Keysight U5303A High-Speed Digitizers Hardware Extension of 89600 VSA Software

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Please refer to the Startup Guide or User Manual which was delivered with your product for safety information.

Sales and Technical Support

To contact Keysight for sales and technical support, refer to the "support" links on the following Keysight web resources:
www.keysight.com/find/digitizer
www.keysight.com/find/assist (worldwide contact information for repair and service).

Information on preventing damage to your Keysight equipment can be found at www.keysight.com/find/tips.

Introduction

The 89600 VSA software (89601B) supports the Keysight U5303A High-Speed Digitizer. This VSA measurement hardware configuration offers broadband vector signal analyzer capabilities. The maximum analysis bandwidth is model dependent.

Model	Option	Maximum Span (Analysis Bandwidth)
U5303A	-SR1-F05	390 MHz (650 MHz in interleaved mode)
	-SR1-F10	390 MHz (781 MHz in interleaved mode)
	-SR2-F05	625 MHz (650 MHz in interleaved mode)
	-SR2-F10	625 MHz (1.25 GHz in interleaved mode)

The present document aims to describe how to configure and use VSA software with Keysight High-Speed Digitizers.

For details about VSA 89600 software usage, please refer to VSA software help (http://rfmw.em.keysight.com/wireless/helpfiles/89600B/WebHelp/89600.htm).

The Vector Signal Analysis Basics application note gives detailed information about VSA analysis theory (http://cp.literature.agilent.com/litweb/pdf/5989-1121EN.pdf).

IMPORTANT   The Keysight High-Speed Digitizers are not supported by the earlier 89601A VSA software, neither by the 32-bit version of the current software i.e. You must use the 64-bit version of the 89600 VSA software with your digitizer.

89600 VSA Sotfware Configuration

Configuring the 89600 VSA software application to use the digitizer hardware

Create a configuration for Keysight U5303A digitizer

1. Start the <u>64-bit</u> version of the 89600 VSA software application.
2. Configure the digitizer as the VSA measurement input by creating an *'Analyzer Configuration'* that uses your digitizer as the *Logical Instrument* (ADC) by performing the following steps:
   a. From the menu, go to **Utilities** > **Hardware** > **Configurations**, and click on **Add New Configuration** button (➕). The 'New Hardware Configuration' dialog opens.
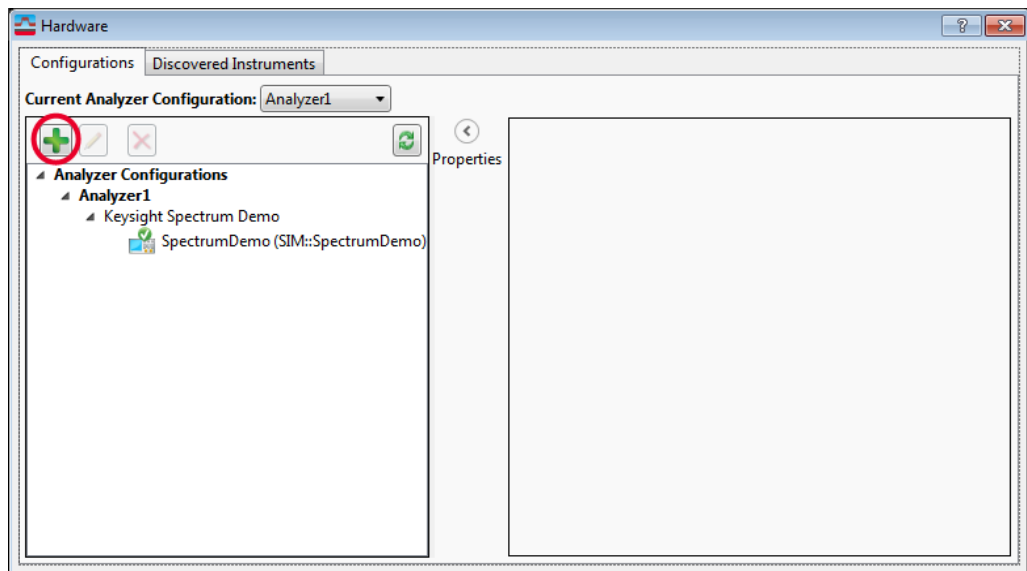
   b. De-select 'Simulate Hardware' if it is selected (1).
   c. Select **Keysight MD2 digitizers**(2) from the list of *'Possible Logical Instrument'* and drag it or click on the ▷ button (3) to add it to the *'Configuration'* box .
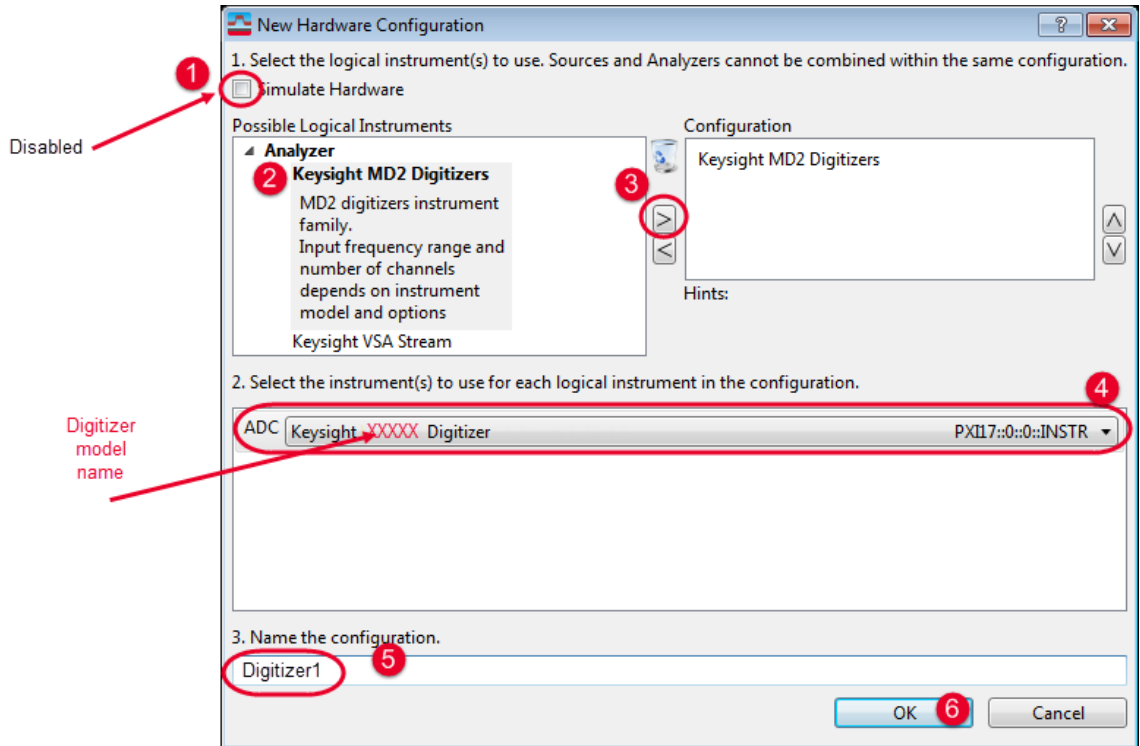
d. In the box below, ensure that the digitizer appears as the 'ADC' entry, and if you have more than one digitizer connected – select the required unit using the drop-down list (4).

e. You may either use the default name or specify another name for this analyzer configuration (5).

f. Click OK to close the *'New Hardware Configuration'* dialog (6).

g. Before closing the 'Hardware Configurations' dialog, use the **Current Analyzer Configuration** drop-down to select the newly created as the current item (*Digitizer1* in the exemple below).
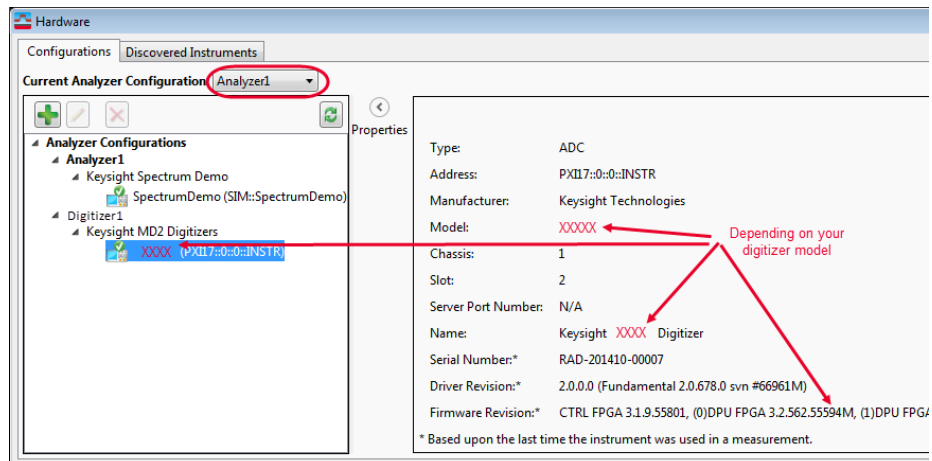
Options and settings specific to high-speed digitizers

For specific acquisition modes, you may need to use high-speed digitizer specific settings. These settings are available throught the digitizer hadware extension, and can be managed from: **Input > Extensions**.
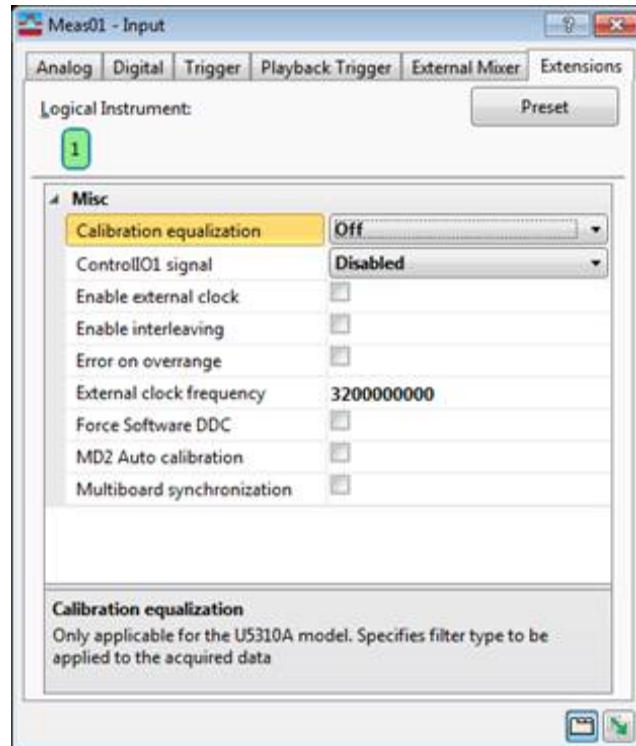
- − **Calibration equalization**: *U5303A doesn't support this feature.*
- − **ControlIO1 signal**: The digitizer supports multi-puproses IOs. This option allows to select the signal used for the ControlIO1. For details about the possible signals, please refer to the User manual of your digitizer, section Multi-Purpose Inputs and Outputs.
- − **Enable external clock**:See External Clock (page 9)
- − **Enable interleaving**:
- − **Error on overrange:** *U5303A doesn't support this feature.*
- − **External clock frequency**: See External Clock (page 9)
- − **Force Software DDC**: This option is effective only if your product has been ordered with the -DDC option (Digital Down-Conversion). By default, this mode is disabled, meaning that the downconversion is done by the hardware (in the digitizer FPGA). When enabling **Force Software DDC**, you disable the DDC mode of the digitizer and only use the software DDC from 89600 VSA. This can allow you to visualize the difference and see the efficiency of the hardware DDC.

- **MD2 Auto Calibration**: See Calibration (page 7)
- **Multiboard synchronization**: See Multi-Module Measurements (page 1)

Calibration

By default 89600 VSA software automatically detects when a change of parameter requires a new calibration of the digitizer module. This requirement is indicated on the bottom right of the screen.
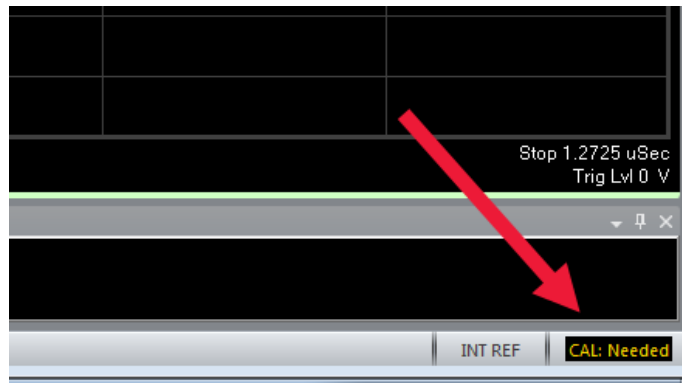
When a calibration is needed, user can either launch it from **Utilities > Calibration** or by clicking on CAL: Needed .

It is possible to let the digitizer automatically performs a selfcalibration when required by a change of the acquisition or digitizer parameter. To proceed, you have to enable the option **MD2 Auto Calibration** from **Input > Extensions** window, then to manually start the calibration once. The following calibrations will be automatic.

However, the **MD2 Auto Calibration** mode is not recommended when you are modifying several parameters, since it can be time consuming to perform a calibration after each parameter change.

Multi-Channel Measurements

When using the Keysight High Speed Digitizers in VSA configuration, the digitizer forms the measurement front-end data acquisition hardware for the 89600 VSA software.

The U5303A digitizer supports single channel I+jQ, and cross channel measurement configurations.

Configure extension parameters for specific acquisition modes

Interleaved Mode

The option of combining two channels of the digitizer in interleaved mode is available if your product has been ordered with the –INT option.

Interleaving allows to double the sampling rate with the trade-off of halving the available center frequency range, as shown in the table below:

Model	Option	Mode	Center Frequency Range	ADC Sampling Rate
U5303A	-SR1	Normal (non-inter-leaved)	0 - 1 GHz	1 GS/s
	-SR2	Normal (non-inter-leaved)	0 - 1.6 GHz	1.6 GS/s
	-SR1	Interleaved	0 - 1.4 GHz	2 GS/s
	-SR2	Interleaved	0 - 1.4 GHz	3.2 GS/s

TIP For best measurement fidelity, you should ensure that the signal center frequency + (analog bandwidth/2) does not cross the Nyquist frequency.
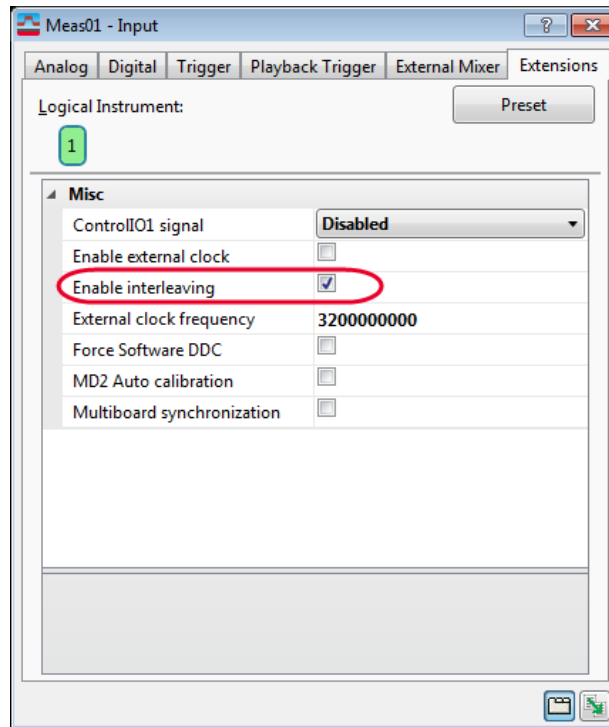
Interleaved mode can be enabled by opening the **Input** > **Extensions..** window from the menu bar. Then select the **Enable Interleaving** option, changes are applied immediately.

External Clock

The sampling rate can be tuned thanks to the external clock. This clock must be continuously present if the mode is selected otherwise an error will occur.

The range of clock input frequency is model dependent, as shown in the table below:

Models	Option	Frequency Range
U5303A	-SR1	1.8 to 2 GHz
	-SR2	1.8 to 3.2 GHz

To use this option, first connect an external clock signal in the accepted range to the CLK IN connector on the digitizer front panel. Please, refer to the your digitizer datasheet for external clock specification.

Then open the **Input** > **Extensions...** window from the menu bar. Select the **Enable external clock option**, and double click the **External clock frequency** value to bring up the editing window. You may then set the value of the external clock frequency being applied. As shown below:

U5303A Hardware Extension of 89600 VSA Software
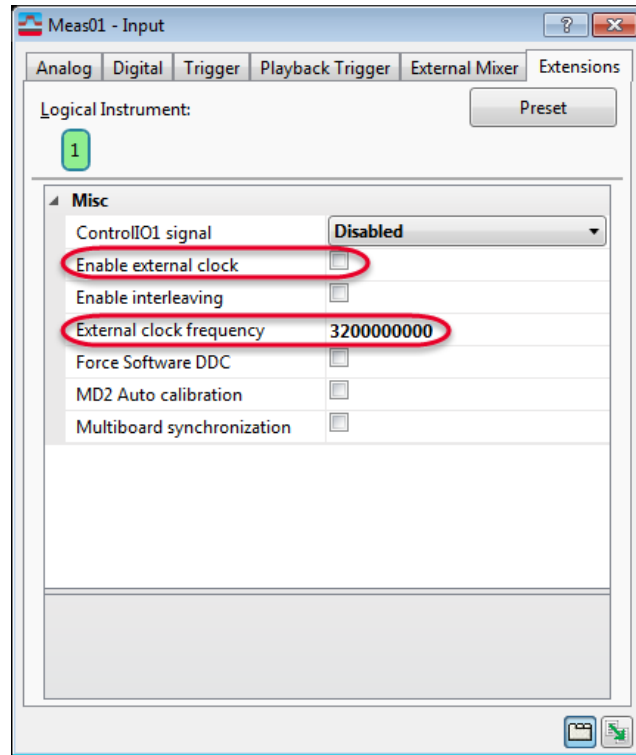
Measurement Setup Parameters

This section provides measurement and parameter setup information which are specific to the 89600 VSA software when used along with the U5303A High Speed Digitizer. This information can help you to properly setup the VSA in this hardware configuration to make measurements using your digitizer.

Measurement Setup Parameters:

Alignment / Calibration	Preset
Channels	Range
Connection	Recording
Coupling	Setup Save/Recall
Center Frequency Range	Span
Frequency Counter	Trigger Holdoff
Hardware	Triggering
Overlap	

Alignment/Calibration: Whenever the digitizer configuration is changed, an internal calibration is required. A manual calibration can be performed at any time from the menu **Utilities > Calibration**.

NOTE The 89600 VSA software uses asynchronous polling to check the calibration status of connected instruments. A CAL: Needed message may appear after a configuration change. This message disappears after performing a new calibration.

TIP If a signal is present on the input of the digitizer, it may affect the internal calibration. If the input signal is preventing a successful internal calibration, a pop-up warning message is raised. In such a case, please perform a manual calibration with the signal turned off or disconnected to allow a successful internal calibration .

Channels: From the menu **Input > Channels**, available options are:
- 1 channel through *n* channels (*n* depends on your digitizer model),
- I+jQ (IN1+jIN2)

The custom channel configuration can be used to specify a non-standard mapping between the digitizer input and the VSA logical channel. The default mapping of the logicals channel to the digitizer inputs is:

Logical Channel	Digitizer Input
1	IN1
2	IN2

From the menu **Input > Analog** the following parameters can be set:

> **Range:** Thedigitizer offers several full scale range. Please refer to product datasheet for details.
> **Coupling**: DC
> **Input Impedance:** 50 Ohms.
> **Connection:** Single Ended.

The frequency measurement parameters can be configured from the **MeasSetup > Frequency** menu.

> **Frequency:** The default setup is shown below as example.

Model Option	Band	Center	Span	Start	Stop
-SR1	0 to 390.625 MHz	195.3125 MHz	390.625 MHz	0	390.625 MHz
-SR2	0 to 625 MHz	312.5 MHz	625 MHz	0	625 MHz

> **Span:** The maximum span is dependent upon both the sampling rate and the analog bandwith of the particular digitizer model.

Model Option	Maximum Span (Analysis Bandwidth)
-SR1 -F05	390.625MHz (650 MHz in interleaved mode)
-SR1 -F10	390.625MHz (781.25 MHz in interleaved mode)
-SR2 -F05	625 MHz (650 MHz in interleaved mode)
-SR2 -F10	625 MHz (1.25 GHz in interleaved mode)

The maximum span is obtained with following formula:

Maximum Span = Min(Sample Rate / 2.56 ; Analog Bandwidth)

The analog bandwidth depends on the digitizer, the option (-Fxx) and interleaving mode (see product datasheet for details).
Maximum span depends also on the digitizer sampling rate.
For details, please refer to VSA software help (http://rfmw.em.keysight.com/wireless/helpfiles/89600B/WebHelp/89600.htm).

> **TIP**   For digitizer with -DDC option, the down-conversion is done by the hardware by default when span: < 300 MHz (-SR2) or for span < 180 MHz (-SR1).
> For digitizer with -LDC option, the down-conversion is done by the hardware by default when span: < 80 MHz (-SR2) or for span < 50 MHz (-SR1).

ResBW: Standard VSA parameter. Can be configured by user.

Main Time Length: Standard VSA parameter. Can be configured by user. Maximum value depends on the memory option of your module.

Center Frequency Range: The range depends on which model you are using:

Model	Option	Mode	Center Frequency Range
U5303A	-SR1	Normal (non-interleaved)	0 - 1 GHz
	-SR2	Normal (non-interleaved)	0 - 1.6 GHz
	-SR1	Interleaved	0 - 1.4 GHz
	-SR2	Interleaved	0 - 1.4 GHz

Frequency Counter: Not available.

Trigger settings can be accessed via the **Input > Trigger** menu:

Trigger Type	Level	Default
External	-5 V to +5 V	2V
Channel	must be set within Offset ± FSR	-
Magnitude[2]	0 to 1.414 V	10 mV

The following trigger parameters are available:

- **Style:** Free Run[1], External, Magnitude[2], and Channel
- **Slope:** available for External, Magnitude and Channel
- **Level:** available for External, Magnitude and Channel
- **Delay:** available for External, Magnitude and Channel
- **Trigger Holdoff:** not supported by the digitizer.

Soft Front Panel Control: The 'Disconnect' feature can be used to pause the VSA and release its control of the digitizer. Then the digitizer can be used independently from the VSA, for example, using the MD2 SFP application. Independent control must be released before resuming VSA measurements. When returning to the VSA sofware and starting or resuming a measurement, the VSA restores the digitizer state that was set before being disconnected.

Hardware: Set up an Analyzer Configuration with the digitizer as the Logical Instrument, as described in Configuring the 89600 VSA software application to use the digitizer hardware (page 1).

Overlap: The digitizer does not support overlap processing. However, overlap processing is available during recording playback.

Recording: The VSA application enables time data recording from the digitizer to the PC's disk drive. The length of waveform recording time is limited by the memory available on the digitizer.

Setup Save/Recall: The digitizer state is not saved when the VSA application is closed. When a setup is recalled into the VSA, the digitizer state is set appropriately based on the recalled VSA setup.

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[1]On "Segmented Capture" feature the free run triggered is not supported. (Segmented Capture feature may be accessed via the MeasSetup > Time menu)
[2]-DDC option is required for Magnitude triggering.