TekExpress® 400G-TXE
Electrical Compliance Solution for Real Time Oscilloscopes
Printable Application Help

077-1366-03

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Printable Application Help

www.tek.com
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- In North America, call 1-800-833-9200.
- Worldwide, visit *www.tek.com* to find contacts in your area.

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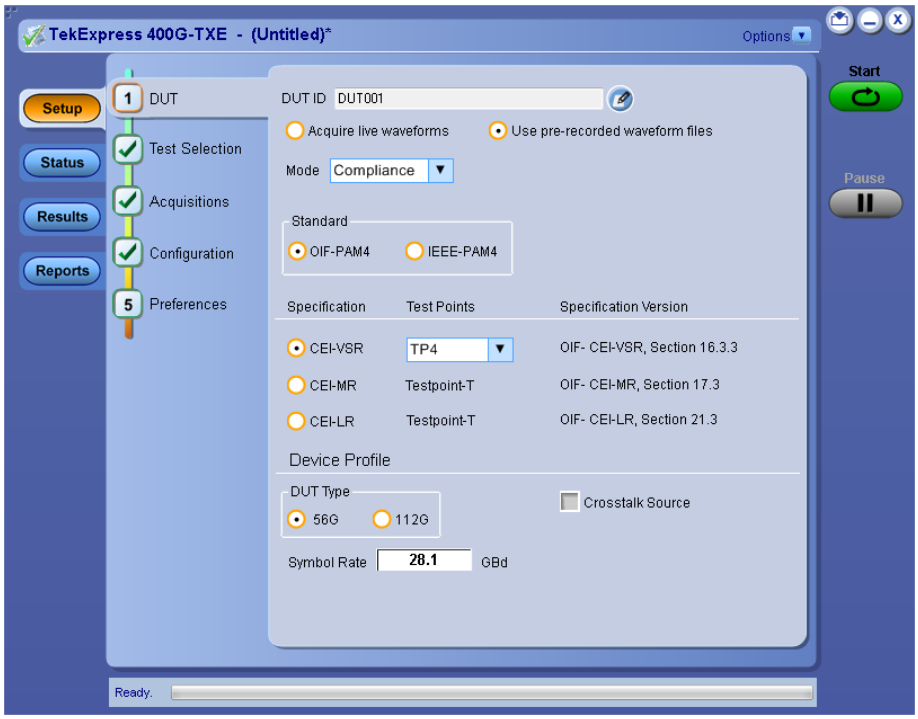


Welcome to Tektronix Real Time Oscilloscope based 400G-TXE electrical compliance test solution. The 400G-TXE is a TekExpress compliance software which evaluates the electrical PAM4 signals to the specification-mandated limits.

The 400G-TXE Real-Time electrical compliance test solution provides turnkey testing and debug of the TX electrical properties, key to OIF (CEI-VSR/CEI-MR/CEI-LR) and IEEE (AUI4/CR4/KR4) PAM4 standards. It tests the OIF-PAM4 and IEEE-PAM4 specification levels in a simple, cost effective manner. It aligns the best in class Real Time Oscilloscope performance with strong market demand for 400G based electrical PAM4 analysis tools.

The 400G-TXE solution offers comprehensive test automation, results margining, data logging, and results reporting in an advanced testing framework.

Key features of TekExpress 400G-TXE include:

- TekExpress 400G-TXE specifically targets the following sections:
  - OIF-CEI-56G-VSR at TP0a: oif2017.449.03, Sections 16.B, Table 16-10
  - OIF-CEI-56G-VSR at TP1a: oif2017.449.03, Sections 16.3.2, Table 16-1
  - OIF-CEI-56G-VSR at TP4: oif2017.449.03, Sections 16.3.3, Table 16-4
  - OIF-CEI-56G-MR at Test point T: oif2014.245.12, section 17.3, Table 17-2, 17-3
  - OIF-CEI-56G-LR at Test point T: oif2014.340.08, section 21.3, Table 21-2, 21-3
  - OIF-CEI-112G-VSR at TP0a: oif2017.346.04, Table 23-9, Section 23.B.1.1
  - OIF-CEI-112G-VSR at TP1a: oif2017.346.04, Table 23-1, Section 23.3.2
  - OIF-CEI-112G-VSR at TP4: oif2017.346.04, Table 23-4, Section 23.3
  - AUI-4/8 at TP0a: IEEE 802.3bs, Draft 3.5, Annex 120D.3.1, Table 120D-1
  - AUI-4/8 at TP1a: IEEE 802.3bs, Draft 3.5, Annex 120E.3.1, Table 120E-1
  - AUI-4/8 at TP4: IEEE 802.3bs, Draft 3.5, Annex 120E.3.2, Table 120E-3
  - 50GBASE-CR/100GBASE-CR2/200GBASE-CR4: IEEE802.3cd Draft 3.5 Section 136.9.3, Table 136-11
  - 50GBASE-KR/100GBASE-KR2/200GBASE-KR4: IEEE802.3cd Draft 3.5 Section 137.9.2
- Streamlined and fully automated transmitter characterization of OIF (CEI-VSR/CEI-MR/CEI-LR) and IEEE (AUI4/CR4/KR4) PAM4 electrical transmitter specifications (chip-to-chip and chip-to-module)
- In-depth analysis and debug capabilities of electrical PAM4 signals in combination with the PAM4 software package

Getting help and support

Conventions

Help uses the following conventions:

- The term "Application" and "Software" refers to the TekExpress 400G-TXE Solution application.
- The term “DUT” is an abbreviation for Device Under Test.
- The term “select” is a generic term that applies to the different methods of choosing a screen item (button, control, list item): using a mouse or using the touch screen.

Table 1: Icon descriptions

Icon	Meaning
	This icon identifies important information.
	This icon identifies conditions or practices that could result in loss of data.
	This icon identifies additional information that will help you use the application more efficiently.

Related documentation

The following documentation is available as part of the TekExpress® 400G-TXE Solution application.

Table 2: Product documentation

Item	Purpose	Location
Help	Application operation and User Interface help	
PDF of the help	Printable version of the compiled help	 PDF file that ships with 400G-TXE Solution software distribution (*TekExpress 400G-TXE-Automated-Test-Solution-Software-Printable-Help-EN-US.pdf*). You can download the PDF version of the manual from the Tektronix website. Part number: 077-1366-02 *www.tek.com*

See also: *Technical support*

Technical support

Tektronix values your feedback on our products. To help us serve you better, please send us your suggestions, ideas, or comments on your application or oscilloscope. Contact Tektronix through mail, telephone, or the website.

When you contact Tektronix Technical Support, please include the following information (be as specific as possible):

General information

- All instrument model numbers
- Hardware options, if any
- Probes used
- Your name, company, mailing address, phone number, FAX number
- 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
- If possible, save the setup files for all the instruments used and the application
- If possible, save the TekExpress setup files, log.xml, *.TekX (session files and folders), and status messages text file
- If possible, save the waveform on which you are performing the measurement as a .wfm file

Getting started

Minimum system requirements

The following table shows the minimum system requirements to install and run the TekExpress 400G-TXE solution.

Table 3: System requirements

Component	Description
Oscilloscope	■ Tektronix DPO70K, DX / SX series oscilloscope ■ Firmware Version: 10.8 or above ■ Opt. DJA, DJAN, PAM4, and SDLA64
Software	■ PAM4 analysis 10.7.0.8 installed ■ IronPython 2.7.3 installed ■ PyVisa 1.0.0.25 installed ■ Microsoft .NET 4.0 Framework ■ Microsoft Internet Explorer 7.0 SP1 or greater, or other Web browser for viewing reports ■ Adobe Reader software 7.0 or greater for viewing portable document format (PDF) files

Instruments and accessories required

TekExpress 400G-TXE application is launched on DPO70K series oscilloscope. The following table lists the instruments and accessories required for this application.

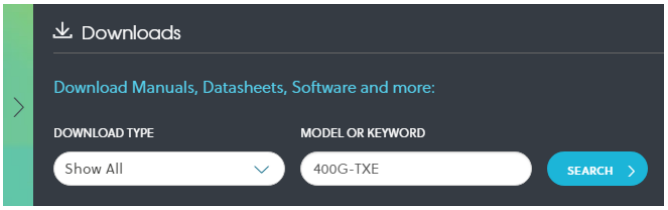
Table 4: Instruments and accessories required for 400G-TXE application

Instrument/Accessory	Model number	Quantity
Oscilloscope	DPO73304DX, MSO73304DX, DPO73304SX, DPS73308SX, DPO75002SX, DPS75004SX, DPO77002SX, DPS77004SX, DPO75902SX, DPS75904SX	2
Cables	Compatible SMA cables with bandwidth greater than 40 GHz for connecting single ended sources ATI channel.	2
Fixtures	■ Wilder Host compliance board CEI-VSR/AUI-4 at TP1a (HCB-P) (Wilder part number: 640-0822-000) ■ Wilder Module compliance board CEI-VSR/AUI-4 at TP4 (MCB) (Wilder part number: 640-0823-000) ■ Any compatible text fixture for CEI-VSR/AUI-4 at TP0a, CEI-MR, CEI-LR, CR and KR	1
DC Blocks	Compatible DC block with bandwidth range 50 KHz to 65 GHz	2
Attenuator	3, 6, or 10 dB attenuators	2

Downloading and installing the software

Complete the following steps to download and install the latest 400G-TXE application. See *Minimum system requirements* for compatibility.

1. Go to *www.tek.com*.
2. Click **Downloads**. In the Downloads menu, select DOWNLOAD TYPE as Software and enter *400G-TXE* in the MODEL OR KEYWORD field and click **SEARCH**.



3. Select the latest version of software and follow the instructions to download. Copy the executable file to the oscilloscope.
4. Double-click the executable and follow the on-screen instructions. The software is installed at *C:\Program Files\Tektronix\TekExpress\400G-TXE*.
5. Select **Analyze** > **TekExpress 400G-TXE** from the TekScope menu to *Launch the application*.

View software version

Use the following instructions to view version information for the application and for the application modules such as the Programmatic Interface and the Programmatic Interface Client.

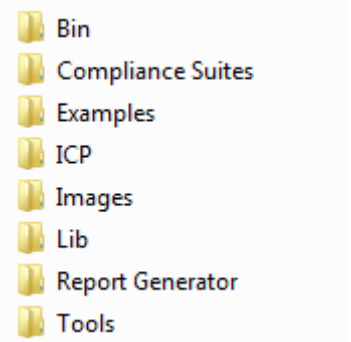
To view version information for 400G-TXE, click button in the TekExpress application and select **About TekExpress**.

NOTE. *This example shows a typical Version Details dialog box, and may not reflect the actual values as shown when you open this item in the application.*

Application directories

The TekExpress 400G-TXE application files are installed at the following location:

C:\Program Files\Tektronix\TekExpress\TekExpress 400G-TXE



The following table lists the application directory names and their purpose.

Table 5: Application directories and usage

Directory names	Usage
Bin	Contains TekExpress 400G-TXE application libraries
Compliance Suites	Contains compliance-specific files
Examples	Contains various support files
ICP	Contains instrument and TekExpress 400G-TXE application-specific interface libraries
Images	Contains images of the TekExpress 400G-TXE application
Lib	Contains utility files specific to the TekExpress 400G-TXE application
Report Generator	Contains style sheets for report generation
Tools	Contains instrument and TekExpress 400G-TXE application-specific files

See also *View test-related files*

File name extensions

File name extensions

The TekExpress 400G-TXE application uses the following file name extensions:

File name extension	Description
.TekX	Application session files (the extensions may not be displayed)
.py	Python sequence file
.xml	Test-specific configuration information (encrypted) files Application log files
.csv	Test result reports Plot data
.mht	Test result reports (default) Test reports can also be saved in HTML format
.pdf	Test result reports Application help document
.xslt	Style sheet used to generate reports

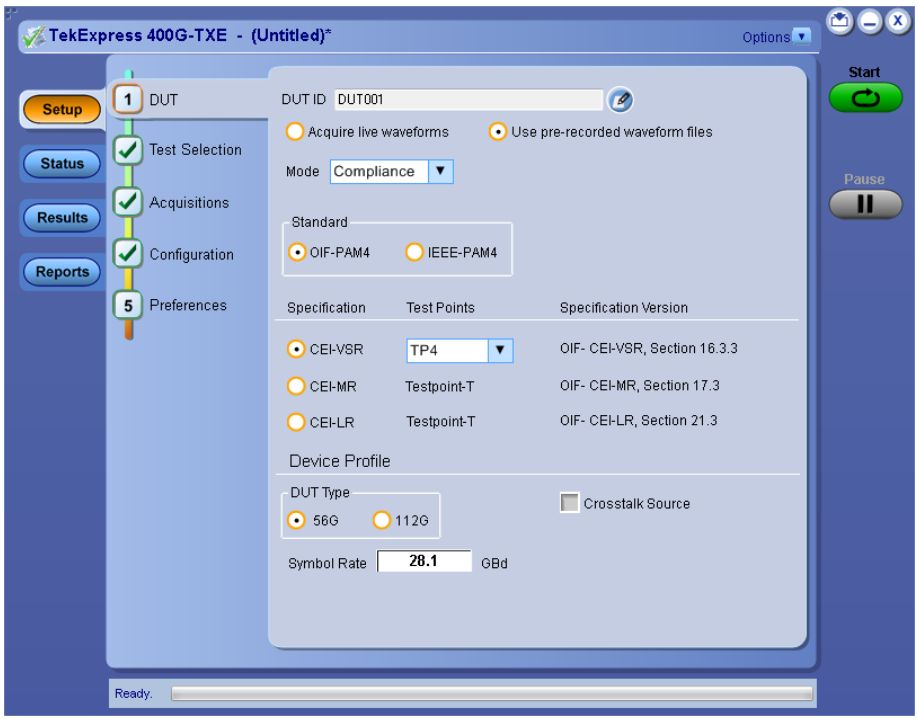
See also *View test-related files*

Application directories

Operating basics

Launch the application

To launch the TekExpress 400G-TXE solution, select **Analyze > TekExpress 400G-TXE** from the TekScope menu.



When you launch the application for the first time, the file C:\Users\<username>\Documents\My TekExpress\400G-TXE\Resources.xml is mapped to drive X:. This file contains information about available network-connected instruments. The session files are stored in X:\400G-TXE\. If this file is not found, then the application runs Instrument Discovery Program to detect the network-connected instruments before launching 400G-TXE solution.

If the application is behind the oscilloscope application, click **Analyze > TekExpress 400G-TXE** to bring it to the front. To keep the 400G-TXE application window on top, select **Keep On Top** from the 400G-TXE *Options menu*.

See also: *Application controls*

Application panel overview

Application panels overview

TekExpress 400G-TXE solution uses panels to group Configuration, Results, and Reports settings. Click any button to open the associated panel. A panel may have one or more tabs that list the selections available in that panel. Controls in a tab can change depending on settings made in the same tab or another tab.

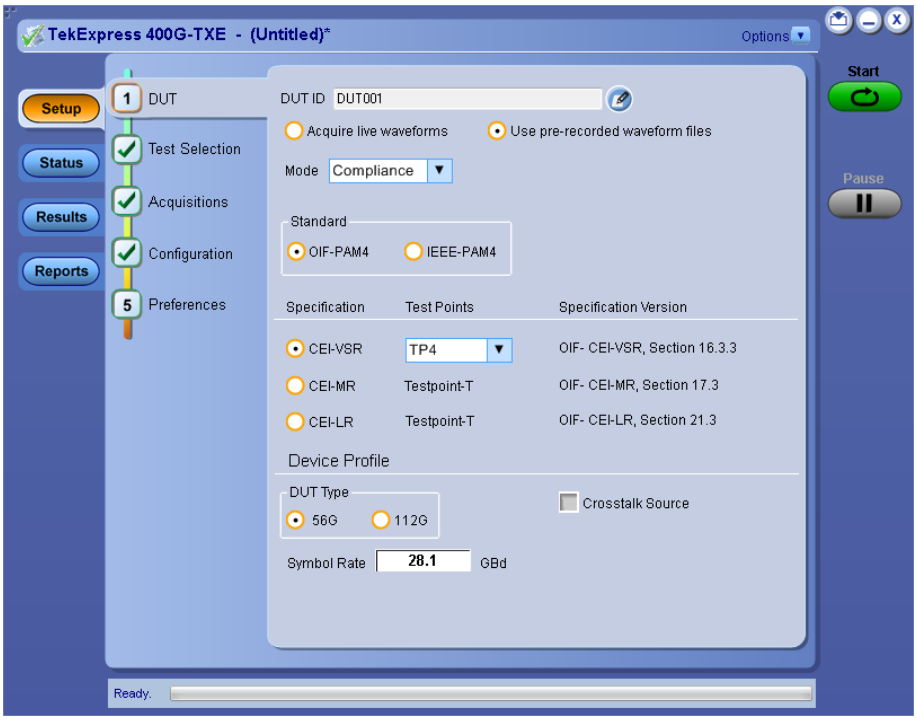


Table 6: Application panels overview

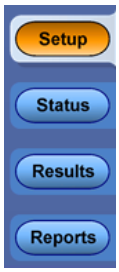
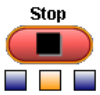
Panel Name	Purpose
Setup panel	To select the test setup controls which are grouped in tabs. The controls in a tab can change depending on settings made in the same tab or another tab. Click the **Setup** button to open this panel. Use this panel to: ■ *Set the DUT parameters* ■ *Select the tests* ■ *Set the acquisition parameters* ■ *Set the configuration parameters* ■ *Set the preferences parameters*
Status panel	This panel displays the acquisition status and analysis status for the selected tests in Test Status and logs in Log View.
Results panel	This tab displays the summary of test results and select result viewing preferences.
Reports panel	Browse for reports, save reports as specific file types, specify report naming conventions, replace current test results in the report with the test result(s) of previous run in current session, select report content to include (summary information, detailed information, user comments, setup configuration, application configuration), and select report viewing options.

See also: *Application controls*

Global application controls

Application controls

Table 7: Application controls descriptions

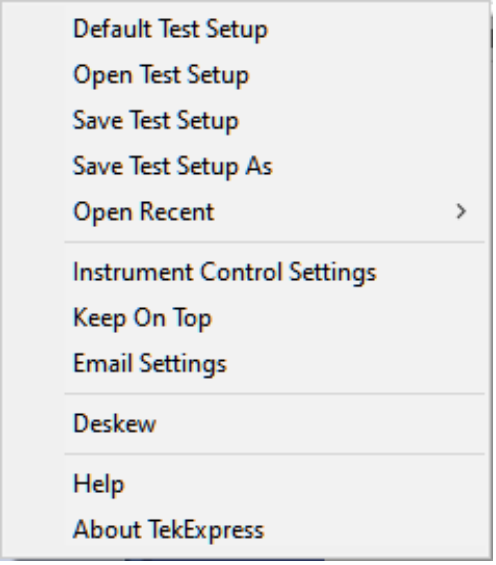
Item	Description
Options menu 	Menu to display global application controls
Panel buttons 	Controls that open panels for configuring test settings and options.
Start/Stop button  	Use the Start button to start the test run of the measurements in the selected order. If prior acquired measurements have not been cleared, the new measurements are added to the existing set. The button toggles to the Stop mode while tests are running. Use the Stop button to abort the test.
Pause \ Continue button  	Use the Pause button to temporarily interrupt the current acquisition. When a test is paused, the button name changes to “Continue.”

Item	Description
Clear button 	Use the Clear button to clear all existing measurement results. Adding or deleting a measurement, or changing a configuration parameter of an existing measurement also clears measurements. This is to prevent the accumulation of measurement statistics or sets of statistics that are not coherent. This button is available only on the *Results panel*.
Minimize button 	Minimizes the application.
Close button 	Exits the application.
Application window move	Place the cursor over the application window and drag it to the desired location.
Mini view / Normal view  	Toggles the application between mini view and normal view. Mini view displays the run messages with the time stamp, progress bar, Start / Stop button, and Pause / Continue button. The application moves to mini view when you click the Start button. 

Options menu overview

To access Options menu, click ▼ in the upper-right corner of the application. It has the following:

Options menu



Menu	Function
Default Test Setup	Opens an untitled test setup with defaults selected Acquire Live Waveforms **Mode**: Compliance **Standard**: OIF-PAM4 **Specification**: CEI-VSR **Test Point**: TP0a **Specification**: OIF-CEI-VSR, Section 16.B.1.1 **DUT Type**: 56G **Symbol rate**: 28.1 GBd
Open Test Setup	Opens a saved test setup
Save Test Setup	Saves the current test setup
Save Test Setup As	Saves the current test setup with a different file name or file type
Open Recent	Displays the recently opened test setups to open
Instrument Control Settings	Detects, lists, and refreshes the connected instruments found on specified connections (LAN, GPIB, USB, and so on)
Keep On Top	Keeps the TekExpress 400G-TXE application on top of all the application
Email Settings	Use to configure email options for test run and results notifications
Deskew	Use to set deskew parameter and read the deskew/attenuation values of the instrument.

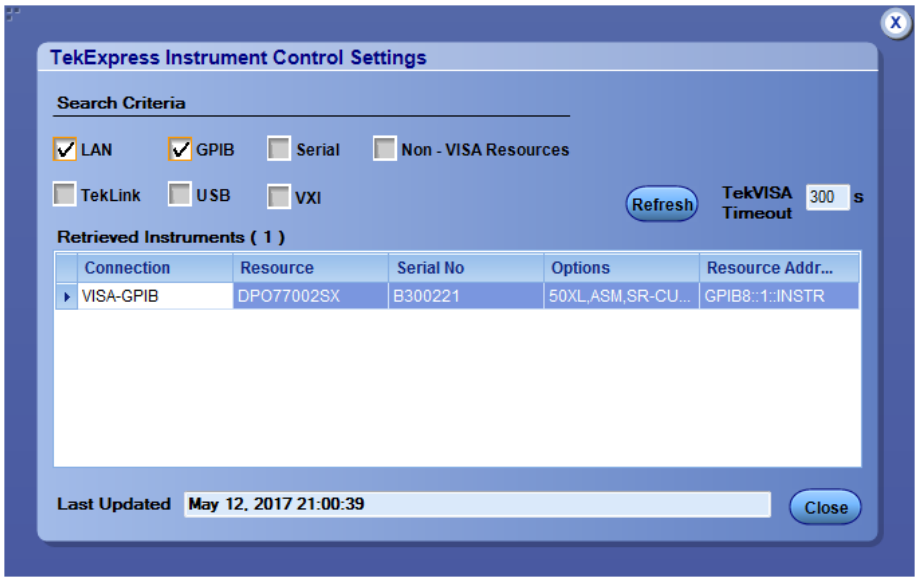
Menu	Function
Help	Displays the TekExpress 400G-TXE help
About TekExpress	■ Displays application details such as software name, version number, and copyright ■ Provides a link to the end-user license agreement ■ Provides a link to the Tektronix Web site

See also:. *Application controls*

TekExpress instrument control settings

Use TekExpress Instrument Control Settings dialog box to search the instruments (resources) connected to the application. You can use the Search Criteria to search the connected instruments depending on the connection type. The details of the connected instrument is displayed in the Retrieved Instruments window.

You can access this dialog box from the **Options** menu.



The connected instruments displayed here can be selected under global settings in the configuration tab.

NOTE. *Select GPIB (Default) when using TekExpress 400G-TXE application.*

See also:. *Options menu overview*

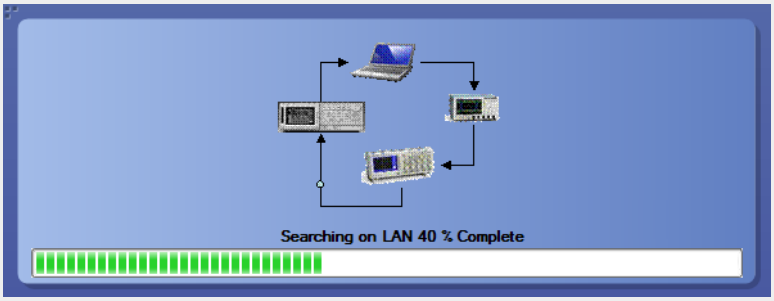
View connected instruments

Use the Instrument Control Settings dialog box to view or search for connected instruments required for the tests. This application uses TekVISA to discover the connected instruments.

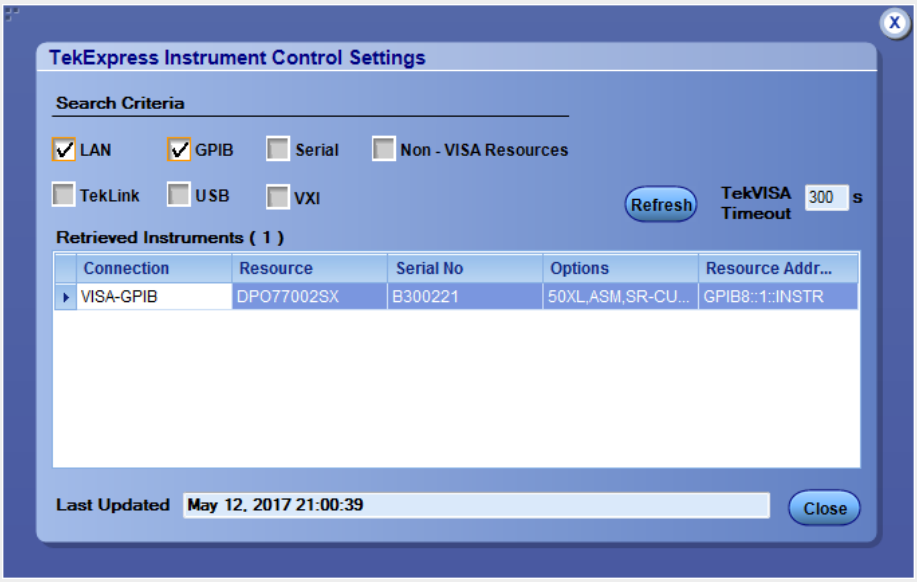
To refresh the list of connected instruments:

1. From the Options menu, select **Instrument Control Settings**.
2. In the Search Criteria section of the Instrument Control Settings dialog box, select the connection types of the instruments for which to search.

   Instrument search is based on the VISA layer, but different connections determine the resource type, such as LAN, GPIB, and USB. For example, if you choose LAN, the search will include all the instruments supported by TekExpress that are communicating over the LAN. If the search does not find any instruments that match a selected resource type, a message appears telling you that no such instruments were found.
3. Click **Refresh**. *TekExpress searches for connected instruments.*



4. After discovery, the dialog box lists the instrument-related details based on the search criteria you selected. For example, if you selected LAN and GPIB as the search criteria, the application checks for the availability of instruments over LAN, then GPIB.



The details of the instruments are displayed in the Retrieved Instruments table. The time and date of instrument refresh is displayed in the Last Updated field.

See also:. *Configuration test parameters*

Equipment connection DIAGRAM

Configure email settings

To be notified by email when a test completes, fails, or produces an error, configure the email settings.

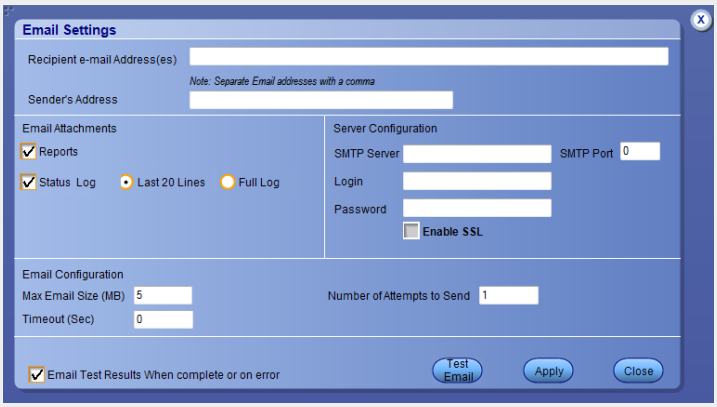
1. Click **Options > Email Settings** to open the Email Settings dialog box.
2. (Required) For Recipient email Address(es), enter one or more email addresses to which to send the test notification. To include multiple addresses, separate the addresses with commas.
3. (Required) For Sender's Address, enter the email address used by the instrument. This address consists of the instrument name followed by an underscore followed by the instrument serial number, then the @ symbol and the email server used. For example: DPO72016C_B130099@yourcompany.com.
4. (Required) In the Server Configuration section, type the SMTP Server address of the Mail server configured at the client location, and the SMTP Port number, in the corresponding fields.

   Enter a valid login name and password in the corresponding fields. Select **Enable SSL**, if the server requires SSL/TLS technology.

   NOTE. *If any of the above required fields are left blank, the settings will not be saved and email notifications will not be sent.*

5. In the Email Attachments section, select from the following options:
   - **Reports**: Select to receive the test report with the notification email.
   - **Status Log**: Select to receive the test status log with the notification email. If you select this option, then also select whether you want to receive the full log or just the last 20 lines.
6. In the Email Configuration section:
   - Select the message file format to send: HTML (the default) or plain text.
   - Enter a maximum file size for the email message. Messages with attachments larger than this limit will not be sent. The default is 5 MB.
   - Enter the number in the Number of Attempts to Send field, to limit the number of attempts that the system makes to send a notification. The default is 1. You can also specify a timeout period.
7. Select the **Email Test Results When complete or on error** check box. Use this check box to quickly enable or disable email notifications.
8. To test your email settings, click **Test Email**.
9. To apply your settings, click **Apply**.
10. Click **Close** when finished.

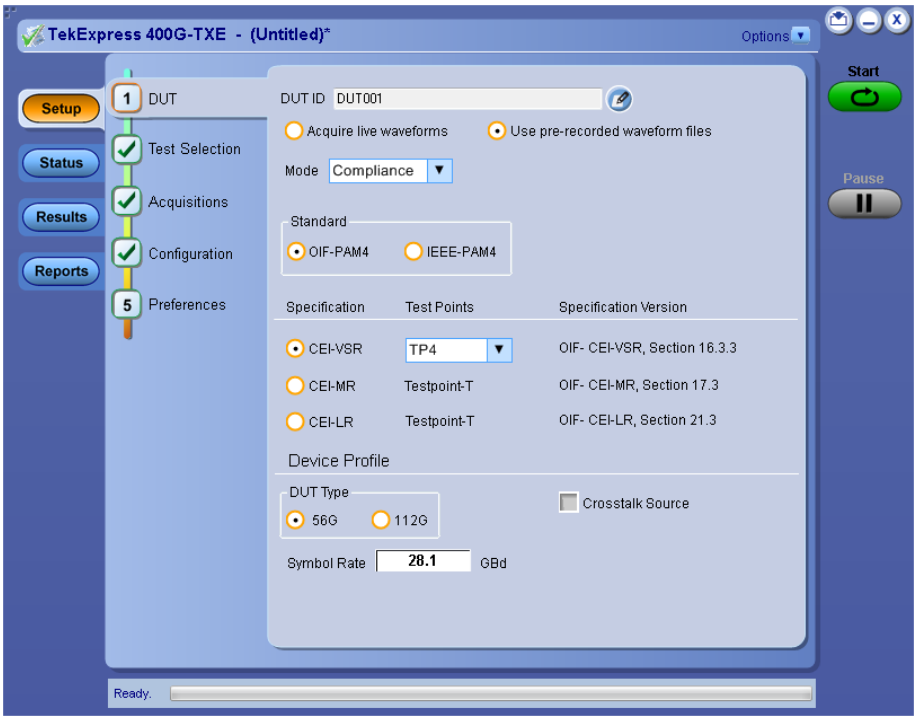
Email settings



Setup panel

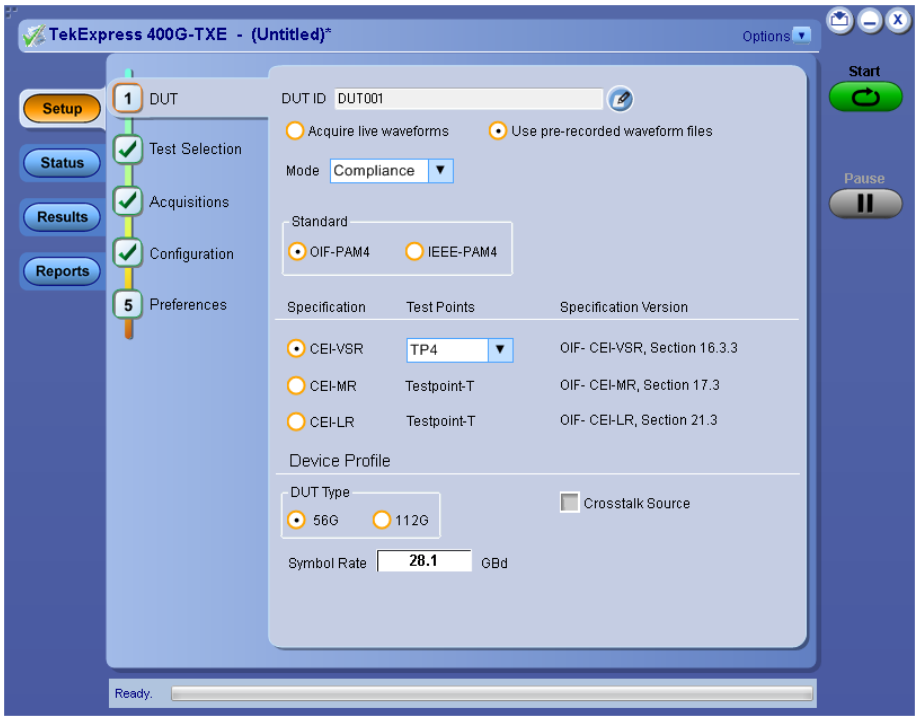
Setup panel overview

The Setup panel contains sequentially ordered tabs that help you guide through the test setup and execution process.



Set DUT parameters

Use the DUT tab to select parameters for the device under test. These settings are global and apply to all tests of current session. DUT settings also affect the list of available tests in the Test Selection tab.



Click **Setup > DUT** to access the DUT parameters:

Table 8: DUT tab settings

Setting	Description
DUT ID	Adds an optional text label for the DUT to reports. The default value is DUT001. The maximum number of characters is 32. You cannot use the following characters in an ID name: (.,..,..., \,/:?"<>|*)
Comments icon (to the right of the DUT ID field)	Opens Comments dialog box to enter text to add to the report. Maximum size is 256 characters. To enable or disable comments appearing on the test report, see *Select report options*.
Acquire live waveforms	Acquire active signals from the DUT for measurement and analysis.
Use pre-recorded waveform files	Run tests on a saved waveform. Select **Options** > **Open Test Setup** to recall a saved test setup.
Mode	■ Compliance ■ User Defined

Setting	Description
Standard	■ OIF-PAM4 ■ IEEE-PAM4
Specification	For OIF-PAM4 standard ■ CEI-VSR ■ CEI-MR ■ CEI-LR For IEEE-PAM4 standard ■ AUI4 ■ CR4 ■ KR4
Test Points	Select the test points from the drop-down list. The options available depends on the Specification selected. For CEI-VSR and AUI4, the test points are TP0a, TP1a, TP4. For CEI-MR and CEI-LR, the test point is Testpoint-T. For CR4, the test point is Testpoint-TP2. For KR4, the test point is Testpoint-TP0a.
Specification Version	Displays the specification version for the selected Specification and Test Points.
Device Profile	
DUT Type	Select the DUT type
Symbol Rate	Set the symbol rate to be tested.
Crosstalk Source	Select crosstalk source when a cross talk generator is connected. This is applicable for eye measurements only.

See also:. *Select tests*

Select tests

Use the Test Selection tab to select the tests. The test measurements available depend on the standards selected in the DUT tab.

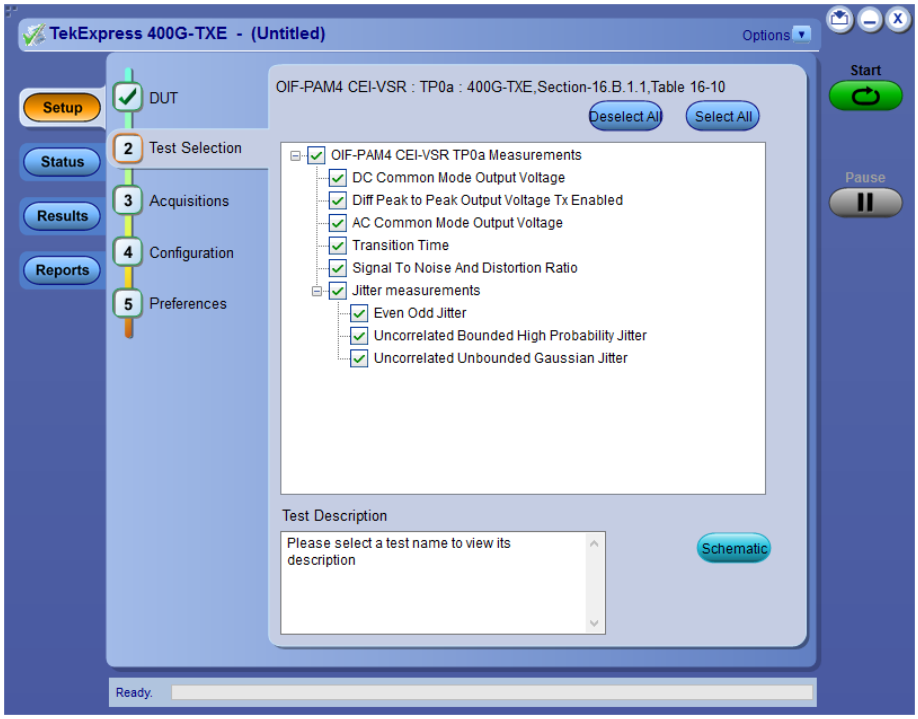


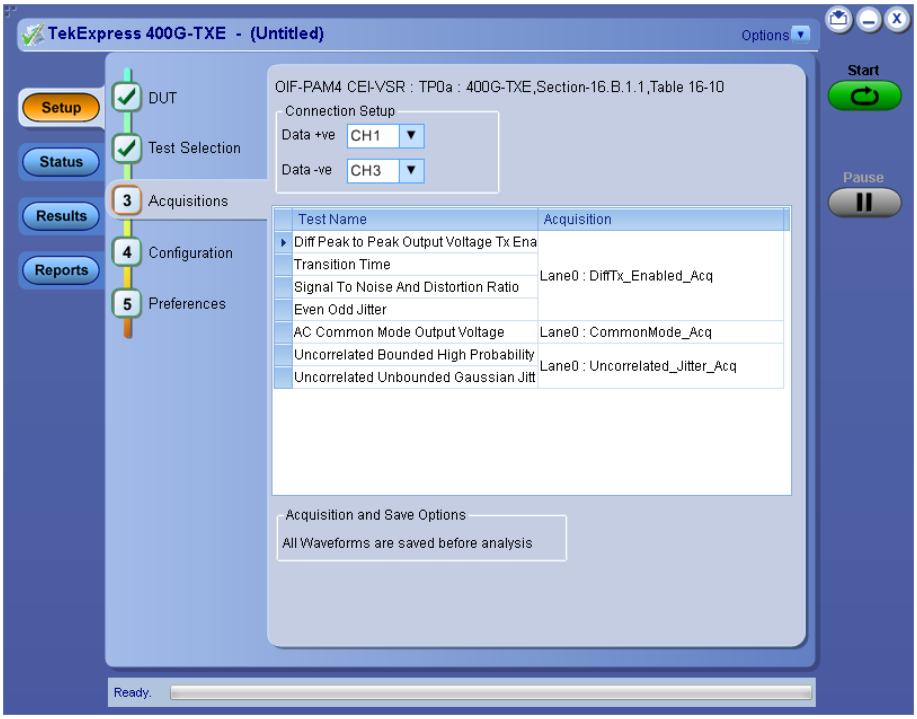
Table 9: Test Selection tab settings

Setting	Description
Tests	Select or clear a test. Highlight a test to show details in the Test Description pane.
Test Description	Shows brief description of the highlighted test in the Test field.
Deselect All	Click to clear all tests.
Select All	Click to select all tests. All tests are selected by default.
Schematic	Click to display the schematic diagram of the DUT test setup for the selected test. Use the diagram to verify the test setup before running the test.

See also:. *Set acquisition tab parameters*

Set acquisition tab parameters

Use the Acquisitions tab to view the test acquisition parameters. The contents displayed on this tab depends on the DUT type and tests selected.



NOTE. *400G-TXE application acquires all waveforms needed by each test before performing the analysis.*

Table 10: Acquisitions tab settings

Setting	Description
Connection Setup	
Data +ve [1]	Select the source channel for data positive.
Data -ve [1]	Select the source channel for data negative.

TekExpress 400G-TXE saves all acquisition waveforms to files by default. The waveforms are saved in a unique folder for each session (a session is started when you click the Start button). The folder path is X:\400G-TXE\Untitled Session\<dutid>\<date>_<time>. The images created for each analysis, CSV files with result values, reports, and other information specific to that particular execution are also saved in this folder.

[1] The data sources must be either ATI or non-ATI channels.

Saving a session moves the session file contents from the Untitled Session folder to the specified folder name, and changes the session name to the specified name.

Set configuration tab parameters

Use Configuration tab to configure the Global Settings and test measurement configurations. The Global Settings and the measurements with configurations available in this tab depend on the Standards selected in the DUT tab.

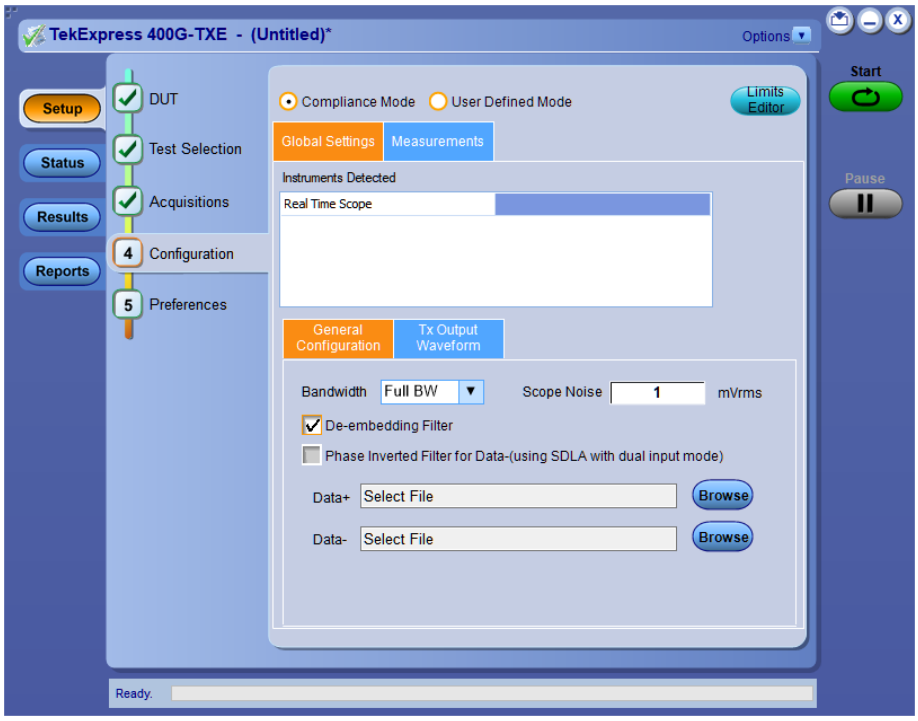
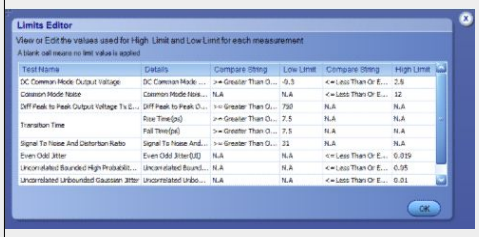


Table 11: Configuration tab settings

Setting	Description
Compliance Mode	Select compliance mode. By default, Compliance Mode is selected.
User Defined Mode	Select user defined mode

Setting	Description
Limits Editor	Shows the upper and lower limits for the applicable measurement using different types of comparisons. Limit names for CEI-VSR 56G and 112G are appended with "_56G" and "_112G" respectively. In Compliance Mode, use the Limits Editor to view the measurement high and low limits used for selected tests. In User Defined Mode, use the Limits Editor to edit the limit settings.  To edit a value, click that field and either select from the displayed list or enter a new value. Use the bottom scroll bar to view all available fields.
Global Settings	
Instruments Detected	Displays the instruments connected to this application. Click the instrument name to open a list of available (detected) instruments. Select **Options** > **Instrument Control Settings** and click Refresh to update the instrument list. ***NOTE.*** *Verify that the* ***GPIB*** *search criteria (default) is selected in the Instrument Control Settings.*
General Configuration	
De-embedding Filter	Select to apply the de-embedding filter file for Data Positive and Data Negative.
Phase Inverted Filter for Data- (using SDLA with dual input mode)	Select this option if the filter is created from SDLA using Dual input option. The negative channel filter must be phase inverted when you select this option.
Data+	Click **Browse** and select the de-embedding filter file (.flt) for data positive signal.
Data-	Click **Browse** and select the de-embedding filter file (.flt) for data negative signal.
Bandwidth	Select the bandwidth limit for the oscilloscope.
Scope Noise	Enter the scope noise in mV. Scope noise the standard deviation of the noise of the oscilloscope. Scope noise is important for many of the electrical measurements. To ensure accurate measurement results, measure the scope noise manually and set the compensation value in the TekExpress. For more information on how to measure and apply scope noise, please refer *PAM4 Analysis tool* help document.
Tx Output Waveform	
Samples per Symbol (M)	Select the number of samples per symbol for calculating the Tx out waveform parameters. If the acquired signal has less samples than specified, re-sampling is done to achieve the required samples per symbol. By default it is 32.
Linear Pulse Length (Np)	Select the linear fit pulse curve length in Unit intervals (UI). It is recommended to use higher value for better accuracy. The analysis time is more when you select higher value.
Linear Pulse Delay (Dp)	Select the delay of the linear fit pulse.
Eye Configuration	

Setting	Description

CTLE Filter File	Select the CTLE Filter File.
	Compliance mode
	■ All: Application will run through the CTLE filters.
	■ For TP1a: CTLE filters from 1 dB - 9dB in steps of 0.5 dB
	■ For TP4: For Near End, 1 dB, 1.5 dB, and 2 dB CTLE filters and for Far End, CTLE filters from 1 dB - 9 dB in steps of 0.5 dB
	■ Best CTLE: After the first run, if the eye measurements are passed, best CTLE filter option gets enabled. User can run the measurement with the Best CLTE instead of looping through all CTLE filters in the specification.
	NOTE. *For 112G, CTLE filters from 1 dB - 13 dB in steps of 1 dB*
	User Defined mode
	■ User can run the measurement with any specified CTLE filter. The application provides CTLE filters from 1 dB - 9 dB.
	Select the CTLE filters from the drop-down list or Custom to browse and select the custom CTLE filter files. Custom CTLE filters (CSV) must contain the following data, delimited by comma:
	CTLE peaking (dB): 1 to 9
	Gain: 0.05 to 2
	Poles and Zeros: 0.5 to 80
	Example:
	`//dB,gain,pole1,pole2,pole3,zero1,zero2`
	`1,0.8913,18.6,14.1,1.2,8.359,1.2`

Target BER (1e-)	Select the Target BER (1e-). As per the compliance, Target BER should be set to 1e-5 and 1e-6 for IEEE and OIF standards respectively. If the Target BER is set to higher values, more time is required to analyse the data. You can select BER of 1e-5 for quicker analysis.
Mask Width	Select the mask width in Unit intervals (UI). This configuration is for Eye symmetry mask width measurement only.

Set preferences tab parameters

Use the Preferences tab to set the application action on completion of a measurement.

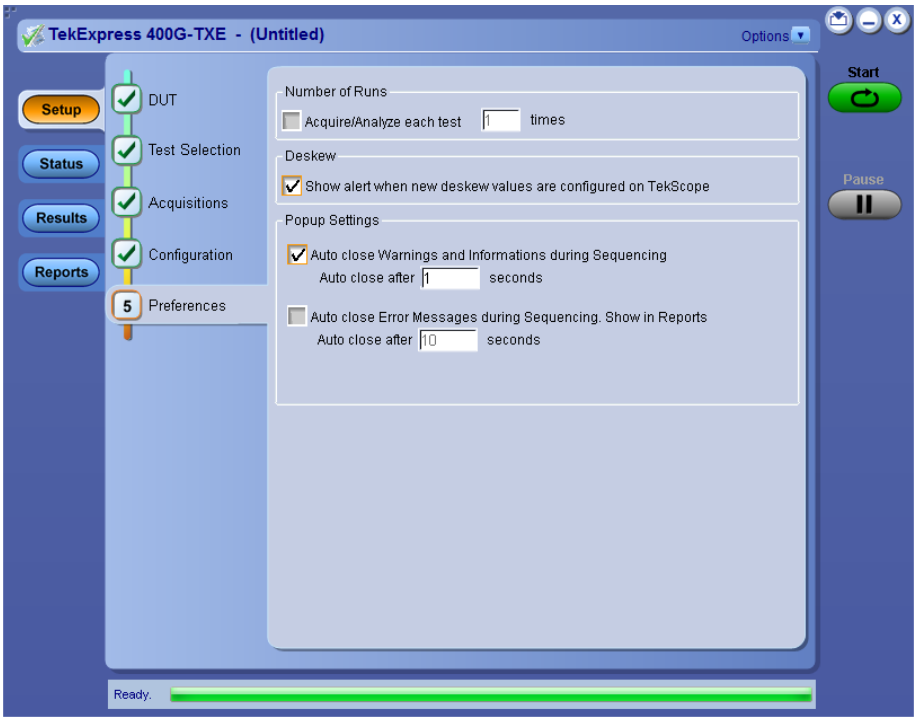


Table 12: Preferences tab settings

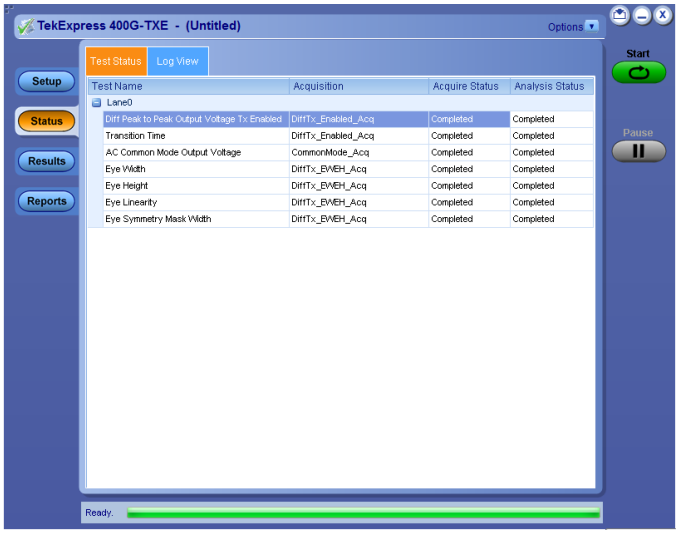
Setting	Description
Number of Runs	
Acquire/Analyze each test <n> times (not applicable to Custom Tests)	Select to repeat the test run by setting the number of times. By default, it is selected with 1 run.
Deskew	
Show alert when new deskew values are configured on TekScope	Select to get notification when the deskew values are modified in TekScope.
Popup Settings	
Auto close Warnings and Informations during Sequencing Auto close after <n> Seconds	Select to auto close warnings/informations during sequencing. Set the Auto close time. By default it is not selected.
Auto close Error Messages during Sequencing. Show in Reports Auto close after <n> Seconds	Select to auto close Error Messages during Sequencing. Set the Auto close time. By default it is not selected.

Status panel

Status panel overview

The Status panel accesses the Test Status and Log View tabs, which provide status on test acquisition and analysis (Test Status tab) and a listing of test tasks performed (Log View tab). The application opens the Test Status tab when you start a test run. You can select the Test Status or the Log View tab to view these items while the tests are running.

Test status view



Log view

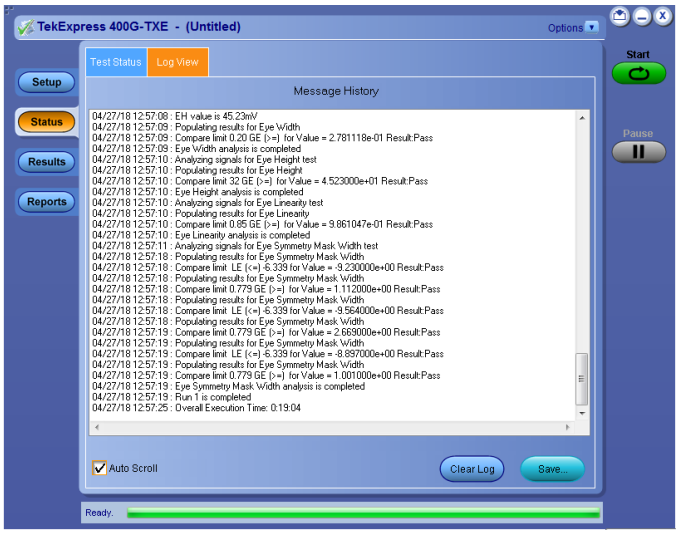


Table 13: Status panel Log View controls

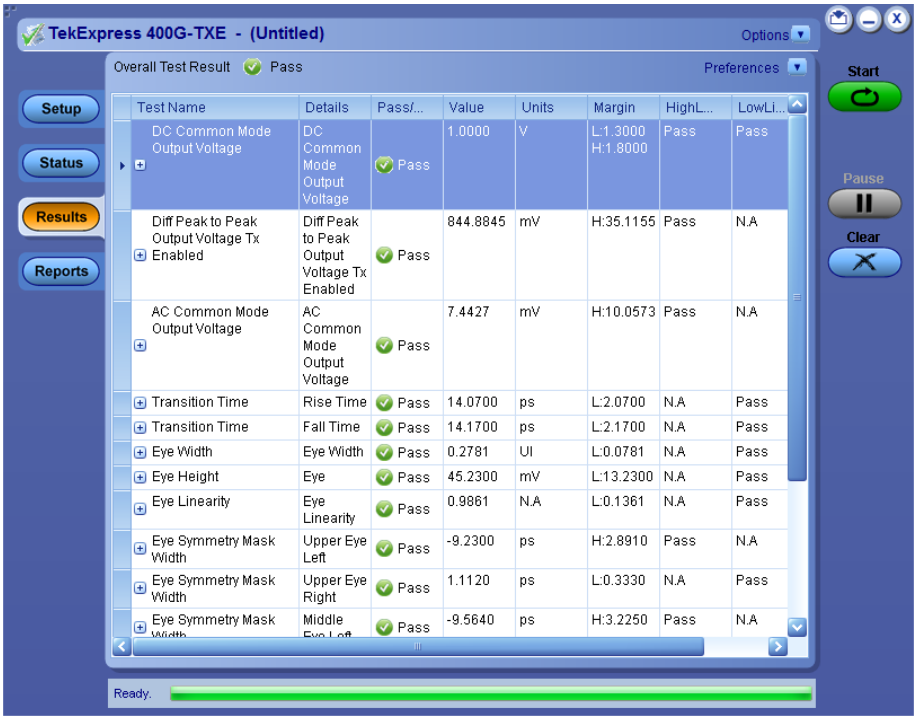
Control	Description
Message History	Lists all executed test operations and timestamp information.
Auto Scroll	Enables automatic scrolling of the log view as information is added to the log during the test.
Clear Log	Clears all messages from the log view.
Save	Saves the log file to a text file. Use the standard Save File window to navigate to and specify the folder and file name to which to save the log text.

See also:. *Application panel overview*

Results panel

Results panel overview

When a test execution is complete, the application automatically opens the **Results** panel to display a summary of test results.



See also:. *View a report*

Application panels overview

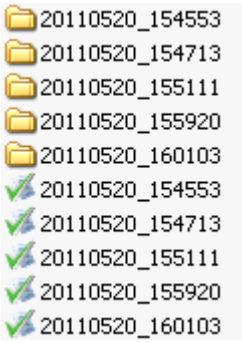
View test-related files

Files related to tests are stored in C:\Users\<username>\Documents\My TekExpress\400G-TXE\. Each test setup in this folder has a test setup *file* and a test setup *folder*, both with the test setup name.

The test setup file is preceded by the TekExpress icon and usually has no visible file name extension.

Inside the test setup folder is another folder named for the DUT ID used in the test sessions. The default is DUT001.

Inside the DUT001 folder are the session folders and files. Each session also has a folder and file pair, both named for the test session using the naming convention (date)_(time). Each session file is stored outside its matching session folder:



Each session folder contains image files of any plots generated from running the test session. If you selected to save all waveforms or ran tests using prerecorded waveform files, these are included here.

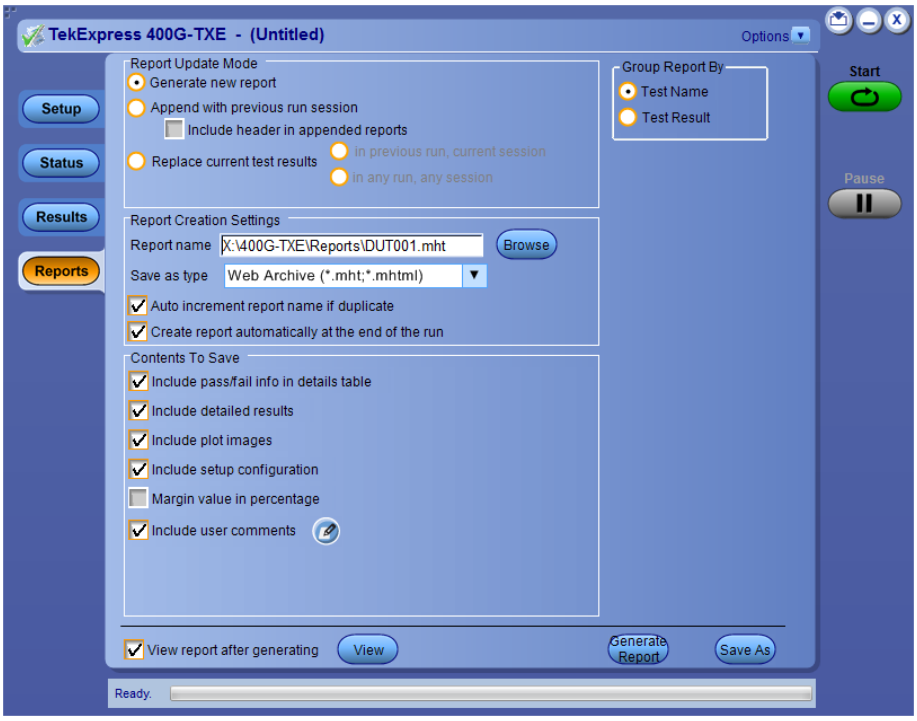
The first time you run a new, unsaved session, the session files are stored in the Untitled Session folder located at ..\My TekExpress\400G-TXE\. When you name and save the session, the files are placed in a folder with the name that you specify. A copy of the test files stay in the Untitled Session folder until you run a new test or until you close the 400G-TXE application.

See also:. *File name extensions*

Reports panel

Reports panel overview

Use the Reports panel to browse for reports, to name and save reports, select test content to include in reports, and to select report viewing options.



For information on setting up reports, see *Select report options*. For information on viewing reports, see *View a report*.

See also:. *Applications panel overview*

Select report options

Click the Reports panel to select the test result information to be included in the report, and the naming conventions to use for the report. For example, always give the report a unique name or select to have the same name incremented each time you run a particular test.

Select the report options before running a test or when creating and saving test setups. Report settings are included in saved test setups.

In the Reports panel, select from the following report options:

Table 14: Report options

Setting		Description
Report Update Mode		
Generate new report		Creates a new report. The report can be in either .mht, .pdf, or .csv file format.
Append with previous run session		Appends the latest test results to the end of the current test results report.
Include header in appended reports		Select to include header in appended reports
Replace current test results	In previous run, current session	Select to replace current test results in the report with the test result(s) of previous run in current session.
	In any run, any session	Select to replace current test results in the report with the test result(s) in selected run session's report. Click  and select the test result of any other run session from another setup.
Report Creation Settings		
Report name		Displays the name and location from which to open a 400G-TXE report. The default location is at *\My TekExpress\400G-TXE\Untitled Session*. The report file in this folder gets overwritten each time you run a test unless you specify a unique name or select to auto increment the report name. Change the report name or location. Do one of the following: ■ In the Report Path field, type over the current folder path and name. ■ Double-click in the Report Path field and then make selections from the pop-up keyboard and click the **Enter** button. Be sure to include the entire folder path, the file name, and the file extension. For example: C:\Users\<username>\Documents\My TekExpress\400G-TXE\DUT001.mht. ***NOTE.*** *You cannot set the file location using the Browse button.* Open an existing report. Click **Browse**, locate and select the report file, and then click **View** at the bottom of the panel.

Setting	Description
Save as type	Saves a report in the specified file type, selected from the drop-down list. ***NOTE.*** *If you select a file type different from the default, be sure to change the report file name extension in the Report Name field to match.*
Auto increment report name if duplicate	Sets the application to automatically increment the name of the report file if the application finds a file with the same name as the one being generated. For example: DUT001, DUT002, DUT003. This option is enabled by default.
Create report automatically at the end of the run	Creates report at the end of the run.
Contents To Save	
Include pass/fail info in details table	Includes pass/fail info in the details table of the report.
Include detailed results	Includes detailed results in the report.
Include plot images	Includes plot images in the report.
Include setup configuration	Select to include hardware and software information in the summary box, at the top of the report. Information includes oscilloscope model and serial number, oscilloscope firmware version, and software versions for the applications used in the measurements.
Margin value in percentage	Select to include the margin value in percentage in the report.
Include user comments	Select to include any comments about the test that you or another user added in the DUT tab of the Setup panel. Comments appear in the Comments section, under the summary box at the beginning of each report.
Group Report By	
Test Name	Select to group the tests in the report by test name.
Test Result	Select to group the tests in the report by test results.
View report after generating	Automatically opens the report in default Web browser, when the test execution is complete. This option is selected by default.
View	Click to view the most current report.
Generate Report	Generates a new report based on the current analysis results.
Save As	Specify a name for the report.

View a report

The application automatically generates a report when the test execution is complete and displays the report in your default Web browser (unless you had cleared the **View Report After Generating** check box in the Reports panel before running the test). If you cleared this check box, or to view a different test report, do the following:

1. Click the **Reports** button.
2. Click the **Browse** button and locate and select the report file to view.
3. In the Reports panel, click **View**.

For information on changing the file type, file name, and other report options, see *Select report options*.

Report contents

A report shows detailed results and plots, as set in the Reports panel.

Tektronix

TekExpress 400G-TXE

Test Report OIF-PAM4 CEI-VSR (TP1a)

Setup Information			
DUT ID	DUT001	Master Scope Information	DPO77002SX, B300159
Date/Time	2019-12-19 03:18:30	Master Scope F/W Version	10.11.0 Build 9
TekExpress 400G-TXE Version	10.1.0.153	Master Scope SPC Status	PASS
TekExpress Framework Version	4.13.0.1	Extension-1 Scope Information	DPO77002SX, B300140
Specification Version	OIF- CEI-VSR, Section 16.3.2	Extension-1 Scope F/W Version	10.11.0 Build 9
Compliance Mode	True	Extension-1 Scope SPC Status	PASS
Execution Mode	Live	Bandwidth	Full BW
Symbol Rate(Actual)	26.5625GBd	PAM4 version	10.7.0.8
Symbol Rate(Configured)	28.1GBd	DPOJET Version	10.1.0.6
Overall Test Result	Pass	Pattern Length	8191
Overall Execution Time	0:19:37		
DUT COMMENT:	400G-TXE CEI-VSR (TP1a)		

Test Name Summary Table	
DC Common Mode Output Voltage	Pass
AC Common Mode Output Voltage	Pass
Transition Time	Pass
Eye Width	Pass
Eye Height	Pass
Eye Linearity	Pass
Eye Symmetry Mask Width	Pass

DC Common Mode Output Voltage

Measurement Details	Iteration	Measured Value	Test Result	Margin	Low Limit	High Limit	Units	Comments
DC Common Mode Output Voltage	1	1.0000	Pass	L:1.3000 H:1.8000	-0.3	2.8	V	N.A
COMMENTS	DC Common Mode Output Voltage is measured using multimeter							

Back to Summary Table

Setup configuration information

The summary box at the beginning of the report lists setup configuration information. This information includes the oscilloscope model and serial number, electrical module model, and software version numbers of all associated applications.

To exclude this information from a report, clear the **Include Setup Configuration** check box in the Reports panel before running the test.

User comments

If you selected to include comments in the test report, any comments you added in the DUT tab are shown at the top of the report.

See also:. *Results panel overview*

View test-related files

Running tests

Equipment connection setup

Click **Setup** > **Test Selection** > **Schematic** to view the equipment setup diagram(s).

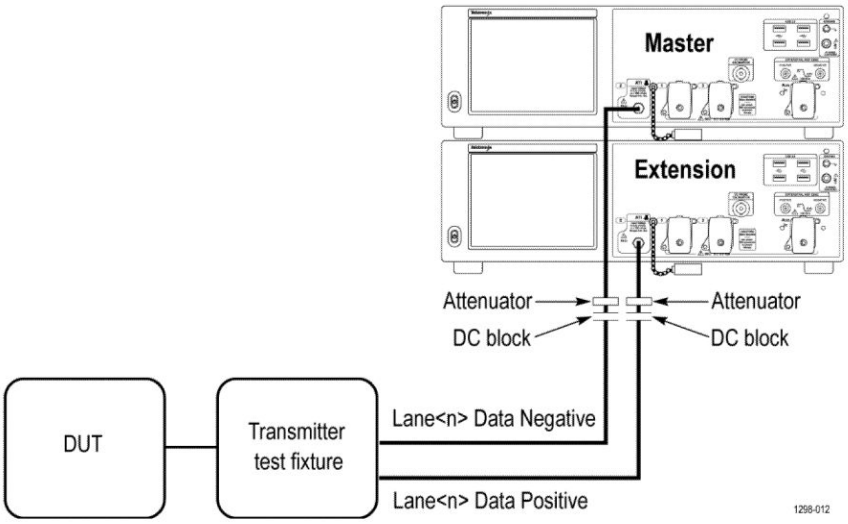


Figure 1: Connection diagram for OIF (CEI-VSR at TP0a, CEI-MR, and CEI-LR) and IEEE (AUI4 at TP0a, CR4, and KR4)

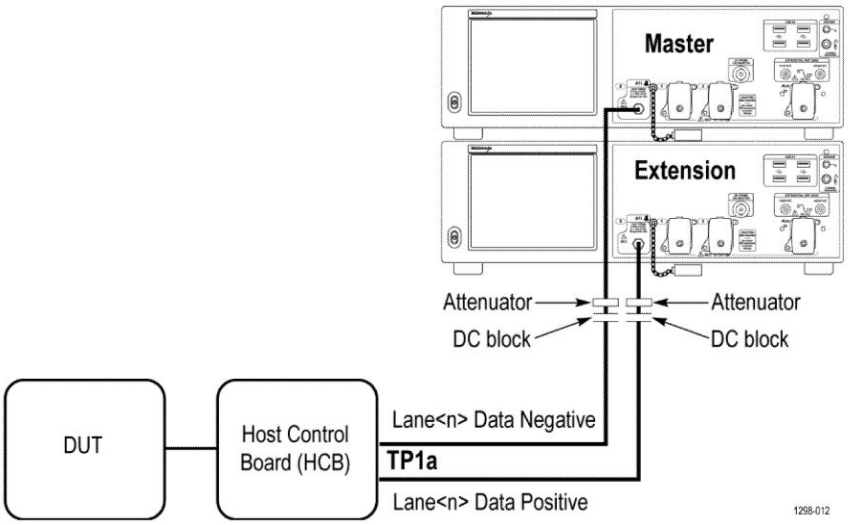


Figure 2: Connection diagram for OIF (CEI-VSR at TP1a) and IEEE (AUI4 at TP1a)

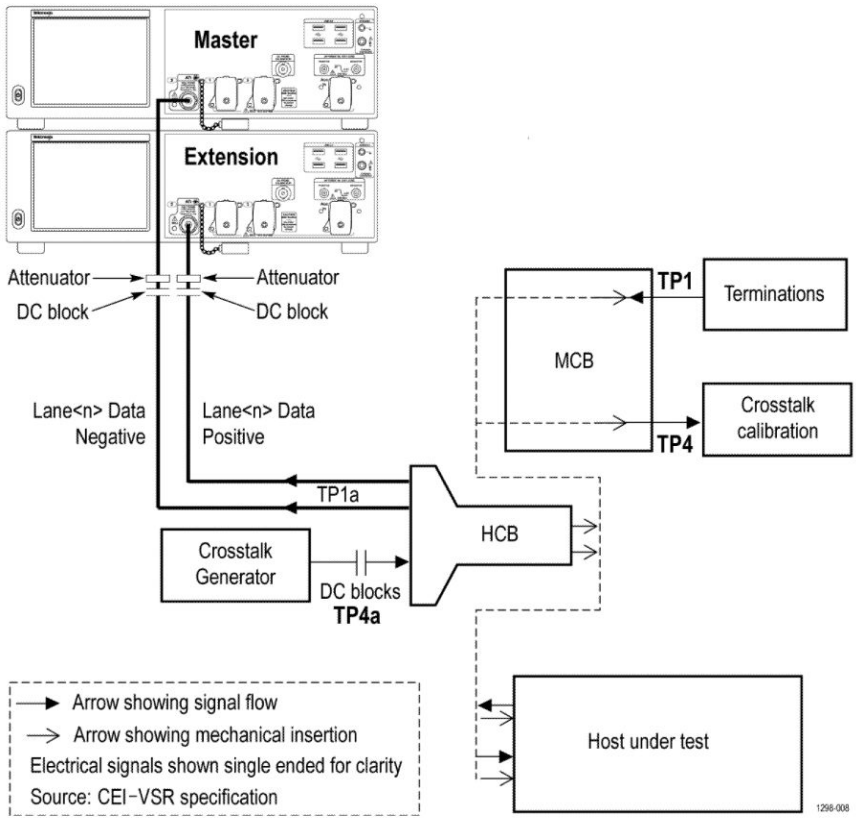


Figure 3: Connection diagram for OIF (CEI-VSR at TP1a) and IEEE (AUI4 at TP1a) for Eye measurements

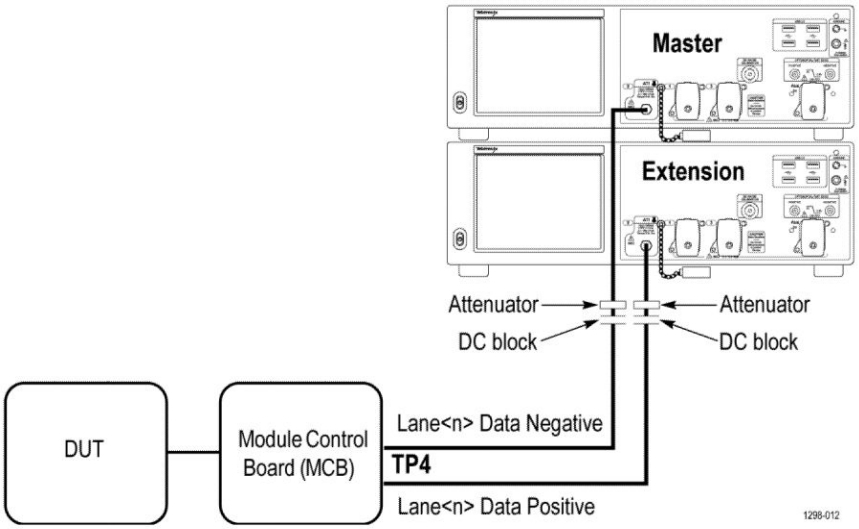


Figure 4: Connection diagram for OIF (CEI-VSR at TP4) and IEEE (AUI4 at TP4)

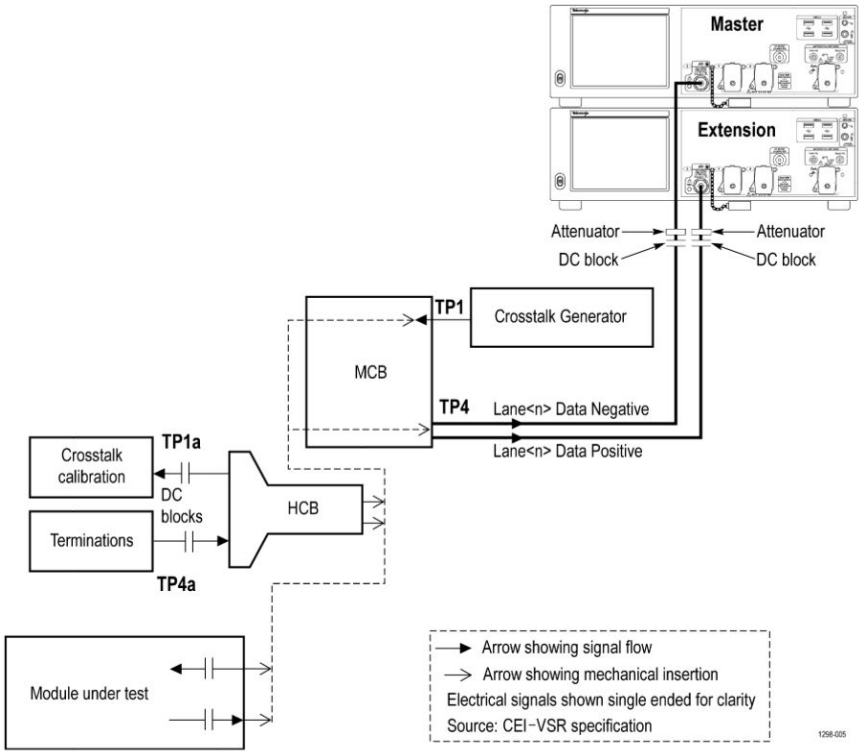


Figure 5: Connection diagram OIF (CEI-VSR at TP4) and IEEE (AUI4 at TP4) for Eye measurements

Prerequisite

Compensate the signal path

Use the following procedure to compensate the internal signal acquisition path. Perform this procedure if the ambient temperature has changed more than 5 °C (9 °F) since you performed the last signal path compensation. Perform the signal path compensation once a week. Failure to do so may result in the instrument not meeting warranted performance levels.

1. Power on and wait for the instrument to complete its warm up period before continuing with this procedure.
2. Disconnect any probes you have connected to the input channels.
3. Set the instrument to Menu mode.
4. Select Instrument Calibration from the Utilities menu.
5. Note any instructions that appear in the resulting control window.
6. Click Run SPC to begin the procedure. The procedure may take several minutes to complete.
7. Verify that the Status changes to Compensated after the procedure is complete. If the Calibration Status field indicates anything other than Compensated, see Signal Path Compensation Status for information on the readout and recommended action.

NOTE. *When making measurements at vertical scale settings less than or equal to 5 mV, you should perform the signal path compensation at least once a week. Failure to do so may result in the instrument not meeting warranted performance levels at those volts/div settings.*

Deskew

If skew is present between positive and negative channels, then the channels need to be deskewed before being used for waveform measurements. TekExpress 400G-TXE provides support for channel deskew and attenuation using the following method:

1. Determine what the skew is for each channel.
2. From the TekScope menu, select Vertical > Deskew.
3. In the Deskew/Attenuation window, click the channel (1 – 4) button for the first channel to be deskewed.
4. Click in the Ch(x) Deskew Time entry field and enter the skew. The skew can be +ve or –ve.
5. Click the channel button for the next channel and repeat step 4.
6. After entering the skew for all the channels that require it, from the Options menu in TekExpress 400G-TXE, select Deskew.

7. In the Deskew dialog box, select the desired level:
   - Less than 100 mV signal amplitude: Select this if the signal amplitude is such that the oscilloscope's vertical setting is less than 100 mV/division.
   - 100 mV or greater signal amplitude: Select this if the signal amplitude is such that the oscilloscope's vertical setting is greater than 100 mV/division.

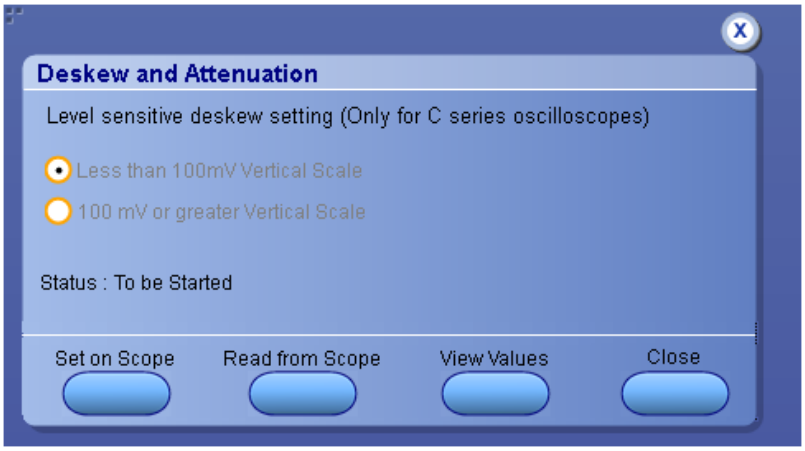
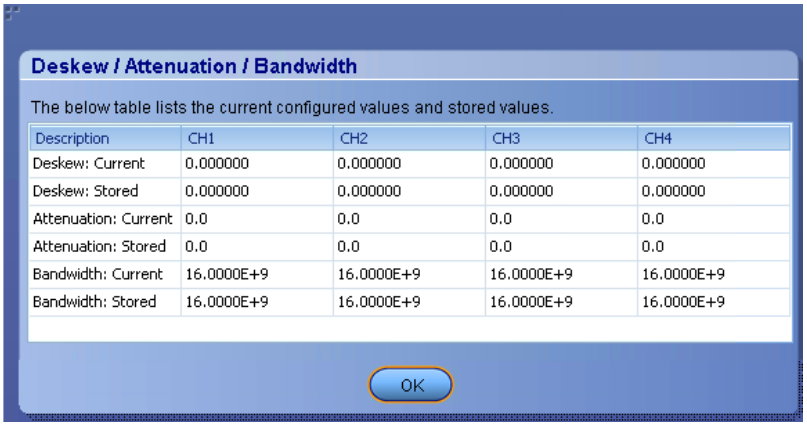


Figure 6: Deskew

8. Click **Set on Scope** to set the stored deskew and attenuation values on oscilloscope.
9. Click **Read from Scope** to read the deskew and attenuation values from the oscilloscope.
10. Click **View values** to view the deskew, attenuation, and bandwidth values.
11. When the status in the dialog box indicates the deskew is finished, click **Close**.



Description	CH1	CH2	CH3	CH4
Deskew: Current	0.000000	0.000000	0.000000	0.000000
Deskew: Stored	0.000000	0.000000	0.000000	0.000000
Attenuation: Current	0.0	0.0	0.0	0.0
Attenuation: Stored	0.0	0.0	0.0	0.0
Bandwidth: Current	16.0000E+9	16.0000E+9	16.0000E+9	16.0000E+9
Bandwidth: Stored	16.0000E+9	16.0000E+9	16.0000E+9	16.0000E+9

Figure 7: Deskew-View values

Each input channel has its own deskew settings. Deskew compensates individual channels for probes or cables of different lengths. The instrument applies the delay values after each completed acquisition. The deskew values are saved as part of the instrument setup. The deskew values for the selected channel are retained until you change the probe, you restore a saved setup, or you recall the factory setup.

NOTE. *If you perform the de-embed settings, then performing the Deskew and Attenuation settings are not required.*

Running tests

Select tests, *set acquisition parameters*, *set configuration parameters*, *set preferences parameters*, and click **Start** to run the tests. While tests are running, you cannot access the Setup or Reports panels. To monitor the test progress, switch between the Status panel and the Results panel.

While the tests are running, other applications may display windows in the background. The TekScope application takes precedence over other applications, but you can switch to other applications by using **Alt + Tab** key combination. To keep the TekExpress 400G-TXE application on top, select **Keep On Top** from the TekExpress Options menu.

The application displays report when the tests execution is complete.

Prerun checklist

1. Make sure that the instruments are warmed up (approximately 20 minutes) and stabilized.
2. Perform compensation: In the oscilloscope main menu, select **Utilities** > **Instrument Compensation**. Click **Help** in the compensation window for steps to perform instrument compensation.

400G-TXE compliance measurements

DC common mode output voltage

This section verifies that the DC common mode output voltage of the DUT is within the conformable limits according to the specification.

Required test equipment

Minimum system requirements

Equipment connection diagram

Standard	Specification	Test Points	Limits	
			Min	Max
OIF-PAM4	OIF-CEI-VSR, Table 16-10	TP0a	-0.3 V	2.8 V
	OIF-CEI-VSR, Table 16-1	TP1a	-0.3 V	2.8 V
	OIF-CEI-VSR, Table 16-4	TP4	-0.35 V	2.85 V
	OIF-CEI-MR, Table 17-2	Testpoint-T	0 V	1.9 V
	OIF-CEI-LR, Table 21-2	Testpoint-T	0 V	1.9 V
IEEE-PAM4	AUI4-IEEE802.3bs, Draft 3.5, Annex 120D.3.1	TP0a	-0.3 V	2.8 V
		TP1a	-0.35 V	2.85 V
		TP4	0 V	1.9 V
	CR4-IEEE802.3cd Draft 3.5, Section 136.9.3	TP2	0 V	1.9 V
	KR4-IEEE802.3cd Draft 3.5, Section 137.9.2	TP0a	0 V	1.9 V

Measurement procedure

Maximum input to be provided to the ATI channels is ≤ 300 mV peak-to-peak. The DC common mode voltage of the signal cannot be measured using ATI channels. Measure the voltage using an external digital multimeter and enter the value in the application.

AC Common Mode Output Voltage

This section verifies that the common mode noise of the DUT is within the conformable limits according to the specification.

Required test equipment

Minimum system requirements

Equipment connection diagram

Standard	Specification	Test Points	Limits	
			Min	Max
OIF-PAM4	OIF-CEI-VSR, Table 16-10	TP0a	NA	12 mV
	OIF-CEI-VSR, Table 16-1	TP1a	NA	17.5 mV
	OIF-CEI-VSR, Table 16-4	TP4	NA	17.5 mV
	OIF-CEI-MR, Table 17-2	Testpoint-T	NA	30 mV
	OIF-CEI-LR, Table 21-2	Testpoint-T	NA	30 mV
IEEE-PAM4	AUI4-IEEE802.3bs, Draft 3.5, Annex 120D.3.1	TP0a	NA	30 mV
		TP1a	NA	17.5 mV
		TP4	NA	17.5 mV
	CR4-IEEE802.3cd Draft 3.5, Section 136.9.3	TP2	NA	30 mV
	KR4-IEEE802.3cd Draft 3.5, Section 137.9.2	TP0a	NA	30 mV

Input

Positive and negative signals from the oscilloscope by setting the bandwidth to 40 GHz

Measurement procedure

The common mode voltage is a measure of the deviation of the common mode signal around the mean value. Find the sum of the positive and negative signals to create the common mode signal and create a vertical histogram on this signal. The RMS value of the vertical histogram is the AC common mode output voltage.

To find the effective common mode voltage after removing the instrumentation noise, use the following formula:

$$\textit{Effective common mode voltage} = \sqrt{(Measured\ value)^2 - (Instrument\ noise)^2}$$

Single-ended output voltage

This section verifies that the single-ended output voltage of the data positive and data negative signals of the DUT is within the conformable limits according to the specification.

Required test equipment

Minimum system requirements

Equipment connection diagram

Standard	Specification	Test Points	Limits	
			Min	Max
OIF-PAM4	OIF-CEI-MR, Table 17-2	Testpoint-T	-0.3 V	1.9 V
	OIF-CEI-LR, Table 21-2	Testpoint-T	-0.3 V	1.9 V
IEEE802.3bs	AUI4-IEEE802.3bs, Draft 3.5, Annex 120D.3.1	TP1a	-0.4 V	3.3 V

Input

Data positive and data negative signals

Measurement procedure

The single-ended output voltage is the measure of maximum and minimum values of the single-ended signals. Since the voltage levels can go beyond the 300 mV peak-to-peak, this measurement cannot be done using the ATI channels of the oscilloscope. Connect a DC block to eliminate the DC content present in the signal and then measure the maximum and minimum values of the positive and negative signals.

Effective Data Positive Max voltage = DC Common Mode + Data Positive Max

Effective Data Positive Max voltage = DC Common Mode + Data Positive Min

NOTE. *DC Common Mode measurement is pre-requisite for this measurement and you will be prompted to measure DC voltage using external multimeter.*

Diff peak to peak output voltage Tx enabled

This section verifies that the differential peak-to-peak voltage of the DUT is within the conformable limits according to the specification.

Required test equipment

Minimum system requirements

Equipment connection diagram

Standard	Specification	Test Points	Limits	
			Min	Max
OIF-PAM4	OIF-CEI-VSR, Table 16-10	TP0a	750 mV	NA
	OIF-CEI-VSR, Table 16-1	TP1a	NA	880 mV
	OIF-CEI-VSR, Table 16-4	TP4	NA	900 mV
	OIF-CEI-MR, Table 17-2	Testpoint-T	NA	1200 mV
	OIF-CEI-LR, Table 21-2	Testpoint-T	NA	1200 mV
IEEE-PAM4	AUI4-IEEE802.3bs, Draft 3.5, Annex 120D.3.1	TP0a	NA	1200 mV
		TP1a	NA	880 mV
		TP4	NA	900 mV
	CR4-IEEE802.3cd Draft 3.5, Section 136.9.3	TP2	NA	1200 mV
	KR4-IEEE802.3cd Draft 3.5, Section 137.9.2	TP0a	NA	1200 mV

Input

QPRBS13-CEI or any valid signal filtered through a fourth order Bessel Thomson filter.

Measurement procedure

The differential peak-to-peak voltage is the peak-to-peak value of the signal acquired using a base oscilloscope.

Diff peak to peak output voltage Tx disabled

This section verifies that the differential peak-to-peak voltage of the DUT is within the conformable limits according to the specification.

Required test equipment

Minimum system requirements

Equipment connection diagram

Standard	Specification	Test Points	Limits	
			Min	Max
IEEE-PAM4	AUI4-IEEE802.3bs,Draft 3.5, Annex 120D. 3.1	TP1a	NA	30 mV
		TP0a	NA	35 mV
	CR4-IEEE802.3cd Draft 3.5, Section 136.9.3	TP2	NA	30 mV
	KR4-IEEE802.3cd Draft 3.5, Section 137.9.2	TP0a	NA	30 mV

Input

Noise signal captured when the DUT is disabled (without applying filters)

Measurement procedure

1. Capture the differential noise using Math1 as source (without applying filters). *Math1 = (Data positive – Data negative)*
2. Select the oscilloscope free run mode option.
3. In oscilloscopes menu, select **Measure** > **Amplitude** and select peak-to-peak measurement.
4. Value of Peak-Peak measurement is reported as the differential peak-to-peak output voltage.

Transition time

This section verifies that the transition time of the DUT is within the conformable limits according to the specification.

Required test equipment

Minimum system requirements

Equipment connection diagram

Standard	Specification	Test Points	Limits	
			Min	Max
OIF-PAM4	OIF-CEI-VSR, Table 16-10	TP0a	7.5 ps	NA
	OIF-CEI-VSR, Table 16-1	TP1a	12 ps	NA
	OIF-CEI-VSR, Table 16-4	TP4	9.5 ps	NA
IEEE802.3bs	AUI4-IEEE802.3bs, Draft 3.5, Annex 120D.3.1	TP1a	10 ps	NA
	AUI4-IEEE802.3bs, Draft 3.5, Annex 120D.3.1	TP4	9.5 ps	NA

Input

QPRBS13-CEI test pattern or any valid signal filtered through a fourth order Bessel Thomson filter.

Measurement procedure

Transition time (rise and fall) are defined as the time between the 20% and 80% times, or 80% and 20% times, respectively, of isolated -1 to +1 or +1 to -1 PAM4 edges. Using the QPRBS13-CEI test pattern, the transitions within sequences of three -1s followed by three +1s, and three +1s followed by three -1s, respectively, are measured. These are PAM4 symbols 1820 to 1825 and 2086 to 2091, respectively, where symbols 1 to 7 are the run of seven +1's. In this case, the 0% level and 100% level may be estimated as the average signal within windows from -1.5 UI to -1 UI and from 1.5 UI to 2 UI relative to the edge.

TekExpress 400G-TXE application captures sufficient record length and uses PAM4 utility to perform this measurement.

Eye width, eye height, eye linearity, and eye symmetry mask width

This section verifies that the eye width, eye height, eye linearity, and eye symmetry mask width of the DUT are within the conformable limits according to the specification.

Required test equipment

Minimum system requirements

Equipment connection diagram

Standard	Measurement	Specification	Test Points	Limits	
				Min	Max
OIF-PAM4	Eye Width	OIF-CEI-VSR, Table 16-1	TP1a	0.2 UI	NA
	Eye Height			35 mV	NA
	Eye Linearity			0.85	NA
	Eye Symmetry Mask Width			EW6	NA
	Near End Eye Width	OIF-CEI-VSR, Table 16-4	TP4	0.265 UI	NA
	Near End Eye Height			70 mV	NA
	Near End Eye Linearity			0.85	NA
	Far End Eye Width			0.2 UI	NA
	Far End Eye Height			70 mV	NA
	Eye Symmetry Mask Width			EW6	NA
IEEE-PAM4	Eye Symmetry Mask Width	AUI4-IEEE802.3bs	TP1a	0.2 UI	NA
	Eye Height			32 mV	NA
	Near End Eye Symmetry Mask Width	AUI4-IEEE802.3bs	TP4	0.265 UI	NA
	Near End Eye Height			70 mV	NA
	Far End Eye Symmetry Mask Width			0.2 UI	NA
	Far End Eye Height			30 mV	NA

Input

Differential signal filtered through fourth order Bessel Thomson filter (with appropriate bandwidth) in concatenation with a Continuous Time Linear Equalizer (CTLE).

Cross talk calibration

Calibrate the co-propagating signals (signal on the other lanes) as per the specification, before performing the eye measurements.

If you want to run with cross talk source, select **Crosstalk Source** from the DUT panel. By default, this option is unselected and application will provide normal connection diagram procedure.

Eye measurements are done after passing the signal through a reference receiver which includes a fourth order Bessel Thomson filter with appropriate bandwidth cutoff and a selectable continuous time linear equalizer (CTLE filter). It is recommended to use PRBS13Q pattern for this measurement.

NOTE. *For 112G-VSR eye measurements, signal will be passed through additional five tap FFE equalizer after Bessel Thomson and CTLE filters*

CTLE filters are selected as per the below table:

Table 15: CTLE filters selection table

Specification	Test point	CTLE filters
CEI-56G-VSR	At Host output TP1a	1 dB - 9 dB
	At Module output TP4 (Near End)	1 dB - 2 dB
	At CEI-VSR Module output TP4 (Far End)	1 dB - 9 dB
CEI-112G-VSR	At Host output TP1a, TP4	1 dB - 13 dB
200/400GAUI-4/8	At Host output TP1a	1 dB - 9 dB
	At Module output TP4 (Near End)	1 dB - 3 dB
	At Module output TP4 (Near End)	1 dB - 9 dB

TekExpress uses PAM4 utility to perform this measurement. Details about measuring eye width and eye height from the equalized signal is explained in OIF-CEI-56G-VSR and IEEE802.3bs specifications.

At module output, the eye measurements is divided into 2 types:

1. Near End Eye measurements
2. Far End Eye measurements

Near end eye width and eye height are same as eye width and eye height measurements. Whereas far end eye width and eye height measurements are done with an emulated loss channel.

Steps to find the best CTLE filter:

1. Best CTLE filter is the one which gives maximum eye area (EW*EH) and it passes corresponding eye parameters.
2. In case of OIF standard, best CTLE filter is the one which gives passing result for Eye width, Eye height and Eye linearity.
3. In case of IEEE standard, best CTLE filter is the one which gives passing eye width and ESMW tests.

Measurement procedure:

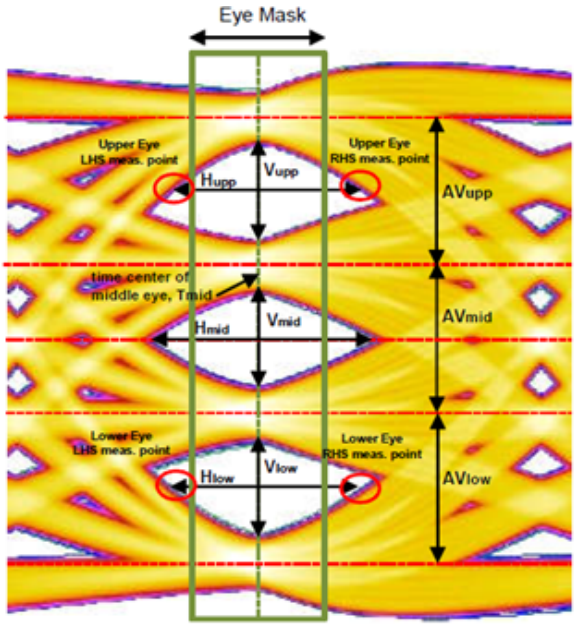
1. Acquire the signal (record length depends on the symbol rate).
2. Calculate eye measurements (Eye width, Eye height and Eye linearity if required) for all CTLE filters at BER of 1e-5.
3. Calculate the Eye Area (EW*EH), select the CTLE with maximum Eye area and passing Eye parameter limits of spec as reference CTLE filter for analysis.
4. Use the reference filter and measure the eye parameters configured at BER as per specification (By default for OIF:1e-6 and for IEEE:1e-5 BER is used).

Eye symmetry mask width (ESMW)

An eye mask of width as per the specification is drawn on the top of eye diagram. All the three eyes have to open beyond the mask drawn which will make the test pass.

Procedure to perform ESMW:

1. Use the reference CTLE filter for analysis. Horizontal mid-point of eye diagram (Tmid) is queried from the PAM4 utility.
2. Mask width has to be read from UI.
3. Mask_Left = Tmid - Mask_Width/2 and Mask_Right = Tmid + Mask_Width/2
4. Test is pass if all 3 eyes extend beyond the Eye width mask, else test is fail.
5. Query Hupp_Left and Hupp_Right values from the PAM4 utility which correspond to the left and right eye boundaries for upper eye.
6. If (Mask_left>=Hupp_Left and Mask_Right<=Hupp_Right) then pass, otherwise fail
7. Repeat steps 5 and 6 for middle and lower eyes. For middle eye, query Hmid_Left and Hmid_Right. Also for lower eye, query Hlow_left and Hlow_right



Signal-to-noise and distortion ratio

This section verifies that the signal-to-noise and distortion ratio (SNDR) of the DUT is within the conformable limits according to the specification.

Required test equipment

Minimum system requirements

Equipment connection diagram

Standard	Specification	Test Points	Limits	
			Min	Max
OIF-PAM4	OIF-CEI-VSR, Table 16-10	TP0a	31 dB	NA
	OIF-CEI-MR, Table 17-2	Testpoint-T	31 dB	NA
	OIF-CEI-LR, Table 21-2	Testpoint-T	31 dB	NA
IEEE-PAM4	AUI4-IEEE802.3bs, Draft 3.5, Annex 120D.3.1	TP0a	31 dB	NA

Standard	Specification	Test Points	Limits	
			Min	Max
IEEE-PAM4	CR4-IEEE802.3cd Draft 3.5, Section 136.9.3	TP2	33.3 dB	NA
IEEE-PAM4	KR4-IEEE802.3cd Draft 3.5, Section 137.9.2	TP0a	32.5 dB	NA

Input

Differential signal filtered through a fourth order Bessel Thomson filter with appropriate bandwidth

Measurement procedure

Signal-to-noise and distortion ratio is measured using the following formula:

$$SNDR = 10\log_{10}\left(\frac{p_{max}^2}{\sigma_e^2 + \sigma_n^2}\right) \quad \text{(dB)}$$

Where,

P_{max} is the linear fit pulse peak

σ_e - RMS error

σ_n – Standard deviation of noise

Pre-cursor and post-cursor equalization ratio

This section verifies that the pre-cursor and post-cursor equalization ratio of the Device Under Test (DUT) is within conformance limits as given in IEEE802.3 200GAUI-4/400GAUI-8 specification at test point TP0a, Table 120D-1, Section 120D.3.1.5.

Required test equipment

Minimum system requirements

Equipment connection diagram

Standard	Specification	Test Points
IEEE-PAM4	AUI4-IEEE802.3bs, Draft 3.5, Annex 120D.3.1	TP0a

Measurement procedure

1. Set the DUT in PRESET state and find the Linear fit pulse response.
2. For pre-cursor test, prompt the user to vary the Local_eq_cm1 value from 0 to 3 and each time find the equalizer coefficients C(-1), C(0) and C(1) value using PRESET linear fit curve and linear fit of each state of Local_eq_cm1.
3. Find the pre-cursor equalization ratio using below formula:

$$\left(\frac{c(-1)}{|c(-1)| + |c(0)| + |c(1)|}\right)$$

4. Vary the Local_eq_c1 value from 0 to 5 and each time find the equalizer coefficients C(-1), C(0) and C(1) value using PRESET Linear fit curve and Linear fit of each state of Local_eq_c1.
5. Find the Post-cursor equalization ratio using below formula:

$$\left(\frac{c(1)}{|c(-1)| + |c(0)| + |c(1)|}\right)$$

Limits

Pre-cursor equalization ratio for each state of Local_eq_cm1 are the following:

Local_eq_cm1 value	$c(-1)\ ratio\ \left(\frac{c(-1)}{\lvert c(-1)\rvert + \lvert c(0)\rvert + \lvert c(1)\rvert}\right)$
0	0±0.04
1	-0.05±0.04
2	-0.1±0.04
3	-0.15±0.04

Pre-cursor equalization ratio for each state of Local_eq_c1 are the following:

Local_eq_c1 value	$c(1)\ ratio\ \left(\frac{c(-1)}{\lvert c(-1)\rvert + \lvert c(0)\rvert + \lvert c(1)\rvert}\right)$
0	0±0.04
1	-0.05±0.04
2	-0.1±0.04
3	-0.15±0.04
4	-0.2±0.04
5	-0.25±0.04

Coefficient range (OIF)

This section verifies that the coefficient range of the DUT is within the conformable limits according to the specification.

Required test equipment

Minimum system requirements

Equipment connection diagram

Standard	Specification	Test Points		Limits	
				Min	Max
OIF-PAM4	OIF-CEI-MR, Table 17-2	Testpoint-T	C(-1)	-15%	0%
			C(0)	60%	100%
			C(1)	-25%	0%
	OIF-CEI-LR, Table 21-2	Testpoint-T	C(-2)	0%	10%
			C(-1)	-28%	0%
			C(0)	60%	100%
			C(1)	-28%	0%

Measurement procedure

1. Acquire the PRESET signal. Export the linear fit impulse response curve from PAM4 utility.
2. Increment a coefficient (C(-2), C(-1), C(0) or C(1)) such that it reaches its maximum value and keep all other coefficients in hold state. Export the Linear fit impulse response from PAM4 utility [1].
3. Find the equalizer coefficients using PRESET and incremented linear fit pulses.
4. Similarly ask the user to sufficiently decrement the equalizer coefficient (C(-1), C(0) and C(1)) one by one such that it reaches its minimum value. Capture the waveform and find the linear fit pulse from the PAM4 utility [2].
5. Find the equalizer coefficients using PRESET and decremented linear fit pulses.
6. Verify that each transmitter equalizer coefficient is within the minimum and maximum range of specification.

[1] Increment each coefficient individually to reach its maximum value. You must reconfigure the coefficient to its original value before incrementing another coefficient.

[2] Decrement each coefficient individually to reach its maximum value. You must reconfigure the coefficient to its original value before decrementing another coefficient.

Coefficient range (IEEE)

This section verifies that the coefficient range of the DUT is within the conformable limits according to the specification.

Required test equipment

Minimum system requirements

Equipment connection diagram

Standard	Specification	Test Points		Limits	
				Min	Max
IEEE-PAM4	CR4-IEEE802.3cd Draft 3.5, Section 136.9.3	TP2	C(-2)	0.1	NA
			C(-1)	NA	-0.25
			C(1)	NA	-0.25
	KR4-IEEE802.3cd Draft 3.5, Section 137.9.2	TP0a	C(-2)	0.1	NA
			C(-1)	NA	-0.25
			C(1)	NA	-0.25

Measurement procedure

1. Range for C(1) or value at minimum state for C(1): with c(−2) and c(−1) both set to zero and both c(0) and c(1) having received sufficient “decrement” requests so that they are at their respective minimum values, c(1) shall be less than or equal to −0.25.
2. Range for C(-1) or value at minimum state for C(-1): with c(−2) and c(1) set to zero and both c(−1) and c(0) having received sufficient “decrement” requests so that they are at their respective minimum values, c(−1) shall be less than or equal to −0.25.
3. Range for C(-2) or value at maximum state for C(-2): with c(−1) and c(1) set to zero, c(0) having received sufficient “decrement” requests so that it is at its minimum value, and c(−2) having received sufficient “increment” requests so that it is at its maximum value, c(−2) shall be greater than or equal to 0.1.

Far end pre-cursor ISI ratio

This section verifies that the far end pre-cursor ISI ratio of the DUT is within the conformable limits according to the specification.

Required test equipment

Minimum system requirements

Equipment connection diagram

Standard	Specification	Test Points		Limits	
				Min	Max
IEEE-PAM4	CR4-IEEE802.3cd Draft 3.5, Section 136.9.3	TP2	C(-2)	0.1	NA
			C(-1)	NA	-0.25
			C(1)	NA	-0.25
	KR4-IEEE802.3cd Draft 3.5, Section 137.9.2	TP0a	C(-2)	0.1	NA
			C(-1)	NA	-0.25
			C(1)	NA	-0.25

Measurement procedure

1. Apply the CTLE filter which produces the optimal eye opening and export the linear fit pulse from the PAM4 utility.
2. Using linear fit impulse, measure the far end pre-cursor ratio:

   Far End Pre-cursor ratio = Ppre/Pmax

   Where,

   Ppre is the value of linear fit pulse 1 UI prior to the time of the pulse peak

   Pmax is the peak amplitude of the linear fit pulse

Transmitter output residual ISI

This section verifies that the maximum value of transmitter output residual ISI of the DUT is within the conformable limits according to the specification.

Required test equipment

Minimum system requirements

Equipment connection diagram

Standard	Specification	Test Points	Limits	
			Min	Max
IEEE-PAM4	AUI4-IEEE802.3bs, Draft 3.5, Annex 120D.3.1	TP0a	34.8 dB	NA

Measurement procedure

1. Acquire the signal and export the linear fit pulse using PAM4 utility.
2. Perform single sequence in PAM4 utility and export the linear fit pulse to a file.
3. Using Linear fit pulse, calculate the SNR-ISI value using below equation:

$$SNR_{ISI} = 20log_{10}\left(\frac{P_{max}}{\sqrt{\sum ISI_{cursors}{}^{2}}}\right)$$

ISI cursors are calculated using below equation:

$$ISI_{cursors} = \left[p\left(t_p + M \times (N_p + 1)\right), p\left(t_p + M \times (N_p + 2)\right), \ldots\ldots\ldots p\left(t_p + M \times (N_p - D_p - 1)\right)\right]$$

Where,

tp is the index of the linear fit pulse where p(tp) = pmax

M is the oversampling ratio of the measured waveform and linear fit pulse

Np is the linear fit pulse length

Nb is given in Table 120D–8

For UAI-4 at TP0a, Equalization has to be performed on signal before running measurement for SNR-ISI. For CR4 and KR4, measurement is done on unequalized signal.

Equalization procedure

gDC	gDC2	G	ZLF	Z1	PLF	P1	P2
-15 to 0	-4 to 0	1	$f_{LF} * 10^{\frac{g_{DC2}}{20}}$	$f_z * 10^{\frac{g_{DC}}{20}}$	$f_b/40$	$f_b/2.5$	f_b*2

1. Equalize the signal with equalization filters given above(varying gDC and gDC2) ad measure the SNR-ISI in each case
2. Maximum value of SNR-ISI is reported out as result.

NOTE. *The observed SNR_{ISI} can be significantly influenced by the measurement setup, for example, the reflections in cables and connectors. High-precision measurement and careful calibration of the setup are recommended.*

Normalized coefficients step size

This section verifies that the normalized coefficients step size of the DUT is within the conformable limits according to the specification.

Required test equipment

Minimum system requirements

Equipment connection diagram

Standard	Specification	Test Points
OIF-PAM4	CEI-MR	T
	CEI-LR	T
IEEE-PAM4	CR4-IEEE802.3cd, Section 136.9.3	TP2
	KR4-IEEE802.3cd, Section 137.9.2	TP0a

Measurement procedure

Normalized coefficient step size is the measure of variation in the equalizer coefficient when the increment or decrement operations were done.

1. Set the DUT in PRESET state. Export the linear fit pulse response from PAM4 utility.
2. Set the DUT in INITIALIZE state. Export the Linear fit pulse response from PAM4 utility.
3. Calculate all the equalizer coefficient C(x) before using these linear fit pulse responses and denote it as C(x)_Before.
4. Increment or decrement the equalizer coefficient in DUT by giving an increment or decrement command.

5. Measure the linear fit pulse response. Calculate the updated equalizer coefficient C(x) in the signal using linear fit pulse response before and after sending increment or decrement request and denote it as C(x)_After.
6. Find the Increment or decrement step size for equalizer coefficient C(x) using below equation.

   Increment or decrement step size = C(x)_After – C(x)_Before

   Normalized coefficient step size for C(x) is calculated using below equation:

   Normalized coefficient step size = Absolute value of ((Increment or Decrement step size) / C(x)_Before)*100
7. Repeat the above method for all the coefficients to find the increment and decrement step sizes.

Limits

Limits		CEI-MR (Normalized limit) C(-1), C(0) and C(1)	CEI-LR (Normalized limit) C(-2), C(-1), C(0) and C(1)	CR4 at TP2 and KR4 at TP0a (Absolute limit)	
				C(-2)	C(-1), C(0) and C(1)
For coefficient increment	Min	0.5%	0.5%	0.005	0.005
	Max	5%	2%	0.025	0.05
For coefficient decrement	Min	-5%	-2%	-0.025	-0.05
	Max	-0.5%	-0.5%	-0.005	-0.005

NOTE. *C(x) is an equalizer coefficient and the values can be C(-2), C(-1), C(0), and C(1)*

Coefficient initialization

This measurement measures the values of equalizer coefficient when the DUT is in OUT_OF_SYNC and NEW_IC states (PRESET1, PRESET2 and PRESET3).

Required test equipment

Minimum system requirements

Equipment connection diagram

Coefficient Update state	ic_reg	Limits	CR4 (TP2) and KR4 (TP0a)			
			C(-2)	C(-1)	C(0)	C(1)
OUT_OF_SYNC	N/A	Min	-0.025	-0.05	0.95	-0.05
		Max	0.025	0.05	1.05	+0.05
NEW_IC	PRESET 1	Min	-0.025	-0.05	0.95	-0.05
		Max	0.025	0.05	1.05	0.05
	PRESET 2	Min	-0.025	-0.2	0.7	-0.15
		Max	0.025	-0.1	0.8	-0.05
	PRESET 3	Min	-0.025	-0.3	0.7	-0.05
		Max	0.025	-0.2	0.8	0.05

Measurement procedure

1. Configure the DUT in PRESET state, capture the signal and export the linear fit pulse curve using PAM4 utility.
2. Configure the DUT into OUT_OF_SYNC state, capture the signal and export the linear fit pulse using PAM4 utility. Find the values of Equalizer coefficients in OUT_OF sync state using the linear fit curves of Preset state and OUT_OF_SYNC state.
3. Configure DUT into NEW_IC state with PRESET1, PRESET2 and PRESET3. Each time export the linear fit pulse using the PAM4 utility. Measure the Equalizer coefficients for the each state (PRESET1, PRESET2 and PRESET3). All the time equalizer coefficients should be within the specified limit as per the specification.

Signaling rate

This section verifies that the signaling speed of the DUT is within the conformable limits according to the specification.

Required test equipment

Minimum system requirements

Equipment connection diagram

Standard	Specification	Test Points	Limits	
			Min	Max
IEEE-PAM4	AUI4-IEEE802.3bs, Draft 3.5, Annex 120D.3.1	TP0a	26.5625 - 100ppm	26.5625 +100 rpm
		TP1a	26.5625 - 100ppm	26.5625 +100 rpm
		TP4	26.5625 - 100ppm	26.5625 +100 rpm
IEEE-PAM4	CR4-IEEE802.3cd Draft 3.5, Section 136.9.3	TP2	26.5625 - 100ppm	26.5625 +100 rpm
IEEE-PAM4	KR4-IEEE802.3cd Draft 3.5, Section 137.9.2	TP0a	26.5625 - 100ppm	26.5625 +100 rpm

Measurement procedure

1. Perform oscilloscope settings.
2. Capture the BT filtered differential signal using Math1 as source. *Math1 = BT_filter(Data positive – Data negative)*
3. Configure signal source in PAM4 utility and perform single sequence.
4. Signaling rate is measured using PAM4 utility and the results are queried.

Level separation mismatch ratio

This section verifies that the level separation mismatch ratio of the DUT is within the conformable limits according to the specification.

Required test equipment

Minimum system requirements

Equipment connection diagram

Standard	Specification	Test Points	Limits	
			Min	Max
OIF-PAM4	OIF-CEI-MR, Table 17-2	Testpoint-T	0.95	NA
	OIF-CEI-LR, Table 21-2	Testpoint-T	0.95	NA
IEEE802.3bs	200GAUI-4/ 400GAUI-8	TP0a	0.95	NA
IEEE802.3cd	50GBase CR/ 100GBase CR2/ 200GBase CR4	TP2	0.95	NA
IEEE802.3cd	50GBase KR/ 100GBase KR2/ 200GBase KR4	TP0a	0.95	NA

Input

Differential signal filtered through a fourth order Bessel Thomson filter with appropriate bandwidth.

Measurement procedure

The level separation mismatch ratio R_{LM} is defined by the following equation:

$R_{LM} = \min ((3.ES_1), (3.ES_2), (2 - 3.ES_1), (2-3.ES_2))$

Where,

$ES_1 = (V_{+1/3} - V_{mid} / (V_{+1} - V_{mid})$

$ES_2 = (V_{-1/3} - V_{mid} / (V_{-1} - V_{mid})$

$V_{mid} = (V_{-1} + V_{+1}) / 2$

V_{-1}, $V_{-1/3}$, $V_{+1/3}$, and V_{+1} are the mean signal levels for each symbol of -1, -1/3, +1/3, and +1 PAM4 symbols, respectively.

Linear fit pulse peak

This section verifies that the linear fit pulse peak voltage of the DUT is within the conformable limits according to the specification.

Required test equipment

Minimum system requirements

Equipment connection diagram

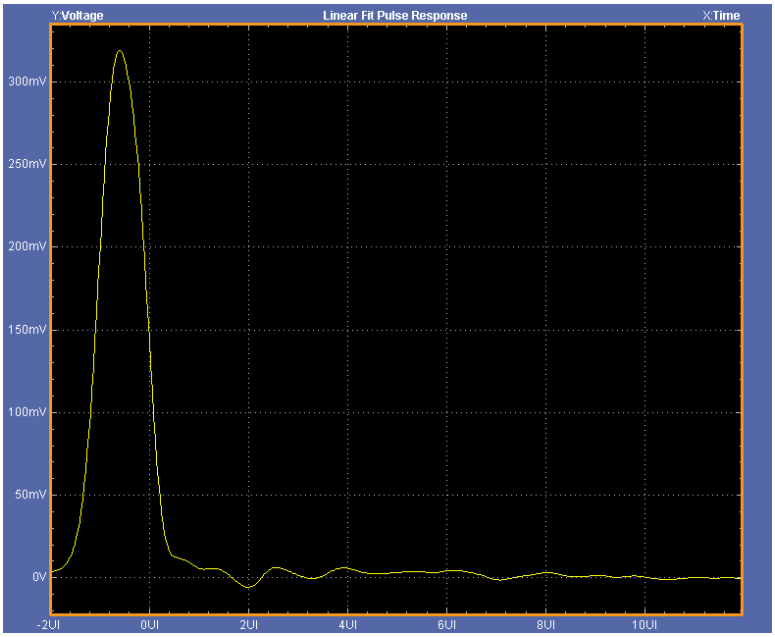
Standard	Specification	Test Points	Limits	
			Min	Max
OIF-PAM4	OIF-CEI-MR, Table 17-2	Testpoint-T	0.83*Steady state voltage	NA
	OIF-CEI-LR, Table 21-2	Testpoint-T	0.83*Steady state voltage	NA
IEEE-PAM4	AUI4-IEEE802.3bs, Draft 3.5, Annex 120D.3.1	TP0a	0.76*Steady state voltage	NA
	CR4-IEEE802.3cd Draft 3.5, Section 136.9.3	TP2	0.49*Steady state voltage	NA
	KR4-IEEE802.3cd Draft 3.5, Section 137.9.2	TP0a	0.75*Steady state voltage	NA

Input

Differential signal filtered through a fourth order Bessel Thomson filter with appropriate bandwidth.

Measurement procedure

The linear fit pulse peak is the peak value of linear fit pulse p(k).



Steady state voltage

This section verifies that the steady state voltage of the DUT is within the conformable limits according to the specification.

Required test equipment

Minimum system requirements

Equipment connection diagram

Standard	Specification	Test Points	Limits	
			Min	Max
OIF-PAM4	OIF-CEI-MR, Table 17-2	Testpoint-T	0.4 V	0.6 V
	OIF-CEI-LR, Table 21-2	Testpoint-T	0.4 V	0.6 V
IEEE802.3bs	AUI4-IEEE802.3bs, Draft 3.5, Annex 120D.3.1	TP0a	0.4 V	0.6 V
IEEE802.3cd	CR4-IEEE802.3cd Draft 3.5, Section 136.9.3	TP2	0.34 V	0.6 V
IEEE802.3cd	KR4-IEEE802.3cd Draft 3.5, Section 137.9.2	TP0a	0.4 V	0.6 V

Input

Differential signal filtered through a fourth order Bessel Thomson filter with appropriate bandwidth.

Measurement procedure

The steady state voltage v_f is defined as the sum of the linear fit pulse p(k), divided by M, as shown in following equation:

$$v_f = \frac{1}{M} \cdot \sum_{k=1}^{M \cdot T\_Np} p(k)$$

Even odd jitter

This section verifies that the maximum value of the even odd jitter of the DUT is within the conformable limits according to the specification.

Required test equipment

Minimum system requirements

Equipment connection diagram

Standard	Specification	Test Points	Limits	
			Min	Max
OIF-PAM4	OIF-CEI-VSR, Table 16-10	TP0a	NA	0.019 UI
	OIF-CEI-MR, Table 17-3	Testpoint-T	NA	0.019 UI
	OIF-CEI-LR, Table 21-3	Testpoint-T	NA	0.019 UI
IEEE-PAM4	AUI4-IEEE802.3bs, Draft 3.5, Annex 120D.3.1	TP0a	NA	0.019 UI
	CR4-IEEE802.3cd Draft 3.5, Section 136.9.3	TP2	NA	0.019 UI
	KR4-IEEE802.3cd Draft 3.5, Section 137.9.2	TP0a	NA	0.019 UI

Input

Differential signal filtered through a fourth order Bessel Thomson filter with the bandwidth of 40 GHz.

Measurement procedure

Even odd jitter is the measure of two repetitions of a QPRBS13-CEI test pattern. The deviation of the time of each transition from an ideal clock at the signaling rate is measured.

Even odd jitter is defined as the magnitude of the difference between the average deviation of all even-numbered transitions and the average deviation of all odd-numbered transitions. Determining if a transition is even or odd is based on the possible transitions (only actual transitions are measured and averaged).

Uncorrelated bounded high probability jitter & Uncorrelated unbounded gaussian jitter

This section verifies that the maximum value of the uncorrelated bounded high probability jitter (UBHPJ) and Uncorrelated unbounded gaussian jitter (UUGJ) is within the conformable limits according to the specification.

Required test equipment

Minimum system requirements

Equipment connection diagram

Standard	Specification	Test Points	UBHPJ limits		UUGJ limits	
			Min	Max	Min	Max
OIF-PAM4	OIF-CEI-VSR, Table 16-10	TP0a	NA	0.05 UI	NA	0.01 UI

Input

Differential signal filtered through a fourth order Bessel Thomson filter with appropriate bandwidth.

Measurement procedure

UBHPJ and UUGJ are measured using a QPRBS13-CEI test pattern. This measurement requires at least 10^7 symbols.

This measurement finds all the zero crossings in the signal and then finds the average pulse width. The difference of the edge time is the jitter value. The jitter is filtered through a high pass filter. Find the CDF of the filtered jitter. The UBHPJ and UUGJ are calculated by the following equation:

$$\begin{bmatrix} UUGJ \\ UBHPJ \end{bmatrix} = \begin{bmatrix} 1.0538 & -1.0538 \\ -9.3098 & 10.3098 \end{bmatrix} \begin{bmatrix} J6 \\ J5 \end{bmatrix}$$

Where,

J5 is the difference between the τHPF at the $(1\text{-}0.5 \times 10^{-5})$ and 0.5×10^{-5} probabilities.

J6 as the difference between the τHPF at the $(1\text{-}0.5 \times 10^{-6})$ and 0.5×10^{-6} probabilities.

Uncorrelated jitter RMS and uncorrelated J3 and J4 Jitter

This section verifies that the maximum value of the uncorrelated J3/J4 jitter (J3u/J4u) and Uncorrelated Jitter RMS (Jrms) are within the conformable limits according to the specification.

Required test equipment

Minimum system requirements

Equipment connection diagram

Standard	Specification	Test Points
OIF-PAM4	CEI-MR	T
	CEI-LR	T
IEEE-PAM4	200GAUI-4/ 400GAUI-8	TP0a
	50GBase CR/ 100GBase CR2/ 200GBase CR4	TP2
	50GBase KR/ 100GBase KR2/ 200GBase KR4	TP0a

Input

Differential signal filtered through a fourth order Bessel Thomson filter with appropriate bandwidth.

Measurement procedure

J4u, J3u and Jrms are defined by measurements of 12 specific transitions in a PRBS13Q pattern to exclude correlated jitter. The 12 transitions represent all possible combinations of four identical symbols followed by two different identical symbols as shown in Table 120D–2. The sequences are located by the symbol indices given in the table where symbols 1 to 7 are the run of seven 3s.

J4u is defined as the time interval that includes all but 10–4 of fJ(t), from the 0.005th to the 99.995th percentile of fJ(t). JRMS is defined as the standard deviation of fJ(t).

J3u is defined as the time interval that includes all but 10–3 of fJ(t), from the 0.05th to the 99.95th percentile of fJ(t).

This measurement requires minimum of 3500 specific transitions. Hence the application will capture 10 waveforms each with 8M. It analyzes the waveforms one by one using PAM4 utility until it accumulates the required number of transitions (3500). Incase of noisy signals, more data is needed to get the required number of transitions which application takes care internally.

Limits

Table 16: J4u jitter limits

Specification	Test Points	Min	Max
CEI-MR	T	NA	0.118 UI
CEI-LR	T	NA	0.118 UI
200GAUI-4/ 400GAUI-8	TP0a	NA	0.118 UI

Table 17: J3u jitter limits

Specification	Test Points	Min	Max
50GBase CR/ 100GBase CR2/ 200GBase CR4	TP2	NA	0.115 UI
50GBase KR/ 100GBase KR2/ 200GBase KR4	TP0a	NA	0.106 UI

Table 18: Jrms limits

Specification	Test Points	Min	Max
200GAUI-4/ 400GAUI-8	TP0a	NA	0.023 UI
50GBase CR/ 100GBase CR2/ 200GBase CR4	TP2	NA	0.023 UI
50GBase KR/ 100GBase KR2/ 200GBase KR4	TP0a	NA	0.023 UI

SCPI commands

About SCPI command

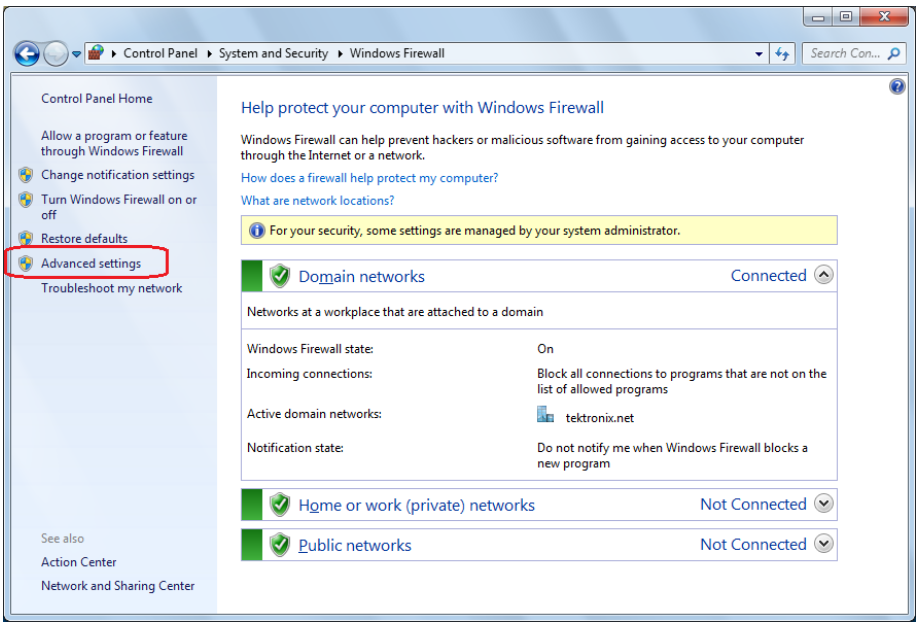
You can use Standard Commands for Programmable Instruments (SCPI) to communicate with the TekExpress application.

Socket configuration for SCPI commands

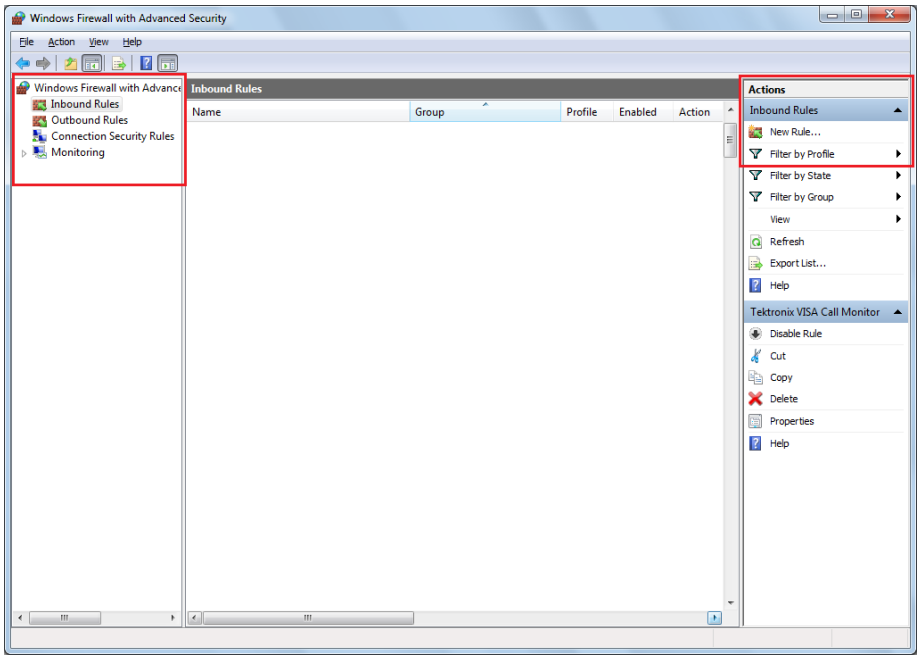
This section describes the steps for TCPIP socket configuration and TekVISA configuration to execute the SCPI commands.

TCPIP socket configuration

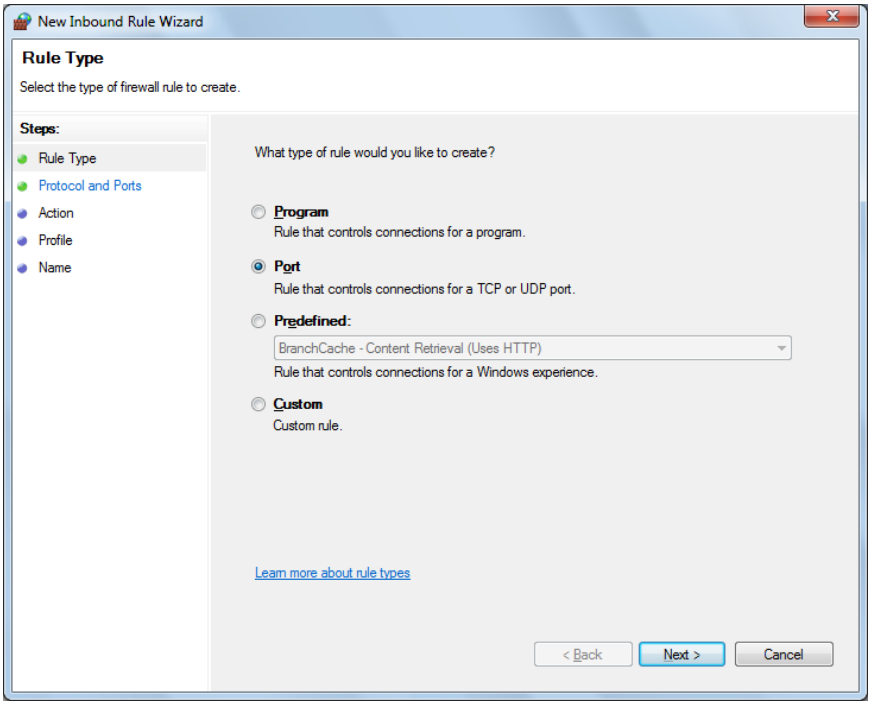
1. Click **Start** > **Control Panel** > **System and Security** > **Windows Firewall** > **Advanced settings**.



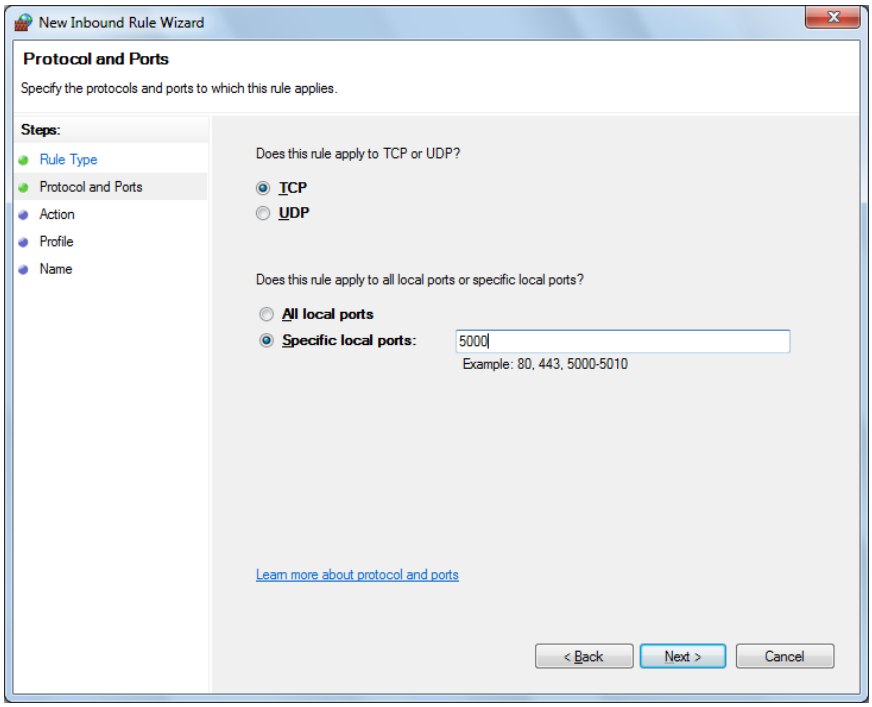
2. In Windows Firewall with Advanced Security menu, select **Windows Firewall with Advanced Security on Local Computer** > **Inbound Rules** and click New Rule…



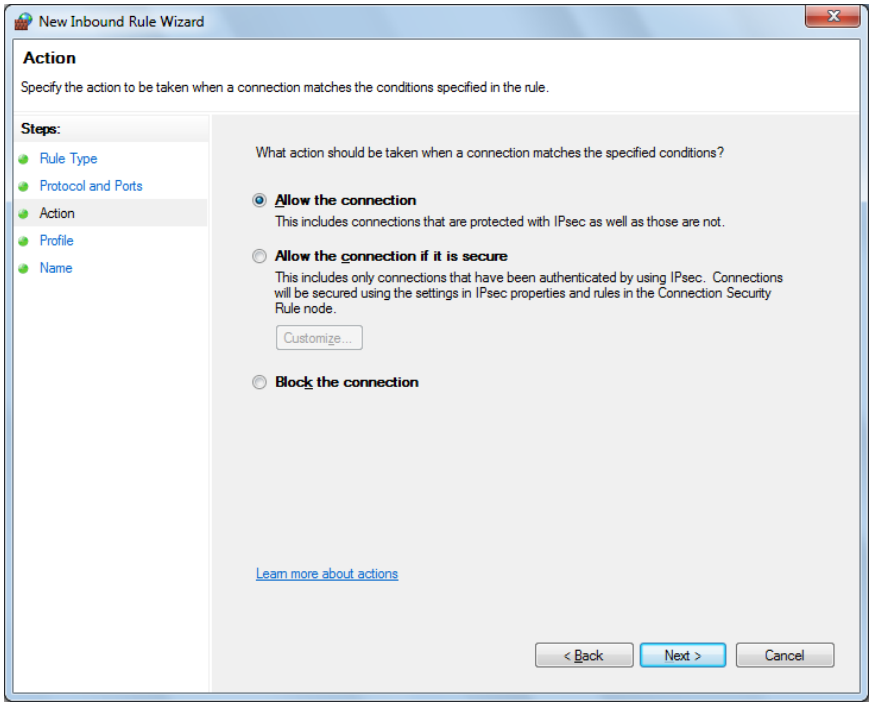
3. In New Inbound Rule Wizard menu
   a. Select **Port** and click **Next**.



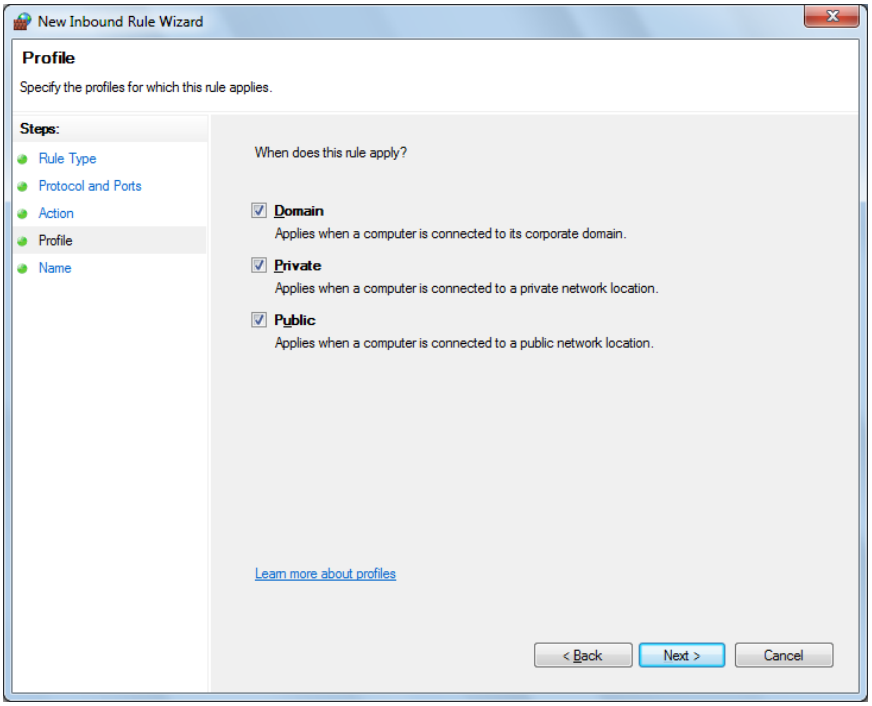
b. Select **TCP** as rule apply and enter 5000 for **Specific local ports** and click **Next**.



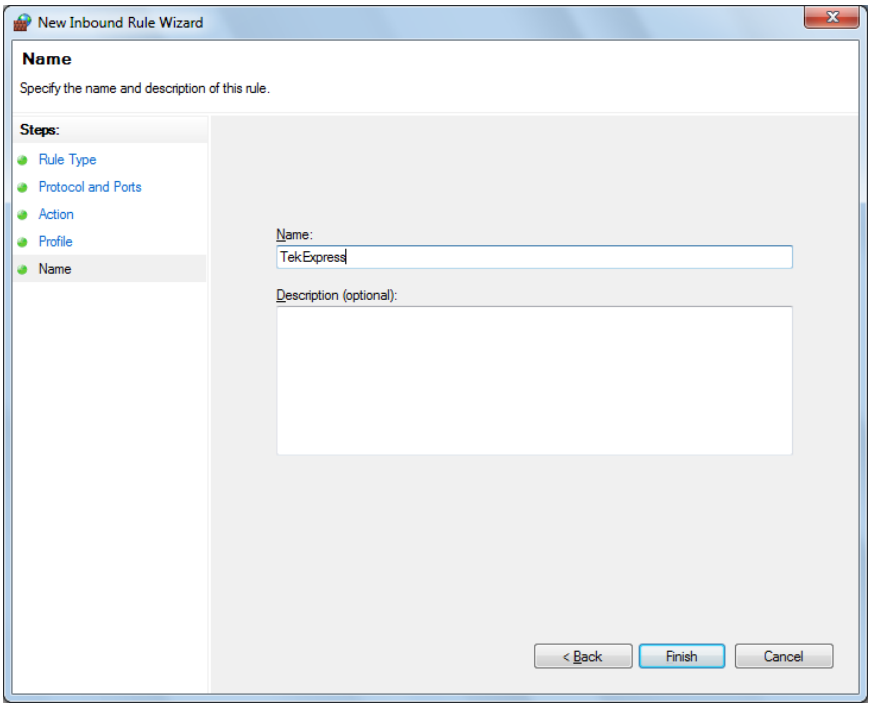
c. Select **Allow the connection** and click **Next**.



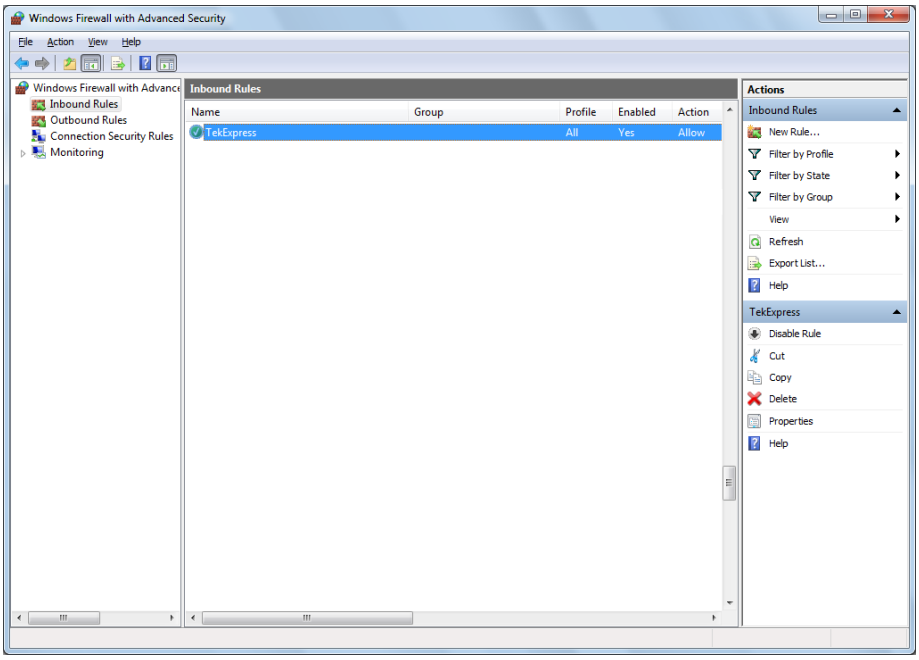
d. Select **Domain, Private, Public** and click **Next**.



e. Enter **Name**, Description (optional), and click **Finish**.

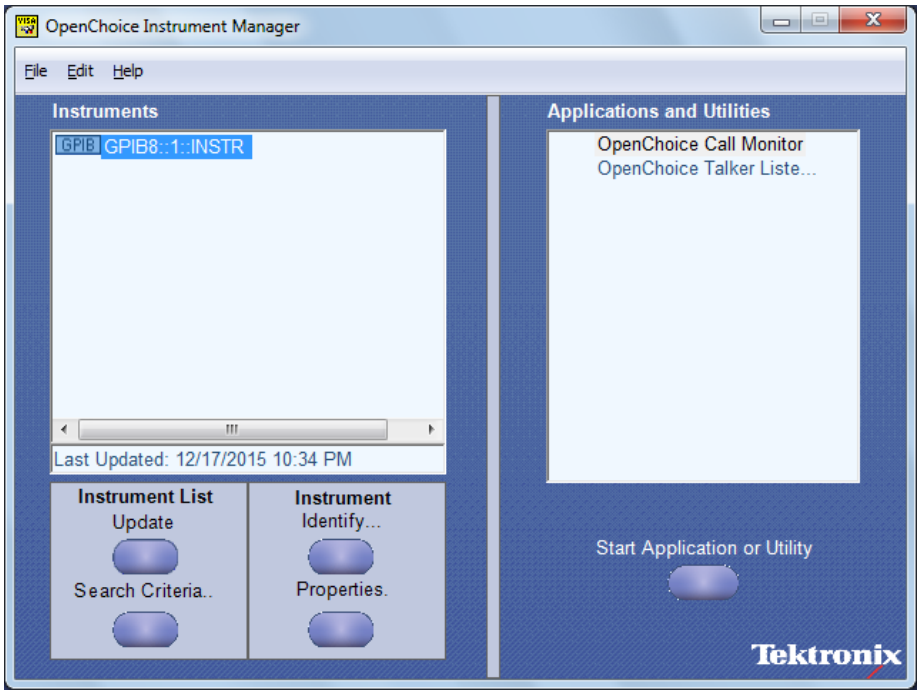


4. Check whether the Rule name is displayed in **Windows Firewall with Advanced Security menu** > **Inbound Rules**.



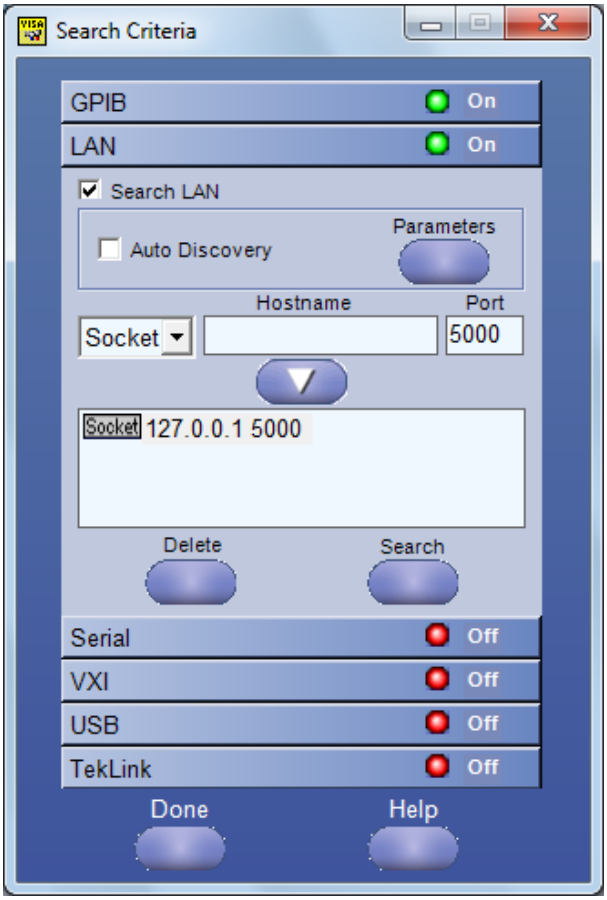
TekVISA configuration

1. Click **Start** > **All Programs** > **TekVISA** > **OpenChoice Instrument Manager**.

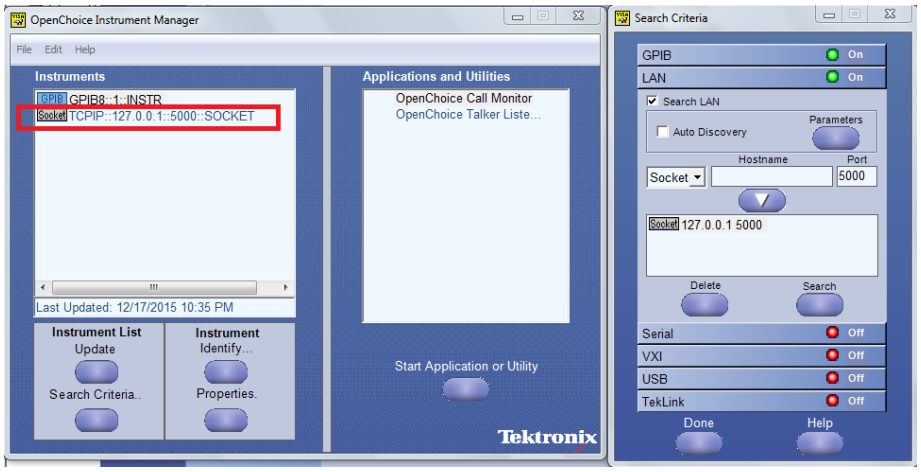


2. Click **Search Criteria**. In Search Criteria menu, click **LAN** to Turn-on. Select **Socket** from the drop-down list, enter the IP address of the TekExpress device in **Hostname** and type **Port** as 5000. Click  to configure the IP address with Port.

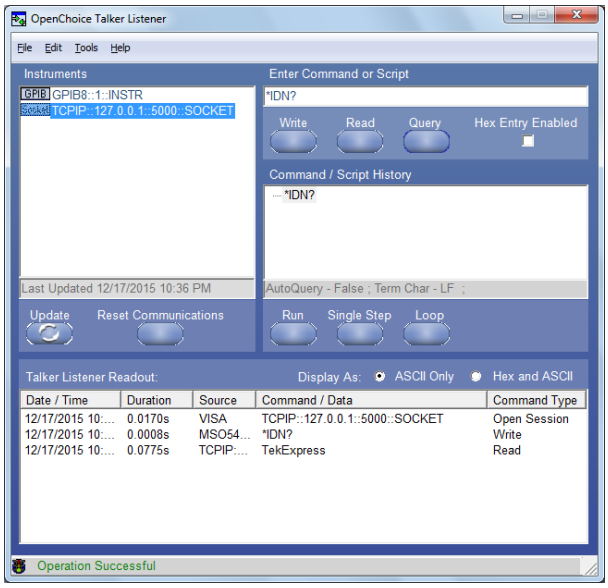
   Enter the Hostname as 127.0.0.1 if the TekVISA and TekExpress application are in the same system, else enter the IP address of the TekExpress application system.



3. Click **Search** to setup the TCPIP connection with the host. Check whether the TCPIP host name is displayed in **OpenChoice Instrument Manager** > **Instruments**.



4. Double-click **OpenChoice Talker Listener** and enter the Command *IDN? in command entry field and click **Query**. Check that the Operation is successful and Talker Listener Readout displays the Command / Data.



TEKEXP:*IDN?

This command queries the active TekExpress application name running on the oscilloscope.

Syntax TEKEXP:*IDN?\n

Inputs NA

Outputs Returns active TekExpress application name running on the oscilloscope.

TEKEXP:*OPC?

This command queries the execution status of the last executed command.

Syntax TEKEXP:*OPC?\n

Inputs NA

Outputs 0 - last command execution is not complete

1 - last command execution is complete

TEKEXP:ACQUIRE_MODE

This command sets the acquire mode as live or pre-recorded.

Syntax TEKEXP:ACQUIRE_MODE {LIVE | PRE-RECORDED}\n

Inputs {LIVE | PRE-RECORDED}

Outputs NA

TEKEXP:ACQUIRE_MODE?

This command queries the acquire mode type.

Syntax TEKEXP:ACQUIRE_MODE?\n

Inputs NA

Outputs {LIVE | PRE-RECORDED}

TEKEXP:EXPORT

This command returns all the bytes of data to the specified file.

Syntax	Outputs
TEKEXP:EXPORT REPORT\n	Returns the report file in bytes
TEKEXP:EXPORT WFM,"<FileName>"\n	Returns the specified waveform file in bytes
TEKEXP:EXPORT IMAGE,"<FileName>"\n	Returns the specified image file in bytes

Inputs FileName - Specifies the file name

TEKEXP:INFO?

This command queries the information about the file(s).

Syntax	Outputs
TEKEXP:INFO? REPORT\n	<ReportFileSize>,"<ReportFileName.mht>"
TEKEXP:INFO? WFM \n	<WfmFile1Size>,"<WfmFileName1.wfm>";<WfmFile2Size>,"<WfmFileName2.wfm>";...
TEKEXP:INFO? IMAGE\n	<Image1FileSize>,"<Image1FileName>";<Image2FileSize>,"<Image2FileName>" ;...

TEKEXP:INSTRUMENT

This command sets the value for the selected instrument type.

Syntax

TEKEXP:INSTRUMENT "<InstrumentType>",<Value>"\n

Inputs

InstrumentType

Value

TIP. *Check Command parameters list section for InstrumentType and Value parameters.*

Outputs

NA

TEKEXP:INSTRUMENT?

This command queries the instrument selected for the specified instrument type.

Syntax

TEKEXP:INSTRUMENT? "<InstrumentType>"\n

Inputs

InstrumentType

TIP. *Check Command parameters list section for InstrumentType parameters.*

Outputs

Returns the instrument selected for the specified instrument type

TEKEXP:LASTERROR?

This command queries the last error string occurred for the current TCP session. If there are no errors since startup, or since the last call to TEKEXP:LASTERROR?\n, this command returns an empty string.

Syntax TEKEXP:LASTERROR?\n

Inputs NA

Outputs <string>

TEKEXP:LIST?

This command queries the list of available device, suite, test, version or instrument.

Syntax	Outputs
TEKEXP:LIST? DEVICE\n	Returns the list of available device(s) as comma separated values.
TEKEXP:LIST? SUITE\n	Returns the list of available suite(s) as comma separated values.
TEKEXP:LIST? TEST\n	Returns the list of available test(s) as comma separated values.
TEKEXP:LIST? VERSION\n	Returns the list of available version(s) as comma separated values.
TEKEXP:LIST? INSTRUMENT,"<InstrumentType>"\n	Returns the list of available instruments' for the given Instrument type as comma separated values.

NOTE. *This command returns the list of items within double quotes ("). Iterate the receive procedure until the list ends with double quotes otherwise the next query commands won't work as expected.*

Inputs InstrumentType

TIP. *Check Command parameters list section for InstrumentType parameters.*

TEKEXP:POPUP

This command sets the response to the active popup shown in the application.

Syntax TEKEXP:POPUP “<PopupResponse>”\n

Inputs PopupResponse

Outputs NA

TEKEXP:POPUP?

This command queries the active popup information shown in the application.

Syntax TEKEXP:POPUP?\n

Inputs NA

Outputs Returns the active popup information in the application.

TEKEXP:REPORT

This command generates the report for the current session.

Syntax TEKEXP:REPORT GENERATE\n

Inputs GENERATE

Outputs NA

TEKEXP:REPORT?

This command queries the queried header field value in the report.

Syntax TEKEXP:REPORT? “<HeaderField>”\n

Inputs HeaderField - Specifies to return the measured value for the indicated test.

TIP. *Check* ***Report*** *for HeaderField parameters.*

Outputs Returns the queried header field value in the report

TEKEXP:RESULT?

This command queries the result available in report summary/details table.

Syntax	Outputs
TEKEXP:RESULT? "<TestName>"\n	Return Pass/Fail status of the test.
TEKEXP:RESULT? "<TestName>","<ColumnName>"\n	Returns all the row values of the specified column for the test.
TEKEXP:RESULT? "<TestName>","<ColumnName>",<RowNumber>\n	Returns the column value for the specified row number [1]

Inputs

TestName - Specifies the name of the test for which to obtain the test result value.

ColumnName - Specifies the column name for the measurement

RowNumber - Specifies the row number of the measurement

TIP. *Check **Results** panel for TestName, ColumnName, and RowNumber parameters.*

[1] Row number starts from zero.

TEKEXP:SELECT

This command selects the device, suite, version, or test.

Syntax

TEKEXP:SELECT <string1>,<string2>,<string4>\n

TEKEXP:SELECT TEST,<string3>,<string4>\n

Inputs

<string1> = {DEVICE | SUITE | VERSION}

<string2> = {DeviceName | SuiteName | VersionName}

<string3> = {“<TestName>"| ALL| REQUIRED }

<string4> = {TRUE | FALSE}

TIP. *Check Command parameters list section for DeviceName, SuiteName, VersionName, and TestName parameters.*

Outputs

NA

TEKEXP:SELECT?

This command queries the name of the selected device, suite, version, or test.

Syntax

TEKEXP:SELECT? {DEVICE | SUITE | TEST | VERSION}\n

Inputs

{DEVICE | SUITE | TEST | VERSION}

Outputs Returns the name of the selected device, suite, version, or test.

TEKEXP:SETUP

This command sets the value of the current setup.

Syntax	Outputs
TEKEXP:SETUP DEFAULT\n	Restore to default Setup
TEKEXP:SETUP OPEN,"<SessionName>"\n	Open the session
TEKEXP:SETUP SAVE\n	Saves the already existing modified session
TEKEXP:SETUP SAVE,"<SessionName>"\n	Save the session

Inputs SessionName - The name of the session

TEKEXP:STATE

This command sets the execution state of the application.

Syntax TEKEXP:STATE {RUN | STOP | PAUSE | RESUME}\n

Inputs {RUN | STOP | PAUSE | RESUME}

Outputs NA

TEKEXP:STATE?

This command queries the current setup state.

Syntax	Outputs
TEKEXP:STATE?	RUNNING | PAUSED | WAIT | ERROR | READY
TEKEXP:STATE? SETUP	SAVED | NOT_SAVED

TEKEXP:VALUE

This command sets the value of parameters of type General, Acquire, Analyze, or DUTID.

Syntax

TEKEXP:VALUE GENERAL,"<ParameterName>",“<Value>”\n

TEKEXP:VALUE ACQUIRE,“<TestName>","<AcquireType>", "<ParameterName>",“<Value>”\n

TEKEXP:VALUE ANALYZE,“<TestName>","<ParameterName>".“<Value>” \n

TEKEXP:VALUE DUTID,“<Value>”\n

TEKEXP:VALUE VERBOSE,{TRUE | FALSE}\n

TEKEXP:VALUE WFMFILE,<Test_Name>,<Aquire_Type>,<FilesName1$FileName2>\n

Inputs

ParameterName - Specifies the parameter name

TestName - Specifies the test name

AcquireType - Specifies the acquire type

Value - Specifes the value to set

FilesName1$FileName2 - Specifies the waveform file name

TRUE - Pop-ups are enabled

FALSE - Pop-ups are disabled

TIP. *Check Command parameters list section for ParameterName, AcquireType, and Value parameters.*

Outputs NA

TEKEXP:VALUE?

This command queries the value of the parameter for type General, Acquire, Analyze, or DUTID.

Syntax	Outputs
TEKEXP:VALUE? GENERAL,"<ParameterName>"\n	Returns the value of Parameter for type GENERAL
TEKEXP:VALUE? ACQUIRE,“<TestName>", "<AcquireType>","<ParameterName>"\n	Returns the value of Parameter for type ACQUIRE
TEKEXP:VALUE? ANALYZE, “<TestName>","<ParameterName>"\n	Returns the value of Parameter for type ANALYZE
TEKEXP:VALUE? DUTID\n	Returns the DUTID value
TEKEXP:VALUE? WFMFILE,<Test_Name>,<Aquire_Type>\n	Returns the waveform file name
TEKEXP:VALUE? VERBOSE	Returns the verbose mode type

Inputs ParameterName - Specifies the parameter name

TestName - Specifies the test name

AcquireType - Specifies the acquire type

TRUE - Pop-ups are enabled

FALSE - Pop-ups are disabled

TIP. *Check Command parameters list section for ParameterName and AcquireType parameters.*

Outputs Returns the value of Parameter for type GENERAL | ACQUIRE | ANALYZE | DUTID.

Command parameters

This section provides the parameters list for the SCPI commands.

Parameters	Description
InstrumentType	Specifies the instrument type. Valid value is Real Time Scope.

Value	Specifies the value parameters.
	■ For InstrumentType, valid values are:
	  ■ Do not use
	  ■ GPIB8::1::INSTR
	■ For DUTID, valid value is Comment.

DeviceName	Specifies the device name. Valid values are: ■ OIF-PAM4 CEI-VSR ■ OIF-PAM4 CEI-MR ■ OIF-PAM4 CEI-LR ■ IEEE-PAM4 AUI4 ■ IEEE-PAM4 CR4 ■ IEEE-PAM4 KR4
SuiteName	Specifies the suite name. Valid values are: ■ TP0a, TP1a, TP4 for OIF-PAM4 CEI-VSR ■ Testpoint-T for OIF-PAM4 CEI-MR and OIF-PAM4 CEI-LR ■ TP0a, TP1a, TP4 for IEEE-PAM4 AUI4 ■ Testpoint-TP2 for IEEE-PAM4 CR4 ■ Testpoint-TP0a for IEEE-PAM4 KR4

Parameters	Description
VersionName	Specifies the version name. Valid values are ■ 400G-TXE,Section-16.B.1.1,Table 16-10 ■ 400G-TXE,Section-16.3.2,Table 16-1 ■ 400G-TXE,Section-16.3.3,Table 16-4 ■ 400G-TXE,Section-17.3.1,Table 17-2 ■ 400G-TXE,Section-21.3,Table 21-2 ■ 400G-TXE,Annex 120D.3.1,Table 120D-1 ■ 400G-TXE,Annex 120E.3.1, Table 120E-1 ■ 400G-TXE,Annex 120E.3.2, Table 120E-3 ■ 400G-TXE,Section 136.9.3, Table 136-11 ■ 400G-TXE,Section 137.9.2
TestName for OIF-PAM4 CEI-VSR	■ DC Common Mode Output Voltage (TP0a, TP1a, TP4) ■ Diff Peak to Peak Output Voltage Tx Enabled (TP0a, TP1a, TP4) ■ AC Common Mode Output Voltage (TP0a, TP1a, TP4) ■ Transition Time (TP0a, TP1a, TP4) ■ Signal To Noise And Distortion Ratio (TP0a, TP1a, TP4) ■ Even Odd Jitter (TP0a) ■ Uncorrelated Bounded High Probability Jitter (TP0a) ■ Uncorrelated Unbounded Gaussian Jitter (TP0a) ■ Eye Width (TP1a) ■ Eye Height (TP1a) ■ Eye Linearity (TP1a) ■ Eye Symmetry Mask Width (TP4) ■ Near End Eye Width (TP4) ■ Near End Eye Height (TP4) ■ Near End Eye Linearity (TP4) ■ Near End Eye Symmetry Mask Width (TP4) ■ Far End Eye Width (TP4) ■ Far End Eye Height (TP4) ■ Far End Eye Symmetry Mask Width (TP4)

Parameters	Description
TestName for OIF-PAM4 CEI-MR	■ DC Common Mode Output Voltage ■ Diff Peak to Peak Output Voltage Tx Enabled ■ AC Common Mode Output Voltage ■ Single Ended Output Voltage ■ Signal To Noise And Distortion Ratio ■ Level Separation Mismatch Ratio ■ Linear Fit Pulse Peak ■ Steady State Voltage ■ Step size for coefficient C(-1) ■ Step size for coefficient C(0) ■ Step size for coefficient C(1) ■ Coefficient Range C(-1) ■ Coefficient Range C(0) ■ Coefficient Range C(1) ■ Even Odd Jitter ■ Jitter RMS ■ Uncorrelated J4 Jitter

Parameters	Description
TestName for OIF-PAM4 CEI-LR	■ DC Common Mode Output Voltage ■ Diff Peak to Peak Output Voltage Tx Enabled ■ AC Common Mode Output Voltage ■ Single Ended Output Voltage ■ Signal To Noise And Distortion Ratio ■ Level Separation Mismatch Ratio ■ Linear Fit Pulse Peak ■ Steady State Voltage ■ Step size for coefficient C(-2) ■ Step size for coefficient C(-1) ■ Step size for coefficient C(0) ■ Step size for coefficient C(1) ■ Coefficient Range C(-2) ■ Coefficient Range C(-1) ■ Coefficient Range C(0) ■ Coefficient Range C(1) ■ Even Odd Jitter ■ Jitter RMS ■ Uncorrelated J4 Jitter

Parameters	Description
TestName for IEEE-PAM4 AUI4	■ DC Common Mode Output Voltage (TP0a, TP1a, TP4) ■ Diff Peak to Peak Output Voltage Tx Disabled (TP0a, TP1a) ■ Diff Peak to Peak Output Voltage Tx Enabled (TP0a, TP1a, TP4) ■ AC Common Mode Output Voltage (TP0a, TP1a, TP4) ■ Signaling Rate (TP0a, TP1a, TP4) ■ Signal To Noise And Distortion Ratio (TP0a) ■ Level Separation Mismatch Ratio (TP0a) ■ Linear Fit Pulse Peak (TP0a) ■ Steady State Voltage (TP0a) ■ Pre Cursor Equalization (TP0a) ■ Post Cursor Equalization (TP0a) ■ Transmitter output residual ISI (TP0a) ■ Even Odd Jitter (TP0a) ■ Uncorrelated J4 Jitter (TP0a) ■ Jitter RMS (TP0a) ■ Single Ended Output Voltage (TP1a) ■ Transition Time (TP1a, TP4) ■ Eye Height (TP1a) ■ Eye Symmetry Mask Width (TP1a) ■ Near End Eye Height (TP4) ■ Near End Eye Symmetry Mask Width (TP4) ■ Far End Eye Height (TP4) ■ Far End Eye Symmetry Mask Width (TP4) ■ Far End Precursor ISI Ratio (TP4)

Parameters	Description
TestName for IEEE-PAM4 CR4 and KR4	■ DC Common Mode Output Voltage ■ Diff Peak to Peak Output Voltage Tx Disabled ■ Diff Peak to Peak Output Voltage Tx Enabled ■ AC Common Mode Output Voltage ■ Signaling Rate ■ Signal To Noise And Distortion Ratio ■ Level Separation Mismatch Ratio ■ Linear Fit Pulse Peak ■ Steady State Voltage ■ Coefficient Range ■ OUT_OF_SYNC ■ NEW_IC PRESET1 ■ NEW_IC PRESET2 ■ NEW_IC PRESET3 ■ Step size for coefficient C(-2) ■ Step size for coefficient C(-1) ■ Step size for coefficient C(0) ■ Step size for coefficient C(1) ■ Even Odd Jitter ■ Jitter RMS ■ Uncorrelated J3 Jitter

ParameterName and Value for General, Acquire and Analyze

Specifies the ParameterName and Value for General, Acquire and Analyze. The configuration parameters available are not same for measurements.

Table 19: ParameterName and Value for General

ParameterName	Value
DUTID Comment	User comment
MODE	■ COMPLIANCE ■ USER-DEFINED

ParameterName	Value
Report Update Mode	■ New ■ Append ■ Replace ■ ReplaceAny
Replace Runsession Path	Session file path. Example: X:\400G-TXE\Session1\DUT001\20170421_121534
Auto increment report name if duplicate	"True" or "False"
Include Pass/Fail Results Summary	"True" or "False"
Include Detailed Results	"True" or "False"
Include Plot Images	"True" or "False"
Include Setup Configuration	"True" or "False"
Include User Comments	"True" or "False"
Report Path	File path Example: TEKEXP:VALUE GENERAL,"Report Path", "X:\400G-TXE\Reports\"
Save As Type	■ Web Archive (*.mht;*.mhtml) ■ PDF (*.pdf;) ■ CSV (*.csv;)
View Report After Generating	"True" or "False"
Report Group Mode	■ Test Name ■ Test Result
Create report at the end	"True" or "False"
Run Test More than Once	"True" or "False"
Number of Runs	1 to 50
On Failure Stop and Notify	"True" or "False"
Timer Warning Info Message Popup	"True" or "False"
Timer Warning Info Message Popup Duration	1 to 300
Timer Error Message Popup	"True" or "False"
Timer Error Message Popup Duration	1 to 300

ParameterName	Value
Lane0 Connected to:Lane0+: Single Ended	Valid values are: ■ CH1 ■ CH2 ■ CH3 ■ CH4
DUT Type	Valid values are: ■ "56G" ■ "112G"
Data Rate (GBd) for OIF-PAM4	Valid values are: ■ For "56G", limit is 18 to 29 ■ For "112G", limit is 36 to 58
Samples per Symbol (M)	32 to 200
Linear pulse length (Np)	Valid values are: ■ For OIF-PAM4: (5 to 100) ■ For IEEE-PAM4: (5 to 200)
Linear pulse delay (Dp)	Valid values are: ■ For OIF-PAM4: (2 to Np-2) ■ For IEEE-PAM4: (2 to Np-2)
NearEnd Mask Width	0.1 to 0.5
FarEnd Mask Width	0.1 to 0.5
Bandwidth	■ "Full BW" ■ "50GHz"
Scope Noise	0 to 20
Target BER (1e-)	4 to 6
Mask Width	0.1 to 0.5

ParameterName	Value
CTLE FilterFile	■ ALL(1-9dB) ■ 0 dB ■ 1 dB ■ 1.5 dB ■ 2 dB ■ 2.5 dB ■ 3 dB ■ 3.5 dB ■ 4 dB ■ 4.5 dB ■ 5 dB ■ 5.5 dB ■ 6 dB ■ 6.5 dB ■ 7 dB ■ 7.5 dB ■ 8 dB ■ 9 dB ■ Custom ■ BestCTLE

ParameterName	Value
Near End CTLE FilterFile	For OIF, valid values are: ■ ALL(1-2dB) ■ 0 dB ■ 1 dB ■ 1.5 dB ■ 2 dB ■ Custom ■ BestCTLE For IEEE, valid values are: ■ ALL(1-3dB) ■ 0 dB ■ 1 dB ■ 1.5 dB ■ 2 dB ■ 2.5 dB ■ 3 dB ■ Custom ■ BestCTLE

ParameterName	Value
Far End CTLE FilterFile	■ ALL(1-9dB) ■ 0 dB ■ 1 dB ■ 1.5 dB ■ 2 dB ■ 2.5 dB ■ 3 dB ■ 3.5 dB ■ 4 dB ■ 4.5 dB ■ 5 dB ■ 5.5 dB ■ 6 dB ■ 6.5 dB ■ 7 dB ■ 7.5 dB ■ 8 dB ■ 9 dB ■ Custom ■ BestCTLE
Apply Filter	"True" or "False"
Data Positive De-Embedding filter	Filter file path Example: TEKEXP:VALUE GENERAL,"De-Embedding filter","C:\"
Data Negative De-Embedding filter	Filter file path Example: TEKEXP:VALUE GENERAL,"De-Embedding filter","C:\"
Crosstalk source	"True" or "False"
Phase Inverted Filter For Data-	"True" or "False"

Examples

This section provides the examples for the SCPI commands.

Example	Description
TEKEXP:*IDN?\n	It returns the active TekExpress application name running on the oscilloscope.
TEKEXP:*OPC?\n	It returns the last command execution status.
TEKEXP:ACQUIRE_MODE PRE-RECORDED\n	It sets the acquire mode as pre-recorded.
TEKEXP:ACQUIRE_MODE?\n	It returns LIVE when acquire mode is set to live.
TEKEXP:EXPORT REPORT\n	It returns the report file in bytes. This can be written into another file for further analysis.
TEKEXP:EXPORT IMAGE,"ImageA.png"\n	It returns the image file in bytes. This can be written into another file for further analysis.
TEKEXP:EXPORT WFM,"WaveformA.wfm"\n	It returns the waveform file in bytes. This can be written into another file for further analysis.
TEKEXP:INFO? REPORT\n	It returns “100,”ReportFileName.mht”", when 100 is the filesize in bytes for the filename ReportFileName.
TEKEXP:INFO? WFM\n	It returns “100,“WfmFileName1.wfm”";“200,“WfmFileName2.wfm”" when 100 is the filesize in bytes for the filename WfmFileName1.wfm and 200 is the filesize in bytes for the filename WfmFileName2.wfm.
TEKEXP:INFO? IMAGE	It returns the image file name.
TEKEXP:INSTRUMENT "Real Time Scope",DPO77002SX (GPIB8::1::INSTR)\n	It sets the instrument value as DPO77002SX (GPIB8::1::INSTR) for the selected instrument type Real Time Scope.
TEKEXP:INSTRUMENT? “Real Time Scope”\n	It returns "IDPO77002SX (GPIB8::1::INSTR), when DPO77002SX (GPIB8::1::INSTR)" is the selected instrument for the instrument type Real Time Scope.
TEKEXP:LASTERROR?\n	It returns ERROR: INSTRUMENT_NOT_FOUND, when no instrument is found.
TEKEXP:LIST? DEVICE\n	It returns "TX-Device,RX-Device" when TX-Device, RX-Device are the available device.
TEKEXP:LIST? INSTRUMENT,"Real Time Scope"\n	It returns "DPO77002SX (GPIB8::1::INSTR),MSO73304DX (TCPIP::134.64.248.91::INSTR)" when DPO72504D (GPIB8::1::INSTR), MSO73304DX (TCPIP:: 134.64.248.91::INSTR) are the list of available instruments.
TEKEXP:MODE COMPLIANCE\n	It sets the execution mode as compliance.
TEKEXP:MODE?\n	It returns COMPLIANCE when the execution mode is compliance.
TEKEXP:POPUP “OK”\n	It sets OK as the response to active popup in the application.
TEKEXP:POPUP?\n	It returns "OK", when OK is the active popup information shown in the application.
TEKEXP:REPORT GENERATE\n	It generates report for the current session.
TEKEXP:REPORT? “Scope Information”\n	It returns "DPO73304SX" when DPO73304SX is the scope model.
TEKEXP:REPORT? “DUT ID”\n	It returns "DUT001" when DNI_DUT001 is the DUT ID.

Example	Description
TEKEXP:RESULT? "Period using SCOPE (Acquire-Analyze Combined)"\n	It returns Pass when the test result is Pass.
TEKEXP:RESULT? "Period using SCOPE (Acquire-Analyze Combined)","Margin",1\n	It returns "L:-50.000ps H:2000.000ps" when L:-50.000ps H: 2000.000ps is the value.
TEKEXP:SELECT DEVICE, TX_Device, TRUE\n	It selects TX_Device
TEKEXP:SELECT? DEVICE\n	It returns "TX-Device" when TX-Device is the selected device type.
TEKEXP:SETUP DEFAULT\n	It restores the application to default setup.
TEKEXP:STATE STOP\n	It stops the test execution.
TEKEXP:STATE?\n	It returns as READY when the application is ready to run next measurement.
TEKEXP:STATE? SETUP\n	It returns as NOT_SAVED when the current setup is not saved.

References

Parameters

About application parameters

This section describes the 400G-TXE application parameters, and includes the default menu settings.

The parameters for the menus, and options list the selections available for each and include the default values.

Setup panel configuration parameters

DUT tab parameters.

Parameters		Selection	Default Setting
DUTID		-	DUT001
Mode		Compliance, User defined	Compliance
Standard		OIF-PAM4, IEEE-PAM4	OIF-PAM4
Specification		For OIF-PAM4, CEI-VSR, CEI-MR, CEI-LR For IEEE-PAM4, AUI4, CR4, KR4	CEI-VSR
Test Points	for CEI-VSR	TP0a, TP1a, TP4	TP0a
	for CEI-MR and CEI-LR	Testpoint-T	Testpoint-T
	for AUI4	TP0a, TP1a, TP4	TP0a
	for CR4	Testpoint-TP2	Testpoint-TP2
	for KR4	Testpoint-TP0a	Testpoint-TP0a
Device Profile			
DUT Type		56G, 112G	56G
Symbol Rate		For 56G, 18 GBd to 29 GBd For 112G, 36 GBd to 58 GBd	28.1 GBd
Crosstalk source		Select, De-select	De-select

Test Selection tab parameters.

Parameters	Selection	Default Setting

CEI-VSR at TP0a	■ DC Common Mode Output Voltage
	■ Diff Peak to Peak Output Voltage Tx Enabled
	■ AC Common Mode Output Voltage
	■ Transition Time
	■ Signal to Noise And Distortion Ratio
	■ Jitter measurements
	  ■ Even Odd Jitter
	  ■ Uncorrelated Bounded High Probability Jitter
	  ■ Uncorrelated Unbounded Gaussian Jitter
		All measurements selected

CEI-VSR at TP1a	■ DC Common Mode Output Voltage
	■ AC Common Mode Output Voltage
	■ Diff Peak to Peak Output Voltage Tx Enabled
	■ Transition Time
	■ Eye measurements
	  ■ Eye Width
	  ■ Eye Height
	  ■ Eye Linearity
	  ■ Eye Symmetry Mask Width
		All measurements selected

Parameters	Selection	Default Setting

CEI-VSR at TP4	■ DC Common Mode Output Voltage
	■ AC Common Mode Output Voltage
	■ Diff Peak to Peak Output Voltage Tx Enabled
	■ Transition Time
	■ Eye measurements
	  ■ Near end eye measurements
	  ■ Near End Eye Width
	  ■ Near End Eye Height
	  ■ Near End Eye Linearity
	  ■ Near End Eye Symmetry Mask Width
	  ■ Far end eye measurements
	  ■ Far End Eye Width
	  ■ Far End Eye Height
	  ■ Far End Eye Symmetry Mask Width
		All measurements selected

Parameters	Selection	Default Setting
CEI-MR	■ DC Common Mode Output Voltage ■ Diff Peak to Peak Output Voltage Tx Enabled ■ AC Common Mode Output Voltage ■ Single Ended Output Voltage ■ Signal To Noise And Distortion Ratio ■ Level Separation Mismatch Ratio ■ Linear Fit Pulse Peak ■ Steady State Voltage ■ Step size for coefficient C(-1) ■ Step size for coefficient C(0) ■ Step size for coefficient C(1) ■ Coefficient Range C(-1) ■ Coefficient Range C(0) ■ Coefficient Range C(1) ■ Even Odd Jitter ■ Jitter RMS ■ Uncorrelated J4 Jitter	All measurements selected

Parameters	Selection	Default Setting
CEI-LR	■ DC Common Mode Output Voltage ■ Diff Peak to Peak Output Voltage Tx Enabled ■ AC Common Mode Output Voltage ■ Single Ended Output Voltage ■ Signal To Noise And Distortion Ratio ■ Level Separation Mismatch Ratio ■ Linear Fit Pulse Peak ■ Steady State Voltage ■ Step size for coefficient C(-2) ■ Step size for coefficient C(-1) ■ Step size for coefficient C(0) ■ Step size for coefficient C(1) ■ Coefficient Range C(-2) ■ Coefficient Range C(-1) ■ Coefficient Range C(0) ■ Coefficient Range C(1) ■ Even Odd Jitter ■ Jitter RMS ■ Uncorrelated J4 Jitter	All measurements selected

Parameters	Selection	Default Setting

AUI4 at TP0a	■ DC Common Mode Output Voltage
	■ Diff Peak to Peak Output Voltage Tx Disabled
	■ Diff Peak to Peak Output Voltage Tx Enabled
	■ AC Common Mode Output Voltage
	■ Signaling Rate
	■ Signal to Noise And Distortion Ratio
	■ Level Separation Mismatch Ratio
	■ Tx Output Waveform Requirements Measurements
	  ■ Linear Fit Pulse Peak
	  ■ Steady State Voltage
	  ■ Pre Cursor Equalization
	  ■ Post Cursor Equalization
	  ■ Transmitter output residual ISI
	■ Jitter measurements
	  ■ Even Odd Jitter
	  ■ Uncorrelated J4 Jitter
	  ■ Jitter RMS
		All measurements selected

Parameters	Selection	Default Setting

AUI4 at TP1a	■ DC Common Mode Output Voltage
	■ Diff Peak to Peak Output Voltage Tx Disabled
	■ Diff Peak to Peak Output Voltage Tx Enabled
	■ AC Common Mode Output Voltage
	■ Single Ended Output Voltage
	■ Signaling Rate
	■ Transition Time
	■ Eye measurements
	  ■ Eye Height
	  ■ Eye Symmetry Mask Width
		All measurements selected

Parameters	Selection	Default Setting

AUI4 at TP4	■ DC Common Mode Output Voltage
	■ Diff Peak to Peak Output Voltage Tx Enabled
	■ AC Common Mode Output Voltage
	■ Signaling Rate
	■ Transition Time
	■ Eye measurements
	  ■ Near end eye measurements
	  ■ Near End Eye Height
	  ■ Near End Eye Symmetry Mask Width
	  ■ Far end eye measurements
	  ■ Far End Eye Height
	  ■ Far End Eye Symmetry Mask Width
	  ■ Far End Precursor ISI Ratio
		All measurements selected

Parameters	Selection	Default Setting

CR4 at TP2 and KR4 at Testpoint-TP0a	■ DC Common Mode Output Voltage
	■ Diff Peak to Peak Output Voltage Tx Disabled
	■ Diff Peak to Peak Output Voltage Tx Enabled
	■ AC Common Mode Output Voltage
	■ Signaling Rate
	■ Single Ended Output Voltage
	■ Level Separation Mismatch Ratio
	■ Tx Output Waveform Requirements Measurements
	  ■ Linear Fit Pulse Peak
	  ■ Steady State Voltage
	  ■ Coefficient Range
	  ■ Coefficient Initialization
	  ■ Normalized coeficient step size measurements
	■ Jitter measurements
	  ■ Even Odd Jitter
	  ■ Uncorrelated J3 Jitter
	  ■ Jitter RMS
		All measurements selected

Configuration tab parameters.

Table 20: Global settings parameters

Parameters		Selection	Default Setting
General Configuration			
De-embedding Filter		Select, De-select	De-select
Data+		File path	None
Data-		File path	None
Bandwidth		Full BW, 50 GHz	Full BW
Scope Noise		0 to 20	1
Tx Output Waveform			
Samples per Symbol (M)		32 to 200	32
Linear Pulse Length (Np)		For OIF-PAM4, 5 to 100 For IEEE-PAM4, 5 to 200	14
Linear Pulse Delay (Dp)		2 to Np-2	2
Eye Configuration for test point TP1a			
CTLE Filter File		All(1-9 dB)	All(1-9 dB)
Target BER (1e-)		4 to 6	6
Mask Width		0.1 UI to 0.5 UI	0.22 UI
Eye Configuration for test point TP4			
Near End CTLE Filter File		All(1-2 dB), 1 dB, 1.5 dB, 2 dB, Custom	All(1-2 dB)
Far End CTLE Filter File		All(1-2 dB), 1 dB, 1.5 dB, 2 dB, 2.5 dB, 3 dB, 3.5 dB, 4 dB, 4.5 dB, 5 dB, 5.5 dB, 6 dB, 6.5 dB, 7 dB, 7.5 dB, 8 dB, 8.5 dB, 9 dB, Custom	All(1-9 dB)
Target BER (1e-)		4 to 6	6
Mask Width	Near End	0.1 UI to 0.5 UI	0.265 UI
	Far End	0.1 UI to 0.5 UI	0.2 UI

Preferences tab parameters.

Parameters	Selection	Default Setting
Acquire/Analyze each test X times	1 to 50	1
Auto close Warnings and Information during Sequencing Auto close after X Seconds	1 to 300	10
Auto close Error Messages during Sequencing, Show in Reports Auto close after X Seconds	1 to 300	10

Reports panel parameters

Parameters	Selection	Default Setting
Report name	-	X:\400G-TXE\Reports \DUT001.mht
Save as Type	PDF (*.pdf;), Web Archive (*.mht; *.mhtml), CSV (*.csv;)	Web Archive (*.mht; *.mhtml)

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