



**HDMXpress 2.1**  
**Printable Application Help**







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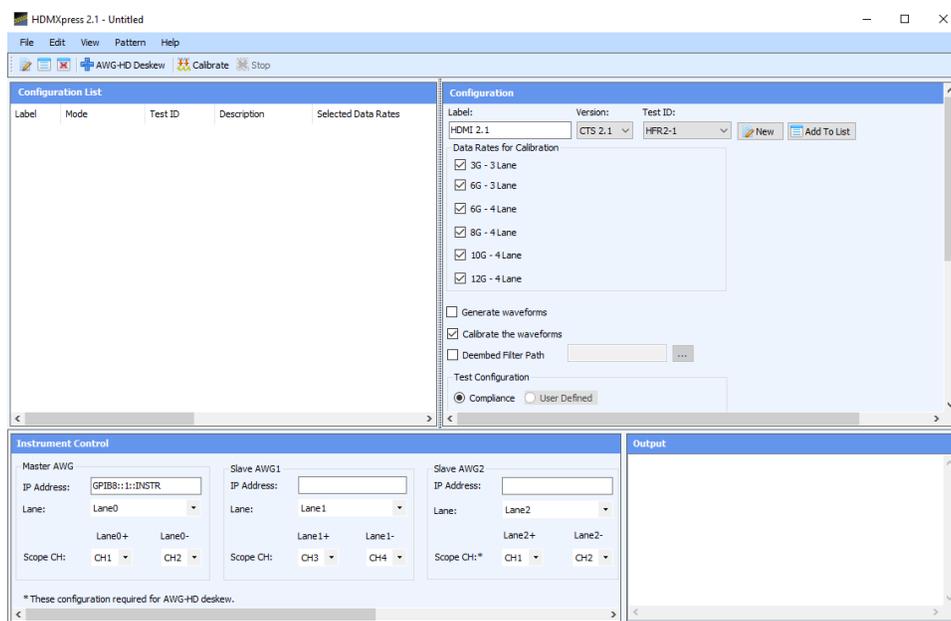
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# Welcome

The HDMXpress 2.1 is a HDMI pattern generation and calibration software that runs on the Arbitrary Waveform Generator. HDMXpress 2.1 supports different FRL electrical patterns LTP and RXSB33PAT at different FRL rates. It also supports closed loop calibration for differential amplitude, inter-pair skew, intra-pair skew, FRL rate and jitter tolerance tests. Once the calibration is completed, the application automatically transfers the waveforms across all the AWGs.



## Key Features

- Supports 3 and 4 Lane.
- Synchronizes the patterns created in the HDMXpress to the TekExpress FRL solution.
- Supports closed loop calibration and creates patterns for electrical testing.
- Supports differential amplitude Swing, Intra-pair skew, Inter-pair skew, Minimum Link rate and Jitter Calibration.
- Supports multilane calibration for HFR2-5 measurement.



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# Introduction

## Conventions

The online help uses the following conventions:

- When steps require a sequence of selections using the software interface, the ">" delimiter marks each transition between a menu and an option. For example, **File > Save**.
- DUT refers to the Device Under Test.
- The terms "waveform" and "signal" are used interchangeably.
- The term AWG refers to a Tektronix Arbitrary Waveform Generator.



# Getting started

## Minimum system requirements

The minimum requirements of the HDMXpress 2.1 application are listed in the following table:

**Table 1: Minimum system requirements**

Component	Description
Supported OS	Windows 10 Professional
Minimum Requirements	More than 8 GB free disk space .Net 4.0 Matlab® Compiler Runtime version 8.0

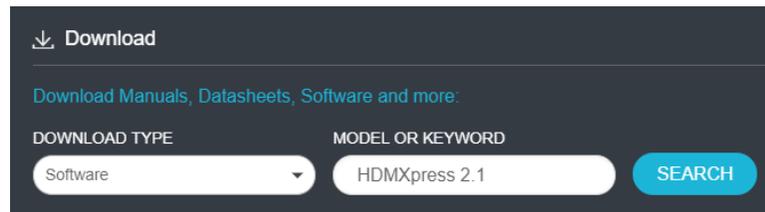
**Prerequisites** TekVisa is required to establish the communication with the signal generators (or other test instruments), over a LAN. You can download and install the software from [www.tek.com](http://www.tek.com).

## Installing the software

An installation wizard installs HDMXpress 2.1. If you have not installed MATLAB Runtime and .NET 4.0, the installer will detect and install it.

Complete the following steps to download and install the latest HDMXpress 2.1 application. See [Minimum system requirements](#) for compatibility.

1. Go to [www.tek.com](http://www.tek.com).
2. Click Downloads. In the **Downloads** menu, select DOWNLOAD TYPE as Software and enter HDMXpress 2.1 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\HDMXpress2.1\.

## Activate the license

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**NOTE.** You must enable option HD21DSM in the oscilloscope to connect to the AWG where HDMXpress 2.1 is installed.

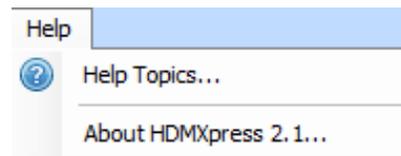
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Activate the license using the option installation wizard on the oscilloscope. Follow these steps to activate the HDMXpress 2.1 license:

1. From the oscilloscope menu bar, click **Utilities > Option Installation**.  
The **TekScope Option Installation** wizard opens.
2. Instructions for using the Options Installation window to activate licenses for installed applications is provided in the oscilloscope online help. Press the **F1** key on the oscilloscope keyboard to open the Option Installation help topic. Follow the directions in the topic to activate the license.

## View version and license information

To view version information, Click **Help > About HDMXpress 2.1**.



### Option Information

From the oscilloscope Help menu, select **About TekScope**.

The Options section in the dialog box displays a list of installed options, including HDMXpress 2.1 (option HD21DSM).

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**NOTE.** Option HD21DSM must be installed on the oscilloscope. The oscilloscope is connected to the AWG (where HDMXpress 2.1 is installed) through LAN network.

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### Additional Information

For HDMXpress 2.1 to be activated on the AWG, the AWG where the HDMXpress 2.1 software installed must be connected via the network to an oscilloscope with option HD21DSM installed.

## Connection setup

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**NOTE.** For HDMXpress to run, the AWG (where the HDMXpress software is installed) must be connected to an oscilloscope on the network were option HD21DSM enabled.

---

Following are the list of tests and setup information for calibrating the waveform:

- Test ID HFR 2-1: Max Differential Swing Tolerance
- Test ID HFR 2-2: Intra-Pair Skew
- Test ID HFR 2-3: Inter-Pair Skew
- Test ID HFR 2-4: Minimum Link Rate Tolerance
- Test ID HFR 2-5: Jitter Tolerance

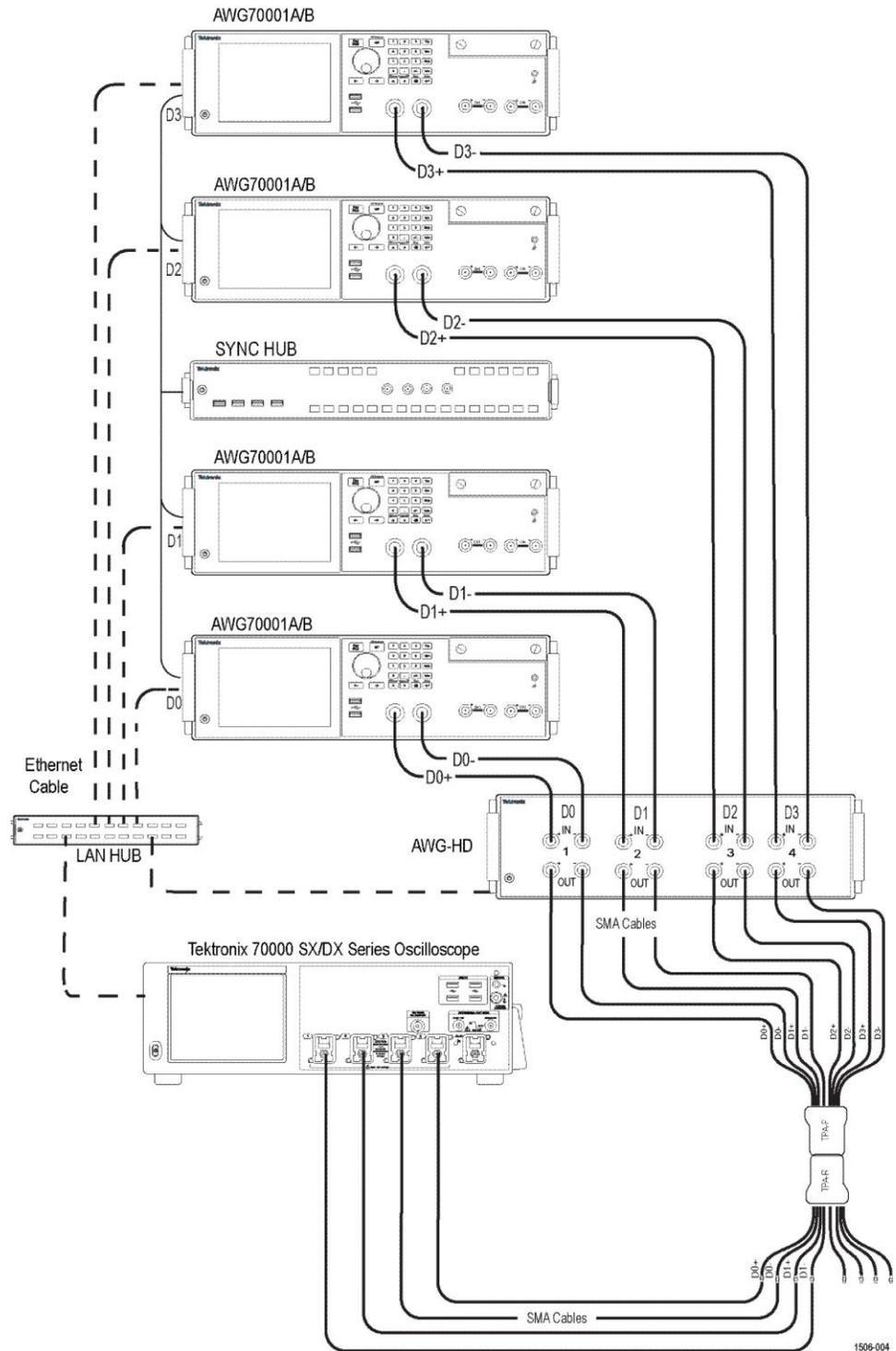


Figure 1: Connection diagram for Calibrating the AWG waveform (Lane0 to D0 and Lane 1 to D1)

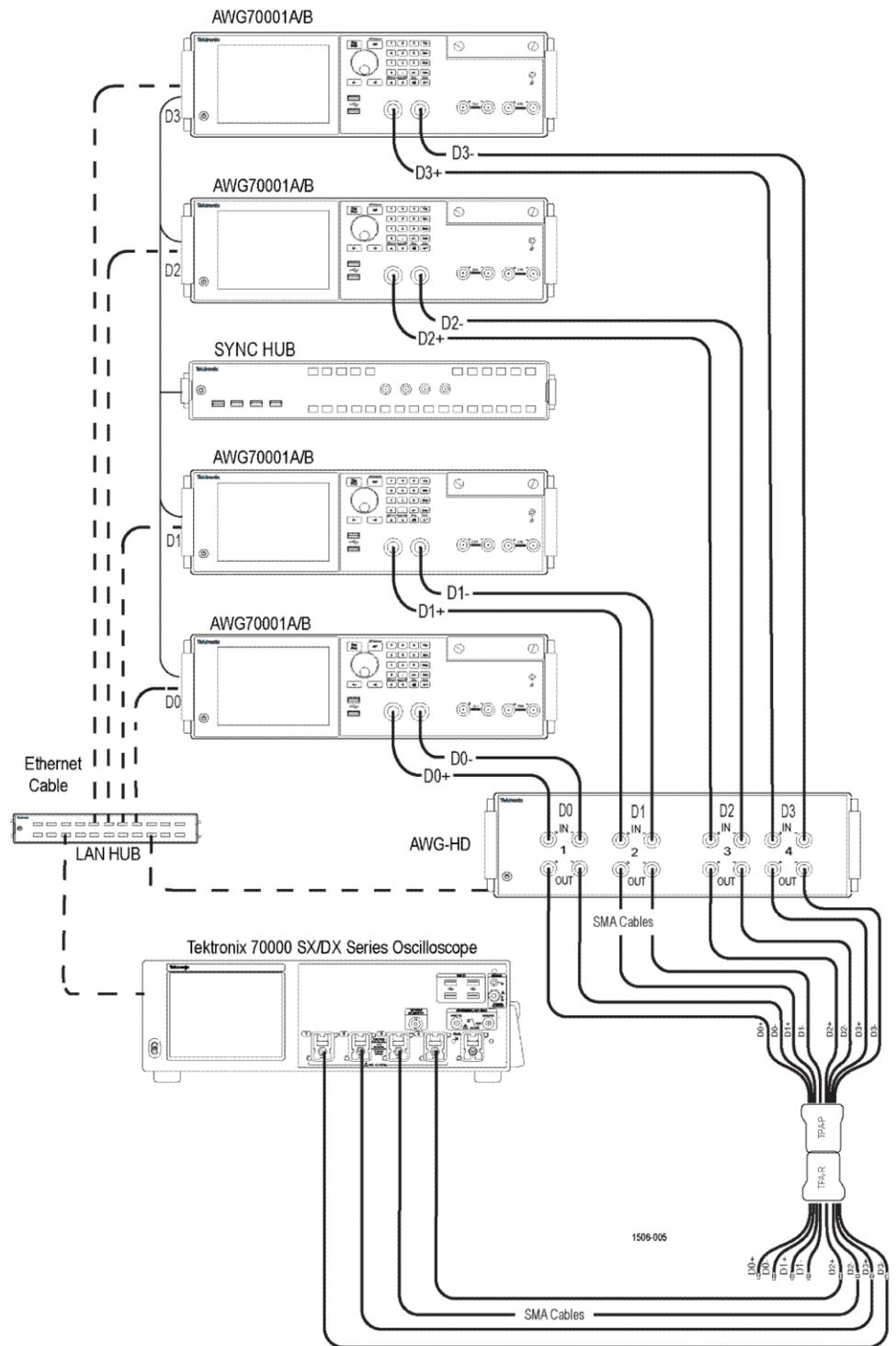


Figure 2: Connection diagram for Calibrating the AWG waveform (Lane2 to D2 and Lane 3 to D3)

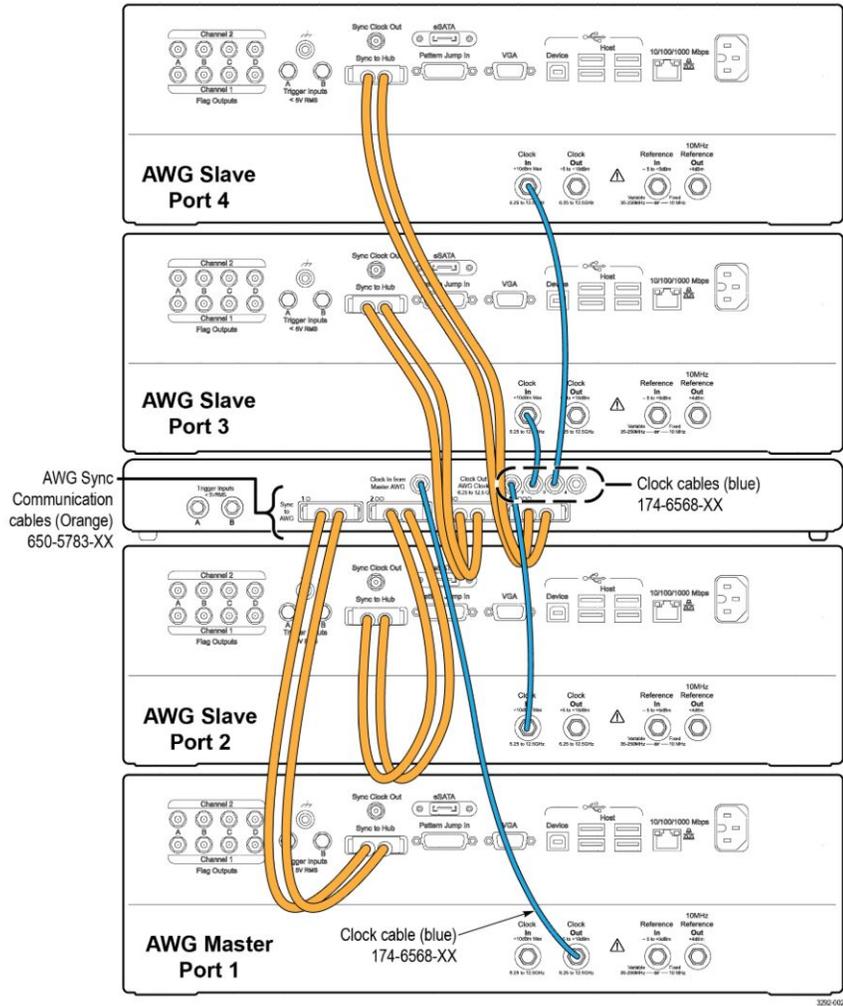
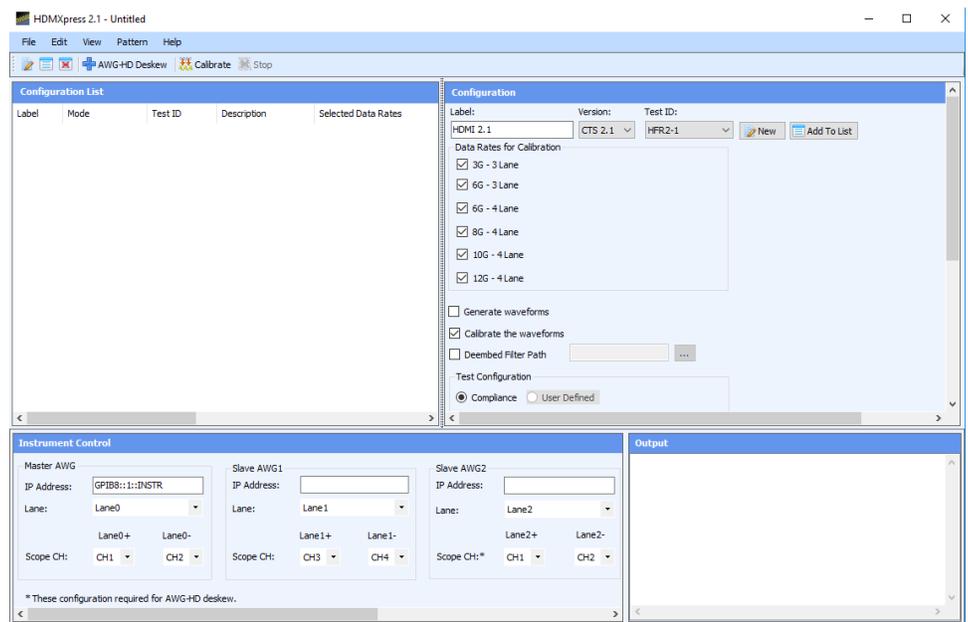


Figure 3: Sink Hub configuration setup

# Operating basics

## Starting the software

From the Start menu, click **All Programs > HDMXpress 2.1**. You can also double-click the **HDMXpress 2.1** shortcut on the desktop.



## Exiting the software

Select **File > Exit** to exit the application.

## File name extensions

The application uses the following file name extensions:

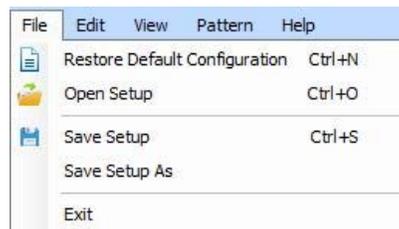
**Table 2: File name extensions**

File name extension	Description
.wfm	Binary file containing an AWG waveform record in a recallable proprietary format.
.flt	Embed/De-Embed filter coefficient.
.png	Schematics and images.

## Menus and toolbars

**Menu bar** The HDMXpress 2.1 has the following menus:

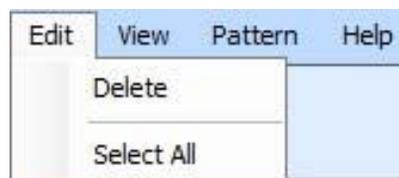
File Menu



The File menu has the following items:

- **Restore Default Configuration:** Restores the default configuration.
- **Open Setup:** Opens a saved setup file.
- **Save Setup:** Saves the setup file in the .setup format in a folder in your C drive.
- **Save Setup As:** Saves the setup under another name in the .setup format.
- **Exit:** Exits the application.

Edit Menu



The edit menu has the following items:

- **Delete:** Deletes the selected configurations.
- **Select All:** Selects all the configurations.

View Menu



The view menu has the following items:

- **Standard Toolbar:**  
Select to view or hide the toolbar. The Standard toolbar uses icons that provide a quick access to many frequently used functions. If the toolbar is hidden before closing the application, it remains hidden when the application is opened again.



The Standard toolbar has the following options:

- **New Configuration:** Creates a new empty template based on the current settings.
- **Add To Configuration List:** The configured pattern is added to the Configuration list.
- **Delete Configuration:** Deletes the selected Pattern from the Configuration list.
- **AWG-HD Deskew:** Click to perform deskew operation of AWG-HD. ( Follow the instructions mentioned in [AWG-HD Deskew Using HDMXpress](#) on page 20 to perform the deskew of all channels of AWG-HD box)
- **Calibrate:** The patterns are calibrated for Lane0 (D0) and the calibrated parameters are applied across all lanes (AWGs).

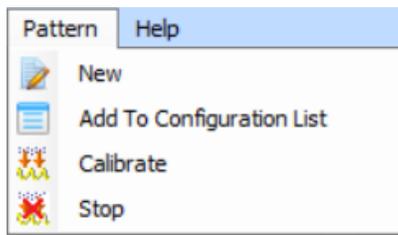
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**NOTE.** When multilane calibrate checkbox is enabled, all the AWG's are calibrated independently.

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- **Stop:** Stops generating the pattern.
- **Status Bar:**  
Select to view or hide the status bar. The status bar displays the AWG name on which the HDMXpress 2.1 is installed. The status bar is displayed by default. If the status bar is hidden before closing the application, it remains hidden when the application is opened again.

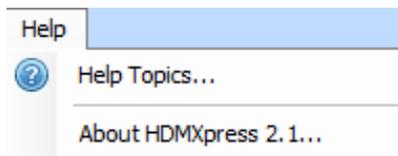
### Pattern Menu



The pattern menu has the following items:

- **New:** Creates a new empty template file based on current settings.
- **Add to Configuration List:** Adds a pattern to the configuration list.
- **Calibrate:** The patterns are calibrated for Lane0 (D0) and the calibrated parameters are applied across all lanes (AWGs).
- **Stop:** Stops generating the pattern.

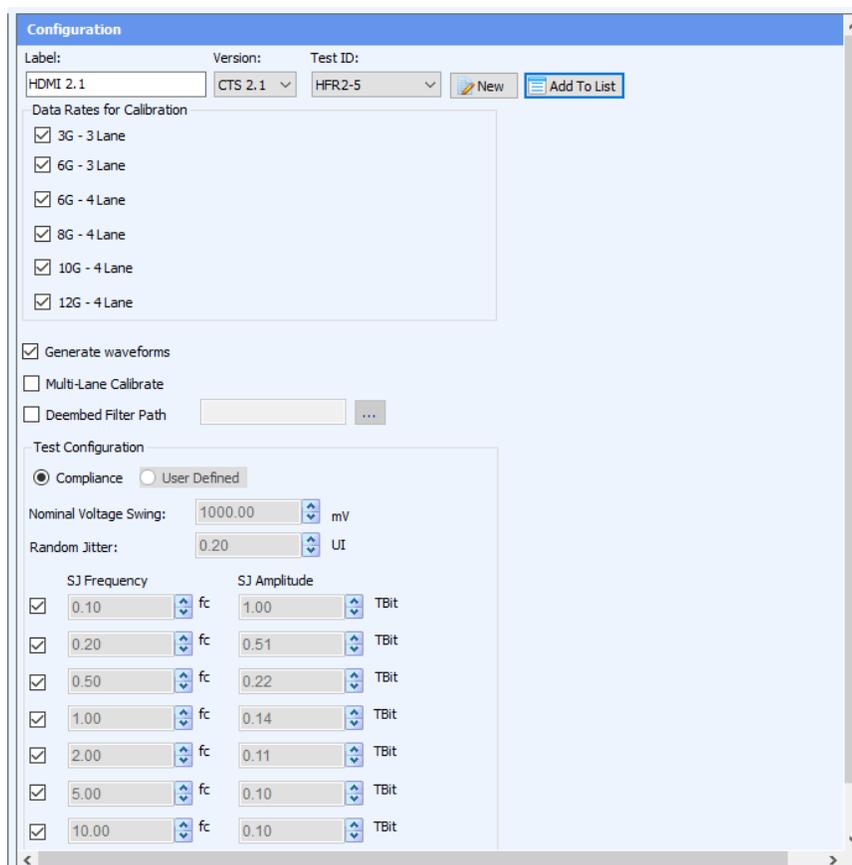
### Help Menu



The help menu has the following items:

- **Help Topics:** Opens the online help.
- **About HDMXpress 2.1:** Displays information about the application, such as the version number.

**Configuration** The configuration window allows you to select the test measurement settings for the device under test (DUT) for the calibration of patterns.



**Label:** Displays the defined test name as HDMI 2.1.

**Version:** Selects the required CTS Version from the drop-down list. The available option is 2.1.

**Test ID:** Selects the test measurement from the drop-down. By default HFR2-1 is selected.

**New:** Click to create a new pattern based on the current settings.

**Add to list:** Click to add pattern to the configuration list.

**Data rates for calibration:** Selects the data rates from 3 G to 12 G.

**Generate waveforms:** Generates the new waveforms pattern. The pattern will be created in all AWGs (master and slave).

**Multi-Lane Calibrate:** Provides an option to Calibrate for all 4 AWGs used in FRL Sink tests and generates FRL Patterns in all the 4 AWGs independently. At a time, two AWGs (Either Lane 0 - Lane 1/ Lane 2 - Lane 3) are calibrated one after the other without changing the connections of the Oscilloscope.

Lane0 should be connected to channel1 & channel2 of the scope and Lane2 should be connected to channel3 & channel4 of the scope.

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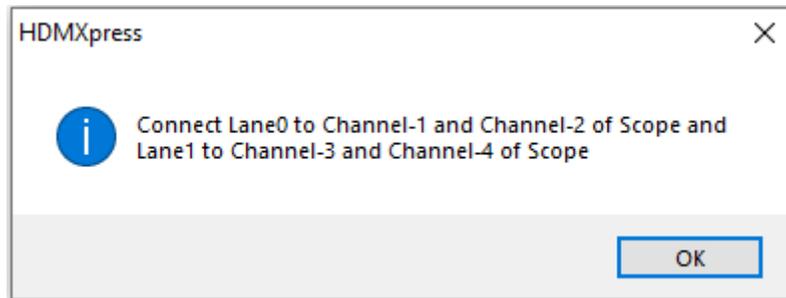
**NOTE.** *Multi-Lane Calibrate option is applicable only for HFR2-5 Jitter Tolerance measurement.*

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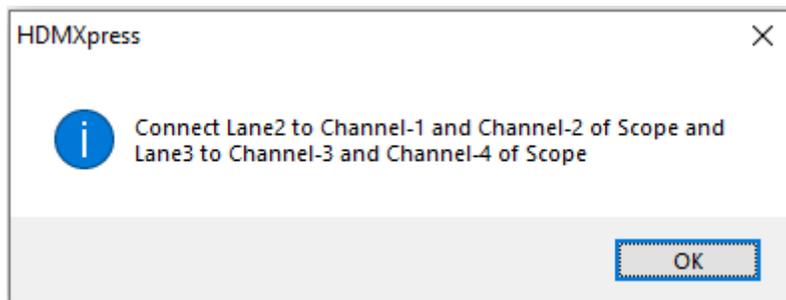
Steps to be followed to calibrate waveforms using Multi-Lane Calibrate option:

1. Select the appropriate **Data Rates, Test ID, SJ Frequencies.**
2. Select the **Multi-Lane Calibrate** checkbox.
3. Click **Add To List**; The respective tests are added into the **Configuration List.**
4. Click **Calibrate** checkbox to calibrate the waveforms.

During the calibration, dialog box appears to Connect Lane 0 and Lane 1 AWGs to the oscilloscope. Refer [Figure 1: Connection diagram for Calibrating the AWG waveform \(Lane0 to D0 and Lane 1 to D1\)](#) on page 6



Once Lane 0 and Lane 1 AWGs are calibrated, additional dialog box appears to calibrate Lane 2 and Lane 3 AWG respectively. Refer [Figure 2: Connection diagram for Calibrating the AWG waveform \(Lane2 to D2 and Lane 3 to D3\)](#) on page 7



**Calibrate the waveforms:** Performs the closed loop calibration on the generated waveforms.

**Deembed filter path:** Selects the filter file which deembeds the receptacle.

**Test configuration:**

**Compliance:** Sets default values for electrical configurations as defined by the CTS specification.

- **Nominal Voltage Swing:** Displays output signal amplitude. By default 1000 mV is selected.
- **Maximum Voltage Swing:** Displays output signal amplitude. By default 1200 mV is selected.
- **Percentage deviation:** Displays percentage of variation in the calibrated values.

**User defined:** select to specify the user defined values for electrical configurations. By default, this option is disabled.

**Configuration list**

Configuration list displays a list of all the patterns. By default it is displayed and opens in the leftmost area of the display window.

After you configure the pattern in the **Configuration -> New** window, select **Add To List**. The configured pattern data will be saved and displayed in the **Configuration List** window. The Configuration list displays Label, Test ID, Mode, Description, Selected Data Rates, Generate Pattern and Calibrate Waveform.

Configuration List						
Label	Mode	Test ID	Description	Selected Data Rates	Generate Pattern	Calibrate Waveform
HDMI 2.1	Compliance	HFR2-1	Amplitude Calibration	3G-3Lane,6G-3Lane,6G-4Lane,8G-4Lane,10G-4Lane,12G-4Lane	False	True
HDMI 2.1	Compliance	HFR2-2	Intra Pair Skew	3G-3Lane,6G-3Lane,6G-4Lane,8G-4Lane,10G-4Lane,12G-4Lane	False	True
HDMI 2.1	Compliance	HFR2-3	Inter Pair Skew	3G-3Lane,6G-3Lane,6G-4Lane,8G-4Lane,10G-4Lane,12G-4Lane	False	True
HDMI 2.1	Compliance	HFR2-4	LinkRate Calibration	3G-3Lane,6G-3Lane,6G-4Lane,8G-4Lane,10G-4Lane,12G-4Lane	False	True
HDMI 2.1	Compliance	HFR2-5	Jitter Calibration	3G-3Lane,6G-3Lane,6G-4Lane,8G-4Lane,10G-4Lane,12G-4Lane	True	True

**NOTE.** You can configure any number of patterns and add them to the configuration list.

After you select a pattern to generate, you must compile it to create the data. Once you generate a pattern (using **Pattern > Generate** from the menu bar), a pattern is created.

To save a configured pattern that is available in the list, select the pattern and select **File > Save Setup As**. The configured pattern is saved as a (.setup) file in the specified location.

After you select a waveform to calibrate, you must compile it to calibrate. Once you calibrate a waveform (using **Calibrate** from the toolbar), a waveform is calibrated.

To save a calibrated waveform that is available in the list, select the waveform and select **File > Save Setup As**. The calibrated waveform is saved as a (.setup) file in the specified location.

---

**NOTE.** *If you close the application without saving the configured pattern or Calibrated waveform, the pattern or waveform data is lost. You can compile the pattern or calibrate the waveform again from the setup, if you have saved the setup using **File > Save Setup** or **Save Setup As**.*

---

You can select multiple contiguous and non-contiguous patterns or waveforms using the **Shift** and **Ctrl** keys, respectively. Selecting multiple configured patterns or waveforms and selecting the **Delete** option deletes all the selected patterns or waveforms. Selecting multiple configured patterns and selecting the **Generate** option generates all the patterns for the selected pattern configurations.

## Instrument Control

The instrument control window allows you to select and configure the instruments used in the application.

HDMXpress 2.1 application works with the following arbitrary waveform generators.

- AWG70001A
- AWG70001B

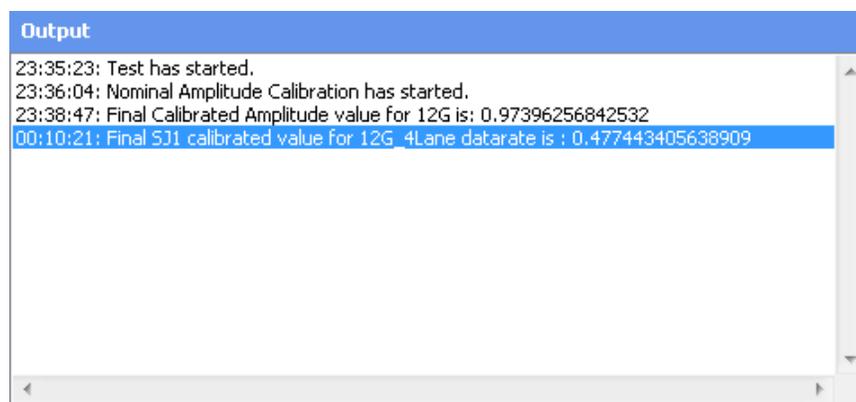
HDMXpress 2.1 creates patterns on Master and Slave AWG. The Clock and Data0 patterns are created on the Master AWG. Data1, Data2 and Data3 patterns are created on the Slave AWG. Configure the Slave AWG and Oscilloscope IP address.



**Table 3: Instrumental control window settings**

<b>Master AWG</b>	
Address	Enter the Master AWG IP address or GPIB address. GPIB8::1::INSTR is the default address.
Lane	Select the Lane. By default Lane0 is selected for the Master AWG.
Scope Channel	Selects the oscilloscope channel connected to 'Lane0+' and 'Lane0-' of AWG.
<b>Slave AWG</b>	
Address	Enter the IP address of the slave AWG. TCP/IP::XXX.XX.XXX.XXX::INSTR is the default address.
Lane	Select the slave AWG Lane. By default Lane1, Lane2, and Lane3 are selected for Slave AWG1, Slave AWG2 and Slave AWG3 respectively.
Scope Channel	Configure the oscilloscope channel for which 'Lane+' and 'Lane-' are connected.
<b>Scope</b>	
IP Address	Enter the oscilloscope IP address. GPIB8::1::INSTR is the default address.
<b>AWG/HD</b>	
MAC/IP Address	Enter the MAC/IP address. TCP/IP::XXX.XX.XXX.XXX::INSTR is the default address.
Port	By default 4000 is selected.

**Output** Output window displays all the log messages.





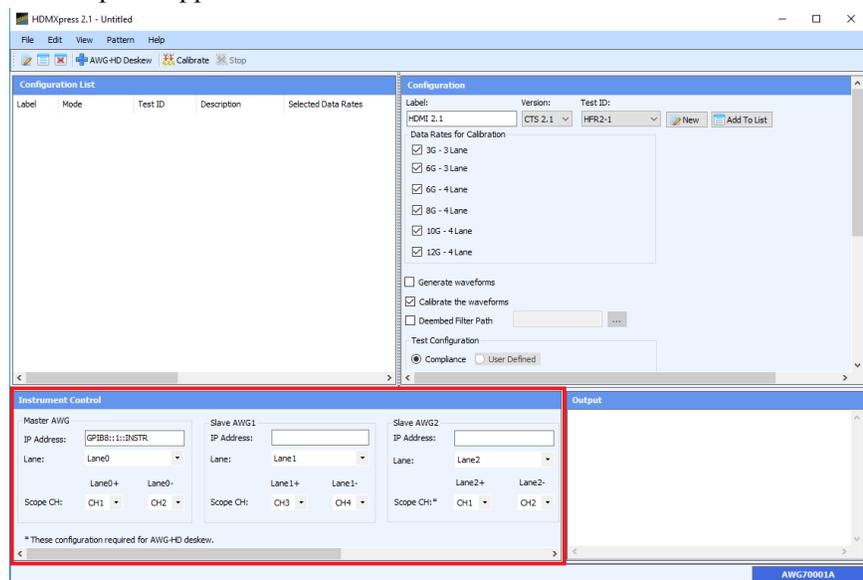
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## AWG-HD Deskew

## AWG-HD Deskew Using HDMXpress

### Steps to deskew AWG-HD using HDMXpress application:

1. For AWG-HD Deskew refer *Figure 1: Connection diagram for Calibrating the AWG waveform (Lane0 to D0 and Lane 1 to D1)* on page 6
2. Enable **Sync** manually in all the AWGs.
3. Install the HDMXpress application on the Master AWG.
4. Launch the application and check the connections of all 4 AWGs through TekVisa.
5. Enter the valid IP addresses in the **Instrument Control** section of the HDMXpress application.



6. Click **AWG-HD Deskew** option in the Toolbar.
7. Once the AWG-HD channel 1 is connected to scope then Click **Ok**. The value is updated in the “FRLSinkCommonSettingsXML” file. If CH1 Deskew is not required, click **Cancel**.



8. Repeat the step 6 and 7 for the AWG-HD Deskew operation for CH2, CH3 and CH4.

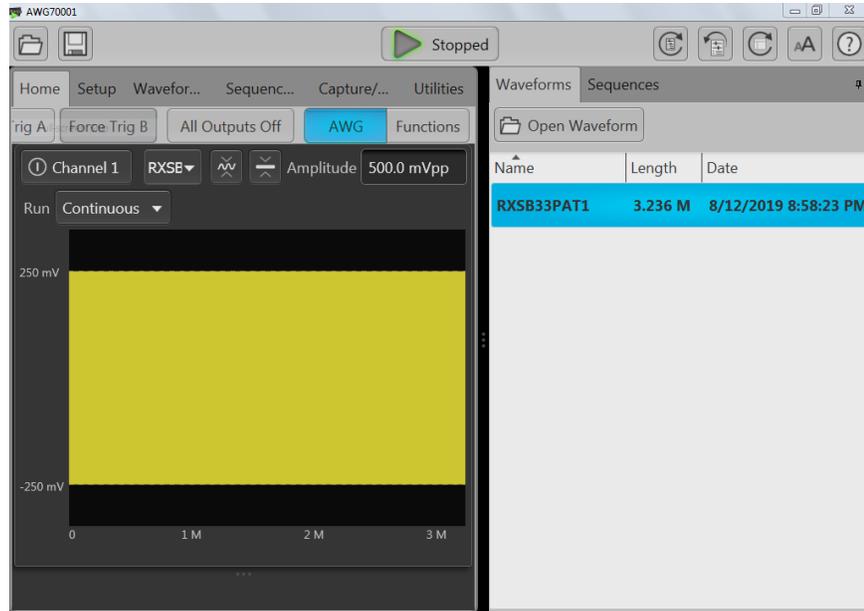
9. Check the Deskew values are updated in the location C:\Users\Public\Tektronix\HDMI21\Compliance and the timestamp of the file should be updated.



```
FRLSinkCommonSettings.xml - Notepad
File Edit Format View Help
<?xml version="1.0" encoding="utf-8" standalone="yes"?>
<AWG-HDMI-Deskew>
  <Ch1>341.87524498431</Ch1>
  <Ch2>373.96889919435</Ch2>
  <Ch3>339.258958564385</Ch3>
</AWG-HDMI-Deskew>
```

**Manual Steps to Deskew AWG-HD:**

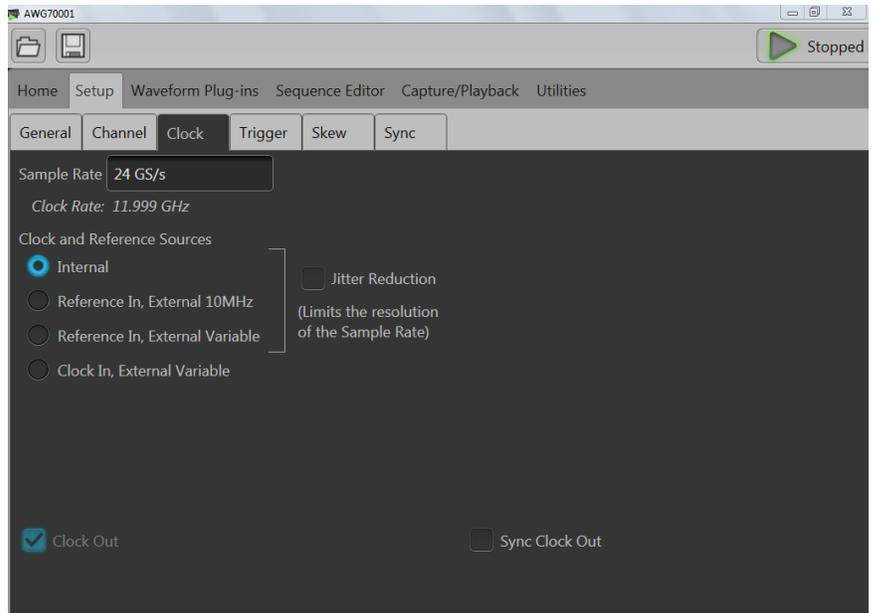
1. Connect the output lanes of AWGs as the input to AWG-HD.
2. For Master AWG(CH1) deskew, connect AWG-HD CH1 output to scope channel.
3. Load any superblock pattern from “Compliance\HFR2-1” folder in the respective AWG.



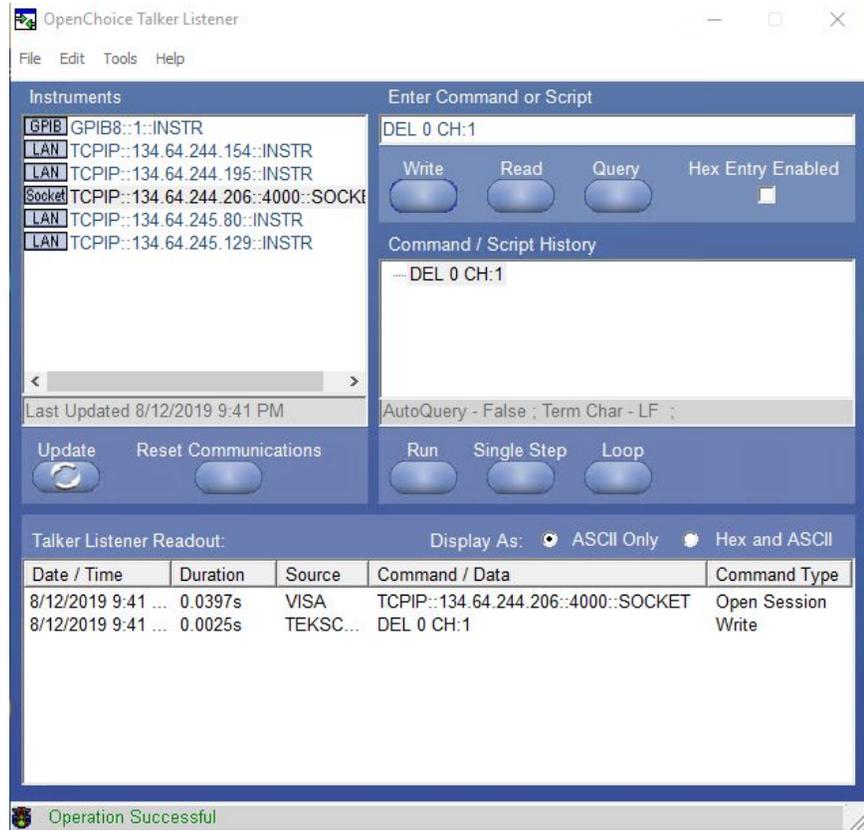
4. Set the sample rate manually in the AWG according to the loaded pattern.
  - For eg: To load superblock pattern, Data Rate with Sample Rates are listed below:

Data Rate	Sample Rates
3 G	24 GS/s
6 G	24 GS/s
8 G	48 GS/s
10 G	40 GS/s

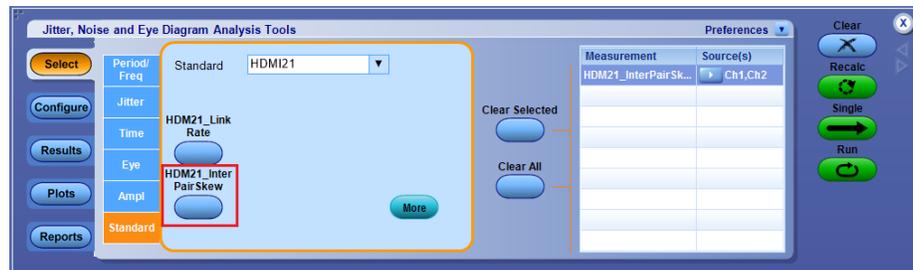
Data Rate	Sample Rates
12 G	48 GS/s



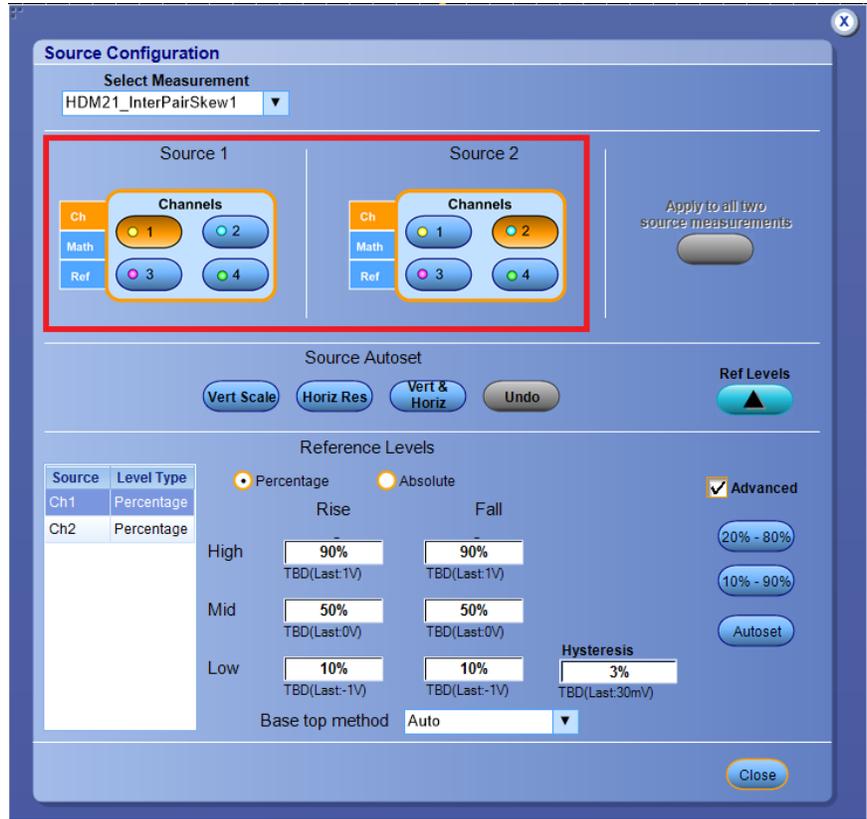
5. Login to oscilloscope, launch TekVisa and add AWG-HD IP address. “DEL 0 CH:1” command sets the deskew of AWG-HD’s CH1 to 0.



6. Launch **DPOJET** in the oscilloscope.
7. From **Select** panel->**Standard** tab->Select **HDM21\_Inter PairSkew** option.



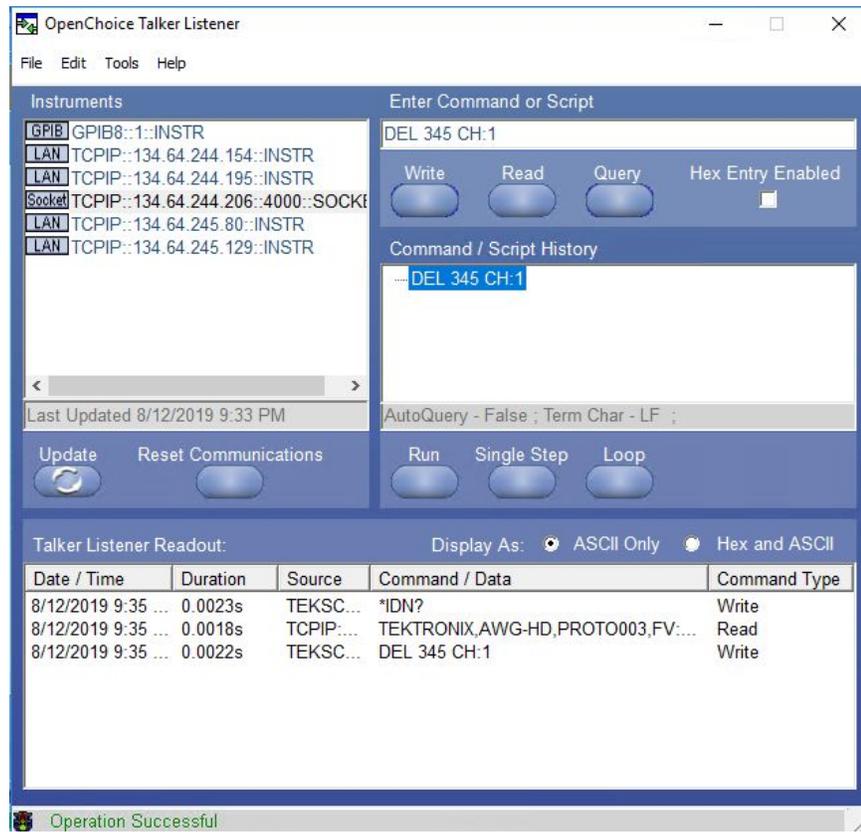
8. Select connected channels in the **Source configuration** window. And set the **Record Length** to 10 M.



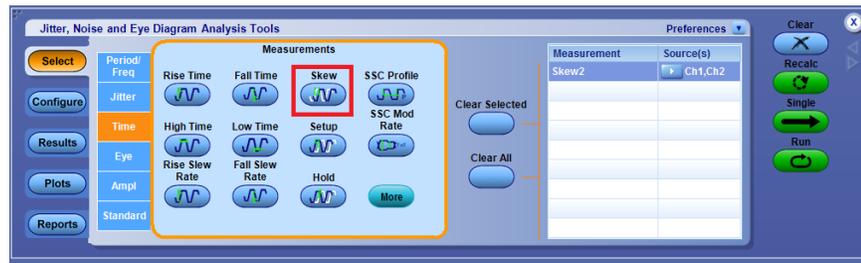
9. Run and check the deskew value.



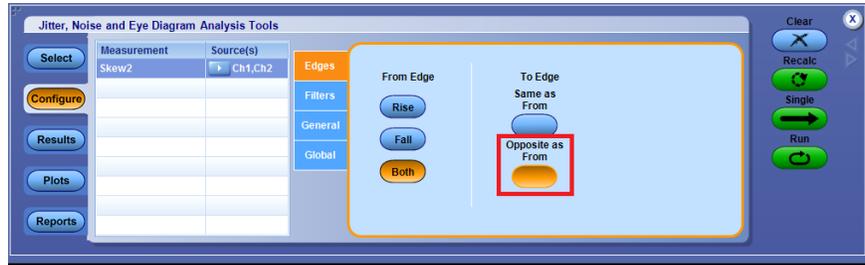
10. Enter the value DEL 345 CH:1 in TekVisa.



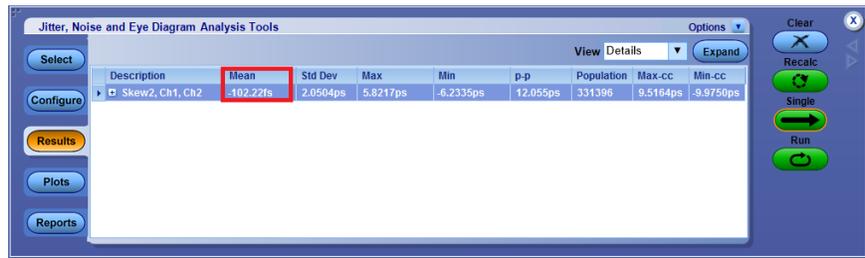
11. Clear the measurement in the DPOJET. Go to **Select** panel, Click **Time** tab and add the skew measurement for the select channels.



12. Go to **Configure** panel and click **Opposite as From** option to get both negative and positive signals.



13. Run and check the value. If the value is more than 1 ps then modify the deskew value in the TekVisa.



eg: If the entered deskew value is 345 and the skew value is -3 ps then enter the value in the command “DEL 342 CH:1” in the TekVisa. Continue till we get the skew value is Less than 1 ps

14. Follow step-1 to step 13 for all the channels deskew.



# Reference

## Shortcut keys

**Table 4: Shortcut keys**

Menu/Menu item	Shortcut key
File	Alt+F
File > Open Setup	Ctrl+O
File > Save Setup	Ctrl+S
View	Alt+V
Pattern	Alt+P
Help	Alt+H

## Parameters values

**Table 5: Parameters values and selection**

Settings	Values	Default value/selection
<b>Configuration</b>		
Label	-	HDMI 2.1
Version	-	CTS 2.1
Test ID	<ul style="list-style-type: none"><li>■ HFR2_1</li><li>■ HFR2_2</li><li>■ HFR2_3</li><li>■ HFR2_4</li><li>■ HFR2_5</li></ul>	HFR2_1
<b>Data Rates for Calibration</b>	<ul style="list-style-type: none"><li>■ 3G - 3 Lane</li><li>■ 6G - 3 Lane</li><li>■ 6G - 4 Lane</li><li>■ 8G - 4 Lane</li><li>■ 10G - 4 Lane</li><li>■ 12G - 4 Lane</li></ul>	All are selected
<b>Test Configuration</b>		
Compliance	Select/Unselect	Selected by default

Settings	Values	Default value/selection
User Defined	NA	NA
Nominal Voltage Swing	-	1000 mV
Maximum Voltage Swing	-	1200 mV
Percentage Deviation	-	5.00 %
<b>Instrument Control</b>		
Address	-	
Clock	-	Channel 1: Analog
Data0		Channel 2: Analog
Data1		Channel 1: Analog
Data2		Channel 2: Analog

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