< Sequence - waits for SSP Command Frame then Internal Trigger Action and stop scenario >

The commands to generate this scenario are shown below (see Figure 4.43**).**

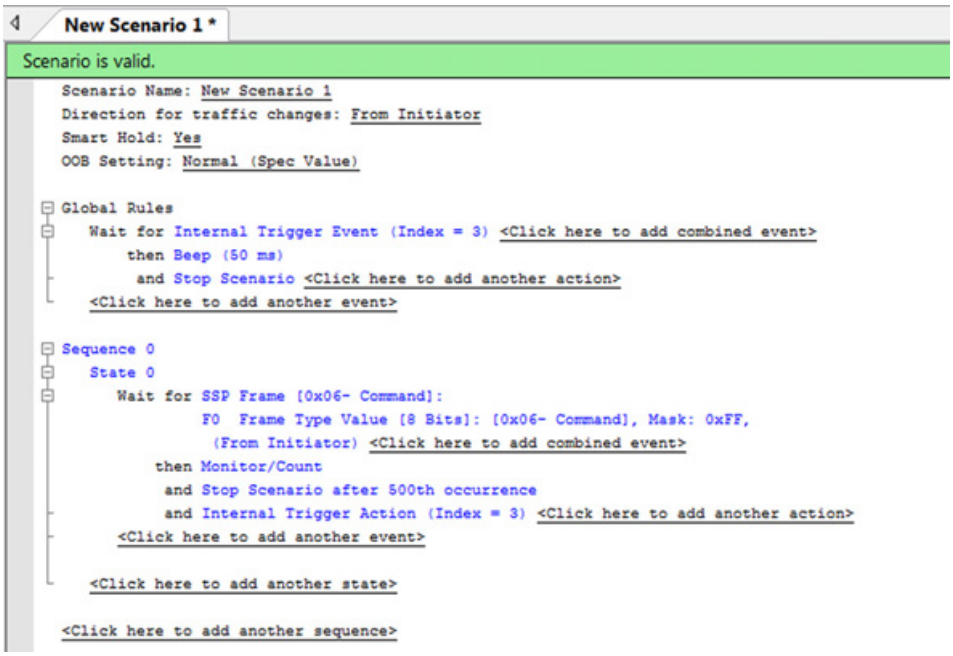


Figure 4.43: Scenario to Turn Off Scenarios with Internal Triggers

4.8.6 Generating a Jammer Marker

The main purpose of this feature to enable the user to mark specific parts of the captured traffic for easier tracking of data.

In Sequence 0 shown below, the Event is Waiting for a CRC Error. After that event occurs an Action will be taken, (see Figure 4.44 on page 462).

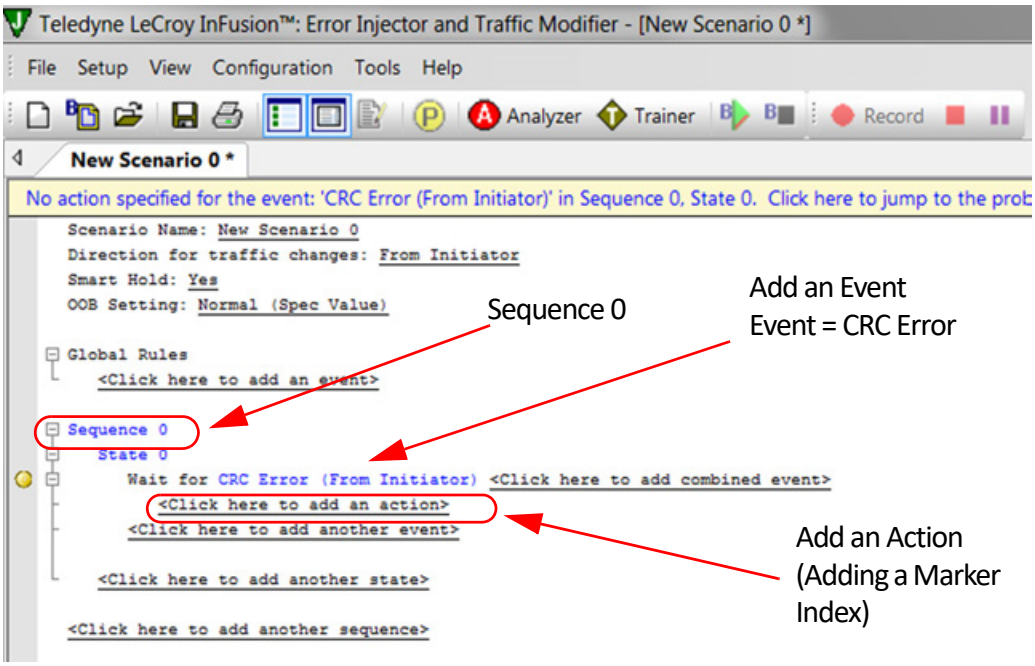


Figure 4.44: Sequence 0: Event = CRC Error, then Add an Action

In this case, Click on <Click here to add an action> and the Action Properties Menu will pop up. To add a Jammer Marker, click on Marker and the Properties section of the Menu will show Marker Index. There are seven Jammer Markers available to the user. See Figure 4.45 on page 463.

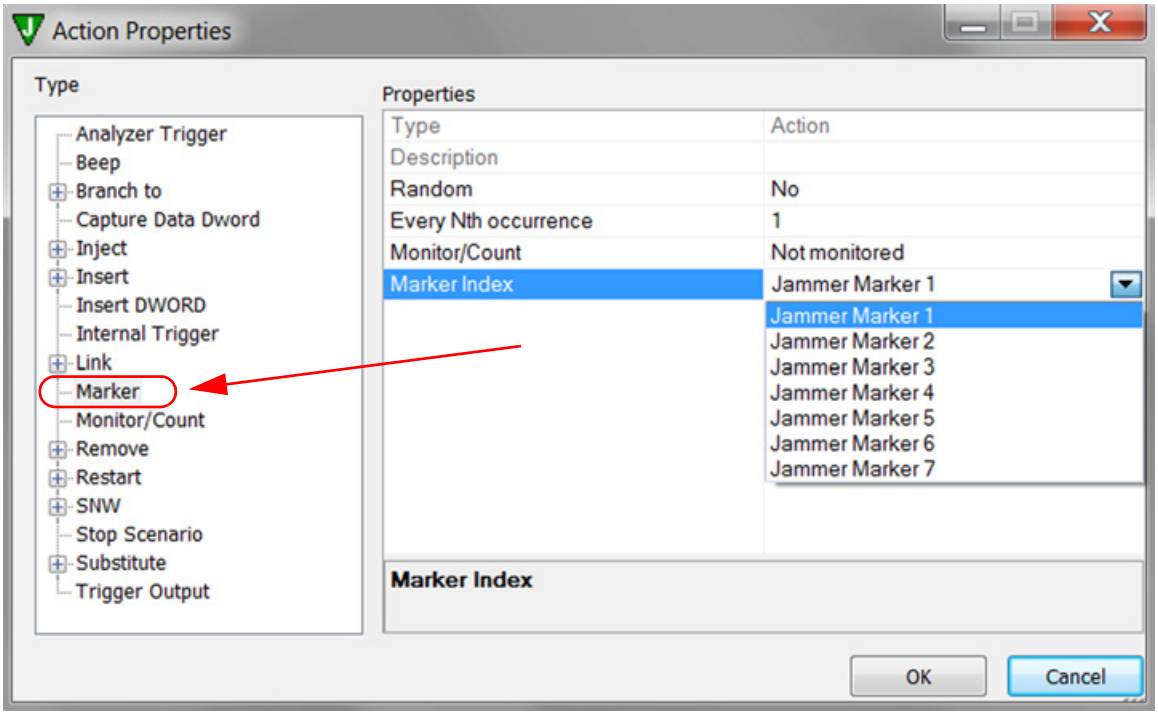


Figure 4.45: Jammer Marker Index 1 – 7

When the Jammer implements this action, the result is adding a marker to the captured trace in the analyzer data stream. See Figure 4.46 on page 464. The added marker (Bookmark = Jammer Marker 7) will be shown as a bookmark in the trace and you can see the list of markers in the bookmark dialog.

Note: As a function of recorded speed and port configuration, the InFusion marker might be off by a tolerance of up to 200 nsec.

Note: The limitation for adding markers to a trace is 10,000.

Note: Jammer Markers do not propagate across cascaded analyzers (see “Expandability” on page 24).

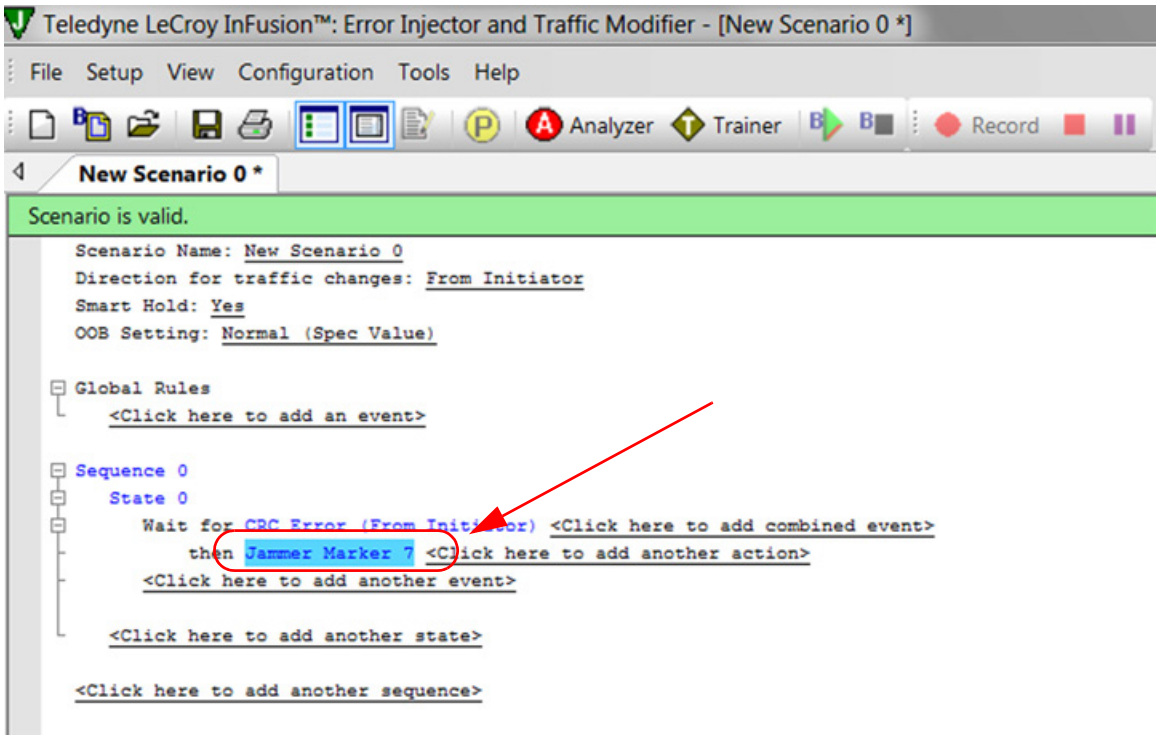


Figure 4.46: Sequence 0: Event = Wait for CRC Error, Action = Add Jammer Marker 7

4.8.7 Summary of Scenario Creation

The suggested process of creating and executing a scenario is as follows:

1. Create a scenario in the main library.
2. Copy the scenario from main library to a device library by drag-and-drop with a mouse. (Each device library is associated with a specific InFusion device.)
3. Download all scenarios in the device library to a InFusion device.
4. Select the scenario in the device library that you want to run on the device.
5. To run the scenario, click the **Start Scenario** button from the Device Library toolbar. The device starts to monitor/modify traffic.

Note: Step 1 is described in detail for each example in following sections. Steps 2 to 5 are described in detail at the end of this chapter.

4.9 Creating Global Rules

This section gives examples for creating the Global Rules area of a scenario. Recall that the Global Rules area defines a single test state. The Global Rules do not have the capacity for multiple states, so that area of a scenario cannot change state.

In terms of InFusion testing, a state defines test “behavior.” In this context, behavior is “waiting” for an event and responding with an action or set of actions that happen simultaneously.

Keep in mind that a test state you implement with the Global Rules operates in parallel with the active test state of each sequence in the scenario.

In effect, InFusion lets you do up to three line tests at the same time. You can do one test with the Global Rules and a separate test with each sequence you create. You can have up to two sequences in a scenario.

The following table summarizes the Global Rules examples that follow.

TABLE 4.6: Global Rules Examples

Example	Description
1	Creating a single event and action (removes a primitive).
2	Creating a single event and action (replaces a primitive).
3	Creating a combined event (a logical OR association of multiple events) and an action.
4	Creating multiple triggers and actions.
5	Creating multiple actions on a single event.
6	Using timers.

4.9.1 Example 1: Creating a Single Event and Action that Removes a Primitive

In this example, the Global Rules area of the scenario waits for each RRDY Normal primitive from the initiator and removes it.

1. Click the **New Scenario** button in the main library or one of the device libraries.
2. In the Scenario Properties dialog, enter the scenario name, description, and direction of traffic change (see Figure 4.17 on page 434).
3. In the Global Rules area, click the prompt to **add an event**.

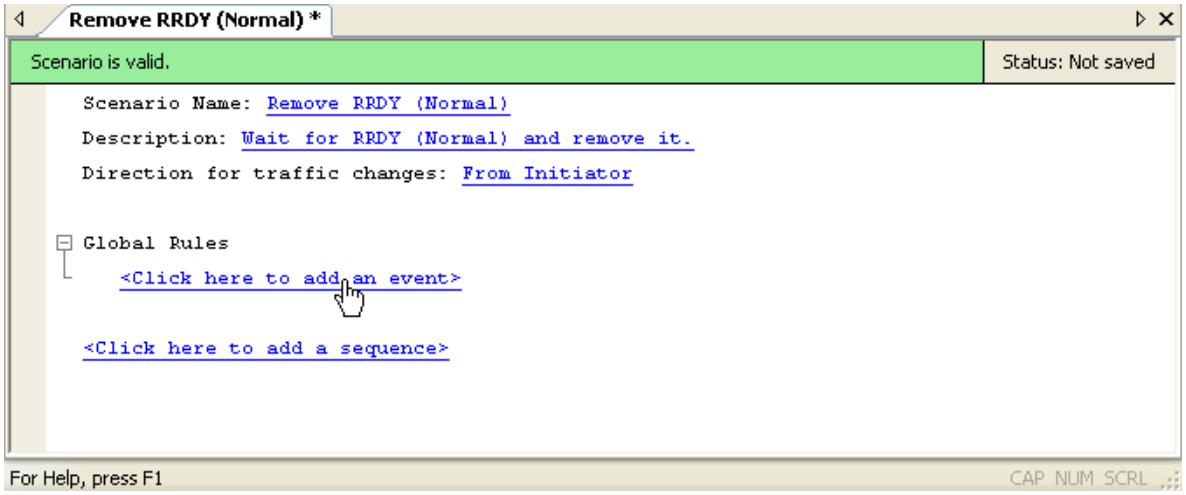


Figure 4.47: Example 1: Adding an Event

The Event Properties dialog box appears (see Figure 4.24 on page 439).

4. In the Type column of the Event Properties dialog, choose **Primitive > SAS Primitive**.

5. In the Type column in the middle of the dialog box, click **Description** if you want to add a description of the event.
6. Click **Direction** to choose the direction of traffic to monitor for the selected event (the default is **From Initiator**, which is what you want for this example).
7. Still in the middle column of the Event Properties dialog box, click **Primitive** to display a drop-down menu that lets you choose the type of primitive for which you want to wait in this scenario. In this example, it is **RRDY (Normal)**.

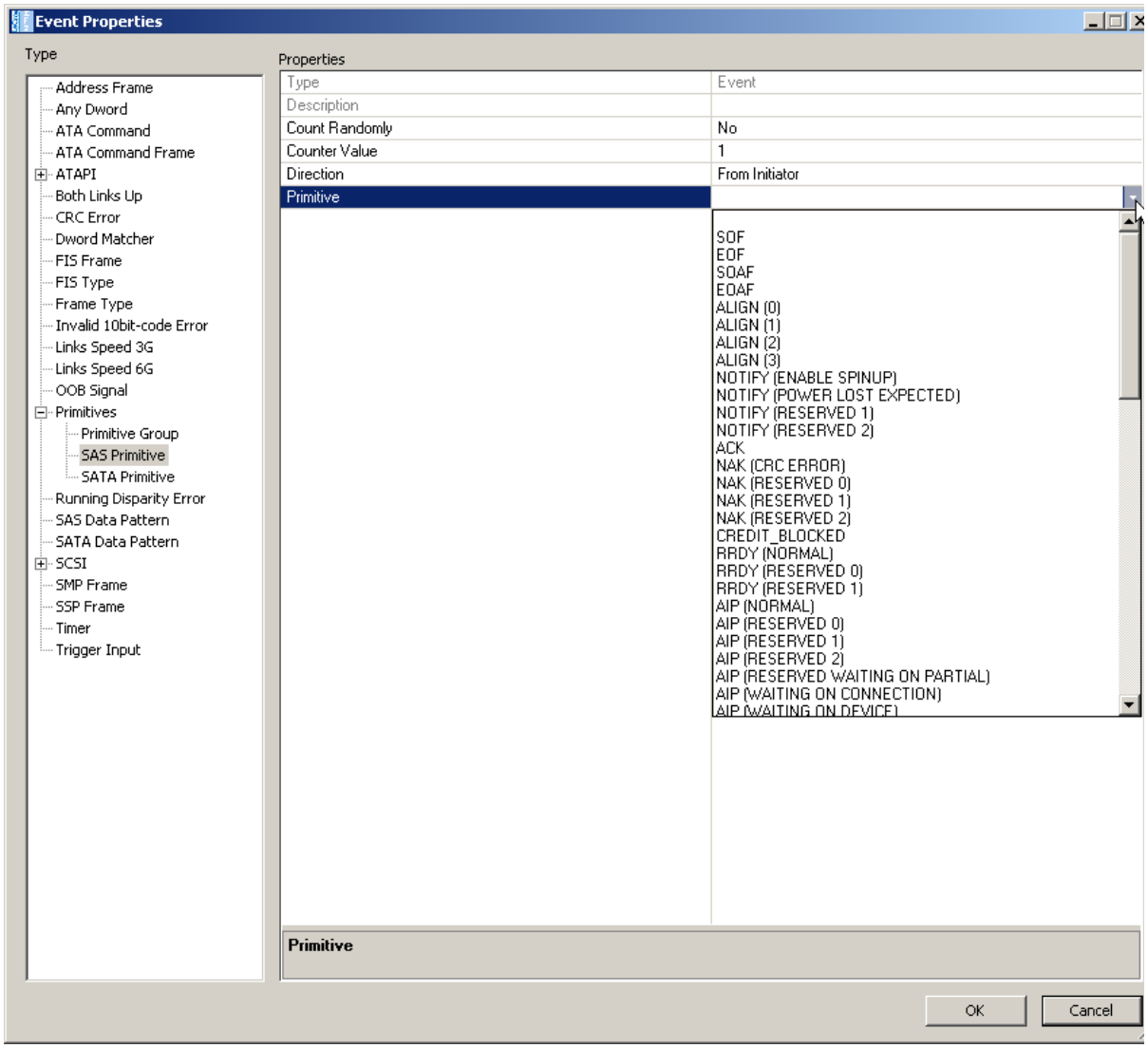


Figure 4.48: Example 1: Event Drop-Down List

8. Click **OK** to close the Event Properties dialog box.
9. In the Global Rules area, click the prompt to **add an action** (see Figure 4.49 on page 467).

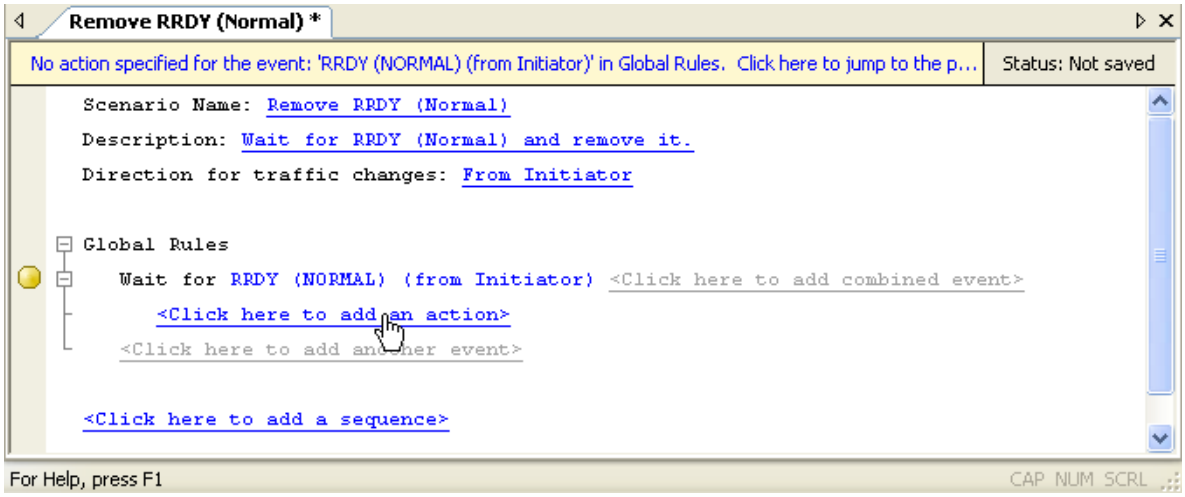


Figure 4.49: Example 1: Entering an Action

The Action Properties dialog box appears (see Figure 4.38 on page 454).

10. In the Type column on the left, choose the action that you want to occur when an RRDY is detected. In this example, it is the **Remove Primitive** action. Select Random **Yes** or **No**, **N** for Every Nth occurrence, and Monitor/Count as **Monitored** or **Not Monitored**.
11. Click **OK** to close the Action Properties dialog box.

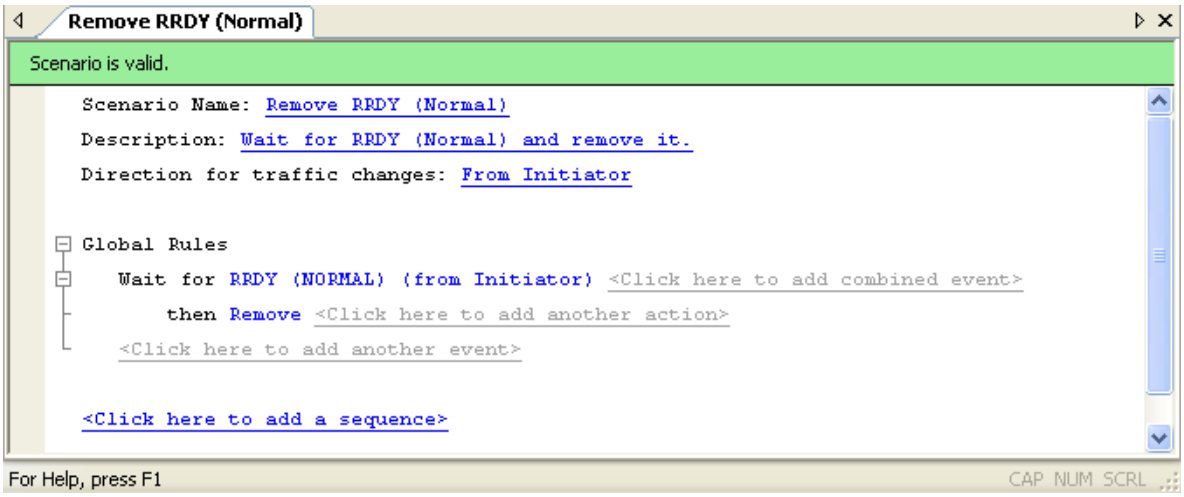


Figure 4.50: Example1: Complete Scenario

12. In the File menu, select **Save Scenario** to save the scenario.

4.9.2 Example 2: Wait for a Primitive and Replace It with an Error

In this example, the Global Rules portion of the scenario waits for each RRDY Normal primitive and replaces it with an ERROR primitive.

1. Click the **New Scenario** button in the main library or one of the device libraries. In the Scenario Properties dialog, enter the scenario name, description, and direction of traffic change.
2. In the Global Rules area, click the prompt to **add an event** to display the Event Properties dialog box.
3. As you did in the previous example, choose **RRDY (Normal)** as the type of primitive to monitor.
4. In the Global Rules area, click the prompt to **add an action** to display the Action Properties dialog box.
5. In the Type column on the left, choose **Substitute > with SAS Primitive** as the action that you want when an RRDY (Normal) occurs.
6. In the middle column of the dialog box, click **Description** if you want to add a description of the action.
7. Still in the middle column of the Event Properties dialog box, click **Primitive** to display a drop-down menu that lets you choose the type of primitive for which to substitute for RRDY (Normal) (see Figure 4.48 on page 466). Choose **ERROR**.
8. Click **OK** to close the Action Properties dialog box.
9. In the File menu, select **Save Scenario** to save the scenario.

   In this example, you set the substitution action to happen at every occurrence of an RRDY (Normal) (as shown in the figure, the action is set for every occurrence). However, you can set an action to happen at other multiples of event occurrence (for example 5, 25, 1000 and so on). You also can set the action to happen at random, within a specified number of event occurrences.

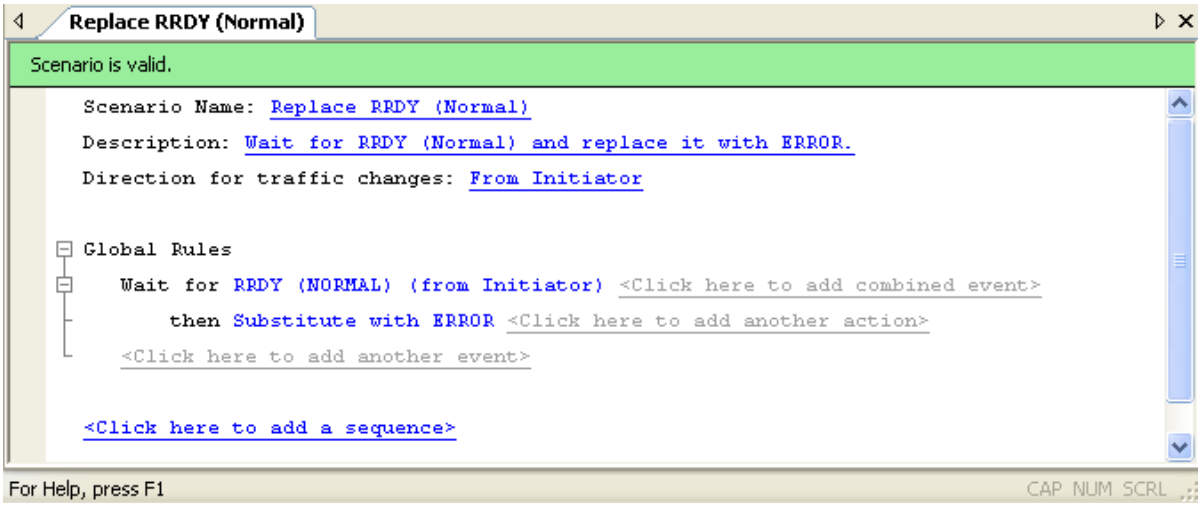


Figure 4.51: Example 2: Complete Scenario

4.9.3 Example 3: Creating OR Conditions

In this example, the Global Rules area of the scenario waits for either of two types of RRDY primitive and replaces them with an ERROR primitive.

This example includes a combined event (a logical OR association of two or more single events). Here, the combined event consists of any occurrence of RRDY (Normal) or RRDY (Reserved 0).

1. Click the **New Scenario** button in the main library or one of the device libraries. In the Scenario Properties dialog, enter the scenario name, description, and direction of traffic change.
2. In the Global Rules area, click the prompt to **add an event** to display the Event Properties dialog box.
3. As you did in example 1 of this chapter, choose **RRDY (Normal)** as the first primitive that you want to monitor.
4. Click the **add combined event** prompt to add a second event.

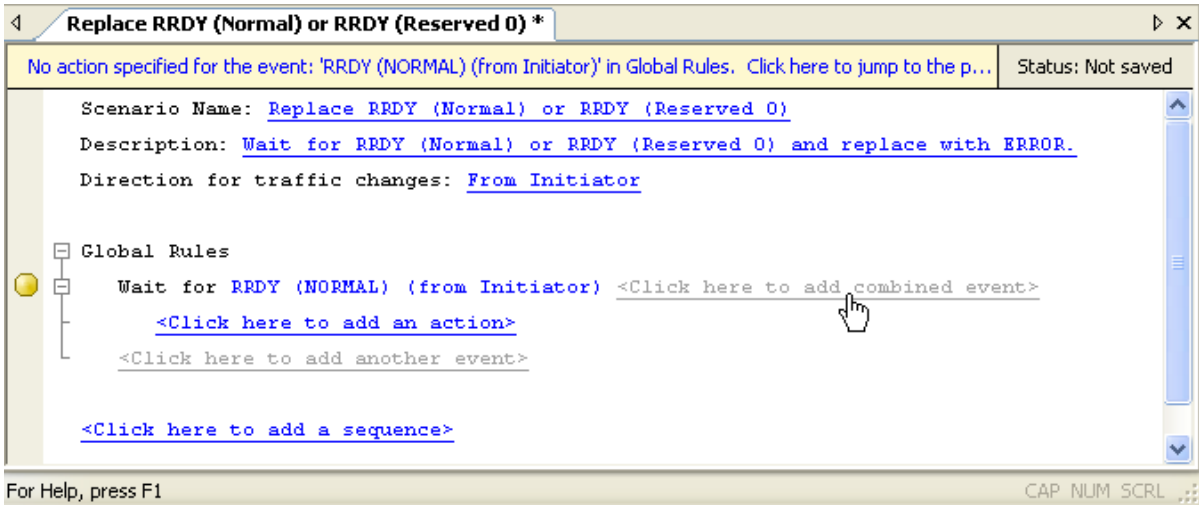


Figure 4.52: Example 3: Entering the Second Event

The Event Properties dialog box displays.

5. Choose **RRDY (Reserved 0)** as the second primitive that you want to monitor.
6. Click **OK** to close the Event Properties dialog box.
7. In the Global Rules area, click the prompt to **add an action** to display the Action Properties dialog box.
8. In the Type list on the left, choose **Substitute SAS Primitive** as the action that you want when either RRDY Reserved 0 or RRDY Normal occurs.
9. Click **OK** to close the Action Properties dialog box.

10. In the File menu, select **Save Scenario** to save the scenario.

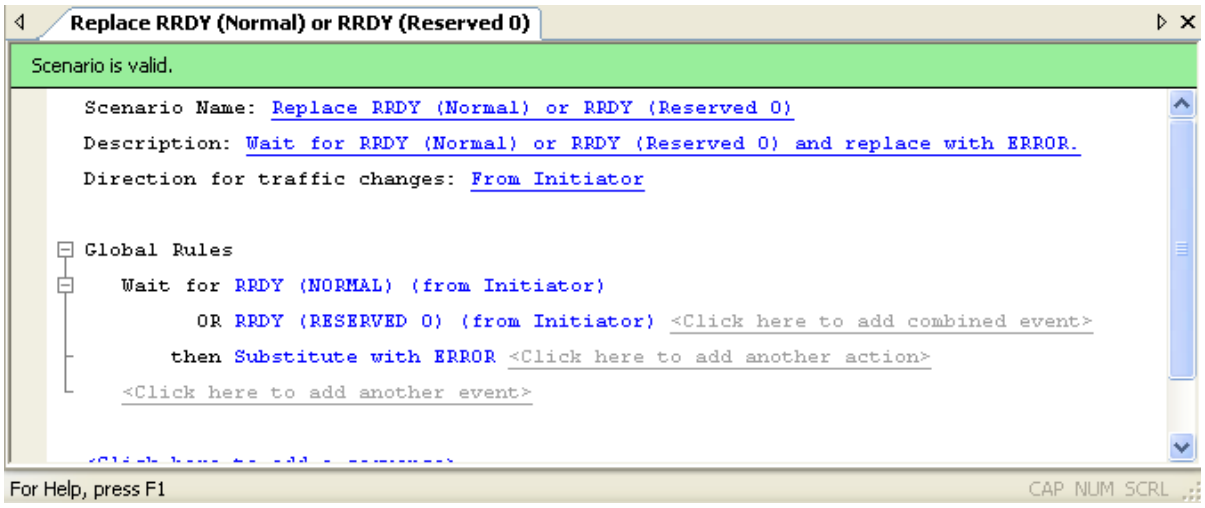


Figure 4.53: Example 3: Complete Scenario

4.9.4 Example 4: Multiple Triggers and Actions

In this example, the Global Rules area of the scenario waits for two events, each of which triggers a different action.

1. Click the **New Scenario** button in the main library or one of the device libraries. In the Scenario Properties dialog, enter the scenario name, description, and direction of traffic change.
2. As you did in example 2, choose **RRDY (Normal)** as the first event to monitor, and substitute with the SAS primitive **ERROR** as action.
3. In the Global Rules area, click the prompt to **add another event** (keep in mind this is not a combined event).

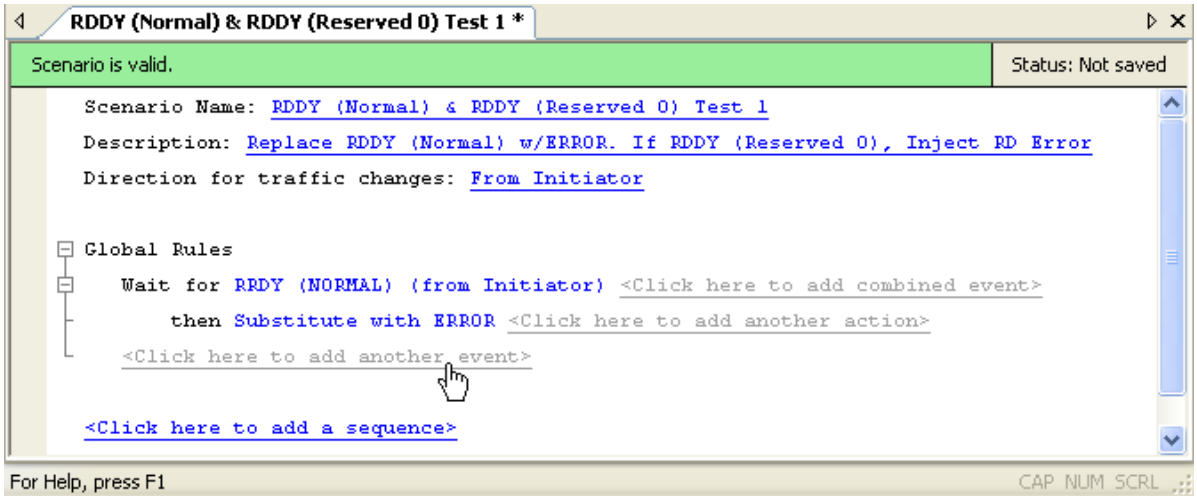


Figure 4.54: Example 4: Entering Second Event

The Event Properties dialog box displays.

In this example, there is a parallel set of events, but each event is associated with its own action. In a combined event, there is a parallel set of events sharing the same action.

4. Using the drop-down menu, choose **RRDY (Reserved 0)** as the second event to monitor.
5. Click **OK** to close the Event Properties dialog box.
6. In the Global Rules area, click the prompt to **add an action** to be triggered by the RRDY (Reserved 0).

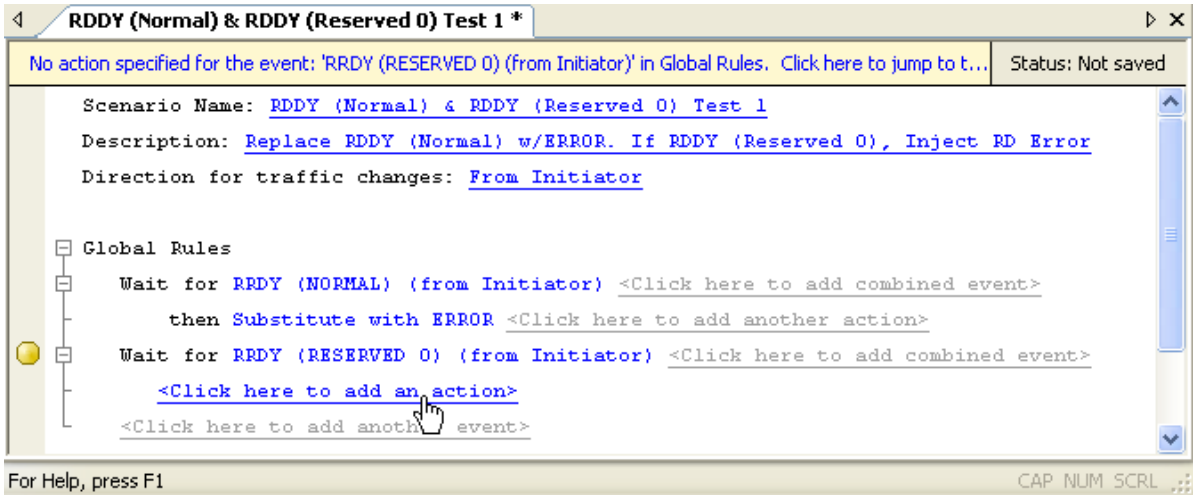


Figure 4.55: Example 4: Entering Second Action

The Action Properties dialog box appears.

7. Use it to choose **Inject RD Error** as the action triggered by RRDY (Reserved 0).
8. Click **OK** to close the Action Properties dialog box.

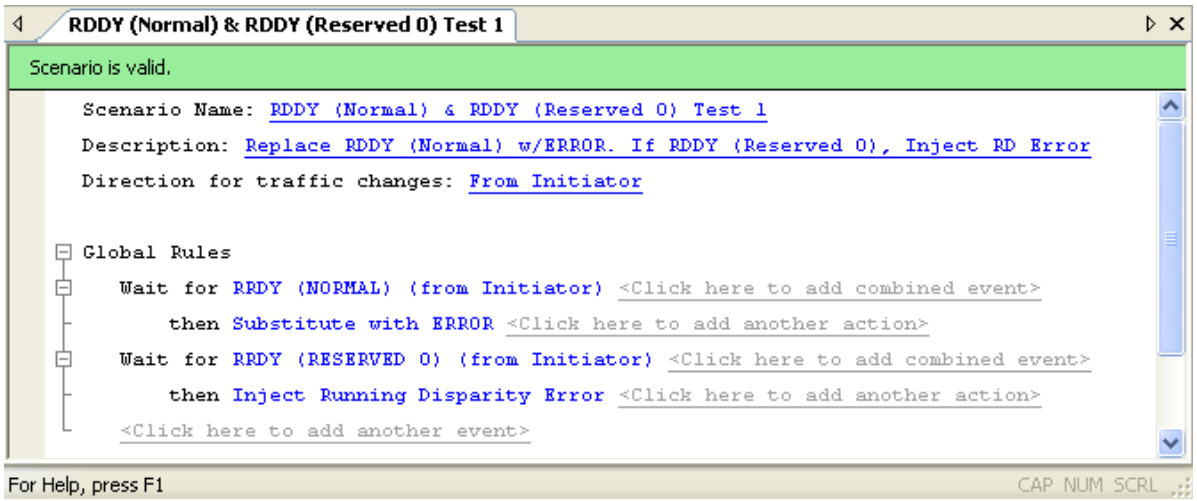


Figure 4.56: Example 4: Complete Scenario

9. In the File menu, select **Save Scenario** to save the scenario.

4.9.5 Example 5: Multiple Actions on a Single Event

In this example, an event triggers a set of actions. The actions occur at the same time. The device waits for an ACK from the initiator. When it occurs, the device beeps, injects an RD error, and increments a counter monitoring for that event (ACK from initiator).

1. Click the **New Scenario** button in the main library or one of the device libraries. In the Scenario Properties dialog, enter the scenario name, description, and direction of traffic change.
2. As in previous examples, configure the first event and its response in the Global Rules area. Choose **ACK** primitive as the event and **Beep** as the action. From the Action Properties drop-down menu, enter **500 ms** as the duration of the beep.
3. Click the **add another action** prompt to add a second action.

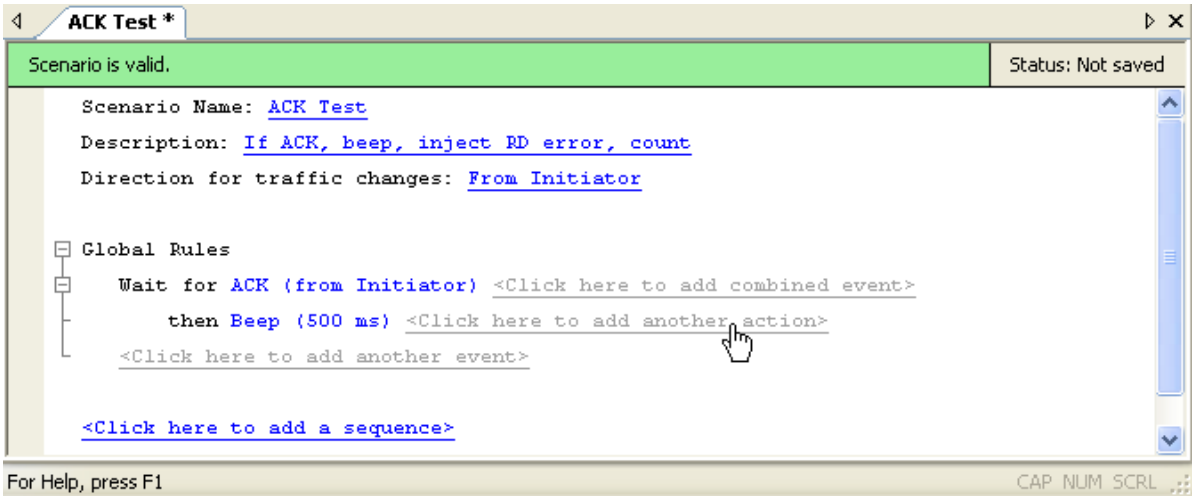


Figure 4.57: Example 5: Entering the Second Action

The Action Properties dialog box appears.

4. Choose **Inject RD Error** as the second action.
5. Click the **add another action** prompt to add a third action.
   The Action Properties dialog box appears.
6. Choose **Monitor/Count** as the third action.
7. Click **OK** to close the Action Properties dialog box.



Figure 4.58: Example 5: Complete Scenario

8. In the File menu, select **Save Scenario** to save the scenario.

   This example sets the counter to increment at each occurrence of an ACK (every 1 ACK).

4.9.6 Example 6: Using Timers

In this example, the Global Rules portion of the scenario waits for an ACK primitive from the initiator. Each time the device detects an ACK, it injects an RD Error into the traffic stream. This state continues for a random period of time, not to exceed 1.790 seconds. After the time period has elapsed (timer times out), the scenario stops.

Although this example sets the timer for a random period, you also can set the timer for known values (2 ms., 5 mins., 1 hr., and so on).

1. Click the **New Scenario** button in the main library or one of the device libraries. In the Scenario Properties dialog, enter the scenario name, description, and direction of traffic change.
2. As in previous examples, configure the first event and its response in the Global Rules area. Choose **ACK** primitive as the event and **Inject RD Error** as the action.
3. Click the prompt to **add another event** (keep in mind this is not a combined event) (see Figure 4.49 on page 467).



Figure 4.59: Example 6: Entering the Second Event

The Event Properties dialog box appears.

4. In the Type column on the left, choose **Timer**. Set the timer for random timing with a maximum time limit of 1.790 seconds.
5. Click **OK** to close the Event Properties dialog box.
6. Click the prompt to **add an action** to correspond with the second event.

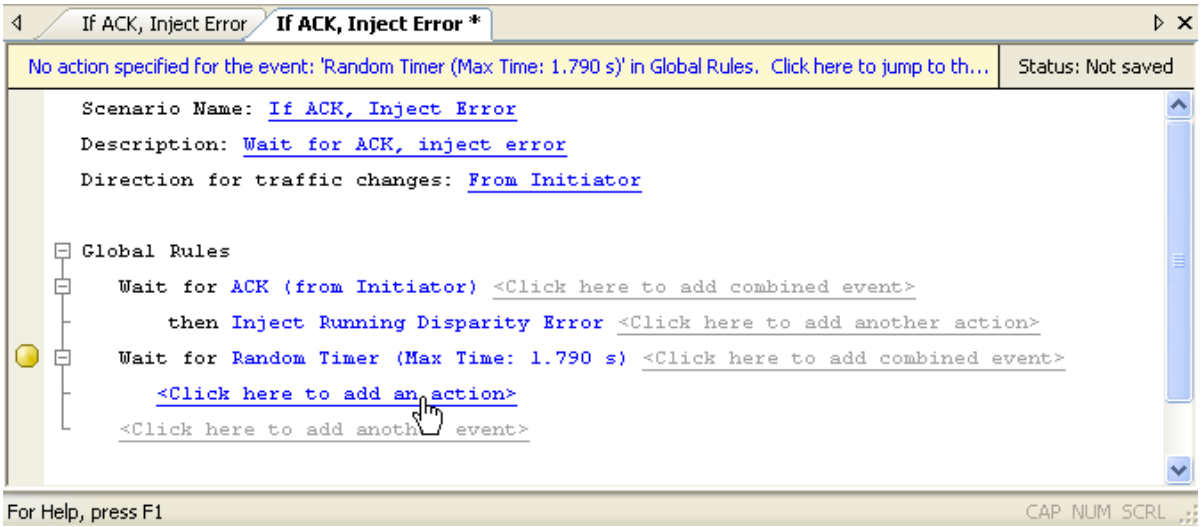


Figure 4.60: Example 6: Entering Second Action

The Action Properties dialog box appears.

7. In the Type list on the left, choose **Stop Scenario** as the action that you want after the timer has expired.
8. Click **OK** to close the Action Properties dialog box.

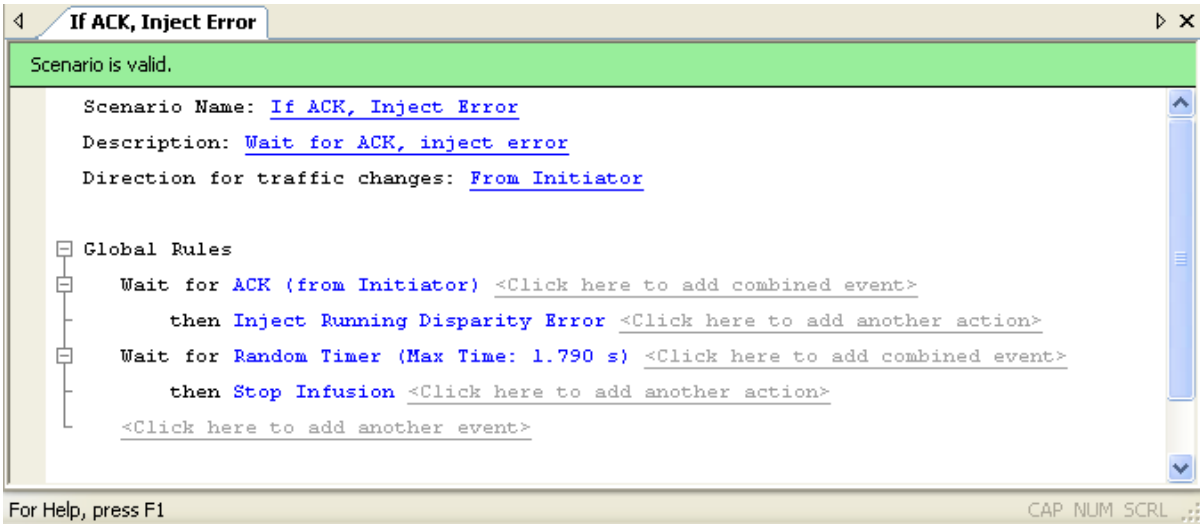


Figure 4.61: Example 6: Complete Scenario

9. In the File menu, select **Save Scenario** to save the scenario.

4.10 Creating a Sequence

This section gives several examples for creating sequences. Recall that a sequence can have multiple states, but only one state is active at any time. In other words, at any point in time, a sequence "waits" for one event (or combined event) and responds with the corresponding action or set of actions when the event occurs.

A sequence is more powerful than Global Rules, because you can create branching or looping test logic with a sequence.You can include up to two sequences in a scenario, but each is completely independent of the other. There is no branching or other interaction between the two, except through the Restart All Sequences action.

You must follow some simple rules when creating sequences:

TABLE 4.7: Sequence Rules

You can use only two branch actions per state. When you specify actions for a state, you can only use two instances of **Branch to an Existing State** or **Branch to a New State**. If you try to use more than two, a red error message appears in the status area of the application that says "Too Many Actions."
You can use only one restart sequence action per state. When you specify actions for a state, you can only use one instance of **Restart Current Sequence** or **Restart All Sequences**. If you try to use more than one, a red error message appears in the status area of the application that says "Too Many Actions."
You can use a maximum of 255 states per sequence. If you try to use more than 255 states, a red error message appears in the status area of the application.

The following table summarizes the examples that follow.

TABLE 4.8: Sequence Examples

Example	Description
7	**Creating two sequences and Global Rules**: This scenario has two objectives that you implement with Global Rules and two sequences. 1) You use Global Rules to replace any of three types of primitives. 2) You use two sequences to detect the order in which a type of frame is received from initiator and target.
8	**Creating a sequence with many states #1**: The objective of this scenario is to detect an incorrect order of primitives and to cause the device to beep when it happens. You implement this scenario with a single five-state sequence.
9	**Creating a sequence with many states #2**: This scenario is an enhancement of example 8. In this scenario, the objective is to detect an incorrect order of primitives, fix it, and cause the device to beep when this happens. As with example 8, you implement this scenario with a single five-state sequence.

4.10.1 Example 7: Creating Two Sequences and Global Rules

In this example, Global Rules substitute an Align (0) primitive for each of the following received from the initiator: Align (1), Align (2), and Align (3). As a separate test operation, two sequences determine the order in which each Identify Address frame is received from initiator and target.

The following tables summarize the logic implemented by each of the sequences.

TABLE 4.9: Example 7: Logic of Sequence 0

State	Description
State 0	If Address Frame is detected from initiator, go to State 1; otherwise, continue to check incoming frames (do not change state).
State 1	If next Address Frame detected is from target, beep 1 second.

TABLE 4.10: Example 7: Logic of Sequence 1

State	Description
State 0	If Address Frame is detected from target, go to State 1; otherwise, continue to check incoming frames (do not change state).
State 1	If next Address Frame detected is from initiator, beep 2 seconds.

There is no interaction between the two sequences. Each of them operates independently (and is independent of the Global Rules). However, the two sequences complement each other with their logic. In this sense, they both combine to implement a test objective.

1. Click the **New Scenario** button in the main library or one of the device libraries. In the Scenario Properties dialog, enter the scenario name, description, and direction of traffic change.

2. As in previous examples, create the Global Rules area.
3. Click the prompt to **add a sequence**. Prompts for the sequence appear beneath the Global Rules area. You create a sequence one state at a time. The application numbers states consecutively from 0 up (1, 2, 3, and so on).

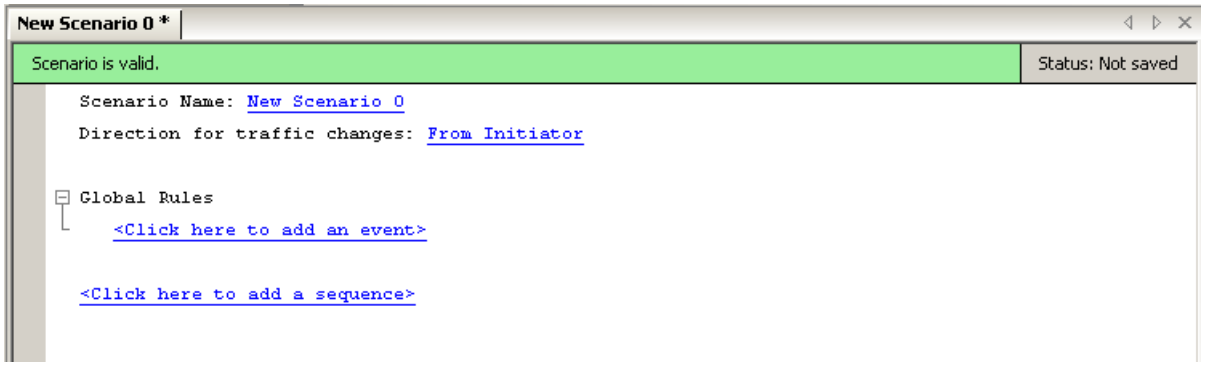


Figure 4.62: Example 7: Adding a Sequence

By default, the name of the first sequence in a scenario is Sequence 0. The name of the first state is State 0. To change the name of a sequence or state, or to associate a description with it, click the name of the sequence or state. A dialog box appears that allows you to enter that information.

Note: The description does not appear on screen, but you can bring it up by clicking the name of the sequence or state.

In the State 0 area, click the prompt to **add an event**.



Figure 4.63: Example 7: Adding an Event for the First State

The Event Properties dialog box displays.

1. In the Event Properties dialog box, select **Address Frame** as the event.

2. Click **OK** to close the Event Properties dialog box.
3. In the State 0 area, click the prompt to **add an action**.



Figure 4.64: Example 7: Adding an Action for the First State

The Action Properties dialog box displays:

1. For the action, select **Branch to > New State**.
2. Click the **OK** button to close the Action Properties dialog box.
3. This saves the action and automatically creates an area for State 1 in the scenario.
4. In the State 1 area, click the prompt to **add an event**. The Event Properties dialog box appears.
5. Choose the **Address Frame** event. In the Direction column, select **From Target** (you want State 1 to trigger on an Identify Address frame received from the target).
6. Click **OK** to close the Event Properties dialog box.
7. Click the prompt to **add an action** for State 1.



Figure 4.65: Example 7: Adding an Action to the Second State

The Action Properties dialog box displays.

1. In this example, you enter the action **Beep**, and you set the duration of the beep for 1 second.
2. Click **OK** to close the Action Properties dialog box.
3. You are finished creating the first sequence. Click the **add another sequence** prompt to create an area in the scenario for the second sequence (Sequence 1) (see Figure 4.66 on page 480).

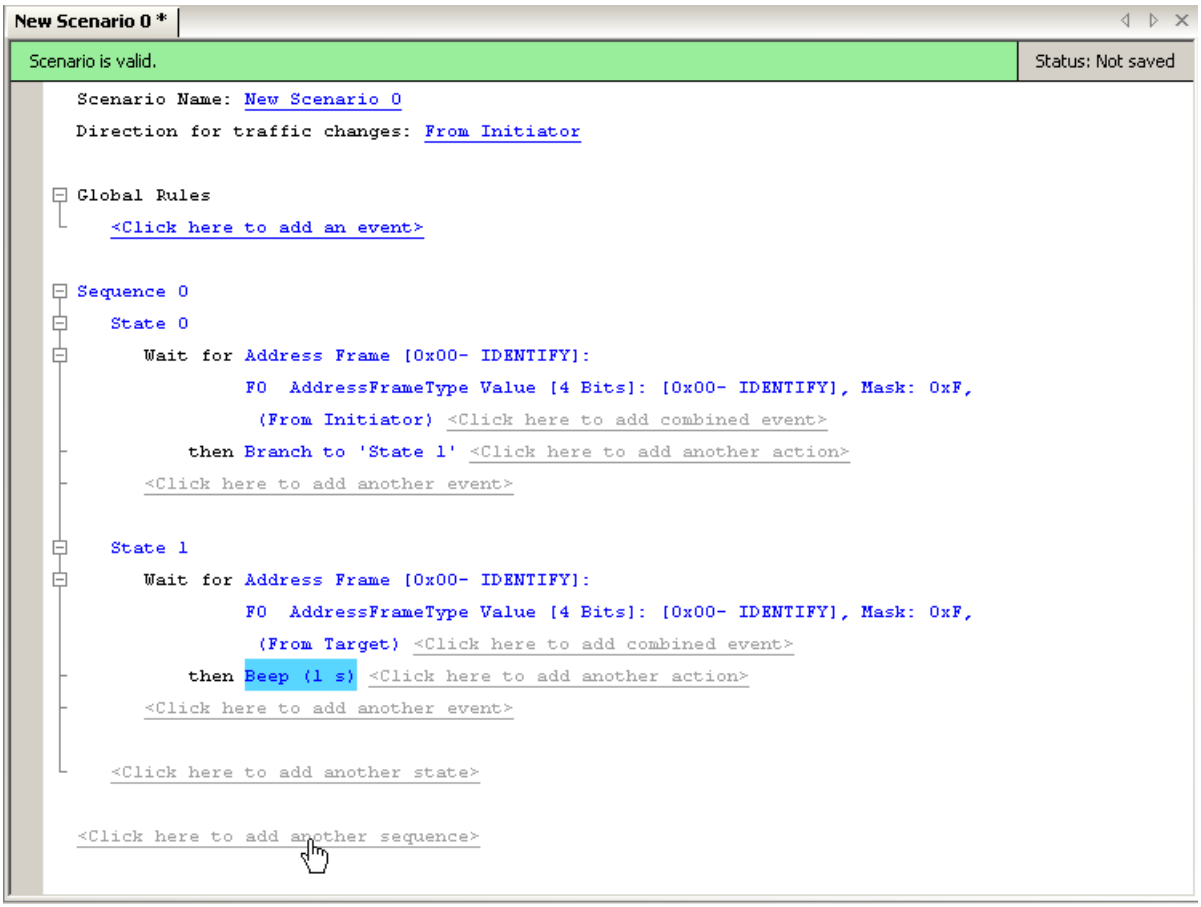


Figure 4.66: Example 7: Adding a Second Sequence

4. Create two states in the second sequence with the characteristics shown in the following table.

TABLE 4.11: Example 7: States for Second Sequence

State	Event	Action
0	Address Frame from Target	Branch to State 1
1	Address Frame from Initiator	Beep for 2 seconds.

5. In the File menu, select **Save Scenario** to save the scenario.

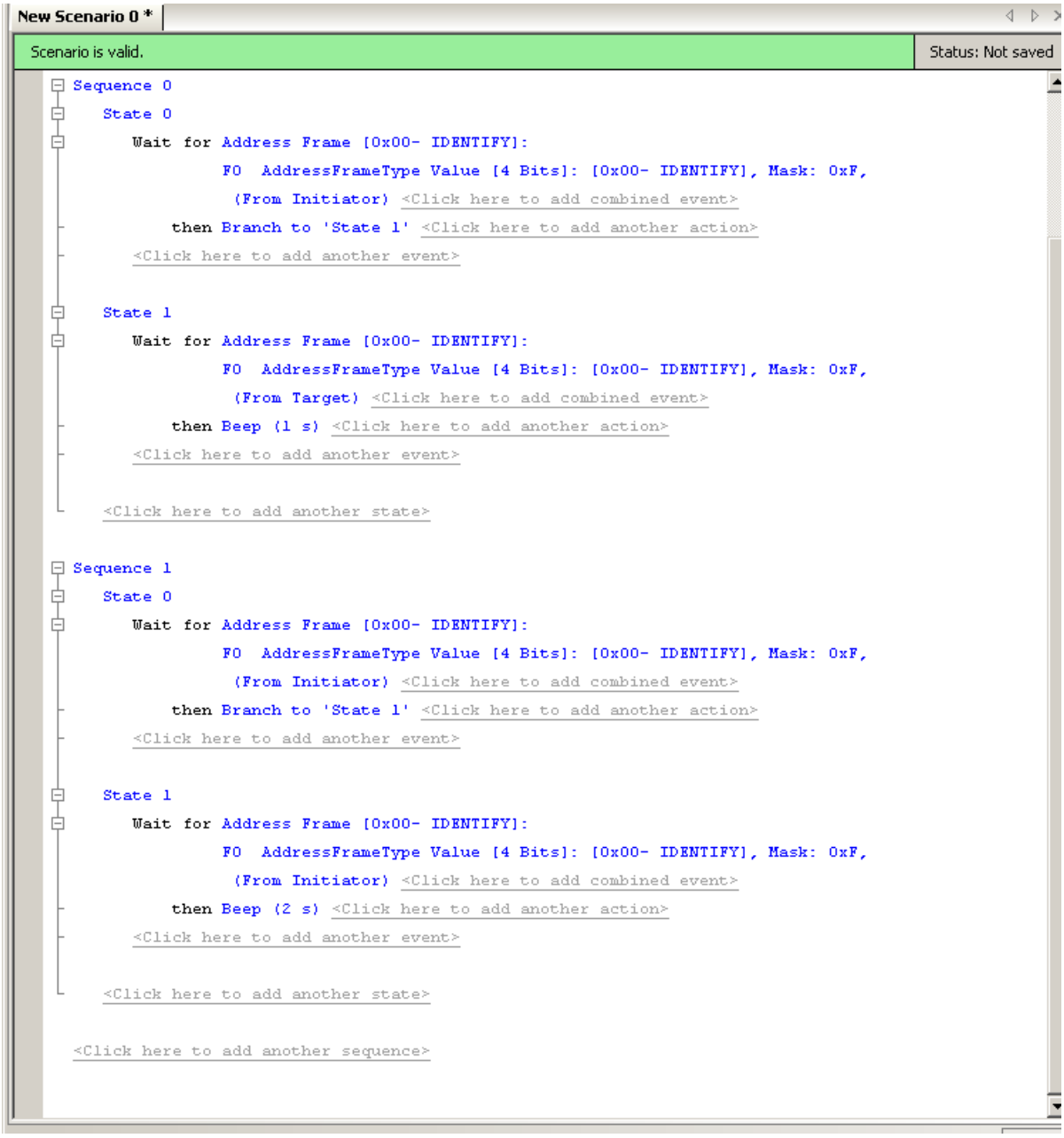


Figure 4.67: Example 7: Sequence Area of Scenario

4.11 Example 8: Creating a Sequence With Many States #1

In this example, a five-state sequence detects if a group of primitives is received out-of-order from the initiator. The expected order is: Align (0), Align (1), Align (2), Align (3). If this scenario detects any other order of these primitives, it causes the device to beep and the scenario to restart.

This example is designed to give you an idea of the powerful logic that you can implement with sequences.

Note that the states in this sequence have been renamed (do not have their default names). The following table summarizes the sequence logic.

TABLE 4.12: Example 8: Logic of Sequence 0

State	Description
Wait for Align (0)	When an Align (0) is received, go to Wait for Align (1).
Wait for Align (1)	If an Align (1) is received next, go to Wait for Align (2); otherwise, go to Indicate Error.
Wait for Align (2)	If an Align (2) is received next, go to Wait for Align (3); otherwise, go to Indicate Error.
Wait for Align (3)	If an Align (3) is received next, restart test; otherwise go to Indicate Error.
Indicate Error	Indicate error and restart test.

1. Click the **New Scenario** button in the main library or one of the device libraries. In the Scenario Properties dialog, enter the scenario name, description, and direction of traffic change.
2. As in previous examples, create the five states for this sequence.

3. In the File menu, select **Save Scenario** to save the scenario.

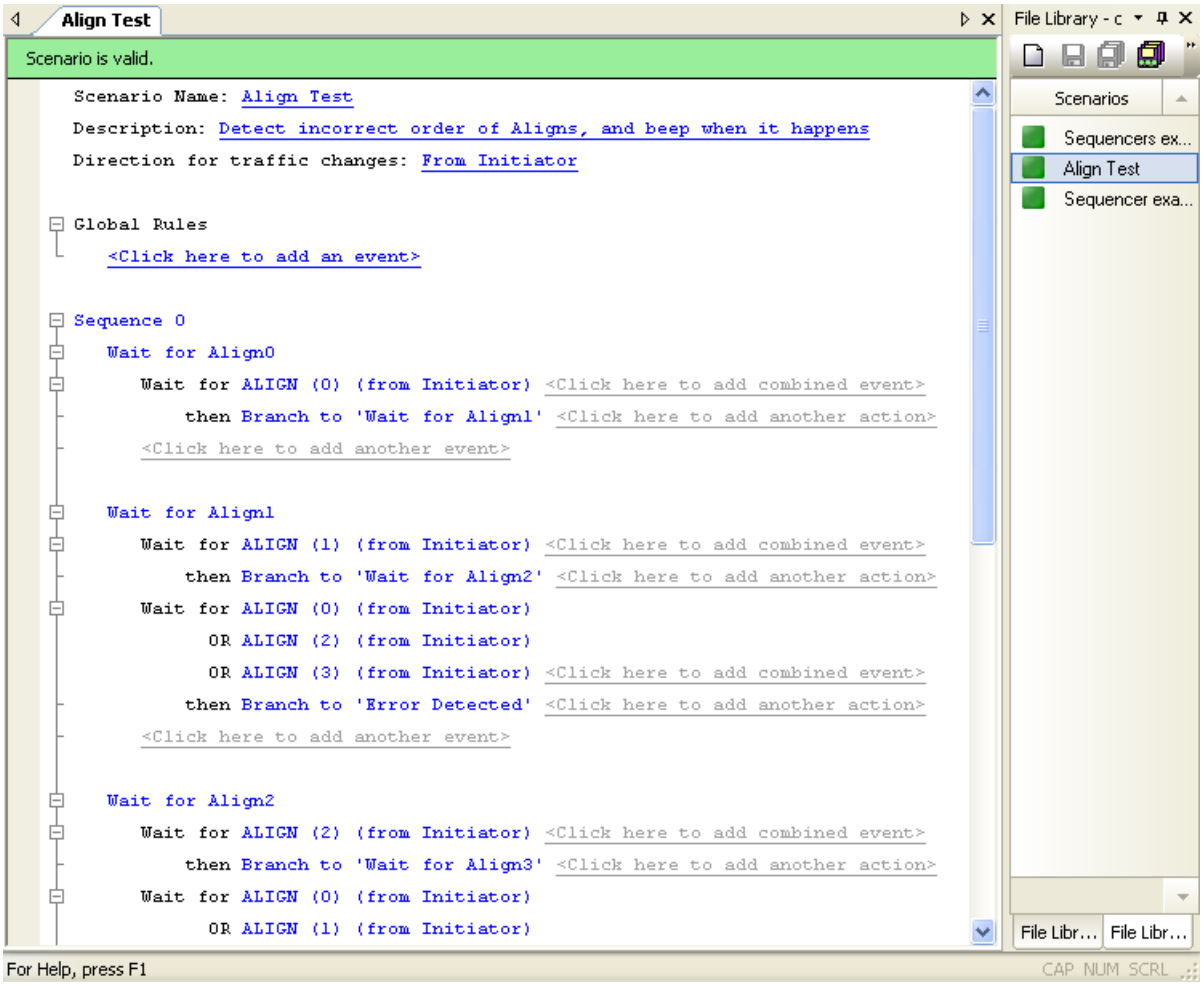


Figure 4.68: Example 8: Top Half of Scenario

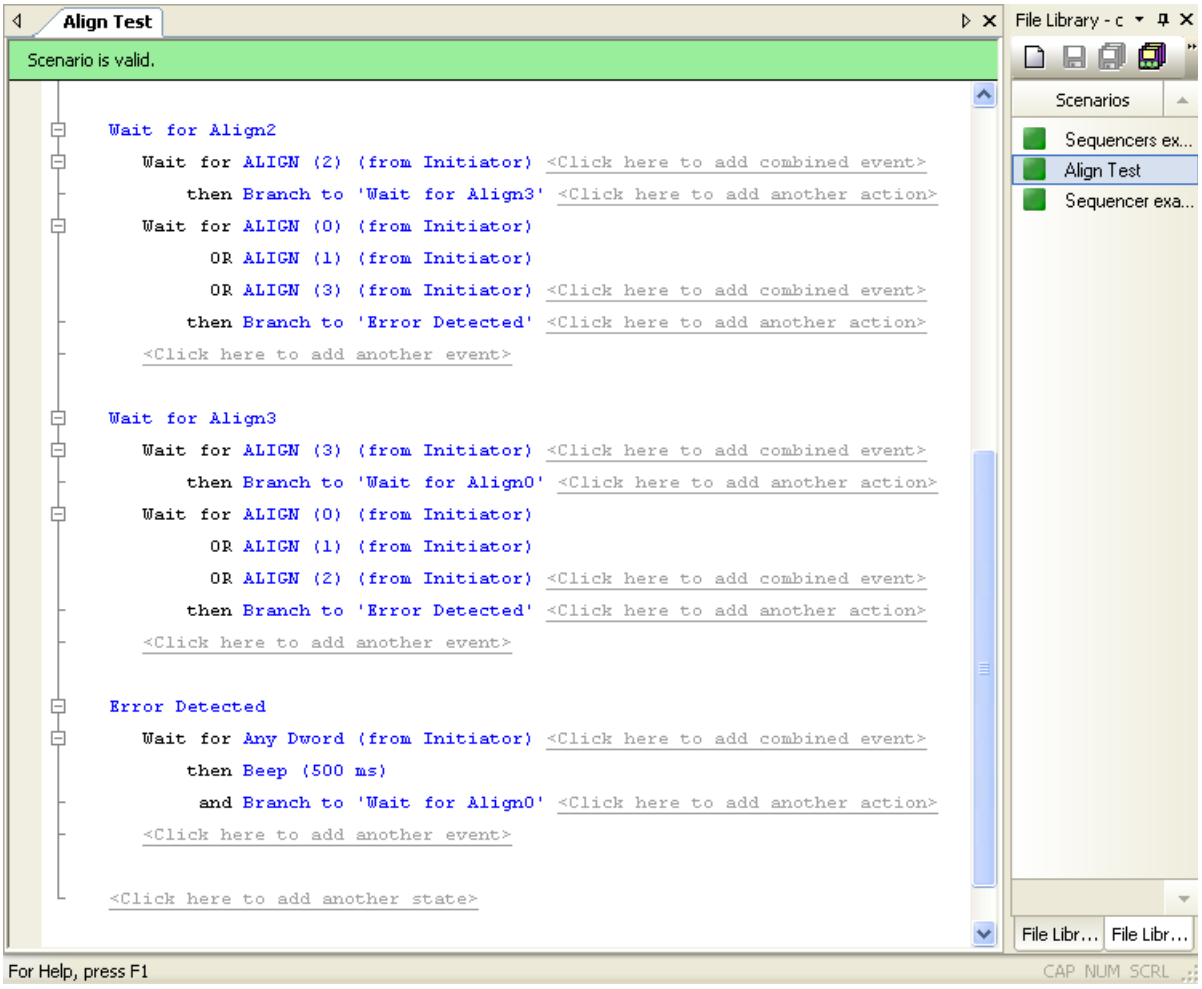


Figure 4.69: Example 8: Bottom Half of Scenario

4.12 Example 9: Creating a Sequence With Many States #2

In this example, a five-state sequence not only detects if a group of primitives is received out-of-order, but it fixes any incorrect order. The logic is similar to that of example 8 with a few small changes. The following table summarizes each state.

TABLE 4.13: Example 9: Logic of Sequence 0

State	Description
Wait for Align (0)	When an Align (0) is received, go to Wait for Align (1).
Wait for Align (1)	If an Align (1) is received next, go to Wait for Align (2); otherwise, replace primitive with Align (1) and go to Indicate Error.
Wait for Align (2)	If an Align (2) is received next, go to Wait for Align (3); otherwise, replace primitive with Align (2) and go to Indicate Error.
Wait for Align (3)	If an Align (3) is received next, restart test; otherwise, replace primitive with Align (3) and go to Indicate Error.
Indicate Error	Indicate error and restart test.

1. Click the **New Scenario** button in the main library or one of the device libraries. In the Scenario Properties dialog, enter the scenario name, description, and direction of traffic change.
2. As in previous examples, create the five states for this sequence.

3. In the File menu, select **Save Scenario** to save the scenario.

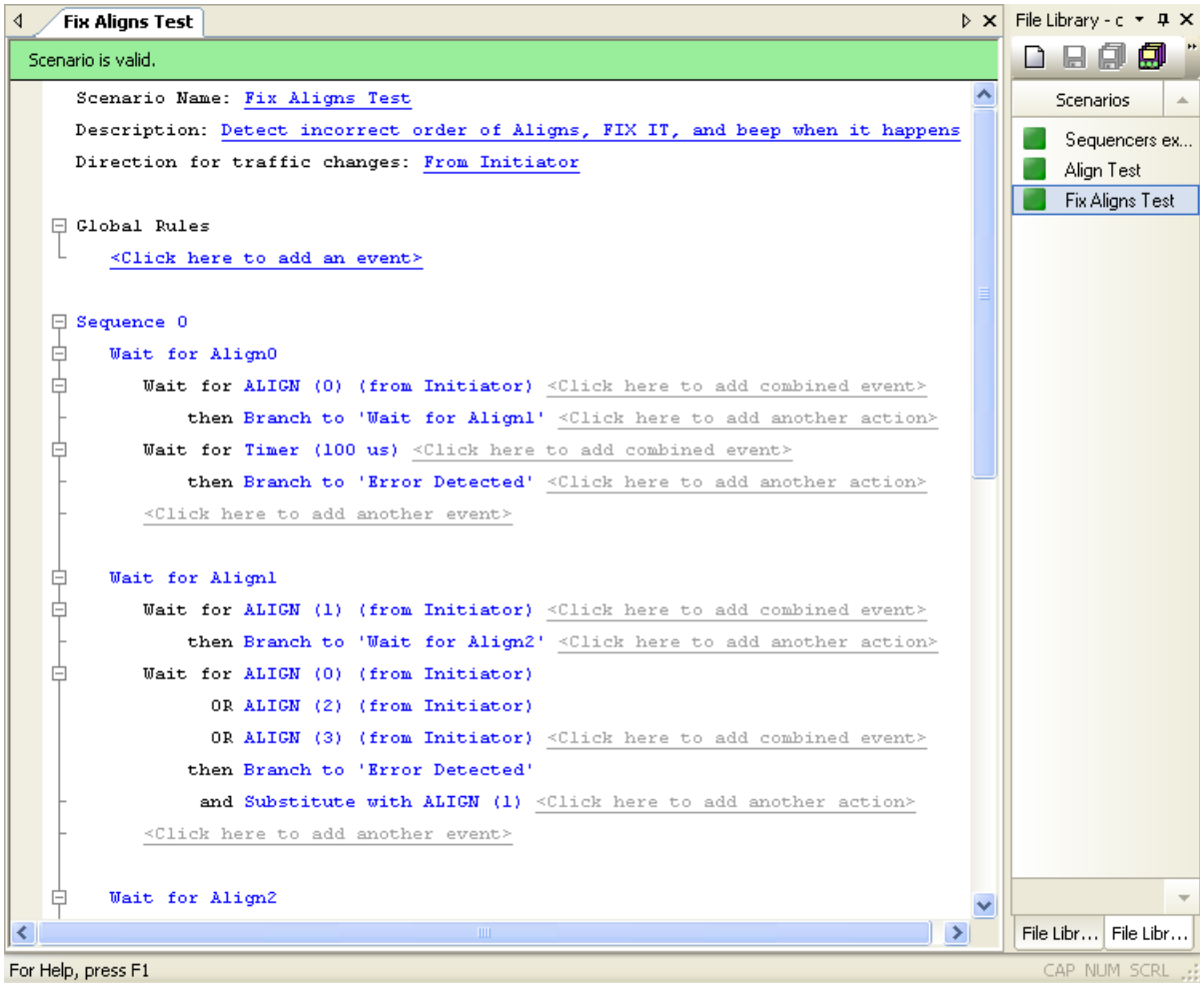


Figure 4.70: Example 9: Top Half of Scenario

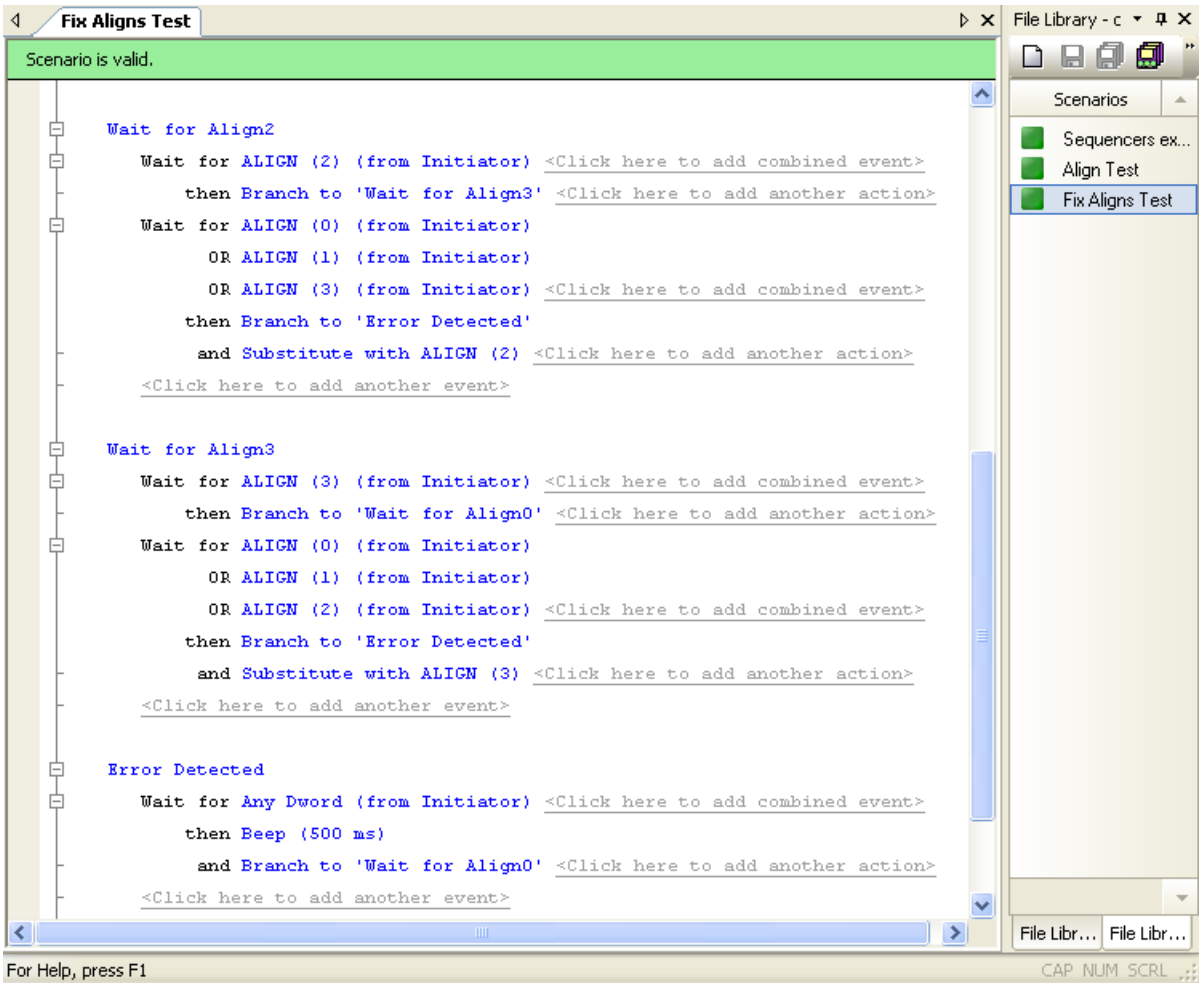


Figure 4.71: Example 9: Bottom Half of Scenario

4.13 Saving a Log File

To save a log file of a Jammer or Device Output, select the wrench from the toolbar below the Scenario window (see Figure 4.72) or below the Device window (see Figure 4.74 on page 489).

Option to Save Output Window Log File

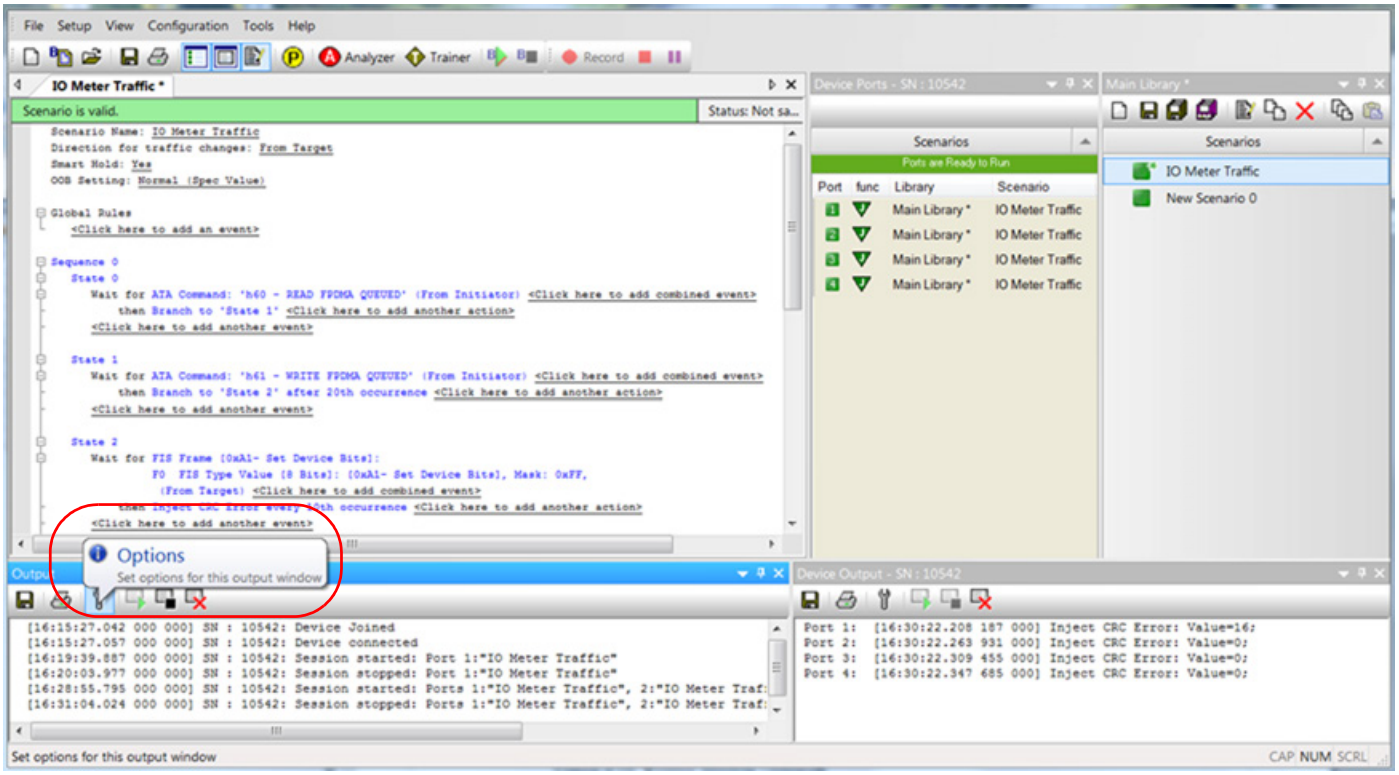


Figure 4.72: Output Window Options

Option to Save Device Output Window Log File

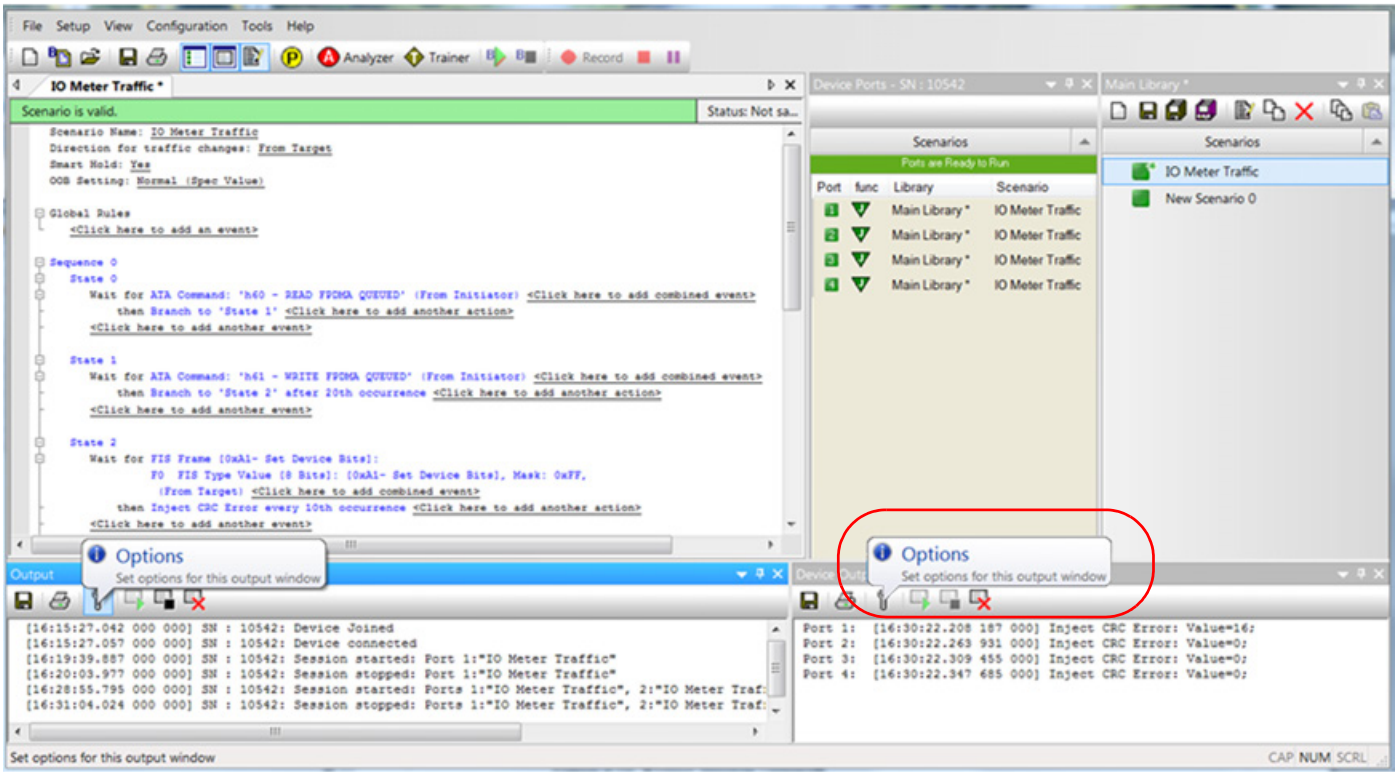


Figure 4.73: Device Output Window Options

Automatically Save Log File

Selecting either “Wrench”will pop up a window which automatically stores the log file for the Window selected. See Figure 4.74.

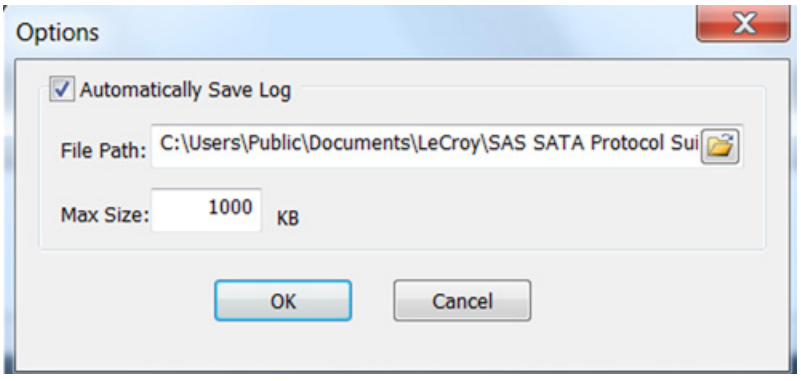


Figure 4.74: Auto Save Log File: Location and Size

You can change the maximum size of the log file by typing in the Max Size window. If you select the folder, you can change the path to the location of the log file. See Figure 4.75 on page 490.

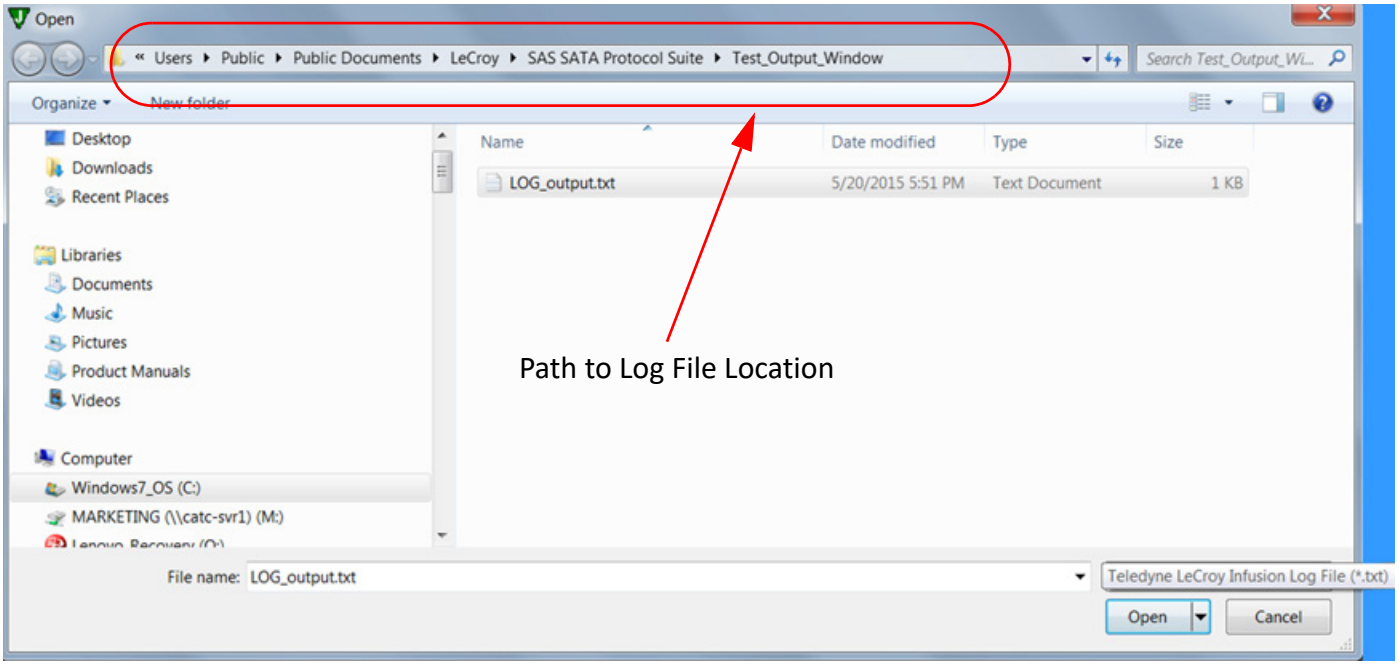


Figure 4.75: User Defined Location of Jammer Output Window Log File

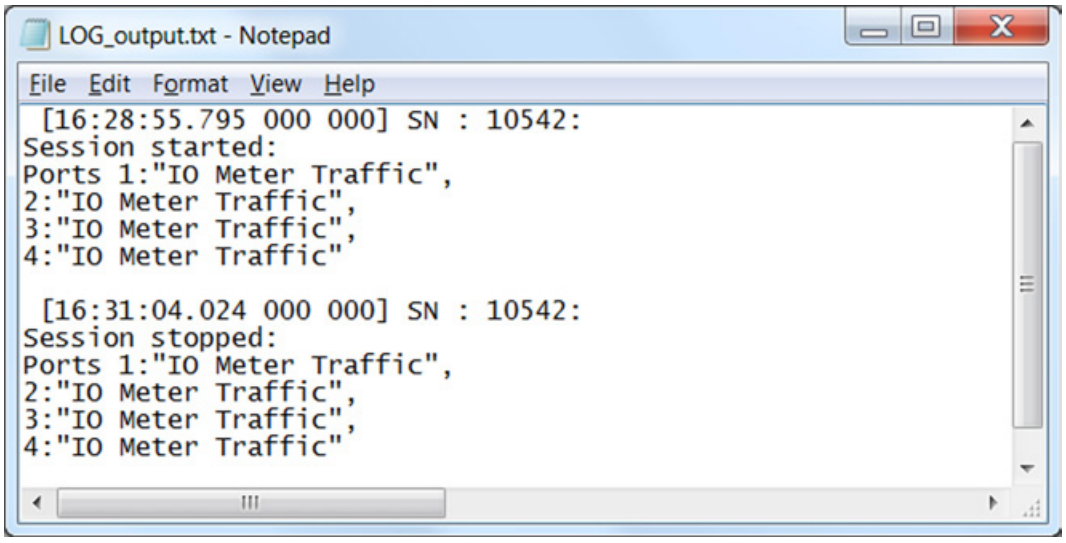


Figure 4.76: Sample Jammer Output Log File

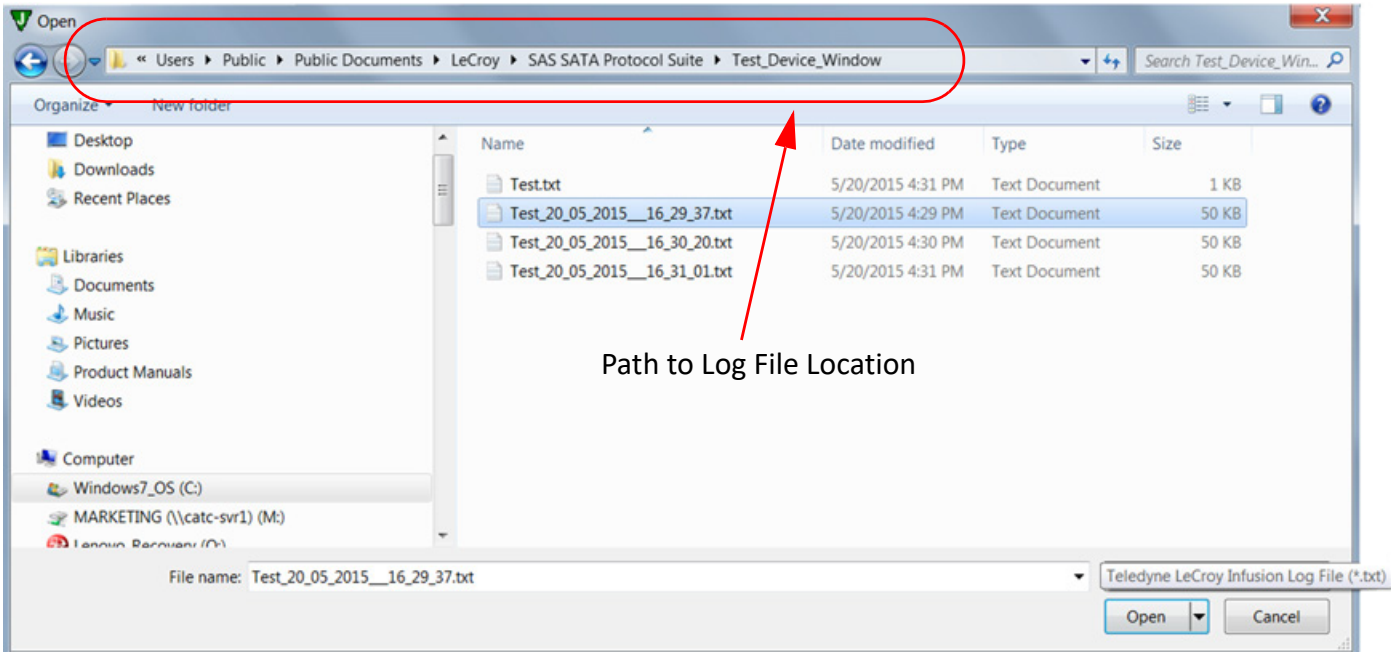


Figure 4.77: User Defined Location of Device Output Window Log File

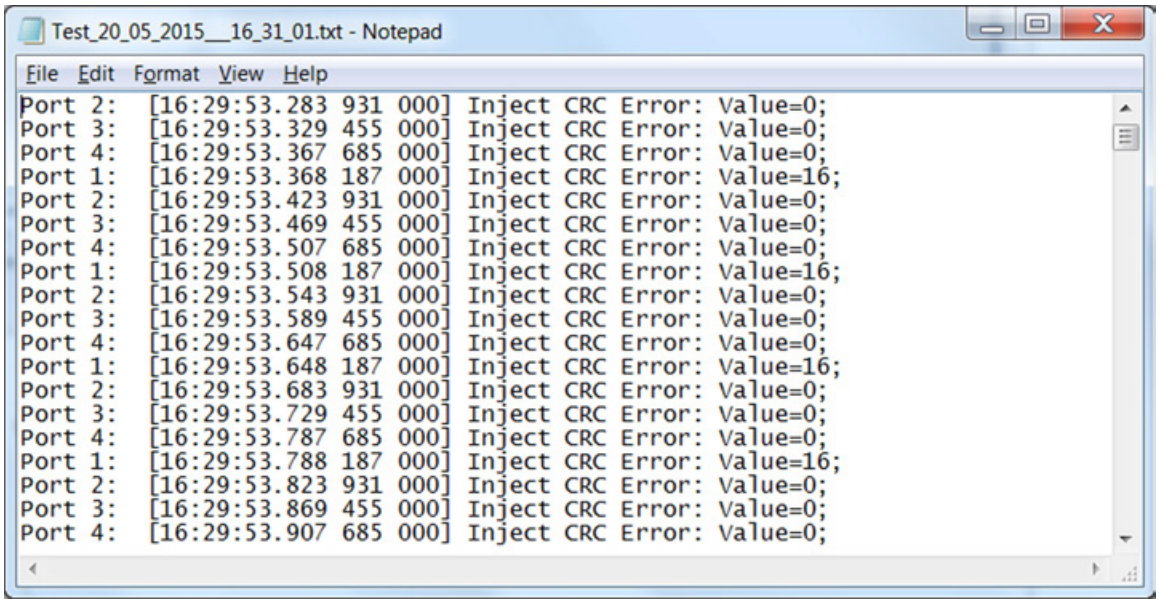


Figure 4.78: Sample Device Output Log File

Copy or Copy All

Another method to capture and save the log file is to simply perform a right click in the log Output Window or Device Window. Then select a portion of the log file to Copy or Copy All. See Figure 4.79.

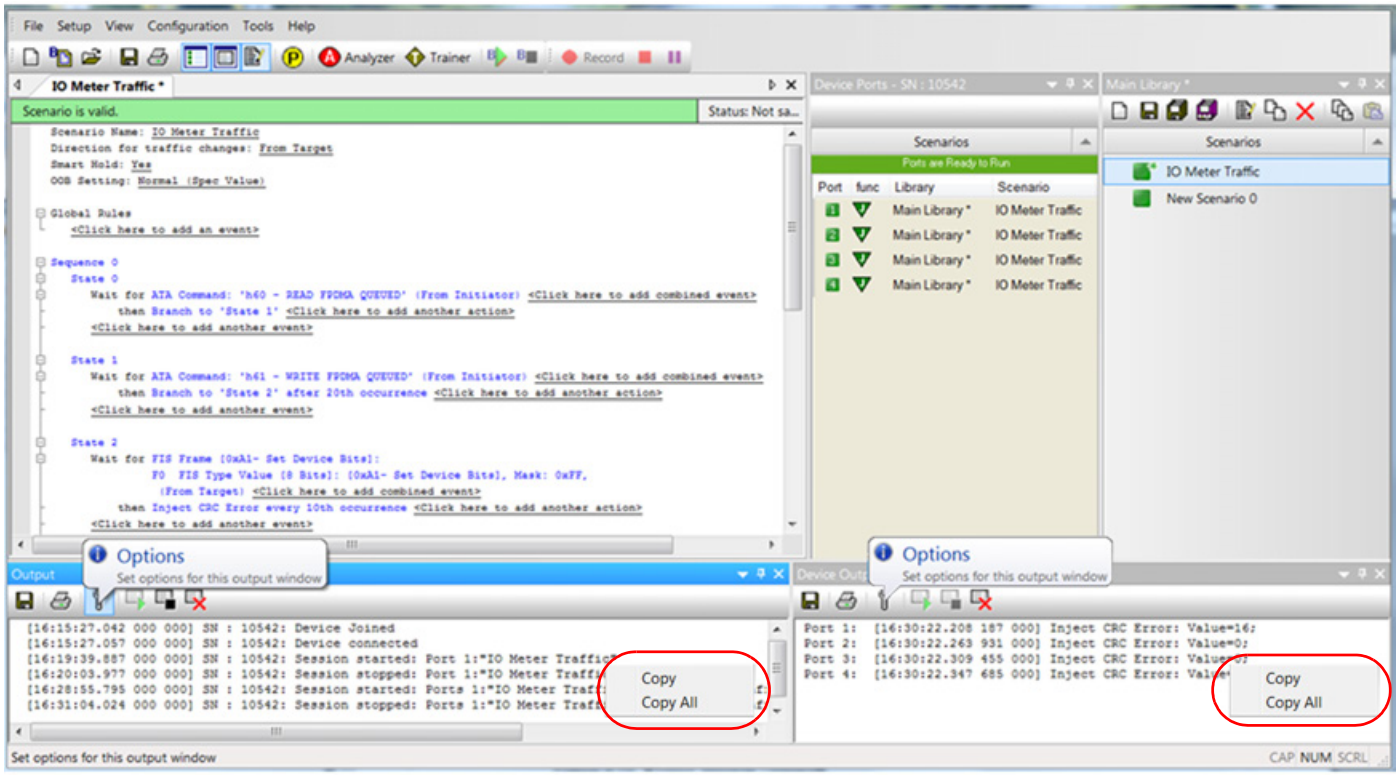


Figure 4.79: Copy Data from Log File Window

4.14 Downloading Scenarios

After you have created a scenario, you need to download it to the InFusion device for execution.

If you use a general library as a scenario archive, then the process of creating and downloading a scenario is as follows:

1. Open the general library (Main library or a File library). Scenarios in the library are listed in the Main Library window.
2. Open the Device Library window by clicking the **Show Device Library** button on application toolbar.
3. Open the Device Library for the device to which you want to download a scenario or scenarios. You can open the device library in two ways: by clicking the **Device Library icon** in the device list window or by double-clicking the **device name**.
4. Copy the scenario from general library to device library by dragging it with the mouse.
5. Download all scenarios in the device library to the InFusion device. To do so, click the **Download all Scenarios** button on the Device Library toolbar (second button from left).

4.15 Running Scenarios

If you use a general library as a scenario archive, then the process of executing a scenario is as follows:

1. Select the scenario to run by clicking it.
2. To run the scenario, click the **Run Scenario** button on the Device Library toolbar (second button from the right). The InFusion device then begins its session.

4.16 Scenario Batch Files

You can write a script with commands to run a sequence of executable scenarios automatically. A Scenario Batch file is a text file with a list of commands to run in sequence when you execute the file. A batch script can manage scenarios and their assigned ports and hardware in sequence, using conditions. The system checks for accuracy of inputs and commands.

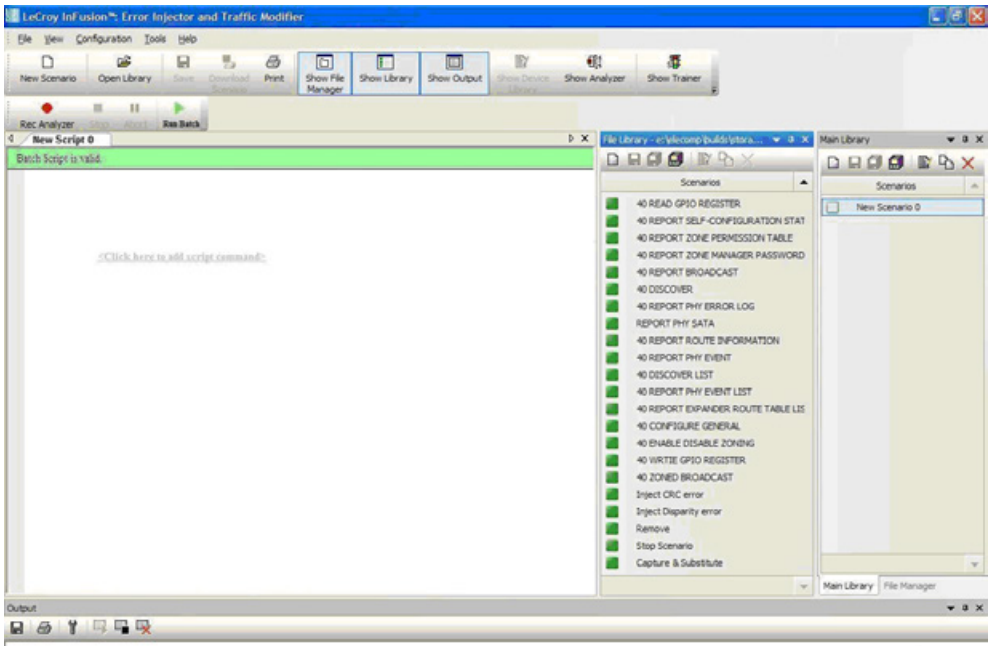
Note: Before you run a Scenario Batch file that requests scenarios, you must download the scenarios to the Scenarios box.

To start a batch script, click the **New Batch Script** 

button or select **File > New Batch Script**.

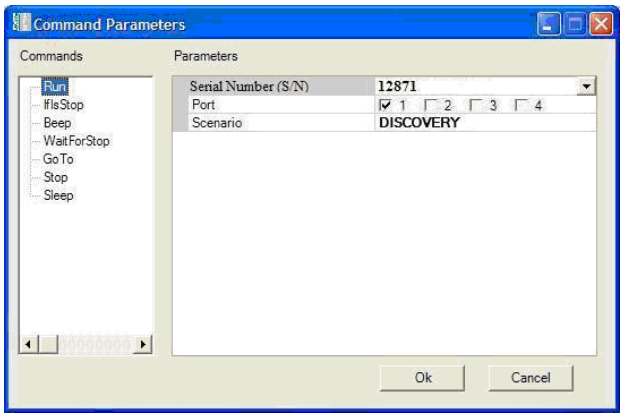
4.16.1 Script Workspace

In the Script Workspace (see the following figure), add a command and make a batch file.



In this window, you can enter a script command by clicking **Click here to add script command**.

1. Select **Click here to add script command** to open the Command Properties dialog.



The **Command Parameters** Dialog contains the list of available commands and their parameters from which to build scenarios and connected hardware and available ports.

2. Select appropriate parameters for the command and click **OK** to display the script in the Script Workspace.



Note: You can select ports from the port list, depending on number of ports licensed.

Note: The hardware Serial Number can already exist or not. If the Serial Number exists, the Serial Number (for example, S/N: 12871) is shown. In Offline and Simulation mode, you can enter a Serial Number. In Online mode, you can only enter an existing Serial Number.

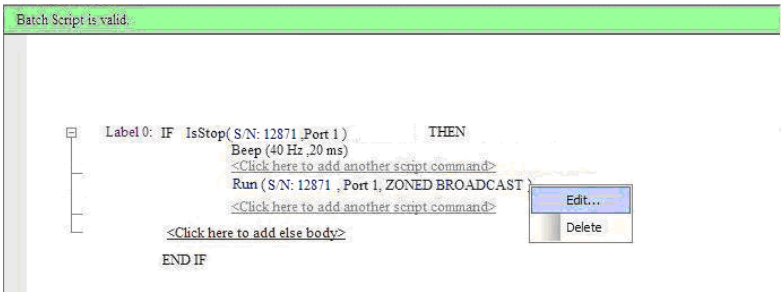
3. To add another command, click **Click here to add another script command**.



To copy a script command, right-click on the command and select **Copy**.
Right-click **Click here to add another script command** and then select **Paste**.

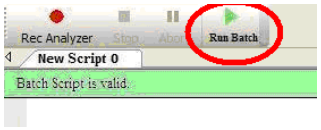
You can also cut, delete, and edit a selected script command.

4. To edit batch commands, click the command, or right-click the command and select **Edit** from popup menu.



To delete a command, right-click and select **Delete** from popup menu, or select command and press **Delete** key on keyboard.

After finishing, if everything is correct, push the **Run Batch** button to execute scenario and save result in the log file.

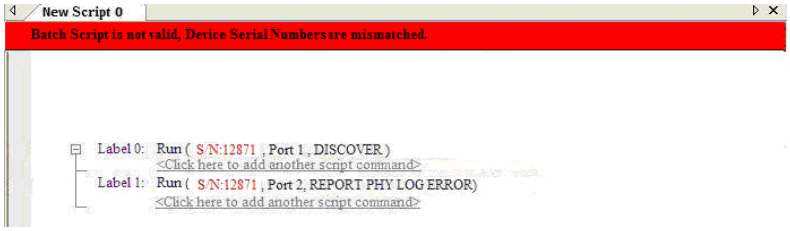


Note: Before you run a Scenario Batch file that requests scenarios, you must download the scenarios to the Scenarios box.

4.16.2 Error Checking

The Script Workspace shows errors by red color. The program reports all errors in the log file.

If you use a script from other InFusion hardware, it may cause an error, for example, mismatch in hardware Mac addresses, or scenarios that are not already in current hardware.



4.16.3 Log

Results of executable batch commands are saved automatically into a log file with user-specified name. The status of executable commands is shown in log area.

4.16.4 Statements

Statements can be conditional statements or non-conditional statements.

IfIsStopped

Shows whether a scenario is already stopped or not.

Format

```
IfIsStopped (Serial Number, Target Port)
```

Parameters

- **Serial Number**: Serial number of hardware
- **Target Port**: Port number in port map

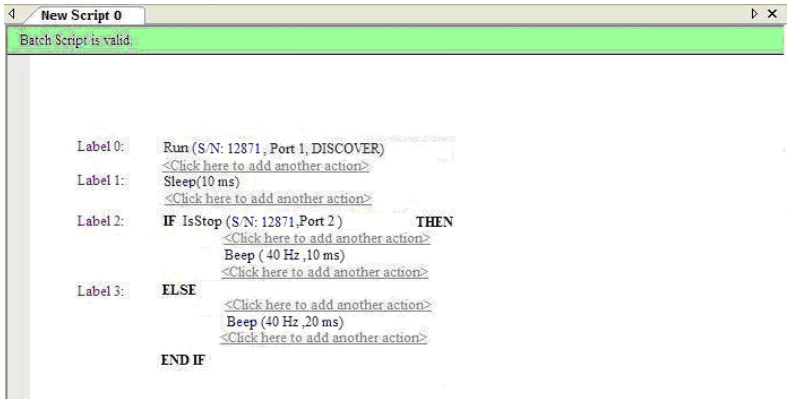
Example

```
IfIsStopped(ox01267, 1) Then
  {
  Beep (750, 300)
  Run (ox01267," Detect AddressFrame Open", 5)
  }
```

The value of second parameter is 5 and shows check stopping mode of combination of port number 1 and port number 3.

After filling parameters from the Command Parameters Dialog, the program makes the IF-ELSE structure in the Script workspace. The ELSE statement is optional. To add an ELSE body, click **Click here to add else body**.





Goto Label

Goes to specified label. Labels can be assigned to each script line.

Format

```
Goto Label3
```

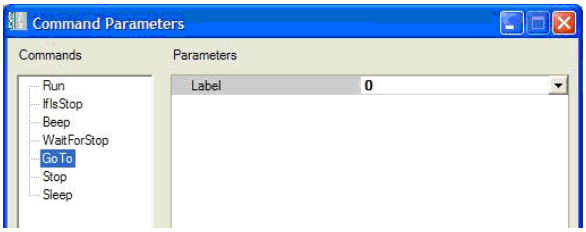
Parameters

None

Example

```
Label3: WaitForStop(0x83456, 2, 100))
Run (ox01267," Inject CRC000", 4)
Goto Label7
```

Note: You can use a **Label** and a **Goto Label** to make loops. First make the label, then make Goto Label. The Command Parameters window shows only enabled Labels. Labels are disabled by default and are in gray color. To enable them, click them to make purple color.







Run

Runs the scenario on hardware on specified ports. If you call this command for the first time and the scenario was not assigned to the hardware and ports before, the scenario is assigned to specified hardware and ports and then scenario runs on the hardware.

Format

```
Run(Serial Number, Scenario Name, Target Port)
```

Parameters

- **Serial Number**: Serial number of hardware
- **Scenario Name**: Name of scenario
- **Target Port**: Port number in port map

Example

```
Run (ox841200," Substitute address frame", 4)
Beep(800, 400)
Run (ox841200," CRC Inject _ Play CD", 8)
WaitForStop(0x63463, 1, 150)
Run (ox841200," Remove Send Cue Sheet", 2)
Goto Label6
Run (S/N: 12871, Port 1, DISCOVER)
```

Note: If the selected ports are busy, scenario cannot run, and the command will be skipped. The result will be written in Log area.

Stop

Stops running scenario by hardware and port name.

Format

```
Stop (Serial Number, Target Port)
```

Parameters

Serial Number: Serial number of hardware

Target Port: Port number in port map

Example

```
Run (ox00820,"Inject CRC000", 2)
Beep(700, 500)
Stop (ox00820, 2)
Goto Label3
...
Label3 : Run(ox005007,"Detect DATA", 8)
Sleep(40)
```

WaitForStop

Used to wait for occurrence of specified condition.

Format

```
WaitForStop(SerialNumber, Target Port, Duration)
```

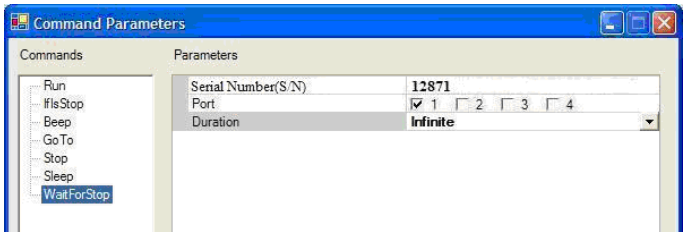
Parameters

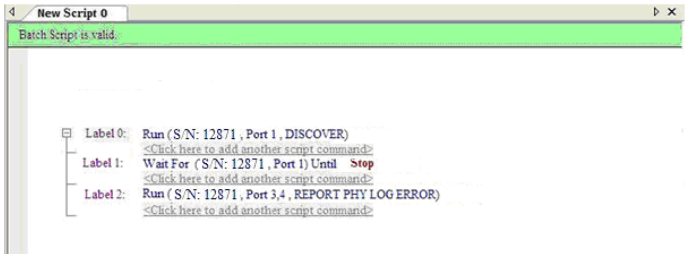
- **Serial Number**: Serial number of hardware
- **Target Port**: Port number in port map
- **Duration**: Integer or random duration in milliseconds. In the Command Parameters Window, WaitForStop duration has three options:
- **Infinite**: Wait until **Stop** command.
- **Random**: Stop after a random time.
- **Finite time**: Stop after specified time in milliseconds.

Example

```
Run (ox001267,"Detect AddressFrame Open", 2)
WaitForStop (0x348790, 2, Forever)
Run (ox005007,"Detect DATA", 4)
```

```
WaitForStop(ox005007, 4, 100)
Stop (ox001267, 2)
```







Sleep

Used to sleep for a few seconds.

Format

```
Sleep(Duration)
```

Parameters

- **Duration**: Integer or random duration in milliseconds

Example

```
Sleep(100)
```



Beep

If specified condition is satisfied, the system beep for specified duration.

Format

```
Beep (Duration, Frequency)
```

Parameters

- **Duration**: Integer or random duration in milliseconds
- **Frequency**: Frequency in hertz

Example

```
IfIsStopped(0x83456, 4)) then
  {
  Beep (2, 20)
  Run (0x83456,"Identify_Disparity error", 8)
  }
```

Chapter 5

Sierra Trainer Traffic Generation

The Sierra Trainer is a traffic generator that can emulate a SAS initiator/target or SATA host/device. Traffic generation enables engineers to test designs under realistic conditions and to transmit known errors, allowing engineers to observe how devices handle faulty link conditions.

Traffic generation is performed via the execution of text-based scripts. These traffic generation files (***.ssg**) contain statements about the types of traffic to be generated. These script files can be edited with either a simple text editor such as Notepad or with the Script Editor utility provided by the application.

Note: When it runs, the trainer turns on the voltage on all channels, whether they are turned on or off previously.

To open the Traffic Generation window, click the **Launch Trainer Icon** 

in the SAS/SATA Protocol Suite window.

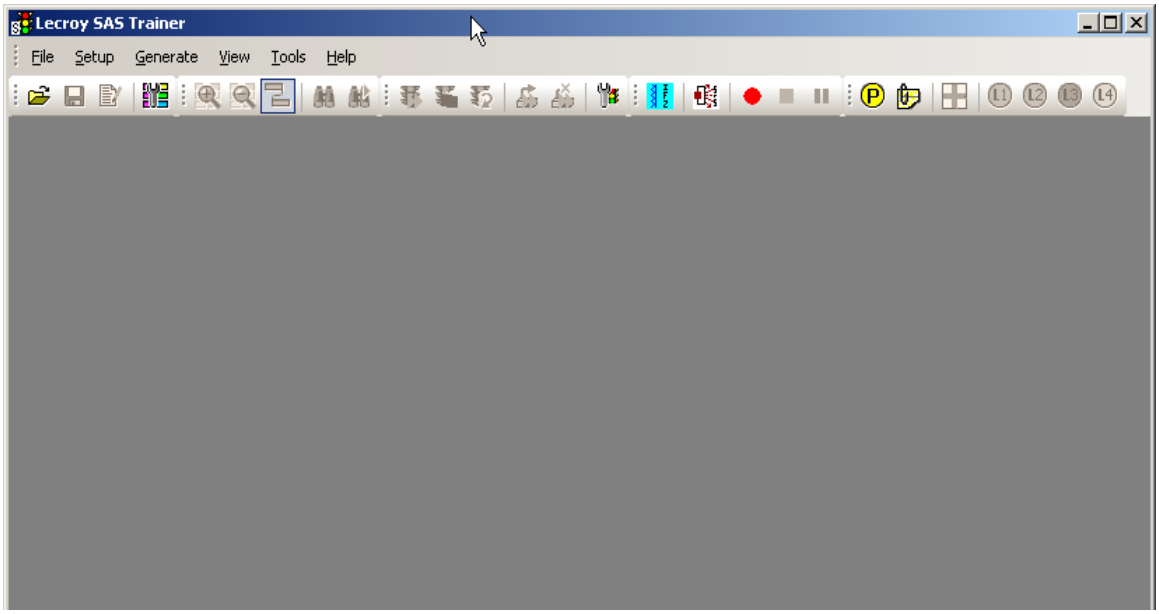


Figure 5.1: Sierra Trainer Window.

5.1 Sierra Trainer Menus

The Sierra Trainer menus are:

5.1.1 File Menu

New GenFile: Starts a new Generation File.

Open: Opens a file.

Close: Closes the current window.

Launch Analyzer: Displays Analyzer Window.

Launch Jammer: Displays Jammer (Infusion) Window.

Save As: Saves the current file with a new name.

Print: Prints part or all of the current traffic data file.

Print Preview: Produces an on-screen preview before printing.

Print Setup: Sets the options for the current or new printer.

Edit Comment: Allows you to enter a comment in a dialog.

Export: Saves trace as text file in Packet View Format.

Convert: Converts an SATrainer Generation File (**.stg** file) to a Generation File (**.ssg** file).

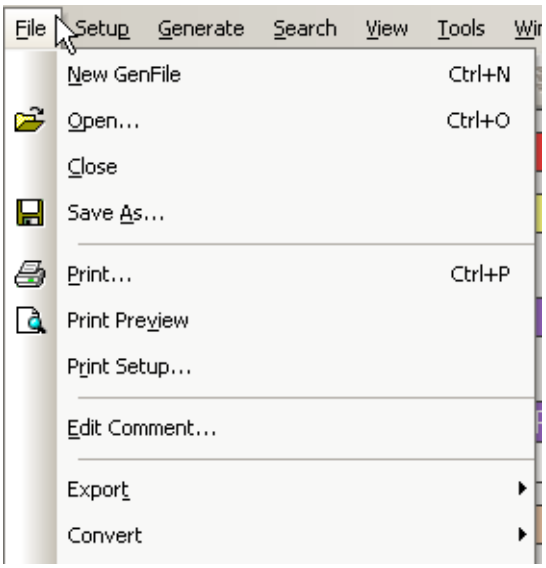


Figure 5.2: Trainer File Menu.

5.1.2 Setup Menu

- Update Sierra Device: See “Update Device” on page 385.
- **Port Configuration**:

You can select different combinations of Trainer with Analyzer and Jammer. When running two different applications on the ports, you must set the same port

configuration in both of them. See “Ports Configuration” on page 124. The following describes possible configurations:

- **Analyzer and Trainer on same port**: You can generate initiator/target traffic and also capture the traffic generated.
- **Analyzer and Trainer on same port, and Analyzer and Trainer on another port**: You can generate initiator/target traffic and also capture the traffic generated on two ports.
- **Trainer on one port, and Analyzer on another port**: Trainer is run on a port generating initiator/target traffic and Analyzer is run on the other port capturing the traffic.
- **Trainer and Jammer on same port**: You can generate initiator/target traffic and also inject errors on the traffic between initiator and target on the port.

Note: See “Multi-Port Trainer Script Assignments to Links” on page 523.

Display Options: Selects what information to display. See “Display Options” on page 581.

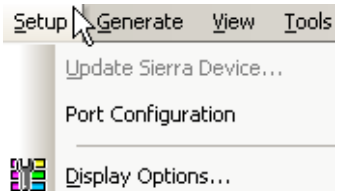


Figure 5.3: Trainer Setup Menu.

5.1.3 Generate Menu

Start Generation: Causes the Generator to begin generation.

Stop Generation: Causes the Generator to stop generation.

Resume Generation: Causes the Generator to resume generation after a stop.

Connect Link: Automatically bring the linkup to the Host, Device, Initiator, or Target connected to the Generator.

Disconnect Link: Disconnect link.

Connect Parameters: Set the “Identify” frame parameter settings to keep the link connected. See “Connection Parameters” on page 586.

Generation Options: Setup the Generation Rules. See “Auto Speed Negotiation” on page 568.

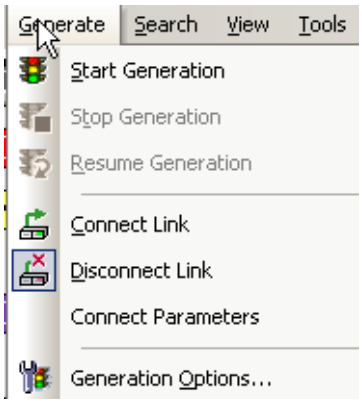


Figure 5.4: Trainer Generate Menu.

5.1.4 Search Menu

Go to Event: Opens a dialog that allows you to go to a frame and time.

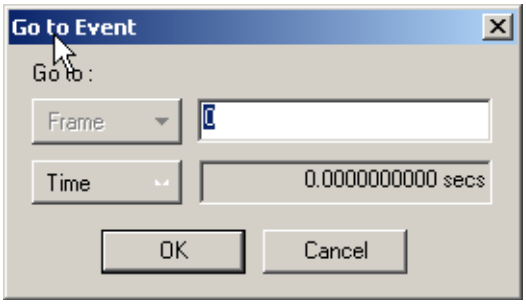


Figure 5.5: Go to Event Dialog.

Go to Marker: Positions the display to the selected marked packet.

Go to: Packet Types, SSP Frames, SMP Frames, Primitives, Errors, Data Lengths, Speed, SATA FIS Type, SATA FIS Port, or Hash Address (Source or Destination).

Find: Displays the Find dialog. See “Find” on page 577.

Find Next: Applies the previous **Find** parameters to the next search.

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

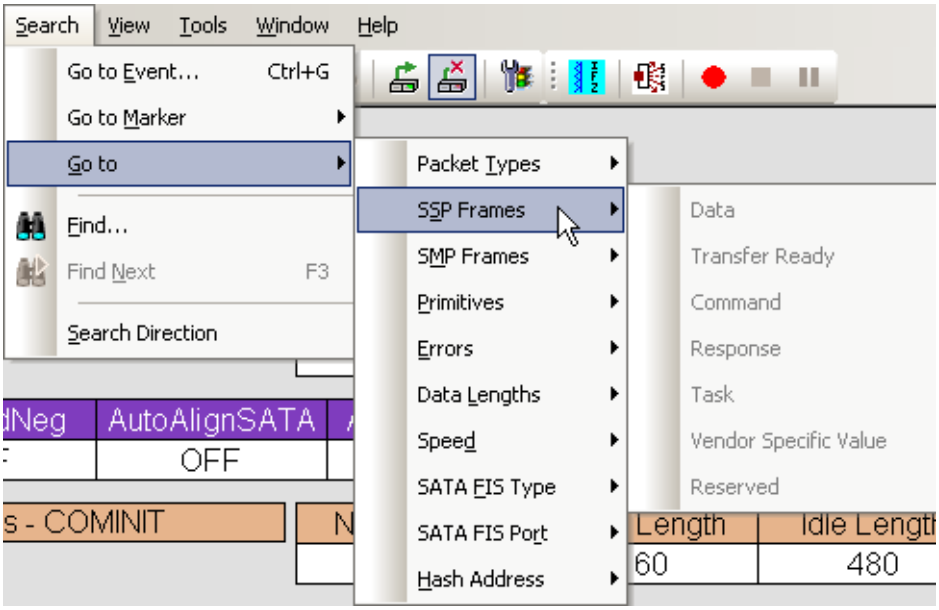


Figure 5.6: Trainer Search Menu.

5.1.5 View Menu

Zoom In: Increases the size of the displayed elements.

Zoom Out: Decreases the size of the displayed elements.

Toolbars: Displays list of available toolbars: Standard, Frequently Used, Generator, Analyzer, Ports, or Customize. See "Resetting the Toolbar" on page 587.

Status Bar: Toggles the Sierra Trainer Status Bar, at the bottom of the window, which shows help messages and the search direction. The right most segment displays the current search direction: Fwd (forward) or Bwd (backward). Change the search direction from the Search menu or double-click the Search Status segment.

Wrap: Wraps displayed packets within the window.

Compact: Displays each row on one line only, with no wrapping.

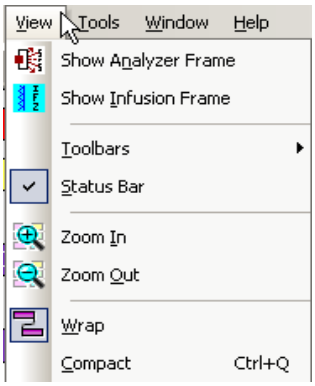


Figure 5.7: Trainer View Menu.

5.1.6 Tools Menu

Hash Address Utility: Opens a dialog that allows you to enter an eight-byte SAS Address to display a Hashed Address.

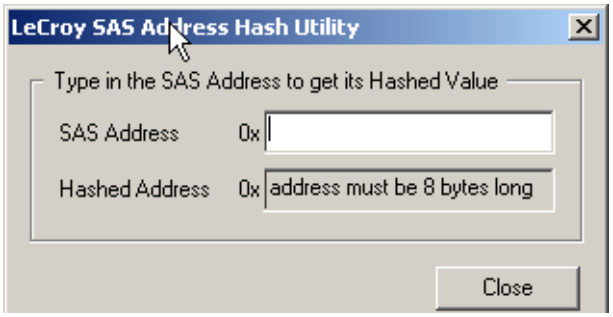


Figure 5.8: Address Hash Utility Dialog.

5.1.7 Window Menu

Cascade: Displays all open windows in an overlapping arrangement.

Tile Horizontal: Displays all open windows in a above-below arrangement.

Tile Vertical: Displays all open windows in a side-by-side arrangement.

Arrange Icons: Arranges minimized windows at the bottom of the display.

Windows: Displays a list of open windows.

5.1.8 Help Menu

Help Topics: Displays online help. You can also select F1.

Check for Updates: Check whether a new software version is available. If so, you can download from the Teledyne LeCroy web site. You can select to Check for updates at application startup.

About: Displays version information.

5.2 Sierra Trainer Main Toolbar

The Sierra Trainer toolbar contains the following buttons:



Figure 5.9: Sierra Trainer Toolbar.

The buttons have the following functions:

	Open Document.		Save As. Opens a dialog in which you can save your edits in the appropriate file type.
	Edit as Text. Edit the text file for the document.		Setup Display Options. Opens the Display Options window.
	Zoom In.		Zoom Out.
	Wrap.		Find.
	Find Next.		Start All Generation.
	Stop All Generation.		Resume All Generation.
	Connect All Link.		Disconnect All Link.
	Setup Generation Options. Opens the Generation Options window.		Launch Jammer (Infusion).
	Launch Analyzer.		Start Recording.
	Stop Recording.		Abort Recording.
	Show Port Configuration Dialog. (See “Ports Configuration” on page 124.)		Show Script Assignment Dialog. (See section below.)
	Tile Windows		Assign Active Script/ Remove Assigned Script for Link 1, 2, 3, or 4 See “Multi-Port Trainer Script Assignments to Links” on page 523.

5.3 Setting Up for Generating Initiator Traffic

Connect the SAS cable from the **Target** port of the Sierra Analyzer to the Target port on the unit under test. This transmits the Traffic Generator stream from the **Target** port to the target-side port on the unit under test.

5.4 Setting Up for Generating Target Traffic

Connect the SAS cable from the **Initiator** port of the Sierra Analyzer to the Initiator-side port on the unit under test. This transmits the Traffic Generator stream from the **Initiator** port to the initiator-side port on the unit under test.

5.5 Creating a Traffic Generation File

Generating traffic is a two-step process.

First, create a text-based Sierra Trainer Traffic Generator file. This text file has an **.ssg** extension. You can create this file by creating a new generator file or editing an existing file.

Note: **ssg** files created in other applications run in the Sierra Trainer.

After the file has been created, it can be opened and displayed in the application. You can invoke the application to transmit the traffic generation file by using the **Start Generation** button  .

Note: For details about traffic generation files, see “Sierra Trainer Generation Language” on page 525.

5.5.1 Creating a New Generator File

You can create a new Sierra Trainer Traffic Generator **.ssg** file.

To create an .**ssg** file:

1. In the Sierra Trainer window, select **File > New GenFile** to display the Global Settings of a new **.ssg** file in a trace view (see Figure 5.10 on page 511).

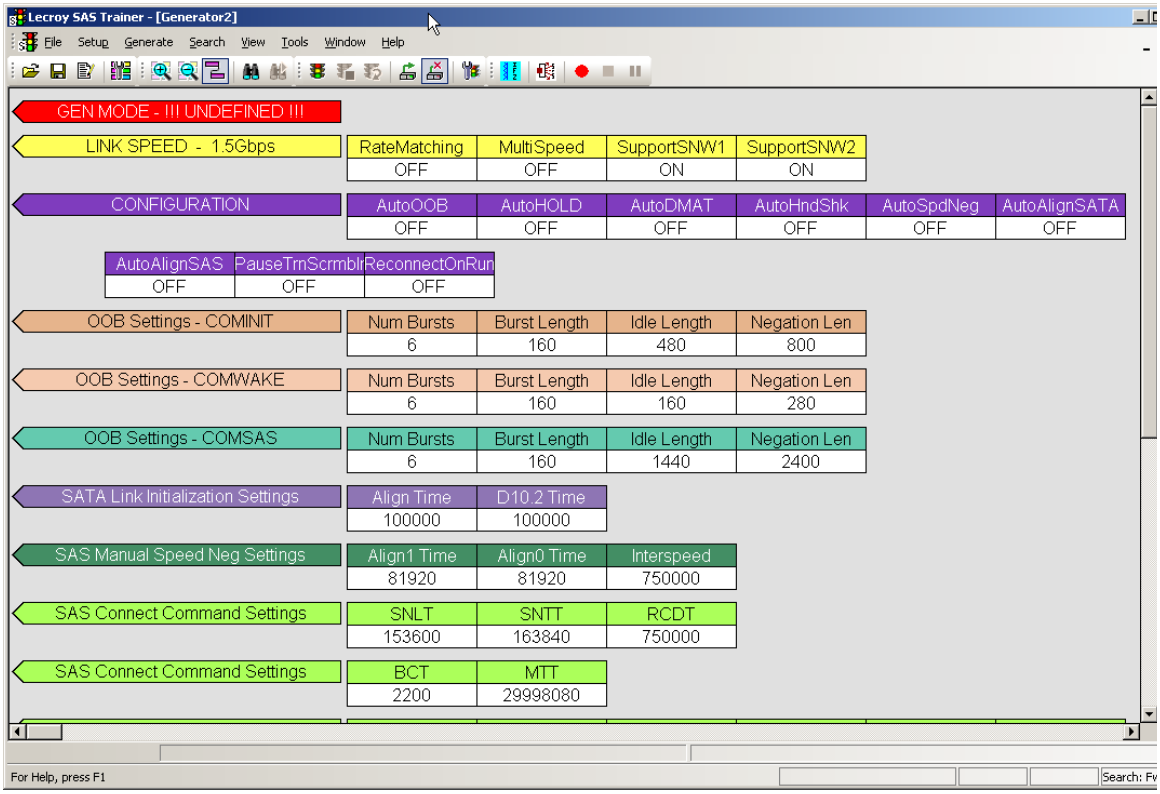


Figure 5.10: New GenFile

2. Click the **Edit as Text** button to enter a Generation Block or Change Settings instructions in the Script Editor. See "Starting the Script Editor" on page 519.

5.5.2 Editing an Example Generation File

The easiest way to generate traffic is to start with one of the example generation files and edit the settings to see how the script file behaves. As you make and save changes, the trace view of the generation file is automatically updated.

The following screenshots show an example file as it appears in the script editor and trace window.

```
%include "Generation\Include\SSPFramesDecl.inc"

Generation
{
   # SendSSPFrameData
   # {
   #     Data = { 21223344 55667788 99AABBCC }
   # }

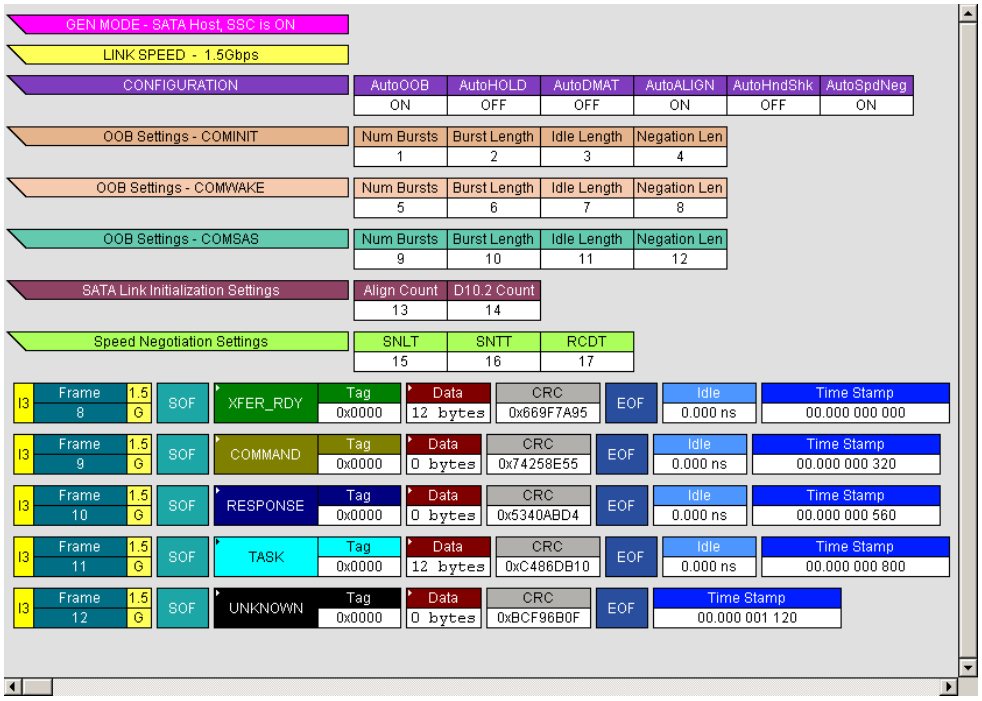
    SendSSPFrameXferRdy
    {
        Data = { 51223344 55667788 99AABBCC }
    }

    SendSSPFrameCommand

    SendSSPFrameResponse

    SendSSPFrameTask
    {
        Data = { 51223344 55667788 99AABBCC }
    }

    SendSSPFrameVendor
}
```



In the screenshot, global settings make up the eight bars at the top of the window. Below that are five frames. If you look at the script itself, there are six frame commands, five active and one commented out.

The following sections describe how to open and edit traffic generation files.

5.5.3 Converting an SATrainer Traffic Generation File

If you have old 2500-based SATrainer Generator **.stg** files (previously used with CATC Tracer/ Exerciser Model120K), you can convert them to Sierra Trainer Traffic Generator **.ssg** files using the legacy **Convert** function.

Perform the following steps to convert an **.stg** file into an .**ssg** file:

1. In the Sierra Trainer window, select **File > Convert > Convert .stg to .ssg** to display an Open dialog.
2. Use Files of Type **SATrainer Generator Files (.stg).**
3. Select an SATrainer Generator ***.stg** file.
4. Click **Open**. The application creates a Sierra Trainer Traffic Generator file (***.ssg**).

Note: SATrainer Generator Files (.stg) are for the CATC Tracer Exerciser model 10K.

5.6 Opening a Traffic Generation File

After the Traffic Generator file (***.ssg)** file has been created, you can open it in the application.

To open a Traffic Generator file:

1. Select **File > Open** on the Menu Bar, or click  on the Toolbar, to display an Open dialog.
2. Select a Generator text file (***.ssg**) and click **Open** to display the file. (The install directory contains example files.)

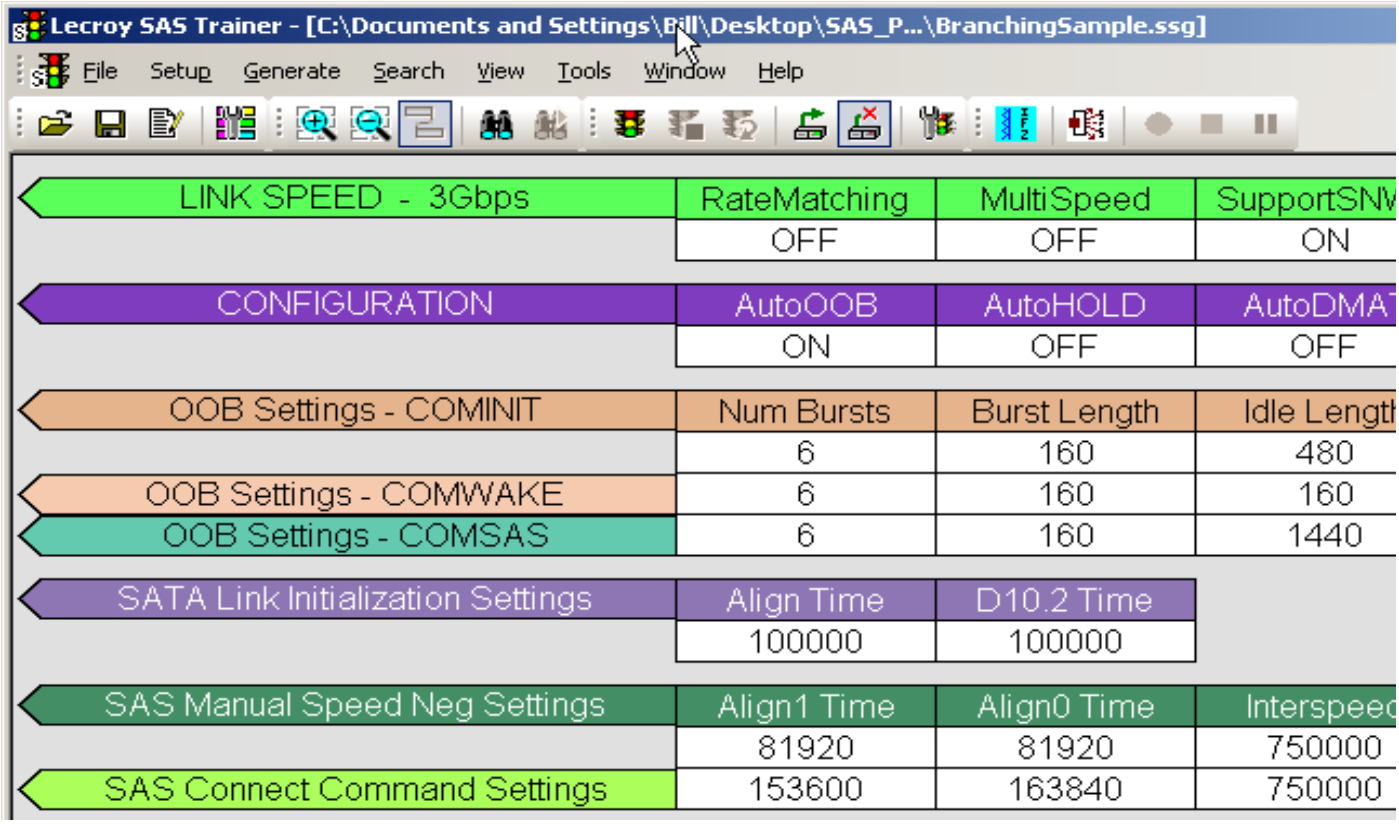


Figure 5.11: Sierra Trainer Generator File

5.6.1 Layout

The **.ssg** file has several colored bars that represent global settings. The bars show the current configuration of the generation file. Example settings are:

- Configuration
- GenMode (SAS or SATA, SSC On or Off)
- Link speed (1.5 Gbps, 3.0 Gbps, or 6.0 Gbps)
- Type of device (Initiator or Device)
- COMINIT
- COMWAKE
- Scrambling Mode

As changes are made and saved to the traffic generation file, the bars immediately update. The traffic pattern to generate appears below the bars as a series of frames. You can edit the traffic generation file to add, edit or remove frames.

5.7 Overview of Generation and Global Settings Files

Example **.ssg** files and **Include** files are in two directories called **\Samples** and **\Include** that are typically installed in: **C:\Users\Public\Documents\LeCroy\SAS SATA Protocol Suite\Generation\Samples**

5.7.1 Traffic Generation (*.ssg) Files

The **.ssg** traffic generation files are text files consisting of **include** statements, a generation block, and optionally global statements.

The generation block is the code responsible for the actual traffic generation. It is marked by the tag **Generation**. The composition and format of the generation block is described later.

```
%include "Generation\Include\Settings.inc"

Generation
{

}
```

The **include** statements provide links to the **Include** files, which provide the definitions for primitives, frames, and settings that hold for most or all of the generation session (global settings).

The definitions for SAS and SATA traffic are contained in Teledyne LeCroy-provided **Include** files: Settings.inc, PrimitivesDecl.inc, AddressFramesDecl.inc, SSPFrames.inc, SMPFrames.inc, and SSPFrames.inc.

5.7.2 Settings.inc File

The **Settings.inc** file contains global statements about the link, the type of device being emulated, and other conditions that are to exist throughout part or all of the traffic generation. This file must be included in the traffic generation file.

There are fifteen groups of settings in this file:

- AutoMode
- COMINIT/COMRESET OOB Signal
- COMWAKE OOB Signal
- COMSAS OOB Signal
- Generation Commands
- Link Speed
- SATA Link Initialization
- SAS Speed Negotiation
- SATA Speed Negotiation
- Autowait:
  - SAS After
  - SAS Before
  - SATA After
  - SATA Before
- Wait Command Timeout
- Scrambling Mode

Details about each group of settings are described in the **Traffic Generation Language** section.

Editing Settings.inc

Text in the **Settings.inc** file can be edited directly or copied into the beginning of the traffic generation file and edited there.

```
%include "Generation\Include\PrimitivesDecl.inc"
%include "Generation\Include\Settings.inc"

Set GenerationMode = GEN_MODE_SATA_HOST

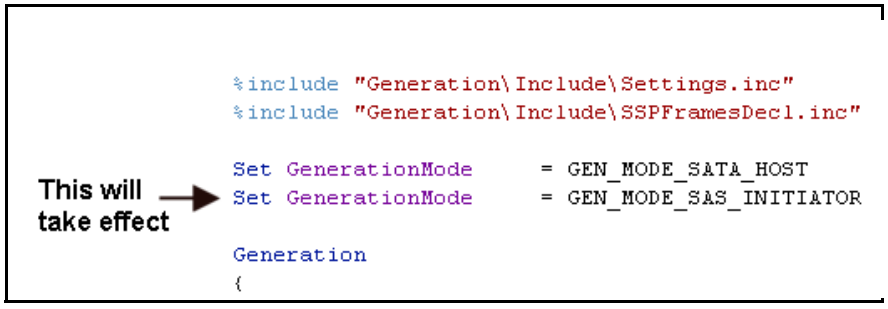
Generation
{

}
```

When editing global settings, keep in mind the following rule: The last line encountered before the generation block takes precedence. Thus, if the following two lines about the device emulation were added just above the generation block, the second would take effect:

set GenerationMode = GEN_MODE_SATA_HOST

set GenerationMode = GEN_MODE_SAS_INITIATOR



5.7.3 The Global Setting "AutoAlign"

AutoAlign is a global setting that may be on or off depending on the type of device you are emulating. There is an AutoAlign setting for SAS and one for SATA, for example, "set AutoAlignSAS = ON" and "set AutoAlignSATA=OFF."

- SAS: Sends AutoAligns every 2048 DWORDs.
- SATA: Sends AutoAligns every 256 DWORDs.

If you plan to set and reset AutoAlign in the middle of traffic generation, you need to know what the defaults are for AutoAlign. The defaults are as follows:

For SATA host/device emulation,:

- AutoAlignSATA is assumed to be ON.
- AutoAlignSAS is assumed to be OFF.

For SAS emulation, the assumptions are opposite:

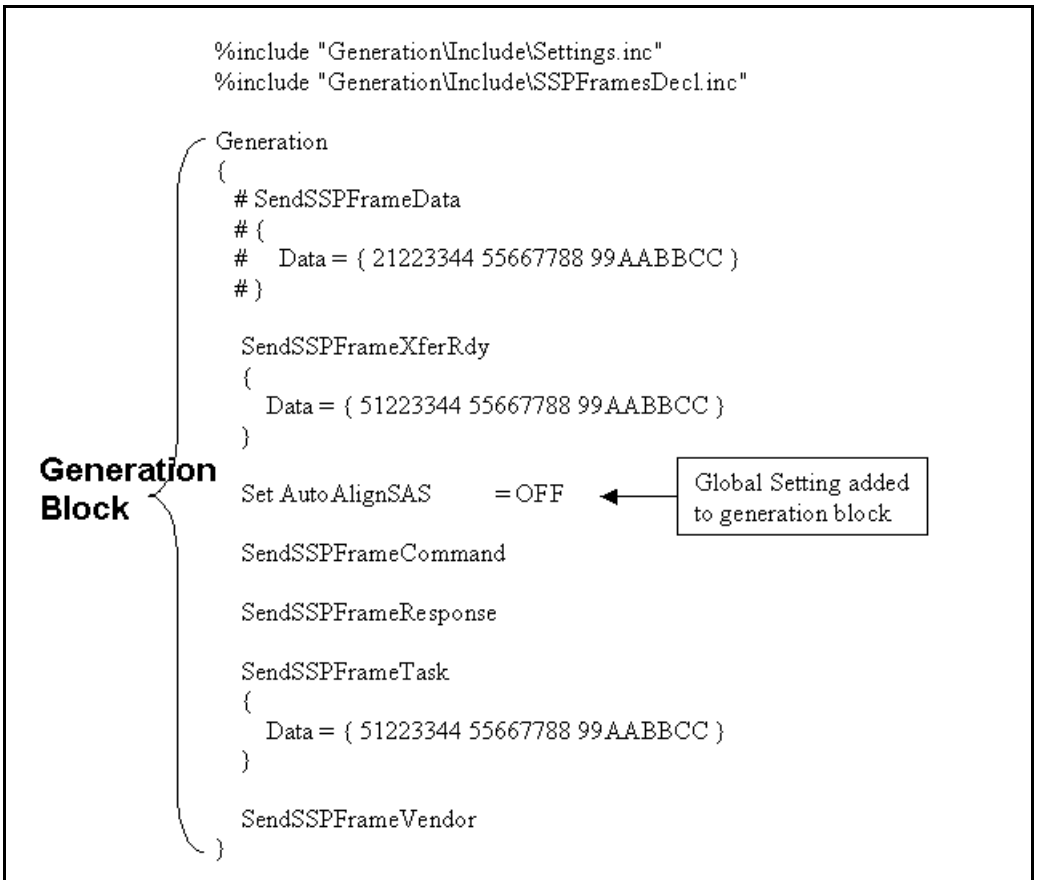
- AutoAlignSATA is assumed to be OFF.
- AutoAlignSAS is assumed to be ON.

For STP:

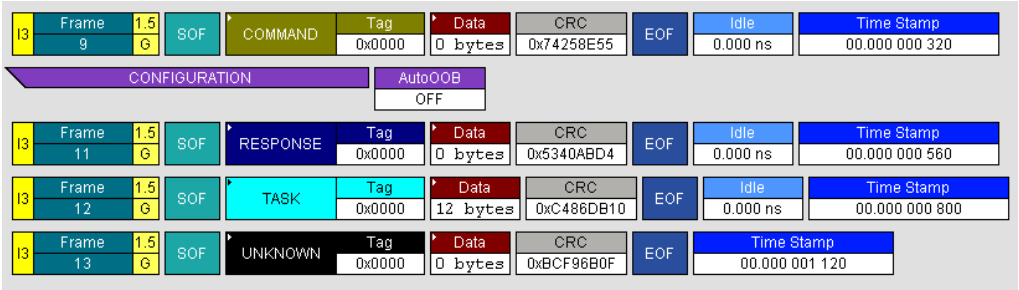
- AutoAlignSAS and AutoAlignSATA are assumed to be ON.

5.7.4 Placing Global Settings in the Generation Block

Some global settings such as AutoAlign = On/Off can be set and reset in the generation block. For example, you might want to set SASAutoAlign = ON prior to traffic generation, and then change to OFF halfway through the generation session.



When placed within the generation block and then viewed in the trace window, global settings appear as colored bars interspersed amidst the traffic.



While most global settings can be set in the generation block, three will be ignored if placed within the generation block:
set Link Speed =
set GenerationMode =
set SSC =

These commands should be configured either in the **Setting.inc** file or at the beginning of the traffic generation file as a global statement.

5.8 Primitive and Frame Definitions

Five other **Include** files are provided that define the most of the known templates for Primitives and Frames. The five are:

- PrimitivesDecl.inc
- AddressFramesDecl.inc
- SSPFramesDecl.inc
- SMPFramesDecl.inc
- STPFramesDecl.inc

Each of the Frame templates defines header and field structure.

The default value for all Frame fields is zero.

5.8.1 Special Conditions for Frames

There are three conditions about Frames that need to be kept in mind when configuring Frame generation:

1. **Frame delimiters need to agree** - At the present time, when defining a Frame, make sure that the Frame Prologue and Frame Epilogue agree. Do not mix types. For example, do not mix a SAS Start of Frame (SOF) with a SAS End of Address Frame (EOAF).

   A SAS SOF should be matched to a SAS EOF. A SAS SOAF should be matched to a SAS EOAF. If generating SATA traffic, a SATA_SOF should be matched to a SATA_EOF.

   At the present time, if you mix different types of prologues and epilogues for any given Frame, the Frame is ignored.

2. **Data Length Fields can be fixed-length or variable** - By default, data frames are of a fixed length. If you want to generate variable length frames, place an asterisk in the Data definition field in the **SSPFramesDecl.inc** file:
   Data : *

```
39
40      ############ DATA ###############
41      Data                        : *     # Variable length field, can be assigned to an array of DWORDs
42
43
```

If you replace the asterisk with a value, then the field becomes fixed length.

3. **CRC Calculations are calculated unless told otherwise** - If the CRC is not explicitly set in the traffic generation file, the application assumes that you want it and calculates and displays it in front of the generated frames.

   If you provide a CRC value, the application uses that value, even if it is incorrect. This gives you the option of configuring the generator to create errors.

If the generation file was created through the Export command (File > Export > To Generator File Format ...), the CRC is calculated but commented out. If the source trace has a bad CRC, the CRC is exported into the generation file and is not commented out.

5.8.2 Primitives Decl.inc File

The **PrimitivesDecl**.inc file defines Primitives. The file consists of declarations (left) and the corresponding byte streams (right).

```
 6   Primitive SOAF                                  = kBC 18 1E 81
 7   Primitive EOAF                                  = kBC 18 67 9F
 8
 9   Primitive "ALIGN (0)"                           = kBC 4A 4A 7B
10   Primitive "ALIGN (1)"                           = kBC 07 07 07
11   Primitive "ALIGN (2)"                           = kBC 61 61 61
12   Primitive "ALIGN (3)"                           = kBC 7B 7B 7B
```

To generate Primitives, copy relevant portions of text on the left (not the bytes shown right) from this file into the generator block section of the **.ssg** file.

5.8.3 Address FramesDecl.inc File

The **AddressFramesDecl**.inc file defines Address frames.

5.8.4 SSPFrames.inc File

The **SSPFrames.inc** file defines SSP frames.

5.8.5 SMPFrames.inc File

The **SMPFrames.inc** file defines SMP frames.

5.8.6 STPFrames.inc File

The **STPFrames.inc** file defines STP frames.

5.9 Starting the Script Editor

To edit an **.ssg** file, use the Script Editor. The Script Edit editing tool displays the **.ssg** file and its supporting **Include** files. The Script Editor utility has several aids to simplify the process of writing and editing scripts: tool-tips, drop-down menus, and colored fields. The Script Editor example below shows several commented lines followed by some instructions. The Script Editor has three areas: toolbar (top), script window, and file tabs (at the bottom of the window). If errors occur, a log opens at the bottom of the window. **Note**: If more than one port of Trainer is licensed, you can assign scripts to one or more ports. See “Multi-Port Trainer Script Assignments to Links” on page 523.

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




```
################################################################################
##  Copyright (C) 2004 Computer Access Technology Corporation                 ##
##                                                                            ##
##  This SASTrainer(TM) generation file contains sample code for              ##
##  wait sessions and conditional branching. It is assumed sample             ##
##  code is to be modified before being generated to a real SAS device.       ##
################################################################################

# Include necessary definition files supplied by CATC.
# The path for include files is considered to start
# in the SASTracer/Trainer program directory.

%include "Generation\Include\Settings.inc"
%include "Generation\Include\PrimitivesDecl.inc"
%include "Generation\Include\SMPFramesDecl.inc"
%include "Generation\Include\WaitCommands.inc"

Set GenerationMode     = GEN_MODE_SAS_INITIATOR
set Speed = LINK_SPEED_3G

# Each generation file must have this main block
Generation
{
    OUTPUT_ON

    ################################################################################
    # Setting timeout value for future wait sessions (µs)
    set WaitTimeout = 239

    ################################################################################
    # Simple wait session with no conditional branching
    WAIT_FOR ( WF_ACK WF_SATA_X_RDY WF_OPEN_RESPONSE )

    ################################################################################
    # Simple wait session with no conditional branching
    # with timeout (previous global timeout value assumed)
    WAIT_FOR ( WF_ACK WF_SATA_X_RDY WF_OPEN_RESPONSE WF_TIMEOUT )

    ################################################################################
    # Simple wait session with no conditional branching
    # with custom timeout (global timeout value ignored and unchanged)
    WAIT_FOR (566) ( WF_ACK WF_SATA_X_RDY WF_OPEN_RESPONSE WF_TIMEOUT )


    ################################################################################
    # Advanced wait sessions with conditional branching
    ################################################################################

    wait  # no timeout value specified - it means we assuyme current global W
    {
        when ( WF_ACK WF_SATA_SYNC )           do
        {
            ACK  (16)
```

Figure 5.12: Script Editor

5.9.1 Script Editor Toolbar

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



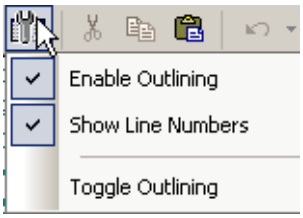
Figure 5.13: Script Editor Toolbar

The buttons have the following functions:

	Save. Saves your edits and immediately updates the setting bars and Frames shown in the trace window.		Add/Remove bookmark. Allows markers to be set or removed to aid in navigation.
	View Options. Opens a menu with three options: Enable Outlining, Toggle Outlining, and Show Line Numbers. See **View Options Menu** below.		Go to next bookmark.
	Cut.		Go to previous bookmark.
	Copy.		Clear all bookmarks.
	Paste.		Find.
	Undo.		Find and Replace.
	Redo.		Go to Trace View
	Print.		Go to Definition of Selected Keyword.
			Open File under Cursor. Opens the file pointed to with the mouse in the script. This command works with **Include** statements.

5.9.2 View Options Menu

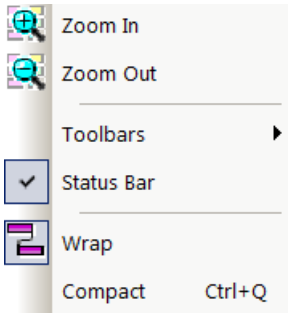
The View Options button displays a menu with the following options:



- **Enable Outlining**: Adds an expandable/collapsible tree structure to the left side of the Script Editor showing the hierarchical relationships of the script lines.
- **Show Line Numbers**: Adds line numbers to the left side of the Script Editor window.
- **Toggle Outlining**: Switches between collapsed and expanded states.

5.9.3 Pop-up Menu

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



- **Zoom In**: Increases the size of the displayed elements
- **Zoom Out**: Decreases the size of the displayed elements
- **Toolbars**: Allows you select the toolbars to display on the top screen.
- **Status Bar:** Toggles between hiding and displaying the status bar showing the port status at the bottom of the screen.
- **Wrap**: Wraps displayed packets within the window.
- **Compact**: Displays each row on one line only, with no wrapping

5.9.4 File Tabs

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



Figure 5.14: File Tab

5.9.5 Error Log

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

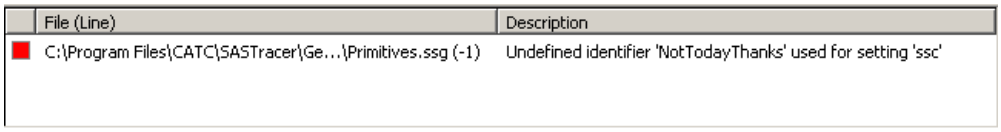


Figure 5.15: Log

5.9.6 Tooltips

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

5.10 Multi-Port Trainer Script Assignments to Links

If more than one port of Trainer is licensed, after you open a generator file (**.ssg**) or create a new generator file ("Creating a Traffic Generation File" on page 510), you can assign scripts to one or more ports.

Click the Port Configuration button to open the Set Port Configuration dialog (see "Ports Configuration" on page 124). Select a port configuration. For example, Trainer may be on Port1 and Port 2 or Port3 and Port4.

After you select port configuration, the Assign Active Script/Remove Assigned Script for Link 1, 2, 3, or 4 buttons have colors. For example, for Trainer on Ports 1 and 2, the buttons are  .

After you open or create a script in the Trainer window, click the L1 or L2 button to assign the script to Port 1 or Port 2. A display appears to the left of the script in the Trainer window.



That link now has link-specific Start, Stop, Resume, Connect, and Disconnect buttons. (See the previous page for the button descriptions.)
Use the link-specific buttons to control each link separately.

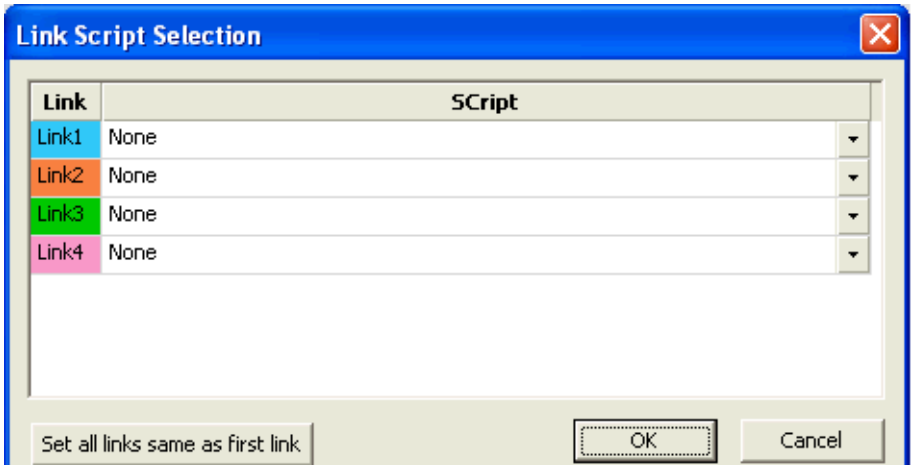
You can click the L1 or L2 button again to remove the script from the link.

After you select port configuration, the Trainer toolbar changes to display the Generation buttons Start All Generation, Stop All Generation, Resume All Generation, Connect All Link, and Disconnect All Link.

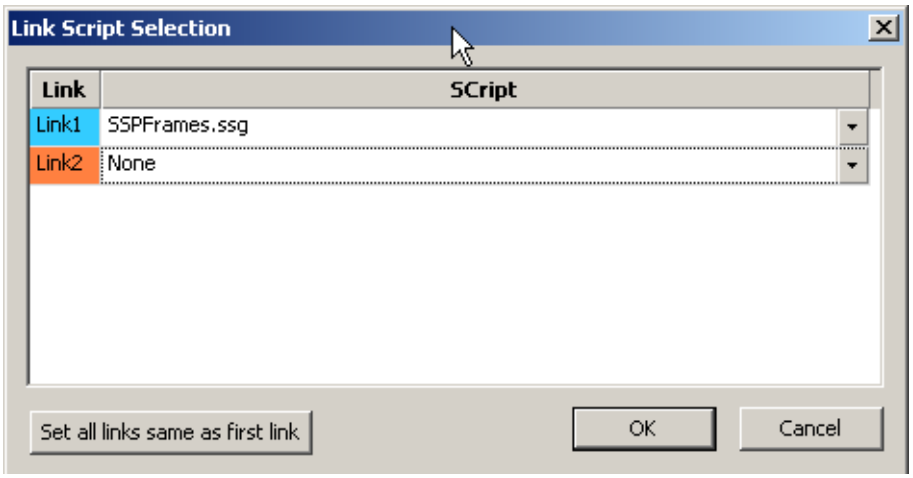


Use these buttons to control all links.

You can click  to open the Link Script Selection script assignment dialog.



For any available Link, you can select any open script from the Script drop-down list.

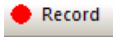


After you select an open script, you can assign or remove a link for that script by clicking **Assign Active Script/Remove Assigned Script for Link.**



5.11 Generating Traffic

After the **.ssg** file has been opened on-screen, recording and traffic generation can begin at any time.

1. (optional) Click 

to begin the recording.
2. If the script does not have a connect block built into it, connect the exerciser to the DUT by clicking the **Connect Link** button  . Clicking this button causes the generator to invoke the various settings in your script (for example, the global settings) and then establish a connection.
3. Click the **Start Generation** button  on the Toolbar.

While generating traffic, a bar appears on the right of the trace view, indicating that traffic generation is taking place. (The green light on the Traffic signal button also blinks during traffic generation).

5.11.1 Stop Traffic Generation

Normally, traffic generation stops automatically when the application reaches the end of the Generator file.

To manually stop traffic generation, click the **Stop Generation** button  .

5.11.2 Resume Traffic Generation

If traffic generation is stopped prior to the end of the script, it can be resumed.

To resume traffic generation, click the **Resume Generation** button  .

5.12 Sierra Trainer Generation Language

The Sierra Trainer File Generation Language is an API that allows you to separate traffic into text commands. These commands are used construct primitives and frames that are sent to the host or the device.

5.12.1 File Structure

Traffic Generation files (***.ssg**) should have the following structure:

Declarations

- Global generation settings
- Constants
- Data patterns
- Chain of symbols (primitives, raw data)
- Packet templates

Note: Some declared objects could be used in further declarations as long as they are previously declared. No forward declarations are allowed at this time.

Generation Blocks

- List of generation instructions

Note: It is possible to create many generation blocks, but currently only a block with the name 'Generation' executes. (Calls of some blocks from another blocks are not currently allowed.)

5.12.2 Language

Comments

#' is the Comment symbol. The line remainder after this symbol is ignored.

/*' '*/' is a Comment Block. All the text between '/' '*' and '*' '/' is ignored.

```
/*
    This is an example of a block of comments.
*/
```

Includes

The directive **%include "FileName.inc"** includes the file **FileName.inc**. This lets you add common definitions and templates into new scripts.

The language parser makes sure the same file is not included more than once.

Example:

```
%include "SomeInc.inc"
# This directive actually includes file 'SomeInc_1.inc'.
```

%inline is the same as **%include**, but without the Language parser check.

5.12.3 Settings

The **Set "Constant Name" = Value** statement sets different constants/modes using the following value types:

- Predefined constants (TRUE, FALSE, ON, OFF, INFINITE)
- Numbers

Examples:

```
Set AutoAlignSATA=ON
Set WaitTimeOut=239
```

5.12.4 Constants

Only unsigned integers can be defined as constants. Some constants are predefined in Sierra Trainer.

Examples:

```
Const SOME_HEX_DATA = 0xAABBFFEE #defines hexadecimal constant
Const SOME_DEC_DATA = 12     # defines decimal constant
Const "SOME DEC DATA" = 64     # defines decimal constant
Const "Some Hex Data" = 0xCDCDBEBE
```

5.12.5 Predefined Constants

- TRUE
- FALSE
- ON

- OFF
- INFINITE

5.12.6 Data Patterns

Data patterns are streams of hexadecimal values. Using '['']' lets the user include constants or predefined data pattern in another pattern.

Examples:

```
DataPattern PATTERN_1 = AAAABBBB [SOME_HEX_DATA] EEEEFFFF   1210ABB1
AAAABBBB 1210ABB1 AAAABBBB 1210ABB1 AAAABBBB 1210ABB1 ["SOME DEC
DATA"] 1210AB
DataPattern PATTERN_2 = 00000000 11111111 22222222 33333333 AAAABBBB
55556666 FEFEFEFE CDCDCDCD 9999BBBB 12343434 6767676B 56BBFF
DataPattern PATTERN_3 = [PATTERN_1] FFFFFFFF EEEEEEEE [SOME_HEX_DATA]
DataPattern SOME_PATTERN = BBBBBBBB DDDDDDDD
```

5.12.7 Primitives

Primitives can be defined using the following:

- Byte values ('k' indicates control symbol). The 10b codes are calculated based on the current running disparity
- Primitives are completely interchangeable with SymChains.

Declaring Raw Data Definitions

Primitive primitive_name = byte_data ... byte_data # (byte_data is Decimal, Hex, 10b, K type or D type format)

SynChain raw_data_name = byte_data ... byte_data # (byte_data is Decimal, Hex, 10b, K type or D type format)

RawData { param_data ... param_data } #(param_data is byte_data, primitive or variables)

Example:

```
Primitive "CHAIN (ONE)" = kBC 1E 1E 1E kBC 1A 0F
SymChain ChainTwo = k28.5 D12.3 D10.2 D11.6
SymChain ChainThree = k28.3 3EA 25 k18 IFA
Primitive SOF = kBC 18 E4 67
Primitive EOF = kBC 18 F0 9B
SymChain raw_data_1 = K28.1 D23.3 D11.4 D14.6
SymChain raw_data_2 = 345 160 023 K15.3 K28.1 D23.3 D11.4 D14.6 # some
RD errors will occur
raw_data_1 ( 1000 ) # send defined above pattern raw_data_1 1000 times
raw_data_2 (  10 )  # send defined above pattern raw_data_2   10 times
raw_data_2 ( 195 )  # send defined above pattern raw_data_2  195 times

RawData { 217 2E1 351 362 }# send RawData pattern - some RD errors
will occur
RawData { K28.1 D23.3 D11.4 D14.6 }    # send RawData pattern
```

Sending OpenAddressFrame Using Standard Frame Templates	Sending the Same OpenAddressFrame Using Raw Data Mechanism
SendOpenAddressFrameSTP {	Set ScramblingMode = SCRAMBLING_MODE_SAS
SourceAddress = { 500805EF FFFF0041 }	RawData {
DestinationAddress = { 500062B0 00000030 }	K28.5 D24.0 D30.0 D01.4
ArbitrationWaitTime = 0x1	21 08 00 01
AccessZoneManagement= 0x0	50 00 62 B0
SourceZoneGroup = 0x0	00 00 00 30
ConnectionRate = 0x8	50 08 05 EF
Features = 0x0	FF FF 00 41
InitiatorConnectionTag = 0x1	00 00 00 01
InitiatorPort = 0x0	00 00 00 00
MoreCompatibleFeatures = 0x0	05 0F 19 E0
PathwayBlockedCount = 0x0	K28.5 D24.0 D07.3 D31.4 }
# CRC = 0x050F19E0 # good crc }	* CRC is inserted manually

```
# RawData with variables embedded
RawData {
K28.5 D24.0 D30.0 D01.4
@variableName1
50 00 62 B0
00 00 00 30
50 08 05 EF
$C
00 00 00 01
00 00 00 00
SendCRC
K28.5 D24.0 D07.3 D31.4 }
}
```

When there are variable values in RawData, you must include SendCRC command instead of last dword. Otherwise, wrong CRC value will be sent. The constraints are:

- Variables are not allowed on First and LAST DWORD (instead of start/end frames).
- SendCRC is only supported on last DWORD before end of frame.

- Raw 10 bits codes. This definition might cause running disparity errors.

Example:

```
Primitive "CHAIN (TWO)" = 305 2D4 1E4 362
```

- Mixed bytes and 10b codes. This definition might cause running disparity errors.

Example:

```
Primitive "CHAIN (TWO)" = 305 2D4 1E4 362 ["CHAIN (ONE)"]
```

SendBulk/SendInc

In order to instruct the trainer to send a bigger volume of data inside a rawdata frame, you may use the following commands:

SendBulk (@varName, repeat)

This command sends the value in the 32-bit variable for 'repeat' number of times.

SendInc (@varName, repeat)

This command sends the value in the 32-bit variable for 'repeat' number of times, by incrementing the variable by 1 in each iteration.

Example:

```
@TxData = 0
rawdata
{
K28.5 D24.0 D04.7 D07.3
11 11 11 11
SendInc (@TxData, 0xA)
22 22 22 22
SendCRC
K28.5 D24.0 D16.7 D27.4
}
```

5.12.8 Packets/ Frames

Using the "Frame" or "Packet" keyword, you can define a frame of traffic to use in the generation stream. Declarations of prolog and epilog may be mixed with field declarations.

```
Frame "name" : "parent name"
{
Field Definition 0: "Field Name : Field Length = Default Value"
…
Field Definition n: "Field Name : Field Length = Default Value"
Primitive Definition 0: "Primitive name, offset, count"
…
Primitive Definition m: "Primitive name, offset, count"
Prolog = "primitive name"
Epilog = "primitive name"
}
```

Field Definition

- Field length is in bits. '*' means that the length is variable and is set based on the assigned value.
- Field starting offset is calculated from frame start based on the length of the previous fields.

Examples:

```
Field32     : 32 = 0xAABBFFEE
FrameType   : 8  = 12
HashedDest  : 24 = HEX_DATA
Reserved1   : 8  = 0xDA
Field16     : 16 = 0xAAAA
Reserved2   : 8  = 0xAD
CRC         : 32
```

Data field Definition

- **Data = { pattern }**: Pattern is assigned to Data.
- **Data = count, value**: A pattern of “count” times “value” is assigned to Data.
- **Data = count, start value, step**: A pattern of values starting with “start value” with steps of “step” and a length of “count” is assigned to Data.

Primitive Definition.

Primitives are inserted into the frame payload. Primitive definitions are inherited by descended frame templates.

- Assigning '*' clears all previous settings (maybe from parent frame template).
- Offset specifies the DWORD offset where this primitive is inserted in the Frame.
- Count specifies how many times to repeat the primitive.

Examples:

```
Primitive : *
Primitive : SOF, 48   # where 48 = offset
Primitive : "CLOSE (NORMAL)", 36, 5   # where 5 = repeat
```

Prolog and Epilog define Primitive chains to be used at the beginning and end of the frame.

Examples:

```
Prolog = SOF # For this frame primitive 'SOF' is a Prolog.
Epilog = EOF # For this frame primitive 'EOF' is an Epilog.
```

Frames can be derived from other Frames, therefore inheriting the layout of the parent Frame. In this case, the user may:

- Change Prolog and Epilog.
- Change default field values.
- Add new fields.

Frame Examples

```
Frame  Some_Frame
{
```

```
    Field32     : 32 = 0xAABBFFEE
    FrameType   : 8  = 12
    HashedDest  : 24 = HEX_DATA
    Reserved1   : 8  = 0xDA
    Field16     : 16 = 0xAAAA
    Reserved2   : 8  = 0xAD
    Data        :  * = PATTERN_1
    CRC         : 32

    Primitive : *
    Primitive : SOF, 48
    Primitive : SOF, 96
    Primitive : "CLOSE (NORMAL)", 36, 5

    Prolog = SOF
    Epilog = EOF
}
Frame Some_Frame_1 : Some_Frame
{
    Field32 = "Some Hex Data"
    Data    = { 11111111 22222222 33333333 44444444 55555555 }
    Opcode    : 128, 8, 0x2A
    LBA       : 64

    Primitive : *
    Primitive : "CLOSE (NORMAL)", 24, 48

    Prolog = "CHAIN (ONE)"
    Epilog = "CHAIN (ONE)"
}
```

5.12.9 Generation Block

Sierra Trainer generates the stream that is defined in this block.

```
Generation
{
Chain Definition (Repeat = N, Idle = M)
Chain Definition (N, M)
Chain Definition
Frame Definition
Frame Definition (RunningDisp = ON/OFF)
Frame Definition
{
Field Definition
Data Definition
} (Repeat = N, Idle = M, RunningDisp = ON/OFF)
}
```

5.12.10 Definitions

Chain Definition:

- Without any parameters, the chain is sent once.
- With “Repeat” and “Idle” parameters, the chain is sent N times and then nothing

is sent (idle) M times. “Repeat” and “Idle” are optional.

Frame Definition

- Without any parameters, send the frame based in default values.
- With “RunningDisp” ON, send the frames based on default values and insert a running disparity error.
- With parameters overriding or adding to a template frame, with or without injection of an overriding or adding to a template frame, with or without injection of running disparity error.

Field Variable Declarations

You can declare a variable (var_name) as a frame of type (frame_type):

```
$var_name = frame_type
```

Note: Frame variables can be declared/re-declared and used many times.

Changing Frame Fields

You can change some fields in a frame variable.

```
Change var_name { field_name = value }
```

Preprocessor Integer Arithmetic

You can declare DWORD variables, make arithmetic operations, and use them in field and parameters assignments.

Note: Arithmetic expressions are allowed only in numeric variable assignments.

Examples:

Legal Operations

```
x = 2
y = ( z = 12 ) + ( SOME_DEC_DATA + 36 ) / 8
z = 0x1 << 5
s = "Some Hex Data" # constant may be used in operations

x++
y--
z += ( x + y )
x = ( ( y & 0xFF ) >> 5 ) / 12

SOF ( Repeat = x, Idle = y )

X
{
Field16 = 0xEEEE   # Example of the data payload assignment which uses
both integer variables, constants, hex literals and data patterns
Data    =  { y y y y 7a7a7a7a "Some Hex Data" "Some Hex Data" 8b8b8b8b
z z z z [PATTERN_3] }
}
( Repeat = 10, Idle = y )  # uses integer variable for parameter/
setting.
```

Illegal operations

```
x = y + 2
SOF ( Repeat = (x+y)*7 )
# - illegal, use z = (x+y)*7  SOF ( Repeat = z ) instead
```

5.12.11 Loops

Loops can be used in two modes:

1. Using an integer number, loop a specified number of loops. This number has to be smaller than 64,000.
2. Using the word “infinite”, loops for ever.

```
Loops ( loop_count/Infinite )
{
 send instructions
 assignments
 change values
 send instructions
}
```

Example:

```
LOOP( 50 )
{
        "CHAIN (ONE)"
        "CHAIN (TWO)"
        Some_Frame
        $Y = Some_Frame { Data = 256, 0xFEFEFEFE }
        Y
        Change Y { Field32 = x }
        Y
        Y
}
```

Note: The Trainer can support up to 4 levels of nested loops.

5.13 Trainer Script Enhancements

The Trainer script language can already produce SAS/SATA Primitive Sequences and Frames.

The Trainer script enhancements described in this section allow generation of Commands and Application Layer sequences (as in the Exerciser), by processing received frames, making complex decisions, and generating the contents of frame in run-time, for both RX and TX. Variables can keep the run-time state of the bus. Low-level commands can manipulate variables and use variables to create patterns.

Trainer language can perform SATA compliance tests with fast SSD devices and provide a SSD performance test tool with limited output data patterns. Trainer has sequential/random LBA command generation and full NCQ support.

Trainer can be programmed to act as SAS Initiator, SAS Target, SATA Host, or SATA Device.

SAS Initiator

As an Initiator, Trainer can send commands in all protocols (SSP/STP/SMP) and interact with its peer to complete the command in normal conditions and some popular error conditions. Limitations are:

- Uses only one command at a time.
- Does not save Read data or reuse bulk read data for next commands.
- Sends only limited Write data patterns.
- Has tight flow control, due to limited RX frame processing.

SAS Target

As a Target, Trainer can receive commands in all protocols (SSP/STP/SMP) and respond to them in normal conditions or some popular error conditions. Limitations are:

- Uses only one command at a time. Command queuing is not supported.
- Does not save incoming write data. Sends back data for all LBAs or generates counter/random data. Cannot be used as a real formatted partition.
- Has tight flow control, due to limited RX frame processing.

SATA Host

As a Host, Trainer can send commands and complete them in normal or some popular error conditions. SATA Host can issue NCQ commands, necessary for SATA compliance tests on SSD devices. Limitations are:

- Does not save Read data or reuse bulk read data for next commands.
- Sends only limited Write data patterns.

SATA Device

As a Device, Trainer can receive commands and respond to them in normal or some popular error conditions. Limitations are:

- Uses only one command at a time. Command queuing is not supported.
- Does not save incoming write data. Sends back data for all LBAs or generates counter/random data. Cannot be used as a real formatted partition. To use the Trainer as a SATA Device in real configurations, only tools like IO-METER (that can work with un-partitioned and un-formatted drives) can be used.

5.13.1 Variable Definition

Variable definition is like definitions in programming languages. You can define up to 512 DWORD (32-bit) variables. There is no constraint on variable names, except you cannot use keywords. Variable scopes are general and you should define them in the script header before the generation block.

The syntax of variable definition is:

```
VAR32 @VariableName1, @VariableName2, ...
VAR64 @VariableName
```

VAR64 holds field values greater than 32 bits, such as SASAddress.

Note: Variable names should start with @.

5.13.2 Assigning Variable Values

You can set variable values in different ways:

- **Constant value:** `@varName1 = 1234`
- **Other variable value**: `@varName1 = @varName2`
- **Result of expression on other variables**:
  `@varName1 = @varName1 + @varName2`
- **Fields of last received frame**: `@varName1 = (SSPFrame)LRF::Frame-Type,`
  where LRF is Last Received Frame

Note: Specifying packet type (SSPFrame) before LRF causes last received frame to be this packet type, and field start-bit position is calculated according to the packet-type definition.

- **Part of last received frame**:
  `@varName1 = LRF[startBitOffset:endBitOffset]`,
  where offsets are bit based

Example:

```
SendSSPFrameCommand_Initiator
    {Data = LRF[startBitOffset:endBitOffset] )
Tag = 0x101}
```

The constraints are 1) Length bigger than 64 bit is not supported and 2) Offsets (StartBitOffset and EndBitOffset) should be in same DWORD, except for length bigger than 32.

- **Random values**: `@varName1 = Random`

5.13.3 Expression on Variables

Mathematical expressions, such as sum, subtract, and shift:

```
@varName1 + @varName2
@varName1 - @ varName2
@varName1 & @varName2
@varName1 | @varName2
@varName1  <<  2
```

Logical expressions, such as compare, equal, not, and, and or:

```
@varName1  >  @varName2
@varName1 < @ varName2
@varName1 ==  @varName2
@varName1 != @ varName2
 (logical expression1) &&  (logical expression2)
(logical expression1) || (logical expression2)
```

Complex expressions (combination of different operators) with prioritizing supported:

```
(@varName1 + @varName2) > @varName3
```

5.13.4 If/While in Logical Expressions

Like programming languages, scripts allow conditional statements.
The **if/while** syntaxes are:

```
If (expression)then
{
        ….
}
else
{
       ….
}

While(@VarName)
{
     …….
}
```

Example for if, then else:

```
@HT_RxFISType = LRF[0:7]
#LRF_SATA_FIS_TYPE_START_BIT:LRF_SATA_FIS_TYPE_END_BIT
if  (@HT_RxFISType == SATA_FIS_TYPE_DMA_ACTIVATE)   then  {…}
 else { if (@HT_RxFISType == SATA_FIS_TYPE_DATA) then  {…}
            else { if (@HT_RxFISType == SATA_FIS_TYPE_RD2H)  then  {…}
} }
```

Example for while:

```
while (@NCQ_Temp0)   {
      @NCQ_Temp1= @NCQ_Temp1 >> 1
      If (@NCQ_Temp1 != 0) then { … }
      @NCQ_Temp0 = @NCQ_Temp1 & 0x00000001     }
```

Note: In this release, **while** condition is limited to simple variable values only. Combining operators is not allowed in **while** expressions. You should move such expressions inside **while** block.

Note: Nested **while** and **if** are supported.

Wait/When/Do in Logical Expressions

The **wait/when/do** syntaxes are:

```
wait (time)
{when
{exp}do
{
      ….
}
elsewhen
{
{exp}do
{
      ….
}
on_timeout
{
      ….
}}
```

Example:

```
wait  { #no timeout use global WaitTimeout value default 1000 useconds
(1 ms)
    when  {WF_OPEN_ACCEPT}   do   { … }
    elsewhen  {WF_OPEN_REJECT}   do   { … }
    on_timeout  { … }     }
```

Example:

```
wait_for (100000)  { WF_OPEN_ACCEPT  WF_TIMEOUT}  { … } # (100 ms)
```

Note: Nested wait should not exceed 2 deep. Use a procedure call to extend wait logic sequence. Wait + Wait_For ok.

5.13.5 Using Variable Values in Creating Patterns on Bus

In creating patterns to send on bus, trainer script allows using variables. In these cases, because the created pattern is dynamic, it is not possible to do scrambling and calculating in software code. These tasks are done in the hardware engine. To activate, set “Auto scramble mode” in “on” state.

The following examples show uses of variables in creating patterns.

Use variable for field value:

```
SendOpenAddressFrameSSP
{
InitiatorPort = 0x1
    InitiatorConnectionTag = @variableName1
…....
}
```

The constraints are:

- Field Length bigger than 64 bit is not supported.
- Field StartBitOffset and EndBitOffset should be in same DWORD, except for length bigger than 32.

Use LRF directly for field value:

```
SendSSPFrameCommand_Initiator
{
    Data = LRF[startBitOffset:endBitOffset]
    Tag  = 0x101
}
```

The constraints are:

- Length bigger than 64 bit is not supported.
- Offsets (StartBitOffset and EndBitOffset) should be in same DWORD, except for length bigger than 32.

```
SendSSPFrameCommand
 {
#Data = {00112233 @variableName1 @variableName2 44556677}
 }
RawData {
 K28.5  D24.0  D30.0  D01.4
              @variableName1
              50     00     62     B0
              00     00     00     30
              50     08     05     EF
              $C
              00     00     00     01
              00     00     00     00
              SendCRC
              K28.5  D24.0  D07.3  D31.4 }
}
```

When there are variable values in RawData, you must include **SendCRC** command instead of last DWORD. Otherwise, wrong CRC value will be sent.

The constraints are:

- Variables are not allowed on First and LAST DWORD (instead of start/end frames).
- **SendCRC** is only supported on last DWORD before end of frame.

```
SendSATAFrame
{
  SATA_SOF
  SATA_DATA ( 0x11223344 )
  SATA_DATA (@variableName1)
  SATA_DATA ( 0x55667788 )
  #SATA_CRC ( 0x99AACCBB ) # good crc - can be changed to bad
  SATA_EOF
}
```

If **SATA_CRC** command is not included, trainer engine computes and inserts correct CRC in pattern.

5.13.6 Timer

Trainer script syntax allows using some timers. You can start a timer anywhere. The timer current value is loadable on variable to be used in expressions and conditions on this expression. There are four timers, named A, B, C, and D.

Starting timer (setting timer value to zero) syntax is:

```
CLEAR_TIMER_A
CLEAR_TIMER_B
CLEAR_TIMER_C
CLEAR_TIMER_D
```

Loading timer current value in variables:

```
@varName1 =TIMER_A
@varName1 =TIMER_B
@varName1 =TIMER_C
@varName1 =TIMER_D
```

Example:

```
CLEAR_TIMER_A
While(@Counter < MaxPeriodCount) {
                  … @Counter = TIMER_A … }
```

5.13.7 PATTERN Counter

Trainer script syntax allows you to use counters on a number of defined events in generation settings.

Syntax for loading counters in variables is:

```
@varName1 = COUNT_REC_RESOURCE_OUTPUT_A
@varName1 = COUNT_REC_RESOURCE_OUTPUT_B
```

```
@varName1 = COUNT_REC_RESOURCE_OUTPUT_C
@varName1 = COUNT_REC_RESOURCE_OUTPUT_D
@varName1 = COUNT_REC_RESOURCE_OUTPUT_E
@varName1 = COUNT_REC_RESOURCE_OUTPUT_F
```

Syntax for clearing (resetting) counters is:

```
CLEAR_REC_RESOURCE_OUTPUT_A
CLEAR_REC_RESOURCE_OUTPUT_B
CLEAR_REC_RESOURCE_OUTPUT_C
CLEAR_REC_RESOURCE_OUTPUT_D
CLEAR_REC_RESOURCE_OUTPUT_E
CLEAR_REC_RESOURCE_OUTPUT_F
```

Example:

```
CLEAR_REC_RESOURCE_OUTPUT_A
While(@Counter < MaxPrimitiveCount) {
      … @Counter = COUNT_REC_RESOURCE_OUTPUT_A … }
```

5.13.8 Procedure Definition

Procedures allow creating simple syntaxes for complex reusable parts in scripts. You can write such code once as a procedure and use everywhere required.

Procedure definition syntax is:

```
procedure procedureName
{
...
}
```

Calling procedure syntax is:

```
Call procedureName
```

5.14 Sierra Trainer Generation Commands

5.14.1 General Commands

IDLE (n)	Generator will insert n idle DWORDs into the generation stream.
CLEAR_CREDIT_AVAIL	This commands clears the credit established with the command WF_CREDIT_AVAIL. (See WF_CREDIT_AVAIL in following section on Wait Commands for explanation).
RD_ERROR	Generator will insert one idle DWORD into the generation stream, which will intentionally break RD sequence creating RD error.

CONNECT	Generator will go through connection sequence using current GenFile settings (gen mode, speed, and so on). Generation will not resume until connection is established.
DISCONNECT	Generator will break existing connection to DUT.
PAUSE	Generator will come to a break and the user will be able to resume generation by pressing Resume button on Generation toolbar. Generator shall transmit idle DWORDs while in the Pause.
OUTPUT_ON	Takes the Trainer out of Electric Idle state. If it is already out of Electric Idle, this is a NOP.
OOB Commands	
COMINIT	Generator will send COMINIT OOB signals using current COMINIT settings.
COMRESET	Generator will send COMRESET OOB signals using current COMRESET settings.
COMWAKE	Generator will send COMWAKE OOB signals using current COMWAKE settings.
COMSAS	Generator will send COMSAS OOB signals using current COMSAS settings.
SATA_ALIGN	Generator will go through SATA_ALIGN stage of SATA SpeedNeg process using current SATA_ALIGN settings.
SATA_D10_2	Generator will go through SATA_D10_2 stage of SATA SpeedNeg process using current SATA_D10_2 settings.
SPEED_NEG_RCDT	Generator will go through SPEED_NEG_RCDT stage of SAS SpeedNeg process using current SPEED_NEG_RCDT settings.
SPEED_NEG_ALIGN0	Generator will go through SPEED_NEG_ALIGN0 stage of SAS SpeedNeg process using current SPEED_NEG_ALIGN0 settings.
SPEED_NEG_ALIGN1	Generator will go through SPEED_NEG_ALIGN1 stage of SAS SpeedNeg process using current SPEED_NEG_ALIGN1 settings.

Set Speed = LINK_SPEED_1_5G	Generator will change speed to 1.5G (if MultiSpeed is enabled). This settings is not applied when Advanced Connect is set.
Set Speed = LINK_SPEED_3G	Generator will change speed to 3G (if MultiSpeed is enabled). This settings is not applied when Advanced Connect is set.
Set Speed = LINK_SPEED_6G	Generator will change speed to 6G (if MultiSpeed is enabled). This settings is not applied when Advanced Connect is set.
Set RX_Speed = LINK_SPEED_XXG	Allows user to set the specific speed for the receivers. XX = 1.5 / 3 / 6 LINK_SPEED_1_5G LINK_SPEED_3G LINK_SPEED_6G
DevSlp	Makes the device-sleep or Power-Disable signal to go high. Trainer doesn't go to Electric idle mode automatically after this command. We can force trainer to go to DC Idle mode using the "disconnect " command after this command. This command works when Generation mode is GEN_MODE_SAS_INITIATOR or GEN_MODE_SATA_HOST
Exit_DevSlp	Makes Device-sleep or Power-Disable signal to go low (comes out of device sleep or power disable mode). This command works when Generation mode is: GEN_MODE_SAS_INITIATOR or GEN_MODE_SATA_HOST
PwrDisable	Makes the device-sleep or Power-Disable signal to go high. Trainer doesn't go to Electric idle mode automatically after this command. We can force trainer to go to DC Idle mode using the "disconnect " command after this command. This command works when Generation mode is GEN_MODE_SAS_INITIATOR or GEN_MODE_SATA_HOST

Exit_PwrDisbale	Makes Device-sleep or Power-Disable signal to go low (comes out of device sleep or power disable mode). This command works when Generation mode is: GEN_MODE_SAS_INITIATOR or GEN_MODE_SATA_HOST
Send_Phy_Capability	Generator will send PHY Capability Bits. (this command is used in SNW3).
Send_Train_TrainDone	Generator will send Train/Train Done Patterns. (This Command is used in Train Windows).
Delay (#)	Generator will wait until # ns before executing next command.
Power_Expansion_On Power_Expansion_Off	Switch on power expansion card. Switch off power expansion card
Exit (ExitCode/Variable)	Call this command in any branch of the Trainer program to stop execution. The Exit code can be specified either with a constant or a variable. When the variable name is recognized, the trainer reads the data in the specified variable and considers it as the exit code. Note: The maximum value that is allowed for the exit code is 255 (0xFF). After exit, the Port Status dialog displays the exit code. **Note:** The Trainer GUI has LED indicators: Green is for pass. Red is for fail. No color is for unknown or for user to review.

set_trainer_interconnect_signal_1 or settrainerinterconnectsignal_1	Set these signals to allow other ports to wait on them using WF_TRAINER_INTERCONNECT_SIGNAL_1
set_trainer_interconnect_signal_2 or settrainerinterconnectsignal_2	Set these signals to allow other ports to wait on them using WF_TRAINER_INTERCONNECT_SIGNAL_2
set_trainer_interconnect_signal_3 or settrainerinterconnectsignal_3	Set these signals to allow other ports to wait on them using WF_TRAINER_INTERCONNECT_SIGNAL_3
set_trainer_interconnect_signal_4 or settrainerinterconnectsignal_4	Set these signals to allow other ports to wait on them using WF_TRAINER_INTERCONNECT_SIGNAL_4
TX_PHY_CAPABILITY	This command holds the 32-bit phy-capability value from the trainer-side. The command can be assign to a 32-bit variable and use it. Generator will copy the current “phy-capability” value to the variable it is assigned to. Example: @Trainer_Phycapability = TX_PHY_CAPABILITY
RECEIVED_PHY_CAPABILITYBITS	This command holds the 32-bit phy-capability value from the receiver-side. The command can be assign to a 32-bit variable and use it. Generator will copy the current “phy-capability” value to the variable it is assigned to. Example: @received_phycapability = RECEIVED_PHY_CAPABILITYBITS

5.14.2 SATA Commands

Look at STP sample file for syntax.

- SEND_SATA_FRAME
- SendSATAFrame
- SATAData
- SATA_Data
- SATACRC
- SATA_CRC
- SATAXXXX
- SATA_XXXX

5.14.3 Primitive Commands

The following is a list of SAS and SATA primitives declared in **Primitives.Decl.inc** as Symbol Chains. If you want to use these primitives in your script, you must also include **Primitives.Decl.inc** in your script.

- SOF
- EOF
- SOAF
- EOAF
- ALIGN (0)
- ALIGN (1)
- ALIGN (2)
- ALIGN (3)
- NOTIFY (ENABLE SPINUP)
- NOTIFY (RESERVED 0)
- NOTIFY (RESERVED 1)
- NOTIFY (RESERVED 2)
- ACK
- NAK (CRC ERROR)
- NAK (RESERVED 0)
- NAK (RESERVED 1
- NAK (RESERVED 2)
- CREDIT_BLOCKED
- RRDY (NORMAL)
- RRDY (RESERVED 0)
- RRDY (CLOSE)
- SATA_SOF
- SATA_EOF
- SATA_CONT
- SATA_DMAT
- SATA_HOLD
- SATA_HOLDA
- SATA_PMACK
- SATA_PMNAK
- SATA_PMREQ_P
- SATA_PMREQ_S
- SATA_R_ERR
- SATA_R_IP
- SATA_R_OK
- SATA_R_RDY
- SATA_SYNC
- SATA_WTRM
- SATA_X_RDY
- SATA_ERROR
- AIP (NORMAL)
- AIP (RESERVED 0)
- AIP (RESERVED 1)

- AIP (RESERVED 2)
- AIP (RESERVED 3)
- AIP (WAITING ON CONNECTION)
- AIP (WAITING ON DEVICE)
- AIP (WAITING ON PARTIAL)
- BREAK
- BROADCAST (CHANGE)
- BROADCAST (RESERVED 0)
- BROADCAST (RESERVED 1)
- BROADCAST (RESERVED 2)
- BROADCAST (RESERVED 3)
- BROADCAST (RESERVED 4)
- BROADCAST (RESERVED CHANGE 0)
- BROADCAST (RESERVED CHANGE 1)
- CLOSE (CLEAR AFFILIATION)
- CLOSE (NORMAL)
- CLOSE (RESERVED 0)
- CLOSE (RESERVED 1)
- ERROR
- HARD_RESET
- OPEN_ACCEPT
- OPEN_REJECT (BAD DESTINATION)
- OPEN_REJECT (CONNECTION RATE NOT SUPPORTED)
- OPEN_REJECT (NO DESTINATION)
- OPEN_REJECT (PATHWAY BLOCKED)
- OPEN_REJECT (PROTOCOL NOT SUPPORTED)
- OPEN_REJECT (RESERVED ABANDON 0)
- OPEN_REJECT (RESERVED ABANDON 1)
- OPEN_REJECT (RESERVED ABANDON 2)
- OPEN_REJECT (RESERVED ABANDON 3)
- OPEN_REJECT (RESERVED CONTINUE 0)
- OPEN_REJECT (RESERVED CONTINUE 1)
- OPEN_REJECT (RESERVED INITIALIZE 0)
- OPEN_REJECT (RESERVED INITIALIZE 1)
- OPEN_REJECT (RESERVED STOP 0)
- OPEN_REJECT (RESERVED STOP 1)
- OPEN_REJECT (RETRY)
- OPEN_REJECT (STP RESOURCES BUSY)
- OPEN_REJECT (WRONG DESTINATION)
- DONE (ACK/NAK TIMEOUT)
- DONE (CREDIT TIMEOUT)
- DONE (NORMAL)
- DONE (RESERVED 0)
- DONE (CLOSE)
- DONE (RESERVED TIMEOUT 0)
- DONE (RESERVED TIMEOUT 1)
- SAS Specific Script-Defined Constants

- SAS_AF_DT_NO_DEVICE_ATTACHED
- SAS_AF_DT_END_DEVICE
- SAS_AF_DT_EDGE_EXPANDER_DEVICE
- SAS_AF_DT_FANOUT_EXPANDER_DEVICE
- SAS_AF_FT_IDENTIFY
- SAS_AF_FT_OPEN
- SAS_AF_PROTOCOL_SMP
- SAS_AF_PROTOCOL_SSP
- SAS_AF_PROTOCOL_STP
- SAS_AF_PROTOCOL_UNKNOWN
- SAS_AF_RATE_1_5_GBPS
- SAS_AF_RATE_3_GBPS
- SAS_AF_RATE_6_GBPS
- SMP_FRAME_TYPE_REQUEST
- SMP_FRAME_TYPE_RESPONSE
- SMP_REPORT_GENERAL
- SMP_REPORT_MANUFACTURER_INFO
- SMP_DISCOVER
- SMP_REPORT_PHY_ERROR_LOG
- SMP_REPORT_PHY_SATA
- SMP_REPORT_ROUTE_INFO
- SMP_CONFIGURE_ROUTE_INFO
- SMP_PHY_CONTROL
- SSP_FRAME_TYPE_DATA
- SSP_FRAME_TYPE_XFER_RDY
- SSP_FRAME_TYPE_COMMAND
- SSP_FRAME_TYPE_RESPONSE
- SSP_FRAME_TYPE_TASK
- SSP_FRAME_TYPE_VENDOR
- MUX (LOGICAL 0)
- MUX (LOGICAL 1)
- BREAK_REPLY
- TRAIN
- TRAIN_DONE
- PS_ACK
- PS_NAK
- PS_REQ_PARTIAL
- PS_REQ_SLUMBER

5.14.4 Primitive Category

- **ALIGN**: 0, 1, 2, or 3
- **NOTIFY**: ENABLE SPINUP, RESERVED 0, RESERVED 1, or RESERVED 2
- ACK
- **NAK**: CRC ERROR, RESERVED 0, RESERVED 1, or RESERVED 2
- **RRDY**: NORMAL, RESERVED 0, CLOSE
- **AIP**: NORMAL, RESERVED 0, RESERVED 1, RESERVED 2, RESERVED 3, WAITING ON CONNECTION, WAITING ON DEVICE, or WAITING ON PARTIAL

- BREAK
- **CLOSE**: CLEAR AFFILIATION, NORMAL, RESERVED 0, RESERVED 1
- CREDIT BLOCKED
- OPEN ACCEPT
- **OPEN REJECT**: BAD DESTINATION, CONNECTION RATE NOT SUPPORTED, NO DESTINATION, PATHWAY BLOCKED, PROTOCOL NOT SUPPORTED, RESERVED ABANDON 0, RESERVED ABANDON 1, RESERVED ABANDON 2, RESERVED ABANDON 3, RESERVED CONTINUE 0, RESERVED CONTINUE 1, RESERVED INITIALIZE 0, RESERVED INITIALIZE 1, RESERVED STOP 0, RESERVED STOP 1, RETRY, STP RESOURCES BUSY, or WRONG DESTINATION
- **BROADCAST**: CHANGE, RESERVED 0, RESERVED 1, RESERVED 2, RESERVED 3, RESERVED 4, RESERVED CHANGE 0, or RESERVED CHANGE 1
- **DONE**: ACK/NAK TIMEOUT, CREDIT TIMEOUT, NORMAL, RESERVED 0, CLOSE, RESERVED TIMEOUT 0, or RESERVED TIMEOUT 1
- SATA FLOW CTRL PRIMITIVE
- SATA IDLE PRIMITIVE
- **SAS PS PRIMITIVE**: PS_REQ_PARTIAL, PS_REQ_SLUMBER, PS_ACK, or PS_NAK

5.14.5 Wait Commands

Syntax:

```
WAIT_FOR { <command1> <command2> ... <group1> <group2> ... }
```

Wait Command Name	Description
WF_TIMEOUT	Timeout Credit Available When WF_TIMEOUT is requested in WAIT_FOR command, the wait session will be released after timeout has elapsed. The Timeout value can be set two different ways: 1. Through the global WaitTimeout setting that can appear anywhere in generation. Default value is 1000 microseconds. Syntax: **Set WaitTimeout = <value> (in microseconds)** 2. Through local WaitTimeout value for this specific wait session. Syntax: **WAIT_FOR (<number_of_microseconds>) {WF_TIMEOUT <other_wait_commands>}** In this case wait for other commands will be released no later then after number_of_microseconds, but global WaitTimeout value remains unchanged for future use. See **Generation\Include\ WaitCommands.inc** in the program folder for the samples of syntax.
WF_SOF	primitive
WF_EOF	primitive
WF_SOAF	primitive
WF_EOAF	primitive
WF_ACK	primitive
WF_NAK_CRC_ERROR	primitive
WF_NAK_RESERVED_0	primitive
WF_NAK_RESERVED_1	primitive
WF_NAK_RESERVED_2	primitive

Wait Command Name	Description
WF_CREDIT_AVAIL	Credit Available This function is based on a 10-bit counter whose value can range from -512 to +511 (twos-complement). This counter is cleared by sending or receiving an OPEN_ACCEPT primitive, or by execution of a CLEAR_CREDIT_AVAIL command in the script. This counter is incremented by receiving any SAS RRDY primitive and is decremented by sending SAS SOF. The wait_for command will wait for this counter to have a positive value between +1 and +511. This wait_for condition is intended to be used before sending a SAS frame within a connection. ClEAR_CREDIT_AVAIL clears this credit function.
WF_CREDIT_BLOCKED_RECEIVED	CreditBlocked Received This function is based on a flip-flop which is cleared by sending or receiving an OPEN_ACCEPT primitive. It is set by receiving a CREDIT_BLOCKED primitive. It is intended to be used in conjunction with wf_credit_avail to prevent script hangs in those cases where there is not going to be any more credit granted.
WF_CREDIT_BLOCKED	primitive
WF_RRDY_NORMAL	primitive
WF_RRDY_RESERVED_0	primitive
WF_RRDY_CLOSE	primitive
WF_BREAK	primitive
WF_CLOSE_CLEAR_AFFILIATION	primitive
WF_CLOSE_NORMAL	primitive
WF_CLOSE_RESERVED_0	primitive
WF_CLOSE_RESERVED_1	primitive
WF_DONE_ACK_NAK_TIMEOUT	primitive
WF_DONE_CREDIT_TIMEOUT	primitive

Wait Command Name	Description
WF_DONE_NORMAL	primitive
WF_DONE_RESERVED_0	primitive
WF_DONE_CLOSE	primitive
WF_DONE_RESERVED_TIMEOUT_0	primitive
WF_DONE_RESERVED_TIMEOUT_1	primitive
WF_ERROR	primitive
WF_HARD_RESET	primitive
WF_AIP_NORMAL	primitive
WF_AIP_RESERVED_0	primitive
WF_AIP_RESERVED_1	primitive
WF_AIP_RESERVED_2	primitive
WF_AIP_RESERVED_WAIT_ON_PART	primitive
WF_AIP_WAIT_ON_CONN	primitive
WF_AIP_WAIT_ON_DEVICE	primitive
WF_AIP_WAIT_ON_PARTIAL	primitive
WF_IDENTIFY_FRAME	Identify Address Frame
WF_OPEN_FRAME	Open Address Frame
WF_SMP_REQUEST	SMP Request Frame
WF_SMP_RESPONSE	SMP Response Frame
WF_REC_RESOURCES_OUTPUT_A	Advanced Wait Condition A This command causes generation to wait for Event "A" to occur that you defined in the Generation Options dialog described at the end of this chapter.
WF_REC_RESOURCES_OUTPUT_B	Advanced Wait Condition B This command causes generation to wait for Event "B" to occur that you defined in the Generation Options dialog described at the end of this chapter.
WF_REC_RESOURCES_OUTPUT_C	Advanced Wait Condition C This command causes generation to wait for Event "C" to occur that you defined in the Generation Options dialog described at the end of this chapter.

Wait Command Name	Description
WF_REC_RESOURCES_OUTPUT_D	Advanced Wait Condition D This command causes generation to wait for Event "D" to occur that you defined in the Generation Options dialog described at the end of this chapter.
WF_REC_RESOURCES_OUTPUT_E	Advanced Wait Condition E This command causes generation to wait for Event "E" to occur that you defined in the Generation Options dialog described at the end of this chapter.
WF_REC_RESOURCES_OUTPUT_F	Advanced Wait Condition F This command causes generation to wait for Event "F" to occur that you defined in the Generation Options dialog described at the end of this chapter.
wf_trainer_interconnect_signal_1	Events used to signal from one port to another.
wf_trainer_interconnect_signal_2	Events used to signal from one port to another.
wf_trainer_interconnect_signal_3	Events used to signal from one port to another.
wf_trainer_interconnect_signal_4	Events used to signal from one port to another.
WF_OOB_COMINIT_DETECTED	COMINIT/COMRESET OOB detected
WF_COMRESET_COMINIT	COMINIT/COMRESET OOB completed
WF_OOB_COMSAS_DETECTED	COMSAS OOB detected
WF_COMSAS	COMSAS OOB completed
WF_OOB_COMWAKE_DETECTED	COMWAKE OOB detected
WF_COMWAKE	COMWAKE OOB completed
WF_OOBUNKNOWN	UNKNOWN OOB
WF_BLOCK1_MISC_RESERVED_0	reserved
WF_BLOCK1_MISC_RESERVED_1	reserved
WF_BLOCK1_MISC_RESERVED_2	reserved
WF_BLOCK1_MISC_RESERVED_3	reserved
WF_BLOCK1_MISC_RESERVED_4	reserved
WF_SATA_CONT	primitive

Wait Command Name	Description
WF_SATA_DMAT	primitive
WF_SATA_EOF	primitive
WF_SATA_ERROR	primitive
WF_SATA_HOLD	primitive
WF_SATA_HOLDA	primitive
WF_SATA_PMACK	primitive
WF_SATA_PMNAK	primitive
WF_SATA_PMREQ_P	primitive
WF_SATA_PMREQ_S	primitive
WF_SATA_R_ERR	primitive
WF_SATA_R_IP	primitive
WF_SATA_R_OK	primitive
WF_SATA_R_RDY	primitive
WF_SATA_SOF	primitive
WF_SATA_SYNC	primitive
WF_SATA_WTRM	primitive
WF_SATA_X_RDY	primitive
WF_OPEN_ACCEPT	primitive
WF_OPEN_REJECT_BAD_DESTINATION	primitive
WF_OPEN_REJECT_CONN_RATE_NOT_SUPPORTED	primitive
WF_OPEN_REJECT_NO_DESTINATION	primitive
WF_OPEN_REJECT_PATHWAY_BLOCKED	primitive
WF_OPEN_REJECT_PROTOCOL_NOT_SUPPORTED	primitive
WF_OPEN_REJECT_RETRY	primitive
WF_OPEN_REJECT_STP_RESOURCES_BUSY	primitive
WF_OPEN_REJECT_WRONG_DESTINATION	primitive
WF_OPEN_REJECT_RESERVED_ABANDON_0	primitive
WF_OPEN_REJECT_RESERVED_ABANDON_1	primitive
WF_OPEN_REJECT_RESERVED_ABANDON_2	primitive
WF_OPEN_REJECT_RESERVED_ABANDON_3	primitive
WF_OPEN_REJECT_RESERVED_CONTINUE_0	primitive
WF_OPEN_REJECT_RESERVED_CONTINUE_1	primitive

Wait Command Name	Description
WF_OPEN_REJECT_RESERVED_INITIALIZE_0	primitive
WF_OPEN_REJECT_RESERVED_INITIALIZE_1	primitive
WF_OPEN_REJECT_RESERVED_STOP_0	primitive
WF_OPEN_REJECT_RESERVED_STOP_1	primitive
WF_ALIGN_0	primitive
WF_ALIGN_1	primitive
WF_ALIGN_2	primitive
WF_ALIGN_3	primitive
WF_NOTIFY_ENABLE_SPINUP	primitive
WF_NOTIFY_RESERVED_0	primitive
WF_NOTIFY_RESERVED_1	primitive
WF_NOTIFY_RESERVED_2	primitive
WF_BROADCAST_CHANGE	primitive
WF_BROADCAST_RESERVED_0	primitive
WF_BROADCAST_RESERVED_1	primitive
WF_BROADCAST_RESERVED_2	primitive
WF_BROADCAST_RESERVED_3	primitive
WF_BROADCAST_RESERVED_4	primitive
WF_BROADCAST_RESERVED_CHANGE_0	primitive
WF_BROADCAST_RESERVED_CHANGE_1	primitive
WF_BLOCK2_MISC_RESERVED_0	reserved
WF_BLOCK2_MISC_RESERVED_1	reserved
WF_TRAIN	primitive
WF_TRAIN_DONE	primitive
WF_BREAK_REPLY	primitive
WF_MUX_LOGICAL_0	primitive
WF_MUX_LOGICAL_1	primitive
WF_PS_REQ_PARTIAL	primitive
WF_PS_REQ_SLUMBER	primitive
WF_PS_ACK	primitive
WF_PS_NAK	primitive

5.14.6 Wait Command Groups

Wait Command Group	Group Contents
WF_TIMEOUT	WF_TIMEOUT_BLOCK_ONE WF_TIMEOUT_BLOCK_TWO
WF_ALL_SOF	WF_SOF
	WF_SOAF
WF_ALL_EOF	WF_EOF
	WF_SOAF
WF_NAK	WF_NAK_CRC_ERROR
	WF_NAK_RESERVED_0
	WF_NAK_RESERVED_1
	WF_NAK_RESERVED_2
WF_RRDY	WF_RRDY_NORMAL
	WF_RRDY_RESERVED_0
	WF_RRDY_CLOSE
WF_CREDIT_OK	WF_CREDIT_AVAIL
	WF_CREDIT_BLOCKED_RECEIVED
WF_CLOSE	WF_CLOSE_CLEAR_AFFILIATION
	WF_CLOSE_NORMAL
	WF_CLOSE_RESERVED_0
	WF_CLOSE_RESERVED_1

Wait Command Group	Group Contents
WF_DONE	WF_DONE_ACK_NAK_TIMEOUT
	WF_DONE_CREDIT_TIMEOUT
	WF_DONE_NORMAL
	WF_DONE_RESERVED_0
	WF_DONE_CLOSE
	WF_DONE_RESERVED_TIMEOUT_0
	WF_DONE_RESERVED_TIMEOUT_1
WF_AIP	WF_AIP_NORMAL
	WF_AIP_RESERVED_0
	WF_AIP_RESERVED_1
	WF_AIP_RESERVED_2
	WF_AIP_RESERVED_WAIT_ON_PART
	WF_AIP_WAIT_ON_CONN
	WF_AIP_WAIT_ON_DEVICE
	WF_AIP_WAIT_ON_PARTIAL
WF_REC_RESOURCES	WF_REC_RESOURCES_OUTPUT_A
	WF_REC_RESOURCES_OUTPUT_B
	WF_REC_RESOURCES_OUTPUT_C
	WF_REC_RESOURCES_OUTPUT_D
	WF_REC_RESOURCES_OUTPUT_E
	WF_REC_RESOURCES_OUTPUT_F
WF_RCV_STATUS	WF_SATA_R_ERR
	WF_SATA_R_OK
WF_PM_REQ	WF_SATA_PMREQ_P
	WF_SATA_PMREQ_S
WF_PM_STATUS	WF_SATA_PMACK
	WF_SATA_PMNAK

Wait Command Group	Group Contents
WF_OPEN_REJECT	WF_OPEN_REJECT_BAD_DESTINATION
	WF_OPEN_REJECT_CONN_RATE_NOT_SUPPORTED
	WF_OPEN_REJECT_NO_DESTINATION
	WF_OPEN_REJECT_PATHWAY_BLOCKED
	WF_OPEN_REJECT_PROTOCOL_NOT_SUPPORTED
	WF_OPEN_REJECT_RETRY
	WF_OPEN_REJECT_STP_RESOURCES_BUSY
	WF_OPEN_REJECT_WRONG_DESTINATION
	WF_OPEN_REJECT_RESERVED_ABANDON_0
	WF_OPEN_REJECT_RESERVED_ABANDON_1
WF_OPEN_REJECT (continued...)	WF_OPEN_REJECT_RESERVED_ABANDON_2
	WF_OPEN_REJECT_RESERVED_ABANDON_3
	WF_OPEN_REJECT_RESERVED_CONTINUE_0
	WF_OPEN_REJECT_RESERVED_CONTINUE_1
	WF_OPEN_REJECT_RESERVED_INITIALIZE_0
	WF_OPEN_REJECT_RESERVED_INITIALIZE_1
	WF_OPEN_REJECT_RESERVED_STOP_0
	WF_OPEN_REJECT_RESERVED_STOP_1
WF_OPEN_RESPONSE	WF_OPEN_ACCEPT
	WF_OPEN_REJECT
WF_ALIGN	WF_ALIGN_0
	WF_ALIGN_1
	WF_ALIGN_2
	WF_ALIGN_3
WF_NOTIFY	WF_NOTIFY_ENABLE_SPINUP
	WF_NOTIFY_RESERVED_0
	WF_NOTIFY_RESERVED_1
	WF_NOTIFY_RESERVED_2

Wait Command Group	Group Contents
WF_BROADCAST	WF_BROADCAST_CHANGE
	WF_BROADCAST_RESERVED_0
	WF_BROADCAST_RESERVED_1
	WF_BROADCAST_RESERVED_2
	WF_BROADCAST_RESERVED_3
	WF_BROADCAST_RESERVED_4
	WF_BROADCAST_RESERVED_CHANGE_0
	WF_BROADCAST_RESERVED_CHANGE_1
WF_SAS_PS_REQ	WF_PS_REQ_PARTIAL
	WF_PS_REQ_SLUMBER
WF_SAS_PS_STATUS	WF_PS_ACK
	WF_PS_ACK

5.14.7 Predefined Constants

Predefined Constant	Internal Value
GEN_MODE_ERROR	0
GEN_MODE_SATA_HOST	1
GEN_MODE_SATA_DEVICE	2
GEN_MODE_SAS_INITIATOR	3
GEN_MODE_SAS_TARGET	4
GEN_LINK_SPEED_1_5G	00
GEN_LINK_SPEED_3G	01
GEN_LINK_SPEED_6G	10
SCRAMBLING_MODE_NONE	0
SCRAMBLING_MODE_SAS	1
SCRAMBLING_MODE_SATA	2

5.14.8 Generation Settings

Setting	Default Value	Description
Global Settings		
GenerationMode	GEN_MODE_ERROR - undefined mode	Generation Mode - must be defined or no generation will take place. Possible Values: GEN_MODE_SATA_HOST GEN_MODE_SATA_DEVICE GEN_MODE_SAS_INITIATOR GEN_MODE_SAS_TARGET
MultiSpeedMode	0	When set, the change of speed within Generation block is allowed with following syntax: set Speed = LINK_SPEED_1_5G / LINK_SPEED_3G / LINK_SPEED_6G
Output Disable	0	This very poorly named register bit forces the Trainer to output data. It is a little like the output_on script command except that its effect cannot be undone for the duration of the script. If this is turned on, none of the out-of-band commands will work, as the output enable is forced on.
SupportSNW1	1	When set, in “Connect command” SNW1 will be tried in Speed Negotiation phase Can only be set outside Generation block.
SupportSNW2	1	When set, in “Connect command” SNW2 will be tried in Speed Negotiation phase. Can only be set outside Generation block.
PauseTrnScrmblr.	0	When set, the generator pauses the Idle scrambler of Train/TrainDone pattern.
ReconnectOnRun	0	When “AdvanceConnect” and “ReconnectOnRun” are set, the “Connect” command forces the Trainer to disconnect the physical link before executing the “Connect” command. When “AdvanceConnect” is not set, this setting does not affect the Trainer.
AdvanceConnect	0	When set, the Trainer uses the “PHY Capability” and “SupportSNW” settings, instead of the “Set Speed” settings, for executing the “Connect” command.
OutputOffAfterDC	On	OutputOffafterDC is set to ON by default, which forces the trainer to put DC Idle (electric idle) on the line when it detects sync is lost on the link. If this bit is set to OFF the trainer will not disable the output even when the link is disconnected, i.e. the trainer continues sending DWORDs on the line.

Setting	Default Value	Description
ASR	On	When set, the generator enables the Asynchronous Signal Recovery feature.
ContPrimUsage	Off	If set to ON, Trainer keeps the type of primitive which is received before cont primitive. It will keep the primitive type during Cont, Idle and Align Dwords, until the time the other primitive is received.
IdleDataMode	AUTO	If set as AUTO, scrambled Idle dwords are transmitted as Idle data. If set as RAW, an user-defined-dword is transmitted as idle data. The user defined dword can be specified by the “IdleDataDword” settings.
IdleDataDword	C2 D2 76 8D	The value of the user-defined-dword (when “IdleDataMode” is Raw) can be specified with this setting. It can be represented by a symbol chain of 4 bytes. Example: Set IdleDataDword = AA BB CC DD Or, Set IdleDataDword = K28.5 D21.5 D21.5 D21.5
AutoMode Settings		
AutoOOBMode	On	When set, the generator will go through the stages of bringing up the link automatically, including waiting for and responding to the device or host it is connected to.
AutoHoldMode	0	When set, the generator will respond automatically to Hold requests. Not supported for version 1.1 (reserved).
AutoDMAT	0	When set, the generator will respond automatically to DMAT requests. Not supported for version 1.1 (reserved).
AutoSpeedNeg	On	When set, the generator will automatically go throughthe speed negotiation process, for the speed set in the PINTERFACEC_SERDES register for the Trainer.
AutoAlignSATA	0	When set, the generator will automatically inserting the stream 2 Align(0) primitives every 254 DWORDs, as specified in the SATA spec.
AutoAlignSAS	On	When set, the generator will automatically inserting the stream Align primitives every 2048 DWORDs, as specified in the SAS spec.Two Align modes can be turned on simultaneously, to support STP

Setting	Default Value	Description
COMINIT Settings		
COMINIT_NegLen	800	The number of bursts to send as part of this OOB type.Each Burst is followed by an Idle. The Burst-Idle pairs are repeated the requested number of times, and then followed by the Negation_length of Idle.
COMINIT_IdleLen	480	Burst time between each OOB idle in OOBIs.During the specified period, the generator will send ALIGN(0) at the specified speed.
COMINIT_BurstLen	160	Idle time between each OOB burst in OOBIs.During the specified period, the generator will keep the line at electric idle.
COMINIT_NumBursts	6	Negation time at the end of the OOB signal in OOBIs.During the specified period, the generator will keep the line at electric idle.
COMWAKE Settings		
COMWAKE_NegLen	280	The number of bursts to send as part of this OOB type.Each Burst is followed by an Idle. The Burst-Idle pairs are repeated the requested number of times, and then followed by the Negation_length of Idle.
COMWAKE_IdleLen	160	Burst time between each OOB idle in OOBIs.During the specified period, the generator will send ALIGN(0) at the specified speed.
COMWAKE_BurstLen	160	Idle time between each OOB burst in OOBIs.During the specified period, the generator will keep the line at electric idle.
COMWAKE_NumBursts	6	Negation time at the end of the OOB signal in OOBIs.During the specified period, the generator will keep the line at electric idle.
COMSAS Settings		
COMSAS_NegLen	2400	The number of bursts to send as part of this OOB type.Each Burst is followed by an Idle. The Burst-Idle pairs are repeated the requested number of times, and then followed by the Negation_length of Idle.
COMSAS_IdleLen	1440	Burst time between each OOB idle in OOBIs.During the specified period, the generator will send ALIGN(0) at the specified speed.
COMSAS_BurstLen	160	Idle time between each OOB burst in OOBIs.During the specified period, the generator will keep the line at electric idle.
COMSAS_NumBursts	6	Negation time at the end of the OOB signal in OOBIs.During the specified period, the generator will keep the line at electric idle.

Setting	Default Value	Description
SATA Link Init Settings		
OOB_SATA_D102_Time	100000	D10.2 time for SATA link synchronization in OOBIs.During the specified period, the generator will transmit D10.2 symbols.
OOB_SATA_Align_Time	100000	ALIGN(0) time for SATA link synchronization in OOBIs.During the specified period, the generator will transmit ALIGN(0) primitives.
SAS Speed Negotiation Settings		
OOB_SAS_Align1_Time	81920	ALIGN(1) time for SAS speed negotiation in OOBIs.During the specified period, the generator will transmit ALIGN(1) primitives.
OOB_SAS_Align0_Time	81920	ALIGN(0) time for SAS speed negotiation in OOBIs.During the specified period, the generator will transmit ALIGN(0) primitives.
OOB_SAS_Interspeed_Time	750000	Interspeed time for SAS speed negotiation in OOBIs.During the specified period, the generator will keep the line at electric idle.
OOB_SpeedNeg_MTT.	29998080 OOBI	The maximum time in OOBI during which training phase of speed negotiation should be completed in Train-SNW.
OOB_SpeedNeg_SNTT.	2200 OOBI	The time in OOBI during which generator transmits phy capability bits in SNW-3. In Automatic connection This value is also used for the time during which generator sends Align0 and Align1 in SNW1 and SNW2.
OOB_SpeedNeg_BCT.	2200 OOBI	The time in OOBI during which generator transmits COMWAKE or D.C. idle during SNW-3.

Setting	Default Value	Description
Phy Capabilities Settings		
Note: Sierra M6-2 can receive SSC per the SAS and SATA specification requirements, and will forward SSC when in analyzer mode. However, in Trainer and Jammer modes, it does not transmit SSC, even when the respective Phy capability bits have been set.		
OOB_SpeedNeg_Phy_start		The START bit shall be set to one. The phy's receiver shall use this bit to establish the timing for the subsequent bits.
OOB_SpeedNeg_ Phy_txSSCtype		A TX SSC TYPE bit set to one indicates that the phy's transmitter uses center-spreading SSC when SSC is enabled. A TX SSC TYPE bit set to zero indicates that the phy's transmitter uses down-spreading SSC when SSC is enabled or that the phy does not support SSC.
OOB_SpeedNeg_Phy_RLLR		The REQUESTED LOGICAL LINK RATE field indicates if the phy supports multiplexing and, if so, the logical link rate that the phy is requesting.
OOB_SpeedNeg_ Phy_g1WithoutSSC		A G1 WITHOUT SSC bit set to one indicates that the phy supports G1 (i.e., 1.5 Gbps) without SSC. A G1 WITHOUT SSC bit set to zero indicates that the phy does not support G1 without SSC.
OOB_SpeedNeg_ Phy_g1WithSSC		A G1 WITH SSC bit set to one indicates that the phy supports G1 (i.e., 1.5 Gbps) with SSC. A G1 WITH SSC bit set to zero indicates that the phy does not support G1 with SSC.
OOB_SpeedNeg_ Phy_g2WithoutSSC		A G2 WITHOUT SSC bit set to one indicates that the phy supports G2 (i.e., 3 Gbps) without SSC. A G2 WITHOUT SSC bit set to zero indicates that the phy does not support G2 without SSC.
OOB_SpeedNeg_ Phy_g2WithSSC		A G2 WITH SSC bit set to one indicates that the phy supports G2 (i.e., 3 Gbps) with SSC. A G2 WITH SSC bit set to zero indicates that the phy does not support G2 with SSC.
OOB_SpeedNeg_ Phy_g3WithoutSSC		A G3 WITHOUT SSC bit set to one indicates that the phy supports G3 (i.e., 6 Gbps) without SSC. A G3 WITHOUT SSC bit set to zero indicates that the phy does not support G3 without SSC.
OOB_SpeedNeg_ Phy_g3WithSSC		A G3 WITH SSC bit set to one indicates that the phy supports G3 (i.e., 6 Gbps) with SSC. A G3 WITH SSC bit set to zero indicates that the phy does not support G3 with SSC.

Setting	Default Value	Description
OOB_SpeedNeg_Phy_Parity		The PARITY bit provides for error detection of all the SNW-3 phy capabilities bits. The PARITY bit shall be set to one or zero such that the total number of SNW-3 phy capabilities bits that are set to one is even, including the START bit and the PARITY bit.

Setting	Default Value	Description
SATA Speed Negotiation Settings		
OOB_SpeedNeg_RCDT	750000	Maximum time in OOBIs during the speed negotiation window for a transmitter to reply with ALIGN(1).
OOB_SpeedNeg_SNTT	163840	Time in OOBIs during which ALIGN(0) or ALIGN(1) is transmitted at each physical link rate during the speed negotiation sequence.
OOB_SpeedNeg_SNLT	153600	Time in OOBIs during which the transmitter shall transmit idle between rates during speed negotiation.
Speed Settings		
Speed	LINK_SPEED_1_5G	Link Speed Possible Values: LINK_SPEED_1_5G LINK_SPEED_3G LINK_SPEED_6G
RateMatching	0	Possible values: 0 (disabled) and 1 (enabled). When RateMatching is enabled, the software programs every other dword as Align(0) primitive, cutting the throughput in half. It is not recommended to use SendInc and SendBulk when you are employing RateMatching, since the automatically generated data will not get rate matched.
Scrambling Mode Settings		
Scrambling	SCRAMBLING_MODE_AUTO	Raw Data Scrambling Mode - Only those raw DWORDs will be scrambled that contain only data bytes (no 10-bit symbols or 'K' bytes. Scrambling is reset by changing ScramblingMode or by any valid SAS or SATA frame. When **Scrambling** is on, scrambling is done by Trainer engine. It automatically detects scrambling type (SAS or SATA) by start frame primitive. When **Scrambling** is off, data is sent without any scrambling. Possible Values: SCRAMBLING_MODE_NONE SCRAMBLING_MODE_SAS SCRAMBLING_MODE_SATA
Wait Timeout Settings		
WaitTimeout	1000	Sets global WaitTimeout value in microseconds

Setting	Default Value	Description
AUTO_WAIT_SAS_AFTER Settings		
AUTO_WAIT_SAS_AFTER_ CLOSE_FOR_CLOSE	FALSE	When set, the generator will insert WAIT_FOR CLOSE command immediately after each CLOSE primitive.
AUTO_WAIT_SAS_AFTER_ EOF_FOR_ACK	FALSE	When set, the generator will insert WAIT_FOR ACK command immediately after each EOF primitive.
AUTO_WAIT_SAS_AFTER_ EOF_FOR_ACK_OR_NAK	FALSE	When set, the generator will insert WAIT_FOR ACK or NAK command immediately after each EOF primitive.
AUTO_WAIT_SAS_AFTER_ OPEN_FOR_OPEN_ACCEPT	FALSE	When set, the generator will insert WAIT_FOR OPEN_ACCEPT command immediately after each Open Address Frame.
AUTO_WAIT_SAS_AFTER_ OPEN_FOR_OPEN_REJECT	FALSE	When set, the generator will insert WAIT_FOR OPEN_REJECT command immediately after each Open Address Frame.
AUTO_WAIT_SAS_AFTER_ IDENTIFY_FOR_IDENTIFY_ FRAME	FALSE	When set, the generator will insert WAIT_FOR Identify Frame command immediately after each Identify Address Frame.
AUTO_WAIT_SAS_AFTER_ SMP_REQ_FOR_RESP	FALSE	When set, the generator will insert WAIT_FOR SMP Response Frame command immediately after each SMP Request Frame.
AUTO_WAIT_SAS_BEFORE Settings		
AUTO_WAIT_SAS_BEFORE_ CLOSE_FOR_CLOSE	FALSE	When set, the generator will insert WAIT_FOR CLOSE command right before each CLOSE primitive.
AUTO_WAIT_SAS_BEFORE_ SOF_FOR_CREDIT	FALSE	When set, the generator will insert WAIT_FOR CREDIT command right before each SOF primitive.
AUTO_WAIT_SAS_BEFORE_ IDENTIFY_FOR_IDENTIFY_ FRAME	FALSE	When set, the generator will insert WAIT_FOR Identify Frame command right before each Identify Address Frame.
AUTO_WAIT_SAS_BEFORE_ OPEN_ACCEPT_FOR_OPEN	FALSE	When set, the generator will insert WAIT_FOR Open Frame command right before each OPEN_ACCEPT primitive.
AUTO_WAIT_SAS_BEFORE_ OPEN_REJECT_FOR_OPEN	FALSE	When set, the generator will insert WAIT_FOR Open Frame command right before each OPEN_REJECT primitive.
AUTO_WAIT_SAS_BEFORE_ AIP_FOR_OPEN	FALSE	When set, the generator will insert WAIT_FOR Open Frame command right before each primitive of AIP group.
AUTO_WAIT_SAS_BEFORE_ SMP_RESP_FOR_REQ	FALSE	When set, the generator will insert WAIT_FOR SMP Request Frame command right before each SMP Response Frame.

Setting	Default Value	Description
AUTO_WAIT_SATA_AFTER Settings		
AUTO_WAIT_SATA_AFTER_X_RDY_FOR_R_RDY	FALSE	When set, the generator will insert WAIT_FOR SATA_R_RDY command immediately after each case of SATA_CONT primitive following SATA_X_RDY primitive.
AUTO_WAIT_SATA_AFTER_WTRM_FOR_STATUS	FALSE	When set, the generator will insert WAIT_FOR SATA_R_ERR or SATA_R_OK command immediately after each case of SATA_CONT primitive following SATA_WTRM primitive.
AUTO_WAIT_SATA_AFTER_PMREQ_S_FOR_RESPONSE	FALSE	When set, the generator will insert WAIT_FOR SATA_PMACK or SATA_PMNAK command immediately after each case of SATA_CONT primitive following SATA_PMREQ_S primitive.
AUTO_WAIT_SATA_AFTER_PMREQ_P_FOR_RESPONSE	FALSE	When set, the generator will insert WAIT_FOR SATA_PMACK or SATA_PMNAK command immediately after each case of SATA_CONT primitive following SATA_PMREQ_P primitive.
AUTO_WAIT_SATA_AFTER_SYNC_FOR_SYNC	FALSE	When set, the generator will insert WAIT_FOR SATA_SYNC command immediately after each case of SATA_CONT primitive following SATA_SYNC primitive.
AUTO_WAIT_SATA_BEFORE Settings		
AUTO_WAIT_SATA_BEFORE_PMACK_FOR_PMREQ	FALSE	When set, the generator will insert WAIT_FOR SATA_PMREQ_S or SATA_PMREQ_P command right before each SATA_PMACK primitive.
AUTO_WAIT_SATA_BEFORE_PMNAK_FOR_PMREQ	FALSE	When set, the generator will insert WAIT_FOR SATA_PMREQ_S or SATA_PMREQ_P command right before each SATA_PMNAK primitive.
AUTO_WAIT_SATA_BEFORE_RERR_FOR_WTRM	FALSE	When set, the generator will insert WAIT_FOR SATA_R_ERR command right before each SATA_WTRM primitive.
AUTO_WAIT_SATA_BEFORE_ROK_FOR_WTRM	FALSE	When set, the generator will insert WAIT_FOR SATA_R_OK command right before each SATA_WTRM primitive.
AUTO_WAIT_SATA_BEFORE_RIP_FOR_SOF	FALSE	When set, the generator will insert WAIT_FOR SATA_R_IP command right before each SATA_SOF primitive.
AUTO_WAIT_SATA_BEFORE_R_RDY_FOR_X_RDY	FALSE	When set, the generator will insert WAIT_FOR SATA_X_RDY command right before each SATA_R_RDY primitive.

5.14.9 Auto Speed Negotiation

The commands SATA_D10.2, SATA_ALIGN, SPEED_NEG_ALIGN0 and SPEED_NEG_ALIGN1 operate differently based on the state of the Auto Speed negotiation (Asng) control bit (which is set or cleared by configuration memory blocks in the stream) and by the current SAS/SATA, Init/Targ state of the Trainer Engine. The table below illustrates different actions done by Trainer Engine executing SATA_D10.2, SATA_ALIGN, SPEED_NEG_ALIGN0 and SPEED_NEG_ALIGN1 commands based on Asng and Trainer Engine setup.

Command	AutoSpeedNeg	Actions
SATA_D10.2	0	Send D10.2 dwords until the count is exhausted, then move on to the next block in stream. The count is specified by the SPEED_NEG_PARAMETER control block.
	1	Send D10.2 dwords until the count is exhausted or an ALIGN_0 is detected (whichever comes first), then move on to the next block in the stream.
SATA_ALIGN	0	Send Align_0 primitives until the count is exhausted, then move on to the next block in the stream. The count is specified by the SPEED_NEG_PARAMETER control block.
	1	If GEN_MODE_SATA_HOST, send Align_0 primitives until the count is exhausted or a non-Align_0 primitive is detected (whichever comes first), then move on to the next block in the stream. If GEN_MODE_SATA_DEVICE, send Align_0 primitives until the count is exhausted or an Align_0 primitive is detected (whichever comes first), then move on to the next block in the stream.
SPEED_NEG_ALIGN0	0	Send Align_0 primitives until the count is exhausted, then move on to the next block in the stream.

Command	AutoSpeedNeg	Actions
	1	Send Align primitives until the count is exhausted, then move on to the next block in the stream. Start with Align_0, and switch to Align_1 if an Align_0 is detected.
SPEED_NEG_ALIGN1	0	Send Align_1 primitives until the count is exhausted.
	1	Do nothing at all.

5.15 Generation Options

Use the Generation Rules to set triggers and filters.

To display the Generation Options dialog, select **Generate > Generation Options** or click the **Setup Generation Options** button.

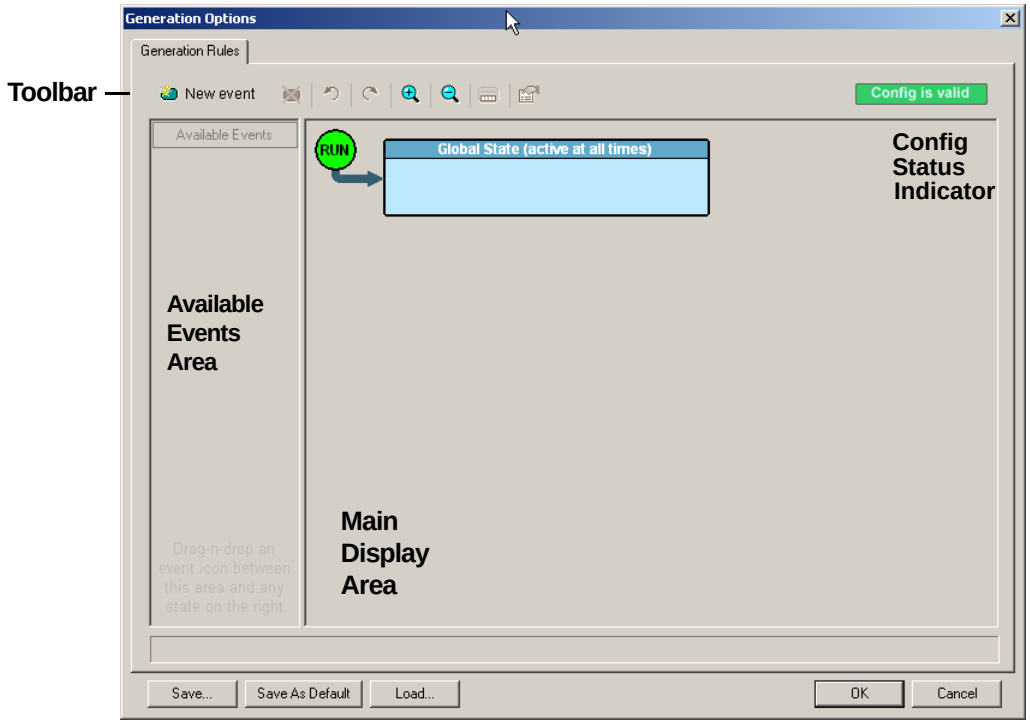


Figure 5.16: Generation Options Window

The page has the following areas:

- **Toolbar:** Contains buttons that control the Generation Rules page.
- **Available Events Area:** Area where you can park Event buttons that you intend to use in the Main Display area.
- **Main Display Area:** Area where you configure trigger and filter rules. You configure rules by dragging Event buttons from the Available Events area and then

assigning actions to those buttons.

- **Config Status Indicator:** A button that indicates if the rule is valid or invalid. If a trigger or filter rule is configured correctly, the button is green and indicates Config is Valid. If a rule is not configured correctly, the button is red and indicates Config is Invalid.

Pop-Up Menus: When you right-click a button or area in the Generation Rules page, a context-sensitive pop-up menu appears that lets you do operations that relate to that button or area.

Properties Dialogs: When you click the Show/Hide Properties Dialog button for an event, action, or state, a dialog allows you to perform the same operations as in the pop-up menus.

Generation Rules Toolbar

The Generation Rules toolbar buttons control the Generation Rules page.



Figure 5.17: Generation Rules Toolbar

TABLE 5.14: Recording Rules Buttons

New event	New Event. Creates a new event in the Available Events area.		Zoom Out. Makes the display appear smaller.
	Delete Event. Deletes the selected event.		Show/Hide Channels. Shows or hides the channel icon on the Event button.
	Undo. Undoes the change made to Recording Rules page. The Undo buffer has unlimited size.		Show/Hide Properties Dialog. Shows or hides the properties dialog of the selected event, action, or state.
	Redo. Restores changes done to the Recording Rules page.	Config is valid	This display appears when the current Recording Rules configuration can be executed by the hardware.
	Zoom In. Enlarges the display (see note). There are five zoom levels. The default level is the middle one.	Config is invalid	This display appears when the current Recording Rules configuration cannot be executed by the hardware.

Note: If you have a wheel on the mouse, you can zoom by holding down the CTRL key and rolling the mouse wheel.

Generation Rules Page: How It Works

You can think of the Generation Rules page as a workspace for creating rules (rules that determine how the analyzer generates traces). Rules are combinations of events and actions.

An event and the action or actions associated with it form a rule state.

Briefly, creating a rule involves the following steps:

1. Creating Event buttons in the Available Events area.
2. Drag-and-drop of Event buttons to the appropriate areas (cells) in the Main Display area.
3. Assigning an action or actions to each Event button.

Creating Event Buttons

To create a rule, first create one or more Event buttons. As you create Event buttons, they appear in the Available Events area. You then can drag-and-drop them into the Main Display area.

To create event buttons:

1. Click the **New Event** button at the left side of the toolbar to display the New Event pop-up menu.

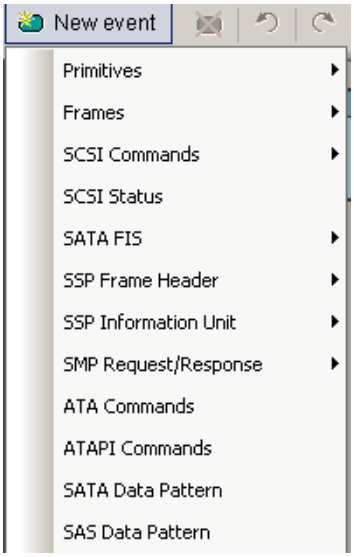


Figure 5.18: New Event Menu

2. Select an event, such as Primitive. The event appears in the Available Events area.

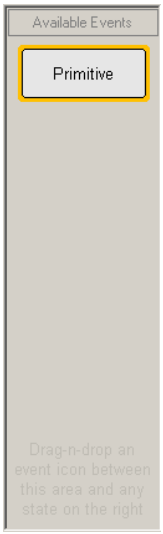


Figure 5.19: Available Events Area

Dragging a Button to the Main Display Area

After you create an Event button in the Available Events area, you can drag the button to the Main Display area and drop it in the appropriate cell (a cell is a grayed-out rectangle with a dashed line around it). You can think of each cell as a target for drag-and-drop of an Event button.

To drag-and-drop the Event button:

1. Place the mouse cursor on the Event button in the Available Events area. Click the left mouse button.
2. Drag the button to the cell. When the button is in the cell, a dashed highlight line appears around the cell. Drop the button in the cell (release the left mouse button). The Event button appears in the cell.

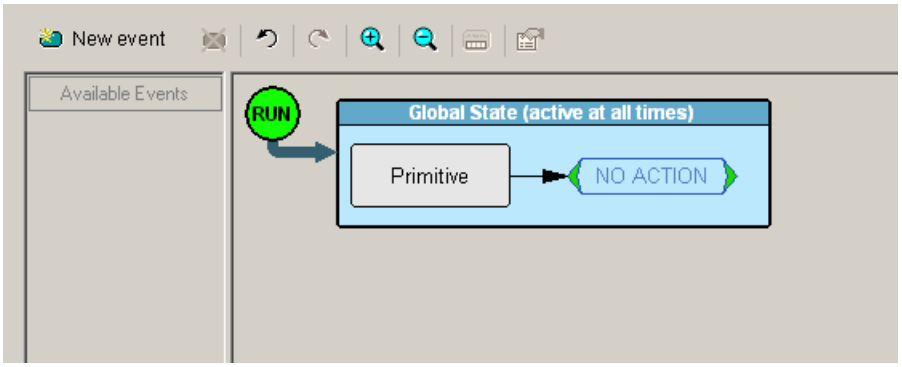


Figure 5.20: Event in Main Display

The default label for the first cell is Global State, which is active at all times.

Assigning an Action

After you have dropped the Event button in a cell in the Main Display area, you can assign an action to the event.

Note: If you do not assign an action to an Event button, the Generator ignores the event.

To assign an action to an Event button:

1. Right-click the **Event** button to display a pop-up menu.

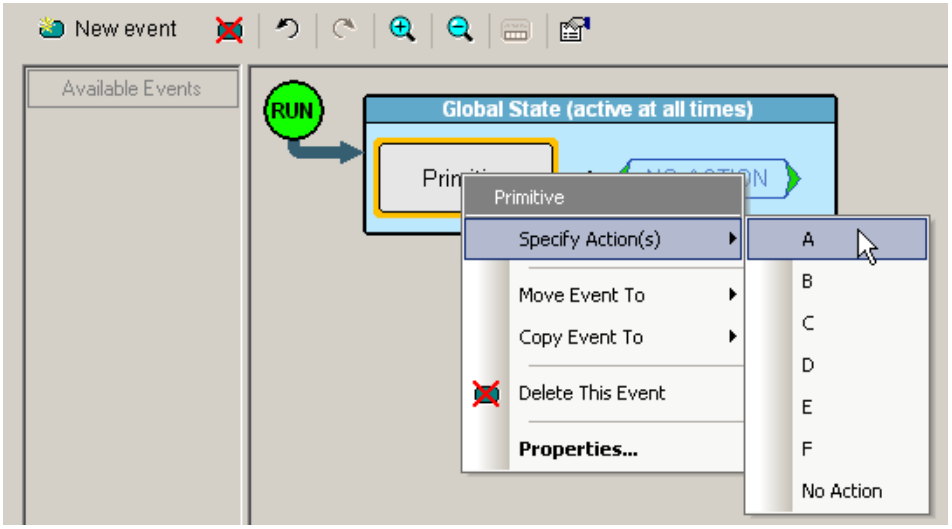


Figure 5.21: Action Menu

2. Select **Specify Action**, and then choose an action from the submenu. The menu closes, and the action is assigned.

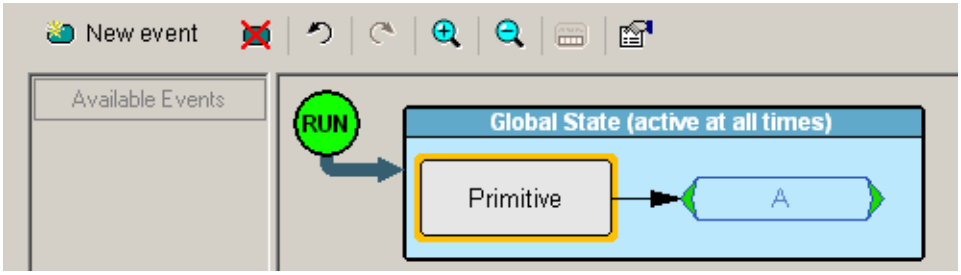


Figure 5.22: Action in Main Display

Note: You can also set actions within the Properties dialog for each event. Double-click the Event button to open the Properties dialog, then select the Actions tab and set your actions.

5.15.1 Generation Rules Pop-Up Menus

The Generation Rules window has context-sensitive pop-up menus that are associated with the following types of object: cells, events, and actions.

5.15.2 Cell Pop-up Menu

If you right-click a cell in the Main Display area that has an Event button contained in it, the Cell pop-up menu appears. The Cell pop-up menu has the following options.

- **New Event**: Displays the same menu that you get when you click the New Event button on the toolbar.
- **Properties**: Displays the Properties dialog for the selected cell.

5.15.3 Action Pop-up Menu

If you click an Action button in the Main Display area, the Action pop-up menu appears with the options **A** through **F** and **No Action**.

5.15.4 Event Pop-up Menu

If you click an Event button in the Main Display area, the Event pop-up menu appears. The Event pop-up menu has the following options:

- **Specify Action(s)**: Opens the Actions submenu, allowing you to assign an action to the event. Options on this submenu are the same as those on the Action pop-up, described previously.
- **Move Event to:** Moves the selected event to a different position in the Recording Rules window.
- **Copy Event to:** Copies the selected event to a different position in the Recording Rules window.
- **Delete This Event:** Deletes the selected Event. Alternatively, you can use the Delete button on the toolbar or keyboard to delete events.
- **Properties**: Displays the Event Properties dialog for the selected event.

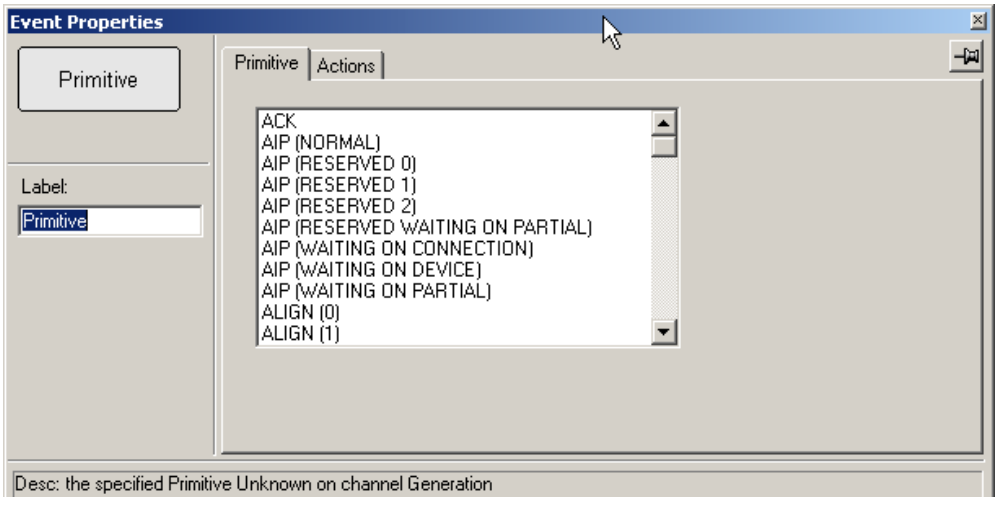


Figure 5.23: Event Properties

The dialog lists the Properties and their Values.

5.15.5 Events and Event Properties

Generation rules are associations between events and actions. These associations determine how trace recording occurs. The supported events are:

- **Primitives**: Primitive Categories or Primitive
- **Frames**: Open Address Frames, Identify Address Frames, Zone Broadcast Address Frames, SSP Frames, or SMP Frames
- SCSI Commands
- SCSI Status
- **SATA FIS**: Register Host to Device, Register Device to Host, Set Device Bits, DMA Activate, DMA Setup, BIST Activate, PIO Setup, Data, Route, or Vend FIS
- **SSP Frame Header**: DATA, XFER_RDY, COMMAND, RESPONSE, TASK, VENDOR, or RESERVED
- **SSP Information Unit**: Command IU, Task IU, XFER_RDY IU, or Response IU
- **SMP Request/Response**: RPT_GENERAL, RPT_MFG_INFO, DISCOVER, RPT_-PHY_ERR_LOG, RPT_PHY_SATA, RPT_RT_INFO, CONFIG_RT_INFO, PHY_CON-TROL, PHY_TEST_FUNCTION, CONFIG_PHY_ZONE, CONFIG_ZONE_PERM, RPT_ZONE_PERM, or RPT_ZONE_RT_TBL
- ATA Commands
- ATAPI Commands
- SATA Data Pattern
- SAS Data Pattern

Data Pattern Mask and Match

If you select Data Pattern as the Event, you can set Data Pattern event properties in the Event Properties dialog.

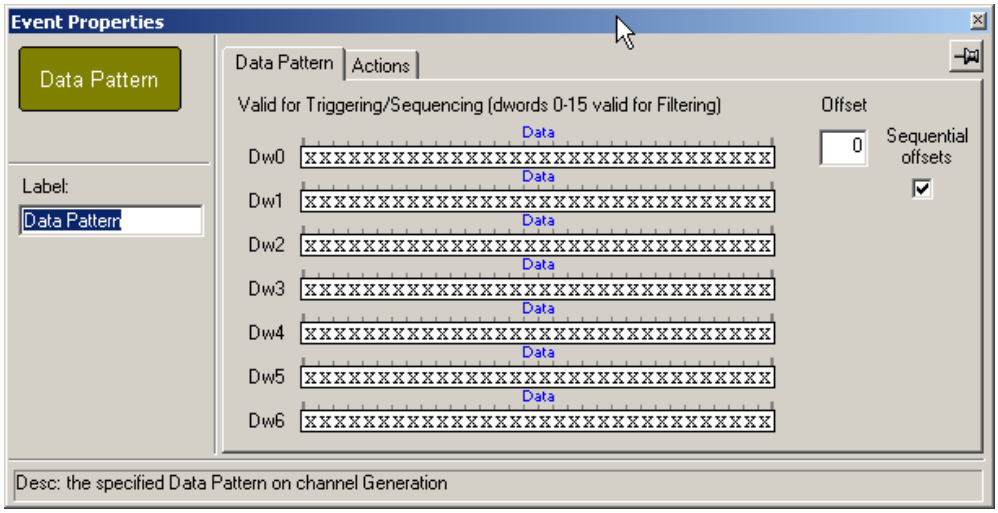


Figure 5.24: Event Properties for Data Pattern Event

In the Data Pattern dialog, you can set the DWORD. You can set the **Offset** by entering an integer. Optionally click the **Sequential Offsets** checkbox.

5.16 Setting Complex “Wait For” Conditions

The Generation Options dialog lets you define complex “Wait For” events and assign a letter value (“A” through “F”) to the definition, so that you can refer to the definition by letter instead of by textual name.

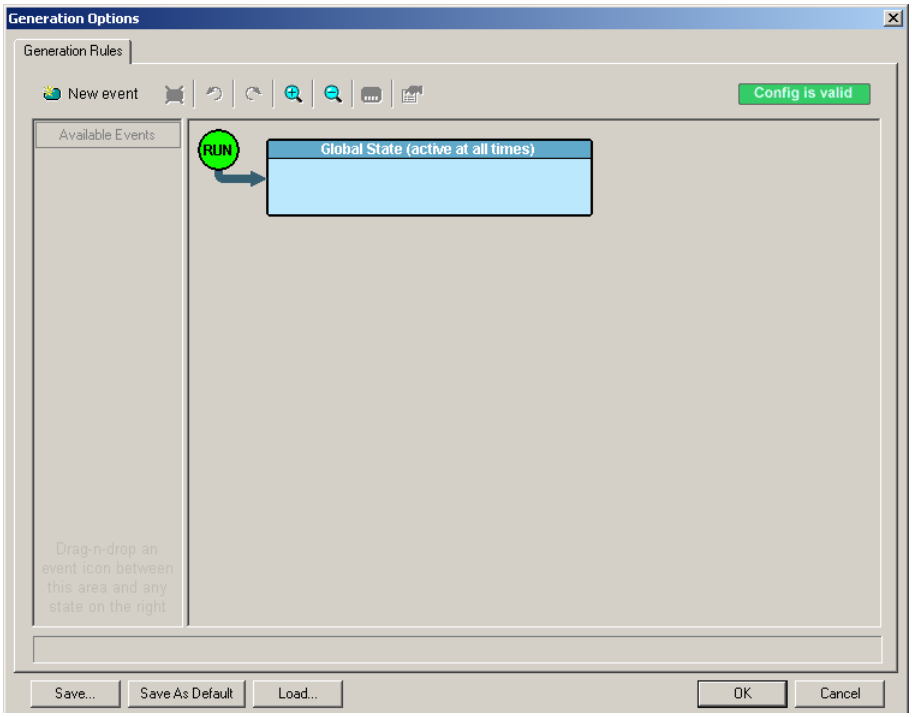
After a letter value has been assigned to an event, the letter is referred to in your generation script using the following command syntax:

```
Wait_For {WF_REC_RESOURCES_OUTPUT_A}
where “A,” in this case, is the defined condition.
```

5.16.1 Setting Conditions with the Generation Options Dialog

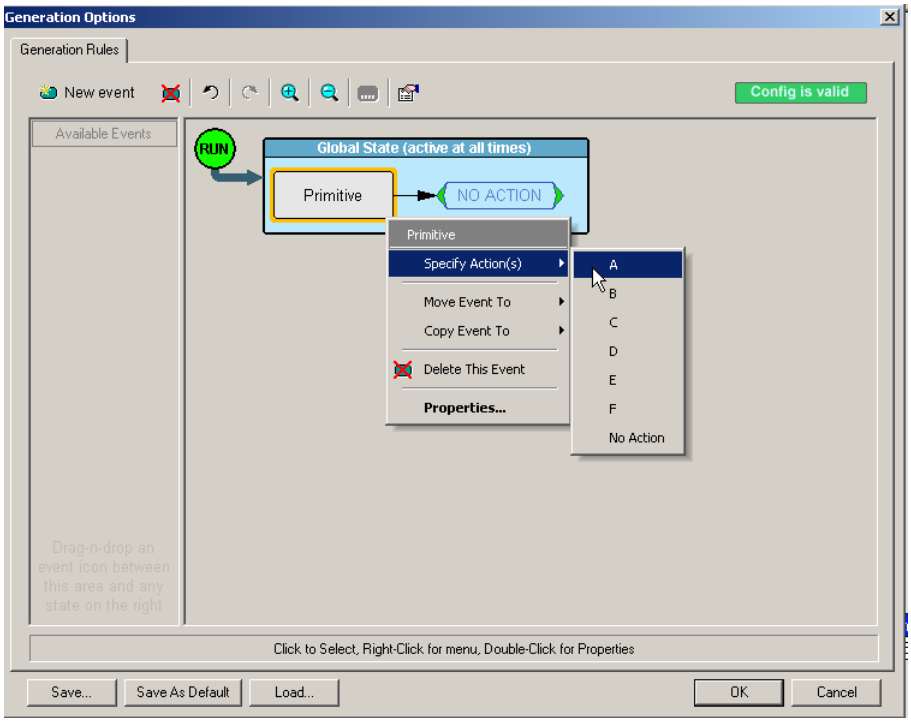
To set a complex condition, open the Generation Options dialog:

1. Select **Generate** > **Generation Options** from the menu to open the Generation Options dialog.

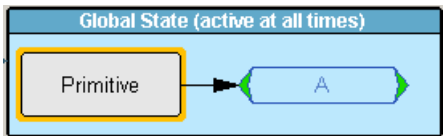


2. Click the **New Events** button and select an event from the menu. The selected event should appear in the **Available Events** area along the left side of the dialog box.
3. Drag the new event button to the **Global State** cell.

4. Right-click the new event button and select **Specify Action(s)**. A menu appears showing the letters A through F and the option “No action”.



5. Select a letter from the menu. The menu closes. The event button should now point to a neighboring button that has the letter value you assigned.



After the condition has been defined, you can then add the **Wait For** command line (with whatever letter you assigned) to your script.

For example:

```
Wait_For {WF_REC_RESOURCES_OUTPUT_A}
```

5.17 Find

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

To run **Find**, select **Search > Find** or by click  on the toolbar.

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

You can also perform searches in which packets or events are excluded from a trace, using the **Exclusion** option.

To perform a search:

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

   Click  in the Toolbar.
   You see the User-Defined Find Events screen:

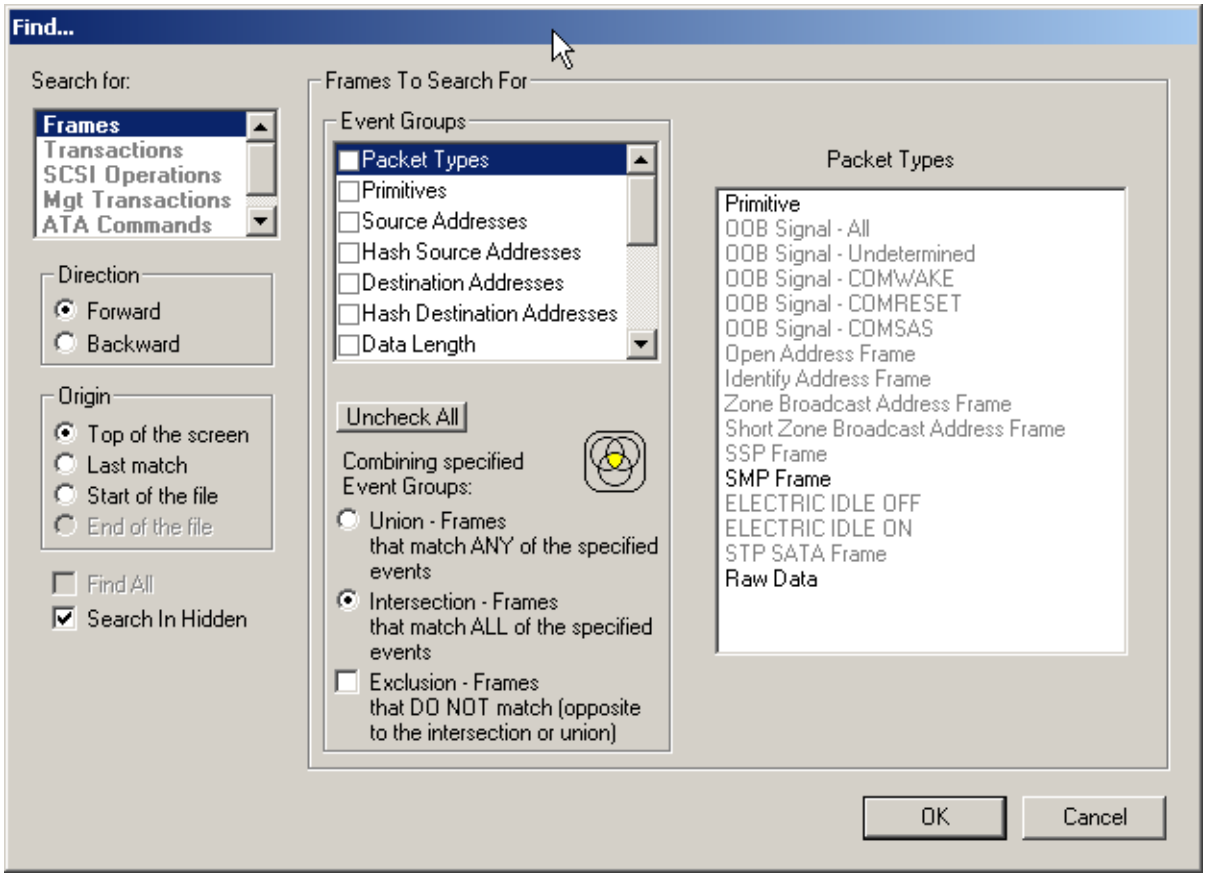


Figure 5.25: Find Dialog

2. Select **Frames, Transactions**, **SCSI Operations**, **Management Transactions, ATA Commands**, or **OOBs** from the top left list box to list that type of event in the Events Group box.
3. Select one or more events from the **Events Group** box:
   - ❑ Packet Types (Header, PHY, Event, Transaction)
   - ❑ Primitives
   - ❑ Source Addresses
   - ❑ Hash Source Addresses
   - ❑ Destination Addresses
   - ❑ Hash Destination Addresses
   - ❑ Data Length

- SMP Frames
- SSP Frames
- Errors
- FIS Types
- FIS Port Number
- Channel
- Data Pattern
- Completion Time

4. Select one of the following options:
   - **Union:** Find all packets matching ANY of the specified events.



   - **Intersection:** Find packets matching ALL of the specified events.



   - **Exclusion:** Exclude packets matching any of the specified events.

     Exclusion works with the other two options:
     Select Union *AND* Exclusion
     (=Exclude packets with ANY of the following fields) or
     Intersection *AND* Exclusion
     (=Exclude packets with ALL of the following fields.)



5. Optionally set the search **Direction** and **Origin**.
6. Optionally check to **Search in Hidden** or **Find All.**
7. Click **OK**.

After the search finishes, the program displays the packets meeting the search criteria.

5.17.1 Data Pattern Mask and Match

If you select Data Pattern as the Event Group in the Find dialog, you can set the Bitmask, Mask, and Match for each bit.

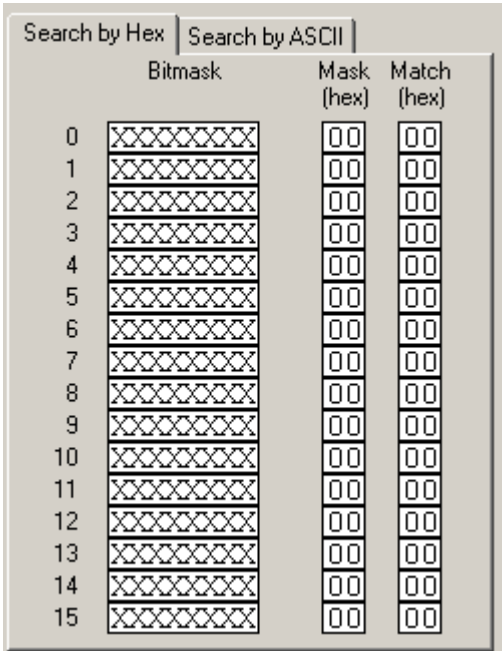


Figure 5.26: Data Pattern

Bitmask and Match always correlate. When you set Bitmask or Match. the other changes to maintain their correlation.

Note: If you set Bitmask/Match before setting Mask, the Mask changes to the default mask. You must change to the Mask that you want. If you set an appropriate Mask before setting Bitmask/ Match, the Mask does not change automatically to a default mask if you change Bitmask/Match.

5.17.2 Find Next

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

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

  OR

- Click  on the Toolbar.

5.17.3 Search Direction

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

5.18 Display Options

You can select what information to display using the Display Options window.

To open the Display Options window:

- Select **Display Options** under Setup on the Menu Bar.

  OR

- Click  on the Toolbar.

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

Restore Factory Presets sets all Display Options values to the installed values.

5.18.1 Color/Format/Hiding Display Options

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

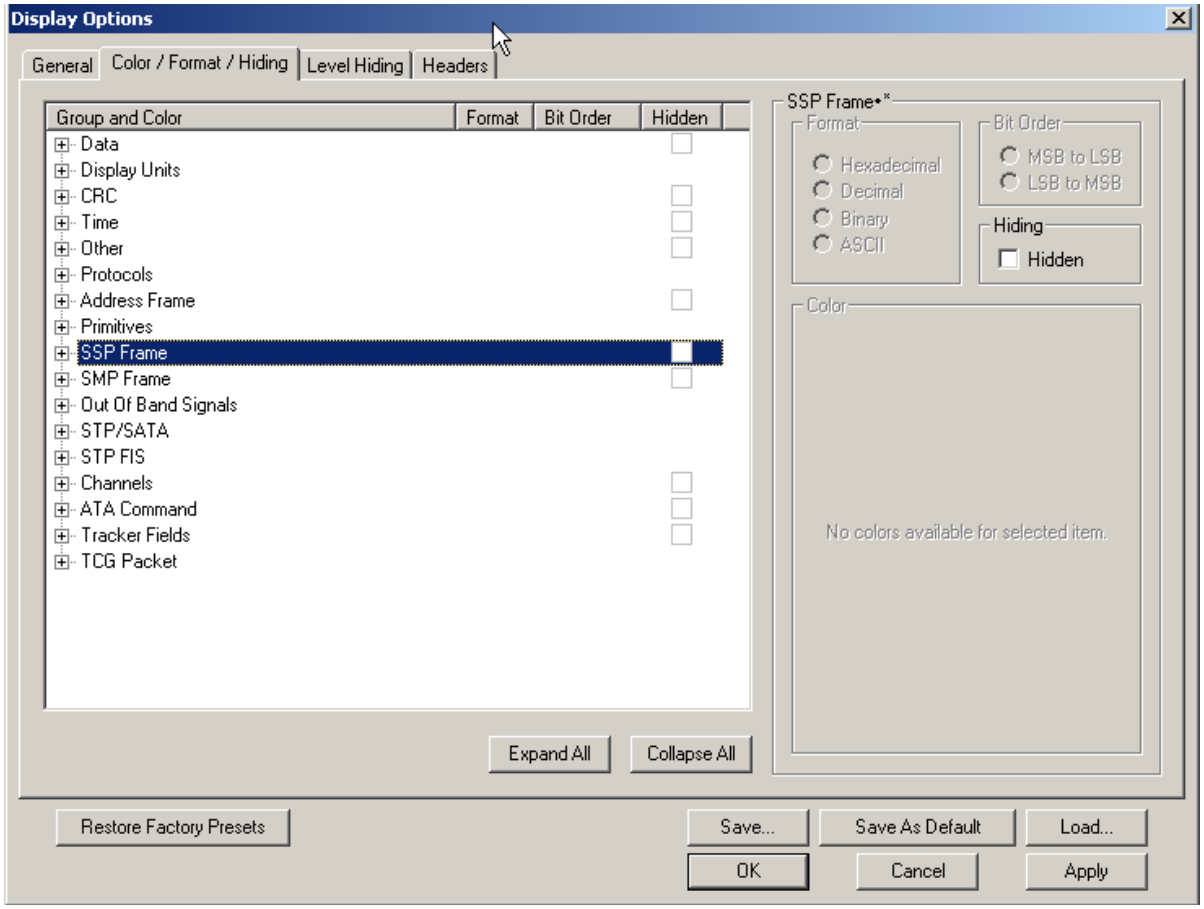


Figure 5.27: Display Options Dialog - Color, Format, Hiding Tab

5.18.2 Color Display Options

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

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

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

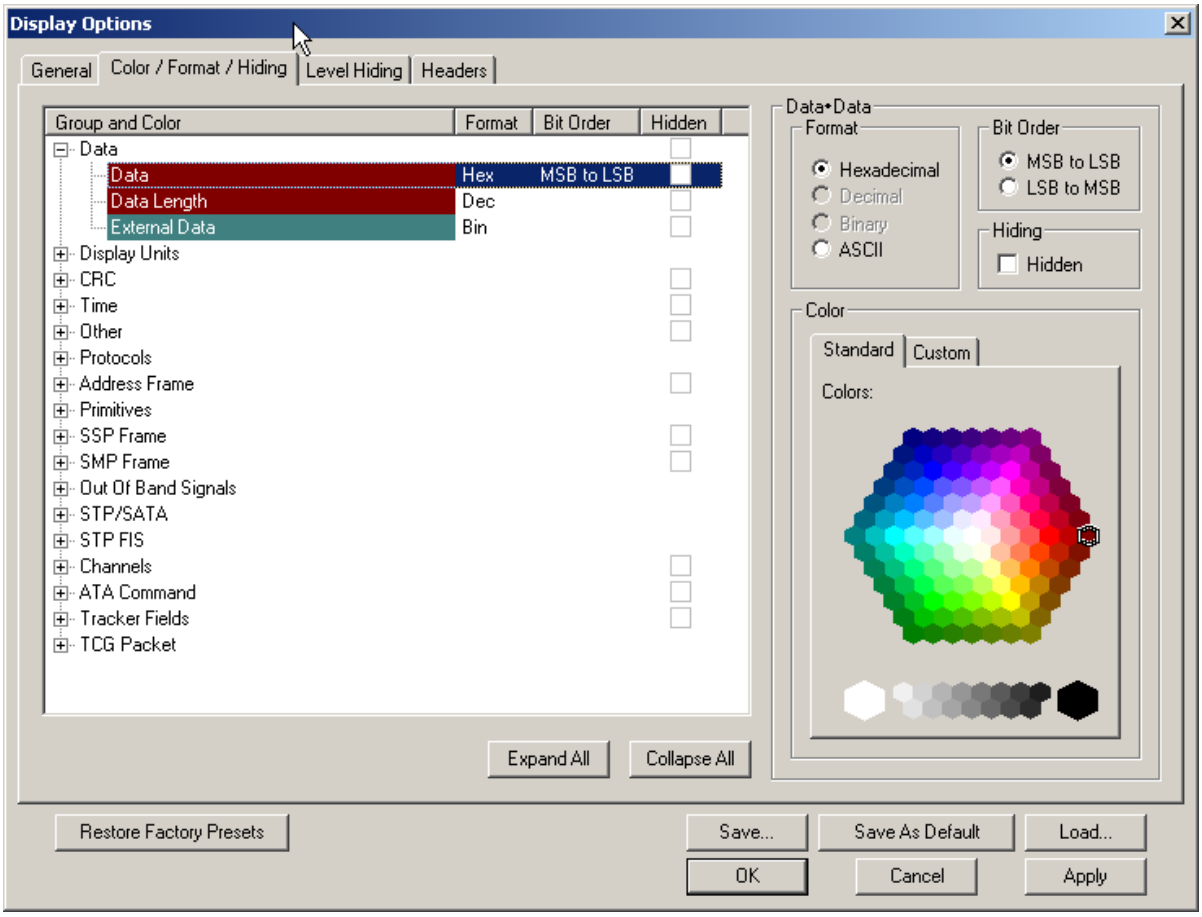


Figure 5.28: Display Options Dialog - Color

To customize colors, use the Custom tab.

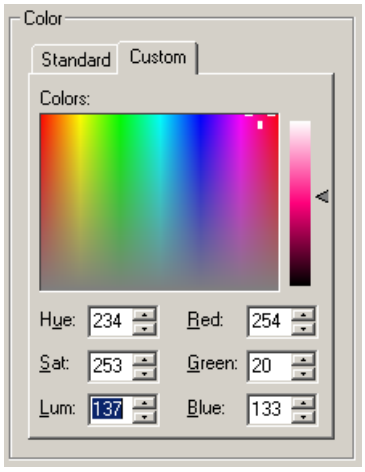


Figure 5.29: Custom Colors

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

5.18.3 Formats Display Options

For each type of data in each group of data, the program has a default data format. Examples of number data formats are Binary, Decimal, and Hexadecimal. An example of a text data format is ASCII.

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

Select a data type in the Group.

Select a format in the Format section. The following formats are available.

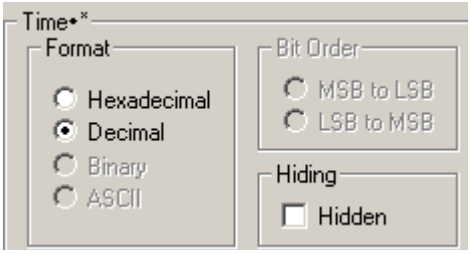


Figure 5.30: Formats

If available, select **Bit Order** in the Format section. The options are MSB to LSB or LSB to MSB.

5.18.4 Hiding Display Options

By default, no data is hidden. You can hide any group of data and any type of data.

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

5.18.5 Level Hiding Options

By default, nothing is hidden. You can hide:

- Packet Types
- Primitives
- Source Addresses
- Destination Addresses
- Data Length
- SMP Frames
- SSP Frames
- Channels
- FIS Types
- FIS Ports
- Gen Global Settings

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

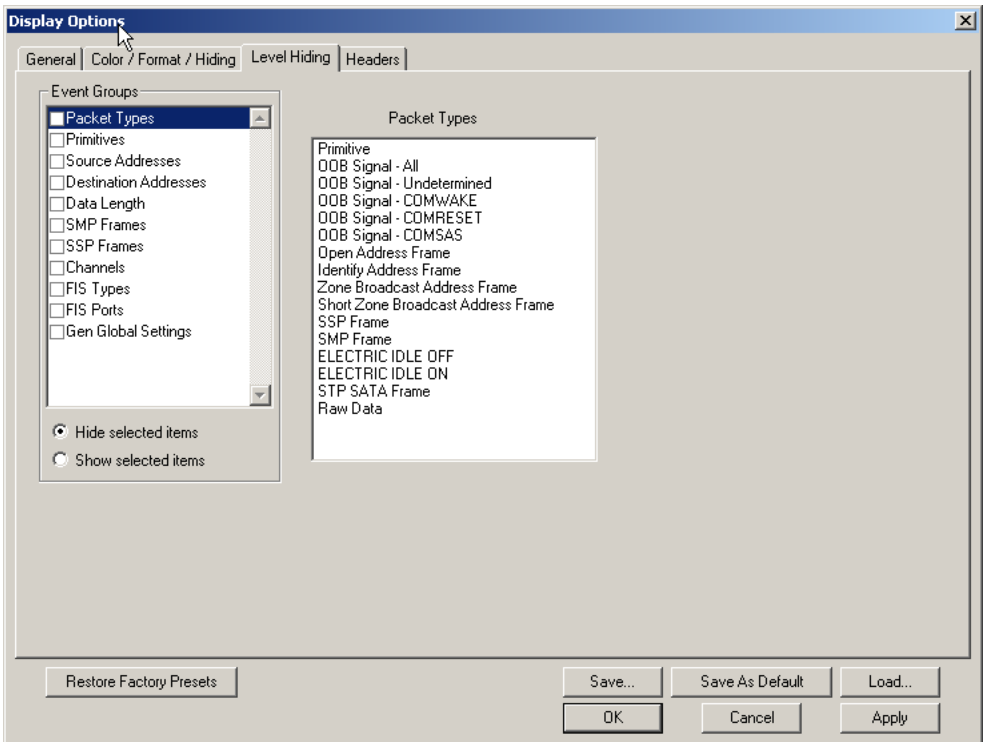


Figure 5.31: Level Hiding Tab

You can select to **Hide selected items** or **Show selected items**.

5.18.6 Headers Options

You can choose the appearance of header fields. Select the **Header** tab, then select the header.

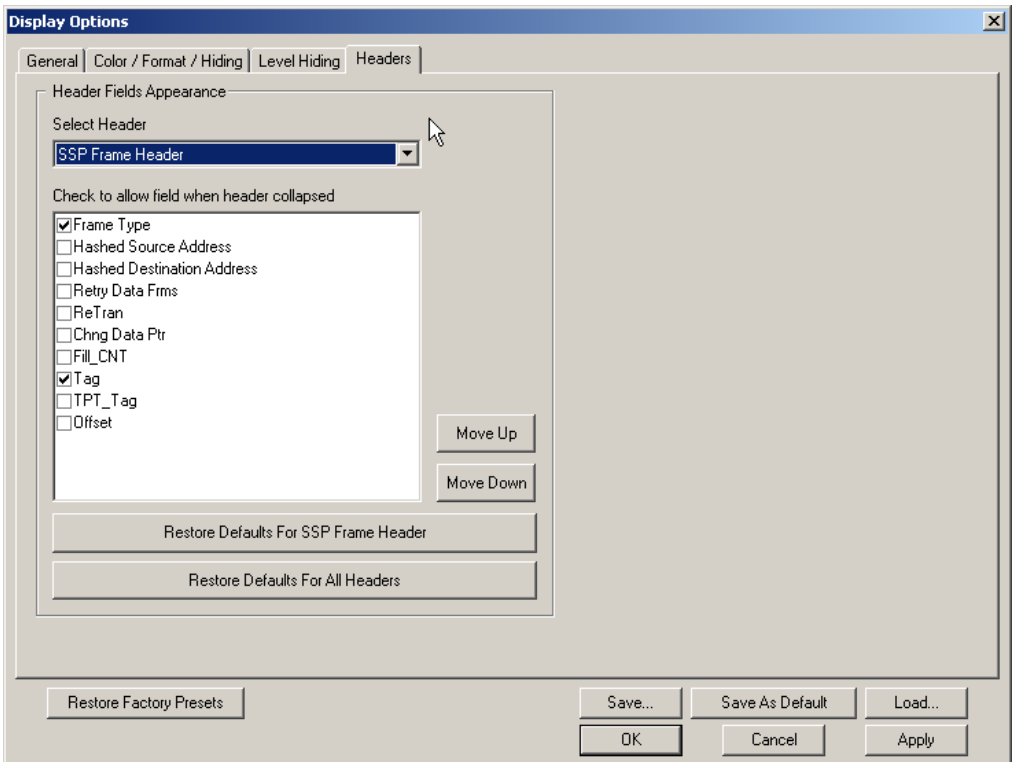


Figure 5.32: Level Hiding Tab

Available headers are:

- SSP Frame Header
- SMP Report General (Request or Response)
- SMP Report Mfg Info (Request or Response)
- SMP Discover (Request or Response)
- SMP Report Phy Error Log (Request or Response)
- SMP Report Route Info (Request or Response)
- SMP Configure Route Info (Request or Response)
- SMP Phy Control (Request or Response)
- SMP Phy Test Function (Request or Response)
- SMP Configure Phy Zone (Request or Response)
- SMP Configure Zone Permission (Request or Response)
- SMP Report Zone Permission (Request or Response)
- SMP Report Zone Routing Table (Request or Response)
- STP Register Host to Device FIS
- STP Register Device to Host FIS
- STP Register Device Bits Device to Host FIS
- STP DMA Activate Device to Host FIS
- STP DMA Setup FIS
- STP BIST Activate FIS

- ❑ STP PIO Setup Device to Host FIS
- ❑ STP Data FIS
- ❑ STP Frame Summary Header
- ❑ SATA Frame Summary Header
- ❑ SAS Delta Time

Check boxes to allow a field when the selected header is collapsed. Example header fields are:

- ❑ Frame Type
- ❑ Function
- ❑ Result
- ❑ Offset
- ❑ FIS Type

You can move items up and down.

You can select to **Restore Defaults** for the selected header or all headers.

5.18.7 Saving Display Options

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

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

5.19 Connection Parameters

To display the connection parameters (see Figure 5.33 on page 587), select **Generate > Connect Parameters**.

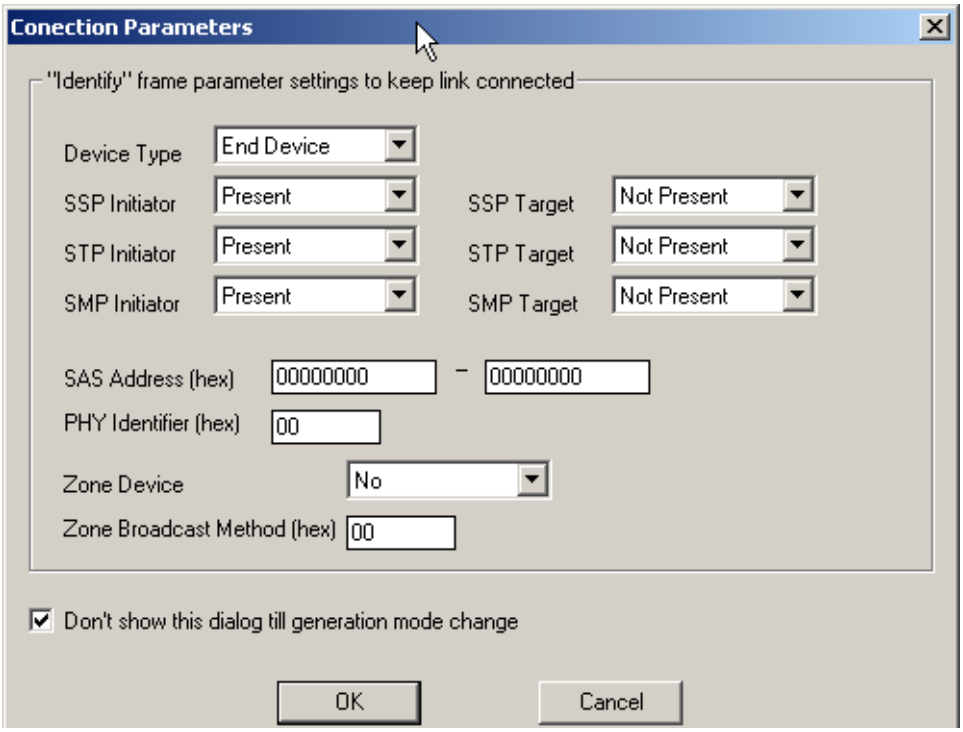


Figure 5.33: Connection Parameters Dialog

You can set the "Identify" frame parameter settings to keep the link connected:

- **Device Type**: End Device, Edge Expander, or Fanout Expander
- **SSP Initiator**: Present or Not Present
- **STP Initiator**: Present or Not Present
- **SMP Initiator**: Present or Not Present
- **SSP Target**: Present or Not Present
- **STP Target**: Present or Not Present
- **SMP Target**: Present or Not Present
- **SAS Address (hex)**: eight digits - eight digits
- **PHY Identifier (hex)**: two digits
- **Zone Device**: Yes or No
- Zone Broadcast Method (hex): two digits

You can select to not show the dialog until there is a generation mode change.

5.20 Resetting the Toolbar

The Analyzer Toolbar has the following:

- **Show InFusion Frame**: Switches to InFusion frame.
- **Show Analyzer Frame**: Switches to Analyzer frame.
- **Start Analyzer**: Start Analyzer without switching to Analyzer frame.
- **Stop Analyzer**: Stop Analyzer without switching to Analyzer frame.
- **Abort Analyzer**: Abort Analyzer without switching to Analyzer frame.

The Generator Toolbar has the following:

- **Start Generation**
- **Stop Generation**
- Resume Generation
- Connect Link
- Disconnect Link
- Generation Options

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

1. Select **View > Toolbars** from the menu bar.
2. Select **Customize** from the submenu to display the Customize dialog box.

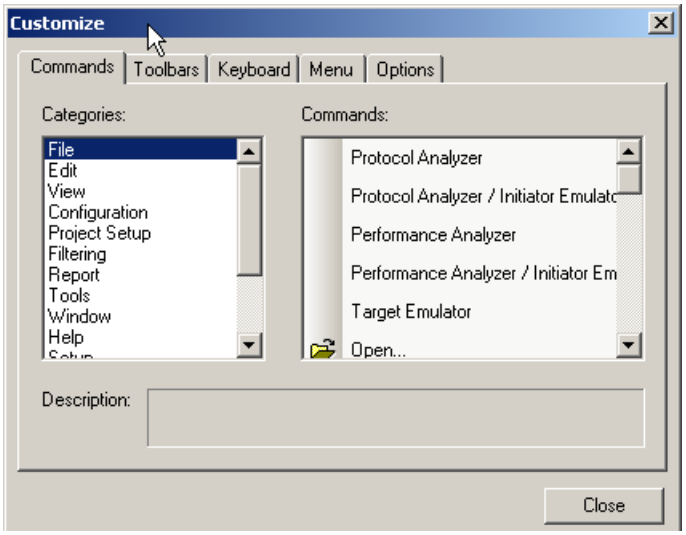


Figure 5.34: Customize Commands

3. Select the **Toolbars** tab to display the Toolbars page of the Customize dialog box.

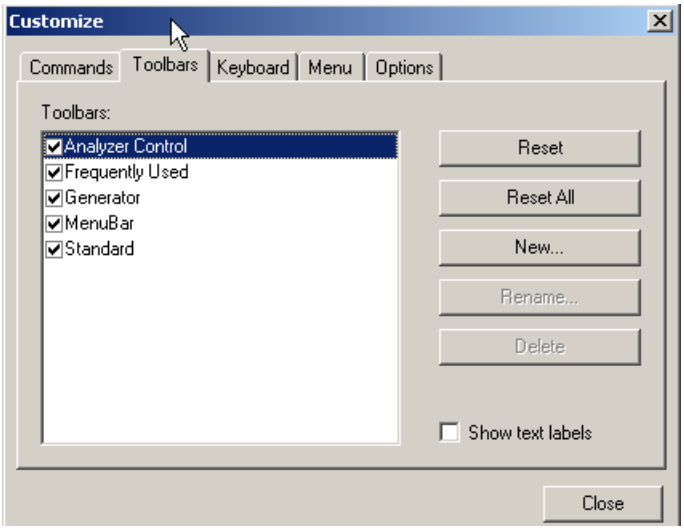


Figure 5.35: Customize Toolbars

4. Click the **Reset All** button.
   The toolbar resets to the factory defaults.

Appendix A

How to Contact Teledyne LeCroy

Send e-mail to Support	psgsupport@teledyne.com
Contact support	teledynelecroy.com/support/contact
Visit Teledyne LeCroy's web site	teledynelecroy.com
Tell Teledyne LeCroy	Report a problem to Teledyne LeCroy Support via e-mail by selecting **Help > Tell Teledyne LeCroy** from the application toolbar. This requires that an e-mail client be installed and configured on the host machine.

Appendix B

China Restriction of Hazardous Substances Table

The following tables are supplied in compliance with China's Restriction of Hazardous Substances (China RoHS) requirements:

	有毒有害物质和元素					
部件名称	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr^{6+})	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
PCBAs	X	O	X	X	X	X
机械硬件	O	O	X	O	O	O
金属片	O	O	X	O	O	O
塑料部件	O	O	O	O	X	X
电源	X	X	X	O	X	X
电源线	X	O	X	O	X	X
保护外壳(如有)	O	O	O	O	X	X
电缆组件(如有)	X	O	X	O	X	X
风扇(如有)	X	O	X	O	X	X
交流滤波器和熔丝组件(如有)	X	O	X	O	O	O
外部电源(如有)	X	X	X	O	X	X
探头(如有)	X	O	X	O	X	X
O: 表明该有毒有害物质在该部件所有均质材料中的含量均在 SJ/T11363-2006 标准规定的限量要求之下。						
X: 表明该有毒有害物质至少在该部件的某一均质材料中的含量超过 SJ/T11363-2006 标准规定的限量要求。						

EFUP (对环境友好的使用时间) 使用条件:
温度: 5摄氏度到40摄氏度
湿度: 5% - 95%最大相对湿度 (无冷凝)
高度: 最高2000米

	Toxic or Hazardous Substances and Elements					
Part Name	Lead (Pb)	Mercury (Hg)	Cadmium (Cd)	Hexavalent Chromium (Cr^{6+})	Polybrominated Biphenyls (PBB)	Polybrominated Diphenyl Ethers (PBDE)
PCBAs	X	O	X	X	X	X
Mechanical Hardware	O	O	X	O	O	O
Sheet Metal	O	O	X	O	O	O
Plastic Parts	O	O	O	O	X	X
Power Supply	X	X	X	O	X	X
Power Cord	X	O	X	O	X	X
Protective Case (if present)	O	O	O	O	X	X
Cable Assemblies (if present)	X	O	X	O	X	X
Fans (if present)	X	O	X	O	X	X
AC Filter/Fuse Assy (if present)	X	O	X	O	O	O
Ext Power Supply (if present)	X	X	X	O	X	X
Probes (if present)	X	O	X	O	X	X
O: Indicates that this toxic or hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement specified in SJ/T11363-2006.						
X: Indicates that this toxic or hazardous substance contained in at least one of the homogenous materials used for this part is above the limit requirement specified in SJ/T11363-2006.						

EFUP (Environmental Friendly Use Period) Use Conditions:

Temperature	5C to 40C
Humidity	5% to 95% max RH (non-condensing)
Altitude	Up to 2000 meters

Appendix C

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:

C.1 Key words

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.

C.2 Comment format

```
/*Comment text*/
```

C.3 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

C.4 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

C.5 Scramble definition format

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

C.6 Role definition format

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

C.7 END_OF_FILE definition

A pattern generator file must include END_OF_FILE as the last statement in the file.

C.8 Example Pattern Generator File

Figure C.1 illustrates a typical Pattern Generator file.

```
/*.....Set Device Bits.....*/
/*Device*/
23.2 23.2.21.5 K28.3                /*X_RDY*/
23.2 23.2.21.5 K28.3                /*X_RDY*/
25.4 25.4.10.5 K28.3                /*CONT*/
XXXX
XXXX
XXXX
XXXX
XXXX
XXXX
XXXX
23.1 23.1 21.5 K28.3                /*SOF*/
00 50 40 A1
E0 00 00 00
21.6 21.6 21.5 K28.3                /*EOF*/
24.2 24.2 21.5 K28.3                /*WTRM*/
24.2 24.2 21.5 K28.3                /*WTRM*/
25.4 25.4 10.5 K28.3                /*CONT*/
XXXX
XXXX
XXXX
XXXX
21.5 21.5 21.4 K28.3                /*SYNC*/
21.5 21.5 21.4 K28.3                /*SYNC*/
25.4 25.4 10.5 K28.3                /*CONT*/
XXXX
XXXX
XXXX
XXXX
Role=Device
Loop=Enable
Scramble=Disable
END_OF_FILE
/*.....*/
```

Figure C.1: Sample Pattern Generator File *spg

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