

JDSU Xgig Maestro User's Guide

Xgig BERT

Xgig Jammer

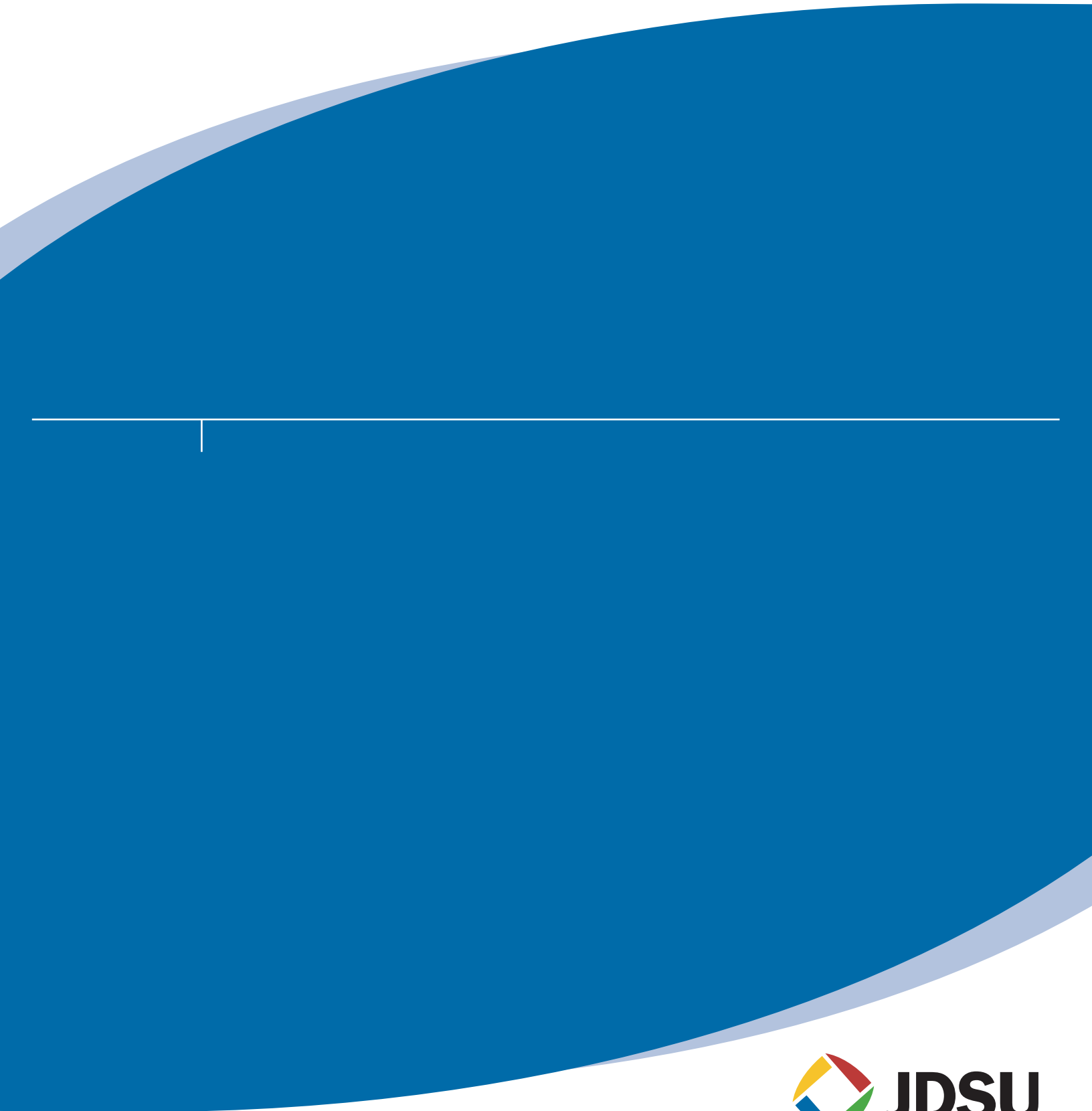
Xgigi Generator

Xgig Target Emulator

Xgig Load Tester

Delay Emulator

version 6.0



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About this Guide

Congratulations on your purchase of this JDSU Xgig Maestro software which, depending on the licenses you obtain, includes Xgig BERT, Xgig Jammer, Xgig Generator, Xgig Target Emulator, Delay Emulator, and Xgig Load Tester.

Who Should Read this Guide

This guide is intended for networking professionals in research and development who need to monitor and test network performance. It is assumed that users of this guide have an engineering background.

What this Guide Contains

This guide is organized into five parts:

- PART ONE: Using Xgig Maestro
- PART TWO: Using Xgig BERT
- PART THREE: Using Xgig Jammer
- PART FOUR: Using Xgig Generator
- PART FIVE: Using Xgig Target Emulator
- PART SIX: Using Xgig Load Tester
- PART SEVEN: Using Delay Emulator

The chapters contain the following information:

Chapter 1, “Using Xgig Maestro” describes the Xgig Maestro graphical user interface and provides procedures to use it.

Chapter 2, “Using the Port Selection and Domain Setup Window” describes how to choose and setup the ports for the BERT and Jammer.

Chapter 3, “Introducing the Xgig BERT” provides a description of the Xgig BERT features included since the last release Xgig Maestro.

Chapter 4, “Using the BERT Tab”, describes the Xgig BERT function tab interface and provides procedures to use it.

Chapter 5, “Configuring BERT Settings” provides procedures and descriptions of the options for setting up a BERT pattern.

Chapter 6, “Configuring Latency Settings” provides procedures and descriptions of the options for setting up latency measurements.

Chapter 7, “Using the Latency Tab” provides procedures and descriptions of the options for running your latency measurement.

Chapter 8, “Bit Error Rate Testing on a Fibre Channel RAID Application Note” describes how to use the Xgig BERT to test a Fibre Channel RAID.

Chapter 9, “Xgig BERT Troubleshooting Tips” contains possible problems that you might encounter and provides solutions.

Chapter 10, “Introducing Xgig Jammer” describes the Jammer features and capabilities.

Chapter 11, “Using the Jammer Tab” describes the Jammer tab interface and provides procedures to use it.

Chapter 12, “Creating Jammer Test Configurations for Fibre Channel” describes the elements on the Xgig Jammer Configuration FC window and how to use them.

Chapter 13, “Creating Jammer Test Configurations for Gigabit Ethernet” describes the elements on the Xgig Jammer Configuration GE window and how to use them.

Chapter 14, “Creating Jammer Test Configurations for SAS and SATA/STP” describes the elements on the Xgig Jammer SAS/SATA/STP Configuration window and how to use them.

Chapter 15, “Creating Jammer Test Configurations for 10GigE” describes the elements in the Xgig Jammer Configuration 10GigE window and how to use them.

Chapter 16, “Xgig Jammer Application Notes” provides examples of how to use the Jammer in practical situations.

Chapter 17, “Introducing Xgig Generator” describes the Generator features and capabilities.

Chapter 18, “Using the Generator Tab” describes the Generator tab interface and provides procedures to use it.

Chapter 19, "Using Generator with Ports" describes the elements of the Xgig Generator Device window and how to use them.

Chapter 20, "Using Generator in Edit Only Mode" describes the elements of the Xgig Generator Macro File and Functions File windows and how to use them.

Chapter 22, "Introducing Xgig Target Emulator" describes the Target Emulator features and capabilities.

Chapter 23, "Using the Target Emulator Tab" describes the Target Emulator tab interface and provides procedures to use it.

Chapter 24, "Using Target Emulator" describes the elements of the Xgig Target Emulator Device window and how to use them.

Chapter 25, "Introducing Xgig Load Tester" describes the Load Tester features and capabilities.

Chapter 26, "Using the Load Tester Tab" describes function tab interface and provides procedures to use it.

Chapter 27, "Configuring Ports" provides procedures in configuring ports for use in Load Tester.

Chapter 28, "Creating Tags" provides procedures in creating tags.

Chapter 29, "Creating and Managing Traffic Patterns" describes procedures in using the Traffic Pattern Editor tab to manage traffic patterns used by Load Tester.

Chapter 30, "Editing Triggers" provides procedures in editing triggers.

Chapter 31, "Managing Multiple Link Services" describes the Link Service tab and the different link service options you can set for the ports locked to Load Tester.

Chapter 32, "Configuring Test Summary Reports" describes procedures in using the creating test summary reports in Load Tester.

Chapter 33, "Introducing Xgig Delay Emulator" describes the Jammer features and capabilities.

Chapter 34, "Using the Delay Emulator Tab" describes the Jammer tab interface and provides procedures to use it.

Chapter 35, "Creating Delay Emulator Test Configurations for Delay Mode" describes the elements on the Xgig Delay Emulator Configuration Delay window and how to use them.

Chapter 36, "Creating Delay Emulator Test Configurations for Reorder Mode" describes the elements on the Xgig Delay Emulator Configuration Reorder window and how to use them.

Appendix A, "Fibre Channel Ordered Sets - Partial List" contains some of the Ordered Set values that are used in this application.

Appendix B, "8-Bit/10-Bit Mapping" contains three tables: one is legal 8-bit/10-bit characters sorted by 10-bit value; the second is 10-bit values with no 8-bit mapping sorted by 10-bit value; the third is legal 10-bit values sorted by K/D code.

Appendix C, "Fibre Channel Legal Arbitrated Loop Physical Addresses" contains translation tables.

Appendix D, “Gigabit Ethernet Ordered Sets - Partial List” contains a table of these values.

Appendix E, “Primitive Encoding” contains a table of K28.5-based Primitive encoding whose 40-bit values have a Hamming distance of at least 8.

Appendix F, “Macro Variables and Functions” describes macro variables and provides a list of the various macro functions.

Appendix G, “Getting Started with Xgig Load Tester” describes how to simplify the detection and resolution of missing frames.

Appendix H, “Simplifying Detection and Resolution of Missing Frames” contains instructions to help you get started in Xgig Load Tester.

Conventions

The following conventions are used in this guide.

Message Formats

This guide uses the following format to highlight special messages:



Note: This format is used to highlight information of importance or special interest.



Caution: This format is used to highlight information that will help you prevent equipment failure or loss of data.

Typographical Conventions

This guide uses the following typographical conventions:

bold sans serif	Commands
<i>italics</i>	Directory names, book titles, named key, for example the Enter key
courier font	Screen text, user-typed command-line entries

Support

You can contact JDSU Monday through Friday, 8 a.m. to 5 p.m. Pacific Time.

Phone: 1-408-400-1100
US Toll-free: 1-866-594-2557
E-mail: techsupport-snt@jdsu.com

PART ONE: Using Xgig Maestro

Chapter 1

Using Xgig Maestro

In this chapter:

- [Xgig Maestro Overview](#)
- [Launching Xgig Maestro](#)
- [Xgig Maestro Global Window](#)
- [Network Connections](#)

Xgig Maestro Overview

Xgig Maestro application is the framework of an Xgig generation system. This framework houses the software for the Xgig BERT, Xgig Jammer, Xgig Generator, Xgig Target Emulator, Xgig Delay Emulator, and Xgig Load Tester (each licensed separately). Combined with an Xgig multi-function blade, this framework lets you test Fibre Channel, Gigabit Ethernet, or Serial Attached SCSI (SAS) / Serial ATA (SATA) networks. You access Xgig BERTs, Xgig Jammers, Xgig Generators, Xgig Target Emulators, Xgig Delay Emulator, and Load Tester from the Maestro General window. Once a Maestro plugin is loaded, its tab appears across the top of the Maestro window. Use these tabs to manage each program. This chapter describes the Xgig Maestro graphical user interface (GUI) basics.

Features

Xgig Maestro has the following features:

- Configuration manager

You can view and access Xgig BERT, Xgig Jammer, Xgig Generator, Xgig Target Emulator, Xgig Delay Emulator, and Xgig Load Tester test configurations/files from each function tab.

- Port discovery, port configuration, and trigger domain set up
- Drag-and-drop capabilities

You can drag a configuration file to the Parameters Status table to load it.

- Xgig Maestro operates under 32-bit versions of Windows Server 2003, Windows XP, and Windows Vista (Business and Ultimate).
- Protocols available in Xgig Maestro are:
 - Fibre Channel
 - Gigabit Ethernet
 - 10GigE
 - FCoE
 - Serial attached SCSI (SAS)
 - Serial AT Attachment/Serial Tunneling Protocol (SATA/STP)

New Features in Xgig Maestro 6.0

This release contains the following new features:

Target Emulator

Xgig Target Emulator now has support for the SATA protocol. The Target Emulator will respond to most of the SATA Gen-3 commands as defined in the SATA Gen-3 standard.

Code changes have been implemented to the Xgig SAS/SATA Generator SDK which runs on the client machine.

New API functions have been introduced for configuring the Target Emulator features.

The Target Emulator also has the ability to inject SATA errors.

Delay Emulator

Delay Emulator is a new tool in the Maestro suite. The purpose of this software is to simulate network congestion. This software emulates network scenarios such as distance, switch processing delay, jitter, and multipath routing.

Queues are used to add delays to frames. Each Delay Emulator test can contain up to eight queues, each of which can have its own delay defined.

Delay Emulator allows you to adjust the delay on live traffic. Delay Emulator includes a real time graph that shows the change in delay.

In addition, Delay Emulator has a frames reorder feature that allows you to reorder the frames consecutively or based on a trigger.

Installing Xgig Maestro

Refer to the *Xgig Maestro Software Installation Guide* for information about how to install the software. See the *Xgig Family Hardware Guide* for information about how to install a multi-function blade in an Xgig chassis. The hardware guide also includes information about cabling the blades to the devices on your network and to the other multi-function blades.

Analyzer Protocols

The Xgig Analyzer software allows you to monitor a network and capture the results of BERT, Jammer, Generator, Target Emulator, Delay Emulator, and Load Tester operations. It supports the following protocols:

- Fibre Channel
- Gigabit Ethernet
- 10GigE
- FCoE
- Serial Attached SCSI (SAS)
- Serial AT Attachment/Serial Tunneling Protocol (SATA/STP)

For detailed information about using and running other Xgig Analyzer software, refer to the *Xgig Analyzer User's Guide*.

Decode Improvements

Decode improvements implemented in each release are documented in the file named `CurrentProtocolVersions.txt` located in the installation folder.

TCP/UDP Port Mapping

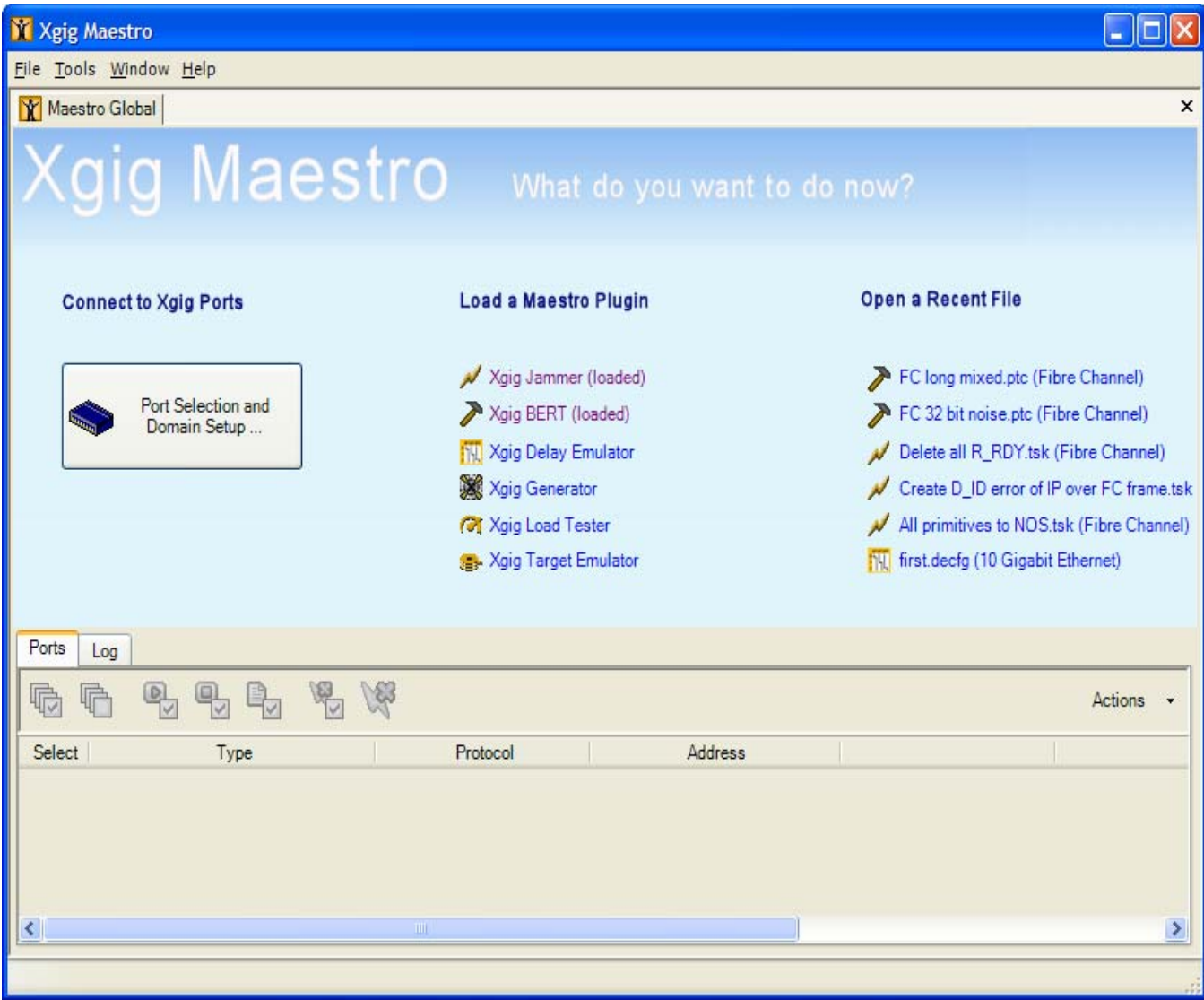
You can change the TCP/UDP port mappings by editing the file named `TCPUDPServices.txt` located in the installation folder.

Launching Xgig Maestro

To launch Xgig Maestro, go to **Start > Programs > JDSU > Xgig Maestro**.

The Xgig Maestro Global window is displayed (Figure 1). The following section describes this window.

Figure 1: Xgig Maestro Window



Xgig Maestro Global Window



Note: BERT, Jammer, Generator, Target Emulator, Load Tester, and Delay Emulator are referred to as *devices* throughout this guide.

The terms *Configurations* and *tests* are used interchangeably in this guide.

Load a Maestro Plugin

The Load Maestro Plugins section allows you to load Maestro plugins as you need them. Once you click a Maestro plugin, that Maestro function will be loaded, and the corresponding tab will appear across the top of the window. We refer to these tabs, generically, as function tabs. Click the icon for the product you want to use. The plugin will be loaded, and the corresponding window will open with the function tab at the top.

The available plugins are:



Xgig Jammer



Xgig BERT



Xgig Generator



Xgig Load Tester



Xgig Target Emulator



Xgig Delay Emulator



Note: You do not need to load every plugin from the Maestro Global window. Once you have loaded one plugin, you can use that function window's **File** menu to create or access files for other functions. When you do so, the plugin for the selected file will be loaded.

Open a Recent File

This option lists the six most recently used files for the various functions. If you want to bypass selecting the plugin to load and locating a recently used file, you can simply click the file in the Maestro Global window. Then, the appropriate plugin will be loaded, and the file you selected will open.

Port Selection and Domain Setup Button

Click the **Port selection and domain setup button** to open the Port Selection and Domain Setup window (Figure 2). You use this window to set up BERT, Jammer, Generator, Target Emulator, Delay Emulator, and Load Tester ports. For more information about this window, refer to [Chapter 2, “Using the Port Selection and Domain Setup Window.”](#)

Figure 2: Port selection and domain setup Button

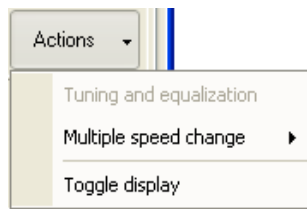


Note: The Port and Domain Setup button is also located on each function tab that is loaded.

Actions Button

The **Actions** button contains menus for **Tuning and Equalization** (6G SAS/SATA Jammer and Generator only), **Multiple speed Change**, and **Toggle Display**. The menu options are only available for the Maestro plugins you have loaded and locked ports for. The Actions button is also located on the function tabs that have been loaded. See [Figure 3](#).

Figure 3: Actions Button Options



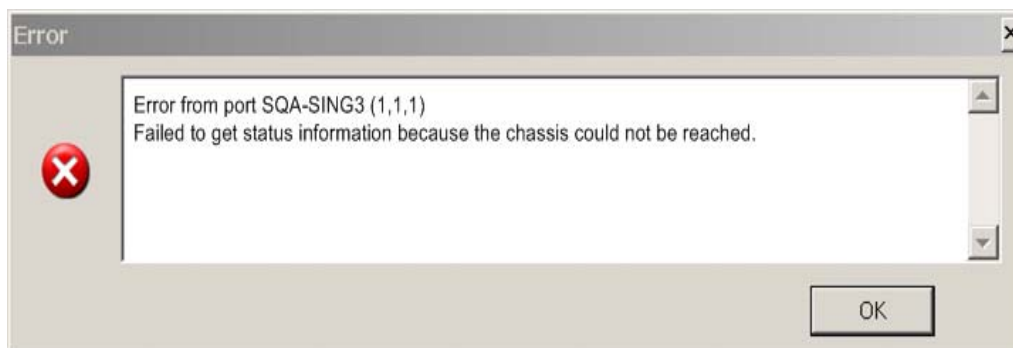
Refer to the chapters for BERT, Jammer, Generator, Target Emulator, Delay Emulator, and Load Tester for a detailed description of the menus and options available for each function associated with the **Actions** button.

Network Connections

Remote BERTs and Jammers do not require a persistent Ethernet LAN connection between the local Xgig Maestro software and the remote hardware to operate properly. The remote BERT/Jammer will continue to run if you lose network connection or exit the Xgig Maestro application.

If the network connection is lost, you will receive the following message:

Figure 4: Network Connection Lost



You may receive this message when using Windows Vista if you do not have the power options set correctly. Make sure the power options for Windows Vista are set to High Performance. If you receive this message, ping the Xgig chassis to see if you get a response. If the ping is successful, try to reconnect to the ports in the domain. If unsuccessful, look for cabling problems at your local system and then within the network; make sure the Xgig chassis is physically connected to the network.

If you can ping the Xgig chassis but cannot lock the ports, and the ports are not locked by another user, as a last resort you may have to reboot the Xgig chassis.

Chapter 2

Using the Port Selection and Domain Setup Window

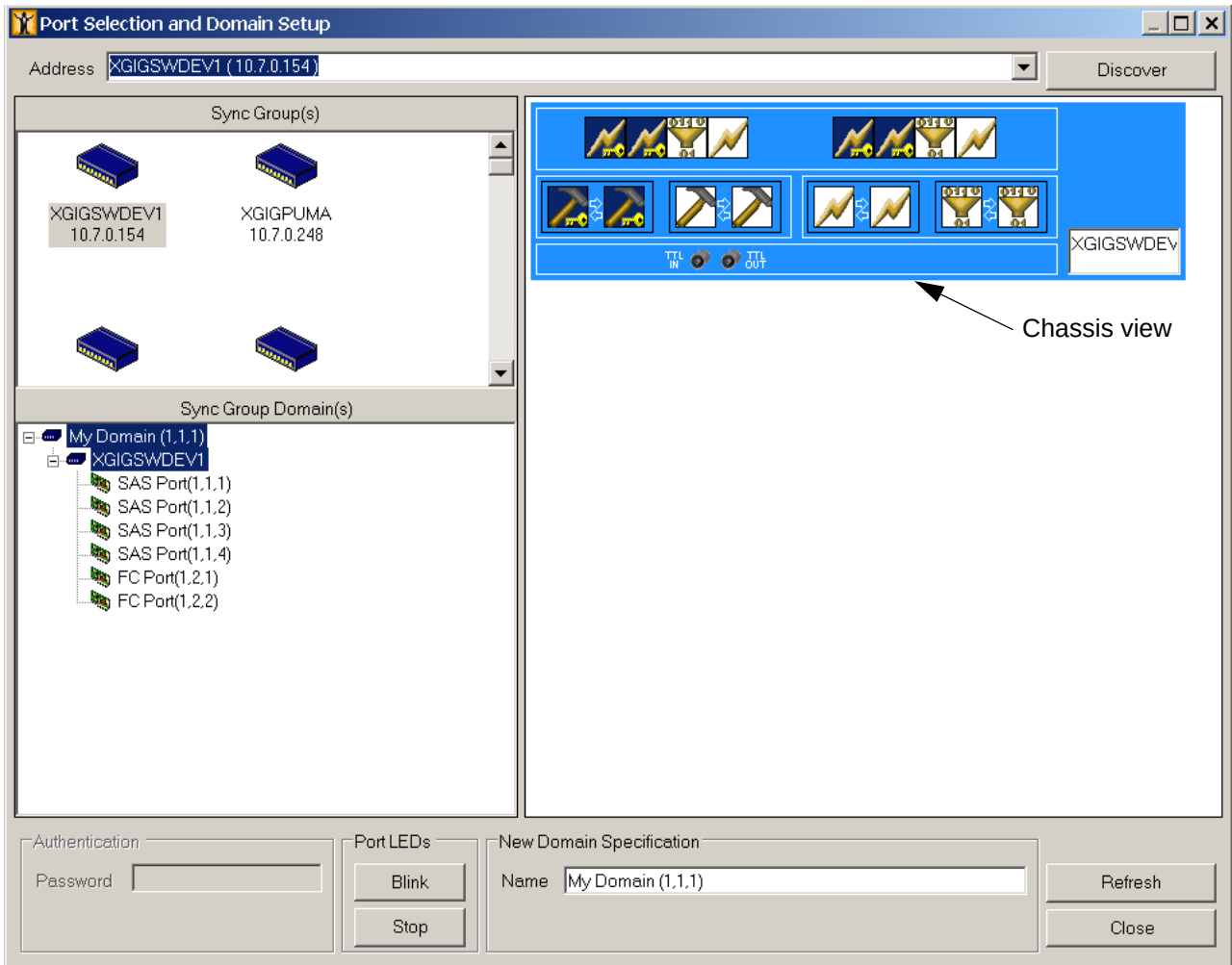
In this chapter:

- [Discovering Sync Groups on the Network](#)
- [Using the Sync Groups Pane](#)
- [Using Chassis View](#)
- [Using Domains](#)
- [Using Other Controls on the Window](#)

Use the Port Selection and Domain Setup window (Figure 5) to locate and set up the chassis and ports that you want to use as Xgig BERTs, Xgig Jammers, Xgig Generators, Xgig Target Emulators, Xgig Load Testers, or Xgig Delay Emulators. To open this window:

- >> Click the **Port selection and domain setup button** in the Maestro Global window or above the Configuration manager in any of Maestro's function windows.

Figure 5: Port Selection and Domain Setup Window with Sync Group Selected



The **Address** field is where you enter the IP address or name of the Xgig chassis you want to access.

The **Discover** button initiates a discovery when you enter an Xgig chassis IP address or name and click.

The **Sync Group(s)** pane lists the chassis Sync Groups discovered by the application.

Chassis view displays a graphic of the chassis in the Sync Group you select in the Sync Group pane.



Note: The 6 Gigabit SAS/SATA Wide Port Analyzer (Xgig-LXP) and the 6 Gibabit SAS/SATA Multi-Function blade each have four ports although eight ports are shown in the chassis view. The four non-operational ports are displayed with a diagonal line as shown here:



The **Domain(s)** pane lists the domains in the selected Sync Group.

The **Authentication** Password area is used to enter the password required to access secured Sync Groups.

New Domain Specification area provides an entry field for a name you assign to domains you set up.

The **Port LEDs** area provides buttons to blink LEDs on the blades in the Xgig chassis.

The **Refresh** button updates the graphic on the screen.

The **Close** button closes the Port Selection and Domain Setup window.

Discovering Sync Groups on the Network

By default, the window displays all the Sync Groups found in the same subnet as your client.

To discover a Sync Group elsewhere on your network:

- 1 Click the **Port Selection and Domain Setup** button to open the window where you locate and set up the chassis and ports that you want to use as Xgig BERTs, Xgig Jammers, Xgig Generators, Xgig Target Emulator, Xgig Load Tester, and Xgig Delay Emulator.
- 2 In the Address text field at the top of the **Port Selection and Domain Setup** window, enter the name or IP Address of the chassis you want to use. Or click on the down arrow at the right end of this field to open a drop-down list of recent entries.
- 3 Click **Discover**.

If the application can discover the chassis, it displays the chassis in the Sync Group(s) pane on the left side of the Port Setup window. The application displays the entire Sync Group to which that chassis belongs. In addition, all Sync Groups found in that same subnet of your network are discovered.

If you are an Administrator on Windows XP or Vista with Windows Firewall enabled and you open the Discovery window for the first time, the firewall will prompt you to unblock XgigMaestro.exe. Click **Unblock** to add XgigMaestro.exe as Firewall Exceptions to allow other Sync Groups in the same subnet to be discovered. If you are a Standard User, you will need the Computer Administrator to unblock XgigMaestro.exe.

For Windows 2003 Server, Windows Firewall must be disabled to allow other Sync Groups in the same subnet to be discovered irrespective of whether you are an Administrator or a Standard User.

Using the Sync Groups Pane

Sync Groups discovered by the application are displayed in this pane. Each Sync Group is represented by an icon and descriptive text. Sync Groups consisting of one single chassis are represented by a single blue chassis icon . Sync Groups consisting of more than one chassis

are represented by a double chassis icon . The text underneath the icon is always the name of the chassis that is the “master” of the Sync Group, followed by its IP Address. If you use the discovery feature to search for a specific chassis, remember that it might be a “slave” chassis within a Sync Group, which means the specific chassis name is not displayed in the Sync Groups pane.

Displaying Sync Group Tool Tips

To view a tool-tip pop-up:

>> Hold the mouse over a Sync Group.

All the names and IP addresses of chassis in that Sync Group are displayed. The master chassis is listed first, followed by chassis in the order they are cabled in the cascade.

Displaying Chassis View

To display the Chassis View:

>> Click on a Sync Group.

The Chassis View is displayed on the right side of the Port Selection and Domain Setup window showing the blade ports and the function assigned to each port.

Unavailable Chassis Indicator

A Sync Group chassis icon with a large red circle with a line through it  indicates the software versions of the client application and the server software on that chassis are not compatible.

Using Chassis View

When you select a Sync Group in the Sync Group(s) pane, Chassis View displays a graphic of the entire Sync Group in the right pane of the Port Selection and Domain Setup window. The master chassis is always shown on top, with chassis shown downwards in the order in which they are cabled in the cascade. Each chassis graphic shows:

- The name and IP Address at the lower right corner
- A graphic, sized to show whether it is a 1, 2, or 4 slot chassis
- Slots in the chassis, numbered 1 through 4, starting at the top left, then bottom left, then top right, and finally bottom right, for a 4 slot chassis

- Each blade installed, represented by a long horizontal white rectangle which contains icons indicating the ports present
- Ports numbered 1 through 4 (if there are 4 ports present), ordered left to right.
- Tool-tips—You can hold the mouse over a chassis, a blade, a port, or a TTL connector to display information about that item. The following tool-tips are available in Chassis View:
 - Chassis Tool-tip
 - Chassis name
 - Chassis IP address
 - Chassis serial number
 - Blade Tool-tip
 - Slot number
 - Blade serial number
 - Blade type
 - Licensed for—lists the Xgig functions which you can use for this blade
 - Port Tool-tip
 - Port—displays the protocol and the location with 3 numbers: chassis, slot, and port number
 - Blade type
 - Function—shows the current Xgig function running on this port
 - Domain—displays the domain to which this port belongs
 - Used by—displays the name of the user that has this port locked, if any
 - Licensed for—indicates the Xgig functions which you can use for this port
 - TTL Tool-tip
 - Used by—displays the name of the user who has this connector locked, if any

Multi-Function Ports and Symbols

Each port has at least a default Xgig application loaded onto it. Icons indicate the type of device that a port is configured as:

- Funnel  represents the Xgig Analyzer
- Fan  represents an odd-numbered Xgig Generator port

- Fan outline  represents an even-numbered Xgig Generator port



Note: To lock a Generator port, you only need to select the odd-numbered port, then right-click the port, select Use Port as, then select the Generator SAS/SATA option.

- Hammer  represents the Xgig BERT
- Lightning bolt  represents the Xgig Jammer
- Stacked Discs  represent the Xgig Target Emulator
- Graph  represents the Xgig Delay Emulator



Note: When locking Delay Emulator ports, both ports will be locked, however, only the odd port will be used. The even port is non-functional for Delay Emulator.

- Solid black double arrows between two Jammer ports  indicate a duplex Jammer.

You can change the function of an Xgig Analyzer port pair to an Xgig BERT, Xgig Jammer, Xgig Generator, Xgig Target Emulator, Xgig Load Tester, or Xgig Delay Emulator pair. The available licenses for the blade determine how you can use each port. The tool-tip provides that information.

A port locked by another client application has a padlock symbol  on the port icon. You cannot perform any actions on ports locked by other client applications. When you lock a port, a golden key is displayed on the port icon .

For more information about changing the function of an Xgig Analyzer port to an Xgig BERT, Xgig Jammer, Xgig Generator, Xgig Target Emulator, Xgig Load Tester, or Xgig Delay Emulator, refer to “Use Port(s) as...” on page 26.

Selecting Chassis Items

To select (or unselect) ports:

>> Click the port icon.

The port turns a dark blue.

You can click any number of ports.

To select a blade:

>> Click on the blade.

To select a chassis:

>> Click on a chassis.

To select a TTL connector

>> Click the connector icon in the chassis view.

Whenever you select an action to be performed on the Chassis view, the application attempts to perform this action on all ports or connectors you have selected. If you try to perform an action on a port or connector that is locked by another user, you receive a rejection message.

Selecting Simplex and Duplex Jammers

When using Fibre Channel or Gigabit Ethernet, you can lock each port pair as two separate simplex Jammers or as one duplex Jammer. This depends upon how you select the ports.

To set up simplex Jammers:

>> Click on each port.

You see two separate selections, and this results in simplex Jammers ([Figure 6](#)).

To setup a duplex Jammer:

>> Click directly in between the ports.

The port pair is selected, which results in a duplex Jammer.

To setup a duplex Jammer using a SAS/SATA wide blade:

>> Click on each port.

The port pair is selected, which results in a duplex Jammer.

You can use the information in “Use Port(s) as...” on page 26 to lock the simplex or duplex Jammer ports.

Figure 6: Locked Devices in Ports Manager

Duplex Jammers display port numbers

Type	Protocol	Address	Status	Domain of Port A	Domain of P
Jammer	SAS/SATA	XGIGSWDEV1 (1,1,1-2)	▶ Running	My Domain (1,1,1)	My Domain
Jammer	Fibre Channel	XGIGSWDEV1 (1,2,1)	▶ Running	My Domain (1,1,1)	N/A
Jammer	Fibre Channel	XGIGSWDEV1 (1,2,2)	▶ Running	My Domain (1,1,1)	N/A
Jammer	Gigabit Ethernet	XGIGSWDEV1 (1,2,3-4)	■ Stopped		



Note: You can only use the SAS Jammer as a duplex Jammer. Follow the instructions for locking duplex Jammer ports.

Authentication for Xgig Chassis

The Xgig chassis has a secure login feature which allows you to protect an Xgig chassis with a password to prevent access by unauthorized users. You set password protection through the Xgig Web Utility for each Xgig chassis (Figure 7).



Note: When locking ports for use as Xgig Generators, the authentication password is not considered. The ports will be locked regardless of whether the authentication password is correct.

Login is only required once from any of the Xgig Maestro or Xgig Analyzer applications running on the same client machine. For example, if you login through Xgig Maestro, you will not be asked for the password again when you access the same Xgig chassis sync group through TraceControl. To make sure you are completely logged off from all Xgig chassis, you must close all Xgig applications.

Figure 7: Xgig Web Utility

[Configurations](#)
[Status](#)
[Upgrades](#)
[Server](#)
[Security](#)
[Help](#)

Client Authentication Status

Current State Disabled

Client Authentication Enabled ☒

Set Password

Confirm Password

Save

For login, the settings of a master Xgig chassis in a sync group apply for all chassis in the sync group. If the master has authentication turned off and a slave(s) has authentication turned on, then the sync group as a whole has authentication turned off. The settings for the master Xgig chassis also apply for the password; the password of the master Xgig chassis is the password of any attached slave. Refer to “Xgig Blade and Port Numbering” in the *Xgig Family Hardware Guide* for more information on master, slaves, and sync groups.

Logging in to an Xgig Chassis from Xgig Maestro

To lock ports or manipulate domains you must log into the Xgig chassis on which the ports reside.

To log in to an Xgig chassis:

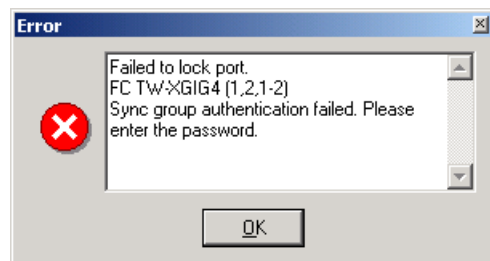
- 1 Open the Port Selection and Domain Setup window.
- 2 Type the Authentication Password in the field at the left lower corner of the window.

You must set up a password. Refer to Online Help provided in the Utility for additional information about setting up a password.

Asterisks indicate that you have entered a password. The password is held in a shared cache which allows you to access the same chassis from other Xgig applications such as Xgig Performance Monitor.

If you attempt to lock a port or modify a domain on a chassis that is protected by a password, an error dialog is displayed if the password in the Authentication Password area is not valid (Figure 8).

Figure 8: Password Error Dialog



Using the Chassis Context Menu to Lock Ports

Once you have typed the password for the chassis and selected ports, right-click on one of them to view the menu of available actions. Menu items that do not apply to all selected items are disabled. Change your selection to have only valid items for the actions you want.

Port pairs are indicated by horizontal black rectangles on the blade, and are grouped as ports 1 and 2, and as ports 3 and 4. For more information about blade configuration and port numbering, refer to the Xgig Family Hardware Guide on the product CD. For BERT, Jammer, Generator, Target Emulator, or Delay Emulator you must select both ports in each pair to attempt any of the actions listed below. For Generator, you only need to select the odd-numbered port in the port pair to perform the actions listed below.

Once you have selected the port(s) you want to lock, right-click one of the selected ports. This displays a drop-down menu with the following options:

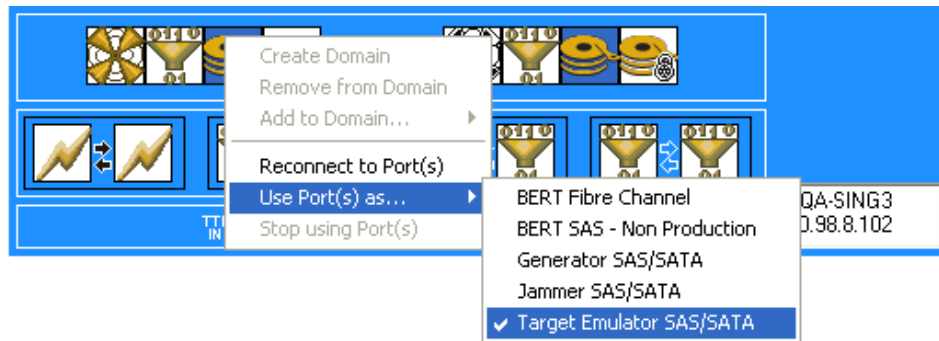
Reconnect to Port(s)

This action is available if the ports are not locked and are already configured as BERTs, Jammers, Generators, Target emulators, Load Testers, or Delay Emulators. When you select this action, it locks the ports and maintains the current configuration and state (including running) of the ports. It also retains the simplex versus duplex Jammer/Delay Emulator setting.

Use Port(s) as...

This action is available if the ports are not locked and are licensed as BERTs, Jammers, Generators, Target Emulators, Load Testers, or Delay Emulators. When you select this action, an additional menu appears that lets you choose the device (depending on available licenses) you want to use. A multi-function blade license allows you to switch the function from an Xgig Analyzer to an Xgig BERT, an Xgig Jammer, Xgig Generator, or an Xgig Target Emulator (Figure 9) running different protocols.

Figure 9: Use Port(s) As Menu



Selecting Protocols and Functions

You can choose from the following functions and network protocols for your Xgig device under the **Use Port(s) as** menu:

- BERT Fibre Channel
- BERT Gigabit Ethernet
- Jammer Fibre Channel
- Jammer Gigabit Ethernet
- Jammer SAS/SATA
- Generator SAS/SATA
- Target Emulator SAS/SATA
- Load Tester Fibre Channel/FCoE
- Delay Emulator Gigabit Ethernet

Stop using Port(s)

This action is available for your locked ports. When you select this action, it releases the ports (but does not stop the BERT, Jammer, Generator, Target Emulator, Load Tester, or Delay Emulator if it is running) and removes the devices from the Ports Manager in the Xgig Maestro window. This allows any user to connect to the ports.

Using Domains



Note: Domain functionality applies only to BERT, Jammer, Target Emulator, Load Tester, and Delay Emulator. Generator cannot add, create, remove, or edit domains.

A domain is a logical set or subset of ports and TTL connectors that belong to the same Sync Group. A domain must contain an even number of hardware analyzer ports. Thus, a logical domain is an even number of analyzer ports between 2 and 64. The actual maximum number of physical ports is determined by the number of Xgig analyzers concatenated together, the number of blades in each chassis, and the port density of each blade. The physical maximum is four chassis, with four blades, with four ports on each blade, for a maximum port count of 64.

A Sync Group can have up to 8 domains if all the domains have only BERT, Jammer, Generator, Target Emulator, Load Tester, and Delay Emulator ports. One primary use for these groups is to share triggers between ports. When using applications such as Xgig Jammer, if you configure a port to look for an external trigger input, the only way to receive such a trigger input is for the port to be part of a domain that gets triggered. And, if you configure a port to create an external trigger output, that trigger is only useful if the port is part of a domain, in which case it triggers that domain. If a domain is triggered, then all ports in that domain receive that external trigger input.

Xgig BERT can also be in a domain. In BERT mode, a trigger can start or stop a BERT. The BERT can trigger the domain when its capture stops or when a mismatch is detected. In Latency mode, triggers are not used.



Note: In Xgig Analyzer, all ports belonging to one Analyzer device are automatically part of one domain. Furthermore, any triggering of that domain triggers all the Analyzer ports, and any completion of a user-defined Trigger Condition in an Analyzer port triggers the entire domain.

Xgig BERT, Jammer, Generator, Target Emulator, Load Tester, and Delay Emulator do not operate under the Analyzer rules. You can choose whether or not:

- To put any port in any domain
- A port should accept or ignore triggers from the domain
- A port should send triggers to the domain.

As an example to illustrate this, you could put an Xgig Jammer port in the same domain as a pair of Xgig Analyzer ports. You could set the Xgig Jammer to give an external trigger output as part of a Test Case. In this way, when the Jammer successfully triggers and jams what you want, this sends an external trigger from the Jammer port that would trigger the domain and the Analyzer.

Another example is using the TTL input on the chassis. You can put the TTL input in the same domain as an Xgig Jammer port, and set the Jammer port to Arm on an external trigger input. In this way, you allow the Jammer to Arm on a TTL input pulse. Note that you can achieve this with a TTL input connector on any chassis in the Sync Group.



Caution: Remember that all elements in a domain receive a trigger when the domain is triggered. Therefore, if you put a TTL input connector and a TTL output connector in the same domain as a Jammer port, thinking that you can use both TTL input and TTL output in separate Test Cases, you should realize that when a TTL signal is received at the TTL input connector, it does not only trigger the Jammer port but also triggers the TTL output connector.

For the Xgig Analyzer, ports are put in the same domain to allow you to stop and start them together, but that is not relevant to the Xgig BERT, Jammer. You start and stop each BERT or Jammer device independently of other devices in the same domain.

Configuring Domains

The way the controls for domains work is similar to the controls for locking and unlocking ports. First select the ports and/or TTL connectors you want to target, and then right-click on one of the selected items to view the menu of available actions. The domain related actions are listed above the port locking actions. This section describes the menu actions you use to configure domains.



Note: You do not have to select Maestro ports in pairs to perform domain related actions. Each port in a pair can be in a different domain. You can use this with a duplex Jammer, in particular, with one port receiving a trigger from TTL input and the other port triggering TTL output.

Create Domain

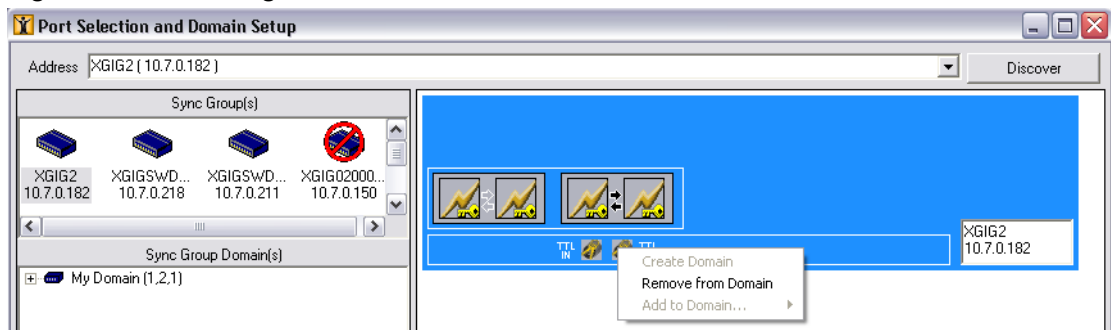
This action is only available on Maestro ports you lock or TTL connectors that are not already in a domain. This action creates a new domain with the name under New Domain Specification at the bottom of the Port Selection and Domain Setup window; all selected ports and TTL connectors are put in that domain. The domain appears in the Domain pane on the left side of the Port Selection and Domain Setup window.

Remove from Domain

This action is only available on Maestro ports not locked by another client application and on TTL connectors not locked by an Xgig Analyzer. When you select this action, it removes selected ports and TTL connectors from the domain.

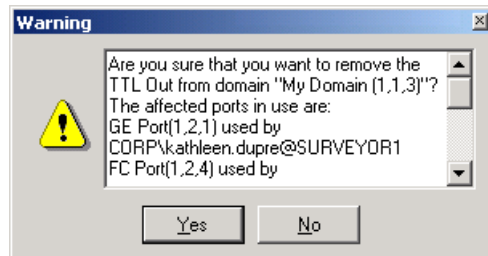
To remove a port or TTL connector from a domain:

- 1 Select the port or TTL connector in the Chassis View.
- 2 Right-click on the item in the graphical display to open the menu (Figure 10).

Figure 10: Removing a Port or TTL Connector from a Domain

3 Select **Remove from Domain**.

The following warning is displayed (Figure 11).

Figure 11: Domain Warning

4 Click **Yes** to remove the port or TTL connector.



Note: Removing the last port from a domain deletes that domain.

Add to Domain...

This action is only available on TTL connectors or Maestro ports that you have locked that are not already in a domain. When you select this command, another menu appears with a list of available domains to choose from. This action adds the ports and TTL connectors to the domain you choose. This can include a domain created by another user consisting of Analyzers.



Note: To share triggers between BERT, Jammer, Generator, Target Emulator, Load Tester, or Delay Emulator, and Analyzers, create the Analyzer domain first, then lock the Maestro ports, and add them to the Analyzer domain

Domain Pane

The Domain pane on the left side of the Port Selection and Domain Setup window contains a list of all the domains in the selected Sync Group. When you click on a domain, you select all the ports and TTL connectors in the Chassis View that are part of that domain.

If you right-click on a domain, there is one menu command, **Remove Domain**. This deletes the domain from the Sync Group entirely. This action is only available on a domain that does not contain any locked ports or an Analyzer capture.

New Domain Specification

To add a domain:

>> Enter the name you want to assign to the next domain in this field.

The default is “My Domain” and then three numbers in parenthesis: chassis number, slot number and port number. The numbers correspond to the first port you select when no ports have been selected.

To override the default:

>> Type your own text.

To reactivate the feature:

>> Clear any text and click on a port.

Using Other Controls on the Window

The Port Selection and Domain Setup window has additional controls on the window that let you flash the port LEDs on a blade, refresh the display, close the window, shut down sync group and upgrade chassis. This section describes these controls.

Controlling LEDs on the Ports

The Port Selection and Domain Setup window has buttons at the bottom that let you flash the port LEDs on a blade. This can help you identify blades in your Xgig chassis.

To flash the LEDs:

- 1 Select the ports you want.
- 2 Click **Blink** to start the LEDs flashing.
The four LEDs on the port blink green.
- 3 Click **Stop** to end the blinking.

The LEDs automatically stop blinking after 40 seconds, if you do not click **Stop**.

Updating the Display

To update the display of the information presented in the Port Selection and Domain Setup window:

>> Click **Refresh**.

This can be useful if another user is making changes to ports at the same time.

Closing the Window

To exit the Port Selection and Domain Setup window:

>> Click **Close**.

Shutting Down a Sync Group

To shut down a sync group:

- 1 Position the cursor over the sync group you want to shut down.
- 2 Select **Shutdown Sync Group** from the Context Menu.

Upgrading a Sync Group

When the software on the chassis is outdated, a new option “Upgrade Sync Group with latest System/Appkit ...” becomes available on the Context Menu. You need to download the latest Upgrade Appkit and use this option to apply the upgrade.

To upgrade sync group:

- 1 Position the cursor over the sync group you want to shut down.
- 2 Select **Upgrade Sync Group with latest System/Appkit...** from the Context Menu.
- 3 When the **Upgrade Sync Group** dialog box appears, confirm the Application and System version numbers and click **Yes** to proceed with upgrade.
The upgrade process may take several minutes, depending on the network performance as well as the number of chassis in the sync group being upgraded.

If you are an Administrator on Windows XP or Vista with Windows Firewall enabled and you upgrade the chassis for the first time, the firewall will prompt you to unblock ProbeUpgradeUtility.exe and SyncGroupUpgradeUtil.exe. Click **Unblock** to add these two programs as Firewall Exceptions to allow the upgrade to happen. If you are a Standard User, you will need the Computer Administrator to unblock these two programs. Otherwise, the upgrade will fail after a timeout of six minutes.

For Windows 2003 Server, Windows Firewall must be disabled to allow the upgrade to happen irrespective of whether you are an Administrator or a Standard User.

PART TWO: Using Xgig BERT

Chapter 3

Introducing the Xgig BERT

In this chapter:

- [Xgig BERT Features](#)
- [Xgig BERT Operation](#)

This chapter describes the JDSU Xgig BERT (Bit Error Rate Tester) and how to use it to test gigabit serial devices.

The Xgig BERT allows you to:

- Test using bit error rate testing at 1.0625, 1.2500, 1.5000, 2.1250, 2.5000, 3.0000, 4.2500 and 8.5000 gigabit per second rates
- Verify physical layer components
- Send legal or illegal 8-bit and 10-bit patterns
- Measure latency

You can use Xgig BERT with JDSU test instruments; for example, it can be combined with the Xgig Analyzer to get more meaningful test results.

Xgig BERT Features

BERT is part of the Xgig Family of instruments. Xgig BERT has the following features:

- Up to 8.5000 gigabits per second (Gbps) Fibre Channel capability
- Xgig Maestro control window handles discovery and port set up for Xgig BERT
- Ability to control ports in a remote Xgig Chassis
- Ability to control multiple BERT ports at a time with one application
- Ability to share triggers with other devices in the same domain
- Improved status LEDs

Three LEDs on the Xgig Maestro window provide status. Similar LEDs are also located on the front of the Xgig blades:

- The Signal LED is a live indicator of Loss of Signal and Loss of Synchronization
- The LOS LED provides latched information about Loss of Synchronization during a test
- The Mismatches LED provides latched information about mismatches during a test

- Compare Zone can contain up to 4096 words
- Supports Fibre Channel Class 4 Ordered Sets
- Improved logging features

Xgig BERT Operation

This section describes how patterns are transmitted to assist you in understanding how Xgig BERT operates.

If you want to create your own patterns to run, rather than use the patterns that are provided with the application, you use the BERT Configuration window.

Opening the BERT Configuration Window

If you want to create a configuration without assigning ports, on the main window menu bar go to:

File > New BERT Configuration > Bit error rate testing > Fibre Channel (Gigabit Ethernet)

To open this window with hardware assigned to the BERT:

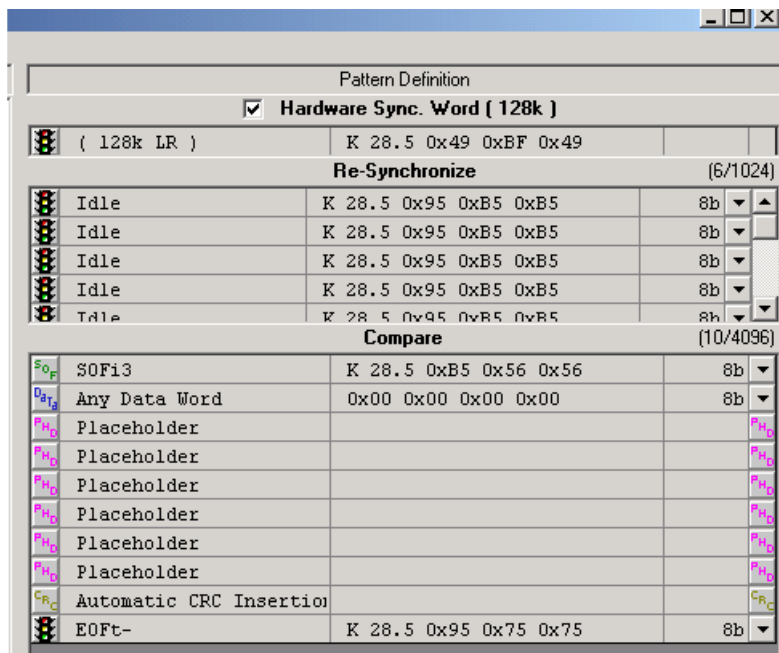
- 1 On the Port Selection and Domain Setup window, discover the chassis and use ports as BERTs. Refer to [Chapter 2, “Using the Port Selection and Domain Setup Window”](#) for details about how to do this.
- 2 Return to the Xgig Maestro main window and click on a device on the BERT tab.
- 3 Click the **Config** button.

The BERT Configuration window is displayed. From this window you can create your own patterns. Refer to [“Using the BERT Configuration Window” on page 80](#) for additional information about how to configure the BERT.

The Xgig BERT Pattern

When you look at the right side of the BERT Configuration window in its default form, you see the Pattern Definition window, divided into three sections ([Figure 12](#)). This is representative of what Xgig BERT sends.

Figure 12: Pattern Definition Window



When stopped, a user-definable word is sent repeatedly. You set this word in the **When stopped send...** box.

When you click **Start** on the BERT tab on the Xgig Maestro window, the following sequence occurs:

- Send 128k Hardware Sync Words to align the receiver (if enabled)
- Send the words in the Re-Synchronize (Re-Sync) Zone (if Re-Sync Mode is on)
- Send the words in the Compare Zone
- Loop from the bottom to the Re-Sync Zone again (or to the top of the Compare Zone if Re-sync Mode is off)
- Continue to loop until a stop condition is met.

Refer to “[Pattern](#)” on page 86 for more information about BERT patterns.

Patterns Sent and Received by Xgig BERT

Patterns are assembled and sent as 40-bit words. Often, those 40 bits represent four characters, symbols, or bytes as represented in 8-bit and 10-bit encoding. This device uses the Fibre Channel mapping of on-screen data to the wire. The data mapping is listed in Table 1.

Table 1: Fibre Channel On-Screen Data Mapping

Most Significant Character	Less Significant Character	Less Significant Character	Least Significant Character
Bits 76543210	7,6,5,4,3,2,1,0	7,6,5,4,3,2,1,0	1,0,1,1,1,1,0,0 K
Bits HGFEDCBA Z	H,G,F,E,D,C,B,A Z	H,G,F,E,D,C,B,A Z	H,G,F,E,D,C,B,A Z
8b to K/D Transform			
Z E D C B A H G F	Z E D C B A H G F	Z E D C B A H G F	K 1 1 1 0 0 1 0 1
K().()	K().()	K().()	K(28).(5)
K/D to 10b Transform (Note that “a” is transmitted first)			
abcdeifghj	abcdeifghj	abcdeifghj	0 0 1 1 1 1 1 0 1 0

The least significant column in Table 1 shows an example of the 0xBC and a control flag converted into the well-known K28.5 “comma” character in a 10-bit space.

Most characters are data characters and can be represented in the form “Dx.y.” There is a small set of characters called control characters that are represented as “Kx.y.”



Note: Some blades give the option of enabling Fibre Channel Frame Scrambling, which is part of the Fibre Channel Specification for 8 Gbps. With scrambling enabled, all Fibre Channel BERT payload words are scrambled in 8-bit form and then encoded to 10-bit form, which means that the bits on the wire do not directly map to the 8-bit characters in the Configuration window.

8-Bit/10-Bit Encoding And Running Disparity

The 8-bit/10-bit encoding method is used to maintain DC balance in the cable by having nearly equal 1s and 0s, as well as having a transition-rich environment for maintaining a clock recovery phase locked loop. Only 10-bit characters that have 4, 5, or 6 ones present are legally used. In general, if a character has 6 ones the next non- 5 ones and 5 zeros character will have 4 ones. Most bytes have two possible 10-bit encodes whose usage depends on the running disparity left by the previous symbol. Refer to [Appendix B, “8-Bit/10-Bit Mapping”](#) for a list of 8-bit/10-bit characters.

Running disparity for a transmission character is calculated on the basis of sub-blocks, where the first 6 bits (abcdei) form one sub-block (6-bit sub-block) and the second 4 bits (fghj) form the other sub-block (4-bit sub-block). The running disparity at the beginning of the 6-bit sub-block is the running disparity at the end of the last transmission character. The running disparity at the beginning of the 4-bit sub-block is the running disparity at the end of the 6-bit sub-block. Running disparity at the end of the transmission character is the running disparity at the end of the 4-bit sub-block. Running disparity for the sub-blocks is calculated as follows:

- Running disparity at the end of any sub-block is positive if the sub-block contains more ones than zeros. It is also positive at the end of the 6-bit sub-block if the 6-bit sub-block is 000111, and it is positive at the end of the 4-bit sub-block if the 4-bit sub-block is 0011.
- Running disparity at the end of any sub-block is negative if the sub-block contains more zeros than ones. It is also negative at the end of the 6-bit sub-block if the 6-bit sub-block is 111000, and it is negative at the end of the 4-bit sub-block if the 4-bit sub-block is 1100.
- Otherwise, running disparity at the end of the sub-block is the same as at the beginning of the sub-block.



Note: All sub-blocks with equal numbers of zeros and ones are disparity neutral. In order to limit the run length of 0s or 1s between sub-blocks, the 8-bit /10-bit transmission code rules specify that sub-blocks encoded as 000111 or 0011 are generated only when the running disparity at the beginning of the sub-block is positive. Running disparity at the end of these sub-blocks is also positive. Likewise, sub-blocks containing 111000 or 1100 are generated only when the running disparity at the beginning of the sub-block is negative. Running disparity at the end of these sub-blocks is also negative.

Fibre Channel Ordered Sets

Fibre Channel utilizes special words beginning with K28.5 followed by three bytes. These are called Ordered Sets. Refer to [Appendix A, “Fibre Channel Ordered Sets - Partial List.”](#)

Legal (Neutral Disparity) Arbitrated Loop Physical Addresses

Fibre Channel has a separate specification for Arbitrated Loop. This specification allows up to 126 devices to be placed in a loop and communicate directly with each other. These devices have disparity-neutral addresses rather than the three byte addresses normally used by switched networks. Not all characters can be used as a Loop ID value. There is a specific list of characters that are disparity-neutral. Some of these characters are mapped the same regardless of running disparity, while others are inverted (ones complement). Refer to [Appendix C, “Fibre Channel Legal Arbitrated Loop Physical Addresses”](#) for this information.

Gigabit Ethernet Ordered Sets

Gigabit Ethernet utilizes special characters called Ordered Sets that usually consist of at least one control character. These include I1 (K28.5 0xC5), I2 (K28.5 0x50), R (K23.7), S (K27.7), T (K29.7), and V (K30.7). Refer to [Appendix D, “Gigabit Ethernet Ordered Sets - Partial List.”](#)

Receiver Limitations

While the transmitter can send almost anything, there are some bit pattern requirements and limitations for the Xgig BERT receiver. The Xgig BERT receiver recovers the clock from the incoming 10-bit pattern using a phase locked loop (PLL). This places the following list of requirements on the incoming signal:

- Have a received clock rate within 250 ppm of the Xgig BERT transmit clock rate. The receiver switches over to its internal transmit clock if the received signal is too fast or too slow.
- Use legal 10-bit values and disparity rules whenever possible.
- Avoid runs of seven or more consecutive 1s or 0s.
- Have at least 3 transitions between 1 and 0 in a 10-bit character for the PLL to maintain tracking.
- Maintain DC balance by having 20 +/- 1 (that is, nearly the same number) of 1s and 0s in a 40 bit word, wherever possible.
- Transmit K28.5 (commas) only in allowed position(s) within the word, depending on the protocol.
 - In Re-Sync mode (described later), you must use negative starting disparity K28.5 (0011111010) symbols for character and word alignment. Never transmit the pattern 0011111 in an unaligned position (in the wrong byte or across bytes or words). This is the comma indicator and the re-synchronizing hardware will bit shift the received pattern to put those seven bits in the expected aligned position (depending on protocol).
 - When re-synchronization is not enabled, the Xgig BERT can receive comma characters in any byte position.
- Use a known, good cable and/or loopback adapter to validate that the pattern can be received without errors before testing an unknown device.

Chapter 4

Using the BERT Tab

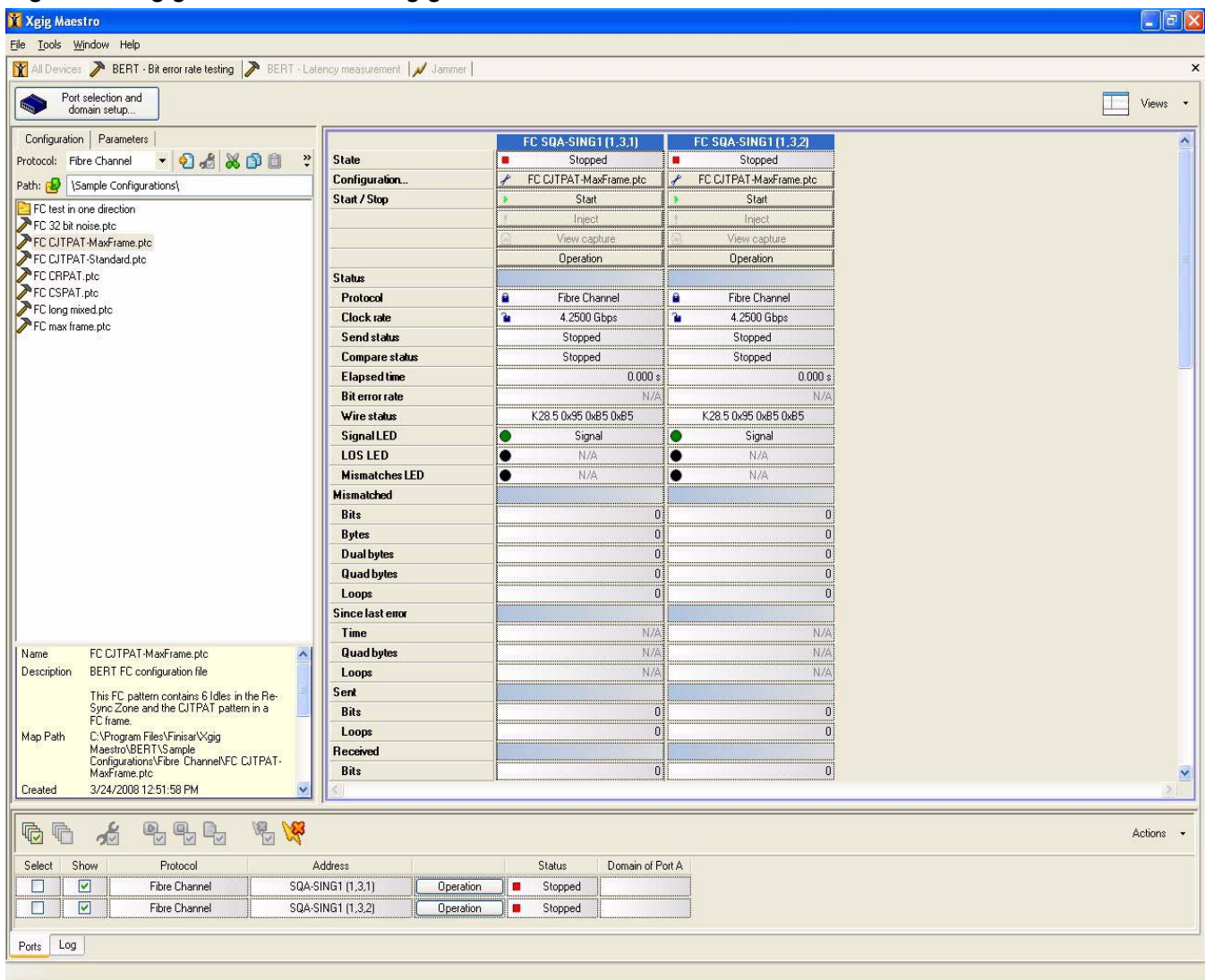
In this chapter:

- Using the Configuration Manager in BERT
- Using the Parameters Status Table in BERT
- Using the Parameters Status Context Menu in BERT
- Using the Ports Manager in BERT
- Using the Log Manager in BERT
- Using the Capture Commands
- Customizing the Appearance of the Maestro/BERT Main Window
- Performing Configuration Tasks in BERT
- Running a BERT Pattern

After you have discovered and locked the BERT ports you want to use and also set up your capturing and monitoring applications, such as Xgig Analyzer, you are ready to run the Xgig BERT application. This chapter provides an overview of the BERT tab and its functions; it also includes steps to run predefined tests supplied with Xgig BERT or tests you have defined and saved.

You should have launched Xgig Maestro as described on page 12 and locked at least one device as described in “Multi-Function Ports and Symbols” on page 21. The Xgig Maestro window (Figure 13) is displayed with the BERT tab on the right. This tab is where you operate the BERTs you have locked.

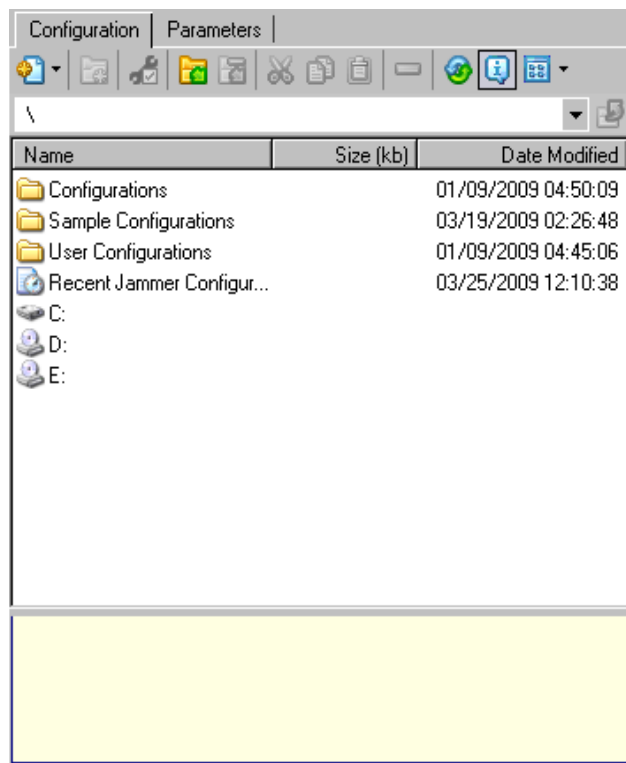
Figure 13: Xgig BERT Tab on the Xgig Maestro Window



Using the Configuration Manager in BERT

The Configuration manager (Figure 14) is associated with the device function tab, BERT and Jammer. The configuration files displayed in the manager are specific to the function tab displayed. The Configuration manager provides a list of test configurations organized in three folders. The **Sample Configurations** folder includes configurations that are provided with the application. The **User Configurations** folder is where the configurations you create are saved. The **Most Recently Used** folder allows you easy access to those configuration files most recently used.

Figure 14: BERT Configuration Manager



The Configuration manager has the following features:

- Protocol selection menu
The drop-down menu lets you select the protocol for the device you are using:
 - Fibre Channel
 - Gigabit Ethernet
- Folder with a list of sample test configurations by device and protocol
- Folder for configurations that you created by device and protocol
- Tool bar that lets you create, load, copy, cut, and paste configuration files. See [“Configuration Manager Tool Bar in BERT” on page 44](#) for more information on this tool bar.

- Context menu

Select a configuration file name and right-click to display a menu where you can choose to create and edit configuration files, and additional operations. See [“Configuration Manager Context Menu in BERT”](#) on page 45 for more information about these menus.
- Drag and drop files

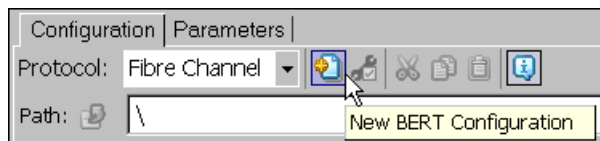
You can drag any configuration from the Configuration manager list onto a device column to load it.
- Browse to map folders of files stored in locations other than the default Sample and User Configuration folders.
- Description pane
 - When you select a configuration file in the list, a description of the file is displayed in the description pane below. It also displays the name of the file, the path where the file is located, the size of the file, the date and time when the file was created, the date and time the file was modified, whether the file is read-only and the Map path where the file is located on your system.
 - When you click the Show/Hide button below the Description pane, you display or hide this pane.
- Recently-Used
 - You can access recently-used BERT files.

Configuration Manager Tool Bar in BERT

The Configuration manager tool bar ([Figure 15](#)) allows you to perform the following functions:

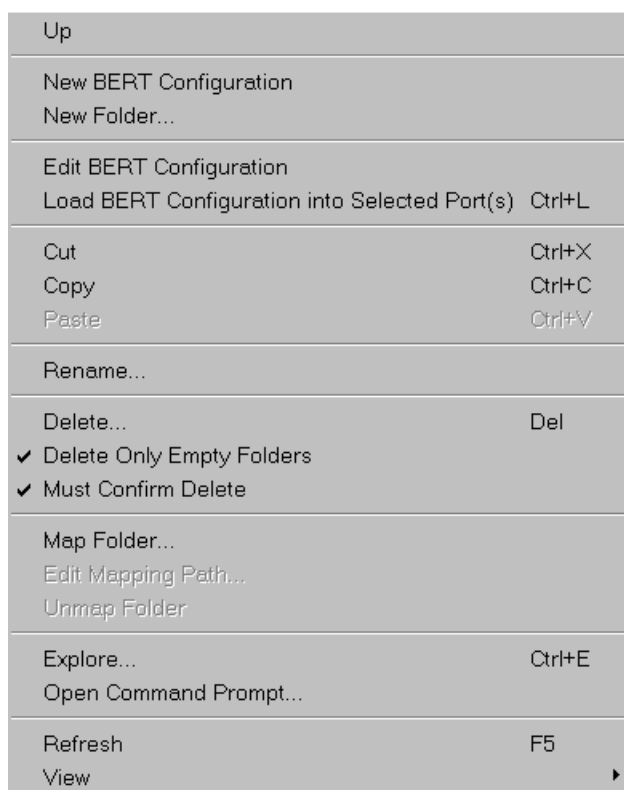
Click the **New Configuration** icon  to open the Configuration window and create a new BERT configuration from scratch. You can also highlight a file and use the **Cut** , **Copy** , and **Paste**  icons to duplicate or move files in the Configuration manager into another folder using the **Path**  shortcut. The Load  icon allows you to load a configuration file into a port or ports. This icon is only active when a port has been locked and is selected in the Port Manager. See [“Loading BERT Configuration Files”](#) for details.

Figure 15: BERT Configuration Manager Tool Bar



Configuration Manager Context Menu in BERT

Figure 16: Configuration Manager Context Menu in BERT

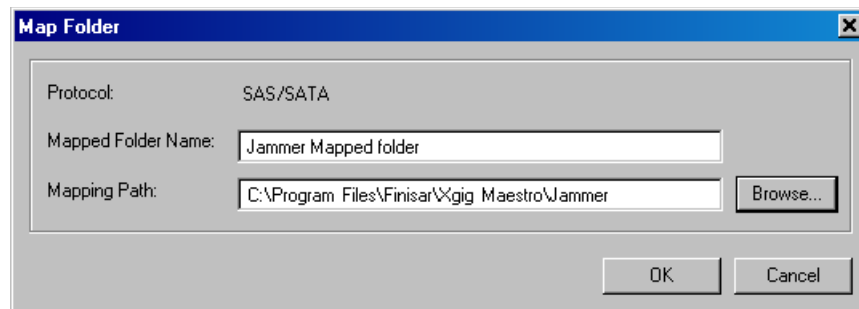


Right-click in the list to choose the following actions from the context-sensitive menu:

- **Up**
Displays the contents one folder level up from the current display.
- **New BERT Configuration**
Opens a new BERT configuration window for editing.
- **New Folder**
Opens the Configuration manager dialog where you can enter the name of a new folder you want to add.
- **Edit BERT Configuration**
Opens the file highlighted in the list, the same as double-clicking on the file name.
- **Load BERT Configuration into Selected Port(s)**
Loads the file highlighted in the list into the port(s) selected in the Ports Manager. See [“Using the Ports Manager in BERT.”](#)
- **Cut**
Removes a selected file or folder from the list.
- **Copy**
Copies a selected file or folder to a clipboard making it available to paste in another location.

- **Paste**
Pastes a file or folder you cut or copied to the location you choose.
- **Rename**
Opens a dialog with the current file or folder name displayed in an entry field that you can modify. It also shows the protocol, path, and current file or folder name.
- **Delete**
Opens a dialog where you can confirm whether you want to delete the highlighted file (configuration) or folder from the list.
- **Delete Only Empty Folders**
Sets this choice as a preference that removes only empty folders from the list. When you select it, a check mark is displayed next to it. It is selected by default.
- **Must Confirm Delete**
Sets this choice as a preference that opens a dialog to confirm that you want to delete a file or folder from the list. When you select it, a check mark is displayed next to it. It is selected by default.
- **Map Folder**
Opens the Map Folder dialog box that lets you map a folder to a name of your choice.

Figure 17: Map Folder dialog box



Enter a name of your choice in the Mapped Folder Name field, and use the **Browse** button to select the folder on your system or network you want to map to this name.

- **Edit Mapping Path**
Allows you to edit the mapping path.
- **Unmap Folder**
Removes a highlighted mapped folder from the Configuration manager.
- **Explore**
Opens a Windows Explorer window showing the directory where the current configuration files are located.
- **Open Command Prompt**
Opens a Windows Command Prompt window showing the directory where the current configuration files are located.
- **Refresh**

Refreshes the Configuration Manager window.

- **View**

Has two choices:

- List

Displays the list of files or folders in the path you choose.

- Details

Displays the list of files or folders with the size and modification date.

Using the Parameters Status Table in BERT

Each BERT device is displayed as a column in the Parameters Status table on the BERT tab (Figure 13). At the top of each column is the protocol, chassis name, followed by the chassis number, the slot number and port number in parentheses. (Figure 18).

Figure 18: BERT device displayed as a column in the Parameters Status table

	FC XGIGSWDEV1 (1,1,1)	FC XGIGSWDEV1 (1,1,3)
State	 Stopped	 Stopped
Configuration...	 FC CJTPAT_ptc	 FC CJTPAT_ptc
Start / Stop	 Start	 Start
	 Inject	 Inject
	 View capture	 View capture
	Operation	Operation
Status		
Protocol	 Fibre Channel	 Fibre Channel
Clock rate	 8.5000 Gbps	 8.5000 Gbps

Each column contains the following categories:

- State
- Configuration
- Start/Stop
- Status
- Sent
- Received
- Compared
- Mismatched
- Since last error

State Category

This category shows the BERT status: Disconnected, Connecting, Starting, Synchronizing, Running, Stopping, Stopped.

Configuration Category

Displays the name of the configuration, if any, loaded into the port. Refer to [“Loading BERT Configuration Files” on page 75](#).

You can press the button bearing the name of the loaded configuration file to open the Configuration Edit window.

Start/Stop

This category contains the buttons to operate each BERT device.

Start/Stop

Start runs a test pattern from the beginning if you click it while the BERT is stopped. When you click **Start**, the Mismatched LEDs and LOS status LEDs are cleared on the Parameters Status table.

Stop causes the BERT to abort running the test pattern and end the test. The BERT always stops sending after it finishes the loop it is sending, and stops comparing after it finishes the loop it is comparing.

Inject

Inserts a bit error while a test is running. The bit error is placed only among words in the Compare Zone of the defined pattern (except the Start Word). In the 40 bit word, bit 19 or 18 is inverted to create the bit error.

View capture

Downloads and displays the captured data of the test you have performed.

Operation

Opens the Operation dialog box

Status Category

This category indicates the current physical setup of the BERT device.

Protocol

Indicates the protocol of the BERT, either Fibre Channel or Gigabit Ethernet. You choose a protocol in the Port Selection and Domain Setup window when you lock ports. The small lock icon indicates that the protocol cannot be changed at this stage.

Clock rate

Indicates the BERT clock rate. It cannot be changed while the BERT is running. The closed lock icon indicates you cannot currently change the clock rate; the open lock icon indicates you can change the clock rate. The clock rate options may include 1.0625 Gbps, 1.2500 Gbps, 2.1250 Gbps, 2.5000 Gbps, 4.2500 Gbps, or 8.5000 Gbps, depending on the blade. Both ports in a port pair must always be set to the same clock rate. Therefore, if you have two BERTs, and one of them is running, the clock rate is locked on both of them.

Domain of Port

Displays the domain name to which a port belongs, if any.

Send Status

The Send Status metric reflects the state of transmitting hardware and reports:

- Stopped
- Waiting for trigger input
- Sending hardware sync
- Sending...
- Stopping...

Compare Status

The Compare Status metric reflects the state of the compare hardware and reports:

- Stopped
- Trying to sync up
- In hardware sync
- Receiving...
- Waiting for trigger input
- Stopping...

Elapsed time

The Elapsed time metric is the period of time since you started the BERT operation and it runs until the BERT is stopped.

Bit error rate

The Bit Error Rate metric is a computed value. When no errors have occurred, the formula is:

$$< 1/(\text{Bits Compared})$$

After an error occurs, the formula changes to:

$$= (\text{Bits Mismatched})/(\text{Bits Compared})$$

Wire status

Shows the current output of the port.

Signal LED

This LED always shows what is occurring at that moment in a test and therefore changes instantaneously. [Table 2](#) describes the LED colors.

Table 2: Signal LED Descriptions

Port column LED color	Blade LED	Description
Green	Green	Signal is detected and the link is synchronized.
Red	Yellow	Loss of synchronization is occurring.
Black	Off	No signal detected on the link.

LOS LED

The loss of synchronization (LOS) LED shows if loss of synchronization has occurred during the current test (if running) or during the previous test (if stopped). The LED is reset when you start the BERT. The LED colors are described in [Table 3](#).

Table 3: LOS LED Descriptions

Port column LED color	Blade LED	Description
Green	Green	The link is synchronized.
Yellow	Yellow	Loss of synchronization was detected at some point while the test was running.
Red	Blinking Yellow	Loss of synchronization is occurring now or in the last 5 seconds.
Black	Off	Not applicable.

Mismatches LED

The Mismatches LED shows if mismatches have occurred during the current test (if running) or during the previous test (if stopped). The LED is reset when you start the BERT. The LED colors are described in [Table 4](#).

Table 4: Mismatches LED Descriptions

Port column LED color	Blade LED	Description
Green	Green	No mismatches occurred during the test.
Red	Blinking Yellow	A mismatch occurred in the last 5 seconds.
Yellow	Yellow	Mismatches were detected.
Black	Off	Not applicable.

Log

This item is hidden by default. **Log available** displays if a log from the last operation is available for viewing. You can view the log, save it to a file, and set up automatic naming and file saving from the Log menu in the Parameters context menu. To use these menu items, refer to [“Using the Log Manager in BERT” on page 61](#).

Capture

This item is hidden by default. **Capture available** displays if a capture from the last operation is available for viewing. You can view the capture log, save it to a file, and set up automatic naming and file saving from the Capture menu in the Parameters context menu. To use these menu items, refer to [“Using the Capture Commands” on page 67](#).

Sent, Received, Compared, Mismatched Categories

Table 5 summarizes these metrics in the Parameters Status table and lists the criteria that the BERT uses to check for errors.

Table 5: Transmitter and Receiver Metric Error Checking

	Bits (40/Word)	Bytes	Dual Bytes	Quad Bytes	Loops
Sent	QB * 40	QB * 4	QB * 2	Counted	Counted
Received	QB * 40	QB * 4	QB * 2	Counted	Copy of compared
Compared	QB * 40	QB * 4	QB * 2	Counted	Counted
Mismatched	Counted	Counted	Counted	Counted	Counted
Since Last Error				Counted	Counted

The following list describes the data in the Parameters Status table that the BERT offers as statistics:

- **Bits:** Computed values, quad bytes (QB) x 40 bits/quad byte, except Mismatches are counted per bit.
- **Bytes:** Computed values, QB x 4, except Mismatched counts bytes with 1 or more errors.
- **Dual Bytes:** Computed values, QB x 2, except Mismatched counts byte pairs with 1 or more errors. Byte pairs are bytes 0 and 1, and bytes 2 and 3.
- **Quad Bytes:** Counted values, Mismatched counts words with 1 or more errors as only 1 word.
- **Loops:** Counted values, except Received Loops equals Compared Loops

Notice that the compare state machine waits for the first compare word to be matched before beginning. If the transmitted pattern is corrupted, the first word might not be found. If the first word is not found, no loops are compared. Under this circumstance the number of Received Bits count rapidly but, Compared Bits, Bytes, Dual Bytes, Quad Bytes and Loops are not incremented.

Since Last Error Category

Time

The Time since last error metric is the elapsed time since the last mismatch was observed.

Quad bytes

The number of quad bytes received since the last mismatch occurred. Is not available when loss of sync disrupts the counting of bits.

Loops

The number of loops received since the last mismatch occurred. Is not available when loss of sync disrupts the counting of bits.

Using the Parameters Status Context Menu in BERT

Right-click on a Parameters status column to display the context menu. The available operations are displayed for the column in which you click. This menu provides controls for configuration files, operation, setting clock rates, setting BERT or Latency mode of operation, choosing capture options, logging test activity, removing a BERT from the Parameters Status table, and changing the appearance of the status table.

Figure 19: BERT Parameters Context Menu

	FC SQA-SING4 (1,1,1)	FC SQA-SING4 (1,1,2)
State	Load configuration file...	Stopped
Configuration...	Save configuration file...	(Not configured from a file)
Start / Stop	Reset configuration	Start
	Edit configuration	Inject
	Start	View capture
	Stop	Operation
	Inject	
Status	Force CDR re-lock	
Protocol	Mode of operation	Fibre Channel
Clock rate	Clock rate	8.5000 Gbps
Send status	Periodic bit error rate	Stopped
Compare status	Scrambling	Stopped
Elapsed time	Tx and Rx stats equal	100 s 0.000 s
Bit error rate		N/A N/A
Wire status	Log	K28.5 0x95 0xB5 0xB5
Signal LED	Capture	No signal
LOS LED	LEDs	N/A
Mismatches LED	Do not show BERT	N/A
Mismatched	Text size	
Bits		0 0
Bytes		0 0
Dual bytes		0 0
Quad bytes		0 0
Loops		0 0

Changing the Clock Rate in BERT

To change the clock rate:

- 1 Right-click anywhere on the specific port column to open the Parameters context menu (Figure 20).

- 2 Select **Clock rate**.

A menu with available choices is displayed.

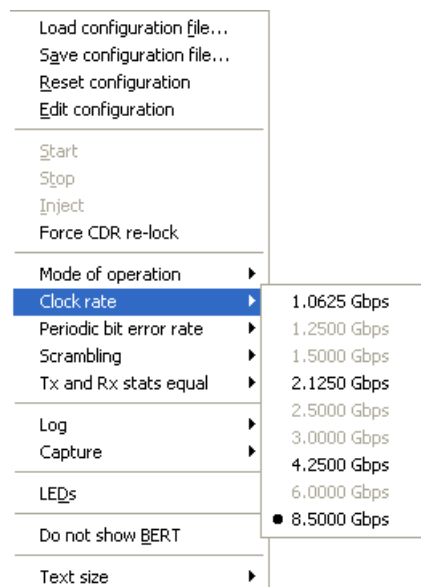
- 3 Click to choose one.

Items that are grayed out are not currently available. A bullet is displayed to the left of the currently operating selection.



Note: The clock rate is not saved in the configuration file. This allows BERT configurations to run independently of the clock rate setting and avoids disrupting the traffic where the BERT is connected.

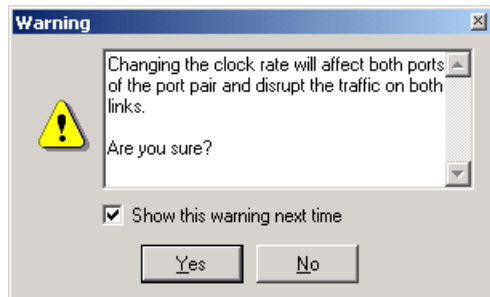
Figure 20: Clock Rate Menu



Note: BERT ports 1 and 2 always share the same clock rate; the same is true of ports 3 and 4 (on a four port blade).



Note: Changing the clock rate disrupts the traffic sent by the BERT. A warning message appears when you change the setting (Figure 21).

Figure 21: Changing Clock Rate Warning

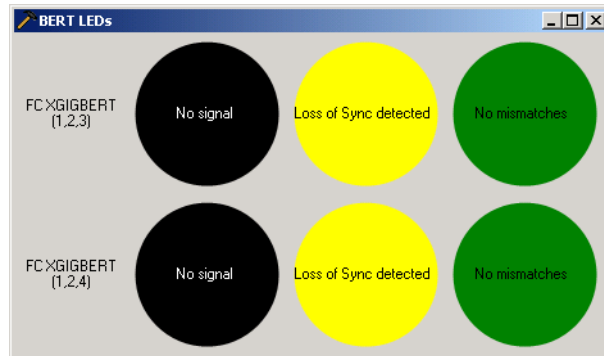
Viewing Port LEDs

LED icons are displayed next to Signal LED, LOS LED and Mismatches LED in the Parameters Status table. To view these LEDs in a larger format:

>> Select LEDs from the Parameters context menu.

The LEDs for the ports you have locked are displayed in a dialog (Figure 22).

Figure 22: BERT LEDs Dialog



Scrambling

Some blades give the option of enabling Fibre Channel Frame Scrambling, which is part of the Fibre Channel Specification for 8.5000 Gbps. You may enable or disable scrambling at any speed. Select **Scrambling** from the Parameters context menu, and then select **Enabled** or **Disabled**. A check mark appears next to the current selection. When Scrambling is enabled, Fibre Channel Frame Scrambling is performed in the Configuration pattern starting after any SOF indicator template and continuing until the next word with a K character (usually EOF).



Note: When changing the clock rate from 8.5000 Gbps to any other speed, Scrambling is automatically set to Disabled. When changing to 8.5000 Gbps, it is automatically set to Enabled. You may then override this setting using the Parameters context menu.

Tx and Rx Stats Equal

When this feature is enabled, the Send and Receive statistics are forced to be equal in each run.

When a run is started, the words in the Re-Sync Zone of the initial loop prior to the first Compare Zone are not counted in the statistics on the sending side. Similarly, the words before the first Start Word are not counted in the statistics on the receiving side.

When a run is stopped, the sending side sends an additional CLS Ordered Set. The receiving side waits for this additional CLS Ordered Set before stopping. A timeout is implemented in case the last CLS Ordered Set is never received.



Note: The Tx and Rx Stats Equal option is only available on the 8.5000 Gbps Fibre Channel blade.

Using the Ports Manager in BERT

The Ports manager displays details about the ports you have locked. It shows the protocol, chassis name (with chassis number, slot number, and port numbers), and other port specific information. You can sort the rows from first to last or last to first by clicking the column heading. For more information about Xgig slot positions and numbering, refer to the Xgig Family Hardware Guide included with the product CD.



Note: If you are disconnected due to a network problem, you can reconnect to the ports by using the Port Selection and Domain Setup window.

Figure 23: BERT Ports Manager

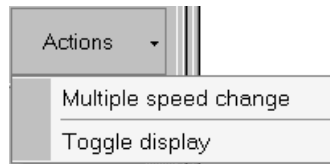
Actions								
Select	Type	Protocol	Address	Start / Stop		Status	Domain of Port A	Domain of Port B
☒	Jammer	SAS/SATA	XGIGSWDEV1 (1.1.7-8)	Start	Operation	Stopped		
☒	BERT - Bit error rate testing	Gigabit Ethernet	XGIGSWDEV1 (1,2,3)	Start	Operation	Stopped		N/A
☒	BERT - Bit error rate testing	Gigabit Ethernet	XGIGSWDEV1 (1,2,4)	Start	Operation	Stopped		N/A

The following icons are displayed on the menu bar:

- **Select All Ports**
Selects all ports in the Ports Manager.
- **Unselect All Ports**
Unselect all ports in the Ports Manager.
- **Load Configuration to Selected Ports**
Load the selected configuration file to all selected ports in the Ports Manager.
- **Start Selected Ports**
Start BERT operation on the selected ports in the Ports Manager.
- **Stop Selected Ports**
Stop BERT operation on the selected ports in the Ports Manager.
- **Show Properties of Selected Ports**
Display the Port Properties dialog box, with information on the selected function, protocol, and clock rate (speed). It also shows the chassis name, IP address, slot and port(s).
- **Disconnect Selected Ports**
Disconnect the selected ports in the Ports Manager.
- **Disconnect All Ports**
Disconnect all ports in the Ports Manager.

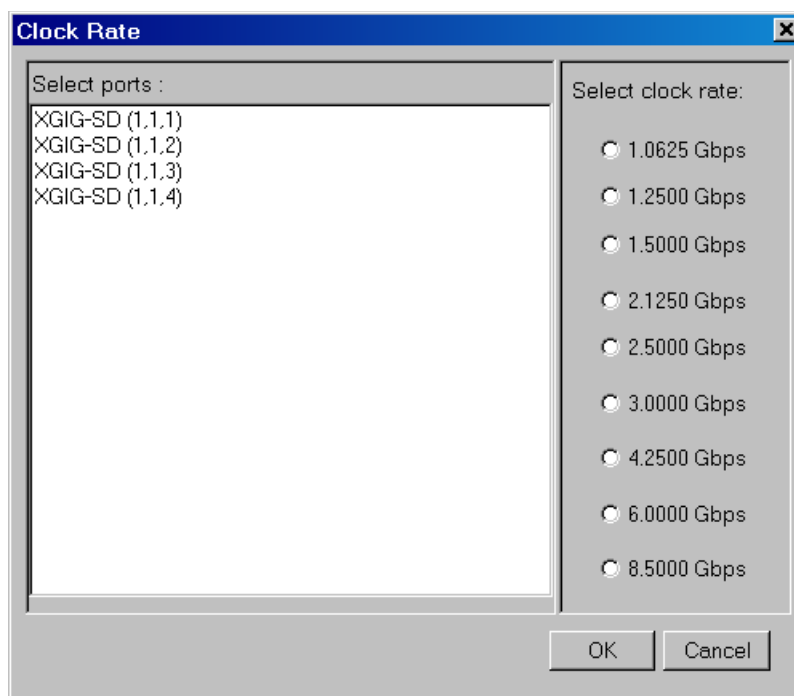
Actions Button

The **Actions** button contains menus for **Multiple speed Change** and **Toggle Display**. See [Figure 24](#).

Figure 24: Actions Button Options

Multiple Speed Change

This option allows you to change the speed of multiple BERT ports simultaneously. If you have the All Devices tab selected, the menu will display BERT, Jammer, and Generator.

Figure 25: BERT Multiple Speed Change Window

Select the ports you want to change the speed for, holding the Ctrl key down to select multiple ports, then click the speed you want to change to, and click **OK** to apply the change.

Toggle Display

This option toggles between a horizontal and vertical view of the ports.

Ports Manager Columns

The Ports Manager includes the following columns:

Operation

Operation is a button you press to display the Operation bar for the device you are using. Refer to [“Running a BERT Pattern” on page 77](#) for additional information.

Status

Information in this column displays the state of the device under test.

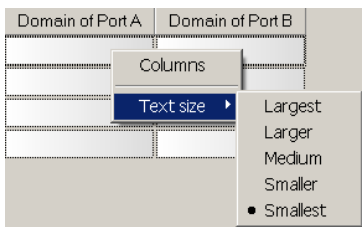
Domain of Port A and Domain of Port B (BERT and Jammer only)

Each of these fields indicates to which domain the respective port belongs. In a simplex Jammer, only port A is relevant. In a duplex Jammer, the lower port number is always port A. You set up domains in the Port Selection and Domain Setup window. Refer to [“Using Domains” on page 27](#) for more information.

Using the Ports Manager Context Menu

You can right-click in the Ports Manager to open the context menu ([Figure 26](#)).

Figure 26: Ports Manager Context Menu



The menu contains the following choices:

Text Size

Refer to [“Changing Text Size” on page 72](#) for information.

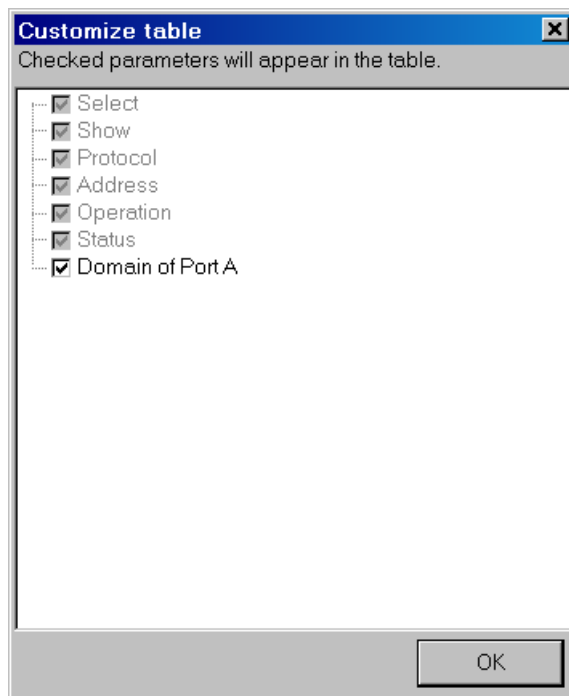
Columns

This choice opens a Customize table dialog ([Figure 27](#)) where you can choose to display **Domain of Port A**.

Click the check box next to this item to display this item in the Ports Manager.

The grayed out items are defaults; you cannot clear these items.

Figure 27: BERT Ports Manager Context Menu Parameters Selection



Using the Log Manager in BERT

To access the Log Manager, click the Log tab at the bottom of the BERT main window.

The purpose of logging is to automatically create a log that reports the results of a BERT test. You can view a log with any text editor.



Note: The log buffer can be up to 10000 entries. During a single test run, if more entries are collected than the maximum number you specified, only the most recent 10000 are logged. You set the maximum number of entries in the Log Options window.

The Filter icons next to the **Type** and **Address** column labels allow you to choose how you want to display device types, by protocol or All, and device addresses, by single address or All devices.

If the **All Devices** tab at the top of the Xgig Maestro main window is selected, then the **Log Source** menu  2 active log sources ▾ shows all log sources as active by default. You can choose to disable BERT logging, Jammer logging, Generator logging, Target Emulator or all four by clicking the **Log Sources** menu and un-checking the selections. If the **BERT-Bit error rate testing**, **Jammer**, or **Generator** tabs in the main window are selected, then the Log Manager displays only the log entries for that tab, respectively.

The following icons are displayed on the Log Manager menu bar:



Display Entry Contents

Lets you save the selected log to a file in the device (BERT or Jammer) Logs folder (for example: C:\Program Files > JDSU > Xgig Maestro > BERT> Logs) or anywhere you want to save it on the network.



Save All Entries As

Lets you save all the logs in the Log Manager to a file.



Save selected entries as

Lets you save the selected logs to a file.



Select All

Selects all the logs in the Log Manager.



Options

Opens the Log Manager Options dialog where you can enter your preferences for the information you want displayed in the Log Manager ([Figure 28](#)).



Clear Filtering

Removes filtering by Type and Address and displays all the devices you have locked.



Clear Selected Entries

Deletes the log entry you have highlighted.



Clear All Entries

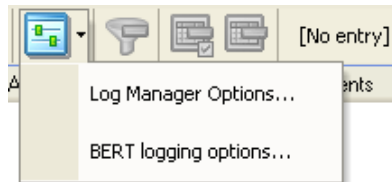
Deletes all the log entries in the Log Manager.

Setting Log Options

To have log files automatically named and saved to a specific location:

- 1 Click the Log Manager Options icon to open the drop-down menu (Figure 28) and select **BERT logging options**.

Figure 28: Log Manager Options Menu



Or:

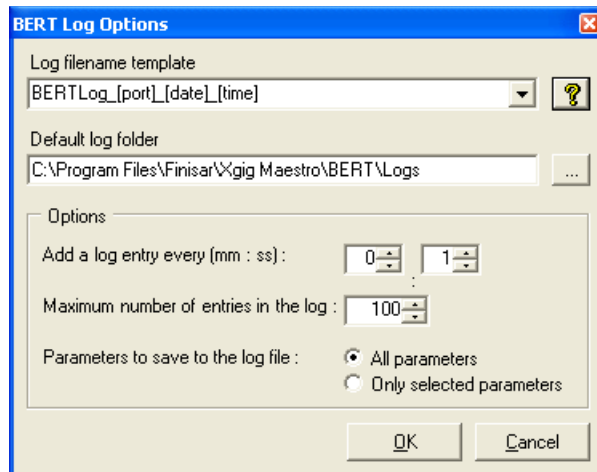
- >> Open the Parameters context menu (Figure 33) and select **Options**.

This command opens the BERT Log Options dialog (Figure 29). It allows you to set up how you want the log files to be automatically named and where you want them saved by default.

The Options area of the dialog lets you:

- Enter the number of minutes and seconds for each log entry to be added
- Enter the maximum number of entries you want in a log
- Select the parameters to be saved to the log file — all parameters or the parameters you chose to display on the Parameters Status table in the Customize table dialog.

Figure 29: Log Options Dialog



- 2 Select a log filename template from the following choices:
 - BERTLog_[port]
 - BERTLog_[port]_[date]_[time]
 - BERTLog_[date]_[time]
 - BERTLog_[date]_[time]_[port]

Or, you can type in your own template. The port, date, and time markers are replaced with their corresponding values. Port is displayed as:

protocol (FC or GE), chassis name (chassis number in the cascade, blade number in the chassis, port number on the blade)

- 3 To set specific time intervals for statistics to be polled, enter minutes and seconds in the Add a log entry every (mm : ss) field.
- 4 To set the number of entries in a log, enter the number.

The default is 100. The minimum number of entries is 1 and the maximum number of entries is 10,000. When a log reaches the maximum number of entries, it drops the oldest entry each time a new one is added.

- 5 To save specific parameters you have chosen in the Parameters Customize Table dialog, click the Only selected parameters radio button.

The default is to save all the parameters to the log.

- 6 Enter the path to the folder where you want to save the log file.

You can browse to where you want to save the log file by clicking .

- 7 Click **OK**.

You have set up the log filename template and default folder to save the log.



Note: Log options are the same for all BERT ports.

Viewing a Log

The Xgig BERT log lists a periodic snapshot of all the statistics you choose (Figure 32). The time between snapshots and the statistics that are logged are two settings available in the Parameters context menu.

To display a log:

- >> Click the Log Manager tab at the bottom of the Xgig Maestro main window to view the log in a tabulated format (Figure 30).

Or you can:

- >> Double-click on the log you want to view in the Log Manager and display the Log Entry Display window (Figure 31).

Or:

- >> Click the **Operation** button for the device in either the Parameters Status table or the Ports manager to open the Operation dialog bar. Then click the **Log** icon.

Or:

- >> Open the Parameters context menu and select **Log > View**

The two latter commands open a window (Figure 32) that allows you to quickly view the Xgig BERT log. Click **Print** at the bottom of the BERT Log to print a hard copy of the log. In the case of these two methods, each time you run a BERT pattern, a new BERT Log is created for that device, and the previous log is discarded.

On the other hand, the Log Manager continues to list the logs and display them depending on the Log Manager options you have selected. See “Setting Log Options” on page 63.

You can save a log to a .txt file or an HTML file. Refer to “Saving a Log” on page 66.

Figure 30: Log Manager

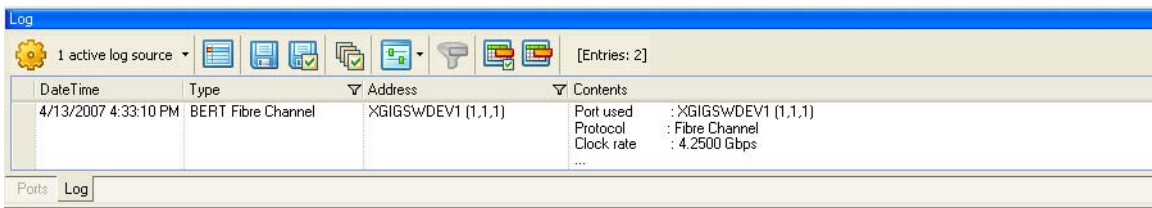


Figure 31: Log Entry Display Window

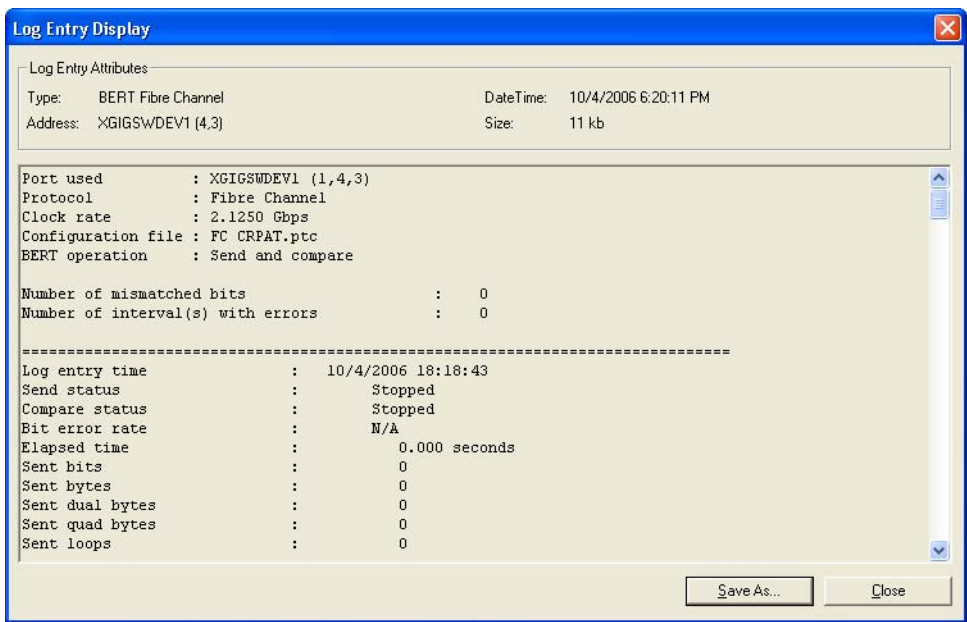
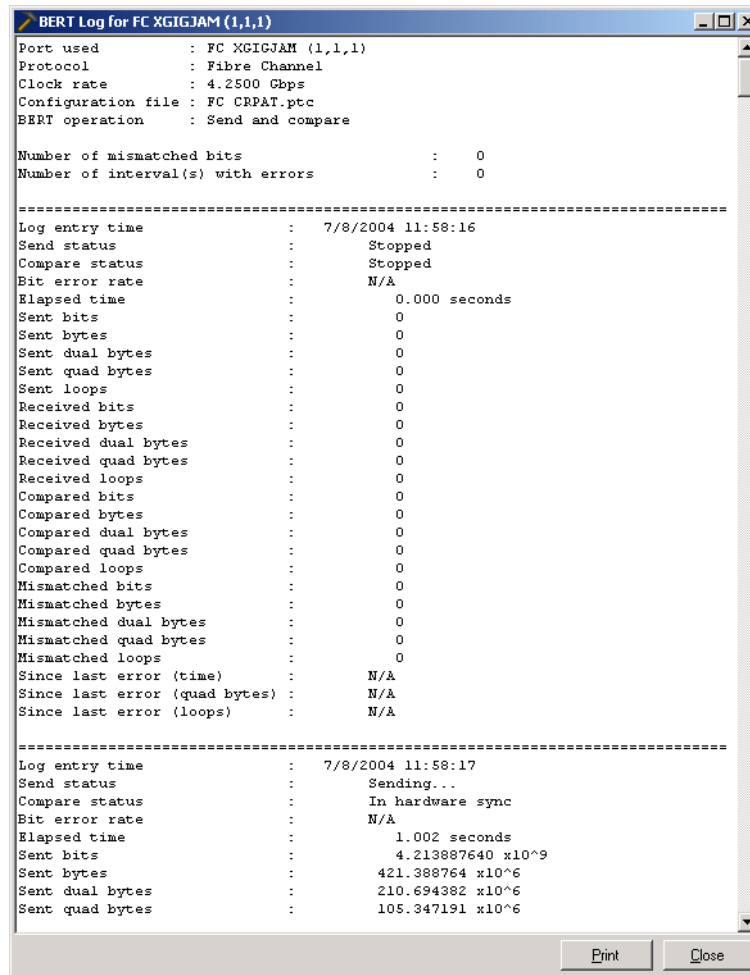


Figure 32: Example of a BERT Log

Saving a Log

You can save a log to a .txt file or an HTML file. You can use the Log Manager tab or the Parameters context menu to accomplish this.

To save a log from the Log Manager tab as an HTML file or a text file:

- 1 Highlight the log you want to save.
- 2 Click the **Save Selected Entries As...** button.

The Save Log Manager Contents As window is displayed that lets you name and save the log as an HTML file to the Saved Logs folder or to a location you prefer.

Or:

Double-click on the log you want to save to display it in the Log Entry Display window (Figure 31), then click **Save As...**

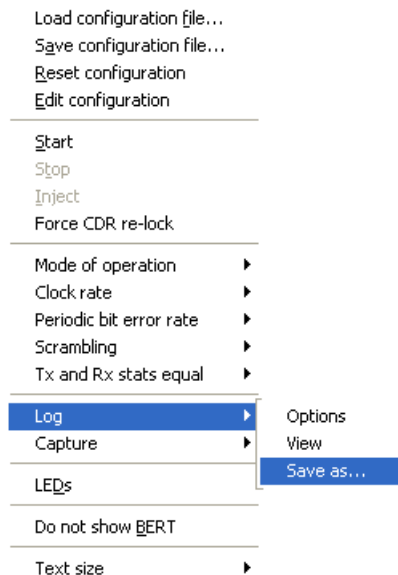
The Save As window is displayed that lets you name and save the log to the Logs folder as a .txt file, or to a location you prefer.

To save a log to a .txt file using the Parameters context menu:

>> Open the Parameters context menu (Figure 33) and select **Log > Save As**.

This command opens a File dialog where you can save the log with a file name you assign to it.

Figure 33: Log Menu



Using the Capture Commands

You can view, save, and set saving options by using the BERT capture commands. These commands are available in the Operation bar and the Parameters context menu.

Viewing a Capture

You can display a window that allows you to quickly view the Xgig BERT capture file. The capture shows 4096, 40-bit words in 10b format (Figure 32). You can print the capture log from this window.

To display a capture log:

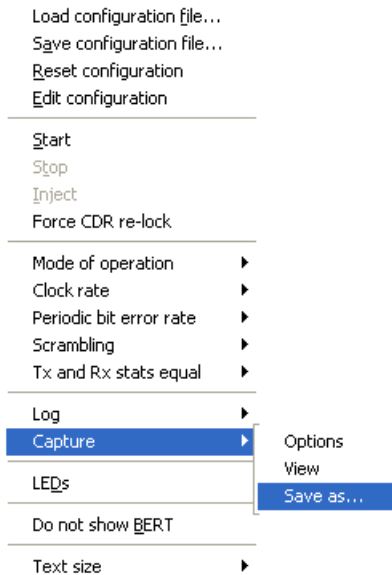
>> Click the **View Capture** button of the specific BERT in the Parameters Status table.

Or:

>> Open the Parameters context menu (Figure 34) and select **Capture > View**.

Or:

>> Click the **Operation** button for the device in either the Parameters Status table or the Ports manager to open the Operation dialog bar. Then click the **Capture** icon.

Figure 34: Capture Menu

Saving a Capture

To save a BERT capture:

- >> Open the Parameters context menu (Figure 34) and select **Capture > Save As**.

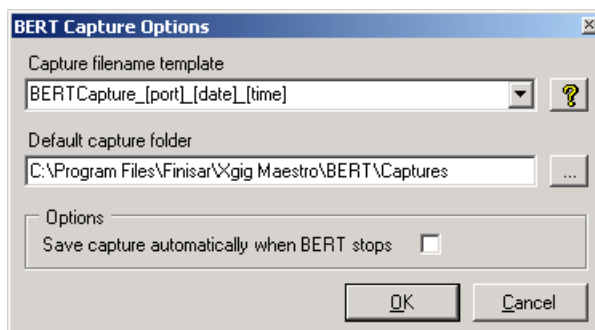
This command opens a File dialog, Saving BERT capture file, where you can save the capture with a file name you assign to it. The default folder is: Program Files > JDSU > Xgig Maestro > BERT > Captures.

Saving and Naming Captures Automatically

To have capture files automatically named and saved to a specific location:

- 1 Open the Parameters context menu. (Figure 34).
- 2 Select **Options**.

This command opens the BERT Capture Options dialog (Figure 35). This dialog allows you to set up how you want the capture files to be automatically named and where you want them saved by default.

Figure 35: BERT Capture Options Dialog

3 Select a capture filename template from the following choices:

- BERTCapture_[port]
- BERTCapture_[port]_[date]_[time]
- BERTCapture_[date]_[time]
- BERTCapture_[date]_[time]_[port]

or, you can type in your own template. The port, date, and time markers are replaced with their corresponding values. Port is displayed as:

protocol (FC or GE), chassis name (chassis number in the cascade,
blade number in the chassis, port number on the blade)

4 Enter the path to the folder where you want to save the capture file.

You can browse to where you want to save the capture file by clicking .

5 Click **OK**.

You have set up the capture filename template and default folder to save the capture.

Captures are saved as .txt files.



Note: Capture options are the same for all BERT ports.

Customizing the Appearance of the Maestro/BERT Main Window

You can move and rearrange the individual device tabs on your monitor screen as you prefer. You can also select the information you want to display in the Parameters Status table. In addition, you can select the size of displayed text.

Using the Window Menu

The **Window** menu allows you to arrange the window display:

Layout

Layout offers choices for rearranging the Maestro device tab windows. The Ports manager and Log Manager windows are not affected by this menu selection.

Internal Tabs

Allows you to restore the Maestro main window to its default format.

Internal MDI

Internal multiple document interface (MDI) lets you isolate each device tab as a separate window that you can activate by clicking anywhere on the window.

Show Hidden Windows

Restores any windows you have closed while using the Internal Tabs or Internal MDI display arrangement.

Arrange Icons

Arranges the icons for minimized windows at the bottom of the screen. If an open document window is at the bottom of the screen, some or all of the icons will be underneath this document window and will not be visible.

Cascade

Arranges all open windows in a cascade style from the top, left corner of the window.

1 All Devices

Brings the All Devices tab to the front as the active window. This window displays ports from all active devices (BERT, Jammer, Generator, and Target Emulator).

2 BERT - Bit error rate testing

Brings the BERT device tab to the front as the active window

3 BERT - Latency measurement

Brings the BERT Latency measurement device tab to the front as the active window

4 Jammer

Brings the Jammer device tab to the front as the active window

5 Generator

Brings the Generator device tab to the front as the active window

6 Target Emulator

Brings the Target Emulator device tab to the front as the active window

Tile Horizontally

After selecting **Layout > Internal MDI**, this command opens and aligns the BERT, BERT Latency measurement, Jammer, Generator, and Target Emulator device windows horizontally one over the other.

Tile Vertically

After selecting **Layout > Internal MDI**, this command opens and aligns the BERT, BERT Latency measurement, Jammer, and Generator device windows vertically one next to the other. You can view the individual device windows by dragging the sides out to resize them.

Minimize All Windows

After selecting **Layout > Internal MDI**, this command minimizes all the open windows. You can restore each window, individually, by using the standard window controls on the header or select **Internal Tabs** to restore the Maestro main window to its default format.

Customizing the Parameters Status table in BERT

You can change the appearance of the Parameters Status table by:

- Removing columns
- Resizing columns
- Changing the text size
- Displaying and hiding status table parameters

Removing columns

If you have a number of devices locked, you can remove a column that you do not need to view without unlocking the port or affecting the operation.

To remove a column:

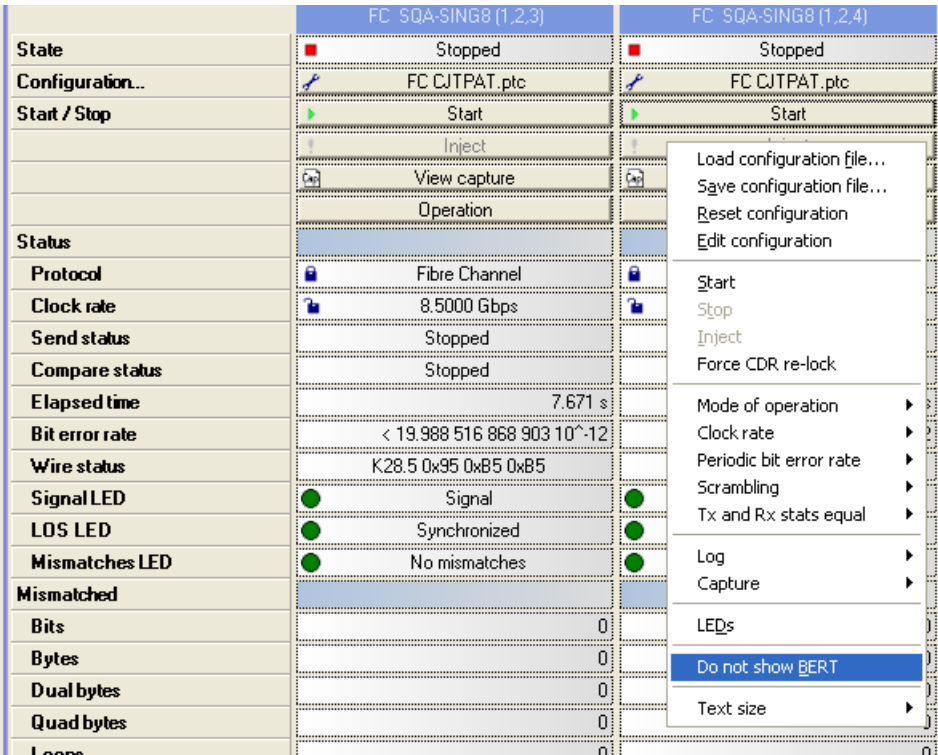
- 1 Right-click on the specific column you want and open the Parameters context menu.
- 2 Select **Do not show BERT** ([Figure 36](#)).

Or:

In the Ports Manager, clear the **Show** check box next to the device you want to remove.

The column is removed, but the device is still locked (“in use”) and displayed in the Ports Manager.

Figure 36: Removing a Device Column



To replace the device column on the Parameters Status table:

>> Click the **Show** check box for the device in the Ports Manager.

Resizing columns

You can resize any of the columns by placing the mouse at the right edge at the top of a column, next to the chassis name. A resizing cursor appears. Hold down the mouse button, and drag the mouse to resize the column.

Changing Text Size

You can choose the text size you want the Parameters Status table or the Ports Manager to display.



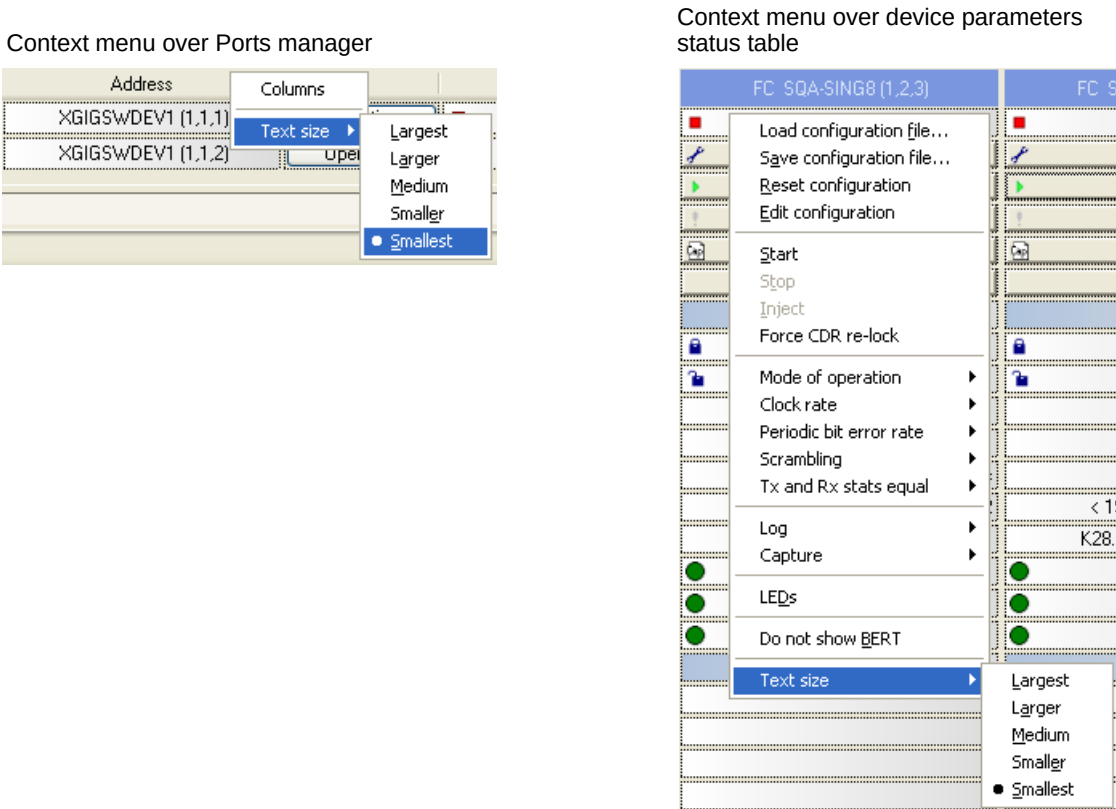
Note: You cannot change the text size in the Log Manager.

To change text size:

- 1 Open the context menu by clicking the right mouse button while the cursor is on the Parameters Status table or the Ports Manager.
- 2 Select **Text size** (Figure 37).
You have five choices from which to select.
Smallest is the default size.
- 3 Select the text size you want.

A bullet is displayed next to the current selection.

Figure 37: Text Size Menu



Displaying and Hiding Parameters in BERT

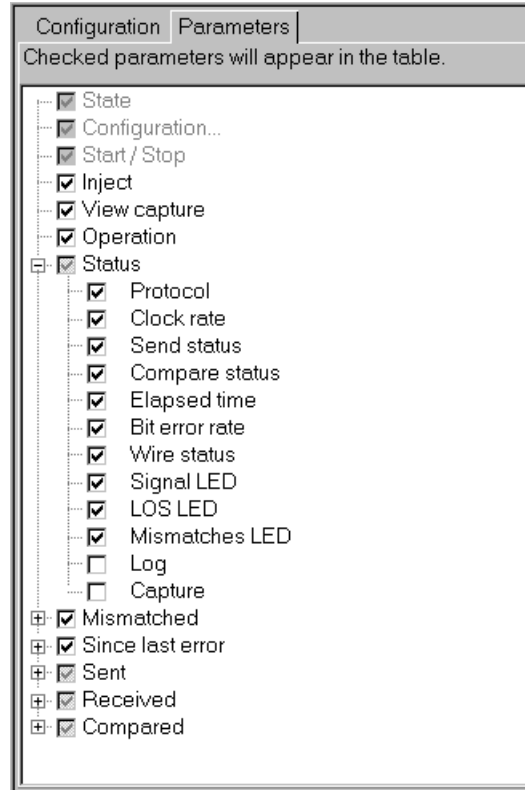
You can hide specific parameters on the Parameters Status table to simplify the status tables and show only the information in which you are interested.

To display or hide parameters on the Parameters Status table:

- 1 Click the Parameters tab at the top of the Configuration manager pane to switch to the Parameters manager (Figure 38).

You can expand the categories by clicking the plus signs on the left.

The default displays most of the parameters.

Figure 38: BERT Parameters Manager

- 2 Click check box to set or clear the check mark next to the parameters.
Checked parameters are displayed.

Performing Configuration Tasks in BERT

This section describes how to handle configuration files from the BERT main window.

Loading BERT Configuration Files

You can load a configuration file on a BERT using one of the following methods:

From the Configuration Manager:

- >> Drag the configuration file from the list in the Configuration Manager onto the Parameters Status table (column for the device) and release the mouse button.

You can drag configuration files from anywhere, including the list of configuration files in the Configuration Manager on the Xgig Maestro window, the system desktop, or Windows Explorer.

From the Parameters Context Menu:

- 1 Right-click on the device column to open the Parameters context menu and select **Load configuration file**.

An Open File dialog is displayed.

- 2 Navigate to the BERT .ptc file that you want to use and click **Open**.

The file is loaded and its name and parameters are displayed in the device column of the Parameters Status table.

From the Ports Manager:

- 1 Check the **Select** check box(es) in the Ports Manager for the port(s) you want to use.
- 2 Click the configuration file you want to load from the Configuration Manager.

- 3 Click the **Load Configuration to Selected Ports** button . This button is located in the Ports Manager and in the Configuration Manager. Both have the same function.

You can use the above methods to navigate to a mapped folder and load a configuration file.

You can also use the above methods to load a pattern for BERT from the text script file with the extension .sct. See the file BERT Text Script - Readme.txt found in the installation folder for further details.

Saving a BERT Configuration File

To save a BERT configuration file you created or edited:

- 1 Right-click on the device column in the Parameters Status table to open the Parameters context menu, and select **Save configuration file**.

A Windows Save dialog is displayed.

- 2 Navigate to where you want to save the configuration file and assign a name to it.

Xgig BERT configuration files are saved with a .ptc extension.

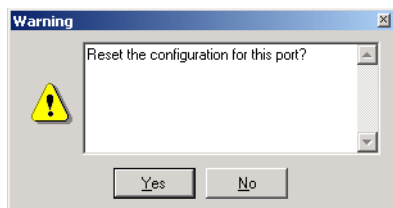
Resetting a BERT Configuration

To clear the configuration from a device:

- 1 Right-click on the device column in the Parameters Status table to open the Parameters context menu, and select **Reset configuration**.

A warning dialog may be displayed asking you to confirm the configuration reset.

Figure 39: Reset Configuration Warning Dialog



- 2 Click **Yes** to clear the configuration from the device.

Editing a BERT Configuration

To create a configuration file for a device, you can start from a blank default configuration or edit the configuration after you have loaded a configuration file to the device.

You can open the Configuration window using one of the following methods:

- 1 Right-click on the device column in the Parameters Status table to open the Parameters context menu.
- 2 Select **Edit configuration**.

Or:

- >> Click the **Configuration** button on the Parameters Status table

This opens the Configuration window for the device that is currently selected. Refer to [“Using the BERT Configuration Window”](#) on page 80.

Running a BERT Pattern

After you have configured a BERT device, you can start the operation.

Figure 40: Operation buttons in Ports Manager

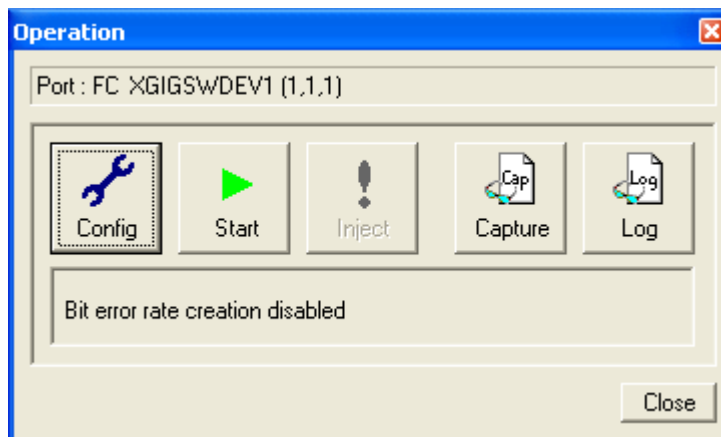


>> Right-click on the selected device columns to open the Parameters context menu where the **Start** command is available (**Stop** and **Inject** are grayed out).

Or:

- 1 On the Ports manager, in the Operation column, click the **Operation** button for the device.
The Operation dialog is displayed (Figure 41).
- 2 Click **Start**.

Figure 41: BERT Operation Dialog



Clicking any of the Operation buttons (including **Config**) takes effect on the BERT device that is currently selected (indicated by the name of the device above the buttons).

Start runs a test pattern from the beginning if you click it while the BERT is stopped. When you click **Start**, the Mismatched LEDs and LOS status LEDs are cleared on the Parameters Status table.

Stop causes the BERT to abort running the test pattern and end the test. The BERT always stops sending after it finishes the loop it is sending, and stops comparing after it finishes the loop it is comparing.

Inject inserts a bit error while a test is running. The bit error is placed only among words in the Compare Zone of the defined pattern (except the Start Word). In the 40 bit word, bit 19 or 18 is inverted to create the bit error.

Capture downloads and displays the captured data of the test you have performed.

Log displays the log data for the test you have performed.

Chapter 5

Configuring BERT Settings

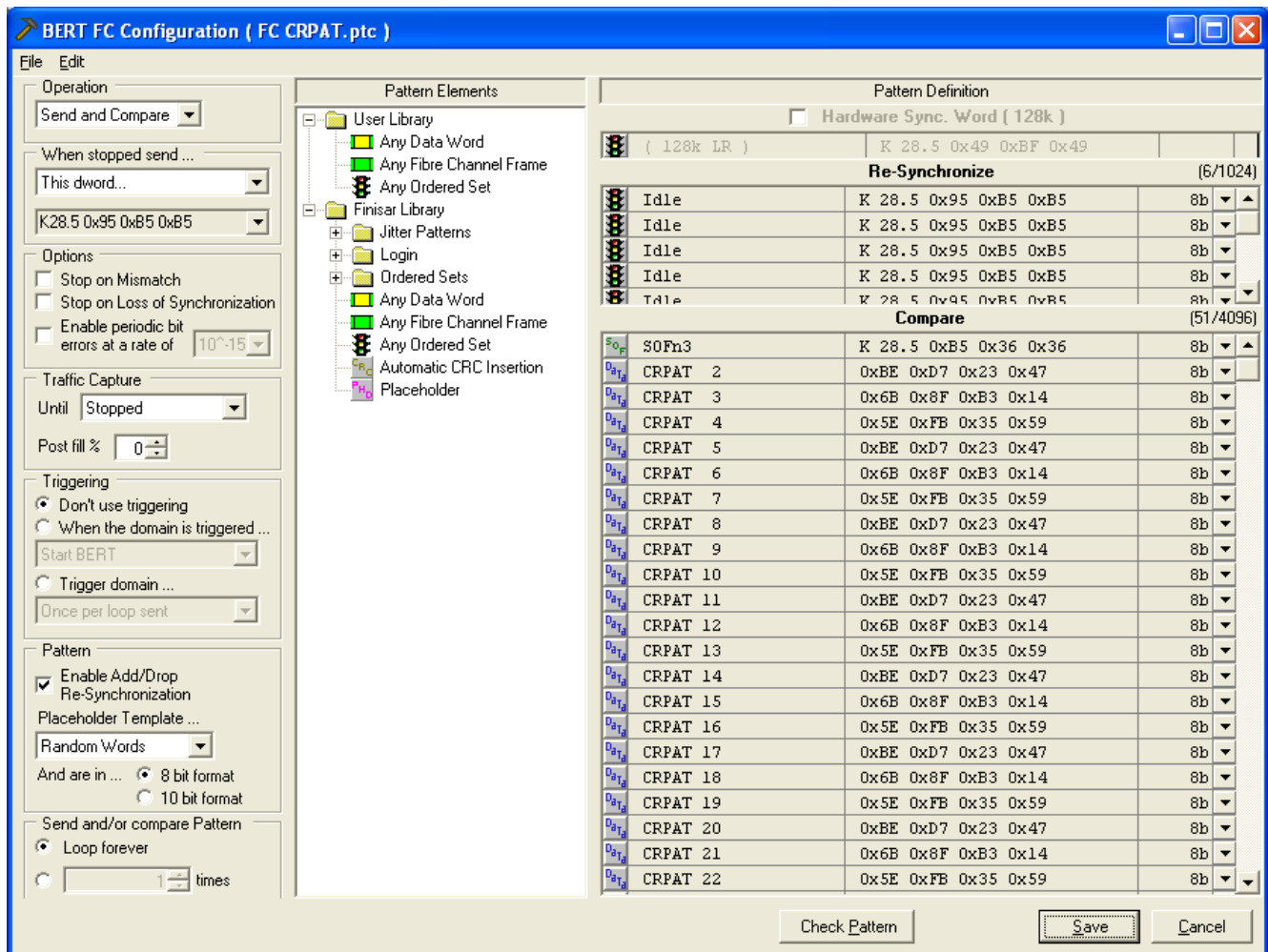
In this chapter:

- Using the BERT Configuration Window
- Protocol-Specific Features
- Cancel and Save Buttons
- BERT Configuration Files

Using the BERT Configuration Window

This section describes each part of the BERT Configuration window (Figure 42) and how to use it.

Figure 42: BERT Configuration Window



Opening the BERT Configuration Window

If you want to create a configuration without assigning ports, on the main window menu bar go to:

File > New BERT configuration > Bit error rate testing > Fibre Channel (Gigabit Ethernet)

Or:

>> Click the **New Configuration** icon at top of the Configuration Manager.

To open this window with hardware assigned to the BERT:

- 1 On the Port Selection and Domain Setup window, discover the chassis and use ports as BERTs. Refer to [Chapter 2, "Using the Port Selection and Domain Setup Window"](#) for details about how to do this.

2 Return to the Xgig Maestro main window and click on a device on the BERT tab, Parameters Status table.

3 Click the **Config** button on the operation bar.

Or:

>> Open the Parameters Status table context menu and select **Edit configuration**.

Or:

>> Click the **Operation** button for the device in the Ports Manager to open the Operation dialog and click the **Config** button.

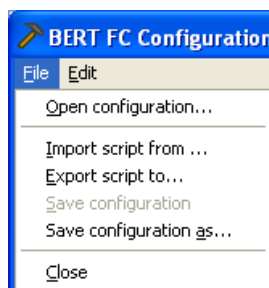
The BERT Configuration window is displayed. From this window you can create your own patterns.

The information in this chapter describes the details of the BERT Configuration window.

Using the Configuration File Menu

The File menu allows you to manipulate the configuration file (Figure 43).

Figure 43: Configuration File Menu



The choices are:

Open Configuration	Open a selected configuration file.
Import Script from	Import the “Re-Synchronize” and “Compare” patterns from a .sct file.
Export Script to	Export and save the “Re-Synchronize” and “Compare” patterns to a .sct file.
Save Configuration	Save the entire configuration to the .ptc file you currently have loaded.
Save Configuration As	Save the entire configuration to a .ptc file with a name you assign to it.
Close	Close the BERT Configuration Window.

The recently-used BERT configuration files appear in the File menu and are loaded when selected.



Note: The .sct files are script files describing bit patterns. You can swap them between configuration files. You can also load a .sct file directly into a BERT device on the Xgig Maestro window.

Using the Configuration Edit Menu

The Edit menu allows you to open the Edit Description dialog (Figure 45).

Figure 44: Configuration Edit Menu

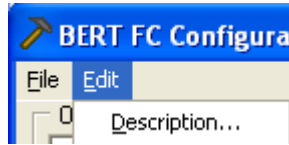
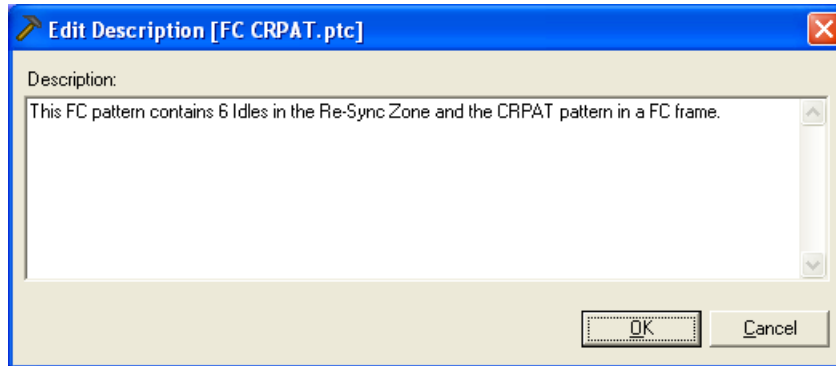


Figure 45: Edit Configuration Description dialog



You can then edit or enter a description for the configuration file and click **OK** to save your changes.

Editing a BERT Configuration

Use step 3 in the previous section to edit a configuration that you have loaded onto the device in the Parameters Status table.

You can also highlight a filename in the Configuration manager and double-click it to display it in the BERT Configuration window.

Operation

Use this drop-down menu on the BERT Configuration window to choose the following Xgig BERT operation mode settings.

Send and Compare Operation

Use the Send and Compare mode, the default setting, when the device under test provides a loop connection such that the bits transmitted return to the Xgig BERT for comparison, or when running two ports in full duplex mode, transmitting to each other.

Send Only Operation

Use this operating mode to transmit “blind.” You can transmit any legal or illegal pattern of bits or disparity to verify performance of a receiver under test. The Xgig BERT receive and compare functions are disabled. This mode is useful for testing the following:

- Data paths for rate divided by 2, 3, 4, 5, etc.
- Phase locked loop extended running 1 or 0 sequence tolerance
- Deserializer comma recognition and synchronization
- Decoding of all legal 10-bit characters
- Decoding of good and bad running disparity situations
- Decoding of all 1024 possible 10-bit characters
- Decoding of all control characters in any byte or bit position
- Noise immunity to non-conforming jitter maximizing patterns
- Remote compare functions on a simplex, very long cable

Using this mode of operation, you can send patterns to another Xgig BERT that is in Compare Only operation mode. You must have the same pattern loaded on both the local and remote Xgig BERT. You must start the Compare Only unit first and then the Send Only unit. At a later time you can reverse the directions.

Compare Only Operation

Use this mode to receive patterns remotely from another Xgig BERT. A remote Xgig BERT sends patterns to the local unit that is in Compare Only operation mode. You must have the same pattern loaded on both the local and remote Xgig BERT. You must start the Compare Only unit first and then start the Send Only unit.

When stopped send...

Use this control to specify what is constantly sent out when the Xgig BERT is in the Stopped state. You can choose:

- Word - Choose a word to be sent continuously, specified in 8-bit or 10-bit mode. The default in Fibre Channel is Idle (K28.5 0x95 0xB5 0xB5) and the default in Gigabit Ethernet is I2/I2 (K28.5 0x50 K28.5 0x50).
- Loss of Synchronization - Transmitter constantly sends ones to simulate Loss of Synchronization.



Note: Whenever you select Loss of Synchronization, the transmitter automatically sends five Hardware Synchronization Words at the end of the very last loop sent, before transitioning back to sending Loss of Sync. This occurs regardless of whether or not the Hardware Sync Word is enabled.

- Passthrough - The port re-times the received traffic and transmits it. This option is only available in Fibre Channel protocol.

Options

The following settings affect Operation.

Stop Operation on Mismatch

When you check this option, the software automatically stops if a mismatch is detected.

Stop Operation on Loss of Synchronization

When you check this option, the software automatically stops if Loss of Synchronization is detected.

Enable Periodic Bit Errors

When you check this option, bit errors are automatically injected into the outgoing traffic within 20 bits of the period specified. You can set the period (10^{-4} to 10^{-15}) here or on the main window, during operation. When calculating the period, only bits in the Compare Zone (except the start word) are counted, and bit errors only occur among these bits. In the 40 bit word, either bit 19 or 18 is inverted to create the bit error.

Traffic Capture

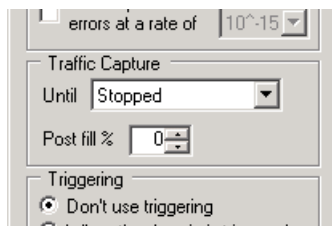
The Xgig BERT includes a capture buffer of 4096, 40-bit words. This buffer captures the last words received at the time of stopping, or the words around a defined trigger point. You can define the trigger point to be the first detected mismatch or a domain trigger in. When sending a finite number of loops, a trigger point automatically occurs at the last word in the last loop, if no other trigger point occurs earlier. The file generated is in ACSII format. You can select options to save the buffer on the Xgig Maestro window. Refer to [“Saving a BERT Configuration File” on page 75](#) and [“Using the Capture Commands” on page 67](#) for more information about these options on the Xgig Maestro window.

To capture traffic:

- 1 Select from the Traffic Capture Until... drop-down menu to choose when you want the traffic capture to stop.

The default is “Until.../Stopped.” This default captures traffic when you start the instrument and continues until you click stop or a “Stop Operation” condition occurs. A Stop Operation condition is defined to stop the whole BERT, not just the Traffic Capture, and is either the first detected mismatch, a domain trigger in, or the last loop of a finite loop setting.

Figure 46: Traffic Capture Settings



When you select “Until.../Mismatch detected,” the Traffic Capture stops on the first detected error. By selecting “Until.../Mismatch detected,” the trigger word in the Traffic Capture file is the first detected mismatch unless the instrument is stopped before an error is detected. Loss of Sync is considered an error.

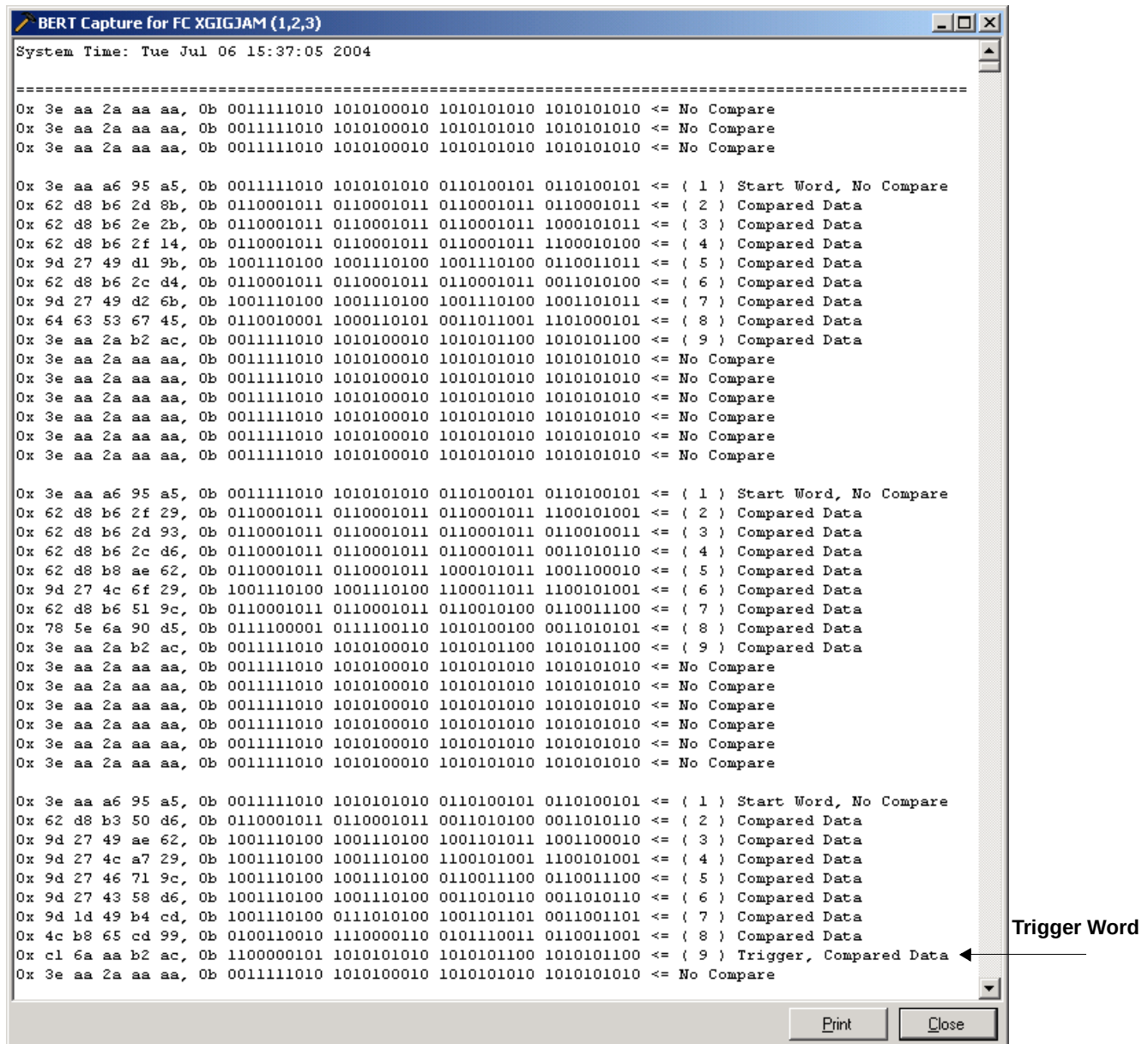
- 2 Select a post fill percentage value.

This determines the percentage of the data in the Traffic Capture file that will appear after a trigger point in the file (if a trigger occurs). Values range from 0% to 99%.

The Traffic Capture is synchronized to begin when the instrument starts.

Refer to “Using the Capture Commands” on page 67 for additional information about captures.

Figure 47: Example of Traffic Capture Output



Triggering

Use this control to specify the behavior of the triggers to and from the Domain that relate to the BERT.

Don't use triggering

No triggering is used when you click this radio button.

When the domain is triggered...Start BERT

When you press **Start**, the Status displays “Waiting for trigger” until a trigger in is received.

When the domain is triggered...Stop BERT

When Xgig BERT receives a domain trigger input, the software automatically presses the Stop button. This also creates a trigger for the Traffic Capture file.

Trigger domain...once per loop sent

The domain is triggered at the end of each loop. The trigger pulse is lengthened and passed through the domain with a different clock frequency; therefore, do not use this feature for short repeating loops.

Trigger domain...On traffic capture stop

A trigger out pulse is created when the Traffic Capture is stopped for any reason.

Trigger domain...once per detected mismatch

The domain is triggered for each mismatched quad byte. The trigger is lengthened, therefore, mismatches that are close together do not create a new pulse. A pulse is also created whenever Loss of Sync is detected.

Pattern

This section describes the options in the Pattern field on the Configuration window.

Add/Drop Re-Synchronization disabled (Non-Sync Mode)

To transmit and receive a bit-for-bit matched pattern, make sure that Enable Add/Drop Re-synchronization in the Pattern area of the Configuration window is not checked.

The following activities occur when you use this setting:

- 1 The Xgig BERT transmits the “stopped” word until you press **Start**.
- 2 If the Hardware Sync Word is enabled, the Xgig BERT transmits 128k words of the Hardware Synchronization Word (data depends on protocol) allowing the Xgig BERT receiver to synchronize characters and words.
- 3 The Xgig BERT receiver disables automatic “comma” alignment and uses the present bit relationships for transmit, receive, and compare.

-
- 4 The transmitter sends the first through last compare words sequentially, repeating until you click Stop, or until a specified number of loops has been sent.
-



Note: The first word of the Compare Zone in any mode is called the “Start Word.”

- 5 The receiver uses the first instance of the Start Word to recognize the beginning of the pattern. Therefore, the very first word must match exactly and is not included in comparison statistics.
- 6 The receiver counts all receiving statistics after the Start Word is matched once.
If a bit toggles to the opposite state from which it was transmitted, it is counted as a mismatch.
If a bit “disappears” resulting in a slippage of the entire pattern, millions of mismatches are likely to result because the receiver and transmitter are now one bit off and cannot be corrected without being re-synchronized.

Add/Drop Re-Synchronization enabled (Re-Sync Mode)

To repeatedly re-synchronize once each loop, before performing a precise bit comparison (to allow for pattern re-timing), select Enable Add/Drop Re-synchronization in the Pattern area of the Configuration window.

The following activities occur when you use this setting:

- 1 The Xgig BERT transmits the “stopped” word until you press Start.
 - 2 If the Hardware Sync Word is enabled, the Xgig BERT transmits 128k words of the Hardware Synchronization Word (data depends on protocol) allowing the Xgig BERT receiver to synchronize characters and words.
 - 3 The generator then transmits the re-synchronization word(s)—those in the “Re-Synchronize” area.
JDSU recommend transmitting at least three of the same re-sync words.
 - 4 The Xgig BERT uses automatic “comma” alignment to realign the received characters and words.
 - 5 The receiver begins counting receive statistics at the first re-sync word.
-



Note: The first re-sync word should be different from the Hardware Sync Word so that the receiver recognizes the Re-Synchronization zone and starts counting receive statistics.

If the Hardware Sync Word is off, then the receive statistics start from the Start Word on the first loop.

- 6 Receiver compare is enabled but held off during the re-sync words.
No errors are counted during this time. This allows the transmitter under test to insert or delete (add/drop) re-sync words and re-time the signal sent to the Xgig BERT.

- 7 Once the Start Word is detected by the receiver, then a bit comparison of the remainder of the pattern is performed (the “Compare Zone”). Note that the Start Word is not counted in the comparison statistics.



Note: Do not use the Start Word in any other place in the pattern, particularly, not in the “Re-sync Zone.”

For example, using six idle words for re-synchronization, and a Compare Zone consisting of a frame with an SOF, 248 data words, a CRC, and an EOF results in 10000 compared bits per loop. Errors in the Idles or SOF are not counted directly. If the received SOF has any mismatched bits, then the receiver skips comparison of that loop and will not record comparison statistics until an SOF match is found.

If a compared bit toggles to the opposite state from which it was transmitted, it is counted as a mismatch.

If a bit “disappears” resulting in a slippage of the entire pattern, hundreds of mismatches are likely to result because the receiver and transmitter are now one bit off for the remainder of the loop. Re-synchronization should correct for minor bit slippage. In the 10000 bit example given, counting the number of mismatched bits and dividing it by 10000 will yield an approximate bit error rate. Remember that 10^{-4} translates to 100% in this example.

Pattern Elements

The Pattern Elements window contains the source templates for creating traffic patterns (Figure 48 and Figure 49). There are frame templates, Ordered Set templates, and special Xgig BERT-specific templates. The template tree that appears in the Pattern Elements window is dependent upon the protocol mode that you set.

Figure 48: Fibre Channel Pattern Element Template Libraries

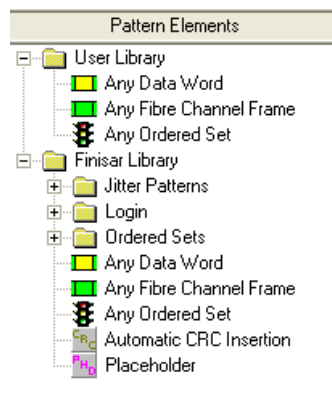
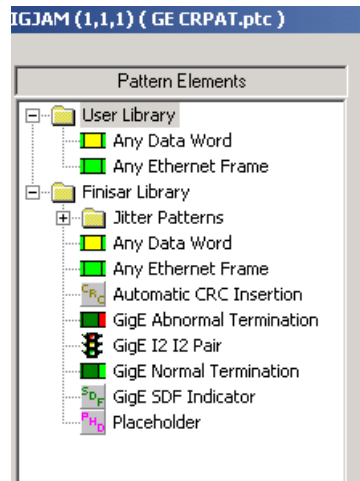


Figure 49: Gigabit Ethernet Pattern Element Template Libraries

You can drag pattern elements within the Pattern Elements window from the read-only JDSU Library to the User Library to edit them.

To edit Pattern Elements in the User Library:

- 1 Click on a user pattern element, pause, and click again to rename it.
- 2 Double-click the user element to edit its contents in an editor dialog.

You can also create new folders in the User Library by using the right mouse button.

Ordered Set Template Editor

The Ordered Set Template Editor is only available for JDSU Fibre Channel Ordered Set Templates.

To open the Template Editor dialog:

- >> Double-click on an Ordered Set Template in the User Library folder of the Pattern Elements window.

Frame Template Editor

To open the Frame Template Editor dialog (Figure 50 and [Figure 51](#)):

- >> Double-click on a Frame Template in the User Library folder of the Pattern Elements window.

Figure 50: Fibre Channel Any Frame Template Editor Dialog

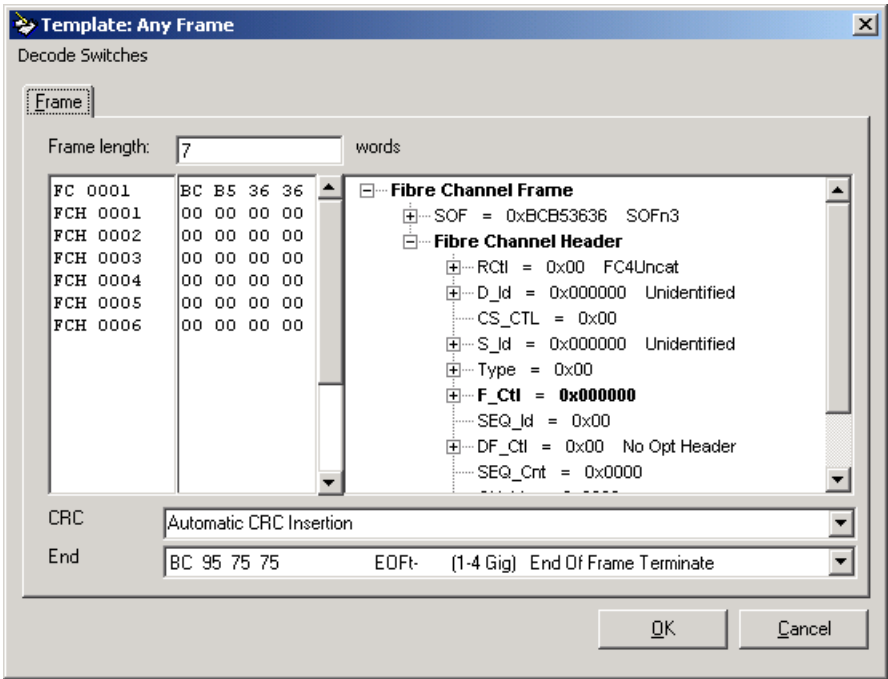
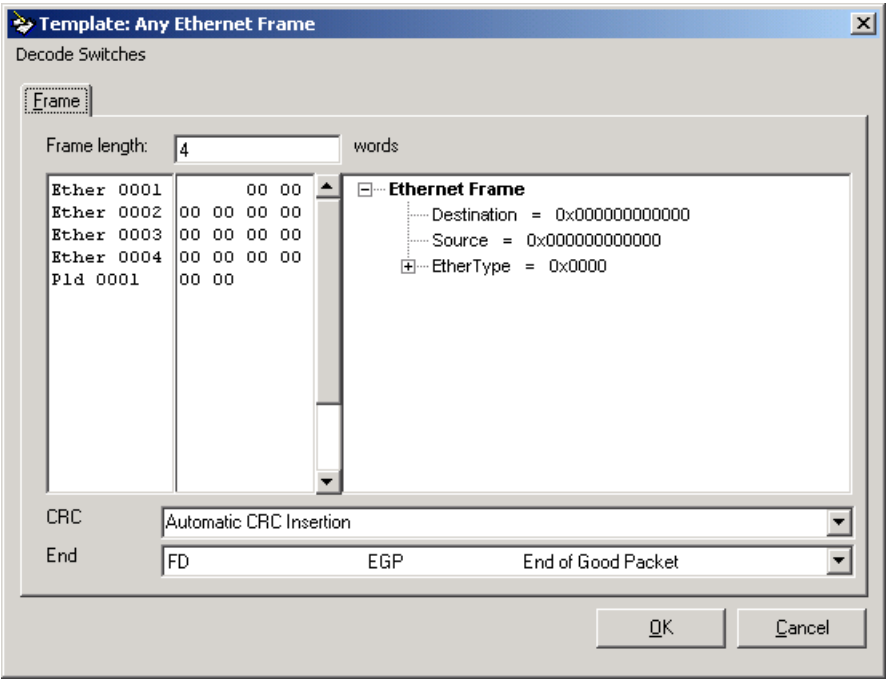


Figure 51: Gigabit Ethernet Any Frame Template Editor Dialog



Decode Switches Menu

The Decode Switches menu lets you select the manner in which you want to display the bytes in a frame. The Decode Switches menu only appears when there is a payload specified (set the number of words in the Frame length field to be greater than the number of words in the header.) Only switches relevant to the current template being edited would appear. There are also contextual switches to further decode responses and data frame templates. For further information about decode switches, refer to the *Xgig Analyzer User's Guide*.

Frame Length

You can enter a legal frame length in words in the Frame Length field at the top of the editor dialog.

Columns

The editor has three columns:

- Word pointers

The left column is a named word pointer. You can select pointers, copy, cut, and paste them. Word values move along with the pointers.

- Fibre Channel frames start with an SOF, have an option VSAN header of 2 words (VSAN 1 and 2), follow on with six header words (FCH1-6), continue with payload words P001-P528, then a CRC, and an EOF.
- Gigabit Ethernet frames start with an S Ordered Set, six preamble bytes, and 1 SDF byte (not shown in the template), followed by 14 header bytes (Ether 0001-0004), payload words Pld 0001-0376, then a CRC and an EOF.

- Word value in hex

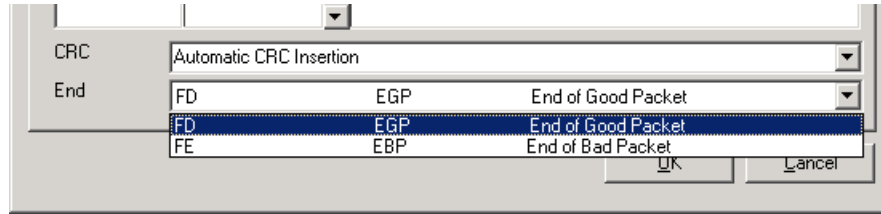
The center column is the word value. These are entered in hexadecimal. All words are D characters, except the K character at the first byte of the SOF word in Fibre Channel, and the K character at the S Ordered Set at the beginning of the frame (not shown in the template).

- Protocol decode string

The right column contains translations of the hex words in the frame into protocol decoded strings. Use the mouse cursor to click on the + symbol, to display a sub-list of possible decode values. You can select one of the elements in the list and the hex word updates to reflect the appropriate bit values.

CRC and End Word Controls

At the bottom of the editor are the CRC and End word controls ([Figure 52](#)). You can type a CRC value or let Automatic CRC Insertion send the valid CRC for the frame.

Figure 52: CRC and End Word Controls

Xgig BERT-Specific Templates

Pattern Elements include some Xgig BERT specific templates. These are specialized template elements that you can only use with the Xgig BERT. Some of these templates are protocol-specific, some are not. The protocol-specific templates are described in the next section. The templates that are not protocol-specific are the Automatic CRC, the Any Data Word, and the Placeholder.

Automatic CRC Generation and Insertion

Fibre Channel and Gigabit Ethernet use a 32-bit cyclic redundancy check (CRC). To insert a dynamically computed CRC, you need to use two Xgig BERT specific templates. One is a protocol-specific SOF or SDF Insertion element (green SOF or SDF icon), the other is the protocol independent Automatic CRC element (yellow CRC icon). The hardware recognizes an Xgig BERT specific SOF or SDF Insertion element and starts a CRC-32 calculation with the word immediately after the element. The calculation continues until the Automatic CRC Insertion element is found, and the CRC is inserted on that word. The CRC is automatically calculated for the entire frame including placeholder entries. You should place the CRC element just prior to the frame terminator.



Important: All entries between the SOF/SDF template and the automatic CRC template must not have control (K) characters, and must be 8-bit entries; 10-bit entries are not handled correctly by CRC.

An SOF or SDF that is not a special template containing a green SDF or SOF icon will not work with the automatic CRC calculator.

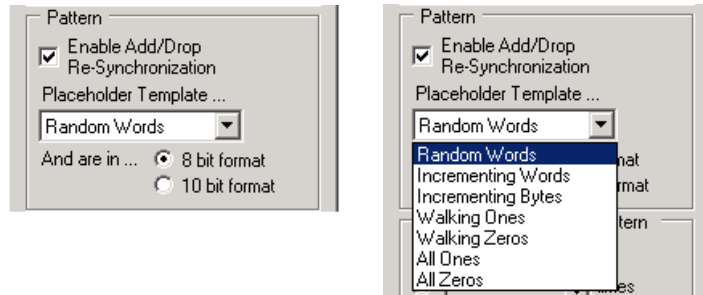
Any Data Word

The Any Data Word template is a one word element that can be used to create an 8-bit data word that has no K-char bits. Once this template is moved to the Pattern Definition window, you can change the word to 10 bit mode, or you can enable K-char bits.

Placeholder

The third element, Placeholder, represents a hardware-based counter/accumulator register. You can include automatic Placeholder words along with the pattern templates. Figure 53 shows the Placeholder Template menu.

Figure 53: Placeholder Template menu



Using the Placeholder Element

To use the Placeholder element, select the one hardware counter type you want to use throughout the pattern. For example, select Incrementing Words, 8-bit Format. Each time you drag a Placeholder element into the pattern, it is pointing to the one Incrementing Word counter in hardware. Every time the pattern encounters this Placeholder, the present value is used and the counter incremented. The same register might be listed repeatedly, for example, four successive Placeholder copies of “Incrementing Bytes.” This results in the pattern transmitting the proper disparity and 10-bit values for the hex characters listed in Table 6.

Table 6: Four Placeholder 8-bit Values for Hex Characters

0x00	0x00	0x00	0x00
0x01	0x01	0x01	0x01
0x02	0x02	0x02	0x02
0x03	0x03	0x03	0x03
(end of first pass through the pattern)			
0x04	0x04	0x04	0x04
0x05	0x05	0x05	0x05
0x06	0x06	0x06	0x06
0x07	0x07	0x07	0x07
(end of second pass through the pattern)			
0x08	0x08	0x08	0x08
:	:	:	:
:	:	:	:
:	:	:	:
:	:	:	:
:	:	:	:
:	:	:	:
:	:	:	:
:	:	:	:
:	:	:	:
:	:	:	:
:	:	:	:
:	:	:	:
:	:	:	:
:	:	:	:
:	:	:	:
:	:	:	:
:	:	:	:
:	:	:	:
: :	:	:	:
0xFF	0xFF	0xFF	0xFF
(end of sixty fourth pass through the pattern)			
0x00	0x00	0x00	0x00

If you change the Placeholder Template setting, all Placeholders in the pattern are affected and when the pattern is restarted, it will use the new setting each time a Placeholder is encountered.

You cannot use the Placeholder as the first compare word. You can use it as the last compare word.

8-Bit Placeholders

The 8-bit Placeholders are transmitted with proper disparity and translated to 10-bit from the registers described in Table 7.

Table 7: 8-bit Placeholder Registers

Register	Description	Initial Value
Random Words	32 Bit Pseudo-Random left shift register with bits 31, 30, 15 and 1NOT XOR'd into the least significant bit.	0x00 00 00 00
Incrementing Bytes	1 Byte Counter x 4, counts 0x00 to 0xFF and then repeats; all bytes are equal.	0x00 00 00 00
Incrementing Words	32-Bit Incrementing counter, counts from 0x00 00 00 00 to 0xFF FF FF FF, then wraps to 0x00 00 00 00 and continues.	0x00 00 00 00
Walking Ones	32-Bit left shift register, shifts from 0x00 00 00 01 to 0x80 00 00 00, then repeats	0x00 00 00 01
Walking Zeros	32-Bit left shift register, shifts from 0xFF FF FF FE to 0x7F FF FF FF, then repeats.	0xFF FF FF FE
All Ones	Static 1's.	
All Zeros	Static 0's.	

10-Bit Placeholders

The 10-bit Placeholders are transmitted without regard for proper disparity directly from the registers described in Table 8.

Table 8: 10-bit Placeholder Registers

Register	Description	Initial Value
Random Words	40-Bit Pseudo-Random left shift register with bits 31, 30, 15 and 1NOT XOR'd into the least significant bit.	0x00 00 00 00 00
Incrementing Bytes	10-Bit Counter x 4, counts 0x000 to 0x3FF and then repeats; all characters are equal.	0x00 00 00 00 00
Incrementing Words	40-Bit Incrementing counter, counts from 0x00 00 00 00 00 to 0xFF FF FF FF FF, then wraps to 0, then continues.	0x00 00 00 00 00
Walking Ones	40-Bit left shift register, shifts from 0x00 00 00 00 01 to 0x80 00 00 00 00, then repeats.	0x00 00 00 00 01
Walking Zeros	40 Bit left shift register, shifts from 0xFF FF FF FF FE to 0x7F FF FF FF FF, then repeats.	0xFF FF FF FF FE
All Ones	Static 1's.	
All Zeros	Static 0's.	

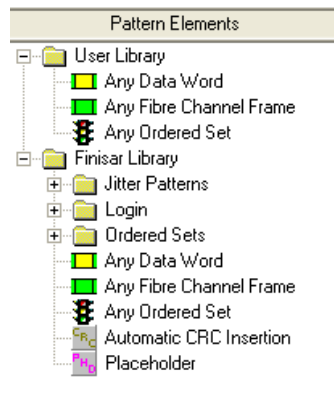


Note: You can only use one representation for Placeholders at a time. When you select Incrementing Words, an incrementing value is placed at each Placeholder location in the pattern.

Xgig BERT-Specific Protocol-Specific Templates

Pattern Elements include some Xgig BERT-specific templates that are only available in a certain protocol mode (Figure 54 and Figure 55). These templates are the SOF Indicator, the SDF Indicator, the GigE Normal Termination Indicator, and the GigE Abnormal Termination Indicator.

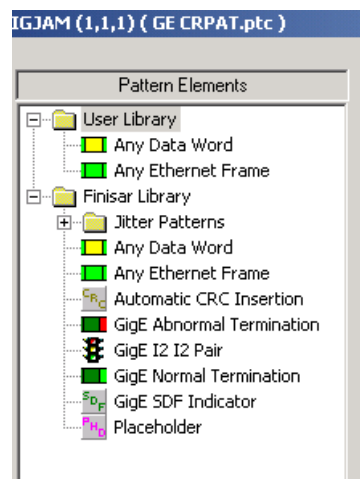
Figure 54: Fibre Channel Pattern Elements



SOF Indicator

The SOF indicator shows a start of frame and resets the automatic CRC calculator in the Fibre Channel Protocol. You edit this template the same way you edit the Fibre Channel Ordered Set Templates. The JDSU Template library contains an SOF indicator for each type of Fibre Channel SOF (for example: SOFi3, SOFn3, etc.). You can also create your own SOF template or edit the data in the Pattern Definition. The SOF indicator element enables the hardware based automatic CRC calculator to begin with the word following the four byte SOF indicator. It is not necessary for any byte in the SOF indicator to be a control (K) character and no bytes of the SOF Indicator are included in CRC calculation.

Figure 55: Gigabit Ethernet Pattern Elements



SDF Indicator

The SDF indicator is usually the second word of a frame and resets the automatic CRC calculator in the Gigabit Ethernet Protocol. The default data is 0x55 0x55 0x55 0xD5. A data word of K27.7 0x55 0x55 0x55 should be put before this template for a proper frame beginning. The SDF indicator element enables the hardware based automatic CRC calculator to begin with the word following the four byte SDF Indicator. It is not necessary for any byte in the SDF Indicator to be a control (K) character and no bytes of the SDF Indicator are included in CRC calculation.

Gigabit Ethernet Normal Termination Indicator

The Gigabit Ethernet Normal Termination Indicator is used to terminate a Gigabit Ethernet frame, and should be placed after the CRC word. The data contents are T/R/I1 or T/R/I2 (K29.7 K23.7 K28.5 0xC5 or 0x50). You cannot edit this data. The hardware automatically chooses between I1 and I2, depending on the incoming current running disparity (if positive, I1 is used, if negative, I2).

Gigabit Ethernet Abnormal Termination Indicator

The Gigabit Ethernet Abnormal Termination Indicator is used to terminate a Gigabit Ethernet frame; you should place it after the CRC word. The data contents are V/R/I1 or V/R/I2 (K30.7 K23.7 K28.5 0xC5 or 0x50). You cannot edit this data. The hardware automatically chooses between I1 and I2, depending on the incoming current running disparity (if positive, I1 is used, if negative, I2).

Using Pattern Definition

The Pattern Definition window is where you create your pattern. The Hardware Sync Word is always shown at the top, and the Compare Zone is always at the bottom. In between these zones is the Re-Sync Zone, if Re-Sync Mode is enabled.

You can place up to 1024 words in the Re-sync Zone and 4096 words in the Compare Zone.



Caution: In Gigabit Ethernet mode, I2 Ordered Sets must be present just before the Start Word to assist in alignment. Make sure to always have I2 Ordered Sets in the Re-Sync Zone. If a Re-Sync Zone is not present and the Hardware Sync Word is turned off, be sure to set the “When stopped send...” word to I2/I2.

To turn the Hardware Sync Word on and off:

>> Click the check box.

Notice that if you do not use the Hardware Sync Word, then all the receive statistics begin with the Start Word, regardless of whether there is a Re-Sync Zone or not. For the first loop, statistics are only taken for the Compare Zone. For subsequent loops, statistics will include all received data as normal.

Creating and Organizing Words

To populate the Re-Sync Zone and Compare Zone:

>> Drag and drop templates from the Pattern Elements window.

When you drag and drop a Frame Template, it is automatically broken up into its constituent words.

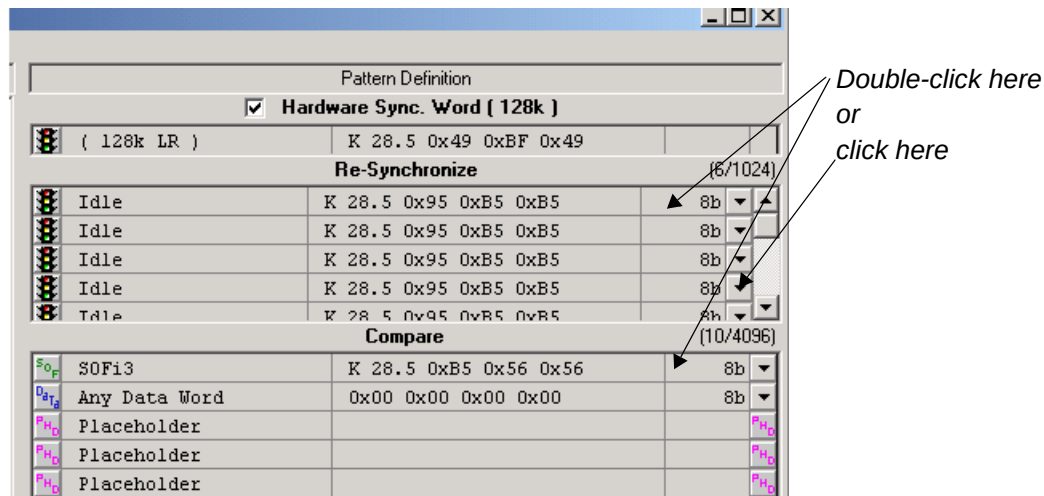
Another way to create and organize words is to use standard cut, copy, and paste commands (only within a single zone at a time).

To edit words in the Re-Sync Zone and Compare Zone, use the Pattern Word Editor.

Using the Pattern Word Editor

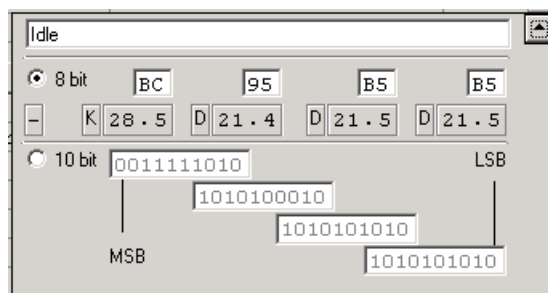
To open the pattern word editor, double-click on an entry in the Re-Synchronize or Compare windows on the right side of the configuration screen (Figure 56) or click on a down arrow on the right side of the entry.

Figure 56: Opening the Pattern Word Editor



The pattern word editor dialog is displayed (Figure 57).

Figure 57: Pattern Word Editor Dialog



This editor allows you to define the actual 10-bit value to be transmitted or the 8-bit value that the hardware encodes to the correct 10-bit translation, based on the running disparity.

Use the following guidelines when you edit words in a pattern:

- For 8-bit mode, use the + or - button to select the incoming disparity for the 10-bit conversion. For 10-bit mode, the + or - has no function.
- You must use 8-bit mode for automatic CRC calculation.

- Note that the translated 10-bit values are ignorant of disparity. You might need to manually pick the opposite starting disparity value by inverting the 10-bit value to follow disparity rules.
- You can enter a name for this word at the top of the editor.
- After selecting 8-bit, you can enter hex values and click on the “D” or “K” to toggle it to the other state.
- If you select 10-bit, you can only enter 1s and 0s. Illegal characters are “??” in hex translations in 8-bit.



Important: Watch out for disparity issues and receiver restrictions if you enter 10-bit values. 10-bit values are always transmitted “As Is;” whereas, 8-bit values are transmitted using correctly generated disparity. 8-bit Ordered Sets are transmitted following the appropriate protocol-specific disparity rules, regardless of the current running disparity.

- The Pattern Word Editor does not allow you to edit the following templates:
 - Automatic CRC
 - Placeholder
 - GigE Normal Termination Indicator
 - GigE Abnormal Termination Indicator

Send and/or compare Patterns... (Finite Loop Setting)

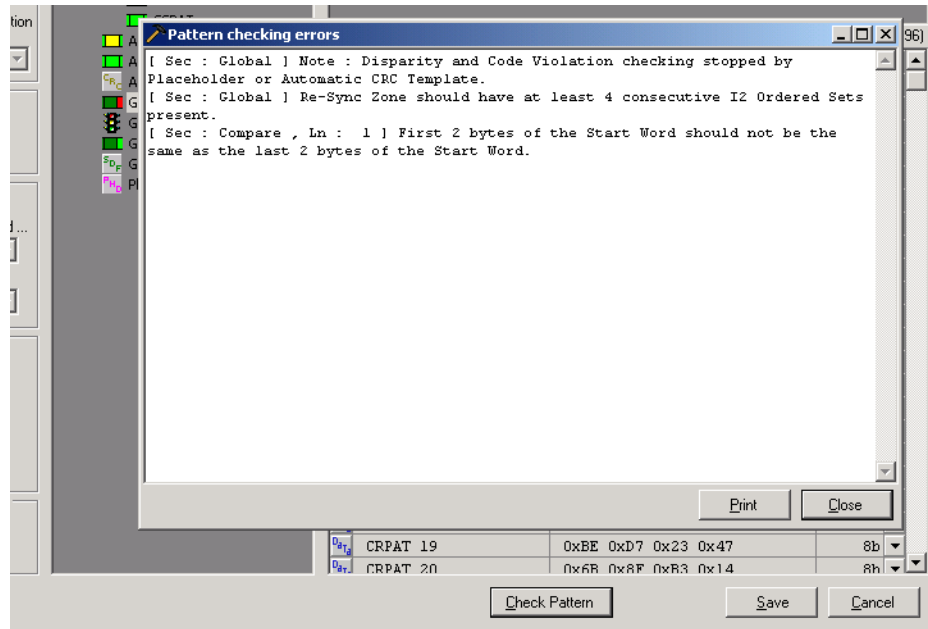
Use this control to send and/or compare the pattern a finite number of times. You can select:

- Looping forever
- A specified number from 1 to 4294967295

When you use a finite number and click **Start**, the Xgig BERT runs until the number of loops are complete; then the unit automatically returns to the stopped state. Additionally, a Traffic Capture “trigger” condition is created at the last word of the last loop.

Check Pattern

You can check your pattern in Xgig BERT for code violations, disparity errors, and warnings that might cause your pattern to fail. After you define a pattern, click the **Check Pattern** button (Figure 58).

Figure 58: Check Pattern Button

Xigig BERT highlights disparity errors and code errors in yellow and reports their line number and byte position. Note that byte 0 refers to the msb on the far left, while byte 3 is on the far right. In addition, it displays the following warnings when it detects pattern errors:

General Warnings

The following warnings are displayed for errors that occur in either protocol:

Start Word should not be used elsewhere in pattern.

Start Word cannot be a Placeholder.

Placeholder cannot be put into the Re-Sync Zone.

Start Word cannot be an auto CRC template.

CRC template cannot be put into Re-Sync Zone.

Compare function will not be useful with 10 bit Placeholders in pattern.

Unaligned comma character may cause Compare function to lose sync with pattern.

Compare Zone should be longer than 8 words to allow for 8 clock width TTL-out pulsing.

Start Word should not be an 8 bit EOF.

Compare Zone cannot be empty.

Fibre Channel Mode Warnings

The following warnings are only displayed in Fibre Channel Mode:

First word of Re-Sync or Compare Zones cannot equal Hardware Sync Word.

10-bit data is not allowed between SOF template and auto CRC template.

K-Char characters are not allowed between SOF template and auto CRC template.

SOF and auto CRC templates must be in pairs where SOF comes before auto CRC.

Auto CRC template found without partner SOF template.

SOF template and auto CRC template must have at least 1 word between them.

SOF template cannot put into the Re-Sync Zone.

Re-Sync Zone must have at least 3 consecutive Ordered Sets present that may be added or dropped.

Compare Zone should not contain Ordered Sets that may be added or dropped.

Gigabit Ethernet Mode Warnings

The following warnings are only displayed in Gigabit Ethernet Mode:

First word of Compare Zone cannot equal Hardware Sync Word.

First 2 bytes of the Start Word should not be the same as the last 2 bytes of the Start Word.

10 bit data is not allowed between SDF template and auto CRC template.

K-Char characters are not allowed between SDF template and auto CRC template.

SDF and auto CRC templates must be in pairs where SDF comes before auto CRC.

Auto CRC template found without partner SDF template.

SDF template and auto CRC template must have at least 1 word between them.

Re-Sync Zone must have at least 4 consecutive I2 Ordered Sets present.

Compare Zone must not have I2 Ordered Sets present, because other devices may add or drop them.

Start Word cannot be a T/R/IX nor V/R/IX template.

You can send your pattern to a device, but if it contains a warning, the results can be unpredictable. Disparity errors do not affect an instrument's performance except as defined by bit DC bias requirements.

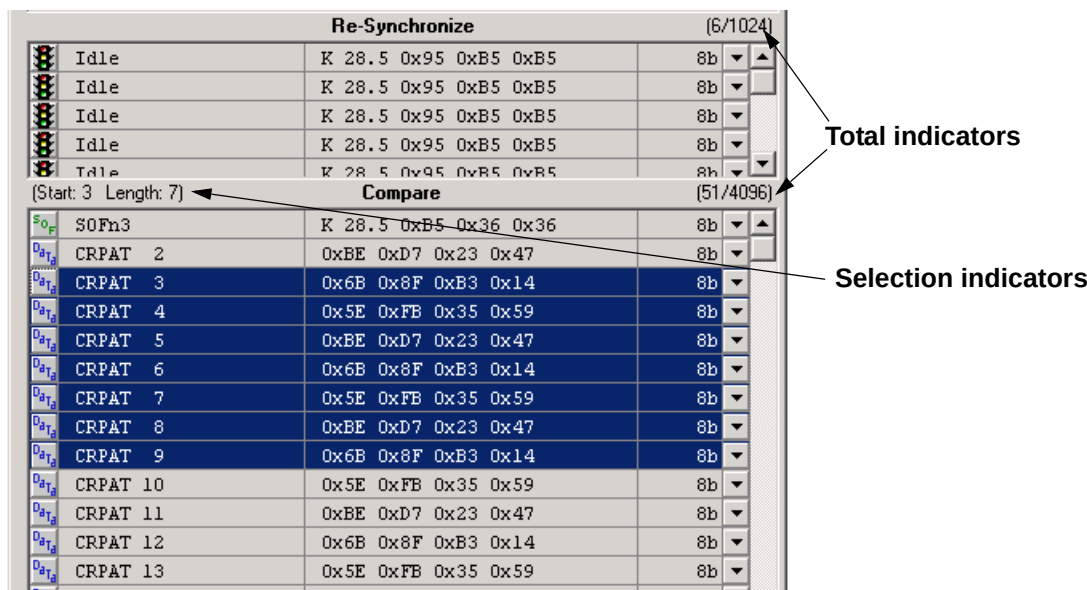
Pattern Indicators

The BERT Configuration window has indicators that show current selection information for the Re-Synchronize Zone and Compare Zone. They are located in the header of each zone (Figure 59).

The selection indicators, on the left side of the header, show the current selection point within a particular pattern window (Start) and the number of items selected (Length). These indicators only appear for the zone you currently have selected (Re-Sync or Compare).

The total indicator on the right of the header displays the number of words used in the pattern and the maximum number of words allowed.

Figure 59: Pattern Indicators



Protocol-Specific Features

This section describes the protocol-specific features for BERT mode.

Fibre Channel

Xgig BERT supports the Fibre Channel protocol as follows:

- The Hardware Sync Word (128k sent at beginning of pattern) is LR (K28.5 0x49 0xBF 0x49)
- The default for the “stopped word” is Idle (K28.5 0x95 0xB5 0xB5)
- The default speed is 2.1250 Gbps for a 2.1250 Gbps blade, 4.2500 Gbps for a 4.2500 Gbps blade and 8.5000 Gbps for an 8.5000 Gbps blade
- The Ordered Set templates in the Pattern Elements window are editable as described previously
- In Re-Sync Mode, received comma characters are aligned to byte 0 (msb) for comparison. (Be sure to only put comma characters in the left-most byte.)

- 8b Ordered Sets are always sent with the proper negative incoming disparity (except EOFs)
- 8b EOFs are always corrected to the right code on-the-fly in hardware according to the running disparity
- In Re-Sync Mode, there should be at least 3 equal consecutive Ordered Sets in the Re-Sync Zone so that other devices may add or drop to re-time
- Xgig BERT-specific SOF template indicators are available
- To use the Automatic CRC template, you should place an SOF indicator template (green icon) at the beginning of the frame, and an Automatic CRC template at the end after the payload, before the EOF
- To use Fibre Channel Frame Scrambling, you should use an SOF indicator template at the beginning of the frame. Scrambling will begin on the next word and continue until a word containing a K character (usually EOF). Scrambling is enabled or disabled for each BERT port in the Parameters context menu on the BERT tab.

Gigabit Ethernet

Xgig BERT supports the Gigabit Ethernet protocol as follows:

- The Hardware Sync Word (128k sent at beginning of pattern) is I2/I2 (K28.5 0x50 K28.5 0x50)
- The default for the “stopped word” is I2/I2 (K28.5 0x50 K28.5 0x50)
- The default speed is 1.25 Gbps
- The Ordered Set templates in the Pattern Elements window are not editable (until you put them into the pattern)
- In Re-Sync Mode, received comma characters are aligned to byte 0 (msb) and byte 2 for comparison. (Be sure to only put comma characters in the left-most byte and the third from left byte.)
- 8b I2 Ordered Sets are always sent with the proper negative incoming disparity. Note that the Check Pattern feature does not include this in its disparity rules.
- 8b I1 Ordered Sets are always sent with the proper positive incoming disparity. Note that the Check Pattern feature does not include this in its disparity rules.
- The Gigabit Ethernet Normal Terminator and Gigabit Ethernet Abnormal Terminator templates automatically choose in hardware between I1 and I2 to terminate the frame with the correct negative disparity.
- In Re-Sync Mode, there should be at least four equal consecutive Ordered Sets in the Re-sync Zone so that other devices can add or drop to re-time (for example, 2 I2/I2 pairs).
- When you use the Automatic CRC template, you should place an SDF indicator template (green icon) at the beginning of the frame, and an Automatic CRC template at the end after the payload, before the frame terminator template.
- The SDF indicator template should usually be the second word of the frame. A word containing the S Ordered Set and three preamble characters (K27.7 0x55 0x55 0x55) should usually be the first word in the frame.

- In Re-Sync mode with the Hardware Sync Word on, if you use I2/I2 as the words in the Re-Sync Zone, when the receiver receives the first loop it will not count the Re-Sync words in the statistics (only for the first loop). This is because the receiver looks for the first word that is different from the Hardware Sync Word (I2/I2) to start accumulating statistics.
- In Re-Sync Mode, the receiver constantly looks for a match of the first two bytes of the Start Word, and aligns the data stream to the msb position upon any match, for comparison purposes. Therefore, you should never use the first two bytes of the Start Word anywhere else in the pattern. In Non-Sync Mode, the alignment is only performed once at the beginning of the first loop received; so the pattern restriction does not apply.
- Xgig BERT specific templates available for Gigabit Ethernet:
 - SDF Indicator
 - GigE Normal Termination Indicator
 - GigE Abnormal Termination Indicator

Cancel and Save Buttons

These buttons control the updating of the entire Configuration window and allow you to save the settings you make.

Cancel

Closes the Configuration window and returns to the main window. All changes that you made since the last time you opened the Configuration window are lost.

Save

If you are in edit only mode, without assigned hardware, the Configuration window displays a **Save** button. Click this button to save the configuration you have created or edited.

BERT Configuration Files

You can use configuration files (with the extension .ptc) to save all the contents of the Configuration window. The current configuration file name is displayed in the Parameters Status table on the Xgig Maestro window and on the title bar in the Configuration window. For information about how to load a configuration file, save a configuration file, reset a configuration, or edit a configuration file, see page [“Loading BERT Configuration Files” on page 75](#).

Chapter 6

Configuring Latency Settings

In this chapter:

- [Using the BERT Latency Configuration Window](#)
- [Saving Configuration Files](#)

Xgig BERT provides latency measurement by sending out frames and measuring the time they take to return to the BERT. The frame pattern is similar to a pattern you can create in BERT mode, but, for the most part, you cannot edit it. The pattern uses the Hardware Sync Word and a Re-Sync Zone with Idles for the appropriate protocol. The Compare Zone (no bit comparison occurs) contains one protocol-specific, dynamically changing frame.

This chapter describes how to use this feature.

To enable the Latency mode:

- 1 Select a port and lock it port as a BERT on the Port Selection and Domain Setup window.
- 2 On the BERT tab, right-click on the port to open the Parameters context menu and select **Mode of operation > Latency mode**.

The Latency tab on the Xgig Maestro window is displayed (Figure 60).

Figure 60: Latency Tab

FC XGIGSWDEV1 (1.2.2)	
State	 Stopped
Configuration...	 (Not configured from a file)
Start / Stop	 Start
	Operation
Status	
Protocol	 Fibre Channel
Clock rate	 2.1250 Gbps
Send status	Stopped
Compare status	Stopped
Elapsed time	0.000 s
Wire status	K28.5 0x95 0xB5 0xB5
Signal LED	 No signal
LOS LED	 N/A
Latency	
Instantaneous	0 ns
Average	0 ns
Minimum	0 ns
Maximum	0 ns
Data points	0

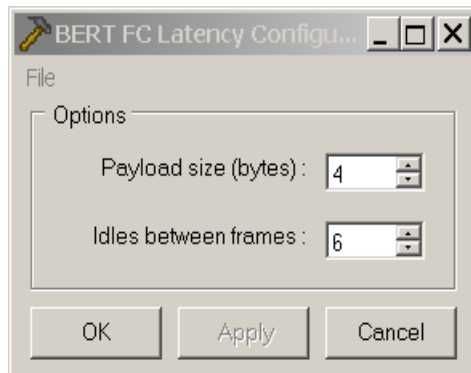
Using the BERT Latency Configuration Window

To configure Latency:

- 1 Be sure the device you want to configure is selected in the Parameters Status table.
- 2 Click the Configuration File button (Figure 60).

The Latency Configuration window is displayed (Figure 61).

Figure 61: Latency Configuration Window



3 Set the following to configure latency.

In the Options area:

- **Payload size**

Controls the number of bytes in the payload of the frame sent. Payload is counted by 4 bytes.

For Fibre Channel, the minimum is 4, maximum is 2112.

For Gigabit Ethernet, the minimum is 10, the maximum is 4066.

- **Idles between frames**

Controls the number of Idle characters between frames. Idles are counted by 1 in Fibre Channel and by 2 in Gigabit Ethernet.

For Fibre Channel, the minimum is 6 and maximum is 1024.

For Gigabit Ethernet, the minimum is 5, the maximum is 2049.

4 Click **Save** or **Cancel**.

These two buttons control updating for the entire Configuration window.

Save

Saves all the Configuration window settings.

Cancel

Closes the Configuration window and returns to the main window. All changes that you made since the last time you opened the Configuration window and clicked **Apply** are lost.

Saving Configuration Files

When you save a configuration file, the file contains the settings from the BERT tab and the Latency tab. You can save the contents of the Configuration window to file names you specify. For more information about configuration files, refer to [“Saving a BERT Configuration File” on page 75](#).

Protocol-Specific Features

This section describes the protocol-specific features for Latency mode:

Fibre Channel

Xgig BERT supports the Fibre Channel protocol as follows:

- The Hardware Sync Word (128k sent at beginning of pattern) is LR (K28.5 0x49 0xBF 0x49).
- The default for the “stopped word” is Idle (K28.5 0x95 0xB5 0xB5).
- The default speed is 2.1250 Gbps for a 2.1250 Gbps blade, 4.2500 Gbps for a 4.2500 Gbps blade, and 8.5000 Gbps for an 8.5000 Gbps blade.
- The frame contains SOFn3, six header words, a user-defined payload length, a good CRC, and EOFt.

Gigabit Ethernet

Xgig BERT supports the Gigabit Ethernet protocol as follows:

- The Hardware Sync Word (128k sent at beginning of pattern) is I2/I2 (K28.5 0x50 K28.5 0x50)
- The default for the “stopped word” is I2/I2 (K28.5 0x50 K28.5 0x50)
- The default speed is 1.25 Gbps.
- The frame contains 14 header bytes, a user-defined payload length, a good CRC, and a normal frame termination.

Chapter 7

Using the Latency Tab

In this chapter:

- [Using the Latency Parameters Status table](#)
- [Latency Operation](#)

This chapter describes how to run a Latency measurement and what you can observe while running a test.

After you have configured your latency settings described in [Chapter 6, “Configuring Latency Settings,”](#) you can run your test. You do this from the Latency tab on the main window (Figure 62).

The Latency Parameters Status table displays information about the test you are running or the test that has just completed.

Figure 62: Latency Tab

FC XGIGSWDEV1 (1.2.2)	
State	 Stopped
Configuration...	 (Not configured from a file)
Start / Stop	 Start
Operation	
Status	
Protocol	 Fibre Channel
Clock rate	 2.1250 Gbps
Send status	Stopped
Compare status	Stopped
Elapsed time	0.000 s
Wire status	K28.5 0x95 0xB5 0xB5
Signal LED	 No signal
LOS LED	 N/A
Latency	
Instantaneous	0 ns
Average	0 ns
Minimum	0 ns
Maximum	0 ns
Data points	0

Using the Latency Parameters Status table

Each Latency device is displayed by a column in the Parameters Status table on the Latency tab (Figure 62). At the top of each column is the protocol and the chassis name, followed by the chassis number, the slot number and port number in parenthesis. Below this is a selection indicator. The selected BERT is indicated by a green check mark under Select in the Ports Manager. When you click the **Start** button and run a Latency measurement, the Parameter status table displays a readout for each port that is running a test; the readout is updated several times a second.

The following metrics are available in the Parameters Status table on the Latency tab.

State Category

This category shows the Latency status:

- Disconnected
- Connecting
- Starting
- Synchronizing
- Running
- Stopping
- Stopped

Configuration File Category

Displays the name of the configuration, if any, loaded into the port. Refer to [“Loading BERT Configuration Files”](#) on page 75.

Status Category

This category indicates the current physical setup for Latency.

Protocol

Indicates the protocol for a Latency measurement. You choose a protocol in the Port Selection and Domain Setup window when you lock ports. The small lock icon indicates that the protocol cannot be changed at this stage.

Clock rate

Indicates the clock rate. The closed lock icon indicates you cannot currently change the clock rate; the open lock icon indicates you can change the clock rate. The clock rate can be 1.0625 Gbps, 1.2500 Gbps, 1.5000 Gbps, 2.1250 Gbps, 2.5000 Gbps, 3.0000 Gbps, 4.2500 Gbps or 8.5000 Gbps. Both ports in a port pair must always be set to the same clock rate. Therefore, if you have two ports, and one of them is running, the clock rate is locked on both of them.

Setting the Clock Rate

To change the clock rate:

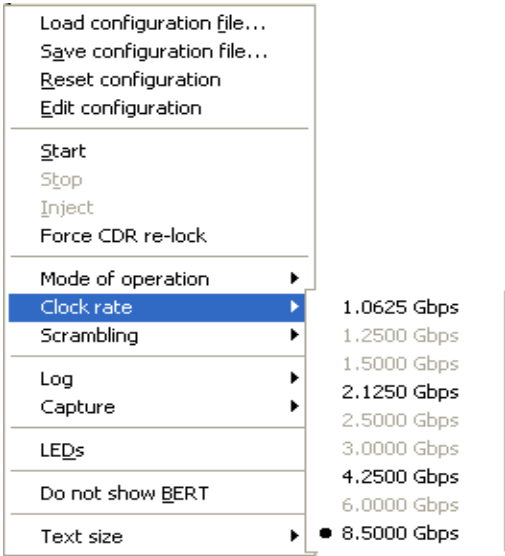
- 1 Right-click anywhere on the specific port column to open the Parameters context menu ([Figure 63](#)).
- 2 Select **Clock rate**.
A menu with available choices is displayed
- 3 Click to choose one.

Items that are grayed out are not currently available. A bullet is displayed to the left of the currently operating selection.



Note: The clock rate is not saved in the configuration file. This allows Latency configurations to run independently of the clock rate setting and avoids breaking the link to which the device is connected.

Figure 63: Clock Rate Menu

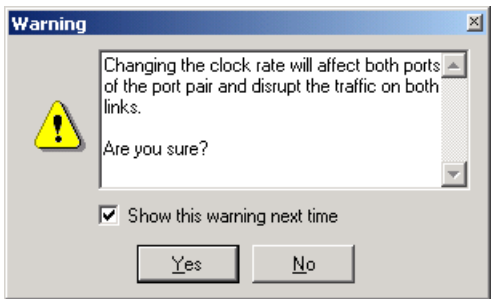


Note: Two adjacent BERT ports share the same clock rate, specifically ports 1 and 2, and also ports 3 and 4.



Note: Changing the clock rate disrupts the traffic sent from the BERT. A warning message appears when you change the setting (Figure 64).

Figure 64: Changing Clock Rate Warning



Send Status

The Send Status metric reflects the state of transmitting hardware and reports the following activities:

- Stopped
- Sending hardware sync
- Sending...
- Stopping...

Compare Status

The Compare Status metric reflects the state of the compare hardware and reports the following activities:

- Stopped
- Trying to sync up
- Receiving...
- Stopping...

Elapsed Time

The Elapsed Time metric is the time since you clicked **Start** on the Latency Operation bar.

Wire status

Shows the current output of the port.

Signal LED

This LED always shows what is occurring at that moment in a test and therefore changes instantaneously. [Table 9](#) describes the LED colors.

Table 9: Signal LED Descriptions

Port column LED color	Blade LED	Description
Green	Green	Signal is detected and the link is synchronized.
Red	Yellow	Loss of synchronization is occurring.
Black	Off	No signal detected on the link.

LOS LED

The loss of synchronization (LOS) LED shows if loss of synchronization has occurred during the current test (if running) or during the previous test (if stopped). The LED is reset when you start the BERT. The LED colors are described in [Table 10](#).

Table 10: LOS LED Descriptions

Port column LED color	Blade LED	Description
Green	Green	The link is synchronized.
Yellow	Yellow	Loss of synchronization was detected at some point while the test was running.
Red	Blinking Yellow	Loss of synchronization is occurring now or in the last 5 seconds.
Black	Off	Not applicable

Latency Category

The Latency category reports the counter values to the nearest word clock period.

Instantaneous Latency

Reports the most recent latency measurement, or reports “Detecting Errors.”

Average Latency

The average latency computed over the course of the operation.

Minimum Latency

The minimum latency found during the course of the operation.

Maximum Latency

The maximum latency found during the course of the operation.

Data Points

The total number of latency measurements (data frames) utilized for measurement over the course of the operation.

Latency Operation

Latency mode functions similarly in Fibre Channel and Gigabit Ethernet protocols. A simple frame is sent out with zeros in the header fields and a dynamically changing payload. The latency measurement is taken as each frame returns to the device. Note that the latency measurements are only valid for topologies where traffic sent by the device loops, eventually, back to itself. Latency mode does not work when you have two BERTs sending data to each other.

After you select the options you want, click **Start** to begin operation, and click **Stop** to end the measurement. Only the options on the Latency tab apply to this operation; options from the BERT tab do not apply to Latency mode, for example, stop on Loss of Sync.

While running, any frames returning with obvious errors that corrupt the latency measurement are ignored. In the event of Loss of Sync or Loss of Signal, the Instantaneous Latency parameter reports “Detecting Errors.”

Chapter 8

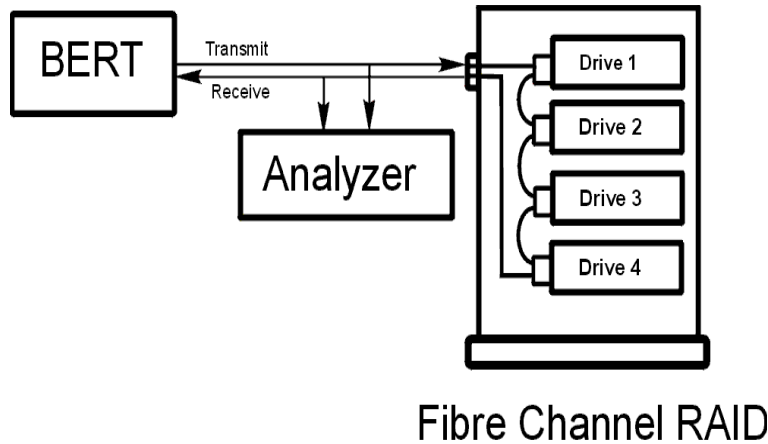
Bit Error Rate Testing on a Fibre Channel RAID Application Note

In this chapter:

- Fibre Channel Physical Layer Testing
- Using the Xgig BERT Fibre Channel System

This application note describes how to use the Xgig BERT to test a Fibre Channel RAID (Figure 65).

Figure 65: Using BERT to Test a Fibre Channel RAID



Fibre Channel Physical Layer Testing

Manufacturers and integrators of Fibre Channel (FC) systems and devices need a method of testing the physical integrity of their hardware components before and after these components are assembled into complex systems. Testing ensures that no physical faults that might compromise system performance are introduced into the system during the manufacturing process. Bit Error Rate Testing (BERT) is an effective verification method that is widely used for data communication applications. Due to the characteristics of Arbitrated Loop topologies, however, BERT testing of complex FC systems, such as RAID, presents challenges to traditional BERT testers.

The data path components of an FC RAID consist of the input/output transceivers, backplane wiring, port bypass circuits, and the elasticity buffers of the installed drives. A traditional BERT transmits a well known bit stream through the data path and monitors the returning stream for changes in the pattern caused by inverted, inserted, or deleted bits. Bit errors are counted, divided by the number of bits sent, and a Bit Error Rate is calculated. The resulting value is compared to a reference value (typically 10^{-12} for FC systems) to determine if the devices are providing acceptable performance.

The unique characteristics of FC Arbitrated Loops can create errors in the BERT statistics even for properly working systems. Inserting or deleting fill words as the data flows through elasticity buffers will alter the bit stream, resulting in reported errors. Additionally, drive buffers might not pass an arbitrary sequence of bits, but instead require a proper FC format. Finally, the drives comprising the FC RAID will need to select a temporary loop master by performing the Loop Initialization Protocol. The BERT must allow the necessary exchanges to pass through and complete before it begins its own testing; traditional BERTs do not have this capability.

Using the Xgig BERT Fibre Channel System

The JDSU Xgig BERT Fibre Channel system has been developed with features that directly address the requirements that have been described.

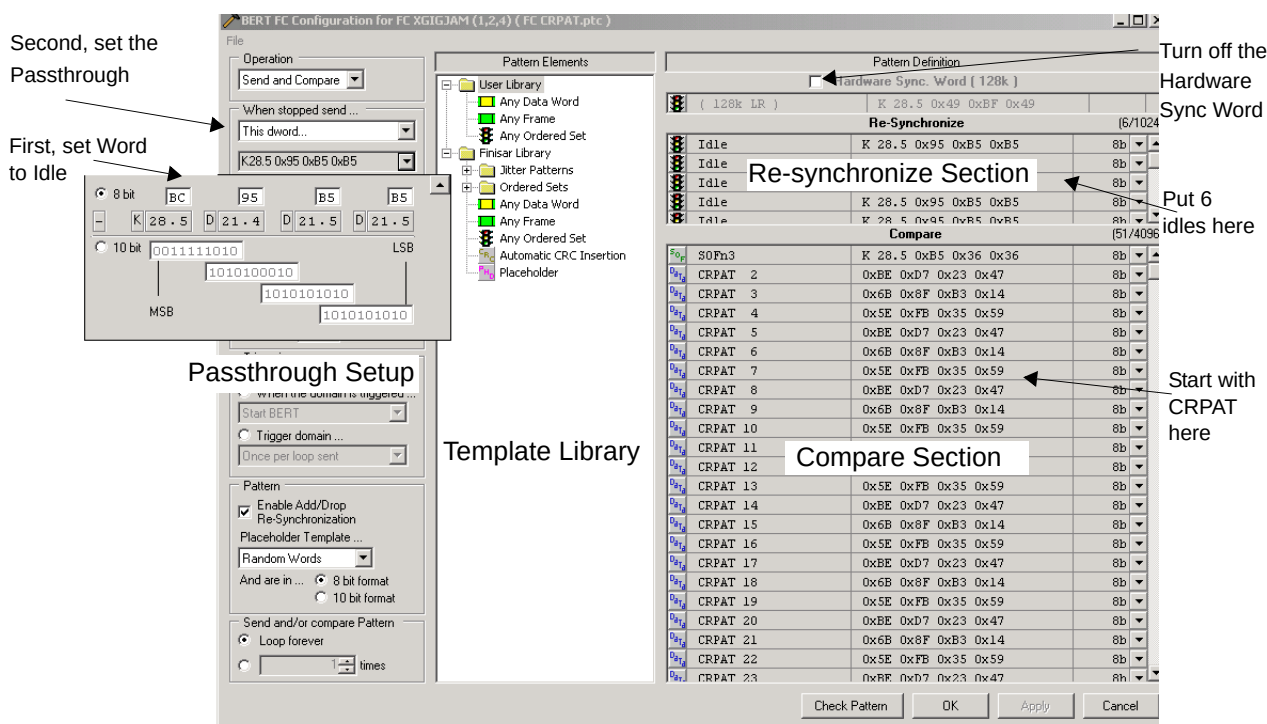
To test RAID systems you need to:

- 1 Plan the script you are going to use to test the RAID. The script consists of two parts:
 - Re-Synchronize —This section of the tool provides the required fill words, such as IDLE, between the frames of the Compare section. Since this portion of the returning stream is not compared, it can contain added or deleted words with no effect on the BERT statistics. The Re-Synchronize feature permits the BERT to accommodate the addition or deletion of fill words by elasticity buffers.
 - Compare—Typically constructed as an FC frame (SOF, contents, CRC, EOF), the BERT detects this portion of the returning bit stream and compares the sequence, bit by bit with the original, to detect errors. Any changes in the bit sequence are reported in the BERT statistics. You can select pre-configured FC frames from the Template Library supplied with the system or create your own. You can edit scripts at the 8b or 10b level. This feature allows the BERT to satisfy the requirement of FC formatting the bit stream.

You might want to create your script using the BERT Configuration window. You can choose an FC frame from the Template Library and load it into the Compare section of the Xgig BERT (Figure 66).

Alternatively, you might want to load a sample configuration file such as FC CRPAT.ptc. This single frame contains a bit pattern intended to stress the link; the Re-Synchronization section contains six IDLE words and the Passthrough flush word is set to IDLE.

Figure 66: Xgig BERT Compare Section



- 2 Make sure the Xgig BERT is set to Passthrough mode before you power up the RAID. Turn off the Hardware Sync Word, then click **Apply**.
- 3 To perform a BERT on a fully populated RAID, the attached drives must be in an idle state where they will simply pass the data bits around the loop.

To reach this state the drives must log-in with a loop master. In this test, there is no initiator on the loop (the BERT does not participate) and the drive with the lowest worldwide name will be selected as the temporary loop master.

Power up the drives so that they initialize and then begin transmitting IDLE around the loop.

- 4 Click **Start** on the BERT tab to run the BERT.

The Xgig BERT utilizes the Passthrough mode that allows it to step off of the loop until the initialization process is complete. Once the drives are initialized, the Xgig BERT can then step back on and begin sending its script. In addition, Passthrough mode flushes the loop with one million $(1024)^2$ user-selectable words when the test is stopped. This operation ensures that, if the test is restarted, none of the original frames continue to circulate in the loop. These frames could potentially become truncated by the restart and result in incorrect error reporting by the BERT.

BERT Statistics

When the Xgig BERT application begins reporting the progress of the test, it indicates the total number of bits sent and the total number of bit errors detected (Figure 67). When a sufficient amount of data has been transmitted, you can stop the BERT.

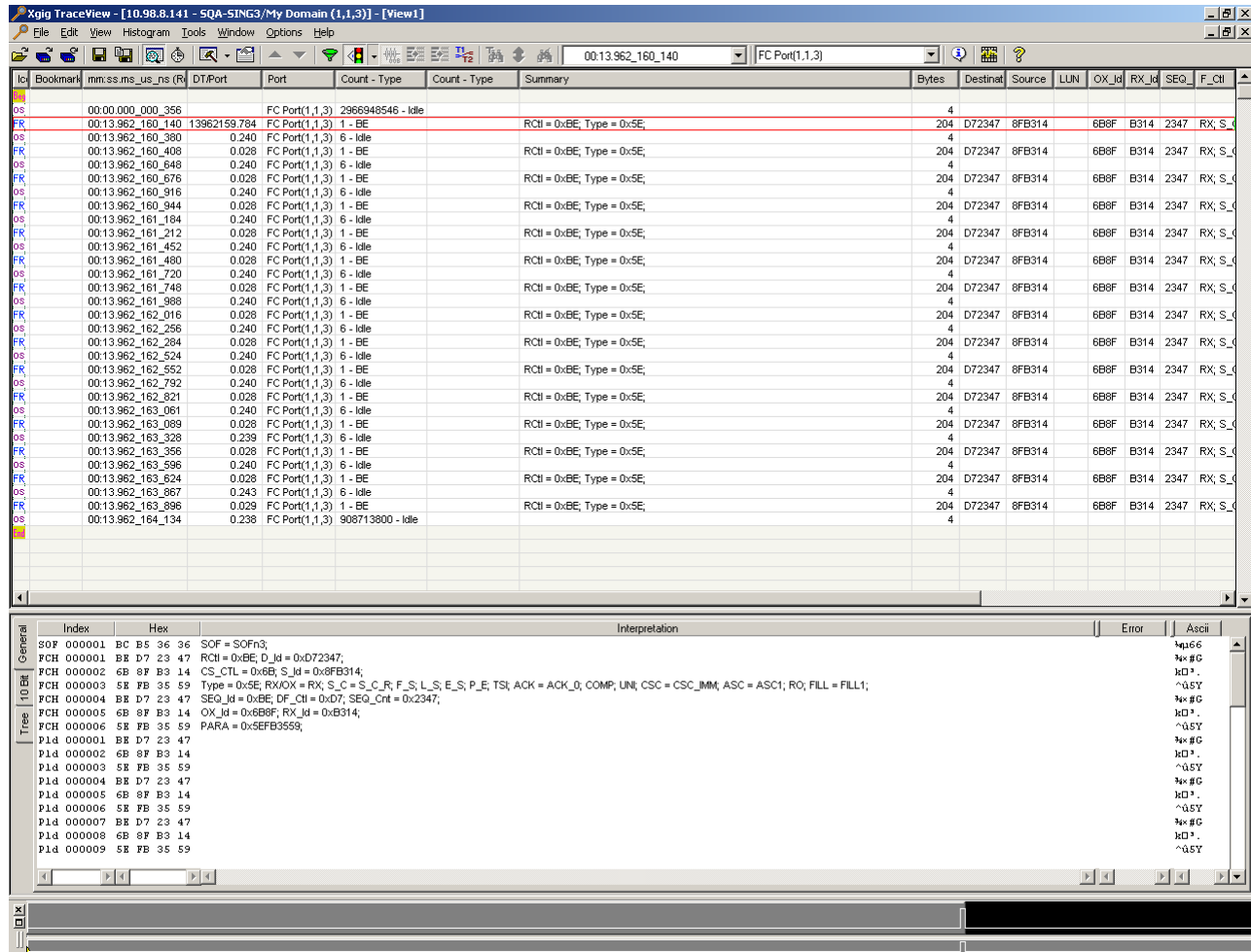
Figure 67: BERT Tab

	FC XGIGSWDEV1 (1,1,1)	FC XGIGSWDEV1 (1,1,3)
State	 Stopped	 Stopped
Configuration...	 FC C1TPAT.ptc	 FC C1TPAT.ptc
Start / Stop	 Start	 Start
	 Inject	 Inject
	 View capture	 View capture
	 Operation	 Operation
Status		
Protocol	 Fibre Channel	 Fibre Channel
Clock rate	 8.5000 Gbps	 8.5000 Gbps
Send status	Stopped	Stopped
Compare status	Stopped	Stopped
Elapsed time	311.000 ms	0.000 s
Bit error rate	N/A	N/A
Wire status	K28.5 0x95 0xB5 0xB5	K28.5 0x95 0xB5 0xB5
Signal LED	 Signal	 Signal
LOS LED	 Synchronized	 N/A
Mismatches LED	 No mismatches	 N/A
Log	Log available	No log available
Capture	Capture available	No capture available
Sent		
Bits	2.568 883 680 10 ⁹	0
Bytes	256.888 368 10 ⁶	0
Dual bytes	128.444 184 10 ⁶	0

Trace Capture Example

In this example, the BERT is set to loop on the script 15 times and stop. A JDSU Xgig Fibre Channel Analyzer is used to capture a trace of the activity on the loop and the data is displayed in Xgig TraceViewer in Figure 68.

Figure 68: TraceViewer Data



The first and last line of the trace show the IDLEs on the loop before the test begins and after the test is stopped. The remaining lines are 15 repetitions of the CRPAT frame with the 6 IDLEs of the Re-Synchronize section separating the frames. After the fifteenth frame the Xgig BERT flushes the loop with one million IDLEs, which then continue to circulate around the loop until the next test is started.

Chapter 9

Xgig BERT Troubleshooting Tips

The chapter contains some possible problems you might encounter when you are using the Xgig BERT and their solutions.

Symptom:

The receive status won't count compared bits in Send and Compare Mode.

Solution:

Check the following:

- Start word is not an 8b EOF or a Gigabit Ethernet Termination element
- Start word is not the Placeholder or Automatic CRC Insertion element
- Note that the first word must be found without any bit errors
- In Re-Sync Mode, all comma characters are only in the byte 0 (msb) position for Fibre Channel or only byte 0 or byte 2 for Gigabit Ethernet

Symptom:

The Automatic CRC calculator is wrong.

Solution:

Confirm that there are no 10B values between the SOF/SDF Indicator and the Automatic CRC Insertion element. Either an SOF or SDF Indicator and the Automatic CRC Indicator must be present.

Symptom:

Bit errors won't go away with this pattern.

Solution:

Confirm that all pattern elements and Placeholders are 8-bit.

Symptom:

My statistics don't seem quite accurate.

Solution:

Remember that the Start Word in the Compare Zone is not counted in compare statistics during the very first loop in Non-Sync Mode, and is not counted during every loop in Re-Sync Mode. Sending is always stopped after comparing, so that sent statistics are greater than received statistics.

Symptom:

Compare Only mode is not working

Solution:

If the receiver misses the hardware synchronizing section of the pattern, the sender must be stopped and started again.

Symptom:

If I pull the cable and re-insert it, Xgig BERT sometimes compares and sometimes not.

Solution:

The receiver must see the hardware synchronizing section of the pattern to get started. You cannot use placeholders if you intend to remove the cable and re-insert it after the pattern is running. The transmit placeholders will continue while the compare placeholders remain frozen. You must use a re-synchronizing pattern with no placeholder elements.

Symptom:

Re-Timing or Re-Synchronizing does not work correctly.

Solution:

You must have your add/drop words only in the Re-synchronization window. If these words are in the compare section as well, the device under test may add/drop them and the remainder of the compare section will fail to compare well. Make sure Enable Add/Drop Re-Synchronization is checked.

Symptom:

I can't get a TTL pulse per loop out with this pattern.

Solution:

The trigger out pulse from the port goes to the motherboard and then to the TTL out connector, and is lengthened and retimed in the process. Use a bigger pattern.

Symptom:

I get unexpected disparity errors with this pattern.

Solution:

In general, 8-bit patterns result in proper disparity automatically. In Fibre Channel, 8-bit ordered sets are recognized by hardware and, other than EOF, assume and force a negative running disparity prior to the K28.5. 10-bit values are transmitted without regard to disparity. You must correct 10-bit value errors. In Gigabit Ethernet, I1 Ordered Sets will always be encoded with incoming positive running disparity and I2 will always be encoded with negative.

Symptom:

If you disconnect the SFP or the cable, (the Xgig BERT is no longer receiving a valid signal) the counters stop counting and the display information is no longer valid. Then, if you reconnect the SFP or cable the counters start accumulating, but the values shown do not reflect the errors that occurred during loss of signal.

Solution:

You must restart the BERT to get accurate information. The loss of signal event is displayed with the LOS LED.

Symptom:

The **Start** button is grayed out.

Solution:

You do not have a port selected, or there are no words in the Compare Zone.

PART THREE: Using Xgig Jammer

Chapter 10

Introducing Xgig Jammer

In this chapter:

- [Xgig Jammer Overview](#)
- [New Features in Xgig Jammer \(Release 5.2\)](#)
- [Features](#)

Xgig Jammer Overview

The JDSU Xgig Jammer includes hardware (Xgig Multi-function Blade) and software that performs real-time data modification for Fibre Channel, Gigabit Ethernet, 10GigE, Serial Attached SCSI (SAS), and Serial ATA (SATA) protocols. You can use the Jammer with JDSU Xgig Analyzers or Bus Doctor to capture and display the network traffic associated with the data modification.

The Xgig Jammer should be used as a digital retiming device. The Xgig Jammer blade re-times the data and re-transmits it with a new clock transparent to the data link (it passes every bit of data.) The Xgig Jammer blade functions in any Fibre Channel, Gigabit Ethernet, 10GigE, SAS, or SATA architecture. It does not log onto a loop, switch, or fabric; it only passes data between two devices. The Xgig Jammer blade can pass Fibre Channel, Gigabit Ethernet, 10GigE, SAS, or SATA traffic, or it can recognize an event or event sequence and modify the traffic. The events can be Ordered Sets, frames, Primitives, Control Characters, SOF, or EOF depending on the selected protocol. A specific Ordered Set, series of Ordered Sets, Primitive Sequence, or Control Character can be modified or replaced. A specific frame or series of frames can be modified in many ways: replacing a frame with idles, truncating a frame, inserting a frame, or changing any bits within a frame.



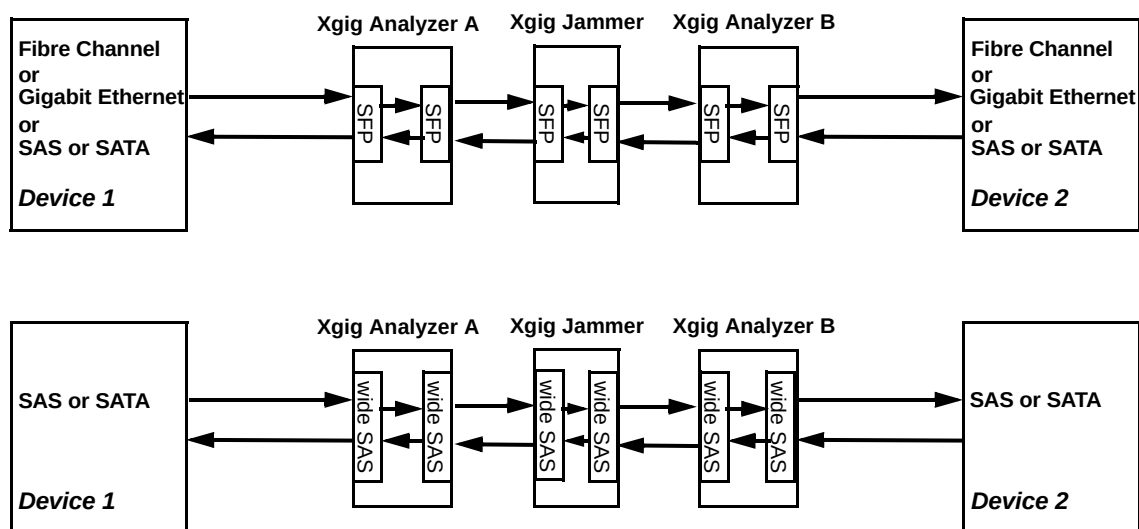
Note: The events and traffic modification options vary with each protocol.

The data modifications are performed on the 8-bit representations of the Ordered Sets, frames, Primitives, Control Characters SOF, and EOF. This ensures that the Xgig Jammer module always produces consistent Fibre Channel, Gigabit Ethernet, 10GigE, SAS, and SATA traffic without disparity errors or clock discontinuities. The exception to this is when the Xgig Jammer is used to insert disparity errors or code violations into a frame, Ordered Set, or Primitive.

Figure 69 shows an example of a configuration where the Xgig Jammer and Xgig Analyzer are inserted into a network with two data paths, designated A and B.

The Xgig Jammer module can detect a Trigger Event and modify data in Path A. The response from Device 2 is detected on Path B.

Figure 69: Duplex Xgig Jammer in Crossover Configuration with Xgig Analyzers



Note: When the Jammer is used in a SATA (or Serial ATA Tunneling Protocol—STP) environment, the Jammer is required to modify the traffic automatically in order to support the flow control mechanism. This happens even if the Jammer is not started, and is only passing through traffic. Therefore, SATA_HOLD and SATA_HOLD A Primitive Sequences are usually not passed through the Jammer, but instead, the Jammer generates its own SATA_HOLD and SATA_HOLD A Primitive Sequences on the fly to maintain flow control with Device 1 and Device 2. Consequently, the Jammer does not allow Jamming of SATA_HOLD or SATA_HOLD A Primitive Sequences because it would not be Jamming actual received traffic.

New Features in Xgig Jammer (Release 5.2)

This release of the Jammer includes the following:

- DCI Jamming is supported for SAS/SATA.
- 10b Frame Replacement is supported for SAS/SATA.
- 66 bit Jam is supported for 10GigE, which allows 64 bit granularity in replacing frame content.
- Advanced arm/trigger options are available allowing the user to arm and trigger on specific occurrences of an arm or trigger condition then return to either the pre-armed or pre-triggered state.
- Jammer supports the reuse of a Dword in an arm frame.
- Jammer's logging capacity has been increased.
- A user can import .tsk test suite files into other test suites.

Features

Xgig Jammer has the following features:

Operation

The Xgig Jammer system (hardware and software), allows you to perform the following operations:

- Change predefined network serial traffic patterns to new patterns.

The Xgig Jammer modifies Trigger Events in the manner you specify. It does not insert or remove network traffic, except for the re-timing circuit that adds or drops appropriate Ordered Sets or Primitives. An exception is in the SAS protocol, where the Jammer might need to rearrange the ordering of Primitives inside a frame so that the first thirty-two, 32-bit words of a frame are not too spread apart for accurate triggering. Another exception is the automatic SATA flow control that is performed.

- Pass traffic, unchanged, that does not match the Trigger Condition pattern.
- Reproduce a pattern change at will.

You can define multiple, sequential, arbitrary Jam cases by entering each of them into a test suite list. Each case can be unique or you can repeat a case within the suite.

Capabilities

The Xgig Jammer has the following capabilities:

- Operates with Fibre Channel, Gigabit Ethernet, 10GigE, SAS, and SATA protocols

Depending on the license you purchase, you can select the protocol that your network uses and display the graphical user interface for that protocol.

- Supports the following line rates:
 - Fibre Channel:

- 1.0625 Gbps
 - 2.1250 Gbps
 - 4.2500 Gbps
 - 8.5000 Gbps
- Gigabit Ethernet:
 - 1.0625 Gbps
 - 1.2500
 - 2.1250 Gbps
 - 4.2500 Gbps
 - 8.5000 Gbps
 - 10.3125 Gbps
- SAS and SATA: Auto negotiates to one of the following:
 - Any speed
 - 1.5 Gbps only
 - 3.0 Gbps only
 - 6.0 Gbps only
- Operates in digital re-timing mode at all times.
- In SAS and SATA, the Jammer auto negotiates out of band (OOB) with other hardware on your network.

You can also force the link to perform OOB at any time. You can force the Jammer to speed-negotiate to a particular speed.
- Allows you to generate a test suite with up to 1024 separate Test Cases per run.

Contains standard editing features such as copy, cut, paste, add, insert, and delete to edit the test suite. An option lets you run the test suite forever in a repeating loop.
- Provides the appropriate MAC (media access control) layer for Fibre Channel, Gigabit Ethernet, 10GigE, or SAS/SATA when you load the application.

Triggering Capabilities

The Xgig Jammer module provides the following Triggering capabilities:

- You have two levels of triggering:
 - Arm (first level)
 - Trigger (second level)
- You can set an Arm condition as a specific Ordered Set, frame, or Primitive Sequence, or as an external Trigger Condition. An external Trigger Condition comes from outside the port (from another port in the same domain or from a TTL-in connector in the same domain).
- You can set the Jammer to repeatedly Arm and/or Trigger on an Ordered Set, frame, Primitive Sequence, Control Character, SOF, or EOF.

- You can set the Jammer to create an external trigger output when the Trigger condition is met. This triggers everything in the same domain as the Jammer port.

Jamming Capabilities

The Xgig Jammer can perform the following types of Jams on the contents of frames:

- Pass a 32-bit word unchanged
- Replace a 32-bit word with a new value, masked nibble by nibble
- Corrupt a 32-bit word with a code violation (Fibre Channel, Gigabit Ethernet, and 10GigE)
- Corrupt a byte with a disparity error or code violation (SAS and SATA only)
- Invert a 32-bit word's specified bit(s)
- Replace a 32-bit word with a new value, masked bit by bit, according to a preset global definition
- Invert a 32-bit word's specified bit(s) according to a preset global definition.
- Replace a 32-bit word with a calculated CRC value (Fibre Channel, SAS and SATA only)
- Set a 32-bit word's specified bit(s) to 1
- Set a 32-bit word's specified bit(s) to 0
- Replace triggered frame with a 10 bit frame (SAS/SATA only)
- Insert a frame after the triggered frame (10GigE only)
- Truncate the target frame to a shorter length, and sends Idles /I/ on top of the remainder of the target frame (10GigE only)

The Xgig Jammer can perform the following types of Jams on Ordered Sets Primitive Sequences, Control Characters, EOF and SOF:

- Pass the Ordered Set or Primitive Sequence unchanged
- Replace the Ordered Set or Primitive Sequence with another standard or user-defined Ordered Set or Primitive Sequence
- Corrupt the Ordered Set with a code violation (Fibre Channel and Gigabit Ethernet)
- Corrupt any byte(s) in the Primitive Sequence with a disparity error or code violation (SAS and SATA only)
- Replace the 32-bit word containing an /S/ character with idles [/I] (10GigE only).
- Replace the 32-bit word containing an /S/ character with idles [/I] (10GigE only).
- Insert a frame after a standard or user defined Ordered Set (10GigE only)

Chapter 11

Using the Jammer Tab

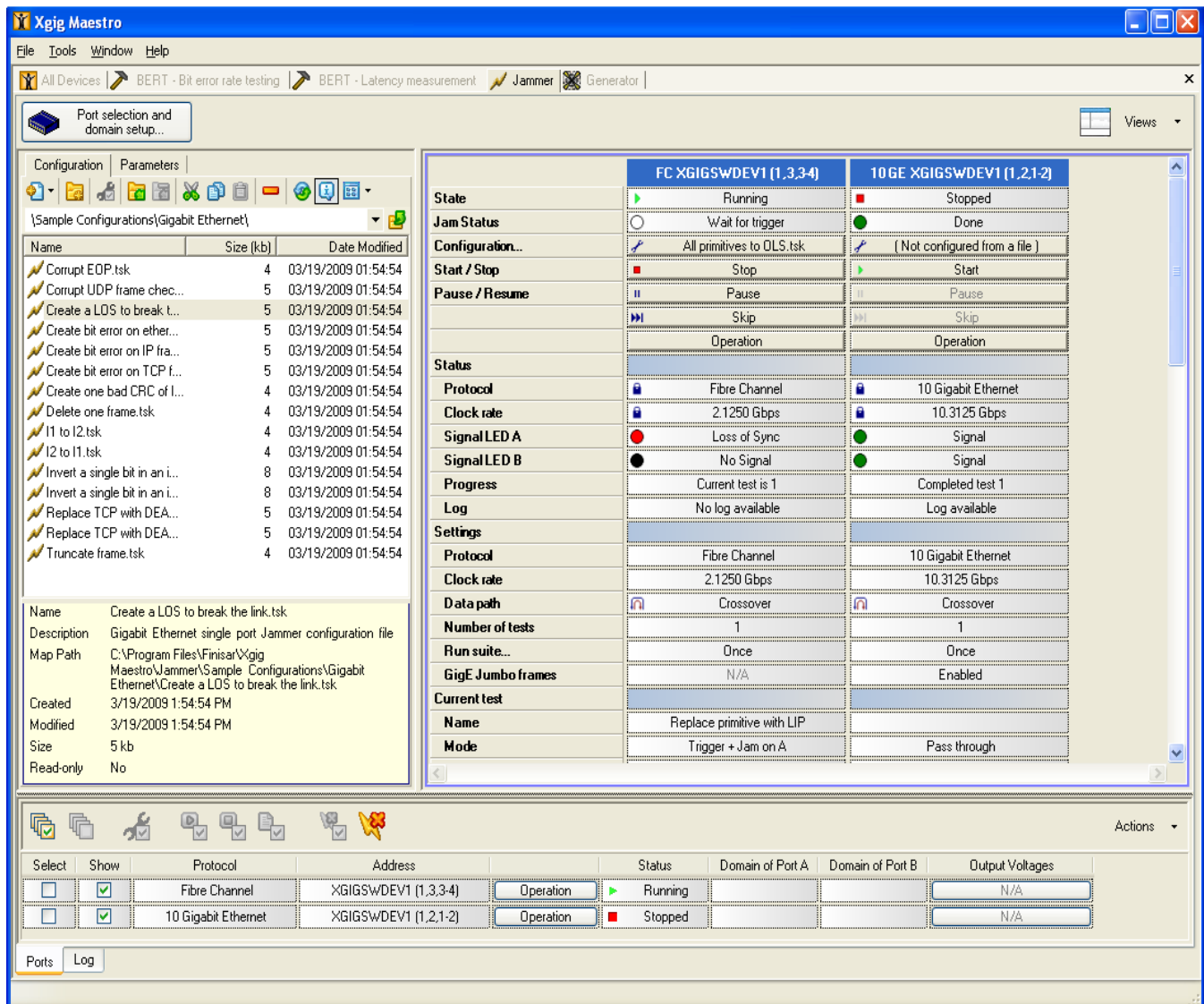
In this chapter:

- Using the Configuration Manager in Jammer
- Using the Parameters Status Table in Jammer
- Using the Parameters Status Context Menu in Jammer
- Using the Ports Manager in Jammer
- Using the Log Manager in Jammer
- Customizing the Appearance of the Maestro/Jammer Main Window
- Performing Configuration Tasks in Jammer
- Running the Test Suite on a Jammer Device

After you have discovered and locked the Jammer ports that you want to use and have set up your capturing and monitoring applications, such as Xgig Analyzer or Bus Doctor, you are ready to run the Xgig Jammer application. This chapter provides an overview of the Jammer tab, on the Xgig Maestro main window, and its functions; it also includes steps to run predefined tests supplied with the Xgig Jammer application or tests you have defined and saved.

You should have launched Xgig Maestro as described on page 12 and locked at least one device as described in “Multi-Function Ports and Symbols” on page 21. The Xgig Maestro window is displayed with the Jammer tab on the right. This tab is where you operate the Jammers you have locked.

Figure 70: Xgig Jammer Tab on Xgig Maestro Window



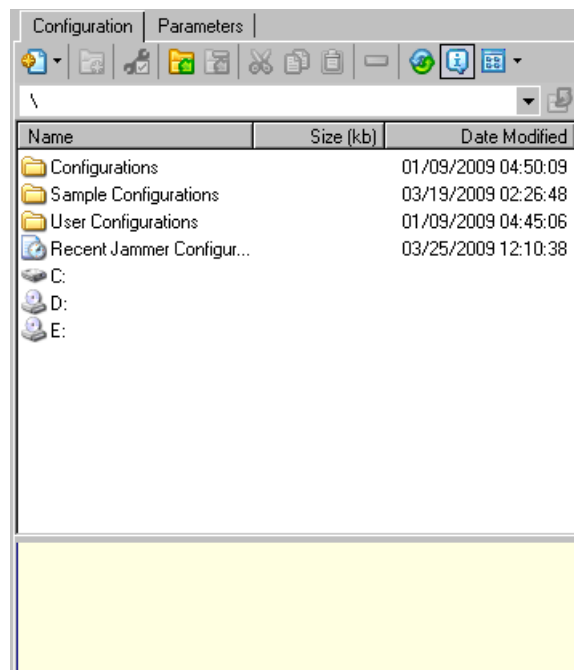
Using the Configuration Manager in Jammer

The Configuration manager (Figure 71) is associated with the device function tab, BERT and Jammer. This window allows you to select the protocol you want to use. This window also displays the configuration files specific to the function tab displayed. The **Sample Configurations** folder includes configurations that are provided with the application. The **User Configurations** folder is where the configurations you create are saved. The **Most Recently Used** folder allows you easy access to those configuration files most recently used. The Configuration Manager also includes a list of all the drives on your system allowing you to locate any configuration files on your system quickly.

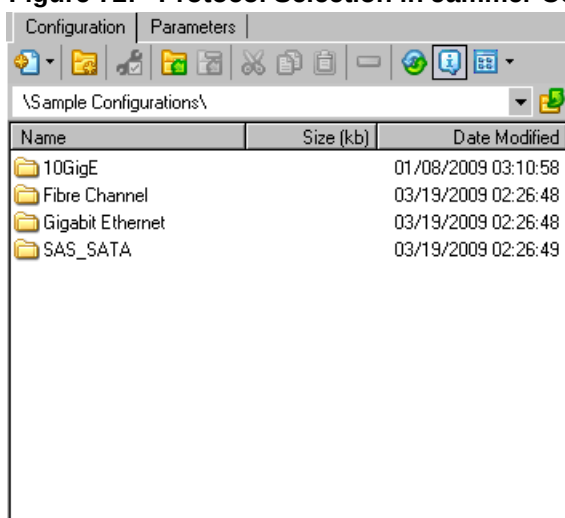
The Configuration manager has the following features:

- The Configuration manager provides a list of test configurations organized into folders and lists all the drives on your system allowing you to easily browse to locate all of your configuration files on your system

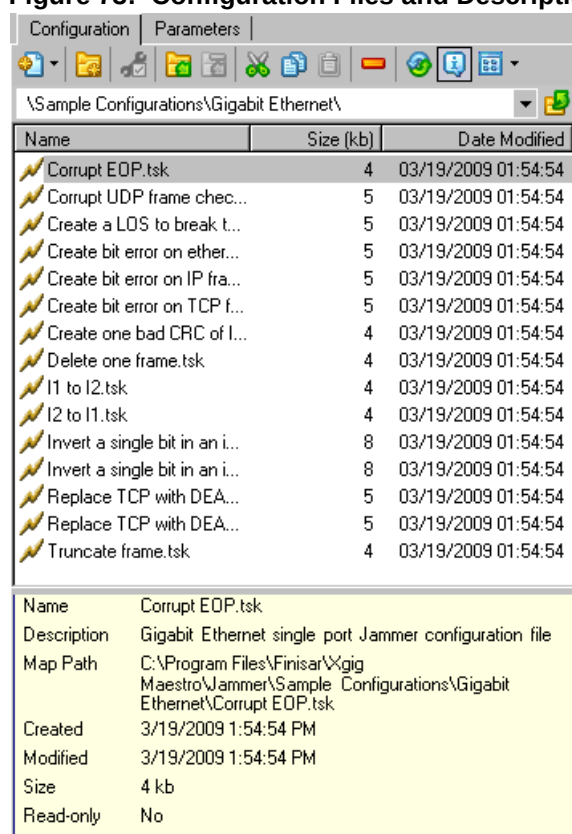
Figure 71: File Location in Jammer Configuration Manager



- The configurations files in the **Configurations**, **Sample**, and **User Configurations** folders are organized according to protocol. When you open one of these folders, the Configuration Manager provides you with a list of protocols to select.

Figure 72: Protocol Selection in Jammer Configuration Manager

- List of configuration files in a folder

Figure 73: Configuration Files and Description Pane

- Description pane
 - When you select a configuration file in the list, a description of the file is displayed in the description pane below. It also displays the name of the file, the path where the file is located, the size of the file, the date and time when the file was created, the date and time the file was modified, whether the file is read-only and the Map path where the file is located on your system.

- When you click the Show/Hide button below the Description pane, you display or hide this pane.
- Drag and drop files

You can drag any configuration from the Configuration manager list onto a device column to load it.
- Tool bar that lets you create, load, copy, cut, and paste configuration files. See [“Configuration Manager Tool Bar in Jammer” on page 139](#) for more information on this tool bar.
- Context menu

Select a configuration file name, and right-click to display a menu where you can choose to create and edit configuration files, and additional operations. See [“Configuration Manager Context Menu in Jammer” on page 140](#) for more information about these menus.
- Browse to map folders of files stored in locations other than the default Sample and User Configuration folders.

Configuration Manager Tool Bar in Jammer

The Configuration manager tool bar ([Figure 74](#)) allows you to perform the following functions:

New Configuration  allows you to open the Configuration window and create a new Jammer configuration from scratch.

New Folder  allows you to create a new folder.

Load  allows you to load a configuration file into a port or ports. This icon is only active when a port has been locked and is selected in the Port Manager. See [“Loading Jammer Configuration Files”](#) for details.

Map  allows you to select a folder that you want to be listed in the Configuration Manager for the selected function tab.

Unmap  allows you to unmap a folder that has been mapped.

Cut  allows you to cut a file from its current location. This is not the same as deleting a file.

Copy  allows you to copy a file.

Paste  allows you to paste a file you have cut or copied.

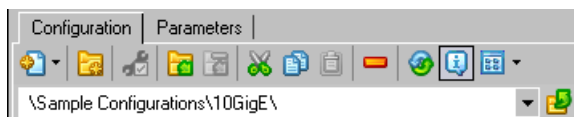
Delete  allows you to delete a file or folder.

Path  allows you to go up one level in the folder tree. This field next to this icon displays the current folder name.

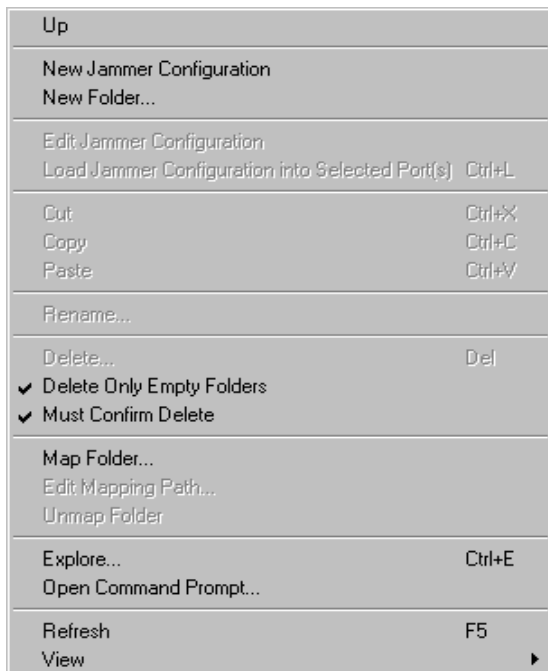
Refresh  allows you to refresh the Configuration Files and Description pane.

Show/Hide  allows you to show or hide the details for the selected file. These details appear in the lower section of the Configuration Manager pane.

View  allows you to view the files in the Configuration Manager as a list including only the file name or to view the details of the files in the list.

Figure 74: Configuration Manager Tool Bar in Jammer

Configuration Manager Context Menu in Jammer

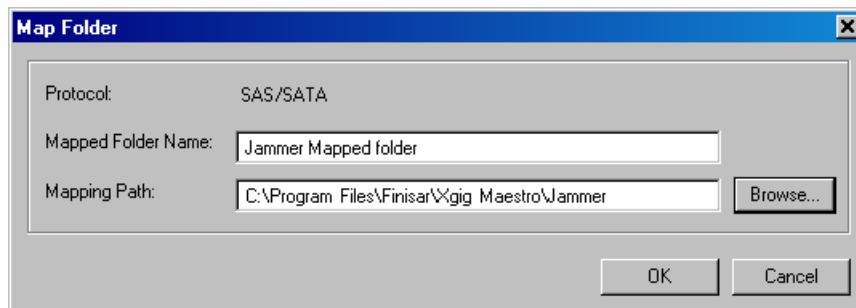
Figure 75: Configuration Manager Context Menu in Jammer

Right-click in the list to choose the following actions from the context-sensitive menu:

- **Up**
Displays the contents one folder level up from the current display.
- **New Jammer Configuration**
Opens a new Jammer configuration window for editing.
- **New Folder**
Opens the Configuration manager dialog where you can enter the name of a new folder you want to add.
- **Edit Jammer Configuration**
Opens the file highlighted in the list, the same as double-clicking on the file name.
- **Load Jammer Configuration into Selected Port(s)**
Loads the file highlighted in the list into the port(s) selected in the Ports Manager. See [“Using the Ports Manager in Jammer.”](#)
- **Cut**
Removes a selected file or folder from the list.

- **Copy**
Copies a selected file or folder to a clipboard making it available to paste in another location.
- **Paste**
Pastes a file or folder you cut or copied to the location you choose.
- **Rename**
Opens a dialog with the current file or folder name displayed in an entry field that you can modify. It also shows the protocol, path, and current file or folder name.
- **Delete**
Opens a dialog where you can confirm whether you want to delete the highlighted file (configuration) or folder from the list.
- **Must Confirm Delete**
Sets this choice as a preference that opens a dialog to confirm that you want to delete a file or folder from the list. When you select it, a check mark is displayed next to it. It is selected by default.
- **Map Folder**
Opens the Map Folder dialog box that lets you map a folder to a name of your choice.

Figure 76: Map Folder dialog box



Enter a name of your choice in the Mapped Folder Name field, and use the **Browse** button to select the folder on your system or network you want to map to this name.

- **Edit Mapping Path**
Allows you to edit the mapping path.
- **Unmap Folder**
Removes a highlighted mapped folder from the Configuration manager.
- **Explore**
Opens a Windows Explorer window showing the directory where the current configuration files are located.
- **Open Command Prompt**
Opens a Windows Command Prompt window showing the directory where the current configuration files are located.
- **Refresh**
Refreshes the Configuration Manager window.

- **View**

Has two choices:

- List

Displays the list of files or folders in the path you choose.

- Details

Displays the list of files or folders with the size and modification date.

Using the Parameters Status Table in Jammer

Each Jammer device (a simplex Jammer or a duplex Jammer is considered as one device) is displayed by a column on the Jammer tab (Figure 77). At the top of each column is the protocol, the chassis name, and in parenthesis the chassis number, the slot number and port number(s) in parenthesis.

To configure how to display the ports in the Parameters Status Table, click on the Views button and do the following:

Select or unselect **Configuration** to display or hide the Configurations tab and Parameters tab where you manage Jammer configuration files and select the Parameters to display, respectively.

Click **Ports** to display or hide the Port Status table.

Figure 77: Jammer Parameters Status table

	FC XGIGSWDEV1 (1.3,3-4)	10GE XGIGSWDEV1 (1.2,1-2)
State	 Running	 Stopped
Jam Status	 Wait for trigger	 Done
Configuration...	 All primitives to OLS.tsk	 (Not configured from a file)
Start / Stop	 Stop	 Start
Pause / Resume	 Pause	 Pause
	 Skip	 Skip
	Operation	Operation
Status		
Protocol	 Fibre Channel	 10 Gigabit Ethernet
Clock rate	 2.1250 Gbps	 10.3125 Gbps
Signal LED A	 Loss of Sync	 Signal
Signal LED B	 No Signal	 Signal
Progress	Current test is 1	Completed test 1
Log	No log available	Log available
Settings		
Protocol	Fibre Channel	10 Gigabit Ethernet
Clock rate	2.1250 Gbps	10.3125 Gbps
Data path	 Crossover	 Crossover
Number of tests	1	1
Run suite...	Once	Once
GigE Jumbo frames	N/A	Enabled
Current test		
Name	Replace primitive with LIP	
Mode	Trigger + Jam on A	Pass through
Arm name		
Trigger name	 Trigger on any primitive	
Jam name	 Replace primitive with OLS	
Arm status	N/A	N/A
Arm-Trigger timeout	N/A	N/A

The first column on the tab is the legend for each row in the device columns and contains the following categories:

- State
- Jam Status
- Configuration
- Status
- Settings
- Current test

Parameters Category Descriptions

State

This row shows the state of the Jammer: Disconnected, Connecting, Paused, Pausing, Running, Skipped, Skipping, Starting, Stopped, or Stopping.

Jam Status

Displays the state of the Jam defined in the currently loaded configuration file: Idle, Waiting for Trigger, Done, Skipped, Timed Out.

Configuration...

Displays the name of the configuration file, if any, loaded into the port.

Start/Stop

Click this button to Start or Stop a test. The green arrow icon indicates you can click the button to Start the test. The red box indicates you can click the button to stop the test.

Pause/Resume

Click this button to pause or resume a test suite that is running.

Skip

Click this button to skip a test that is running and move to the next test in the suite.

Operation

Opens the Operation dialog box

Status Category

This category gives the status of the test suite that you have loaded into the Jammer.

Protocol

Indicates the protocol of the Jammer: Fibre Channel, Gigabit Ethernet, SAS, or SATA. You choose a protocol in the Port Selection and Domain Setup window when you lock ports. The small lock icon indicates that the protocol cannot be changed at this stage. For SAS and SATA Jammer, you may choose the protocol between SAS and SATA using the **Edit protocol and speed settings** option.

Clock rate

Indicates the Jammer clock rate. The closed lock icon indicates you cannot currently change the clock rate; the open lock icon indicates you can change the clock rate.

In Gigabit Ethernet, the clock rate is always 1.2500 Gbps, therefore, the icon is always locked.

In Fibre Channel, the clock rate can be 1.0625 Gbps, 2.1250 Gbps, 4.2500 Gbps, or 8.5000 Gbps.

In SAS and SATA, you can choose to auto-negotiate to any speed. You can also set the Jammer to force the link to only negotiate to either 1.5 Gbps, 3.0 Gbps, or 6.0 Gbps.

Both ports in a port pair must always be set to the same clock rate. Therefore, if you have two single Jammers, and one of them is running, the clock rate is locked on both.

Signal LED A and Signal LED B

These two indicators change color, green, red, yellow, black, depending on the link status. They also match the **Link** status LEDs on the front panel of the blade in the Xgig chassis. Refer to the table below for the description of each LED color.

Table 11: Xgig Jammer Blade LEDs

Label on Blade	Blade	Parameters Status table-Signal A, Signal B
In Use	- Green when port locked by client application - Black otherwise	
Link (3G) Signal (6G)	- Green -FC, GE: when traffic is good - Green-SAS/SATA: Speed set - Yellow -FC, GE: Loss Of Synchronization - Yellow-SAS/SATA: No speed set (Before OOB/In OOB) - Blinking Yellow -SAS/SATA: In OOB - Off-FC, GE: Loss Of Signal - Off-SAS/SATA: No signal (nothing connected)	- Green -FC, GE: when traffic is good - Green-SAS/SATA: Speed set - Yellow -FC, GE: Loss Of Synchronization - Yellow-SAS/SATA: No speed set (Before OOB/In OOB) - Blinking Yellow -SAS/SATA: In OOB - Black-SAS/SATA: No signal (nothing connected)

Progress

Indicates where the Jammer is in the test suite while it is running or where it is stopped or paused.

Log

Indicates if a log from the last operation is available for viewing.

Settings Category

This category indicates the current physical setup of the Jammer device. You can change most of the settings in this category by using the Parameters Status context menu for each device you have locked.

Protocol

Indicates the current protocol setting for the Jammer: Fibre Channel, Gigabit Ethernet, 10GigE, SAS, or SATA.

To change the Protocol, you must select a device (port) from the port context menu in the Port Selection and Domain Setup window.

For SAS and SATA you can edit the protocol and the speed from the Parameters Status context menu.

Clock Rate

Indicates the Jammer clock rate. The clock rate options and behavior is different for the protocols and speeds. The clock rate options may include 1.0625 Gbps, 1.2500 Gbps, 2.1250 Gbps, 2.5000 Gbps, 4.2500 Gbps, 8.5000, or 10.3125 Gbps, depending on the blade. Both ports in a port pair must always be set to the same clock rate. Therefore, if you have two Jammers, and one of them is running, the clock rate is locked on both of them. See [“Changing the Clock Rate of a Jammer” on page 151](#) for instructions on changing the clock rate.

Data path

For Fibre Channel and Gigabit Ethernet protocols, Xgig Jammer allows two routing possibilities for the data path through a duplex Jammer port pair. When the data path is set to “no crossover,” traffic flows into a small form factor pluggable (SFP) device, through the Jammer, then back out through the same SFP device. When the data path is set to “crossover,” this is similar to the data path in JDSU Analyzers. Traffic flows into a port, crosses over, and flows back out the other SFP of the port pair. This can be especially useful for copper connections.

Simplex Jammers always are in “no crossover” mode because they only have one port.

Duplex Jammers have crossover set by default.

For the SAS and SATA protocols, the Jammer is always duplex and set to crossover mode. See [“Changing the Data Path for A Duplex Jammer” on page 157](#) for instructions on changing the data path.

Number of tests

Displays the number of Test Cases in the currently loaded test suite. You can change the number of Test Cases to run in the Jammer Configuration window.

Run suite...

Indicates if the test suite is set to run only once or to loop forever (until you click **Stop**).

GigE Jumbo Frames

This indicates if Gigabit Ethernet jumbo frame support is enabled. (This is only available in the Gigabit Ethernet Jammer.) When enabled, the Jammer supports jumbo frames up to 16 KB in size, however, the latency through the port is about 136 microseconds. Otherwise, only normal 1500 byte frames are supported, with a latency of about 17 microseconds.

Current Test Category

This group of parameters gives information and status about the current test in the test suite that the Jammer is running or about to run.

Name

Displays the name of the current test.

Mode

Displays the current test mode setting that you set in the Jammer Configuration window.

Arm name, Trigger name, and Jam name

Displays the names given to each of the components of the current test.

Arm status

For a Test Case with an Arm condition, this indicates if that condition has been met.

Arm-Trigger timeout

Displays the number of 32-bit words the Jammer waits for the Trigger condition to be met after the Arm condition has been met. After this expires, the Jammer rolls back to wait again for the Arm condition.

Trigger occurred

Indicates if a trigger and Jam have occurred for this test case.

Trigger timed out

Indicates if the Arm-Trigger timeout has ever occurred for this Test Case.

Repeat Mode

Indicates the Test Case mode and whether or not it is repeated. You set this in the Jammer Configuration window, Test Case Repeat settings dialog.

Repeat Count

Indicates the number of times the Test Case is repeated.

Test Timeout

Indicates the total amount of time you have set the Jammer to wait for a Test Case to fully complete (including all repeats) before aborting and going to the next Test Case, preceded by the amount of time currently left. For example, when the Jammer is in the running state, the timer would show 59 sec/1:30 for a test configured to timeout after one minute, thirty seconds, while 59 seconds remain before the timeout.

Using the Parameters Status Context Menu in Jammer

Right-click on the Parameters Status table to display the context menus shown in Figure 78. Each protocol has a unique context menu. The available operations are displayed for the column in which you click. This menu provides controls for configuration files, for setting clock rates, setting the data path, allowing jumbo frames, logging test activity, removing a Jammer from the Parameters Status table, and the appearance of the status table.

Refer to the following pages for more information about the how to use the context menu choices:

- “Using the Parameters Status Table in Jammer” on page 143 for information about the parameter settings you make from these menus.
- “Running the Test Suite on a Jammer Device” on page 178 for information about running the Jammer.
- “Using the Log Manager in Jammer” on page 166 for choosing log preferences.
- “Performing Configuration Tasks in Jammer” on page 177 for information about using the Load configuration file, Save configuration file, Reset configuration, and Edit configuration selections from these menus.

Figure 78: Jammer Parameters Status table Context Menus

Fibre Channel	Gigabit Ethernet	10GigE	SAS/SATA
FC XGIGSWDEV1 (1.3.3-4)	GE XGIGSWDEV1 (1.3.3-4)	10GE XGIGSWDEV1 (1.2.1-2)	SAS/SATA XGIGRODL (1.2.5-6)
Stopped	Stopped	Running	Stopped
Idle	Idle	Wait for trigger	Idle
(Not configured from a file)	(Not configured from a file)	full-frame-jam.tsk	SAS - Create one bad CRC.tsk
Start	Start	Stop	Start
Pause	Pause	Pause	Pause
Skip	Skip	Skip	Skip
Operation	Operation	Operation	
Load configuration file... Save configuration file... Reset configuration Edit configuration Start Pause Skip Clock rate Data path Log Do not show Jammer Text size	Load configuration file... Save configuration file... Reset configuration Edit configuration Start Pause Skip Data path Jumbo frames Log Do not show Jammer Text size	Load configuration file... Save configuration file... Reset configuration Edit configuration Stop Pause Skip Replace received invalid data with IDLEs Log Do not show Jammer Text size	Load configuration file... Save configuration file... Reset configuration Edit configuration Start Pause Skip Force CDR re-lock on Port A Force CDR re-lock on Port B Reset Link Edit protocol and speed settings... Log Do not show Jammer Text size
N/A	Disabled	Once Enabled	

Changing the SAS/SATA Protocol Setting of a Jammer

The procedure for changing the SAS/SATA protocol setting depend on the blade’s speed.

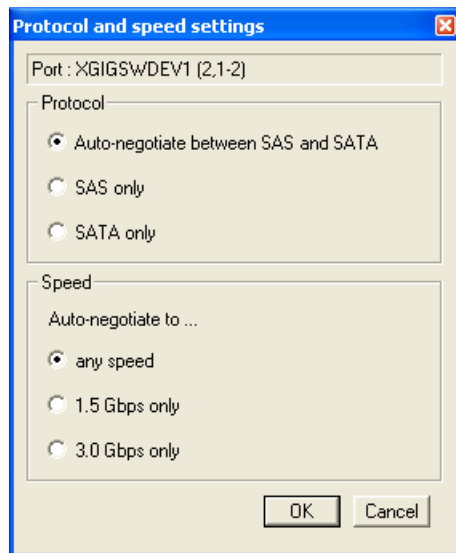
Changing the Protocol Setting for 3G Blades

To edit the SAS and SATA protocol setting on a 3G blade:

- 1 Select **Edit protocol and speed settings** from the Parameters Status context menu.

A dialog is displayed that lets you choose Auto-Negotiate between SAS and SATA (the default), SAS only, SATA only (Figure 79).

Figure 79: SAS/SATA Protocol Setting Dialog for 3G Blades



- 2 Click a radio button to choose the protocol.
- 3 Click **OK** to close the dialog and apply the settings.

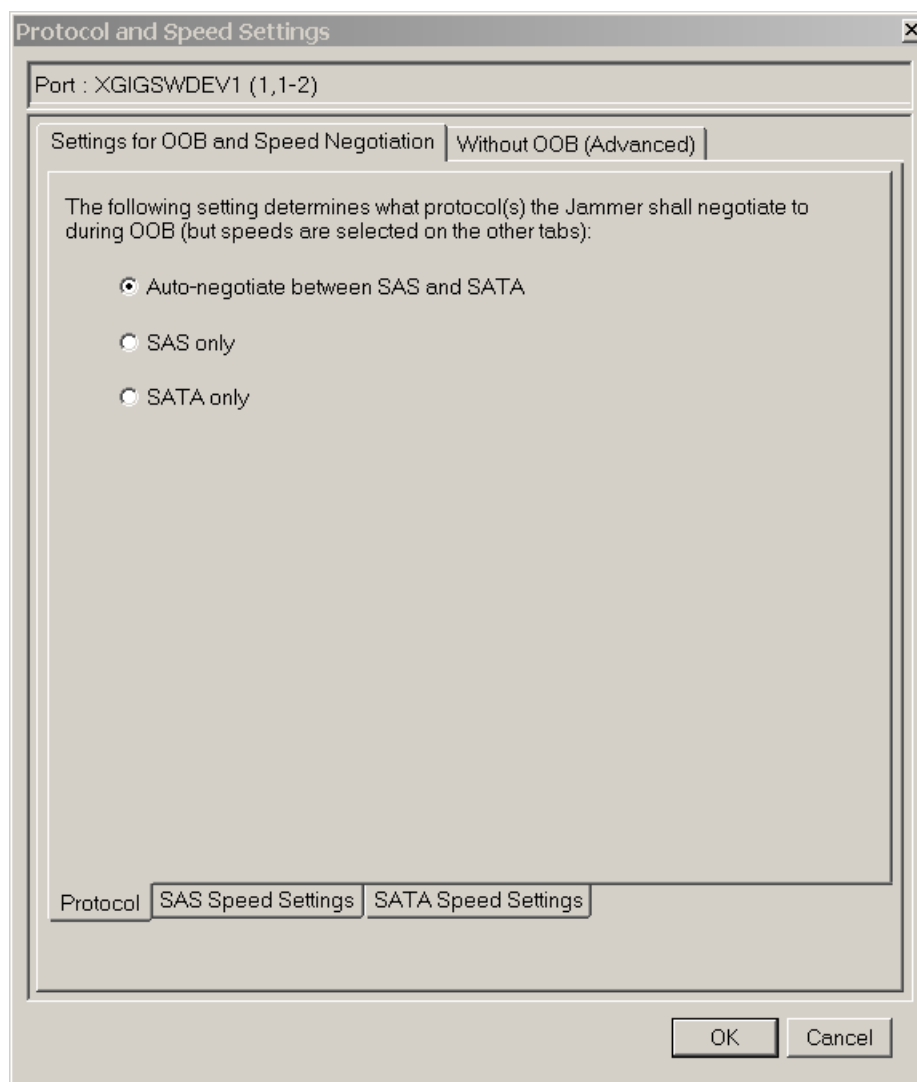
You will receive a warning message. Click **OK** to apply the setting and reset the link, or click **Cancel** to discard the changes.

Changing the Protocol Setting for 6G Blades

To edit the SAS and SATA protocol setting on a 6G blade:

- 1 Select **Edit protocol and speed settings** from the Parameters Status context menu.

A dialog is displayed that lets you choose Auto-Negotiate between SAS and SATA (the default), SAS only, SATA only (Figure 80).

Figure 80: SAS/SATA Protocol Setting Dialog for 6G Blades

- 2 Click a radio button to choose the protocol on the Protocol tab.
- 3 If you made a change from the previous setting, the option below will appear at the bottom of the dialog.

☐ **Reset link after changes are applied to the settings above**

Check this check box if you want the link to reset when the change is applied upon clicking **OK**. Otherwise, clicking **OK** will apply the change, but the protocol will not change until the next time OOB initialization occurs.

- 4 Click **OK** to close the dialog and apply the setting.

Changing the Clock Rate of a Jammer

The procedure for changing the clock rate for a port depend of the blade's speed and selected protocol.

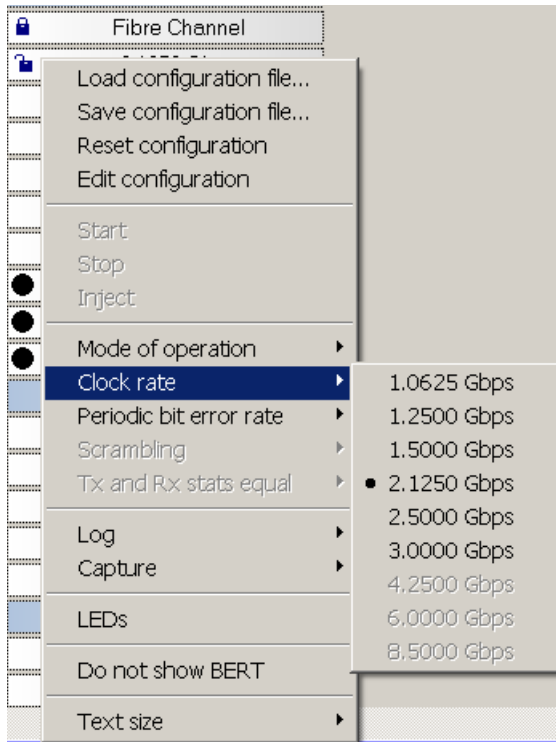
Changing the Fibre Channel Clock Rate for All But 6G Blades

To change the clock rate or speed on all but 6G blades for the Fibre Channel protocol:

- 1 Right-click anywhere on the specific device column to open the Parameters context menu.
- 2 Select **Clock rate**.

The speed choices are displayed (Figure 81).

Figure 81: Fibre Channel Clock Rate Menu (except 6G blades)



- 3 Click to choose one.

A bullet is displayed to the left of the currently operating selection.

- 4 Click **OK** to close the dialog.

You will receive a warning message. Click **OK** to apply the setting and reset the link, or click **Cancel** to discard the changes.

Changing the Gigabit Ethernet Clock Rate for All But 6G Blades

To change the clock rate or speed on all but 6G blades for the gigabit ethernet protocol:

- 1 Right-click anywhere on the specific device column to open the Parameters context menu.
- 2 Select **Clock rate**.

The speed choices are displayed (Figure 81).

- 3 Click to choose one.

A bullet is displayed to the left of the currently operating selection.

- 4 Click **OK** to close the dialog.

You will receive a warning message. Click **OK** to apply the setting and reset the link, or click **Cancel** to discard the changes.

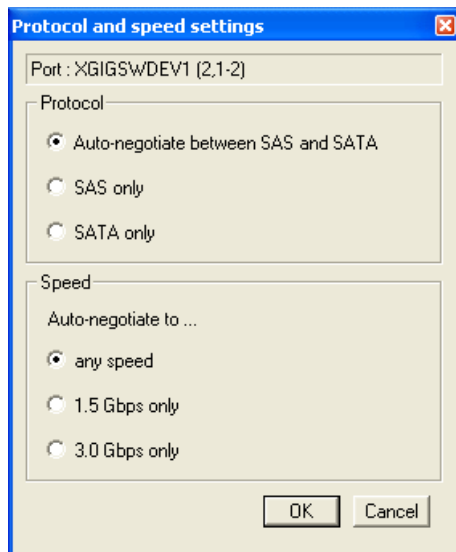
Changing the SAS/SATA Clock Rate for 3G Blades

To change the clock rate or speed 3G blades for the SAS/SATA protocol:

- 1 Right-click anywhere on the specific device column to open the Parameters context menu.
- 2 Select **Edit Protocol and speed settings** for SAS or SATA Jammer.

The speed choices are displayed (Figure 82).

Figure 82: SAS/SATA 3Gbps Speed Settings Dialog



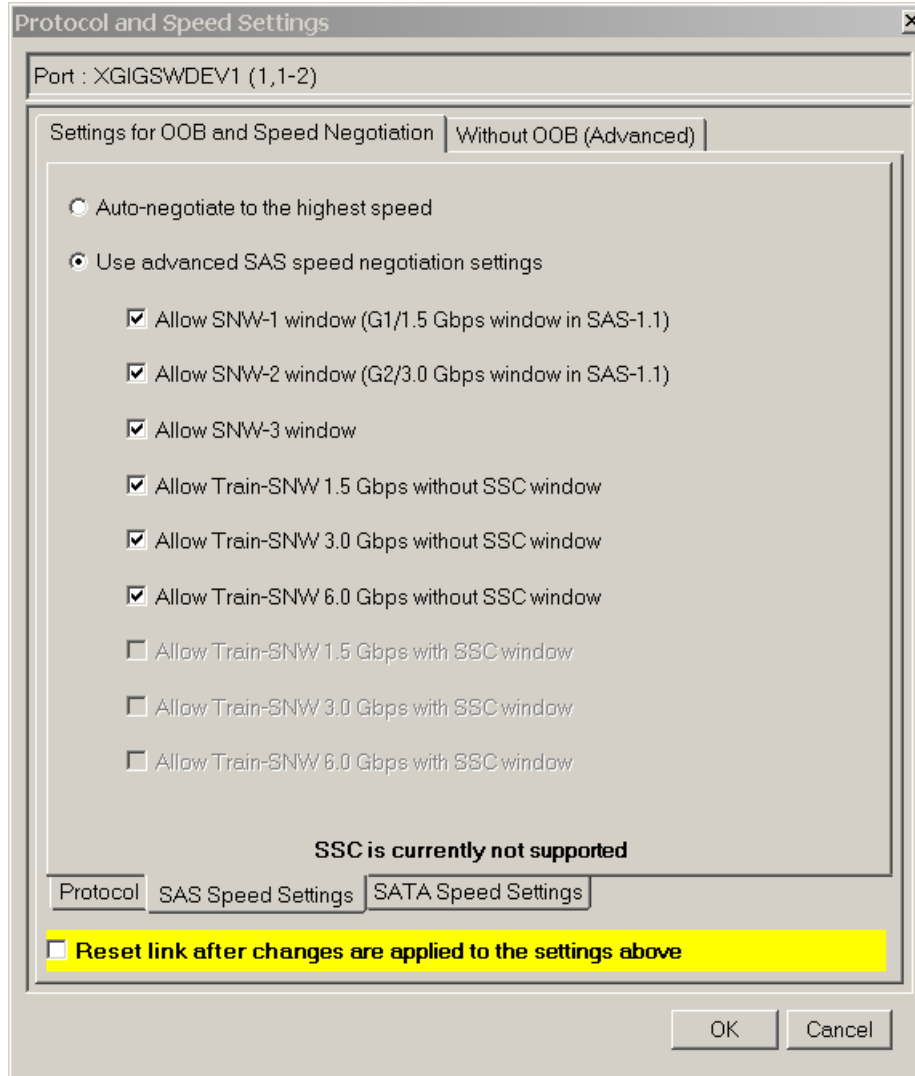
- 3 Click to choose one.
You can also specify one or both protocols. Refer to [“Protocol” on page 146](#).
- 4 Click to choose one.
- 5 Click a radio button in the in the **Speed** section of the **Protocol and speed setting** dialog.
- 6 Click **OK** to close the dialog.

You will receive a warning message. Click **OK** to apply the setting and reset the link, or click **Cancel** to discard the changes.

Changing the SAS/SATA Clock Rate for 6Gbps Blades

To change the clock rate or speed 6Gbps blades for the SAS/SATA protocol:

- 1 Select **Edit protocol and speed settings** from the context menu.
- 2 The **Protocol and speed settings** dialog appears.

Figure 83: Speed Settings Menu for SAS and SATA on a 6Gbps blade

If you made a change from the previous setting, the option below will appear at the bottom of the dialog.

☐ **Reset link after changes are applied to the settings above**

- 3 Check this check box if you want the link to reset when the change is applied upon clicking **OK**. Otherwise, clicking **OK** will apply the change, but the protocol will not change until the next time OOB initialization occurs.
- 4 Select either the SAS Speed Settings or the SATA Speed Settings tab. See [Figure 83](#).



Note: Both ports of the port pair share one protocol and one clock rate; therefore, two adjacent simplex Jammers always have the same protocol and clock rate.

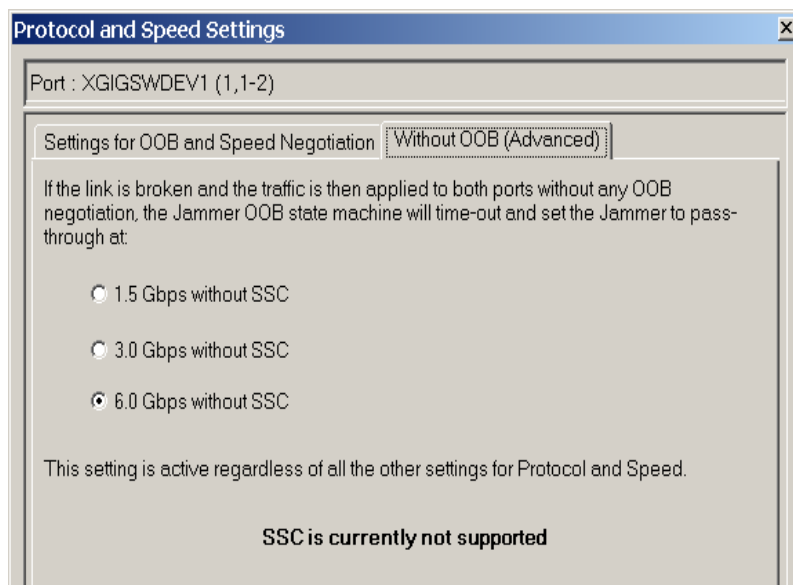
- 5 Select the speed setting you want for SAS or SATA.
- 6 Click **OK** to close the dialog and apply the setting.

The 6Gbps blade also has a Without OOB (Advanced) tab at the top of the window see [Figure 84](#). This allows you to set the speed the Jammer if no OOB is detected after a broken link. This can be useful if, for some reason, you want to attach equipment without going through OOB.

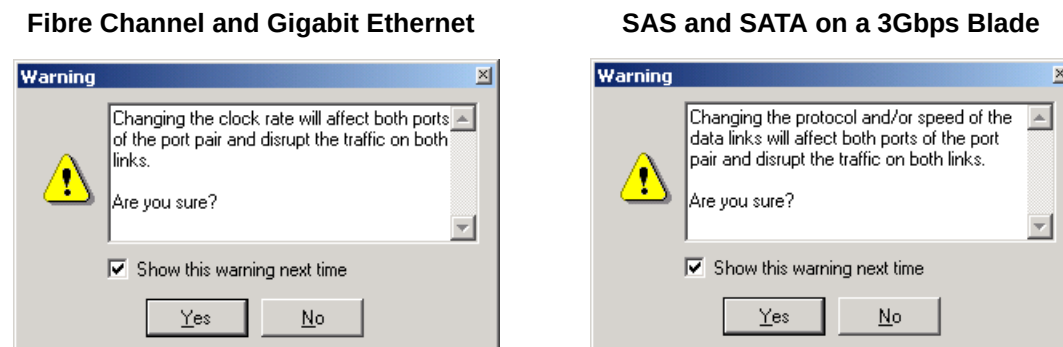


Note: For Fibre Channel and SAS/SATA only The clock rate is not saved in the configuration file. This allows Jammer scripts to run independently of the clock rate setting and avoids breaking the link to which the Jammer is connected.

Figure 84: Without OOB (Advanced) Tab



Caution: Changing the clock rate disrupts the traffic passed through the FC and 3 Gbps SAS/SATA Jammer. A warning message appears when you change the setting (Figure 85).

Figure 85: Changing Clock Rate and Protocol/Speed Warning Dialogs

Scrambling

Some blades give the option of enabling Fibre Channel Frame Scrambling, which is part of the Fibre Channel Specification for 8.5000 Gbps. You may enable or disable scrambling at any speed. Select **Scrambling** from the Parameters context menu, and then select **Enabled** or **Disabled**. A check mark appears next to the current selection. When Scrambling is enabled, Fibre Channel Frame Scrambling is performed in the Configuration pattern starting after any SOF indicator template and continuing until the next word with a K character (usually EOF).



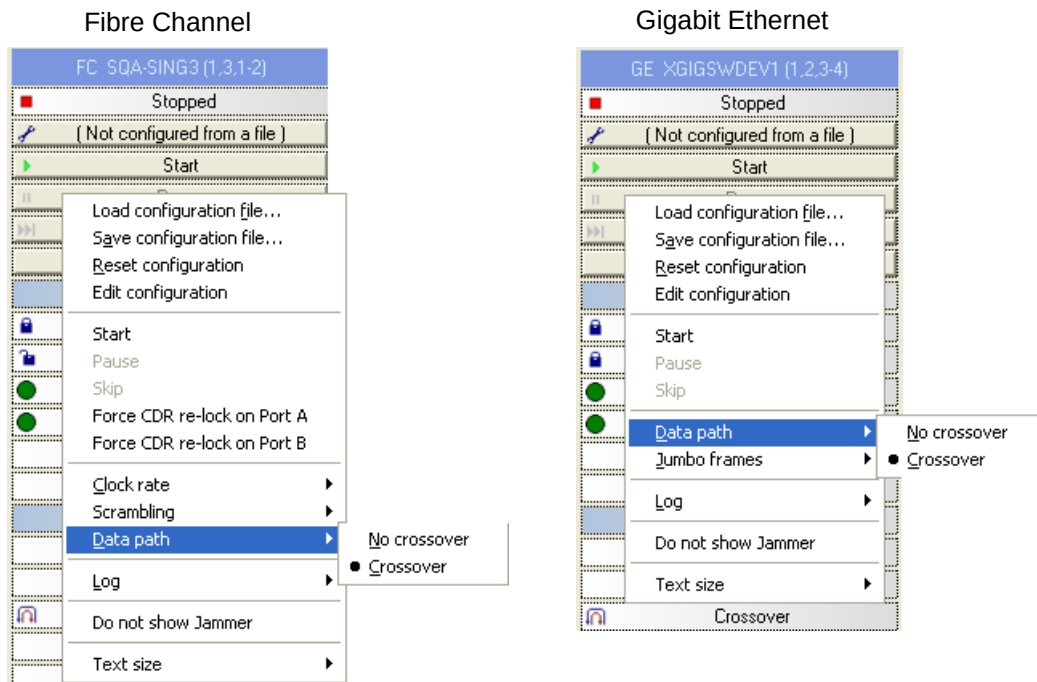
Note: When changing the clock rate from 8.5000 Gbps to any other speed, Scrambling is automatically set to Disabled. When changing to 8.5000 Gbps, it is automatically set to Enabled. You may then override this setting using the Parameters context menu.

Changing the Data Path for A Duplex Jammer

To change the crossover setting for a duplex Jammer:

- 1 Right-click anywhere on the column of the desired device to open the Parameters context menu (Figure 86).

Figure 86: Data Path Menu for Fibre Channel and Gigabit Ethernet



- 2 Select **Data path**.

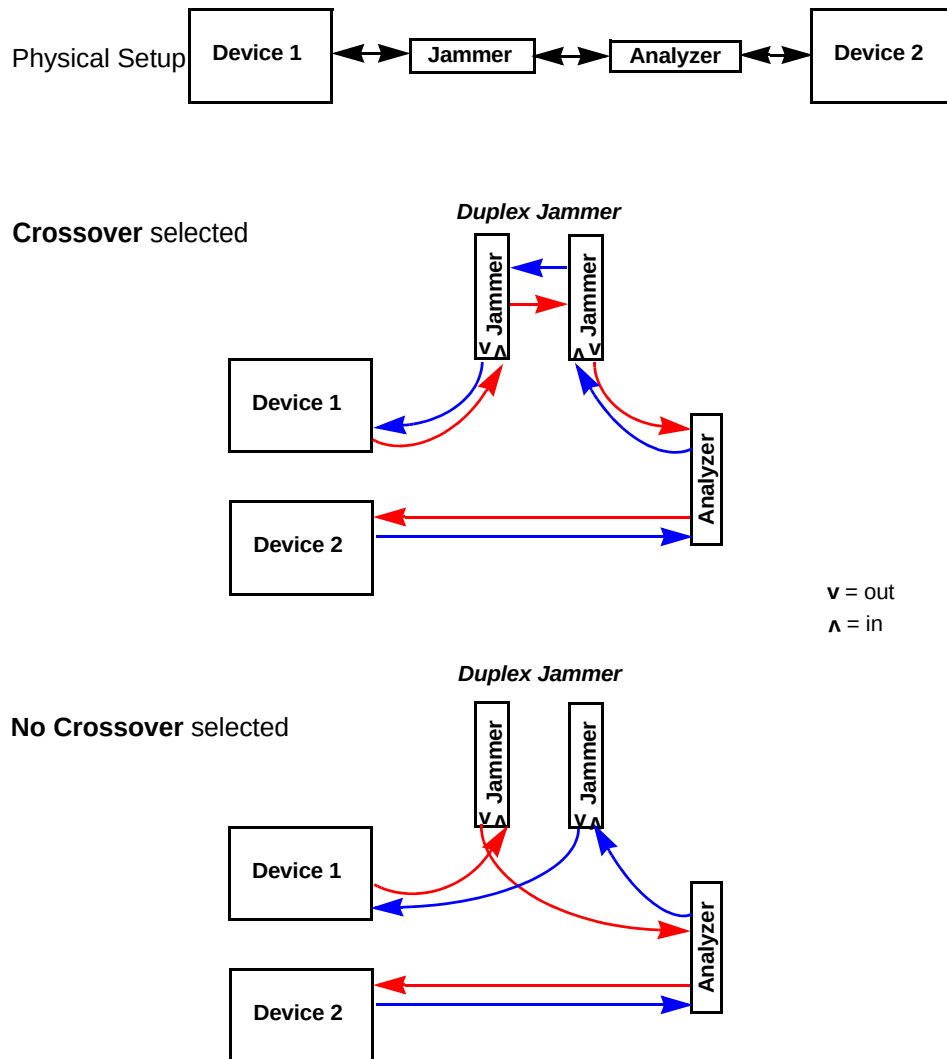
Another menu appears with the two choices:

- No crossover
- Crossover

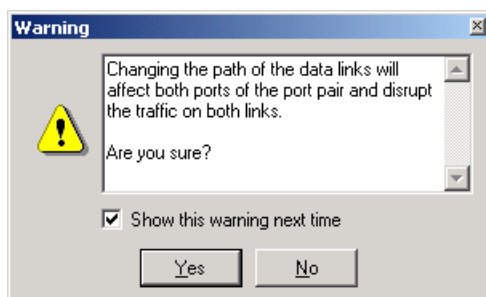
- 3 Select one.

A bullet is displayed to the left of the currently operating selection.

Setting the data path allows you to control the data path for connections similar to those in Figure 87.

Figure 87: Data Path for Devices

Caution: Changing the data path disrupts the traffic passed through the Jammer. A warning message appears when you change the setting (Figure 88).

Figure 88: Changing Data Path Warning

Changing the GigE Jumbo Frames Setting

To change the jumbo frame setting:

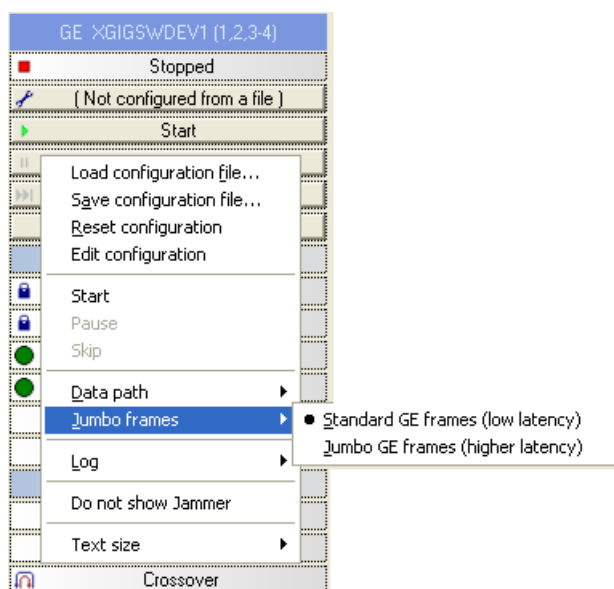
- 1 Open the Parameters context menu (Figure 89).
- 2 Select **Jumbo frames**.

Another menu appears with the two choices.

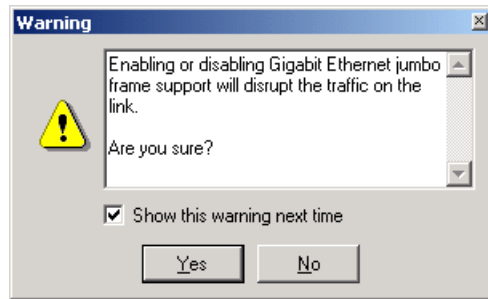
- 3 Click to choose one.

A bullet is displayed to the left of the currently operating selection.

Figure 89: GigE Jumbo Frames Menu



Caution: Changing the supported frame size disrupts the traffic passed through the Jammer. A warning message appears when you change the setting (Figure 90).

Figure 90: GigE Jumbo Frame Warning

Note: The frame size (Gigabit Ethernet only) is not saved in the configuration file. This allows Jammer scripts to run independently of this setting and not disrupt the link when a new configuration is loaded.

Replace Received Invalid Data with Idles

This option is for 10GigE only. It allows you to replace invalid data with Idles before it passes through the Jammer.

Using the Ports Manager in Jammer

The Ports manager displays details about the ports you have locked. It shows the protocol, chassis name (with chassis number, slot number, and port numbers), and other port specific information. You can sort the rows from first to last or last to first by clicking the column heading. For more information about Xgig slot positions and numbering, refer to the Xgig Family Hardware Guide included with the product CD.



Note: If you are disconnected due to a network problem, you can reconnect to the ports by using the Port Selection and Domain Setup window.

Figure 91: Jammer Ports Manager

Actions ▾								
Select	Type	Protocol	Address	Start / Stop	Operation	Status	Domain of Port A	Domain of Port B
☒	Jammer	SAS/SATA	XGIGSWDEV1 (1.1.7-8)	Start	Operation	Stopped		
☒	BERT - Bit error rate testing	Gigabit Ethernet	XGIGSWDEV1 (1,2,3)	Start	Operation	Stopped		N/A
☒	BERT - Bit error rate testing	Gigabit Ethernet	XGIGSWDEV1 (1,2,4)	Start	Operation	Stopped		N/A

The following icons are displayed on the menu bar:



Select All Ports

Selects all ports in the Ports Manager.



Unselect All Ports

Unselect all ports in the Ports Manager.



Load Configuration to Selected Ports

Load the selected configuration file to all selected ports in the Ports Manager.



Start Selected Ports

Start BERT operation on the selected ports in the Ports Manager.



Stop Selected Ports

Stop BERT operation on the selected ports in the Ports Manager.



Show Properties of Selected Ports

Display the Port Properties dialog box, with information on the selected function, protocol, and clock rate (speed). It also shows the chassis name, IP address, slot and port(s).



Disconnect Selected Ports

Disconnect the selected ports in the Ports Manager.



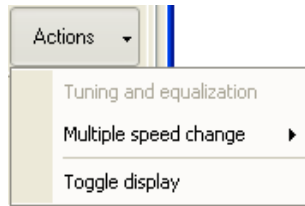
Disconnect All Ports

Disconnect all ports in the Ports Manager.

Actions Button

The **Actions** button contains menus for **Tuning and Equalization** (6G SAS/SATA Jammer and Generator only), **Multiple speed Change**, and **Toggle Display**. See [Figure 92](#).

Figure 92: Actions Button Options



Tuning and Equalization

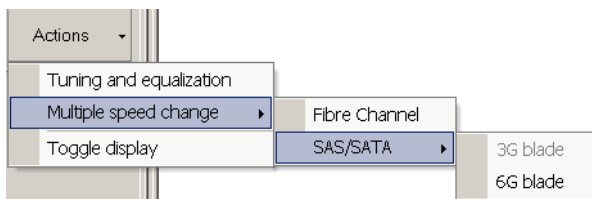
Tuning and Equalization are procedures to optimize ports on the 6G SAS/SATA 4x/Wide-Port Blade for your environment. When you connect the Xgig SAS Analyzer, Jammer, or Generator in a new environment (for example, after changing devices or cable length) we recommend that you run the Tuning procedure detailed in the *Xgig Tuning and Equalization* document.

Multiple Speed Change

This option allows you to change the speed of multiple Jammer ports simultaneously. If you have the All Devices tab selected, the menu will display BERT, Jammer, and Generator. For Jammer, you can choose to change the speed of 6.0 Gbps and 3.0 Gbps blades.

Select the ports you want to change the speed for, holding the Ctrl key down to select multiple ports, then click the speed you want to change to, and click **OK** to apply the change.

Figure 93: Multiple Speed Change Menu



For Jammer Fibre channel

Select the ports you want to change the speed for, then click the speed you want to change to, and click **OK** to apply the change.

For Jammer SAS/SATA 3.0 Gbps

- 1 Select the ports you want to change the speed for.
- 2 Select the protocol you want, Auto-negotiate, SAS only, or SATA only.
- 3 Select the speed you want to change to.

- 4 Check the **Reset link after and changes are applied** check box if you want the link to reset when the change is applied upon clicking **OK**. Otherwise, clicking **OK** will apply the change, but the protocol will not change until the next time OOB initialization occurs.

For Jammer SAS/SATA 6.0 Gbps

- 1 Select the protocol you want, **Auto-negotiate**, **SAS only**, or **SATA only**.
- 2 Select either the **SAS Speed Settings** or the **SATA Speed Settings** tab.

If you made a change from the previous setting, a check box will appear at the bottom of the dialog highlighted in yellow with a message that reads, **Reset link after and changes are applied to above settings**.

- 3 Check the **Reset link after and changes are applied** check box if you want the link to reset when the change is applied upon clicking **OK**. Otherwise, clicking **OK** will apply the change, but the protocol will not change until the next time OOB initialization occurs.
- 4 Select the speed settings you want for SAS or SATA.
- 5 Click **OK** to close the dialog and apply the setting.

The 6Gbps blade also has a Without OOB (Advanced) tab at the top of the window see. This allows you to set the speed the Jammer if no OOB is detected after a broken link. This can be useful if, for some reason, you want to attach equipment without going through OOB.



Note: For Fibre Channel and SAS/SATA only The clock rate is not saved in the configuration file. This allows Jammer scripts to run independently of the clock rate setting and avoids breaking the link to which the Jammer is connected.

Toggle Display

This option toggles between a horizontal and vertical view of the ports.

Ports Manager Columns

The Ports Manager includes the following columns:

Operation

Operation is a button you press to display the Operation bar for the device you are using. Refer to [“Running the Test Suite on a Jammer Device” on page 178](#) for additional information.

Status

Information in this column displays the state of the device under test.

Domain of Port A and Domain of Port B

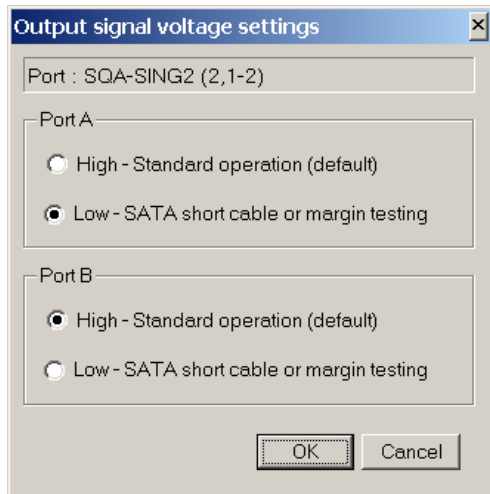
Each of these fields indicates to which domain the respective port belongs. In a simplex Jammer, only port A is relevant. In a duplex Jammer, the lower port number is always port A. You set up domains in the Port Selection and Domain Setup window. Refer to [“Using Domains” on page 27](#) for more information.

Output Voltages

The Output Voltage settings are for the SAS and SATA protocols and display each port number and the corresponding output voltage setting.

Click on the Output Voltages field in the Port Manager to open the dialog box. This allows you to select the amplitude control for the output voltage buffers. There are two output voltage settings, High and Low.

Figure 94: Output Signal Voltage Dialog



High: The default setting is High. If the output voltage for a port is set to high, then the Output Voltages field in the Port Manager reads “Norm” Port 1 - Norm 2 - Low.

The High setting, is useful for driving extended length cables. This setting also provides a pre-emphasis circuit that boosts higher frequency signals to compensate for signal amplitude loss that affects the data eye in long trace length runs.



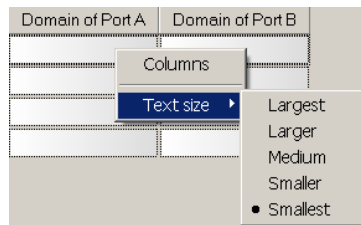
Caution: For ports on 6G blades using a SATA cable connected to a SATA device, it is possible for the SATA receiver voltage to exceed the maximum specifications. To keep the SATA receiver voltage within the specifications, it is advisable that you set the output voltage for these ports to “Low”.

Low: If the output voltage for a port is set to Low, then the Output Voltages field in the Port Manager reads “Low” Port 1 - Low 2 - Norm. You can set the signal to Low when you are using short cables with SATA devices.

Using the Ports Manager Context Menu

You can right-click in the Ports Manager to open the context menu ([Figure 95](#)).

Figure 95: Ports Manager Context Menu



The menu contains the following choices:

Text Size

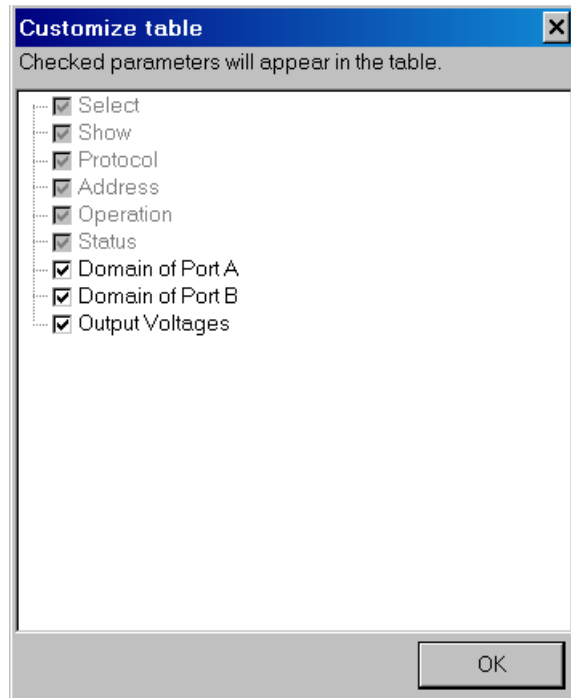
Refer to [“Changing Text Size” on page 174](#) for information.

Columns

This choice opens a Customize table dialog ([Figure 96](#)) where you can choose to display **Domain of Port A**.

Click the check box next to this item to display this item in the Ports Manager.

The grayed out items are defaults; you cannot clear these items.

Figure 96: Jammer Ports Manager Context Menu Parameters Selection

Using the Log Manager in Jammer

To access the Log Manager, click the Log tab at the bottom of the Jammer main window.

The purpose of logging is to automatically create a log that reports which Jam tests have occurred and which ones might have reached the timeout limit while not finding a trigger to Jam. You can view a log with any text editor.

The Filter icons next to the **Type** and **Address** column labels allow you to choose how you want to display device types, by protocol or All, and device addresses, by single address or All devices.

If the **All Devices** tab at the top of the Xgig Maestro main window is selected, then the **Log Source** menu  2 active log sources ▾ shows all log sources as active by default. You can choose to disable BERT logging, Jammer logging, Generator logging, Target Emulator logging, or all four by clicking the **Log Sources** menu and un-checking the selections. If the **BERT-Bit error rate testing**, **Jammer**, or **Generator** tabs in the main window are selected, then the Log Manager displays only the log entries for that tab, respectively.

The following icons are displayed on the Log Manager menu bar:



Display Entry Contents

Lets you save the selected log to a file in the device Logs folder (for example: C:\Program Files > JDSU > Xgig Maestro > Jammer > Logs) or anywhere you want to save it on the network.



Save All Entries As

Lets you save all the logs in the Log Manager to a file.

**Save selected entries as**

Lets you save the selected logs to a file.

**Select All**

Selects all the logs in the Log Manager.

**Options**

Opens the Log Manager Options dialog where you can enter your preferences for the information you want displayed in the Log Manager ([Figure 97](#)).

**Clear Filtering**

Removes filtering by Type and Address and displays all the devices you have locked.

**Clear Selected Entries**

Deletes the log entry you have highlighted.

**Clear All Entries**

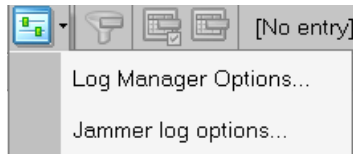
Deletes all the log entries in the Log Manager.

Setting Log Options

To have log files automatically named and saved to a specific location:

- 1 Click the Log Manager Options icon to open the drop-down menu (Figure 97), and select **Jammer logging options**.

Figure 97: Log Manager Options Menu

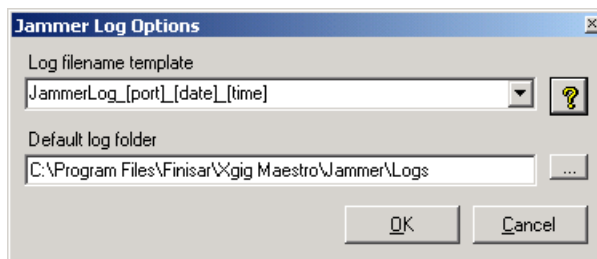


Or:

Open the Parameters context menu and select **Options**.

Either of these commands opens the Jammer Log Options dialog (Figure 98). This dialog allows you to set up how you want the log files to be automatically named and the default location where you want them saved. You can also change the filename and folder when you save the log.

Figure 98: Log Options Dialog



- 2 Select a log filename template from the following choices:

- JammerLog_[port]
- JammerLog_[port]_[date]_[time]
- JammerLog_[date]_[time]
- JammerLog_[date]_[time]_[port]

Or, you can type in your own template. Any [port], [date], and [time] in the template is replaced by the corresponding value. Port is displayed as:

protocol (FC, GE, or SAS), chassis name (chassis number in the cascade, blade number in the chassis, port number on the blade)

- 3 Enter the path to the folder where you want to save the log file.

You can browse to where you want to save the log file by clicking .

- 4 Click **OK**.

You have set up the log filename template and default folder to save the log.



Note: These settings apply to all Jammer logs. Log options are the same for all Jammer ports.

Viewing a Log

The Jammer log shows the status of each Test Case during the entire length of the test run

To display a log:

>> Click the Log Manager tab at the bottom of the Xgig Maestro main window to view the log in a tabulated format (Figure 99).

Or:

>> Double-click on the log you want to view in the Log Manager to display the Log Entry Display (Figure 100).

Or:

>> Click the **Log** button on the Operation bar (with the appropriate Jammer device selected in the Parameters Status table; a green check mark indicates the device is selected).

Or you can:

>> Open the Parameters context menu and select **Log > View**.

These two latter commands open a window that allows you to quickly view the Xgig Jammer log. (Figure 101). In the case of these two methods, each time you run a Jammer, a new Jammer log is created for the device, and the previous log is discarded. Click **Print** at the bottom of the Jammer log to print a hard copy of the log.

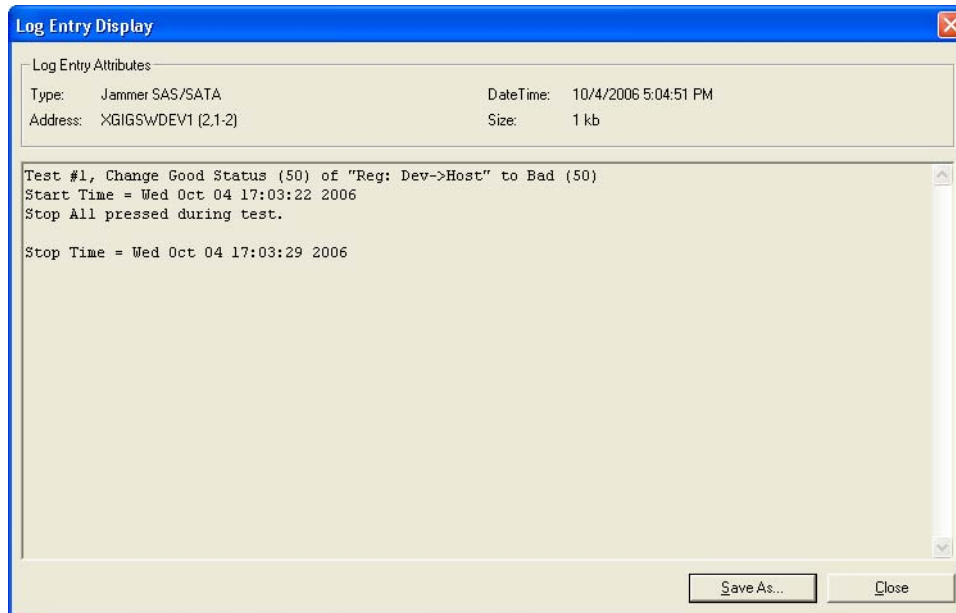
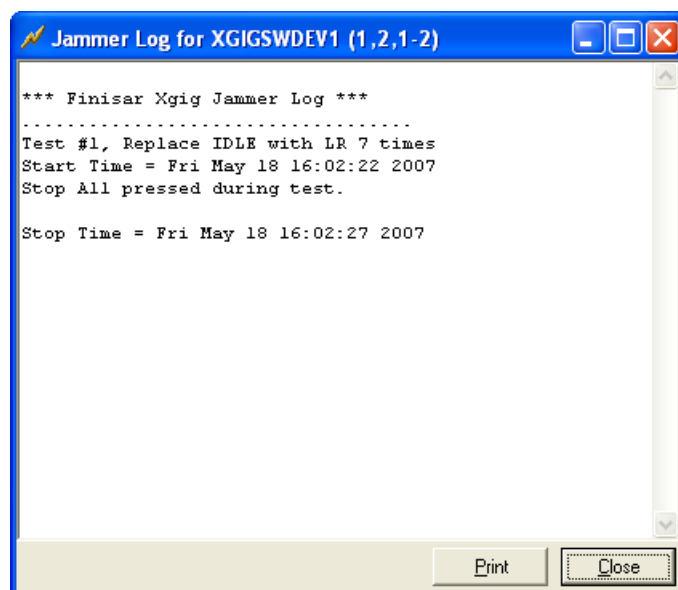
On the other hand, the Log Manager continues to list the logs and display them depending on the Log Manager options you have selected. See “Setting Log Options” on page 168.

You can save a log to a .txt file or an HTML file. Refer to “Saving a Log” on page 170.

Figure 99: Log Manager

DateTime	Type	Address	Contents
4/12/2007 2:38:39 PM	BERT Fibre Channel	XGIGSWDEV1 (1,1,1)	Port used : XGIGSWDEV1 (1,1,1) Protocol : Fibre Channel Clock rate : 8.5000 Gbps ...
4/12/2007 2:38:38 PM	BERT Fibre Channel	XGIGSWDEV1 (1,1,2)	Port used : XGIGSWDEV1 (1,1,2) Protocol : Fibre Channel Clock rate : 8.5000 Gbps ...
4/12/2007 2:37:11 PM	BERT Fibre Channel	XGIGSWDEV1 (1,1,1)	Port used : XGIGSWDEV1 (1,1,1) Protocol : Fibre Channel Clock rate : 8.5000 Gbps

Ports: Log

Figure 100: Viewing a Log in the Log Entry Display**Figure 101: Example of a Jammer Log Display**

Saving a Log

You can save a log from the Log Manager tab or the Parameters context menu.

To save a log from the Log Manager tab as an HTML file or text file:

- 1 Highlight the log you want to save.
- 2 Click the **Save Selected Entries As...** button.

The Save Log Manager Contents As window is displayed that lets you name and save the log as an HTML file to the Saved Logs folder or to a location you prefer.

Or:

- >> Double-click on the log you want to save to display it in the Log Entry Display window (Figure 100), then click **Save As...**

The Save As window is displayed that lets you name and save the log to the Logs folder as a .txt file, or to a location you prefer.

To save a log to a .txt file using the Parameters context menu:

- >> Open the Parameters context menu (Figure 102) and select **Log > Save As**.

This command opens a File dialog where you can save the log with a file name you assign to it. The default location is Program Files > JDSU > Xgig Maestro > Jammer > Logs.

Figure 102: Log Menu



Customizing the Appearance of the Maestro/Jammer Main Window

You can move and rearrange the individual device tabs on your monitor screen as you prefer. You can also select the information you want to display in the Parameters Status table. In addition, you can select the size of displayed text.

Using the Window Menu

The **Window** menu allows you to arrange the window display:

Layout

Layout offers choices for rearranging the Maestro device tab windows. The Ports manager and Log Manager windows are not affected by this menu selection.

Internal Tabs

Allows you to restore the Maestro main window to its default format.

Internal MDI

Internal multiple document interface (MDI) lets you isolate each device tab as a separate window that you can activate by clicking anywhere on the window.

Show Hidden Windows

Restores any windows you have closed while using the Internal Tabs or Internal MDI display arrangement.

Arrange Icons

Arranges the icons for minimized windows at the bottom of the screen. If an open document window is at the bottom of the screen, some or all of the icons will be underneath this document window and will not be visible.

Cascade

Arranges all open windows in a cascade style from the top, left corner of the window.

1 All Devices

Brings the All Devices tab to the front as the active window. This window displays ports from all active devices (BERT, Jammer, Generator, and Target Emulator).

2 BERT - Bit error rate testing

Brings the BERT device tab to the front as the active window

3 BERT - Latency measurement

Brings the BERT Latency measurement device tab to the front as the active window

4 Jammer

Brings the Jammer device tab to the front as the active window

5 Generator

Brings the Generator device tab to the front as the active window

6 Target Emulator

Brings the Target Emulator device tab to the front as the active window

Tile Horizontally

After selecting **Layout > Internal MDI**, this command opens and aligns the BERT, BERT Latency measurement, Jammer, Generator, and Target Emulator device windows horizontally one over the other.

Tile Vertically

After selecting **Layout > Internal MDI**, this command opens and aligns the BERT, BERT Latency measurement, Jammer, and Generator, and Target Emulator device windows vertically one next to the other. You can view the individual device windows by dragging the sides out to resize them.

Minimize All Windows

After selecting **Layout > Internal MDI**, this command minimizes all the open windows. You can restore each window, individually, by using the standard window controls on the header or select **Internal Tabs** to restore the Maestro main window to its default format.

Customizing the Parameters Status table in Jammer

You can change the appearance of the Parameters Status table by:

- Removing columns
- Resizing columns
- Changing the text size
- Displaying and hiding status table parameters

Removing columns

If you have a number of devices locked, you can remove a column that you do not need to view without unlocking the port or affecting the operation.

To remove a column:

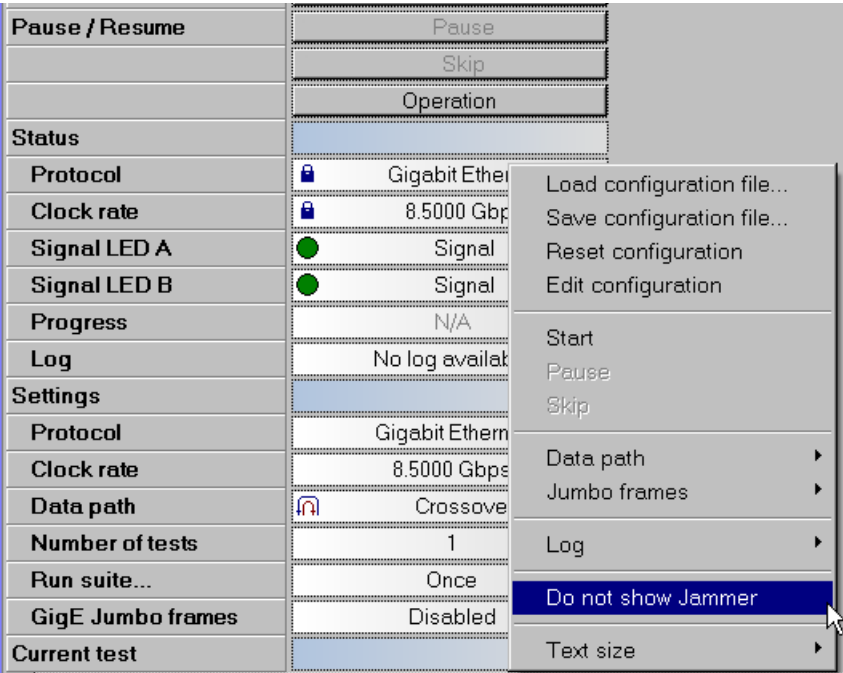
- 1 Right-click on the specific column you want and open the Parameters context menu.
- 2 Select **Do not show Jammer** ([Figure 103](#)).

Or:

In the Ports Manager, clear the **Show** check box next to the device you want to remove.

The column is removed, but the device is still locked (“in use”) and displayed in the Ports Manager.

Figure 103: Removing a Device Column



To replace the device column on the Parameters Status table:

>> Click the **Show** check box for the device in the Ports Manager.

Resizing columns

You can resize any of the columns by placing the mouse at the right edge at the top of a column, next to the chassis name. A resizing cursor appears. Hold down the mouse button, and drag the mouse to resize the column.

Changing Text Size

You can choose the text size you want the Parameters Status table or the Ports Manager to display.



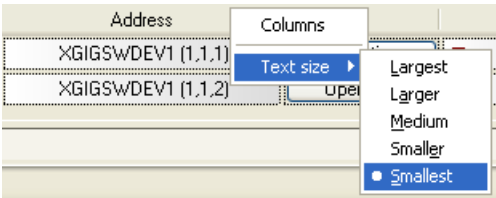
Note: You cannot change the text size in the Log Manager.

To change text size:

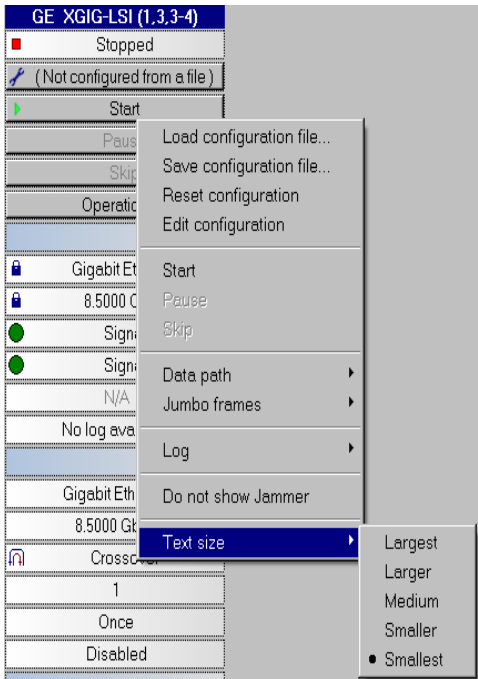
- 1 Open the context menu by clicking the right mouse button while the cursor is on the Parameters Status table or the Ports Manager.
- 2 Select **Text size** (Figure 104).
You have five choices from which to select.
Smallest is the default size.
- 3 Select the text size you want.
A bullet is displayed next to the current selection.

Figure 104: Text Size Menu

Context menu over Ports manager



Context menu over device parameters status table



Displaying and Hiding Parameters in Jammer

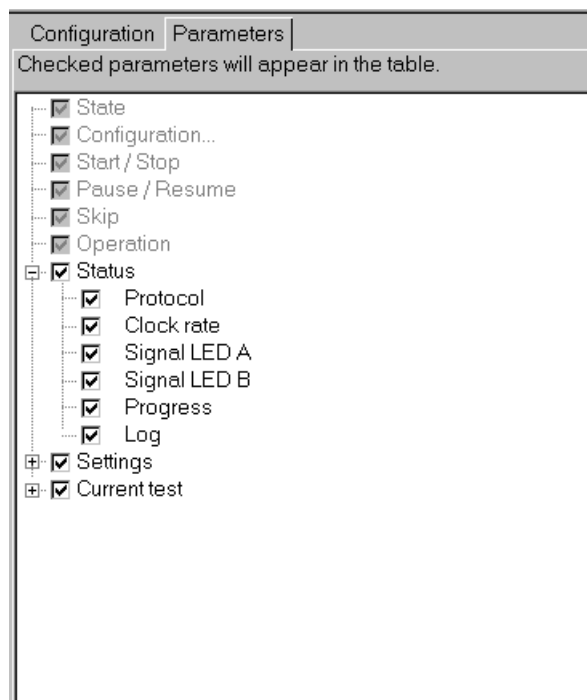
You can hide specific parameters on the Parameters Status table to simplify the status tables and show only the information in which you are interested.

To display or hide parameters on the Parameters Status table:

- 1 Click the Parameters tab at the top of the Configuration manager pane to switch to the Parameters manager (Figure 105).

You can expand the categories by clicking the plus signs on the left.

The default displays most of the parameters.

Figure 105: Jammer Parameters Manager

- 2 Click check box to set or clear the check mark next to the parameters.
Checked parameters are displayed.

Performing Configuration Tasks in Jammer

This section describes how to handle configuration files from the Jammer main window.

Loading Jammer Configuration Files

You can load a configuration file on a Jammer using one of the following methods:

From the Configuration Manager:

- >> Drag the configuration file from the list in the Configuration Manager onto the Parameters Status table (column for the device) and release the mouse button.

You can drag configuration files from anywhere, including the list of configuration files in the Configuration Manager on the Xgig Maestro window, the system desktop, or Windows Explorer.

From the Parameters Context Menu

- 1 Right-click on the device column to open the Parameters context menu and select **Load configuration file**.

An Open File dialog is displayed.

- 2 Navigate to the Jammer .tsk file that you want to use and click **Open**.

The file is loaded and its name and parameters are displayed in the device column of the Parameters Status table.

From the Ports Manager:

- 1 Check the **Select** check box(es) in the Ports Manager for the port(s) you want to use.
- 2 Click the configuration file you want to load from the Configuration Manager.

- 3 Click the **Load Configuration to Selected Ports** button . This button is located in the Ports Manager and in the Configuration Manager. Both have the same function.

You can use the above methods to navigate to a mapped folder and load a configuration file.

Saving a Jammer Configuration File

To save a Jammer configuration file you created or edited:

- 1 Right-click on the device column in the Parameters Status table to open the Parameters context menu, and select **Save configuration file**.

A Windows Save dialog is displayed.

- 2 Navigate to where you want to save the configuration file and assign a name to it.

Xgig Jammer configuration files are saved with a .tsk extension.

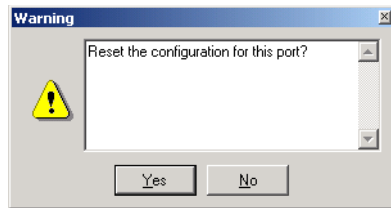
Resetting a Jammer Configuration

To clear the configuration from a device:

- 1 Right-click on the device column in the Parameters Status table to open the Parameters context menu, and select **Reset configuration**.

A warning dialog may be displayed asking you to confirm the configuration reset.

Figure 106: Reset Configuration Warning Dialog



- 2 Click **Yes** to clear the configuration from the device.

Editing a Jammer Configuration

To create a configuration file for a device, you can start from a blank default configuration or edit the configuration after you have loaded a configuration file to the device.

You can open the Configuration window using one of the following methods:

- 1 Right-click on the device column in the Parameters Status table to open the Parameters context menu.
- 2 Select **Edit configuration**.

Or:

>> Click the **Configuration** button on the Parameters Status table

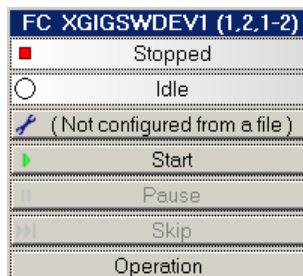
This opens the Configuration window for the device that is currently selected. Refer to or [“Using the Jammer Configuration Window” on page 230](#) for more information.

Running the Test Suite on a Jammer Device

After you have configured a Jammer device, you can start the operation. Three methods are available:

>> Click the **Start** button on the Parameters Status table.

Figure 107: Parameters Status table Start Button



Or you can:

>> Right-click on the device column to open the Parameters context menu where the **Start**, **Pause**, **Skip**, and **Stop** commands are available.

Or:

1 On the Ports manager, select the device.

2 Click the **Start** button  .

Or:

1 On the Ports manager, in the Operation column, click the **Operation** button for the device.

The Operation dialog is displayed (Figure 108 and Figure 109).

2 Click **Start**.

Figure 108: Jammer Tab Operation Bar for Fibre Channel and Gigabit Ethernet



Figure 109: Jammer Operation Dialog for SAS and SATA



Clicking any of the Operation buttons (including **Config**) takes effect on the Jammer device that is currently selected in the Parameters Status table.

Start runs the Test Suite from the beginning if you click it while the Jammer is stopped. The Start button label becomes a Stop label while the Test Suite is running.

Pause causes the Jammer to pause and not run the next Test Case in the Test Suite when the current Test Case is completed. When you click **Pause**, the State of the Jammer is “Pausing” while the current Test Case is still running. When the current Test Case completes (or is skipped), the Jammer is in the “Paused” state waiting for user intervention.

Skip causes the Jammer to abort the current Test Case and move on to the next one. If the Jammer is “Paused,” you can click **Skip** to jump through your Test Suite without running any Test Cases until you get to the Test Case you want to run and resume testing. If you skip past the last Test Case in the Test Suite and the Test Suite is not set to loop forever, then the Jammer goes to the Stopped state as if the Test Suite completed.

To let a test run to the end and then skip to another test:

- 1 Click **Pause**.
Wait for the current test to finish.
- 2 Click **Skip** to step through the tests.
- 3 Observe the progress field on the Parameters Status table to track tests in the queue.
- 4 Click **Start**.

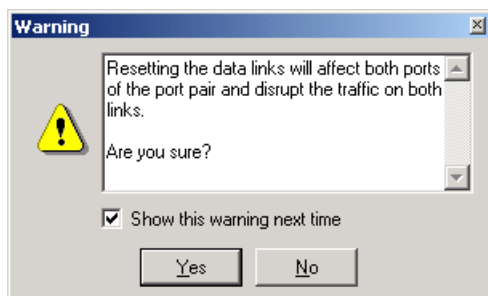
Stop causes the Jammer to abort running the entire Test Suite and go to the Stopped state.

Reset Link (SAS and SATA only) causes the Jammer, at any time, to reset the link and enter OOB initialization. This does not affect any of the other buttons nor does it change the running state of the Jammer.



Note: Resetting the link disrupts the traffic passed through the Jammer. A warning message appears when you choose this action (Figure 110).

Figure 110: Reset Warning



Log indicates a log is available for viewing. Click **Log** to view the latest test log.

Chapter 12

Creating Jammer Test Configurations for Fibre Channel

In this chapter:

- [Defining Your Own Test Configurations](#)
- [Using the Jammer Configuration Window](#)
- [Configuring Arm and Trigger Conditions](#)
- [Configuring the Jam Definition](#)

Defining Your Own Test Configurations

Xgig Jammer lets you define your own test configurations and save them with or without hardware available.

You can create a configuration from scratch, or you can open and edit an existing configuration. Also, you can edit a configuration in edit only mode, which is independent of any hardware, or you can edit a configuration that is currently loaded to a Jammer device.

To edit a configuration in edit only mode:

>> Double-click on a configuration file in the Configuration manager.

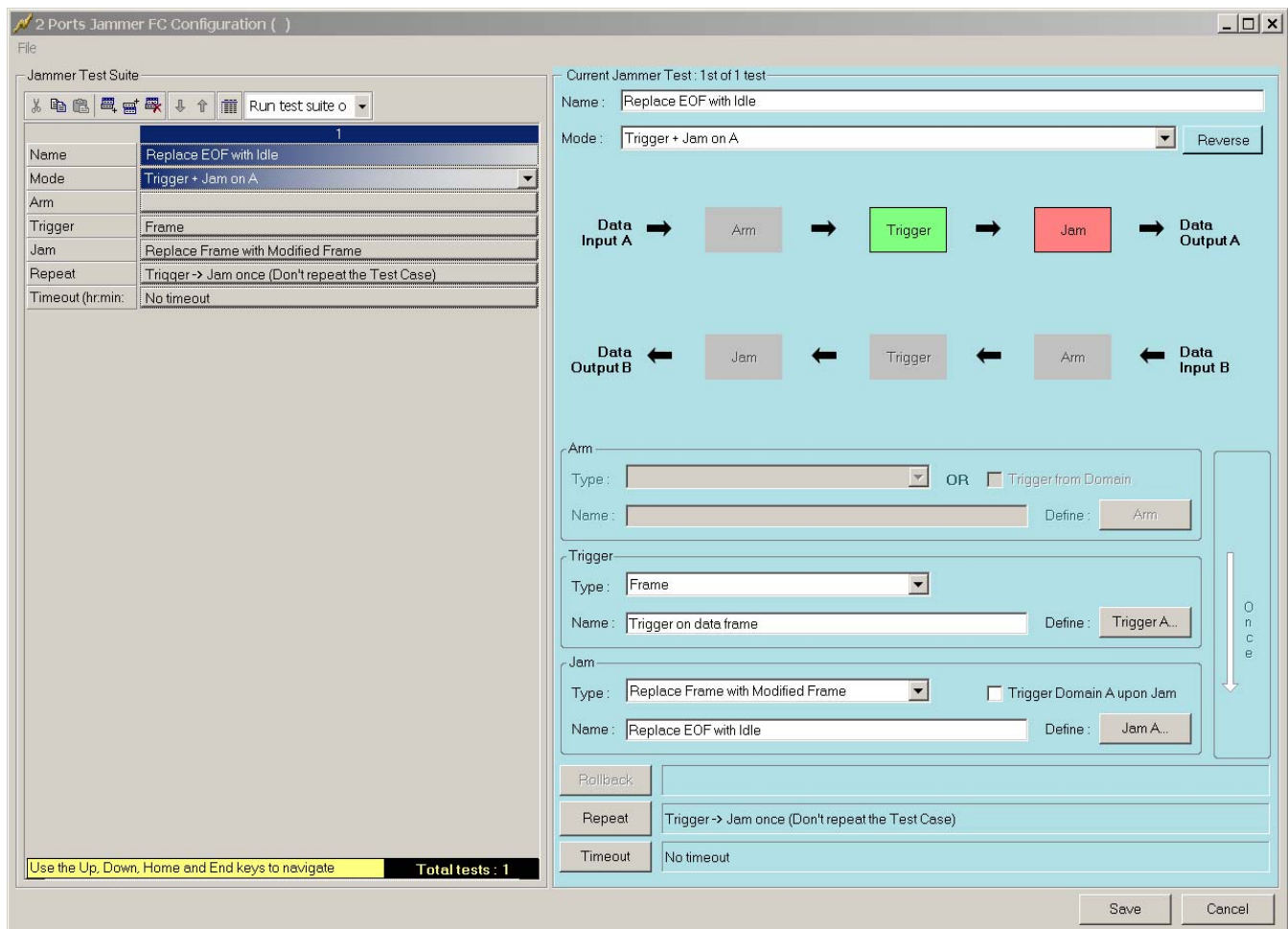
Or:

>> Right-click on the configuration in the Configuration manager and choose **Edit Jammer Configuration** from the context menu.

The edit only mode Jammer Configuration window opens (Figure 111).

This window allows you to set up your own Test Cases, name them, organize them, and save them to files so that you can use them again.

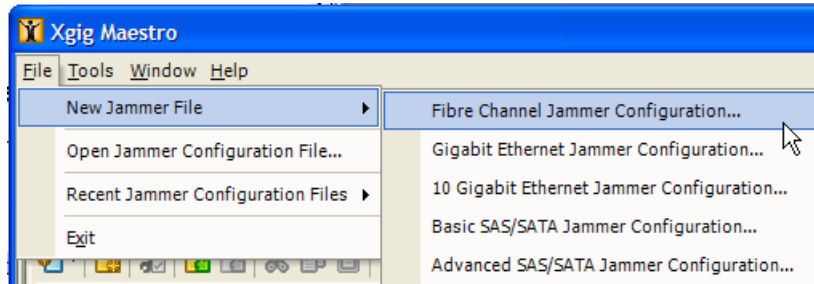
Figure 111: Edit Only Jammer Configuration Window



To start a configuration from scratch in edit only mode:

- >> Select **New Jammer Configuration** from the Configuration manager context menu or the File menu (Figure 112) on the Xgig Maestro menu bar.

Figure 112: Maestro File Menu



Or:

- >> Click the New Configuration icon  at the top of the Configuration manager.

Or:

- >> Right-click the configuration in the Configuration manager and choose **New Fibre Channel Jammer Configuration** from the context menu.

To save your configuration in edit only mode:

- >> Click **Save** at the bottom of the Jammer Configuration window or open the File menu at the top of the Jammer Configuration window and select **Save Configuration As...** or **Save Configuration**.

Any changes you make have no effect on actual Jammer devices you control.

To edit a configuration that is loaded to a Jammer port:

- >> Click **Configuration...** in the device column.

Or:

- >> Right-click in the Parameters Status table in the device column to open the context menu and select **Edit configuration**.

Or:

- >> Click **Operation** in the device column to open the Operation dialog, then click **Config**.

The Xgig Jammer Configuration window in hardware edit mode is displayed (Figure 113). This window allows you to set up your own Test Cases, name them, and save them to a file so that you can use them again.

Click **Apply** or **OK** and Jammer accepts the changes. They are immediately reflected in the Parameters Status table and affect the Jammer device the next time you run it.

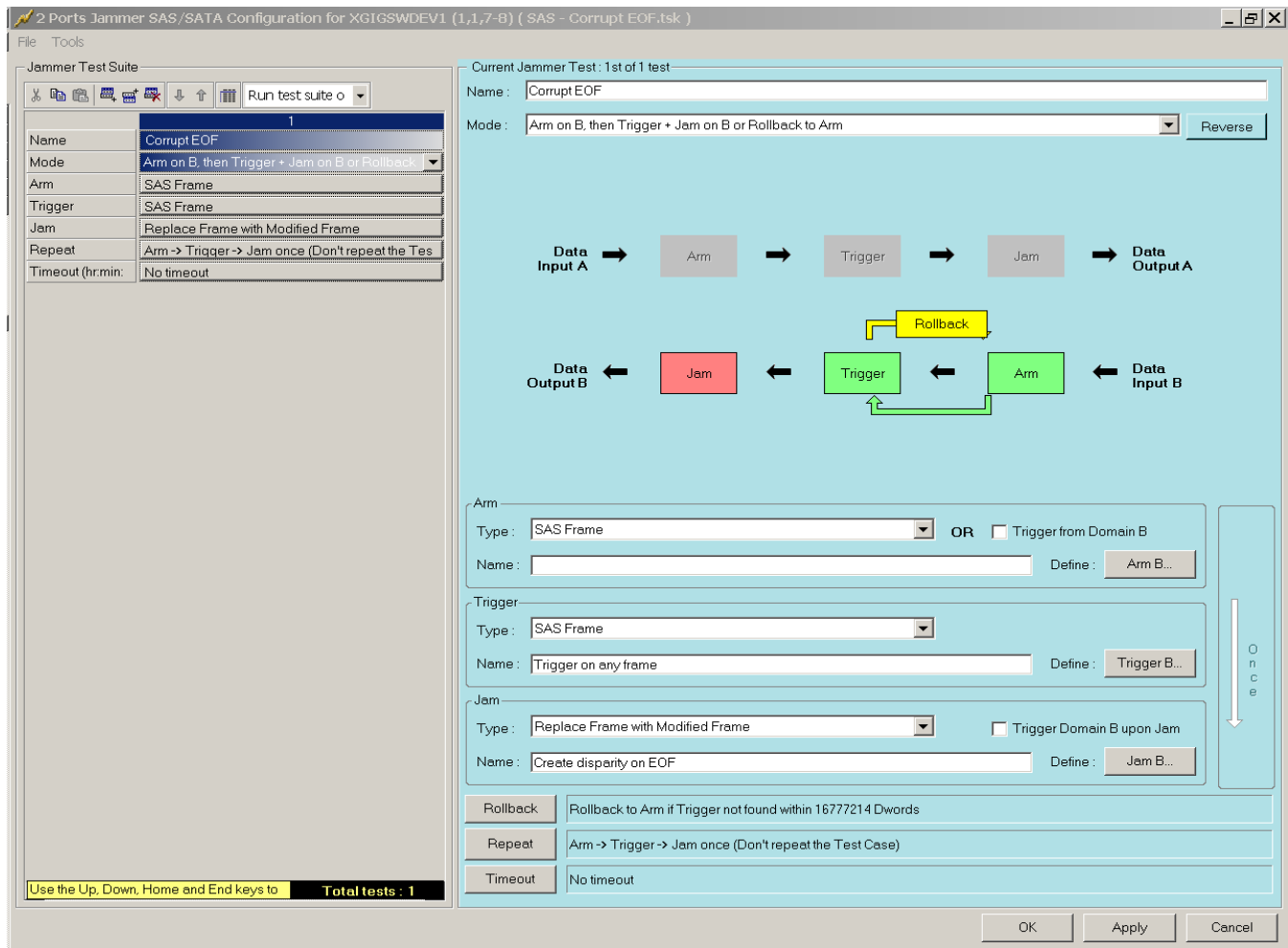
To save your configuration edits:

- >> Open the File menu at the top of the Jammer Configuration window and select **Save Configuration As...** or **Save Configuration**.

Or:

- >> Right-click in the Parameters Status table in the device column to open the context menu and select **Save configuration file ...**

Figure 113: Xgig Jammer Configuration Window



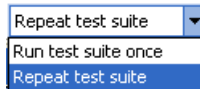
Using the Jammer Configuration Window

The Jammer Configuration window title bar indicates how many ports it is configuring, the protocol, and the configuration file name, if any. If you are using hardware edit mode, the chassis name, chassis number, slot number, and port number are also listed. The elements of the Jammer Configuration window are described in the following sections.

Using the Jammer Test Suite Tools

The Test Suite lists the series of Xgig Jammer tests in the order in which you want them to execute. The suite includes one or more tests. The highlighted test appears as the Current Jammer Test on the upper right side of the window. Each test in the suite executes in sequence with a test reset time of approximately 130 (200 max) milliseconds.

Repeat Test Suite



If you select **Repeat Test Suite**, the Jammer tests continuously run from the top of the Test Suite to the bottom and then loop back to the top until you click **Stop** on the Xgig Jammer Tab in Xgig Maestro.

Creating a Test Suite

When you create a Test Suite you use the edit buttons at the top of the Test Suite window.

The edit button definitions for the Jammer Test Suite are:

Cut	Removes the highlighted test and holds its contents in the memory buffer.
Copy	Copies the highlighted test to the memory buffer.
Paste	Inserts the current memory buffer contents before the currently highlighted test.
Add	Adds a new blank test to the bottom of the suite.
Insert	Inserts a new blank test above the currently highlighted test.
Delete	Removes the highlighted test from the suite. If only one test is present, then the contents of this test are cleared.

To duplicate a test at another point in the Test Suite:

- 1 Highlight the test you want to duplicate.
- 2 Click **Copy**.
- 3 Highlight the test in the suite that is just after the point where you want the duplicate test inserted.
- 4 Click **Paste**.

The duplicate test is inserted.

Refer to [“Configuring Arm and Trigger Conditions”](#) on page 189 and [“Configuring the Jam Definition”](#) on page 193 for information about configuring each test.

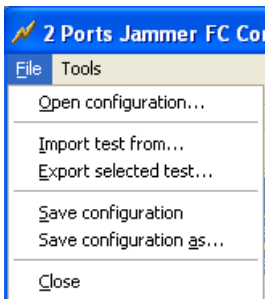
Using the Context Menu

The same operations (Cut, Copy, Paste, etc.) can be performed with the options available in the Context menu. In addition, the direction of an individual test can be reversed by selecting the ‘Reverse Current’ option. To reverse the direction of all tests, select the ‘Reverse All’ option.

Using the Configuration File Menu

The File menu is the only menu on the menu bar (Figure 114).

Figure 114: Configuration File Menu



The choices are:

Open Configuration	Open a selected configuration file.
Import to Selected Test	Import a Test Case from a .tst file or an entire test suite, .tsk file, to the currently highlighted position.
Export Selected Test	Export and save the currently highlighted test to a .tst file.
Save Configuration	Save the entire Test Suite to the .tsk file you currently have loaded.
Save Configuration As	Save the entire Test Suite to a .tsk file with a name you assign to it.
Close	Close the Jammer Configuration Window.

The recently used FC Jammer configuration files appear in the file menu and are loaded when selected.



Note: The .tst files are only for storing individual Test Cases and swapping them between configuration files. You cannot load .tst files directly into a Jammer device on the Xgig Maestro window.

Using the Current Jammer Test Window

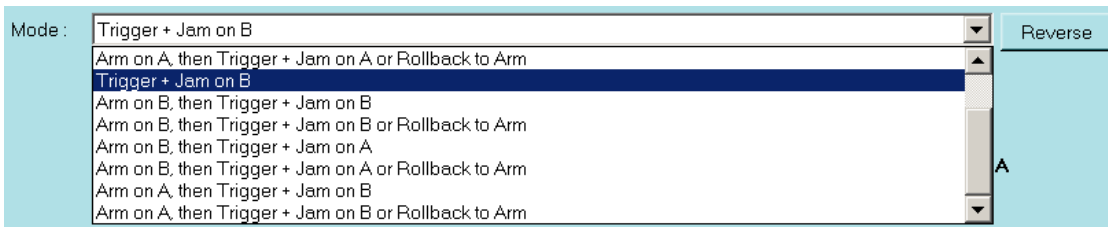
The graphics in this section of the window represent the hardware configuration for the selected test in the Jammer Test Suite.

Mode

Use Mode drop-down (Figure 115) near the top of the window to display a list of the possible configuration choices. In a duplex Jammer all path A and path B options are available. In a simplex Jammer, only path A is available. If you are editing a configuration without any associated Jammer ports, both paths are available.

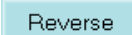
The input to path A (on top) is always port A and the input to path B (on the bottom) is always port B. The external trigger input and output that are available on path A always are linked to the domain shown on the Xgig Maestro window as “Domain of port A.” The trigger input and output on the bottom on path B are in the “Domain of port B.” However, the Data Path setting on the Xgig Maestro window determines to which port paths A and B send data. Refer to [“Data path” on page 147](#) for more information about these settings.

Figure 115: Mode Drop-down Menu

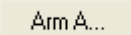


The functions represented by the graphic are:

Reverse

You can reverse the direction of the jam by selecting the Reverse button  .

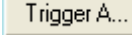
Arm

Use the Arm condition  to define the frame or Ordered Set to find prior to the frame or Ordered Set to be modified. You can also use an external trigger input to the Jammer.

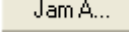


Note: If you use an external trigger input to define the Arm condition, then you cannot select the external trigger output for that path in that Test Case, and vice versa. For information regarding using the external trigger input and output during a Test Case, refer to [“Using Domains and External Triggering” on page 319.](#) However, you can use an external trigger in on port A with an external trigger out on port B, and vice versa.

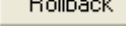
Trigger

The Trigger event  is the frame or Ordered Set to be modified. The Trigger event can be in the next word after the Arm event.

Jam

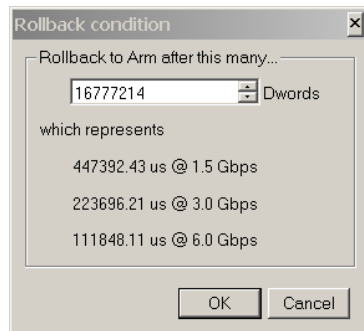
The Jam definition  contains modifications to be made to the Trigger event. It is the same type (frame or Ordered Set) as the Trigger event.

Rollback

The Rollback option  parameter defines the time or word count parameter between the Arm and Trigger events. If the Trigger does not follow the Arm event in the allotted time or word count, the Xgig Jammer begins looking for the Arm event again. Click **Rollback** to display the dialog box shown in Figure 116.



Note: This value is saved in terms of words, not time, so keep this in mind if you save a Test Case using a device running at 2.125 Gbps and later open the configuration on a Jammer running at 1.0625 Gbps.

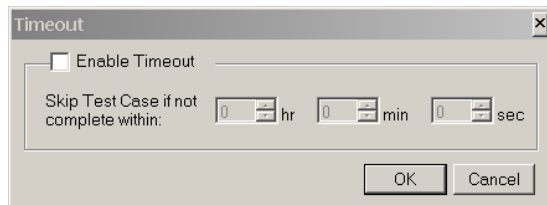
Figure 116: Rollback Condition Dialog

Timeout

This **Timeout** option defines the period of time to wait for a specified test to complete before aborting and proceeding to the next test in the suite.

To set the timeout:

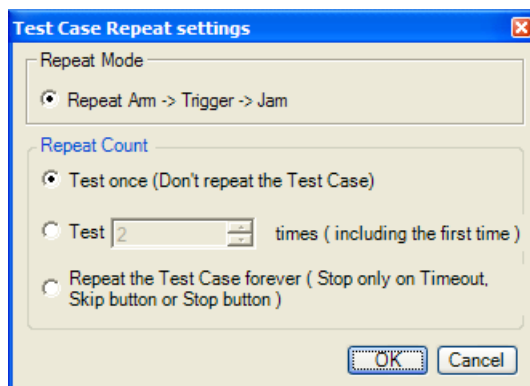
- 1 Click **Timeout** to display the dialog box in Figure 117.
- 2 Enter the hours, minutes, and seconds you want to wait.
Use the check box to enable or disable this feature.

Figure 117: Timeout Dialog

- 3 Click **OK**.

Repeat

Click this option to repeat the **Arm > Trigger > Jam** sequence once, n times, or forever (Figure 118).

Figure 118: Test Case Repeat Settings

Trigger From Domain A (or B)

Click this option to arm when the domain associated with the port is triggered.

Trigger Domain A (or B) upon Jam

Click this option to trigger a domain whenever the Trigger condition is met.

Configuring Arm and Trigger Conditions

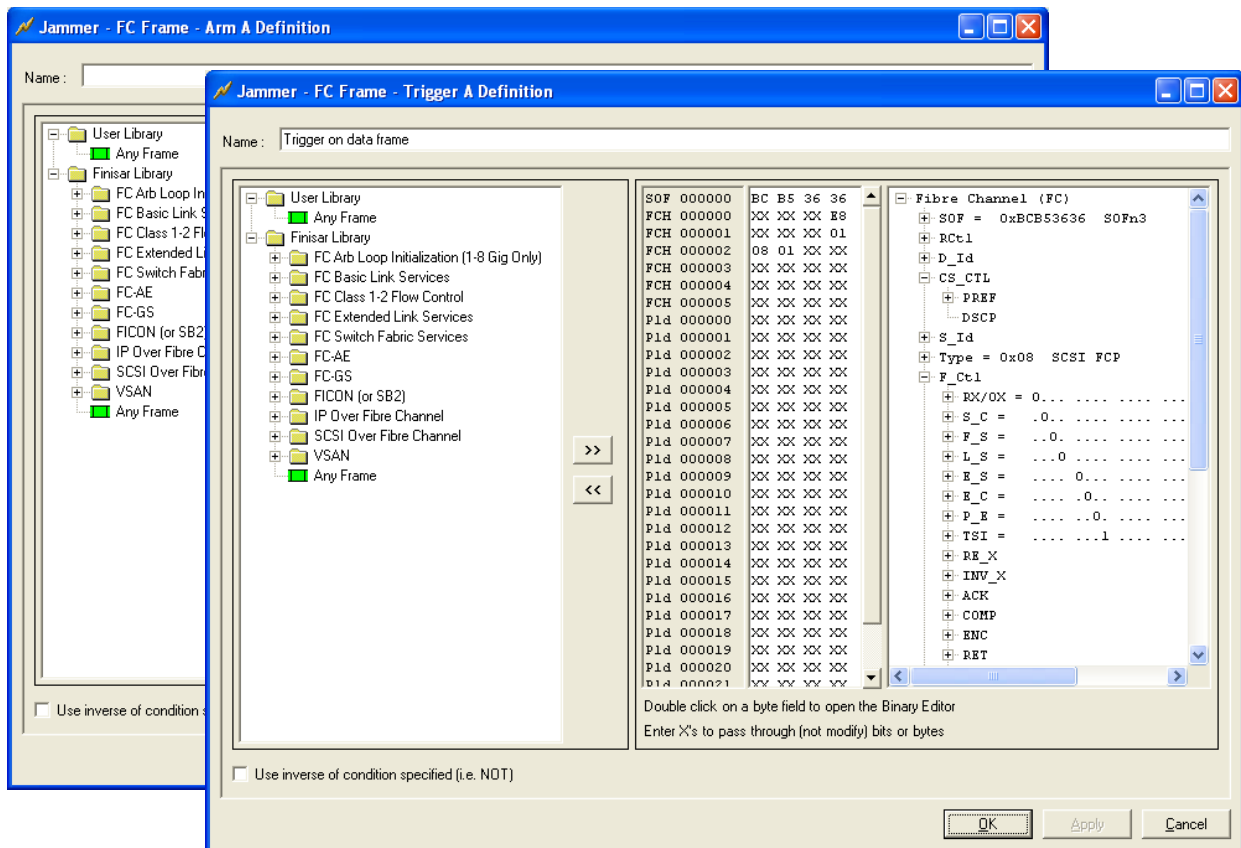
Arm and Trigger conditions recognize specific Ordered Sets or frames, depending on the protocol.

In Fibre Channel, you can specify any standard Ordered Set, or a user-defined Ordered Set (K28.5 followed by three data bytes). You can also use a frame as a condition, by specifying the SOF, the 6 word header, and up to the first 25 payload words.

Depending on the Mode you select, the appropriate graphic diagram shows the Trigger and optional Arm conditions, along with the Jam event. If the Mode you select does not include an Arm condition, the Arm button remains disabled.

To set Arm and Trigger conditions:

- 1 For the Arm and/or Trigger, open the Type drop-down on the Current Jammer Test window and select Frame or Ordered Set.
- 2 Click on the **Arm** or **Trigger** button in the Xgig Jammer Configuration window.
The window for the condition is displayed (Figure 119). If you are in hardware edit mode, the protocol, chassis name, chassis number, slot number, and port numbers are displayed in the title bar.
- 3 Set the values as required to specify a unique Arm and Trigger sequence for the specific test.
The following sections describe the available values.

Figure 119: Fibre Channel Arm and Trigger Windows for Frames

Setting Frame Conditions

You can specify frame conditions in two ways. One way is to load a template from the Template Library tree, and the other way is to manually specify bits in the frame.

To use a template:

- 1 Select a template from the Template Library tree on the left.
- 2 Click the double right arrow button to set the Trigger Condition.

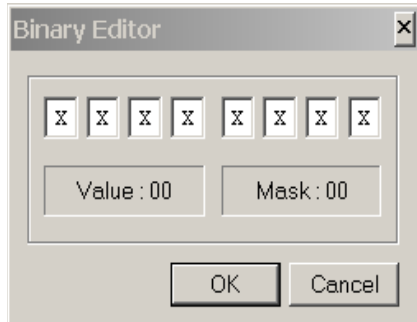
The condition is indicated on the right side of the window.

To manually specify a frame:

- >> Type hexadecimal values directly into the center column of the window.

An X represents a nibble that can be any value (a “don’t care”).

To set individual bits in any field, double-click on the hex entry to open the Binary Editor (Figure 120). In the hex view, partially defined hex characters appear as question marks: X001=?

Figure 120: Binary Editor Dialog

Another way to manually edit the frame condition is to make selections from the tree view in the right window pane.

Saving a Frame Condition

If you create a frame condition that you want to save and make easily available for future use, you can save it into the “User Library” folder in the Template Library tree. To do this:

>> Highlight the folder and click the double left arrow button.

When you check the “Use inverse of condition specified (i.e. NOT)” option, it means that the first frame encountered that does not match what you have specified creates a “condition met” event.

For each frame condition, you can specify an optional name at the top of the window. This name is also shown on the Jammer Configuration window under the Type selection, and on the main Xgig Maestro window.

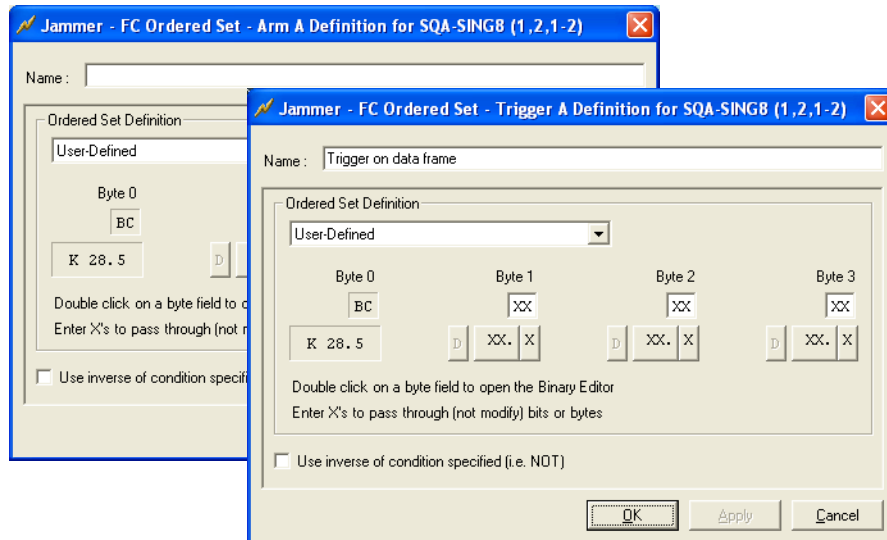
Setting Ordered Set Conditions

To set an Ordered Set condition, choose a value from the drop-down list. All legal Fibre Channel Ordered Sets are available as well as a User Defined selection at the bottom of the drop-down list as shown in Figure 121.

To edit the user-defined value:

>> Type a hex value into the byte field, or double-click on a byte field to open the Binary Editor.

As in frame conditions, an X indicates “don’t care” and a ? indicates a partially specified hex character. You can also check the “Use inverse of condition specified (i.e. NOT)” option; this means the first word encountered that does not match what you have specified creates a “condition met” event.

Figure 121: Fibre Channel Arm and Trigger Windows-Ordered Sets

To edit the values:

>> Enter a hex value, or double-click the byte field to open the Binary Editor.

As in frame conditions, an X indicates “don’t care” and a ? indicates a partially specified hex character.

As with frame conditions, you can specify an optional name at the top of the window. This name is also shown in the Jammer Configuration window under the Type selection and on the main Xgig Maestro window.

Configuring the Jam Definition

The **Jam Definition** window defines how to modify the event specified on the **Trigger Condition** window.

The Jam is always the same type (frame or Ordered Set) as the Trigger.

For any Jam Definition, you can specify an optional name at the top of the window. This name is also displayed on the Jammer Configuration window under the Type selection and on the main Xgig Maestro window.

Jamming an Ordered Set

If the Trigger Event is an Ordered Set, click the **Jam** button on the Xgig Jammer Configuration window, to open the Ordered Set Jam Definition window (Figure 122).

The Ordered Set Jam Definition window allows you to modify any Ordered Set by replacing it with a different Ordered Set, or by replacing it with a code violation. The code violation is a predefined 10-bit value that replaces the last 10 bits of the target Ordered Set in its 40-bit form. The control to edit the Ordered Set is similar to that in the Trigger Condition window.

Figure 122: Fibre Channel Ordered Set Jam Definition Window



For example, assume that the Trigger Event was a CLS, the Jam was set to replace it with an Idle and the repeat count was set to *forever*. This replaces every CLS in the link traffic with an Idle until you click **Stop** or the specified timeout occurs. Note that the number that you specify in the **Repeat** setting is the number of repetitions that occur including the first Jam. In addition, remember that if an Arm condition is specified, each repeat Jam requires the Arm and Trigger condition be met each time.

Jamming a Frame

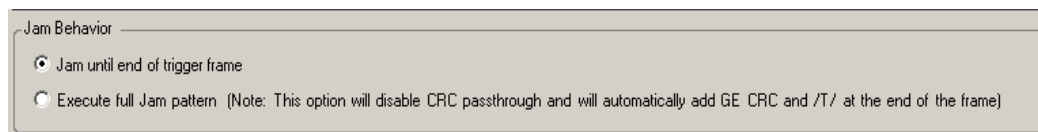
To define a Jam for a frame:

- 1 On the Configuration window, select one of the following from the Type drop-down menu for Jam:
 - Replace Frame with Modified Frame
 - Replace Frame with Truncated Frame
 - Replace Frame with Idles
- 2 Click the **Jam** button to open the Frame Jam Definition Window.

Jam Behavior

This controls the number of user-defined header/payload Jams performed relative to the target trigger frame. The **Jam Behavior** section is present on all tabs of the **Frame Jam Definition** window.

Figure 123: Jam Behavior Selection



- **Jam until end of trigger frame**

Jams defined in the Header and Payload tabs are performed until the end of the target trigger frame (or until an abnormal termination of the frame). All Jams defined that would take place on the original CRC or later are ignored. However, if the frame that is triggered on has more words than the Jams you specify, the remaining words are passed through. This is the standard way to Jam a frame, and is the way the GTX Jammer always Jams frames.

- **Execute full Jam pattern**

All Header and Payload Jams take place, even if they overwrite beyond the end of the target trigger frame. Use the control at the top of the Payload tab to define how many payload Jams should take place.

The last defined Jam is the last Payload Jam, unless there are no payload Jams defined then the sixth Header word is the last defined Jam. In any case, when you select this option, the options for modifying the CRC and EOF on the SOF/CRC/EOF tab are unavailable.

If the target trigger frame is longer than the number of Jams defined, then the portion of the target trigger frame that extends after the last defined Jam is overwritten with Idles. If the target trigger frame is shorter, then the Jammer switches back to pass-through immediately after the last defined Jam.



Note: Be careful when using this option because you may overwrite a portion of important traffic (a frame or Flow Control Ordered Sets).

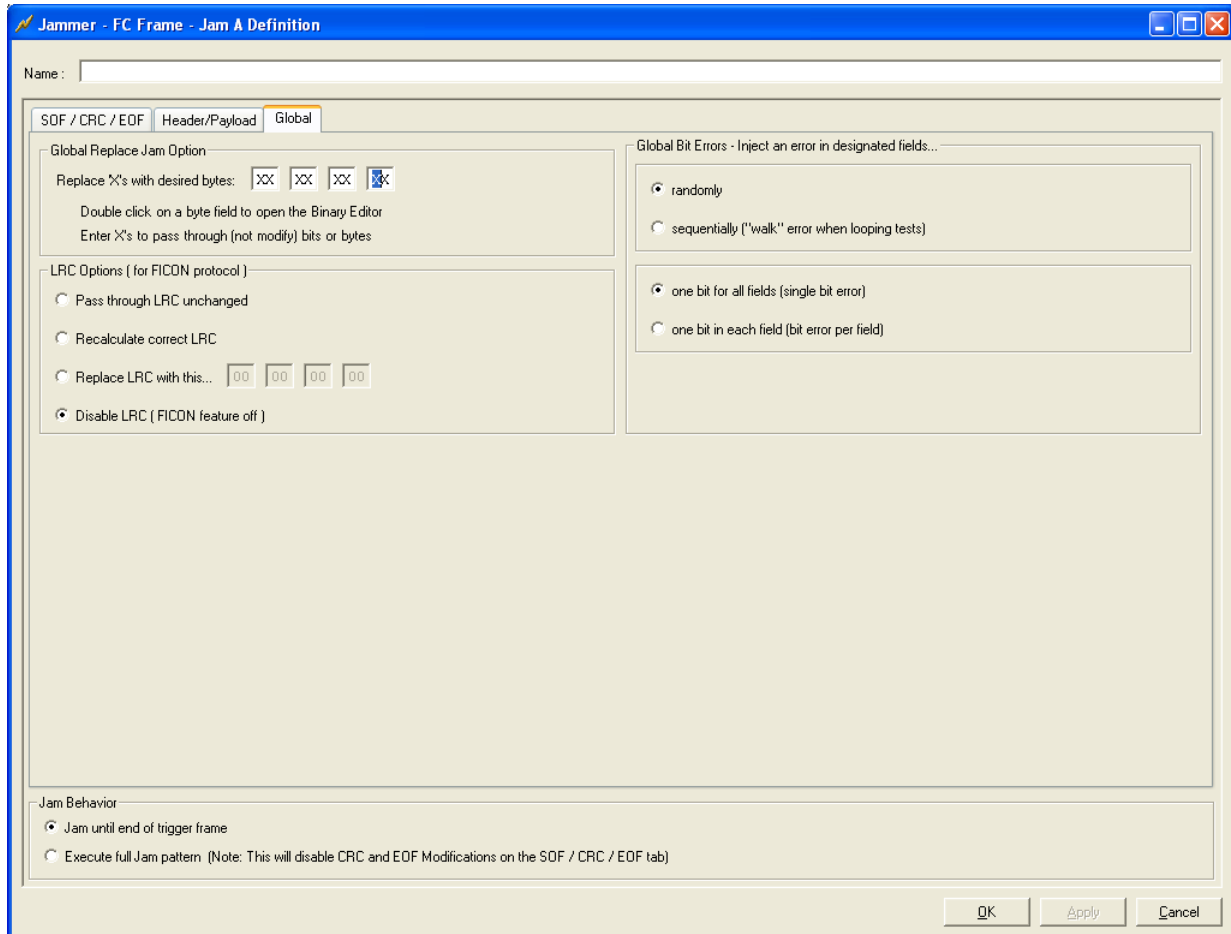
Replace Frame with Modified Frame

Each tab contains options relevant to different frame modifications.

Using the Global Tab

Use this tab (Figure 124) to define Jam parameters that apply globally to the frame.

Figure 124: Fibre Channel Global Tab



Global Replace Jam Option

Use the Global Replace Jam Option to set specific bits in a word to 1 or 0 while passing through the remaining bits. You can apply this change globally to any word in the frame. Define one Global Replace Jam word for each Test Case.

To edit these bits:

>> Enter hex values, or double-click on a byte field to open the Binary Editor.

Any bits left as Xs are passed through.

Global Bit Errors

The Jammer software can introduce bit errors repeatedly in sequential or random fashion to predefined fields. These bit errors are introduced to the 32-bit form of the target words (not the 40-bit form) so code violations are not created. The Global Bit Errors control allows you four options.

- Select **one bit for all fields** and **randomly**. This causes the Jammer to inject a single bit error in the group of all fields selected in the header or payload for a single Test Case. If the Jammer Test Suite is set to *loop*, then single bit errors are randomly injected into these fields, with one bit for each cycle of the Test Suite.
- Select **one bit for all fields** and **sequentially**. This also injects a single bit error in the group of all fields selected in the header or payload. If the Test Suite is set to loop forever, the bit error walks through all the selected fields.
- Select **one bit in each field** and **randomly** does the same thing as the first option; however, there will be one error for each word selected in the header or payload.
- Select **one bit in each field** and **sequentially** does the same thing as the second option; however, there will be one error for each word selected in the header or payload.

LRC Options

This option is only available for Fibre Channel. The FICON protocol uses an LRC which is a special checksum located in the eighth payload word. This option controls what happens to that payload word during the Jam, as well as, for any other words that qualify as being an LRC (that is, if you select Replace Jams with SOFs, then the fourteenth word after each SOF is an LRC word).

- Pass through LRC unchanged

Whatever word is present in an LRC word is passed through regardless of what you have defined on the Payload tab for that word.

- Recalculate correct LRC

An LRC is calculated and placed wherever an LRC word occurs. The LRC only functions correctly in valid frames (SOF followed by at least 14 data words).

- Replace LRC with this

LRC words are all replaced with this new word, regardless of what you have defined on the Payload tab for that word.

- Disable LRC

The Jams defined on the Payload tab take place with no special cases for LRC words.

Using the SOF/CRC/EOF Tab for Fibre Channel

Use the choices on this tab to modify the Start of Frame (SOF), Cyclic Redundancy Check (CRC), and End of Frame (EOF) words of the original target frame (Figure 125).

Figure 125: Fibre Channel SOF/CRC/EOF Tab

Figure 125 shows the 'SOF / CRC / EOF' tab in the 'Jammer - FC Frame - Jam A Definition' dialog. The dialog is configured for four bytes (Byte 0 to Byte 3). The 'SOF Modification' section has 'Replace SOF with this...' selected, with a dropdown menu showing 'SOFn3'. The 'CRC Modification' section has 'Recalculate correct CRC' selected. The 'EOF Modification' section has 'Replace EOF with this...' selected, with a dropdown menu showing 'EOFi3'. A list of other Ordered Sets is visible in the dropdown: Idle, R_RDY, ARB(F0), ARBx, OPNyx, OPNfr, and OPNvr. At the bottom, 'Jam Behavior' has 'Jam until end of trigger frame' selected. Buttons for 'OK', 'Apply', and 'Cancel' are at the bottom right.

Modifying SOF/EOF

You can replace the start and end of frame characters with another SOF, EOF, or other Ordered Set. For example, you can change SOFn3 to an SOFi3, which changes a frame from a sequence member to the start of a new sequence.

CRC Options

CRC options include:

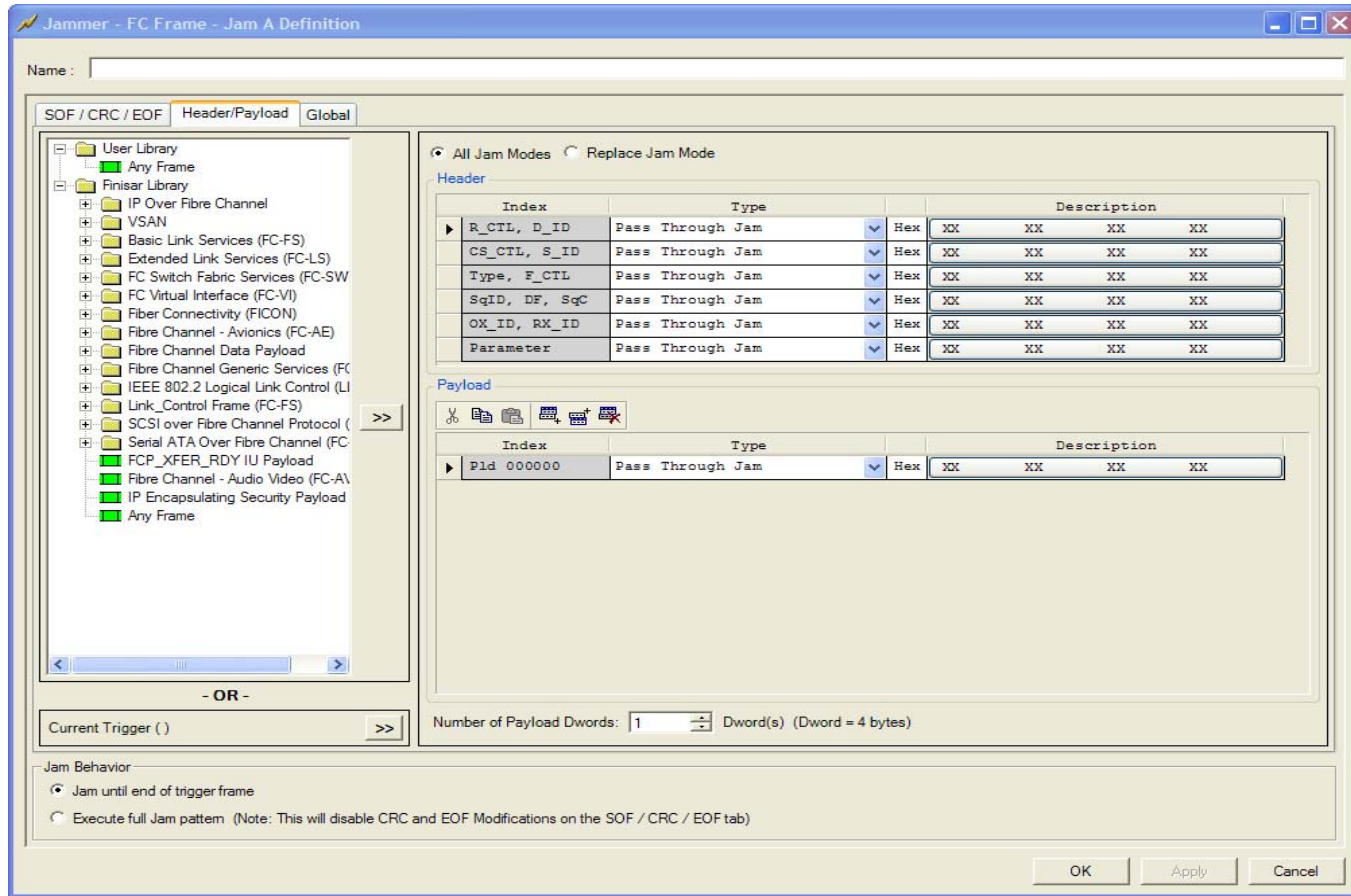
- Pass through CRC unchanged - Not changing the CRC in the original target frame
- Recalculate correct CRC - Recalculating the CRC to make it correct for the modified data
- Replace CRC with this - Replacing with a user-specified data word or Ordered Set

Depending on the changes made to a frame, the old CRC might be invalid. If the CRC is passed through, an invalid Fibre Channel frame might be created. The lowest layer of Fibre Channel error checking should recognize this type of error. The normal system response is to terminate the exchange and start over. If the frame is modified and the CRC is recalculated, a valid frame with modified data is created. If, for example, the modifications are made to SCSI commands embedded in the payload, the SCSI error checking routines should trap and handle the error.

Using the Header/Payload Tab for Fibre Channel

Any parameter in the Fibre Channel header can be modified (Figure 126). Select either the **Replace Jam** or **All Jam Modes** radio button to define the Jam frame.

Figure 126: Fibre Channel Header/Payload Tab



Similar to defining an Arm or Trigger Condition, there are two ways to specify your frame Jam Definition. One way is to load a template from the Template Library tree, and the other way is to manually specify bits in the frame.

To use a template:

- 1 Highlight a template in the Template Library tree on the left side of the window.
- 2 Click the double right arrow to display the Jam definition on the right side of the window.

When you use a template, the Jam definition is populated with Replace Jams of the specified data, while all other bits are passed through.

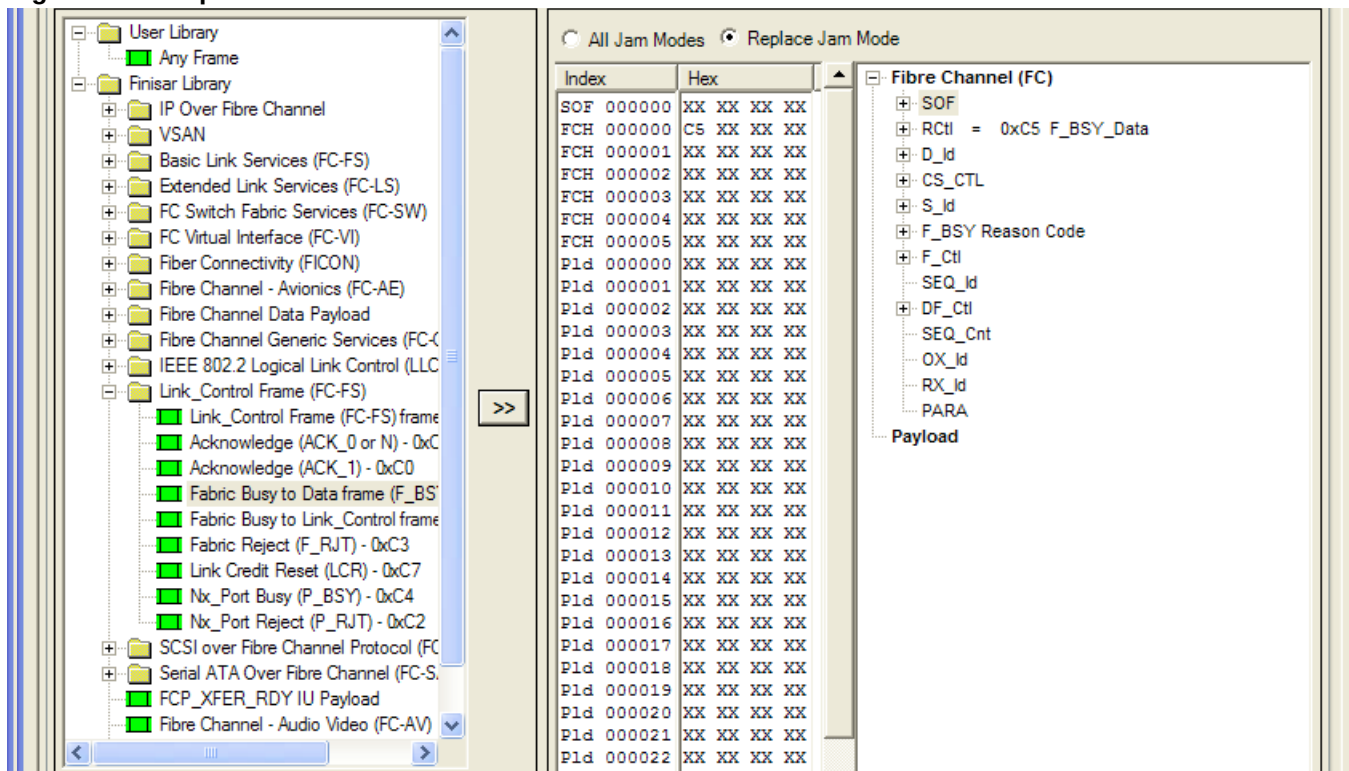
Notice the special choice at the bottom left, “Current Trigger.” This is a copy of the frame condition you have specified for the Trigger. Click the double right arrow to use this.

When you use a template, the Jam definition is populated with Replace Jams of the specified data, while all other bits are passed through.

To manually edit the values, enter a value into the byte field. An **X** in a nibble passes the original value through.

Select the **Replace 8b Jam Mode** radio button to open a dialog that allows you to replace an entire frame either by using a template or manually entering values. The Replace 8b Jam Mode dialog also contains a view of the frame contents, similar to those seen the Arm and Trigger Condition windows. These values correspond to the hex values defined in the center column.

Figure 127: Replace 8b Jam Mode



Select the **All Jam Modes** radio button opens a dialog that provides the following choices for each word in a frame on the Header/Payload tab:

- **Replace 8b Jam** - This function allows you to replace each nibble with a new value. Choose between a standard Ordered Set or a user-defined Ordered Set or data word. For user-defined values, you can specify a value for each nibble.
- **Apply Global Replace Jam** - This function allows individual bits to be set to 1, set to 0 or passed through unchanged according to the Global Replace Jam defined on the Global Tab.
- **Insert Code Violation Jam** - Introduce a pre-defined, fixed code violation to the current word.
- **Invert Jam** - Invert defined bits and pass through the rest. Enter 1s at the appropriate bit locations.
- **Pass Through Jam** - Pass through the current word unchanged.
- **Replace Jam with CRC** - This word contains the current CRC value. CRC calculation is reset and started at the word after any SOF. Note that there should be only valid data words between an SOF and its partner automatic CRC insertion or else the CRC value will be incorrect. Violations of this rule include using Ordered Sets or inserting code violations.

- **Set Bits To 0s Jam**- Set defined bits to 0s and pass through the rest. Enter 0s at the appropriate bit locations.
- **Set Bits To 1s Jam** - Set defined bits to 1s and pass through the rest. Enter 1s at the appropriate bit locations.
- **Apply Global Bit Error Jam** - Apply the Global Bit Error function set on the Global tab. Enter 1s at the appropriate bit locations.

You can modify any and all words in the payload. Decide what portion of the payload you want to modify. The larger the portion of the payload that is selected, the longer the time between Test Cases in the suite. Switching from one Test Case to the next is a software operation, so the time between cases will be on the order of hundreds of milliseconds.

Use the **Number of payload words** counter to define the number of payload Jams (Figure 128). Use the scroll bar to position the display to the desired word.

Figure 128: Selecting Frame Jam Size

Number of payload words : 16 word(s) (word = 4 bytes)

The drop-down menus are the same as those found on the Header words. See page 199.



Note: If you place an SOF in header word 2, and an automatic CRC in payload word 10, the CRC is calculated over header words 3 to 6 and continues with payload words 1 to 9.

You can also use the List View controls at the top to cut, copy, paste, add, insert, or delete words.

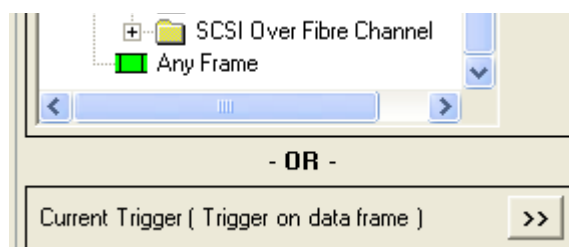
Similar to defining an Arm or Trigger Condition, there are two ways to specify your frame Jam Definition. One way is to load a template from the Template Library tree, and the other way is to manually specify bits in the frame.

To use a template:

- 1 Highlight a template in the Template Library tree on the left side of the window.
- 2 Click the double right arrow to display the Jam definition on the right side of the window.

Notice the special choice at the bottom left, Current Trigger (Figure 129). This is a copy of the frame condition you have specified for the Trigger. The name of the Trigger Condition (if any) is shown in parenthesis. Click the double right arrow to use this.

Figure 129: Current Trigger Option



When you use a template, the Jam definition is populated with Replace Jams of the specified data, while all other bits are passed through.

To manually specify a frame word Jam, select a Jam Type from the drop-down menu (under the Type column), then specify any additional definition (if necessary) by clicking on the data field (under the Description column).

Replace Frame with Truncated Frame

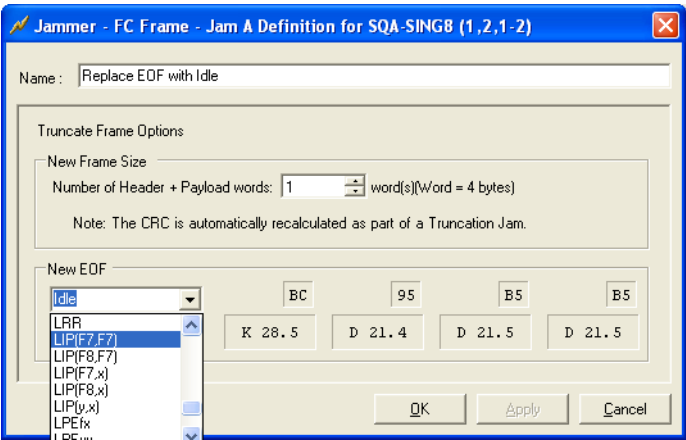
This option truncates the target frame to a shorter length and sends Idles on top of the remainder of the target frame.

To replace a frame with a truncated frame:

- >> Use the up and down arrow buttons or type the number of words you want to truncate the frame to (including header and payload, not including SOF, CRC, and EOF).

The CRC is automatically recalculated. If the target frame is already shorter than the specified truncation length, no truncation occurs. In any case, the EOF is always replaced with the new EOF you select from the drop-down menu.

Figure 130: Fibre Channel - Replace Frame with Truncated Frame



Replace Frame with Idles

This option replaces the target frame with Idles.

Chapter 13

Creating Jammer Test Configurations for Gigabit Ethernet

In this chapter:

- [Defining Your Own Test Configurations](#)
- [Using the Jammer Configuration Window](#)
- [Configuring Arm and Trigger Conditions for Gigabit Ethernet](#)
- [Configuring the Jam Definition for Gigabit Ethernet](#)

Defining Your Own Test Configurations

Xgig Jammer lets you define your own test configurations and save them with or without hardware available.

You can create a configuration from scratch, or you can open and edit an existing configuration. Also, you can edit a configuration in edit only mode, which is independent of any hardware, or you can edit a configuration that is currently loaded to a Jammer device.

To edit a configuration in edit only mode:

>> Double-click on a configuration file in the Configuration manager.

Or:

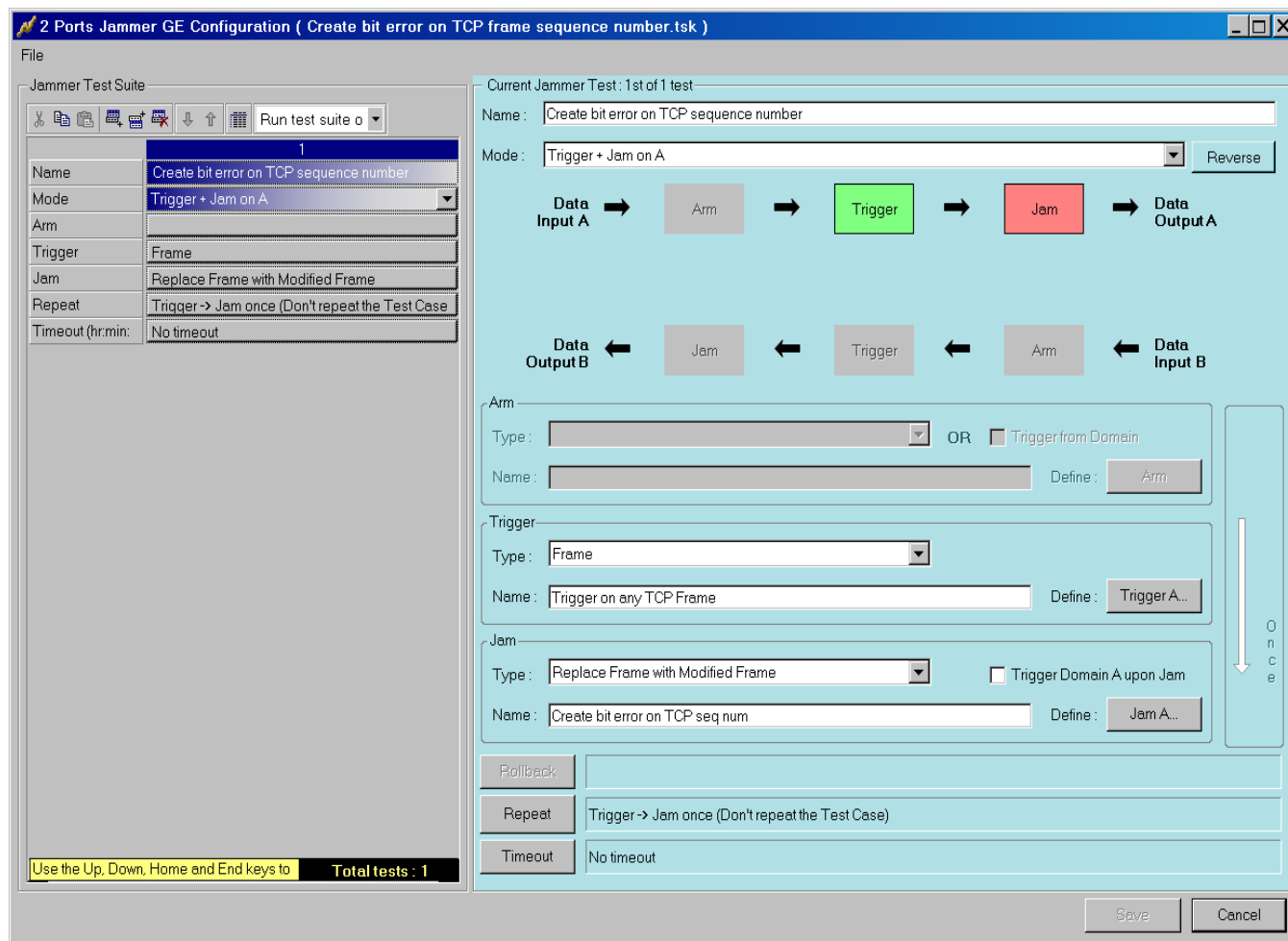
>> Right-click on the configuration in the Configuration manager and choose **Edit Jammer Configuration** from the context menu.

>> Or:

>> Right-click the configuration file in the Configuration manager to open the context menu, and select **Edit Configuration**.

The edit only mode Jammer Configuration window opens ([Figure 131](#)).

This window allows you to set up your own Test Cases, name them, organize them, and save them to files so that you can use them again.

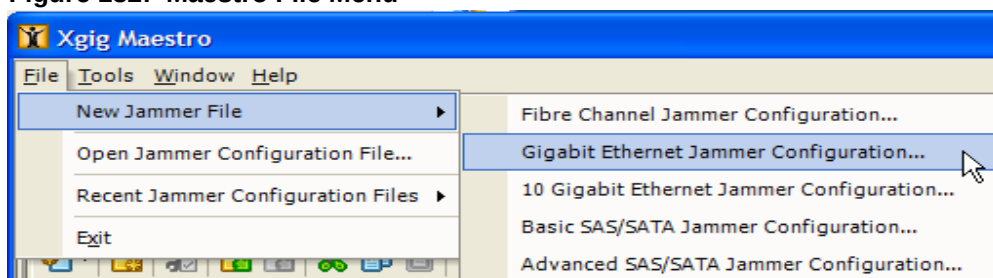
Figure 131: Edit Only Jammer Configuration window

To start a configuration from scratch in edit only mode:

- >> Select **New Jammer Configuration** from the context menu or the File menu (Figure 132) on the Xgig Maestro menu bar.

Or:

- >> Click the New Configuration icon at the top of the Configuration manager.

Figure 132: Maestro File Menu

To save your configuration in edit only mode:

- >> Click **Save** at the bottom of the Jammer Configuration window or open the File menu on the Jammer Configuration window and select **Save Configuration** or **Save Configuration As**.

Any changes you make have no effect on actual Jammer devices you control.

To edit a configuration that is loaded to a Jammer port:

- >> Click **Configuration...** in the device column.

Or:

- >> Right-click in the Parameters Status table in the device column to open the context menu and select **Edit configuration**.

Or:

- >> Click **Operation** in the device column to open the Operation dialog, then click **Config**.

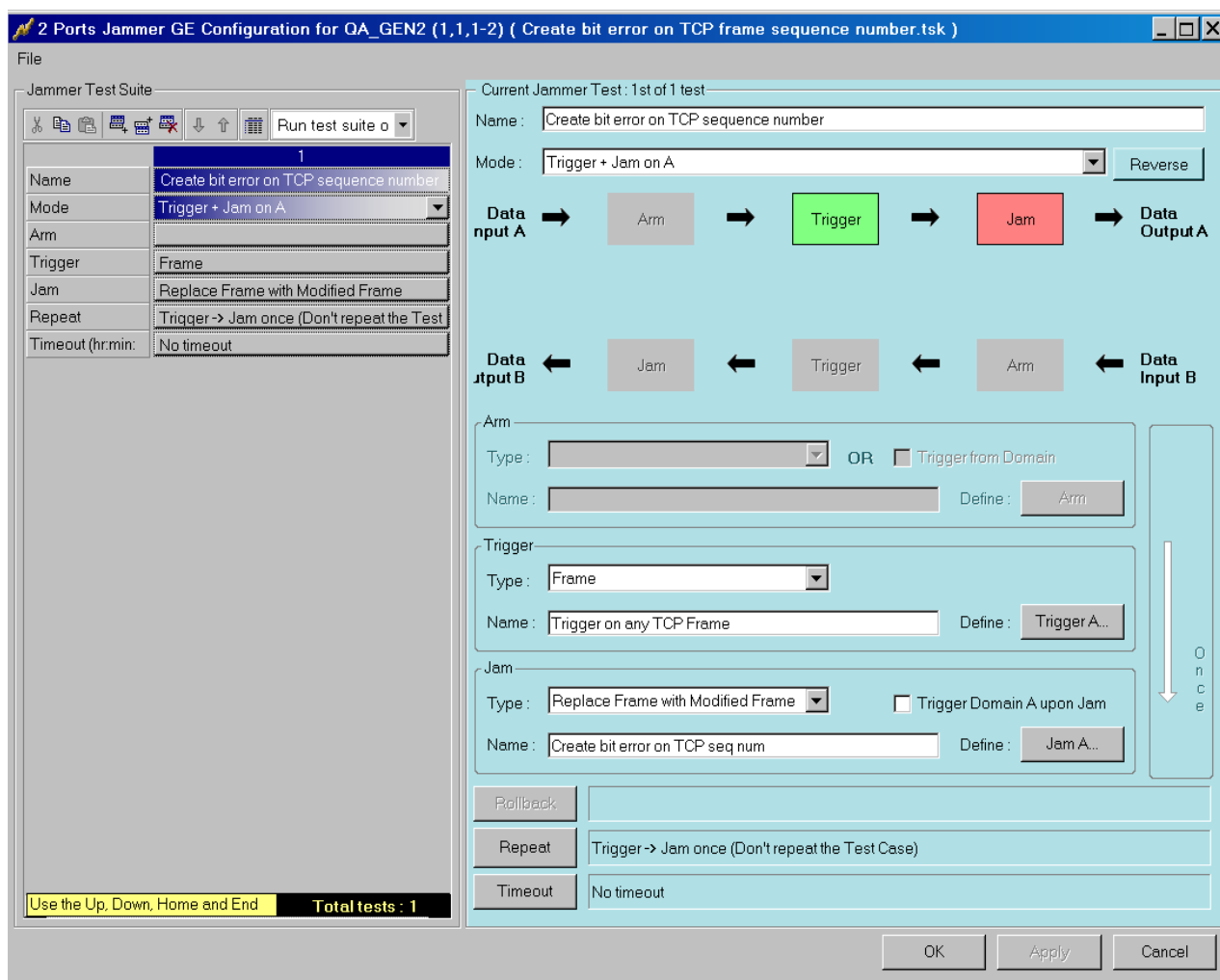
The Xgig Jammer Configuration window in hardware edit mode is displayed ([Figure 133](#)).

This window allows you to set up your own Test Cases, name them, and save them to a file so that you can use them again.

Click **Apply** or **OK** and Jammer accepts the changes. They are immediately reflected in the Parameters Status table and affect the Jammer device the next time you run it.

To save your configuration edits:

- >> Open the File menu at the top of the Jammer Configuration window and select **Save Configuration As...** or **Save Configuration**.

Figure 133: Xgig Jammer Configuration Window

Using the Jammer Configuration Window

The Jammer Configuration window title bar indicates how many ports it is configuring, the protocol, and the configuration file name, if any. If you are using hardware edit mode, the chassis name, chassis number, slot number, and port number are also listed. The elements of the Jammer Configuration window are described in the following sections.

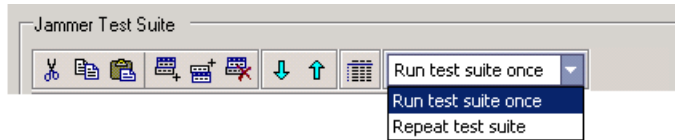
Using the Jammer Test Suite Tools

The Test Suite lists the series of Xgig Jammer tests in the order in which you want them to execute. The suite includes one or more tests. The highlighted test appears as the Current Jammer Test on the upper right side of the window. Each test in the suite executes in sequence with a test reset time of approximately 130 (200 max) milliseconds.

Creating a Test Suite

When you create a Gigabit Ethernet Jammer Test Suite, you use the toolbar in the Jammer Test Suite section of the Configuration window ([Figure 134](#)).

Figure 134: 10GigE Jammer Test Suite Toolbar



The following list describes the icons on the toolbar:

	Cut current test	Removes the highlighted test and holds its contents in the memory buffer.
	Copy current text	Copies the highlighted test to the memory buffer.
	Paste last test cut or copied	Inserts the current memory buffer contents before the currently highlighted test.
	Add new test to bottom of stack	Adds a new blank test to the bottom of the suite.
	Insert new test before current test	Inserts a new blank test above the currently highlighted test.
	Delete current test	Removes the highlighted test from the suite. If only one test is present, then the contents of this test are cleared.
	Move current test down the stack	Moves the highlighted test down one in the test order.
	Move current test up the stack	Moves the highlighted test up one in the test order.
	Toggle view	Toggles Test Suite between Card View and List View.
	Run test suite once or Repeat test suite	When you choose Repeat test suite, the tests run according the settings you define in the Jammer Current Test window.

To duplicate a test at another point in the Test Suite:

- 1 Highlight the test you want to duplicate.
- 2 Click **Copy**.
- 3 Highlight the test in the suite that is just after the point where you want the duplicate test inserted.
- 4 Click **Paste**.

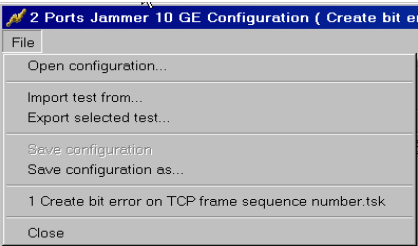
The duplicate test is inserted.

Refer to “[Configuring Arm and Trigger Conditions for Gigabit Ethernet](#)” and “[Configuring the Jam Definition for Gigabit Ethernet](#)” for information about configuring each test.

Using the Configuration File Menu

The File menu is the only menu on the menu bar (Figure 135).

Figure 135: Configuration File Menu



The choices are:

Open Configuration	Open an existing .tsk configuration file.
Import to Selected Test	Import a Test Case from a .tst file or an entire test suite, .tsk file, to the currently highlighted position. A Test Case is one line in the Jammer Test Suite.
Export Selected Test	Export and save the currently highlighted test to a .tst file.
Save Configuration	Save the entire Test Suite to the .tsk file you currently have loaded.
Save Configuration As	Save the entire Test Suite to a .tsk file with a name you assign to it.
Close	Close the Jammer Configuration Window.

The recently used Gigabit Ethernet Jammer configuration files appear in the file menu and are loaded when selected.

Using the Current Jammer Test Window



Note: The .tst files are only for storing individual Test Cases and swapping them between configuration files. You cannot load .tst files directly into a Jammer device on the Xgig Maestro window.

The graphics in this section of the window represent the hardware configuration for the selected test in the Jammer Test Suite.

Mode

For 10GigE, Mode menus are available near the top of the Current Jammer Test window (Figure 136) and also near the top of each Test Case in the Jammer Test Suite window (Figure 137).

The input to path A (on top) is always port A and the input to path B (on the bottom) is always port B. The external trigger input and output that is available on path A always are linked to the domain shown on the Xgig Maestro window as “Domain of port A.” The trigger input and output on the bottom on path B are in the “Domain of port B.” However, the Data Path setting on the Xgig Maestro window determines to which port paths A and B send data. Refer to [“Data path” on page 147](#) for more information about these settings.

Figure 136: Mode Drop-down Menu in Current Jammer Test - Right Pane

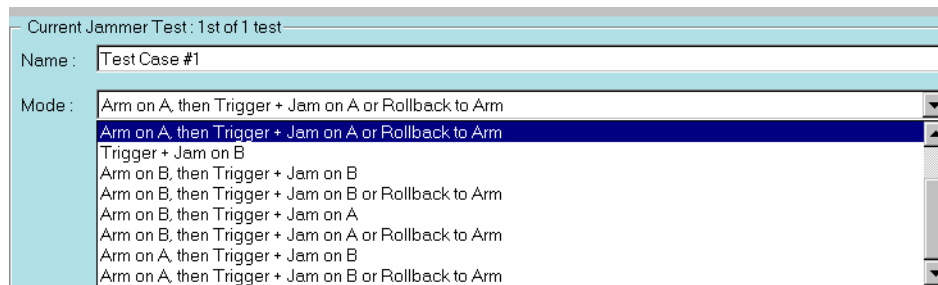
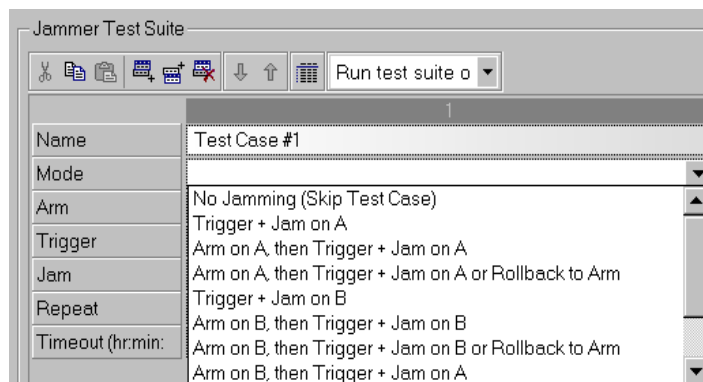


Figure 137: Mode Drop-down Menu in Test Suite - Left Pane



Reverse

You can reverse the direction of the jam by selecting the **Reverse** button.

Arm and Trigger

To define Arm and Trigger conditions, select a respective Type from each drop-down menu. Then click the Arm or Trigger button to open the corresponding definition window.

You can use an external input as an Arm condition. Check Trigger from Domain A (or B) to enable this feature. You must put the corresponding Jammer port into a domain for this to work properly.

The Trigger event can be in the next Dword after the Arm event in the traffic stream.

Jam

To define a Jam:

- 1 Select a Type from the drop-down menu, if available.
- 2 Click the Jam button to open the Jam Definition window.

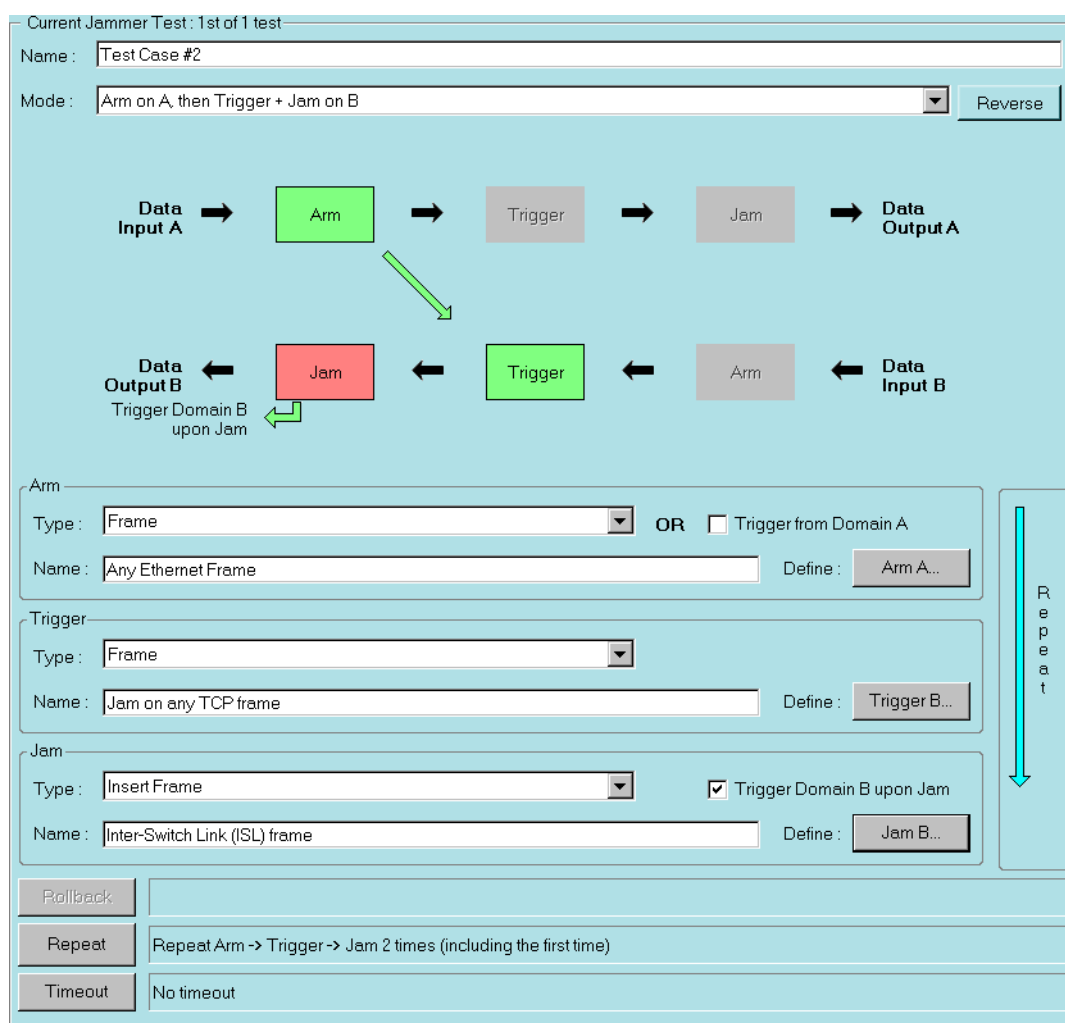
The Jam Definition specifies the modifications to be made to the traffic matching the Trigger Condition.

In addition, the Jammer port can trigger out to the Domain it is in when a Jam takes place. Check Trigger Domain A (or B) upon Jam to enable this feature.



Note: If you use an external trigger input to define the Arm condition, then you cannot select the external trigger output for that path in that Test Case, and vice versa. For information regarding using the trigger input and output during a Test Case, refer to [“Using Domains and External Triggering” on page 319](#). However, you can use an external trigger in on port A with an external trigger out on port B, and vice versa. [Figure 138](#) shows an example.

Figure 138: Trigger In and Trigger Out



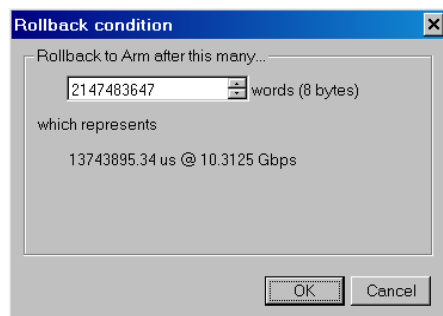
Rollback

The Rollback option defines the time or Dword count parameter between the Arm and Trigger events. If the Trigger does not follow the Arm event in the allotted time or Dword count, the Jammer begins looking for the Arm event again. Click **Rollback** to display the dialog shown in Figure 139.



Note: This value is saved in terms of Dwords, not time, so keep this in mind if you save a Test Case using a device running at 3.0 Gbps and later open the configuration on a Jammer running at 1.5 Gbps.

Figure 139: Rollback Condition Dialog



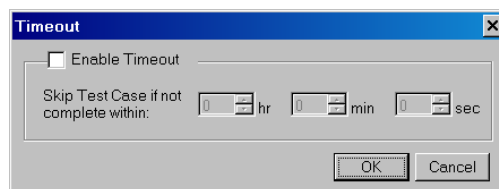
Timeout

The timeout option defines the period of time to wait for a specified test to complete before aborting and proceeding to the next test in the suite.

To set the timeout:

- 1 Click **Timeout** to display the dialog box in Figure 140.
- 2 Check **Enable Timeout**.
- 3 Enter the hours, minutes, and seconds you want to wait.

Figure 140: Timeout Dialog

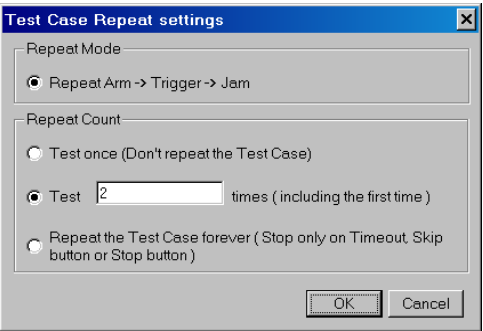


- 4 Click **OK**.

Repeat

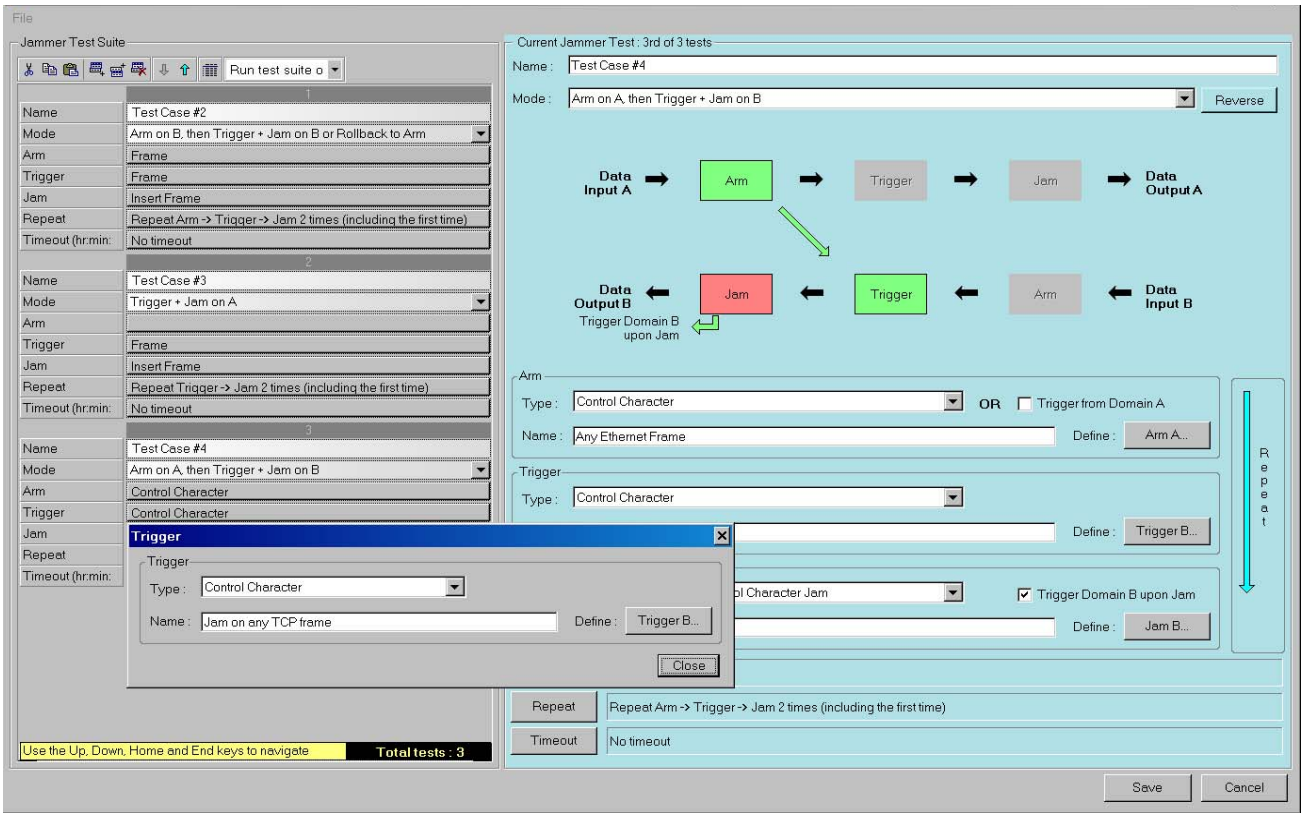
Click **Repeat** to open the dialog shown in Figure 141. The Repeat Mode setting allows you to configure what is repeated when using an Arm condition. The first option means the Jammer will match the Arm condition once, then will repeat matching the Trigger condition as specified by the Repeat Count setting below. The second Repeat Mode option means that the Jammer must match the Arm condition each time before looking for a Trigger.

Figure 141: Repeat Test Dialog



You can also configure options for each Test Case directly in the Test Suite, instead of clicking in the Current Jammer Test pane. Click on the area of the Test Case you want to modify to open the corresponding dialog (Figure 142).

Figure 142: Configuring Options Directly in the Test Suite



Configuring Arm and Trigger Conditions for Gigabit Ethernet

Arm and Trigger conditions recognize specific Ordered Sets or frames, depending on the protocol.

In Gigabit Ethernet, you can specify any standard Ordered Set or any user-defined one or two bytes of K/D characters (of which standard Ordered Sets are a subset). You can also use a frame, for which you can specify the Gigabit Ethernet header and up to 114 bytes of payload.

Depending on the Mode you select, the appropriate graphic diagram shows the Trigger and optional Arm conditions, along with the Jam event. If the Mode you select does not include an Arm condition, the Arm button remains disabled.

To set Arm and Trigger conditions:

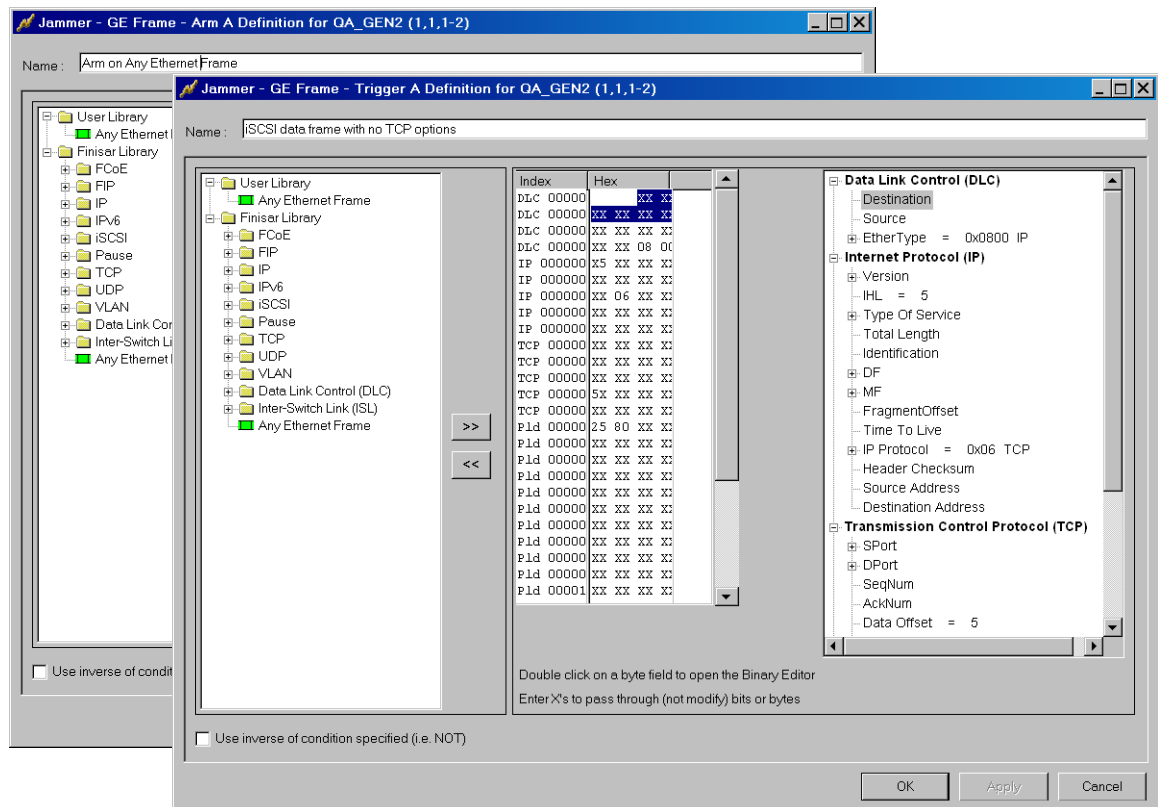
- 1 Click on the **Arm** or **Trigger** button in the Xgig Jammer Configuration window.

The window for the condition is displayed (Figure 143). If you are in hardware edit mode, the protocol, chassis name, chassis number, slot number, and port numbers are displayed in the title bar.

- 2 Open the Type drop-down in the Arm or Trigger Condition window and select Frame or Ordered Set.
- 3 Set the values as required to specify a unique Arm and Trigger sequence for the specific test.

The following sections describe the available values.

Figure 143: Gigabit Ethernet Arm and Trigger Windows for Frames



Setting Frame Conditions

You can specify frame conditions in two ways. One way is to load a template from the Template Library tree, and the other way is to manually specify bits in the frame.

To use a template:

- 1 Select a template from the Template Library tree on the left.
- 2 Click the double right arrow button to set the Trigger Condition.

The condition is indicated on the right side of the window.

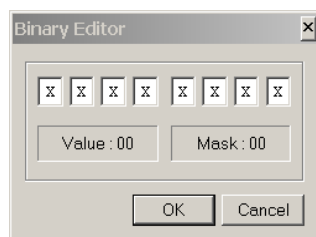
To manually specify a frame:

>> Type hexadecimal values directly into the center column of the window.

An X represents a nibble that can be any value (a “don’t care”).

To set individual bits in any field, double-click on the hex entry to open the Binary Editor (Figure 144). In the hex view, partially defined hex characters appear as question marks: X001=?

Figure 144: Binary Editor Dialog



Another way to manually edit the frame condition is to make selections from the tree view in the right window pane.

Saving a Frame Condition

If you create a frame condition that you want to save and make easily available for future use, you can save it into the “User Library” folder in the Template Library tree. To do this:

>> Highlight the folder and click the double left arrow button.

Frame conditions have the option of “Use inverse of condition specified (i.e., NOT).” When you check this option, it means that the first frame encountered that does not match what you have specified creates a “condition met” event.

For each frame condition, you can specify an optional name at the top of the window. This name is also shown on the Jammer Configuration window under the Mode selection, and on the main Xgig Maestro window.

Setting Ordered Set Conditions

To arm or trigger on an Ordered Set:

- 1 Click on the Arm or Trigger button in the Jammer Configuration window.
- 2 Open the Type drop-down in the Arm or Trigger Condition window and select Ordered Set.
- 3 Set the values as required to specify a unique Arm and Trigger sequence for the specific test.

You can choose from any standard Ordered Set or choose user-defined (Figure 145). All choices are either one byte or two bytes. A user-defined condition can use any K/D character(s).

To edit the values:

>> Enter a hex value, or double-click the byte field to open the Binary Editor.

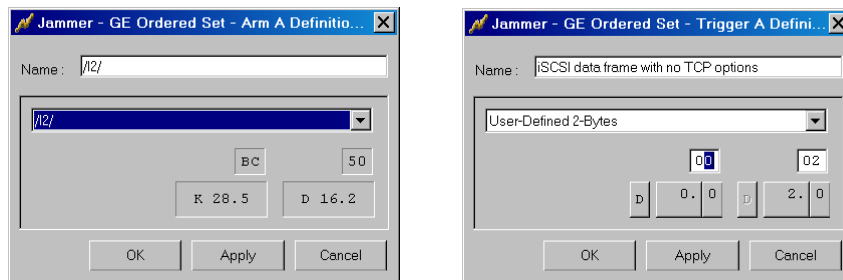
As in frame conditions, an X indicates “don’t care” and a ? indicates a partially specified hex character.

You can also click on the K/D character display (for example, 16.2) to open drop down menus of possible values from which you can select. A period separates the two values. Click the K or D to toggle the Control Characters setting.



Note: In Gigabit Ethernet, if you choose a one byte Ordered Set Trigger condition, then the Jam definition must be one byte. If you choose a two byte Ordered Set, then the Jam must be two bytes.

Figure 145: Gigabit Ethernet Arm and Trigger Windows-Ordered Sets



Note: Two byte Ordered Set conditions are only met when aligned to the normal 16-bit boundary (in alignment with the I2 Ordered Sets). For example, if you specify a condition of 50-K28.5, hoping that the condition would be met by two I2 (K28.5-50-K28.5-50), this condition would not be met.

As with frame conditions, you can specify an optional name at the top of the window. This name is also shown in the Jammer Configuration window under the Mode selection and on the main Xgig Maestro window.

Configuring the Jam Definition for Gigabit Ethernet

The **Jam Definition** window defines how to modify the event specified on the **Trigger Condition** window.

The Jam is always the same type (frame or Ordered Set) as the Trigger.

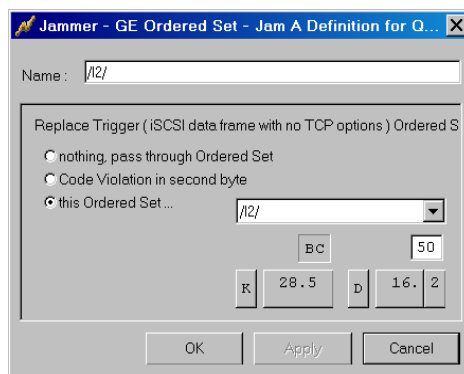
For any Jam Definition, you can specify an optional name at the top of the window. This name is also displayed on the Jammer Configuration window under Mode selection and on the main Xgig Maestro window.

Jamming an Ordered Set

If the Trigger Event is an Ordered Set, click the **Jam** button on the Xgig Jammer Configuration window, to open the Ordered Set Jam Definition window (Figure 146).

The Ordered Set Jam Definition window allows you to modify any Ordered Set by replacing it with a different Ordered Set, or by replacing it with a code violation. The code violation is a predefined 10-bit value that replaces the last 10 bits of the target Ordered Set in its 40-bit form. The control to edit the Ordered Set is similar to that in the Trigger Condition window.

Figure 146: Gigabit Ethernet Ordered Set Jam Definition Window



For example, assume that the Trigger Event was an I1, the Jam was set to replace it with an I2 and the repeat count was set to *forever*. This replaces every I1 in the link traffic with an I2 until you click **Stop** or the specified timeout occurs. Note that the number that you specify in the **Repeat** setting is the number of repetitions that occur including the first Jam. In addition, remember that if an Arm condition is specified, each repeat Jam requires the Arm and Trigger condition be met each time. An exception is in Gigabit Ethernet: if the Trigger condition is met more than once in a 32-bit word, then the Jam occurs multiple times in that same word, and then begins looking for the Arm condition, again, on the next word.

Jamming a Frame

To define a Jam for a frame:

- 1 Click the Jam button on the Xgig Jammer Configuration window to open the Frame Jam Definition window (Figure 147).
- 2 Under the Jam Type drop-down, choose to:

- Modify traffic
- Truncate a frame
- Replace the frame with Idles (I2)

The following paragraphs describe these choices.

Replace Frame with Modified Frame

Each tab contains options relevant to different frame modifications.

Using the Global Tab

Use this tab (Figure 147) to define Jam parameters that apply globally to the frame.

Global Match/Mask Option

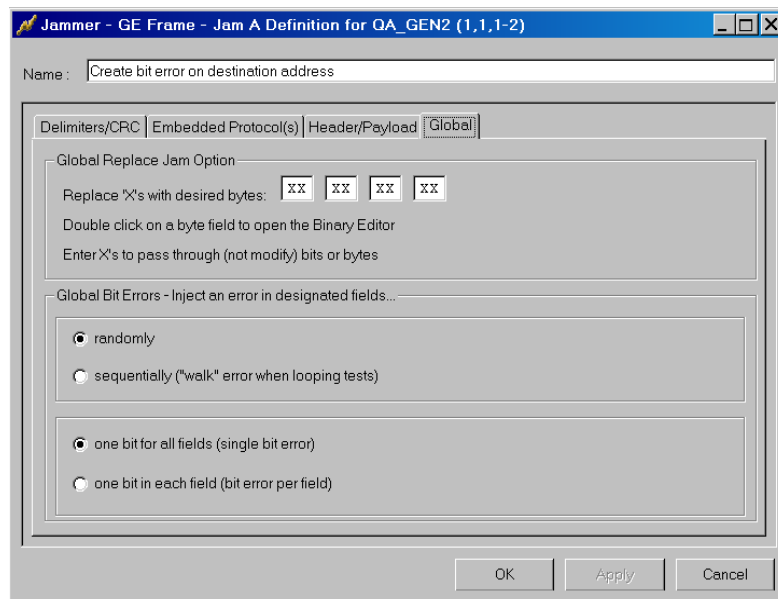
Use the Global Match/Mask word to set specific bits in a word to 1 or 0 while passing through the remaining bits. You can apply this global mask to any word in the frame. Define one Global Match/Mask for each Test Case.

To edit these bits:

>> Enter hex values, or double-click on a byte field to open the Binary Editor.

Any bits left as Xs are passed through.

Figure 147: Gigabit Ethernet Global Tab



Global Bit Errors

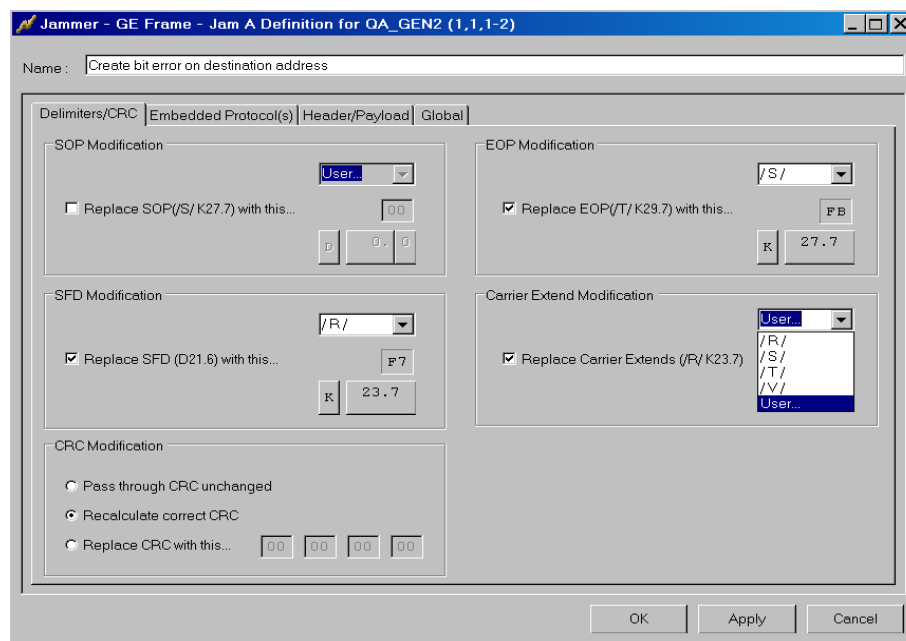
The Jammer software can introduce bit errors repeatedly in sequential or random fashion to predefined fields. These bit errors are introduced to the 32-bit form of the target words (not the 40-bit form) so code violations are not created. The Global Bit Errors control allows you four options.

- Select **one bit for all fields** and **randomly**. This causes the Jammer to inject a single bit error in the group of all fields selected in the header or payload for a single Test Case. If the Jammer Test Suite is set to *loop*, then single bit errors are randomly injected into these fields, with one bit for each cycle of the Test Suite.
- Select **one bit for all fields** and **sequentially**. This also injects a single bit error in the group of all fields selected in the header or payload. If the Test Suite is set to loop forever, the bit error walks through all the selected fields.
- Select **one bit in each field** and **randomly** does the same thing as the first option; however, there will be one error for each word selected in the payload or header.
- Select **one bit in each field** and **sequentially** does the same thing as the second option; however, there will be one error for each word selected in the payload or header.

Using the Delimiters/CRC Tab for Gigabit Ethernet

Use the choices on this tab to modify the Start of Packet (SOP), Start Frame Delimiter (SFD), CRC, End of Packet (EOP), and Carrier Extend(s) of the original frame (Figure 148).

Figure 148: Gigabit Ethernet Delimiters/CRC Tab



Modifying SOP/SFD/EOP/ Carrier Extend(s)

To modify any of these special characters in the target trigger frame:

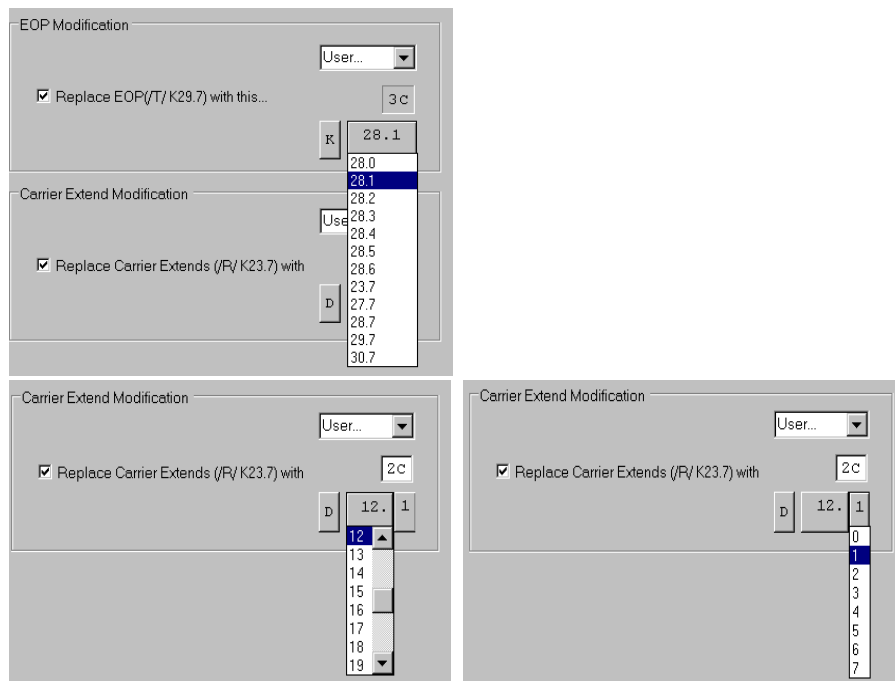
- 1 Check the appropriate box to select replacement.
- 2 Open the drop-down menu and choose a standard Gigabit Ethernet Ordered Set, or select User-defined.

If you choose User-defined, you can specify any value.

To edit the value enter a hex value into the byte field or double-click to display the Binary Editor.

You can also click on the K/D character display (for example, 16.2) to open drop-down menus of possible values from which you can select (Figure 149). A separator (a period) distinguishes the two values. Click the K or D to toggle the Control Character setting.

Figure 149: K/D Character Value Drop-down Menus



CRC Options

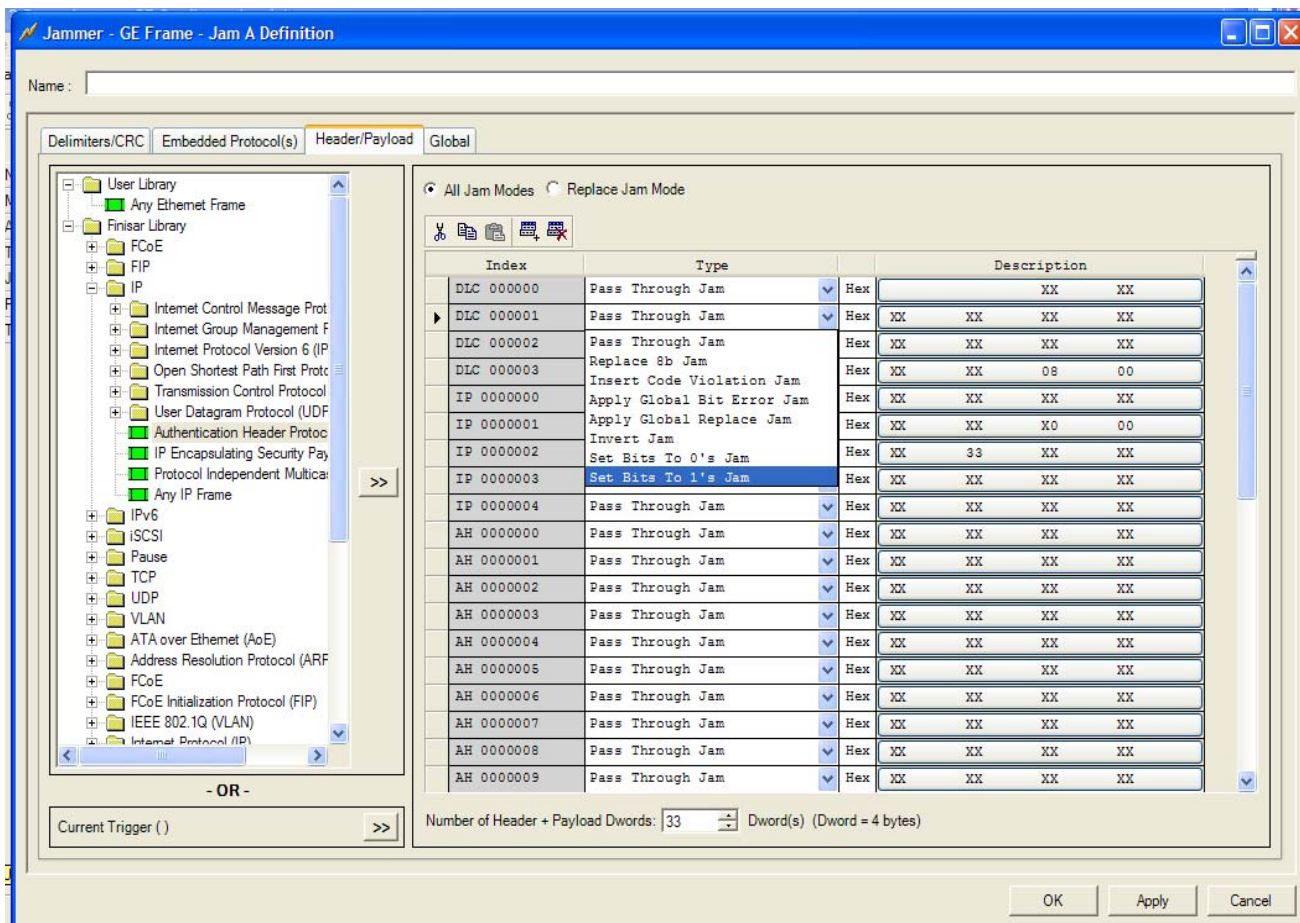
The CRC options include:

- Not changing the CRC in the original target frame
- Recalculating the CRC to make it correct for the modified data
- Replacing with a user-specified data word

Using the Header/Payload Tab for Gigabit Ethernet

You can modify any parameter or word on the Gigabit Ethernet Header/Payload Tab (Figure 150).

Figure 150: Gigabit Ethernet Header/Payload Tab



The Gigabit Ethernet window always shows Jam definitions for the header and 4096 payload words (for the maximum supported 16 Kilobyte jumbo frames). If the frame that is Jammed has less than 4096 payload words, the extra Jam definitions do not take effect. The Jammer does not support Gigabit Ethernet frames larger than 4096 payload words.

Notice the first line of the Jam Definition (Ether 0001) has only the first two bytes of the Destination Address header field. This is to visually orient the frame in the same manner as the Arm and Trigger Condition windows.

Similar to defining an Arm or Trigger Condition, there are two ways to specify your frame Jam Definition. One way is to load a template from the Template Library tree, and the other way is to manually specify bits in the frame.

To use a template:

- 1 Highlight a template in the Template Library tree on the left side of the window.
- 2 Click the double right arrow to display the Jam definition on the right side of the window.

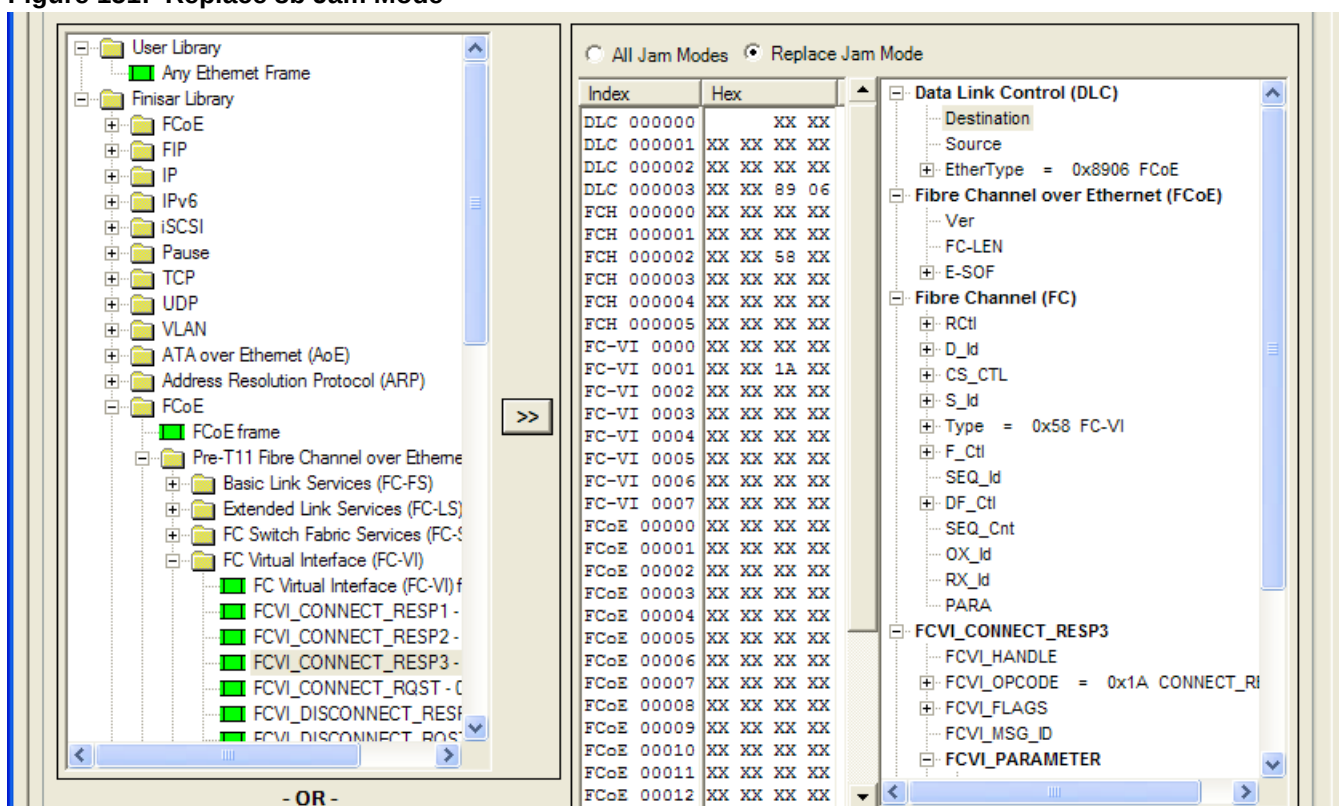
Notice the special choice at the bottom left, “Current Trigger.” This is a copy of the frame condition you have specified for the Trigger. Click the double right arrow to use this.

When you use a template, the Jam definition is populated with Replace Jams of the specified data, while all other bits are passed through.

To manually edit the values, enter a value into the byte field. An **X** in a nibble passes the original value through.

Select the **Replace 8b Jam Mode** radio button to open a dialog that allows you to replace an entire frame either by using a template or manually entering values. The Replace 8b Jam Mode dialog also contains a view of the frame contents, similar to those seen the Arm and Trigger Condition windows. These values correspond to the hex values defined in the center column.

Figure 151: Replace 8b Jam Mode



Selecting the **All Jam Modes** radio button opens a dialog that provides the following choices for each word in a frame on the Header/Payload tab:

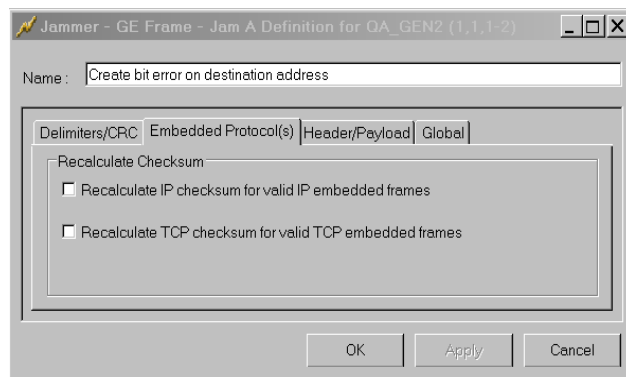
- **Apply Global Match Mask Jam** - This function allows individual bits to be set to 1, set to 0 or passed through unchanged according to the Global Match/Mask defined on the Global tab.
- **Invert Jam** - Invert defined bits and pass through the rest. Enter 1s at the appropriate bit locations.
- **Pass Through Jam** - Pass through the current word unchanged.

- **Replace 8b Jam** - Replace nibbles with new values. Each drop-down represents a byte so you can replace a byte with a standard Ordered Set. If you choose User-defined, you can specify any K/D character. To edit these values, enter a value into the byte field or double-click to display the Binary Editor. If you specify a bit as a 0 or 1, you must specify the values of the other three bits in that nibble also. Any nibbles with an X are passed through.
- **Set Bits To 0s Jam** - Set defined bits to 0s and pass through the rest. Enter 0s at the appropriate bit locations.
- **Set Bits To 1s Jam** - Set defined bits to 1s and pass through the rest. Enter 1s at the appropriate bit locations.
- **Apply Global Bit Error Jam** - Apply the Global Bit Error function set on the Global tab.
- **Insert Code Violation Jam** - Introduce a predefined, fixed code violation to a byte in that word. Which byte is corrupted depends on the alignment orientation of the frame. The Jam Definition of the word before a Code Violation Jam must always be a Pass Through Jam. A Code Violation Jam cannot be placed in the first word of a frame (Ether 0001).

Using the Embedded Protocol(s) Tab for Gigabit Ethernet

Figure 152 shows the Embedded Protocol(s) tab for Gigabit Ethernet. The available functions are described in this section.

Figure 152: Gigabit Ethernet Embedded Protocol(s) Tab



Recalculate Checksum

Select the check boxes to choose recalculation of IP and TCP checksums.

Recalculate IP checksum for valid IP embedded frames

Checking this option replaces the IP checksum in the Jammed frame with a recalculated value. For the checksum to be inserted properly, the frame, after Jamming takes place, must have a Gigabit Ethernet header EtherType field value of 0x0800 and a valid IP header IHL field.

Recalculate TCP checksum for valid TCP embedded frames

Checking this option replaces the TCP checksum in the Jammed frame with a recalculated value. For the checksum to be inserted properly, the frame, after Jamming takes place, must meet the same requirements as those listed for the IP checksum, and, in addition, have an accurate IP header Total Length field, an IP header IP Protocol field value of 0x06, and a valid TCP header Data Offset field.

Also, the Jumbo Frames setting (see “[GigE Jumbo Frames](#)” on page 147) must be correct for the TCP checksum insertion to work. If the Jammed frame is “normal size” (1500 Gigabit Ethernet payload bytes or less) then either setting is correct. If the Jammed frame is a jumbo frame (16 KB Gigabit Ethernet payload bytes or less), then you must select the jumbo setting. The Jammer does not support recalculating the TCP checksum for larger frames.

The TCP checksum recalculation is not available when using the Repeat Jam feature.

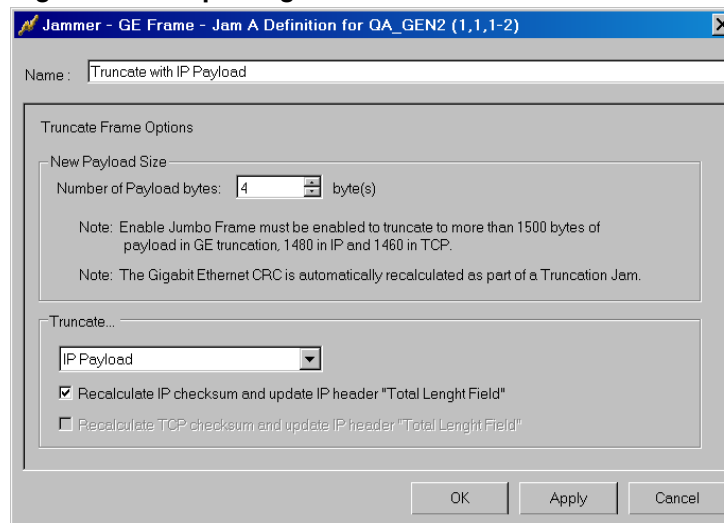
Replace Frame with Truncated Frame

This option truncates the target frame to a shorter length and sends Idles (I2) on top of the remainder of the target frame.

In the Truncate Frame Options window:

- 1 Choose the type of payload you want to truncate from the drop-down menu:
 - Gigabit Ethernet
 - IP
 - TCP
- 2 Enter the number of bytes you want the payload to be truncated to (this does not include the CRC or other delimiters).

Figure 153: Replacing a Frame with a Truncated Frame



Gigabit Ethernet Payload

For a Gigabit Ethernet payload, the New Payload Size setting specifies how many bytes to leave after the Gigabit Ethernet header (the first 14 bytes of the frame). For normal sized frame support, you can specify from 0 to 1500 bytes, and for jumbo sized frame support, you can specify from 0 to 16383 bytes. If the target frame is shorter than the specified number of bytes, then no Jamming occurs.

IP Payload

For an IP payload, the New Payload Size setting specifies how many bytes to leave after the IP header. For normal sized frame support you can specify from 0 to 1480 bytes, and for jumbo sized frame support, you can specify from 0 to 16364 bytes. You also have the option to replace the IP checksum with a recalculated value, which also automatically updates the IP header Total Length field.

For the truncation or the IP checksum option to work properly, there are some requirements of the incoming target frame. The frame must have a Gigabit Ethernet header EtherType field value of 0x0800, a valid IP header IHL field, and a valid IP header Total Length field. If the Jammed frame is shorter than the specified number of bytes, then no truncation occurs, but the IP checksum can be recalculated if you select it.

TCP Payload

For a TCP payload, the New Payload Size setting specifies how many bytes to leave after the TCP header. For normal sized frame support you can specify from 0 to 1460 bytes, and for jumbo sized frame support you can specify from 0 to 16344 bytes. You also have the options to replace the IP and/or TCP checksums with recalculated values (either option also automatically updates the IP header Total Length field).

For the truncation to occur and for the checksum options to work, the incoming target frame must meet the same requirements listed earlier for IP payload truncation, and, in addition, have an IP header IP Protocol field value of 0x06 and a valid TCP header Data Offset field. If the Jammed frame is shorter than the specified number of bytes, then no truncation occurs, but the checksums can be recalculated if you select them.

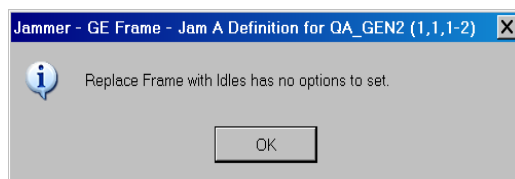
In addition, TCP checksum recalculation is not available when using the Repeat Jam feature.

For any successful truncation, the Gigabit Ethernet CRC is automatically replaced with a recalculated value.

Replace Frame with Idles

This option replaces the target frame with I2 Ordered Sets in the Gigabit Ethernet Jammer.

Figure 154: Gigabit Ethernet - Replace Frame with Idles



Chapter 14

Creating Jammer Test Configurations for SAS and SATA/STP

In this chapter:

- [Defining Your Own SAS and SATA/STP Test Configurations](#)
- [Using the Jammer Configuration Window](#)
- [Configuring SAS Arm and Trigger Conditions](#)
- [Configuring the SAS Jam Definition](#)
- [Configuring SATA/STP Arm and Trigger Conditions](#)
- [Configuring the SATA/STP Jam Definition](#)

Defining Your Own SAS and SATA/STP Test Configurations

Xgig Jammer lets you define your own test configurations and save them with or without hardware available.

You can create a configuration from scratch, or you can open and edit an existing configuration. Also, you can edit a configuration in edit only mode, which is independent of any hardware, or you can edit a configuration that is currently loaded to a Jammer device.

To edit a configuration in edit only mode:

>> Double-click on a configuration file in the Configuration manager.

Or:

>> Right-click on the configuration in the Configuration manager and choose **Edit Jammer Configuration** from the context menu.

The edit only mode Jammer Configuration window opens.

This window allows you to set up your own Test Cases, name them, organize them, and save them to files so that you can use them again.

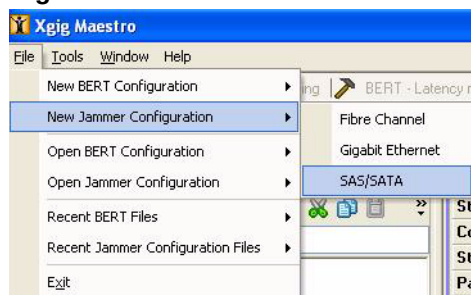
To start a configuration from scratch in edit only mode:

>> Select **New Jammer Configuration** from the context menu or the File menu (Figure 155) on the Xgig Maestro menu bar.

Or:

>> Click the New Configuration icon at the top of the Configuration manager with the appropriate protocol selected next to it.

Figure 155: Maestro File Menu



To save your configuration in edit only mode:

>> Click **Save** at the bottom of the Jammer Configuration window or open the File menu on the Jammer Configuration window and select **Save Configuration** or **Save Configuration As**.

Any changes you make have no effect on actual Jammer devices you control.

To edit a configuration that is loaded to a Jammer port:

>> Click **Configuration...** in the device column on the Parameters Status table.

Or:

>> Right-click in the Parameters Status table in the device column to open the context menu and select **Edit configuration**.

Or:

>> Highlight the configuration file in the Configuration manager, open the context menu, and select **Edit Configuration**.

Or:

>> Click **Operation** in the device column to open the Operation dialog, then click **Config**.

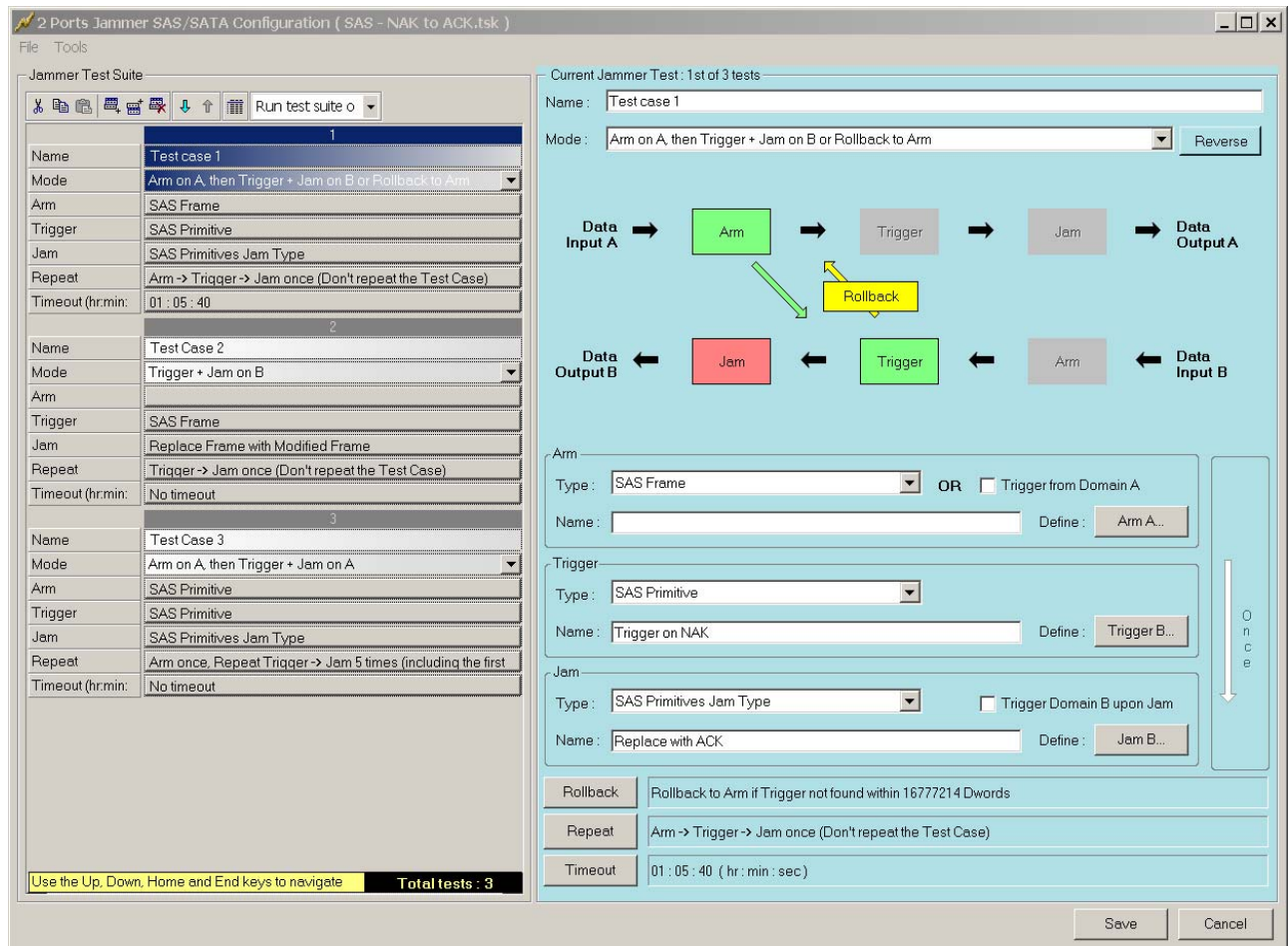
The Xgig Jammer Configuration window in hardware edit mode is displayed (Figure 156). This window allows you to set up your own Test Cases, name them, and save them to a file so that you can use them again.

Click **Apply** or **OK** and Jammer accepts the changes. They are immediately reflected in the Parameters Status table and affect the Jammer device the next time you run it.

To save your configuration edits:

>> Open the File menu at the top of the Jammer Configuration window and select **Save Configuration As...** or **Save Configuration**.

Figure 156: Xgig SAS and SATA/STP Jammer Configuration Window



Using the Jammer Configuration Window

The Jammer Configuration window title bar indicates how many ports it is configuring, the protocol, and the configuration file name, if any. If you are using hardware edit mode, the chassis name, chassis number, slot number, and port numbers are also listed. The components of the Jammer Configuration window are described in the following sections.

Using the Jammer Test Suite Tools

The Test Suite, the pane on the left side of the configuration window, lists the series of Xgig Jammer tests in the order in which you want them to execute ([Figure 157](#)). The suite includes one or more tests. The highlighted test appears as the Current Jammer Test on the right side of the window. Each test in the suite executes in sequence with a set up time from the end of one test to the start of the next of approximately 130 (200 max) milliseconds.

Figure 157: SAS/SATA Jammer Test Suite Windows

Card View

Jammer Test Suite

Repeat test suite

1	
Name	Expander Test Case #1
Mode	Arm on A, then Trigger + Jam on B or Rollback to
Arm	SAS Frame
Trigger	SAS Primitive - Triple Primitive Sequence
Jam	SAS Primitives Jam Type
Repeat	Arm once, Repeat Trigger -> Jam 3 times (including t
Timeout (hr:min:sec)	01 : 05 : 40

2	
Name	Expander Test Case #2
Mode	Trigger + Jam on B
Arm	
Trigger	SAS Frame
Jam	Replace Frame with Modified Frame
Repeat	Trigger -> Jam once (Don't repeat the Test Case)
Timeout (hr:min:sec)	No timeout

3	
Name	Expander Test Case #3
Mode	Arm on A, then Trigger + Jam on A
Arm	SAS Primitive - Redundant Primitive Sequence
Trigger	SAS Primitive - Triple Primitive Sequence
Jam	SAS Primitives Jam Type
Repeat	Arm once, Repeat Trigger -> Jam 5 times (including t
Timeout (hr:min:sec)	No timeout

Use the Up, Down, Home and End keys to navigate

Total tests: 3

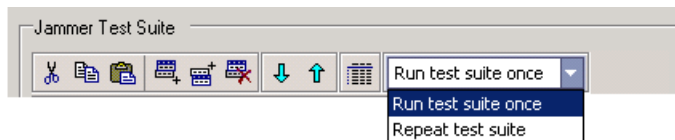
List View

	Name	Mode	Arm	Trigger	Jam	Repeat	Timeout (hr:min:sec)
1	Expander Test Case #1	Arm on A, then Trigger +	SAS Frame	SAS Primitive - Tr	SAS Primitives Ja	Arm once, Repeat	01 : 05 : 40
2	Expander Test Case #2	Trigger + Jam on B		SAS Frame	Replace Frame wi	Trigger -> Jam on	No timeout
3	Expander Test Case #3	Arm on A, then Trigger +	SAS Primitive - R	SAS Primitive - Tr	SAS Primitives Ja	Arm once, Repeat	No timeout

Using the SAS/SATA Jammer Test Suite Toolbar

When you create a SAS/SATA Jammer Test Suite, you use the toolbar in the Jammer Test Suite section of the Configuration window (Figure 158).

Figure 158: SAS/SATA Jammer Test Suite Toolbar



The following list describes the icons on the toolbar:

	Cut current test	Removes the highlighted test and holds its contents in the memory buffer.
	Copy current text	Copies the highlighted test to the memory buffer.
	Paste last test cut or copied	Inserts the current memory buffer contents before the currently highlighted test.
	Add new test to bottom of stack	Adds a new blank test to the bottom of the suite.
	Insert new test before current test	Inserts a new blank test above the currently highlighted test.
	Delete current test	Removes the highlighted test from the suite. If only one test is present, then the contents of this test are cleared.
	Move current test down the stack	Moves the highlighted test down one in the test order.
	Move current test up the stack	Moves the highlighted test up one in the test order.
	Toggle view	Toggles Test Suite between Card View and List View.
	Run test suite once or Repeat test suite	When you choose Repeat test suite, the tests run continuously from the top of the Test Suite to the bottom and loopback to the top until you click stop.

Using the Context Menu

The same operations (Cut, Copy, Paste, etc.) can be performed with the options available in the Context menu. In addition, the direction of an individual test can be reversed by selecting the 'Reverse Current' option. To reverse the direction of all tests, select the 'Reverse All' option.

Using the Configuration Menus

Two menus are available in the Configuration window: **File** and **Tools**.

The choices on the File menu are:

Import to Selected Test	Import a Test Case from a .tst file or an entire test suite, .tsk file, to the currently highlighted position. A Test Case is one test in the Jammer Test Suite.
Export Selected Test	Export and save the currently highlighted test to a .tst file.
Save Configuration	Save the entire Test Suite to the .tsk file you currently have loaded.
Save Configuration As	Save the entire Test Suite to a .tsk file with a name you assign to it.
Close	Close the Jammer Configuration Window.

The recently used FC Jammer configuration files appear in the file menu and are loaded when selected.



Note: The .tst files are only for storing individual Test Cases and swapping them between configuration files. You cannot load .tst files directly into a Jammer device on the Xgig Maestro window.

The Tools menu in the SAS/SATA Configuration window lets you open the SAS Hashed Address Calculator.

The SAS Hashed Address Calculator is also available by clicking the Hashed ID button at the bottom right corner of the SAS Frame Arm or Trigger Condition windows.

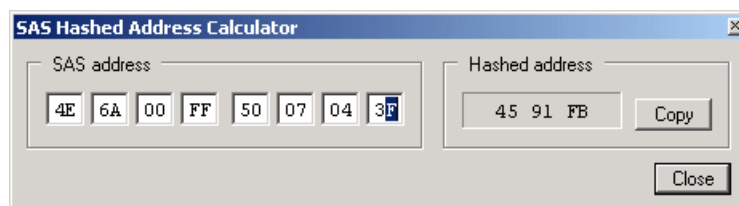
SSP frames use a hashed address that is derived from the SAS device address. The SAS Hashed Address Calculator allows you to calculate the hashed address from the SAS address. You must use the hashed address when setting an Arm Condition, Trigger Condition, or Jam Definition for an SSP frame.

To determine the hashed address:

>> Type the SAS address into the calculator.

The hashed address updates on the right.

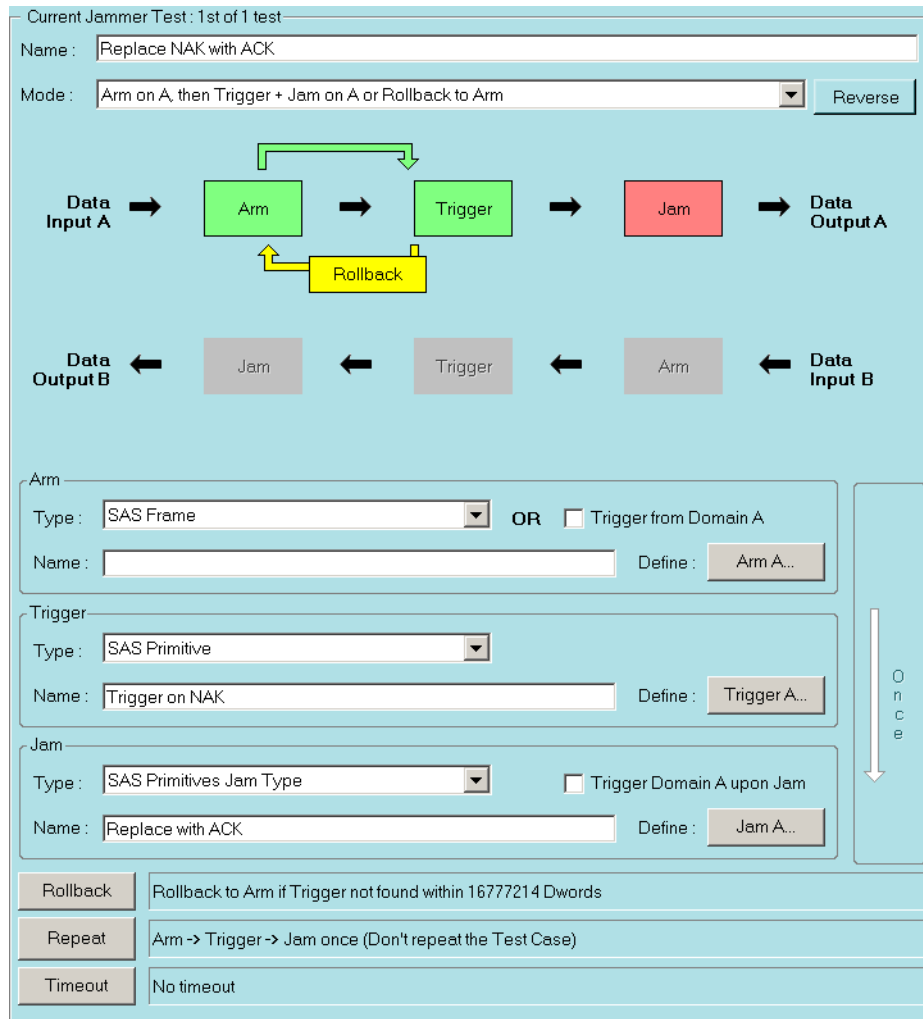
Figure 159: SAS Hashed Address Calculator



Using the Current Jammer Test Window

The graphics in this section of the window represent the hardware configuration for the selected test in the Jammer Test Suite (Figure 160).

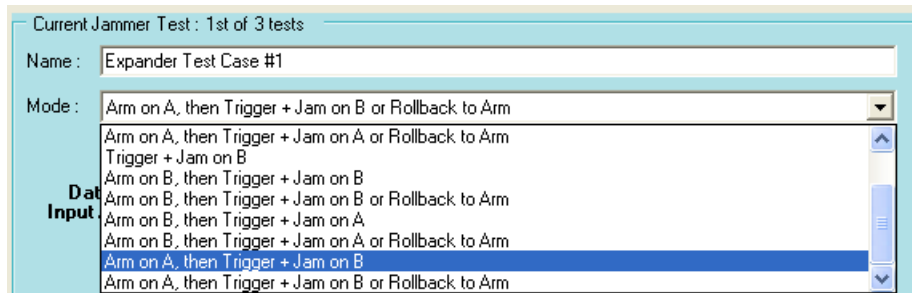
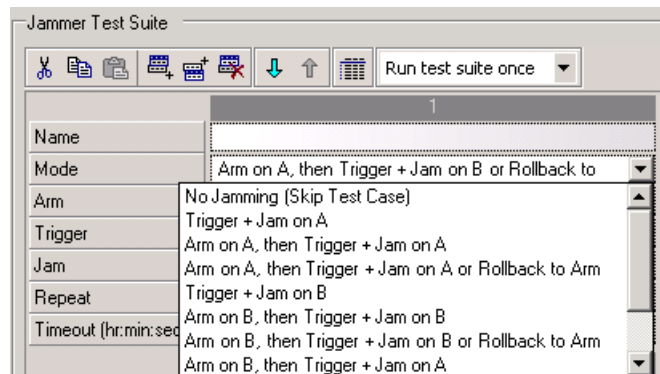
Figure 160: Current Jammer Test Window



Mode

For SAS/SATA, Mode menus are available near the top of the Current Jammer Test window (Figure 161) and also near the top of each Test Case in the Jammer Test Suite window (Figure 162).

The input to path A (on top) is always port A and the input to path B (on the bottom) is always port B. The external trigger input and output that are available on path A always are linked to the domain shown on the Xgig Maestro window as “Domain of port A.” The trigger input and output on the bottom on path B are in the “Domain of port B.”

Figure 161: Mode Drop-down Menu in Current Jammer Test - Right Pane**Figure 162: Mode Drop-down Menu in Test Suite - Left Pane**

Reverse

You can reverse the direction of the jam by selecting the Reverse button.

Arm and Trigger

To define Arm and Trigger conditions, select a respective Type from each drop-down menu. Then click the Arm or Trigger button to open the corresponding definition window.

You can use an external input as an Arm condition. Check Trigger from Domain A (or B) to enable this feature. You must put the corresponding Jammer port into a domain for this to work properly.

The Trigger event can be in the next Dword after the Arm event in the traffic stream.

Jam

To define a Jam:

- 1 Select a Type from the drop-down menu, if available.
- 2 Click the Jam button to open the Jam Definition window.

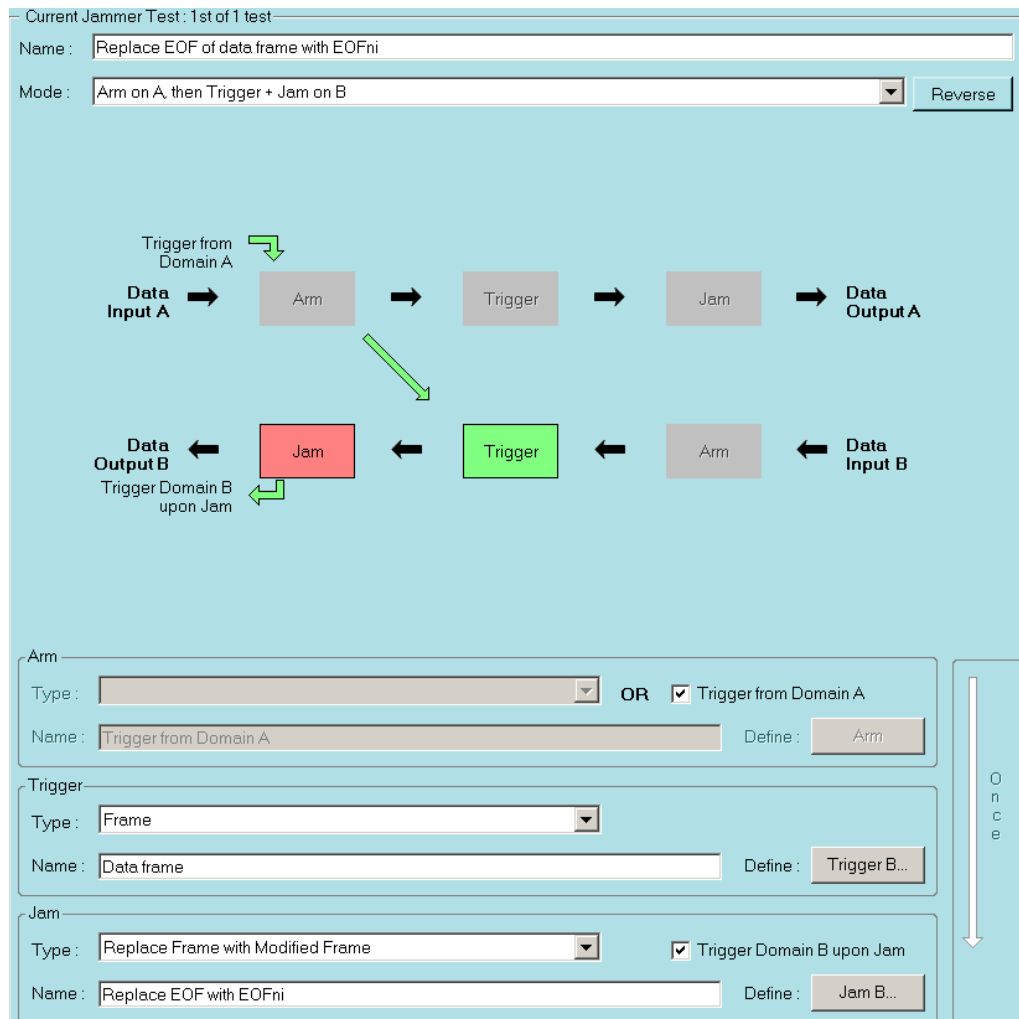
The Jam Definition specifies the modifications to be made to the traffic matching the Trigger Condition.

In addition, the Jammer port can trigger out to the Domain it is in when a Jam takes place. Check Trigger Domain A (or B) upon Jam to enable this feature.



Note: If you use an external trigger input to define the Arm condition, then you cannot select the external trigger output for that path in that Test Case, and vice versa. For information regarding using the trigger input and output during a Test Case, refer to [“Using Domains and External Triggering” on page 319](#). However, you can use an external trigger in on port A with an external trigger out on port B, and vice versa. [Figure 163](#) shows an example.

Figure 163: Trigger In and Trigger Out



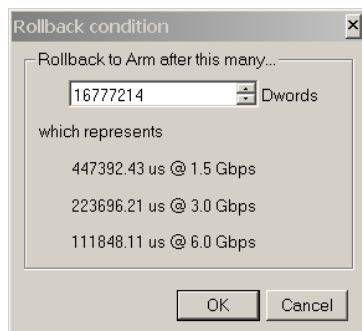
Rollback

The Rollback option defines the time or Dword count parameter between the Arm and Trigger events. If the Trigger does not follow the Arm event in the allotted time or Dword count, the Jammer begins looking for the Arm event again. Click **Rollback** to display the dialog shown in Figure 164.



Note: This value is saved in terms of Dwords, not time, so keep this in mind if you save a Test Case using a device running at 3.0 Gbps and later open the configuration on a Jammer running at 1.5 Gbps.

Figure 164: Rollback Condition Dialog



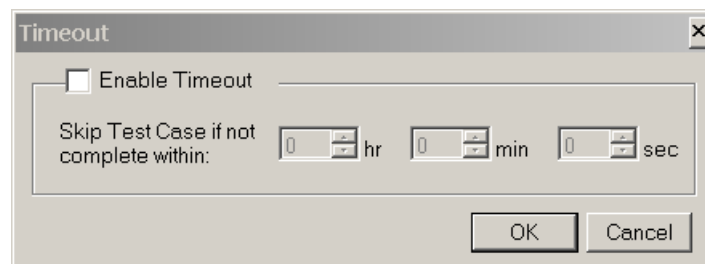
Timeout

The timeout option defines the period of time to wait for a specified test to complete before aborting and proceeding to the next test in the suite.

To set the timeout:

- 1 Click **Timeout** to display the dialog box in Figure 165.
- 2 Check **Enable Timeout**.
- 3 Enter the hours, minutes, and seconds you want to wait.

Figure 165: Timeout Dialog

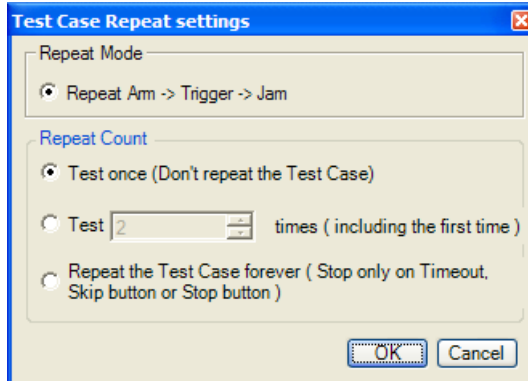


- 4 Click **OK**.

Repeat

Click **Repeat** to open the dialog shown in [Figure 167](#). For Basic Jammer Configurations, the Repeat Mode setting allows you to configure what is repeated when using an Arm condition. The Repeat Mode option means that the Jammer must match the Arm condition each time before looking for a Trigger. The Repeat Count allows you set the number of times a test case is repeated.

Figure 166: Repeat Test Dialog - Basic Jammer Configuration



For Advanced Jammer Configurations, this setting allows you to configure what is repeated when using an Arm or Trigger condition. The **Repeat** dialog uses counters to provide an increased level of control over the Jam allowing you to skip over extraneous instances of the arm or trigger condition and target the precise data you want to Jam.

You can force the Jammer to match the Arm condition a given number of times before triggering, and you can skip a given number of occurrences of the trigger before Jamming. Once you reach the Jam, you can Jam all occurrences of the trigger condition forever or jam a given number of sequential occurrences of the trigger condition.

Unless you select to Jam forever, you can choose to repeat all or part of the arm-trigger-Jam process either returning to the pre-armed state waiting for another occurrence of the arm condition or returning to the armed state waiting for another occurrence of the trigger condition.

The Repeat Mode option means that the Jammer must match the Arm condition each time before looking for a Trigger. The Repeat Count allows you set the number of times a test case is repeated.

Figure 167: Repeat Test Dialog- Advanced Jammer Configuration

Test Case Counters and Repeat Settings

Step 1: Wait for occurrence(s) of the Arm Condition.

Step 2: Then, ignore the next occurrence(s) of the Trigger Condition before Triggering and Jamming.

Step 3: ☐ Jam (sequential) occurrence(s) of the Trigger Condition.

☒ Jam all occurrences of the Trigger Condition forever (Stop only on Timeout, Skip button or Stop button).

Step 4: Then ☐ begin Step 1 again.

☐ begin Step 2 again.

Repeat Count

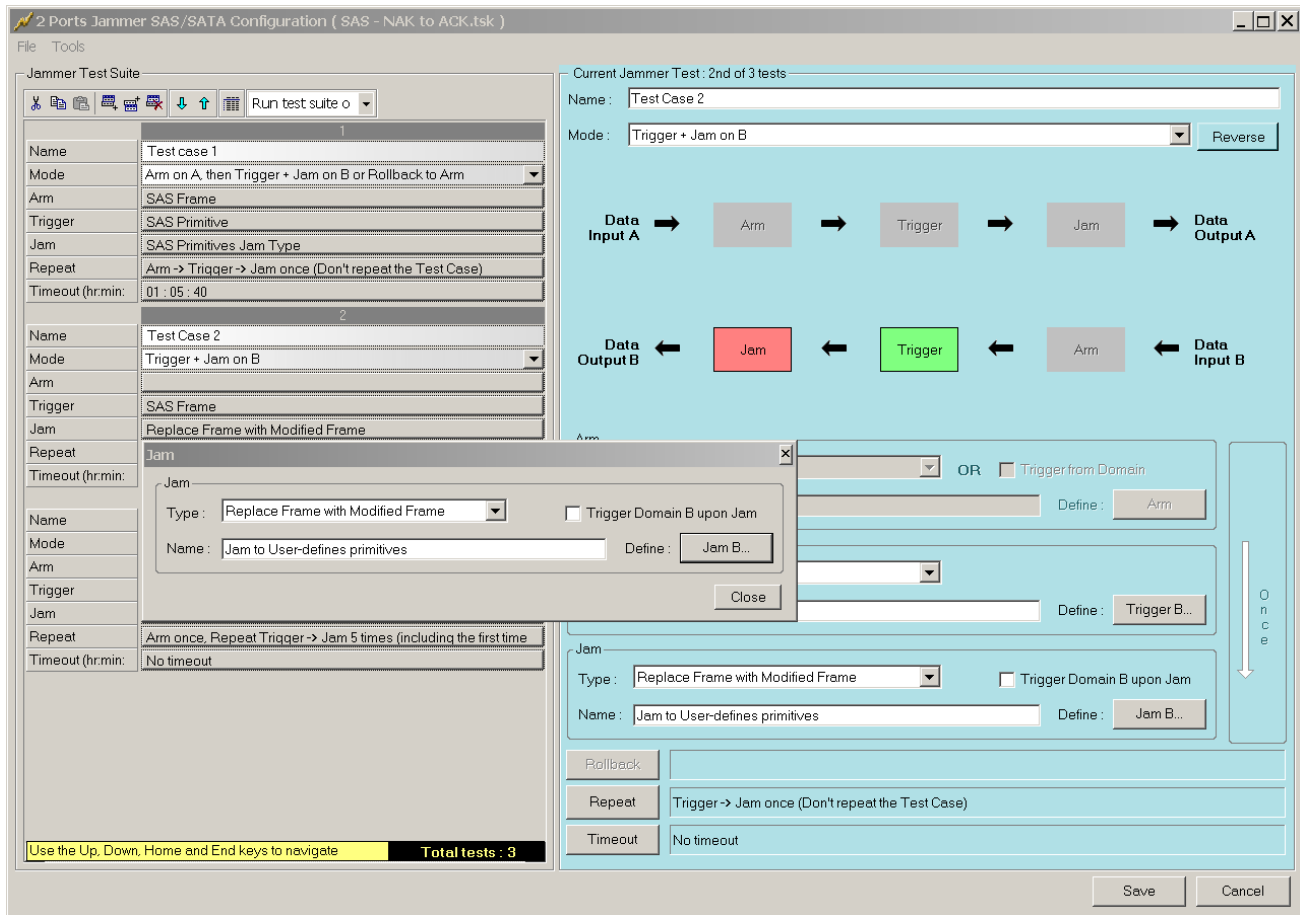
☐ Test once (Don't repeat the Test Case)

☒ Test times (including the first time)

☐ Repeat the Test Case forever (Stop only on Timeout, Skip button or Stop button)

OK Cancel

You can also configure options for each Test Case directly in the Test Suite, instead of clicking in the Current Jammer Test pane. Click on the area of the Test Case you want to modify to open the corresponding dialog (Figure 168).

Figure 168: Configuring Options Directly in the Test Suite

Configuring SAS Arm and Trigger Conditions

SAS Arm and Trigger conditions recognize specific frames or Primitives.

For Frame conditions, you can specify SOF, SOAF, or either (use all Xs for “either”). You can specify up to 31 additional Dwords after the SOF or SOAF.

You can also define a wildcard specifying bits to be masked out of an arm word and passed through in the corresponding trigger word.

For Primitive Conditions, you can choose from groups of Single, Extended, Triple, or Redundant Primitive Sequences.

For a Single Primitive Sequence, you can specify any standard Single Primitive Sequence or you can specify any user-defined 4 bytes of K/D characters (of which standard Primitives are a subset). You can also specify where you want the Jammer to look for the matching Dword: only inside frames, only outside frames, or anywhere.



Note: The Jammer does not look for any matching conditions during OOB initialization or Speed Negotiation.

For Triple, Extended, and Redundant Primitive Sequences, you can choose any standard Extended, Triple or Redundant Primitive Sequence. To match the condition, the Jammer only needs to match one valid Primitive.

The Arm and Trigger windows are identical. In addition, you can select the domain triggered input as an Arm condition.

Depending on the Mode you select, the appropriate graphic diagram shows the Trigger and optional Arm conditions, along with the Jam event. If the Mode you select does not include an Arm condition, the Arm button remains disabled.

To set Arm and Trigger conditions:

- 1 Click on the **Arm** or **Trigger** button in the Jammer Configuration window.

The window for the condition is displayed (Figure 169). If you are in hardware edit mode, the protocol, chassis name, chassis number, slot number, and port numbers are displayed in the title bar.

- 2 Set the values as required to specify a unique Arm and Trigger sequence for the specific test.

The following sections describe the available values.

Figure 169: SAS Frame Arm and Trigger Window Examples

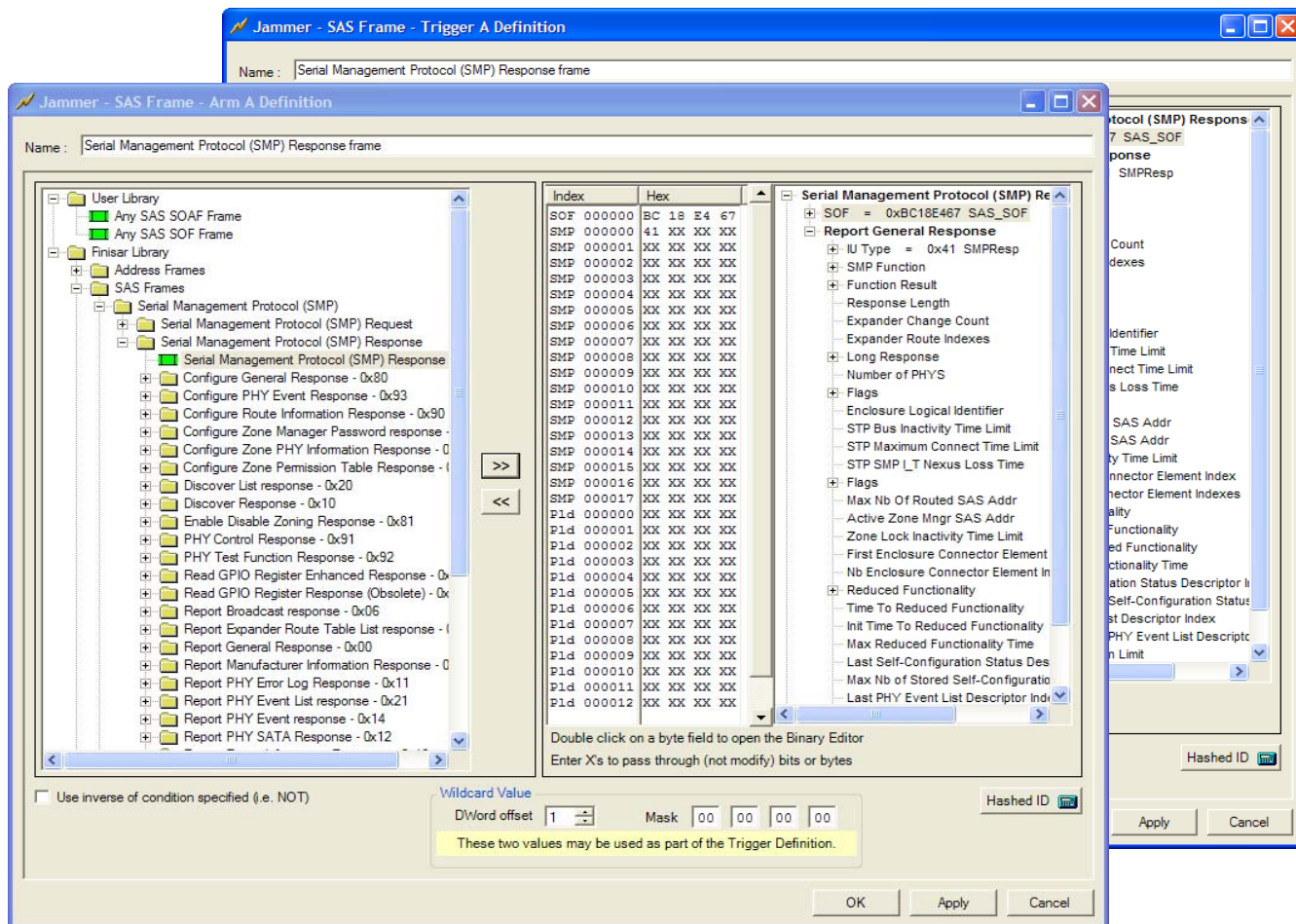
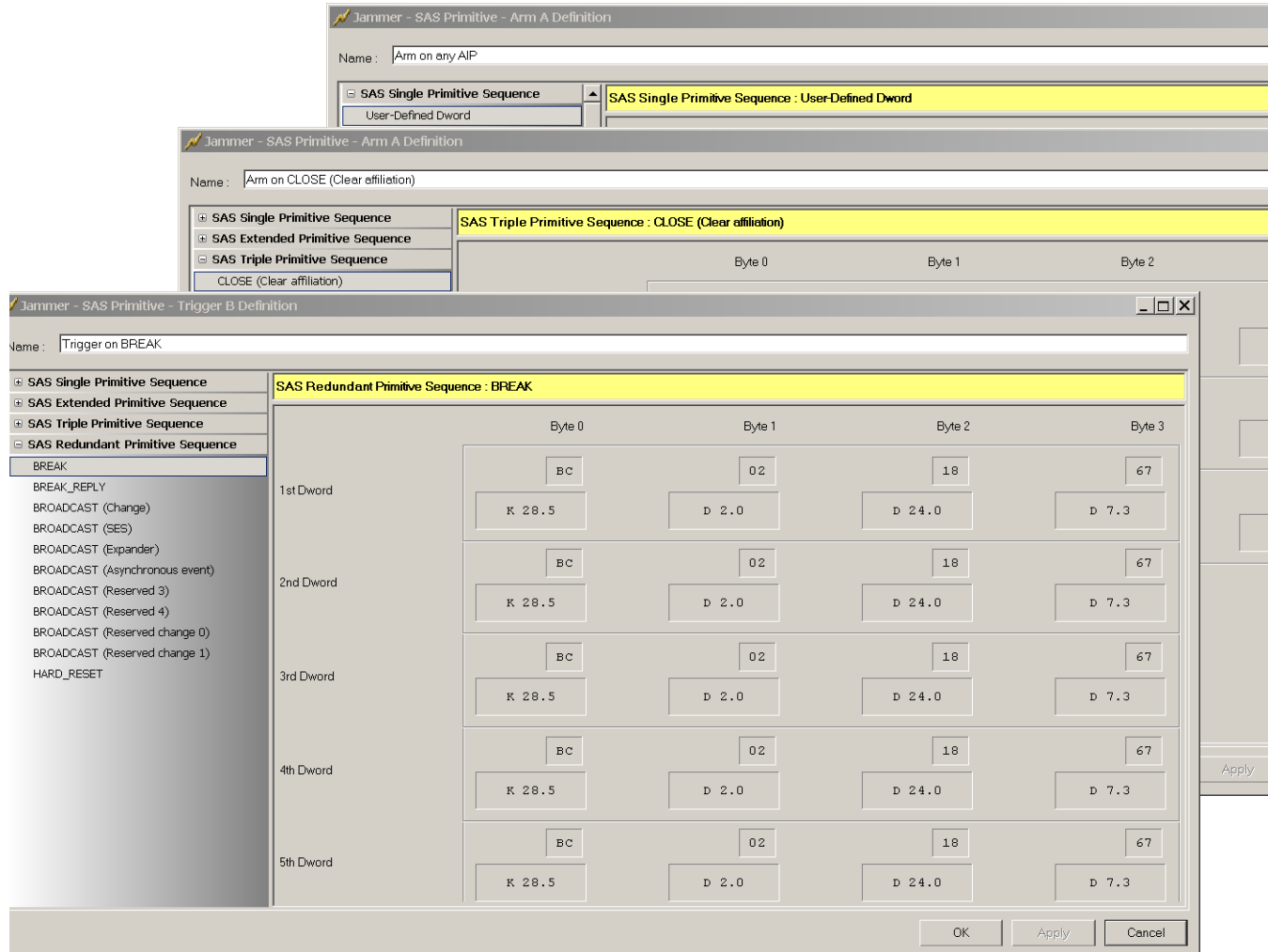


Figure 170: SAS Primitives Arm and Trigger Window Examples

Setting Frame Conditions

You can specify frame conditions in three ways:

- Load a template from the Template Library tree
- Manually specify bits in the frame
- Select fields from the tree view in the right pane

To use a template:

- 1 Select a template from the Template Library tree on the left.
- 2 Click the double right arrow button to set the Frame Condition.

The condition is indicated on the right side of the window.

To manually specify a frame:

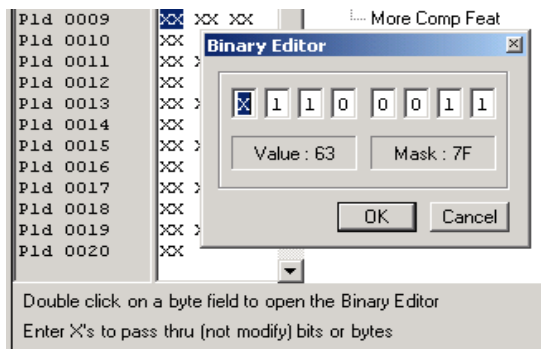
>> Type hexadecimal values directly into the center column of the window.

An X represents a nibble that can be any value (a “don’t care”).

To set individual bits in any field, double-click on the hex entry to open the Binary Editor (Figure 171). In the hex view, partially defined hex characters appear as question marks: X001=?

When you use the tree view, values are automatically entered into the center column in the right window pane.

Figure 171: Binary Editor Dialog



Saving a Frame Condition

If you create a frame condition that you want to save and make easily available for future use, you can save it into the “User Library” folder in the Template Library tree. To do this:

>> Click the double left arrow button.

Frame conditions have the option of “Use inverse of condition specified (i.e. NOT).” When you check this option, it means that the first frame encountered that does not match what you have specified creates a “condition met” event.

For each frame condition, you can specify an optional name at the top of the window. This name is also shown on the Jammer Configuration window under the Type selection, and on the main Xgig Maestro window.

Setting Primitive Sequence Conditions

You can choose a Primitive Sequence from any of the categories listed on the left side of the window: Single, Extended, Triple, or Redundant. For Single Primitives, you can also choose where to match: anywhere, only outside of frames, or only inside of frames.

Single Primitives include a User-defined option.

To edit the user-defined value:

>> Type a hex value into the byte field.

Or

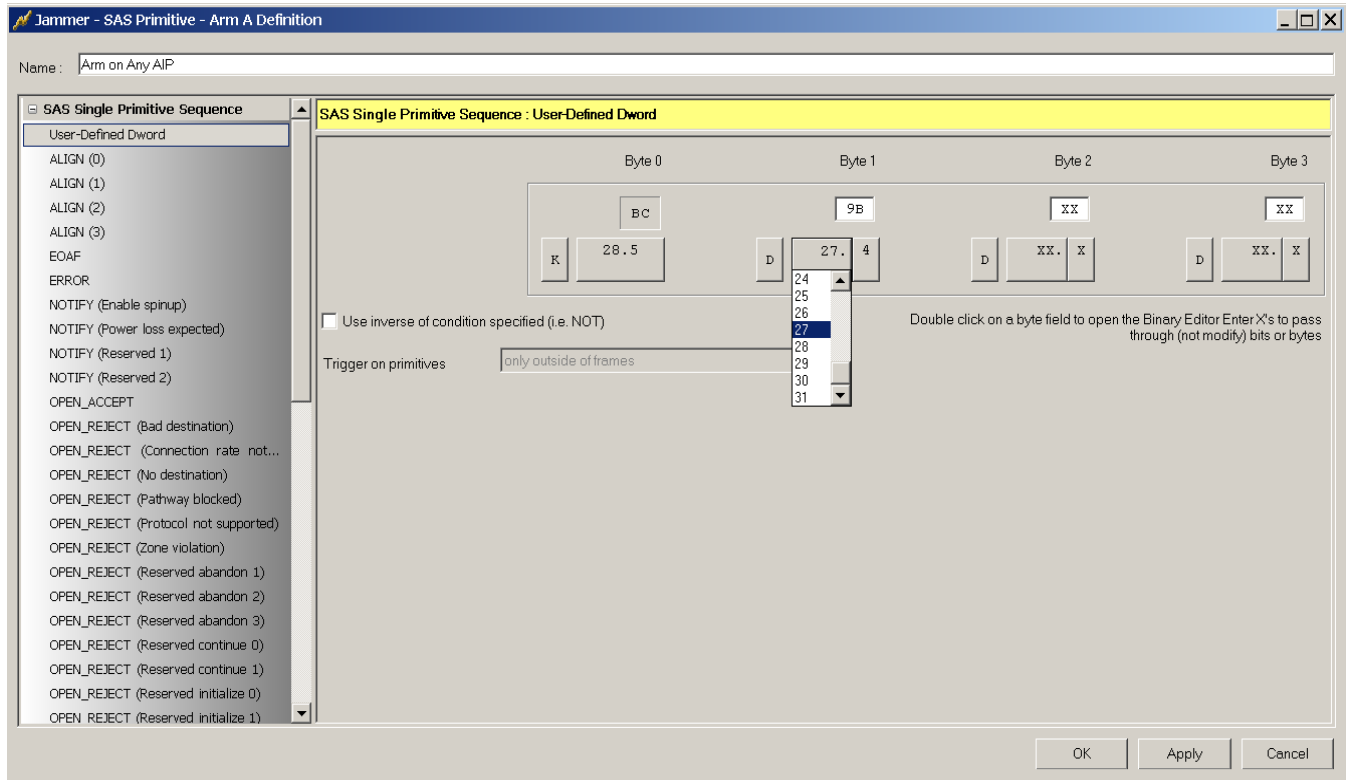
>> Double-click on a byte field to open the Binary Editor.

As in frame conditions, an X indicates “don’t care” and a ? indicates a partially specified hex character.

Or

>> Click to toggle between K and D, and choose data from the drop-down menu of legal 8-bit characters.

Figure 172: Selecting K and D Legal 8-bit Characters



You can also check the “Use inverse of condition specified (i.e. NOT)” option; this means the first word encountered that does not match what you have specified creates a “condition met” event.

As with frame conditions, you can specify an optional name at the top of the window. This name is also shown in the Jammer Configuration window under the Type selection and on the main Xgig Maestro window.

Configuring the SAS Jam Definition

The SAS **Jam Definition** window defines how to modify the event specified on the **Trigger Condition** window.

The Jam is always the same type (frame or Primitive Sequence) as the Trigger.

For any Jam Definition, you can specify an optional name at the top of the window. This name is also displayed on the Jammer Configuration window under the Type selection and on the main Xgig Maestro window.

Jamming a Frame

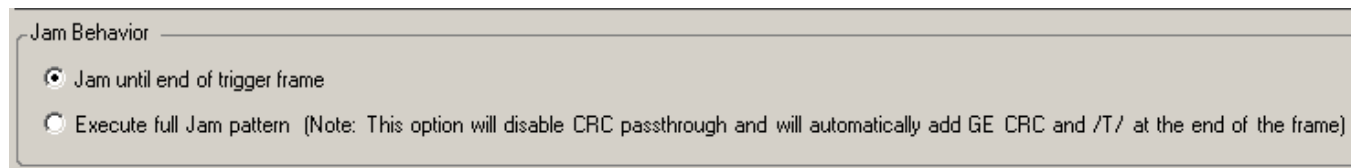
If the Trigger Event is a frame, click the **Jam** button on the Jammer Configuration window to open the Frame Jam Definition window.

The content of the Jam Definition window corresponds to the type of frame Jam you choose on the Jammer Configuration window (modify frame, truncate frame, or replace frame with Idles). The following paragraphs describe these choices.

Jam Behavior

This controls the number of user-defined header/payload Jams performed relative to the target trigger frame. The **Jam Behavior** section is present on all tabs of the **Frame Jam Definition** window.

Figure 173: Jam Behavior Selection



- Jam until end of trigger frame

Jams defined in the Header/Payload tab are performed until the end of the target trigger frame (or until an abnormal termination of the frame). All Jams defined that would take place on the original CRC or later are ignored. However, if the frame that is triggered on has more Dwords than the Jams you specify, the remaining Dwords are passed through. The CRC and EOF of the original target trigger frame are always jammed according to the CRC and EOF settings on the SOF/CRC/EOF tab. This is the standard way to Jam a frame.

- Execute full Jam pattern

All header and payload Jams take place, even if they overwrite beyond the end of the target trigger frame. Use the control at the bottom of the Header/Payload tab to define how many Jams should take place.

The last defined Jam is the last Header/Payload Jam. The options for modifying the CRC and EOF on the SOF/CRC/EOF tab are unavailable.

If the target trigger frame is longer than the number of Jams defined, then the portion of the target trigger frame that extends after the last defined Jam is overwritten with Idles. If the target trigger frame is shorter, then the Jammer switches back to pass-through immediately after the last defined Jam.



Note: Be careful when using this option because you may overwrite a portion of important traffic (a frame or Flow Control Primitives).

Replace Frame with Modified Frame

Each tab contains options relevant to different frame modifications.

Using the Global Tab

Use this tab (Figure 174) to define Jam parameters that apply globally to the frame.

Global Replace Jam Option

Use the Global Replacement Dword to set specific bits in a Dword to 1 or 0 while passing through the remaining bits. You can apply this global replacement to any Dword in the frame. Define one Global Replacement for each Test Case.

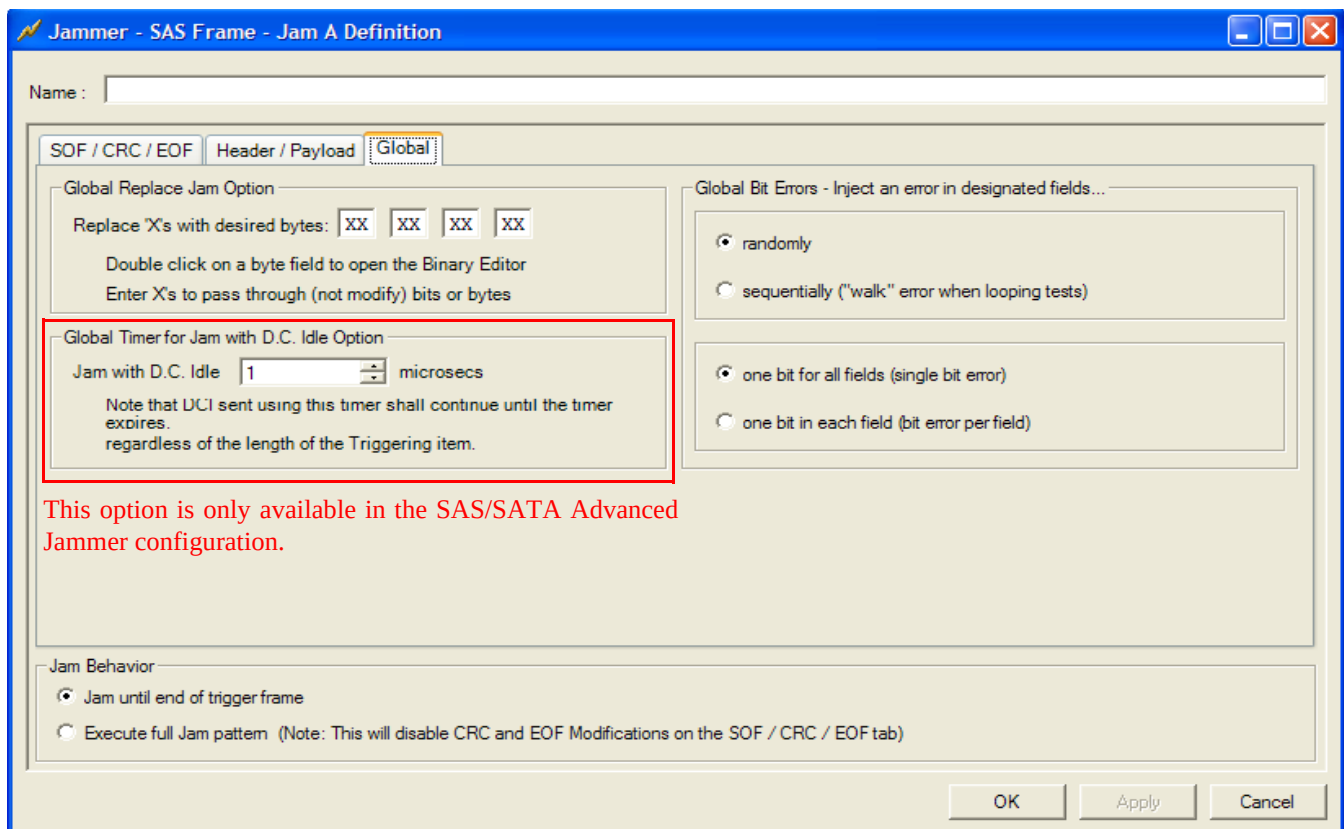
To edit these bits:

>> Enter hex values, or double-click on a byte field to open the Binary Editor.

Any bits left as Xs are passed through.

The difference between this Global Replacement option versus the Replace Dword option found on the Header/Payload tab is that the Global Replacement option allows masking down to the bit level, whereas the other option allows masking at the nibble level.

Figure 174: SAS Global Tab



This option is only available in the SAS/SATA Advanced Jammer configuration.

Global Bit Errors

The Jammer software can introduce bit errors repeatedly in sequential or random fashion to predefined fields. These bit errors are introduced to the 32-bit form of the target Dwords (not the 40-bit form) so code violations are not created. The Global Bit Errors control allows you four options.

- Select **one bit for all fields** and **randomly**. This causes the Jammer to inject a single bit error in the group of all fields selected in the header or payload for a single Test Case. If the Jammer Test Suite is set to *loop*, then single bit errors are randomly injected into these fields, with one bit for each cycle of the Test Suite.
- Select **one bit for all fields** and **sequentially**. This also injects a single bit error in the group of all fields selected in the header or payload. If the Test Suite is set to loop forever, the bit error walks through all the selected fields.
- Select **one bit in each field** and **randomly** does the same thing as the first option; however, there will be one error for each Dword selected in the header or payload.
- Select **one bit in each field** and **sequentially** does the same thing as the second option; however, there will be one error for each Dword selected in the header or payload.



Note: The location of the bit errors are moved each time you run this entire Test Case, not each time you repeat the Jam within the Test Case.

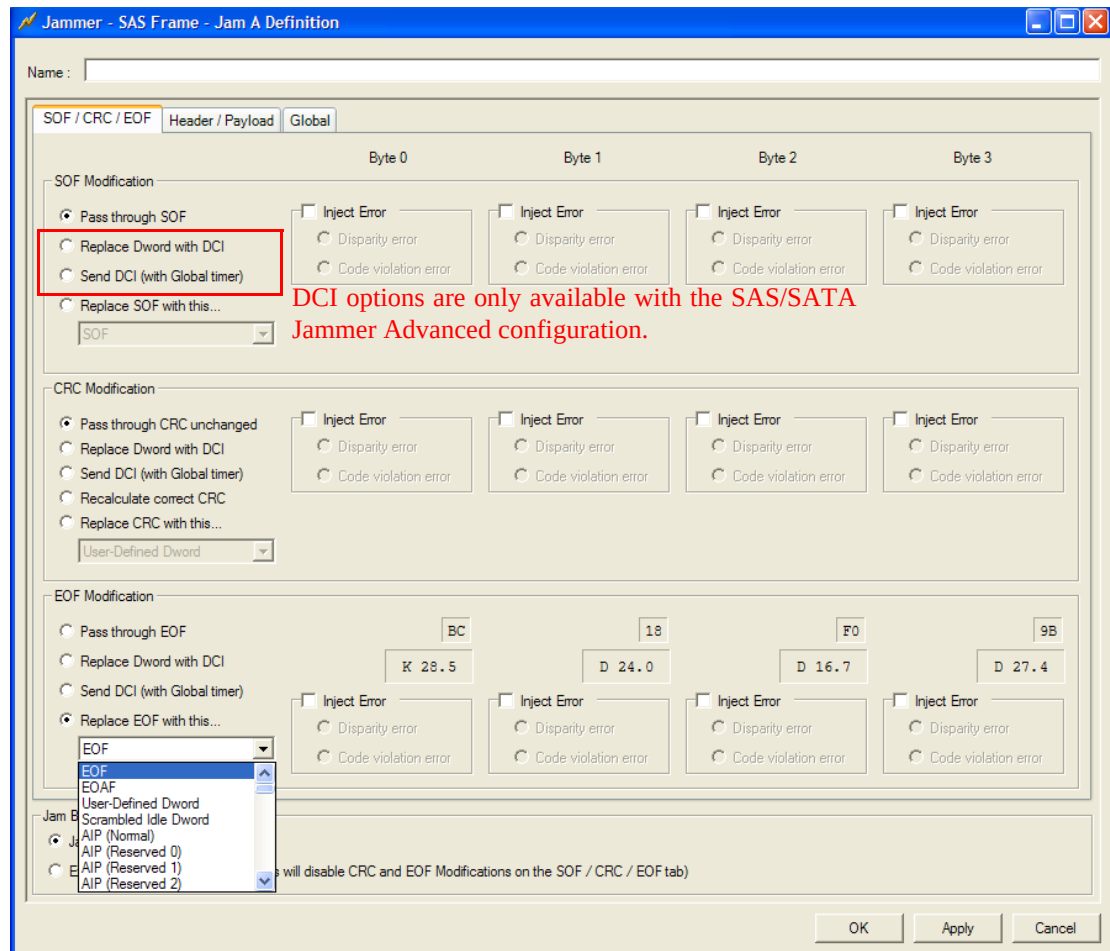
Global Timer for Jam with D.C. Idle

In an Advanced SAS/SATA Jammer configuration, the Jammer software allows you to set a global timer for Jamming with D.C. Idles. When using this option, DCI will continue until the timer expires regardless of the triggering item.

Using the SOF/CRC/EOF Tab

Use the choices on this tab to modify the Start of Frame (SOF), Cyclic Redundancy Check (CRC), and End of Frame (EOF) Dwords of the original target frame (Figure 175).

Figure 175: Serial Attached SCSI SOF/CRC/EOF Tab



SOF/EOF Options

You can pass through or replace the start and end of frame Dwords with another SOF, EOF, another standard Primitive, a Scrambled Idle Dword, or any four user-defined K/D characters. In addition to these options, you can send an error on any byte of the Dwords.

DCI options are available only in the Advanced SAS/SATA Jammer configurations. These allow you to replace a Dword with a DCI or to send DCI with the Global timer set in the Global tab.

Check Inject Error for any byte(s) on which you want to send errors. Then choose Disparity Error or Code Violation. If you choose Disparity Error, the Jammer inverts the running disparity at that byte. If that byte is a neutral 10b character, you might not see the disparity error until a later byte. The Code Violation option replaces the byte with a predefined 10-bit illegal character.

CRC Options

CRC options include:

- Not changing the CRC in the original target frame
- Recalculating the CRC to make it correct for the modified data
- Replace Dword with DCI
- Send DCI (with Global timer)
- Replacing with a user-specified data Dword or Primitive

With the addition of recalculating the CRC, you configure the CRC option in the same way as the SOF/EOF options.

Depending on the changes made to a frame, the old CRC might be invalid. If the CRC is passed through, an invalid frame might be created. The lowest layer of protocol error checking should recognize this type of error. If the frame is modified and the CRC is recalculated, a valid frame with modified data is created. If, for example, the modifications are made to SCSI commands embedded in the payload, the SCSI error checking routines should trap and handle the error.

Recalculating a CRC might not work if you corrupt the frame with illegal Primitives, errors, or Scrambled Idle Dwords.

Using the Header/Payload Tab

You can modify any and all words in the header and payload ([Figure 176](#)). Select either the **Replace Jam** or **All Jam Modes** radio button.

Similar to defining an Arm or Trigger Condition, there are two ways to specify your frame Jam Definition. One way is to load a template from the Template Library tree, and the other way is to manually specify bits in the frame.

To use a template:

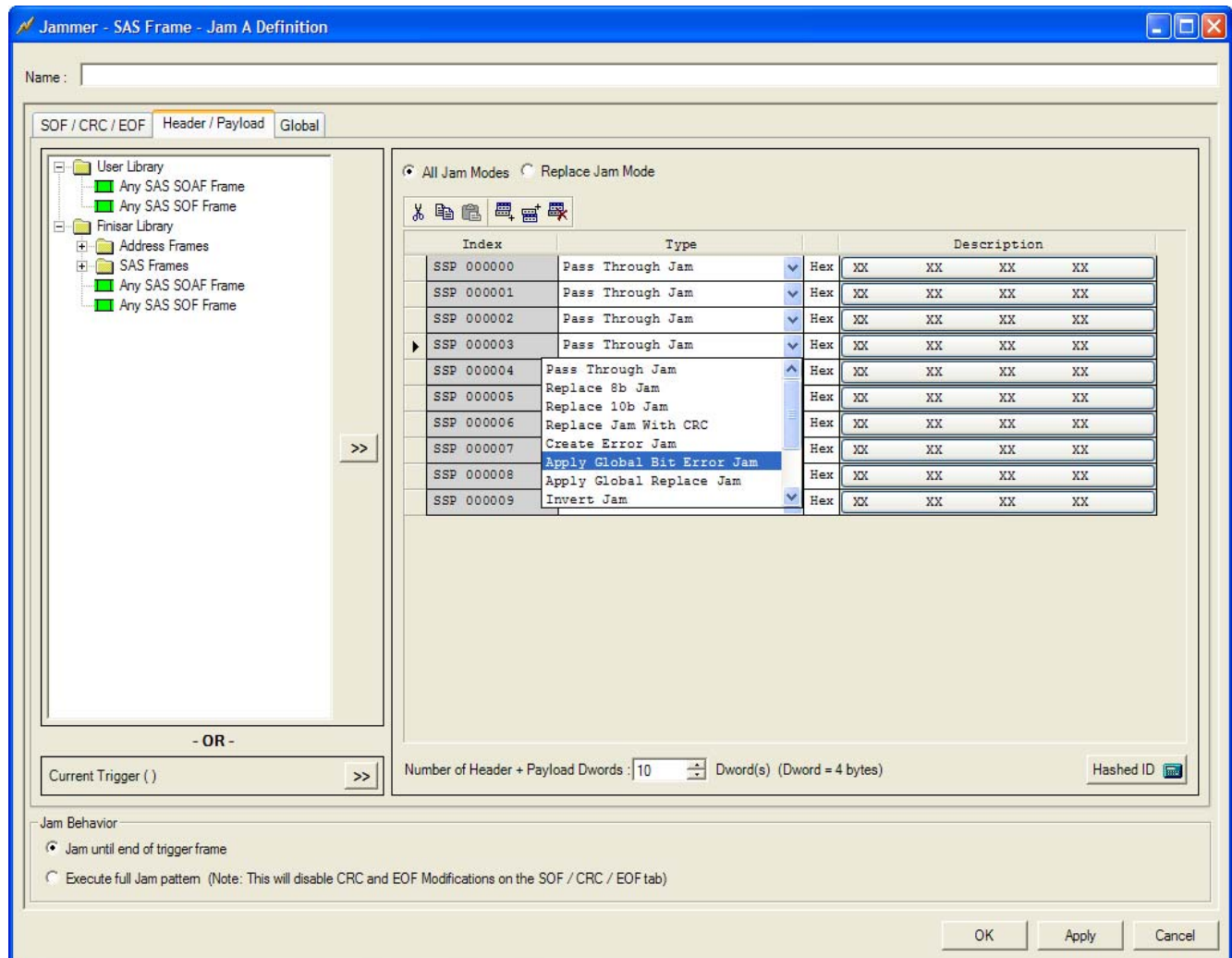
- 1 Highlight a template in the Template Library tree on the left side of the window.
Tree View is structured similar to the display on the right side of the Arm and Trigger Condition windows. You can make selections from the tree; this creates the appropriate Replace Jams.
- 2 Click the double right arrow to display the Jam definition on the right side of the window.

When you use a template, the Jam definition is populated with Replace Jams of the specified data, while all other bits are passed through.

To manually edit the values, enter a value into the byte field. An **X** in a nibble passes the original value through.

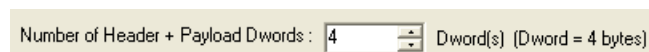


Note: The more Dwords in a Jam Definition, the longer the time between Test Cases in the suite. Switching from one Test Case to the next is a software operation, so the time between cases will be on the order of hundreds of milliseconds.

Figure 176: SAS Header/Payload Tab

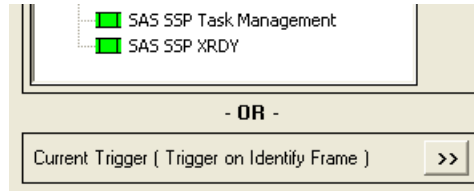
To manually define each nibble, enter a value into the byte field or double-click to display the Binary Editor. If you specify a bit as a 0 or 1, you must specify the values of the other three bits in that nibble as well. An **X** in a nibble passes the original value through. Choose any K/D character for an entire byte by using the drop-down controls. Click on the K or D to toggle this setting.

Use the **Number of Header + Payload Dwords** counter to define the number of Dwords to Jam. (Figure 177). Use the scroll bar to position the display to the desired Dword, if necessary.

Figure 177: Setting Header + Payload Size

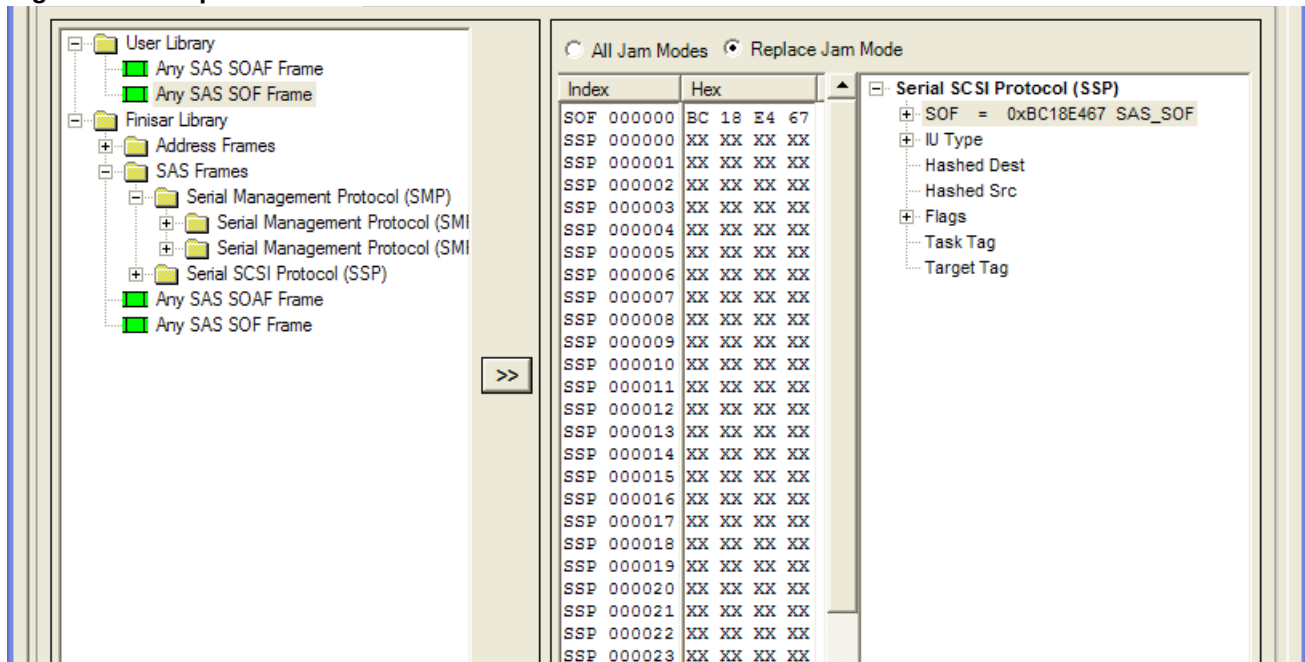
You can also use the List View controls at the top to cut, copy, paste, add, insert, or delete Dwords.

Notice the special choice at the bottom left, **Current Trigger** (Figure 178). This is a copy of the frame condition you have specified for the Trigger. The name of the Trigger Condition (if any) is shown in parenthesis. Click the double right arrow to use this.

Figure 178: Current Trigger Option

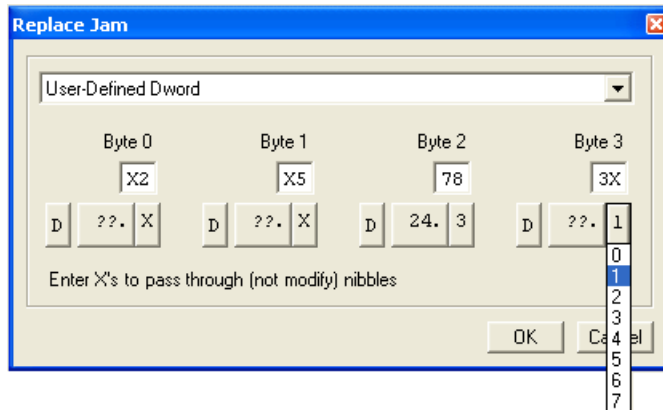
To manually specify a frame Dword Jam, select the **All Jam Modes** radio button. Select a Jam Type from the drop-down menu (under the Type column), then specify any additional definition (if necessary) by clicking on the data field (under the Description column).

Selecting the **Replace Jam Mode** radio button opens a dialog that allows you to replace an entire frame either by using a template or manually entering values. The Replace Jam Mode dialog also contains a view of the frame contents, similar to those seen the Arm and Trigger Condition windows. These values correspond to the hex values defined in the center column.

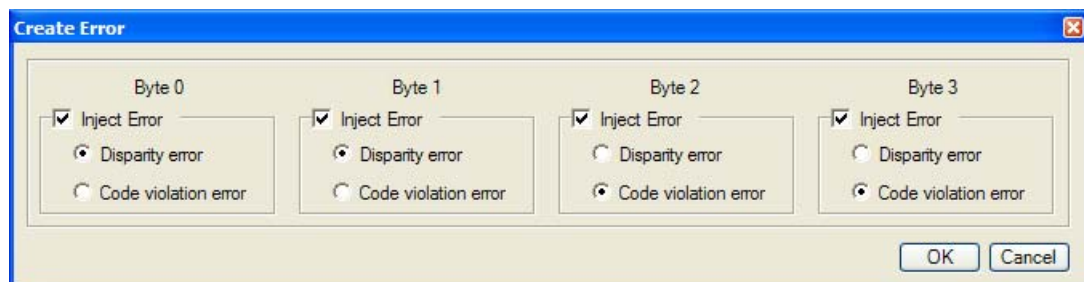
Figure 179: Replace Jam Mode

Selecting the **All Jam Modes** radio button opens a dialog that provides the following choices are available for each Dword in a frame on the Header/Payload tab:

- **Replace 8b Jam Mode** - This function allows you to replace the Dword with any standard Primitive, a Scrambled Idle Dword, or a user-defined Dword (Figure 180).

Figure 180: Replace Jam Dialog

- **Replace 10b Jam** (Advanced Jammer Configurations only) - This function allows you to replace the Dword with any standard Primitive, a Scrambled Idle Dword, or a user-defined Dword.
- **Apply Global Replace Jam** - This function allows individual bits to be set to 1, set to 0 or passed through unchanged according to the Global Replacement Dword defined on the Global Tab.
- **Create Error Jam** - Check Inject Error for any byte(s) on which you want to send errors (Figure 181). Then choose Disparity Error or Code Violation. If you choose Disparity Error, the Jammer inverts the running disparity at that byte. If that byte is a neutral 10b character, you might not see the disparity error until a later byte. The Code Violation option replaces the byte with a predefined 10-bit illegal character.

Figure 181: Create Error Dialog

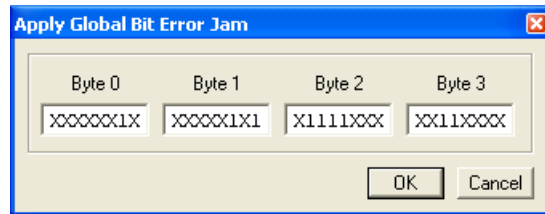
- **Invert Jam** - Invert defined bits and pass through the rest. Enter 1s at the appropriate bit locations.
- **Pass Through Jam** - Pass through the current Dword unchanged.
- **Replace Jam with CRC** - This word contains the current CRC value. CRC calculation is reset and started at the Dword after any SOF. Note that there should be only valid data Dwords between an SOF and its partner automatic CRC insertion or else the CRC value will be incorrect. Violations of this rule include using Primitives, Scrambled Idle Dwords, or code violations.



Note: If you place an SOF in Dword 2, and an automatic CRC in Dword 10, the CRC is calculated over Dwords 3 to 9.

- **Set Bits To 0s Jam-** Set defined bits to 0s and pass through the rest. Enter 0s at the appropriate bit locations.
- **Set Bits To 1s Jam -** Set defined bits to 1s and pass through the rest. Enter 1s at the appropriate bit locations.
- **Apply Global Bit Error Jam -** Apply the Global Bit Error function set on the Global tab. Enter 1s at the appropriate bit locations (Figure 182).

Figure 182: Apply Global Bit Error Jam Bit Location Dialog



Replace Frame with Truncated Frame

This option truncates the target frame to a shorter length and sends Scrambled Idle Dwords on top of the remainder of the target frame (Figure 183).

>> Use the up and down arrow buttons or type the number of Dwords you want to truncate the frame to (including header and payload, not including SOF, CRC, and EOF).

You can pass through or replace the SOF Dword with another SOF, another standard Primitive, a Scrambled Idle Dword, or any four user-defined K/D characters. In addition to these options, you can send an error on any byte of the Dword.

DCI options are available only in the Advanced SAS/SATA Jammer configurations. These allow you to replace a Dword with a DCI or to send DCI with the Global timer set in the Global tab.

The CRC must be replaced or recalculated in one of the following ways:

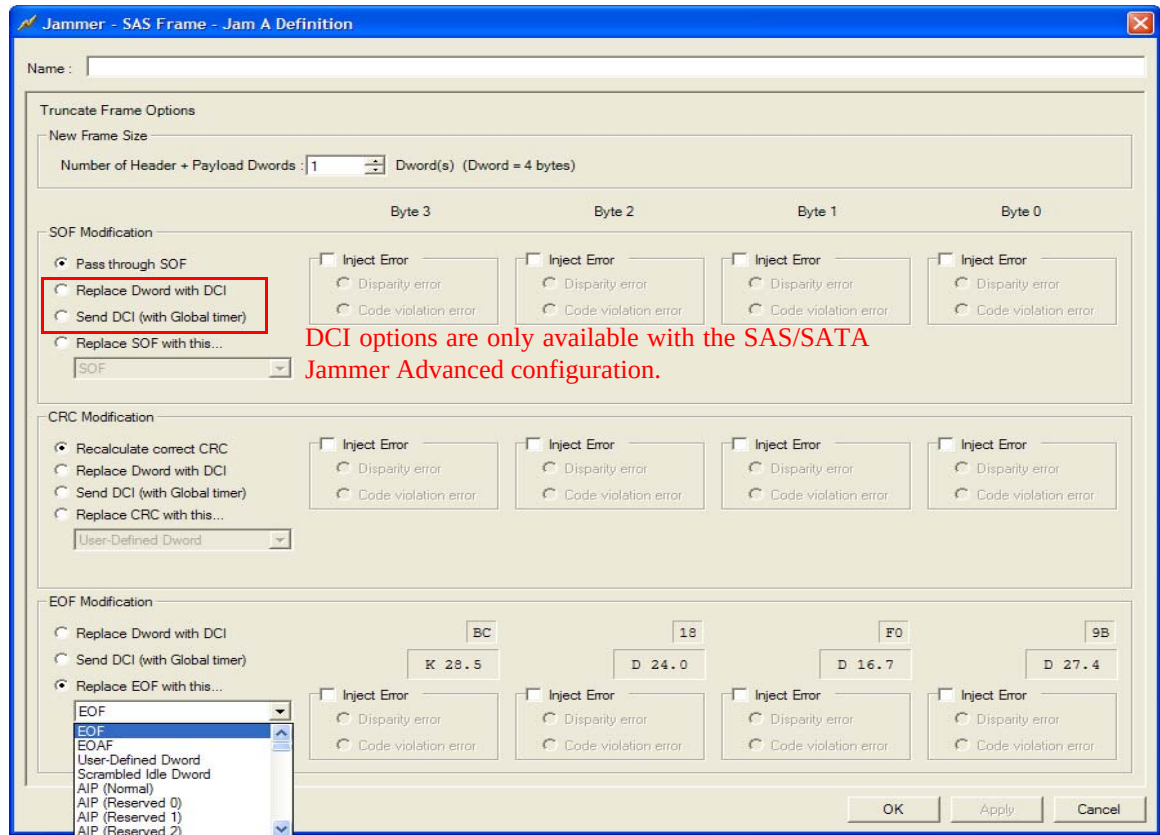
- Recalculating the CRC to make it correct for the modified data
- Replacing with a user-specified data Dword or Primitive
- Replace Dword with DCI
- Send DCI (with Global timer)

Replacing the CRC is specified the same way as the SOF. You can also send an error on any byte.

You must select a replacement Dword for the EOF. This is specified in the same way as the SOF. You can also send an error on any byte.

Check **Inject Error** for any byte(s) on which you want to send errors. Then choose Disparity Error or Code Violation. If you choose Disparity Error, the Jammer inverts the running disparity at that byte. If that byte is a neutral 10b character, you might not see the disparity error until a later byte. The Code Violation option replaces the byte with a predefined 10-bit illegal character.

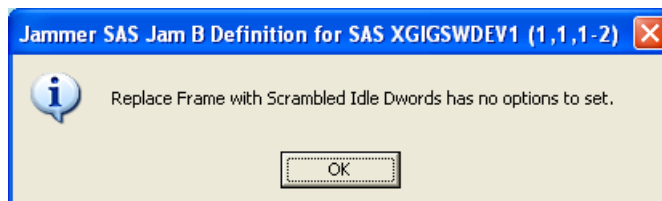
Figure 183: SAS - Replace Frame with Truncated Frame



Replace Frame with Scrambled Idle Dwords

This option replaces the target frame with Scrambled Idle Dwords. The following dialog is displayed (Figure 184).

Figure 184: SAS - Replace Frame with Scrambled Idle Dwords.



Jamming a Primitive Sequence

If the Trigger Event is a Primitive Sequence, click the **Jam** button on the Jammer Configuration window to open the Primitive Sequence Jam Definition window (Figure 185, Figure 186, Figure 187).

Figure 185: Single Primitive Sequence Jam Definition Window

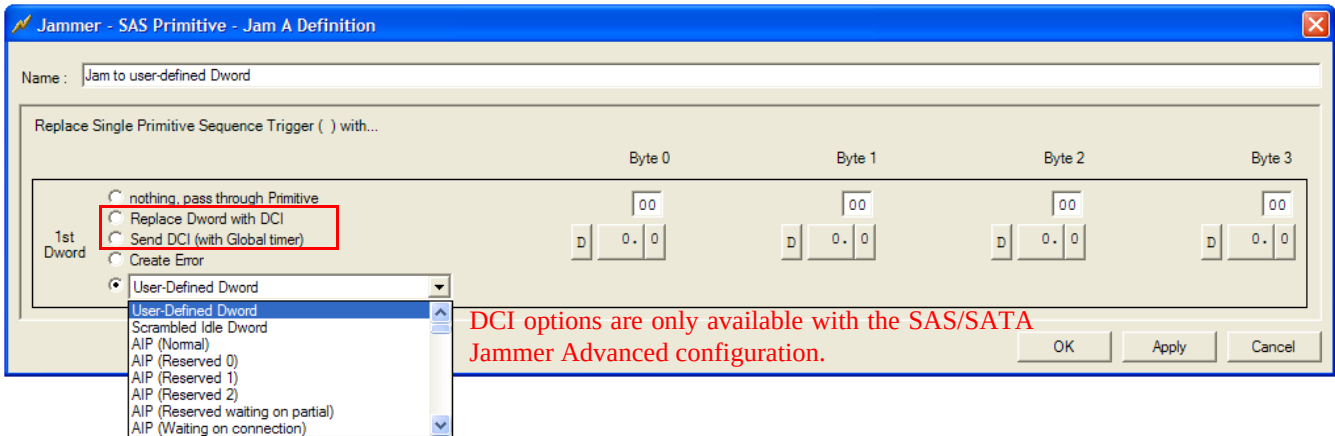


Figure 186: Triple Primitive Sequence Jam Definition Window

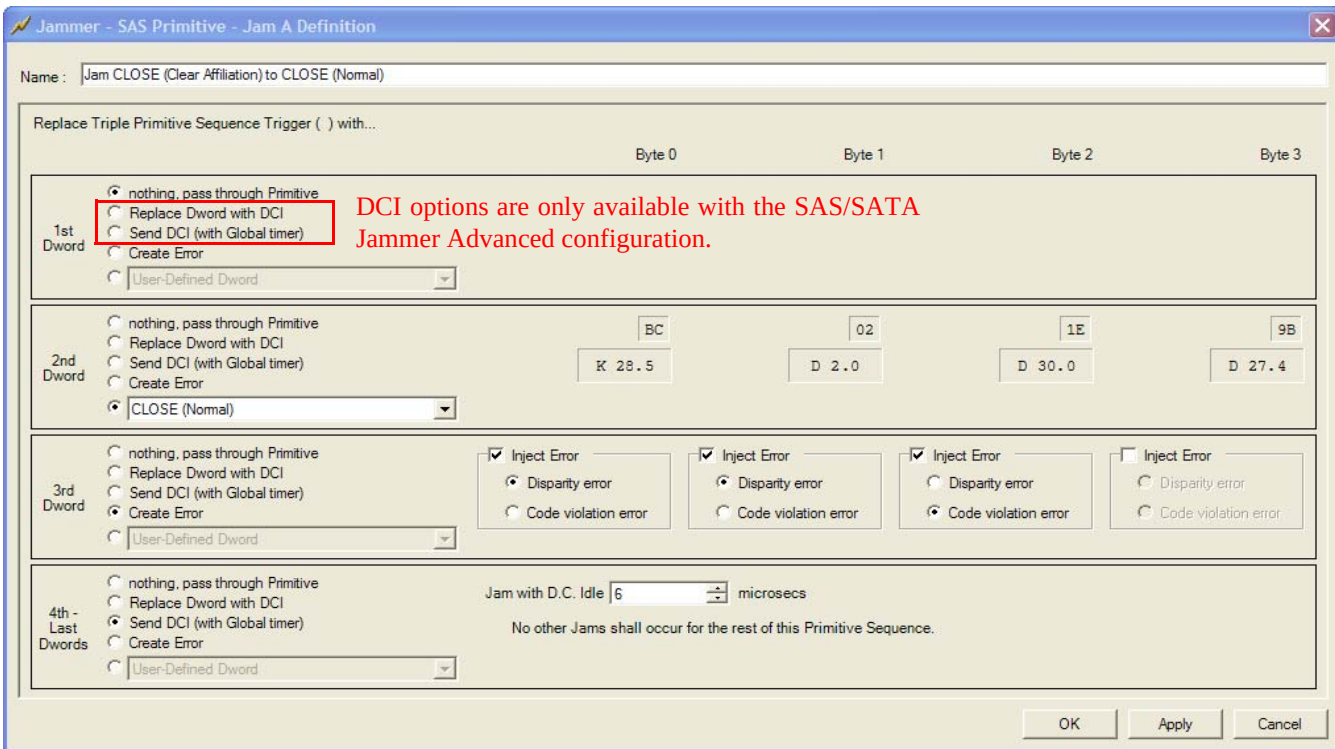


Figure 187: Redundant Primitive Sequence Jam Definition Window

Jammer - SAS Primitive - Jam A Definition
 Name : Jam BROADCAST (Change) to BROADCAST (Expander)

Replace Redundant Primitive Sequence Trigger () with...

	Byte 0	Byte 1	Byte 2	Byte 3	
1st Dword	☒ nothing, pass through Primitive ☐ Replace Dword with DCI ☐ Send DCI (with Global timer) ☐ Create Error ☐ User-Defined Dword				
2nd Dword	☐ nothing, pass through Primitive ☐ Replace Dword with DCI ☐ Send DCI (with Global timer) ☐ Create Error ☒ BROADCAST (Expander)	BC K 28.5	E4 D 4.7	81 D 1.4	18 D 24.0
3rd Dword	☐ nothing, pass through Primitive ☒ Replace Dword with DCI ☐ Send DCI (with Global timer) ☐ Create Error ☐ User-Defined Dword				
4th Dword	☐ nothing, pass through Primitive ☒ Replace Dword with DCI ☐ Send DCI (with Global timer) ☐ Create Error ☐ User-Defined Dword				
5th Dword	☐ nothing, pass through Primitive ☐ Replace Dword with DCI ☐ Send DCI (with Global timer) ☒ Create Error ☐ User-Defined Dword				
	☒ Inject Error ☒ Disparity error ☐ Code violation error	☒ Inject Error ☐ Disparity error ☒ Code violation error	☒ Inject Error ☒ Disparity error ☐ Code violation error	☒ Inject Error ☒ Disparity error ☐ Code violation error	
6th Dword	☐ nothing, pass through Primitive ☐ Replace Dword with DCI ☐ Send DCI (with Global timer) ☐ Create Error ☐ User-Defined Dword				
7th - Last Dwords	☐ nothing, pass through Primitive ☐ Replace Dword with DCI ☒ Send DCI (with Global timer) ☐ Create Error ☐ User-Defined Dword				

Jam with D.C. Idle 6 microseconds
 No other Jams shall occur for the rest of this Primitive Sequence.

OK Apply Cancel

The number of Dwords shown in the Definition window corresponds to the type of Primitive Sequence you specified as the Trigger Condition (one Dword for a Single or Extended, four for a Triple, or seven for a Redundant Primitive Sequence).

Ideally, any Triple or Redundant Sequences that the Jammer triggers on should be three or six Dwords long, respectively. If the Dwords are shorter, then the Jammer does not use all of the Jams specified in this window. If the Dwords are longer, then any Dword over the ideal third or sixth Dword in the sequence is Jammed according to the fourth or seventh Dword Jam Definition, respectively.

For each Dword, you have three options:

- Pass through the Primitive
- Corrupt any byte(s) with an error
- Replace Dword with DCI
- Send DCI (with Global timer)

- Replace the Primitive with a new Dword

To pass through a Primitive, select the top option for that Dword.

To create an error, select Create Error for that Dword. Then check Inject Error for any byte(s) on which you want to send errors. Then choose Disparity Error or Code Violation. If you choose Disparity Error, the Jammer inverts the running disparity at that byte. If that byte is a neutral 10b character, you might not see the disparity error until a later byte. The Code Violation option replaces the byte with a predefined 10-bit illegal character.

DCI options are available only in the Advanced SAS/SATA Jammer configurations. These allow you to replace a Dword with a DCI or to send DCI with the Global timer set in the Global tab.

You can replace the Dword with any K/D characters, any standard Primitive, or a Scrambled Idle Dword, by selecting the bottom option and choosing from the drop-down list.

Configuring SATA/STP Arm and Trigger Conditions

Arm and Trigger conditions recognize specific frames or Primitives.

For Frame conditions, SATA_SOF is automatically specified. You can specify up to 31 additional Dwords after the SOF.

You can also define a wildcard specifying bits to be masked out of an arm word and passed through in the corresponding trigger word.

For Primitive Conditions, you can choose from groups of Single, Repeated, or Continued Primitive Sequences.

For a Single Primitive Sequence, you can specify any standard Single Primitive Sequence. You can also specify where you want the Jammer to look for the matching Dword: only inside frames, only outside frames, or anywhere.



Note: The Jammer does not look for any matching conditions during OOB initialization or speed negotiation.

For Repeated Primitive Sequences, you can choose either SATA_PMACK or SATA_PMNAK.

For Continued Primitive Sequences, you can choose any standard Continued Primitive Sequence.

The Arm and Trigger windows are identical (Figure 189 and Figure 190). In addition, you can select the domain triggered input as an Arm condition.

Depending on the Mode you select, the appropriate graphic diagram shows the Trigger and optional Arm conditions, along with the Jam event. If the Mode you select does not include an Arm condition, the Arm button remains disabled.

To set Arm and Trigger conditions:

- 1 Click the **Arm** or **Trigger** button in the Jammer Configuration window.

The window for the condition is displayed (Figure 188). If you are in hardware edit mode, chassis name, chassis number, slot number, and port numbers are displayed in the title bar.

- 2 Set the values as required to specify a unique Arm and Trigger sequence for the specific test. The following sections describe the available values.

Figure 188: SATA/STP Frame Arm and Trigger Window Examples

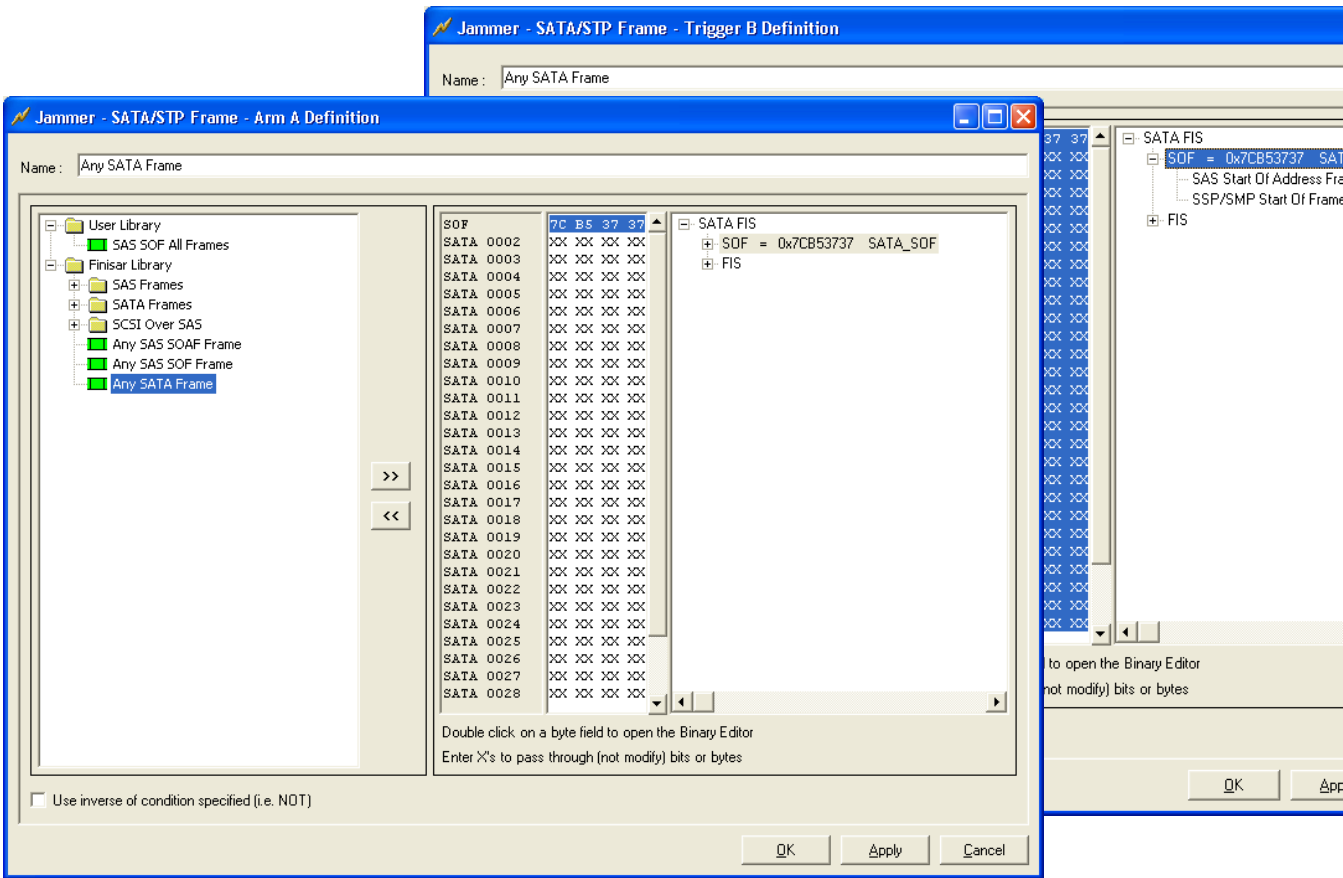


Figure 189: SATA/STP Continued Primitives Arm Window Example

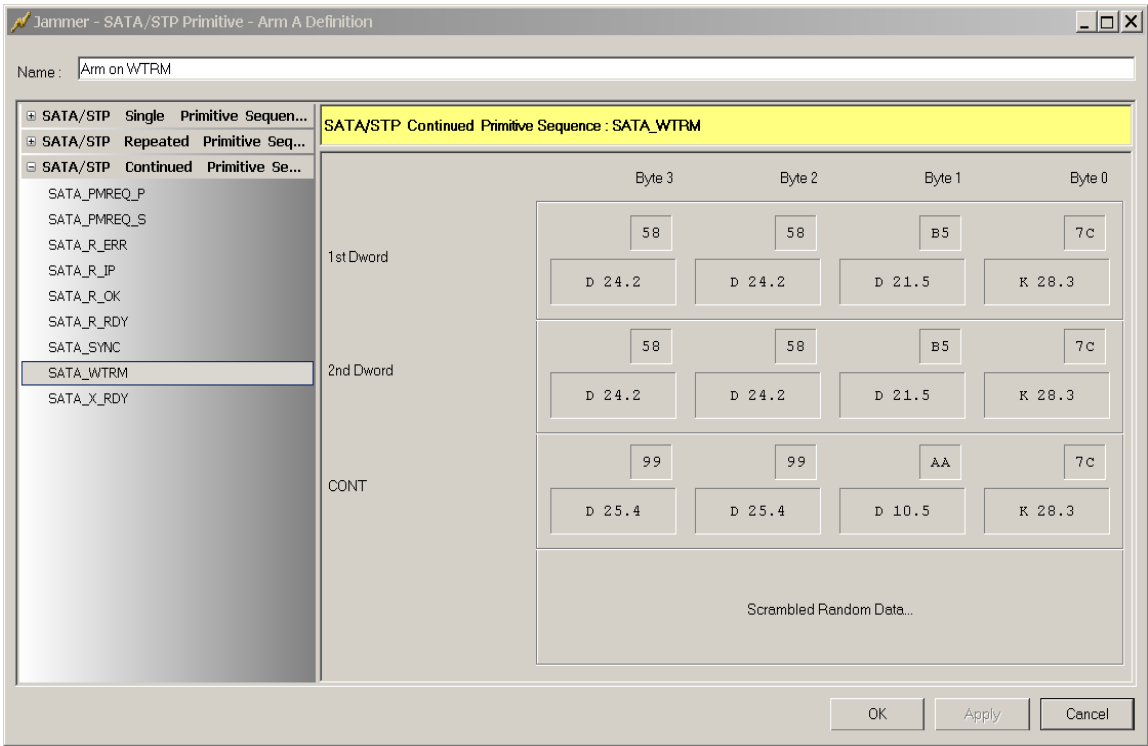


Figure 190: SATA/STP Single Primitive Trigger Window Example

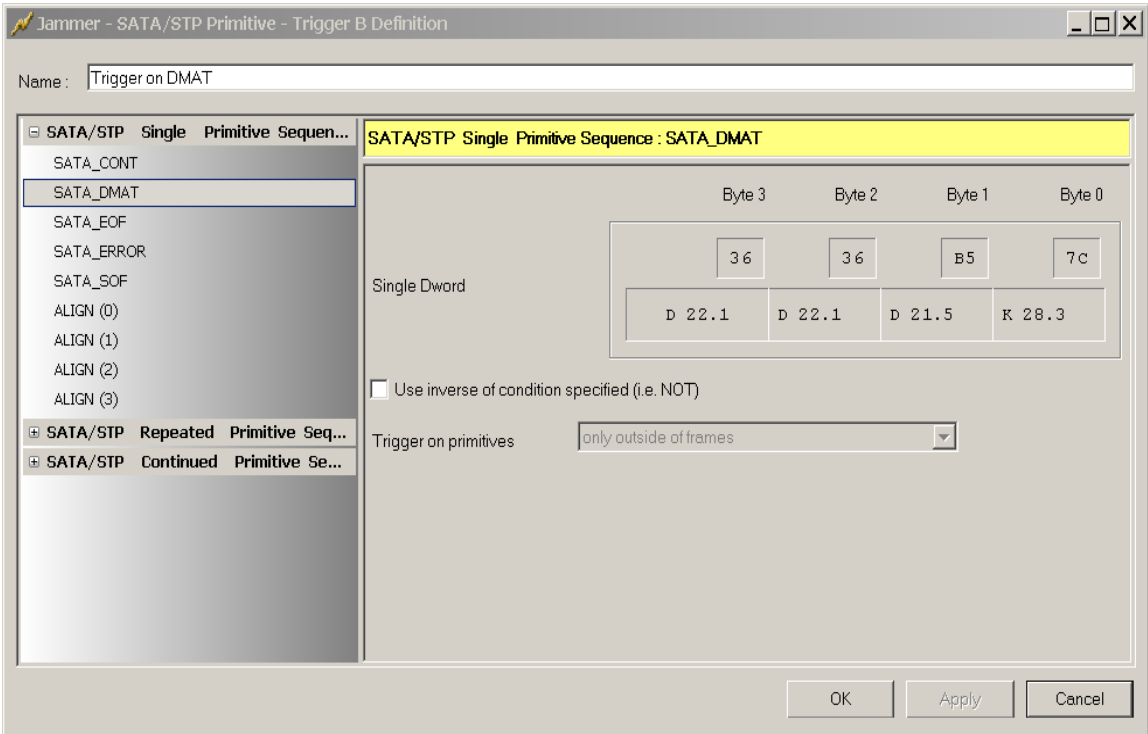
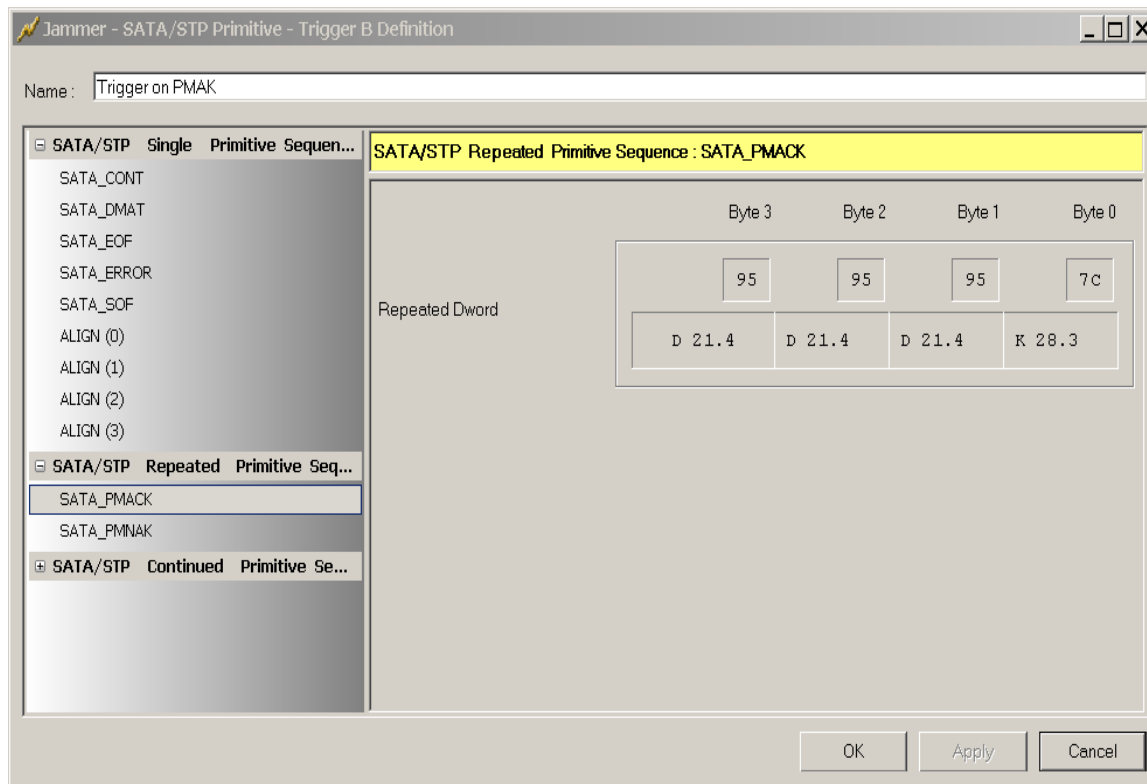


Figure 191: SATA/STP Repeated Primitives Trigger Window Example



Setting Frame Conditions

You can specify frame conditions in three ways:

- Load a template from the Template Library tree
- Manually specify bits in the frame
- Select fields from the tree view in the right pane

To use a template:

- 1 Select a template from the Template Library tree on the left.
- 2 Click the double right arrow button to set the Trigger Condition.

The condition is indicated on the right side of the window.

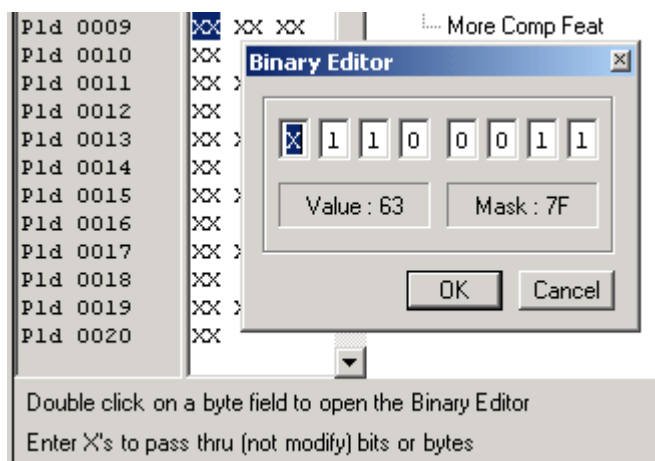
To manually specify a frame:

>> Type hexadecimal values directly into the center column of the window.

An X represents a nibble that can be any value (a “don’t care”).

To set individual bits in any field, double-click on the hex entry to open the Binary Editor (Figure 192 on page 260). In the hex view, partially defined hex characters appear as question marks: X001=?

When you use the tree view, values are automatically entered into the center column in the right window pane.

Figure 192: Binary Editor Dialog

Saving a Frame Condition

If you create a frame condition that you want to save and make easily available for future use, you can save it into the “User Library” folder in the Template Library tree. To do this:

>> Highlight the folder and click the double left arrow button.

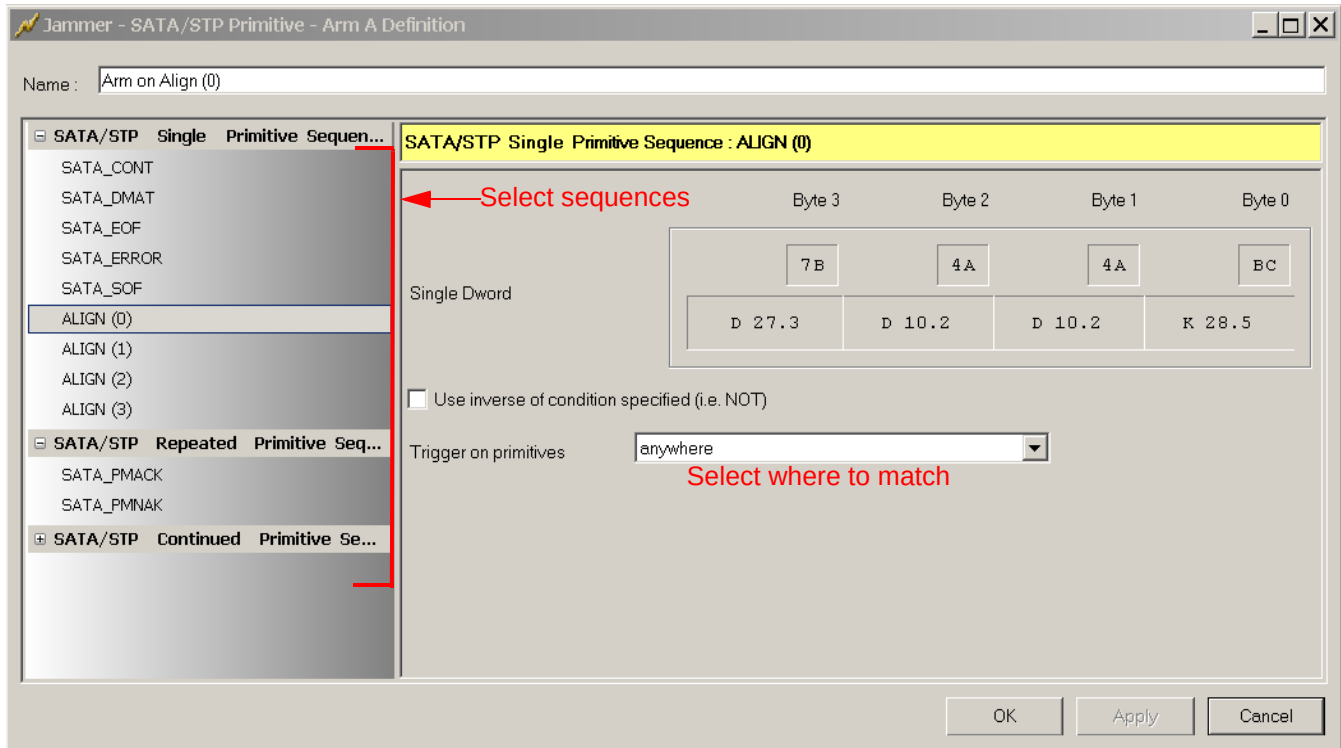
Frame conditions have the option of “Use inverse of condition specified (i.e., NOT).” When you check this option, it means that the first frame encountered that does not match what you have specified creates a “condition met” event.

For each frame condition, you can specify an optional name at the top of the window. This name is also shown on the Jammer Configuration window under the Type selection, and on the main Xgig Maestro window.

Setting Primitive Sequence Conditions

You can choose a Primitive Sequence from any of the categories on the left side of the window: Single, Repeated, or Continued. For Single Primitives, you can also choose where to match: anywhere, only outside of frames, or only inside of frames.

Figure 193: SATA/STP Single Primitive Sequence Conditions Example



You can check the “Use inverse of condition specified (i.e. NOT)” option; this means the first Dword encountered that does not match what you have specified creates a “condition met” event.

As with frame conditions, you can specify an optional name at the top of the window. This name is also shown in the Jammer Configuration window under the Type selection and on the main Xgig Maestro window.

Configuring the SATA/STP Jam Definition

The **Jam Definition** window defines how to modify the event specified on the **Trigger Condition** window.

The Jam is always the same type (frame or Primitive Sequence) as the Trigger.

For any Jam Definition, you can specify an optional name at the top of the window. This name is also displayed on the Jammer Configuration window under the Type selection and on the main Xgig Maestro window.

Jamming a Frame

If the Trigger Event is a frame, click the **Jam** button on the Jammer Configuration window to open the Frame Jam Definition window.

The content of the Jam Definition window corresponds to the type of frame Jam you choose on the Jammer Configuration window (modify frame, truncate frame, or replace frame with SATA_SYNC Continued Primitive Sequence). The following paragraphs describe these choices.

Replace Frame with Modified Frame

Each tab contains options relevant to different frame modifications.

Using the Global Tab

Use this tab (Figure 194) to define Jam parameters that apply globally to the frame.

Global Replace Jam Option

Use the Global Replacement Dword to set specific bits in a Dword to 1 or 0 while passing through the remaining bits. You can apply this global replacement to any Dword in the frame. Define one Global Replacement for each Test Case.

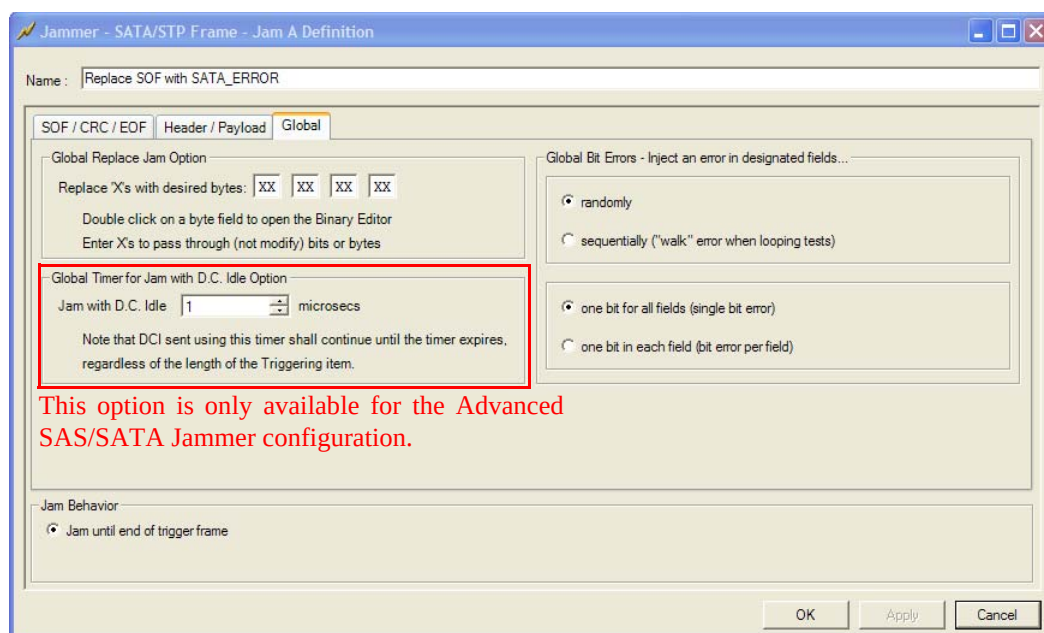
To edit these bits:

>> Enter hex values, or double-click on a byte field to open the Binary Editor.

Any bits left as Xs are passed through.

The difference between this Global Replacement option versus the Replace Dword option found on the Header/Payload tab is that the Global Replacement option allows masking down to the bit level, whereas the other option allows masking at the nibble level.

Figure 194: SATA/STP Global Tab



This option is only available for the Advanced SAS/SATA Jammer configuration.

Global Bit Errors

The Jammer software can introduce bit errors repeatedly in sequential or random fashion to predefined fields. These bit errors are introduced to the 32-bit form of the target Dwords (not the 40-bit form) so code violations are not created. The Global Bit Errors control allows you four options.

- Select **one bit for all fields** and **randomly**. This causes the Jammer to inject a single bit error in the group of all fields selected in the header or payload for a single Test Case. If the Jammer Test Suite is set to *loop*, then single bit errors are randomly injected into these fields, with one bit for each cycle of the Test Suite.
- Select **one bit for all fields** and **sequentially**. This also injects a single bit error in the group of all fields selected in the header or payload. If the Test Suite is set to loop forever, the bit error walks through all the selected fields.
- Select **one bit in each field** and **randomly** does the same thing as the first option; however, there will be one error for each Dword selected in the header or payload.
- Select **one bit in each field** and **sequentially** does the same thing as the second option; however, there will be one error for each Dword selected in the header or payload.



Note: The location of the bit errors are moved each time you run this entire Test Case, not each time you repeat the Jam within the Test Case.

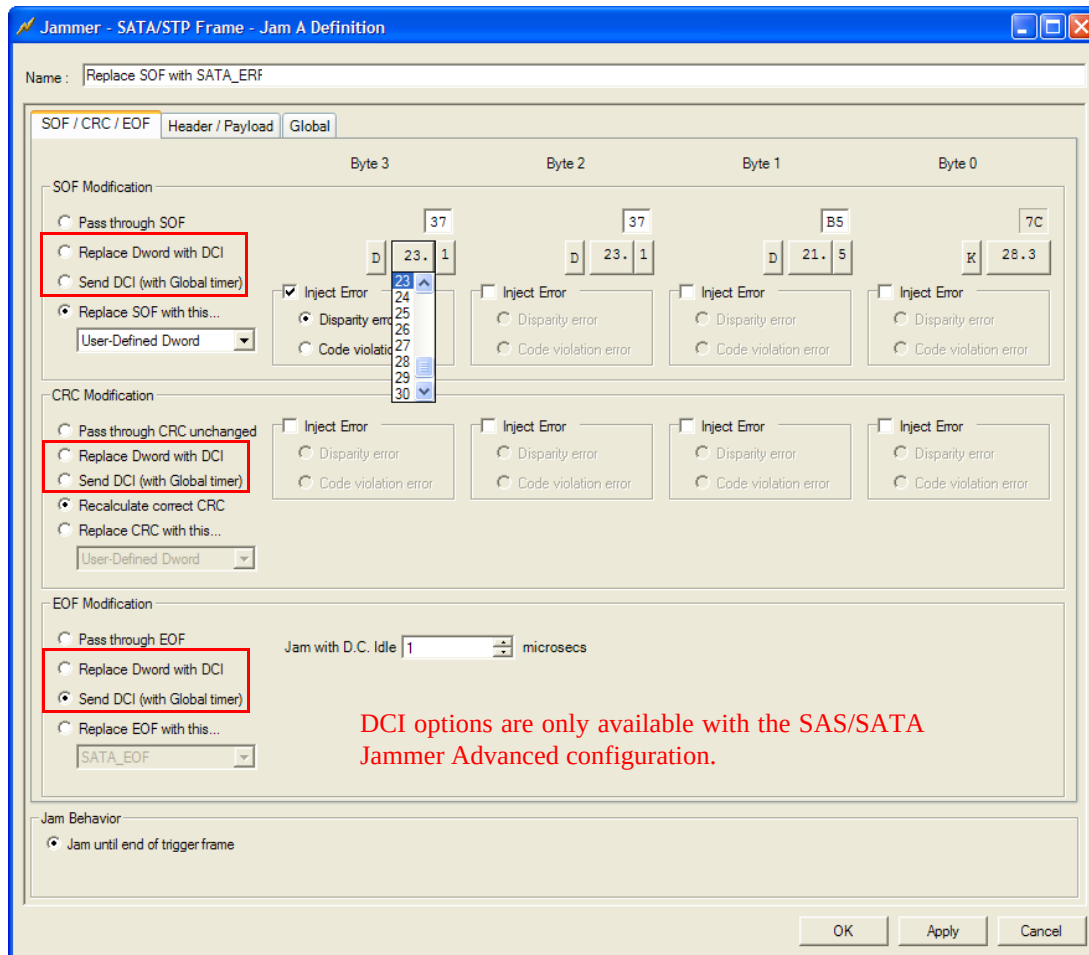
Global Timer for Jam with D.C. Idle

In an Advanced SAS/SATA Jammer configuration, the Jammer software allows you to set a global timer for Jamming with D.C. Idles. When using this option, DCI will continue until the timer expires regardless of the triggering item.

Using the SOF/CRC/EOF Tab

Use the choices on this tab to modify the Start of Frame (SOF), Cyclic Redundancy Check (CRC), and End of Frame (EOF) Dwords of the original target frame (Figure 195).

Figure 195: SATA/STP SOF/CRC/EOF Tab



SOF/EOF Options

You can pass through or replace the start and end of frame Dwords with another standard Primitive, Scrambled Primitive Data, or any four user-defined K/D characters. In addition to these options, you can send an error on any byte of the Dwords.

DCI options are available only in the Advanced SAS/SATA Jammer configurations. These allow you to replace a Dword with a DCI or to send DCI with the Global timer set in the Global tab.

Check Inject Error for any byte(s) on which you want to send errors. Then choose Disparity Error or Code Violation. If you choose Disparity Error, the Jammer inverts the running disparity at that byte. If that byte is a neutral 10b character, you might not see the disparity error until a later byte. The Code Violation option replaces the byte with a predefined 10-bit illegal character.

CRC Options

CRC options include:

- Not changing the CRC in the original target frame
- Replace Dword with DCI
- Send DCI (with Global timer)
- Recalculating the CRC to make it correct for the modified data
- Replacing with a user-specified data Dword, Primitive, or Scrambled Primitive Data

With the addition of recalculating the CRC, you configure the CRC option in the same way as the SOF/EOF options.

Depending on the changes made to a frame, the old CRC might be invalid. If the CRC is passed through, an invalid frame might be created. The lowest layer of protocol error checking should recognize this type of error. If the frame is modified and the CRC is recalculated, a valid frame with modified data is created.

Using the Header/Payload Tab

Similar to defining an Arm or Trigger Condition, there are two ways to specify your frame Jam Definition. One way is to load a template from the Template Library tree, and the other way is to manually specify bits in the frame.

To use a template:

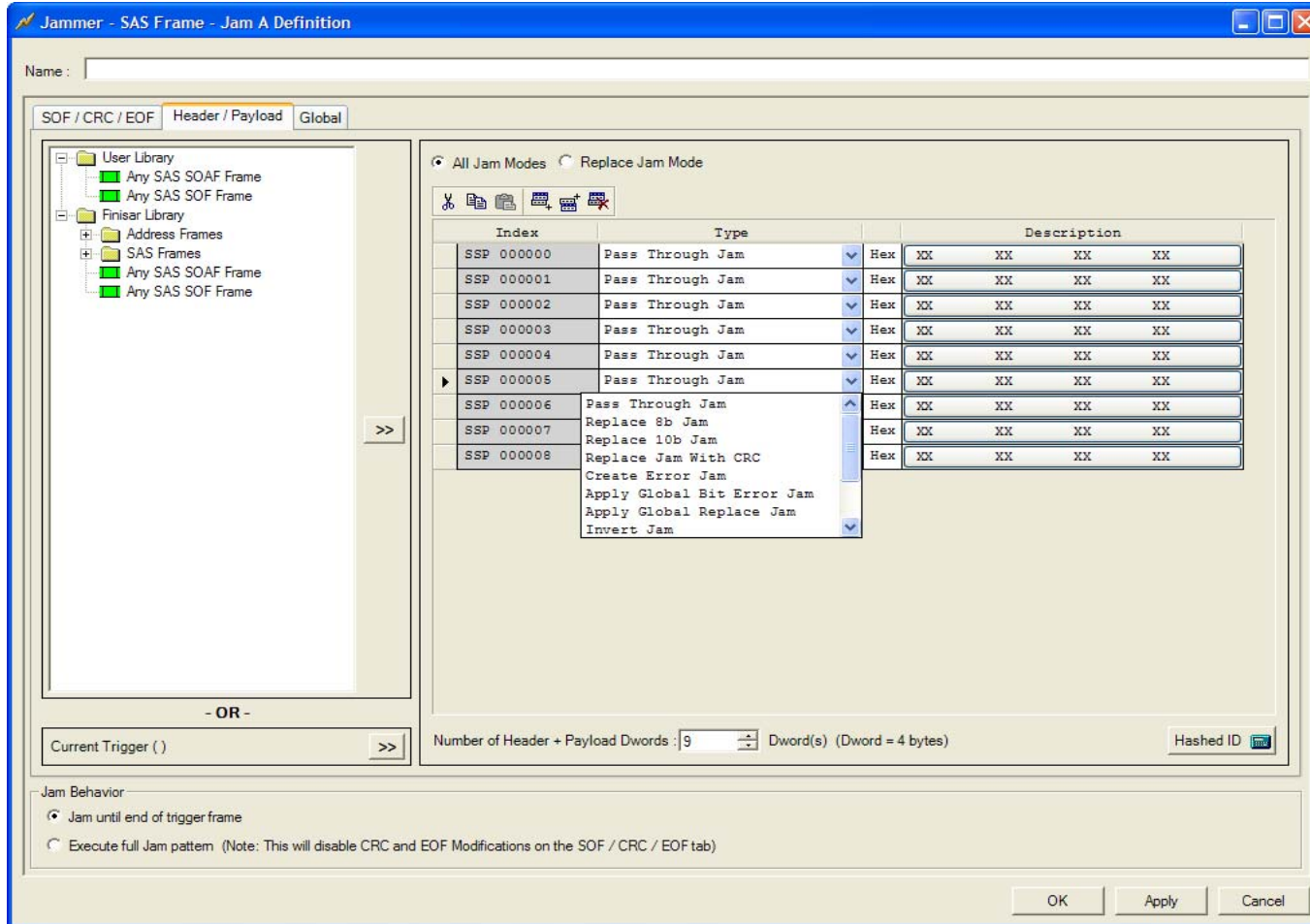
- 1 Highlight a template in the Template Library tree on the left side of the window.
Tree View is structured similar to the display on the right side of the Arm and Trigger Condition windows. You can make selections from the tree; this creates the appropriate Replace Jams.
- 2 Click the double right arrow to display the Jam definition on the right side of the window.

When you use a template, the Jam definition is populated with Replace Jams of the specified data, while all other bits are passed through.

To manually edit the values, enter a value into the byte field. An **X** in a nibble passes the original value through.

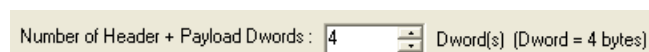


Note: The more Dwords in a Jam Definition, the longer the time between Test Cases in the suite. Switching from one Test Case to the next is a software operation, so the time between cases will be on the order of hundreds of milliseconds.

Figure 196: SATA/STP Header/Payload Tab

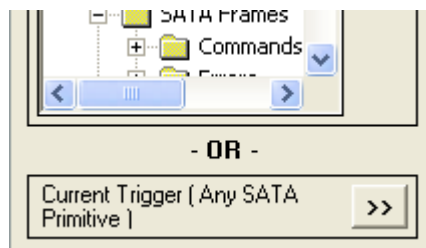
To manually define each nibble, enter a value into the byte field or double-click to display the Binary Editor. If you specify a bit as a 0 or 1, you must specify the values of the other three bits in that nibble as well. An **X** in a nibble passes the original value through. Choose any K/D character for an entire byte by using the drop-down controls. Click on the K or D to toggle this setting.

Use the **Number of Header + Payload Dwords** counter to define the number of Dwords to Jam (Figure 197). Use the scroll bar to position the display to the desired Dword, if necessary.

Figure 197: Setting Header + Payload Size

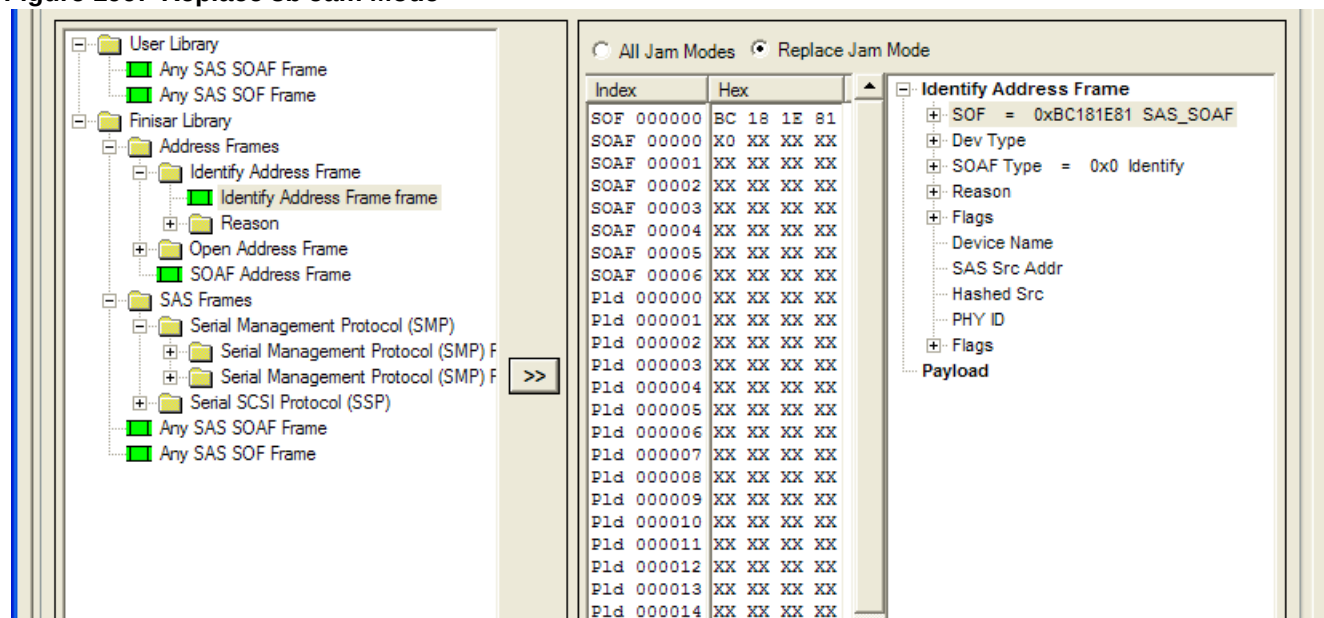
You can also use the List View controls at the top to cut, copy, paste, add, insert, or delete Dwords.

Notice the special choice at the bottom left, **Current Trigger** (Figure 198). This is a copy of the frame condition you have specified for the Trigger. The name of the Trigger Condition (if any) is shown in parenthesis. Click the double right arrow to use this.

Figure 198: Current Trigger Option

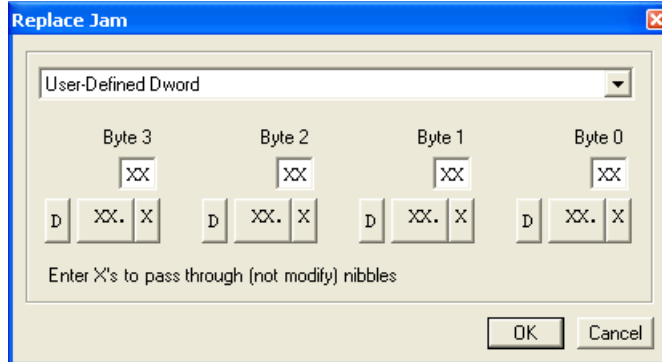
To manually specify a frame Dword Jam, select the **All Jam Modes** radio button. Select a Jam Type from the drop-down menu (under the Type column), then specify any additional definition (if necessary) by clicking on the data field (under the Description column).

Selecting the **Replace Jam Mode** radio button opens a dialog that allows you to replace an entire frame either by using a template or manually entering values. The Replace Jam Mode dialog also contains a view of the frame contents, similar to those seen the Arm and Trigger Condition windows. These values correspond to the hex values defined in the center column.

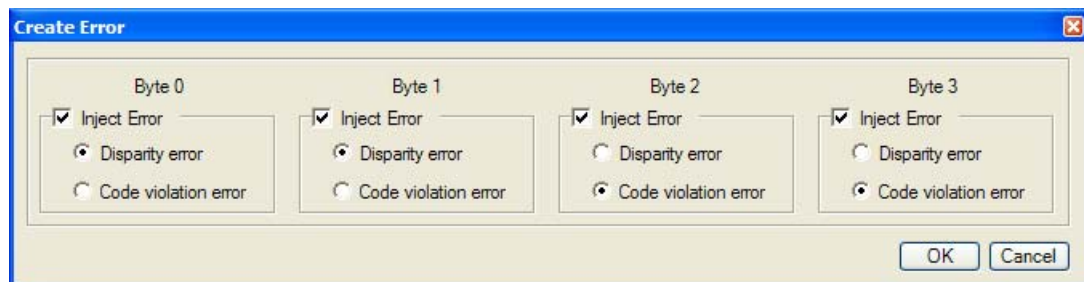
Figure 199: Replace 8b Jam Mode

Selecting the **All Jam Modes** radio button opens a dialog that provides the following choices are available for each Dword in a frame on the Header/Payload tab:

- **Apply Global Replace Jam** - This function allows individual bits to be set to 1, set to 0 or passed through unchanged according to the Global Replacement Dword defined on the Global Tab.
- **Replace 8b Jam Mode** - This function allows you to replace the Dword with any standard Primitive, a Scrambled Idle Dword, or a user-defined Dword (Figure 200).

Figure 200: Replace 8b Jam Dialog

- **Replace 10b Jam** (Advanced Jammer Configurations only) - This function allows you to replace the Dword with any standard Primitive, a Scrambled Idle Dword, or a user-defined Dword (Figure 200).
- **Create Error Jam** - Check Inject Error for any byte(s) on which you want to send errors (Figure 201). Then choose Disparity Error or Code Violation. If you choose Disparity Error, the Jammer inverts the running disparity at that byte. If that byte is a neutral 10b character, you might not see the disparity error until a later byte. The Code Violation option replaces the byte with a predefined 10-bit illegal character.

Figure 201: Create Error Dialog

- **Invert Jam** - Invert defined bits and pass through the rest. Enter 1s at the appropriate bit locations.
- **Pass Through Jam** - Pass through the current Dword unchanged.
- **Replace 8b Jam** - You can replace the Dword with any standard Primitive, Scrambled Primitive Data, or a user-defined Dword (Figure 200).

To define each nibble, enter a value into the byte field or double-click to display the Binary Editor. If you specify a bit as a 0 or 1, you must specify the values of the other three bits in that nibble also. An **X** in a nibble passes the original value through. Choose any K/D character for an entire byte by using the drop-down controls. Click on the K or D to toggle this setting.

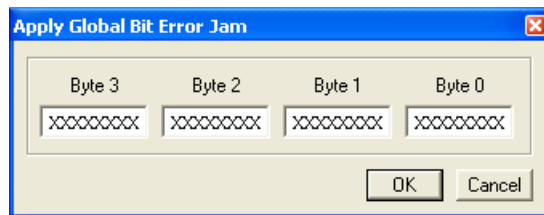
- **Replace Jam with CRC** - This word contains the current CRC value. CRC calculation is reset and started at the Dword after any SOF. Note that there should be only valid data Dwords between an SOF and its partner automatic CRC insertion or else the CRC value will be incorrect. Violations of this rule include using Primitives, Scrambled Primitive Data, or code violations.



Note: If you place an SOF in Dword 2, and an automatic CRC in Dword 10, the CRC is calculated over Dwords 3 to 9.

- **Set Bits To 0s Jam**- Set defined bits to 0s and pass through the rest. Enter 0s at the appropriate bit locations.
- **Set Bits To 1s Jam** - Set defined bits to 1s and pass through the rest. Enter 1s at the appropriate bit locations.
- **Apply Global Bit Error Jam** - Apply the Global Bit Error function set on the Global tab. Enter 1s at the appropriate bit locations (Figure 202).

Figure 202: Apply Global Bit Error Jam Bit Location Dialog



Replace Frame with Truncated Frame

This option truncates the target frame to a shorter length and sends SATA_WTRM on top of the remainder of the target frame (Figure 203).

>> Use the up and down arrow buttons or type the number of Dwords you want to truncate the frame to (including header and payload, not including SOF, CRC, and EOF).

You can pass through or replace the SOF Dword with another standard Primitive, Scrambled Primitive Data, or any four user-defined K/D characters. In addition to these options, you can send an error on any byte of the Dword.

DCI options are available only in the Advanced SAS/SATA Jammer configurations. These allow you to replace a Dword with a DCI or to send DCI with the Global timer set in the Global tab.

The CRC must be replaced or recalculated in one of the following ways:

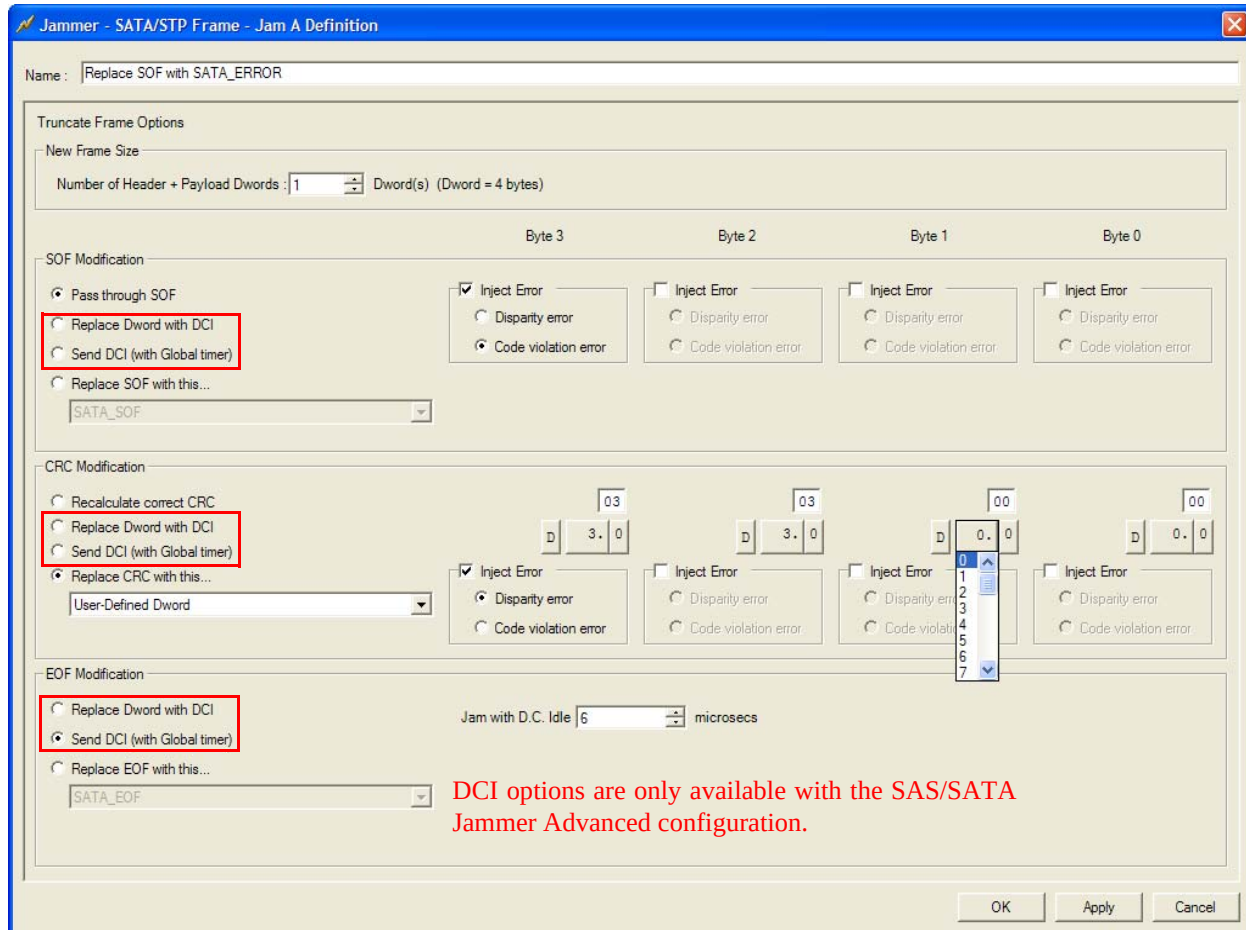
- Recalculating the CRC to make it correct for the modified data
- Replacing with a user-specified data Dword or Primitive
- Relapse Dword with DCI
- Send DCI (with Global timer)

Replacing the CRC is specified the same way as the SOF. You can also send an error on any byte.

You must select a replacement Dword for the EOF. This is specified in the same way as the SOF. You can also send an error on any byte.

Check **Inject Error** for any byte(s) on which you want to send errors. Then choose Disparity Error or Code Violation. If you choose Disparity Error, the Jammer inverts the running disparity at that byte. If that byte is a neutral 10b character, you might not see the disparity error until a later byte. The Code Violation option replaces the byte with a predefined 10-bit illegal character.

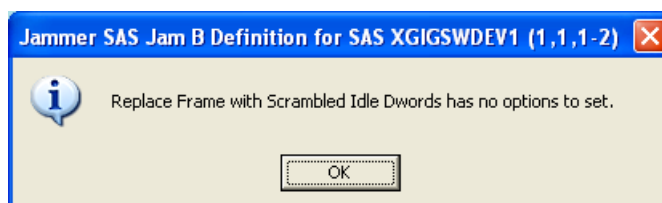
Figure 203: SATA/STP - Replace Frame with Truncated Frame



Replace with Scrambled Idle Dwords

This option replaces the target frame with Scrambled Idle Dwords. The following dialog is displayed (Figure 204).

Figure 204: SAS - Replace Frame with Scrambled Idle Dwords.



Jamming a Primitive Sequence

If the Trigger Event is a Primitive Sequence, click the **Jam** button on the Jammer Configuration window, to open the Primitive Sequence Jam Definition window (Figure 205, Figure 206, Figure 207). A dialog is displayed corresponding to your choice of Trigger Condition Primitive Sequence type.

Figure 205: Single Primitive Sequence Jam Definition Window

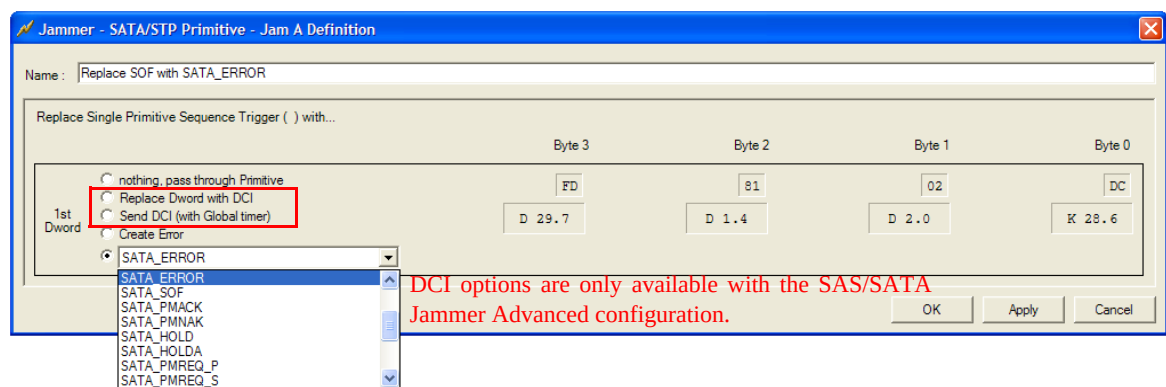


Figure 206: Continued Primitive Sequence Jam Definition Window

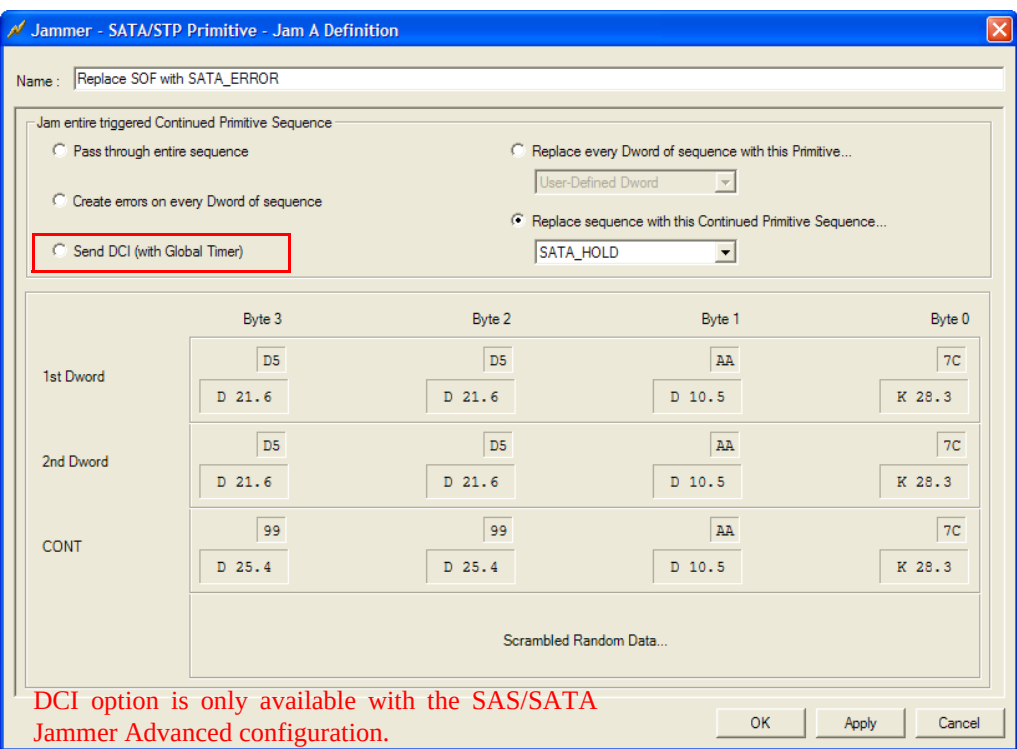
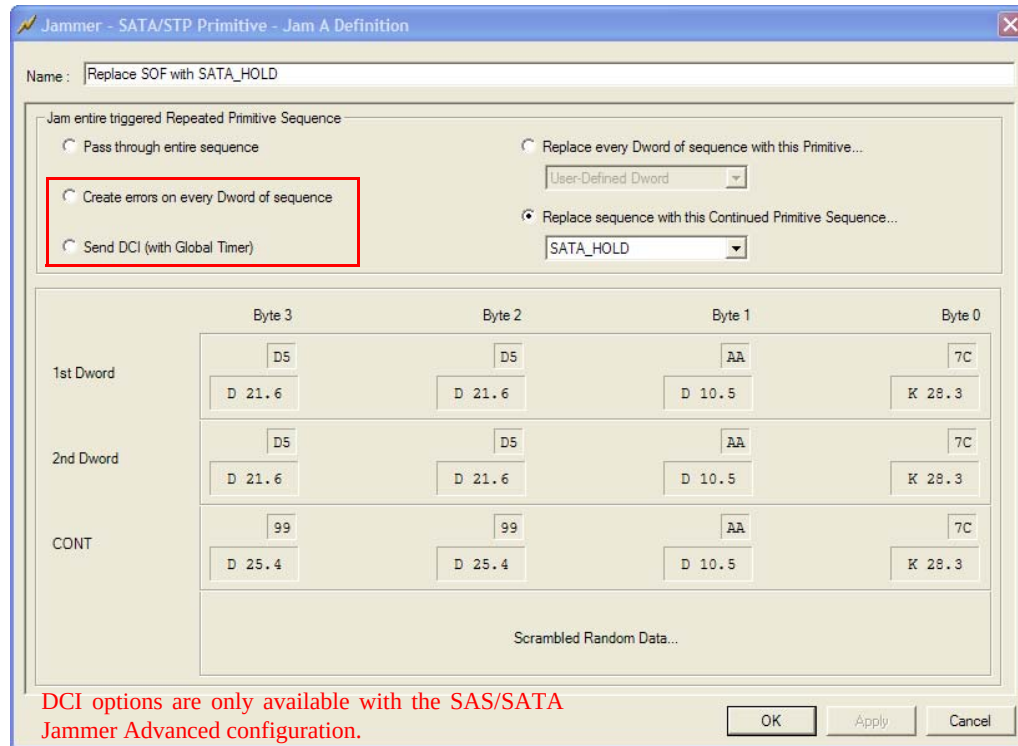


Figure 207: Repeated Primitive Sequence Jam Definition Window

Jamming a Single Primitive Sequence

For the Jam, you have three options:

- Pass through the Primitive
- Corrupt any byte(s) with an error
- Replace the Primitive with a new Dword
- Replace Dword with DCI
- Send DCI (with Global timer)

To pass through the Primitive, select the top option.

To create an error, select Create Error. Then check Inject Error for any byte(s) on which you want to send errors. Then choose Disparity Error or Code Violation. If you choose Disparity Error, the Jammer inverts the running disparity at that byte. If that byte is a neutral 10b character, you might not see the disparity error until a later byte. The Code Violation option replaces the byte with a predefined 10-bit illegal character.

You can replace the Dword with any K/D characters, any standard Primitive, or Scrambled Primitive Data, by selecting the bottom option and choosing from the drop-down list.

DCI options are available only in the Advanced SAS/SATA Jammer configurations. These allow you to replace a Dword with a DCI or to send DCI with the Global timer set in the Global tab.

Jamming a Continued or Repeated Primitive Sequence

Four options allow you to Jam the entire Primitive Sequence:

- Pass through entire sequence
- Create errors on every Dword of the sequence
- Replace every Dword of the sequence with a specific Dword
- Replace sequence with a Continued Primitive Sequence
- Send DCI (with Global timer)

Pass through and Create Errors work the same as Single Primitive Sequences.

You can replace every Dword of the sequence with another specific Dword by choosing **Replace every Dword of sequence with this Primitive...** You can replace the sequence with any K/D characters, any standard Primitives, or Scrambled Primitive Data by choosing from the drop-down menu. Choosing PMACK or PMNAK is equivalent to replacing with a Repeated Primitive Sequence.

You can replace the sequence with a standard Continued Primitive Sequence by choosing **Replace sequence with this Continued Primitive Sequence...** Choose from the drop-down menu.

DCI options are available only in the Advanced SAS/SATA Jammer configurations. These allow you to replace a Dword with a DCI or to send DCI with the Global timer set in the Global tab.

Chapter 15

Creating Jammer Test Configurations for 10GigE

In this chapter:

- Defining Your Own Test Configurations for 10GigE
- Using the Jammer Configuration Window for 10GigE
- Configuring the Arm Condition for 10GigE
- Configuring the Trigger Condition for 10GigE
- Configuring the Jam Definition for 10GigE

Defining Your Own Test Configurations for 10GigE

Xgig Jammer lets you define your own test configurations and save them with or without hardware available.

You can create a configuration from scratch, or you can open and edit an existing configuration. Also, you can edit a configuration in edit only mode, which is independent of any hardware, or you can edit a configuration that is currently loaded to a Jammer device.

To edit a configuration in edit only mode:

>> Double-click on a configuration file in the Configuration manager.

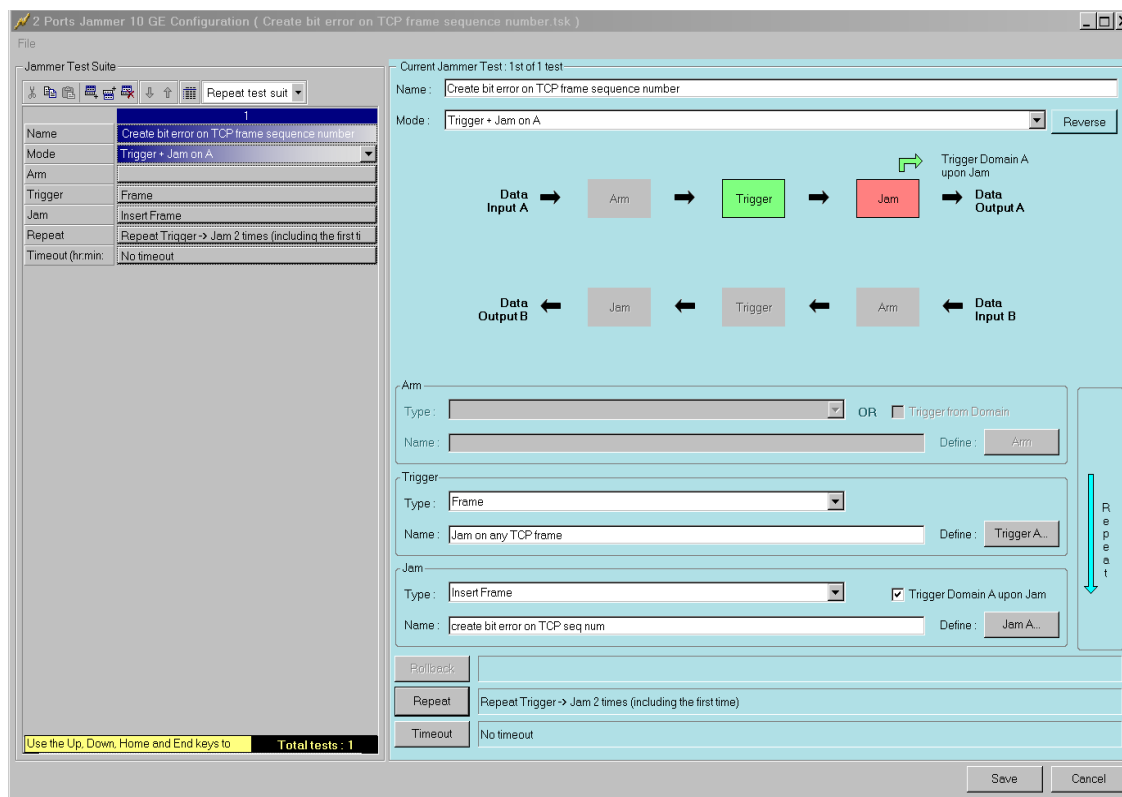
or:

>> Right-click on the configuration file in the Configuration manager and choose **Edit Jammer Configuration** from the context menu.

The edit only mode Jammer Configuration window opens (Figure 208).

This window allows you to set up your own Test Cases, name them, organize them, and save them to files so that you can use them again.

Figure 208: Edit Only Jammer Configuration Window



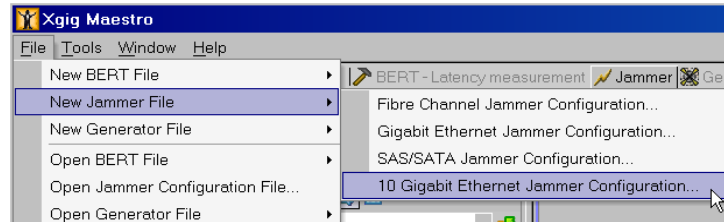
To start a configuration from scratch in edit only mode:

>> Select **New Jammer Configuration** from the context menu or the File menu (Figure 209) on the Xgig Maestro menu bar. Then, select **10 Gigabit Ethernet Jammer** from the drop down menu.

or:

- >> Click the New Configuration icon at the top of the Configuration manager.

Figure 209: Maestro File Menu



To save your configuration in edit only mode:

- >> Click **Save** at the bottom of the Jammer Configuration window or open the File menu on the Jammer Configuration window and select **Save Configuration** or **Save Configuration As**.

Any changes you make have no effect on actual Jammer devices you control.

To edit a configuration that is loaded to a Jammer port:

- >> Click **Configuration...** in the device column.

or:

- >> Right-click in the Parameters Status table in the device column to open the context menu and select **Edit configuration**.

or:

- >> Click **Operation** in the device column to open the Operation dialog, then click **Config**.

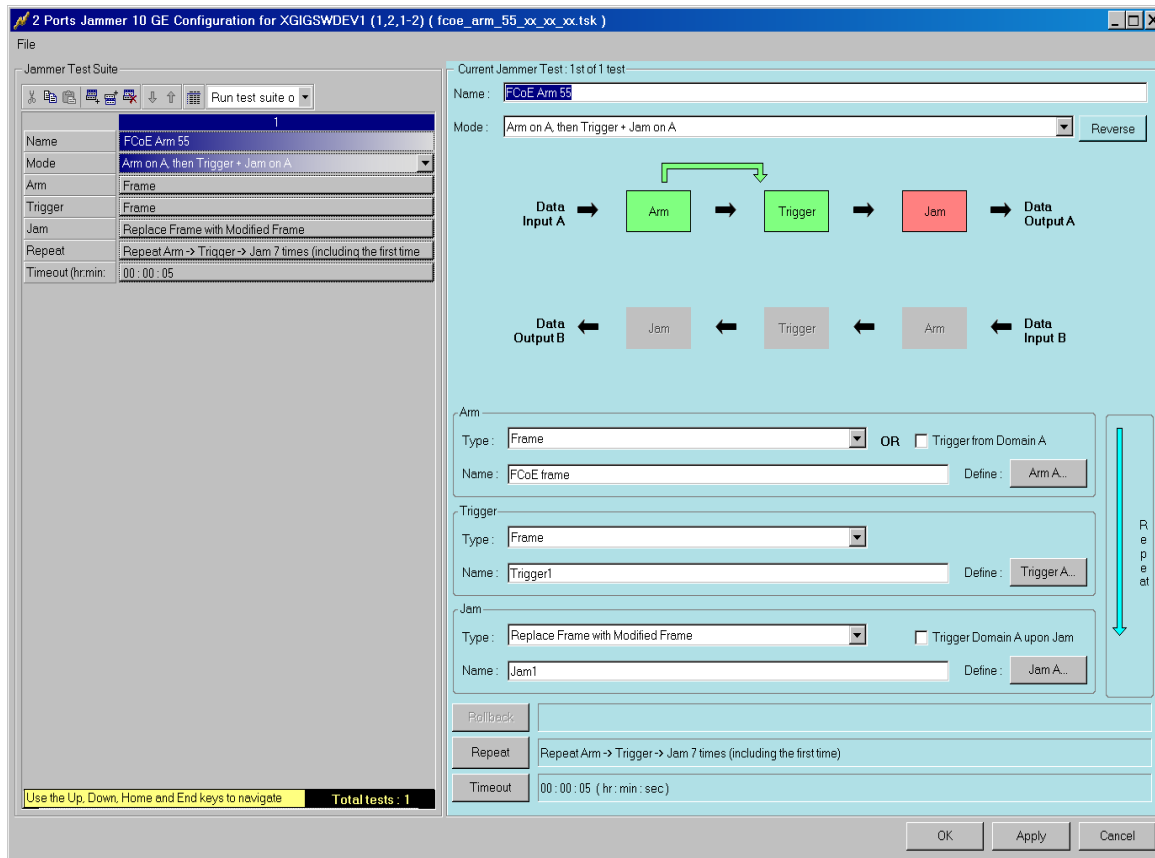
The Xgig Jammer Configuration window in hardware edit mode is displayed (Figure 210).

This window allows you to set up your own Test Cases, name them, and save them to a file so that you can use them again.

Click **Apply** or **OK** and Jammer accepts the changes. They are immediately reflected in the Parameters Status table and affect the Jammer device the next time you run it.

To save your configuration edits:

- >> Open the File menu at the top of the Jammer Configuration window and select **Save Configuration As...** or **Save Configuration**.

Figure 210: Xgig Jammer Configuration Window

Using the Jammer Configuration Window for 10GigE

The Jammer Configuration window title bar indicates how many ports it is configuring, the protocol, and the configuration file name, if any. If you are using hardware edit mode, the chassis name, chassis number, slot number, and port number are also listed. The elements of the Jammer Configuration window are described in the following sections.

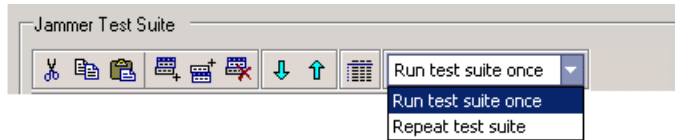
Using the Jammer Test Suite Tools for 10GigE

The Jammer Test Suite (left pane) lists the series of Xgig Jammer tests in the order in which you want them to execute. The suite includes one or more tests. The highlighted test appears as the Current Jammer Test (right pane). Each test in the suite executes in sequence with a test reset time of approximately 130 (200 max) milliseconds.

Creating a Test Suite

When you create a 10GigE Jammer Test Suite, you use the toolbar in the Jammer Test Suite section of the Configuration window (Figure 211).

Figure 211: 10GigE Jammer Test Suite Toolbar



The following list describes the icons on the toolbar:

	Cut current test	Removes the highlighted test and holds its contents in the memory buffer.
	Copy current text	Copies the highlighted test to the memory buffer.
	Paste last test cut or copied	Inserts the current memory buffer contents before the currently highlighted test.
	Add new test to bottom of stack	Adds a new blank test to the bottom of the suite.
	Insert new test before current test	Inserts a new blank test above the currently highlighted test.
	Delete current test	Removes the highlighted test from the suite. If only one test is present, then the contents of this test are cleared.
	Move current test down the stack	Moves the highlighted test down one in the test order.
	Move current test up the stack	Moves the highlighted test up one in the test order.
	Toggle view	Toggles Test Suite between Card View and List View.
	Run test suite once or Repeat test suite	When you choose Repeat test suite, the tests run according the settings you define in the Jammer Current Test window.

To duplicate a test at another point in the Test Suite:

- 1 Highlight the test you want to duplicate.
- 2 Click **Copy**.
- 3 Highlight the test in the suite that is just after the point where you want the duplicate test inserted.
- 4 Click **Paste**.

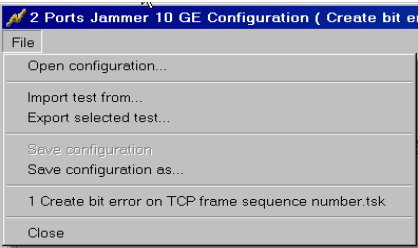
The duplicate test is inserted.

Refer to “Configuring the Arm Condition for 10GigE”, “Configuring the Trigger Condition for 10GigE” and “Configuring the Jam Definition for 10GigE” for information about configuring each test.

Using the Configuration File Menu

The File menu is the only menu on the menu bar (Figure 212).

Figure 212: Configuration File Menu



The choices are:

Open Configuration	Open an existing .tsk configuration file.
Import to Selected Test	Import a Test Case from a .tst file or an entire test suite, .tsk file, to the currently highlighted position. A Test Case is one line in the Jammer Test Suite.
Export Selected Test	Export and save the currently highlighted test to a .tst file.
Save Configuration	Save the entire Test Suite to the .tsk file you currently have loaded.
Save Configuration As	Save the entire Test Suite to a .tsk file with a name you assign to it.
Close	Close the Jammer Configuration Window.

The recently used 10GigE Jammer configuration files appear in the file menu and are loaded when selected.



Note: The .tst files are only for storing individual Test Cases and swapping them between configuration files. You cannot load .tst files directly into a Jammer device on the Xgig Maestro window.

Using the Current Jammer Test Window for 10GigE

The graphics in this section of the window represent the hardware configuration for the selected test in the Jammer Test Suite (Figure 213).

Figure 213: Current Jammer Test Window

Current Jammer Test: 1st of 1 test

Name:

Mode: Reverse

The diagram illustrates the hardware configuration for the selected test. It shows two paths, A (top) and B (bottom). Path A starts with Data Input A, followed by an Arm block (green), a Trigger block (green), a Jam block (red), and Data Output A. Path B starts with Data Input B, followed by an Arm block (grey), a Trigger block (grey), a Jam block (grey), and Data Output B. A Rollback block (yellow) is connected to the Trigger block in Path A and the Jam block in Path B. A green arrow indicates a flow from the Arm block to the Trigger block in Path A. A red arrow indicates a flow from the Trigger block to the Jam block in Path A. A blue arrow indicates a flow from the Jam block to the Data Output A. A vertical blue arrow on the right side of the diagram is labeled 'Repeat'.

Arm

Type: OR ☐ Trigger from Domain A

Name: Define: Arm A...

Trigger

Type:

Name: Define: Trigger A...

Jam

Type: ☒ Trigger Domain A upon Jam

Name: Define: Jam A...

Rollback:

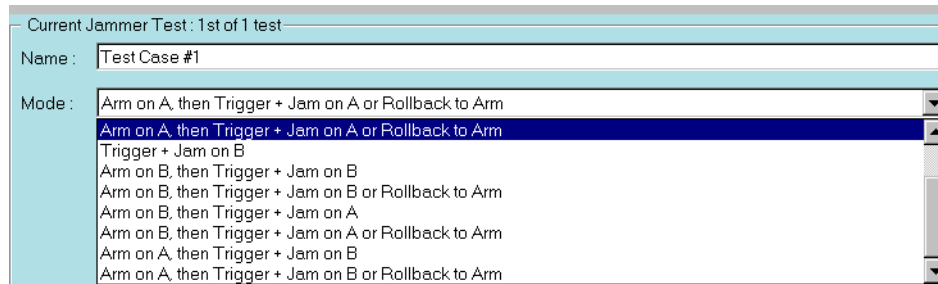
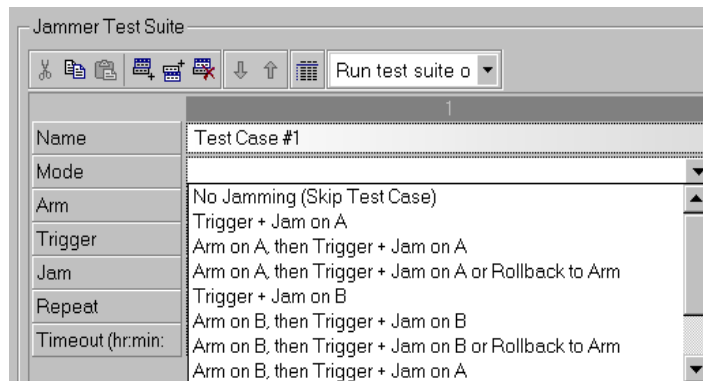
Repeat:

Timeout:

Mode

For 10GigE, Mode menus are available near the top of the Current Jammer Test window (Figure 214) and also near the top of each Test Case in the Jammer Test Suite window (Figure 215).

The input to path A (on top) is always port A and the input to path B (on the bottom) is always port B. The external trigger input and output that are available on path A always are linked to the domain shown on the Xgig Maestro window as “Domain of port A.” The trigger input and output on the bottom on path B are in the “Domain of port B.”

Figure 214: Mode Drop-down Menu in Current Jammer Test - Right Pane**Figure 215: Mode Drop-down Menu in Test Suite - Left Pane**

Reverse

You can reverse the direction of the jam by selecting the **Reverse** button.

Arm and Trigger

To define Arm and Trigger conditions, select a respective Type from each drop-down menu. Then click the Arm or Trigger button to open the corresponding definition window.

You can use an external input as an Arm condition. Check Trigger from Domain A (or B) to enable this feature. You must put the corresponding Jammer port into a domain for this to work properly.

The Trigger event can be in the next Dword after the Arm event in the traffic stream.

Jam

To define a Jam:

- 1 Select a Type from the drop-down menu, if available.
- 2 Click the Jam button to open the Jam Definition window.

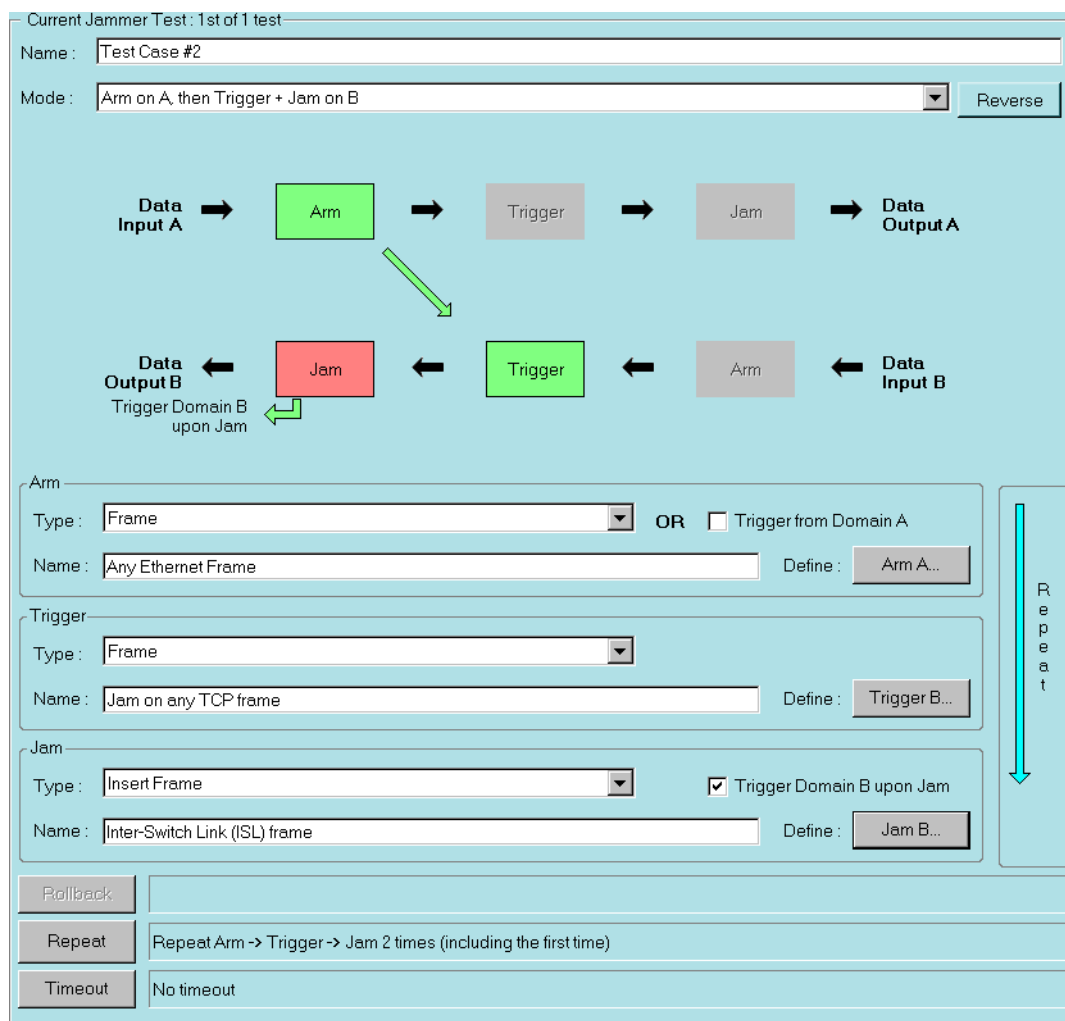
The Jam Definition specifies the modifications to be made to the traffic matching the Trigger Condition.

In addition, the Jammer port can trigger out to the Domain it is in when a Jam takes place. Check Trigger Domain A (or B) upon Jam to enable this feature.



Note: If you use an external trigger input to define the Arm condition, then you cannot select the external trigger output for that path in that Test Case, and vice versa. For information regarding using the trigger input and output during a Test Case, refer to [“Using Domains and External Triggering” on page 319](#). However, you can use an external trigger in on port A with an external trigger out on port B, and vice versa. [Figure 216](#) shows an example.

Figure 216: Trigger In and Trigger Out



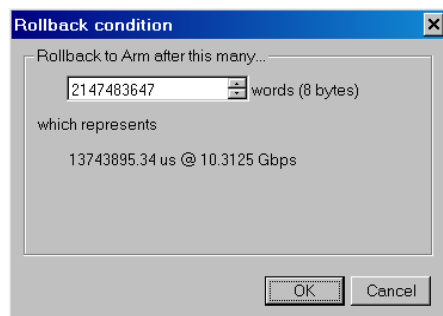
Rollback

The Rollback option defines the time or Dword count parameter between the Arm and Trigger events. If the Trigger does not follow the Arm event in the allotted time or Dword count, the Jammer begins looking for the Arm event again. Click **Rollback** to display the dialog shown in Figure 217.



Note: This value is saved in terms of Dwords, not time, so keep this in mind if you save a Test Case using a device running at 3.0 Gbps and later open the configuration on a Jammer running at 1.5 Gbps.

Figure 217: Rollback Condition Dialog



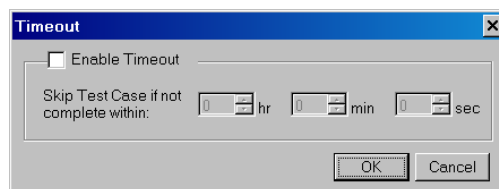
Timeout

The timeout option defines the period of time to wait for a specified test to complete before aborting and proceeding to the next test in the suite.

To set the timeout:

- 1 Click **Timeout** to display the dialog box in Figure 218.
- 2 Check **Enable Timeout**.
- 3 Enter the hours, minutes, and seconds you want to wait.

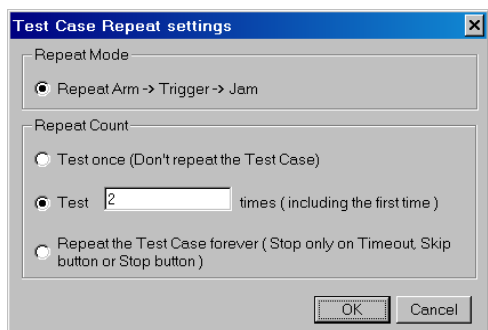
Figure 218: Timeout Dialog



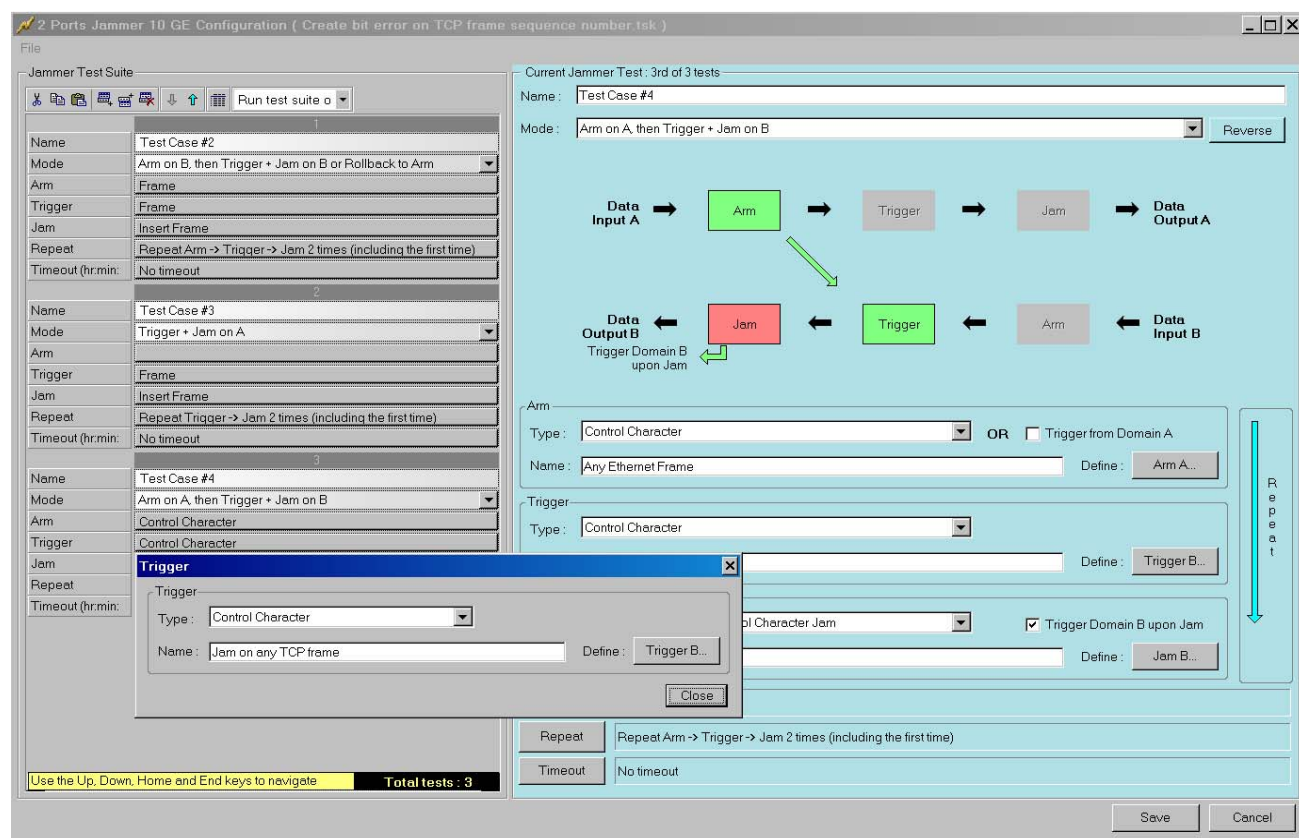
- 4 Click **OK**.

Repeat

Click **Repeat** to open the dialog shown in Figure 219. The Repeat Mode setting allows you to configure what is repeated when using an Arm condition. The first option means the Jammer will match the Arm condition once, then will repeat matching the Trigger condition as specified by the Repeat Count setting below. The second Repeat Mode option means that the Jammer must match the Arm condition each time before looking for a Trigger.

Figure 219: Repeat Test Dialog

You can also configure options for each Test Case directly in the Test Suite, instead of clicking in the Current Jammer Test pane. Click on the area of the Test Case you want to modify to open the corresponding dialog (Figure 220).

Figure 220: Configuring Options Directly in the Test Suite

Configuring the Arm Condition for 10GigE

The 10GigE Arm condition recognizes specific ordered sets, control characters, or frames.

In 10GigE, you can select from the following:

- Frame - Allows you to specify the 10GigE header and up to 114 bytes of payload
- Ordered Set - Provides you with predefined ordered sets, or allows you to define a four byte ordered set
- Control Character - Allows you to choose from pre-defined control characters

Depending on the Mode you select, the appropriate graphic diagram shows the Trigger and optional Arm conditions, along with the Jam event. If the Mode you select does not include an Arm condition, the **Arm** button is disabled.

To set Arm conditions:

- 1 Select Frame, Ordered Set, or Control Character from the **Type** drop-down menu in the Arm section of the Current Jammer Test window.
- 2 Click on the **Arm** button to open the Arm window.

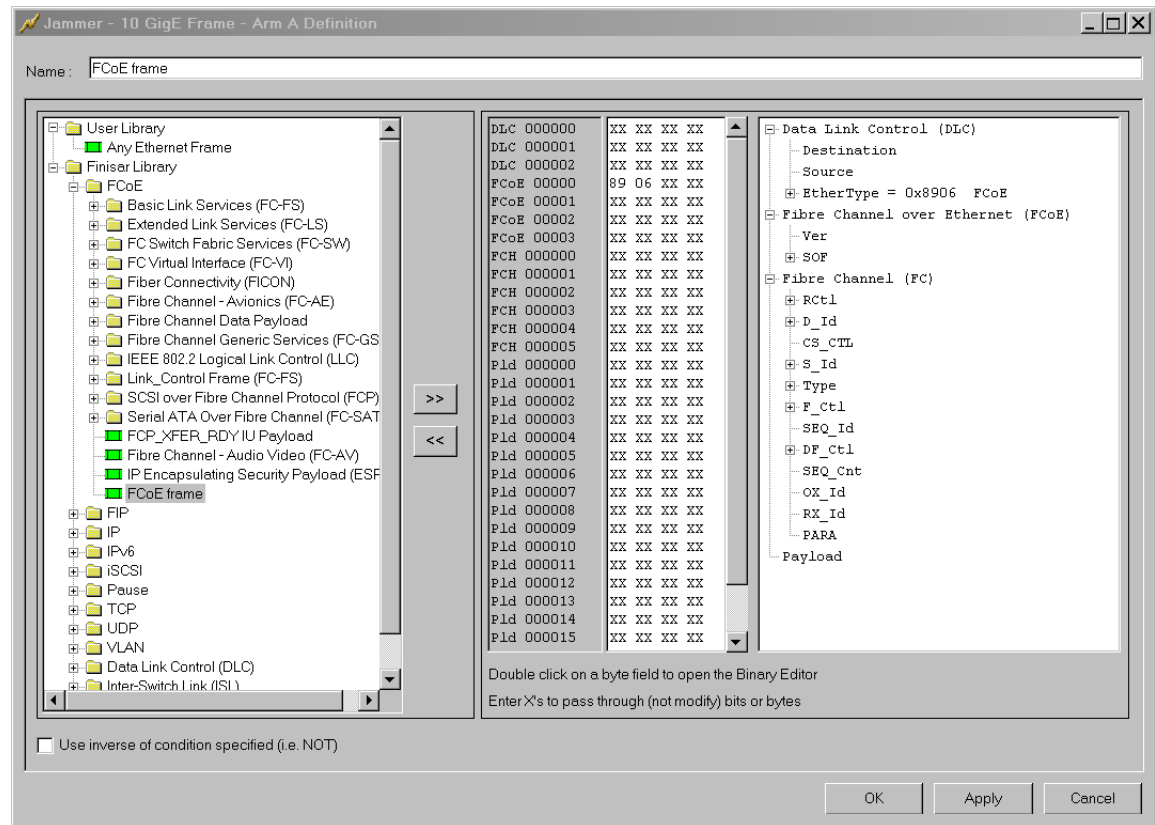
The window for the condition is displayed (Figure 221). If you are in hardware edit mode, the protocol, chassis name, chassis number, slot number, and port numbers are displayed in the title bar.

- 3 Set the values as required to specify the Arm condition as part of a unique Arm and Trigger sequence for the specific test.

The following sections describe the available values.

Setting Frame Conditions for 10GigE Arm

You can specify frame conditions in two ways. One way is to load a template from the Template Library tree, and the other way is to manually specify bits in the frame.

Figure 221: Gigabit Ethernet Arm Window for Frames

To use a template:

- 1 Select a template from the Template Library tree on the left.
- 2 Click the double right arrow button to set the Trigger Condition.

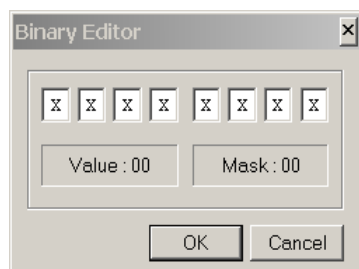
The condition is indicated on the right side of the window.

To manually specify a frame:

- >> Type hexadecimal values directly into the center column of the window.

An X represents a nibble that can be any value (a “don’t care”).

To set individual bits in any field, double-click on the hex entry to open the Binary Editor (Figure 222). In the hex view, partially defined hex characters appear as question marks: X001=?

Figure 222: Binary Editor Dialog

Another way to manually edit the frame condition is to make selections from the tree view in the right window pane.

Saving a Frame Condition

If you create a frame condition that you want to save and make easily available for future use, you can save it into the “User Library” folder in the Template Library tree. To do this:

>> Highlight the folder and click the double left arrow button.

Frame conditions have the option of “Use inverse of condition specified (i.e., NOT).” When you check this option, it means that the first frame encountered that does not match what you have specified creates a “condition met” event.

For each frame condition, you can specify an optional name at the top of the window. This name is also shown on the Jammer Configuration window under the Mode selection, and on the main Xgig Maestro window.

Setting Ordered Set Conditions for 10GigE Arm

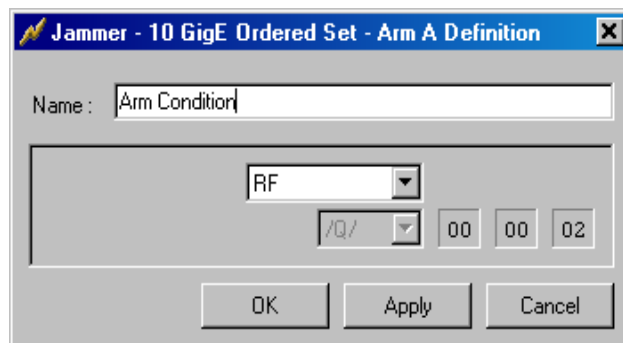
You can choose from a predefined Ordered Set (LF or RF) or choose user-defined (Figure 223). All choices are four bytes. You can select either /Q/ or /Fsig/ for the first byte of a user-defined ordered set. You can enter hex values for the remaining three bytes.

To edit the values:

>> Enter a hex value, or double-click the byte field to open the Binary Editor.

As in frame conditions, an X indicates “don’t care” and a ? indicates a partially specified hex character.

Figure 223: 10GigE Arm Window-Ordered Sets

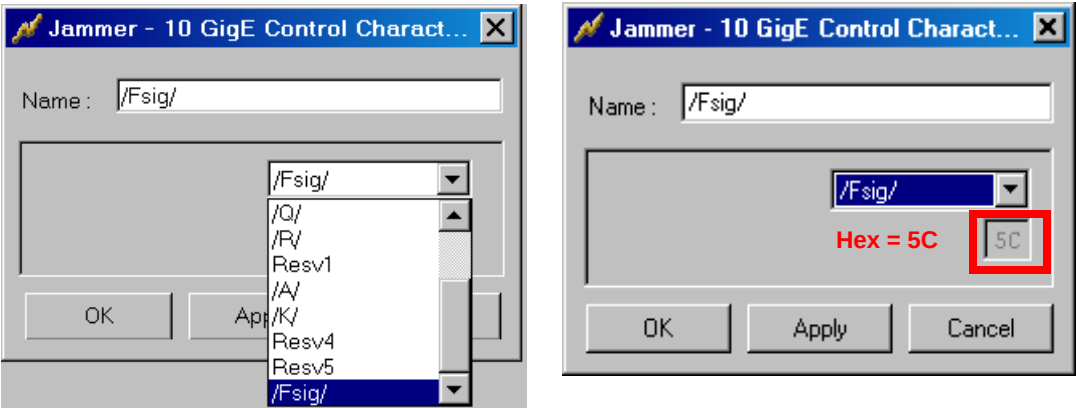


As with frame conditions, you can specify an optional name at the top of the window. This name is also shown in the Jammer Configuration window under the Mode selection and on the main Xgig Maestro window.

Setting Control Character Conditions for 10GigE Arm

You can choose from any standard one byte Control Character (Figure 224). The field below the drop-down menu shows the hex value of the Control Character selected.

Figure 224: 10GigE Arm Window Control Characters



Configuring the Trigger Condition for 10GigE

The 10GigE Trigger condition recognizes specific ordered sets, control characters, frames, SOP, and EOP.

In 10GigE, you can select a trigger from the following options:

- Frame - Allows you to specify the 10GigE header and up to 114 bytes of payload
- Ordered Set - Provides you with predefined ordered sets, or allows you to define a four byte ordered set
- Control Character - Allows you to choose from pre-defined control characters
- SOP - Allows you to trigger at the SOP
- EOP - Allows you to trigger at EOP

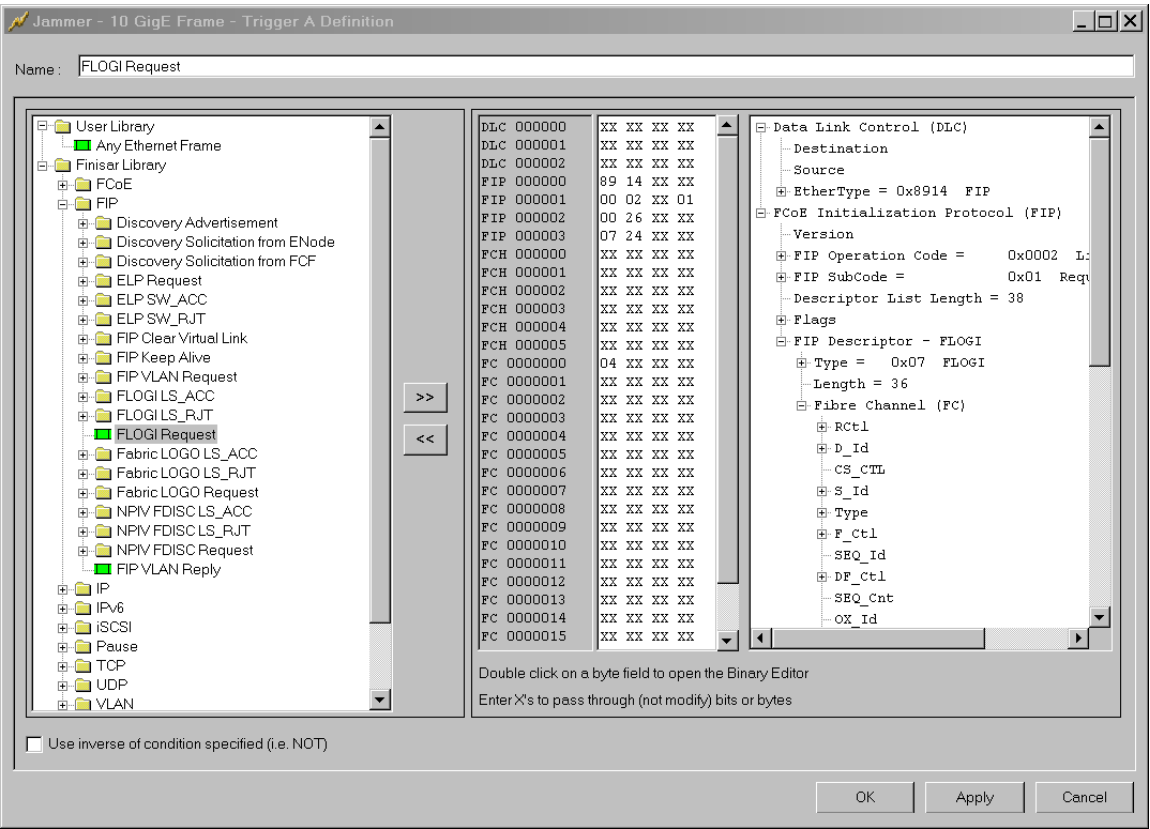
Depending on the Mode you select in the **Jammer Configuration** window, the appropriate graphic diagram shows the Trigger and optional Arm conditions, along with the Jam event. If the Mode you select does not include an Arm condition, the Arm button remains disabled.

To set Trigger conditions:

- 1 Open the Type drop-down in the Trigger Condition window, and select Frame, Ordered Set, Control Character, SOP, or EOP.
- 2 Click the **Trigger** button in the Xgig Jammer Configuration window.
The window for the condition is displayed (Figure 221). If you are in hardware edit mode, the protocol, chassis name, chassis number, slot number, and port numbers are displayed in the title bar.
- 3 Set the values as required to specify the Trigger condition as part of a unique Arm and Trigger sequence for the specific test.

The following sections describe the available values.

Figure 225: 10GigE Trigger Window for Frames



Setting Frame Conditions for a 10GigE Trigger

You can specify frame conditions in two ways. One way is to load a template from the Template Library tree, and the other way is to manually specify bits in the frame.

To use a template:

- 1 Select a template from the Template Library tree on the left.
- 2 Click the double right arrow button to set the Trigger Condition.

The condition is indicated on the right side of the window.

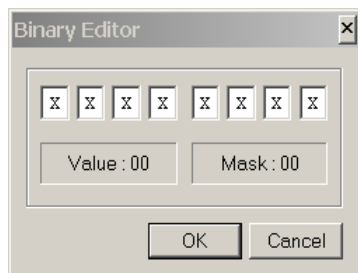
To manually specify a frame:

>> Type hexadecimal values directly into the center column of the window.

An X represents a nibble that can be any value (a “don’t care”).

To set individual bits in any field, double-click on the hex entry to open the Binary Editor (Figure 222). In the hex view, partially defined hex characters appear as question marks: X001=?

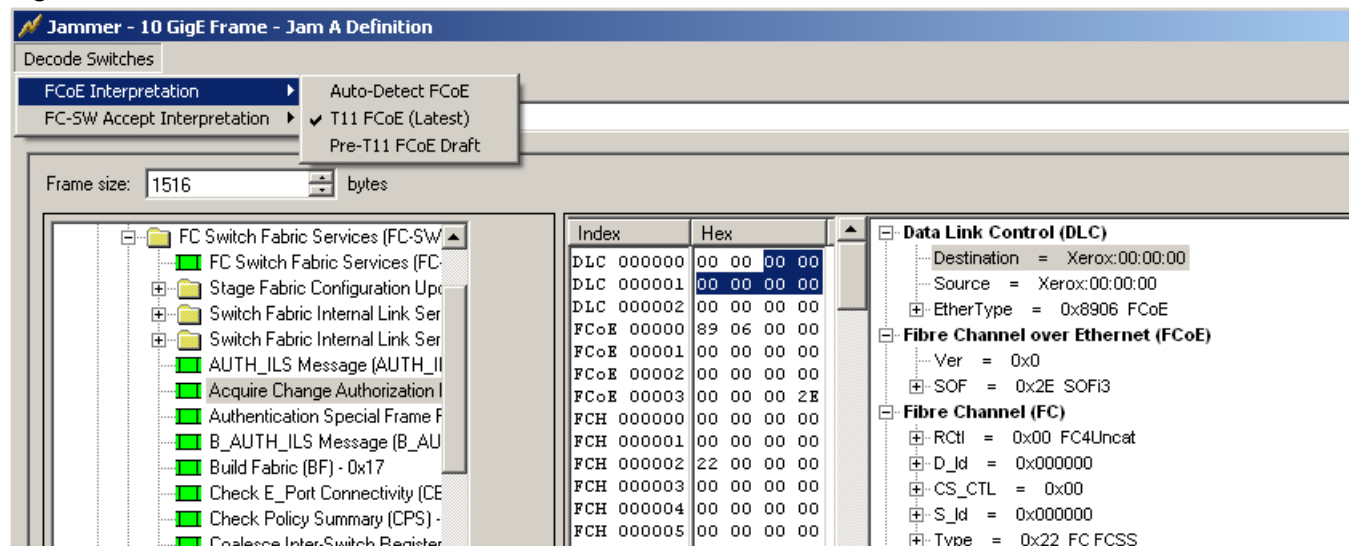
Figure 226: Binary Editor Dialog



Another way to manually edit the frame condition is to make selections from the tree view in the right window pane.

Decode Switches Menu

Some templates allow you to specify decode switches. When you load a template that has this option, the **Decode Switches Menu** appears in the upper left corner of the window. The decode switches provide detailed contextual options for decode; for example, further decode of response and data frames. The Decode Switches menu is context sensitive and will only show the decode options available for the specific template you are creating.

Figure 227: Decode Switches Menu

Note: Once the **Decode Switches** menu appears, it remains visible. However, if you load a template that has no decode options, the menu is greyed out and inactive.

The **Decode Switches** menu is intended to help you create a user-defined template. When editing a User Library template, Decode Switches are stored inside the template so they are still ON the next time you open this particular template.

Decode switches allow you to further decode Response and Data frames that can't be decoded without knowing what the associated command frame is. Below is a description of the switches available for Jammer's Trigger and Insert Frame conditions:

FCoE Interpretations

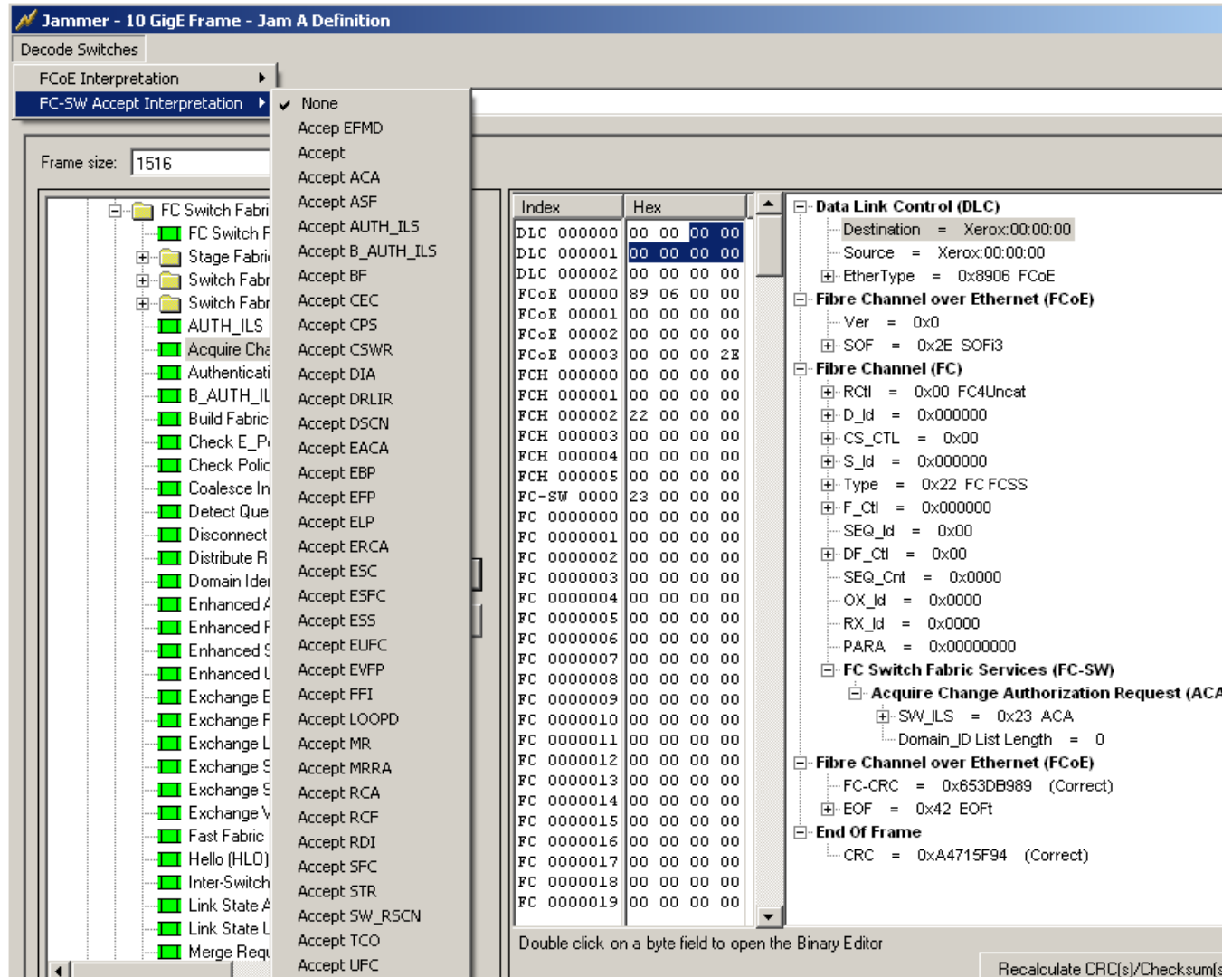
This menu is available for FCoE frames. Fibre Channel over Ethernet (FCoE) is the proposed mapping of Fibre Channel over selected full duplex IEEE 802.3 networks. The **Auto-Detect FCoE** setting automatically detects the version and is the default decode switch. The auto-detect mode works on a per-FCoE frame basis. It assumes that the FCoE frame reserved bits are set to zero and detects which FCoE specification is in use depending on where the zeroes are. If you end up with multiple errors and erroneous decoding of the FCoE frames, it is because the auto-detect mode assumptions do not work with your particular trace. This requires that select manually which FCoE specification to use. Available settings are:

- **Auto-Detect FCoE**
Automatically detects the specification version by looking at the frame header.
- **T11 FCoE (Latest)**
Selects the latest draft of the T11 standards committee specification as of this Xgig Analyzer release date.
- **Pre-T11 FCoE Draft**
Selects the pre-T11 standards committee draft, 07-303v0.pdf.\

FC-SW Accept Interpretation

This menu item is available for FC-SW (Fibre Channel Switch Fabric Internal Link Service) Accept frames. It contains a list of the possible Switch Link Service Accept frame formats.

Figure 228: Decode Switch Options for FC-SW Accept Interpretation



Saving a Frame Condition

If you create a frame condition that you want to save and make easily available for future use, you can save it into the "User Library" folder in the Template Library tree. To do this:

>> Highlight the folder and click the double left arrow button.

Frame conditions have the option of "Use inverse of condition specified (i.e., NOT)." When you check this option, it means that the first frame encountered that does not match what you have specified creates a "condition met" event.

For each frame condition, you can specify an optional name at the top of the window. This name is also shown on the Jammer Configuration window under the Mode selection, and on the main Xgig Maestro window.

Setting Ordered Set Conditions for a 10GigE Trigger

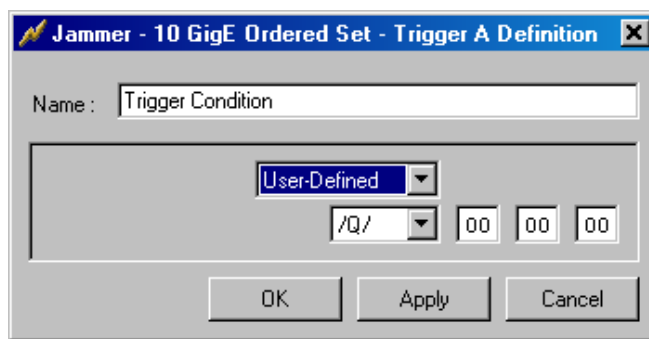
You can choose from a predefined Ordered Set (LF or RF) or choose user-defined (Figure 223). All choices are four bytes. You can select either /Q/ or /Fsig/ for the first byte of a user-defined ordered set. You can enter hex values for the remaining three bytes.

To edit the values:

>> Enter a hex value, or double-click the byte field to open the Binary Editor.

As in frame conditions, an X indicates “don’t care” and a ? indicates a partially specified hex character.

Figure 229: 10GigE Trigger Window-Ordered Sets

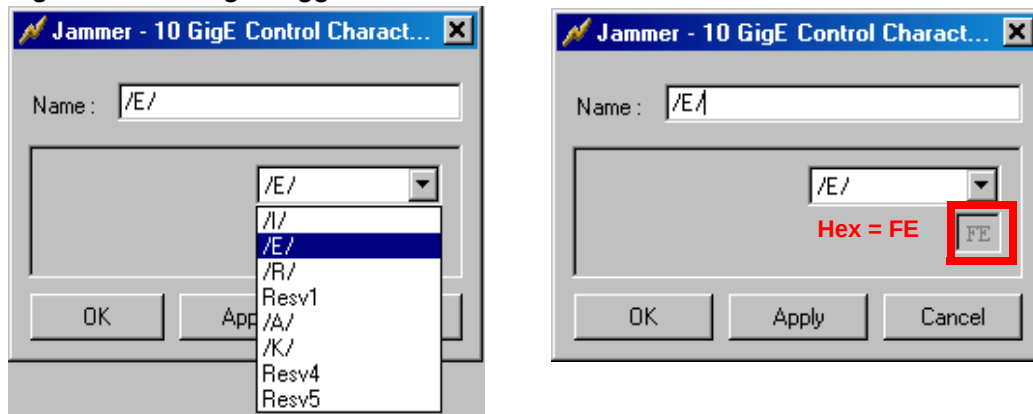


As with frame conditions, you can specify an optional name at the top of the window. This name is also shown in the Jammer Configuration window under the Mode selection and on the main Xgig Maestro window.

Setting Control Character Conditions for a 10GigE Trigger

You can choose from any standard one byte Control Character (Figure 230). The field below the drop-down menu shows the hex value of the Control Character selected.

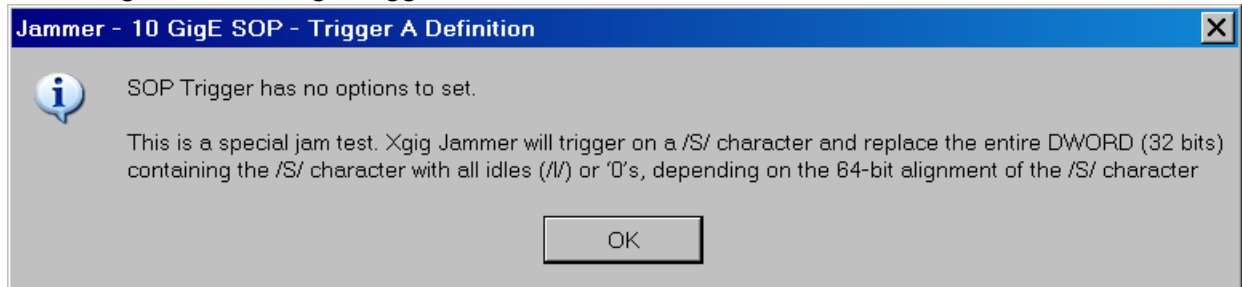
Figure 230: 10GigE Trigger Window Control Characters



Setting SOP Trigger for 10GigE

The SOP Trigger has no options to set. When you set the test to trigger at the start of the packet (SOP), the following window appears, which states that for this type of jam test, the Jammer will trigger on an /S/ character, and the entire DWORD (32 bits) will be replaced with (/I/s or “0”s depending on the 64 bit alignment of the /S/ character.

Figure 231: 10GigE Trigger SOP

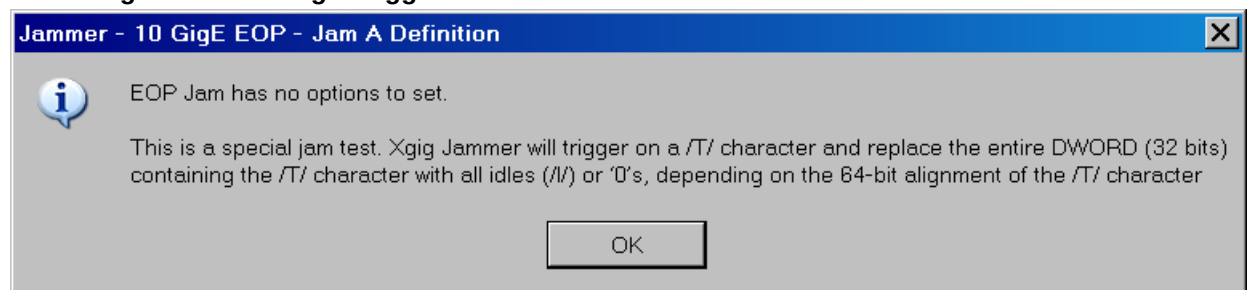


Note: When you select SOP as the trigger, the only jam type available is SOP. The jam window contain a message similar to the one above.

Setting EOP Trigger for 10GigE

The EOP Trigger has no options to set. When you set the test to trigger at the end of the packet (EOP), the following window appears, which states that for this type of jam test, the Jammer will trigger on an /T/ character, and the entire DWORD (32 bits) will be replaced with (/I/s or “0”s depending on the 64 bit alignment of the /T/ character.

Figure 232: 10GigE Trigger SOP



Note: When you select EOP as the trigger, the only jam type available is EOP. The jam window contain a message similar to the one above.

Configuring the Jam Definition for 10GigE

The **Jam Definition** window defines how to modify the event specified on the **Trigger Condition** window.

The type of Jam available depends on the type of Trigger selected. In the case of SOP and EOP, the Jam is always the same type as the trigger.

For any Jam Definition, you can specify an optional name at the top of the window. This name is also displayed on the Jammer Configuration window under Mode selection and on the main Xgig Maestro window.

Jamming an Ordered Set for 10GigE

If the Trigger Event is an Ordered Set, click the **Jam** button on the Xgig Jammer Configuration window, to open the Ordered Set Jam Definition window (Figure 233).

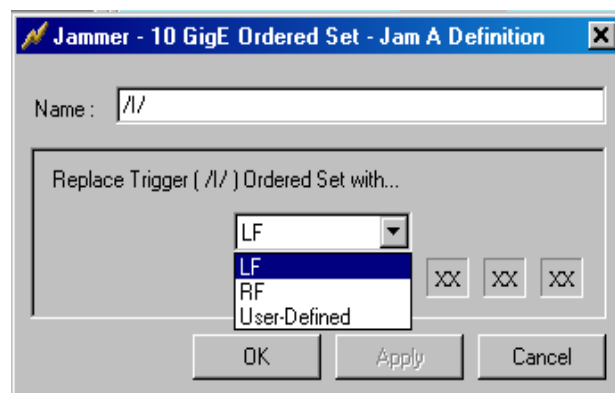
The Ordered Set Jam Definition window allows you to modify any Ordered Set by replacing it with a different Ordered Set. You can choose from a predefined Ordered Set (LF or RF) or choose user-defined (Figure 223). All choices are four bytes. You can select either /Q/ or /Fsig/ for the first byte of a user-defined ordered set. Then, you can enter hex values for the remaining three bytes.

To edit the values:

>> Enter a hex value, or double-click the byte field to open the Binary Editor.

As in frame conditions, an X indicates “don’t care” and a ? indicates a partially specified hex character.

Figure 233: 10GigE Ordered Set Jam Definition Window

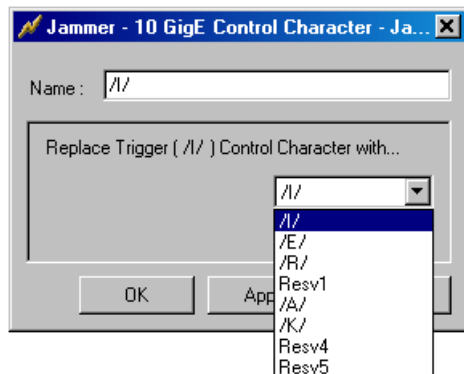


Jamming a Control Character for 10GigE

If the Trigger Event is a Control Character, click the **Jam** button on the Xgig Jammer Configuration window, to open the Control Character Jam Definition window (Figure 233).

The Control Character Jam Definition window allows you to modify any Control Character by replacing it with a different Control Character.

Figure 234: 10GigE Ordered Set Jam Definition Window



Jamming a Frame for 10GigE

To define a Jam for a frame:

- 1 Select a Jam from the **Jam Type** drop-down menu.
- 2 Click the **Jam** button to configure the jam.

This section explains the available Jam Types.

- [Replace Frame with Modified Frame](#)
- [Replace Frame with Truncated Frame](#)
- [Replace Frame with Idles](#)
- [Insert Frame](#)
- [Duplicate Frame](#)
- [Insert Dword](#)

Replace Frame with Modified Frame

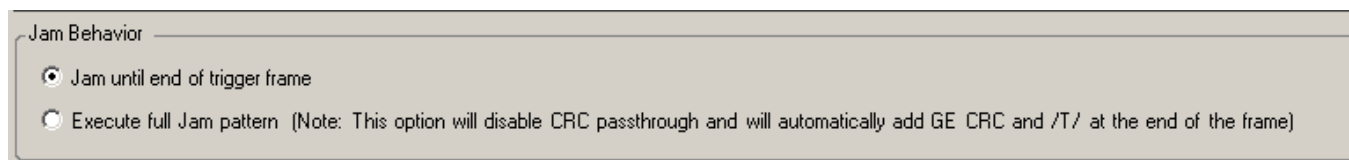
Each tab of the Modified Frame window contains options relevant to different frame modifications.

- Global
- Delimiters/CRC
- Header/Payload
- Embedded Protocol(s)

Jam Behavior (All Tabs)

The **Jam Behavior** pane is located at the bottom of each tab in the **Frame Jam Definition** window. The Jam behavior settings control the number of user-defined header/payload Jams performed relative to the target trigger frame.

Figure 235: Jam Behavior Selection



- **Jam until end of trigger frame**

Jams defined in the Header/Payload tab are performed until the end of the target trigger frame (or until an abnormal termination of the frame). All Jams defined that would take place on the original CRC or later are ignored. However, if the frame that is triggered on has more Dwords than the Jams you specify, the remaining Dwords are passed through. The CRC and EOF of the original target trigger frame are always jammed according to the CRC and EOF settings on the SOF/CRC/EOF tab. This is the standard way to Jam a frame.

- **Execute full Jam pattern**

All header and payload Jams are executed even if they overwrite beyond the end of the target trigger frame.

If the target trigger frame is longer than the number of Jams defined, then the portion of the target trigger frame that extends after the last defined Jam is overwritten with /I/. If the target trigger frame is shorter, then the Jammer switches back to pass-through immediately after the last defined Jam. Use the control on the Header/Payload tab at the bottom of the List View pane to define how many payload Jams should take place.

The Execute full Jam option is supported only when any template from the FCoE library is loaded into the Header/Payload edit area.

The following **Delimiter** options are supported:

- FCoE SOF modification
- FCoE EOF modification (always enabled)
- FCoE embedded CRC recalculate / replace
- GigE CRC recalculate/ replace

The GigE CRC is recalculated or replaced based on the user input and appended automatically at the end of the payload.

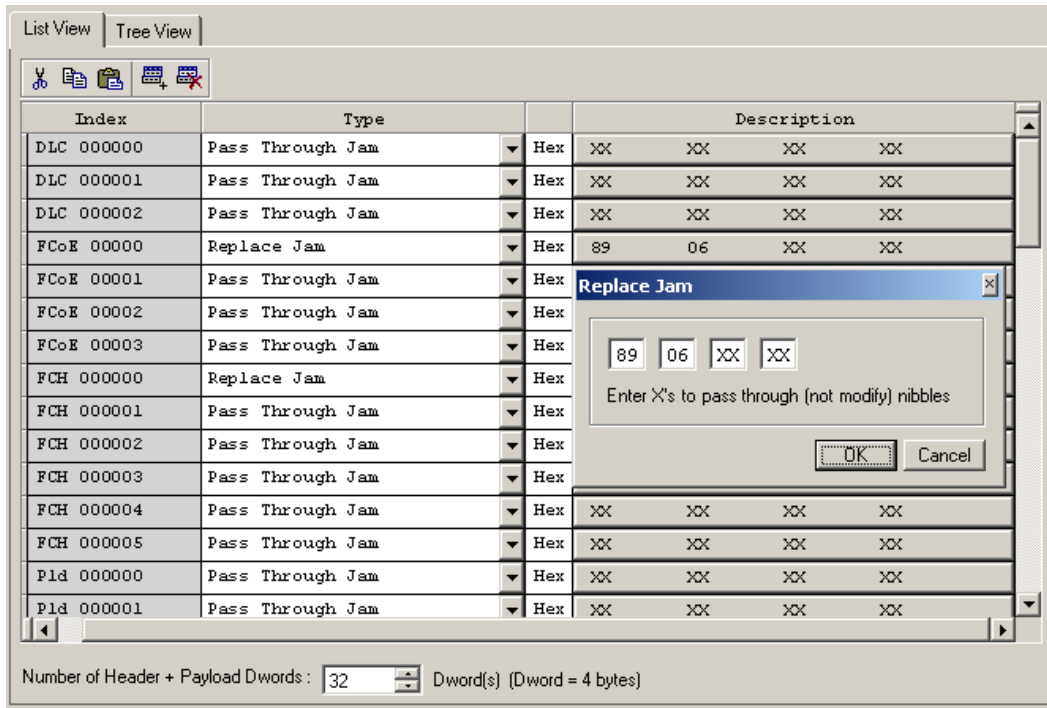


Note: For correct FCoE recalculation, any number of Header + payload words can be specified as long as the minimum embedded FCoE frame payload size is 2 Dwords.

Non-FCoE Frames

Non-FCoE frames can also be supported by using the **Replace Jam Editor** to change the ether type byte field in the payload area, but you must specify the payload size as a multiple of Dword.

Figure 236: Replace Frame Editor



Important: Currently, when Jamming with modified frame, the delimiter modification may not occur consistently when jamming from a protocol-specific frame to a non-protocol frame and vice-versa. However, the CRC recalculation always occurs.

— For Trigger FCoE -> Jam to Non-FCoE frame, FCoE delimiter modification is applied and overrides the specified field in the Header Payload area. FCoE CRC modification is not applied.

— For Trigger Non-FCoE frame -> Jam to FCoE frame, FCoE delimiter modification is not applied. However, valid FCoE delimiter value can be entered on the Header/Payload tab. FCoE CRC modification is applied.

Using the Global Tab

Use this tab (Figure 237) to define Jam parameters that apply globally to the frame.

Global Replace Jam Option

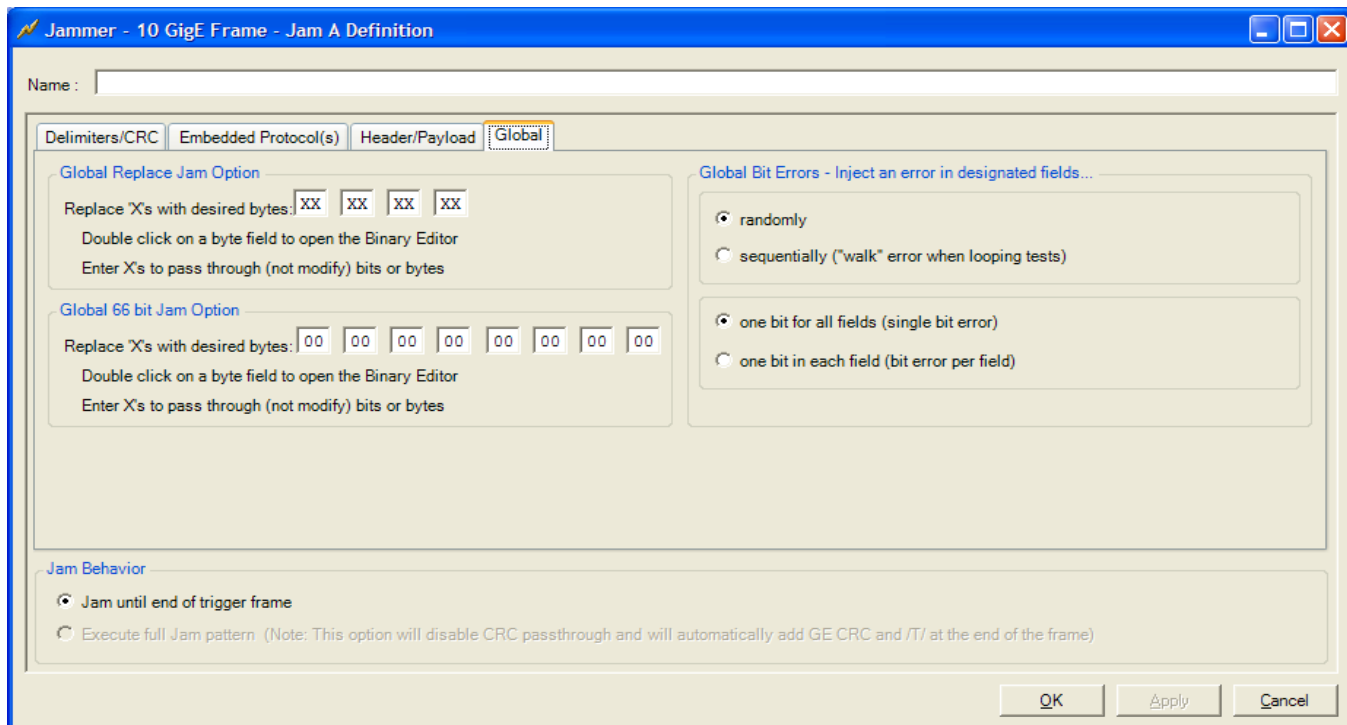
Use the Global Replace Jam Option word to set specific bits on an 8 bit level in a word to 1 or 0 while passing through the remaining bits. You can apply this replace jam option to any word in the frame. Define one Global Replace Jam Option for each Test Case.

To edit these bits:

>> Enter hex values, or double-click on a byte field to open the Binary Editor.

Any bits left as Xs are passed through.

Figure 237: 10GigE Global Tab



Global 66b Jam Option

Use the Global 66b Jam Option word to set specific bits at the 64 bit level in a word to either 1 or 0 while passing through the remaining bits. You can apply this 66b jam option to any word in the frame. Define one Global 66b Jam Option for each Test Case.

To edit these bits:

>> Enter hex values, or double-click on a byte field to open the Binary Editor.

Any bits left as Xs are passed through.

Global Bit Errors

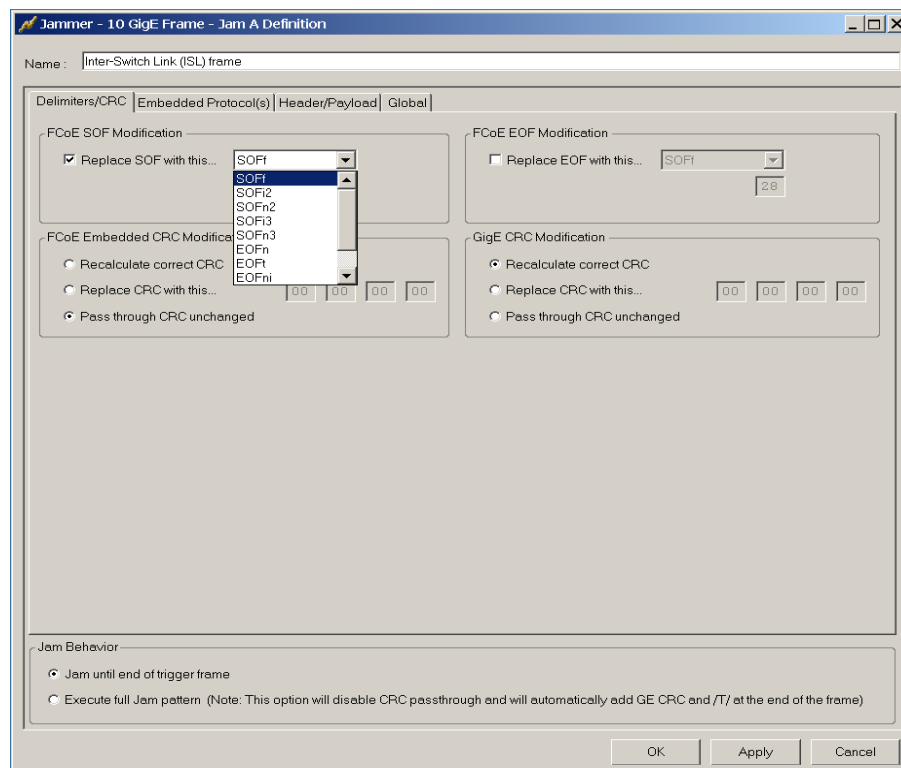
The Jammer software can introduce bit errors repeatedly in sequential or random fashion to predefined fields. These bit errors are introduced to the 32-bit form of the target words (not the 40-bit form) so code violations are not created. The Global Bit Errors control allows you four options.

- Select **one bit for all fields** and **randomly**. This causes the Jammer to inject a single bit error in the group of all fields selected in the header or payload for a single Test Case. If the Jammer Test Suite is set to *loop*, then single bit errors are randomly injected into these fields, with one bit for each cycle of the Test Suite.
- Select **one bit for all fields** and **sequentially**. This also injects a single bit error in the group of all fields selected in the header or payload. If the Test Suite is set to loop forever, the bit error walks through all the selected fields.
- Select **one bit in each field** and **randomly** does the same thing as the first option; however, there will be one error for each word selected in the payload or header.
- Select **one bit in each field** and **sequentially** does the same thing as the second option; however, there will be one error for each word selected in the payload or header.

Using the Delimiters/CRC Tab for Gigabit Ethernet

Use the choices on this tab to modify the FCoE Start of Frame (SOF), FCoE Embedded CRC Modification, FCoE End of Frame (EOF), and GigE Carrier Modification of the original frame (Figure 238).

Figure 238: 10GigE Delimiters/CRC Tab



Modifying SOF/EOF

To modify these special characters in the target trigger frame:

- 1 Check the appropriate box to select replacement.
- 2 Open the drop-down menu and choose a standard 10GigE Ordered Set, or select User-defined.

If you choose User-defined, you can specify any value.

To edit the value enter a hex value into the byte field or double-click to display the Binary Editor.

FCoE Embedded CRC/10GigE CRC Options

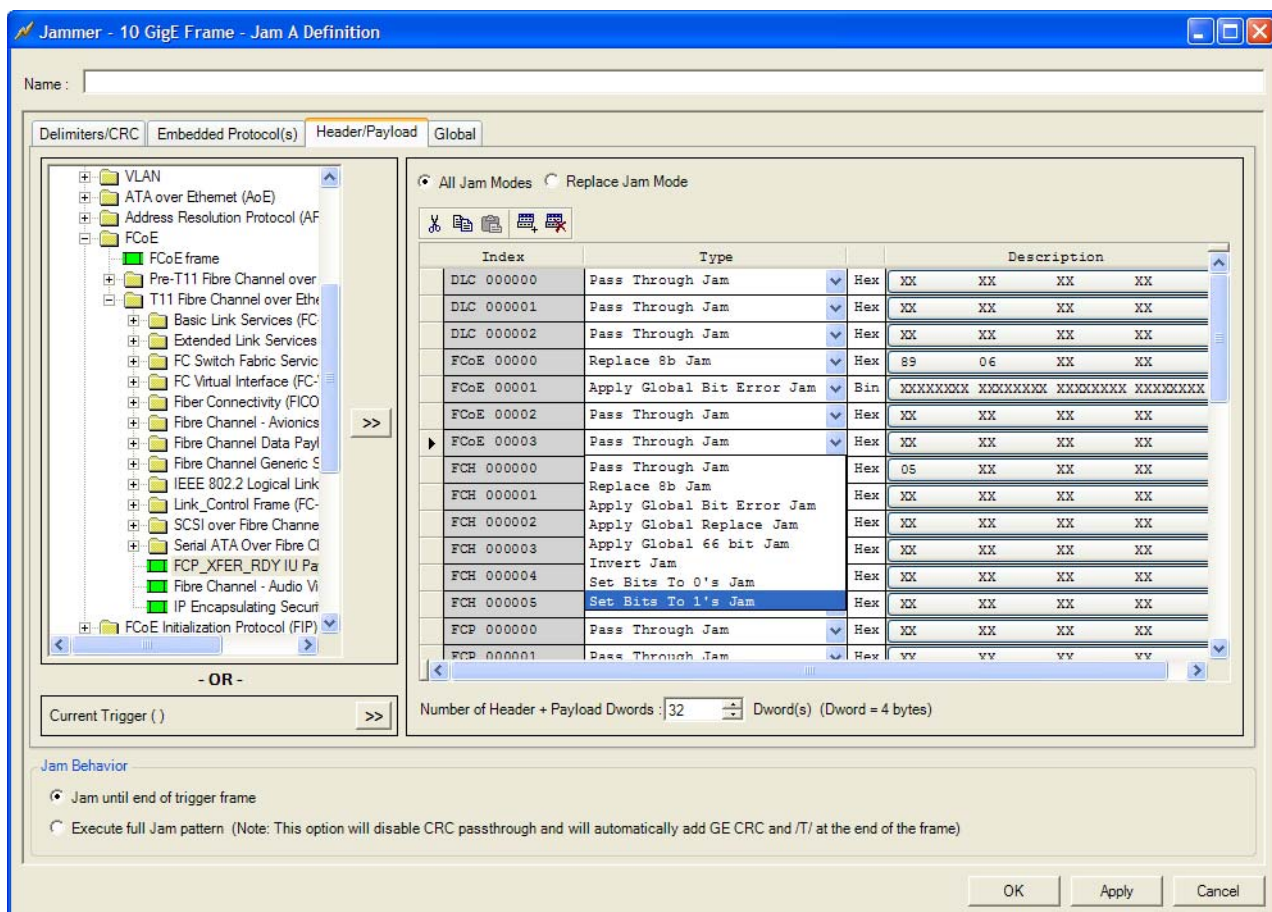
The CRC options include:

- Not changing the CRC in the original target frame
- Recalculating the CRC to make it correct for the modified data
- Replacing with a user-specified data word

Using the Header/Payload Tab for 10GigE

You can modify any parameter or word on the 10GigE Header/Payload Tab (Figure 239).

Figure 239: 10GigE Header/Payload Tab



The 10GigE window always shows Jam definitions for the header and 4096 payload words (for the maximum supported 16 Kilobyte jumbo frames). If the frame that is Jammed has less than 4096 payload words, the extra Jam definitions do not take effect. The Jammer does not support 10GigE frames larger than 4096 payload words.

Notice the first line of the Jam Definition (Ether 0001) has only the first two bytes of the Destination Address header field. This is to visually orient the frame in the same manner as the Arm and Trigger Condition windows.

Similar to defining an Arm or Trigger Condition, there are two ways to specify your frame Jam Definition. One way is to load a template from the Template Library tree, and the other way is to manually specify bits in the frame.

To use a template:

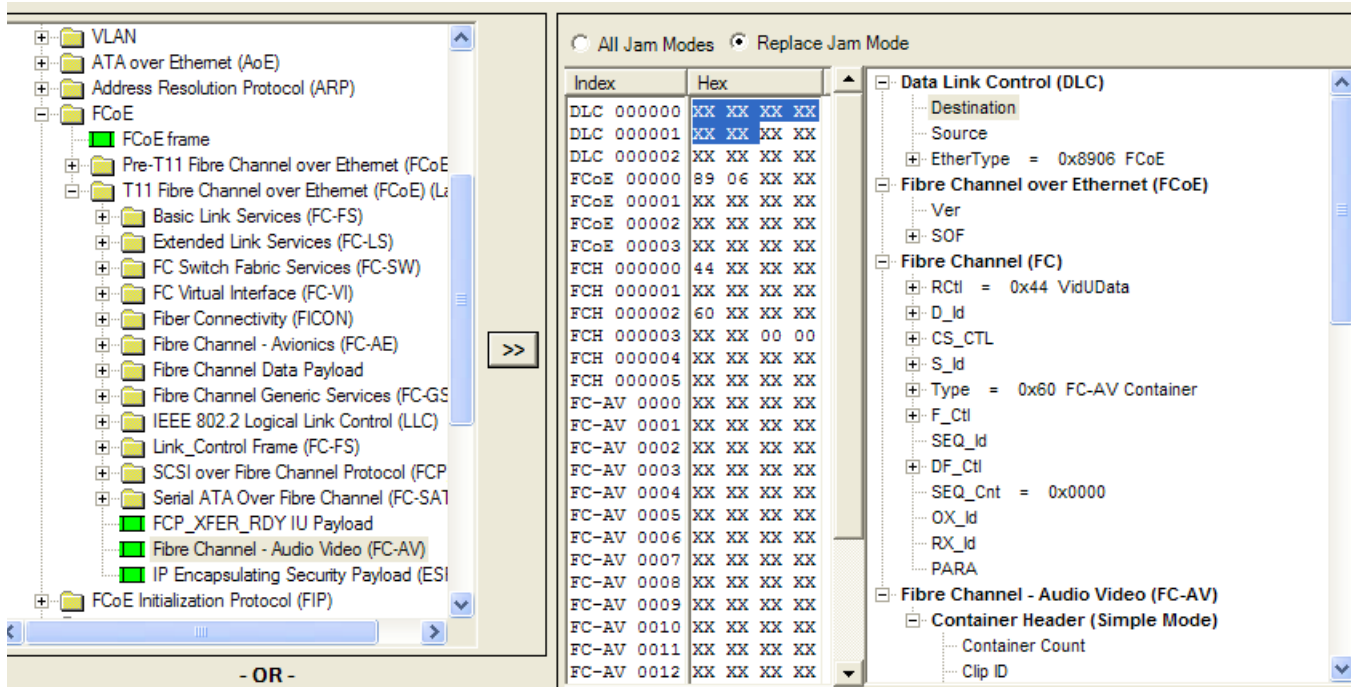
- 1 Highlight a template in the Template Library tree on the left side of the window.
Tree View is structured similar to the display on the right side of the Arm and Trigger Condition windows. You can make selections from the tree; this creates the appropriate Replace Jams.
- 2 Click the double right arrow to display the Jam definition on the right side of the window.

Notice the special choice at the bottom left, “Current Trigger.” This is a copy of the frame condition you have specified for the Trigger. Click the double right arrow to use this.

When you use a template, the Jam definition is populated with Replace Jams of the specified data, while all other bits are passed through.

To manually edit the values, enter a value into the byte field. An **X** in a nibble passes the original value through.

Selecting the **Replace 8b Jam Mode** radio button opens a dialog that allows you to replace an entire frame either by using a template or manually entering values. The Replace 8b Jam Mode dialog also contains a view of the frame contents, similar to those seen the Arm and Trigger Condition windows. These values correspond to the hex values defined in the center column.

Figure 240: Replace 8b Jam Mode

Selecting the **All Jam Modes** radio button opens a dialog that provides the following choices for each word in a frame on the Header/Payload tab:

Replace 66 bit - This function allows individual bits to be set to 1, set to 0 or passed through unchanged according to the **Global 66 Jam** option defined on the Global tab.

Apply Global Replace Jam - This function allows individual bits to be set to 1, set to 0 or passed through unchanged according to the Global Replace Jam option defined on the Global tab.

Invert Jam - Invert defined bits and pass through the rest. Enter 1s at the appropriate bit locations.

Pass Through Jam - Pass through the current word unchanged.

Replace 8b Jam - Replace nibbles with new values. Each drop-down represents a byte so you can replace a byte with a standard Ordered Set. If you choose User-defined, you can specify any K/D character. To edit these values, enter a value into the byte field or double-click to display the Binary Editor. If you specify a bit as a 0 or 1, you must specify the values of the other three bits in that nibble also. Any nibbles with an X are passed through.

Set Bits To 0s Jam - Set defined bits to 0s and pass through the rest. Enter 0s at the appropriate bit locations.

Set Bits To 1s Jam - Set defined bits to 1s and pass through the rest. Enter 1s at the appropriate bit locations.

Apply Global Bit Error Jam - Apply the Global Bit Error function set on the Global tab.

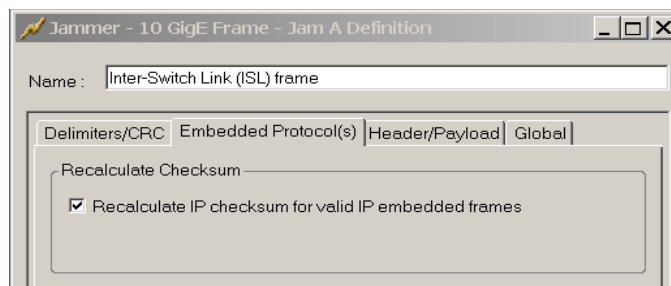
Insert Code Violation Jam - Introduce a predefined, fixed code violation to a byte in that word. Which byte is corrupted depends on the alignment orientation of the frame. The Jam Definition of the word before a Code Violation Jam must always be a Pass Through Jam. A Code Violation Jam cannot be placed in the first word of a frame (Ether 0001).

Tree View - Another way to manually edit or view your Jam Definition is to click the **Switch to** button at the lower right corner to toggle between List View and Tree View. The List View interface is described in the procedures in this chapter. Tree View is structured similar to the display on the right side of the Arm and Trigger Condition windows. You can make selections from the tree; this creates the appropriate Replace Jams.

Using the Embedded Protocol(s) Tab for Gigabit Ethernet

Figure 241 shows the Embedded Protocol(s) tab for Gigabit Ethernet. This tab has a Recalculate Checksum option. Checking the **Recalculate IP checksum for valid IP embedded frame** check box replaces the IP checksum in the Jammed frame with a recalculated value. For the checksum to be inserted properly, the frame, after Jamming takes place, must have a Gigabit Ethernet header EtherType field value of 0x0800 and a valid IP header IHL field.

Figure 241: Gigabit Ethernet Embedded Protocol(s) Tab



Replace Frame with Truncated Frame

This option truncates the target frame to a shorter length and sends Idles /I/ on top of the remainder of the target frame.

In the Truncate Frame Options window:

- 1 Choose the type of payload you want to truncate from the drop-down menu:
 - Gigabit Ethernet
 - IP
 - TCP
 - FCoE
- 2 Enter the number of bytes you want the payload to be truncated to (this does not include the CRC or other delimiters).

Gigabit Ethernet Payload

For a Gigabit Ethernet payload, the **Number of Payload bytes** setting specifies how many bytes to leave after the Gigabit Ethernet header (the first 14 bytes of the frame). You can specify from 0 to 1500 bytes. If the target frame is shorter than the specified number of bytes, then no Jamming occurs. You also have the option to replace the IP checksum with a recalculated value, which also automatically updates the IP header Total Length field.

For any successful truncation, the Gigabit Ethernet CRC is always replaced with a recalculated value.

IP Payload

For an IP payload, the **Number of Payload bytes** setting specifies how many bytes to leave after the IP header. You can specify from 0 to 1480 bytes. You also have the option to replace the IP checksum with a recalculated value, which also automatically updates the IP header Total Length field.

For the truncation or the IP checksum/IP header option to work properly, there are some requirements of the incoming target frame. The frame must have a Gigabit Ethernet header EtherType field value of 0x0800, a valid IP header IHL field, and a valid IP header Total Length field. If the Jammed frame is shorter than the specified number of bytes, then no truncation occurs, but the IP checksum can be recalculated if you select it.

For any successful truncation, the Gigabit Ethernet CRC is always replaced with a recalculated value.

TCP Payload

For a TCP payload, the **Number of Payload bytes** setting specifies how many bytes to leave after the TCP header. You can specify from 0 to 1460 bytes. You also have the option to replace the IP checksum with a recalculated value, which also automatically updates the IP header Total Length field.

For the truncation to occur and for the checksum options to work, the incoming target frame must meet the same requirements listed earlier for IP payload truncation, and, in addition, have an IP header IP Protocol field value of 0x06, a valid TCP header Data Offset field, and a valid IP header Total Length field. If the Jammed frame is shorter than the specified number of bytes, then no truncation occurs, but the IP checksum can be recalculated if you select it.

For any successful truncation, the Gigabit Ethernet CRC is automatically replaced with a recalculated value.

FCoE Payload

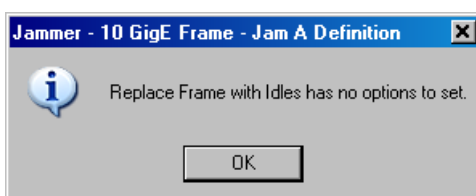
For an FCoE payload, the **Payload Dwords** setting specifies how many Dwords (Dword = 4 bytes) to leave after the FCoE header. You can specify from 1 to 4096 Dwords. You also have to specify an EOF for the FCoE frame.

For any successful truncation, both the FCoE and the Gigabit Ethernet CRCs are always replaced with a recalculated value.

Replace Frame with Idles

This option replaces the target frame with /I/ Ordered Sets in the 10GigE Jammer. There are no options to set for this Jam.

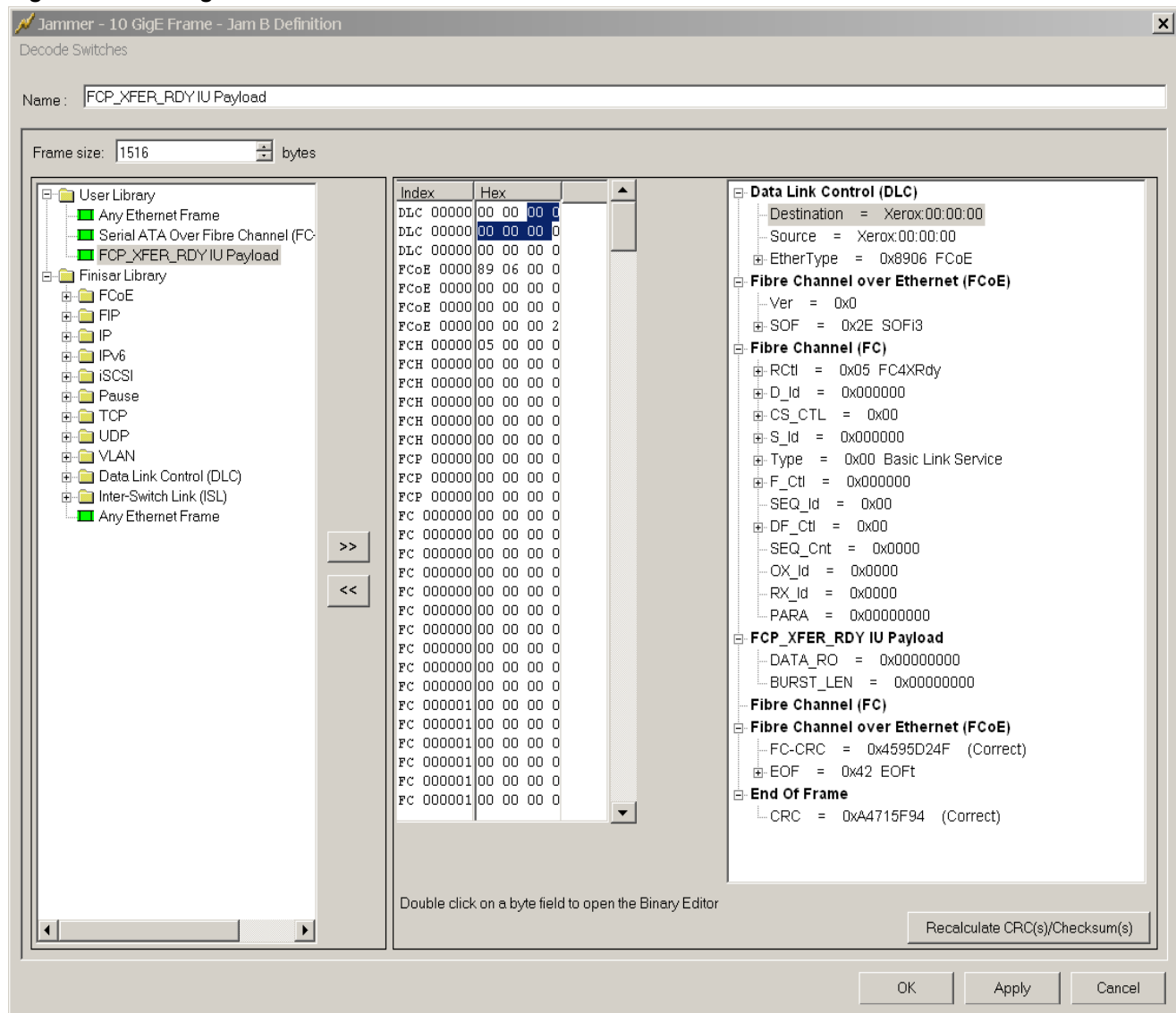
Figure 242: 10GigE - Replace Frame with Idles



Insert Frame

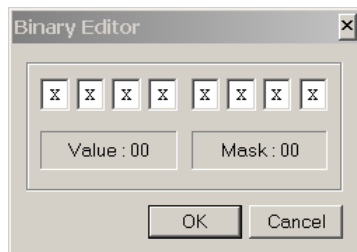
This option allows you to insert a 10GigE frame after the triggered frame. You can define the header and the payload using the Template Tree on the left pane, or you can manually define the frame.

Figure 243: 10GigE Jam - Insert Frame Window



To use a template, click a frame template from the User Library or the JDSU Library in the left pane, then click the double right arrows to apply the template. The frame header and payload information appears on the right side of the window.

To manually define a frame, type hexadecimal values directly into the center column of the window. To set individual bits in any field, double-click on the hex entry to open the Binary Editor (Figure 244). In the hex view, partially defined hex characters appear as question marks: X001=?

Figure 244: Binary Editor Dialog

The frame size is indicated at the top of the window. You can adjust the frame size within the limits defined by the protocol and frame content.

The software automatically recalculates the applicable CRCs, and checksums each time you change the frame. If the CRC or checksum is incorrect, an entry is displayed in the frame contents next to the incorrect CRC or checksum showing the correct value of the CRC. To apply the correct recalculation of the CRC and checksum, click the **Recalculate CRC(s)/Checksum(s)** button at the bottom of the Jam Definition window.

Decode Switches Menu

Some templates allow you to specify decode switches. When you load a template that has this option, the **Decode Switches Menu** appears in the upper left corner of the window. The decode switches provide detailed contextual options for decode; for example, further decode of response and data frames. The Decode Switches menu is context sensitive and will only show the decode options available for the specific template you are creating.



Note: Once the **Decode Switches** menu appears, it remains visible. However, if you load a template that has no decode options, the menu is greyed out and inactive.

The **Decode Switches** menu is intended to help you create a user-defined template. When editing a User Library template, Decode Switches are stored inside the template so they are still ON the next time you open this particular template.

Decode switches allow you to further decode Response and Data frames that can't be decoded without knowing what the associated command frame is. Below is a description of the switches available for Jammer's Trigger and Insert Frame conditions:

FCoE Interpretations

This menu is available for FCoE frames. Fibre Channel over Ethernet (FCoE) is the proposed mapping of Fibre Channel over selected full duplex IEEE 802.3 networks. The **Auto-Detect FCoE** setting automatically detects the version and is the default decode switch. The auto-detect mode works on a per-FCoE frame basis. It assumes that the FCoE frame reserved bits are set to zero and detects which FCoE specification is in use depending on where the zeroes are. If you end up with multiple errors and erroneous decoding of the FCoE frames, it is because the auto-detect mode assumptions do not work with your particular trace. This requires that select manually which FCoE specification to use. Available settings are:

- **Auto-Detect FCoE**
Automatically detects the specification version by looking at the frame header.

- **T11 FCoE (Latest)**
Selects the latest draft of the T11 standards committee specification as of this Xgig Analyzer release date.
- **Pre-T11 FCoE Draft**
Selects the pre-T11 standards committee draft, 07-303v0.pdf.

FC-ELS Accept Interpretation

This menu item is available for FC-ELS (Fibre Channel Extended Link Services) Accept frames. It contains a list of the possible Link Services Accept frame formats.

Saving a Frame

If you create a frame that you want to save and make easily available for future use, you can save it into the “User Library” folder in the Template Library tree. To do this:

- 1 Make sure the frame contents are displayed in the right pane.
- 2 Type a name for the frame, and click the double left arrow button.

The frame appears in the User Library.

Duplicate Frame

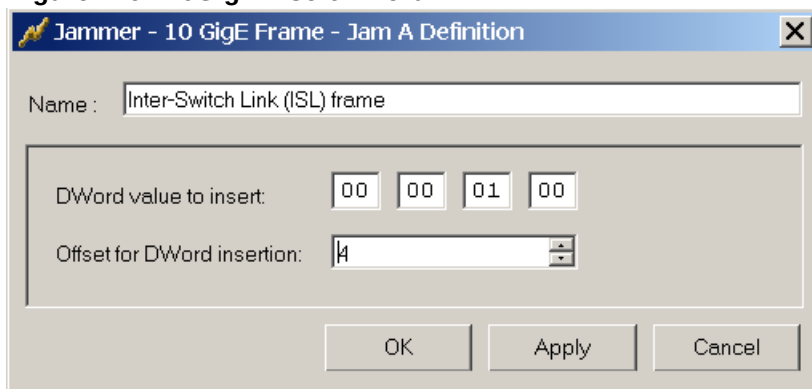
You can duplicate the triggered frame and insert it after the frame. There are no options to set for this Jam.

Figure 245: 10GigE - Duplicate Frame



Insert Dword

This option allows you to insert a 32-bit word to the triggered frame at a particular offset. The position of offset 0 begins after the preamble of a frame. The 32-bit data to be inserted is user programmable. Only data characters can be inserted. The GE CRC, FCoE CRC, IP checksum are automatically recalculated.

Figure 246: 10GigE Insert Dword

Jammer - 10 GigE Frame - Jam A Definition

Name : Inter-Switch Link (ISL) frame

DWord value to insert: 00 00 01 00

Offset for DWord insertion: 4

OK Apply Cancel

If the repeat jam option is used for an Insert Dword jam, the IPG between frames must be greater than minimum IPG. If the triggered frames are spaced by minimum IPG, the insertion process may be aborted before the specified number of repeat jams, and you will receive an error notice.

Chapter 16

Xgig Jammer Application Notes

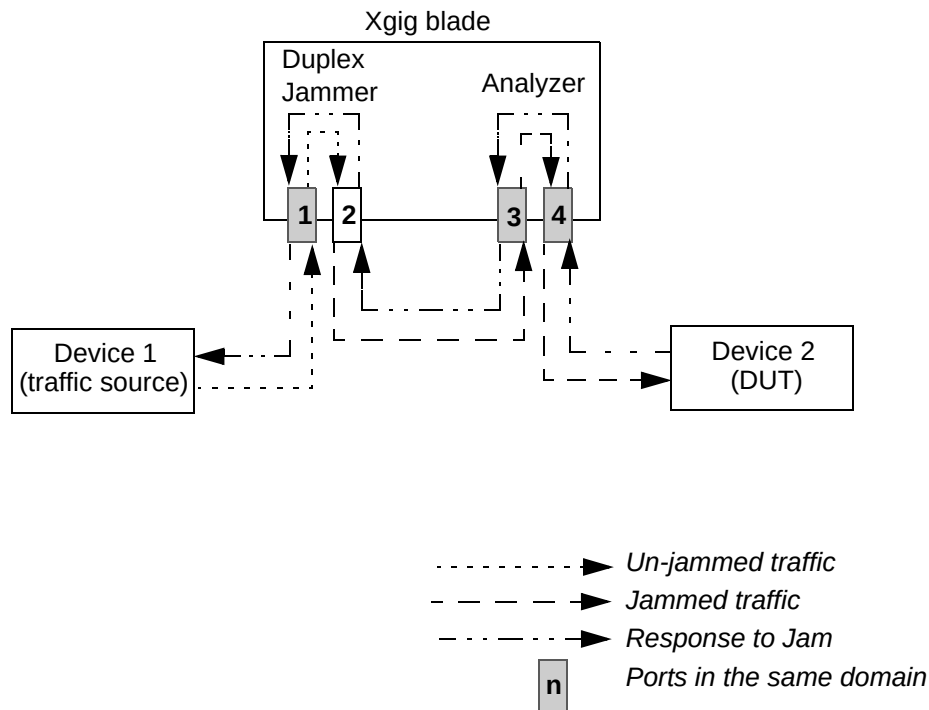
In this chapter:

- [Setting Up the Xgig Jammer and Xgig Analyzer to Capture a Jam](#)
- [Testing Strategies for the Xgig Jammer](#)
- [Replace Frame with Modified Traffic - Fibre Channel](#)
- [Using Domains and External Triggering](#)
- [How to Setup a Single Port Xgig Jammer](#)

Setting Up the Xgig Jammer and Xgig Analyzer to Capture a Jam

Typically, when setting up a Jammer test, it is customary to have a traffic source, a device under test (DUT), a Jammer and an Analyzer. You can set up the Analyzer to capture the traffic (including the Jam) and the response to the Jam. [Figure 247](#) illustrates the setup.

Figure 247: Xgig Jammer and Analyzer Setup



In this setup, ports 1 and 2 are part of a duplex Jammer configured in crossover. The sequence of events is described as follows:

- 1 The source traffic goes into port 1, which is Path A in the Jammer configuration.
- 2 An Arm-Trigger-Jam sequence creates a Jam and the traffic goes out port 2 and then into port 3 of the Analyzer.
- 3 The Analyzer captures the incoming traffic including the Jam.
- 4 The traffic goes to the DUT, which responds.
- 5 The response goes in port 4 of the Analyzer and is also captured.
- 6 The reply goes all the way back to the traffic source by going through ports 4, 3, 2 and 1.

To see the Jam in the capture, you must stop the Analyzer when the Jam data is in the Analyzer's buffer. You can accomplish this in two ways:

- Configure the Analyzer to trigger on traffic such as the Jam itself or around the Jam.
- Setup the Jammer to trigger the Analyzer.

To setup the Jammer to trigger the Analyzer, the Jammer port that generates the trigger and the Analyzer ports that receive the trigger must be in the same Domain. To set this up:

- 1 Using Xgig TraceControl (Analyzer), create an Analyzer Domain using ports 3 and 4.
- 2 Setup port 3 to stop capturing on a trigger, but do not specify a template for the Trigger Condition.
- 3 Set the clock rate on the Analyzer.
- 4 Using Xgig Maestro (Jammer), go to **Port > Port Selection and Domain Setup** on the menu bar.
- 5 Select and Use ports 1 and 2 as a duplex Jammer.
- 6 Select port 1, right-click, and select **Add to Domain...**, then select the Domain in which the Analyzers are.

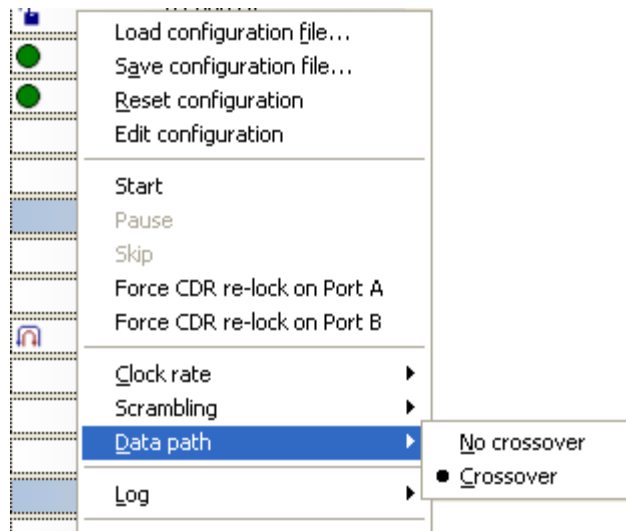
Now ports 1, 3 and 4 are in the same Domain and will receive each other's triggers.

Figure 248: Ports Selected for the Same Domain



- 7 To select the Crossover data path, go back to the main Xgig Maestro window, right-click on the port pair in the Parameters Status table and select **Data path > Crossover** (Figure 249).

Figure 249: Setting Data Path in the Parameters Status table



- 8 Use a Jammer configuration that triggers on Path A and triggers Domain A.
- 9 Start the Analyzer and Jammer.
- 10 Each time the Jammer Jams, the Analyzer is triggered and stopped.
- 11 View and save the capture.
- 12 Restart the Analyzer for the next Jam.

Testing Strategies for the Xgig Jammer

The Xgig Jammer is designed to verify the operation of a Fibre Channel, Gigabit Ethernet, SAS, or SATA/STP based system by introducing errors in a controlled and repeatable way. The Fibre Channel, Gigabit Ethernet, SAS, or SATA/STP devices under test are assumed to be functional and operating properly with or without the Xgig Jammer system inserted in the link.

The goal of Xgig Jammer testing is to modify the traffic moving between the devices, creating errors, which should be recognized and handled correctly by the network. The range of tests that can be created is unlimited. A Fibre Channel test can include:

- Replace an Open (OPN) sent by a host with an Idle. Does the host recognize that the OPN was never received?
- Modify a frame and leave the CRC unchanged. Does the receiving device recognize a bad frame?
- Modify a SCSI command within a frame and correct the CRC. Does the SCSI error checking software recognize a bad command?

The Xgig Jammer can be used both with black-box and white-box test strategies. For black box testing, the Xgig Jammer can be configured to cause a wide range of potential error conditions. The operating environment should trap, handle, and then report the actions the system took for each of these errors. If an error is not trapped or handled correctly, the Xgig Jammer can be configured to redo the specific test. The details of the traffic to and from the offending device are captured by the Xgig Analyzer for examination.

Using the Xgig Jammer for a white-box test strategy requires a two-stage process. Analyze the error checking software in the device and determine the expected response to specific classes of errors. Exercise all the error checking routines by creating the errors with the Xgig Jammer and then verify that the system responds correctly.

Replace Frame with Modified Traffic - Fibre Channel

The Fibre Channel Jammer frame function “Replace w/ Modified Traffic” allows a large number of ways to alter a target frame. These alterations come in four basic types:

- Simple frame modification
- Frame truncation and/or modification
- Replacement of a frame with multiple frames
- Replacement of a frame with Ordered Sets.

Each of these types is described in this application note. All of the following cases assume you are using the Jam behavior option set to “Jam until end of trigger frame.”

Simple Frame Modification

The “Replace w/ Modified Traffic” feature always allows you to modify any word of the target frame. The “SOF/CRC/EOF” tab allows you to edit the SOF, CRC, and EOF. The “Header” tab allows you to define Jamming for the first 6 words of the frame. The “Payload” tab allows you to define Jamming for the rest of the frame, for however many words you decide, up to the maximum legal frame length (528 payload words).

During operation, when the Jammer finds the target frame, it steps through each word performing each requested change, until it reaches the target frame's CRC. At this point, even if you have defined extra words in the “Payload” tab, the Jammer ignores these extra instructions and instead follows your instructions for the CRC word and EOF. On the other hand, if you do not specify as many words in the “Payload” tab as are in the target frame, then the Jammer passes through the remaining payload words until the CRC of the target frame.

An example of a simple modification would be leaving the structure of the target frame intact but changing its data. To do this you would leave the SOF as an SOF, modify the data with other data, keep the position of the CRC, and leave the EOF as an EOF.

Frame Truncation and/or Modification

You can also truncate and modify a frame at the same time. In order to accomplish this, define as many data word modifications as the desired length of the new frame, then select an “Automatic CRC” to be inserted after the data words, followed by an EOF. Fill the rest of the “Payload” tab with “Idles” or some other Ordered Sets. To be safe, define the full amount of 528 words, in case the target frame is very large.

Regardless of how many payload words you specify, or how long the target frame is, when the Jammer reaches the target frame's CRC and EOF, it looks for specific instructions regarding them (on the “SOF/CRC/EOF” tab). Do not forget to replace both the CRC and EOF with the desired Ordered Sets.

This form of truncation does not work correctly if the target frame is shorter than the new frame you have defined. The Jammer would modify the target frame up to the point of its CRC, and then jump to the CRC and EOF instructions, which are defined as other Ordered Sets. The resulting frame fragment would have an SOF, some data words, and then whatever Ordered Sets you defined for the CRC and EOF words.

Another Frame Jamming feature “Replace Frame w/ Truncated Frame” is a simple way to access a subset of this functionality. The feature asks for only two simple inputs from the user:

- The number of words the new frame should have
- A new EOF

The Jammer passes through the original frame (without modifying) until it reaches the specified length, and then sends a good CRC and the user-specified EOF, followed by “Idles” to replace the rest of the target frame. The feature automatically deals safely with the case where the target frame is shorter than the new specified length. In this case, the frame is simply passed through with no changes, but the new EOF is used.

Replacement of Frame with Multiple Frames

Perhaps the most advanced use of the “Replace w/ Modified Traffic” feature is to replace the target frame with more than one frame. This is probably only wise if you know the target frame is large, because the replacement traffic you specify must fit in the space from the SOF to the EOF of the target frame.

To create multiple frames, repeat patterns of SOF, 6 or more data words, an automatic CRC and an EOF, throughout the Jam definition. Make sure to define some number of Ordered Sets, for example, “Idles” between each frame. Remember to specify what to do with the target frame’s SOF, CRC, and EOF (on the “SOF/CRC/EOF” tab). Either use them as part of your smaller frames or replace them with other Ordered Sets. As noted previously, the CRC and EOF functionality take precedence over payload words.

The LRC options you set on the “Global” tab take place for all frames you create or alter. The LRC is the eighth payload word, that is, 14 words after any SOF. Frames shorter than 14 data words are not affected. Any Ordered Set between an SOF and the LRC word cancels the word count, so that the global LRC option is ignored for that “frame” and the Jammer defers to what was specified in the “Payload” tab.

Replacement of Frame with Ordered Sets

Choose Ordered Sets to replace the SOF, CRC, and EOF of the target frame (“SOF/CRC/EOF” tab), as well as all entries in the “Header” and “Payload” tabs. Make sure to specify enough payload words to cover the largest possible expected target frame (defining all 528 payload words is the safest method).

Note that the Frame Jamming feature “Replace Frame w/ Idles” is a simple way to access a subset of this functionality. This feature replaces the target frame with only “Idles.” It automatically adjusts for any size of target frame.

Using Domains and External Triggering

This is a complex example of using domains and external triggering.

For this example, you want to have an Xgig duplex Jammer Arm on a TTL input, then Trigger on a frame and Jam it, and trigger an Xgig Analyzer in the same Sync Group. You want the Jam to occur on port A.

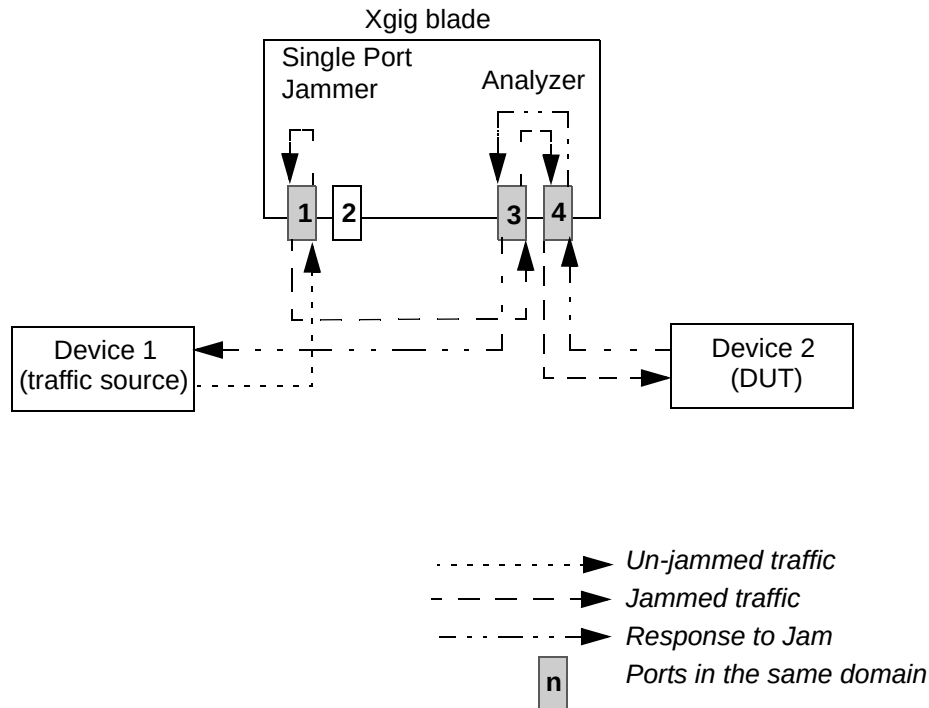
- 1** Set the Jammer Test Case mode to Arm B Followed by Trigger A Jams A.
- 2** For the Arm B, check Trigger from Domain B.
- 3** Set up the desired Trigger condition and Jam definition for the frame.
- 4** Check Trigger Domain A.
- 5** In the Port Selection and Domain Setup window, put port B in the same Domain as the TTL input connector.
- 6** Add port A to the domain of the Xgig Analyzer ports you are using to capture.

When the TTL input connector triggers, it will trigger the domain containing port B and will Arm the Jammer. When the Jammer finds its Trigger condition, it will Jam and then trigger the domain that contains the Analyzer ports.

How to Setup a Single Port Xgig Jammer

When you lock two Jammer ports separately as simplex Jammers, they always have a data path without crossover. To use a Jammer port with an Analyzer on the same blade, the connections would be made as in [Figure 250](#).

Figure 250: Single Port Jammer Setup



The connection at port 1 requires that the transmit path and receive path go to different locations, so the cables must be separate. Therefore this sort of setup is probably not possible with copper connections.

When using a single port Jammer setup, the GUI refers only to path A and port A because the device has only one port. This is still true if you use port 2 as a single port Jammer.

Remember that you could use the Jammer on port 2 as part of another completely different testing setup (however, it must still share the same protocol and clock rate settings).



Note: If you load a duplex Jammer configuration file (one that utilizes path B) to a single port simplex Jammer, you receive a warning that the configuration will be “flattened.” This means that any path B settings get transferred to path A. If the duplex port configuration uses both a trigger from domain (input) and trigger domain (output), then only the trigger domain (output) is used after flattening (and therefore you should review such configurations before use).

PART FOUR: Using Xgig Generator

Chapter 17

Introducing Xgig Generator

In this chapter:

- [Xgig Generator Overview](#)
- [Xgig Generator Features](#)
- [SAS/SATA Generator Application Programming Interface \(API\)](#)

Xgig Generator Overview

This chapter provides an overview of the JDSU Xgig Generator and lists its features. The JDSU Xgig Generator includes hardware (6G Xgig Multi-function Blade) and software that tests a device over a SAS or SATA domain by sending legal or illegal frames and traffic and comparing incoming payloads to expected data patterns. JDSU combines powerful and reliable hardware with an easy-to-use software interface capable of testing all aspects of SAS and SATA protocol. The software development kit (SDK) includes an extensive function library for customizing the test environment.

Xgig Generator, used with the Xgig Analyzer software, provides a complete test solution including the ability to analyze the data generated and to capture and display SAS and SATA data in a customized trace view.

Xgig Generator Features

Xgig Generator is part of the Xgig family of instruments. Generator has the following features:

- Supports data transfer rates of up to 6.0 Gbps for SAS and SATA
- Allows users to execute and define parameters for compiled tests
- Allows users to create, edit, and execute functions files
- Allows users to create, edit, and execute macro files
- Allows users to create and edit frames
- Allows users to edit read, write, and sense buffers
- Displays current read, write, and sense buffers
- Handles port discovery and setup
- Allows users to control ports in a remote Xgig Chassis
- Allows users to run and manage multiple tester sessions

SAS/SATA Generator Application Programming Interface (API)

The Generator software allows the user to write and compile tests using C/C++. This functionality requires that the user be familiar with the API function library and the process of writing a compiled test. To this end, the Maestro software includes a Generator API Help system, available in the Help menu of the Maestro main window. Using this API Help system along with this manual will help you understand and control the functionality of the Generator software.

LEDs on the Xgig Blade

The LEDs on the blade front panel provide status about each port. [Table 12](#) describes the LEDs you see on the blade.

Table 12: Xgig Blade LEDs

Label on Blade	Blade
In Use	- Green when port locked by client application - Yellow: N/A - Black otherwise
Rate	- Green when link rate is 1.5Gbps or 3Gbps - Yellow when link rate is 6.0Gbps - Black: Loss of Signal
Link (3G) Signal (6G)	- Green-SAS/SATA: Link established - Yellow-SAS/SATA: In OOB) - Black:Loss Of Signal
Frame	- Green: Frames being transmitted/received - Yellow: N/A - Black: No frames
Error	- Green: N/A - Yellow: Phy error occurred - Black: No error
Trigger	Not used (Black)

Chapter 18

Using the Generator Tab

In this chapter:

- Using the Configuration Manager Function Tabs in Generator
- Using the Parameters Status Table in Generator
- Using the Ports Manager in Generator
- Using Log Manager in Generator
- Customizing the Appearance of the Maestro/Generator Main Window

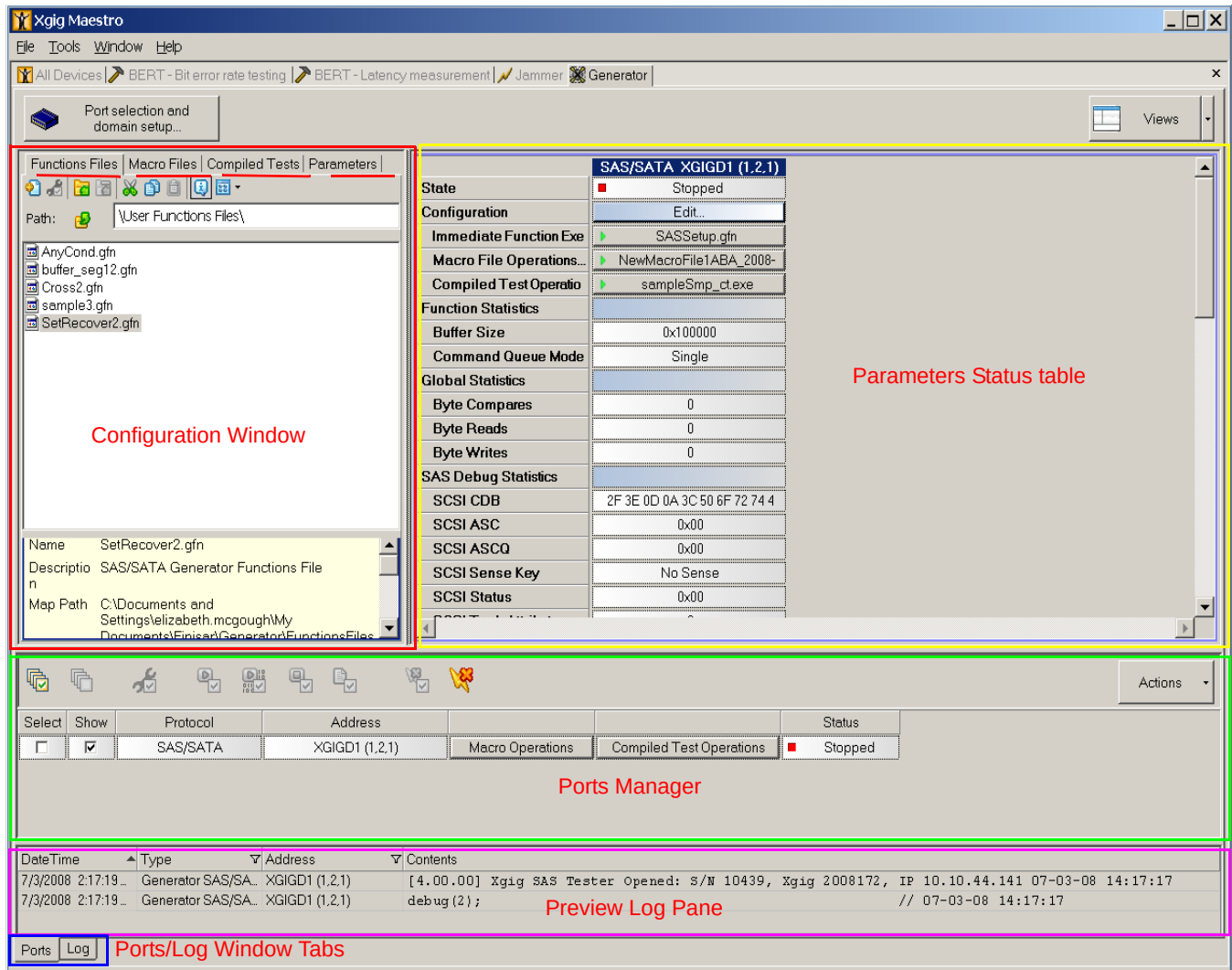
This chapter provides an overview of the Generator tab, on the Xgig Maestro main window, and its functions.



Note: This section refers to specific functions described in the Generator API Help System, which can be accessed by selecting Generator API Help from the main Help drop-down menu in the Maestro main window.

You should have launched Xgig Maestro as described in [“Launching Xgig Maestro” on page 12](#) and locked at least one device as described in [“Multi-Function Ports and Symbols” on page 21](#). The Xgig Maestro window is displayed with the Generator tab on the right as shown in the figure below. This tab is where you operate the Generators you have locked.

The main menu, shown below, is divided into panes similar to the Windows Explorer structure for ease of navigation and viewing. Right-click menus enable you to perform the desired task within a specific pane

Figure 251: Xgig Generator Tab on Xgig Maestro Window

The Generator tab of the Maestro Window contains the following components as shown above:

Configuration Manager, **outlined in red**, contains the function tabs and the parameters tab. These tabs are described in “Using the Configuration Manager Function Tabs in Generator” on page 330 and “Displaying and Hiding Parameters in Generator” on page 347.

The Parameters Status table, **outlined in yellow**, provides status information for the port(s) you have locked. This table is described in “Using the Parameters Status Table in Generator” on page 331.

The Ports Manager, **outlined in green**, allows you to control settings and operations for the port(s) you have locked. This pane is described in “Using the Ports Manager in Generator” on page 338.

The Preview Log pane, **outlined in magenta**, is a quick reference for the Log Manager. This pane is described in “Using Log Manager in Generator” on page 341.

The Ports and Log window tabs, **outlined in blue**, switch between the Ports and Log windows.

Using the Configuration Manager Function Tabs in Generator

There are three function tabs in the Configuration Manager, **Function Files**, **Macro File**, and **Compiled Tests**. The files displayed in the manager are specific to the function tab displayed. The Configuration Manager provides a list of files organized in the following three folders:

- **Sample Files** includes configurations that are provided with the application.



Note: The two sample compiled test files provided are described in “[Sample Compiled Test Files](#)” on page 370.

- **User Configurations** is the default location where files you create are saved.
- **Most Recently Used** allows you easy access to those configuration files most recently used.

The Configuration Manager also includes a list of all the drives on your system allowing you to locate any configuration files on your system quickly.

The tool bar in the Configuration Manager contains the following icons and functionality:

New File  allows you to create a new functions file from the **Functions File** tab or to create a new macro file from the **Macro Files** tab. This icon is not present on the Compile Test tab because you cannot create compiled test files from the GUI.

Load  allows you to load the selected functions, macro, or compiled test file into a port. This icon is only active when a port has been locked and is selected in the Port Manager. You can also drag-and-drop a file from the Configuration Manager into a port.

Map  allows you to select a folder that you want to be listed in the Configuration Manager for the selected function tab.

Unmap  allows you to unmap a folder that has been mapped.

Cut  allows you to cut a file from its current location. This is not the same as deleting a file.

Copy  allows you to copy a file.

Paste  allows you to paste a file you have cut or copied.

Path  allows you to go up one level in the folder tree. This field next to this icon displays the current folder name.

Show/Hide  allows you to show or hide the details for the selected file. These details appear in the lower section of the Configuration Manager pane.

View  allows you to view the files in the Configuration Manager as a list including only the file name or to view the details of the files in the list.

Using the Parameters Status Table in Generator

The port(s) you have locked are displayed as vertical columns in the Generator Parameters Status table. At the top of each column is the protocol, the chassis name, and in parenthesis the chassis number, the slot number and port number(s) in parenthesis.

Figure 252: Generator Parameters Status table

	SAS/SATA XGIGD1 (1.3.3)
State	 Stopped
Configuration	Edit...
Immediate Function Execution	 SASBuffer.gfn
Macro File Operations...	 SASRandomRead.key
Compiled Test Operations...	 sample2.exe
Function Statistics	
Buffer Size	0x100000
Command Queue Mode	Single
Global Statistics	
Byte Compares	0
Byte Reads	0
Byte Writes	0
SAS Debug Statistics	
SCSI CDB	28 00 0A 01 33 F8 00 01 00 00 00 00
SCSI ASC	0x00
SCSI ASCQ	0x00
SCSI Sense Key	No Sense
SCSI Status	0xFF
SCSI Task Attribute	0
LUN	0x0000000000000000
Response Code	0x00
Payload Size	1048
SATA Debug Statistics	
SATA Device Type	SATA Host
Miscellaneous Debug Statistics	
Last API Return Code	void
Last Executed API Function	debug(0x2)
Debug Level	2 (lib trace)
Destination Address	0x0000000000000000
Source Address	0x500A0BD003081C78
IO Timeout	10
Phys	1
Ports	1

The first column on the tab is the legend for each row in the device columns and contains the following categories:

- State
- Configuration
- Function Statistics
- Global Statistics
- SAS Debug Statistics
- SATA Debug Statistics

- Miscellaneous Debug Statistics

Parameters Category Descriptions for Generator

State

The current state of the port, i.e. stopped, stopping, running, disconnected, connecting, etc.

Configuration...

Opens the edit window for macros, functions files, and compiled tests. From this edit window you can create or edit macro files and functions files, and you can define parameters for an existing compiled test file.

Immediate Function Execution

Indicates the currently loaded functions file. If no functions file is loaded, the field will read, “No Functions File Loaded”. Clicking this field, with or without a functions file loaded, displays the function library and allows you to select a single function and execute it using the **Start**  button. See [“Executing a Function on a Generator Device” on page 358](#) for more information on this functionality.

Macro File Operations

Indicates the currently loaded macro file. Clicking the file name allows you to either execute the macro or edit the macro file. If no macro file is loaded, the field will read, “No Macro File Loaded”.

Compiled Test Operations

Indicates the currently loaded compiled test file. Clicking the file name allows you to either execute the compiled test or edit the compiled test by defining parameters for the test. If no compiled test file is loaded, the field will read, “No Compiled Test Loaded”.



Note: To remove the configuration for a port, right-click the device column in the Parameters Status table, and select **Reset Configuration**. This effectively “unloads” the functions, macro, and compiles test files you have loaded into the port.

Function Statistics

This category provides information about the settings that define how functions are executed.

Buffer Size

The size of the separate transmit and receive buffers. When a data transfer reaches the end of a buffer, it wraps to the beginning and overwrites previous data (receive) or resends previous data (transmits). The buffer size is user configurable and can be changed by using the `resize_buf()` function.

Command Queue Mode

The current command queue mode for SCSI I/O transfers, i.e. Single, Auto, or Stack. Refer to the `cmdque_mode()` function. The default setting is Single.

Global Statistics

This category provides information about whether bytes are being processed within specified limits.

Byte Compares

Total number of bytes compared since being reset by the `stats_reset()` function or since the start of the current test session.

Byte Reads

The total number of bytes read since being reset by the `stats_reset()` function or since the beginning of the current tester session.

Byte Writes

The total number of bytes written since being reset by the `stats_reset()` function or since the beginning of the current Generator testing session.

SAS Debug Statistics

This category provides information to help determine the cause of errors occurring during Generator testing.

SCSI CDB

These 16 bytes are the current values contained in the most recently sent SCSI command.

SCSI ASC

Sense key information (according to the SCSI-3 specification) returned in the latest response frame.

SCSI ASCQ

Sense code qual information (according to the SCSI-3 specification) returned in the latest response frame.

SCSI Sense Key

Sense key information (according to the SCSI-3 specification) returned in the latest response frame.

SCSI Status

The value of the SCSI status byte returned in the latest response frame. When a command is issued to a target, the status value is set to 0xFF, which is changed when the command is complete.

SCSI Task Attribute

The SCSI queuing mode or task attribute used in SCSI command frames. This can be changed with the `queue_xx()` functions. Refer to the `queue_aca`, `queue_head`, `queue_ordered`, `queue_simple`, and `queue_untagged` functions for more information.

LUN

A decimal value indicating the current logical unit number (LUN) to be used in command frames during SCSI operations.

Response Code

Response information code from the response frame of the most recently completed command.

Payload Size

The maximum payload (or frame) size for SAS.

SATA Debug Statistics**SATA Device Type**

SATA device type, either SATA host or SATA device. Refer to the `get_g_info` function for more information about `sata_device_type`.

Miscellaneous Debug Statistics**Last API Return Code**

Indicator to determine the success of a function. Refer to the Generator API Help system for a list of possible returns for a specific function and the definitions for each return.

Last Executed API Function

Indicates the most recent API function that was executed. This includes single functions as well as functions in functions files and macro files.

Debug Level

Indicates the current debug level. The default value is 2- Display trace of library calls.

To change the debug level:

1Select **Debug level** from the context menu.

2 Select the debug level you want: 0 (no tracing), 2 (lib trace), 3 (driver trace), 4 (lib and driver trace), or 6 (lib trace and return codes).

Destination Address

A hexadecimal value indicating the current destination/target ID to be used during SAS operations.

Source Address

A hexadecimal value indicating the current source/initiator ID to be used during SAS operations.

IO Timeout

The length of time to be completed by an operation before an I/O timeout is generated. The timeout value (ioto) is displayed in seconds. At the beginning of an operation, such as the start of a SCSI command, an internal timer starts. While waiting for the operation to progress, the code checks the timer and returns to operator control after ioto seconds have elapsed. For long operations, (such as a FORMAT command), set the timeout value to an appropriately high value.

Phys

The number of phys available on or supported by the tester in use.

Ports

The number of logical ports currently configured on the tester in use. This number can never be more than the number of phys. Currently, Generator can only set port width to 1. Refer to the `sas_set_port_width()` function for more information.

Receive Index

The current index (or offset) in the receive buffer.

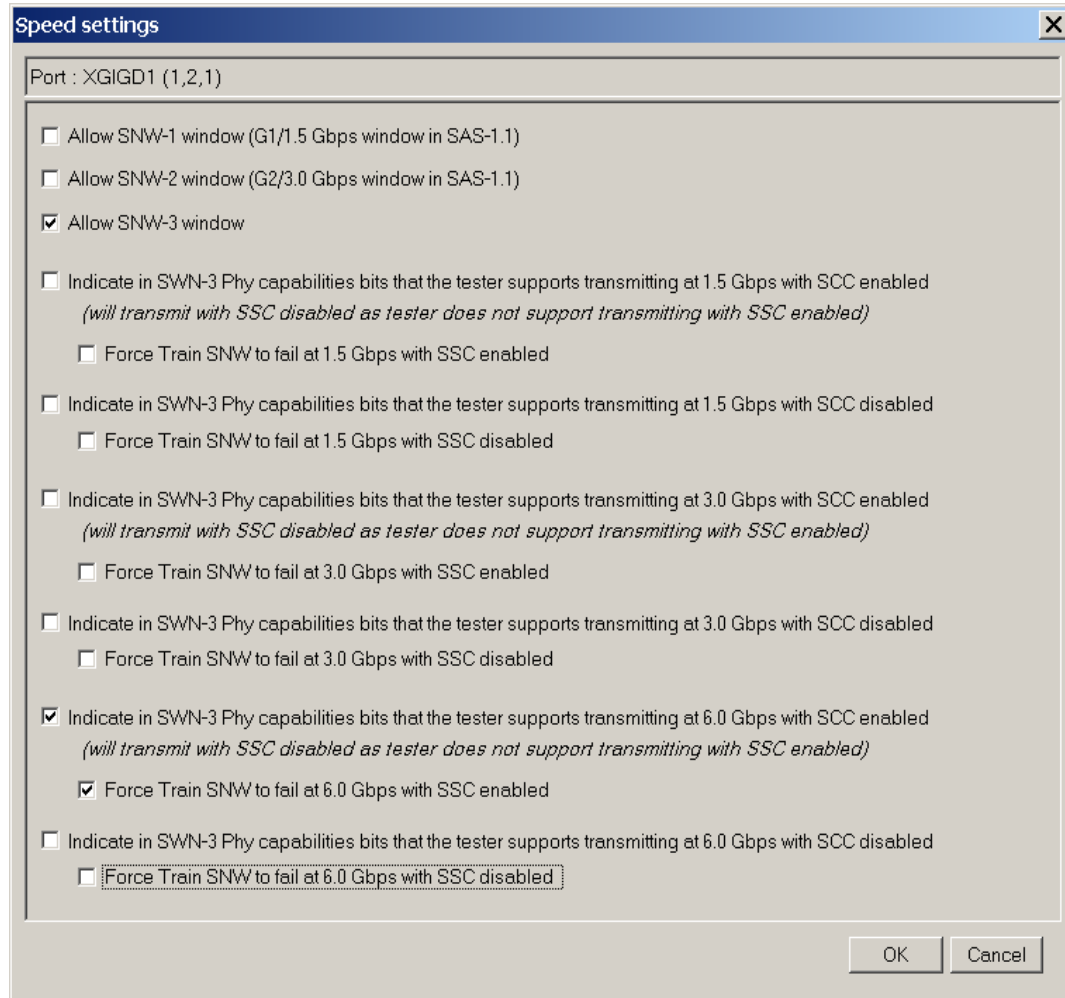
Speed

The data transfer rate of the Generator, (1.5G or 3G SATA or 1.5G, 3G, or 6G SAS). Refer to the `set_speed()` and `set_speed_ex()` functions for more information.

To change the speed settings:

- 1** Select **Edit speed settings** from the context menu.

The Speed Settings window appears.

Figure 253: Speed Settings Window

- 2 Check the SAS-1.1 or SATA 1.5Gig link rate to force the link to negotiate to 1.5Gbps.
- 3 Check the SAS-1.1 or SATA 3.0Gig link rate to force the link to negotiate to 3.0Gbps.
- 4 Check both of the two check boxes above to allow the link to auto-negotiate to the highest available speed.
- 5 Select Allow SNW-3 Window (SAS-2) if you have a SAS device that you want to run at 6.0Gbps. This type of speed negotiation allows for adaptation at both 1.5G and 3G link rates.
- 6 Select Support SATA 6.0 Gbps Speed Negotiation to allow the SATA link to auto-negotiate to the highest available speed.



Note: If you select the “Support SAS-2 speed negotiation setting”, then the Phy capabilities and Fail train sections become active and allow you to change the settings. Otherwise, these sections are inactive as these settings are not applicable.

The phy capabilities are transmitted by the tester during the SAS-2 SNW3 window at the selected speed. Refer to the `get_speed_ex` and `set_speed_ex` functions in the Generator API Help.

This setting defines what you want to convey to a device in the SNW-3 Phy capabilities bits. You can choose to indicate that the tester supports transmitting at a given speed with SSC enabled or with SSC disabled. We do not currently support transmitting with SSC enabled. Therefore, the tester will transmit with SSC disabled even if you set the tester to indicate otherwise.

7 If applicable, set the desired Phy capabilities.

The Fail train is a bitmask that forces the corresponding Train speed negotiation window(s) (SNW) to fail at the selected speed. Refer the to `get_speed_ex`, `sas_set_timers`, `set_speed_ex` functions in the Generator API Help.

This setting forces the train SNW to fail at a given speed with SSC enabled or with SSC disabled. setting indicates fail train SNW can be set with SSC disabled. We do not currently support forcing the train SNW to fail with SSC enabled. Therefore, the tester will force the train SNW to fail with SSC disabled even if the settings indicate otherwise.

8 If applicable, set the desired Fail train SNW settings.

9 Click **OK** to close the dialog and apply the settings.

Transfer Mode

The type of data transfer for I/O functions. Refer to the `hgen_mode()` function for more information.

Transmit Index

The current index (or offset) in the transmit buffer.

FPGA Version

Represents a bit file revision code for the Xgig blade's FPGA.

Embedded OS Version

Indicates the version of JDSU software running on the Xgig chassis.

Link Type

Current link type: Unknown, SAS link, or SATA link. Refer to the `get_g_info` function for more information about `link_type`.

Link Type Config

Current link type configuration: SAS only, SATA only, or SAS and SATA. Refer to the `get_g_info` function for more information about `link_type_cfg`.

Using the Ports Manager in Generator

The Ports manager displays details about the ports you have locked (Figure 254). It shows the protocol, chassis name (with chassis number, slot number, and port numbers), and other port specific information. You can sort the rows from first to last or last to first by clicking the column heading.



Note: If you are disconnected due to a network problem, you can reconnect to the ports by using the Port Selection and Domain Setup window.

Figure 254: Ports Manager

Select	Show	Protocol	Address			Status
☒	☒	SAS/SATA	SQA-SING3 (1.1.1)	Macro Operations	Compiled Test Operations	Stopped
☒	☒	SAS/SATA	SQA-SING3 (1.1.7)	Macro Operations	Compiled Test Operations	Stopped

The following icons are displayed on the menu bar:

**Select All Ports**

Selects all ports in the Ports Manager.

**Unselect All Ports**

Unselect all ports in the Ports Manager.

**Load Configuration to Selected Ports**

Load the selected functions, macro, or compiled test file to all selected ports in the Ports Manager.

**Start Selected Ports**

Start loaded macro file on the selected ports in the Ports Manager.

**Start Compiled Test on Selected Ports (Generator Only)**

Execute the loaded compiled test on the selected ports in the Ports Manager.

**Stop Selected Ports**

Stop Generator operation on the selected ports in the Ports Manager.

**Show Properties of Selected Ports**

Display the Port Properties dialog box, with information on the selected function, protocol, and clock rate (speed). It also shows the chassis name, IP address, slot and port(s).

**Disconnect Selected Ports**

Disconnect the selected ports in the Ports Manager.

**Disconnect All Ports**

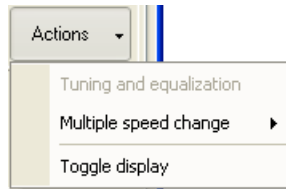
Disconnect all ports in the Ports Manager.

**Hot-Reset Selected Ports**

Reset Generator or Target Emulator running in chassis.

Actions Button

The **Actions** button contains menus for **Tuning and Equalization** (6G SAS/SATA Jammer and Generator only), **Multiple speed Change**, and **Toggle Display**. See [Figure 255](#).

Figure 255: Actions Button Options

Tuning and Equalization

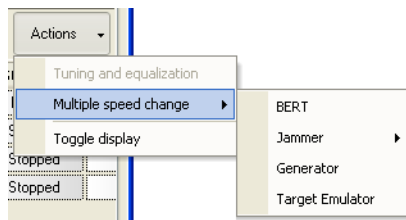
Tuning and Equalization are procedures to optimize ports on the 6G SAS/SATA 4x/Wide-Port Blade for your environment. When you connect the Xgig SAS Analyzer, Jammer, or Generator in a new environment (for example, after changing devices or cable length) we recommend that you run the Tuning procedure detailed in the *Xgig Tuning and Equalization* document.

Multiple Speed Change for Generator

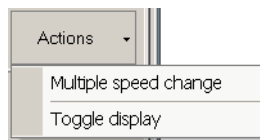
This option allows you to change the speed of multiple Generator ports simultaneously. Using this menu, you can choose to change the speed on Generator ports. If you have the All Devices tab selected, the menu will display BERT, Jammer, and Generator.

Figure 256: Multiple Speed Change Menus

All Devices tab selected



Generator



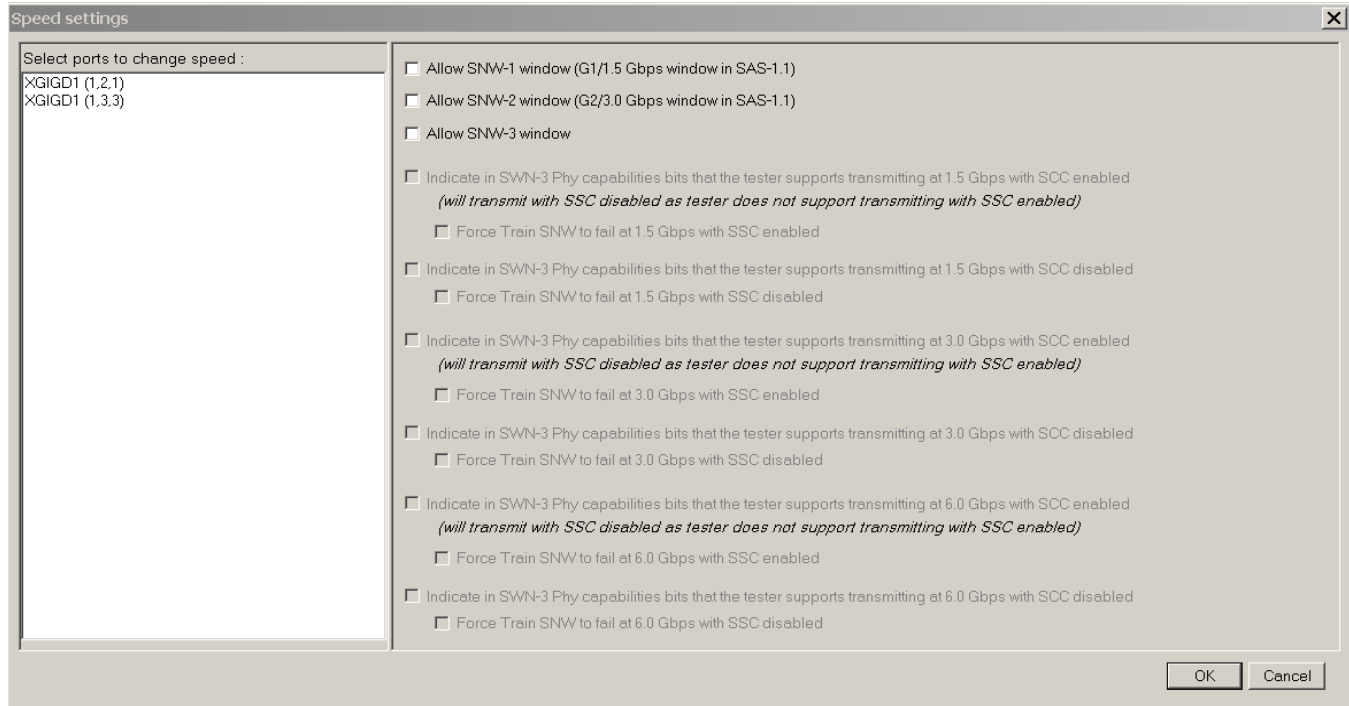
To change multiple speed settings if the **All Devices** tab is selected in the Maestro window:

- 1 Click **Generator** in the **Multiple Speed Change** drop-down menu.

The **Speed Settings** window appears.

To change **Multiple speed change** if the **Generator** tab is selected:

The **Speed Settings** window appears. This menu differs from the main speed settings window in that it includes an additional pane that allows you to select the ports for which you want to change the speed.

Figure 257: Multiple Speed Settings Window for Generator

- 2 Select the ports that you want to change the speed for.
- 3 For instructions on filling out the main pane of the window, see [“Speed” on page 335](#).
- 4 Click **OK** to apply the changes.

Toggle Display

This option toggles between a horizontal and vertical view of the ports.

Using Log Manager in Generator

To access the Log Manager, click the Log tab at the bottom of the Generator main window.

Generator creates logs that report which operations have occurred and which ones encountered errors during execution. These logs are contained within the Log Manager. To access the Log Manager, select the Log tab at the bottom of the Maestro window.

The Log Manager shows the status of each operation and test executed.



Note: The Ports Manager contains a small preview log pane at the bottom of the window for quick reference of log entries.

The Log Manager continues to list the logs and display them depending on the Log Manager options you have selected.

Figure 258: Log Manager

DateTime	Type	Address	Contents
5/16/2008 7:34:25 PM	Generator SAS/SATA	SQA-SING16 (1,1,1)	[4.00.00] Xgig SAS Tester Opened: S/N 10307, Xgig 10009711, IP 10.98.8.99 05-16-08 19:34:14
5/16/2008 7:34:25 PM	Generator SAS/SATA	SQA-SING16 (1,1,1)	debug (2); // 05-16-08 19:34:15
5/16/2008 7:57:37 PM	Generator SAS/SATA	SQA-SING16 (1,1,1)	[4.00.00] Xgig SAS Tester Opened: S/N 10307, Xgig 10009711, IP 10.98.8.99 05-16-08 19:57:32
5/16/2008 7:57:37 PM	Generator SAS/SATA	SQA-SING16 (1,1,1)	debug (2); // 05-16-08 19:57:33
5/16/2008 7:58:02 PM	Generator SAS/SATA	SQA-SING16 (1,1,1)	access_control_out(0x0, 0x0); // 05-16-08 19:58:02
5/16/2008 7:58:08 PM	Generator SAS/SATA	SQA-SING16 (1,1,1)	!-IMPLICIT ERROR-! E--> IO Timeout error // 05-16-08 19:58:08
5/16/2008 7:59:29 PM	Generator SAS/SATA	SQA-SING16 (1,1,1)	[4.00.00] Xgig SAS Tester Opened: S/N 10307, Xgig 10009711, IP 10.98.8.99 05-16-08 19:59:26
5/16/2008 7:59:29 PM	Generator SAS/SATA	SQA-SING16 (1,1,1)	debug (2); // 05-16-08 19:59:26

The Filter icons next to the **Type** and **Address** column labels allow you to choose how you want to display device types, by protocol or All, and device addresses, by single address or All devices.

If the **All Devices** tab at the top of the Xgig Maestro main window is selected, then the **Log Source** menu  2 active log sources shows all log sources as active by default. You can choose to disable BERT logging, Jammer logging, Generator logging, Target Emulator logging or all four by clicking the **Log Sources** menu and un-checking the selections. If the **BERT-Bit error rate testing**, **Jammer**, or **Generator** tabs in the main window are selected, then the Log Manager displays only the log entries for that tab, respectively.

The following icons are displayed on the Log Manager menu bar:



Display Entry Contents

Lets you save the selected log to a file in the device Logs folder (for example: C:\Program Files > JDSU > Xgig Maestro > Jammer > Logs) or anywhere you want to save it on the network.



Save All Entries As

Lets you save all the logs in the Log Manager to a file.



Save selected entries as

Lets you save the selected logs to a file.



Select All

Selects all the logs in the Log Manager.



Options

Opens the Log Manager Options dialog where you can enter your preferences for the information you want displayed in the Log Manager (Figure 259).



Clear Filtering

Removes filtering by Type and Address and displays all the devices you have locked.

**Clear Selected Entries**

Deletes the log entry you have highlighted.

**Clear All Entries**

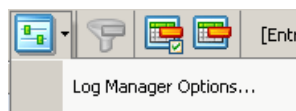
Deletes all the log entries in the Log Manager.

Setting Log Options

To set up default naming and locations of Generator log files:

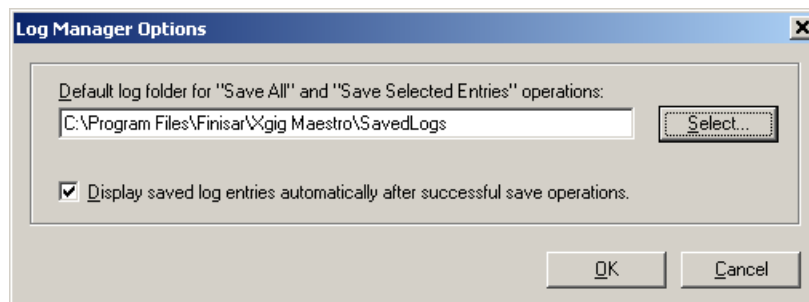
- 1 Click the Log Manager Options icon to open the drop-down menu, and select **Log Manager Options**.

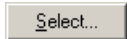
Figure 259: Log Manager Options Menu



The Generator Log Options dialog is displayed. This dialog allows you to set up how you want the log files to be automatically named and the default location you want them saved to. You can also change the filename and folder when you save the log.

Figure 260: Log Options Dialog



- 2 Enter the path to the folder where you want to save log files.
You can browse to where you want to save the log file by clicking  .
- 3 Click **OK**.
- 4 To display save log entries automatically after successful save operations, check the box at the bottom of the **Log Options** dialog.

The right-click menu in the Log Manager contains the same options as those shown in the Log Manager tool bar and detailed in this section.

Saving a Log

You can save a log from the Log Manager.

To save a log from the Log Manager as an HTML file:

- 1 Highlight the log(s) you want to save.
- 2 Click the **Save Selected Entries As**  button.

The **Save Log Manager Contents As** window is displayed. This window lets you name and save the log as an HTML file to the Saved Logs folder or to a location you prefer.

Customizing the Appearance of the Maestro/Generator Main Window

You can move and rearrange the individual device tabs on your monitor screen as you prefer. You can also select the information you want to display in the Parameters Status table. In addition, you can select the size of displayed text.

Using the Window Menu

The **Window** menu allows you to arrange the window display:

Layout

Layout offers choices for rearranging the Maestro device tab windows. The Ports manager and Log Manager windows are not affected by this menu selection.

Internal Tabs

Allows you to restore the Maestro main window to its default format.

Internal MDI

Internal multiple document interface (MDI) lets you isolate each device tab as a separate window that you can activate by clicking anywhere on the window.

Show Hidden Windows

Restores any windows you have closed while using the Internal Tabs or Internal MDI display arrangement.

Arrange Icons

Arranges the icons for minimized windows at the bottom of the screen. If an open document window is at the bottom of the screen, some or all of the icons will be underneath this document window and will not be visible.

Cascade

Arranges all open windows in a cascade style from the top, left corner of the window.

1 All Devices

Brings the All Devices tab to the front as the active window. This window displays ports from all active devices (BERT, Jammer, Generator, and Target Emulator).

2 BERT - Bit error rate testing

Brings the BERT device tab to the front as the active window

3 BERT - Latency measurement

Brings the BERT Latency measurement device tab to the front as the active window

4 Jammer

Brings the Jammer device tab to the front as the active window

5 Generator

Brings the Generator device tab to the front as the active window

6 Target Emulator

Brings the Target Emulator device tab to the front as the active window

Tile Horizontally

After selecting **Layout > Internal MDI**, this command opens and aligns the BERT, BERT Latency measurement, Jammer, and Generator device windows horizontally one over the other.

Tile Vertically

After selecting **Layout > Internal MDI**, this command opens and aligns the BERT, BERT Latency measurement, Jammer, and Generator device windows vertically one next to the other. You can view the individual device windows by dragging the sides out to resize them.

Minimize All Windows

After selecting **Layout > Internal MDI**, this command minimizes all the open windows. You can restore each window, individually, by using the standard window controls on the header or select **Internal Tabs** to restore the Maestro main window to its default format.

Customizing the Parameters Status table in Jammer

You can change the appearance of the Parameters Status table by:

- Removing columns
- Resizing columns
- Changing the text size
- Displaying and hiding status table parameters

Removing columns

If you have a number of devices locked, you can remove a column that you do not need to view without unlocking the port or affecting the operation.

To remove a column:

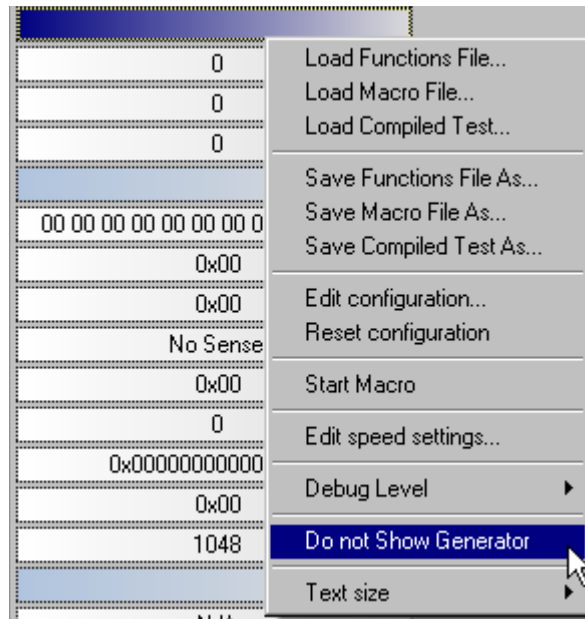
- 1 Right-click on the specific column you want and open the Parameters context menu.
- 2 Select **Do not show Generator** (Figure 261).

Or:

In the Ports Manager, clear the **Show** check box next to the device you want to remove.

The column is removed, but the device is still locked (“in use”) and displayed in the Ports Manager.

Figure 261: Removing a Device Column



To replace the device column on the Parameters Status table:

>> Click the **Show** check box for the device in the Ports Manager.

Resizing columns

You can resize any of the columns by placing the mouse at the right edge at the top of a column, next to the chassis name. A resizing cursor appears. Hold down the mouse button, and drag the mouse to resize the column.

Changing Text Size

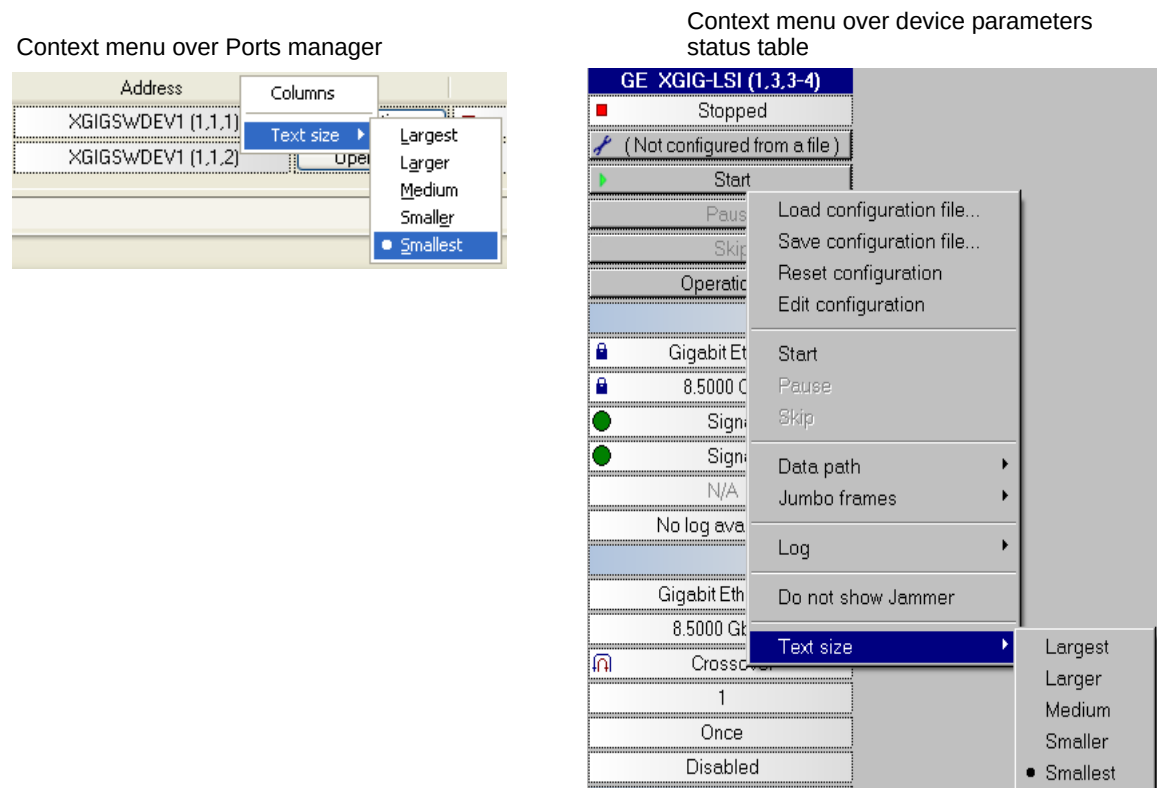
You can choose the text size you want the Parameters Status table or the Ports Manager to display.



Note: You cannot change the text size in the Log Manager.

To change text size:

- 1 Open the context menu by clicking the right mouse button while the cursor is on the Parameters Status table or the Ports Manager.
- 2 Select **Text size** (Figure 262).
You have five choices from which to select.
Smallest is the default size.
- 3 Select the text size you want.
A bullet is displayed next to the current selection.

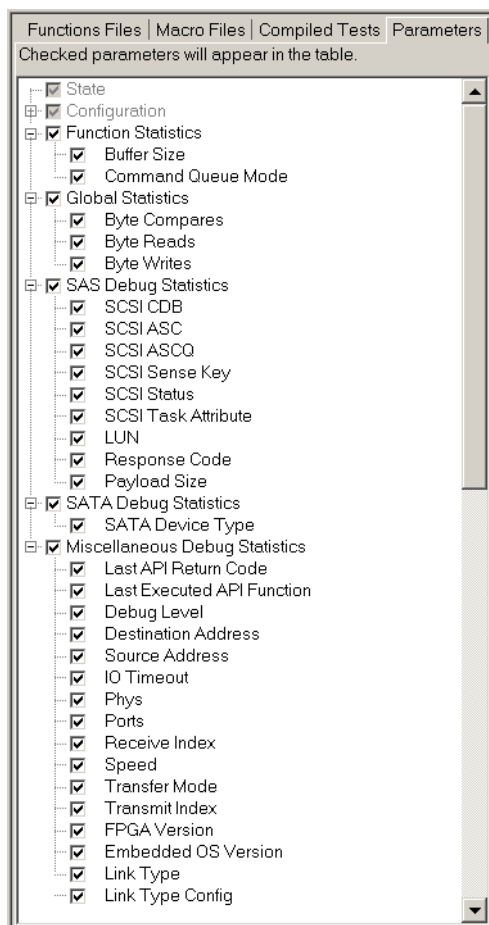
Figure 262: Text Size Menu

Displaying and Hiding Parameters in Generator

The **Parameters** tab next to the functions tabs allows you to select the parameters you want to display in the Parameters Status table. You can hide specific parameters to simplify the status tables and show only the information in which you are interested.

To display or hide parameters on the Parameters Status table:

- 1 Click the **Parameters** tab.
You can expand the categories by clicking the plus signs on the left.
The default displays all of the parameters.

Figure 263: Parameters Tab

2 Click the check box next to a parameter to set or clear the check mark for that parameter.

Checked parameters are displayed in the Parameters Status table.

For details about each of the parameters in the Parameters Status table, see [Using the Parameters Status Table in Generator](#)”.

Chapter 19

Using Generator with Ports

In this chapter:

- Loading a Configuration File
- Launching the Generator Device Window
- Generator Device Menu Bar
- Output/Status/Buffers Pane
- Immediate Execution Tab
- Macro File Tab
- Compiled Test Tab

After you have discovered and locked the Generator ports you want to use and also set up your capturing and monitoring applications, such as Xgig Analyzer or Bus Doctor, you are ready to run the Xgig Generator application. This chapter explains the process of managing and executing all of the configuration files for your device.

Loading a Configuration File

The Generator Device window represents the device selected in the ports manager on the Generator tab. This window contains tabs for functions, macros and compiles tests. This chapter discusses the functionality of each tab.

To access the Generator Device window you need to load a functions file, macro file, or compiled test file to a device.

To load a functions, macro, or compiled test file to a port, locate the file you want to load in the Configuration window, then drag the file to the port, and drop it.

Launching the Generator Device Window

You can open the Generator Device window from either the Parameters status table or the Ports Manager.

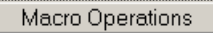
To open the Generator Device window for a device from the **Parameters Status table**:

- 1 Click the **Start**  button on the Parameters Status table for the functions file, macro file, or compiled test file for your device.

The respective Operation window is displayed.

- 2 Click the **Edit**  **Edit** button to open the Generator Device window.

To open the Generator Device window for a device from the **Ports Manager**:

- 1 Check the Select check box next to your device in the **Ports Manager**.
- 2 Click the either the Macro Operations  button or the  for the device.

The respective Operations window is displayed.

- 3 Click the **Edit**  **Edit** button to open the Generator Device window.

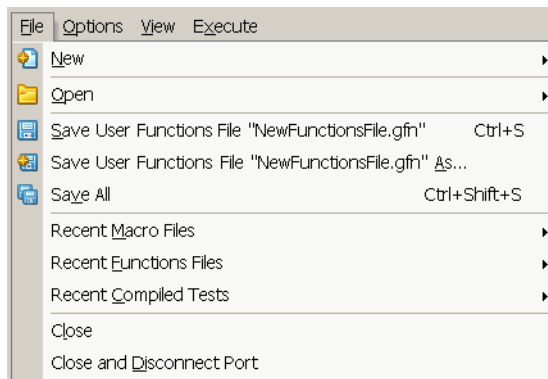
Once the window is open, select the tab you want to use.

Generator Device Menu Bar

The menu bar at the top of the Generator Device window contains the following menus.

File

The File menu (Figure 264) allows you to create a new configuration or open an existing or recently-used configuration file for editing. You can also close the application from this menu.

Figure 264: File Menu

To create a new macro or functions file:

- >> Select **New**, then select:
 - New Functions File
 - New Macro File

A blank file is opened on the tab for the file type you selected.

To open an existing functions, macro, or compiled test file:

- >> Select **Open**, then select:
 - Open Functions File
 - Open Macro File
 - Open Compiled Test

The file is opened on the tab for the file type you selected.

To Save the currently displayed file:

- >> Select *Save Macro* file "..."

To Save the currently displayed file as another name or to another location:

- >> Select *Save Macro* file "... As

To Save all open files:

- >> Select *Save All*.

To open a recently-used functions, macro, or compiled test file:

- 1 Select one of the following:
 - Recent Macro File
 - Recent Functions File
 - Recent Compiled Test File
- 2 Click on the file you want to open.

The file is opened on the tab for the file type you selected.

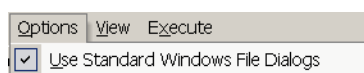
To close the Generator Device window, click **Close**.

To close the Generator Device window and disconnect the port for the device, click **Close and Disconnect Port**.

Options

The Options menu (Figure 265) allows you to use standard Windows file dialogs for **Open** and **Save As...** commands instead of the dialogs customized for Generator. For example, if the Macro tab is active and the **Use Standard Windows File Dialogs** is selected, then when you select **Save As...** from the **File** menu, the title of the resulting dialog box will read, “*Save Macro File As...*” However, if the **Use Standard Windows File Dialogs** is not selected, the same dialog box will read, “*Save Generator Macro File for Protocol SAS/SATA as*”.

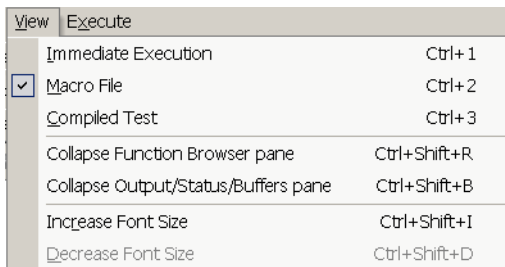
Figure 265: Options Menu



View

The View menu allows you to switch between tabs in the Generator Device window by clicking the entry for the desired tab. This menu also allows you to collapse/expand the Function Browser pane, which is the left pane containing the function library on the left, or to collapse/expand the Output/Status/Buffers pane, which is the bottom pane. These two panes are not shown in the Compiled Test window.

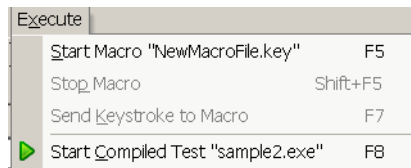
Figure 266: View Menu



Execute

The Execute menu provides the following choices for macros:

- **Start Macro** executes the currently loaded macro file.
- **Stop Macro** stops the execution of a macro
- **Send Keystroke to Macro** simulates a keystroke to stop looping during macro execution. This selection is active only if the `loopk` function is invoked in your macro. Refer to the description for `loopk` in the function library.
- **Start Compiled Test** executes the currently loaded compiled test file.

Figure 267: Execute Menu

Output/Status/Buffers Pane

This pane is located at the bottom of the **Immediate Execution** and **Macro File** tabs. It allows you to set the debug level, view the output and status of executed functions and macros, edit buffers, and set status viewing options.

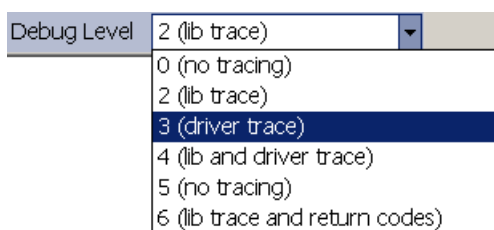
Setting the Debug Level

To view the debug level control, make sure the bottom pane of the window is expanded. If it is not, select **Expand Output/Status/Buffers pane** from the **View** menu. The debug control is located on the Output/Status tab.

The following debug levels are available:

- 0 (no tracing) does not display any traces
- 2 (lib trace) displays library traces
- 3 (driver trace) displays driver traces
- 4 (lib and driver trace) displays both library and driver traces
- 6 (lib trace and return codes) displays library traces and return codes

The default debug level is 2, which displays library traces only. To set the debug level, click the Debug Level drop-down menu, and select the appropriate debug level.

Figure 268: Setting the Debug Level

Setting the Status Viewing Information

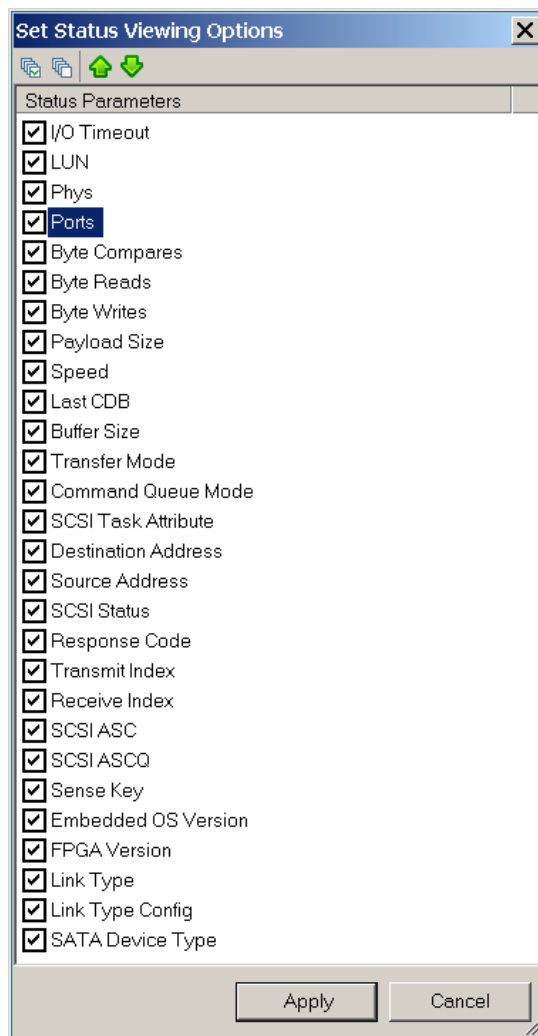
The status of the device selected in the Parameters Status table is displayed in the Status pane of the Generator Device window.

To view the Status of the device, make sure the bottom pane of the window is expanded. If it is not, select **Expand Output/Status/Buffers pane** from the **View** menu. The Status information is located on the **Output/Status** tab.

Figure 269: Status Information for Selected Device

I/O Timeout:	10	LUN:	0x0000000000000000
Phys:	1	Ports:	1
Byte Compares:	0	Byte Reads:	0
Byte Writes:	0	Payload Size:	1048
Speed:	3.0 gig	Last CDB:	28 00 00 0B 8D 9B 00 00 64 00 00 00
Buffer Size:	0x100000	Transfer Mode:	DMAHC
Command Queue Mode:	Single	SCSI Task Attribute:	0
Destination Address:	0x0000000000000000	Source Address:	0x500A0BD003081C78
SCSI Status:	0xFF	Response Code:	0x00
Transmit Index:	0xC800	Receive Index:	0xC800
SCSI ASC:	0x00	SCSI ASCQ:	0x00
Sense Key:	No Sense	Embedded OS Version:	04.00.00

The parameters listed in the Status pane correspond to those shown in the Parameters Status table for the device. For a definition of these categories, refer to [“Using the Parameters Status Table in Generator” on page 331](#).

Figure 270: Set Status Viewing Options Window

To select which parameters you want to display in the Status pane:

- 1 Click the Set Status Viewing Options  button.

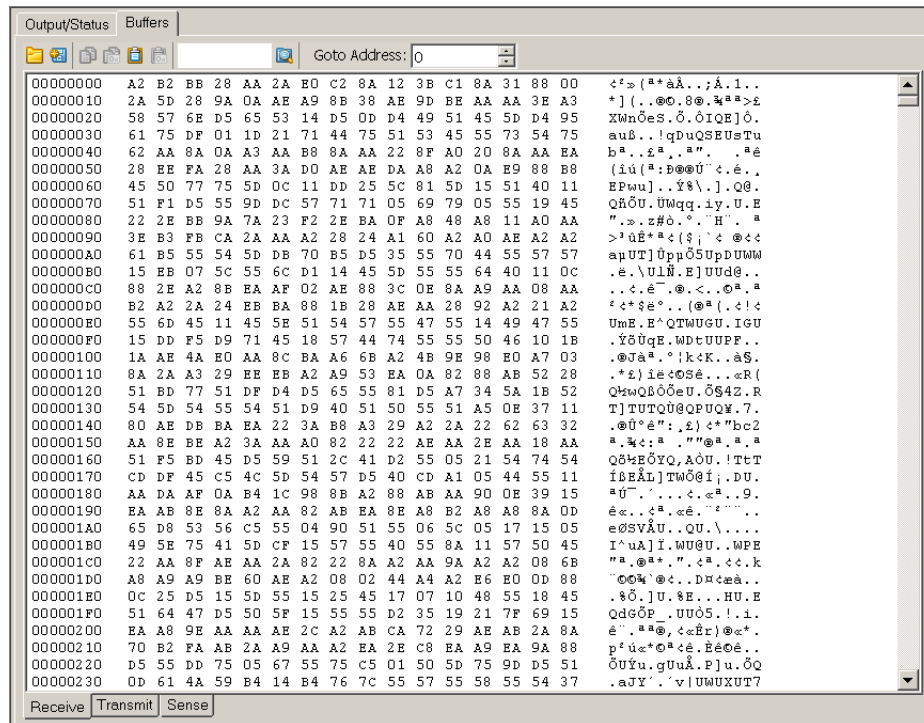
- 2 The Set Status Viewing Options window appears.
- 3 Select which parameters you want to view in the Status pane.
- 4 Use the **Move Up/Move Down**  buttons to arrange the order of the parameters.
- 5 Click **Apply**.

Accessing the Buffer Editor

The Buffer Editor enables you to view and manipulate the transmit, receive, and sense buffers. A buffer is a .bin file that displays data used in SCSI data frames. SCSI data is sent from the transmit buffer and to the receive buffer during SCSI I/O operations. The sense buffer displays the sense data of the most recent commands containing that data. Refer to the `dmaset()`, `dmast()`, `get_g_info("bufsz")`, `get_g_info("tx_ptr")`, and `get_g_info("rx_ptr")` functions for more information.

To access the buffer editor, open the main configuration window for a port. Select the **Macro File** tab. Then, select the **Buffers** tab.

Figure 271: Buffer Editor



Data is shown in both hexadecimal and ASCII.

Opening a Buffer File

To open a buffer file:

- 1 Select the tab for the type of buffer you want to open, i.e. **Receive**, **Transmit**, or **Sense**.
- 2 Click the **Folder**  icon in the top left corner of the pane.

- 3 Browse to the buffer file you want to open.
- 4 Click OK.

The buffer file is displayed in the buffer pane.

Editing a Buffer

Both the hexadecimal and ASCII fields in the read and write buffers can be edited. The Address field indicates the selected position.

To edit a buffer file:

- 1 Move to the desired cell using the **GotoAddress** field or by typing text into the **Search** field.
- 2 Type an appropriate value. If you are editing a hexadecimal value, the ASCII value changes accordingly, and if you are editing an ASCII value, the hexadecimal value changes accordingly.
- 3 Use the **Copy**  icon to copy an selection of the buffer, and then use the **Paste**  icon to paste the selected contents into another buffer, into the current buffer, or into a text editor as ASCII.
- 4 Alternatively, you can use the **Copy as a hex string**  icon to copy a selection of the buffer as a hex string and use the **Paste as a hex string**  icon to paste the selected contents into another buffer, into the current buffer, or into a text editor as a hex sting.
- 5 You can also do the following:
 - Copy a section from another buffer file and paste it into the current file or visa versa using the right-click menu. This menu also contains the option to copy/paste as ASCII or as a hex string.
 - Paste another buffer file into the current file at an insertion point by using the right-click menu.
- 6 Save the buffer file by selecting the **Save** icon in the top, left corner of the pane. Saving a buffer, saves the data on all three tabs into a single file.

Immediate Execution Tab

After you have configured a Generator device, you can use the Immediate Execute tab to execute individual functions, or to create, edit, and execute functions files.

The **Immediate Execution** window is comprised of two panels. The left panel is the contents pane. It lists the functions present in the functions file. See Creating a Functions File below.

The right pane is the function library. Each of the functions in the library are represented in the API Help System on the product CD. The functions in the library are listed in the contents pane by name; current parameters in hexadecimal; and the parameter types: b (byte), d (dword), q (quad), s (string parameter), w (word), and o (optional parameter), which currently cannot be edited or added; and the function category.

You can sort the functions in either pane in the following ways:

- Alphabetically in ascending or descending order by toggling the Function Name heading.

- By category with the categories alphabetically in ascending or descending order by toggling the Function Type heading.
- By parameter types with the parameter types listed by number of parameters from most to least or from least to most by toggling the Parameter heading.

Click the **Clear Filter**  icon to remove the filters you have applied by typing text into the search field and revert to viewing all functions in the functions library.

To view the details of the functions in the library or the contents pane, click the **Show/Hide Function Info**  button at the top of the pane. The details for each function correspond to an entry in the Generator API Help available from the Help menu in the Maestro main window. To display the contents of the information pane for the selected function in a popup window, click the **Display Help Contents in Popup Window**  button.

As you begin to click various functions in the function library or the contents pane, while you have the Show Function Info pane open, you create a history of the functions you've selected. You can navigate back and forth through the functions you've selected by using the **Go Back** and **Go Forward**  buttons at the top of the Function Information pane. You can execute a function from the Immediate Execution tab of the Generator Device window or from the Parameters Status table in the Maestro window.

Editing Function Parameters

To edit a function's parameters inline:

- 1 Right-click the function, and select Edit Parameters Inline.
- 2 Type directly in the parameters field to edit inline, or click the arrow at the end of the field to open a drop-down window.

This window is the same as the Popup Parameters Editor.

To edit a function's parameters using the Popup Parameters Editor:

- 1 Right-click the function, and select Popup Parameters Editor.
- 2 The Popup Parameters Editor appears with the following options in the menu:
 - Apply and execute
 - Apply and close
 - Discard and close
 - Reset parameter values
 - Show parameters info

Depending on the function, the following parameters may be available for editing:

Display - Displays the values in hexadecimal or decimal, depending on the field selected. Use the drop-down menu to change the display.

Byte - Byte- or bit-specific data. A byte is equal to 8 bits.

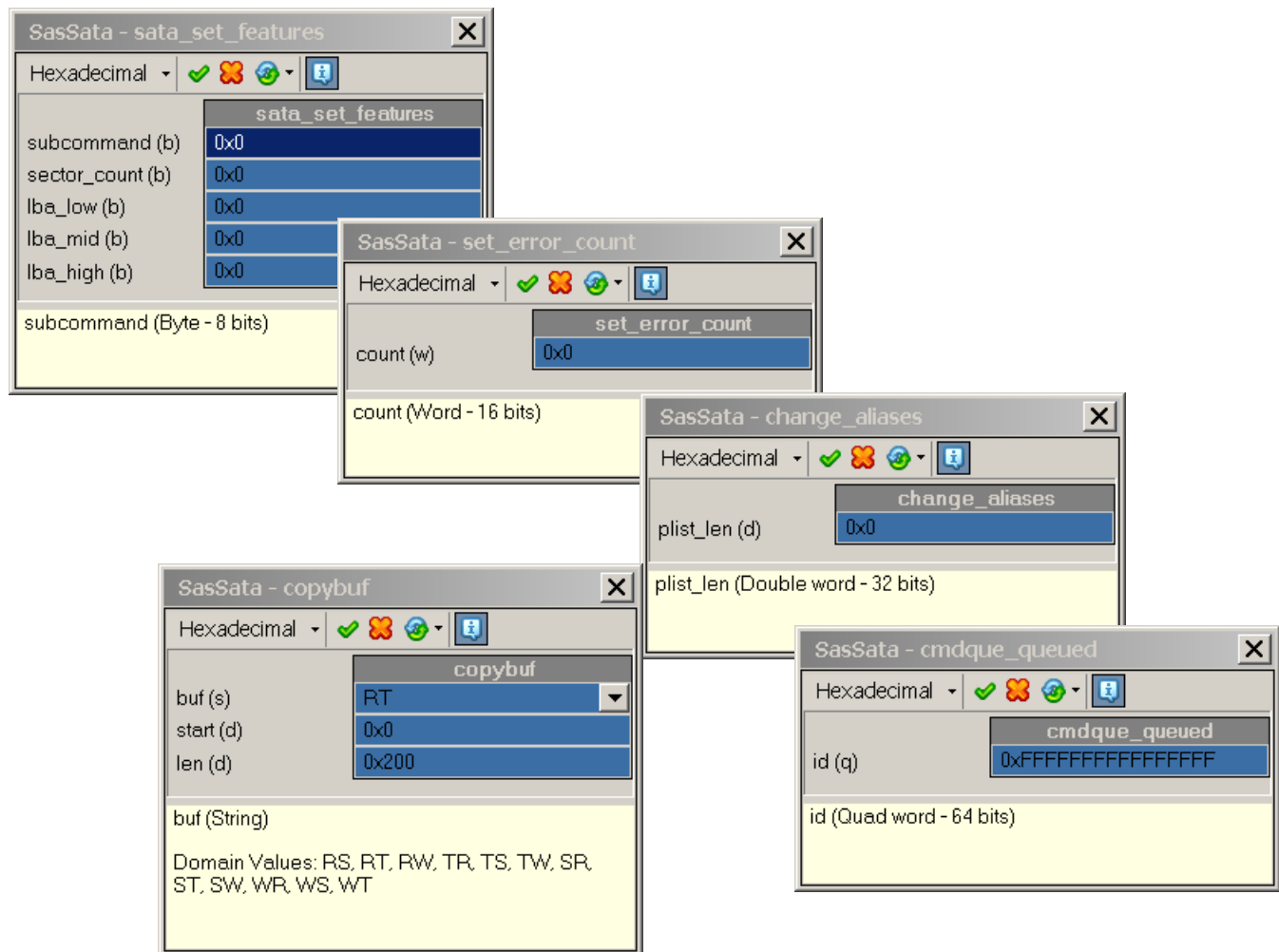
Word - Word or short integer data. A word is equal to 16 bits.

Double - Double word or long integer data. A double word is equal to 32 bits.

Quad - A quad is equal to 64 bits or 4 words.

String - Constant text or string data. Enter data without quotation marks.

Figure 272: Popup Parameters Editor Window



Executing a Function on a Generator Device

You can execute an individual function from the Contents pane or from the Function Library.

To execute a function from the Generator Device window:

- 1 Locate the function you want to execute in the function library or contents pane of the window by using the scroll bar or by typing the name of the function into the **Search Function** field.
- 2 Set the parameters as necessary for the selected function. The right-click menu provides editing options. These options are described in [“Editing Function Parameters”](#).
- 3 Click the **Start**  button to execute the function.

You can also perform immediate function execution from the Parameter status table in the Maestro window.

To execute a function from the Parameters Status table:

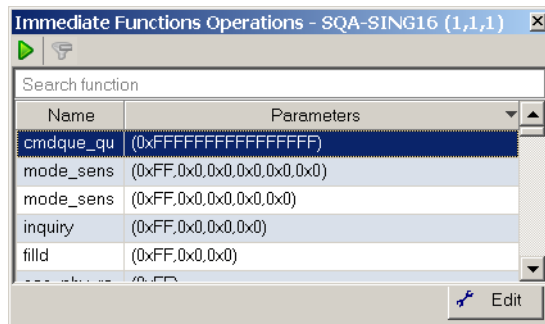
- 1 Click the **Start**  button on the Parameters Status table next to the Immediate Function Execution field.

Figure 273: Parameters Status table Start Function Button

SAS/SATA XGIG01 (1,3,3)	
State	 Stopped
Configuration	Edit...
Immediate Function Execution	 SASBuffer.gfn
Macro File Operations...	 SASRandomRead key
Compiled Test Operations...	 sample2.exe
Function Statistics	

The Immediate Functions Operations window is displayed.

Figure 274: Immediate Functions Operations Window



- 2 Locate the function you want to execute by using the scroll bar or by typing the name of the function into the **Search Function** field.
- 3 Set the parameters as necessary for the selected function. The right-click menu provides editing options. These options are described in [“Editing Function Parameters”](#).
- 4 Click the **Start**  button to execute the function.

Opening a Functions File

To open a recently used Xgig Generator functions file:

- 1 Click the arrow next to the **Open Functions file**  button in the menu bar.
- 2 Click the functions file you want to open.

An **Immediate Execution** window appears with the functions file loaded.

To browse to a functions file, and open it:

- 1 Click the **Open Functions file**  button in the menu bar.
- 2 Browse to the functions file you want to open.
- 3 Click the **Open** button.

An **Immediate Execution** window appears with the functions file.

Creating a New Functions File

A functions file is a .gfn file that contains a list of functions. You can use a functions file as a repository to group a specified set of functions with a certain set of parameters. You can also use a functions file to define and maintain the order of a group of functions for use in a macro file. In addition, you can select, edit parameters for, and execute individual functions from a function file.

To create a new macro or functions file using the **File** menu:

>> Select **New**, then select **Functions File**

To create a new functions file from the Contents pane, click the **New Generator Functions File**  icon in the Contents pane menu bar.

A blank file is opened on the tab.

Adding Functions to a Functions File

To add a function from the function library to the functions file:

- 1 Click the index position in the Contents pane where you want to add a function.
- 2 Click the function in the function library that you want to add to the functions file.
- 3 Click the **Send Selected Function to Functions File**  button.

The function appears in the Contents pane at the selected index position.



Note: A convenient shortcut for adding functions to a file is to hold down the Ctrl button on your keyboard, then click and drag the function file to the Contents pane.

- 4 Click the Save or Save as button at the top of the window to save the functions file.
- 5 Click the Done button to close the window.

Moving Functions within a Functions File

To move a function up or down in within the functions file:

- 1 Click the function you want to move.
- 2 Click the **Move Up/Move Down**  buttons at the top of the Contents pane.

To remove a function you have added to your functions file:

- 1 Click the function you want to remove from the file.
- 2 Click the **Delete Selected User Function**  button at the top of the Contents pane.

You can also interchange one function with another, move a function for another index location, or copy a function to another index location by right-clicking the function and selecting the appropriate action.

Saving a Functions File

To save a functions file, click the **Save**  button.

To save the file as another name or to another location:

- 1 Click the **Save As**  button.

The **Save/Save As** dialog appears.



Note: If you want to use the standard Windows file dialogs instead of the dialogs customized for Generator, select **Use Standard Windows File Dialogs** from the **Options** menu in the Generator Device window menu bar.

- 2 Navigate to the location where you want to save the file.
- 3 Type a name for the file.
- 4 Click **Save**.
- 5 Click the **Done** button to close the window. If you make changes to the file and then click try to close the window, you will receive prompt asking you if you want to save the file before closing it.

Macro File Tab

Opening a Macro File

To open a recently used Xgig Generator macro file:

- 1 Click the arrow next to the **Open Macro file**  button in the menu bar.
- 2 Click the macro file you want to open.

A macro window appears with the macro loaded.

To browse to a macro file and open it:

- 1 Click the **Open Macro file**  button in the menu bar.
- 2 Browse to the macro file you want to open.
- 3 Click the **Open** button.

A macro window appears with the macro loaded.

Editing a Macro File

The macro editor enables you to easily create macros for automating a test sequence. Macros are ideal for non programmers because they are quick and easy to create and don't require a C compiler or knowledge of C programming. The macro language, however, has limitations. You can't write a macro test that takes pointers or addresses as function parameters.

A macro file is a .key file that can be created with any ASCII editor or by using the Macro File Editor. A macro file can contain up to 62 user-defined macro tests (0–9, A–Z, and a–z). Each macro test contains a sequence of functions to be called upon when invoking the macro test. In addition to functions, macro tests can also include variables, branches, jumps, loops, and macro functions.



Note: This section pertains to individual macro files, which can be created and edited independently of a device. You do not need to lock ports to perform these actions. The Macro Editor window described in this chapter is separate from the Generator Device window, which allows a user to manage and execute all configuration files for a selected device from a central window. Refer to [Chapter 19, “Using Generator with Ports”](#) for more information.

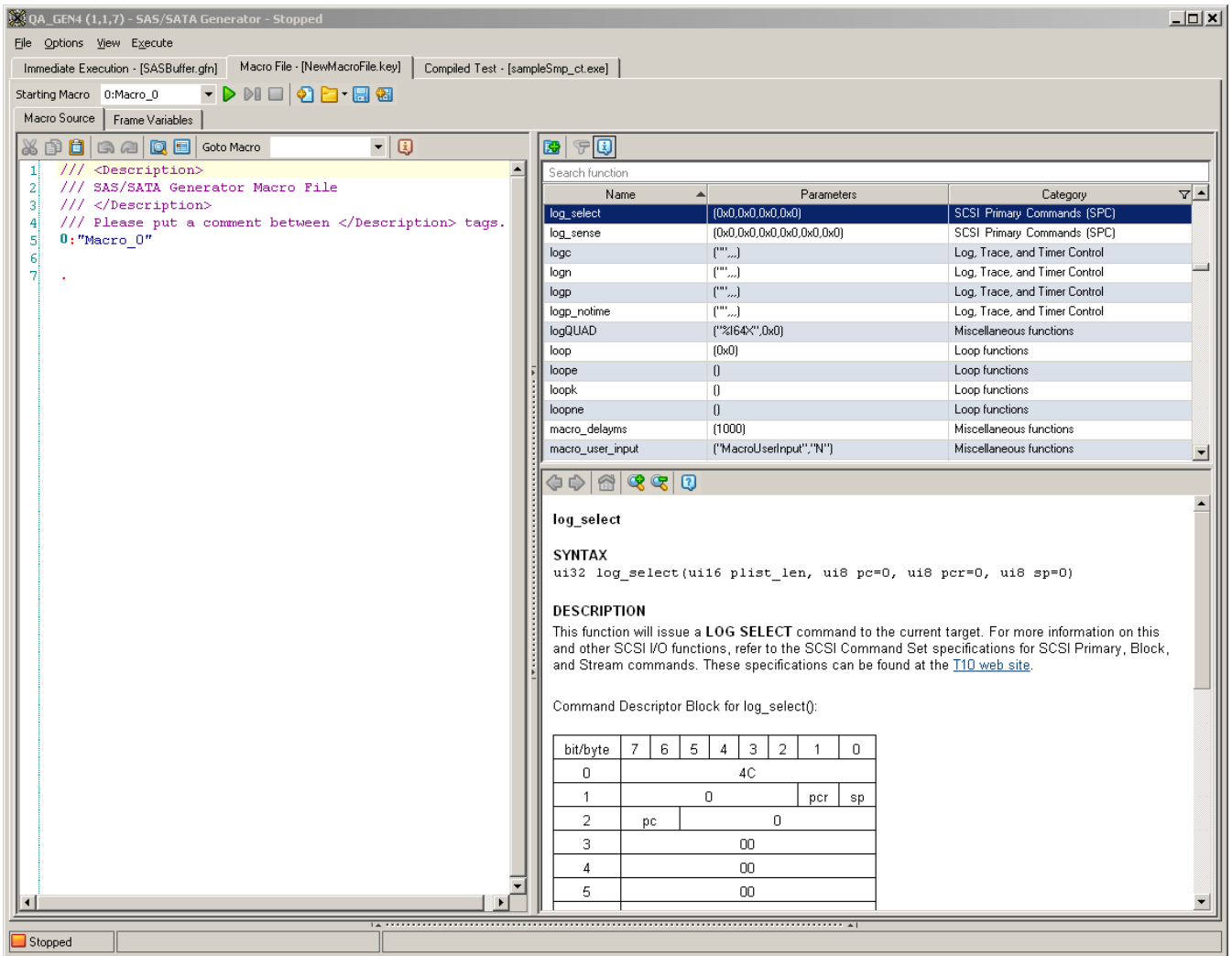
Creating a New Macro File

To create a new Xgig Generator Macro file:

- 1 Select the Macro Files tab in the Configuration window.
- 2 Click the **New Macro File**  icon in the Configuration menu.

A new Macro Editor window appears.

Figure 275: Macro File Editor Window with Macro File Loaded



Macro File Structure

When creating macro tests, you must adhere strictly to the correct syntax. Extraneous spaces are generally not allowed. Numeric variables are decimal values unless they are preceded by 0x, in which case, they are hexadecimal.

In a new macro file, the macro content begins with description tags. This is a placeholder for the description of your file. The description you type here will appear in the Details pane when the file is selected in the Macro Files tab in Generator.

The list of functions in a macro always starts with a number (default = 0) followed by a red colon and ends with a red period. When you open a new macro, the beginning of the macro is indicated by a “0:”, and the end is indicated by a “.” on a new line as shown in the figure above.

You can either choose to build your macro as one string of functions, or you can separate it into routines. Essentially, each routine is a complete macro, beginning and ending with the symbols listed above. Each routine should be numbered sequentially. As mentioned above, the default number for the beginning of a macro is zero. You can change this number to one or another number if you choose.

Each macro or routine needs a name. The name should be enclosed in quotation marks and be placed immediately after the red colon indicating the beginning of the macro (no space).

Begin populating your macro with functions. Place a semicolon after each function. Place comments after `//` on a new line. A single comment that extends over multiple lines in the macro file must have a comment indicator `//` at the beginning of each line. The figure below shows a completed macro containing three routines.

Figure 276: Sample Macro File Contents

```

1  /// <Description>
2  /// SAS Random Read, Write, and Compare Macro File
3  /// </Description>
4  1:"Random Write/Read Compare"
5  // Random Write/Read with Hardware Compare Stop on Error
6  debug(0);
7  // Get user input
8  user_input("Transfer Length:", "N");
9  INT0=get_user_int();
10 // Display user input
11 debug(2);
12 logp("Random Write/Read Compare");
13 logp("Transfer Length: %u", INT0);
14 // If transfer length = 0 then exit
15 jumpz(INT0, 3);
16 debug(0);
17 // Setup
18 set_len(INT0);
19 test_unit_ready();
20 dmarst("R");
21 xfermode("DMARW", 0, 3);
22 // Set program logic error to ignore errors so program logic error is not
23 // logged when the command queue mode is set to terminate
24 pea("CONT");
25 // Set command queue mode to terminate to complete outstanding commands
26 cmdque_mode(8);
27 pea("LOGC");
28 read_capacity_10(0,0,0);
29 LNG0=get_long("R",0);
30 LNG1=add(INT0,1);
31 LNG2=sub(LNG0,LNG1);
32 // Set command queue mode to single
33 cmdque_mode(0);
34 queue_full_wait(1);
35 xfermode("DMAHC", 0, 3);
36 jump(2);
37 .
38 2:"Routine 2"
39 // Random Write/Read loopne()
40 random_blk(0,LNG2);
41 dmarst("W");
42 write_10_blk();
43 read_10_blk();
44 loopne();
45 queue_full_wait(0);
46 logp("Random Write/Read Compare completed");
47 debug(2);
48 .
49 3:"Routine 3"
50 // Random Write/Read Exit
51 logp("Random Write/Read Compare did not complete, transfer length is 0 ");
52 .

```

Adding Functions to a Macro File

To add a function from the function library to a macro file:

- 1 Place the cursor at the location where you want to add the function.
- 2 Click the function in the function library that you want to add to the macro file.
- 3 Click the Add Function to Macro  button.

The function appears in the Contents pane at the selected position.



Note: A convenient shortcut for adding functions to a macro file is to hold down the **Ctrl** button on your keyboard, then click and drag the function file to the Contents pane.

- 4 Click the Save or Save as button at the top of the window to save the macro file.

- 5 Set the parameters as necessary for each function. The right-click menu provides editing options. These options are described in [Editing Function Parameters](#) above.
- 6 Refer to [Appendix F, “Macro Variables and Functions and the Adding Frame Variables to a Macro](#) section below for function and variable types and syntax as well as examples.
- 7 Indicate the end of the macro with a period on a line by itself.
- 8 Follow steps 1-3 to add the desired macros to the macro file, sequentially numbering the start of each one.

Adding Frame Variables to a Macro

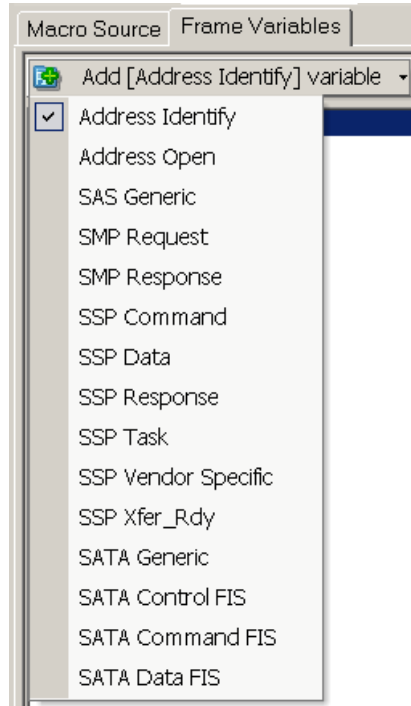
The frame editor is an easy-to-use feature for customizing both legal and illegal SAS and SATA frames to send to a device. You can create and edit frame variables in the Macro File Editor window.

To access the Frame Editor, open the macro file that you want to add frame variables to, then select the Frame Variables tab.

To add a frame to a macro:

- 1 Select a frame variable, i.e. FRM0, FRM1, etc.
- 2 Click the **Add [...] variable** drop-down menu, and select the frame type that you want to use.

Figure 277: Frame Variables Drop Down Menu



Generator will fill in the fields in the right pane depending on which frame type you selected.

- 3 Type a name for the frame variable in the **Name** field.

- 4 To set the destination address for a SAS variable, click the **Get** button next to the **Dest Addr** field. This address indicates where the frame is being sent. If the frame type is not Identify or Open Address, this is the value that will set the hashed address for the frame and will be used in the automatically generate open address frame that will precede the specified frame. Once you've set the address, click **Set**.
- 5 To get the source address for a SAS variable, click the **Get** button next to the **Src Addr** field. This address indicates where the frame is coming from. If the frame type is not Identify or Open Address, this is the value that will set the hashed address for the frame and will be used in the automatically generate open address frame that will precede the specified frame.

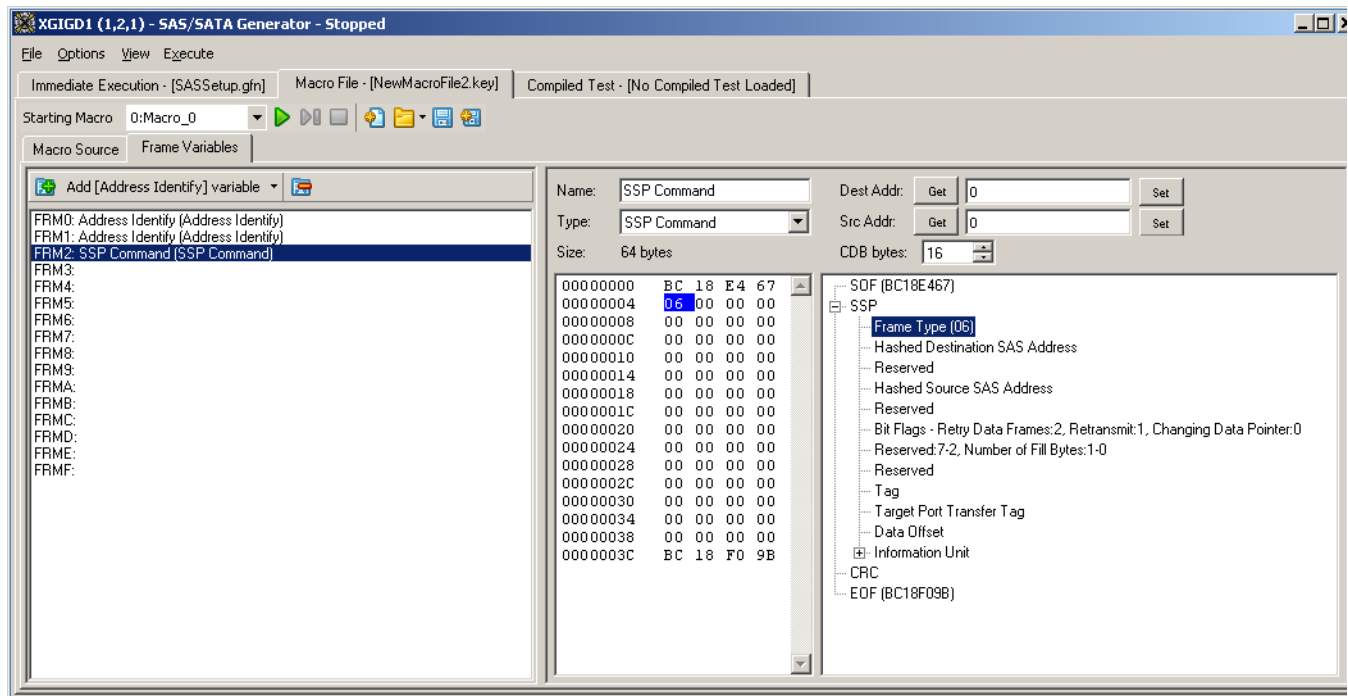


Note: SATA variables use a logical block address (LBA) setting instead of source and destination addresses.

- 6 Type an LBA address for the variable in the **LBA** field. This address indicates the logical block address used to identify the frame. Once you've set the address, click **Set**.

The contents of the frame is listed in the following two panes as shown below.

Figure 278: Frame Variables Window



Frame Decode Pane

This pane lists the contents of the specific frame. This information pane tracks with the frame hex data pane. When you click on node in the frame, the frame hex data size pane shows the number of dwords/bytes that make up that node. When you double-click a node with a defined value in the information pane, such as “Frame Type [06]”, the corresponding hex value is set. The main components of a frame are:

- SOF

- Header (Expand this to show nodes)
- CRC
- EOF

Just above this pane are two fields. The first indicates the total size of the frame. The second, which allows you to add or remove certain types of bytes, such as FIS or CDB bytes from a frame, is only available for certain frame variable types. To add bytes to or remove bytes from the frame, click the up/down arrows next to the field.

Frame Hex Data Pane

This pane lists the bytes for a specific frame component. To edit the byte value:

- Select the byte value, then type another value.

You can add bytes to specific types of frames to increase the size of the frame. If the selected frame type allows the addition of bytes, a numeric field will be displayed above the **Frame Hex Data** pane.

Running a Macro on a Generator Device

You can run a macro file from the Macro File tab of the Generator Device window or from the Parameters Status table in the Maestro window. When running macro files from the Parameters Status table, you can run the files on multiple devices simultaneously

To run a macro file for a device from the Generator Device window, click the **Start**  button on the menu bar of the **Macro File** tab.

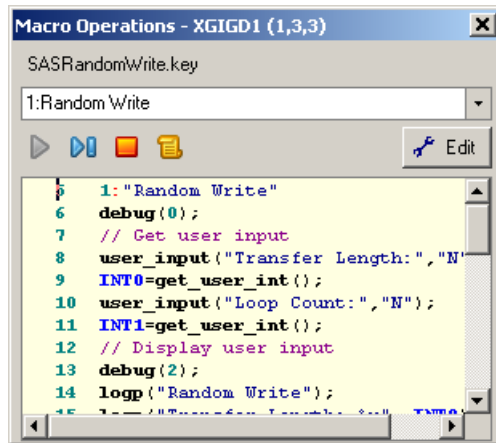
To run a single macro for a device from the Parameters Status table:

- 1 Click the **Start**  button on the Parameters Status table for Macro File Operations. You need to have a macro file loaded to perform this action.

Figure 279: Parameters Status table Start Macro Button

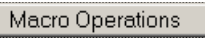
SAS/SATA XGIGD1 (1.3.3)	
State	 Stopped
Configuration	Edit...
Immediate Function Execution	 SASBuffer.gfn
Macro File Operations...	 SASRandomRead.key

The Macro Operations window is displayed.

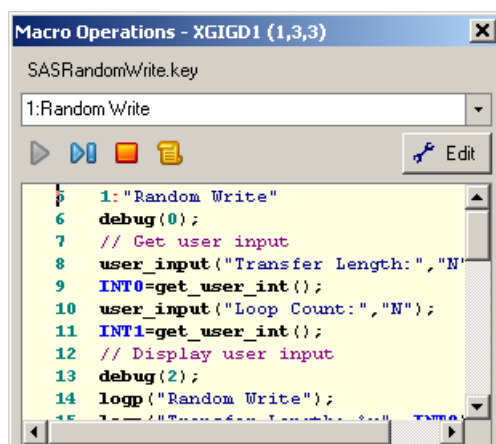
Figure 280: Macro Operations Window

- 2 Click the Preview Macro  button if you want to preview the macro contents.
- 3 Click the **Start**  button to run the macro.
- 4 Click the **Abort Macro**  button to stop the execution of a macro.
- 5 Click the **Send Keystroke**  button to simulate a keystroke to stop looping during macro execution. This selection is active only if the loopk function is invoked in your macro. Refer to the description for loopk in the function library.
- 6 A log entry is generated.

To execute a macro for a device from the Ports Manager:

- 1 Click the Macro Operations  button for the device.

The Macro Operations window is displayed.

Figure 281: Macro Operations Window

- 2 Click the Preview Macro  button if you want to preview the macro contents.
- 3 Click the **Start**  button to run the macro.
- 4 A log entry is generated.

To simultaneously run macros on multiple devices from the Port Manager:

- 1 Select each device that you want to run macros on by checking the **Select** check box for the device.
- 2 Select the macro file you want to load from the Configuration Manager.
- 3 Click the **Load Configuration into Selected Ports**  button.
- 4 Click the **Start Macro on Selected Ports**  button.
- 5 A log entry is generated.

To stop a macro file in progress, right click the device column in the Parameter status table, and select **Stop Macro**.

Saving a Macro File

To save a macro file, click the **Save**  button.

To save the file as another name or to another location:

- 1 Click the **Save As**  button.

The **Save/Save As** dialog appears.



Note: If you want to use the standard Windows file dialogs instead of the dialogs customized for Generator, select **Use Standard Windows File Dialogs** from the **Options** menu in the Generator Device window menu bar.

- 2 Navigate to the location where you want to save the file.
- 3 Type a name for the file.
- 4 Click **Save**.
- 5 Click the **Done** button to close the window. If you make changes to the file and then try to close the window, you will receive prompt asking you if you want to save the file before closing it.

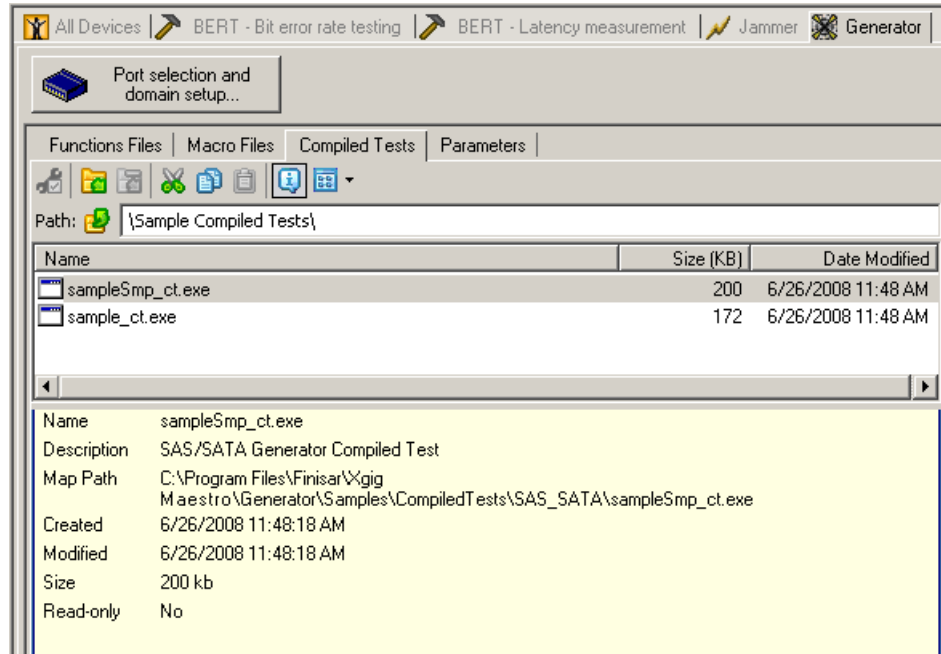
Compiled Test Tab

A compiled test file is a .exe file written using the JDSU SAS/SATA Generator API. Refer to the Generator API Help for instructions on creating compiled tests. The Generator GUI does not allow you to modify the .exe file. However, the GUI does allow you to add parameters to a compiled test, which, when saved, creates a .gen file of the same name.

Using this section, you can add and edit parameters for a compiled test file, essentially, creating .gen files.

Sample Compiled Test Files

The Generator software includes sample compiled test files. These files are located in the Sample Files folder of the Configuration Manager in the Maestro Window as shown below.

Figure 282: Sample Compiled Test Folder

This section gives a briefly describes the operations performed when running each of the sample tests.

Sample_ct

Upon execution, this test file opens the tester, requests the fpga version string then displays the returns in the command window listing the bit file version found to be running on your tester. The test then pauses and prompts you to press any key to continue. When you press a key, the test completes and closes the command window.

Samplesmp_ct

This test assumes that your tester is attached to an expander.

Upon execution, this test queries the expander, performs discover smp requests, retrieves the manufacturing information, performs report general requests, records report general responses, and lists the number of phys. For each phy, the test issues and smp discover request and displays the returns in the command window. The test then pauses and prompts you to press any key to continue. When you press a key, the test completes and closes the command window.

Opening a Compiled Test File

To open a recently used Xgig Generator compiled test file:

- 1 Click the arrow next to the **Open Compiled Test**  button in the menu bar.
- 2 Click the compiled test file you want to open.

A compiled test window appears with the compiled test file loaded.

To browse to a compiled test and open it:

- 1 Click the **Open Compiled Test**  button in the menu bar.
- 2 Browse to the compiled test file you want to open.
- 3 Click the **Open** button.

A compiled test window appears with the compiled test loaded.

Adding Parameters to a Compiled Test File

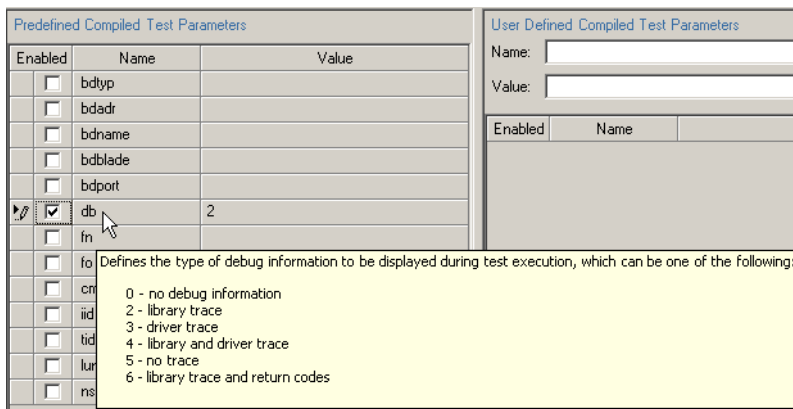
The **Description** field allows you to type a description for the compiled test. This description will appear in information panes when the file is selected.

The **Predefined Compiled Test Parameters** pane lists common command line parameters. These parameters are listed in the **Common Command Line Parameters** section of the API Help. Holding the mouse over one of these parameters brings up a tool tip window containing information about the parameter such as the definition, use, and defined or suggested values.

Example:

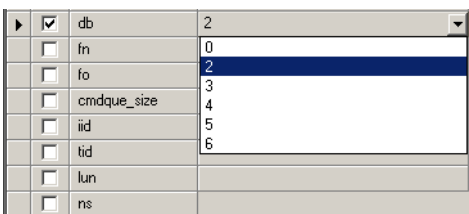
Holding the mouse over the `bdtyp` parameter displays the following tool tip.

Figure 283: Bdtyp Compiled Test Parameter Tool Tip



The tool tip describes the parameter and lists the possible values. Selecting this row and clicking the value drop-down menu, the possible values as shown in the figure below.

Figure 284: Bdtyp Compiled Test Parameter Values



Click the row with the desired parameter to make it editable. The  icon appears next to the enabled field to indicate that this is the parameter you are editing.

To select a value for this parameter, click the value you want from the drop-down list.



Note: Not all parameter values fields have a drop-down menu for the value. Some tool tips indicate a value range or define the type of information required and the format required.

To enable a parameter for the compiled test, select the **Enable** check box next to the parameter.

The **User Defined Compiled Test Parameters** pane allows you to create your own parameters.

To create a parameter:

- 1 Type a name in the **Name** field.
- 2 Type a value in the **Value** field.
- 3 Click the **Add Parameter** button.

The parameter appears in the list below as shown in the following figure.

Figure 285: User Defined Parameter

User Defined Compiled Test Parameters

Name: test parameter 2

Add Param

Value: 02x02

Remove Selected

Enabled	Name	Value
☐	test parameter	02x01
☐	test parameter 2	02x02

- 4 Click the row with the desired parameter to make it editable. The  icon appears next to the enabled field to indicate that this is the parameter you are editing.

To enable a parameter for the compiled test, select the **Enable** check box next to the parameter.

To delete the parameter, select the entire row, and click the **Remove Selected** button.

Running a Compiled Test on a Generator Device

After you have configured a Generator device and loaded a compiled test file, you can run the file.



Note: Before launching a compiled test, the GUI disconnects from the port then reconnects to the port when the test is complete.

You can run a compiled test file from the Compiled Test tab of the Generator Device window or from the Parameters Status table in the Maestro window. When running compiled tests from the Parameters Status table, you can run the test files on multiple devices simultaneously.

To run a compiled test for a device from the Generator Device window, click the **Start**  button on the menu bar.

To run a single compiled test file for a device from the Parameters Status table:

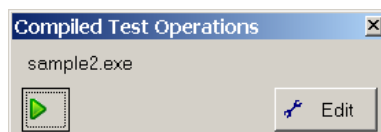
- 1 Click the **Start**  button on the Parameters Status table next to the Compiled Test Operations field. You need to have a compiled test file loaded to perform this action.

Figure 286: Parameters Status table Start Compiled Test Button

SAS/SATA XGIGD1 (1,3,3)	
State	 Stopped
Configuration	Edit...
Immediate Function Execution	 SASBuffer.gln
Macro File Operations...	 SASRandomRead.key
Compiled Test Operations...	 sample2.exe
Function Statistics	

The Compiled Test Operations window is displayed.

Figure 287: Compiled Test Operations Window



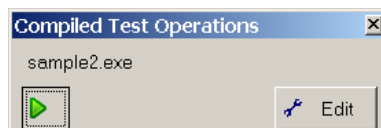
- 2 Click the **Start**  button to run the compiled test.
- 3 A log entry is generated.

To execute a compiled test for a device from the Ports Manager:

- 1 Click the Compiled Test Operations  button for the device.

The Compiled Test Operations window is displayed.

Figure 288: Compiled Test Operations Window



- 2 Click the **Start**  button to run the compiled test.
- 3 A log entry is generated.

To simultaneously run compiled tests on multiple devices from the Port Manager:

- 1 Select each device that you want to run compiled tests on by checking the **Select** check box for the device.
- 2 Select the compiled test file you want to load.
- 3 Click the **Load Configuration into Selected Ports**  button.
- 4 Click the **Start Compiled Tests on Selected Ports**  button.
- 5 A log entry is generated.

Saving a Compiled Test File

To save a compiled test file, click the **Save**  button.

To save the file as another name or to another location:

- 1 Click the **Save As**  button.

The **Save/Save As** dialog appears.



Note: If you want to use the standard Windows file dialogs instead of the dialogs customized for Generator, select **Use Standard Windows File Dialogs** from the **Options** menu in the Generator Device window menu bar.

If you click the **Save as** selection to save a .gen file as a new file name, a copy of the existing compiled test .exe will be created with along with the new .gen file.

- 2 Navigate to the location where you want to save the file.
- 3 Type a name for the file.
- 4 Click **Save**.
- 5 Click the **Done** button to close the window. If you make changes to the file and then try to close the window, you will receive prompt asking you if you want to save the file before closing it.

Chapter 20

Using Generator in Edit Only Mode

In this chapter:

- [Creating/Editing a Functions File](#)
- [Creating/Editing a Macro File](#)
- [Editing Parameters for a Compiled Test](#)

This chapter explains the process of creating and editing functions files or macro files independent of any device. These actions do not require any ports to be locked.



Note: This section refers to specific functions described in the Generator API Help System, which can be accessed by selecting Generator API Help from the main Help drop-down menu in the Maestro main window.

Creating/Editing a Functions File

A functions file is a .gfn file that contains a list of functions. Using this section, you can create a new functions file, edit an existing functions file, or use an existing functions file as a template to create another file. You can also change the parameters of any function. Each of the functions in the Generator GUI are represented in the API Help System on the product CD.



Note: This section pertains to individual functions files, which can be created and edited independently of a device. You do not need to lock ports to perform these actions. The User Functions Editor window described in this chapter is separate from the Generator Device window, which allows a user to manage and execute all configuration files for a selected device from a central window. Refer to [Chapter 19, “Using Generator with Ports”](#) for more information.

Creating a New Functions File

To create a new Xgig Generator Functions file:

- 1 Select the Functions Files tab in the Configuration window.
- 2 Click the **New Generator Functions File**  icon in the Configuration menu.

A new User Functions Editor window appears.

Opening a Functions File

To open an Xgig Generator Functions file:

- 1 Select the Functions Files tab in the Configuration window.

The following three folders are shown:

- Sample Functions Files - Functions files provided by JDSU
- User Functions Files - Functions files created by the user and saved here
- Most Recently Used - Functions files used recently

- 2 Double-click one of the folders to open it, or click the Path  icon, and navigate to the folder that contains the functions file you want to open.

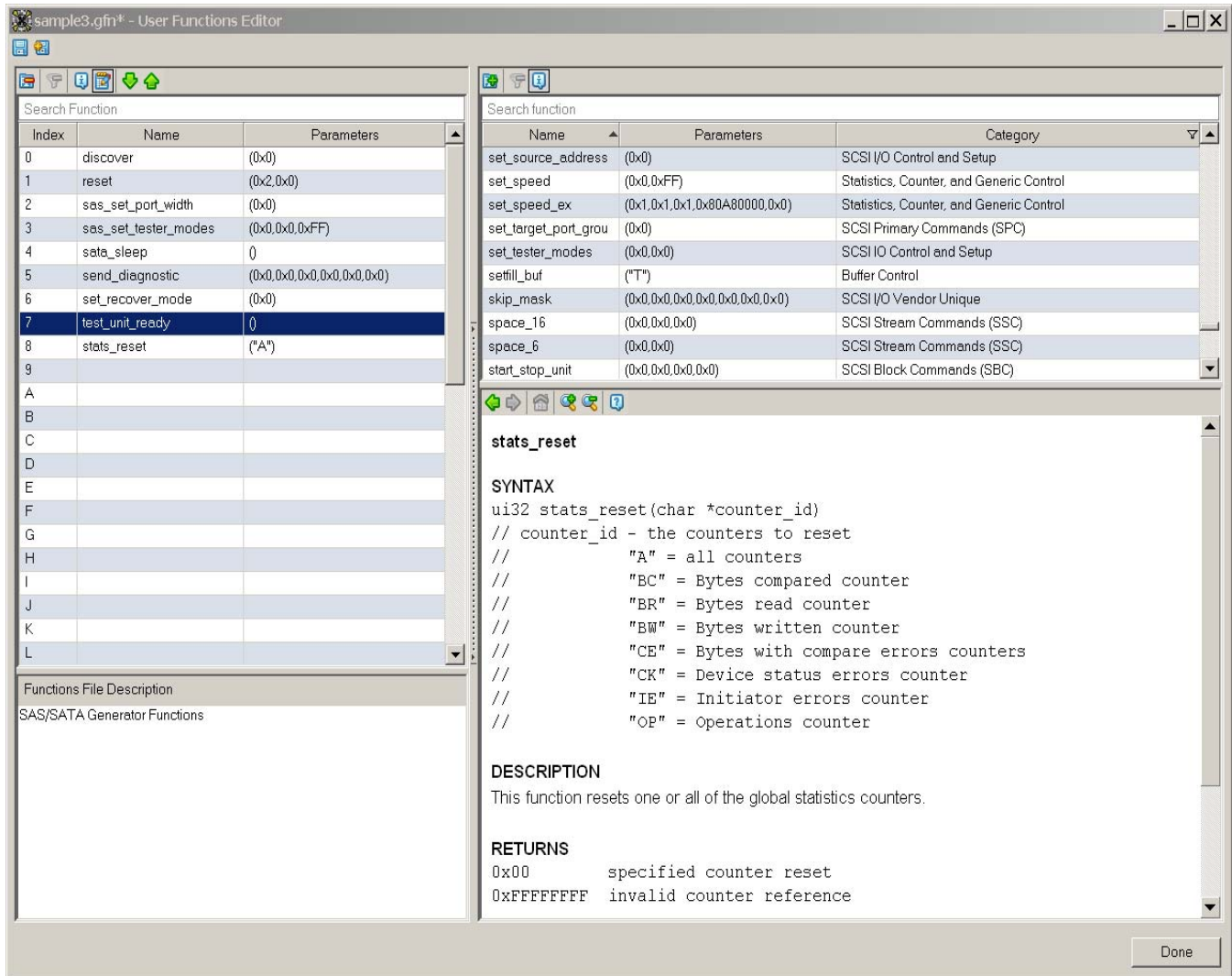


Note: To map a folder, click the **Map folder**  icon. Browse to the folder you want to map, type a folder name, then click **OK**. To unmap a folder, click the **Unmap**  icon, and the folder is removed.

3 Double-click the functions file you want to open.

The file is opened in the User Functions Editor window as shown in the figure below.

Figure 289: User Functions File Editor Window



This window is comprised of two panels. The left panel is the contents pane. It lists the functions present in the functions file.

The right pane is the function library. The functions in the library are listed in the contents pane by name; current parameters in hexadecimal; and the parameter types: b (byte), d (dword), q (quad), s (string parameter), w (word), and o (optional parameter), which currently cannot be edited or added; and the function category.

You can sort the functions in either pane in the following ways:

- Alphabetically in ascending or descending order by toggling the Function Name heading.
- By category with the categories alphabetically in ascending or descending order by toggling the Function Type heading.

- By parameter types with the parameter types listed by number of parameters from most to least or from least to most by toggling the Parameter heading.

Click the **Clear Filter**  icon to remove the filters you have applied by typing text into the search field and revert to viewing all functions in the functions library.

To view the details of the functions in the library or the contents pane, click the **Show/Hide Function Info**  button at the top of the pane. The details for each function correspond to an entry in the Generator API Help available from the Help menu in the Maestro main window. To display the contents of the information pane for the selected function in a popup window, click the **Display Help Contents in Popup Window**  button.

As you begin to click various functions in the function library or the contents pane, while you have the Show Function Info pane open, you create a history of the functions you've selected. You can navigate back and forth through the functions you've selected by using the **Go Back** and **Go Forward**  buttons at the top of the Function Information pane.

Adding Functions to a Functions File

To add a function from the function library to the functions file:

- 1 Click the index position in the Contents pane where you want to add a function.
- 2 Click the function in the function library that you want to add to the functions file.
- 3 Click the **Send Selected Function to Functions File**  button.

The function appears in the Contents pane at the selected index position.



Note: A convenient shortcut for adding functions to a file is to hold down the Ctrl button on your keyboard, then click and drag the function file to the Contents pane.

- 4 Click the Save or Save as button at the top of the window to save the functions file.
- 5 Click the Done button to close the window.

Moving Functions within a Functions File

To move a function up or down in within the functions file:

- 1 Click the function you want to move.
- 2 Click the Move Up/Move Down  buttons at the top of the Contents pane.

To remove a function you have added to your functions file:

- 1 Click the function you want to remove from the file.
- 2 Click the **Delete Selected User Function**  button at the top of the Contents pane.

You can also interchange one function with another, move a function for another index location, or copy a function to another index location by right-clicking the function and selecting the appropriate action.

Editing Function Parameters

To edit a function's parameters inline:

- 1 Right-click the function, and select Edit Parameters Inline.
- 2 Type directly in the parameters field to edit inline, or click the arrow at the end of the field to open a drop-down window.

This window is the same as the Popup Parameters Editor.

To edit a function's parameters using the Popup Parameters Editor:

- 1 Right-click the function, and select Popup Parameters Editor.
- 2 The Popup Parameters Editor appears.

Depending on the function, the following parameters may be available for editing:

Display - Displays the values in hexadecimal or decimal, depending on the field selected. Use the drop-down menu to change the display.

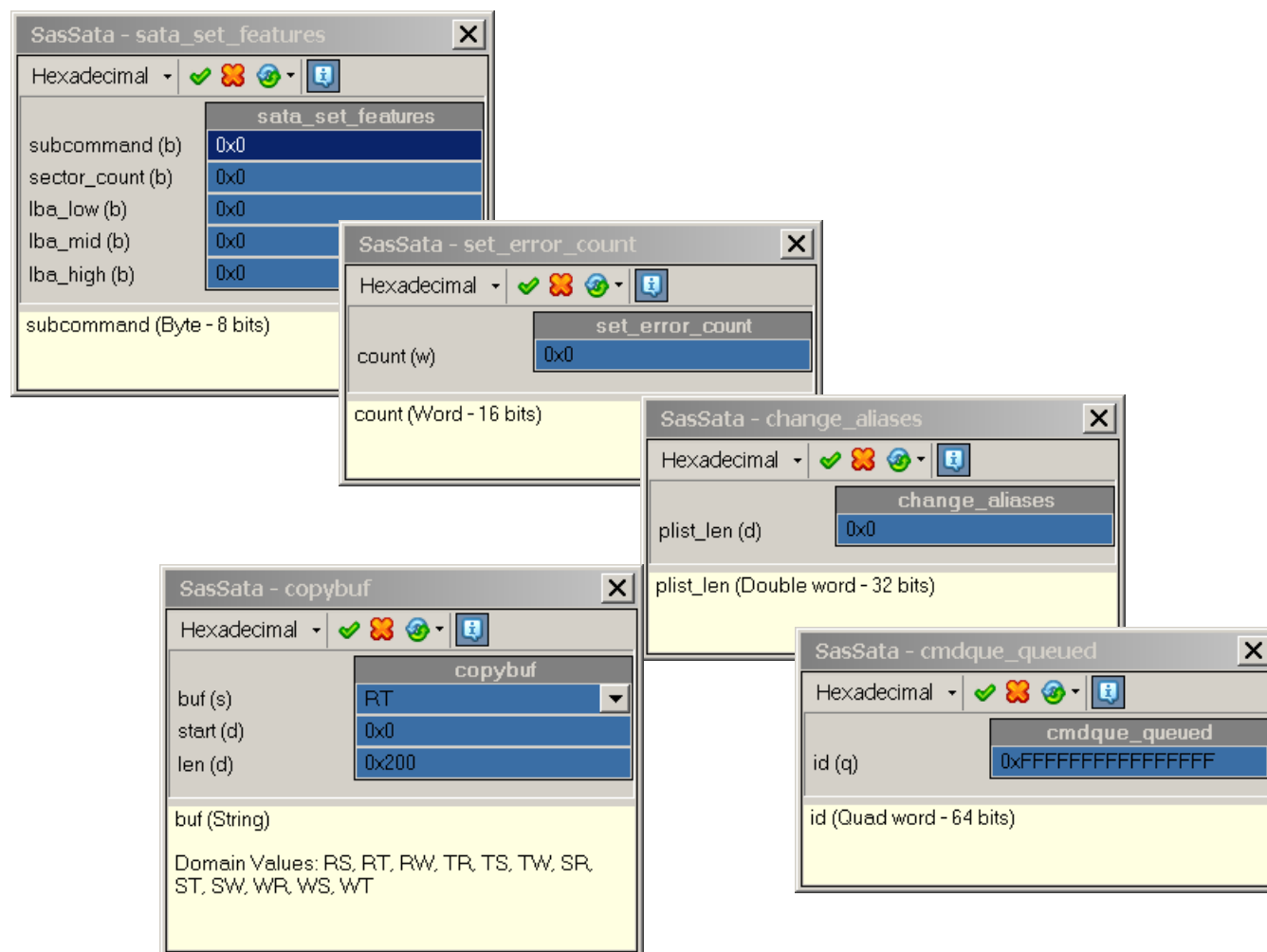
Byte - Byte- or bit-specific data. A byte is equal to 8 bits.

Word - Word or short integer data. A word is equal to 16 bits.

Double - Double word or long integer data. A double word is equal to 32 bits.

Quad - A quad is equal to 64 bits or 4 words.

String - Constant text or string data. Enter data without quotation marks.

Figure 290: Popup Parameters Editor Window

Functions File Description Editor

To add a description to your functions file:

- 1 Click the Show/Hide Functions File Descriptions Editor  button at the top of the contents pane.
- 2 Type a description in the Functions File Description pane.

Saving a Functions File

To save a functions file, click the **Save**  button.

To save the file as another name or to another location:

- 1 Click the **Save As**  button.

The **Save/Save As** dialog appears.



Note: If you want to use the standard Windows file dialogs instead of the dialogs customized for Generator, select **Use Standard Windows File Dialogs** from the **Options** menu in the Generator Device window menu bar.

- 2 Navigate to the location where you want to save the file.
- 3 Type a name for the file.
- 4 Click **Save**.
- 5 Click the **Done** button to close the window. If you make changes to the file and then click try to close the window, you will receive prompt asking you if you want to save the file before closing it.

Creating/Editing a Macro File

The macro editor enables you to easily create macros for automating a test sequence. Macros are ideal for non programmers because they are quick and easy to create and don't require a C compiler or knowledge of C programming. The macro language, however, has limitations. You can't write a macro test that takes pointers or addresses as function parameters.

A macro file is a .key file that can be created with any ASCII editor or by using the Macro File Editor. A macro file can contain up to 62 user-defined macro tests (0–9, A–Z, and a–z). Each macro test contains a sequence of functions to be called upon when invoking the macro test. In addition to functions, macro tests can also include variables, branches, jumps, loops, and macro functions.



Note: This section pertains to individual macro files, which can be created and edited independently of a device. You do not need to lock ports to perform these actions. The Macro Editor window described in this chapter is separate from the Generator Device window, which allows a user to manage and execute all configuration files for a selected device from a central window. Refer to [Chapter 19, “Using Generator with Ports”](#) for more information.

Creating a New Macro File

To create a new Xgig Generator Macro file:

- 1 Select the Macro Files tab in the Configuration window.
- 2 Click the **New Generator Macro File**  icon in the Configuration menu.

A new Macro Editor window appears.

Opening a Macro File

To open an Xgig Generator Macro file:

- 1 Select the Macro Files tab in the Configuration window.

The following three folders are shown:

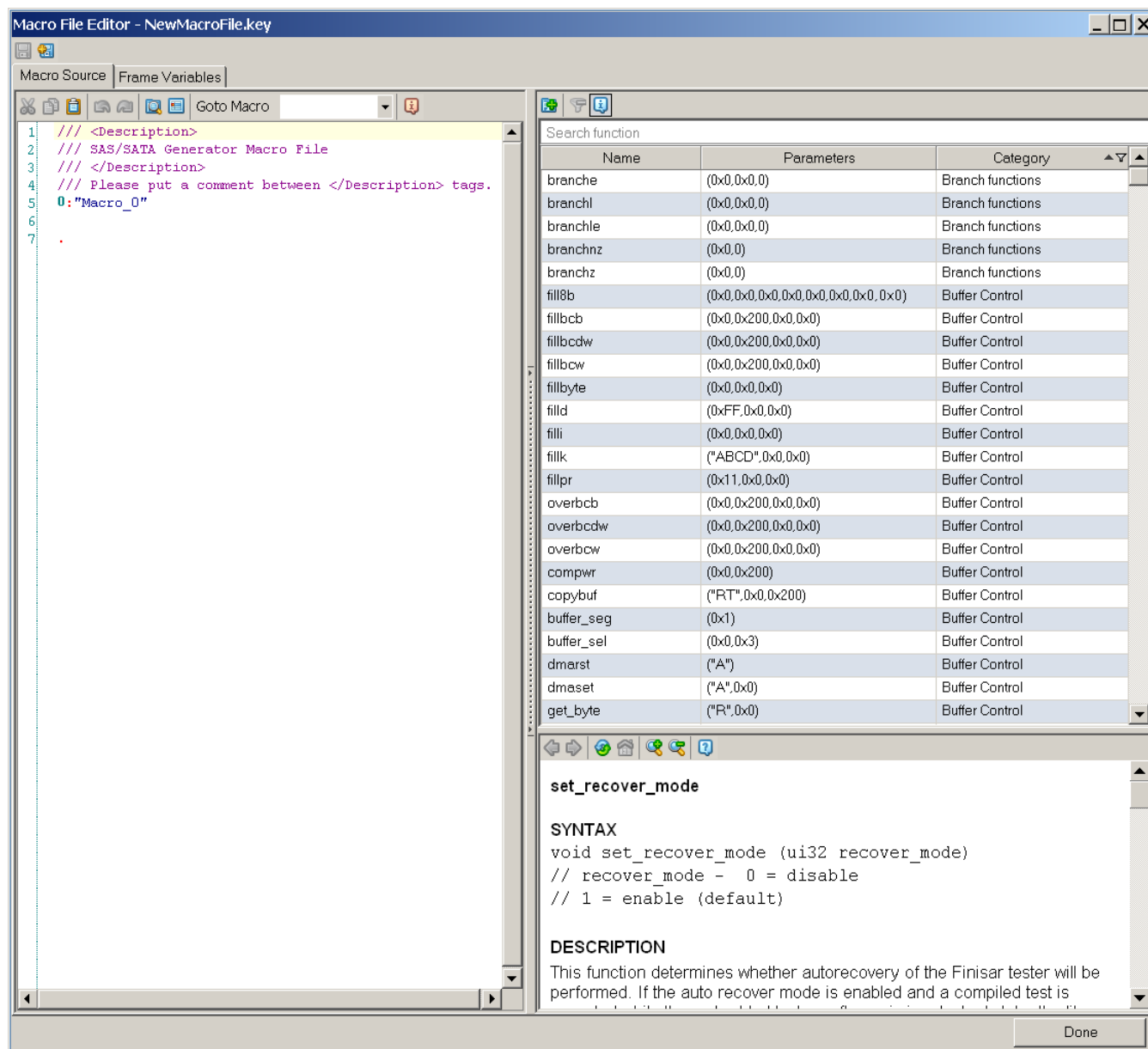
- Sample Macro Files - Macro files provided by JDSU
 - User Macro Files - Macro files created by the user and saved here
 - Most Recently Used - Macro files used recently
- 2 Double click one of the folders to open it, or click the Path  icon, and navigate to the folder that contains the macro file you want to open.



Note: To map a folder, click the **Map folder**  icon. Browse to the folder you want to map, type a folder name, then click **OK**. To unmap a folder, click the **Unmap**  icon, and the folder is removed.

- 3 Double-click the macro file you want open.

The file is opened in the Macro File Editor window as shown in the figure below.

Figure 291: Macro File Editor Window - Blank

Macro File Structure

When creating macro tests, you must adhere strictly to the correct syntax. Extraneous spaces are generally not allowed. Numeric variables are decimal values unless they are preceded by 0x, in which case, they are hexadecimal.

In a new macro file, the macro content begins with description tags. This is a placeholder for the description of your file. The description you type here will appear in the Details pane when the file is selected in the Macro Files tab in Generator.

The list of functions in a macro always starts with a number (default = 0) followed by a red colon and ends with a red period. When you open a new macro, the beginning of the macro is indicated by a "0:", and the end is indicated by a "." on a new line as shown in the figure above.

You can either choose to build your macro as one string of functions, or you can separate it into routines. Essentially, each routine is a complete macro, beginning and ending with the symbols listed above. Each routine should be numbered sequentially. As mentioned above, the default number for the beginning of a macro is zero. You can change this number to one or another number if you choose.

Each macro or routine needs a name. The name should be enclosed in quotation marks and be placed immediately after the red colon indicating the beginning of the macro (no space).

Begin populating your macro with functions. Place a semicolon after each function. Place comments after `//` on a new line. A single comment that extends over multiple lines in the macro file must have a comment indicator `//` at the beginning of each line. The figure below shows a completed macro containing three routines.

Figure 292: Sample Macro File Contents

```

1  /// <Description>
2  /// SAS Random Read, Write, and Compare Macro File
3  /// </Description>
4  1:"Random Write/Read Compare"
5  // Random Write/Read with Hardware Compare Stop on Error
6  debug(0);
7  // Get user input
8  user_input("Transfer Length:", "N");
9  INT0=get_user_int();
10 // Display user input
11 debug(2);
12 logp("Random Write/Read Compare");
13 logp("Transfer Length: %u", INT0);
14 // If transfer length = 0 then exit
15 jumpz(INT0, 3);
16 debug(0);
17 // Setup
18 set_len(INT0);
19 test_unit_ready();
20 dmarst("R");
21 xfermode("DMARW", 0, 3);
22 // Set program logic error to ignore errors so program logic error is not
23 // logged when the command queue mode is set to terminate
24 pea("CONT");
25 // Set command queue mode to terminate to complete outstanding commands
26 cmdque_mode(8);
27 pea("LOGC");
28 read_capacity_10(0,0,0);
29 LNG0=get_long("R",0);
30 LNG1=add(INT0,1);
31 LNG2=sub(LNG0,LNG1);
32 // Set command queue mode to single
33 cmdque_mode(0);
34 queue_full_wait(1);
35 xfermode("DMAHC", 0, 3);
36 jump(2);
37 .
38 2:"Routine 2"
39 // Random Write/Read loopne()
40 random_blk(0,LNG2);
41 dmarst("W");
42 write_10_blk();
43 read_10_blk();
44 loopne();
45 queue_full_wait(0);
46 logp("Random Write/Read Compare completed");
47 debug(2);
48 .
49 3:"Routine 3"
50 // Random Write/Read Exit
51 logp("Random Write/Read Compare did not complete, transfer length is 0 ");
52 .

```

Adding Functions to a Macro File

To add a function from the function library to a macro file:

- 1 Place the cursor at the location where you want to add the function.
- 2 Click the function in the function library that you want to add to the macro file.
- 3 Click the Add Function to Macro  button.

The function appears in the Contents pane at the selected position.



Note: A convenient shortcut for adding functions to a macro file is to hold down the **Ctrl** button on your keyboard, then click and drag the function file to the Contents pane.

- 4 Click the Save or Save as button at the top of the window to save the macro file.

- 5 Set the parameters as necessary for each function. The right-click menu provides editing options. These options are described in [Editing Function Parameters](#) above.
- 6 Refer to [Appendix F, “Macro Variables and Functions](#) and the [Adding Frame Variables to a Macro](#) section below for function and variable types and syntax as well as examples.
- 7 Indicate the end of the macro with a period on a line by itself.
- 8 Follow steps 1-3 to add the desired macros to the macro file, sequentially numbering the start of each one.
- 9 Click the Save or Save as button to save the macro file.
- 10 Click the Done button to close the window.

Adding Frame Variables to a Macro

The frame editor is an easy-to-use feature for customizing both legal and illegal SAS and SATA frames to send to a device. You can create and edit frame variables in the Macro File Editor window.

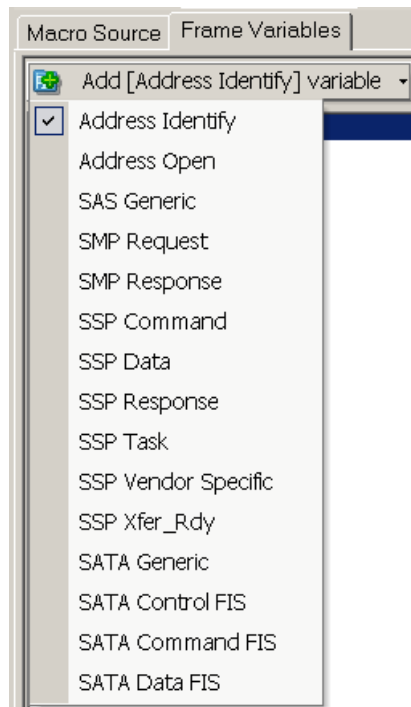
To access the Frame Editor, open the macro file that you want to add frame variables to, then select the Frame Variables tab.



Note: You do not need to have locked any ports to add frame variables to a macro file.

To add a frame to a macro:

- 1 Select a frame variable, i.e. FRM0, FRM1, etc.
- 2 Click the **Add [...] variable** drop-down menu, and select the frame type that you want to use.



Generator will fill in the fields in the right pane depending on which frame type you selected.

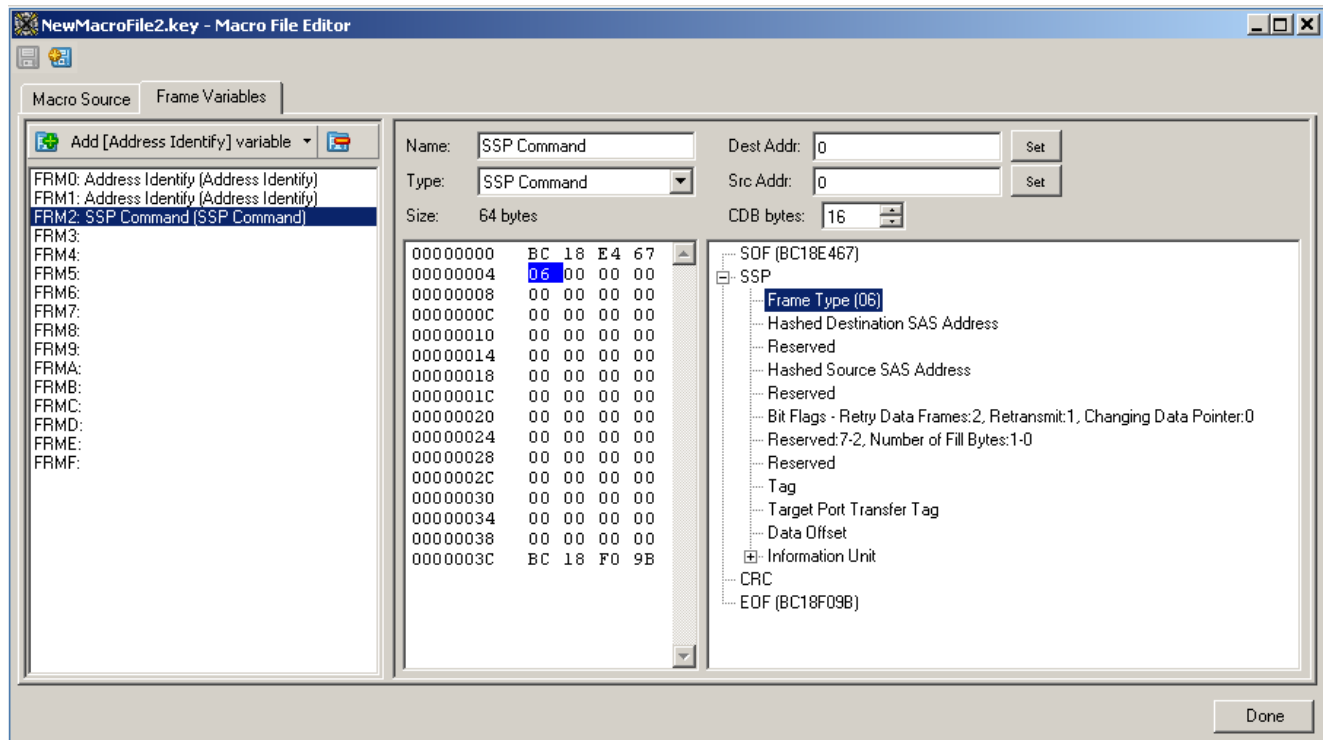
- 3 Type a name for the frame variable in the **Name** field.
- 4 Type a destination address for a SAS variable in the **Dest Addr** field. This address indicates where the frame is being sent. If the frame type is not Identify or Open Address, this is the value that will set the hashed address for the frame and will be used in the automatically generate open address frame that will precede the specified frame. Once you've set the address, click **Set**.
- 5 Type a destination address for a SAS variable in the **Src Addr** field. This address indicates where the frame is coming from. If the frame type is not Identify or Open Address, this is the value that will set the hashed address for the frame and will be used in the automatically generate open address frame that will precede the specified frame. Once you've set the address, click **Set**.



Note: SATA variables use a logical block address (LBA) setting instead of source and destination addresses.

- 6 To set the LBA for a SATA variable, type an LBA address for the variable in the **LBA** field. This address indicates where the frame is coming from. If the frame type is not Identify or Open Address, this is the value that will set the hashed address for the frame and will be used in the automatically generate open address frame that will precede the specified frame. Once you've set the address, click **Set**.

The contents of the frame is listed in the following two panes as shown below.



Frame Decode Pane

The left pane lists the contents of the specific frame. This information pane tracks with the frame hex data pane. When you click on a node in the frame, the frame hex data size pane shows the number of dwords/bytes that make up that node. The components of a frame are:

- SOF
- Header (Expand this to show nodes)
- CRC
- EOF

Just above this pane are two fields. The first indicates the total size of the frame. The second, which allows you to add or remove certain types of bytes, such as FIS or CDB bytes from a frame, is only available for certain frame variable types. To add bytes to or remove bytes from the frame, click the up/down arrows next to the field.

Frame Hex Data Pane

The right pane lists the bytes for a specific frame component. To edit the byte value:

- Select the byte value, then type another value.

You can add bytes to specific types of frames to increase the size of the frame. If the selected frame type allows the addition of bytes, a numeric field will be displayed above the **Frame Hex Data** pane.

Save the macro with your changes by clicking the **Save** icon in the upper, left corner of the macro window.

Save the macro with your changes by clicking the **Save** icon in the upper, left corner of the macro window.

Saving a Macro File

To save a macro file, click the **Save**  button.

To save the file as another name or to another location:

- 1 Click the **Save As**  button.

The **Save/Save As** dialog appears.



Note: If you want to use the standard Windows file dialogs instead of the dialogs customized for Generator, select **Use Standard Windows File Dialogs** from the **Options** menu in the Generator Device window menu bar.

- 2 Navigate to the location where you want to save the file.
- 3 Type a name for the file.
- 4 Click **Save**.

- 5 Click the **Done** button to close the window. If you make changes to the file and then try to close the window, you will receive prompt asking you if you want to save the file before closing it.

Editing Parameters for a Compiled Test

A compiled test file is a .exe file written using the JDSU SAS/SATA Generator API. Refer to the Generator API Help for instructions on creating compiled tests. The Generator GUI does not allow you to modify the .exe file. However, the GUI does allow you to add parameters to a compiled test, which, when saved, creates a .gen file of the same name.

Using this section, you can add and edit parameters for a compiled test file, essentially, creating .gen files.



Note: This section pertains to individual compiled test files, whose parameters can be created and edited independently of a device. You do not need to lock ports to perform these actions. The Compiled Test Editor window described in this chapter is separate from the Generator Device window, which allows a user to manage and execute all configuration files for a selected device from a central window. Refer to [Chapter 19, “Using Generator with Ports”](#) for more information.

Opening a Compiled Test File

To open an Xgig Generator Compiled Test file:

- 1 Select the Compiled Tests tab in the Configuration window.

The following three folders are shown:

- Sample Compiled Tests - Compiled test files provided by JDSU
- User Compiled Tests - Compiled test files created by the user and saved here
- Most Recently Used - Compiled test files used recently

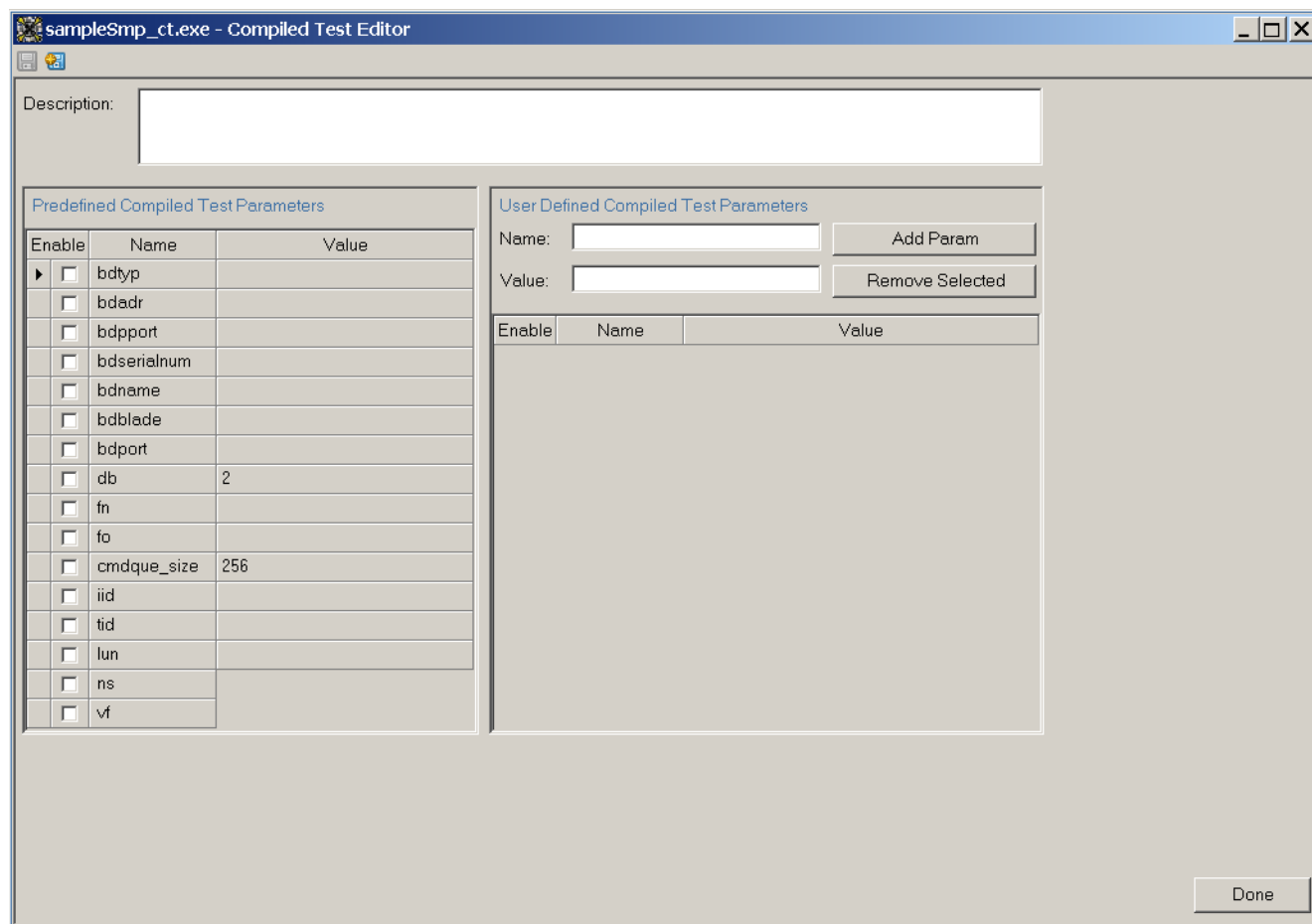
- 2 Double-click one of the folders to open it, or click the Path  icon, and navigate to the folder that contains the compiled test file you want to open.



Note: To map a folder, click the **Map folder**  icon. Browse to the folder you want to map, type a folder name, then click **OK**. To unmap a folder, click the **Unmap**  icon, and the folder is removed.

- 3 Double-click the compiled test file you want to open.

The file is opened in the Compiled Test Editor window as shown in the figure below.

Figure 293: Compiled Test Editor Window

Adding Parameters to a Compiled Test File

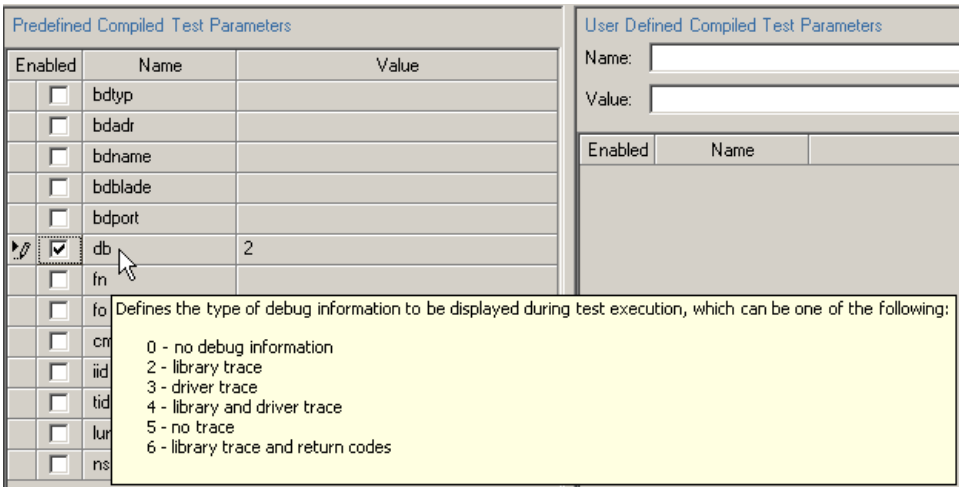
The **Description** field allows you to type a description for the compiled test. This description will appear in information panes when the file is selected.

The **Predefined Compiled Test Parameters** pane lists common command line parameters. These parameters are listed in the **Common Command Line Parameters** section of the API Help. Holding the mouse over one of these parameters brings up a tool tip window containing information about the parameter such as the definition, use, and defined or suggested values.

Example:

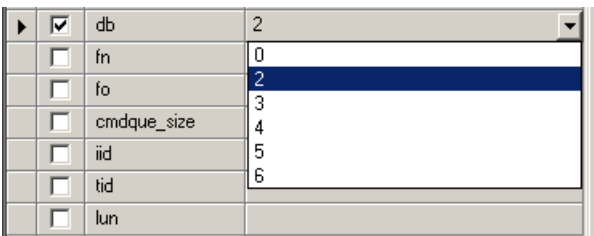
Holding the mouse over the bdtyp parameter displays the following tool tip.

Figure 294: Bdtyp Compiled Test Parameter Tool Tip



The tool tip describes the parameter and lists the possible values. Selecting this row and clicking the value drop-down menu, the possible values as shown in the figure below.

Figure 295: Bdtyp Compiled Test Parameter Values



Click the row with the desired parameter to make it editable. The  icon appears next to the enabled field to indicate that this is the parameter you are editing.

To select a value for this parameter, click the value you want from the drop-down list.



Note: Not all parameter values fields have a drop-down menu for the value. Some tool tips indicate a value range or define the type of information required and the format required.

To enable a parameter for the compiled test, select the **Enable** check box next to the parameter.

The **User Defined Compiled Test Parameters** pane allows you to create your own parameters. To create a parameter:

- 1 Type a name in the **Name** field.
- 2 Type a value in the **Value** field.
- 3 Click the **Add Parameter** button.

The parameter appears in the list below as shown in the following figure.

Figure 296: User Defined Parameter

Enabled	Name	Value
☐	test parameter	02x01
☐	test parameter 2	02x02

- Click the row with the desired parameter to make it editable. The icon appears next to the enabled field to indicate that this is the parameter you are editing.

To enable a parameter for the compiled test, select the **Enable** check box next to the parameter.

To delete the parameter, select the entire row, and click the **Remove Selected** button.

Saving a Compiled Test File

To save a compiled test file, click the **Save** button.

To save the file as another name or to another location:

- Click the **Save As** button.

The **Save/Save As** dialog appears.



Note: If you want to use the standard Windows file dialogs instead of the dialogs customized for Generator, select **Use Standard Windows File Dialogs** from the **Options** menu in the Generator Device window menu bar.

If you click the **Save as** selection to save a .gen file as a new file name, a copy of the existing compiled test .exe will be created with along with the new .gen file.

- Navigate to the location where you want to save the file.
- Type a name for the file.
- Click **Save**.
- Click the **Done** button to close the window. If you make changes to the file and then try to close the window, you will receive prompt asking you if you want to save the file before closing it.

Chapter 21

Trace to Script Feature

In this chapter:

- [The Trace to Script Feature](#)
- [TraceToScript_Tool Command-line Utility](#)
- [Additional Information](#)

The Trace to Script Feature

The trace to script feature generates test script/program automatically from a captured trace. The generated script will send traffic according to the trace; receive traffic and compare it with the expected version from the trace.

The trace to script feature involves three (3) processes:

- 1 Conversion: Converting the capture trace to a script
- 2 Compilation: Compiling the script into a compile test
- 3 Playback: Running the Compiled Test and comparing the test results

The TraceToScript_Tool command-line utility is used to for the conversion process.

The trace to script feature supports SAS/SATA trace, narrow port trace only. Each port pair in the trace will have individual script and they must be generated separately.

The trace to script feature relies on Xgig Analyzer tool to open and understand Xgig Analyzer trace format. Xgig Analyzer version 4.6 or higher is needed when converting a trace to script.

Hardware and Software Requirements

The table below summarizes the requirements for the Trace to Script Feature.

Table 13: Hardware and Software Requirements

Process	Software	Hardware
Conversion	Xgig Analyzer 4.6 or higher, Xgig Maestro or Xgig Generator SDK	None
Compilation	Xgig Generator SDK	None
Playback	Xgig Generator SDK	Xgig Generator ports

Dependency on Analyzer

Trace To Script feature relies on an Xgig Analyzer tool to open and understand Xgig Analyzer trace format.

Analyzer version 4.6 fixed a few critical issues related to trace file parsing. So Analyzer version 4.6 or higher is needed when converting trace to script.

This dependency only applies to the conversion process. Compilation and playback can happen without analyzer installation.

Conversion

Converting the capture trace to a script is done with the Trace to Script tool. To know more about the Trace to Script tool, refer to [“TraceToScript_Tool Command-line Utility”](#).

Conversion Output

The conversion outputs include one .cpp file and one .h file

The .h file contains constant definitions and trace data

The .cpp file contains the script, calling a series of functions to transmit and receive traffic

Fine Tuning After Conversion

After the script is generated from the trace, you may make necessary modifications to best suit the test setup and requirements.

In the generated script, various functions are called to transmit and receive traffic. Parameters of these functions can be modified to change the behavior of the script.

If a different link speed is desired/needed, the generated `set_speed_ex()` call can be modified.

If the generated script is a function, then it must be declared and included in the main test program, before it is invoked.

After the script is generated from the trace, you may make necessary modifications to best suit the test setup and requirements

In the generated script, various functions are called to transmit and receive traffic. Parameters of these functions can be modified to change the behavior of the script

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In the generated script, various functions are called to transmit and receive traffic. Parameters of these functions can be modified to change the behavior of the script.

If a different link speed is desired/needed, the generated `set_speed_ex()` call can be modified.

If the generated script is a function, then it must be declared the included in the main test program, before it is invoked.

In the generated header file, there is a global variable named `DefaultTimeout`, which specifies the time-out value for receiving frames in terms of ns.

If this value is set to zero, the script will use the actual timing in the trace as time-out values for each frame.

Actual timing refers to the timestamp differences between adjacent frames.

Compilation Process

The generated script needs compilation before it can be played back.

The script call a series of functions to transmit and receive traffic. These functions are defined and implemented in `script_playback.h` and `script_playback.cpp`, which are included in the Xgig Generator SDK. These two files must be compiled together with the generated script, along with other libraries in the SDK.

Depending on the script generation option, the script needs to be compiled differently:

For **function script**, it needs to be declared and included in the user defined main test program to compile

For **sample script**, it can replace the `sample.cpp` file in SDK sample project, then it will be compiled into the sample project

For sample SMP script, it can replace the `sampleSmp.cpp` file in SDK sampleSmp project, then it will be compiled into the sampleSmp project

Playback Process

Playing back the script is simply running the test program compiled from the script.

If all transmission are made successfully and all received traffic match the expected version, the playback will succeed. Otherwise, the playback may fail and terminate prematurely.

The playback process tries to reproduce the scenario captured in the trace. But not all environment settings are captured by the trace, these have to be managed manually, such as, state and content of the drive.

To best reproduce the scenario, the playback setup should be kept as identical to the original setting as possible.

Completeness of the trace used sometimes affects the playback result.

TraceToScript_Tool Command-line Utility

The TraceToScript_Tool command-line utility is a tool to convert Xgig Analyzer trace to C/C++ script. It makes use of the `trace_to_script()` API function. This tool can be found in the SAS Xgig Generator SDK folder or `C:\Program Files\JDSU\Xgig SAS Generator SDK`.

To use the TraceToScript_Tool command-line utility, run the `TraceToScript_Tool.exe` executable file with the required parameters.

Syntax:

```
C:\Program Files\JDSU\Xgig SAS Generator SDK\tracetoscript_tool
-input=tracePath -output=scriptPath -tx=txPort -rx=rxPort -start=startTime
-end=endTime -option=options
```

Example:

```
C:\Program Files\JDSU\Xgig SAS Generator SDK\tracetoscript_tool
-input=C:\test.tgp -output=C:\tracetoscript.cpp -tx=11 -rx=12 -start=0
-end=0 -option=01010002
```

The parameters are categorized and further discussed below.

File Path

tracePath: The full path of the trace file to be converted (*.tgp file).

scriptPath: The full path of the generated script files.

One .cpp file and one .h file will be generated with the name given

Any extension given will be ignored

For example:

sample.cpp -> sample.cpp + sample.h

sample.h -> sample.cpp + sample.h

sample -> sample.cpp + sample.h

sample.exe -> sample.cpp + sample.h

Ports

txPort: The blade and port number in the trace, to which the generated script is expecting to send. The lower nibble indicates the port number and the higher nibble indicates the blade index.

rxPort: The blade and port number in the trace, from which the generated script is expecting to receive. The API searches the specified ports in the trace, if the trace doesn't have any items for the ports specified, the generated script will not have any sending/receiving activities.

Duration

startTime: The time (in ns) in the trace where the trace will be converted from.

endTime: The time (in ns) in the trace where the trace will be converted to.

If both startTime and endTime are zero, the whole trace will be converted.

The API searches the timestamp in the trace, if the trace doesn't have any items between the duration specified, the generated script will not have any sending/receiving activities.

Options

options: A 4-byte value. Each byte controls different aspect of the trace to script feature, and can be ORed together. If any of the 4 bytes are not specified, the default value for that byte will take effect.

Table 14: Options and Corresponding Values

OPTION	VALUE
WAIT_FOR_EXACT_FRAME	0x00000000
WAIT_FOR_EOF	0x00000001

Table 14: Options and Corresponding Values

OPTION	VALUE
WAIT_FOR_FRAME_TYPE	0x00000002
WAIT_FOR_EXACT_FRAME_EXCEPT_DATA_PAYLOAD	0x00000003
DATA_FRAME_FULL	0x00000000
DATA_FRAME_HEADER_ONLY	0x00000100
FUNCTION_SCRIPT	0x00000000
SAMPLE_SCRIPT	0x00010000
SAMPLE_SMP_SCRIPT	0x00020000
EXACT_DEVICE_ADDRESS	0x00000000
AUTO_DEVICE_ADDRESS	0x01000000

The following sections describes the above mentioned options.

Receiving Frame Options

These options control the compare criterion between received frames and frames in the trace.

WAIT_FOR_EXACT_FRAME: The entire received frame will be compared (default value)

WAIT_FOR_EOF: Only the EOF of the received frame is compared, i.e. only makes sure received traffic is a frame

WAIT_FOR_FRAME_TYPE: Only the frame type of the received frame is compared

WAIT_FOR_EXACT_FRAME_EXCEPT_DATA_PAYLOAD: All parts, except for data payload in DATA frame, will be compared

Transmitting Frame Options

These options control transmitting frame contents for DATA frames

DATA_FRAME_FULL: When sending DATA frames, the full content from the trace are used (default value)

DATA_FRAME_HEADER_ONLY: When sending DATA frames, the DATA frame payload are not from the trace, but are all zeros

Script Generation Options

These options control the format of the generated script.

FUNCTION_SCRIPT: Generated script will be a in a function (default value)

SAMPLE_SCRIPT: Generated script will follow the format of sample.cpp file in Xgig Generator SDK sample project

SAMPLE_SMP_SCRIPT: Generated script will follow the format of sampleSmp.cpp file in Xgig Generator SDK sample SMP project

The table below summarizes the script generation options.

Table 15: Script Generation Options

Options	Output	Purpose	Initialization Content	Additional Setup	Automatic Link Establishment
FUNCTION_SCRIPT	A function	To be used with customer test project, where initialization are done in common modules	Tester discovery and port locking NOT included	Tester discovery and port locking, declaration/inclusion of the function, invocation of the function	No
SAMPLE_SCRIPT	Complete cpp source, in sample.cpp format	To be used with Xgig Generator SDK sample project	Tester discovery and port locking included	Change tester name/IP	Yes
SAMPLE_SMP_SCRIPT	Complete cpp source, in sampleSmp.cpp format	To be used with Xgig Generator SDK sampleSmp project	SMP discovery and port locking included	Change tester name/IP	Yes

Variable Options

These options control variable settings

EXACT_DEVICE_ADDRESS: The source and destination addresses used will follow the values in the trace (default value)

AUTO_DEVICE_ADDRESS: The source and destination addresses will be obtained in run time from the actual connected device

Additional Information

Maximum size of trace

There is no limit on the size of the trace to be converted. However, if the trace is large, the converted script will also be large and may fail to compile due to memory availability on the build machine

Two options affects the size of the generated script when there are data frames in the trace:

Receiving Frame Options – decides whether expected DATA frame payload need to be recorded in the generated script

Transmitting Frame Options – decides whether transmitting DATA frame payload need to be recorded in the generated script

When the actual data in the DATA frames has no significance to the test result, options can be configured to ignore transmitting and receiving DATA frame payload to reduce the size of the generated script

AUTO_DEVICE_ADDRESS option and SMP

AUTO_DEVICE_ADDRESS option will enable the generated script to automatic discover the connected device and set the source and destination addresses

This option helps to minimize the modifications needed when you use a different device from the one used in the original trace to playback

However, in SMP setup, even though the devices connected to the expander can be discovered automatically, there is no way to know the intended one to communicate to for each frame

Microprogramming mode and the implications

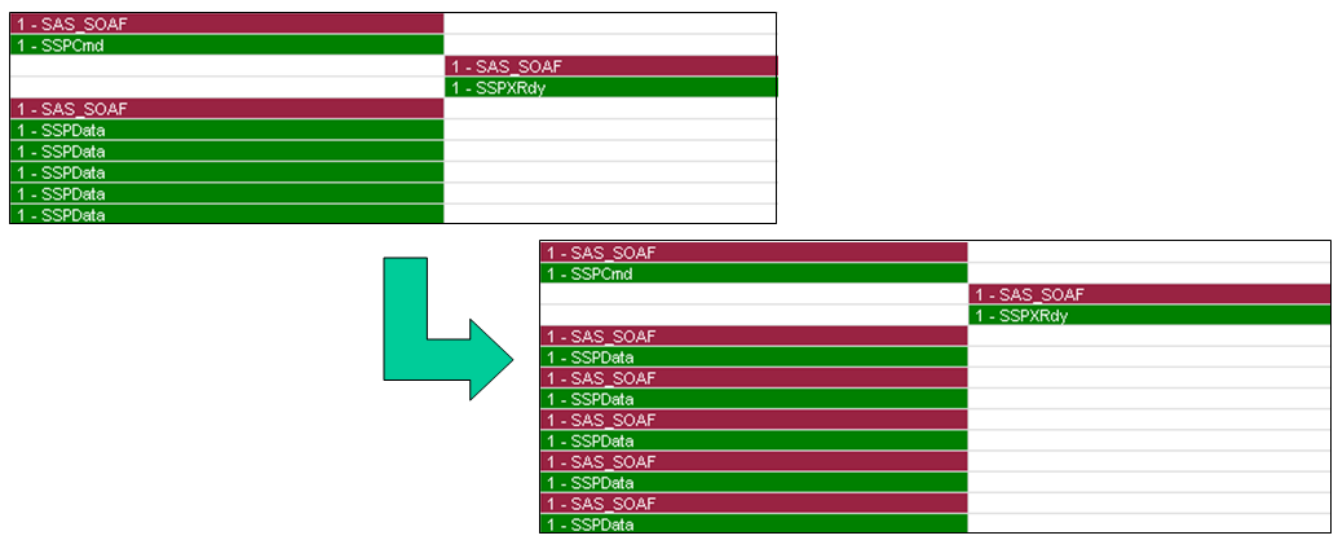
The generated script uses microprogramming mode to transmit and receive traffic which results to a slower operation.

Each frame is sent separately. SAS connection is closed after each frame is sent. Thus, a new connection is opened for every frame to sent.

Result: the original trace could have multiple frames sent within one connection, but the playback trace will have new connections for each of these frames. And thus, be slower.

Refer to the figure below.

Figure 297: Resulting trace from multiple frames sent within one connection



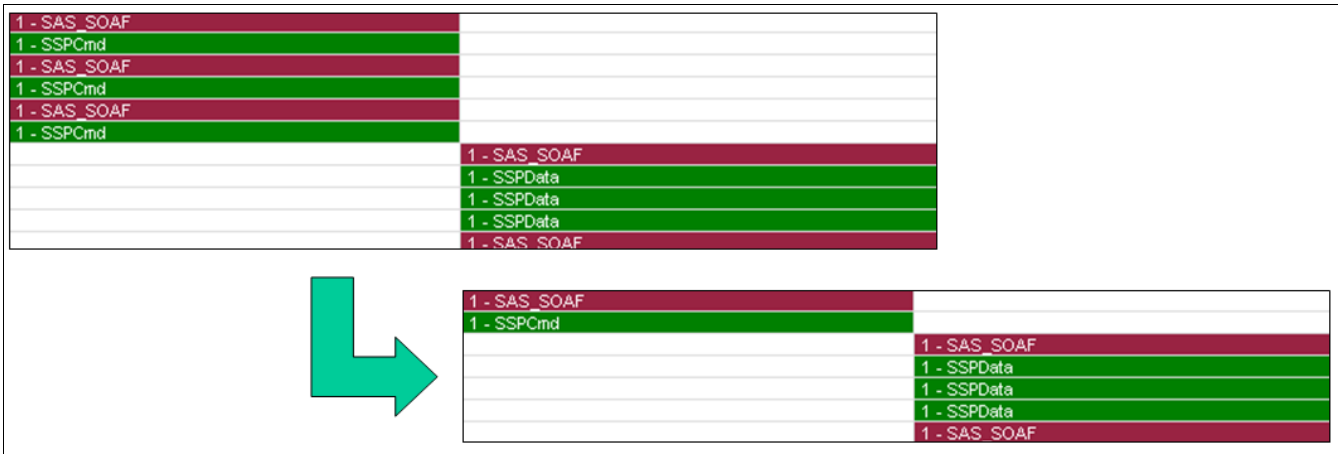
Auto/Stack mode

In auto/stack mode, or in SATA NCQ, the initiator can issue multiple commands to the target without waiting for the responses.

For the generated script, due to the frame-by-frame sending scheme and client software control mechanic, command sending speed is not fast enough compared to the target device. The script controlled initiator will hardly be fast enough to send out multiple commands before responses come back from the target device. Thus, to achieve command stacking is difficult in playback

Refer to the figure below:

Figure 298: Auto/Stack mode trace comparison



Hardware receiving buffer limit and competition for channel

Xgig Generator has hardware receiving buffer approximately equal to 3 SAS frames. Once the buffer is full, software must receive the data and clear the buffer before more data can be received by the generator.

When the receiving buffer is full, generator will credit block all incoming transmit requests, and the target will keep trying to send. At the same time, if generator is also trying to transmit, they will compete for the channel. In most cases, the target will win – result: Generator is unable to transmit without receiving first.

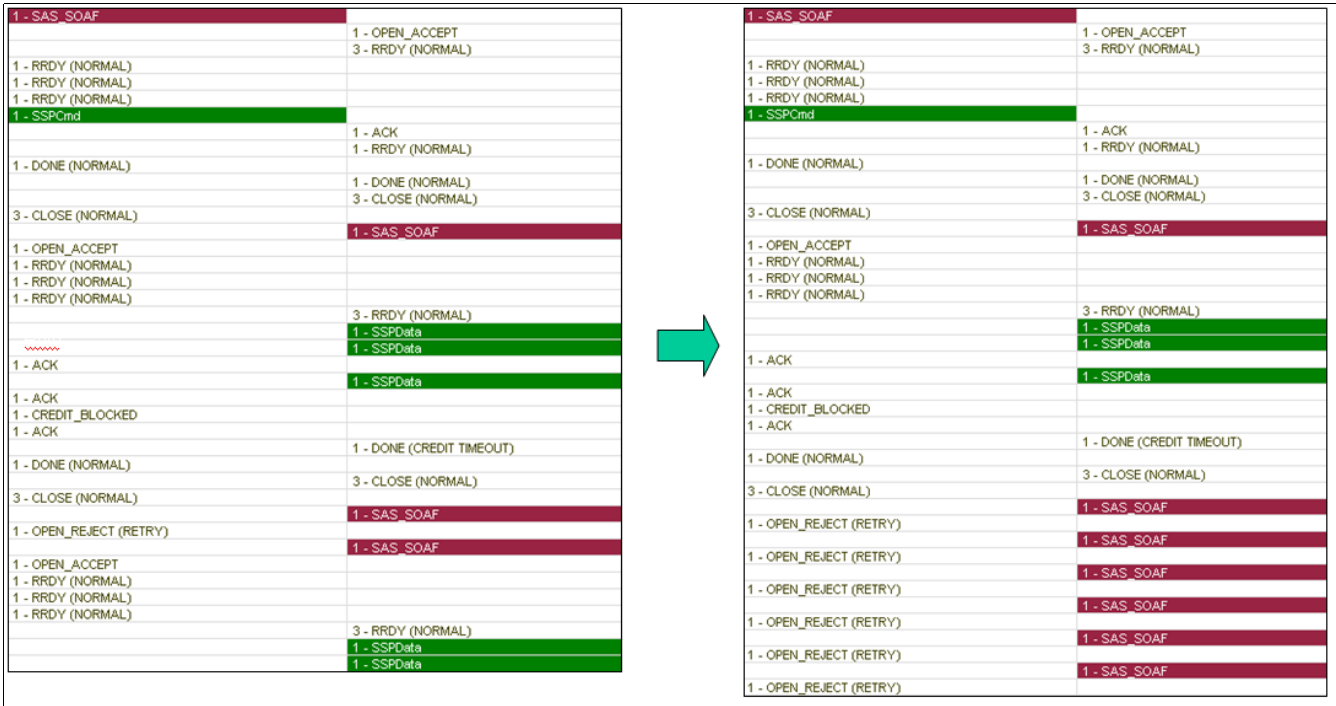
In the generated script, sending and receiving frames follows the original trace. The script has no knowledge when the receiving buffer is full. So to overcome the above mentioned issue, the script will try to receive frames to clear the receiving buffer if it failed to send out frames, and re-try the transmission after receiving.

This will result to the following:

- Contributes to the command stacking issue
- Delays between receiving while trying to transmit frames

Refer to the figure below:

Figure 299: Hardware receiving buffer limit and competition for channel



PART FIVE: Using Xgig Target Emulator

Chapter 22

Introducing Xgig Target Emulator

In this chapter:

- [Xgig Target Emulator Overview](#)
- [Xgig Target Emulator Features](#)
- [SAS/SATA Target Application Programming Interface \(API\)](#)
- [LEDs on the Xgig Blade](#)

Xgig Target Emulator Overview

The Xgig Target Emulator offers advanced testing and troubleshooting capabilities to storage equipment designers, testers, and manufacturers. Extending the capabilities of the Xgig platform of design and test tools, the Target Emulator connects to users' systems and supports SAS/SATA protocol-level testing at 1.5, 3.0, and 6.0 Gb/s. With full configurability, flexible responsiveness, and automated operation, the Target Emulator is the ideal tool for accelerating the bring-up, regression, and manufacturing testing of SAS/SATA equipment.

Xgig Target Emulator, used with the Xgig Analyzer software, provides a complete test solution including the ability to analyze the data generated and to capture and display SAS/SATA data in a customized trace view.

The Target Emulator builds upon the proven Xgig platform, a flexible chassis-and-blade hardware architecture supporting multiple protocols. Utilizing this architecture and JDSU's Xgig 6 Gb/s multi-function 4-link (wide) blades, 2-link (narrow) blades with dual mini-SAS/I-Pass connectors(1), and LXP all-in-one, the Target Emulator allows bidirectional SAS/SATA target emulation up to level-4 functionality (such as SCSI commands) across up to 4 ports per blade or 8 ports per chassis.

Xgig Target Emulator Features

Xgig Target Emulator is part of the Xgig family of instruments. Target Emulator has the following features:

- Part of the best-of-breed Xgig platform of design and test tools
- Supports bidirectional SAS/SATA target emulation up to level-4 functionality
- Operates at 1.5, 3.0, and 6.0 Gb/s
- Support for up to 8 simultaneous users leverages test tool investment across an entire development team
- Blade supports 4 SAS/SATA Target Emulators per blade and up to 8 Target Emulators per chassis
- Responds to SATA Gen-3 commands as defined in the Serial ATA Revision 3.0 specification, in addition to all of its current SAS-2 commands and operates within SATA Revision 3.0 (Gold Revision) protocol timeout specifications.
- Provides the ability to inject SATA errors such as the following:
 - CRC manipulations: allow CRC error insertion
 - Line Errors, such as, disparity errors: create disparity errors
 - FIS Manipulations: customize FIS content of the specified FIS types
 - Misplaced Primitives: send SATA primitives upon receipt and/or transmit of specified FIS types
 - EOF error: remove from frame of the specified FIS types
 - Delay injection: set delay in transmitting specified FIS types
 - Delay Drive Readiness: set the time delay the Target Emulator takes to respond after link rest
- Provides the ability to place the DUT into BIST mode (as specified in the SATA Rev.3.0 Gold specification) and specify the various options for this mode. However, the Target Emulator will not support BIST mode.
- Runs on Windows 2003 (Server: Service Pack 2), XP (Professional: Service Pack 3), Vista (Business and Ultimate versions), and Windows Server 2008 (Standard and Enterprise versions with Service Pack 2).

SAS/SATA Target Application Programming Interface (API)

The Target Emulator software allows the user to write and compile tests using C/C++. This functionality requires that the user be familiar with the API function library and the process of writing a compiled test. To this end, the Maestro software includes a Target Emulator API Help system, available in the Help menu of the Maestro main window. Using this API Help system along with this manual will help you understand and control the functionality of the Target Emulator software.

LEDs on the Xgig Blade

The LEDs on the blade front panel provide status about each port. [Table 16](#) describes the LEDs you see on the blade.

Table 16: Xgig Blade LEDs

Label on Blade	Blade
In Use	- Green when port locked by client application - Yellow: N/A - Unlit otherwise
Rate	- Green when link rate is 1.5Gbps or 3Gbps - Yellow when link rate is 6.0Gbps - Black: No Signal or Loss of Signal (LOS)
Link (3G) Signal (6G)	- Green-SAS/SATA: Link established - Yellow-SAS/SATA: In OOB) - Black: No Signal or Loss of Signal (LOS)
Frame	- Green: Frames being transmitted/received - Yellow: N/A - Black: No frames
Error	- Green: N/A - Yellow: Phy error occurred - Black: No error
Trigger	Not used (Black)

Chapter 23

Using the Target Emulator Tab

In this chapter:

- Using the Configuration Manager Function Tabs in Target Emulator
- Using the Parameters Status Table in Target Emulator
- Using the Ports Manager in Target Emulator
- Using Log Manager in Target Emulator
- Customizing the Appearance of the Maestro/Target Emulator Main Window

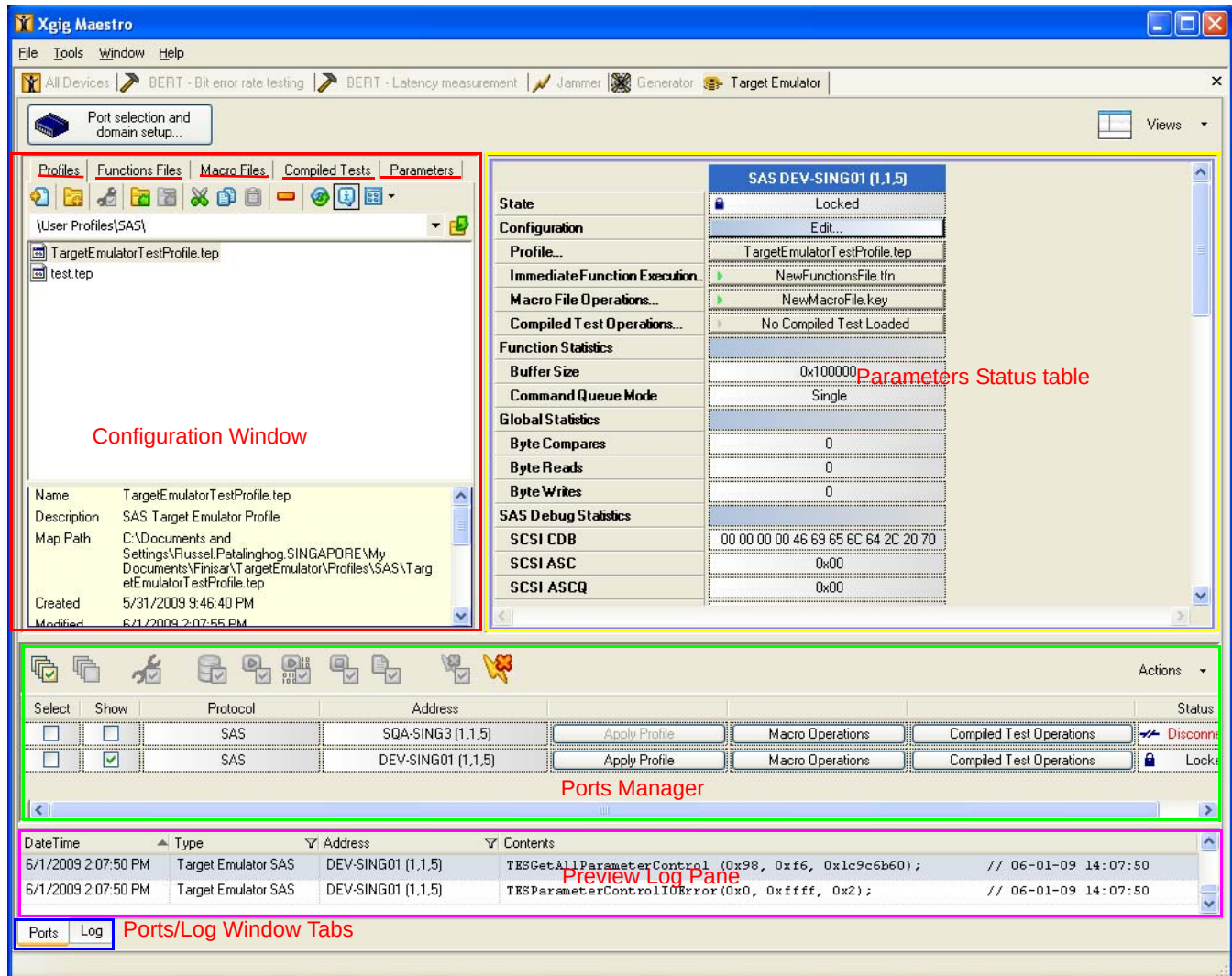
This chapter provides an overview of the Target Emulator tab, on the Xgig Maestro main window, and its functions.



Note: This section refers to specific functions described in the Generator API Help System, which can be accessed by selecting Generator API Help from the main Help drop-down menu in the Maestro main window.

You should have launched Xgig Maestro as described in [“Launching Xgig Maestro” on page 12](#) and locked at least one device as described in [“Multi-Function Ports and Symbols” on page 21](#). The Xgig Maestro window is displayed with the Target Emulator tab on the right as shown in the figure below. This tab is where you operate the Target Emulators you have locked.

The main menu, shown below, is divided into panes similar to the Windows Explorer structure for ease of navigation and viewing. Right-click menus enable you to perform the desired task within a specific pane

Figure 300: Xgig Target Emulator Tab on Xgig Maestro Window

The Target Emulator tab of the Maestro Window contains the following components as shown above:

Configuration Manager, **outlined in red**, contains the function tabs and the parameters tab. These tabs are described in “Using the Configuration Manager Function Tabs in Target Emulator” on page 415 and “Displaying and Hiding Parameters in Target Emulator” on page 458.

The Parameters Status table, **outlined in yellow**, provides status information for the port(s) you have locked. This table is described in “Using the Parameters Status Table in Target Emulator” on page 416.

The Ports Manager, **outlined in green**, allows you to control settings and operations for the port(s) you have locked. This pane is described in “Using the Ports Manager in Target Emulator” on page 448.

The Preview Log pane, **outlined in magenta**, is a quick reference for the Log Manager. This pane is described in “Using Log Manager in Target Emulator” on page 451.

The Ports and Log window tabs, [outlined in blue](#), switch between the Ports and Log windows.

Using the Configuration Manager Function Tabs in Target Emulator

There are five function tabs in the Configuration Manager, **Profiles**, **Function Files**, **Macro File**, **Compiled Tests** and **Parameters**. The files displayed in the manager are specific to the function tab displayed. The Configuration Manager provides a list of files organized in three types of folders:

- **Sample Files** includes configurations that are provided with the application.
- **User Configurations** is the default location where files you create are saved.
- **Most Recently Used** allows you easy access to those configuration files most recently used.

The Configuration Manager also includes a list of all the drives on your system allowing you to locate any configuration files on your system quickly.

The tool bar in the Configuration Manager contains the following icons and functionality:

New File  allows you to create a new profile file from the **Profiles File** tab, to create a new functions file from the **Functions File** tab, or to create a new macro file from the **Macro Files** tab. This icon is not present on the Compile Test tab because you cannot create compiled test files from the GUI.

New Folder  allows you to create a new folder within the **Sample Profiles** folder or the **User Profiles** folders.

Load  allows you to load the selected profiles, functions, macro, or compiled test file into a port. This icon is only active when a port has been locked and is selected in the Port Manager. You can also drag-and-drop a file from the Configuration Manager into a port.

Map  allows you to select a folder that you want to be listed in the Configuration Manager for the selected function tab.

Unmap  allows you to unmap a folder that has been mapped.

Cut  allows you to cut a file from its current location. This is not the same as deleting a file.

Copy  allows you to copy a file.

Paste  allows you to paste a file you have cut or copied.

Delete  allows you to delete a file you have selected.

Refresh  allows you to refresh the file list.

Path  allows you to go up one level in the folder tree. This field next to this icon displays the current folder name.

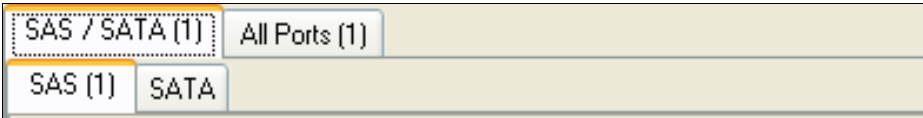
Show/Hide  allows you to show or hide the details for the selected file. These details appear in the lower section of the Configuration Manager pane.

View  allows you to view the files in the Configuration Manager as a list including only the file name or to view the details of the files in the list.

Using the Parameters Status Table in Target Emulator

The port(s) you have locked are displayed in the Target Emulator Parameters Status table. The ports are arranged into tabs based on protocol type (refer to [Figure 301](#)).

Figure 301: Port Tabs



Click on the **SAS/SATA** tab to display the SAS and SATA port tabs. The number beside the protocol name indicates the number of ports using that protocol.

Click the **All Ports** tab to display the all the locked ports under one tab.

Under the tabs, each port is displayed as a column. All the parameters of the port are displayed as rows.

At the top of each column is the protocol, the chassis name, and the chassis number, the slot number and port number(s) in parenthesis.

Figure 302: Target Emulator Parameters Status table

SAS SQA-SING3(1.1.7)	
State	Locked
Configuration	Edit...
Profile...	TargetEmulatorTestProfile.tep
Immediate Function Execution...	NewFunctionsFile.tfn
Macro File Operations...	NewMacroFile.key
Compiled Test Operations...	No Compiled Test Loaded
Function Statistics	
Buffer Size	0x100000
Command Queue Mode	Single
Global Statistics	
Byte Compares	0
Byte Reads	0
Byte Writes	0
SAS Debug Statistics	
SCSI CDB	00 00 00 00 00 00 00 00 00 00
SCSI ASC	0x00
SCSI ASCQ	0x00
SCSI Sense Key	No Sense
SCSI Status	0x00
SCSI Task Attribute	0
LUN	0x0000000000000000
Response Code	0x00
Payload Size	1048
Miscellaneous Debug Statistics	
Last API Return Code	
Last Executed API Function	
Debug Level	2 (lib trace)
Destination Address	0x0000000000000000
Source Address	0x500A0BD0070828C4
IO Timeout	10

The first column on the tab is the legend for each row in the device columns and contains the following categories:

- State
- Configuration
- Function Statistics
- Global Statistics
- SAS Debug Statistics
- Miscellaneous Debug Statistics

The following categories are only available for SAS:

- Target Characteristics
- Delay Injections
- Frame Field Replacements

- CRC Error Injections
- EOF Error Injections
- Disparity Error Injections
- Data Miscompare Injections
- Data Offset/Length Error Injections
- Status and Sense Injections
- Break Sequence Error Injections
- Hard Reset Sequence Error
- Reset Sequence Error Injections

The following categories are only available for SATA:

- Identify Device Data Configuration
- FIS Delay Injections
- FIS Error Injections
- Custom FIS Injections
- FIS Primitive Injections

Parameters Category Descriptions for Target Emulator

State

The current state of the port, such as stopped, stopping, running, disconnected, connecting, and others.

Configuration...

Opens the edit window for macros, functions files, and compiled tests. From this edit window you can create or edit macro files and functions files, and you can define parameters for an existing compiled test file.

Profile

Indicates the currently loaded Profile. If no functions file is loaded, the field will read, “No Profile Loaded”. Clicking this field, with or without a functions file loaded, displays the function library opens the **Target Emulator Device** window.

Immediate Function Execution

Indicates the currently loaded functions file. If no functions file is loaded, the field will read, “No Functions File Loaded”. Clicking this field, with or without a functions file loaded, displays the function library and allows you to select a single function and execute it using the **Start**  button. See [“Executing a Function on a Generator Device” on page 358](#) for more information on this functionality.

Macro File Operations

Indicates the currently loaded macro file. Clicking the file name allows you to either execute the macro or edit the macro file. If no macro file is loaded, the field will read, “No Macro File Loaded”.

Compiled Test Operations

Indicates the currently loaded compiled test file. Clicking the file name allows you to either execute the compiled test or edit the compiled test by defining parameters for the test. If no compiled test file is loaded, the field will read, “No Compiled Test Loaded”.



Note: To remove the configuration for a port, right-click the device column in the Parameters Status table, and select **Reset Configuration**. This effectively “unloads” the functions, macro, and compiles test files you have loaded into the port.

Function Statistics

This category provides information about the settings that define how functions are executed.

Buffer Size

The size of the separate transmit and receive buffers. When a data transfer reaches the end of a buffer, it wraps to the beginning and overwrites previous data (receive) or resends previous data (transmits). The buffer size is user configurable and can be changed by using the `resize_buf()` function.

Command Queue Mode

The current command queue mode for SCSI I/O transfers, i.e. Single, Auto, or Stack. Refer to the `cmdqueue_mode()` function. The default setting is Single.

Global Statistics

This category provides information about whether bytes are being processed within specified limits.

Byte Compares

Total number of bytes compared since being reset by the `stats_reset()` function or since the start of the current test session.

Byte Reads

The total number of bytes read since being reset by the `stats_reset()` function or since the beginning of the current tester session.

Byte Writes

The total number of bytes written since being reset by the `stats_reset()` function or since the beginning of the current Generator testing session.

SAS Debug Statistics

This category provides information to help determine the cause of errors occurring during Generator testing.

SCSI CDB

These 16 bytes are the current values contained in the most recently sent SCSI command.

SCSI ASC

Sense key information (according to the SCSI-3 specification) returned in the latest response frame.

SCSI ASCQ

Sense code qual information (according to the SCSI-3 specification) returned in the latest response frame.

SCSI Sense Key

Sense key information (according to the SCSI-3 specification) returned in the latest response frame.

SCSI Status

The value of the SCSI status byte returned in the latest response frame. When a command is issued to a target, the status value is set to 0xFF, which is changed when the command is complete.

SCSI Task Attribute

The SCSI queuing mode or task attribute used in SCSI command frames. This can be changed with the `queue_xx()` functions. Refer to the `queue_aca`, `queue_head`, `queue_ordered`, `queue_simple`, and `queue_untagged` functions for more information.

LUN

A decimal value indicating the current logical unit number (LUN) to be used in command frames during SCSI operations.

Response Code

Response information code from the response frame of the most recently completed command.

Payload Size

The maximum payload (or frame) size for SAS.

Miscellaneous Debug Statistics

Last API Return Code

Indicator to determine the success of a function. Refer to the Generator API Help system for a list of possible returns for a specific function and the definitions for each return.

Last Executed API Function

Indicates the most recent API function that was executed. This includes single functions as well as functions in functions files and macro files.

Debug Level

Indicates the current debug level. The default value is 2- Display trace of library calls.

To change the debug level:

- 1 Select **Debug level** from the context menu.
- 2 Select the debug level you want: 0 (no tracing), 2 (lib trace), 3 (driver trace), 4 (lib and driver trace), or 6 (lib trace and return codes).

Destination Address

A hexadecimal value indicating the current destination/target ID to be used during SAS operations.

Source Address

A hexadecimal value indicating the current source/initiator ID to be used during SAS operations.

IO Timeout

The length of time to be completed by an operation before an I/O timeout is generated. The timeout value (ioto) is displayed in seconds. At the beginning of an operation, such as the start of a SCSI command, an internal timer starts. While waiting for the operation to progress, the code checks the timer and returns to operator control after ioto seconds have elapsed. For long operations, (such as a FORMAT command), set the timeout value to an appropriately high value.

Phys

The number of phys available on or supported by the tester in use.

Ports

The number of logical ports currently configured on the tester in use. This number can never be more than the number of phys. Currently, Generator can only set port width to 1. Refer to the `sas_set_port_width()` function for more information.

Receive Index

The current index (or offset) in the receive buffer.

Speed

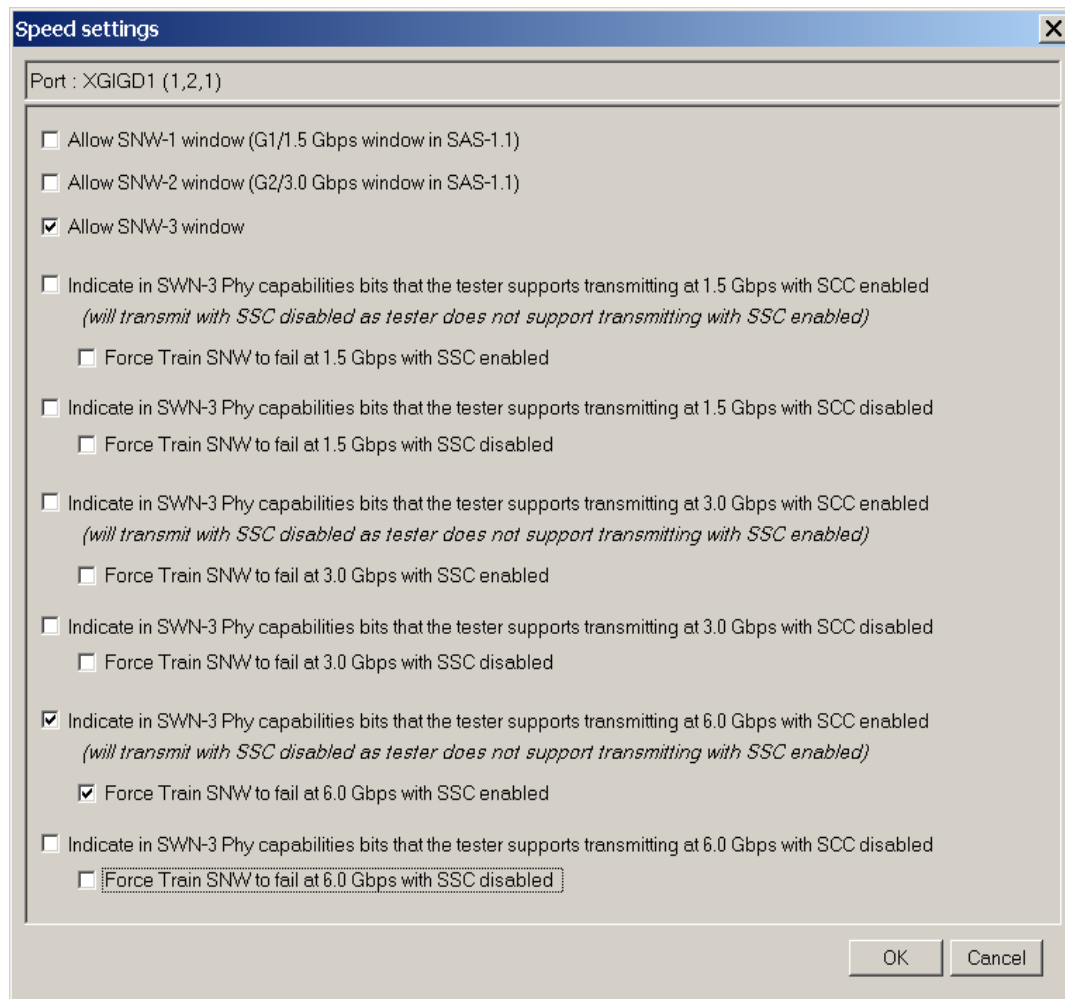
The data transfer rate of the Target Emulator, (1.5G or 3G SATA or 1.5G, 3G, or 6G SAS). Refer to the `set_speed()` and `set_speed_ex()` functions for more information.

To change the speed settings:

- 1 Select **Edit speed settings** from the context menu.

The Speed Settings window appears (Only in SAS Mode).

Figure 303: Speed Settings Window



- 2 Check the SAS-1.1 or SATA 1.5Gig link rate to force the link to negotiate to 1.5Gbps.
- 3 Check the SAS-1.1 or SATA 3.0Gig link rate to force the link to negotiate to 3.0Gbps.
- 4 Check both of the two check boxes above to allow the link to auto-negotiate to the highest available speed.

- 5 Select Allow SNW-3 Window (SAS-2) if you have a SAS device that you want to run at 6.0Gbps. This type of speed negotiation allows for adaptation at both 1.5G and 3G link rates..



Note: If you select the “Support SAS-2 speed negotiation setting”, then the Phy capabilities and Fail train sections become active and allow you to change the settings. Otherwise, these sections are inactive as these settings are not applicable.

The phy capabilities are transmitted by the tester during the SAS-2 SNW3 window at the selected speed. Refer to the `get_speed_ex` and `set_speed_ex` functions in the Generator API Help.

This setting defines what you want to convey to a device in the SNW-3 Phy capabilities bits. You can choose to indicate that the tester supports transmitting at a given speed with SSC enabled or with SSC disabled. We do not currently support transmitting with SSC enabled. Therefore, the tester will transmit with SSC disabled even if you set the tester to indicate otherwise.

- 6 If applicable, set the desired Phy capabilities.

The Fail train is a bitmask that forces the corresponding Train speed negotiation window(s) (SNW) to fail at the selected speed. Refer the to `get_speed_ex`, `sas_set_timers`, `set_speed_ex` functions in the Generator API Help.

This setting forces the train SNW to fail at a given speed with SSC enabled or with SSC disabled. setting indicates fail train SNW can be set with SSC disabled. We do not currently support forcing the train SNW to fail with SSC enabled. Therefore, the tester will force the train SNW to fail with SSC disabled even if the settings indicate otherwise.

- 7 If applicable, set the desired Fail train SNW settings.

- 8 Click **OK** to close the dialog and apply the settings.

Transfer Mode

The type of data transfer for I/O functions. Refer to the `hgen_mode()` function for more information.

Transmit Index

The current index (or offset) in the transmit buffer.

FPGA Version

Represents a bit file revision code for the Xgig blade’s FPGA.

Embedded OS Version

Indicates the version of JDSU software running on the Xgig chassis.

Link Type

Current link type: Unknown, SAS link, or SATA link. Refer to the `get_g_info` function for more information about `link_type`.

Link Type Config

Current link type configuration: SAS only, SATA only, or SAS and SATA. Refer to the `get_g_info` function for more information about `link_type_cfg`.

Parameters in SAS Mode**Target Characteristics**

This category provides information about the emulated target.

Vendor ID

Indicates the Vendor ID of the emulated target drive set in the Target Emulator profile.

Product ID

Indicates the Product ID of the emulated target drive set in the Target Emulator profile.

Product Revision

Indicates the Product Revision number of the emulated target drive set in the Target Emulator profile.

Device Serial

Indicates the device serial number of the emulated target drive set in the Target Emulator profile.

Device Capacity (sectors)

Indicates the device capacity of the emulated target drive set in the Target Emulator profile.

Transfer Size (sectors)

Indicates the transfer size of the emulated target drive set in the Target Emulator profile.

Delay Injections

The following parameters reflect the delay injection settings for the Target Emulator profile applied to the port.

Response Frame Delays

Indicates the number of delays for response frames set in the Target Emulator profile.

DATA Fame Delays

Indicates the number of delays for DATA frames set in the Target Emulator profile.

XFER_RDY Frame Delays

Indicates the number of delays for XFER_RDY frames set in the Target Emulator profile.

Min. Resp. Frame countdown

Indicates the minimum number of times a response frame is detected before emitting the required frame response as set in the Target Emulator profile.

Min. DATA Frame Countdown

Indicates the minimum number of times a DATA frame is detected before emitting the required frame response as set in the Target Emulator profile.

Min. XFER_RDY Frame Countdown

Indicates the minimum number of times a XFER_RDY frame is detected before emitting the required frame response as set in the Target Emulator profile.

Total Injections Counter

Indicates the number of errors that have been injected.

Frame Field Replacements

The following parameters reflect the Frame Field Injections settings for the Target Emulator profile applied to the port.

Enabled for Resp. Frames

Indicates **True** if Frame Fields are enabled and **False** if not.

Freq. for Resp. Frames

Indicates the number of times a request frame is detected before emitting the Response frame as set in the Target Emulator profile.

Countdown for Resp. Frames

Indicates the number of events until the next Frame Field Replacements.

Enabled for DATA Frames

Indicates **True** if Frame Fields are enabled and **False** if not.

Freq. for DATA Frames

Indicates the number of times a request frame is detected before emitting the DATA frame as set in the Target Emulator profile.

Countdown DATA Frames

Indicates the number of events until the next Frame Field Replacements.

Enabled for XFER_RDY Frames

Indicates **True** if Frame Fields are enabled and **False** if not.

Freq. for XFER_RDY Frames

Indicates the number of times a request frame is detected before emitting the XFER_RDY frame as set in the Target Emulator profile.

Countdown for XFER_RDY Frames

Indicates the number of events until the next Frame Field Replacements.

Total Injections Counter

Indicates the number of errors that have been injected.

CRC Error Injections

The following parameters reflect the CRC Error Injection settings for the Target Emulator profile applied to the port.

Enabled for Resp. Frames

Indicates **True** if CRC error injections are enabled for response frames and **False** if not.

Freq. for Resp. Frames

Indicates the number of times a request frame is detected before emitting the Response frame as set in the Target Emulator profile.

Countdown for Resp. Frames

Indicates the number of events until the next error injection (1 means an error will be injected during the next event).

Enabled for DATA Frames

Indicates **True** if CRC error injections are enabled for DATA frames and **False** if not.

Freq. for DATA Frames

Indicates the number of times a request frame is detected before emitting the DATA frame as set in the Target Emulator profile.

Countdown DATA Frames

Indicates the number of events until the next error injection (1 means an error will be injected during the next event).

Enabled for XFER_RDY Frames

Indicates **True** if CRC error injections are enabled for XFER_RDY frames and **False** if not.

Freq. for XFER_RDY Frames

Indicates the number of times a request frame is detected before emitting the XFER_RDY frame as set in the Target Emulator profile.

Countdown for XFER_RDY Frames

Indicates the number of events until the next error injection (1 means an error will be injected during the next event).

Total Injections Counter

Indicates the number of errors that have been injected.

EOF Error Injections

The following parameters reflect the EOF Error Injection settings for the Target Emulator profile applied to the port.

Enabled for Resp. Frames

Indicates **True** if EOF error injections are enabled for response frames and **False** if not.

Freq. for Resp. Frames

Indicates the number of times a request frame is detected before emitting the Response frame as set in the Target Emulator profile.

Countdown for Resp. Frames

Indicates the number of events until the next error injection (1 means an error will be injected during the next event).

Enabled for DATA Frames

Indicates **True** if EOF error injections are enabled for DATA frames and **False** if not.

Freq. for DATA Frames

Indicates the number of times a request frame is detected before emitting the DATA frame as set in the Target Emulator profile.

Countdown for DATA Frames

Indicates the number of events until the next error injection (1 means an error will be injected during the next event).

Enabled for XFER_RDY Frames

Indicates **True** if EOF error injections are enabled for XFER_RDY frames and **False** if not.

Freq. for XFER_RDY Frames

Indicates the number of times a request frame is detected before emitting the XFER_RDY frame as set in the Target Emulator profile.

Countdown for XFER_RDY Frames

Indicates the number of events until the next error injection (1 means an error will be injected during the next event).

Total Injections Counter

Indicates the number of errors that have been injected.

Disparity Error Injections

The following parameters reflect the Disparity Error Injection settings for the Target Emulator profile applied to the port.

Enabled for Resp. Frames

Indicates **True** if disparity error injections are enabled for response frames and **False** if not.

Freq. for Resp. Frames

Indicates the number of times a request frame is detected before emitting the required frame response as set in the Target Emulator profile.

Countdown for Resp. Frames

Indicates the number of events until the next error injection (1 means an error will be injected during the next event).

Enabled for DATA Frames

Indicates **True** if disparity error injections are enabled for DATA frames and **False** if not.

Freq. for DATA Frames

Indicates the number of times a request frame is detected before emitting the required frame response as set in the Target Emulator profile.

Countdown for DATA Frames

Indicates the number of events until the next error injection (1 means an error will be injected during the next event).

Enabled for XFER_RDY Frames

Indicates **True** if disparity error injections are enabled for DATA frames and **False** if not.

Freq. for XFER_RDY Frames

Indicates the number of times a request frame is detected before emitting the required frame response as set in the Target Emulator profile.

Countdown for XFER_RDY Frames

Indicates the number of events until the next error injection (1 means an error will be injected during the next event).

Total Injections Counter

Indicates the number of errors that have been injected.

Data Mismatch Injections

The following parameters reflect the Data Mismatch Injection settings for the Target Emulator profile applied to the port.

Enabled

Indicates **True** if Data Mismatch error injections are enabled and **False** if not.

Start Byte

Indicates the start location of the Byte range where the original data replacement will take place.

Stop Byte

Indicates the stop location of the Byte range where the original data replacement will take place.

Replacement Pattern

Indicates the data pattern that will replace the original data.

Frequency

Indicates the number of times a request frame is detected before emitting the modified data frames.

Countdown

Indicates the number of events until next error injection (1 means an error will be injected during the next event).

Total Injections Counter

Indicates the number of errors that have been injected.

Data Offset/Length Error Injections

The following parameters reflect the Data Mismatch Injection settings for the Target Emulator profile applied to the port.

Enabled for DATA Frames

Indicates **True** if Data Offset/Length Error injections are enabled for DATA frames and **False** if not.

Freq. for DATA Frames

Indicates the number of times the DATA frames are detected before the requested changes are injected into the frame.

Countdown for DATA Frames

Indicates the number of events until next error injection (1 means an error will be injected during the next event).

Enabled for XFER_RDY Frames

Indicates **True** if Data Offset/Length Error injections are enabled for XFER_RDY frames and **False** if not.

Freq. for XFER_RDY Frames

Indicates the number of times the XFER_RDY frames are detected before the requested changes are injected into the frame.

Countdown for XFER_RDY Frames

Indicates the number of events until next error injection (1 means an error will be injected during the next event).

Total Injections Counter

Indicates the number of errors that have been injected.

Status and Sense Injections

The following parameters reflect the Status and Sense Injection settings for the Target Emulator profile applied to the port.

Injectons Defined

Indicates the number of customized SCSI commands defined in the Target Emulator Profile.

Min. Frequency

Indicates the minimum frequency value set among all custom defined SCSI command codes in the profile.

Max. Frequency

Indicates the maximum frequency value set among all custom defined SCSI command codes in the profile.

Min. Countdown

Indicates the minimum countdown value set among all custom defined SCSI command codes in the profile.

Max. Countdown

Indicates the maximum countdown value set among all custom defined SCSI command codes in the profile.

Total Injectons Counter

Indicates the number of errors that have been injected.

Break Sequence Error Injectons***Injectons Defined***

Indicates the number of customized SCSI commands defined in the Target Emulator Profile.

Min. Frequency

Indicates the minimum frequency value set among all custom defined SCSI command codes in the profile.

Max. Frequency

Indicates the maximum frequency value set among all custom defined SCSI command codes in the profile.

Min. Countdown

Indicates the minimum countdown value set among all custom defined SCSI command codes in the profile.

Max. Countdown

Indicates the maximum countdown value set among all custom defined SCSI command codes in the profile.

Total Injections Counter

Indicates the number of errors that have been injected.

Hard Reset Sequence Error Injections***Injections Defined***

Indicates the number of customized SCSI commands defined in the Target Emulator Profile.

Min. Frequency

Indicates the minimum frequency value set among all custom defined SCSI command codes in the profile.

Max. Frequency

Indicates the maximum frequency value set among all custom defined SCSI command codes in the profile.

Min. Countdown

Indicates the minimum countdown value set among all custom defined SCSI command codes in the profile.

Max. Countdown

Indicates the maximum countdown value set among all custom defined SCSI command codes in the profile.

Total Injections Counter

Indicates the number of errors that have been injected.

Reset Sequence Error Injections***Injections Defined***

Indicates the number of customized SCSI commands defined in the Target Emulator Profile.

Min. Frequency

Indicates the minimum frequency value set among all custom defined SCSI command codes in the profile.

Max. Frequency

Indicates the maximum frequency value set among all custom defined SCSI command codes in the profile.

Min. Countdown

Indicates the minimum countdown value set among all custom defined SCSI command codes in the profile.

Max. Countdown

Indicates the maximum countdown value set among all custom defined SCSI command codes in the profile.

Total Injections Counter

Indicates the number of errors that have been injected.

Parameters for SATA Mode

Identify Device Data Configuration

Serial Number

Indicates the serial number of the Target Emulator drive. To change this value, right-click on the parameters column and select **Edit Configuration** to open the Target Emulator Device window.

Firmware Revision

Indicates the firmware version of the Target Emulator drive. To change this value, right-click on the parameters column and select **Edit Configuration** to open the Target Emulator Device window.

Model Number

Indicates the model number of the Target Emulator drive. To change this value, right-click on the parameters column and select **Edit Configuration** to open the Target Emulator Device window.

Multiple Count (sectors)

Indicates the maximum number of logical sectors per DRQ data block that the device supports for READ/WRITE MULTIPLE commands. For SATA devices, this is set to 16 or less. Only values 0x01, 0x02, 0x04, 0x08 and 0x10 are allowed.

28 bits addressable user sects.

Indicates a value that is one greater than the maximum user addressable LBA. The maximum value that shall be placed in this field is 0FFF_FFFFh. If this field contains 0FFF_FFFFh and the device has user addressable LBAs greater than or equal to 0FFF_FFFFh then words 100..103 contain the total number of user addressable LBAs

48 bits addressable user sects

Indicates a value that is one greater than the maximum LBA in user accessible space when the 48-bit Addressing feature set is supported. The maximum value that shall be placed in this field is 0000_FFFF_FFFF_FFFFh. Support of these words is mandatory if the 48-bit Address feature set is supported.

Supports SATA 6 Gbps

Indicates whether the support for Serial ATA Gen3 signalling speed (6.0Gbps) is enabled in the Identify Device Data Configuration. The SATA Target Emulator attempts speed negotiation at 6.0Gbps, if this Bit is 1.

Supports SATA 3 Gbps

Indicates whether the support for Serial ATA Gen2 signalling speed (3.0Gbps) is enabled in the Identify Device Data Configuration. The SATA Target Emulator attempts speed negotiation at 3.0Gbps, if this Bit is 1 and Word 76 Bit 3 is 0.

Supports SATA 1.5 Gbps

Indicates whether the support for Serial ATA Gen1 signalling speed (1.5Gbps) is enabled in the Identify Device Data Configuration. The SATA Target Emulator attempts speed negotiation at 1.5Gbps, if this Bit is 1, both Word 76 Bit 3 and Word 76 Bit 2 are 0.

Supports dev. auto partial to slumber

Indicates whether the support for Device Automatic Partial to Slumber transitions is enabled in the Identify Device Data Configuration.

Supports host auto partial to slumber

Indicates whether the support for Host Automatic Partial to Slumber transitions is enabled in the Identify Device Data Configuration.

Supports unload while NCQ

Indicates whether the support for Unload while NCQ commands outstanding is enabled in the Identify Device Data Configuration. If this feature is enabled, the Target Emulator supports the Priority field in the READ FPDMA QUEUED and WRITE FPDMA QUEUED commands and optimization based on this information.

Support dev. initiated PMREQ

Indicates whether the support for device initiating interface power management is enabled in the Identify Device Data Configuration.

Supports recep. host initiated PMREQ

Indicates whether the support for Host Automatic Partial to Slumber transitions is enabled in the Identify Device Data Configuration.

Supports NCQ

Indicates whether the support for Native Command Queuing is enabled in the Identify Device Data Configuration.

Supports dev. initiated PMREQ

Indicates whether the support for receipt of device-initiated interface power management requests is enabled in the Identify Device Data Configuration. The SATA Target Emulator will only initiate interface power management when it is in STANDBY mode. STANDBY mode can be achieved by issuing a Standby Immediate ATA command to the target emulator. When initiating interface power management, the target emulator issues PMREQ_S primitives to the host.

Supports host protected area

Indicates whether the Host Protected Area (HPA) feature set is enabled in the Identify Device Data Configuration.

Supports 48 bits addressing

Indicates whether the 48-bit Address feature set is supported.

Supports idle IMM unload

Indicates whether the IDLE IMMEDIATE command with unload feature is supported.

Supports FUA EXT

Indicates whether the WRITE DMA FUA EXT command and WRITE MULTIPLE FUA EXT command is supported.

FIS Delay Injections***Dev. to Host FIS delay (secs)***

Indicates the Device to Host FIS delay time (in seconds) as specified in the delay injection section of the Target Emulator Profile.

Dev. to Host FIS delay countdown

Indicates the Device to Host FIS delay countdown before the next Device to Host FIS delay injection.

Dev. to Host FIS Delay Frequency

Indicates the Device to Host FIS delay frequency as specified in the delay injection section of the Target Emulator Profile.

DMA Activate FIS delay (secs)

Indicates the DMA Activate FIS delay time (in seconds) as specified in the delay injection section of the Target Emulator Profile.

DMA Activate FIS delay countdown

Indicates the DMA Activate FIS delay countdown before the next DMA Activate FIS delay injection.

DMA Activate FIS delay frequency

Indicates the DMA Activate FIS delay frequency as specified in the delay injection section of the Target Emulator Profile.

DMA Setup FIS delay (secs)

Indicates the DMA Setup FIS delay time (in seconds) as specified in the delay injection section of the Target Emulator Profile.

DMA Setup FIS delay countdown

Indicates the DMA Setup FIS delay countdown before the next DMA Activate FIS delay injection.

DMA Setup FIS delay frequency

Indicates the DMA Setup FIS delay frequency as specified in the delay injection section of the Target Emulator Profile.

Data FIS delay (secs)

Indicates the Data FIS delay time (in seconds) as specified in the delay injection section of the Target Emulator Profile.

Data FIS delay countdown

Indicates the Data FIS delay countdown before the next Data FIS delay injection.

Data FIS delay frequency

Indicates the Data FIS delay frequency as specified in the delay injection section of the Target Emulator Profile.

PIO Setup FIS delay (secs)

Indicates the PIO Setup FIS delay time (in seconds) as specified in the delay injection section of the Target Emulator Profile.

PIO Setup FIS delay countdown

Indicates the PIO Setup FIS delay countdown before the next PIO Setup FIS delay countdown.

PIO Setup FIS delay frequency

Indicates the PIO Setup FIS delay frequency as specified in the delay injection section of the Target Emulator Profile.

Set Device Bits FIS delay (secs)

Indicates the Set Device Bits FIS delay time (in seconds) as specified in the delay injection section of the Target Emulator Profile.

Set Device Bits FIS delay countdown

Indicates the Set Device Bits FIS delay countdown before the next DMA Activate FIS delay injection.

Set Device Bits FIS delay frequency

Indicates the Set Device Bits FIS delay frequency as specified in the delay injection section of the Target Emulator Profile.

Total injection count

Indicates the total number of delay injections sent.

FIS Error Injections***Dev. to Host FIS errors enabled***

Indicates whether there are errors enabled for the Device to Host FIS type.

Dev. to Host FIS errors injected

Indicates the error type injected for the Device to Host FIS type.

Dev. to Host FIS error frequency

Indicates the number of request frames to detect before emitting a modified frame. For example, If you set a frequency of **4**, an error will be injected every **4th frame**.

Dev. to Host FIS error countdown

Indicates the number of request frames remaining before injecting the error.

DMA Activate FIS errors enabled

Indicates whether there are errors enabled for the DMA Activate FIS type.

DMA Activate FIS errors injected

Indicates the error type injected for the DMA Activate FIS type.

DMA Activate FIS error frequency

Indicates the number of request frames to detect before emitting a modified frame. For example, If you set a frequency of **4**, an error will be injected every **4th frame**.

DMA Activate FIS error countdown

Indicates the number of request frames remaining before injecting the error.

DMA Setup FIS errors enabled

Indicates whether there are errors enabled for the DMA Setup FIS type.

DMA Setup FIS errors injected

Indicates the error type injected for the DMA Setup FIS type.

DMA Setup FIS error frequency

Indicates the number of request frames to detect before emitting a modified frame. For example, If you set a frequency of **4**, an error will be injected every **4th frame**.

DMA Setup FIS error countdown

Indicates the number of request frames remaining before injecting the error.

Data FIS errors enabled

Indicates whether there are errors enabled for the Data FIS type.

Data FIS errors injected

Indicates the error type injected for the Data FIS type.

Data FIS error frequency

Indicates the number of request frames to detect before emitting a modified frame. For example, If you set a frequency of **4**, an error will be injected every **4th frame**.

Data FIS error countdown

Indicates the number of request frames remaining before injecting the error.

PIO Setup FIS errors enabled

Indicates whether there are errors enabled for the PIO Setup FIS type.

PIO Setup FIS errors injected

Indicates the error type injected for the PIO Setup FIS type.

PIO Setup FIS error frequency

Indicates the number of request frames to detect before emitting a modified frame. For example, If you set a frequency of **4**, an error will be injected every **4th frame**.

PIO Setup FIS error countdown

Indicates the number of request frames remaining before injecting the error.

Set Device Bits FIS errors enabled

Indicates whether there are errors enabled for the Set Device Bits FIS type.

Set Device Bits FIS errors injected

Indicates the error type injected for the Set Device Bits FIS type.

Set Device Bits error frequency

Indicates the number of request frames to detect before emitting a modified frame. For example, If you set a frequency of **4**, an error will be injected every **4th frame**.

Set Device Bits FIS error countdown

Indicates the number of request frames remaining before injecting the error.

Total injection count

Indicates the total number of FIS error injections sent.

Custom FIS Injections***Enabled for Dev. to Host FIS***

Indicates whether there are custom FIS injections enabled for the Device to Host FIS type.

Custom size for Dev. to Host FIS (dword)

Indicates the size (in Dwords) of the Custom FIS.

Freq. for Dev. to Host FIS

Indicates the number of request frames to detect before emitting a Custom FIS. For example, If you set a frequency of **4**, an error will be injected every **4th frame**.

Countdown for Dev. to Host FIS

Indicates the number of request frames remaining before injecting the error.

Enabled for DMA Activate FIS

Indicates whether there are custom FIS injections enabled for the DMA Activate FIS type.

Custom size for DMA Activate FIS (dword)

Indicates the size (in Dwords) of the Custom FIS.

Freq. for DMA Activate FIS

Indicates the number of request frames to detect before emitting a Custom FIS. For example, If you set a frequency of **4**, an error will be injected every **4th frame**.

Countdown for DMA Activate FIS

Indicates the number of request frames remaining before injecting the error.

Enabled for DMA Setup FIS

Indicates whether there are custom FIS injections enabled for the DMA Setup FIS type.

Custom size for DMA Setup FIS (dword)

Indicates the size (in Dwords) of the Custom FIS.

Freq. for DMA Setup FIS

Indicates the number of request frames to detect before emitting a Custom FIS. For example, If you set a frequency of **4**, an error will be injected every **4th frame**.

Countdown for DMA Setup FIS

Indicates the number of request frames remaining before injecting the error.

Enabled for PIO Setup FIS

Indicates whether there are custom FIS injections enabled for the PIO Setup FIS type.

Custom size for PIO Setup FIS (dword)

Indicates the size (in Dwords) of the Custom FIS.

Freq. for DMA PIO FIS

Indicates the number of request frames to detect before emitting a Custom FIS. For example, If you set a frequency of **4**, an error will be injected every **4th frame**.

Countdown for PIO Setup FIS

Indicates the number of request frames remaining before injecting the error.

Enabled for Set Device Bits FIS

Indicates whether there are custom FIS injections enabled for the Set Device Bits FIS type.

Custom size for Set Device Bits FIS (dword)

Indicates the size (in Dwords) of the Custom FIS.

Freq. for Set Device Bits FIS

Indicates the number of request frames to detect before emitting a Custom FIS. For example, If you set a frequency of **4**, an error will be injected every **4th frame**.

Countdown for Set Device Bits FIS

Indicates the number of request frames remaining before injecting the error.

Total injection count

Indicates the total number of Custom FIS injections sent.

FIS Primitive Injections***Enabled for Dev. to Host FIS***

Indicates whether there are primitive injections enabled for the Device To Host FIS type.

Prim. injected after Dev. to Host FIS

Indicates the type of primitive injected after the Device to Host FIS.

Prim. count for Dev. to Host FIS

Indicates the number of the specified primitive to be injected.

Freq. for Dev. to Host FIS

Indicates the number of FIS frame occurrence of the specified FIS type before injecting the primitive.

Countdown for Dev. to Host FIS

Indicates the number of request frames remaining before injecting the primitive.

Enabled for DMA Activate FIS

Indicates whether there are primitive injections enabled for the DMA Activate FIS type.

Prim. injected after DMA Activate FIS

Indicates the number of the specified primitive to be injected.

Prim. count for DMA Activate FIS

Indicates the number of the specified primitive to be injected.

Freq. for DMA Activate FIS

Indicates the number of FIS frame occurrence of the specified FIS type before injecting the primitive.

Countdown for DMA Activate FIS

Indicates the number of request frames remaining before injecting the primitive.

Enabled for DMA Setup FIS

Indicates whether there are primitive injections enabled for the DMA Setup FIS type.

Prim. injected after DMA Setup FIS

Indicates the number of the specified primitive to be injected.

Prim. count for DMA Setup FIS

Indicates the number of the specified primitive to be injected.

Freq. for DMA Setup FIS

Indicates the number of FIS frame occurrence of the specified FIS type before injecting the primitive.

Countdown for DMA Setup FIS

Indicates the number of request frames remaining before injecting the primitive.

Enabled for Data FIS

Indicates whether there are primitive injections enabled for the Data FIS type.

Prim. injected after Data FIS

Indicates the number of the specified primitive to be injected.

Prim. count for Data FIS

Indicates the number of the specified primitive to be injected.

Freq. for Data FIS

Indicates the number of FIS frame occurrence of the specified FIS type before injecting the primitive.

Countdown for Data FIS

Indicates the number of request frames remaining before injecting the primitive.

Enabled for PIO Setup FIS

Indicates whether there are primitive injections enabled for the PIO Setup FIS type.

Prim. injected after PIO Setup FIS

Indicates the number of the specified primitive to be injected.

Prim. count for PIO Setup FIS

Indicates the number of the specified primitive to be injected.

Freq. for PIO Setup FIS

Indicates the number of FIS frame occurrence of the specified FIS type before injecting the primitive.

Countdown for PIO Setup FIS

Indicates the number of request frames remaining before injecting the primitive.

Enabled for Set Device Bits FIS

Indicates whether there are primitive injections enabled for the Set Device Bits FIS type.

Prim. injected after Set Device Bits FIS

Indicates the number of the specified primitive to be injected.

Prim. count for Set Device Bits FIS

Indicates the number of the specified primitive to be injected.

Freq. for Set Device Bits FIS

Indicates the number of FIS frame occurrence of the specified FIS type before injecting the primitive.

Countdown for Set Device Bits FIS

Indicates the number of request frames remaining before injecting the primitive.

Enabled for Host to Dev. FIS

Indicates whether there are primitive injections enabled for the Host to Device FIS type.

Prim. injected after Host to Dev. FIS

Indicates the number of the specified primitive to be injected.

Prim. count for Host to Dev. FIS

Indicates the number of the specified primitive to be injected.

Freq. for Set Host to Dev. FIS

Indicates the number of FIS frame occurrence of the specified FIS type before injecting the primitive.

Countdown for Host to Dev. FIS

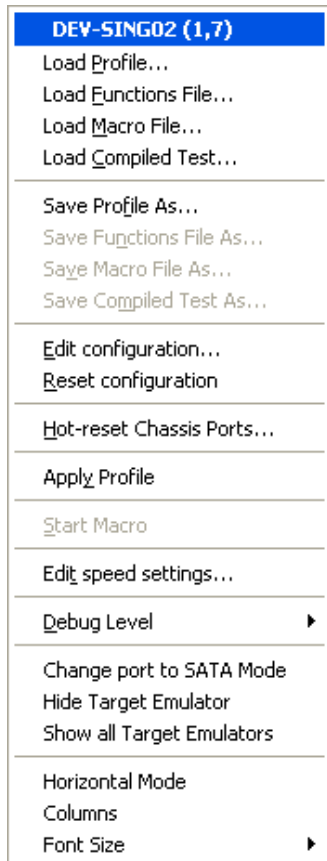
Indicates the number of request frames remaining before injecting the primitive.

Total injection count

Indicates the total number of primitive injections sent.

Using the Parameters Status Table Context Menu

Right-click on a Parameters status column to display the context menu. The available operations are displayed for the column in which you click. This menu provides controls for configuration files, operation, setting clock speed, setting Target Emulator mode of operation (SAS to SATA), removing a Target Emulator from the Parameters Status table, and changing the appearance of the status table.

Figure 304: Parameters Status Table Context Menu for Target Emulator

Loading Files

To load a Profile click **Load Profile...**

To load a Functions File, click **Load Functions File...**

To load Macro File, click **Load Macro File...**

To load a Compiled Test, click **Load Compiled Test...**

Saving Files

To save the current Profile, click **Save Profile As...**

To save the current Functions file, click **Save Functions File As...**

To save the current Macro File, click **Save Macro File As...**

To save the current Compiled Test, click **Save Compiled Test As...**

Editing Configuration

To edit the current port configuration, click **Edit configuration...**

To reset the port configuration to the default settings, click **Reset configuration**.

Resetting Chassis Ports

To do a hot-reset on the selected port (applicable to Generator or Target Emulator ports only), click on **Hot-reset Chassis Ports...**

This will reset all locked Generator or Target Emulator ports and clear the settings applied to the port. You need to reconnect to the port again to use it.

Applying Profile Changes

To apply all the changes made to the profile, or to apply the newly loaded profile, click on **Apply Profile**.

Starting Macro

To start a macro file that was loaded, click **Start Macro**.

Editing Speed settings

To set the speed for the port, click on **Edit speed settings...**

This option is for SAS TE port only. For SATA TE, speed is part of the SATA Identify Device Data settings.

Setting the Debug Level

To set the debug level, click **Debug Level** then select the level from the pop-up menu.

Changing port mode

When you first lock a port as a Target Emulator, it will be in SAS Mode. To change the port to SATA mode, click **Change port to SATA Mode**.

Displaying Target Emulator ports

To hide ports locked as Target emulator from the Parameters Status Table, click on **Hide Target Emulator**. To show the hidden port right-click on the Parameters Stable Table and click **Show all Target Emulators**.

Displaying Ports in the Parameters Status Table

By default locked ports are displayed as columns with the parameters displayed as rows. To reverse this, where the ports are displayed as rows and the parameters are displayed as columns, click **Horizontal Mode**.

To select which parameters will be displayed as columns, click **Columns**. The **Customize Band** window opens where you can select which columns to display.

To change the font size of the labels and text used in the Parameters Status Table, click on **Font Size** and then select the font size from the pop-up menu. By default, the font size is set to the smallest.

Using the Ports Manager in Target Emulator

The Ports manager displays details about the ports you have locked (Figure 305). It shows the protocol, chassis name (with chassis number, slot number, and port numbers), and other port specific information. You can sort the rows from first to last or last to first by clicking the column heading.



Note: If you are disconnected due to a network problem, you can reconnect to the ports by using the Port Selection and Domain Setup window.

Figure 305: Ports Manager

The following icons are displayed on the menu bar:

**Select All Ports**

Selects all ports in the Ports Manager.

**Unselect All Ports**

Unselect all ports in the Ports Manager.

**Load Configuration to Selected Ports**

Load the selected functions, macro, or compiled test file to all selected ports in the Ports Manager.

**Apply Profile to Selected Ports**

Load the selected functions, macro, or compiled test file to all selected ports in the Ports Manager.

**Start Selected Ports**

Start loaded macro file on the selected ports in the Ports Manager.

**Start Compiled Test on Selected Ports (Generator Only)**

Execute the loaded compiled test on the selected ports in the Ports Manager.

**Stop Selected Ports**

Stop Generator operation on the selected ports in the Ports Manager.

**Show Properties of Selected Ports**

Display the Port Properties dialog box, with information on the selected function, protocol, and clock rate (speed). It also shows the chassis name, IP address, slot and port(s).

**Disconnect Selected Ports**

Disconnect the selected ports in the Ports Manager.

**Disconnect All Ports**

Disconnect all ports in the Ports Manager.

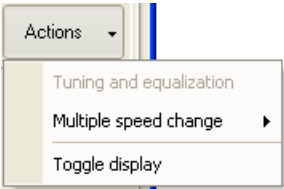
**Hot-reset Selected Ports**

Reset Generator or Target Emulator running in chassis.

Actions Button

The **Actions** button contains menus for **Tuning and Equalization** (6G SAS/SATA Jammer and Generator only), **Multiple speed Change**, and **Toggle Display**. See [Figure 306](#).

Figure 306: Actions Button Options



Tuning and Equalization

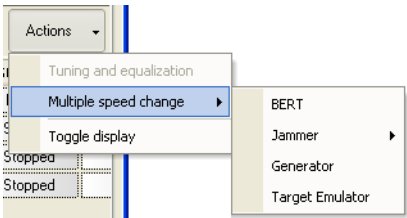
Tuning and Equalization are procedures to optimize ports on the 6G SAS/SATA 4x/Wide-Port Blade for your environment. When you connect the Xgig SAS Analyzer, Jammer, Generator, or Target Emulator in a new environment (for example, after changing devices or cable length) we recommend that you run the Tuning procedure detailed in the *Xgig Tuning and Equalization* document.

Multiple Speed Change for Target Emulator

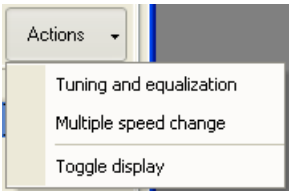
This option allows you to change the speed of multiple Target Emulator ports simultaneously. Using this menu, you can choose to change the speed on Target Emulator ports. If you have the All Devices tab selected, the menu will display BERT, Jammer, and Generator.

Figure 307: Multiple Speed Change Menus

All Devices tab selected

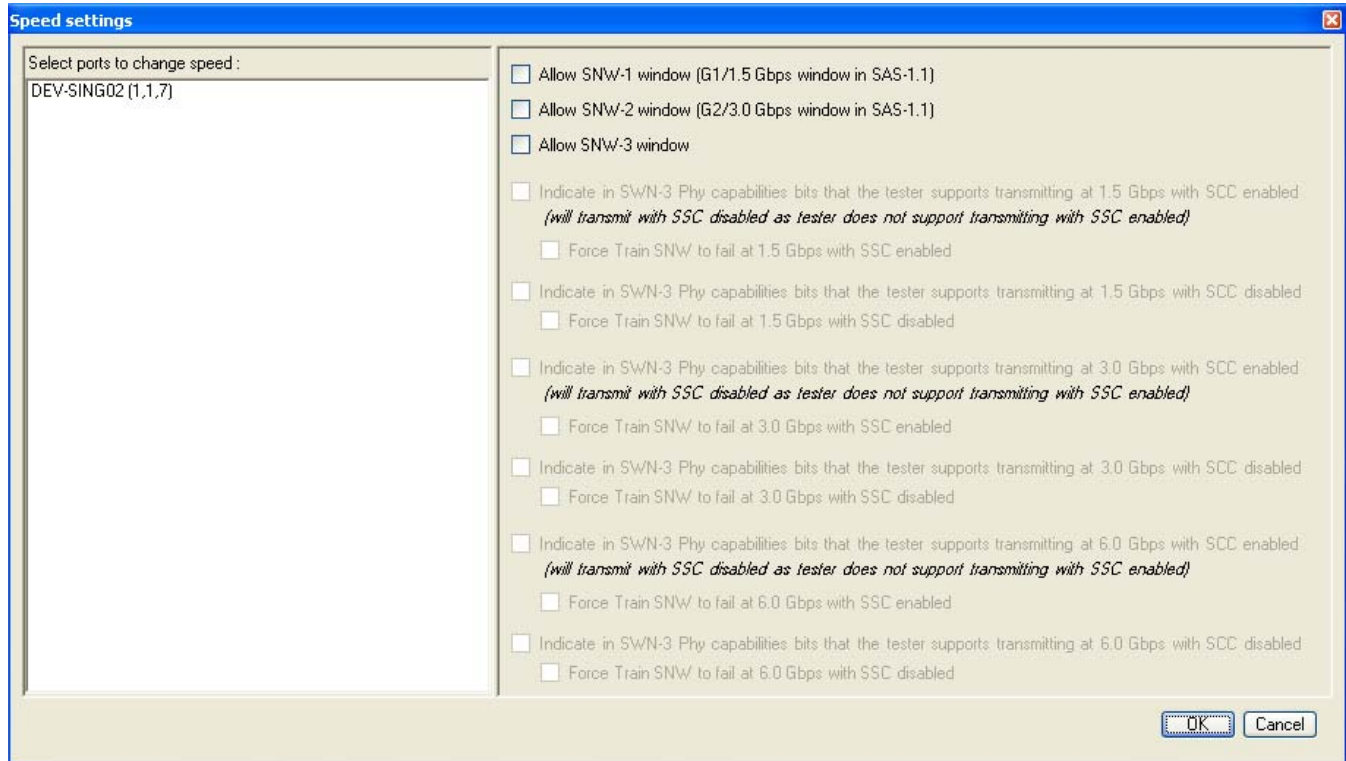


Tar-



To change **Multiple speed change** if the **Target Emulator** tab is selected:

The **Speed Settings** window appears. This menu differs from the main speed settings window in that it includes an additional pane that allows you to select the ports for which you want to change the speed.

Figure 308: Multiple Speed Settings Window for Target Emulator

- 1 Select the ports that you want to change the speed for.
- 2 For instructions on filling out the main pane of the window, see “Speed” on page 422.
- 3 Click **OK** to apply the changes.

Toggle Display

This option toggles between a horizontal and vertical view of the ports.

Using Log Manager in Target Emulator

To access the Log Manager, click the **Log** tab at the bottom of the Target Emulator main window.

Target Emulator creates logs that report which operations have occurred and which ones encountered errors during execution. These logs are contained within the Log Manager. To access the Log Manager, select the Log tab at the bottom of the Maestro window.

The Log Manager shows the status of each operation and test executed.



Note: The Ports Manager contains a small preview log pane at the bottom of the window for quick reference of log entries.

The Log Manager continues to list the logs and display them depending on the Log Manager options you have selected.

Figure 309: Log Manager

TargetEmulator logging active  [Entries: 620]			
DateTime	Type	Address	Contents
6/1/2009 5:21:56 PM	Target Emulator SAS	SQA-SING3 (1,1,7)	TESParameterControlIOErrorResp(0x2, 0x0, 0x0, 0x0, 0x0, 0xffe5);// 06-01-09 17:21:56
6/1/2009 5:21:56 PM	Target Emulator SAS	SQA-SING3 (1,1,7)	TESParameterControlIOErrorResp(0x3, 0x0, 0x0, 0x0, 0x0, 0xffff);// 06-01-09 17:21:56
6/1/2009 5:21:56 PM	Target Emulator SAS	SQA-SING3 (1,1,7)	TESParameterControlIOErrorResp(0x4, 0x0, 0x0, 0x0, 0x0, 0xffef);// 06-01-09 17:21:56
6/1/2009 5:21:56 PM	Target Emulator SAS	SQA-SING3 (1,1,7)	TESParameterControlFrameError(0x1, 0x1, 0x0); // 06-01-09 17:21:56
6/1/2009 5:21:56 PM	Target Emulator SAS	SQA-SING3 (1,1,7)	TESParameterControlFrameError(0x1, 0x1, 0x1); // 06-01-09 17:21:56
6/1/2009 5:21:56 PM	Target Emulator SAS	SQA-SING3 (1,1,7)	TESParameterControlFrameError(0x1, 0x1, 0x5); // 06-01-09 17:21:56
6/1/2009 5:21:56 PM	Target Emulator SAS	SQA-SING3 (1,1,7)	TESParameterControlFrameError(0x2, 0x1, 0x0); // 06-01-09 17:21:56

The Filter icons next to the **Type** and **Address** column labels allow you to choose how you want to display device types, by protocol or All, and device addresses, by single address or All devices.

If the **All Devices** tab at the top of the Xgig Maestro main window is selected, then the **Log Source** menu  2 active log sources ▾ shows all log sources as active by default. You can choose to disable BERT logging, Jammer logging, Generator logging, Target Emulator or all four by clicking the **Log Sources** menu and un-checking the selections. If the **BERT-Bit error rate testing**, **Jammer**, **Generator** or **Target Emulator** tab in the main window are selected, then the Log Manager displays only the log entries for that tab, respectively.

The following icons are displayed on the Log Manager menu bar:



Display Entry Contents

Lets you save the selected log to a file in the device Logs folder (for example: C:\Program Files > JDSU > Xgig Maestro > SavedLogs) or anywhere you want to save it on the network.



Save All Entries As

Lets you save all the logs in the Log Manager to a file.



Save selected entries as

Lets you save the selected logs to a file.



Select All

Selects all the logs in the Log Manager.



Options

Opens the Log Manager Options dialog where you can enter your preferences for the information you want displayed in the Log Manager (Figure 310).



Clear Filtering

Removes filtering by Type and Address and displays all the devices you have locked.

**Clear Selected Entries**

Deletes the log entry you have highlighted.

**Clear All Entries**

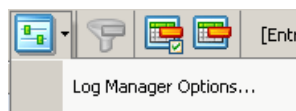
Deletes all the log entries in the Log Manager.

Setting Log Options

To set up default naming and locations of Target Emulator log files:

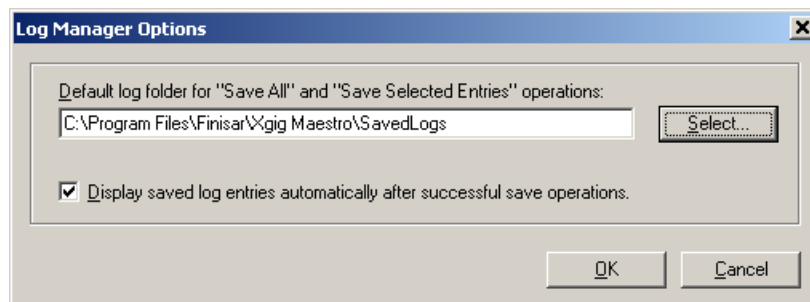
- 1 Click the **Log Manager Options** icon to open the drop-down menu, and select **Log Manager Options**.

Figure 310: Log Manager Options Menu

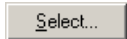


The Target Emulator **Log Manager Options** dialog is displayed. This dialog allows you to set up how you want the log files to be automatically named and the default location you want them saved to. You can also change the filename and folder when you save the log.

Figure 311: Log Options Dialog



- 2 Enter the path to the folder where you want to save log files.

You can browse to where you want to save the log file by clicking  .

- 3 Click **OK**.

- 4 To display saved log entries automatically after successful save operations, check the box at the bottom of the **Log Options** dialog.

The right-click menu in the Log Manager contains the same options as those shown in the Log Manager tool bar and detailed in this section.

Saving a Log

You can save a log from the Log Manager.

To save a log from the Log Manager as an HTML file:

- 1 Highlight the log(s) you want to save.
- 2 Click the **Save Selected Entries As**  button.

The **Save Log Manager Contents As** window is displayed. This window lets you name and save the log as an HTML file to the Saved Logs folder or to a location you prefer.

Customizing the Appearance of the Maestro/Target Emulator Main Window

You can move and rearrange the individual device tabs on your monitor screen as you prefer. You can also select the information you want to display in the Parameters Status table. In addition, you can select the size of displayed text.

Using the Window Menu

The **Window** menu allows you to arrange the window display:

Layout

Layout offers choices for rearranging the Maestro device tab windows. The Ports manager and Log Manager windows are not affected by this menu selection.

Internal Tabs

Allows you to restore the Maestro main window to its default format.

Internal MDI

Internal multiple document interface (MDI) lets you isolate each device tab as a separate window that you can activate by clicking anywhere on the window.

Show Hidden Windows

Restores any windows you have closed while using the Internal Tabs or Internal MDI display arrangement.

Arrange Icons

Arranges the icons for minimized windows at the bottom of the screen. If an open document window is at the bottom of the screen, some or all of the icons will be underneath this document window and will not be visible.

Cascade

Arranges all open windows in a cascade style from the top, left corner of the window.

Tile Horizontally

After selecting **Layout > Internal MDI**, this command opens and aligns the BERT, BERT Latency measurement, Jammer, and Generator device windows horizontally one over the other.

Tile Vertically

After selecting **Layout > Internal MDI**, this command opens and aligns the BERT, BERT Latency measurement, Jammer, Delay Emulator, Generator, Load Tester, and Target Emulator device windows vertically one next to the other. You can view the individual device windows by dragging the sides out to resize them.

Minimize All Windows

After selecting **Layout > Internal MDI**, this command minimizes all the open windows. You can restore each window, individually, by using the standard window controls on the header or select **Internal Tabs** to restore the Maestro main window to its default format.

The following options appear when you select **Layout > Internal Tabs**:

1 Maestro Global

Brings the Maestro Global tab to the front as the active window. This window displays ports from all active devices (BERT, Jammer, Delay Emulator, Generator, Load Tester and Target Emulator).

2 Jammer

Brings the Jammer device tab to the front as the active window

3 BERT - Bit error rate testing

Brings the BERT device tab to the front as the active window

4 BERT - Latency measurement

Brings the BERT Latency measurement device tab to the front as the active window

5 Delay Emulator

Brings the Delay Emulator device tab to the front as the active window

6 Generator

Brings the Generator device tab to the front as the active window

7 Load Tester

Brings the Load Tester device tab to the front as the active window

8 Target Emulator

Brings the Target Emulator device tab to the front as the active window

Customizing the Parameters Status table in Target Emulator

You can change the appearance of the Parameters Status table by:

- Removing columns
- Resizing columns
- Changing the text size
- Displaying and hiding status table parameters

Removing columns

If you have a number of devices locked, you can remove a column that you do not need to view without unlocking the port or affecting the operation.

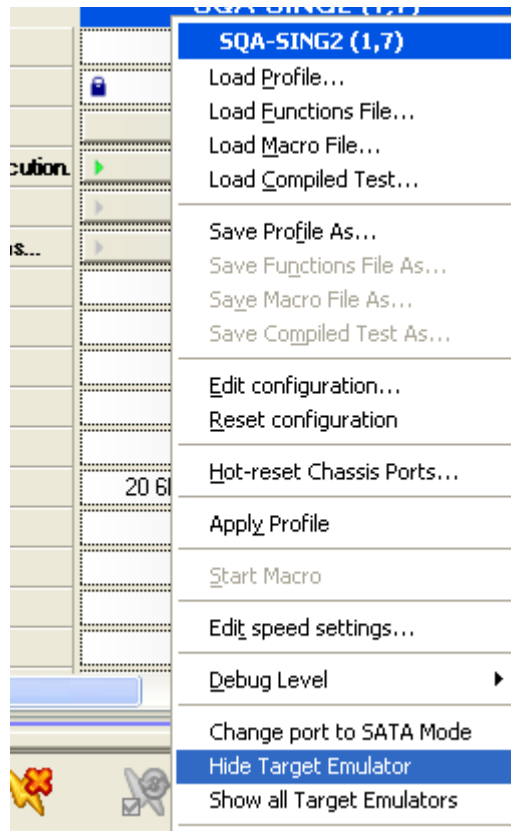
To remove a column:

- 1 Right-click on the specific column you want and open the Parameters context menu.
- 2 Select **Hide Target Emulator**([Figure 312](#)).

Or:

In the Ports Manager, clear the **Show** check box next to the device you want to remove.

The column is removed, but the device is still locked (“in use”) and displayed in the Ports Manager.

Figure 312: Removing a Device Column

To replace the device column on the Parameters Status table:

>> Click the **Show** check box for the device in the Ports Manager.

Resizing columns

You can resize any of the columns by placing the mouse at the right edge at the top of a column, next to the chassis name. A resizing cursor appears. Hold down the mouse button, and drag the mouse to resize the column.

Changing Text Size

You can choose the text size you want the Parameters Status table or the Ports Manager to display.



Note: You cannot change the text size in the Log Manager.

To change text size:

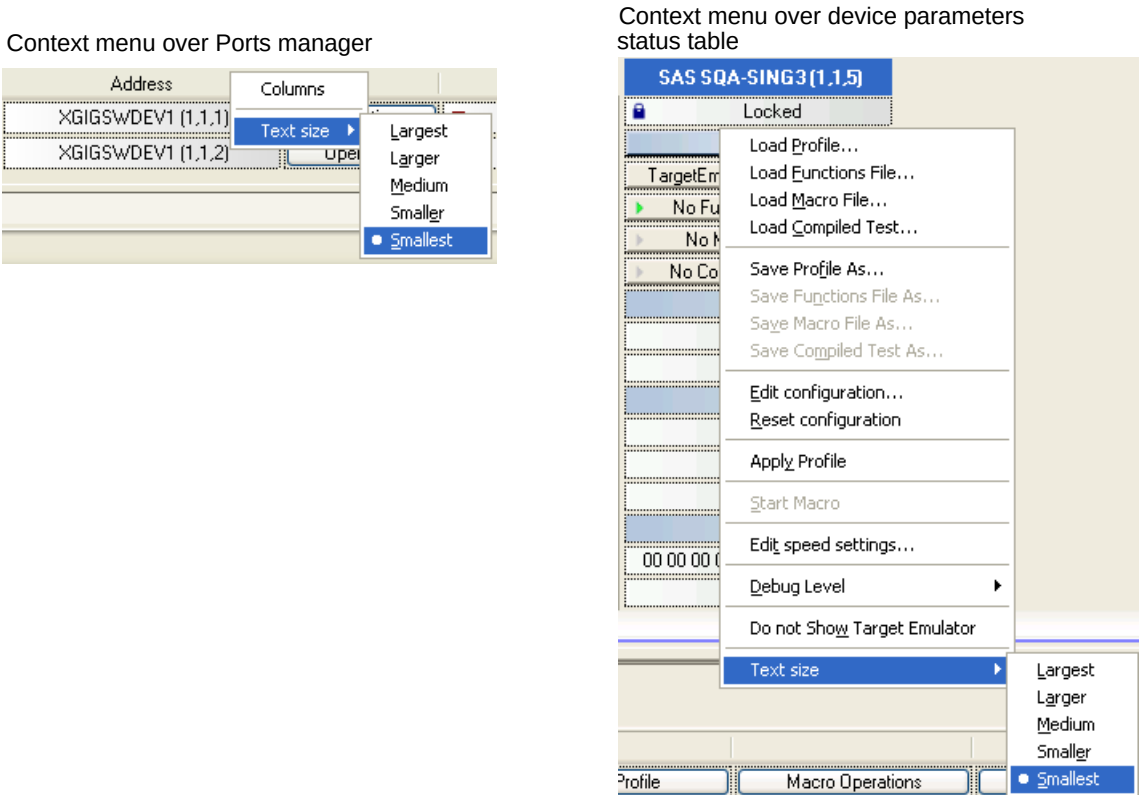
- 1 Open the context menu by clicking the right mouse button while the cursor is on the Parameters Status table or the Ports Manager.
- 2 Select **Text size** (Figure 313).

You have five choices from which to select.

Smallest is the default size.

- 3
- Select the text size you want.
- A bullet is displayed next to the current selection.

Figure 313: Text Size Menu

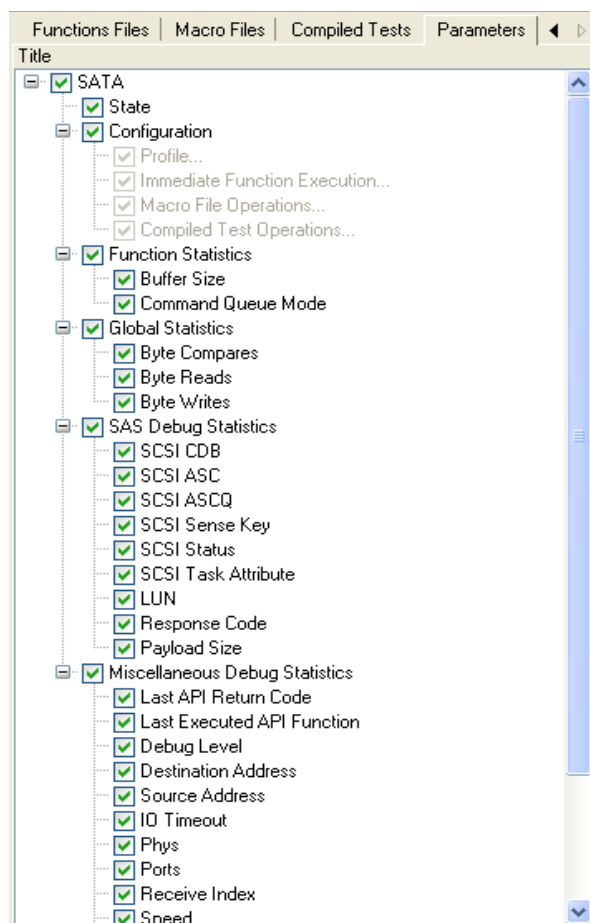


Displaying and Hiding Parameters in Target Emulator

The **Parameters** tab next to the functions tabs allows you to select the parameters you want to display in the Parameters Status table. You can hide specific parameters to simplify the status tables and show only the information in which you are interested.

To display or hide parameters on the Parameters Status table:

- 1
- Click the **Parameters** tab.
- You can expand the categories by clicking the plus signs on the left.
- The default displays all of the parameters.

Figure 314: Parameters Tab

- 2 Click the check box next to a parameter to set or clear the check mark for that parameter.

Checked parameters are displayed in the Parameters Status table.

For details about each of the parameters in the Parameters Status table, see [Using the Parameters Status Table in Target Emulator](#)”.

Chapter 24

Using Target Emulator

In this chapter:

- Loading a Configuration File
- Launching the Target Emulator Device Window
- Target Emulator Device Menu Bar
- Output/Status/Buffers Pane
- Profile Tab
- Immediate Execution Tab
- Macro File Tab
- Compiled Test Tab
- Setting up a test with Target Emulator and HBA

After you have discovered and locked the Target Emulator ports you want to use and also set up your capturing and monitoring applications, such as Xgig Analyzer or Bus Doctor, you are ready to run the Xgig Target Emulator application. This chapter explains the process of managing and executing all of the configuration files for your device.

Loading a Configuration File

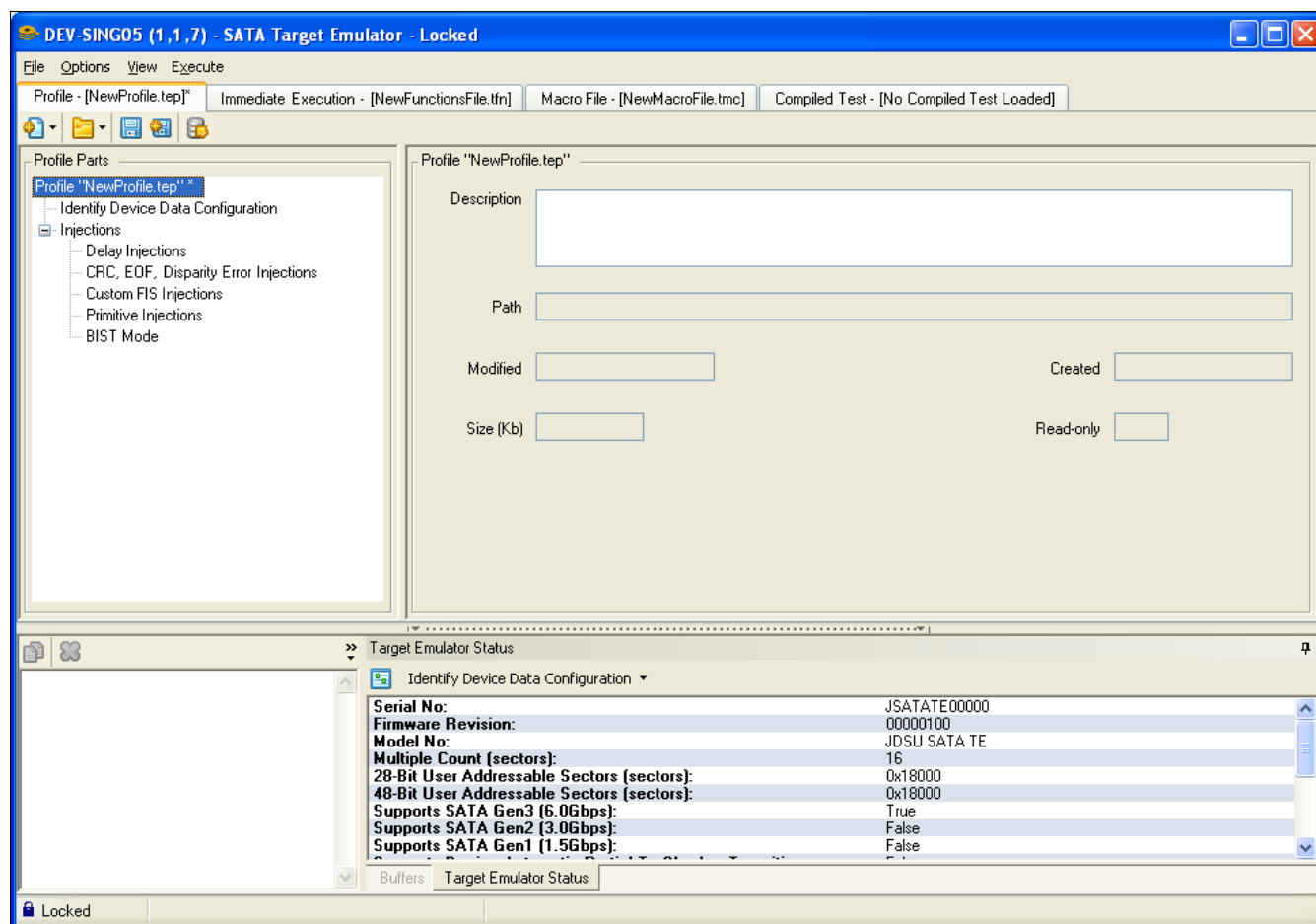
The Target Emulator Device window represents the device selected in the ports manager on the Target Emulator tab. This window contains tabs for profiles, functions, macros and compiled tests. This chapter discusses the functionality of each tab.

To access the Target Emulator Device window you need to load a profile file, functions file, macro file, or compiled test file to a device.

To load a functions, macro, or compiled test file to a port, locate the file you want to load in the Configuration window, then drag the file to the port, and drop it.

Launching the Target Emulator Device Window

Figure 315: Target Emulator Device Window



You can open the Target Emulator Device window (Figure 315) from either the Parameters status table or the Ports Manager.

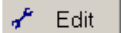
To open the Target Emulator Device window for a device from the **Parameters Status table**, Click the **Edit**  button on the Parameters Status table.

The **SAS Target Emulator** window is displayed.

To open the Target Emulator Device window for a device from the **Ports Manager**:

- 1 Check the **Select** check box next to your device in the **Ports Manager**.
- 2 Click the **Macro Operations** button or the **Compiled Test Operations** button for the device.

The respective Operations window is displayed.

- 3 Click the **Edit**  button to open the Target Emulator Device window.

Once the window is open, select the tab you want to use.

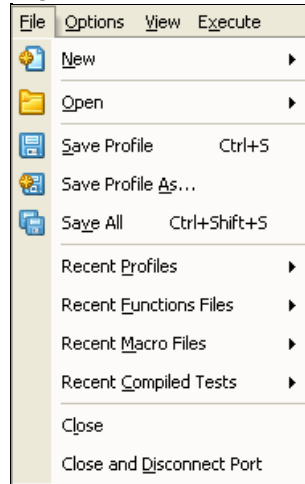
Target Emulator Device Menu Bar

The menu bar at the top of the Target Emulator Device window contains the following menus.

File

The File menu (Figure 316) allows you to create a new configuration or open an existing or recently-used configuration file for editing. You can also close the application from this menu.

Figure 316: File Menu



To create a new profile, macro or functions file:

- >> Select **New**, then select:
 - New Profile
 - New Profile from Port
 - New Functions File
 - New Macro File

A blank file is opened on the tab for the file type you selected.

To open an existing profile, functions, macro, or compiled test file:

- >> Select **Open**, then select:
 - Open Profile
 - Open Functions File
 - Open Macro File
 - Open Compiled Test

The file is opened on the tab for the file type you selected.

To Save the currently displayed file:

- >> Select **Save Macro file “...”**

To Save the currently displayed file as another name or to another location:

- >> Select **Save Macro file “...” As**

To Save all open files:

>> Select **Save All**.

To open a recently-used functions, macro, or compiled test file:

- 1 Select one of the following:
 - Recent Profiles
 - Recent Macro Files
 - Recent Functions Files
 - Recent Compiled Test Files
- 2 Click on the file you want to open.

The file is opened on the tab for the file type you selected.

To close the Target Emulator Device window, click **Close**.

To close the Target Emulator Device window and disconnect the port for the device, click **Close and Disconnect Port**.

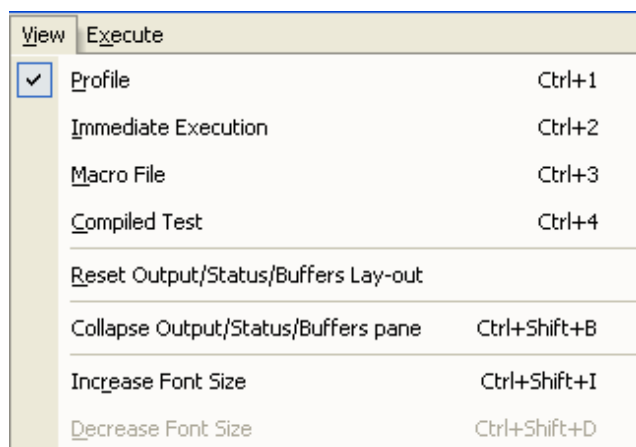
Options

The **Options** menu lets you select or unselect the option to confirm profile item deletion. When the **Confirm Profile Item Deletion** option is selected, a message box will verify first if you are really want to remove a profile like an error injection.

View

The View menu allows you to switch between tabs in the Target Emulator Device window by clicking the entry for the desired tab. This menu also allows you to collapse/expand the Function Browser pane, which is the left pane containing the function library on the left, or to collapse/expand the Output/Status/Buffers pane, which is the bottom pane. These two panes are not shown in the Compiled Test window.

Figure 317: View Menu

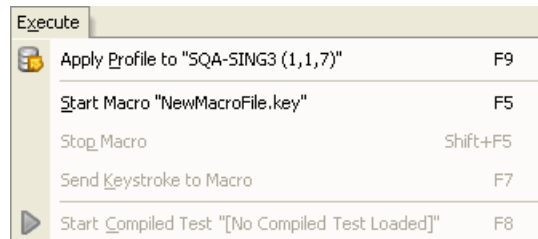


Execute

The Execute menu provides the following choices for macros:

- **Apply Profile** applies the selected profile to the port.
- **Start Macro** executes the currently loaded macro file.
- **Stop Macro** stops the execution of a macro
- **Send Keystroke to Macro** simulates a keystroke to stop looping during macro execution. This selection is active only if the `loopk` function is invoked in your macro. Refer to the description for `loopk` in the function library.
- **Start Compiled Test** executes the currently loaded compiled test file.

Figure 318: Execute Menu



Output/Status/Buffers Pane

This pane is located at the bottom of the **Profile**, **Immediate Execution**, **Macro File** and **Compiled Test** tabs. It allows you to set the debug level, view the output and status of executed functions and macros, edit buffers, and set status viewing options.

You can also click and drag on the Buffer/Status pane to move it to a different location, float the window, or dock them back to the TE Device Window.

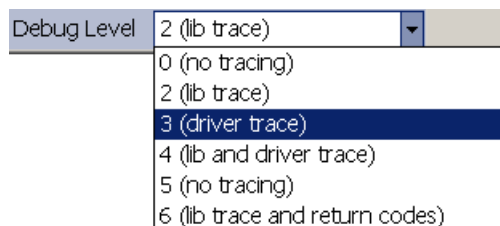
Setting the Debug Level

To view the debug level control, make sure the bottom pane of the window is expanded. If it is not, select **Expand Output/Status/Buffers pane** from the **View** menu. The debug control is located on the **Output/Status** tab.

The following debug levels are available:

- 0 (no tracing) does not display any traces
- 2 (lib trace) displays library traces
- 3 (driver trace) displays driver traces
- 4 (lib and driver trace) displays both library and driver traces
- 6 (lib trace and return codes) displays library traces and return codes

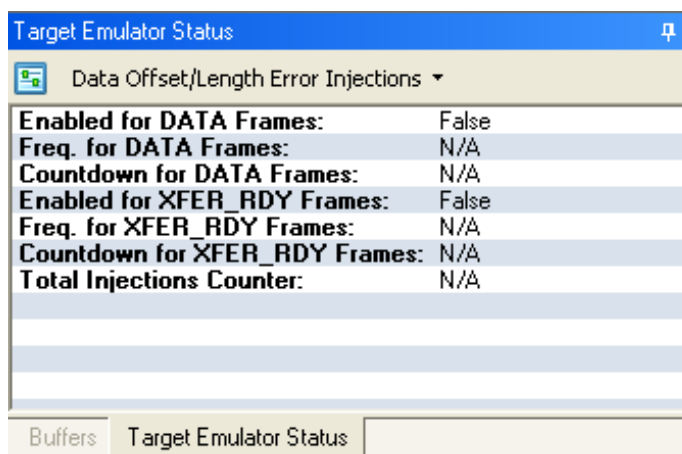
The default debug level is 2, which displays library traces only. To set the debug level, click the Debug Level drop-down menu, and select the appropriate debug level.

Figure 319: Setting the Debug Level

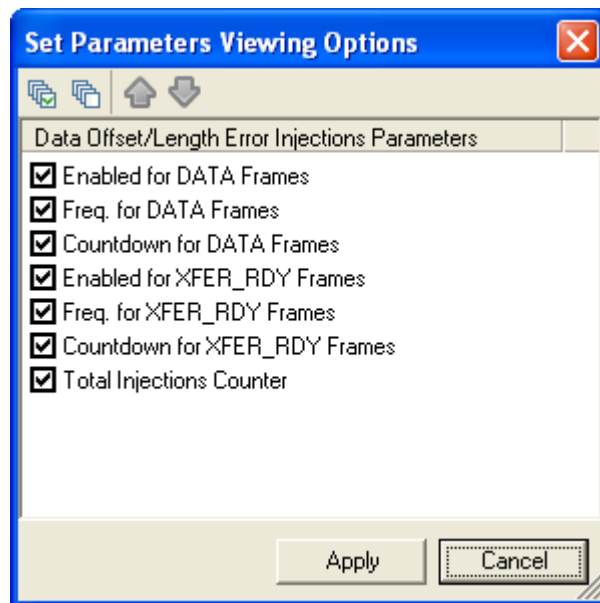
Setting the Status Viewing Information

The status of the device selected in the Parameters Status table is displayed in the Status pane of the Target Emulator Device window.

To view the status of the device, make sure the bottom pane of the window is expanded. If it is not, select **Expand Output/Status/Buffers** pane from the **View** menu. The Status information is located on the **Target Emulator Status** tab (refer to [Figure 320](#)).

Figure 320: Status Information for Selected Device

The parameters listed in the Status pane correspond to those shown in the Parameters Status table for the device. For a definition of these categories, refer to “[Using the Parameters Status Table in Target Emulator](#)” on page 416.

Figure 321: Set Parameters Viewing Options Window

To select which parameters you want to display in the Status pane:

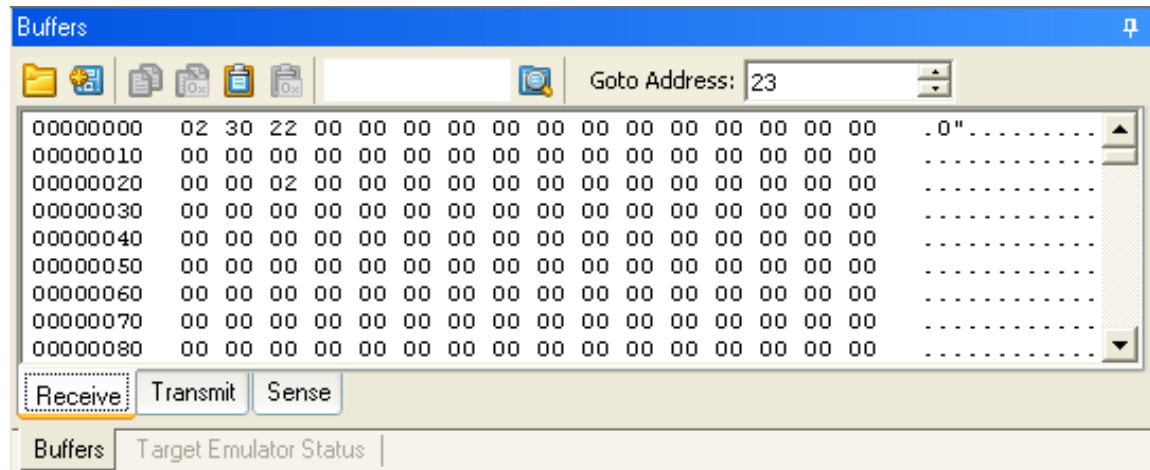
- 1 Click the **Set Parameters Viewing Options**  button.
- 2 The **Set Parameters Viewing Options** window appears.
- 3 Select which parameters you want to view in the Status pane.
- 4 Use the **Move Up/Move Down**   buttons to arrange the order of the parameters.
- 5 Click **Apply**.

The information displayed on the Target Emulator Status is updated whenever a change in the profile is done and sent to the port.

Accessing the Buffer Editor

The Buffer Editor enables you to view and manipulate the transmit, receive, and sense buffers. A buffer is a .bin file that displays data used in SCSI data frames. SCSI data is sent from the transmit buffer and to the receive buffer during SCSI I/O operations. The sense buffer displays the sense data of the most recent commands containing that data. Refer to the `dmaset()`, `dmast()`, `get_g_info("bufsz")`, `get_g_info("tx_ptr")`, and `get_g_info("rx_ptr")` functions for more information.

To access the buffer editor, open the Target Emulator Device Window. Then, click on the **Buffers** tab on the lower pane (refer to [Figure 322](#)).

Figure 322: Buffer Editor

Data is shown in both hexadecimal and ASCII.

Opening a Buffer File

To open a buffer file:

- 1 Select the tab for the type of buffer you want to open, specifically **Receive**, **Transmit**, or **Sense**.
- 2 Click the **Folder**  icon in the top left corner of the pane.
- 3 Browse to the buffer file you want to open.
- 4 Click OK.

The buffer file is displayed in the buffer pane.

Editing a Buffer

Both the hexadecimal and ASCII fields in the read and write buffers can be edited. The Address field indicates the selected position.

To edit a buffer file:

- 1 Move to the desired cell using the **GotoAddress** field or by typing text into the **Search** field.
- 2 Type an appropriate value. If you are editing a hexadecimal value, the ASCII value changes accordingly, and if you are editing an ASCII value, the hexadecimal value changes accordingly.
- 3 Use the **Copy**  icon to copy a selection of the buffer, and then use the **Paste**  icon to paste the selected contents into another buffer, into the current buffer, or into a text editor as ASCII.
- 4 Alternatively, you can use the **Copy as a hex string**  icon to copy a selection of the buffer as a hex string and use the **Paste as a hex string**  icon to paste the selected contents into another buffer, into the current buffer, or into a text editor as a hex sting.
- 5 You can also do the following:

- Copy a section from another buffer file and paste it into the current file or visa versa using the right-click menu. This menu also contains the option to copy/paste as ASCII or as a hex string.
 - Paste another buffer file into the current file at an insertion point by using the right-click menu.
- 6 Save the buffer file by selecting the **Save** icon in the top, left corner of the pane. Saving a buffer, saves the data on all three tabs into a single file.

Profile Tab

After you have configured a Target Emulator device, you can use the Profile tab to create Target Emulator profiles and apply them to the locked Target Emulator ports.

Profile Action buttons

New Profile

There are two options when you create a profile. These options can be accessed by clicking the inverted triangle beside the button. Selecting **New Profile from Port** will create a new profile based on the profile currently loaded to the port. If you select **New Profile**, a new blank profile with all the default settings will be created.

Open Profile

To load a previously saved profile, click **Open Profile**. You can also click on the inverted triangle to show a list of recent profiles opened. Clicking the Open Profile button opens the **Open Target Emulator Profile** window where you can browse for, and select the profile to open.

Save Profile

To save changes to the current profile, click **Save Profile**.

Save Profile As

To create a new profile with the changes to the current profile, click **Save Profile As**. The **Save Target Emulator Profile As** window will open where you can enter a new name for the file and browse for the preferred location of the new profile.

Apply Profile to Port

Once you are done editing the profile, you can now apply it to the port. Click **Apply Profile to Port**.

Profile Parts Pane

This pane lists the parts of the profile. When you select a part name from the pane, the Parts Option pane will show the options available for that part.

Profile Parts in SAS Mode

The following parts are available when the locked port is in SAS Mode.

Profile

This part gives the details of the Profile file. You can enter a description for the current profile to better describe it.

Target Characteristics

The main function of Target emulator is to emulate a target storage device. You can set the device characteristics with these options.

Speed Negotiation

These options lets you set the speed settings to be used between the emulated target and the host or initiator. To know more about speed settings, refer to [“Speed” on page 335](#).

Custom Commands

You can add, edit or delete custom SCSI commands for the profile from these options.

To add a custom command, click **Add Custom Command**. A new entry under the Custom Command pane will be added.

To customize that command, select it. The options on the right side of the pane will become available. Adjust the settings according to your test preferences.

You can add up to sixteen (16) custom commands.

Injectons

Aside from creating a virtual storage device or target, Target Emulator also gives you the option to inject different types of errors into the responses sent to the host or initiator. This allows you to create a number of scenarios to fully test your devices.

The following are the different error injection types that can be configured into Target Emulator device profile's responses.

Break, Hard Reset, Reset Seq. Injections

Inject Reset, Hard Reset, and Break sequences in frames sent by the target depending on the request command.

CRC, EOF, Disparity Error Injections

Inject CRC, EOF, or Disparity errors in frames sent by the target.

Data Miscompare Injections

Inject Data Miscompare errors in frames sent by the target.

Data Offset/Length Error Injections

Inject errors in data offset or data length fields of Data and XFER_RDY frames sent by the target.

Delay Injections

Insert delays for target responses (DATA, Response, or XFER_RDY frames) depending on the request.

Frame Field Replacements

Replace a portion of a frame sent by the target with a given data pattern.

Status and Sense Injections

Inject status and sense data in response frames sent by the target, depending on the response frames.

Profile Parts in SATA Mode**Identify Device Data Configuration**

This part lets you customize the IDENTIFY DEVICE data of the Target Emulator Port. Some parameters of the IDENTIFY DEVICE data cannot be changed hence the options for these locked parameters are not displayed in the Parts Options Pane.

The following table lists modifiable Identify Device Data fields supported by the SATA Target Emulator:

Table 17: List of Supported Modifiable Identify Device Data Fields

Word	Description	Default Value
10-19	Serial Number - 20 ASCII characters	JSATATE00000
23-26	Firmware Revision - 8 ASCII characters	00000100
27-46	Model Number - 40 ASCII characters	JDSU SATA TE
47	7:0 Multiple Count - 0x00 = Reserved - 0x01 - 0x10 = Maximum number of logical sectors that shall be transferred per DRQ block on READ/WRITE MULTIPLE commands (0x01, 0x02, 0x04, 0x08 or 0x10 only) - 0x11 - 0xFF = Reserved	0x10
60-61	Total Number of User Addressable Logical Sectors - Maximum value is 0x0FFFFFFF	0x00018000

Table 17: List of Supported Modifiable Identify Device Data Fields

Word	Description	Default Value
76	14 Supports Device Automatic Partial to Slumber transitions	0
	13 Supports Host Automatic Partial to Slumber transitions	0
	11 Supports Unload while NCQ commands outstanding	1
	9 Supports receipt of host-initiated power management requests	1
	8 Supports Native Command Queuing	1
	3 Supports Serial ATA Gen 3 signalling speed (6.0Gbps) - The SATA Target Emulator attempts speed negotiation at 6.0Gbps, if this Bit is 1.	1
	2 Supports Serial ATA Gen 2 signalling speed (3.0Gbps) - The SATA Target Emulator attempts speed negotiation at 3.0Gbps, if this Bit is 1 and Word 76 Bit 3 is 0.	0
	1 Supports Serial ATA Gen 1 signalling speed (1.5Gbps) - The SATA Target Emulator attempts speed negotiation at 1.5Gbps, if this Bit is 1, both Word 76 Bit 3 and Word 76 Bit 2 are 0.	0
78	3 Device supports initiating interface power management - The SATA Target Emulator will only initiate interface power management when it is in STANDBY mode. - STANDBY mode can be achieved by issuing a Standby Immediate ATA command to the target emulator. - When initiating interface power management, the target emulator issues PMREQ_S primitives to the host.	1
82	10 Host Protected Area feature set supported	1
83	10 48-bit Address feature set supported	1
84	13 IDLE IMMEDIATE with UNLOAD FEATURE supported	1
	6 WRITE DMA FUA EXT and WRITE MULTIPLE FUA EXT commands supported	1
100-103	Total Number of User Addressable Logical Sectors for 48-bit Address feature set - Maximum value is 0x0000FFFFFFFFFFFF	0x00000000000018000

Injections

Delay Injections

Inject delays for different FIS Types.

CRC, EOF, Disparity Injections

Inject CRC, EOF, or Disparity errors in FIS sent by the target.

Custom FIS Injections

Inject customized FIS or Frame Information Structure. A FIS is a group of Dwords that convey information between host and device as described previously. The boundaries of the FIS are defined by primitives. The primitives may be also be inserted to control the rate of the information flow. You can customize the FIS Frame from the Parts Options pane.

Primitive Injections

Injects SATA Primitives to FIS Frame. You can select the Primitive type to inject, how many of that primitive is injected, and the frequency.

BIST Mode

The Built In Self Test (BIST) Mode is intended for Inspection/Observation Testing, as well as support for conventional laboratory equipment, rather than for in-system automated testing. Using this part of the profile, you can inject the BIST Activate FIS used to place the receiver in one of several loopback modes. You can also set a user-defined loopback mode pattern definition.

Parts Options Pane

As you select the profile part on the Profile Parts pane, the options for that selected part will appear on the Parts Option Pane. To know the different parameters for the Target Emulator profile, refer to [“Using the Parameters Status Table in Target Emulator” on page 416](#).

When you edit an option for the profile part, you can immediately apply that change into the port by clicking the **Apply Profile Part** button. The Parameter Status table of that port will be updated to reflect the change.

The following parts configures the Target characteristics for ports in SAS Mode:

Target Characteristics

Characteristics for the emulated target are set under this option.

Speed Negotiation

This part lets you set the speed negotiation options for the emulated target.

Custom Commands

This part lets you add, edit or delete custom SCSI commands for the profile from these options.

For the Port in SATA Mode, you have the following part for the device:

Identify Device Data Configuration

The options pane for this part is divided into three columns:

- **Word** - this column lists the Word numbers
- **Description** - this column lists the description for the Word. This column also allows you to customize the word. To do so, select the checkbox of the particular parameter to enable that parameter. You can customize the value for those parameters that have an optional text entry box.
- **Value** - The Hex values are arranged according to the correct endian format as stated in the ATA specifications (the least significant byte first for 16-bit values, and the least significant word first for greater or equal to 32-bit values) as reflected in the IDENTIFY DEVICE data.

Injections in SAS Mode

Break, Hard Reset, Reset Seq. Injections

There are three (3) tabs for this error type:

Break Sequence Errors

To add a break sequence error do the following:

- 1 Click the **Add Injection** button.
A new custom command will be added to that list. You can add up to 10 custom commands.
- 2 Click the custom command in the list to enable the options on the right side of the pane.
- 3 Edit the SCSI Command Code as needed.
- 4 Edit the Frequency, or the number of times the request frames are detected before the requested changes are injected into the frame.

To delete a break sequence error:

- 1 Select the custom command to delete from the list.
- 2 Click **Remove Injection**.

Hard Reset Sequence Errors

To add a hard reset sequence error do the following:

- 1 Click the **Add Injection** button.
A new custom command will be added to that list. You can add up to 10 custom commands.
- 2 Click the custom command in the list to enable the options on the right side of the pane.
- 3 Edit the SCSI Command Code as needed.

- 4 Edit the Frequency, or the number of times the request frames are detected before the requested changes are injected into the frame.

To delete a hard reset sequence error:

- 1 Select the custom command to delete from the list.
- 2 Click **Remove Injection**.

Reset Sequence Errors

To add a reset sequence error do the following:

- 1 Click the **Add Injection** button.
A new custom command will be added to that list. You can add up to 10 custom commands.
- 2 Click the custom command in the list to enable the options on the right side of the pane.
- 3 Edit the SCSI Command Code as needed.
- 4 Edit the Frequency, or the number of times the request frames are detected before the requested changes are injected into the frame.

To delete a reset sequence error:

- 1 Select the custom command to delete from the list.
- 2 Click **Remove Injection** button.

CRC, EOF, Disparity Error Injections

You can insert an CRC, EOF, or Disparity Error injection for each of the request frame types.

To insert CRC errors for any of the request frames (Response, DATA, or XFER_RDY frame):

- 1 Select **Insert CRC Errors** checkbox under the **Response Frame Errors**, **DATA Frame Errors**, or **XFER_RDY Frame Errors** pane.
- 2 Edit the frequency, or the number of times the request frames are detected before the requested changes are injected into the frame.

To insert EOF errors for any of the request frames (Response, DATA, or XFER_RDY frame):

- 1 Select **Insert EOF Errors** checkbox under the **Response Frame Errors**, **DATA Frame Errors**, or **XFER_RDY Frame Errors** pane.
- 2 Edit the frequency, or the number of times the request frames are detected before the requested changes are injected into the frame.

To insert Disparity errors for any of the request frames (Response, DATA, or XFER_RDY frame):

- 1 Select **Insert Disparity Errors** checkbox under the **Response Frame Errors**, **DATA Frame Errors**, or **XFER_RDY Frame Errors** pane.
- 2 Edit the frequency, or the number of times the request frames are detected before the requested changes are injected into the frame.

Data Mismatch Injections

You can set Target Emulator to insert data mismatch errors to the frames sent by the target.

To insert data mismatch errors:

- 1 Select **Enable data mismatch error injection** checkbox.
- 2 Set the byte range where the original data will be replaced by setting the start and end bytes of the range.
- 3 Enter the data pattern that will replace the original data.
- 4 Enter the frequency, or the number of times the request frames are detected before the requested changes are injected into the frame.

Data Offset/Length Error Injections

You can set Target Emulator to inject errors in data offset or data length fields of Data and XFER_RDY frames sent by the target.

To have a DATA frame error injection:

- 1 Select **Enable data offset and data length error injection** checkbox in the **DATA Frame Error Injection** pane.
- 2 Set the value of the “Data Offset” field in the frame header.
- 3 Set the value of the data payload length.
- 4 Enter the frequency, or the number of times the request frames are detected before the requested changes are injected into the frame.

To have an XFER_RDY frame error injection:

- 1 Select **Enable data offset and data length error injection** checkbox in the **XFER_RDY Frame Error Injection** pane.
- 2 Set the value of the “Data Offset” field in the frame header.
- 3 Set the value of the data payload length.
- 4 Enter the frequency, or the number of times the request frames are detected before the requested changes are injected into the frame.

Delay Injections

You can insert delays for target responses (DATA, Response, or XFER_RDY frames) depending on the request.

There are three (3) tabs for this error type:

Delays for Response Frames

To add a custom command with delays, do the following:

- 1 Click the **Add Injection** button.
A new custom command will be added to that list. You can add up to 10 custom commands.
- 2 Click the custom command in the list to enable the options on the right side of the pane.
- 3 Edit the SCSI Command Code as needed.
- 4 Enter the delay time (in milliseconds).
- 5 Edit the Frequency, or the number of times the request frames are detected before the requested changes are injected into the frame.

To delete the delay injection:

- 1 Select the command with the delay injection to delete.
- 2 Click **Remove Injection**.

Delays for DATA Frames

To add a custom command with delays, do the following:

- 1 Click the **Add Injection** button.
A new custom command will be added to that list. You can add up to 10 custom commands.
- 2 Click the custom command in the list to enable the options on the right side of the pane.
- 3 Edit the SCSI Command Code as needed.
- 4 Enter the delay time (in milliseconds).
- 5 Edit the Frequency, or the number of times the request frames are detected before the requested changes are injected into the frame.

To delete the delay injection:

- 1 Select the command with the delay injection to delete.
- 2 Click **Remove Injection**.

Delays for XFER_RDY Frames

- 1 Click the **Add Injection** button.
A new custom command will be added to that list. You can add up to 10 custom commands.
- 2 Click the custom command in the list to enable the options on the right side of the pane.
- 3 Edit the SCSI Command Code as needed.
- 4 Enter the delay time (in milliseconds).
- 5 Edit the Frequency, or the number of times the request frames are detected before the requested changes are injected into the frame.

To delete the delay injection:

- 1 Select the command with the delay injection to delete.
- 2 Click **Remove Injection**.

Frame Field Replacements

Frame Field replacement error injection replaces a portion of a frame sent by the target with a given data pattern.

You can set Frame Field replacement injections for Response Frame Field, DATA Frame Payload, and XFER_RDY Frame Field.

To have Frame Field replacement injections for Response Frames:

- 1 Select **Enable frame field replacement** checkbox under the **Response Frame Field Replacement**.
- 2 Set the number of bytes to replace.
- 3 Set the starting byte number to replace.
- 4 Enter the pattern to be used for replacement.
- 5 Set the frequency, or the number of times the request frames are detected before the requested changes are injected into the frame.

To have Frame Field replacement injections for DATA Frames:

- 1 Select **Enable frame payload replacement** checkbox under the **DATA Frame Payload Replacement**.
- 2 Set the number of payload bytes to replace.
- 3 Set the starting payload byte number to replace.
- 4 Enter the pattern to be used for replacement.
- 5 Set the frequency, or the number of times the request frames are detected before the requested changes are injected into the frame.

To have Frame Field replacement injections for XFER_RDY Frames:

- 1 Select **Enable frame field replacement** checkbox under the **XFER_RDY Frame Field Replacement**.
- 2 Set the number of bytes to replace.
- 3 Set the starting byte number to replace.
- 4 Enter the pattern to be used for replacement.
- 5 Set the frequency, or the number of times the request frames are detected before the requested changes are injected into the frame.

Status and Sense Injections

You can inject status and sense data in response frames sent by the target, depending on the response frames.

To add a custom command with status and sense error injections, do the following:

- 1 Click the **Add Injection** button.
A new custom command will be added to that list. You can add up to 10 custom commands.
- 2 Click the custom command in the list to enable the options on the right side of the pane.
- 3 Edit the SCSI Command Code as needed.
- 4 Enter the Response Status.
- 5 Enter the Sense Key.
- 6 Set the Sense Data Length
- 7 Set the ASC.
- 8 Set the ASCQ.
- 9 Edit the Frequency, or the number of times the request frames are detected before the requested changes are injected into the frame.

To delete the delay injection:

- 1 Select the command with the delay injection to delete.
- 2 Click **Remove Injection**.

When you edit an option for the profile part, you can immediately apply that change into the port by clicking the **Apply Profile Part** button. The Parameter Status table of that port will be updated to reflect the change.

Injections in SATA Mode

Delay Injection

You can inject delays on the transmitting frame.

To set delay injections:

- 1 Select the FIS type from the **Delay Injections** pane.
- 2 Specify how long the delay is in the Delay field. You can also use the up or down buttons to adjust the value.
- 3 Specify how frequent the delays will be injected in the **Frequency** field.

Example:

If you set a delay time of **5** seconds and a frequency of **4**, a delay of **5 seconds** will be injected every **4th frame**.

- 4 Click **Apply Profile Part** to send the changes to the port. The Target Emulator Status will be updated.

CRC, EOF, Disparity Error Injections

You can insert a CRC, EOF, or Disparity Error injection for each of the FIS types.

To insert a CRC, EOF or Disparity Error for a FIS Type:

- 1 Select the error type under the specific FIS Errors pane.
- 2 Specify the number of request frames to detect before emitting a modified frame.
Note that only one type of error is allowed per FIS type. Once you select one, the other error types are disabled.
- 3 Click **Apply Profile Part** to send the changes to the port. The Target Emulator Status will be updated.

Custom FIS Injections

You can modify a particular FIS with Customized FIS contents.

To create a customized FIS to be injected after a specific FIS type:

- 1 Select the FIS Type from the **Custom FIS Injections** pane.
- 2 Specify the size of the custom FIS in the Custom FIS Size field.
- 3 Set the frequency of injection for the custom FIS.
- 4 Customize the FIS frame by directly editing the Hex values of the DWords in the **Custom FIS Frame box**.
- 5 Click **Apply Profile Part** to send the changes to the port. The Target Emulator Status will be updated.

Primitive Injections

You can control the injection of primitives.

To inject SATA primitives:

- 1 Select the FIS type where SATA primitives will be injected.
- 2 Select the primitive type from the **Primitive** drop-down menu.
- 3 Set the number of the specified primitive to be injected in the **Primitive Count** field.
- 4 Specify the number of FIS frame occurrence of the specified FIS type before injecting the primitive in the **Frequency** field.

Example:

You selected **0x46 Data FIS** from the Primitive Injections pane, selected a primitive type of **PMNAK**, specified a primitive count of **16** and frequency of **2**. This means that for every 2 blocks of 0x46 Data FIS frames transmitted, 16 PMNAK primitives will be injected after the transmission of the second block of 0x46 Data FIS.

- 5 Click **Apply Profile Part** to send the changes to the port. The Target Emulator Status will be updated.

BIST Mode

You can send out the BIST Activate FIS with your customized parameters. The BIST Activate FIS is transmitted to tell the Host to initiate a Built In Self Test (BIST).

To customize the BIST Activate FIS:

- 1 Select the pattern definition from the **Patter Definition** drop-down menu. This parameter defines the Pattern Definition byte in the BIST Activate FIS frame. If you select User defined BIST mode, you can set the 1 byte hex value of the pattern definition in the **Value** field.
- 2 Enter a 4 byte hex value for **Data 1** and **Data 2** field. The **Data 1** and **Data 2** parameters define the data information used to determine what pattern is transmitted as a result of the BIST Activate FIS.
- 3 Click **Apply Profile Part** to send the changes to the port. The Target Emulator Status will be updated.

Immediate Execution Tab

After you have configured a Generator device, you can use the Immediate Execute tab to execute individual functions, or to create, edit, and execute functions files.

The **Immediate Execution** window is comprised of two panels. The left panel is the contents pane. It lists the functions present in the functions file. See Creating a Functions File below.

The right pane is the function library. Each of the functions in the library are represented in the API Help System on the product CD. The functions in the library are listed in the contents pane by name; current parameters in hexadecimal; and the parameter types: b (byte), d (dword), q (quad), s (string parameter), w (word), and o (optional parameter), which currently cannot be edited or added; and the function category.

You can sort the functions in either pane in the following ways:

- Alphabetically in ascending or descending order by toggling the Function Name heading.
- By category with the categories alphabetically in ascending or descending order by toggling the Function Type heading.
- By parameter types with the parameter types listed by number of parameters from most to least or from least to most by toggling the Parameter heading.

Click the **Clear Filter**  icon to remove the filters you have applied by typing text into the search field and revert to viewing all functions in the functions library.

To view the details of the functions in the library or the contents pane, click the **Show/Hide Function Info**  button at the top of the pane. The details for each function correspond to an entry in the Generator API Help available from the Help menu in the Maestro main window. To display the contents of the information pane for the selected function in a popup window, click the **Display Help Contents in Popup Window**  button.

As you begin to click various functions in the function library or the contents pane, while you have the Show Function Info pane open, you create a history of the functions you've selected. You can navigate back and forth through the functions you've selected by using the **Go Back** and **Go Forward**  buttons at the top of the Function Information pane. You can execute a function from the Immediate Execution tab of the Generator Device window or from the Parameters Status table in the Maestro window.

Editing Function Parameters

To edit a function's parameters inline:

- 1 Right-click the function, and select Edit Parameters Inline.
- 2 Type directly in the parameters field to edit inline, or click the arrow at the end of the field to open a drop-down window.

This window is the same as the Popup Parameters Editor.

To edit a function's parameters using the Popup Parameters Editor:

- 1 Right-click the function, and select Popup Parameters Editor.
- 2 The Popup Parameters Editor appears with the following options in the menu:
 - Apply and execute
 - Apply and close
 - Discard and close
 - Reset parameter values
 - Show parameters info

Depending on the function, the following parameters may be available for editing:

Display - Displays the values in hexadecimal or decimal, depending on the field selected. Use the drop-down menu to change the display.

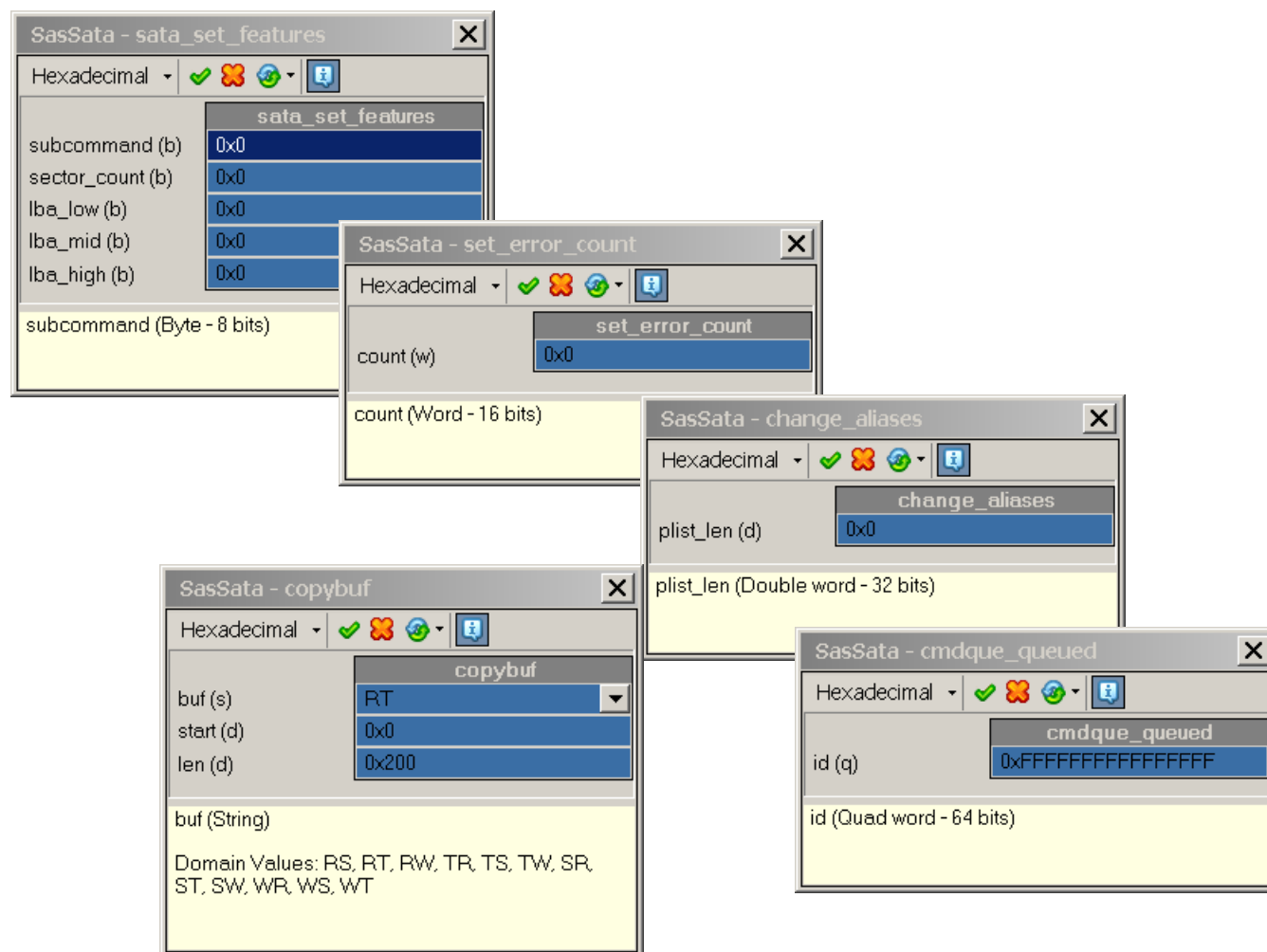
Byte - Byte- or bit-specific data. A byte is equal to 8 bits.

Word - Word or short integer data. A word is equal to 16 bits.

Double - Double word or long integer data. A double word is equal to 32 bits.

Quad - A quad is equal to 64 bits or 4 words.

String - Constant text or string data. Enter data without quotation marks.

Figure 323: Popup Parameters Editor Window

Executing a Function on a Generator Device

You can execute an individual function from the Contents pane or from the Function Library.

To execute a function from the Generator Device window:

- 1 Locate the function you want to execute in the function library or contents pane of the window by using the scroll bar or by typing the name of the function into the **Search Function** field.
- 2 Set the parameters as necessary for the selected function. The right-click menu provides editing options. These options are described in [“Editing Function Parameters”](#).
- 3 Click the **Start**  button to execute the function.

You can also perform immediate function execution from the Parameter status table in the Maestro window.

To execute a function from the Parameters Status table:

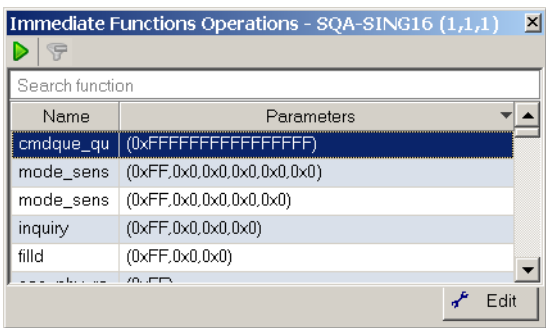
- 1 Click the **Start**  button on the Parameters Status table next to the Immediate Function Execution field.

Figure 324: Parameters Status table Start Function Button

SAS/SATA XGIGD1 (1.3.3)	
State	 Stopped
Configuration	Edit...
Immediate Function Execution	 SASBuffer.gln
Macro File Operations...	 SASRandomRead.key
Compiled Test Operations...	 sample2.exe
Function Statistics	

The Immediate Functions Operations window is displayed.

Figure 325: Immediate Functions Operations Window



- 2 Locate the function you want to execute by using the scroll bar or by typing the name of the function into the **Search Function** field.
- 3 Set the parameters as necessary for the selected function. The right-click menu provides editing options. These options are described in “[Editing Function Parameters](#)”.
- 4 Click the **Start**  button to execute the function.

Opening a Functions File

To open a recently used Xgig Generator functions file:

- 1 Click the arrow next to the **Open Functions file**  button in the menu bar.
- 2 Click the functions file you want to open.

An **Immediate Execution** window appears with the functions file loaded.

To browse to a functions file, and open it:

- 1 Click the **Open Functions file**  button in the menu bar.
- 2 Browse to the functions file you want to open.
- 3 Click the **Open** button.

An **Immediate Execution** window appears with the functions file.

Creating a New Functions File

A functions file is a .gfn file that contains a list of functions. You can use a functions file as a repository to group a specified set of functions with a certain set of parameters. You can also use a functions file to define and maintain the order of a group of functions for use in a macro file. In addition, you can select, edit parameters for, and execute individual functions from a function file.

To create a new macro or functions file using the **File** menu:

>> Select **New**, then select **Functions File**

To create a new functions file from the Contents pane, click the **New Generator Functions File**  icon in the Contents pane menu bar.

A blank file is opened on the tab.

Adding Functions to a Functions File

To add a function from the function library to the functions file:

- 1 Click the index position in the Contents pane where you want to add a function.
- 2 Click the function in the function library that you want to add to the functions file.
- 3 Click the **Send Selected Function to Functions File**  button.

The function appears in the Contents pane at the selected index position.



Note: A convenient shortcut for adding functions to a file is to hold down the Ctrl button on your keyboard, then click and drag the function file to the Contents pane.

- 4 Click the Save or Save as button at the top of the window to save the functions file.
- 5 Click the Done button to close the window.

Moving Functions within a Functions File

To move a function up or down in within the functions file:

- 1 Click the function you want to move.
- 2 Click the **Move Up/Move Down**  buttons at the top of the Contents pane.

To remove a function you have added to your functions file:

- 1 Click the function you want to remove from the file.
- 2 Click the **Delete Selected User Function**  button at the top of the Contents pane.

You can also interchange one function with another, move a function for another index location, or copy a function to another index location by right-clicking the function and selecting the appropriate action.

Saving a Functions File

To save a functions file, click the **Save**  button.

To save the file as another name or to another location:

- 1 Click the **Save As**  button.

The **Save/Save As** dialog appears.



Note: If you want to use the standard Windows file dialogs instead of the dialogs customized for Generator, select **Use Standard Windows File Dialogs** from the **Options** menu in the Generator Device window menu bar.

- 2 Navigate to the location where you want to save the file.
- 3 Type a name for the file.
- 4 Click **Save**.
- 5 Click the **Done** button to close the window. If you make changes to the file and then click try to close the window, you will receive prompt asking you if you want to save the file before closing it.

Macro File Tab

Opening a Macro File

To open a recently used Xgig Generator macro file:

- 1 Click the arrow next to the **Open Macro file**  button in the menu bar.
- 2 Click the macro file you want to open.

A macro window appears with the macro loaded.

To browse to a macro file and open it:

- 1 Click the **Open Macro file**  button in the menu bar.
- 2 Browse to the macro file you want to open.
- 3 Click the **Open** button.

A macro window appears with the macro loaded.

Editing a Macro File

The macro editor enables you to easily create macros for automating a test sequence. Macros are ideal for non programmers because they are quick and easy to create and don't require a C compiler or knowledge of C programming. The macro language, however, has limitations. You can't write a macro test that takes pointers or addresses as function parameters.

A macro file is a .key file that can be created with any ASCII editor or by using the Macro File Editor. A macro file can contain up to 62 user-defined macro tests (0–9, A–Z, and a–z). Each macro test contains a sequence of functions to be called upon when invoking the macro test. In addition to functions, macro tests can also include variables, branches, jumps, loops, and macro functions.



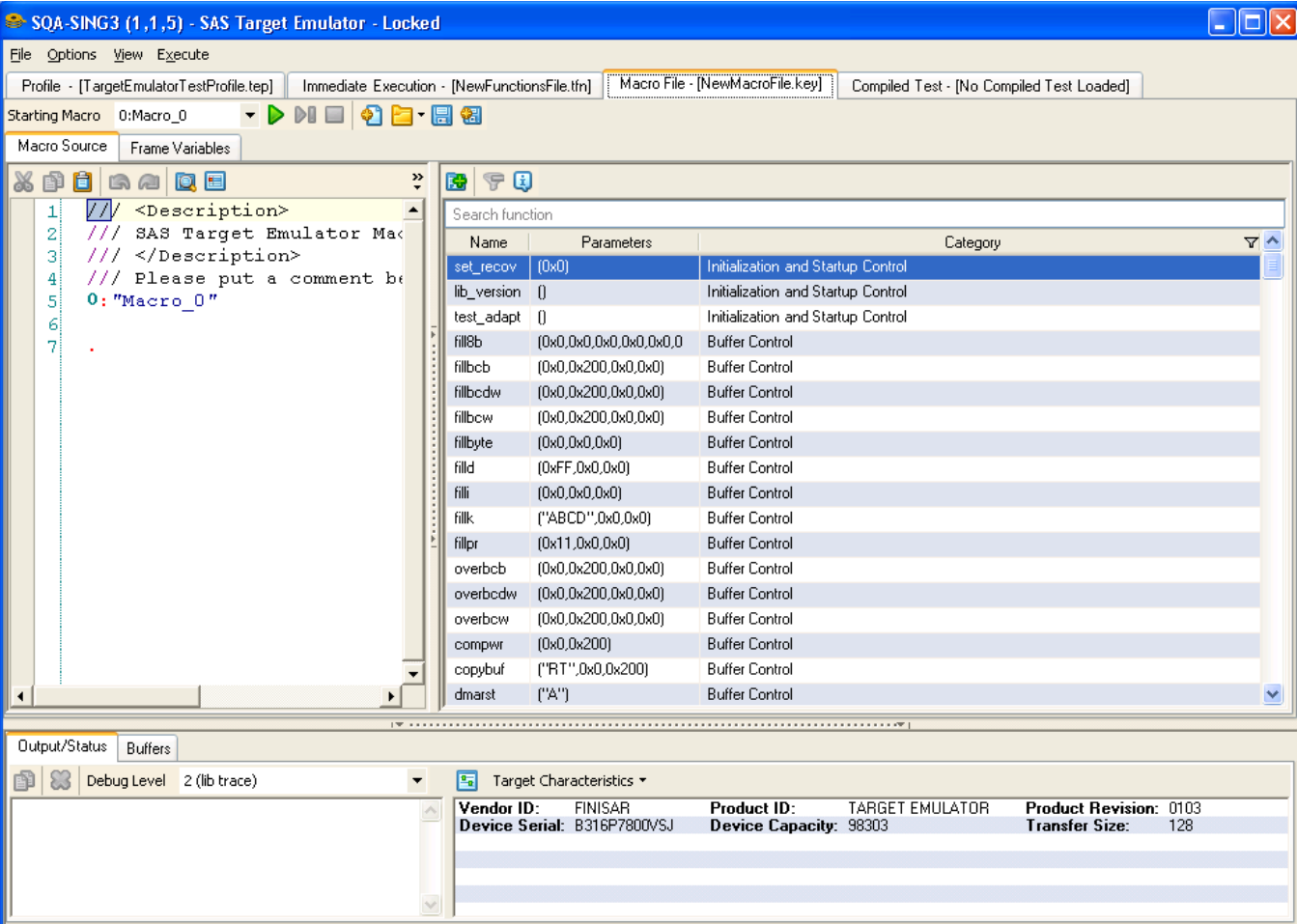
Note: This section pertains to individual macro files, which can be created and edited independently of a device. You do not need to lock ports to perform these actions. The Macro Editor window described in this chapter is separate from the Target Emulator Device window, which allows a user to manage and execute all configuration files for a selected device from a central window. Refer to [Chapter 24, “Using Target Emulator”](#) for more information.

Creating a New Macro File

To create a new Xgig Generator Macro file:

- 1 Select the Macro Files tab in the Configuration window.
- 2 Click the **New Macro File**  icon in the Configuration menu.
A new Macro Editor window appears.

Figure 326: Macro File Editor Window with Macro File Loaded



Macro File Structure

When creating macro tests, you must adhere strictly to the correct syntax. Extraneous spaces are generally not allowed. Numeric variables are decimal values unless they are preceded by 0x, in which case, they are hexadecimal.

In a new macro file, the macro content begins with description tags. This is a placeholder for the description of your file. The description you type here will appear in the Details pane when the file is selected in the Macro Files tab in Target Emulator.

The list of functions in a macro always starts with a number (default = 0) followed by a red colon and ends with a red period. When you open a new macro, the beginning of the macro is indicated by a “0:”, and the end is indicated by a “.” on a new line as shown in the figure above.

You can either choose to build your macro as one string of functions, or you can separate it into routines. Essentially, each routine is a complete macro, beginning and ending with the symbols listed above. Each routine should be numbered sequentially. As mentioned above, the default number for the beginning of a macro is zero. You can change this number to one or another number if you choose.

Each macro or routine needs a name. The name should be enclosed in quotation marks and be placed immediately after the red colon indicating the beginning of the macro (no space).

Begin populating your macro with functions. Place a semicolon after each function. Place comments after `//` on a new line. A single comment that extends over multiple lines in the macro file must have a comment indicator `//` at the beginning of each line. The figure below shows a completed macro containing three routines.

Figure 327: Sample Macro File Contents

```

1  /// <Description>
2  /// SAS Random Read, Write, and Compare Macro File
3  /// </Description>
4  1:"Random Write/Read Compare"
5  // Random Write/Read with Hardware Compare Stop on Error
6  debug(0);
7  // Get user input
8  user_input("Transfer Length:", "N");
9  INTO=get_user_int();
10 // Display user input
11 debug(2);
12 logp("Random Write/Read Compare");
13 logp("Transfer Length: %u", INTO);
14 // If transfer length = 0 then exit
15 jumpz(INTO, 3);
16 debug(0);
17 // Setup
18 set_len(INTO);
19 test_unit_ready();
20 dmarst("R");
21 xfermode("DMARW", 0, 3);
22 // Set program logic error to ignore errors so program logic error is not
23 // logged when the command queue mode is set to terminate
24 pea("CONT");
25 // Set command queue mode to terminate to complete outstanding commands
26 cmdque_mode(8);
27 pea("LOGC");
28 read_capacity_10(0,0,0);
29 LNG0=get_long("R", 0);
30 LNG1=add(INTO,1);
31 LNG2=sub(LNG0,LNG1);
32 // Set command queue mode to single
33 cmdque_mode(0);
34 queue_full_wait(1);
35 xfermode("DMAHC", 0, 3);
36 jump(2);
37 .
38 2:"Routine 2"
39 // Random Write/Read loopne()
40 random_blk(0,LNG2);
41 dmarst("W");
42 write_10_blk();
43 read_10_blk();
44 loopne();
45 queue_full_wait(0);
46 logp("Random Write/Read Compare completed");
47 debug(2);
48 .
49 3:"Routine 3"
50 // Random Write/Read Exit
51 logp("Random Write/Read Compare did not complete, transfer length is 0 ");
52 .

```

Adding Functions to a Macro File

To add a function from the function library to a macro file:

- 1 Place the cursor at the location where you want to add the function.
- 2 Click the function in the function library that you want to add to the macro file.

- 3 Click the Add Function to Macro  button.

The function appears in the Contents pane at the selected position.



Note: A convenient shortcut for adding functions to a macro file is to hold down the **Ctrl** button on your keyboard, then click and drag the function file to the Contents pane.

- 4 Click the Save or Save as button at the top of the window to save the macro file.
- 5 Set the parameters as necessary for each function. The right-click menu provides editing options. These options are described in [Editing Function Parameters](#) above.
- 6 Refer to [Appendix F, “Macro Variables and Functions and the Adding Frame Variables to a Macro](#) section below for function and variable types and syntax as well as examples.
- 7 Indicate the end of the macro with a period on a line by itself.
- 8 Follow steps 1-3 to add the desired macros to the macro file, sequentially numbering the start of each one.

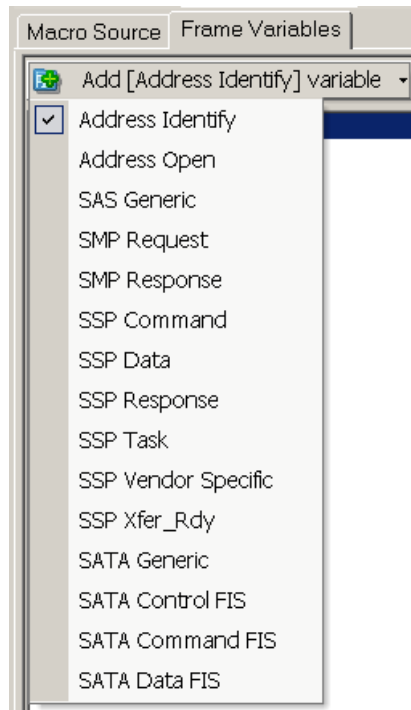
Adding Frame Variables to a Macro

The frame editor is an easy-to-use feature for customizing both legal and illegal SAS and SATA frames to send to a device. You can create and edit frame variables in the Macro File Editor window.

To access the Frame Editor, open the macro file that you want to add frame variables to, then select the Frame Variables tab.

To add a frame to a macro:

- 1 Select a frame variable, i.e. FRM0, FRM1, etc.
- 2 Click the **Add [...] variable** drop-down menu, and select the frame type that you want to use.

Figure 328: Frame Variables Drop Down Menu

Generator will fill in the fields in the right pane depending on which frame type you selected.

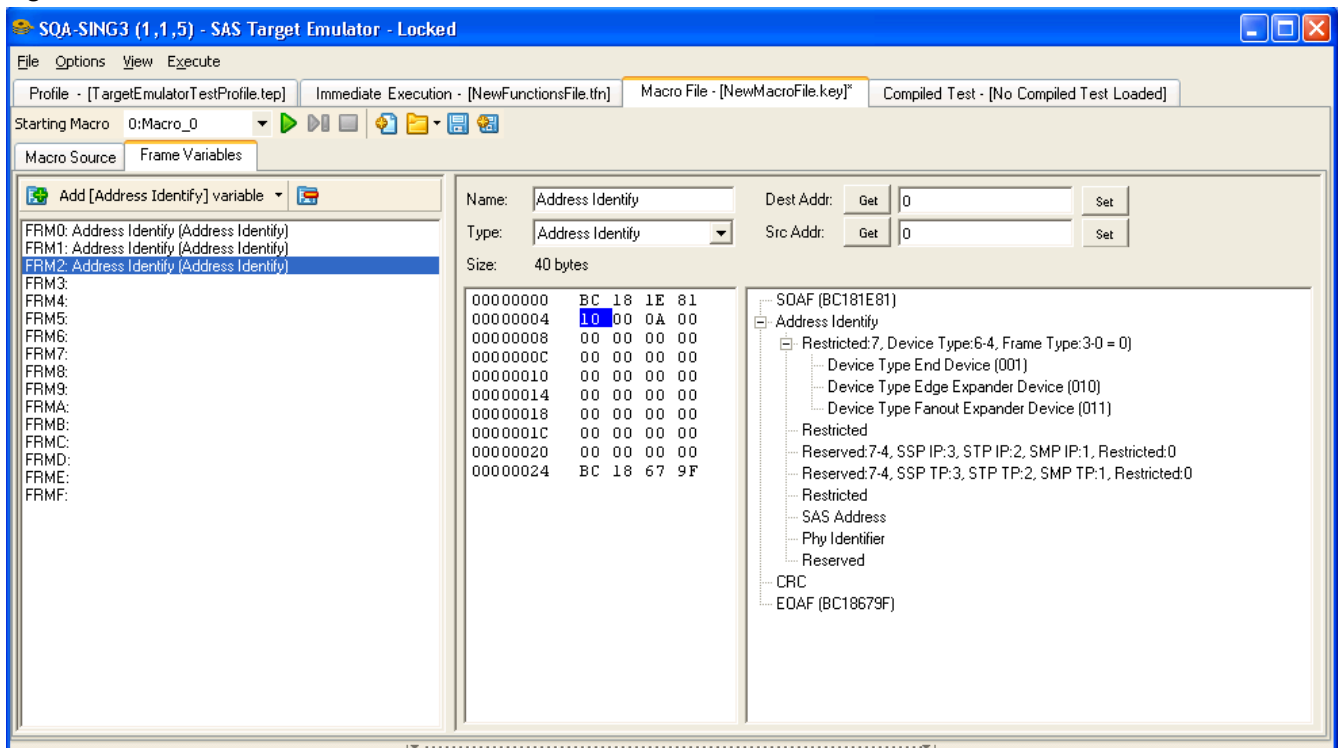
- 3 Type a name for the frame variable in the **Name** field.
- 4 To set the destination address for a SAS variable, click the **Get** button next to the **Dest Addr** field. This address indicates where the frame is being sent. If the frame type is not Identify or Open Address, this is the value that will set the hashed address for the frame and will be used in the automatically generate open address frame that will precede the specified frame. Once you've set the address, click **Set**.
- 5 To get the source address for a SAS variable, click the **Get** button next to the **Src Addr** field. This address indicates where the frame is coming from. If the frame type is not Identify or Open Address, this is the value that will set the hashed address for the frame and will be used in the automatically generate open address frame that will precede the specified frame.



Note: SATA variables use a logical block address (LBA) setting instead of source and destination addresses.

- 6 Type an LBA address for the variable in the **LBA** field. This address indicates the logical block address used to identify the frame. Once you've set the address, click **Set**.

The contents of the frame is listed in the following two panes as shown below.

Figure 329: Frame Variables Window

Frame Decode Pane

This pane lists the contents of the specific frame. This information pane tracks with the frame hex data pane. When you click on node in the frame, the frame hex data size pane shows the number of dwords/bytes that make up that node. When you double-click a node with a defined value in the information pane, such as “Frame Type [06]”, the corresponding hex value is set. The main components of a frame are:

- SOF
- Header (Expand this to show nodes)
- CRC
- EOF

Just above this pane are two fields. The first indicates the total size of the frame. The second, which allows you to add or remove certain types of bytes, such as FIS or CDB bytes from a frame, is only available for certain frame variable types. To add bytes to or remove bytes from the frame, click the up/down arrows next to the field.

Frame Hex Data Pane

This pane lists the bytes for a specific frame component. To edit the byte value:

- Select the byte value, then type another value.

You can add bytes to specific types of frames to increase the size of the frame. If the selected frame type allows the addition of bytes, a numeric field will be displayed above the **Frame Hex Data** pane.

Running a Macro on a Target Emulator Device

You can run a macro file from the Macro File tab of the Target Emulator Device window or from the Parameters Status table in the Maestro window. When running macro files from the Parameters Status table, you can run the files on multiple devices simultaneously.

To run a macro file for a device from the Target Emulator Device window, click the **Start**  button on the menu bar of the **Macro File** tab.

To run a single macro for a device from the Parameters Status table:

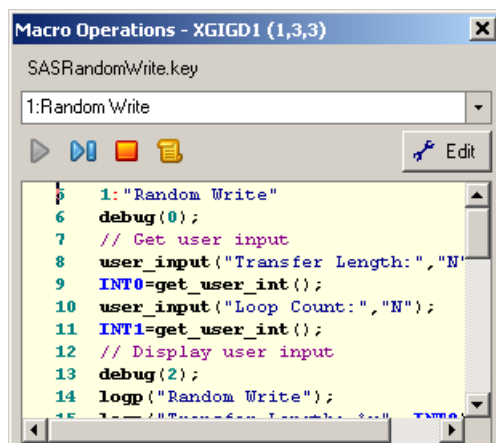
- 1 Click the **Start**  button on the Parameters Status table for Macro File Operations. You need to have a macro file loaded to perform this action.

Figure 330: Parameters Status table Start Macro Button

SAS/SATA XGIGD1 (1,3,3)	
State	 Stopped
Configuration	Edit...
Immediate Function Execution	 SASBuffer.gfn
Macro File Operations...	 SASRandomRead.key

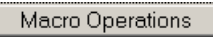
The Macro Operations window is displayed.

Figure 331: Macro Operations Window

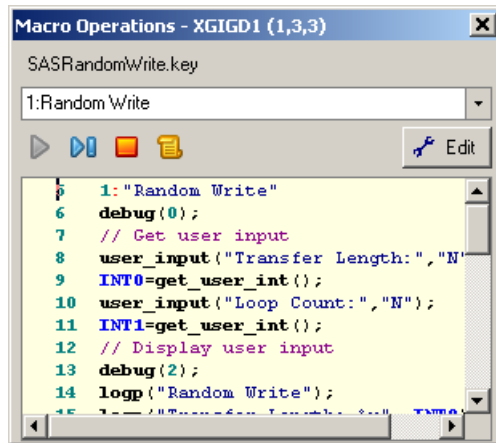


- 2 Click the Preview Macro  button if you want to preview the macro contents.
- 3 Click the **Start**  button to run the macro.
- 4 Click the **Abort Macro**  button to stop the execution of a macro.
- 5 Click the **Send Keystroke**  button to simulate a keystroke to stop looping during macro execution. This selection is active only if the loopk function is invoked in your macro. Refer to the description for loopk in the function library.
- 6 A log entry is generated.

To execute a macro for a device from the Ports Manager:

- 1 Click the Macro Operations  button for the device.

The Macro Operations window is displayed.

Figure 332: Macro Operations Window

- 2 Click the Preview Macro  button if you want to preview the macro contents.
- 3 Click the **Start**  button to run the macro.
- 4 A log entry is generated.

To simultaneously run macros on multiple devices from the Port Manager:

- 1 Select each device that you want to run macros on by checking the **Select** check box for the device.
- 2 Select the macro file you want to load from the Configuration Manager.
- 3 Click the **Load Configuration into Selected Ports**  button.
- 4 Click the **Start Macro on Selected Ports**  button.
- 5 A log entry is generated.

To stop a macro file in progress, right click the device column in the Parameter status table, and select **Stop Macro**.

Saving a Macro File

To save a macro file, click the **Save**  button.

To save the file as another name or to another location:

- 1 Click the **Save As**  button.

The **Save/Save As** dialog appears.



Note: If you want to use the standard Windows file dialogs instead of the dialogs customized for Target Emulator, select **Use Standard Windows File Dialogs** from the **Options** menu in the Target Emulator Device window menu bar.

- 2 Navigate to the location where you want to save the file.
- 3 Type a name for the file.
- 4 Click **Save**.

- 5 Click the **Done** button to close the window. If you make changes to the file and then try to close the window, you will receive prompt asking you if you want to save the file before closing it.

Compiled Test Tab

A compiled test file is a .exe file written using the JDSU SAS/SATA Target Emulator API. Refer to the Generator and Target Emulator API Help for instructions on creating compiled tests. The Target Emulator GUI does not allow you to modify the .exe file. However, the GUI does allow you to add parameters to a compiled test, which, when saved, creates a .gen file of the same name.

Using this section, you can add and edit parameters for a compiled test file, essentially, creating .gen files.

Opening a Compiled Test File

To open a recently used Xgig Target Emulator compiled test file:

- 1 Click the arrow next to the **Open Compiled Test**  button in the menu bar.
- 2 Click the compiled test file you want to open.

A compiled test window appears with the compiled test file loaded.

To browse to a compiled test and open it:

- 1 Click the **Open Compiled Test**  button in the menu bar.
- 2 Browse to the compiled test file you want to open.
- 3 Click the **Open** button.

A compiled test window appears with the compiled test loaded.

Adding Parameters to a Compiled Test File

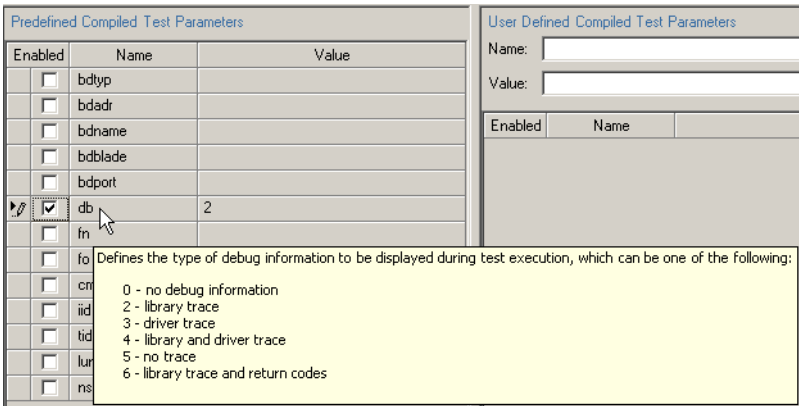
The **Description** field allows you to type a description for the compiled test. This description will appear in information panes when the file is selected.

The **Predefined Compiled Test Parameters** pane lists common command line parameters. These parameters are listed in the **Common Command Line Parameters** section of the API Help. Holding the mouse over one of these parameters brings up a tool tip window containing information about the parameter such as the definition, use, and defined or suggested values.

Example:

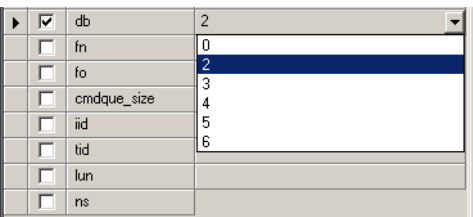
Holding the mouse over the bdtyp parameter displays the following tool tip.

Figure 333: Bdtyp Compiled Test Parameter Tool Tip



The tool tip describes the parameter and lists the possible values. Selecting this row and clicking the value drop-down menu, the possible values as shown in the figure below.

Figure 334: Bdtyp Compiled Test Parameter Values



Click the row with the desired parameter to make it editable. The  icon appears next to the enabled field to indicate that this is the parameter you are editing.

To select a value for this parameter, click the value you want from the drop-down list.



Note: Not all parameter values fields have a drop-down menu for the value. Some tool tips indicate a value range or define the type of information required and the format required.

To enable a parameter for the compiled test, select the **Enable** check box next to the parameter.

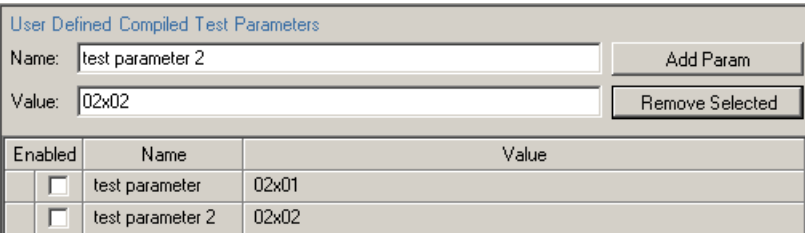
The **User Defined Compiled Test Parameters** pane allows you to create your own parameters.

To create a parameter:

- 1 Type a name in the **Name** field.
- 2 Type a value in the **Value** field.
- 3 Click the **Add Parameter** button.

The parameter appears in the list below as shown in the following figure.

Figure 335: User Defined Parameter



- 4 Click the row with the desired parameter to make it editable. The  icon appears next to the enabled field to indicate that this is the parameter you are editing.

To enable a parameter for the compiled test, select the **Enable** check box next to the parameter.

To delete the parameter, select the entire row, and click the **Remove Selected** button.

Running a Compiled Test on a Target Emulator Device

After you have configured a Target Emulator device and loaded a compiled test file, you can run the file.



Note: Before launching a compiled test, the GUI disconnects from the port then reconnects to the port when the test is complete.

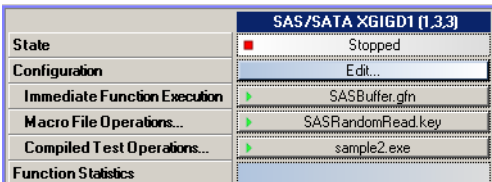
You can run a compiled test file from the Compiled Test tab of the Target Emulator Device window or from the Parameters Status table in the Maestro window. When running compiled tests from the Parameters Status table, you can run the test files on multiple devices simultaneously.

To run a compiled test for a device from the Target Emulator Device window, click the **Start**  button on the menu bar.

To run a single compiled test file for a device from the Parameters Status table:

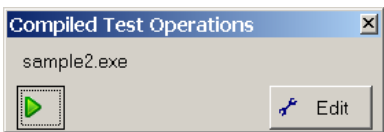
- 1 Click the **Start**  button on the Parameters Status table next to the Compiled Test Operations field. You need to have a compiled test file loaded to perform this action.

Figure 336: Parameters Status table Start Compiled Test Button



The Compiled Test Operations window is displayed.

Figure 337: Compiled Test Operations Window



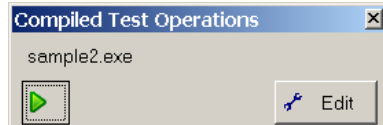
- 2 Click the **Start**  button to run the compiled test.
- 3 A log entry is generated.

To execute a compiled test for a device from the Ports Manager:

- 1 Click the Compiled Test Operations  button for the device.

The Compiled Test Operations window is displayed.

Figure 338: Compiled Test Operations Window



- 2 Click the **Start**  button to run the compiled test.
- 3 A log entry is generated.

To simultaneously run compiled tests on multiple devices from the Port Manager:

- 1 Select each device that you want to run compiled tests on by checking the **Select** check box for the device.
- 2 Select the compiled test file you want to load.
- 3 Click the **Load Configuration into Selected Ports**  button.
- 4 Click the **Start Compiled Tests on Selected Ports**  button.
- 5 A log entry is generated.

Saving a Compiled Test File

To save a compiled test file, click the **Save**  button.

To save the file as another name or to another location:

- 1 Click the **Save As**  button.

The **Save/Save As** dialog appears.



Note: If you want to use the standard Windows file dialogs instead of the dialogs customized for Generator, select **Use Standard Windows File Dialogs** from the **Options** menu in the Generator Device window menu bar.

If you click the **Save as** selection to save a .gen file as a new file name, a copy of the existing compiled test .exe will be created with along with the new .gen file.

- 2 Navigate to the location where you want to save the file.
- 3 Type a name for the file.
- 4 Click **Save**.

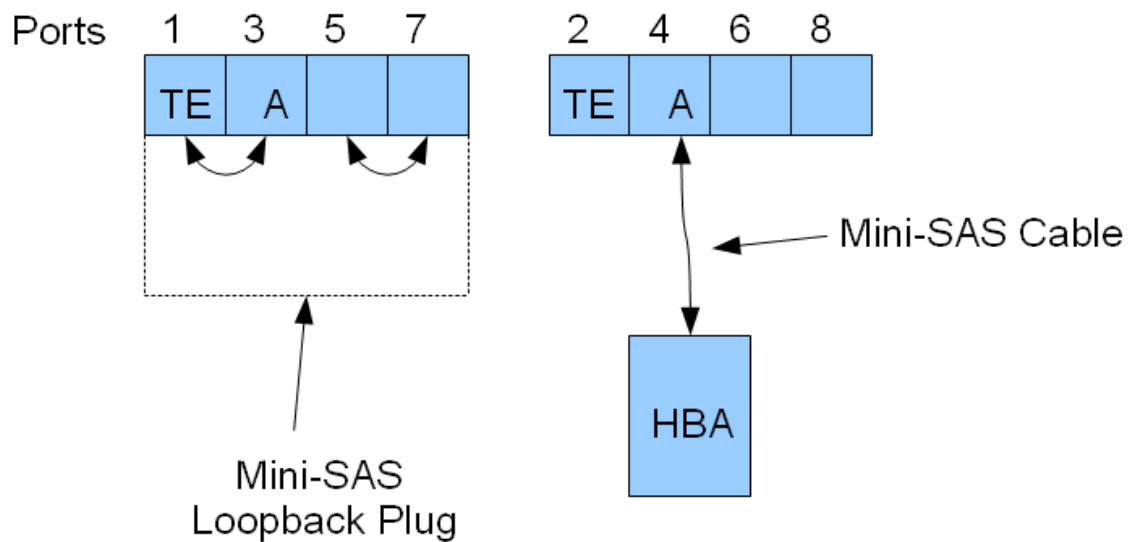
- Click the **Done** button to close the window. If you make changes to the file and then try to close the window, you will receive prompt asking you if you want to save the file before closing it.

Setting up a test with Target Emulator and HBA

The following setup process will discuss how to build a test setup with Xgig Target Emulator, Xgig Analyzer, and a Host Bus Adapter (HBA).

Set up the proper connection between the Xgig Chassis and the HBA.

Figure 339: Test setup for Target Emulator, Analyzer and HBA



- Connect the Host PC's HBA to the Xgig Blade using a Mini-SAS cable. Refer to [Figure 339](#) for the connection diagram.
- Use a Mini-SAS loop back plug to create a loop back for the other ports of the blade.

This connection setup promises better signal integrity (shorter cables), and is better if 6G interfacing speed is needed.

Lock the ports to SATA TE on Maestro.

- Launch Xgig Maestro on you PC (ideally not installed in your Host PC).
- Click on **Port Selection and Domain Setup** button from the **Maestro Global** tab.
- Select a chassis that has a 8-port wide blade and a port pair with Target Emulator licence.
- Click on the first port pair. Refer to [Figure 339](#).
- Right-click on the selected ports and select **Use Port(a) as...>Target Emulator SAS/SATA**.
- Go to the Parameters Status Table and right click on the locked port.
- Select **Change port to SATA mode**.

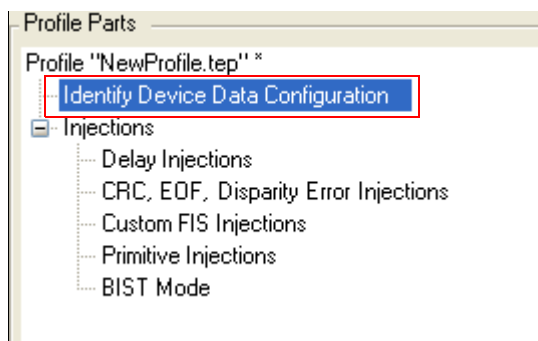
Lock the ports to Xgig Analyzer

Please refer to the *Xgig Analyzer User's Guide* on how to lock the ports to Xgig Analyzer.

Set the Signalling speed from the Identify Device Data Configuration.

- 1 From the Parameters Status Table, click on **Edit** on the **Configuration** row. This will open the Target Emulator Device window.
- 2 Click the **Identify Device Data Configuration** on **Profile Parts** pane. The Parts Options pane will display the options for the Identify Device Data Configuration.

Figure 340: Identify Device Data Configuration on Profile Parts Pane



- 3 Scroll down the Parts Options pane to **Dword 76**.
- 4 Select the signalling speed that to be used by the Target Emulator.
- 5 Once done, click on **Apply Profile Part**. This will send the new settings to the Target Emulator port.

The Target Emulator is now ready to be used for the test.

Power-on the PC.

Turn on the PC. After the Windows operating system has loaded, you will not see the Target Emulator Drive in Windows Explorer. You need to initialize and format the drive first.

Initialize and Format the Target Emulator drive.

To initialize the drive, go to Computer Management:

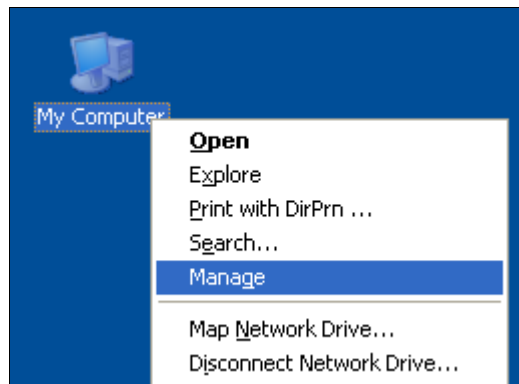
- 1 Click **Start**, and then click **Control Panel**.
- 2 Click **Performance and Maintenance**.
- 3 Click **Administrative Tools**, and then double-click **Computer Management**.

Alternatively, you can do the following:

- 1 Right-click on the **My Computer** icon.
- 2 Select **Manage**. This will open the **Computer Management** window (refer to [Figure 341](#)).

Note that you must be logged on as an administrator or a member of the Administrators group in order to complete this procedure. If your computer is connected to a network, network policy settings might also prevent you from completing this procedure.

Figure 341: My Computer Context Menu

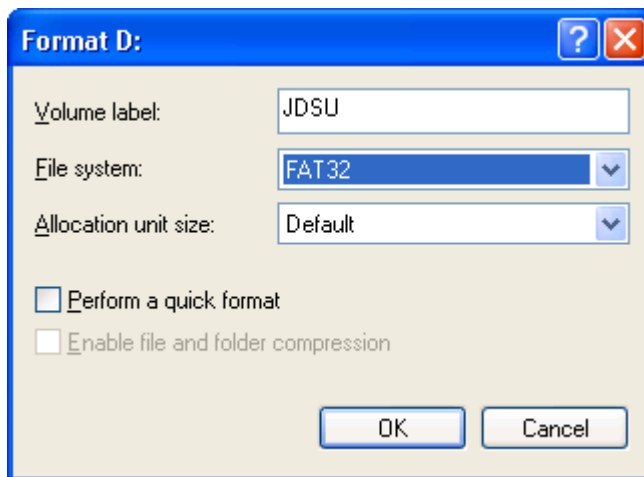


New disks appear as **Not Initialized**. Before you can use a disk, you must first initialize it. If you start **Disk Management** after adding a disk, the **Initialize Disk Wizard** appears so you can initialize the disk.

After initializing, you must format the drive. To format the drive:

- 1 Click on Disk Management from the **Computer Management** window.
- 2 Right-click on the drive on the Disk Management window and select **Format**.

Figure 342: Format Drive



- 3 Enter the Volume label.
- 4 Select the file system.

Note that NTFS is not recommended for capacity greater than 48MB because NTFS writes disk and partition information to the start and end sectors of the drive, which in our case, will encounter a circular buffer wraparound, and there will be errors. The FAT32 file system writes disk and partition information only to the starting sectors of the drive, so this can be applied for all cases.

- 5 Click **OK** to start formatting.

Copy files to the drive.

Once the Target Emulator drive has been formatted, you can copy files to the drive to test if you can write data into it..

You can reboot the Host PC and verify that the file is still intact.

Modify Device Data.

If you have verified that the files you copied into the Target Emulator drive has been properly written and read, you can now try modifying the Device Data of the Target Emulator drive.

- 1 Go to the Maestro window in the client PC.
- 2 Under Identify Device Data Configuration in the Target Emulator Device window, change the Model Number to a different model, for example, “JSATA”, and then click **Apply Profile Part**.
- 3 Change the values in both word 60-61 and word 100-103 to change the drive capacity. YOU must specify the number of sectors.

For Example $10\text{Gig} = 10 \times 1024 \times 1024 \times 1024 = 10737418240\text{Bytes}$. You need to divide this value by 512 = $20971520 = 0x140\ 0000$ sectors.
- 4 Reboot the Host PC so that the changes to the Target Emulator drive will be detected and reflected in the Host PC.

After you have completed this procedure you can now proceed with you other tests.

PART SIX: Using Xgig Load Tester

Chapter 25

Introducing Xgig Load Tester

In this chapter:

- [Xgig Load Tester Overview](#)
- [Features](#)
- [Capabilities](#)
- [Components](#)

Xgig Load Tester Overview

The Xgig Load Tester is a new generation product on the Xgig platform for the Fibre Channel (FC) protocol and Fibre Channel over Ethernet (FCoE) protocol. The Xgig Load Tester is a powerful data stream generator at full line rate and is used for data performance tests of Fibre Channel and FCoE networking equipment and components. Load tester supports FC line rates of 1.0625 Gbps, 2.1250 Gbps, 4.2500 Gbps, or 8.5000 Gbps and FCoE Line.

Xgig Load Tester is compatible with Xgig 4G, 8G, and 10G multi-functional blades. Xgig 4G blades are available with two or four ports and is capable of triggering the Xgig Analyzer.

Using Load Tester in conjunction with other JDSU products like the Xgig Analyzer creates a complete test setup for your Fibre Channel configuration.



Note: The JDSU Xgig Load Tester only supports the Xgig chassis and Xgig blades. Depending on licensing, each port pair has the ability to support Load Tester functions as well as other Xgig functions with the same sync group.

The following sections discuss the features and components of the Xgig Load Tester.

Features

Xgig Load Tester has the following features:

Link Service

Link initialization (LR,OLS,NOS)

Login (Fabric, NPIV, N_Port)

FC data traffic generation

- 1024 data streams per physical port with multi- S_ID, D_ID and OX_ID
- Continuous and burst traffic profile with fixed or variable payload size
- > 100% theoretical line rate (minimum IFG of 3 IDLES, unidirectional traffic only)
- 8 uniquely configurable traffic profiles per Physical N_Port with the following configurable parameters:
 - continuous and burst traffic profiles
 - fixed or variable payload sizes
 - user selectable payloads
- 1024 Tx streams per physical N_Port with 8G FC you get 1024 streams and 512 streams with 4G FC

Rx Stream monitoring and reporting

- 1024 Tx streams per physical N_Port

- Throughput reports
- Error counters
- Latency
- Statistics reports in spreadsheet format

Triggering

You can trigger Analyzers with a TTL output via a BNC connector when an erroneous event occurs.

Error Injection

You can set Load Tester to inject CRC errors in the generated traffic.

Capabilities

The Xgig Load tester is capable of performing the following types of tests:

Subsystem design and debug

- ASIC physical layer test
- Hardware robustness test

Functional test

- Switch performance test
- Switch regression test
- Switch stress test
- System conformance test (w/ MLTT)

Interoperability test

- Network data integrity test
- Fabric stress test
- Fabric scalability test

Manufacturing test

Xgig Load Tester is capable of Hardware verification.

Components

This section defines the components central to the Load Tester process. These components are discussed in context in the subsequent chapters.

The load tester process involves the following primary components

- Physical N_Ports
- tags
- data streams
- traffic profile engines
- traffic patterns
- topology

Each Load Tester port transmits and receives data through a Physical N_Port. The Load Tester port manages credits, performs Link Service operations, as well as blasts data streams at line rate in complex topologies, with stressful payload patterns, to challenge the performance capabilities of the switch and the entire SAN.

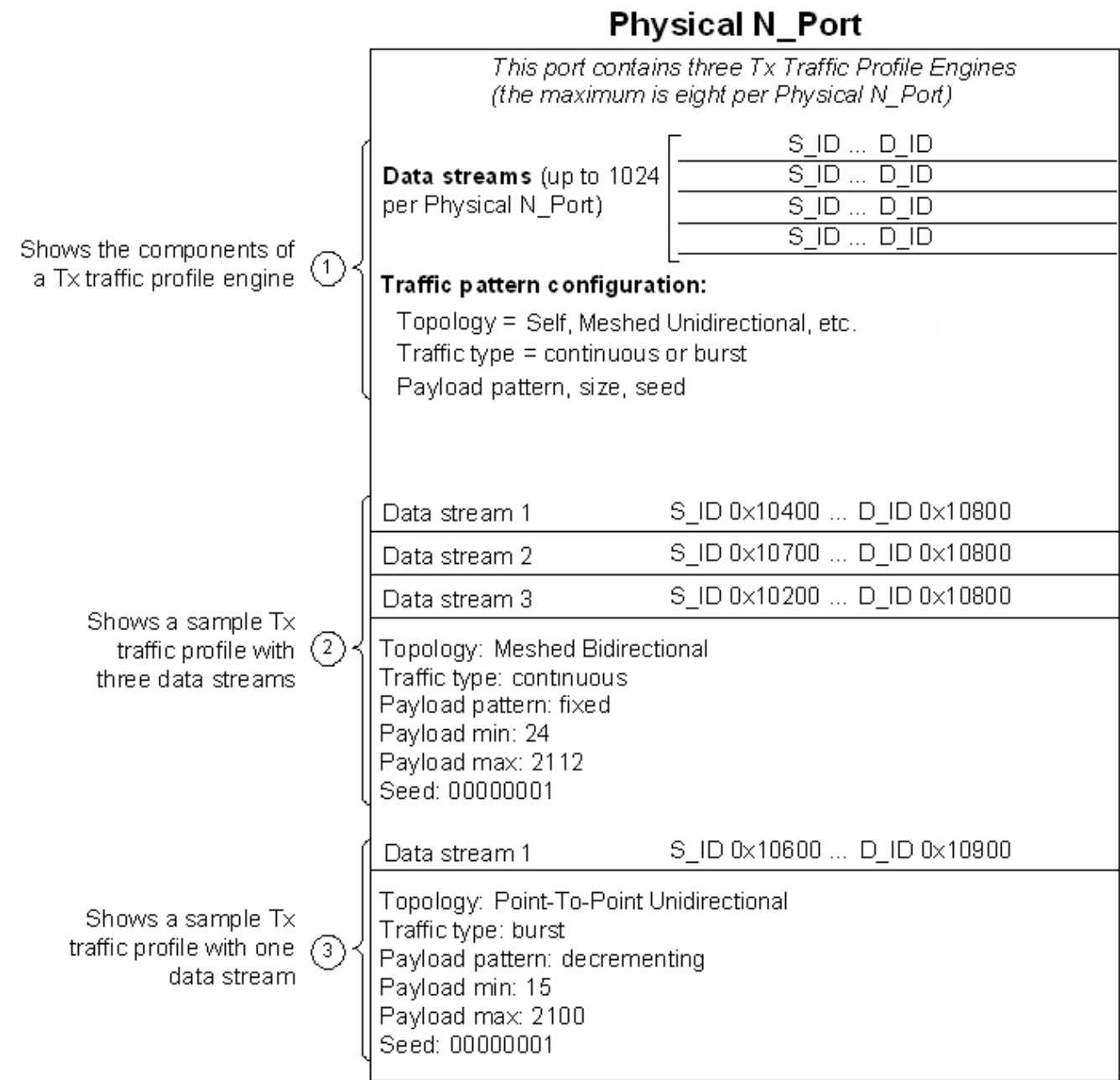
Physical N_Port

Due to hardware constraints, the following resources are available for each Physical N_Port:

- 8 Traffic Profile Engines
- 1024 TX Data Streams shared among the 8 Traffic Profile Engines
- 1024 RX Data Streams shared among the 8 Traffic Profile Engines

The following diagram illustrates the configuration of a Physical N_Port.

Figure 343: Example: Physical N_Port Configuration



Tags

Tags are an organizational tool for ports in Load Tester. A tag contains a name, a description, and a list of ports to which the tag is applied. You can apply a tag to any number of ports. When you select a tag, the available ports are listed. When configuring ports, configuring traffic patterns, or setting up multi port link service, you can use tags to quickly find a pre-defined set of ports that you want to perform an action on. When a tag uses an API command as a parameter, the API command will apply to all the ports associated with the tag.

Data Streams

A data stream is defined to be a unique entity within a Load Tester port, defined by its S_ID and D_ID. More than one data stream with the same S_ID and D_ID may coexist with a single Load Tester port, however, they will be monitored for errors independently.



Note: The terms *data stream* and *stream* have the same meaning and are used interchangeably in this guide.

Traffic Profile Engines

There exist 8 uniquely configurable Traffic Profile Engines per Physical N_Port. A Traffic Profile Engine is used to transmit one or more data streams. A Physical N_Port can receive up to 1024 data streams, and Traffic Profile Engines are not required for the receive logic.

Each Traffic Profile Engine have the following uniquely configurable parameters:

- One or more data streams
- Traffic type - continuous or burst
- Payload Pattern/Type
- Payload Size - fixed or random
- Port Topology: the group of ports and the way in which these ports shall be organized to transfer data to each other. (partially meshed, fully meshed)

Traffic Patterns

The term traffic pattern applies to a traffic profile engine. Each Physical N_Port can have up to eight traffic profile engines. Each traffic profile engine contains a traffic pattern configuration, which is a combination of Physical N_Port traffic topologies and traffic configuration settings such as traffic type and payload type, payload size, and seed information.

The Traffic Pattern concept allows a group of ports that share a port topology to also share all the configurations related to the traffic profile engines. When you create a traffic pattern, each port that transmits in the traffic pattern will allocate a single Traffic Profile Engine. In the case where the Port Topology is bi-directional, all ports will allocate a single Traffic Profile Engine.

Creating and saving traffic patterns is a good way to preserve test configurations so that you can reuse them.

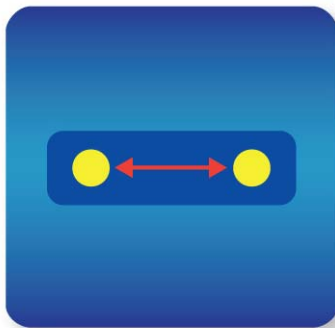
Topology

The term topology applies to an individual test. Tests run on a Physical N_Port are defined by a traffic pattern configuration. One aspect of the traffic pattern is the topology, which defines the direction and flow of the link traffic between ports. For each test in Load Tester, the ports can have any of the following logical link topologies:

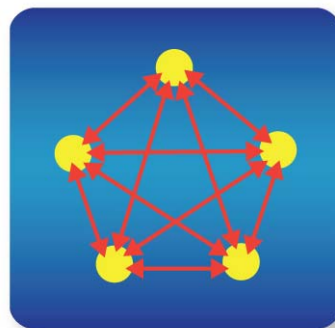
- **Self** - defines a configuration where data traffic is sent back to the transmitter



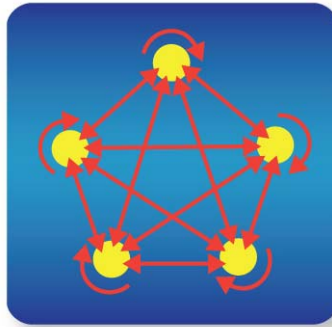
- **Pair Port**- defines a source port sends data to the corresponding port in a port pair on a blade



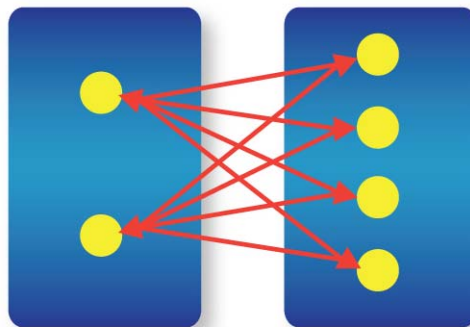
- **Fully Meshed Exclude Self**- defines a configuration where traffic is sent to all ports except to the transmitter



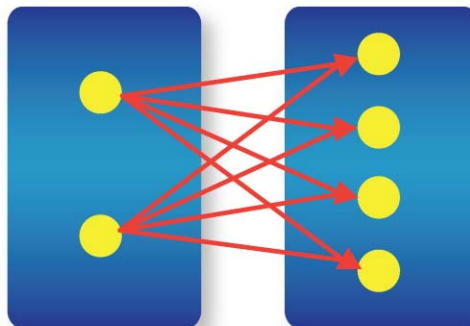
- **Fully Meshed Include Self**- Super set of partially meshed topology. It defines that each port in one test sends and receives the data traffic to and from the rest of the ports. Each port in the list transmits to all the other ports in the list including itself.



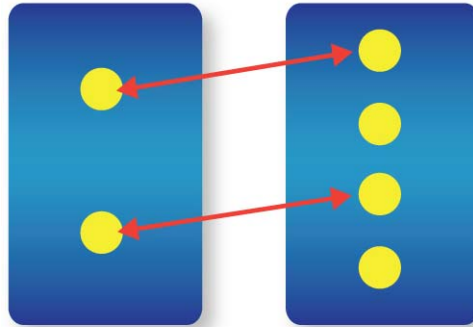
- **Meshed Bidirectional** - defines the specific port(s) send(s)/receive(s) data traffics to/from the other ports that are configured for one test



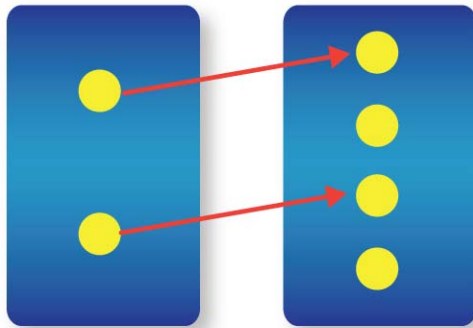
- **Meshed Unidirectional** - defines the specific port(s) send(s) data traffics to the other ports that are configured for one test.



- **Point-to-Point Bidirectional** - defines the source and destination ports send data traffic to ports with the same numbered tag.



- **Point-to-Point Unidirectional** - defines the source ports send data traffic to destination ports with same numbered tag.



Note: For the Partially Meshed topography, a user provides a set of source ports and destination ports. Each of the source ports sends traffic to each of the destination ports.

Chapter 26

Using the Load Tester Tab

In this chapter:

- [Load Tester Domain Operations](#)
- [Physical Ports Tab](#)
- [Traffic Tab](#)
- [Log Tab](#)
- [Load Tester Device Window](#)

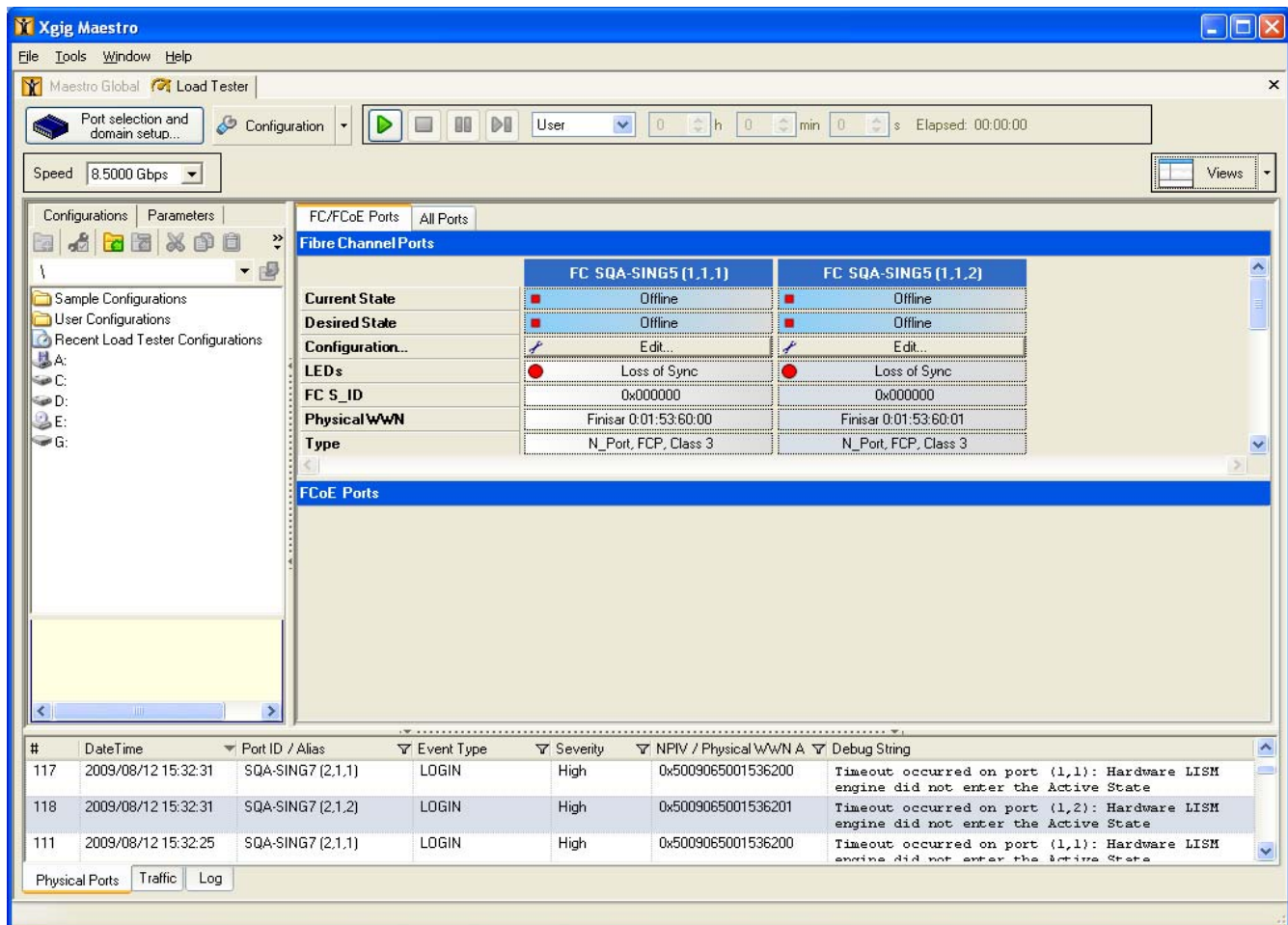
In order to use Load Tester, you must lock one or more port pairs on the blades within your Xgig chassis for use as Load Testers as described in [“Multi-Function Ports and Symbols”](#) on page 21. In order to use ports as Load Testers, the multi-function blade they reside in must be licensed for this functionality.

You should have launched Xgig Maestro as described in [“Launching Xgig Maestro”](#) on page 12 and locked at least one pair port

After you have discovered and locked the Load Tester ports you want to use and set up your capturing and monitoring applications, such as Xgig Analyzer, you are ready to run the Xgig Load Tester application. This chapter provides an overview of the Load Tester tab on the Xgig Maestro main window, and its functions.

Clicking the Load Tester tab in the Maestro main window displays the Xgig Load Tester window, shown below. This tab is where you operate the Load Testers you have locked.

Figure 344: Xgig Load Tester Window



Load Tester Domain Operations

On the upper part of the Load Tester window are the domain operations buttons and options that you can use to configure and run your tests. These are:

Port selection and domain setup - Opens the **Port selection and domain setup** dialog box where you can select, lock, and unlock ports to use for Load Tester.

Configuration Button - Opens the Load Tester multi-tab Device Window. You can click the drop-down arrow to see more configuration option listed below:

Link Service - Opens the **Link Service** tab in the Load Tester Device Window that displays all the ports locked as Load Testers and also the different Link Service options you can set for the ports.

Configure FC Ports - Opens the **FC Ports Configuration** tab in the Load Tester Device Window where you can configure individual or multiple FC ports locked to Load Tester.

Configure FCoE Ports - Opens the **FCoE Ports Configuration** tab in the Load Tester Device Window where you can configure individual or multiple FCoE ports locked to Load Tester.

Flow Control - Opens the **Flow Control** tab in the Load Tester Device Window where you can configure the traffic flows for individual or multiple FC or FCoE ports locked to Load Tester.

Tags Manager - Opens the **Tags Manager** tab in the Load Tester Device Window where you can create, edit, and delete tags used in Load Tester.

Traffic Pattern Editor - Opens **Traffic Pattern Configuration** tab in the Load Tester Device Window where you can create, edit, or delete traffic patterns used in the tests.

Traffic Pattern Wizard - Launches the Traffic Pattern Wizard.

Triggers - Opens the **Triggers** tab in the Load Tester Device Window where you can turn on and pause triggers.

Failover - Opens the **Failover** tab in the Load Tester Device Window where you can configure the failover settings for Fibre Channel ports.

Calculate Throughput - Opens the **Calculate Throughput** dialog box where you can select the which portions of the frame will be used in the calculation of the throughput.

Test Summary - Opens the **Test Summary Report Options** dialog box where you can configure the generated test summary report after a test completes.

Save Configuration - Opens the **Save Load Tester Configuration As** dialog box where you may save the current test configuration under the folder and name of your choice.

Start - Starts the test by sending requests to the ports to log into the Fabric, and if you have not done so, it will also initialize the hardware with the selected configuration and then begins the test.

Stop - Stops the test if a test was in progress and requests the ports go to a logged in state.

Pause - Pauses the current test in progress. It makes no changes to the users selected configuration.

Resume - Resumes the test in progress.

Test Length - Sets the amount time or number of frames that the test will run.

Speed - Sets the speed of the ports to use during the test.

View - Shows the options for displaying the different sections of the Load Tester Graphical User Interface (GUI). The available options would be dependent on the current tab presented in the Load Tester GUI.

The Load Tester window is further divided into three tabs: the Physical Ports, Traffic, and Log. These tabs are discussed in the following sections.

Physical Ports Tab

The Physical Ports tab is the default display of the Load Tester form after the function is launched.

The following section describes the different parts of the tab.

Parameters Status table

The Parameters Status table shows the ports you have locked. The locked tabs are organized by Fibre Channel (FC) and Fibre Channel over Ethernet (FCoE) ports. The locked ports are can be divided in a sorted manner in the **FC/FCoE Ports** tab or displayed unsorted in the **All Ports** tab.

To configure how to display the ports in the Parameters Status Table, click on the View button and do the following:

Select or unselect **Configuration** to display or hide the Configurations tab and Parameters tab where you manage Load Tester configuration files and select the Parameters to display, respectively.

Select or unselect **Log** to display or hide the Configurations tab and Parameters tab where you manage Load Tester configuration files and select the Parameters to display, respectively.

Click **Ports** to display the options for displaying the ports in the Parameters Status Table.

Tile Horizontally - Select this option to display the Fibre Channel Ports pane before the FCoE Ports pane

Tile Vertically - Select this option to display the Fibre Channel Ports pane beside the FCoE Ports pane

Tabs - Select this option to display the Fibre Channel Ports pane and FCoE Ports as tabs.

Each Load Tester port is displayed by a column on the Parameters Status table (Figure 345). At the top of each column is the protocol, the chassis name, and in parenthesis the chassis number, the slot number and port number(s).

Figure 345: Parameters Status table

	FC SQA-SING7 (2.2.3)	FC SQA-SING7 (2.2.4)
Current State	 Offline	 Offline
Desired State	 Offline	 Offline
Configuration...	 Edit...	 Edit...
LEDs	 Loss of signal	 Loss of signal
FC S_ID	0x000000	0x000000
Physical WWN	Finisar 0:01:53:C5:12	Finisar 0:01:53:C5:13
Type	N_Port, FCP, Class 3	N_Port, FCP, Class 3
Used TX Resources		
Profiles	1/8	1/8
Streams	1/1024	1/1024
Settings - General		
NPIV	0	0
Port Pair Speed	8 Gbps	8 Gbps
Settings - OX_ID		
OX_ID Mode	Multi-frame Exchange Incrementing	Multi-frame Exchange Incrementing
Flow Control		

The first column on the Parameters Status table lists the legends of rows, which are user configurable. There are following parameter categories available to display depending on the type of port:

For Fibre Channel Ports

- Current State
- Desired State
- Configuration
- LEDs
- FC S_ID
- Physical WWN
- Type
- Port Group Tag List
- Used TX Resources
- Settings - General
- Settings - OX_ID
- RSCN
- Flow Control
- SFP Status
- Error Counters

For FCoE Ports

- Current State
- Desired State
- Configuration...

- LEDs
- E_Node Source MAC
- VN_Port MAC Addresses...
- Ethernet MAC Addresses...
- FCF MAC Addresses
- FC S_ID
- Physical WWN
- Type
- Port Group Tag List
- Used TX Resources
- Settings - General
- Login/FIP
- DCBX
- Settings - OX_ID
- RSCN
- Flow Control
- SFP Status
- Error Counters

You can select the parameters that will appear on the Parameters Status Table by selecting the parameters from the Parameters panel on the left of the Parameters Status Table.

Parameters Category Descriptions for Fibre Channel Ports

Current State

This row shows the following current status of the Load Tester:

- Laser Off
- Offline
- Port Failure
- Link Initializing
- Link Active
- Logout in Progress
- Fabric Login in Progress
- Logged in to Fabric
- NPIV Login in Progress
- NPIVs Logged In

- N-Port Login in Progress
- Logged In
- Test in Progress
- Unknown State

Refer to the `get_State()` function in the API Help for more information.

Desired State

This row shows the target state of the Load Tester ports: Laser Off, Offline, Link Active, Logged in to Fabric, NPIVs Logged In, Logged In, Test in Progress. Refer to the `get_DesiredState` function in the API Help for more information.

Configuration

This row contains the **Configuration...** button that launches the **FCoE Port Configuration** window for the selected port.

LEDs

This indicator changes color, green, red, yellow, black, depending on the link status. The indicator corresponds to the Link status LEDs on the blade in the Xgig chassis. Refer to the `get_LEDState` function in the API Help for more information.

The LEDs on the blade's front panel provide status about each port on the blade. See [Table 18: Xgig Fibre Channel Blade Link Status LED](#) below.

Table 18: Xgig Fibre Channel Blade Link Status LED

Port column LED color	Description
Black	Loss of signal
Red	Loss of synchronization
Green	Synchronized
Yellow	Loss of synchronization has occurred

Once sync has been resolved, a red LED turns to yellow. To reset the LED indicator to green, you need to reset the LED.

To reset the blade LEDs:

- 1 Right-click in the Parameters Status table to open the Parameters context menu.
- 2 Select **Reset LED** or **Reset LEDs for all ports**.

FC S_ID

This row shows the Source ID. This is the initial address given to this Load Tester by the switch during Fabric Login.

Physical WWN

This row shows the World Wide Name (WWN) of the port. Refer to the `get_wwnByNpiv` function in the API Help for more information.

Type

This row indicates the port type, for example, N_Port, FCP, Class 3.

Port Group Tag List

Indicates the tags that are applied to the port. You can also view the port's tags by selecting **Port Tags** from the Parameters context menu. In addition, you can add a tag to or remove a tag from a port by selecting **Add Tag** or **Remove Tag** from the Parameters context menu. Refer to the `get_TagList` function in the API Help for more information.

Used TX Resources

This category displays the number of traffic profiles used or data streams used. Refer to the `get_TrafficUsedStreams` function in the API Help for more information.

Profiles

Indicates the number of continuous or burst traffic profiles used by the Physical N_Port.

Streams

Indicates the number of data streams being used by the Physical N_Port. Each physical Load Tester transmission path support a maximum of 1024 data streams.

Settings - General

This category indicates the current physical setup of the Load Tester port. You can change the settings in this category by using the Parameters context menu for each port you have locked.

When changing the line rate from 8.5000 Gbps to any other speed, Scrambling is automatically set to Disabled. When changing to 8.5000 Gbps, it is automatically set to Enabled. You may then manually override this setting by selecting **Configure Port** from the Parameters context menu.

Alias

Indicates the current alias or label assigned to the port. Refer to the `Alias` function in the API Help for more information.

NPIV

Indicates the number of virtual S_IDs that will be requested during the NPIV Login by using FDISC command(s). The Physical S_ID is not included in this number.

N_Port ID Virtualization is a Fibre Channel standard, that allows a single Physical N_Port to acquire more than one S_ID. The Load Tester supports NPIV during Login. For example, a unique stream could be created for each NPIV S_ID, destined to a single D_ID.

Port Pair Speed

This indicates the link rate for the port. In Fibre Channel, the link rate can be 1.0625 Gbps, 2.1250 Gbps, 4.2500 Gbps, or 8.5000 Gbps.

When the speed of a port is changed, the speed for the corresponding port in the port pair is changed automatically. In addition, if the scrambling and idle primitive settings are changed automatically in response to a speed change for a port, the scrambling and idle primitive settings for the corresponding port are changed automatically.



Note: Xgig Load Tester does not support speed auto-negotiation. To change the speed for a port, select **Configure port** from the Parameters context menu. To change the speed of multiple ports, select **Configure multiple ports** from the Parameters context menu. For more information, refer to Chapter 27: “[Configuring Ports](#)”.

Scramble

The 8G blades give the option of enabling Fibre Channel Frame Scrambling, which is the mandatory requirement for 8G Fibre Channel (8GFC) Specification. Xgig Load Tester offers the options to enable/disable the scrambling feature at 1.0625 Gbps, 2.1250 Gbps, 4.2500 Gbps, or 8.5000 Gbps.

To enable Scrambling:

- 1 Right-click on the port to open the Parameters context menu.
- 2 Select **Configure port**.
- 3 Select the **Scrambling** checkbox.
- 4 Click **Ok**.

When Scrambling is enabled, Fibre Channel Frame Scrambling is performed in the Configuration pattern starting after any SOF indicator template and continues until the next word with a K character (usually EOF). Scrambling is enabled by default for line rate 8.5000 Gbps. Scrambling is disabled by default for line rates 1.0625 Gbps, 2.1250 Gbps, and 4.2500 Gbps. See `ScramblingMode` in the API Help.

For more information, refer to [Chapter 27, “Configuring Ports.”](#)

Idle Primitive

Indicates the idle primitive setting. Per 8GFC specification, the available options are **Idle** and **ARB(FF)**. The idle primitive setting is **ARB(FF)** by default for line rate 8.5000 Gbps. The idle primitive setting is **Idle** by default for line rates 1.0625 Gbps, 2.1250 Gbps, and 4.2500 Gbps. Refer to the `IdleIsARBff` function in the API Help system located on the product CD for more information.

Minimum IFG

Displays the Minimum Inter-Frame Gap (IFG). It is the guaranteed minimum number of idles between consecutive frames. Refer to the `MinimumInterPacketGap` function in the API Help for more information.

RX Buffer Size

Displays the buffer-to-buffer credits that will be advertised by the Load Tester port to the switch in Fabric Login (FLOGi) command. Refer to the `RxCredits` function in the API Help for more information.

Login Retry Limit

Displays the Login Retry Limit set for this port. If the login fails, then it will automatically retry after an elapsed time defined by login retry delay. See the `LoginRetryCountLimit` and `LoginRetryDelay` functions for more information.

Login Retry Delay

Displays the amount of time before a login retry is executed. See the `LoginRetryCountLimit` and `LoginRetryDelay` functions for more information.

Settings - OX_ID

This category indicates the current OX_ID of the Load Tester port. You can change the settings in this category by using the Parameters context menu for each port you have locked.

OX_ID Mode

The OX_ID is a field in the header of the Fibre Channel frame whose value is inserted by the Load Tester. The OX_ID value chosen depends on the mode selected. Possible modes include: **Multi-frame Exchange Incrementing**, **Single-frame Exchange Incrementing**, and **Single-frame Exchange Random**.

Refer to the `OxidMode` function in the API Help for more information.

OX_ID has the following modes:

- **Multi-frame Exchange Incrementing**
The **Multi-frame Exchange Incrementing** mode assigns the OX_ID similar to the manner hosts assign OX_IDs. When sending Fibre Channel frames, this mode assigns each exchange and all frames within the exchange a unique OX_ID. This mode will correctly report sequence errors, unaccounted frames and out-of-order frames in both S_ID / D_ID and S_ID / D_ID / OX_ID routing environments.

When testing ISLs or SAN equipment where routing policies are based on S_ID / D_ID / OX_ID, the **Multi-frame Exchange Incrementing** mode is the only configuration that will provide valid test results specifically for out of sequence or unaccounted frames analysis.

Refer to `TrafficOxidBase` and `TrafficOxidStep` functions for more information on user configuration of these values.

- **Single-frame Exchange Incrementing**

For a given Physical N_Port, the value of the OX_ID increases by one for each consecutive frame transmitted by the Load Tester. The lower and upper bounds can be specified by the user.

Refer to `OxidMin` and `OxidMax` functions in the API Help for more information.

- **Single-frame Exchange Random**

For a given Physical N_Port, the value of the OX_ID will be random between a lower and upper bound. The OX_ID value varies in a pseudo random manner, changing for each consecutive frame transmitted. The lower and upper bounds can be specified by the user. Refer to `OxidMin` and `OxidMax` functions in the API Help for more information.

Additional Clarification

The **Single-frame Exchange Incrementing** and **Single-frame Exchange Random** OX_ID test modes send test frames that vary the OX_ID of each successive frame sent. Incrementing or Random OX_ID modes can be used to test for single-frame exchanges that are received in an order different than how they were transmitted. When testing in this configuration, the Unaccounted Frames and Sequence Errors counters will be set to 0 and should be ignored. Because the Fibre Channel specification does not explicitly define in-order or out-of-order exchanges the column heading “Out of Order Frames” should be interpreted as “single-frame exchanges received in an order other than the order transmitted.”

OX_ID Minimum

Displays the minimum value to be used for OX_ID when the OX_ID mode is set to **Single-frame Exchange Incrementing** or **Single-frame Exchange Random**.

Refer to the `OxidMin` function in the API Help for more information.

OX_ID Maximum

Displays the maximum value to be used for OX_ID when the OX_ID mode is set to **Single-frame Exchange Incrementing** or **Single-frame Exchange Random**.

Refer to the `OxidMax` function in the API Help for more information.

OX_ID Seed

Indicates the seed value for the OX_ID in random mode

A seed is a number used to initialize a random number generator. The random generator is initialized once using the seed, and the subsequent patterns will be generated automatically in a random manner. Refer to **Single-frame Exchange Random** OX_ID Mode discussed above.

You can also refer to the OxidSeed function in the API Help system on the product CD for more information.

RSCN

Indicates whether or not this port register to receive Registered State Change Notifications (RSCN) from the Fabric

Flow Control

Max TX Credits

Indicates the phys current count of remaining credits. When this value reaches 0, the phy must receive an Rrdy prior to transmitting another frame.

TX Credits Available

Indicates the phys transmit credit count that was received from the login target. This value will be 1 during login. Post login this will contain an integer value returned from the switch. It represents the maximum depth of the targets receive buffer.

ns @Zero Credits

When Current TX Credit count reaches Maximum TX Credit Value an underlying counter starts incrementing. When a credit is received, and the Current TX Credit count drops, the number of nanoseconds is stored.

SFP Status

Indicates the status of the Small Form-factor Pluggable (SFP) optical transceiver

SFP Rx Power

Indicates the SFP Rx power of the port
See `get_SFPRxPower` in the API Help.

SFP Tx Power

Indicates the SFP Tx power of the port
See `get_SFPTxPower` in the API Help.

SFP Make

Indicates the SFP Make number of the port
See `get_SFPMake` in the API Help.

SFP Model

Indicates the SFP Model of the port
See `get_SFPMoDel` in the API Help.

Error Counters

Contains all the errors reported back to Load Tester when statistics are updated

CRC Errors

Displays number of CRC Errors

See `get_CRCErrors` in the API Help.

Code Violations

Indicates number of Code Violations

See `get_CodeViolationErrors` in the API Help.

Disparity Errors

Displays number of Disparity Errors

See `get_DisparityErrors` in the API Help.

Sequence Errors

Displays number of Sequence Errors. This counter do not apply for LAN traffic so they are all 0 for LAN data streams.

See `get_FrameSequenceErrors` in the API Help.

Out Of Order

Indicates number of Out of Order Frame Errors. A sequence error occurs when a frame arrives that is not the expected successor (increased by one). This counter do not apply for LAN traffic so they are all 0 for LAN data streams.

Refer to the `get_FrameOutOfOrderErrors` function in the API Help for more information.

Unaccounted Frames

Displays number of Unaccounted Frames. An unaccounted frame occurs when then one or more frames have not arrived when the final frame of the sequence arrives. For LAN traffic “Unaccounted Frames” are derived from FCoE algorithm that applies to every 32 frames. Although this may not be true packet loss, it often reflects packet drop or extreme delay.

Refer to the `get_FrameDroppedErrors` function in the API Help for more information.

Misdirected

Displays the number of Misdirected Errors. A misdirected error occurs when a frame arrives that was not destined for the selected load tester port. Refer to the `get_FrameMisdirectedErrors` function in the API Help for more information.

Error Recovery Count

If the Load Tester has zero credits for longer than E_D_TOV (Default is 2 seconds) then the Load Tester issues a LR to the switch, implicitly causing credits available to the value achieved at login, and the Error Recovery Count increments. If a test was running at the time of the error recovery event, it will resume after LISM completes. Refer to the `getErrorRecoveryCount` function in the API Help for more information.

Additional Information on Error Counters

The following error counters are tracked by the Load Tester receiver on a PER STREAM basis. The Load Tester can track 512/1024 streams per receiver.

Sequence Errors

Displays the number of sequence errors. The sequence error counter increments anytime the SEQ_CNT of the current frame is not equal to the last frame's SEQ_CNT+1.



Note: Unaccounted frames, out of order frames, CRC errors, Disparity errors, and Code Violations will all lead to Sequence errors.

Unaccounted Frames

Displays the number of unaccounted frames. Each stream is similar to a unidirectional exchange consisting of a single sequence of 32 frames. The Load Tester remembers the SEQ_CNT of all the frames in the current pending exchange. When the final frame of the exchange arrives, indicated by SEQ_CNT=31, a 32-bit memory is evaluated and the unaccounted frame counter is incremented for each missing frame.



Note: Due to a limitation of the Load Tester if the frame with SEQ_CNT=31 is dropped by the switch, the unaccounted frame counter will NOT increment, but the SEQUENCE error count will increment. Frames dropped by switch with SEQ_CNT=0-30 will all increment the unaccounted frame counter. This is assuming Exchange Length is equal to 32.



Warning: All frames with CRC errors will be discarded by the Load Tester receiver "prior" to doing unaccounted frame evaluation. This is by design, since the data integrity of all fields in a frame with a CRC error is uncertain. For example, if a frame arrives with SEQ_CNT=30 AND also has a CRC Error, then it is discarded by the Load Tester, and when the final frame with SEQ_CNT=31 for the exchange arrives, a 32-bit memory will be evaluated and it will show that the frame with SEQ_CNT=30 did not arrive and the unaccounted frame counter will be incremented.

In general, frames with code violations or running disparity errors will also lead to a CRC error.

Out of Order

An out of order frame counter increases if the SEQ_CNT of the current frame is less than the SEQ_CNT of the last frame.

Error Counter Example:

The following example assume Exchange Length equal to 32.

If for a particular stream, frames arrive with the following SEQ_CNT's:

0, 1, 3, 2, 4, 5, 6, 8, 9, . . . , 31

Error Counter Summary for this stream:

Number of Sequence errors: 3

Out of order errors: 1

Unaccounted Frames: 1 (evaluated when frame with SEQ_CNT=31 arrives to allow immediate trigger)

Parameters Category Descriptions for FCoE Ports**Current State**

This row shows the following current status of the Load Tester:

- Laser Off
- Offline
- Port Failure
- Link Initializing
- Link Active
- Logout in Progress
- Fabric Login in Progress
- Logged in to Fabric
- NPIV Login in Progress
- NPIVs Logged In
- N-Port Login in Progress
- Logged In
- Test in Progress
- Unknown State

Refer to the `get_State()` function in the API Help for more information.

Desired State

This row shows the target state of the Load Tester ports: Laser Off, Offline, Link Active, Logged in to Fabric, NPIVs Logged In, Logged In, Test in Progress. Refer to the `get_DesiredState` function in the API Help for more information.

Configuration

This row contains the **Configuration...** button that launches the **FCoE Port Configuration** window for the selected port.

LEDs

This indicator changes color, green, red, yellow, black, depending on the link status. The indicator corresponds to the Link status LEDs on the blade in the Xgig chassis. Refer to the `get_LEDState` function in the API Help for more information.

The LEDs on the blade's front panel provide status about each port on the blade. See [Table 18: Xgig Fibre Channel Blade Link Status LED](#) below.

Table 19: Xgig Fibre Channel Blade Link Status LED

Port column LED color	Description
Black	Loss of signal
Red	Loss of synchronization
Green	Synchronized
Yellow	Loss of synchronization has occurred

Once sync has been resolved, a red LED turns to yellow. To reset the LED indicator to green, you need to reset the LED.

To reset the blade LEDs:

- 1 Right-click in the Parameters Status table to open the Parameters context menu.
- 2 Select **Reset LED** or **Reset LEDs for all ports**.

E_Node Source MAC

This row shows the E_Node Ethernet address for the FCoE port.

VN_Port MAC Addresses

This row shows the View button that opens the VN_Port Addresses window that lists the VN_Port Addresses and details.

As the Load Tester VN_Ports are being acquired during NPIV Login, the user can click the **View VN_Port MAC Addresses...** button from the Physical Ports grid. This will open port's **VN_Port MAC Addresses** window displaying the Source and Destination MAC addresses, Fibre Channel Source Id and World Wide Name, and the status for each VN_Port (Online - Green, Offline - Red).

If the user clicks the **Advanced** button, the Enode and VN_Port Keep Alive timer values will be displayed.

One or multiple VN_Ports can be selected and right-clicked to bring up the option to change the Enode or VN_Port Keep Alive timer value. Setting the value to zero will disable the transmission of Keep Alives for that VN_Port. If the Keep Alive settings for a VN_Port are set to an incorrect interval or disabled, the switch will eventually send a Clear Virtual Links to the Load Tester. Upon receipt of the Clear Virtual Links, the status of the VN_Port will be changed to Offline, and the contents of the Clear Virtual Links will be added to the log.

Ethernet MAC Addresses

This row shows the View button that opens the **Ethernet MAC Addresses** window that lists the Ethernet Addresses and details.

FCF MAC Addresses

Indicates the MAC address for the FCF discovered during the FCoE login process.

FC S_ID

This row shows the Source ID. This is the initial address given to this Load Tester by the switch during Fabric Login.

Physical WWN

This row shows the World Wide Name (WWN) of the port. Refer to the `get_wwnByNpiv` function in the API Help for more information.

Type

This row indicates the port type.

Port Group Tag List

Indicates the tags that are applied to the port. You can also view the port's tags by selecting **Port Tags** from the Parameters context menu. In addition, you can add a tag to or remove a tag from a port by selecting **Add Tag** or **Remove Tag** from the Parameters context menu. Refer to the `get_TagList` function in the API Help for more information.

Used TX Resources

This category displays the number of traffic profiles used or data streams used. Refer to the `get_TrafficUsedStreams` function in the API Help for more information.

Profiles

Indicates the number of continuous or burst traffic profiles used by the Physical N_Port.

Streams

Indicates the number of data streams being used by the Physical N_Port. Each physical Load Tester transmission path support a maximum of 1024 data streams.

Settings - General

This category indicates the current physical setup of the Load Tester port. You can change the settings in this category by using the Parameters context menu for each port you have locked.

When changing the line rate from 8.5000 Gbps to any other speed, Scrambling is automatically set to Disabled. When changing to 8.5000 Gbps, it is automatically set to Enabled. You may then manually override this setting by selecting **Configure Port** from the Parameters context menu.

Alias

Indicates the current alias or label assigned to the port. Refer to the Alias function in the API Help for more information.

NPIV

Indicates the number of virtual S_IDs that will be requested during the NPIV Login by using FDISC command(s). The Physical S_ID it not included in this number.

N_Port ID Virtualization is a Fibre Channel standard, that allows a single Physical N_Port to acquire more than one S_ID. The Load Tester supports NPIV during Login. For example, a unique stream could be created for each NPIV S_ID, destined to a single D_ID.

stem located on the product CD for more information.

Minimum IFG

Displays the Minimum Inter-Frame Gap (IFG). It is the guaranteed minimum number of idles between consecutive frames. Refer to the MinimumInterPacketGap function in the API Help for more information.

Login/FIP

This category indicates the current Login/FIP

Login VLAN Tag

Indicates the Ethernet value that this FCoE port will use for all frames during the FCoE login process.

VLAN Class Of Service

Indicates the enable vector that will be sent in a PFC pause frame. The bits set in the bitmask correspond to the classes that will be paused in the receive datapath.

VLAN VID

Indicates the VLAN VID assigned to the port.

Login Retry Limit

Displays the Login Retry Limit set for this port. If the login fails, then it will automatically retry after an elapsed time defined by login retry delay. See the `LoginRetryCountLimit` and `LoginRetryDelay` functions for more information.

Login Retry Delay

Displays the amount of time before a login retry is executed. See the `LoginRetryCountLimit` and `LoginRetryDelay` functions for more information.

Max RX FCoE Payload

Indicates the maximum size to be used by the **trafficId**.

FIP Keep Alive

Indicates whether the enable/disable FIP frames/timers (Tx and Rx) for the port(s) are enabled. It will display **True** if they are enabled.

DCBX

This category indicates the current DCBX settings of the Load Tester port.

Enable

Indicates whether DCBX operation for the port is enabled or disabled.

FCoE Logical Link

Indicates the DCBX Logical Link Down FCoE Logical Link Status (LLS) flag value. Please note this DCBX feature may not be present.

Ethernet Logical Link

Indicates the DCBX Logical Link Down FCoE Logical Link Status (LLS) flag value for LAN traffic. Please note this DCBX feature may not be present..

Keep Alive Interval

Indicates the LLDP (DCBX) interval timer that governs the repeat frequency of outgoing DCBX frames.

Keep Alive Timeout

Indicates the LLDP (DCBX) Time To Live value that is inserted into all outgoing DCBX frames.

Parameters...

This row contains the **Parameters...** that will launch the **DCBX Parameters** window for the selected port.

Settings - OX_ID

This category indicates the current OX_ID of the Load Tester port. You can change the settings in this category by using the Parameters context menu for each port you have locked.

OX_ID Mode

The OX_ID is a field in the header of the Fibre Channel frame whose value is inserted by the Load Tester. The OX_ID value chosen depends on the mode selected. Possible modes include: **Multi-frame Exchange Incrementing**, **Single-frame Exchange Incrementing**, and **Single-frame Exchange Random**.

Refer to the OxidMode function in the API Help for more information.

OX_ID has the following modes:

- **Multi-frame Exchange Incrementing**
The **Multi-frame Exchange Incrementing** mode assigns the OX_ID similar to the manner hosts assign OX_IDs. When sending Fibre Channel frames, this mode assigns each exchange and all frames within the exchange a unique OX_ID. This mode will correctly report sequence errors, unaccounted frames and out-of-order frames in both S_ID / D_ID and S_ID / D_ID / OX_ID routing environments. When testing ISLs or SAN equipment where routing policies are based on S_ID / D_ID / OX_ID, the **Multi-frame Exchange Incrementing** mode is the only configuration that will provide valid test results specifically for out of sequence or unaccounted frames analysis.

Refer to TrafficOxidBase and TrafficOxidStep functions for more information on user configuration of these values.
- **Single-frame Exchange Incrementing**
For a given Physical N_Port, the value of the OX_ID increases by one for each consecutive frame transmitted by the Load Tester. The lower and upper bounds can be specified by the user.

Refer to OxidMin and OxidMax functions in the API Help for more information.
- **Single-frame Exchange Random**
For a given Physical N_Port, the value of the OX_ID will be random between a lower and upper bound. The OX_ID value varies in a pseudo random manner, changing for each consecutive frame transmitted. The lower and upper bounds can be specified by the user. Refer to OxidMin and OxidMax functions in the API Help for more information.

Additional Clarification

The **Single-frame Exchange Incrementing** and **Single-frame Exchange Random** OX_ID test modes send test frames that vary the OX_ID of each successive frame sent. Incrementing or Random OX_ID modes can be used to test for single-frame exchanges that are received in an order different than how they were transmitted. When testing in this configuration, the Unaccounted Frames and Sequence Errors counters will be set to 0 and should be ignored. Because the Fibre Channel specification does not explicitly define in-order or out-of-order exchanges the column heading “Out of Order Frames” should be interpreted as “single-frame exchanges received in an order other than the order transmitted.”

OX_ID Minimum

Displays the minimum value to be used for OX_ID when the OX_ID mode is set to **Single-frame Exchange Incrementing** or **Single-frame Exchange Random**.

Refer to the OxidMin function in the API Help for more information.

OX_ID Maximum

Displays the maximum value to be used for OX_ID when the OX_ID mode is set to **Single-frame Exchange Incrementing** or **Single-frame Exchange Random**.

Refer to the OxidMax function in the API Help for more information.

OX_ID Seed

Indicates the seed value for the OX_ID in random mode

A seed is a number used to initialize a random number generator. The random generator is initialized once using the seed, and the subsequent patterns will be generated automatically in a random manner. Refer to **Single-frame Exchange Random OX_ID Mode** discussed above.

You can also refer to the OxidSeed function in the API Help system on the product CD for more information.

RSCN

Indicates whether or not this port register to receive Registered State Change Notifications (RSCN) from the Fabric

Flow Control

This category displays the flow control settings of the port.

PFC Override

Indicates whether the PFC Pause frames are enabled. If enabled PFC Pause frames are detected and transmitted, otherwise non-PFC Pause frames are detected and transmitted.

RX Pause Detect Delay

Indicates the delay for the detection of frames. The step-size for this value is 51.2 ns (1 quanta).

RX Pause Detect Mask

Indicates the specified classes of service that will be lossy based on a bitmask. Lossy channels ignore received pause frames.

SFP Status

Indicates the status of the Small Form-factor Pluggable (SFP) optical transceiver

SFP Rx Power

Indicates the SFP Rx power of the port
See `get_SFPRxPower` in the API Help.

SFP Tx Power

Indicates the SFP Tx power of the port
See `get_SFPTxPower` in the API Help.

SFP Make

Indicates the SFP Make number of the port
See `get_SFPMake` in the API Help.

SFP Model

Indicates the SFP Model of the port
See `get_SFPMoDel` in the API Help.

Errors Counters

Contains all the errors reported back to Load Tester when statistics are updated

CRC Errors

Displays number of CRC Errors
See `get_CRCErrors` in the API Help.

Alignment Errors

Indicates the number of times the FCoE **portid** has left the Aligned/Locked state
See `get_RxLostAlignmentCountEthernet` in the API Help.

Sequence Errors

Displays number of Sequence Errors
See `get_FrameSequenceErrors` in the API Help.

Out Of Order

Indicates number of Out of Order Frame Errors. A sequence error occurs when a frame arrives that is not the expected successor (increased by one). Refer to the `get_FrameOutOfOrderErrors` function in the API Help for more information.

Unaccounted Frames

Displays number of unaccounted frames. An unaccounted frame occurs when then one or more frames have not arrived when the final frame of the sequence arrives. Refer to the `get_FrameDroppedErrors` function in the API Help for more information.

Misdirected

Displays the number of Misdirected Errors. A misdirected error occurs when a frame arrives that was not destined for the selected load tester port. Refer to the `get_FrameMisdirectedErrors` function in the API Help for more information.

Additional Information on Error Counters

The following error counters are tracked by the Load Tester receiver on a PER STREAM basis. The Load Tester can track 512/1024 streams per receiver. The following descriptions assume Exchange Length equal to 32.

Sequence Errors

Displays the number of sequence errors. The sequence error counter increments anytime the `SEQ_CNT` of the current frame is not equal to the last frame's `SEQ_CNT+1`.



Note: Unaccounted frames, out of order frames, CRC errors, Disparity errors, and Code Violations will all lead to Sequence errors.

Unaccounted Frames

Displays the number of unaccounted frame. Each stream is similar to a unidirectional exchange consisting of a single sequence of 32 frames. The Load Tester remembers the `SEQ_CNT` of all the frames in the current pending exchange. When the final frame of the exchange arrives, a 32-bit memory is evaluated and the unaccounted frame counter is incremented for each missing frame.



Note: Due to a limitation of the Load Tester if the frame with `SEQ_CNT=31` is dropped by the switch, the unaccounted frames counter will NOT increment, but the SEQUENCE error count will increment. Frames dropped by switch with `SEQ_CNT=0-30` will all increment the unaccounted frame counter. This is assuming Exchange Length is equal to 32.



Warning: All frames with CRC errors will be discarded by the Load Tester receiver "prior" to doing unaccounted frame evaluation. This is by design, since the data integrity of all fields in a frame with a CRC error is uncertain. For example, if a frame arrives with `SEQ_CNT=30` AND also has a CRC Error, then it is discarded by the Load Tester, and when the final frame with `SEQ_CNT=31` for the exchange arrives, a 32-bit memory will be evaluated and it will show that the frame with `SEQ_CNT=30` did not arrive and the unaccounted frame counter will be incremented.

In general, frames with code violations or running disparity errors will also lead to a CRC error.

Out of Order

An out of order frame counter increases if the SEQ_CNT of the current frame is less than the SEQ_CNT of the last frame.

Error Counter Example:

The following example assume Exchange Length equal to 32.

If for a particular stream, frames arrive with the following SEQ_CNT's:

0, 1, 3, 2, 4, 5, 6, 8, 9, . . . , 31

Error Counter Summary for this stream:

Number of Sequence errors: 3

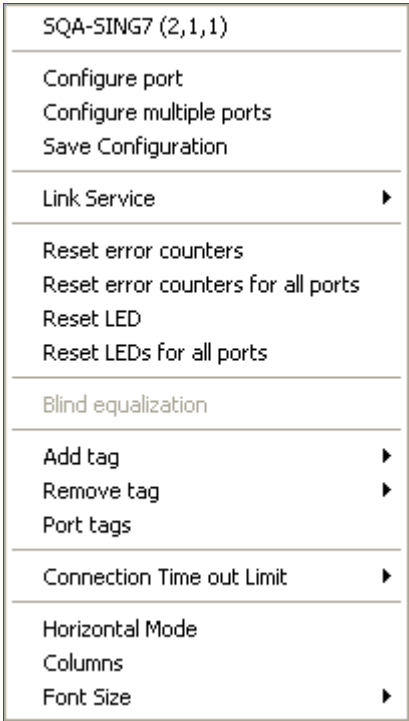
Out of order errors: 1

Unaccounted frames: 1 (evaluated when frame with SEQ_CNT=31 arrives to allow immediate trigger)

Using the Parameters Context Menu for Fibre Channel Ports

Right-click anywhere in the port column to display the context menu for that port. This menu is shown in Figure 346.

Figure 346: Load Tester Parameters context menu



The Parameters context menu contains the following options:

Configure port

Directs to **FC Ports Configuration** tab in the Load Tester Device Window.

For more information on the options in the **FC Ports Configuration** tab, refer to [“Using the Ports Configuration Tabs” on page 549](#).

Configure multiple ports

Directs to FC Ports Configuration tab in the Load Tester Device window. For more information, refer to [“Using the Ports Configuration Tabs” on page 549](#).

Save Configuration

Directs to the **Save Load Tester Configuration As** dialog where you may save the configuration under the folder and name of your choice.

Link Service

Opens the sub-menu for link service options listed below:

Turn laser OFF

Turns the laser off

Turn laser ON

Turns the laser on

Link Offline

Takes the port(s) offline, and sets the Desired State of the port(s) to "Offline".

Link Initialization

Enables the hardware LISM engine for the port(s), and set the Desired State of the port(s) to "Link Active". If successful, the hardware LISM engine will enter the Active state and transmit the IDLE primitive. This function will operate in accordance with the settings of the login retry count and login retry delay values. If unsuccessful, the state of the port(s) will be "Port Failure".

Fabric login

Logs into and registers with the Fabric with the port(s) specified, and sets the Desired State of the port(s) to "Logged in to Fabric".

The port(s) will send Fabric Login (FLOGI) to the Name Server (Well Known Address 0xFFFFFE), followed by a Port Login (PLOGI), Register FC Types (RFT_ID), and State Change Registration (SCR) to the Directory Server (Well Known Address 0xFFFFFC).

This function will operate in accordance with the settings of the login retry count and login retry delay values. If the Fabric login is unsuccessful, the state of the port(s) will be "Port Failure".

NPIV login

Logs the port to the switch and will attempt to acquire Virtual Ports from the Fabric, and set the Desired State of the port(s) to "NPIVs Logged In". The number of Virtual Ports to acquire per port is set via the `NPIVports()` function.

The port(s) will send Fabric Discover (FDISC) to the Name Server (Well Known Address 0xFFFFFE), followed by a Port Login (PLOGI) and Register FC Types (RFT_ID) to the Directory Server (Well Known Address 0xFFFFFC) if a Virtual ID (NPIV) was successfully acquired.

This function will operate in accordance with the settings of the login retry count and login retry delay values. If unsuccessful, the state of the port(s) will be "Port Failure".

NPort login

Send Port Login (PLOGI) frames to all Load Tester ports present in the Fabric, and set the Desired State of the port(s) to "Logged In". The port(s) will send a Get Port Identifiers (GID_PT) to the Directory Server, to discover the available Load Tester ports in the Fabric zone. It will then send PLOGI frames to the available Load Tester ports.

This function will operate in accordance with the settings of the login retry count and login retry delay values. If unsuccessful, the state of the port(s) will be "Port Failure".

Logout

Sends a Port Logout to the Fabric for the port(s) specified, and set the Desired State of the port(s) to "Link Active". This function will operate in accordance with the settings of the login retry count and login retry delay values. If unsuccessful, the state of the port(s) will be "Port Failure".

Inject Link Reset

Resets the credit count for the port(s) by entering the LR1 State, and following the Link Reset protocol.

Virtual Cable Pull

Turns the port(s) laser off, and then back on to simulate a cable pull while a test is running. The port(s) will automatically attempt to Login, and if successful, will resume running the test.

Start Blasting FLOGi Continuously

Initiates a continuous Blast FLOGI test.

Blast FLOGI is a special error mode for testing Switch recovery. The Load Tester ports blasts a canned FLOGI frame at the switch continuously.

Stop Blasting FLOGi Continuously

Stops the continuous FLOGi blast.

Reset LEDs

Click to reset the status LEDs for the port(s) on the Xgig blade and the Parameters Status table.

Reset error counters

Resets all the counters of the Port

Reset error counters for all ports

Resets all the error counters of all locked ports

Reset LED

Resets the status LED for the port on the Xgig blade and the Parameters Status table

Reset LEDs for all ports

Reset the status LEDs for all the locked ports on the Xgig blade and the Parameters Status table

Blind Equalization

Resets the SERDES to help synchronize to wire data.

Add tag

Lets you add a tag alias to a port

To add a tag using the context menu:

- 1 Right-click on the port to open the Parameters context menu.
- 2 Click on **Add tag**.
- 3 Select the tag to add to the port (Figure 347).

Figure 347: Add tag



To create a new tag and add it to the port:

- 1 Select **[New Tag]**. This will open the **Create New Tag** dialog box.
- 2 Enter a name for the new tag.
- 3 Click **Ok** to save the new tag and add it to the port.

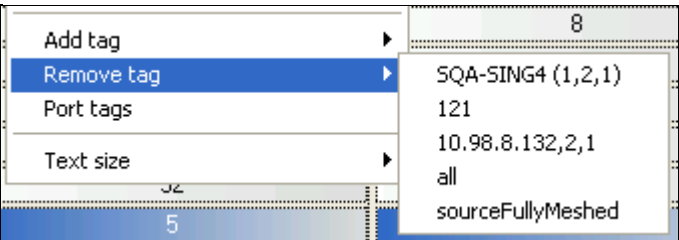
Remove tag

Lets you remove a tag from the port

To remove a tag using the context menu:

- 1 Right-click on the port to open the Parameters context menu.
- 2 Click on **Remove tag**.
- 3 Select the tag to remove from the port (Figure 348).

Figure 348: Remove tag



Port tags

Displays a list of all tags that have been applied to the port

For more information about creating or editing tags, refer to Chapter 28: “Creating Tags”.

Connection Time out

Lets you define the length of time that the client may go without receiving an update from the Xgig Chassis before it disconnects from the ports. Normally the chassis sends updates several times a second.

Horizontal Mode

Displays the port as rows and the parameters as columns.

To return to default layout for the ports:

- 1 Right-click on the port to open the Parameters context menu.
- 2 Click on **Vertical Mode**.

Columns

Opens the **Customize Band** dialog box where you can select which parameters to show in the Parameters Status Table when the display is in Horizontal Mode.

To select or unselect the parameters to show as columns:

- 1 Select the **Visibility** radio button.
- 2 Click on the checkboxes of the parameters to display or hide.
- 3 Click **OK** when you are done.

To arrange the sequence of columns displayed:

- 1 Select the **Sorting** radio button.
- 2 Click and drag the parameter names according to your preferred sequence.
- 3 Click **OK** when you are done.

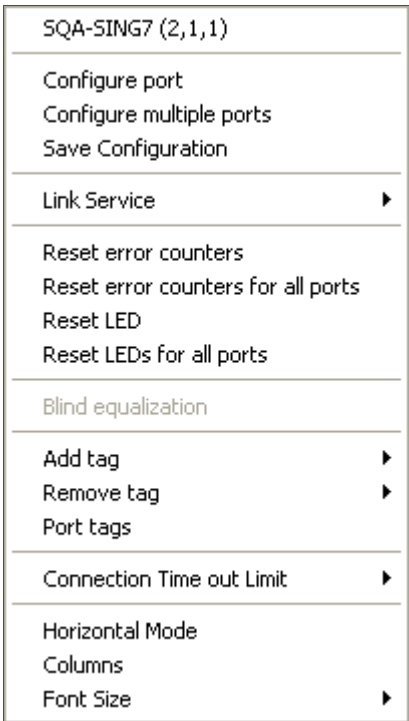
Font Size

Lets you select the size of the text used in the Parameters Status Table.

Using the Parameters Context Menu for FCoE Ports

Right-click anywhere in the port column to display the context menu for that port. This menu is shown in Figure 346.

Figure 349: Load Tester Parameters context menu



The Parameters context menu contains the following options:

Configure port

Directs to **FCoE Ports Configuration** tab in the Load Tester Device Window.

For more information on the options in the **FCoE Ports Configuration** tab, refer to [“Using the Ports Configuration Tabs” on page 549](#).

Configure multiple ports

Directs to FCoE Ports Configuration tab in the Load Tester Device window. For more information, refer to [“Using the Ports Configuration Tabs” on page 549](#).

Save Configuration

Directs to the **Save Load Tester Configuration As** dialog where you may save the configuration under the folder and name of your choice.

DCBX Parameters

Opens the **DCBX Parameters** window ([Figure 350](#)) where you can view the Load Tester port's DCBX settings.

Figure 350: DCBX Parameters Window

QA_LT1 (1,1,1) - DCBX Parameters

Port Id: QA_LT1 (1,1,1) Default Load Tester parameters shown

DCBX Address

Dest MAC: 01:80:C2:00:00:0E

Src MAC: 00:90:65:02:94:58

Chassis ID MAC: 00:90:65:02:2E:3B

Port ID MAC: 00:90:65:02:94:58

Protocol Control

Operation Version: 2

Rx Sequence Number: 0

Tx Acknowledge Number: 0

Priority Groups ETS

Operation Version: 0

☒ Enabled ☒ Willing ☐ Error

PG IDs	7	6	5	4	3	2	1	0
6	☐	☐	☐	☐	☐	☐	☐	☐
5	☐	☐	☐	☐	☐	☐	☐	☐
4	☐	☐	☐	☐	☐	☐	☐	☐
3	☐	☐	☐	☐	☐	☐	☐	☐
2	☐	☐	☐	☐	☐	☐	☐	☐
1	☐	☐	☐	☐	☒	☐	☐	☐
0	☒	☒	☒	☒	☐	☒	☒	☒

Number of Traffic Classes (TC) supported: 8

Priority Flow Control

Operation Version: 0

☒ Enabled ☒ Willing ☐ Error

Class of Service (CoS) Mask: 0000 1000b

Number of Traffic Classes (TC) supported: 8

Applications

Operation Version: 0

☒ Enabled ☒ Willing ☐ Error

Type	App Id	App type	App priority Mask
FCOE	0x8906	Ethernet Type	0000 1000b
FIP	0x8914	Ethernet Type	0000 1000b

Logical Link Down LAN LLS

Operation Version: 0

☒ Enabled ☐ Error ☒ Willing ☐ LLS

Logical Link Down FCoE LLS

Operation Version: 0

☒ Enabled ☐ Error ☒ Willing ☐ LLS

Close

VN_Port MAC Addresses

Opens the VN_Port Addresses window that lists the VN_Port Addresses and details.

Ethernet MAC Addresses

Opens the Ethernet MAC Addresses window that lists the Ethernet Addresses and details.

Link Service

Opens the sub-menu for link service options listed below:

Turn laser OFF

Turns the laser off

Turn laser ON

Turns the laser on

Link Offline

Takes the port(s) offline, and sets the Desired State of the port(s) to "Offline".

Link Initialization

Enables the hardware LISM engine for the port(s), and set the Desired State of the port(s) to "Link Active". If successful, the hardware LISM engine will enter the Active state and transmit the IDLE primitive. This function will operate in accordance with the settings of the login retry count and login retry delay values. If unsuccessful, the state of the port(s) will be "Port Failure".

Fabric login

Logs into and registers with the Fabric with the port(s) specified, and sets the Desired State of the port(s) to "Logged in to Fabric".

The port(s) will send Fabric Login (FLOGI) to the Name Server (Well Known Address 0xFFFFFE), followed by a Port Login (PLOGI), Register FC Types (RFT_ID), and State Change Registration (SCR) to the Directory Server (Well Known Address 0xFFFFFC).

This function will operate in accordance with the settings of the login retry count and login retry delay values. If the Fabric login is unsuccessful, the state of the port(s) will be "Port Failure".

NPIV login

Logs the port to the switch and will attempt to acquire Virtual Ports from the Fabric, and set the Desired State of the port(s) to "NPIVs Logged In". The number of Virtual Ports to acquire per port is set via the `NPIVports()` function.

The port(s) will send Fabric Discover (FDISC) to the Name Server (Well Known Address 0xFFFFFE), followed by a Port Login (PLOGI) and Register FC Types (RFT_ID) to the Directory Server (Well Known Address 0xFFFFFC) if a Virtual ID (NPIV) was successfully acquired.

This function will operate in accordance with the settings of the login retry count and login retry delay values. If unsuccessful, the state of the port(s) will be "Port Failure".

NPort login

Send Port Login (PLOGI) frames to all Load Tester ports present in the Fabric, and set the Desired State of the port(s) to "Logged In". The port(s) will send a Get Port Identifiers (GID_PT) to the Directory Server, to discover the available Load Tester ports in the Fabric zone. It will then send PLOGI frames to the available Load Tester ports.

This function will operate in accordance with the settings of the login retry count and login retry delay values. If unsuccessful, the state of the port(s) will be "Port Failure".

Logout

Sends a Port Logout to the Fabric for the port(s) specified, and set the Desired State of the port(s) to "Link Active". This function will operate in accordance with the settings of the login retry count and login retry delay values. If unsuccessful, the state of the port(s) will be "Port Failure".

Inject Link Reset

Resets the credit count for the port(s) by entering the LR1 State, and following the Link Reset protocol.

Virtual Cable Pull

Turns the port(s) laser off, and then back on to simulate a cable pull while a test is running. The port(s) will automatically attempt to Login, and if successful, will resume running the test.

Start Blasting FLOGi Continuously

Initiates a continuous Blast FLOGI test.

Blast FLOGI is a special error mode for testing Switch recovery. The Load Tester ports blasts a canned FLOGI frame at the switch continuously.

Stop Blasting FLOGi Continuously

Stops the continuous FLOGi blast.

Reset LEDs

Click to reset the status LEDs for the port(s) on the Xgig blade and the Parameters Status table.

Reset error counters

Resets all the counters of the Port

Reset error counters for all ports

Resets all the error counters of all locked ports

Reset LED

Resets the status LED for the port on the Xgig blade and the Parameters Status table

Reset LEDs for all ports

Reset the status LEDs for all the locked ports on the Xgig blade and the Parameters Status table

Flow Control

Opens the sub-menu for flow control options listed below:

Start sending pause frames

Starts sending pause frames continuously based on mode.

Stop sending pause frames

Stops sending pause frames on ports specified.

Send one pause frame

This function will invoke all ports to send a single pause frame.

Add tag

Lets you add a tag alias to a port

To add a tag using the context menu:

- 1 Right-click on the port to open the Parameters context menu.
- 2 Click on **Add tag**.
- 3 Select the tag to add to the port (Figure 347).

Figure 351: Add Tag



To create a new tag and add it to the port:

- 1 Select **[New Tag]**. This will open the **Create New Tag** dialog box.
- 2 Enter a name for the new tag.
- 3 Click **Ok** to save the new tag and add it to the port.

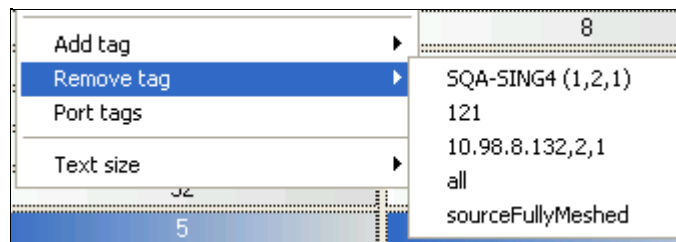
Remove tag

Lets you remove a tag from the port

To remove a tag using the context menu:

- 1 Right-click on the port to open the Parameters context menu.
- 2 Click on **Remove tag**.
- 3 Select the tag to remove from the port ([Figure 348](#)).

Figure 352: Remove tag



Port tags

Displays a list of all tags that have been applied to the port

For more information about creating or editing tags, refer to Chapter 28: [“Creating Tags”](#).

Horizontal Mode

Displays the port as rows and the parameters as columns.

To return to default layout for the ports:

- 1 Right-click on the port to open the Parameters context menu.
- 2 Click on **Vertical Mode**.

Columns

Opens the **Customize Band** dialog box where you can select which parameters to show in the Parameters Status Table when the display is in Horizontal Mode.

To select or unselect the parameters to show as columns:

- 1 Select the **Visibility** radio button.
- 2 Click on the checkboxes of the parameters to display or hide.
- 3 Click **OK** when you are done.

To arrange the sequence of columns displayed:

- 1 Select the **Sorting** radio button.
- 2 Click and drag the parameter names according to your preferred sequence.
- 3 Click **OK** when you are done.

Font Size

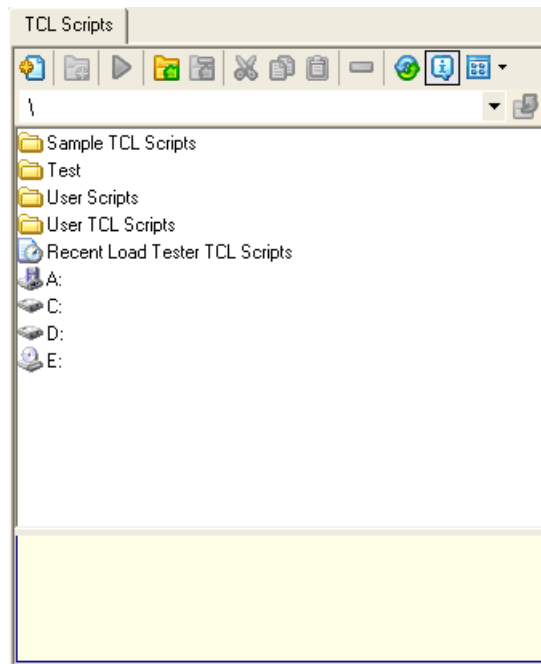
Lets you select the size of the text used in the Parameters Status Table.

Traffic Tab

The Traffic Tab contains live traffic statistics information about the Load Tester ports' TX and RX data paths. and is divided into sub tabs, the TX Tab (Figure 354) and the RX tab (Figure 357). Under the TX tab, there are two more sub-tabs: Pattern Based View and Port Based View. Under Rx tab, there are two spreadsheet pane views: Physical Port pane and RX Streams pane.

A TCL Scripts Manager (Figure 353) is also found in the Traffic tab that allows you to create, edit and manage TCL Script files.

Figure 353: TCL Scripts Manager



Using the TCL Scripts Manager

To create a new TCL script file:

- 1 Click **New TCL Script** button. The **New TCL Script** window opens.
- 2 Enter the TCL script.

- 3 Click on **Save**. The **Save TCL Script** as window opens.
- 4 Double-click the folder where you want to save the TCL Script file.

To save the TCL Script file to a different folder, or to map a new folder, click **Map Folder**. In the **Map Folder** dialog box, enter the name for the folder to map in the **Mapped Folder Name** text box.

Enter the path of the folder to map, or click **Browse** to locate it.

Click **Ok**. The new folder will be added to the list of mapped folders.
- 5 Enter the name of the file in the **File name** text box.
- 6 Click **Save**.

To open a saved TCL Script:

- 1 Double-click the folder where the file is located.
- 2 Double-click the file.

To run a saved TCL Script:

- 1 Open the script file.
- 2 From the script viewer, click **Run**.

TX Pattern Based View

The Pattern Based View tab lists all configured traffic patterns and the participating ports of each traffic pattern. From this tab you can create, copy, edit and delete traffic patterns. Additionally, you can adjust the average load of each port in the selected traffic patterns in real time using the incremental load adjuster or pause and resume the selected traffic pattern. You can also reset the load to the default value.

The details for each traffic pattern are displayed in columns. Each column represents a particular property of that traffic pattern. You may need to scroll horizontally to see all the columns.

By default, you have a sample traffic pattern in the Pattern Based View named “default”. You can edit this traffic pattern for your needs.

On top of the list of traffic patterns there are several buttons for editing the traffic patterns. Below is a table with the descriptions of the buttons.

Table 20: Traffic Pattern operation buttons

Icon	Description
	Create new Traffic Pattern - click to create a new traffic pattern. The Traffic Pattern Editor tab in the Load Tester Device Window will open.
	Copy Traffic Pattern - click to copy the selected traffic pattern. The Traffic Pattern Editor tab in the Load Tester Device Window will open with the name of the selected traffic pattern appended with the suffix “(Copy)”. You can also rename the traffic pattern Label.
	Edit selected Traffic Pattern - click to edit the selected traffic pattern. The Traffic Pattern Editor tab in the Load Tester Device Window box will open.
	Delete selected Traffic Pattern - click to edit the selected traffic pattern. The Traffic Pattern Editor tab in the Load Tester Device Window box will open.
	View - Opens the Traffic Pattern View for the selected traffic pattern where the traffic configuration details are displayed.
	% Increment Average Load - Increases the average load of the traffic pattern by the specified delta.
	% Decrement Average Load - Decreases the average load of the traffic pattern by the specified delta.
	Return loads to default value - Returns the load to the value set in the Traffic Pattern configuration.
	Pause - Pauses all enabled profiles on the specified port(s). This function does not change the enabled/disabled state of the individual profiles.
	Resume - Resumes all paused profiles on the specified port(s). This function does not change the enabled/disabled state of the individual profiles.
	Clear Filter - Removes all the filters that have been applied.
	Display % PFC Paused Tx Bandwidth for port - Opens the Percentage of PFC Paused Tx Bandwidth window.

To inject errors during a test (this only applies to FC ports):

- 1 Click **Inject Errors**.
- 2 Select **Inject One Code Violation Error** to inject a coding violation on Byte 0 to the ports. The illegal character that is sent is composed of a 6-bit part and a 4-bit part.
- 3 Select **Inject One Disparity Error** to inject a disparity error on Byte 3 to the ports. It will flip the disparity on Byte 3.

To send pause frames (available only for FCoE ports):

- 1 Click **Flow Control**.
- 2 Select **Start sending pause frames** to start sending pause frames continuously based on mode.

- 3 Select **Stop sending pause frames** to stop sending pause frames on ports specified.
- 4 Select **Send one pause frame** to invoke all ports to send a single pause frame.

To show or hide traffic values:

Click **Static** to show or hide static traffic values.

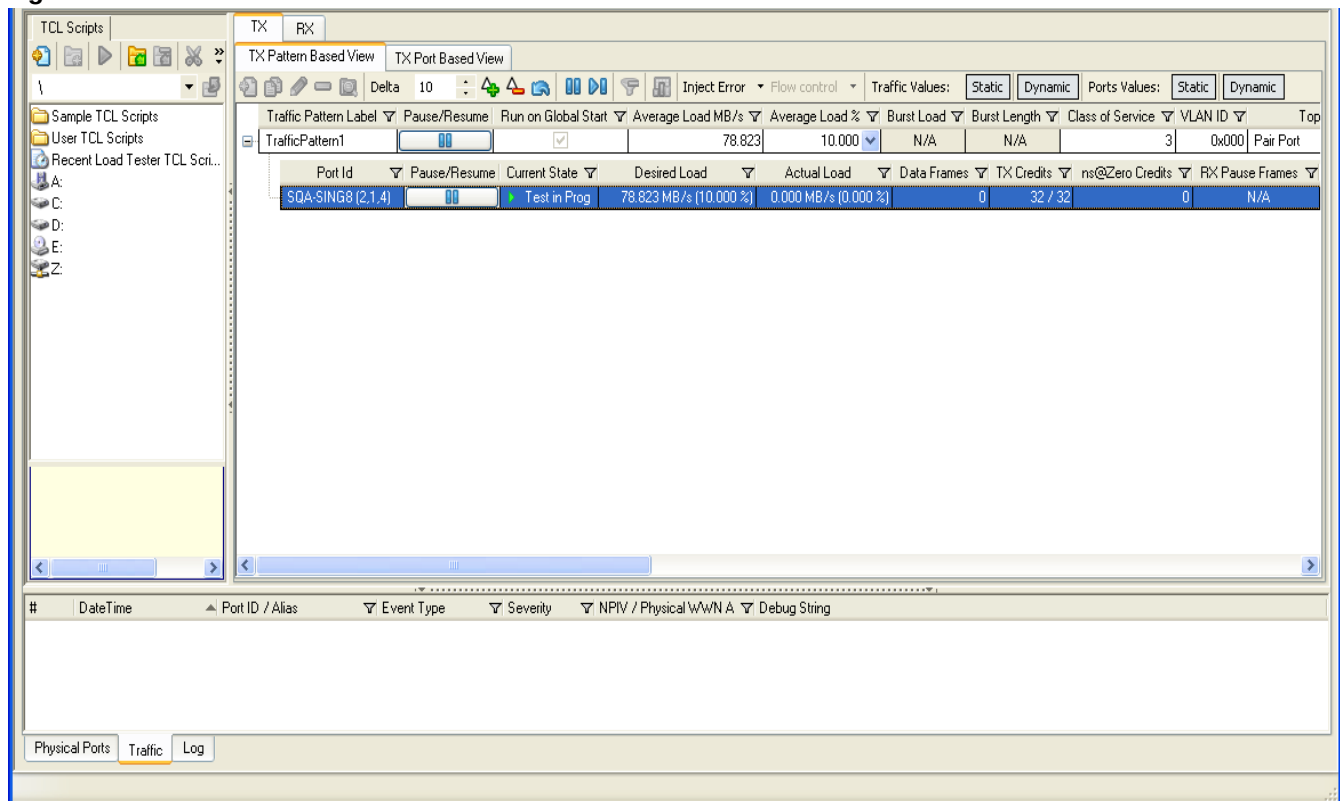
Click **Dynamic** to show or hide dynamic traffic values.

To show or hide ports values:

Click **Static** to show or hide static ports values.

Click **Dynamic** to show or hide dynamic ports values.

Figure 354: TX Pattern Based View



The main or top level bands represent the traffic patterns. Clicking on the expand button (represented by the cross icon) will expand the band and show the ports used in that traffic pattern.

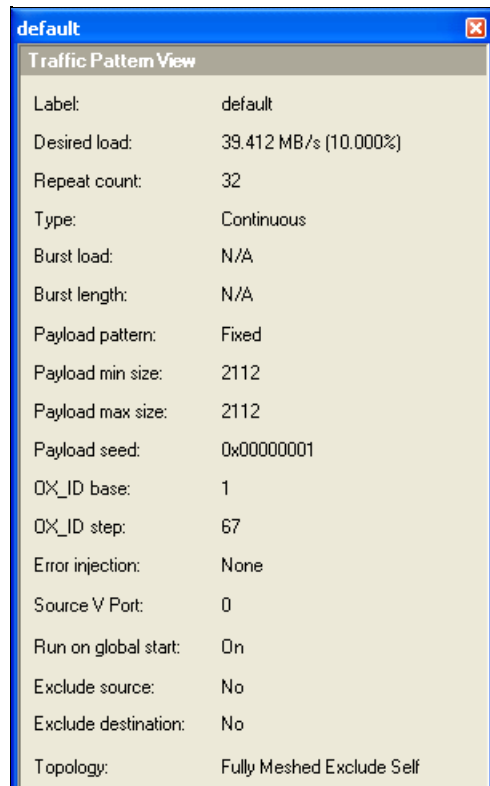
Right-clicking on the TX window will bring up the context menu. Depending on where you right-click in the TX window, different options will appear in the context menu.

If you right-click on the Traffic Pattern band or row, the following options will be displayed:

- **Add Traffic Pattern** - Opens the **Traffic Pattern Editor** tab in the Load Tester Device Window to allow the user to create a new traffic pattern
- **Edit Traffic Pattern** - Opens the **Traffic Pattern Editor** tab in the Load Tester Device Window to allow the user to edit the selected traffic pattern

- **Delete Traffic Pattern** - Deletes the selected traffic pattern
- **View Traffic Pattern** - Opens the **Traffic Pattern View** window (Figure 355) that displays configuration settings of the selected traffic pattern
- **Pause** - Pauses the current test
- **Resume** - Resumes the current test
- **Reset Counters for all ports** - Resets all counters of the ports in the traffic pattern

Figure 355: Traffic Pattern View



- **Columns** - Opens the Columns dialog box where you can select which columns to display
- **Collapse All** - Collapse all expanded bands
- **Expand All** - Expands all collapsed bands
- **Hide Filters** - Hides the filter icons
- **Clear Filter** - Removes all applied filters for the selected Traffic Pattern
- **Font Size** - Lets you select the size of the text used for the traffic pattern table.

If you right-click on the port band or row, the following will be the options:

- **Add Traffic Pattern** - Opens the Traffic Pattern Configuration Dialog Box to allow the user to create a new traffic pattern
- **Pause** - Pauses the traffic on the selected port of the traffic pattern
- **Resume** - Resumes the traffic on the selected port of the traffic pattern
- **Reset Counters** - Resets all counters of the port

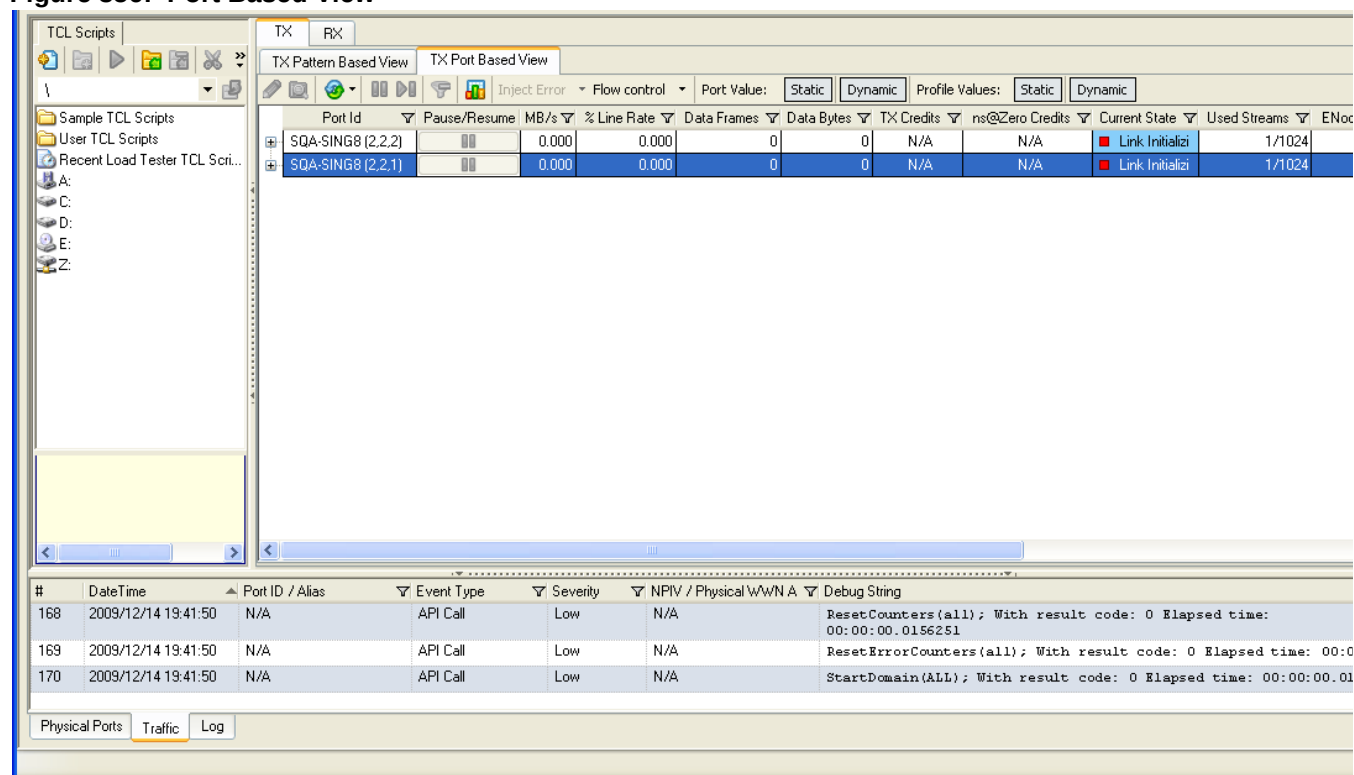
- **Reset Counters for all ports** - Resets all counters of the ports in the traffic pattern
- **Port Properties** - Opens a message box that list the properties of the port
- **Port Tags** - Opens a message box that displays the tags
- **Flow Control** - Displays additional options to **Start sending pause frames**, **Stop sending pause frames**, and **Send one pause frame** (available only for FCoE ports).
- **Columns** - Opens the Columns dialog box where you can select which columns to display
- **Hide Filters** - Hides the filter icons
- **Clear Filter** - Removes all applied filters for the selected Traffic Pattern
- **Font Size** - Lets you select the size of the text used for the traffic pattern table.

TX Port Based View

The Port Based View shows all reserved (locked) ports and their profiles (refer to [Figure 356](#)). Each port can have up to 8 profiles numbered from 0 to 7. Each profile is associated with one traffic pattern. A single physical port can allocate up to 8 traffic profile engines each representing a traffic pattern.



Note: There is no limit on the number of engines a port can receive from, as long as the configuration does not exceed 1024 RX data streams (1024 = 10 Gig and 8 Gig, 512 = 4 Gig).

Figure 356: Port Based View

On top of the list of traffic patterns there are several buttons for editing the traffic patterns. Below is a table with the descriptions of the buttons.

Table 21: TX Port Based View operation buttons

Icon	Description
	Edit selected Traffic Pattern - click to edit the selected traffic pattern. The Traffic Pattern Editor tab in the Load Tester Device Window will open.
	View - Opens the Traffic Pattern View for the selected traffic pattern where the traffic configuration details are displayed.
	Reset Counters - Clears all counters to 0, not including error counters. The client copy of the counters is updated asynchronously from the server, so a counter refresh interval will have to pass before the client copy of the counters reflect the reset action. Click on the drop-down arrow beside the icon to either reset the Error Counters for a selected port or reset the Error Counters for all ports.
	Pause - Pauses all enabled profiles on the specified port(s). This function does not change the enabled/disabled state of the individual profiles.
	Resume - Resumes all paused profiles on the specified port(s). This function does not change the enabled/disabled state of the individual profiles.

Table 21: TX Port Based View operation buttons

Icon	Description
	Clear Filter - Removes all the filters that have been applied.
	Display % PFC Paused Tx Bandwidth for port - Opens the Percentage of PFC Paused Tx Bandwidth window.

To inject errors during a test:

- 1 Click **Inject Errors**.
- 2 Select **Inject One Code Violation Error** to inject a coding violation on Byte 0 to the ports. The illegal character that is sent is composed of a 6-bit part and a 4-bit part.
- 3 Select **Inject One Disparity Error** to inject a disparity error on Byte 3 to the ports. It will flip the disparity on Byte 3.

To send pause frames (available only for FCoE ports):

- 1 Click **Flow Control**.
- 2 Select **Start sending pause frames** to start sending pause frames continuously based on mode.
- 3 Select **Stop sending pause frames** to stop sending pause frames on ports specified.
- 4 Select **Send one pause frame** to invoke all ports to send a single pause frame.

To show or hide traffic values:

Click **Static** to show or hide static traffic values.

Click **Dynamic** to show or hide dynamic traffic values.

To show or hide ports values:

Click **Static** to show or hide static ports values.

Click **Dynamic** to show or hide dynamic ports values.

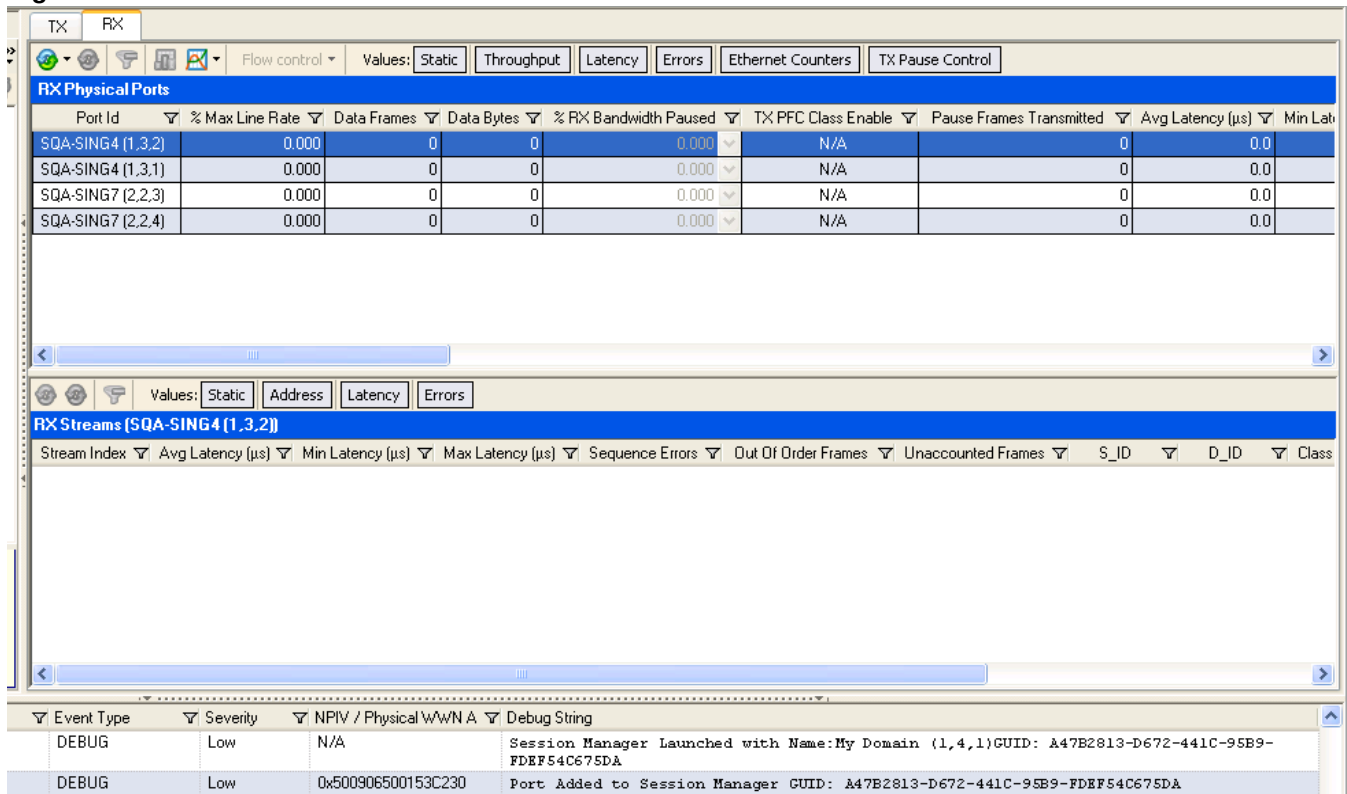
If you right-click on the port band or row, the following options will be available:

- **Reset Counters** - Resets all counters of the port
- **Reset Counters for all ports** - Resets all counters of the port
- **Pause** - Pauses the selected port
- **Resume** - Resumes the selected port
- **Port Properties** - Opens a message box that lists the properties of the port
- **Port Tags** - Opens a message box that displays the tags
- **Columns** - Opens the Columns dialog box where you can select which columns to display

-
- **Flow Control** - Displays additional options to **Start sending pause frames**, **Stop sending pause frames**, and **Send one pause frame** (available only for FCoE ports)
 - **Inject Error** - Lets you inject either **One Code Violation Error** or **One Disparity Error**
 - **Columns** - Opens the **Columns** dialog box where you can select which columns to display
 - **Collapse All** - Collapse all expanded bands
 - **Expand All** - Expands all collapsed bands
 - **Hide Filters** - Hides the filter icons
 - **Clear Filter** - Removes all applied filters for the selected Traffic Pattern
 - **Font Size** - Lets you select the size of the text used for the traffic pattern table.

RX Physical Ports

The Physical Ports View under the RX tab lists the physical ports locked by this instance of the Load Tester application and displays the statistics associated with the data streams received and processed by the RX data path.

Figure 357: RX Tab

Below is a table with the descriptions of the operation buttons for the RX Physical Ports View.

Table 22: RX Physical Ports View operation buttons

Icon	Description
	Reset Counters - Clears all counters to 0, not including error counters. The client copy of the counters is updated asynchronously from the server, so a counter refresh interval will have to pass before the client copy of the counters reflect the reset action. Click on the drop-down arrow beside the icon to either reset the Error Counters for a selected port or reset the Error Counters for all ports.
	Reset Triggers - Resets all Triggered Frame Errors and content allowing receipt of new Trigger Frames.
	Clear Filter - Removes all the filters that have been applied.
	Display Throughput per Priority Group - Opens the Display Throughput per Priority Group window.
	Latency and % of Max Frame Rate Charts - Gives you the option to display either the chart of percentage of max line rate or latency for a selected port.

To send pause frames (available only for FCoE ports):

- 1 Click **Flow Control**.

- 2 Select **Start sending pause frames** to start sending pause frames continuously based on mode.
- 3 Select **Stop sending pause frames** to stop sending pause frames on ports specified.
- 4 Select **Send one pause frame** to invoke all ports to send a single pause frame.

To show or hide traffic values:

Click **Static** to show or hide static traffic values.

Click **Dynamic** to show or hide dynamic traffic values.

To show or hide ports values:

Click **Static** to show or hide static ports values.

Click **Dynamic** to show or hide dynamic ports values.

If you right-click on the port band or row, the following options will be available:

- **Reset Counters** - Resets all counters for the selected port
- **Reset Counters for all ports**- Resets all counters for all ports
- **Reset Triggers** - Resets the triggers applied to this port
- **Port Properties** - Opens a message box that lists the properties of the port
- **Port Tags** - Opens a message box that displays the tags
- **Flow Control** - Displays additional options to **Start sending pause frames**, **Stop sending pause frames**, and **Send one pause frame** (available only for FCoE ports)
- **Columns** - Opens the Columns dialog box where you can select which columns to display
- **Hide Filters** - Hides the filter icons
- **Clear Filter** - Removes all applied filters for the selected Traffic Pattern
- **Font Size** - Lets you select the size of the text used for the traffic pattern table.

RX Streams

The RX Streams View lists the details of all the 1024 possible streams. Depending on the configuration of the Traffic Patterns in the Load Tester application, there may be up to 1024 RX Streams shown per Physical N_Port.

Below is a table with the descriptions of the operation buttons for the RX Streams View.

Table 23: RX Streams View operation buttons

Icon	Description
	Reset Counters - Clears all counters to 0, not including error counters. The client copy of the counters is updated asynchronously from the server, so a counter refresh interval will have to pass before the client copy of the counters reflect the reset action. Click on the drop-down arrow beside the icon to either reset the counters for a selected port or reset the counters for all ports.
	Reset Triggers - Resets all Triggered Frame Errors and content allowing receipt of new Trigger Frames.
	Clear Filter - Removes all the filters that have been applied.

If you right click on the stream band or row, the following options will be available:

- **Reset Counters** - Resets the counters of the selected stream
- **Reset Trigger** - Resets the triggers for the selected stream
- **Columns** - Opens the **Columns** dialog box where you can select which columns to display
- **Hide Filters** - Hides the filter icons
- **Clear Filter** - Removes all applied filters for the selected Traffic Pattern
- **Font Size** - Lets you select the size of the text used for the traffic pattern table.

Log Tab

The Log tab or view (Figure 358) displays the log entries generated for the tests you run. It displays the logs according to the sorting order of the columns. The date and time of the log shows when the log entry was generated.

Figure 358: Log Tab

 Load Tester logging active         [Entries: 78]						
#	DateTime	Port ID / Alias	Event Type	Severity	NPIV / Physical WWN A	Debug String
54	2008/12/05 15:21:11	N/A	API Call	Low	N/A	ltapi_connection.
55	2008/12/05 15:21:33	N/A	API Call	Low	N/A	ltapi_connection.
56	2008/12/05 15:21:33	N/A	API Call	Low	N/A	ltapi_connection.
57	2008/12/05 15:21:33	N/A	API Call	Low	N/A	ltapi_connection.
58	2008/12/05 15:37:26	N/A	API Call	Low	N/A	ltapi_connection.
59	2008/12/05 15:37:35	N/A	API Call	Low	N/A	ltapi_connection.
60	2008/12/05 15:44:27	N/A	API Call	Low	N/A	ltapi_connection.
61	2008/12/05 15:44:27	N/A	API Call	Low	N/A	ltapi_connection.
62	2008/12/05 15:44:27	N/A	API Call	Low	N/A	ltapi_connection.
63	2008/12/05 15:44:31	N/A	API Call	Low	N/A	ltapi_connection.
64	2008/12/05 15:44:39	N/A	API Call	Low	N/A	ltapi_connection.
65	2008/12/05 15:44:46	N/A	API Call	Low	N/A	ltapi_connection.
66	2008/12/05 15:44:51	N/A	API Call	Low	N/A	ltapi_connection.
67	2008/12/05 15:44:55	N/A	API Call	Low	N/A	ltapi_connection.
68	2008/12/05 15:53:00	N/A	API Call	Low	N/A	ltapi_connection.
69	2008/12/05 23:53:35	N/A	API Call	Low	N/A	ltapi_connection.
70	2008/12/05 23:53:36	N/A	API Call	Low	N/A	ltapi_connection.
71	2008/12/05 23:53:36	N/A	API Call	Low	N/A	ltapi_connection.

Viewing a Log

The Load Tester log shows a list of all events that occurred during the duration of the test.

The Log Manager continuously lists the logs and displays them with options you have selected.

You can save the log to a *.csv file, *.txt file or an HTML file.

To save a log from the Log Manager tab as an HTML file or text file:

- 1 Highlight the log you want to save.
- 2 Click the **Save Selected Entries As...** button. The Save Log Manager Contents As window is displayed.
- 3 Name and save the log as an HTML or text file to the Saved Logs folder or to a location you prefer.

Naming Log Files and Setting Locations

To set up default naming and locations of Load Tester log files:

- 1 Click the Log Manager Options icon to open the drop-down menu (Figure 359) and select **Log Manager Options**.

Figure 359: Log Manager Options Menu

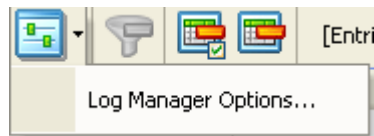
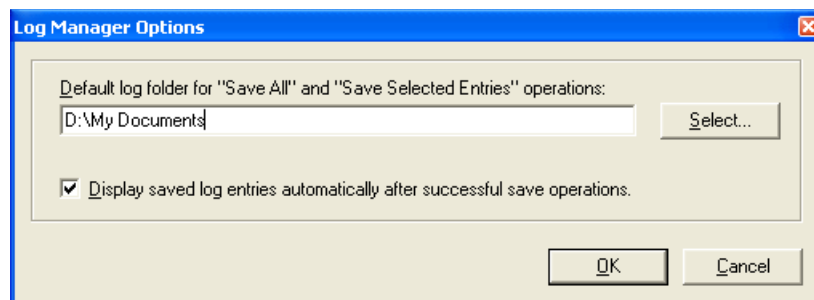


Figure 360: Log Options Dialog



- 2 Enter the path to the folder where you want to save the log file.
You can browse to where you want to save the log file by clicking the **Select** button.
- 3 Click **OK**.



Note: These settings apply to all Load Tester logs. Log options are the same for all Load Tester ports.

Multi-filtering Event Types

You can filter the logs using more than one event type by using multi-filtering feature.

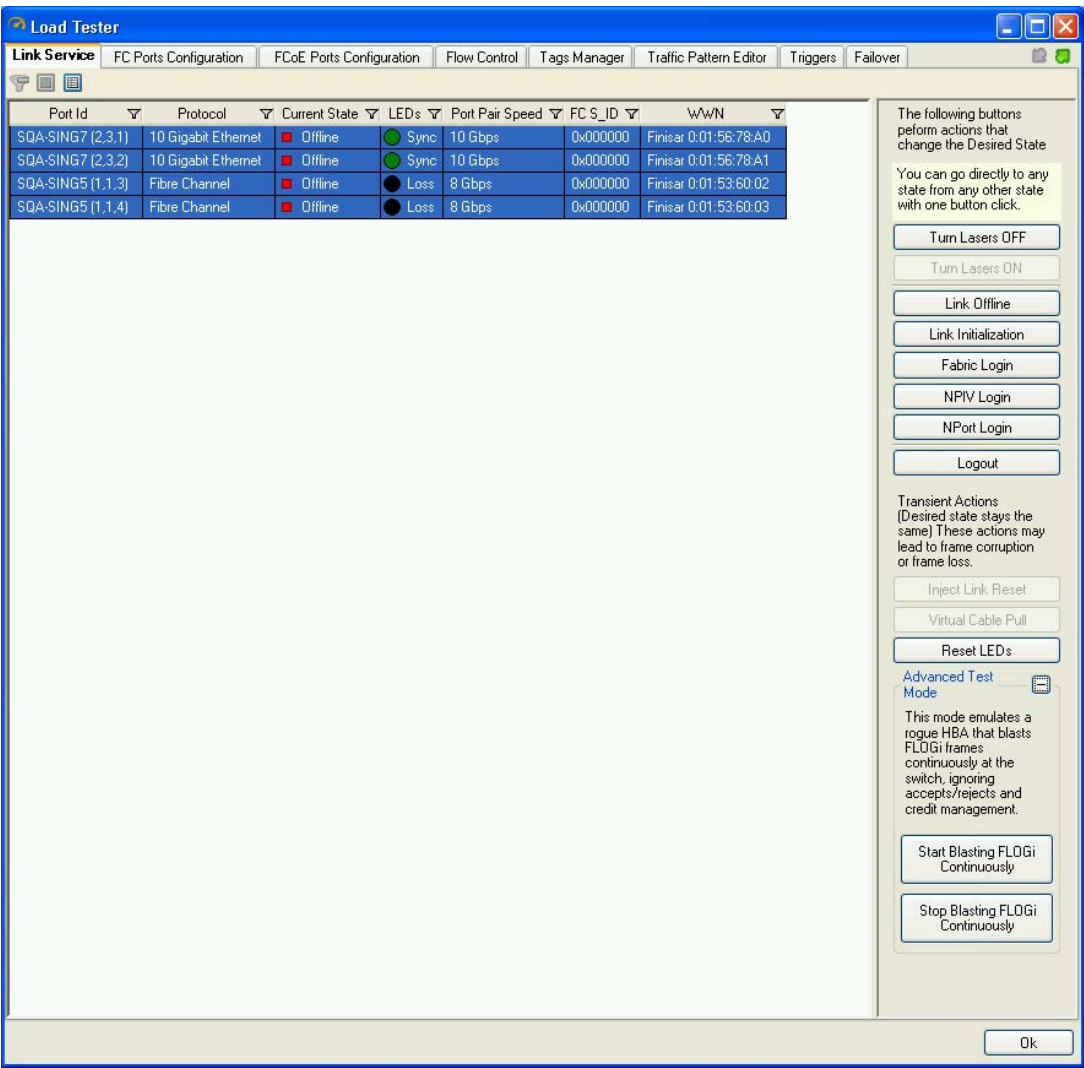
To filter the logs using more than one event type:

- 1 Click the **Filter** icon on the Event column.
- 2 Select **Multi-filtering**. A dialog box will appear with checkboxes for available event types.
- 3 Check the boxes of the events you want to use.
- 4 Click **Ok** to apply multi-filtering.

Load Tester Device Window

You can configure the Load Tester using the different settings found in the Load Tester Device Window (Figure 361).

Figure 361: Load Tester Device Window



The Load Tester Device Window is divided into the following tabs:

Link Service

The Link Service tab contains options to customize the link service settings for a port or group of ports.

FC Ports Configuration

The FC Ports Configuration tab lets you manage and configure all the Fibre Channel ports that have been locked for use with the Xgig Load Tester. From this tab you can view and access configuration setting for each port, filter ports according to tags or chassis, or select one or more ports for deletion.

FCoE Ports Configuration

The FCoE Ports Configuration tab lets you manage and configure all the FCoE ports that have been locked for use with the Xgig Load Tester. From this tab you can view and access configuration setting for each port, filter ports according to tags or chassis, or select one or more ports for deletion.

Flow Control

The Flow Control tab lets you manage the traffic flow or stream settings for individual ports and group of ports.

Tags Manager

The Tags Manager lets you create, edit, or delete the tags by Load Tester.

Traffic Pattern Editor

The Traffic Pattern Editor tab is where you create or edit a traffic pattern to be used

Triggers

The Triggers tab displays all the available triggers you can set when you run a test in Load Tester. You can turn on and pause triggers through this dialog box.

Failover

The Failover tab lets you set the failover settings for Fibre Channel Load Tester ports.

Chapter 27

Configuring Ports

In this chapter:

- Using the Ports Configuration Tabs
- Configuring Fibre Channel Ports
- Configuring FCoE Ports
- Organizing Ports
- Flow Control Tab
- Failover Tab

After locking the ports for use as a Load Tester, you must configure the selected ports, defining the ports based properties.

You can configure the FC ports either individually or as a group using the FC Ports Configuration tab in the Load Tester Device Window (Figure 362).

For FCoE ports, you can configure individual ports or as groups using the FCoE Configuration tab in the Load Tester Device window (Figure 362).

Figure 362: FC Port Configuration Tab

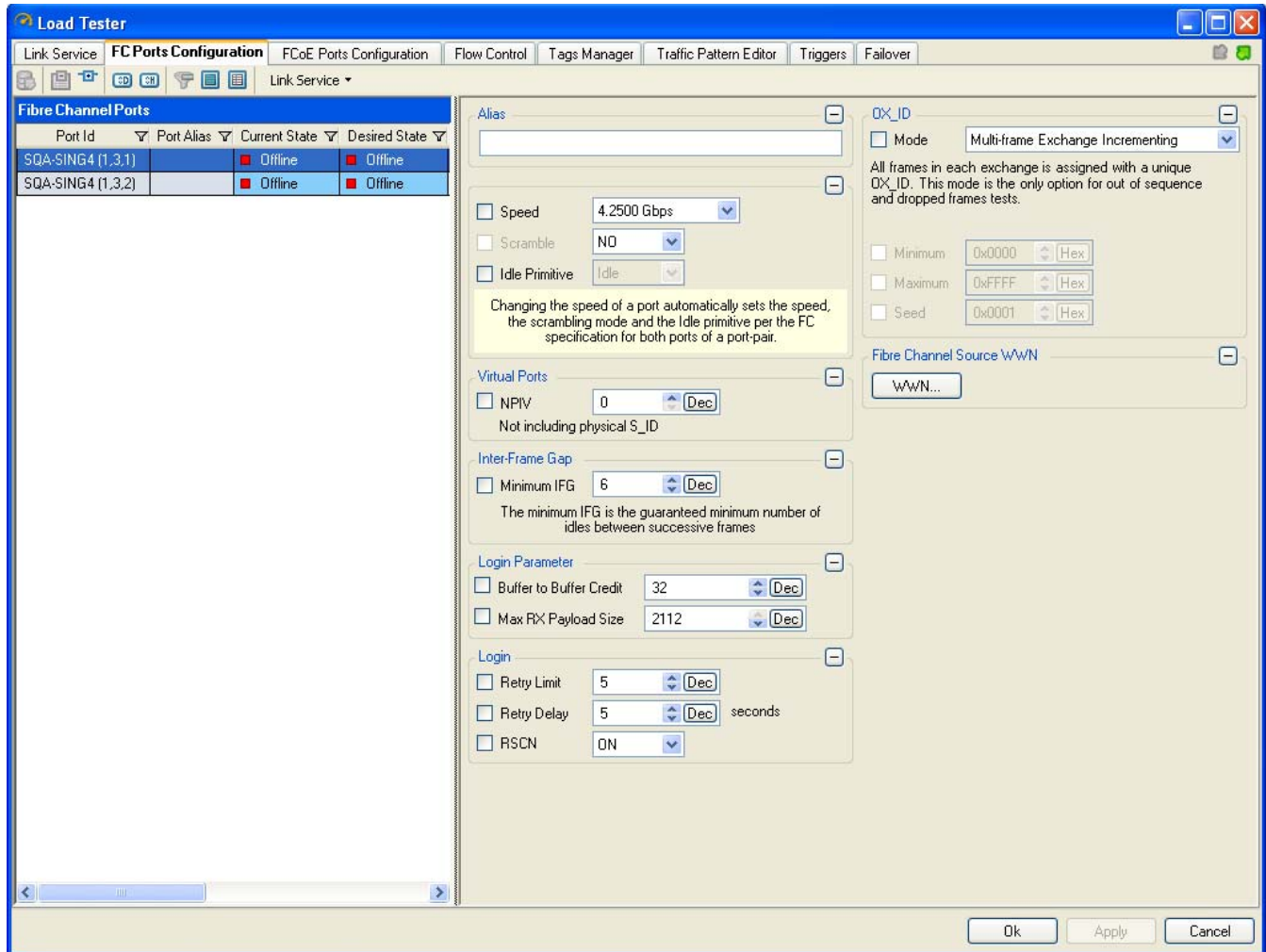
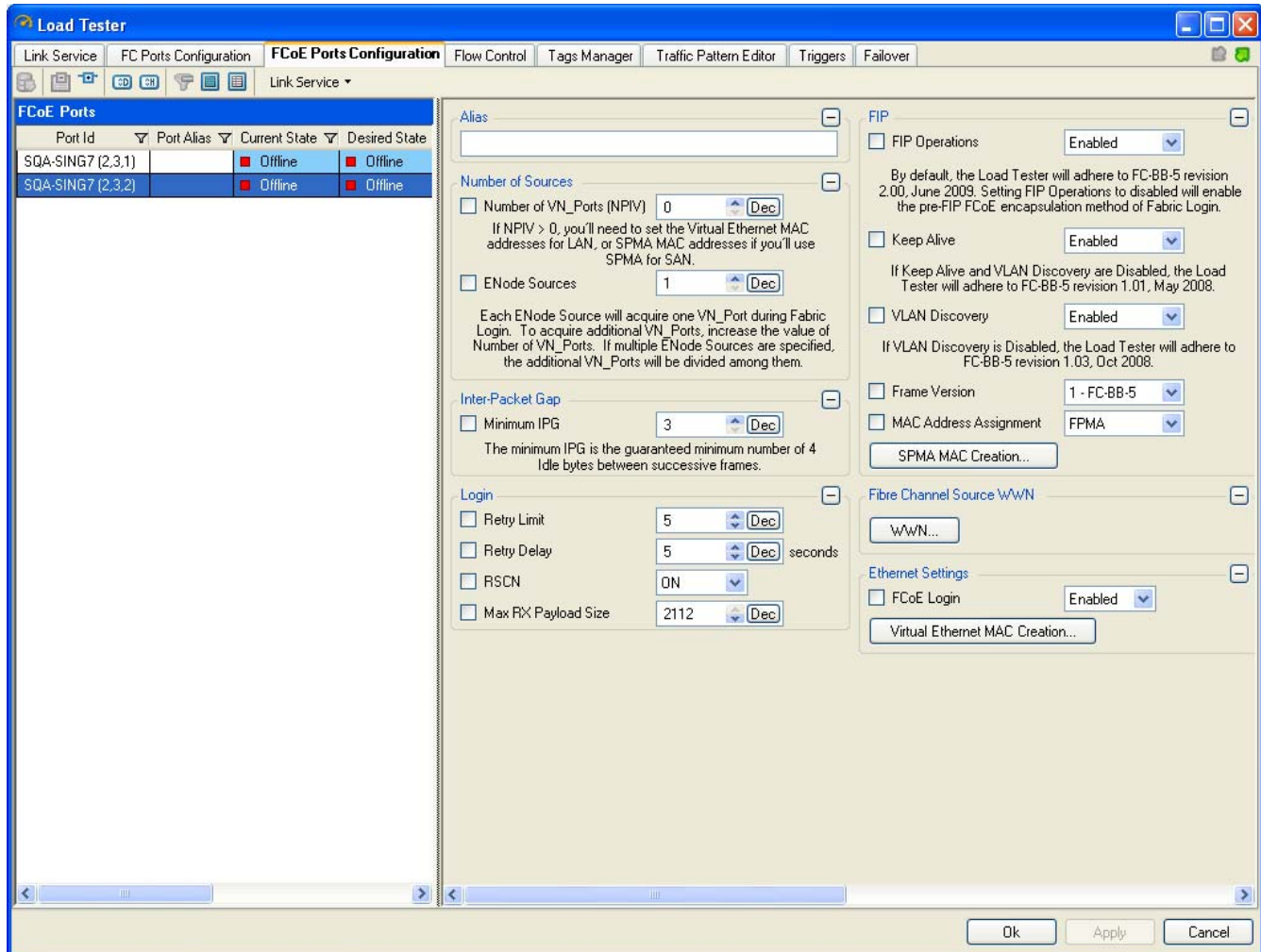


Figure 363: FCoE Ports Configuration Tab

Using the Ports Configuration Tabs

The Load Tester Device Windows have two tabs for configuring the ports locked as Load Testers: the FC Ports Configuration tab and the FCoE Ports Configuration tab. From these tabs you can view and access configuration setting for each port, filter ports according to tags or chassis, or select one or more ports for deletion.

The Ports Configuration tabs are each divided into two main panes, the left is a ports list and the right is the Port Configuration Control.

Operation buttons on the Ports Configurations tabs are listed below:

Apply - sends the changes in the configuration to the locked ports.

Expand Groupboxes - expands all the configuration groupboxes

Collapse Groupboxes - collapses all the configuration groupboxes

Numeric Editors in Decimal - change all the numeric editors into decimal format

Numeric Editors in Hexadecimal - change all the numeric editors into hexadecimal format

Clear Filters - removes all filters set for the Ports List

Select all Ports - select all ports listed in the Ports List

Deselect all Ports - deselect all ports selected

Link Service - lists link service options

Configuring Fibre Channel Ports

Once you have locked ports for use with Load Tester you can use the FC Ports Configuration tab to configure the settings for those ports. You can also access a port's configuration setup by right-clicking on the Parameters Status table and selecting **Configure port**.

To configure Fibre Channel ports:

- 1 Click on the **Configuration** drop-down button on the Xgig Maestro main window.
- 2 Select **Configure FC Ports**. This will open the **FC Ports Configuration** tab in the Load Tester Device Window. Alternatively, you can right-click on the FC port in the Parameters Status Table and select **Configure port**. This will open the **Fibre Channel Port Configuration** dialog box, which is the same as the FC Ports Configuration tab in the Load Tester Device Window.
- 3 Select the port from the list on the left panel. The configuration panel on the right will update with the settings for the selected port.
- 4 Set the alias for the selected port. Enter the alias in the **Alias** text field. You can set the alias if only one port is selected.
- 5 Select the speed of the port from the **Speed** drop-down list. Options are 1.0625 Gbps, 2.1250 Gbps, 4.2500 Gbps, or 8.5000 Gbps.



Note: When the speed of a port is changed, the speed for the corresponding port in the port pair is changed automatically. In addition, if the scrambling and idle primitive settings are changed automatically in response to a speed change for a port, the scrambling and idle primitive settings for the corresponding port are changed automatically.

- 6 Set the scrambling feature **ON** or **OFF** from the **Scramble** drop-down list.

Scrambling is enabled by default for line rate 8.5000 Gbps. Scrambling is disabled by default for line rates 1.0625 Gbps, 2.1250 Gbps, and 4.2500 Gbps.



Note: If the scrambling setting is changed automatically in response to a speed change for a port, the scrambling setting for the corresponding port is changed automatically.

- 7 Select the idle primitive to use on the port from the **Idle Primitive** drop-down list. Options are **Idle** and **ARB(FF)**. The default is **ARB(FF)**.

The idle primitive setting is **Idle** by default for line rates 1.0625 Gbps, 2.1250 Gbps, and 4.2500 Gbps. Refer to the `IdleIsARBff` function in the API Help system located on the product CD for more information.



Note: If the idle primitive setting is changed automatically in response to a speed change for a port, the idle primitive setting for the corresponding port is changed automatically.

Virtual Ports

- 1 Set the number of virtual ports to use on the port in the **NPIV** field. You can set up to 255 virtual ports in addition to the Physical S_ID.
- 2 Use the **up**  or **down**  button to increase or decrease the value, or enter it directly. To show the value in hexadecimal or decimal format, click on the **Hex** or **Dec** button at the right side of the NPIV field.

Inter-Frame Gap

- 1 Set the guaranteed minimum number of idles between successive frames in the **Minimum IFG** field. You can set a value from 3 to 65535.
- 2 Use the **up**  or **down**  button to increase or decrease the value, or enter it directly. To show the value in hexadecimal or decimal format, click on the **Hex** or **Dec** button at the right side of the Minimum IFG field.

Login Parameter

- 1 Set the Buffer-To-Buffer Credit in the **Buffer-to-Buffer Credit** field. You can set a value from 1 to 256. Use the **up**  or **down**  button to increase or decrease the value, or enter it directly. To show the value in hexadecimal or decimal format, click on the **Hex** or **Dec** button at the right side of the **Buffer-to-Buffer Credit** field.
- 2 Set the Max RX Payload Size limit in the **Max RX Payload Size** field. You can set a value from 64 to 2112. Use the **up**  or **down**  button to increase or decrease the value, or enter it directly. To show the value in hexadecimal or decimal format, click on the **Hex** or **Dec** button at the right side of the **Max RX Payload Size** field.

Login

- 1 Set the login retry limit in the **Retry Limit** field. You can set a value from 0 to 100 retries. Use the **up**  or **down**  button to increase or decrease the value, or enter it directly. To show the value in hexadecimal or decimal format, click on the **Hex** or **Dec** button at the right side of the **Retry Limit** field.
- 2 Set the login retry delay in the **Retry Delay** field. You can set a value from 1 to 60 seconds. Use the **up**  or **down**  button to increase or decrease the value, or enter it directly. To show the value in hexadecimal or decimal format, click on the **Hex** or **Dec** button at the right side of the **Retry Delay** field.
- 3 Set the Registered State Change Notification (RSCN) service **ON** or **OFF** from the **RSCN** drop-down list. By default, this service is turned off.

OX_ID

- 1 Select the Originator Exchange Identifier (OX_ID) mode from the **Mode** drop-down list. Options are **Multi-frame Exchange Incrementing**, **Single-frame Exchange Incrementing**, and **Single-frame Exchange Random**.

Multi-frame Exchange Incrementing

In this mode, all transmitter traffic streams for a given Physical N_Port are given a unique OX_ID prior to starting the test. In Multi-frame Exchange Incrementing OX_ID mode, the number of frames per sequence, per exchange (OX_ID) becomes a fixed number, 32. As a result, for a given Tx traffic stream, there is a unique OX_ID, and the Fibre Channel header SEQ_CNT increments from 0 to 31 for each frame sent then resets. The next frame from this stream is the first frame of the next sequence with SEQ_CNT returning to zero. See [Chapter 29, “Creating and Managing Traffic Patterns”](#) for user control of these values.

Single-frame Exchange Incrementing

In this mode, consecutive frames generated from a single Load Tester port will have a new OX_ID. There is no relationship between the OX_ID chosen and the stream or traffic profile engine. Define a lower and upper bound. In Single-frame Exchange Incrementing mode, the step size is always 1.

Single-frame Exchange Random

In this mode, consecutive frames generated from a single Load Tester port will have a new OX_ID. There is no relationship between the OX_ID chosen and the stream or traffic profile engine. Define a lower and upper bound.

- 2 Set the minimum value for the OX_ID in the **Minimum** field. This minimum value will be used when the incrementing and random modes are selected. You can set a value from 0 to 65535. Use the **up**  or **down**  button to increase or decrease the value, or enter it directly. To show the value in hexadecimal or decimal format, click on the **Hex** or **Dec** button at the right side of the **Minimum** field. This option is only applicable for single-frame exchange modes.
- 3 Set the maximum value for the OX_ID in the **Maximum** field. This maximum value will be used when the incrementing and random modes are selected. You can set a value from 0 to 65535. Use the **up**  or **down**  button to increase or decrease the value, or enter it directly. To show the value in hexadecimal or decimal format, click on the **Hex** or **Dec** button at the right side of the **Maximum** field. This option is only applicable for single-frame exchange modes.
- 4 Set the seed value in the **Seed** field.

A seed is the initial OX_ID pattern value. The random generator is initialized once using the seed, and the subsequent patterns will be generated automatically in a random manner.

This option is only applicable for Single-frame Exchange Random OX_ID mode.

Fibre Channel Source WWN

- 1 Click on the **WWN** button to configure the WWN or Port name of the selected port. The **Fibre Channel Source WWN** dialog box will open where you can set the source WWN options of the individual ports.
- 2 Click **Apply** to implement the changes you made to the WWN settings, or click **Ok** to save the WWN settings and close the dialog box.

Advanced

Click the **Blind Equalization**  button to execute blind equalization for the selected port (for 8G Blades only).



Note: The Serializer/Deserializer (SERDES) performs equalization based on its current parameters. In the event that these parameters are not sufficient to establish link then blind equalization can be performed. Blind equalization will reset the equalizer in order to reacquire link but in doing so will disrupt incoming traffic.

Implicit Fabric Login

Implicit Fabric Login bypasses Fabric Login with the switch, and allows the Load Tester port to begin transmitting data once the link is in the Active State.

- 1 Select **Enabled** or **Disabled** from the **Enable** drop-down menu.
- 2 Enter the Tx buffer-to-buffer credits of the physical port in the **Tx Credits** field. This will adjust the Tx buffer-to-buffer credits of the physical port while in Implicit Fabric Login mode.
- 3 Set the Fibre Channel S_ID used during Implicit Fabric Login in the **FC Source Id** field.

Click **Apply** on the FC Ports Configuration tab to save the changes you made or click **Cancel** to discard them.

Click **Ok**.

Configuring FCoE Ports

Once you have locked the FCoE ports for use with Load Tester you can use the FCoE Ports Configuration tab to configure the settings for those ports. You can also access a port's configuration setup by right-clicking on the Parameters Status table and selecting **Configure port**.

To configure FCoE ports:

- 1 Click on the **Configuration** drop-down button on the Xgig Maestro main window.
- 2 Select **Configure FCoE Ports**. This will open the **FCoE Ports Configuration** tab in the Load Tester Device Window. Alternatively, you can right-click on the FC port in the Parameters Status Table and select **Configure port**. This will open the **FCoE Port Configuration** dialog box, which is the same as the FCoE Ports Configuration tab in the Load Tester Device Window.

- 3 Select the port from the list on the left panel. The configuration panel on the right will update with the settings for the selected port.
- 4 Set the alias for the selected port. Enter the alias in the **Alias** text field. You can set the alias if only one port is selected.

Number of Sources

- 1 Set the number of virtual ports to use on the port in the **Number of VN_Ports(NPIV)** field. You can set up to 255 virtual ports in addition to the Physical S_ID.
- 2 Use the **up**  or **down**  button to increase or decrease the value, or enter it directly. To show the value in hexadecimal or decimal format, click on the **Hex** or **Dec** button at the right side of the **Number of VN_Ports(NPIV)** field.

If you enter an NPIV value greater than zero (0), you will need to set the Virtual Ethernet MAC addresses for LAN, or SPMA MAC addresses if you will use SPMA for SAN.

- 3 Set the number of ENode Sources in the **ENode Sources** field.

Each ENode Source will acquire one VN_port during Fabric Login. To acquire additional VN_Ports, increase the value of the Number of VN_Ports. If multiple ENode Sources are specified, the additional VN_Ports will be divided among them.

Inter-Packet Gap

- 1 Set the guaranteed minimum number of idles between successive frames in the **Minimum IFG** field. You can set a value from 3 to 65535.
- 2 Use the **up**  or **down**  button to increase or decrease the value, or enter it directly. To show the value in hexadecimal or decimal format, click on the **Hex** or **Dec** button at the right side of the Minimum IFG field.

Login

- 1 Set the login retry limit in the **Retry Limit** field. You can set a value from 0 to 100 retries. Use the **up**  or **down**  button to increase or decrease the value, or enter it directly. To show the value in hexadecimal or decimal format, click on the **Hex** or **Dec** button at the right side of the **Retry Limit** field.
- 2 Set the login retry delay in the **Retry Delay** field. You can set a value from 1 to 60 seconds. Use the **up**  or **down**  button to increase or decrease the value, or enter it directly. To show the value in hexadecimal or decimal format, click on the **Hex** or **Dec** button at the right side of the **Retry Delay** field.
- 3 Set the Registered State Change Notification (RSCN) service **ON** or **OFF** from the **RSCN** drop-down list. By default, this service is turned off.
- 4 Set the login retry limit in the **Max RX Payload Size** field. You can set a value from 0 to 100 retries. Use the **up**  or **down**  button to increase or decrease the value, or enter it directly. To show the value in hexadecimal or decimal format, click on the **Hex** or **Dec** button at the right side of the **Max RX Payload Size** field.

FIP

- 1 Enable or disable the FCoE Initialization Protocol (FIP) operations for the port by selecting **Enabled** or **Disabled** from the **FIP Operations** drop-down menu.
By default, the Load Tester will adhere to FC-BB-5 revision 2.00, June 2009. Setting FIP Operations to Disabled will enable pre-FIP FCoE encapsulation method of Fabric Login.
- 2 Enable or disable the Keep Alive frames/timers (Tx and Rx) for the port(s) by selecting **Enabled** or **Disabled** from the **Keep Alive** drop-down menu.
If **Keep Alive** and **VLAN Discovery** are set to **Disabled**, the Load Tester will adhere to FC-BB-5 revision 1.01, May 2008.
- 3 Enable or disable the VLAN Discovery for the port by selecting **Enabled** or **Disabled** from the **VLAN Discovery** drop-down menu.
If VLAN Discovery is Disabled, the Load Tester will adhere to FC-BB-5 revision 1.03, Oct. 2008.
- 4 Set the FIP Version for the port from the **Frame Version** drop-down menu.
- 5 Select the MAC Address Assignment mode to be used on the port selecting **FPMA** or **SPMA** from the **MAC Address Assignment** drop-down menu. If you select SPMA, click the **SPMA MAC Creation...** button to open the SPMA MAC Creation dialog box where you can view the Base and Step set for the ports.

Fibre Channel Source WWN

- 1 Click on the **WWN** button to configure the WWN or Port name of the selected port. **The Fibre Channel Source WWN** dialog box will open where you can set the source WWN options of the individual ports.
- 2 Click **Apply** to implement the changes you made to the WWN settings, or click **Ok** to save the WWN settings and close the dialog box.

Ethernet Settings

- 1 Enable or disable the FCoE Login by selecting **Enabled** or **Disabled** from the **FCoE Login** drop-down menu.
- 2 Click the **Virtual Ethernet MAC Creation...** button to open the **Virtual Ethernet MAC Creation** dialog box where you can view the Base and Step set for the ports.

Login VLAN Tag

- 1 Enable or disable the VLAN tags during the FCoE login process by selecting **Enabled** or **Disabled** from the **Enable** drop-down menu.
- 2 Set the numeric Class of Service (COS) value by selecting the value from the **VLAN Class of Service** drop-down list.
- 3 Set the FIP VLAN Request VID. Use the **up**  or **down**  button to increase or decrease the value, or enter it directly. To show the value in hexadecimal or decimal format, click on the **Hex** or **Dec** button at the right side of the **FIP VLAN Request VID** field

- 4 Enable or disable **Automatic VLAN VID Discovery** by selecting **Enabled** or **Disabled** from the **FCoE Login** drop-down menu.
By default, the login process will use the first available VID returned in the FIP VLAN Notification.
- 5 Set the VLAN VID for the port if you disabled **Automatic VLAN VID Discovery**. Use the **up**  or **down**  button to increase or decrease the value, or enter it directly. To show the value in hexadecimal or decimal format, click on the **Hex** or **Dec** button at the right side of the **Frame Version** field.

DCBX

- 1 Enable or disable the DCBX by selecting **Enabled** or **Disabled** from the **DCBX** drop-down menu.
- 2 Set the LLDP (DCBX) interval timer that governs the repeat frequency of outgoing DCBX frames in the **Keep Alive Interval** field. Use the **up**  or **down**  button to increase or decrease the value, or enter it directly. To show the value in hexadecimal or decimal format, click on the **Hex** or **Dec** button at the right side of the **Keep Alive Interval** field.
- 3 Set the LLDP (DCBX) Time To Live value that is inserted into all outgoing DCBX frames in the **Keep Alive Timeout** field. Use the **up**  or **down**  button to increase or decrease the value, or enter it directly. To show the value in hexadecimal or decimal format, click on the **Hex** or **Dec** button at the right side of the **Keep Alive Timeout** field.
- 4 Click the **Parameters** button to open the DCBX Parameters window for the selected ports.

OX_ID

- 1 Select the Originator Exchange Identifier (OX_ID) mode from the **Mode** drop-down list. Options are **Multi-frame Exchange Incrementing**, **Single-frame Exchange Incrementing**, and **Single-frame Exchange Random**.

Multi-frame Exchange Incrementing

In this mode, all transmitter traffic streams for a given Physical N_Port are given a unique OX_ID prior to starting the test. In Multi-frame Exchange Incrementing OX_ID mode, the number of frames per sequence, per exchange (OX_ID) becomes a fixed number, 32. As a result, for a given Tx traffic stream, there is a unique OX_ID, and the Fibre Channel header SEQ_CNT increments from 0 to 31 for each frame sent then resets. The next frame from this stream is the first frame of the next sequence with SEQ_CNT returning to zero. See [Chapter 29, “Creating and Managing Traffic Patterns”](#) for user control of these values.

Single-frame Exchange Incrementing

In this mode, consecutive frames generated from a single Load Tester port will have a new OX_ID. There is no relationship between the OX_ID chosen and the stream or traffic profile engine. Define a lower and upper bound. In Single-frame Exchange Incrementing mode, the step size is always 1.

Single-frame Exchange Random

In this mode, consecutive frames generated from a single Load Tester port will have a new OX_ID. There is no relationship between the OX_ID chosen and the stream or traffic profile engine. Define a lower and upper bound.

- 2 Set the minimum value for the OX_ID in the **Minimum** field. This minimum value will be used when the incrementing and random modes are selected. You can set a value from 0 to 65535. Use the **up**  or **down**  button to increase or decrease the value, or enter it directly. To show the value in hexadecimal or decimal format, click on the **Hex** or **Dec** button at the right side of the **Minimum** field. This option only applicable for single-frame exchange modes.
- 3 Set the maximum value for the OX_ID in the **Maximum** field. This maximum value will be used when the incrementing and random modes are selected. You can set a value from 0 to 65535. Use the **up**  or **down**  button to increase or decrease the value, or enter it directly. To show the value in hexadecimal or decimal format, click on the **Hex** or **Dec** button at the right side of the **Maximum** field. This option only applicable for single-frame exchange modes.
- 4 Set the seed value in the **Seed** field.

A seed is the initial OX_ID pattern value. The random generator is initialized once using the seed, and the subsequent patterns will be generated automatically in a random manner.

This option is only applicable for Single-frame Exchange Random OX_ID mode.

Demo Mode

Select **Disabled** or **Enabled** in the **FCF Emulator** drop down menu to disable or enable the FCoE switch or Fibre Channel Forwarder (FCF) Emulator.

Enabling the FCF Emulator allows this port to emulate an FCF. The selected port should be connected to another Load Tester port that is not running the FCF Emulator. The two ports must be in the Link Active state (perform Link Initialization) before attempting to login or start a test. The FCF Emulator port should be configured as a receive-only port.

After you are done, Click **Apply** on the FCoE Ports Configuration tab to save the changes you made or click **Cancel** to discard them.

Click **Ok**. Your settings are applied to the selected ports.

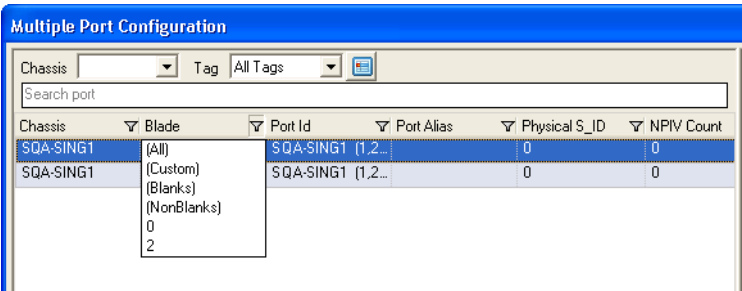
Organizing Ports

Each port property column has a **Filter**  button to allow you to apply filters.

To apply a filter:

- 1 Click on the **Filter**  button and a drop-down list will appear listing all values for that property from all ports (refer to [Figure 364](#)).

Figure 364: Filter Options

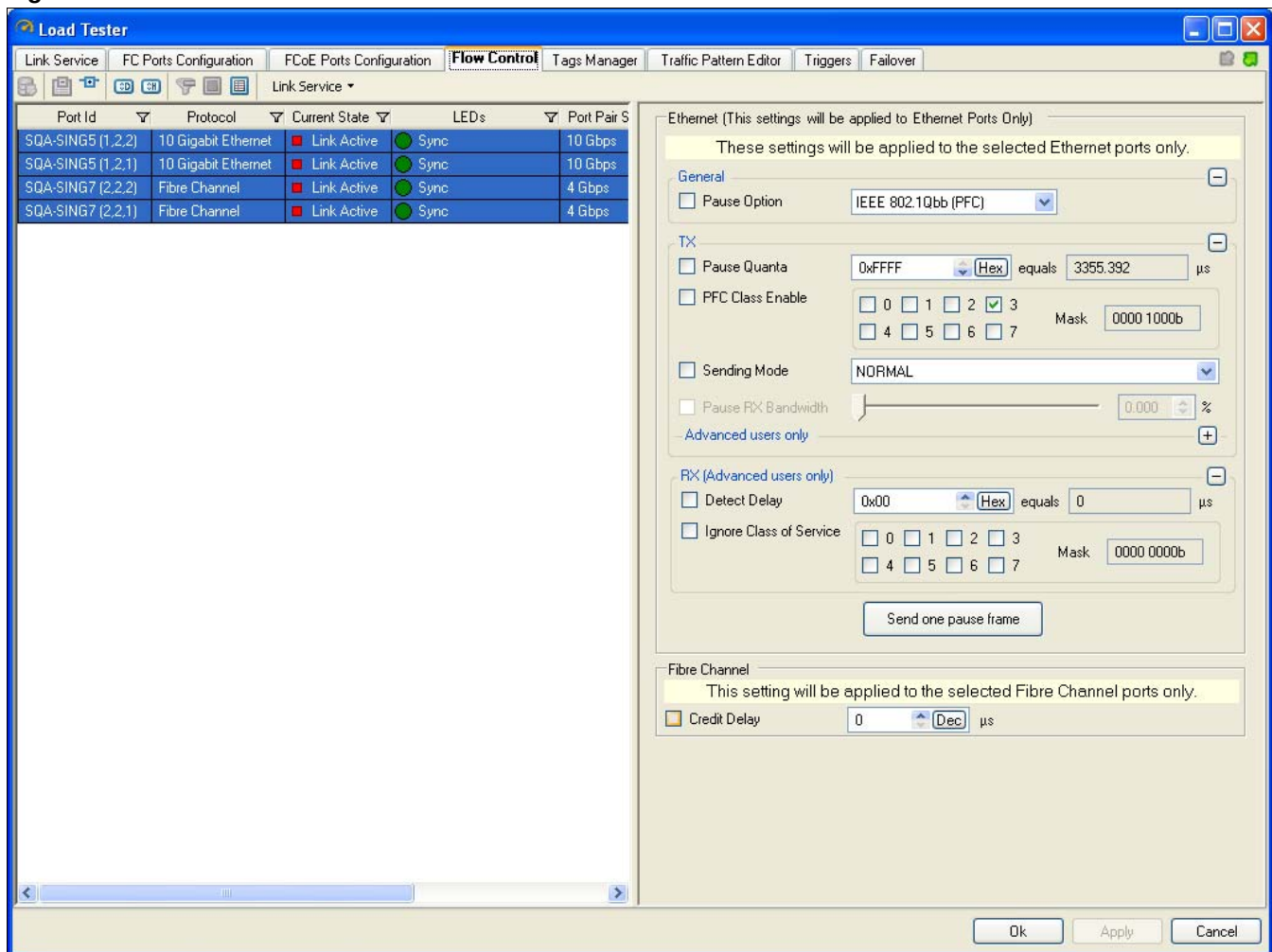


2 Select the appropriate value.

The filter icon for that property now appears blue  to indicate the filter has been applied. You can apply additional filters to further refine the list of ports.

Flow Control Tab

You can configure the traffic flows for individual or multiple FC or FCoE ports locked to Load Tester through the Flow Control tab (Figure 365) in the Load Tester Device Window.

Figure 365: Flow Control Tab

The **Flow Control** tab is divided into the Ports list and the flow control settings.

The flow control settings for Ethernet Ports are:

General

Pause Option

This option lets you set whether the PFC Pause frames are enabled. If selected, PFC Pause frames are detected and transmitted, otherwise non-PFC Pause frames are detected and transmitted.

TX

Pause Quanta

This is the time defined in PAUSE quanta (51.2ns) sent in the PAUSE frame.

PFC Class Enable

This option allows you to set the class enable vector that will be sent in a PFC pause frame.

The bits set in the bitmask correspond to the classes of service that will be paused in the receive datapath. This API only applies when PFC is enabled.

Sending Mode

This option allows you to configure the Load Tester to transmit pause frames at a constant interval/rate.

Possible modes are:

NORMAL - Load Tester does not generate test pause frames.

TXOFF_ONLY - Load Tester sends pause frames with the pause quanta of the frame set to the pause duration. Note if pause duration is set to 0 it actually sends pause frames with zero pause time.

TXOFF_TXON - Load Tester sends single pause frame with non-zero pause time followed by a single pause frame with zero pause time.

TXOFF_REPEATED_TXON_REPEATED: Load Tester sends repeated pause frames with non-zero pause time followed by repeated pause frames with zero pause time.

Pause RX Bandwidth

This option allows you to set the percentage of time the RX datapath will be paused in step-sizes of 1/1000 of a percent.

Note only those enabled classes of service will be paused in PFC Mode.

This option lets you specify the desired RX datapath bandwidth. Sometimes we may not be able to achieve the bandwidth input without adjusting some other parameters, such as settings for the Pause Quanta Value, TX off TX off duration, and others. If this is the case it will set the bandwidth to the closest possible and you can get the real bandwidth by calling the corresponding get function.

For advanced users, the following options are available:

TX off TX off duration

This option specifies the duration between sending the first TXOFF pause frame and the next first TXOFF pause frame.

TX off TX on duration - This API only applies when sending mode selected is **TXOFF_TXON** or **TXOFF_REPEATED_TXON_REPEATED**. In these modes, this option specifies the duration between sending the (first) TXOFF pause frame and the (first) TXON pause frame.

Note the value set in this option should be less than the value set with **Pause Quanta** option, and the value set here needs to be less than the value set in **TX off TX off duration** (if it is non-zero). Invalid value will get warning message, and the pause frames may not be generated correctly and the **Pause RX Bandwidth** may not get the correct result.

Repeat Interval

This option only applies when **TXOFF_REPEATED_TXON_REPEATED** is set as the sending mode.

It configures the duration between two consecutive TXOFF pause frames OR the duration between two consecutive TXON pause frames.

Note the value set in this API needs to be less than the value set with the **TXOFF_TXON** option. Invalid value will get warning message, and the pause frames may not be generated correctly and **Pause RX Bandwidth** may not get the correct result.

RX

These options are for advanced users only.

Detect Delay

This option allows the you to delay the RX detection of pause frames. The step-size for this value is 51.2 ns (1 pause quanta).

Ignore Class of Service

This API allows the user to specify which classes of service will be lossy based on a bitmask. Lossy channels ignore received pause frames.

Send one pause frame button

This button, once pressed, will invoke all ports to send a single pause frame.

The following option is for Fibre Channel ports only:

Credit Delay

This option assists the user in creating slow device emulation in a Fibre Channel environment. The port will require that N nanoseconds have elapsed before issuing another credit.

The Table below provides the number of nanoseconds per transmitted Dword.

Table 24: Number of nanoseconds per transmitted Dword

8 Gig	4.71 ns
4 Gig	9.41 ns
2 Gig	18.88 ns
1 Gig	37.64 ns

For any given speed, a nanosecond delay less than values above will have no effect.

To create a slow device the delay value must exceed the frame transmit time for the given speed.

$$(((\text{frame size SoF-EoF}) / 4) + \text{minimum IFG}) * \text{ns per Dword}$$

For example a full size payload with a minimum IFG of 6 is 2172 bytes.

$$2172 / 4 = 543 \text{ Dwords}$$

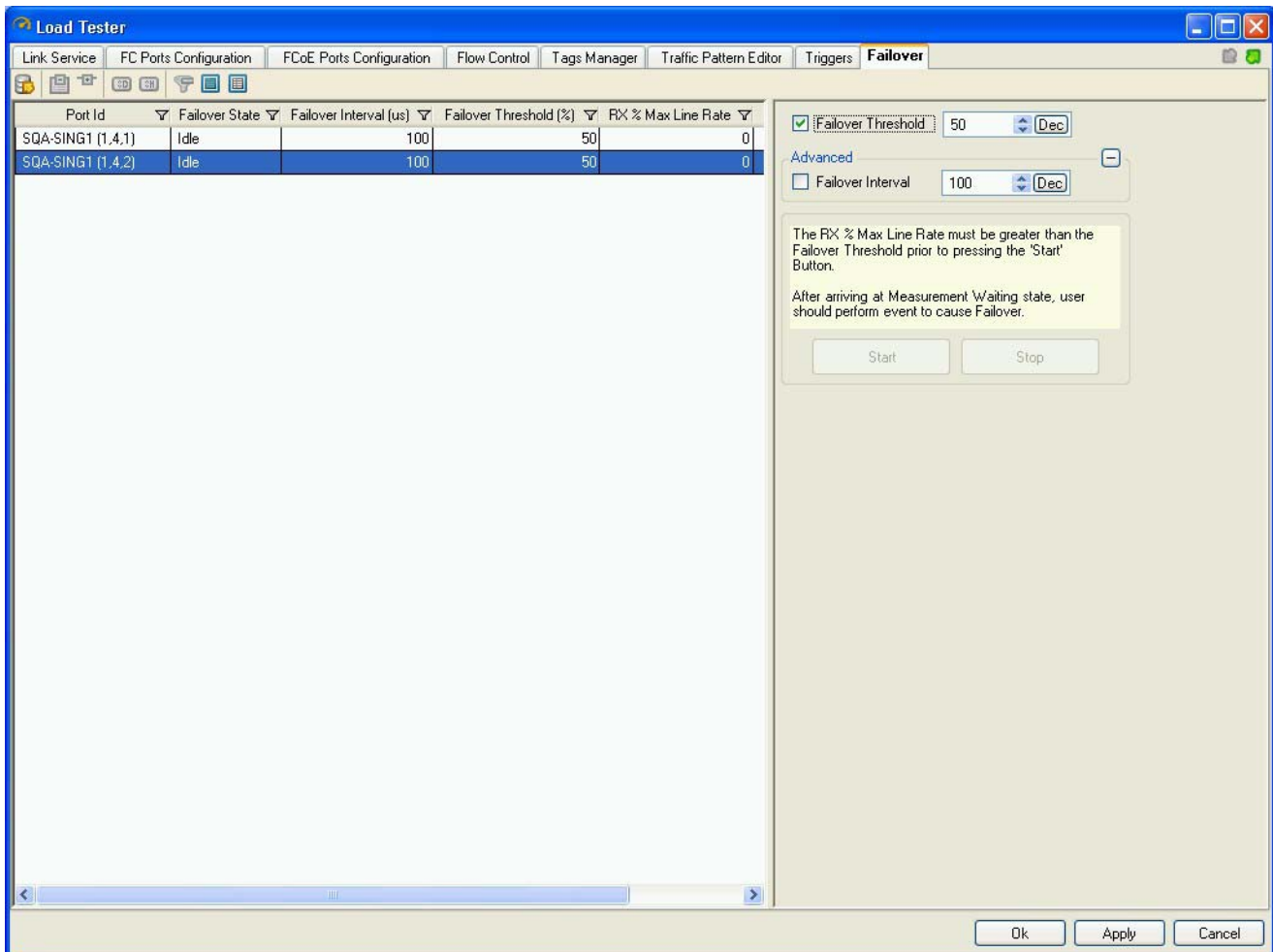
$$543 * 9.41 = 5109.63 \rightarrow 5109 \text{ ns per frame.}$$

To create a slow device the value provided must exceed 5109. A value of 10219 will reduce throughput by approximately 50 % at 4 Gig.

Failover Tab

The Failover tab lets you set the failover settings for Fibre Channel Load Tester ports.

Figure 366: Failover Tab



Note: Only 4G and 8G FC ports are displayed in the ports list. Failover is not supported in 10G FCoE.

Operation buttons on the Ports List in the Failover tab are listed below:

Apply - sends the changes in the configuration to the locked ports.

Expand Groupboxes - expands all the configuration groupboxes

Collapse Groupboxes - collapses all the configuration groupboxes

Numeric Editors in Decimal - change all the numeric editors into decimal format

Numeric Editors in Hexadecimal - change all the numeric editors into hexadecimal format

Clear Filters - removes all filters set for the Ports List

Select all Ports - select all ports listed in the Ports List

Deselect all Ports - deselect all ports selected

The options in the Failover settings are:

Failover Threshold

This option lets you set the threshold, in terms of percentage of the maximum line rate (1 - 99), for the selected port. This option is only supported on Fibre Channel ports.

Failover Interval

This option lets you set a time interval in number of microseconds (1 - 0xFFFFFFFF) for the selected port(s). The system determines whether the traffic count reaches a defined threshold in each interval. This option is only supported on Fibre Channel ports.

Start Button

Pressing this button will start timing failover occurrences in the selected port(s).

Stop Button

Pressing this button will stop timing failover occurrences in the selected port(s).



Note: The RX % Max Line Rate of the selected port(s) must be greater than the Failover Threshold prior to pressing the **Start** Button.

Once the selected port(s) arrives at **Measurement Waiting** state, you should perform event to cause Failover.

Chapter 28

Creating Tags

In this chapter:

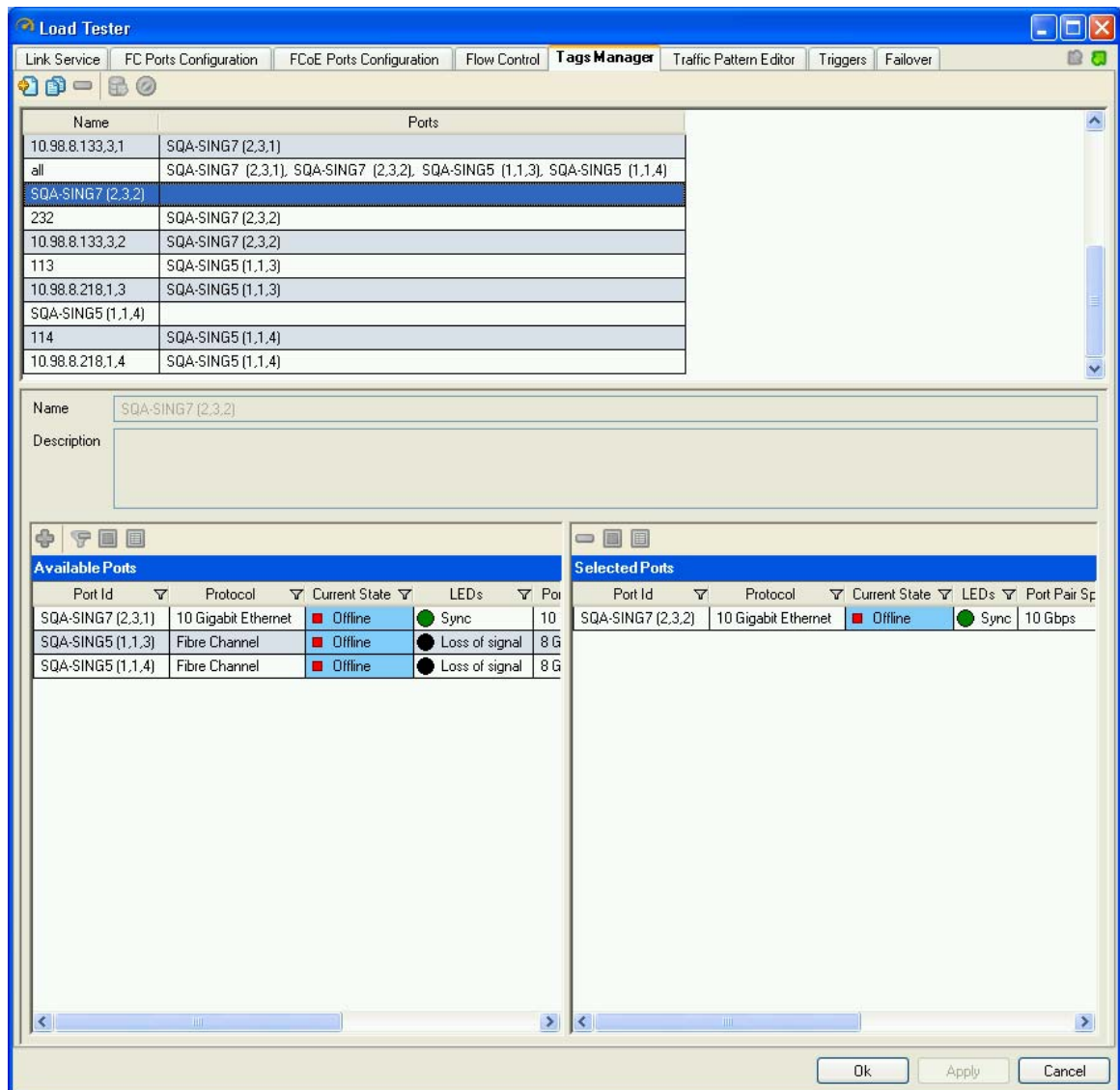
- [The Tags Manager](#)
- [Creating Tags](#)
- [Copying Tags](#)
- [Editing Tags](#)
- [Deleting Tags](#)

Tags are an organizational tool for ports in Load Tester. A tag contains a name, a description, and a list of ports to which the tag is applied. You can apply a tag to any number of ports. When configuring ports, configuring traffic patterns, or setting up multi-port link service, you can use tags to quickly find a pre-defined set of ports that you want to performs an action on. When a tag uses an API command as a parameter, the API command will apply to all the ports associated with the tag.

The Tags Manager

The Tags Manager tab allows you to create, edit, or delete the tags used by Load Tester (refer to Figure 367).

Figure 367: Load Tester Tags Manager Tab.



Available tags are listed on the tags list with their description. Selecting a tag from the list will update the **Name** and **Description** fields at the lower part of the dialog box. The **Selected Ports** list will also be updated with the ports associated with the selected tag.



Note: System tags can not be deleted. Systems tags are the tags created by the load tester when a user opens the port.

Creating Tags

To create tags:

- 1 Click the **New**  button. The tags list will be disabled and focus will be on the lower half of the dialog box.
- 2 Enter a name for the tag in the **Name** text box.
- 3 Enter a description for the new tag in the **Description text** box. A detailed description makes the tag easier to use.
- 4 Click on the port to include into the tag in the **Available Ports** list. To sort or organize the list of ports available refer to Chapter 27 “[Organizing Ports](#)”.
- 5 Click the **Add** button to add the selected port to the **Selected Ports** list.
- 6 Click the **Apply**  button.

The new tag is added to the tags list.

Copying Tags

To copy tags:

- 1 Select the tag to copy from the tags list.
- 2 Click the **Copy**  button. The name of the tag will be appended with “**(Copy)**”.
- 3 Enter a new name for the copied tag or retain it.

The new tag is added to the tags list.

Editing Tags

To edit tags:

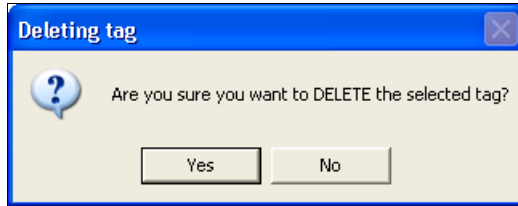
- 1 Select the tag you want to edit from the Tags list.
- 2 Add a new port to the tag by selecting the port to add and clicking the **Add** button from the **Available Ports** list.
- 3 Remove a port from the tag by selecting the port from the **Selected Ports** list and clicking the **Delete** button.

The tag is updated in the tags list.

Deleting Tags

To delete tags:

- 1 Select the tag to delete from the tags list.
- 2 Click the **Delete**  button.
- 3 Click **Yes** on the **Deleting tag** dialog box.

Figure 368: Deleting tag dialog box

The tag is deleted in the tags list.

Chapter 29

Creating and Managing Traffic Patterns

In this chapter:

- [Traffic Pattern Editor Tab](#)
- [Creating Traffic Patterns](#)
- [Editing Traffic Patterns](#)
- [Deleting Traffic Patterns](#)

The term traffic pattern applies to a traffic profile engine. Each Physical N_Port can have up to eight traffic profile engines. Each traffic profile engine contains a traffic pattern configuration, which is a combination of Physical N_Port traffic topologies and traffic configuration settings such as traffic type and payload type, payload size, and seed information.

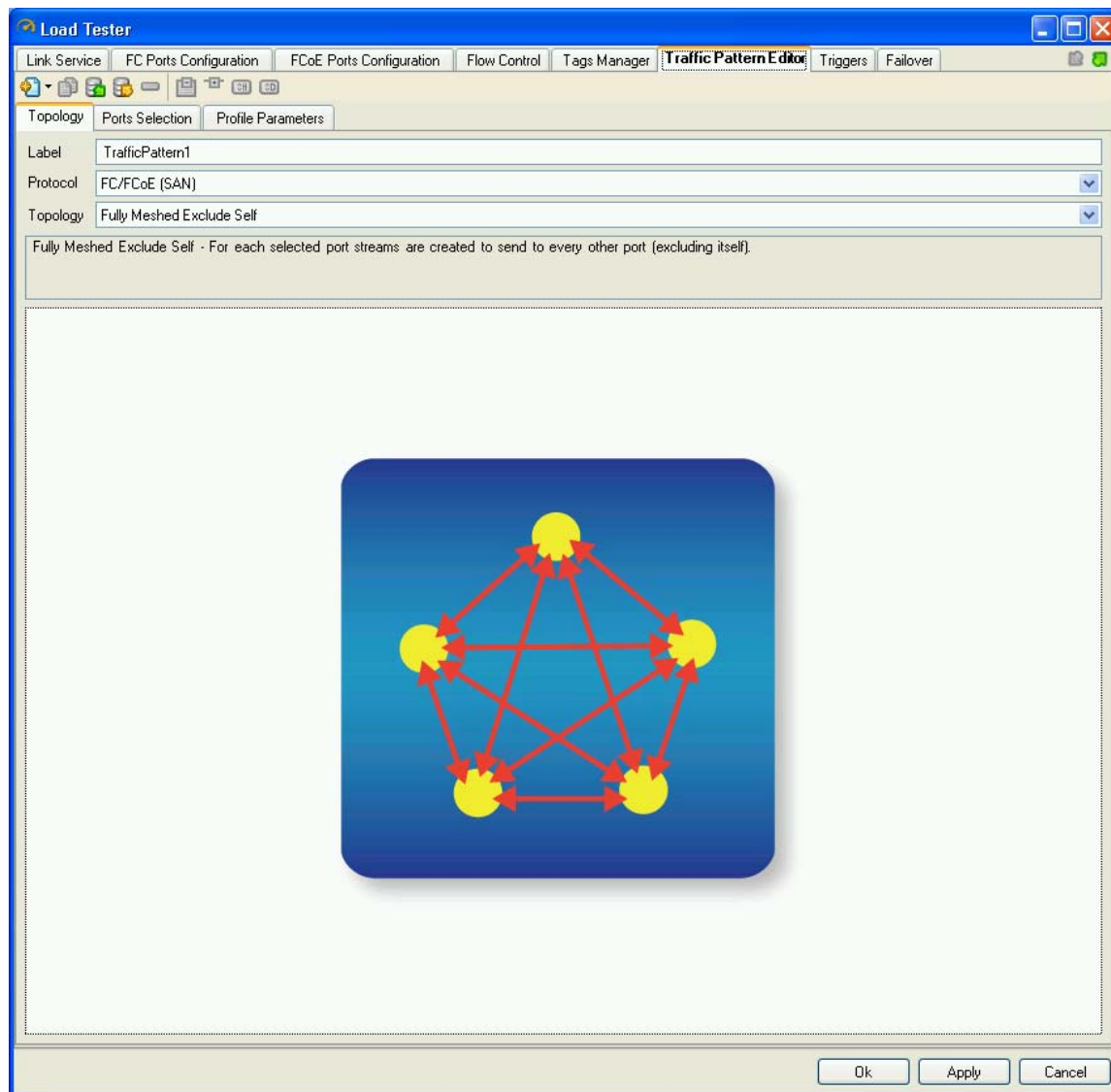
The Traffic Pattern concept allows a group of ports that share a port topology to also share all the configurations related to the traffic profile engines. When you create a traffic pattern, each port that transmits in the traffic pattern will allocate a single Traffic Profile Engine. In the case where the Port Topology is bi-directional, all ports will allocate a single Traffic Profile Engine.

Creating and saving traffic patterns is a good way to preserve test configurations so that you can reuse them.

Traffic Pattern Editor Tab

The Traffic Pattern Editor tab is where you create or edit a traffic pattern to be used by the Xgig Load Tester.

Figure 369: Traffic Pattern Editor tab



Operation buttons on the Ports Configurations tabs are listed below:

Create New - lets you create a new traffic pattern manually or by using the Traffic Pattern Wizard

Copy - creates a copy of the traffic pattern and appends “(Copy)” to the Label. You can then save the new traffic pattern with any change you made.

Load - opens a dialog box where you can select the traffic pattern to edit.

Apply - sends the changes in the traffic pattern to the Load Tester.

Delete - deletes the currently loaded traffic pattern.

Expand Groupboxes - expands all the configuration groupboxes

Collapse Groupboxes - collapses all the configuration groupboxes

Numeric Editors in Decimal - change all the numeric editors into decimal format

Numeric Editors in Hexadecimal - change all the numeric editors into hexadecimal format

There are three sub-tabs: **Topology**, **Ports Selection**, and **Profile Parameters**. These three tabs are further discussed below.

Topology

This tab lets you configure the topology to be used by a traffic pattern.

Label

This field contains the name of the traffic pattern.

Protocol

This field lets you select the protocol to use with the traffic pattern.

Description box

This pane contains the description of the topology selected in the Topology drop-down menu.

Topology diagram

This pane displays the graphical representation of the topology currently selected in the Topology drop-down menu.

Ports Selection

This tab lets you configure the ports used in the selected traffic pattern.

Label

Displays the traffic pattern name

Protocol

Displays the protocol used by the traffic pattern

Topology

Displays the topology used by the traffic pattern

Selection

Lets you select whether to select the ports to be used with the traffic pattern by individual ports or by tags

Available Ports Pane

Lists the ports locked as Load Tester that are available for use with the traffic patterns.

The operation buttons on this pane are:

Add to Selected Ports - moves the selected port to the Selected Ports list.

Clear Filters - removes all the filters that were set for the list of ports.

Select all Ports - selects all ports in the list

Deselect all Ports - unselects all ports in the list

To add ports from the Available Ports pane to the Selected Ports pane:

- 1 Select the port from the list.
- 2 Click on the **Add to Selected Ports** button. You can also click and drag the port from the Available Ports to the Selected Ports.
- 3 Repeat the step above for the rest of the ports you want to add.

Selected Port Pane

Lists the ports that are used in the traffic pattern

Removes to Selected Ports - moves the selected port to the Available Ports list.

Select all Ports - selects all ports in the list

Deselect all Ports - unselects all ports in the list

To remove a port from the Selected ports:

- 1 Select the port from the list.
- 2 Click on the Remove from Selected Ports button. You can also click and drag the port from the Selected Ports to the Available Ports.
- 3 Repeat the step above for the rest of the ports you want remove.

Profile Parameters

This tab lets you configure the parameters of the profile to use with the traffic pattern.

Label

This displays the traffic pattern name.

Protocol

This field displays the protocol used for the traffic pattern.

Topology

This field displays the topology used for the traffic pattern.

Load Characteristics Pane

This pane contains options to configure the load characteristics of the traffic pattern.

Average Load

Lets you set the throughput of the traffic pattern. The term ‘average’ means the average throughput out expects to achieve over the duration of several bursts.

Continuous

Select **Continuous** to use a traffic profile with a continuous load. You can adjust the intended load before or during the test.

Burst

Select **Burst** to create a traffic profile with an average load and a burst load for a specified number of frames.

If you select Burst, **Burst Load** and **Burst Length** options would be available for editing.

Burst Load - load during the burst

Burst Length - the number of frames sent during a single burst.

Burst Time

This field displays the burst time (in microseconds) for specific traffic. If **Continuous** mode is selected, this field will display the length of time in microseconds from SOF to EOF for each frame transmitted. If **Burst** mode is selected, this field will display the length of time in microseconds from start to end of burst including Idles between burst frames.

This is only valid if all ports are configured for at the same speed.

Idle Time

This field displays the idle time (in microseconds) for the specified traffic. If **Continuous** mode is selected, this field will display the length of time in microseconds between each frame sent. The amount of time Idles are sent. If **Burst** mode is selected, this field will display the length of time in microseconds between burst frame sets. The amount of time Idles are sent between bursts.

This is only valid if all ports are configured for at the same speed.

Intra-Burst Frame Time

This field displays the frame time within a burst. If **Continuous** mode is selected, this field will display the length of time in microseconds between each frame sent. The amount of time Idles are sent. If **Burst** mode is selected, this field will display the length of time in microseconds between each frame sent. The amount of time Idles are sent between frames in the burst.

This is only valid if all ports are configured for at the same speed.

Intra-Burst Idle Time

This field displays the idle time within a burst. If **Continuous** mode is selected, this field will display the length of time in microseconds from SOF to EOF for each frame transmitted. If **Burst** mode is selected, this field will display the length of time in microseconds from start to end of burst including Idles between burst frames.

This is only valid if all ports are configured for at the same speed.

Payload Characteristics

This pane lets you configure the payload to use with the traffic pattern.

Auto-generated

Select this option if you want the Load Tester to generate the payload for the traffic automatically. Otherwise select **User-defined**.

Payload Content

This menu allows you to select payload pattern from the **Pattern** drop-down list.

Options are:

- Fixed
- Incrementing
- Decrementing
- RotateLeft
- RotateRight
- Random
- CJPAT

- CRPAT
- CSPAT
- 32 Bit Noise
- Long Mixed

For SAN traffic, payload is the FC payload data, and for LAN traffic, payload is the part after Ethertype and before CRC.

Starting Value

This function lets you set the starting payload value. The Traffic Frame Pattern Seed must be between 0 and 2112.

User-defined

This field lets you use your own payload template.

Payload template (user-defined data) should only contain Hex characters, e.g. "01 02 A1 EF ...", and formatting characters, e.g. Space, Tab, and Enter. A buffer (512 bytes for FC; 1024 bytes for FCoE) will be created for template data. If the size of template data is less than the buffer size, zeros will be appended to fully occupy the buffer. The buffer will then be repeatedly used in frame payload.

Payload Size (Bytes)

This pane contains options to configure the payload size. For SAN traffic, payload size is the size of FC payload, and for LAN traffic payload size is counted starting from the Ethertype and ending right before CRC. The default payload size for SAN profile is 2112, and the default payload size for LAN profile is 1024.

Fixed

This option lets you set the payload size to a fixed value.

Random

This option lets you set the payload size to a random value. The payload will be randomized between the minimum and maximum values you will set.

Minimum

This option lets you set the minimum size for the payload if you selected to use a random payload size.

Maximum

This option lets you set the maximum size for the payload if you selected to use a random payload size.

Oversized

This option lets you use oversized frames in the payload.

Stream\Exchange Characteristics

This pane contains options to configure the Stream or exchange characteristics.

Exchange Length

This option lets you instruct the HW to limit the number of frames in an exchange to the value you specify.

Interleave Exchanges

This option lets you instructs the HW to continue sending N frames from each table entry before moving to the next entry in the table.

Virtual Addresses Requested Per Port (SAN profile) / Virtual End Stations Created Per Port (LAN profile)

This function allows you to limit how many virtual ports (NPIVs) to use per port for this traffic pattern during traffic topology configuration. A port may have acquired 5 NPIV addresses but a source V port count of 0 will not use any of them for topology generation. Please note that this count does not include the S_ID acquired by the physical Load Tester port.

Exchange Replication

This option lets you set the number of times to repeat the existing traffic configuration. If a source port is configured to transmit to 3 other ports, it will have 3 table entries one for each destination.

A repeat count of 2 will create 6 table entries where each set of port targets is duplicated.

A 4 Gig blade has a limit of 512 table entries and an 8 Gig blade has a limit of 1024.

OX_ID Base

This option lets you set the starting OX_ID when **Multi-frame Exchange Incrementing OX_ID** mode is selected. This option is not available for LAN profile.

OX_ID Step

This options lets you set the spacing between consecutive **OX_IDs when Multi-frame Exchange Incrementing OX_ID** mode is selected. This option is not available for LAN profile.

Exclude first S_ID

This option lets you control whether the source phy address is excluded or included during traffic topology generation. Port phy addresses are excluded only if there are NPIV addresses available. This option is not available for LAN profile.

Exclude first D_ID

This option lets you control whether the destination phy address is excluded or included during traffic topology generation. Port phy addresses are excluded only if there are NPIV addresses available. This option is not available for LAN profile.

Total Exchanges Created

This field displays the total number of exchanges created. Click on the **Calculate** button to submit all the settings you set so that the total number exchanges created will be displayed on the **Total Exchanges Created** field.

VLAN Tag

This pane contains options for the VLAN tag.

Use VLAN Tag

This option enables assigning a VLAN Tag to a Traffic Pattern. The VLAN Tag will be used on all traffic streams associated with the traffic pattern.

Class of Service

This option lets you select the Class of Service (COS) with the VLAN Tag. The default COS for SAN profile is 3, and the default COS for LAN profile is 7.

VLAN ID

This option lets you set the VLAN ID to use. You can either select **AUTO** to automatically generate the VLAN ID or enter a value.

VLAN Tag

This field shows the VLAN ID to be used.

Use VLAN ID Range

This option lets you enable or disable the VLAN ID Range feature. If the VLAN ID Range feature is enabled, the COS Mask feature will be disabled and the Enable COS Mask options will not be available.

VLAN ID Range

This function sets the starting Vlan ID value or base if the VLAN ID Range feature is enabled. A base of 1 and step of 1 will create VLAN IDs of 1 2 3 4 5 ...

A popular topology of point to point will require the user to increase the number of streams by increasing **Exchange Replication** field on the Profile Parameters dialog of the Traffic Pattern Editor.

There is an individual port limit of 1024 VLAN IDs. Four ports will be required to cover the complete VLAN ID number space.

VLAN ID Step

This options lets you set the VLAN ID step value if the Traffic VLAN ID Range feature is enabled.

A base of 1 and step of 1 will create VLAN IDs of 1 2 3 4 5 ...

A popular topology of point to point will require the user to increase the number of streams by increasing **Exchange Replication** field on the Profile Parameters dialog of the Traffic Pattern Editor.

There is an individual port limit of 1024 VLAN IDs. Four ports will be required to cover the complete VLAN ID number space.

Enable COS Mask

This option will override the Class of Service setting of the VLAN Tag with the classes of service that are specified in the mask. To enable a class of service, click the check box next to the corresponding class of service.

This allows the current traffic profile to run over multiple classes of service.

Ethertype

This pane contains the details for the Ethertype.

The **Ethertype** field lets you specify the Ethertype value for LAN Profile. For SAN profile this is hard-coded to 0x8906 (FCoE Ethertype), and for LAN profile this defaults to 0x0800 (IP Ethertype) but the user can enter other Ethertype.

Error Injection

This pane contains the options for Error Injection.

FC/FCoE CRC

Selecting this option will force Fibre Channel CRC errors to be generated for all frames generated by the specified traffic pattern. A simple way to use this feature is to create an CRC error traffic configuration with minimum load that is not enabled at the start of a test. During the test errors may selectively generated with the resume and pause buttons. For Ethernet ports, this will generate embedded FC CRC errors within the FCoE packet.

Ethernet CRC

This option will force Ethernet CRC errors to be generated for all frames generated by the specified traffic pattern. A simple way to use this feature is to create an CRC error traffic configuration with minimum load that is not enabled at the start of a test. During the test errors may selectively generated with the resume and pause buttons.

FC/FCoE SOF

This option will force Fiber Channel SOF errors to be generated for all frames generated by the traffic pattern. Possible errors are:

NONE, which sends frames without SOF. For FC it will send FC IDLE instead, and for FCoE it will send 0x00 instead.

INVALID, which sends frames with invalid SOF: it will flip bit 0 of the SOF.

FC/FCoE EOF

This option will force Fiber Channel EOF errors to be generated for all frames generated by the specified traffic pattern. Possible errors are:

NONE, which sends frames without EOF. For FC it will send FC IDLE instead, and for FCoE it will send 0x00 instead.

INVALID, which sends frames with invalid EOF: it will flip bit 0 of the EOF.

Additional***Include Meta-data (Signature)***

This option will set whether to include or exclude Meta-data from the frame in specified traffic pattern.

Run on Global Start

This option controls whether the traffic pattern is enabled when the test is started. If this option is not selected/enabled, the traffic pattern will be set to paused once started.



Note: When the user has configured a Load Tester Traffic Configuration to inject CRC Errors and inject Invalid SOF Errors, when the frames are received by an Xgig Analyzer the frames will not be decoded since it requires a valid SOF, so the CRC field will not be recognized and no CRC error will be displayed. It is expected that a switch will discard any frames with invalid SOF and/or CRC errors so it should be noted that the destination Load Tester port will not receive and thus will not display counts of these invalid frames.

Creating Traffic Patterns

To create a new traffic pattern you must set configure the options on each tab of the Traffic Pattern Editor.

Adjust the settings in the Topology tab

- 1 Go to the **Traffic Pattern Editor** tab from the Load Tester Device window. By default the Traffic Pattern Editor tab will open with a new traffic pattern with default settings.
- 2 Enter a name or label for the new traffic pattern in the **Label** text box.
- 3 Select **FC/FCoE (SAN)** or **Ethernet (LAN)** from the **Protocol** drop-down list.
- 4 Select the traffic pattern topology from the **Topology** drop-down list. The description section and the topology diagram will be updated according to the topology selected.

Adjust the settings in the Ports Selection tab

- 1 Select the ports to use in the traffic pattern from the **Available Ports** pane.
- 2 Click on the **Add to Selected Ports** button to move the selected ports from the **Available Ports** pane to the **Selected Ports** pane.

Adjust the settings in the Profile Parameter tab

Load Characteristics pane

- 1 Set the throughput of the traffic pattern in the **Average Load** field. The term ‘average’ means the average throughput out expects to achieve over the duration of several bursts. Use the **up**  or **down**  button to increase or decrease the value, or enter it directly.
- 2 Specify if the value you set in the **Average Load** field is in **MBps** or a percentage (%) of theoretical maximum line rate. The term ‘average’ means that a link can be oversubscribed, in which case the desired or intended loads of each traffic profile may not be achieved.
- 3 Select the traffic profile type to use:

Select **Continuous** to use a traffic profile with a continuous load. You can adjust the intended load before or during the test.

Select **Burst** to create a traffic profile with an average load and a burst load for a specified number of frames.

If you select **Burst**, you must also set the **Burst Load** (the load during the burst) and **Burst Length** (the number of frames sent during a single burst). The Burst length must be greater than 1.

Click the **Calculate** button to update the following fields:

- Burst Time
- Idle Time
- Intra-Burst Frame Time
- Intra-Burst Idle Time

Payload Characteristics pane

- 1 Select the **Auto-generated** option if you prefer to have the payload generated by the Load Tester or if you prefer to use your own payload content, select **User-defined**.

If you chose to use auto-generated payloads, select the payload pattern from the **Payload Content** drop-down menu. Options are:

- Fixed
- Incrementing
- Decrementing
- RotateLeft
- RotateRight
- Random
- CJPAT
- CRPAT
- CSPAT
- 32 Bit Noise
- Long Mixed

- 2 Specify the start value for the payload in the **Starting value** field. To show the value in hexadecimal or decimal format, click on the **Hex** or **Dec** button.

A seed is the initial payload pattern value. The random generator is initialized once using the seed, and the subsequent patterns will be generated automatically in a random manner.

- 3 Select the type of payload size to use.

Select **Fixed** to specify the size of the payload. To show the value in hexadecimal or decimal format, click on the **Hex** or **Dec** button.

Select **Random** to set the payload size between a minimum and maximum size.

- 4 Set the minimum size of the payload in the **Min Size** field. To get a fixed size payload both the minimum and maximum payload size field must be the same. To show the value in hexadecimal or decimal format, click on the **Hex** or **Dec** button.

To get random payload size generation between an upper and lower bounds (inclusive), use the **Min Size** and **Max Size** fields.

- 5 Set the maximum size of the payload in the **Max Size** field. To get a fixed size payload both the minimum and maximum payload size field must be the same. To show the value in hexadecimal or decimal format, click on the **Hex** or **Dec** button.

To get random payload size generation between an upper and lower bounds (inclusive), use the **Min Size** and **Max Size** fields.

Select **Oversized** option to use oversize frames in the payload.

Stream\Exchange Characteristics

- 1 Set the **Exchange Length** to your desired value. To show the value in hexadecimal or decimal format, click on the **Hex** or **Dec** button.
- 2 Check **Interleave Exchanges** to instruct the hardware to continue sending N frames from each table entry before moving to the next entry in the table.
- 3 Limit how many virtual ports (NPIVs) to use per port for this traffic pattern during traffic topology configuration by setting the value the **Virtual Addresses Requested Per Port** field. To show the value in hexadecimal or decimal format, click on the **Hex** or **Dec** button.
- 4 Set the number of times to repeat the existing traffic configuration by entering the limit in the **Exchange Replication**. If a source port is configured to transmit to 3 other ports, it will have 3 table entries one for each destination. To show the value in hexadecimal or decimal format, click on the **Hex** or **Dec** button.
- 5 Set the **OX_ID Base** value. To show the value in hexadecimal or decimal format, click on the **Hex** or **Dec** button.
- 6 Set the **OX_ID Step** value. To show the value in hexadecimal or decimal format, click on the **Hex** or **Dec** button.
- 7 Select **Exclude first S_ID** to exclude the source phy address during traffic topology generation. Port phy addresses are excluded only if there are NPIV addresses available.
- 8 Select **Exclude first D_ID** to exclude the destination phy address during traffic topology generation. Port phy addresses are excluded only if there are NPIV addresses available.
- 9 Click Calculate to update the value in the **Total Exchanges Created** field.

VLAN Tag

- 1 Select **Use VLAN Tag** to enable assigning a VLAN Tag to the Traffic Pattern. The VLAN Tag will be used on all traffic streams associated with the traffic pattern.
- 2 Select the **Class of Service**. A user may select from 0 to 7 classes of service (CoS) for a single traffic configuration.
- 3 Enter the **VLAN ID**. To show the value in hexadecimal or decimal format, click on the **Hex** or **Dec** button. Select **AUTO** to set the VLAN ID automatically based on the value returned from the FCF during login.
- 4 Select **Enable COS Mask**.
- 5 Select the appropriate checkbox. Each number represents a Class of Service (COS) for which PFC is enabled.

Ethertype

Thus field displays the Ethertype value which indicates the protocol used in the data field of the frame.

Error Injection

- 1 Select **FC/FCoE CRC** to force Fibre Channel CRC errors to be generated for all frames generated by the specified traffic pattern. A simple way to use this feature is to create an CRC error traffic configuration with minimum load that is not enabled at the start of a test. During the test errors may selectively be generated with the resume and pause buttons. For Ethernet ports, this will generate embedded FC CRC errors within the FCoE packet.
- 2 Select **FC/FCoE SOF** to force Fiber Channel SOF errors to be generated for all frames generated by the traffic pattern. Possible errors are:

NONE, which sends frames without SOF. For FC it will send FC IDLE instead, and for FCoE it will send 0x00 instead.

INVALID, which sends frames with invalid SOF: it will flip bit 0 of the SOF.
- 3 Select **FC/FCoE EOF** to force Fiber Channel EOF errors to be generated for all frames generated by the specified traffic pattern. Possible errors are:

NONE, which sends frames without EOF. For FC it will send FC IDLE instead, and for FCoE it will send 0x00 instead.

INVALID, which sends frames with invalid EOF: it will flip bit 0 of the EOF.
- 4 Select **Ethernet CRC** to inject Ethernet CRC errors when the Ethernet Protocol is selected for the traffic pattern.

Additional

- 1 Select Include Meta-data (Signature) to set whether to include or exclude Meta-data from the frame in specified traffic pattern.
- 2 Select the **Run on global start** checkbox.



Note: When you select **Run on global start**, the traffic pattern you are creating or editing will start when the **Start** button from the Load Tester main window is clicked. Do not select this option if you do not want to start that traffic pattern when the **Start** button on the Load Tester main window is clicked.

If this is not selected, the traffic pattern will be configured but in a paused state when the test is started. You may activate this traffic configuration with the **Resume** button.

Click **Ok** to save the new traffic pattern or click **Apply** to implement any change you made to the settings.

Using the Traffic Pattern Wizard

Another option to create a new traffic pattern, is the Traffic Pattern Wizard. The wizard lets you setup a new traffic pattern in five steps.

You can launch the Traffic Pattern Wizard by:

- 1 Clicking the **Configuration** dropdown arrow from the Load Tester main tab and selecting **Traffic Pattern Wizard**; or,

- 2 Clicking the **Create New** dropdown arrow in the Traffic Pattern Editor tab in the Load Tester Device Window and selecting **New using Wizard**.

Once the wizard is open, options will be the same as the Traffic Pattern Editor but will be displayed in sequential pages. Refer to [“Traffic Pattern Editor Tab” on page 595](#) for descriptions of the options.

Editing Traffic Patterns

To edit a traffic pattern:

- 1 Go to the Traffic tab from the Load Tester main window.
- 2 Select the traffic pattern from the **Pattern Based View**.
- 3 Click on the **Edit**  button. The **Traffic Pattern Editor tab** appears.
- 4 Do the necessary revisions to the selected traffic pattern.
- 5 Click **Ok** when you are done.

Deleting Traffic Patterns

To delete a traffic pattern:

- 1 Go to the Traffic tab on from the Load Tester window.
- 2 Select the Traffic Pattern from the **Pattern Based View**.
- 3 Click the **Delete**  button. A confirmation box will appear.
- 4 Click **Yes**.

Chapter 30

Editing Triggers

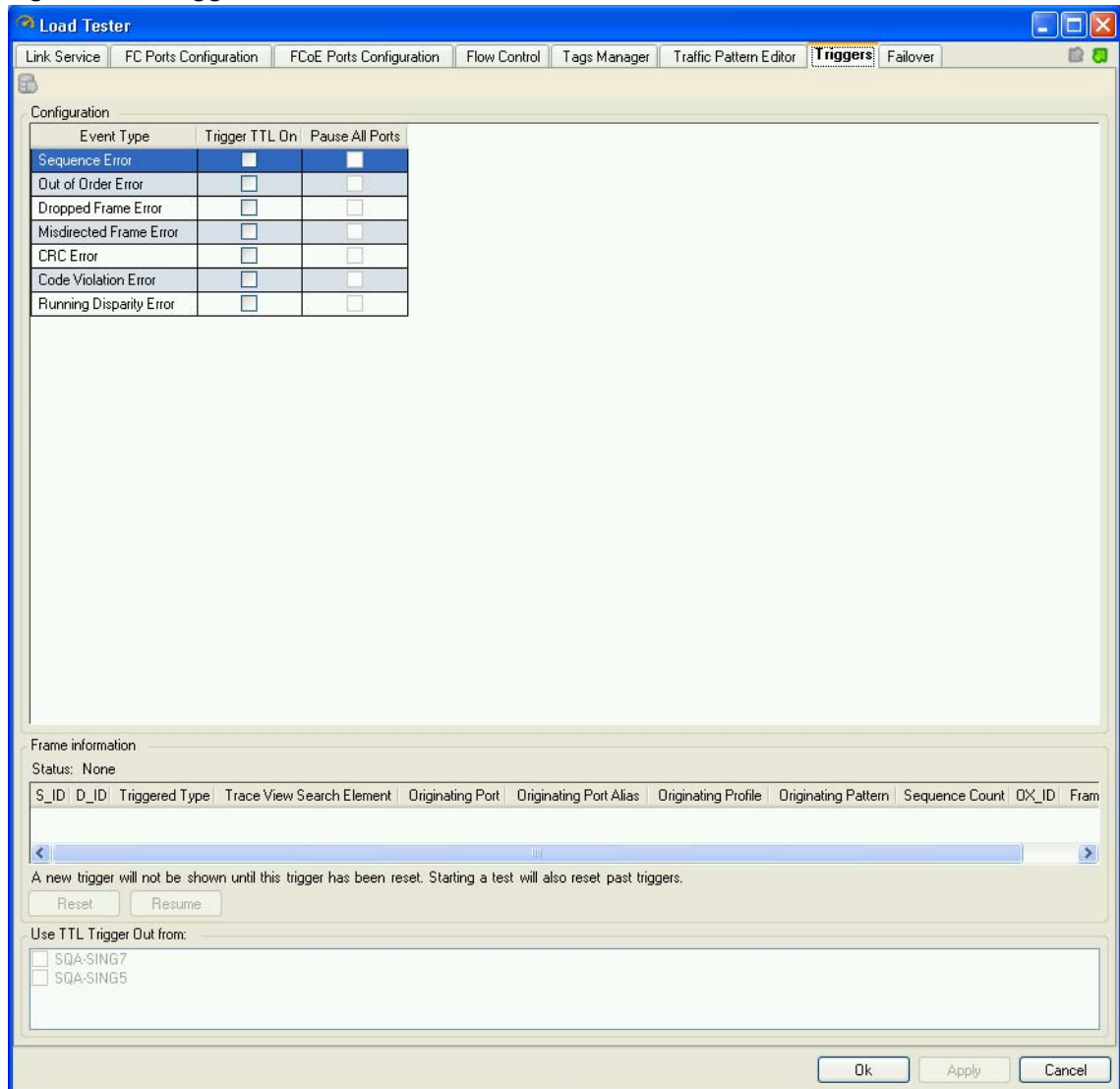
In this chapter:

- [The Triggers Tab](#)
- [Editing Triggers](#)

The Triggers Tab

The Triggers dialog box displays all the available triggers you can set when you run a test in Load Tester. You can enable triggering based on error events and configure all LT ports to pause test when trigger conditions are met through this dialog box.

Figure 370: Triggers Tab



Configuration

The **Configuration** pane lists all the event types that Load Tester use as triggers to log errors.

The event types are:

- **Sequence Error** - If a frame arrives that is not the expected successor (increase by one) then a sequence error trigger is invoked.
- **Out Of Order** - If a frame arrives that is not the expected successor and has a sequence count less than the previous arrived frame, then an out-of-order error trigger is invoked.

- **Dropped** - If the final frame of the sequence arrives and there is at least one frame that hasn't arrived then an unaccounted frame trigger is invoked.
- **Misdirected** - If a frame that was not destined for the Load Tester port arrives, a misdirected error is invoked.
- **CRC Error** - If a data transmission does not pass the cyclic redundancy check, a CRC error is invoked.
- **Code Violations** - If a 10-bit transmission character is not decoded to a valid data or control character using the validity checking rules specified for the 8b/10b transmission code, then a code violation error is invoked.
- **Running Disparity Error** - If there have been a predominance of 1's or 0's in the binary stream of encoded transmission characters, then a running disparity error is invoked.

Frame information

This provides the user with information about the traffic (data) frame that was received on a port that registered that error.

Use TTL Trigger Out From

This to allows the user to select the chassis to use to trigger TTL out from.

Editing Triggers

To edit a trigger:

- 5 Click on the **Triggers** tab from the Load Tester Device Window.
- 6 Select or unselect the **Trigger TTL On** checkbox for the Event Type you want to use.
- 7 Select or unselect the **Pause All Ports** checkbox for the Event Type you want to pause all ports at the trigger.
- 8 Click on **Resume** to resume running the triggers. Note that once you resume running a trigger, all information will be lost.
- 9 Click **Apply**.

Chapter 31

Managing Multiple Link Services

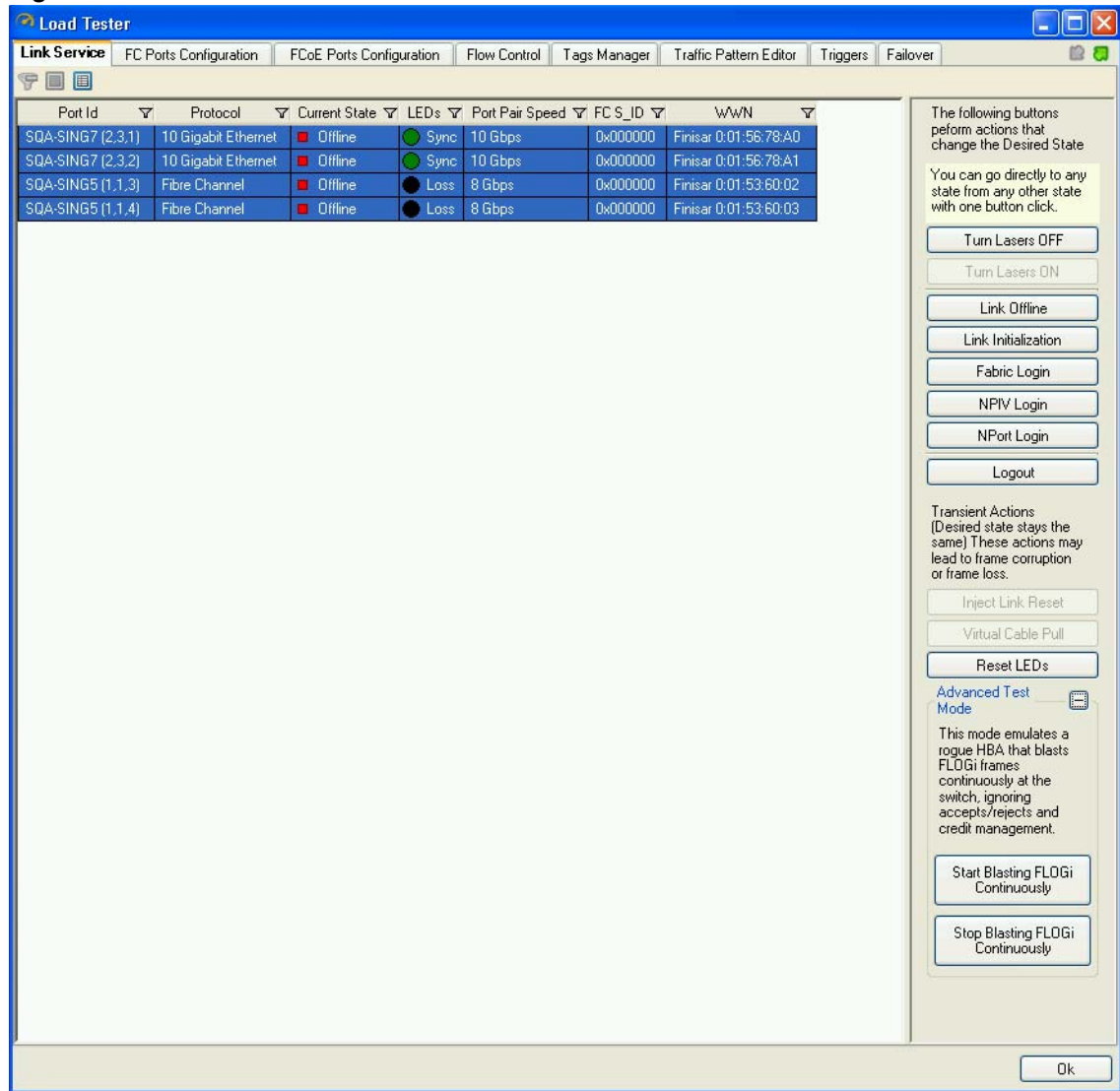
In this chapter:

- [The Link Service Tab](#)
- [Managing the Link Service Operations](#)

The Link Service Tab

The Multiple Link Service tab displays all the ports on the chassis that are locked as Load Testers and also the different Link Service options you can set for the ports. To know more about the options, refer to “Using the Parameters Context Menu for Fibre Channel Ports” on page 540 or “Using the Parameters Context Menu for FCoE Ports” on page 546.

Figure 371: Link Service Tab



Managing the Link Service Operations

To activate or deactivate the Link Service operations for ports:

- 1 Select the port or ports to manage from the list. For more information on how to filter the ports listed, refer to “Organizing Ports” on page 579.
- 2 To select multiple ports, hold down the **Ctrl** key while clicking on the ports to manage.
- 3 Click **Turn Lasers OFF** to turn the lasers off for the selected port(s).

- 4 Click **Turn Lasers ON** to turn the lasers on for the selected port(s).
- 5 Click **Link Offline** to put the port(s) on an offline state.
- 6 Click **Link Initialization** to initialize the links.
- 7 Click **Fabric Login** to login the port(s) to the Fabric.
- 8 Click **NPIV Login** to log the port(s) to the switch to request NPIV addresses for the port.
- 9 Click **NPort login** to log the port(s) to the other ports.
- 10 Click **Logout** to log the port(s) out.
- 11 Click **Inject Link Reset** to reset the credit count for the port(s) by entering the LR1 State, and following the Link Reset protocol.
- 12 Click **Virtual Cable Pull** to turn the port(s) laser off, and then turn it back on to simulate a cable pull while a test is running. The port(s) will automatically attempt to Login, and if successful, will resume running the test.
- 13 Click **Reset LEDs** to reset the status LEDs for the port(s) on the Xgig blade and the Parameters Status table.
- 14 Click **Start Blasting FLOGi Continuously** to initiate a continuous Blast FLOGI test.

Blast FLOGI is a special error mode for testing Switch recovery. The Load Tester ports blasts a canned FLOGI frame at the switch continuously.
- 15 Click **Stop Blasting FLOGi Continuously** to stop the continuous FLOGi blast.

Chapter 32

Configuring Test Summary Reports

In this chapter:

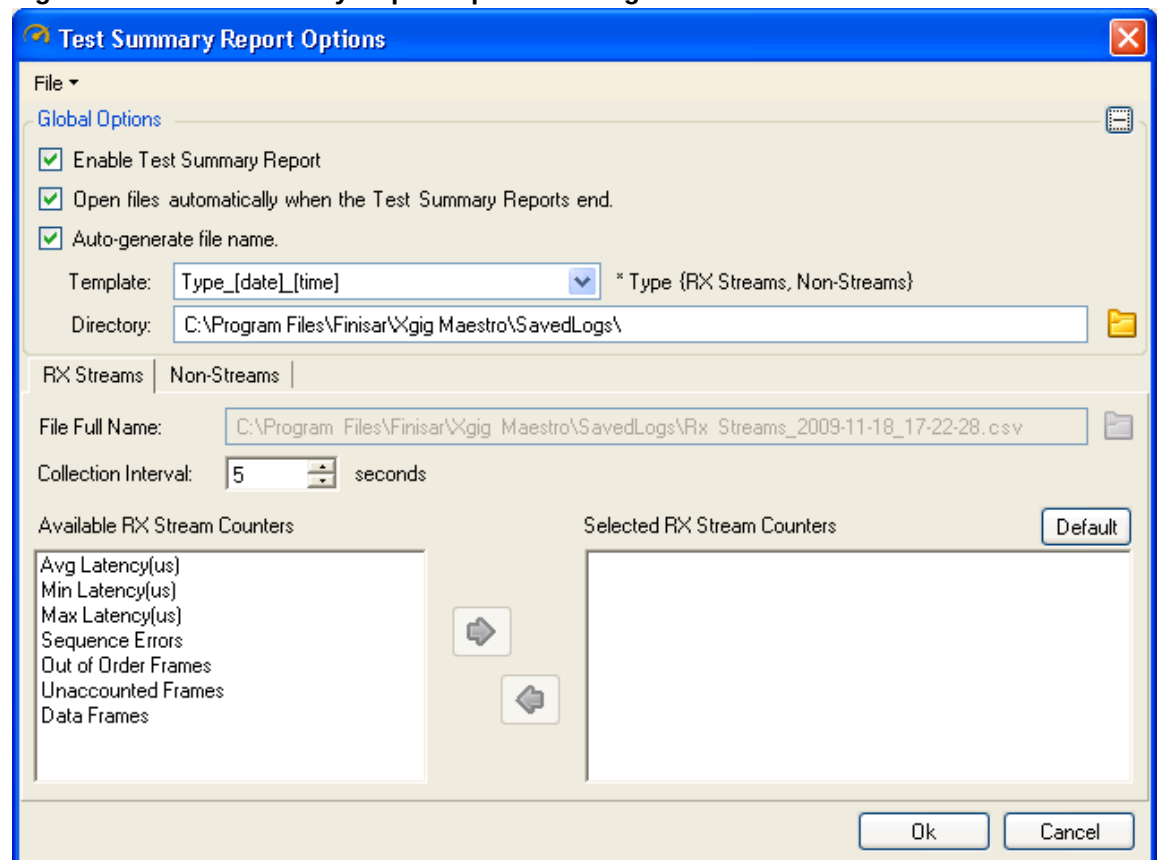
- [The Test Summary Report Options Dialog](#)
- [Configuring Test Summary Reports](#)

The Test Summary Report summarizes the information collected during the test. The Test Summary Report is generated after a test is completed. Load Tester generates two reports that are saved as .csv files. One report is for stream data collected, and the other is non-stream data collected.

The Test Summary Report Options Dialog

The **Test Summary Report Options** dialog box displays all the options for the test summary reports. To open the Test Summary Report Options dialog box, click on the **Configuration** button on the Load Tester Device Window and select **Test Summary**.

Figure 372: Test Summary Report Options Dialog



The Test Summary Report dialog box has the following options:

File button

This button lets you open recently saved stream and non-stream Test Summary Reports (TSR).

Global Options

This pane contains general options for the Test Summary Report.

Enable Test Summary Report

This option runs the Test Summary Report at the start of the test to collect during the test.

Open files automatically when the Test Summary Reports end

This option opens the generated Test Summary Report .csv file after the test completes.

Auto-generate file name

This option automatically sets the filename for the Test Summary Report.

Template

This drop down menu lets you select the format of the auto-generated file name of the Test Summary Report.

Directory

This text field lets you specify where the auto-generated Test Summary Report will be saved. You can click on the **Browse** button to locate the directory in your computer.

RX Streams Tab

This tab contains options for the reporting of RX stream information.

File Full Name:

This text field is enabled when you did not select Auto-generate file name option on the Global Options pane. This text field lets you specify generated Test Summary Report will be saved. You can click on the **Browse** button to locate the directory in your computer.

Collection Interval

This field lets you specify the interval time (in seconds) for the collection of data that will be included in the Test Summary Report.

Available RX Stream Counters

This pane lists all the RX Stream counters that can be included Test Summary Report.



Note: Static information from the test, i.e. port configuration data, are not included in the Available RX Stream Counters pane. These static information are automatically included in the Test Summary Report. Only dynamic information, such as counter values, are listed.

Selected RX Stream Counter

This pane displays the selected RX Stream counters that will be included in the Test Summary Report.

Default button

The **Default** button arranges selected RX Physical Ports counters according to their default sequence in the **RX Streams** tab, under the **RX** tab in the **Traffic** tab of the Load Tester module main screen.

Non-Streams Tab

This tab contains options for the reporting of RX stream information.

File Full Name:

This text field is enabled when you did not select Auto-generate file name option on the Global Options pane. This text field lets you specify generated Test Summary Report will be saved. You can click on the **Browse** button to locate the directory in your computer.

Collection Interval

This field lets you specify the interval time (in seconds) for the collection of data that will be included in the Test Summary Report.

RX Physical Port counters Tab

This tab lets you select which Available RX Physical Ports counters will be included in the Traffic Summary Report.

Available RX Physical Ports counters

This pane lists all available RX Physical Ports counters that can be included in the Traffic Summary Report.



Note: Static information from the test, for example port configuration data, are not included in the Available RX Physical Ports counters pane. These static information are automatically included in the Test Summary Report. Only dynamic information, such as counter values, are listed.

Selected RX Physical Ports counters

This pane displays the selected RX Physical Ports counters that will be included in the Test Summary Report.

Default button

The **Default** arranges selected RX Physical Ports counters according to their default sequence in the **RX Physical Ports tab** under the **RX** tab in **Traffic Tab** of the Load Tester module main screen.

TX Ports counters Tab

This tab lets you select which Available TX Ports counters will be included in the Traffic Summary Report.

Available TX Ports counters

This pane lists all available RX Physical Ports counters that can be included in the Traffic Summary Report.



Note: Static information from the test, for example port configuration data, are not included in the Available TX counters pane. These static information are automatically included in the Test Summary Report. Only dynamic information, such as counter values, are listed.

Selected TX Ports counters

This pane displays the selected RX Physical Ports counters that will be included in the Test Summary Report.

Default button

The **Default** arranges selected TX Ports counters according to their default sequence in the **TX Port Based View** tab under the **TX** tab in **Traffic Tab** of the Load Tester module main screen.

Configuring Test Summary Reports

Configuring Global Options

To configure the Global Options of the Test Summary Reports, do the following:

- 1 Open the **Test Summary Report Options** dialog box.
- 2 Select the **Enable Test Summary Report** checkbox to enable the test summary report feature and generate test summary reports after a test is completed.
- 3 Select the **Open files automatically when the Test Summary Reports end.** checkbox to open the generated .csv files after the test is completed.
- 4 Select the **Auto-generate file name.** checkbox to automatically generate the file name of the .csv files that are created. Select the format of the file name from the **Template** drop-down menu. Enter the directory path where the generated .csv files will be saved. You can use the **Browse** buttons to locate the folder in your computer.

Configuring Rx Streams Options

- 1 Click the **RX Streams** tab.
- 2 If you did not select the **Auto-generate file name.** option from the **Global Options** pane, enter the file's full path and name in the **File Full Name:** text box.
- 3 Enter the interval time for collecting the data in the **Collection Interval** box. You can use the up or down arrow to change the value.
- 4 Select the RX Stream counter to include in the report from the **Available RX Stream Counters** pane.
- 5 Click the **Add** button (represented by green arrow pointing right). Repeat until all the counters to include are listed in the **Selected RX Stream Counters** pane.

- 6 Click the **Default** button if you want to rearrange the selected counters according to their original sequence.
- 7 To remove a counter from the Selected RX Streams Counters pane, select the counter then click on the **Remove** button (represented by a green arrow pointing left).

Configuring Non-Streams Options

- 1 Click the **Non-Streams** tab.
- 2 If you did not select the **Auto-generate file name.** option from the **Global Options** pane, enter the file's full path and name in the **File Full Name:** text box.
- 3 Enter the interval time for collecting the data in the **Collection Interval** box. You can use the up or down arrow to change the value.
- 4 Click the **RX Physical Port counters** tab.
- 5 Select the RX Physical Ports counter to include in the report from the **Available RX Physical Ports counters** pane.
- 6 Click the **Add** button (represented by green arrow pointing right). Repeat until all the counters to include are listed in the **Selected RX Physical Ports counters** pane.
- 7 Click the **Default** button if you want to rearrange the selected counters according to their original sequence.
- 8 To remove a counter from the **Selected RX Physical Port counters** pane, select the counter then click on the **Remove** button (represented by a green arrow pointing left).
- 9 Click the **TX Ports counters** tab.
- 10 Select the TX Ports counter to include in the report from the **Available TX Port counters** pane.
- 11 Click the **Add** button (represented by green arrow pointing right). Repeat until all the counters to include are listed in the **Selected TX Port counters** pane.
- 12 Click the **Default** button if you want to rearrange the selected counters according to their original sequence.
- 13 To remove a counter from the **Selected TX Port counters** pane, select the counter then click on the **Remove** button (represented by a green arrow pointing left).

PART SEVEN: Using Xgig Delay Emulator

Chapter 33

Introducing Xgig Delay Emulator

In this chapter:

- [Xgig Delay Emulator Overview](#)
- [Features](#)
- [Cabling](#)

Xgig Delay Emulator Overview

The JDSU Xgig Delay Emulator includes hardware (Xgig Multi-function Blade) and software that performs real-time delay modification for the 10GigE protocol. You can use the Delay Emulator with JDSU Xgig Analyzers to capture and display the network traffic associated with the delay modification.

The Xgig Delay Emulator should be used as a digital retiming device. The Xgig Delay Emulator blade re-times the data and re-transmits it with a new clock transparent to the data link (it passes every bit of data.) The Xgig Delay Emulator blade functions in any 10GigE architecture. It does not log onto a loop, switch, or fabric; it only passes data between two devices. The Xgig Delay Emulator blade can pass 10GigE traffic, or it can recognize an event or event sequence and modify the traffic. The events must be 10GigE frames. A specific frame or series of frames can be modified in two ways: inserting a variety of delays or reordering a frame.

Features

Xgig Delay Emulator has the following features:

Operation

The Xgig Delay Emulator system (hardware and software), allows you to perform the following operations:

- Emulate network scenarios such as distance, switch processing delay, jitter, and multipath routing.
- Simulate network congestion.

You can use simulated congestion to help characterize effects on QoS and bandwidth throttle.

Capabilities

The Xgig Delay Emulator has the following capabilities:

- Operates with 10GigE protocol
- Supports the 10.3125 Gbps line rate.
- Supports frames from 64 bytes to 9k jumbo frames.
- Operates in digital re-timing mode at all times.
- Contains standard editing features such as copy, cut, paste, add, insert, and delete to edit the test suite. An option lets you run the test suite forever in a repeating loop.
- Provides the appropriate MAC (media access control) layer when you load the application.

Triggering Capabilities

The Xgig Delay Emulator module provides the following Triggering capabilities:

- You have two levels of triggering:
 - Arm (first level)

- Trigger (second level)
- You can set an Arm condition as a specific DWord within a frame.
- You can set an Trigger condition as a specific DWord within a frame.

Delay Capabilities

- The Xgig Delay Emulator can perform the following types of Delays on the contents of frames:
 - Fixed delay
 - Jitter delay
 - Ramp down delay
 - Ramp up delay
 - Random delay
 - Random Jitter delay
- The minimum delay through the system is approximately 30 microseconds.
- The maximum programmable delay is approximately 1.3 seconds.
- A test supports up to eight queues.

Reorder Capabilities

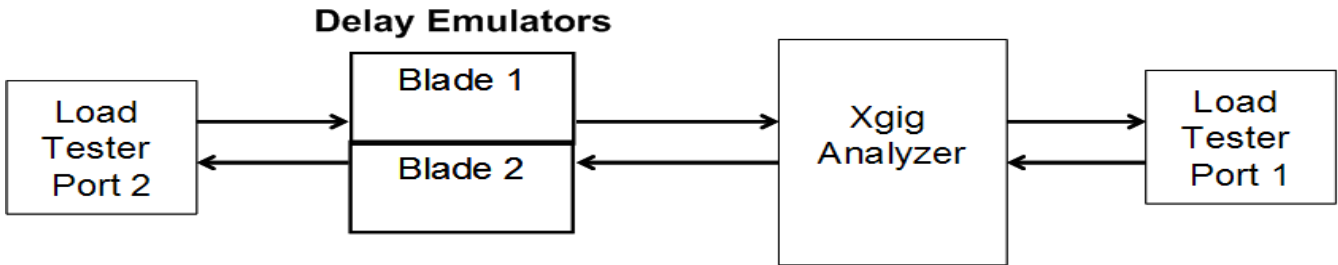
The Xgig Delay Emulator can perform the following types of frame reorder:

- Consecutive reorder
- Trigger reorder

Cabling

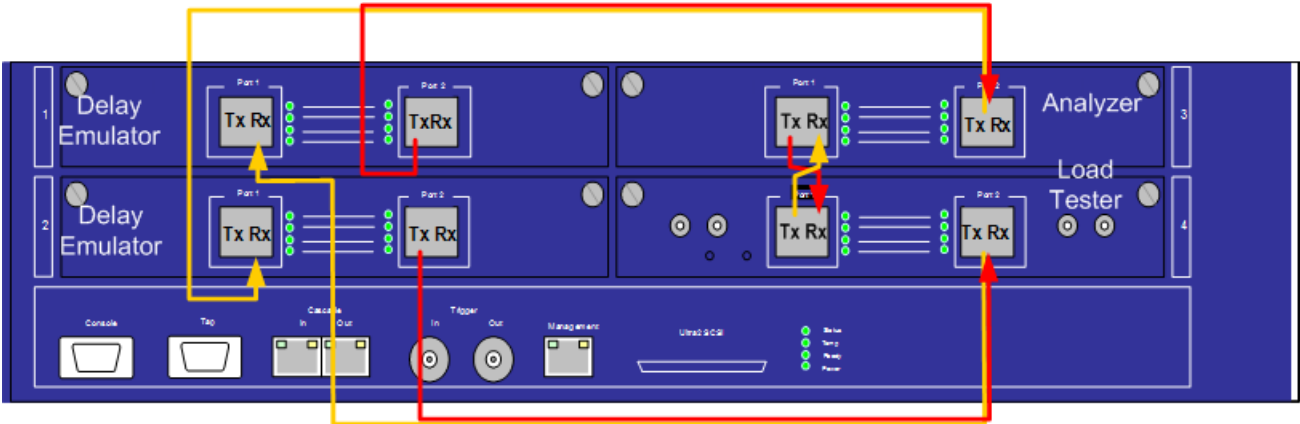
Test Setups containing Delay Emulator require special cabling if you want to use them to test data in both directions. Because Delay Emulator uses only the odd port of a port pair, data flows only from the Rx connector of Port one to the Tx connector of port two. The flow of data in the opposite direction, from the Rx connector of port two to the Tx connector of port one is not possible because port two is not used. Therefore, if you want to perform delay emulation on traffic flowing in both directions between two devices, you must use a second blade running Delay Emulator. See the example below.

Figure 373: Delay Emulator Test Setup



The following diagram shows the cabling for the Delay Emulator in the example above.

Figure 374: Delay Emulator Cabling Diagram



One cable connects the Load Tester to the Delay Emulator. The cable for the Tx Rx connection comes out of port 2 of the Load Tester then splits. The Rx cable plugs into the Tx connector of port 2 of the second Delay Emulator. The Tx cable plugs into the Rx connector of port 1 of the first Delay Emulator.

Another cable connects the Delay Emulator to Analyzer. The cable for the Tx Rx connection comes out of port 2 of the Analyzer then splits. The Rx cable plugs into the Tx connector of port 2 of the first Delay Emulator. The Tx cable plugs into the Rx port of port 1 of the second Delay Emulator.

A third cable connects the Load Tester to the Analyzer through port 1 of both blades.

Chapter 34

Using the Delay Emulator Tab

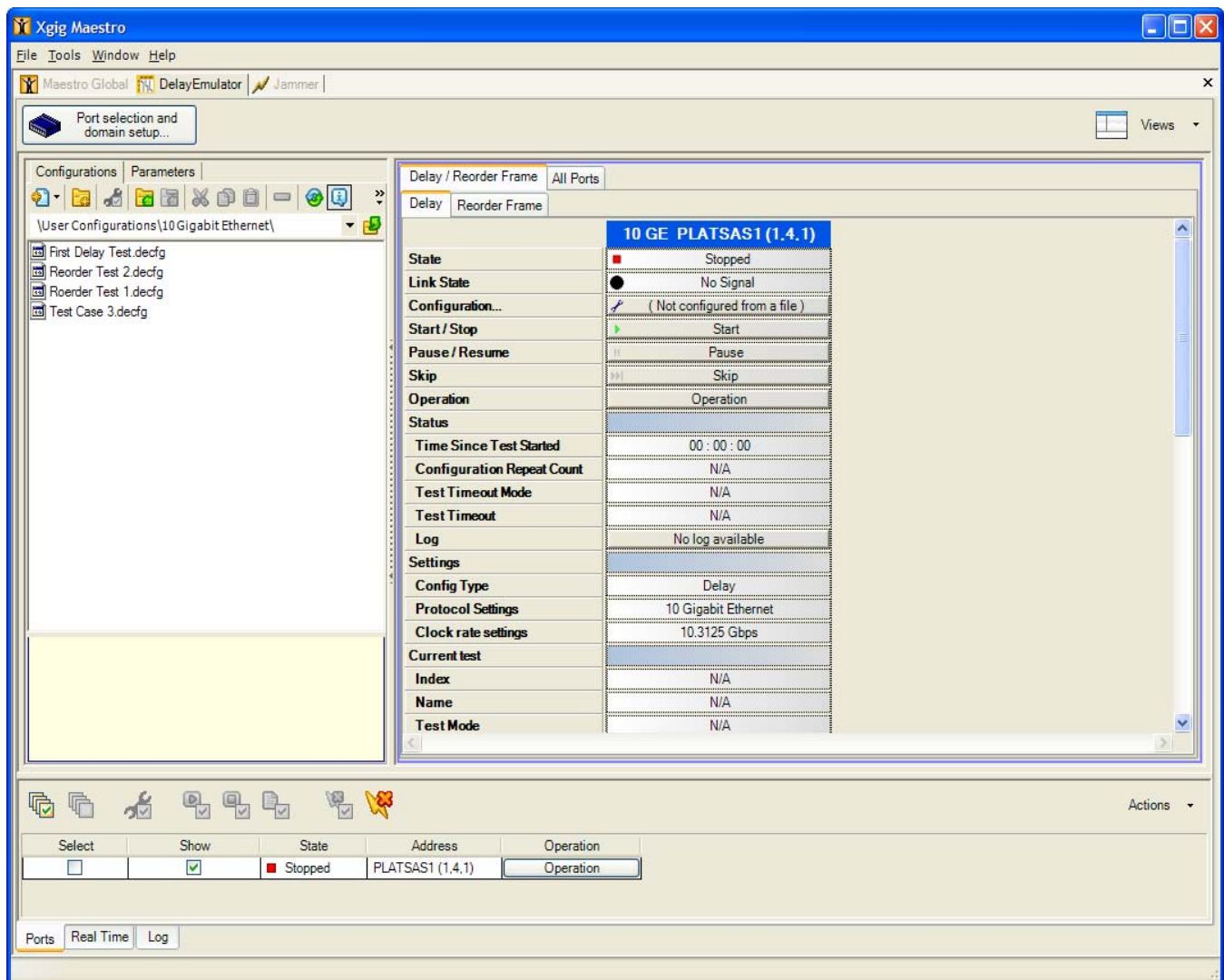
In this chapter:

- Using the Configuration Manager in Delay Emulator
- Using the Parameters Status Table in Delay Emulator
- Using the Parameters Status Context Menu in Delay Emulator
- Using the Ports Manager in Delay Emulator
- Using the Real Time Tab
- Using the Log Manager in Delay Emulator
- Customizing the Appearance of the Maestro/Delay Emulator Main Window
- Performing Configuration Tasks in Delay Emulator
- Running the Test Suite on a Delay Emulator Device

After you have discovered and locked the Delay Emulator ports that you want to use and have set up your capturing and monitoring applications, such as Xgig Analyzer, you are ready to run the Xgig Delay Emulator application. This chapter provides an overview of the Delay Emulator tab, on the Xgig Maestro main window, and its functions; it also includes steps to run predefined tests supplied with the Xgig Delay Emulator application or tests you have defined and saved.

You should have launched Xgig Maestro as described on page 12 and locked at least one device as described in “[Multi-Function Ports and Symbols](#)” on page 21. The Xgig Maestro window is displayed with the Delay Emulator tab on the right. This tab is where you operate the Delay Emulators you have locked.

Figure 375: Xgig Delay Emulator Tab on Xgig Maestro Window



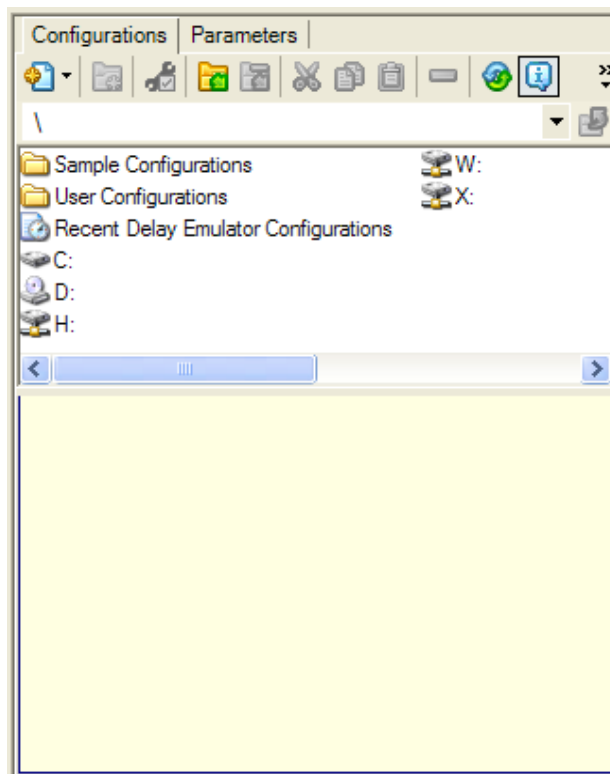
Using the Configuration Manager in Delay Emulator

The Configuration manager (Figure 376) is associated with the device function tab. This window also displays the configuration files specific to the function tab displayed. The **Sample Configurations** folder includes configurations that are provided with the application. The **User Configurations** folder is where the configurations you create are saved. The **Most Recently Used** folder allows you easy access to those configuration files most recently used. The Configuration Manager also includes a list of all the drives on your system allowing you to locate any configuration files on your system quickly.

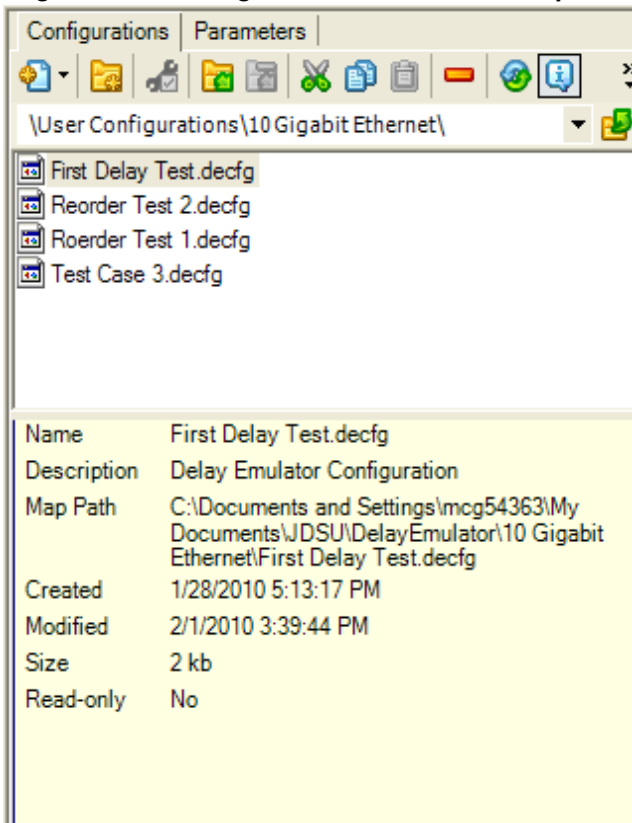
The Configuration manager has the following features:

- The Configuration manager provides a list of test configurations organized into folders and lists all the drives on your system allowing you to easily browse to locate all of your configuration files on your system

Figure 376: File Location in Delay Emulator Configuration Manager



- List of configuration files in a folder

Figure 377: Configuration Files and Description Pane

- Description pane
 - When you select a configuration file in the list, a description of the file is displayed in the description pane below. It also displays the name of the file, the path where the file is located, the size of the file, the date and time when the file was created, the date and time the file was modified, whether the file is read-only and the Map path where the file is located on your system.
 - When you click the Show/Hide button below the Description pane, you display or hide this pane.
- Drag and drop files

You can drag any configuration from the Configuration manager list onto a device column to load it.
- Tool bar that lets you create, load, copy, cut, and paste configuration files. See [“Configuration Manager Tool Bar in Delay Emulator” on page 635](#) for more information on this tool bar.
- Context menu

Select a configuration file name, and right-click to display a menu where you can choose to create and edit configuration files, and additional operations. See [“Configuration Manager Context Menu in Delay Emulator” on page 636](#) for more information about these menus.
- Browse to map folders of files stored in locations other than the default Sample and User Configuration folders.

Configuration Manager Tool Bar in Delay Emulator

The Configuration manager tool bar ([Figure 378](#)) allows you to perform the following functions:

New Configuration  allows you to open the Configuration window and create a new Delay Emulator configuration from scratch.

New Folder  allows you to create a new folder.

Load  allows you to load a configuration file into a port or ports. This icon is only active when a port has been locked and is selected in the Port Manager. See [“Loading Delay Emulator Configuration Files”](#) for details.

Map  allows you to select a folder that you want to be listed in the Configuration Manager for the selected function tab.

Unmap  allows you to unmap a folder that has been mapped.

Cut  allows you to cut a file from its current location. This is not the same as deleting a file.

Copy  allows you to copy a file.

Paste  allows you to paste a file you have cut or copied.

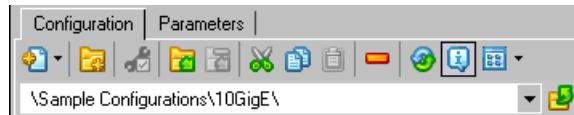
Delete  allows you to delete a file or folder.

Path  allows you to go up one level in the folder tree. This field next to this icon displays the current folder name.

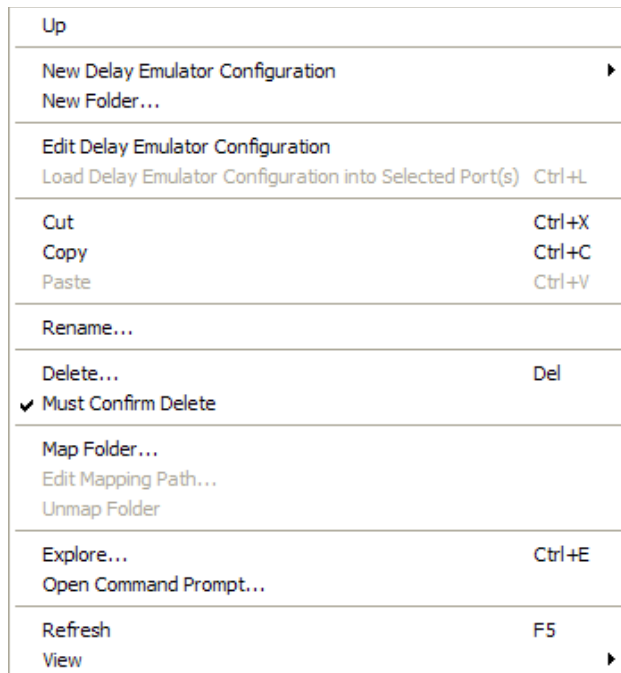
Refresh  allows you to refresh the Configuration Files and Description pane.

Show/Hide  allows you to show or hide the details for the selected file. These details appear in the lower section of the Configuration Manager pane.

View  allows you to view the files in the Configuration Manager as a list including only the file name or to view the details of the files in the list.

Figure 378: Configuration Manager Tool Bar in Delay Emulator

Configuration Manager Context Menu in Delay Emulator

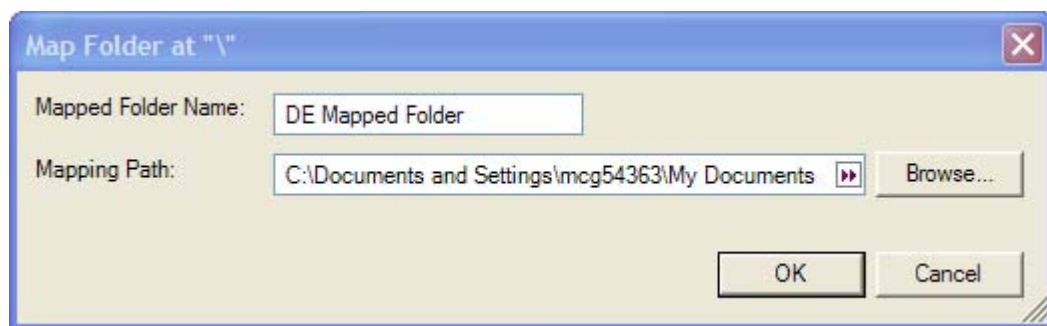
Figure 379: Configuration Manager Context Menu in Delay Emulator

Right-click in the list to choose the following actions from the context-sensitive menu:

- **Up**
Displays the contents one folder level up from the current display.
- **New Delay Emulator Configuration**
Allows you to open either a new Delay-Mode configuration or a Re-order Mode configuration.
- **New Folder**
Opens the Configuration manager dialog where you can enter the name of a new folder you want to add.
- **Edit Delay Emulator Configuration**
Opens the file highlighted in the list, the same as double-clicking on the file name.
- **Load Delay Emulator Configuration into Selected Port(s)**
Loads the file highlighted in the list into the port(s) selected in the Ports Manager. See [“Using the Ports Manager in Delay Emulator.”](#)

- **Cut**
Removes a selected file or folder from the list.
- **Copy**
Copies a selected file or folder to a clipboard making it available to paste in another location.
- **Paste**
Pastes a file or folder you cut or copied to the location you choose.
- **Rename**
Opens a dialog with the current file or folder name displayed in an entry field that you can modify. It also shows the protocol, path, and current file or folder name.
- **Delete**
Opens a dialog where you can confirm whether you want to delete the highlighted file (configuration) or folder from the list.
- **Must Confirm Delete**
Sets this choice as a preference that opens a dialog to confirm that you want to delete a file or folder from the list. When you select it, a check mark is displayed next to it. It is selected by default.
- **Map Folder**
Opens the Map Folder dialog box that lets you map a folder to a name of your choice.

Figure 380: Map Folder dialog box



Enter a name of your choice in the Mapped Folder Name field, and use the **Browse** button to select the folder on your system or network you want to map to this name.

- **Edit Mapping Path**
Allows you to edit the mapping path.
- **Unmap Folder**
Removes a highlighted mapped folder from the Configuration manager.
- **Explore**
Opens a Windows Explorer window showing the directory where the current configuration files are located.
- **Open Command Prompt**

Opens a Windows Command Prompt window showing the directory where the current configuration files are located.

- **Refresh**

Refreshes the Configuration Manager window.

- **View**

Has two choices:

- List

Displays the list of files or folders in the path you choose.

- Details

Displays the list of files or folders with the size and modification date.

Using the Parameters Status Table in Delay Emulator

The Parameters Status pane contains two tabs, **All Ports** and **Delay/Reorder Frame**. The **All Ports** tab shows all devices that have been locked. The **Delay/Reorder Frame** tab shows the devices locked according to their mode. Each Delay Emulator device is displayed by a column on the Delay Emulator tab (Figure 381). At the top of each column is the chassis name and the chassis number, the slot number, and port number(s) in parenthesis.

The locked ports can be divided in a sorted manner in the **Delay/Reorder Frame** tab or displayed unsorted in the **All Ports** tab.

To configure how to display the ports in the Parameters Status Table, click on the Views button and do the following:

Select or unselect **Configuration** to display or hide the Configurations tab and Parameters tab where you manage Delay Emulator configuration files and select the Parameters to display, respectively.

Select or unselect **Port Selection** to display or hide the Port Selection table.

Click **Ports** to display the options for displaying the ports in the Parameters Status Table.

Tile Horizontally - Select this option to display the Delay pane before the Reorder Frame pane. This allows you to drag and drop a port from one mode to the other.

Tile Vertically - Select this option to display the Delay pane beside the Reorder Frame pane. This allows you to drag and drop a port from one mode to the other.

Tabs - Select this option to display the Delay pane and Reorder Frame pane as tabs.

Each Delay Emulator port is displayed by a column on the Parameters Status table (Figure 381). At the top of each column is the protocol, the chassis name, and in parenthesis the chassis number, the slot number and port number(s).

Figure 381: Delay Emulator Parameters Status table

Delay / Reorder Frame		All Ports
Delay	Reorder Frame	
10 GE PLATSAS1 (1.4.1)		
State		Stopped
Link State		No Signal
Configuration...		(Not configured from a file)
Start / Stop		Start
Pause / Resume		Pause
Skip		Skip
Operation		Operation
Status		
Time Since Test Started		00 : 00 : 00
Configuration Repeat Count		N/A
Test Timeout Mode		N/A
Test Timeout		N/A
Log		No log available
Settings		
Config Type		Delay
Protocol Settings		10 Gigabit Ethernet
Clock rate settings		10.3125 Gbps
Current test		
Index		N/A
Name		N/A
Test Mode		N/A

The first column on the tab is the legend for each row in the device columns and contains the following categories for Delay and for Reorder Frame:

- State
- Link State
- Configuration
- Status
- Settings

Parameters Category Descriptions

State

This row shows the state of the Delay Emulator: Disconnected, Connecting, Starting, Running, Stopping, Skipping, Pausing, Paused, Stopped

Link State

Indicating the state of the signal, whether it is present, no signal is present, or the signal has been lost.

Configuration

Displays the name of the configuration file, if any, loaded into the port.

Start/Stop

Click this button to Start or Stop a test. The green arrow icon indicates you can click the button to Start the test. The red box indicates you can click the button to stop the test.

Pause/Resume

Click this button to pause or resume a test suite that is running.

Skip

Click this button to skip a test that is running and move to the next test in the suite.

Operation

Opens the Operation dialog box

Status Category

This category gives the status of the test suite that you have loaded into the Delay Emulator.

Time Since Test Started

Indicates the time elapsed since the current test started.

Configuration Repeat Count

Indicated how many times the test suite has been repeated.

Test Timeout Mode

Indicates whether the timeout option is set.

Test Timeout

Indicates the time value for the timeout option.

Log

Indicates if a log from the last operation is available for viewing.

Settings Category

This category indicates the current physical setup of the Delay Emulator device. You can change most of the settings in this category by using the Parameters Status context menu for each device you have locked.

Config Type

Indicates whether the configuration is delay-mode or reorder-mode.

Protocol

Indicates the current protocol setting for the Delay Emulator.

Clock Rate

Indicates the Delay Emulator clock rate.

Current Test Category

This category shows the condition of the test currently loaded in the Delay Emulator device.

Index

Indicates the number of the test within the queue that is being executed.

Name

Indicates the name of the test currently loaded in the Delay Emulator device.

Test Mode

Indicates whether the test mode is Arm, Trigger or Trigger

Using the Parameters Status Context Menu in Delay Emulator

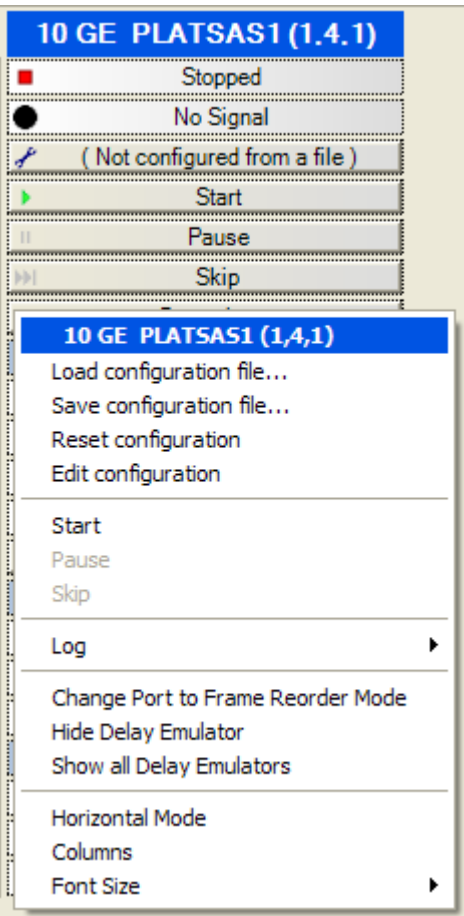
Right-click on the Parameters Status table to display the context menus shown in Figure 382. Each protocol has a unique context menu. The available operations are displayed for the column in which you click. This menu provides controls for configuration files, setting the data path, logging test activity, removing a Delay Emulator from the Parameters Status table, and the appearance of the status table.

Refer to the following pages for more information about the how to use the context menu choices:

- [“Using the Parameters Status Table in Delay Emulator” on page 639](#) for information about the parameter settings you make from these menus.
- [“Running the Test Suite on a Delay Emulator Device” on page 661](#) for information about running the Delay Emulator.
- [“Using the Log Manager in Delay Emulator” on page 650](#) for choosing log preferences.

- “Performing Configuration Tasks in Delay Emulator” on page 660 for information about using the Load configuration file, Save configuration file, Reset configuration, and Edit configuration selections from these menus.

Figure 382: Delay Emulator Parameters Status table Context Menus



Log

This setting allows you to view the log, open the options menu for the log, or save the current log.

Change Port to Delay/Reorder Mode

This setting changes the configuration applied to the selected ports to the other mode. If the current configuration is a delay-mode configuration, this setting changes the configuration to reorder-mode and visa versa. The current configuration remains as a saved file. A new blank configuration is applied to the ports containing zero tests.

This option allows you to immediately create a blank configuration and begin editing it while it is loaded into to the hardware.

Using the Ports Manager in Delay Emulator

The Ports manager displays details about the ports you have locked. It shows the protocol, chassis name (with chassis number, slot number, and port numbers), and other port specific information. You can sort the rows from first to last or last to first by clicking the column heading. For more information about Xgig slot positions and numbering, refer to the Xgig Family Hardware Guide included with the product CD.



Note: If you are disconnected due to a network problem, you can reconnect to the ports by using the Port Selection and Domain Setup window.

Figure 383: Delay Emulator Ports Manager



The following icons are displayed on the menu bar:



Select All Ports
Selects all ports in the Ports Manager.



Unselect All Ports
Unselect all ports in the Ports Manager.



Load Configuration to Selected Ports
Load the selected configuration file to all selected ports in the Ports Manager.



Start Selected Ports
Start BERT operation on the selected ports in the Ports Manager.



Stop Selected Ports
Stop BERT operation on the selected ports in the Ports Manager.



Show Properties of Selected Ports
Display the Port Properties dialog box, with information on the selected function, protocol, and clock rate (speed). It also shows the chassis name, IP address, slot and port(s).



Disconnect Selected Ports
Disconnect the selected ports in the Ports Manager.

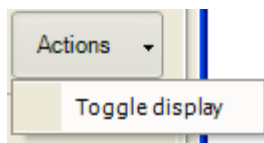


Disconnect All Ports
Disconnect all ports in the Ports Manager.

Actions Button

The **Actions** button contains menus for **Toggle Display**. See [Figure 384](#).

Figure 384: Actions Button Options



Toggle Display

This option toggles between a horizontal and vertical view of the ports.

Ports Manager Columns

The Ports Manager includes the following columns:

Select

Indicates whether you want to select a port pair

Show

Indicates whether you want to show this port pair in the Ports Manager.

Operation

Operation is a button you press to display the Operation bar for the device you are using. Refer to [“Running the Test Suite on a Delay Emulator Device” on page 661](#) for additional information.

State

This column displays the state of the device under test.

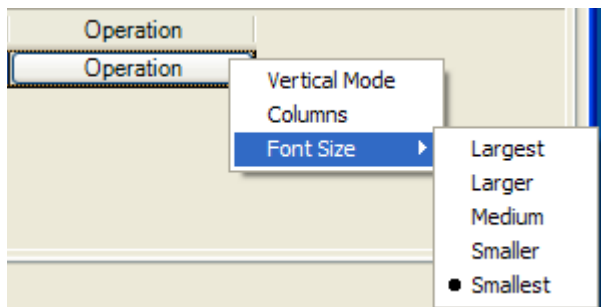
Address

This column displays the chassis name and the chassis number, the slot number, and port number(s) in parenthesis.

Using the Ports Manager Context Menu

You can right-click in the Ports Manager to open the context menu (Figure 385).

Figure 385: Ports Manager Context Menu



The menu contains the following choices:

Text Size

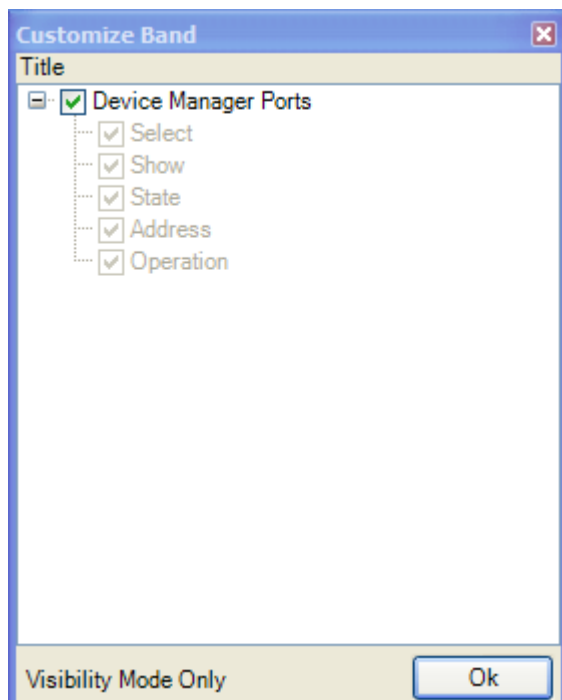
Refer to “[Changing Text Size](#)” on page 658 for information.

Columns

This choice opens a Customize table dialog (Figure 386) where you can choose which columns you want to display.

Click the check box next to this item to display this item in the Ports Manager.

The grayed out items are defaults; you cannot clear these items.

Figure 386: Delay Emulator Ports Manager Context Menu Parameters Selection

Using the Real Time Tab

To access the real time latency graph, click the **Real Time** tab at the bottom of the Delay Emulator main window.

Delay-Mode

The Real Time window contains a table showing parameters for each device running. The parameters include:

- Port ID
This includes the chassis number, the slot number, and the port number
- Current Test Index
Indicates the position of the current test within the test suite
- Test Name
Indicates the name of the current test
- Time Started
Indicates when the current test started
- Time Out
Indicates the timeout value if applicable
- Configuration Repeat Count
Indicates how many times the configuration has been repeated.

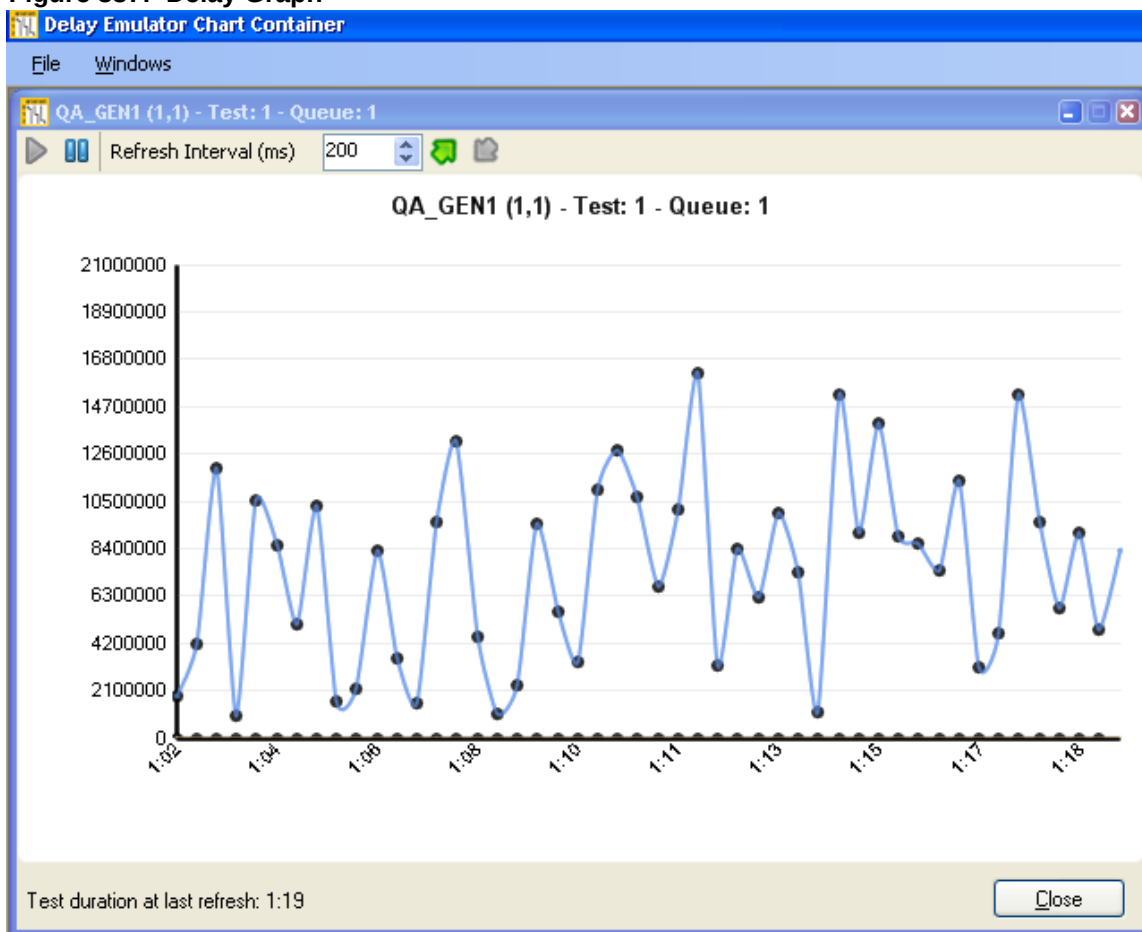
The following parameters are present for each queue when you expand the configuration table”

- Operation Status
Indicates the state of the port, started, triggered stopped, etc.
- Operation Mode
Indicates the type of delay

When a test is running, the device’s ports appear in table in the upper half of the window. If multiple test are running, each device appears in the table. To expand the an entry in the table to view the queues for that test, click the plus sign on the left. This opens the delay control.

Delay Graph

To access the delay graph, click the button in the **Delay** field. This graph allows you to view the delay change in real time. The graph has a control at the top of the window that allows you to set the latency value in nanoseconds. You can either type a value in the field or click the up/down buttons to change the value in increments of one. Id the delay type is “Fixed Delay”, you can change the delay value while a test is running. If you would like to pause the graph, click the Pause button in the top left corner of the window. To resume, click the Play button. To undock the graph, click the green undock button. You can close this window and reopen it at any time while the test is running.

Figure 387: Delay Graph

Reorder-Mode

The Real Time window contains a table showing parameters for each device running. The parameters include:

- Port ID
This includes the chassis number, the slot number, and the port number
- Current Test Index
Indicates the position of the current test within the test suite
- Test Name
Indicates the name of the current test
- Time Started
Indicates when the current test started
- Time Out
Indicates the timeout value if applicable
- Configuration Repeat Count
Indicates how many times the configuration has been repeated.

- **Frames Reordered**
Indicates the number of frames that have been reordered
- **Operation Status**
Indicates the state of the port, started, triggered stopped, etc.
- **Operation Mode**
Indicates the type of delay

When a test is running, the device's ports for the device appear in a table in the lower half of the window. If multiple test are running, each device appears in the table.

Using the Log Manager in Delay Emulator

To access the Log Manager, click the **Log** tab at the bottom of the Delay Emulator main window.

The purpose of logging is to automatically create a log that reports which delay or reorder tests have occurred and which ones might have reached the timeout limit while not finding a trigger. You can view a log with any text editor.

The Filter icons next to the **Type** and **Address** column labels allow you to choose how you want to display device types, by protocol or All, and device addresses, by single address or All devices.

If the **All Devices** tab at the top of the Xgig Maestro main window is selected, then the **Log Source** menu  2 active log sources ▾ shows all log sources as active by default. You can choose to disable BERT logging, Delay Emulator logging, Generator logging, Target Emulator logging, or all four by clicking the **Log Sources** menu and un-checking the selections. If the **BERT-Bit error rate testing**, **Jammer**, **Target Emulator**, or **Generator** tabs in the main window are selected, then the Log Manager displays only the log entries for that tab, respectively.

The following icons are displayed on the Log Manager menu bar:



Display Entry Contents

Lets you save the selected log to a file in the device Logs folder (for example: C:\Program Files > JDSU > Xgig Maestro > Delay Emulator > Logs) or anywhere you want to save it on the network.



Save All Entries As

Lets you save all the logs in the Log Manager to a file.



Save selected entries as

Lets you save the selected logs to a file.



Select All

Selects all the logs in the Log Manager.



Options

Opens the Log Manager Options dialog where you can enter your preferences for the information you want displayed in the Log Manager (Figure 388).

**Clear Filtering**

Removes filtering by Type and Address and displays all the devices you have locked.

**Clear Selected Entries**

Deletes the log entry you have highlighted.

**Clear All Entries**

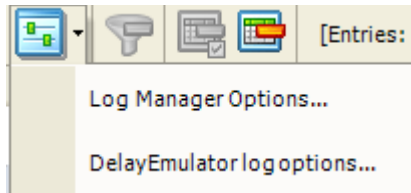
Deletes all the log entries in the Log Manager.

Setting Log Options

To have log files automatically named and saved to a specific location:

- 1 Click the Log Manager Options icon to open the drop-down menu (Figure 388), and select **Delay Emulator logging options**.

Figure 388: Log Manager Options Menu

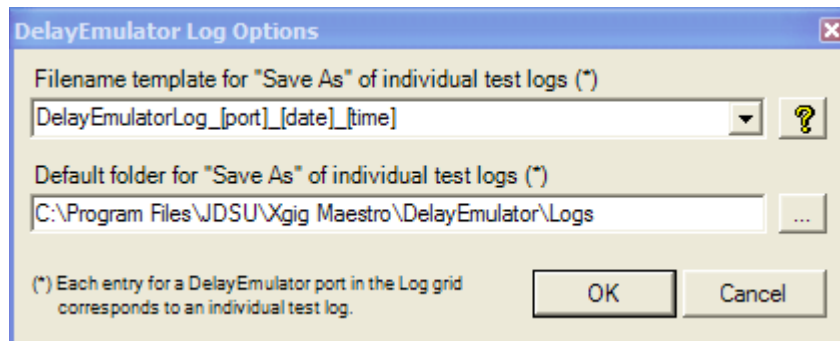


Or:

Open the Parameters context menu and select **Options**.

Either of these commands opens the Delay Emulator Log Options dialog (Figure 389). This dialog allows you to set up how you want the log files to be automatically named and the default location where you want them saved. You can also change the filename and folder when you save the log.

Figure 389: Delay Emulator Log Options Dialog



- 2 Select a log filename template from the following choices:

- Delay EmulatorLog_[port]
- Delay EmulatorLog_[port]_[date]_[time]
- Delay EmulatorLog_[date]_[time]
- Delay EmulatorLog_[date]_[time]_[port]

Or, you can type in your own template. Any [port], [date], and [time] in the template is replaced by the corresponding value. Port is displayed as:

protocol, chassis name (chassis number in the cascade, blade number in the chassis, port number on the blade)

- 3 Enter the path to the folder where you want to save the log file.

You can browse to where you want to save the log file by clicking .

- 4 Click **OK**.

You have set up the log filename template and default folder to save the log.



Note: These settings apply to all Delay Emulator logs. Log options are the same for all Delay Emulator ports.

Viewing a Log

The Delay Emulator log shows the status of each Test Case during the entire length of the test run

To display a log:

- >> Click the Log Manager tab at the bottom of the Xgig Maestro main window to view the log in a tabulated format (Figure 390).

Or:

- >> Click the **Log** button on the Operation bar (with the appropriate Delay Emulator device selected in the Parameters Status table; a green check mark indicates the device is selected).

Or you can:

- >> Open the Parameters context menu and select **Log > View**.

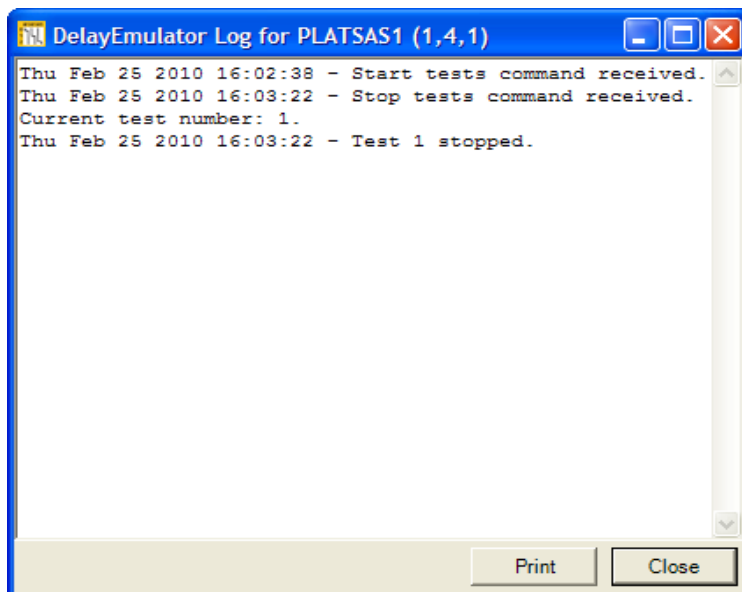
These two latter commands open a window that allows you to quickly view the Xgig Delay Emulator log. (Figure 391). In the case of these two methods, each time you run a Delay Emulator, a new Delay Emulator log is created for the device, and the previous log is discarded. Click **Print** at the bottom of the Delay Emulator log to print a hard copy of the log.

On the other hand, the Log Manager continues to list the logs and display them depending on the Log Manager options you have selected. See [“Setting Log Options” on page 652](#).

You can save a log to a `.txt` file or an HTML file. Refer to “Saving a Log” on page 654.

Figure 390: Log Manager

 DelayEmulator logging active         [Entries: 73]			
DateTime	Type	Address	Contents
2/23/2010 4:58:07 PM	Delay Emulator	API Trace	GetTriggerStateNameString(167643824, 1, tsArm, "") Return: ecSuccess Spent:00:00:00
2/23/2010 4:58:07 PM	Delay Emulator	API Trace	GetConfigurationModifiedState(119419448, False) Return: ecSuccess Spent:00:00:00
2/23/2010 4:58:07 PM	Delay Emulator	API Trace	GetConfigurationModifiedState(119419448, False) Return: ecSuccess Spent:00:00:00
2/23/2010 4:58:07 PM	Delay Emulator	API Trace	GetTriggerStateNameString(167643824, 1, tsTrigger, "") Return: ecSuccess Spent:00:00:00
2/23/2010 4:58:07 PM	Delay Emulator	API Trace	GetConfigurationModifiedState(119419448, False) Return: ecSuccess Spent:00:00:00
2/23/2010 4:58:07 PM	Delay Emulator	API Trace	GetConfigurationModifiedState(119419448, False) Return: ecSuccess Spent:00:00:00

Figure 391: Example of a Delay Emulator Log Display

Saving a Log

You can save a log from the Log Manager tab or the Parameters context menu.

To save a log from the Log Manager tab as an HTML file or text file:

- 1 Highlight the log you want to save.
- 2 Click the **Save Selected Entries As...** button.

The Save Log Manager Contents As window is displayed that lets you name and save the log as an HTML file to the Saved Logs folder or to a location you prefer.

To save a log to a .txt file using the Parameters context menu:

- >> Open the Parameters context menu (Figure 392) and select **Log > Save As**.

This command opens a File dialog where you can save the log with a file name you assign to it. The default location is Program Files > JDSU > Xgig Maestro > Delay Emulator > Logs.

Figure 392: Log Menu

Customizing the Appearance of the Maestro/Delay Emulator Main Window

You can move and rearrange the individual device tabs on your monitor screen as you prefer. You can also select the information you want to display in the Parameters Status table. In addition, you can select the size of displayed text.

Using the Window Menu

The **Window** menu allows you to arrange the window display:

Layout

Layout offers choices for rearranging the Maestro device tab windows. The Ports manager and Log Manager windows are not affected by this menu selection.

Internal Tabs

Allows you to restore the Maestro main window to its default format.

Internal MDI

Internal multiple document interface (MDI) lets you isolate each device tab as a separate window that you can activate by clicking anywhere on the window.

Show Hidden Windows

Restores any windows you have closed while using the Internal Tabs or Internal MDI display arrangement.

Arrange Icons

Arranges the icons for minimized windows at the bottom of the screen. If an open document window is at the bottom of the screen, some or all of the icons will be underneath this document window and will not be visible.

Cascade

Arranges all open windows in a cascade style from the top, left corner of the window.

1 All Devices

Brings the All Devices tab to the front as the active window. This window displays ports from all active devices (BERT, Delay Emulator, Generator, and Target Emulator).

2 BERT - Bit error rate testing

Brings the BERT device tab to the front as the active window

3 BERT - Latency measurement

Brings the BERT Latency measurement device tab to the front as the active window

4 Jammer

Brings the Delay Emulator device tab to the front as the active window

5 Generator

Brings the Generator device tab to the front as the active window

6 Target Emulator

Brings the Target Emulator device tab to the front as the active window

7 Delay Emulator

Brings the Delay Emulator device tab to the front as the active window.

Tile Horizontally

After selecting **Layout > Internal MDI**, this command opens and aligns the BERT, BERT Latency measurement, Delay Emulator, Generator, and Target Emulator device windows horizontally one over the other.

Tile Vertically

After selecting **Layout > Internal MDI**, this command opens and aligns the BERT, BERT Latency measurement, Delay Emulator, and Generator, and Target Emulator device windows vertically one next to the other. You can view the individual device windows by dragging the sides out to resize them.

Minimize All Windows

After selecting **Layout > Internal MDI**, this command minimizes all the open windows. You can restore each window, individually, by using the standard window controls on the header or select **Internal Tabs** to restore the Maestro main window to its default format.

Customizing the Parameters Status table in Delay Emulator

You can change the appearance of the Parameters Status table by:

- Removing columns
- Resizing columns
- Changing the text size
- Displaying and hiding status table parameters

Removing columns

If you have a number of devices locked, you can remove a column that you do not need to view without unlocking the port or affecting the operation.

To remove a column:

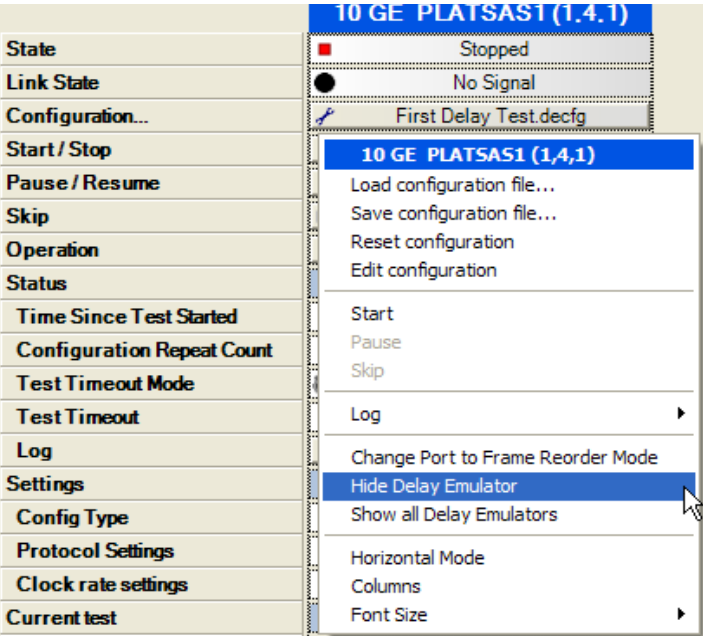
- 1 Right-click on the specific column you want and open the Parameters context menu.
- 2 Select **Hide Delay Emulator** (Figure 393).

Or:

In the Ports Manager, clear the **Show** check box next to the device you want to remove.

The column is removed, but the device is still locked (“in use”) and displayed in the Ports Manager.

Figure 393: Removing a Device Column



To replace the device column on the Parameters Status table:

- >> Click the **Show** check box for the device in the Ports Manager.

Resizing columns

You can resize any of the columns by placing the mouse at the right edge at the top of a column, next to the chassis name. A resizing cursor appears. Hold down the mouse button, and drag the mouse to resize the column.

Changing Text Size

You can choose the text size you want the Parameters Status table or the Ports Manager to display.



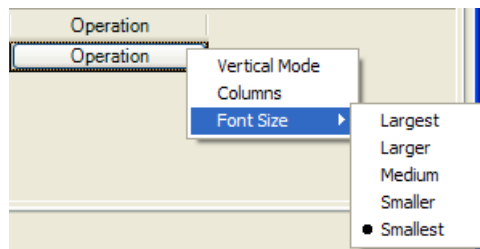
Note: You cannot change the text size in the Log Manager.

To change text size:

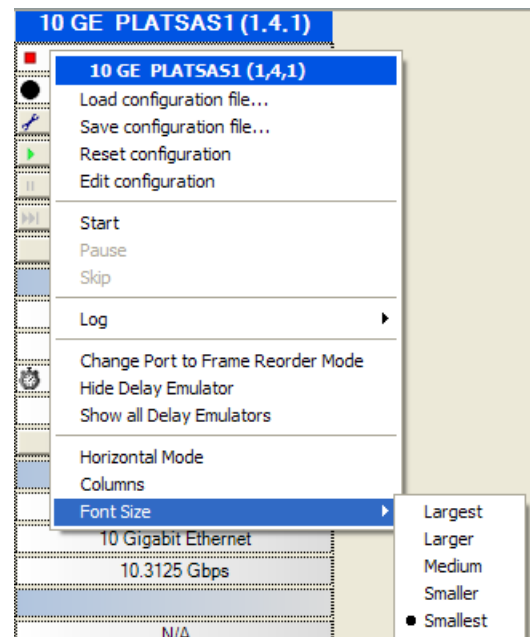
- 1 Open the context menu by clicking the right mouse button while the cursor is on the Parameters Status table or the Ports Manager.
- 2 Select **Text size** (Figure 394).
You have five choices from which to select.
Smallest is the default size.
- 3 Select the text size you want.
A bullet is displayed next to the current selection.

Figure 394: Text Size Menu

Context menu over Ports manager



Context menu over device parameters status table



Displaying and Hiding Parameters in Delay Emulator

You can hide specific parameters on the Parameters Status table to simplify the status tables and show only the information in which you are interested.

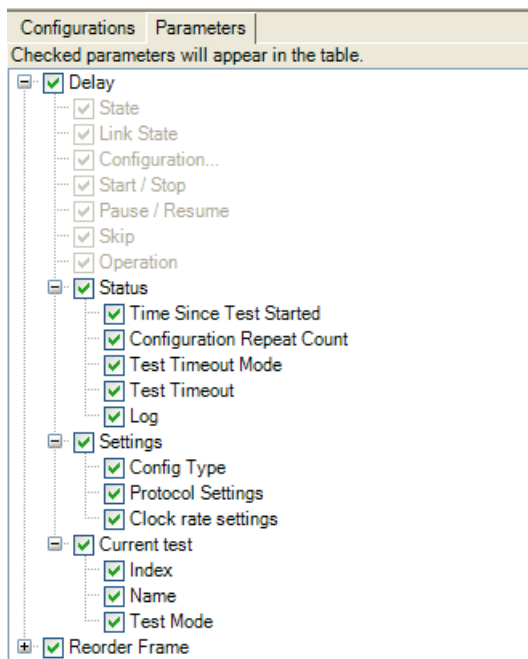
To display or hide parameters on the Parameters Status table:

- 1 Click the Parameters tab at the top of the Configuration manager pane to switch to the Parameters manager (Figure 395).

You can expand the categories by clicking the plus signs on the left.

The default displays most of the parameters.

Figure 395: Delay Emulator Parameters Manager



- 2 Click check box to set or clear the check mark next to the parameters.
Checked parameters are displayed.

Performing Configuration Tasks in Delay Emulator

This section describes how to handle configuration files from the Delay Emulator main window.

Loading Delay Emulator Configuration Files

You can load a configuration file on a Delay Emulator using one of the following methods:

From the Configuration Manager:

- >> Drag the configuration file from the list in the Configuration Manager onto the Parameters Status table (column for the device) and release the mouse button.

You can drag configuration files from anywhere, including the list of configuration files in the Configuration Manager on the Xgig Maestro window, the system desktop, or Windows Explorer.

From the Parameters Context Menu

- 1 Right-click on the device column to open the Parameters context menu and select **Load configuration file**.

An Open File dialog is displayed.

- 2 Navigate to the Delay Emulator .decfg file that you want to use and click **Open**.

The file is loaded and its name and parameters are displayed in the device column of the Parameters Status table.

From the Ports Manager:

- 1 Check the **Select** check box(es) in the Ports Manager for the port(s) you want to use.
- 2 Click the configuration file you want to load from the Configuration Manager.

- 3 Click the **Load Configuration to Selected Ports** button . This button is located in the Ports Manager and in the Configuration Manager. Both have the same function.

You can use the above methods to navigate to a mapped folder and load a configuration file.

Saving a Delay Emulator Configuration File

To save a Delay Emulator configuration file you created or edited:

- 1 Right-click on the device column in the Parameters Status table to open the Parameters context menu, and select **Save configuration file**.

A Windows Save dialog is displayed.

- 2 Navigate to where you want to save the configuration file and assign a name to it.

Xgig Delay Emulator configuration files are saved with a .decfg extension.

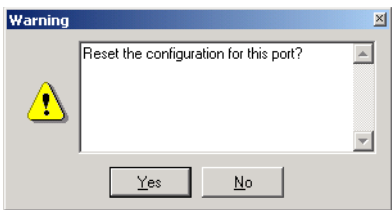
Resetting a Delay Emulator Configuration

To clear the configuration from a device:

- 1 Right-click on the device column in the Parameters Status table to open the Parameters context menu, and select **Reset configuration**.

A warning dialog may be displayed asking you to confirm the configuration reset.

Figure 396: Reset Configuration Warning Dialog



- 2 Click **Yes** to clear the configuration from the device.

Editing a Delay Emulator Configuration

To create a configuration file for a device, you can start from a blank default configuration or edit the configuration after you have loaded a configuration file to the device.

You can open the Configuration window using one of the following methods:

- 1 Right-click on the device column in the Parameters Status table to open the Parameters context menu.
- 2 Select **Edit configuration**.

Or:

>> Click the **Configuration** button on the Parameters Status table

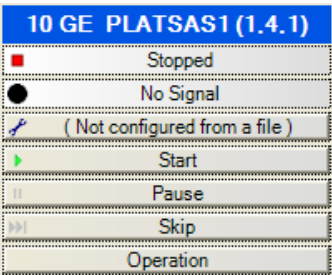
This opens the Configuration window for the device that is currently selected. Refer to or [“Using the Jammer Configuration Window” on page 230](#) for more information.

Running the Test Suite on a Delay Emulator Device

After you have configured a Delay Emulator device, you can start the operation. Three methods are available:

>> Click the **Start** button on the Parameters Status table.

Figure 397: Parameters Status table Start Button



Or you can:

>> Right-click on the device column to open the Parameters context menu where the **Start**, **Pause**, **Skip**, and **Stop** commands are available.

Or:

1 On the Ports manager, select the device.

2 Click the **Start** button  .

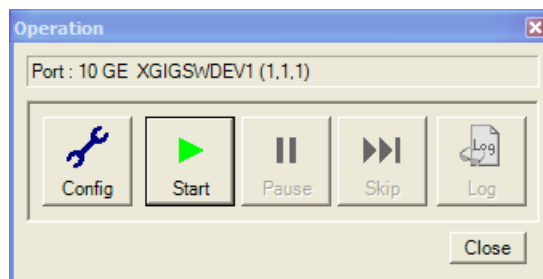
Or:

1 On the Ports manager, in the Operation column, click the **Operation** button for the device.

The Operation dialog is displayed (Figure 398).

2 Click **Start**.

Figure 398: Delay Emulator Tab Operation Bar



Clicking any of the Operation buttons (including **Config**) takes effect on the Delay Emulator device that is currently selected in the Parameters Status table.

Start runs the Test Suite from the beginning if you click it while the Delay Emulator is stopped. The Start button label becomes a Stop label while the Test Suite is running.

Pause causes the Delay Emulator to pause and not run the next Test Case in the Test Suite when the current Test Case is completed. When you click **Pause**, the State of the Delay Emulator is “Pausing” while the current Test Case is still running. When the current Test Case completes (or is skipped), the Delay Emulator is in the “Paused” state waiting for user intervention.

Skip causes the Delay Emulator to abort the current Test Case and move on to the next one. If the Delay Emulator is “Paused,” you can click **Skip** to jump through your Test Suite without running any Test Cases until you get to the Test Case you want to run and resume testing. If you skip past the last Test Case in the Test Suite and the Test Suite is not set to loop forever, then the Delay Emulator goes to the Stopped state as if the Test Suite completed.

To let a test run to the end and then skip to another test:

1 Click **Pause**.

Wait for the current test to finish.

2 Click **Skip** to step through the tests.

3 Observe the progress field on the Parameters Status table to track tests in the queue.

4 Click **Start**.

Stop causes the Delay Emulator to abort running the entire Test Suite and go to the Stopped state.

Log indicates a log is available for viewing. Click **Log** to view the latest test log.

Chapter 35

Creating Delay Emulator Test Configurations for Delay Mode

In this chapter:

- [Defining Your Own Test Configurations for Delay Mode](#)
- [Using the Delay-Mode Configuration Window](#)
- [Configuring the Classify Condition in Delay-Mode](#)
- [Configuring the Arm Condition in Delay-Mode](#)
- [Configuring the Trigger Condition in Delay-Mode](#)

Defining Your Own Test Configurations for Delay Mode

Xgig Delay Emulator lets you define your own test configurations and save them with or without hardware available.

You can create a configuration from scratch, or you can open and edit an existing configuration. Also, you can edit a configuration in edit only mode, which is independent of any hardware, or you can edit a configuration that is currently loaded to a Delay Emulator device.

To edit a configuration in edit only mode:

>> Double-click a configuration file in the Configuration manager.

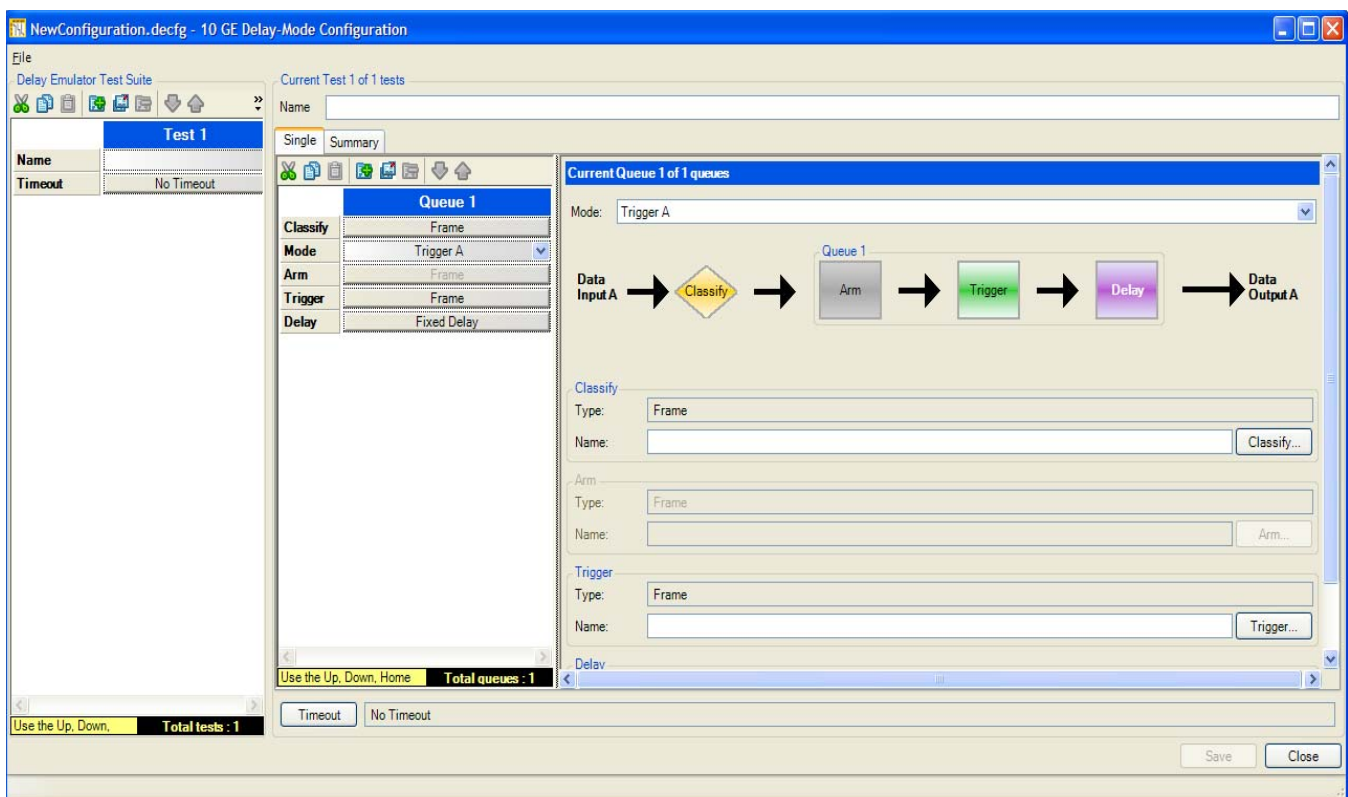
or:

>> Right-click the configuration file in the Configuration manager, and choose **Edit Delay Emulator Configuration** from the context menu.

The edit only mode Delay Emulator Configuration window opens (Figure 399).

This window allows you to set up your own Test Cases, name them, organize them, and save them to files so that you can use them again.

Figure 399: Edit Only Delay Emulator Configuration Window



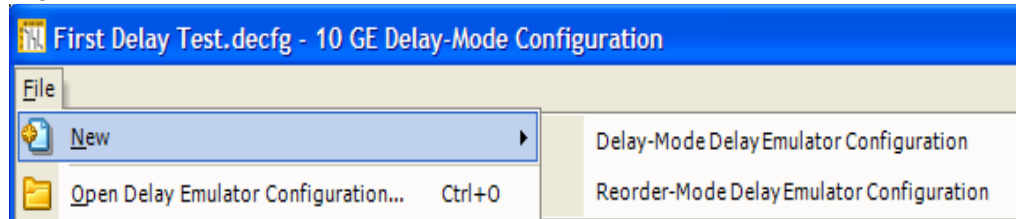
To start a configuration from scratch in edit only mode:

>> Select **New Delay Emulator Configuration** from the context menu or the File menu (Figure 400) on the Xgig Maestro menu bar. Then, select **Delay-Mode** or **Reorder-Mode Delay Emulator Configuration** from the drop down menu.

or:

>> Click the New Configuration icon at the top of the Configuration manager.

Figure 400: Maestro File Menu



To save your configuration in edit only mode:

>> Click **Save** at the bottom of the Delay Emulator Configuration window, or open the File menu on the Delay Emulator Configuration window and select **Save Delay Emulator Configuration** or **Save Delay Emulator Configuration As**.

Any changes you make have no effect on actual Delay Emulator devices you control.

To edit a configuration that is loaded to a Delay Emulator port:

>> Click **Configuration...** in the device column.

or:

>> Right-click in the Parameters Status table in the device column to open the context menu and select **Edit configuration**.

or:

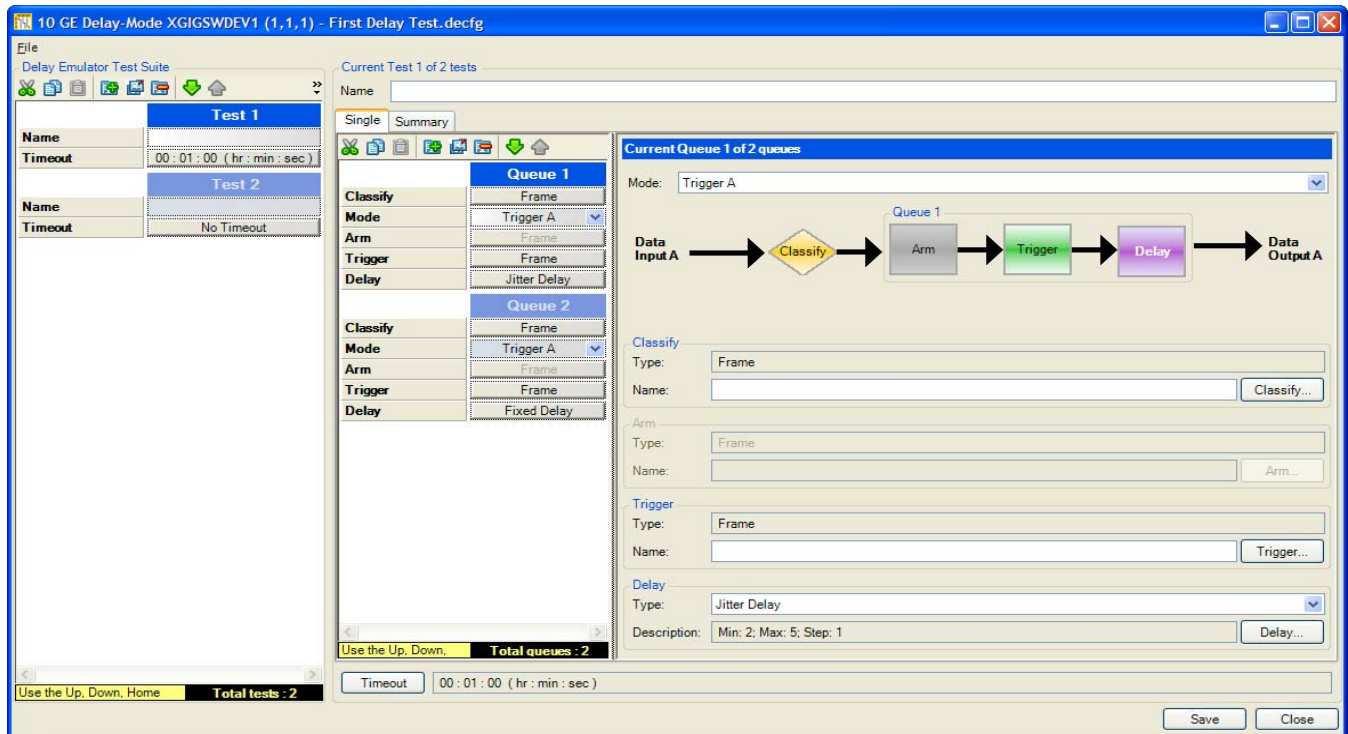
>> Click **Operation** in the device column to open the Operation dialog, then click **Config**.

The Xgig Delay Emulator Configuration window in hardware edit mode is displayed (Figure 401). This window allows you to set up your own Test Cases, name them, and save them to a file so that you can use them again.

Click **Apply** or **OK** and Delay Emulator accepts the changes. They are immediately reflected in the Parameters Status table and affect the Delay Emulator device the next time you run it.

To save your configuration edits:

>> Open the File menu at the top of the Delay Emulator Configuration window and select **Save Delay Emulator Configuration** or **Save Delay Emulator Configuration As**.

Figure 401: Xgig Delay Emulator Configuration Window

Using the Delay-Mode Configuration Window

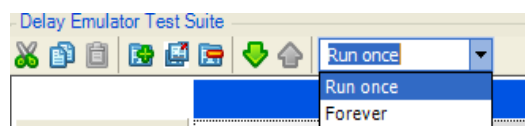
The Delay Emulator Configuration window title bar indicates how many ports it is configuring, the protocol, and the configuration file name, if any. If you are using hardware edit mode, the chassis name, chassis number, slot number, and port number are also listed. The elements of the Delay Emulator Configuration window are described in the following sections.

Using the Delay Emulator Test Suite Tools

The Delay Emulator Test Suite (left pane) lists the series of Xgig Delay Emulator tests in the order in which you want them to execute. The number of tests in a test suite has no limit. Each test can contain between one and eight queues. The highlighted test appears as the Current Delay Emulator Test (right pane). Each test in the suite executes in sequence.

Creating a Test Suite

When you create a Delay Emulator Test Suite, you use the toolbar in the Delay Emulator Test Suite section of the Configuration window ([Figure 402](#)).

Figure 402: 10GigE Delay Emulator Test Suite Toolbar

The following list describes the icons on the toolbar:

	Cut current test	Removes the highlighted test and holds its contents in the memory buffer.
	Copy current text	Copies the highlighted test to the memory buffer.
	Paste last test cut or copied	Inserts the current memory buffer contents before the currently highlighted test.
	Add new test to bottom of stack	Adds a new blank test to the bottom of the suite.
	Insert new test before current test	Inserts a new blank test above the currently highlighted test.
	Delete current test	Removes the highlighted test from the suite. If only one test is present, then the contents of this test are cleared.
	Move current test down the stack	Moves the highlighted test down one in the test order.
	Move current test up the stack	Moves the highlighted test up one in the test order.
	Run test suite once or Repeat test suite	When you choose Repeat test suite, the tests run according the settings you define in the Delay Emulator Current Test window. You can also type a number in this field to indicate you want the test suite to repeat a certain number of times.

To duplicate a test at another point in the Test Suite:

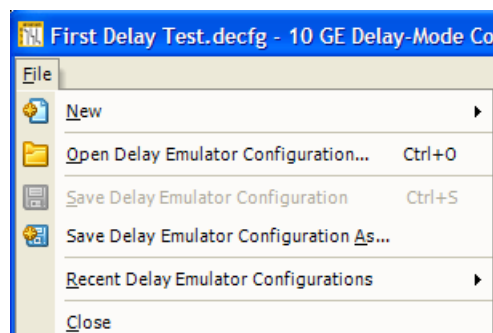
- 1 Highlight the test you want to duplicate.
- 2 Click **Copy**.
- 3 Highlight the test in the suite that is just after the point where you want the duplicate test inserted.
- 4 Click **Paste**.

The duplicate test is inserted.

Using the Configuration File Menu

The File menu is the only menu on the menu bar (Figure 403).

Figure 403: Configuration File Menu



The choices are:

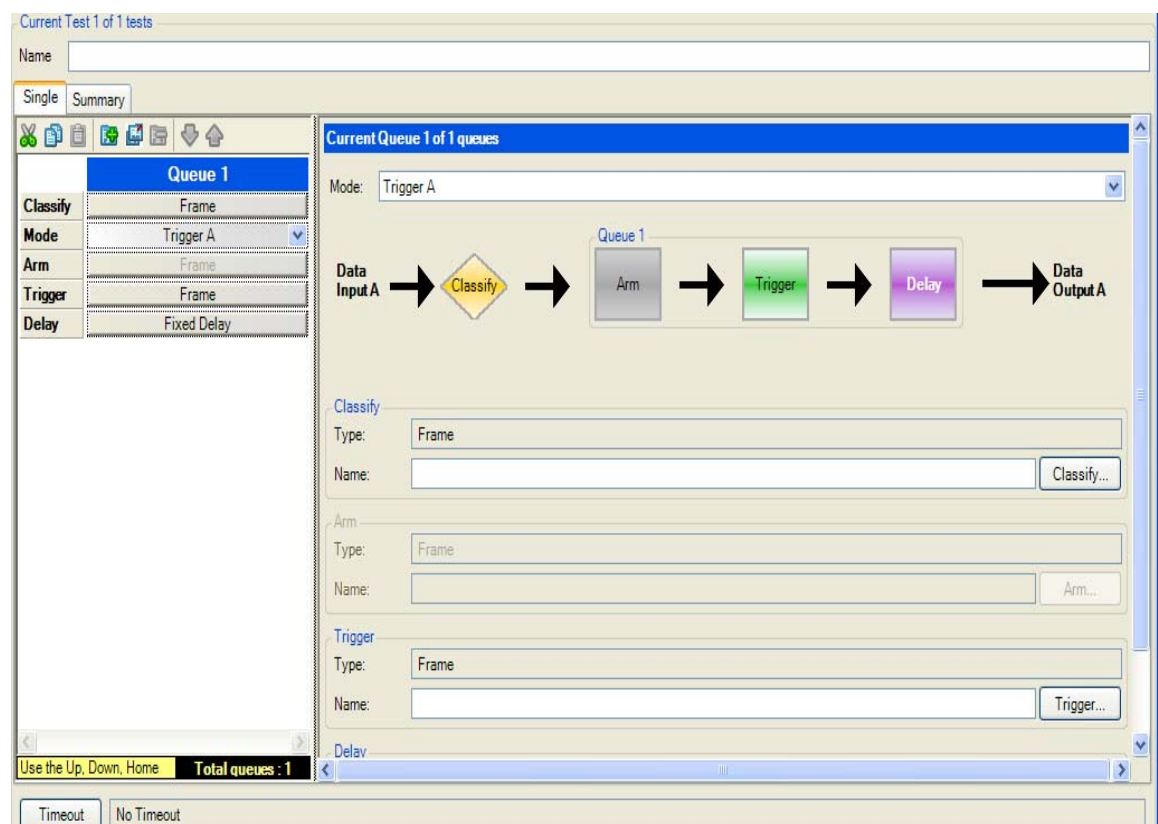
New Configuration	Creates a new delay or reorder .decfg configuration file.
Open Configuration	Open an existing .decfg configuration file.
Save Configuration	Save the entire Test Suite to the .decfg file you currently have loaded.
Save Configuration As	Save the entire Test Suite to a .decfg file with a name you assign to it.
Recent Configuration	Open a recently opened .decfg configuration file.
Close	Close the Delay Emulator Configuration Window.

The recently used Delay Emulator configuration files appear in the file menu and are loaded when selected.

Using the Current Delay Emulator Test Window: Delay-Mode

The graphics in this section of the window represent the hardware configuration for the selected test in the Delay Emulator Test Suite (Figure 404).

Figure 404: Current Delay Emulator Test Window



Single Tab

The **Single** tab shows the contents for a single test within the test suite. A test is comprised of queues, which are delays. A test can have up to eight queues. Each queue has its own settings. To populate a test, you must create queues. Use the toolbar to create and control queues within a test. The toolbar on the **Single** tab contains the same functions for queues as the left pane has for tests.

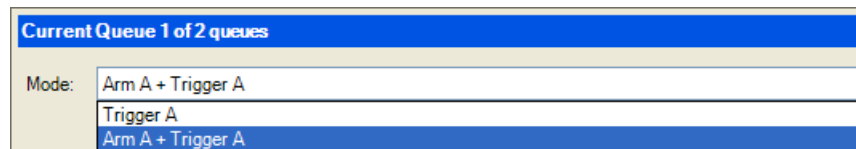
Create a Queue

To create a queue within a test, click the **Add Queue**  button. The queue appears below the toolbar. The following sections illustrate the process of defining the parameters for a queue.

Mode

The Mode menu is available near the top of the Current Delay Emulator Test window (Figure 405) and also near the top of each queue in the Delay Emulator **Single** tab (Figure 401).

Figure 405: Mode Drop-down Menu in Current Delay Emulator Test



Classify

The Classify menu are available in the left pane of the Current Delay Emulator Test window and also in each queue in the Delay Emulator **Single** tab. To define Classify condition, click the Classify button in the queue or in the left pane to open the corresponding definition window.

Arm and Trigger

The Arm and Trigger menus are available in the left pane of the Current Delay Emulator Test window and also in each queue in the Delay Emulator **Single** tab. To define Arm and Trigger conditions, click the Arm or Trigger **Frame** button in the queue. Now, click the Arm or Trigger button in the queue or in the left pane to open the corresponding definition window.

Delay

The Delay menu allows you to select what type of delay you want. Click the Delay button to access the Delay dialog. All delays are in addition to the smallest delay of 30ms and are rounded up or down to the nearest 6ns increment.

Select the type of delay you want from the drop-down menu.

Fixed Delay

Emulates a fixed delay for each buffer segment

For Fixed Delay, type the delay value in nanoseconds.

Jitter Delay

Emulates inter-packet gap variations for each buffer segment

For Jitter Delay, type the min. and max. values as well as the step size in nanoseconds.

Ramp Down Delay

Emulates delays that decrease with each buffer segment

For Ramp Down Delay, type the min. and max. values as well as the step size in nanoseconds.

Ramp Up Delay

Emulates delays that increase with each buffer segment

For Ramp Up Delay, type the min. and max. values as well as the step size in nanoseconds.

Random Delay

Emulates random inter-packet gap variations for each buffer segment

For random delay, type the min. and max. delay values in nanoseconds.

Random Jitter Delay

Emulate random inter-packet gap variations for each buffer segment

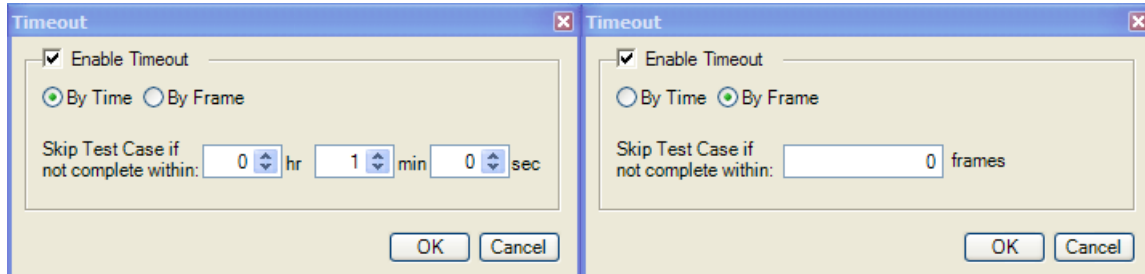
For Random Jitter Delay, type the mean value in nanoseconds and the percentage of change in value to define your range. For example. If your mean is 1000ns, and your percentage is 5, then your delay values will range from 950 to 1050ns

Timeout

The timeout option defines the period of time to wait for a specified test to complete before aborting and proceeding to the next test in the suite.

To set the timeout:

- 1** Click **Timeout** to display the dialog box in Figure 406.
- 2** Check **Enable Timeout**.
- 3** Select either By Time or By Frame.
- 4** For By Time, enter the hours, minutes, and seconds you want to wait.
- 5** For By Frame, enter the number of frames you want to wait for.

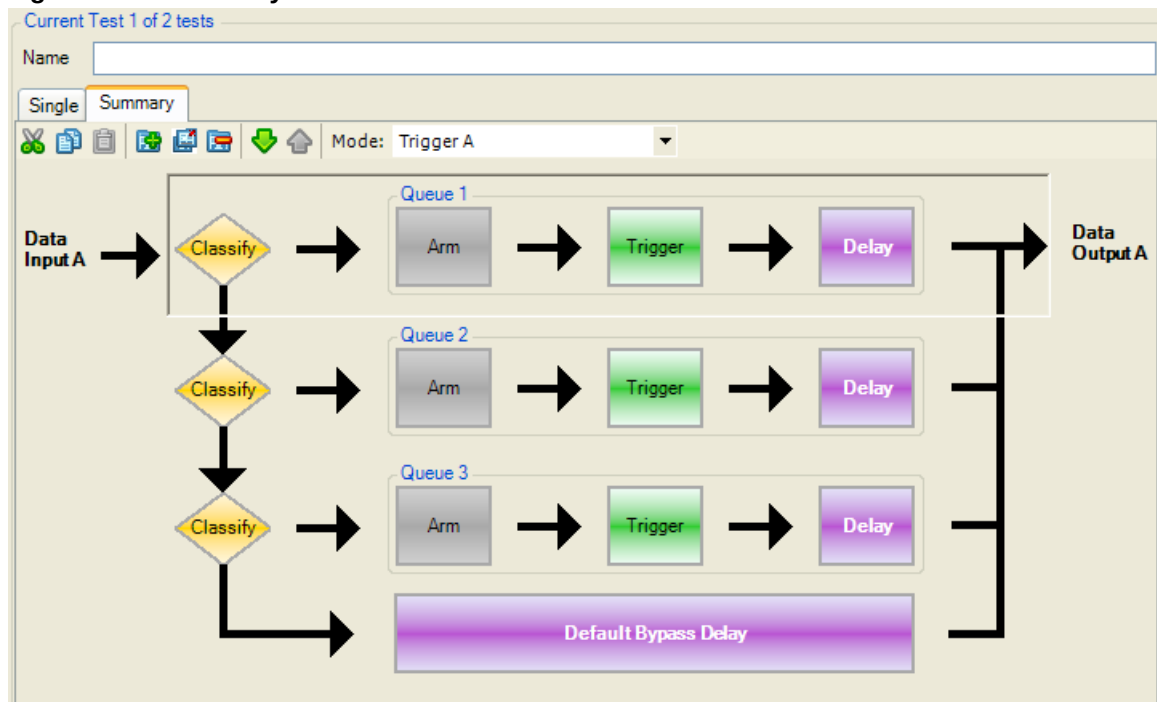
Figure 406: Timeout Dialog

6 Click **OK**.

Summary Tab

The Summary tab provides a graphical representation of all the queues in a test. The flow of information goes from the classify condition to the Arm and/or Trigger condition. If the Classify condition for a queue is not met, the Classify condition for the next queue is compared. If none of the Classify conditions in the test are met, the process defaults to the bypass delay.

The bypass delay is a fixed delay set at 30 microseconds, which is the smallest delay possible.

Figure 407: Summary Tab


Configuring the Classify Condition in Delay-Mode

The Classify condition of a queue is compared first. If it is met, the queue process begins. The queue process consists of either Arm and Trigger or just Trigger. If the Classify condition is not met, the Classify condition of the next queue is compared. The Classify condition recognizes specific DWords within frames.



Note: If none of the Classify conditions in the queue are met, the software uses the default bypass delay, which acts as a catch all for traffic that doesn't go through the queues. This flow is represented on the Summary tab of the **Delay Emulator Configuration** window.

Depending on the Mode you select in the **Delay Emulator Configuration** window, the appropriate graphic diagram shows the Classify condition, the Trigger and optional Arm conditions, and the Delay. If the Mode you select does not include an Arm condition, the Arm button remains disabled.

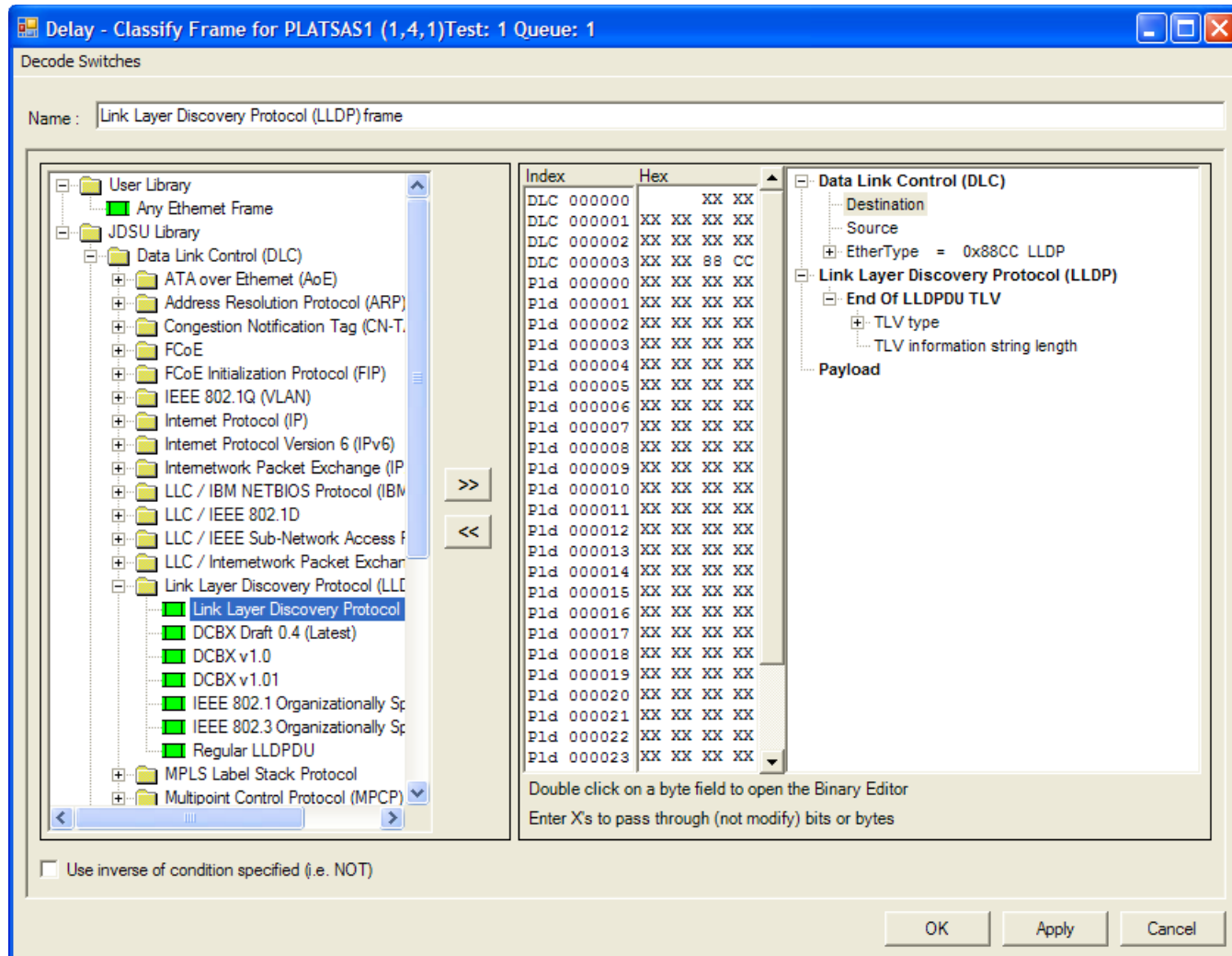
To set Classify conditions:

- 1 Click the **Classify** button in the Xgig Delay Emulator Configuration window.

The window for the condition is displayed (Figure 408). If you are in hardware edit mode, the protocol, chassis name, chassis number, slot number, and port numbers are displayed in the title bar.

- 2 Set the values as required to specify the Classify condition as part of a unique Classify, Arm and Trigger sequence for the specific test.

The following sections describe the available values.

Figure 408: Classify Window for Delay

Setting Frame Conditions for Classify in Delay-Mode

You can specify frame conditions in two ways. One way is to load a template from the Template Library tree, and the other way is to manually specify bits in the frame.

To use a template:

- 1 Select a template from the Template Library tree on the left.
- 2 Click the double right arrow button to set the Trigger Condition.

The condition is indicated on the right side of the window.

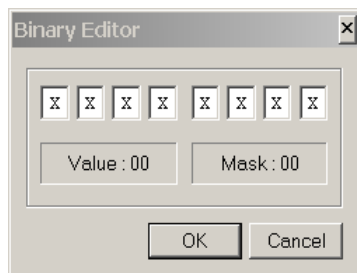
To manually specify a frame:

>> Type hexadecimal values directly into the center column of the window.

An X represents a nibble that can be any value (a “don’t care”).

To set individual bits in any field, double-click on the hex entry to open the Binary Editor (Figure 409). In the hex view, partially defined hex characters appear as question marks: X001=?

Figure 409: Binary Editor Dialog

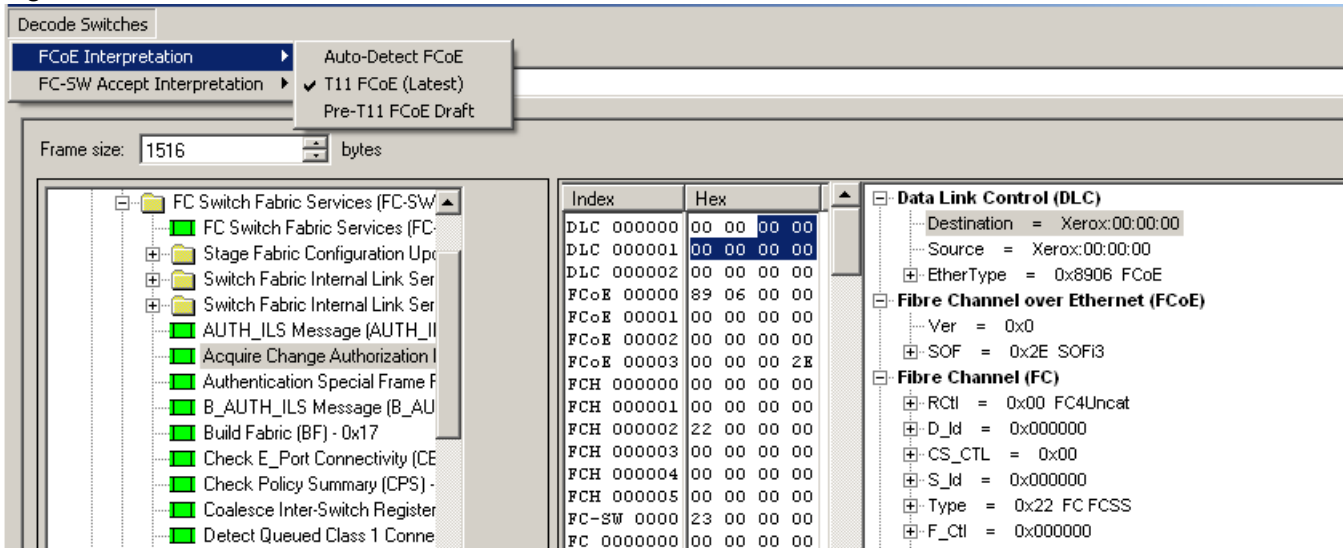


Another way to manually edit the frame condition is to make selections from the tree view in the right window pane.

Decode Switches Menu

Some templates allow you to specify decode switches. When you load a template that has this option, the **Decode Switches Menu** appears in the upper left corner of the window. The decode switches provide detailed contextual options for decode; for example, further decode of response and data frames. The Decode Switches menu is context sensitive and will only show the decode options available for the specific template you are creating.

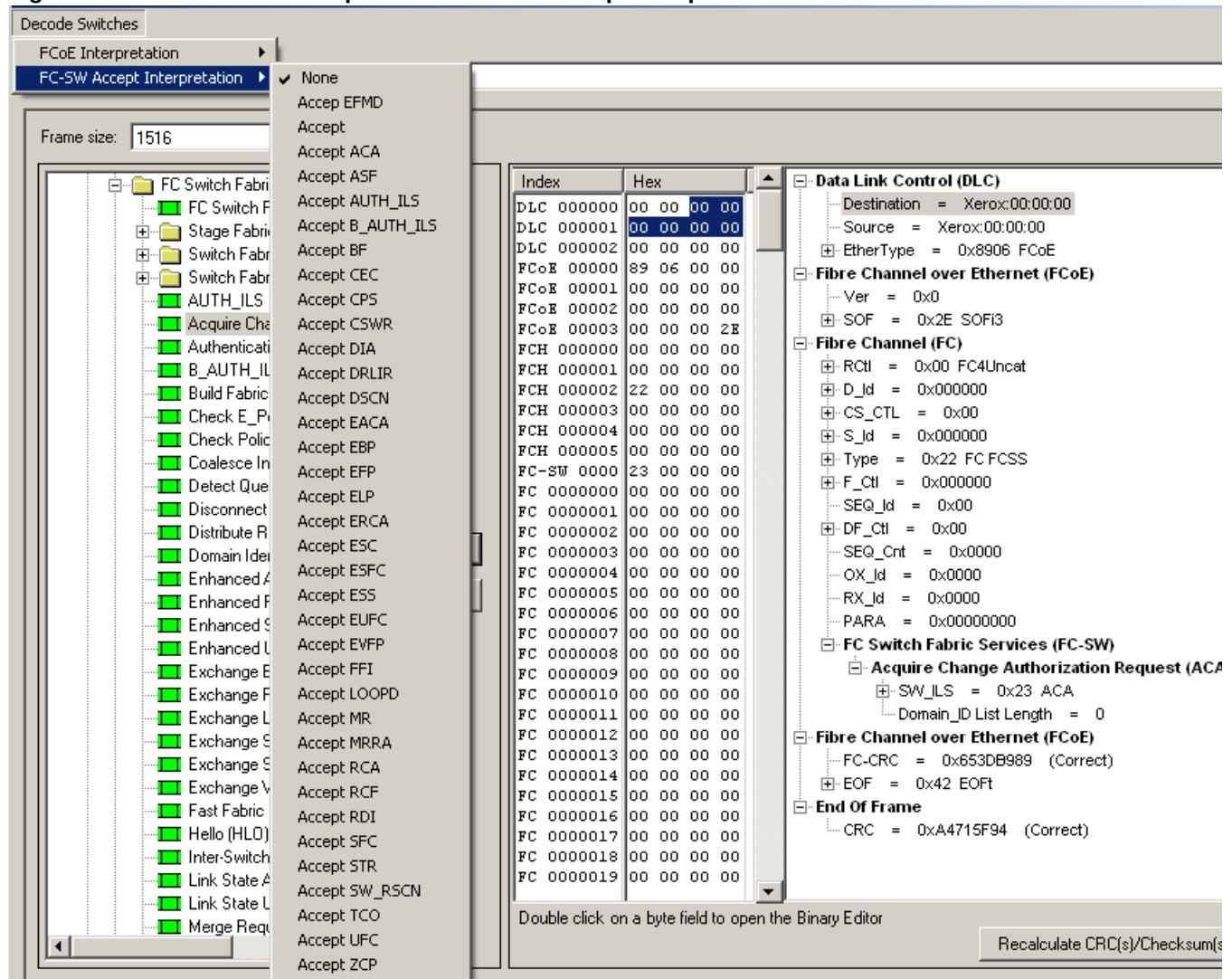
Figure 410: Decode Switches Menu



 **Note:** Once the **Decode Switches** menu appears, it remains visible. However, if you load a template that has no decode options, the menu is greyed out and inactive.

The **Decode Switches** menu is intended to help you create a user-defined template. When editing a User Library template, Decode Switches are stored inside the template so they are still ON the next time you open this particular template.

Decode switches allow you to further decode Response and Data frames that can't be decoded without knowing what the associated command frame is. Below is a description of the switches avaFC-SW Accept Interpretation

Figure 411: Decode Switch Options for FC-SW Accept Interpretation


Saving a Frame Condition

If you create a frame condition that you want to save and make easily available for future use, you can save it into the “User Library” folder in the Template Library tree. To do this:

>> Highlight the folder and click the double left arrow button.

Frame conditions have the option of “Use inverse of condition specified (i.e., NOT).” When you check this option, it means that the first frame encountered that does not match what you have specified creates a “condition met” event.

For each frame condition, you can specify an optional name at the top of the window. This name is also shown on the Delay Emulator Configuration window under the Mode selection, and on the main Xgig Maestro window.

Configuring the Arm Condition in Delay-Mode

The Arm condition recognizes specific DWords within frames.

Depending on the Mode you select, the appropriate graphic diagram shows the Classify condition, the Trigger and optional Arm conditions, and the Delay. If the Mode you select does not include an Arm condition, the **Arm** button is disabled.

To set Arm conditions:

- 1 Click on the **Arm** button to open the Arm window.

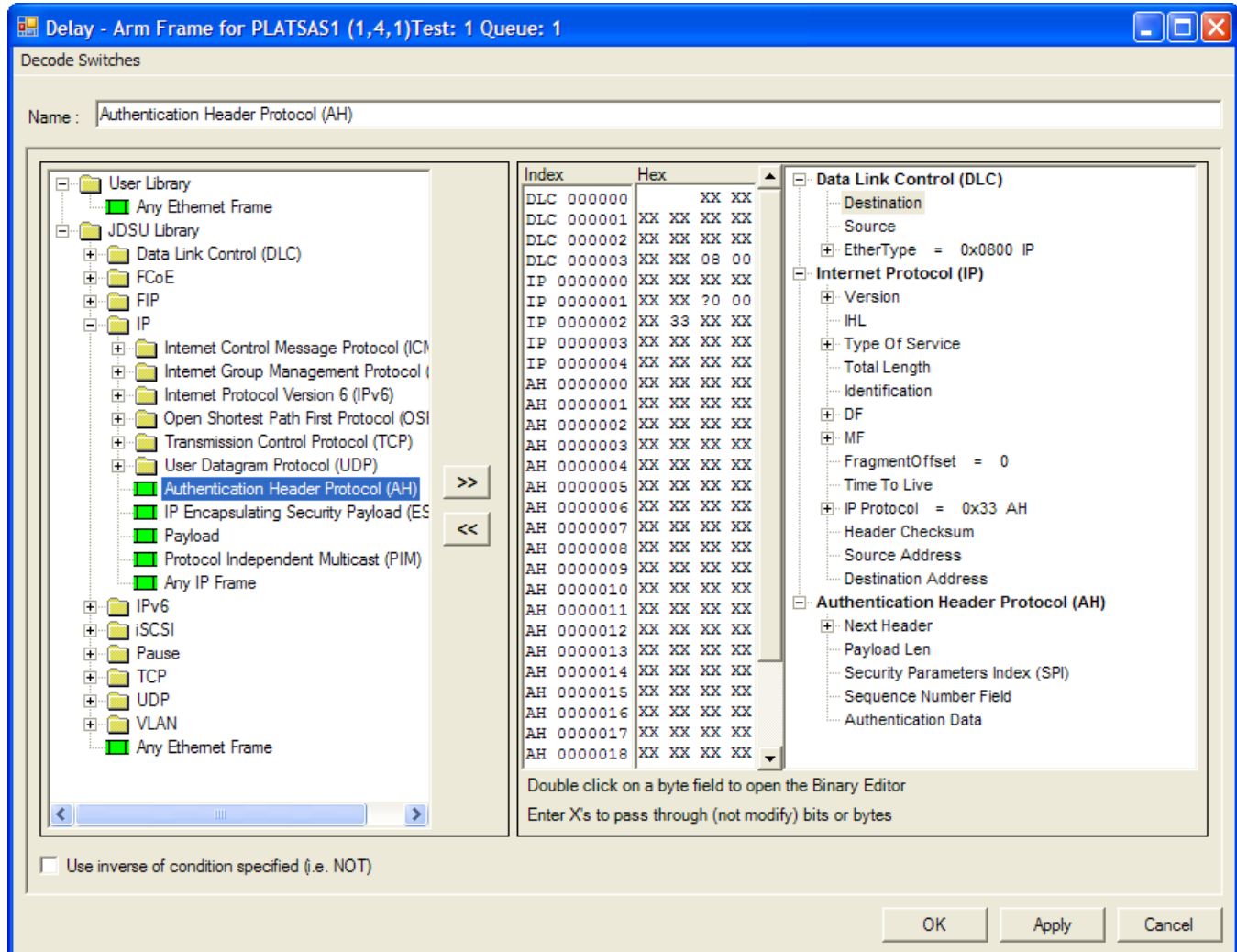
The window for the condition is displayed (Figure 412). If you are in hardware edit mode, the protocol, chassis name, chassis number, slot number, and port numbers are displayed in the title bar.

- 2 Set the values as required to specify the Arm condition as part of a unique Arm and Trigger sequence for the specific test.

The following sections describe the available values.

Setting Frame Conditions for Arm in Delay-Mode

You can specify frame conditions in two ways. One way is to load a template from the Template Library tree, and the other way is to manually specify bits in the frame.

Figure 412: Arm Window for Delay

To use a template:

- 1 Select a template from the Template Library tree on the left.
- 2 Click the double right arrow button to set the Trigger Condition.

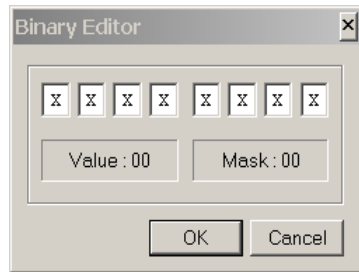
The condition is indicated on the right side of the window.

To manually specify a frame:

- >> Type hexadecimal values directly into the center column of the window.

An X represents a nibble that can be any value (a “don’t care”).

To set individual bits in any field, double-click on the hex entry to open the Binary Editor (Figure 413). In the hex view, partially defined hex characters appear as question marks: X001=?

Figure 413: Binary Editor Dialog

Another way to manually edit the frame condition is to make selections from the tree view in the right window pane.

Saving a Frame Condition

If you create a frame condition that you want to save and make easily available for future use, you can save it into the “User Library” folder in the Template Library tree. To do this:

>> Highlight the folder and click the double left arrow button.

Frame conditions have the option of “Use inverse of condition specified (i.e., NOT).” When you check this option, it means that the first frame encountered that does not match what you have specified creates a “condition met” event.

For each frame condition, you can specify an optional name at the top of the window. This name is also shown on the Delay Emulator Configuration window under the Mode selection, and on the main Xgig Maestro window.

Configuring the Trigger Condition in Delay-Mode

The Trigger condition recognizes specific DWords within frames.

Depending on the Mode you select in the **Delay Emulator Configuration** window, the appropriate graphic diagram shows the Classify condition, the Trigger and optional Arm conditions, and the Delay. If the Mode you select does not include an Arm condition, the Arm button remains disabled.

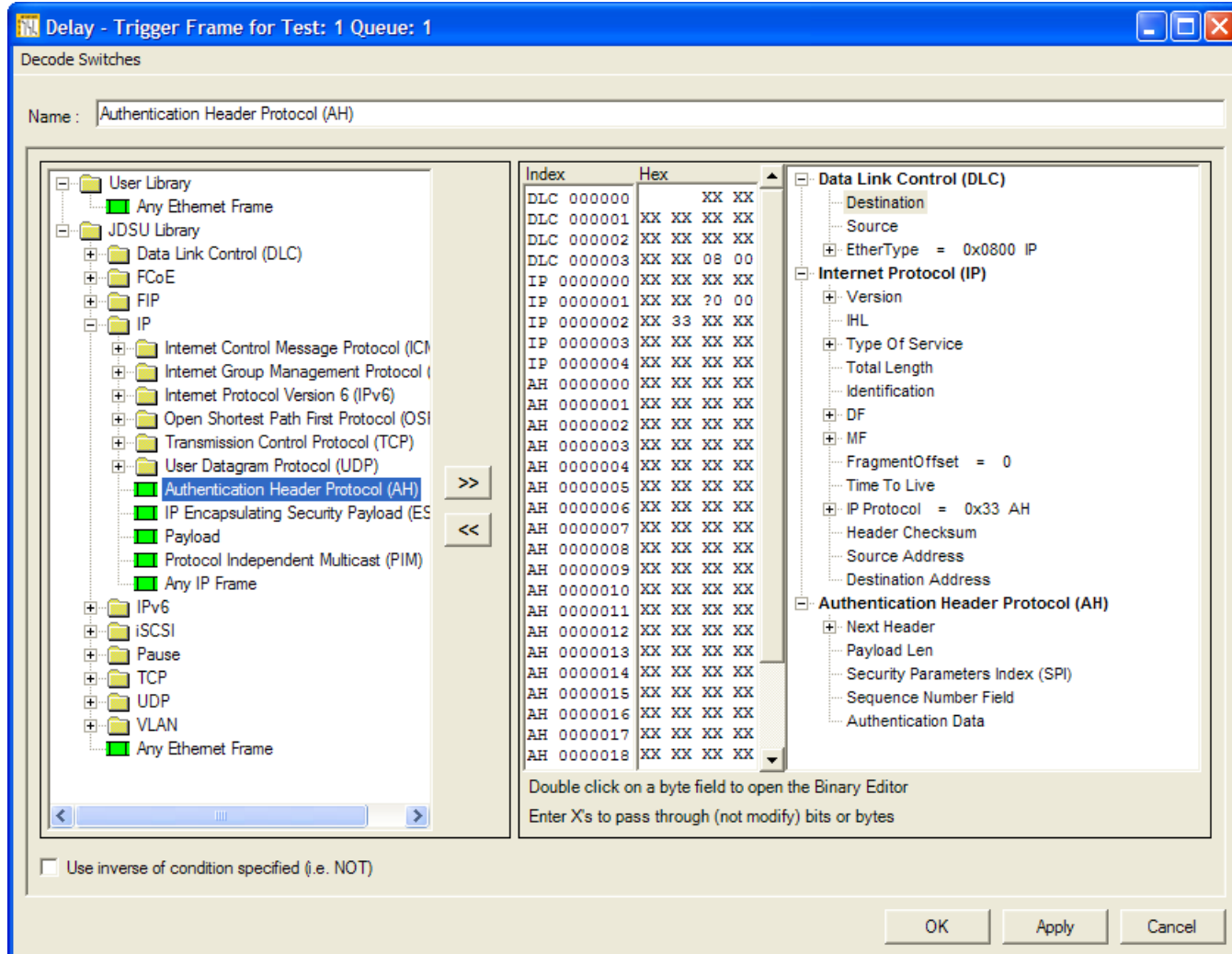
To set Trigger conditions:

- 1 Click the **Trigger** button in the Xgig Delay Emulator Configuration window.

The window for the condition is displayed (Figure 414). If you are in hardware edit mode, the protocol, chassis name, chassis number, slot number, and port numbers are displayed in the title bar.

- 2 Set the values as required to specify the Trigger condition as part of a unique Arm and Trigger sequence for the specific test. The default setting for the Trigger condition is to trigger on any frame.

The following sections describe the available values.

Figure 414: 10GigE Trigger Window for Frames

Setting Frame Conditions for a Trigger in Delay-Mode

You can specify frame conditions in two ways. One way is to load a template from the Template Library tree, and the other way is to manually specify bits in the frame.

To use a template:

- 1 Select a template from the Template Library tree on the left.
- 2 Click the double right arrow button to set the Trigger Condition.

The condition is indicated on the right side of the window.

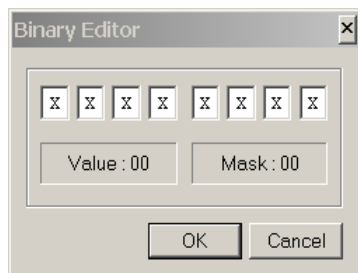
To manually specify a frame:

>> Type hexadecimal values directly into the center column of the window.

An X represents a nibble that can be any value (a “don’t care”).

To set individual bits in any field, double-click on the hex entry to open the Binary Editor (Figure 415). In the hex view, partially defined hex characters appear as question marks: X001=?

Figure 415: Binary Editor Dialog

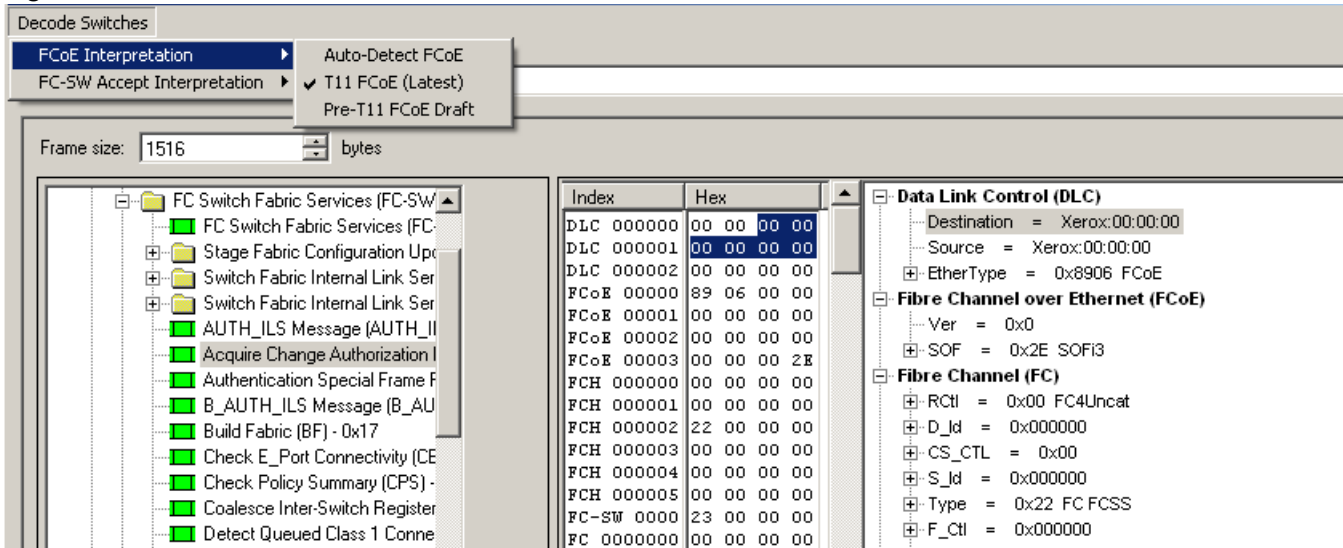


Another way to manually edit the frame condition is to make selections from the tree view in the right window pane.

Decode Switches Menu

Some templates allow you to specify decode switches. When you load a template that has this option, the **Decode Switches Menu** appears in the upper left corner of the window. The decode switches provide detailed contextual options for decode; for example, further decode of response and data frames. The Decode Switches menu is context sensitive and will only show the decode options available for the specific template you are creating.

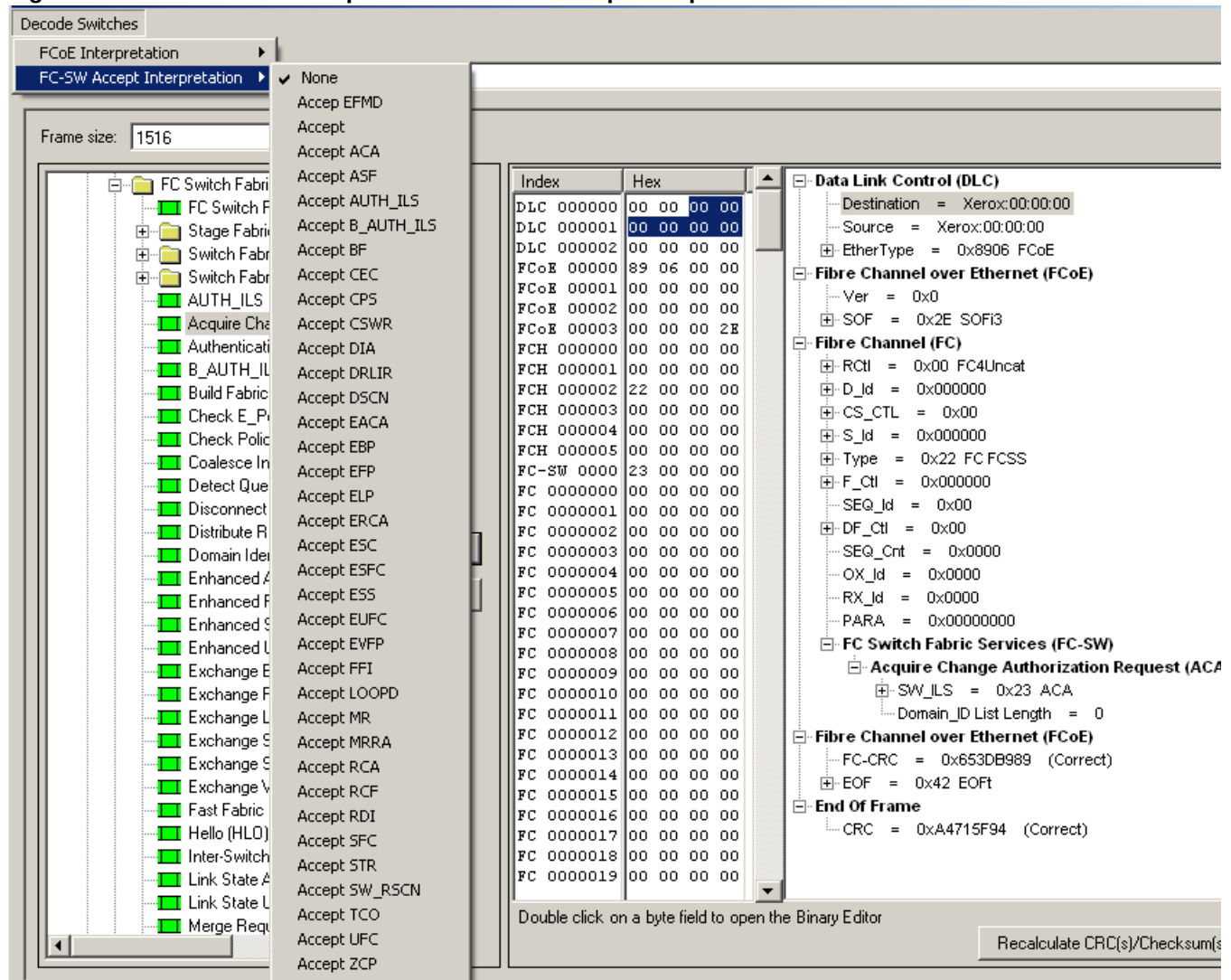
Figure 416: Decode Switches Menu



 **Note:** Once the **Decode Switches** menu appears, it remains visible. However, if you load a template that has no decode options, the menu is greyed out and inactive.

The **Decode Switches** menu is intended to help you create a user-defined template. When editing a User Library template, Decode Switches are stored inside the template so they are still ON the next time you open this particular template.

Decode switches allow you to further decode Response and Data frames that can't be decoded without knowing what the associated command frame is. Below is a description of the switches available.

Figure 417: Decode Switch Options for FC-SW Accept Interpretation

Saving a Frame Condition

If you create a frame condition that you want to save and make easily available for future use, you can save it into the “User Library” folder in the Template Library tree. To do this:

>> Highlight the folder and click the double left arrow button.

Frame conditions have the option of “Use inverse of condition specified (i.e., NOT).” When you check this option, it means that the first frame encountered that does not match what you have specified creates a “condition met” event.

For each frame condition, you can specify an optional name at the top of the window. This name is also shown on the Delay Emulator Configuration window under the Mode selection, and on the main Xgig Maestro window.

Chapter 36

Creating Delay Emulator Test Configurations for Reorder Mode

In this chapter:

- [Defining Your Own Test Configurations for Reorder Mode](#)
- [Using the Reorder-Mode Configuration Window](#)
- [Configuring the Arm Condition in Reorder-Mode](#)
- [Configuring the Trigger Condition in Reorder-Mode](#)
- [Configuring the Reorder Condition](#)

Defining Your Own Test Configurations for Reorder Mode

Xgig Delay Emulator lets you define your own test configurations and save them with or without hardware available.

You can create a configuration from scratch, or you can open and edit an existing configuration. Also, you can edit a configuration in edit only mode, which is independent of any hardware, or you can edit a configuration that is currently loaded to a Delay Emulator device.

To edit a configuration in edit only mode:

>> Double-click a configuration file in the Configuration manager.

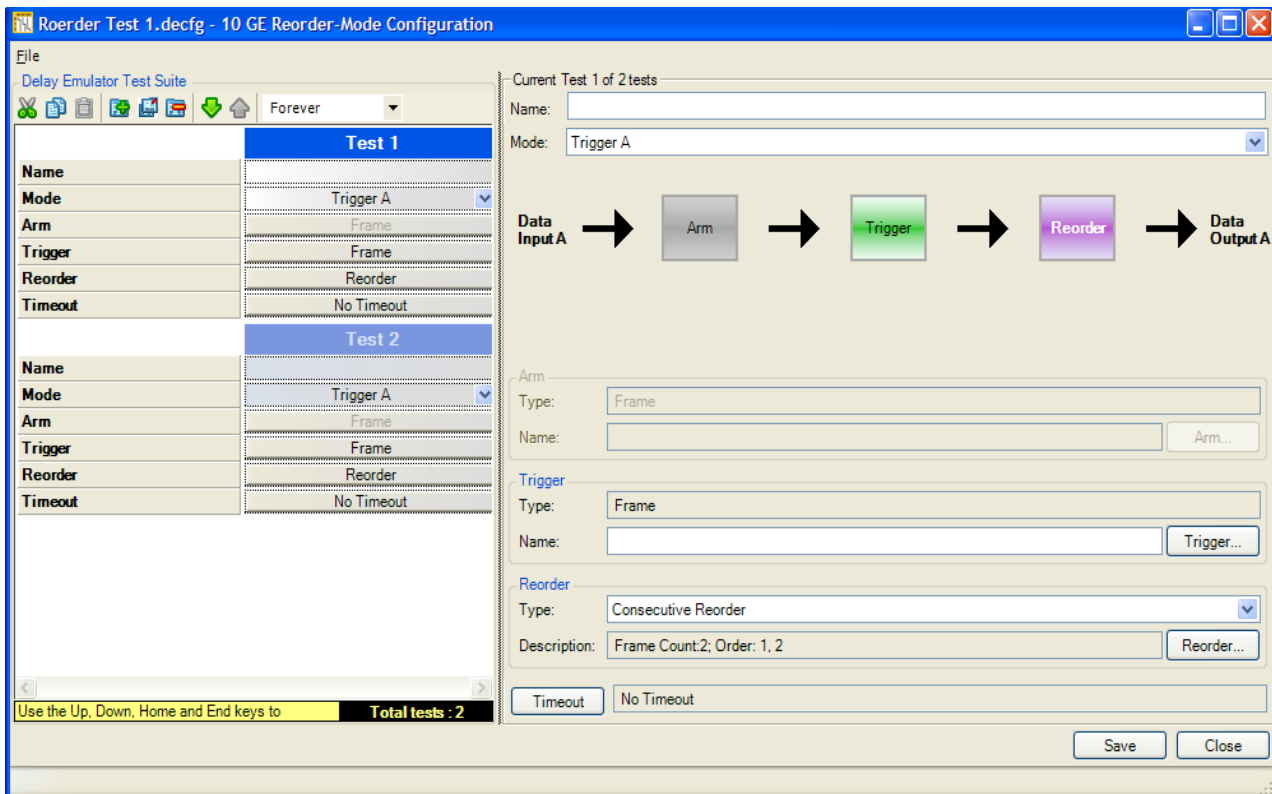
or:

>> Right-click the configuration file in the Configuration manager, and choose **Edit Delay Emulator Configuration** from the context menu.

The edit only mode Delay Emulator Configuration window opens (Figure 418).

This window allows you to set up your own Test Cases, name them, organize them, and save them to files so that you can use them again.

Figure 418: Edit Only Delay Emulator Configuration Window



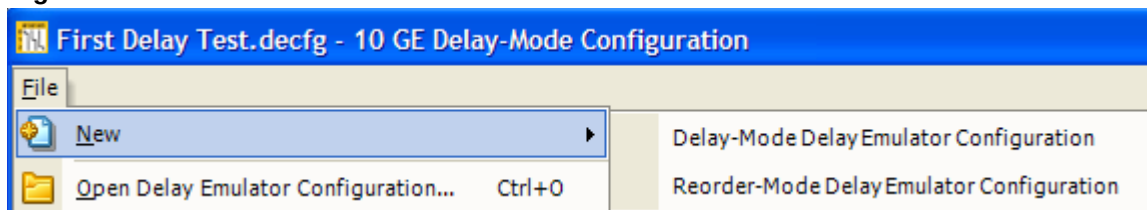
To start a configuration from scratch in edit only mode:

>> Select **New Delay Emulator Configuration** from the context menu or the File menu (Figure 419) on the Xgig Maestro menu bar. Then, select **Delay-Mode or Reorder-Mode Delay Emulator Configuration** from the drop down menu.

or:

>> Click the New Configuration icon at the top of the Configuration manager.

Figure 419: Maestro File Menu



To save your configuration in edit only mode:

>> Click **Save** at the bottom of the Delay Emulator Configuration window, or open the File menu on the Delay Emulator Configuration window and select **Save Delay Emulator Configuration** or **Save Delay Emulator Configuration As**.

Any changes you make have no effect on actual Delay Emulator devices you control.

To edit a configuration that is loaded to a Delay Emulator port:

>> Click **Configuration...** in the device column.

or:

>> Right-click in the Parameters Status table in the device column to open the context menu and select **Edit configuration**.

or:

>> Click **Operation** in the device column to open the Operation dialog, then click **Config**.

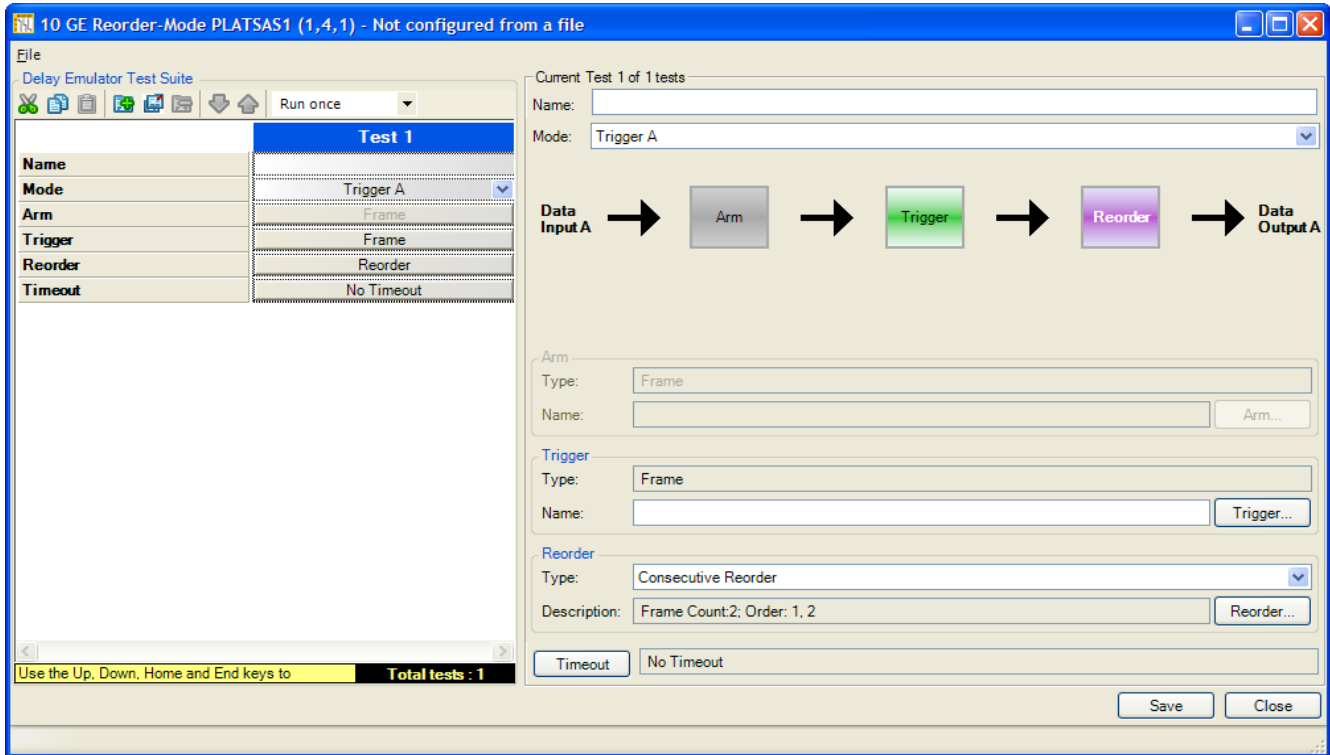
The Xgig Delay Emulator Configuration window in hardware edit mode is displayed (Figure 420). This window allows you to set up your own Test Cases, name them, and save them to a file so that you can use them again.

Click **Apply** or **OK** and Delay Emulator accepts the changes. They are immediately reflected in the Parameters Status table and affect the Delay Emulator device the next time you run it.

To save your configuration edits:

>> Open the File menu at the top of the Delay Emulator Configuration window and select **Save Delay Emulator Configuration** or **Save Delay Emulator Configuration As**.

Figure 420: Xgig Delay Emulator Configuration Window



Using the Reorder-Mode Configuration Window

The Delay Emulator Configuration window title bar indicates how many ports it is configuring, the protocol, and the configuration file name, if any. If you are using hardware edit mode, the chassis name, chassis number, slot number, and port number are also listed. The elements of the Delay Emulator Configuration window are described in the following sections.

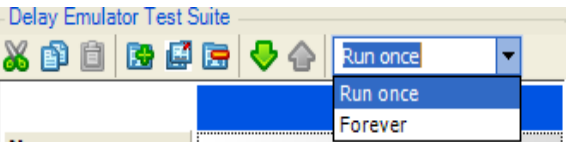
Using the Delay Emulator Test Suite Tools in Reorder-Mode

The Delay Emulator Test Suite (left pane) lists the series of Xgig Delay Emulator tests in the order in which you want them to execute. The number of test in the test suite has no limit. Each test can contain between two and eight frames to be reordered. The highlighted test appears as the Current Delay Emulator Test (right pane). Each test in the suite executes in sequence.

Creating a Test Suite

When you create a Delay Emulator Test Suite, you use the toolbar in the Delay Emulator Test Suite section of the Configuration window (Figure 421).

Figure 421: 10GigE Delay Emulator Test Suite Toolbar



The following list describes the icons on the toolbar:

	Cut current test	Removes the highlighted test and holds its contents in the memory buffer.
	Copy current text	Copies the highlighted test to the memory buffer.
	Paste last test cut or copied	Inserts the current memory buffer contents before the currently highlighted test.
	Add new test to bottom of stack	Adds a new blank test to the bottom of the suite.
	Insert new test before current test	Inserts a new blank test above the currently highlighted test.
	Delete current test	Removes the highlighted test from the suite. If only one test is present, then the contents of this test are cleared.
	Move current test down the stack	Moves the highlighted test down one in the test order.
	Move current test up the stack	Moves the highlighted test up one in the test order.
	Run test suite once or Repeat test suite	When you choose Repeat test suite, the tests run according the settings you define in the Delay Emulator Current Test window. You can also type a number in this field to indicate that you want the test suite to repeat a certain number of times.

To duplicate a test at another point in the Test Suite:

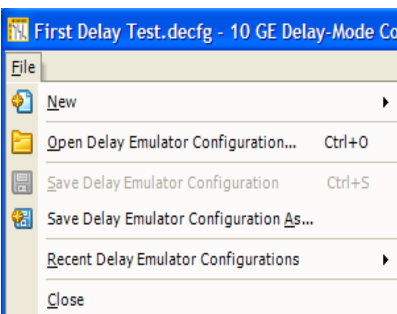
- 1 Highlight the test you want to duplicate.
- 2 Click **Copy**.
- 3 Highlight the test in the suite that is just after the point where you want the duplicate test inserted.
- 4 Click **Paste**.

The duplicate test is inserted.

Using the Configuration File Menu

The File menu is the only menu on the menu bar (Figure 422).

Figure 422: Configuration File Menu



The choices are:

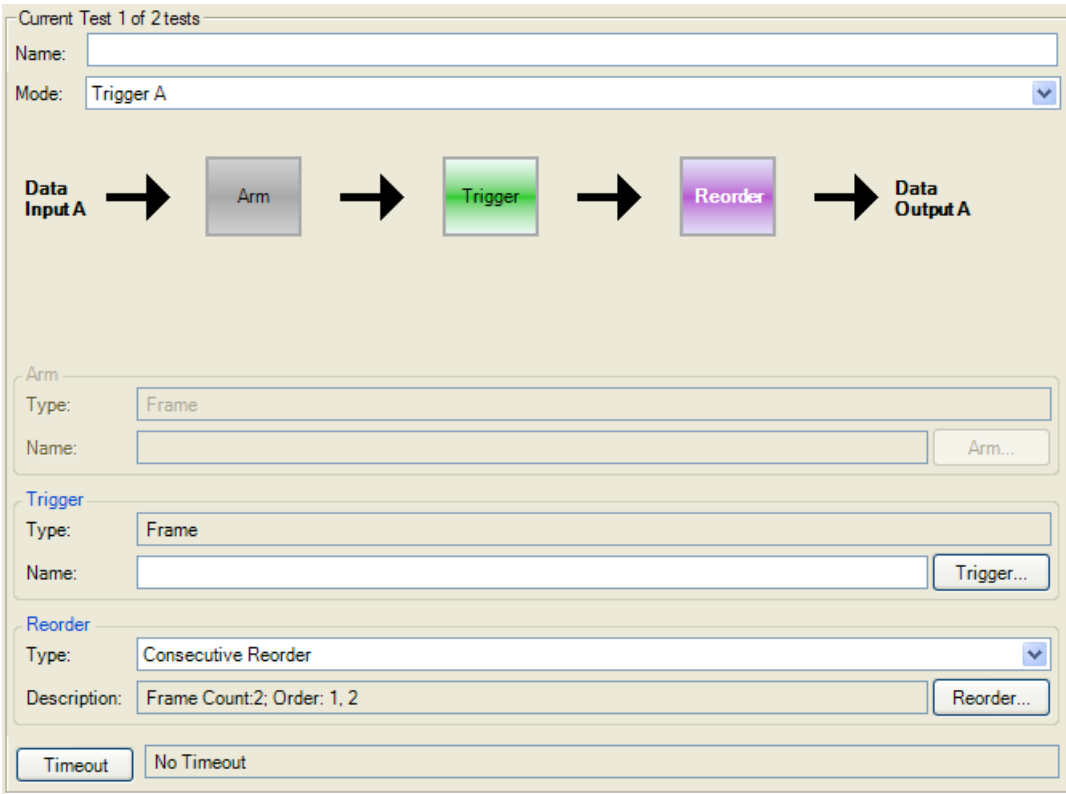
New Configuration	Creates a new delay or reorder .decfg configuration file.
Open Configuration	Open an existing .decfg configuration file.
Save Configuration	Save the entire Test Suite to the .decfg file you currently have loaded.
Save Configuration As	Save the entire Test Suite to a .decfg file with a name you assign to it.
Recent Configuration	Open a recently opened .decfg configuration file.
Close	Close the Delay Emulator Configuration Window.

The recently used Delay Emulator configuration files appear in the file menu and are loaded when selected.

Using the Current Delay Emulator Test Window: Reorder-Mode

The graphics in this section of the window represent the hardware configuration for the selected test in the Delay Emulator Test Suite (Figure 423).

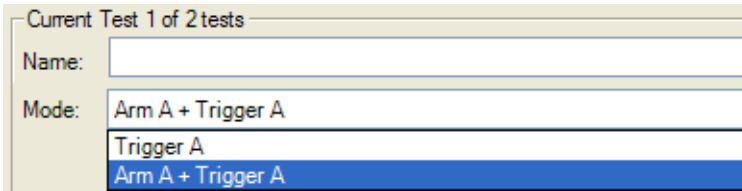
Figure 423: Current Delay Emulator Test Window



Mode

The Mode menu is available near the top of the Current Delay Emulator Test window (Figure 424).

Figure 424: Mode Drop-down Menu in Current Delay Emulator Test - Right Pane



Arm and Trigger

The Arm and Trigger buttons are located in the right pane of the Current Delay Emulator Test window. To define Arm and Trigger conditions, click the Arm or Trigger button.

Reorder

The Reorder button is located in the right pane of the Current Delay Emulator Test window. To define the Reorder condition, click the Reorder button.

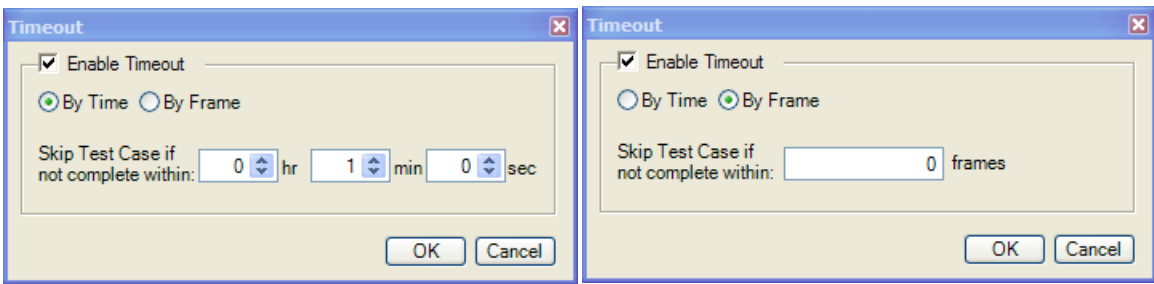
Timeout

The timeout option defines the period of time to wait for a specified test to complete before aborting and proceeding to the next test in the suite.

To set the timeout:

- 1 Click **Timeout** to display the dialog box in Figure 425.
- 2 Check **Enable Timeout**.
- 3 Enter the hours, minutes, and seconds you want to wait.

Figure 425: Timeout Dialog



- 4 Click **OK**.

Configuring the Arm Condition in Reorder-Mode

The Arm condition recognizes specific DWords within frames.

Depending on the Mode you select, the appropriate graphic diagram shows the Trigger and optional Arm conditions. If the Mode you select does not include an Arm condition, the **Arm** button is disabled.

To set Arm conditions:

- 1 Click on the **Arm** button to open the Arm window.

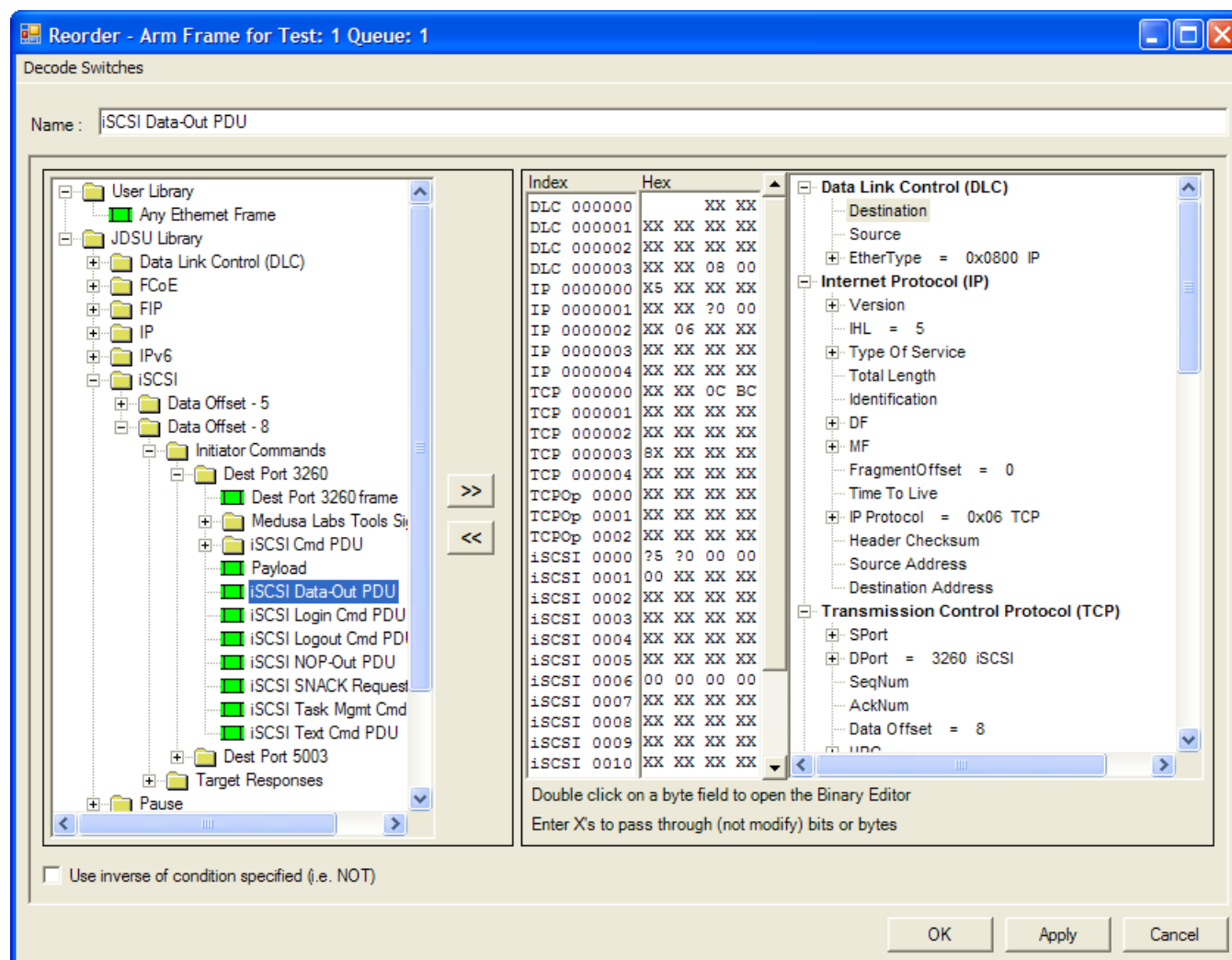
The window for the condition is displayed (Figure 426). If you are in hardware edit mode, the protocol, chassis name, chassis number, slot number, and port numbers are displayed in the title bar.

- 2 Set the values as required to specify the Arm condition as part of a unique Arm and Trigger sequence for the specific test.

The following sections describe the available values.

Setting Frame Conditions for Arm for Reorder

You can specify frame conditions in two ways. One way is to load a template from the Template Library tree, and the other way is to manually specify bits in the frame.

Figure 426: Arm Window for Frames

To use a template:

- 1 Select a template from the Template Library tree on the left.
- 2 Click the double right arrow button to set the Trigger Condition.

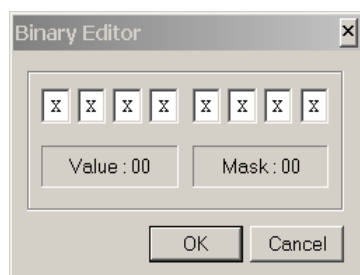
The condition is indicated on the right side of the window.

To manually specify a frame:

- >> Type hexadecimal values directly into the center column of the window.

An X represents a nibble that can be any value (a “don’t care”).

To set individual bits in any field, double-click on the hex entry to open the Binary Editor (Figure 427). In the hex view, partially defined hex characters appear as question marks: X001=?

Figure 427: Binary Editor Dialog

Another way to manually edit the frame condition is to make selections from the tree view in the right window pane.

Saving a Frame Condition

If you create a frame condition that you want to save and make easily available for future use, you can save it into the “User Library” folder in the Template Library tree. To do this:

>> Highlight the folder and click the double left arrow button.

Frame conditions have the option of “Use inverse of condition specified (i.e., NOT).” When you check this option, it means that the first frame encountered that does not match what you have specified creates a “condition met” event.

For each frame condition, you can specify an optional name at the top of the window. This name is also shown on the Delay Emulator Configuration window under the Mode selection, and on the main Xgig Maestro window.

Configuring the Trigger Condition in Reorder-Mode

The Trigger condition recognizes DWords within frames.

Depending on the Mode you select in the **Delay Emulator Configuration** window, the appropriate graphic diagram shows the Trigger and optional Arm conditions, along with the Delay. If the Mode you select does not include an Arm condition, the Arm button remains disabled.

To set Trigger conditions:

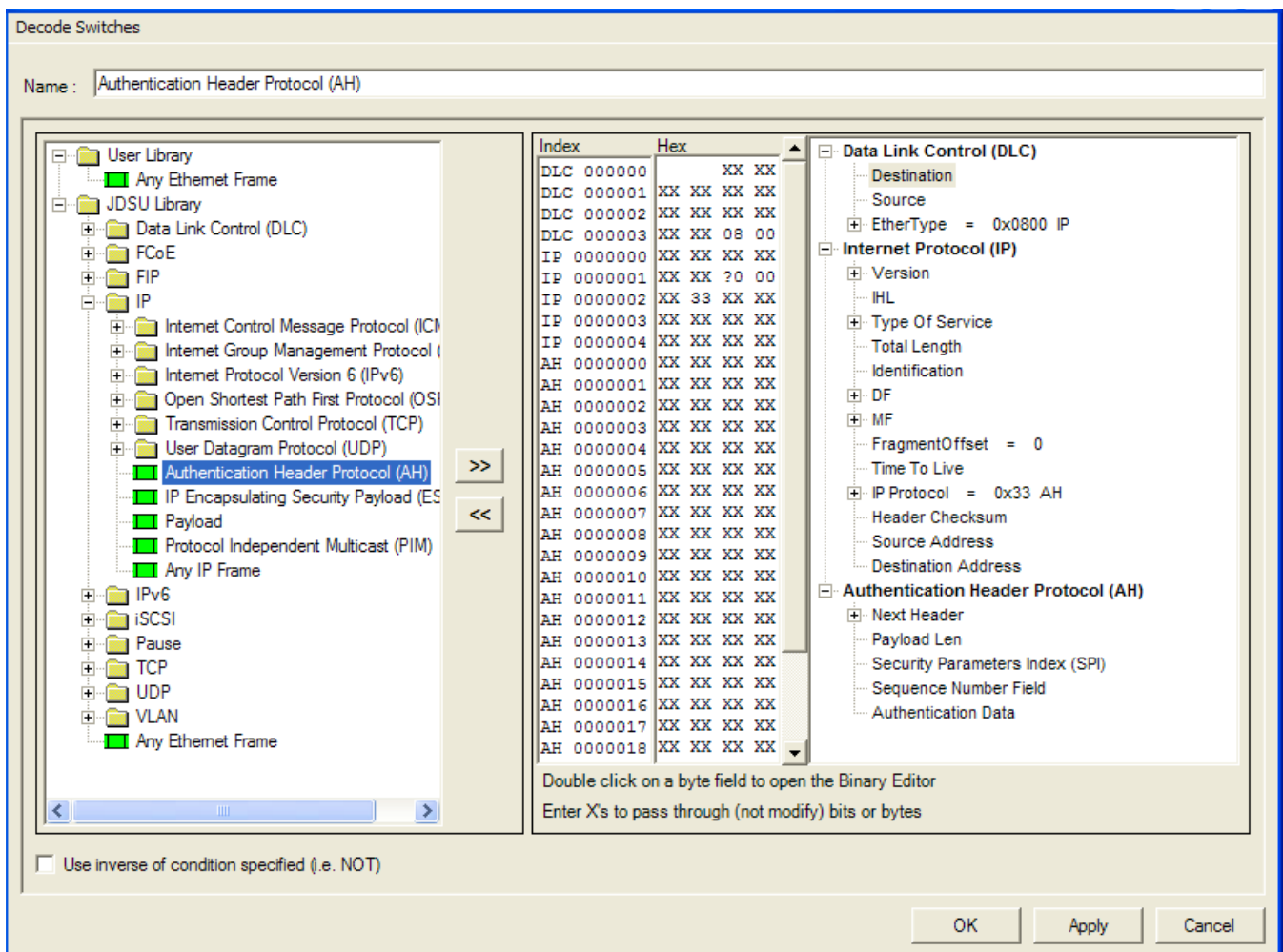
- 1 Click the **Trigger** button in the Xgig Delay Emulator Configuration window.

The window for the condition is displayed (Figure 428). If you are in hardware edit mode, the protocol, chassis name, chassis number, slot number, and port numbers are displayed in the title bar.

- 2 Set the values as required to specify the Trigger condition as part of a unique Arm and Trigger sequence for the specific test.

The following sections describe the available values.

Figure 428: Trigger Window for Frames



Setting Frame Conditions for a Trigger in Reorder-Mode

You can specify frame conditions in two ways. One way is to load a template from the Template Library tree, and the other way is to manually specify bits in the frame.

To use a template:

- 1 Select a template from the Template Library tree on the left.
- 2 Click the double right arrow button to set the Trigger Condition.

The condition is indicated on the right side of the window.

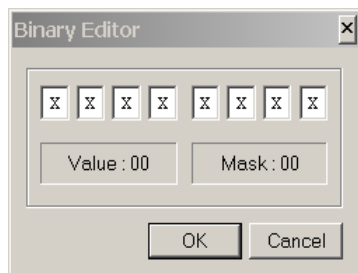
To manually specify a frame:

>> Type hexadecimal values directly into the center column of the window.

An X represents a nibble that can be any value (a “don’t care”).

To set individual bits in any field, double-click on the hex entry to open the Binary Editor (Figure 429). In the hex view, partially defined hex characters appear as question marks: X001=?

Figure 429: Binary Editor Dialog

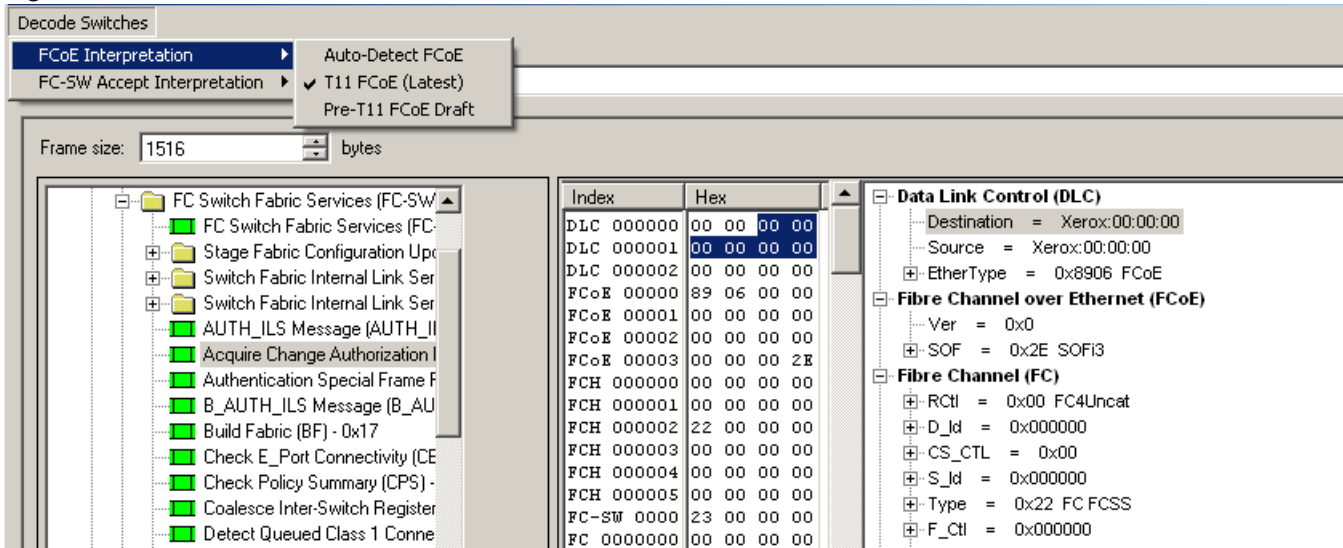


Another way to manually edit the frame condition is to make selections from the tree view in the right window pane.

Decode Switches Menu

Some templates allow you to specify decode switches. When you load a template that has this option, the **Decode Switches Menu** appears in the upper left corner of the window. The decode switches provide detailed contextual options for decode; for example, further decode of response and data frames. The Decode Switches menu is context sensitive and will only show the decode options available for the specific template you are creating.

Figure 430: Decode Switches Menu

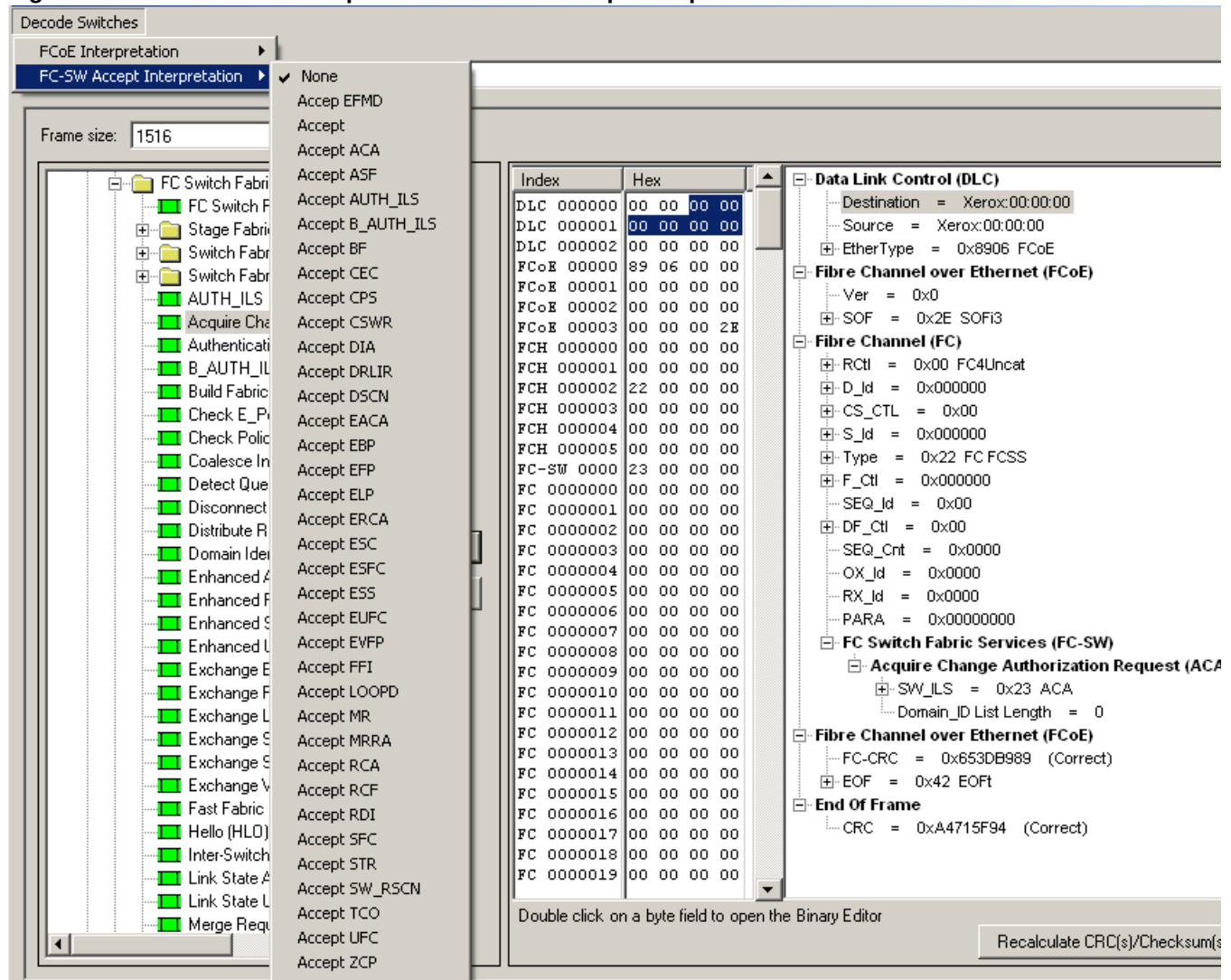


Note: Once the **Decode Switches** menu appears, it remains visible. However, if you load a template that has no decode options, the menu is greyed out and inactive.

The **Decode Switches** menu is intended to help you create a user-defined template. When editing a User Library template, Decode Switches are stored inside the template so they are still ON the next time you open this particular template.

Decode switches allow you to further decode Response and Data frames that can't be decoded without knowing what the associated command frame is. Below is a description of the switches available.

Figure 431: Decode Switch Options for FC-SW Accept Interpretation



Saving a Frame Condition

If you create a frame condition that you want to save and make easily available for future use, you can save it into the “User Library” folder in the Template Library tree. To do this:

>> Highlight the folder and click the double left arrow button.

Frame conditions have the option of “Use inverse of condition specified (i.e., NOT).” When you check this option, it means that the first frame encountered that does not match what you have specified creates a “condition met” event.

For each frame condition, you can specify an optional name at the top of the window. This name is also shown on the Delay Emulator Configuration window under the Mode selection, and on the main Xgig Maestro window.

Configuring the Reorder Condition

The Reorder definition tells the software the way you want to reorder frames, how many frames to reorder, and in which order to place them.

Depending on the Mode you select, the appropriate graphic diagram shows the Trigger and optional Arm conditions. If the Mode you select does not include an Arm condition, the **Arm** button is disabled.

To define the Reorder:

- 1 Click the **Reorder** button to open the Reorder window.

The Reorder window is displayed (Figure 426).

- 2 Select the type of reorder you want.

- Consecutive Reorder

For a consecutive reorder, every frame including the trigger frame is reordered.

- Trigger Reorder

For a trigger reorder, all frames of the type specified in the trigger are reordered beginning with the frame including the trigger frame.

- 3 Select the number of frames you want to reorder, between two and eight.
- 4 Drag the frames to reorder them.
- 5 Click OK.

Appendix A

Fibre Channel Ordered Sets - Partial List

Fibre Channel defines certain combinations of characters called Ordered Sets. The table in this appendix shows a partial list. The following abbreviations are used in the table:

SOF Start-of-frame delimiter

EOF End-of-frame delimiter

ALPA, D, S, Type Arbitrated Loop Physical Address, Destination, Source, Mark Type. These are limited to 127 specific hex values.

Name	Function	Beginning RD	Ordered Set	8 Bit Hex
SOFc1	SOF Connect Class 1	Negative	K28.5 D21.5 D23.0 D23.0	K28.5 B5 17 17
SOFi1	SOF Initiate Class 1	Negative	K28.5 D21.5 D23.2 D23.2	K28.5 B5 57 57
SOFn1	SOF Normal Class 1	Negative	K28.5 D21.5 D23.1 D23.1	K28.5 B5 37 37
SOFi2	SOF Initiate Class 2	Negative	K28.5 D21.5 D21.2 D21.2	K28.5 B5 55 55
SOFn2	SOF Normal Class 2	Negative	K28.5 D21.5 D21.1 D21.1	K28.5 B5 35 35
SOFi3	SOF Initiate Class 3	Negative	K28.5 D21.5 D22.2 D22.2	K28.5 B5 56 56
SOFn3	SOF Normal Class 3	Negative	K28.5 D21.5 D22.1 D22.1	K28.5 B5 36 36
SOFf	SOF Fabric	Negative	K28.5 D21.5 D24.2 D24.2	K28.5 B5 58 58
SOFc4	SOF Activate Class 4	Negative	K28.5 D21.5 D25.0 D25.0	K28.5 B5 19 19
SOFi4	SOF Initiate Class 4	Negative	K28.5 D21.5 D25.2 D25.2	K28.5 B5 59 59
SOFn4	SOF Normal Class 4	Negative	K28.5 D21.5 D25.1 D25.1	K28.5 B5 39 39

Name	Function	Beginning RD	Ordered Set	8 Bit Hex
EOft	EOF Terminate	Negative Positive	K28.5 D21.4 D21.3 D21.3 K28.5 D21.5 D21.3 D21.3	K28.5 95 75 75 K28.5 B5 75 75
EOFdt	EOF Disconnect-Terminate	Negative Positive	K28.5 D21.4 D21.4 D21.4 K28.5 D21.5 D21.4 D21.4	K28.5 95 95 95 K28.5 B5 95 95
EOFa	EOF Abort	Negative Positive	K28.5 D21.4 D21.7 D21.7 K28.5 D21.5 D21.7 D21.7	K28.5 95 F5 F5 K28.5 B5 F5 F5
EOFn	EOF Normal	Negative Positive	K28.5 D21.4 D21.6 D21.6 K28.5 D21.5 D21.6 D21.6	K28.5 95 D5 D5 K28.5 B5 D5 D5
EOFdti	EOF Disconnect-Terminate-Invalid	Negative Positive	K28.5 D10.4 D21.4 D21.4 K28.5 D10.5 D21.4 D21.4	K28.5 8A 95 95 K28.5 AA 95 95
EOFni	EOF Normal-Invalid	Negative Positive	K28.5 D10.4 D21.6 D21.6 K28.5 D10.5 D21.6 D21.6	K28.5 8A D5 D5 K28.5 AA D5 D5
EOFrt	EOF Remove-Terminate Class 4	Negative Positive	K28.5 D21.4 D25.4 D25.4 K28.5 D21.5 D25.4 D25.4	K28.5 95 99 99 K28.5 B5 99 99
EOFrti	EOF Remove-Terminate Invalid Class 4	Negative Positive	K28.5 D10.4 D25.4 D25.4 K28.5 D10.5 D25.4 D25.4	K28.5 8A 99 99 K28.5 AA 99 99
IDLE	Idle	Negative	K28.5 D21.4 D21.5 D21.5	K28.5 95 B5 B5
R_RDY	Receiver_Ready	Negative	K28.5 D21.4 D10.2 D10.2	K28.5 95 4A 4A5
VC_RDY	Virtual Circuit Ready	Negative	K28.5 D21.7 VC.ID VC.ID	K28.5 F5 xx xx
BB_SCs	Buffer-to-buffer State Change (SOF)	Negative	K28.5 D21.4 D22.4 D22.4	K28.5 95 96 96
BB_SCr	Buffer-to-buffer State Change (R_RDY)	Negative	K28.5 D21.4 D22.6 D22.6	K28.5 95 D6 D6
SYNx	Clock Synchronization Word x	Negative	K28.5 D31.3 CS_x CS_x	K28.5 7F xx xx
SYNy	Clock Synchronization Word y	Negative	K28.5 D31.3 CS_y CS_y	K28.5 7F xx xx
SYNz	Clock Synchronization Word z	Negative	K28.5 D31.3 CS_z CS_z	K28.5 7F xx xx
OLS	Offline	Negative	K28.5 D21.1 D10.4 D21.2	K28.5 35 8A 55
NOS	Not_Operational	Negative	K28.5 D21.2 D31.5 D5.2	K28.5 55 BF 45
LR	Link_Reset	Negative	K28.5 D9.2 D31.5 D9.2	K28.5 49 BF 49
LRR	Link_Reset_Response	Negative	K28.5 D21.1 D31.5 D9.2	K28.5 55 BF 49
OPNyx	Open Loop Port	Negative	K28.5 D17.4 ALPD ALPS	K28.5 91 xx xx
OPNfr	Open Loop Port	Negative	K28.5 D17.4 D31.7 D31.7	K28.5 91 FF FF
CLS	Close Loop Port	Negative	K28.5 D5.4 D21.5 D21.5	K28.5 85 B5 B5
MRK	Mark	Negative	K28.5 D31.2 type ALPS	K28.5 5F xx xx
LIP	Loop Initialization, Acquire PA	Negative	K28.5 D21.0 D23.7 D23.7	K28.5 15 F7 F7
LIP	Loop Initialization, Rcvr Fail	Negative	K28.5 D21.0 D24.7 D23.7	K28.5 15 F8 F7
LIP	Loop Initialization, Reinitialize	Negative	K28.5 D21.0 D23.7 ALPS	K28.5 15 F7 xx
LIP	Loop Initialization, Fail at PS	Negative	K28.5 D21.0 D24.7 ALPS	K28.5 15 F8 xx
LIP	Loop Initialization, Reset PD	Negative	K28.5 D21.0 ALPD ALPS	K28.5 15 xx xx
LPEyx	Loop Port Enable, enable PD	Negative	K28.5 D5.0 ALPD ALPS	K28.5 05 xx xx
LPEfx	Loop Port Enable, enable all	Negative	K28.5 D5.0 D31.7 ALPS	K28.5 05 FF xx
LPByx	Loop Port Bypass, bypass PD	Negative	K28.5 D9.0 ALPD ALPS	K28.5 09 xx xx
ARBx	Arbitrate For Loop	Negative	K28.5 D20.4 ALPS ALPS	K28.5 94 xx xx
ARB(F0)	Arbitrate For Loop, fairness	Negative	K28.5 D20.4 D16.7 D16.7	K28.5 94 F0 F0

Appendix B

8-Bit/10-Bit Mapping

This appendix contains tables sorted by values for 8-bit/10-bit mapping.

The following table lists:

Legal 8-Bit/10-Bit Characters Sorted by 10-Bit Value

10B Dec	8B Dec	ASCII+	HEX	Previous Disparity	Data Byte Name	10 B	Comment
85	87	W	57	RD +	D23.2	00 0101 0101	
86	215	x	D7	RD +	D23.6	00 0101 0110	
87	247	÷	F7	RD +	K23.7	00 0101 0111	
89	55	7	37	RD +	D23.1	00 0101 1001	
90	183	.	B7	RD +	D23.5	00 0101 1010	
91	23	ETB	17	RD +	D23.0	00 0101 1011	
92	119	w	77	RD +	D23.3	00 0101 1100	
93	151	—	97	RD +	D23.4	00 0101 1101	
94	247	÷	F7	RD +	D23.7	00 0101 1110	
101	72	H	48	RD +	D8.2	00 0110 0101	
102	200	È	C8	RD +	D8.6	00 0110 0110	
105	40	(	28	RD +	D8.1	00 0110 1001	
106	168	ˆ	A8	RD +	D8.5	00 0110 1010	
107	8	BS	08	RD +	D8.0	00 0110 1011	
108	104	h	68	RD +	D8.3	00 0110 1100	
109	136	ˆ	88	RD +	D8.4	00 0110 1101	
110	232	è	E8	RD +	D8.7	00 0110 1110	
113	231	ç	E7	RD +	D7.7	00 0111 0001	
114	135	‡	87	RD +	D7.4	00 0111 0010	
115	103	g	67	RD +	D7.3	00 0111 0011	
116	7	BEL	07	RD +	D7.0	00 0111 0100	
117	71	G	47	RD +	D7.2	00 0111 0101	
118	199	Ç	C7	RD +	D7.6	00 0111 0110	
121	39	'	27	RD +	D7.1	00 0111 1001	
122	167	§	A7	RD +	D7.5	00 0111 1010	
149	91	[	5B	RD +	D27.2	00 1001 0101	
150	219	Û	DB	RD +	D27.6	00 1001 0110	
151	251	û	FB	RD +	K27.7	00 1001 0111	
153	59	;	3B	RD +	D27.1	00 1001 1001	
154	187	»	BB	RD +	D27.5	00 1001 1010	
155	27	ESC	1B	RD +	D27.0	00 1001 1011	
156	123	{	7B	RD +	D27.3	00 1001 1100	
157	155	>	9B	RD +	D27.4	00 1001 1101	
158	251	û	FB	RD +	D27.7	00 1001 1110	
165	68	D	44	RD +	D4.2	00 1010 0101	
166	196	Ä	C4	RD +	D4.6	00 1010 0110	
169	36	\$	24	RD +	D4.1	00 1010 1001	
170	164	ä	A4	RD +	D4.5	00 1010 1010	
171	4	EOT	04	RD +	D4.0	00 1010 1011	
172	100	d	64	RD +	D4.3	00 1010 1100	
173	132	ˆ	84	RD +	D4.4	00 1010 1101	
174	228	ä	E4	RD +	D4.7	00 1010 1110	
177	244	ô	F4	RD +	D20.7	00 1011 0001	
178	148	ˆ	94	RD +	D20.4	00 1011 0010	
179	116	t	74	RD +	D20.3	00 1011 0011	
180	20	DC4	14	RD +	D20.0	00 1011 0100	
181	84	T	54	RD+/-	D20.2	00 1011 0101	
182	212	Ô	D4	RD+/-	D20.6	00 1011 0110	
183	244	ô	F4	RD--	D20.7	00 1011 0111	
185	52	4	34	RD+/-	D20.1	00 1011 1001	
186	180	ˆ	B4	RD+/-	D20.5	00 1011 1010	
187	20	DC4	14	RD--	D20.0	00 1011 1011	
188	116	t	74	RD--	D20.3	00 1011 1100	
189	148	ˆ	94	RD--	D20.4	00 1011 1101	
197	88	X	58	RD +	D24.2	00 1100 0101	
198	216	Ø	D8	RD +	D24.6	00 1100 0110	
201	56	8	38	RD +	D24.1	00 1100 1001	
202	184	,	B8	RD +	D24.5	00 1100 1010	

203	24	CAN	18	RD +	D24.0	00 1100 1011	
204	120	x	78	RD +	D24.3	00 1100 1100	
205	152	ˆ	98	RD +	D24.4	00 1100 1101	
206	248	ø	F8	RD +	D24.7	00 1100 1110	
209	236	ì	EC	RD +	D12.7	00 1101 0001	
210	140	œ	8C	RD +	D12.4	00 1101 0010	
211	108	l	6C	RD +	D12.3	00 1101 0011	
212	12	FF	0C	RD +	D12.0	00 1101 0100	
213	76	L	4C	RD+/-	D12.2	00 1101 0101	
214	204	ì	CC	RD+/-	D12.6	00 1101 0110	
217	44	,	2C	RD+/-	D12.1	00 1101 1001	
218	172	¬	AC	RD+/-	D12.5	00 1101 1010	
219	12	FF	0C	RD--	D12.0	00 1101 1011	
220	108	l	6C	RD--	D12.3	00 1101 1100	
221	140	œ	8C	RD--	D12.4	00 1101 1101	
222	236	ì	EC	RD--	D12.7	00 1101 1110	
225	252	ü	FC	RD +	D28.7	00 1110 0001	
226	156	œ	9C	RD +	D28.4	00 1110 0010	
227	124		7C	RD +	D28.3	00 1110 0011	
228	28	FS	1C	RD +	D28.0	00 1110 0100	
229	92	\	5C	RD+/-	D28.2	00 1110 0101	
230	220	Ü	DC	RD+/-	D28.6	00 1110 0110	
233	60	<	3C	RD+/-	D28.1	00 1110 1001	
234	188	¼	BC	RD+/-	D28.5	00 1110 1010	
235	28	FS	1C	RD--	D28.0	00 1110 1011	
236	124		7C	RD--	D28.3	00 1110 1100	
237	156	œ	9C	RD--	D28.4	00 1110 1101	
238	252	ü	FC	RD--	D28.7	00 1110 1110	
242	156	œ	9C	RD --	K28.4	00 1111 0010	Reserved*
243	124		7C	RD --	K28.3	00 1111 0011	Reserved*
244	28	FS	1C	RD --	K28.0	00 1111 0100	Reserved*
245	92	\	5C	RD --	K28.2	00 1111 0101	Reserved*
246	220	Ü	DC	RD --	K28.6	00 1111 0110	Reserved*
248	252	ü	FC	RD --	K28.7	00 1111 1000	Test
249	60	<	3C	RD --	K28.1	00 1111 1001	Reserved*
250	188	¼	BC	RD --	K28.5	00 1111 1010	Sync
277	93	]	5D	RD +	D29.2	01 0001 0101	
278	221	ÿ	DD	RD +	D29.6	01 0001 0110	
279	253	ÿ	FD	RD +	K29.7	01 0001 0111	
281	61	=	3D	RD +	D29.1	01 0001 1001	
282	189	½	BD	RD +	D29.5	01 0001 1010	
283	29	GS	1D	RD +	D29.0	01 0001 1011	
284	125	}	7D	RD +	D29.3	01 0001 1100	
285	157	—	9D	RD +	D29.4	01 0001 1101	
286	253	ÿ	FD	RD +	D29.7	01 0001 1110	
293	66	B	42	RD +	D2.2	01 0010 0101	
294	194	Ä	C2	RD +	D2.6	01 0010 0110	
297	34	"	22	RD +	D2.1	01 0010 1001	
298	162	¢	A2	RD +	D2.5	01 0010 1010	
299	2	STX	02	RD +	D2.0	01 0010 1011	
300	98	b	62	RD +	D2.3	01 0010 1100	
301	130	,	82	RD +	D2.4	01 0010 1101	
302	226	â	E2	RD +	D2.7	01 0010 1110	
305	242	ò	F2	RD +	D18.7	01 0011 0001	
306	146	'	92	RD +	D18.4	01 0011 0010	
307	114	r	72	RD +	D18.3	01 0011 0011	
308	18	DC2	12	RD +	D18.0	01 0011 0100	
309	82	R	52	RD+/-	D18.2	01 0011 0101	
310	210	Ö	D2	RD+/-	D18.6	01 0011 0110	
311	242	ò	F2	RD--	D18.7	01 0011 0111	
313	50	2	32	RD+/-	D18.1	01 0011 1001	
314	178	ˆ	B2	RD+/-	D18.5	01 0011 1010	
315	18	DC2	12	RD--	D18.0	01 0011 1011	
316	114	r	72	RD--	D18.3	01 0011 1100	
317	146	'	92	RD--	D18.4	01 0011 1101	
325	95	—	5F	RD +	D31.2	01 0100 0101	
326	223	ß	DF	RD +	D31.6	01 0100 0110	
329	63	?	3F	RD +	D31.1	01 0100 1001	
330	191	¿	BF	RD +	D31.5	01 0100 1010	
331	31	US	1F	RD +	D31.0	01 0100 1011	
332	127	DELETE	7F	RD +	D31.3	01 0100 1100	
333	159	ÿ	9F	RD +	D31.4	01 0100 1101	
334	255	ÿ	FF	RD +	D31.7	01 0100 1110	

337	234	ê	EA	RD +	D10.7	01 0101 0001	442	176	°	B0	RD--	D16.5	01 1011 1010
338	138	Š	8A	RD +	D10.4	01 0101 0010	450	142	—	8E	RD +	D14.4	01 1100 0010
339	106	j	6A	RD +	D10.3	01 0101 0011	451	110	n	6E	RD +	D14.3	01 1100 0011
340	10	LF	0A	RD +	D10.0	01 0101 0100	452	14	SO	0E	RD +	D14.0	01 1100 0100
341	74	J	4A	RD+/-	D10.2	01 0101 0101	453	78	N	4E	RD+/-	D14.2	01 1100 0101
342	202	Ê	CA	RD+/-	D10.6	01 0101 0110	454	206	î	CE	RD+/-	D14.6	01 1100 0110
345	42	*	2A	RD+/-	D10.1	01 0101 1001	456	238	î	EE	RD +	D14.7	01 1100 1000
346	170	a	AA	RD+/-	D10.5	01 0101 1010	457	46	.	2E	RD+/-	D14.1	01 1100 1001
347	10	LF	0A	RD--	D10.0	01 0101 1011	458	174	®	AE	RD+/-	D14.5	01 1100 1010
348	106	j	6A	RD--	D10.3	01 0101 1100	459	14	SO	0E	RD--	D14.0	01 1100 1011
349	138	Š	8A	RD--	D10.4	01 0101 1101	460	110	n	6E	RD--	D14.3	01 1100 1100
350	234	ê	EA	RD--	D10.7	01 0101 1110	461	142	—	8E	RD--	D14.4	01 1100 1101
353	250	ú	FA	RD +	D26.7	01 0110 0001	462	238	î	EE	RD--	D14.7	01 1100 1110
354	154	š	9A	RD +	D26.4	01 0110 0010	465	225	â	E1	RD--	D1.7	01 1101 0001
355	122	z	7A	RD +	D26.3	01 0110 0011	466	129	—	81	RD--	D1.4	01 1101 0010
356	26	SUB	1A	RD +	D26.0	01 0110 0100	467	97	a	61	RD--	D1.3	01 1101 0011
357	90	Z	5A	RD+/-	D26.2	01 0110 0101	468	1	SOH	01	RD--	D1.0	01 1101 0100
358	218	Ú	DA	RD+/-	D26.6	01 0110 0110	469	65	A	41	RD--	D1.2	01 1101 0101
361	58	:	3A	RD+/-	D26.1	01 0110 1001	470	193	Á	C1	RD--	D1.6	01 1101 0110
362	186	°	BA	RD+/-	D26.5	01 0110 1010	473	33	!	21	RD--	D1.1	01 1101 1001
363	26	SUB	1A	RD--	D26.0	01 0110 1011	474	161	j	A1	RD--	D1.5	01 1101 1010
364	122	z	7A	RD--	D26.3	01 0110 1100	481	254	þ	FE	RD--	D30.7	01 1110 0001
365	154	š	9A	RD--	D26.4	01 0110 1101	482	158	—	9E	RD--	D30.4	01 1110 0010
366	250	ú	FA	RD--	D26.7	01 0110 1110	483	126	~	7E	RD--	D30.3	01 1110 0011
369	239	ï	EF	RD--	D15.7	01 0111 0001	484	30	RS	1E	RD--	D30.0	01 1110 0100
370	143	—	8F	RD--	D15.4	01 0111 0010	485	94	^	5E	RD--	D30.2	01 1110 0101
371	111	o	6F	RD--	D15.3	01 0111 0011	486	222	þ	DE	RD--	D30.6	01 1110 0110
372	15	SI	0F	RD--	D15.0	01 0111 0100	488	254	þ	FE	RD --	K30.7	01 1110 1000
373	79	O	4F	RD--	D15.2	01 0111 0101	489	62	>	3E	RD--	D30.1	01 1110 1001
374	207	İ	CF	RD--	D15.6	01 0111 0110	490	190	¾	BE	RD--	D30.5	01 1110 1010
377	47	/	2F	RD--	D15.1	01 0111 1001	533	94	^	5E	RD +	D30.2	10 0001 0101
378	175	—	AF	RD--	D15.5	01 0111 1010	534	222	þ	DE	RD +	D30.6	10 0001 0110
389	64	@	40	RD +	D0.2	01 1000 0101	535	254	þ	FE	RD +	K30.7	10 0001 0111
390	192	Ä	C0	RD +	D0.6	01 1000 0110	537	62	>	3E	RD +	D30.1	10 0001 1001
393	32SPACE		20	RD +	D0.1	01 1000 1001	538	190	¾	BE	RD +	D30.5	10 0001 1010
394	160		A0	RD +	D0.5	01 1000 1010	539	30	RS	1E	RD +	D30.0	10 0001 1011
395	0	NUL	00	RD +	D0.0	01 1000 1011	540	126	~	7E	RD +	D30.3	10 0001 1100
396	96	`	60	RD +	D0.3	01 1000 1100	541	158	—	9E	RD +	D30.4	10 0001 1101
397	128	—	80	RD +	D0.4	01 1000 1101	542	254	þ	FE	RD +	D30.7	10 0001 1110
398	224	ä	E0	RD +	D0.7	01 1000 1110	549	65	A	41	RD +	D1.2	10 0010 0101
401	230	æ	E6	RD +	D6.7	01 1001 0001	550	193	Á	C1	RD +	D1.6	10 0010 0110
402	134	†	86	RD +	D6.4	01 1001 0010	553	33	!	21	RD +	D1.1	10 0010 1001
403	102	f	66	RD +	D6.3	01 1001 0011	554	161	j	A1	RD +	D1.5	10 0010 1010
404	6	ACK	06	RD +	D6.0	01 1001 0100	555	1	SOH	01	RD +	D1.0	10 0010 1011
405	70	F	46	RD+/-	D6.2	01 1001 0101	556	97	a	61	RD +	D1.3	10 0010 1100
406	198	Æ	C6	RD+/-	D6.6	01 1001 0110	557	129	—	81	RD +	D1.4	10 0010 1101
409	38	&	26	RD+/-	D6.1	01 1001 1001	558	225	â	E1	RD +	D1.7	10 0010 1110
410	166	ı	A6	RD+/-	D6.5	01 1001 1010	561	241	ñ	F1	RD +	D17.7	10 0011 0001
411	6	ACK	06	RD--	D6.0	01 1001 1011	562	145	'	91	RD +	D17.4	10 0011 0010
412	102	f	66	RD--	D6.3	01 1001 1100	563	113	q	71	RD +	D17.3	10 0011 0011
413	134	†	86	RD--	D6.4	01 1001 1101	564	17	DC1	11	RD +	D17.0	10 0011 0100
414	230	æ	E6	RD--	D6.7	01 1001 1110	565	81	Q	51	RD+/-	D17.2	10 0011 0101
417	246	ö	F6	RD +	D22.7	01 1010 0001	566	209	Ñ	D1	RD+/-	D17.6	10 0011 0110
418	150	—	96	RD +	D22.4	01 1010 0010	567	241	ñ	F1	RD--	D17.7	10 0011 0111
419	118	v	76	RD +	D22.3	01 1010 0011	569	49	1	31	RD+/-	D17.1	10 0011 1001
420	22	SYN	16	RD +	D22.0	01 1010 0100	570	177	±	B1	RD+/-	D17.5	10 0011 1010
421	86	V	56	RD+/-	D22.2	01 1010 0101	571	17	DC1	11	RD--	D17.0	10 0011 1011
422	214	Ö	D6	RD+/-	D22.6	01 1010 0110	572	113	q	71	RD--	D17.3	10 0011 1100
425	54	6	36	RD+/-	D22.1	01 1010 1001	573	145	'	91	RD--	D17.4	10 0011 1101
426	182	¶	B6	RD+/-	D22.5	01 1010 1010	581	80	P	50	RD +	D16.2	10 0100 0101
427	22	SYN	16	RD--	D22.0	01 1010 1011	582	208	Ð	D0	RD +	D16.6	10 0100 0110
428	118	v	76	RD--	D22.3	01 1010 1100	585	48	0	30	RD +	D16.1	10 0100 1001
429	150	—	96	RD--	D22.4	01 1010 1101	586	176	°	B0	RD +	D16.5	10 0100 1010
430	246	ö	F6	RD--	D22.7	01 1010 1110	587	16	DLE	10	RD +	D16.0	10 0100 1011
433	240	ð	F0	RD--	D16.7	01 1011 0001	588	112	p	70	RD +	D16.3	10 0100 1100
434	144	—	90	RD--	D16.4	01 1011 0010	589	144	—	90	RD +	D16.4	10 0100 1101
435	112	p	70	RD--	D16.3	01 1011 0011	590	240	ð	F0	RD +	D16.7	10 0100 1110
436	16	DLE	10	RD--	D16.0	01 1011 0100	593	233	é	E9	RD +	D9.7	10 0101 0001
437	80	P	50	RD--	D16.2	01 1011 0101	594	137	‰	89	RD +	D9.4	10 0101 0010
438	208	Ð	D0	RD--	D16.6	01 1011 0110	595	105	i	69	RD +	D9.3	10 0101 0011
441	48	0	30	RD--	D16.1	01 1011 1001	596	9	HT	09	RD +	D9.0	10 0101 0100
							597	73	l	49	RD+/-	D9.2	10 0101 0101
							598	201	É	C9	RD+/-	D9.6	10 0101 0110

Reserved*

8-Bit/10-Bit Mapping

601	41	)	29	RD+/-	D9.1	10 0101 1001	713	45	-	2D	RD+/-	D13.1	10 1100 1001
602	169	©	A9	RD+/-	D9.5	10 0101 1010	714	173	-	AD	RD+/-	D13.5	10 1100 1010
603	9	HT	09	RD--	D9.0	10 0101 1011	715	13	CR	0D	RD--	D13.0	10 1100 1011
604	105	i	69	RD--	D9.3	10 0101 1100	716	109	m	6D	RD--	D13.3	10 1100 1100
605	137	‰	89	RD--	D9.4	10 0101 1101	717	141	—	8D	RD--	D13.4	10 1100 1101
606	233	é	E9	RD--	D9.7	10 0101 1110	718	237	í	ED	RD--	D13.7	10 1100 1110
609	249	ù	F9	RD +	D25.7	10 0110 0001	721	226	â	E2	RD--	D2.7	10 1101 0001
610	153	™	99	RD +	D25.4	10 0110 0010	722	130	,	82	RD--	D2.4	10 1101 0010
611	121	y	79	RD +	D25.3	10 0110 0011	723	98	b	62	RD--	D2.3	10 1101 0011
612	25	EM	19	RD +	D25.0	10 0110 0100	724	2	STX	02	RD--	D2.0	10 1101 0100
613	89	Y	59	RD+/-	D25.2	10 0110 0101	725	66	B	42	RD--	D2.2	10 1101 0101
614	217	Û	D9	RD+/-	D25.6	10 0110 0110	726	194	Ä	C2	RD--	D2.6	10 1101 0110
617	57	9	39	RD+/-	D25.1	10 0110 1001	729	34	"	22	RD--	D2.1	10 1101 1001
618	185	ı	B9	RD+/-	D25.5	10 0110 1010	730	162	¢	A2	RD--	D2.5	10 1101 1010
619	25	EM	19	RD--	D25.0	10 0110 1011	737	253	ý	FD	RD--	D29.7	10 1110 0001
620	121	y	79	RD--	D25.3	10 0110 1100	738	157	—	9D	RD--	D29.4	10 1110 0010
621	153	™	99	RD--	D25.4	10 0110 1101	739	125	}	7D	RD--	D29.3	10 1110 0011
622	249	ù	F9	RD--	D25.7	10 0110 1110	740	29	GS	1D	RD--	D29.0	10 1110 0100
625	224	à	E0	RD--	D0.7	10 0111 0001	741	93	]	5D	RD--	D29.2	10 1110 0101
626	128	`	80	RD--	D0.4	10 0111 0010	742	221	Ÿ	DD	RD--	D29.6	10 1110 0110
627	96	˘	60	RD--	D0.3	10 0111 0011	744	253	ý	FD	RD --	K29.7	10 1110 1000
628	0	NUL	00	RD--	D0.0	10 0111 0100	745	61	=	3D	RD--	D29.1	10 1110 1001
629	64	@	40	RD--	D0.2	10 0111 0101	746	189	½	BD	RD--	D29.5	10 1110 1010
630	192	À	C0	RD--	D0.6	10 0111 0110	773	188	¼	BC	RD +	K28.5	11 0000 0101
633	32SPACE		20	RD--	D0.1	10 0111 1001	774	60	<	3C	RD +	K28.1	11 0000 0110
634	160		A0	RD--	D0.5	10 0111 1010	775	252	ü	FC	RD +	K28.7	11 0000 0111
645	79	O	4F	RD +	D15.2	10 1000 0101	777	220	Ü	DC	RD +	K28.6	11 0000 1001
646	207	İ	CF	RD +	D15.6	10 1000 0110	778	92	\	5C	RD +	K28.2	11 0000 1010
649	47	/	2F	RD +	D15.1	10 1000 1001	779	28	FS	1C	RD +	K28.0	11 0000 1011
650	175	—	AF	RD +	D15.5	10 1000 1010	780	124		7C	RD +	K28.3	11 0000 1100
651	15	SI	0F	RD +	D15.0	10 1000 1011	781	156	œ	9C	RD +	K28.4	11 0000 1101
652	111	o	6F	RD +	D15.3	10 1000 1100	785	227	ã	E3	RD +	D3.7	11 0001 0001
653	143	—	8F	RD +	D15.4	10 1000 1101	786	131	f	83	RD +	D3.4	11 0001 0010
654	239	ı	EF	RD +	D15.7	10 1000 1110	787	99	c	63	RD +	D3.3	11 0001 0011
657	229	å	E5	RD +	D5.7	10 1001 0001	788	3	ETX	03	RD +	D3.0	11 0001 0100
658	133	...	85	RD +	D5.4	10 1001 0010	789	67	C	43	RD+/-	D3.2	11 0001 0101
659	101	e	65	RD +	D5.3	10 1001 0011	790	195	Ä	C3	RD+/-	D3.6	11 0001 0110
660	5	ENQ	05	RD +	D5.0	10 1001 0100	793	35	#	23	RD+/-	D3.1	11 0001 1001
661	69	E	45	RD+/-	D5.2	10 1001 0101	794	163	£	A3	RD+/-	D3.5	11 0001 1010
662	197	Å	C5	RD+/-	D5.6	10 1001 0110	795	3	ETX	03	RD--	D3.0	11 0001 1011
665	37	%	25	RD+/-	D5.1	10 1001 1001	796	99	c	63	RD--	D3.3	11 0001 1100
666	165	¥	A5	RD+/-	D5.5	10 1001 1010	797	131	f	83	RD--	D3.4	11 0001 1101
667	5	ENQ	05	RD--	D5.0	10 1001 1011	798	227	ã	E3	RD--	D3.7	11 0001 1110
668	101	e	65	RD--	D5.3	10 1001 1100	801	243	ó	F3	RD +	D19.7	11 0010 0001
669	133	...	85	RD--	D5.4	10 1001 1101	802	147	"	93	RD +	D19.4	11 0010 0010
670	229	å	E5	RD--	D5.7	10 1001 1110	803	115	s	73	RD +	D19.3	11 0010 0011
673	245	õ	F5	RD +	D21.7	10 1010 0001	804	19	DC3	13	RD +	D19.0	11 0010 0100
674	149	•	95	RD +	D21.4	10 1010 0010	805	83	S	53	RD+/-	D19.2	11 0010 0101
675	117	u	75	RD +	D21.3	10 1010 0011	806	211	Ó	D3	RD+/-	D19.6	11 0010 0110
676	21	NAK	15	RD +	D21.0	10 1010 0100	809	51	3	33	RD+/-	D19.1	11 0010 1001
677	85	U	55	RD+/-	D21.2	10 1010 0101	810	179	³	B3	RD+/-	D19.5	11 0010 1010
678	213	Ö	D5	RD+/-	D21.6	10 1010 0110	811	19	DC3	13	RD--	D19.0	11 0010 1011
681	53	5	35	RD+/-	D21.1	10 1010 1001	812	115	s	73	RD--	D19.3	11 0010 1100
682	181	µ	B5	RD+/-	D21.5	10 1010 1010	813	147	"	93	RD--	D19.4	11 0010 1101
683	21	NAK	15	RD--	D21.0	10 1010 1011	814	243	ó	F3	RD--	D19.7	11 0010 1110
684	117	u	75	RD--	D21.3	10 1010 1100	817	248	ø	F8	RD--	D24.7	11 0011 0001
685	149	•	95	RD--	D21.4	10 1010 1101	818	152	~	98	RD--	D24.4	11 0011 0010
686	245	õ	F5	RD--	D21.7	10 1010 1110	819	120	x	78	RD--	D24.3	11 0011 0011
689	255	ÿ	FF	RD--	D31.7	10 1011 0001	820	24	CAN	18	RD--	D24.0	11 0011 0100
690	159	Ÿ	9F	RD--	D31.4	10 1011 0010	821	88	X	58	RD--	D24.2	11 0011 0101
691	127DELETE		7F	RD--	D31.3	10 1011 0011	822	216	Ø	D8	RD--	D24.6	11 0011 0110
692	31	US	1F	RD--	D31.0	10 1011 0100	825	56	8	38	RD--	D24.1	11 0011 1001
693	95	—	5F	RD--	D31.2	10 1011 0101	826	184	,	B8	RD--	D24.5	11 0011 1010
694	223	ß	DF	RD--	D31.6	10 1011 0110	834	139	<	8B	RD +	D11.4	11 0100 0010
697	63	?	3F	RD--	D31.1	10 1011 1001	835	107	k	6B	RD +	D11.3	11 0100 0011
698	191	¿	BF	RD--	D31.5	10 1011 1010	836	11	VT	0B	RD +	D11.0	11 0100 0100
706	141	—	8D	RD +	D13.4	10 1100 0010	837	75	K	4B	RD+/-	D11.2	11 0100 0101
707	109	m	6D	RD +	D13.3	10 1100 0011	838	203	Ë	CB	RD+/-	D11.6	11 0100 0110
708	13	CR	0D	RD +	D13.0	10 1100 0100	840	235	ë	EB	RD +	D11.7	11 0100 1000
709	77	M	4D	RD+/-	D13.2	10 1100 0101	841	43	+	2B	RD+/-	D11.1	11 0100 1001
710	205	Í	CD	RD+/-	D13.6	10 1100 0110	842	171	«	AB	RD+/-	D11.5	11 0100 1010
712	237	í	ED	RD +	D13.7	10 1100 1000	843	11	VT	0B	RD--	D11.0	11 0100 1011

Reserved*
(Not Used)

844	107	k	6B	RD--	D11.3	11 0100 1100	
845	139	<	8B	RD--	D11.4	11 0100 1101	
846	235	ë	EB	RD--	D11.7	11 0100 1110	
849	228	ä	E4	RD--	D4.7	11 0101 0001	
850	132	"	84	RD--	D4.4	11 0101 0010	
851	100	d	64	RD--	D4.3	11 0101 0011	
852	4	EOT	04	RD--	D4.0	11 0101 0100	
853	68	D	44	RD--	D4.2	11 0101 0101	
854	196	Ä	C4	RD--	D4.6	11 0101 0110	
857	36	\$	24	RD--	D4.1	11 0101 1001	
858	164	¤	A4	RD--	D4.5	11 0101 1010	
865	251	û	FB	RD--	D27.7	11 0110 0001	
866	155	>	9B	RD--	D27.4	11 0110 0010	
867	123	{	7B	RD--	D27.3	11 0110 0011	
868	27	ESC	1B	RD--	D27.0	11 0110 0100	
869	91	[	5B	RD--	D27.2	11 0110 0101	
870	219	Û	DB	RD--	D27.6	11 0110 0110	
872	251	û	FB	RD --	K27.7	11 0110 1000	Reserved*
873	59	;	3B	RD--	D27.1	11 0110 1001	
874	187	»	BB	RD--	D27.5	11 0110 1010	
901	71	G	47	RD--	D7.2	11 1000 0101	
902	199	Ç	C7	RD--	D7.6	11 1000 0110	
905	39	'	27	RD--	D7.1	11 1000 1001	
906	167	§	A7	RD--	D7.5	11 1000 1010	
907	7	BEL	07	RD--	D7.0	11 1000 1011	
908	103	g	67	RD--	D7.3	11 1000 1100	
909	135	‡	87	RD--	D7.4	11 1000 1101	
910	231	ç	E7	RD--	D7.7	11 1000 1110	
913	232	è	E8	RD--	D8.7	11 1001 0001	
914	136	^	88	RD--	D8.4	11 1001 0010	
915	104	h	68	RD--	D8.3	11 1001 0011	
916	8	BS	08	RD--	D8.0	11 1001 0100	
917	72	H	48	RD--	D8.2	11 1001 0101	
918	200	È	C8	RD--	D8.6	11 1001 0110	
921	40	(	28	RD--	D8.1	11 1001 1001	
922	168	¨	A8	RD--	D8.5	11 1001 1010	
929	247	÷	F7	RD--	D23.7	11 1010 0001	
930	151	—	97	RD--	D23.4	11 1010 0010	
931	119	w	77	RD--	D23.3	11 1010 0011	
932	23	ETB	17	RD--	D23.0	11 1010 0100	
933	87	W	57	RD--	D23.2	11 1010 0101	
934	215	×	D7	RD--	D23.6	11 1010 0110	
936	247	÷	F7	RD --	K23.7	11 1010 1000	Reserved*
937	55	7	37	RD--	D23.1	11 1010 1001	
938	183	·	B7	RD--	D23.5	11 1010 1010	

The following table lists:

10-Bit Values with No 8-bit Mapping Sorted by 10-Bit Value

10B Dec	10 B	COMMENT
0	00 0000 0000	ILLEGAL
1	00 0000 0001	ILLEGAL
2	00 0000 0010	ILLEGAL
3	00 0000 0011	ILLEGAL
4	00 0000 0100	ILLEGAL
5	00 0000 0101	ILLEGAL
6	00 0000 0110	ILLEGAL
7	00 0000 0111	ILLEGAL
8	00 0000 1000	ILLEGAL
9	00 0000 1001	ILLEGAL
10	00 0000 1010	ILLEGAL
11	00 0000 1011	ILLEGAL
12	00 0000 1100	ILLEGAL
13	00 0000 1101	ILLEGAL
14	00 0000 1110	ILLEGAL
15	00 0000 1111	ILLEGAL
16	00 0001 0000	ILLEGAL
17	00 0001 0001	ILLEGAL
18	00 0001 0010	ILLEGAL
19	00 0001 0011	ILLEGAL
20	00 0001 0100	ILLEGAL
21	00 0001 0101	ILLEGAL
22	00 0001 0110	ILLEGAL
23	00 0001 0111	ILLEGAL
24	00 0001 1000	ILLEGAL
25	00 0001 1001	ILLEGAL
26	00 0001 1010	ILLEGAL
27	00 0001 1011	ILLEGAL
28	00 0001 1100	ILLEGAL
29	00 0001 1101	ILLEGAL
30	00 0001 1110	ILLEGAL
31	00 0001 1111	ILLEGAL
32	00 0010 0000	ILLEGAL
33	00 0010 0001	ILLEGAL
34	00 0010 0010	ILLEGAL
35	00 0010 0011	ILLEGAL
36	00 0010 0100	ILLEGAL
37	00 0010 0101	ILLEGAL
38	00 0010 0110	ILLEGAL
39	00 0010 0111	ILLEGAL
40	00 0010 1000	ILLEGAL
41	00 0010 1001	ILLEGAL
42	00 0010 1010	ILLEGAL
43	00 0010 1011	ILLEGAL
44	00 0010 1100	ILLEGAL
45	00 0010 1101	ILLEGAL
46	00 0010 1110	ILLEGAL
47	00 0010 1111	ILLEGAL
48	00 0011 0000	ILLEGAL
49	00 0011 0001	ILLEGAL
50	00 0011 0010	ILLEGAL
51	00 0011 0011	ILLEGAL

52	00 0011 0100	ILLEGAL
53	00 0011 0101	ILLEGAL
54	00 0011 0110	ILLEGAL
55	00 0011 0111	ILLEGAL
56	00 0011 1000	ILLEGAL
57	00 0011 1001	ILLEGAL
58	00 0011 1010	ILLEGAL
59	00 0011 1011	ILLEGAL
60	00 0011 1100	ILLEGAL
61	00 0011 1101	ILLEGAL
62	00 0011 1110	ILLEGAL
63	00 0011 1111	ILLEGAL
64	00 0100 0000	ILLEGAL
65	00 0100 0001	ILLEGAL
66	00 0100 0010	ILLEGAL
67	00 0100 0011	ILLEGAL
68	00 0100 0100	ILLEGAL
69	00 0100 0101	ILLEGAL
70	00 0100 0110	ILLEGAL
71	00 0100 0111	ILLEGAL
72	00 0100 1000	ILLEGAL
73	00 0100 1001	ILLEGAL
74	00 0100 1010	ILLEGAL
75	00 0100 1011	ILLEGAL
76	00 0100 1100	ILLEGAL
77	00 0100 1101	ILLEGAL
78	00 0100 1110	ILLEGAL
79	00 0100 1111	ILLEGAL
80	00 0101 0000	ILLEGAL
81	00 0101 0001	ILLEGAL
82	00 0101 0010	ILLEGAL
83	00 0101 0011	ILLEGAL
84	00 0101 0100	ILLEGAL
88	00 0101 1000	ILLEGAL
95	00 0101 1111	ILLEGAL
96	00 0110 0000	ILLEGAL
97	00 0110 0001	ILLEGAL
98	00 0110 0010	ILLEGAL
99	00 0110 0011	ILLEGAL
100	00 0110 0100	ILLEGAL
103	00 0110 0111	ILLEGAL
104	00 0110 1000	ILLEGAL
111	00 0110 1111	ILLEGAL
112	00 0111 0000	ILLEGAL
119	00 0111 0111	ILLEGAL
120	00 0111 1000	ILLEGAL
123	00 0111 1011	ILLEGAL
124	00 0111 1100	ILLEGAL
125	00 0111 1101	ILLEGAL
126	00 0111 1110	ILLEGAL
127	00 0111 1111	ILLEGAL
128	00 1000 0000	ILLEGAL
129	00 1000 0001	ILLEGAL
130	00 1000 0010	ILLEGAL
131	00 1000 0011	ILLEGAL
132	00 1000 0100	ILLEGAL
133	00 1000 0101	ILLEGAL
134	00 1000 0110	ILLEGAL
135	00 1000 0111	ILLEGAL
136	00 1000 1000	ILLEGAL
137	00 1000 1001	ILLEGAL
138	00 1000 1010	ILLEGAL
139	00 1000 1011	ILLEGAL
140	00 1000 1100	ILLEGAL
141	00 1000 1101	ILLEGAL

142	00 1000 1110	ILLEGAL	276	01 0001 0100	ILLEGAL
143	00 1000 1111	ILLEGAL	280	01 0001 1000	ILLEGAL
144	00 1001 0000	ILLEGAL	287	01 0001 1111	ILLEGAL
145	00 1001 0001	ILLEGAL	288	01 0010 0000	ILLEGAL
146	00 1001 0010	ILLEGAL	289	01 0010 0001	ILLEGAL
147	00 1001 0011	ILLEGAL	290	01 0010 0010	ILLEGAL
148	00 1001 0100	ILLEGAL	291	01 0010 0011	ILLEGAL
152	00 1001 1000	ILLEGAL	292	01 0010 0100	ILLEGAL
159	00 1001 1111	ILLEGAL	295	01 0010 0111	ILLEGAL
160	00 1010 0000	ILLEGAL	296	01 0010 1000	ILLEGAL
161	00 1010 0001	ILLEGAL	303	01 0010 1111	ILLEGAL
162	00 1010 0010	ILLEGAL	304	01 0011 0000	ILLEGAL
163	00 1010 0011	ILLEGAL	312	01 0011 1000	ILLEGAL
164	00 1010 0100	ILLEGAL	318	01 0011 1110	ILLEGAL
167	00 1010 0111	ILLEGAL	319	01 0011 1111	ILLEGAL
168	00 1010 1000	ILLEGAL	320	01 0100 0000	ILLEGAL
175	00 1010 1111	ILLEGAL	321	01 0100 0001	ILLEGAL
176	00 1011 0000	ILLEGAL	322	01 0100 0010	ILLEGAL
184	00 1011 1000	ILLEGAL	323	01 0100 0011	ILLEGAL
190	00 1011 1110	ILLEGAL	324	01 0100 0100	ILLEGAL
191	00 1011 1111	ILLEGAL	327	01 0100 0111	ILLEGAL
192	00 1100 0000	ILLEGAL	328	01 0100 1000	ILLEGAL
193	00 1100 0001	ILLEGAL	335	01 0100 1111	ILLEGAL
194	00 1100 0010	ILLEGAL	336	01 0101 0000	ILLEGAL
195	00 1100 0011	ILLEGAL	343	01 0101 0111	ILLEGAL
196	00 1100 0100	ILLEGAL	344	01 0101 1000	ILLEGAL
199	00 1100 0111	ILLEGAL	351	01 0101 1111	ILLEGAL
200	00 1100 1000	ILLEGAL	352	01 0110 0000	ILLEGAL
207	00 1100 1111	ILLEGAL	359	01 0110 0111	ILLEGAL
208	00 1101 0000	ILLEGAL	360	01 0110 1000	ILLEGAL
215	00 1101 0111	ILLEGAL	367	01 0110 1111	ILLEGAL
216	00 1101 1000	ILLEGAL	368	01 0111 0000	ILLEGAL
223	00 1101 1111	ILLEGAL	375	01 0111 0111	ILLEGAL
224	00 1110 0000	ILLEGAL	376	01 0111 1000	ILLEGAL
231	00 1110 0111	ILLEGAL	379	01 0111 1011	ILLEGAL
232	00 1110 1000	ILLEGAL	380	01 0111 1100	ILLEGAL
239	00 1110 1111	ILLEGAL	381	01 0111 1101	ILLEGAL
240	00 1111 0000	ILLEGAL	382	01 0111 1110	ILLEGAL
241	00 1111 0001	ILLEGAL	383	01 0111 1111	ILLEGAL
247	00 1111 0111	ILLEGAL	384	01 1000 0000	ILLEGAL
251	00 1111 1011	ILLEGAL	385	01 1000 0001	ILLEGAL
252	00 1111 1100	ILLEGAL	386	01 1000 0010	ILLEGAL
253	00 1111 1101	ILLEGAL	387	01 1000 0011	ILLEGAL
254	00 1111 1110	ILLEGAL	388	01 1000 0100	ILLEGAL
255	00 1111 1111	ILLEGAL	391	01 1000 0111	ILLEGAL
256	01 0000 0000	ILLEGAL	392	01 1000 1000	ILLEGAL
257	01 0000 0001	ILLEGAL	399	01 1000 1111	ILLEGAL
258	01 0000 0010	ILLEGAL	400	01 1001 0000	ILLEGAL
259	01 0000 0011	ILLEGAL	407	01 1001 0111	ILLEGAL
260	01 0000 0100	ILLEGAL	408	01 1001 1000	ILLEGAL
261	01 0000 0101	ILLEGAL	415	01 1001 1111	ILLEGAL
262	01 0000 0110	ILLEGAL	416	01 1010 0000	ILLEGAL
263	01 0000 0111	ILLEGAL	423	01 1010 0111	ILLEGAL
264	01 0000 1000	ILLEGAL	424	01 1010 1000	ILLEGAL
265	01 0000 1001	ILLEGAL	431	01 1010 1111	ILLEGAL
266	01 0000 1010	ILLEGAL	432	01 1011 0000	ILLEGAL
267	01 0000 1011	ILLEGAL	439	01 1011 0111	ILLEGAL
268	01 0000 1100	ILLEGAL	440	01 1011 1000	ILLEGAL
269	01 0000 1101	ILLEGAL	443	01 1011 1011	ILLEGAL
270	01 0000 1110	ILLEGAL	444	01 1011 1100	ILLEGAL
271	01 0000 1111	ILLEGAL	445	01 1011 1101	ILLEGAL
272	01 0001 0000	ILLEGAL	446	01 1011 1110	ILLEGAL
273	01 0001 0001	ILLEGAL	447	01 1011 1111	ILLEGAL
274	01 0001 0010	ILLEGAL	448	01 1100 0000	ILLEGAL
275	01 0001 0011	ILLEGAL	449	01 1100 0001	ILLEGAL

455	01 1100 0111	ILLEGAL	568	10 0011 1000	ILLEGAL
463	01 1100 1111	ILLEGAL	574	10 0011 1110	ILLEGAL
464	01 1101 0000	ILLEGAL	575	10 0011 1111	ILLEGAL
471	01 1101 0111	ILLEGAL	576	10 0100 0000	ILLEGAL
472	01 1101 1000	ILLEGAL	577	10 0100 0001	ILLEGAL
475	01 1101 1011	ILLEGAL	578	10 0100 0010	ILLEGAL
476	01 1101 1100	ILLEGAL	579	10 0100 0011	ILLEGAL
477	01 1101 1101	ILLEGAL	580	10 0100 0100	ILLEGAL
478	01 1101 1110	ILLEGAL	583	10 0100 0111	ILLEGAL
479	01 1101 1111	ILLEGAL	584	10 0100 1000	ILLEGAL
480	01 1110 0000	ILLEGAL	591	10 0100 1111	ILLEGAL
487	01 1110 0111	ILLEGAL	592	10 0101 0000	ILLEGAL
491	01 1110 1011	ILLEGAL	599	10 0101 0111	ILLEGAL
492	01 1110 1100	ILLEGAL	600	10 0101 1000	ILLEGAL
493	01 1110 1101	ILLEGAL	607	10 0101 1111	ILLEGAL
494	01 1110 1110	ILLEGAL	608	10 0110 0000	ILLEGAL
495	01 1110 1111	ILLEGAL	615	10 0110 0111	ILLEGAL
496	01 1111 0000	ILLEGAL	616	10 0110 1000	ILLEGAL
497	01 1111 0001	ILLEGAL	623	10 0110 1111	ILLEGAL
498	01 1111 0010	ILLEGAL	624	10 0111 0000	ILLEGAL
499	01 1111 0011	ILLEGAL	631	10 0111 0111	ILLEGAL
500	01 1111 0100	ILLEGAL	632	10 0111 1000	ILLEGAL
501	01 1111 0101	ILLEGAL	635	10 0111 1011	ILLEGAL
502	01 1111 0110	ILLEGAL	636	10 0111 1100	ILLEGAL
503	01 1111 0111	ILLEGAL	637	10 0111 1101	ILLEGAL
504	01 1111 1000	ILLEGAL	638	10 0111 1110	ILLEGAL
505	01 1111 1001	ILLEGAL	639	10 0111 1111	ILLEGAL
506	01 1111 1010	ILLEGAL	640	10 1000 0000	ILLEGAL
507	01 1111 1011	ILLEGAL	641	10 1000 0001	ILLEGAL
508	01 1111 1100	ILLEGAL	642	10 1000 0010	ILLEGAL
509	01 1111 1101	ILLEGAL	643	10 1000 0011	ILLEGAL
510	01 1111 1110	ILLEGAL	644	10 1000 0100	ILLEGAL
511	01 1111 1111	ILLEGAL	647	10 1000 0111	ILLEGAL
512	10 0000 0000	ILLEGAL	648	10 1000 1000	ILLEGAL
513	10 0000 0001	ILLEGAL	655	10 1000 1111	ILLEGAL
514	10 0000 0010	ILLEGAL	656	10 1001 0000	ILLEGAL
515	10 0000 0011	ILLEGAL	663	10 1001 0111	ILLEGAL
516	10 0000 0100	ILLEGAL	664	10 1001 1000	ILLEGAL
517	10 0000 0101	ILLEGAL	671	10 1001 1111	ILLEGAL
518	10 0000 0110	ILLEGAL	672	10 1010 0000	ILLEGAL
519	10 0000 0111	ILLEGAL	679	10 1010 0111	ILLEGAL
520	10 0000 1000	ILLEGAL	680	10 1010 1000	ILLEGAL
521	10 0000 1001	ILLEGAL	687	10 1010 1111	ILLEGAL
522	10 0000 1010	ILLEGAL	688	10 1011 0000	ILLEGAL
523	10 0000 1011	ILLEGAL	695	10 1011 0111	ILLEGAL
524	10 0000 1100	ILLEGAL	696	10 1011 1000	ILLEGAL
525	10 0000 1101	ILLEGAL	699	10 1011 1011	ILLEGAL
526	10 0000 1110	ILLEGAL	700	10 1011 1100	ILLEGAL
527	10 0000 1111	ILLEGAL	701	10 1011 1101	ILLEGAL
528	10 0001 0000	ILLEGAL	702	10 1011 1110	ILLEGAL
529	10 0001 0001	ILLEGAL	703	10 1011 1111	ILLEGAL
530	10 0001 0010	ILLEGAL	704	10 1100 0000	ILLEGAL
531	10 0001 0011	ILLEGAL	705	10 1100 0001	ILLEGAL
532	10 0001 0100	ILLEGAL	711	10 1100 0111	ILLEGAL
536	10 0001 1000	ILLEGAL	719	10 1100 1111	ILLEGAL
543	10 0001 1111	ILLEGAL	720	10 1101 0000	ILLEGAL
544	10 0010 0000	ILLEGAL	727	10 1101 0111	ILLEGAL
545	10 0010 0001	ILLEGAL	728	10 1101 1000	ILLEGAL
546	10 0010 0010	ILLEGAL	731	10 1101 1011	ILLEGAL
547	10 0010 0011	ILLEGAL	732	10 1101 1100	ILLEGAL
548	10 0010 0100	ILLEGAL	733	10 1101 1101	ILLEGAL
551	10 0010 0111	ILLEGAL	734	10 1101 1110	ILLEGAL
552	10 0010 1000	ILLEGAL	735	10 1101 1111	ILLEGAL
559	10 0010 1111	ILLEGAL	736	10 1110 0000	ILLEGAL
560	10 0011 0000	ILLEGAL	743	10 1110 0111	ILLEGAL

747	10 1110 1011	ILLEGAL	881	11 0111 0001	ILLEGAL
748	10 1110 1100	ILLEGAL	882	11 0111 0010	ILLEGAL
749	10 1110 1101	ILLEGAL	883	11 0111 0011	ILLEGAL
750	10 1110 1110	ILLEGAL	884	11 0111 0100	ILLEGAL
751	10 1110 1111	ILLEGAL	885	11 0111 0101	ILLEGAL
752	10 1111 0000	ILLEGAL	886	11 0111 0110	ILLEGAL
753	10 1111 0001	ILLEGAL	887	11 0111 0111	ILLEGAL
754	10 1111 0010	ILLEGAL	888	11 0111 1000	ILLEGAL
755	10 1111 0011	ILLEGAL	889	11 0111 1001	ILLEGAL
756	10 1111 0100	ILLEGAL	890	11 0111 1010	ILLEGAL
757	10 1111 0101	ILLEGAL	891	11 0111 1011	ILLEGAL
758	10 1111 0110	ILLEGAL	892	11 0111 1100	ILLEGAL
759	10 1111 0111	ILLEGAL	893	11 0111 1101	ILLEGAL
760	10 1111 1000	ILLEGAL	894	11 0111 1110	ILLEGAL
761	10 1111 1001	ILLEGAL	895	11 0111 1111	ILLEGAL
762	10 1111 1010	ILLEGAL	896	11 1000 0000	ILLEGAL
763	10 1111 1011	ILLEGAL	897	11 1000 0001	ILLEGAL
764	10 1111 1100	ILLEGAL	898	11 1000 0010	ILLEGAL
765	10 1111 1101	ILLEGAL	899	11 1000 0011	ILLEGAL
766	10 1111 1110	ILLEGAL	900	11 1000 0100	ILLEGAL
767	10 1111 1111	ILLEGAL	903	11 1000 0111	ILLEGAL
768	11 0000 0000	ILLEGAL	904	11 1000 1000	ILLEGAL
769	11 0000 0001	ILLEGAL	911	11 1000 1111	ILLEGAL
770	11 0000 0010	ILLEGAL	912	11 1001 0000	ILLEGAL
771	11 0000 0011	ILLEGAL	919	11 1001 0111	ILLEGAL
772	11 0000 0100	ILLEGAL	920	11 1001 1000	ILLEGAL
776	11 0000 1000	ILLEGAL	923	11 1001 1011	ILLEGAL
782	11 0000 1110	ILLEGAL	924	11 1001 1100	ILLEGAL
783	11 0000 1111	ILLEGAL	925	11 1001 1101	ILLEGAL
784	11 0001 0000	ILLEGAL	926	11 1001 1110	ILLEGAL
791	11 0001 0111	ILLEGAL	927	11 1001 1111	ILLEGAL
792	11 0001 1000	ILLEGAL	928	11 1010 0000	ILLEGAL
799	11 0001 1111	ILLEGAL	935	11 1010 0111	ILLEGAL
800	11 0010 0000	ILLEGAL	939	11 1010 1011	ILLEGAL
807	11 0010 0111	ILLEGAL	940	11 1010 1100	ILLEGAL
808	11 0010 1000	ILLEGAL	941	11 1010 1101	ILLEGAL
815	11 0010 1111	ILLEGAL	942	11 1010 1110	ILLEGAL
816	11 0011 0000	ILLEGAL	943	11 1010 1111	ILLEGAL
823	11 0011 0111	ILLEGAL	944	11 1011 0000	ILLEGAL
824	11 0011 1000	ILLEGAL	945	11 1011 0001	ILLEGAL
827	11 0011 1011	ILLEGAL	946	11 1011 0010	ILLEGAL
828	11 0011 1100	ILLEGAL	947	11 1011 0011	ILLEGAL
829	11 0011 1101	ILLEGAL	948	11 1011 0100	ILLEGAL
830	11 0011 1110	ILLEGAL	949	11 1011 0101	ILLEGAL
831	11 0011 1111	ILLEGAL	950	11 1011 0110	ILLEGAL
832	11 0100 0000	ILLEGAL	951	11 1011 0111	ILLEGAL
833	11 0100 0001	ILLEGAL	952	11 1011 1000	ILLEGAL
839	11 0100 0111	ILLEGAL	953	11 1011 1001	ILLEGAL
847	11 0100 1111	ILLEGAL	954	11 1011 1010	ILLEGAL
848	11 0101 0000	ILLEGAL	955	11 1011 1011	ILLEGAL
855	11 0101 0111	ILLEGAL	956	11 1011 1100	ILLEGAL
856	11 0101 1000	ILLEGAL	957	11 1011 1101	ILLEGAL
859	11 0101 1011	ILLEGAL	958	11 1011 1110	ILLEGAL
860	11 0101 1100	ILLEGAL	959	11 1011 1111	ILLEGAL
861	11 0101 1101	ILLEGAL	960	11 1100 0000	ILLEGAL
862	11 0101 1110	ILLEGAL	961	11 1100 0001	ILLEGAL
863	11 0101 1111	ILLEGAL	962	11 1100 0010	ILLEGAL
864	11 0110 0000	ILLEGAL	963	11 1100 0011	ILLEGAL
871	11 0110 0111	ILLEGAL	964	11 1100 0100	ILLEGAL
875	11 0110 1011	ILLEGAL	965	11 1100 0101	ILLEGAL
876	11 0110 1100	ILLEGAL	966	11 1100 0110	ILLEGAL
877	11 0110 1101	ILLEGAL	967	11 1100 0111	ILLEGAL
878	11 0110 1110	ILLEGAL	968	11 1100 1000	ILLEGAL
879	11 0110 1111	ILLEGAL	969	11 1100 1001	ILLEGAL
880	11 0111 0000	ILLEGAL	970	11 1100 1010	ILLEGAL

8-Bit/10-Bit Mapping

971	11 1100 1011	ILLEGAL
972	11 1100 1100	ILLEGAL
973	11 1100 1101	ILLEGAL
974	11 1100 1110	ILLEGAL
975	11 1100 1111	ILLEGAL
976	11 1101 0000	ILLEGAL
977	11 1101 0001	ILLEGAL
978	11 1101 0010	ILLEGAL
979	11 1101 0011	ILLEGAL
980	11 1101 0100	ILLEGAL
981	11 1101 0101	ILLEGAL
982	11 1101 0110	ILLEGAL
983	11 1101 0111	ILLEGAL
984	11 1101 1000	ILLEGAL
985	11 1101 1001	ILLEGAL
986	11 1101 1010	ILLEGAL
987	11 1101 1011	ILLEGAL
988	11 1101 1100	ILLEGAL
989	11 1101 1101	ILLEGAL
990	11 1101 1110	ILLEGAL
991	11 1101 1111	ILLEGAL
992	11 1110 0000	ILLEGAL
993	11 1110 0001	ILLEGAL
994	11 1110 0010	ILLEGAL
995	11 1110 0011	ILLEGAL
996	11 1110 0100	ILLEGAL
997	11 1110 0101	ILLEGAL
998	11 1110 0110	ILLEGAL
999	11 1110 0111	ILLEGAL
1000	11 1110 1000	ILLEGAL
1001	11 1110 1001	ILLEGAL
1002	11 1110 1010	ILLEGAL
1003	11 1110 1011	ILLEGAL
1004	11 1110 1100	ILLEGAL
1005	11 1110 1101	ILLEGAL
1006	11 1110 1110	ILLEGAL
1007	11 1110 1111	ILLEGAL
1008	11 1111 0000	ILLEGAL
1009	11 1111 0001	ILLEGAL
1010	11 1111 0010	ILLEGAL
1011	11 1111 0011	ILLEGAL
1012	11 1111 0100	ILLEGAL
1013	11 1111 0101	ILLEGAL
1014	11 1111 0110	ILLEGAL
1015	11 1111 0111	ILLEGAL
1016	11 1111 1000	ILLEGAL
1017	11 1111 1001	ILLEGAL
1018	11 1111 1010	ILLEGAL
1019	11 1111 1011	ILLEGAL
1020	11 1111 1100	ILLEGAL
1021	11 1111 1101	ILLEGAL
1022	11 1111 1110	ILLEGAL
1023	11 1111 1111	ILLEGAL

The following table lists:

Legal 10-Bit Values Sorted by 8-Bit Hex Code

10B Dec	8B Dec	ASCII+	HEX	Previous Disparity	Data Byte FC Name	10 B	COMMENT
3950		NUL	00	RD +	D0.0	01 1000 1011	
628	0	NUL	00	RD--	D0.0	10 0111 0100	
468	1	SOH	01	RD--	D1.0	01 1101 0100	
555	1	SOH	01	RD +	D1.0	10 0010 1011	
299	2	STX	02	RD +	D2.0	01 0010 1011	
724	2	STX	02	RD--	D2.0	10 1101 0100	
788	3	ETX	03	RD +	D3.0	11 0001 0100	
795	3	ETX	03	RD--	D3.0	11 0001 1011	
171	4	EOT	04	RD +	D4.0	00 1010 1011	
852	4	EOT	04	RD--	D4.0	11 0101 0100	
660	5	ENQ	05	RD +	D5.0	10 1001 0100	
667	5	ENQ	05	RD--	D5.0	10 1001 1011	
404	6	ACK	06	RD +	D6.0	01 1001 0100	
411	6	ACK	06	RD--	D6.0	01 1001 1011	
116	7	BEL	07	RD +	D7.0	00 0111 0100	
907	7	BEL	07	RD--	D7.0	11 1000 1011	
107	8	BS	08	RD +	D8.0	00 0110 1011	
916	8	BS	08	RD--	D8.0	11 1001 0100	
596	9	HT	09	RD +	D9.0	10 0101 0100	
603	9	HT	09	RD--	D9.0	10 0101 1011	
436	16	DLE	10	RD--	D16.0	01 1011 0100	
587	16	DLE	10	RD +	D16.0	10 0100 1011	
564	17	DC1	11	RD +	D17.0	10 0011 0100	
571	17	DC1	11	RD--	D17.0	10 0011 1011	
308	18	DC2	12	RD +	D18.0	01 0011 0100	
315	18	DC2	12	RD--	D18.0	01 0011 1011	
804	19	DC3	13	RD +	D19.0	11 0010 0100	
811	19	DC3	13	RD--	D19.0	11 0010 1011	
180	20	DC4	14	RD +	D20.0	00 1011 0100	
187	20	DC4	14	RD--	D20.0	00 1011 1011	
676	21	NAK	15	RD +	D21.0	10 1010 0100	
683	21	NAK	15	RD--	D21.0	10 1010 1011	
420	22	SYN	16	RD +	D22.0	01 1010 0100	
427	22	SYN	16	RD--	D22.0	01 1010 1011	
91	23	ETB	17	RD +	D23.0	00 0101 1011	
932	23	ETB	17	RD--	D23.0	11 1010 0100	
203	24	CAN	18	RD +	D24.0	00 1100 1011	
820	24	CAN	18	RD--	D24.0	11 0011 0100	
612	25	EM	19	RD +	D25.0	10 0110 0100	
619	25	EM	19	RD--	D25.0	10 0110 1011	
393	32	SPACE	20	RD +	D0.1	01 1000 1001	
633	32	SPACE	20	RD--	D0.1	10 0111 1001	
473	33	!	21	RD--	D1.1	01 1101 1001	
553	33	!	21	RD +	D1.1	10 0010 1001	
297	34	"	22	RD +	D2.1	01 0010 1001	
729	34	"	22	RD--	D2.1	10 1101 1001	
793	35	#	23	RD+/-	D3.1	11 0001 1001	
169	36	\$	24	RD +	D4.1	00 1010 1001	
857	36	\$	24	RD--	D4.1	11 0101 1001	
665	37	%	25	RD+/-	D5.1	10 1001 1001	

409	38	&	26	RD+/-	D6.1	01 1001 1001
121	39	'	27	RD +	D7.1	00 0111 1001
905	39	'	27	RD--	D7.1	11 1000 1001
105	40	(	28	RD +	D8.1	00 0110 1001
921	40	(	28	RD--	D8.1	11 1001 1001
601	41	)	29	RD+/-	D9.1	10 0101 1001
441	48	0	30	RD--	D16.1	01 1011 1001
585	48	0	30	RD +	D16.1	10 0100 1001
569	49	1	31	RD+/-	D17.1	10 0011 1001
313	50	2	32	RD+/-	D18.1	01 0011 1001
809	51	3	33	RD+/-	D19.1	11 0010 1001
185	52	4	34	RD+/-	D20.1	00 1011 1001
681	53	5	35	RD+/-	D21.1	10 1010 1001
425	54	6	36	RD+/-	D22.1	01 1010 1001
89	55	7	37	RD +	D23.1	00 0101 1001
937	55	7	37	RD--	D23.1	11 1010 1001
201	56	8	38	RD +	D24.1	00 1100 1001
825	56	8	38	RD--	D24.1	11 0011 1001
617	57	9	39	RD+/-	D25.1	10 0110 1001
389	64	@	40	RD +	D0.2	01 1000 0101
629	64	@	40	RD--	D0.2	10 0111 0101
469	65	A	41	RD--	D1.2	01 1101 0101
549	65	A	41	RD +	D1.2	10 0010 0101
293	66	B	42	RD +	D2.2	01 0010 0101
725	66	B	42	RD--	D2.2	10 1101 0101
789	67	C	43	RD+/-	D3.2	11 0001 0101
165	68	D	44	RD +	D4.2	00 1010 0101
853	68	D	44	RD--	D4.2	11 0101 0101
661	69	E	45	RD+/-	D5.2	10 1001 0101
405	70	F	46	RD+/-	D6.2	01 1001 0101
117	71	G	47	RD +	D7.2	00 0111 0101
901	71	G	47	RD--	D7.2	11 1000 0101
101	72	H	48	RD +	D8.2	00 0110 0101
917	72	H	48	RD--	D8.2	11 1001 0101
597	73	I	49	RD+/-	D9.2	10 0101 0101
437	80	P	50	RD--	D16.2	01 1011 0101
581	80	P	50	RD +	D16.2	10 0100 0101
565	81	Q	51	RD+/-	D17.2	10 0011 0101
309	82	R	52	RD+/-	D18.2	01 0011 0101
805	83	S	53	RD+/-	D19.2	11 0010 0101
181	84	T	54	RD+/-	D20.2	00 1011 0101
677	85	U	55	RD+/-	D21.2	10 1010 0101
421	86	V	56	RD+/-	D22.2	01 1010 0101
85	87	W	57	RD +	D23.2	00 0101 0101
933	87	W	57	RD--	D23.2	11 1010 0101
197	88	X	58	RD +	D24.2	00 1100 0101
821	88	X	58	RD--	D24.2	11 0011 0101
613	89	Y	59	RD+/-	D25.2	10 0110 0101
396	96	`	60	RD +	D0.3	01 1000 1100
627	96	`	60	RD--	D0.3	10 0111 0011
467	97	a	61	RD--	D1.3	01 1101 0011
556	97	a	61	RD +	D1.3	10 0010 1100
300	98	b	62	RD +	D2.3	01 0010 1100
723	98	b	62	RD--	D2.3	10 1101 0011
787	99	c	63	RD +	D3.3	11 0001 0011
796	99	c	63	RD--	D3.3	11 0001 1100
172	100	d	64	RD +	D4.3	00 1010 1100
851	100	d	64	RD--	D4.3	11 0101 0011

8-Bit/10-Bit Mapping

659	101	e	65	RD +	D5.3	10 1001 0011	610	153	™	99	RD +	D25.4	10 0110 0010
668	101	e	65	RD--	D5.3	10 1001 1100	621	153	™	99	RD--	D25.4	10 0110 1101
403	102	f	66	RD +	D6.3	01 1001 0011	340	10	LF	0A	RD +	D10.0	01 0101 0100
412	102	f	66	RD--	D6.3	01 1001 1100							
115	103	g	67	RD +	D7.3	00 0111 0011	347	10	LF	0A	RD--	D10.0	01 0101 1011
908	103	g	67	RD--	D7.3	11 1000 1100	836	11	VT	0B	RD +	D11.0	11 0100 0100
108	104	h	68	RD +	D8.3	00 0110 1100	843	11	VT	0B	RD--	D11.0	11 0100 1011
915	104	h	68	RD--	D8.3	11 1001 0011	212	12	FF	0C	RD +	D12.0	00 1101 0100
595	105	i	69	RD +	D9.3	10 0101 0011	219	12	FF	0C	RD--	D12.0	00 1101 1011
604	105	i	69	RD--	D9.3	10 0101 1100	708	13	CR	0D	RD +	D13.0	10 1100 0100
435	112	p	70	RD--	D16.3	01 1011 0011	715	13	CR	0D	RD--	D13.0	10 1100 1011
588	112	p	70	RD +	D16.3	10 0100 1100	452	14	SO	0E	RD +	D14.0	01 1100 0100
563	113	q	71	RD +	D17.3	10 0011 0011	459	14	SO	0E	RD--	D14.0	01 1100 1011
572	113	q	71	RD--	D17.3	10 0011 1100	372	15	SI	0F	RD--	D15.0	01 0111 0100
307	114	r	72	RD +	D18.3	01 0011 0011	651	15	SI	0F	RD +	D15.0	10 1000 1011
316	114	r	72	RD--	D18.3	01 0011 1100	356	26	SUB	1A	RD +	D26.0	01 0110 0100
803	115	s	73	RD +	D19.3	11 0010 0011	363	26	SUB	1A	RD--	D26.0	01 0110 1011
812	115	s	73	RD--	D19.3	11 0010 1100	155	27	ESC	1B	RD +	D27.0	00 1001 1011
179	116	t	74	RD +	D20.3	00 1011 0011	868	27	ESC	1B	RD--	D27.0	11 0110 0100
188	116	t	74	RD--	D20.3	00 1011 1100	228	28	FS	1C	RD +	D28.0	00 1110 0100
675	117	u	75	RD +	D21.3	10 1010 0011	235	28	FS	1C	RD--	D28.0	00 1110 1011
684	117	u	75	RD--	D21.3	10 1010 1100	244	28	FS	1C	RD --	K28.0	00 1111 0100Reserved*
419	118	v	76	RD +	D22.3	01 1010 0011	779	28	FS	1C	RD +	K28.0	11 0000 1011
428	118	v	76	RD--	D22.3	01 1010 1100	283	29	GS	1D	RD +	D29.0	01 0001 1011
92	119	w	77	RD +	D23.3	00 0101 1100	740	29	GS	1D	RD--	D29.0	10 1110 0100
931	119	w	77	RD--	D23.3	11 1010 0011	484	30	RS	1E	RD--	D30.0	01 1110 0100
204	120	x	78	RD +	D24.3	00 1100 1100	539	30	RS	1E	RD +	D30.0	10 0001 1011
819	120	x	78	RD--	D24.3	11 0011 0011	331	31	US	1F	RD +	D31.0	01 0100 1011
611	121	y	79	RD +	D25.3	10 0110 0011	692	31	US	1F	RD--	D31.0	10 1011 0100
620	121	y	79	RD--	D25.3	10 0110 1100	345	42	*	2A	RD+/-	D10.1	01 0101 1001
397	128	_	80	RD +	D0.4	01 1000 1101							
626	128	_	80	RD--	D0.4	10 0111 0010	841	43	+	2B	RD+/-	D11.1	11 0100 1001
466	129	_	81	RD--	D1.4	01 1101 0010	217	44	,	2C	RD+/-	D12.1	00 1101 1001
557	129	_	81	RD +	D1.4	10 0010 1101	713	45	-	2D	RD+/-	D13.1	10 1100 1001
301	130	,	82	RD +	D2.4	01 0010 1101	457	46	.	2E	RD+/-	D14.1	01 1100 1001
722	130	,	82	RD--	D2.4	10 1101 0010	377	47	/	2F	RD--	D15.1	01 0111 1001
786	131	f	83	RD +	D3.4	11 0001 0010	649	47	/	2F	RD +	D15.1	10 1000 1001
797	131	f	83	RD--	D3.4	11 0001 1101							
173	132	"	84	RD +	D4.4	00 1010 1101	361	58	:	3A	RD+/-	D26.1	01 0110 1001
850	132	"	84	RD--	D4.4	11 0101 0010	153	59	;	3B	RD +	D27.1	00 1001 1001
658	133	...	85	RD +	D5.4	10 1001 0010							
						0010	873	59	;	3B	RD--	D27.1	11 0110 1001
669	133	...	85	RD--	D5.4	10 1001 1101	233	60	<	3C	RD+/-	D28.1	00 1110 1001
402	134	†	86	RD +	D6.4	01 1001 0010	249	60	<	3C	RD --	K28.1	00 1111 1001Reserved*
						0010	774	60	<	3C	RD +	K28.1	11 0000 0110
413	134	†	86	RD--	D6.4	01 1001 1101	281	61	=	3D	RD +	D29.1	01 0001 1001
114	135	‡	87	RD +	D7.4	00 0111 0010							
909	135	‡	87	RD--	D7.4	11 1000 1101	745	61	=	3D	RD--	D29.1	10 1110 1001
109	136	^	88	RD +	D8.4	00 0110 1101	489	62	>	3E	RD--	D30.1	01 1110 1001
914	136	^	88	RD--	D8.4	11 1001 0010	537	62	>	3E	RD +	D30.1	10 0001 1001
594	137	‰	89	RD +	D9.4	10 0101 0010	329	63	?	3F	RD +	D31.1	01 0100 1001
						0010							
605	137	‰	89	RD--	D9.4	10 0101 1101	697	63	?	3F	RD--	D31.1	10 1011 1001
434	144	_	90	RD--	D16.4	01 1011 0010	341	74	J	4A	RD+/-	D10.2	01 0101 0101
589	144	_	90	RD +	D16.4	10 0100 1101							
562	145	'	91	RD +	D17.4	10 0011 0010	837	75	K	4B	RD+/-	D11.2	11 0100 0101
573	145	'	91	RD--	D17.4	10 0011 1101	213	76	L	4C	RD+/-	D12.2	00 1101 0101
306	146	'	92	RD +	D18.4	01 0011 0010	709	77	M	4D	RD+/-	D13.2	10 1100 0101
317	146	'	92	RD--	D18.4	01 0011 1101	453	78	N	4E	RD+/-	D14.2	01 1100 0101
802	147	"	93	RD +	D19.4	11 0010 0010	373	79	O	4F	RD--	D15.2	01 0111 0101
813	147	"	93	RD--	D19.4	11 0010 1101	645	79	O	4F	RD +	D15.2	10 1000 0101
178	148	"	94	RD +	D20.4	00 1011 0010							
189	148	"	94	RD--	D20.4	00 1011 1101	357	90	Z	5A	RD+/-	D26.2	01 0110 0101
674	149	•	95	RD +	D21.4	10 1010 0010	149	91	[	5B	RD +	D27.2	00 1001 0101
						0010							
685	149	•	95	RD--	D21.4	10 1010 1101	869	91	[	5B	RD--	D27.2	11 0110 0101
418	150	—	96	RD +	D22.4	01 1010 0010	229	92	\	5C	RD+/-	D28.2	00 1110 0101
						0010	245	92	\	5C	RD --	K28.2	00 1111 0101Reserved*
429	150	—	96	RD--	D22.4	01 1010 1101	778	92	\	5C	RD +	K28.2	11 0000 1010
93	151	—	97	RD +	D23.4	00 0101 1101	277	93	]	5D	RD +	D29.2	01 0001 0101
930	151	—	97	RD--	D23.4	11 1010 0010							
205	152	~	98	RD +	D24.4	00 1100 1101	741	93	]	5D	RD--	D29.2	10 1110 0101
818	152	~	98	RD--	D24.4	11 0011 0010	485	94	^	5E	RD--	D30.2	01 1110 0101

533	94	^	5E	RD +	D30.2	10 0001 0101	410	166	!	A6	RD+/-	D6.5	01 1001 1010
325	95	_	5F	RD +	D31.2	01 0100 0101	122	167	§	A7	RD +	D7.5	00 0111 1010
693	95	_	5F	RD--	D31.2	10 1011 0101	906	167	§	A7	RD--	D7.5	11 1000 1010
339	106	j	6A	RD +	D10.3	01 0101 0011	106	168	~	A8	RD +	D8.5	00 0110 1010
348	106	j	6A	RD--	D10.3	01 0101 1100	922	168	~	A8	RD--	D8.5	11 1001 1010
835	107	k	6B	RD +	D11.3	11 0100 0011	602	169	©	A9	RD+/-	D9.5	10 0101 1010
844	107	k	6B	RD--	D11.3	11 0100 1100	346	170	^a	AA	RD+/-	D10.5	01 0101 1010
211	108	l	6C	RD +	D12.3	00 1101 0011	842	171	«	AB	RD+/-	D11.5	11 0100 1010
220	108	l	6C	RD--	D12.3	00 1101 1100	218	172	¬	AC	RD+/-	D12.5	00 1101 1010
707	109	m	6D	RD +	D13.3	10 1100 0011	714	173	-	AD	RD+/-	D13.5	10 1100 1010
716	109	m	6D	RD--	D13.3	10 1100 1100	458	174	®	AE	RD+/-	D14.5	01 1100 1010
451	110	n	6E	RD +	D14.3	01 1100 0011	378	175	-	AF	RD--	D15.5	01 0111 1010
460	110	n	6E	RD--	D14.3	01 1100 1100	650	175	-	AF	RD +	D15.5	10 1000 1010
371	111	o	6F	RD--	D15.3	01 0111 0011	442	176	°	B0	RD--	D16.5	01 1011 1010
652	111	o	6F	RD +	D15.3	10 1000 1100	586	176	°	B0	RD +	D16.5	10 0100 1010
355	122	z	7A	RD +	D26.3	01 0110 0011	570	177	±	B1	RD+/-	D17.5	10 0011 1010
364	122	z	7A	RD--	D26.3	01 0110 1100	314	178	^z	B2	RD+/-	D18.5	01 0011 1010
156	123	{	7B	RD +	D27.3	00 1001 1100	810	179	³	B3	RD+/-	D19.5	11 0010 1010
867	123	{	7B	RD--	D27.3	11 0110 0011	186	180	'	B4	RD+/-	D20.5	00 1011 1010
227	124		7C	RD +	D28.3	00 1110 0011	682	181	μ	B5	RD+/-	D21.5	10 1010 1010
236	124		7C	RD--	D28.3	00 1110 1100	426	182	¶	B6	RD+/-	D22.5	01 1010 1010
243	124		7C	RD --	K28.3	00 1111 0011 Reserved*	90	183	·	B7	RD +	D23.5	00 0101 1010
780	124		7C	RD +	K28.3	11 0000 1100	938	183	·	B7	RD--	D23.5	11 1010 1010
284	125	}	7D	RD +	D29.3	01 0001 1100	202	184	,	B8	RD +	D24.5	00 1100 1010
739	125	}	7D	RD--	D29.3	10 1110 0011	826	184	,	B8	RD--	D24.5	11 0011 1010
483	126	~	7E	RD--	D30.3	01 1110 0011	618	185	¹	B9	RD+/-	D25.5	10 0110 1010
540	126	~	7E	RD +	D30.3	10 0001 1100	362	186	°	BA	RD+/-	D26.5	01 0110 1010
332	127	DELETE	7F	RD +	D31.3	01 0100 1100	154	187	»	BB	RD +	D27.5	00 1001 1010
691	127	DELETE	7F	RD--	D31.3	10 1011 0011	874	187	»	BB	RD--	D27.5	11 0110 1010
338	138	Š	8A	RD +	D10.4	01 0101 0010	234	188	^¼	BC	RD+/-	D28.5	00 1110 1010
349	138	Š	8A	RD--	D10.4	01 0101 1101	250	188	^¼	BC	RD --	K28.5	00 1111 1010 Sync
834	139	‹	8B	RD +	D11.4	11 0100 0010	773	188	^¼	BC	RD +	K28.5	11 0000 0101 (Not Used)
845	139	‹	8B	RD--	D11.4	11 0100 1101	282	189	^½	BD	RD +	D29.5	01 0001 1010
210	140	Œ	8C	RD +	D12.4	00 1101 0010	746	189	^½	BD	RD--	D29.5	10 1110 1010
221	140	Œ	8C	RD--	D12.4	00 1101 1101	490	190	^¾	BE	RD--	D30.5	01 1110 1010
706	141	_	8D	RD +	D13.4	10 1100 0010	538	190	^¾	BE	RD +	D30.5	10 0001 1010
717	141	_	8D	RD--	D13.4	10 1100 1101	330	191	¿	BF	RD +	D31.5	01 0100 1010
450	142	_	8E	RD +	D14.4	01 1100 0010	698	191	¿	BF	RD--	D31.5	10 1011 1010
461	142	_	8E	RD--	D14.4	01 1100 1101	390	192	À	C0	RD +	D0.6	01 1000 0110
370	143	_	8F	RD--	D15.4	01 0111 0010	630	192	À	C0	RD--	D0.6	10 0111 0110
653	143	_	8F	RD +	D15.4	10 1000 1101	470	193	Á	C1	RD--	D1.6	01 1101 0110
354	154	š	9A	RD +	D26.4	01 0110 0010	550	193	Á	C1	RD +	D1.6	10 0010 0110
365	154	š	9A	RD--	D26.4	01 0110 1101	294	194	Â	C2	RD +	D2.6	01 0010 0110
157	155	›	9B	RD +	D27.4	00 1001 1101	726	194	Â	C2	RD--	D2.6	10 1101 0110
866	155	›	9B	RD--	D27.4	11 0110 0010	790	195	Ã	C3	RD+/-	D3.6	11 0001 0110
226	156	œ	9C	RD +	D28.4	00 1110 0010	166	196	Ä	C4	RD +	D4.6	00 1010 0110
237	156	œ	9C	RD--	D28.4	00 1110 1101	854	196	Ä	C4	RD--	D4.6	11 0101 0110
242	156	œ	9C	RD --	K28.4	00 1111 0010 Reserved*	662	197	Å	C5	RD+/-	D5.6	10 1001 0110
781	156	œ	9C	RD +	K28.4	11 0000 1101	406	198	Æ	C6	RD+/-	D6.6	01 1001 0110
285	157	_	9D	RD +	D29.4	01 0001 1101	118	199	Ç	C7	RD +	D7.6	00 0111 0110
738	157	_	9D	RD--	D29.4	10 1110 0010	902	199	Ç	C7	RD--	D7.6	11 1000 0110
482	158	_	9E	RD--	D30.4	01 1110 0010	102	200	È	C8	RD +	D8.6	00 0110 0110
541	158	_	9E	RD +	D30.4	10 0001 1101	918	200	È	C8	RD--	D8.6	11 1001 0110
333	159	Ÿ	9F	RD +	D31.4	01 0100 1101	598	201	É	C9	RD+/-	D9.6	10 0101 0110
690	159	Ÿ	9F	RD--	D31.4	10 1011 0010	342	202	Ê	CA	RD+/-	D10.6	01 0101 0110
394	160		A0	RD +	D0.5	01 1000 1010	838	203	Ë	CB	RD+/-	D11.6	01 0100 0110
634	160		A0	RD--	D0.5	10 0111 1010	214	204	Ì	CC	RD+/-	D12.6	00 1101 0110
474	161	i	A1	RD--	D1.5	01 1101 1010	710	205	Í	CD	RD+/-	D13.6	10 1100 0110
554	161	i	A1	RD +	D1.5	10 0010 1010	454	206	Î	CE	RD+/-	D14.6	01 1100 0110
298	162	¢	A2	RD +	D2.5	01 0010 1010	374	207	Ï	CF	RD--	D15.6	01 0111 0110
730	162	¢	A2	RD--	D2.5	10 1101 1010	646	207	Ï	CF	RD +	D15.6	10 1000 0110
794	163	£	A3	RD+/-	D3.5	11 0001 1010	438	208	Ð	D0	RD--	D16.6	01 1011 0110
170	164	¤	A4	RD +	D4.5	00 1010 1010	582	208	Ð	D0	RD +	D16.6	10 0100 0110
858	164	¤	A4	RD--	D4.5	11 0101 1010							
666	165	¥	A5	RD+/-	D5.5	10 1001 1010							

566	209	Ñ	D1	RD+/-	D17.6	10 0011 0110	430	246	ö	F6	RD--	D22.7	01 1010 1110
310	210	Ò	D2	RD+/-	D18.6	01 0011 0110	87	247	÷	F7	RD +	K23.7	00 0101 0111
806	211	Ó	D3	RD+/-	D19.6	11 0010 0110	94	247	÷	F7	RD +	D23.7	00 0101 1110
182	212	Ô	D4	RD+/-	D20.6	00 1011 0110	929	247	÷	F7	RD--	D23.7	11 1010 0001
678	213	Õ	D5	RD+/-	D21.6	10 1010 0110	936	247	÷	F7	RD --	K23.7	11 1010 1000Reserved*
422	214	Ö	D6	RD+/-	D22.6	01 1010 0110	206	248	ø	F8	RD +	D24.7	00 1100 1110
86	215	×	D7	RD +	D23.6	00 0101 0110	817	248	ø	F8	RD--	D24.7	11 0011 0001
934	215	×	D7	RD--	D23.6	11 1010 0110	609	249	ù	F9	RD +	D25.7	10 0110 0001
198	216	Ø	D8	RD +	D24.6	00 1100 0110	622	249	ù	F9	RD--	D25.7	10 0110 1110
822	216	Ø	D8	RD--	D24.6	11 0011 0110	353	250	ú	FA	RD +	D26.7	01 0110 0001
614	217	Ù	D9	RD+/-	D25.6	10 0110 0110	366	250	ú	FA	RD--	D26.7	01 0110 1110
358	218	Ú	DA	RD+/-	D26.6	01 0110 0110	151	251	û	FB	RD +	K27.7	00 1001 0111
150	219	Û	DB	RD +	D27.6	00 1001 0110	158	251	û	FB	RD +	D27.7	00 1001 1110
870	219	Ü	DB	RD--	D27.6	11 0110 0110	865	251	û	FB	RD--	D27.7	11 0110 0001
230	220	Ü	DC	RD+/-	D28.6	00 1110 0110	872	251	û	FB	RD --	K27.7	11 0110 1000Reserved*
246	220	Û	DC	RD --	K28.6	00 1111 0110Reserved*	225	252	ü	FC	RD +	D28.7	00 1110 0001
777	220	Û	DC	RD +	K28.6	11 0000 1001	238	252	ü	FC	RD--	D28.7	00 1110 1110
278	221	Ý	DD	RD +	D29.6	01 0001 0110	248	252	ü	FC	RD --	K28.7	00 1111 1000Test
742	221	Ý	DD	RD--	D29.6	10 1110 0110	775	252	ü	FC	RD +	K28.7	11 0000 0111
486	222	Þ	DE	RD--	D30.6	01 1110 0110	279	253	ý	FD	RD +	K29.7	01 0001 0111
534	222	Þ	DE	RD +	D30.6	10 0001 0110	286	253	ý	FD	RD +	D29.7	01 0001 1110
326	223	ß	DF	RD +	D31.6	01 0100 0110	737	253	ý	FD	RD--	D29.7	10 1110 0001
694	223	ß	DF	RD--	D31.6	10 1011 0110	744	253	ý	FD	RD --	K29.7	10 1110 1000Reserved*
398	224	à	E0	RD +	D0.7	01 1000 1110	481	254	þ	FE	RD--	D30.7	01 1110 0001
625	224	à	E0	RD--	D0.7	10 0111 0001	488	254	þ	FE	RD --	K30.7	01 1110 1000Reserved*
465	225	á	E1	RD--	D1.7	01 1101 0001	535	254	þ	FE	RD +	K30.7	10 0001 0111
558	225	á	E1	RD +	D1.7	10 0010 1110	542	254	þ	FE	RD +	D30.7	10 0001 1110
302	226	â	E2	RD +	D2.7	01 0010 1110	334	255	ÿ	FF	RD +	D31.7	01 0100 1110
721	226	â	E2	RD--	D2.7	10 1101 0001	689	255	ÿ	FF	RD--	D31.7	10 1011 0001
785	227	ã	E3	RD +	D3.7	11 0001 0001							
798	227	ã	E3	RD--	D3.7	11 0001 1110							
174	228	ä	E4	RD +	D4.7	00 1010 1110							
849	228	ä	E4	RD--	D4.7	11 0101 0001							
657	229	å	E5	RD +	D5.7	10 1001							
						0001							
670	229	å	E5	RD--	D5.7	10 1001 1110							
401	230	æ	E6	RD +	D6.7	01 1001							
						0001							
414	230	æ	E6	RD--	D6.7	01 1001 1110							
113	231	ç	E7	RD +	D7.7	00 0111 0001							
910	231	ç	E7	RD--	D7.7	11 1000 1110							
110	232	è	E8	RD +	D8.7	00 0110 1110							
913	232	è	E8	RD--	D8.7	11 1001 0001							
593	233	é	E9	RD +	D9.7	10 0101							
						0001							
606	233	é	E9	RD--	D9.7	10 0101 1110							
337	234	ê	EA	RD +	D10.7	01 0101							
						0001							
350	234	ê	EA	RD--	D10.7	01 0101 1110							
840	235	ë	EB	RD +	D11.7	11 0100 1000							
846	235	ë	EB	RD--	D11.7	11 0100 1110							
209	236	ì	EC	RD +	D12.7	00 1101 0001							
222	236	ì	EC	RD--	D12.7	00 1101 1110							
712	237	í	ED	RD +	D13.7	10 1100 1000							
718	237	í	ED	RD--	D13.7	10 1100 1110							
456	238	î	EE	RD +	D14.7	01 1100 1000							
462	238	î	EE	RD--	D14.7	01 1100 1110							
369	239	ï	EF	RD--	D15.7	01 0111 0001							
654	239	ï	EF	RD +	D15.7	10 1000 1110							
433	240	ð	F0	RD--	D16.7	01 1011 0001							
590	240	ð	F0	RD +	D16.7	10 0100 1110							
561	241	ñ	F1	RD +	D17.7	10 0011 0001							
567	241	ñ	F1	RD--	D17.7	10 0011 0111							
305	242	ò	F2	RD +	D18.7	01 0011 0001							
311	242	ò	F2	RD--	D18.7	01 0011 0111							
801	243	ó	F3	RD +	D19.7	11 0010 0001							
814	243	ó	F3	RD--	D19.7	11 0010 1110							
177	244	ô	F4	RD +	D20.7	00 1011 0001							
183	244	ô	F4	RD--	D20.7	00 1011 0111							
673	245	õ	F5	RD +	D21.7	10 1010							
						0001							
686	245	õ	F5	RD--	D21.7	10 1010 1110							
417	246	ö	F6	RD +	D22.7	01 1010							
						0001							

The following table lists:

Legal 10-bit Values Sorted by K/D Code

10B Dec	8B Dec	ASCII+	HEX	Previous Disparity	Data Byte FC	10 B Name	COMMENT
395	0	NUL	00	RD +	D0.0	01 1000 1011	
628	0	NUL	00	RD--	D0.0	10 0111 0100	
393	32	SPACE	20	RD +	D0.1	01 1000 1001	
633	32	SPACE	20	RD--	D0.1	10 0111 1001	
389	64	@	40	RD +	D0.2	01 1000 0101	
629	64	@	40	RD--	D0.2	10 0111 0101	
396	96	`	60	RD +	D0.3	01 1000 1100	
627	96	`	60	RD--	D0.3	10 0111 0011	
397	128	_	80	RD +	D0.4	01 1000 1101	
626	128	_	80	RD--	D0.4	10 0111 0010	
394	160		A0	RD +	D0.5	01 1000 1010	
634	160		A0	RD--	D0.5	10 0111 1010	
390	192	À	C0	RD +	D0.6	01 1000 0110	
630	192	À	C0	RD--	D0.6	10 0111 0110	
398	224	à	E0	RD +	D0.7	01 1000 1110	
625	224	à	E0	RD--	D0.7	10 0111 0001	
468	1	SOH	01	RD--	D1.0	01 1101 0100	
555	1	SOH	01	RD +	D1.0	10 0010 1011	
473	33	!	21	RD--	D1.1	01 1101 1001	
553	33	!	21	RD +	D1.1	10 0010 1001	
469	65	A	41	RD--	D1.2	01 1101 0101	
549	65	A	41	RD +	D1.2	10 0010 0101	
467	97	a	61	RD--	D1.3	01 1101 0011	
556	97	a	61	RD +	D1.3	10 0010 1100	
466	129	_	81	RD--	D1.4	01 1101 0010	
557	129	_	81	RD +	D1.4	10 0010 1101	
474	161	ı	A1	RD--	D1.5	01 1101 1010	
554	161	ı	A1	RD +	D1.5	10 0010 1010	
470	193	Á	C1	RD--	D1.6	01 1101 0110	
550	193	Á	C1	RD +	D1.6	10 0010 0110	
465	225	á	E1	RD--	D1.7	01 1101 0001	
558	225	á	E1	RD +	D1.7	10 0010 1110	
340	10	LF	0A	RD +	D10.0	01 0101 0100	
347	10	LF	0A	RD--	D10.0	01 0101 1011	
345	42	*	2A	RD+/-	D10.1	01 0101 1001	
341	74	J	4A	RD+/-	D10.2	01 0101 0101	
339	106	j	6A	RD +	D10.3	01 0101 0011	
348	106	j	6A	RD--	D10.3	01 0101 1100	
338	138	Š	8A	RD +	D10.4	01 0101 0010	
349	138	Š	8A	RD--	D10.4	01 0101 1101	
346	170	ª	AA	RD+/-	D10.5	01 0101 1010	
342	202	Ê	CA	RD+/-	D10.6	01 0101 0110	
337	234	ê	EA	RD +	D10.7	01 0101 0001	
350	234	ê	EA	RD--	D10.7	01 0101 1110	
836	11	VT	0B	RD +	D11.0	11 0100 0100	
843	11	VT	0B	RD--	D11.0	11 0100 1011	
841	43	+	2B	RD+/-	D11.1	11 0100 1001	
837	75	K	4B	RD+/-	D11.2	11 0100 0101	
835	107	k	6B	RD +	D11.3	11 0100 0011	
844	107	k	6B	RD--	D11.3	11 0100 1100	
834	139	‹	8B	RD +	D11.4	11 0100 0010	
845	139	‹	8B	RD--	D11.4	11 0100 1101	
842	171	«	AB	RD+/-	D11.5	11 0100 1010	
838	203	Ë	CB	RD+/-	D11.6	11 0100 0110	
840	235	ë	EB	RD +	D11.7	11 0100 1000	
846	235	ë	EB	RD--	D11.7	11 0100 1110	
212	12	FF	0C	RD +	D12.0	00 1101 0100	
219	12	FF	0C	RD--	D12.0	00 1101 1011	
217	44	,	2C	RD+/-	D12.1	00 1101 1001	
213	76	L	4C	RD+/-	D12.2	00 1101 0101	
211	108	l	6C	RD +	D12.3	00 1101 0011	
220	108	l	6C	RD--	D12.3	00 1101 1100	
210	140	œ	8C	RD +	D12.4	00 1101 0010	
221	140	œ	8C	RD--	D12.4	00 1101 1101	
218	172	ŕ	AC	RD+/-	D12.5	00 1101 1010	
214	204	ì	CC	RD+/-	D12.6	00 1101 0110	
209	236	ì	EC	RD +	D12.7	00 1101 0001	
222	236	ì	EC	RD--	D12.7	00 1101 1110	
708	13	CR	0D	RD +	D13.0	10 1100 0100	
715	13	CR	0D	RD--	D13.0	10 1100 1011	
713	45	-	2D	RD+/-	D13.1	10 1100 1001	
709	77	M	4D	RD+/-	D13.2	10 1100 0101	
707	109	m	6D	RD +	D13.3	10 1100 0011	
716	109	m	6D	RD--	D13.3	10 1100 1100	
706	141	_	8D	RD +	D13.4	10 1100 0010	
717	141	_	8D	RD--	D13.4	10 1100 1101	
714	173	-	AD	RD+/-	D13.5	10 1100 1010	
710	205	í	CD	RD+/-	D13.6	10 1100 0110	
712	237	í	ED	RD +	D13.7	10 1100 1000	
718	237	í	ED	RD--	D13.7	10 1100 1110	
452	14	SO	0E	RD +	D14.0	01 1100 0100	
459	14	SO	0E	RD--	D14.0	01 1100 1011	
457	46	.	2E	RD+/-	D14.1	01 1100 1001	
453	78	N	4E	RD+/-	D14.2	01 1100 0101	
451	110	n	6E	RD +	D14.3	01 1100 0011	
460	110	n	6E	RD--	D14.3	01 1100 1100	
450	142	_	8E	RD +	D14.4	01 1100 0010	
461	142	_	8E	RD--	D14.4	01 1100 1101	
458	174	®	AE	RD+/-	D14.5	01 1100 1010	
454	206	î	CE	RD+/-	D14.6	01 1100 0110	
456	238	î	EE	RD +	D14.7	01 1100 1000	
462	238	î	EE	RD--	D14.7	01 1100 1110	
372	15	SI	0F	RD--	D15.0	01 0111 0100	
651	15	SI	0F	RD +	D15.0	10 1000 1011	
377	47	/	2F	RD--	D15.1	01 0111 1001	
649	47	/	2F	RD +	D15.1	10 1000 1001	
373	79	O	4F	RD--	D15.2	01 0111 0101	
645	79	O	4F	RD +	D15.2	10 1000 0101	
371	111	o	6F	RD--	D15.3	01 0111 0011	
652	111	o	6F	RD +	D15.3	10 1000 1100	
370	143	_	8F	RD--	D15.4	01 0111 0010	
653	143	_	8F	RD +	D15.4	10 1000 1101	
378	175	™	AF	RD--	D15.5	01 0111 1010	
650	175	™	AF	RD +	D15.5	10 1000 1010	
374	207	ÿ	CF	RD--	D15.6	01 0111 0110	
646	207	ÿ	CF	RD +	D15.6	10 1000 0110	
369	239	ÿ	EF	RD--	D15.7	01 0111 0001	
654	239	ÿ	EF	RD +	D15.7	10 1000 1110	
436	16	DLE	10	RD--	D16.0	01 1011 0100	
587	16	DLE	10	RD +	D16.0	10 0100 1011	
441	48	0	30	RD--	D16.1	01 1011 1001	
585	48	0	30	RD +	D16.1	10 0100 1001	
437	80	P	50	RD--	D16.2	01 1011 0101	
581	80	P	50	RD +	D16.2	10 0100 0101	
435	112	p	70	RD--	D16.3	01 1011 0011	
588	112	p	70	RD +	D16.3	10 0100 1100	
434	144	_	90	RD--	D16.4	01 1011 0010	
589	144	_	90	RD +	D16.4	10 0100 1101	
442	176	°	B0	RD--	D16.5	01 1011 1010	
586	176	°	B0	RD +	D16.5	10 0100 1010	
438	208	Ð	D0	RD--	D16.6	01 1011 0110	
582	208	Ð	D0	RD +	D16.6	10 0100 0110	
433	240	ð	F0	RD--	D16.7	01 1011 0001	
590	240	ð	F0	RD +	D16.7	10 0100 1110	
564	17	DC1	11	RD +	D17.0	10 0011 0100	
571	17	DC1	11	RD--	D17.0	10 0011 1011	
569	49	1	31	RD+/-	D17.1	10 0011 1001	
565	81	Q	51	RD+/-	D17.2	10 0011 0101	
563	113	q	71	RD +	D17.3	10 0011 0011	
572	113	q	71	RD--	D17.3	10 0011 1100	
562	145	'	91	RD +	D17.4	10 0011 0010	

573	145	'	91	RD--	D17.4	10 0011 1101	419	118	v	76	RD +	D22.3	01 1010 0011
570	177	±	B1	RD+/-	D17.5	10 0011 1010	428	118	v	76	RD--	D22.3	01 1010 1100
566	209	Ñ	D1	RD+/-	D17.6	10 0011 0110	418	150	–	96	RD +	D22.4	01 1010 0010
561	241	ñ	F1	RD +	D17.7	10 0011 0001	429	150	–	96	RD--	D22.4	01 1010 1101
567	241	ñ	F1	RD--	D17.7	10 0011 0111	426	182	¶	B6	RD+/-	D22.5	01 1010 1010
308	18	DC2	12	RD +	D18.0	01 0011 0100	422	214	Ö	D6	RD+/-	D22.6	01 1010 0110
315	18	DC2	12	RD--	D18.0	01 0011 1011	417	246	ö	F6	RD +	D22.7	01 1010 0001
313	50	2	32	RD+/-	D18.1	01 0011 1001	430	246	ö	F6	RD--	D22.7	01 1010 1110
309	82	R	52	RD+/-	D18.2	01 0011 0101	91	23	ETB	17	RD +	D23.0	00 0101 1011
307	114	r	72	RD +	D18.3	01 0011 0011	932	23	ETB	17	RD--	D23.0	11 1010 0100
316	114	r	72	RD--	D18.3	01 0011 1100	89	55	7	37	RD +	D23.1	00 0101 1001
306	146	'	92	RD +	D18.4	01 0011 0010	937	55	7	37	RD--	D23.1	11 1010 1001
317	146	'	92	RD--	D18.4	01 0011 1101	85	87	W	57	RD +	D23.2	00 0101 0101
314	178	²	B2	RD+/-	D18.5	01 0011 1010	933	87	W	57	RD--	D23.2	11 1010 0101
310	210	Ö	D2	RD+/-	D18.6	01 0011 0110	92	119	w	77	RD +	D23.3	00 0101 1100
305	242	ò	F2	RD +	D18.7	01 0011 0001	931	119	w	77	RD--	D23.3	11 1010 0011
311	242	ò	F2	RD--	D18.7	01 0011 0111	93	151	—	97	RD +	D23.4	00 0101 1101
804	19	DC3	13	RD +	D19.0	11 0010 0100	930	151	—	97	RD--	D23.4	11 1010 0010
811	19	DC3	13	RD--	D19.0	11 0010 1011	90	183	·	B7	RD +	D23.5	00 0101 1010
809	51	3	33	RD+/-	D19.1	11 0010 1001	938	183	·	B7	RD--	D23.5	11 1010 1010
805	83	S	53	RD+/-	D19.2	11 0010 0101	86	215	×	D7	RD +	D23.6	00 0101 0110
803	115	s	73	RD +	D19.3	11 0010 0011	934	215	×	D7	RD--	D23.6	11 1010 0110
812	115	s	73	RD--	D19.3	11 0010 1100	94	247	÷	F7	RD +	D23.7	00 0101 1110
802	147	"	93	RD +	D19.4	11 0010 0010	929	247	÷	F7	RD--	D23.7	11 1010 0001
813	147	"	93	RD--	D19.4	11 0010 1101	203	24	CAN	18	RD +	D24.0	00 1100 1011
810	179	³	B3	RD+/-	D19.5	11 0010 1010	820	24	CAN	18	RD--	D24.0	11 0011 0100
806	211	Ó	D3	RD+/-	D19.6	11 0010 0110	201	56	8	38	RD +	D24.1	00 1100 1001
801	243	ó	F3	RD +	D19.7	11 0010 0001	825	56	8	38	RD--	D24.1	11 0011 1001
814	243	ó	F3	RD--	D19.7	11 0010 1110	197	88	X	58	RD +	D24.2	00 1100 0101
299	2	STX	02	RD +	D2.0	01 0010 1011	821	88	X	58	RD--	D24.2	11 0011 0101
724	2	STX	02	RD--	D2.0	10 1101 0100	204	120	x	78	RD +	D24.3	00 1100 1100
297	34	"	22	RD +	D2.1	01 0010 1001	819	120	x	78	RD--	D24.3	11 0011 0011
729	34	"	22	RD--	D2.1	10 1101 1001	205	152	~	98	RD +	D24.4	00 1100 1101
293	66	B	42	RD +	D2.2	01 0010 0101	818	152	~	98	RD--	D24.4	11 0011 0010
725	66	B	42	RD--	D2.2	10 1101 0101	202	184	,	B8	RD +	D24.5	00 1100 1010
300	98	b	62	RD +	D2.3	01 0010 1100	826	184	,	B8	RD--	D24.5	11 0011 1010
723	98	b	62	RD--	D2.3	10 1101 0011	198	216	Ø	D8	RD +	D24.6	00 1100 0110
301	130	,	82	RD +	D2.4	01 0010 1101	822	216	Ø	D8	RD--	D24.6	11 0011 0110
722	130	,	82	RD--	D2.4	10 1101 0010	206	248	ø	F8	RD +	D24.7	00 1100 1110
298	162	¢	A2	RD +	D2.5	01 0010 1010	817	248	ø	F8	RD--	D24.7	11 0011 0001
730	162	¢	A2	RD--	D2.5	10 1101 1010	612	25	EM	19	RD +	D25.0	10 0110 0100
294	194	À	C2	RD +	D2.6	01 0010 0110	619	25	EM	19	RD--	D25.0	10 0110 1011
726	194	À	C2	RD--	D2.6	10 1101 0110	617	57	9	39	RD+/-	D25.1	10 0110 1001
302	226	â	E2	RD +	D2.7	01 0010 1110	613	89	Y	59	RD+/-	D25.2	10 0110 0101
721	226	â	E2	RD--	D2.7	10 1101 0001	611	121	y	79	RD +	D25.3	10 0110 0011
180	20	DC4	14	RD +	D20.0	00 1011 0100	620	121	y	79	RD--	D25.3	10 0110 1100
187	20	DC4	14	RD--	D20.0	00 1011 1011	610	153	™	99	RD +	D25.4	10 0110 0010
185	52	4	34	RD+/-	D20.1	00 1011 1001	621	153	™	99	RD--	D25.4	10 0110 1101
181	84	T	54	RD+/-	D20.2	00 1011 0101	618	185	¹	B9	RD+/-	D25.5	10 0110 1010
179	116	t	74	RD +	D20.3	00 1011 0011	614	217	Û	D9	RD+/-	D25.6	10 0110 0110
188	116	t	74	RD--	D20.3	00 1011 1100	609	249	ù	F9	RD +	D25.7	10 0110 0001
178	148	"	94	RD +	D20.4	00 1011 0010	622	249	ù	F9	RD--	D25.7	10 0110 1110
189	148	"	94	RD--	D20.4	00 1011 1101	356	26	SUB	1A	RD +	D26.0	01 0110 0100
186	180	´	B4	RD+/-	D20.5	00 1011 1010	363	26	SUB	1A	RD--	D26.0	01 0110 1011
182	212	Ô	D4	RD+/-	D20.6	00 1011 0110	361	58	:	3A	RD+/-	D26.1	01 0110 1001
177	244	ô	F4	RD +	D20.7	00 1011 0001	357	90	Z	5A	RD+/-	D26.2	01 0110 0101
183	244	ô	F4	RD--	D20.7	00 1011 0111	355	122	z	7A	RD +	D26.3	01 0110 0011
676	21	NAK	15	RD +	D21.0	10 1010 0100	364	122	z	7A	RD--	D26.3	01 0110 1100
683	21	NAK	15	RD--	D21.0	10 1010 1011	354	154	š	9A	RD +	D26.4	01 0110 0010
681	53	5	35	RD+/-	D21.1	10 1010 1001	365	154	š	9A	RD--	D26.4	01 0110 1101
677	85	U	55	RD+/-	D21.2	10 1010 0101	362	186	º	BA	RD+/-	D26.5	01 0110 1010
675	117	u	75	RD +	D21.3	10 1010 0011	358	218	Û	DA	RD+/-	D26.6	01 0110 0110
684	117	u	75	RD--	D21.3	10 1010 1100	353	250	ú	FA	RD +	D26.7	01 0110 0001
674	149	•	95	RD +	D21.4	10 1010 0010	366	250	ú	FA	RD--	D26.7	01 0110 1110
685	149	•	95	RD--	D21.4	10 1010 1101	155	27	ESC	1B	RD +	D27.0	00 1001 1011
682	181	µ	B5	RD+/-	D21.5	10 1010 1010	868	27	ESC	1B	RD--	D27.0	11 0110 0100
678	213	Õ	D5	RD+/-	D21.6	10 1010 0110	153	59	;	3B	RD +	D27.1	00 1001 1001
673	245	ö	F5	RD +	D21.7	10 1010 0001	873	59	;	3B	RD--	D27.1	11 0110 1001
686	245	ö	F5	RD--	D21.7	10 1010 1110	149	91	[	5B	RD +	D27.2	00 1001 0101
420	22	SYN	16	RD +	D22.0	01 1010 0100	869	91	[	5B	RD--	D27.2	11 0110 0101
427	22	SYN	16	RD--	D22.0	01 1010 1011	156	123	{	7B	RD +	D27.3	00 1001 1100
425	54	6	36	RD+/-	D22.1	01 1010 1001	867	123	{	7B	RD--	D27.3	11 0110 0011
421	86	V	56	RD+/-	D22.2	01 1010 0101	157	155	>	9B	RD +	D27.4	00 1001 1101

866	155	›	9B	RD--	D27.4	11 0110 0010	330	191	¿	BF	RD +	D31.5	01 0100 1010
154	187	»	BB	RD +	D27.5	00 1001 1010	698	191	¿	BF	RD--	D31.5	10 1011 1010
874	187	»	BB	RD--	D27.5	11 0110 1010	326	223	ß	DF	RD +	D31.6	01 0100 0110
150	219	Û	DB	RD +	D27.6	00 1001 0110	694	223	ß	DF	RD--	D31.6	10 1011 0110
870	219	Û	DB	RD--	D27.6	11 0110 0110	334	255	ÿ	FF	RD +	D31.7	01 0100 1110
158	251	û	FB	RD +	D27.7	00 1001 1110	689	255	ÿ	FF	RD--	D31.7	10 1011 0001
865	251	û	FB	RD--	D27.7	11 0110 0001	171	4	EOT	04	RD +	D4.0	00 1010 1011
228	28	FS	1C	RD +	D28.0	00 1110 0100	852	4	EOT	04	RD--	D4.0	11 0101 0100
235	28	FS	1C	RD--	D28.0	00 1110 1011	169	36	\$	24	RD +	D4.1	00 1010 1001
233	60	<	3C	RD+/-	D28.1	00 1110 1001	857	36	\$	24	RD--	D4.1	11 0101 1001
229	92	\	5C	RD+/-	D28.2	00 1110 0101	165	68	D	44	RD +	D4.2	00 1010 0101
227	124		7C	RD +	D28.3	00 1110 0011	853	68	D	44	RD--	D4.2	11 0101 0101
236	124		7C	RD--	D28.3	00 1110 1100	172	100	d	64	RD +	D4.3	00 1010 1100
226	156	œ	9C	RD +	D28.4	00 1110 0010	851	100	d	64	RD--	D4.3	11 0101 0011
237	156	œ	9C	RD--	D28.4	00 1110 1101	173	132	"	84	RD +	D4.4	00 1010 1101
234	188	¼	BC	RD+/-	D28.5	00 1110 1010	850	132	"	84	RD--	D4.4	11 0101 0010
230	220	Ü	DC	RD+/-	D28.6	00 1110 0110	170	164	□	A4	RD +	D4.5	00 1010 1010
225	252	ü	FC	RD +	D28.7	00 1110 0001	858	164	□	A4	RD--	D4.5	11 0101 1010
238	252	ü	FC	RD--	D28.7	00 1110 1110	166	196	Ä	C4	RD +	D4.6	00 1010 0110
283	29	GS	1D	RD +	D29.0	01 0001 1011	854	196	Ä	C4	RD--	D4.6	11 0101 0110
740	29	GS	1D	RD--	D29.0	10 1110 0100	174	228	ä	E4	RD +	D4.7	00 1010 1110
281	61	=	3D	RD +	D29.1	01 0001 1001	849	228	ä	E4	RD--	D4.7	11 0101 0001
745	61	=	3D	RD--	D29.1	10 1110 1001	660	5	ENQ	05	RD +	D5.0	10 1001 0100
277	93	]	5D	RD +	D29.2	01 0001 0101	667	5	ENQ	05	RD--	D5.0	10 1001 1011
741	93	]	5D	RD--	D29.2	10 1110 0101	665	37	%	25	RD+/-	D5.1	10 1001 1001
284	125	}	7D	RD +	D29.3	01 0001 1100	661	69	E	45	RD+/-	D5.2	10 1001 0101
739	125	}	7D	RD--	D29.3	10 1110 0011	659	101	e	65	RD +	D5.3	10 1001 0011
285	157	—	9D	RD +	D29.4	01 0001 1101	668	101	e	65	RD--	D5.3	10 1001 1100
738	157	—	9D	RD--	D29.4	10 1110 0010	658	133	...	85	RD +	D5.4	10 1001 0010
282	189	½	BD	RD +	D29.5	01 0001 1010	669	133	...	85	RD--	D5.4	10 1001 1101
746	189	½	BD	RD--	D29.5	10 1110 1010	666	165	¥	A5	RD+/-	D5.5	10 1001 1010
278	221	Ý	DD	RD +	D29.6	01 0001 0110	662	197	À	C5	RD+/-	D5.6	10 1001 0110
742	221	Ý	DD	RD--	D29.6	10 1110 0110	657	229	á	E5	RD +	D5.7	10 1001 0001
286	253	ý	FD	RD +	D29.7	01 0001 1110	670	229	á	E5	RD--	D5.7	10 1001 1110
737	253	ý	FD	RD--	D29.7	10 1110 0001	404	6	ACK	06	RD +	D6.0	01 1001 0100
788	3	ETX	03	RD +	D3.0	11 0001 0100	411	6	ACK	06	RD--	D6.0	01 1001 1011
795	3	ETX	03	RD--	D3.0	11 0001 1011	409	38	&	26	RD+/-	D6.1	01 1001 1001
793	35	#	23	RD+/-	D3.1	11 0001 1001	405	70	F	46	RD+/-	D6.2	01 1001 0101
789	67	C	43	RD+/-	D3.2	11 0001 0101	403	102	f	66	RD +	D6.3	01 1001 0011
787	99	c	63	RD +	D3.3	11 0001 0011	412	102	f	66	RD--	D6.3	01 1001 1100
796	99	c	63	RD--	D3.3	11 0001 1100	402	134	†	86	RD +	D6.4	01 1001 0010
786	131	f	83	RD +	D3.4	11 0001 0010	413	134	†	86	RD--	D6.4	01 1001 1101
797	131	f	83	RD--	D3.4	11 0001 1101	410	166	‡	A6	RD+/-	D6.5	01 1001 1010
794	163	£	A3	RD+/-	D3.5	11 0001 1010	406	198	Æ	C6	RD+/-	D6.6	01 1001 0110
790	195	Å	C3	RD+/-	D3.6	11 0001 0110	401	230	æ	E6	RD +	D6.7	01 1001 0001
785	227	ä	E3	RD +	D3.7	11 0001 0001	414	230	æ	E6	RD--	D6.7	01 1001 1110
798	227	ä	E3	RD--	D3.7	11 0001 1110	116	7	BEL	07	RD +	D7.0	00 0111 0100
484	30	RS	1E	RD--	D30.0	01 1110 0100	907	7	BEL	07	RD--	D7.0	11 1000 1011
539	30	RS	1E	RD +	D30.0	10 0001 1011	121	39	'	27	RD +	D7.1	00 0111 1001
489	62	>	3E	RD--	D30.1	01 1110 1001	905	39	'	27	RD--	D7.1	11 1000 1001
537	62	>	3E	RD +	D30.1	10 0001 1001	117	71	G	47	RD +	D7.2	00 0111 0101
485	94	^	5E	RD--	D30.2	01 1110 0101	901	71	G	47	RD--	D7.2	11 1000 0101
533	94	^	5E	RD +	D30.2	10 0001 0101	115	103	g	67	RD +	D7.3	00 0111 0011
483	126	~	7E	RD--	D30.3	01 1110 0011	908	103	g	67	RD--	D7.3	11 1000 1100
540	126	~	7E	RD +	D30.3	10 0001 1100	114	135	‡	87	RD +	D7.4	00 0111 0010
482	158	—	9E	RD--	D30.4	01 1110 0010	909	135	‡	87	RD--	D7.4	11 1000 1101
541	158	—	9E	RD +	D30.4	10 0001 1101	122	167	§	A7	RD +	D7.5	00 0111 1010
490	190	¾	BE	RD--	D30.5	01 1110 1010	906	167	§	A7	RD--	D7.5	11 1000 1010
538	190	¾	BE	RD +	D30.5	10 0001 1010	118	199	Ç	C7	RD +	D7.6	00 0111 0110
486	222	þ	DE	RD--	D30.6	01 1110 0110	902	199	Ç	C7	RD--	D7.6	11 1000 0110
534	222	þ	DE	RD +	D30.6	10 0001 0110	113	231	ç	E7	RD +	D7.7	00 0111 0001
481	254	þ	FE	RD--	D30.7	01 1110 0001	910	231	ç	E7	RD--	D7.7	11 1000 1110
542	254	þ	FE	RD +	D30.7	10 0001 1110	107	8	BS	08	RD +	D8.0	00 0110 1011
331	31	US	1F	RD +	D31.0	01 0100 1011	916	8	BS	08	RD--	D8.0	11 1001 0100
692	31	US	1F	RD--	D31.0	10 1011 0100	105	40	(	28	RD +	D8.1	00 0110 1001
329	63	?	3F	RD +	D31.1	01 0100 1001	921	40	(	28	RD--	D8.1	11 1001 1001
697	63	?	3F	RD--	D31.1	10 1011 1001	101	72	H	48	RD +	D8.2	00 0110 0101
325	95	—	5F	RD +	D31.2	01 0100 0101	917	72	H	48	RD--	D8.2	11 1001 0101
693	95	—	5F	RD--	D31.2	10 1011 0101	108	104	h	68	RD +	D8.3	00 0110 1100
332	127	DELETE	7F	RD +	D31.3	01 0100 1100	915	104	h	68	RD--	D8.3	11 1001 0011
691	127	DELETE	7F	RD--	D31.3	10 1011 0011	109	136	^	88	RD +	D8.4	00 0110 1101
333	159	ÿ	9F	RD +	D31.4	01 0100 1101	914	136	^	88	RD--	D8.4	11 1001 0010
690	159	ÿ	9F	RD--	D31.4	10 1011 0010	106	168	¨	A8	RD +	D8.5	00 0110 1010

8-Bit/10-Bit Mapping

922	168	ˆ	A8	RD--	D8.5	11 1001 1010	
102	200	È	C8	RD +	D8.6	00 0110 0110	
918	200	È	C8	RD--	D8.6	11 1001 0110	
110	232	è	E8	RD +	D8.7	00 0110 1110	
913	232	è	E8	RD--	D8.7	11 1001 0001	
596	9	HT	09	RD +	D9.0	10 0101 0100	
603	9	HT	09	RD--	D9.0	10 0101 1011	
601	41	)	29	RD+/-	D9.1	10 0101 1001	
597	73	l	49	RD+/-	D9.2	10 0101 0101	
595	105	i	69	RD +	D9.3	10 0101 0011	
604	105	i	69	RD--	D9.3	10 0101 1100	
594	137	‰	89	RD +	D9.4	10 0101 0010	
605	137	‰	89	RD--	D9.4	10 0101 1101	
602	169	©	A9	RD+/-	D9.5	10 0101 1010	
598	201	É	C9	RD+/-	D9.6	10 0101 0110	
593	233	é	E9	RD +	D9.7	10 0101 0001	
606	233	é	E9	RD--	D9.7	10 0101 1110	
87	247	÷	F7	RD +	K23.7	00 0101 0111	
936	247	÷	F7	RD --	K23.7	11 1010 1000	Reserved*
151	251	û	FB	RD +	K27.7	00 1001 0111	
872	251	û	FB	RD --	K27.7	11 0110 1000	Reserved*
244	28	FS	1C	RD --	K28.0	00 1111 0100	Reserved*
779	28	FS	1C	RD +	K28.0	11 0000 1011	
249	60	<	3C	RD --	K28.1	00 1111 1001	Reserved*
774	60	<	3C	RD +	K28.1	11 0000 0110	
245	92	\	5C	RD --	K28.2	00 1111 0101	Reserved*
778	92	\	5C	RD +	K28.2	11 0000 1010	
243	124		7C	RD --	K28.3	00 1111 0011	Reserved*
780	124		7C	RD +	K28.3	11 0000 1100	
242	156	œ	9C	RD --	K28.4	00 1111 0010	Reserved*
781	156	œ	9C	RD +	K28.4	11 0000 1101	
250	188	¼	BC	RD --	K28.5	00 1111 1010	Sync
773	188	¼	BC	RD +	K28.5	11 0000 0101	(Not Used)
246	220	Û	DC	RD --	K28.6	00 1111 0110	Reserved*
777	220	Û	DC	RD +	K28.6	11 0000 1001	
248	252	ü	FC	RD --	K28.7	00 1111 1000	Test
775	252	ü	FC	RD +	K28.7	11 0000 0111	
279	253	ý	FD	RD +	K29.7	01 0001 0111	
744	253	ý	FD	RD --	K29.7	10 1110 1000	Reserved*
488	254	þ	FE	RD --	K30.7	01 1110 1000	Reserved*
535	254	þ	FE	RD +	K30.7	10 0001 0111	

Appendix C

Fibre Channel Legal Arbitrated Loop Physical Addresses

This appendix contains legal (neutral disparity) arbitrated loop physical addresses (APLAs) sorted from highest (at the top) to the lowest (at the bottom) priority.

Loop ID	ALPAA HEX	Name	RD -- Code	RD-/+ Code	Previous Running Disparity RD+ Code
7E	00	D0.0	10 0111 0100		01 1000 1011
7D	01	D1.0	01 1101 0100		10 0010 1011
7C	02	D2.0	10 1101 0100		01 0010 1011
7B	04	D4.0	11 0101 0100		00 1010 1011
7A	08	D8.0	11 1001 0100		00 0110 1011
79	0F	D15.0	01 0111 0100		10 1000 1011
78	10	D16.0	01 1011 0100		10 0100 1011
77	17	D23.0	11 1010 0100		00 0101 1011
76	18	D24.0	11 0011 0100		00 1100 1011
75	1B	D27.0	11 0110 0100		00 1001 1011
74	1D	D29.0	10 1110 0100		01 0001 1011
73	1E	D30.0	01 1110 0100		10 0001 1011
72	1F	D31.0	10 1011 0100		01 0100 1011
71	23	D3.1		11 0001 1001	
70	25	D5.1		10 1001 1001	
6F	26	D6.1		01 1001 1001	
6E	27	D7.1	11 1000 1001		00 0111 1001
6D	29	D9.1		10 0101 1001	
6C	2A	D10.1		01 0101 1001	
6B	2B	D11.1		11 0100 1001	
6A	2C	D12.1		00 1101 1001	
69	2D	D13.1		10 1100 1001	
68	2E	D14.1		01 1100 1001	
67	31	D17.1		10 0011 1001	
66	32	D18.1		01 0011 1001	
65	33	D19.1		11 0010 1001	
64	34	D20.1		00 1011 1001	
63	35	D21.1		10 1010 1001	
62	36	D22.1		01 1010 1001	
61	39	D25.1		10 0110 1001	
60	3A	D26.1		01 0110 1001	
5F	3C	D28.1		00 1110 1001	
5E	43	D3.2		11 0001 0101	
5D	45	D5.2		10 1001 0101	
5C	46	D6.2		01 1001 0101	
5B	47	D7.2	11 1000 0101		00 0111 0101
5A	49	D9.2		10 0101 0101	
59	4A	D10.2		01 0101 0101	
58	4B	D11.2		11 0100 0101	
57	4C	D12.2		00 1101 0101	
56	4D	D13.2		10 1100 0101	
55	4E	D14.2		01 1100 0101	
54	51	D17.2		10 0011 0101	
53	52	D18.2		01 0011 0101	
52	53	D19.2		11 0010 0101	
51	54	D20.2		00 1011 0101	
50	55	D21.2		10 1010 0101	
4F	56	D22.2		01 1010 0101	
4E	59	D25.2		10 0110 0101	
4D	5A	D26.2		01 0110 0101	
4C	5C	D28.2		00 1110 0101	
4B	63	D3.3	11 0001 1100		11 0001 0011
4A	65	D5.3	10 1001 1100		10 1001 0011
49	66	D6.3	01 1001 1100		01 1001 0011
48	67	D7.3	11 1000 1100		00 0111 0011
47	69	D9.3	10 0101 1100		10 0101 0011
46	6A	D10.3	01 0101 1100		01 0101 0011
45	6B	D11.3	11 0100 1100		11 0100 0011
44	6C	D12.3	00 1101 1100		00 1101 0011
43	6D	D13.3	10 1100 1100		10 1100 0011
42	6E	D14.3	01 1100 1100		01 1100 0011
41	71	D17.3	10 0011 1100		10 0011 0011
40	72	D18.3	01 0011 1100		01 0011 0011
3F	73	D19.3	11 0010 1100		11 0010 0011
3E	74	D20.3	00 1011 1100		00 1011 0011
3D	75	D21.3	10 1010 1100		10 1010 0011
3C	76	D22.3	01 1010 1100		01 1010 0011

3B	79	D25.3	10 0110 1100		10 0110 0011
3A	7A	D26.3	01 0110 1100		01 0110 0011
39	7C	D28.3	00 1110 1100		00 1110 0011
38	80	D0.4	10 0111 0010		01 1000 1101
37	81	D1.4	01 1101 0010		10 0010 1101
36	82	D2.4	10 1101 0010		01 0010 1101
35	84	D4.4	11 0101 0010		00 1010 1101
34	88	D8.4	11 1001 0010		00 0110 1101
33	8F	D15.4	01 0111 0010		10 1000 1101
32	90	D16.4	01 1011 0010		10 0100 1101
31	97	D23.4	11 1010 0010		00 0101 1101
30	98	D24.4	11 0011 0010		00 1100 1101
2F	9B	D27.4	11 0110 0010		00 1001 1101
2E	9D	D29.4	10 1110 0010		01 0001 1101
2D	9E	D30.4	01 1110 0010		10 0001 1101
2C	9F	D31.4	10 1011 0010		01 0100 1101
2B	A3	D3.5		11 0001 1010	
2A	A5	D5.5		10 1001 1010	
29	A6	D6.5		01 1001 1010	
28	A7	D7.5	11 1000 1010		00 0111 1010
27	A9	D9.5		10 0101 1010	
26	AA	D10.5		01 0101 1010	
25	AB	D11.5		11 0100 1010	
24	AC	D12.5		00 1101 1010	
23	AD	D13.5		10 1100 1010	
22	AE	D14.5		01 1100 1010	
21	B1	D17.5		10 0011 1010	
20	B2	D18.5		01 0011 1010	
1F	B3	D19.5		11 0010 1010	
1E	B4	D20.5		00 1011 1010	
1D	B5	D21.5		10 1010 1010	
1C	B6	D22.5		01 1010 1010	
1B	B9	D25.5		10 0110 1010	
1A	BA	D26.5		01 0110 1010	
19	BC	D28.5		00 1110 1010	
18	C3	D3.6		11 0001 0110	
17	C5	D5.6		10 1001 0110	
16	C6	D6.6		01 1001 0110	
15	C7	D7.6	11 1000 0110		00 0111 0110
14	C9	D9.6		10 0101 0110	
13	CA	D10.6		01 0101 0110	
12	CB	D11.6		11 0100 0110	
11	CC	D12.6		00 1101 0110	
10	CD	D13.6		10 1100 0110	
0F	CE	D14.6		01 1100 0110	
0E	D1	D17.6		10 0011 0110	
0D	D2	D18.6		01 0011 0110	
0C	D3	D19.6		11 0010 0110	
0B	D4	D20.6		00 1011 0110	
0A	D5	D21.6		10 1010 0110	
09	D6	D22.6		01 1010 0110	
08	D9	D25.6		10 0110 0110	
07	DA	D26.6		01 0110 0110	
06	DC	D28.6		00 1110 0110	
05	E0	D0.7	10 0111 0001		01 1000 1110
04	E1	D1.7	01 1101 0001		10 0010 1110
03	E2	D2.7	10 1101 0001		01 0010 1110
02	E4	D4.7	11 0101 0001		00 1010 1110
01	E8	D8.7	11 1001 0001		00 0110 1110
00	EF	D15.7	01 0111 0001		10 1000 1110

Appendix D

Gigabit Ethernet Ordered Sets - Partial List

Gigabit Ethernet defines certain combinations of characters called Ordered Sets. The table in this appendix shows a partial list.

Name	Function	Beginning RD	Ordered Set	8 Bit Hex
C1	Configuration - flip disparity	Positive	K28.5 D21.5 config_reg[7:0] config_reg[15:8]	
C2	Configuration - sustain disparity	Negative	K28.5 D2.2 config_reg	
I1	Idle - correct disparity	Positive	K28.5 D5.6	0xBC 0xC5
I2	Idle - preserve disparity	Negative	K28.5 D16.2	0xBC 0x50
R	Carrier extend	Negative Positive	K23.7	0xF7
S	Start of packet	Negative	K27.7	0xFB
T	End of packet	Negative Positive	K29.7	0xFD
V	Error propagation	Negative Positive	K30.7	0xFE

Appendix E

Primitive Encoding

The table in this appendix ([Table 25](#)) describes a set of the K28.5-based Primitive encoding whose 40-bit values (after 8b10b encoding with either starting running disparity) have a Hamming distance (that is, the number of bits different in two patterns) of at least 8. Unassigned encodings might be used by future versions of this standard (Reprinted from American National Standard T10/1562-D).

Table 25: Primitives with Hamming Distance of 8

1st	2nd	3rd	4th	Assignment
K28.5	D01.3	D01.3	D01.3	ALIGN (2)
K28.5	D01.4	D01.4	D01.4	ACK
K28.5	D01.4	D02.0	D31.4	RRDY (RESERVED 0)
K28.5	D01.4	D04.7	D24.0	NAK (RESERVED 1)
K28.5	D01.4	D07.3	D30.0	CREDIT_BLOCKED
K28.5	D01.4	D16.7	D07.3	NAK (RESERVED 2)
K28.5	D01.4	D24.0	D16.7	RRDY (NORMAL)
K28.5	D01.4	D27.4	D04.7	NAK (CRC ERROR)
K28.5	D01.4	D30.0	D02.0	RRDY (RESERVED 1)
K28.5	D01.4	D31.4	D29.7	NAK (RESERVED 0)

Table 25: Primitives with Hamming Distance of 8

1st	2nd	3rd	4th	Assignment
K28.5	D02.0	D01.4	D29.7	ERROR
K28.5	D02.0	D02.0	D02.0	HARD_RESET
K28.5	D02.0	D04.7	D01.4	CLOSE (RESERVED 1)
K28.5	D02.0	D07.3	D04.7	CLOSE (CLEAR AFFILIATION)
K28.5	D02.0	D16.7	D31.4	
K28.5	D02.0	D24.0	D07.3	BREAK
K28.5	D02.0	D29.7	D16.7	
K28.5	D02.0	D30.0	D27.4	CLOSE (NORMAL)
K28.5	D02.0	D31.4	D30.0	CLOSE (RESERVED 0)
K28.5	D04.7	D01.4	D24.0	BROADCAST (RESERVED 1)
K28.5	D04.7	D02.0	D01.4	BROADCAST (CHANGE)
K28.5	D04.7	D04.7	D04.7	BROADCAST (RESERVED 2)
K28.5	D04.7	D07.3	D29.7	BROADCAST (RESERVED 0)
K28.5	D04.7	D16.7	D02.0	BROADCAST (RESERVED 3)
K28.5	D04.7	D24.0	D31.4	BROADCAST (RESERVED CHANGE 0)
K28.5	D04.7	D27.4	D07.3	BROADCAST (RESERVED CHANGE 1)
K28.5	D04.7	D29.7	D30.0	BROADCAST (RESERVED 4)
K28.5	D04.7	D31.4	D27.4	
K28.5	D07.0	D07.0	D07.0	ALIGN (1)
K28.5	D07.3	D01.4	D31.4	
K28.5	D07.3	D02.0	D04.7	
K28.5	D07.3	D04.7	D30.0	
K28.5	D07.3	D07.3	D07.3	
K28.5	D07.3	D24.0	D29.7	
K28.5	D07.3	D27.4	D16.7	
K28.5	D07.3	D29.7	D27.4	
K28.5	D07.3	D30.0	D24.0	
K28.5	D07.3	D31.4	D02.0	
K28.5	D10.2	D10.2	D27.3	ALIGN (0)
K28.5	D16.7	D01.4	D02.0	
K28.5	D16.7	D02.0	D07.3	
K28.5	D16.7	D04.7	D31.4	

Table 25: Primitives with Hamming Distance of 8

1st	2nd	3rd	4th	Assignment
K28.5	D16.7	D16.7	D16.7	OPEN_ACCEPT
K28.5	D16.7	D24.0	D27.4	
K28.5	D16.7	D27.4	D30.0	
K28.5	D16.7	D29.7	D24.0	
K28.5	D16.7	D30.0	D04.7	
K28.5	D16.7	D31.4	D01.4	
K28.5	D24.0	D01.4	D16.7	
K28.5	D24.0	D02.0	D29.7	
K28.5	D24.0	D04.7	D07.3	SOF
K28.5	D24.0	D07.3	D31.4	EOAF
K28.5	D24.0	D16.7	D27.4	EOF
K28.5	D24.0	D24.0	D24.0	
K28.5	D24.0	D27.4	D02.0	
K28.5	D24.0	D29.7	D04.7	
K28.5	D24.0	D30.0	D01.4	SOAF
K28.5	D27.3	D27.3	D27.3	ALIGN (3)
K28.5	D27.4	D01.4	D07.3	AIP (RESERVED WAITING ON PARTIAL)
K28.5	D27.4	D04.7	D02.0	
K28.5	D27.4	D07.3	D24.0	AIP (WAITING ON CONNECTION)
K28.5	D27.4	D16.7	D30.0	AIP (RESERVED 1)
K28.5	D27.4	D24.0	D04.7	AIP (WAITING ON PARTIAL)
K28.5	D27.4	D27.4	D27.4	AIP (NORMAL)
K28.5	D27.4	D29.7	D01.4	AIP (RESERVED 2)
K28.5	D27.4	D30.0	D29.7	AIP (WAITING ON DEVICE)
K28.5	D27.4	D31.4	D16.7	AIP (RESERVED 0)
K28.5	D29.7	D02.0	D30.0	OPEN_REJECT (RESERVED CONTINUE 0)
K28.5	D29.7	D04.7	D27.4	OPEN_REJECT (RESERVED STOP 1)
K28.5	D29.7	D07.3	D16.7	OPEN_REJECT (RESERVED INITIALIZE 1)
K28.5	D29.7	D16.7	D04.7	OPEN_REJECT (PATHWAY BLOCKED)
K28.5	D29.7	D24.0	D01.4	OPEN_REJECT (RESERVED CONTINUE 1)
K28.5	D29.7	D27.4	D24.0	OPEN_REJECT (RETRY)
K28.5	D29.7	D29.7	D29.7	OPEN_REJECT (NO DESTINATION)

Table 25: Primitives with Hamming Distance of 8

1st	2nd	3rd	4th	Assignment
K28.5	D29.7	D30.0	D31.4	OPEN_REJECT (RESERVED INITIALIZE 0)
K28.5	D29.7	D31.4	D07.3	OPEN_REJECT (RESERVED STOP 0)
K28.5	D30.0	D01.4	D04.7	DONE (ACK/NAK TIMEOUT)
K28.5	D30.0	D02.0	D16.7	
K28.5	D30.0	D07.3	D27.4	DONE (CREDIT TIMEOUT)
K28.5	D30.0	D16.7	D01.4	DONE (RESERVED 0)
K28.5	D30.0	D24.0	D02.0	
K28.5	D30.0	D27.4	D29.7	DONE (RESERVED TIMEOUT 0)
K28.5	D30.0	D29.7	D31.4	DONE (RESERVED 1)
K28.5	D30.0	D30.0	D30.0	DONE (NORMAL)
K28.5	D30.0	D31.4	D24.0	DONE (RESERVED TIMEOUT 1)
K28.5	D31.3	D01.3	D07.0	NOTIFY (RESERVED 1)
K28.5	D31.3	D07.0	D01.3	NOTIFY (RESERVED 0)
K28.5	D31.3	D10.2	D10.2	NOTIFY (RESERVED 2)
K28.5	D31.3	D31.3	D31.3	NOTIFY (ENABLE SPINUP)
K28.5	D31.4	D01.4	D30.0	OPEN_REJECT (RESERVED ABANDON 3)
K28.5	D31.4	D02.0	D27.4	OPEN_REJECT (RESERVED ABANDON 0)
K28.5	D31.4	D04.7	D29.7	OPEN_REJECT (CONNECTION RATE NOT SUPPORTED)
K28.5	D31.4	D07.3	D02.0	OPEN_REJECT (RESERVED ABANDON 2)
K28.5	D31.4	D16.7	D24.0	OPEN_REJECT (WRONG DESTINATION)
K28.5	D31.4	D27.4	D01.4	OPEN_REJECT (STP RESOURCES BUSY)
K28.5	D31.4	D29.7	D07.3	OPEN_REJECT (PROTOCOL NOT SUPPORTED)
K28.5	D31.4	D30.0	D16.7	OPEN_REJECT (RESERVED ABANDON 1)
K28.5	D31.4	D31.4	D31.4	OPEN_REJECT (BAD DESTINATION)

Appendix F

Macro Variables and Functions

This appendix defines the variables used in macros as well as the various types of macro functions. This appendix also shows the syntax for these elements and provides examples of the context in which the variables and functions could be used. Numeric variables are decimal values unless they are preceded by 0x, in which case, they are hexadecimal.

Macro Variables

Macro tests have 80 variables that can be used. Sixteen are integer variables, sixteen are long variables, sixteen are quadword variables, sixteen are frame variables, and sixteen are string variables. Integer variables are 16 bits long, long variables are 32 bits long, and quadword variables are 64 bits long. String variables can be any length. Frame variables are user-created frames listed in the User Frames pane.

Integer, long, and quadword variables may be freely used in any function with its size converted to the size the function expects. For example, if the variable LNG0 is passed to a function expecting an integer parameter, the value is reduced to integer size by discarding the upper 16 bits before being passed to the function. So if `LNG0 = asgn(0x12348001)`, 0x8001 will be passed to the function, although the variable LNG0 itself will still contain its original value. Note that if the function takes a signed rather than an unsigned integer, 0x8001 will be treated as a negative number even though LNG0 was not negative.

STR variables can be used in any function that has a string as its parameter type.

Only function return values can be stored in variables. If a function returns a long and it is assigned to an integer variable, the value will be truncated to fit.

INT0, INT1, ... INTF – integer variables

Example: `INT0=get_int("R", 0L);`

LNG0, LNG1, ... LNGF – long variables

Example: `LNG0=get_g_info("bufsz");`

QUAD0, QUAD1, ... QUADF – quadword variables

Example: `QUAD0=get_info_64("lun");`



Note: A QUAD variable can't be used as a parameter in arithmetic functions because arithmetic functions work only with INT or LNG variables.

STR0, STR1, ... STRF – string variables

Example: `STR0=asgnstr("This is STR0.");`

FRM0, FRM1, ... FRMF – frame variables

Example: `INT0=transmit(FRM0);`

transmit(), receive(), display_receive(), assign_receive() – frame functions

Use the macro-specific function `asgn(xx)` to set the variable to a constant value.

Use the macro-specific function `asgnstr("")` to set the string variable.

Example: `LNG0=asgn(1);`

Example: `STR0=asgnstr("This is STR0.");`

Additional quadword examples:

`QUAD0=asgn(1);`

`logQUAD("QUAD0=%I64u", QUAD0);`

`LNG0=asgn(2);`

`logp("LNG0(ASGN 2)=%d", LNG0);`

`QUAD1=add(LNG0, 2);`


```
QUAD0=asgn(1);
logQUAD("QUAD0=0x%I64X", QUAD0);
QUAD1=asgn(0xffffffffffffffff);
logQUAD("QUAD1=0x%I64X", QUAD1);
logQUAD("QUAD1=%I64d", QUAD1);
logQUAD("QUAD1=%I64u", QUAD1);
```



Note: The example below will not work because you can't use QUAD as a parameter in arithmetic functions.

```
QUAD1=or(QUAD0, 0);
logQUAD("QUAD1=%I64u", QUAD1);
LNG1=OR(QUAD0, 0);
logp("LNG1=%d", LNG1);
```

Macro Functions

Branches

Branch functions move the execution pointer to a new line in the macro, above or below the current branch function, allowing the use of conditional statements inside a single macro. The variable X is a relative line number, where X=-1 is the line before the branch and X=1 is the line after the branch.

branche(xx, yy, X)

This function branches if xx=yy. The parameters xx and yy can be constants or variables.

branchl(xx, yy, X)

This function branches if xx<yy. The parameters xx and yy can be constants or variables.

branchle(xx, yy, X)

This function branches if xx≤yy. The parameters xx and yy can be constants or variables.

branchnz(xx, X)

This function branches if xx is nonzero. The parameters xx and yy can be constants or variables.

branchz(xx, X)

This function branches if xx=0. The parameters xx and yy can be constants or variables.

Jumps

Jump functions take execution to the beginning of a new macro, allowing multiple macro tests to comprise a larger test sequence. Note that macros that are jumped to must reside in the same macro file.

jump(X)

This function jumps unconditionally to a new macro X.

jumpe(xx, yy, X)

This function jumps to a new macro X if $xx=yy$. The parameters xx and yy can be constants or variables.

jump1(xx, yy, X)

This function jumps to a new macro X if $xx<yy$. The parameters xx and yy can be constants or variables.

jumple(xx, yy, X)

This function jumps to a new macro X if $xx\leq yy$. The parameters xx and yy can be constants or variables.

jumpnz(xx, X)

This function jumps to a new macro X if xx is nonzero. The parameter xx can be a constant or a variable.

jumpz(xx, X)

This function jumps to a new macro X if $xx=0$. The parameter xx can be a numerical constant or one of the variables provided.

jumpsub(X)

This function jumps to a new macro X. Upon completion of macro X, the control jumps back to the calling macro at the line immediately following the jumpsub() line, allowing for subroutine-like functionality.



Note: The macro function jumpsub() can't be nested.

Loops

Loop functions take execution of the macro test back to the beginning of the current macro. If you right-click on the macro and select Macro Keystroke from the menu, the current loop will terminate with execution continuing with the function immediately following the loop function. If you right-click on the macro and select Macro Abort from the menu, macro execution ends entirely.

loop(n)

Returns execution to the beginning of the macro. The function will loop n times after which execution will continue with the function immediately following the loop(n) function, if any.



Note: The macro function loop() can't be nested directly. If it is nested, the outermost loop() will act as a loopk(). This function cannot be nested indirectly. If you use a jumpsub(x) in a loop() where x is a macro that contains another loop, this results in an indirect case of a nested loop().

Example:

```
1:"outer loop"
jumpsub(2)
loop(1)
.
2:"sub"
loop(1)
.
```

loope()

Loops to the beginning of the macro if an error occurred between the beginning of the macro and the `loope()` function. If no error occurred during a loop, the loop will terminate and fall through to the next function in the macro.

loopk()

Loops until you select **Send Keystroke to Macro**, which is in the Execute menu of the Generator Device window. See [Chapter 19, “Using Generator with Ports](#).

loopne()

Same as `loope()` except that it loops while there is no error.

Logical Functions

Since only function return codes can be stored in variables, the functions described below are used to perform initialization, simple math, or logical manipulation. In the following variable descriptions, integer refers to 16-bit data types and long refers to 32-bit data types.

add(xx, yy)

Returns the sum of `xx` and `yy` as a long. The parameters are expected to be longs. Integer parameters will be automatically converted to longs as described above.

and(xx, yy)

Returns the bit-wise and of `xx` and `yy` as a long. The parameters are expected to be longs.

asgn(xx)

Returns the parameter `xx` as a long and is used to initialize both integer and long variables.

bit_shift(xx, RIGHT, BITS)

If `RIGHT` is zero, returns `xx<<BITS` (`xx` shifted to the left by `BITS` number of bits). If `RIGHT` is nonzero, returns `xx>>BITS` (`xx` shifted to the right by `BITS` number of bits).

itoi(0xXX, 0xYY)

Returns the integer `0xXXYY` as a long and is used to concatenate two one-byte integers into a single two-byte integer. The results may not be as expected if either parameter exceeds `0xFF` in size.

itol2(0xXXXX, 0xYYYY)

Returns the long `0xXXXXYYYY` and is used to concatenate two two-byte integers into a single long.

itol4(0xWW, 0xXX, 0xYY, 0xZZ)

Returns the long 0xWWXXYYZZ and is used to concatenate four one-byte integers into a single long. The results may not be as expected if any parameter exceeds 0xFF in size.

not(xx)

Returns the bit-wise not of the value xx as a long. The parameter is expected to be a long.

or(xx, yy)

Returns the bit-wise or of xx and yy as a long. The parameters are expected to be longs.

sub(xx, yy)

Returns xx-yy as a long. The parameters are expected to be longs. The results will not be as expected if xx<yy since the returned value is unsigned.

xor(xx, yy)

Returns the bit-wise xor of xx and yy as a long. The parameters are expected to be longs.

Miscellaneous Functions

asgnstr("xx")

Returns the parameter xx as a string used to initialize string variables.

clear_log_view

Clears the log pane.

rtnfilesz("path name")

Returns the size of a binary file as a long. The parameter is a string path name.

copy_user_string(STR0)

Copies the current user string, as set by user_input(), into the string variable. The parameter is a string variable STR0-STRF.

Example:

```
user_input("Enter Name of File", "S");
copy_user_string(STR0);
```

transmit(FRM0)

Transmits a user frame using frame_user(). The return value is TRUE (1) or FALSE (0).

Example:

```
INT0=transmit(FRM0);
logp("INT0 = 0x%04X", INT0);
```

receive()

Receives and stores the frame in the macro receive buffer using get_frame(1) and get_frame_info(). The return value is TRUE (1) or FALSE (0).

Example:

```
INT0=receive();
```

display_receive()

Displays the frame in the macro receive buffer in raw data format in the log window. The return value is TRUE (1) or FALSE (0).

Example:

```
INT1=display_receive();  
logp("INT1 = 0x%04X", INT1);
```

asgn_receive (xx)

Assign the receive buffer dword to a variable.

Example:

```
INT0=receive();  
logp("INT0 = 0x%04X", INT0);  
// LNG0 = receive buffer dword 1  
LNG0=asgn_receive(1);  
logp("LNG0 = 0x%08X", LNG0);
```

macro_user_input

Displays an input dialog with `p_string` as prompt. The expected data type for the value to be provided by the user is specified by the second parameter `expectedType`. To retrieve the value entered by the user, the macro developer must assign the return value to a compatible macro variable (INT, LNG, QUAD or STR). An error message will be shown if the user enters a value that is not of the expected data type or if macro tries to assign the function return to an incompatible macro variable.

macro_user_output

Writes a text string to the Log after appending a timestamp to the string. The string may contain variable formatting codes that should match each of the optional parameters provided. The acceptable formatting codes are the same used by the `sprintf` standard C function.

macro_delayms

Delays the macro execution for about `ms_delay` milliseconds.

transmit_smp (FRM0)

Transmits an SMP user frame using `sas_smp_user()`. The received SMP response is also retrieved to the macro receive buffer. Thus, the `receive()` should not be called after `transmit_SMP`. The return value is TRUE (1) or FALSE (0).

Example:

```
INT0=transmit_SMP(FRM0);  
logp("INT0 = 0x%04X", INT0);
```


Appendix G

Getting Started with Xgig Load Tester

In this chapter:

- Overview
- Performing Self Test without a Switch
- Performing a Test with a Fibre Channel Switch
- Saving a Configuration
- Loading a Configuration
- Burst Mode explained

Overview

Getting started with the Xgig Load Tester is a simple and quick process that does not require a fibre channel switch. If you want to learn how to use Load Tester, the examples shown below will show you how to generate traffic using two ports looped back to each other through an Xgig Analyzer.

An Xgig Analyzer is not required but this will assist with traffic verification. The loop back configuration without a switch will require additional steps that will be explained. If you have a Fibre Channel switch you can go directly to [Performing a Test with a Fibre Channel Switch](#).

Performing Self Test without a Switch

You can perform a Self Test in Load Tester without using Fibre Channel switch through the use of a loop back configuration. The process of performing the self test has been broken down into the following discussion.

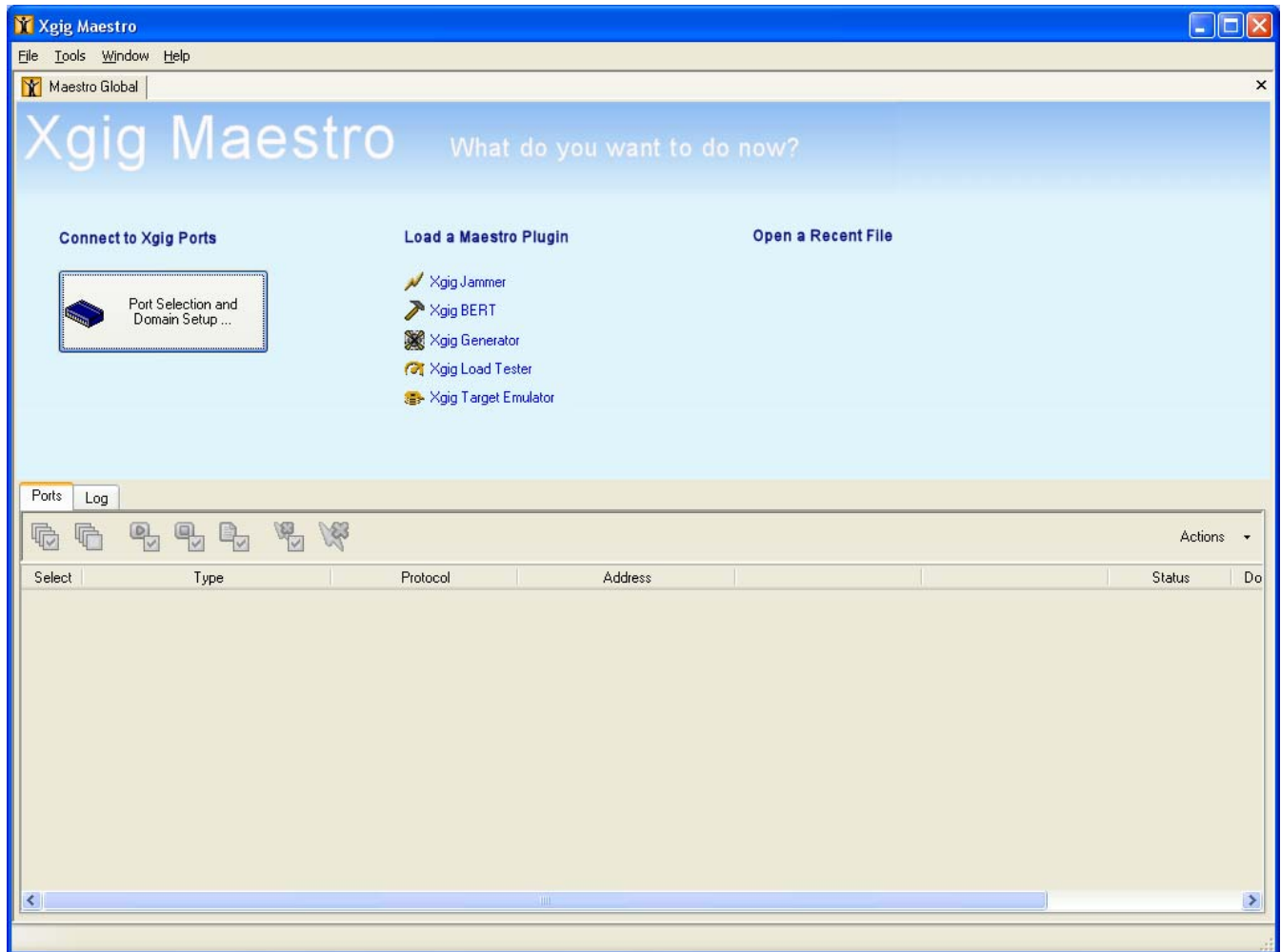
Please note that it is assumed that the name and or IP address of the chassis is known.

Starting the Xgig Load Tester

To start the Xgig Load Tester application:

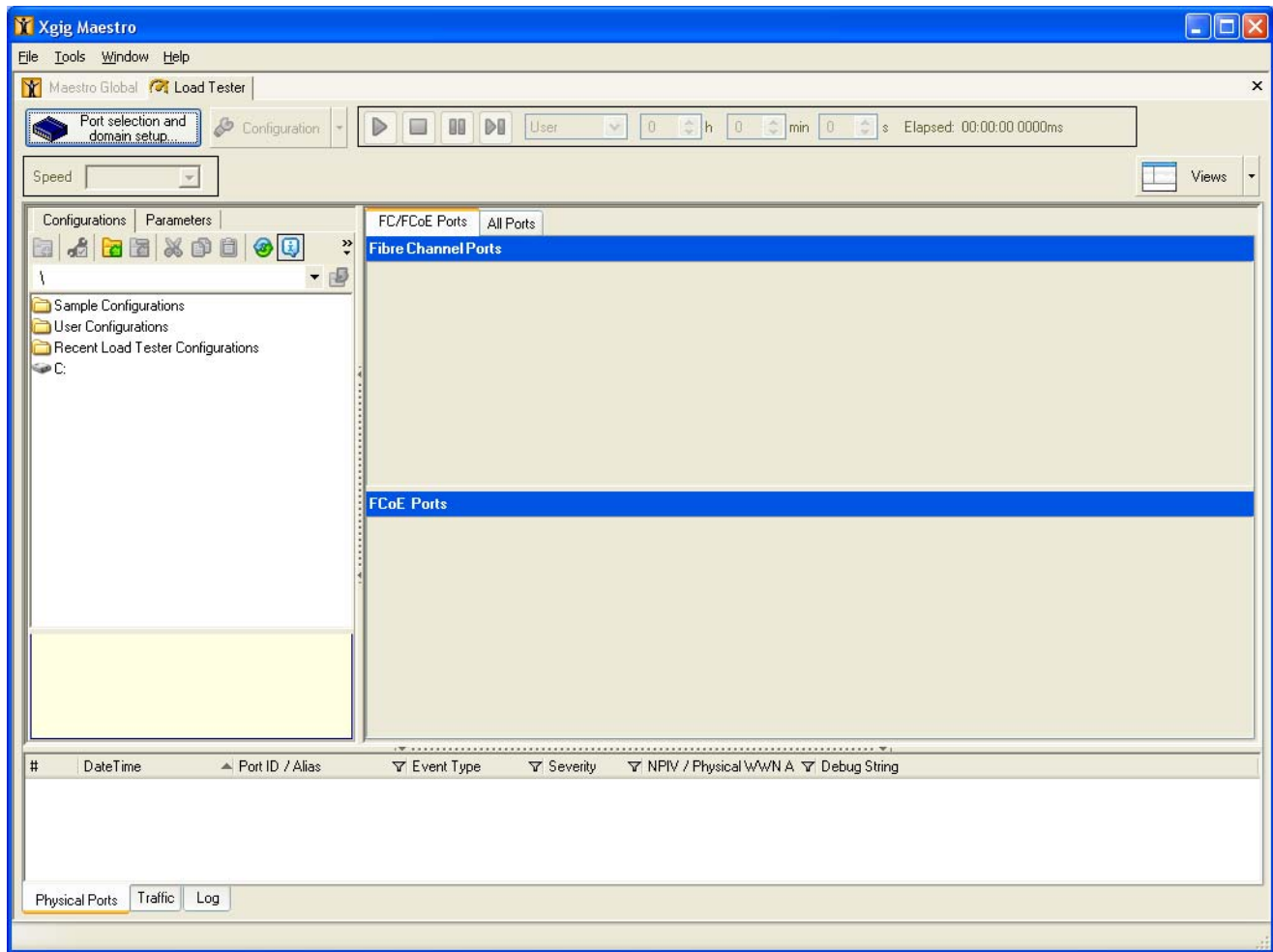
- 1 Go to **Start> All Programs> JDSU> Xgig Maestro**.

The Xgig Maestro application opens with the **Maestro Global** tab ([Figure 432](#)).

Figure 432: Xgig Maestro Start Window

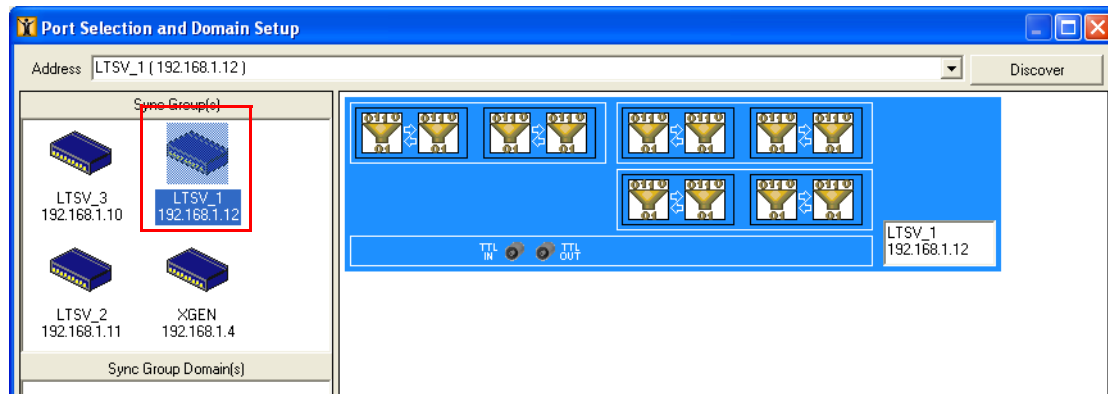
- 2 Click on **Load Tester** under **Load a Maestro Plugin**.

Your Xgig Maestro application will now look similar to [Figure 433](#).

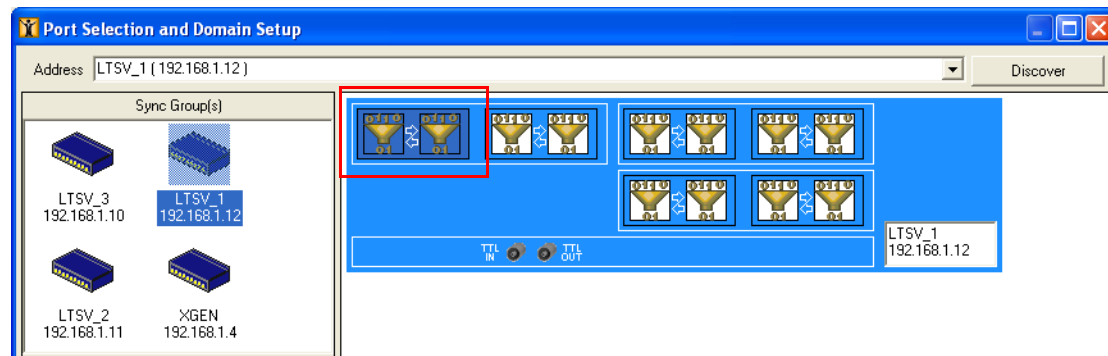
Figure 433: Xgig Load Tester Window

Locking the ports to use in the Load Tester

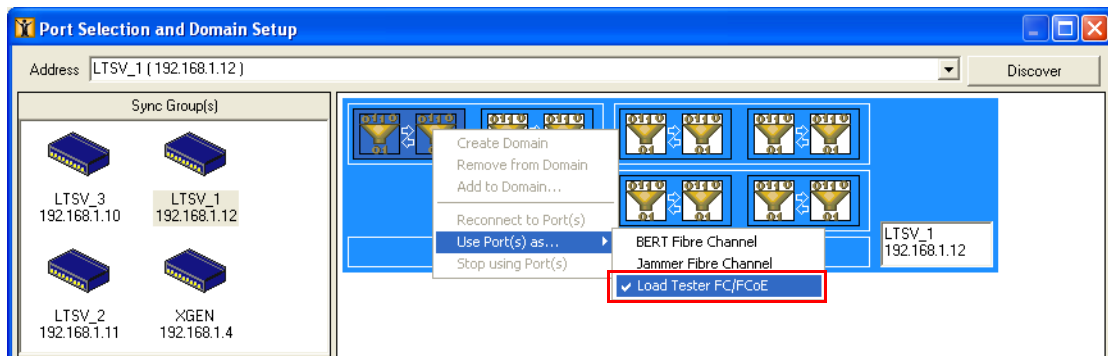
- 1 Click the **Port selection and domain setup...**  button in the top left corner.
- 2 Select your chassis from the **Port Selection and Domain Setup** dialog box (Figure 434).

Figure 434: Selected Chassis

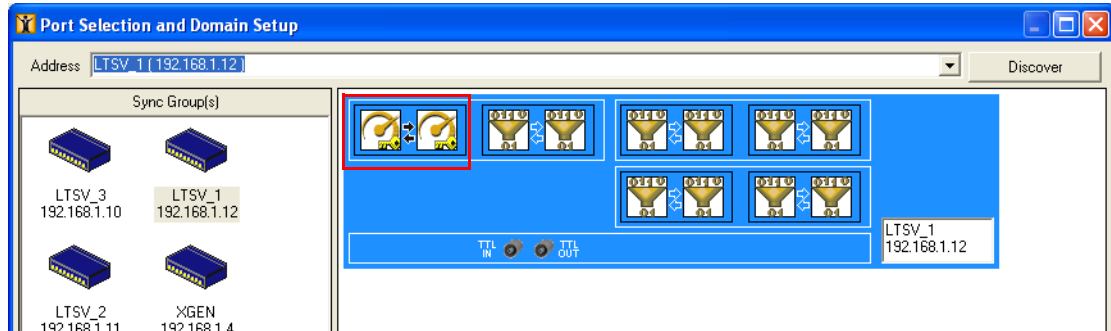
- 3 Click on the ports you wish to use to highlight them.

Figure 435: Selected Ports

- 4 Right-click on one of the ports and select **Use Port(s) as...** and then select **Load Tester FC/FCoE Channel**.

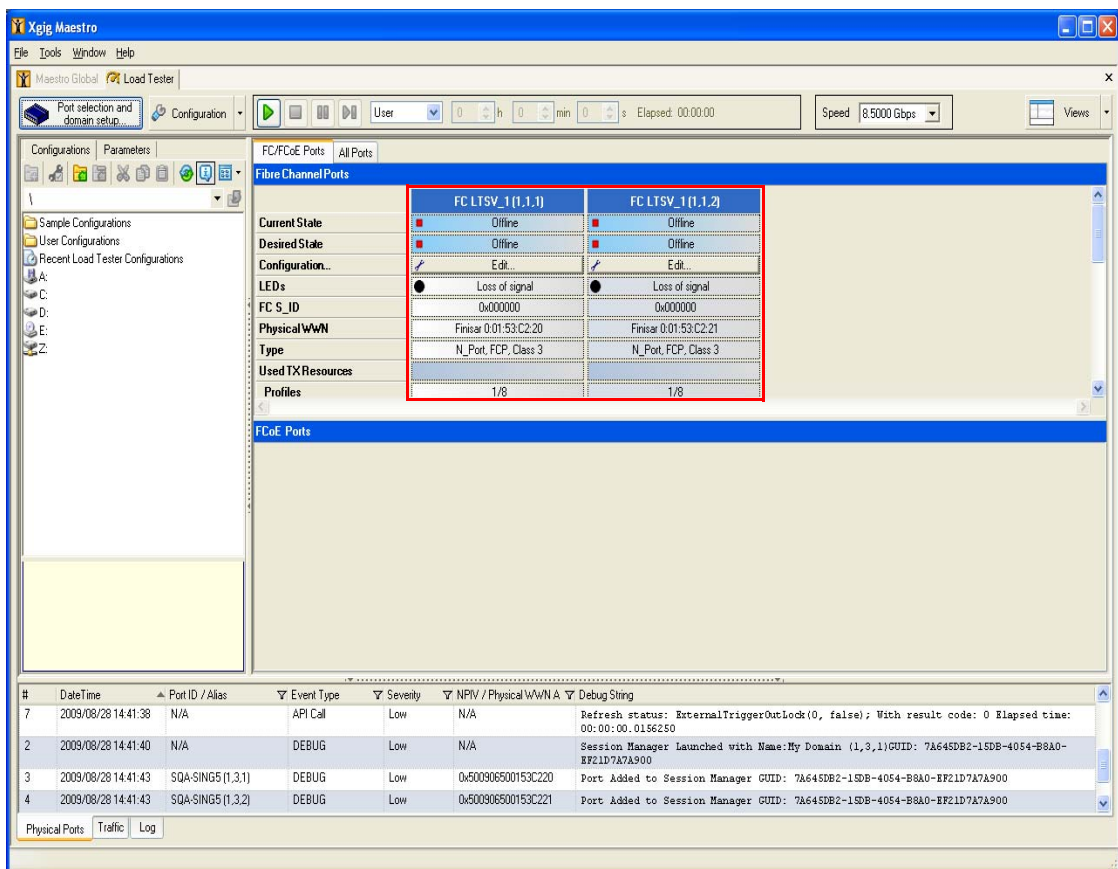
Figure 436: Locking the ports as Load Testers

You will now see your two selected ports locked and ready for use. (refer to Figure 437).

Figure 437: Locked ports

5 Click the **Close** button to close the dialog box.

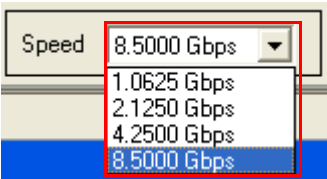
Your Maestro Load Tester session will now appear similar to Figure 438.

Figure 438: Load Tester window with locked ports

Setting the Speed for the Test

After locking the ports as Load Testers, you should verify if the speed of the link is correct. To quickly set the link speed for your hardware setup, select the speed to use (in Gbps) from the **Speed** drop-down menu found in the upper left corner (refer to Figure 439).

Figure 439: Speed Drop-down Menu



You will notice that the LEDs with the **Loss of sync occurred** status may have turned yellow if they were previously red (refer to Figure 440).

Figure 440: Loss of Sync occurred LED status

	FC LTSV_1 (1,1,1)	FC LTSV_1 (1,1,2)
Current State	Offline	Offline
Goal State	Offline	Offline
Configuration...	Edit...	Edit...
LEDs	Loss of sync occurred	Loss of sync occurred
Physical S_ID	0x000000	0x000000
Physical WWN	Finisar 0:01:52:7A:00	Finisar 0:01:52:7A:01
Port Group Tag List	::LTSV_1 (1,1,1):111::192.168.1.12,1,	::LTSV_1 (1,1,2):112::192.168.1.12,1,

Editing the Topology

Once you finished setting the speed, you need to change the traffic topology.
Near the bottom of the window you will see three tabs labeled **Physical Ports**, **Traffic** and **Log**.

To edit the topology:

- 1 Click on the **Traffic** tab to display the **TX** tab.

Figure 441: Traffic tab

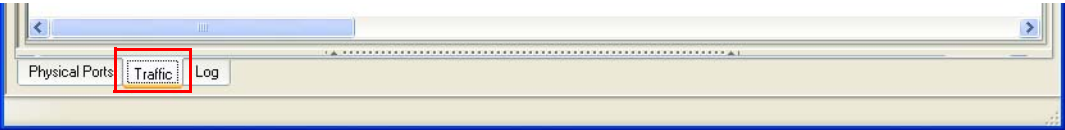
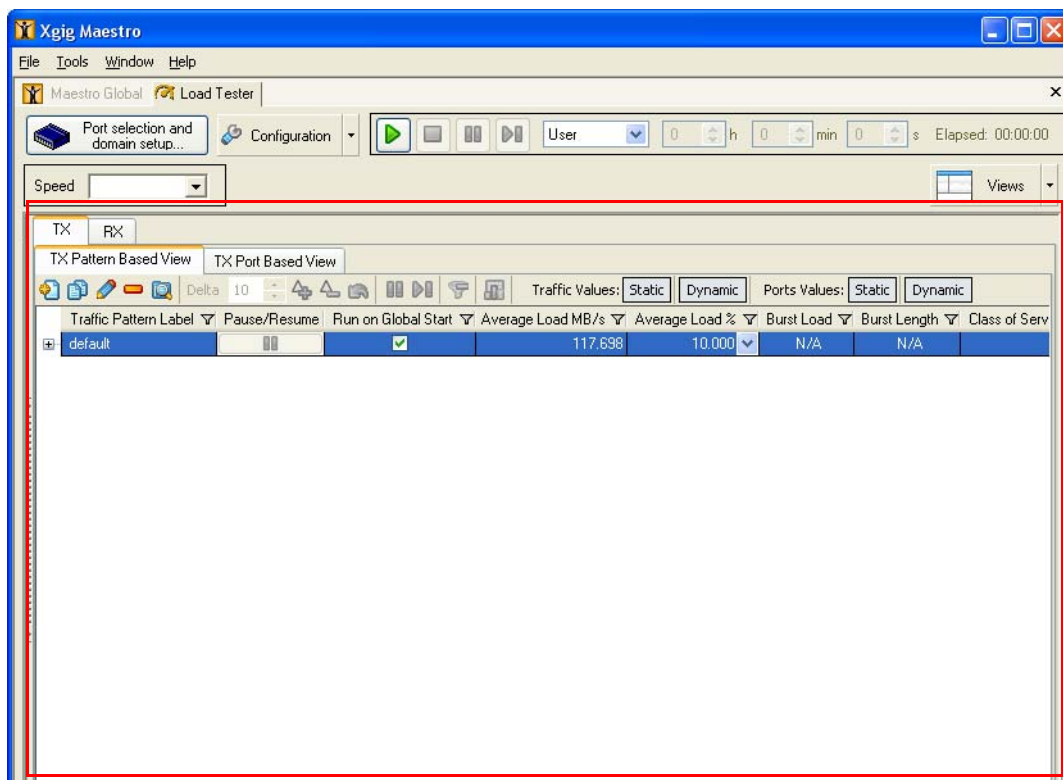
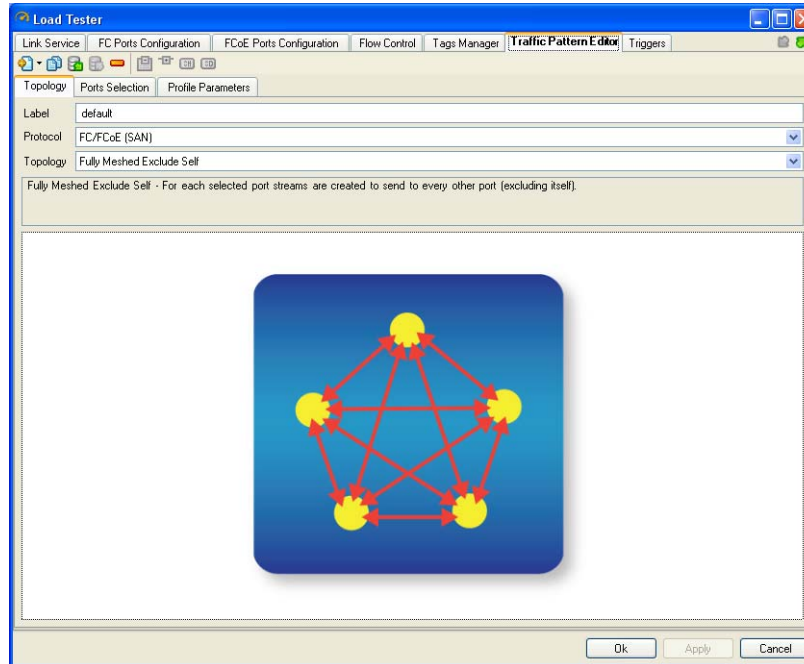
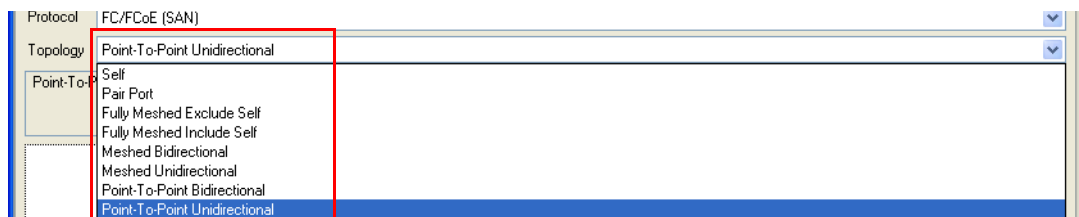


Figure 442: TX tab in the Traffic tab

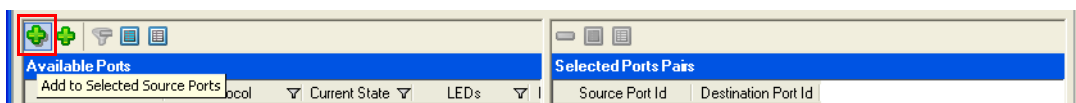
- 2 Click the pencil  icon to open the **Traffic Pattern Editor** tab in the Load Tester Device Window so you edit the default traffic configuration provided for you.

Figure 443: Traffic Pattern Editor Tab

- 3 Change the topology to **Point to Point Unidirectional** from the **Topology** drop-down menu.

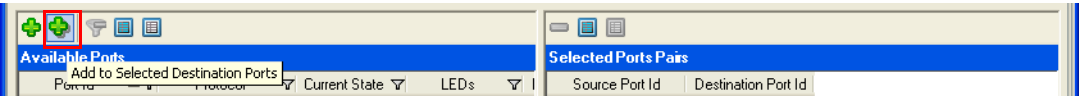
Figure 444: Topology drop-down menu

- 4 Click on the **Ports Selection Tab** to select ports for the traffic pattern.
- 5 Select the first port from the **Available Ports** pane and add it to the source port list by clicking **Add Selected Ports to Source** button (Figure 445).

Figure 445: Add Selected Ports to Source

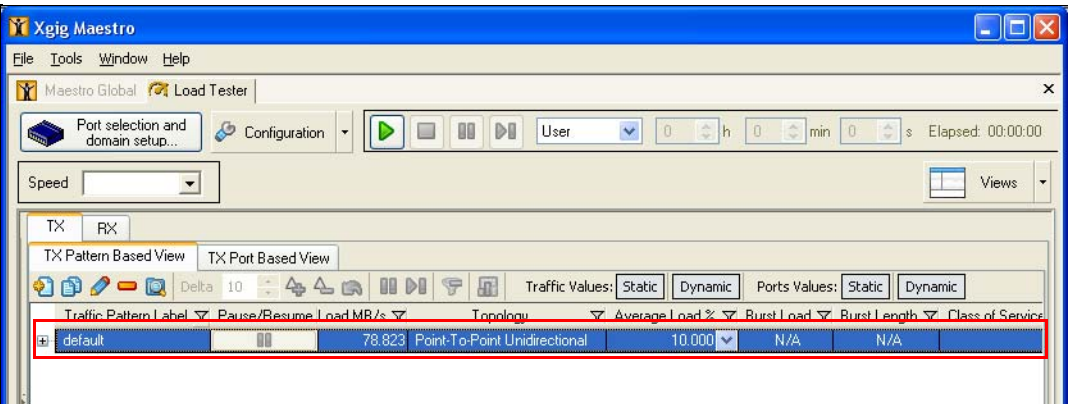
- 6 Select the second port and add it to the destination port list by clicking **Add Selected Ports to Destination**.

Figure 446: Add Selected Ports to Destination



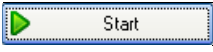
- 7 Click **Ok** to close the dialog box. The **default** traffic bar has been changed.
The topology column is now set to **Point to Point Unidirectional**.

Figure 447: Changed traffic bar



- 8 Click on the **Physical Ports** tab at the bottom of the window to display the ports.

Starting the Test

To start the traffic click on the **Start**  button at the top of the window.

You will notice that current and goal states of the ports change from **Offline** to **Test in Progress**.

Figure 448: Test in Progress State

	FC LTSV_1 (1,1,1)	FC LTSV_1 (1,1,2)
Current State	Test in Progress	Test in Progress
Goal State	Test in Progress	Test in Progress
Configuration...	Edit...	Edit...
LEDs	Loss of sync occurred	Loss of sync occurred
Physical S_ID	0x010112	0x000112
Physical WWN	Finisar 0:01:52:7A:00	Finisar 0:01:52:7A:01
Port Group Tag List	::LTSV_1 (1,1,1)::111::192.168.1.12,1	::LTSV_1 (1,1,2)::112::192.168.1.12,1
Used TX Resources		
Used Profiles	1	0
Used Streams	1	0
Settings		
Alias		
NPIV	0	0
Port Pair Speed	4 Gbps	4 Gbps

You have now started a test and traffic is now being sent from one port to another.

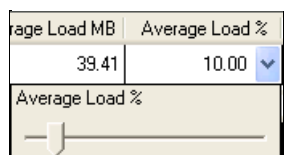
Adjusting the Load on the fly

If you have an analyzer connected you will notice that the test is running but the load is only 10%. It is simple to adjust the load while the test is running.

To adjust the load:

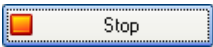
- 1 Click on the **Traffic** tab to show the **TX** tab.
- 2 Click on the plus sign (+) next to the **default** traffic pattern to display the ports in the traffic configuration.
- 3 Mouse over to the **10.00** in the **Average Load %** column to activate the arrow down  button.
- 4 Click the arrow down button to activate the **Average Load %** slider.

Figure 449: Average Load % Slider



- 5 Click and drag the slider up to **50%**.
- 6 If you drag the slider down to **0** and the traffic load will drop to zero. Moving it back to **50** or **100%** will increase the load which you can verify with both the analyzer, if you are using one, and the counters displayed in the **Traffic** tab. For now just leave it at **50%**.

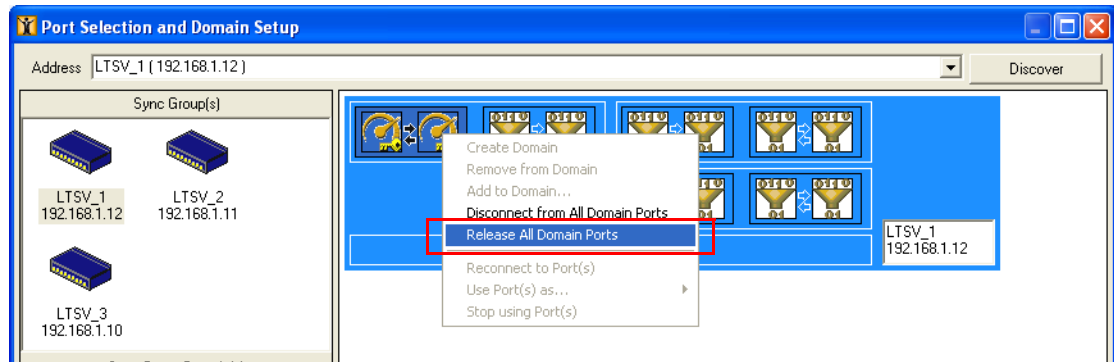
Stopping the test

To stop the test, click the **Stop**  button on the upper part of the window.

Unlock the ports

To unlock the ports you locked for the test:

- 1 Click on the **Port selection and domain setup** button to open the **Port Selection and Domain Setup** dialog box.
- 2 Click on the locked ports to highlight them.
- 3 Right-click on one of the locked port icons and select **Release All Domain Ports** (refer to [Figure 450](#)).

Figure 450: Release All Domain Ports

- 4 Click the **Close** button to close this dialog box.

You are now done, you may exit the Maestro application.

Performing a Test with a Fibre Channel Switch

If you have a Fibre Channel switch, you can run a test in Load Tester by using the following discussion. It is assumed that the name and or IP address of the chassis is known.

Starting the Xgig Load Tester

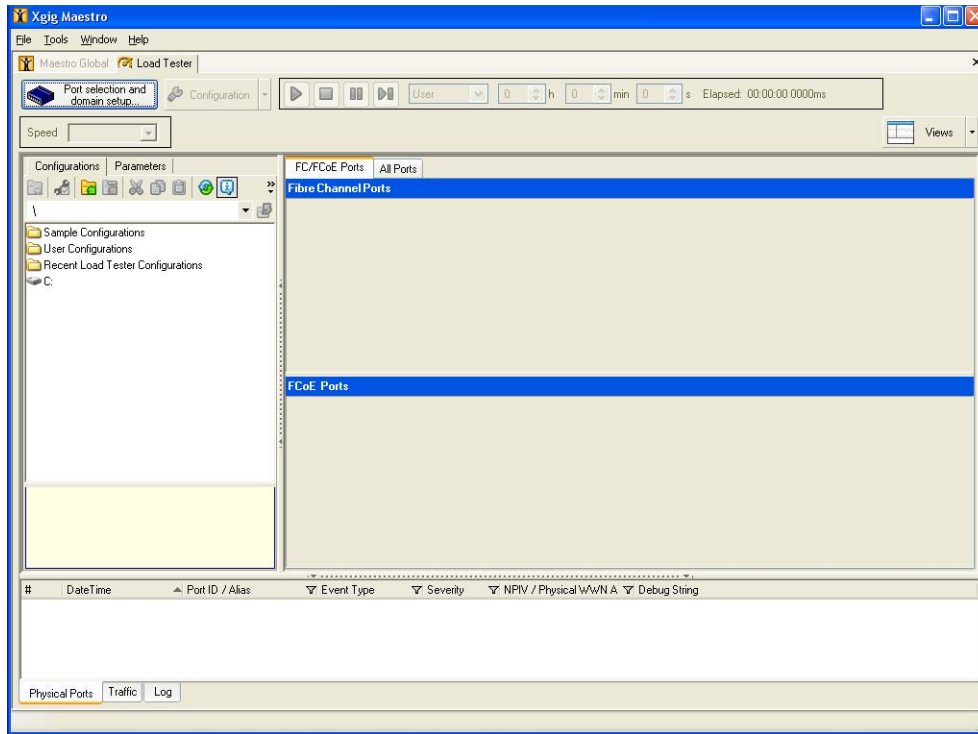
To start the Xgig Load Tester application:

- 1 Go to **Start> All Programs> JDSU> Xgig Maestro**

The Xgig Maestro application will be opened.

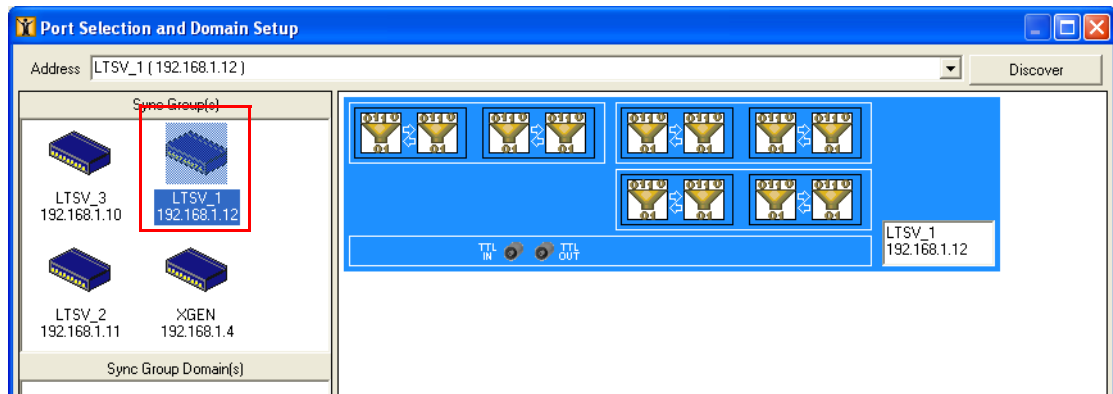
- 2 Click on the **Load Tester** tab.

Your Xgig Maestro application will now look similar to [Figure 451](#).

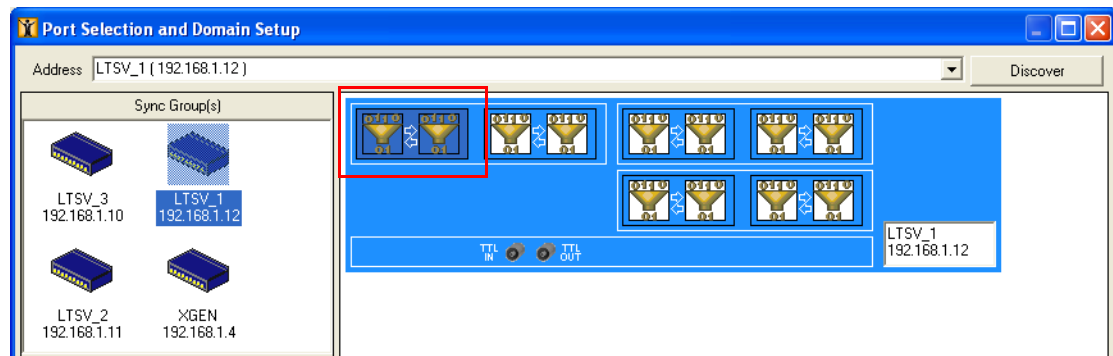
Figure 451: Xgig Load Tester Window

Locking the ports to use in the Load Tester

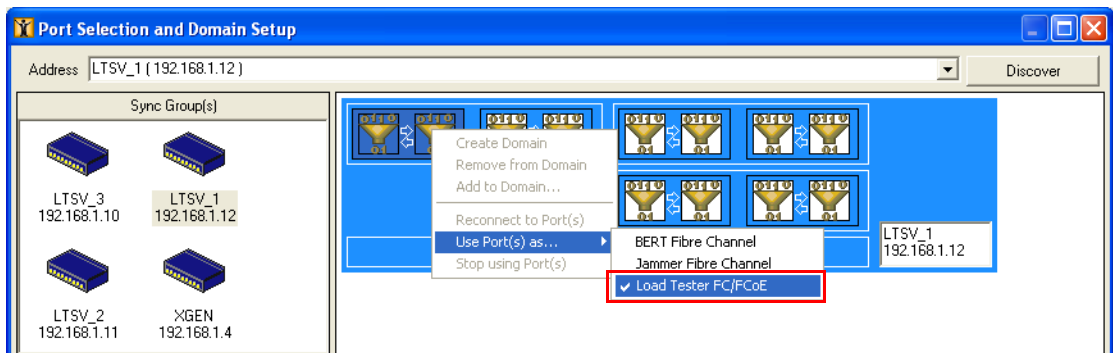
- 1 Click the **Port selection and domain setup...**  button in the top left corner.
- 2 Select your chassis from the **Port Selection and Domain Setup** dialog box (Figure 452).

Figure 452: Selected Chassis

- 3 Click on the ports you wish to use to highlight them.

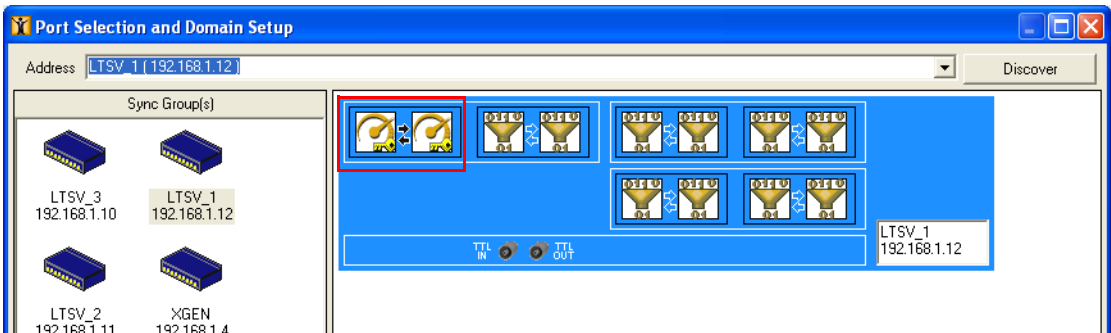
Figure 453: Selected ports

- 4 Right-click on one of the ports and select **Use Port(s) as...** and then select **Load Tester FC/FCoE**.

Figure 454: Locking the ports to Load Tester

You will now see your two selected ports locked and ready for use. (refer to Figure 437).

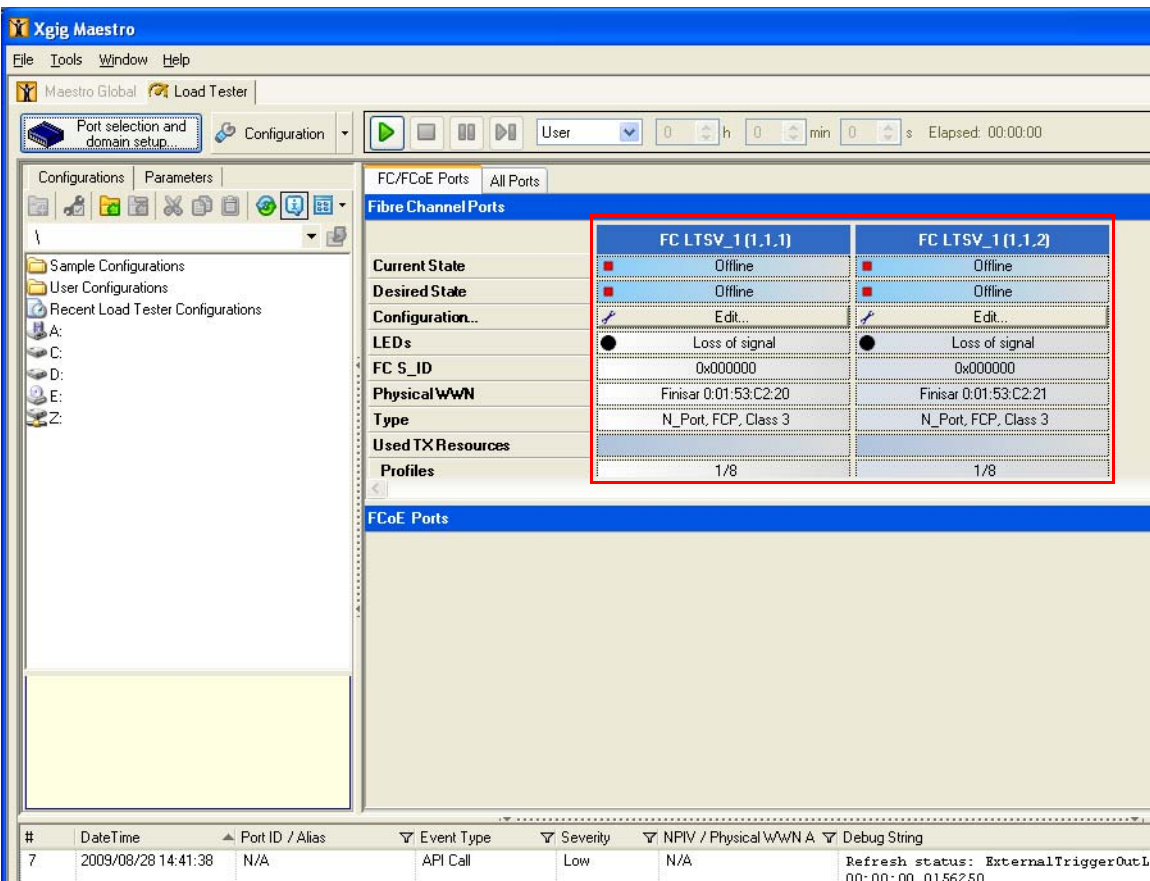
Figure 455: Locked ports



5 Close the dialog box.

Your Maestro Load Tester session will now appear similar to Figure 456.

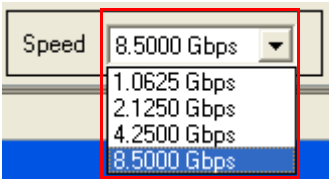
Figure 456: Load Tester window with locked ports



Setting the Speed for the Test

After locking the ports as Load Testers, you should verify if the speed of the link is correct. To quickly set the link speed for your hardware setup, select the speed to use (in Gbps) from the **Speed** drop-down menu found in the upper left corner (refer to Figure 457).

Figure 457: Speed Drop-down Menu



You will notice that the LEDs with the **Loss of sync occurred** status may have turned yellow if they were previously red (refer to Figure 440).

Figure 458: Loss of Sync occurred LED status

	FC LTSV_1 (1,1,1)	FC LTSV_1 (1,1,2)
Current State	Offline	Offline
Goal State	Offline	Offline
Configuration...	Edit...	Edit...
LEDs	Loss of sync occurred	Loss of sync occurred
Physical S_ID	0x000000	0x000000
Physical WWN	Finisar 0:01:52:7A:00	Finisar 0:01:52:7A:01
Port Group Tag List	..LTSV_1 (1,1,1):111::192.168.1.12,1	..LTSV_1 (1,1,2):112::192.168.1.12,1

Starting the Test

To start the traffic click on the **Start**  button at the top of the window.

You will notice that current and goal states of the ports change from **Offline** to **Test in Progress**.

Figure 459: Test in Progress State

Xgig Maestro		
File Tools Window Help		
All Devices BERT - Bit error rate testing BERT - Latency measurement Jammer Load Tester		
Port selection and domain setup... Configure ports Create/edit tags Create traffic pattern Edit triggers Multiple port link service		
Speed 4 Gbps Start Stop Pause Resume Test Length 0 : 0 : 0		
	FC LTSV_1 (1,1,1)	FC LTSV_1 (1,1,2)
Current State	Test in Progress	Test in Progress
Goal State	Test in Progress	Test in Progress
Configuration...	Edit...	Edit...
LEDs	Loss of sync occurred	Loss of sync occurred
Physical S_ID	0x010112	0x000112
Physical WWN	Finisar 0:01:52:7A:00	Finisar 0:01:52:7A:01
Port Group Tag List	..LTSV_1 (1,1,1):111::192.168.1.12,1	..LTSV_1 (1,1,2):112::192.168.1.12,1

You have now started a test and traffic is being sent from one port to another.

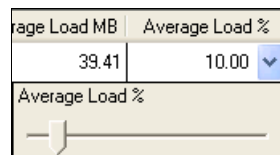
Adjusting the Load on the fly

If you have an analyzer connected you will notice that the test is running but the load is only 10%. It is simple to adjust the load while the test is running.

To adjust the load:

- 1 Click on the **Traffic** tab to show the **TX** tab.
- 2 Click on the plus sign (+) next to the **default** traffic pattern to display the ports in the traffic configuration.
- 3 Mouse over to the **10.00** in the **Average Load %** column to activate the arrow down  button.
- 4 Click the arrow down button to activate the **Average Load %** slider.

Figure 460: Average Load % Slider



- 5 Click and drag the slider up to **50%**.
- 6 Now drag the slider down to **0** and the traffic load will drop to zero. Moving it back to **50** or **100%** will increase the load which you can verify with both the analyzer, if you are using one, and the counters displayed in the Traffic tab. For now just leave it at **50%**.

Stopping the test

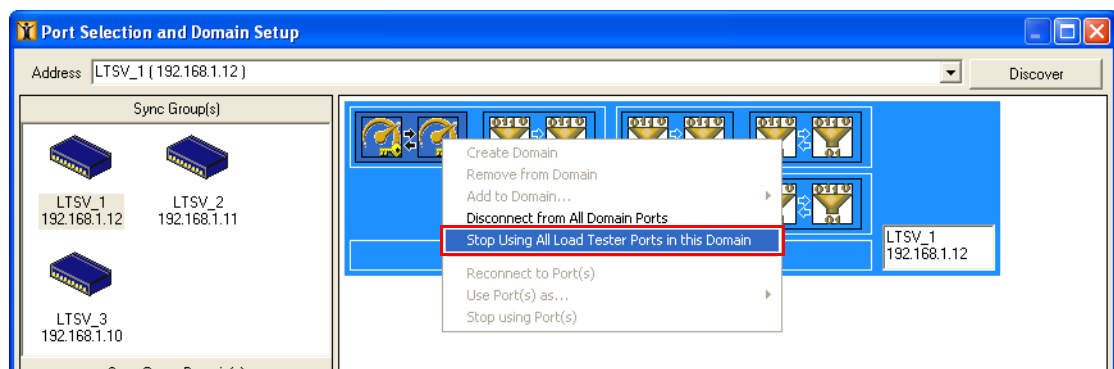
To stop the test, click the **Stop**  button on the upper part of the window.

Unlock the ports

To unlock the ports you locked for the test:

- 1 Click on **Port selection and domain setup** button to open the **Port Selection and Domain Setup** dialog box.
- 2 Click on the locked ports to highlight them.
- 3 Right click on one of the locked port icons and select **Stop Using All Load Tester Ports in this Domain** (refer to Figure 450).

Figure 461: Stop Using All Load Tester Ports in this Domain



- 4 Click the **Close** button to close this dialog box.

You are now done, you may exit the Maestro application.

Saving a Configuration

Load Tester allows you to save a configuration that you have setup or used. The following discussion will breakdown the process of saving you Load Tester configuration. Please note that it is assumed that the name and or IP address of the chassis is known.

Starting the Xgig Load Tester

To start the Xgig Load Tester application:

- 1 Go to **Start> All Programs> JDSU> Xgig Maestro**

The Xgig Maestro application will be opened.

- 2 Click on the **Load Tester** tab.

Your Xgig Maestro application will now look similar to [Figure 433](#).

Locking the ports to use in the Load Tester

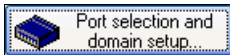
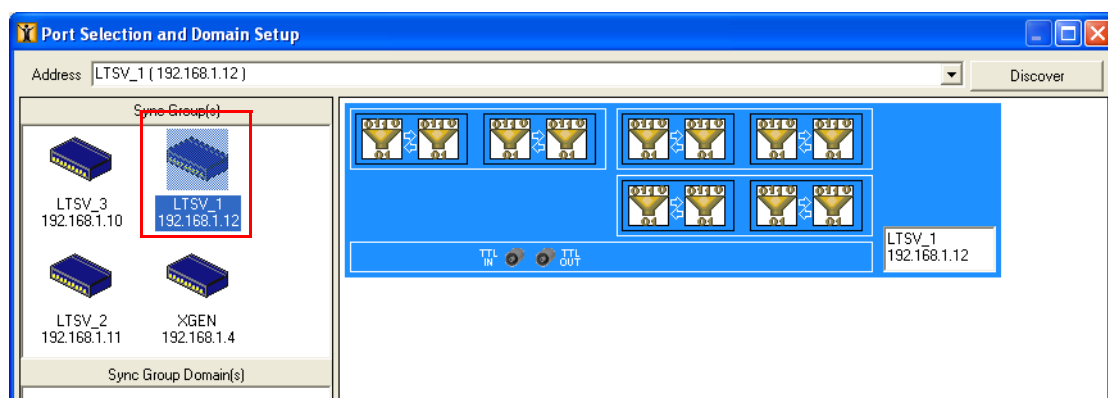
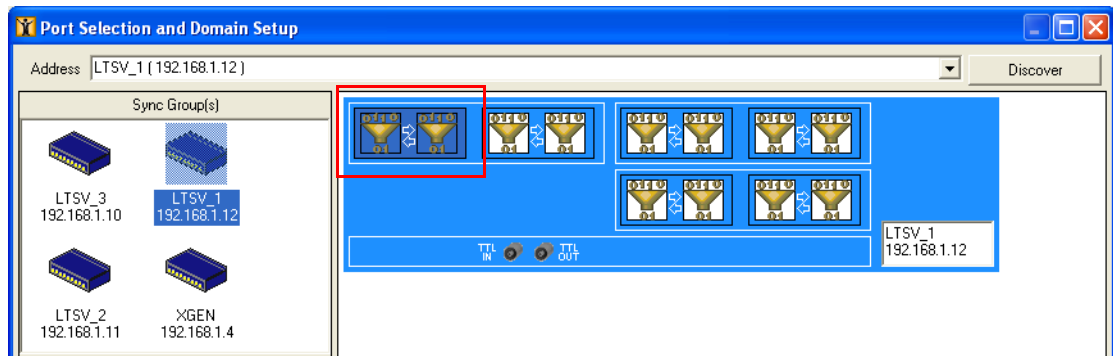
- 1 Click the **Port selection and domain setup...**  button in the top left corner.
- 2 Select your chassis from the **Port Selection and Domain Setup** dialog box (refer to [Figure 462](#)).

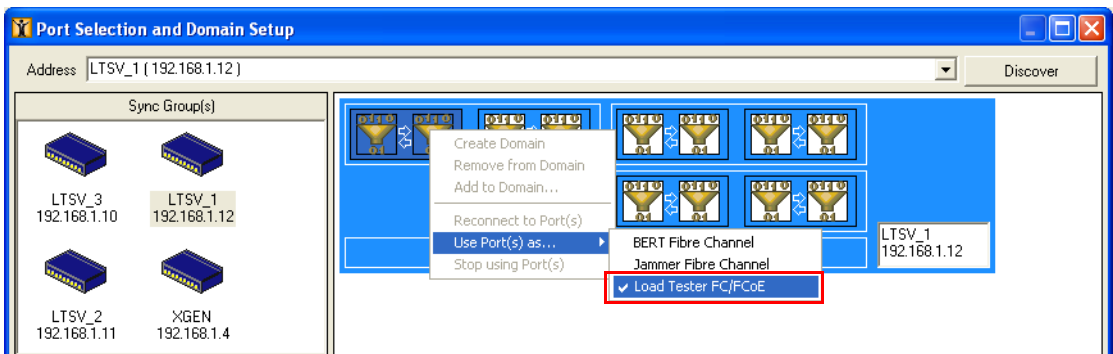
Figure 462: Selected Chassis



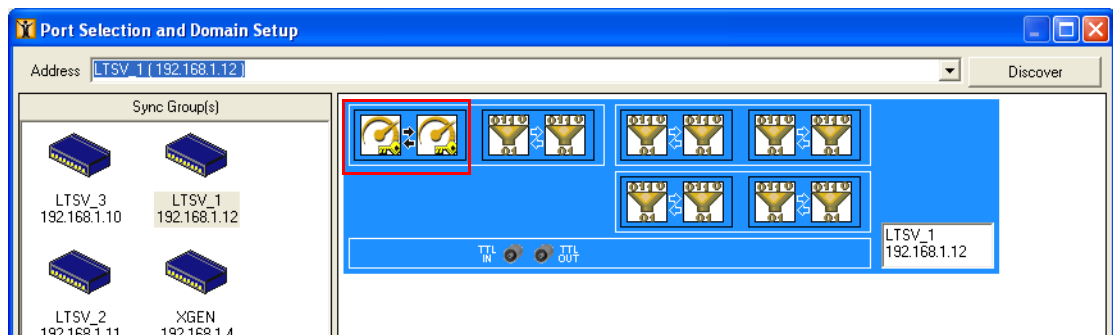
- 3 Click on the ports you wish to use to highlight them.

Figure 463: Selected Ports

- 4 Right-click on one of the ports and select **Use Port(s) as...** and then select **Load Tester FC/FCoE**.

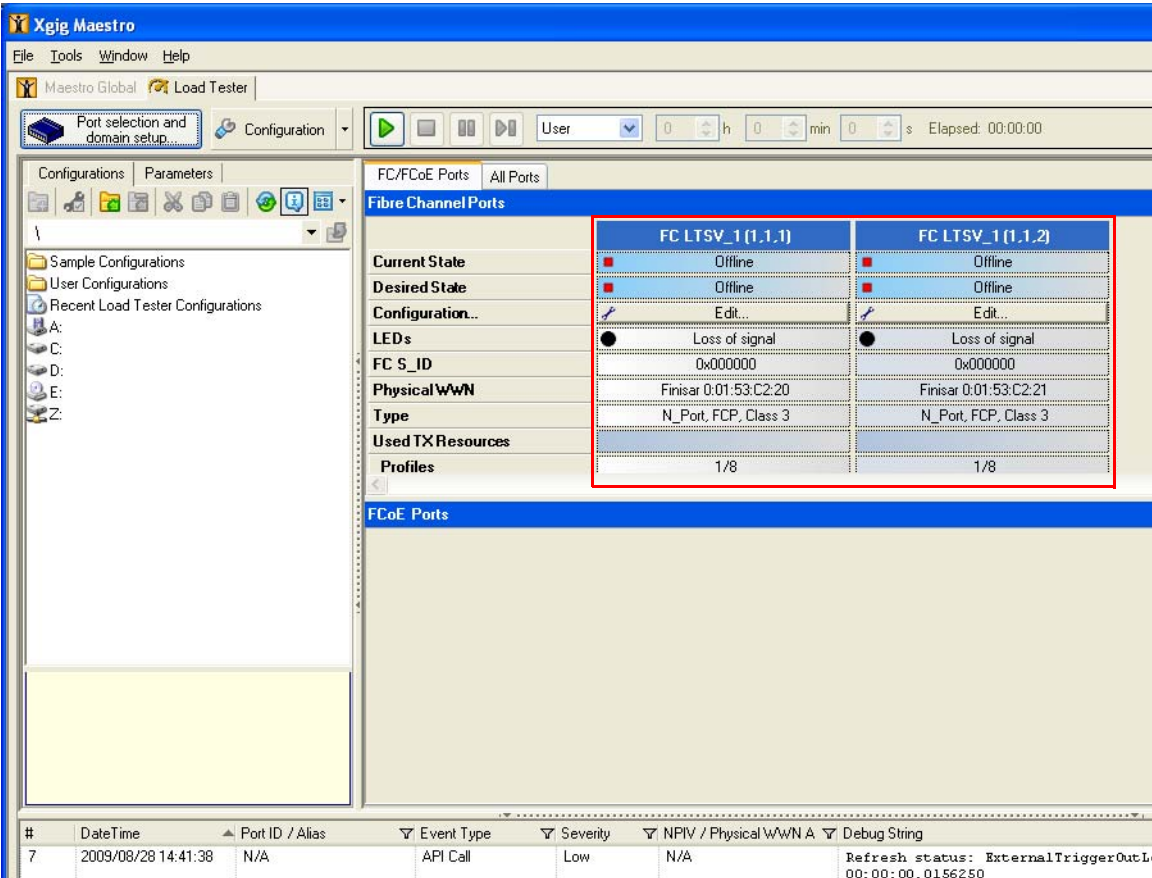
Figure 464: Locking the ports to Load Tester

You will now see your two selected ports locked and ready for use (refer to [Figure 437](#)).

Figure 465: Locked ports

- 5 Close the dialog box. Your Maestro Load Tester session will now appear similar to [Figure 466](#).

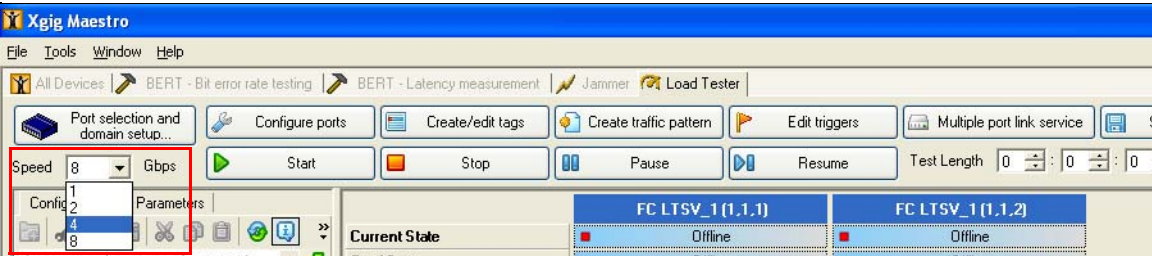
Figure 466: Load Tester window with locked ports



Setting the Speed for the Test

After locking the ports as Load Testers, you should verify if the speed of the link is correct. To quickly set the link speed for your hardware setup, select the speed to use (in Gbps) from the **Speed** drop-down menu found in the upper left corner (refer to Figure 439).

Figure 467: Speed Drop-down Menu



Now you will notice that the LEDs with the **Loss of sync occurred** status may have turned yellow if they were previously red (refer to Figure 440).

Figure 468: Loss of Sync occurred LED status

	FC LTSV_1 (1.1.1)	FC LTSV_1 (1.1.2)
Current State	Offline	Offline
Goal State	Offline	Offline
Configuration...	Edit...	Edit...
LEDs	Loss of sync occurred	Loss of sync occurred
Physical S_ID	0x000000	0x000000
Physical WWN	Finisar 0:01:52:7A:00	Finisar 0:01:52:7A:01
Port Group Tag List	::LTSV_1 (1.1.1):111::192.168.1.12,1	::LTSV_1 (1.1.2):112::192.168.1.12,1

Starting the Test

To start the traffic click on the **Start**  button at the top of the window.

You will notice that current and goal states of the ports change from **Offline** to **Test in Progress**.

Figure 469: Test in Progress State

Xgig Maestro		
File Tools Window Help		
All Devices BERT - Bit error rate testing BERT - Latency measurement Jammer Load Tester		
Port selection and domain setup...	Configure ports	Create/edit tags
Create traffic pattern	Edit triggers	Multiple port link service
Speed 4 Gbps	Start	Stop
	Pause	Resume
Test Length 0 : 0 : 0		
	FC LTSV_1 (1.1.1)	FC LTSV_1 (1.1.2)
Current State	Test in Progress	Test in Progress
Goal State	Test in Progress	Test in Progress
Configuration...	Edit...	Edit...
LEDs	Loss of sync occurred	Loss of sync occurred
Physical S_ID	0x010112	0x000112
Physical WWN	Finisar 0:01:52:7A:00	Finisar 0:01:52:7A:01
Port Group Tag List	::LTSV_1 (1.1.1):111::192.168.1.12,1	::LTSV_1 (1.1.2):112::192.168.1.12,1

You have now started a test and traffic is being sent between the ports. You also now have a working configuration that you can save.

Stopping the test

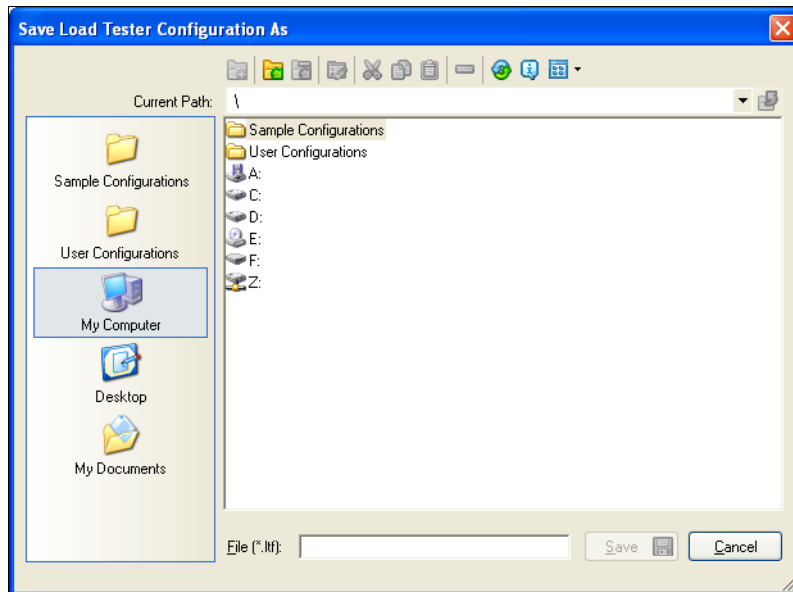
Before the current working configuration, you should stop the test.

To stop the test, click the **Stop**  button on the upper part of the window.

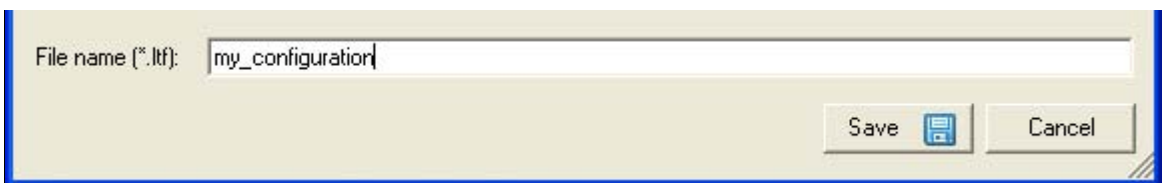
Saving the Configuration

To save the configuration:

- 1 Click the **Configuration** button in the top of the window and select **Save Configuration** from the dropdown menu to the **Save Load Tester Configuration As** dialog box (.).

Figure 470: Save Load Tester Configuration As dialog box

- 2 Create a name for the configuration that you wish to save.
For this example we will use **my_configuration**.

Figure 471: File name field

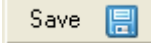
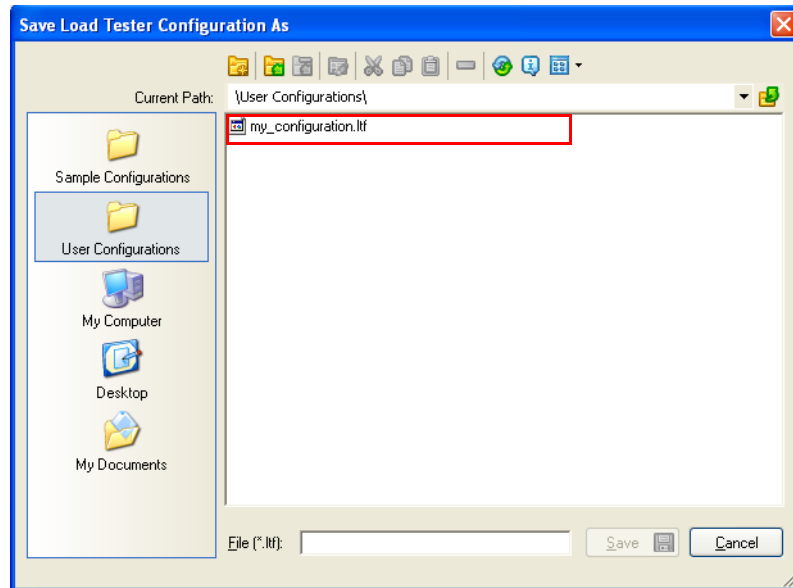
- 3 Click the **Save**  button to save your configuration.
- 4 As a quick check, you can click the **Save configuration** button again and see that your configuration has been saved.

Figure 472: Save Load Tester Configuration As dialog box

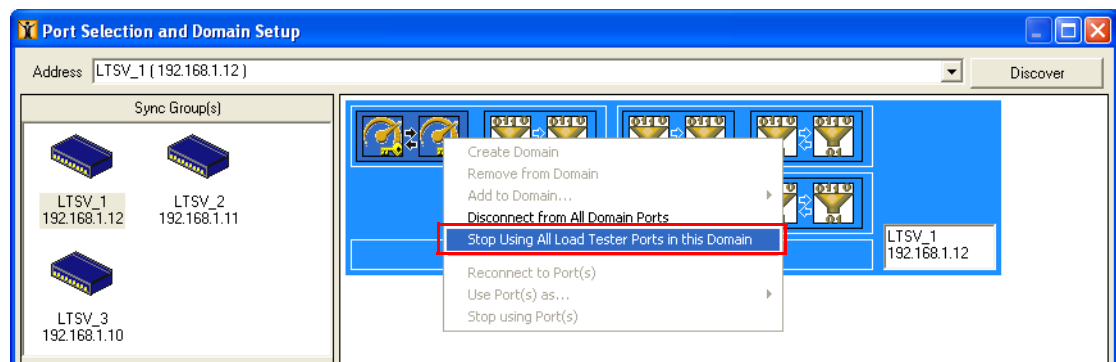
- 5 Click the **Cancel** button to close the dialog box.

Unlock the ports

Once you are done saving the Load Tester configuration you may unlock the ports already.

To unlock the ports you locked for the test:

- 1 Click on **Port selection and domain setup** button to open the **Port Selection and Domain Setup** dialog box.
- 2 Click on the locked ports to highlight them.
- 3 Right click on one of the locked port icons and select **Release All Domain Ports** (refer to Figure 473).

Figure 473: Stop Using All Load Testers Ports in this Domain

- 4 Click the **Close** button to close this dialog box.

You are now done, you may exit the Maestro application.

Loading a Configuration

Load Tester also allows you to load a configuration that you have saved. The following discussion will breakdown the process of loading you Load Tester configuration. Please note that it is assumed that the name and or IP address of the chassis is known.

Starting the Xgig Load Tester

To start the Xgig Load Tester application:

- 1 Go to **Start > All Programs > JDSU > Xgig Maestro**

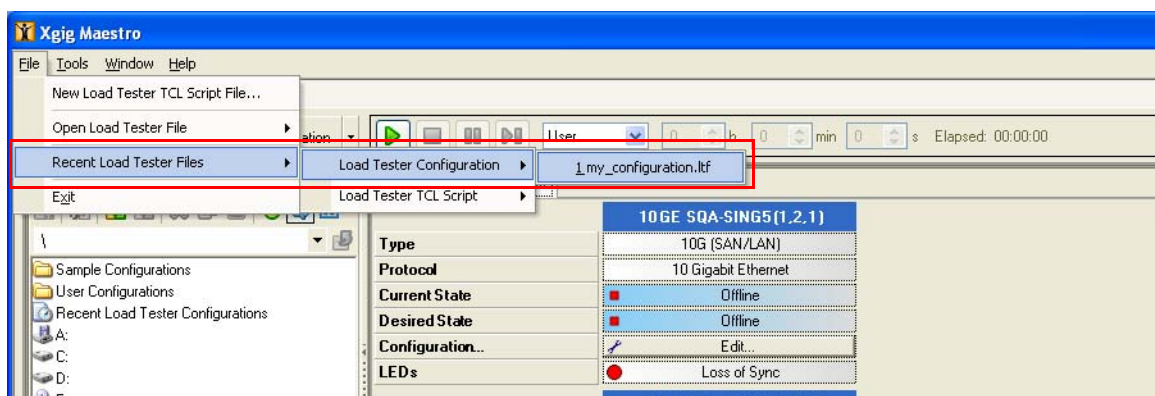
The Xgig Maestro application will be opened.

- 2 Click on the **Load Tester** tab.

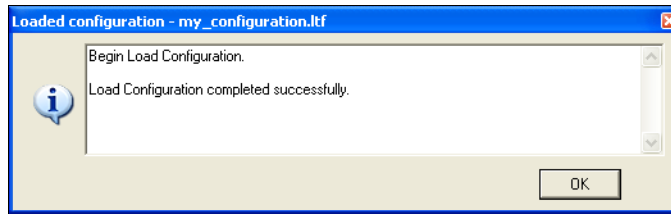
Your Xgig Maestro application will now look similar to [Figure 433](#).

- 3 Open the configuration file that you saved by selecting **File > Recent Load Tester Files > Load Tester Configuration > my_configuration.ltf** from the Menu toolbar.

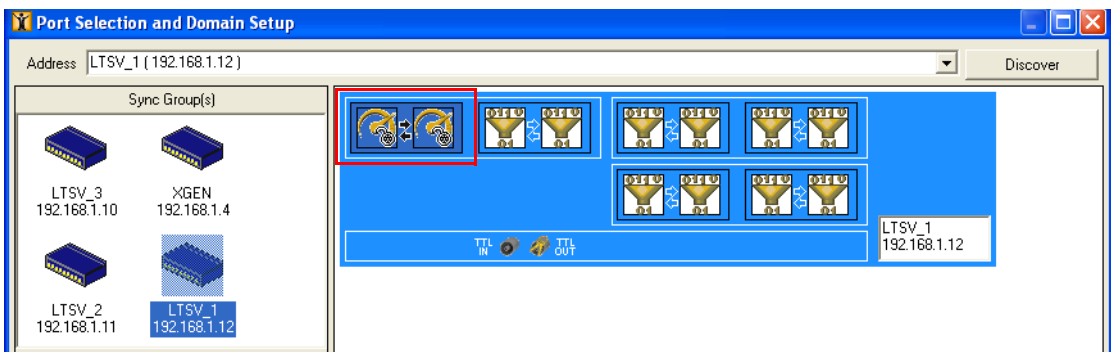
Figure 474: Load Recent Load Tester File



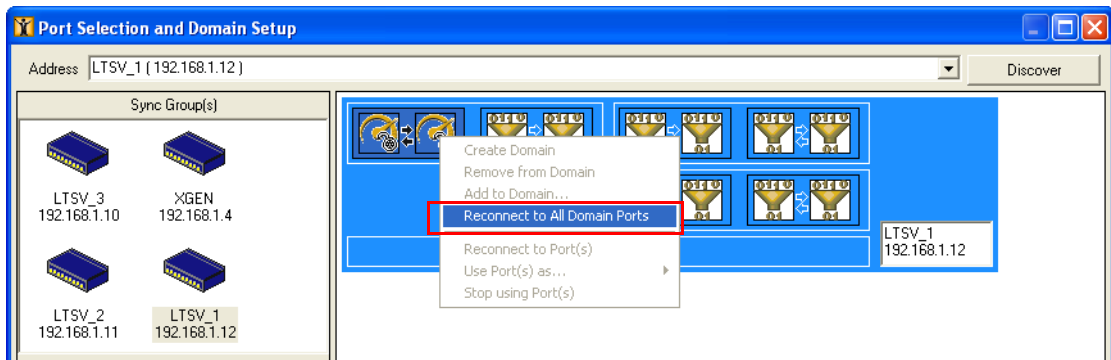
The load configuration process will begin. When the process completes, the message box ([Figure 475](#)) describing the status of the configuration load will appear.

Figure 475: Loaded Configuration message box

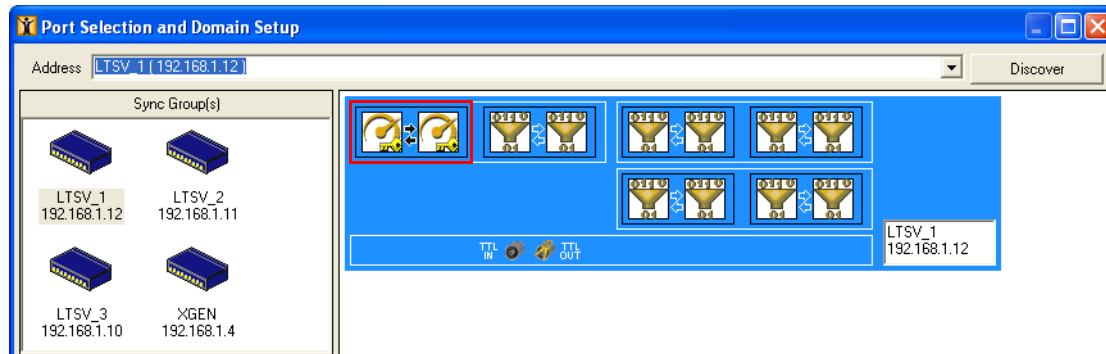
- 4 Click **Ok** to close the message box. The **Physical Ports** tab will still be empty.
- 5 Click on **Port selection and domain setup** button to open the **Port Selection and Domain Setup** dialog box.
- 6 Select your chassis.
- 7 Click on the ports that have open silver locks on them (refer to [Figure 476](#)).

Figure 476: Unlocked Ports

- 8 Right-click on one of the selected ports and select **Reconnect to All Domain Ports** ([Figure 477](#)).

Figure 477: Reconnect to All Domain Ports

The ports will now have yellow key icons ([Figure 478](#)) on them.

Figure 478: Locked Ports

- 9 Click the **Close** button to close this dialog.

You will now see the ports that were listed in the configuration file and have been loaded. All their settings and traffic configuration topologies have been restored. The ports will be in an offline state. You may now continue your testing.

Burst Mode explained

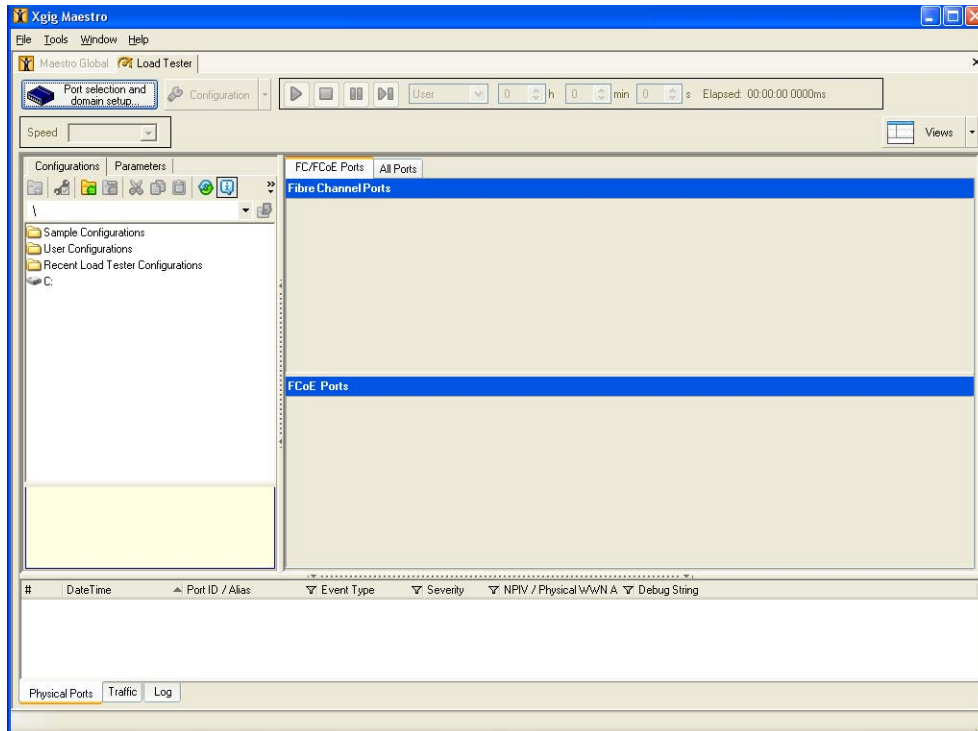
The following discussion is a working example of the Load Tester configuration and trace output.

The first part of the example is the typical Load Tester setup.

Starting the Xgig Load Tester

To start the Xgig Load Tester application:

- 1 Go to **Start> All Programs> JDSU> Xgig Maestro**
The Xgig Maestro application opens with the **Maestro Global** tab (Figure 479).
- 2 Click on **Load Tester** under **Load a Maestro Plugin**.

Figure 479: Xgig Load Tester Window

Locking the ports to use in the Load Tester

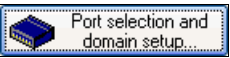
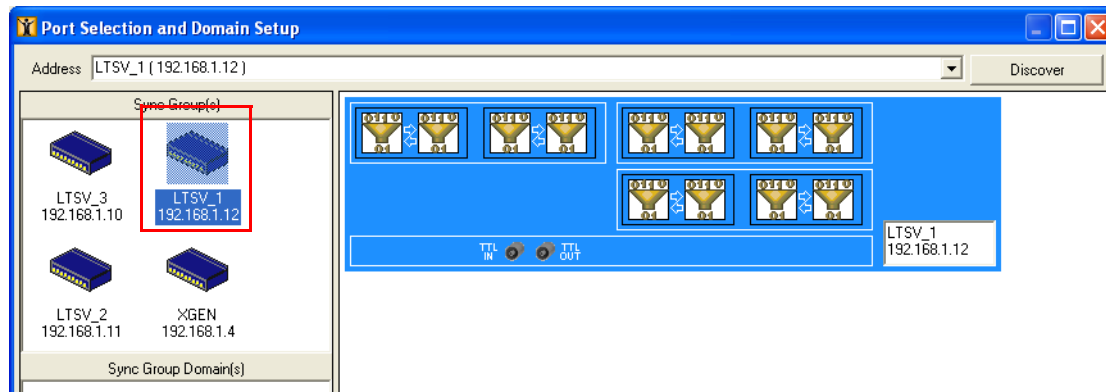
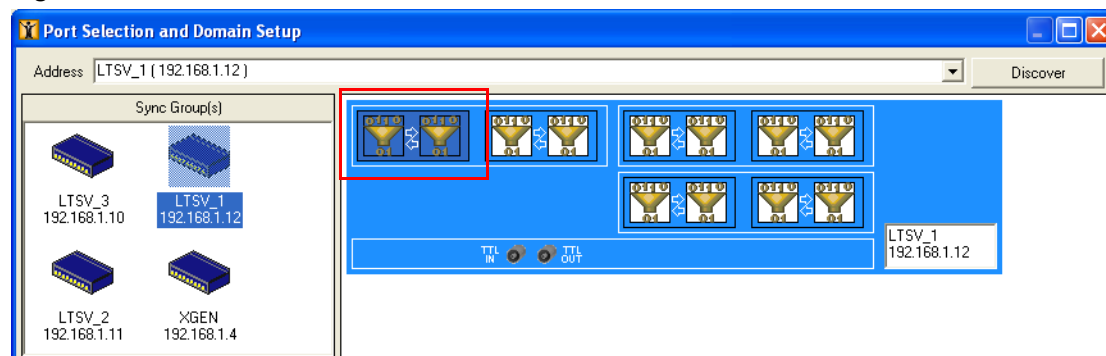
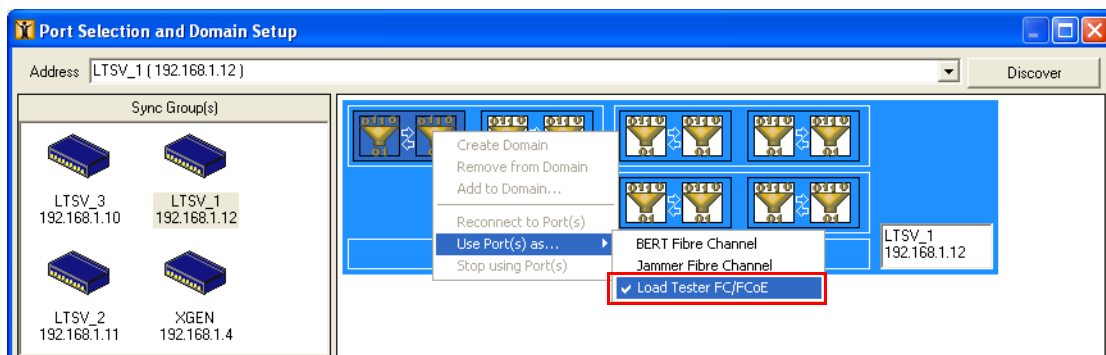
- 1 Click the **Port selection and domain setup...**  button in the top left corner.
- 2 Select your chassis from the **Port Selection and Domain Setup** dialog box (refer to [Figure 480](#)).

Figure 480: Selected Chassis

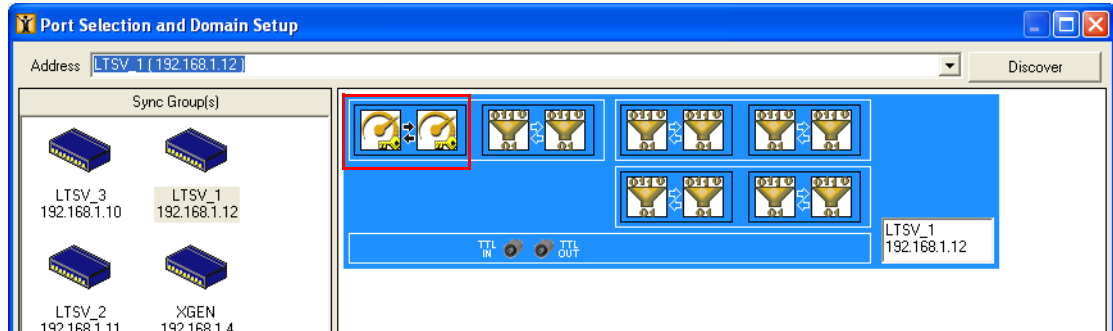
- Click on the ports you wish to use to highlight them.

Figure 481: Selected Ports

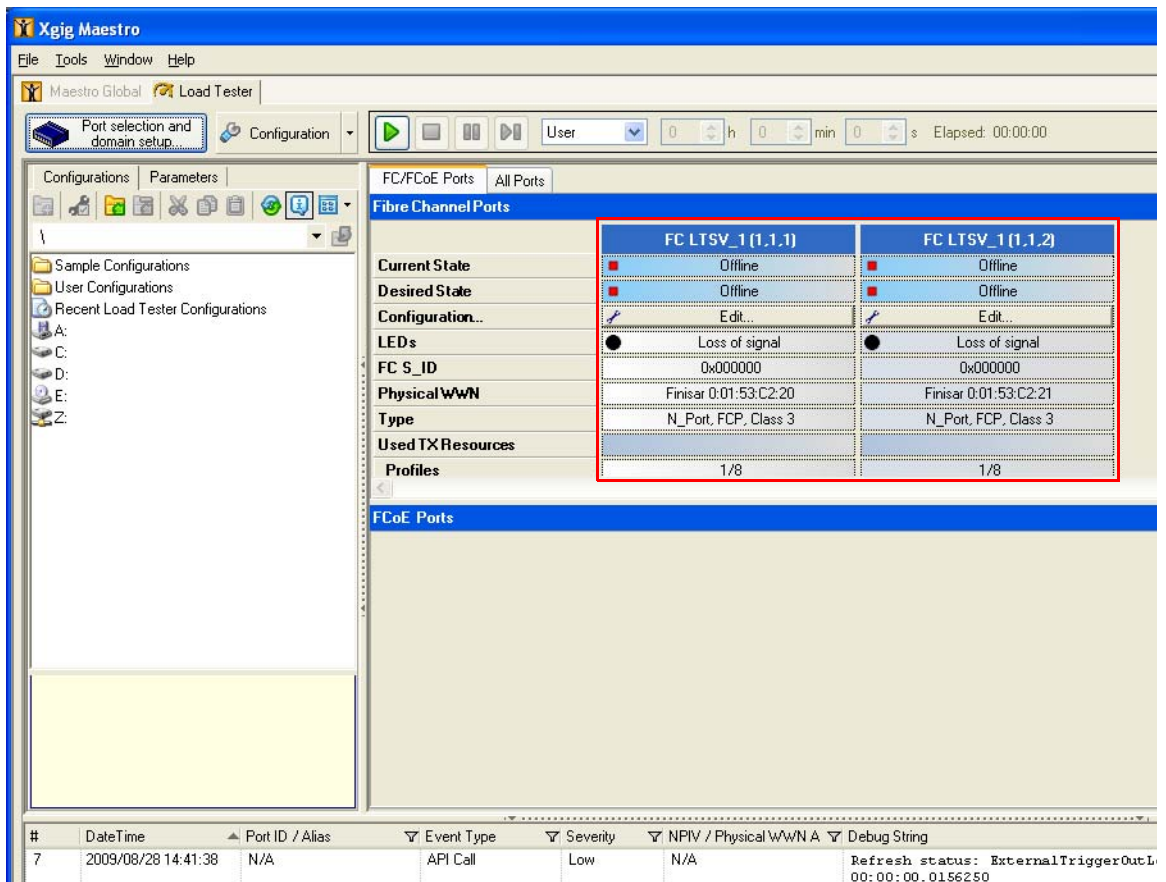
- Right-click on one of the ports and select **Use Port(s) as...** and then select **Load Tester FC/FCoE**.

Figure 482: Locking the ports to Load Tester

You will now see your two selected ports locked and ready for use. (refer to Figure 483).

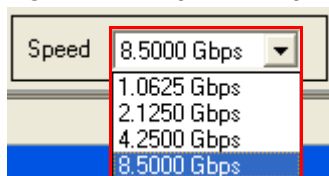
Figure 483: Locked ports

- Click on the **Close** button to close the dialog box. Your Maestro Load Tester session will now appear similar to Figure 484.

Figure 484: Load Tester window with locked ports

Setting the Speed for the Test

After locking the ports as Load Testers, you should verify if the speed of the link is correct. To quickly set the link speed for your hardware setup, select the speed to use (in Gbps) from the **Speed** drop-down menu found in the upper left corner (refer to Figure 439).

Figure 485: Speed Drop-down Menu

Now you will notice that the LEDs with the **Loss of sync occurred** status may have turned yellow if they were previously red (refer to [Figure 440](#)).

Figure 486: Loss of Sync occurred LED status

	FC LTSV_1 (1,1,1)	FC LTSV_1 (1,1,2)
Current State	Offline	Offline
Goal State	Offline	Offline
Configuration...	Edit...	Edit...
LEDs	Loss of sync occurred	Loss of sync occurred
Physical S_ID	0x000000	0x000000
Physical WWN	Finisar 0:01:52:7A:00	Finisar 0:01:52:7A:01
Port Group Tag List	::LTSV_1 (1,1,1):111::192.168.1.12,1,	::LTSV_1 (1,1,2):112::192.168.1.12,1,

Editing the Topology

Once you finished setting the speed, you need to change the traffic topology.

Near the bottom of the window you will see three tabs labeled **Physical Ports**, **Traffic** and **Log**.

To edit the topology:

- 1 Click on the **Traffic** tab to display the **TX** tab.

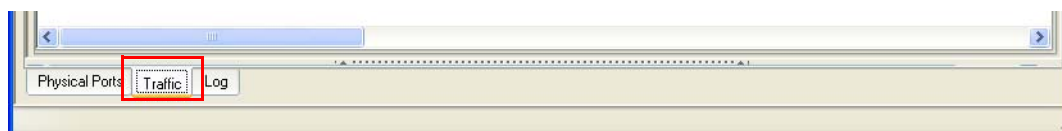
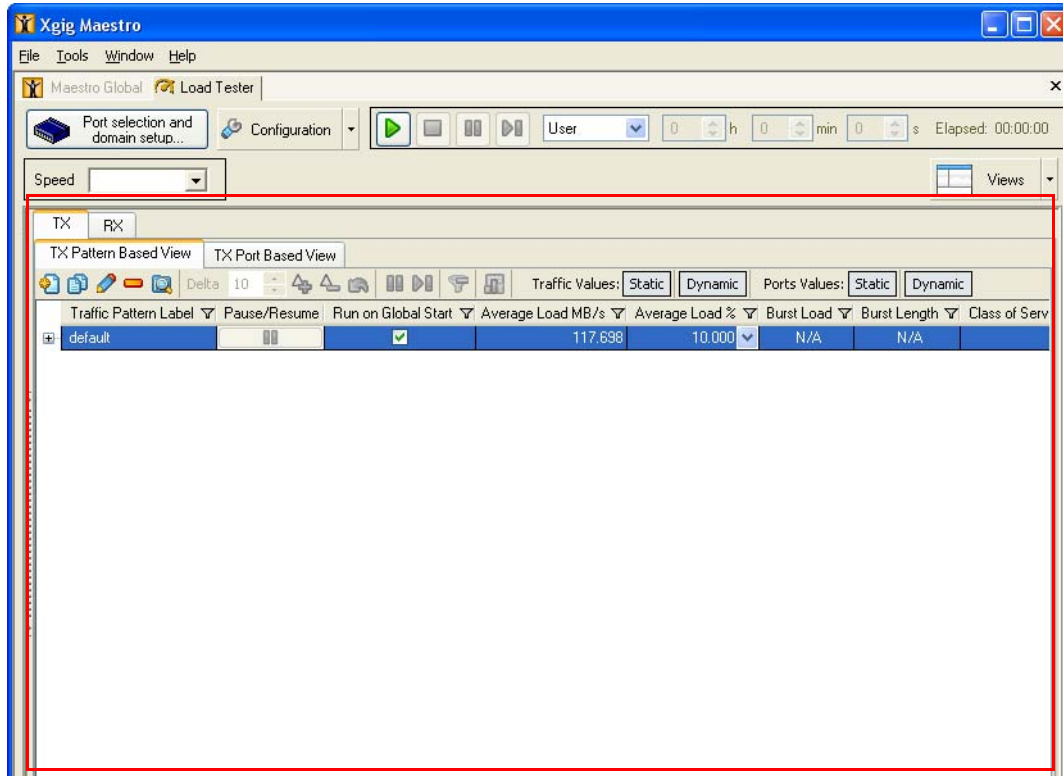
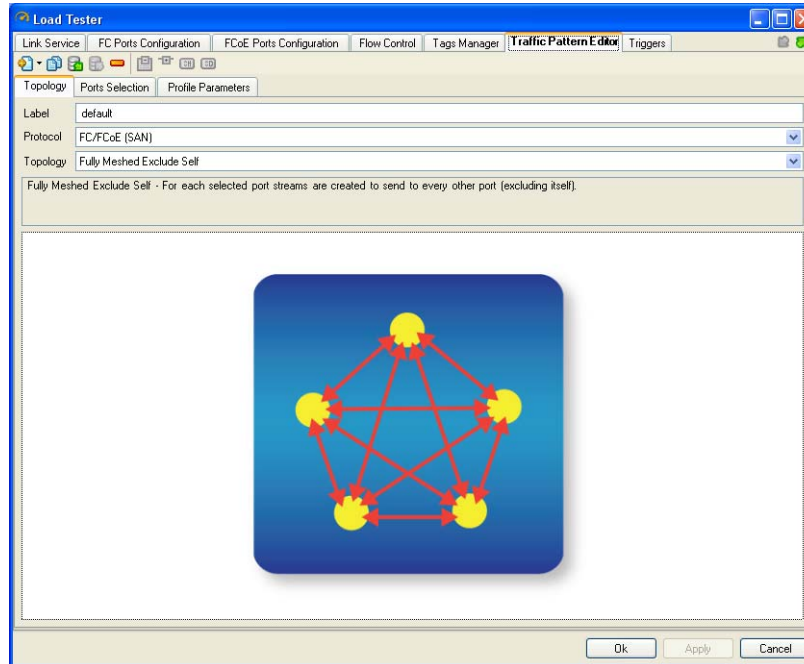
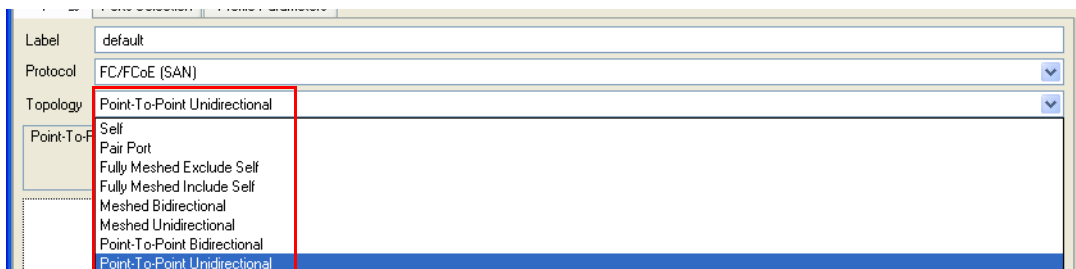
Figure 487: Traffic tab

Figure 488: TX tab in the Traffic tab

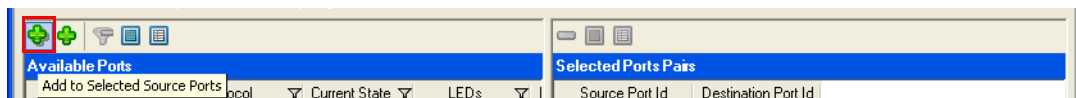
- 2 Click the pencil icon  to open the **Traffic Pattern Editor** tab in the Load tester Device Window so you can edit the **default** traffic configuration provided for you.

Figure 489: Traffic Pattern Editor Tab

- 3 Change the topology to **Point to Point Unidirectional**.

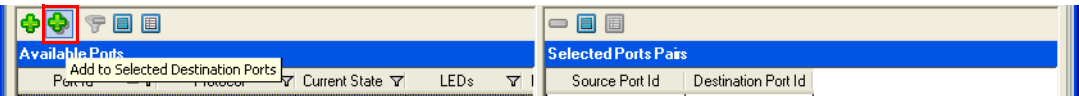
Figure 490: Topology drop-down menu

- 4 Click on the **Ports Selection** tab to select ports for the traffic pattern.
- 5 Select the first port from the **Available Ports** pane and add it to the source port list by clicking **Add Selected Ports to Source** button (Figure 491).

Figure 491: Add to Selected Source Ports

- 6 Select the second port and add it to the destination port list by clicking **Add Selected Ports to Destination**.

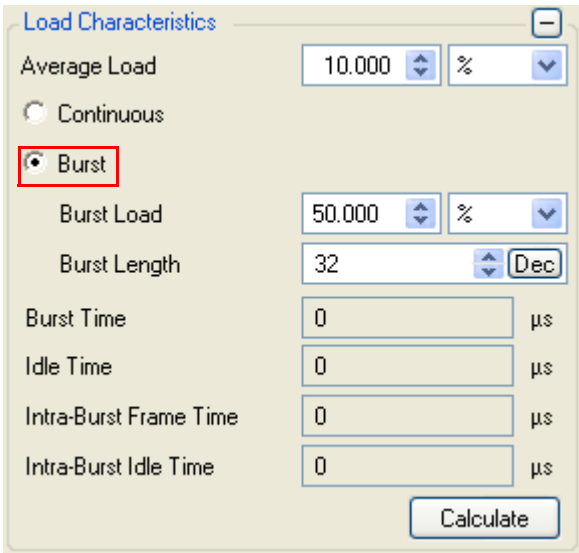
Figure 492: Add to Selected Destination Ports



7

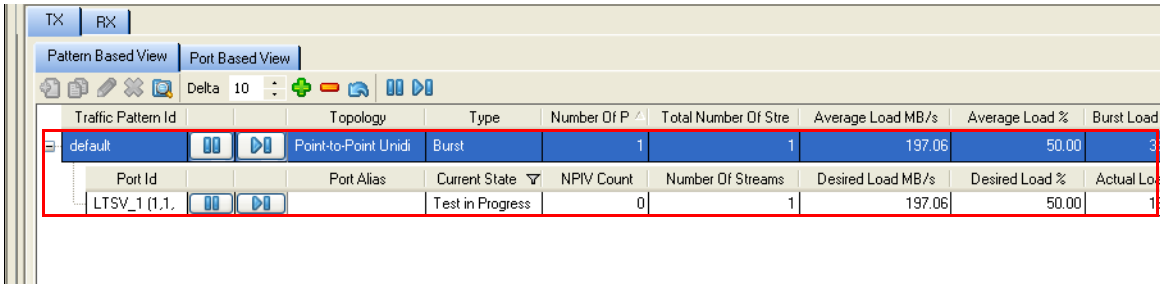
- 8 Select the **Burst** radio button in the **Load Characteristics** pane (Figure 493) **Profile Parameters** tab.

Figure 493: Load Characteristics Pane



- 9 Set **Burst Length** to **128**, **Burst Load** to **100.00** and **Desired Load** to **50.00 %**.
- 10 Click **Ok** to close the dialog box.
- 11 Expand the **default** traffic pattern.

Figure 494: Changed traffic bar



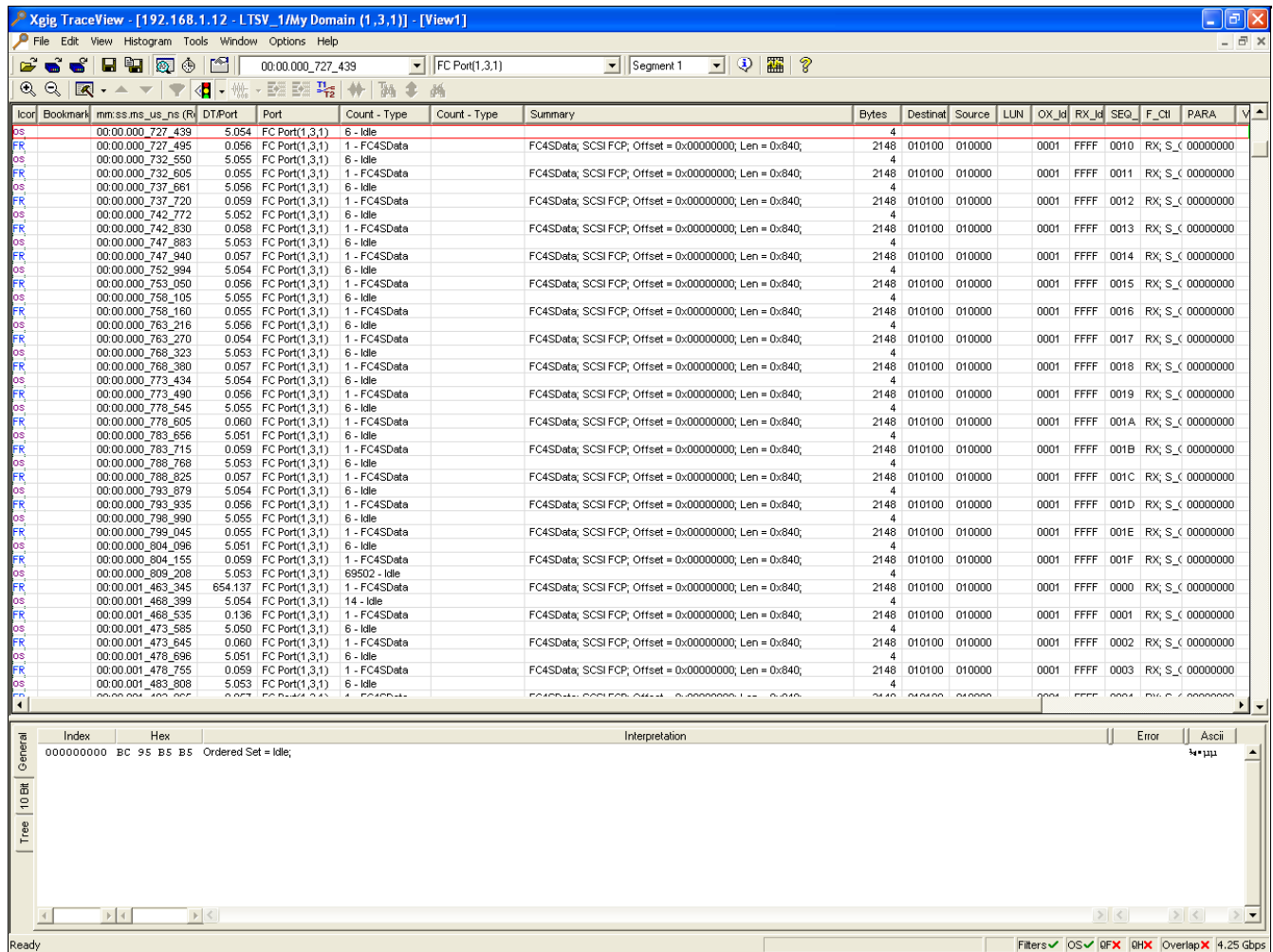
- 12 Click on the **Start** button at the top of the window.

Burst Mode Explanation

Below is a sample Xgig TraceView snapshot (Figure 495) of the traffic on the wire.

As you can see there are 6 idles between the frames and every 128 frames there is a gap with 69502 idles. The load on the wire is roughly equal between 100% load and Idles giving us an average load of 50%.

Figure 495: Xgig TraceView Snapshot



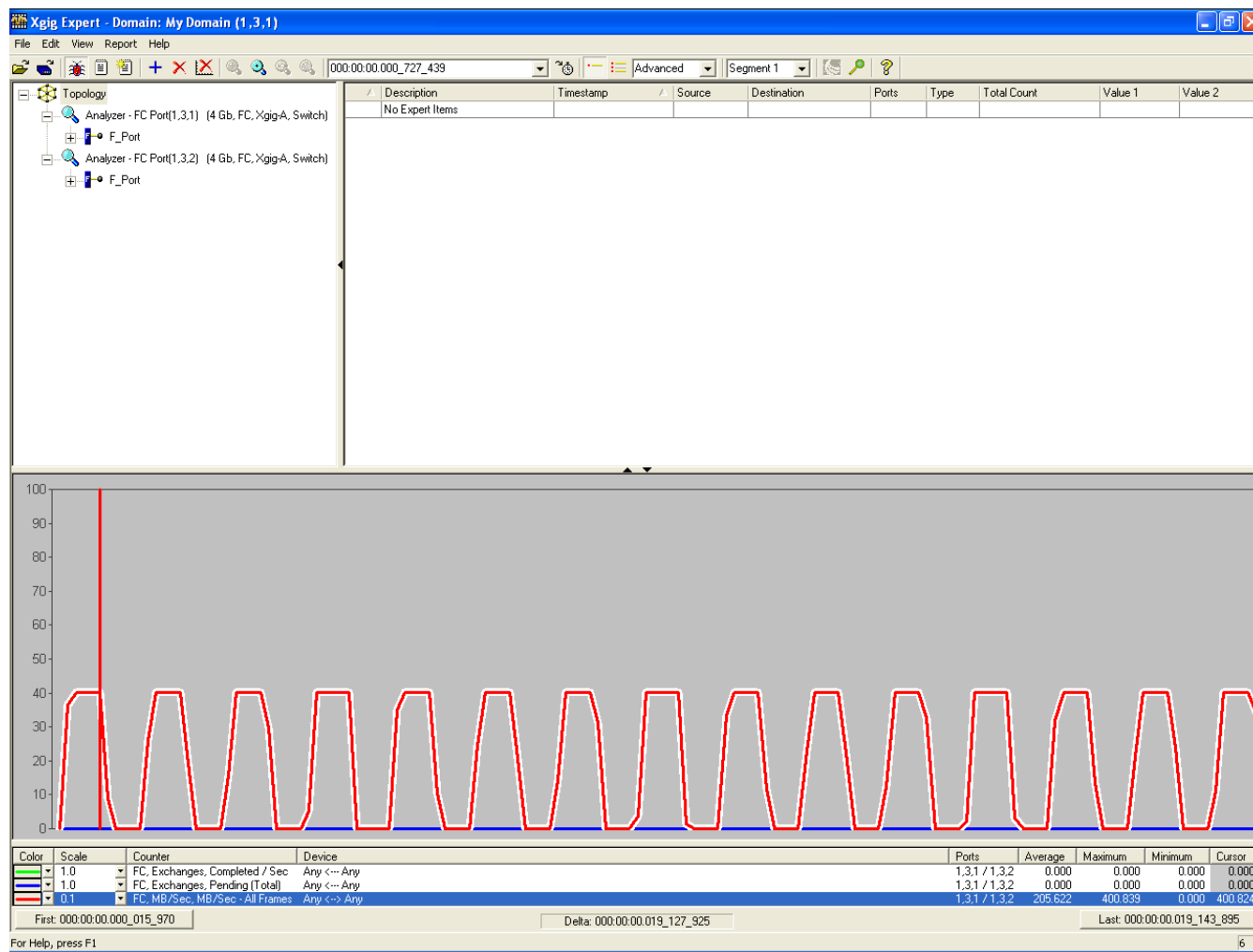
In the example of the trace we have 128 full size frames (2148 bytes) with 6 idles (24 bytes) between frames which equates to 2172 bytes.

278016 bytes = 128 full size frames* (2148 bytes + (6 idles* 4))

278008 bytes = the gap of 69502 idles which is almost identical to the load.

The graphical representation of the load on the wire is shown in Figure 496.

You can see the digital saw tooth display of full load and no load. When summed together they represent the average load of **50%**.

Figure 496: Xgig Expert Snapshot

You can now stop the test.

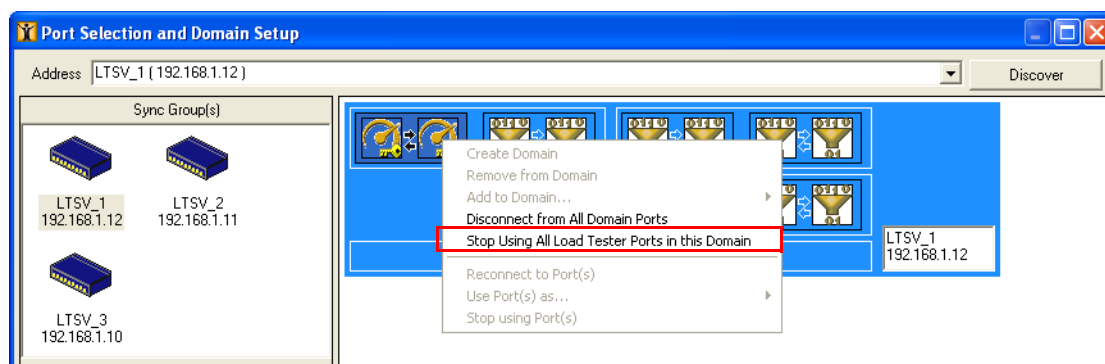
Stopping the test

To stop the test, click the **Stop** button on the upper part of the window.

Unlock the ports

To unlock the ports you locked for the test:

- 1 Click on **Port selection and domain setup** button to open the **Port Selection and Domain Setup** dialog box.
- 2 Click on the locked ports to highlight them.
- 3 Right click on one of the locked port icons and select **Stop Using All Load Tester Ports in this Domain** (refer to Figure 497).

Figure 497: Stop Using All Load Tester Ports in this Domain

4 Click the **Close** button to close this dialog box.

You are now done, you may exit the Maestro application.

Appendix H

Simplifying Detection and Resolution of Missing Frames

In this chapter:

- [Abstract](#)
- [Frame Delivery Errors](#)
- [The Xgig Load Tester](#)
- [How the Load Tester Works](#)

Abstract

A critical performance metric for switches is whether they drop, misdirect, or deliver frames out of order. Traditional network analysis tools fall short of being able to easily detect, monitor, and analyze these types of errors, making this a challenging and time-consuming metric for developers to measure accurately.

The JDSU Xgig Load Tester offers unique capabilities for comprehensively measuring this key performance metric in even the most complex network configurations. This case study will show developers how the Load Tester can be used in conjunction with the Xgig Analyzer to accelerate development and troubleshooting of network switches, enabling error resolution in minutes. After reading this case study, developers will be able to confidently configure and connect test hardware, set triggers, detect errors, capture traces, search and locate error frames, and debug and resolve these types of errors quickly and easily.

Frame Delivery Errors

One of the key characteristics of Fibre Channel switches is that they do not lose frames or change frame order. When an expected frame is not received at its destination, there are three possible scenarios:

- 1 The frame actually arrives out of order. For example, frames are received with SEQ_CNT of 1, 2, 3, 5, 4.
- 2 The frame was dropped at the switch.
- 3 The frame was directed to the wrong destination. For example, even though the frame was addressed to D_ID1, it was sent to D_ID2.

Triggering the above frame delivery errors is impossible to accomplish with analysis tools only. This is the case because the capture triggers of real-time traffic can be defined based upon a single frame while capturing the mal-delivery events relies on the information of a sequence of frames.

For dropped frames or frames sent to the wrong destination, the frame never arrives at the port of interest so there's no frame off of which to trigger. For frames arriving out-of-order, intra-frame analysis does not track sequence number so these slip past as well. While it is possible to use analyzers by themselves to detect missing and out-of-order frames, the process is complex and unreliable as it is difficult to set up real-time triggers that guarantee error detection and capture.

The Xgig Load Tester

JDSU overcomes the difficulties of detecting missing, and out-of-order frames with the Xgig Load Tester. The Load Tester is one of the multi-functional capabilities that can be licensed and enabled on Xgig Fibre Channel Blades. Emulating the end ports of Fibre Channel data links, the Load Tester is able to track frame sequences by comparing received frames against expected frames.

The Load Tester generates traffic streams to pass through switches and monitors both sides of the link to ensure that frames both arrive and arrive in the correct sequence. Because the Load Tester generates deterministic/known traffic, it detects the missing frames at its receiving paths and is able to differentiate the error events of dropped frames, out of order frames, and misdirected frames.

When detecting error events, Xgig Load Tester is also capable of triggering the Analyzer to capture the erroneous trace real time for debugging.

The Load Tester combined with the Xgig Analyzer provides the capabilities you need to detect, capture, locate, and debug missing frame errors. With the proper test setup, you will be able to capture accurate information in the trace buffer to easily find the frame in error and locate the source of the problem. Such a setup eliminates tedious guesswork and time-consuming manual searches through large trace buffers. Because the Load Tester highlights the exact frame that caused the error, developers can identify and source the errors quickly and easily.

How the Load Tester Works

The Load Tester is based on proprietary technology that enables it to verify data integrity.

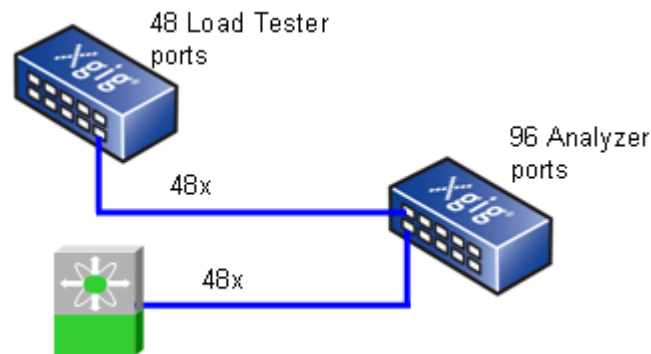
There are several steps to detect the three missing and out-of-order frame scenarios:

- 1 Configure and Connect Hardware
- 2 Set Triggers
- 3 Detect Error and Capture Trace
- 4 Search Trace Buffer to Locate and Identify Error
- 5 Debug Error

As an example, this case study will show how to configure a test setup for a 48-port switch.

Configure and Connect Hardware

The Load Tester ports are connected to 48 switch ports and the analyzer ports are put in line for capturing the traffic. [Figure 498](#) shows the diagram of the test setup. The Analyzer does not participate in data transfers but rather observes them non-intrusively.

Figure 498: Load Tester Test Setup

The Xgig Load Tester sends out the triggering signal through the chassis trigger port. Therefore, the trigger in-port on the chassis that holds the Analyzer blades needs to be connected to the trigger out-port on the Load Tester chassis. In the case that the Load Tester and Analyzer ports are in the same chassis, a BNC cable is required to loop back between the "trigger out" and "trigger in" ports. In this example, there are 48 Load Tester ports in 3 chassis and 96 Analyzer ports in 6 chassis. Each Load Tester chassis is associated with 2 Analyzer chassis for testing the same group of links, as shown in above figure. A few options for setting up the triggering connections are available.

Option 1: Setting up one Load Tester chassis and two Analyzer chassis as one testing group. For each group of links, connect the 2 Analyzer chassis through the cascading ports and group all 32 ports under the same time domain. Ports in the same time domain can share one trigger condition. Connect the "Trigger out" port on the Load Tester chassis to the "Trigger in" port on one of the two Analyzer chassis. This setup will allow you to cross trigger and test 16 switch ports within the group.

Option 2: The Xgig system allows for a maximum of 4 chassis to be in the same time domain (i.e., 64 ports). A special setup is required if cross triggering is required among all 48 switch ports. Use two time domains for the Analyzer ports: one domain of 64 ports (Domain 1) and the other domain of 32 ports (Domain 2). The chassis in the same domain are cascaded together. These two domains can be connected through the trigger ports on the chassis to share the same trigger from the Load Tester chassis. Select the "Trigger out" port on one chassis in Domain 1 to connect to the "Trigger in" port on one chassis in Domain 2. All three Load Tester chassis need to be cascaded together and defined in one time domain. Finally the "Trigger Out" port on one of the Load Tester chassis needs to be connected to one of the available "Trigger In" ports on the Analyzer chassis.

Management of all Load Tester ports, even across multiple Xgig chassis, is consolidated through a single PC running Maestro and Xgig Analyzer. Maestro uniquely allows users to utilize the same GUI to manage other Xgig generation functions such as BERT, Jammer, and Generator, thus eliminating the need to switch between different GUIs when using multiple tools.

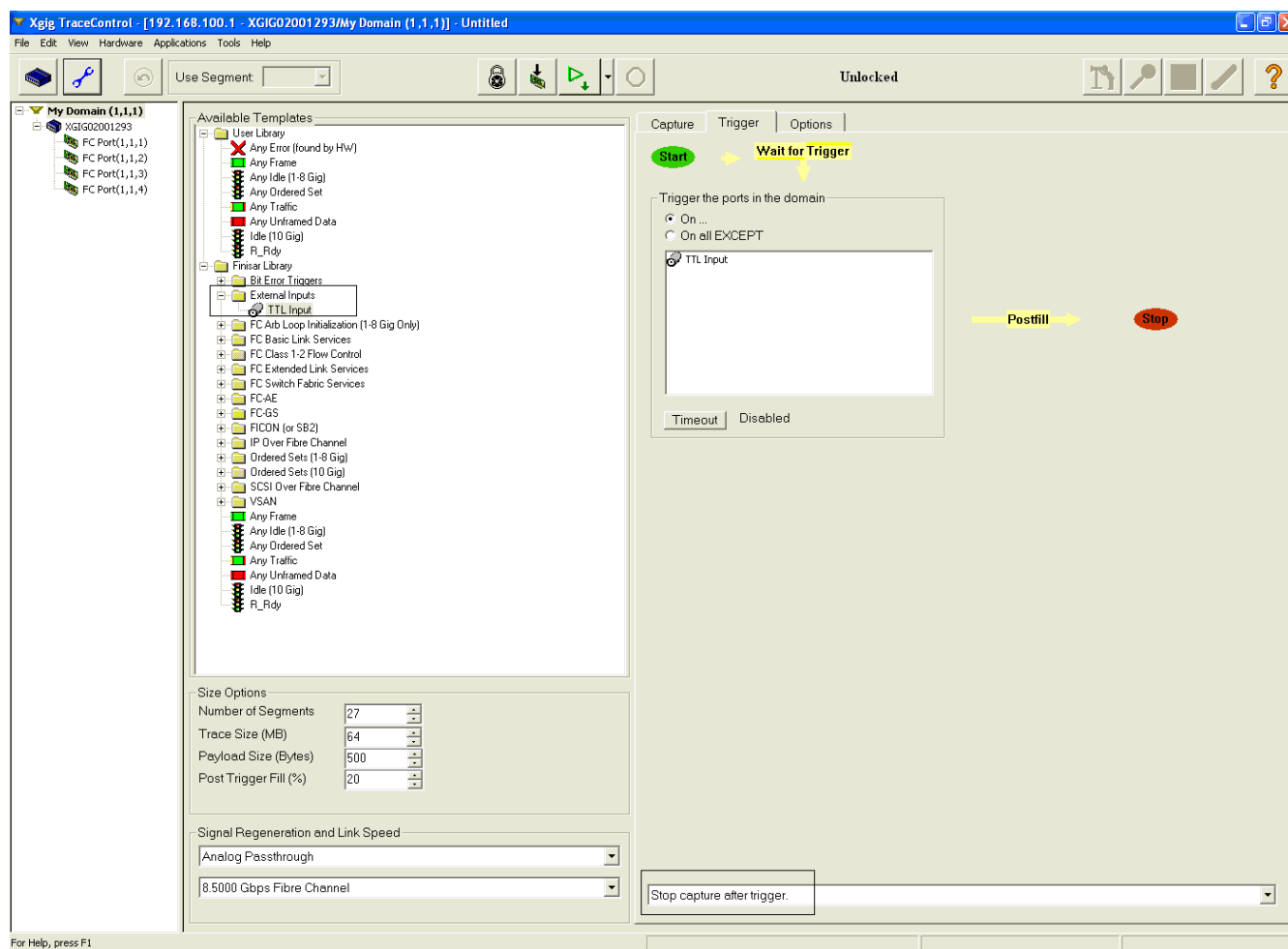
Set Triggers

With the hardware in place, it is time to configure links and set triggers. These need to be configured in both TraceControl and Maestro.

From TraceControl:

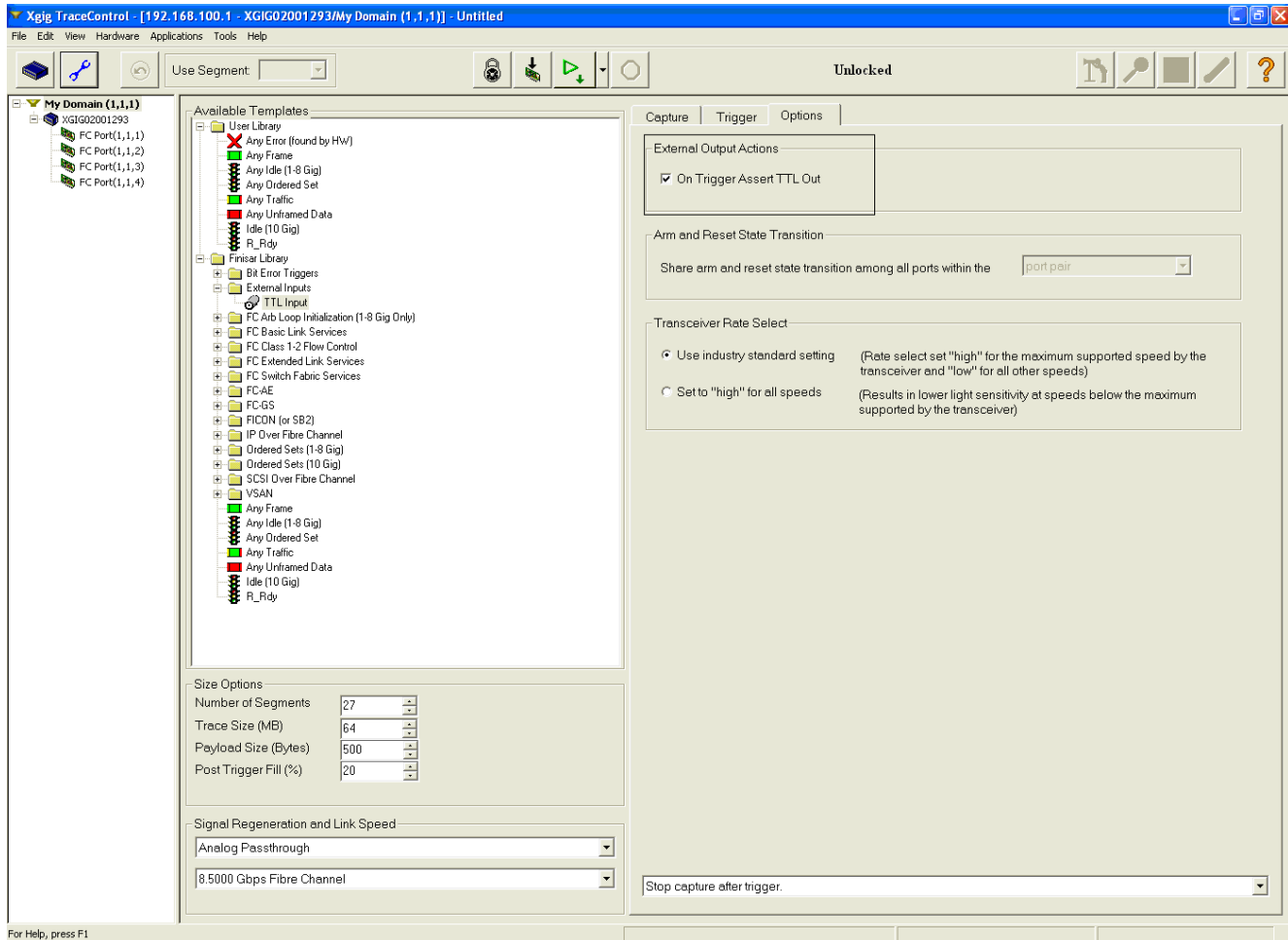
- 1 Select the “Capture Stop after Trigger” trigger scheme
- 2 Select the TTL input for the Analyzer port by dragging the TTL input template from the JDSU library to the appropriate ports in the domain template to enable the external trigger
- 3 Choose a “Post Trigger” field with a suggested value between 20-50% (refer to [Figure 499](#)).

Figure 499: Choosing a “Post Trigger” field



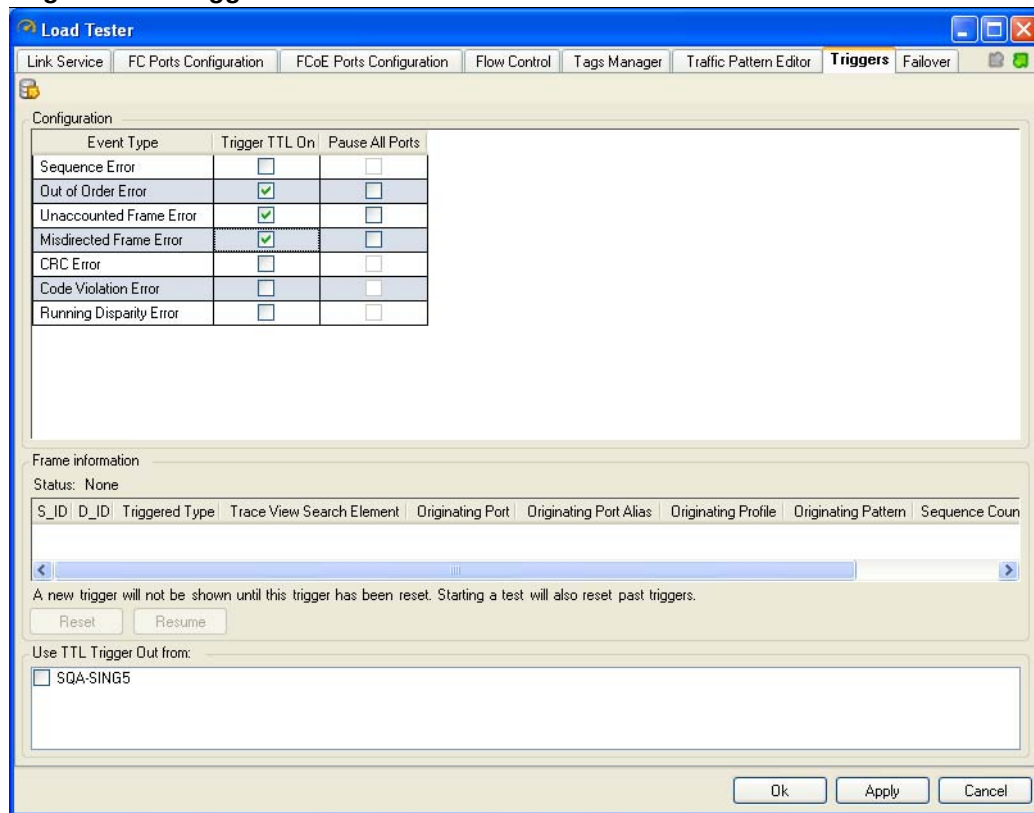
For option 2 setup, there are following additional steps:

- 1 On the Analyzer chassis (Domain 1) that is connected to the Load Tester chassis, follow the steps described above to select the “TTL input” as capture stop trigger condition
- 2 Select “External Output Actions” on “Option” pane (Domain 1).

Figure 500: Selecting “External Output Actions” on “Option” pane

From Maestro Load Tester GUI,

- Select all 48 ports under the same time domain.
- Select the "Set Trigger" pane and choose "Out of Order Frame Error", "Misdirected Frame Error", and "Dropped Frame Error" to be "Trigger TTL On". If triggered, the trigger frame information will be shown in the bottom window.

Figure 501: Triggers Tab

If you plan on capturing traces for multiple errors, configure the Analyzer with multiple memory segments. The Xgig trace buffer, more than large enough for capturing multiple missing frame errors, can be divided into up to 128 segments. Each event capture will fill one segment. In this way, you can catch multiple instances of missing errors without needing to reset the trace memory. However, the Load Tester port does need to be reset from the "Trigger" pane after the trigger event for the next error event.

Detect Error and Capture Trace

Run the system until an error is detected. (If no error is detected, your system is robust and free of missing or out-of-order frame problems.)

Once the Load Tester determines that any of the three error scenarios has occurred, it will trigger the Analyzer. As the Analyzer has been collecting traffic the entire time the system has been running, this trigger actually stops traffic collection. The Xgig Analyzer offers the option to control how much post-trigger traffic to collect when you set the "Post Fill" field in the TraceControl Configuration pane.

You can now begin searching the trace buffer to identify which error scenario has occurred.

Search Trace Buffer to Locate and Identify Errors

Once an error is detected by the Load Tester and the Analyzer is triggered, you need to locate the frame that caused the error within the trace buffer. Using traditional tools, developers have to search through the trace buffer manually since they don't know which frame caused the error.

The Load Tester simplifies this process by displaying the triggering frame, the trigger type, and key characteristics including S_ID, D_ID, OX_ID, stream frame count, and sequence count. There is also a "TraceView Search Element" value that can be used to search the trace. Armed with this information, you can use Xgig's unique and powerful Quick Search capabilities in TraceView to quickly filter through the trace buffer and locate the trigger frame. Using other filters supported by the Analyzer, you can easily determine which of the three scenarios applies and identify related frames to help in debugging the problem.

Problem Solved

Once the problem is resolved, you can repeat these steps to continue testing the switch with other traffic patterns. Alternatively, you can create more complex topologies by moving to a full any port-to-any port configuration or introducing additional switches to the fabric.

JDSU's Xgig Testing and Analysis platform is the industry's leading Fibre Channel troubleshooting and debugging tool. Xgig's unique cross-triggering capabilities between the Load Tester and the Analyzer enable the test and capture of sophisticated network problems that would be otherwise too difficult to pursue with an analyzer alone and guarantees the accurate measurement of events such as missing frames to accelerate the troubleshooting process. With the powerful combination of the Load Tester and the Analyzer, backed by JDSU's intuitive GUI control application, you can guarantee switch robustness with the greatest speed and highest confidence.

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