



TekExpress® LVDS
Physical Layer Measurement and Debug Solution
Application Help (5/6 Series MSO)



077-1622-02



TekExpress® LVDS
Physical Layer Measurement and Debug Solution
Application Help (5/6 Series MSO)

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077-1622-02

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

Table of Contents

| | |
|--|----|
| List of Figures..... | 8 |
| List of Tables..... | 9 |
| Welcome..... | 10 |
| Getting help and support..... | 11 |
| Related documentation..... | 11 |
| Conventions..... | 11 |
| Technical Support..... | 11 |
| Getting started..... | 13 |
| Supported oscilloscopes..... | 13 |
| Recommended probes..... | 13 |
| Downloading and installing the software..... | 13 |
| Activate the license..... | 14 |
| View software version..... | 14 |
| File name extensions..... | 14 |
| Operating basics..... | 16 |
| Launch the application..... | 16 |
| Exit the application..... | 17 |
| Application controls..... | 17 |
| Global application controls..... | 18 |
| Options menu overview..... | 18 |
| TekExpress instrument control settings..... | 19 |
| View connected instruments..... | 19 |
| Configure email settings..... | 20 |
| Application panels overview..... | 21 |
| Setup panel..... | 22 |
| Setup panel overview..... | 22 |
| Set DUT parameters..... | 22 |
| Select tests..... | 27 |
| Set acquisition tab parameters..... | 29 |
| Set configuration tab parameters..... | 31 |
| Set preferences tab parameters..... | 35 |
| Status panel overview..... | 36 |
| Results panel..... | 38 |
| Results panel overview..... | 38 |
| Preferences menu..... | 39 |
| View test-related files..... | 39 |
| Reports panel..... | 40 |
| Report configuration settings..... | 40 |
| Configure report view settings..... | 40 |
| View a report..... | 42 |
| Report content..... | 42 |
| Running tests..... | 46 |
| Equipment connection diagram..... | 46 |
| Compensate the signal path..... | 49 |

| | |
|--|----|
| Running tests..... | 50 |
| View test results..... | 50 |
| Saving and recalling test setup..... | 51 |
| Test setup files overview..... | 51 |
| Save a test setup..... | 51 |
| Open load a saved test setup..... | 51 |
| Create a test setup from default settings..... | 51 |
| Create a test setup using an existing one..... | 52 |
| SCPI commands..... | 53 |
| About SCPI command..... | 53 |
| Socket configuration for SCPI commands..... | 53 |
| TEKEXP:*IDN?..... | 59 |
| TEKEXP:*OPC?..... | 60 |
| TEKEXP:ACQUIRE_MODE..... | 60 |
| TEKEXP:ACQUIRE_MODE?..... | 60 |
| TEKEXP:EXPORT..... | 60 |
| TEKEXP:INFO?..... | 61 |
| TEKEXP:INSTRUMENT..... | 61 |
| TEKEXP:INSTRUMENT?..... | 61 |
| TEKEXP:LASTERROR?..... | 62 |
| TEKEXP:LIST?..... | 62 |
| TEKEXP:POPOP..... | 62 |
| TEKEXP:POPOP?..... | 63 |
| TEKEXP:REPORT..... | 63 |
| TEKEXP:SESSION DELETE..... | 63 |
| TEKEXP:SESSION SAVE..... | 63 |
| TEKEXP:SESSION LIST..... | 64 |
| TEKEXP:SESSION CURRENT..... | 64 |
| TEKEXP:RESULT:STATISTICS Test Name..... | 64 |
| TEKEXP:RESULT:STATISTICS ALL..... | 65 |
| TEKEXP:SESSION RUN..... | 65 |
| TEKEXP:SESSION SAVE..... | 65 |
| TEKEXP:SESSION DEFAULT..... | 66 |
| TEKEXP:SESSION LOAD..... | 66 |
| TEKEXP:TESTINFO?..... | 66 |
| TEKEXP:REPORT?..... | 67 |
| TEKEXP:RESULT?..... | 67 |
| TEKEXP:SELECT..... | 67 |
| TEKEXP:SELECT?..... | 68 |
| TEKEXP:SETUP..... | 68 |
| TEKEXP:STATE..... | 68 |
| TEKEXP:STATE?..... | 69 |
| TEKEXP:VALUE..... | 69 |
| TEKEXP:VALUE?..... | 69 |
| Command Parameters List..... | 70 |
| Examples..... | 75 |
| Algorithms..... | 78 |
| Data..... | 78 |
| Unit Interval..... | 78 |

| | |
|----------------------------------|----|
| Rise Time..... | 78 |
| Fall Time..... | 79 |
| Data Width..... | 79 |
| Data Intra Skew (PN)..... | 79 |
| Data Peak to Peak..... | 79 |
| Jitter..... | 80 |
| Clock (SSC off)..... | 84 |
| Frequency..... | 84 |
| Period..... | 84 |
| Duty Cycle..... | 85 |
| Clock Intra Skew (PN)..... | 85 |
| Clock Peak to Peak..... | 85 |
| Clock SSC ON or Data SSC ON..... | 86 |
| Profile..... | 86 |
| Mod Rate..... | 86 |
| Frequency Deviation..... | 86 |
| Frequency Deviation Max..... | 86 |
| Frequency Deviation Min..... | 86 |
| Index..... | 88 |

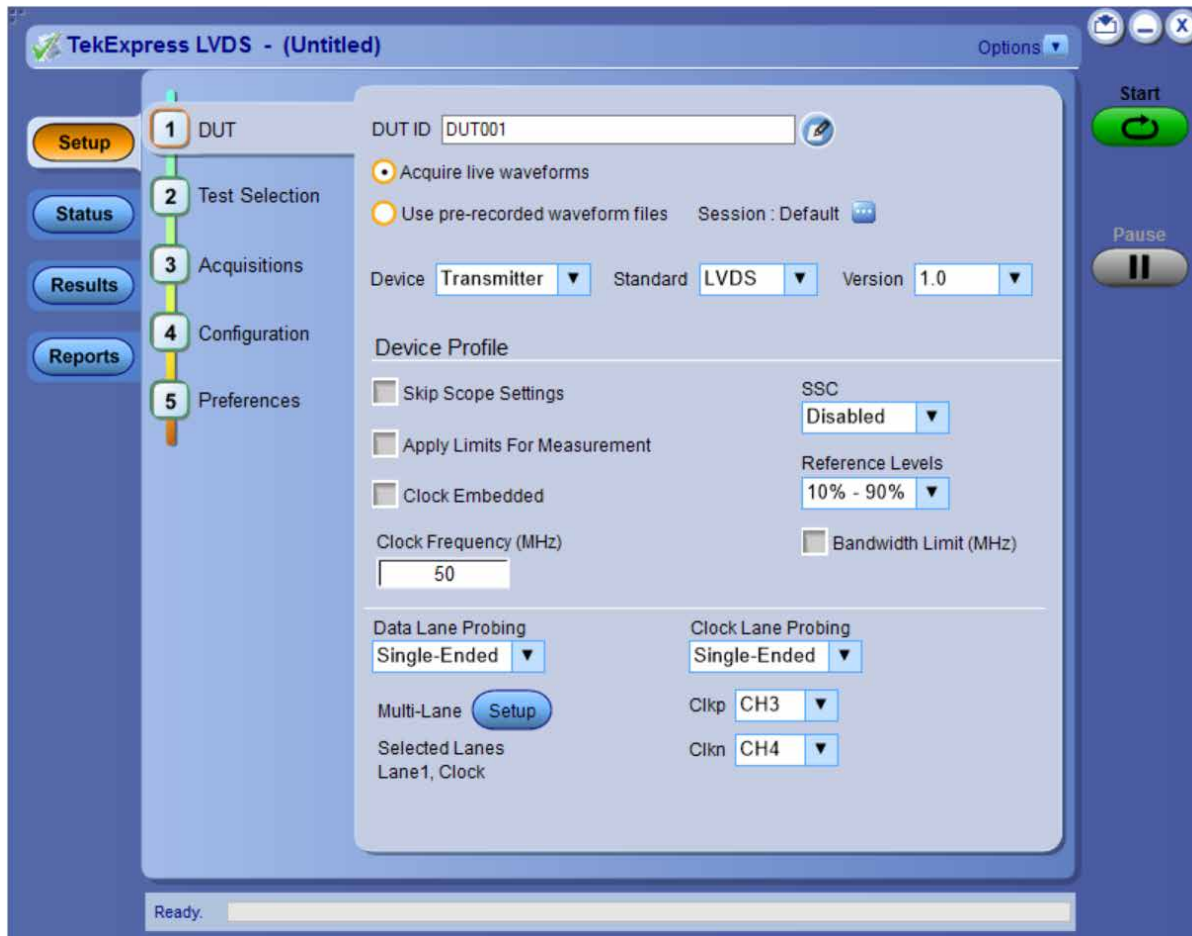
List of Figures

| | |
|---|----|
| Figure 1: TekExpress LVDS Measurements..... | 28 |
| Figure 2: TekExpress LVDS Measurements..... | 29 |
| Figure 3: Configuration tab: Global Settings..... | 32 |
| Figure 4: Configuration tab: Measurements..... | 35 |
| Figure 5: Preferences tab..... | 36 |
| Figure 6: Test status view in the Status panel..... | 37 |
| Figure 7: Log view in the Status panel..... | 37 |

List of Tables

| | |
|---|----|
| Table 1: Product documentation..... | 11 |
| Table 2: Icon descriptions..... | 11 |
| Table 3: File name extension | 14 |
| Table 4: Application control description..... | 17 |
| Table 5: Application panels overview..... | 21 |
| Table 6: DUT tab settings..... | 23 |
| Table 7: Test Selection tab settings..... | 29 |
| Table 8: Acquisitions tab settings..... | 30 |
| Table 9: Configuration tab: Common parameters..... | 31 |
| Table 10: Configuration tab: Global settings..... | 32 |
| Table 11: Configuration tab: Measurements settings..... | 35 |
| Table 12: Preferences tab settings..... | 36 |
| Table 13: Status panel settings..... | 38 |
| Table 14: Report panel view settings..... | 41 |
| Table 15: ParameterName and value for DUT tab..... | 70 |
| Table 16: ParameterName and value for test selection tab..... | 72 |
| Table 17: ParameterName and value for acquisition tab..... | 73 |
| Table 18: ParameterName and value for Preference tab..... | 73 |
| Table 19: ParameterName and value for analyze..... | 73 |
| Table 20: ParameterName and value for General..... | 74 |

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

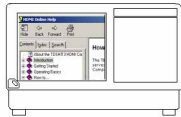
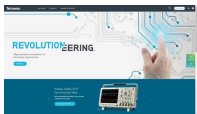
- Supports measurement from multiple LVDS standards
- Configurable test settings and limits
- Automatic mask for data rate and maximum voltage swing (MSV)
- Generic clock recovery configuration
- Reference level and filter file selection
- Multi-Run support
- Supports multiple report formats
- Supports 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 (077-1622-xx) | In-depth operation and UI help. |  |
| PDF of the Online Help (077-1623-xx) | | |

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

5/6 Series MSO (MSO54, MSO56, MSO58, MSO64) with bandwidth \geq 350 MHz.

70K series MSO with bandwidth \geq 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**
TDP3500/TDP4000/TDP7704/TDP7706/TDP/7708 with probe accessories
- **Single ended Probes**
SMA to BNC adapter (DUT fixture dependent)

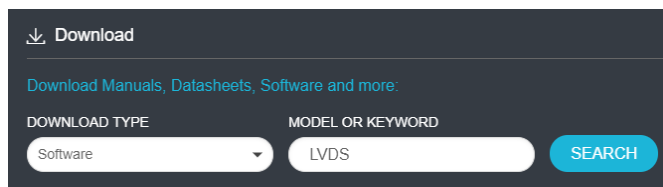
Quantity of the probes is based on number of lanes chosen.

- **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 **Applications > TekExpress LVDS 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 |

Table continued...

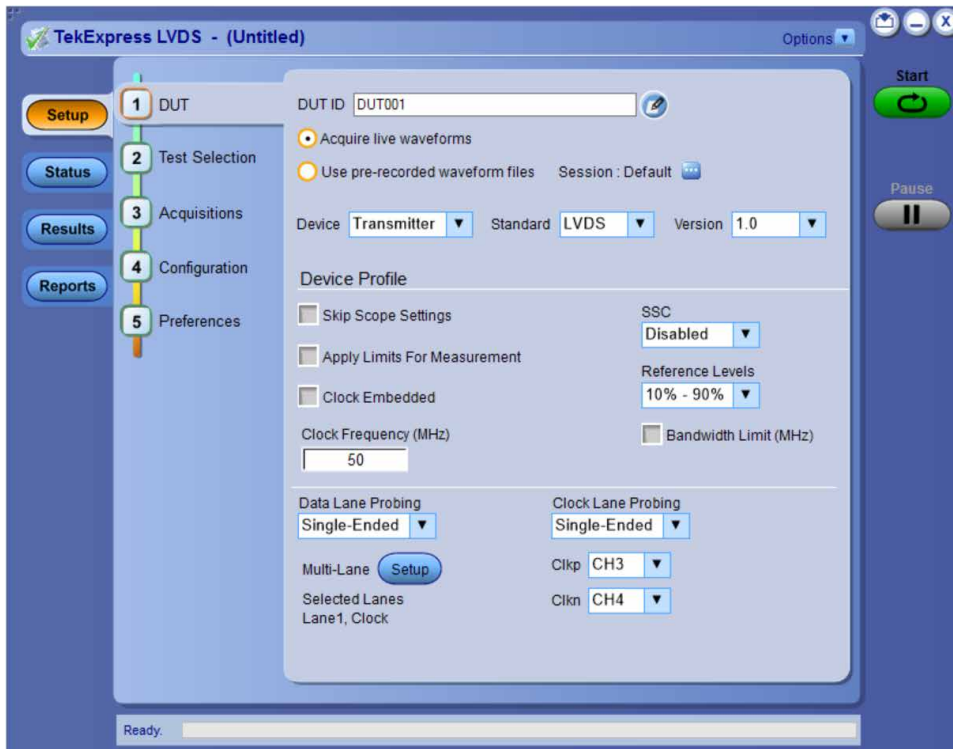
| File name extension | Description |
|---------------------|--|
| .csv | Test result reports Plot data |
| .mht | Test result reports (default) Test reports can also be saved in HTML formats. |
| .msk | A user mask file. |
| .pdf | Test result reports Application help document |
| .xslt | Style sheet used to generate reports |
| .png | Captured images |
| .flt | Inverse filter co-efficient |

Operating basics

Launch the application

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

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 **Applications > TekExpress LVDS 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  | Toggles the application between mini view and normal view. Mini view displays the run messages with the time stamp, progress bar, Start / Stop button, and Pause / Continue button. The application moves to mini view when you click the Start button. |

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 **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 | Keeps the TekExpress LVDS application on top of all the application  Note: When Keep on Top is selected, you cannot access the combo boxes in the application panels. |
| <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 |

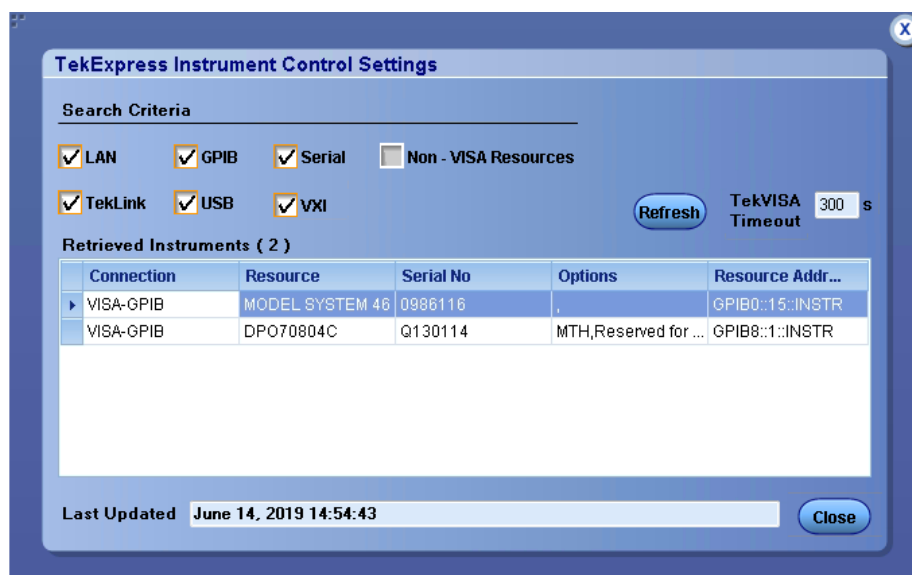
See also

[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.

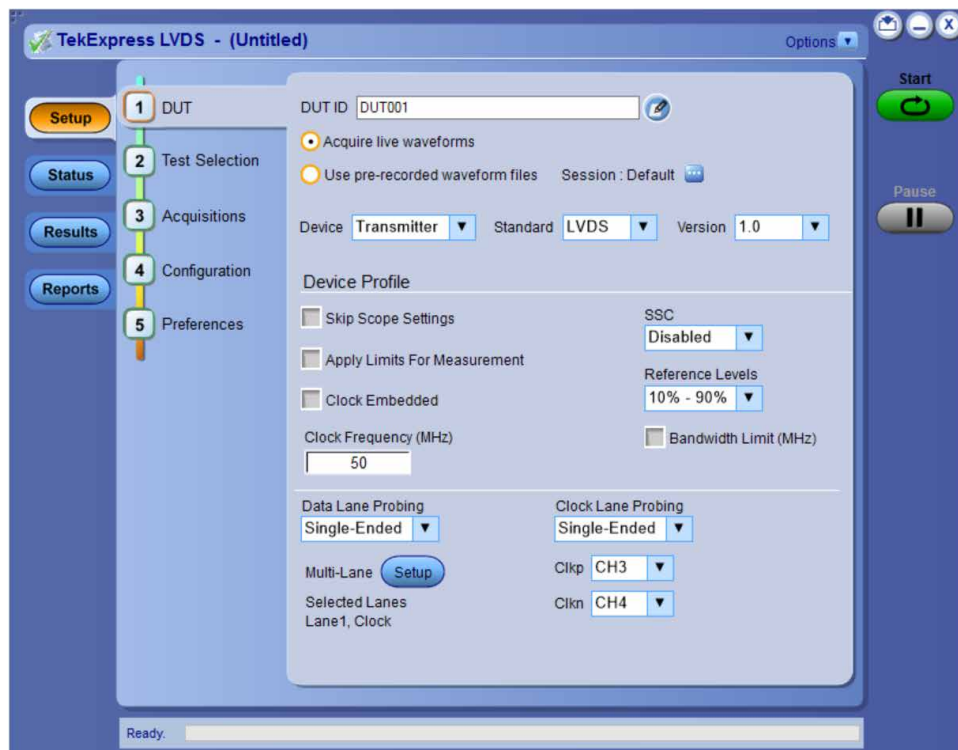


Table 5: Application panels overview

| Panel Name | Purpose |
|-------------------------------|---|
| Setup panel | The Setup panel shows the test setup controls. Click the Setup button to open this panel. Use this panel to: <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. |

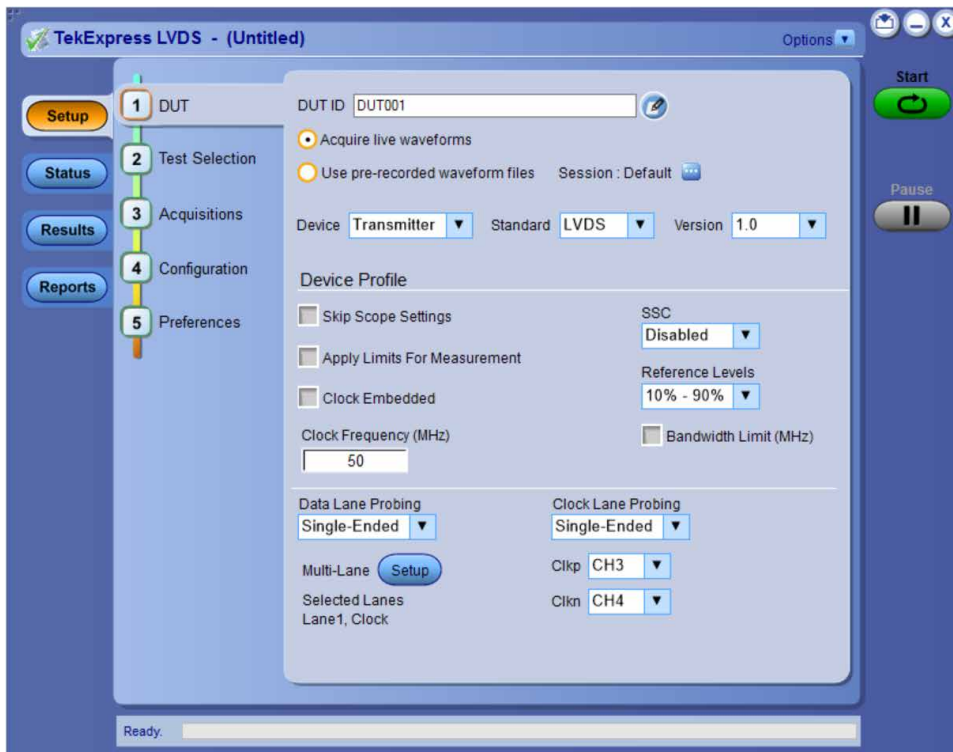
See also

[Application controls](#)

Setup panel


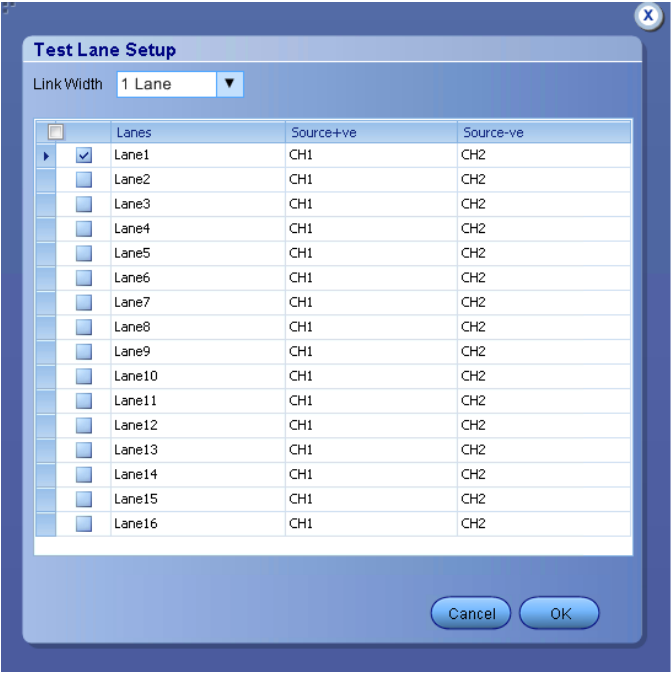

Setup panel overview

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 |
|-----------------------|--|
| 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"> In the Test Lane Setup dialog box, select the desired number of lanes from the Link Width drop-down list. 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

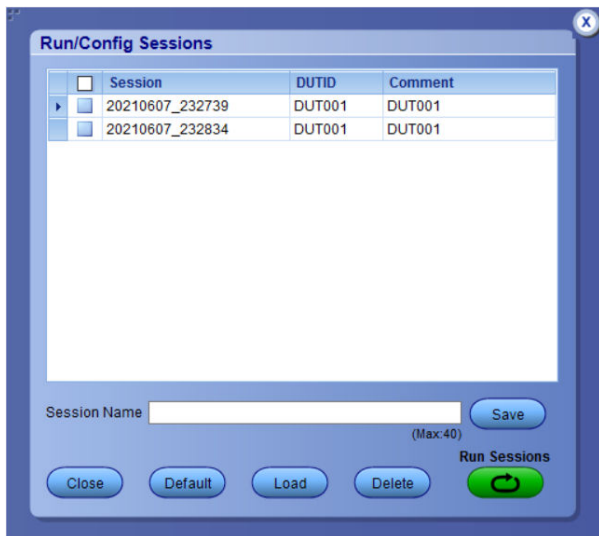
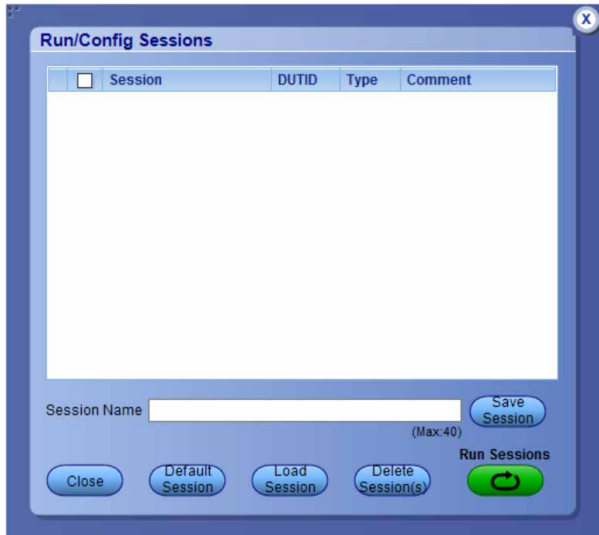
Multiple-sessions run feature allows you to save multiple config sessions and runs the multiple config/run sessions together.

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.



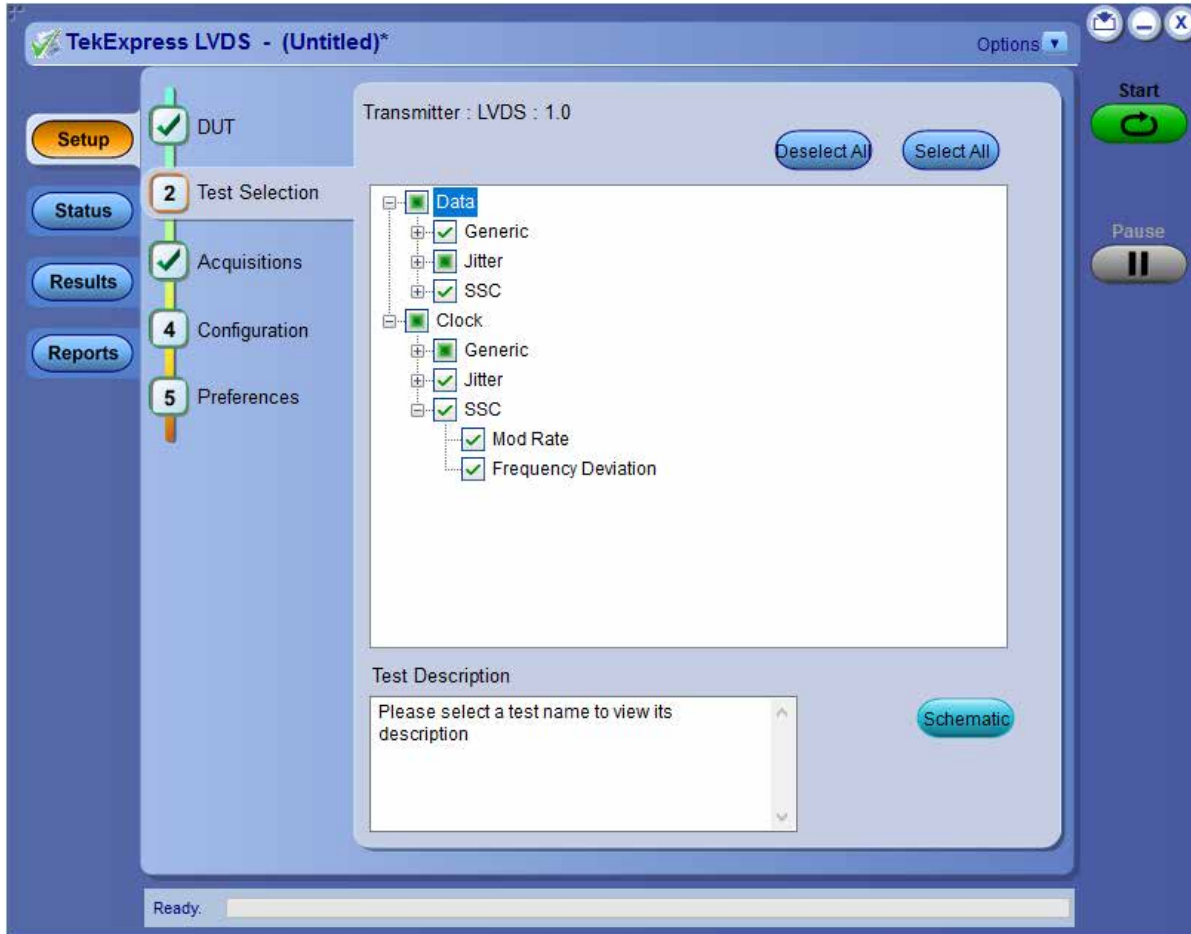


Figure 1: TekExpress LVDS Measurements

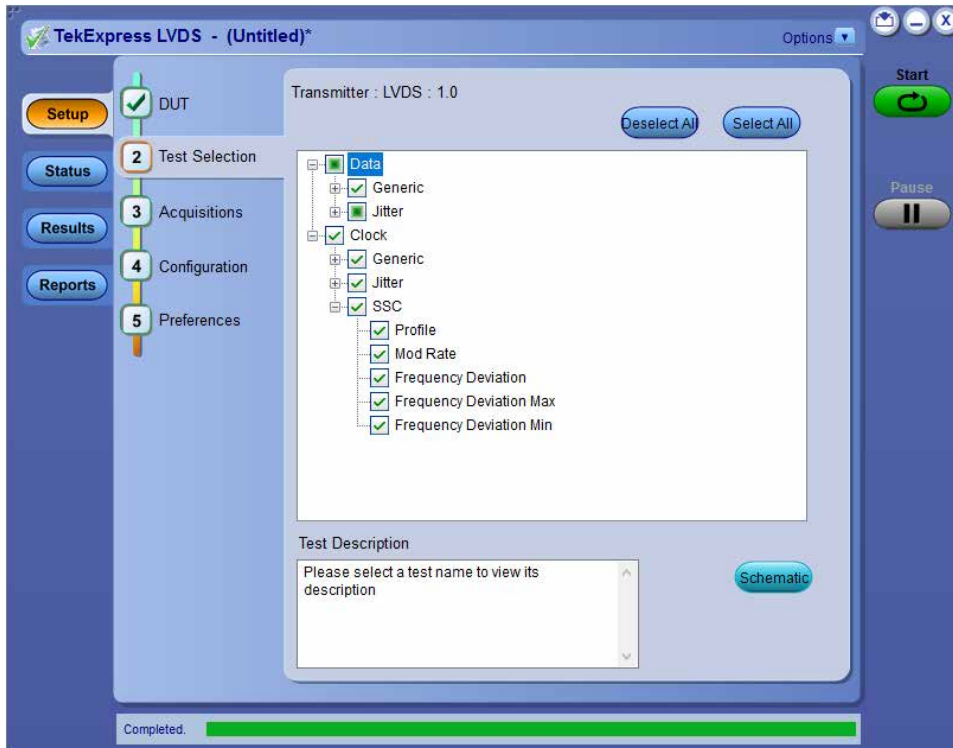


Figure 2: TekExpress LVDS Measurements

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.

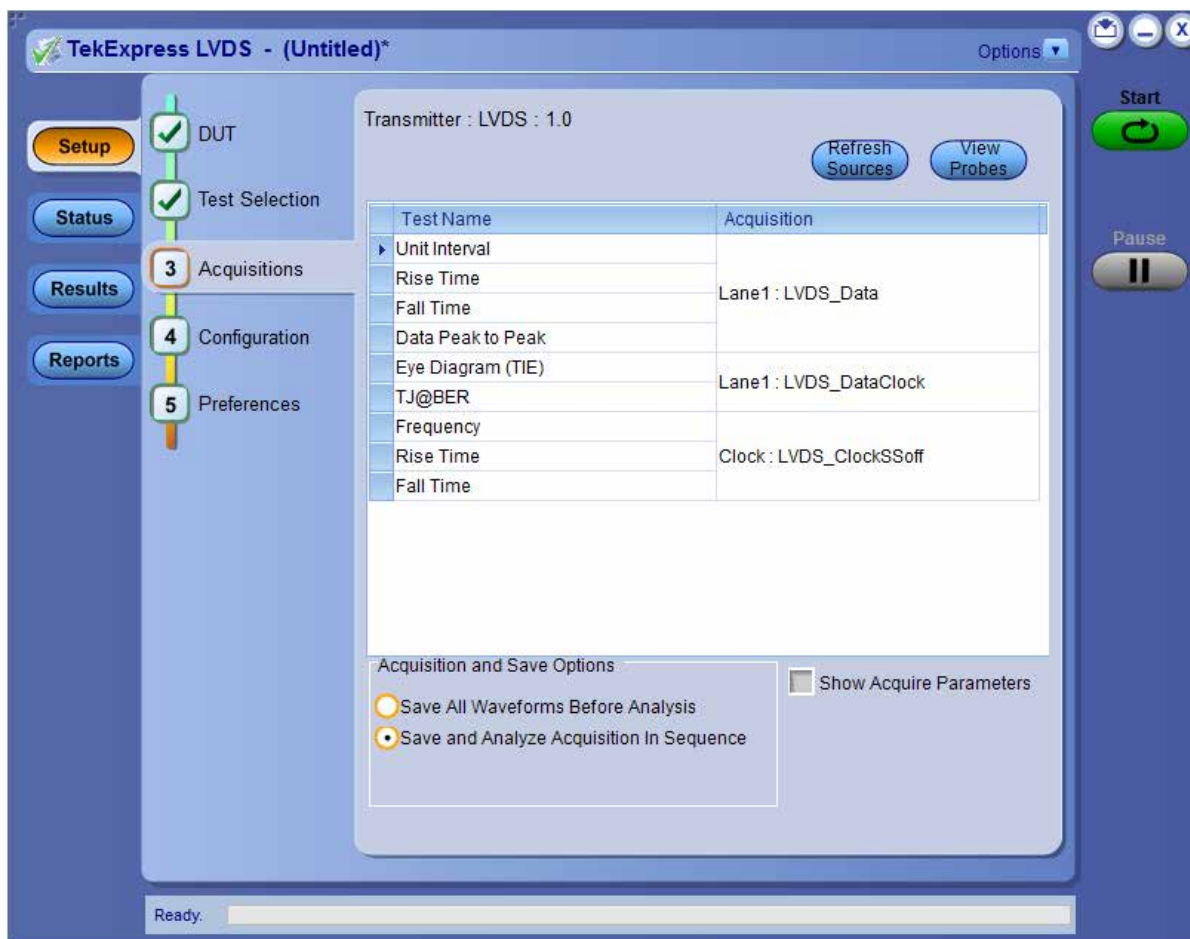


Table 8: Acquisitions tab settings

| 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 |

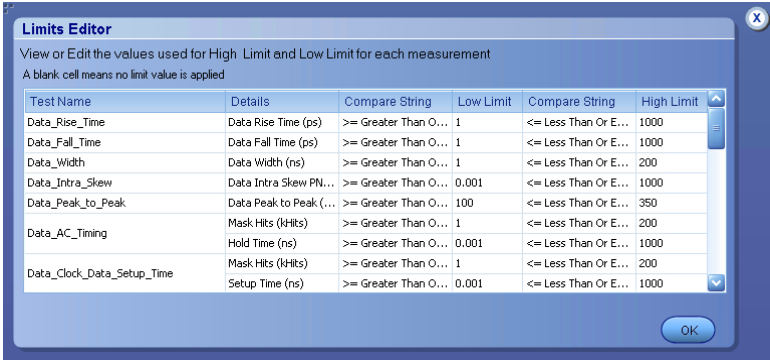
The TekExpress LVDS saves all acquisition waveforms to files by default. Waveforms are saved in a unique folder for each session (a session is started when you click the **Start** button). The folder path is X:\TekExpress LVDS\Untitled Session\\

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 | <p>Displays the upper and lower limits for the applicable measurement using different types of comparisons.</p>  <p>The screenshot shows a dialog box titled "Limits Editor" with a close button (X) in the top right corner. Below the title bar, there is a subtitle "View or Edit the values used for High Limit and Low Limit for each measurement" and a note "A blank cell means no limit value is applied". The main content is a table with the following columns: Test Name, Details, Compare String, Low Limit, Compare String, and High Limit. The table contains the following rows:</p> <table border="1"> <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 (Hits)</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 (Hits)</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> <p>An "OK" button is located at the bottom right of the dialog box.</p> | 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 (Hits) | >= 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 (Hits) | >= 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 (Hits) | >= 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 (Hits) | >= Greater Than O... | 1 | <= Less Than Or E... | 200 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Setup Time (ns) | >= Greater Than O... | 0.001 | <= Less Than Or E... | 1000 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

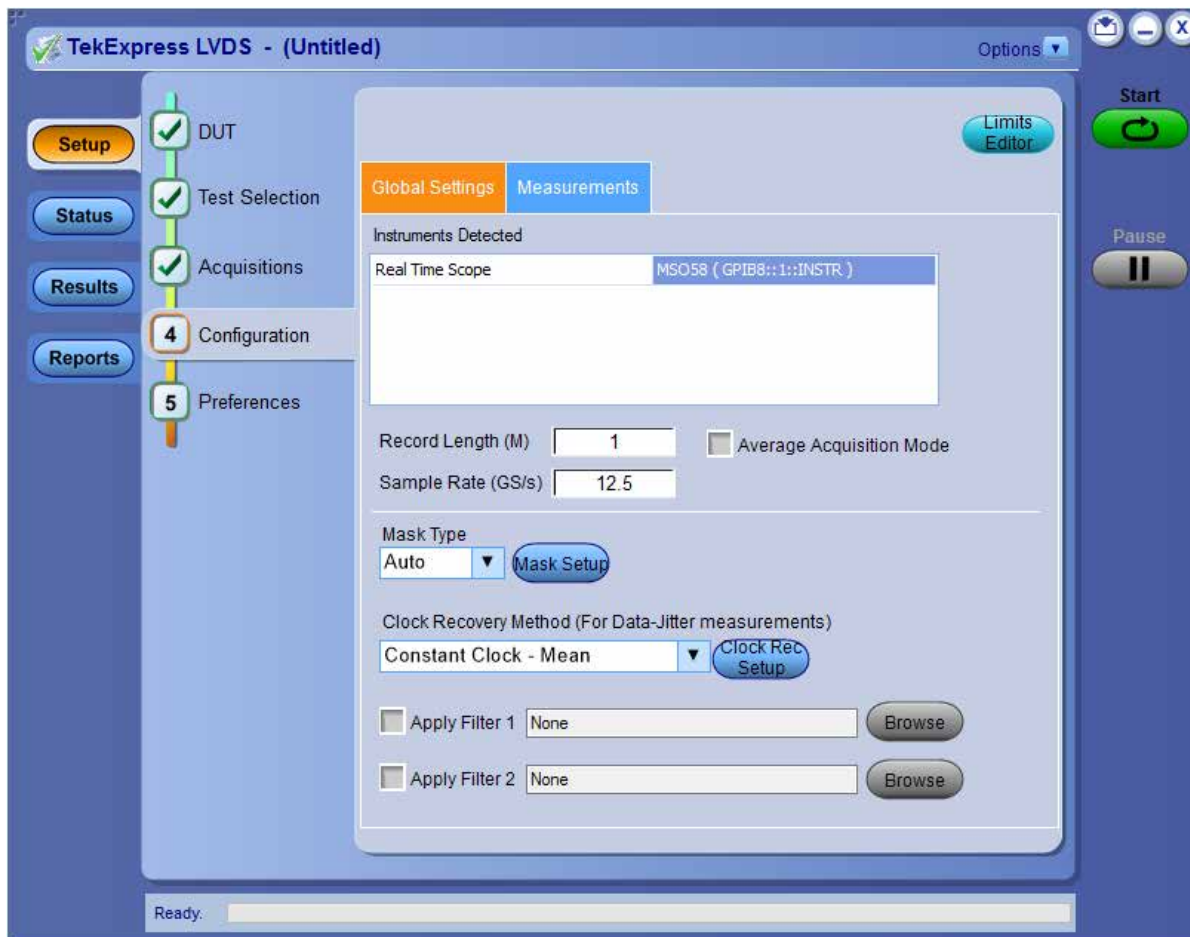


Figure 3: Configuration tab: Global Settings

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...

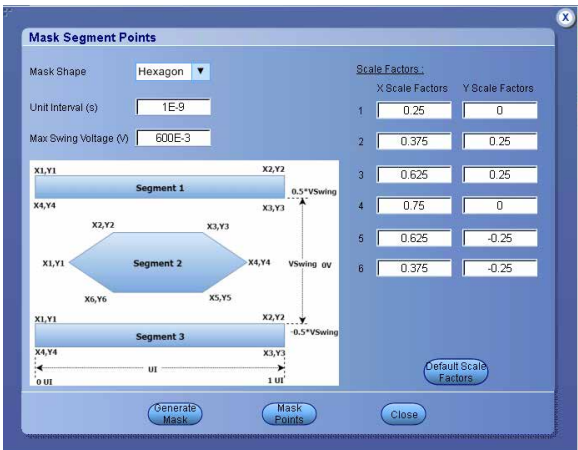
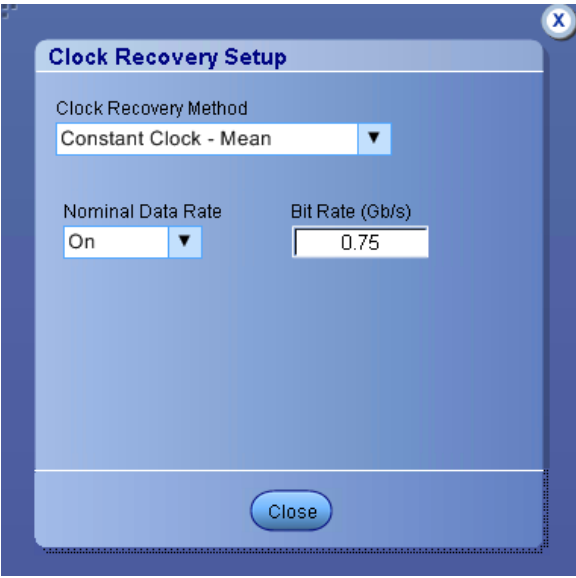
| Setting | Description |
|-----------------------------|---|
| Average Number of Waveforms | Enter the average number of Waveforms value in the text box Available only when Average Acquisition Mode is enabled. |
| Mask Type | Select the mask type from the drop-down list. <ul style="list-style-type: 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) | Select the clock recovery method from the drop-down list. <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.

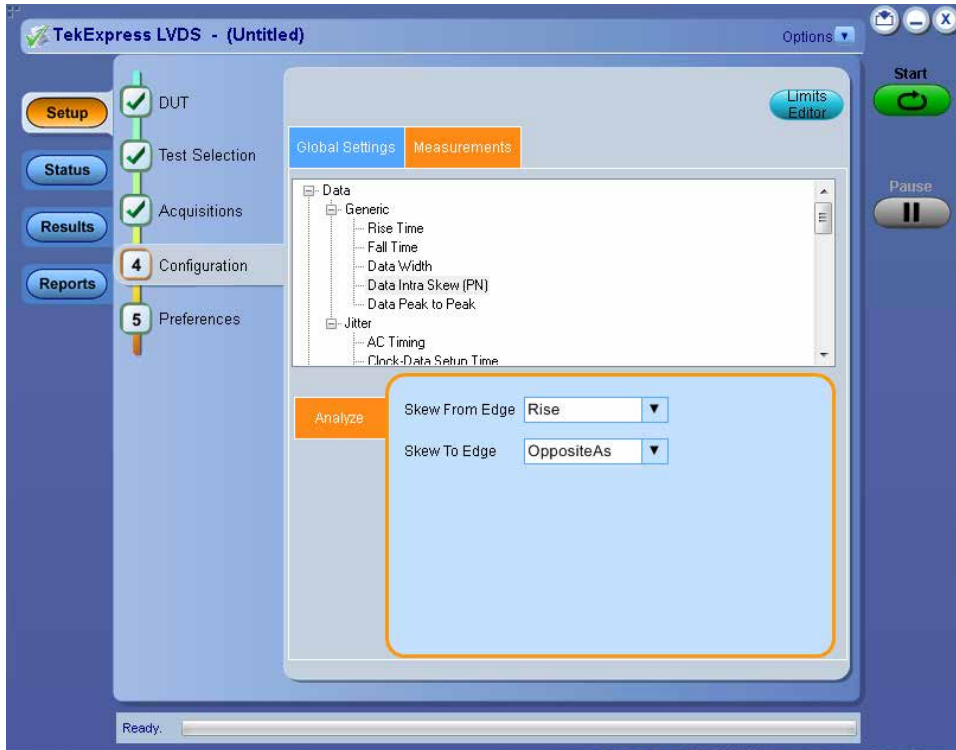



Figure 4: Configuration tab: Measurements

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.

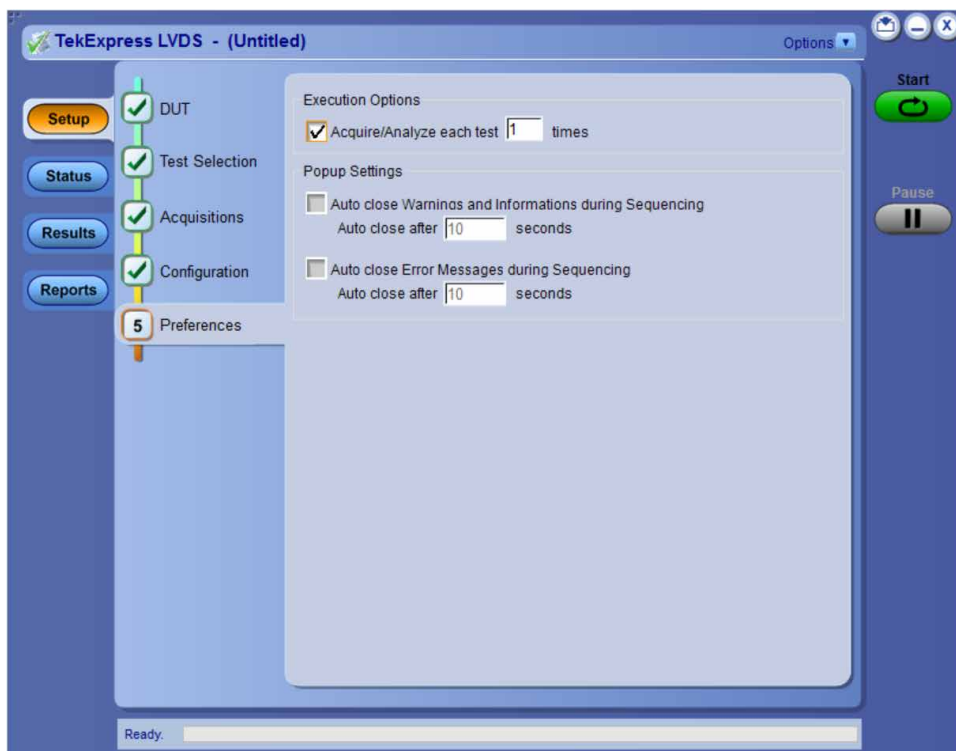


Figure 5: Preferences tab

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 Auto close after <no> Seconds | Select to auto close warnings/information during sequencing. Set the Auto close time. By default it is unselected. |
| Auto close Error Messages during Sequencing. Show in Reports Auto close after <no> Seconds | Select to auto close Error Messages during Sequencing. Set the Auto close time. By default it is unselected. |

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.

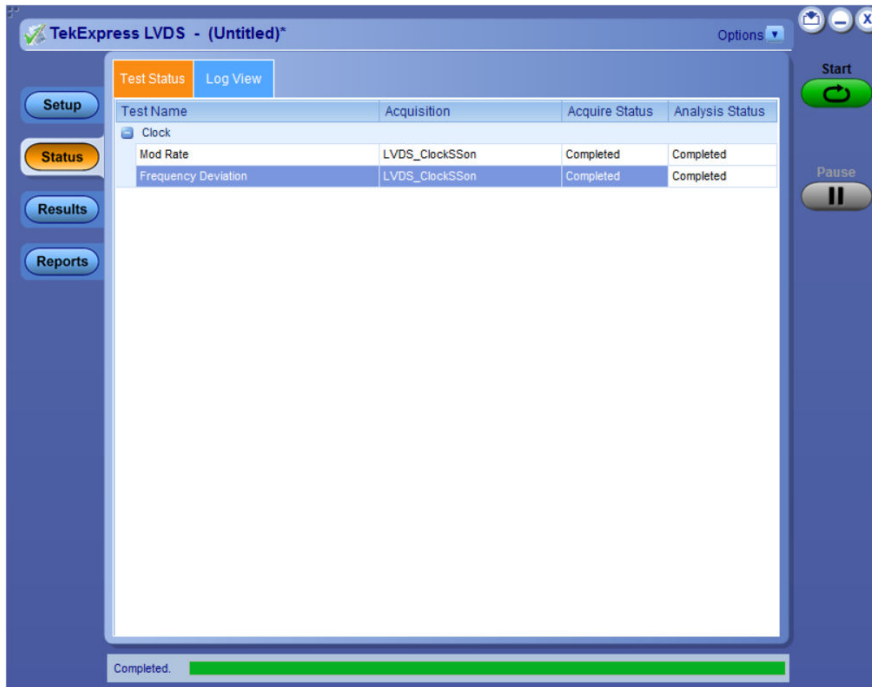


Figure 6: Test status view in the Status panel

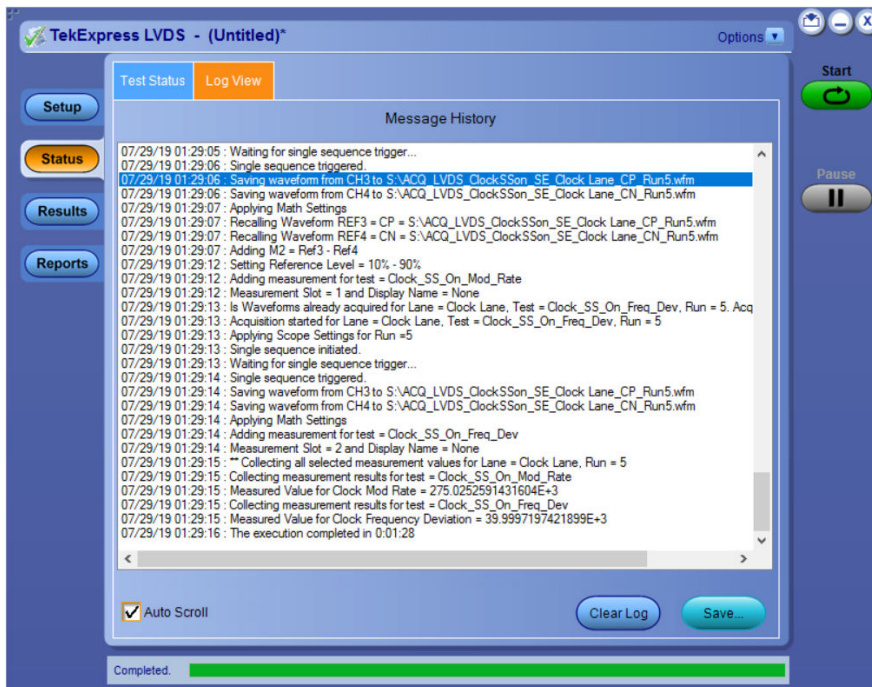


Figure 7: Log view in the Status panel

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. |

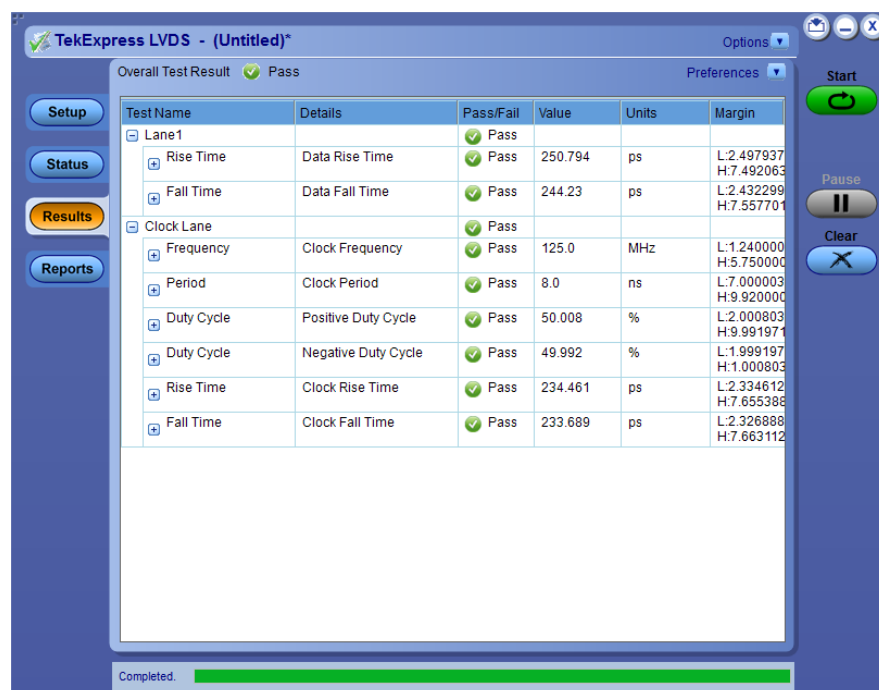
See also

[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

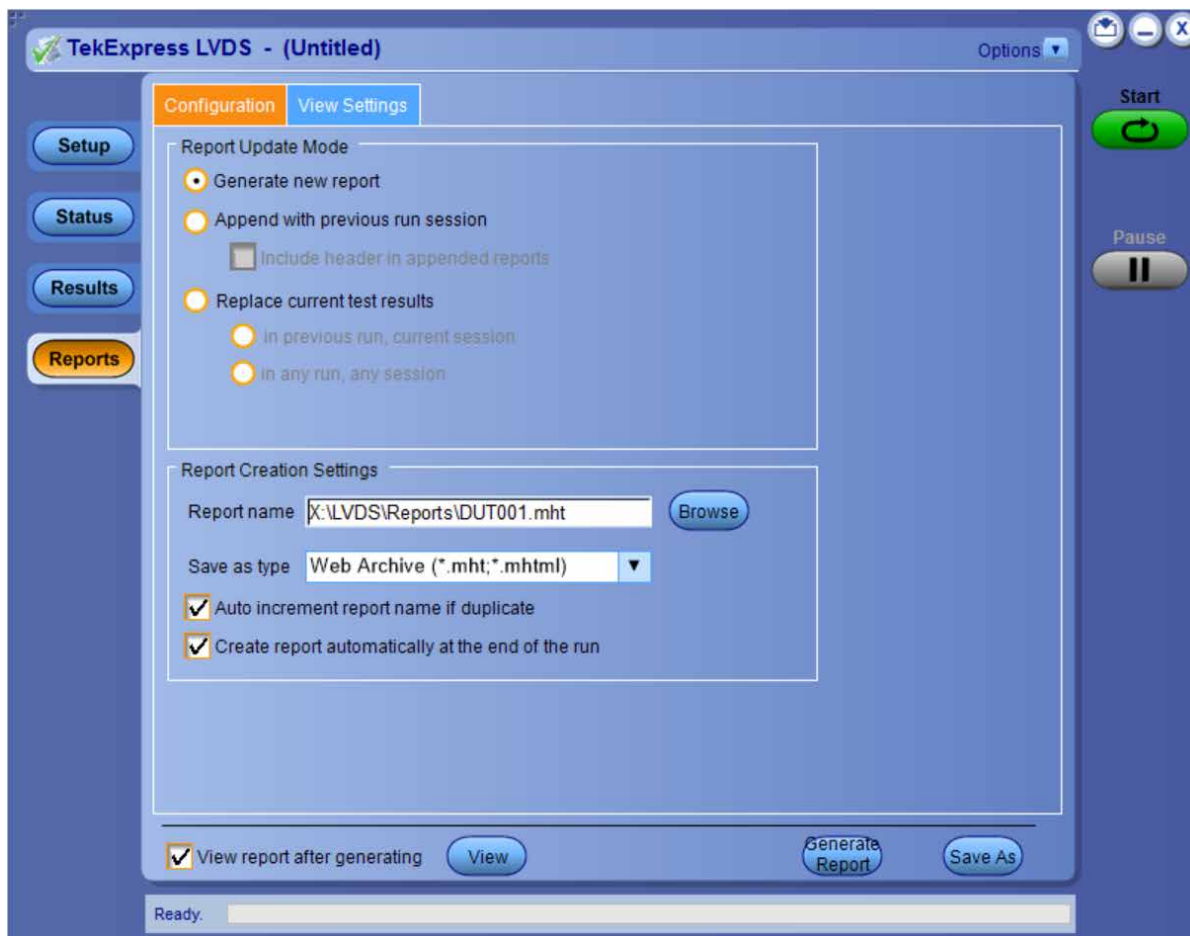
[File name extensions](#)

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.



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.

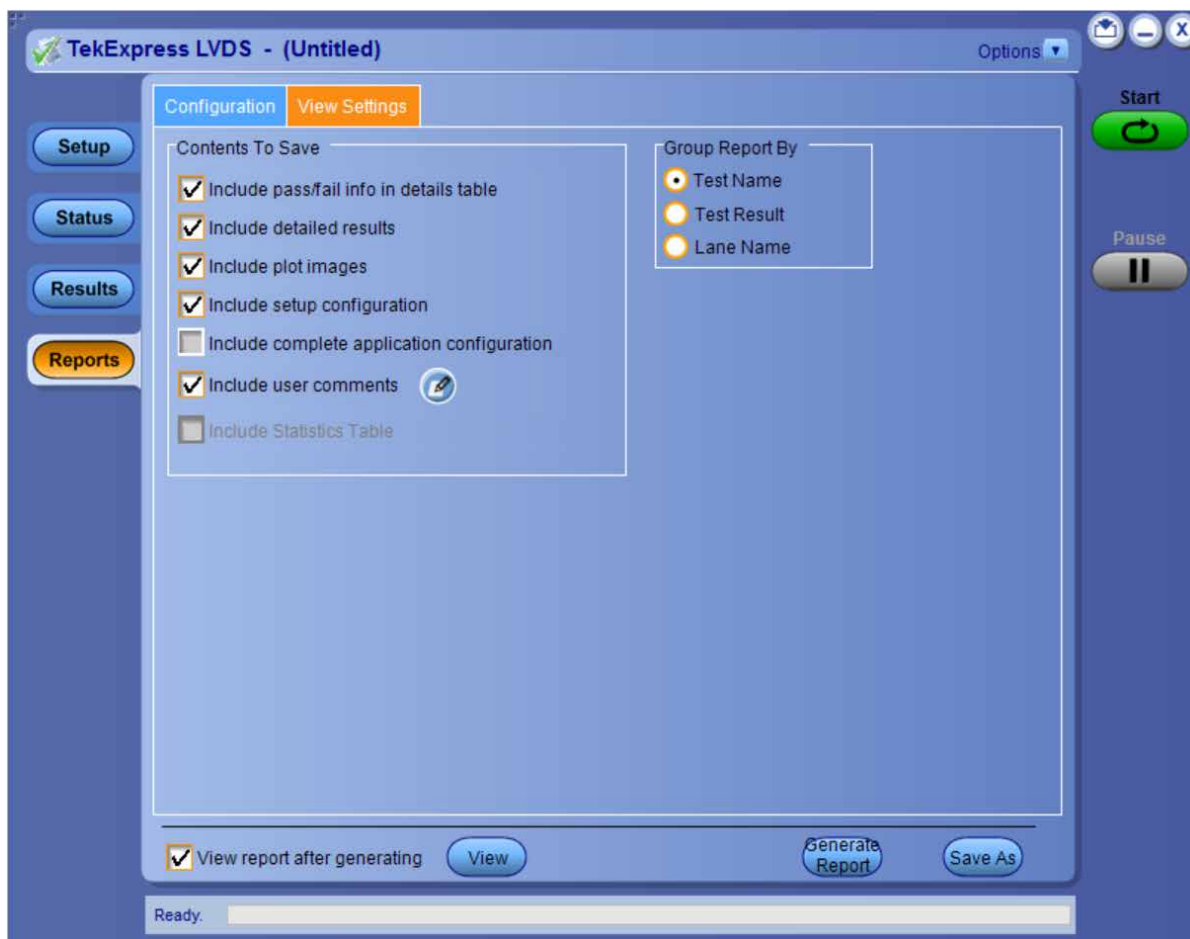


Table 14: Report panel view settings

| 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. |
| 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. |

Table continued...

| Control | Description |
|------------------------|---|
| 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, FactoryCalibration | 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 | | | | | | | |

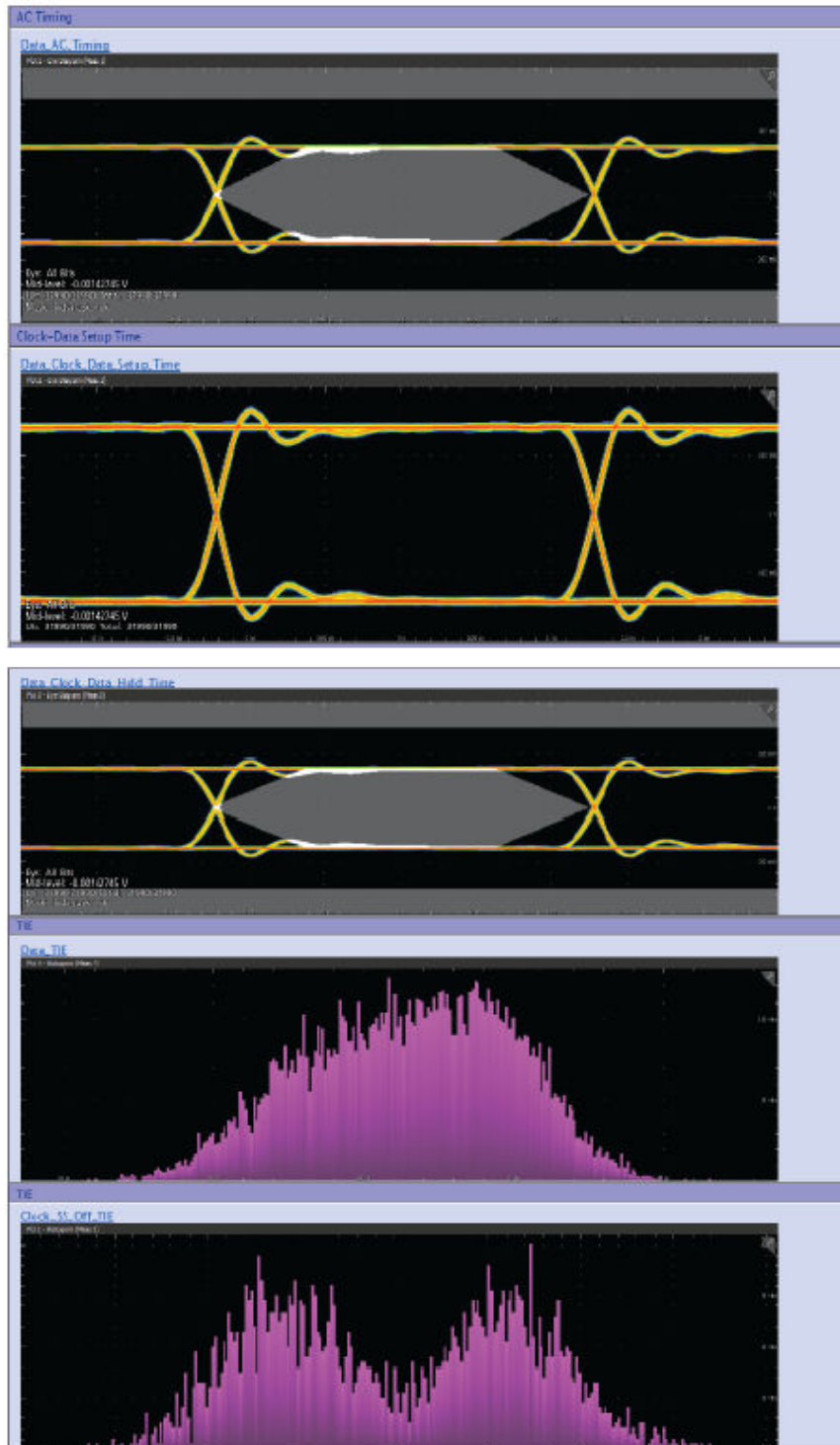
[Back to Summary Table](#)

| 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:3.750000e+002MHz | 1 | 700 |
| COMMENTS | NA | | | | | | | |

[Back to Summary Table](#)



[Setup configuration information](#)

[User comments](#)

See also

[Results panel overview](#)

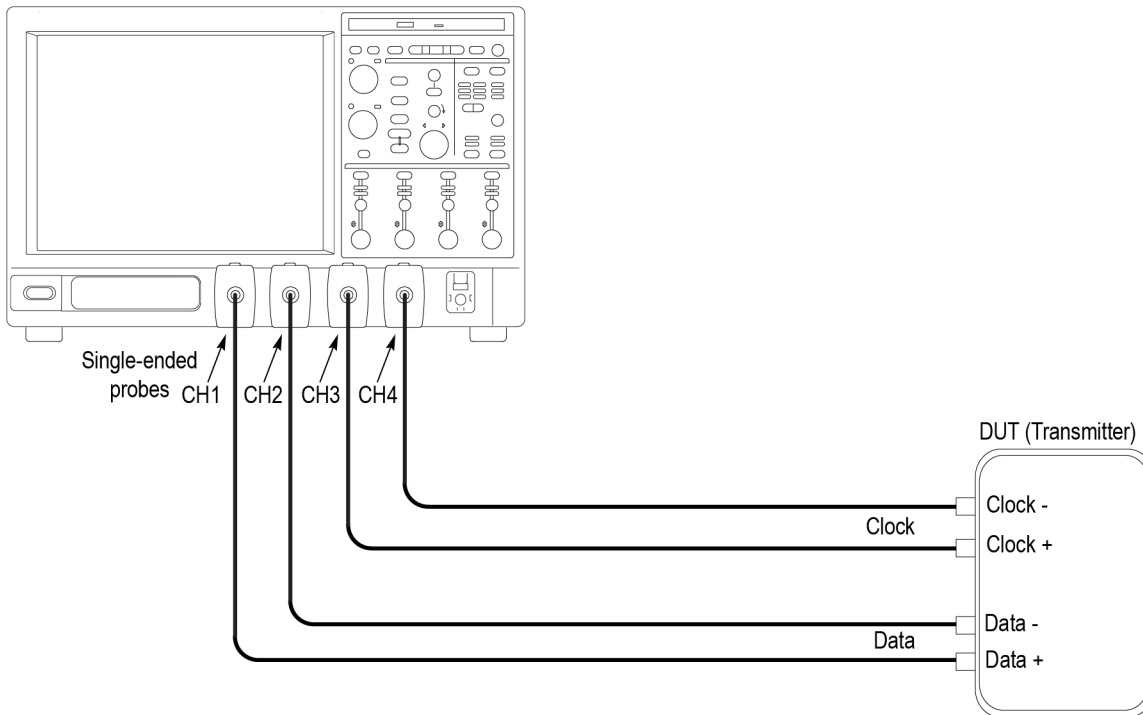
[View test-related files](#)

Running tests

Equipment connection diagram

Single-ended Connection Diagram

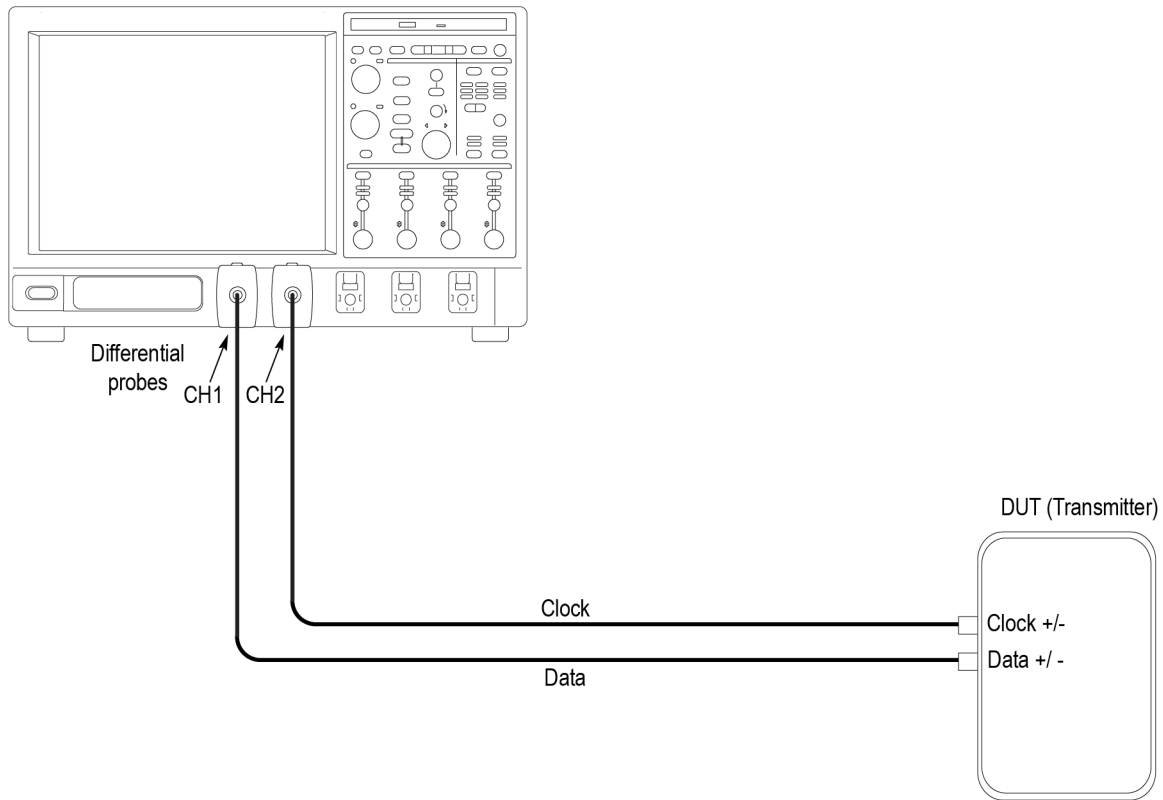
DPO70KC Series



1623 001

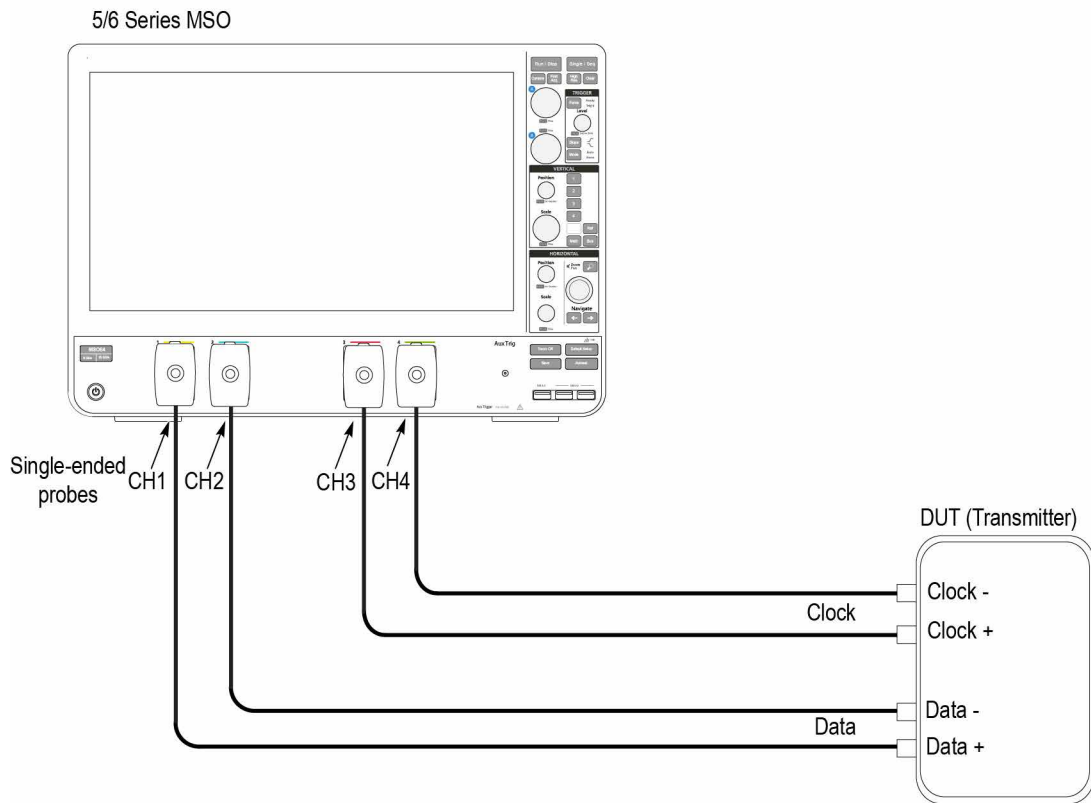
Differential Connection Diagram

DPO70KC Series



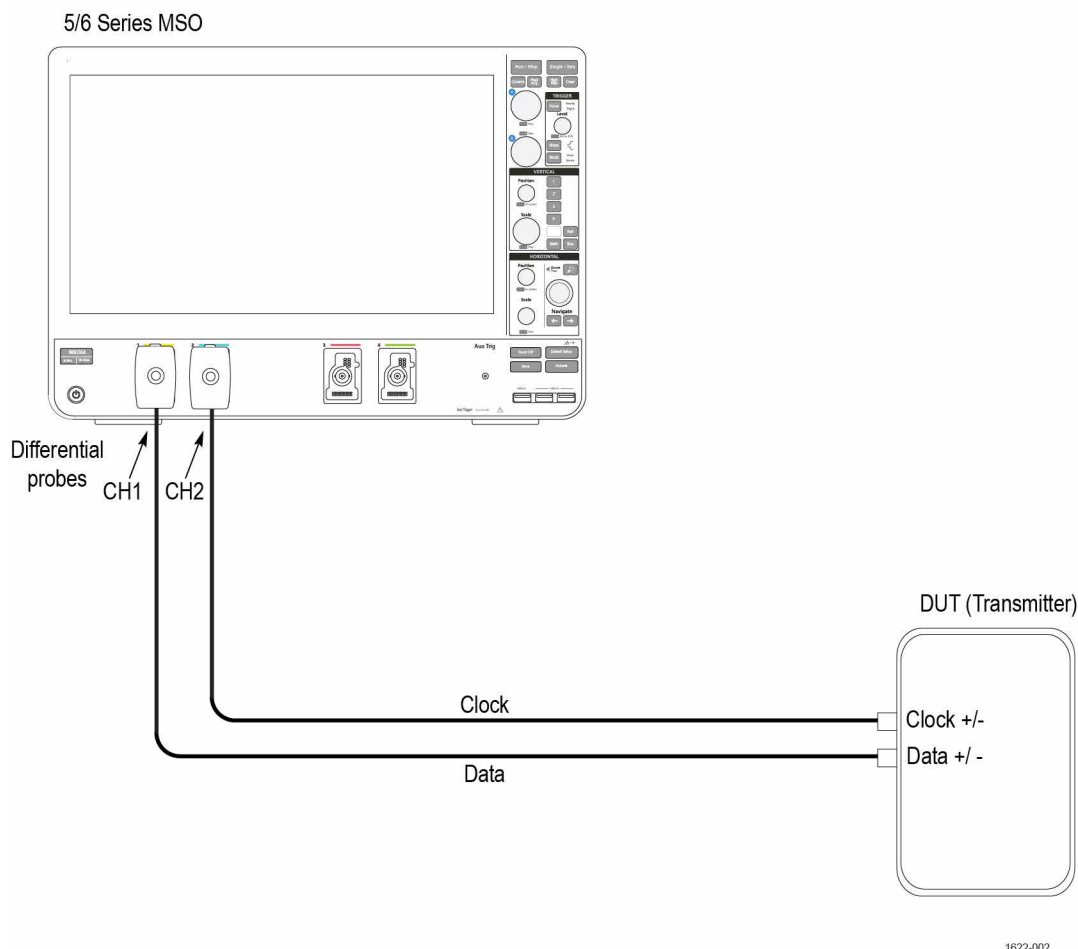
1623 002

Single-ended Connection Diagram



1622-001

Differential Connection Diagram



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

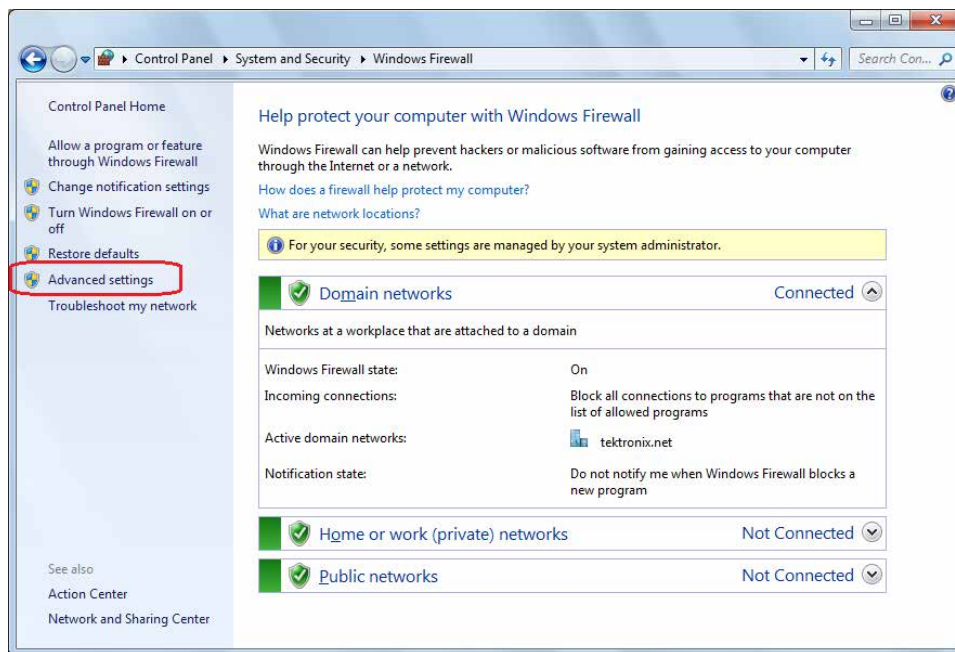
You can use Standard Commands for Programmable Instruments (SCPI) to communicate with the TekExpress application.

Socket configuration for SCPI commands

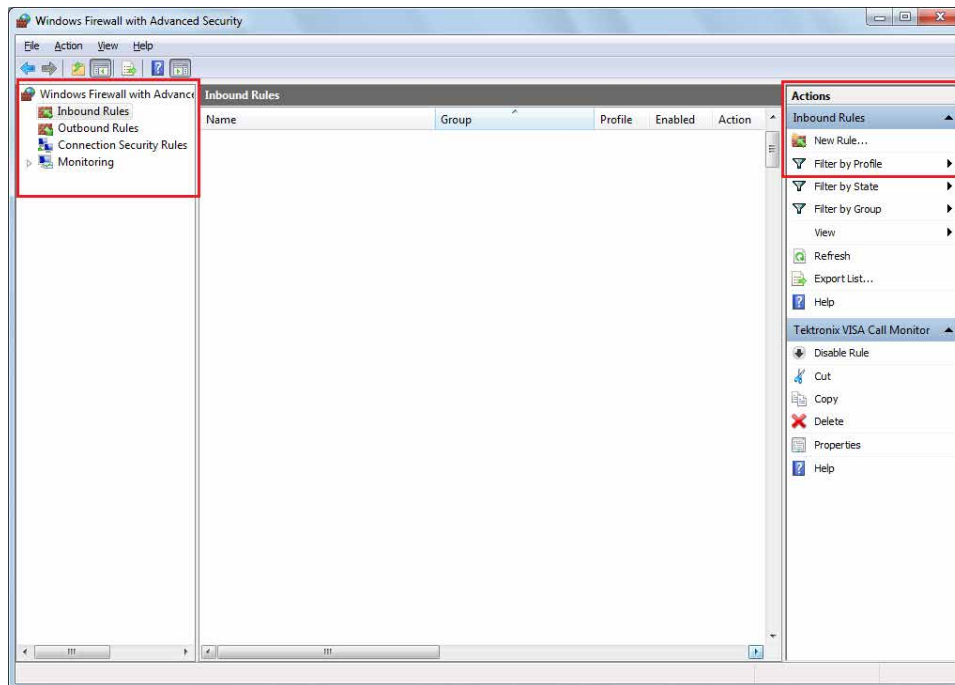
This section describes the steps for TCP/IP socket configuration and TekVISA configuration to execute the SCPI commands.

TCP/IP socket configuration

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

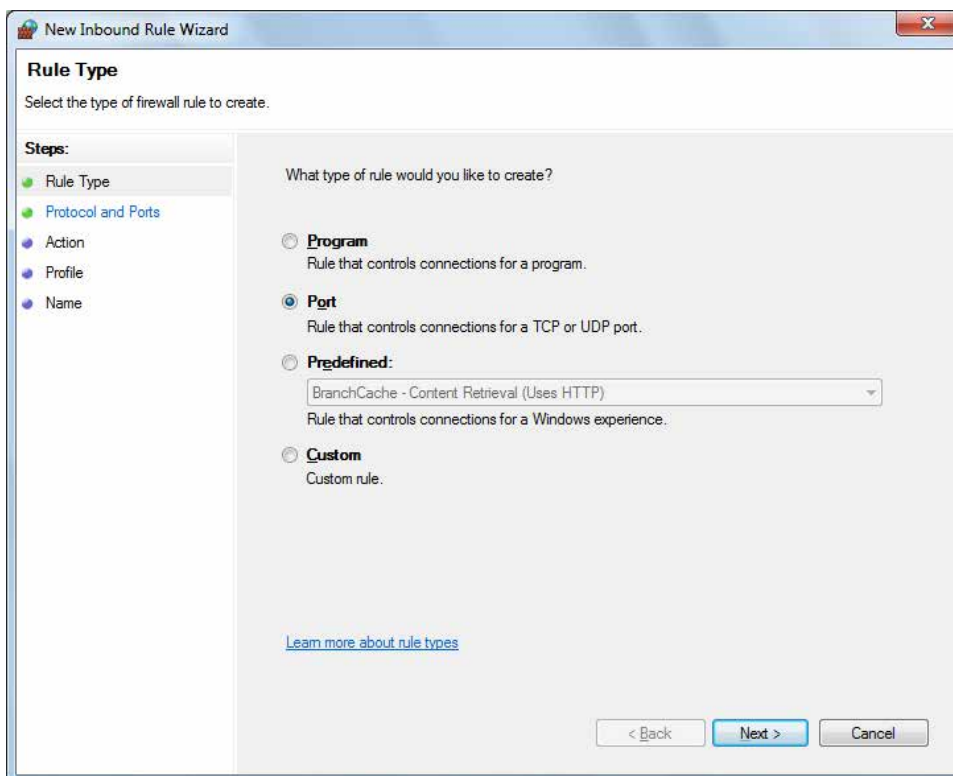


2. In Windows Firewall with Advanced Security menu, select **Windows Firewall with Advanced Security on Local Computer > Inbound Rules** and click New Rule...

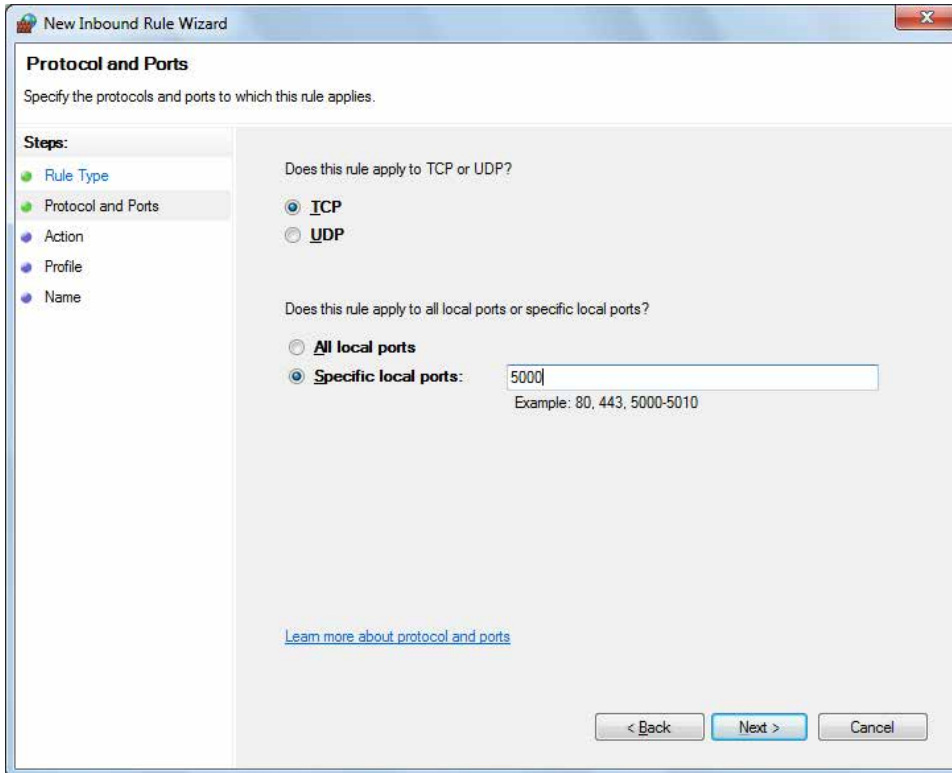


3. In New Inbound Rule Wizard menu

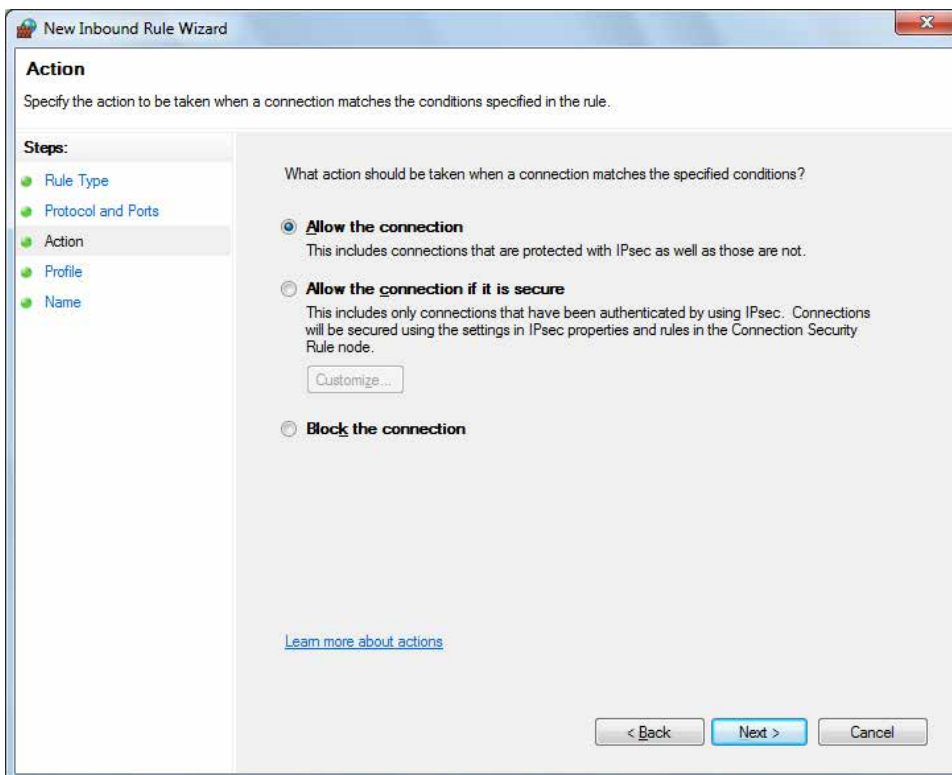
a. Select **Port** and click **Next**.



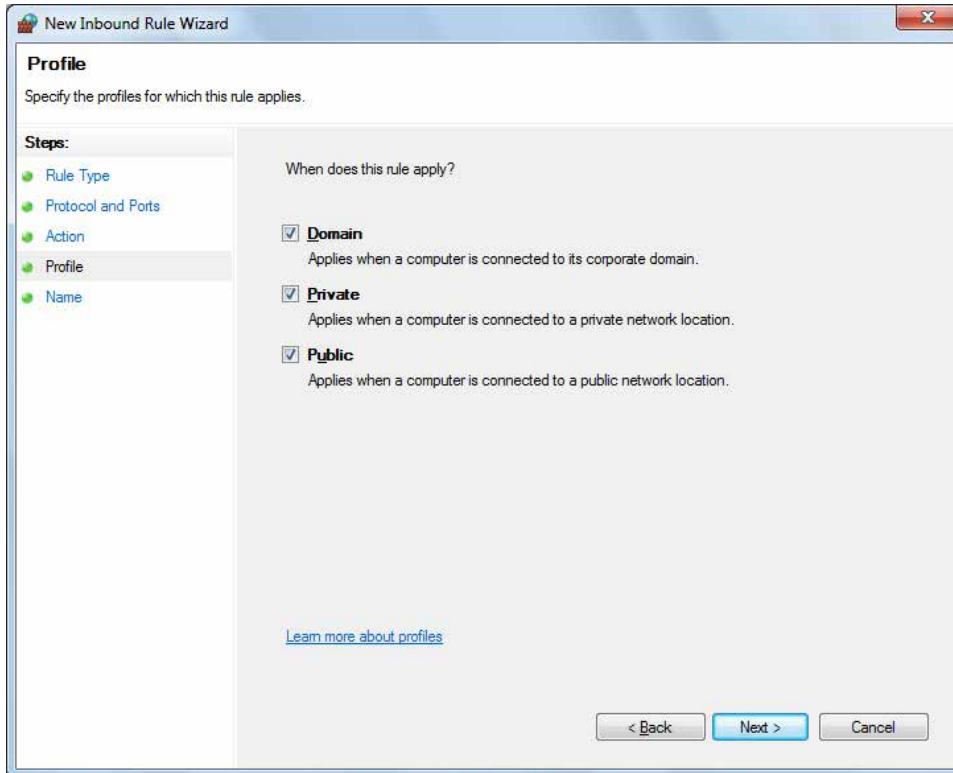
b. Select **TCP** as rule apply and enter 5000 for **Specific local ports** and click **Next**.



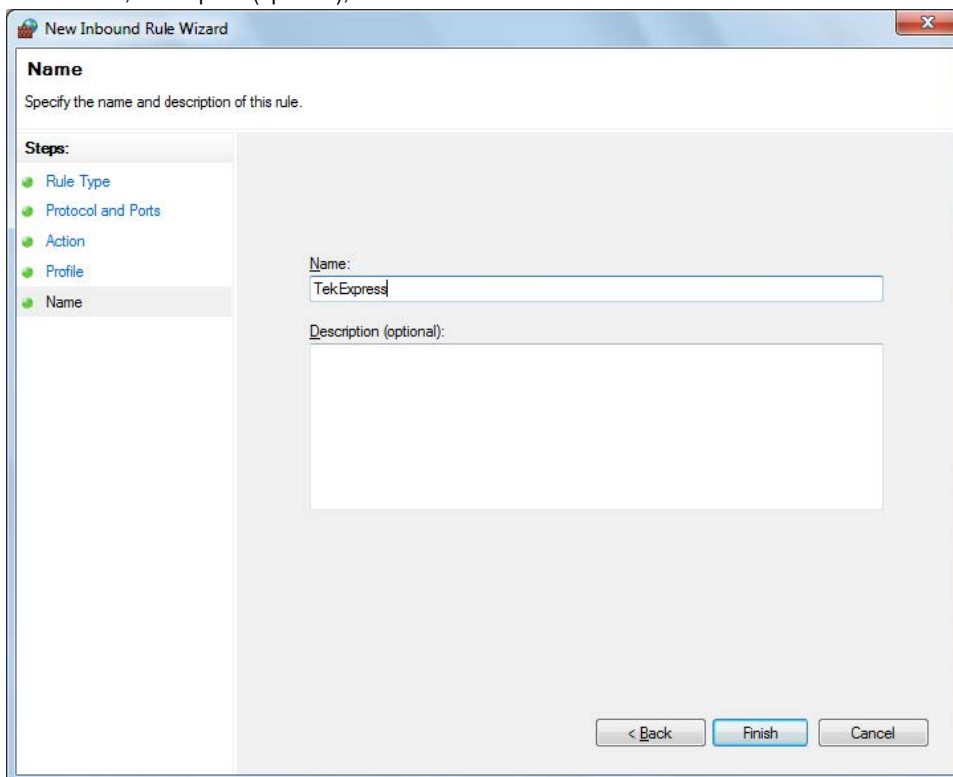
- c. Select **Allow the connection** and click **Next**.



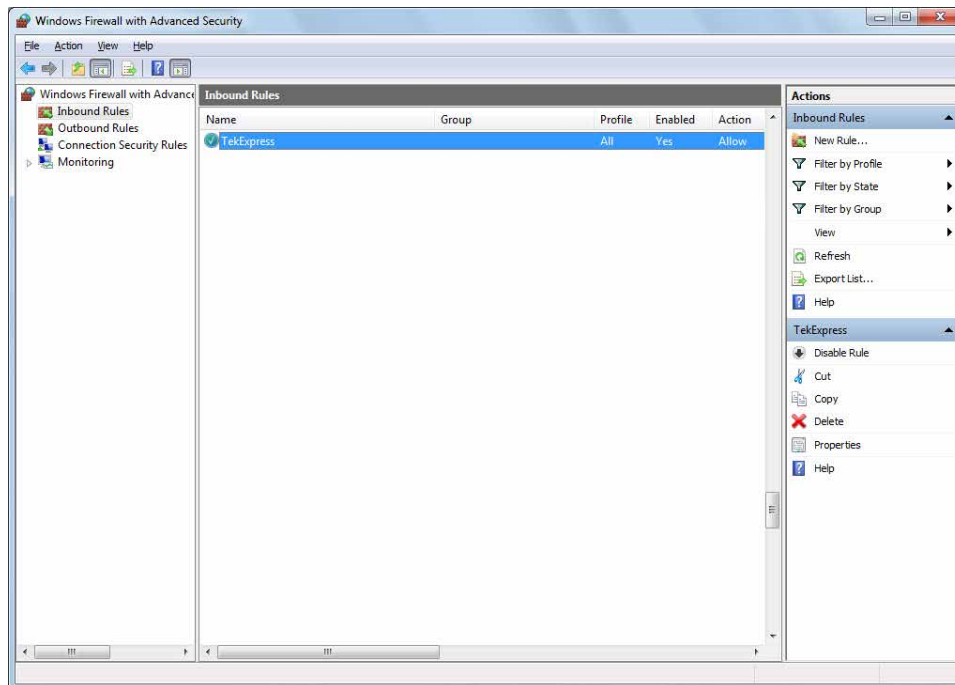
- d. Select **Domain, Private, Public** and click **Next**.



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

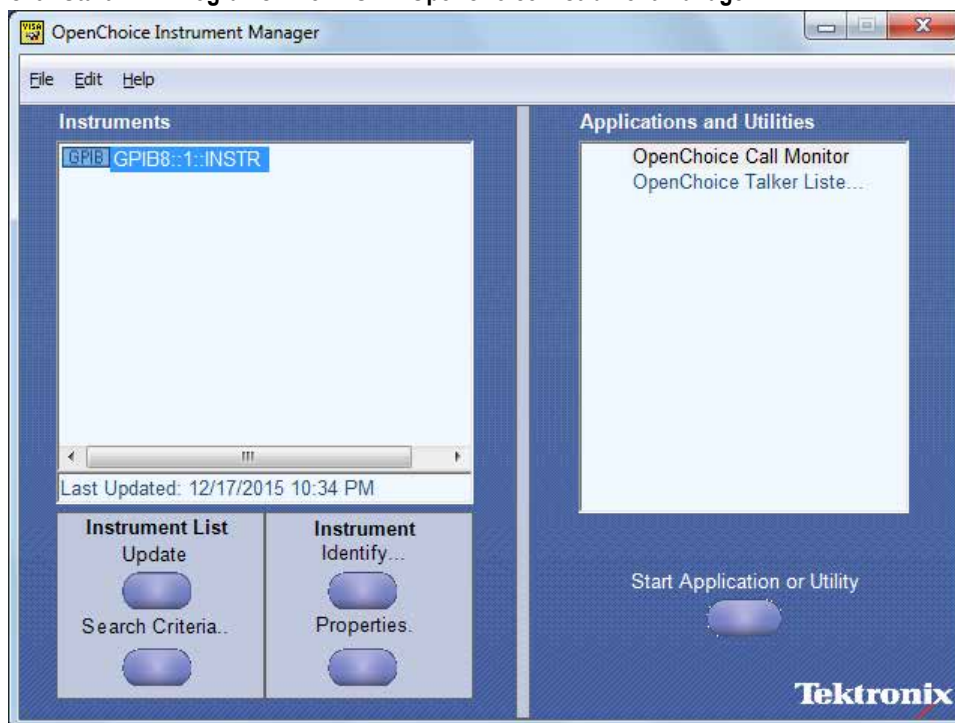


4. Check whether the Rule name is displayed in **Windows Firewall with Advanced Security menu > Inbound Rules**.



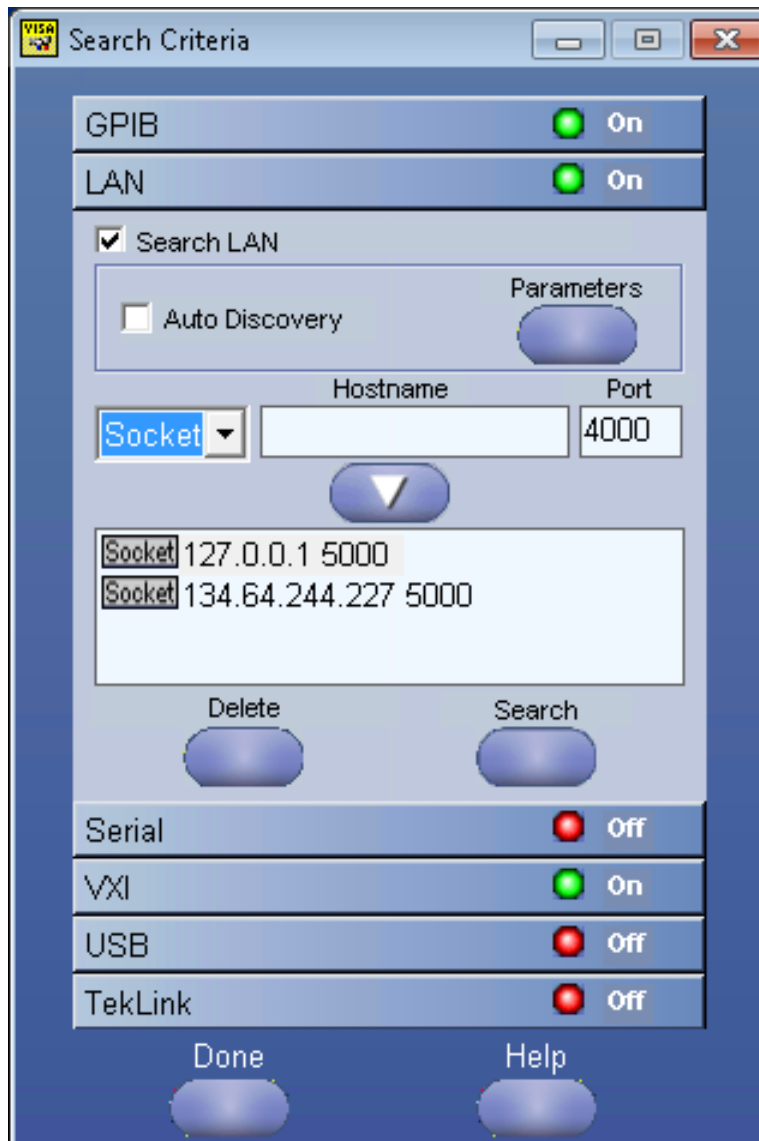
TekVISA configuration

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

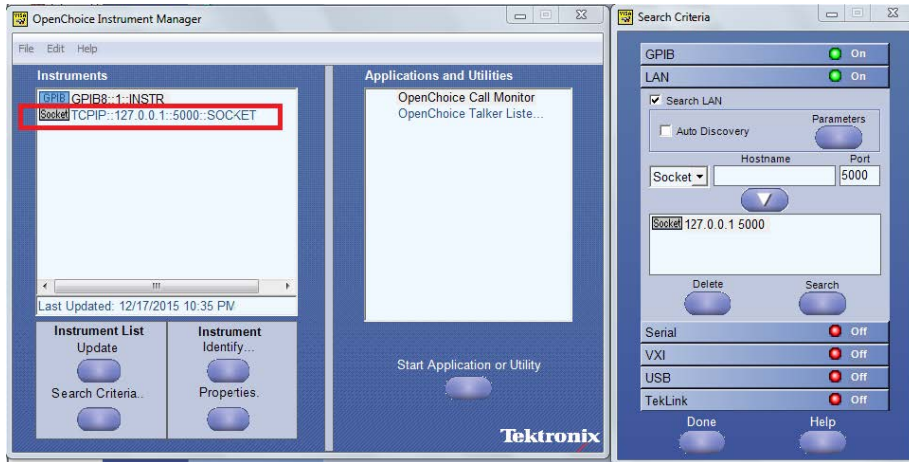


2. Click **Search Criteria**. In Search Criteria menu, click **LAN** to Turn-on. Select **Socket** from the drop-down list, enter the IP address of the TekExpress device in **Hostname** and type **Port** as 5000. Click  to configure the IP address with Port.

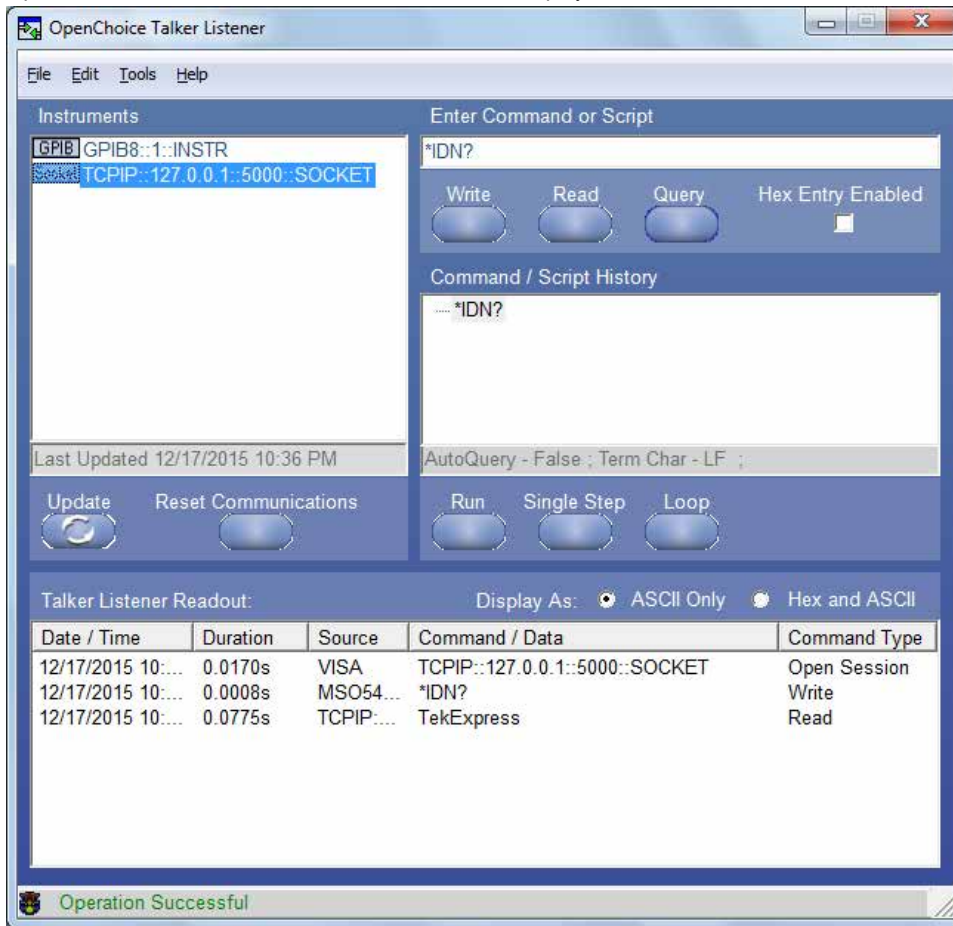
Enter the Hostname as 127.0.0.1 if the TekVISA and TekExpress application are in the same system, else enter the IP address of the TekExpress application system.



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



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



TEKEXP:*IDN?

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

Syntax

TEKEXP: *IDN? \n

Inputs

NA

Outputs

Returns active TekExpress application name running on the oscilloscope.

TEKEXP:*OPC?

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

Syntax

```
TEKEXP:*OPC?\n
```

Inputs

NA

Outputs

0 - last command execution is not complete

1 - last command execution is complete

TEKEXP:ACQUIRE_MODE

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

Syntax

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

Inputs

```
{LIVE | PRE-RECORDED}
```

Outputs

NA

TEKEXP:ACQUIRE_MODE?

This command queries the acquire mode type.

Syntax

```
TEKEXP:ACQUIRE_MODE?\n
```

Inputs

NA

Outputs

```
{LIVE | PRE-RECORDED}
```

TEKEXP:EXPORT

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

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

Inputs

FileName - Specifies the file name

TEKEXP:INFO?

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

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

TEKEXP:INSTRUMENT

This command sets the value for the selected instrument type.

Syntax

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

Inputs

InstrumentType

Value



Tip: Check *Command parameters list* section for InstrumentType and Value parameters.

Outputs

NA

TEKEXP:INSTRUMENT?

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

Syntax

TEKEXP:INSTRUMENT? "<InstrumentType>"\n

Inputs

InstrumentType



Tip: Check *Command parameters list* section for InstrumentType parameters.

Outputs

Returns the instrument selected for the specified instrument type

TEKEXP:LASTERROR?

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

Syntax

TEKEXP:LASTERROR?\n

Inputs

NA

Outputs

<string>

TEKEXP:LIST?

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

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



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

Inputs

InstrumentType



Tip: Check *Command parameters list* section for Instrument Type 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:POPUP?

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

Syntax

```
TEKEXP:POPUP?\n
```

Inputs

NA

Outputs

Returns the active popup information in the application.

TEKEXP:REPORT

This command generates the report for the current session.

Syntax

```
TEKEXP:REPORT GENERATE\n
```

Inputs

GENERATE

Outputs

NA

TEKEXP: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:REPORT?

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

Syntax

```
TEKEXP:REPORT? "<HeaderField>"\n
```

Inputs

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



Tip: Check **Report** for HeaderField parameters.

Outputs

Returns the queried header field value in the report

TEKEXP:RESULT?

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

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

Inputs

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

ColumnName - Specifies the column name for the measurement

RowNumber - Specifies the row number of the measurement



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

TEKEXP:SELECT

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

Syntax

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

¹ Row number starts from zero.

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

Inputs

```
<string1> = {DEVICE | SUITE | VERSION}
```

```
<string2> = {DeviceName | SuiteName | VersionName}
```

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

```
<string4> = {TRUE | FALSE}
```



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

Outputs

NA

TEKEXP:SELECT?

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

Syntax

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

Inputs

```
{DEVICE | SUITE | TEST | VERSION}
```

Outputs

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

TEKEXP:SETUP

This command sets the value of the current setup.

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

Inputs

SessionName - The name of the session

TEKEXP:STATE

This command sets the execution state of the application.

Syntax

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

Inputs

{RUN | STOP | PAUSE | RESUME}

Outputs

NA

TEKEXP:STATE?

This command queries the current setup state.

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

TEKEXP:VALUE

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

Syntax

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

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

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

```
TEKEXP:VALUE DUTID, "<Value>"\n
```

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

```
TEKEXP:VALUE WFMFILE, <Test_Name>, <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.

Table 15: 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 |

Table continued...

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

Table 16: 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 17: ParameterName and value for acquisition tab

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

Table 18: 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 19: 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 20: 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 | |
| Save 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 At The End | <ul style="list-style-type: none"> • TRUE • FALSE |
| Include Pass/Fail Results Summary | <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 |
| Table continued... | |

| ParameterName | Description |
|--------------------------|--|
| 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 |
| Nominal Data Rate | <ul style="list-style-type: none"> • On • Off |
| Bit Rate (GHz) | 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?\n | It returns the active TekExpress application name running on the scope. |
| TEKEXP:*OPC?\n | It returns the last command execution status. |
| TEKEXP:ACQUIRE_MODE PRE-RECORDED\n | It sets the acquire mode as pre-recorded. |
| TEKEXP:ACQUIRE_MODE?\n | It returns LIVE when acquire mode is set to live. |
| TEKEXP:EXPORT REPORT\n | It returns the report file in bytes. This can be written into another file for further analysis. |
| TEKEXP:INFO? REPORT\n | It returns "100;ReportFileName.mht", when 100 is the file size in bytes for the filename ReportFileName. |

Table continued...

| Example | Description |
|---|--|
| TEKEXP:INFO? WFM\n | It returns "100,"WfmFileName1.wfm";200,"WfmFileName2.wfm"" when 100 is the file size 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",MSO58 (GPIB8::1::INSTR)\n | It sets the instrument value as MSO58 (GPIB8::1::INSTR) for the selected instrument type Real Time Scope. |
| TEKEXP:INSTRUMENT? "Real Time Scope"\n | It returns "MSO56 (GPIB8::1::INSTR), when MSO56 (GPIB8::1::INSTR)" is the selected instrument for the instrument type Real Time Scope. |
| TEKEXP:LASTERROR?\n | It returns ERROR: INSTRUMENT_NOT_FOUND, when no instrument is found. |
| TEKEXP:LIST? DEVICE\n | It returns "Transmitter, Receiver" when Transmitter, Receiver are the available device. |
| TEKEXP:LIST? INSTRUMENT,"Real Time Scope"\n | It returns "MSO58 (GPIB8::1::INSTR), MSO56 (TCPIP::134.64.248.91::INSTR)" when MSO58 (GPIB8::1::INSTR), MSO56 (TCPIP::134.64.248.91::INSTR) are the list of available instruments. |
| TEKEXP:MODE COMPLIANCE\n | It sets the execution mode as compliance. |
| TEKEXP:MODE?\n | It returns COMPLIANCE when the execution mode is compliance. |
| TEKEXP:POPOPUP "OK"\n | It sets OK as the response to active popup in the application. |
| TEKEXP:POPOPUP?\n | It returns "OK", when OK is the active popup information shown in the application. |
| TEKEXP:REPORT GENERATE\n | It generates report for the current session. |
| TEKEXP:REPORT? "Scope Model"\n | It returns "MSO54" when MSO54 is the scope model. |
| TEKEXP:REPORT? "DUT ID"\n | It returns "DUT001" when DNI_DUT001 is the DUT ID. |
| TEKEXP:RESULT? " Data_Rise_Time"\n | It returns Pass when the test result is Pass. |
| TEKEXP:RESULT? "1 Data_Rise_Time",1\n | It returns "L:-50.000ps H:2000.000ps" when L:-50.000ps H: 2000.000ps is the value. |
| TEKEXP:SELECT DEVICE, Transmitter, TRUE\n | It selects Transmitter. |
| TEKEXP:SELECT? DEVICE\n | It returns " Transmitter " when Transmitter is the selected device type. |
| TEKEXP:SETUP DEFAULT\n | It restores the application to default setup. |

Table continued...

| Example | Description |
|--|--|
| TEKEXP:STATE STOP\n | It stops the test execution. |
| TEKEXP:STATE?\n | It returns as READY when the application is ready to run next measurement. |
| TEKEXP:STATE? SETUP\n | It returns as NOT_SAVED when the current setup is not saved. |
| TEKEXP:VALUE GENERAL," Clock Lane Probing", "Single-Ended"\n | It sets the Single-Ended parameter value to Clock Lane Probing. |
| TEKEXP:VALUE? GENERAL," Clock Lane Probing "\n | It returns "SingleEnded" when "Clock Lane Probing" is SingleEnded. |
| TEKEXP:SELECT TEST ," Data_Rise_Time",True | Execute this command to select an individual test. This command will select " Data_Rise_Time" test in the Signal Test tab. |
| TEKEXP:VALUE ANALYZE,"Data Intra Skew(PN)", "Skew From Edge", "Rise" | This Command sets "Rise" value to "Skew from edge" |

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} 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:

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

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:

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

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:

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

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:

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

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:

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

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

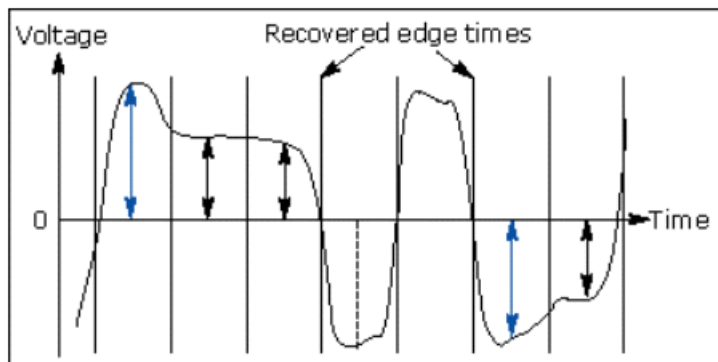
Dual Dirac Random Jitter (RJ- $\delta\delta$) is the rms magnitude of all timing errors not exhibiting deterministic behavior, calculated based on a simplifying assumption that the histogram of all deterministic jitter can be modeled as a pair of equal magnitude dirac functions (impulses). A single RJ- $\delta\delta$ 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_{RefMid} 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_{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.

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:

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

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

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:

$$T_n^{\text{Skew}} = T_n^{\text{Mid2}} - T_n^{\text{Mid1}}$$

Where:

T^{Skew} is the timing skew.

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

$T^{2\text{nd}}$ 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:

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

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.

Index

A

About TekExpress [10](#)
Acquire parameters
 viewing in reports [42](#)
Acquisition tab [29](#)
Analysis options [35](#)
Application panels overview [21](#)

B

Bandwidth Limit
 clock channels [23](#)
 data channels [23](#)
Button
 clear log [36](#)
 Email settings [35](#)
 save [36](#)

C

Clearing test results [50](#)
Compensate the signal path [49](#)
Configuration tab parameter
 instruments detected [31](#)
Configuration tab parameters
 global settings [31](#)
Connected instruments
 searching for [19](#)
Contacting Tektronix [11](#)
Conventions [11](#)
Create a test setup from default settings [51](#)
Create a test setup using an existing one [52](#)

D

Delete the run/config session [63](#)
DUT ID [23](#)
DUT parameter
 device [23](#)
 device profile [23](#)
DUT type
 device [23](#)

E

Email notification and setup [20](#)
Exiting the application [17](#)

F

Features (LVDS) [10](#)
File name extensions [14](#)

G

Global controls [18](#)
GPIB [19](#)

I

Installing the software [13](#)
Instruments
 discovering connected [19](#)
 viewing connected [19](#)
Instruments detected [31](#)

L

LAN [19](#)
Live waveforms [23](#)
Load the run/config session [66](#)
Loading a test setup [51](#)
Log view
 save file [36](#)
LVDS features [10](#)

M

Menus
 Options [18](#)
 Preferences [50](#)
Multiple-session run [26](#)
My TekExpress folder
 files stored in [39](#)

N

Non-VISA [19](#)

O

Opening a saved test setup [51](#)
Options menu
 Instrument control settings [19](#)
Oscilloscope compensation [49](#)
Override the run/config session [63](#)

P

Panels [21](#)
Pattern [23](#)
Pattern type [23](#)
Preferences menu [38, 40](#)
Preferences tab
 send an Email [35](#)
 setup panel [35](#)

Q

- Query the available list in the run/config session [64](#)
- Query the current run/config session [64](#)
- Query the statistics value for a test measurement [64](#)
- Query the statistics value for all test measurements [65](#)

R

- Recalling a test setup [51](#)
- Recommended probes [13](#)
- Related Documentation [11](#)
- Report contents [42](#)
- Report sections [42](#)
- Reports
 - receiving in email notifications [20](#)
- Reports panel [21](#)
- Results panel
 - summary of test results [38, 40](#)
 - test name [38, 40](#)
- Results Panel [50](#)
- Run button [18](#)
- Run the run/config saved session [65](#)
- Running tests [50](#)

S

- Save log file [36](#)
- Save the run/config sessions [65](#)
- Saving tests [39](#)
- SCPI commands
 - TEKEXP:*IDN? [59](#)
 - TEKEXP:*OPC? [60](#)
 - TEKEXP:ACQUIRE_MODE [60](#)
 - TEKEXP:ACQUIRE_MODE? [60](#)
 - TEKEXP:EXPORT [60](#)
 - TEKEXP:INFO? [61](#)
 - TEKEXP:INSTRUMENT [61](#)
 - TEKEXP:INSTRUMENT? [61](#)
 - TEKEXP:LASTERROR? [62](#)
 - TEKEXP:LIST? [62](#)
 - TEKEXP:POPUP [62](#)
 - TEKEXP:POPUP? [63](#)
 - TEKEXP:REPORT [63](#)
 - TEKEXP:REPORT? [67](#)
 - TEKEXP:RESULT? [67](#)
 - TEKEXP:SELECT [67](#)
 - TEKEXP:SELECT? [68](#)
 - TEKEXP:SETUP [68](#)
 - TEKEXP:STATE [68](#)
 - TEKEXP:STATE? [69](#)
 - TEKEXP:VALUE [69](#)
 - TEKEXP:VALUE? [69](#)
- Search for connected instruments [19](#)
- Selecting tests [27](#)
- Session folders and files [39](#)
- Set the default session [66](#)
- Setup
 - acquisition tab [29](#)

- Setup files [51](#)
- Setup panel [21](#)
- Software installation [13](#)
- Source [23](#)
- Status panel
 - log view [36](#)
 - message history [36](#)
 - test status [36](#)
- Support [11](#)
- Supported oscilloscopes [13](#)

T

- Technical support [11](#)
- Tek Link [19](#)
- TEKEXP:RESULT:STATISTICS? "ALL" [65](#)
- TEKEXP:RESULT:STATISTICS? "Test Name" [64](#)
- TEKEXP:SESSION DEFAULT [66](#)
- TEKEXP:SESSION DELETE, "Session1, Session2" [63](#)
- TEKEXP:SESSION LOAD, "Session Name" [66](#)
- TEKEXP:SESSION RUN, "Session Name's separated by comma" [65](#)
- TEKEXP:SESSION SAVE, "SessionName", "True" [63](#)
- TEKEXP:SESSION SAVE, "Session Name" [65](#)
- TEKEXP:SESSION? CURRENT [64](#)
- TEKEXP:SESSION? LIST [64](#)
- TEKEXP:TESTINFO? [66](#)
- Test Name [29](#)
- Test reports [42](#)
- Test results
 - send by email [20](#)
- Test Results
 - clearing displayed [50](#)
- Test selection
 - TekExpress LVDS [27](#)
 - test description [27](#)
- Test selection controls [27](#)
- Test setup files [39, 51](#)
- Test setups
 - load [51](#)
 - open [51](#)
 - recalling [51](#)
- Test status
 - acquire status [36](#)
 - analysis status [36](#)
 - autoscroll [36](#)
- Test-related files [39](#)
- Tests
 - running [50](#)
 - selecting [27](#)

V

- View a report [42](#)

W

- Waveform files
 - locating and storing [39](#)
- Wavelength [23](#)