



TekExpress® LVDS
Physical Layer Measurement and Debug Solution
Application Help (70K Series MSO)



077-1623-01





TekExpress® LVDS
Physical Layer Measurement and Debug Solution
Application Help (70K Series MSO)

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077-1623-01

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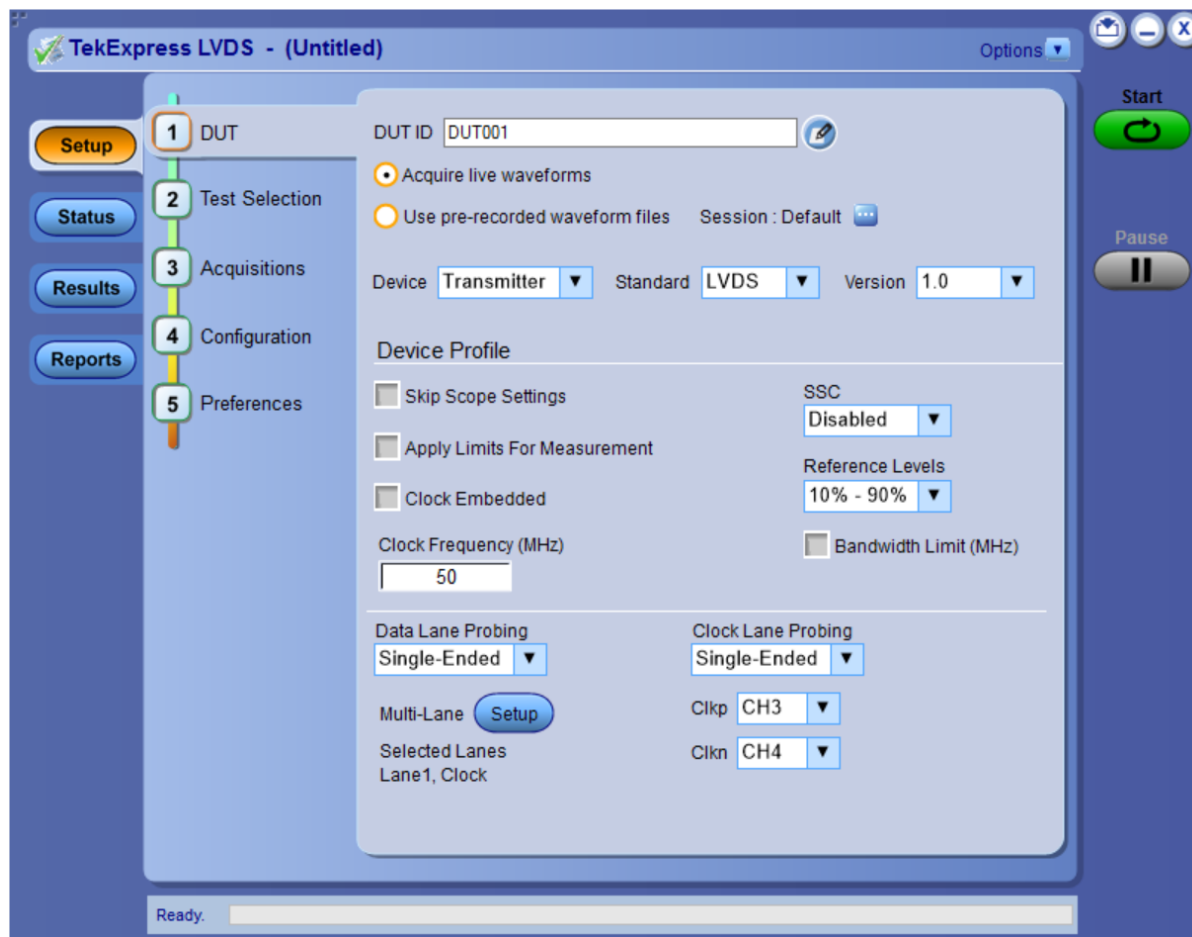
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Welcome



Welcome to the TekExpress® LVDS application. The Tektronix TekExpress® LVDS transmitter test application offers physical layer test solution for transmitter parameter measurements and characterization. The TekExpress® LVDS automated test solution, along with a Tektronix 5/6 Series MSO or 70KC oscilloscope provides an easy way to measure, test, debug, and characterize the electrical and timing measurements of various flavors of LVDS.

Key features and benefits

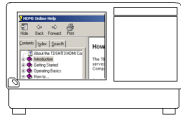

- Supports measurement from multiple LVDS standards
- Configurable test settings and limits
- Automatic mask for data rate and maximum voltage swing (MSV)
- Generic clock recovery configuration
- Reference level and filter file selection
- Multi-Run support
- Supports multiple report formats
- Supports TekExpress remote API - SCPI commands

Getting help and support

Related documentation

The following manuals are available as part of the TekExpress LVDS application documentation set.

Table 1: Product documentation




Item	Purpose	Location
Online Help	In-depth operation and UI help.	
PDF of the Online Help (077-1623-xx)	In-depth operation and UI help.	

Conventions

Help uses the following conventions:

- The term "Application," and "Software" refers to the TekExpress LVDS application.
- The term "DUT" is an abbreviation for Device Under Test.
- The term "select" is a generic term that applies to the two methods of choosing a screen item (button control, list item): using a mouse or using the touch screen.
- A Note identifies important information.

Table 2: 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.

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 Web site. See [Contacting Tektronix](#) at the front of this document for contact information.

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
- Modules 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

Supported oscilloscopes

Supported models

70K series MSO with bandwidth ≥ 350 MHz.

Bandwidth selection is based on the signal characteristics (data rate) as shown below:

$$\text{Bandwidth} = (\text{Data rate}/2) * 5$$

Some examples to calculate the bandwidth are as follows:

- For 800 Mbps data rate, $(800/2) * 5 = 2$ GHz
- For 1.5 Gbps data rate, $(1.5/2) * 5 = 3.750$ GHz
- For 5 Gbps data rate, $(5/2 * 5) = 12.5$ GHz

Recommended probes

The following are the list of probes required:

- **Differential Probes**
Two Differential probes P7700 - 70000C oscilloscopes with probe accessories
- **Single ended Probes**
SMA to BNC adapter (DUT fixture dependent)

Downloading and installing the software

Complete the following steps to download and install the latest LVDS application.

1. Go to www.tek.com.
2. Click **Downloads**. In the Downloads menu, select DOWNLOAD TYPE as Software and enter LVDS 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\TekExpress LVDS*.
5. Select **Analyze > TekExpress LVDS** from the oscilloscope Menu bar to launch the application.

Activate the license

Activate the license using the Option Installation wizard in the TekScope application:

1. In the **TekScope** application menu bar, click **Utilities > Option Installation**.

The **TekScope** Option Installation wizard opens.

2. Push the F1 key on the oscilloscope keyboard to open the Option Installation help topic.
3. Follow the directions in the help topic to activate the license.

View software version

Use the following instructions to view version information for the application and for the application modules.

To view version information for LVDS, click **Options > About TekExpress**.



File name extensions

The TekExpress LVDS application uses the following file name extensions:

Table 3: File name extension

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 formats.
.msk	A user mask file.
.pdf	Test result reports Application help document

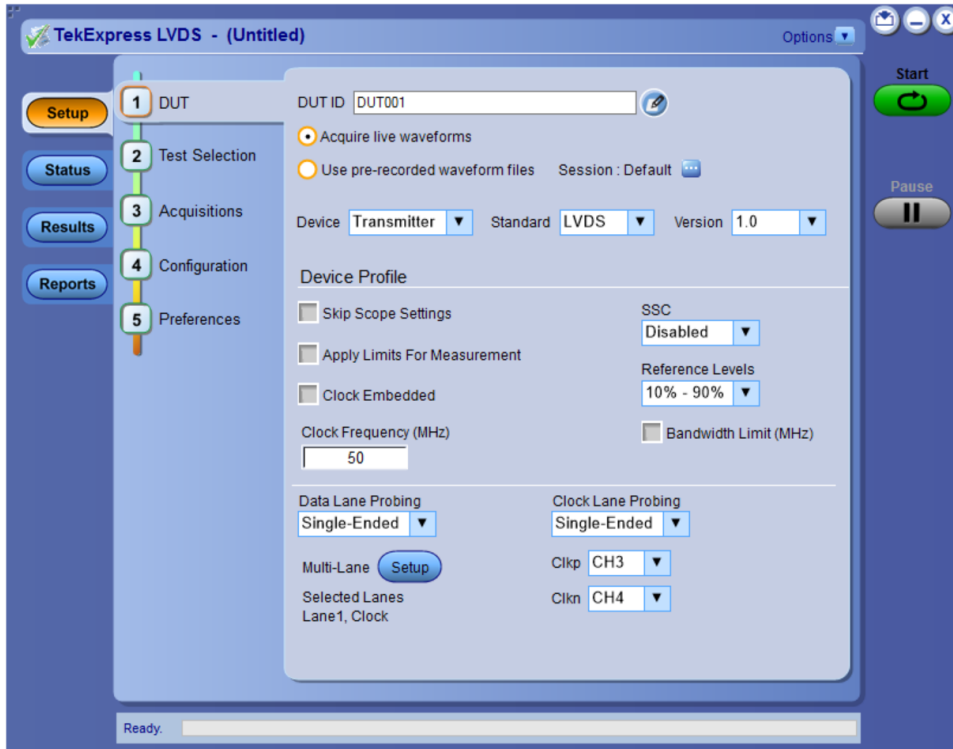
Table continued...

File name extension	Description
.xslt	Style sheet used to generate reports
.png	Captured images
.flt	Inverse filter co-efficient

Operating basics

Launch the application

To launch the TekExpress LVDS application, select **Analyze > TekExpress LVDS** from the oscilloscope Menu bar.



After first launch of Tekexpress LVDS application following changes take place on the oscilloscope.

During launch, a "My TekExpress" folder is created in the Documents folder of the current user and gets mapped to "X" drive. When the application is closed properly, the "X" drive will get unmapped.



Note: If a user with new login ID launches "TekExpress LVDS.exe", the "My TekExpress" folder is created in the Documents folder of the new user.

When you first run the application after installation, the application checks for Resources.xml located in the X:\ folder. The Resources.xml file gets created in the X: drive. If the file is not found, then the application creates the file with equipment details. Session files are then stored inside the X: \LVDS folder. If this file is not found, the application runs an instrument discovery program to detect connected instruments before launching TekExpress LVDS.

To keep the TekExpress LVDS application window on top, select **Keep On Top** from the [Options menu](#). If the application goes behind the oscilloscope application, click **Analyze > TekExpress LVDS** to move the application to be in front.



Note: When **Keep on Top** is selected, you cannot access the combo boxes in the application panels.

See also

[Exit the application](#)

Exit the application

To exit the application, click  on the application title bar. Follow on-screen prompts to save any unsaved session, save test setup files, or exit the application.



Note: Using other methods to exit the application can result in abnormal termination of the application.

Application controls

This section describes the application controls.

Table 4: Application control description












Item	Description
<p><i>Options menu</i></p> 	Menu to display global application controls.
<p><i>Test panel</i></p> 	Controls that open tabs for configuring test settings and options.
<p>Start / Stop button</p>  	<p>Use the Start button to start the test run of the measurements in the selected order. If prior acquired measurements are not cleared, then new measurements are added to the existing set.</p> <p>The button toggles to the Stop mode while tests are running. Use the Stop button to abort the test.</p>
<p>Pause / Continue button</p> 	Use the Pause button to pause the acquisition. When a test is paused, this button changes as Continue .
<p>Clear button</p> 	<p>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 <i>Results panel</i>.</p> <p> Note: This button is visible only when there are results data on the panel.</p>
<p>Application window move icon</p> 	Place the cursor over the top of the application window to move the application window to the desired location


Table continued...

Item	Description
Minimize icon 	Minimizes the application.
Close icon 	Close the application.
Mini view / Normal view 	<p>Toggles the application between mini view and normal view.</p> <p>Mini view displays the run messages with the time stamp, progress bar, Start / Stop button, and Pause / Continue button.</p> <p>The application moves to mini view when you click the Start button.</p>

Global application controls

The menus and controls that appear outside the individual tabs are called “Global Controls”. These are used to specify the devices to be tested.

Options menu overview

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


Menu	Function
Default Test Setup	Opens an untitled test setup with defaults selected
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
<i>Instrument Control Settings</i>	Detects, lists, and refreshes the connected instruments found on specified connections (LAN, GPIB, USB, and so on)
Keep On Top	<p>Keeps the TekExpress LVDS application on top of all the application</p> <p> Note: When Keep on Top is selected, you cannot access the combo boxes in the application panels.</p>
<i>Email Settings</i>	Configures email options for test run and results notifications
Help	Displays the TekExpress LVDS help

Table continued...

Menu	Function
About TekExpress	<ul style="list-style-type: none"> 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

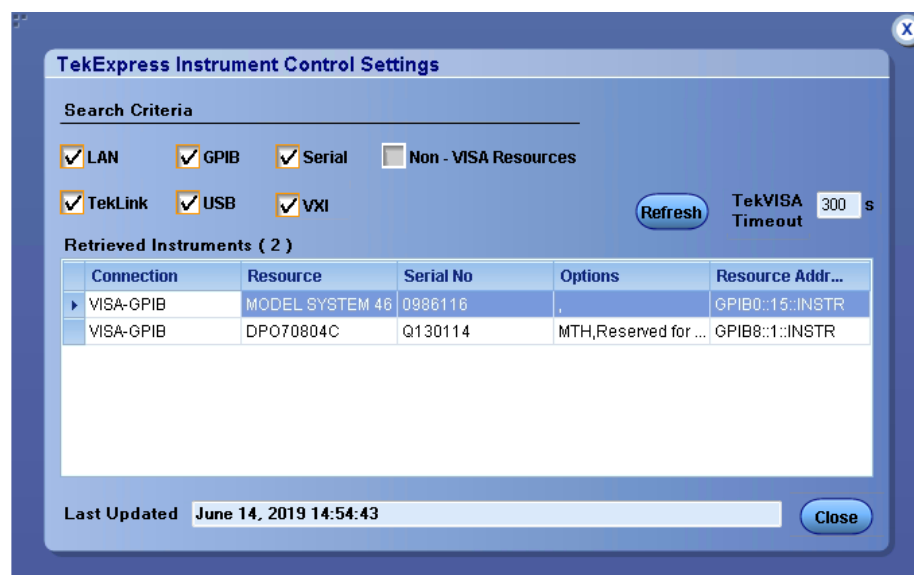
See also

[Application controls](#)

TekExpress instrument control settings

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

To access, click **Options > Instrument Control Settings**.



The connected instruments displayed here can be selected for use under Global Settings in the test configuration section.



Note: Select **GPIB** (Default) and **LAN** when using TekExpress LVDS application on 6 series MSO instruments.

See also

[Options menu overview](#)

View connected instruments

Use the TekExpress Instrument Control Settings dialog box to search the instruments (resources) connected to the application. The application uses TekVISA to discover the connected instruments.



Note: The instruments required for the test setup must be connected and it must be recognized by the application before running the test.

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 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.
3. Click **Refresh**. TekExpress searches for connected instruments.
4. After searching, the dialog box lists the instrument-related details based on the search criteria. For example, for the Search Criteria as LAN and GPIB, the application displays all LAN and GPIB instruments connected to the application.

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

[Equipment connection diagram](#) on page 46

Configure email settings

Use the **Email Settings** utility to get notified by email when a measurement completes, or produces any error condition. Follow the steps to configure email settings:

1. Select **Options > Email Settings** to open the Email Settings dialog box.
2. (Required) For **Recipient email Address(es)**, enter one or more recipient email addresses. 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 ID. For example: user@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.

If this server requires password authentication, enter a valid login name, password, and host name in the corresponding fields.



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:
 - 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.

Application panels overview

TekExpress LVDS application uses panels to group Test Setup 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.

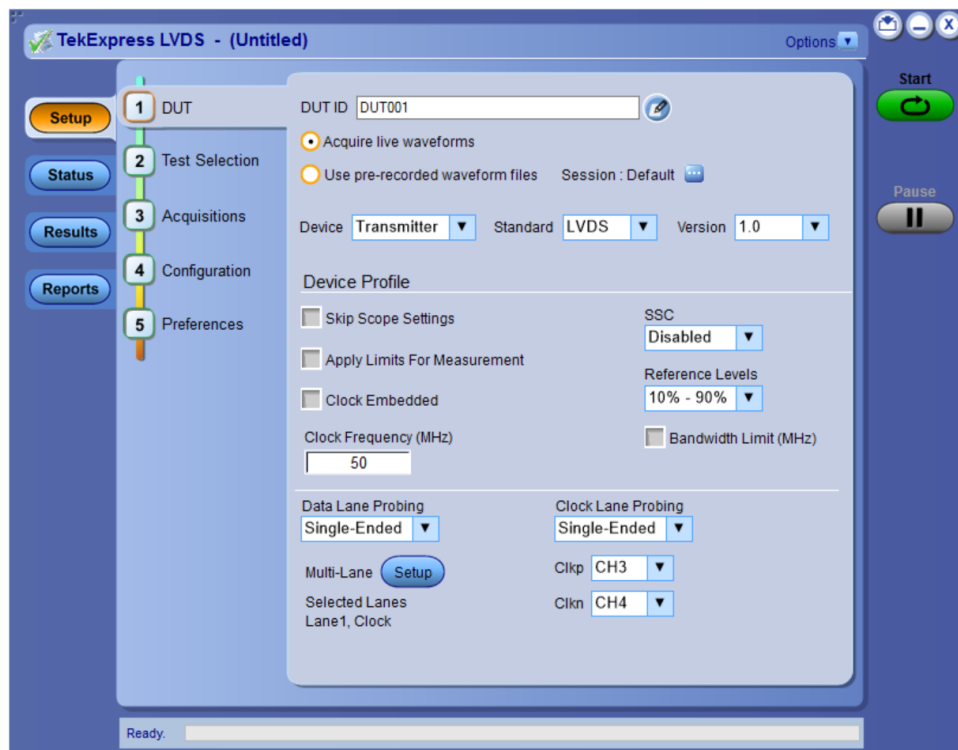


Table 5: Application panels overview

Panel Name	Purpose
Setup panel	<p>The Setup panel shows the test setup controls. Click the Setup button to open this panel.</p> <p>Use this panel to:</p> <ul style="list-style-type: none"> • Set DUT tab parameters • Select tests • Set acquisition tab parameters • Set configuration tab parameters • Set preferences tab parameters
Status panel	View the progress and analysis status of the selected tests, and view test logs.
Results panel	View 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, select report content to include (summary information, detailed information, user comments, setup configuration, application configuration, etc.), and select report viewing options.

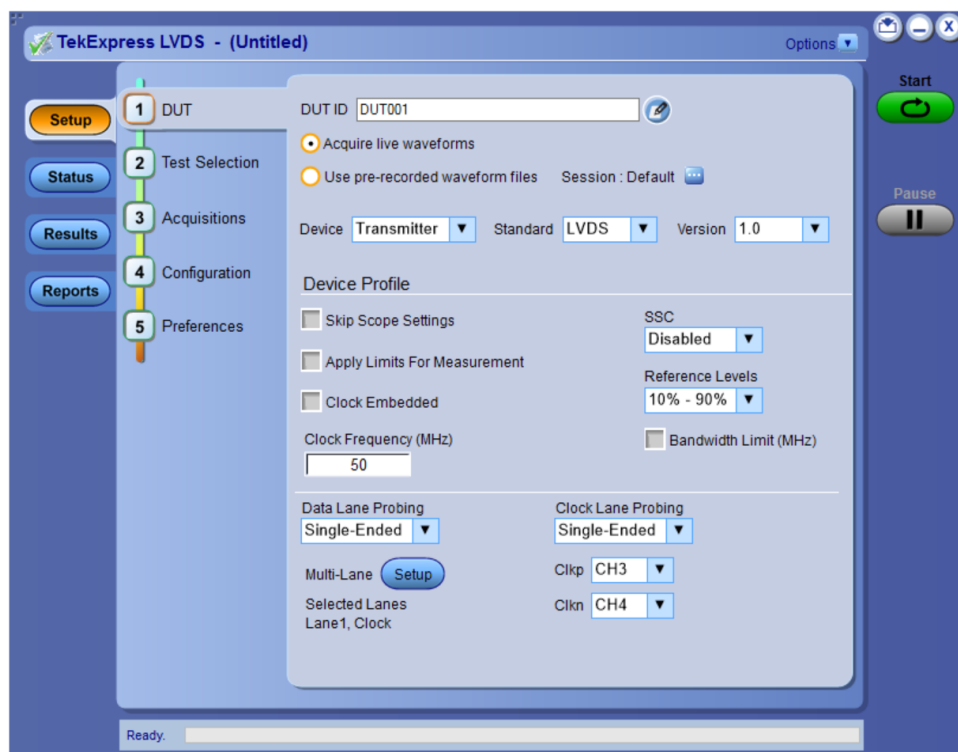
See also

[Application controls](#)

Setup panel

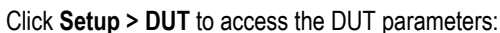
Setup panel overview

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 the current session. DUT settings also affect the list of available tests in the Test Selection tab.






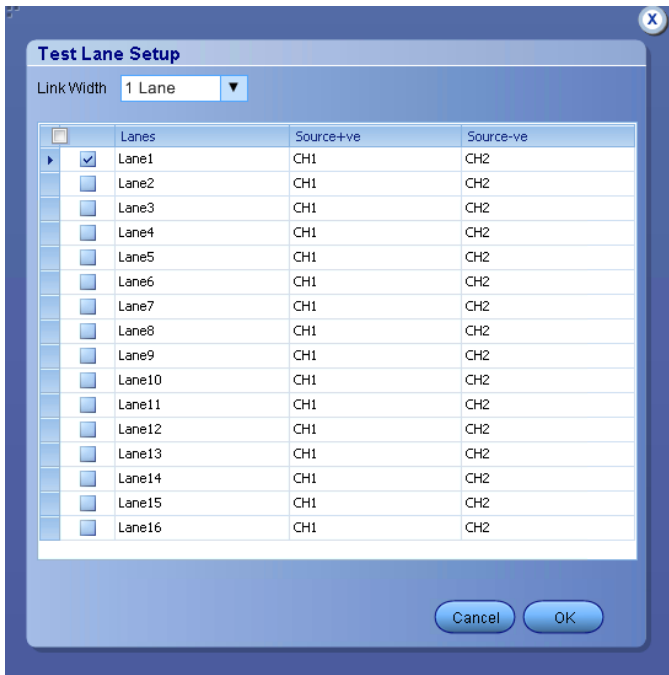

Settings	Description
DUT ID	<p>Adds an optional text label for the DUT to reports. The default value is DUT001. The maximum number of characters is 32.</p> <p>You cannot use the following characters in an ID name: (,.,,.,.,.,\,/:?"<> *)</p>
 Comments icon (to the right of the DUT ID field)	<p>Opens the 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.</p>
Acquire live waveforms	Acquires active signals from the DUT for measurement and analysis.
Session : Default	<p>Click  to save multiple config sessions or run multiple sessions together. Check Multiple-session run on page 26 for details about how to save multiple config sessions and runs the multiple config/run sessions together.</p>
Device	Select the device type from the drop-down list.
Standard	Select the standard from the drop-down list.
Version	Select the version from the drop-down list.
Device Profile	
Skip Scope Settings	Select to skip the oscilloscope settings.
Apply Limits for Measurement	Select to apply the limits for the measurements.
Clock Embedded	Select to enable the embedded clock.

Table continued...

Settings	Description
Clock Frequency (MHz)	Enter the clock frequency value in the text box.
Bandwidth Limit	Select to enable bandwidth limit for all lanes.
Bandwidth Value (MHz)	<p>Enter the low-pass bandwidth limit filter value in the text box.</p> <p>Note: Bandwidth is adjusted to the closest available value in the oscilloscope using geometric rounding.</p> <p> Example: When you set the bandwidth limit as 50 for an oscilloscope having available Bandwidth limit values of 20 MHz, 250 MHz, and 500 MHz, the application applies the closest bandwidth limit (20 MHz) for all the channels of the oscilloscope.</p>
SSC	Switch the SSC enabled/disabled from the drop-down list. By default Disabled is selected.
Reference Levels	Select the reference level from the drop-down list.
Data Lane Probing	Select the data lane probing from the drop-down list.
Clock Lane Probing	Select the clock lane probing from the drop-down list.
CkIp-CkIn	Select the channel from the drop-down list.
Multi-Lane Setup	<p>Displays the test lanes selected for the test session.</p> <p>To change lanes selected for testing, click Setup.</p>  <ol style="list-style-type: none"> 1. In the Test Lane Setup dialog box, select the desired number of lanes from the Link Width drop-down list. 2. In the Test Lane Setup menu, select the number of lanes selected, the Source+ve, and the Source-ve for each lane and click OK. <p> Note: Your selections display in the Lane Setup section of the DUT tab.</p>

See also

[Select tests](#)

Multiple-session run

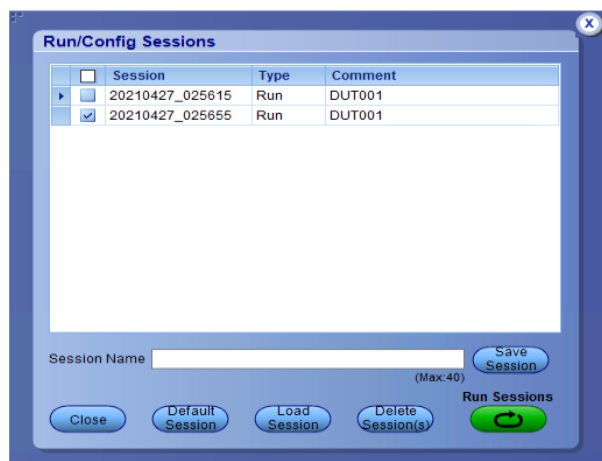
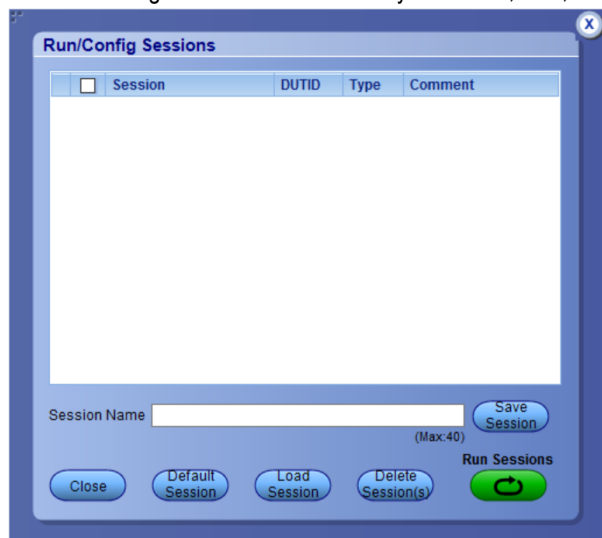
Multiple-sessions run feature allows you to save multiple config sessions and runs the multiple config/run sessions together.

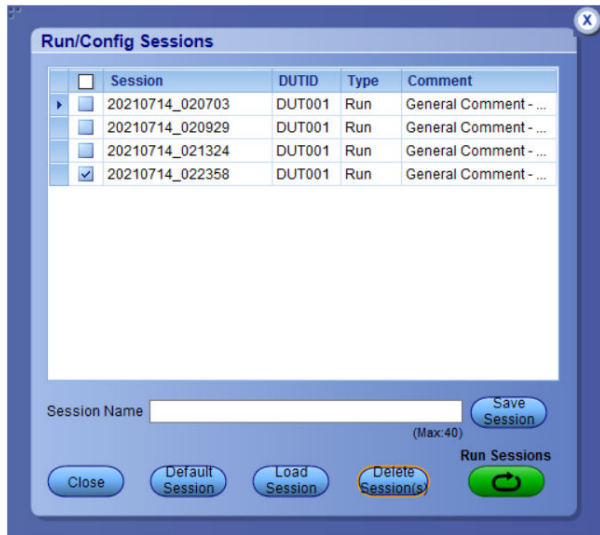
Click () button in the DUT panel. The Run/Config Sessions window displays the list of saved Run/Config sessions.

Run the test that are selected in the Test Selection tab, the Run sessions are created automatically and displayed in the **Run/Config Sessions** window after the test is executed. You can also save the Config session by configuring the settings in the application.

The Run/Config sessions window provides the summary of the sessions with session name, Type. You can also note-down the configuration changes in the comment column.

The Run/Config Session window allows you to save, load, delete, and set the sessions as default.





- **Session name:** Enter the name to save the config session. The maximum number of character supported is 40 and special characters (.,,.,.,.,\,/:?"<>|*) are not supported.
- **Save Session:** Save current configuration as a session with the given session name.
- **Close:** Close the Run/Config Session window.
- **Default Session:** Sets the application configurations to default values.
- **Load session:** Load the selected config/run session.
- **Delete Session(s):** Delete the selected config/run session.
- **Run Sessions:** Run the selected config/run session.

Enable/ Disable the Multi Run session

By default the **Multi Run Session** is enabled in the application. Set the `IsMultiSessionRunEnabled` value to false to disable the **Multi Run Session** feature in the `TekExpress.exe.Config` file, which is downloaded along the application.

Select tests

Use the **Test Selection** tab to select the tests. The test measurements available depends on the settings selected in the DUT. tab.

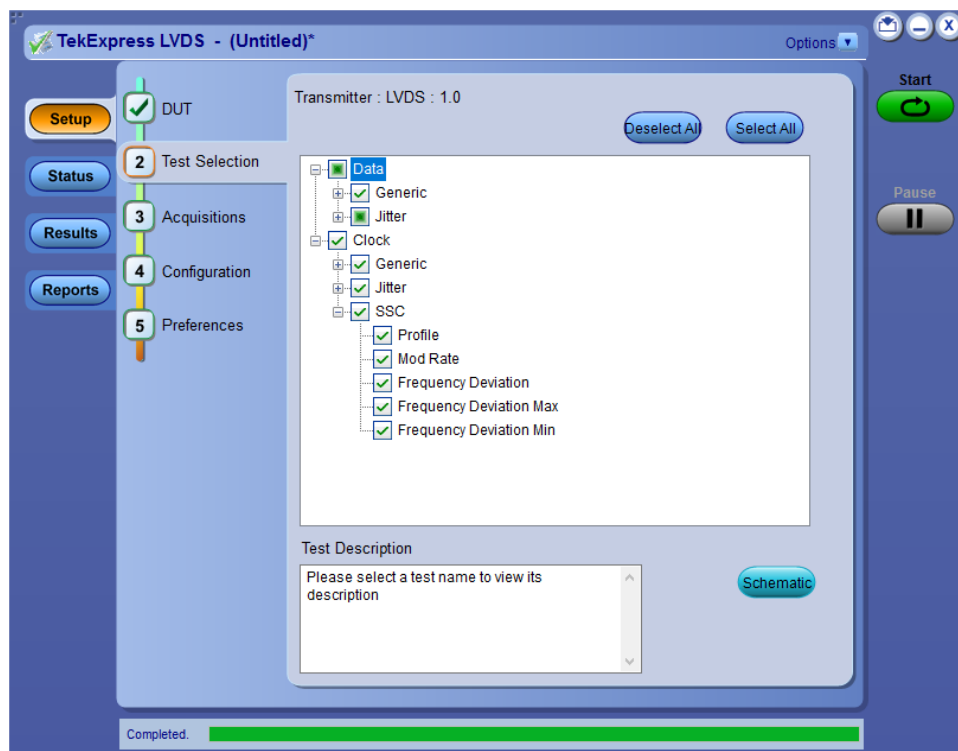


Figure 1: TekExpress LVDS Measurements

Table 7: Test Selection tab settings

Setting	Description
Deselect All	Deselect or select all tests in the list.
Select All	
Tests	Click on a test to select or unselect. Highlight a test to show details in the Test Description pane.
Test Description	Shows brief description of the highlighted test in the test tree.
Schematic	Shows an equipment and test fixture setup schematic (connection diagram) for the selected test. Use to set up the equipment and fixtures or to verify the 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 the tests selected.

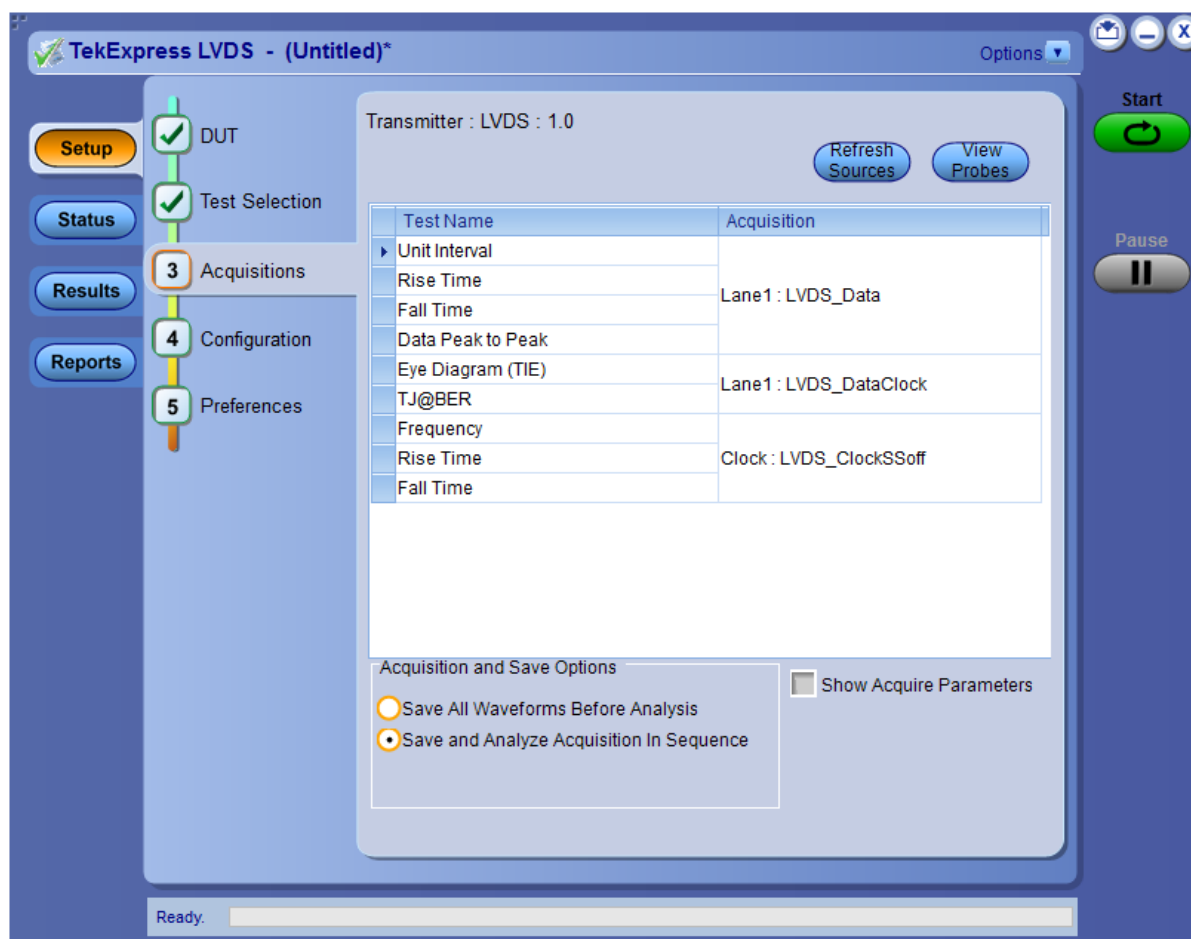


Table 8: Acquisitions tab settings

Settings	Description
View Probes	Displays the detected probe configuration. Use the View Probes dialog box to view the connected probes.
Refresh sources	Refresh and updates the sources list.
Acquisition and Save options	
Save All Waveforms Before Analysis	Saves all the waveforms before the analysis.
Save and Analyze Acquisition In Sequence	Saves and then analyses the acquisition in sequence.
Show Acquire Parameters	Select to view the acquisition parameters

The TekExpress LVDS saves all acquisition waveforms to files by default. 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:\TekExpress LVDS\Untitled Session\<dutid>\<date>_<time>`. Images created for each analysis, XML files with result values, reports, and other information specific to the sessions are also saved in this folder.

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 the **Configuration** tab to view and configure the Global Settings and the measurement configurations. The measurement specific configurations available in this tab depends on the selections made in the **DUT** panel and **Test Selection** panel.

Table 9: Configuration tab: Common parameters

Setting	Description																																																												
Limits Editor	<div>Displays the upper and lower limits for the applicable measurement using different types of comparisons.</div> <div><div><div>Limits Editor</div><div>View or Edit the values used for High Limit and Low Limit for each measurement A blank cell means no limit value is applied</div><table><thead><tr><th>Test Name</th><th>Details</th><th>Compare String</th><th>Low Limit</th><th>Compare String</th><th>High Limit</th></tr></thead><tbody><tr><td>Data_Rise_Time</td><td>Data Rise Time (ps)</td><td>>= Greater Than O...</td><td>1</td><td><= Less Than Or E...</td><td>1000</td></tr><tr><td>Data_Fall_Time</td><td>Data Fall Time (ps)</td><td>>= Greater Than O...</td><td>1</td><td><= Less Than Or E...</td><td>1000</td></tr><tr><td>Data_Width</td><td>Data Width (ns)</td><td>>= Greater Than O...</td><td>1</td><td><= Less Than Or E...</td><td>200</td></tr><tr><td>Data_Intra_Skew</td><td>Data Intra Skew PN...</td><td>>= Greater Than O...</td><td>0.001</td><td><= Less Than Or E...</td><td>1000</td></tr><tr><td>Data_Peak_to_Peak</td><td>Data Peak to Peak (...)</td><td>>= Greater Than O...</td><td>100</td><td><= Less Than Or E...</td><td>350</td></tr><tr><td>Data_AC_Timing</td><td>Mask Hits (kHits)</td><td>>= Greater Than O...</td><td>1</td><td><= Less Than Or E...</td><td>200</td></tr><tr><td></td><td>Hold Time (ns)</td><td>>= Greater Than O...</td><td>0.001</td><td><= Less Than Or E...</td><td>1000</td></tr><tr><td>Data_Clock_Data_Setup_Time</td><td>Mask Hits (kHits)</td><td>>= Greater Than O...</td><td>1</td><td><= Less Than Or E...</td><td>200</td></tr><tr><td></td><td>Setup Time (ns)</td><td>>= Greater Than O...</td><td>0.001</td><td><= Less Than Or E...</td><td>1000</td></tr></tbody></table><div>OK</div></div></div>	Test Name	Details	Compare String	Low Limit	Compare String	High Limit	Data_Rise_Time	Data Rise Time (ps)	>= Greater Than O...	1	<= Less Than Or E...	1000	Data_Fall_Time	Data Fall Time (ps)	>= Greater Than O...	1	<= Less Than Or E...	1000	Data_Width	Data Width (ns)	>= Greater Than O...	1	<= Less Than Or E...	200	Data_Intra_Skew	Data Intra Skew PN...	>= Greater Than O...	0.001	<= Less Than Or E...	1000	Data_Peak_to_Peak	Data Peak to Peak (...)	>= Greater Than O...	100	<= Less Than Or E...	350	Data_AC_Timing	Mask Hits (kHits)	>= Greater Than O...	1	<= Less Than Or E...	200		Hold Time (ns)	>= Greater Than O...	0.001	<= Less Than Or E...	1000	Data_Clock_Data_Setup_Time	Mask Hits (kHits)	>= Greater Than O...	1	<= Less Than Or E...	200		Setup Time (ns)	>= Greater Than O...	0.001	<= Less Than Or E...	1000
Test Name	Details	Compare String	Low Limit	Compare String	High Limit																																																								
Data_Rise_Time	Data Rise Time (ps)	>= Greater Than O...	1	<= Less Than Or E...	1000																																																								
Data_Fall_Time	Data Fall Time (ps)	>= Greater Than O...	1	<= Less Than Or E...	1000																																																								
Data_Width	Data Width (ns)	>= Greater Than O...	1	<= Less Than Or E...	200																																																								
Data_Intra_Skew	Data Intra Skew PN...	>= Greater Than O...	0.001	<= Less Than Or E...	1000																																																								
Data_Peak_to_Peak	Data Peak to Peak (...)	>= Greater Than O...	100	<= Less Than Or E...	350																																																								
Data_AC_Timing	Mask Hits (kHits)	>= Greater Than O...	1	<= Less Than Or E...	200																																																								
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	Setup Time (ns)	>= Greater Than O...	0.001	<= Less Than Or E...	1000																																																								

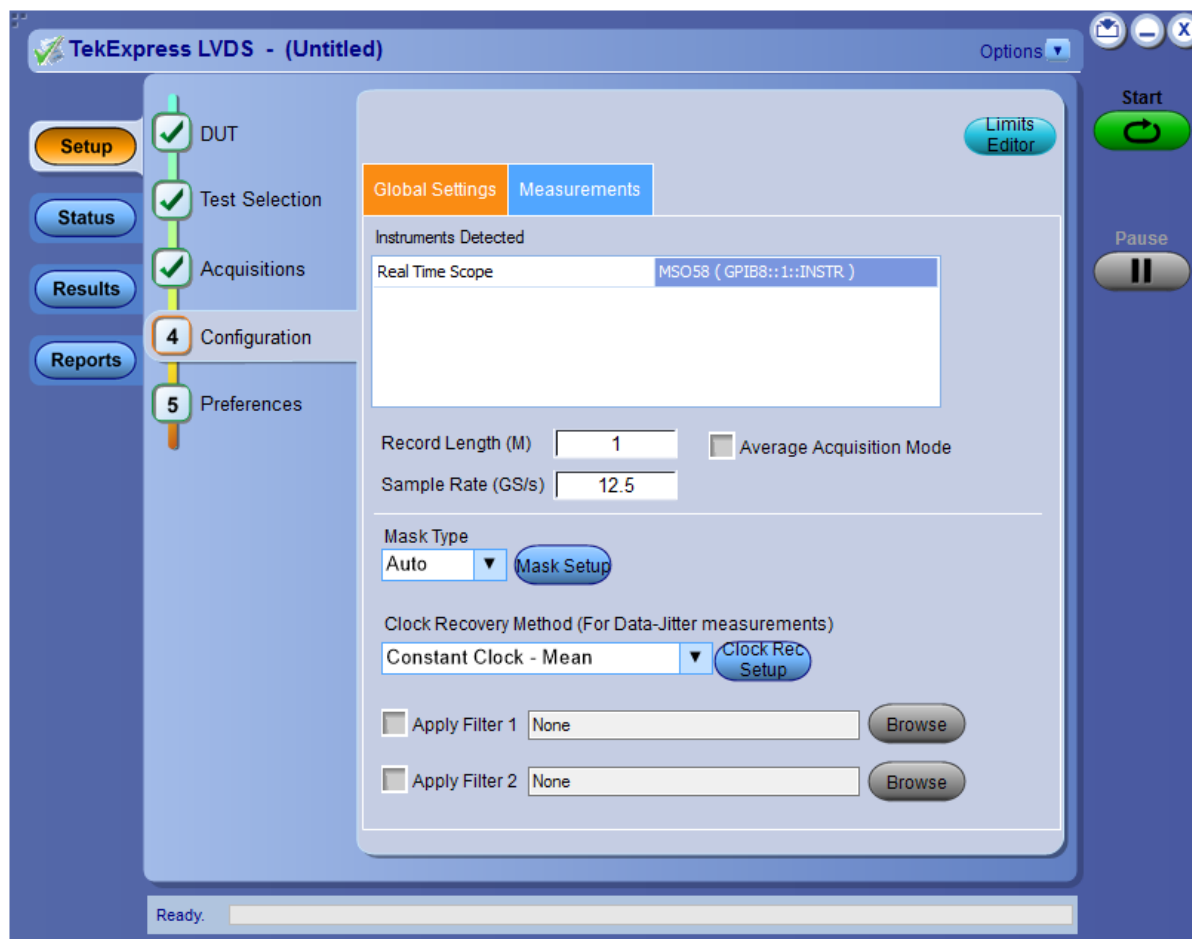


Figure 2: Configuration tab: Global Settings

Table 10: Configuration tab: Global settings


Setting	Description
Global Settings	
Instruments Detected	<p>Displays the instruments connected to this application. Click on the instrument name to open a list of available (detected) instruments.</p> <p>Select Options > Instrument Control Settings and click Refresh to update the instrument list.</p> <p> Note: Verify that the LAN and GPIB search criteria (default setting) in the Instrument Control Settings is selected when using the TekExpress LVDS application.</p>
Record Length (M)	Enter the record length value in the text box.
Sample Rate (GS/s)	Enter the sample rate value in the text box.
Average Acquisition Mode	Select to enable the average acquisition mode.

Table continued...

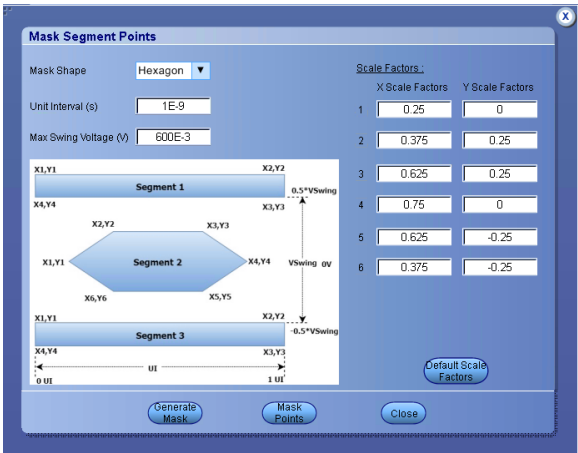
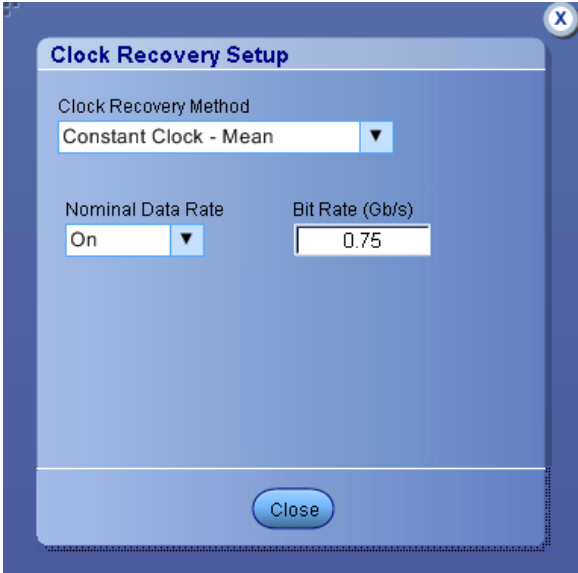
Setting	Description
Average Number of Waveforms	Enter the average number of Waveforms value in the text box Available only when Average Acquisition Mode is enabled.
Mask Type	Select the mask type from the drop-down list. <ul style="list-style-type: none"> Auto Manual
Mask Setup	<p>Mask Shape: Select the desired mask shape from the drop-down.</p> <ul style="list-style-type: none"> Square Hexagon Octagon <p>Unit Interval (s): Displays the horizontal length of the segments 1 and 2, which is equal to the unit interval of the data signal.</p> <p>Max Swing Voltage (V): Displays peak to peak voltage of data signal.</p> <p>Scale Factors:</p> <ul style="list-style-type: none"> X Scale factors: Displays x co-ordinate value of a mask point relative to UI (unit interval). Y Scale factors: Displays y co-ordinate value of a mask point relative to UI (unit interval). <p>Default Scale Factor: Click to populate all the default values of x and y scale factors.</p> <p>Generate Mask: Click to generate the automatic mask file.</p> <p>Click Generate Mask: reflects only the changes done in UI .</p> <p>Mask Point: Click to view the absolute values of all the points in mask file.</p> <p>Close: Click to close the auto mask utility.</p> 

Table continued...

Setting	Description
Clock Recovery Method (For Data-Jitter measurements)	<p>Select the clock recovery method from the drop-down list.</p> <ul style="list-style-type: none"> • Constant Clock Mean • Explicit Clock Edge • PLL Custom Bandwidth-Type 1 • PLL Custom Bandwidth-Type 2
Clock Recovery Setup	<p>Clock Recovery Method: Select the desired clock recovery method based on the DUT.</p> <p>Nominal Data Rate: Select the nominal data rate from the drop-down list.</p> <p>Bit Rate (Gb/s): Enter the bit rate value, only when nominal data rate is turned on.</p> 
Apply Filter 1	Select the check box to enable the filter 1 and browse to select the filter file.
Apply Filter 2	Select the check box to enable the filter 2 and browse to select the filter file.



Note: Filter file selection for de-embedding is based on the sample rate selection on the horizontal settings tab in the measurements panel.

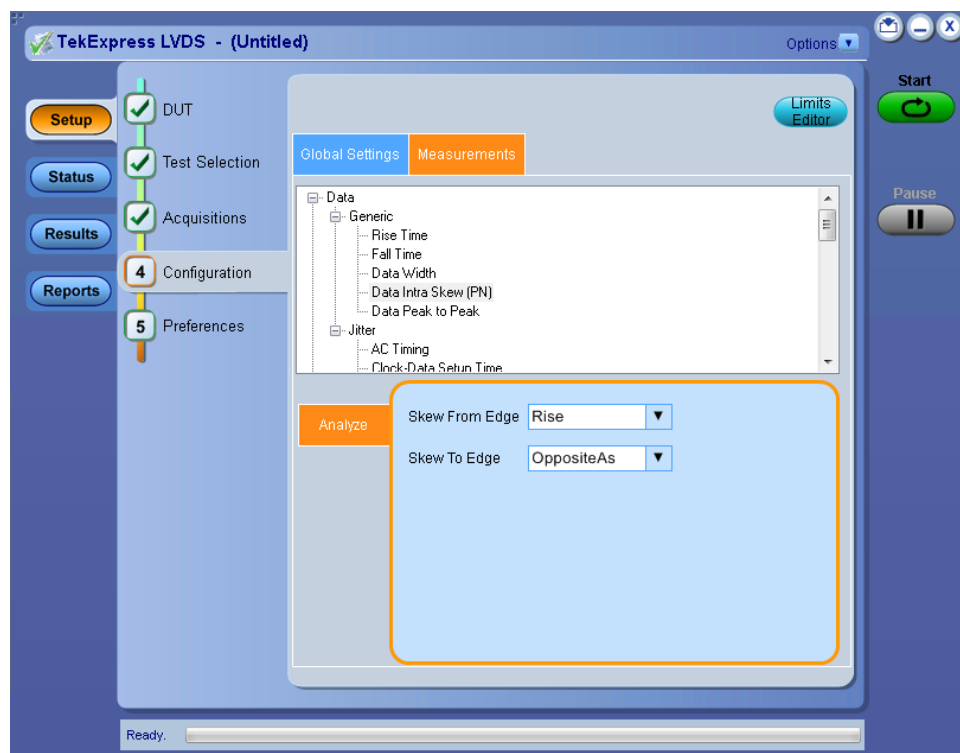



Figure 3: Configuration tab: Measurements

Table 11: Configuration tab: Measurements settings

Setting	Description
Measurements	<p>Displays the measurements that are selected in the Test Selection tab. The tests are grouped with unique acquisition type names.</p> <p>Note:</p>  <ul style="list-style-type: none"> When a parent test group is selected and any change is made, the change will be applied to all the tests. Individual test configuration is possible by selecting the test and making the required changes.
Analyze	Available for Data Intra Skew (PN) and Clock Intra Skew (PN)
Skew From Edge	<ul style="list-style-type: none"> Rise Fall
Skew To Edge	<ul style="list-style-type: none"> SameAs OppositeAs

Set preferences tab parameters

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

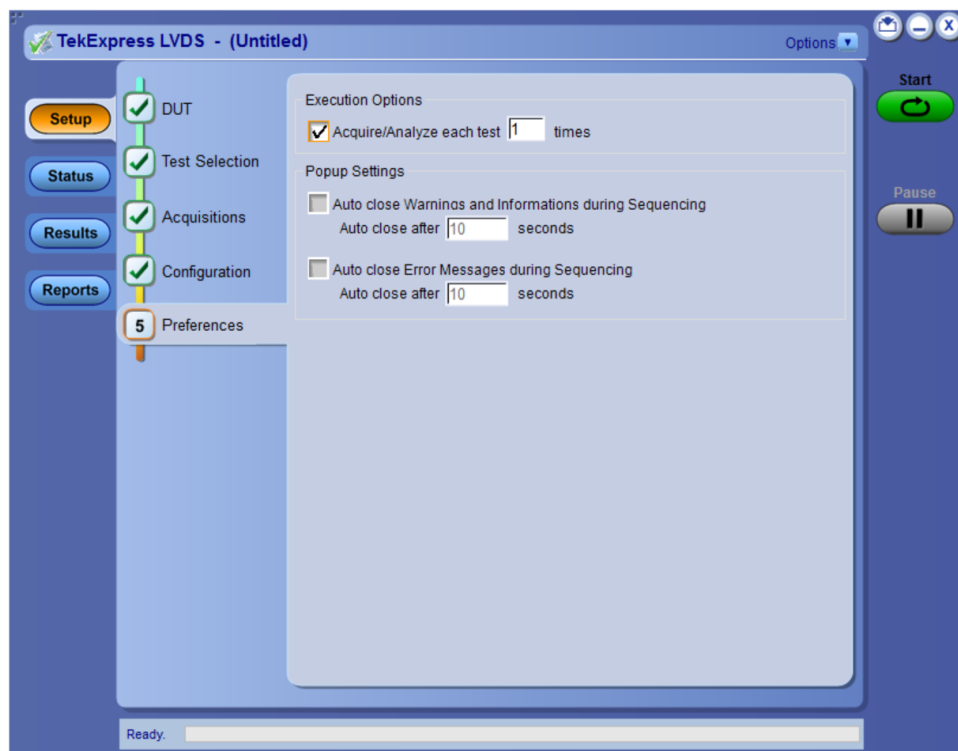


Figure 4: Preferences tab

Table 12: Preferences tab settings

Setting	Description
Execution Options	
Acquire/Analyze each test <no> times (not applicable to Custom Tests)	Select to repeat the test run by setting the number of times. By default the value is 1.
Popup Settings	
Auto close Warnings and Information during Sequencing	Select to auto close warnings/information during sequencing. Set the Auto close time. By default it is unselected.
Auto close after <no> Seconds	
Auto close Error Messages during Sequencing. Show in Reports	Select to auto close Error Messages during Sequencing. Set the Auto close time. By default it is unselected.
Auto close after <no> Seconds	

Status panel overview

The **Status** panel accesses the **Test Status** and **Log View** tabs, which provide status on test acquisition and analysis (Test Status) 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 tests are running.

Test Status: The tests are grouped and displayed based on the Clock and Data lane. It displays the tests along with the Acquisition type, Acquire, and Analysis status of the tests. In pre-recorded mode, Acquire status is not valid.

Log View: It displays the detailed execution status of the tests.

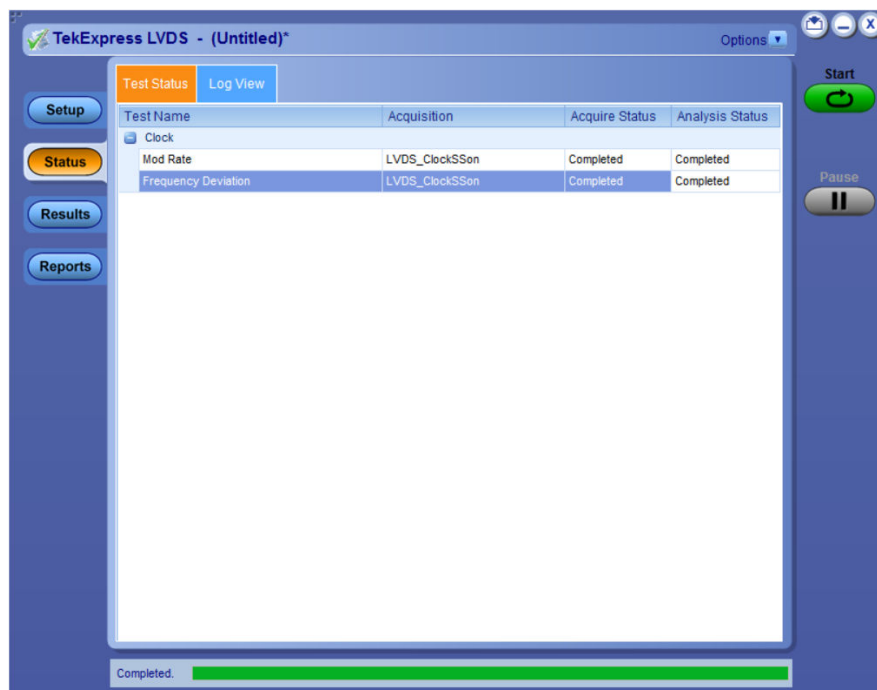


Figure 5: Test status view in the Status panel

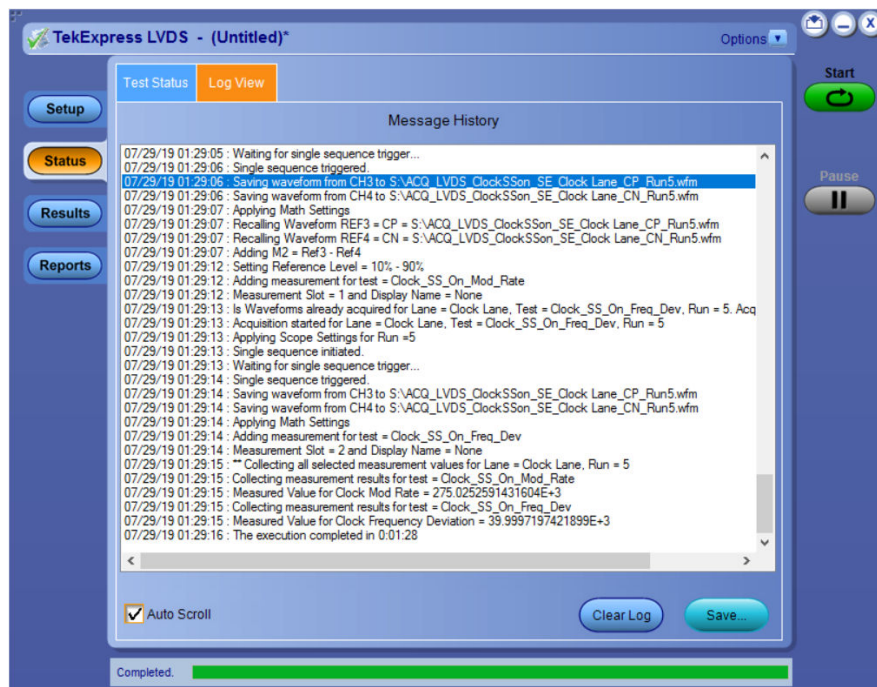


Figure 6: Log view in the Status panel

Table 13: Status panel settings

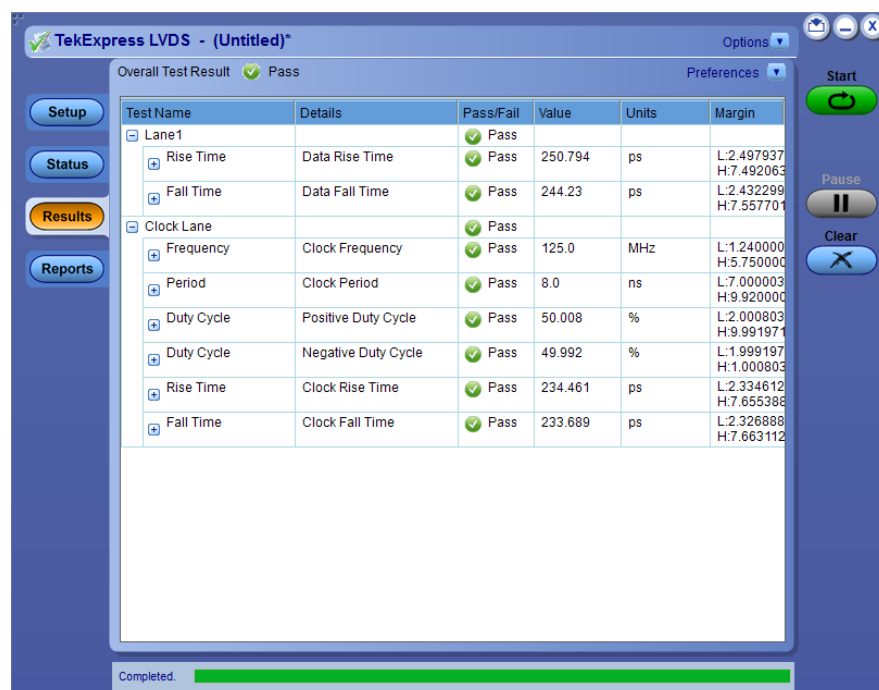
Control	Description
Message History	Lists all executed test operations and timestamp information.
Auto Scroll	Enables automatic scrolling of the log view as information is added to the log during the test execution.
Clear Log	Clears all messages from the log view.
Save	Saves the log file to a text file. 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.



Each test result occupies a row in the Results table. By default, results are displayed in summary format with the measurement details collapsed and with the Pass/Fail column visible. Change the view in the following ways:

- To remove or restore the Pass/Fail column, select **Preferences > Show Pass/Fail**.
- To collapse all expanded tests, select **Preferences > View Results Summary**.
- To expand all tests listed, select **View Results Details** from the **Preferences** menu in the upper right corner.
- To enable or disable the wordwrap feature, select **Preferences > Enable Wordwrap**.

- To view the results grouped by lane or test, select the corresponding item from the Preferences menu.
- To expand the width of a column, place the cursor over the vertical line that separates the column from the column to the right. When the cursor changes to a double-ended arrow, hold down the mouse button and drag the column to the desired width.
- To clear all test results displayed, click **Clear**.

See also

[View a report](#)

[Application panel overview](#)

Preferences menu

The **Preferences** menu is part of the **Results** panel display. Use the Preferences menu to change how some items display in the Results panel.

- To include pass/fail details info in the details table, select **Show Pass/Fail**.
- To view the results summary, select **View Results Summary**.
- To expand all tests listed, select **View Results Details**.
- To enable or disable the wordwrap feature, select **Enable Wordwrap**.
- To group the tests by lane, select **Group by Lane**.
- To group the tests, select **Group by Test**.

See also

[Results panel overview](#)

View test-related files






Files related to tests are stored in `My TekExpress\LVDS\Untitled session` folder. Each test setup in this folder has both 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:

```

 20190710_222926
 20190711_235310
 20190711_235444
 20190711_235310.TekX
 20190711_235444.TekX

```

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 `X:\LVDS`. 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 LVDS application.

See also

[File name extensions](#)

Reports panel

The **Report** panel contains the **Configuration** and **View Settings** tabs to configure the report generation settings and select the test result information to include in the report. You can use the Reports panel to configure report generation settings, select test content to include in reports, generate the report, view the report, browse for reports, name and save reports, and select report viewing options.

Report configuration settings

The Configuration tab describes the report generation settings to configure the Reports panel. Select report settings before running a test or when creating and saving test setups. Report settings configured are included in saved test setups.

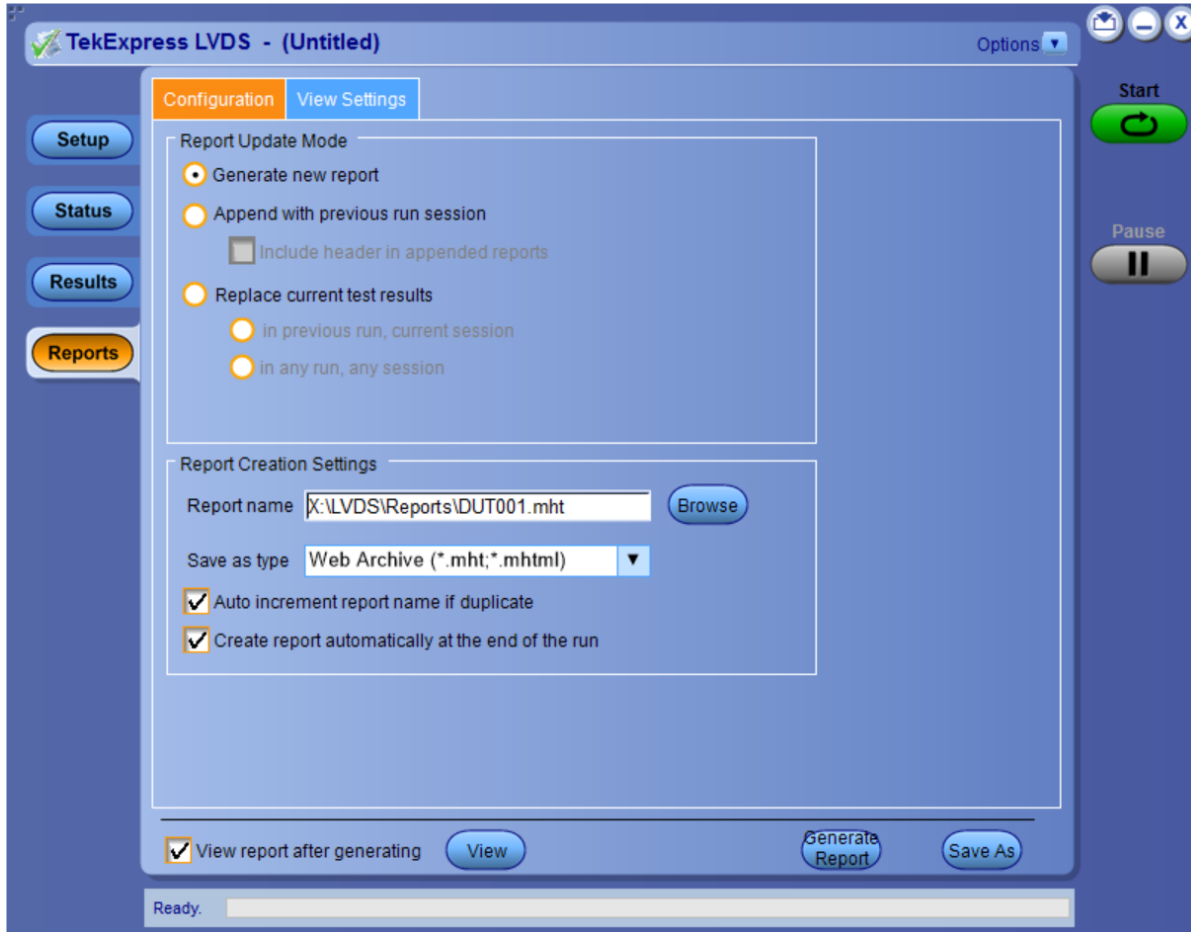




Table 14: Report configuration panel settings

Control	Description
View report after generating	Automatically opens the report in a 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.
Report Update Mode Settings	
Table continued...	

Control	Description
Generate new report	Each time when you click Run and when the test execution is complete, it will create a new report. The report can be in either .mht, .pdf, or .csv file formats.
Append with previous run session	Appends the latest test results to the end of the current test results report. Each time when you click this option and run the tests, it will run the previously failed tests and replace the failed test result with the new pass test result in the same report.
Include header in appended reports	Select to include header in appended reports.
Replace current test in previous run session	Replaces the previous test results with the latest test results. Results from newly added tests are appended to the end of the report.
In previous run, current session	Select to replace current test results in the report with the test result(s) of previous run in the current session.
In any run, any session	Select to replace current test results in the report with the test result(s) in the selected run session's report. Click and select test result of any other run session.
Report Creation Settings	
Report name	<p>Displays the name and path of the <Application Name> report. The default location is at \My Documents>\My TekExpress\<Application Name>\Reports. 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.</p> <p>To change the report name or location, do one of the following:</p> <ul style="list-style-type: none"> In the Report Path field, type the current folder path and name. Double-click in the Report Path field and then make selections from the popup keyboard and click Enter. <p>Be sure to include the entire folder path, the file name, and the file extension. For example: C:\Documents and Settings\your user name\My Documents\My TekExpress\<Application Name> \DUT001.mht.</p> <p> Note: You cannot set the file location using the Browse button.</p> <p>Open an existing report</p> <p>Click Browse, locate and select the report file and then click View at the bottom of the panel.</p>
Save as type	<p>Saves a report in the specified file type, selected from the drop-down list. The report is saved in .csv, .pdf, or .mht.</p> <p>Note:</p> <p> 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.</p>
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	Select to create the report with the settings configured, at the end of run.

Configure report view settings

The View Settings tab describes the report view settings to configure the Reports panel. Select report view settings before running a test or when creating and saving test setups. Report settings configured are included in saved test setups.

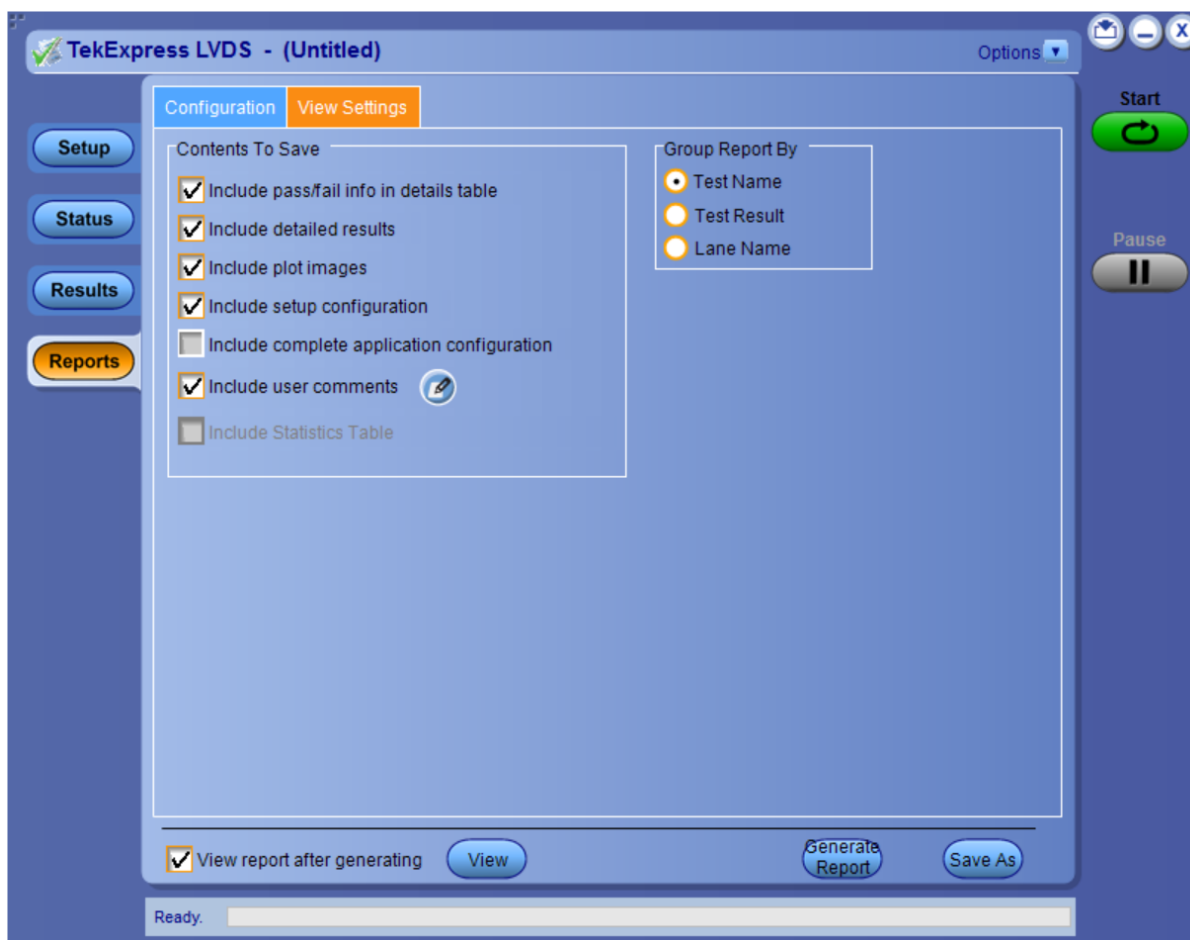


Table 15: Report panel view settings

Control	Description
Contents To Save Settings	
Include pass/fail info in details table	Select to include pass/fail information in the details table of the report.
Include detailed results	Select to include detailed results in the report.
Include plot images	Select to include the plot images in the report.
Include setup configuration	Sets the application to include hardware and software information in the summary box at the top of the report. Information includes: the oscilloscope model and serial number, the oscilloscope firmware version, and software versions for applications used in the measurements.
Include complete application configuration	Select to include the complete application configuration in the report.

Table continued...

Control	Description
Include user comments	Select to include any comments about the test that you or another user have added in the DUT tab of the Setup panel. Comments appear in the Comments section, below the summary box at the beginning of each report.
Include statics table	Select to include test run statistics in the report. This is enabled when you run any test for more than once. Set Acquire/Analyze each test in the Preferences tab to more than one, to run any test for multiple times.
Group Report By	
Test Name	Select to group the test results based on the test name in the report. Select to display the test results by test name.
Test Result	Select to group the test results based on the test result in the report.
Lane Name	Select to display the test results by lane.

View a report

The application automatically generates a report when test execution is complete and displays the report in your default Web browser (unless you 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**.



Note: The iteration column will be displayed only when more than one test run is selected.

For information on changing the file type, file name, and other report options, see [Select report options](#).

Report content

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



TekExpress LVDS

LVDS Test Report

Setup Information			
DUT ID	DUT001	Scope Serial Number	C012030
Date/Time	2019-07-16 23:17:57	SPC, Factory Calibration	PASS
Execution Mode	Live	Scope F/W Version	1.16.6.6557
TekExpress Version	Framework: 4.11.0.45	DUT Clock Probing	Single-Ended
App Version	LVDS: 1.0.0.177	DUT Data Probing	Single-Ended
Overall Execution Time	0:00:56	Scope Model	MS058
		ProbModel1	"1X"
		ProbModel2	"1X"
		ProbModel3	"1X"
		ProbModel4	"1X"
		ProbModel5	"1X"
		ProbModel6	"1X"
		ProbModel7	"1X"
		ProbModel8	"1X"
		ProbeSerial1	"N/A"
		ProbeSerial2	"N/A"
		ProbeSerial3	"N/A"
		ProbeSerial4	"N/A"
		ProbeSerial5	"N/A"
		ProbeSerial6	"N/A"
		ProbeSerial7	"N/A"
		ProbeSerial8	"N/A"
DUT COMMENT:		General Comment - LVDS	

Test Name Summary Table	
Rise Time	Pass
Fall Time	Pass
Frequency	Pass
Period	Pass
Duty Cycle	Pass
Rise Time	Pass
Fall Time	Pass

Rise Time								
Measurement Details	Lane	Iteration	Measured Value	Units	Test Result	Margin	Low Limit	High Limit
Data Rise Time	Lane1	1	250.794	ps	Pass	L:2.497937e+002ps H:7.492063e+002ps	1	1000
COMMENTS		NA						

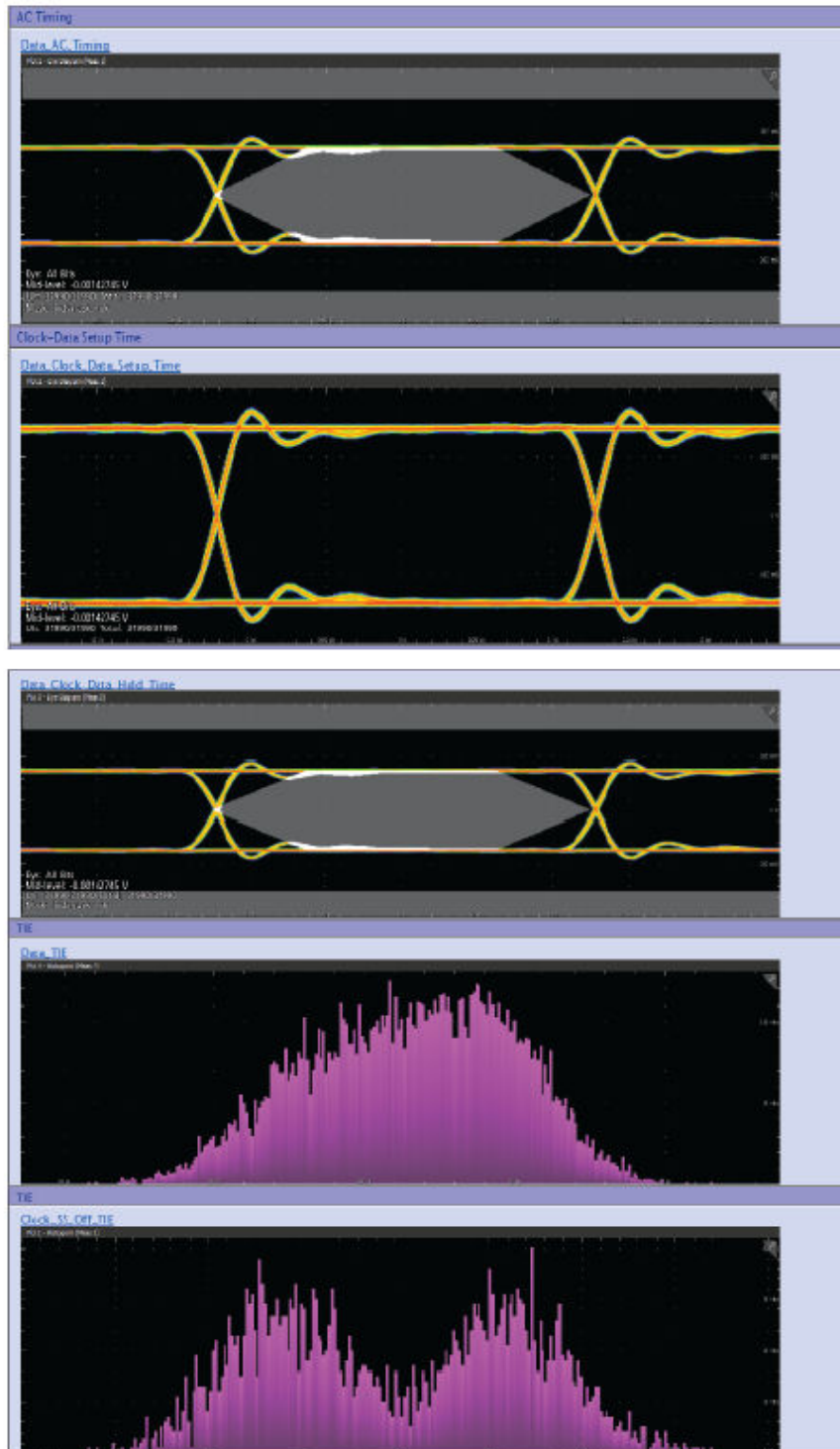
[Back to Summary Table](#)

Fall Time								
Measurement Details	Lane	Iteration	Measured Value	Units	Test Result	Margin	Low Limit	High Limit
Data Fall Time	Lane1	1	244.23	ps	Pass	L:2.432299e+002ps H:7.557701e+002ps	1	1000
COMMENTS		NA						

[Back to Summary Table](#)

Frequency								
Measurement Details	Lane	Iteration	Measured Value	Units	Test Result	Margin	Low Limit	High Limit
Clock Frequency	Clock Lane	1	125.0	MHz	Pass	L:1.240000e+002MHz H:5.750000e+002MHz	1	700
COMMENTS		NA						

[Back to Summary Table](#)



[Setup configuration information](#)

[User comments](#)

See also

[Results panel overview](#)

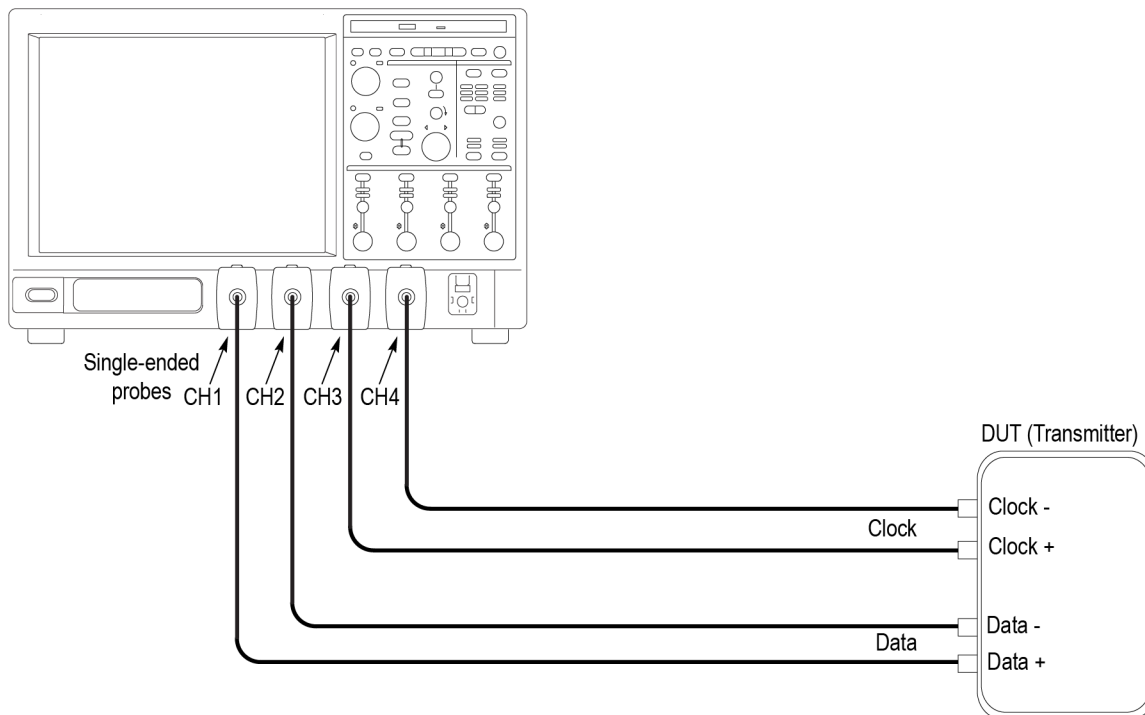
[*View test-related files*](#)

Running tests

Equipment connection diagram

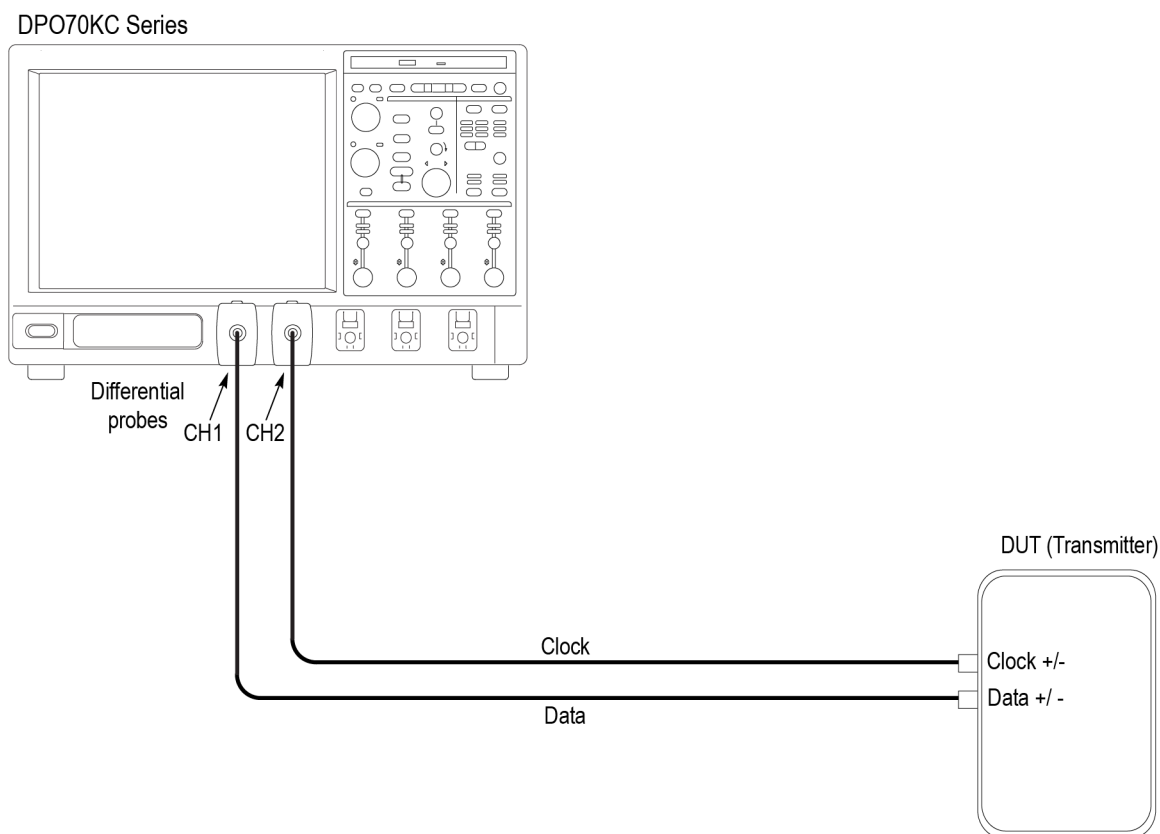
Single-ended Connection Diagram

DPO70KC Series



1623 001

Differential Connection Diagram



1623 002

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.

Running tests

Use [Set DUT parameters](#), [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 tests are running, the other applications will be displayed at the background. If you want the TekExpress LVDS application to run in the foreground 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.

View test results

When a test completes, the application switches to the Results panel, which shows a summary of test results.

Each test result occupies a row in the Results table. By default, results are displayed in summary format, with the measurement details collapsed. You can change the view in the following ways:

- To view the results grouped by lane, test, or data rate, select the corresponding item from the Preferences menu.
- To expand all tests listed, select **View Results Details** from the Preferences menu.
- To expand and collapse tests, use the plus and minus buttons to the left of the test rows.
- To collapse all expanded tests, select **Preferences > View Results Summary**.
- To enable or disable the wordwrap feature, select **Preferences > Enable Wordwrap**.
- To expand the width of a column, place the cursor over the vertical line that separates the column from the one to the right. When the cursor changes to a double-ended arrow, hold down the mouse button and drag the column to the desired width.
- To sort the test information by column, click the column head. When sorted in ascending order, a small up arrow is displayed. When sorted in descending order, a small down arrow is displayed.
- To clear all test results displayed, click **Clear** ().

Saving and recalling test setup

Test setup files overview

Saved test setup information (such as the selected oscilloscope, general parameters, acquisition parameters, measurement limits, waveforms (if applicable), and other configuration settings) are saved under the setup name at **X:\LVDS**.

Use test setups to:

- Run a new session, to acquire live waveforms, using a saved test configuration.
- Create a new test setup using an existing one.
- View all the information associated with a saved test, including the log file, the history of the test status as it executed, and the results summary.
- Run a saved test using saved waveforms.

See also

[Save a test setup](#)

[Open \(load\) a saved test setup](#)

Save a test setup

You can save a test setup before or after running a test. You can create a test setup from [already created test setup](#), or using [default test setup](#). When you select the default test setup, the parameters are set to the application's default value.

Select **Options > Save Test Setup** to save the opened setup.

Select **Options > Save Test Setup As** to save the setup with different name.

Open load a saved test setup

To Open (load) a saved test setup, do the following:

1. Select **Options > Open Test Setup**.
2. Select the setup from the list and click **Open**. Setup files are located at **X:\LVDS**.

See also

[About test setups](#)

[Create a test setup using an existing one](#)

[Create a test setup from default settings](#)

Create a test setup from default settings

To create a test setup using default settings, follow the steps:

1. Select **Options > Default Test Setup**. For default test setup, the parameters are set to the application's default value.
2. Click application [Setup](#) and set the parameters
3. Click application [Reports](#) and set the report options
4. Optional: Click **Start** to run the test and verify that it runs correctly and captures the specified test information and reports. If it does not, then edit the parameters and repeat this step until the test runs to your satisfaction
5. Select **Options > Save Test Setup**. Enter the file name and click Save. The application saves the file to **X:\LVDS\<session_name>**

Create a test setup using an existing one

To create a test setup using an existing one, follow the steps:

1. Select **Options > Open Test Setup**
2. Select a setup from the list and then click **Open**
3. Click application setup and modify the parameters
4. Click application reports and modify the report options
5. Select **Options > Save Test Setup As**
6. Enter test setup name, and click **Save**.

SCPI commands

About SCPI command

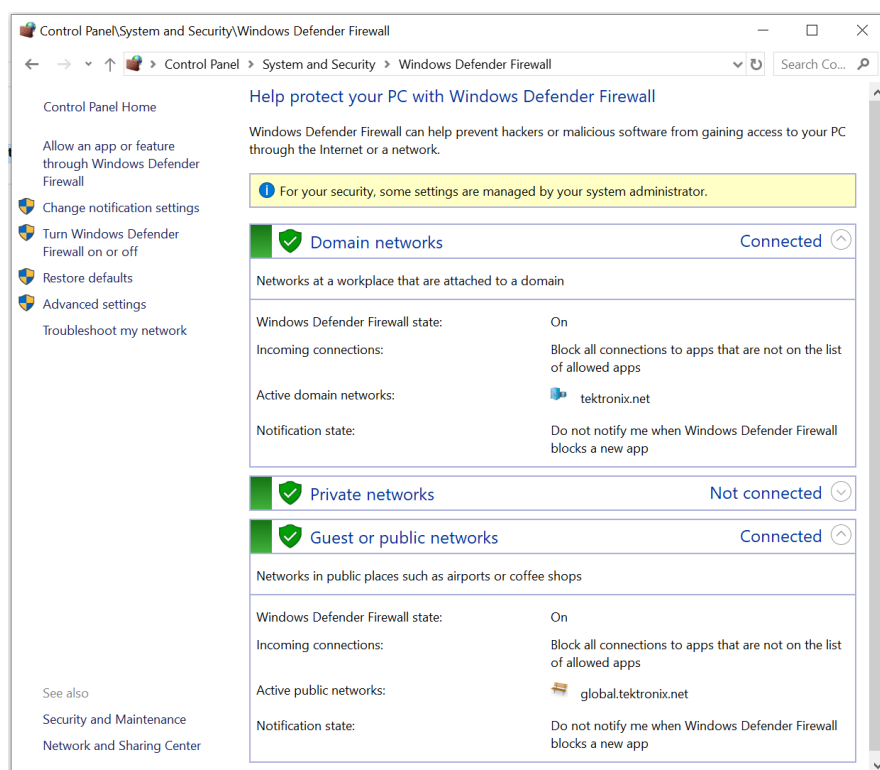
You can use Standard Commands for Programmable Instruments (SCPI) to communicate with the TekExpress application.

Socket configuration for SCPI commands

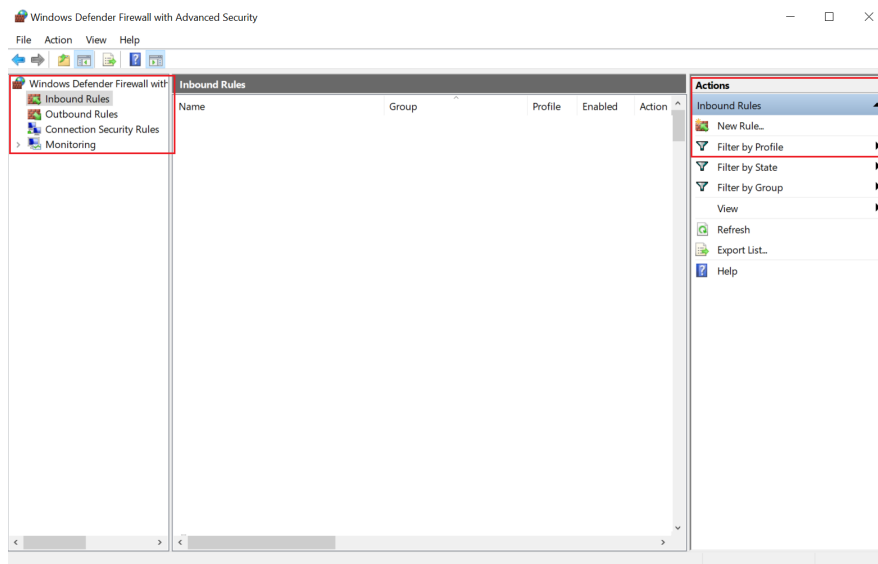
This section describes the steps for TCP/IP socket configuration and TekVISA configuration to execute the SCPI commands.

TCP/IP socket configuration

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

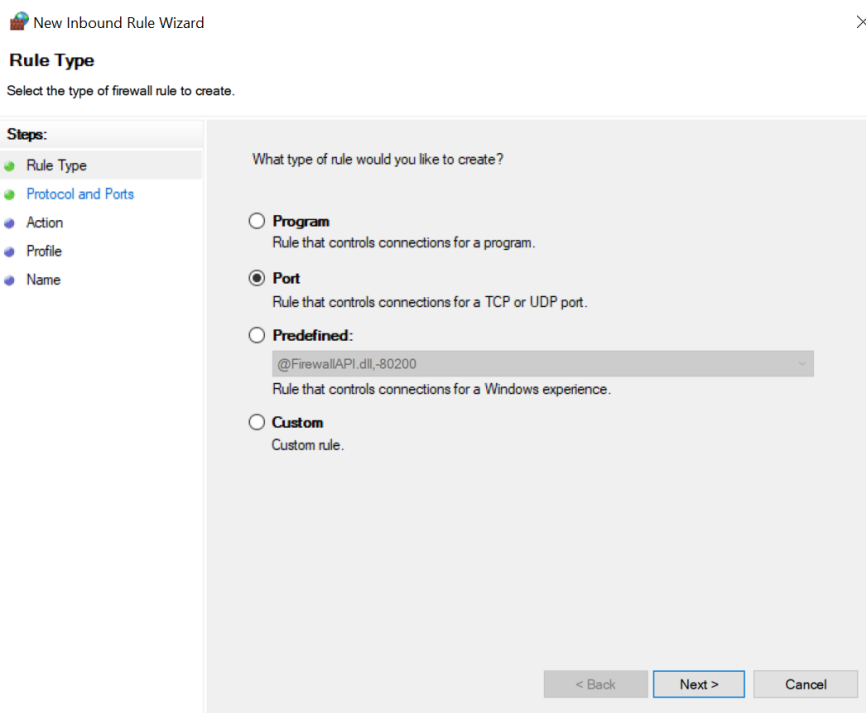


2. In Windows Firewall with Advanced Security menu, select **Windows Firewall with Advanced Security on Local Computer > Inbound Rules** and click New Rule...



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**.

New Inbound Rule Wizard

Protocol and Ports

Specify the protocols and ports to which this rule applies.

Steps:

- Rule Type
- Protocol and Ports
- Action
- Profile
- Name

Does this rule apply to TCP or UDP?

☒ TCP
☐ UDP

Does this rule apply to all local ports or specific local ports?

☐ All local ports
☒ Specific local ports:
Example: 80, 443, 5000-5010

< Back Next > Cancel

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

New Inbound Rule Wizard

Action

Specify the action to be taken when a connection matches the conditions specified in the rule.

Steps:

- Rule Type
- Protocol and Ports
- Action
- Profile
- Name

What action should be taken when a connection matches the specified conditions?

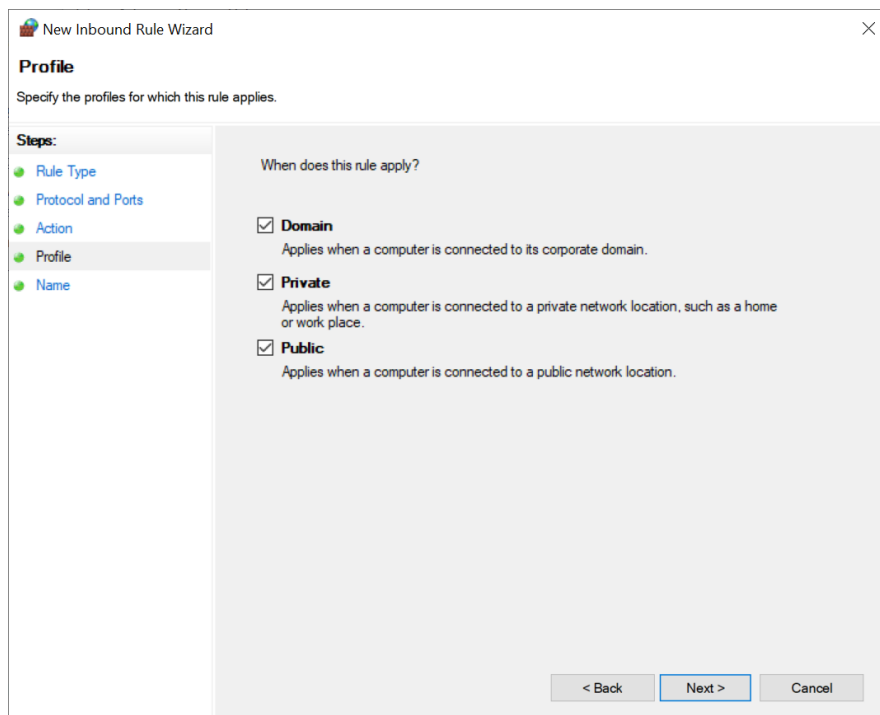
☒ **Allow the connection**
This includes connections that are protected with IPsec as well as those are not.

☐ **Allow the connection if it is secure**
This includes only connections that have been authenticated by using IPsec. Connections will be secured using the settings in IPsec properties and rules in the Connection Security Rule node.
[Customize...](#)

☐ **Block the connection**

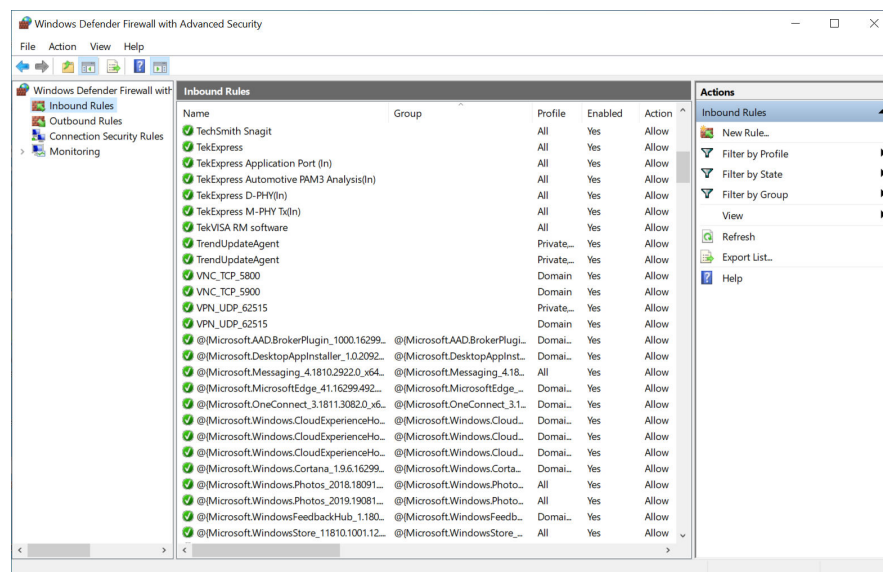
< Back Next > Cancel

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



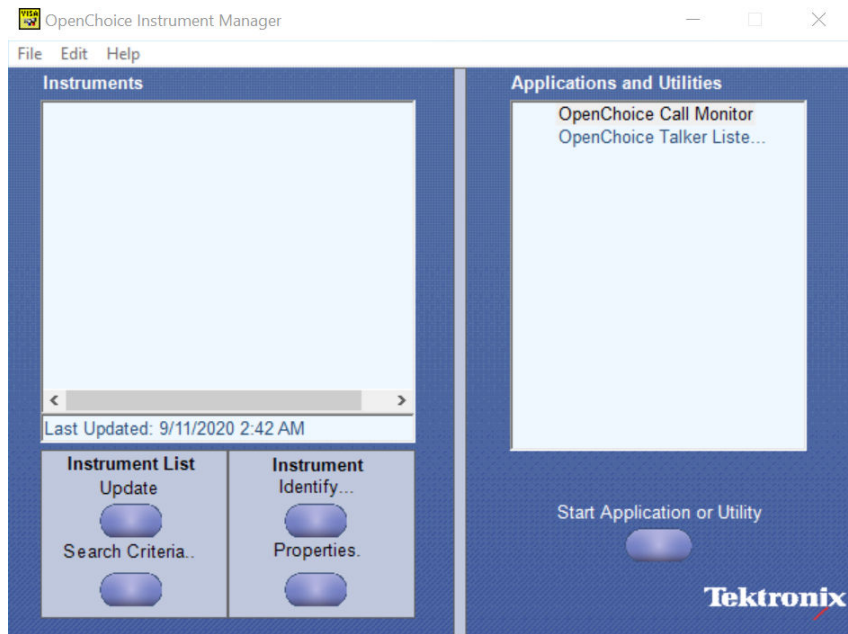
e. Enter **Name**, Description (optional), and click **Finish**.


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



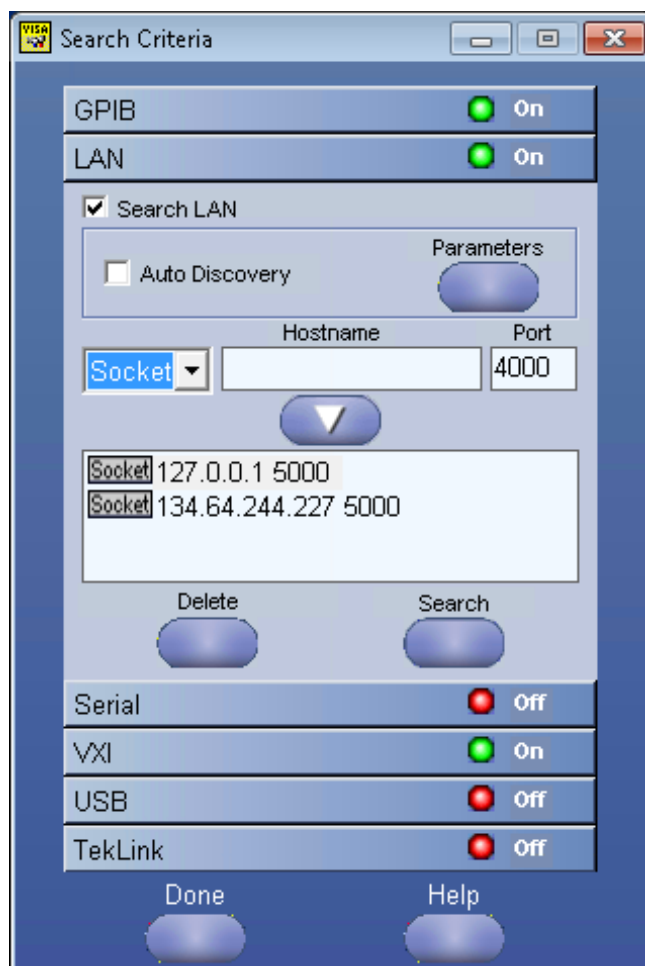
TekVISA configuration

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

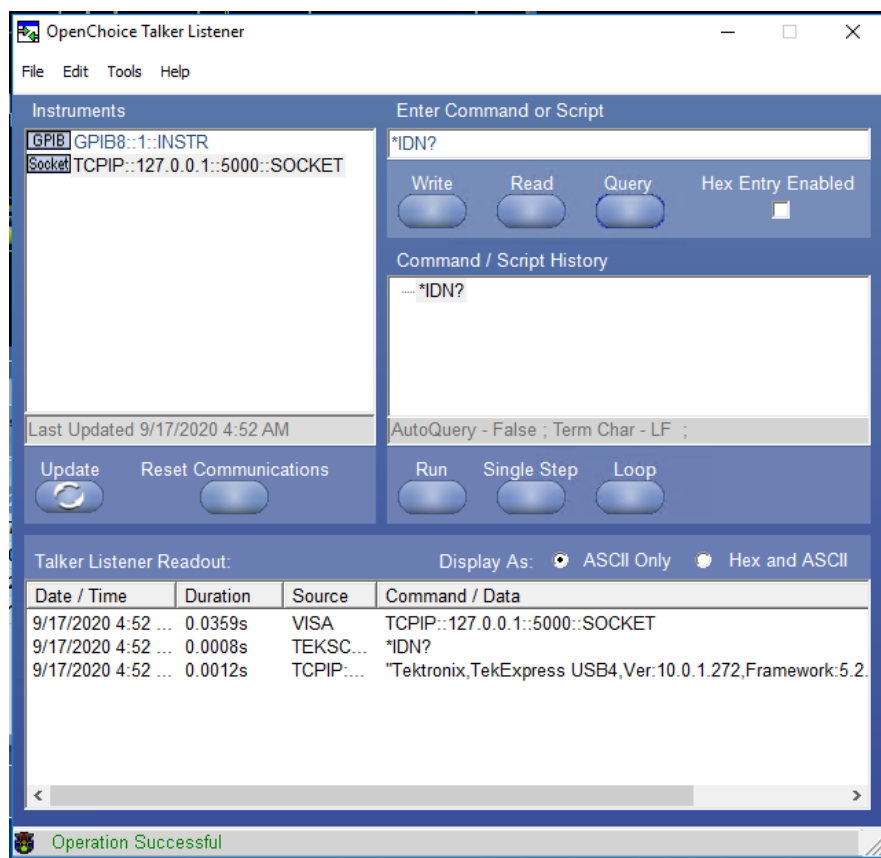


2. Click **Search Criteria**. In Search Criteria menu, click **LAN** to Turn-on. Select **Socket** from the drop-down list, enter the IP address of the TekExpress device in **Hostname** and type **Port** as 5000. Click  to configure the IP address with Port.

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:POPOP

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

Syntax

TEKEXP:POPOP "<PopupResponse>"\n

Inputs

PopupResponse

Outputs

NA

TEKEXP:POPOP?

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

Syntax

TEKEXP:POPOP?\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

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.

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:SESSION DELETE

Deletes the selected config/run session.

Syntax

```
TEKEXP:SESSION DELETE, "Session1, Session2" (set)
```

Command arguments

Argument Name	Argument value
<Session Name>	<String>

Examples

TEKEXP:SESSION DELETE, "Session1, Session2", deletes the selected config/run session.

TEKEXP:SESSION SAVE

Overrides the selected config/run session.

Syntax

TEKEXP:SESSION SAVE, "SessionName", "True" (set)

Command arguments

Argument Name	Argument Type	Argument Value
<Session Name>	<String>	{True False} or {1 0} It represents enabled or disabled. Where, <ul style="list-style-type: none"> • True or 1 - enabled • False or 0 - disabled

Returns

{True | False} or {0 | 1}

Examples

TEKEXP:SESSION SAVE, "SessionName", "True", overrides the selected config/run session.

TEKEXP:SESSION LIST

Returns the list of available config/run session.

Syntax

TEKEXP:SESSION? LIST

Returns

Returns the list of available config/run session.

Examples

TEKEXP:SESSION? LIST, returns the list of available config/run session.

TEKEXP:SESSION CURRENT

Returns the selected config/run session.

Syntax

TEKEXP:SESSION? CURRENT

Returns

Returns the selected config/run session.

Examples

TEKEXP:SESSION? CURRENT, returns the selected config/run session.

TEKEXP:RESULT:STATISTICS Test Name

This query command returns the statistics for test name which is passed as argument.

Syntax

TEKEXP:RESULT:STATISTICS? "Test Name" (Query)

Returns

Returns statistics for test name which is passed as argument.

Examples

TEKEXP:RESULT:STATISTICS? "Test Name", returns measurement results separated by ";" if it has multiple sub measurements. Sample: <Measurement Detail>, Min : <min value>, Max : <max value>, Avg.Value : <avg. value>, Std.Dev : <std.dev>, Units : <unit> for test name which is passed as argument.

TEKEXP:RESULT:STATISTICS ALL

This query command returns statistics for all tests which are passed as argument.

Syntax

TEKEXP:RESULT:STATISTICS? "ALL" (Query)

Returns

Returns statistics for all tests which are passed as argument.

Examples

TEKEXP:RESULT:STATISTICS? "ALL", returns measurement results separated by ";" if it has multiple sub measurements. Sample: TestName : <Test Name>, Details : <Measurement Detail>, Iter.Count : <Iteration Count>, Min : <min value>, Max : <max value>, Avg.Value : <avg. value>, Std.Dev : <std.dev>, Units : <unit> for all test name which are passed as argument.

TEKEXP:SESSION RUN

Run the selected config/run session.

Syntax

TEKEXP:SESSION RUN, "Session Name's separated by comma" (set)

Command arguments

Argument Name	Argument value
<Session Name>	<String>
Session Name's separated by comma (to run the multiple run sessions)	<String>

Examples

TEKEXP:SESSION RUN, "Session Name's separated by comma", runs the selected config/run session.

TEKEXP:SESSION SAVE

Enter the name to save the run/config session.

Syntax

```
TEKEXP:SESSION SAVE, "Session Name" (set)
```

Command arguments

Argument Name	Argument value
<Session Name>	<String>

Examples

```
TEKEXP:SESSION SAVE, "Session Name" saves the session.
```

TEKEXP:SESSION DEFAULT

Sets the application configurations to default value.

Syntax

```
TEKEXP:SESSION DEFAULT (set)
```

Examples

```
TEKEXP:SESSION DEFAULT, sets the application configurations to default value.
```

TEKEXP:SESSION LOAD

Load the selected config/run session.

Syntax

```
TEKEXP:SESSION LOAD, "Session Name" (set)
```

Command arguments

Argument Name	Argument value
<Session Name>	<String>

Examples

```
TEKEXP:SESSION LOAD, "Session Name", load the selected config/run session.
```

TEKEXP:TESTINFO?

This command returns the complete information about the selected test.

The information includes application name, TestID, Device selected, Suite selected, version, Test name, Test description.

Syntax

```
TEKEXP:TESTINFO? (Query)
```

Returns

<String>

Examples

TEKEXP:TESTINFO? This command returns the following details:

```
<TekExpress> <Test Id="11101" Device="TX-Device" Suite="Group1" Version="Spec 1.0" Name="Algorithm Library Measurement"
Description="This is Algorithm Library measurement test. Refer Section-B of TekExpress SampleApp Development Guide for more details.
```

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>, <Acquire_Type>, <FileName1$FileName2>\n
```

Inputs

ParameterName - Specifies the parameter name

TestName - Specifies the test name

AcquireType - Specifies the acquire type

Value - Specifies the value to set

FileName1\$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>, <Acquire_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 List

The section provides the parameters list for the SCPI commands.

TekExpress LVDS command parameters

ParameterName and Value for DUT, Test selection, Acquisition, Configuration and Preferences tabs Specifies the ParameterName and Value for DUT, Test selection, Acquisition, Configuration, and Preferences tabs.

Table 16: ParameterName and value for DUT tab

Parameters	Description
DUT ID	Specifies the value parameters. For DUTID, valid value is: Comment
Acquiremode	Specifies the acquire mode parameter: Acquire live waveforms
Use pre-recorded mode	Specifies the pre-recorded parameter: Use pre-recorded waveform files
Device	Specifies Device as Transmitter
Standard	Specifies Device as Transmitter
Version	Specifies version <ul style="list-style-type: none"> 1.0
Skip Scope settings	<ul style="list-style-type: none"> TRUE FALSE
Apply Limits for Measurement	<ul style="list-style-type: none"> TRUE FALSE
Clock Embedded	<ul style="list-style-type: none"> TRUE FALSE
Reference levels	<ul style="list-style-type: none"> 10 % to 90 % 20 % to 80 %
Clock Frequency (MHz)	1 to 500

Table continued...

Parameters	Description
SSC	<ul style="list-style-type: none">• Enabled• Disabled
Multi-Lane	Configures the lanes and channels
Clock-Lane Probing	Specifies the selected source. <ul style="list-style-type: none">• Single-ended• Differential
Data-Lane Probing	Specifies the selected source. <ul style="list-style-type: none">• Single-ended• Differential

Table 17: ParameterName and value for test selection tab

Parameters	Description
Test Name	<p>Specifies the test measurement name.</p> <p>Valid values are:</p> <ul style="list-style-type: none"> • Data_Unit_Interval • Data_Rise_Time • Data_Fall_Time • Data_Width • Data_TnT • Data_TJ_BER • Data_TIE • Data_RJ_Delta • Data_Peak_to_Peak • Data_Intra_Skew • Data_Inter_Skew • Data_DJ_Delta • Data_DDJ • Data_Clock_Data_Setup_Time • Data_Clock_Data_Hold_Time • Data_AC_Timing • Clock_SS_On_Profile • Clock_SS_On_Mod_Rate • Clock_SS_On_Freq_Dev_Min • Clock_SS_On_Freq_Dev_Max • Clock_SS_On_Freq_Dev • Clock_SS_Off_TJ@BER • Clock_SS_Off_TIE • Clock_SS_Off_RJ_Delta • Clock_SS_Off_Period • Clock_SS_Off_Peak_to_Peak • Clock_SS_Off_Intra_Skew • Clock_SS_Off_Frequency • Clock_SS_Off_Fall_Time • Clock_SS_Off_DJ_Delta • Clock_SS_Off_DutyCycle

Table 18: ParameterName and value for acquisition tab

Parameters	Description
Acquisition and Save Options	<p>Saves the acquisitions and waveforms</p> <ul style="list-style-type: none"> • Save All Waveforms Before Analysis • Save and Analyze Acquisition in Sequence

Table 19: ParameterName and value for Preference tab

Parameters	Description
Number of Runs	1 to 1000
On Test Failure, stop and notify me of the failure	TRUE or FALSE
On Test Failure, pause the test and let me investigate	TRUE or FALSE
On Test Failure, rerun the test	TRUE or FALSE
Auto Close Warnings and information's during Sequencing Auto close after seconds	TRUE or FALSE
Auto Close Error Message during Sequencing	TRUE or FALSE
Email Settings	Recipient e-mail Address Sender's Address

Table 20: ParameterName and value for analyze

TestName	ParameterName	Description
Data Intra Skew (PN)	Skew From edge	<ul style="list-style-type: none"> • Rise • Fall
Data Intra Skew (PN)	Analysis Mode	<ul style="list-style-type: none"> • SameAs • OppositeAs
Clock Intra Skew (PN)	Analysis Mode	<ul style="list-style-type: none"> • Rise • Fall
Data Intra Skew (PN)	Analysis Mode	<ul style="list-style-type: none"> • SameAs • OppositeAs

Table 21: ParameterName and value for General

ParameterName	Description
Generate new report	<ul style="list-style-type: none"> • TRUE • FALSE
Append with previous run session	<ul style="list-style-type: none"> • TRUE • FALSE
Replace current test results	<ul style="list-style-type: none"> • TRUE • FALSE
Report name	

Table continued...

ParameterName	Description
Save Report As Type	Web Archive (*.mht;*.mhtml) PDF (*.pdf;) CSV (*.csv;)
Auto increment report name if duplicate	<ul style="list-style-type: none"> • TRUE • FALSE
Create report automatically at the end of the run	<ul style="list-style-type: none"> • TRUE • FALSE
Include pass/fail info in details table	<ul style="list-style-type: none"> • TRUE • FALSE
Include plot images	<ul style="list-style-type: none"> • TRUE • FALSE
Include setup configuration	<ul style="list-style-type: none"> • TRUE • FALSE
Include complete application configuration	<ul style="list-style-type: none"> • TRUE • FALSE
Include user comments	<ul style="list-style-type: none"> • TRUE • FALSE
View report after generating	<ul style="list-style-type: none"> • TRUE • FALSE
Test name	<ul style="list-style-type: none"> • TRUE • FALSE
Test result	<ul style="list-style-type: none"> • TRUE • FALSE
Lane name	<ul style="list-style-type: none"> • TRUE • FALSE
Record Length (M)	0.1 to 20
Sample Rate (GS/s)	1 to 50
Average Acquisition Mode	<ul style="list-style-type: none"> • TRUE • FALSE
Mask Type	<ul style="list-style-type: none"> • Auto • Manual
Table continued...	

ParameterName	Description
Nominal Data Rate	<ul style="list-style-type: none"> On Off
Bit Rate (Gbls)	0 to 1000
BandWidth (MHz)	0 to 1000
Damping Factor	0.5 to 2

Examples

This section provides the examples for the SCPI commands.

Example	Description
TEKEXP:*IDN?	It returns the active TekExpress application name running on the scope.
TEKEXP:*OPC?	It returns the last command execution status, if status is executed it returns "1" else "0".
TEKEXP:SELECT TEST	+ ParameterName+ "," + value
TEKEXP:ACQUIRE_MODE PRE-RECORDED	It sets the acquire mode as pre-recorded.
TEKEXP:ACQUIRE_MODE?	It returns LIVE when acquire mode is set to live or it returns pre-recorded when acquire mode is set to pre-recorded.
TEKEXP:EXPORT REPORT	It returns the report file in bytes. This can be written into another file for further analysis.
TEKEXP:INFO? REPORT	It returns "100,"ReportFileName.mht", when 100 is the file size in bytes for the filename ReportFileName.
TEKEXP:INFO? WFM	It returns "100,"WfmFileName1.wfm";"200, "WfmFileName2.wfm" when 100 is the filesize in bytes for the filename WfmFileName1.wfm and 200 is the file size in bytes for the filename WfmFileName2.wfm.
TEKEXP:INSTRUMENT "Real Time Scope",DPO73304SX (GPIB8::1::INSTR)	It sets the instrument value as DPO73304SX(GPIB8::1::INSTR) for the selected instrument type Real Time Scope.
TEKEXP:INSTRUMENT? "Real Time Scope"	It returns "DPO73304SX (GPIB8::1::INSTR), when DPO73304SX (GPIB8::1::INSTR)" is the selected instrument for the instrument type Real Time Scope.
TEKEXP:LASTERROR?	It returns ERROR: INSTRUMENT_NOT_FOUND, when no instrument is found.
TEKEXP:LIST? DEVICE	It returns "USB4" when TX-Device, RXDevice are the available device.
TEKEXP:LIST? INSTRUMENT, "Real Time Scope"	It returns "DPO73304SX (GPIB8::1::INSTR), DPO73304DX (TCPIP::134.64.248.91::INSTR)" when DPO73304SX (GPIB8::1::INSTR), DPO73304DX (TCPIP::134.64.248.91::INSTR) are the list of available instruments.
TEKEXP:MODE COMPLIANCE	It sets the execution mode as compliance.
TEKEXP:MODE?	It returns COMPLIANCE when the execution mode is compliance or It returns USER-DEFINED when the execution mode is user defined.
TEKEXP:POPOP OK	It sets OK as the response to active popup in the application.
TEKEXP:POPOP?	It returns "OK", when OK is the active popup information shown in the application.
Table continued...	

Example	Description
TEKEXP:REPORT GENERATE	It generates report for the current session.
TEKEXP:REPORT? "Scope Model Number"	Returns "DPO73304SX" when DPO73304SX is the scope model.
TEKEXP:REPORT? DUT ID	It returns "DUT001" when DNI_DUT001 is the DUT ID.
TEKEXP:RESULT? "Total Jitter"	It returns Pass when the test result is Pass.
TEKEXP:RESULT? "Total Jitter",1	It returns the 2nd Sub measurements Margin L and H values.
TEKEXP:SELECT DEVICE, USB4, TRUE	It selects USB4.
TEKEXP:SELECT? DEVICE	It returns USB4
TEKEXP:SETUP DEFAULT	It restores the application to default setup.
TEKEXP:STATE STOP	It stops the test execution.
TEKEXP:STATE?	It returns as READY when the application is ready to run next measurement.
TEKEXP:STATE? SETUP	It returns as NOT_SAVED when the current setup is not saved else it returns SAVED.
TEKEXP:VALUE GENERAL, "Test Method", "DPOJET"	It sets the Test Method parameter value to DPOJET.
TEKEXP:VALUE? GENERAL, "Test Method"	It returns "DPOJET" when DPOJET is the Test Method value.
TEKEXP:SELECT TEST , "Total Jitter", True	Execute this command to select an individual test. This command will select "Total Jitter" test in the Signal Test tab.

Algorithms

Data

Unit Interval

- **If the Signal Type is Clock.** The unit interval measurement calculates the time period, which is the duration of a cycle as defined by a start and a stop edge. Edges are defined by polarity, threshold, and hysteresis. The application calculates clock period measurement using the following equation:

$$P_n^{Clock} = T_{n+1} - T_n$$

Where:

P^{Clock} is the clock period.

T is the V_{RefMid} crossing time for the selected polarity.

- **If the Signal Type is Data.** The unit interval measurement calculates the duration of a Unit Interval. The application calculates this measurement using the following equation:

$$P_n^{Data} = (T_n^{Data} - T_{n-1}^{Data}) / K_n$$

Where:

P^{Data} is the unit interval.

T^{Data} Data is the V_{RefMid} crossing time in either direction.

$K_n = C_n - C_{n-1}$ is the estimated number of unit intervals between two successive edges. C_n is the calculated data bit index of T_n Data. Each measurement result P_n Data is repeated K_n times in the measurement result vector, so that the measurement population is equal to the number of unit intervals in the qualified waveform, rather than the number of edge pairs.

Rise Time

The Rise Time measurement is the time difference between when the V_{RefHi} reference level is crossed and the V_{RefLo} reference level is crossed on the rising edge of the waveform. The Rise Time algorithm uses the V_{Ref} values as the reference voltage level. Each edge is defined by the slope, voltage reference level (threshold), and hysteresis.

The application calculates this measurement using the following equation:

$$T_n^{Rise} = T_n^{Hi+} - T_n^{Lo+}$$

Where:

T^{Rise} is the Rise Time.

T^{Hi+} is the V_{RefHi} crossing on the rising edge.

T^{Lo+} is the V_{RefLo} crossing on the rising edge.

Fall Time

The Fall Time measurement is the time difference between when the V_{RefLo} reference level is crossed and the V_{RefHi} reference level is crossed on the falling edge of the waveform. The Fall Time algorithm uses the V_{Ref} values as the reference voltage level. Each edge is defined by the slope, voltage reference level (threshold), and hysteresis.

The application calculates this measurement using the following equation:

$$T_n^{\text{Fall}} = T_n^{\text{Lo-}} - T_n^{\text{Hi-}}$$

Where:

T^{Fall} is the Fall Time.

$T^{\text{Lo-}}$ is the V_{RefLo} crossing on the falling edge.

$T^{\text{Hi-}}$ is the V_{RefHi} crossing on the falling edge.

Data Width

The Eye Width measurement is the measured minimum horizontal eye opening at the zero reference level and uses the clock recovery settings specified in the configuration panel..

The application calculates this measurement using the following equation:

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

Where:

UI_{AVG} is the average UI.

$TIE_{\text{pk-pk}}$ is the Peak-Peak TIE.

Data Intra Skew (PN)

Skew is the time between the mid reference level crossing on Source positive to the mid reference level crossing on Source negative of specified lane. The direction of the edge crossing is configurable.

The application calculates this measurement using the following equation:

$$T_n^{\text{Skew}} = T_n^{\text{Main}} - T_n^{\text{2nd}}$$

Where:

T^{Skew} is the timing skew.

T^{Main} is the Main input Mid reference crossing time in the configured direction.

T^{2nd} is the 2nd input Mid2 reference crossing time in the configured direction.

Data Peak to Peak

Cycle Pk-Pk is a voltage measurement which measures the absolute difference between the maximum and minimum amplitude for every cycle of the waveform. It calculates the peak-to-peak value for all cycles of the waveform. The peak value is measured from Fall slope to

the next rise if the valid slope is a Fall. The next peak would be from Rise to next fall slope. The peak-to-peak value is calculated on all the pairs of minimum and maximum values available.

The application calculates the Cycle Pk-Pk using the following equation:

$$V_{Pk-PK(n)} = \left| V_{CycleMax} - V_{CycleMin} \right| \quad \text{for consecutive cycles}$$

Where:

$V_{Max}(n)$ is the maximum peak amplitude.

$V_{Min}(n)$ is the minimum peak amplitude.

n is the number of cycles from 1 to the last valid edge.

Jitter

AC Timing

Mask Hits

The Mask hits measurement uses the clock recovery settings specified in the Configuration panel and reports the number of unit intervals in the acquisition for which mask hits occurred, for a user-specified mask. In the Results Summary view, the Mask hits measurement reports the total number of unit intervals for which a mask hit occurred in at least one mask zone. In the Results Details view, the number of hits in each of three segments is reported.

The Mask hits measurement has several unique properties:

- Unlike other measurements, it requires a Mask hits plot. Adding a Mask hits measurement will cause the corresponding plot to be created automatically. If you delete a Mask hits plot, the application will remove the corresponding Mask hits measurement after verifying the action with you.
- The Mask hits measurement does not support the Worst-Case Waveforms logging feature.
- The Mask hits measurement does not support Measurement Range Limits.
- The Mask hits measurement does not support Population Limit.

Hold

The Hold Time measurement is the elapsed time between when the clock waveform crosses its own voltage reference level and the designated edge of a data waveform. The closest data edge to the clock edge that falls within the range limits is used. The Hold time is calculated individually for every unit interval which occurs within a single clock cycle.

The application calculates this measurement using the following equation:

$$T_n^{Hold} = T_n^{2nd} - T_i^{Main}$$

Where:

T^{Hold} is the hold time.

T^{Main} is the Main input (clock) Mid reference crossing time in the specified direction.

T^{2nd} is the 2nd input (data) Mid2 reference crossing time in the specified direction.



Note: The order of the input sources for Setup and Hold measurements (Source1 = Clock, Source2 = Data) differs from the order of input sources on the Setup/Hold Trigger menu in the oscilloscope.

Clock-Data Setup Time

Mask Hits

The Mask hits measurement uses the clock recovery settings specified in the Configuration panel and reports the number of unit intervals in the acquisition for which mask hits occurred, for a user-specified mask. In the Results Summary view, the Mask hits measurement reports the total number of unit intervals for which a mask hit occurred in at least one mask zone. In the Results Details view, the number of hits in each of three segments is reported.

The Mask hits measurement has several unique properties:

- Unlike other measurements, it requires a Mask hits plot. Adding a Mask hits measurement will cause the corresponding plot to be created automatically. If you delete a Mask hits plot, the application will remove the corresponding Mask hits measurement after verifying the action with you.
- The Mask hits measurement does not support the Worst-Case Waveforms logging feature.
- The Mask hits measurement does not support Measurement Range Limits.
- The Mask hits measurement does not support Population Limit.

Setup

Setup Time is the time between the mid reference level crossing of the clock source (Source1) and the closest previous mid reference level crossing of the data source (Source2). The crossings (edges) may be configured to be rising, falling or either. The setup time is calculated individually for every unit interval which occurs within a single clock cycle.

The application calculates this measurement using the following equation:

$$T_n^{Setup} = T_i^{Main} - T_n^{2nd}$$

Where:

T^{Setup} is the setup time.

T^{Main} is the Main input (clock) Mid reference crossing time in the specified direction.

T^{2nd} is the 2nd input (data) Mid2 reference crossing time in the specified direction.

Clock-Data Hold Time

Mask Hits

The Mask hits measurement uses the clock recovery settings specified in the configuration panel and reports the number of unit intervals in the acquisition for which mask hits occurred, for a user-specified mask. In the Results Summary view, the Mask hits measurement reports the total number of unit intervals for which a mask hit occurred in at least one mask zone. In the Results Details view, the number of hits in each of three segments is reported.

The Mask hits measurement has several unique properties:

- Unlike other measurements, it requires a Mask hits plot. Adding a Mask hits measurement will cause the corresponding plot to be created automatically. If you delete a Mask hits plot, the application will remove the corresponding Mask hits measurement after verifying the action with you.
- The Mask hits measurement does not support the Worst-Case Waveforms logging feature.
- The Mask hits measurement does not support Measurement Range Limits.
- The Mask hits measurement does not support Population Limit.

Hold

The Hold Time measurement is the elapsed time between when the clock waveform crosses its own voltage reference level and the designated edge of a data waveform. The closest data edge to the clock edge that falls within the range limits is used. The hold time is calculated individually for every unit interval which occurs within a single clock cycle.

The application calculates this measurement using the following equation:

$$T_n^{Hold} = T_n^{2nd} - T_i^{Main}$$

Where:

T^{Hold} is the hold time.

T^{Main} is the Main input (clock) Mid reference crossing time in the specified direction.

T^{2nd} is the 2nd input (data) Mid2 reference crossing time in the specified direction.



Note: The order of the input sources for Setup and Hold measurements (Source1 = Clock, Source2 = Data) differs from the order of input sources on the Setup/Hold Trigger menu in the oscilloscope.

TIE

TIE (Time Interval Error) is the difference in time between an edge in the source waveform and the corresponding edge in a reference clock. The reference clock is usually determined by a clock recovery process performed on the source waveform. For Explicit-Clock, clock recovery process is performed on an explicitly identified source. It uses the clock recovery settings specified in the Configuration panel.

- **If the Signal Type is Clock.** The application calculates Clock TIE measurement using the following equation:

$$TIE_n^{Clock} = T_n^{Clock} - T_n^{Clock}$$

Where:

TIE^{Clock} is the clock time interval error.

T^{Clock} is the corresponding edge time for the specified reference clock.

- **If the Signal Type is Data.** The application calculates Data TIE measurement using the following equation:

$$TIE_k^{Data} = T_k^{Data} - T_k^{Data}$$

Where:

TIE^{Data} is the data time interval error.

T^{Data} is the corresponding edge time for the specified reference clock.

The subscript k is used to indicate that there is one measurement per actual edge.

TJ@BER

Total Jitter at a specified Bit Error Rate (BER) extrapolated value predicts a peak-to-peak jitter that will only be exceeded with a probability equal to the BER. It is generally not equal to the total jitter actually observed in any given acquisition. A single TJ@BER value is determined for each acquisition, by means of RJ-DJ separation analysis and uses the clock recovery settings specified in the configuration panel.

DJ-Delta

Dual Dirac Deterministic Jitter (DJ- $\delta\delta$) is the peak-to-peak magnitude for all timing errors exhibiting deterministic behavior, calculated based on a simplifying assumption that the histogram of all deterministic jitter can be modeled as a pair of equal magnitude dirac functions (impulses). A single DJ- $\delta\delta$ value is determined for each acquisition, by means of RJ-DJ separation analysis. It uses the clock recovery settings specified in the configuration panel.

RJ-Delta

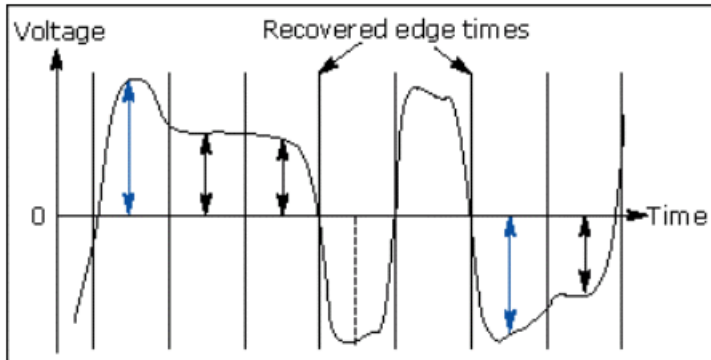
Dual Dirac Random Jitter (RJ- $\delta\delta$) is the rms magnitude of all timing errors not exhibiting deterministic behavior, calculated based on a simplifying assumption that the histogram of all deterministic jitter can be modeled as a pair of equal magnitude dirac functions (impulses). A single RJ- $\delta\delta$ value is determined for each acquisition, by means of RJ-DJ separation analysis. It uses the clock recovery settings specified in the configuration panel.

DDJ

Data-Dependent Jitter (DDJ) is the peak-to-peak amplitude for that portion of the deterministic jitter directly correlated with the data pattern in the waveform. A single DDJ value is determined for each acquisition, by means of RJ-DJ separation analysis. It uses the clock recovery settings specified in the configuration panel.

De-Emphasis Level

The T/nT Ratio measurement reports the amplitude ratio between transition and non-transition bits. The measurement calculates the ratios of all non-transition eye voltages (2nd and subsequent eye voltages after one edge but before the next) to their nearest preceding transition eye voltage (1st eye voltage succeeding an edge). In the accompanying diagram, it is the ratio of the Black voltages to the Blue voltages. The results are given in dB.



The application calculates the T/nT Ratio using the following equations:

$$TnT(m) = dB \left(\frac{v_{EYE-HI-NTRAN}(m)}{v_{EYE-HI-TRAN}(n)} \right) \text{ following a rising edge.}$$

$$TnT(m) = dB \left(\frac{v_{EYE-LO-NTRAN}(m)}{v_{EYE-LO-TRAN}(n)} \right) \text{ following a falling edge.}$$

Where:

$v_{EYE-HI-TRAN}$ is the High voltage at the interpolated midpoint of the first unit interval following a positive transition.

$v_{EYE-LO-TRAN}$ is the Low voltage at the interpolated midpoint of the first unit interval following a negative transition.

$v_{EYE-HI-NTRAN}$ is the High voltage at the interpolated midpoint of all unit intervals except the first following a positive transition.

$V_{EYE-LO-NTRAN}$ is the Low voltage at the interpolated midpoint of all unit intervals except the first following a negative transition.

m is the index for all non-transition UIs.

n is the index for the nearest transition UI preceding the UI specified by m . In a time trend plot of the measurement results, there is one measurement for each non-transition bit in the waveform (that is the black arrows in the diagram).

Clock (SSC off)

Frequency

Frequency measurement calculates the inverse of the data period for each cycle.

- **If the Signal Type is Clock.** The application calculates clock frequency measurement using the following equation:

$$F_n^{Clock} = 1 / P_n^{Clock}$$

Where:

F^{Clock} is the clock frequency.

P^{Clock} is the clock period measurement.

- **If the Signal Type is Data.** The application calculates data frequency measurement using the following equation:

$$F_n^{Data} = 1 / P_n^{Data}$$

Where:

F^{Data} is the data frequency.

P^{Data} is the data period measurement.

Period

- **If the Signal Type is Clock.** The Period measurement calculates the duration of a cycle as defined by a start and a stop edge. Edges are defined by polarity, threshold, and hysteresis. The application calculates clock period measurement using the following equation:

$$P_n^{Clock} = T_{n+1} - T_n$$

Where:

P^{Clock} is the clock period.

T is the $V_{Ref}Mid$ crossing time for the selected polarity.

- **If the Signal Type is Data.** The Period measurement calculates the duration of a Unit Interval. The application calculates this measurement using the following equation:

$$P_n^{Data} = (T_n^{Data} - T_{n-1}^{Data}) / K_n$$

Where:

P^{Data} is the data period.

T^{Data} Data is the $V_{Ref}Mid$ crossing time in either direction.

$K_n = C_n - C_{n-1}$ is the estimated number of unit intervals between two successive edges. C_n is the calculated data bit index of T_n Data. Each measurement result P_n Data is repeated K_n times in the measurement result vector, so that the measurement population is equal to the number of unit intervals in the qualified waveform, rather than the number of edge pairs.

Duty Cycle

The +Duty Cycle and –Duty Cycle measurements calculate the ratio of the positive (or negative) portion of the cycle relative to the period.

The application calculates these measurements using the following equations:

$$D_n^+ = W_n^+ / P_n^{Clock}$$

$$D_n^- = W_n^- / P_n^{Clock}$$

Where:

D^+ is the positive duty cycle.

D^- is the negative duty cycle.

W^+ is the positive pulse width.

W^- is the negative pulse width.

P^{Clock} is the period.

Clock Intra Skew (PN)

Skew is the time between the mid reference level crossing on Source positive to the mid reference level crossing on Source negative of specified lane. The direction of the edge crossing is configurable.

The application calculates this measurement using the following equation:

$$T_n^{Skew} = T_n^{Main} - T_n^{2nd}$$

Where:

T^{Skew} is the timing skew.

T^{Main} is the Main input Mid reference crossing time in the configured direction.

T^{2nd} is the 2nd input Mid2 reference crossing time in the configured direction.

Clock Peak to Peak

Cycle Pk-Pk is a voltage measurement which measures the absolute difference between the maximum and minimum amplitude for every cycle of the waveform. It calculates the peak-to-peak value for all cycles of the waveform. The peak value is measured from Fall slope to the next rise if the valid slope is a Fall. The next peak would be from Rise to next fall slope. The peak-to-peak value is calculated on all the pairs of minimum and maximum values available.

The application calculates the Cycle Pk-Pk using the following equation:

$$V_{Pk-PK(n)} = \left| V_{CycleMax} - V_{CycleMin} \right| \quad \text{for consecutive cycles}$$

Where:

$V_{Max}(n)$ is the maximum peak amplitude.

$V_{Min}(n)$ is the minimum peak amplitude.

n is the number of cycles from 1 to the last valid edge.

Clock SSC ON or Data SSC ON

Profile

SSC Profile shows the modulation profile of the Spread Spectrum Clocking (SSC). It is the time trend plot of the SSC profile. All SSC measurements use the Period measurement with a second order low pass filter. Using the profile you can analyze the SSC modulation rate by using the horizontal cursors. You can also analyze the peak-to-peak frequency deviation by using the vertical cursors.

The following are the default configurations that are required:

- Constant Clock Recovery (CCR) Mean set as the Clock Recovery method.
- Low pass filter with 1.98 MHz cut off frequency set by default. This is the standard Fiber Channel cut off frequency.
- Available plots are Time Trend, Data Array, Histogram and Spectrum plots.

Mod Rate

SSC Modulating Rate is the modulating frequency of a spread spectrum clock. It is the rate that the clock frequency changes. Clock recovery is used on the measurement. The method is constant clock mean.

Frequency Deviation

SSC frequency deviation is the spread spectrum clock frequency deviation from the nominal frequency in ppm (parts per million). Clock recovery is used on the measurement. The method is constant clock mean.

Frequency Deviation Max

SSC frequency deviation MAX is defined as the maximum frequency shift as a function of time. It represents the frequency deviation in terms of ppm (parts-per-million).

- Find the 50% edges on the SSC profile.
- Calculate the HIGH value between the n and $n+1$ edge.
- Find the Maximum frequency deviation as HIGH.

The application calculates the measurement using the equation:

$$\text{Freq Dev Max(ppm)} = ((\text{Maximum Freq} - \text{Nominal Data Rate}) / \text{Nominal Data Rate}) * 1e6$$

The difference between the SSC frequency deviation MAX and SSC frequency deviation MIN measurements are that they compute the maximum frequency deviation and minimum frequency deviation separately. By doing this the limits can be applied separately. Available plots are Time Trend, Data Array, Histogram and Spectrum plots.

Frequency Deviation Min

The SSC frequency deviation MIN is defined as the minimum frequency shift as a function of time. It represents the frequency deviation in terms of ppm (parts per million).

- Find the 50% edges on the SSC profile.
- Calculate the LOW value between the n and $n+1$ edge.
- Find the Minimum frequency deviation as LOW.

The application calculates the measurement using the equation:

Freq Dev Min(ppm)= ((Minimum Freq-Nominal Data Rate)/Nominal Data Rate) 1e6*

Available plots are Time Trend, Data Array, Histogram and Spectrum plots.

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