Online Help

Tektronix

Option SST Serial ATA and Serial Attached SCSI Analysis Module Online Help

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www.tektronix.com

Tektronix, Inc., P.O. Box 500, Beaverton, OR 97077

Option SST Serial ATA and Serial Attached SCSI Analysis Module Online Help, Version 1.0.0

Software Warranty

Tektronix warrants that the media on which this software product is furnished and the encoding of the programs on the media will be free from defects in materials and workmanship for a period of three (3) months from the date of shipment. If a medium or encoding proves defective during the warranty period, Tektronix will provide a replacement in exchange for the defective medium. Except as to the media on which this software product is furnished, this software product is provided “as is” without warranty of any kind, either express or implied. Tektronix does not warrant that the functions contained in this software product will meet Customer’s requirements or that the operation of the programs will be uninterrupted or error-free.

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General Safety Summary

Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it. To avoid potential hazards, use this product only as specified.

Only qualified personnel should perform service procedures.

While using this product, you may need to access other parts of the system. Read the General Safety Summary in other system manuals for warnings and cautions related to operating the system.

To Avoid Fire or Personal Injury:

Connect and Disconnect Properly: Do not connect or disconnect probes or test leads while they are connected to a voltage source.

Observe All Terminal Ratings: To avoid fire or shock hazard, observe all ratings and markings on the product. Consult the product manual for further ratings information before making connections to the product.

Do Not Operate With Suspected Failures: If you suspect there is damage to this product, have it inspected by qualified service personnel.

Symbols and Terms: The following terms and symbols may appear in the online help.

⚠ **WARNING:** Warning statements identify conditions or practices that could result in injury or loss of life.

⚠ **CAUTION:** Caution statements identify conditions or practices that could result in damage to this product or other property.

Terms on the Product: The following terms may appear on the product:

DANGER indicates an injury hazard immediately accessible as you read the marking.

WARNING indicates an injury hazard not immediately accessible as you read the marking.

CAUTION indicates a hazard to property including the product.

Symbols on the Product: The following symbol may appear in the product:

⚠ CAUTION Refer to Help

Introduction

Using Online Help

Online help has many advantages over a printed manual because of advanced search capabilities. You can select Help> Topics on the right side of the application menu bar to display the Help file.

The main (opening) Help screen shows three tabs across the top, each of which offers a unique mode of assistance:

- Contents (TOC) tab - organizes the help into book-like sections. Select a book icon to open a section; select any of the topics listed under the book.
- Index tab - enables you to scroll a list of alphabetical keywords. Select the topic of interest to display the corresponding help page.
- Find tab - allows a text-based search. Follow these steps:

1. Type the word or phrase you want to find in the search box.
2. If the word or phrase is not found, try the Index tab.
3. Select some matching words in the next box to narrow your search.
4. Choose a topic in the lower box, and then select the Display button.

***Note**: The Find tab function does not include words found in graphics*

- To print a topic, select the Print button from the help topics menu bar.
- Select Options from the menu bar for other commands, such as to annotate a topic, to keep the help window on top, or to use system colors.

Select the Back button to return to the previous help window. Sometimes you can jump from one topic to another through a hyperlink. If the Back button is grayed out, or a jump is not available, choose the Help Topics button to return to the originating help folder.

- Browse buttons (Next >> and Previous <<) allow you to move forward and backward through topics in the order of the Table of Contents (TOC).
- A Note: in the topic text indicates important information.

Note: *Green-underlined text indicates a jump (hyperlink) to another topic. Select the green text to jump to the related topic. For example, select the green text to jump to the topic on Feedback to contact Tektronix.*

You can tell when the cursor is over an active hyperlink (button, jump, or popup), because the arrow cursor changes to a small pointing hand cursor.

The light bulb icon and word Tip in the graphic above indicates additional information to help you operate the application more efficiently.

Related Documentation

In addition to the online help, the Serial ATA and SAS test modules, *Optional Applications Software on a Windows-Based Oscilloscope CD-ROM* includes a Quick Reference guide in PDF format. Refer to the *Option SST Serial ATA and Serial Attached SCSI Test Module Application Reference* for the following information:

- A short tutorial to help you quickly take measurements
- An overall menu map of the entire application

In addition to the online help for the SATA and SAS test modules, you can refer to the RT-Eye Serial Data Compliance and Analysis Application online help for information about how to use the RT-Eye application.

Refer to *the Optional Applications Software on a Windows-Based Oscilloscope Installation Manual* for the following information:

- Software warranty
- Software license agreement
- List of all available applications, compatible oscilloscopes, and relevant software and firmware version numbers

- Installation procedures
- Instructions for enabling an application
- Instructions for downloading files from the Tektronix Web site. The *Optional Applications Software on a Windows-Based Oscilloscope CD-ROM* includes many PDF files in the Documents directory that you can view and print.

Reference to Standards

- Serial ATA-II specifications PHYii Spec Rev 1_0 052604.pdf.
- SAS specifications ANSI INCITS 376-2003 dated 30th October 2003

Conventions

Online help topics use the following conventions:

- The term "module", "SATA or SAS test module" or "application" refers to the Serial ATA or SAS plug-in software modules.
- The term "RT-Eye application" refers to the Tektronix RT-Eye Serial Data Compliance and Analysis Application with which the Serial ATA and SAS modules can be run.
- The term "oscilloscope" refers to any product on which this application runs.
- The term "select" is a generic term that applies to the two mechanical methods of choosing an option: with a mouse or with the touch screen.
- The term "channel" is context dependent. It can refer to the transmit channel of the device under test or to an oscilloscope channel.
- The term "DUT" is an abbreviation for Device Under Test.
- When steps require a sequence of selections using the application interface, the ">" delimiter marks each transition between a menu and an option. For example, one of the steps to recall a setup file would appear as File> Recall.

Contacting Tektronix

Phone	1-800-833-9200*
Address	Tektronix, Inc. 14200 SW Karl Braun Drive P.O. Box 500 Beaverton, OR 97077USA
Web site	www.tektronix.com
Sales support	1-800-833-9200, select option 1*
Service support	1-800-833–9200, select option 2*
Technical support	Email: techsupport@tektronix.com, or sata2-feedback@tek.com 1-800-833-9200, select option 3* 6:00 a.m. - 5:00 p.m. Pacific time

* This telephone number is toll free in North America. After office hours, please leave a voice mail message. Outside North America, contact a Tektronix sales office or distributor. See the Tektronix Web site for a list of offices.

Updates through the Web Site

You can find information about this and other applications at the Tektronix Inc. Web site, www.tektronix.com. Check this site for firmware updates and other information about our application.

Feedback

Tektronix values your feedback on our products. To help us serve you better, please send us your suggestions, ideas, or comments on the application.

Direct your feedback via email to techsupport@tektronix.com or sata2-feedback@tek.com or FAX at (503) 627-5695 and include the following information. Please be as specific as possible.

General information:

- Instrument model number and hardware options if any, with serial number
- Probes used
- Your name, company, mailing address, phone number, FAX number, email address
- Please indicate if you would like to be contacted by Tektronix about your suggestion or comments

Application specific information:

- Software version number
- Description of the problem such that technical support can duplicate the problem
- The setup file of the oscilloscope and the application is also required to identify the problem
- If possible, save the waveform on which you are performing the measurement as a .wfm file

Note: *To find the Software version number, click Help> About in the application.*

Once you have gathered this information, you can contact technical support by fax or through email. If using email, be sure to enter "Option SST Software Problem" in the subject line, and attach the .wfm files.

You can then attach the file to your email (depending on the capabilities of your email editor).

Getting Started

About the Option SST Analysis Modules

The Option SST Analysis Modules consist of two modules–Serial ATA and SAS– that are plug-in software modules to the Tektronix RT-EYE Serial Compliance and Analysis application that runs on some Tektronix Windows-based oscilloscopes.

You can use these modules to test storage devices as per the Serial Advanced Technology Attachment or SATA (Gen I and Gen II) and Serial Attached SCSI (SAS) standards. After the measurements are taken, the results are displayed to show whether the device has passed or failed the test.

Other features include:

- Performs Eye, Timing, and Amplitude measurements, and OOB tests according to industry standard methods
- Selects and configures multiple measurements using differential or single-ended probe inputs for receiver and transmitter devices
- Creates, formats, and generates reports

The measurements that are available in the Serial ATA module are: Eye, Bit Rate, Differential Skew, Rise and Fall Time, Unit Interval, Differential Voltage, AC CM Voltage, COMINIT, COMWAKE, and COMRESET.

The measurements that are available in the SAS module are: Eye, Bit Rate, Rise and Fall Time, Differential Skew, COMINIT, COMWAKE, and COMRESET.

Compatibility

The Option SST analysis modules run on the following Tektronix instruments:

Oscilloscopes

- TDS6604
- TDS6604B

- TDS6804B
- TDS7704B

Arbitrary Waveform Generators

- AWG 610/615
- AWG 710/710B

Recommended Accessories

The Option SST Test Modules support the following probes:

- P7380SMA
- P7380
- SMA Cables
- 14dB Attenuator: Tektronix 5X Attenuator (SMA male-to-female) - (Order 015-1002-01.)

Test fixtures: Crescent Heart Software (www.c-h-s.com)

Requirements and Restrictions

- The RT-EYE Serial Compliance and Analysis application must be installed for the Option SST Test Modules to run.
- The Sun Java Run-Time Environment (JRE) V1.4.0 and The Mathworks MATLAB Run-Time Server are components of the Option SST test modules. When you install the application, the InstallShield Wizard automatically installs the proper software components.

MATLAB Server. The MATLAB server is dedicated to the RT-Eye application and cannot be used for other purposes. Do not close the Matlab Server icon in the oscilloscope task bar because this will disrupt the operation of the Option SST Test Modules. The application will close the MATLAB sever when you exit the application.

Starting the Application

For supported non-B series oscilloscopes, on the oscilloscope menu bar, select File> Run Application> RT-Eye Serial Compliance and Analysis. For supported B-series oscilloscopes, on the oscilloscope menu bar, click App> RT-Eye Serial Compliance and Analysis.

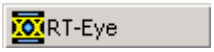
- To start the Serial ATA module, from the RT-EYE Serial Compliance and Analysis application, select Module> Serial ATA.
- To start the SAS module, from the RT-EYE Serial Compliance and Analysis application, select Module> SAS.

The application starts and displays the Measurements Select menu.

You can move between modules by selecting the module name from the Modules menu in the application menu bar.

Maximizing and Minimizing the Application

To minimize the application and selected module, select File> Minimize in the application menu bar.

To maximize the application and selected module, select 

in the task bar.

To hide the application and the selected module, select the  Hide button.

Returning to the Application

For supported non-B series oscilloscopes, to return to the application, click the APP button on the top right of the oscilloscope display. For supported B-series oscilloscopes, click App> Restore Application from the menu bar.

Exiting the Application

To exit the RT-Eye application and the selected module, select File> Exit or the (Exit) command button in the application menu bar. When you exit the application, you can elect to keep the oscilloscope setup currently in use with the

application or to restore the oscilloscope setup that was present before you started the application.

Application Directories and Usage

The modules use directories to save and recall setup files and use file name extensions to identify the file type.

The following table lists the default directory names:

Table 1: Default directory names and their use

Default directory names*	Directory use
C:\Program Files\TekApplications\tdsrt-eye\modules\SATA	Serial ATA application home location
\modules\SATA\AWGFiles	AWG files used by Serial ATA
\modules\SATA\limits	Limit files for Pass or Fail compliance tests for Serial ATA
\modules\SATA\setup	Setup files for Serial ATA
C:\Program Files\TekApplications\tdsrt-eye\modules\SAS	SAS application home location
\modules\SAS\AWGFiles	AWG files used by SAS
\modules\SAS\limits	Limit files for Pass or Fail compliance tests for SAS
\modules\SAS\setup	Setup files for SAS
\Examples\Masks	Mask files for serial data standards
\Examples\RemoteCtrl	Sample remote control program
\Examples\WFMS	Waveforms for learning
\temp	Temporary files
\images	Plot files
\ReportGenerator\modules\SATA\Reports	Files created for the Serial ATA module by the Report Generator utility
\ReportGenerator\modules\SAS\Reports	Files created for the SAS module by the Report Generator utility
*** All subdirectories are located in the c:\TekApplications\tdsrt-eye directory, except the home location of the Option SST test modules.**	

File Name Extensions

The following table lists the file name extensions and their descriptions:

Table 2: File name extensions and their descriptions

Extension	Description
.bmp	File that uses a "bitmap" format
.csv	File that uses a "comma separated variable" format
.dat	File with binary format
.fig	Plot file with binary data
.gif	File that uses a "graphic interchange format"
.ini	Application setup file
.jpg	File that uses the a "joint photographic experts group" format; also known as JPEG
.lim	Limits file used with Pass/Fail compliance
.mat	MATLAB waveform vector header saved to the hard disk
.msk	Waveform mask file used with plots
.pdf	File that uses a "portable data format"
.png	File that uses a "portable network graphics" format
.rgt	File that defines the report template
.rpl	File that defines the report layout
.rpt	File created by the Report Generator utility
.rtf	File that uses a "rich text format"
.set	Oscilloscope setup file saved that is recalled with an application .ini file; both files will have the same name
.wfm	Waveform file; can be recalled into Reference memory

Operating Basics

Opt. SST Application View

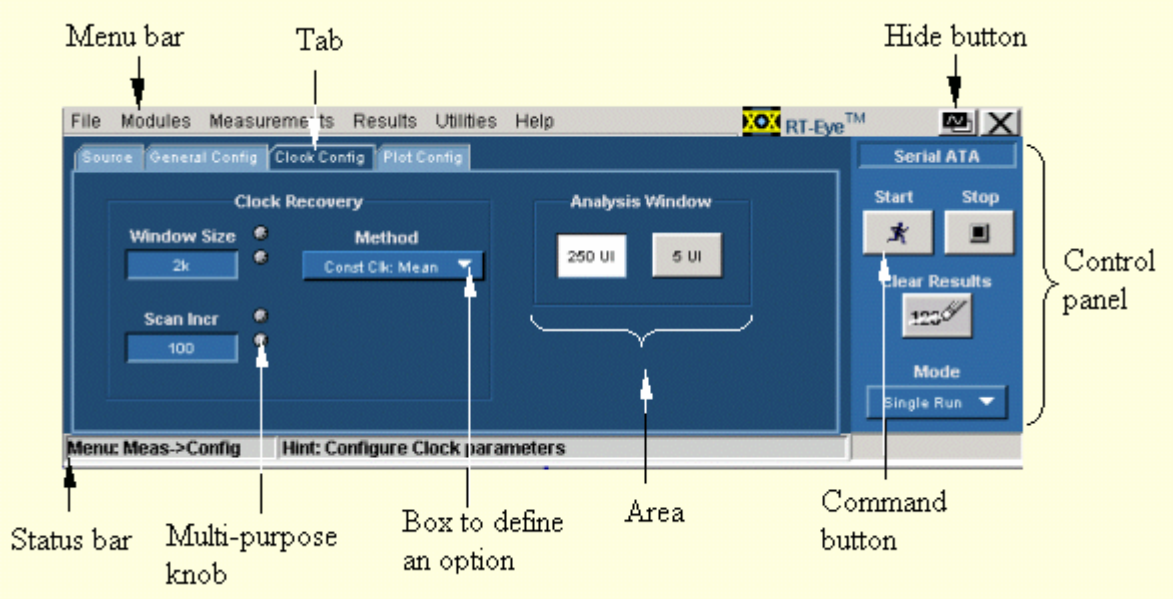


Figure 1: Application view

Application User Interface Items

Table 3: Application user interface and their description

Item	Description
Area	Visual frame that encloses a set of related options
Box	Use to define an option; enter a value with the keypad or multipurpose knob
Browse	Displays a window where you can look through a list of directories and files
Button	Use to define an options; not a command button
Check box	Use to select or clear an option
Command button	Initiates an immediate action, such as the Start command button in the Control panel
Control panel	Located to the right of the application; contains command buttons that you use often
List box	Use to define from a list
Menu	All options in the application window (except the Control panel) that display when you select a menu bar item
Menu bar	Located at the top of the application display and contains the application menus
Option	Any named button (other than the command button) or any named box that defines a control or task
Status bar	Line located at the bottom of the application display that shows the name of the current menu (location) and the next step that you might take (action)
Scroll bar	Vertical or horizontal bar at the side or bottom of a display area that you use to move around in that area
Tab	Short cut to a menu in the menu bar or a category of menu options; most tabs are short cuts
Virtual keyboard	On-screen keyboard that you can use to enter values (numeric keyboard) or alphanumeric strings (text) for descriptions and file names

Serial ATA and SAS Measurements

The following tables list the Serial ATA and SAS measurements that the modules support.

Table 4: Default directory names and their use

Measurement	Description
Eye	Measures, analyzes, and characterizes the differential output voltage, jitter, rise and fall time for transition and non-transition bits
Bit Rate	Measures the inverse of the average bit time for the clock recovery window
Differential Skew	Measures the time difference between the single-ended mid-point of the TX+/RX+ signal rising/falling edge and the single-ended mid-point of the TX–/RX– signal falling/rising edge
Rise and Fall Time	Measures the rise and fall times of the waveform. The rise and fall times are defined over a 20%-80% output level change from the High and Low reference levels
Unit Interval	Measures the time required to transmit one bit
Differential Voltage	Measures the minimum and maximum differential voltage amplitude for a given data pattern
AC Common Mode Voltage	Measures the maximum sinusoidal amplitude

Out Of Band Tests

Table 5: Default directory names and their use

Out of Band Tests	Description
COMINIT	Is used by the device to request a reset from the host in accordance with a particular sequence of bursts
COMRESET	Is indicated by transmitting bursts of data separated by an idle bus condition. The OOB COMRESET signal consists of no less than six data bursts with inter-burst temporal spacing
COM WAKE	The OOB COMWAKE signaling consists of no less than six data bursts including inter-burst spacing

Menus

Menus

The Option SST application consists of two software plug-in modules that run on the RT-Eye Serial Data Compliance and Analysis application – Serial ATA (SATA) and SAS. Each module has a menu that allows you to save and recall files, select measurements and configure them, view results, and generate reports.

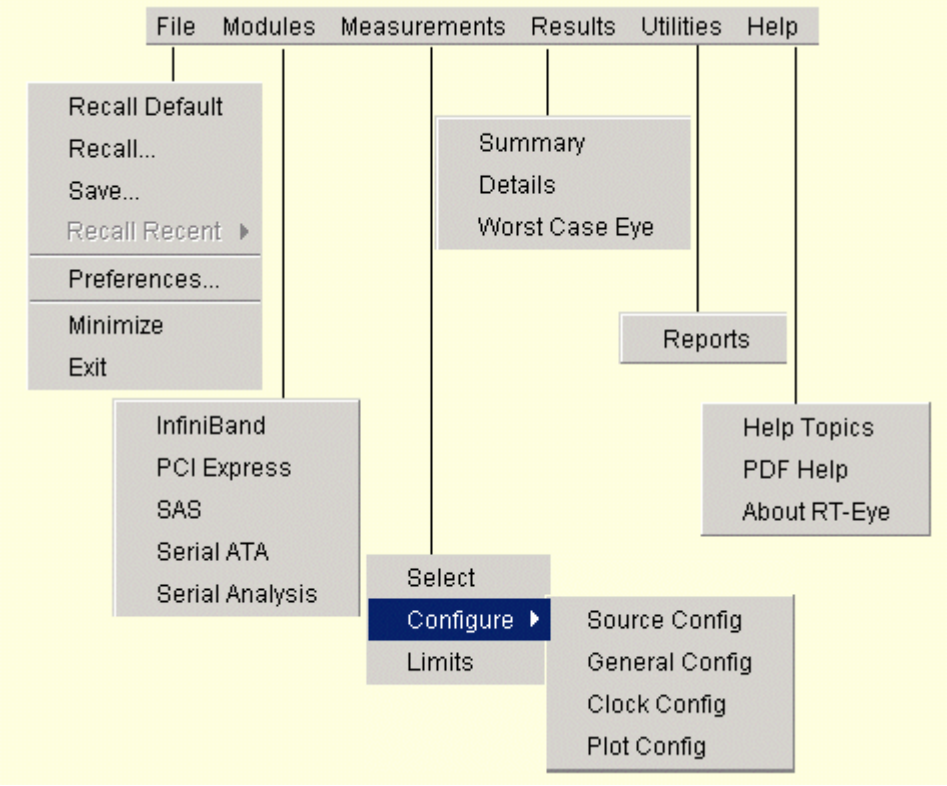


Figure 2: Default directory names and their use

File Menu

You can use the File menus to save and recall different application setups and recently accessed files.

Note: *The File> Save function saves application settings in an .ini file and the settings of the oscilloscope application in a .set file with a matching name.*

If an oscilloscope .set file with a matching name is found when you recall an application setup file, then the oscilloscope settings are also recalled. If the .set file is missing or cannot be opened by the oscilloscope, then the application recalls the application settings and displays a message that the Recall of the .set file failed.

Do not edit a setup file or recall a file not generated by the application.

Click File from the application menu bar.

The File menu has the following selections:

Table 6: File menu and their descriptions

Menu/function	Description or function
Recall Default	Recalls most default parameters for the active module (Serial ATA or SAS)
Recall*	Browse to select an application setup (.ini) file to recall the setup file. Recall restores the application to the values saved in the setup
Save*	Saves the current application settings in a .ini file
Recall Recent	Select from the list of four most recently accessed setup files (saved or recalled) and recall that setup
Preferences	Displays the Preferences menu, settings apply until you exit the application; saved setup files include the settings
Minimize	Minimizes the application
Exit	Exits the application; you can choose to retain the current oscilloscope settings or restore the oscilloscope to the settings prior to starting the application
*** Save or Recall functions also save or recall the associated oscilloscope setup file (.ini); an oscilloscope file is recalled if the application finds a .set with a matching name**	

Measurements Menu

You can use the Measurements Menu to select and configure the measurement that you want to make.

Click Measurement from the application menu bar. The Measurement menu has the following selections:

Table 7: Measurement menu and their descriptions

Menu/function	Description or function
Select	Displays the Measurements for the selected module
Configure	Displays the configuration tabs for the selected measurements
Limits	Displays the Limits file

Click Measurement > Configure from the application menu bar. You can use the Configure menu item to select and configure the measurements that you have selected.

The Configure menu item has the following selections:

Table 8: Configure menu and their descriptions

Menu item	Description
Source	Displays the source parameters to configure for the selected tests
General Config	Displays the general parameters to configure for the selected tests
Clock Config*	Displays the clock parameters to configure for the selected tests
Plot Config**	Displays the plot parameters to plot an eye diagram
*** This tab is not available for SAS measurements** **** This tab is enabled only for Eye measurement**	

Results Menu

You can view the results of the measurements using the Results Menu.

Click Results from the application menu bar. The Results Menu has the following selections:

Table 9: Results menu and their descriptions

Menu item	Description
Summary	Displays a summary of the results of the measurement or test
Details	Displays the details of the results of the measurement or test
Worst Case Eye*	Displays the plot of the Eye Diagram
*** This selection is not available for the SAS module**	

Utilities Menu

You can use the Utility Menu to open the report generator pane. You can create custom layouts and templates to generate custom reports. Click Utilities from the application menu bar.

Help Menu

You can use the Help Menu to open the common help file for the plug-in SATA and SAS modules, and version information about the modules.

Click Help from the application menu bar.

The Help menu has the following selections:

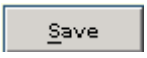
Table 10: Help menu and their descriptions

Menu item	Description
Help Topics	Displays the help file for the modules
PDF Help	Displays the PDF file adapted from the online help
About RT-EYE	Displays the About box with version information

Saving and Recalling Files

Saving a Setup File

To save the application and oscilloscope settings to a setup file, follow these steps:

1. Select File> Save. View the Save browser.
2. The Save dialog box appears. To view details about the file, such as size, type, and date modified, select the Details tool.
3. In the file browser, select the directory in which to save the setup file or use the current directory.
4. Select or use the keyboard to enter a new file name. The application appends an ".ini" extension to the name of the application setup file.
5. Select the 

command button.

Note: *The application also saves the oscilloscope setup to a ".set" file when you save an application setup. Both the application .ini file and oscilloscope .set file have the same file name.*

Recalling a Saved Setup File

To recall the application and oscilloscope settings from saved setup files, follow these steps:

1. Select File> Recall. View the Recall browser.
2. The Recall dialog box appears. To view details about the file, such as size, type, and date modified, select the Details tool.

3. In the Recall dialog box, select the directory from which to recall the setup file.

4. Select a setup file name, and then select Open.

Note: *The application recalls the .ini setup file and the associated oscilloscope setup if the application can find a .set file with a matching name.*

⚠ Do not edit setup files. If you try to recall a setup file that has been edited, the recall operation fails.

⚠ If a matching .set file is not found or if the .set file does not recall correctly to the oscilloscope, then you are notified that the oscilloscope recall failed while the application recall succeeded.

Recalling the Default Setup

To recall the default application settings, select File> Recall Default.

Note*: Most of the settings for the active module are recalled to the default state.*

Recalling a Recently Saved or Accessed Setup File

To recall a recently saved or accessed setup file, select File> Recall Recent… and then select the file from the drop down list of setup file names.

Note: *The application also recalls the associated oscilloscope setup if the application can find a .set file with a matching name.*

⚠ Do not edit setup files. If you try to recall a setup file that has been edited, the recall operation fails.

⚠ If a matching .set file is not found or if the .set file does not recall correctly to the oscilloscope, then you are notified that the oscilloscope recall failed while the application recall succeeded.

Taking Measurements

Setting Preferences

You can set preferences for the selected module. To set preferences, select File> Preferences from the application menu.

The following diagram and table list the preferences that you can set for the Serial ATA module and their descriptions:

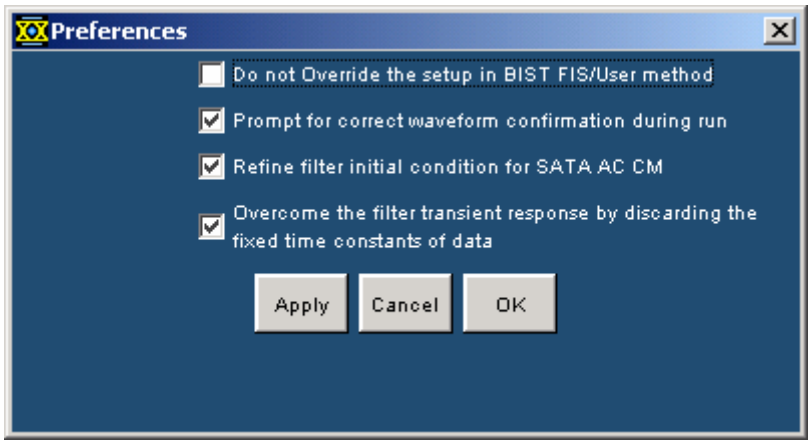


Figure 3: SATA Preferences

Table 11: Preferences for SATA measurements

Preference	Description
Do not override the setup in BIST FIS/User method	Enable this to use the default BIST FIS/User method setup. The oscilloscope setup will not be overwritten
Prompt for correct waveform confirmation during run	Enable this to be prompted for the correct waveform after acquiring the data
Refine filter initial condition for SATA AC CM	Enable this to calculate the initial conditions for the low pass filter
Overcome the filter transient response by discarding the fixed time constants of data	Enable this to discard a fixed number of data points for filtering the acquired data. The first five time constants are discarded

Options two, three, and four are selected by default. If options three and four have been cleared, we recommend that you select them to get accurate results.

If neither option is selected then, filter operation will start from an arbitrary sample point and filtered data can be affected by the filter transient response. The filter transient response depends on the initial jitter on the data.

The following diagram and table list the preferences that you can set for the SAS module and their descriptions.

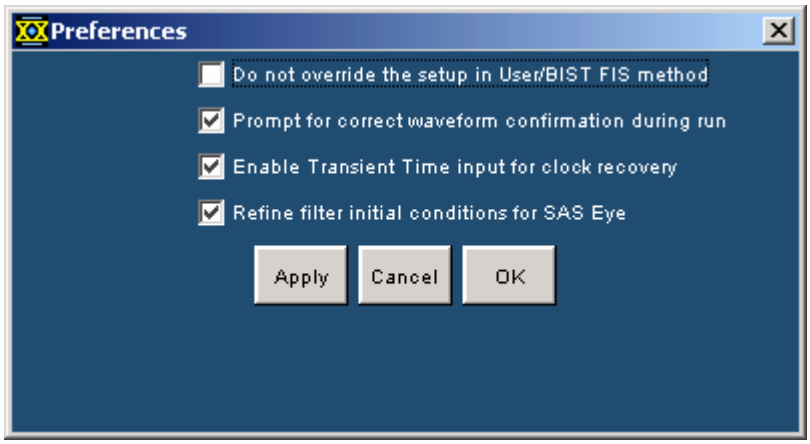


Figure 4: SAS Preferences

Table 12: Preferences for SAS measurements

Preference	Description
Do not override the setup in BIST FIS/User method	Enable this to use the default BIST FIS/User method setup. The oscilloscope setup will not be overwritten
Prompt for correct waveform confirmation during run	Enable this to be prompted for the correct waveform after acquiring the data
Enable Transient Time input for clock recovery	Enable this to select the desired data point for filtering from the acquired data. All data points before the desired point will be discarded. You can enter the transient time value in the general configuration tab
Refine filter initial conditions for SAS Eye	Enable this to calculate the initial conditions for the low pass filter

Options two, three, and four are selected by default. If options three and four have been cleared, we recommend that you select them to get accurate results for the Eye measurement for the SAS module.

If neither option is selected then, filter operation will start from an arbitrary sample point and filtered data can be affected by the filter transient response. The filter transient response depends on the initial jitter on the data.

When you select option three, the configured transient time should be greater than three times the number of clock transitions. The number of transitions is 550 otherwise the application displays the error message indicating that enough UI edges are not available to calculate eye height. The eye generation fails to complete successfully. For example, in the TDS7704B oscilloscope for align.pat the recommended horizontal scale is > 40 ns for sufficient clock transitions.

When you select option four, ensure that the acquired waveform has more than 550 clock transitions otherwise the application displays the error message indicating that enough UI edges are not available to calculate eye height. The eye generation fails to complete successfully.

The SAS Eye measurement requires at least three data packets that has ≥ 550 clock transitions in the acquired data to calculate clock recovery correctly. If the acquired pattern has insufficient clock transitions (550) then you need to acquire more packets for sufficient clock transitions.

Using a Limit File

Each module (SATA and SAS) provides a limit file that includes the measurements and their range of permitted values. The module uses the limit file to determine the Pass or Fail status for the measurements.

To change the limit file that your module uses, select Measurements> Limits. Browse to the directory and select a limit file to use with a .lim file name extension.

For the Serial ATA module, the files SerialATA-6k.lim and SerialATA-7k.lim are available for the TDS6000 and TDS7000 series of supported oscilloscopes. For the SAS module, the files SAS-6k.lim and SAS-7k.lim are available for the TDS6000 and TDS7000 series of supported oscilloscopes.

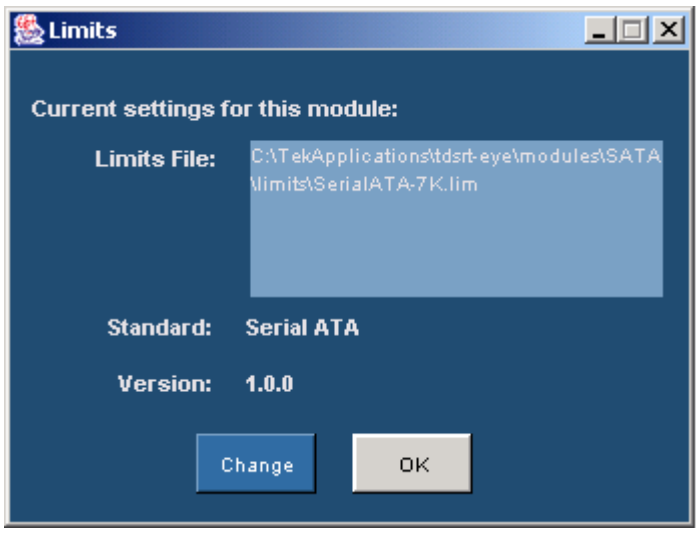


Figure 5: Changing Limit Files

Note: *You must not edit the limits file. If you edit the limit file, the measurements will not execute.*

Control Panel

You use the Control Panel to start or stop the sequence of processes for the application and oscilloscope to acquire information from a waveform. The application then determines if the algorithm for the selected measurement can be applied to the waveform information. Sequencing is the steps to acquire waveform information, determine if the information is usable for the measurement, take the measurement, and display the results.

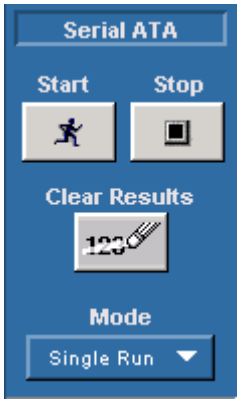


Figure 6: Control panel

Table 13: Control panel buttons and their descriptions

Command button	Description
Start	Start command button; use to start the sequencing based on the selected Sequence Mode
Stop	Stop command button; use to stop sequencing
Clear Results	Clear results command button; use to clear all previous results in the Results Summary menu, Results Details menu
Mode	Select Mode; Single or Single No Acq

Sequence Mode

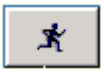
There are two Sequencing modes: Single Run and Single No Acq. The following table lists the modes and their descriptions:

Table 14: Sequence modes and their descriptions

Mode	Description
Single Run	Acquires a new waveform if the source is Ch1, Ch2, Ch3, or Ch4, Ref waveforms, or from file; for all sources the application sequences until complete
Single No Acq	Recalculates the selected measurements without acquiring new data

Acquiring Data

To acquire data from waveforms and take measurements, follow these steps:

1. In the Control Panel (on the right side of the application display), select a Sequence mode.
2. The application uses the Sequence mode to acquire waveforms and take measurements when you select the Start command button. The choices are: Single Run and Single No Acq.
3. Select the  button for continuous acquisitions or for measurements on a new or existing acquisition.
4. If you select the Single Run or the Single No Acq mode, the application displays the results when the sequencing is complete.
5. Select the  Stop button to stop the sequencing.

Note: *Use the*  *command button to delete all measurement results.*

Editing a Serial ATA Mask File

The mask files for Serial ATA are located in C:\Program Files\TekApplications\tdsRT-Eye\lib\RTEye. The mask file name indicates the technology, test point, number of unit intervals, and the device usage model. For example, for the file SataTX250G1i.msk, "Sata" indicates the technology, "TX" indicates transmitter, "250" indicates the number of unit intervals, and "G1i"indicates the device usage model.

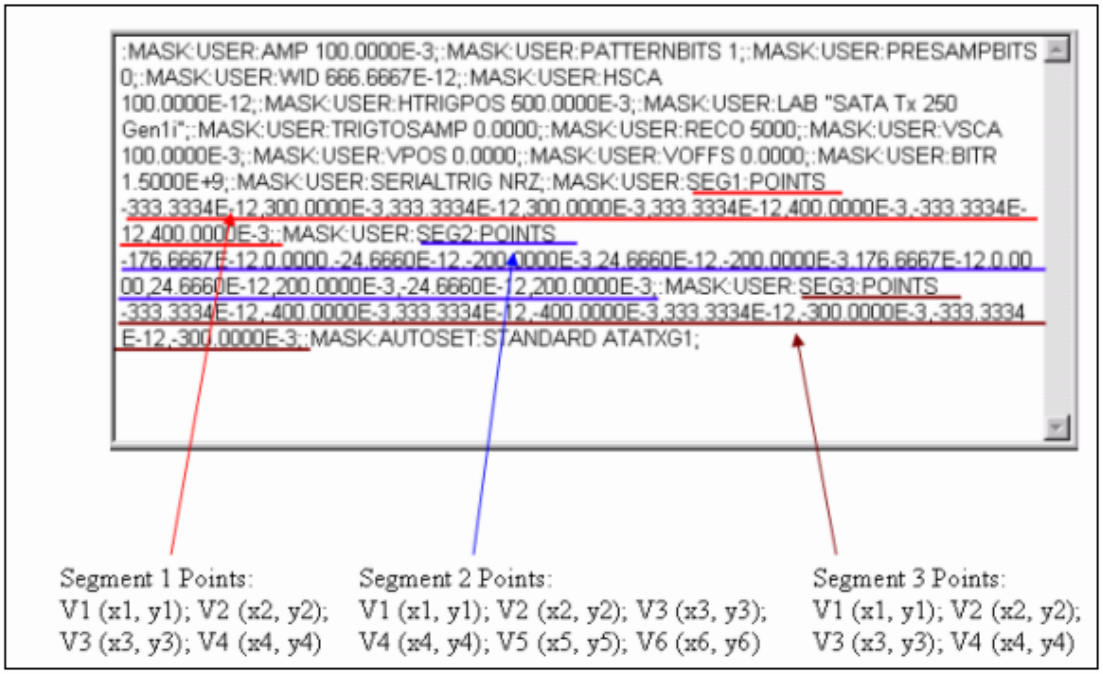


Figure 7: Example of a mask file

The following diagram shows a typical eye mask, the segments, and vertices.

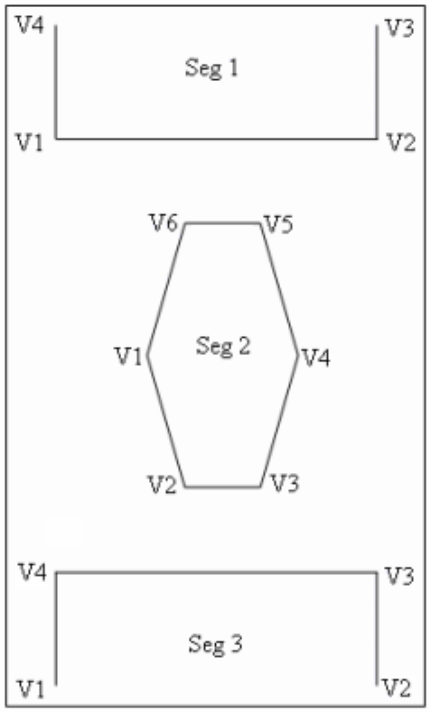


Figure 8: Example of mask template

The Serial ATA specifications do not specify eye mask geometry. The Serial ATA module provides tentative mask geometry for the eye mask test. You can edit the mask file (.msk) and modify the segment vertices to suit your needs. You can open the .msk file in Notepad, and after editing, save it in the same location with the same file name.

Note: *Before you overwrite the mask file, ensure that you backup the file.*

The following Serial ATA mask files are available for a transmitter and receiver:

Transmitter mask files	Receiver mask files
SataTX250G1i	SataRX250G1i
SataTX250G1m	SataRX250G1m
SataTX250G1x	SataRX250G1x
SataTX250G2i	SataRX250G2i
SataTX250G2m	SataRX250G2m
SataTX250G2x	SataRX250G2x
SataTX5G1i	SataRX5G1i
SataTX5G1m	SataRX5G1m
SataTX5G1x	SataRX5G1x
SataTX5G2i	SataRX5G2i
SataTX5G2m	SataRX5G2m
SataTX5G2x	SataRX5G2x

How To...

Set up the DUT

Methods to Test a DUT

You can set up the Device Under Test (DUT) and test it in two ways: using the Arbitrary Waveform Generator (AWG), or the BIST FIS/User-defined method.

In the AWG method, the AWG provides an external stimulus to the DUT. The DUT, in turn, responds with the OOB signals and Align Patterns on which the 4Serial ATA and SAS test modules can make measurements.

In the BIST FIS/User method, you can program the DUT to emit or transmit various patterns on which the Serial ATA and SAS test modules can make measurements.

The following table lists the test fixture connectors and the signals that are connected to the test fixture:

Table 15: Test fixture, host, and drive connections

Test fixture connectors	Host connections	Drive connections
J2	Tx+	Rx+
J3	Tx–	Rx–
J4	Rx–	Tx–
J5	Rx+	Tx+

Test the Transmitter Host DUT using AWG Method

To test a transmitter host device using an AWG, set up the equipment as follows:

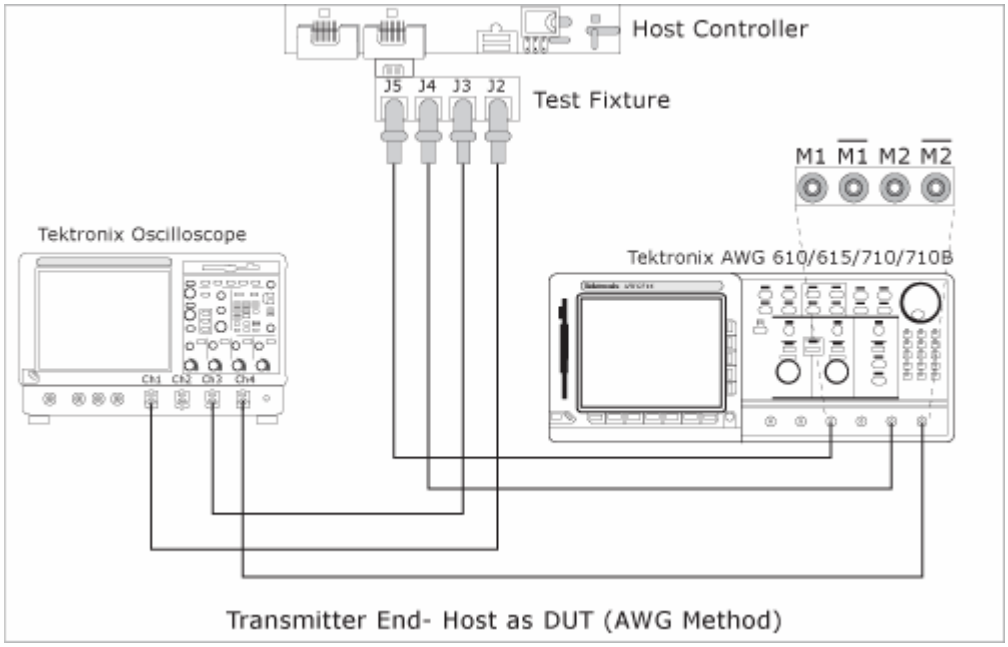


Figure 9: Test the transmitter host DUT using AWG method

You can use SMA cables or P7380SMA cables to connect the DUT to the oscilloscope and the AWG.

For a Host as the DUT, connect the SMA cables (single-ended probes) as follows:

- AWG Marker 1 to J5 (Rx+)
- AWG Marker 2 to J4 (Rx–)
- Oscilloscope Channel 1 to J2 (Tx+)
- Oscilloscope Channel 3 to J3 (Tx–)

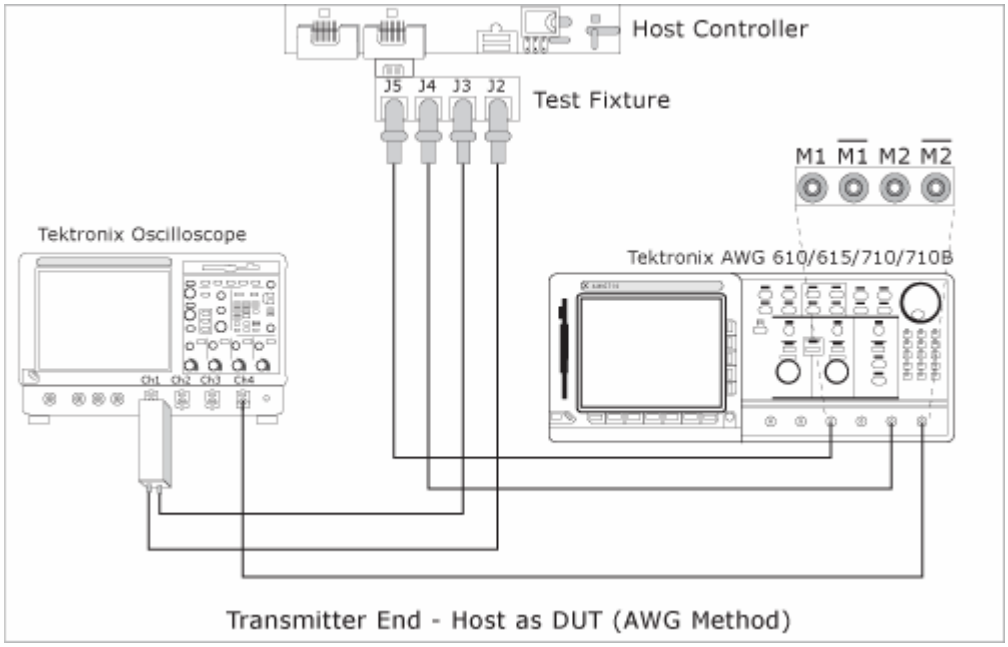


Figure 10: Test the transmitter host DUT using AWG method

For a Host as the DUT, connect the P7380SMA cables (differential probes) as follows:

- AWG Marker 1 to J5 (Rx+)
- AWG Marker 2 to J4 (Rx–)
- Oscilloscope Channel 1 or 3 to J2 (Tx+) or J3 (Tx–)

Note: *If you use oscilloscope channels 1 and 3 for Tx+ and Tx–, then use oscilloscope channels 2 or 4 as trigger. If you use oscilloscope channels 2 and 4 for Tx+ and Tx–, then use oscilloscope channels 1 or 3 as trigger.*

Note*: When you use a P7380SMA probe, and if the peak-to-peak signal amplitude is more than 625 mV, set Attenuation Dynamic Range of the probe to 12.5X. If the signal peak to peak amplitude is less than 625 mV, set Attenuation Dynamic Range of the probe to 2.5X. Ensure that the V term Source is set to Auto.*

Test the Transmitter Drive DUT using AWG Method

To test a transmitter drive device using an AWG, set up the equipment as follows:

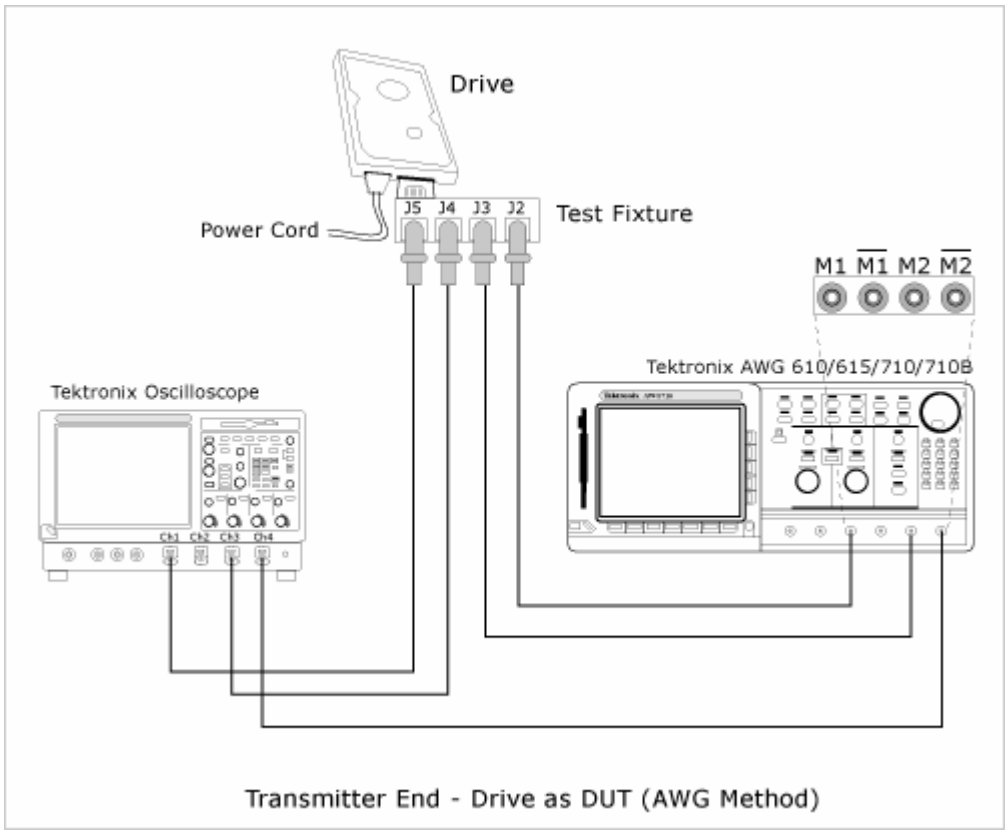


Figure 11: Test the transmitter drive DUT using AWG method

You can use SMA cables or P7380SMA cables to connect the DUT to the oscilloscope and the AWG.

For a Drive as the DUT, connect the SMA cables (single-ended probes) as follows:

- AWG Marker 1 to J2 (Rx+)
- AWG Marker 2 to J3 (Rx–)
- Oscilloscope Channel 1 to J5 (Tx+)

- Oscilloscope Channel 3 to J4 (Tx–)

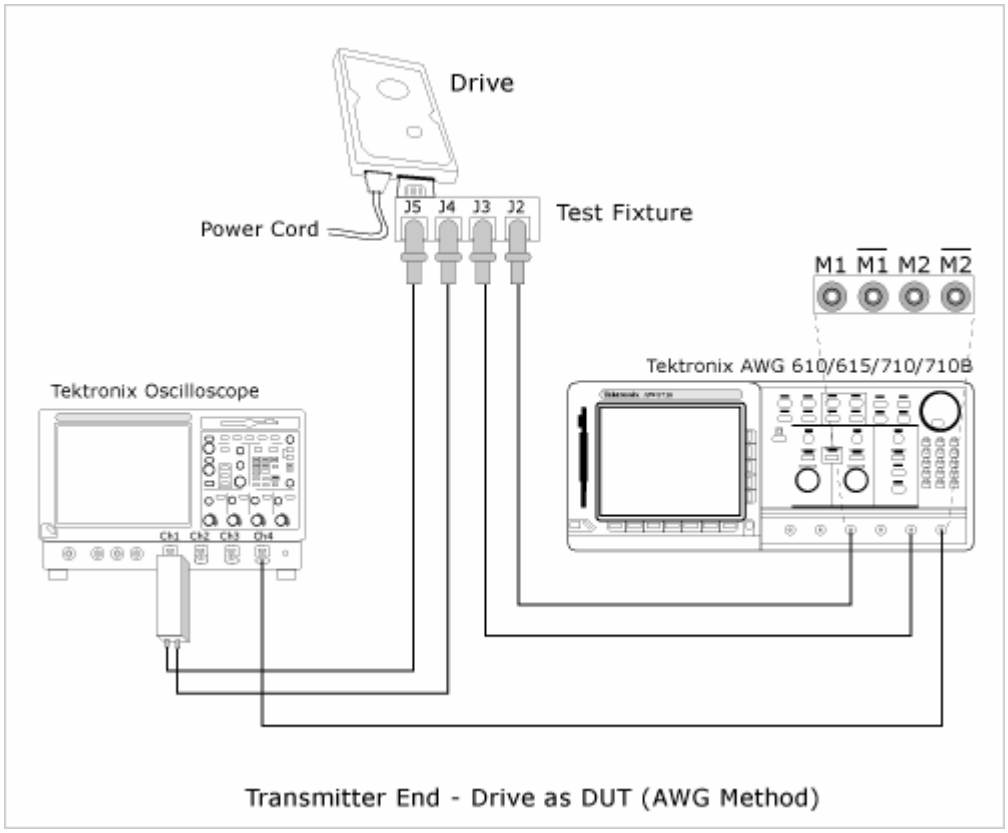


Figure 12: Test the transmitter drive DUT using AWG method

For a Drive as the DUT, connect the P7380SMA cables (differential single-ended probes) as follows:

- AWG Marker 1 to J2 (Rx+)
- AWG Marker 2 to J3 (Rx–)
- Oscilloscope Channel 1 or 3 to J5 (Tx+) and J4 (Tx–)

Note: *If you use oscilloscope channels 1 and 3 for Tx+ and Tx–, then use oscilloscope channels 2 or 4 as trigger. If you use oscilloscope channels 2 and 4 for Tx+ and Tx–, then use oscilloscope channels 1 or 3 as trigger.*

***Note**: When you use a P7380SMA probe, and if the peak-to-peak signal amplitude is more than 625 mV, set Attenuation Dynamic Range of the probe to 12.5X. If the signal peak to peak amplitude is less than 625 mV, set Attenuation Dynamic Range of the probe to 2.5X. Ensure that the V term Source is set to Auto.*

Test the Transmitter Host DUT using BIST FIS/User Method

To test a transmitter host device using a vendor-specific method (or BIST FIS), set up the equipment as follows:

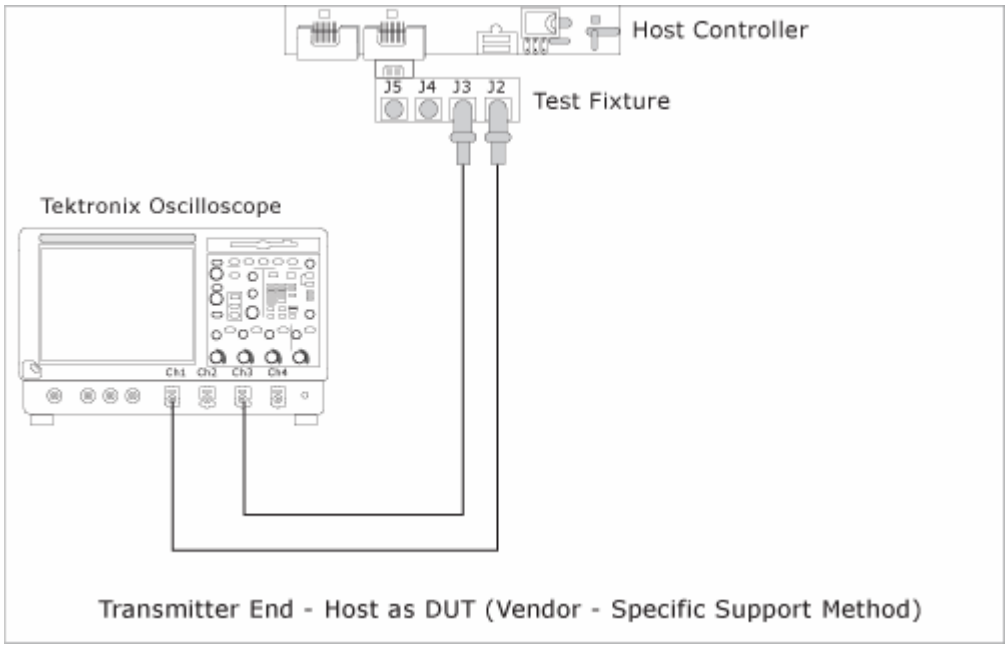


Figure 13: Test the transmitter host DUT using BIST FIS/User method

For a Host as the DUT, connect the SMA cables (single-ended probes) as follows:

- Oscilloscope Channel 1 to J2 (Tx+)
- Oscilloscope Channel 3 to J3 (Tx–)

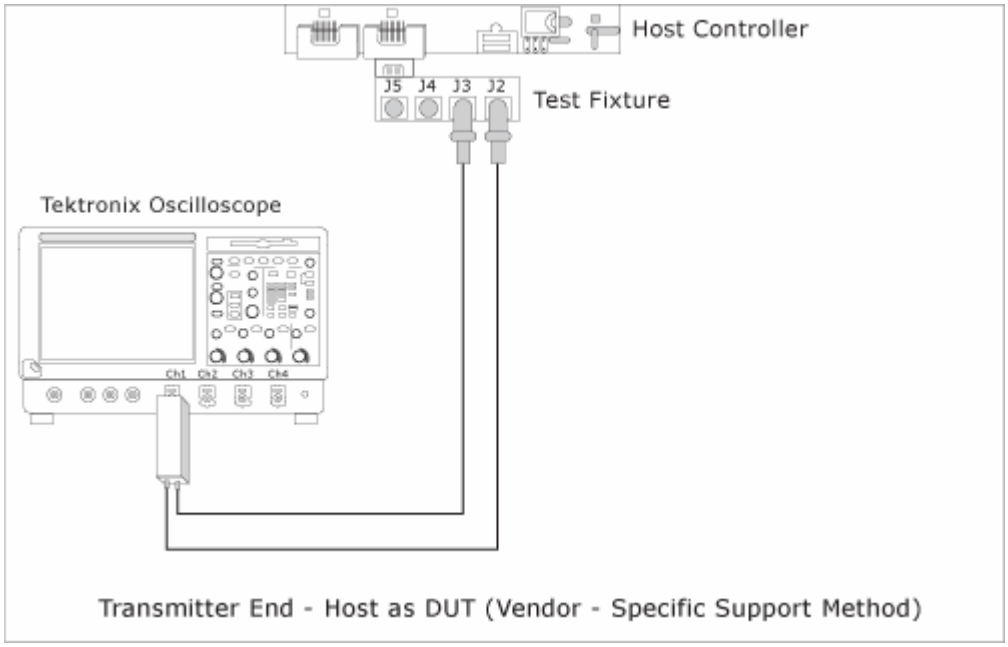


Figure 14: Test the transmitter host DUT using BIST FIS/User method

For a Host as the DUT, connect the P7380SMA cables (differential probes) as follows:

- Oscilloscope Channel 1 or 3 to J2 (Tx+) or J3 (Tx–)

***Note**: When you use a P7380SMA probe, and if the peak-to-peak signal amplitude is more than 625 mV, set Attenuation Dynamic Range of the probe to 12.5X. If the signal peak to peak amplitude is less than 625 mV, set Attenuation Dynamic Range of the probe to 2.5X. Ensure that the V term Source is set to Auto.*

Test the Transmitter Drive DUT using BIST FIS/User Method

To test a transmitter drive device using a vendor-specific method (or BIST FIS), set up the equipment as follows:

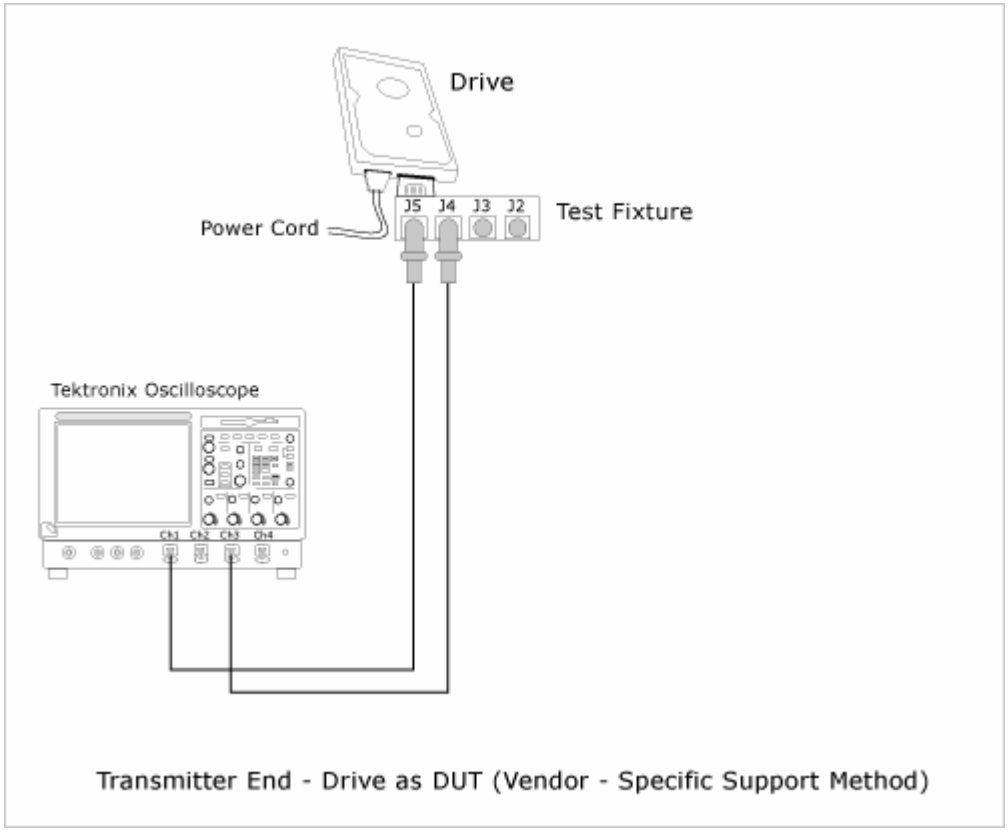


Figure 15: Test the transmitter drive DUT using BIST FIS/User method

For a Drive as the DUT, connect the SMA cables (single-ended probes) as follows:

- Oscilloscope Channel 1 to J5 (Tx+)
- Oscilloscope Channel 3 to J4 (Tx–)

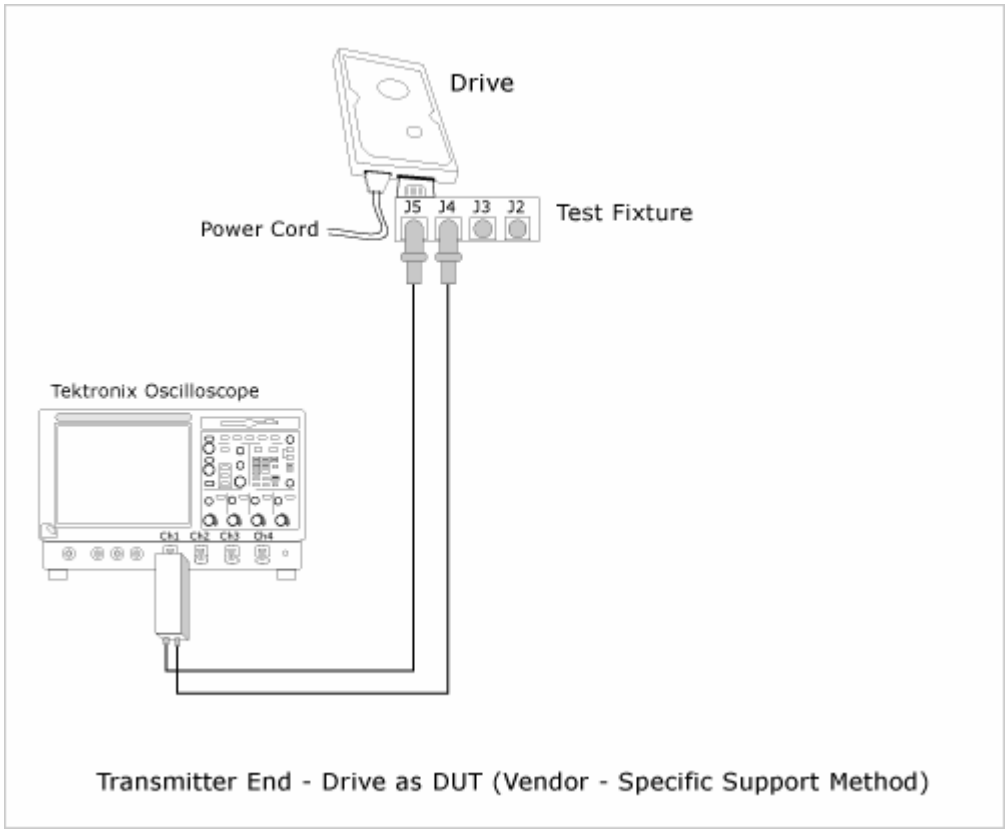


Figure 16: Test the transmitter drive DUT using BIST FIS/User method

For a Drive as the DUT, connect the P7380SMA cables (differential probes) as follows:

- Oscilloscope Channel 1 or 3 to J5 (Tx+) and J4 (Tx–)

***Note**: When you use a P7380SMA probe, and if the peak-to-peak signal amplitude is more than 625 mV, set Attenuation Dynamic Range of the probe to 12.5X. If the signal peak to peak amplitude is less than 625 mV, set Attenuation Dynamic Range of the probe to 2.5X. Ensure that the V term Source is set to Auto.*

Test the Receiver Host DUT using AWG Method

To test a receiver host device using an AWG, set up the equipment as follows:

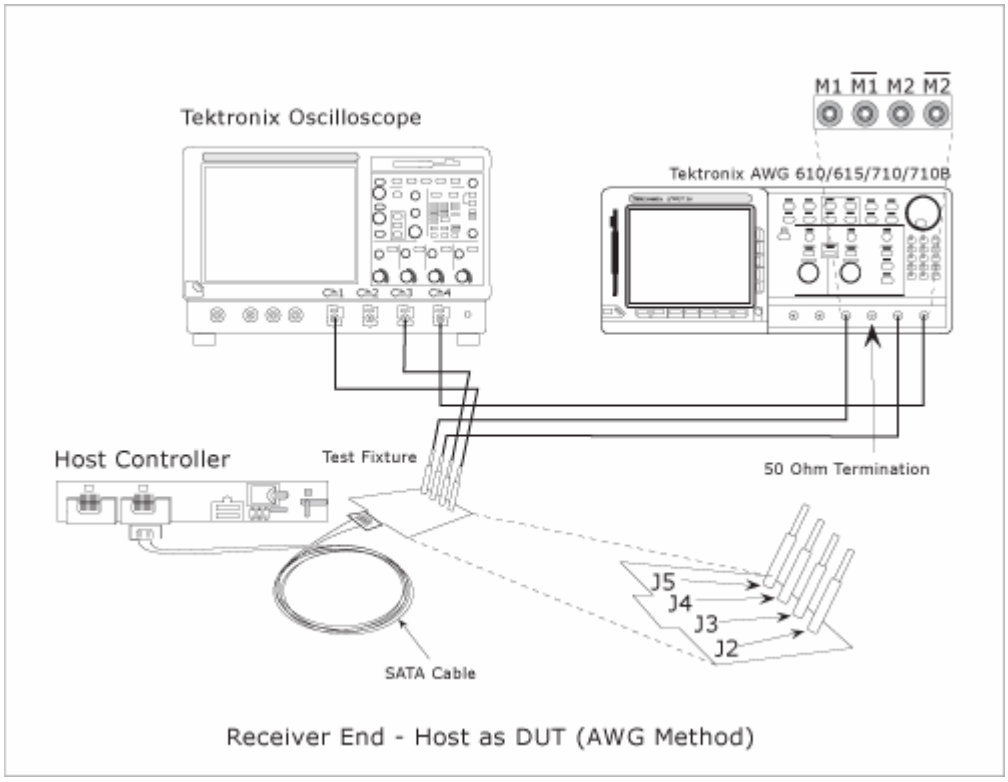


Figure 17: Test the receiver host DUT using AWG method

You can use SMA cables or P7380SMA cables to connect the DUT to the oscilloscope and the AWG.

For a Host as the DUT, connect the SMA cables (single-ended probes) as follows:

- AWG Marker 1 to J5 (Rx+)
- AWG Marker 2 to J4 (Rx–)
- Oscilloscope Channel 1 to J2 (Tx+)
- Oscilloscope Channel 3 to J3 (Tx–)

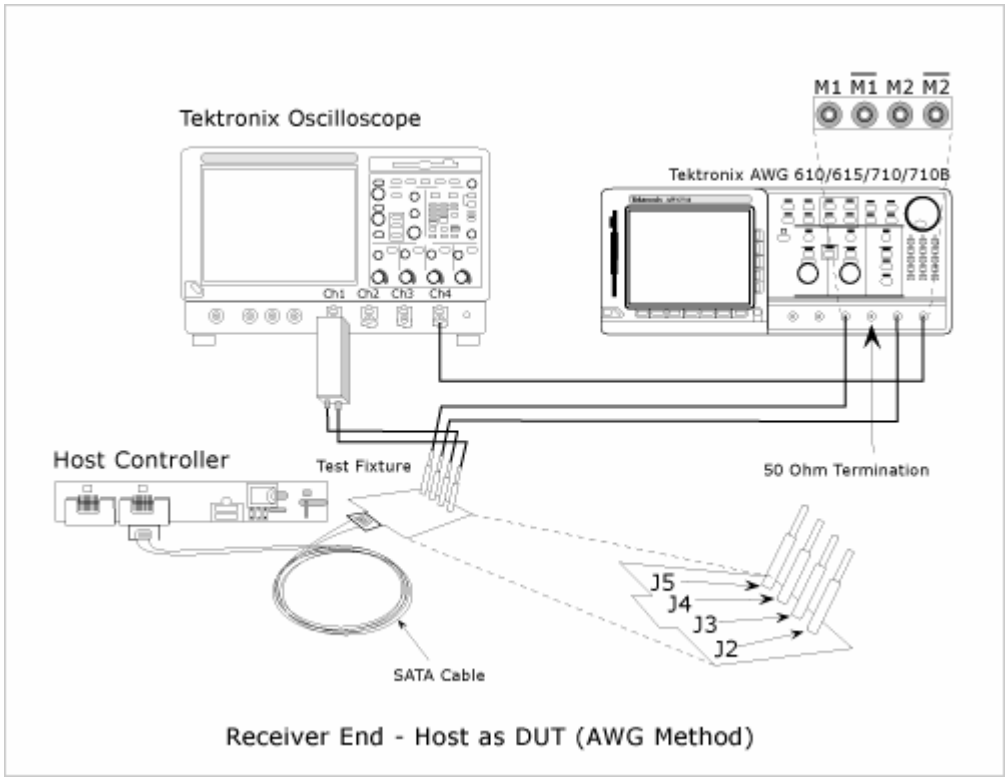


Figure 18: Test the receiver host DUT using AWG method

For a Host as the DUT, connect the P7380SMA cables (differential probes) as follows:

- AWG Marker 1 to J5 (Rx+)
- AWG Marker 2 to J4 (Rx–)
- Oscilloscope Channel 1 or 3 to J2 (Tx+) or J3 (Tx–)

Note: *If you use oscilloscope channels 1 and 3 for Tx+ and Tx–, then use oscilloscope channels 2 or 4 as trigger. If you use oscilloscope channels 2 and 4 for Tx+ and Tx–, then use oscilloscope channels 1 or 3 as trigger.*

***Note**: When you use a P7380SMA probe, and if the peak-to-peak signal amplitude is more than 625 mV, set Attenuation Dynamic Range of the probe to 12.5X. If the signal peak to peak amplitude is less than 625 mV, set Attenuation Dynamic Range of the probe to 2.5X. Ensure that the V term Source is set to Auto.*

Test the Receiver Drive DUT using AWG Method

To test a receiver drive device using an AWG, set up the equipment as follows:

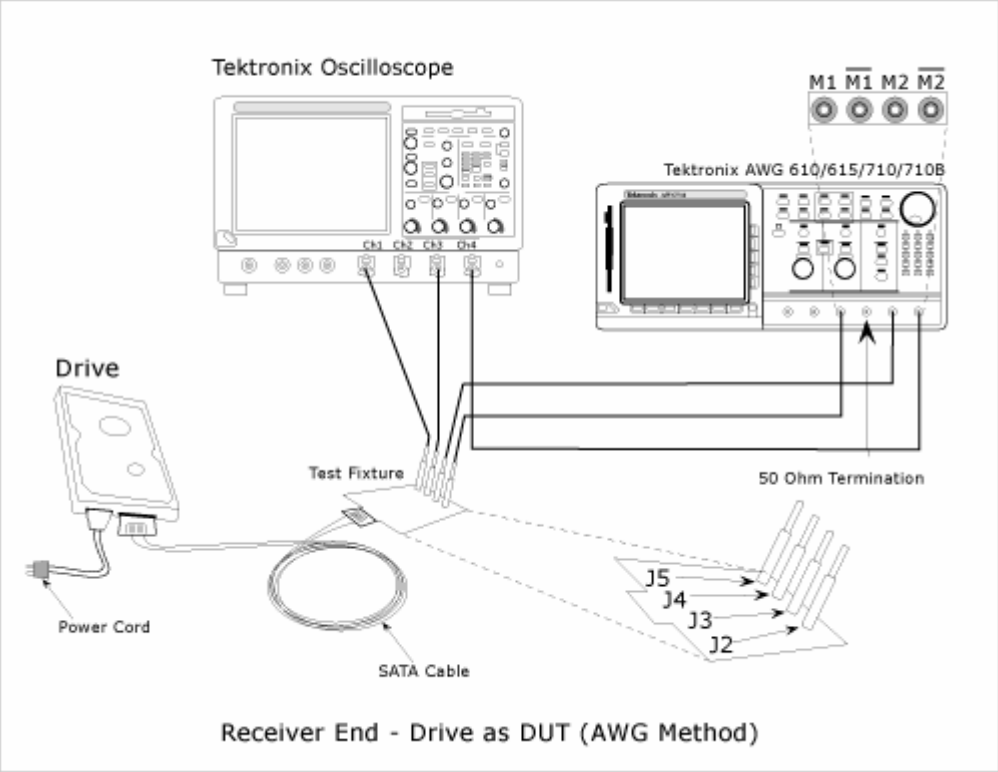


Figure 19: Test the receiver drive DUT using AWG method

For a Drive as the DUT, connect the SMA cables (single-ended probes) as follows:

- AWG Marker 1 to J2 (Rx+)
- AWG Marker 2 to J3 (Rx–)
- Oscilloscope Channel 1 to J5 (Tx+)
- Oscilloscope Channel 3 to J4 (Tx–)

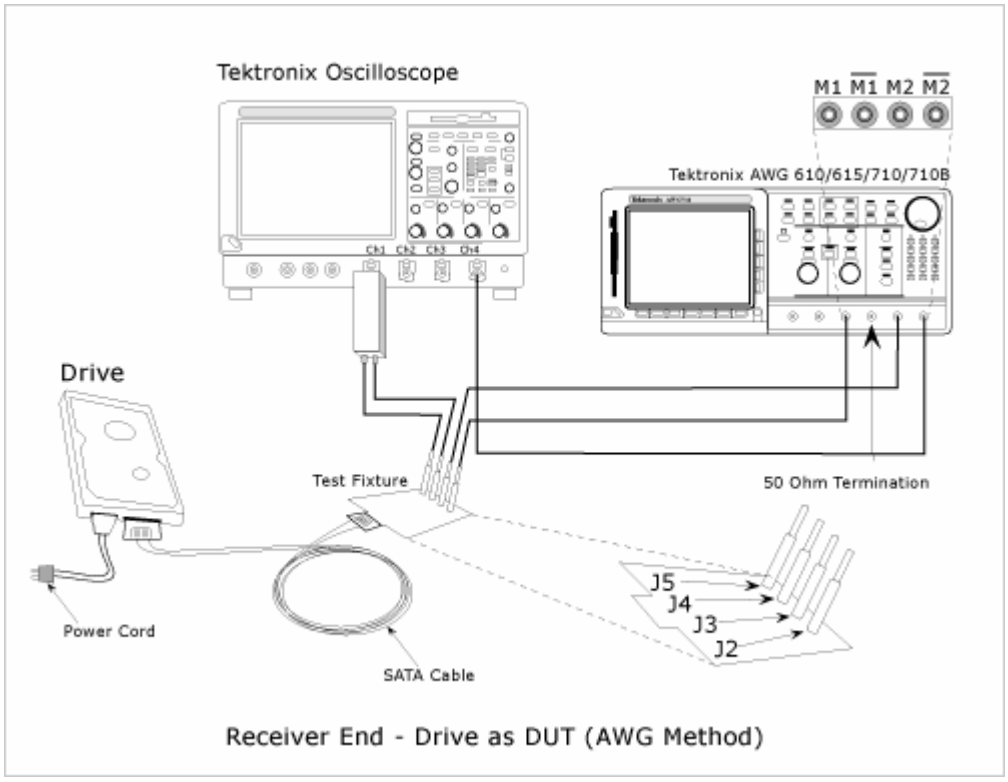


Figure 20: Test the receiver drive DUT using AWG method

For a Drive as the DUT, connect the P7380SMA cables (differential probes) as follows:

- AWG Marker 1 to J2 (Rx+)
- AWG Marker 2 to J3 (Rx−)
- Oscilloscope Channel 1 or 3 to J5 (Tx+) and J4 (Tx−)

***Note**: If you use oscilloscope channels 1 and 3 for Tx+ and Tx−, then use oscilloscope channels 2 or 4 as trigger. If you use oscilloscope channels 2 and 4 for Tx+ and Tx−, then use oscilloscope channels 1 or 3 as trigger.*

***Note**: When you use a P7380SMA probe, and if the peak-to-peak signal amplitude is more than 625 mV, set Attenuation Dynamic Range of the probe to 12.5X. If the signal peak to peak amplitude is less than 625 mV, set Attenuation Dynamic Range of the probe to 2.5X. Ensure that the V term Source is set to Auto.*

Test the Receiver Host DUT using BIST FIS/User Method

To test a receiver host device using a vendor-specific method (or BIST FIS), set up the equipment as follows:

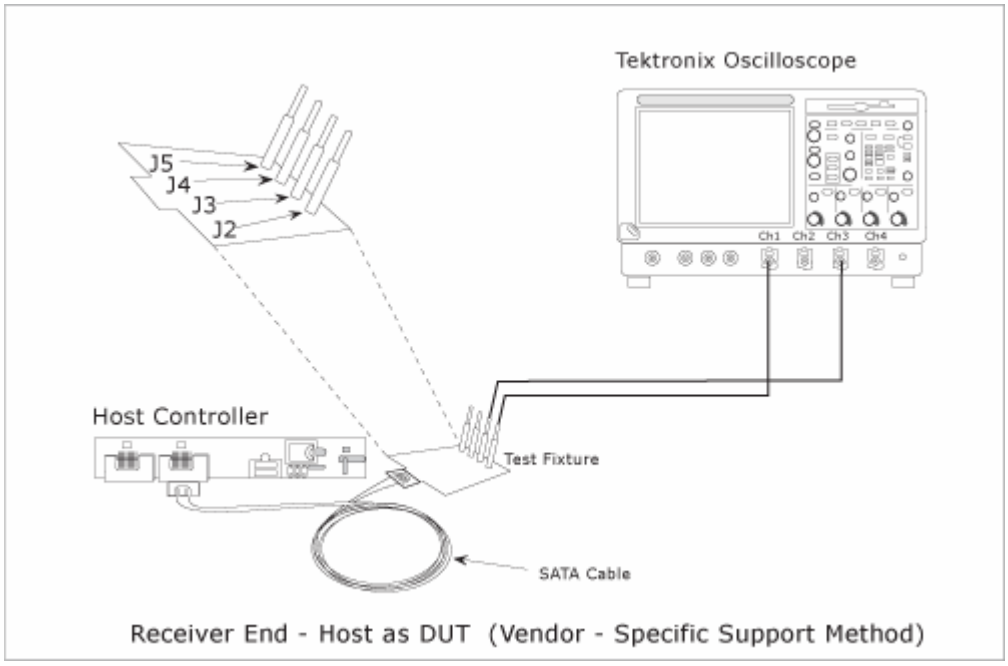


Figure 21: Test the receiver host DUT using BIST FIS/User method

For a Host as the DUT, connect the SMA cables (single-ended probes) as follows:

- Oscilloscope Channel 1 to J2 (Rx+)
- Oscilloscope Channel 3 to J3 (Rx−)

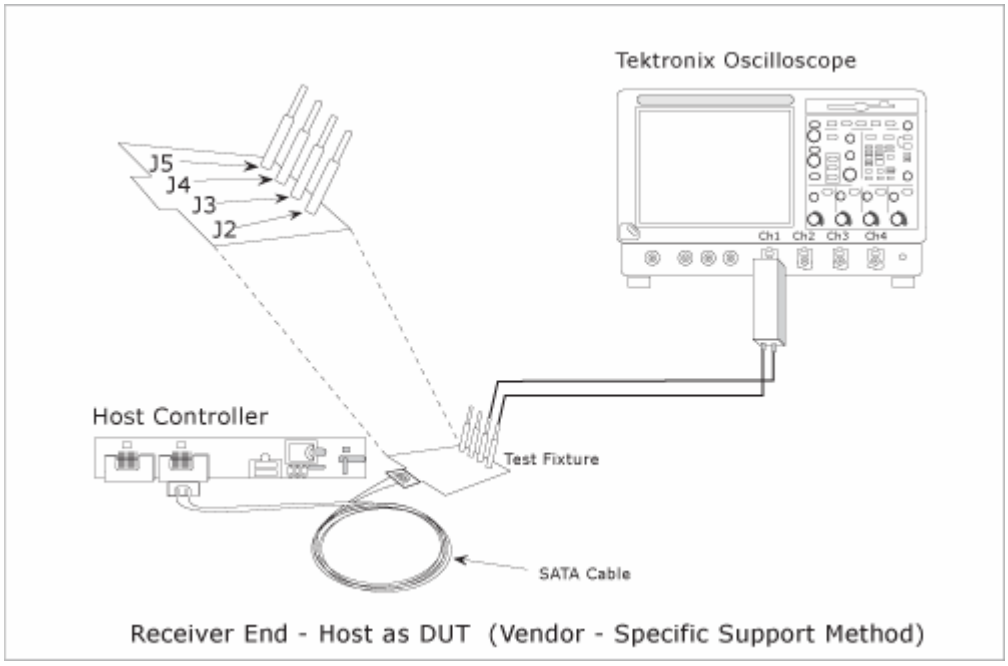


Figure 22: Test the receiver host DUT using BIST FIS/User method

For a Host as the DUT, connect the P7380SMA cables (differential probes) as follows:

- Oscilloscope Channel 1 to J2 and J3

***Note**: When you use a P7380SMA probe, and if the peak-to-peak signal amplitude is more than 625 mV, set Attenuation Dynamic Range of the probe to 12.5X. If the signal peak to peak amplitude is less than 625 mV, set Attenuation Dynamic Range of the probe to 2.5X. Ensure that the V term Source is set to Auto.*

Test the Receiver Drive DUT using BIST FIS/User Method

To test a receiver drive device using a vendor-specific method (or BIST FIS), set up the equipment as follows:

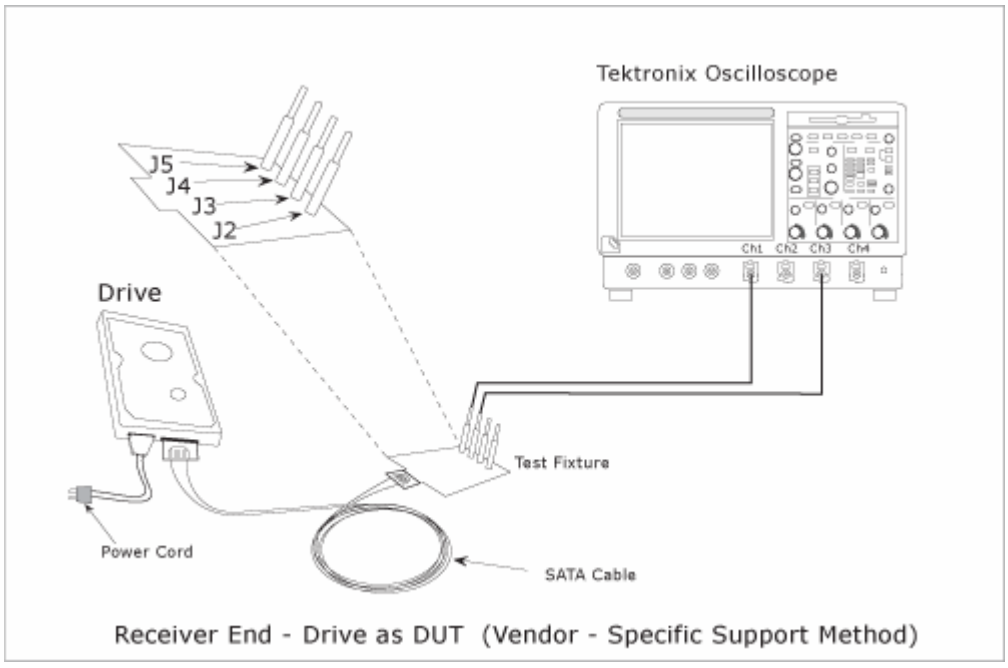


Figure 23: Test the receiver drive DUT using BIST FIS/User method

For a Drive as the DUT, connect the SMA cables (single-ended probes) as follows:

- Oscilloscope Channel 1 to J5 (Tx+)
- Oscilloscope Channel 3 to J4 (Tx−)

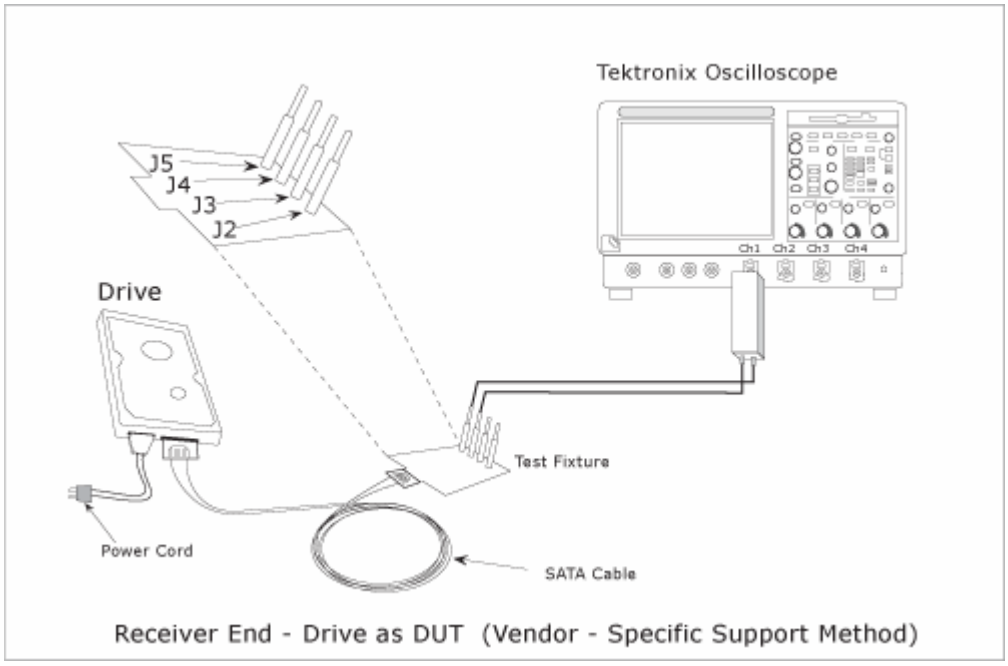


Figure 24: Test the receiver drive DUT using BIST FIS/User method

For a Drive as the DUT, connect the P7380SMA cables (differential probes) as follows:

- Oscilloscope Channel 1 to J4 and J5

***Note**: When you use a P7380SMA probe, and if the peak-to-peak signal amplitude is more than 625 mV, set Attenuation Dynamic Range of the probe to 12.5X. If the signal peak to peak amplitude is less than 625 mV, set Attenuation Dynamic Range of the probe to 2.5X. Ensure that the V term Source is set to Auto.*

Select and Configure SATA Measurements

Select SATA Measurements

To select a measurement, select Measurements> Select from the menu bar. The following screen appears:

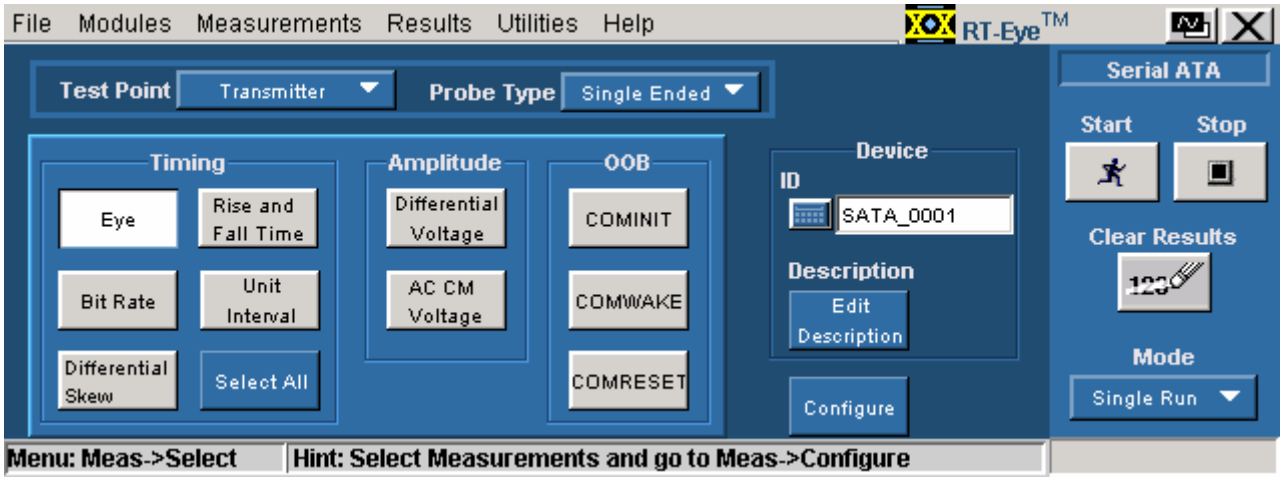


Figure 25: Measurements screen

The Serial ATA measurements that are available for transmitter and receiver devices are as follows:

Table 16: SATA measurements for transmitter and receiver

Device	Measurements		
	Timing	Amplitude	Out Of Band
Transmitter	Eye, Bit Rate, Differential Skew*, Rise and Fall Time, Unit Interval	Differential Voltage, AC CM Voltage*	COMINIT, COMWAKE, COMRESET
Receiver	Eye, Bit Rate, Differential Skew*, Rise and Fall Time, Unit Interval	Differential Voltage, AC CM Voltage*	–
*** These measurements are available only when you use a single-ended probe (SMA cable).**			

You can select one or more Timing measurements at a time by clicking the buttons. You can select all Timing measurements by clicking the Select All button.

Configure SATA Measurements

To configure one or more measurements, select Measurements> Configure from the application menu bar, or click the Configure button in the Measurement screen.

The Configure screen has the following tabs: Source, General Config, Clock Config, and Plot Config. The Plot Config tab, with parameters to generate an eye diagram, is available only for the Eye Measurement.

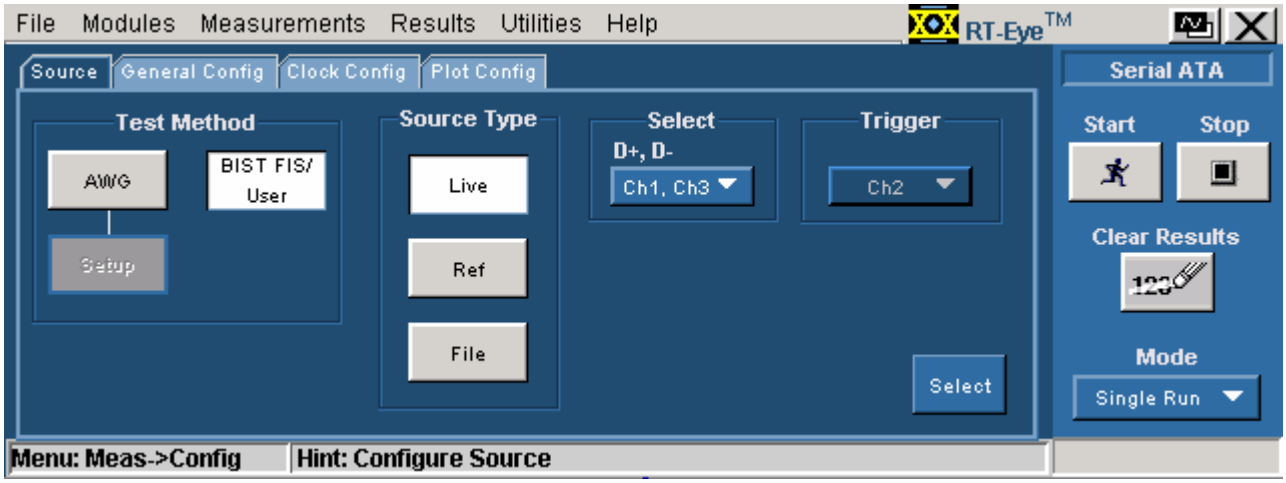


Figure 26: Configure Source panel for a single-ended probe

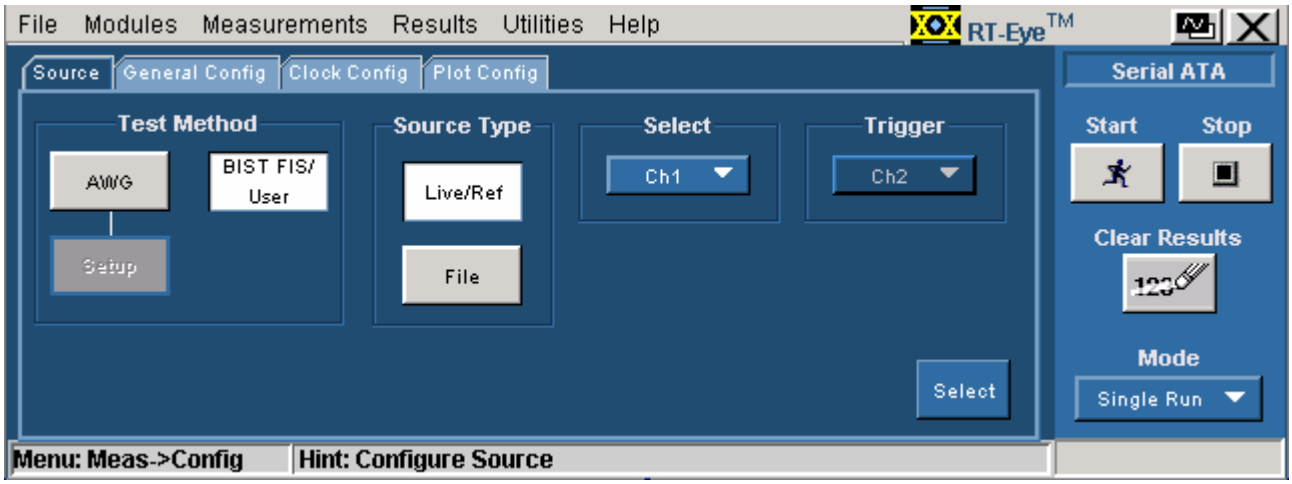


Figure 27: Configure Source panel for a differential probe

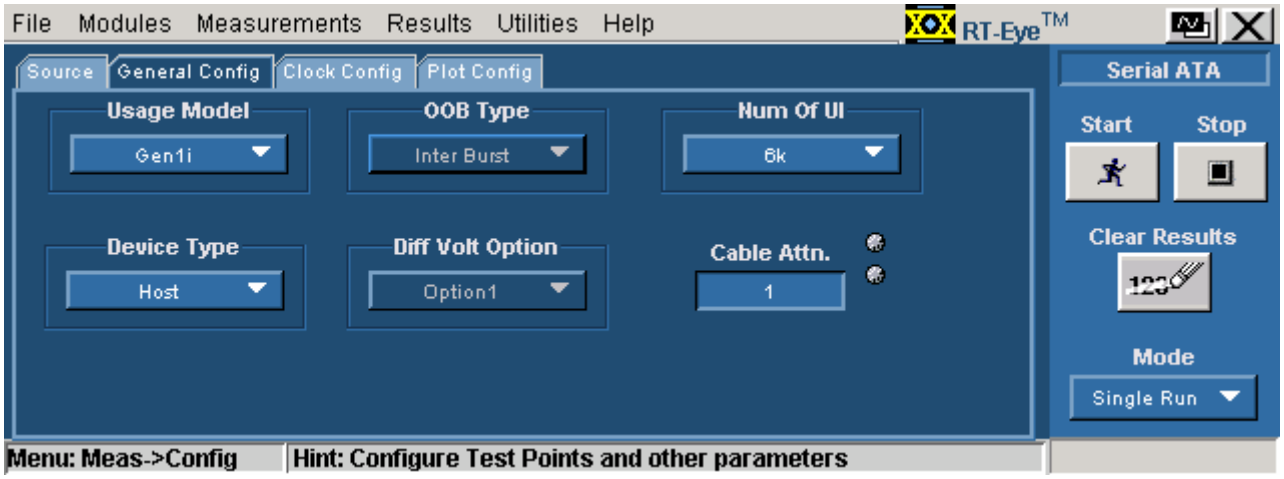


Figure 28: Configure General Config panel

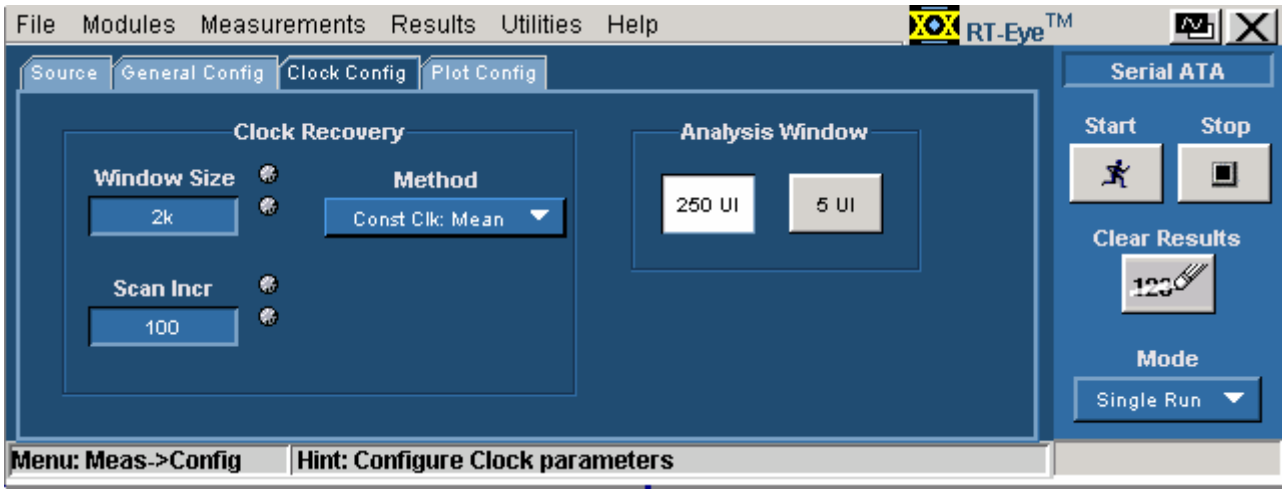


Figure 29: Configure Clock Config panel

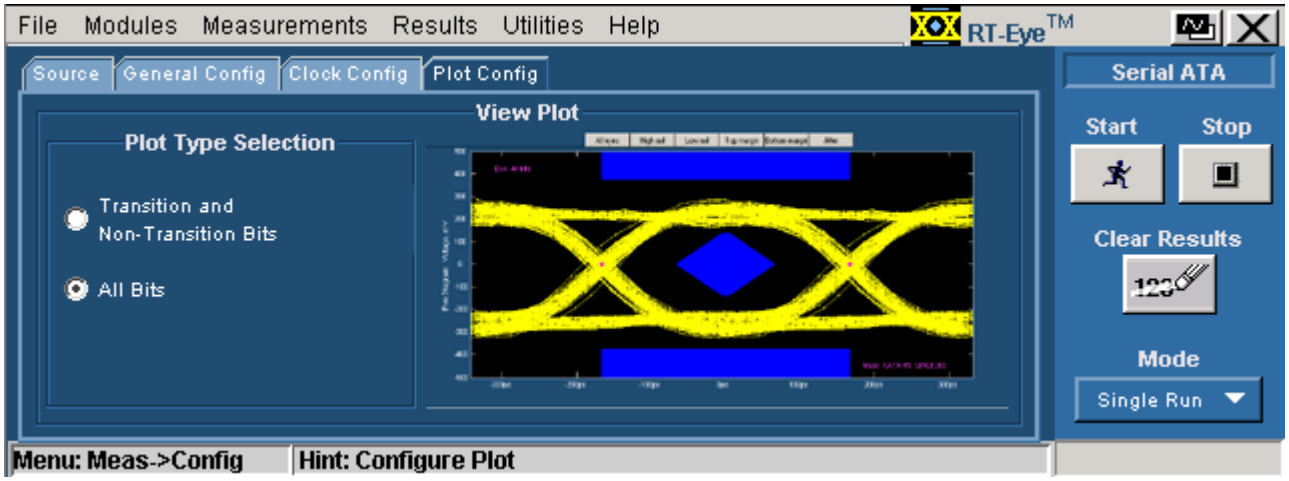


Figure 30: Configure Plot Config panel

The following table lists the configuration parameters for the Serial ATA measurements:

	Eye	Bit Rate	Differential Skew	Rise and Fall Time	Unit Interval	Differential Voltage	AC CM Voltage	COMINIT	COMWAKE	COMRESET
Transmitter	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Receiver	✓	✓	✓	✓	✓	✓	✓			
Single-ended probe	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Differential probe	✓	✓		✓	✓	✓		✓	✓	✓
Source tab										
Test Method: AWG	✓	✓	✓	✓	✓		✓	✓	✓	✓
Test Method: BIST-FIS	✓	✓	✓	✓	✓	✓	✓			
Source Type: Live	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Source Type: Ref	✓	✓	✓	✓	✓	✓	✓			
Source Type: File	✓	✓	✓	✓	✓	✓	✓			
Trigger	✓	✓	✓	✓	✓		✓	✓	✓	✓
Select File Prefix						✓				
File Type						✓				
General Config tab										
Device Type	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Usage Model	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
OOB Type								✓	✓	✓
Num of UI	✓	✓	✓	✓	✓	✓	✓			
Cable Attn.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Diff Volt Option						✓				
Clock Config tab										
Window Size	✓	✓			✓					
Scan Incr	✓	✓			✓					
Method	✓	✓			✓					
Analysis Window	✓	✓			✓					
Plot Config tab										
Transition and Non-transition bits	✓									
All Bits	✓									

Enter Device Details

You can enter the details of the device that you are testing.

Figure 31: Enter device details

To do this, follow these steps:

1. Select Measurements> Select from the application menu.
2. Under Device, type the device ID that you want to use. You can also use the virtual keyboard to enter the text.
3. Click Edit Description to type in a description of the device or edit an existing description. You can also use the virtual keyboard to enter the text.

Virtual Keyboard

Virtual Keyboard - Numeric

1. Click any number box to display the icon for the numeric keyboard.
2. Click the icon to display the numeric keyboard.

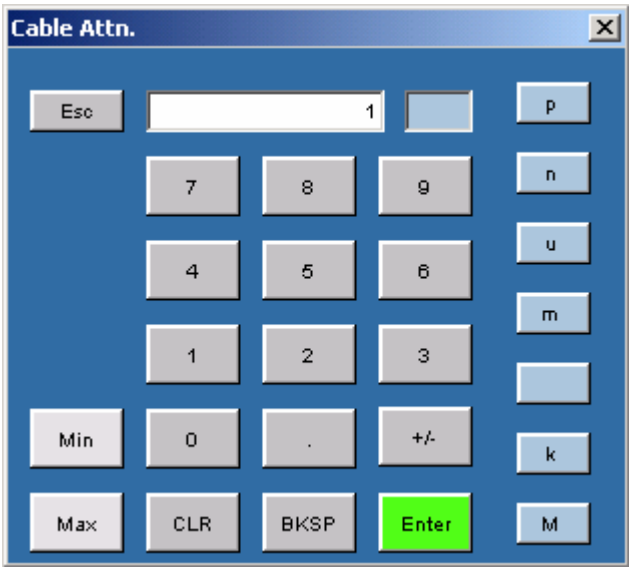


Figure 32: Virtual keyboard - Numeric

3. Click the number keys to enter the desired value.
4. Select a unit of measure.
5. Click Enter to confirm your entry. Selections are not effective until you click Enter.

Virtual Keyboard - Text

1. Click any text box to display the icon for the text keyboard.
2. Click the icon to display the text keyboard.

Figure 33: Virtual keyboard - Text

3. Use the text keyboard to enter the required text (such as a file name).
4. Click Enter to confirm your entry. Selections are not effective until you click Enter.

Set up the AWG

You can set up the Arbitrary Waveform Generator (AWG) in three ways: GPIB, Network, and Manual. From the Source tab, select the Test method as AWG and click Setup. The following options are available:

Table 17: AWG setup modes

Options	To Do
Network	Connect to the AWG using the LAN or peer-to-peer and set up the connection automatically
GPIB	Connect to the AWG using the GPIB and set up the connection automatically
Manual	Connect to the AWG manually

To connect to and set up the AWG using the Network option, follow these steps:

1. Click Network from the AWG Setup screen.
2. Enter the IP Address of the AWG.

3. Select the AWG Drive (Floppy or Main) on which the source pattern files for the test is located.

4. Click Test Connection to verify whether the oscilloscope is connected correctly to the AWG. When you click Test Connection, the application:

   - detects the AWG model
   - sets the AWG marker values
   - sets the AWG clock speed

To connect to and set up the AWG using the GPIB option, follow these steps:

1. Click GPIB from the AWG Setup screen.

2. Select the Board Type, GPIB Address (Primary and Secondary), and the Time Out value.

3. Select the AWG Drive (Floppy or Main) on which the source pattern files for the test is located.

4. Click Test Connection to verify whether the oscilloscope is connected correctly to the AWG. When you click Test Connection, the application:

   - detects the AWG model
   - sets the AWG marker values
   - sets the AWG clock speed

To connect to and set up the AWG using the Manual option, follow these steps:

1. Click Manual from the AWG Setup screen.

2. Select the AWG Type from the AWG Setup screen.

3. Follow the on-screen prompts to connect the AWG and the oscilloscope.

Perform SATA Tests for Transmitter

Transmitter Measurements

Timing measurements that are available for a Serial ATA Transmitter are Eye, Bit Rate, Differential Skew, Rise and Fall Time, and Unit Interval. You can select one or more measurements at a time. You can select all measurements by

clicking the Select All button. The Differential Skew measurement is available only when you use a single-ended probe (SMA cable).

Amplitude measurements that are available for a Serial ATA Transmitter are Differential Voltage and AC CM Voltage. The AC CM Voltage measurement is available only when you use a single-ended probe (SMA cable).

Out Of Band (OOB) Signaling Tests are available for a Serial ATA Transmitter. The OOB tests that are supported by the Serial ATA module are COMINIT, COMWAKE, and COMRESET.

Perform Transmitter Eye, Unit Interval, and Bit Rate Tests

Follow these steps to measure the Eye, Unit Interval, and Bit Rate for a transmitter.

1. Set up the DUT (Host or Drive) as shown in the How To Set up the DUT section.
2. Select Measurements> Select from the menu bar.
3. Select Test Point as Transmitter and Probe Type as Single-ended or Differential.
4. Click Eye, Unit Interval, and Bit Rate. You can select any one or all of them.
5. To change the configuration settings, select Measurements> Configure from the menu bar or click the Configure button.

   In the Source tab, click Live, Ref, or File. If you are using a single-ended probe, select the channels for D+ and D–, and the Trigger channel. The trigger channels available exclude those channels that you have selected as D+ D–. Select the Test Method. For the BIST FIS/User test method, Trigger option is not available.

Table 18: Source parameters for a single-ended probe

Select	Parameter	Options	To Do
Test Method		AWG, BIST FIS/User	Select the test method to use. The module uses the source pattern files located on the AWG, or uses a vendor-specific method to test the DUT
Live	Select D+ D–	Ch1 Ch3, Ch1 Ch4, Ch2 Ch3, Ch2 Ch4	Set the channel pair from which to acquire data
	Trigger	Ch1, Ch2, Ch3, Ch4	Set the channel from which to acquire trigger data
Ref	Select D+ D–	Ref1 Ref2, Ref1 Ref3, Ref1 Ref4, Ref2 Ref1, Ref2 Ref3, Ref2 Ref4, Ref3 Ref1, Ref3 Ref2, Ref3 Ref4, Ref4 Ref1, Ref4 Ref2, Ref4 Ref3	Set the Ref channel pair from which to acquire data
File	Select File(s) D+ D–	Browse	Load the data from .csv files

For a differential probe, the source parameters are:

Table 19: Source parameters for a differential probe

Select	Parameter	Options	To Do
Test Method		AWG, BIST FIS/User	Select the test method to use. The module uses the source pattern files located on the AWG, or uses a vendor-specific method to test the DUT
Live/Ref	Select	Ch1, Ch2, Ch3, Ch4, Ref1, Ref2, Ref3, Ref4	Set the channel from which to acquire data
	Trigger	Ch1, Ch2, Ch3, Ch4	Set the channel from which to acquire trigger data
File	Select File	Browse	Load the data from a .csv file

If you choose Live/Ref and select a Ref channel from which to acquire data, then the Trigger selection is not available.

In the General Config tab, set the Device Type, Usage model, Number of UI, and Cable Attenuation.

Table 20: General configuration parameters

Parameter	Options	To do
Usage Model	Gen1i, Gen1x, Gen1m, Gen2i, Gen2x, Gen2m	Select the generation to which the device belongs
Device Type	Host, Drive	Select the type of device to test
Num of UI	6k, 12k, 30k, 60k, 120k	Select the number of unit intervals for which to acquire data
Cable Attn	Range: 100 p-10 G	Type the cable attenuation or enter the value within the range from the numeric keypad

In the Clock Config tab, set the Clock Recovery parameters, and Analysis Window size.

Table 21: Clock configuration parameters

Parameter	Options	To do
Window Size	Range: 1000-5000 UI	Type the clock recovery window size or enter the value from the numeric keypad
Scan Incr	Range: 1-250 UI	Type the scan increment value or enter it from the numeric keypad
Method	Const Clk: Mean Const Clk: Median	Select the clock recovery method to use to recover the signal clock
Analysis Window	250 UI, 5 UI	Set the analysis window to one of the two

Note: *If the Analysis Window is set to 5 UI, sufficient number of unit intervals may not be available to calculate the transition and non-transition eye heights. While scanning, these two calculations may fail to complete. You can expect the message "Unable to calculate transition eye height/non-transition eye height". It is recommended that you select All Bits option in the plot configuration when the Analysis Window is 5 UI.*

6. From the Control panel, select the mode (Single Run or Single No Acq).

7. Click the Start button to start taking the measurement. When the measurement is complete, the summary of the results and plots are displayed.

8. If the results are not automatically displayed, select Results> Summary to view the results. To view detailed results, select Results> Details.

Perform Transmitter Differential Skew Test

Follow these steps to measure the Differential Skew for a transmitter.

1. Set up the DUT (Host or Drive) as shown in the How To Set up the DUT section. Refer to the setup that uses single-ended probes (SMA cable).

2. Select Measurements> Select from the menu bar.

3. Select Test Point as Transmitter and Probe Type as Single-ended. This measurement is not available for a Differential probe.

4. Click Differential Skew.

5. To change the configuration settings, select Measurements> Configure from the menu bar or click the Configure button.

   In the Source tab, click Live, Ref, or File. Select the channels for D+ and D–, and the Trigger channel. The trigger channels available exclude those channels that you have selected as D+ D–. Select the Test Method. For the BIST FIS/User test method, Trigger option is not available.

Table 22: Source configuration parameters

Select	Parameter	Options	To Do
Test Method		AWG, BIST FIS/User	Select the test method to use. The module uses the source pattern files located on the AWG, or uses a vendor-specific method to test the DUT
Live	Select D+ D–	Ch1 Ch3, Ch1 Ch4, Ch2 Ch3, Ch2 Ch4	Set the channel pair from which to acquire data
	Trigger	Ch1, Ch2, Ch3, Ch4	Set the channel from which to acquire trigger data
Ref	Select D+ D–	Ref1 Ref2, Ref1Ref3, Ref1 Ref4, Ref2 Ref1, Ref2 Ref3, Ref2 Ref4, Ref3 Ref1, Ref3 Ref2, Ref3 Ref4, Ref4 Ref1, Ref4 Ref2, Ref4 Ref3	Set the Ref channel pair from which to acquire data
File	Select File(s) D+ D–	Browse	Load the data from .csv files

In the General Config tab, set the Device Type, Cable Attenuation, and Usage model.

Table 23: General configuration parameters

Parameter	Options	To do
Usage Model	Gen1i, Gen1x, Gen1m, Gen2i, Gen2x, Gen2m	Select the generation to which the device belongs
Device Type	Host, Drive	Select the type of device to test
Num of UI	6k, 12k, 30k, 60k, 120k	Select the number of unit intervals for which to acquire data
Cable Attn	Range: 100 p-10 G	Type the cable attenuation or enter the value within the range from the numeric keypad
Test Method	AWG, BIST FIS/User	Select the test method to use. The module uses the source pattern files located on the AWG, or uses a vendor-specific method to test the DUT

6. From the Control panel, select the mode (Single Run or Single No Acq).
7. Click the Start button to start taking the measurement. When the measurement is complete, the summary of the results is displayed.
8. If the results are not automatically displayed, select Results> Summary to view the results. To view detailed results, select Results> Details.

Perform Transmitter Rise and Fall Time Test

Follow these steps to measure the Rise and Fall Time for a transmitter.

1. Set up the DUT (Host or Drive) as shown in the How To Set up the DUT section.
2. Select Measurements> Select from the menu bar.
3. Select Test Point as Transmitter and Probe Type as Single-ended or Differential.
4. Click Rise and Fall Time.
5. To change the configuration settings, select Measurements> Configure from the menu bar or click the Configure button.

In the Source tab, click Live, Ref, or File. If you are using a single-ended probe, select the channels for D+ and D–, and the Trigger channel. The trigger channels available exclude those channels that you have selected as D+ D–. Select the Test Method. For the BIST FIS/User test method, Trigger option is not available.

Table 24: Source configuration parameters for a single-ended probe

Select	Parameter	Options	To Do
Test Method		AWG, BIST FIS/User	Select the test method to use. The module uses the source pattern files located on the AWG, or uses a vendor-specific method to test the DUT
Live	Select D+ D–	Ch1 Ch3, Ch1 Ch4, Ch2 Ch3, Ch2 Ch4	Set the channel pair from which to acquire data
	Trigger	Ch1, Ch2, Ch3, Ch4	Set the channel from which to acquire trigger data
Ref	Select D+ D–	Ref1 Ref2, Ref1 Ref3, Ref1 Ref4, Ref2 Ref1, Ref2 Ref3, Ref2 Ref4, Ref3 Ref1, Ref3 Ref2, Ref3 Ref4, Ref4 Ref1, Ref4 Ref2, Ref4 Ref3	Set the Ref channel pair from which to acquire data
File	Select File(s) D+ D–	Browse	Load the data from .csv files

For a differential probe, the parameters are:

Table 25: Source configuration parameters for a differential probe

Select	Parameter	Options	To Do
Test Method		AWG, BIST FIS/User	Select the test method to use. The module uses the source pattern files located on the AWG, or uses a vendor-specific method to test the DUT
Live/Ref	Select	Ch1, Ch2, Ch3, Ch4, Ref1, Ref2, Ref3, Ref4	Set the channel to acquire data from
	Trigger	Ch1, Ch2, Ch3, Ch4	Set the channel to acquire trigger data from
File	Select File	Browse	Load the data from a .csv file

If you choose Live/Ref and select a Ref channel from which to acquire data, then the Trigger selection is not available.

In the General Config tab, set the Device Type, Cable Attenuation, Number of UI, and Usage model.

Table 26: General configuration

Parameter	Options	To Do
Usage Model	Gen1i, Gen1x, Gen1m, Gen2i, Gen2x, Gen2m	Select the generation to which the device belongs
Device Type	Host, Drive	Select the type of device to test
Num of UI	6k,12k, 30k, 60k, 120k	Select the number of unit intervals for which to acquire data
Cable Attn	Range: 100 p-10 G	Type the cable attenuation or enter the value within the range from the numeric keypad

6. From the Control panel, select the mode (Single Run or Single No Acq).

7. Click the Start button to start taking the measurement. When the measurement is complete, the summary of the results is displayed.

8. If the results are not automatically displayed, select Results> Summary to view the results. To view detailed results, select Results> Details.

Perform Transmitter Differential Voltage Test

Follow these steps to measure the Differential Voltage for a transmitter.

1. Set up the DUT (Host or Drive) as shown in the How To Set up the DUT section.
2. Select Measurements> Select from the menu bar.
3. Select Test Point as Transmitter and Probe Type as Single-ended or Differential.
4. Click Differential Voltage.
5. To change the configuration settings, select Measurements> Configure from the menu bar or click the Configure button.

   In the Source tab, click Live, Ref, or File. If you are using a single-ended probe, select the channels for D+ and D–. Select the Test Method.

Table 27: Source configuration parameters

Select	Parameter	Options	To Do
Test Method		BIST FIS/User	Select the test method BIST FIS/User to use. The AWG method is not available for this measurement
Live	Select D+ D–	Ch1 Ch3, Ch1 Ch4, Ch2 Ch3, Ch2 Ch4	Set the channel pair from which to acquire data
Ref	Select D+ D–	Ref1 Ref2, Ref1Ref3, Ref1 Ref4, Ref2 Ref1, Ref2 Ref3, Ref2 Ref4, Ref3 Ref1, Ref3 Ref2, Ref3 Ref4, Ref4 Ref1, Ref4 Ref2, Ref4 Ref3	Set the Ref channel pair from which to acquire data
File	Select File Prefix	Browse	Set the path and alphanumeric prefix for the files that you want to load
	File Type	CSV, wfm	Select the type of file that you want to load. The application uses the File Prefix and the .wfm or .csv file name extension to search for the specified file type
Help			Select the Help button to get a brief description of how to load files with a prefix and specified type

For a differential probe, the source parameters are:

Table 28: Source configuration parameters

Select	Parameter	Options	To Do
Test Method		BIST FIS/User	Select the test method BIST FIS/User to use. The AWG method is not available for this measurement
Live/Ref	Select	Ch1, Ch2, Ch3, Ch4, Ref1, Ref2, Ref3, Ref4	Set the channel from which to acquire data
File	Select File Prefix	Browse	Set the path and alphanumeric prefix for the files that you want to load
	File Type	CSV, wfm	Select the type of file that you want to load. The application uses the File Prefix and the .wfm or .csv file name extension to search for the specified file type
Help			Select the Help button to get a brief description of how to load files with a prefix and specified type

When you click the Help button, the following help text is displayed. It describes how the module uses the File Prefix and the File Type that you specified to search for the pattern files. Ensure that four pattern files: HFTP.csv, MFTP.csv, LFTP.csv, and LBP.csv, are present in the path you specified.

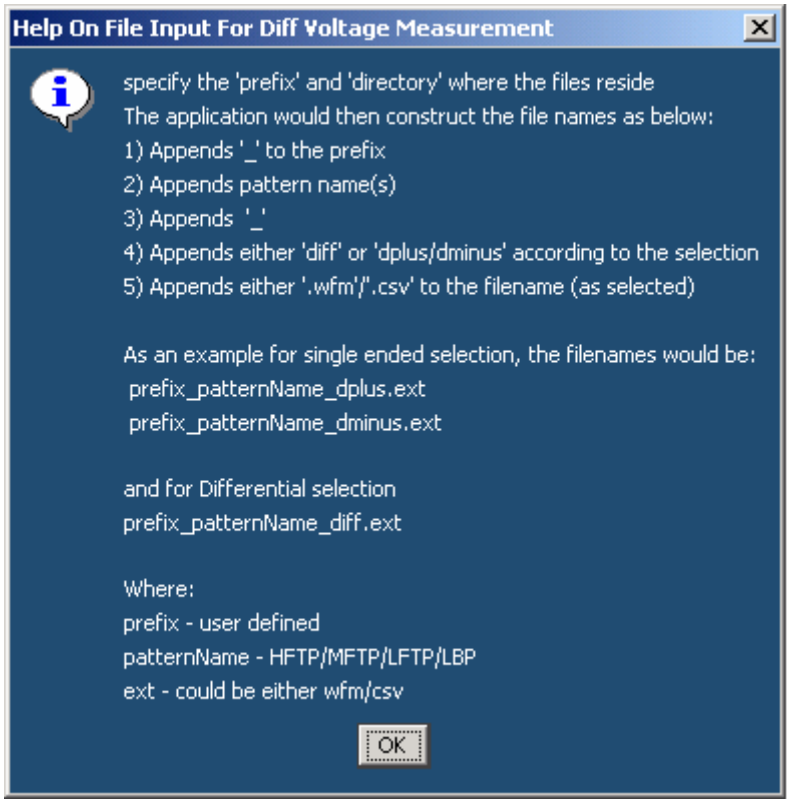


Figure 34: Help screen for differential output voltage measurement

In the General Config tab, set the Device Type, Cable Attenuation, Usage model, Number of UI, and Differential Volt Option.

Table 29: General configuration parameters

Parameter	Options	To do
Usage Model	Gen1i, Gen1x, Gen1m, Gen2i, Gen2x, Gen2m	Select the generation to which the device belongs
Device Type	Host, Drive	Select the type of device to test
Num of UI	6k, 12k, 30k, 60k, 120k	Select the number of unit intervals for which to acquire data
Cable Attn	Range: 100 p-10 G	Type the cable attenuation or enter the value within the range from the numeric keypad
Diff Volt Option	Option1, Option2	Select Option1 to use the lone bit pattern, and Option2 to if no lone bit pattern is available

6. From the Control panel, select the mode(Single Run or Single No Acq).
7. Click the Start button to start taking the measurement. When the measurement is complete, the summary of the results is displayed.
8. If the results are not automatically displayed, select Results> Summary to view the results. The Time Units option is the results summary is not available for this test. To view detailed results, select Results> Details.

Perform Transmitter AC CM Voltage Test

Follow these steps to measure the AC Common Mode Voltage for a transmitter.

1. Set up the DUT (Host or Drive) as shown in the How To Set up the DUT section. Refer to the setup that uses single-ended probes.
2. Select Measurements> Select from the menu bar.
3. Select Test Point as Transmitter and Probe Type as Single-ended.
4. Click AC CM Voltage.

5. To change the configuration settings, select Measurements> Configure from the menu bar or click the Configure button.

   In the Source tab, click Live, Ref, or File. Select the channels for D+ and D–, and the Trigger channel. The trigger channels available exclude those channels that you have selected as D+ D–. Select the Test Method.

Table 30: Source configuration parameters

Select	Parameter	Options	To Do
Test Method		AWG, BIST FIS/User	Select the test method to use. The module uses the source pattern files located on the AWG, or uses a vendor-specific method to test the DUT
Live	Select D+ D–	Ch1 Ch3, Ch1 Ch4, Ch2 Ch3, Ch2 Ch4	Set the channel pair from which to acquire data
	Trigger	Ch1, Ch2, Ch3, Ch4	Set the channel from which to acquire trigger data
Ref	Select D+ D–	Ref1 Ref2, Ref1 Ref3, Ref1 Ref4, Ref2 Ref1, Ref2 Ref3, Ref2 Ref4, Ref3 Ref1, Ref3 Ref2, Ref3 Ref4, Ref4 Ref1, Ref4 Ref2, Ref4 Ref3	Set the Ref channel pair from which to acquire data
File	Select File(s) D+ D–	Browse	Load the data from .csv files

In the General Config tab, set the Device Type, Cable Attenuation, Usage model, and Number of UI.

Table 31: General configuration parameters

Parameter	Options	To do
Usage Model	Gen1i, Gen1x, Gen1m, Gen2i, Gen2x, Gen2m	Select the generation to which the device belongs
Device Type	Host, Drive	Select the type of device to test
Num of UI	6k, 12k, 30k, 60k, 120k	Select the number of unit intervals for which to acquire data
Cable Attn	Range: 100 p-10 G	Type the cable attenuation or enter the value within the range from the numeric keypad

6. From the Control panel, select the mode (Single Run or Single No Acq).
7. Click the Start button to start taking the measurement. When the measurement is complete, the summary of the results is displayed.
8. If the results are not automatically displayed, select Results> Summary to view the results. The Time Units option is the results summary is not available for this test. To view detailed results, select Results> Details.

Perform Transmitter COMINIT, COMWAKE, and COMRESET Tests

Follow these steps to perform the COMINIT, COMWAKE, and COMRESET Tests for a transmitter.

1. Set up the DUT (Host or Drive) as shown in the How To Set up the DUT section. Refer to the test setup for transmitter device that uses the AWG test method.
2. Select Measurements> Select from the menu bar.
3. Select Test Point as Transmitter and Probe Type as Single-ended or Differential.
4. Click any one of the OOB tests: COMINIT, COMWAKE, or COMRESET.
5. To change the configuration settings, select Measurements> Configure from the menu bar or click the Configure button.

In the Source tab, click Live. If you are using a single-ended probe, select the channels for D+ and D–, and the Trigger channel. The trigger channels available exclude those channels that you have selected as D+ D–. Select the Test Method.

Table 32: Source configuration parameters

Probe Type	Parameter	Options	To Do
Test Method		AWG	Select the test method to connect to and set up the AWG
Single-ended	Select D+ D–	Ch1 Ch3, Ch1 Ch4, Ch2 Ch3, Ch2 Ch4	Set the channel pair from which to acquire data
	Trigger	Ch1, Ch2, Ch3, Ch4	Set the channel from which to acquire trigger data
Differential	Select	Ch1, Ch2, Ch3, Ch4, Ref1, Ref2, Ref3, Ref4	Set the channel from which to acquire data
	Trigger	Ch1, Ch2, Ch3, Ch4	Set the channel from which to acquire trigger data

Note: *Trigger is not available for the combination—COMRESET test for Device Type as host and OOB Type as Inter-burst.*

In the General Config tab, set the Device Type, Usage model, and COMINIT/COMWAKE/ COMRESET Type.

Table 33: General configuration parameters

Parameter	Options	To do
Usage Model	Gen1i, Gen1x, Gen1m, Gen2i, Gen2x, Gen2m	Select the generation to which the device belongs
Device Type	Host, Drive	Select the type of device to test
Cable Attn	Range: 100 p-10 G	Type the cable attenuation or enter the value within the range from the numeric keypad
OOB Type	In Spec, Out Of Spec, Inter Burst	Select the type of OOB test to perform

6. From the Control panel, select the mode as Single Run or Single No Acq. The Single No Acq mode works similar to the Single Run mode.

7. Click the Start button to start taking the measurement. When the measurement is complete, the summary of the results is displayed.

8. If the results are not automatically displayed, select Results> Summary to view the results. To view detailed results, select Results> Details.

Perform SATA Tests for Receiver

Receiver Measurements

Timing measurements that are available for a Serial ATA Receiver are Eye, Bit Rate, Differential Skew, Rise and Fall Time, and Unit Interval. You can select one or more measurements at a time. You can select all measurements by clicking the Select All button. The Differential Skew measurement is available only when you use a single-ended probe.

Amplitude measurements that are available for a Serial ATA Receiver are Differential Voltage and AC CM Voltage. The AC CM Voltage measurement is available only when you use a single-ended probe.

Perform Receiver Eye, Unit Interval, and Bit Rate Tests

Follow these steps to measure the Eye, Unit Interval, and Bit Rate for a receiver.

1. Set up the DUT (Host or Drive) as shown in the How To Set up the DUT section.

2. Select Measurements> Select from the menu bar.

3. Select Test Point as Receiver and Probe Type as Single-ended or Differential.

4. Click Eye, Unit Interval, and Bit Rate.

5. To change the configuration settings, select Measurements> Configure from the menu bar or click the Configure button.

   In the Source tab, click Live, Ref, or File. If you are using a single-ended probe, select the channels for D+ and D–, and the Trigger channel. The

trigger channels available exclude those channels that you have selected as D+ D–.

Table 34: Source configuration parameters

Select	Parameter	Options	To Do
Test Method		AWG, BIST FIS/User	Select the test method to use. The module uses the source pattern files located on the AWG, or uses a vendor-specific method to test the DUT
Live	Select D+ D–	Ch1 Ch3, Ch1 Ch4, Ch2 Ch3, Ch2 Ch4	Set the channel pair to acquire data from
	Trigger	Ch1, Ch2, Ch3, Ch4	Set the channel to acquire trigger data from
Ref	Select D+ D–	Ref1 Ref2, Ref1 Ref3, Ref1 Ref4, Ref2 Ref1, Ref2 Ref3, Ref2 Ref4, Ref3 Ref1, Ref3 Ref2, Ref3 Ref4, Ref4 Ref1, Ref4 Ref2, Ref4 Ref3	Set the Ref channel pair to acquire data from
File	Select File(s) D+ D–	Browse	Load the data from .csv files

For a differential probe, the source parameters are:

Table 35: Source configuration parameters

Select	Parameter	Options	To Do
Test Method		AWG, BIST FIS/User	Select the test method to use. The module uses the source pattern files located on the AWG, or uses a vendor-specific method to test the DUT
Live/Ref	Select	Ch1, Ch2, Ch3, Ch4, Ref1, Ref2, Ref3, Ref4	Set the channel to acquire data from
	Trigger	Ch1, Ch2, Ch3, Ch4	Set the channel to acquire trigger data from
File	Select File	Browse	Load the data from a .csv file

If you choose Live/Ref and select a Ref channel from which to acquire data, then the Trigger selection is not available.

In the General Config tab, set the Usage model, Device Type, Cable Attenuation, and select the Test Method.

Table 36: General configuration parameters

Parameter	Options	To do
Usage Model	Gen1i, Gen1x, Gen1m, Gen2i, Gen2x, Gen2m	Select the generation to which the device belongs
Device Type	Host, Drive	Select the type of device to test
Num of UI	6k, 12k, 30k, 60k, 120k	Select the number of unit intervals for which to acquire data
Cable Attn	Range: 100 p-10 G	Type the cable attenuation or enter the value within the range from the numeric keypad

In the Clock Config tab, set the Clock Recovery parameters, and Analysis Window size.

Table 37: Clock configuration parameters

Parameter	Options	To do
Window Size	Range: 1000-5000 UI	Type the clock recovery window size or enter the value from the numeric keypad
Scan Incr	Range: 1-250 UI	Type the scan increment value or enter it from the numeric keypad
Method	Const Clk: Mean, Const Clk: Median	Select the clock recovery method to use to recover the signal clock
Analysis Window	250 UI, 5 UI	Set the analysis window to one of the two

If you have selected Eye, in the Plot Config tab, set the parameters to plot the Eye diagram.

Table 38: Plot configuration parameters

Parameter	To Do
Transition and Non-Transition Bits	Plot the transition and non-transition bits as two separate eye diagrams
All Bits	Plot all bits (transition and non-transition) in a single eye diagram

6. From the Control panel, select the mode (Single Run or Single No Acq).
7. Click the Start button to start taking the measurement. When the measurement is complete, the summary of the results is displayed.
8. If the results are not automatically displayed, select Results> Summary to view the results. To view detailed results, select Results> Details. For an Eye measurement, you can view a plot of the transition and non-transition bits as separate plots or all bits as a single plot.

Perform Receiver Differential Skew Test

Follow these steps to measure the Differential Skew for a receiver.

1. Set up the DUT (Host or Drive) as shown in the How To Set up the DUT section.
2. Select Measurements> Select from the menu bar.
3. Select Test Point as Receiver and Probe Type as Single-ended.
4. Click Differential Skew.
5. To change the configuration settings, select Measurements> Configure from the menu bar or click the Configure button.

   In the Source tab, click Live, Ref, or File. Select the channels for D+ and D–, and the Trigger channel. The trigger channels available exclude those channels that you have selected as D+ D–. Select the Test Method.

Table 39: Source configuration parameters

Select	Parameter	Options	To Do
Test Method		AWG, BIST FIS/User	Select the test method to use. The module uses the source pattern files located on the AWG, or uses a vendor-specific method to test the DUT
Live	Select D+ D–	Ch1 Ch3, Ch1 Ch4, Ch2 Ch3, Ch2 Ch4	Set the channel pair to acquire data from
	Trigger	Ch1, Ch2, Ch3, Ch4	Set the channel to acquire trigger data from
Ref	Select D+ D–	Ref1 Ref2, Ref1 Ref3, Ref1 Ref4, Ref2 Ref1, Ref2 Ref3, Ref2 Ref4, Ref3 Ref1, Ref3 Ref2, Ref3 Ref4, Ref4 Ref1, Ref4 Ref2, Ref4 Ref3	Set the Ref channel pair to acquire data from
File	Select File(s) D+ D–	Browse	Load the data from .csv files

In the General Config tab, set the Usage model, Device Type, Number of Unit Intervals, Cable Attenuation.

Table 40: General configuration parameters

Parameter	Options	To do
Usage Model	Gen1i, Gen1x, Gen1m, Gen2i, Gen2x, Gen2m	Select the generation to which the device belongs
Device Type	Host, Drive	Select the type of device to test
Num of UI	6k, 12k, 30k, 60k, 120k	Select the number of unit intervals for which to acquire data
Cable Attn	Range: 100 p-10 G	Type the cable attenuation or enter the value with the range from the numeric keypad

6. From the Control panel, select the mode (Single Run or Single No Acq).
7. Click the Start button to start taking the measurement. When the measurement is complete, the summary of the results is displayed.
8. If the results are not automatically displayed, select Results> Summary to view the results. To view detailed results, select Results> Details.

Perform Receiver Rise Time and Fall Time Test

Follow these steps to measure the Rise and Fall Time for a receiver.

1. Set up the DUT (Host or Drive) as shown in the How To Set up the DUT section.
2. Select Measurements> Select from the menu bar.
3. Select Test Point as Receiver and Probe Type as Single-ended or Differential.
4. Click Rise and Fall Time.
5. To change the configuration settings, select Measurements> Configure from the menu bar or click the Configure button.

   In the Source tab, click Live, Ref, or File. If you are using a single-ended probe, select the channels for D+ and D–, and the Trigger channel. The trigger channels available exclude those channels that you have selected as D+ D–. Select the Test Method.

Table 41: Source configuration parameters

Select	Parameter	Options	To Do
Test Method		AWG, BIST FIS/User	Select the test method to use. The module uses the source pattern files located on the AWG, or uses a vendor-specific method to test the DUT
Live	Select D+ D–	Ch1 Ch3, Ch1 Ch4, Ch2 Ch3, Ch2 Ch4	Set the channel pair from which to acquire data
	Trigger	Ch1, Ch2, Ch3, Ch4	Set the channel from which to acquire trigger data
Ref	Select D+ D–	Ref1 Ref2, Ref1 Ref3, Ref1 Ref4, Ref2 Ref1, Ref2 Ref3, Ref2 Ref4, Ref3 Ref1, Ref3 Ref2, Ref3 Ref4, Ref4 Ref1, Ref4 Ref2, Ref4 Ref3	Set the Ref channel pair from which to acquire data
File	Select File(s) D+ D–	Browse	Load the data from .csv files

For a differential probe, the source parameters are:

Table 42: Source configuration parameters

Select	Parameter	Options	To Do
Test Method		AWG, BIST FIS/User	Select the test method to use. The module uses the source pattern files located on the AWG, or uses a vendor-specific method to test the DUT
Live/Ref	Select	Ch1, Ch2, Ch3, Ch4, Ref1, Ref2, Ref3, Ref4	Set the channel to acquire data from
	Trigger	Ch1, Ch2, Ch3, Ch4	Set the channel to acquire trigger data from
File	Select File	Browse	Load the data from a .csv file

If you choose Live/Ref and select a Ref channel from which to acquire data, then the Trigger selection is not available.

In the General Config tab, set the Device Type, Usage model, and Number of UI.

Table 43: General configuration parameters

Parameter	Options	To do
Usage Model	Gen1i, Gen1x, Gen1m, Gen2i, Gen2x, Gen2m	Select the generation to which the device belongs
Device Type	Host, Drive	Select the type of device to test
Num of UI	6k, 12k, 30k, 60k, 120k	Select the number of unit intervals for which to acquire data
Cable Attn	Range: 100 p-10 G	Type the cable attenuation or enter the value within the range from the numeric keypad

6. From the Control panel, select the mode (Single Run or Single No Acq)
7. Click the Start button to start taking the measurement. When the measurement is complete, the summary of the results is displayed.
8. If the results are not automatically displayed, select Results> Summary to view the results. To view detailed results, select Results> Details.

Perform Receiver Differential Voltage Test

Follow these steps to measure the Differential Voltage for a receiver.

1. Set up the DUT (Host or Drive) as shown in the How To Set up the DUT section.
2. Select Measurements> Select from the menu bar.
3. Select Test Point as Receiver and Probe Type as Single-ended or Differential.
4. Click Differential Voltage.
5. To change the configuration settings, select Measurements> Configure from the menu bar or click the Configure button.

In the Source tab, click Live, Ref, or File. If you are using a single-ended probe, select the channels for D+ and D–. Select the Test Method.

Table 44: Source configuration parameters

Select	Parameter	Options	To Do
Test Method		BIST FIS/User	Select the test method BIST FIS/User to use. The AWG method is not available for this measurement
Live	Select D+ D–	Ch1 Ch3, Ch1 Ch4, Ch2 Ch3, Ch2 Ch4	Set the channel pair to acquire data from
Ref	Select D+ D–	Ref1 Ref2, Ref1 Ref3, Ref1 Ref4, Ref2 Ref1, Ref2 Ref3, Ref2 Ref4, Ref3 Ref1, Ref3 Ref2, Ref3 Ref4, Ref4 Ref1, Ref4 Ref2, Ref4 Ref3	Set the Ref channel pair to acquire data from
File	Select File Prefix	Browse	Set the path and alphanumeric prefix for the files that you want to load
	File Type	CSV, wfm	Select the type of file that you want to load. The application uses the File Prefix and the .wfm or .csv file name extension to search for the specified file type
Help			Select the Help button to get a brief description of how to load files with a prefix and specified type

For a differential probe, the source parameters are:

Table 45: Source configuration parameters

Select	Parameter	Options	To Do
Test Method		BIST FIS/User	Select the test method BIST FIS/User to use. The AWG method is not available for this measurement
Live/Ref	Select	Ch1, Ch2, Ch3, Ch4, Ref1, Ref2, Ref3, Ref4	Set the channel to acquire data from
File	Select File Prefix	Browse	Set the path and alphanumeric prefix for the files that you want to load
	File Type	CSV, wfm	Select the type of file that you want to load. The application prefixes the File Prefix you entered to and searches for the specified file type
Help			Select the Help button to get a brief description of how to load files with a prefix and specified type

When you click the Help button, the following help text is displayed. It describes how the module uses the File Prefix and the File Type that you specified to search for the pattern files. Ensure that four pattern files: HFTP.csv, MFTP.csv, LFTP.csv, and LBP.csv, are present in the path you specified.

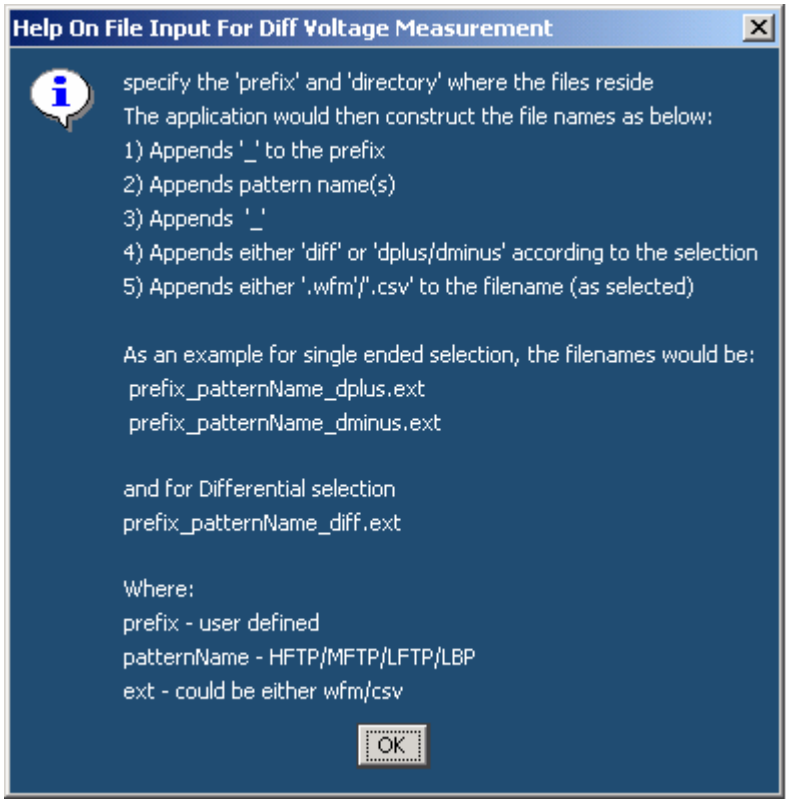


Figure 35: Help screen for differential output voltage measurement

In the General Config tab, set the Device Type, Cable Attenuation, Usage model, Number of UI, and Differential Volt Option.

Table 46: General configuration parameters

Parameter	Options	To do
Usage Model	Gen1i, Gen1x, Gen1m, Gen2i, Gen2x, Gen2m	Select the generation to which the device belongs
Device Type	Host, Drive	Select the type of device to test
Num of UI	6k, 12k, 30k, 60k, 120k	Select the number of unit intervals for which to acquire data
Cable Attn	Range: 100 p-10 G	Type the cable attenuation or enter the value within the range from the numeric keypad
Diff Volt Option	Option1, Option2	Select Option1 to use the lone bit pattern, and Option2 to if no lone bit pattern is available

6. From the Control panel, select the mode (Single Run or Single No Acq).
7. Click the Start button to start taking the measurement. When the measurement is complete, the summary of the results is displayed.
8. If the results are not automatically displayed, select Results> Summary to view the results. The Time Units option is the results summary is not available for this test. To view detailed results, select Results> Details.

Perform Receiver AC CM Voltage Test

Follow these steps to measure the AC Common Mode Voltage for a receiver.

1. Set up the DUT (Host or Drive) as shown in the How To Set up the DUT section.
2. Select Measurements> Select from the menu bar.
3. Select Test Point as Receiver and Probe Type as Single-ended.
4. Click AC CM Voltage.
5. To change the configuration settings, select Measurements> Configure from the menu bar or click the Configure button.

In the Source tab, click Live, Ref, or File. Select the channels for D+ and D–, and the Trigger channel. The trigger channels available exclude those channels that you have selected as D+ D–. For the BIST FIS/User test method, Trigger option is not available. Select the Test Method.

Table 47: Source configuration parameters

Select	Parameter	Options	To Do
Test Method		AWG, BIST FIS/User	Select the test method to use. The module uses the source pattern files located on the AWG, or uses a vendor-specific method to test the DUT
Live	Select D+ D–	Ch1 Ch3, Ch1 Ch4, Ch2 Ch3, Ch2 Ch4	Set the channel pair to acquire data from
	Trigger	Ch1, Ch2, Ch3, Ch4	Set the channel to acquire trigger data from
Ref	Select D+ D–	Ref1 Ref2, Ref1 Ref3, Ref1 Ref4, Ref2 Ref1, Ref2 Ref3, Ref2 Ref4, Ref3 Ref1, Ref3 Ref2, Ref3 Ref4, Ref4 Ref1, Ref4 Ref2, Ref4 Ref3	Set the Ref channel pair to acquire data from
File	Select File(s) D+ D–	Browse	Load the data from .csv file

In the General Config tab, set the Device Type, Cable Attenuation, Usage model, and Number of UI.

Table 48: General configuration parameters

Parameter	Options	To do
Usage Model	Gen1i, Gen1x, Gen1m, Gen2i, Gen2x, Gen2m	Select the generation to which the device belongs
Device Type	Host, Drive	Select the type of device to test
Num of UI	6k, 12k, 30k, 60k, 120k	Select the number of unit intervals for which to acquire data
Cable Attn	Range: 100 p-10 G	Type the cable attenuation or enter the value within the range from the numeric keypad

6. From the Control panel, select the mode (Single Run or Single No Acq).

7. Click the Start button to start taking the measurement. When the measurement is complete, the summary of the results is displayed.

8. If the results are not automatically displayed, select Results> Summary to view the results. The Time Units option is the results summary is not available for this test. To view detailed results, select Results> Details.

View SATA Test Results

Summary Results

You can view the summary results of the measurements by selecting Results> Summary. The application displays results for the measurements for the current acquisition.

The Results Summary menu shows the current data and all acquisition data for each statistical value.

The Results Summary menu displays the following information as a table. Wherever measurement limits are not available, those fields in the table are blank.

Table 49: Results Summary table

Option	Description
Measurement	Displays the selected measurements
Statistic	Displays the type of statistic used
Value	Displays the measured value of the measurement
Lower Lim	Displays the measured lower limit of the measurement
Upper Lim	Displays the measured upper limit of the measurement
Status	Displays the status of the measurement as Pass or Fail

Other options in the Results Summary screen include:

Table 50: Results Summary options

Option	Description
Show Plot	Displays the plot of the eye diagram
Worst Case Eye	Displays all the worst cases for high rail, low rail, top margin, bottom margin, and jitter
Details	Shortcut to the Results Details menu
Time Units	Displays results in Unit Intervals or seconds

Detailed Results

You can view the detailed results of the measurements by selecting Results> Details. The application displays results for the measurements for the current acquisition.

For a selected measurement, the Results Details menu displays the following information as a table. Wherever measurement limits are not available, those fields in the table are blank.

Table 51: Results Details table

Option	Description
Result, Statistic	Displays the different statistics for the measurement—Population, Mean, Standard Deviation, Maximum, Minimum, Peak-Peak Value.
Value	Displays the measured value of the measurement
Lower Lim	Displays the measured lower limit of the measurement
Upper Lim	Displays the measured upper limit of the measurement
Status	Displays the status of the measurement as Pass or Fail

Other options in the Results Details screen include:

Table 52: Results Details options

Option	Description
Show Plot	Displays the plot of the eye diagram
Worst Case Eye	Displays all the worst cases for high rail, low rail, top margin, bottom margin, and jitter
Details	Shortcut to the Results Details menu
Time Units	Displays results in Unit Intervals or seconds

Eye Results

You can view the eye results of the measurements by selecting Results> Summary or Results> Details. The application displays results for the eye measurement for the current acquisition.

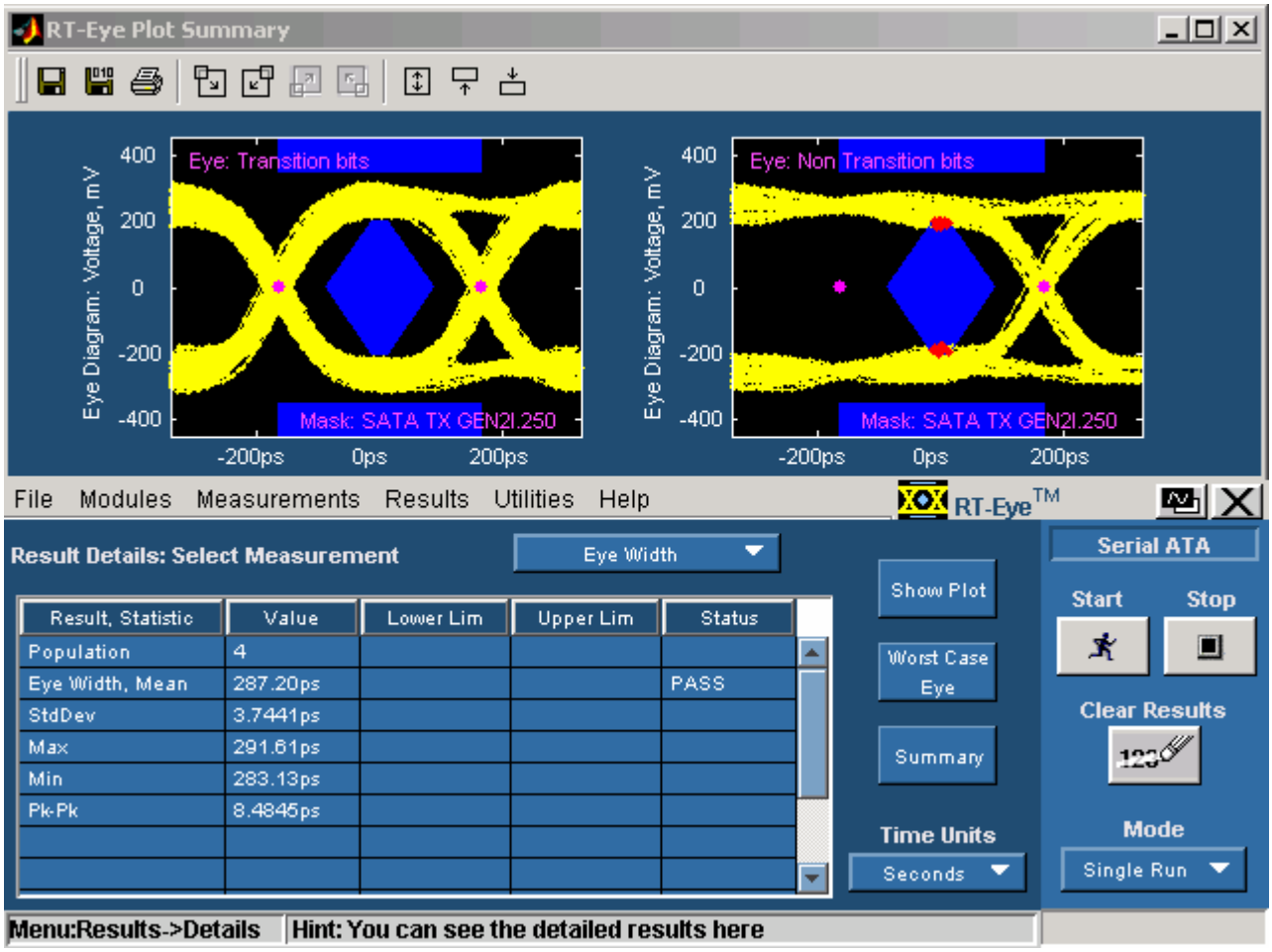


Figure 36: Eye result details with transition and non-transition bits

You can also view this by clicking the Show Plot button in the Results Summary or Results Details screen. If you have selected the Transition and Non-transition Bits option in the plot configuration tab, then the application displays the data acquired in two separate plots. If you have selected the All Bits option, then the application displays the data acquired in one plot.

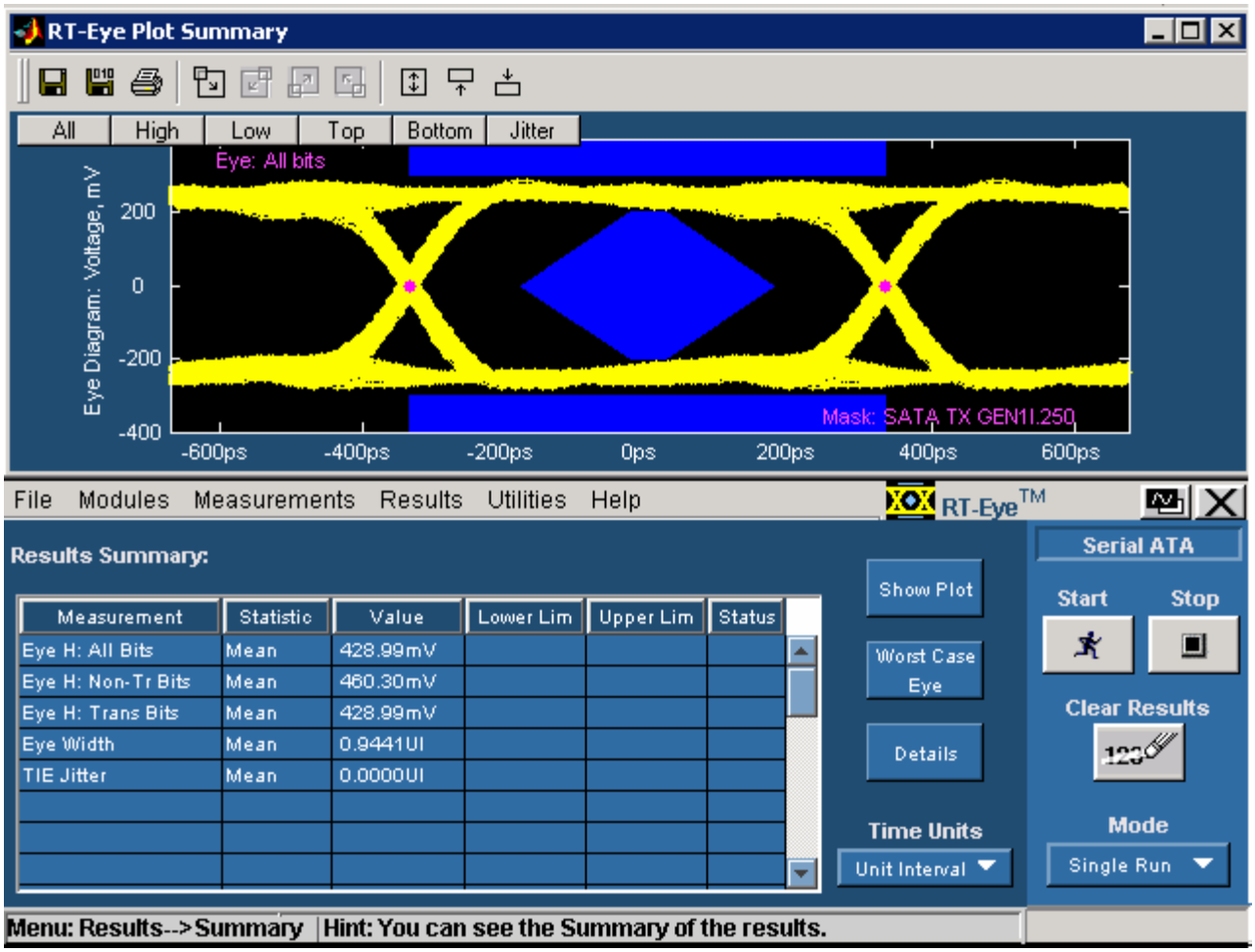


Figure 37: Eye result summary with all bits

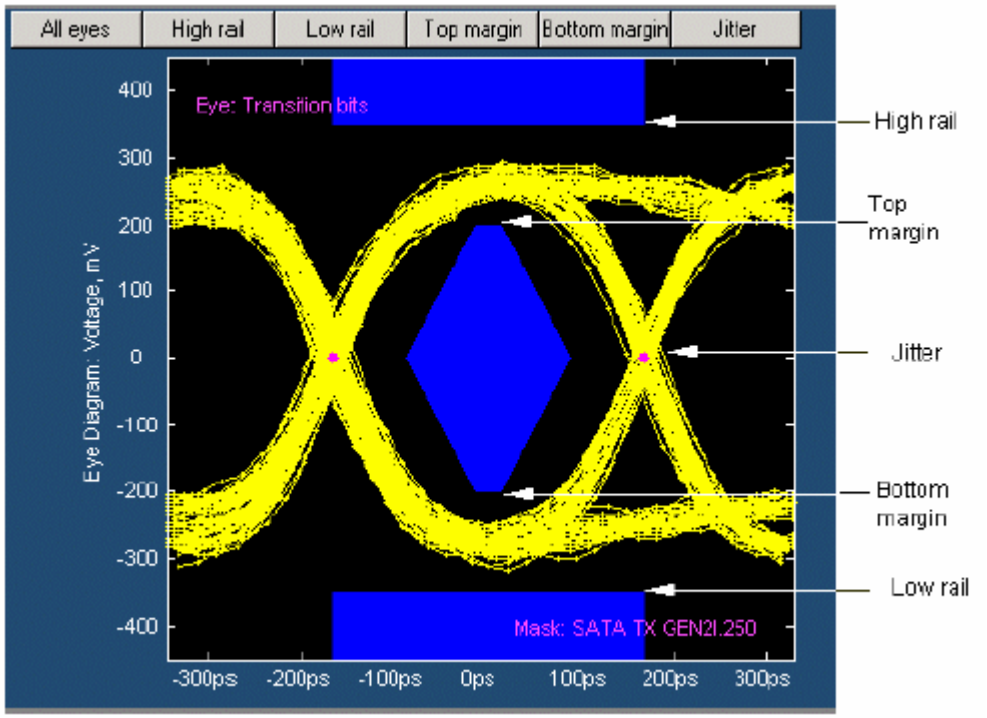


Figure 38: Eye Results

In the figure, the following buttons are available.

Table 53: Eye Results

Options	Description
All Eyes	Click All Eyes to display all the worst cases for high rail, low rail, top margin, bottom margin, and jitter
High Rail	Click High Rail to display the worst case signal values (maximum overshoot) at the high rail or top mask
Low Rail	Click Low Rail to display the worst case signal values (maximum overshoot) at the low rail or bottom mask
Top Margin	Click Top Margin to display the worst case signal values (maximum undershoot) at the top margin of the middle mask
Bottom Margin	Click Bottom Margin to display the worst case signal values (maximum undershoot) at the bottom margin of the middle mask
Jitter	Click Jitter to display the worst case jitter values at the crossovers

The eye results are displayed in a table that shows the statistic, the upper and lower limits, and the status (pass/fail) of the measurement.

Select Results> Worst Case Eye from the menu or click the Worst Case Eye button. This shows all the worst cases—Worst Top Margin, Worst Bottom Margin, Worst Upper Rail, Worst Lower Rail, and Worst Jitter.

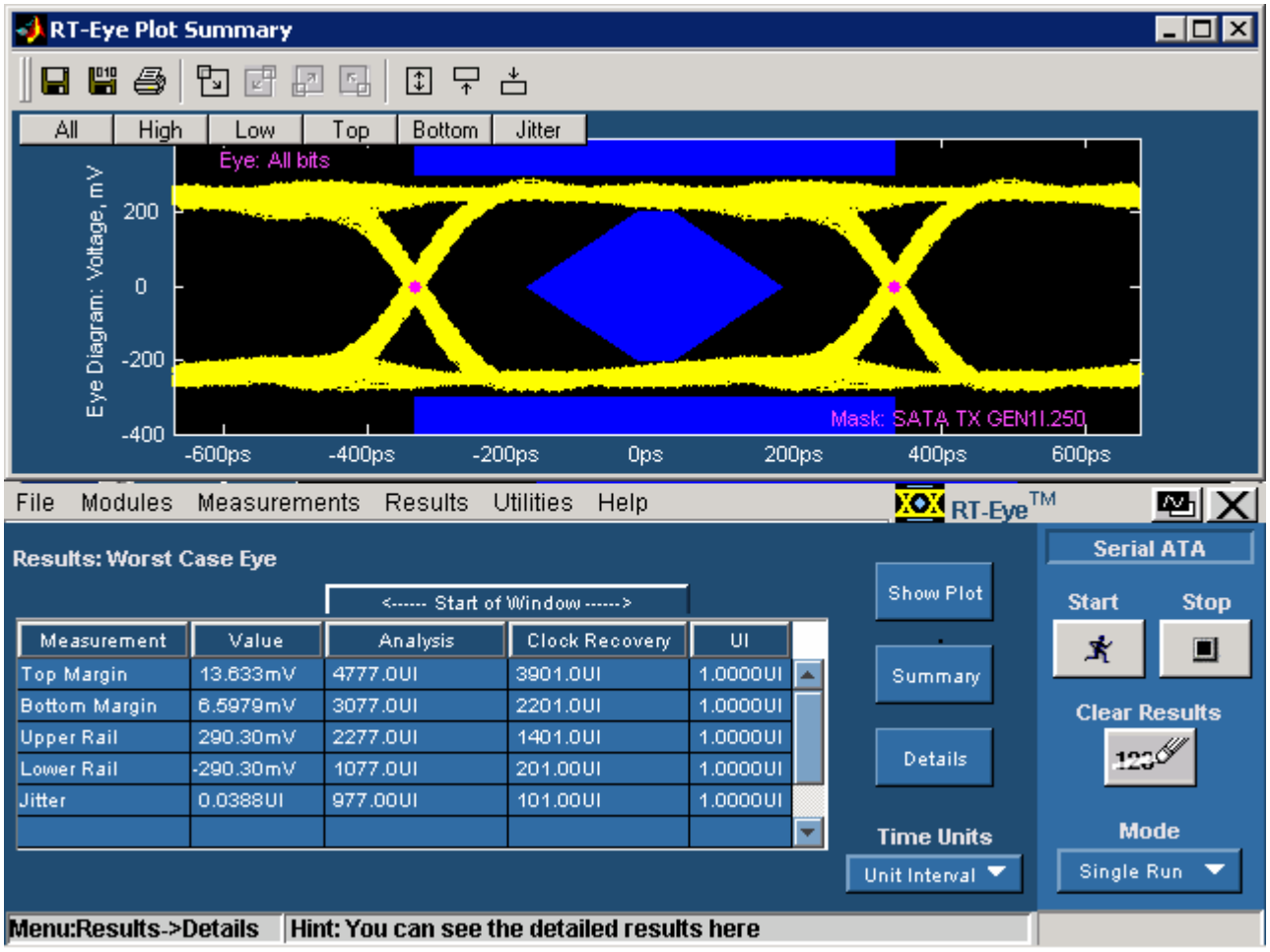


Figure 39: Eye plot of Worst Case

Results Plot

The following figure displays the Eye plot for transition bits. You can view this plot if you have set the option–Transition and Non-Transition Bits–in Configure> Plot Config.

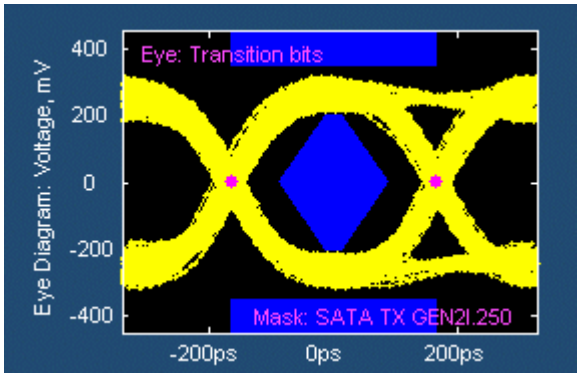


Figure 40: Eye plot of transition bits

The following figure displays the Eye plot for non-transition bits. You can view this plot if you have set the option–Transition and Non-Transition Bits–in Configure> Plot Config.

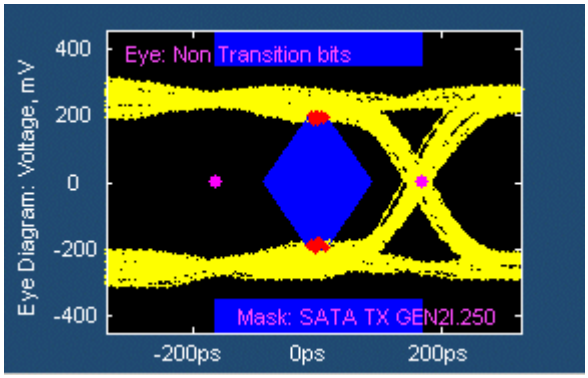


Figure 41: Eye plot of non-transition bits

The following figure displays the Eye plot for All bits. You can view this plot if you have set the option–All Bits–in Configure> Plot Config.

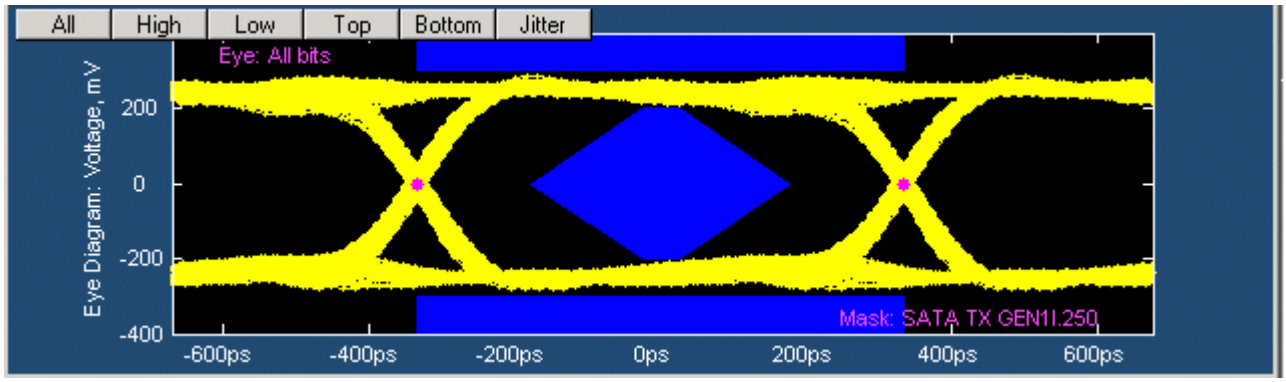


Figure 42: Eye plot of All bits

Bit Rate Results for a SATA Device

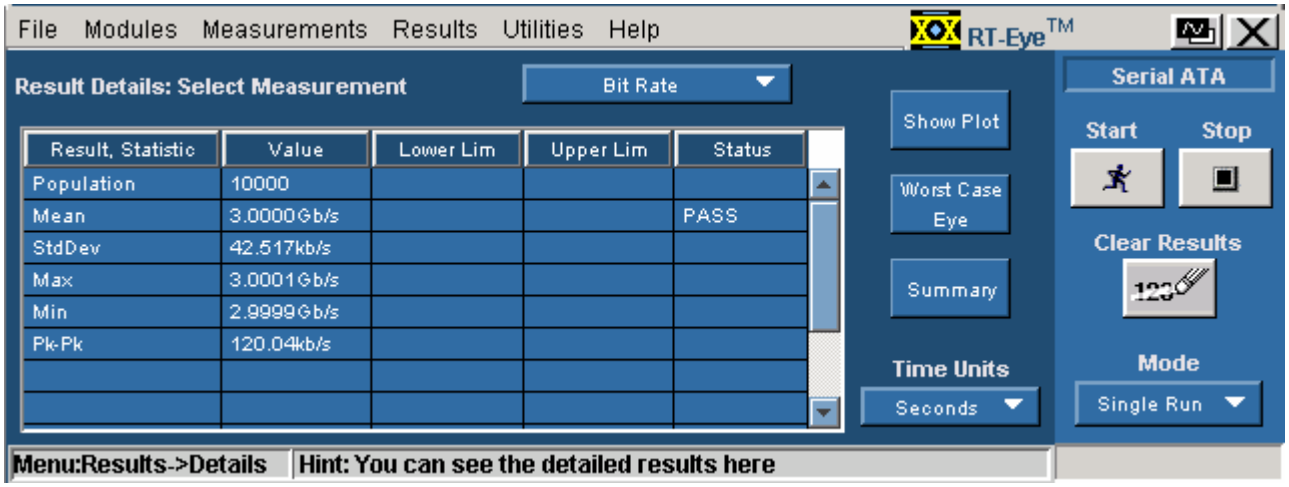


Figure 43: Bit Rate result details

Differential Skew Results for a SATA Device

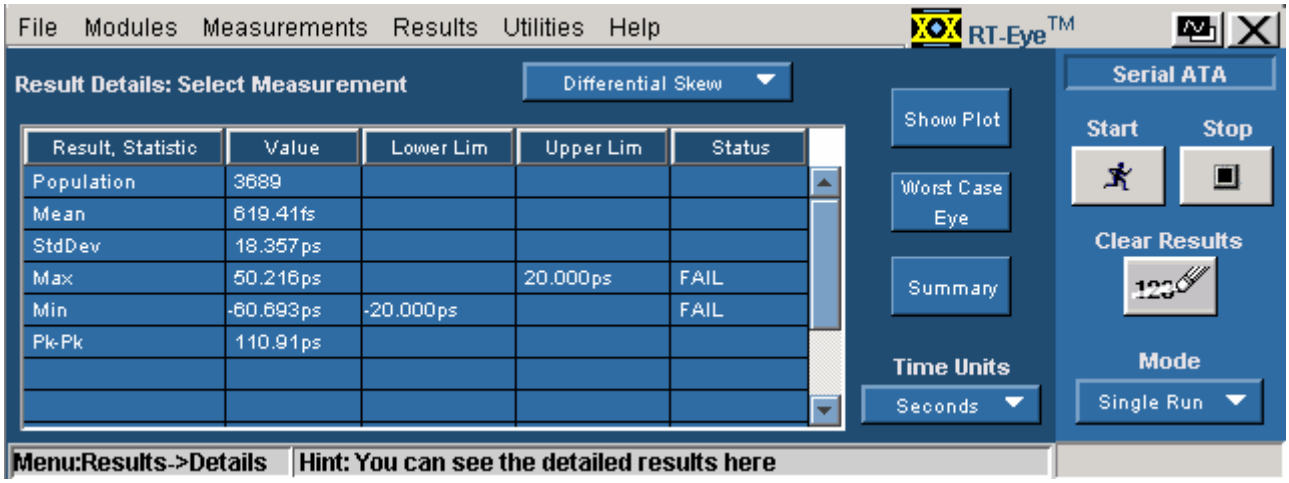


Figure 44: Differential Skew result details

Rise and Fall Time Results for a SATA Device

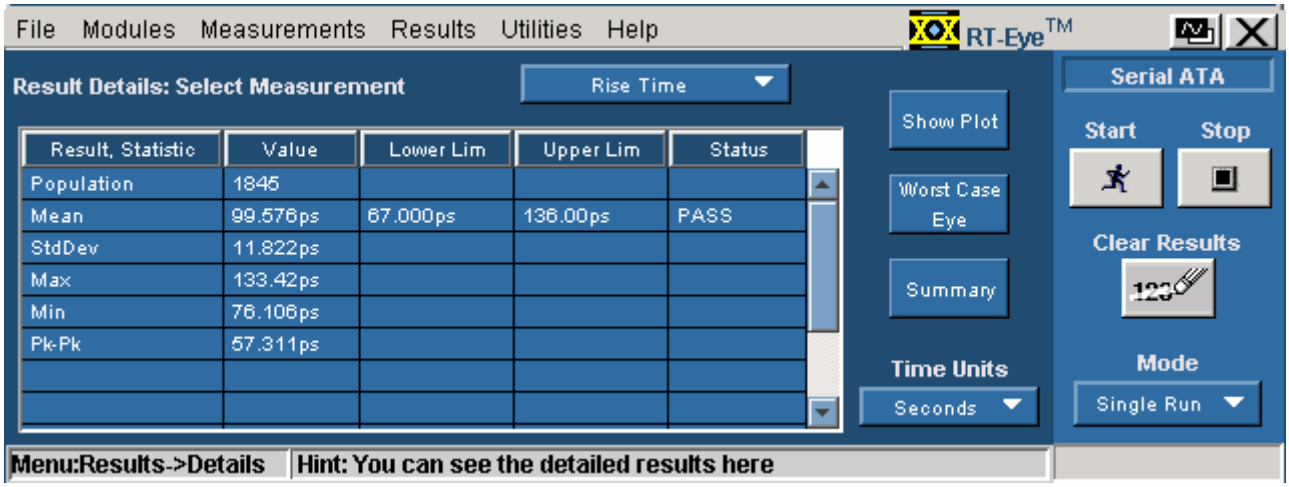


Figure 45: Rise Time result details

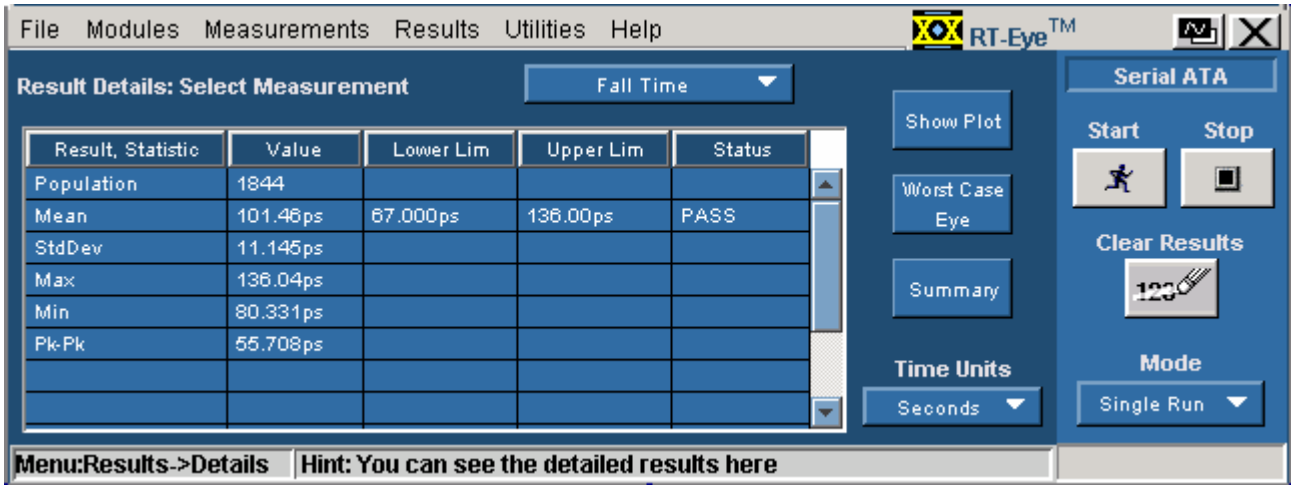


Figure 46: Fall Time result details

Unit Interval Results for a SATA Device

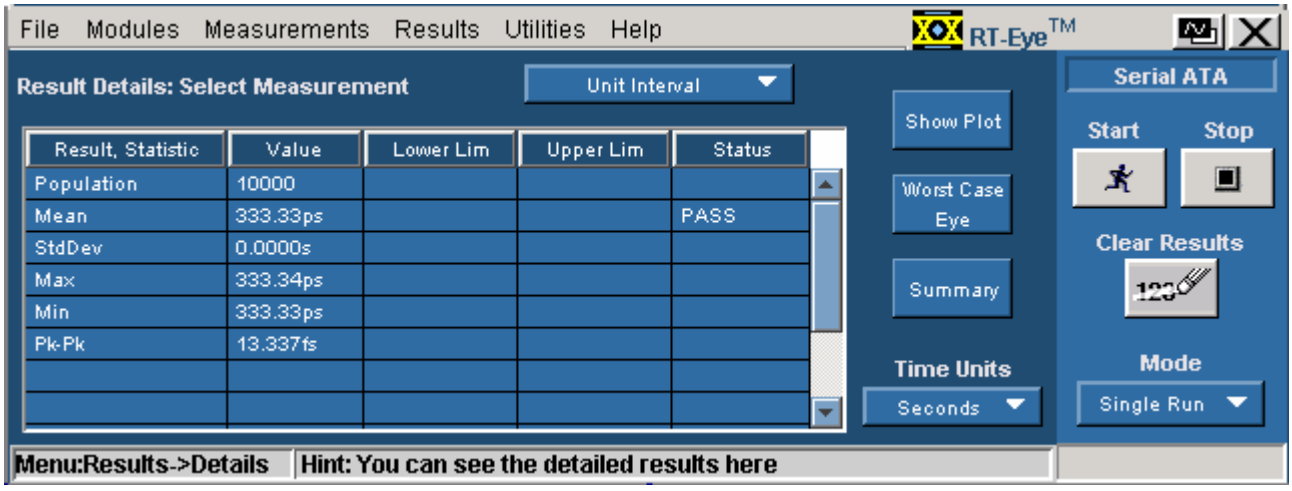


Figure 47: Unit Interval result details

Differential Voltage Results for a SATA Device

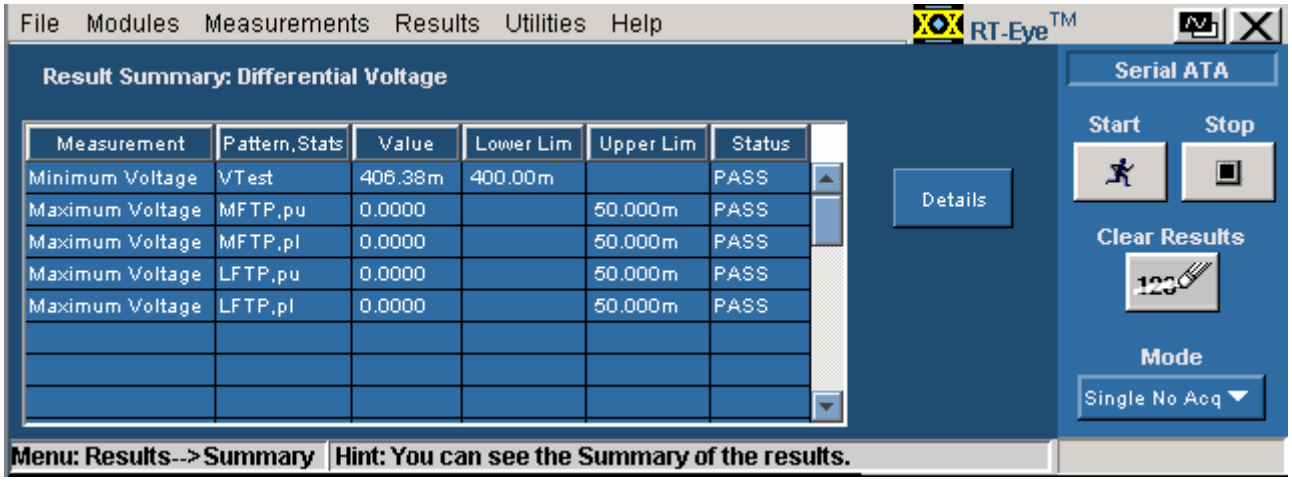


Figure 48: Differential Voltage result summary

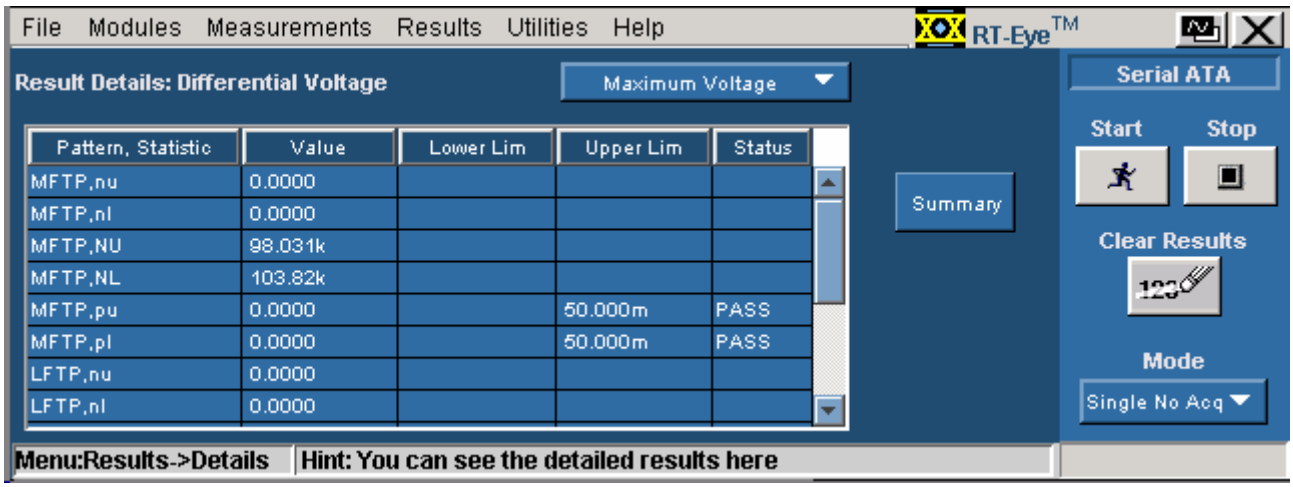


Figure 49: Differential Voltage (maximum voltage) result details

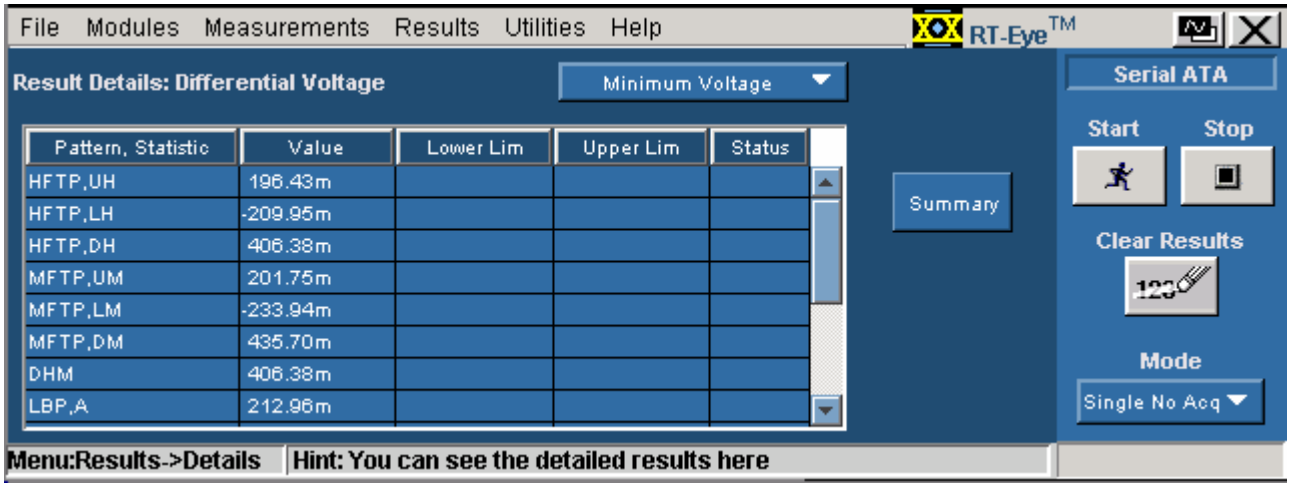


Figure 50: Differential Voltage (minimum voltage) result details

AC CM Voltage Results for a SATA Device

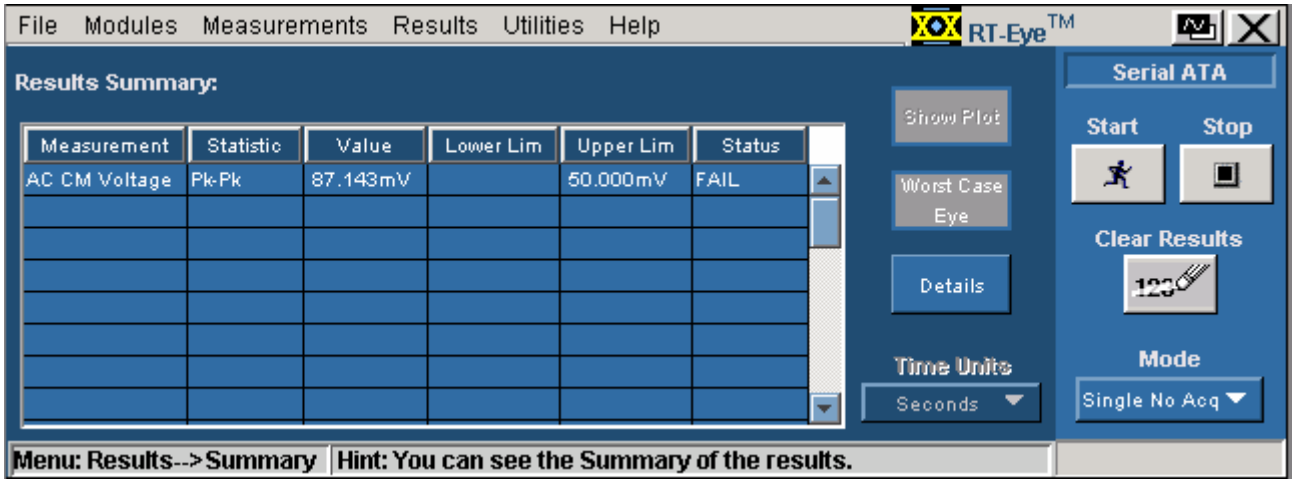


Figure 51: AC CM Voltage result summary

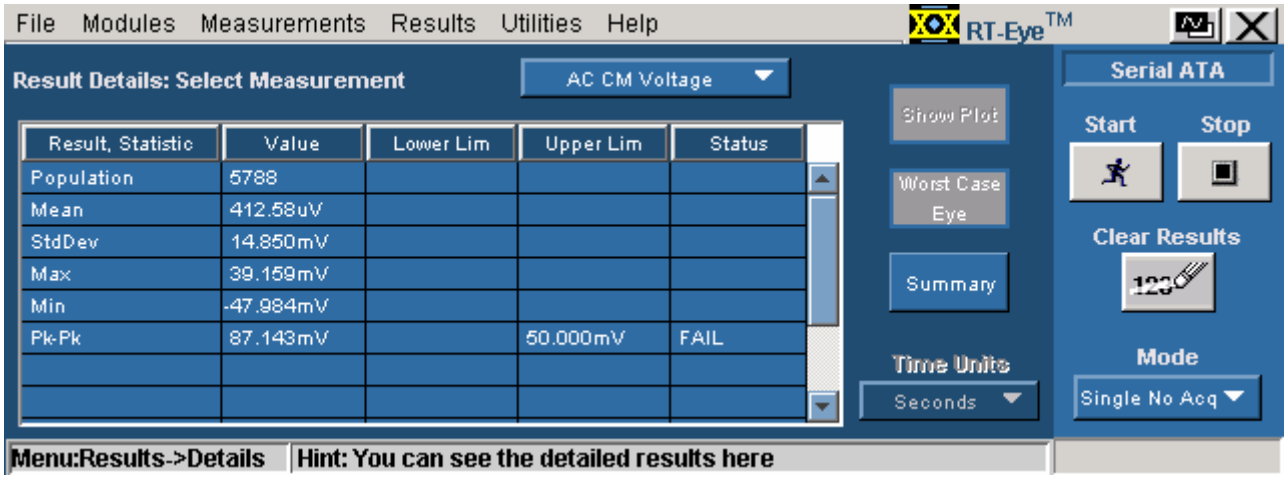


Figure 52: AC CM Voltage result details

COMINIT Results for a SATA Device

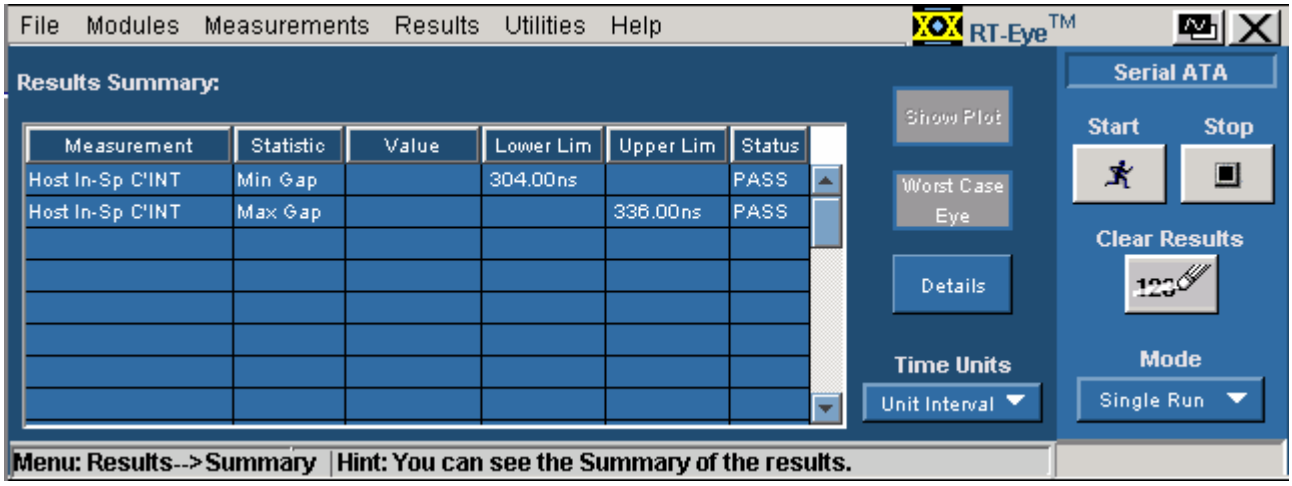


Figure 53: COMINIT result summary

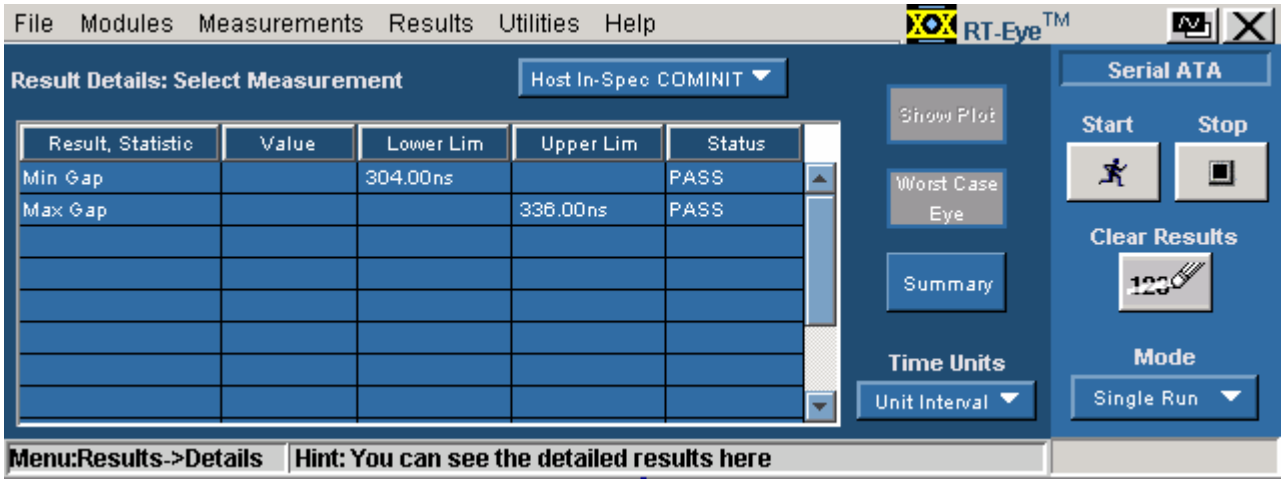


Figure 54: COMINIT result details

COMWAKE Results for a SATA Device

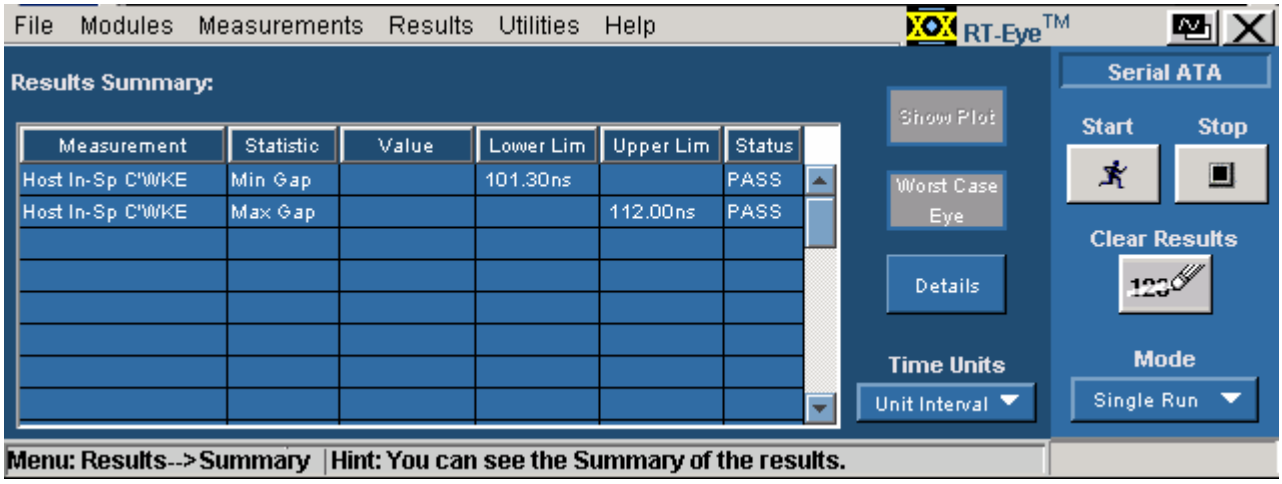


Figure 55: COMWAKE result summary

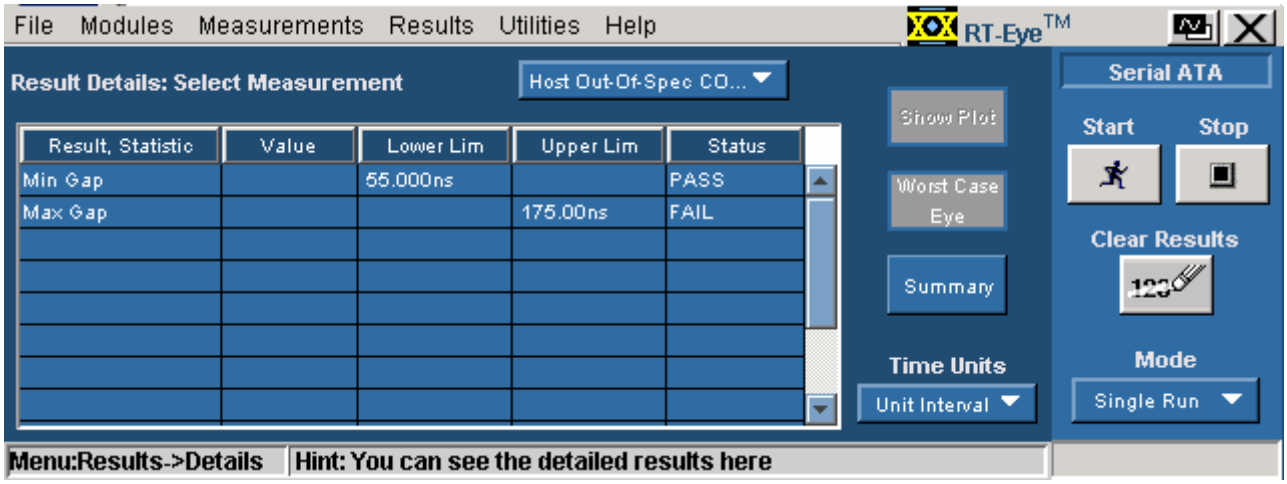


Figure 56: COMWAKE result details

COMRESET Results for a SATA Device

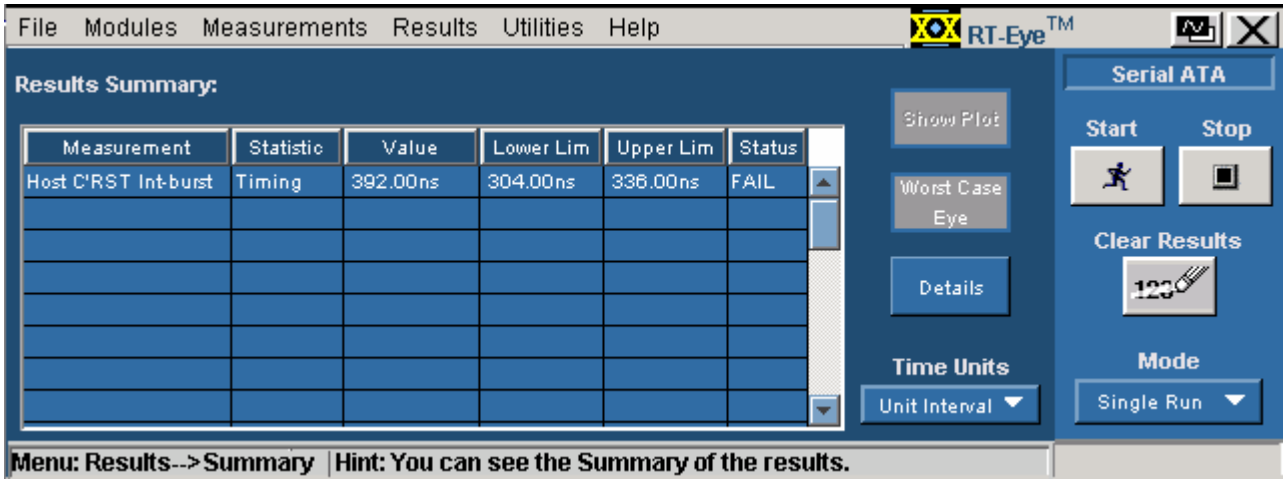


Figure 57: COMRESET result summary

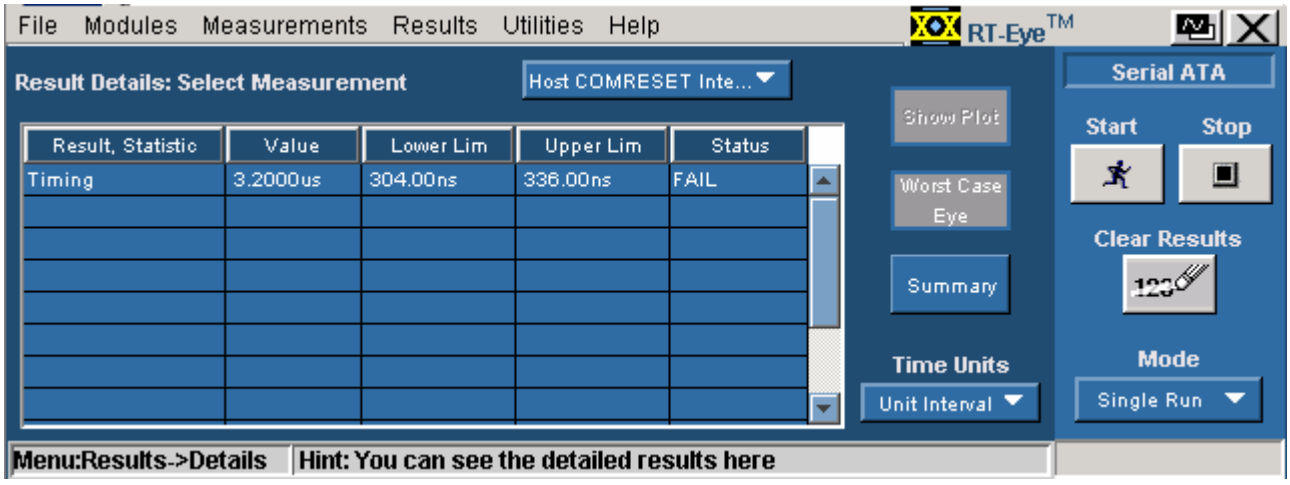


Figure 58: COMRESET result details

Select and Configure SAS Measurements

Select SAS Measurements

To select a measurement, select Measurements> Select from the menu bar. The following screen is displayed:

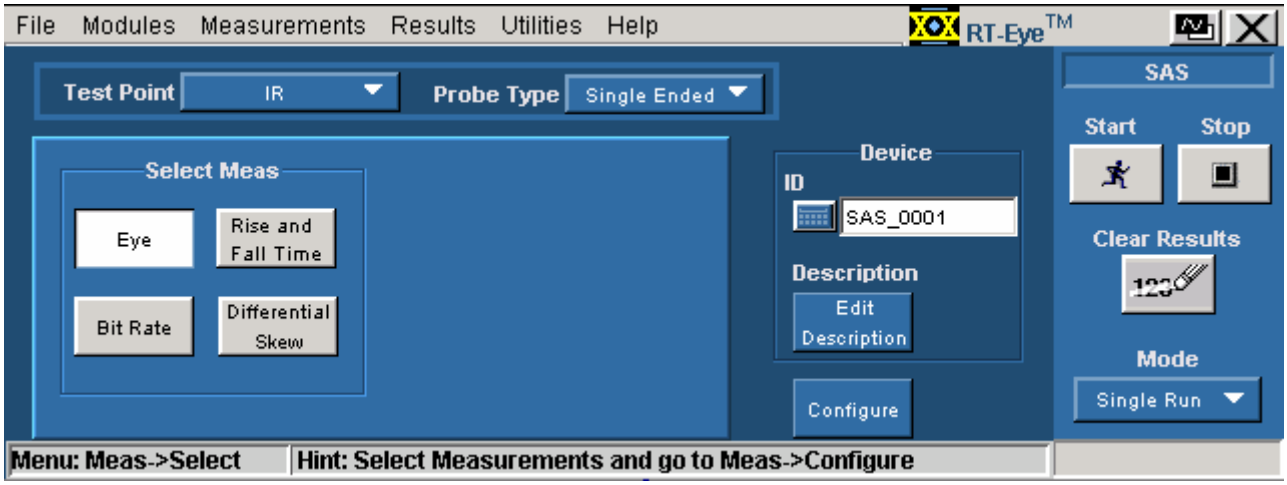


Figure 59: SAS measurements for receiver

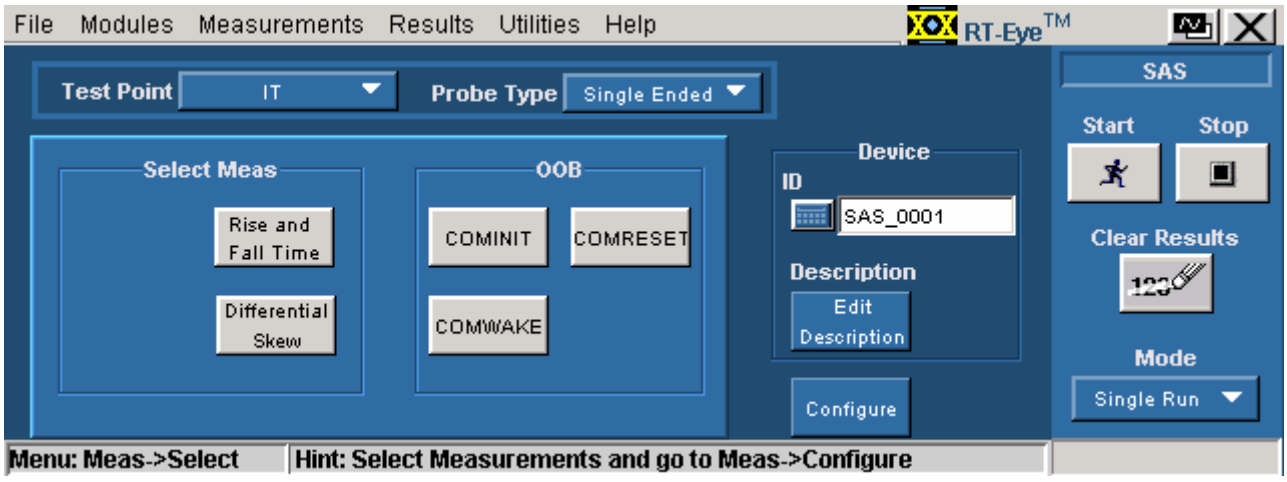


Figure 60: SAS measurements for transmitter

The SAS measurements that are available for transmitter and receiver devices are as follows:

Table 54: SAS measurements for transmitter and receiver devices

Device	Measurements	
	Timing	Out Of Band
Transmitter (Test points—IT, CT, XT)	Rise and Fall Time, Differential Skew*	COMINIT, COMWAKE, COMRESET
Receiver (Test points—IR, CR, XR)	Eye, Bit Rate, Rise and Fall Time, Differential Skew*	–
*** Available only when you use a single-ended probe.**		

The test points for a transmitter are: IT (internal connector), CT (external connector), and XT (expander). The test points for a receiver are: IR (internal connector), CR (external connector), and XR (expander).

Configure SAS Measurements

To configure one or more measurements, select Measurements> Configure from the application menu bar, or click the Configure button in the Measurement screen.

The Configure screen has the following tabs: Source, General Config, and Plot Config. The Plot Config tab, with parameters to generate an eye diagram, is available only for the Eye Measurement.

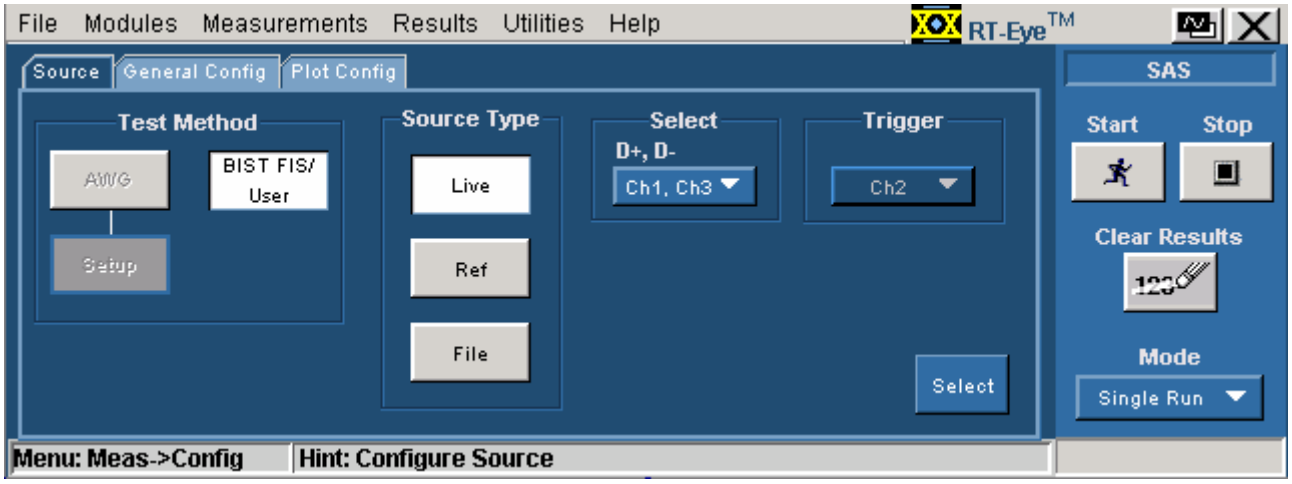


Figure 61: Configure Source panel for a single-ended probe

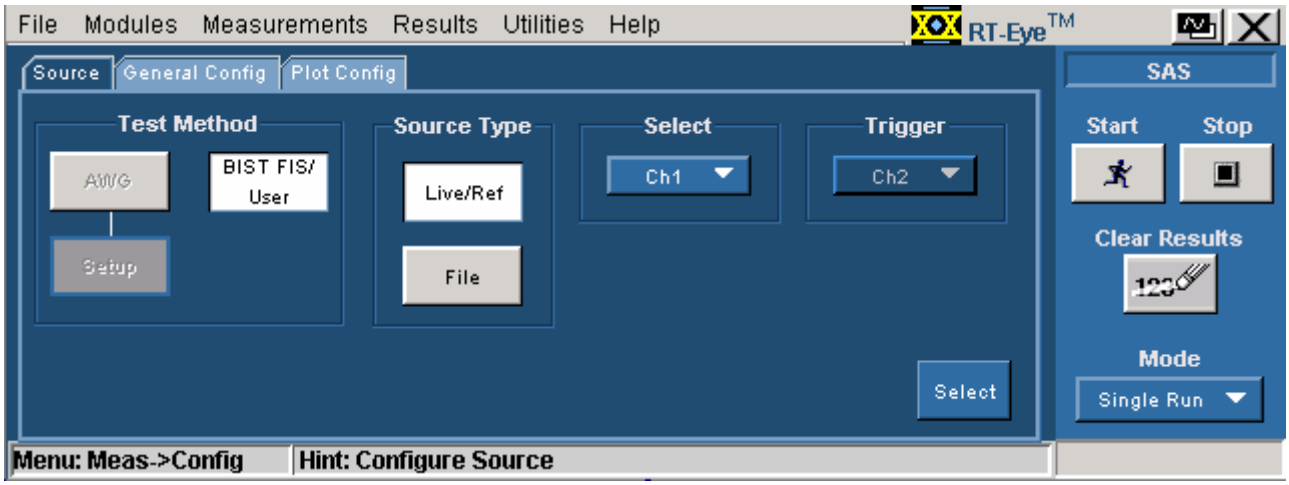


Figure 62: Configure Source panel for a differential probe

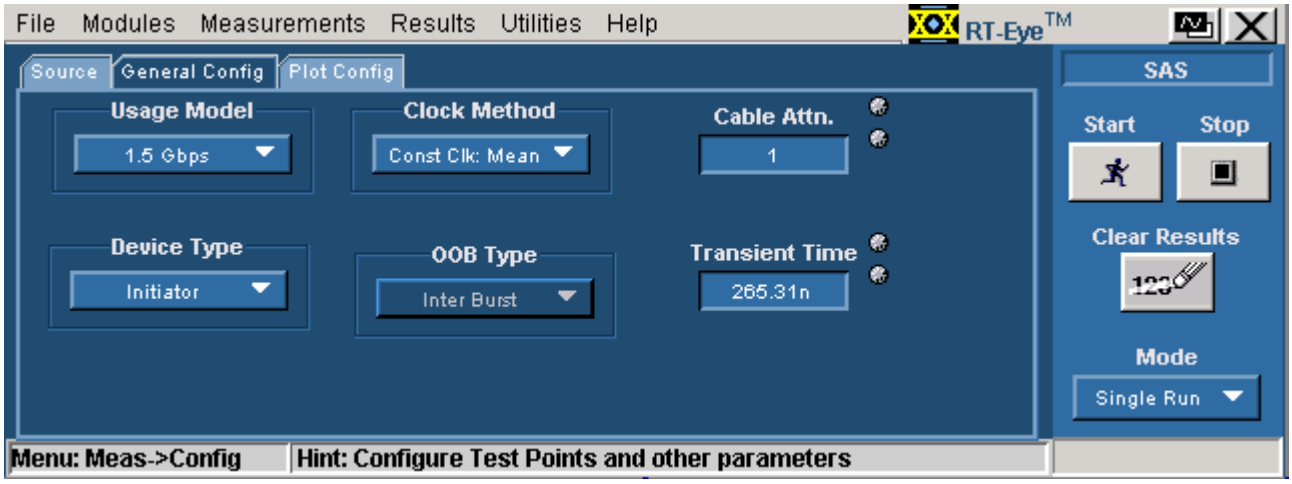


Figure 63: General configuration

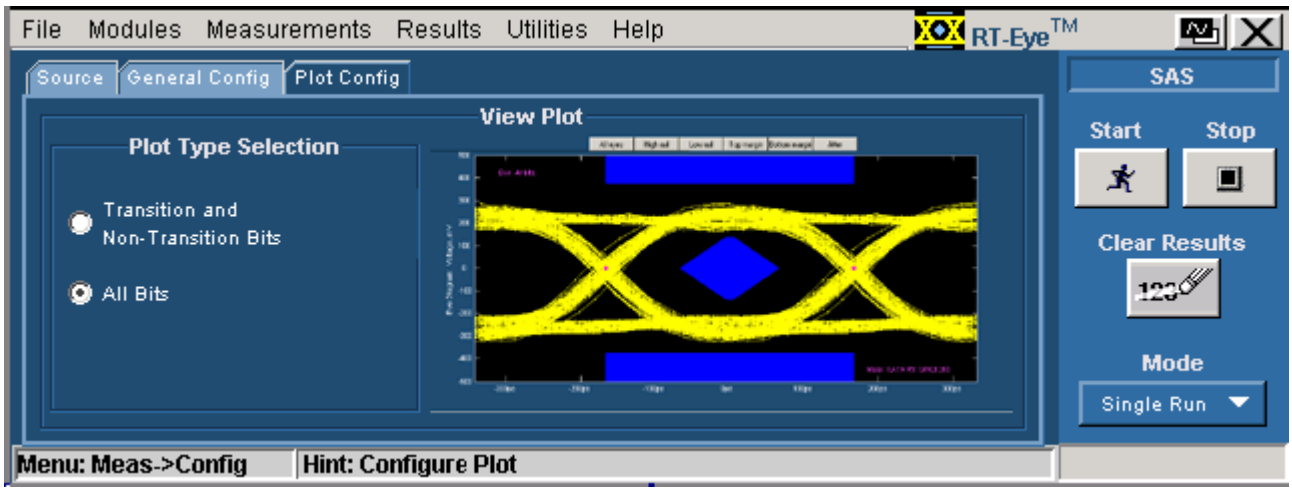


Figure 64: Plot parameters

The following table lists the configuration parameters for the SAS measurements:

	Eye	Bit Rate	Rise and Fall Time	Differential Skew	COMINIT	COMWAKE	COMRESET
Transmitter			✓	✓	✓	✓	✓
Receiver	✓	✓	✓	✓			
Single-ended probe	✓	✓	✓	✓	✓	✓	✓
Differential probe	✓	✓	✓		✓	✓	✓
Source tab							
Test Method: AWG					✓	✓	✓
Test Method: BIST-FIS	✓	✓	✓	✓			
Source Type: Live	✓	✓	✓	✓	✓	✓	✓
Source Type: Ref	✓	✓	✓	✓			
Source Type: File	✓	✓	✓	✓			
Trigger	✓	✓		✓	✓	✓	
General Config tab							
Usage Model	✓	✓	✓	✓	✓	✓	✓
Device Type	✓	✓	✓	✓	✓	✓	✓
OOB Type					✓	✓	✓
Clock Method	✓	✓		✓			
Cable Attn	✓	✓	✓	✓	✓	✓	✓
Transient Time	✓						
Plot Config tab							
Transition and Non-transition bits	✓						
All Bits	✓						

Perform SAS Tests for Transmitter

Transmitter Measurements

The measurements that are available for a SAS Transmitter are Rise and Fall Time and Differential Skew.

Out Of Band (OOB) Signaling Tests are available for a SAS Transmitter. The OOB tests that are supported by the SAS module are COMINIT, COMWAKE, and COMRESET.

Perform Transmitter Rise Time and Fall Time Test

Follow these steps to measure the Rise and Fall Time for a transmitter.

1. Set up the DUT (Host or Drive) as shown in the How To Set up the DUT section.
2. Select Measurements> Select from the menu bar.
3. Select Test Point as IT, CT, or XT and Probe Type as Single-ended or Differential.
4. Click Rise and Fall Time.
5. To change the configuration settings, select Measurements> Configure from the menu bar or click the Configure button.

   In the Source tab, click Live, Ref, or File. If you are using a single-ended probe (SMA cable), select the channels for D+ and D–, and the Trigger channel. The trigger channels available exclude those channels that you have selected as D+ D–. Select the Test Method to use.

Table 55: Source configuration parameters

Select	Parameter	Options	To Do
Test Method		AWG, BIST FIS/User	Select the test method to use. The module uses the source pattern files located on the AWG, or uses a vendor-specific method to test the DUT
Live	Select D+ D–	Ch1 Ch3, Ch1 Ch4, Ch2 Ch3, Ch2 Ch4	Set the channel pair from which to acquire data
	Trigger	Ch1, Ch2, Ch3, Ch4	Set the channel from which to acquire trigger data
Ref	Select D+ D–	Ref1 Ref2, Ref1 Ref3, Ref1 Ref4, Ref2 Ref1, Ref2 Ref3, Ref2 Ref4, Ref3 Ref1, Ref3 Ref2, Ref3 Ref4, Ref4 Ref1, Ref4 Ref2, Ref4 Ref3	Set the Ref channel pair from which to acquire data
File	Select File(s) D+ D–	Browse	Load the data from .csv files

For a differential probe, the source parameters are:

Table 56: Source configuration parameters

Select	Parameter	Options	To Do
Test Method		AWG, BIST FIS/User	Select the test method to use. The module uses the source pattern files located on the AWG, or uses a vendor-specific method to test the DUT
Live/Ref	Select	Ch1, Ch2, Ch3, Ch4, Ref1, Ref2, Ref3, Ref4	Set the channel from which to acquire data
	Trigger	Ch1, Ch2, Ch3, Ch4	Set the channel from which to acquire trigger data
File	Select File	Browse	Load the data from a .csv file

If you choose Live/Ref and select a Ref channel from which to acquire data, then the Trigger selection is not available.

In the General Config tab, set the Device Type, Cable Attenuation, Usage model, and Clock Method.

Table 57: General configuration parameters

Parameter	Options	To Do
Usage Model	1.5 Gbps, 3.0 Gbps	Select the speed at which the device transmits or receives data
Device Type	Initiator, Target, Expander*	Select the type of device to test
Clock Method	Const Clk: Mean, Const Clk: Median	Select the clock recovery method to use to recover the signal clock
Cable Attn	Range: 100 p-10 G	Type the cable attenuation or enter the value within the range from the numeric keypad
*** The option, Expander, is the only available option when the test point chosen is XT.**		

6. From the Control panel, select the mode (Single Run or Single No Acq).
7. Click the Start button to start taking the measurement. When the measurement is complete, the summary of the results is displayed.
8. If the results are not automatically displayed, select Results> Summary to view the results. To view detailed results, select Results> Details.

Perform Transmitter Differential Skew Test

Follow these steps to measure the Differential Skew for a transmitter.

1. Set up the DUT (Host or Drive) as shown in the How To Set up the DUT section.
2. Select Measurements> Select from the menu bar.
3. Select Test Point as IT, CT, or XT and Probe Type as Single-ended.
4. Click Differential Skew.
5. To change the configuration settings, select Measurements> Configure from the menu bar or click the Configure button.

In the Source tab, click Live, Ref, or File. Select the channels for D+ and D–, and the Trigger channel. The trigger channels available exclude those channels that you have selected as D+ D–. Select the Test Method.

Table 58: Source configuration parameters

Select	Parameter	Options	To Do
Test Method		AWG, BIST FIS/User	Select the test method to use. The module uses the source pattern files located on the AWG, or uses a vendor-specific method to test the DUT
Live	Select D+ D–	Ch1 Ch3, Ch1 Ch4, Ch2 Ch3, Ch2 Ch4	Set the channel pair from which to acquire data
	Trigger	Ch1, Ch2, Ch3, Ch4	Set the channel from which to acquire trigger data
Ref	Select D+ D–	Ref1 Ref2, Ref1 Ref3, Ref1 Ref4, Ref2 Ref1, Ref2 Ref3, Ref2 Ref4, Ref3 Ref1, Ref3 Ref2, Ref3 Ref4, Ref4 Ref1, Ref4 Ref2, Ref4 Ref3	Set the Ref channel pair from which to acquire data
File	Select File(s) D+ D–	Browse	Load the data from .csv files

In the General Config tab, set the Device Type, Cable Attenuation, and Usage model.

Table 59: General configuration parameters

Parameter	Options	To do
Device Type	Initiator, Target	Select the type of device to test
Usage Model	1.5 Gbps, 3.0 Gbps	Select the speed at which the device transmits or receives data
Cable Attn	Range: 100 p-10 G	Type the cable attenuation or enter the value within the range from the numeric keypad

6. From the Control panel, select the mode (Single Run or Single No Acq).
7. Click the Start button to start taking the measurement. When the measurement is complete, the summary of the results is displayed.

8. If the results are not automatically displayed, select Results> Summary to view the results. To view detailed results, select Results> Details.

Perform Transmitter COMINIT, COMWAKE, and COMRESET Tests

Follow these steps to perform the COMINIT, COMWAKE, and COMRESET Tests for a transmitter.

1. Set up the DUT (Host or Drive) as shown in the How To Set up the DUT section.
2. Select Measurements> Select from the menu bar.
3. Select Test Point as IT or CT, and Probe Type as Single-ended or Differential.
4. Click any one of the OOB tests: COMINIT, COMWAKE, or COMRESET.
5. To change the configuration settings, select Measurements> Configure from the menu bar or click the Configure button.

In the Source tab, click Live. If you are using a single-ended probe (SMA cable), select the channels for D+ and D–, and the Trigger channel. The trigger channels available exclude those channels that you have selected as D+ D–. Select the Test Method.

Table 60: Probe type

Probe Type	Parameter	Options	To Do
	Test Method	AWG	Select the test method to connect to and set up the AWG
Single-ended	Select D+ D–	Ch1 Ch3, Ch1 Ch4, Ch2 Ch3, Ch2 Ch4	Set the channel pair from which to acquire data fro
	Trigger	Ch1, Ch2, Ch3, Ch4	Set the channel from which to acquire trigger data
Differential	Select	Ch1, Ch2, Ch3, Ch4, Ref1, Ref2, Ref3, Ref4	Set the channel from which to acquire data
	Trigger	Ch1, Ch2, Ch3, Ch4	Set the channel from which to acquire trigger data

Note: *Trigger is not available for the combination—COMRESET test for Device Type as host and OOB Type as Inter-burst.*

In the General Config tab, set the Device Type, Usage model, and COMINIT/COMWAKE/ COMRESET Type.

Table 61: General Config tab

Parameter	Options	To do
Device Type	Initiator, Target	Select the type of device to test
Usage Model	1.5 Gbps, 3.0 Gbps	Select the speed at which the device transmits or receives data
Cable Attn	Range: 100 p-10 G	Type the cable attenuation or enter the value within the range from the numeric keypad
OOB Type	In Spec, Out Of Spec, Inter Burst	Select the type of OOB test to perform

6. From the Control panel, select the mode as Single Run or Single No Acq. The Single No Acq mode works similar to the Single Run mode.

7. Click the Start button to start taking the measurement. When the measurement is complete, the summary of the results is displayed.

8. If the results are not automatically displayed, select Results> Summary to view the results. To view detailed results, select Results> Details.

Perform SAS Tests for Receiver

Receiver Measurements

Measurements that are available for a SAS Receiver are Eye, Bit Rate, Rise and Fall Time, and Differential Skew. You can select one measurement at a time.

Perform Receiver Eye and Bit Rate Tests

Follow these steps to measure the Eye, Bit Rate, or both for a receiver:

1. Set up the DUT (Host or Drive) as shown in the How To Set up the DUT section.

2. Select Measurements> Select from the menu bar.

3. Select Test Point as IR, CR, XR, and Probe Type as Single-ended or Differential.

4. Click Eye and Bit Rate.

5. To change the configuration settings, select Measurements> Configure from the menu bar or click the Configure button.

   In the Source tab, click Live, Ref, or File. If you are using a single-ended probe (SMA cable), select the channels for D+ and D–, and the Trigger channel. The trigger channels available exclude those channels that you have selected as D+ D–. Select the Test Method.

Table 62: Source tab

Select	Parameter	Options	To Do
Test Method		AWG, BIST FIS/User	Select the test method to use. The module uses the source pattern files located on the AWG, or uses a vendor-specific method to test the DUT
Live	Select D+ D–	Ch1 Ch3, Ch1 Ch4, Ch2 Ch3, Ch2 Ch4	Set the channel pair to acquire data from
	Trigger	Ch1, Ch2, Ch3, Ch4	Set the channel to acquire trigger data from
Ref	Select D+ D–	Ref1 Ref2, Ref1 Ref3, Ref1 Ref4, Ref2 Ref1, Ref2 Ref3, Ref2 Ref4, Ref3 Ref1, Ref3 Ref2, Ref3 Ref4, Ref4 Ref1, Ref4 Ref2, Ref4 Ref3	Set the Ref channel pair to acquire data from
File	Select File(s) D+ D–	Browse	Load the data from .csv files

In the General Config tab, set the Device Type, Usage model, Clock Recovery Method, Cable Attenuation and Transient Time.

Table 63: General Config tab

Parameter	Options	To do
Usage Model	1.5 Gbps, 3.0 Gbps	Select the speed at which the device transmits or receives data
Device Type	Initiator, Target, Expander*	Select the type of device to test
Clock Method	Const Clk: Mean, Const Clk: Median	Select the clock recovery method to use to recover the signal clock
Cable Attn	Range: 100 p-10 G	Type the cable attenuation or enter the value within the range from the numeric keypad
Transient Time**	.25 - 10 time constants	The transient time value should be at least five times the acquisition duration. Type the transient time or enter the value within the range from the numeric keypad. The corresponding settling time of Unit Intervals will be removed from the filtered data
*** The Expander option is the only available option when the XR test point is chosen.** **** Available for Eye measurement only if enabled in the Preferences.**		

If you have selected Eye, in the Plot Config tab, set the parameters to plot the Eye diagram. If you have selected Eye, and in the Preferences menu, selected Enable Transient Response input for clock recovery, you can enter the Transient Time.

Table 64: Plot Config tab

Parameter	To Do
Transition and Non-Transition Bits	Plot the transition and non-transition bits as two separate eye diagrams
All Bits	Plot all bits (transition and non-transition) in a single eye diagram

6. From the Control panel, select the mode (Single Run or Single No Acq).

7. Click the Start button to start taking the measurement. When the measurement is complete, the summary of the results is displayed.

8. If the results are not automatically displayed, select Results> Summary to view the results. To view detailed results, select Results> Details.

Note: *The SAS Eye measurement requires at least three data packets that has ≥ 550 clock transitions in the acquired data to calculate clock recovery correctly. If the acquired pattern has insufficient clock transitions (550) then you need to acquire more packets for sufficient clock transitions.*

Perform Receiver Differential Skew Test

Follow these steps to measure the Differential Skew for a receiver.

1. Set up the DUT (Host or Drive) as shown in the How To Set up the DUT section.

2. Select Measurements> Select from the menu bar.

3. Select Test Point as IR, CR, or XR and Probe Type as Single-ended.

4. Click Differential Skew.

5. To change the configuration settings, select Measurements> Configure from the menu bar or click the Configure button.

   In the Source tab, click Live, Ref, or File. Select the channels for D+ and D–, and the Trigger channel. The trigger channels available exclude those channels that you have selected as D+ D–. Select the Test Method.

Table 65: Source tab

Select	Parameter	Options	To Do
Test Method		AWG, BIST FIS/User	Select the test method to use. The module uses the source pattern files located on the AWG, or uses a vendor-specific method to test the DUT
Live	Select D+ D–	Ch1 Ch3, Ch1 Ch4, Ch2 Ch3, Ch2 Ch4	Set the channel pair to acquire data from
	Trigger	Ch1, Ch2, Ch3, Ch4	Set the channel to acquire trigger data from
Ref	Select D+ D–	Ref1 Ref2, Ref1 Ref3, Ref1 Ref4, Ref2 Ref1, Ref2 Ref3, Ref2 Ref4, Ref3 Ref1, Ref3 Ref2, Ref3 Ref4, Ref4 Ref1, Ref4 Ref2, Ref4 Ref3	Set the Ref channel pair to acquire data from
File	Select File(s) D+ D–	Browse	Load the data from .csv files

In the General Config tab, set the Device Type, Usage model, and Cable Attenuation.

Table 66: General Config tab

Parameter	Options	To do
Usage Model	1.5 Gbps, 3 Gbps	Select the speed at which the device transmits or receives data
Device Type	Initiator, Target	Select the type of device to test
Cable Attn	Range: 100 p-10 G	Type the cable attenuation or enter the value with the range from the numeric keypad

6. From the Control panel, select the mode (Single Run or Single No Acq).
7. Click the Start button to start taking the measurement. When the measurement is complete, the summary of the results is displayed.
8. If the results are not automatically displayed, select Results> Summary to view the results. To view detailed results, select Results> Details.

Perform Receiver Rise Time and Fall Time Test

Follow these steps to measure the Rise and Fall Time for a receiver.

1. Set up the DUT (Host or Drive) as shown in the How To Set up the DUT section.
2. Select Measurements> Select from the menu bar.
3. Select Test Point as IR, CR, or XR, and Probe Type as Single-ended or Differential.
4. Click Rise and Fall Time.
5. To change the configuration settings, select Measurements> Configure from the menu bar or click the Configure button.

   In the Source tab, click Live, Ref, or File. If you are using a single-ended probe (SMA cable), select the channels for D+ and D–, and the Trigger channel. The trigger channels available exclude those channels that you have selected as D+ D–. Select the Test Method.

Table 67: Source tab

Select	Parameter	Options	To Do
Test Method		AWG, BIST FIS/User	Select the test method to use. The module uses the source pattern files located on the AWG, or uses a vendor-specific method to test the DUT
Live	Select D+ D–	Ch1 Ch3, Ch1 Ch4, Ch2 Ch3, Ch2 Ch4	Set the channel pair to acquire data from
	Trigger	Ch1, Ch2, Ch3, Ch4	Set the channel to acquire trigger data from
Ref	Select D+ D–	Ref1 Ref2, Ref1 Ref3, Ref1 Ref4, Ref2 Ref1, Ref2 Ref3, Ref2 Ref4, Ref3 Ref1, Ref3 Ref2, Ref3 Ref4, Ref4 Ref1, Ref4 Ref2, Ref4 Ref3	Set the Ref channel pair to acquire data from
File	Select File(s) D+ D–	Browse	Load the data from .csv files

For a differential probe, the source parameters are:

Table 68: Differential probe

Select	Parameter	Options	To Do
Test Method		AWG, BIST FIS/User	Select the test method to use. The module uses the source pattern files located on the AWG, or uses a vendor-specific method to test the DUT
Live/Ref	Select	Ch1, Ch2, Ch3, Ch4, Ref1, Ref2, Ref3, Ref4	Set the channel to acquire data from
	Trigger	Ch1, Ch2, Ch3, Ch4	Set the channel to acquire trigger data from
File	Select File	Browse	Load the data from a .csv file

If you choose Live/Ref and select a Ref channel to acquire data from, then the Trigger selection is not available.

In the General Config tab, set the Device Type, Usage model, and Cable Attenuation.

Table 69: General Config tab

Parameter	Options	To do
Usage Model	1.5 Gbps, 3.0 Gbps	Select the speed at which the device transmits or receives data
Device Type	Initiator, Target, Expander*	Select the type of device to test
Cable Attn	Range: 100 p-10 G	Type the cable attenuation or enter the value within the range from the numeric keypad
*** The Expander option is the only available option when XR test point is chosen.**		

6. From the Control panel, select the mode (Single Run or Single No Acq).
7. Click the Start button to start taking the measurement. When the measurement is complete, the summary of the results is displayed.
8. If the results are not automatically displayed, select Results> Summary to view the results. To view detailed results, select Results> Details.

View SAS Tests Results

Summary Results

You can view the summary results of the measurements by selecting Results> Summary. The application displays results for the measurements for the current acquisition.

The Results Summary menu shows the current data and all acquisition data for each statistical value.

The Results Summary menu displays the following information as a table. Wherever measurement limits are not available, those fields in the table are blank.

Table 70: Results Summary menu

Option	Description
Measurement	Displays the selected measurements
Statistic	Displays the type of statistic used
Value	Displays the measured value of the measurement
Lower Lim	Displays the measured lower limit of the measurement
Upper Lim	Displays the measured upper limit of the measurement
Status	Displays the status of the measurement as Pass or Fail

Other options in the Results Summary screen include:

Table 71: Results Summary screen

Option	Description
Show Plot	Displays the plot of the eye diagram
Details	Shortcut to the Results Details menu
Time Units	Displays results in Unit Intervals or seconds

Detailed Results

You can view the detailed results of the measurements by selecting Results> Details. The application displays results for the measurements for the current acquisition.

For a selected measurement, the Results Details menu displays the following information as a table. Wherever measurement limits are not available, those fields in the table are blank.

Table 72: Results Details menu

Option	Description
Result, Statistic	Displays the different statistics for the measurement—Population, Mean, Standard Deviation, Maximum, Minimum, Peak-Peak Value.
Value	Displays the measured value of the measurement
Lower Lim	Displays the measured lower limit of the measurement
Upper Lim	Displays the measured upper limit of the measurement
Status	Displays the status of the measurement as Pass or Fail

Other options in the Results Details screen include:

Table 73: Results Details screen

Option	Description
Show Plot	Displays the plot of the eye diagram
Details	Shortcut to the Results Details menu
Time Units	Displays results in Unit Intervals or seconds

Eye Results

You can view the eye results of the measurements by selecting Results> Summary or Results> Details. The application displays results for the eye measurement for the current acquisition.

You can also view this by clicking the Show Plot button in the Results Summary or Results Details screen. If you have selected the Transition and Non-transition bits option in the plot configuration tab, then the application displays the data acquired in two separate plots.

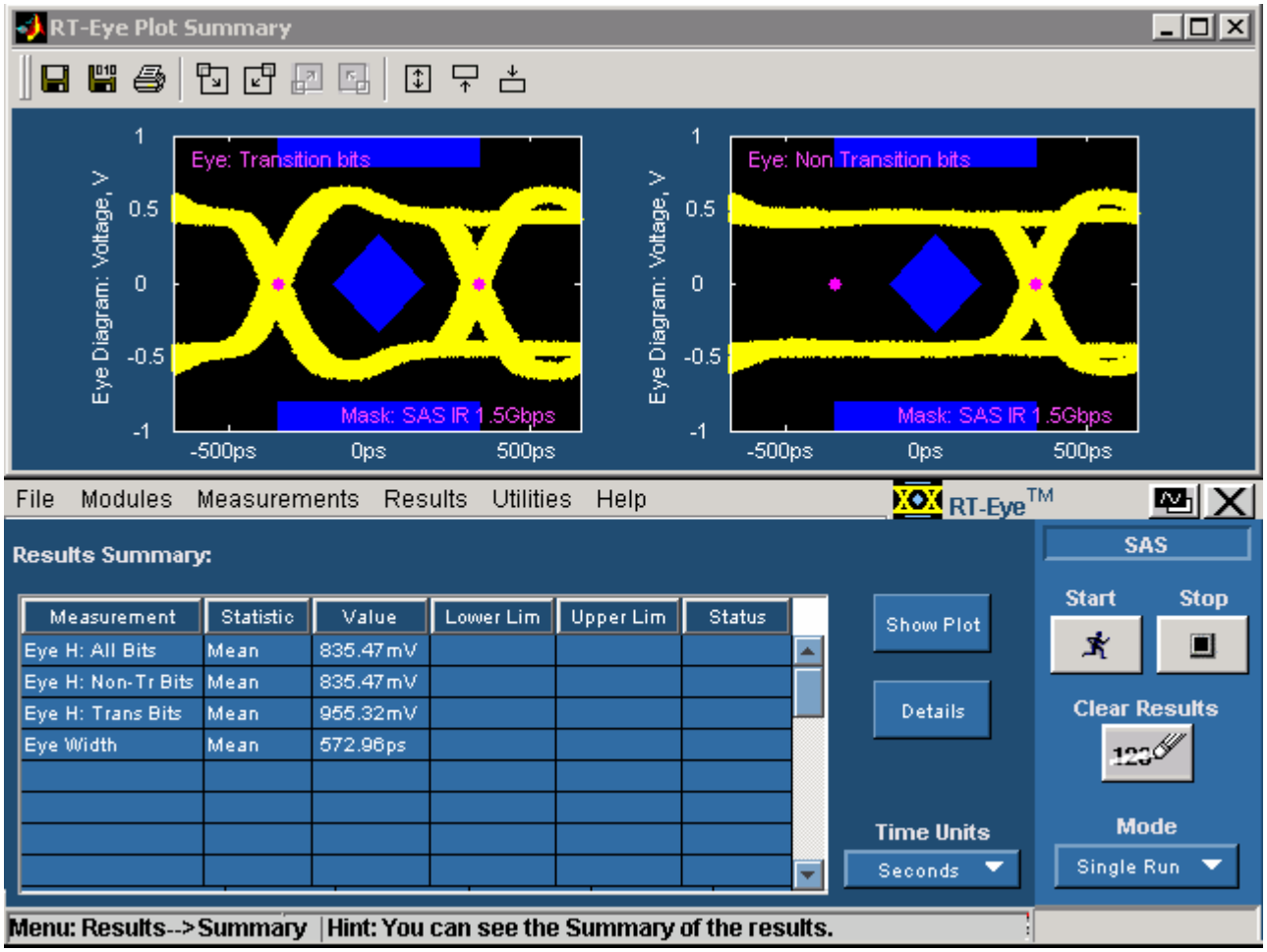


Figure 65: Eye Plot with transition and non-transition bits

If you have selected the All Bits option, then the application displays the data acquired in one plot.

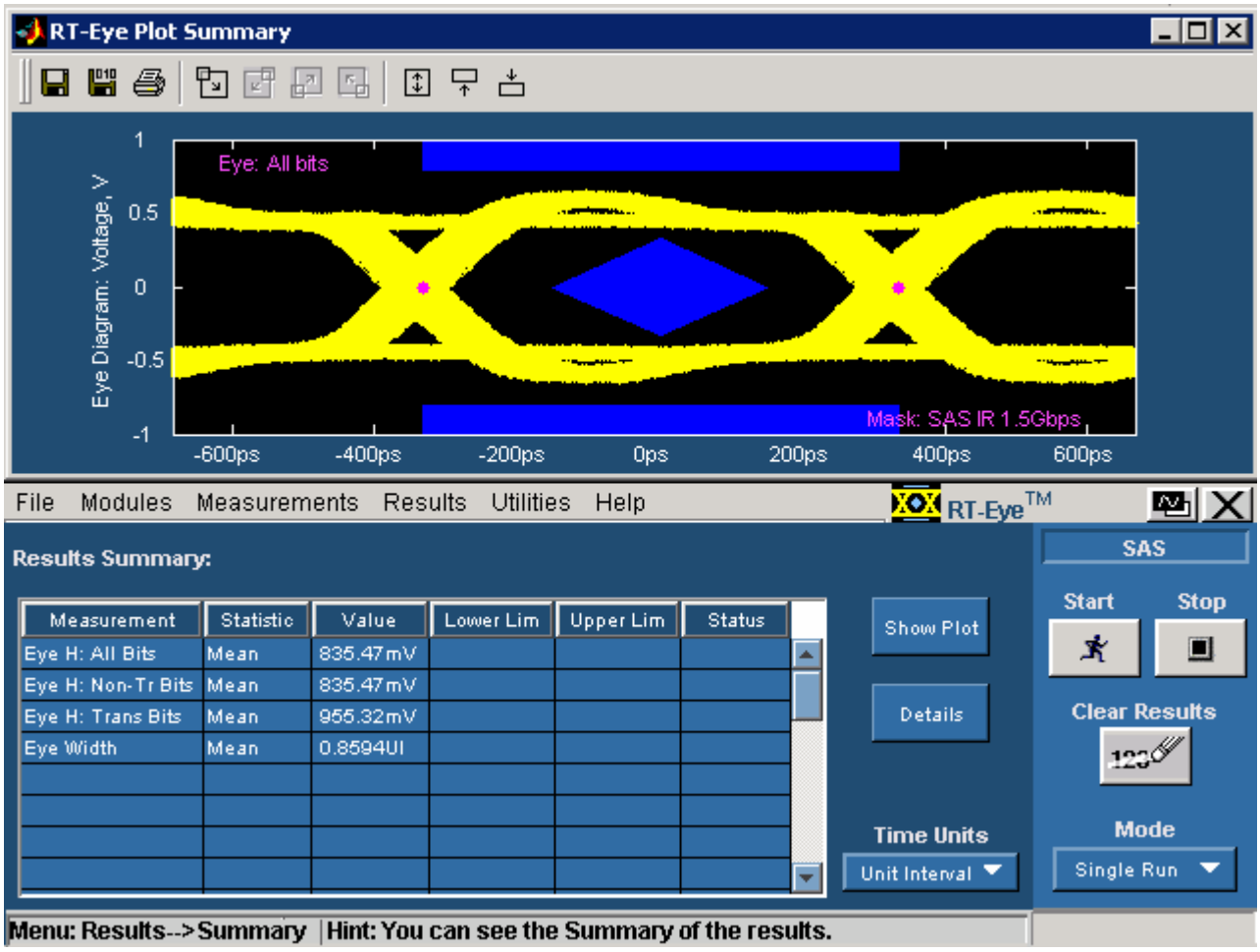


Figure 66: Eye Plot with All bits

The eye results are displayed in a table that shows the statistic, the upper and lower limits, and the status (pass/fail) of the measurement.

Results Plot

The following figure displays the Eye plot for transition bits and non-transition bits. You can view this plot if you have set the option–Transition and Non-Transition Bits–in Configure> Plot Config.

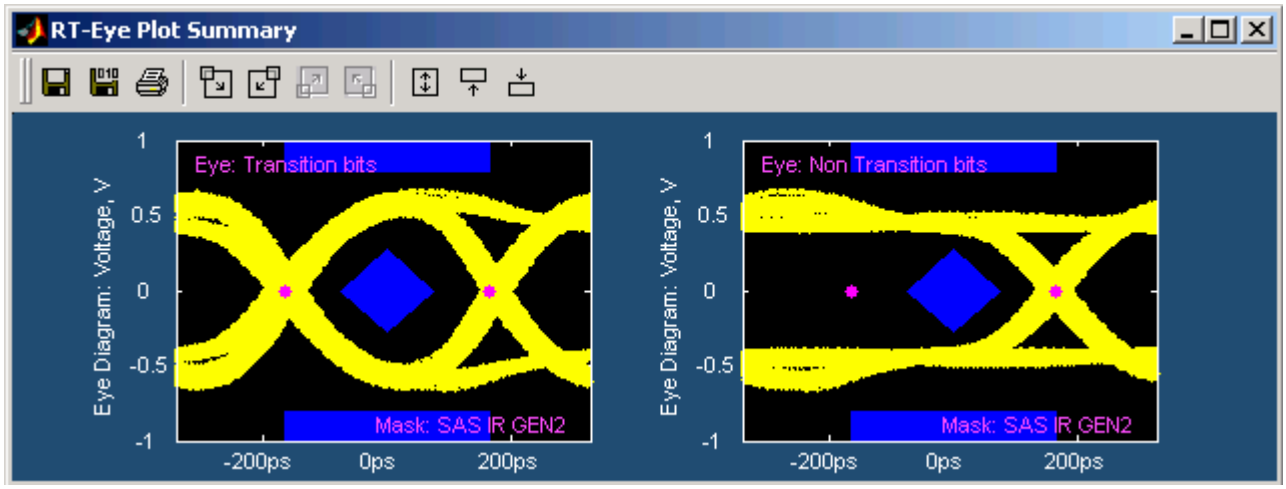


Figure 67: Eye Plot with transition and non-transition bits

The following figure displays the Eye plot for all bits. You can view this plot if you have set the All Bits option in Configure> Plot Config.

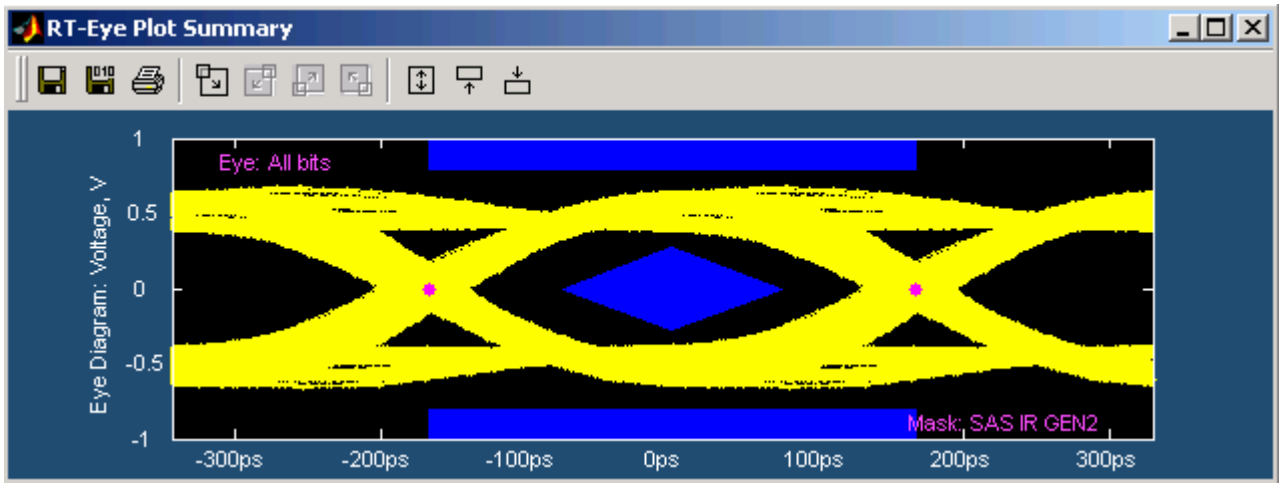


Figure 68: Eye Plot with all bits

Bit Rate Results for a SAS Device

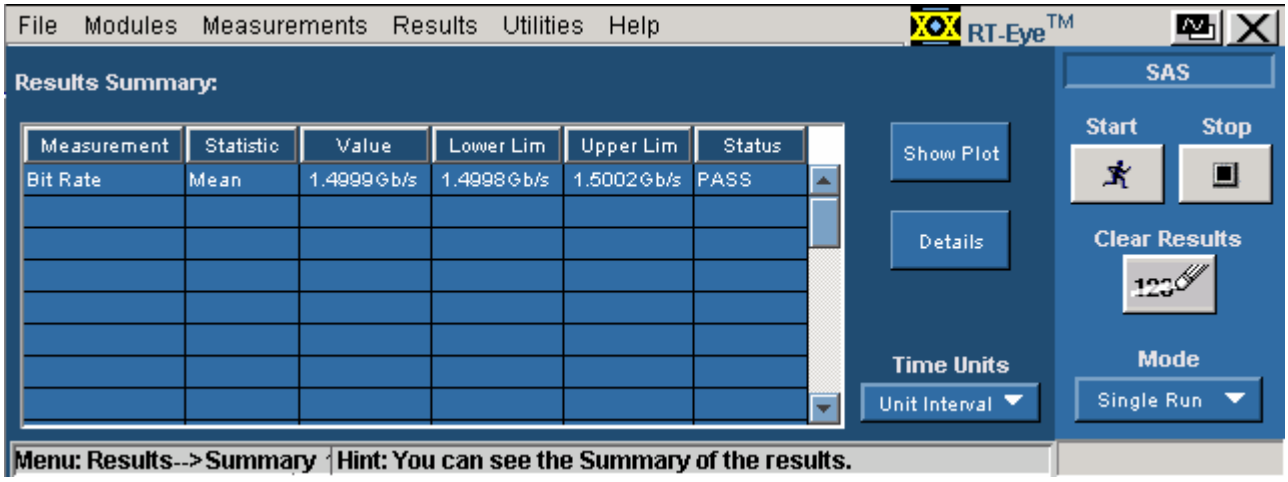


Figure 69: Bit Rate result summary

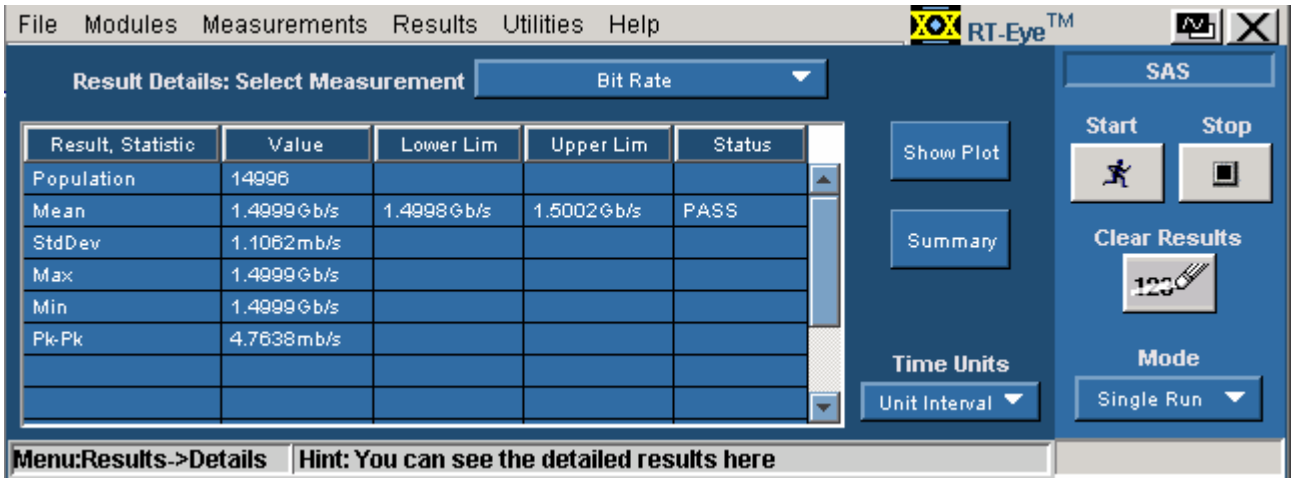


Figure 70: Bit Rate result details

Rise and Fall Time Results for a SAS Device

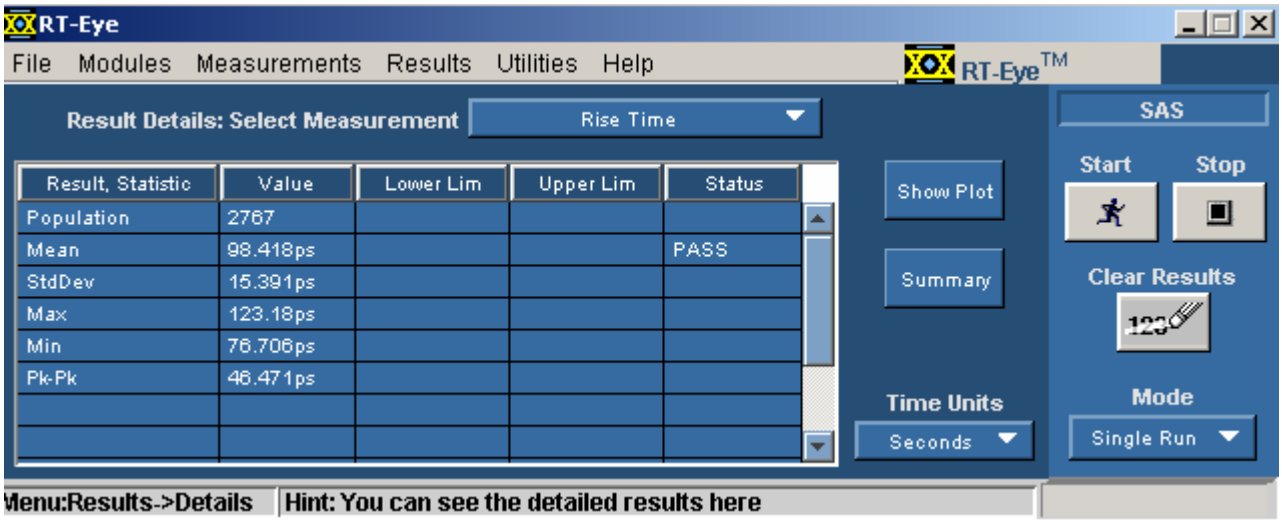


Figure 71: Rise Time result details

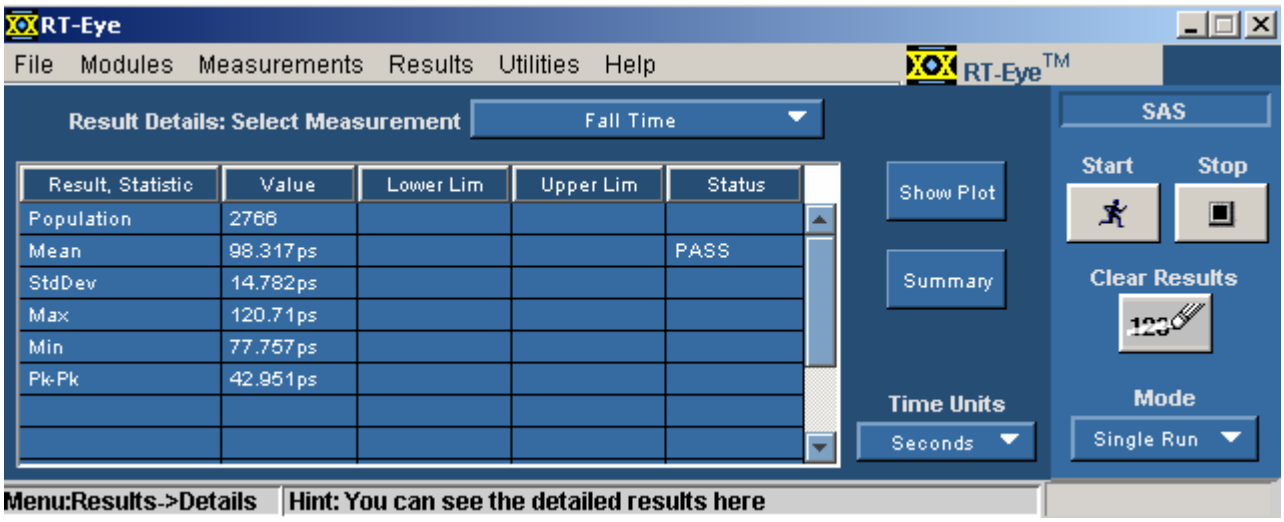


Figure 72: Fall Time result details

Differential Skew Results for a SAS Device

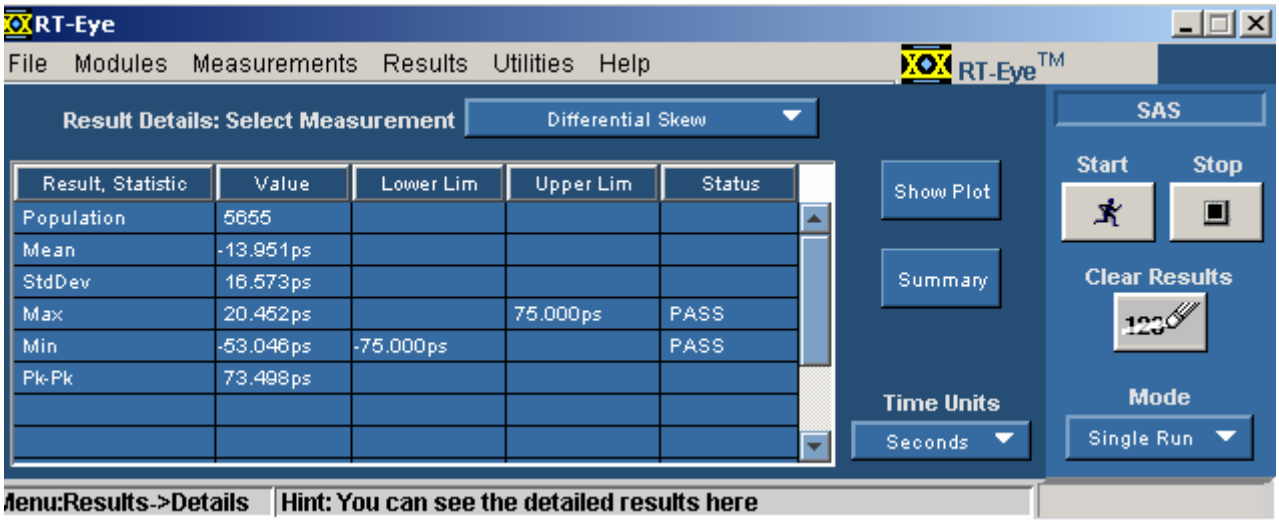


Figure 73: Differential Skew result details

COMINIT for a SAS Device

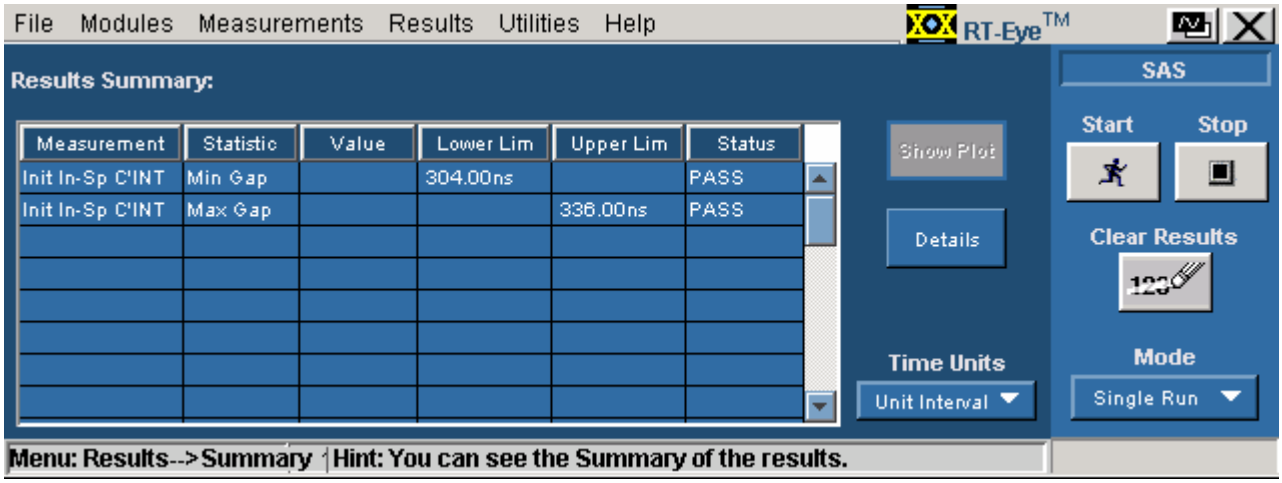


Figure 74: COMINIT result summary

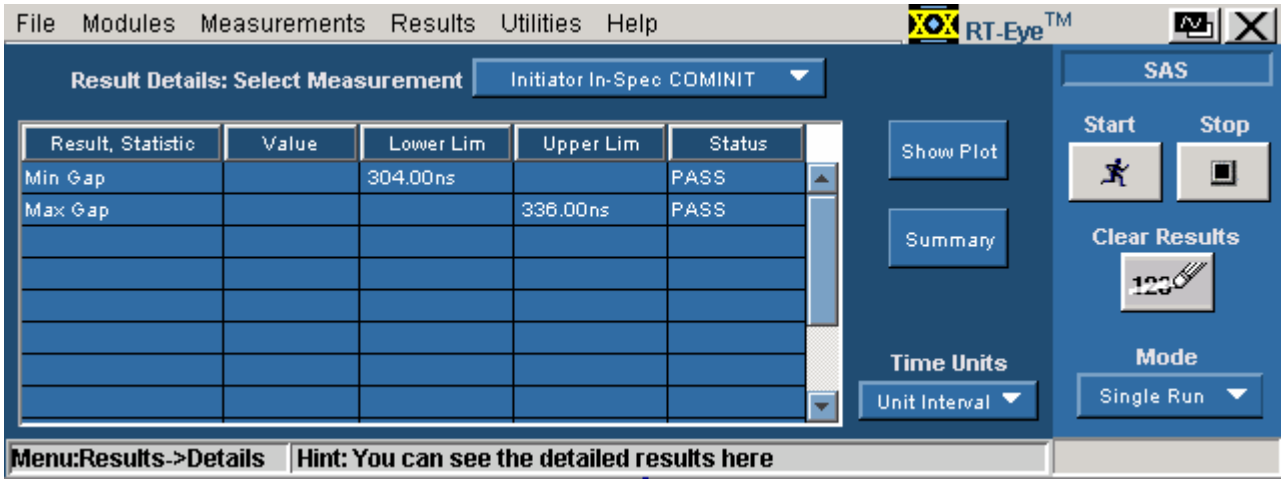


Figure 75: COMINIT result details

COMWAKE Results for a SAS Device

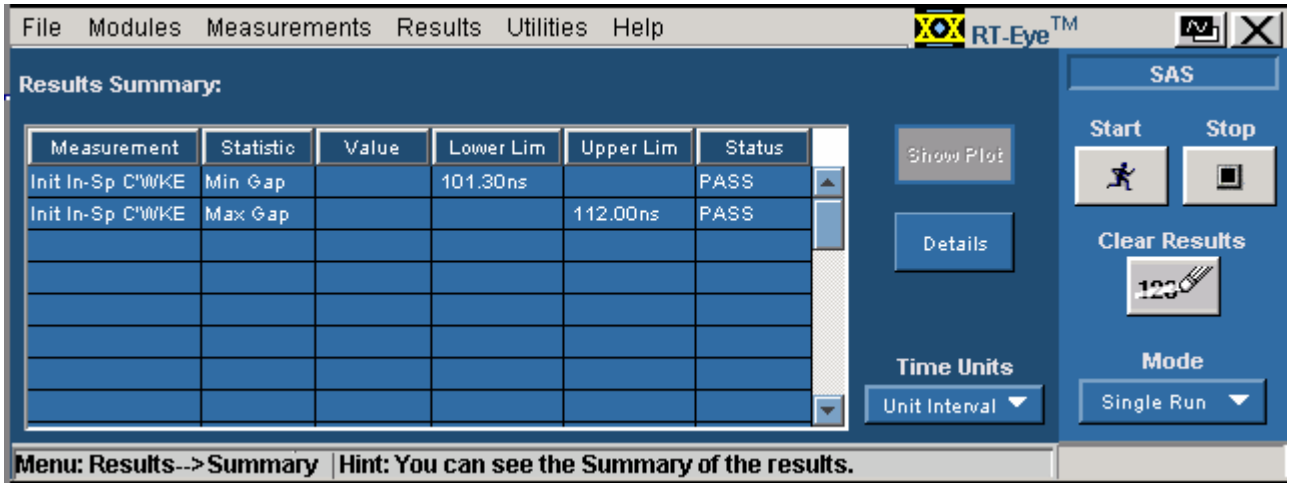


Figure 76: COMWAKE result summary

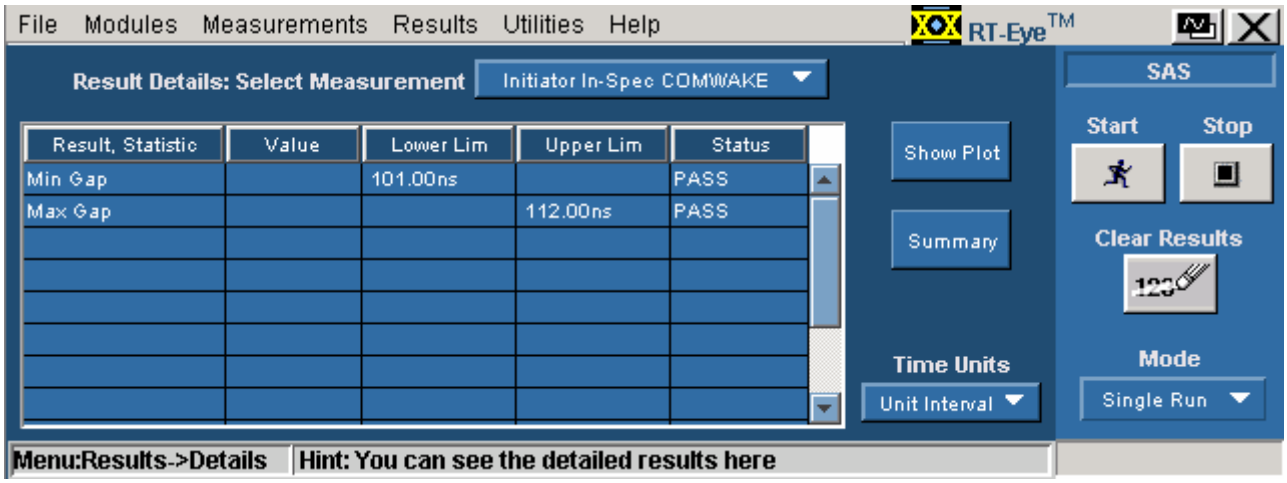


Figure 77: COMWAKE result details

COMRESET Results for a SAS Device

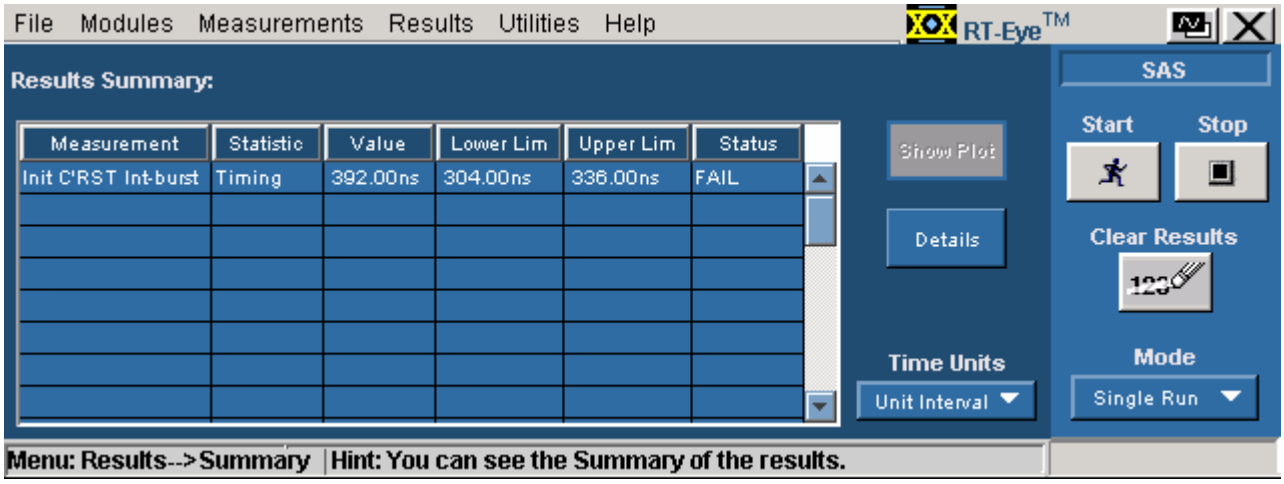


Figure 78: COMRESET result summary

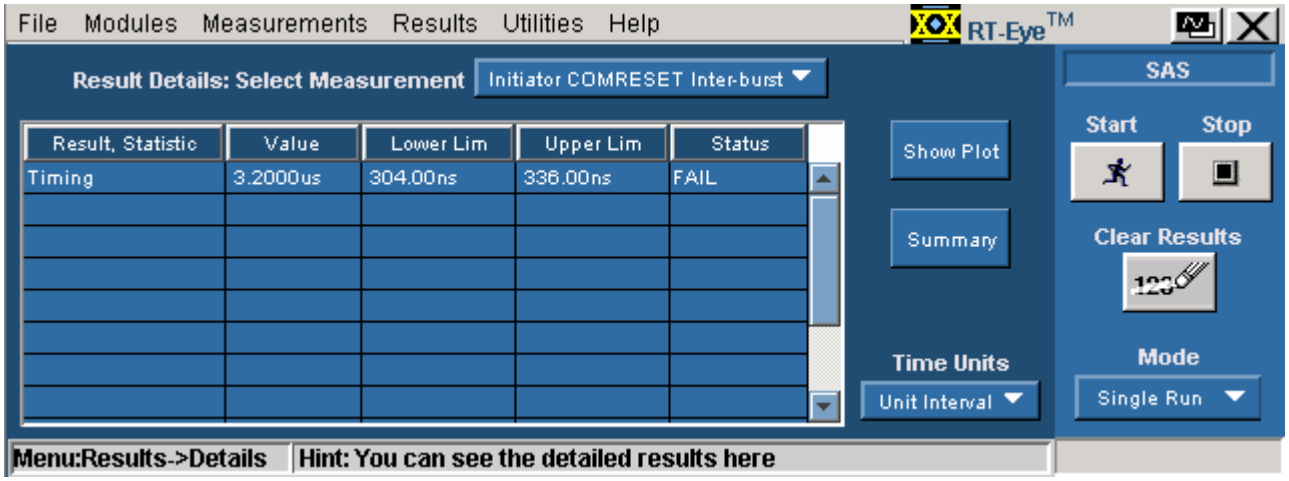


Figure 79: COMRESET result details

Generating a Report

About Generating a Report

You can use the Report Generator utility to customize and generate a compliance report to view later or to share with others. The utility is independent from the RT-Eye application, yet is accessible from the application.

Note: *The utility yields a .rpt file that can only be viewed from the Report Generator. You can select to export to an .rtf formatted file.*

Report Generator File Directories

Table 74: Report Generator File Directories

Directory	Description
Reports	Default location where the utility stores the reports
Templates	Each .rgt template defines the contents and layout of one page in the report; you can use existing page templates, edit templates, or create new templates
Layouts	Each .rpl layout file defines all the pages (template files) to include in the report; you can use an existing report layout, edit layouts, or create new layouts

Starting the Report Generator and Accessing the Online Help

The online help for the Report Generator utility contains all the information you need to design and produce compliance report files. To start the report generator utility from the module and access the online help, follow these steps:

1. Select Utilities> Reports.
2. Select the Define Test Template or the Define Report Layout tab.
3. Select the 

command button.

4. From the menu bar in the Report Generator window, select Help> Help Topics. The help system for the Report Generator utility starts and opens.

You can refer to the online help topics for the Report Generator utility for information on how to do the following tasks:

- Use an existing test template or report layout
- Edit an existing test template or report layout
- Create a new test template or report layout
- Add Fields: Native, Oscilloscope, module-specific fields

Setting Up a Test Template and Layout for a Report

The Report Generator utility allows you to design the contents and layout of a report that reflects your unique needs. In addition to a predefined template for each page, there is also a predefined report that includes all the predefined pages.

Generating and Printing a Report

To generate and print a report, follow these steps:

1. Select Utilities> Reports.

2. Select the 

tab.

   Do not touch the screen. Wait while the Report Generator creates the report. The oscilloscope fills the display while the application takes a screen print. When complete, the oscilloscope shrinks to half size and automatically redisplays the module that you are running.

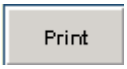
   The report displays when it is complete. You may need to use the Alt+Tab key combination to bring the Report Generator window to the front.

3. You need to save the report to retain the file. To save the report, select File> Save from the menu bar of the Report Viewer. The report file is in a .rpt format and can only be viewed with the Report Viewer.

   Later, you can use the Browse and View buttons in the Generate Report menu to open your saved report file.

4. To use a different file, edit a file, or create a new report layout (or test template) file, refer to the Report Generator online help.

5. To print the report, first verify that a printer is configured from the oscilloscope task bar.

6. From the Report Generator menu, select the 

button.

   You can also navigate to the saved file in the Report Generator window and send the file to a printer without having to open the file in the Report Viewer.

   To share a report with others, you may want to generate a smaller file. To do so, refer to the Creating a PDF File of the Compliance Report topic.

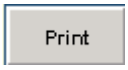
7. To export the report as an .rtf file, select File> Export to RTF from the menu bar of the Report Generator window. You can transfer the .rtf file to a personal computer, and view or print the file from a word processing program.

Creating a PDF File of the Compliance Report

You can send a report file to a "virtual" printer to create a smaller and more portable PDF file of your compliance report. To create a PDF file, follow these steps:

1. Verify that a distiller program (for example, Adobe Acrobat Distiller 6.0) is configured from the oscilloscope task bar.

2. From the Report Generator menu in the selected module, select the

   button.

3. Select the Distiller from the Printer Name selection menu.

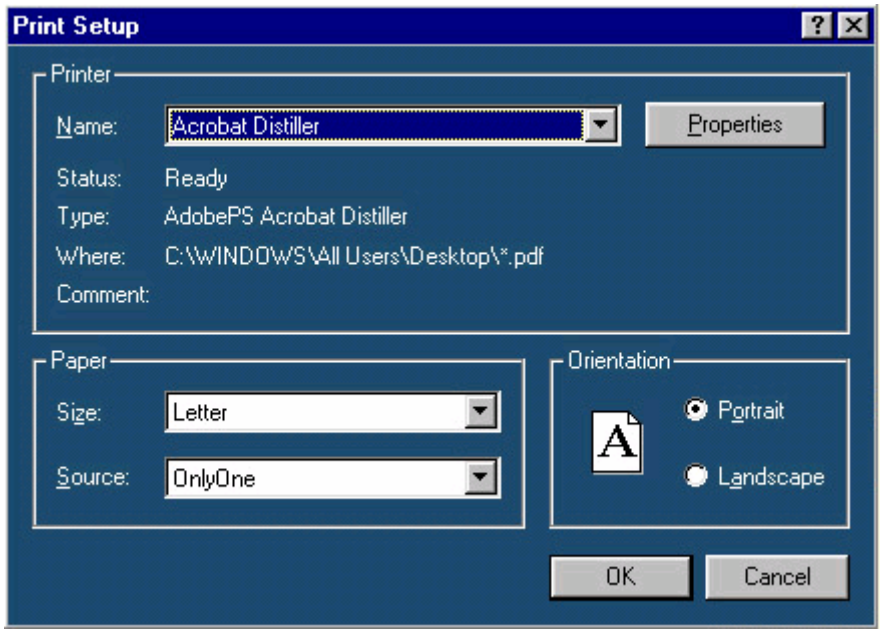


Figure 80: Creating a PDF file

4. Send the report to the distiller (select OK).
5. When the PDF file is complete, you can use other features of the distiller to enhance the report, such as add watermarks if available.

Test Template Menu

Note: *Refer to the online help topics for the Report Generator utility for information on how to create a new test template or on how to edit an existing test template.*

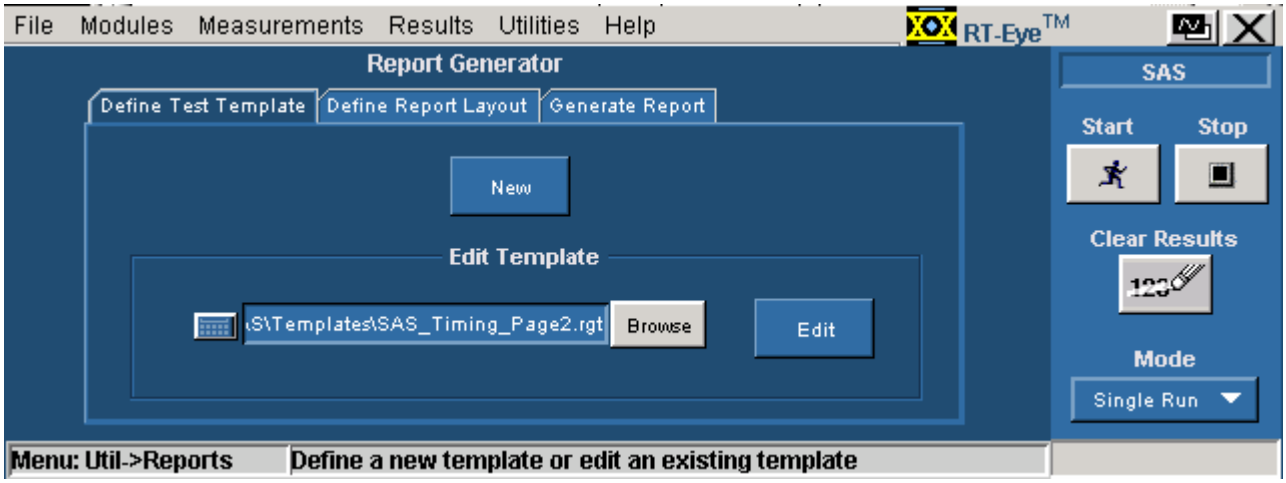


Figure 81: Defining a test template

Report Layout Menu

Note: *Refer to the online help topics for the Report Generator utility for information on how to create a new report layout or how to edit an existing report layout.*

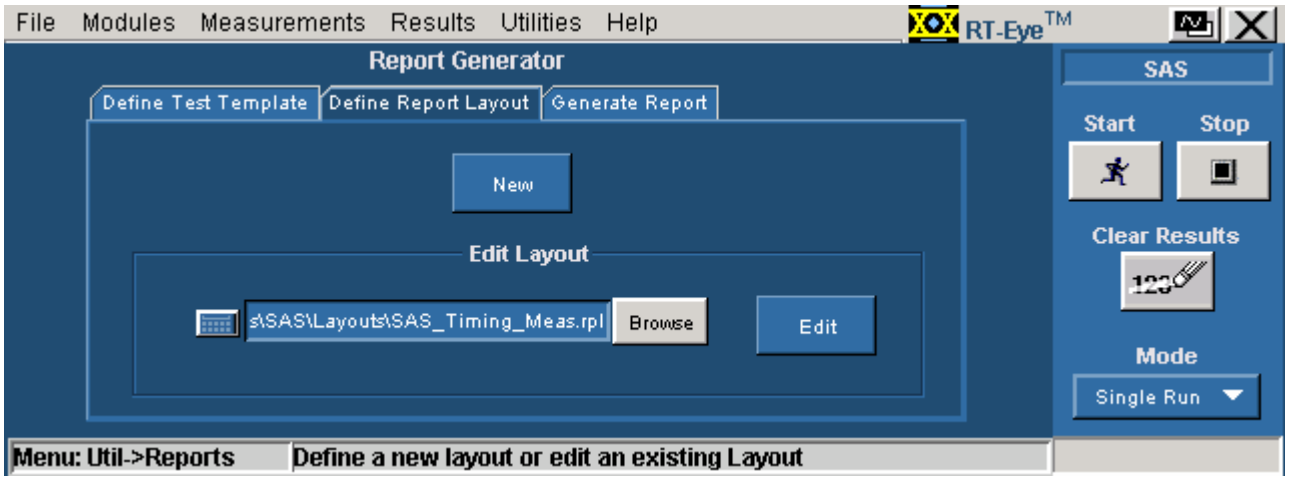


Figure 82: Defining a report layout

Report Generator Menu Options

Table 75: Report Generator menu options

Option	Description
Browse	Select the directory in which to save the report file and enter a file name; select a file for a template or layout and edit as needed
Generate	Create a report
View	View a report
Print	Print a report

Report Generate Menu

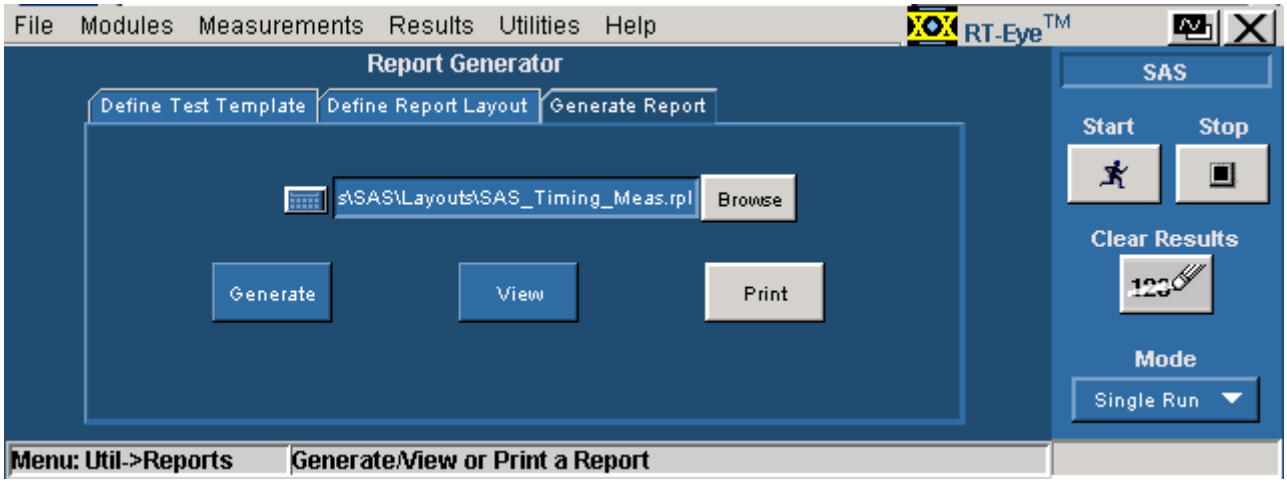


Figure 83: Generating a report

Report Generator Fields

You can use the fields in the report generator utility to customize the contents and layout of a report. The utility has the following groups of fields:

- Oscilloscope
- Application
- Native

Application Fields General Information List

This is an example of the fields available for the general oscilloscope information in the report.

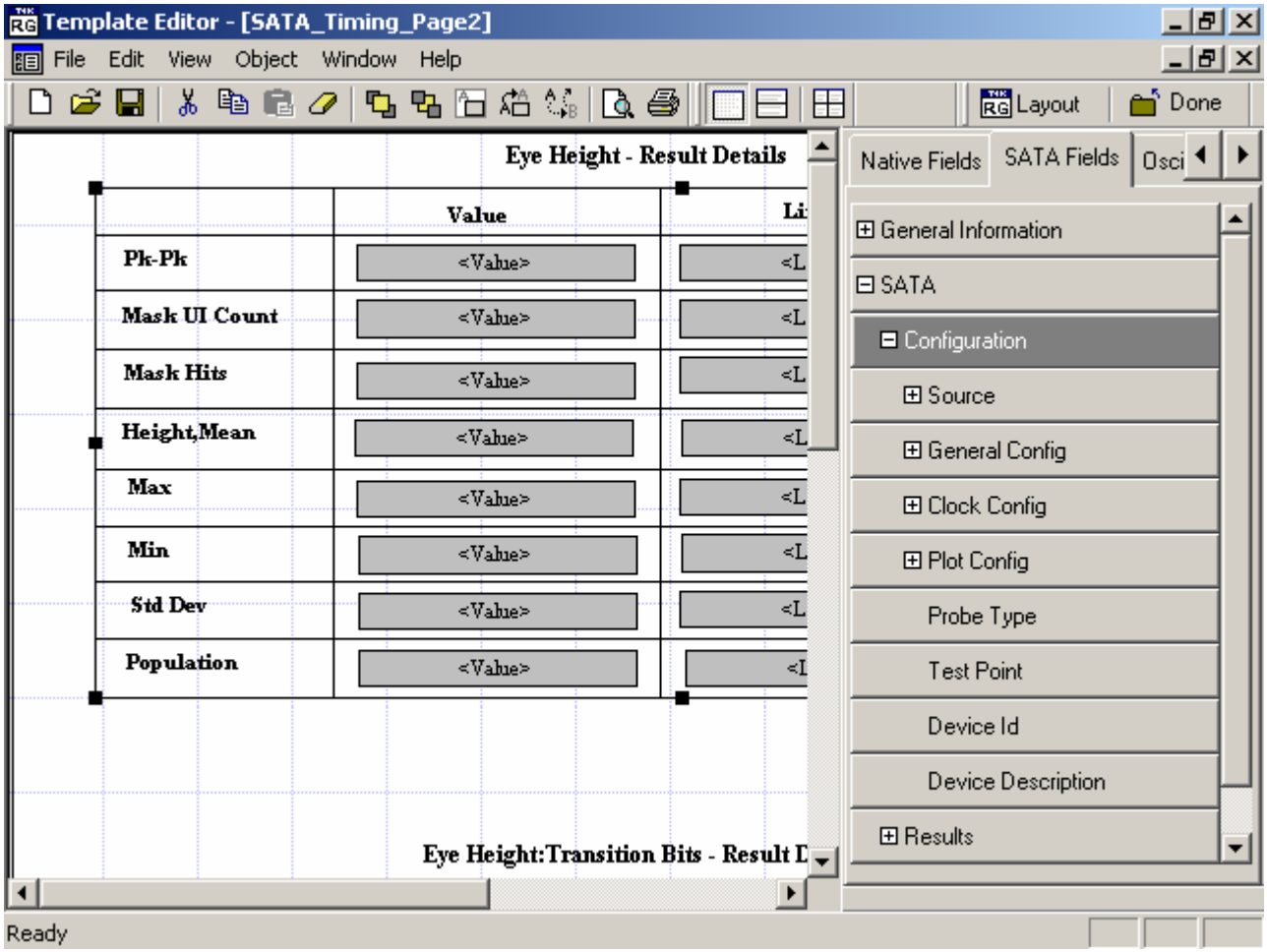


Figure 84: Example of application fields in a report

Application Fields Configuration List and an Example

This is an example of the fields available for the configuration information. This example also shows the expanded list of fields available for Source in the report.

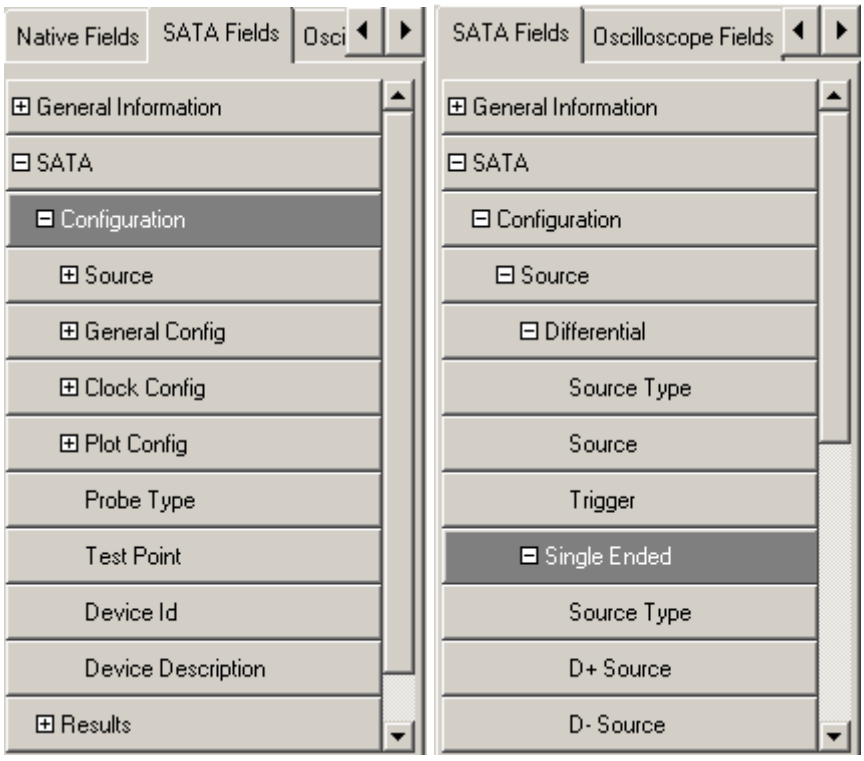


Figure 85: Example of configuration fields

Application Fields Results List and Specific Measurements Example

This is an example of the fields available for the measurement results information. This example also shows the expanded list of fields available for the Eye measurement in the report.

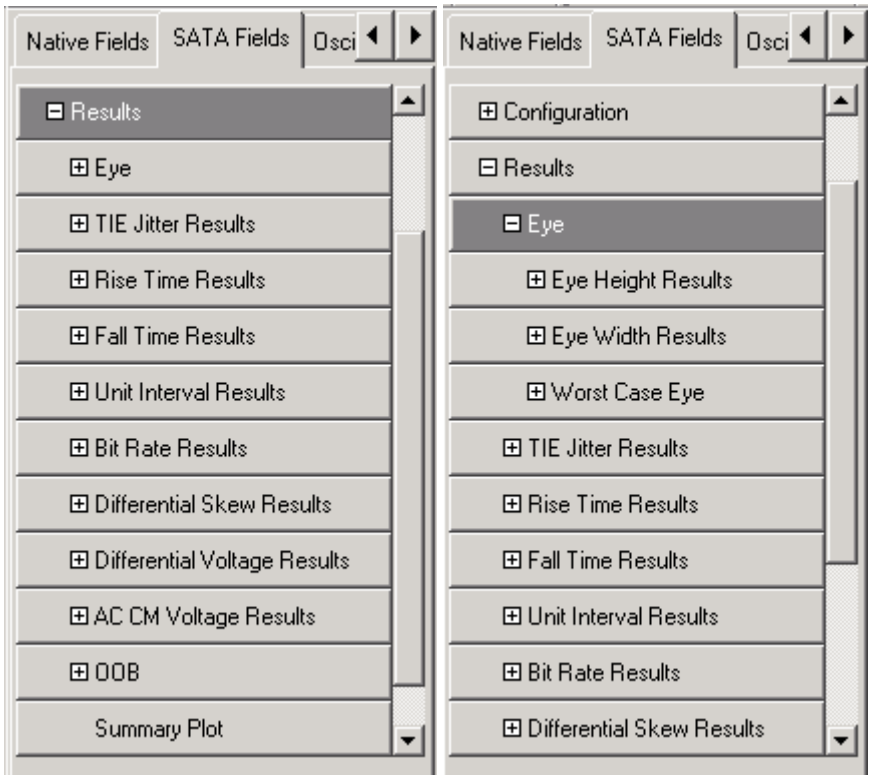


Figure 86: Example of fields for Eye results

Oscilloscope Fields and Native Fields Lists

This is an example of the fields available for the oscilloscope controls and other miscellaneous accoutrements in the report, such as lines.

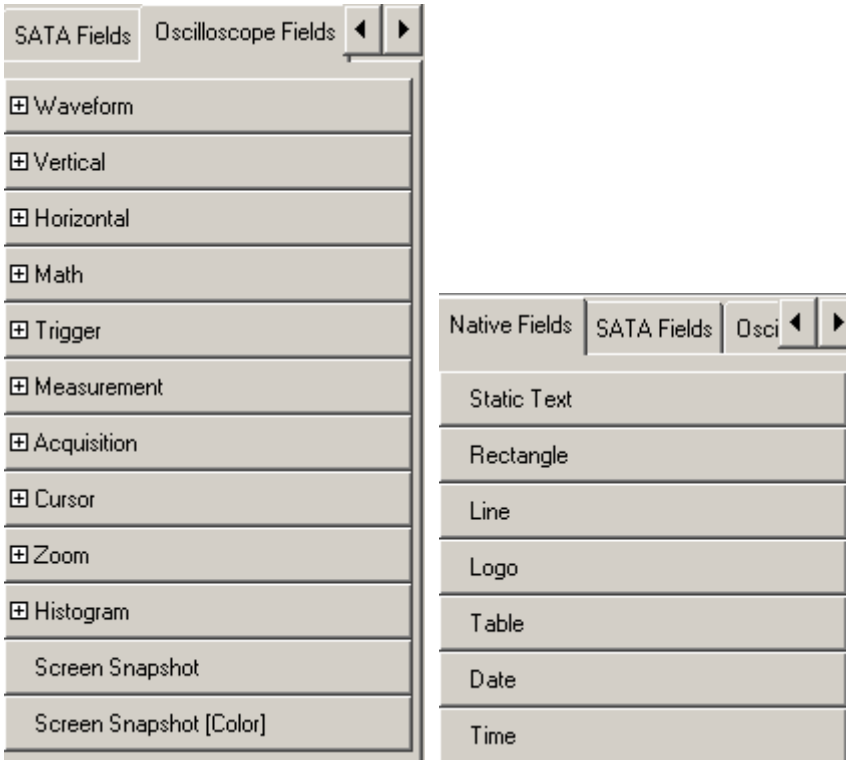


Figure 87: Example of oscilloscope and native fields

References

Shortcut Keys

Table 76: Shortcut keys

Menu item	Shortcut keys
File	Alt F
File> Recall Default	Alt F + D
File> Recall	Alt F + R
File> Save	Alt F + S
File> Recall Recent	Alt F + C
File> Preferences	Alt F + P
File> Minimize	Alt F + N
File> Exit	Alt F + X
Modules	Alt D
Modules> InfiniBand	Alt D + B
Modules> PCI Express	Alt D + P
Modules> SAS	Alt D + A
Modules> Serial ATA	Alt D + T
Modules> Serial Analysis	Alt D + S
Measurements	Alt M
Measurements> Select	Alt M + C
Measurements> Configure	Alt M + C
Measurements> Configure> Source	Alt M + C + S
Measurements> Configure> General Config	Alt M + C + G
Measurements> Configure> Clock Config	Alt M + C + C
Measurements> Configure> Plot Config	Alt M + C + P
Measurements> Limits	Alt M + L
Results	Alt R
Results> Summary	Alt R + S
Results> Details	Alt R + D
Results> Worst Case Eye	Alt R + E
Utilities	Alt U
Utilities> Reports	Alt U + R
Help	Alt H
Help> Help Topics	Alt H + T
Help> PDF Help	Alt H + P
Help> About RT-Eye	Alt H + A

Error Messages

In addition to the error messages available in the RT-Eye Serial Data Compliance and Analysis software, the following error messages are available for the Option SST analysis modules.

Table 77: Error messages

Error Codes	Error Message	Possible Solution
AWG Setup		
SAS-E101	Problem in AWG connection or AWG setup files are not present	Check the connection to the AWG or ensure that the setup files are present on the AWG
SATA-E101	Problem in AWG connection or AWG setup files are not present	Check the connection to the AWG or ensure that the setup files are present on the AWG
SATA-E102	GEN2 testing for this measurement can not be conducted with AWG610	Use AWG710 to conduct this measurement
Differential Voltage		
SATA-E400	Measurement failed to complete successfully	Acquire the signal again and rerun the measurement
SATA-E425	Pattern mismatch error	Load the correct pattern and perform the test again
SATA-E426	Memory allocation failure	Restart the system
SATA-E427	Min. Voltage sample criteria failed	Increase the number of unit intervals and try again
SATA-E428	Max. Voltage sample criteria failed	Increase the number of unit intervals and try again
SAS Eye		
SAS-E471	Time constant to chop the data Edges is not correct. Adjust with in the range	Increase the duration of the acquired waveform. The acquired duration should be ≥ 5 times the configured transient time
Miscellaneous		
E302	Waveform math operation failed	Verify that the waveform is correct
SATA-E201	Waveform(s) not proper, make sure probes and fixtures are properly connected.	Check the probe and fixture connection and try acquiring the signal again
SAS-E201	Waveform(s) not proper, make sure probes and fixtures are properly connected.	Check the probe and fixture connection and try acquiring the signal again

Default Settings

Default Settings for SATA Measurements (Part 1)

Table 78: Default settings

Menu/Parameter	Selection	Default
File> Preferences	• Do not override the setup in BIST FIS/User method • Prompt for correct waveform confirmation during run • Refine filter initial condition for SATA AC CM • Overcome the filter transient response by discarding the fixed time constants of data	Not selected Selected Selected Selected
Measurements	Eye, Bit Rate, Rise and Fall Time, Unit Interval, Differential Skew, Differential Voltage, AC CM Voltage, COMINIT, COMWAKE, COMRESET	Eye
Test Point	Transmitter, Receiver	Transmitter
Probe Type	Single Ended, Differential	Single Ended
Device Details	None	SATA_0001
Eye> Configure> Source tab		
Test Method	AWG, BIST FIS/User	AWG
Source Type	Live, Ref, File	Live
Select D+D–	Ch1Ch3, Ch1Ch4, Ch2Ch3, Ch2Ch4	Ch1Ch3
Trigger	Ch1 to Ch4	Ch2
Eye> Configure> General Config tab		
Usage Model	Gen1i, Gen1x, Gen1m, Gen2i, Gen2x, Gen2m	Gen1i
Device Type	Host, Drive	Host
Cable Attn	100 p-10 G	1
Eye> Configure> Clock Config tab		
Clock Recovery: Window Size	1000-5000 UI	2k
Clock Recovery: Scan Incr	1-250 UI	100
Clock Recovery: Method	Const Clk: Mean, Const Clk: Median	Const Clk: Mean
Analysis Window	250 UI, 5 UI	250 UI
Eye> Configure> Plot Config tab		
Plot Type Selection	Transition and Non-transition Bits, All Bits	All Bits

Default Settings for SATA Measurements (Part 2)

Table 79: Default settings

Menu/Parameter	Selection	Default
Rise and Fall Time> Configure> Source tab		
Test Method	AWG, BIST FIS/User	AWG
Source Type	Live, Ref, File	Live
Select D+D–	Ch1Ch3, Ch1Ch4, Ch2Ch3, Ch2Ch4	Ch1Ch3
Trigger	Ch1 to Ch4	Ch2
Rise and Fall Time> Configure> General Config tab		
Usage Model	Gen1i, Gen1x, Gen1m, Gen2i, Gen2x, Gen2m	Gen1i
Device Type	Host, Drive	Host
Num of UI	6k, 12k, 30k, 60k, 120k	6k
Cable Attn	100 p-10 G	1
Bit Rate > Configure> Source tab		
Test Method	AWG, BIST FIS/User	AWG
Source Type	Live, Ref, File	Live
Select D+D–	Ch1Ch3, Ch1Ch4, Ch2Ch3, Ch2Ch4	Ch1Ch3
Trigger	Ch1 to Ch4	Ch2
Bit Rate> Configure> General Config tab		
Usage Model	Gen1i, Gen1x, Gen1m, Gen2i, Gen2x, Gen2m	Gen1i
Device Type	Host, Drive	Host
Num of UI	6k, 12k, 30k, 60k, 120k	6k
Cable Attn	100 p-10 G	1
Bit Rate> Configure> Clock Config tab		
Clock Recovery: Window Size	1000-5000 UI	2k
Clock Recovery: Scan Incr	1-250 UI	100
Clock Recovery: Method	Const Clk: Mean, Const Clk: Median	Const Clk: Mean
Analysis Window	250 UI, 5 UI	250 UI

Table 80: Default settings

Menu/Parameter	Selection	Default
Unit Interval> Configure> Source tab		
Test Method	AWG, BIST FIS/User	AWG
Source Type	Live, Ref, File	Live
Select D+D–	Ch1Ch3, Ch1Ch4, Ch2Ch3, Ch2Ch4	Ch1Ch3
Trigger	Ch1 to Ch4	Ch2
Unit Interval> Configure> General Config tab		
Usage Model	Gen1i, Gen1x, Gen1m, Gen2i, Gen2x, Gen2m	Gen1i
Device Type	Host, Drive	Host
Num of UI	6k, 12k, 30k, 60k, 120k	6k
Cable Attn	100 p-10 G	1
Unit Interval> Configure> Clock Config tab		
Clock Recovery: Window Size	1000-5000 UI	2k
Clock Recovery: Scan Incr	1-250 UI	100
Clock Recovery: Method	Const Clk: Mean, Const Clk: Median	Const Clk: Mean
Analysis Window	250 UI, 5 UI	250 UI
Differential Skew> Configure> Source tab*		
Test Method	AWG, BIST FIS/User	AWG
Source Type	Live, Ref, File	Live
Select D+D–	Ch1Ch3, Ch1Ch4, Ch2Ch3, Ch2Ch4	Ch1Ch3
Trigger	Ch1 to Ch4	Ch2
Differential Skew> Configure> General Config tab		
Usage Model	Gen1i, Gen1x, Gen1m, Gen2i, Gen2x, Gen2m	Gen1i
Device Type	Host, Drive	Host
Num of UI	6k, 12k, 30k, 60k, 120k	6k
Cable Attn	100 p-10 G	1

Default Settings for SATA Measurements (Part 3)

Table 81: Default settings

Menu/Parameter	Selection	Default
Differential Voltage > Configure> Source tab		
Test Method	BIST FIS/User	BIST FIS/User
Source Type	Live, Ref, File	Live
Select D+D–	Ch1Ch3, Ch1Ch4, Ch2Ch3, Ch2Ch4	Ch1Ch3
Differential Voltage> Configure> General Config tab		
Usage Model	Gen1i, Gen1x, Gen1m, Gen2i, Gen2x, Gen2m	Gen1i
Device Type	Host, Drive	Host
Num of UI	6k, 12k, 30k, 60k, 120k	6k
Cable Attn	100 p-10 G	1
Diff Volt Option	Option1, Option2	Option1
AC CM Voltage> Configure> Source tab*		
Test Method	BIST FIS/User, AWG	AWG
Source Type	Live, Ref, File	Live
Select D+D–	Ch1Ch3, Ch1Ch4, Ch2Ch3, Ch2Ch4	Ch1Ch3
Trigger	Ch1 to Ch4	Ch2
AC CM Voltage> Configure> General Config tab		
Usage Model	Gen1i, Gen1x, Gen1m, Gen2i, Gen2x, Gen2m	Gen1i
Device Type	Host, Drive	Host
Num of UI	6k, 12k, 30k, 60k, 120k	6k
Cable Attn	100 p-10 G	1
*** These measurements are available only for single-ended probes**		

Default Settings for SATA Measurements (Part 4)

Table 82: Default settings

Menu/Parameter	Selection	Default
OOB Measurements		
Test Point	Transmitter	Transmitter
COMINIT> Configure> Source tab		
Test Method	AWG	AWG
Source Type	Live	Live
Select D+D–	Ch1Ch3, Ch1Ch4, Ch2Ch3, Ch2Ch4	Ch1Ch3
Trigger	Ch1 to Ch4	Ch2
COMINIT> Configure> General Config tab		
Usage Model	Gen1i, Gen1x, Gen1m, Gen2i, Gen2x, Gen2m	Gen1i
Device Type	Host, Drive	Host
COMINIT Type	In Spec, Out of Spec	In Spec
Cable Attn	100 p-10 G	1
COMWAKE> Configure> Source tab		
Test Method	AWG	AWG
Source Type	Live	Live
Select D+D–	Ch1Ch3, Ch1Ch4, Ch2Ch3, Ch2Ch4	Ch1Ch3
Trigger	Ch1 to Ch4	Ch2
COMWAKE> Configure> General Config tab		
Usage Model	Gen1i, Gen1x, Gen1m, Gen2i, Gen2x, Gen2m	Gen1i
Device Type	Host, Drive	Host
COMWAKE Type	In Spec, Out of Spec	In Spec
Cable Attn	100 p-10 G	1
COMRESET> Configure> Source tab		
Test Method	AWG	AWG
Source Type	Live	Live
Select D+D–	Ch1Ch3, Ch1Ch4, Ch2Ch3, Ch2Ch4	Ch1Ch3
Trigger	Ch1 to Ch4	Ch2
COMRESET> Configure> General Config tab		
Usage Model	Gen1i, Gen1x, Gen1m, Gen2i, Gen2x, Gen2m	Gen1i
Device Type	Host, Drive	Host
COMWAKE Type	InterBurst	InterBurst
Cable Attn	100 p-10 G	1
Results	Summary, Details, Worst Case Eye	Summary

Default Settings for SAS Measurements (Part 1)

Table 83: Default settings

Menu/Parameter	Selection	Default
File> Preferences	• Do not override the setup in BIST FIS/User method • Prompt for correct waveform confirmation during run • Enable Transient Time input for clock recovery • Refine filter initial conditions for SAS Eye	Not selected Selected Selected Selected
Measurements	Eye, Bit Rate, Rise and Fall Time, Differential Skew, COMINIT, COMWAKE, COMRESET	Eye
Test Point	IT, CT, XT, IR, CR, XR	IR
Probe Type	Single Ended, Differential	Single Ended
Device Details	None	SAS_0001
Eye> Configure> Source tab		
Test Method	BIST FIS/User	BIST FIS/User
Source Type	Live, Ref, File	Live
Select D+D–	Ch1Ch3, Ch1Ch4, Ch2Ch3, Ch2Ch4	Ch1Ch3
Eye> Configure> General Config tab		
Usage Model	1.5 Gbps, 3.0 Gbps	1.5 Gbps
Device Type	Initiator, Target	Initiator
Clock Method	Const Clk: Mean, Const Clk: Median	Const Clk: Mean
Cable Attn	100 p-10 G	1
Transient Time	.25 - 10 time constants	
Eye> Configure> Plot Config tab		
Plot Type Selection	Transition and Non-transition Bits, All Bits	All Bits
Rise and Fall Time> Configure> Source tab		
Test Method	BIST FIS/User	BIST FIS/User
Source Type	Live, Ref, File	Live
Select D+D–	Ch1Ch3, Ch1Ch4, Ch2Ch3, Ch2Ch4	Ch1Ch3
Rise and Fall Time> Configure> General Config tab		
Usage Model	1.5 Gbps, 3.0 Gbps	1.5 Gbps
Device Type	Initiator, Target	Initiator
Cable Attn	100 p-10 G	1

Default Settings for SAS Measurements (Part 2)

Table 84: Default settings

Menu/Parameter	Selection	Default
Bit Rate> Configure> Source tab		
Test Method	BIST FIS/User	BIST FIS/User
Source Type	Live, Ref, File	Live
Select D+D–	Ch1Ch3, Ch1Ch4, Ch2Ch3, Ch2Ch4	Ch1Ch3
Bit Rate> Configure> General Config tab		
Usage Model	1.5 Gbps, 3.0 Gbps	1.5 Gbps
Device Type	Initiator, Target	Initiator
Cable Attn	100 p-10 G	1
Differential Skew> Configure> Source tab*		
Test Method	BIST FIS/User	BIST FIS/User
Source Type	Live, Ref, File	Live
Select D+D–	Ch1Ch3, Ch1Ch4, Ch2Ch3, Ch2Ch4	Ch1Ch3
Differential Skew> Configure> General Config tab		
Usage Model	1.5 Gbps, 3.0 Gbps	1.5 Gbps
Device Type	Initiator, Target	Initiator
Cable Attn	100 p-10 G	1
*** This measurement is available only for single-ended probes**		

Table 85: Default settings

Menu/Parameter	Selection	Default
COMINIT> Configure> Source tab		
Test Method	AWG	AWG
Source Type	Live	Live
Select D+D–	Ch1Ch3, Ch1Ch4, Ch2Ch3, Ch2Ch4	Ch1Ch3
Trigger	Ch1 to Ch4	Ch2
COMINIT> Configure> General Config tab		
Usage Model	1.5 Gbps, 3.0 Gbps	1.5 Gbps
Device Type	Initiator, Target	Initiator
COMINIT Type	In Spec, Out of Spec	In Spec
Cable Attn	100 p-10 G	1
COMRESET> Configure> Source tab		
Test Method	AWG	AWG
Source Type	Live	Live
Select D+D–	Ch1Ch3, Ch1Ch4, Ch2Ch3, Ch2Ch4	Ch1Ch3
COMRESET> Configure> General Config tab		
Usage Model	1.5 Gbps, 3.0 Gbps	1.5 Gbps
Device Type	Initiator, Target	Initiator
COMRESET Type	InterBurst	InterBurst
Cable Attn	100 p-10 G	1
COMWAKE> Configure> Source tab		
Test Method	AWG	AWG
Source Type	Live	Live
Select D+D–	Ch1Ch3, Ch1Ch4, Ch2Ch3, Ch2Ch4	Ch1Ch3
Trigger	Ch1 to Ch4	Ch2
COMWAKE> Configure> General Config tab		
Usage Model	1.5 Gbps, 3.0 Gbps	1.5 Gbps
Device Type	Initiator, Target	Initiator
COMWAKE Type	In Spec, Out of Spec, InterBurst	In Spec
Cable Attn	100 p-10 G	1
Results	Summary, Details	Summary

GPIB Commands

GPIB Information

For information on how to operate the oscilloscope using the application-specific GPIB commands, refer to the following documents:

- The user manual for your oscilloscope provides general information on how to operate the oscilloscope
- The online help for your oscilloscope can provide details on how to use GPIB commands to control the oscilloscope if you install the GPIB Programmer guide (and code examples) from the oscilloscope CD-ROM.

Remote GPIB Support

The remote GPIB support for the Serial ATA and SAS modules is limited to saving and recalling the setup, running the measurement, and querying for results.

Your GPIB program should comply with the following guidelines:

- The application startup must complete before sending additional GPIB commands to the application. Query the variable application; it will return "TDSRT-EYE" when the application startup is complete
- Recall a setup file from GPIB to select measurements and set up the application
- The measurements cycle must complete before data is queried. Query the variable SequencerState; it will return "Ready" when sequencing is complete
- The resultFor variable must be set before querying results; pause a second after setting each variable
- The error variable should be checked to ensure that an error has not occurred because of a measurement command problem; the measError variable returns errors specific to the measurement selected by resultFor

Introduction to GPIB Command Syntax

With knowledge of the GPIB command syntax, you can design a GPIB program to do the following tasks:

- Start the RT-Eye application
- Recognize an active application with GPIB protocol
- Program and read application setup parameters
- Sequence measurements
- Read measurement results
- Generate reports

GPIB Reference Materials

To use GPIB commands with your oscilloscope, you can refer to the following materials:

- The rt-eyectrl.c file on the oscilloscope hard drive (located in the c:\TekApplications\tdsrt-eye\Examples\RemoteCtrl directory) provided an example of a GPIB program that can execute the application
- The GPIB Program Example topic provides guidelines to use while designing a GPIB program
- The programmer information in the online help of your oscilloscope

Starting and Setting Up the Application Using GPIB

To start the RT-Eye application, you must send the oscilloscope the following GPIB command:

application:activate "RT-Eye Serial Compliance and Analysis"

Note: *The name of the application in the previous string is identical to the name of the application from the oscilloscope Run Application list.*

The application uses the GPIB VARIABLE:VALUE command with arguments to execute some features. The set of GPIB commands does not include the variable names and variable values necessary to select and configure the measurements in the GPIB program.

You must manually set up the application and oscilloscope, selecting and configuring the measurements that you want to use with your GPIB program, and save them in a setup file in the default setup folder for that module. Use the name of the saved setup file as the value for the "recallName" variables in your GPIB program.

`Variable:Value RT-Eye Command`

Description

This command accepts string arguments for a control or data variable and a value to which to set the argument.

Syntax

VARIABLE:VALUE "<variable name>","<variable value>"

***Note**: The arguments <variable name> and <variable value> are required in the order indicated.*

VARIABLE:VALUE? <variable name> for query.

⚠ **CAUTION.** Commands are case and space sensitive. Your program will not operate correctly if you do not follow the capitalization and spacing precisely.

Variable:Value Command Arguments and Queries (Part 1)

Table 86: Command arguments and queries

Group /Name	Value	Function	Query returns
application	{exit}	Terminates the active application	Returns TDSRT-EYE when the application is active
version	Query only		Returns the version number of the application
Sequencer			
sequencerMode	{Single No Acq, Single}	Sets the sequencer mode	Returns the sequencer mode
sequencerState	{Stop, Sequencing}	Sends the measurement sequencing command	Returns {Most recent setting, Ready}; Ready indicates that the value was processed
reset	{Results}	Clears the active measurements results and plots	Returns {Most recent setting, Ready}; Ready indicates that the value was processed
Active module			
module	{SerialAnalysis, InfiniBand, PCIExpress, SATA, SAS}	Switches to the module specified	Returns the active module
Recall setup			
setup	{Default, Recall}	Performs the Recall Default setup function	Returns {Most recent setting, Ready}; Most recent setting indicates that the value is being processed; Ready indicates that the value was processed
recallName	Any string from 1 to 40 characters: A to Z, 0 to 9, or special characters like “.”	Sets the Recall setup file name; file name extension of .ini is optional	Returns the name of the setup file to be recalled (without an extension)
recallDirectory	Query only		Returns the current setting (determined from module command) of recall directory default, such as SATA\setup

Variable:Value Command Arguments and Queries (Part 2)

Table 87: Command arguments and queries

Group /Name	Value	Function	Query returns
reportGen	{Now}	Exports content from current measurements into a report template/layout where the template/layout are default or as specified in the recalled setup file; concatenates the Template name and a Time stamp for the file name	{Most recent setting, Ready} Ready indicates report has been created and saved.
Compliance module only			
satareportDeviceID	Any string from 1 to 40 characters: A to Z, 0 to 9, or special characters like "."	Specifies the device ID field for report generation for the SATA module	Returns the specified DeviceID; applies to only the SATA module
sasreportDeviceID	Any string from 1 to 40 characters: A to Z, 0 to 9, or special characters like "."	Specifies the device ID field for report generation for the SAS module	Returns the specified DeviceID; applies to only the SAS module
Result variables			
resultFor	{Measurement Name}	Specifies the measurement that is the source for detailed results queries; refer to the tables between this one and the error codes table	Returns the selected measurements for the queries associated with the resultFor command
resultForWorstEye	{Worst Case Eye Measurement Name}	Specifies the measurement that is the source for detailed results queries; refer to the tables between SATA Measurement Names table and the SATA Measurement Names table	Returns the selected Worst Case Eye measurements for the queries associated with the resultForWorstEye command

Variable name	Query return for measurement
Statistics for all measurements selected with resultFor	
max	Returns the maximum measurement value
mean	Returns the mean measurement value
min	Returns the minimum measurement value
pkpk	Returns the peak-to-peak measurement value
population	Returns the number of measurements used to the current statistics
stdDev	Returns the standard deviation measurement set
Other non-statistical information that appears in the Results menus	
maskUIControl	Returns the number of UIs examined for mask hits
maskHits	Returns the number of UIs containing one or more mask hit
Query results for Worst Case Eye Measurement	
worstValue	Returns measurement value for the worst eye measurement set
worstStartAnalyWindow	Returns the Start analysis window position
worstStartClockRecovery	Returns the Start clock recovery window position
worstUI	Returns measurement value in terms of UI for the worst eye measurement set
Limits	
status	Pass or Fail status; Pass when the measurement passes the test or Fail with limits defined
Misc	
measUnits	Return a units string for the measurement, such as s for seconds
Messages that return strings	
resultForStatus	Returns one of the following strings: “Active” when the value of resultFor is an active measurement “Inactive” when the value of resultFor is a known measurement that is not active “Unknown” when the value of resultFor is an unknown measurement Any of the results specified in this table are not valid unless this variable is “Active”
error	Returns a general error
warning	Returns a warning from the most recent measurement
measError	Returns a measurement specific error

Measurements Results Queries

⚠ **CAUTION**: Before doing measurement queries, be sure to insert a one second delay after the resultFor command to allow the statistics variables to refresh.

You need to use the VARIABLE:VALUE? form to enter measurement results queries in your GPIB program. Before you can do this, you must first set the measurement with the resultFor command.

The next several tables list the measurement results queries for the measurement selected in the resultFor variable.

Worst Case Eye Measurement Names for the resultForWorstEye Variable

Table 88: Worst case eye measurement names

Worst Case Eye Measurement Names	Value	Start Analysis Window	Start Clock Recovery	UI
Worst Top Margin	Yes	Yes	Yes	Yes
Worst Bottom Margin	Yes	Yes	Yes	Yes
Worst Upper Rail	Yes	Yes	Yes	Yes
Worst Lower Rail	Yes	Yes	Yes	Yes
Worst Jitter	Yes	Yes	Yes	Yes

SATA Measurement Names for the resultFor Variable

Table 89: SATA measurement names

Measurement Names	Stats	And…
Eye Width	Yes	
Eye Height	Yes	maskUICount,maskHits
Eye Height Transition Bits	Yes	maskUICount,maskHits
Eye Height Non-Transition Bits	Yes	maskUICount,maskHits
TIE Jitter	Yes	
Fall Time	Yes	
Rise Time	Yes	
Unit Interval	Yes	
Bit Rate	Yes	
Differential Skew	Yes	
AC CM Voltage	Yes	

SAS Measurement Names for the resultFor Variable

Table 90: SAS measurement names

Measurement Names	Stats	And…
Eye Width	Yes	
Eye Height	Yes	maskUICount, maskHits
Eye Height Transition Bits	Yes	maskUICount, maskHits
Eye Height Non-Transition Bits	Yes	maskUICount, maskHits
Fall Time	Yes	
Rise Time	Yes	
Bit Rate	Yes	
Differential Skew	Yes	

Measurement Algorithms

Eye Diagram for Serial ATA

The Serial ATA signal consists of Spread Spectrum Clocking (SSC). The Eye will not be accurate if generated on a large number of Unit Intervals. The algorithm uses a sliding window or the scan mode, to reduce the effect of SSC.

Scan mode:

The scan mode method is as follows:

1. Select a large window, for example 2000 UI, for clock recovery.
2. Recover the clock on the 2000 UI window.
3. Calculate the UI values.
4. Go to the center 250 UI or 5 UI (Analysis Window) according to the user selection.
5. Adjust the phase values at this 250/5 UI.
6. Create Eye diagram on analysis window.
7. Calculate the five values:
   - Jitter
   - Top rail
   - Bottom rail

- Bottom opening
- And top opening

Move the window by a certain number of unit intervals, for example 100 UI. Repeat all the earlier steps mentioned. Compare all the results computed in the current window with that of the previous window and keep the worst values. Keep moving the window until it reaches end of the data and repeat the same process to get the worst five values and corresponding eye.

The algorithm calculates the Eye Width and Eye Height values to generate the Eye diagram.

Eye Width:

The Eye Width measurement is the measured minimum horizontal eye opening at the zero reference level as shown in the eye diagram.

$$T_{EYE-WIDTH} = UI_{AVG} - TIE_{Pk-Pk}$$

Where:

$T_{EYE-WIDTH}$ is the average UI

TIE_{PK-PK} is the Peak-Peak Time Interval Error

Eye Height:

The Eye Height measurement is the measured minimum vertical eye opening at the UI center as shown in the plot of the eye diagram. There are three types of Eye Height values: Eye Height, Eye Height Transition, and Eye Height Non-Transition.

$$T_{EYE-HEIGHT} = V_{EYE-HI-MIN} - V_{EYE-LO-MAX}$$

Where:

$V_{EYE-HI-MIN}$ is the minimum of the High voltage at mid UI

$V_{EYE-LO-MAX}$ is the maximum of the Low voltage at mid UI

Eye Height – Transition:

$$T_{EYE-HEIGHT-TRAN} = V_{EYE-HI-TRAN-MIN} - V_{EYE-LO-TRAN-MAX}$$

Where:

$V_{EYE-HI-TRAN-MIN}$ is the minimum of the High transition bit eye voltage at mid UI

$V_{EYE-LO-TRAN-MAX}$ is the maximum of the Low transition bit eye voltage at mid UI

Eye Height – Non-transition:

$$T_{EYE-HEIGHT-NTRAN} = V_{EYE-HI-NTRAN-MIN} - V_{EYE-LO-NTRAN-MAX}$$

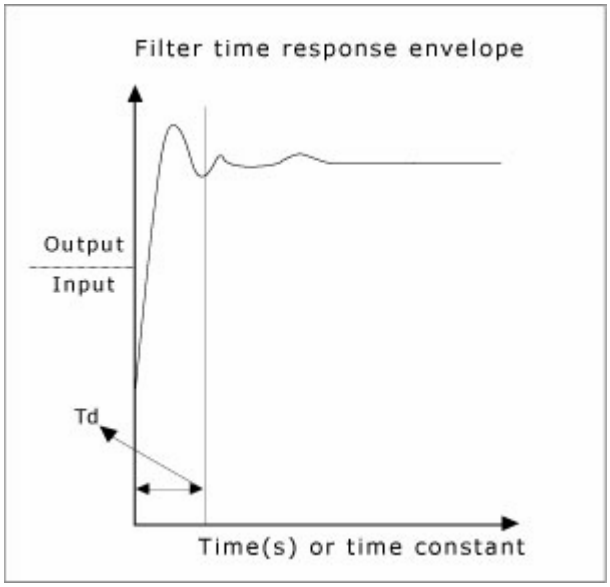
Where:

$V_{EYE-HI-NTRAN-MIN}$ is the minimum of the High non-transition bit eye voltage at mid UI

$V_{EYE-LO-NTRAN-MAX}$ is the maximum of the Low non-transition bit eye voltage at mid UI

Eye Diagram for SAS

The Clock Recovery Module recovers the clock using the CCR Mean/Median technique. Recalculate the clock by adjusting the Low Pass Filter TIE to get the corrected clock. This clock is used to calculate TIE and Eye. The filter used is the Low Pass Filter first order Butterworth.



The output/input is graphed over time (unit interval). The response shows the filter behavior. At first, the filter ramps up and then tries to settle down after the dotted line. This ramping up is due to initial conditions used for the filter. To overcome this, the simplest method is to discard the Td time duration of filtered data. The Td is called as variable of time constant and one time constant (tau) = 1/(2*pi*fc) where fc is the filter cut off frequency. fc is bitrate/1667.

$$TIE = InterpolatedDataEdges - CCR$$

The algorithm calculates the Eye Width and Eye Height values to generate the Eye diagram.

Eye Width:

The Eye Width measurement is the measured minimum horizontal eye opening at the zero reference level as shown in the eye diagram.

$$T_{EYE-WIDTH} = UI_{AVG} - TIE_{Pk-Pk}$$

Where:

$T_{EYE-WIDTH}$ is the average UI

TIE_{PK-PK} is the Peak-Peak Time Interval Error

Eye Height:

The Eye Height measurement is the measured minimum vertical eye opening at the UI center as shown in the plot of the eye diagram. There are three types of

Eye Height values: Eye Height, Eye Height Transition, and Eye Height Non-Transition.

$$T_{EYE-HEIGHT} = V_{EYE-HI-MIN} - V_{EYE-LO-MAX}$$

Where:

$V_{EYE-HI-MIN}$ is the minimum of the High voltage at mid UI

$V_{EYE-LO-MAX}$ is the maximum of the Low voltage at mid UI

Eye Height – Transition:

$$T_{EYE-HEIGHT-TRAN} = V_{EYE-HI-TRAN-MIN} - V_{EYE-LO-TRAN-MAX}$$

Where:

$V_{EYE-HI-TRAN-MIN}$ is the minimum of the High transition bit eye voltage at mid UI

$V_{EYE-LO-TRAN-MAX}$ is the maximum of the Low transition bit eye voltage at mid UI

Eye Height – Non-transition:

$$T_{EYE-HEIGHT-NTRAN} = V_{EYE-HI-NTRAN-MIN} - V_{EYE-LO-NTRAN-MAX}$$

Where:

$V_{EYE-HI-NTRAN-MIN}$ is the minimum of the High non-transition bit eye voltage at mid UI

$V_{EYE-LO-NTRAN-MAX}$ is the maximum of the Low non-transition bit eye voltage at mid UI

When the preference "Refine Filter initial condition for SAS Eye" is selected the algorithm uses four-point forward averaging technique from the first clock edge up to two time constants (tau) of clock edges, and the first order backward filtering to calculate the filter initial conditions.

$$1Tau = \frac{1}{2\pi f_C}$$

where f_c is the cut-off frequency and is equal to fBaud/1667. Depending on the device speed, the cut-off frequency changes.

For a 3 Gbps device speed, the algorithm averages TIE values till the index 2*tau/average_Period, where the average_Period is 1/calculated device speed. The number of indexes is ~550.

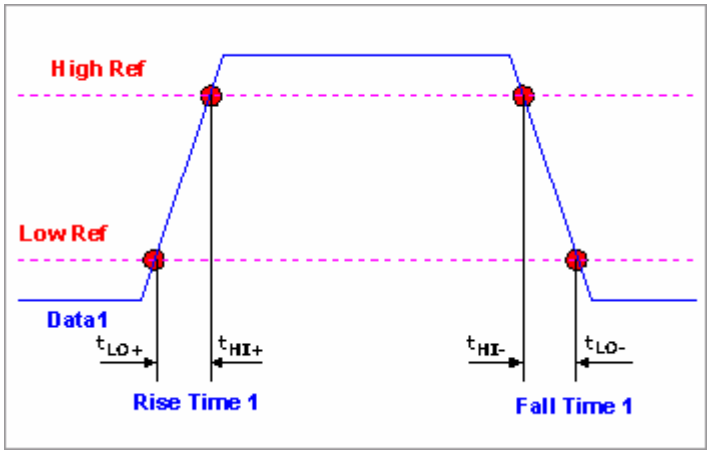
For a 1.5 Gbps device speed, the number of indexes is ~550.

How to calculate the record length to set in case of non automated mode?

Set the record length as follows to ensure that the acquired waveform is greater than the clock transitions as mentioned for the device speeds. To retain the shape of the bit transmitted eight sample points should be available during each rise and fall slope and >=8 samples in each unit interval. An ideal record length would be 550*8 which is approximately 10 K.

Rise Time

Rise time is the time difference between 20% and 80% of the normalized amplitude of the captured signal at the rising edge.



$$t_{RISE}(n) = t_{HI+}(i) - t_{LO+}(j)$$

Where:

t_{RISE} is a Rise Time measurement

t_{HI+} is a set of t_{HI} for rising edges only

t_{LO+} is a set of t_{LO} for rising edges only

i and j are indexes for nearest adjacent pairs of t_{LO+} and t_{HI+}

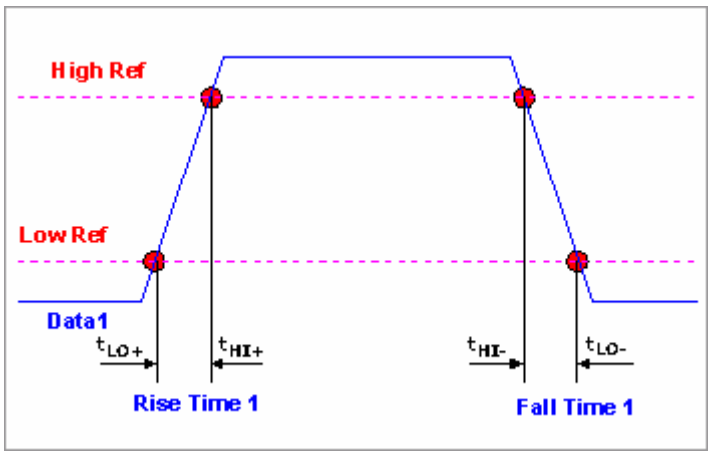
n is the index of rising edges in the waveform

Rise Time is as follows:

$$t_{DIFF\_RISE}(n) = t_{DIFF\_HI+}(i) - t_{DIFF\_LO+}(j)$$

Fall Time

Fall time is the time difference between 20% and 80% of the normalized amplitude of the captured signal at the falling edge.



$$t_{FALL}(n) = t_{LO-}(i) - t_{HI-}(j)$$

Where:

T_{FALL} is a Fall Time measurement

t_{HI-} is a set of t_{HI} for falling edges only

t_{LO-} is a set of t_{LO} for falling edges only

i and j are indexes for nearest adjacent pairs of t_{LO-} and t_{HI-}

n is the index of falling edges in the waveform

Fall Time is as follows:

$$t_{DIFF\_FALL}(n) = t_{DIFF\_LO-}(i) - t_{DIFF\_HI-}(j)$$

Bit Rate

The Bit Rate measurement calculates the baud (such as frequency) of the recovered clock.

$$BR = \frac{1}{UI(n)}$$

Where:

UI is the associated Unit Interval measurement

n is the index to UI in the waveform

Unit Interval

The Unit Interval measurement calculates the cycle duration of the recovered clock.

$$UI(n) = t_{R-CLK}(n+1) - t_{R-CLK}(n)$$

$$UI_{AVG} = Mean(UI(n))$$

Where:

t_{R-CLK} is a recovered clock edge

n is the index to UI in the waveform

Differential Skew

The Skew measurement is the time delay between the two single-ended waveform sources.

$$T_{SKEW}(n) = t_{D+MID}(n) - t_{D-MID}(n)$$

Where:

t_{SKEW} is the Skew measurement

t_{D+MID} is the mid level crossing time of v_{D+}

t_{D-MID} is the mid level crossing time of v_{D-}

n is the index to edges in the waveform

Differential Voltage

The algorithm calculates the minimum and maximum differential voltages. The calculations are performed on a series of patterns and the first few are common to Option1 and Option2.

In the following equations,

$\bar{x}$ is the mean of the voltage samples in the histogram

s is the standard deviation of the voltage samples in the histogram

n is the number of samples that contribute to the histogram

Steps 1 and 2 for an HFTP pattern:

$$UH = [\bar{x} - \frac{1.96s}{\sqrt{n}}]$$

$$LH = [\bar{x} + \frac{1.96s}{\sqrt{n}}]$$

Steps 3 and 4: for an MFTP pattern:

$$UM = [\bar{x} - \frac{1.96s}{\sqrt{n}}]$$

$$LM = [\bar{x} + \frac{1.96s}{\sqrt{n}}]$$

Step 5:

$$DH = UH - LH$$

$$DM = UM - LM$$

$$DHM = \min(DH, DM)$$

Step 6 using an LBP pattern, Option 1:

$$A = [\bar{x} - \frac{1.96s}{\sqrt{n}}]$$

$$B = [\bar{x} + \frac{1.96s}{\sqrt{n}}]$$

Step 7:

$$VTestLBP = A - B$$

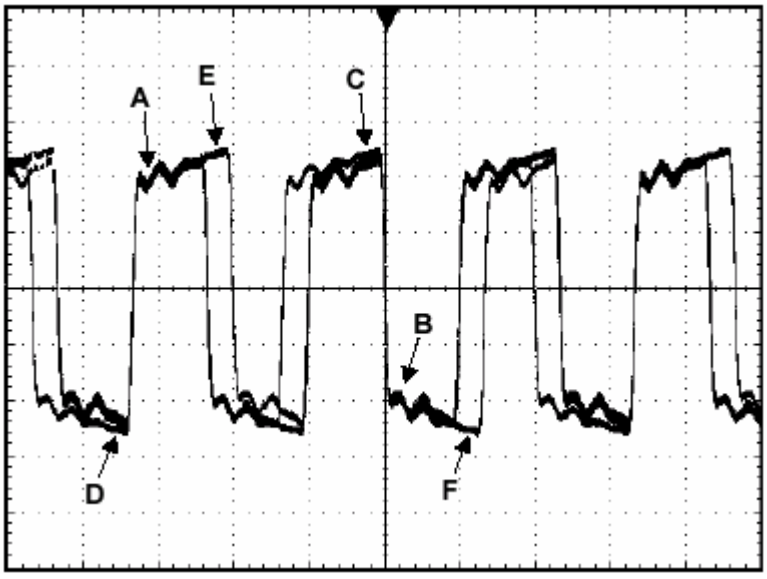
$$VTest = \min(VTestLBP, DHM)$$

Step 6 using an LFTP pattern, Option 2:

$$A = [\bar{x} - \frac{1.96s}{\sqrt{n}}]$$

$$B = [\bar{x} + \frac{1.96s}{\sqrt{n}}]$$

Steps 8-11: Calculate the mean of voltage samples in the histogram at points C, D, E, and F.



Step 12:

$$VTestAPP = (A + C + F) - (B + D + E)$$

$$VTest = \min(VTestAPP, DHM)$$

Maximum Differential Voltage:

Step 1: High Test UI

$$VU = \frac{1}{2} V_{DIFFTX}(\max)$$

NU is the number of histogram hits between 0 and VU millivolts: nu is the number of histogram hits between VU and VU+300 millivolts.

Step 2: Low Test UI

$$VL = -\frac{1}{2} V_{DIFFTX}(\max)$$

NL is the number of histogram hits between VL and 0 millivolts: nl is the number of histogram hits between VL − 300 millivolts and VL.

Step 3:

$$pu = \frac{nu}{nu + NU}$$

$$pl = \frac{nl}{nl + NL}$$

AC Common Mode Voltage

The AC Common Mode Voltage measurement calculates the AC statistics of the Common Mode voltage waveform with the DC value removed. This v_{AC-CM} is filtered with a filter having a cut-off frequency of Bitrate/2.

$$v_{AC-CM}(i) = v_{CM}(i) - V_{CM}$$

Where:

i is the index of all waveform values

v_{AC-CM} is the AC Common Mode voltage signal

v_{CM} is the Common Mode voltage signal

V_{CM} is the DC Common Mode voltage signal

Jitter Measurements using TDSJIT3

Serial ATA Transmitter Jitter Measurements using TDSJIT3

Jitter is an accumulation of short-term variations of the zero crossings from ideal positions in time. A Reference Clock defines the ideal positions in time. The Reference Clock method separates jitter from SSC, tracks SSC and other low frequency modulation but not jitter. Reference Clock extraction is performed using either hardware or software PLLs.

Two Reference Clock PLLs are defined as type 2 PLL with a -3 dB corner frequency

$f_{c3dB} = f_{BAUD}/N$ (N = 10 (Gen2i), 500 (Gen2i), 1667 (Gen1x, Gen2x)) given a transition density of 1.0 (corresponding to a 1010101010 clock-like pattern) and damping factor î = 0.707 min to 1.00 max.

For Gen1i and Gen1x,

f_{BAUD} = 1.5 Gbps and for Gen2i and Gen2x, f_{BAUD} = 3 Gbps.

There are several types of jitter which are separated into two classes: deterministic and random. Deterministic jitter is bounded and random jitter is not. The amount of tolerable jitter is limited by the desired bit error rate performance of the channel. Two classes of jitter are used in analysis because they accumulate differently.

You can configure the reference clock in the TDSJIT3 application as a second order PLL.

The following table lists the measurements for the Serial ATA devices that you can use with the TDSJIT3 application.

Table 91: Measurements for SATA devices used with TDSJIT3

Parameters	Serial ATA				Measurements with TDSJIT3
Transmitter	Gen1i	Gen1x	Gen2i	Gen2x	✓
Tj at Connector, Data-Data, 5UI Dj at Connector, Data-Data, 5UI	✓				✓
Tj at Connector, Data-Data, 250UI Dj at Connector, Data-Data, 250UI	✓				✓
Tj at Connector, Clk-Data, $f_{BAUD}/10$ Dj at Connector, Clk-Data, $f_{BAUD}/10$			✓		✓
Tj at Connector, Clk-Data, $f_{BAUD}/500$ Dj at Connector, Clk-Data, $f_{BAUD}/500$			✓		✓
Tj after CIC, Clk-Data, $f_{BAUD}/1667$ Dj after CIC, Clk-Data, $f_{BAUD}/1667$		✓		✓	✓

Serial ATA SSC time domain profile extraction using TDSJIT3

The SSC time domain profile is extracted by clock period measurement. The SSC profile is measured at different cut off frequencies by applying Butterworth 1st order with the following characteristics (3 dB, 20 dB/decade rolloff) 35 KHz (CP1), 50 KHz (CP2), 100 KHz (CP3), 500 KHz (CP4), 1 MHz (CP5), 5 MHz (CP6) on the clock period measurements.

TDSJIT3 setup and configuration:

1. Select SelectMeas and select Clock Period.
2. Select ConfigureMeas and select the Filters tab.

3. Select Low-pass filter (f2, first order) and configure the cutoff frequencies — 35 KHz (CP1), 50 KHz (CP2), 100 KHz (CP3), 500 KHz (CP4), 1 MHz (CP5), 5 MHz (CP6).

4. From the main menu, select Plot> Create. From Add Plot, select Cycle Trend.

Note: *Do not configure the High Pass Filter.*

5. Select Advanced and configure the Settling Time. Based on the settling time, the initial filtered data will be discarded.

6. Select Go to Results and select Run/Stop or Single. Select the clock periods one after another to see the results and plot for each clock period.

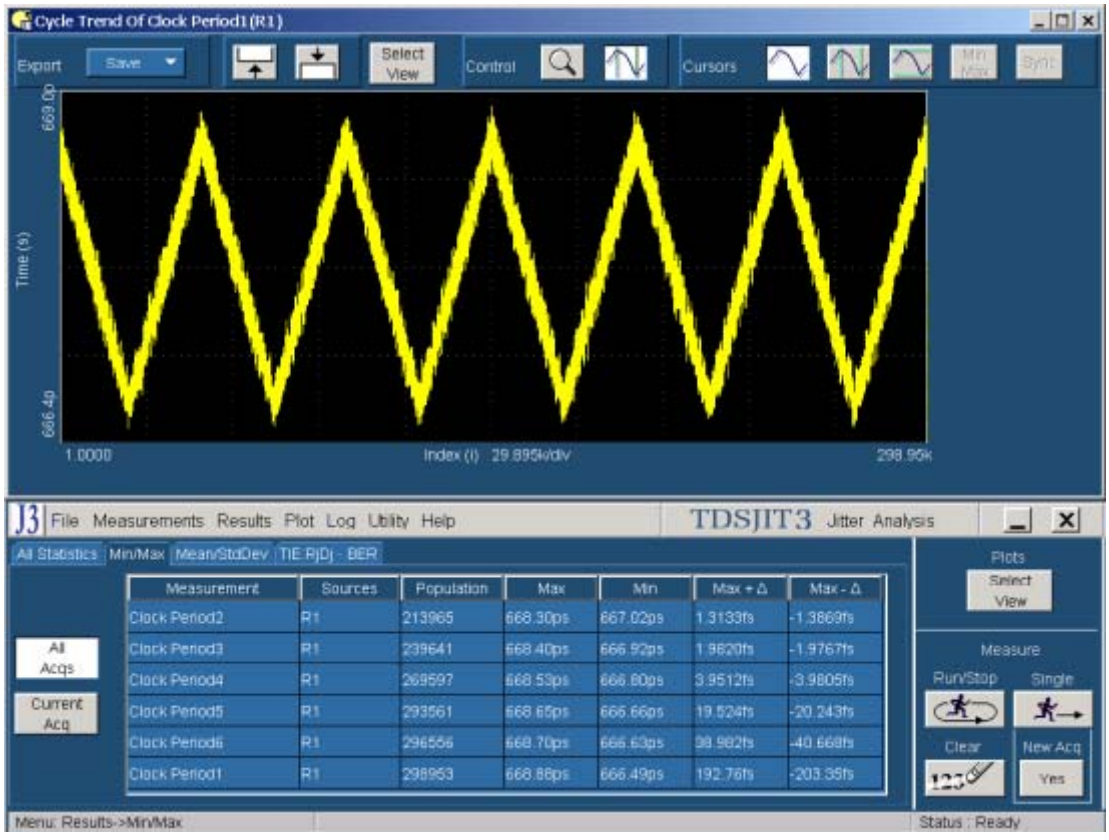


Figure 88: SSC time domain profile extraction

TDSJIT3 Setup to measure Tj/Dj, 5 UI for a Gen1i device

Follow the steps to measure the Tj at Connector, Data-Data, 5 UI and Dj at Connector, Data-Data, 5 UI for a Gen1i device:

1. Select SelectMeas> Data tab. Select TIE.

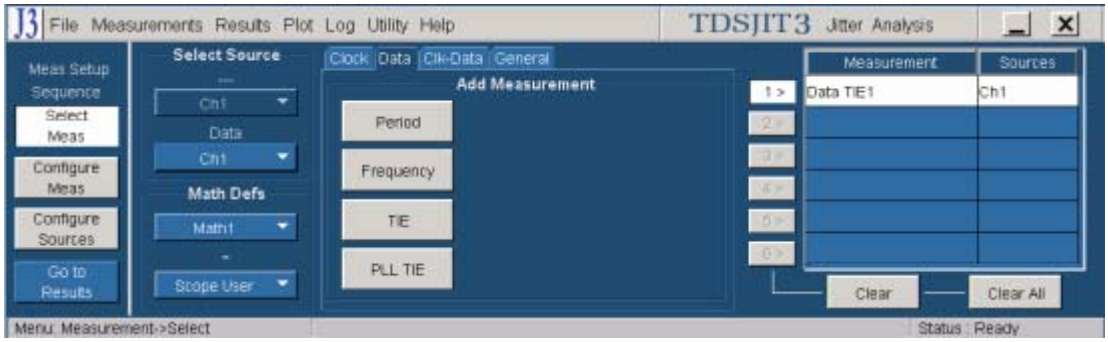


Figure 89: Selecting measurement

2. From ConfigureMeas, select the Filters tab. In High Pass (F1), set Freq (F1) to 300 Mhz.

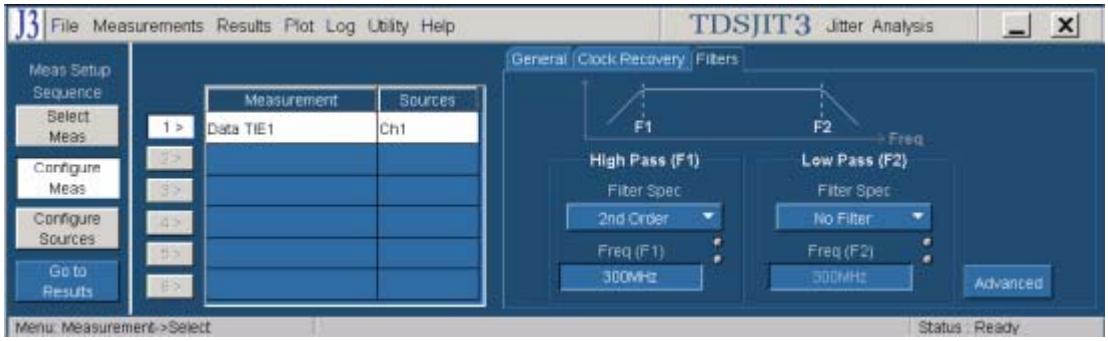


Figure 90: Configuring filters

3. Select the General tab. Set Rj/Dj Analysis to On, set Data Pattern Type to Repeating, and Pattern Length to 2640 UI. The pattern used is CJTPAT.

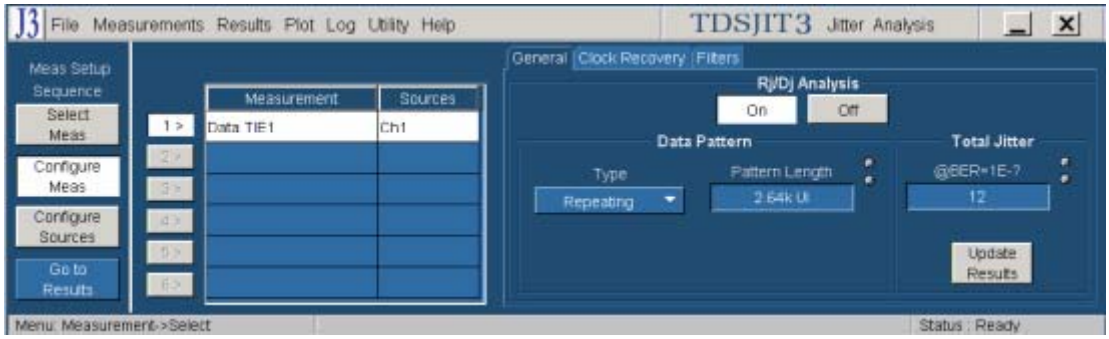


Figure 91: Configuring general parameters

4. Select Go to Results and select Run/Stop or Single.

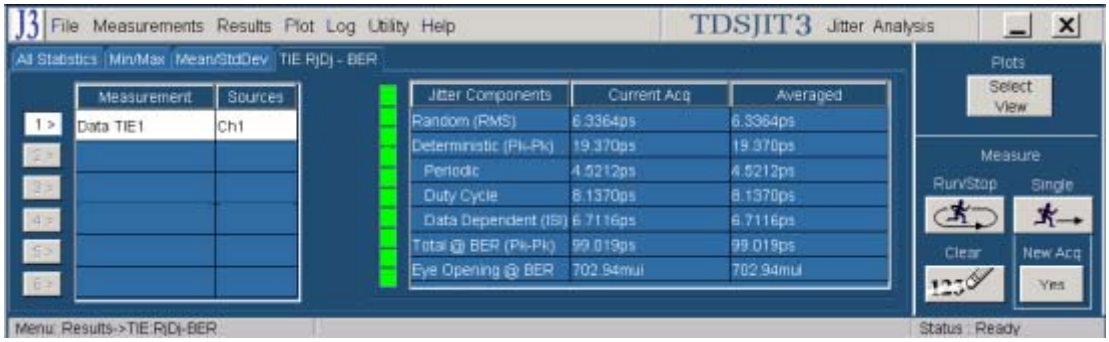


Figure 92: Measurement results

Note: *The maximum PLL Bandwidth is equal to Baudrate/10, which is $1.5e^9/10$ or 150 MHz. Since the Loop Bandwidth is 300 MHz, you cannot perform this test using PLL. You can do the equivalent by recovering the clock using Constant Clock Recovery (CCR) and applying a high-pass filter on the TIE.*

TDSJIT3 Setup to measure Tj/Dj, 250 UI for a Gen1i device

Follow the steps to measure the Tj at Connector, Data-Data, 250 UI and Dj at Connector, Data-Data, 250 UI for a Gen1i device:

1. Select SelectMeas> Data tab. Select PLL TIE.

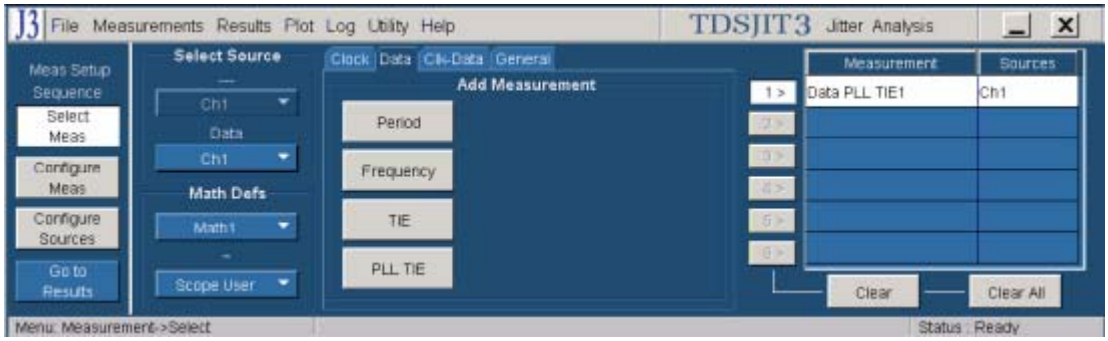


Figure 93: Selecting measurements

2. Select ConfigureMeas. Select the Clock Recovery tab. Set Loop BW-Custom to 6 MHz (250 UI). You can configure the Damping Factor between .707 - 1.0 (default .707). Setting the Damping Factor is optional.

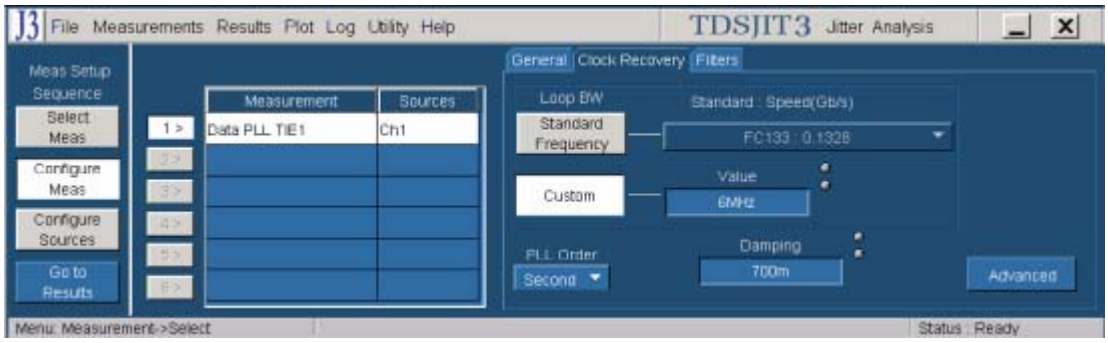


Figure 94: Configuring clock recovery

3. Select the General tab. Set Rj/Dj Analysis to On, set Data Pattern Type to Repeating, and Pattern Length to 2640 UI. The pattern used is CJTPAT.

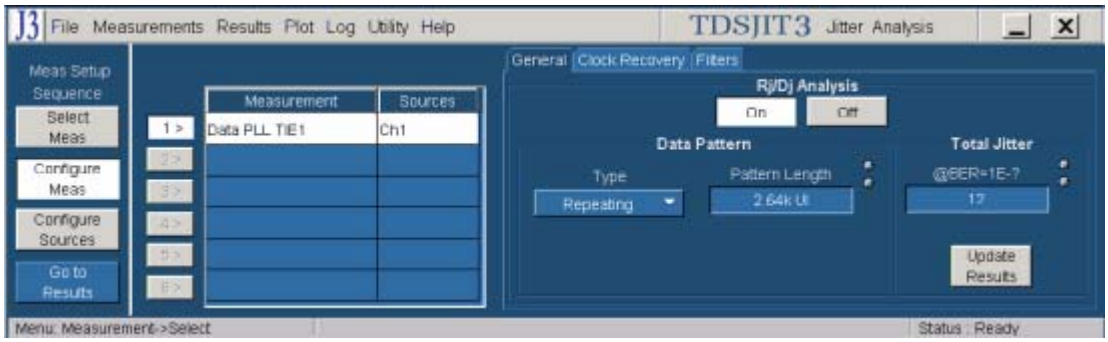


Figure 95: Configuring general parameters

4. Select Go to Results and select Run/Stop or Single.

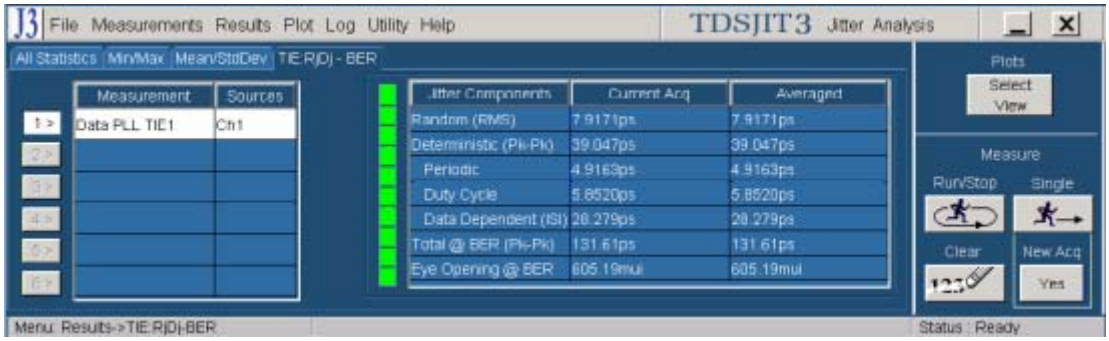


Figure 96: Measurement results

TDSJIT3 Setup to measure Tj/Dj for a Gen1x device

Follow the steps to measure the Tj after CIC, Clk-Data, fBAUD/1667, and Dj after CIC, Clk-Data, fBAUD/1667 for a Gen1x device:

1. Select Measurements> Data tab. Select PLL TIE.
2. Select ConfigureMeas. Select the Clock Recovery tab. Set Loop BW-Custom to 890 KHz (fBaud/1667). You can configure the damping factor between .707 - 1.0 (default .707). Setting the Damping Factor is optional.
3. Select the General tab. Set Rj/Dj Analysis to On, set Data Pattern Type to Repeating, and Pattern Length to 2640 UI. The pattern used is CJTPAT.
4. Select Go to Results and select Run/Stop or Single.

TDSJIT3 Setup to measure Tj/Dj, Clk-Data, fBaud/500 for a Gen2i device

Follow the steps to measure the Tj at Connector, Clk-Data, fBAUD/500, and Dj at Connector, Clk-Data, fBAUD/500 for a Gen2i device:

1. Select SelectMeas> Data tab. Select PLL TIE.
2. Select ConfigureMeas. Select the Clock Recovery tab. Set Loop BW-Custom to 6 MHz (500 UI). You can configure the damping factor between .707 - 1.0 (default .707). Setting the Damping Factor is optional.
3. Select the General tab. Set Rj/Dj Analysis to On, set Data Pattern Type to Repeating, and Pattern Length to 2640 UI. The pattern used is CJTPAT.

4. Select Go to Results and select Run/Stop or Single.

TDSJIT3 Setup to measure Tj/Dj for a Gen2x device

Follow the steps to measure the Tj after CIC, Clk-Data, fBAUD/1667, and Dj after CIC, Clk-Data, fBAUD/1667for a Gen2x device:

1. Select SelectMeas> Data tab. Select PLL TIE.
2. Select ConfigureMeas. Select the Clock Recovery tab. Set Loop BW-Custom to 1.8 MHz (fBaud/1667). You can configure the damping factor between .707 - 1.0 (default .707). Setting the Damping Factor is optional.
3. Select the General tab. Set Rj/Dj Analysis to On, set Data Pattern Type to Repeating, and Pattern Length to 2640 UI. The pattern used is CJTPAT.
4. Select Go to Results and select Run/Stop or Single.

TDSJIT3 Setup to measure Tj/Dj, Clk-Data for a Gen2i device

Follow the steps to measure the Tj at Connector, Clk-Data, fBAUD/10, and Dj at Connector, Clk-Data, fBAUD/10 for a Gen2i device:

1. Select SelectMeas> Data tab. Select PLL TIE.
2. Select ConfigureMeas. Select the Clock Recovery tab. Set Loop BW-Custom to 300 MHz (10 UI). You can configure the Damping Factor between .707 - 1.0 (default .707). Setting the Damping Factor is optional.
3. Select the General tab. Set Rj/Dj Analysis to On, set Data Pattern Type to Repeating, and Pattern Length to 2640 UI. The pattern used is CJTPAT.
4. Select Go to Results and select Run/Stop or Single.

SAS Receiver Jitter Measurements using TDSJIT3

You can use TDSJIT3 to measure jitter for a SAS Receiver.

Table 92: Measure jitter

Parameters	SAS 1.5 Gbps and 3 Gbps IR	CR	XR
Total Jitter	✓	✓	✓
Deterministic Jitter	✓	✓	✓

TDSJIT3 Setup for a SAS 1.5 Gbps device

Follow the steps to measure the jitter for a SAS 1.5 Gbps receiver:

Figure 97: Configuring filters for a 1.5 Gbps SAS device

1. Select Data> Data tab. Select TIE. Select ConfigureMeas and select the Filter tab.
2. Select F1 (high-pass filter).
3. Set the cutoff High Pass Frequency to 890 KHz (fBaud/1667) and F2 (off).

***Note**: Do not configure the Low Pass Filter.*

4. Select the General tab. Set Rj/Dj Analysis to On. Set Data Pattern Type to Repeating, and Pattern Length to 2240 UI. The pattern used is CJTPAT.
5. Select Go to Results and select Run/Stop or Single.

TDSJIT3 Setup for a SAS 3.0 Gbps device

Follow the steps to measure the jitter for a SAS 3.0 Gbps receiver:

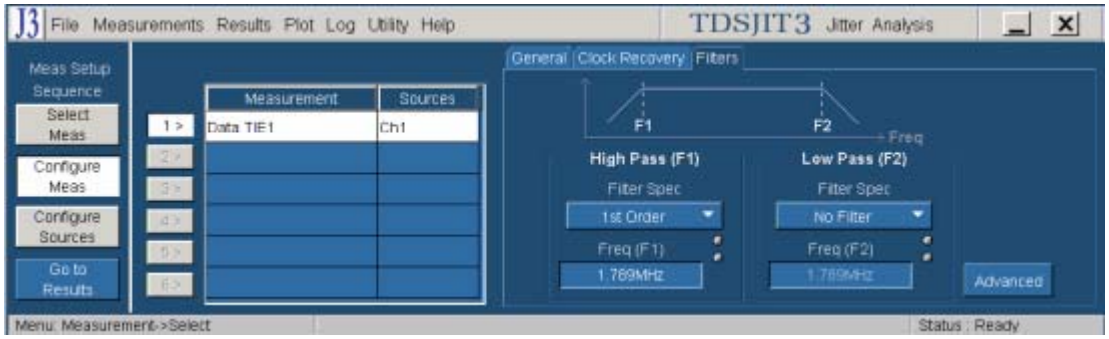


Figure 98: Configuring filters for a 1.5 Gbps SAS device

1. Select Data> Data tab. Select TIE. Select ConfigureMeas and select the Filter tab.
2. Select F1 (high-pass filter).
3. Set the cutoff High Pass Frequency to 1.8 MHz (fBaud/1667) and F2 (off).

Note: *Do not configure the Low Pass Filter.*

4. Select the General tab. Set Rj/Dj Analysis to On. Set Data Pattern Type to Repeating, and Pattern Length to 2240 UI. The pattern used is CJTPAT.
5. Select Go to Results and select Run/Stop or Single.