COPPER MOUNTAIN®
TECHNOLOGIES

631 E New York Street | Indianapolis, IN 46202 USA
www.coppermountaintech.com

Network Analyzers using SNVNA software

Operating and Programing manual

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U.S.: +1.317.222.5400
Latin America: +1.9154.706.5920

Singapore: +65.63.23.6546
EMEA: +44 75 03 69 21 13

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Introduction

This operating manual is intended to provide you with all information that is necessary for setup, manual, and remote control of the Copper Mountain Technologies Vector Network Analyzer. Please use the navigation tools on the left side to access the sections.

If you have any questions or comments, please contact us.

This manual covers the Analyzer models containing between 6 and 16 ports, which are controlled by the SNVNA software version 25.1.1. The Analyzer models are listed below:

SN0906	SN0912	SN5090-6	SN5090-12
SN0908	SN0914	SN5090-8	SN5090-14
SN0910	SN0916	SN5090-10	SN5090-16

This manual contains designs, specifications, functional overview, and detailed operation procedures for the Analyzer to ensure effective and safe use of its technical capabilities.

Maintenance and operation of the Analyzer should be performed by qualified engineers with basic experience in the operation of microwave circuits.

Glossary — The abbreviations used in this document.

Web Sites

Copper Mountain Technologies

Safety Instructions

It is highly recommended to follow all safety warnings and precautions provided in this document for operating, servicing, and repairing the Analyzer.

The Analyzer should be used only by skilled and thoroughly trained personnel with the required skills and knowledge of safety precautions.

The Analyzer complies with INSTALLATION CATEGORY II as well as POLLUTION DEGREE 2 as defined in IEC61010–1.

The Analyzer is a MEASUREMENT CATEGORY I (CAT I) device. Do not use the Analyzer as a CAT II, III, or IV device.

The Analyzer is for INDOOR USE only.

The Analyzer has been tested as a stand-alone device and in combination with the accessories supplied by Copper Mountain Technologies, in accordance with the requirements of the standards described in the Declaration of Conformity. If the Analyzer is integrated with another system, compliance with related regulations and safety requirements are to be confirmed by the builder of the system.

Never operate the Analyzer in an environment containing flammable gasses or fumes.

Operators must not remove the cover or any other part of the housing. The Analyzer must not be repaired by the operator. Component replacement or internal adjustment must be performed by qualified maintenance personnel only.

Never operate the Analyzer if the power cable is damaged.

Never connect the test ports to A/C power mains.

Electrostatic discharge can damage the Analyzer whether connected to or disconnected from the DUT. Static charge can build up on your body and damage sensitive internal components of both the Analyzer and the DUT. To avoid damage from electric discharge, observe the following:

- Always use a desktop anti-static mat under the DUT.
- Always wear a grounding wrist strap connected to the desktop anti-static mat via daisy-chained 1 MΩ resistor.
- Connect the post marked  on the body of the Analyzer to the common ground of the test station.

All general safety precautions related to operation of electrically energized equipment must be observed.

Definitions of safety symbols used on the instrument and in the manual are listed below.



Refers to the Manual if the instrument is marked with this symbol.



Alternating current.

Direct current.

On (Supply).



Off (Supply).



A chassis terminal; a connection to the instrument's chassis, which includes all exposed metal surfaces.

WARNING

This sign denotes a hazard. It calls attention to a procedure, practice, or condition that, if not correctly performed or adhered to, could result in injury or death to personnel.

CAUTION

This sign denotes a hazard. It calls attention to a procedure, practice, or condition that, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the instrument.

NOTE

This sign denotes important information. It calls attention to a procedure, practice, or condition that is essential for the user to understand.

General Overview

The Vector Network Analyzer is designed for use in the process of development, adjustment, and testing of various electronic devices in industrial and laboratory facilities, including as a component of an automated measurement system. The Analyzer is designed for operation with an external PC, which is not supplied with the Analyzer.

The overview of the Analyzer measurement capabilities is represented in Measurement Capabilities.

The block diagram of the Analyzer is represented in Principle of Operation.

Specifications

The specifications of each Analyzer can be found in the corresponding datasheet.

Measurement Capabilities

Measured parameters	• Sii, where i takes a value from 1 to 6/8/10/12/14/16 (depending on the Analyzer model, see corresponding datasheet). • Sij, i ≠ j, i take a value from 1 to 6/8/10/12/14/16 (depending on the Analyzer model, see corresponding datasheet). Absolute power of the incident, reflected or transmitted DUT signals.
Number of measurement channels	Up to 32 channels. Each channel is represented on the screen as an individual channel window. Each channel has its own stimulus signal settings such as frequency range, number of test points, power level, etc.
Data traces	Up to 64 data traces can be displayed in each channel window. A data trace represents S-parameter of the DUT or absolute power of the incident, reflected or transmitted DUT signals.
Memory traces	Each of the 64 data traces can be saved into memory for further comparison with the current values. Memory traces can be created for each data trace. Up to 10 memory traces can be created for each data trace.
Data display formats	Logarithmic magnitude, SWR, phase, expanded phase, group delay, linear magnitude, real part, imaginary part, Smith chart format, and polar format.

Sweep Setup Features

Sweep type	Linear, logarithmic, and segment frequency sweep, when the stimulus power is a fixed value.
Power sweep	Linear power sweep when the frequency is a fixed value.
CW time sweep	Linear time sweep when the frequency and power are fixed values.
Measured points per sweep	From 2 to 200,001.
Segment sweep	A frequency sweep within several user-defined segments. Frequency range, number of points, source power, and IF bandwidth can be set for each segment.
Power settings	The power level can be set the same for all ports or individually for each port in the frequency sweep mode when the stimulus power is a fixed value. The power slope depending on frequency can be set to compensate for high-frequency attenuation in cables.
Sweep trigger	Trigger modes: continuous, single, hold. Trigger sources: internal, manual, external, bus.
Trigger output	Synchronization of external devices with specified events in the Analyzer measurement cycle. A logic signal appears on the "Trig 1" connector with the specified polarity and according to the specified events.

Trace Display Functions

Trace display	Data trace, memory trace, or simultaneous data and memory traces.
Trace math	Data trace modification by math operations: addition, subtraction, multiplication or division between the data, and memory traces.
Autoscaling	Automatic selection of the scale division and reference level value to have the trace most effectively displayed.
Reference level automatic selection	Automatic selection of the reference level. After selection, the data trace shifts vertically so that the reference level crosses the trace in the middle.
Automatic reference level tracking	Automatic tracking of the reference level after each scan. The tracking method choice is: maximum, minimum, center, or active marker.
Electrical delay	Linear phase correction according the specified electrical delay.
Phase offset	Phase offset by the specified value in degrees.

Accuracy Enhancement

Calibration	Calibration of a test setup (which includes the Analyzer, cables, and adapters) significantly increases the accuracy of measurements. Calibration allows for correction of errors caused by imperfections in the measurement system: directivity, source, load match, tracking, and isolation.
Calibration methods	The following calibration methods of various sophistication and accuracy enhancement are available: • reflection and transmission normalization • full one-port calibration (SOL) • one-path N-port calibration • full N-port calibration (SOLT)
Reflection and transmission normalization	The simplest calibration method. It provides limited accuracy.
Full one-port calibration (SOL)	Method of calibration performed for one-port reflection measurements. It ensures high accuracy.
One-path N-port calibration	Method of calibration performed for reflection and one-way transmission measurements, for example, for measuring Sii and Sji only. It ensures high accuracy for reflection measurements, and reasonable accuracy for transmission measurements.
Full N-port calibration (SOLT)	Method of calibration performed for full S-parameter matrix measurement of a N-port DUT. It ensures high accuracy.
Mechanical calibration kits	It is possible to select one of the predefined calibration kits of various manufacturers or define additional ones.
Electronic calibration modules	Copper Mountain Technologies' automatic calibration modules (ACMs) make Analyzer calibration faster and easier than traditional mechanical calibration and provide the highest accuracy.

Sliding load calibration standard	The use of sliding load calibration standard allows significant increase in calibration accuracy at high frequencies compared to a fixed load calibration standard.
Unknown thru calibration standard	The use of an arbitrary reciprocal two-port thru device instead of a defined by parameters thru during a full N-port calibration allows calibration if the parameters of an available thru are unknown. This method allows calibration of the test setup for measurements of non-insertable devices.
Defining of calibration standards	Different methods of calibration standard definition are available: • standard definition by polynomial model • standard definition by database (S-parameters)
Error correction interpolation	When such settings as start/stop frequencies and number of points are changed, compared to the settings of calibration, interpolation or extrapolation of the calibration coefficients will be applied (Extrapolation is not recommended).
Port Extension	Calibration plane compensation for delay in the test setup.

Supplemental Calibration Methods

Power calibration	Method of the port power calibration which allows to maintain more stable power levels at the DUT input. The calibration requires connection of an external USB power meter.
Receiver calibration	Method of the receiver gain calibration to the accurate absolute power measurement.

Marker Functions

Data markers	Up to 64 markers for each trace. A marker indicates the stimulus value and measurement result at a given point of the trace.
Reference marker	Enables indication of any maker value as relative to the reference marker.
Marker search	Search for max, min, peak, or target values on a trace.
Marker search additional features	User-defined search range. Available as either a tracking marker, or as a one-time search.
Setting parameters by markers	Setting of start, stop, and center frequencies from the marker frequency, and setting of reference level by the measurement result of the marker.
Marker math functions	Statistics, bandwidth, flatness, RF filter.
Statistics	Calculation and display of mean, standard deviation and peak-to-peak values of the trace.
Bandwidth	Determines bandwidth between cutoff frequency points for an active marker or absolute maximum. The bandwidth value, center frequency, lower frequency, higher frequency, Q value, and insertion loss are displayed.
Flatness	Displays gain, slope, and flatness between two markers on a trace.
RF filter	Displays insertion loss and peak-to-peak ripple of the passband, and the maximum signal magnitude in the stopband. The passband and stopband are defined by two pairs of markers.

Data Analysis

Port impedance conversion	This function converts S-parameters measured at the Analyzer's nominal port impedance into values which would be found if measured at arbitrary port impedance.
De-embedding	This function allows mathematical exclusion of the effects of the fixture circuit connected between the calibration plane and the DUT. This circuit should be described by an S-parameter matrix in a Touchstone file.
Embedding	This function allows mathematical simulation of the DUT parameters after virtual insertion of a fixture circuit between the calibration plane and the DUT. This circuit should be described by an S-parameter matrix in a Touchstone file.
S-parameter conversion	This function allows conversion of the measured S-parameters to the following parameters: reflection impedance and admittance, transmission impedance and admittance, and inverse S-parameters.
Time domain transformation	This function performs transformation from frequency domain into response of the DUT to various stimulus types in time domain. Modeled stimulus types: bandpass impulse, lowpass impulse, and lowpass step. Time domain span is set arbitrarily from zero to maximum, which is determined by the frequency steps. Various window shapes allow optimizing the tradeoff between resolution and the level of spurious sidelobes.
Time domain gating	This function mathematically removes unwanted responses in time domain, allowing for measurement of the frequency response without the influence of selected fixture elements. Gating filter types: bandpass or notch. For better tradeoff between gate resolution and the level of spurious sidelobes the following filter shapes are available: maximum, wide, normal, and minimum.
Measurement of Balanced Devices	These measurements include the following function: • Balance-unbalance conversion mathematically simulates measurements of the balanced circuits using the results of unbalanced measurements.

	• Differential port matching function simulates the embedding of a matching circuit in a balanced port generated by a balance-unbalance conversion function. • Port reference Impedance conversion for balanced connection function changes the reference impedance for each test logical balanced port to an arbitrary value.

Other Features

Familiar graphical user interface	Intuitive graphical user interface ensures fast and easy Analyzer operation.
Printout/saving of traces	The traces and data printout function has a preview feature. Previewing, saving, and printing can be performed using MS Word, Image Viewer for Windows, or the Analyzer Print Wizard.
Linux OS support	The Linux version of the software is designed to run on x86 PCs running Linux. **NOTE** Tests must be performed to determine if the software is compatible with a particular version of Linux.

Remote Control

SCPI	Remote control using textual commands SCPI (Standard Commands for Programmable Instruments). Text messages are delivered over PC networks using HiSLIP or TCP/IP Socket network protocols. VISA Library is recommended to support HiSLIP protocol. The TCP/IP Socket protocol can be supported by the VISA library or directly programmed in any language or environment that supports TCP/IP Sockets. The VISA library is free and widely used software in the field of testing and measurement.

Principles of Operation

Analyzers consist of a measuring unit that performs comparing the incident and passed through the Device Under Test (hereinafter DUT) signals, as well as test fixtures (measuring cables, adapters, etc.), and calibration tools. Test fixtures and calibration tools are not included in the delivery set.

The measuring unit, or comparator, provides:

- Generation of a probing signal in a wide frequency and power range.
- Extraction of the incident signal, the signal that passed through the DUT, and the signal reflected from its inputs.
- Analog processing using a frequency-converted receiver (voltages proportional to the incident and reflected signals are distinguished).
- Pre-digital processing.

The principle of operation is based on measuring the ratio of the amplitudes and phase difference between the source signal and the signals transmitted or reflected from the DUT. The final calculation and displaying the measurement results of complex transmission and reflection coefficients, as a function of the ratio of the amplitudes and phase difference from the frequency of the signal source, is performed by an external controlling computer. The connection to the computer is made via a USB interface.

Test cables are designed to connect multiport DUTs to analyzer ports. They should have low amplitude and phase instability when they are bent. Adapters should be used to prevent cable damage and improve measurement repeatability. Calibration tools are used to perform a standard procedure that eliminates the imperfection of the measurement path when determining complex transmission and reflection coefficients and significantly reduces measurement errors. Analyzers can be calibrated using automatic calibration modules (ACM), measurement kits with resistive matched loads or with matched loads with a movable absorber, as well as measurement kits with precision transmission line segments.

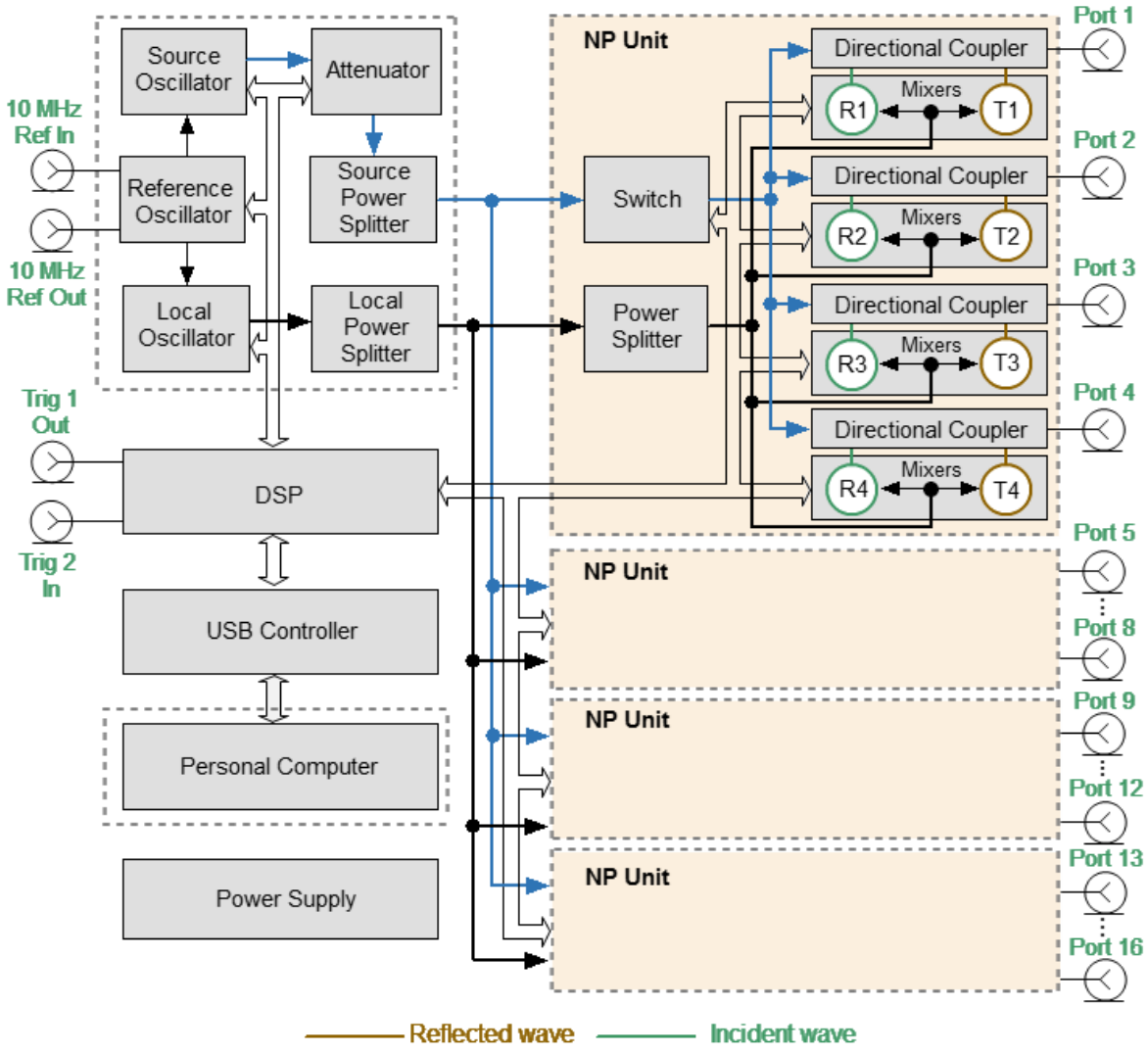
The Analyzer combines in one housing:

- Source and local signal oscillators.
- Power control attenuator.
- Power splitters.
- Switch.
- Directional couplers (measuring bridges).
- Multichannel receiver.
- Control unit based on signal processor and/or programmable logic device.

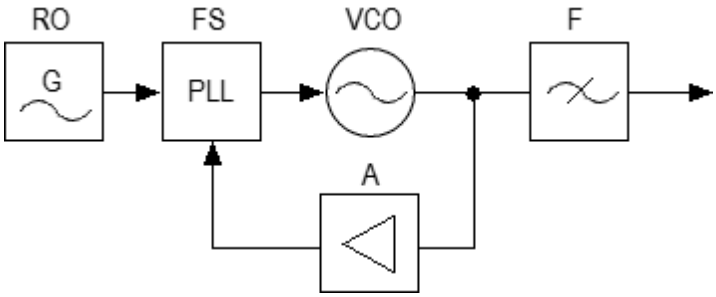
- Power Supply.

The complete specification and list of supported features are given in the datasheet of the corresponding Analyzer.

The block diagram of the Analyzer is shown in the figure below.



The Block Diagram of the Analyzer



RO — reference oscillator, FS — frequency synthesizers

PLL — phase-locked loop, VCO — voltage controlled oscillator

A — amplifier, F — filter

Source Oscillator Block Diagram

The source oscillator includes a wideband VCO. VCO frequency control is performed using a PLL circuit, which is based on a frequency synthesizer. Overlapping of the operating frequency range is carried out by multiplying or dividing the base VCO range, followed by filtering out the side components of the output signal spectrum. The local oscillator, required for the operation of the receiver, has a similar frequency generating principle. A reference oscillator with phase-locked loop from an internal or external 10 MHz reference oscillator is used for source and local oscillators and for the formation of a reference signal. The reference oscillator is shown on the Source Oscillator Block Diagram as an auxiliary component.

The output signal power level is controlled by a programmable attenuator, which is a part of the automatic loop control system as an output actuating element. The attenuation value is set depending on the working capacity of the DUT and the dynamic range of the Analyzer.

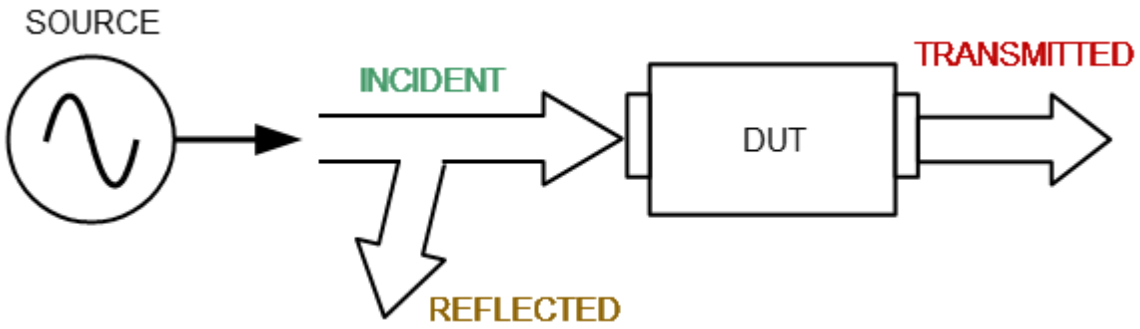
To change the probing direction required for determining the parameters of multiport DUTs in one connection, a switch is provided in the circuit. The switch allows to sequentially send a signal to one of the Analyzer's ports over time. Thus, any port can act as a source or receiver of a signal.

Extraction of measuring signals is performed using directional couplers. These signals, corresponding to the incident and reflected (or transmitted through the DUT) waves, arrive into a superheterodyne multichannel receiver, where they are transferred to an intermediate frequency and filtered. After filtering, the IF signals are sent to the ADC, where they are converted into digital form. Further signal processing (filtering, phase difference measurement, amplitude measurement) is performed in the signal processor. The IF measurement filters are digital and have a bandwidth as specified in the datasheet. The multichannel receiver can have from 12 to 32 identical receiving channels (2 channels per port). One of the channels (the reference channel) processes the incident wave signals, while the second (the measuring channel)

processes the signal passed through the DUT or reflected from its inputs. The reference receiving channel or reference receiver is denoted by the letter R with an index corresponding to the port number. The measurement receiving channel or measuring receiver is denoted by the Latin letter T with an index.

Principle of Measuring S-parameters

The DUT is connected to the Analyzer ports. The Analyzer emits a test signal (stimulus) out of a source port. Simultaneously, all ports of the Analyzer are receivers. The frequency of the test signal changes in the specified range discretely from point to point. At each frequency point, the Analyzer simultaneously measures the magnitude and phase of the signal transmitted through and reflected from the DUT. These are compared with the magnitude and phase of the incident test signal. The Analyzer calculates the S-parameters of the DUT at each frequency point based on this comparison (see figure below).



S-parameter Terms

The S-parameter is the relation between the complex magnitudes of two waves:

$$S_{mn} = \frac{outgoing\ wave\ at\ Port\ m}{incoming\ wave\ at\ Port\ n}$$

Providing the $incoming\ wave\ at\ Port$, except n = 0, where $m,\ n$ denote the DUT port number.

For example, for a six-port DUT, the Analyzer measures the full scattering matrix:

$$S = \begin{bmatrix} S11 & S12 & S13 & S14 & S15 & S16 \\ S21 & S22 & S23 & S24 & S25 & S26 \\ S31 & S32 & S33 & S34 & S35 & S36 \\ S41 & S42 & S43 & S44 & S45 & S46 \\ S51 & S52 & S53 & S54 & S55 & S56 \\ S61 & S62 & S63 & S64 & S65 & S66 \end{bmatrix}$$

For the measurement of S11, S21, S31, S41, S51, S61 parameters, test Port 1 will operate as a signal source. The incident and reflected waves will be measured by Port 1. The transmitted wave will be measured by Port 2, Port 3, ..., Port 6. For the measurement of S12, S22, S32, S42, S52, S62 parameters, test Port 2 will operate as a signal source. The incident and reflected waves will be measured by Port 2. The transmitted wave will be measured by Port1, Port 3, ... Port6.

For example, a sixteen-port DUT measures the full scattering matrix:

$$S = \begin{bmatrix} S11 & S12 & \dots & S0115 & S0116 \\ S21 & S22 & \dots & S0215 & S0216 \\ \dots & & & & \\ S1501 & S1502 & \dots & S1515 & S1516 \\ S1601 & S1602 & \dots & S1615 & S1616 \end{bmatrix}$$

When a stimulus is applied to one of the test ports, the Analyzer measures sixteen S-parameters, which constitute one column in the S-parameter matrix. To have the full scattering matrix, the sixteen-port Analyzer applies a stimulus to all the sixteen test ports one after another.

You do not need to change the connection of the DUT to the Analyzer.

Preparation for Use

Unpack the Analyzer and other accessories.

CAUTION	Please keep packaging to safely ship the instrument for annual calibration!

First, install the SNVNA software from the shipped flash-drive or www.coppermountaintech.com on the PC that will be used to operate the Analyzer. The software installation procedure is described in Software Installation.

Connect the Analyzer to a 100 to 253 VAC 50/60 Hz power source by means of the external power cable supplied with the instrument. Connect the USB-port of the Analyzer to the PC using the USB Cable supplied in the package.

Warm up the Analyzer for the time stated in its datasheet.

Assemble the test setup using cables, connectors, fixtures, etc., which allow DUT connection to the Analyzer.

Perform calibration of the Analyzer. Calibration procedures are described in Calibration and Calibration Kit.

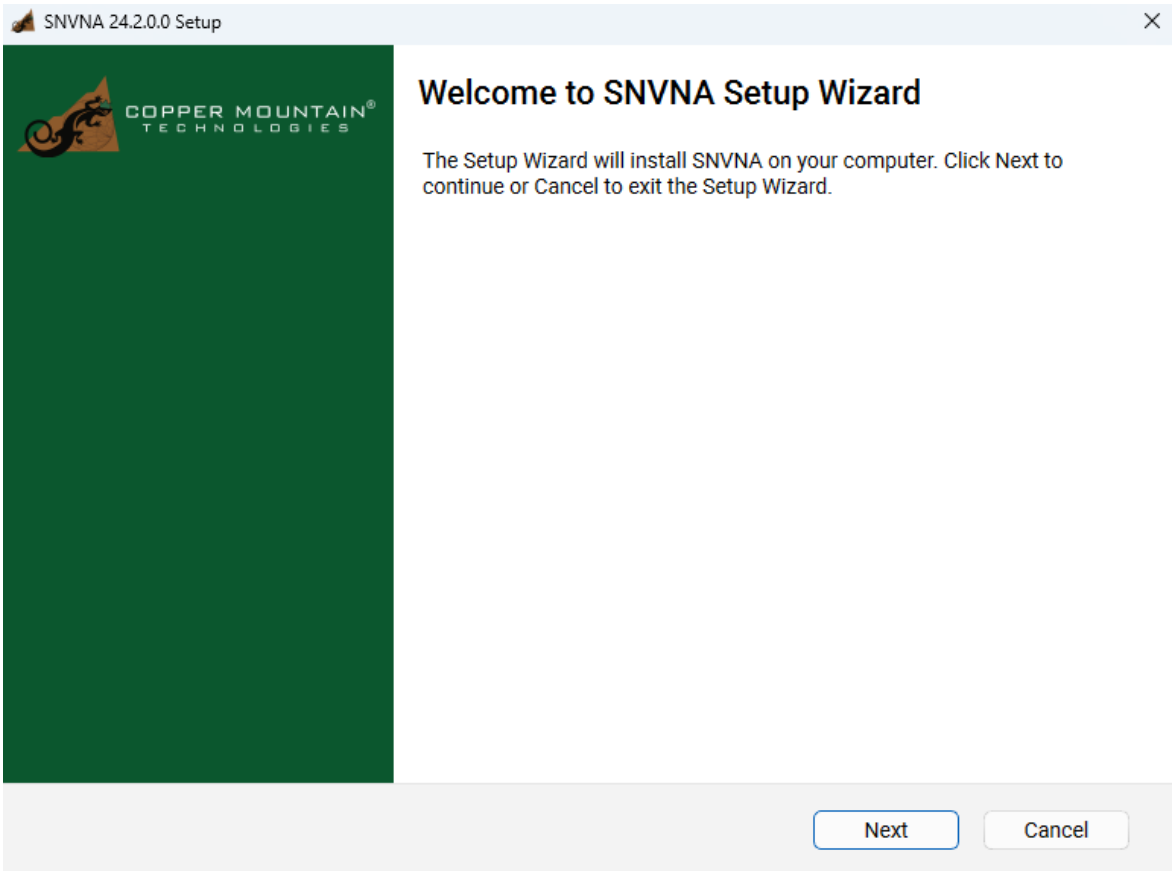
Software Installation

Minimal system requirements	WINDOWS 10 and above Processor: Intel(R) Core(TM) i3-3220 CPU 3.30 GHz RAM: 8 GB System type: 64-bit operation system Display resolution: 1280x1024 Free drive space: 1 GB USB 2.0

Windows Installation Procedure

Find the software installer file **SNVNA_Installer_X.X.X.X.exe** in the shipped flash-drive, or download it from www.coppermountaintech.com. X.X.X.X stands for the version number.

1. Run the **SNVNA_Installer_X.X.X.X.exe** installer file. The SNVNA Setup Wizard will appear on the screen. Click on the **Next** button.

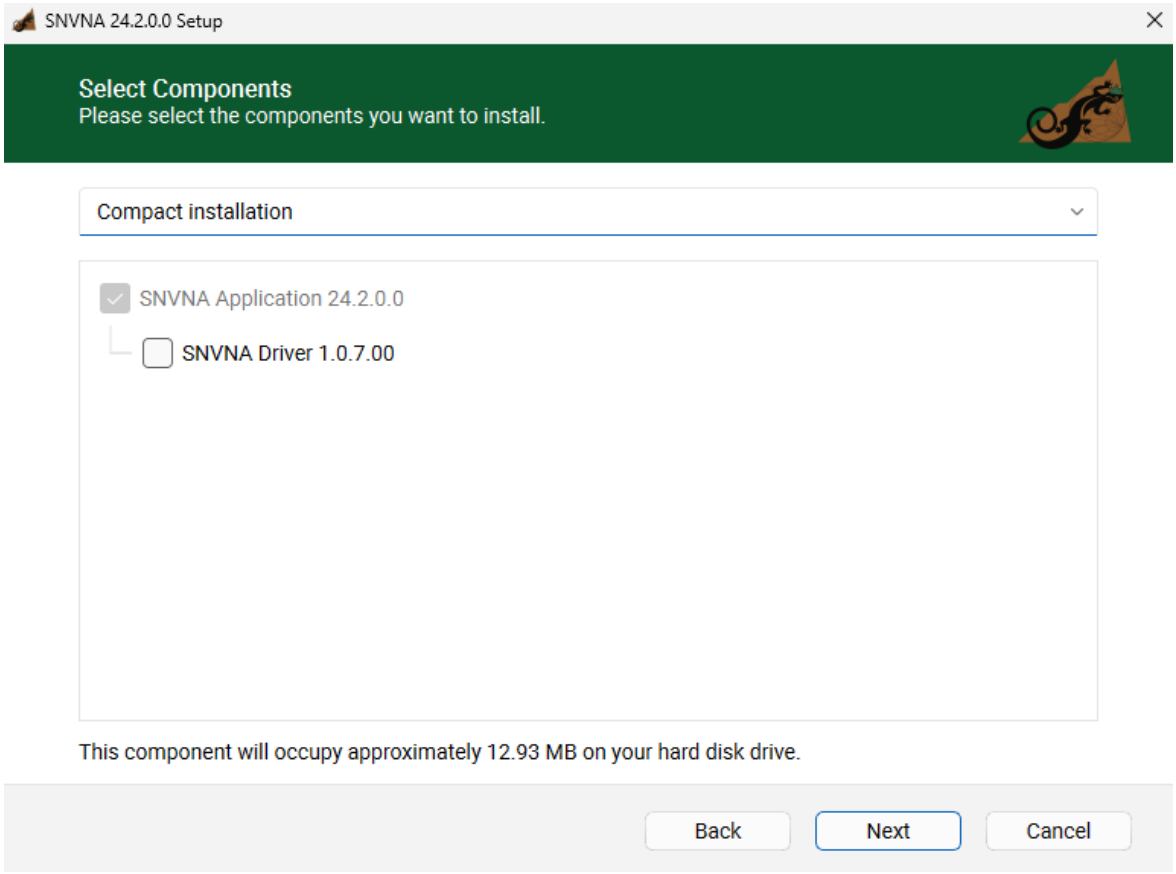


Installation Wizard

2. Select the installation option from the list (see table below). Click on the **Next** button.

Installation Option	Description
Compact installation [default]	SNVNA software is installed only. WinUSB is not installed. **WARNING** In this case, the SNVNA software does not support operation with external devices, such as Automatic Calibration Modules.
Full installation	SNVNA software and WinUSB are installed. **WARNING** The SNVNA software supports the WinUSB driver. S2VNA, S4VNA, RVNA, and TRVNA software versions below 22.1.0 do not support the WinUSB driver. After installing SNVNA, all supported hardware will only work with the WinUSB driver and will no longer connect to other software with versions below 22.1.0. To

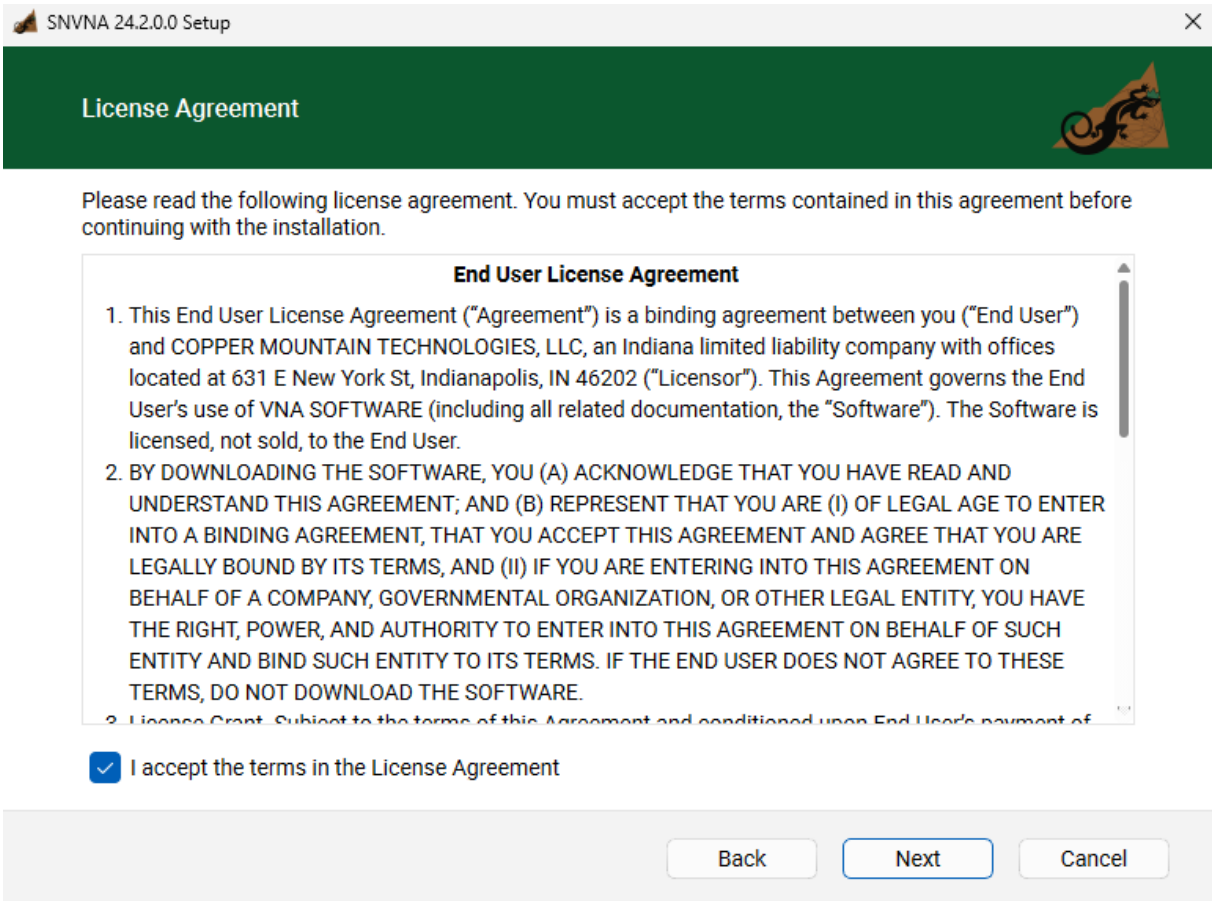
Installation Option	Description
	ensure correct operation with the devices across multiple programs, update these software to the latest versions from the www.coppermountaintech.com website.



Selecting Components

3. Read the license agreement. If you accept the terms contained in the agreement, select the I accept the terms in the License Agreement checkbox. Click on the Next button.

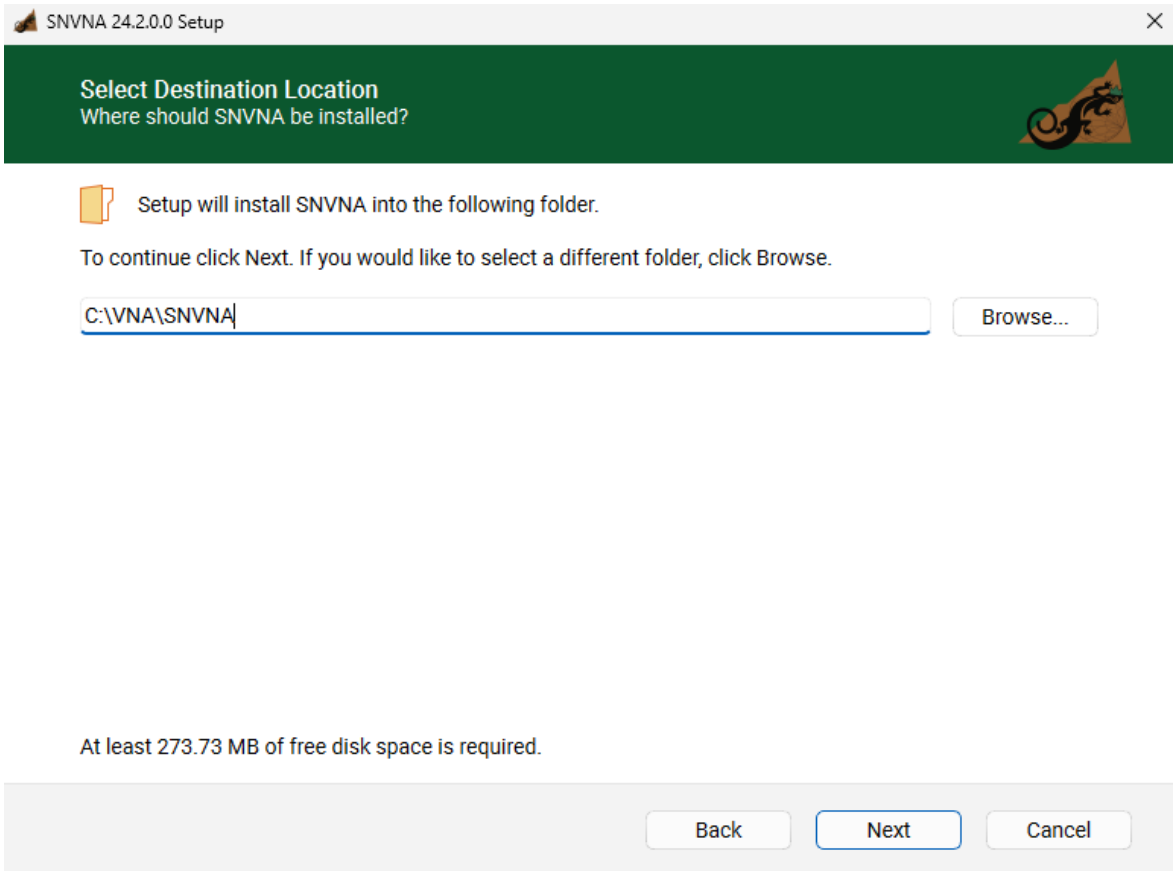
WARNING	If the checkbox is not selected, the **Next** button will not be active. The Setup will not complete the installation.



License Agreement

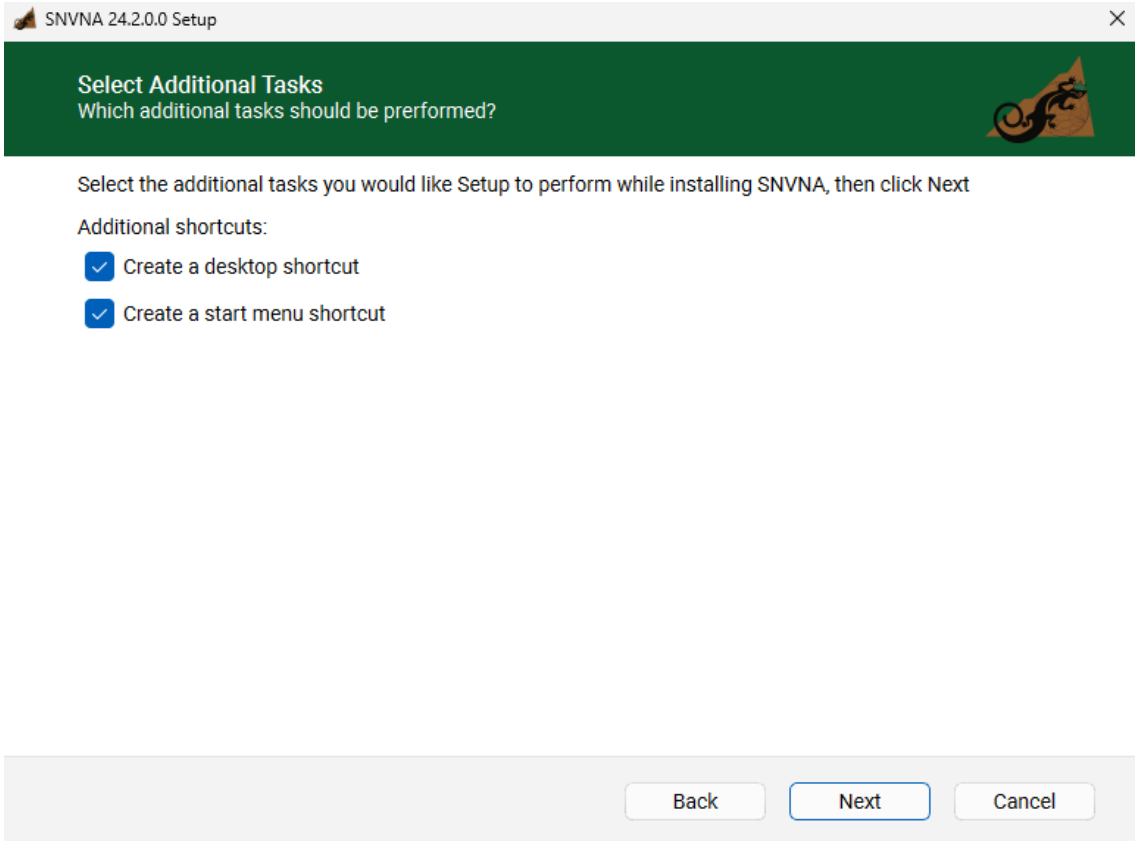
4. If necessary, change the installation path by clicking the **Browse...** button and selecting the installation path. Click on the **Next** button.

NOTE The default installation path for the software is C:\VNA\SNVNA.



Selecting Software Location

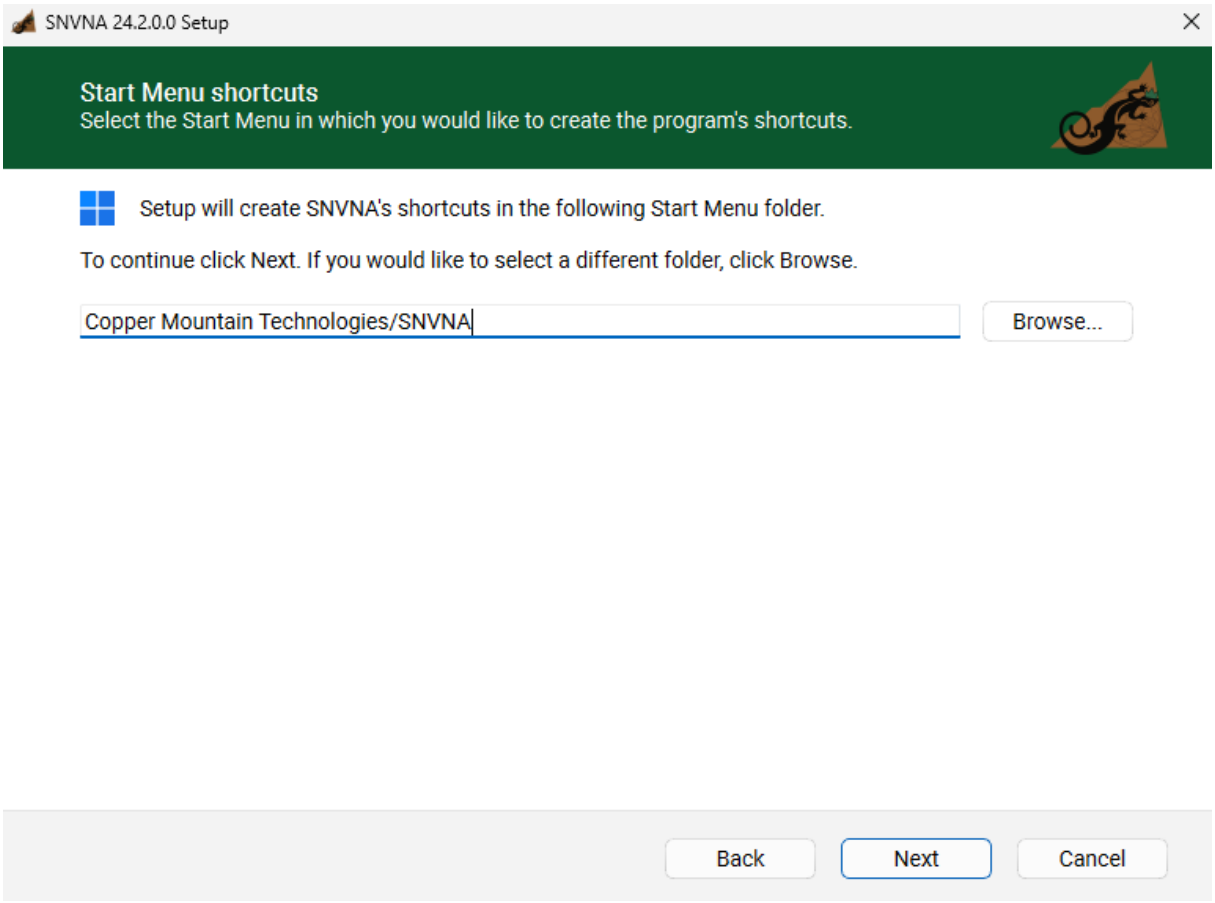
5. In the window that appears, you can create a shortcut on the desktop and a folder in the Start menu for launching the program. If necessary, select the additional tasks by selecting the **Create a desktop shortcut** and(or) **Create a start menu shortcut.** Click on the **Next** button.



Selecting Additional Tasks

6. If the **Create a start menu shortcut** checkbox is selected, choose the folder in the Start menu to create the program shortcut. If you need to change the folder, click on the **Browse...** button and select the desired folder. Click on the **Next** button.

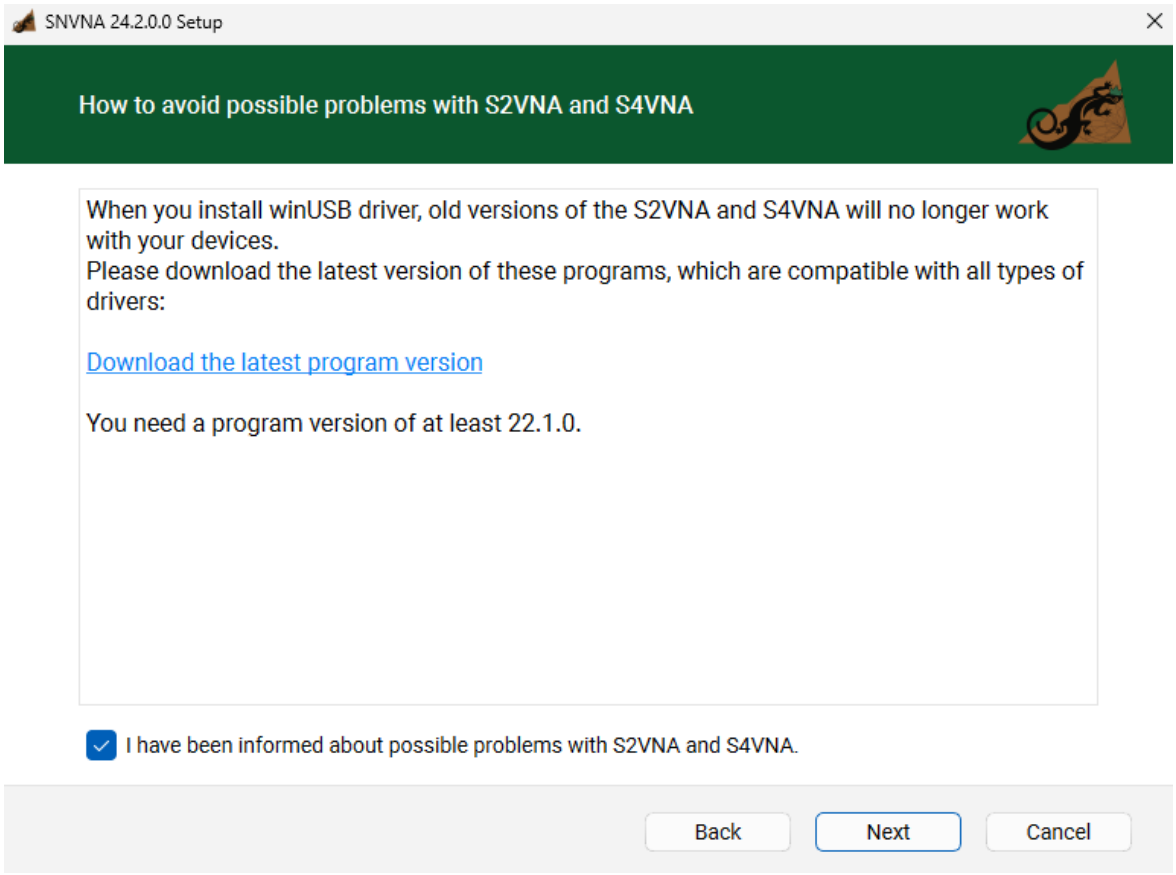
NOTE The default folder is Copper Mountain Technologies/SNVNA.



Selecting Start Menu Folder

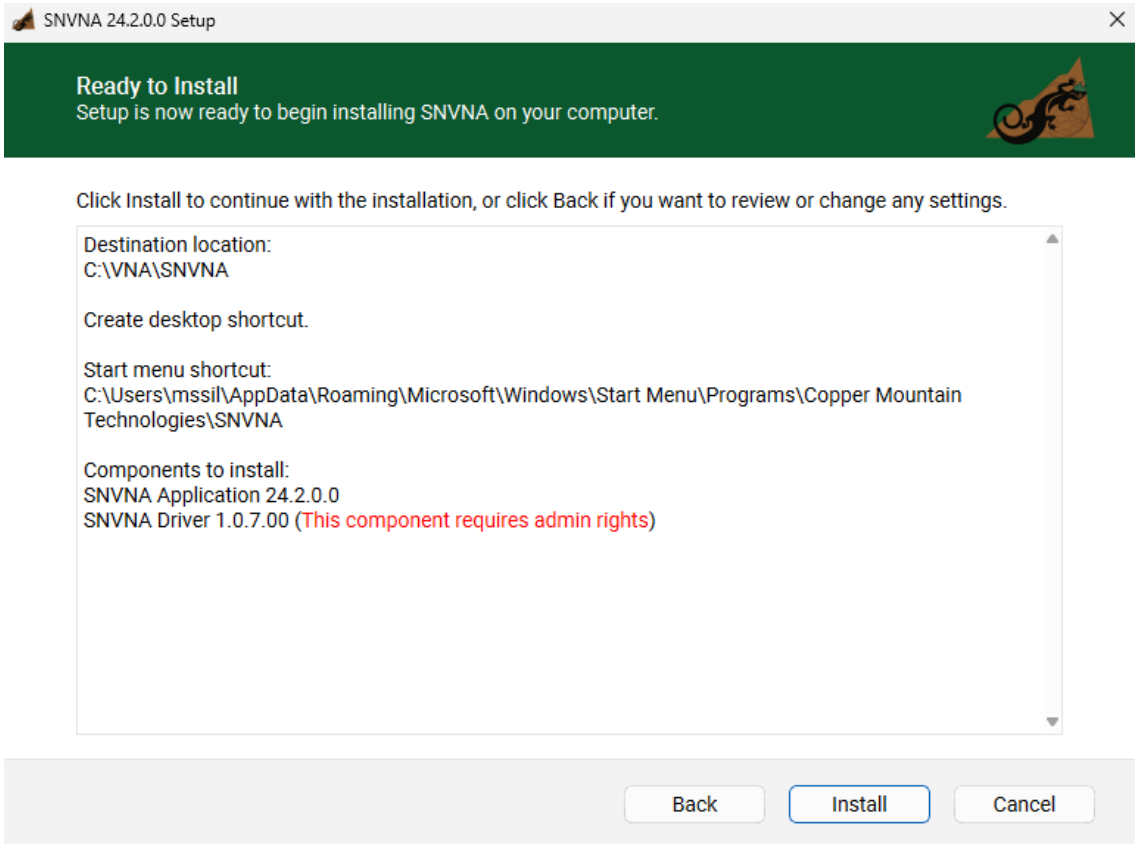
7. If you are performing full installation with WinUSB, read the information in the wizard before proceeding with the installation. Select the **I have been informed about possible problems with S2VNA/S4VNA** checkbox to continue the installation. Click on the **Next** button.

WARNING If the checkbox is not selected, the **Next** button will not be active. The Setup will not complete the installation.



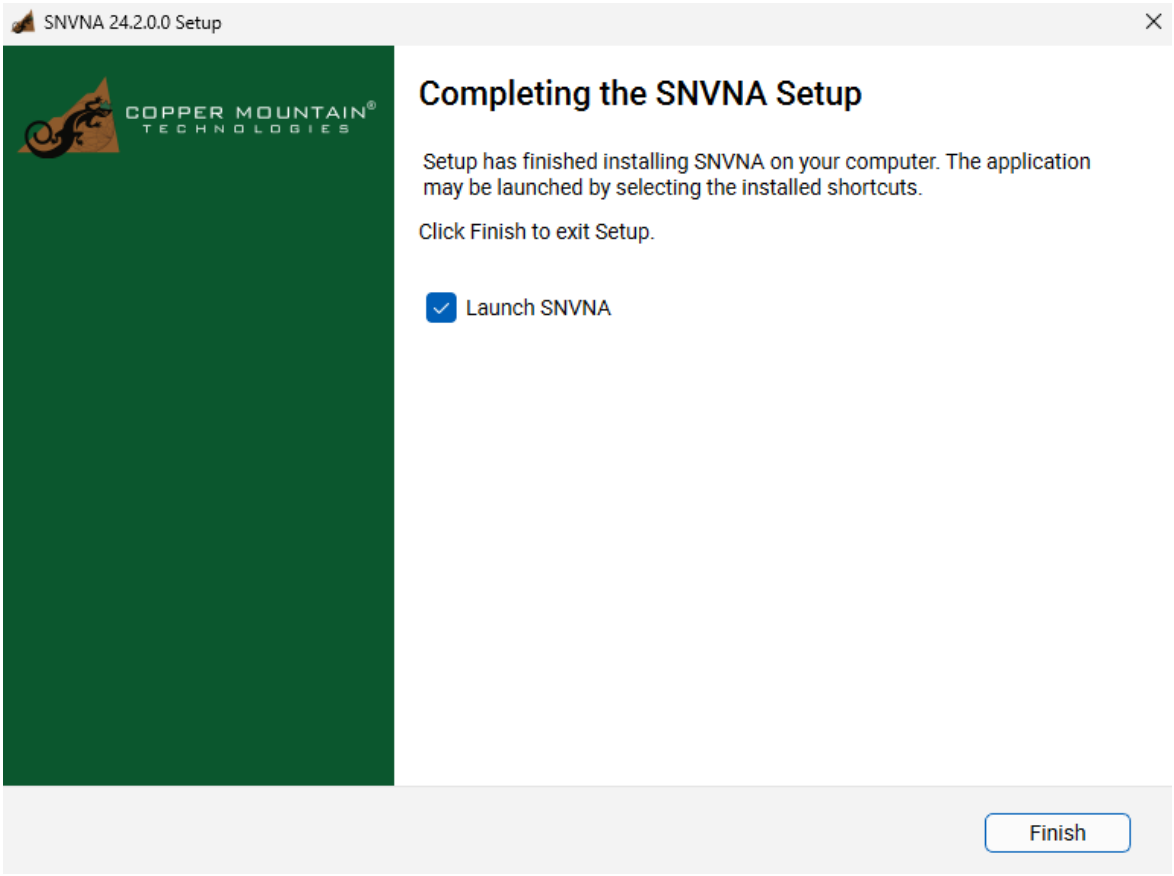
Actual Version S2VNA and S4VNA

8. Click on the **Install** button and wait till the end of installation.



Ready to Install

8. After the installation, select the **Launch NoiseFigure** checkbox to launch the program upon completion. Click on the **Finish** button to complete installation.



Completing Installation

Default installation paths for files in WINDOWS

Software components	Path
SNVNA	C:\VNA\SNVNA
VNA driver	C:\VNA\SNVNA\Driver
Data Files	C:\VNA\SNVNA

Instrument Series

This section describes the different models of Analyzers:

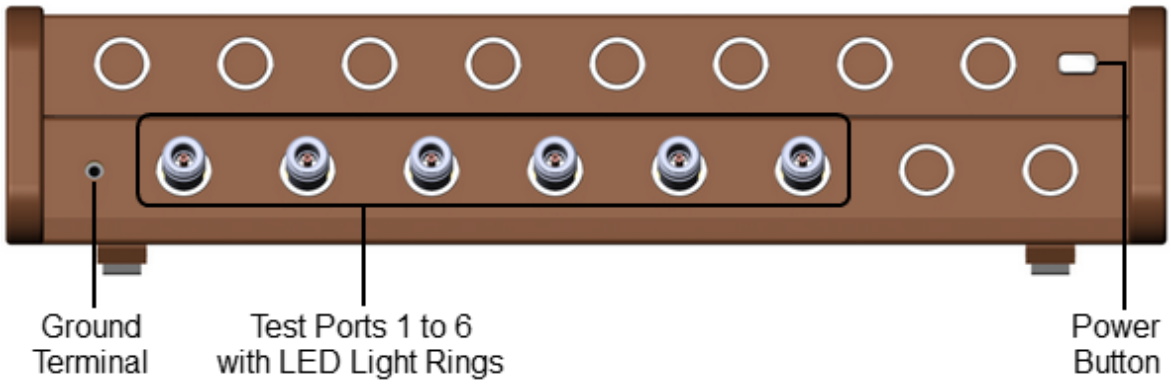
SN0906	SN5090-6
SN0908	SN5090-8
SN0910	SN5090-10
SN0912	SN5090-12
SN0914	SN5090-14
SN0916	SN5090-16

The front and rear panels of each Analyzer are shown further in this section, along with the controls located on those panels.

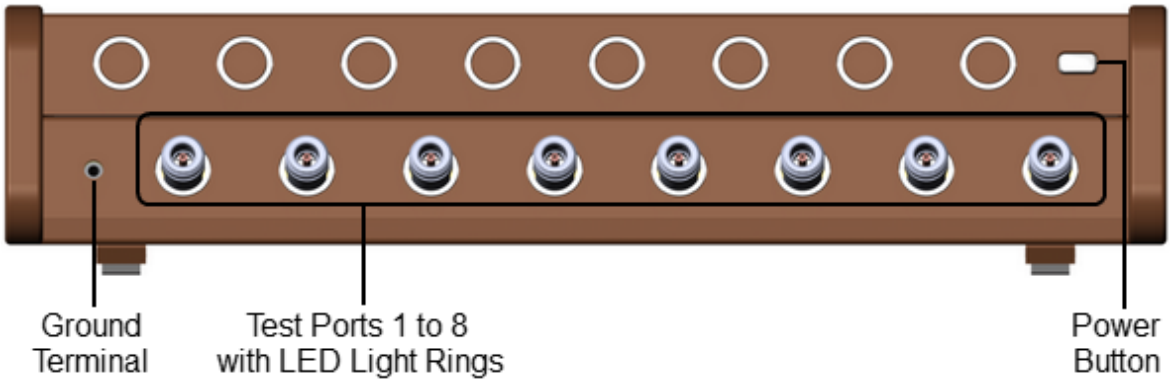
Front Panel

The multiport VNA series deliver a lab grade performance with all the features engineers have come to expect to be included in standard software. The multiport VNA series is available with 6, 8, 10, 12, 14, or 16 test ports. All models of the series have a universal design (desktop use / rack mounting).

The front view of the each Analyzers model is represented in the figures below.

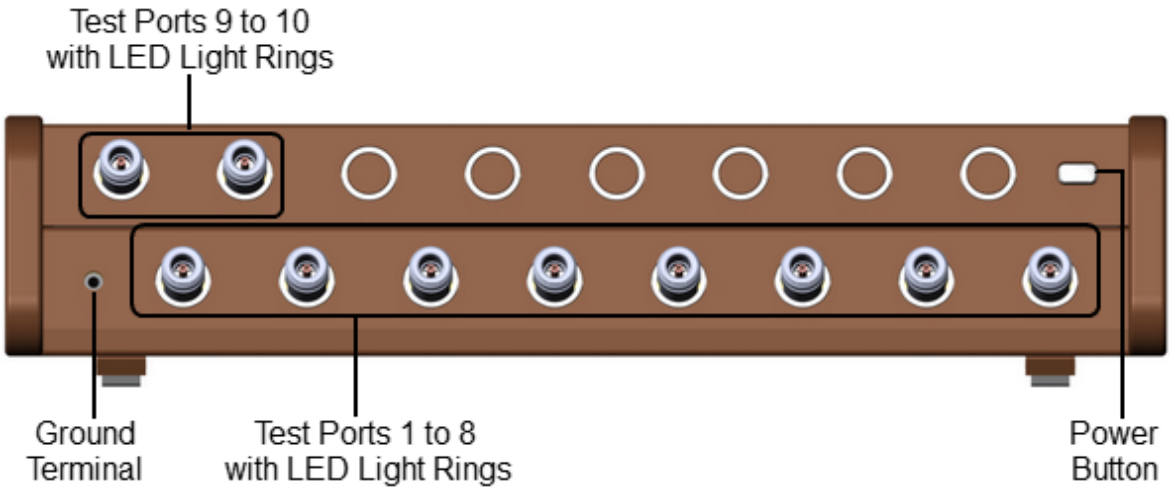


SN0906

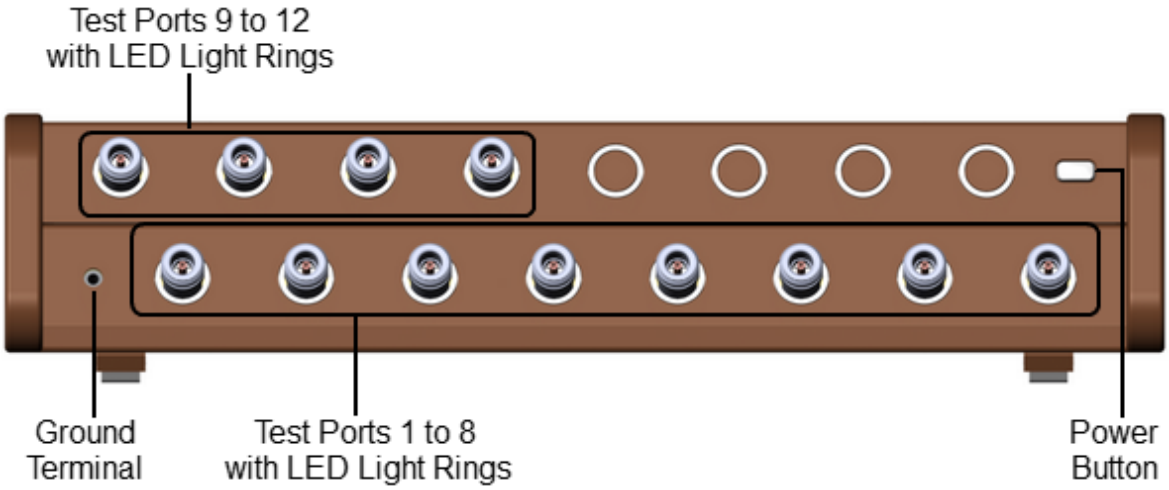


SN0908

Front Panel

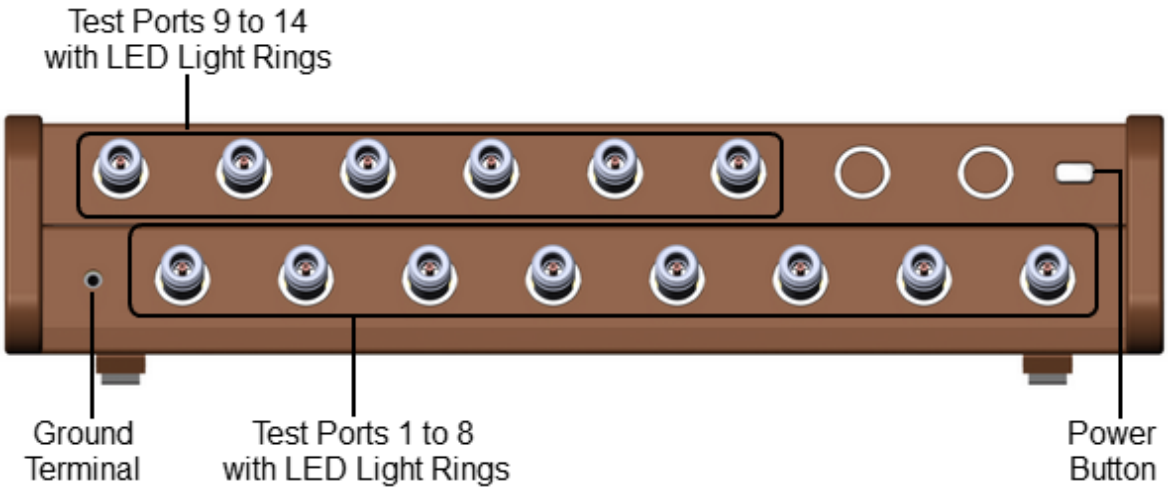


SN0910

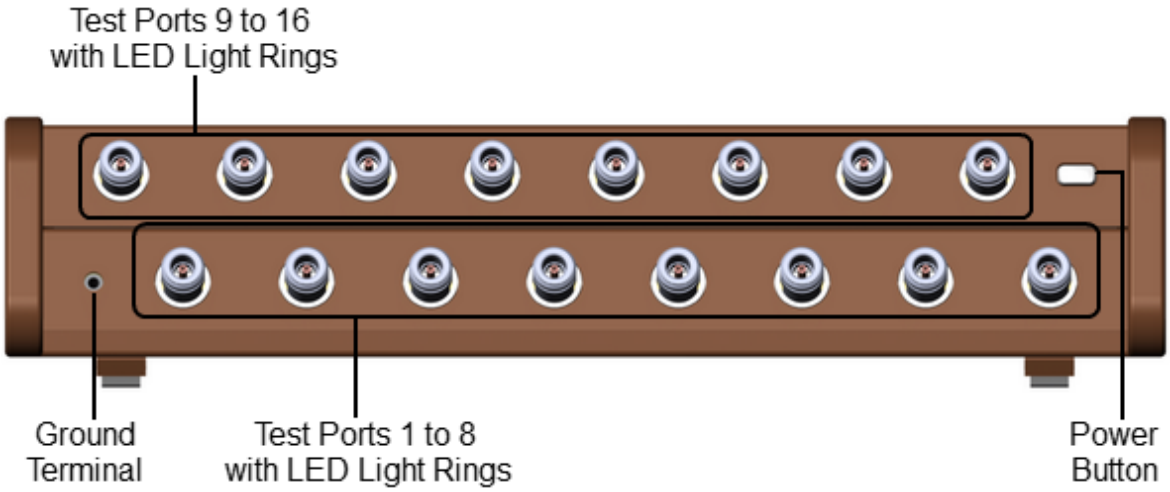


SN0912

Front Panel



SN0914



SN0916

Front Panel

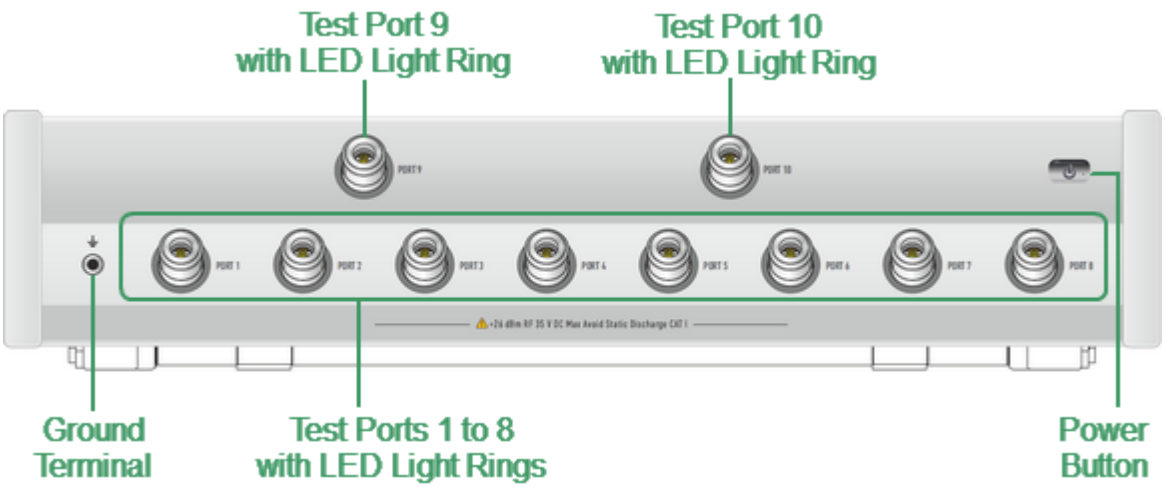


SN5090-6

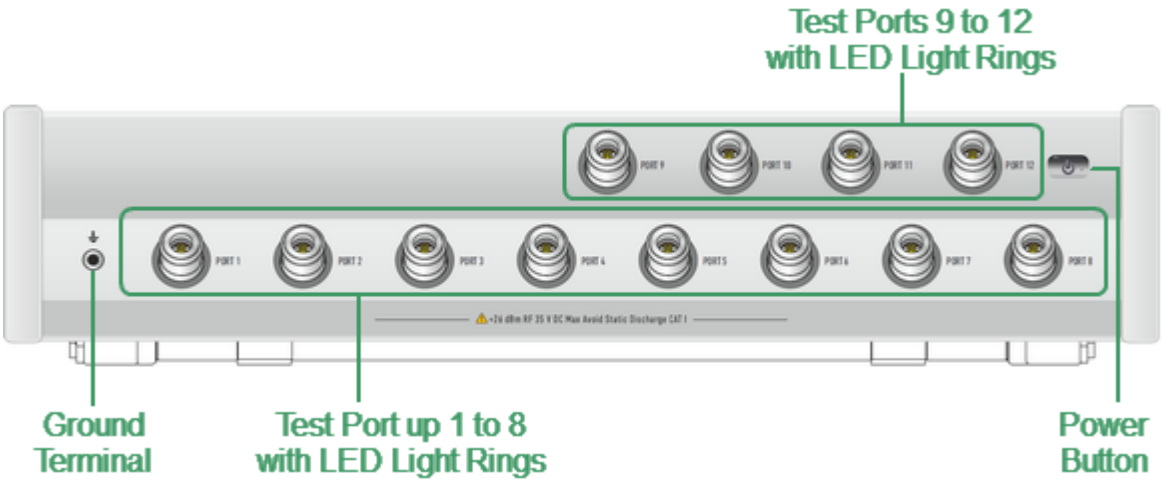


SN5090-8

Front Panel

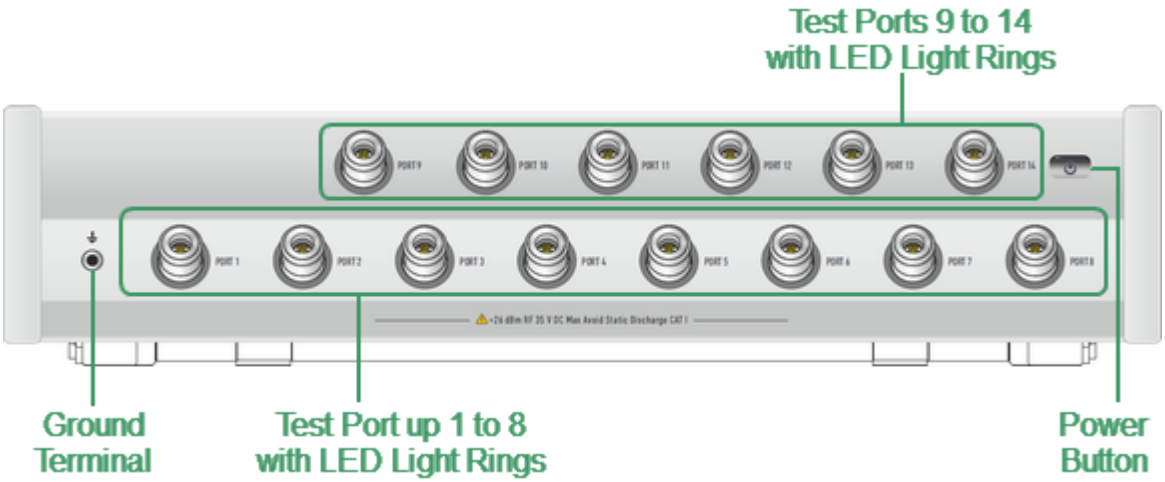


SN5090-10

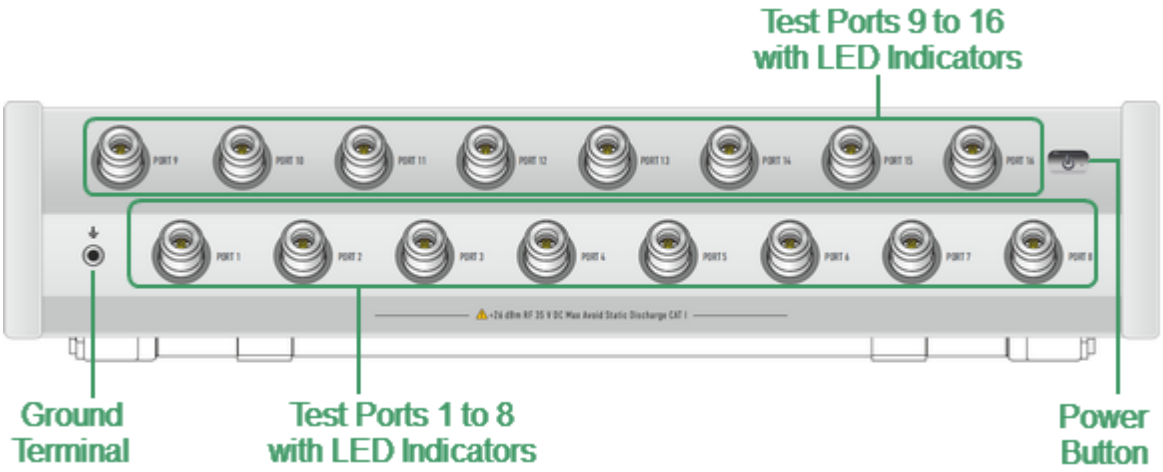


SN5090-12

Front Panel



SN5090-14



SN5090-16

Front Panel

Part of front Panel

Power Button



Switches the Analyzer ON and OFF.

The Analyzer can be turned ON/OFF at any time. The VNA loads its operating firmware from the PC each time upon powering up. The process takes approximately 10 seconds, after which the Analyzer is ready for operation.

NOTE

The USB driver will be installed onto the PC when the Analyzer is turned ON for the first time. The driver installation procedure is described in Software Installation. Some PCs may require re-installation of the driver if the Analyzer is plugged into a different USB port.

Test Ports with LED Indicators



Test Port 1, Port2 etc. (the number of ports depends on the Analyzer model, see corresponding datasheet) are intended for DUT connection. Multiport VNA models have type-N female test ports connector type.

Each test port has an LED light ring as indicator. A test port can be used either as a source of the stimulus signal or as a receiver of the response signal from the DUT. The stimulus signal can only appear on the only one port at a time. The LED light ring identifies which test port is operating as a signal source.

Connecting the DUT to only one test port on the Analyzer allows the measurement of reflection parameters (e.g. S11 or S55) of the DUT.

Connecting the DUT to all test ports of the Analyzer allows for the measurement of the full S-parameter matrix of the DUT.

CAUTION	Do not exceed the maximum allowed power of the input RF signal (or maximum DC voltage) indicated on the front panel. This may lead to damage of the Analyzer.

Ground Terminal

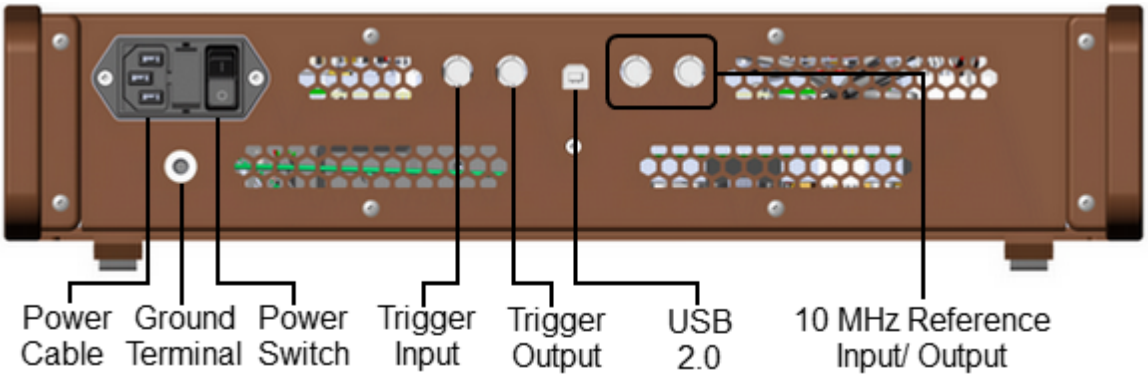


Use the terminal for grounding.

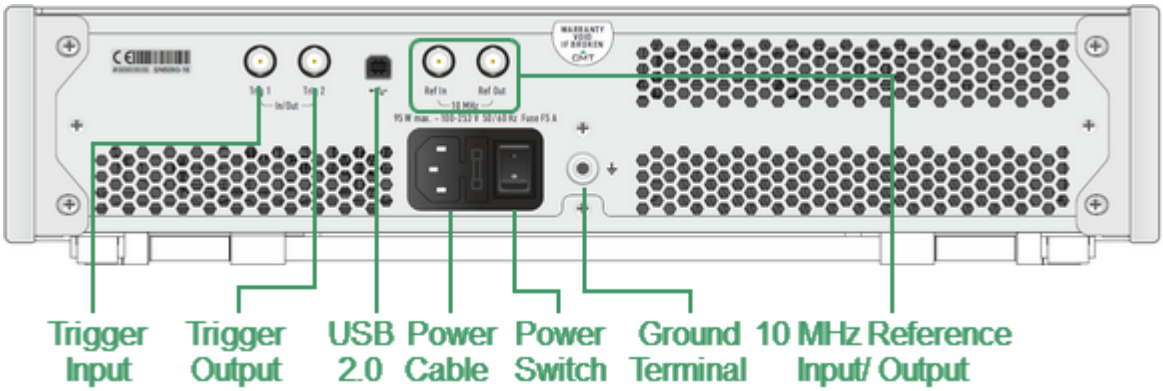
To avoid damage from electric discharge, connect the ground terminal on the body of the Analyzer to a reliable earth ground shared with the DUT in the test environment.

Rear Panel

The rear view of the Analyzers is represented in the figures below.



SN0906, SN0908, SN0910, SN0912, SN0914, SN0916 Rear Panel



SN5090-6/8/10/12/14/16 Rear Panel

Part of Rear Panel

Power Cable Receptacle



The power cable receptacle is intended for 100 to 253 V 50/60 Hz power cable connection. The cable receptacle has a built-in switch and fuse holder. The power switch serves as the disconnecting device (device that cuts off power supply) of the Analyzer. The power supply must be turned off to avoid danger such as electric shock when the device is unused for prolonged periods of time. A fuse protects the Analyzer from the excessive current.

Power Switch



The power switch serves as the disconnecting device (device that cuts off power supply) of the Analyzer. Power supply must be turned off to avoid danger such as electric shock when the device is unused for prolonged periods of time.

Trigger Signal Input Connector



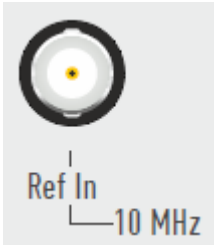
This connector allows the connection of an external trigger source. Connector type is BNC female. For input and signal parameters, see instrument specification.

Trigger Signal Output Connector



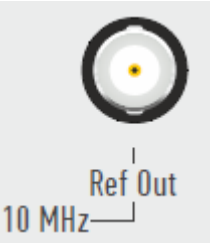
This connector can be used to provide trigger to an external device. The port outputs signal with various waveforms depending on the setting of the Output Trigger Function: before frequency setup pulse, before sampling pulse, after sampling pulse, ready for external trigger, end of sweep pulse, measurement sweep.

Internal Reference Frequency Input Connector



External reference frequency is 10 MHz, input level is 2 dBm ± 2 dB, and input impedance at «Ref In» is 50 Ω. Connector type is BNC female.

External Reference Frequency Output Connector



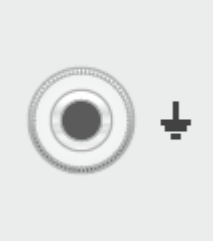
Input reference signal level is 3 dBm ± 2 dB at 50 Ω impedance. Connector type is BNC female.

USB 2.0 High Speed Port



The USB port is intended for connection to an external PC.

Ground Terminal



To avoid electric shock, use the terminal for grounding. The ground terminal allows connection directly to the body of the Analyzer to the test station ground and ensure electrical safety.

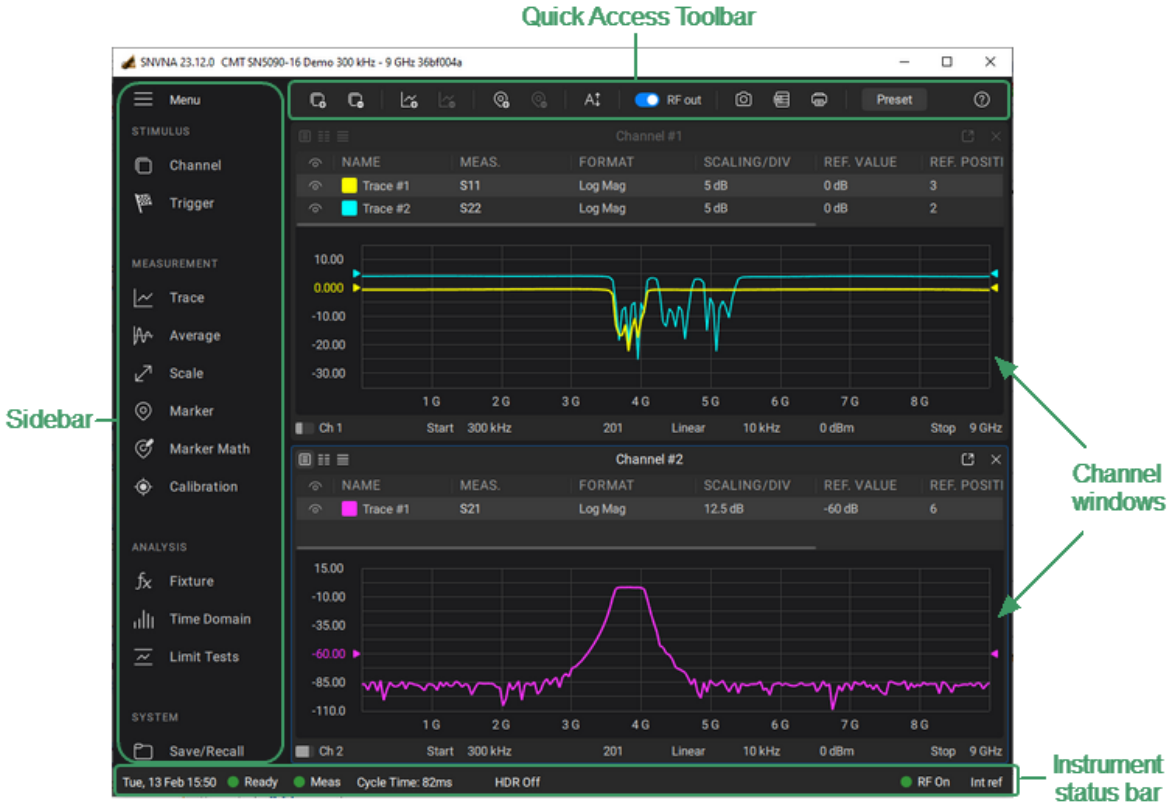
User Interface

The software is displayed as an Analyzer window on the PC screen. The Analyzer window contains:

- Sidebar and Quick Access Toolbar to control the Analyzer.
- Channel windows to display measurement results in the form of traces and numerical values.
- Instrument status bar to display information about the state of the Analyzer.

A detailed description of the software window elements is given further in this section.

An example of the Analyzer window, with the main elements highlighted, is shown in the figure below.

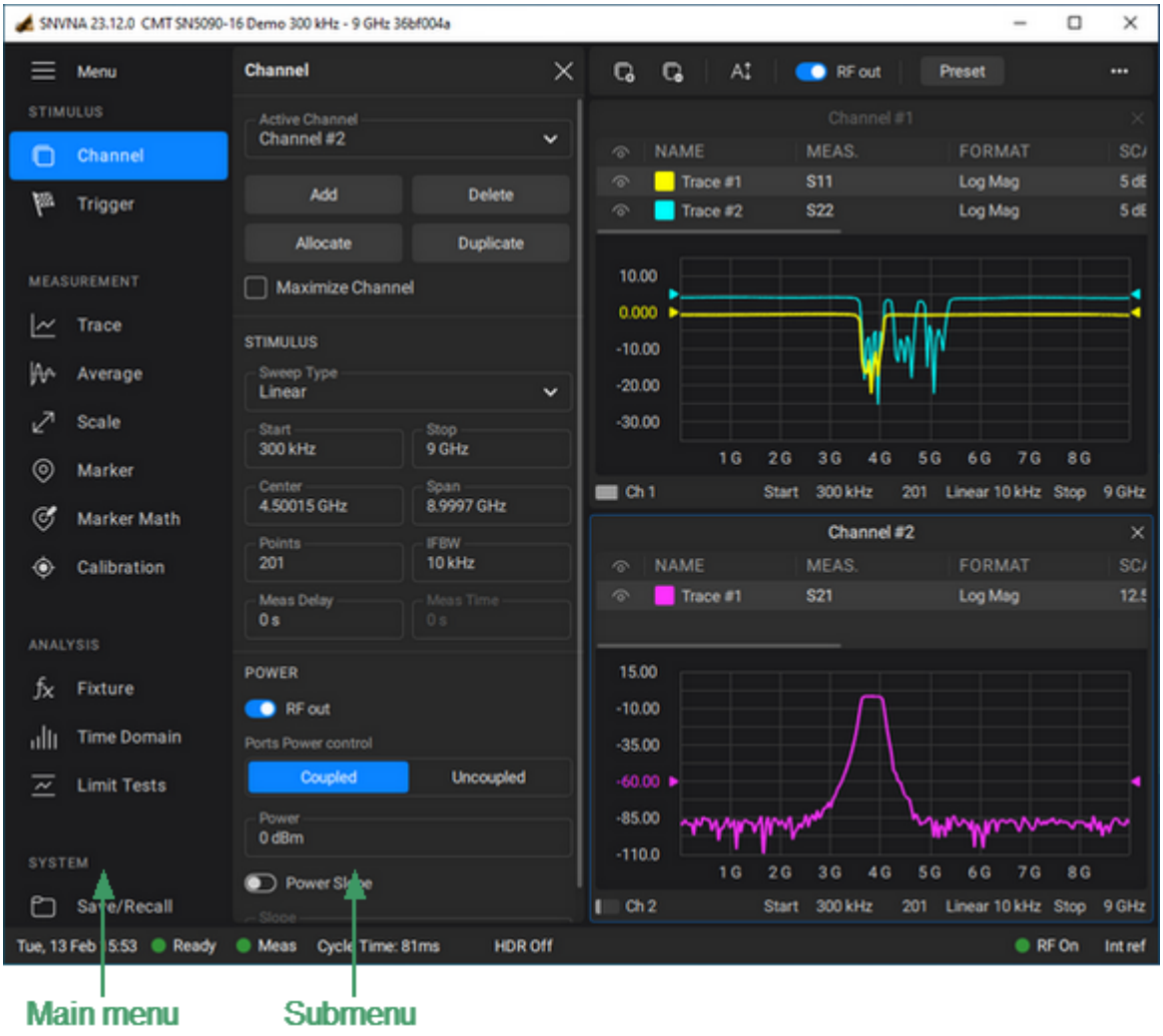


Analyzer Window

Sidebar

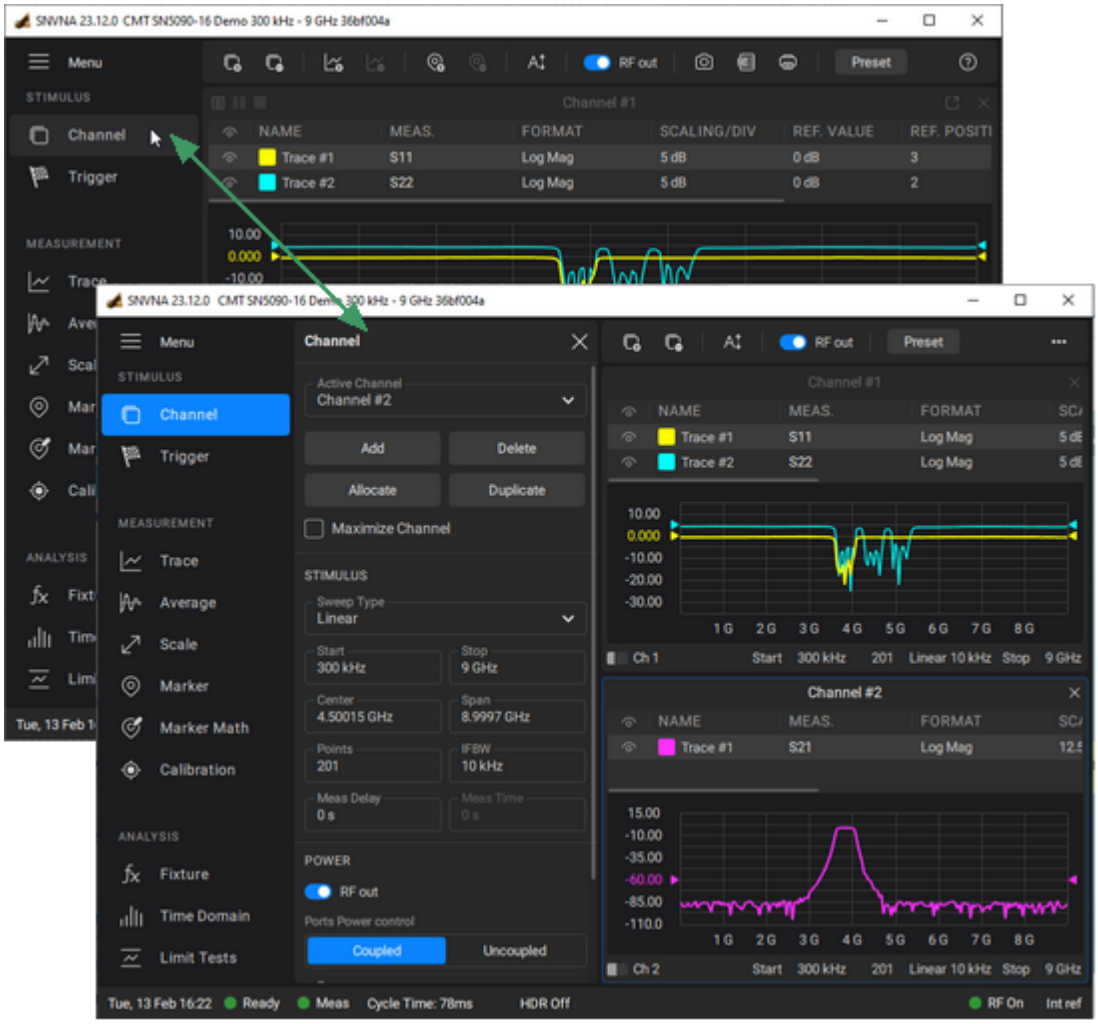
The sidebar is located along the left side of the Analyzer window and allows easy access to all software functions.

The sidebar consists of 2 levels: the main menu and the submenu (see figure below).



Sidebar

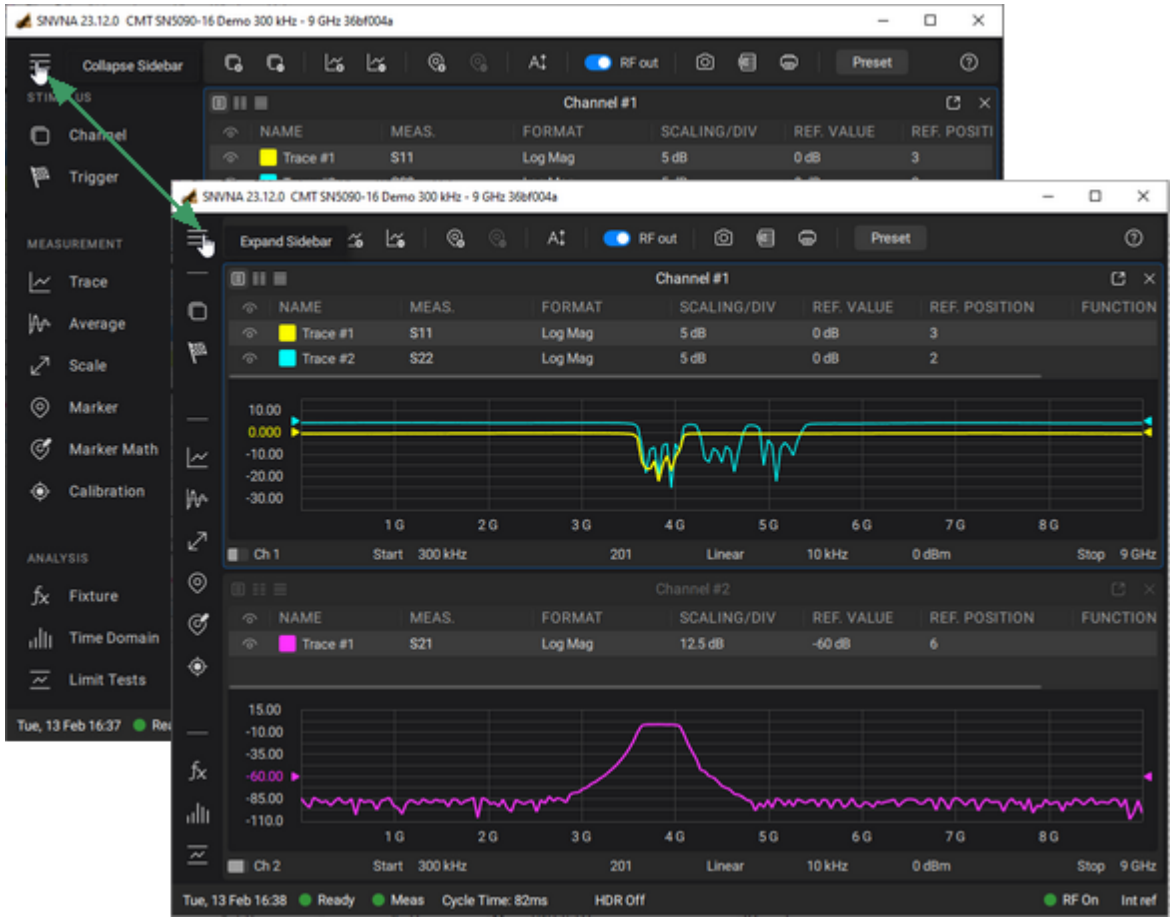
The main menu contains buttons corresponding to the functions of the Analyzer. Click on the function button in the main menu to expand or collapse its submenu (see figure below). By default, the submenu is hidden.



Example of the Expanded or Collapsed Sidebar

NOTE If necessary, the submenu can be closed by clicking the ✕ icon in the right upper corner of the submenu.

If necessary, the main menu can be expanded or collapsed. To do this, click on the icon located at the top of the main menu (see figure below).



Example of the Expanded or Collapsed Main Menu

NOTE	Collapse the main menu to increase the size of the channel windows.

Quick Access Toolbar

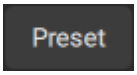
The quick access toolbar is located along the top of the Analyzer window and contains the buttons for the most frequently used functions (see figure below).



Quick Access Toolbar

Description of the buttons is given in the table below.

Button	Description
	Click on the button to add channel (corresponds to the **Add** button in Channel submenu, see Channel Allocation).
	Click on the button to remove active channel (corresponds to the **Delete** button in Channel submenu, see Channel Allocation).
	Click on the button to add trace (corresponds to the **Add Trace** button in Trace submenu, see Traces and Diagram Allocation).
	Click on the button to delete active trace (corresponds to the **Delete Trace** button in Trace submenu, see Traces and Diagram Allocation).
	Click on the button to add marker (corresponds to the **Add** button in Marker submenu, see Markers).
	Click on the button to delete the active marker (corresponds to the **Delete** button in Marker submenu, see Markers).
	Click on the button to define the trace scale automatically for all traces (corresponds to the **Autoscale All** button in Scale submenu, see Automatic Scaling).
	Click on the toggle to enable/disable the stimulus signal. Measurements cannot be performed while the stimulus is disabled (corresponds to the **RF out** toggle in Channel submenu. see RF Out Function).

Button	Description
	Click on the button to save charts as images (*.PNG or *.JPG file), see Graph Printing.
	Click on the button to save charts as document (*.DOCX file), see Graph Printing.
	Click on the button to open Print Wizard, see Graph Printing..
	Click on the button to reset the Analyzer to the initial condition (corresponds to the **Preset** button in Save/Recall submenu, see Analyzer Presetting).
	Click on the button to request information about the Analyzer (see About).

Channel Windows

The channel window displays the measurement results in the form of traces and numerical values. The screen can display up to 32 channel windows simultaneously. Each window corresponds to one channel. The Analyzer hardware processes channels sequentially.

In turn, each channel window can display up to 64 traces of measured parameters. If there is more than one trace in a channel window, the way they are displayed can be changed in the diagram (see Trace Layout in the Channel Window).

The general view of the channel window is represented in the figure below.



Channel Window

Each channel window contains a Channel title to be defined by the user, a Trace manager for displaying and changing to the name and parameters of the traces, a Diagram for displaying traces, as well as information about the channel status in the form of the Channel Status Bar. Use the Markers feature to display the measurement values at the indicated trace points.

Each window has the following parameters:

- Stimulus signal settings:
  - Frequency range
  - Number of Points
  - Sweep Type
  - Power level
- IF Bandwidth and average
- Calibration

Docking and Undocking Channel Windows

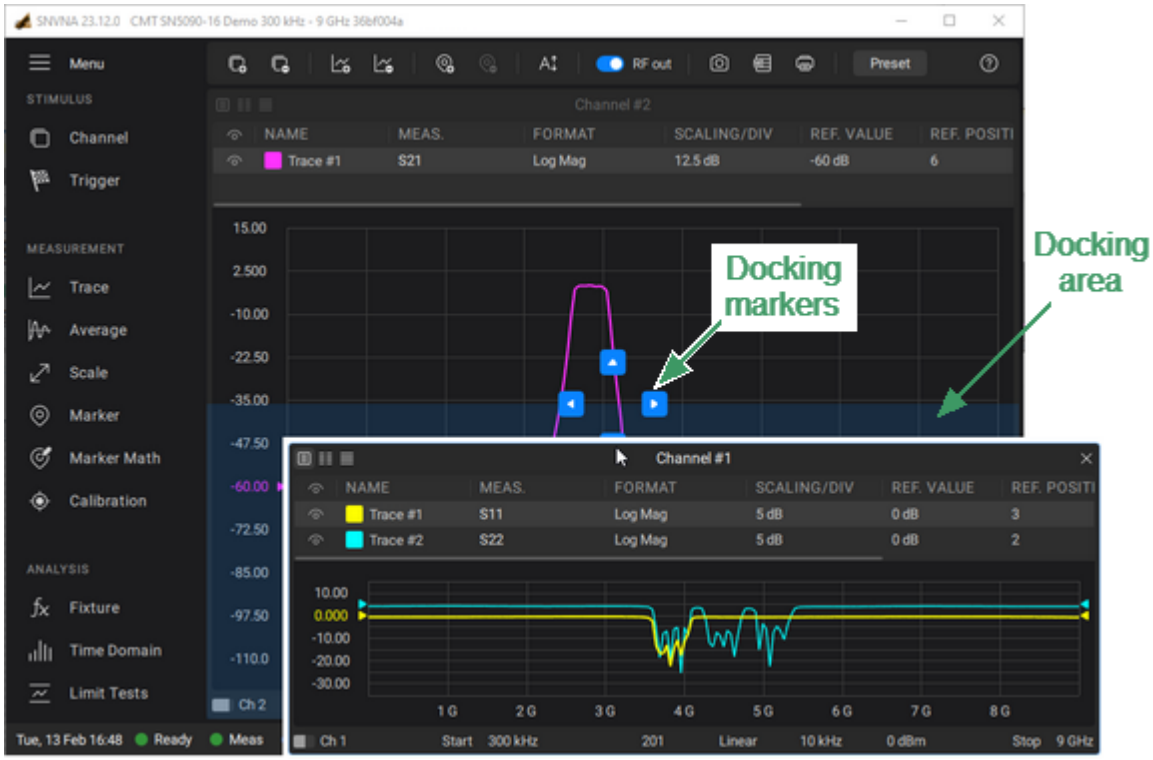
If there are more than one channels, the software allows the user to dock and undock channel windows in the Analyzer window or outside of it.

To undock the channel window, click the  icon in the right upper corner of the channel window (see figure below), or drag the channel window by the title bar outside of the Analyzer window.



Undocking of the Channel Window

To dock the channel window, grab the title bar of the channel window and drag the window to the right place. As soon as the channel window is above the available space, docking markers in the form of arrows will appear in the connection area (see figure below). Move the channel window to the docking marker and, after highlighting the connection area, release the window.



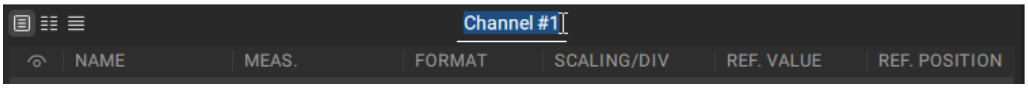
Docking of the Channel Window

Channel Title Bar

The channel title feature allows a comment to be entered for each channel window.

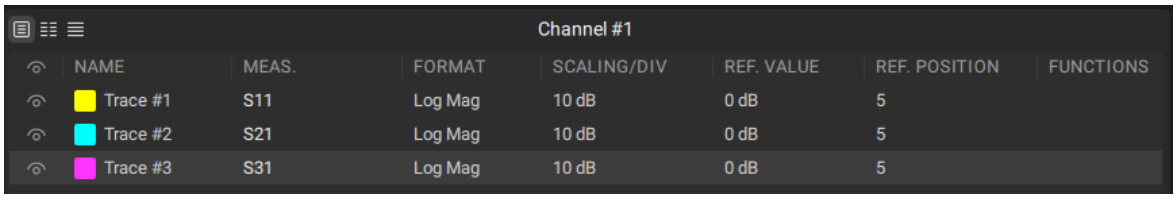
Editing the Channel Title

1. Double click on the heading name area at the top of the channel window and enter the heading text.

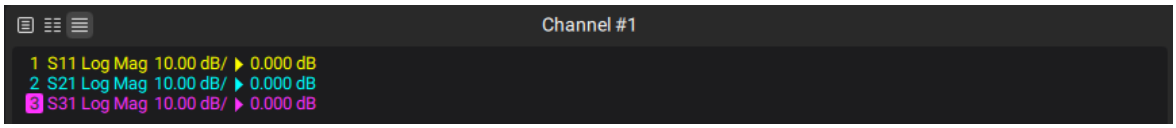


Trace Manager

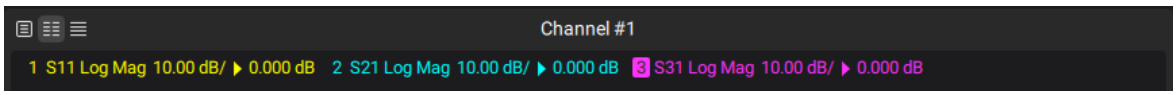
The trace manager displays the name and parameters of a trace. There are three ways to present the trace manager: tabular, column, and inline (see figure below). By default, the trace manager is displayed in the channel window as tabular.



Tabular View



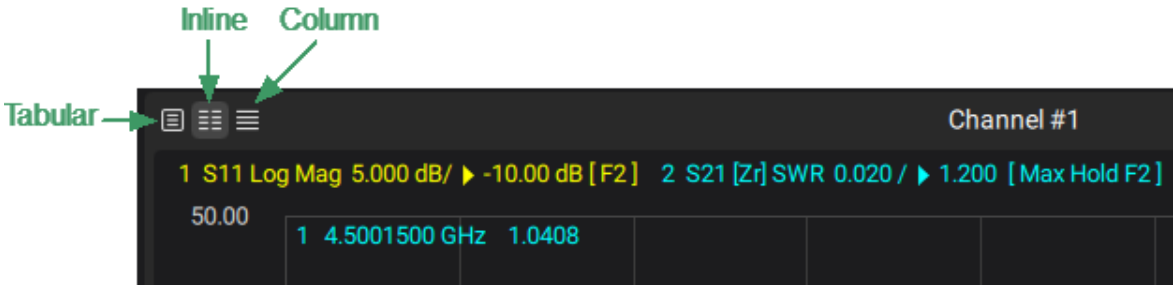
Column View



Inline View

Trace Manager

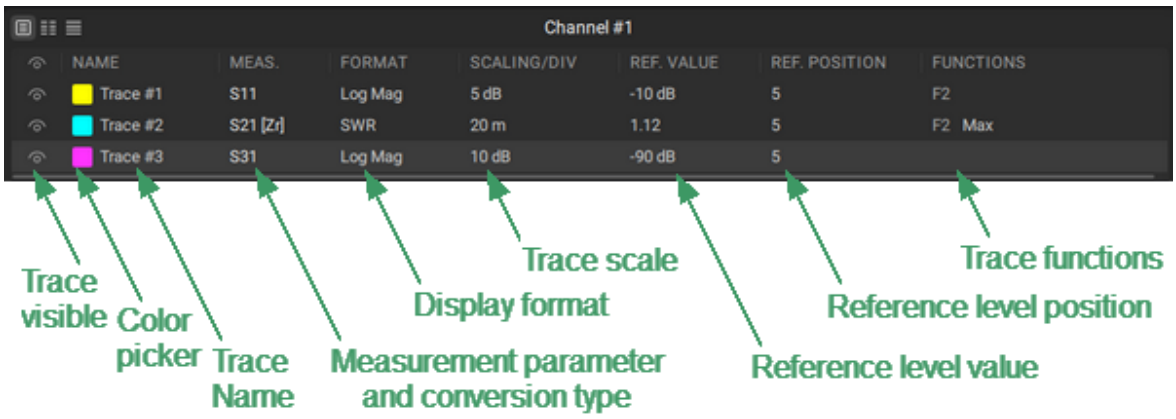
To switch between trace manager views, click on the required icon in the upper left corner of the channel window (see figure below).



Buttons for Switching of Trace Manager View

NOTE	With a large number of traces, use the tabular or inline view of trace manager to reduce the clutter of the channel window.

The number of rows in the trace manager depends on the number of traces in the channel. The trace manager is represented in the figure below.



Trace Status Field (Tabular View)

The trace manager allows the user to set the channel parameters quickly and easily. The operations described in this section help to adjust the most frequently used settings. The complete set of channel functions can be accessed via the sidebar.

Each line contains the data of one trace of the channel:

- Displaying a trace in a channel, where  indicates that the trace is visible, and  indicates that the trace is hidden. The field is only available in tabular view. For a detailed description of this setting, see Trace Visible.
- The color picker of data trace. The field is only available in tabular view. The color picker can be set using the trace manager or sidebar. For a detailed description of this setting, see Color Picker.
- The trace name from **1** to **64** (inline view), or the trace full name (tabular view). The active trace name is highlighted in an inverted color. For a detailed description of this setting, see Changing Trace Full Name.
- Measured parameter: **S11**, **S21**, ... **S1616**, or absolute power value: **T1(n)**, **T2(n)**, ..., **T16(n)**, **R1(n)**, **R2(n)**, ... **R16(n)**, or absolute power meter value: **P1**, **P2**,... **P16**. The conversion method is also displayed when measuring S-parameters (see table below). For a detailed description of the setting, see S-Parameters and Conversion Function.0

Status	Symbol	Definition
Conversion	**Zr**	Reflection impedance
	Zt	Transmission impedance

Status	Symbol	Definition
	Yr	Reflection admittance
	Yt	Transmission admittance
	1/S	S-parameter inversion
	Ztsh	Transmission-shunt impedance
	Ytsh	Transmission-shunt admittance
	Conj	Conjugation

- Display format, e.g. **Log Mag**. For a detailed description of the setting, see Format Setting.
- Trace scale in measurement units per scale division, e.g. **10.0 dB**. For a detailed description of the setting, see Rectangular Scale and Circular Scale.
- Reference level value, e.g. **0.00 dB**. For a detailed description of the setting, see Rectangular Scale.
- Reference level position (the parameter is only available in tabular view), e.g. **5**. For a detailed description of the setting, see Rectangular Scale.
- Trace functions (see table below). Trace functions is indicated as symbols in square brackets in line view of the trace manager.

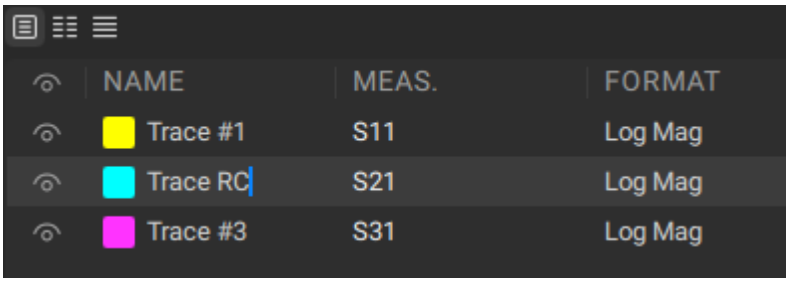
Function	Symbol	Definition
Error Correction	**RO**	OPEN response calibration
	RS	SHORT response calibration
	RT	THRU response calibration
	OP	One-path N-port calibration
	F1	Full one-port SOL calibration
	F2, F3, F4, F5, F6, F7, F8, F9, F10,	Full N-port SOLT calibration (N take a value from 2 to 6/8/10/12/14/16. N depending on the Analyzer model, see corresponding datasheet)

Function	Symbol	Definition
	F11, F12, F13, F14, F15, F16	
Other Calibrations	**RC**	Receiver calibration
	PC	Power calibration
Data Analysis	**Z0**	Port impedance conversion
	Dmb	Fixture de-embedding
	Emb	Fixture embedding
	Pxt	Port extension
Trace Display	No indication	Data trace memory does not exist
	Data & Memory	Data and memory traces
	Data	Data trace only, memory exists
	Memory	Memory trace
	Off	Data and memory traces OFF
Trace Hold	No indication	Trace hold OFF
	Max	Hold the maximum value
	Min	Hold the minimum value
Memory Buffer	No indication	Memory buffer OFF (One memory trace)
	FIFO: n/m	Memory trace n (m is queue depth)

Function	Symbol	Definition
Math Operations	No indication	Data trace memory does not exist
	Data/Mem	Data / Memory
	Data*Mem	Data * Memory
	Data+Mem	Data + Memory
	Data–Mem	Data – Memory
	Off	Math operation OFF
Electrical Delay	**Del**	Electrical delay other than zero
Smoothing	**Sm**	Trace smoothing
Gating	**Gat**	Time domain gating

Changing Trace Full Name Trace Manager

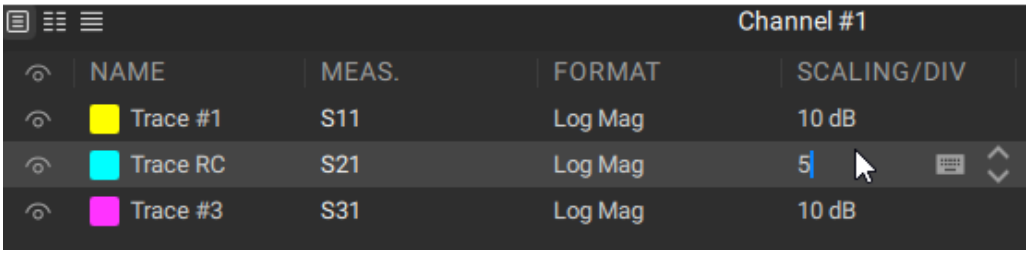
1. Switch trace manager in tabular view.
2. Click on the trace name field in the trace manager.
3. Enter a unique name of trace in the field.



Quick Trace Parameter Editing

1. Click on the required field in the trace manager.

2. Enter or select the required parameter value.

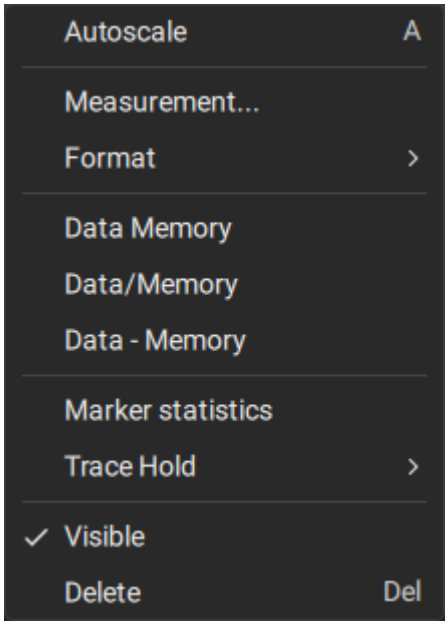


Quick Parameter Editing of Several Traces

Trace manager in tabular view allows the user to change parameters of several traces simultaneously. For example, you can assign the same format to all channel traces, or add memory traces to all traces at the same time.

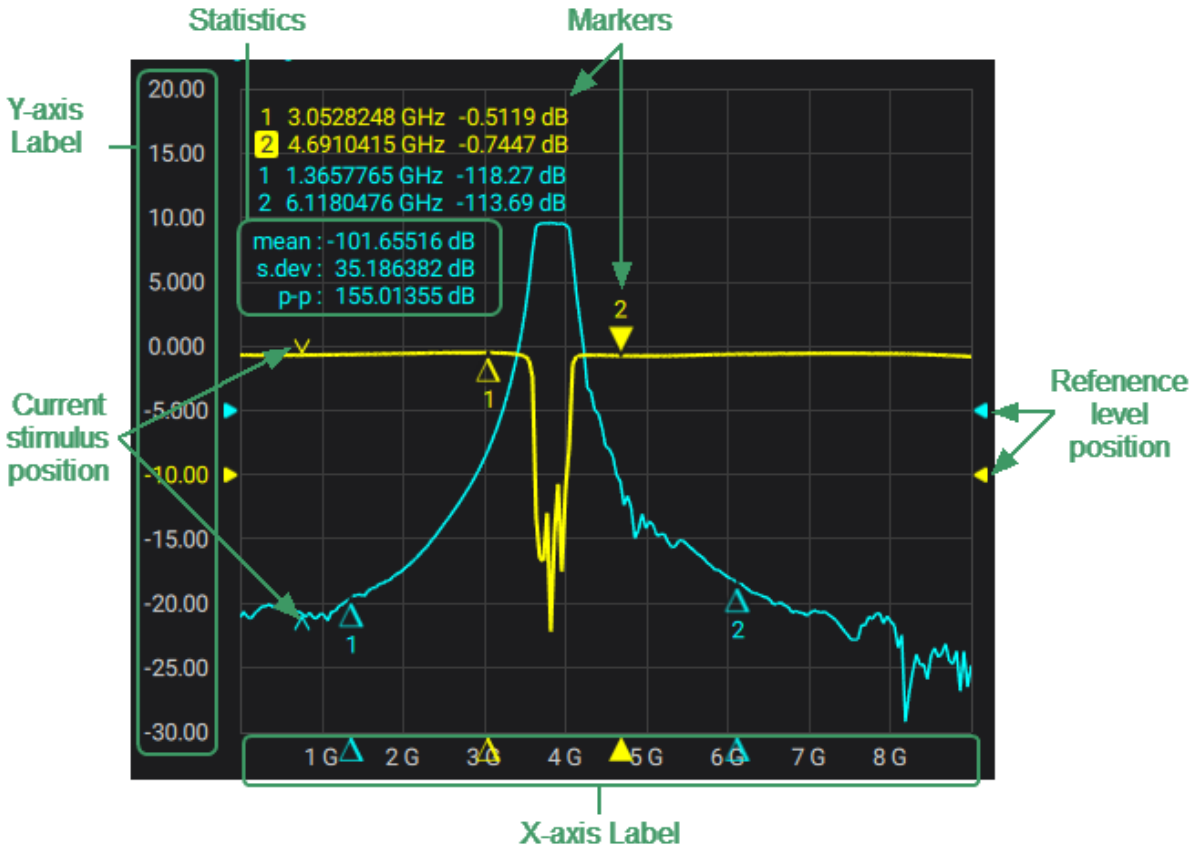
1. Click on the **CTRL** button on the keyboard and highlight the rows in the table.

2. Right-click on the selected rows and, in the pop-up window that opens, select the parameter to change (see figure below).



Diagram

The graph area in the channel window is called a diagram. The channel window can display up to 64 diagrams simultaneously. The diagram displays traces and numeric data.



Diagram

The diagram contains the following elements:

- **Y-axis label** (vertical graticule label) displays the vertical axis numeric data for the active trace. The data for all traces can be displayed or hidden to gain more screen space for the trace display.
- **X-axis label** (horizontal graticule label) displays stimulus axis numeric data (frequency, power level or time). X-axis label can be hidden to gain more screen space for the trace display.
- **Reference level position** indicates the reference level position of the trace.
- **Markers** indicates the measured values at points along the active trace. The markers for all traces can be simultaneously displayed.
- **Marker functions**: statistics, bandwidth, flatness, RF filter.

- **Current stimulus position** indicator appears when the sweep duration exceeds 1.5 sec.

For more information about placing diagrams in the channel window, see Traces and Diagram Allocation.

Trace Layout in the Channel Window

The traces can be rearranged if the number of the displayed traces is more than one. All the traces can be allocated to one diagram, or each trace can be displayed on an individual diagram (see figures below). For more information about placing traces and diagrams in the channel window, see Traces and Diagram Allocation.



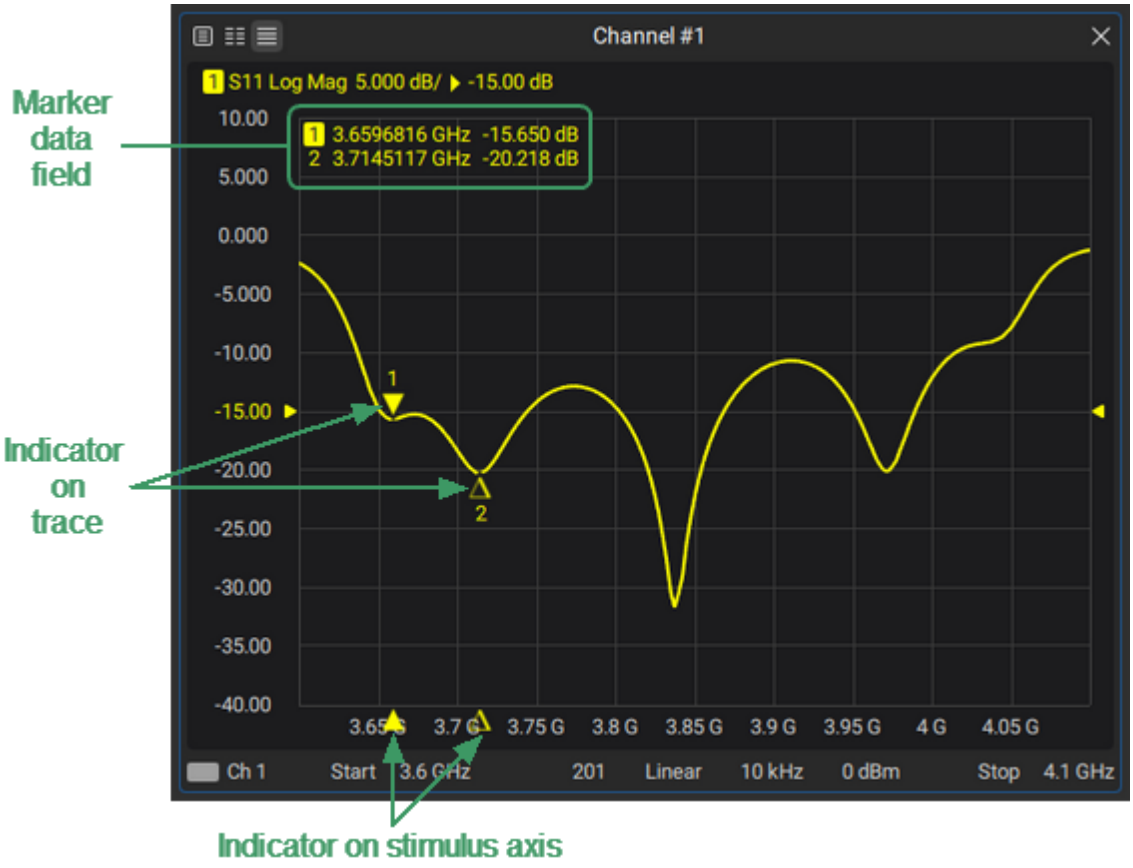
All Traces in One Diagram (Example)



Each Trace on an Individual Diagram (Example)

Markers

The markers indicate the stimulus values and the measured values at selected points of the trace (see figure below).



Markers

The markers are numbered from 1 to 64. The reference marker is indicated with an R symbol. The active marker is indicated in the following manners:

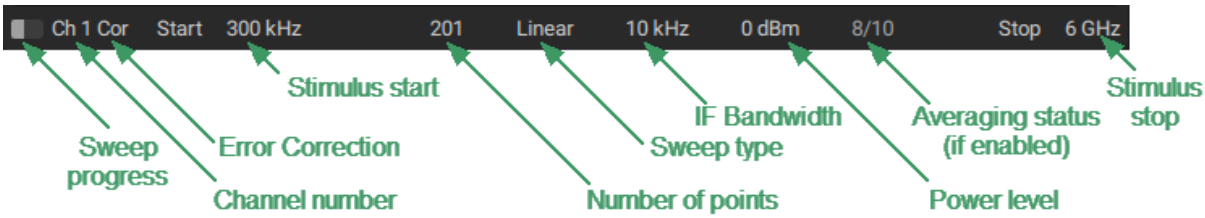
- Its number is highlighted with inverse color.
- The indicator on the trace is located above the trace.
- The indicator on the trace and stimulus indicator is fully colored.

NOTE The use of markers is described in Markers.

Channel Status Bar

The channel status bar is located in the bottom part of the channel window (see figure below).

The channel status bar displays information about stimulus signal settings and the IF bandwidth of the receivers.



Channel Status Bar

It contains the following elements:

- **Sweep progress** indicator displays a progress bar when the channel data is being updated.
- **Error correction** field displays the integrated status of error correction for S-parameter traces. The values of this field are represented in the table below. For a detailed description, see Error Correction Status.

Symbol	Definition
Cor	Error correction is enabled. The stimulus settings are the same for the measurement and the calibration.
C?	Error correction is enabled. The stimulus settings are not the same for the measurement and the calibration. Interpolation is applied.
C!	Error correction is enabled. The stimulus settings are not the same for the measurement and the calibration. Extrapolation is applied.
None	Error correction is turned off.
	No calibration data. No calibration was performed.

- **Stimulus start** field allows to display and enter the start frequency or power, depending on the sweep type. This field can be switched to indicate the stimulus center frequency; in this case, the word Start will change to Center. For a detailed description of stimulus setting, see Sweep Range.

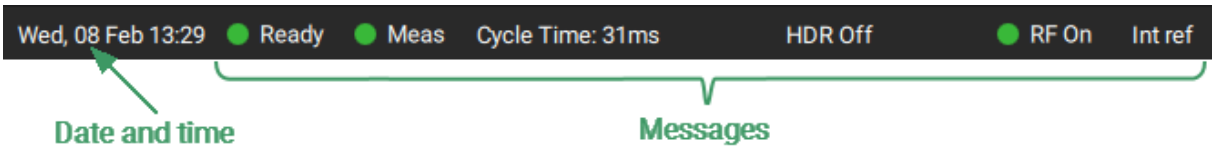
- **Number of Points** field allows to display and enter the number of sweep points. The number of points can be set from 2 to the instrument maximum. For a detailed description, see Number of Points.
- **Sweep type** field allows to display and select the sweep type. The values of this field are represented in the table below. For a detailed description, see Sweep Type.

Symbol	Definition
Linear	Linear frequency sweep.
Logarithm	Logarithmic frequency sweep.
Segment	Segment frequency sweep.
Power	Power sweep.

- **IF bandwidth** field allows to display and set the IF bandwidth. The values can be set from 1 Hz. For a detailed description, see IF Bandwidth Setting.
- **Power level** field allows to display and enter the port output power. In power sweep mode, the field switches to indicate the constant frequency of the source. For a detailed description, see Stimulus Power.
- **Averaging status** field displays the averaging status, if this function is enabled. The first number is the averaging current counter value, the second one is the averaging factor. For a detailed description, see Averaging Setting.
- **Stimulus stop** field allows to display and enter the stop frequency or power, depending on the sweep type. This field can be switched to indication of stimulus span; in this case, the word Stop will change to Span. For a detailed description of stimulus setting, see Sweep Range.

Instrument Status Bar

The instrument status bar is located at the bottom of the Analyzer window. The instrument status bar displays information about the state of the Analyzer.



Instrument Status Bar

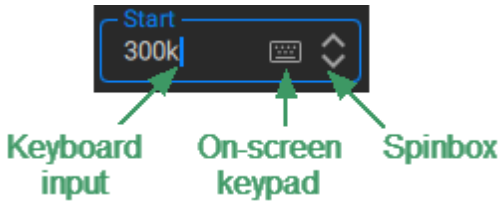
Messages in the Instrument Status Bar

Field Description	Message	Instrument Status	Note
DSP status	**Not Ready**	No communication between DSP and PC.	
	Loading	DSP firmware is loading.	
	Ready	DSP is running normally.	
Sweep status	**Meas**	A sweep is in progress.	For a detailed description, see Trigger Settings.
	Hold	A sweep is on hold.	
	Ext	Waiting for **External** trigger.	
	Man	Waiting for **Manual** trigger.	
	Bus	Waiting for **Bus** trigger.	
Cycle Time	**Cycle Time: XX**	Indication of measured cycle time.	For a detailed description, see Cycle Time.

Field Description	Message	Instrument Status	Note
Factory calibration error	**Factory Cal Failure**	Calibration data in ROM has an error. **THE ANALYZER IS DAMAGED AND REQUIRES FACTORY REPAIR.**	When placing a mouse pointer over the field, a pop-up message will appear with information about the errors.
High Dynamic Range	**HDR Off**	High Dynamic Range is turned OFF.	
RF signal	**RF Off**	Stimulus signal output is turned OFF.	For a detailed description, see RF Out Function.
	RF On	Stimulus signal output is turned ON.	
Reference source	**Ext Ref**	External reference frequency input (10 MHz) is turned on.	For a detailed description, see Reference Frequency Oscillator Selection.
	Int Ref	Internal reference frequency input (10 MHz) is turned on.	

Textbox Control

Textbox control is used for entering numerical values and units in the submenu, window etc. (see figure below).

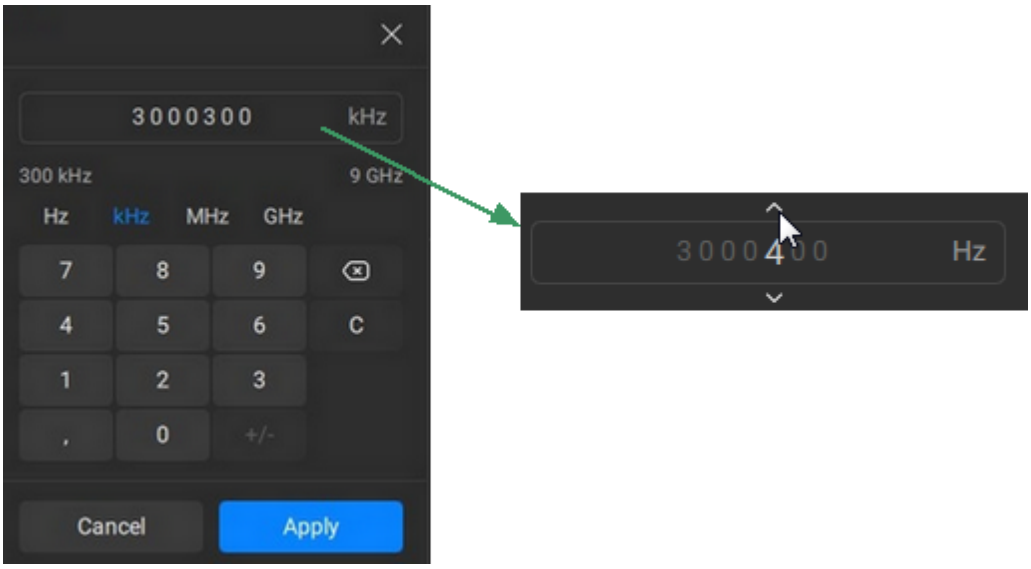


Textbox

Keyboard input is used for entering a numerical value and unit with the physical keyboard.

On-screen keypad is used for entering a numerical value and unit with a set of on-screen buttons (see figure below). To open on-screen keypad click on  icon in the textbox.

The on-screen keypad entry field also contains textbox. To change number in a digit position, click on it and use arrow-buttons (see figure below).



On-screen Keypad

On the right side of each textbox there is a spinbox ( icon) that you can use to quickly change the value.

Setting Measurement Conditions

This section describes how to set the various measurement conditions of the Analyzer.

Measurement procedure

To perform measurements, do the following according to each measurement task:

1. Set the required number of the channels, and their parameters. Set the required number of traces and their parameters for each channel. For a detailed description, see Channel and Trace Setting.

2. Set the stimulus signal parameters for each channel. For a detailed description, see Stimulus Settings.

3. Assign the measured parameters display format and scale to the traces. For a detailed description, see Measurement Parameters Settings, Format Setting, and Scale Settings.

4. If necessary, set the related trigger settings to synchronize measurements with any events. For a detailed description, see Trigger Settings.

5. Set the optimization parameters to improve the signal to noise ratio. For a detailed description, see Measurement Optimization.

Channel and Trace Setting

The Analyzer supports 32 channels, each of which allows measurements with individualized stimulus parameter settings. The parameters related to a channel are listed in the table below.

Channel Parameters

N	Parameter Description
1	Sweep Type
2	Sweep Range
3	Number of Points
4	Stimulus Power Level
5	Power Slope Feature
6	Constant Frequency
7	Segment Sweep Table
8	Trigger Mode
9	IF Bandwidth
10	Averaging
11	Calibration
12	Fixture Simulator
13	General S-Parameter Conversion

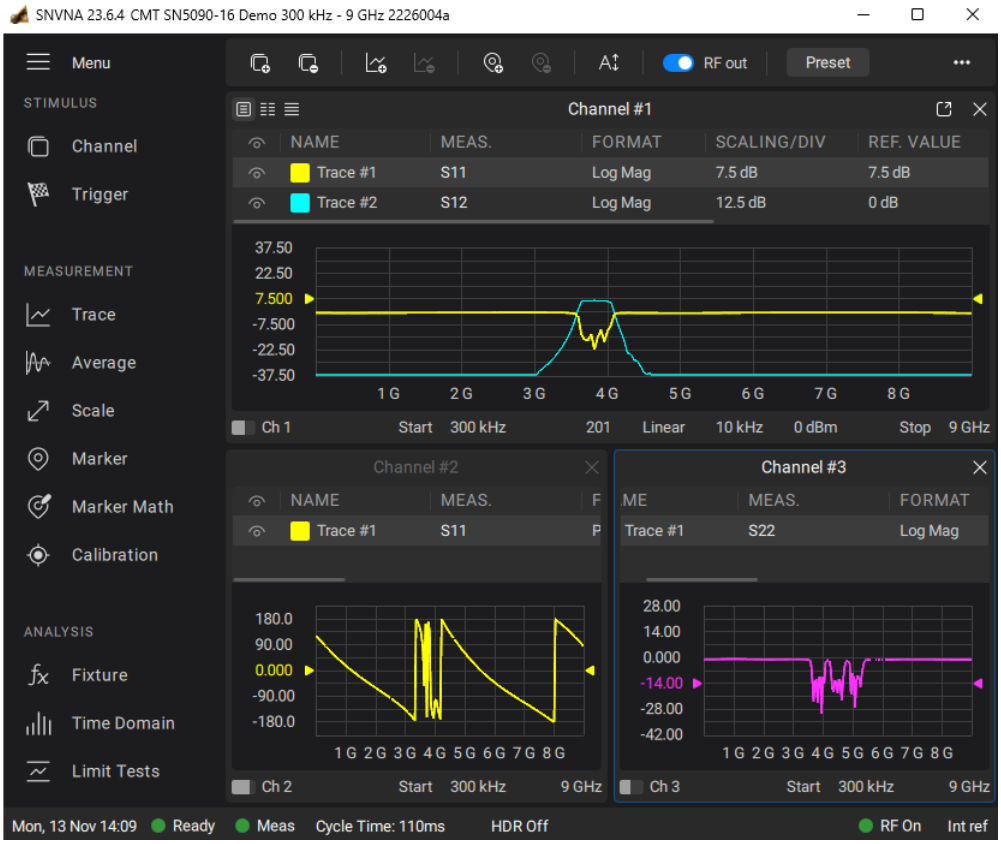
Each channel window can contain up to 64 different traces. Each trace is assigned a measured parameter (S-parameter), display format, and other parameters. The related trace parameters are listed in the table below.

Trace Parameters

N	Parameter Description
1	Measured Parameter and Parameter Transformation
2	Display Format
3	Scale Settings
4	Electrical Delay, Phase Offset
5	Memory Trace, Math Operation
6	Smoothing
7	Markers
8	Time Domain
9	Limit Test
10	Ripple Limit Test
11	Peak Limits Test

Channel Allocation

A channel is represented on the screen as an individual channel window. By default, only one channel window opens. The screen can display up to 32 channel windows simultaneously.



An Example of Using Several Channel Windows

Channels can be added, duplicated with all settings, or deleted (see description below). If there are several channels in the Analyzer window, activate the channel before setting channel parameters or performing calibration.

By default, the channel is called **Channel #n**, where **n** is the channel number. If necessary, the channel name can be changed (see Channel Title Bar).

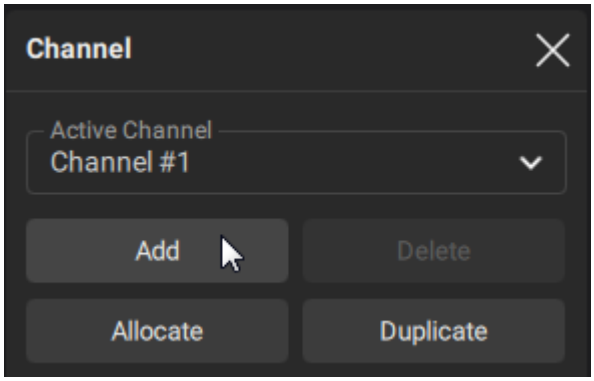
The channel windows do not overlap each other in the Analyzer window. If necessary, the channel window can be docked and undocked on the Analyzer window, as well as outside of it (see Dock and undock channel windows).

The measurements are executed for open channel windows sequentially. Measurements for any hidden channel windows are not performed.

Adding Channel

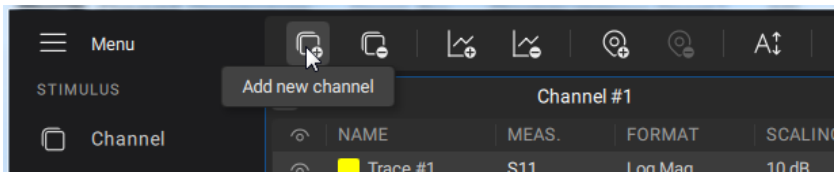
The new channel name is **Channel #n**, where **n** is the largest of all existing channel numbers plus one. If necessary, the channel title can be changed (see Channel Title Bar).

1. Click on the **Channel > Add** buttons in the sidebar.



NOTE

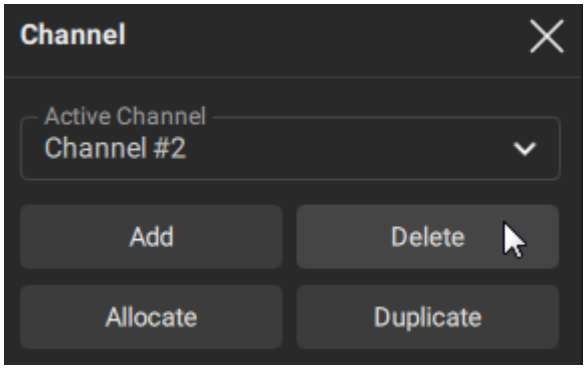
You can quickly add channels with the help of the Quick Access Toolbar:



Deleting Channel

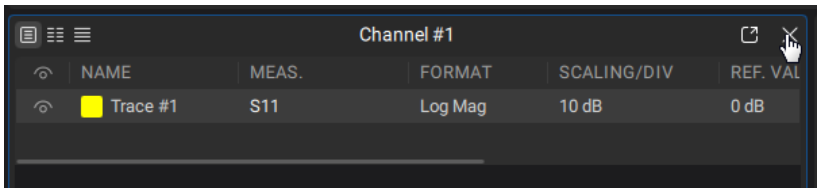
1. Select the channel (see Selection of Active Trace, Diagram, Channel).

2. Click on the **Channel > Delete** buttons in the sidebar.

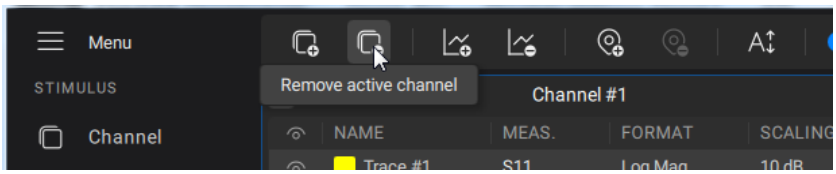


NOTE

You can quickly delete channel by clicking the icon in the upper right corner of the channel window:



Also, you can quickly delete channel with the help of the Quick Access Toolbar:



Channel Duplication

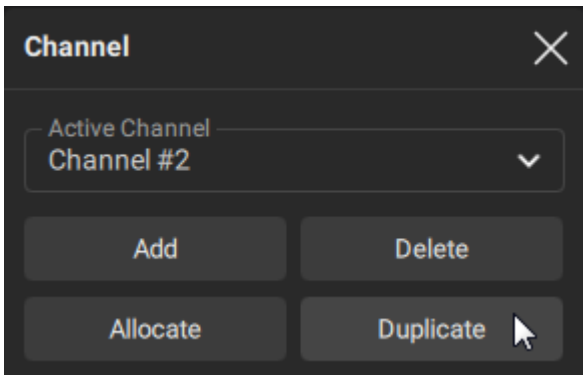
This function copies the channel with all its settings (including calibration).

The new channel name is **Channel #m**, where **m** is the largest of all existing channel numbers plus one. If necessary, the channel title can be changed (see Channel Title Bar).

---

1. Select the channel (see Selection of Active Trace, Diagram, Channel).

2. Click on the **Channel > Duplicate** buttons in the sidebar.

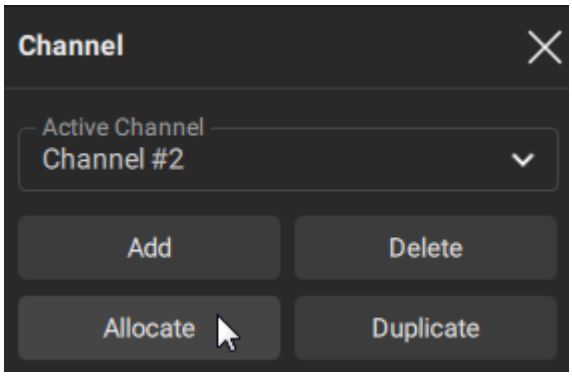


Channel Allocation

This function places the required number of channels onto the Analyzer window.

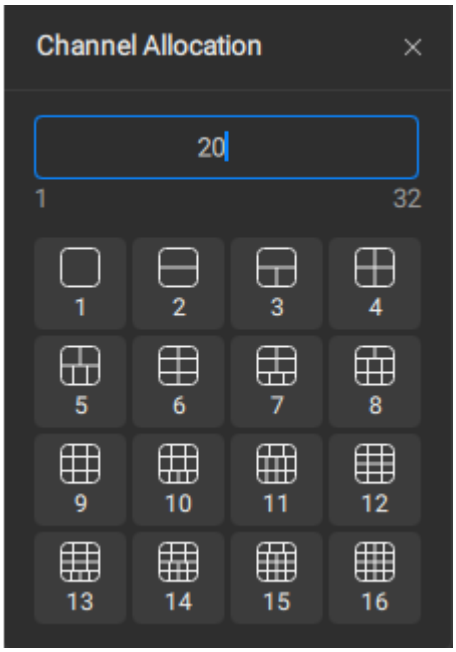
---

1. Click on the **Channel > Allocate** buttons in the sidebar.



2. Enter the required number of channel windows in the textbox in the **Channel Allocation** pop-up window.

If the number of channel windows does not exceed more than 16, you can choose one of the layouts shown below the textbox.



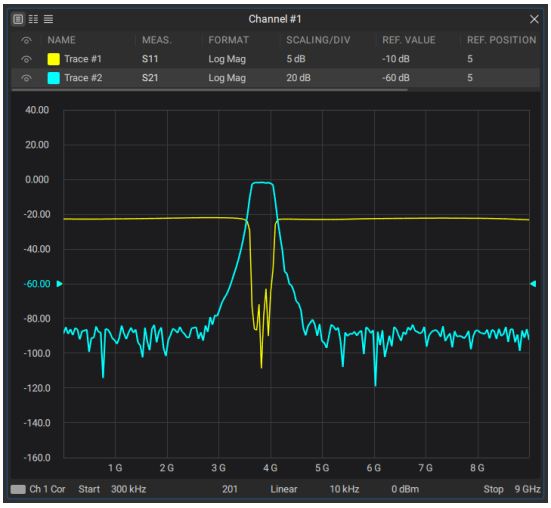
SCPI DISPlay:SPLit

NOTE For each open channel window, set the stimulus parameters, adjust other settings, and perform calibration. For a detailed description, see Stimulus Settings.

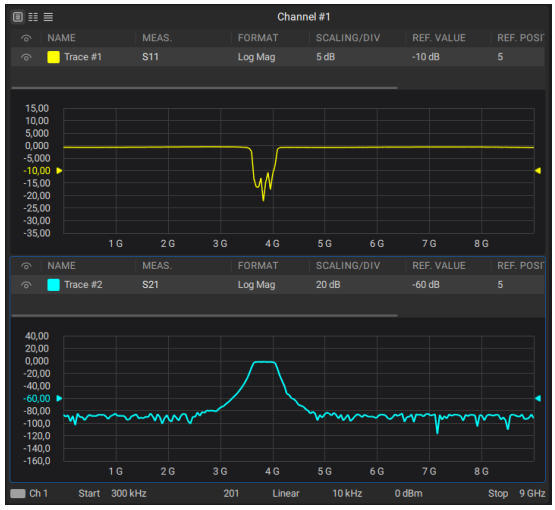
Traces and Diagram Allocation

Each channel window can contain up to 64 different traces. Traces can be displayed in one diagram, overlapping each other, or in separate diagrams within a channel window (see figures below). Each trace can be placed into a separate diagram.

By default, the channel window contains one diagram with one trace.



Displaying Two Traces on the Same Diagram



Displaying Two Traces on Two Different Diagrams

Unlike channel windows, the number of traces and layout of the trace in diagrams are not related. The number of traces and the number of diagrams are set independently.

All traces are assigned an individual number which cannot be changed.

Each trace is assigned the following initial settings: name, measured parameter, format, scale, and color, which can be modified:

- By default, the display trace name is as follows: **Trace #n**, where **n** is a number of the trace. If necessary, the channel name can be changed in tabular view of trace manager, see Editing the Trace Name.
- The measured parameters are set in the following succession: **S11, S21...S1616**. For a detailed description of changing measured parameter, see S Parameter.
- By default, the display format for all traces is set to logarithmic magnitude (dB). For a detailed description of changing display format, see Format Setting.
- By default, the scale parameters are set as follows: division is set to 10 dB, reference level value is set to 0 dB, and the reference level position is in the

middle of the diagram. For a detailed description of changing scale parameters, see Scale Settings.

- The trace color is determined by its number. This color can be changed. For a detailed description of changing color, see Color Picker of Trace.

If two or more traces and diagrams need to be enabled, the number of traces and diagrams can be set as described below.

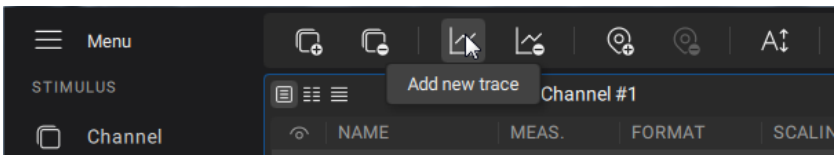
NOTE The full cycle of the trace update depends on the set of measured S-parameters and the type of calibration. For example, a full cycle may include one sweep of port 1 as the signal source (when measuring S11). When measuring two traces S11, S22, two successive sweeps are performed. To measure the full matrix of S-parameters of the four-terminal network, four successive sweeps will be performed. When using a full 4-port calibration (SOLT), regardless of the number of traces and measured S-parameters, four successive sweeps are also performed. When using full n-port calibration (SOLT), regardless of the number of traces and measured S-parameters, n successive sweeps are also performed.

Adding Trace

1. Activate channel and diagram (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Trace > Add Trace** buttons in the sidebar.

SCPI CALCulate:PARameter:COUNt

NOTE You can quickly add a trace with the help of the Quick Access Toolbar:

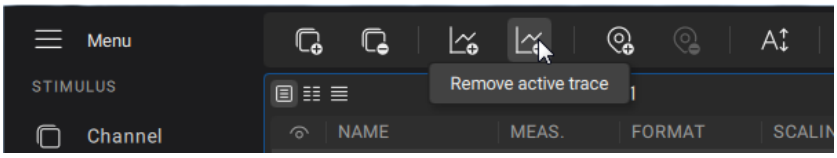


Deleting Trace

1. Select the trace (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Trace > Delete Trace** buttons in the sidebar.

SCPI CALCulate:PARameter:COUNt

NOTE You can quickly delete a trace with the help of the Quick Access Toolbar:



Adding Diagram

The new diagram is added last in the channel and contains one trace.

1. Select the channel (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Trace > Add Diagram** buttons in the sidebar.

Deleting Diagram

When a diagram is deleted, all its traces are transferred to the diagram of the first diagram.

1. Select the channel (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Trace > Delete Diagram** buttons in the sidebar.

Diagram Allocation

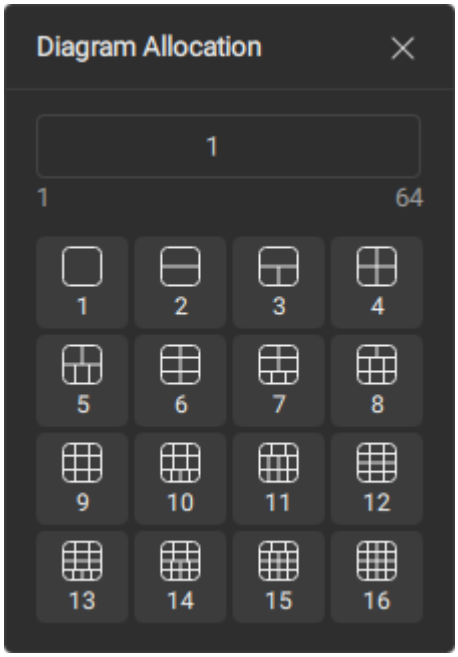
The function places the required number of diagrams in the channel.

---

1. Click on the **Trace > Allocate** buttons in the sidebar. **Diagram Allocation** dialog will open.

2. Enter the required number of diagrams in the textbox in **Diagram Allocation** pop-up window.

   If the number of diagrams does not exceed 16, you can choose one of the layouts below the textbox.



SCPI DISPlay:WINDow:SPLit

Splitting Trace in Diagrams

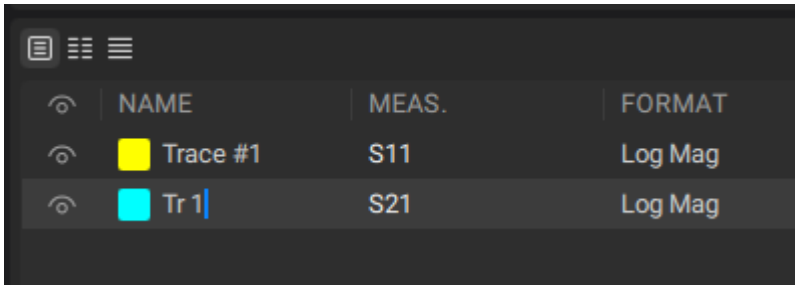
The function evenly splits all traces in the diagrams.

If the number of traces is greater than the number of diagrams, traces will be assigned successively (beginning from the smallest trace number) to the number of available diagrams. When all diagrams are utilized, the process will continue from the first diagram (the following in succession traces will be added in diagrams).

1. Click on the **Trace > Split All** buttons in the sidebar.

Editing the Trace Name

1. Switch trace manager in tabular view.
2. Double click on the name of the required trace and enter the text.



Trace Visible

The function shows or hides a trace in the channel.

1. Setting trace visibility via the sidebar:
   - Select the trace (see Selection of Active Trace, Diagram, Channel).
   - Click on the **Trace** button in the main menu.
   - Select or clear the **Trace visible** checkbox in the submenu.

   Setting trace visibility via a trace manager:
   - Click on the icon  of the desired trace in the trace manager (tabular view only).

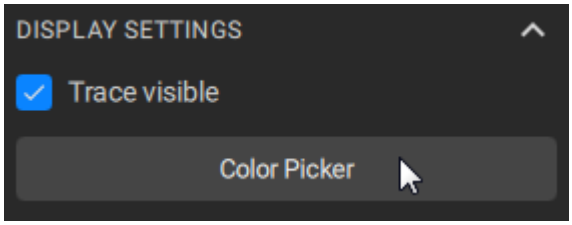
Color Picker of Trace

The color of traces can be customized if necessary.

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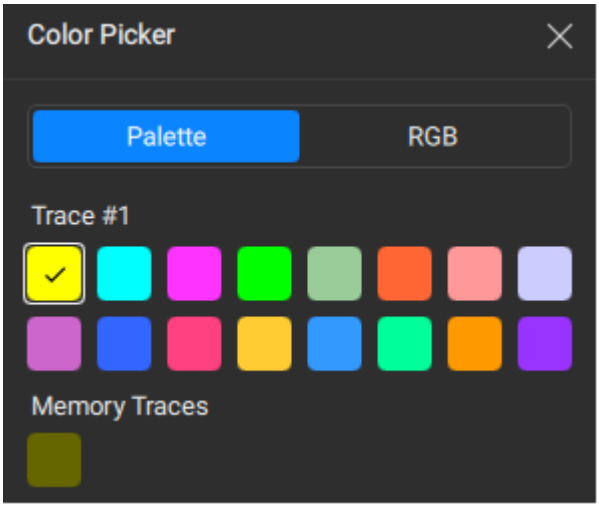
1. Setting color via a sidebar:

   - Select the trace (see Selection of Active Trace, Diagram, Channel).
   - Click on the **Trace** button in the main menu.
   - Click on the **Color Picker** button in the submenu.

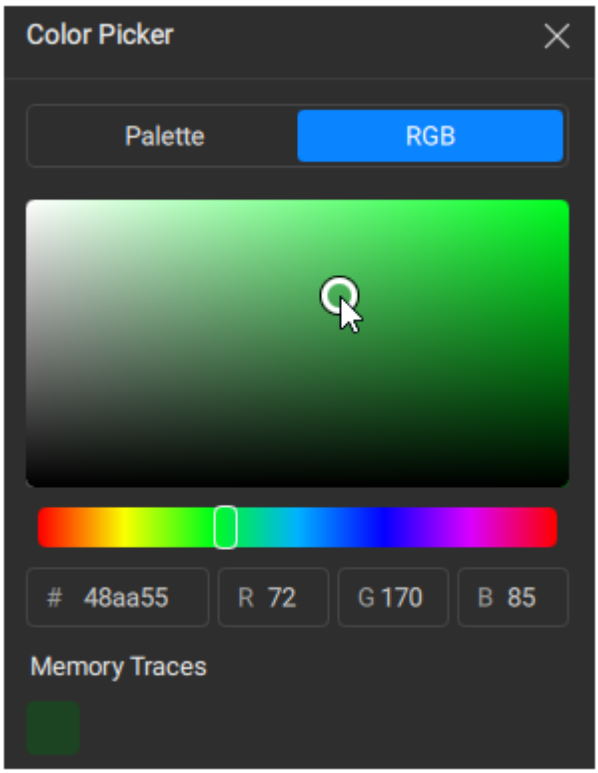


   - Select the color of the data trace in the pop-up window using either a standard palette or an RGB wheel:

     1. To use a standard palette, click on the **Palette** segment switch button and select the color between the suggested set of 16 standard colors.



     2. To use an RGB wheel, click on the **RGB** segment switch button and either use your mouse pointer to select a color from the color wheel or enter the rate or color components (from 0 to 255) in the textboxes **#**, **R**, **G** and **B.**

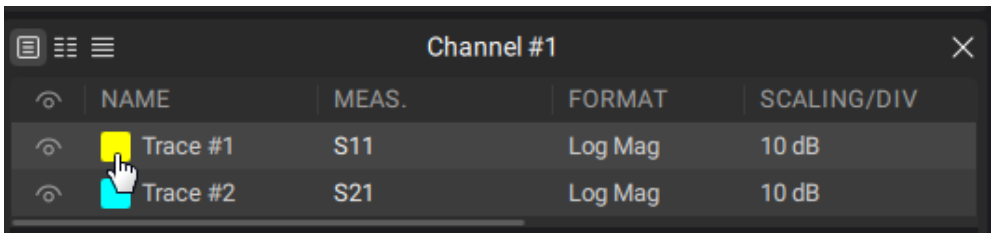


NOTE When switching between the Palette and RGB segment switch buttons, the program displays the trace in a color that was last selected on these tabs.

NOTE The color of the memory trace is displayed at the bottom of the pop-up window.

Setting color via a trace manager:

- Click on the corresponding icon  in the trace manager.



- Select the color of the data trace in the pop-up window using either a standard palette or an RGB wheel (as describe above).

SCPI DISPlay:COLor:TRACe:DATA

Selection of Active Trace, Diagram, Channel

The selected control commands are applied to the active channel or trace respectively. If there are several diagrams in a channel, the active diagram must be selected.

The boundary line of the active channel window or active diagram is highlighted in blue. The active trace belongs to the active channel, and its title is highlighted in an inverse color.

Activate the channel/diagram/trace before setting the parameters of or deleting that channel/diagram/trace.

Selection of Active Channel

The active channel can be selected if the Analyzer window contains two or more channels.

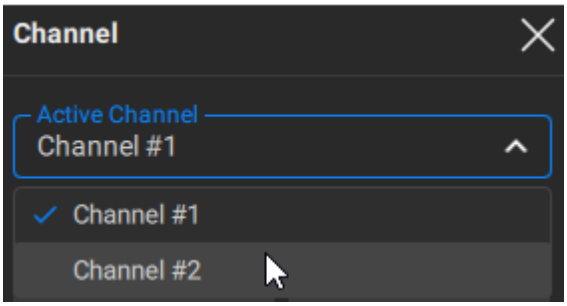
The boundary line of the active channel window is highlighted in blue.



Active Channel

1. Click the **Channel** button in the main menu.

2. Click on the **Active channel** drop-down list in the submenu and select the required channel from the list.



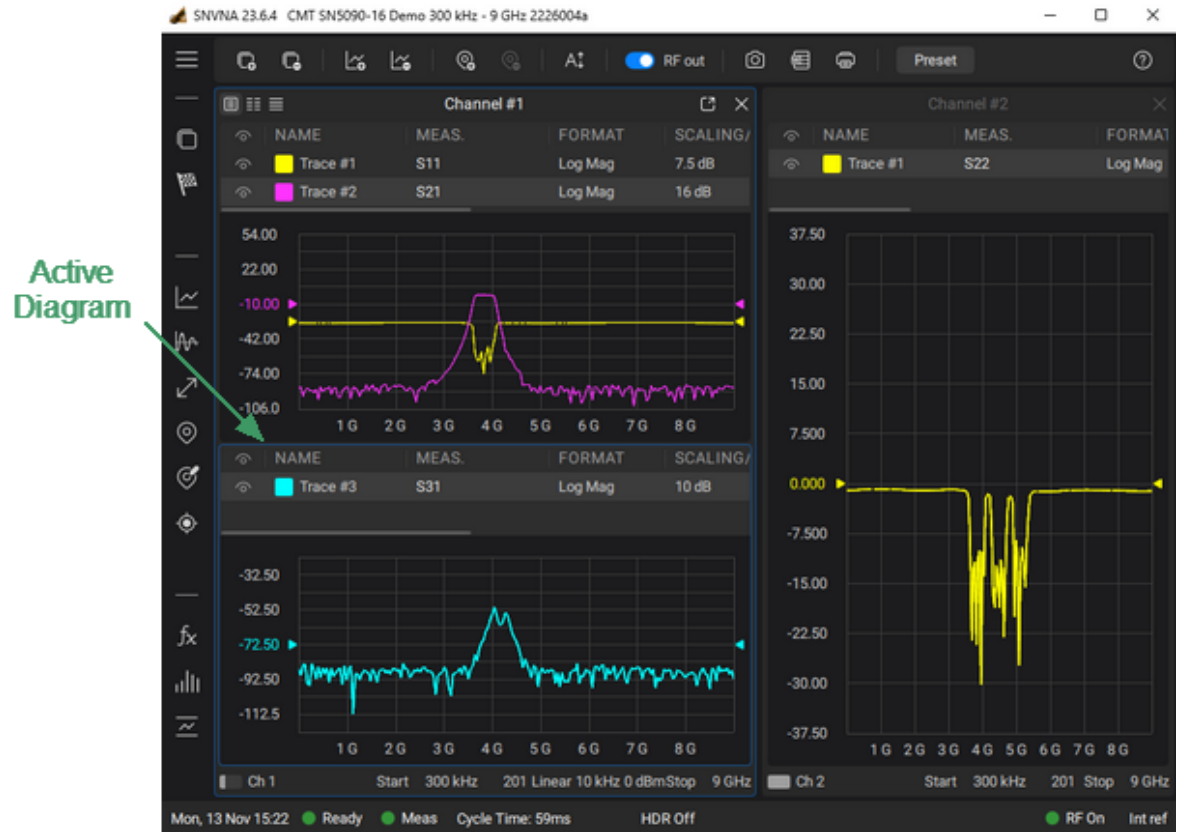
SCPI DISPlay:WINDow:ACTivate

NOTE You can quickly activate the channel by clicking on it in the channel window.

Selection of Active Diagram

The active diagram can be selected if the active channel window contains two or more diagrams simply by clicking on the diagram in the channel window.

The boundary line of the active diagram is highlighted in blue.



Active Diagram

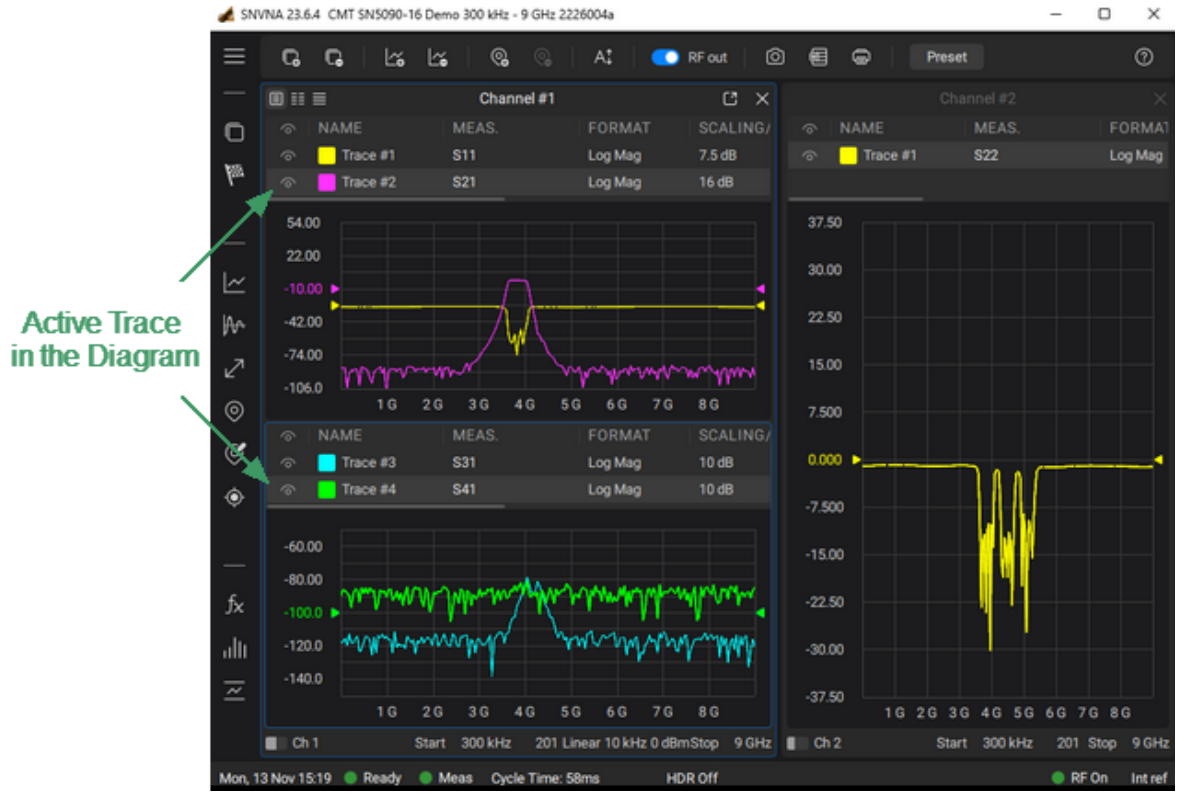
1	Click on the desired diagram in the channel window.

NOTE	The diagram is activated automatically when the active trace is selected in it.

Selection of Active Trace

The active trace can be selected if the active channel window contains two or more traces.

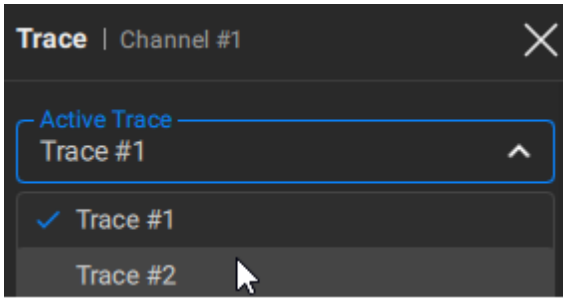
The active trace is highlighted in a trace manager.



Active Trace

1. Click the **Trace** button in the main menu.

2. Click on the **Active Trace** drop-down list in the submenu and select the required trace from the list.



SCPI CALCulate:PARameter:SELect

NOTE You can quickly activate the trace by clicking on it in the trace manager, or on any item (trace, marker) having the same color.

Trace/Channel Window Maximizing

When there are several channel windows displayed, the desired channel window can be temporarily maximized to full-screen size by double-clicking on it. The other channel windows will not be visible, but this will not interrupt measurements in those channels.

Similarly, when there are several traces displayed in a channel window, the desired trace can be temporarily maximized to full-screen size by double-clicking on it. The other traces will not be visible, but this will not interrupt measurements of those traces.

The figure below shows an example of first enlarging the channel and then enlarging the trace within the channel, and then returning to the initial state.



Active Channel/Trace Window Maximizing

NOTE

If undocking channels is done in the software, then maximizing of the channels windows area by the user will not affect the undocking chanells area, and vice versa, maximizing by the user of undocking channels area will not affect the channels windows area.

NOTE

Channel maximizing is disabled when a channel is added, removed, or undocked, and when channels are allocated.

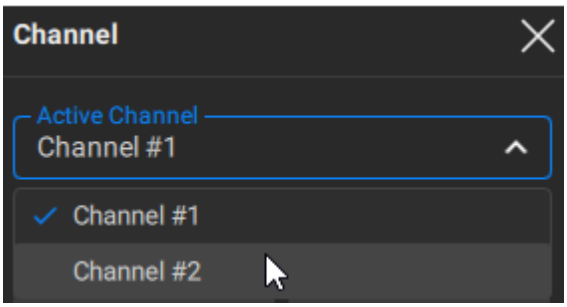
Maximizing of traces in the active channel is disabled if a trace is added or removed and when allocating traces, or when starting a measuring calibration step.

Channel Window Maximizing

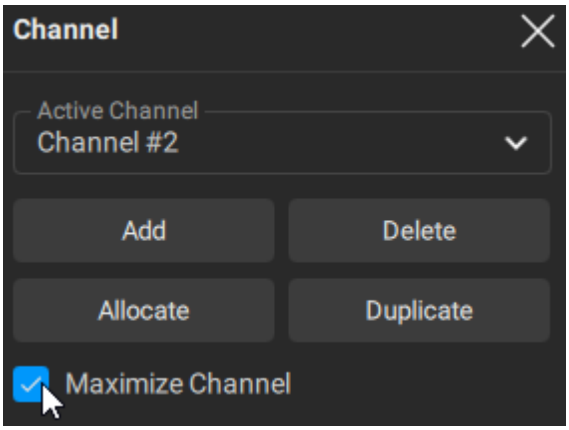
The function is available if there is more than one channel.

1. Click the **Channel** button in the main menu.

2. Click on the **Active channel** drop-down list in the submenu and select the required channel from the list.



3. Select the **Maximize Channel** checkbox in the submenu.



SCPI DISP:MAX

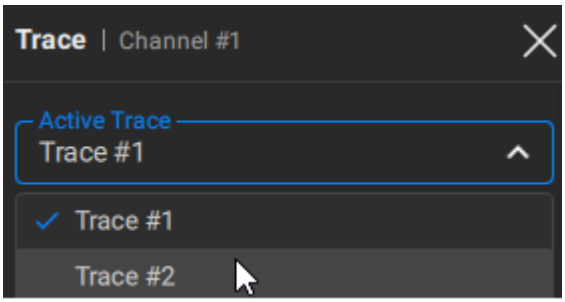
NOTE You can also maximize the channel by double-clicking on the desired channel window (see figure above).

Trace Maximizing

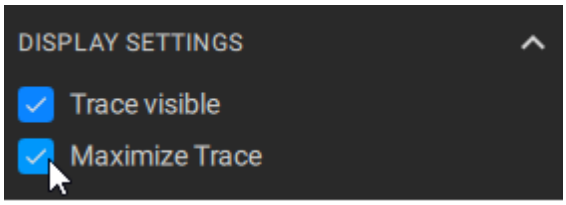
The function is available if there is more than one trace in the active channel window.

1. Click the **Trace** button in the main menu.

2. Click on the **Active Trace** drop-down list in the submenu and select the required trace from the list.



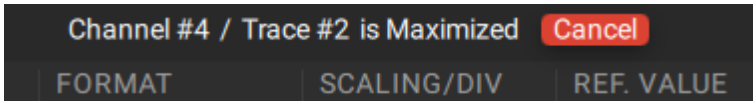
3. Select the **Maximize Trace** checkbox in the submenu.



SCPI DISP:WIND:MAX

NOTE You can also maximize the trace by double-clicking on the desired trace in the channel window (see figure above).

NOTE When switching to the the trace or channel window maximizing mode, the corresponding mode status next to the Channel title is displayed: Channel # is Maximized or Trace # is Maximized. To exit the trace or channel window maximizing mode, click on the **Cancel** button in the Channel title.



Stimulus Settings

This section describes how to set the stimulus signal parameters.

The stimulus is a signal with a known amplitude and phase, fed by the Analyzer to the device under test.

The stimulus parameter settings are applied to each channel. The channel must be activated before setting the stimulus parameters (see Selection of Active Channel).

NOTE To maximize measurement accuracy, perform measurements with the same stimulus settings as were used for calibration.

Sweep Type

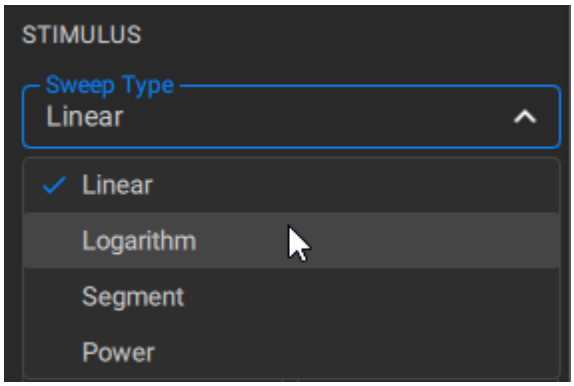
The sweep type determines how the stimulus range is scanned:

- By frequency (linear frequency sweeps, logarithmic frequency sweeps or segment sweep mode).
- By power (linear power sweep).
- By time when the stimulus frequency is fixed (see CW Time Sweep Mode).

The set sweep type is displayed in the channel status bar (see figure below).

Setting Sweep Type

1. Select the channel (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Channel** button in the main menu.
3. Click on the desired sweep type in the **Sweep Type** drop-down list in the submenu (see figure above):
   - **Linear** — Linear frequency sweep
   - **Logarithm** — Logarithmic frequency sweep
   - **Segment** — Segment frequency sweep
   - **Power** — Power sweep

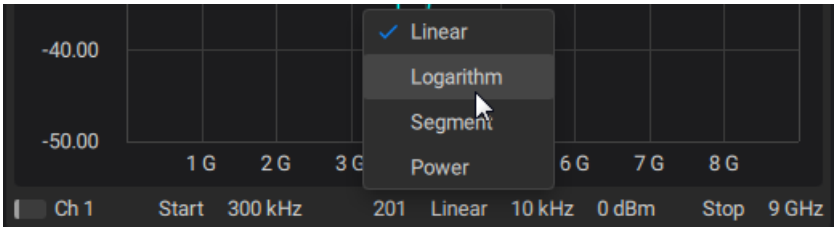


SCPI SENSe:SWEep:TYPE

NOTE Setting CW Time Sweep Type see in CW Time Sweep Mode.

NOTE

The sweep type can be selected in the channel status bar (see figure above). To do this, left click on the respective field in the channel status bar and select the required type in the drop-down list:



Sweep Range

By default, the sweep range is set to the frequency range of the Analyzer. The sweep range can be changed if necessary.

The sweep range should be set for the linear and logarithmic frequency sweeps and for the linear power sweep.

The sweep range can be set using either Start/Stop or Center/Span values (see figure below).

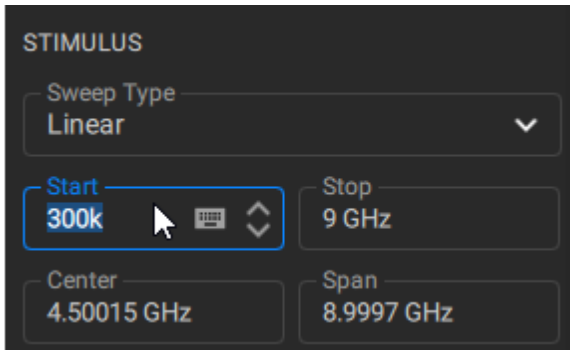
Setting Sweep Range

---

1. Select the channel (see Selection of Active Trace, Diagram, Channel).

2. Click on the **Channel** button in the main menu.

3. Click on the **Start/Stop** or **Center/Span** textbox in the submenu and enter the numerical values (see figure above).



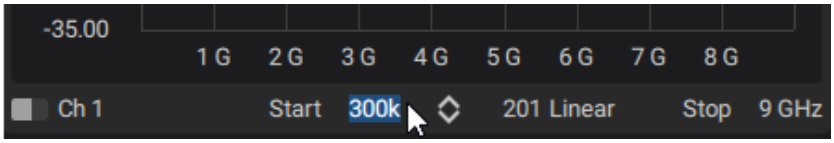
SCPI

SENSe:FREQuency:STARt, SENSe:FREQuency:STOP, SOURce:POWer:STARt, SOURce:POWer:STOP

SENSe:FREQuency:CENTer, SENSe:FREQuency:SPAN, SOURce:POWer:CENTer, SOURce:POWer:SPAN

NOTE

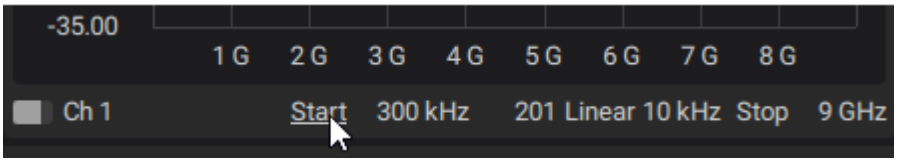
The Start, Stop, Center, and Span values of the sweep range can be set in the channel status bar. Move the mouse over the Start/Stop or Center/Span value in the channel status bar, click on it, and enter the numerical value:


-35.00
1 G
2 G
3 G
4 G
5 G
6 G
7 G
8 G
Ch 1
Start
300k
201 Linear
Stop
9 GHz

Switching Between Start/Center and Stop/Span Modes

1. Select the channel (see Selection of Active Trace, Diagram, Channel).

2. Click the **Start** field to change it to **Center**, or the **Stop** field to change it to **Span** in the channel status bar (see figure above).



NOTE If linear and logarithmic frequency sweeps is activated, the values on the Start, Stop, Center and Span fields will be represented in Hz.

If power sweep is activated, the values on the Start, Stop, Center and Span fields will be represented in dBm.

NOTE If span is set to zero the CW Time Sweep Mode is automatically turned ON.

Number of Points

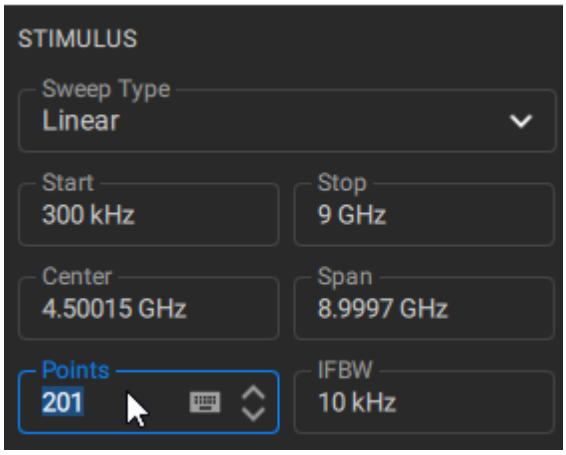
The number of points is the number of measurements gathered in a sweep cycle in the range of stimulus change.

The number of points should be set for the linear and logarithmic frequency sweeps, and for the linear power sweep.

Increasing the number of points directly proportionally increases the scan cycle time and reduces the measurement performance. To obtain a higher trace resolution, the number of points is increased. To increase the productivity of measurements, the number of points is reduced to values that provide an acceptable resolution of the trace. To maintain high measurement accuracy, the number of points for calibration and DUT measurements must match.

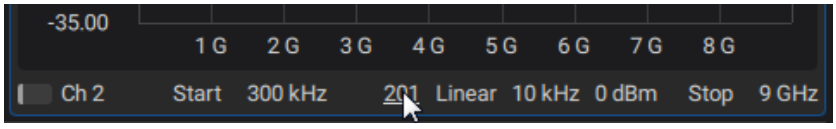
Setting Number of Points

1. Select the channel (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Channel** button in the main menu.
3. Click on the **Points** field in the submenu and enter the numerical value.



SCPI SENSe:SWEep:POINts

NOTE The number of points can be set in the channel status bar. Move the mouse over the respective value in the channel status bar, click on it, and enter the numerical value:



Stimulus Power and Power Slope Feature

The stimulus power level should be set for the linear and logarithmic frequency sweeps, as well as for segment frequency sweep types.

The power slope feature allows compensation of power loss with increasing frequency in the measurement cables. The power slope can be set for the linear, logarithmic, and segment frequency sweep types.

For a segmented sweep type, the power level and power slope setting methods described in this section can only be used if the power level and power slope are set to the same for all sweep segments. For the setting of individual power levels and power slopes for each segment, see Segment Table Editing.

Setting the Power Level and Power Slope for All Ports

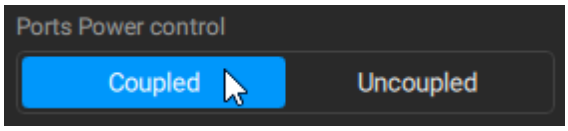
The power levels and power slopes of all test ports are set the same: power is 0 dBm, power slope is 0 dBm/Hz.

---

1. Select the channel (see Selection of Active Trace, Diagram, Channel).

2. Click on the **Channel** button in the main menu.

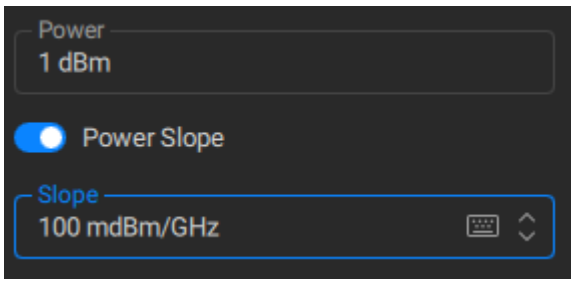
3. Click on the **Coupled** button in Ports Power Control in the submenu.



4. Click on the **Power** field in the submenu and enter the numerical value of power level.

5. If you need to set the power slope:

   - Toggle the **Power Slope** ON in the submenu.
   - Click on the **Slope** field in the submenu and enter the required value.



SCPI SOURce:POWer:PORT:COUPle

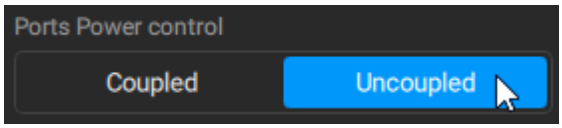
SOURce:POWer

SOURce:POWer:SLOPe:STATe, SOURce:POWer:SLOPe

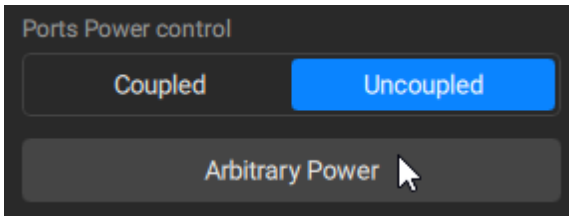
Setting the Power Level and Power Slope for Individual Port

The power level and power slope for each port individually are set in the Ports Table pop-up window.

1. Select the channel (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Channel** button in the main menu.
3. Click on the **Uncoupled** button in Ports Power Control in the submenu.

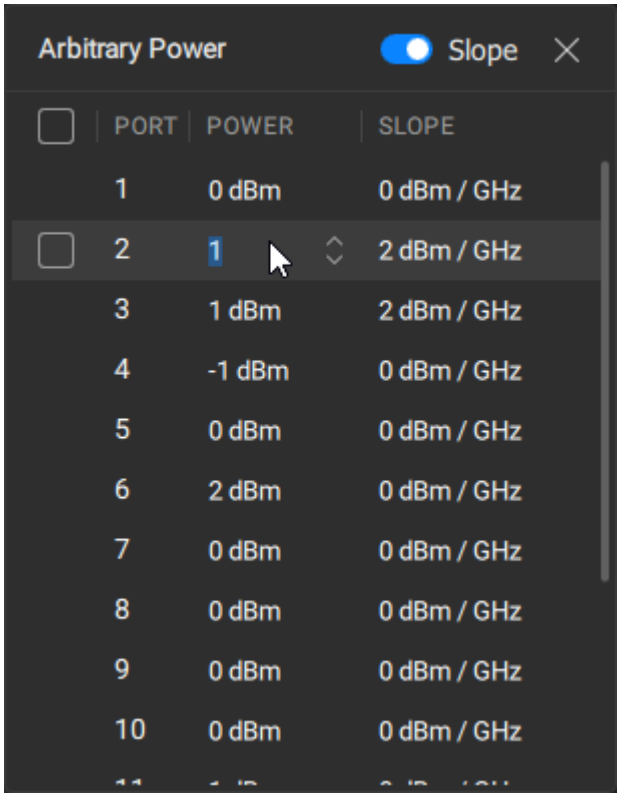


4. Click on the **Arbitrary Power** button in the submenu.



5. Set the required port settings in the **Arbitrary Power** pop-up window (see figure above):

- Click on the **POWER** field and enter the numerical value of power level.
- If you need to set the power slope, toggle the **Power Slope** ON at the top right corner. Then, click on the **SLOPE** field in the table and enter the required value.

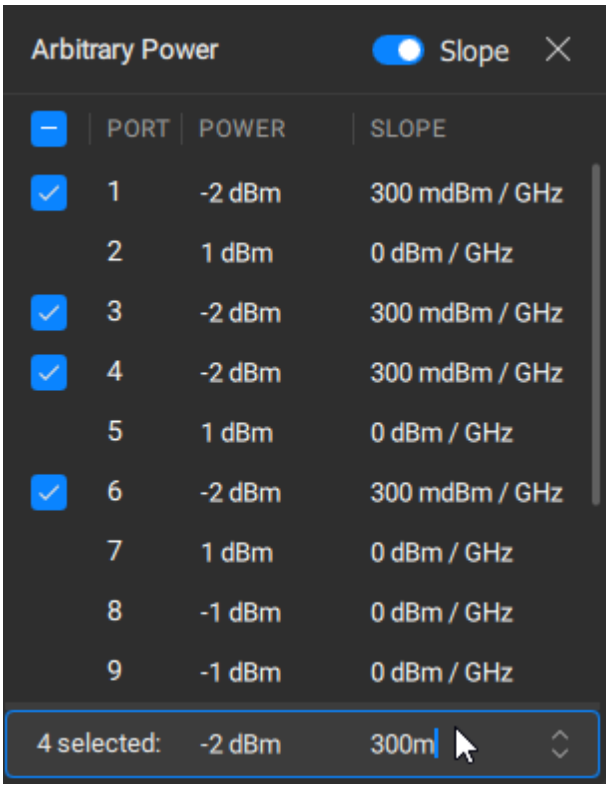


SCPI SOURce:POWer:PORT

Setting Power Level and Power Slope for the Group of Ports

The function sets identical power level and power slope values for a port group in the Ports Table window.

1. Select the checkboxes of the required ports in the corresponding rows in a table (see figure below).
2. Next, at the bottom of the **Arbitrary Power** pop-up window, a line will appear for changing the parameters of the selected port group. Enter the required parameter value of the power level and power slope here.


Arbitrary Power
Slope
PORT
POWER
SLOPE
1 -2 dBm 300 mdBm / GHz
2 1 dBm 0 dBm / GHz
3 -2 dBm 300 mdBm / GHz
4 -2 dBm 300 mdBm / GHz
5 1 dBm 0 dBm / GHz
6 -2 dBm 300 mdBm / GHz
7 1 dBm 0 dBm / GHz
8 -1 dBm 0 dBm / GHz
9 -1 dBm 0 dBm / GHz
4 selected: -2 dBm 300m

Constant Frequency

The constant frequency determines the fixed frequency for the linear power sweep. By default, the constant frequency is set to 600 MHz.

Setting the Constant Frequency of the Source

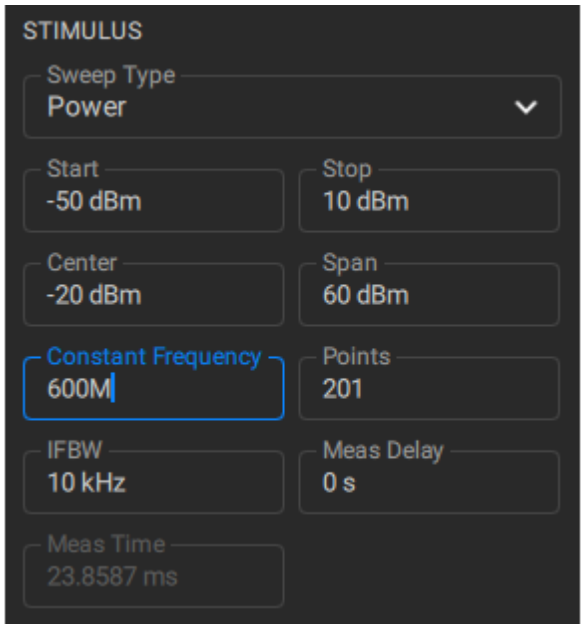
---

1. Select the channel (see Selection of Active Trace, Diagram, Channel).

2. Click on **Channel** button in the main menu.

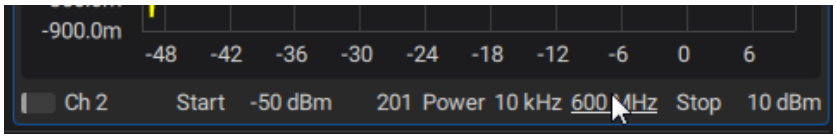
3. Select **Power** sweep type in the **Sweep Type** drop-down list in the submenu.

4. Click on **Constant Frequency** textbox in the submenu and enter the numerical values.



NOTE

The constant frequency can be set in the channel status bar. In power sweep mode, the constant frequency of the source is indicated in **Power level** field in the channel status bar. Move the mouse over the respective value in the channel status bar, click on it, and enter the numerical value:



Segment Table Editing

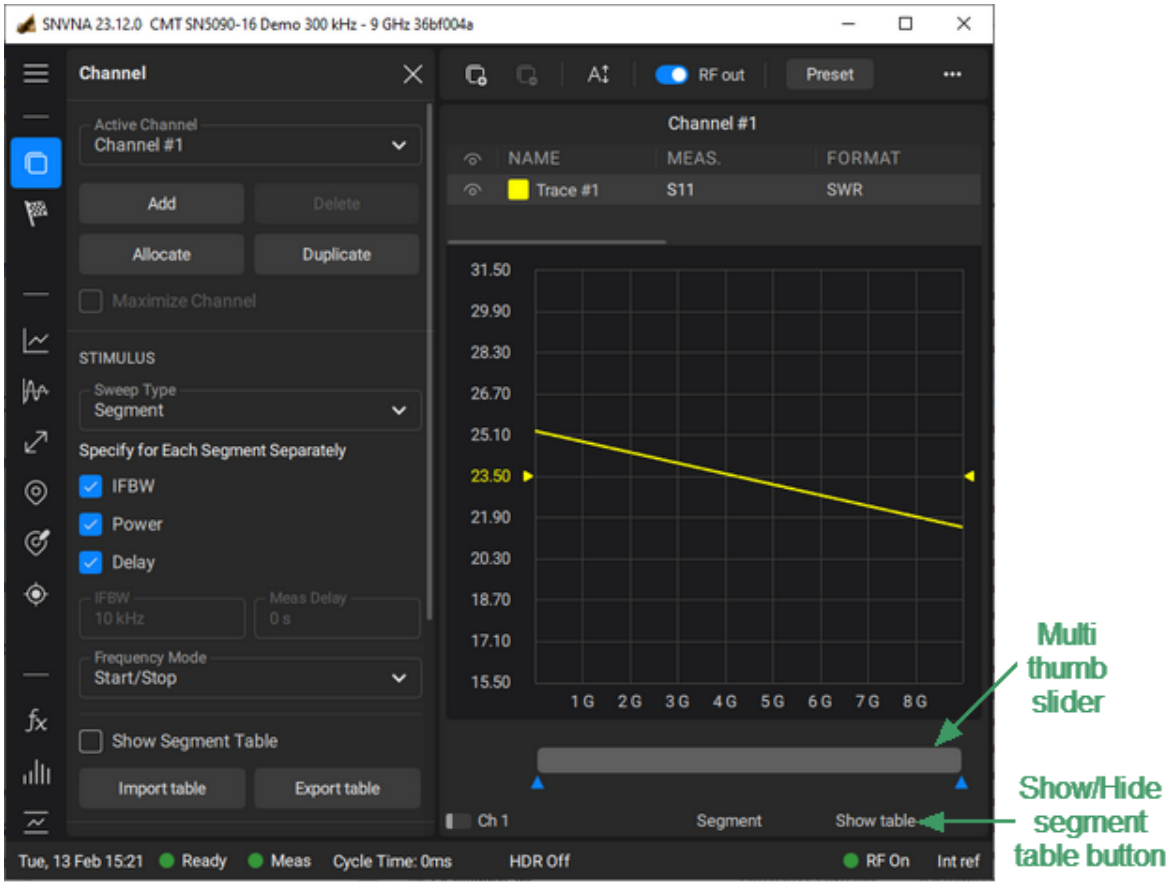
When selecting the **Segment** scan type (see Sweep Type), the frequency range of the stimulus can be divided by the user into segments with individual parameters.

By default, the segment table contains one segment with the default Analyzer sweep range. The user sets the required number of segments and parameters of each of them. The number of segments is limited only by the instrument's maximum number of points.

Start or center frequency, stop or span frequency, and number of points are set for each parameter. It is also possible to enable and set optionally individual settings such as: IF bandwidth, power level, and delay time. If the optional settings are disabled, then all segments will use the same settings as set for the linear sweep. By default, the values set in the segment are used, not the linear sweep values.

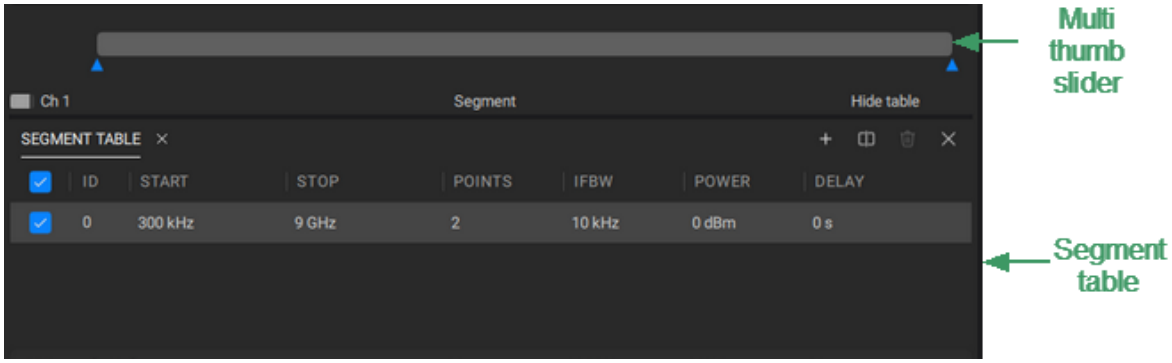
In segment scan mode, the analyzer scans all segments in ascending order of frequency. As a result, one trace is displayed, which is a collection of all measured data.

Scan settings for each segment are set and displayed in the segment table or a multi-thumb slider. Regardless of the setting method, the segment parameters are changed simultaneously in both the multi-thumb slider and the segment table. The segment table and multi-thumb slider are situated in the bottom of the channel window. Segment table can be displayed or hidden. By default, the segment table is hidden (see figure below).



Multi-thumb Slider (Segment Table is Hidden)

The expanded segment table is shown in the figure below. Each row describes one segment. The table can contain one or more rows.



Segment Table

Note that the GUI multi-thumb slider allows to approximately divide the sweep range into segments. To fine-tune the sweep range and set other parameters, use the segment table or the segment popup in the multi-thumb slider. Description of setting parameters using segment table is given below, description of setting parameters

using multi-thumb slider see in Setting Segment Parameters Using Multi-thumb Slider.

Setting Frequency Mode

The frequency range can be set as either Start/Stop or Center/Span.

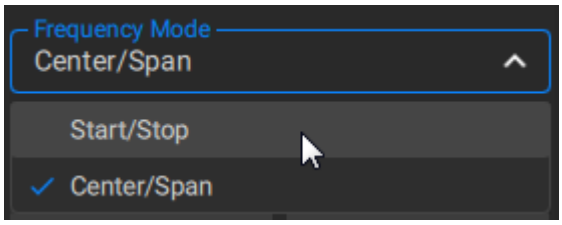
---

1. Select the channel (see Selection of Active Trace, Diagram, Channel).

2. Click on **Channel** button in the main menu.

3. Select **Segment** sweep type in the **Sweep Type** drop-down list in the submenu.

4. Click on **Frequency Mode** drop-down list on the submenu and select between the **Start/Stop** and **Center/Span** modes.



Setting Linear Sweep Parameters for All Segments

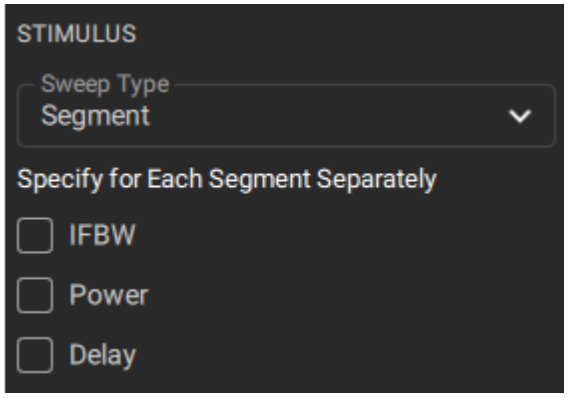
For any segment, the following additional parameter columns can be enabled/disabled: IF bandwidth, power level, and delay time. The corresponding value set for linear sweep will be used if an additional column in the segment table is disabled (same for all segments). The values specified for each segment are used by default, not linear sweep values. An additional column can be enabled/disabled in the sidebar.

---

1. Select the channel (see Selection of Active Trace, Diagram, Channel).

2. Click on **Channel** button in the main menu.

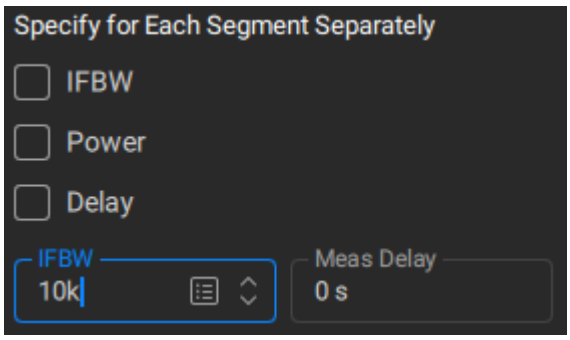
3. Clear the **IFBW** (IF bandwidth column), or **Power** (power level column), or **Delay** (delay time column) checkboxes in **Specify for Each Segment Separately** area in the submenu.

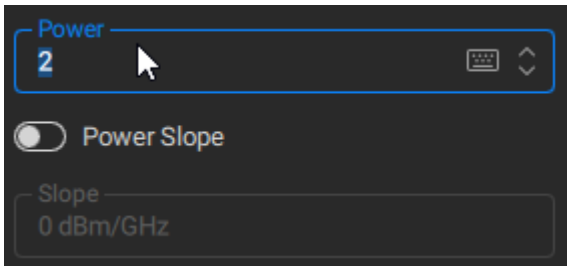


4. Click on the **IFBW**, or **Meas Delay**, or **Power** textboxes in the submenu and enter the numerical value. If you need to set the power slope:

   - Toggle the **Power Slope** ON in the submenu.
   - Click on the **Slope** field in the submenu and enter the required value.

NOTE The **Power** textbox is active if power coupling function is enabled (see Setting the Power Level and Power Slope for All Ports).





Setting Segment Parameters Using Segment Table

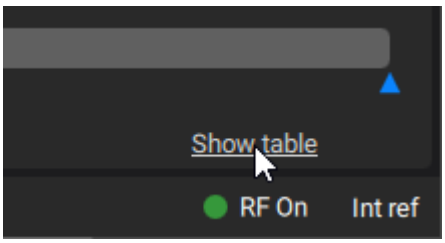
Displaying Segment Table

1. Select the channel (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Channel** button in the main menu.
3. Select the **Segment** sweep type in the **Sweep Type** drop-down list in the submenu.
4. Select the **Show Segment Table** checkbox in the submenu to show the segment table, or clear the checkbox in the submenu to hide the segment table.



NOTE The segment table is shown/hidden in the channel status bar. Click on the **Show table** button in the channel status

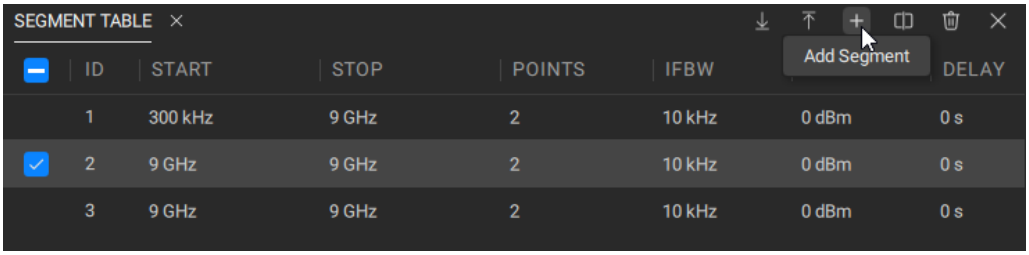
bar to show the segment table. When the button is clicked, the name of button changes to **Hide table**.



Adding Segments in Segment Table

1. Show the table, if it is hidden (see Displaying Table).

2. Highlight a row in the table and click on the + icon situated in the top right of the table. The new segment will appear at the end of the selected segment.

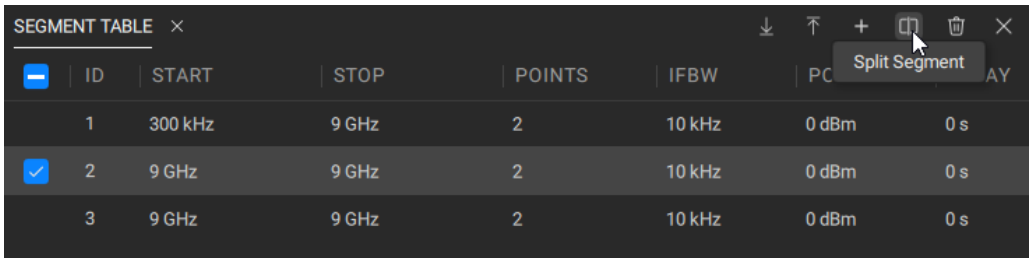


Splitting a Segment in Half in Segment Table

1. Display the table, if it is hidden (see Displaying Table).

2. Highlight a row in the table.

3. Click on icon, situated in the top right of the table. The selected segment will be split in half.



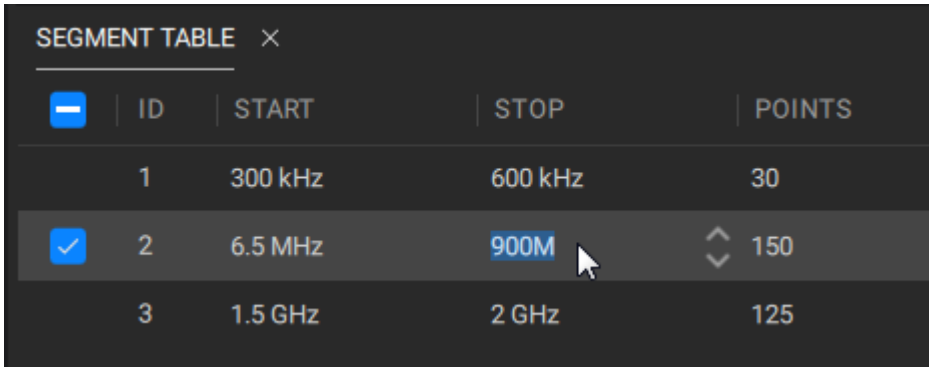
Setting Segment Parameters in Segment Table

NOTE Adjacent segments must not overlap in the frequency domain.

1. Show the table, if it is hidden (see Displaying Table).

2. Click on the field in the table and enter the numerical value.

   NOTE Each segment contains three mandatory parameters: start frequency, stop frequency, and number of points, and three parameters which can be optionally enabled/disabled: IF bandwidth, power level, and delay time (see Setting Linear Sweep Parameters for All Segments). Three optional parameters are enabled by default. The corresponding value set for linear sweep will be used if the parameter is disabled (same for all the segments).



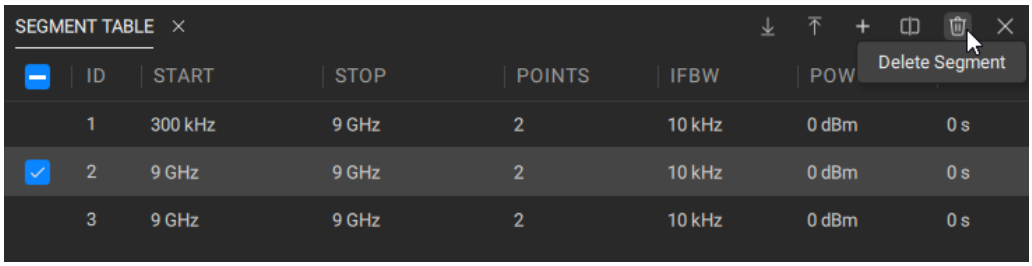
SCPI SENSe:SEGMent:DATA

Deleting Segments in Segment Table

1. Display the table, if it is hidden (see Displaying Table).

2. Highlight a row(s) in the table and click on the icon, located in the top right of the table.

   After deleting the segment, the row will disappear from the table and the segment indication area in the multi-thumb slider will be deselected.



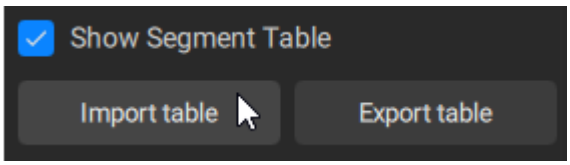
Import and Export Segment Table

The segment table can be saved into a *.INI file to a hard disk and later recalled.

---

1. Importing the segment table:
   - Click on the **Channel > Import table** buttons in the sidebar.
   - Then, select the directory and enter the file name in the dialog that appears.

2. Exporting the segment table:
   - Click on the **Channel > Export table** buttons in the sidebar.
   - Then, select the directory and the file name in the dialog that appears.



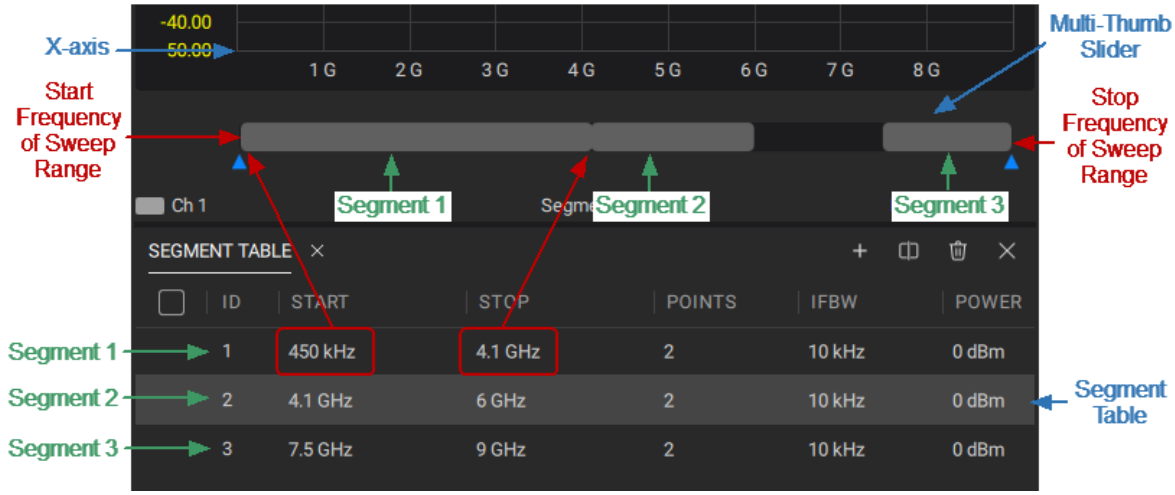
SCPI MMEMory:STORe:SEGMent, MMEMory:LOAD:SEGMent

Setting Segment Parameters Using Multi-thumb Slider

Multi-thumb slider is placed under the channel window and visually displays the frequency ranges of the specified segments. GUI slider matches user defined sweep range. By default, the sweep range of the slider equals the default Analyzer sweep range. When changing the frequency boundaries of the segments, the width of the GUI slider does not change. Regardless of the setting method, the segment parameters are changed simultaneously in both the multi-thumb slider and the segment table.

Use the GUI slider to approximately split the sweep range into segments. To fine-tune the sweep range and set other parameters, use segment table or segment pop-up window in the multi-thumb slider.

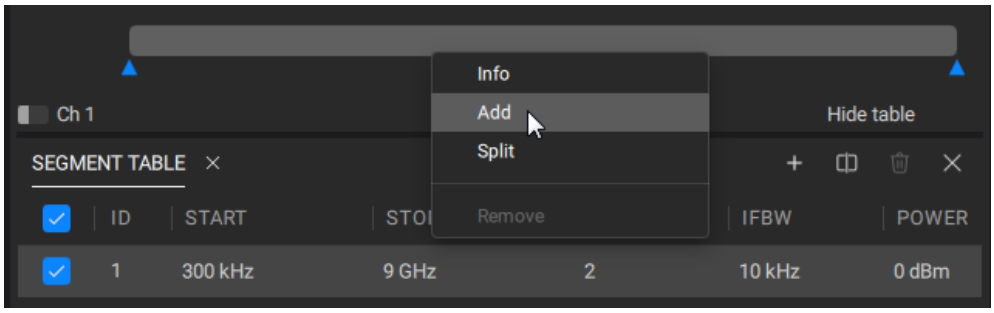
The figure below shows an example of a segment table containing 3 segments. Start and stop frequency is shown for the first segment. The figure also shows the start frequency of the sweep range (corresponding to the start frequency of the first segment) and the final scan frequency (corresponding to the stop frequency of the last segment).



Correspondence of the Multi-thumb Slider to the Segment Table and User Defined Sweep Range

Adding Segment in Multi-thumb Slider

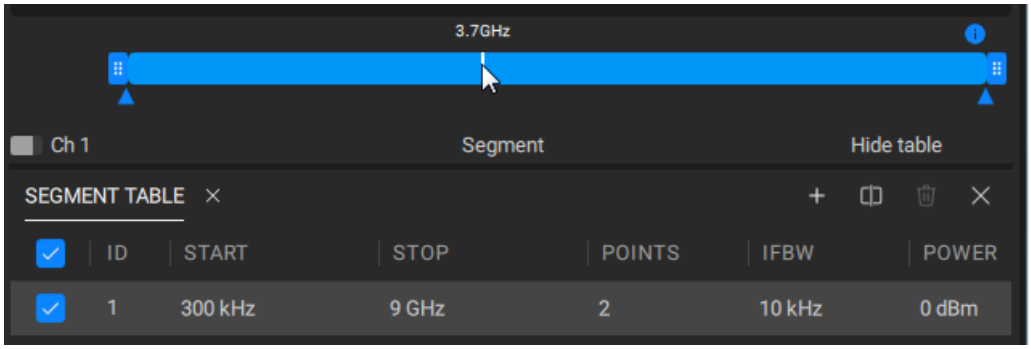
1. Right click on the multi-thumb slider and, in the opened drop-down list, select **Add** value. The new segment will appear at the end of the selected segment.



Arbitrary Splitting Segment in Multi-thumb Slider

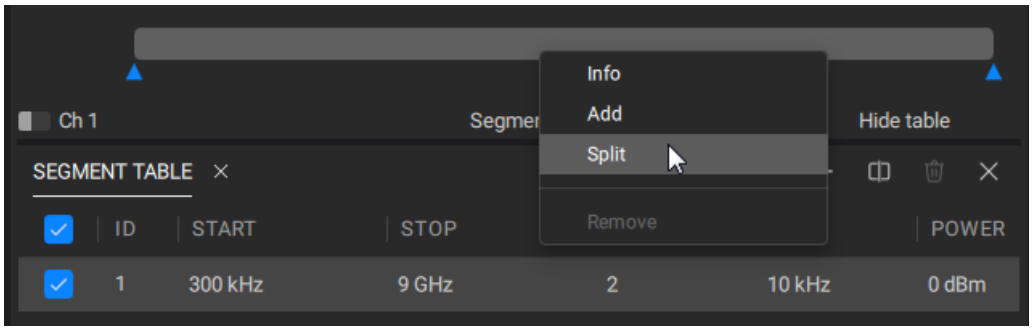
Use the multi-thumb slider area for a quick split of sweep range in segments.

1. Move the mouse pointer on the multi-thumb slider (the numeric value is displayed above the pointer) and double-click on the slider to set the border of the new segment.



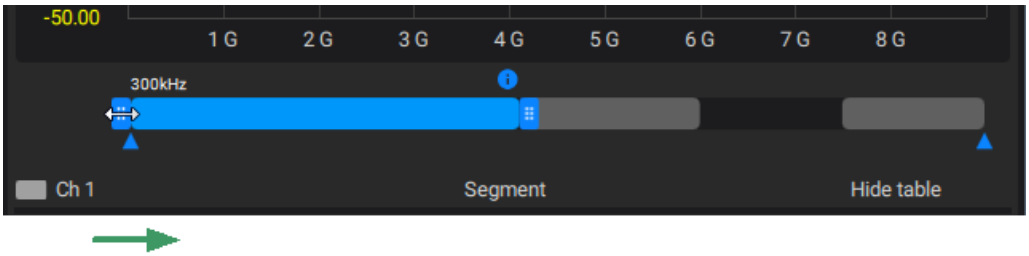
Splitting a Segment in Half in Multi-thumb Slider

1. Right click on the segment and, in the opened drop-down list, select **Split**.

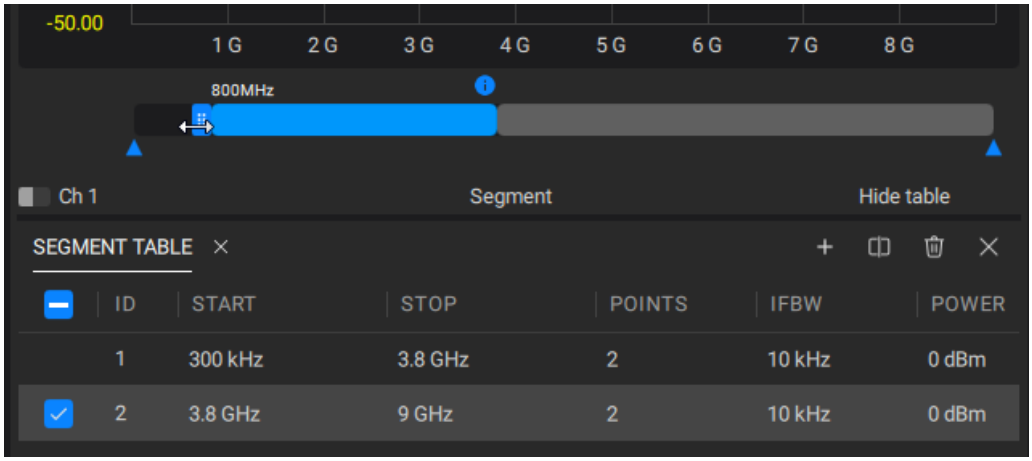


Changing Start or Stop Frequency of Segment in Multi-thumb Slider

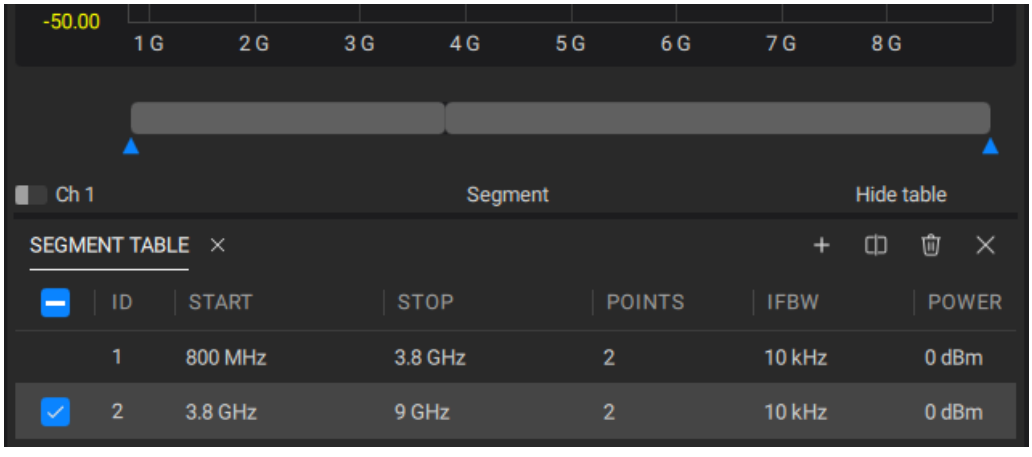
1. Move the mouse pointer to the segment boundary in the multi-thumb slider until the mouse pointer icon becomes as shown in the figure.



2. Drag the mouse pointer towards the center or edges of the multi-thumb slider. The new frequency value is displayed above the slider.

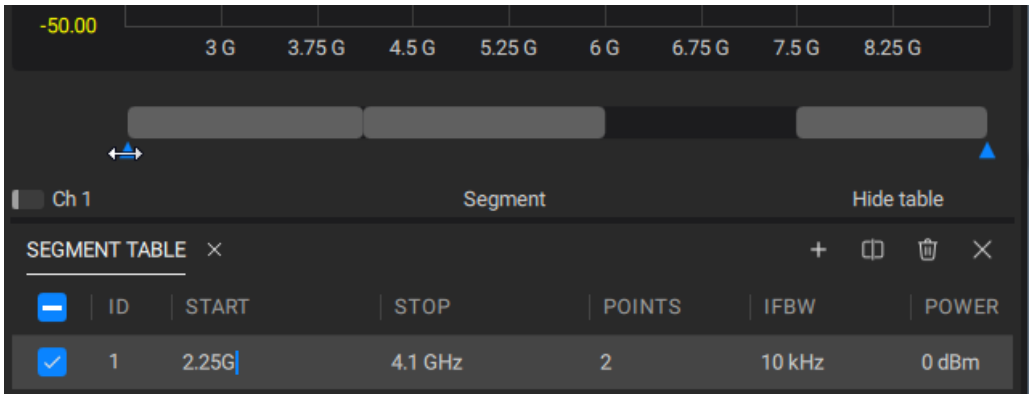


3. Release the mouse. After that, the frequency will change on the X-axis of channel and in the segment table.



Changing Start or Stop Frequency of Sweep Range in Multi-thumb Slider

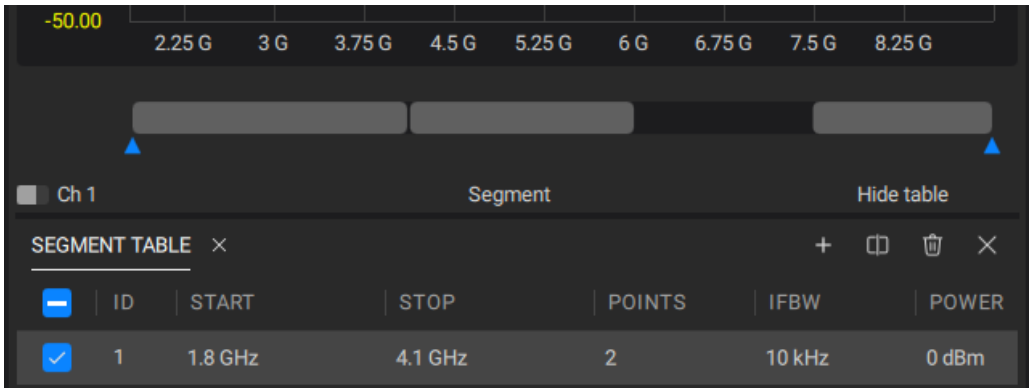
1. Move the mouse pointer to the left (or right) of the multi-thumb slider until the pointer icon becomes as shown in the figure (see the level pointer in the figure below).



2. Drag the mouse pointer to the center of the multi-thumb slider until an additional dash style segment appears on the left (or right) slider as shown in the figure below. The new start or stop frequency of sweep will be indicated next to the pointer.



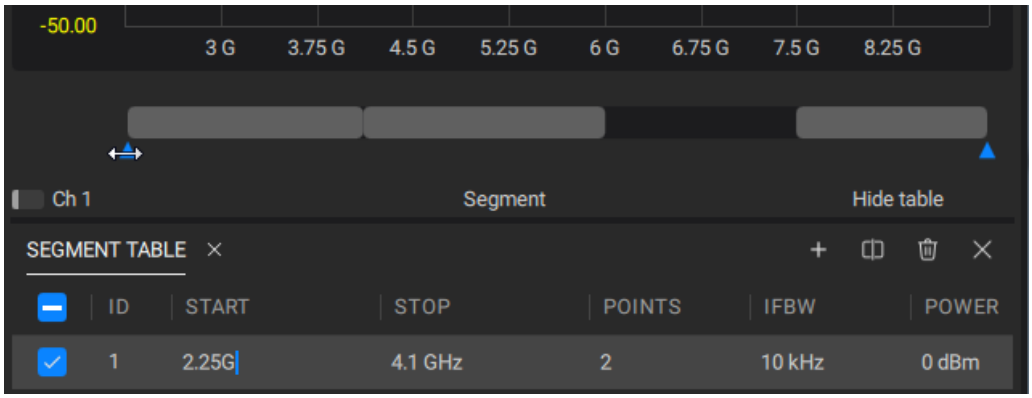
3. Release the mouse. After that, the frequency will change on the X-axis of channel and in the segment table.



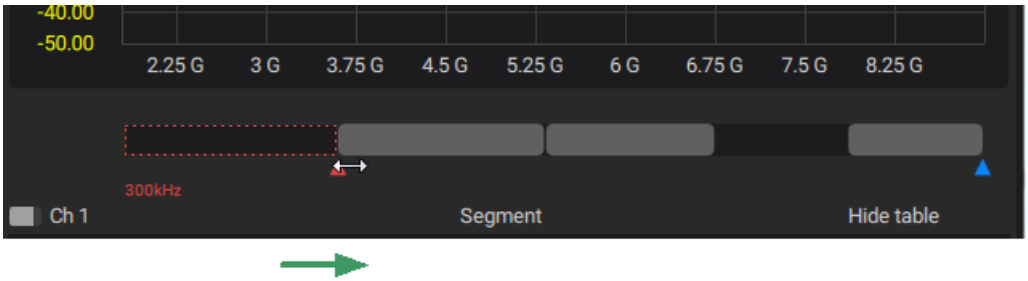
Restoring Start or Stop Frequency of Sweep to Analyzer Sweep Range in Multi-thumb Slider

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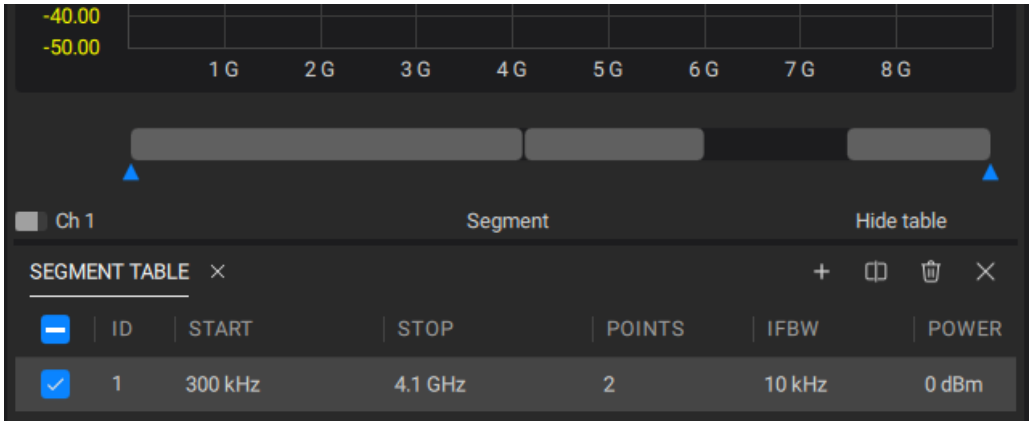
1. Move the mouse pointer to the left (or right) scale pointer until the pointer icon becomes as shown in the figure.



2. Then, drag the mouse pointer to the center of the multi-thumb slider until the pointer color changes to red (see figure below).

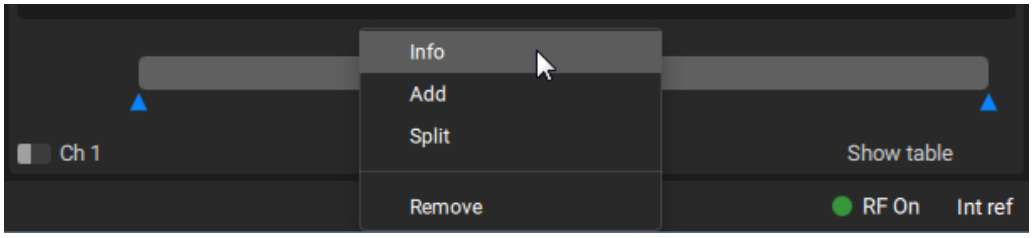


3. Release the mouse. After that, the frequency will change on the X-axis of channel and in the segment table.



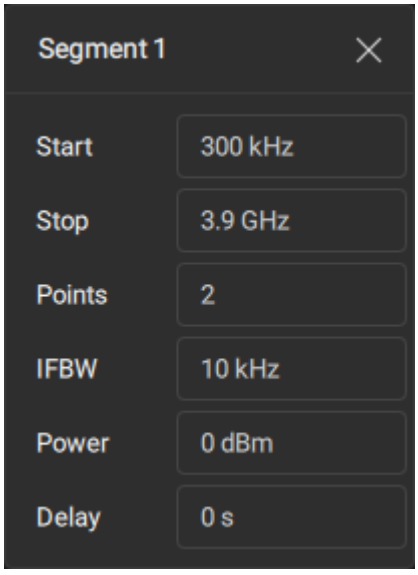
Setting Segment Parameters in Multi-thumb Slider

1. Right click on the segment and, in the opened drop-down list, select **Info**.



2. Click on the field in the pop-up window and enter the numerical value.

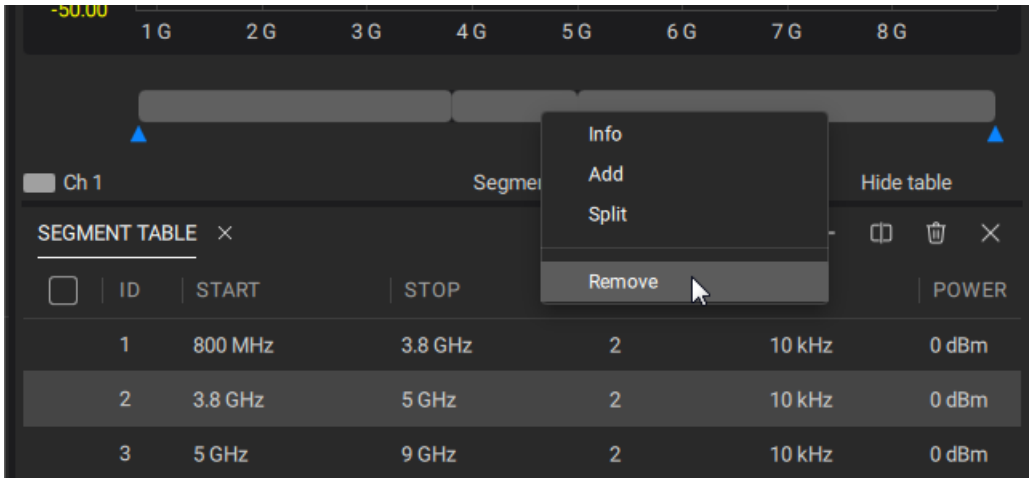
NOTE Each segment contains three mandatory parameters: start frequency, stop frequency, and number of points, and three parameters which can be optionally enabled/disabled: IF bandwidth, power level, and delay time (see Setting Linear Sweep Parameters for All Segments). Three optional parameters are enabled by default. The corresponding value set for linear sweep will be used if the parameter is disabled (same for all the segments).



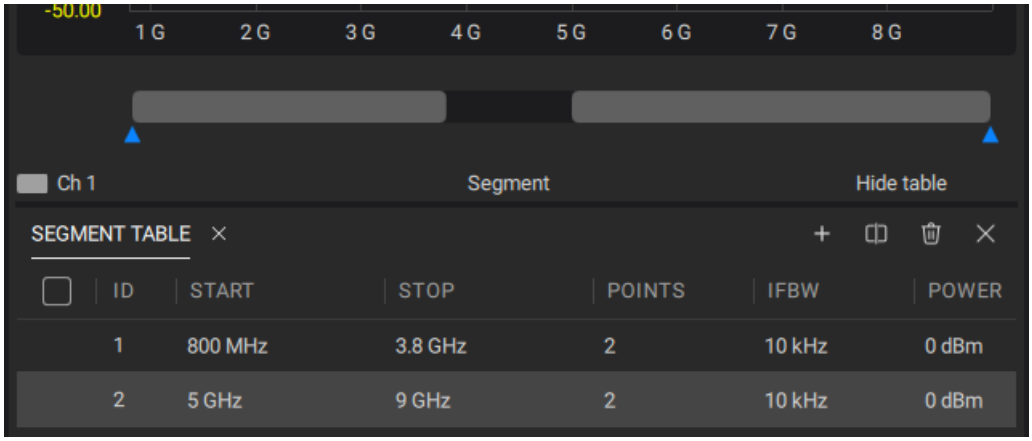
SCPI SENSe:SEGMent:DATA

Removing Segments in Multi-thumb Slider

1. Right click on the segment in the multi-thumb slider and, in the opened context menu, select **Remove**.



After deleting the segment, the segment indication area in the multi-thumb slider will be deselected.

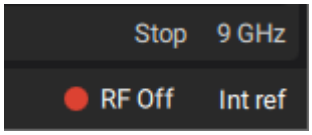


RF Out Function

The RF Out function temporarily disables the stimulus signal. Measurements cannot be performed while the stimulus is disabled.

The RF Out function is applied to the Analyzer, not to individual channels. Indication of RF Out status appears in the instrument status bar (see Instrument Status Bar).

When turning off the RF Out function, the LED of the signal source port will turn off on the front panel of the analyzer.

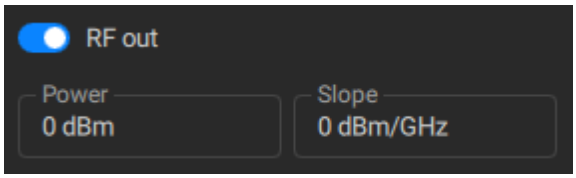


RF Out OFF

Enabling or Disabling RF Out

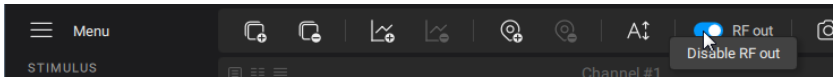
1. Click on the **Channel** button in the main menu.

2. Toggle the **RF Out** ON/OFF in the submenu.



SCPI OUTP

NOTE You can quickly enable/disable RF Out with the help of the Quick Access Toolbar:

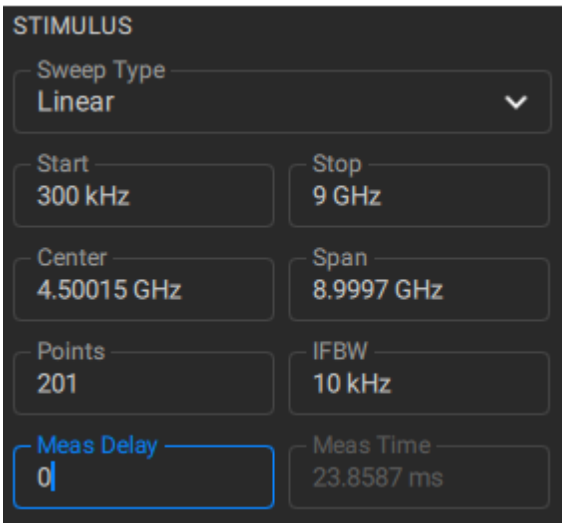


Measurement Delay

The measurement delay function adds an additional time delay at each measurement point between the moment when the source output frequency becomes stable and the start of the measurement. This capability can be useful for measuring electrically-long devices.

Setting Measurement Delay

1. Select the channel (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Channel** button in the main menu.
3. Click on the **Meas Delay** textbox in the submenu and enter the numerical values.



SCPI SENSe:SWEep:POINt:TIME

CW Time Sweep Mode

In the CW time sweep mode, the Analyzer displays measured data as a function of time when the stimulus frequency is fixed. This function is automatically turned on when the stimulus span is set to zero.

A horizontal scale will then display the time.

In CW time sweep mode, the following elements change from frequency representation to time representation:

- stimulus axis labels
- marker stimulus value
- SCPI commands response:

  CALCulate:DATA:XAXis?

  CALCulate:TRACe:DATA:XAXis

  CALCulate:MARKer:X

NOTE

The measurement time is determined by the following formula:

$$T_{st} = N\left(\frac{1.19}{IFBW} + T_{md} + T_{hw}\right),$$

where N — number of points,

$IFBW$ — IF bandwidth,

T_{md} — measurement delay,

T_{hw} — hardware delay

The Analyzer automatically calculates the measurement time value based on the current settings: number of points, IF bandwidth, measurement delay. An arbitrary value can be set for sweep time; in this case, the Analyzer corrects the measurement delay value. To set the minimum possible measurement time, set the measurement delay to zero (see Measurement Delay). Measurement time is displayed in the **Meas time** textbox in the Channel submenu.

The measurement time should not be confused with the measurement cycle time displayed in the instrument status bar. The table below shows the difference between measurement time and cycle time.

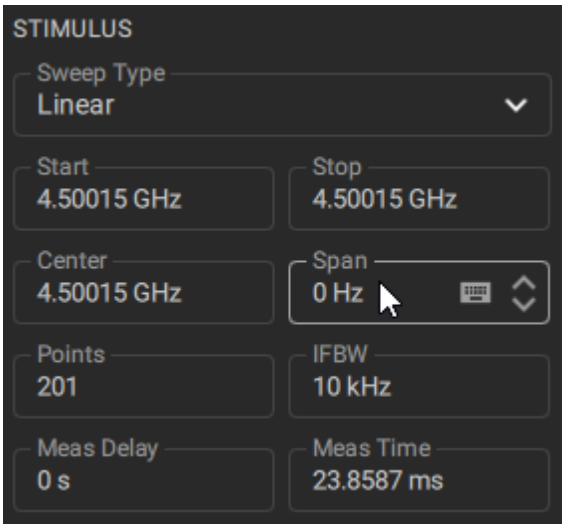
	Sweep Time value	Cycle Time value
Method	Theoretically estimated	Actually measured
Scope	One channel	All sweeping channels
Sweep direction	One sweep direction[1]	All sweep directions[2]
Range	From the first sweep point to the last sweep point, excluding the time between sweeps	Between the start points of two consecutive measurement cycles, including the time between sweeps

1 One port is the stimulus source.

2 All ports can be used as a stimulus source.

Activating and Setting CW Time Sweep Mode

1. Select the channel (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Channel** button in the main menu.
3. Click on the **Span** textbox in the submenu and enter 0 using the keyboard.
4. Click on the **Center** textbox in the submenu and enter the frequency under test.
5. Click on the **Meas Delay** textbox in the submenu and enter the measurement delay value (if necessary).



NOTE Other sweep settings (number of points, power level, IF bandwidth) can be set arbitrarily, depending on the measurement task.

Trigger Settings

This section describes the settings for initiating Analyzer measurements. The signal or event that starts the analyzer measurement cycle is called a trigger. Trigger initiation is used when it is necessary to perform measurements simultaneously with other equipment in the measurement setup, they are initiated by trigger.

The trigger system is used to control the operation of the analyzer from internal signals, signals from external devices, or user actions (manual start or start via SCPI commands). You can select the trigger source in the program (see Trigger Source). The setting applies to the Analyzer.

The measurement cycle, by default, includes the measurement of all channels of the Analyzer. In a single measurement cycle, the channels are measured sequentially one after another. Under certain conditions, a channel may be excluded from the measurement cycle (see Channel Initiation Mode and Trigger Scope) or averaging of results based on the trigger signal can be performed in the channel (see Averaging Trigger).

For a detailed description of the transitions and states of the trigger system at the Analyzer and channel levels, see Trigger State Diagram.

When synchronizing the Analyzer with the external equipment, you can specify the function, polarity, position of the trigger signal, and the delay between the trigger event and the and the start of the measurement sequence (see External Trigger Settings).

The Analyzer can also serve as a source of synchronization signals for other devices. For this purpose, a trigger output is provided on the rear panel of the analyzer (see Trigger Output).

Trigger State Diagram

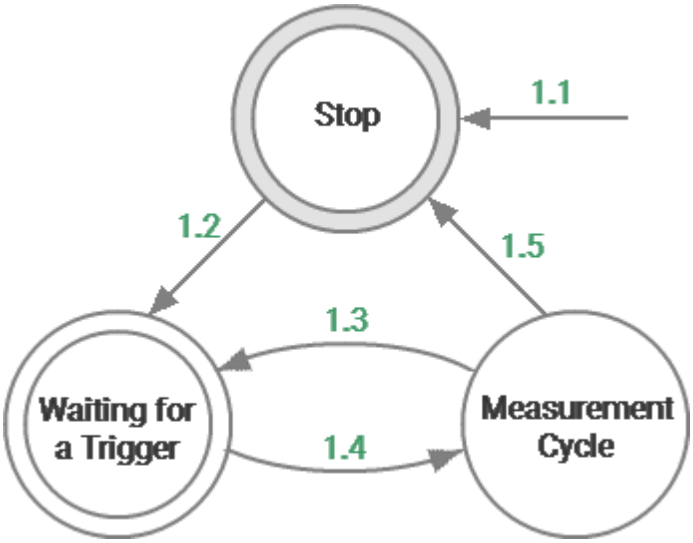
The trigger system operates at two levels: at the Analyzer level and at the channel level.

Analyzer States

The Analyzer can be in one of the following three states:

- **Stop** — the Analyzer waits for any channel to enter the **Initiated** state.
- **Waiting for a Trigger** — the Analyzer waits for the trigger signal. If the **Internal** trigger source (see Trigger Source) is selected, it is automatically generated.
- **Measurement Cycle** — all initiated channels are measured in turn.

The figure below shows the states of the Analyzer, and the transitions between them.



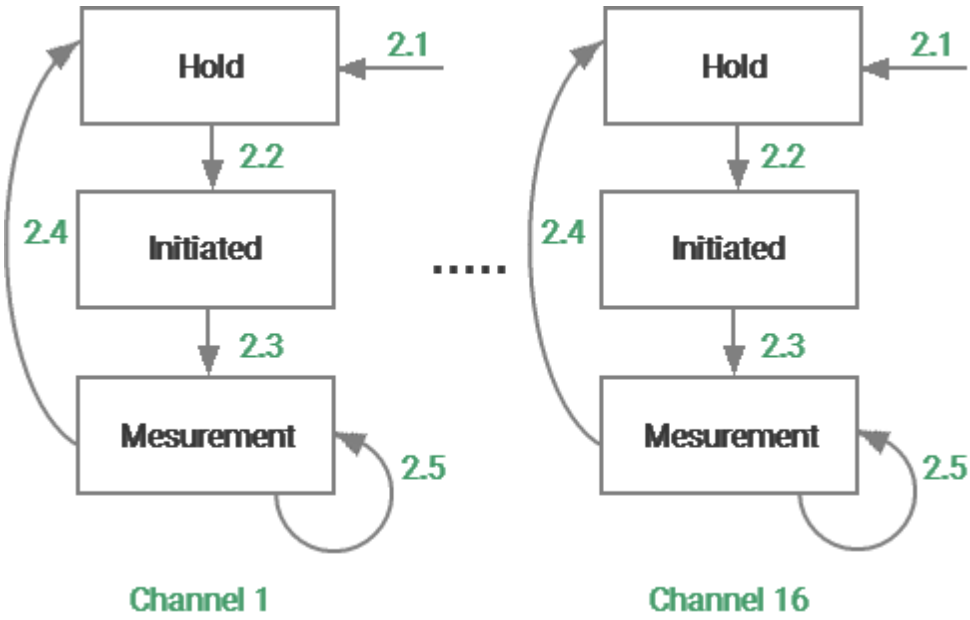
Analyzer States and Transitions

Channel States

Channels can be in one of the three following states:

- **Hold** — the channel waits for initiation. If the continuous initiation mode (see Channel Initiation Mode) is selected, the channel is automatically initiated.
- **Initiated** — the channel waits for the measurement after the trigger signal and measurement of other channels in the queue.
- **Measurement** — the channel is measured.

The figure below shows the channel states, and the transitions between them.



Channel States and Transitions

The table below describes the transitions between Analyzer and channel states.

Transition	Condition	Button	Command
1.1 To Stop	Power on	—	—
	Reset	**Save/Reccal > Preset**	SYSTem:PRESet, *RST
	Abort of the current measurement cycle.	**Trigger > Restart**	ABORt
	Changing Analyzer settings by user or by SCPI command.	For example: **Channel > Start**	For example: SENSe:FREQuency:STARt
1.2 Stop –> Waiting for Trigger	One or more channels make the transition 2.2 to the Initiated state.	—	—

Transition	Condition	Button	Command
1.3 Waiting for Trigger –> Measurement Cycle	Automatically, if the trigger source is set to **Internal**.	**Trigger > Internal**	TRIGger:SOURce INT
	At a signal arrival at the external trigger input, if the trigger source is set to **External**.	**Trigger > External**	TRIGger:SOURce EXT
	When a button is pressed, if the trigger source is set to **Manual**.	**Trigger > Manual** **Trigger > Trigger**	TRIGger:SOURce MAN
	Upon receipt of a SCPI command, if the trigger source is set to **Bus**.	**Trigger > Bus**	TRIGger:SOURce BUS TRIGger:SINGle, TRIGer, *TRG
1.4 Measurement Cycle –> Waiting for Trigger	At the end of a measurement cycle, when at least one channel is in **Continuous** initiation mode.	**Trigger > Continuous**	INITiate:CONTinuous ON
	After measuring a point, when the **On Point** trigger function is active.	**Trigger > Event { On Point }**	TRIGger:POINt ON
1.5 Measurement Cycle –> Stop	At the end of a measurement cycle, when **Continuous** initiation mode is disabled for all channels.	**Trigger > Hold**	—

Transition	Condition	Button	Command
2.1 To Hold	The same condition as transition 1.1	—	—
	When the Initiation Mode of the channel has been set to **Hold**.	**Trigger > Hold**	INITiate:CONTinuous OFF
2.2 Hold –> Initiated	Every time, if the **Continuous** initialization mode of the channel is turned ON.	**Trigger > Continuous**	INITiate:CONTinuous ON
	Once, when the **Single** initiation mode of the channel has been set.	**Trigger > Single**	INITiate
2.3 Initiated –> Measurement	Upon the occurrence of one of the conditions in transition 1.3 and after measurement of other channels in the queue.	—	—
2.4 Measurement –> Hold	At the end of channel measurement.	—	—
2.5 Repeat measurement	If the averaging trigger function is ON, the measurement repeats N times, where N is the averaging factor.	**Average > Avg Trigger > On**	TRIGger:AVERage

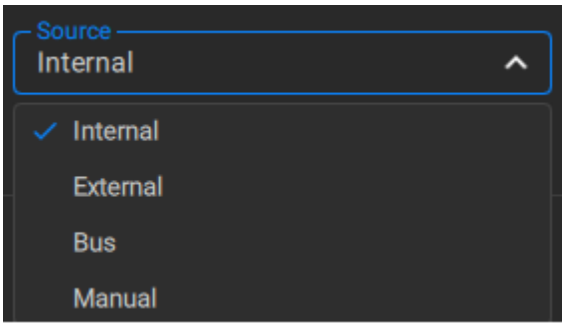
Trigger Source

One of four trigger sources can be selected (see figure below). This setting works at the Analyzer level.

Trigger Source	Function
Internal [default]	The Analyzer generates a trigger signal automatically when needed.
External	The trigger signal is a logic signal at the external trigger input (see External Trigger Settings).
Bus	The trigger signal is generated by a command from the program controlling the Analyzer via SCPI.
Manual	The trigger signal is generated by pressing the **Trigger** button in the Analyzer software.

Setting Trigger Source

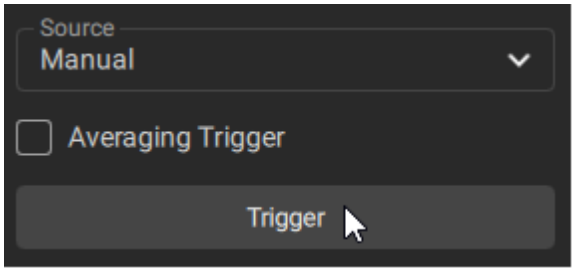
1. Click on the **Trigger** button in main menu.
2. Click on the required trigger source in **Source** drop-down list in the submenu.



SCPI TRIGger:SOURce

Launch Control in Manual Mode

1. If **Manual** trigger source is selected, the trigger is generated by clicking on the following buttons: **Trigger > Trigger**.



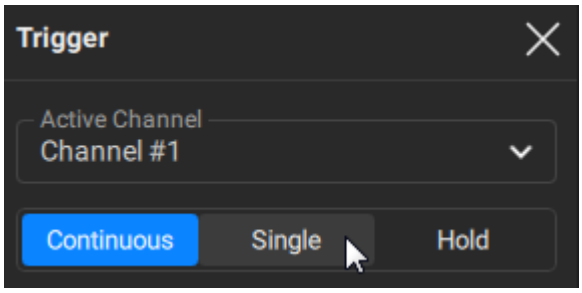
Channel Initiation Mode

The channel initiation mode determines whether the channel will be included in the measurement cycle when a trigger signal is detected.

Channel Initiation Mode	Function
Continuous [default]	The channel automatically transitions to the Initiated state at the end of each measurement.
Single	The channel is initiated once. At the end of the measurement, the channel goes into the Hold state.
Hold	The channel is idle and not updating.

Setting Channel Initiation Mode

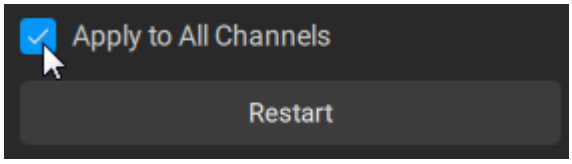
1. Select the channel (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Trigger** button in the main menu.
3. Click on the button of the required channel initiation mode in the submenu.



SCPI INITiate:CONTinuous, INITiate

Setting Channel Initiation Mode for All Channels

1. Select the **Apply to All Channels** checkbox in the sidebar.

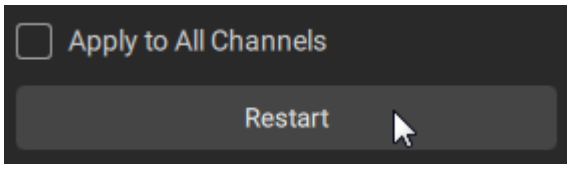


SCPI INITiate:CONTinuous:ALL

Restarting the Current Measurement Cycle

Restarting aborts the sweep and puts the Analyzer into the Stop state. If there are channels in the continuous initiation state, the Analyzer is put into the Waiting for a Trigger state (see Trigger State Diagram).

1. Click on the **Trigger > Restart** button in the sidebar.



SCPI ABORt

Trigger Scope

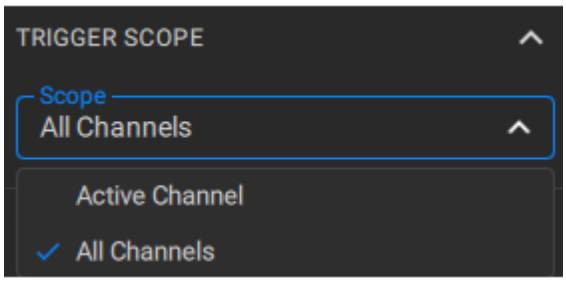
The trigger scope function selects whether all initiated channels or an active channel, if initiated, will be measured on a trigger condition (see figure below).

Trigger Scope	Function
All Channels [default]	All initiated[1] channels will be measured on a trigger condition.
Active Channel	Only the active channel, if initiated, will be measured on a trigger condition.
1 For a detailed description of the channel initiation mode settings, see Channel Initiation Mode.	

Setting Trigger Scope

1. Click on the **Trigger** button in the main menu.

2. Click on the **Scope** drop-down list in the TRIGGER SCOPE accordion and select the required trigger scope.



SCPI TRIGger:SCOPe

Averaging Trigger

The averaging trigger function completes averaging with a single trigger signal. This function affects the channels in which the averaging function is enabled (see Averaging Setting).

Averaging Trigger	Function
OFF [default]	One sweep is performed in response to one trigger signal regardless of the state of the channel averaging function. If the channel averaging is turned on, N trigger signals are required to complete the averaging process (where N is the averaging factor). The trigger signal does not reset the result of the previous averaging.
ON	N sweeps are performed in response to one trigger signal for the channel with the averaging on (where N is the averaging factor). One trigger signal is required to complete the averaging process in the channel. The trigger signal starts a new averaging cycle in the channel.

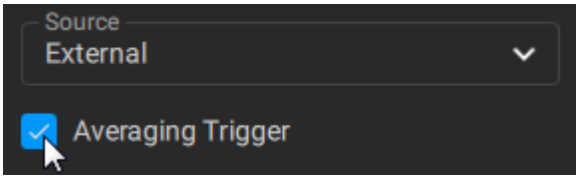
The averaging trigger function is convenient in conjunction with an external, software (BUS), or manual trigger source. When the function is enabled, the averaging result can be obtained on one trigger signal by performing a number of sweeps equal to the averaging factor (see Averaging Setting). Program commands of waiting for the end of the measurement cycle *OPC?, *WAI are triggered after averaging is completed. Turn this function OFF when the internal trigger source is used.

NOTE If the trigger event function is set to On Point, it takes precedence over the averaging trigger function. In this case, to complete averaging, the number of trigger pulses equal to the number of points multiplied by the averaging factor is required.

NOTE If multiple channels are open at the same time, one trigger signal starts a measurement cycle the required number of times for the channels with averaging on, and once for channels with averaging OFF.

Enabling Averaging Trigger

1. Select the channel (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Trigger** button in the main menu.
3. Select the **Averaging Trigger** checkbox in the submenu.



SCPI TRIGger:AVERage

External Trigger Settings

This section describes the settings of the external trigger. The logic signal at **Trig 2** connector on the rear panel of the Analyzer is an external trigger signal (see Instrument Series).



Trigger Signal Input Connector

To work with an external trigger:

1. Select trigger source **External** (see Trigger Source).
2. Set the external trigger event, polarity, position, and delay (see the subsections in this section).

Trigger Event

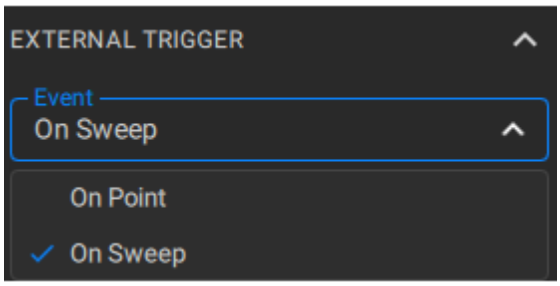
This setting selects the external trigger event.

Trigger event	Function
On Sweep [default]	One trigger signal starts a full measurement cycle — the measurement of all frequency points of all channels included in the measurement cycle.
On Point	One trigger signal starts the measurement of one frequency point of a channel. The next trigger signal starts the measurement of the next frequency point of the channel, and so on.

Setting Trigger Event

1. Click on the **Trigger** button in the main menu.

2. Click on the required trigger event in the **Event** drop-down list in the EXTERNAL TRIGGER accordion in submenu and select desired event.



SCPI TRIGger:POINt

Trigger Polarity

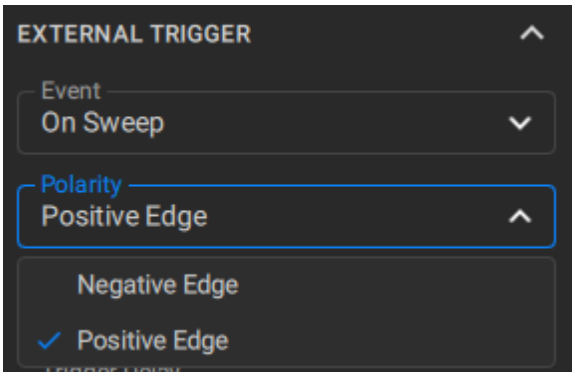
This setting selects the external trigger polarity.

Trigger polarity	Function
Positive Edge [default]	The positive edge of the input signal of an external trigger is the trigger signal.
Negative Edge	The negative edge of the input signal of an external trigger is the trigger signal.

Setting Trigger Polarity

1. Click on the **Trigger** button in the main menu.

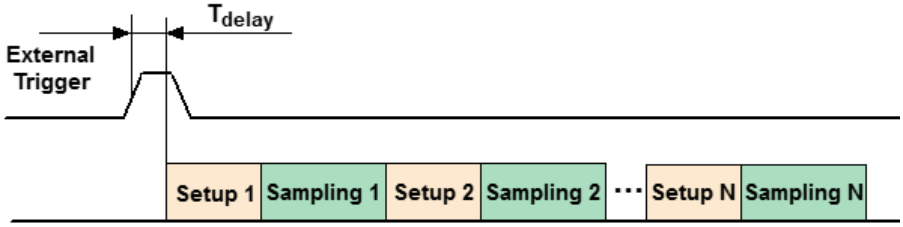
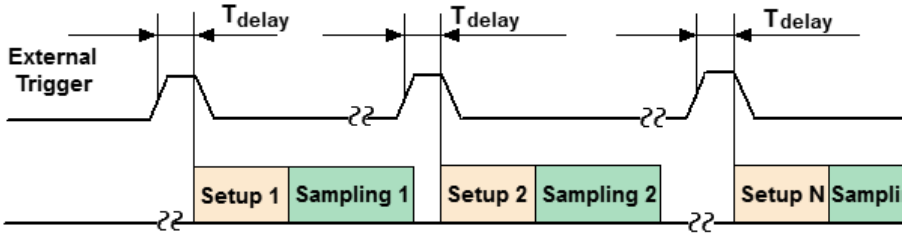
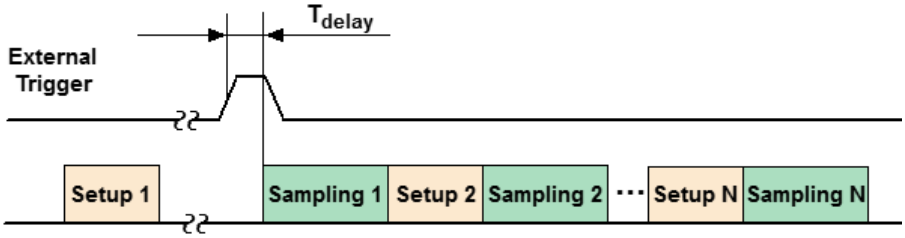
2. Click on the **Polarity** drop-down list in the EXTERNAL TRIGGER accordion in submenu and select the polarity between the **Negative Edge** or **Positive Edge**.

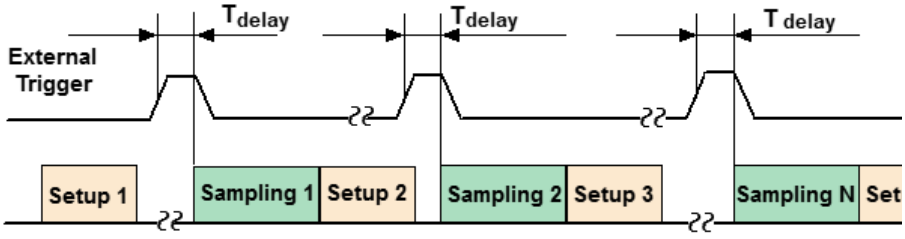


SCPI TRIGger:EXTernal:SLOPe

Trigger Position

The position of the external trigger determines the moment when the Analyzer expects an external trigger signal—before the frequency setup or before measuring (ADC sampling). The frequency setup precedes the measurement for each frequency point.

Trigger Position	Function
Before Setup [default]	The trigger signal is expected before the frequency setup. The frequency setup starts when the trigger signal arrives (see figure below). After the frequency setup is completed, the Analyzer begins ADC sampling.  External Trigger Delay Before Setup, Point Trigger is OFF  External Trigger Delay Before Setup, Point Trigger is ON
Before Sampling	The trigger signal is expected before the ADC sampling when the frequency is already set. After sampling, the Analyzer automatically transitions to the next frequency (see figure below). 

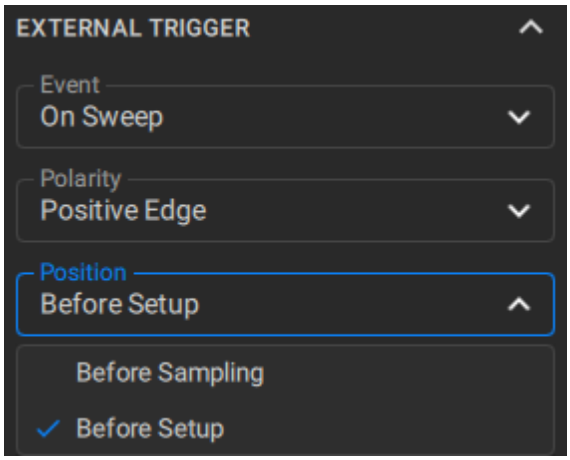
Trigger Position	Function
	External Trigger Delay Before Sampling, Point Trigger is OFF  External Trigger Delay Before Sampling, Point Trigger is ON

NOTE This function is intended for use in conjunction with the **On Point** trigger function (see Trigger Event). In the case of the **On Sweep** trigger function, the trigger position will be performed only for the first sweep point.

Setting Trigger Position

1. Click on the **Trigger** button in the main menu.

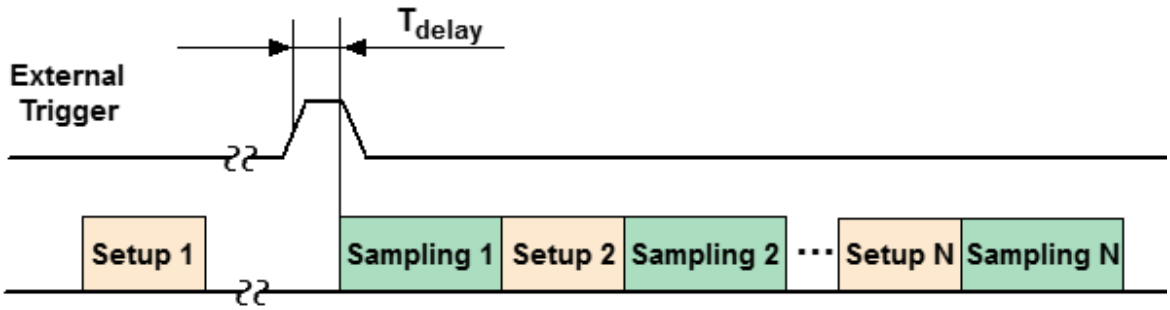
2. Click on the **Position** drop-down list in the EXTERNAL TRIGGER accordion in submenu and select the position between **Before Sampling** or **Before Setup**.



SCPI TRIGger:EXTernal:POSition

Trigger Delay

The external trigger delay sets the response delay with respect to the external trigger signal (see figure below).

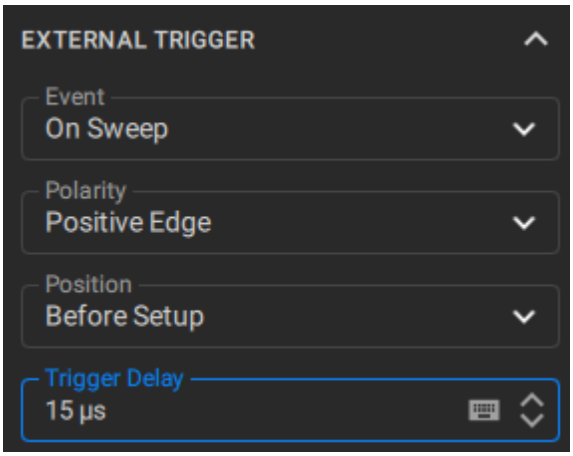


External Trigger Delay

Setting Trigger Delay

1. Click on the**Trigger** button in the main menu.

2. Click on the **Trigger Delay** textbox in the EXTERNAL TRIGGER accordion in submenu and enter the numerical values.

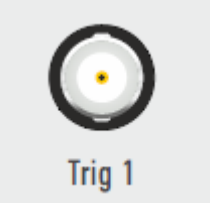


SCPI TRIGger:EXTernal:DELay

Trigger Output

This section describes the settings of the trigger output. The trigger output is a special Analyzer **Trig 1** connector used to output a logical signal from the Analyzer. By default, trigger output is disabled.

The trigger output is designed to synchronize external devices with the Analyzer measurement cycle.



Trigger Output Connector

To work with trigger output:

1. Turn ON trigger output (see Enabling Trigger Output).
2. Set the polarity of the trigger (see Trigger Output Polarity).
3. Select the trigger signal condition (see Function Output Trigger).

Enabling Trigger Output

This setting enables/disables the trigger output. By default, the trigger output is disabled.

NOTE	If the **Ext Trigger Ready** function is selected (see Function Output Trigger), the trigger source must be set to **External** to enable the trigger output (see Trigger Source).

Enabling/Disabling Trigger Output

1. Click on the **Trigger** button in the main menu.

2. Toggle TRIGGER OUTPUT ON/OFF in the TRIGGER OUTPUT accordion in the submenu.



SCPI	TRIGger:OUTPut:STATe

Trigger Output Polarity

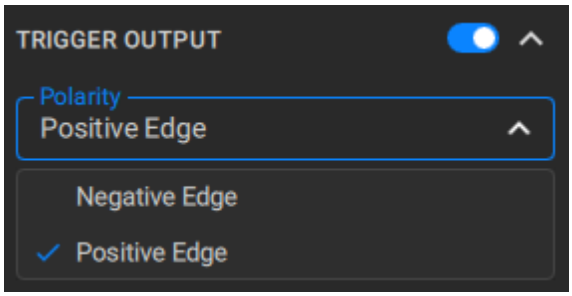
This setting selects the trigger output polarity.

Trigger Output Polarity	Function
Positive Edge [default]	The positive edge of the signal at the trigger output corresponds to the event.
Negative Edge	The negative edge of the signal at the trigger output corresponds to the event.

Setting Trigger Output Polarity

1. Click on the **Trigger** button in the main menu.

2. Click on the **Polarity** drop-down list in the TRIGGER OUTPUT accordion in submenu and select the polarity between the **Negative Edge** or **Positive Edge**.



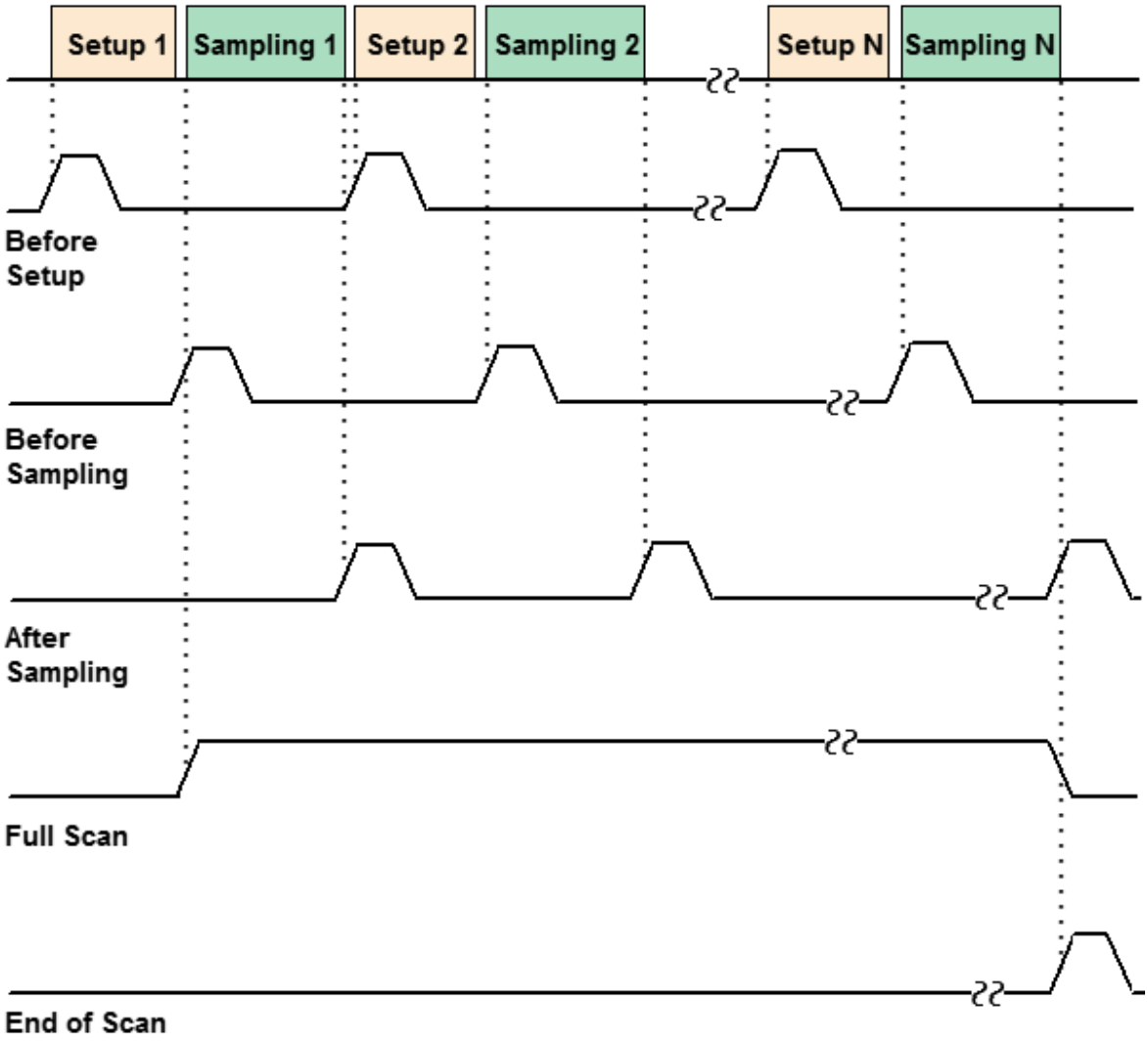
SCPI TRIGger:OUTPut:POLarity

Function Output Trigger

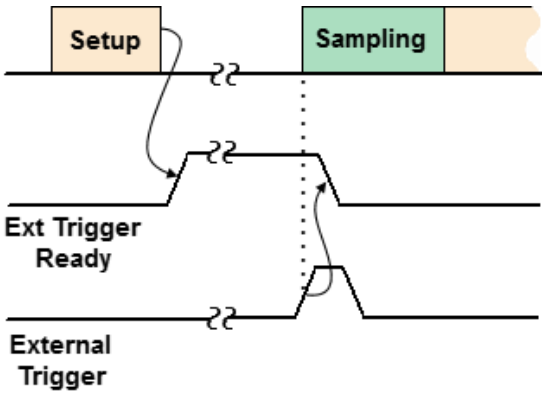
The purpose of the trigger output depends on the selected function.

Function Output Trigger	Description
Before Sampling	Single pulse before sampling.
Before Setup	Single pulse before setup frequency.
After Sampling	Single pulse after sampling.
Ext Trigger Ready	Indicates that the Analyzer is ready for the external trigger state. The signal position depends on the external trigger position setting. After the arrival of the external trigger, the ready for trigger signal is deselected and the measurement has begun.
End of Scan	Single pulse at the end of the sweep.
Full Scan	The pulse duration is equal to the duration of the measurement from the first to the last point.

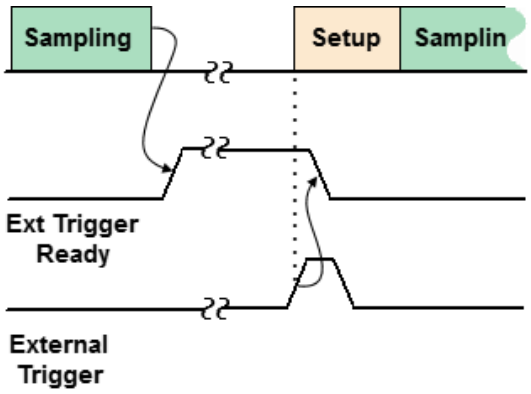
The figures below show the trigger output signal generation, depending on the selected trigger condition.



Trigger Output (except Ext Trig Ready)



External Trigger Set Before Sampling



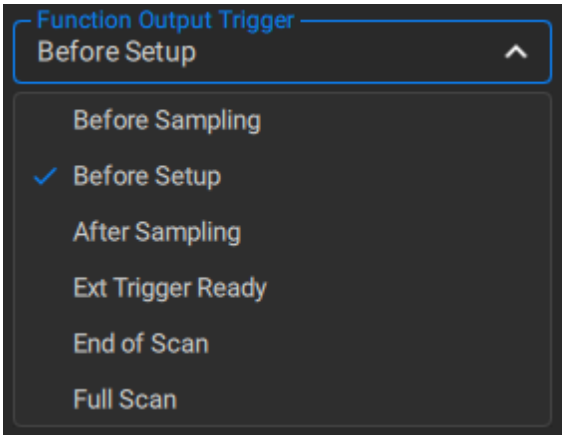
External Trigger Set Before Setup

Trigger Output (Ext Trigger Ready Only)

Setting Function Output Trigger

1. Click on the **Trigger** button in the main menu.

2. Click on the **Function Output Trigger** drop-down list in the TRIGGER OUTPUT accordion in submenu and select the required function.



SCPI TRIGger:OUTPut:FUNCtion

Measurement Parameters Settings

This section describes the settings of the measurement parameter selection. The parameter selection is applied to traces within a channel.

The Analyzer allows:

- S-parameter measurement with conversion of measurement results into the following parameters: impedance or admittance in reflection/transmission measurement, equivalent impedance or admittance in transmission shunt measurements (see S-Parameters and Conversion Function).
- General S-Parameter Conversion is used for general conversion of S-parameters to Z, Y-parameters based on the full matrix of S-parameters.
- Absolute power measurement at the receiver input (see Absolute Measurements).
- Absolute power measurement with an external power meter (see Absolute Power Measurement with an External Power Meter).

S-Parameters and Conversion Function

A measured S-parameter (S11, S21,...S1616) is set for each trace. For a detailed description of the principle of measuring S-parameters, see Principle of measuring S-parameters.

S-parameter conversion function is used to convert the measurement results into different parameters: impedance or admittance in reflection/transmission measurement, inverse S-parameter, equivalent impedance or admittance in transmission shunt measurements. Each trace can also be assigned an S-parameter conversion function that converts the measurement results (S_{ab}) into the following parameters:

Parameter	Equation
Inverse S-parameter ($1/S$)	$\frac{1}{S_{ab}}$
S-parameter complex conjugate ($Conj$)	S_{ab}^{*}
Impedance in reflection measurement (Zr)	$Zr = Z0a \cdot \frac{1+Saa}{1-Saa}$
Impedance in transmission measurement (Zt)	$Zt = \frac{2\cdot\sqrt{Z0a\cdot Z0b}}{Sab} - (Z0a + Z0b)$
Equivalent impedance in transmission shunt measurements ($Ztsh$)	$Ztsh = \frac{1}{Ytsh}$
Admittance in reflection measurement (Yr)	$Yr = \frac{1}{Zr}$
Admittance in transmission measurement (Yt)	$Yt = \frac{1}{Zt}$
Equivalent admittance in transmission shunt measurements ($Ytsh$)	$Ytsh = \frac{2\cdot\sqrt{Y0a\cdot Y0b}}{Sab} - (Y0a + Y0b)$
$Z0a$ is the characteristic impedance of Port a. $Z0b$ is the characteristic impedance of Port b. Sab is the measured S-parameter (a and b are the port identifiers). $Y0a = \frac{1}{Z0a}$, $Y0b = \frac{1}{Z0b}$	

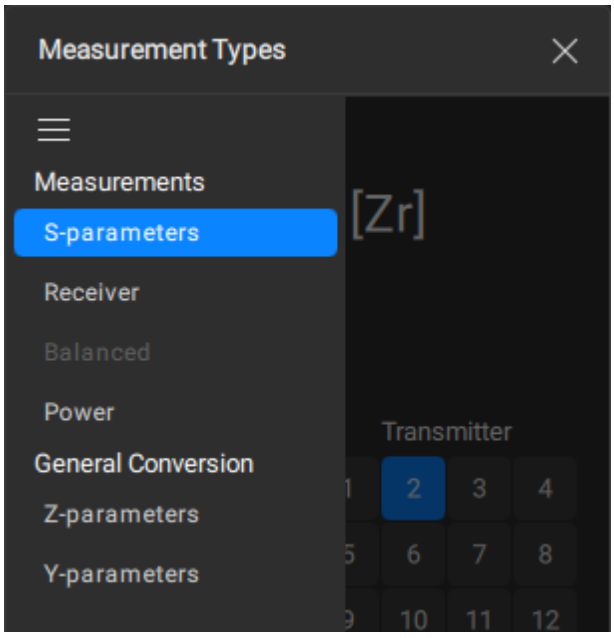
NOTE

Equations for Zr, Zt, Yr, Yt are approximate. The general method of converting S-parameters to Z, Y-parameters is presented in the General S-Parameter Conversion. The reason for using the approximate method is the measurement speed, as only one S-parameter is used in the calculations, whereas the general method requires measurement of the full matrix of S-parameters.

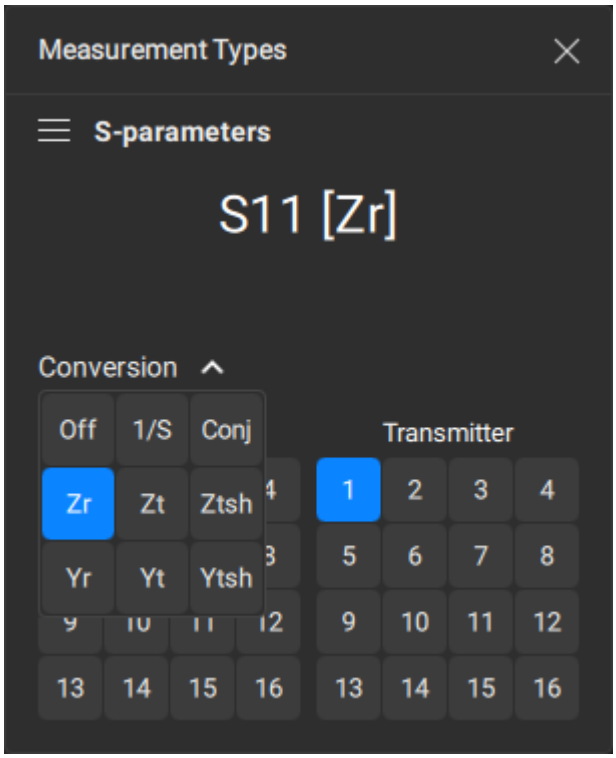
Setting S-Parameter and Conversion Function

1. Select the channel and trace (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Trace** button in the main menu.
3. Click on the **More Measurement** button in the submenu.
4. In the opened **Measurement Types** pop-up window (see figure below):

   1. Click on the ☰ icon and select the **S-parameters** in list if it is not selected.



   2. Select the **Receiver** and **Transmitter** port numbers.
   3. Click on the **Conversion** drop-down list and select the required conversion function.

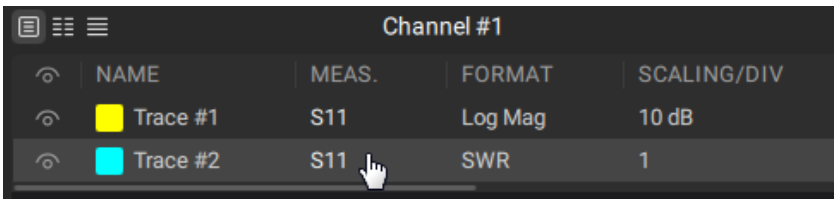


NOTE The S-parameter and conversion function (for example S11 [Zr] in figure above) corresponding to this selection are displayed in the upper text field of the pop-up window and in trace manager.

SCPI CALCulate:PARameter:DEFine

CALCulate:CONVersion, CALCulate:TRACe:CONVersion, CALCulate:CONVersion:FUNCtion, CALCulate:TRACe:CONVersion:FUNCtion

NOTE You can quickly select S-parameter and conversion function with the help of the trace manager. Click on the respective field in the trace manager and select the required S-parameter and conversion function in the pop-up window:



General S Parameter Conversion

This section describes the most common method of transformation of the S-parameters to Z, Y-parameters. The method is described in: Dean A. Frickey's "Conversions Between S, Z, Y, h, ABCD, and T Parameters which are Valid for Complex Source and Load Impedances".

The port impedances Z01, Z02, ... Z016 are real numbers determined by the SYSTEM IMPEDANCE accordion (see System Impedance Z0) when the Port Z Conversion function is not active. If the Port ZConversion function is active, then the port impedances Z01, Z02, ... Z016 are complex numbers determined by the Port ZConversion table (see Port Reference Impedance (Z) Conversion).

Setting General Conversion Function

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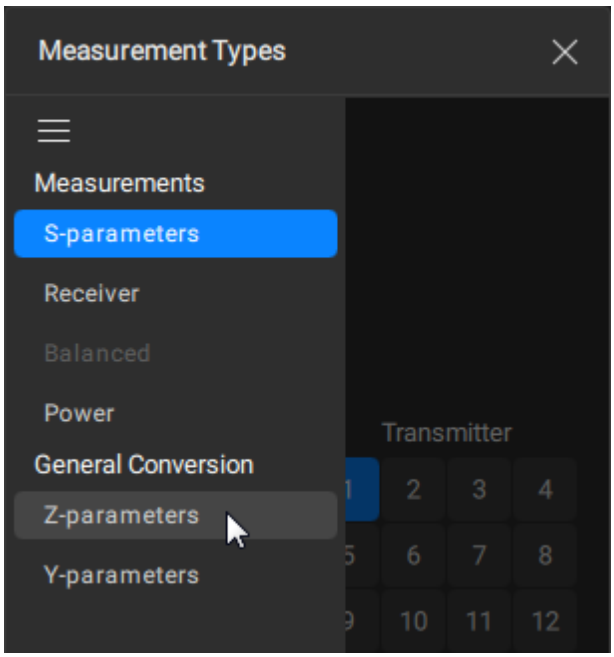
1. Select the channel and trace (see Selection of Active Trace, Diagram, Channel).

2. Click on the **Trace** button in the main menu.

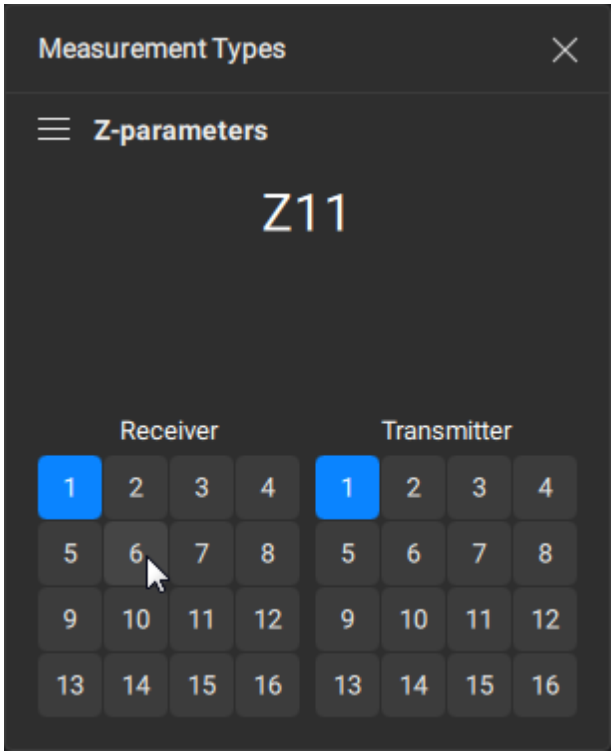
3. Click on the **More Measurement** button in the submenu.

4. In the opened **Measurement Types** pop-up window (see figure below):

   1. Click on the icon and select the conversion type in **General Conversion** in list.



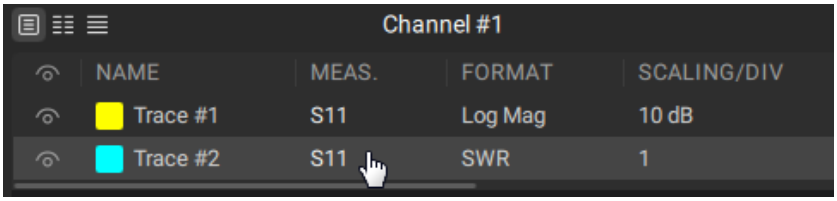
2. Select the **Receiver** and **Transmitter** port numbers.



NOTE The name of the selected general conversion function (for example **Z11** figure above) corresponding to this selection is displayed in the upper text field of the pop-up window and in trace manager.

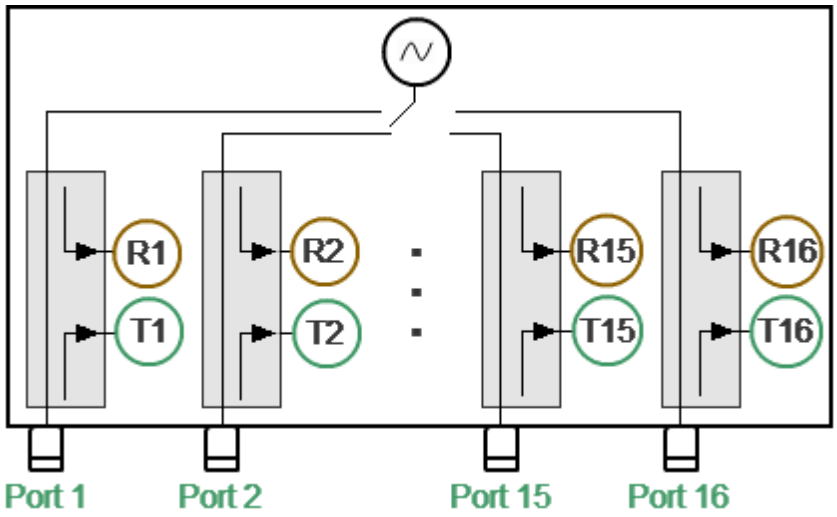
NOTE

You can quickly select general conversion function with the help of the trace manager. Click on the respective field in the trace manager and select the required conversion type and ports in the pop-up window:



Absolute Measurements

Absolute measurements are measurements of the absolute power of a signal at a receiver input. Unlike relative measurements of S-parameters, which represent a relation between the signals at inputs of two receivers, absolute measurements determine the signal power at the input of one receiver. A sixteen-port Analyzer has thirty two independent receivers: sixteen test signal receivers **T1, T2, ...,T16** and sixteen reference signal receivers **R1, R2, ..., R16** (see figure below).



Analyzer Block Diagram

There are 512 types of absolute measurements depending on the combination of the receiver and source port numbers (see table below).

Symbols	Definition
T1(n)	Test signal receiver of Port 1 (Source Port n)
T2(n)	Test signal receiver of Port 2 (Source Port n)
. . .	
T16(n)	Test signal receiver of Port 16 (Source Port n)
R1(n)	Reference signal receiver of Port 1 (Source Port n)

Symbols	Definition
R2(n)	Reference signal receiver of Port 2 (Source Port n)
. . .	
R16(n)	Reference signal receiver of Port 16 (Source Port n)

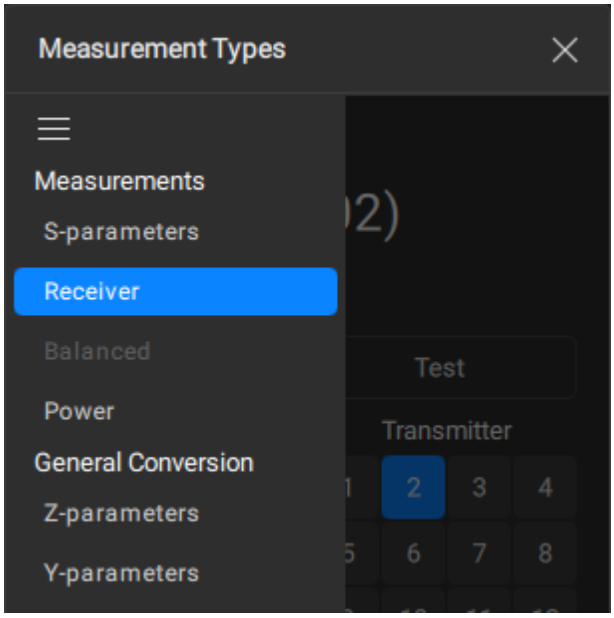
NOTE

In absolute measurement mode, **dBm** measurement units are used for logarithmic magnitude format, and **W** measurement units are used in the linear magnitude format. Other formats are not applicable to absolute measurements.

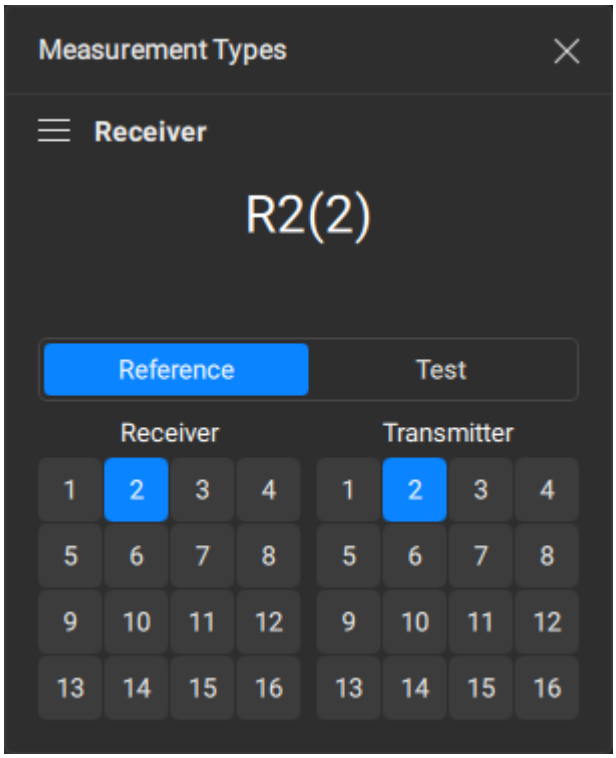
Setting Measured Absolute Parameter for Trace

1. Select the channel and trace (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Trace** button in the main menu.
3. Click on the **More Measurement** button in the submenu.
4. In the opened **Measurement types** pop-up window (see figure below):

    1. Click on the  icon and select the **Receiver** in list if it is not selected.



2. Select the type of receiver by clicking **Reference** or **Test** button in the segment switch.



3. Select **Receiver** and **Source** port numbers.

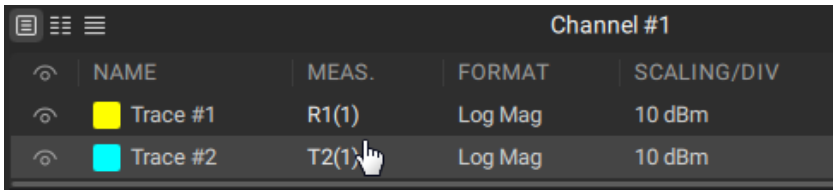
NOTE The absolute measurement (for example R2(2) in figure above) corresponding to this selection is displayed in the upper text field of the pop-up window.

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NOTE

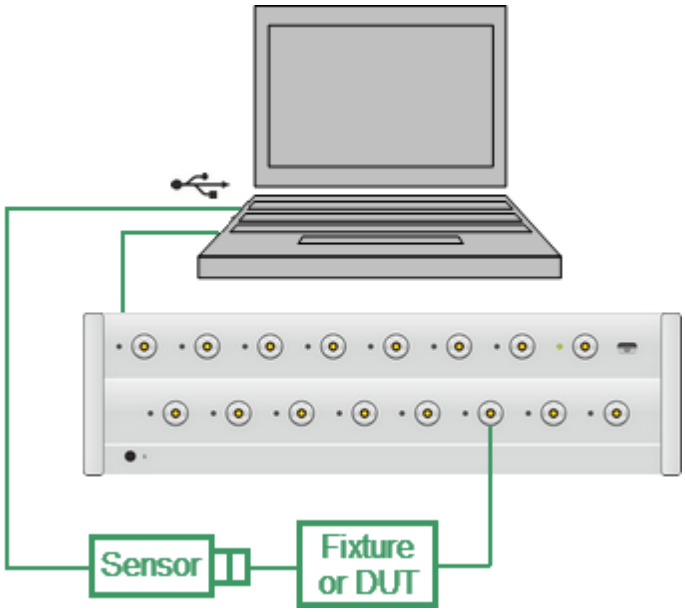
The absolute measurements are indicated in the trace status field in trace manager when enabled.

You can quickly select absolute measurements with the help of the trace manager. Left click on the respective field in the trace manager and select the required absolute measurements in the pop-up window:



Absolute Power Measurement with an External Power Meter

The absolute power measurement method involves using an external power meter to accurately measure the power levels of an RF signal in a transmission line or device under test (DUT). To perform absolute power measurement, the power meter must be connected to both the Analyzer and the fixture or DUT (see figure below).



Power Meter Setup Example

The list of power meters supported by the Analyzer is described in Power Meter Settings section. The specific range of measurement capability depends on the power meter model and the type of power sensor being used (see the manufacturer's datasheet).

Before taking measurement with the power meter, it is recommended to perform Zero Correction and Power Calibration (optional) for ensuring more accurate and reliable measurements and results.

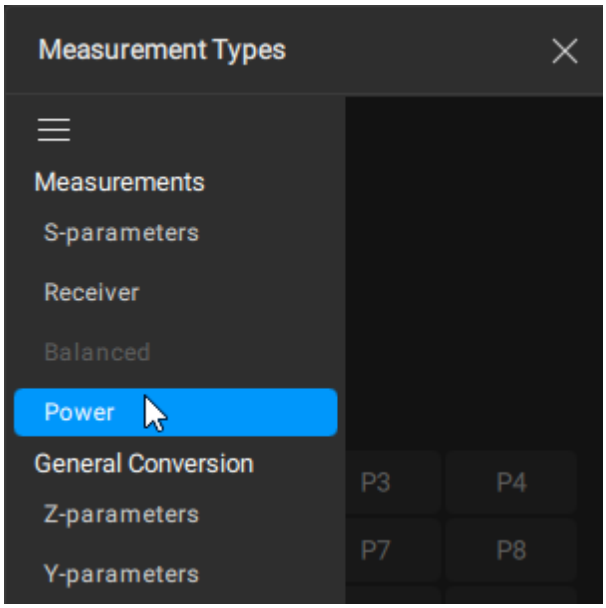
NOTE

In absolute power measurement mode, **dBm** measurement units are used for logarithmic magnitude format, and **W** measurement units are used in the linear magnitude format. Other formats are not applicable to absolute measurements.

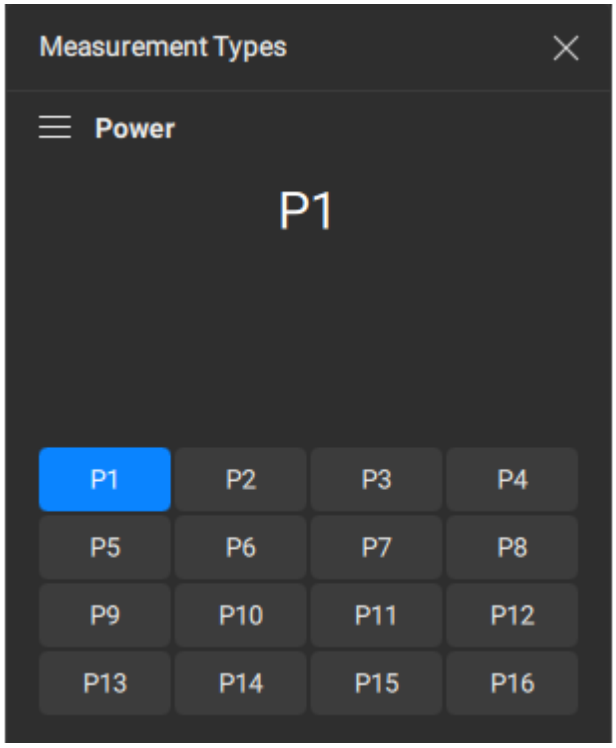
Setting Absolute Power Measurement for Trace

1. Connect the power peter to the PC and perform Zero Correction (see Power Meter Settings).
2. If necessary, perform Power Calibration (see Power Calibration).
3. Select the channel and trace (see Selection of Active Trace, Diagram, Channel).
4. Click on the **Trace** button in the main menu.
5. Click on the **More Measurement** button in the submenu.
6. In the opened **Measurement Types** pop-up window (see figures below):

    1. Click on the  icon and select the **Power** in list if it is not selected.



    2. Select Power Meter trace.

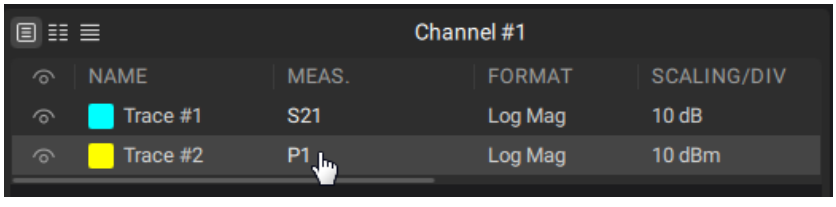


NOTE The absolute power measurement (for example P1 in figure above) corresponding to this selection is displayed in the upper text field of the pop-up window.

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NOTE The absolute power measurements are indicated in the trace status field in trace manager when enabled.

You can quickly select absolute power measurements with the help of the trace manager. Left click on the respective field in the trace manager and select the required absolute measurements in the pop-up window:



Format Setting

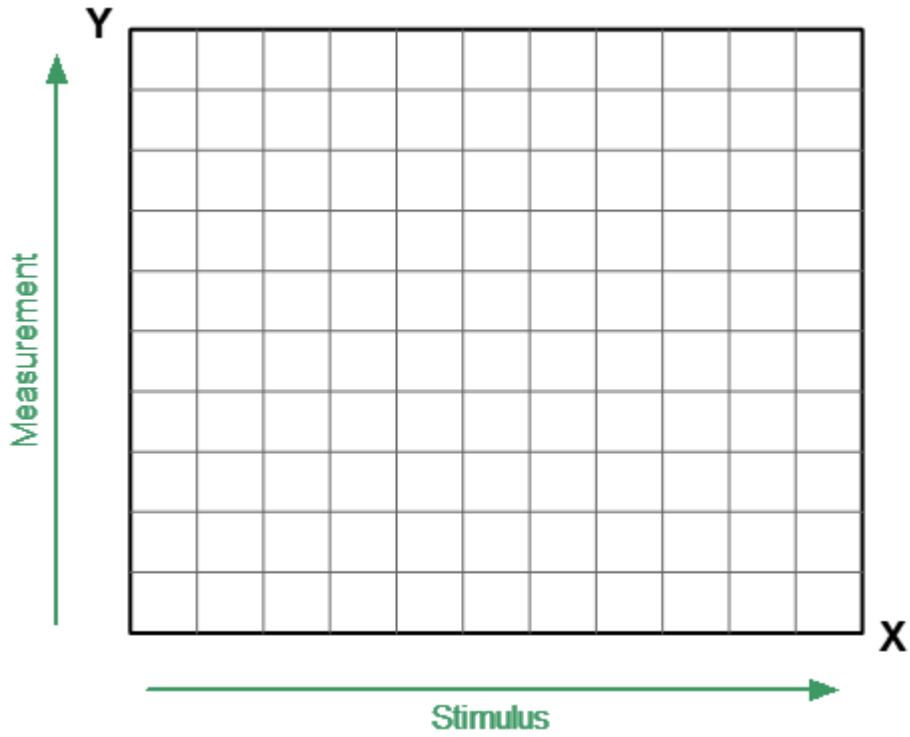
The format setting determines how measured data will be presented on the diagram.

The Analyzer offers three S-parameter measurement display types:

- Rectangular format
- Polar format
- Smith chart format

Rectangular Formats

In this format, stimulus values are plotted along X-axis and the measured data are plotted along Y-axis (see figure below).



Rectangular Format

To display the complex-valued S-parameters along the scalar Y-axis, they must be transformed into a real number. Rectangular formats involve various types of transformation of an S-parameter

$$S = a + j \cdot b,$$

where a — real part of S-parameter complex value,

b — imaginary part of S-parameter complex value.

There are eight types of rectangular formats depending on the measured value plotted along Y-axis (see table below).

Rectangular Formats

Format Type Description	Label	Data Type (Y-axis)	Measurement Unit (Y-axis)
Logarithmic Magnitude	**Log Mag**	S-parameter logarithmic magnitude: $20 \cdot \log\|S\|$, $\|S\| = \sqrt{a^2 + b^2}$	Decibel (dB)
Voltage Standing Wave Ratio	**SWR**	$\frac{1+\|S\|}{1-\|S\|}$	Dimensionless value
Phase	**Phase**	S-parameter phase from –180° to +180°: $\frac{180}{\pi} \cdot arctg\frac{b}{a}$	Degree (°)
Expanded Phase	**Ex Phase**	S-parameter phase, measurement range expanded to from below –180° to over +180°	Degree (°)
Group Delay	**Delay**	Signal propagation delay within the DUT: $-\frac{d\varphi}{d\omega}$, $\varphi = arctg\frac{b}{a},\ \omega = 2\pi \cdot f$	Second (sec.)
Linear Magnitude	**Lin Mag**	S-parameter linear magnitude: $\sqrt{a^2 + b^2}$	Dimensionless value
Real Part	**Real**	S-parameter real part: $a = re(S)$	Dimensionless value
Imaginary Part	**Imag**	S-parameter imaginary part: $b = im(S)$	Dimensionless value

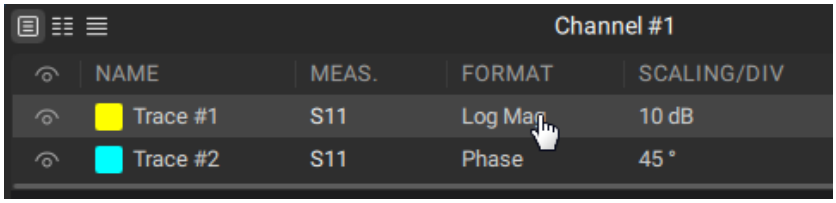
Setting Rectangular Formats

The format for each trace of the channel can be selected individually.

1. Select the channel and trace (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Trace** button in the main menu.
3. Click on the **Format** drop-down list in the submenu and select the required rectangular format from list:
   - **Lod Mag** — Logarithmic magnitude.
   - **SWR** — Voltage Standing Wave Ratio.
   - **Phase**
   - **Ex phase** — Extended phase.
   - **Delay** — Group delay.
   - **Lin Mag** — Linear magnitude.
   - **Real** — Real Part.
   - **Imag** — Imaginary Part.

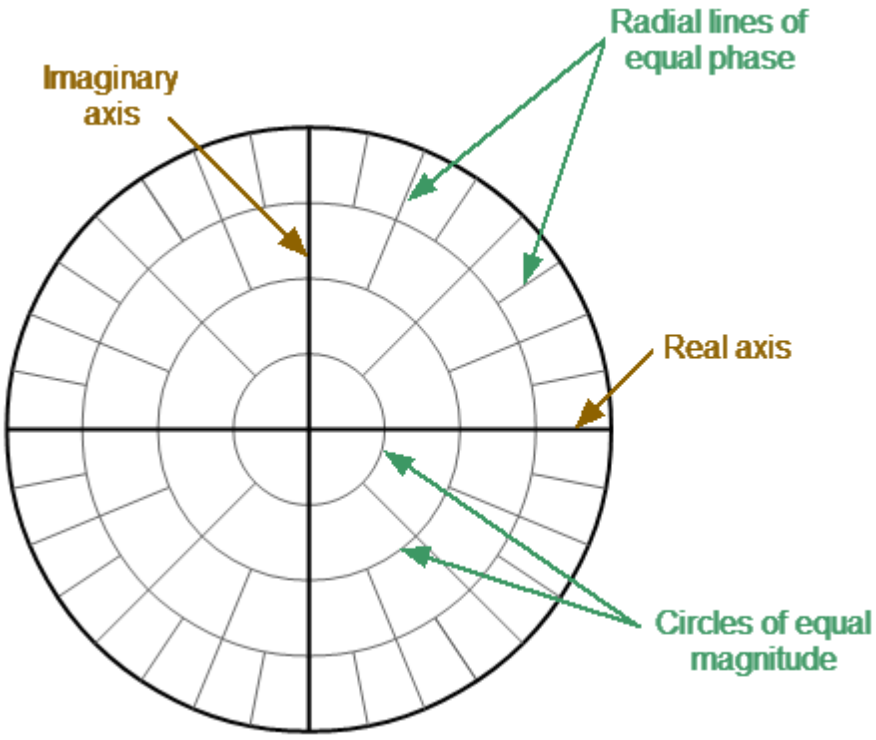
SCPI CALCulate:FORMat

NOTE You can quickly select the format with the help of the trace manager. Left click on the respective field in the trace manager and select the required format in the pop-up window:



Polar Format

The Polar format is used to display the amplitude and phase of the reflection coefficient (Γ) when measuring S11, S22, S33,... S1616. The complex reflection coefficient values are displayed on the polar diagram in the complex plane. The complex plane is formed by the real horizontal and the imaginary vertical axes. The grid lines correspond to points of equal amplitude and phase (see figure below).

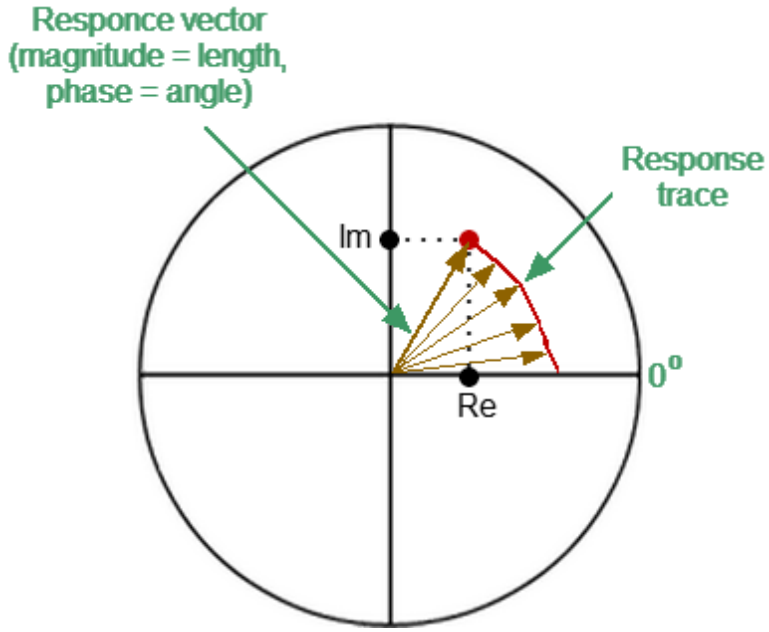


Polar Format

NOTE

On circular diagrams (Polar and Smith chart), any point of the trace can be defined in the following two ways (see figure below):

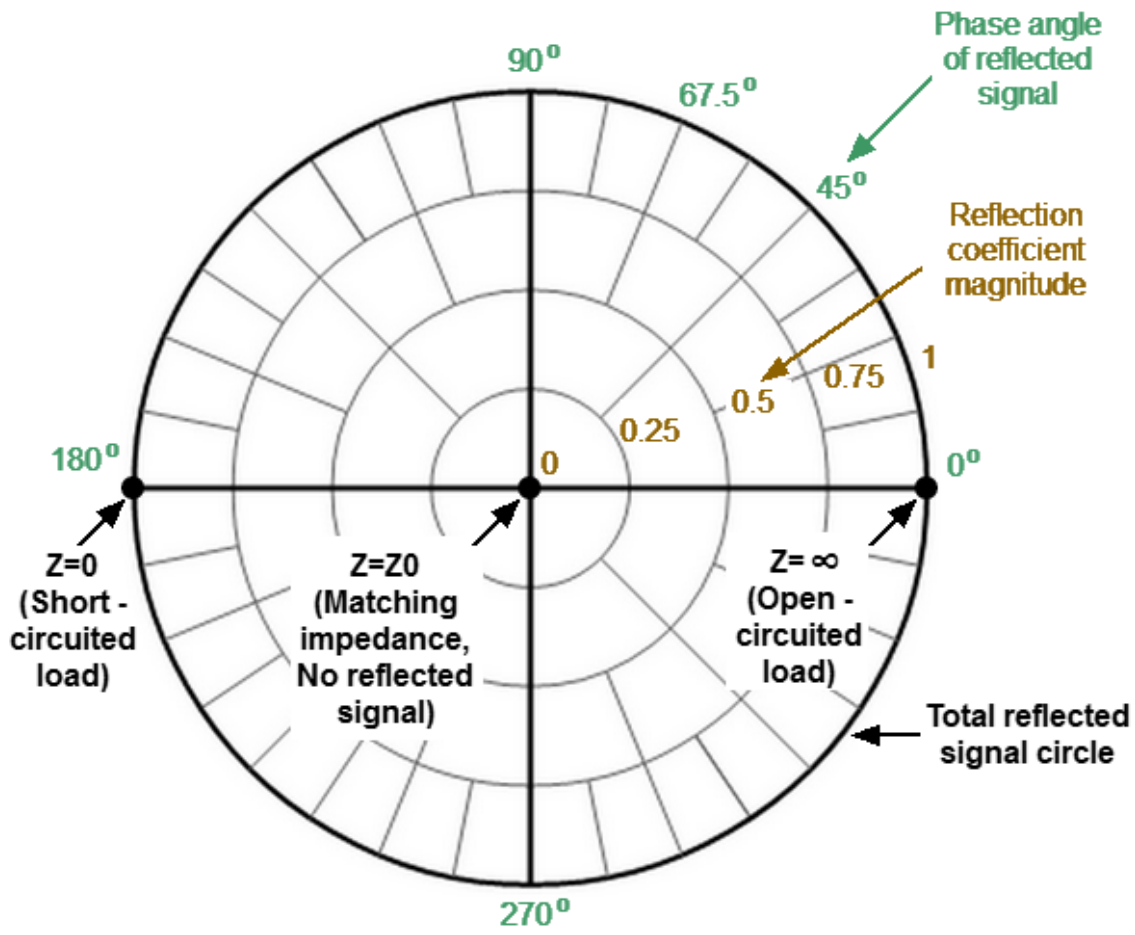
- Coordinates of the point (Re, Im) on the real and imaginary coordinate axes.
- Parameters of the vector directed to the point from the center of the diagram. The length of this vector is equal to the response amplitude, and the angle between the vector and the positive part of the real coordinate axis is equal to the phase of the response. The angle is calculated counterclockwise.



NOTE

Traces on all types of Smith chart and polar format are the same; the Analyzer replaces the base grid and default marker format when switching formats.

The Polar format diagram with the characteristic points is shown in the figure below.



Properties of Polar Format

Basic properties of the Polar format:

- The center of the diagram corresponds to the reflection coefficient $\Gamma = 0$ (reference impedance Z0 on the input test port of the DUT when measuring S11, S22,...S1616 matched circuit, no reflection).
- The outer circle of the diagram corresponds to the reflection coefficient $\Gamma = 1$ ($|Sii| = 1$, unmatched circuit, total reflection).
- Points with the same amplitude are located on a circle with the center coinciding with the center of the diagram.
- Points with the same phase are located on a line starting from the center.
- At the rightmost point of the horizontal axis, the impedance has an infinitely large value (open circuited load).
- At the leftmost point of the horizontal axis, the impedance value is zero (short circuited load).

The polar graph does not have a frequency axis, so frequency is indicated by markers. There are three types of polar formats corresponding to the data displayed by the marker; the traces remain the same for all the format types (see table below).

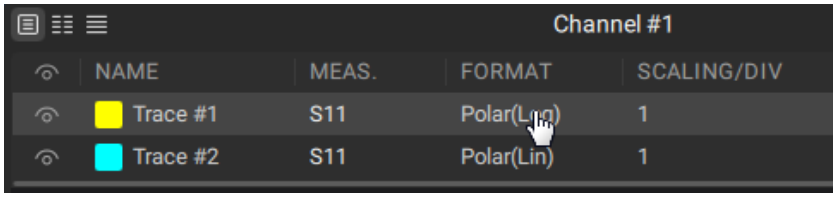
Format Type Description	Label	Data Displayed by Marker	Measurement Unit
Linear Magnitude and Phase	**Polar (Lin)**	S-parameter linear magnitude	Dimensionless value
		S-parameter phase	Degree (°)
Logarithmic Magnitude and Phase	**Polar (Log)**	S-parameter logarithmic magnitude	Decibel (dB)
		S-parameter phase	Degree (°)
Real and Imaginary Parts	**Polar (Re/Im)**	S-parameter real part	Dimensionless value
		S-parameter imaginary part	Dimensionless value

Setting Polar Format

1. Select the channel and trace (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Trace** button in the main menu.
3. Click on the **Format** drop-down list in the submenu and select the required polar format from the list:
   - **Polar (Log)** — Logarithmic magnitude and phase.
   - **Polar (Lin)** — Linear magnitude and phase.
   - **Polar (Re/Im)** — Real and imaginary parts.

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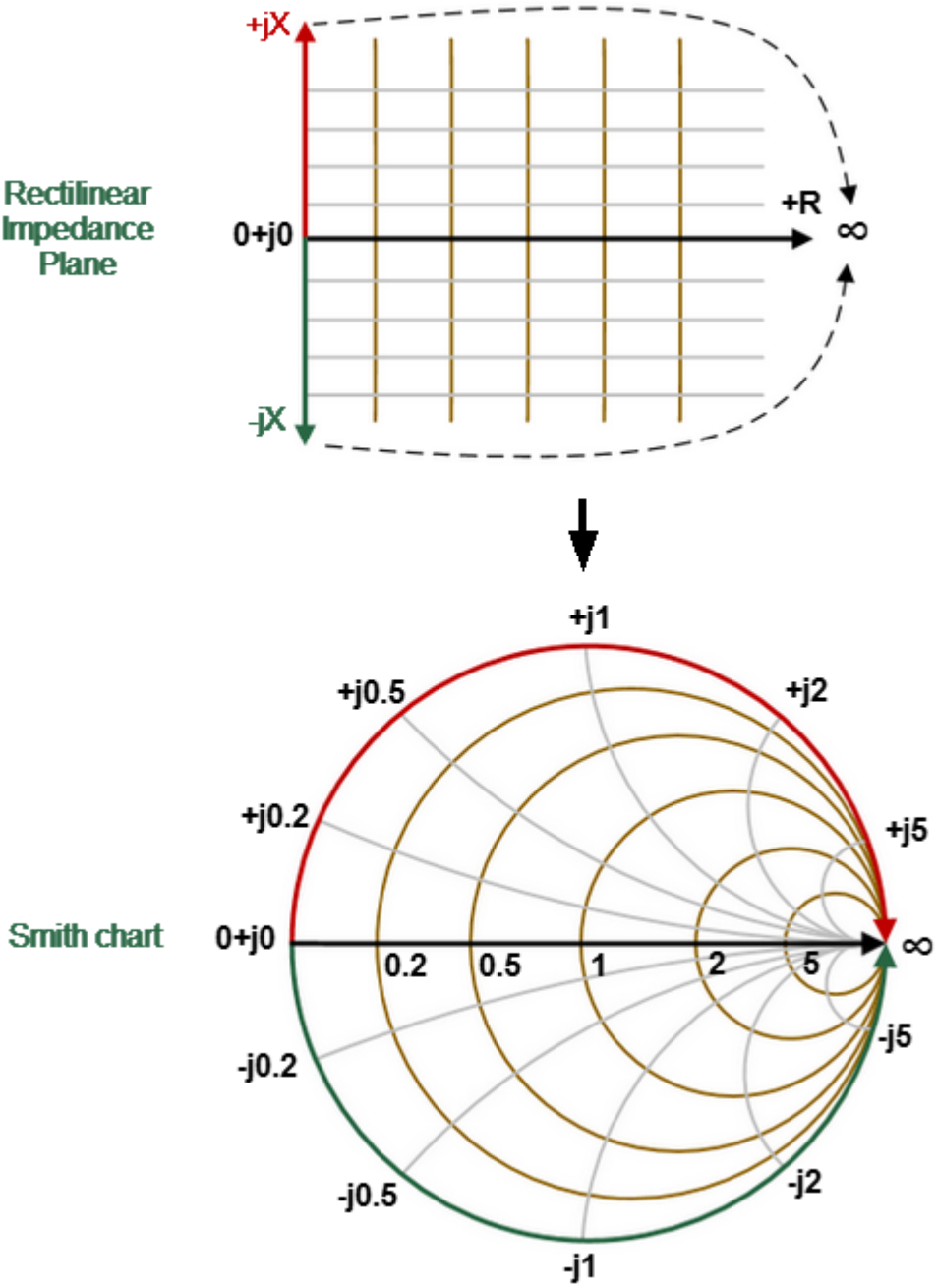
NOTE You can quickly select format with the help of the trace manager. Left click on the respective field in the trace manager and select the required format in the pop-up window:



Smith Chart Format

The Smith chart is a circular chart on which the measured complex reflection coefficients (S11, S22,...S1616) are compared with the normalized impedance of the DUT.

The Smith chart is formed from a rectilinear impedance plane by collapsing the area with positive resistance into a single unit circle (see figure below).

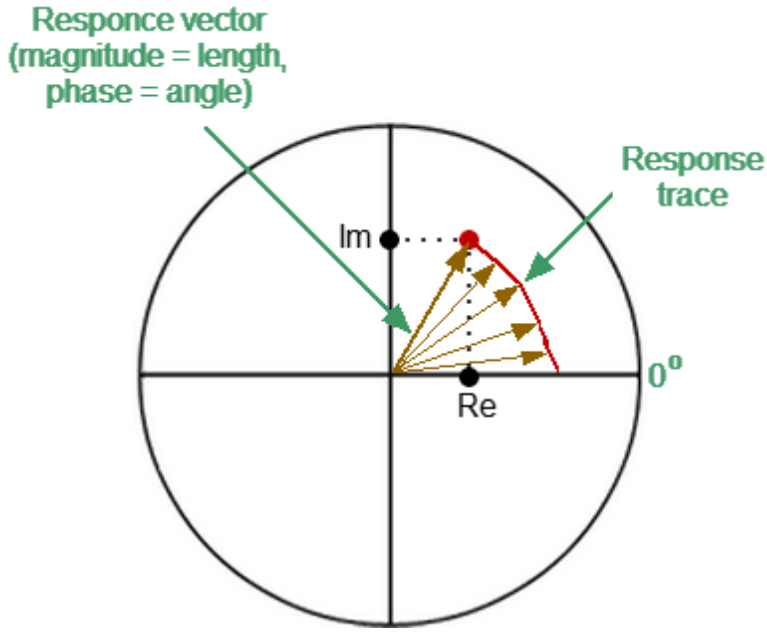


Converting Rectilinear Impedance Plane to Smith Chart

NOTE

On circular diagrams (Polar and Smith chart), any point of the trace can be defined in the following two ways (see figure below):

- Coordinates of the point (Re, Im) on the real and imaginary coordinate axes.
- Parameters of the vector directed to the point from the center of the diagram. The length of this vector is equal to the response amplitude, and the angle between the vector and the positive part of the real coordinate axis is equal to the phase of the response. The angle is calculated counterclockwise.



Basic properties of the Smith chart (see figure below):

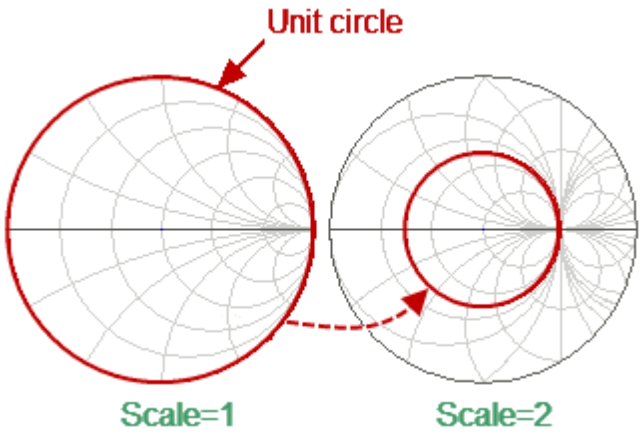
- Each point on the diagram is equivalent to the complex impedance of the DUT:

$$Z = R + jX,$$

  where R — real part of the impedance (resistance), X — imaginary part of the impedance (reactance).
- The horizontal axis is resistance; reactance on this axis is equal to zero.
- Grid lines of the diagram consist of circles of constant resistance and arcs of constant reactance.
- The center of the diagram corresponds to the system reference impedance (Z/Z0 = 1).

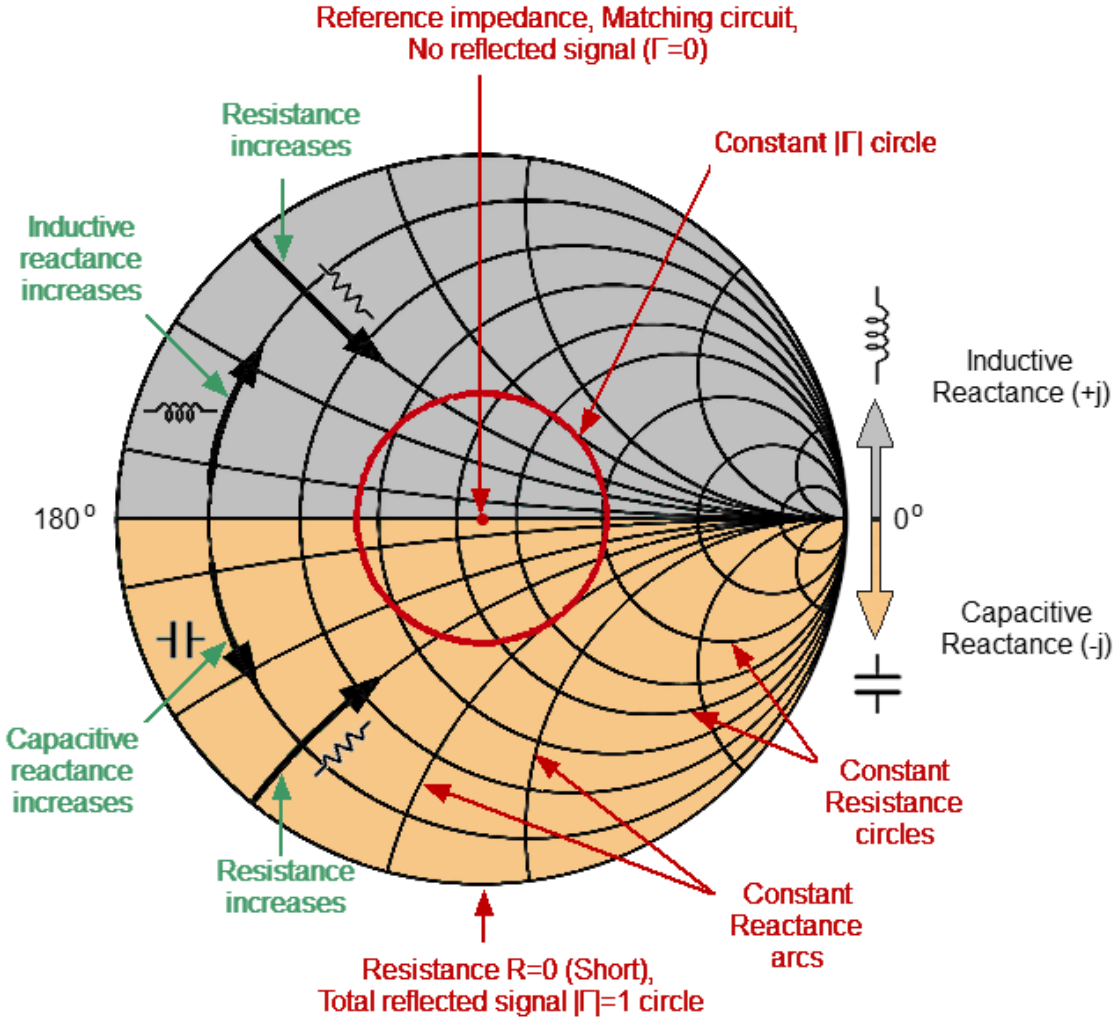
- At the rightmost point of the horizontal axis, the impedance has an infinitely large value (Open circuited load).
- At the leftmost point of the horizontal axis, the impedance value is zero (Short circuited load).
- The outer circle of the diagram at scale = 1 (or unit circle) corresponds to a zero resistance value (reactance only). The measured points inside the unit circle correspond to the passive load; the points outside to the active load.

NOTE Location of the unit circle at a scale greater than 1



- The upper and lower halves of the diagram correspond to the positive (inductive) and negative (capacitive) reactive components of impedance.
- The reflection coefficient value (Γ) at any point of the diagram is determined by the distance from it to the center of the diagram. Thus, any circle with the center coinciding with the center of the diagram contains equal values of the modulus of the reflection coefficient. The center of the diagram corresponds to a matched circuit with no reflected signal ($\Gamma = 0$). The unit circle diagram corresponds to an unmatched circuit with total reflection $|\Gamma| = 1$.

Use the Smith chart to assess circuit mismatch and determine whether the load is resistive, inductive, capacitive, or complex. The Smith chart format is useful for looking for mismatches introduced by parasitic elements connected in series with the DUT.

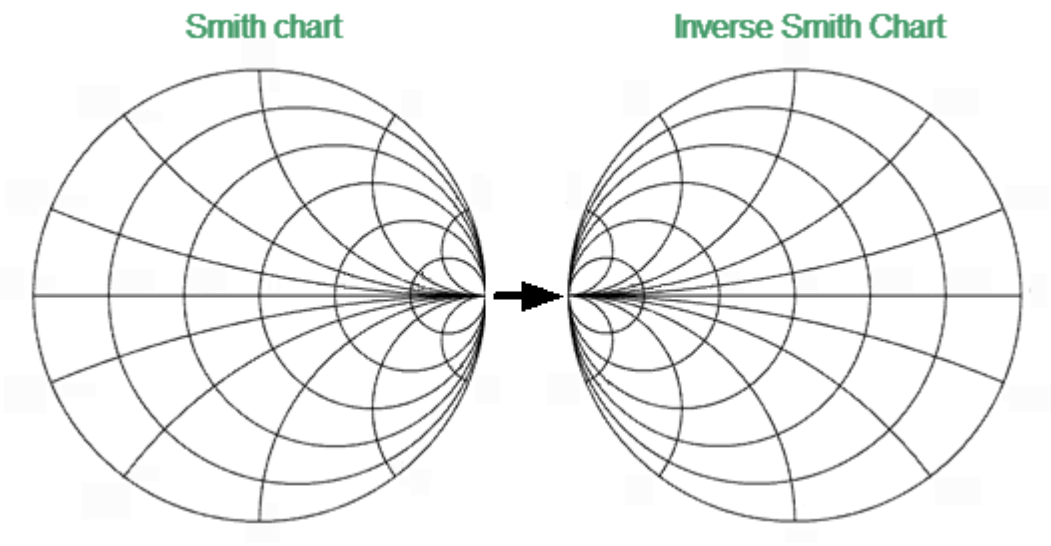


Smith chart properties

Inverse Smith Chart (Complex Admittance)

The Inverse Smith chart is a circular chart on which the measured complex reflection coefficients (S11, S22,...S1616) are compared with the normalized DUT admittance. Complex admittance is the inverse of complex impedance.

To build an Inverse Smith chart, mirror the Smith chart on the horizontal axis (see figure below).



Convert Smith Chart to Inverse Smith Chart

Basic properties of the Inverse Smith chart:

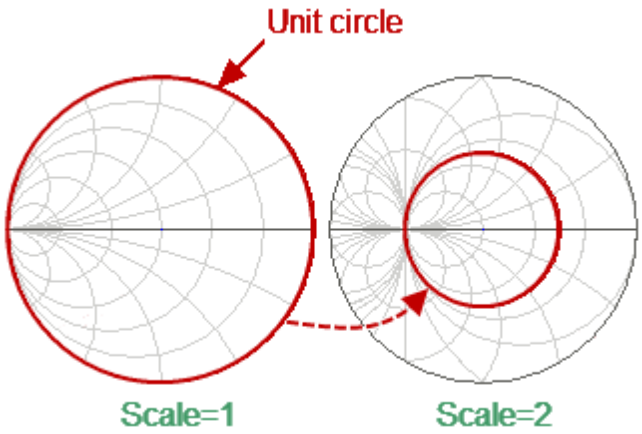
- Each point on the diagram is equivalent to the complex conductance of the DUT:

$$Y = G + jB,$$

  where G — real part of conductivity (conductance), B — imaginary part of conductivity (susceptance).

- The horizontal axis is only conductance; susceptance on this axis is equal to zero.
- The grid lines of the diagram consist of circles of constant conductance width and arcs of constant susceptance width.
- The center of the diagram corresponds to the reference conductivity of the system (Y/Y0 = 1).
- At the leftmost point of the horizontal axis, admittance is infinitely large (Short circuited load).
- At the rightmost point of the horizontal axis, admittance is equal to zero (Open circuited load).
- The outer circle at scale = 1 (or unit circle) corresponds to the zero value of conductance (susceptance only). The measured points inside the unit circle correspond to the passive load; the points outside to the active load.

NOTE Position of the unit circle at a scale greater than 1



- The upper and lower halves of the diagram correspond to the negative (inductive) and positive (capacitive) reactive components (admittance).
- The reflection coefficient display (Γ) on the Inverse Smith chart coincides with its display on the Smith chart. The center of the diagram corresponds to a matched circuit with no reflected signal (Γ=0). The unit circle diagram corresponds to an unmatched circuit with total reflection |Γ| = 1.

Use the Inverse Smith chart (admittance diagram) to search for a mismatch introduced by the parasitic elements shunting the DUT.

The Smith chart format does not have a frequency axis, so frequency is indicated by markers.

There are five types of Smith chart formats (see table below) corresponding to the data displayed by the marker; the traces remain the same for all the format types.

Format Type Description	Label	Data Displayed by Marker	Measurement Unit
Linear Magnitude and Phase	**Smith (Lin)**	S-parameter linear magnitude	Dimensionless value
		S-parameter phase	Degree (°)

Format Type Description	Label	Data Displayed by Marker	Measurement Unit
Logarithmic Magnitude and Phase	**Smith (Log)**	S-parameter logarithmic magnitude	Decibel (dB)
		S-parameter phase	Degree (°)
Real and Imaginary Parts	**Smith (Re/Im)**	S-parameter real part	Dimensionless value
		S-parameter imaginary part	Dimensionless value
Complex Impedance (at Input)	**Smith (R + jX)**	Resistance at input: $R = re(Z_{inp})$ $Z_{inp} = Z_0 \frac{1+S}{1-S}$	Ohm (Ω)
		Reactance at input: $X = im(Z_{inp})$	Ohm (Ω)
		Equivalent capacitance or inductance: $C = -\frac{1}{\omega X}, \quad X < 0$ $L = \frac{X}{\omega}, \quad X > 0$	Farad (F) Henry (H)

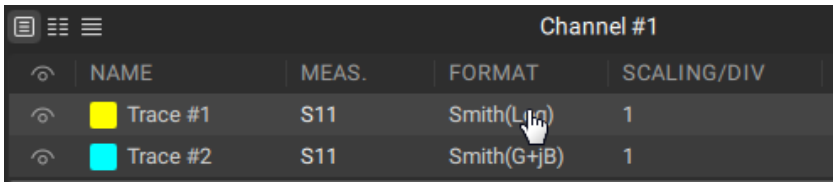
Format Type Description	Label	Data Displayed by Marker	Measurement Unit
Complex admittance (at Input)	**Smith (G + jB)**	Conductance at input: $G = re(Y_{inp})$ $Y_{inp} = \frac{1}{Z0} \cdot \frac{1-S}{1+S}$	Siemens (S)
		Susceptance at input: $B = imp(Y_{inp})$	Siemens (S)
		Equivalent capacitance or inductance: $C = \frac{B}{\omega}, \quad B > 0$ $L = -\frac{1}{\omega B}, \quad B < 0$	Farad (F) Henry (H)
Z0 — test port impedance. Z0 setting is described in System Impedance Z0.			

Setting Smith Chart Format

1. Select the channel and trace (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Trace** button in the main menu.
3. Click on the **Format** drop-down list in the submenu and select the required Smith format:
   - **Smith (Log)** — Logarithmic magnitude and phase.
   - **Smith (Lin)** — Linear magnitude and phase.
   - **Smith (Re/Im)** — Real and imaginary parts.
   - **Smith (R + jX)** — Complex impedance (at input).
   - **Smith (G + jB)** — Complex admittance (at input).

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NOTE You can quickly select the format with the help of the trace manager. Left click on the respective field in the trace manager and select the required format in the pop-up window.



Scaling Settings

The section describes how to set the scale for the different available formats.

The scale setting options depend on the selected data display format: rectangular format or circular format. For a detailed description of the scale settings for the different formats, see Rectangular Scale and Circular Scale (Polar and Smith).

You can apply the Automatic Scaling function for both formats.

These functions are also available when using the rectangular format:

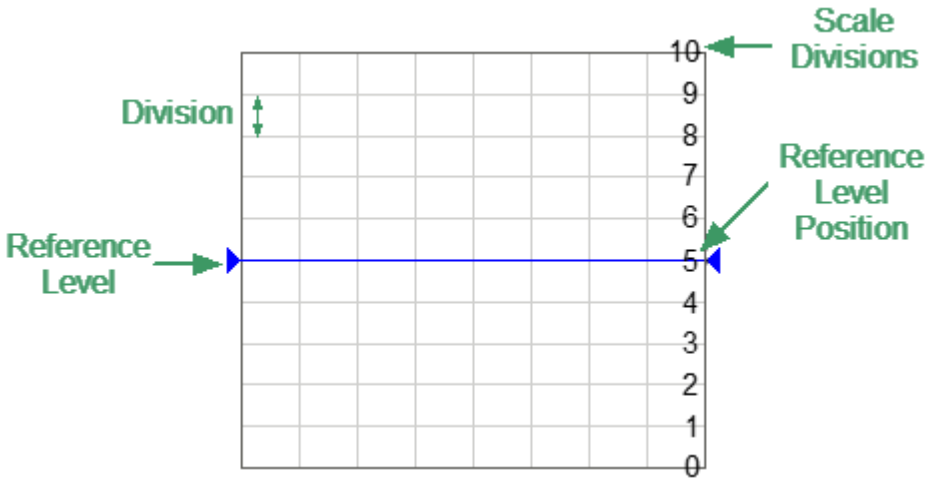
- Reference Level Automatic Selection
- Automatic Reference Level Tracking

This section also describes the electric delay setting functions (see Electrical Delay Setting), phase offsets (see Phase Offset Setting), and chart zooming feature (see Chart Zooming).

Rectangular Scale

For rectangular format, the following parameters can be set (see figure below):

- scale division
- reference level value
- reference level position
- number of scale divisions



Rectangular Scale

Setting Rectangular Scale

The scale of each trace can be set independently.

---

1. Click on the **Scale** button in the main menu.

2. Select the channel in the **Active Channel** drop-down list in the submenu.

   NOTE You can quickly activate the channel by clicking on it in the channel window (see more in Selection of Active Trace, Diagram, Channel).

3. Select the trace in **Active Trace** drop-down list in the submenu.

   NOTE You can quickly activate the trace by clicking on it in the trace manager (see more in Selection of Active Trace, Diagram, Channel).

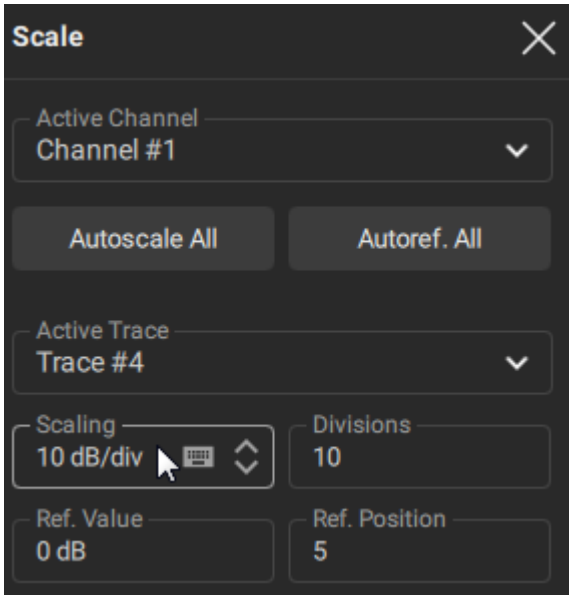
4. Select the required rectangular scale (see Rectangular Formats).

5 Enter the numerical values in the respective textboxes in the submenu:

- **Scaling** — The scale of a trace.
- **Ref. Value** — The reference level of a trace.
- **Divisions** — The number of trace scale divisions.

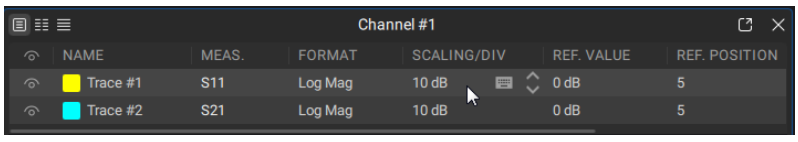
NOTE The number of scale divisions affects all traces of the channel.

- **Ref. Position** — The position of the reference level.



SCPI DISPlay:WINDow:TRACe:Y:PDIVision, DISPlay:WINDow:TRACe:Y:RLEVel, DISPlay:WINDow:TRACe:Y:RPOSition, DISPlay:WINDow:Y:DIVisions

NOTE You can quickly select the scale, reference value, and reference position with the help of the trace manager. Left click on the respective field in the trace manager and enter the required numerical value in the field.



These parameters can also be set in diagram:

- To set parameter **Scaling**, also known as the vertical scale division value, move the mouse over the vertical graticule label and scroll using the mouse wheel (see figure below).
- To set parameter **Ref. Value**, move the mouse over the vertical graticule label and scroll using the mouse wheel while pressing the left mouse button:

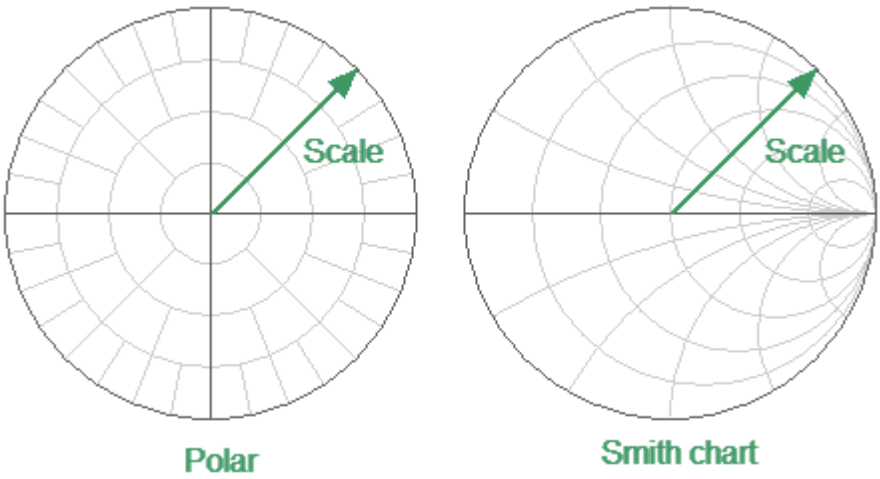


- The parameter **Ref. Position** is indicated on the vertical scale by the symbols "▶" and "◀". To set parameter **Ref. Position**, move the mouse onto the reference level symbol until an arrow appears on it, then press the left mouse button, and, without releasing it, drag the reference level symbol to the desired position:



Circular Scale

For Polar formats and Smith chart formats, the outer circle value can be set (see figure below).



Circular Scale

Setting Circular Scale

---

1. Click on the **Scale** button in the main menu.

2. Select the channel in the **Active Channel** drop-down list in the submenu.

   NOTE You can quickly activate the channel by clicking on it in the channel window (see more Selection of Active Trace, Diagram, Channel).

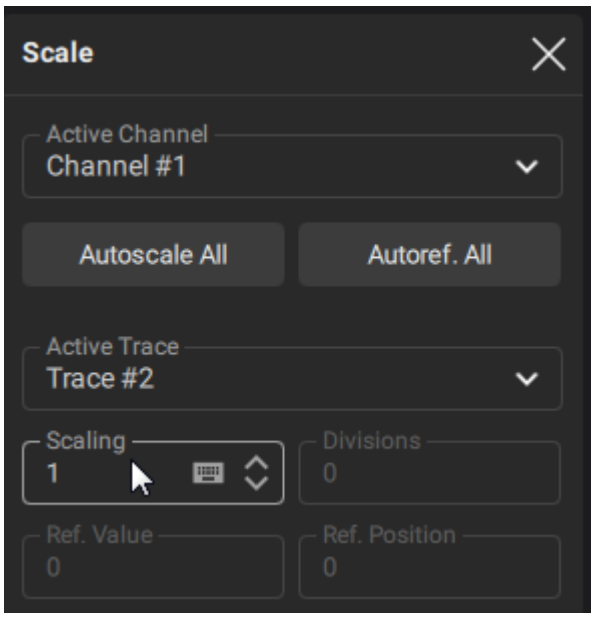
3. Select the trace in **Active Trace** drop-down list in the submenu.

   NOTE You can quickly activate the trace by clicking on it in the trace manager (see more Selection of Active Trace, Diagram, Channel).

4. Select the required circular scale (see Polar Format and Smith Chart Format).

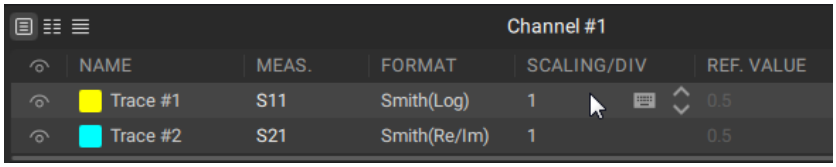
5. Click on **Scaling** textbox in the submenu and enter the numerical values.

   NOTE Next textboxes: **Ref. Value**, **Ref. Position**, **Divisions** are not available for setting circular scale.



SCPI DISPlay:WINDow:TRACe:Y:PDIVision

NOTE You can quickly select the scale with the help of the trace manager. Left click on the respective field in the trace manager and enter the required numerical value in the field.



Automatic Scaling

The automatic scaling function automatically adjusts the trace scale so that the trace of the measured value fits into the diagram entirely.

In rectangular format, two parameters are adjustable: scale division and reference level position. In circular format, the outer circle value is adjustable.

Automatic Scaling Procedure

---

1. Click on the **Scale** button in the main menu.

2. Select the channel in the **Active Channel** drop-down list in the submenu.

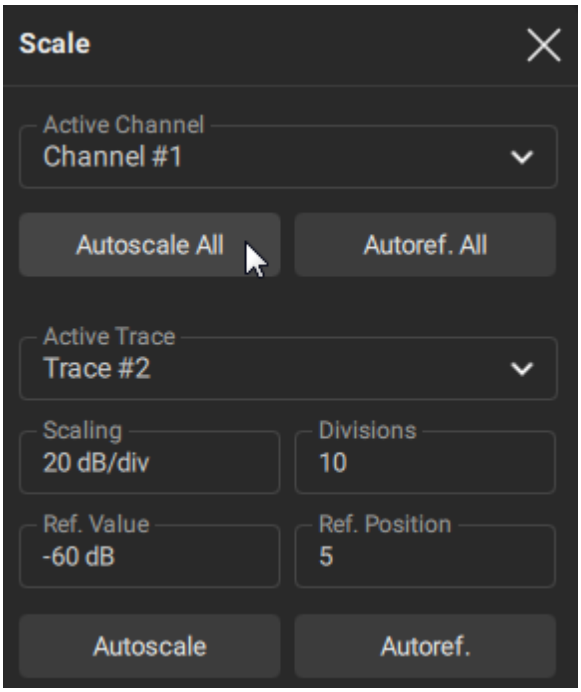
   NOTE You can quickly activate the channel by clicking on it in the channel window (see more Selection of Active Trace, Diagram, Channel).

3. Select the trace in **Active Trace** drop-down list in the submenu.

   NOTE You can quickly activate the trace by clicking on it in the trace manager (see more Selection of Active Trace, Diagram, Channel).

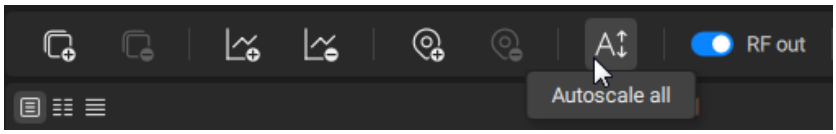
4. Click on the **Autoscale** button in the submenu to automatically select the scale of the active trace.

   Click on the **Autoscale All** button in the submenu to automatically select the scale of all traces of the active channel.



SCPI DISPlay:WINDow:TRACe:Y:AUTO

NOTE You can quickly set autoscale to all traces of the active channel with the help of the Quick Access Toolbar:



Reference Level Automatic Selection

This function automatically selects the reference level in rectangular coordinates. After selection, the trace of the measured value shifts vertically so that the reference level crosses the trace in the middle. The scale division is unaffected.

Automatic Reference Level Automatic Procedure

1. Click on the **Scale** button in the main menu.

2. Select the channel in the **Active Channel** drop-down list in the submenu.

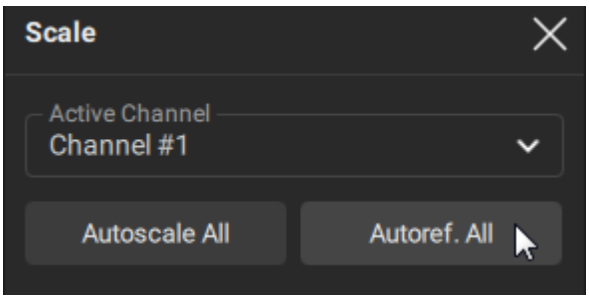
   NOTE You can quickly activate the channel by clicking on it in the channel window (see more Selection of Active Trace, Diagram, Channel).

3. Select the trace in the **Active Trace** drop-down list in the submenu.

   NOTE You can quickly activate the trace by clicking on it in the trace manager (see more Selection of Active Trace, Diagram, Channel).

4. Click on the **Autoref.** button in the submenu to automatically select the reference level of the active trace.

   Click on the **Autoref. All** button in the submenu to automatically select the reference level of all traces of the active channel.



SCPI DISPlay:WINDow:TRACe:Y:RLEVel:AUTO

Automatic Reference Level Tracking

The automatic reference level tracking function tracks the reference level of a trace. When enabled, the trace reference level is updated with each scan according to the selected method: maximum, minimum, mean, or according to the value of the active marker. The scale per division value does not change. The function is only applicable to the rectangular format.

Automatic Reference Level Tracking Procedure

1. Click on the **Scale** button in the main menu.

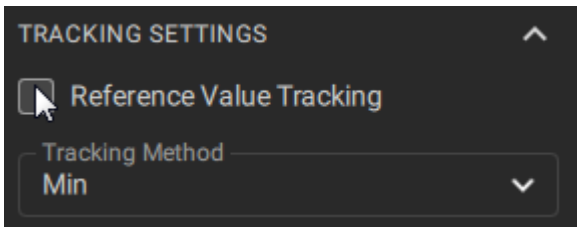
2. Select the channel in the **Active Channel** drop-down list in the submenu.

   NOTE You can quickly activate the channel by clicking on it in the channel window (see more Selection of Active Trace, Diagram, Channel).

3. Select the trace in the **Active Trace** drop-down list in the submenu.

   NOTE You can quickly activate the trace by clicking on it in the trace manager (see more Selection of Active Trace, Diagram, Channel).

4. Select the **Reference Value Tracking** checkbox in the TRACKING SETTINGS accordion in submenu.



5. Click on the **Tracking method** drop-down list in the submenu and select the required reference level tracking method from the list:

   - **Max** — maximum trace value
   - **Min** — minimum trace value
   - **Mean** — average trace value
   - **Active Marker** — active marker value

Electrical Delay Setting

The electrical delay function compensates for the electrical delay of the trace measurement. This function is useful during the performance of such measurements as phase deviations from linear.

If the electrical delay setting is other than zero, the S-parameter value will be corrected in accordance with the following formula:

$$S = S_{meas} \cdot e^{j \cdot 2\pi \cdot f \cdot t},$$

where f — frequency, Hz

t — electrical delay, sec

The electrical delay can be specified in seconds or as an equivalent distance (meters, feet, inches). Choose between the media (coax or waveguide) and set the velocity factor and the waveguide cutoff (for waveguide media only). When the value for equivalent distance in entered, the Analyzer automatically recalculates it into a delay.

The electrical delay is set individually for each trace, which totally distinguishes this method from the Port extension method.

Setting Electrical Delay

The electrical delay is set for each trace independently.

---

1. Click on the **Scale** button in the main menu.

2. Select the channel in the **Active Channel** drop-down list in the submenu.

   NOTE You can quickly activate the channel by clicking on it in the channel window (see more Selection of Active Trace, Diagram, Channel).

3. Select the trace in the **Active Trace** drop-down list in the submenu.

   NOTE You can quickly activate the trace by clicking on it in the trace manager (see more Selection of Active Trace, Diagram, Channel).

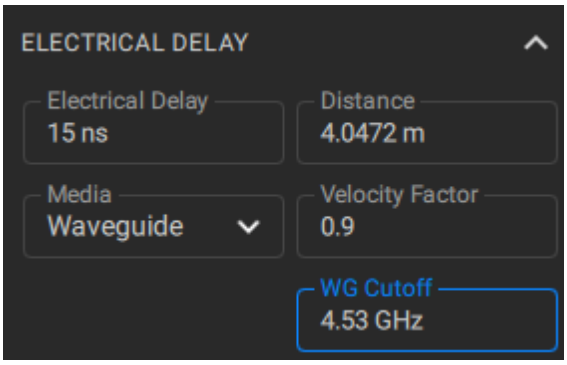
4. Click on the **Electrical Delay** or **Distance** textbox in ELECTRICAL DELAY accordion in the submenu and enter the numerical value.

   NOTE You can change the units of equivalent distance (see Decimal Units).

5. Click on the **Media** drop-down list in ELECTRICAL DELAY accordion in the submenu and select the required transmission line between **Coax** and **Waveguide**.

6. Click on the **Velocity Factor** textbox in ELECTRICAL DELAY accordion in the submenu and enter the numerical value.

7. If **Waveguide** media is selected, click on the **WG Cutoff** textbox in ELECTRICAL DELAY accordion in the submenu and enter the numerical value.



SCPI CALCulate:CORRection:EDELay:TIME

CALCulate:CORRection:EDELay:DISTance

CALCulate:CORRection:EDELay:MEDia

CALCulate:CORRection:EDELay:RVELocity

CALCulate:CORRection:EDELay:WAVeguide:CUToff

Phase Offset Setting

The phase offset function adds the constant offset to the phase of a trace.

Setting Phase Offset

The value of the phase offset is set in degrees for each trace independently.

---

1. Click on the **Scale** button in the main menu.

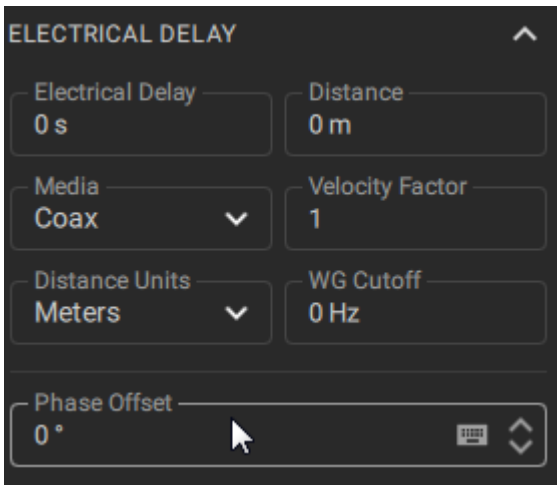
2. Select the channel in the **Active Channel** drop-down list in the submenu.

   NOTE You can quickly activate the channel by clicking on it in the channel window (see more Selection of Active Trace, Diagram, Channel).

3. Select the trace in the **Active Trace** drop-down list in the submenu.

   NOTE You can quickly activate the trace by clicking on it in the trace manager (see more Selection of Active Trace, Diagram, Channel).

4. Click on the **Phase Offset** textbox in ELECTRICAL DELAY accordion in the submenu and enter the numerical value.



SCPI CALCulate:CORRection:OFFSet:PHASe

Chart Zooming

The zooming feature allows you to quickly magnify an area of a diagram so you can examine it more closely.

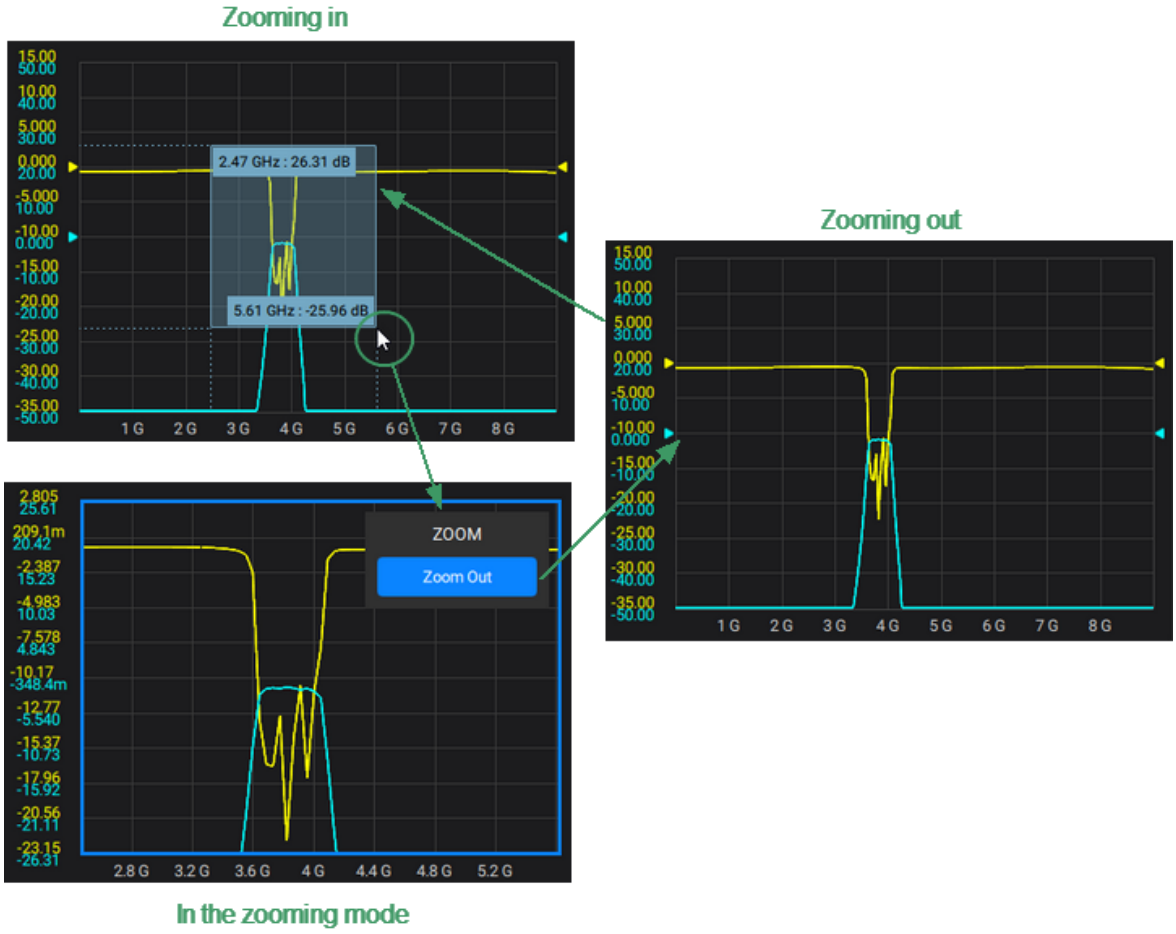


Chart Zooming

NOTE The zooming mode does not affect the sweep parameters. For example, if the sweep range is set from 300 kHz to 9 GHz, the measurements will be performed withing the specified sweep range and will not be limited to the zoomed area.

Chart Zooming In/Out

1. Click on the **Scale** button in the main menu.

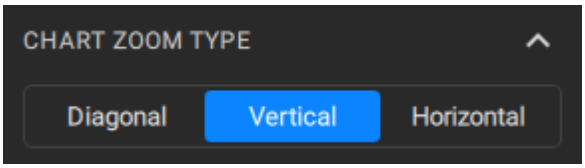
2. Select the channel in the **Active Channel** drop-down list in the submenu.

   NOTE You can quickly activate the channel by clicking on it in the channel window (see more Selection of Active Trace, Diagram, Channel).

3. Select the trace in the **Active Trace** drop-down list in the submenu.

   NOTE You can quickly activate the trace by clicking on it in the trace manager (see more Selection of Active Trace, Diagram, Channel).

4. Click on the **Diagonal | Vertical | Horizontal** segment button in CHART ZOOM TYPE accordion and select the type of the zoom.



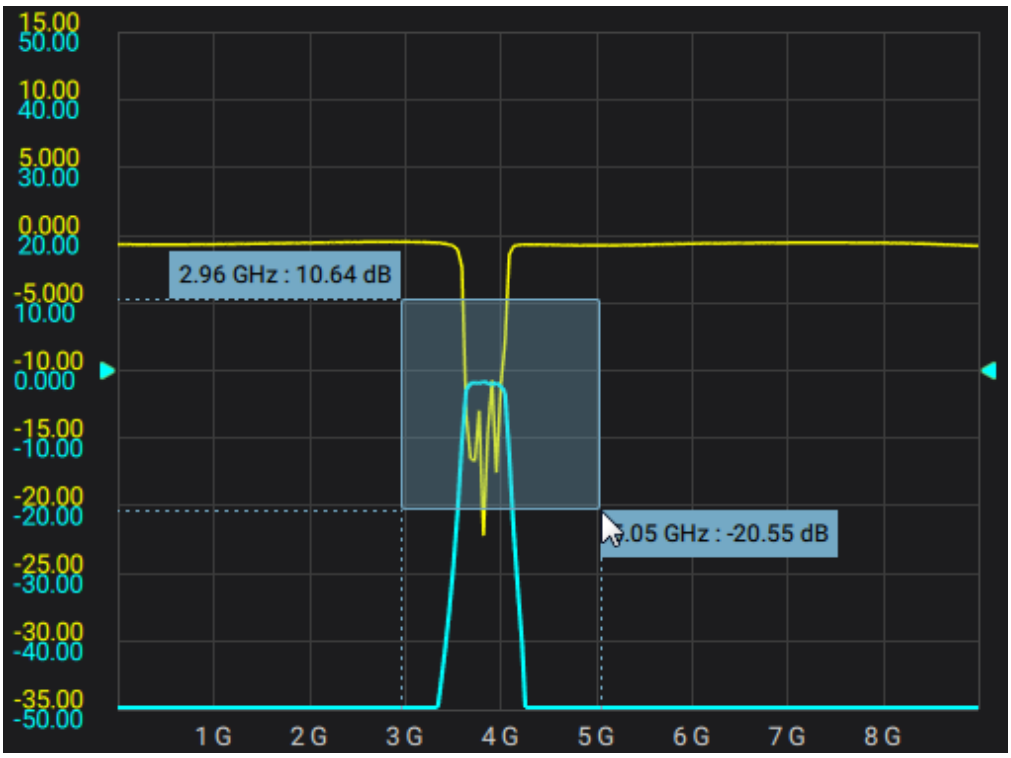
5 Move the mouse pointer to the channel window and select a desired area on the chart to be zoomed in:

1. Position the pointer at the starting point of the area you want to magnify.

2. Press and hold the left mouse button and drag the pointer to the ending point of the area you want to magnify.

3. Release the mouse button, and the selected area is zoomed in.

NOTE The smaller the area you select, the greater the magnification.



6 If you want to zoom the chart out, click on the **Zoom Out** button in the right upper corner of the channel window.

NOTE The chart will be displayed at its default scale.

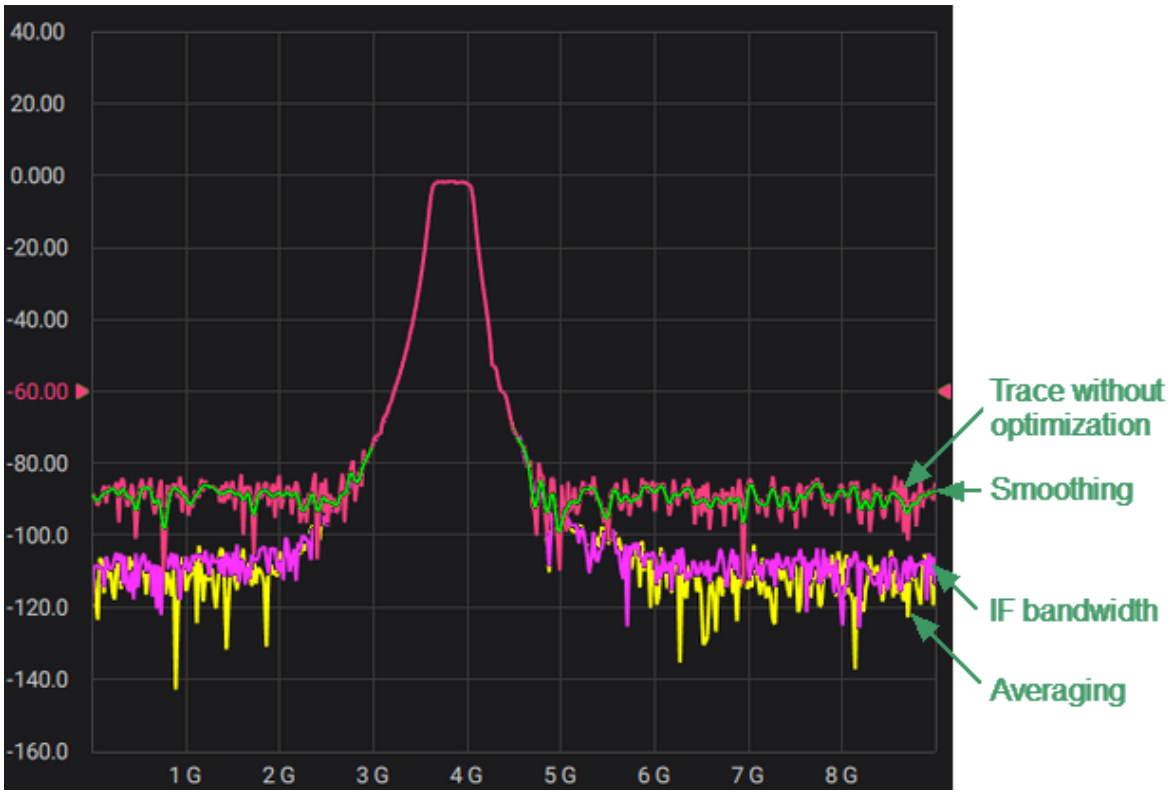


Measurement Optimization

This section describes ways to optimize the measurement:

- Narrowing the IF bandwidth of measurement receivers increases the signal-to-noise ratio and extends the dynamic range of measurements. This increases the value of the sweep time. For a detailed description, see IF bandwidth.
- Averaging increases the signal-to-noise ratio and extends the dynamic range of the measurements. Averaging does not increase the value of the sweep time. The averaging result is complete after N sweeps, where N is an averaging factor. For a detailed description, see Averaging.
- Smoothing does not change the dynamic range of the measurements, but does reduce the noise emissions of the signal. For a detailed description, see Smoothing.

The figure below shows an example of applying different optimization methods to the signal: the IF bandwidth is reduced by a factor of 10, averaging factor is set to 100, and smoothing is applied with an aperture of 2%.



Example of the Application of Different Measurement Optimization

IF Bandwidth Setting

The IF bandwidth setting selects the bandwidth of the receivers. The IF bandwidth value can be selected from the following series: 1 Hz, 1.5 Hz, 2 Hz, 3 Hz, 5 Hz, 7 Hz, 10 Hz, 15 Hz, 20 Hz ... 200 kHz, 300 kHz.

Narrowing the IF bandwidth increases the signal-to-noise ratio and extends the dynamic range of measurements. Narrowing the IF bandwidth by 10 will nominally extend the dynamic range by 10 dB. Narrowing the IF bandwidth also increases the measurement time.

Setting IF bandwidth

The IF bandwidth is set for each channel independently.

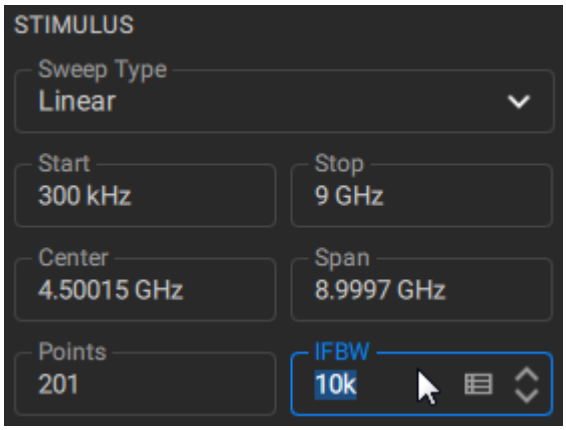
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1. Select the channel (see Selection of Active Trace, Diagram, Channel).

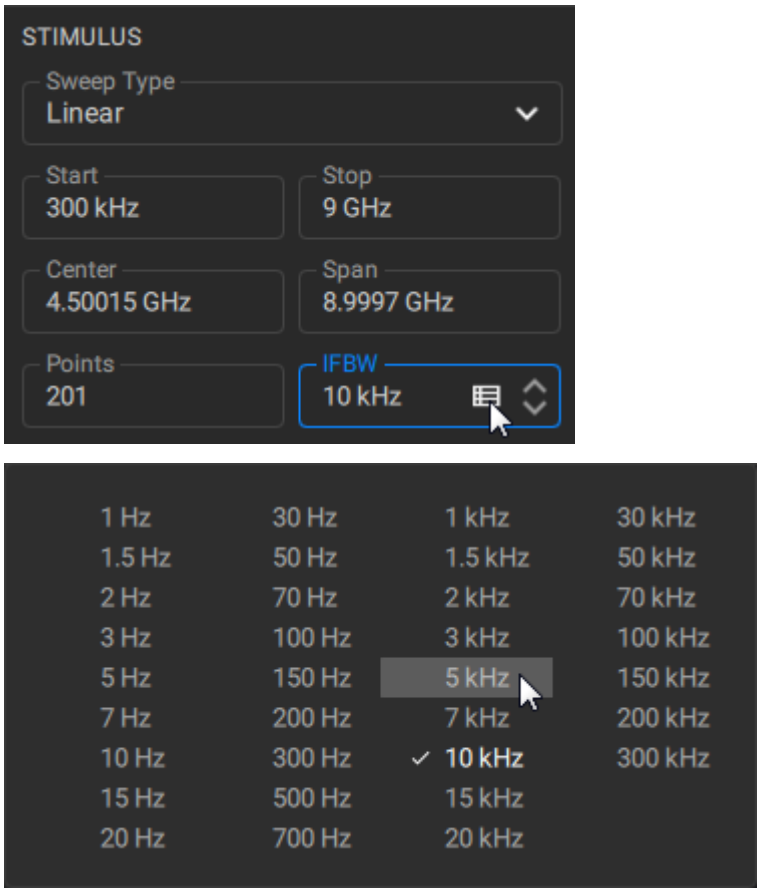
2. Click on the **Channel** button in the main menu.

3. Enter the numerical values of IF bandwidth:

   - Click on the **IFBW** textbox in the submenu and enter the numerical value using keyboard or spinbox (see figure below).



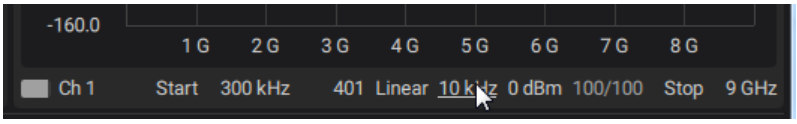
   - Click on the icon in **IFBW** textbox in the submenu and select the numerical value from the list in pop-up window (see figures below).



SCPI SENSe:BANDwidth (SENSe:BWIDth)

NOTE The IF bandwidth can be setting in the channel status bar (see figure above):

- Right click on the respective field in the channel status bar and enter the numerical values using keyboard or spinbox.
- Left click on the respective field in the channel status bar and select the numerical value from the list in pop-up window:



Averaging Setting

Averaging of each measurement point is performed over several sweeps. The benefits of the averaging function are similar to those of IF bandwidth narrowing-- it increases the signal-to-noise ratio and extends the dynamic range of measurements.

Averaging of each measurement point is made across multiple sweeps in accordance with the following formula:

$$\begin{cases} M_i = S_i, & i = 0 \\ M_i = (1 - \frac{1}{n}) \cdot M_{i-1} + \frac{S_i}{n}, & i > 0, n = min\ (i + 1,\ N) \end{cases}$$

where M_i — i-the sweep averaging result

S_i — i-the sweep measurement parameter (S-parameter) value

N — averaging factor from 2 to 200; the higher the factor value, the stronger the averaging effect

When the averaging function is enabled, the current number of iterations and the averaging factor, e.g. 9/10, will appear in the channel status bar. The averaging process is considered stable when the two numbers are equal.

Setting Averaging

Averaging should be set for each channel individually.

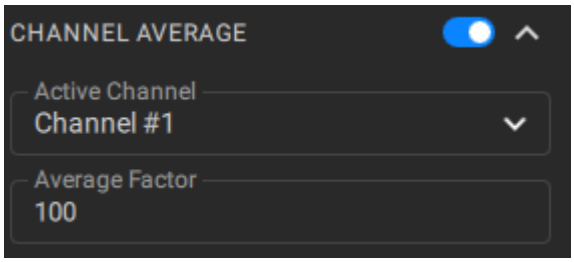
---

1. Click on the **Average** button in the main menu.

2. Select the channel in the **Active Channel** drop-down list in the submenu.

   NOTE You can quickly activate the channel by clicking on it in the channel window (see more Selection of Active Trace, Diagram, Channel).

3. Toggle **CHANNEL AVERAGE** ON in the CHANNEL AVERAGE accordion in in the submenu.



4. Click on the **Average Factor** textbox in the submenu and enter the numerical values.

SCPI SENSe:AVERage, SENSe:AVERage:COUNt

Averaging Trigger

The averaging trigger function completes averaging with a single trigger signal. This function affects the channels in which the averaging function is enabled (see Averaging Setting).

Averaging Trigger	Function
OFF [default]	One sweep is performed in response to one trigger signal regardless of the state of the channel averaging function. If the channel averaging is turned on, N trigger signals are required to complete the averaging process (where N is the averaging factor). The trigger signal does not reset the result of the previous averaging.
ON	N sweeps are performed in response to one trigger signal for the channel with the averaging on (where N is the averaging factor). One trigger signal is required to complete the averaging process in the channel. The trigger signal starts a new averaging cycle in the channel.

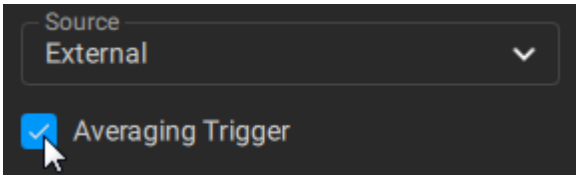
The averaging trigger function is convenient in conjunction with an external, software (BUS), or manual trigger source. When the function is enabled, the averaging result can be obtained on one trigger signal by performing a number of sweeps equal to the averaging factor (see Averaging Setting). Program commands of waiting for the end of the measurement cycle *OPC?, *WAI are triggered after averaging is completed. Turn this function OFF when the internal trigger source is used.

NOTE If the trigger event function is set to On Point, it takes precedence over the averaging trigger function. In this case, to complete averaging, the number of trigger pulses equal to the number of points multiplied by the averaging factor is required.

NOTE If multiple channels are open at the same time, one trigger signal starts a measurement cycle the required number of times for the channels with averaging on, and once for channels with averaging OFF.

Enabling Averaging Trigger

1. Select the channel (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Trigger** button in the main menu.
3. Select the **Averaging Trigger** checkbox in the submenu.



SCPI TRIGger:AVERage

Smoothing Setting

Smoothing averages the adjacent points of the trace by the moving window. The window aperture is set as a percent of the total number of trace points.

Smoothing does not increase the dynamic range of the Analyzer, nor does it increase measurement time. Smoothing helps to reduce noise bursts.

Setting Smoothing

Smoothing is set for each trace independently.

---

1. Click on the **Average** button in the main menu.

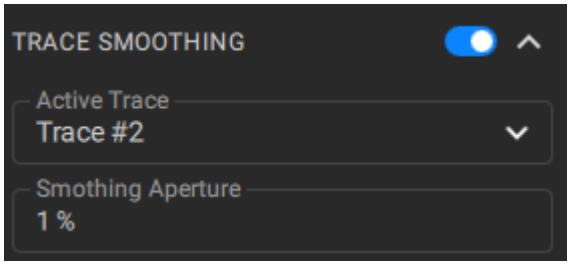
2. Select the channel in the **Active Channel** drop-down list in the submenu.

   NOTE You can quickly activate the channel by clicking on it in the channel window (see Selection of Active Trace, Diagram, Channel).

3. Select the trace in **Active Trace** drop-down list in the submenu.

   NOTE You can quickly activate the trace by clicking on it in the trace manager (see Selection of Active Trace, Diagram, Channel).

4. Toggle **TRACE SMOOTHING** ON in the TRACE SMOOTHING accordion in in the submenu.



5. Click on the **Smoothing Aperture** textbox in the submenu and enter the numerical values.

SCPI CALCulate:SMOothing, CALCulate:SMOothing:APERture

Calibration and Calibration Kits

Measurement accuracy is affected by errors introduced by the Analyzer and measurement setup. The nature of these errors is varied — some are systematically repeated, and some are random. Calibration is a process used to evaluate systematically repeated errors and mathematically exclude them from the measurement results in the correction process.

NOTE Be sure to properly calibrate if accurate measurements are required. Only a properly calibrated instrument provides the accuracy specified in the data sheet.

The section contains information about calibration, calibration kits, and automatic calibration module (ACM):

- General information about calibration (see General Information).
- Working with calibration standards and calibration kits (see Calibration Standards and Calibration Kits).
- Calibration types and procedures (see Calibration Types and Calibration Wizard).
- Power calibration with an external power meter to maintain an accurate power level at the DUT input (see Power Calibration).
- Calibration of receivers for accurate power measurements (see Receiver Calibration).
- Working with the automatic calibration module (ACM), which allows simplification and acceleration of the analyzer calibration process (see Calibration with the Automatic Calibration Module).

General Information

This section details general information about calibration:

- Guidelines for calibration (see Basic Calibration Guidelines).
- Description of measurement errors (see Measurement Errors).
- Error models (see Error Model).
- Calibration steps (see Calibration Steps).

Basic Calibration Guidelines

Follow the guidelines below to perform calibration correctly and reduce accidental errors. Observance of the guidelines will ensure the specified accuracy of the device.

General Guidelines

1. Select all fixtures for connecting the DUT and assemble the measuring setup before starting the calibration. Perform calibration in the plane passing through the connectors to which the DUT is connected.
2. Calibrate the measuring setup at the same stimulus parameters (frequency range, number of points, stimulus power) at which measurements will be performed. Changing these parameters after calibration may significantly reduce the accuracy of the measurements.
3. During calibration, do not set the IF bandwidth wider than planned for measurements.
4. Choose a calibration kit according to the type and gender of the DUT connectors.
5. The frequency range of the selected calibration kit must correspond to the range in which the calibration is performed.
6. When choosing a calibration kit, note that for SOLT calibrations the most accuracy will be provided by the calibration kit in which the parameters of the standards are most accurately defined.
7. The calibration kit selected in the Analyzer software must strictly correspond to the one actually used.
8. For easy measurements, you can create custom calibration kits from the available standards, or specially manufactured calibration kits to solve specific measuring tasks. To include a standard in a calibration kit, calculate or measure its parameters using a high precision measuring tool. Create a description in the form of a model of standard or S-parameter table of standard and download this description to the analyzer software.
9. The choice of calibration method depends on the measurement being performed, its accuracy requirements, the permissible calibration labor intensity, and the availability of calibration kits.
10. For the SOLT calibrations, use an ACM (Automatic Calibration Module) to reduce:
    - the labor intensity of the calibration without loss of accuracy
    - wear of connectors
    - operator errors
11. If an additional component (cable, attenuator, adapter) is added to the measurement setup after calibration, you should perform recalibration, or use

the de-embedding function or the port extension function to compensate for the added electrical length (delay) and losses.

Recommendations for Reducing Random Measurement Errors

1. To reduce errors introduced by the instrument noise of the Analyzer, increase the source power of the stimulus signal, narrow the IF bandwidth, and apply averaging over several measurement sweep values.
2. To reduce errors in the temperature drift of the electrical characteristics of the Analyzer and the components of the measuring setup:
   - Perform measurements in a room with a stable, controlled temperature, at which the technical characteristics of the analyzer are guaranteed.
   - Recalibrate if the room temperature has changed significantly after calibration.
   - Warm-up the analyzer for the length of time determined in the specification before starting the calibration.
   - Keep the calibration standards unpacked in the room where the measurements are taken to stabilize the parameters before starting the calibration.
3. To reduce the connector repeatability errors:
   - Apply proper connector care — connectors must be good and clean (see Connector Care).
   - Use a special wrench with a standardized tightening torque when connecting the DUT and calibration standards to the measurement connectors.
   - Do not change the position of the components of the measuring setup during or after calibration.
   - Recalibrate if the setup components have been rearranged.

Measurement Errors

S-parameter measurements are influenced by various measurement errors, which can be divided into two categories:

- systematic errors
- random errors

Random errors comprise errors such as noise fluctuations and thermal drift in electronic components, changes in the mechanical dimensions of cables and connectors subject to temperature drift, repeatability of connections, and cable bends. Random errors are unpredictable and hence cannot be estimated and eliminated in calibration. Random errors can be reduced by having the stimulus power at the correct setting, IF bandwidth narrowing, sweep averaging, maintaining a constant environment temperature, observance of the Analyzer warm-up time, careful connector handling, and avoiding cable bending after calibration.

Random errors and related methods of correction are not mentioned further in this section.

Systematic errors are errors caused by imperfections in the components of the measurement system (see Systematic Errors). Such errors occur repeatedly, and their characteristics do not change with time. Systematic errors can be determined and then reduced by performing a mathematical correction of the measurement results.

Calibration is the process of measuring precision devices with predefined parameters to determine systematic errors, and such precision devices are called *calibration standards*. The most used calibration standards are SHORT, OPEN, and LOAD.

The process of mathematical compensation of the systematic errors is called *error correction*.

Systematic Errors

The systematic measurement errors of the Analyzer are divided into the following categories according to their source:

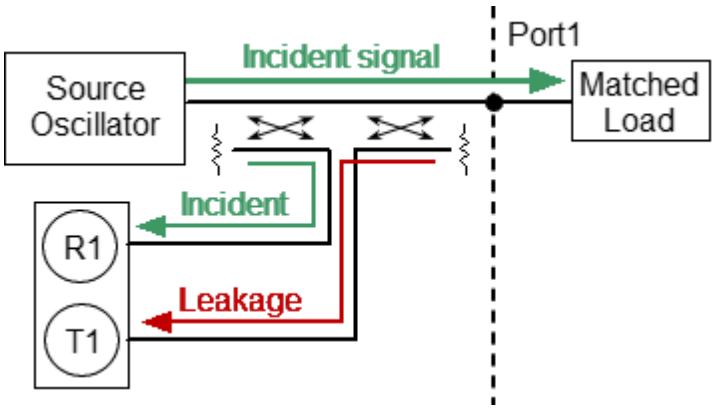
- directivity
- source match
- load match
- reflection tracking
- transmission tracking
- isolation

The measurement results before error correction are called *uncorrected*.

The residual values of the systematic measurement errors after error correction are called *effective*.

Directivity Error

A directivity error (**Ed**) is caused by incomplete separation of the incident signal from the reflected signal by the directional coupler in the source port. In this case, part of the incident signal energy enters the receiver of the reflected signal. Directivity errors do not depend on the characteristics of the DUT, and usually have a greater effect on reflection measurements.

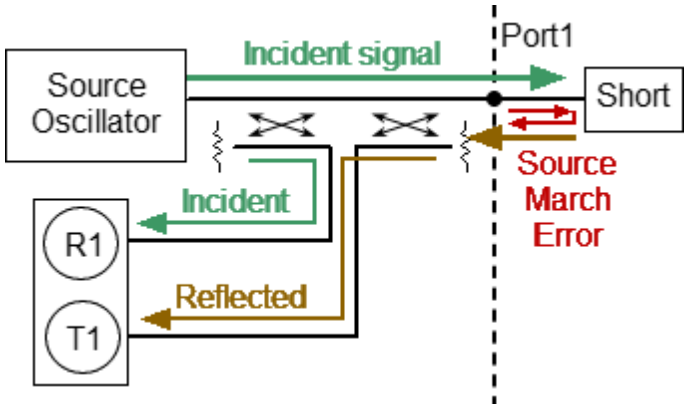


Directivity Error

Source Match Error

A source match error (**Es**) is caused by a mismatch between the source port and the input of the DUT. In this case, part of the signal reflected by the DUT reflects at the source port and re-enters the input of the DUT. The error affects both reflection measurement and transmission measurement. Source match errors depend on the difference between the input impedance of the DUT and test port impedance when it functions as a signal source.

Source match errors heavily affect measurements of a DUT with poor input matching.

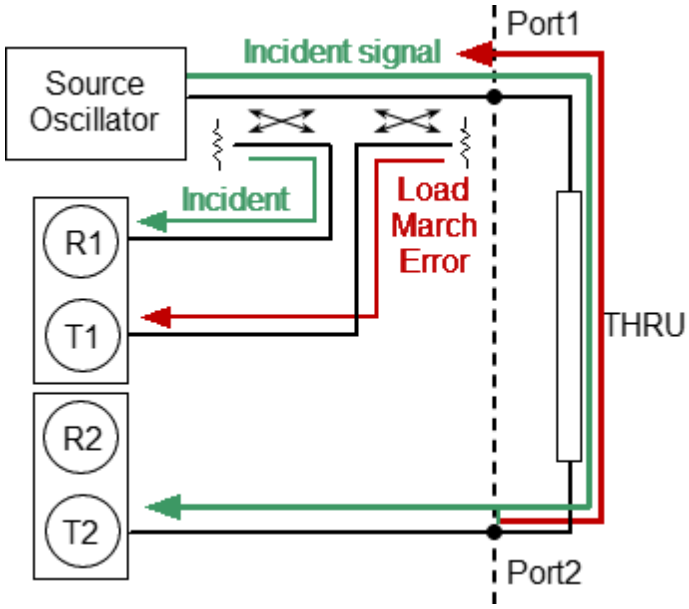


Source Match Error

Load Match Error

A load match error (**El**) is caused by a mismatch between the receiver port and the output of the DUT. In this case, part of the signal transmitted through the DUT reflects at the receiver port and returns to the output of the DUT. The error occurs during transmission measurements and reflection measurements (for a two-port DUT). Load match errors depend on the difference between output impedance of the DUT and test port impedance when used as a signal receiver.

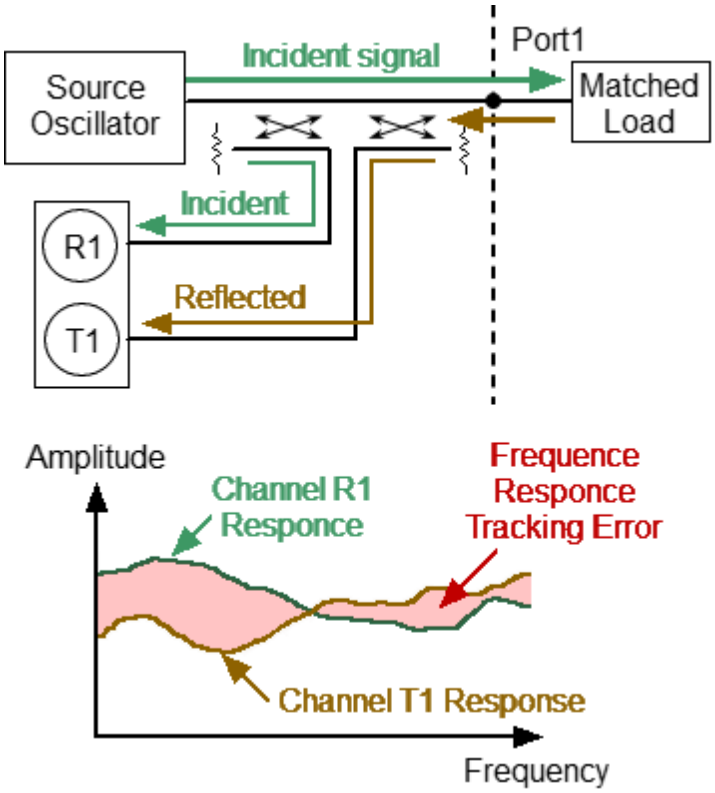
In transmission measurements, the load match error has considerable influence if the output of the DUT is poorly matched. In reflection measurements, the load match error has considerable influence in cases of poor output match and low attenuation between the output and input of the DUT.



Load Match Error

Reflection Tracking Error

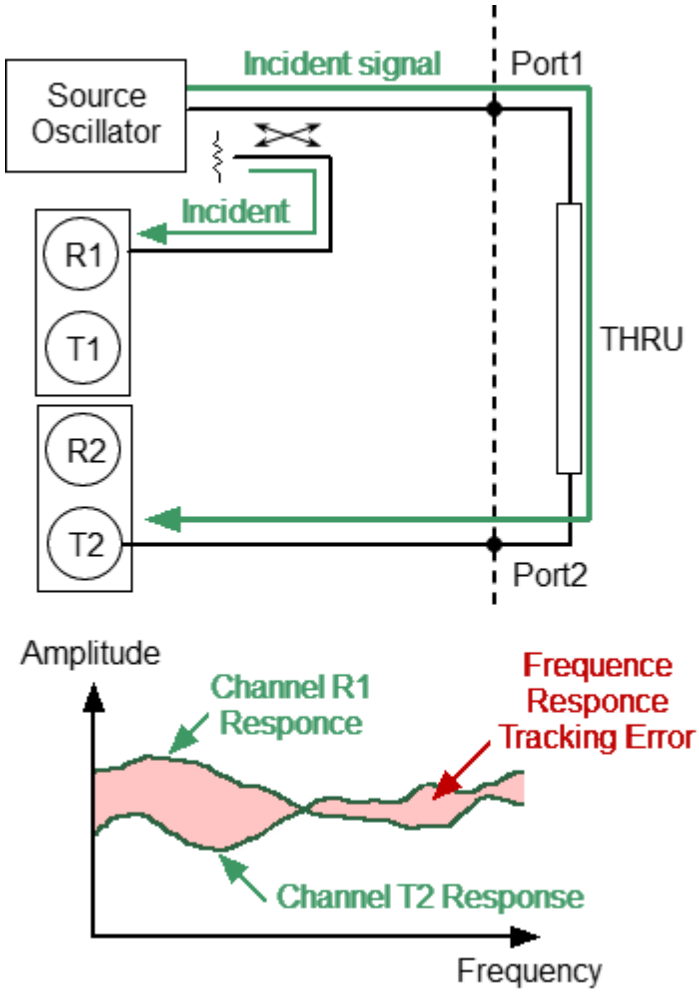
A reflection tracking error (**Er**) is caused by differences in frequency response between the test receiver and the reference receiver of the source port during reflection measurement.



Reflection Tracking Error

Transmission Tracking Error

A transmission tracking error (**Et**) is caused by differences in frequency response between the test receiver of the receiver port and the reference receiver of the source port during transmission measurement.

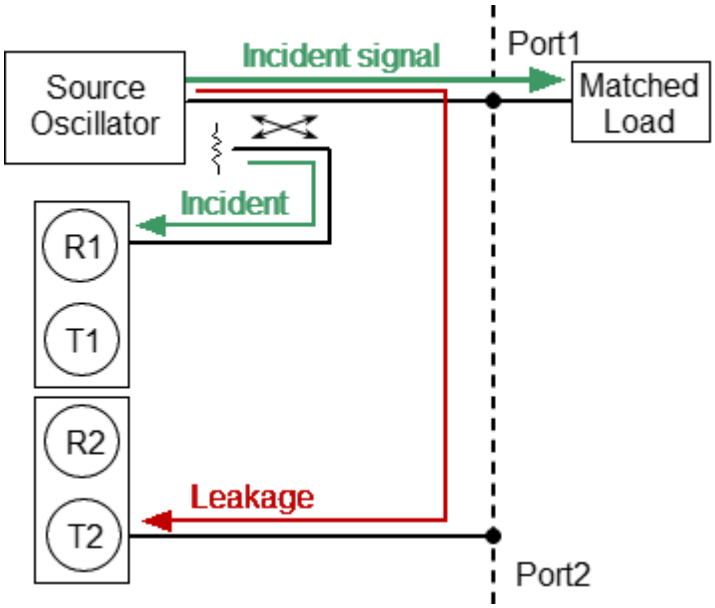


Transmission Tracking Error

Isolation Error

Isolation error (**Ex**) is caused by a leakage of the signal from the source port to the receiver port, bypassing the DUT.

The Analyzer has very good isolation, which helps avoid this error for most measurements. Isolation error measurement is an optional step in all types of calibration.



Isolation Error

Error Model

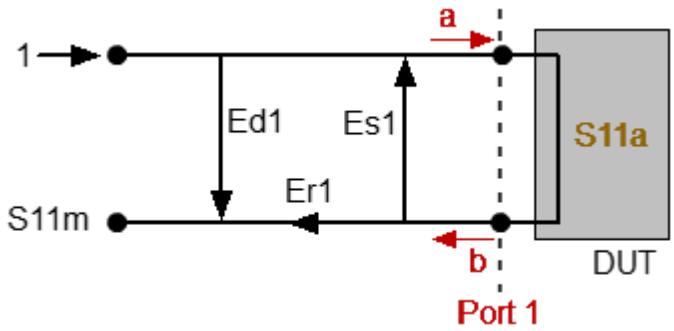
Signal (directed) graphs are used as error models to analyze systematic errors of the Analyzer.

This section describes the following error models:

- One-Port Error Model
- Two-Port Error Model
- Three-Port Error Model
- Four-Port Error Model
- N-Port Error Model

One-Port Error Model

Only one port of the Analyzer is used when performing reflection measurements. The signal flow graph of errors for Port 1 is represented in the figure below. The signal flow graph of the errors for Port 2 will be similar.



a — incident wave, b — reflected wave

S11a — reflection coefficient actual value

S11m — reflection coefficient measured value

One-port Error Model

The measurement result at Port 1 is affected by the following three systematic error terms:

- **Ed1** is directivity
- **Es1** is source match
- **Er1** is reflection tracking

For normalization, the stimulus value is taken equal to 1. All the values used in the model are complex.

After determining all the three error terms — **Ed1, Es1, Er1** — for each measurement frequency by means of a **full one-port calibration (SOL)**, you can calculate (mathematically eliminate the errors from the measured value S11m) the actual value of the reflection coefficient S11a.

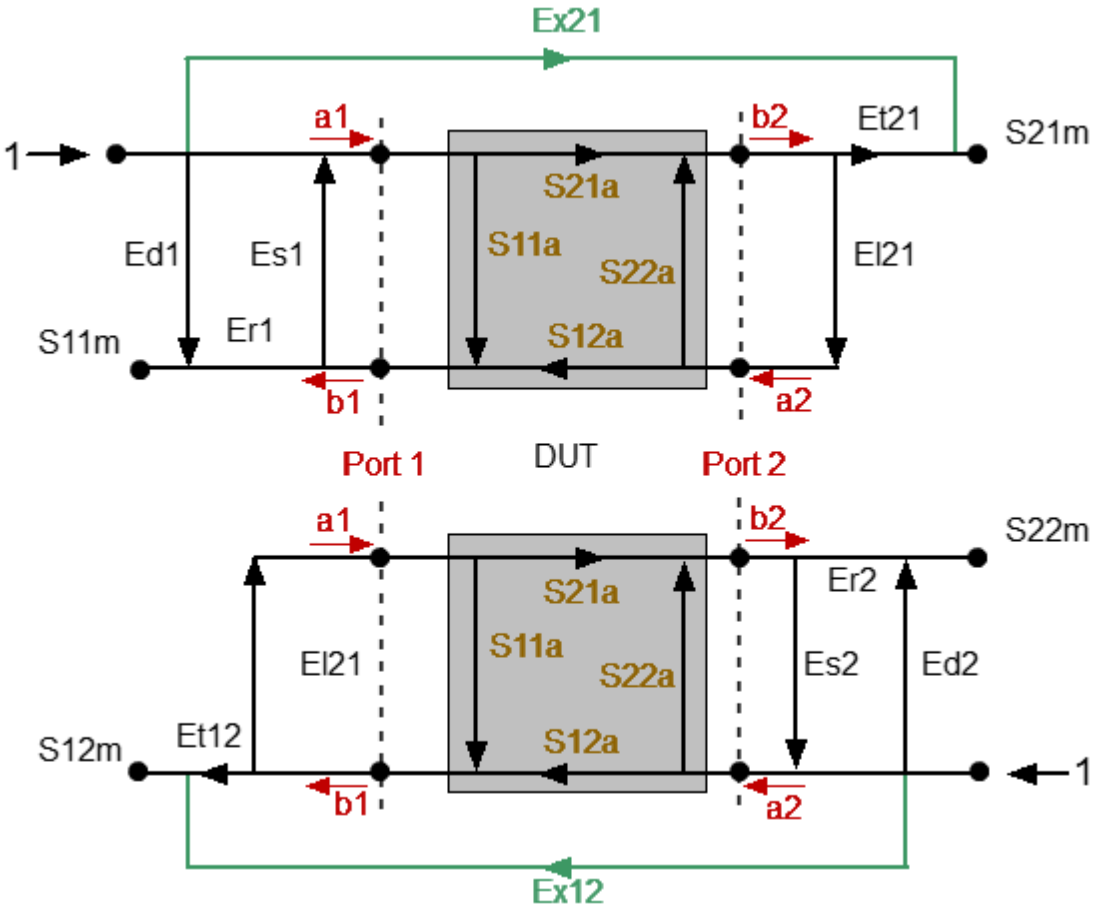
There are simplified methods which eliminate the effects of only one or two of the three systematic errors.

For a detailed description of calibration methods, see Calibration Types.

Two-Port Error Model

There are two signal flow graphs considered for two-port measurements. One of the graphs has Port 1 as the stimulus source, the other graph has Port 2 as the stimulus source.

The signal flow graphs of error effects in a two-port system are represented in the figure below.



a1, a2 — incident waves, b1, b2 — reflected waves

S11a, S21a, S12a, S22a — actual value of DUT parameters

S11m, S21m, S12m, S22m — measured DUT parameters values

Two-port Error Model

For normalization the stimulus value is taken equal to 1. All the values used in the model are complex. The measurement result in a two-port system is affected by twelve systematic error terms.

These terms are described in the table below.

Description	Stimulus Source	
	Port 1	**Port 2**
Directivity	**Ed1**	**Ed2**
Source match	**Es1**	**Es2**
Reflection tracking	**Er1**	**Er2**
Transmission tracking	**Et1**	**Et2**
Load match	**El1**	**El2**
Isolation	**Ex1**	**Ex2**

After determining all twelve error terms for each measurement frequency by means of a two-port calibration (SOLT), you can calculate the actual value of the S-parameters: S11a, S21a, S12a, S22a.

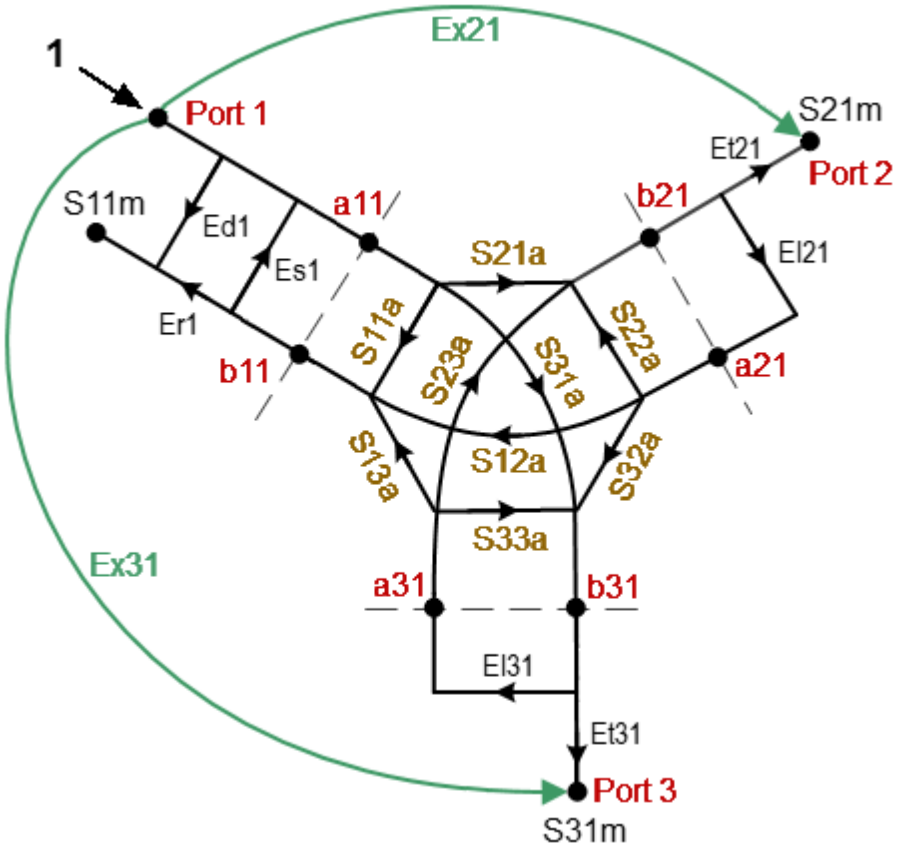
There are simplified methods which eliminate the effect of only one or several of the twelve systematic error terms.

NOTE When using a two-port calibration, all four measurements S11m, S21m, S12m, S22m need to be known to determine any S-parameters. That is why updating one or all S-parameters necessitates two sweeps — first with Port 1 as a signal source, and then with Port 2 as a signal source.

For a detailed description of calibration methods, see Calibration Types.

Three-Port Error Model

A measurement result in a three-port system is affected by twenty-seven systematic error terms. The signal flow graph of error effects in the three-port system is represented in the figure below. The graph shows when Port 1 is used as the stimulus source.



S11a, S12a, S13a, S21a, S22a, S23a, S31a, S32a, S33a — actual value of DUT parameters

S11m, S12m, S21m, S21m, S22m, S23m, S31m, S32m, S33m — measured DUT parameters values

Three-port Error Model

NOTE The systematic error terms are shown for Ports 1, 2, and 3. For other port triplets, the systematic error terms will be similar.

Systematic error terms in a three-port system are represented in the table below.

Description	Stimulus Source		
	Port 1	**Port 2**	**Port 3**
Directivity	**Ed1**	**Ed2**	**Ed3**
Source match	**Es1**	**Es2**	**Es3**
Reflection tracking	**Er1**	**Er2**	**Er3**
Transmission tracking	**Et21, Et31**	**Et12, Et32**	**Et13, Et23**
Load match	**El21, El31**	**El12, El32**	**El13, El23**
Isolation	**Ex21, Ex31**	**Ex12, Ex32**	**Ex13, Ex23**

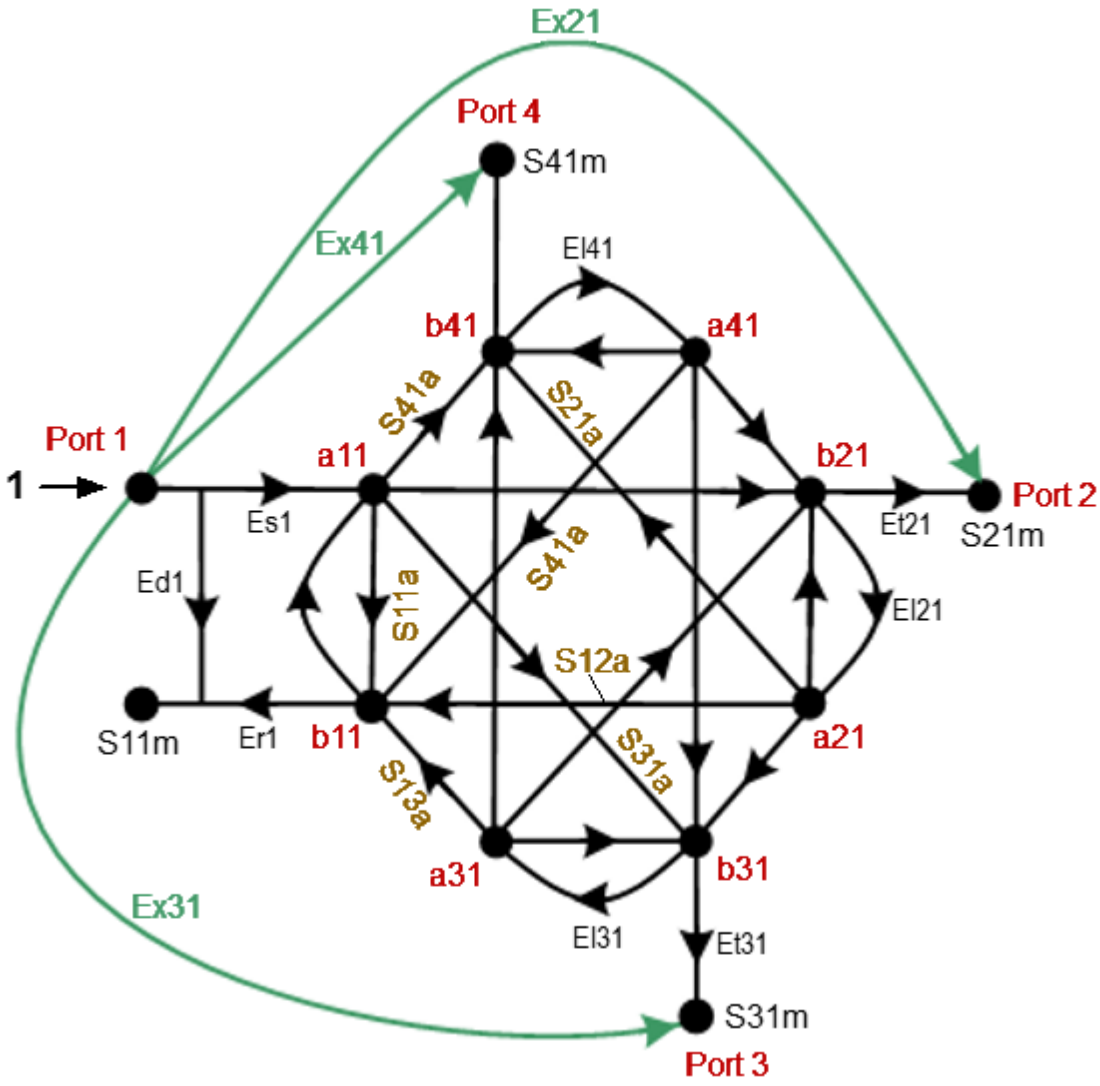
After determining of all twenty seven error terms for each measurement frequency by means of a free-port SOLT , you can calculate the true value of the S-parameters: S11a, S21a, … S33a.

NOTE When using a three-port calibration, all nine measurements S11m, S21m, … S33m need to be known to determine any S-parameters. That is why updating one or all of the S-parameters necessitates three sweeps with each port as a signal source.

For a detailed description of calibration methods, see Calibration Types.

Four-Port Error Model

A measurement result in a four-port system is affected by forty eight systematic error terms. The signal flow graph of error effects in the four-port system is represented in the figure below.The graph shows when Port 1 is used as the stimulus source.



S11a, S12a, S13a, S14a, S21a, S22a, S23a, S24a, S31a, S32a, S33a, S34a, S41a, S42a, S43a, S44a — actual value of DUT parameters

S11m, S12m, S13m, S14m, S21m, S22m, S23m, S24m, S31m, S32m, S33m, S34m, S41m, S42m, S43m, S44m — measured DUT parameters values

Four-port Error Model

Systematic error terms in a four-port system are represented in the table below.

Description	Stimulus Source			
	Port 1	**Port 2**	**Port 3**	**Port 4**
Directivity	**Ed1**	**Ed2**	**Ed3**	**Ed4**
Source match	**Es1**	**Es2**	**Es3**	**Es4**
Reflection tracking	**Er1**	**Er2**	**Er3**	**Er4**
Transmission tracking	**Et21, Et31, Et41**	**Et12, Et32, Et42**	**Et13, Et23, Et43**	**Et14, Et24, Et34**
Load match	**El21, El31, El41**	**El12, El32, El42**	**El13, El23, El43**	**El14, El24, El34**
Isolation	**Ex21, Ex31, Ex41**	**Ex12, Ex32, Ex42**	**Ex13, Ex23, Ex43**	**Ex14, Ex24, Ex34**

After determining of all forty eight error terms for each measurement frequency by means of a four-port SOLT , you can calculate the true value of the S-parameters: S11a, S21a, … S44a.

NOTE When using a four-port calibration, all sixteen measurements S11m, S21m, … S44m need to be known to determine any S-parameters. That is why updating one or all of the S-parameters necessitates four sweeps: with each port as a signal source.

For a detailed description of calibration methods, see Calibration Types.

N-Port Error Model

In general, for an N-port system, the measurement result will be affected by (3·N·N) systematic error terms.

Systematic error terms in an N-port system are represented in the table below.

Description	Stimulus Source			
	Port 1	**Port 2**	**...**	**Port N**
Directivity	**Ed1**	**Ed2**	**...**	**EdN**
Source match	**Es1**	**Es2**	**...**	**EsN**
Reflection tracking	**Er1**	**Er2**	**...**	**ErN**
Transmission tracking	**Et21, Et31, ..., EtN1**	**Et12, Et32, ..., EtN2**	**...**	**Et1N, Et2N, ..., EtNN**
Load match	**El21, El31, ..., ElN1**	**El12, El32, ..., ElN2**	**...**	**El14, El24, ..., ElNN**
Isolation	**Ex21, Ex31, ..., ExN1**	**Ex12, Ex32, ..., ExN2**	**...**	**Ex14, Ex24, ..., ExNN**

After determining of all the (3·N·N) error terms for each measurement frequency by means of a N-port SOLT calibration, you can calculate the true value of the S-parameters.

NOTE When using N-port calibration, (N·N) measurements need to be known to determine any S-parameters. That is why updating one or all of the S-parameters necessitates N sweeps with each port as a signal source.

For a detailed description of calibration methods, see Calibration Types.

NOTE Particular cases of the N-port system:

- Two-Port Error Model
- Three-Port Error Model
- Four-Port Error Model

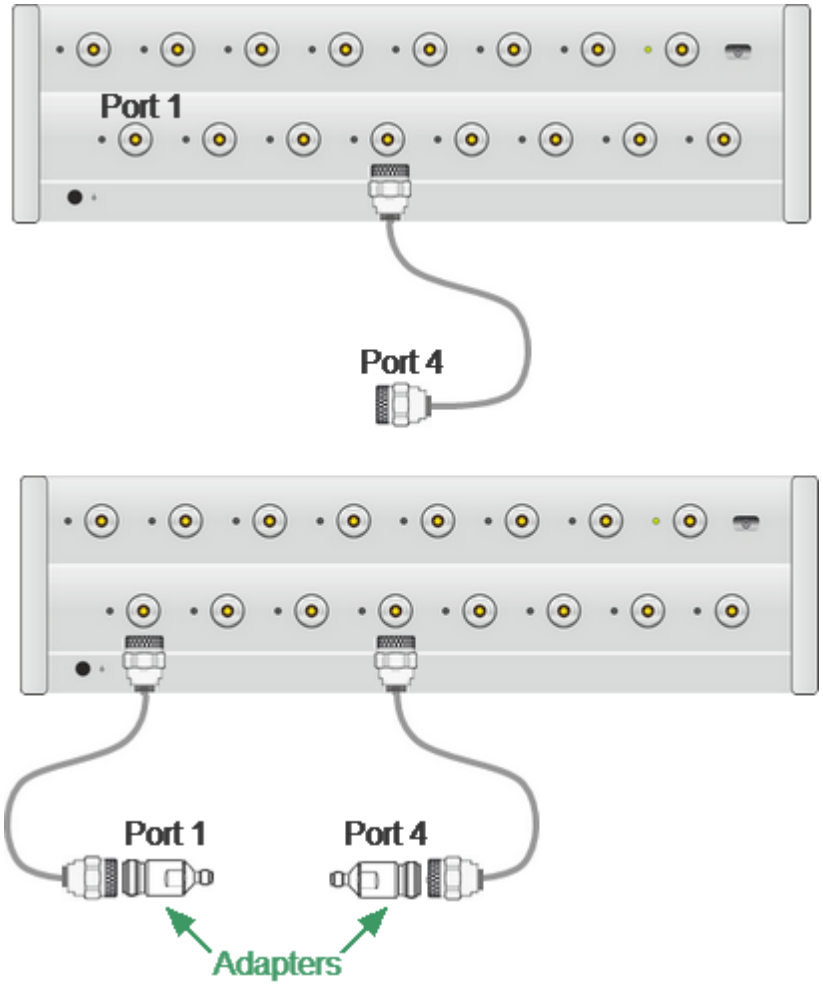
Analyzer Test Port Definition

The test ports of the Analyzer are defined by means of calibration. A test port is a connector accepting a calibration standard in the process of calibration.

A type-N female connector on the front panel of the Analyzer will be the test port if calibration standards are connected directly to it.

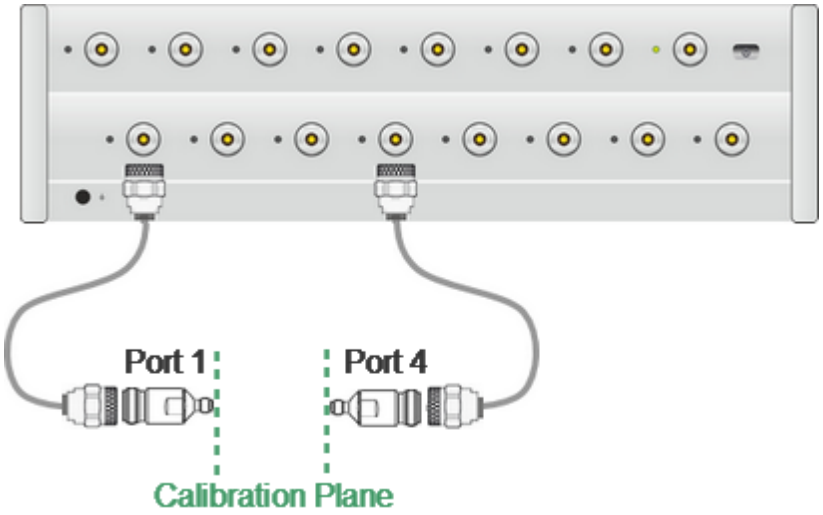
It is sometimes necessary to connect coaxial cables and/or adapters to the connector(s) on the front panel to interface with a DUT of a different connector type. In such cases, calibration standards are connected to the connector of the cable or adapter.

The figure below represents two cases of test port definition for 2-port measurements. The use of cables and/or adapters does not affect the measurement results if they are integrated into the process of calibration.



Test Port Defining

The term calibration plane is used in some cases. The calibration plane is an imaginary plane located at the ends of the connectors, which accept calibration standards during calibration.



Calibration Plane

Calibration Steps

The process of calibration comprises the following steps:

1. Selection of a calibration kit matching the connector type of the test port (see Calibration Standards and Calibration Kits). The calibration kit includes such standards as SHORT, OPEN, and LOAD with matched impedance. Magnitude and phase responses i.e. S-parameters of the standards are well known. The characteristics of the standards are represented in the form of an equivalent circuit model, as described in Circuit Model Standards.

2. Selection of the calibration type for the calibrated ports (creation of a calibration configuration) and measurement performed step by step in the wizard within a specified frequency range (see Calibration Wizard). Selection of a calibration type is based on the required accuracy of measurements (see Calibration Types and Procedures). The calibration type determines which error terms of the model (or all of them) will be compensated.

3. The Analyzer compares the measured parameters of the standards against their predefined values. The difference is used for calculation of the calibration coefficients (systematic errors).

4. The table of calibration coefficients is saved in the software and used for error correction of the measured results of any DUT.

Calibration is always made for a specific channel, as it depends on the channel stimulus settings — particularly on the frequency span. This means that a table of calibration coefficients is being stored for each individual channel.

Calibration Standards and Calibration Kits

Calibration Standard

Calibration standards are precision physical devices that serve as a calibration standard for the Analyzer.

Each calibration standards has its own connector with a specific type, specific gender, and standard definition. A description of the connector parameters is given in Description of Connectors.

A calibration standard definition is a mathematical description of its parameters (see Standard Definition). During calibration, the Analyzer measures standards and mathematically compares the results to the definitions of those standards. The comparison results are used to determine errors in the measurement system.

Calibration standards can be combined into a calibration kit.

Calibration Kit

A calibration kit is a set of calibration standards with a specific connector type and specific parameters.

The Analyzer provides definitions of calibration kits produced by different manufacturers. The definitions of the calibration kits can be added, and the predefined kits can be modified.

The calibration kit editing procedure is described in Calibration Kits Management.

Types of Calibration Standards

Calibration standard type is a category of physical devices used to define the parameters of the standard. The Analyzer supports the following types of the calibration standards:

- OPEN (the coaxial connector only)
- SHORT
- LOAD
- THRU/DELAY
- SLIDING LOAD

Gender of Calibration Standard

The gender of a calibration standard is typically denoted on the calibration standard label.

A calibration standard can be labeled either with:

- The gender of a calibration standard itself – –M– for male, –F– for female, and –G– for genderless type of standard.
- The gender of the analyzer port which the calibration standard is mated to – (m) for male and (f) for female port types.

For example, the same standard can be labeled as Short –F– or Short (m).

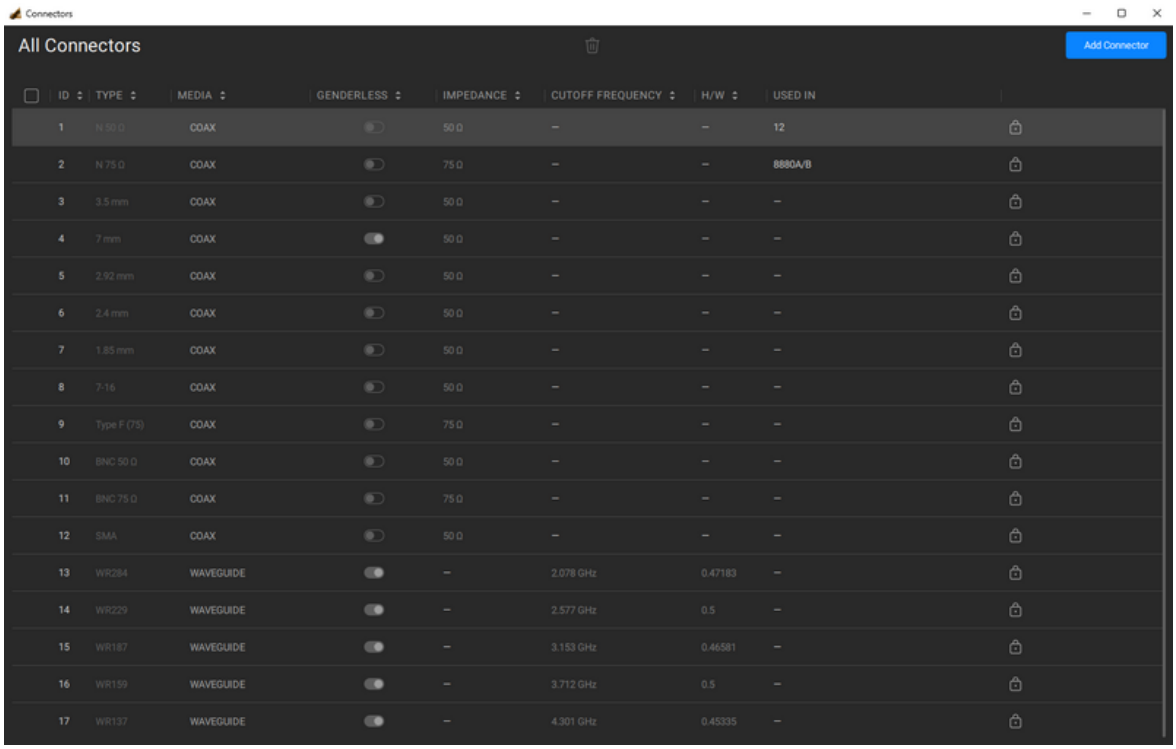
The gender of calibration standards is accounted for by the software. The Analyzer software uses the first type of designation in the Calibration Kit Manager: the gender of a calibration standard itself, denoted as **–M–** for male, **–F–** for female, and **–G–** for genderless type of standards.

Description of Connectors

The All Connectors window displays the table of available in the software connector types. Each row describes one connector with specific type, media, gender, and other parameters (see figure below). Connector types must be selected in accordance with the connectors of the measured DUT.

By default, the table contains the predefined connectors, which parameters cannot be changed. It is possible to add new user-define connector. The deleting function is available for user-defined connector only.

The description of the columns from the table of connectors see in the table below.



All Connector Pop-up Window

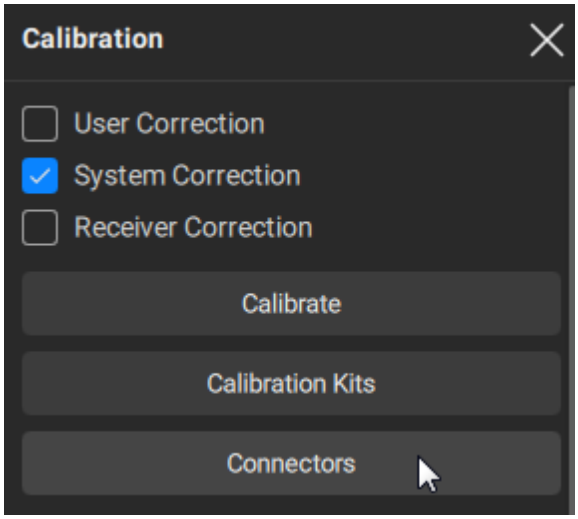
Columns of the Connector Table

Column	Description
ID	Sequential number of connector.
TYPE	Connector type name.
MEDIA	The offset media of connector type: • COAX (coaxial). • WAVEGUIDE.
GENDERLESS	Toggle button is between genderless and gendered (both male and female connectors) for coaxial connector. For waveguide, the field is unavailable (the waveguide is genderless).
IMPEDANCE	The characteristic impedance for the coaxial connector. Value has an impact on various parameter conversions. For example, the impedance enters into the calculation of the S-parameters for the calibration standards, if they are derived from a circuit model. The calculation of the (default) reference impedances for balanced ports. For waveguide, the field is unavailable.
CUTOFF FREQUENCY	The cut off frequency of the waveguide. The cutoff frequency of the waveguide is achieved at a wavelength in the waveguide equal to twice its width. Take care not to confuse this with the minimum and maximum operating frequency of the waveguide, which are usually given by the manufacturer with a margin relative to the cut off frequency. For coaxial connector, the field is unavailable.

Column	Description
H/W	The waveguide height to width ratio. Used in the waveguide loss model when the loss value is not zero. For coaxial connector, the field is unavailable.
USED IN	The field displays in what calibration kits the connector is used. The field displays the number of calibration kits (no titles), if the connector participates in more than 3 calibration kits.
Icon 	The icon of predefined connector.

Starting All Connectors Pop-up Window

1. Click on the **Calibration > Connectors** buttons in the sidebar.

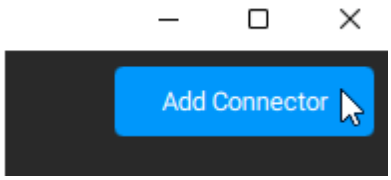


Adding New User-Defined Connector

New connector is added to the end of the table.

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1. Click on the **Add Connector** button in the Connector pop-up window.

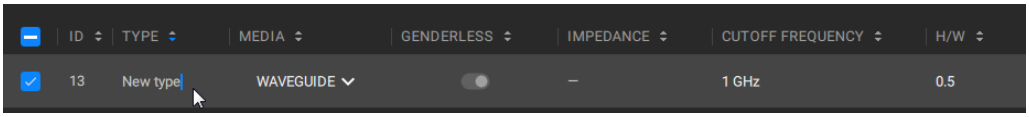


Editing User-Defined Connector Type

The type of a connector appears in corresponding field in the Calibration Kit pop-up window (see Calibration Kit Management).

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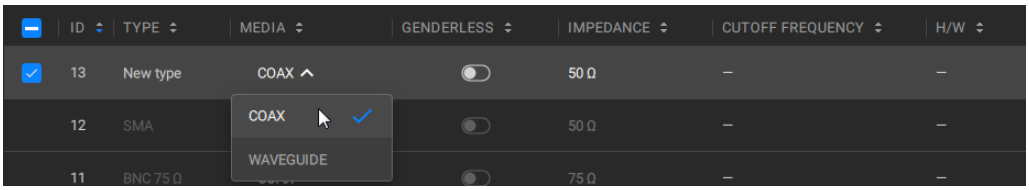
1. Click on required field in column **TYPE** in the table and enter the type name.



Selecting User-Defined Connector Media

The media of a connector appears in the corresponding field in the Calibration Kit pop-up window (see Calibration Kit Management).

1. Click on the required field in column **MEDIA** in the table and select media between **COAX** or **WAVEGUIDE**.

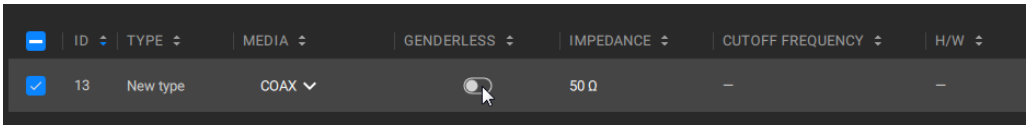


Enabling Genderless of Connector

By default, connector gender is gendered and the toggle button is turned OFF. It is necessary to select the gender (male/female) in the Standard pop-up window (see Standard Definition).

The waveguide is genderless and the toggle button is unavailable.

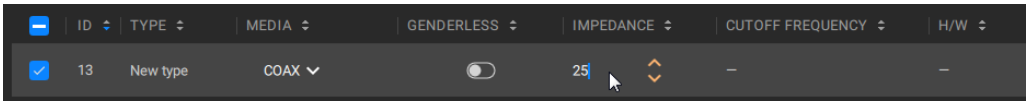
1. Toggle **GENDERLESS** ON in required connector.



Editing Connector Parameters (Impedance, Cutoff Frequency, H/W)

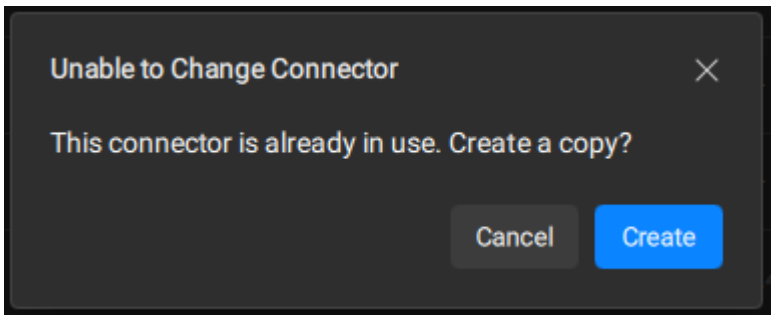
The parameters are shown in the Standard pop-up window (see Standard Definition) and can be changed in it later.

1. Click on the required field **Impedance**, **Cutoff Frequency** or **H/W** in the table and enter the numerical value.



NOTE

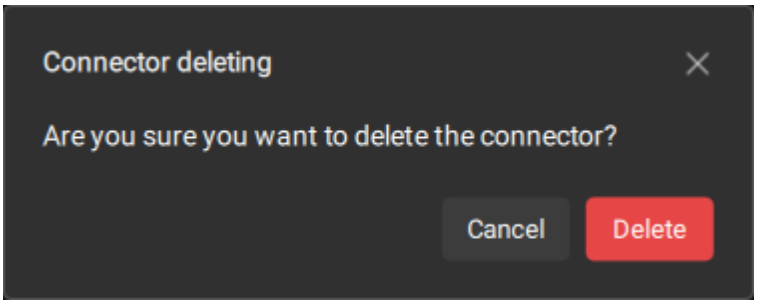
It is not possible to change the parameters of the user-defined connector used in the calibration kits. A message will appear in All Connectors window asking you to duplicate this connector:



Deleting User-Define Connector

A user-defined connector(s) can be deleted.

1. Select the checkbox(s) in the left column of the table near the required connector(s).
2. Click on the  icon in the top area of the Connector pop-up window.
3. Click on **Delete** button in the opened dialog.

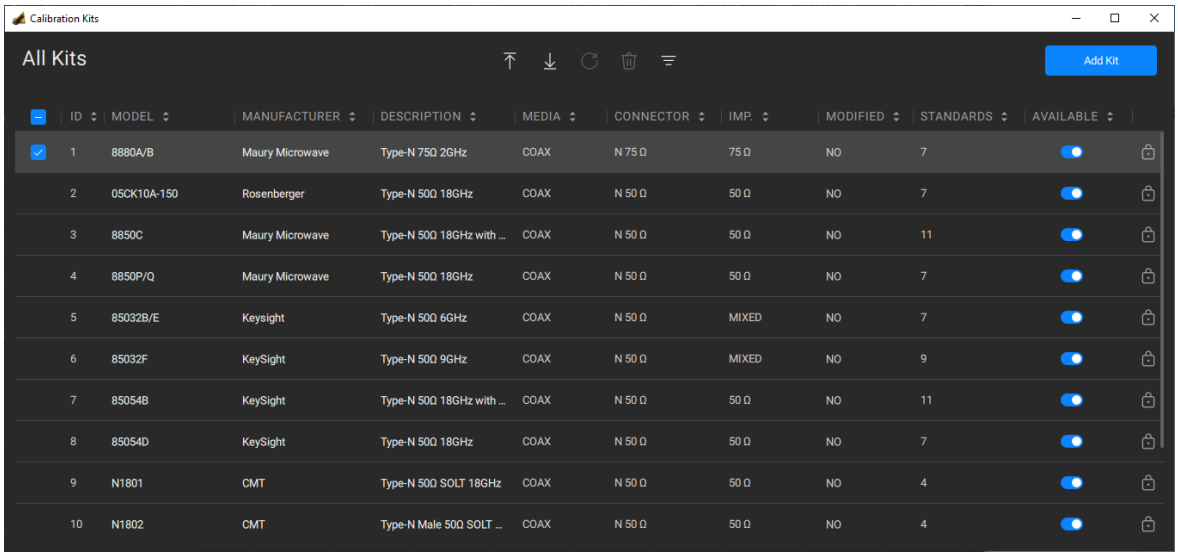


NOTE

If you remove the connector used in the User-Defined calibration kits, all kits will replace this type of connector with the first one in the table (N 50 Ω).

Calibration Kits Management

The All Kits pop-up window manages the calibration kit description. The pop-up window contains a table of calibration kits. Each row in the table describes one calibration kit. For the description of the columns from the table of calibration kits, see the table below. Here you can add, delete or redefine a calibration kit (see figure below).



Calibration Kits Pop-up Window

Calibration kit redefining can be required for the following purposes:

- To add a user-defined standard into the kit, e.g. a non-zero-length thru.
- To precise the standard parameters to improve the calibration accuracy.

By default, the table contains predefined kits, which parameters can be changed as needed. Changes made to a predefined calibration kit can be restored to the initial state.

You can add user-defined calibration kits. A new user-defined calibration kit can be added if a required kit is not included in the list of predefined kits. The user-defined calibration kits can be deleted at any time.

Any changes made to the predefined or user-defined calibration kits are automatically saved in the software.

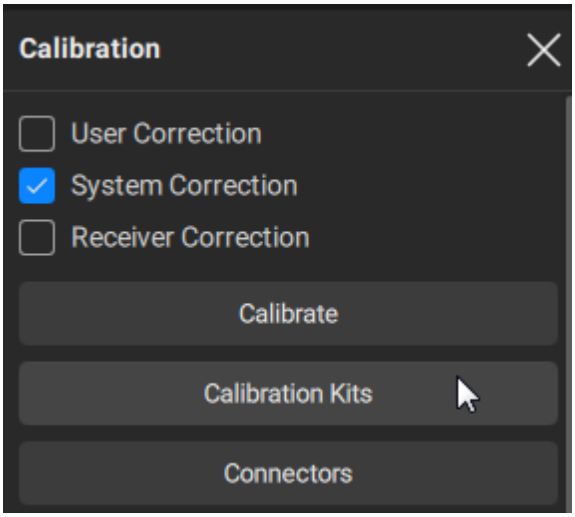
Columns of the Calibration Kit Table

Column	Description
ID	Sequential number of calibration kit.
MODEL	The model appears on the Calibration Wizard pop-up window (see Selecting Calibration Plane). The manufacturer and description are just to provide information for the user. The user can edit these fields.
MANUFACTURER	
DESCRIPTION	
MEDIA	The offset media of all standards in calibration kit: • COAX (coaxial) • WAVEGUIDE If the calibration kit includes standards with different media, the field will show MIXED.
CONNECTOR	The type of connectors of all standards in calibration kit (see Description of Connectors). If the calibration kit includes standards with different types of connectors, the field will show MIXED.
IMP.	The impedance of all standards in a calibration kit. If the calibration kit includes standards with different impedance, the field will show MIXED.
MODIFIED	Date of the latest kit changes.
STANDARDS	Number of standards in a calibration kit.
AVAILABLE	Toggle to select available kit (see Showing Only Available Kits). NOTE In the calibration wizard, it will be possible to select only calibration kits that toggle AVAILABLE ON. Kits that toggle AVAILABLE OFF will not be shown in the wizard.

Column	Description
Icon	The icon of a predefined kit.

Starting Calibration Kits pop-up Window

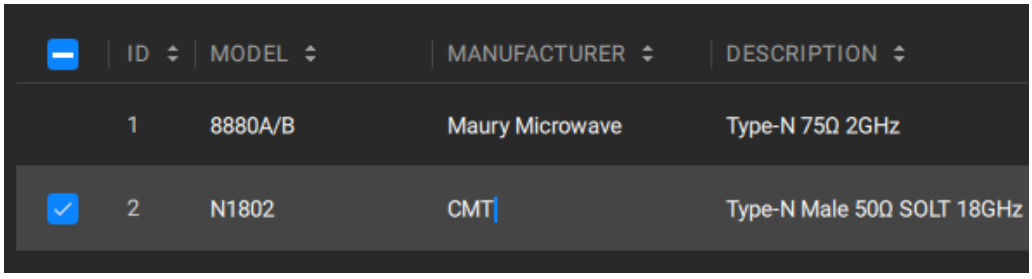
1. Click on the **Calibration > Calibration Kits** buttons in sidebar.



Editing Calibration Kit Model, Manufacturer, and Description

The model of a calibration kit, its manufacturer, and description can be edited in the table of the calibration kits. The model appears on the Calibration Wizard pop-up window in the calibration kit selection field (see Selecting Calibration Plane). The manufacturer and description are just to provide information.

1. Click on the **Model**, **Manufacturer**, or **Description** field for the required calibration kit in the table and enter the new text.



Editing Calibration Kit Standards

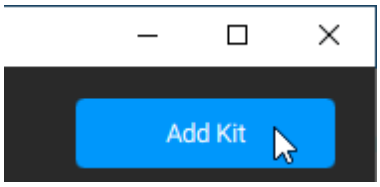
1. Double-click on the required row in the table of calibration kits.

   Next, the Standards pop-up window opens. For a detail description of this window, see Standards Management in Calibration Kit.

Adding New User-Defined Calibration Kits

New calibration kits are added to the end of the table.

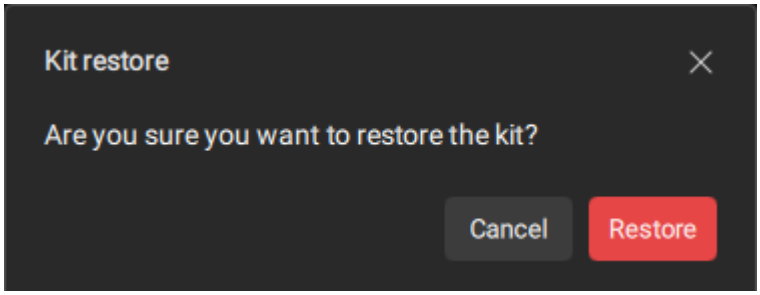
1. Click on the **Add Kit** button in the Calibration Kits pop-up window.



Predefined Calibration Kit Restoring

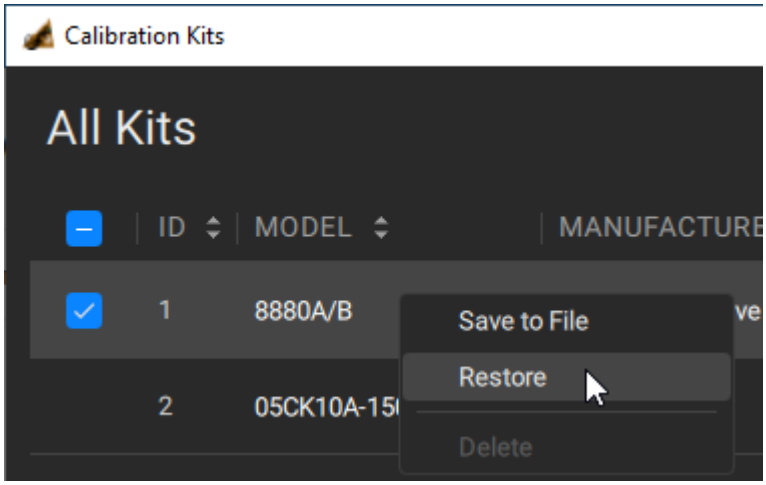
A predefined calibration kit can be restored but cannot be deleted.

1. Select the checkbox(es) in left column of the table near the required calibration kit(s).
2. Click on the  icon in top area of the Calibration Kits pop-up window.
3. Click the **Restore** button in the opened dialog.



SCPI SENSe:CORRection:COLLect:CKIT:RESet

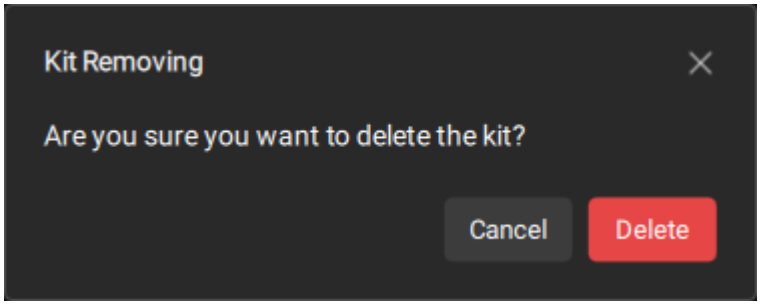
NOTE Calibration kits can also be restored by right-clicking on the highlighted row(s) in the table, then selecting the **Restore** field in the pop-up window:



Deleting User-Define Calibration Kit

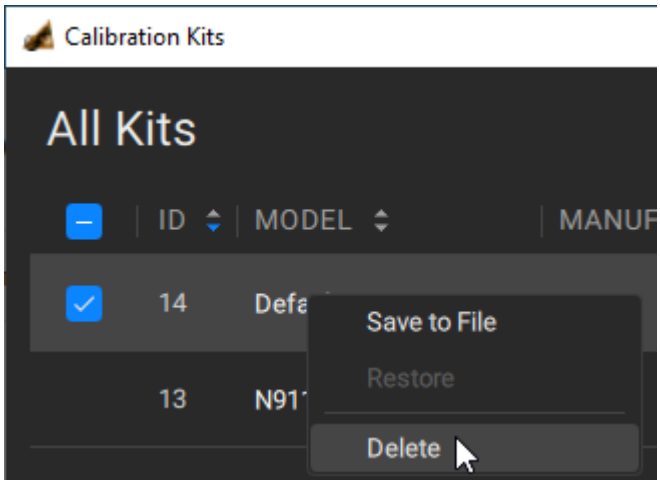
A user-defined calibration kit cannot be restored but can be erased.

1. Select the checkbox(es) in left column of the table near the required calibration kit(s).
2. Click on the  icon in top area of the Calibration Kits pop-up window.
3. Click the **Delete** button in the opened dialog.



NOTE

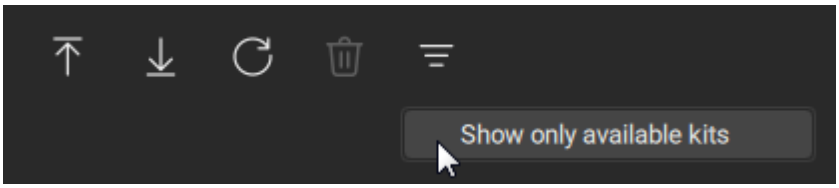
Calibration kits can also be deleted by right-clicking on the highlighted row(s) in the table, then selecting the **Delete** field in the pop-up window:



Showing Only Available Kits

This option hides not available calibration kits in the calibration kits table.

1. Toggle **AVAILABLE** OFF in non-required calibration kit.
2. Click on the  icon in top area of the Calibration Kits in the pop-up window.
3. Click **Show only available kits**.



NOTE If this option is active, the icon in the top area changes to a  icon.

Saving Calibration Kits to File

Saving a calibration kit to file is necessary for copying it to a different line of the table or to a different Analyzer.

This command is not necessary to save changes made by the user to the definitions of the kit, as these changes are saved automatically.

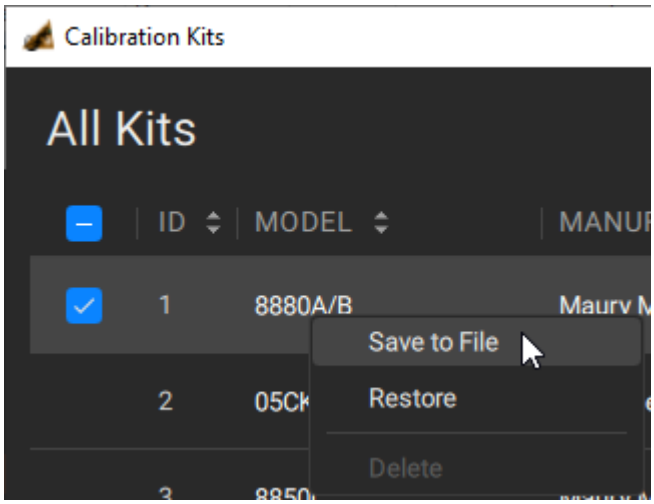
The calibration kits is saved as a *.NCK file to a hard disk and can be recalled later .

1. Select the checkbox in the left column of the table near the required calibration kit.
2. Click on the  icon in top area of the Calibration Kits pop-up window.
3. Select a path and enter the file name in the **Save calibration kit to file** dialog.

SCPI MMEMory:STORe:CKIT

NOTE

Calibration kits can also be saved by right-clicking on the highlighted row(s) in the table, then selecting the **Save to File** field in the pop-up window:



Loading Calibration Kits from File

Calibration kit files created by the previous command can also be loaded. Calibration kits from the file are added to the end of the table.

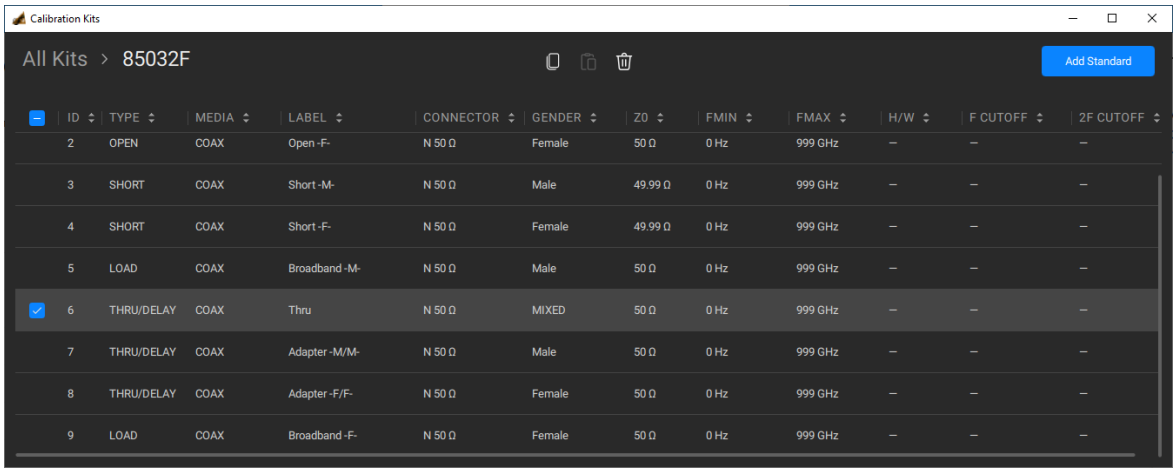
1. Click on the  icon in top area of the Calibration Kits pop-up window.
2. Select a path and the file name in the **Load calibration kit from file** dialog.

SCPI MMEMory:LOAD:CKIT

Standards Management in Calibration Kit

The Standards pop-up window displays calibration kit standards information, and can add and delete standards in a calibration kit (see figure below).

To view the standards included in the calibration kit, double-click on the required row in the table of the Calibration Kit pop-up window (see Calibration Kit Management). The name of the open calibration kit is displayed in the pop-up window title bar.



Standards Pop-up Window

The Standards pop-up window contains a view-only table of standards and controls. Each row in the table describes one standard. For a description of the columns from the table of standards, see the table below.

Columns of the Standards Table

Column	Description
ID	Number of standard in calibration kit
TYPE	The standard type (see Types of Calibration Standards)
MEDIA	The offset media of standard: • COAX (coaxial) • WAVEGUIDE
LABEL	Standard label

Column	Description
CONNECTOR	The type of standard connector (see Editing User-Defined Connector Type)
GENDER	The gender of a standard: • Male • Female • Genderless
Z0	Offset characteristic impedance value (Ω) of the coaxial media
FMIN	Minimum operating frequency of the coaxial standard
FMAX	Maximum operating frequency of the coaxial standard
H/W	Waveguide height to width ratio
F Cutoff	Lower cutoff frequency of the waveguide standard
2F Cutoff	Upper cutoff frequency of the waveguide standard

Editing Standard Definition

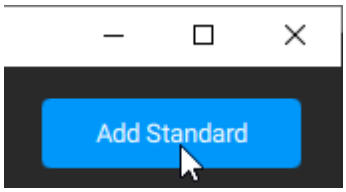
1. Double-click on the required row in the standard table.

   Next, the Standard Definition pop-up window opens. For a detailed description of the window, see Standard Definition.

Adding New Standard to Calibration Kit

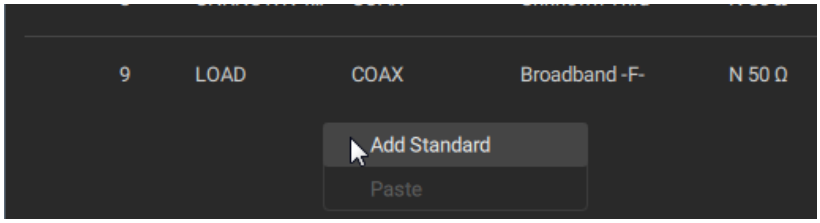
New standards are added to the end of the table.

1. Click on the **Add Standard** button in the Standard pop-up window.



NOTE

Standard can also be added by right-clicking on the area outside the table and selecting the **Add Standard** field in the pop-up window:

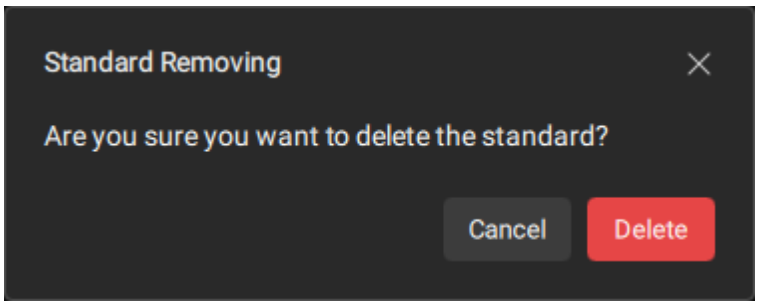


Deleting Standard from Calibration Kit

1. Select the checkbox(es) in the left column of the table near the required calibration standards(s).

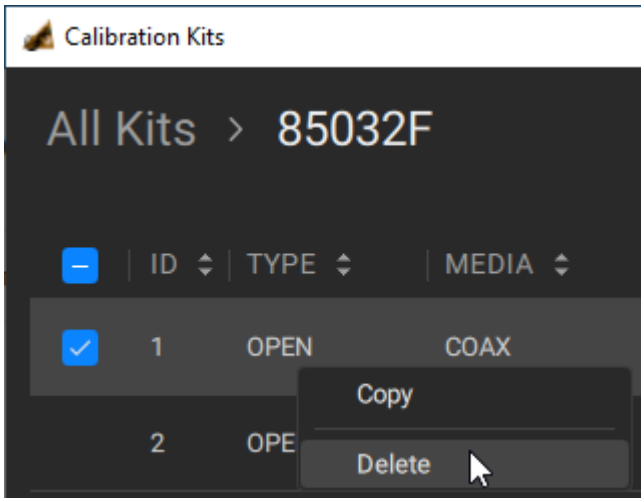
2. Click on the  icon in top area of the Standard pop-up window.

3. Click the **Delete** button in the opened dialog.



NOTE

Standard(s) can also be deleted by right-clicking on the highlighted row(s) in the table, and then selecting the **Delete** field in the pop-up window:



NOTE

Predefined calibration kits can be restored (see Predefined Calibration Kit Restoration).

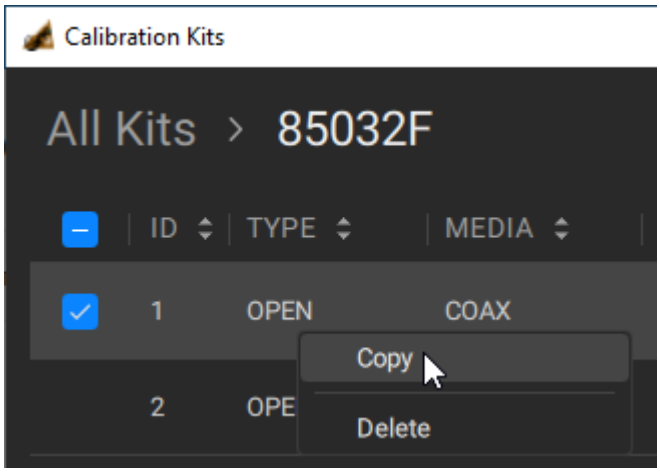
Calibration Standard Copy/Paste Function

New standards are added to the end of the table.

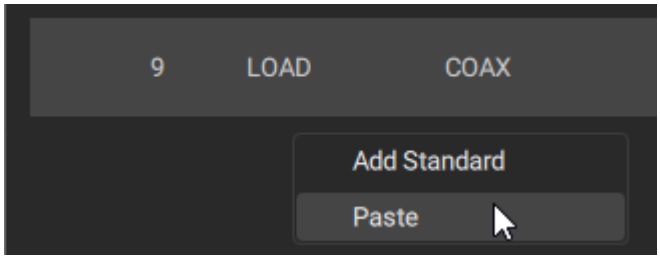
1. Select the checkbox(es) in left column of the table near the required calibration standard(s).
2. Click on the  icon to copy standard(s) into the clipboard in the top area of the Standard pop-up window.
3. Click on the  icon to paste standard(s) from the clipboard in the top area of the Standard pop-up window.

NOTE

Standard(s) can also be copied into the clipboard by selecting the checkbox(es) in left column of the table, then selecting the **Copy** field in the pop-up window:

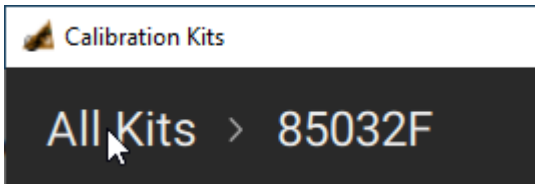


To paste a standard from the clipboard, right-click on the area outside the table and select the **Paste** field in the pop-up window:



Back to Calibration Kits Management

1. Click on **All Kits** in the breadcrumbs in top left of the Standard pop-up window.



Standard Definition

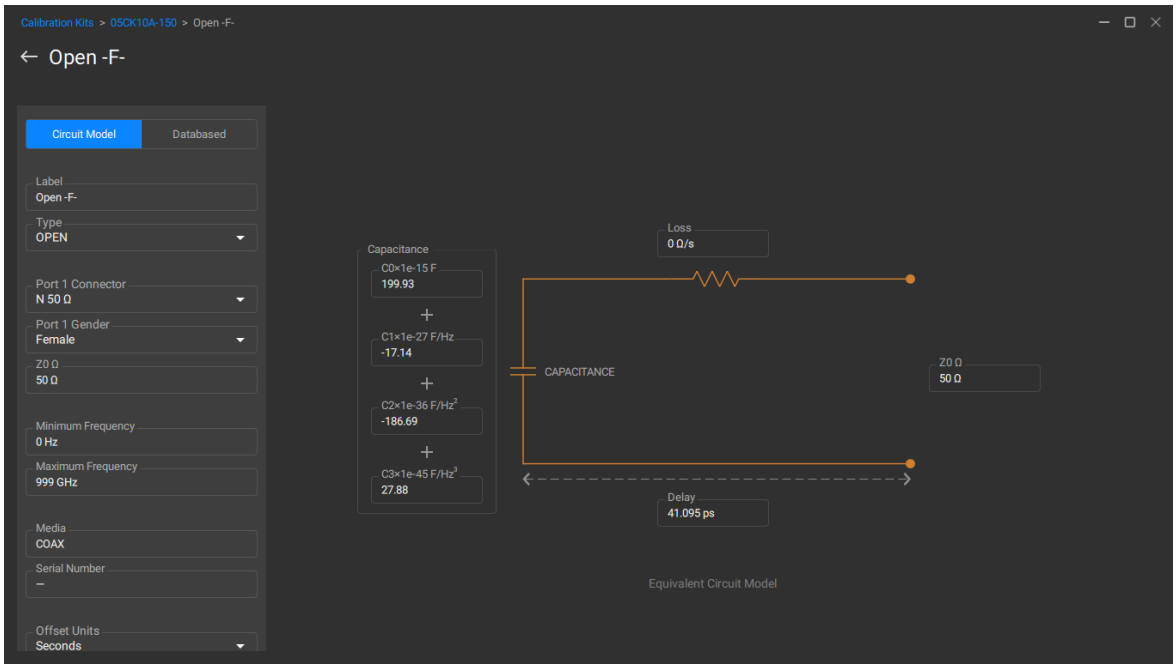
The Standard Definition pop-up window edits the calibration kit standard definition. The Analyzer provides two methods of defining a standard:

- Circuit Model
- Databased (The calibration standards defined by S-parameters are called Databased standards).

Each standard is characterized by the lower and upper values of the operating frequency for the coaxial, or by the cutoff and double cutoff frequencies for the waveguide media.The measurements of the standards outside the specified frequency range are ignored in the process of calibration.

To open the Standard Definition pop-up window, double-click on the required row in the table of the Standards pop-up window (see Standards Management in Calibration Kit). The name of the open calibration kit and standard name are displayed in the pop-up window title bar.

The example of Standard Definition pop-up window defined by the circuit model for one calibration standard is shown below.

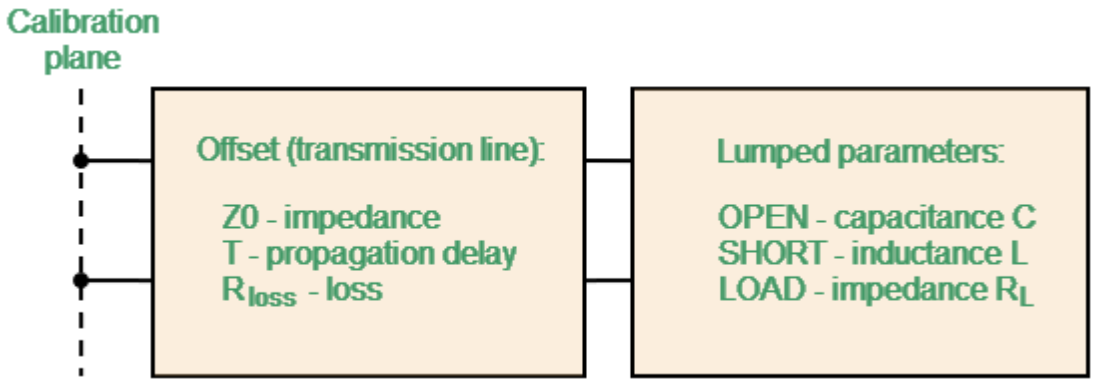


Standard Definition Pop-up Window for the Standards Defined by the Circuit Model

Circuit Model Standards

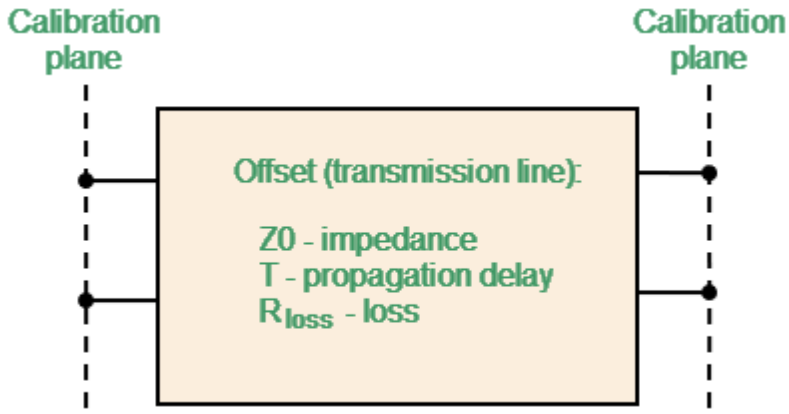
A model of a calibration standard presented as an equivalent circuit is used for determining the S-parameters of the standard. The model is employed for OPEN, SHORT, LOAD, THRU/DELAY standard types.

The one-port model is used for OPEN, SHORT and LOAD (see Full One-Port Calibration) standards. This is shown in the figure below.



One-port Standard Model

The two-port model is used for THRU/DELAY standards (see figure below).



Two-port Standard Model

For a description of the numeric parameters of an equivalent circuit model of a calibration standard, see the table below.

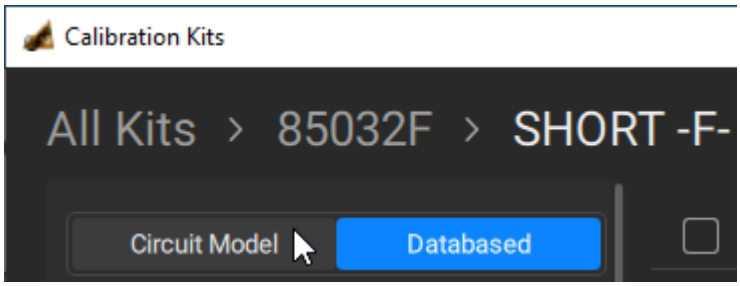
Parameter (as in the software)	Parameter Definition
Z0 Ω	The characteristic impedance of the transmission line, serving as the offset. Unit: [Ω]. For the coaxial line specified real value of characteristic impedance, usually equal to 50 Ω or 75 Ω. NOTE Z0 of the selected connector type is installed by default.
Delay (Length)	The offset delay. It is defined as one-way signal propagation time in the transmission line. Unit: [seconds]. The delay can be measured or mathematically determined by dividing the exact physical length by the propagation velocity in the line. For waveguide, delay is conventionally taken to be equal to the delay of a coaxial line of the same length. The actual signal delay in waveguide is frequency-dependent and is calculated in the software. Instead of delay, you can specify the length of the offset. Unit: [meters]. The software calculates the delay according to the formula for a coaxial air line: $$T = \frac{\sqrt{\varepsilon_r} l}{c},$$ where l — line length [m], c — light speed in free space 299792458 [m/s], ε_r— relative permittivity of air 1.000649. The offset delay can be switched to the physical length [m] (see Selecting Offset Units). The length can be specified instead of the delay, provided that the offset of the calibration standard is a coaxial airline or a waveguide. If the calibration standard manufacturer provides delay data, specify delay.

Parameter (as in the software)	Parameter Definition
Loss	The offset loss in one-way propagation due to the skin effect. Unit: [Ω/sec]: • The loss in the coaxial transmission line is determined by measuring the delay T [sec] and loss L [dB] at a frequency of 1 GHz. The measured values are used in the following formula: $R\pi[\Omega/s] = \frac{L[dB]\cdot Z0[\Omega]}{4.3429[dB]\cdot T[s]}$ • The loss in waveguide is typically set to 0 due to its very small influence. However, the software supports a waveguide loss model. If the calibration standard manufacturer provides loss data, specify it.
Terminal Imp. Ω	Load impedance of a fixed load calibration standard. Unit: [Ω]. For the coaxial calibration standard specified real value of characteristic impedance, usually equal to 50 Ω or 75 Ω.
Capacitance **(C0, C1, C2, C3)**	The fringe capacitance of an OPEN standard, which causes a phase offset of the reflection coefficient at high frequencies. The fringe capacitance model is described as a function of frequency, which is a polynomial of the third degree: $C = C0 + C1 \cdot f + C2 \cdot f^2 + C3 \cdot f^3$, where f — frequency [Hz], C0…C3 — polynomial coefficients. Units: C0[F], C1[F/Hz], C2[F/Hz^2], C3[F/Hz^3].
Inductance **(L0, L1, L2, L3)**	The residual inductance of a SHORT standard, which causes a phase offset of the reflection coefficient at high frequencies. The residual inductance model is described as a function of frequency, which is a polynomial of the third degree: $L = L0 + L1 \cdot f + L2 \cdot f^2 + L3 \cdot f^3$, where f — frequency [Hz],

Parameter (as in the software)	Parameter Definition
	L0…L3 — polynomial coefficients. Units: L0[H], L1[H/Hz], L2[H/Hz^2], L3[H/Hz^3].
Minimum Frequency, Maximum Frequency	The minimum and maximum standard operating frequency in the coaxial. Used for calibration that uses several calibration standards, each of which does not cover entire frequency range.The measurements of the standards outside the specified frequency range are ignored in the process of calibration.
H/W	The waveguide width-to-height ratio. Used in the waveguide loss model when the loss value is not zero.
F Cutoff, 2F Cutoff	The cutoff frequency and the doubled cutoff frequency of the waveguide. The cutoff frequency of the waveguide is achieved at a wavelength in the waveguide equal to twice its width. Take care not to confuse this with the minimum and maximum operating frequency of the waveguide, which are usually given by the manufacturer with a margin relative to the cutoff frequency.

Selecting Circuit Model Definition

1. Click the **Circuit Model** button in the sidebar of the Standard pop-up window.



Editing Standard Label

1. Click on the **Label** textbox in the sidebar of Standard pop-up window and enter the standard label.

SCPI SENSe:CORRection:COLLect:CKIT:STAN:LABel

NOTE It is recommended to mark gender in Label textbox (see Gender of Calibration Standard).

Editing Standard Serial Number

1. Click on the **Serial Number** textbox in the sidebar of Standard pop-up window, and enter numeric serial number.

   NOTE The standard serial number will be displayed in the corresponding calibration step in calibration wizard.

Selecting Standard Type

1. Click on the **Type** drop-down list in the sidebar of Standard pop-up window, and select standard type.

SCPI SENSe:CORRection:COLLect:CKIT:STAN:TYPE

Selecting Standard Port Connector and Gender

1. Click on the **Port 1 Connector** (and **Port 2 Connector** for two-port standard only) drop-down list in the sidebar of Standard pop-up window, and select connector type.

2. Click on the **Port 1 Gender** (and **Port 2 Gender** for two-port standard only) drop-down list in the sidebar of Standard pop-up window, and select connector gender.

   NOTE For coaxial gendered media only.

Editing Standard Impedance Z0

1. Click on the **Z0 Ω** textbox in sidebar or a similar field in Equivalent circuit model area of Standard pop-up window, and enter the numerical value.

   NOTE Editing Z0 impedance of the standard is usually not required, because it is set according to the selected connector.

SCPI SENSe:CORRection:COLLect:CKIT:STAN:Z0

Editing Standard Capacitance, Inductance, Terminal Impedance, Loss

1. Click on the required textbox in the equivalent circuit model area of the Standard pop-up window and enter the numerical value.

SCPI SENSe:CORRection:COLLect:CKIT:STAN:C0,
SENSe:CORRection:COLLect:CKIT:STAN:C1,
SENSe:CORRection:COLLect:CKIT:STAN:C2,
SENSe:CORRection:COLLect:CKIT:STAN:C3

SENSe:CORRection:COLLect:CKIT:STAN:L0,
SENSe:CORRection:COLLect:CKIT:STAN:L1,
SENSe:CORRection:COLLect:CKIT:STAN:L2,
SENSe:CORRection:COLLect:CKIT:STAN:L3

SENSe:CORRection:COLLect:CKIT:STAN:ARBitrary

Editing Standard Waveguide Height to Width Ratio

1. Click on the **H/W** textbox in the sidebar of Standard pop-up window, and enter the numerical value.

   NOTE Editing height to width ratio of the standard is usually not required, because it is set according to the selected connector.

Editing Standard Minimum Frequency and Maximum Frequency, or F Cutoff and 2F Cutoff

1. Click on the required textbox in the sidebar of Standard pop-up window, and enter the numerical value.

   NOTE Editing minimum frequency and maximum frequency, or F Cutoff and 2F Cutoff of the standard is usually not required, because it is set according to the selected connector.

SCPI SENSe:CORRection:COLLect:CKIT:STAN:FMINimum, SENSe:CORRection:COLLect:CKIT:STAN:FMAXimum

Editing Offset Units, Offset Permittivity and Standard Delay (Length)

1. Click on the **Offset Units** drop-down list in the sidebar of the Standard pop-up window and select units between **Distance** or **Seconds**.

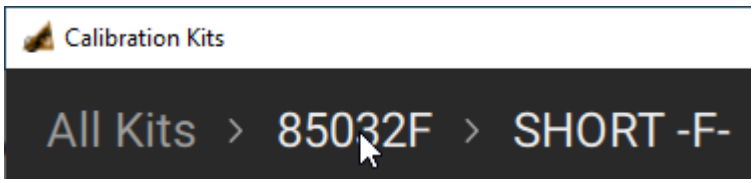
2. If offset unit is selected **Distance**, click on the **Offset Permittivity** textbox in the sidebar of the Standard pop-up window and enter the numerical value.

3. Click on the required **Delay** (**Length**) textbox in the equivalent circuit area of the Standard pop-up window and enter the numerical value.

SCPI SENSe:CORRection:COLLect:CKIT:STAN:DELay, SENSe:CORRection:COLLect:CKIT:STAN:LOSS

Back to Calibration Kits Management or Standards Management

1. Click on **All Kits** or on the calibration kit name in the breadcrumbs in the top left of the Standard Definition pop-up window.



Databased Standards

The calibration standards defined by data are set using the table of S-parameters. Each row of the table contains the frequency and S-parameters of the calibration standard. For one-port standards, the table contains the value of only one parameter — S11, and for two-port standards the table contains the values of all the four parameters — S11, S21, S12, S22.

The table of S-parameters can be filled in manually or downloaded from a Touchstone file. Files with a *.S1P extension are used for one-port standards, and files with a *.S2P extension are used for two-port standards.

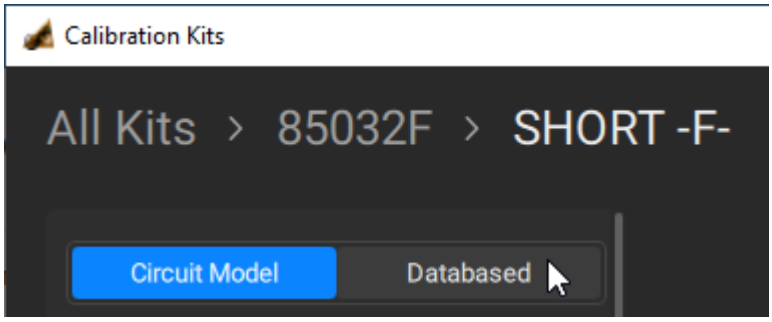
The data in the table can be represented in three formats according to the user settings:

- Real part and imaginary part
- Linear magnitude and Phase (°)
- Logarithmic magnitude (dB) and Phase (°)

The following rule is applied for the calibration of a two-port standard: the standard is considered to be connected by Port 1 (S11) to the port with the smallest number and by Port 2 (S22) to the port with the biggest number. If a two-port standard needs to be reversed, use the Reverse Port function.

Selecting Databased Definition

1. Click on the **Databased** button in the Standard Definition manager.



Editing Standard Label

1. Click on the **Label** textbox in the sidebar of Standard pop-up window and enter the standard label.

SCPI SENSe:CORRection:COLLect:CKIT:STAN:LABel

NOTE It is recommended to mark gender in Label textbox (see Gender of Calibration Standard).

Editing Standard Serial Number

1. Click on the **Serial Number** textbox in the sidebar of Standard pop-up window, and enter numeric serial number.

   NOTE The standard serial number will be displayed in the corresponding calibration step in calibration wizard.

Selecting Standard Type

1. Click on the **Type** drop-down list in the sidebar of Standard pop-up window, and select standard type.

SCPI SENSe:CORRection:COLLect:CKIT:STAN:TYPE

Selecting Standard Port Connector and Gender

1. Click on the **Port 1 Connector** (and **Port 2 Connector** for two-port standard only) drop-down list in the sidebar of Standard pop-up window, and select connector type.

2. Click on the **Port 1 Gender** (and **Port 2 Gender** for two-port standard only) drop-down list in the sidebar of Standard pop-up window, and select connector gender.

   NOTE For coaxial gendered media only.

Editing Standard Impedance Z0

1. Click on the **Z0 Ω** textbox in sidebar or a similar field in Equivalent circuit model area of Standard pop-up window, and enter the numerical value.

   NOTE Editing Z0 impedance of the standard is usually not required, because it is set according to the selected connector.

SCPI SENSe:CORRection:COLLect:CKIT:STAN:Z0

Editing Standard Waveguide Height to Width Ratio

1. Click on the **H/W** textbox in the sidebar of Standard pop-up window, and enter the numerical value.

   NOTE Editing height to width ratio of the standard is usually not required, because it is set according to the selected connector.

Editing Standard Minimum Frequency and Maximum Frequency, or F Cutoff and 2F Cutoff

1. Click on the required textbox in the sidebar of Standard pop-up window, and enter the numerical value.

   NOTE Editing minimum frequency and maximum frequency, or F Cutoff and 2F Cutoff of the standard is usually not required, because it is set according to the selected connector.

SCPI SENSe:CORRection:COLLect:CKIT:STAN:FMINimum, SENSe:CORRection:COLLect:CKIT:STAN:FMAXimum

Selecting Table Format

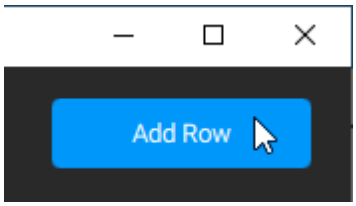
1. Click on the **Format** drop-down list in the sidebar of the Standard pop-up window and select required format:

   - **REAL/IMAGINARY** — real part and imaginary part
   - **MAGNITUDE/ANGLE** — linear magnitude and Phase (°)
   - **DECIBEL/ANGLE** — logorithmic magnitude (dB) and Phase (°)

Adding New Row to Table

New row is added to the end of the table.

1. Click on the **Add Row** button in the Standard pop-up window.

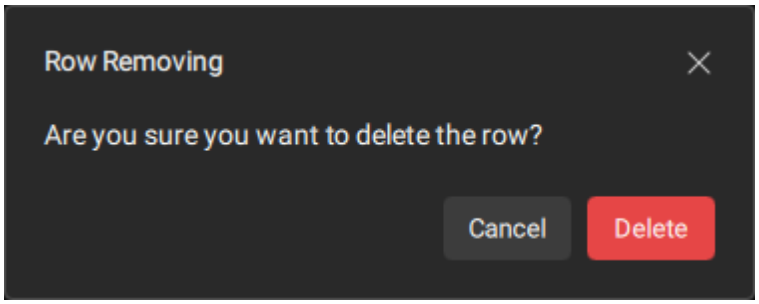


Editing Row Data

1. Click on the fields in table of the Standard pop-up window and enter the required numerical value.

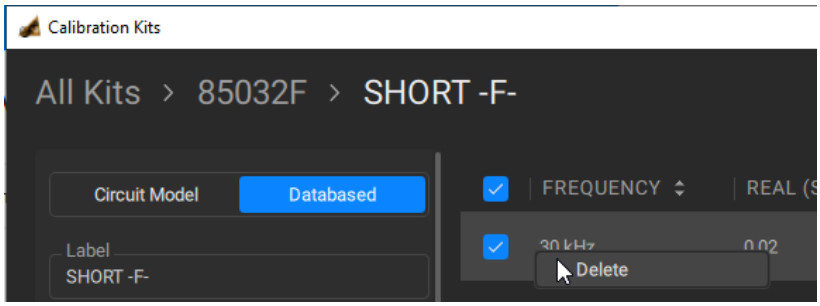
Deleting Row from Table

1. Select the checkbox(es) in the left column of the table near the required row.
2. Click on the  icon in top area of the Standard pop-up window.
3. Click the **Delete** button in the opened dialog.



NOTE

Row(s) can also be deleted by highlighting the required rows in the table, then selecting the **Delete** field in the pop-up window:



Reverse Port

Reverse Port is available for two-port standard. By default, the standard is considered to be connected by Port 1 (S11) to the port with the smallest number and by Port 2 (S22) to the port with the largest number. Use Reverse Port function if a two-port standard needs to be reversed.

1. Click on the  icon in top area of Standard pop-up window.

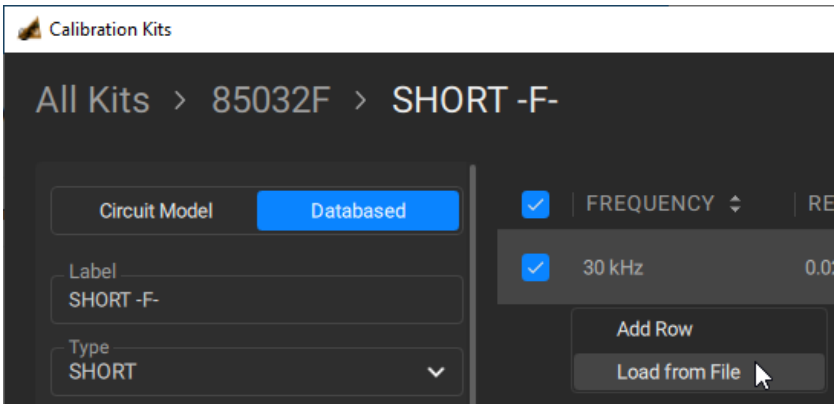
Loading Data from Touchstone File

The table of S-parameters can be loaded from Touchstone file. The Touchstone file type (*.S1P or *.S2P) is determined automatically depending on the type of standard.

1. Select standard type (see Selecting Standard Type).
2. Click on the  icon in top area of the Standard pop-up window.
3. Select a path and the file name in the pop-up window.

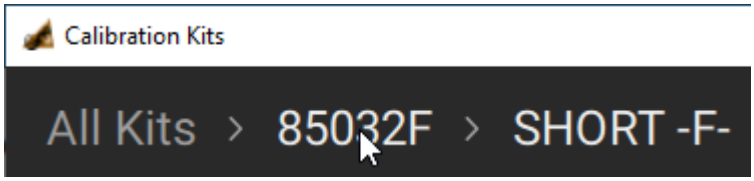
NOTE

The table of S-parameters can be loaded by right-clicking on the area outside the table and selecting **Load from File** field in the pop-up window that opens:



Back to Calibration Kits Management or Standards Management

1. Click on **All Kits** or on the calibration kit name in the breadcrumbs in the top left of the Standard Definition pop-up window.



Calibration Types

The Analyzer supports several types of calibration for one, two, or more ports. Calibrations differ in accuracy, set of correctable systematic errors, number and type of used calibration standards.

Calibration with Mechanical Calibration Kit

The manual calibration uses a calibration kit. In this case, each standard is connected to a calibrated measurement port. The calibration types vary by quantity and type of the standards being used, by type of error correction, and accuracy.

Calibration with the Automatic Calibration Module

Automatic calibration allows to reduce the number of connections of measures. Calibration is performed using a special device – Automatic calibration module (ACMs). The automatic calibration provides higher accuracy potentially.

The table below shows an overview of the calibration types.

Calibration Type	Calibration Kit	ACM	S-Parameters	Standards	Errors	Accuracy
Reflection Normalization	+	–	Sii[1]	• SHORT or OPEN • LOAD (if optional directivity is performed)	Eri, Edi[2]	Low
Transmission Normalization	+	–	Sij[1] or Sji[1]	• THRU • 2 LOADs (if optional isolation calibration is performed)	Eti, Exi[3] or Etj, Exj[3]	Low
Full One-Port Calibration (SOL)	+	+	Sii[1]	• SHORT • OPEN • LOAD	Eri, Edi, Esi	High

Calibration Type	Calibration Kit	ACM	S-Parameters	Standards	Errors	Accuracy
One-Path N-Ports Calibration	+	+	Sij, Sjj[1] or Sii, Sji[1]	• SHORT • OPEN • LOAD • THRU • 2 LOADs (if optional isolation calibration is performed)	Erj, Edj, Esj, Etj, Exj[3] or Eri, Edi, Esi, Eti, Exi[3]	Medium
Full N-Ports Calibration (SOLT, SOLR) [4]	+	+	Sii, ..., Sij ... Sji, ..., Sjj[1]	• SHORT • OPEN • LOAD	See Error terms in a N-port system	High

Calibration Type	Calibration Kit	ACM	S-Parameters	Standards	Errors	Accuracy
				• THRU (if SOLT calibration is performed) or UNKNOWN THRU (if SOLR calibration is performed) • 2 LOADs (if optional isolation calibration is performed)		

1. Indexes i and j take a value from 1 to N, N is 6/8/10/12/14/16 (depending on the Analyzer model, see corresponding datasheet).
2. If optional directivity calibration is performed.
3. If optional isolation calibration is performed.
4. SOLR calibration is used when it is not possible to perform SOLT calibration using a DEFINED THRU from the calibration kit. This type of calibration is most commonly used when measuring non-incertable devices.

Power Calibration

Factory calibration of the source power on the analyzer ports is performed along the plane of the analyzer ports. However, factory calibration may not guarantee sufficient accuracy in all cases, for example, when connecting the DUT, measuring fixture with losses can be used. Power calibration helps maintain a more accurate power level at the input of the DUT, corrected for the use of fixtures. Calibration requires external USB power meter connection. Power calibration is most often used in frequency conversion measurement setup, as well as for measuring non-linear DUTs.

Receiver Calibration

Factory calibration of the reference and measuring receivers is carried out along the plane of the analyzer ports. As in the case of power calibration, factory calibration of receivers may not guarantee sufficient accuracy in all cases, for example, when connecting a DUT, measuring fixture with losses may be used. Therefore, in setups that require measurement of the absolute power level of the DUT signals, it is necessary to calibrate the receivers to compensate for the influence of the fixture.

Calibration Wizard Overview

The Calibration Wizard allows to create and customize various calibration configurations. It is possible to create multiple configurations and perform calibration later by simply selecting the desired configuration from the list.

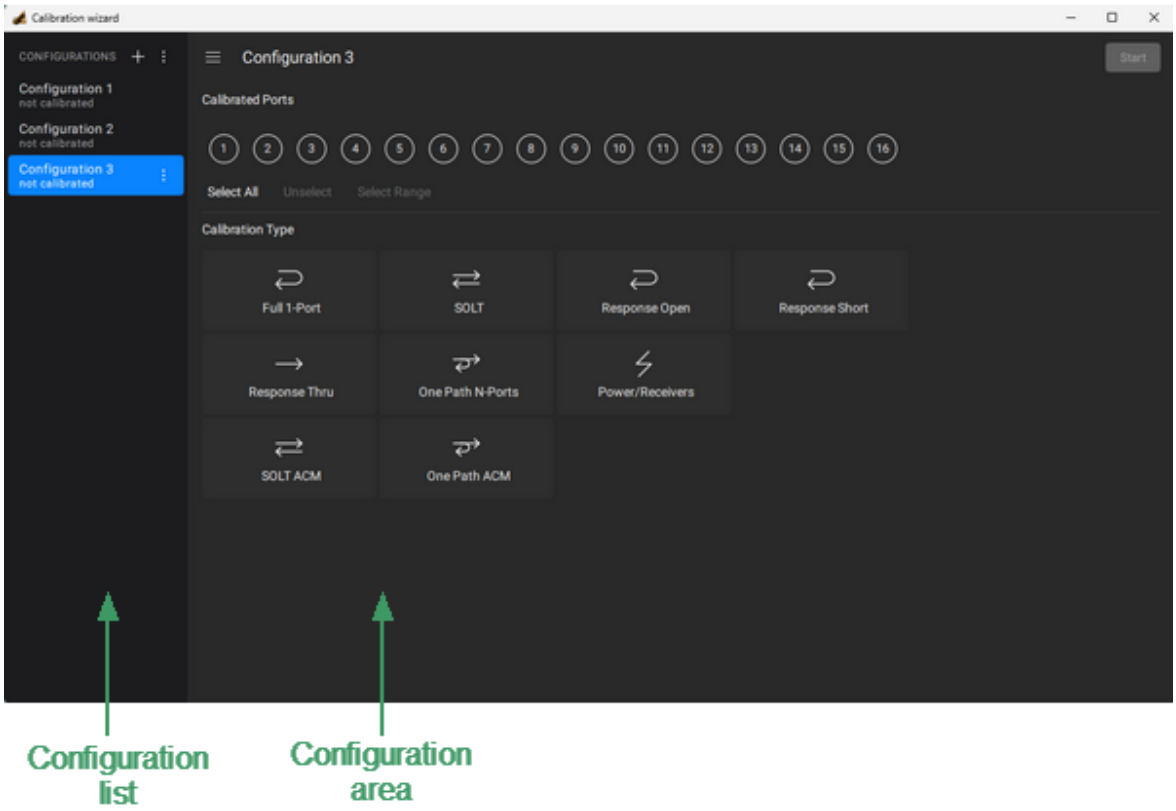
The configuration is used to combine ports into a group and assign a calibration type to that group. You can create several port groups in a single configuration and assign the required calibration types to them. For example, Port 1 can be combined into group 1. This group can be assigned to the Reflection Normalization (Response Open) calibration type. Then, Port 2 and Port 3 can be combined into group 2, and this group can be assigned Full one-port (SOL) calibration type. Next, Port 4, Port 5, Port 6 and Port 7 can be combined into group 3, and this group can be assigned another type of ACM calibration and so on.

Once ports have been grouped together, set the calibration plane parameters for all groups by selecting the connector type and connector gender for each port, as well as the calibration kit or ACM used in calibration. Then, perform the calibration step-by-step.

NOTE Each port can only be used in one group. If necessary, ports can be rearranged.

NOTE The Calibration Wizard does not allow to create S-parameter calibrations and power/receiver calibrations in the same configuration. Power/receiver calibrations should be done in a separate configuration.

The Calibration Wizard pop-up window is shown in the figure below. The window contains a configuration list with the created configurations and a configuration area for customization of calibration configuration. You can click on areas or labels in the figure to go to a description of the wizard parts.



Calibration Wizard Pop-up Window

The sequence of actions to perform calibration in the wizard:

1. Run Calibration Wizard (see Starting Calibration Wizard Pop-up Window).
2. Create a configuration (see Adding New Configuration) or use an existing configuration (see Editing a Configuration).
3. If creating a new configuration: create port groups and assign each group the required calibration type (see Creating a New Ports Group).
4. If creating a new configuration: select a calibration plane for each port involved in the calibration (see Selecting Calibration Plane). Calibration plane must be selected in accordance with the connectors of the measured DUT.
5. Run the configuration (see Starting Configuration).
6. Complete calibration steps (see Step-by-Step Configuration Execution).
7. Apply a configuration (see Applying a Configuration).

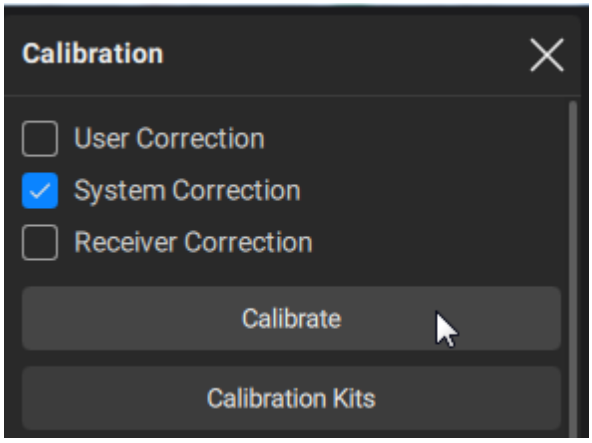
For a detailed description of each calibration type and step-by-step execution of the calibration procedure, see Calibrations Step-by-Step.

Starting Calibration Wizard Pop-up Window

1. Select the channel (see Selection of Active Trace, Diagram, Channel) and set the parameters of the channel (frequency range, IF bandwidth, etc).

2. If calibration is performed using the calibration kit, make sure required calibration kit is marked as **AVAILABLE** in Calibration Kits Management. If the calibration kit is missing, add the kit and its description.

3. Click on the **Calibration > Calibrate** buttons in the sidebar.

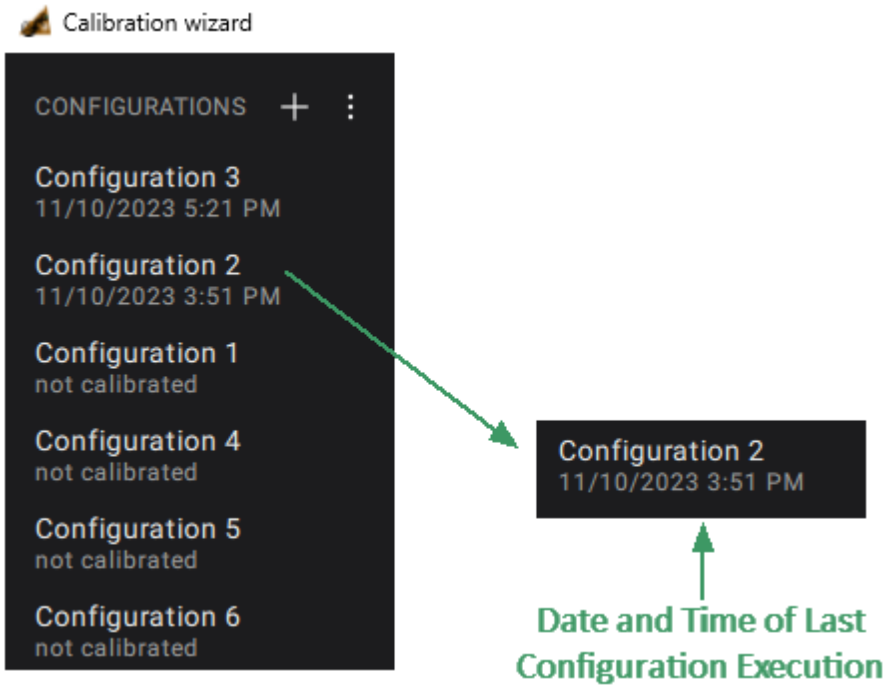


Configuration List

The Configuration List contains user-created configurations and allows to add, remove, and run the desired configuration.

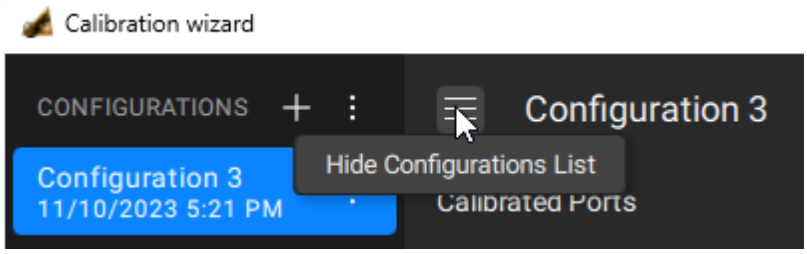
Each configuration has a unique title that can be changed if it is necessary. Information about the date and time of its last execution is displayed under the title of the configuration. If the configuration has not been performed, then **not calibrated** is displayed in the date and time line.

Configurations are sorted by date and time in descending order. If the configuration has not been not performed, it will be located at the end of the list. If there are several such configurations, they are sorted by name.



Configuration List

The configuration list can be shown/hidden by clicking on the icon in the upper left corner of the of configuration area. When performing calibration, the configuration list is automatically hidden.

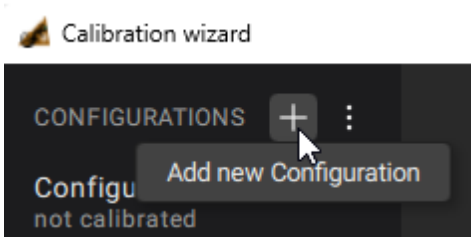


Configuration List Show/Hide Button

Adding New Configuration

1. Click on the icon in the configuration list.

   NOTE If there are no configurations in the wizard, you can create the first configuration by pressing the **ADD CONFIGURATION** button in the configuration area.



SCPI SENSe:CORRection:CONFiguration:CREate

NOTE Each configuration has a unique title name. You can rename a configuration title name if necessary (see Renaming Configuration).

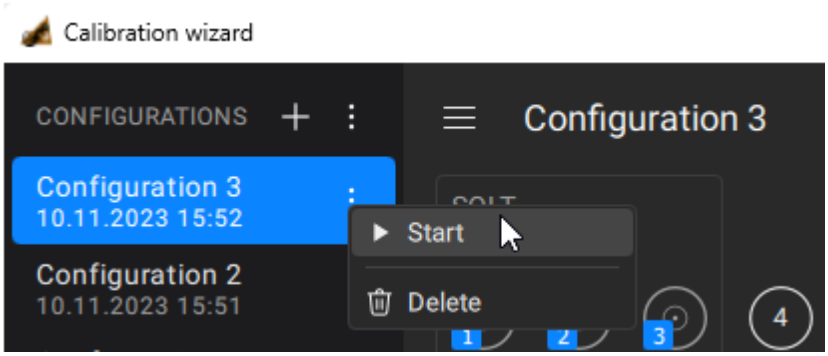
Starting Configuration from Configuration List

You can run customized configuration. To learn more about configuring, see Configuration Area.

---

1. Highlight the required configuration in the configuration list, then click the vertical-ellipsis button ⋮ and click on **Start** in the pop-up window.

   NOTE If the configuration is not customized (parameters of the calibration plane for all created port groups are not set), **Start** in the pop-up window will not be available.

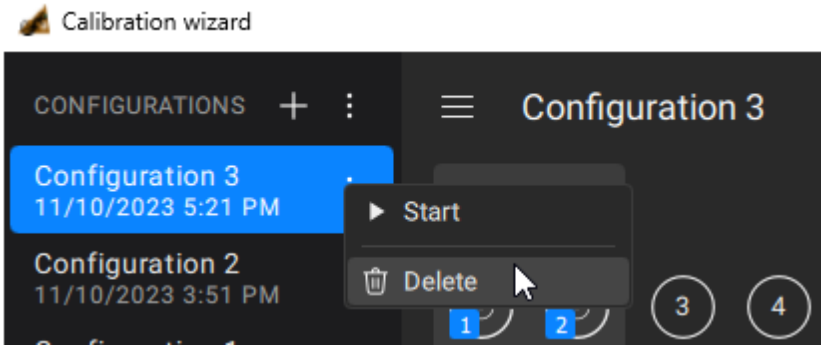


NOTE You can run configuration calibration from the configuration area (see Configuration Area).

Deleting Configuration

NOTE Deleting a configuration does not remove or turn off the correction in the channels.

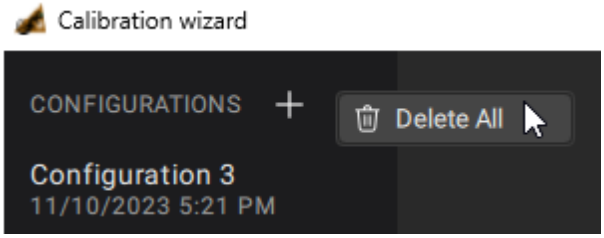
1. Highlight a configuration in the wizard configuration list.
2. Click the ⋮ vertical-ellipsis button to the right of the configuration name.
3. Select **Delete** in the pop-up window.



SCPI SENSe:CORRection:CONFiguration:DELete

Deleting All Calibration Configurations

1. Click the ⋮ vertical-ellipsis button in the wizard configuration list.
2. Select **Delete All** in the pop-up window.



SCPI SENSe:CORRection:CONFiguration:DELete:ALL

Configuration Area

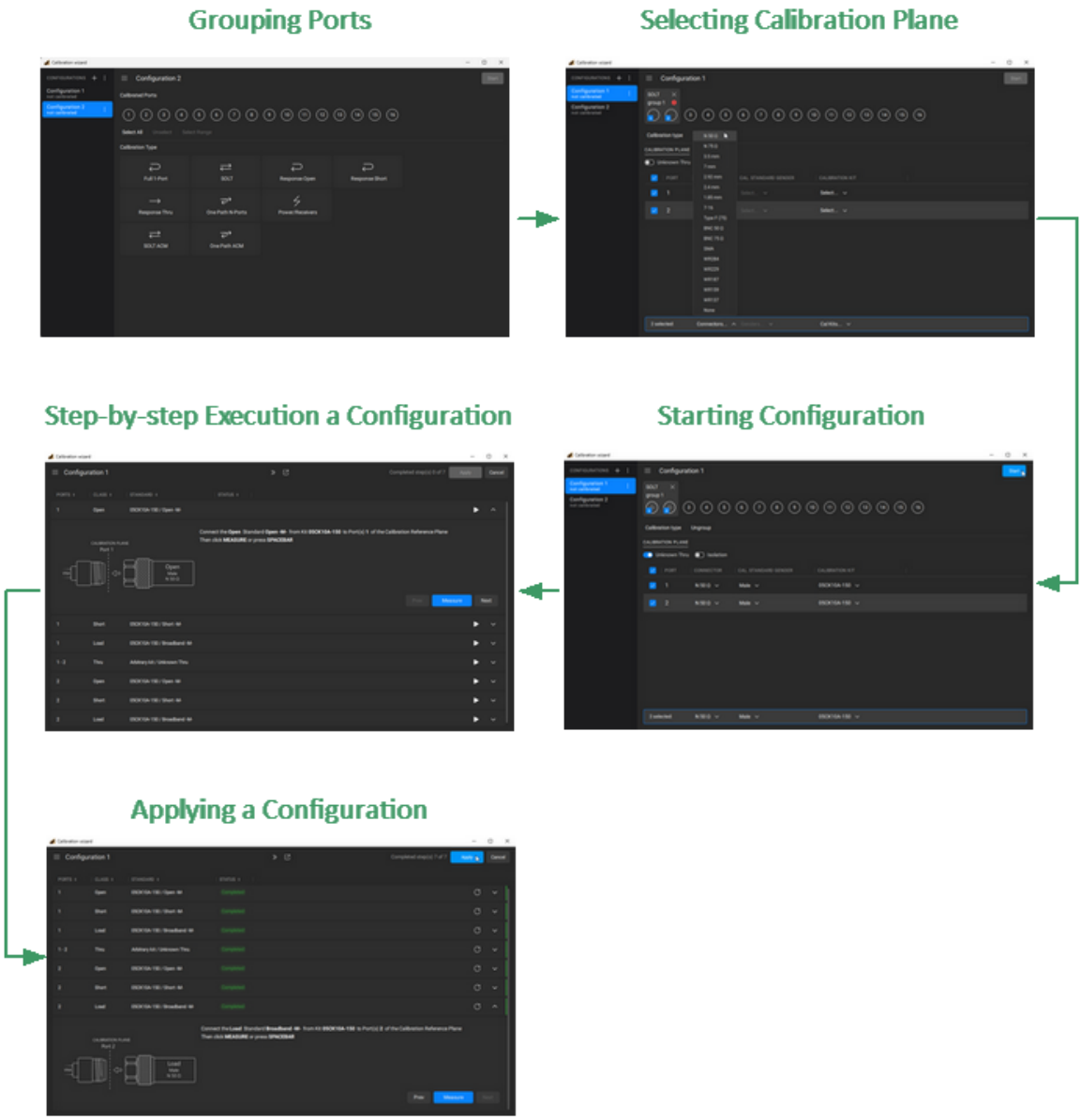
In Configuration Area the user sequentially customizes configuration and performs calibration (see figure below).The sequence of actions is the following:

1. Grouping Ports.
2. Selecting Calibration Plane.
3. Starting Configuration.
4. Step-by-Step Configuration Execution
5. Applying a Configuration.

In order to set up and execute the configuration, create a configuration (see Adding New Configuration). In Configuration Area Grouping Ports step will open.

Each step of working with the Configuration Area is described in subsections of this section below. To go to the description of the required step, you can click on the area or figure labels below.

You can also select the already created configuration (see Configuration List) and reuse it or reconfigure it (see Editing a Configuration).

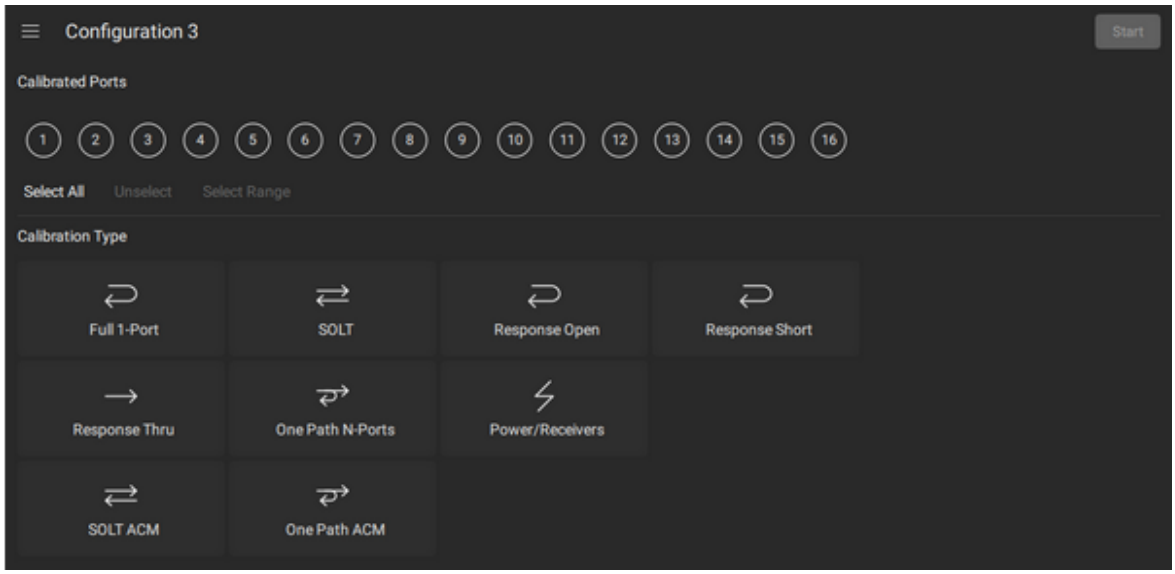


Configuration Area

Grouping Ports

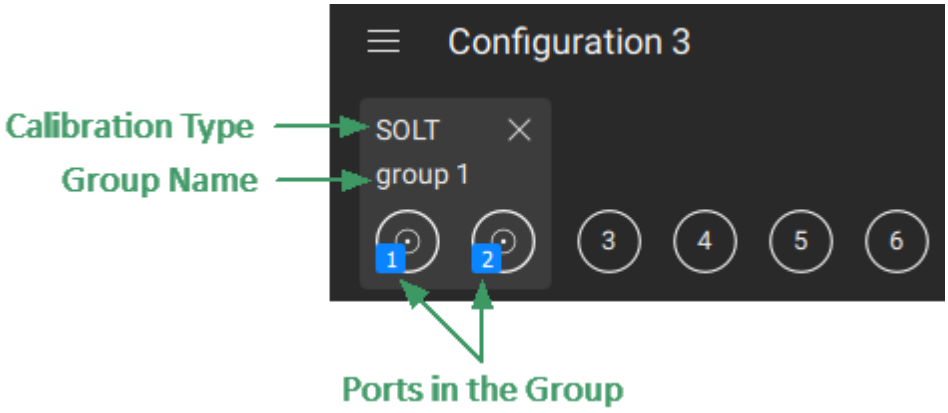
When the configuration is created, the Configuration Area will display port icons and calibration types. At this stage, it is necessary to combine the ports into a group and assign the required type of calibration to the group (see figure below). You can create several port groups with different calibration types.

NOTE Each port can only be used in one group.



An example of combining the ports into a group (SOLT calibration is assigned for Port 1 and Port 2)

When calibration type is selected, ports are indicated grouped together in a tab labeled with group name with number and calibration type (see the example in the figure below).

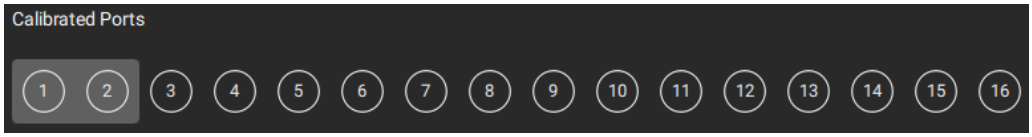


Port Group Tab

Creating a New Ports Group

NOTE The Calibration Wizard does not allow to create S-parameter calibrations and power/receiver calibrations in the same configuration. Power/receiver calibrations should be done in a separate configuration.

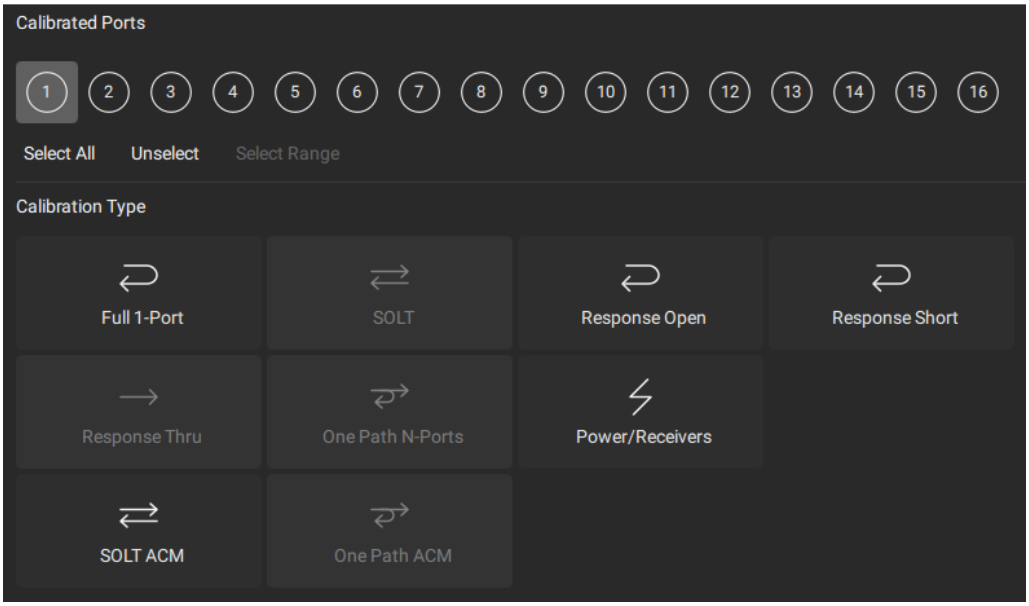
1. Add the required ports to a group by clicking on the port number icons in the Calibrated Ports area.



2. Click on the button with the desired calibration type in the Calibration Type area. For a detailed description of each calibration type and step-by-step execution of the calibration procedure, see the following sections:

- Reflection Normalization (RO – Response Open or RS – Response Short)
- Transmission Normalization (RT – Response Thru)
- Full One-Port Calibration (SOL)
- One-Path N-Ports Calibration (OP)
- Full N-port Calibration (SOLT)
- Sliding Load Calibration
- Unknown Thru Calibration
- Automatic Calibration (ACM)
- Power Calibration (PC)
- Receiver Calibration (RC)

NOTE If the button is not active, this type of calibration is not available for the selected number of ports.



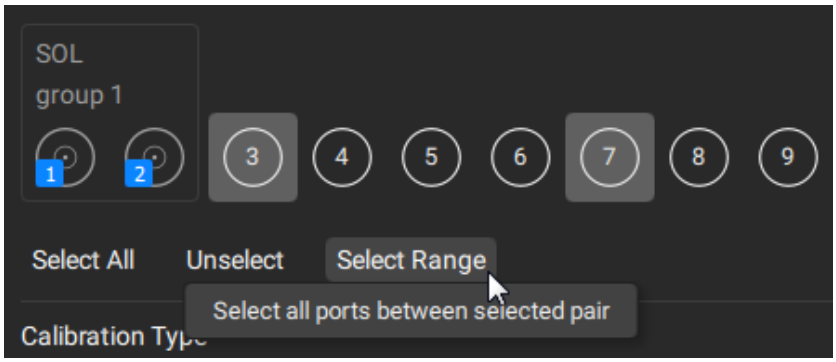
3 If you need to assign the next group of ports, highlight the required port number icons in the Calibrated Ports area and select the calibration type for them.

SCPI SENSe:CORRection:CONFiguration:GROup:CREate

NOTE

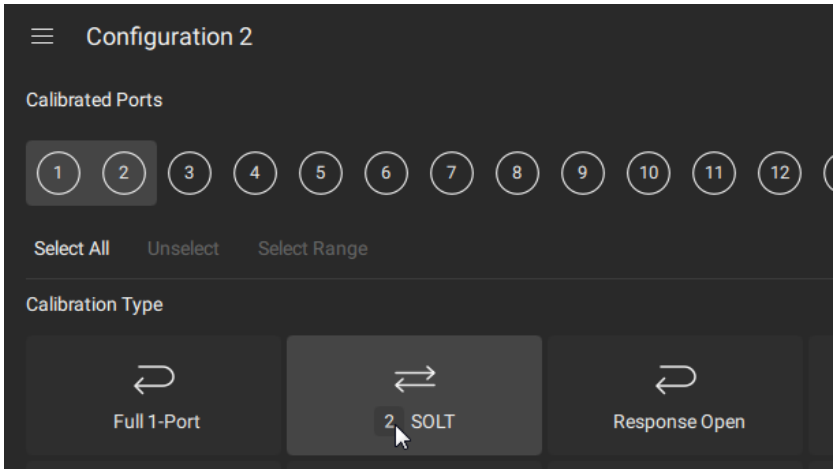
Use the buttons below to quickly select/deselect the ports in the group:

- Click on the **Select All** button to select all not occupied port.
- Click on the **Unselect** button to cancel port selection.
- Click on **Select Range** to select all ports between selected pair of ports (see figure below).

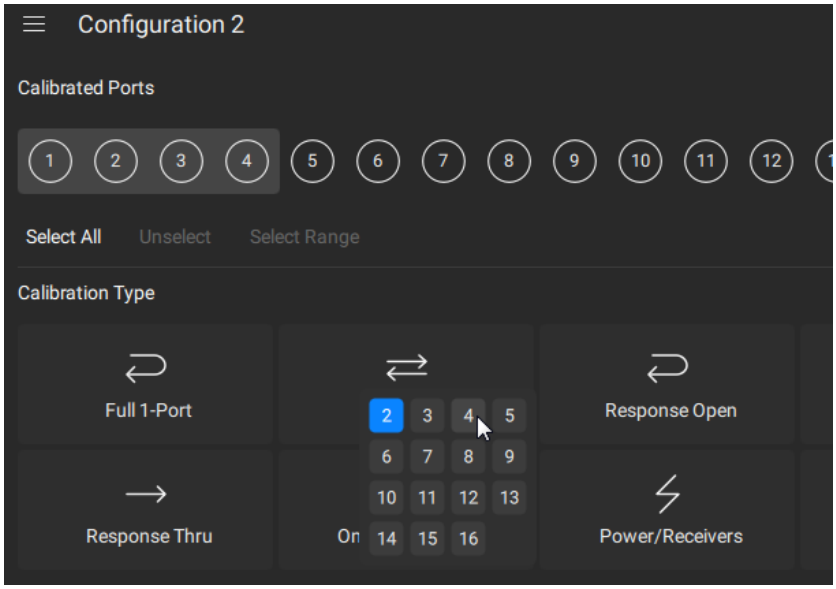


NOTE

You can assign a calibration to a group of ports by clicking on the number to the left of the calibration name in Calibration Type:

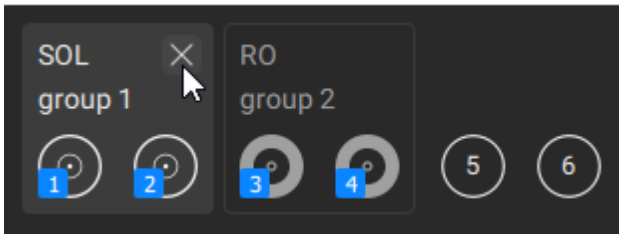


Then click on the icon with the required number of ports in the group in the pop-up window that opens (ports are combined into a group in order from the first free port).



Deleting a Ports Group

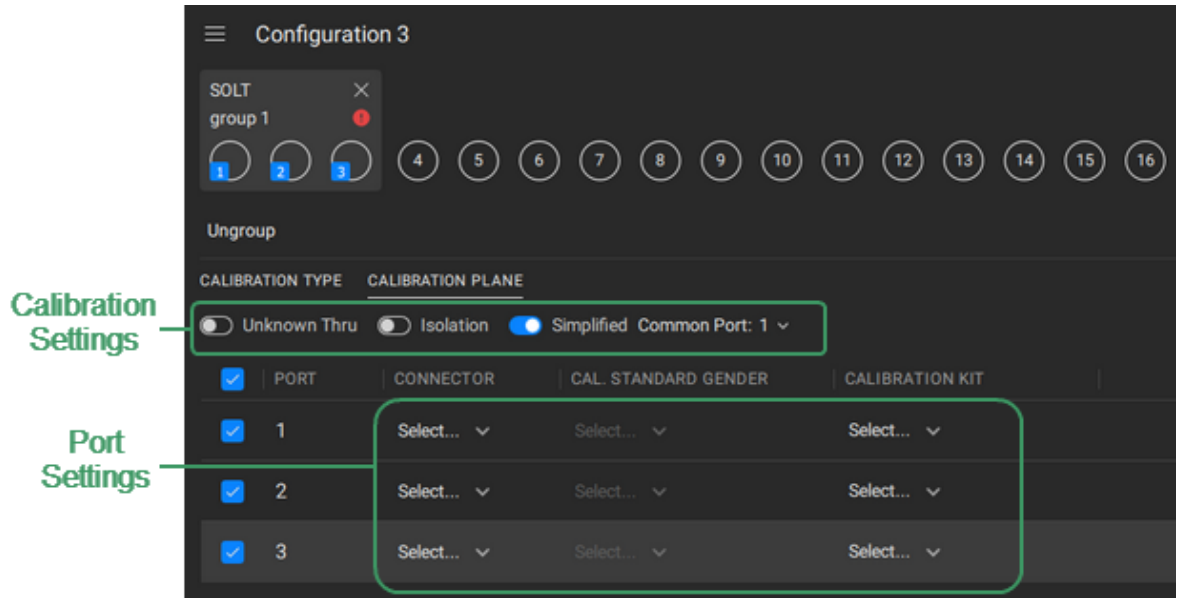
1. Click on  icon in the required Ports Group Tab in the Calibrated Ports area



SCPI SENSe:CORRection:CONFiguration:GROup:DELete

Selecting Calibration Plane

After assigning a group, it is necessary to configure the calibration plane of the ports in the groups. The configuration is performed in the CALIBRATION PLANE tab in Configuration Area (see figure below). The plane settings to be defined depend on the selected calibration (see table below).



Example of Calibration Plane Definition Tab

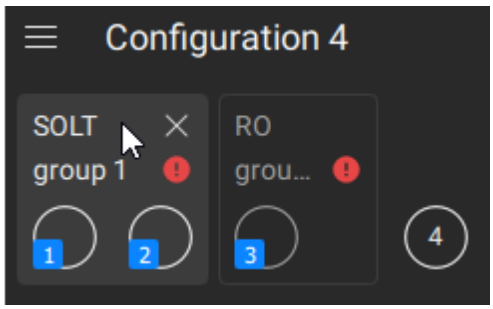
Calibration Plane Settings

Calibration Type	Calibration Settings	Port Settings
Reflection Normalization (RO or RS)	LOAD standard	Connector type Connector gender Calibration kit
Transmission Normalization (RT) One-Path N-Ports Calibration (OP)	Source Port Isolation calibration	
Full One-Port Calibration (SOL)	—	
Full N-port Calibration (SOLT)	Unknown Thru Isolation calibration	

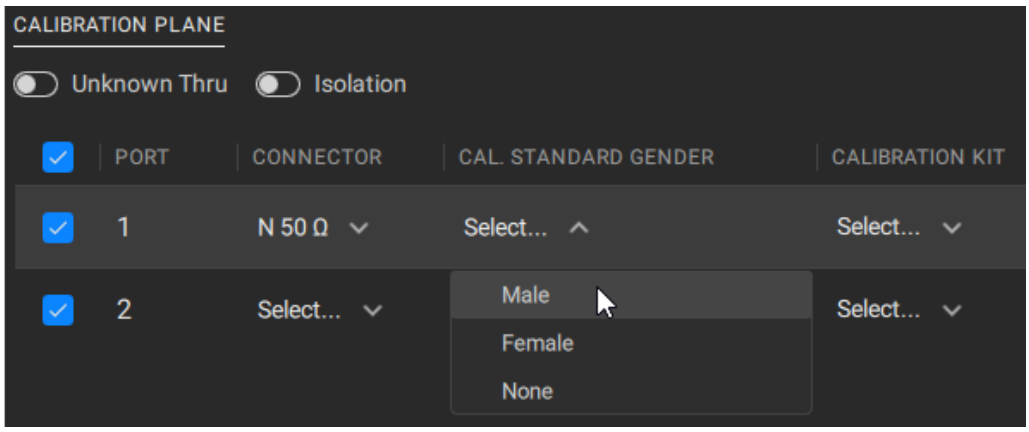
Calibration Type	Calibration Settings	Port Settings
	Simplified Calibration and Source Port (If the group has 2 or more ports)	
Automatic Calibration (ACM)	Desired ACM connected to the analyzer Resolve Missing Thru (If the group has 2 or more ports) Simplified Calibration and Source Port (If the group has 3 or more ports) (optional)	Connector type Connector gender
Power Calibration (PC)	Desired Power meter connected to the analyzer	POWER calibration type
Receiver Calibration (RC)		Reference and Test Receiver calibration type Source Port Reference and Test Offset

Selecting Calibration Plane

1. If multiple port groups are created in the Calibrated Ports area in the configuration, click on the required ports group tab (see Grouping Ports).



2. For each port in the group, click on the fields in the table and set the desired port parameters, as well as the calibration parameters in the CALIBRATION PLANE tab. For example, for a full two-port calibration (SOLT) using the calibration kit, select the desired connector type and gender, as well as the calibration kit, and if necessary, enable an unknown thru and isolation. For power calibration, select a power meter and set the loss parameters, if necessary. For a detailed description of the parameters required to set the calibration plane, refer to the description of each calibration type in Calibration Wizard.



3. If several port groups are created, then switching between groups, configure the calibration planes in each group.

NOTE If the calibration plane of at least one port is not configured, then the configuration cannot be run.

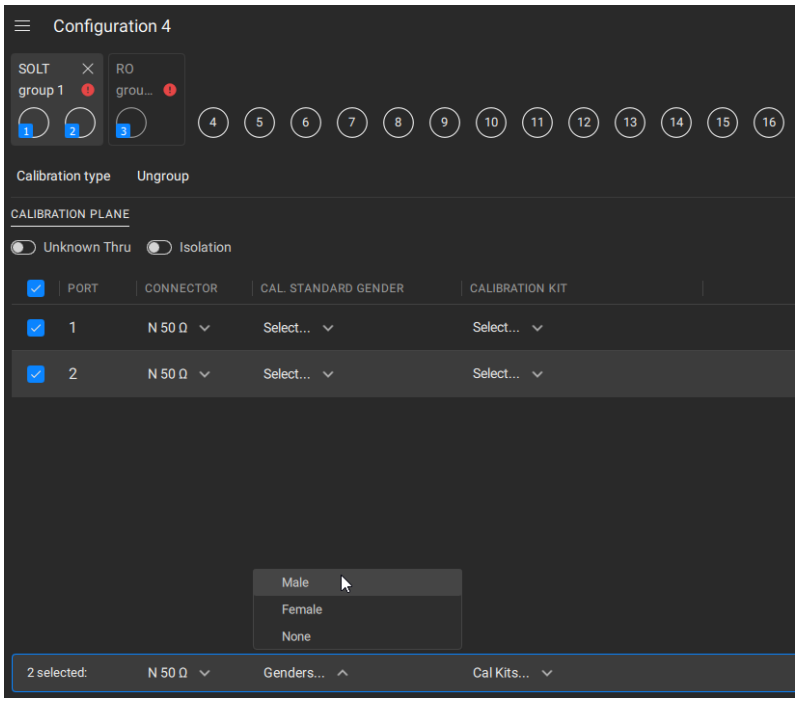
SCPI SENSe:CORRection:CONFiguration:CONNection

SENSe:CORRection:CONFiguration:GROup:CKIT:SELect

NOTE

You can install parameter to several ports at the same time:

- Select the checkboxes in the corresponding rows in a table. A line will then appear at the bottom of the table to change the parameter group.
- Click on the parameter and select the desired value from the drop-down list.



NOTE

The wizard automatically checks if the selected port connector type and gender match the calibration kit standard, or if no calibration type is selected in Power/Receiver calibration. If there is a discrepancy, e.g. there is no suitable standard in the calibration kit, the  icon will appear next to the group name. Hover the mouse over the icon to see where the discrepancies occur. The calibration procedure cannot begin if there are any discrepancy messages present.

A duplicate icon appears near the corresponding line in table.

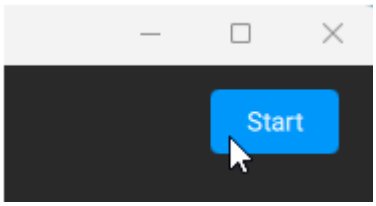
Starting Configuration

To start the calibration procedure, set the parameters of the calibration plane for all created port groups (see Selection Calibration Plane). If the calibration plane of at least one port is not configured, then the configuration cannot be run.

Starting Configuration in Configuration Area

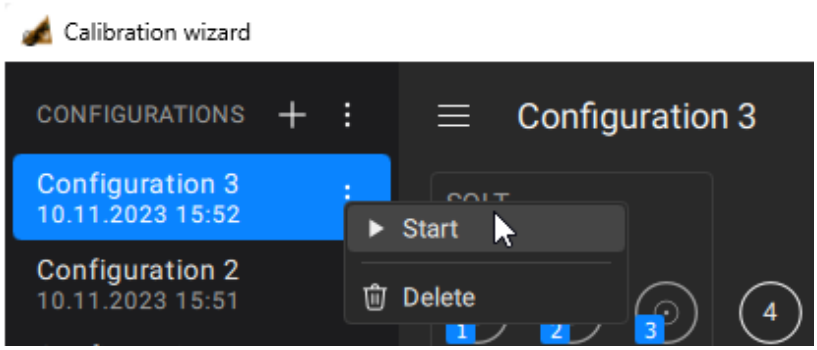
1. Click on **START** button in the Configuration area.

   NOTE The **Start** button is unavailable if there are any mistakes in the configuration of at least one of the groups (not all parameters are set, an inappropriate kit is selected, and so on).



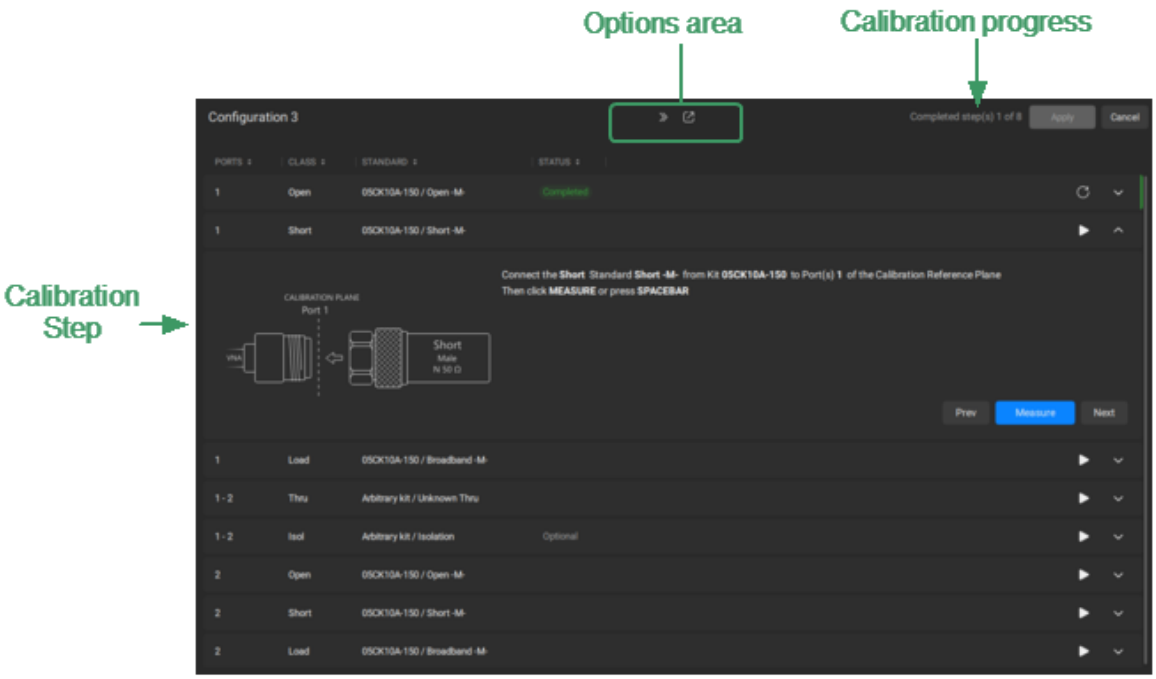
SCPI SENSe:CORRection:COLLect:STARt

NOTE You can run configuration calibration from the configuration list. Highlight the required configuration in the configuration list, then click the vertical-ellipsis button ⋮ and click on **Start** in the pop-up window:



Step-by-Step Configuration Execution

After running the configuration, the Configuration Area will display calibration progress, calibration steps, options, and buttons to apply or stop the calibration (see figure below). The configuration list is hidden when starting the calibration procedure.



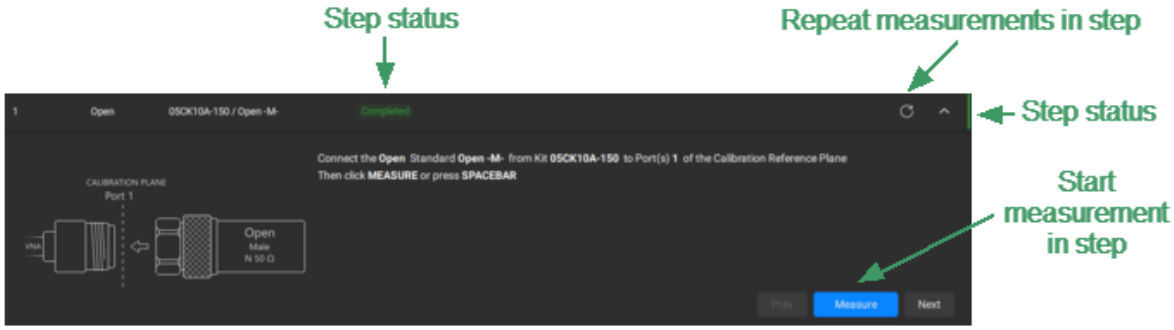
Configuration Area when Executing Calibration Steps (Configuration List is Hidden)

Calibration Step

All measurements for the selected configuration are displayed in the wizard as separate calibration steps. Calibration steps can be performed in any order. Steps marked as **Optional** in the STATUS field are performed at the user's discretion.

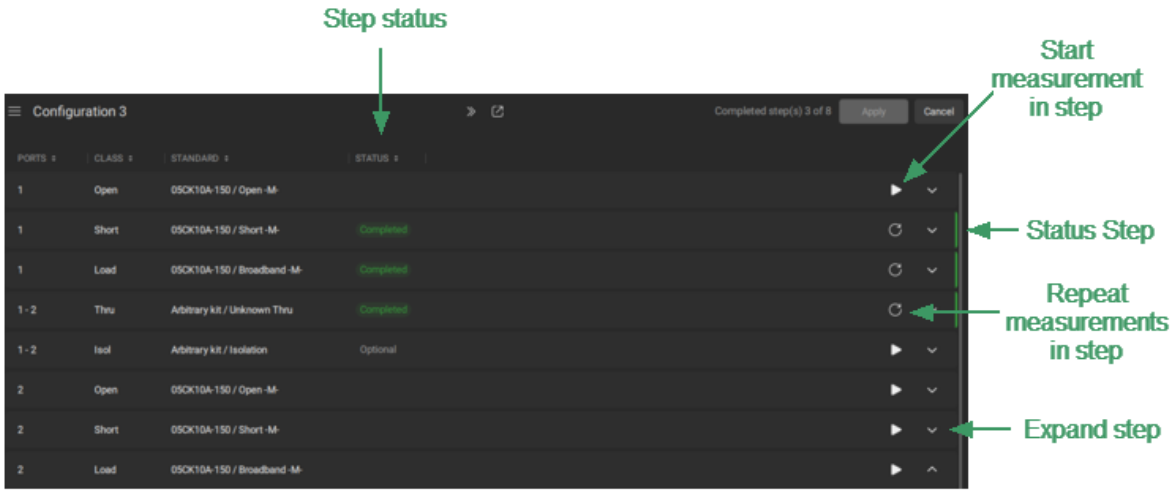
When the step is selected, traces corresponding to the step will be set in the active channel, allowing you to control the characteristics of the connected standard.

Each calibration step contains the numbers of the ports to be calibrated, necessary information about the connection of the standard(s), ACM, power meter, etc., and buttons for measuring and switching between steps (see figure below).



Expanded Calibration Step

Only one calibration step can be expanded at a time. You can perform calibration in collapsed mode when all steps are collapsed (see figure below).



Collapsed Calibration Steps

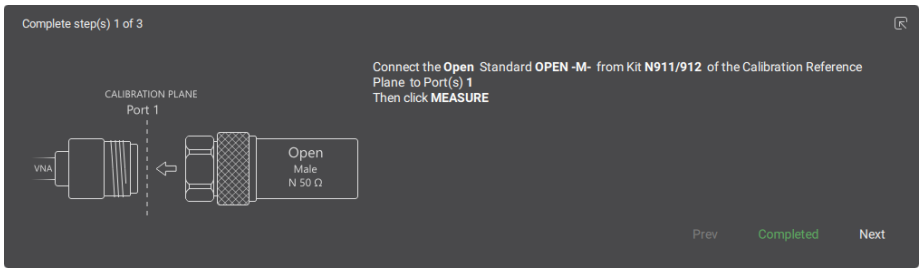
To perform the calibration step, connect the standard to the required port(s) and perform the measurement. After performing the measurement, the step status will

show **Complete** (see figures below). If necessary, the measurement of the step can be repeated.

A detailed description of each calibration type, as well as step-by-step execution of the calibration procedure, see in Calibrations Step-by-step.

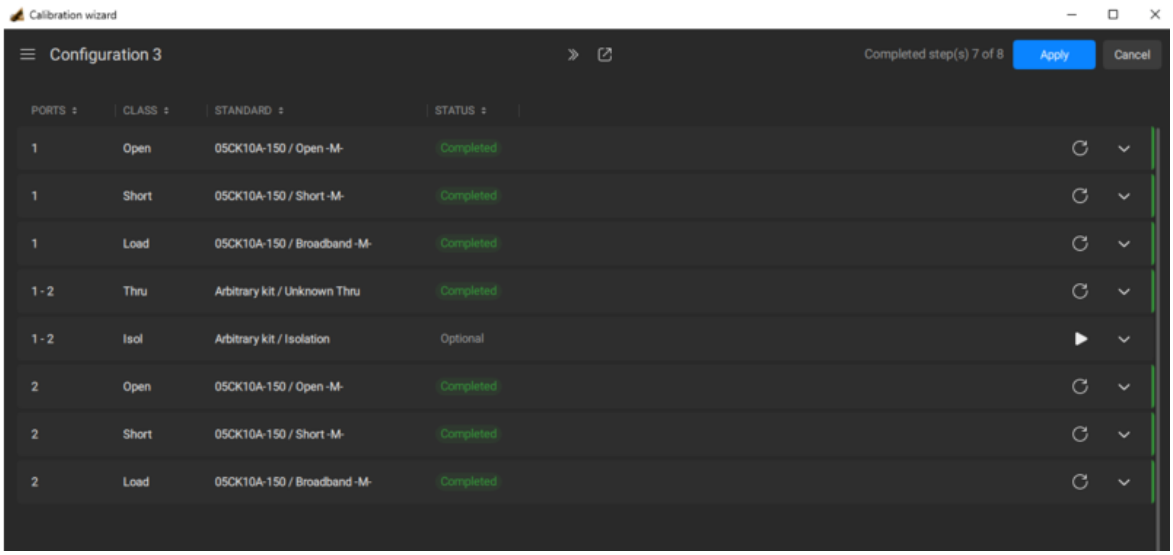
Options Area

The wizard has several calibration options. See the table below for a description of these options.

Option	Definition
AutoNext 	Automatic transition to the next calibration step after measurement. By default, the AutoNext option is set to none. After the measurement is complete, the next step automatically expands. NOTE If this option is enabled, the icon changes to  .
Compact mode 	Switches the wizard window to a compact view (see figure below). In this view, the wizard contains only a line with information about the number of remaining calibration steps and the current calibration step with buttons to perform the calibration. Use this mode if during the calibration process it is necessary to monitor the channel measurement results in the main program window.  To return to the normal view, click the  icon in the upper right corner of the window.

Applying a Configuration

The configuration can be applied if all mandatory calibration steps have been completed.



Applying a Configuration (Optional Step Isolation is not performed)

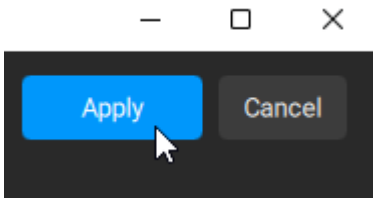
You can abort the calibration at any time. After applying calibration, the Calibration Wizard automatically closes and the correction is applied to the active channel.

NOTE If the calibration is canceled, all standard measurement results will be lost.

Applying Configuration in Configuration Area

1. Click on **Apply** button in the Configuration area.

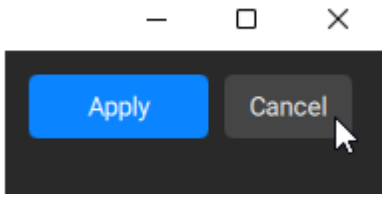
   NOTE The **Apply** button is unavailable if all the mandatory calibration steps have been completed.



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Aborting Configuration

1. Click on **Cancel** button in the upper right corner of the wizard.



SCPI SENSe:CORRection:COLLect:STOP

Editing a Configuration

The wizard allows to reuse the created configuration. In this case, all settings of groups and calibration planes of the specified ports will be saved.

If necessary, changes to the configuration can be made:

- Change the calibration type of a group.
- Change configuration title.
- Delete a port group (see Deleting a Ports Group).
- Add new port group (see Creating a New Ports Group).
- Change the settings of the calibration plane (see Selecting Calibration Plane).

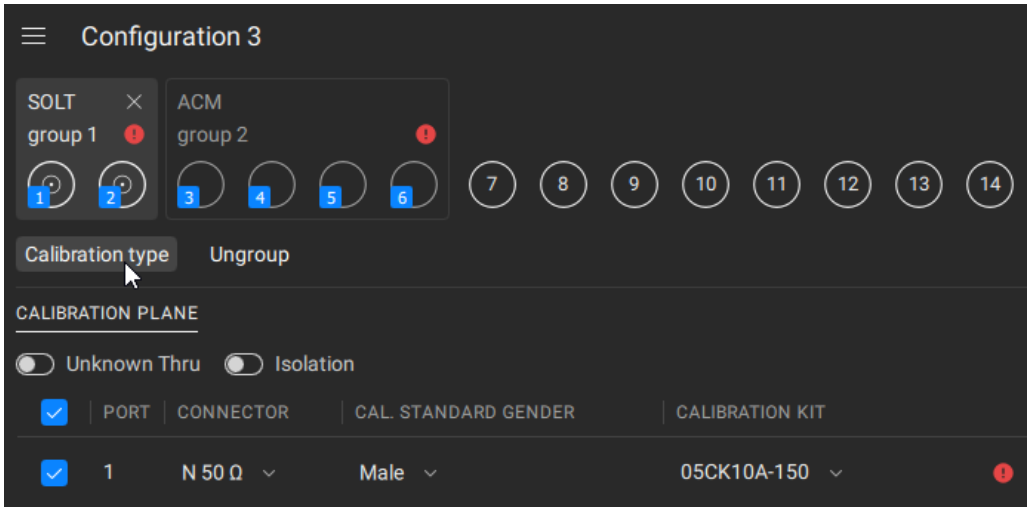
Further the calibration is performed as described in Starting Configuration.

Changing Calibration Type of a Group

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1. Select the required group in the Calibrated Ports area.

2. Click on the **Calibration type** button as shown in figure below.



3. Select the desired calibration type from those available.

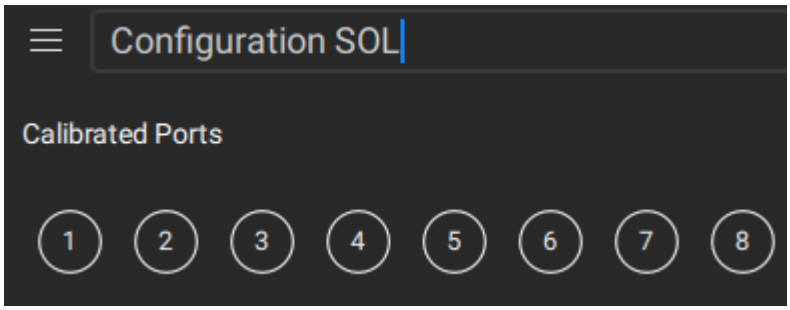
4. After making the changes, make sure make sure that all the calibration plane parameters are set (see Selecting Calibration Plane).

   The wizard automatically checks if the selected port connector type and gender match the calibration kit standard. If there is a discrepancy, the  icon will appear next to the group name. Hover the mouse over the icon to see where the discrepancies occur. The calibration procedure cannot begin if there are any discrepancy messages present.

Renaming Configuration

NOTE Configuration header name must be unique. If when renaming, the configuration name is the same as an existing one, characters **(n)** will be added to the name, where n is the number in order.

1. Click the title of the configuration title, then edit name.



Calibrations Step-by-Step

The sections below provide a description and detailed step-by-step execution of each type of calibration in the wizard:

- Reflection Normalization (RO – Response Open or RS – Response Short)
- Transmission Normalization (RT – Response Thru)
- Full One-Port Calibration (SOL)
- One-Path N-Ports Calibration (OP)
- Full N-port Calibration (SOLT)
- Sliding Load Calibration
- Unknown Thru Calibration
- Automatic Calibration (ACM)
- Power Calibration (PC)
- Receiver Calibration (RC)

For a detailed description of the wizard and its capabilities see Calibration Wizard Overview.

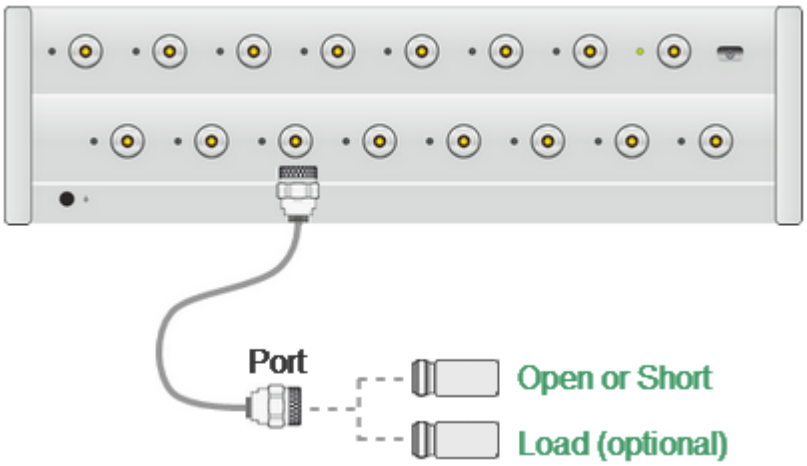
Reflection Normalization

Reflection normalization is the simplest calibration method used for Sii reflection coefficient measurements where the index i has a value from 1 to N, and N is 6/8/10/12/14/16 (depending on the Analyzer model, see corresponding datasheet). Measurement of one standard (SHORT or OPEN) is enough to perform this type of calibration (see figure below). This method is called normalization, because the measured S-parameter at each frequency point is divided (normalized) by the corresponding S-parameter of the calibration standard. Reflection normalization corrects the reflection tracking error (**Er**) only. This constrains the accuracy of the method.

NOTE

Reflection normalization can also be referred to as response open or response short calibration, depending on the standard being used (OPEN or SHORT).

An optional LOAD standard measurement can be performed to correct directivity errors (**Ed**). This optional directivity calibration increases the accuracy of the reflection normalization. An optional LOAD standard measurement is ON by default.



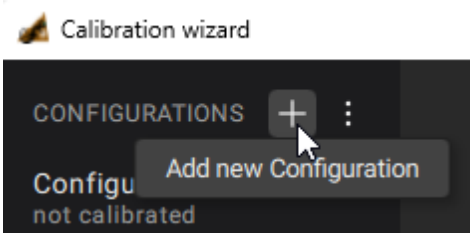
Reflection Normalization

Setting up and Performing Reflection Normalization

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1. Run Calibration Wizard. Click on the **Calibration > Calibrate** buttons in the sidebar (see Starting Calibration Wizard Pop-up Window).

2. Create a configuration. Click on the  icon in the configuration list (see Adding New Configuration).

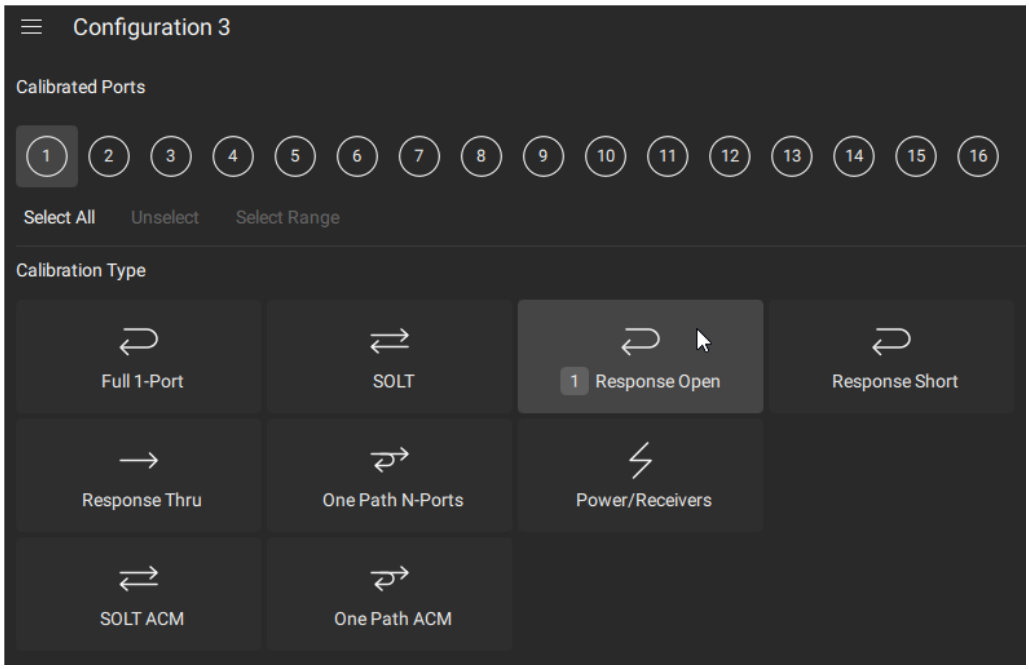


NOTE You can use an existing configuration (see Editing a Configuration).

3 Add ports to a group by clicking on the port number icons in the Calibrated Ports area.

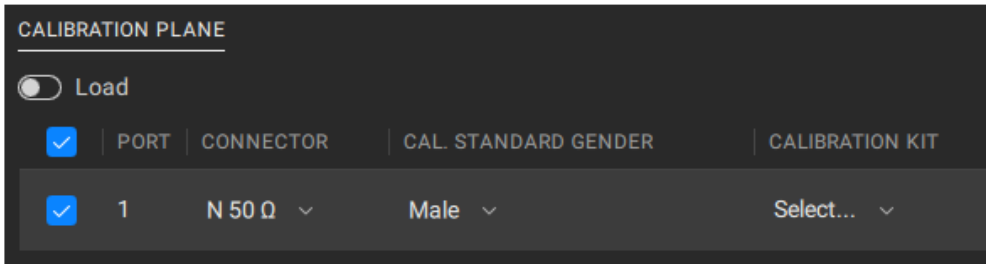
Click on the **Response Open** or **Response Short** buttons in the Calibration Type (see Creating a New Ports Group).

NOTE You can add more than one port to the group and perform calibration for multiple ports at once for your convenience.



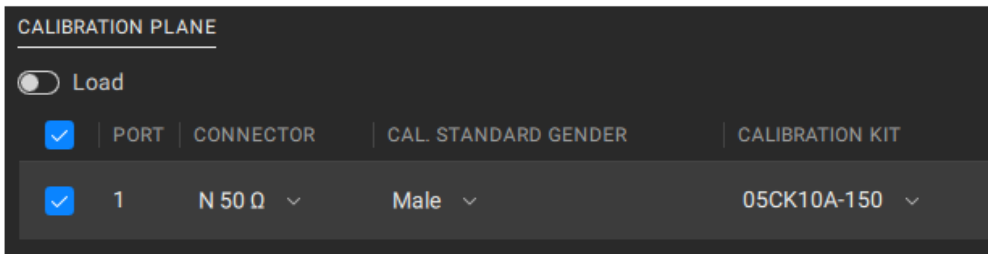
4 Select the calibration plane (see Selecting Calibration Plane):

- Select the type and gender of the calibration plane connector in the corresponding fields CONNECTOR and CAL. STANDARD GENDER.



- Select calibration kit from the CALIBRATION KIT drop-down list.

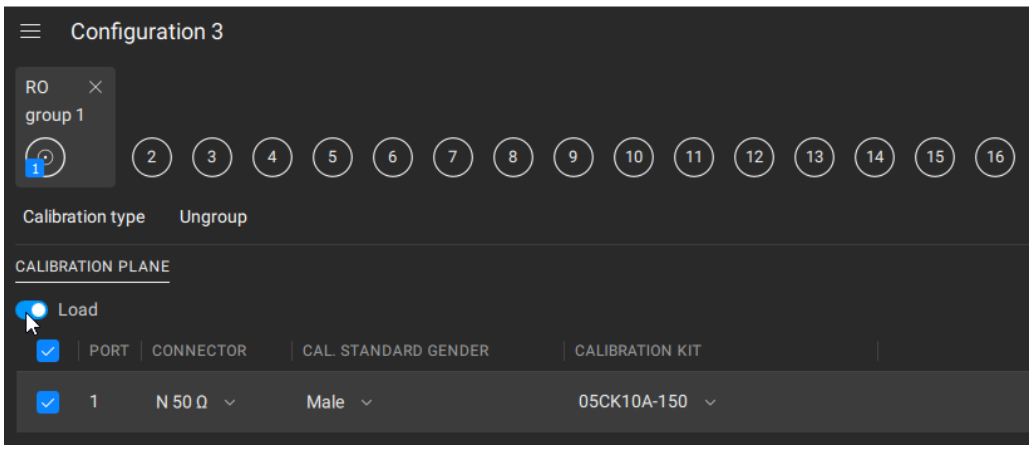
NOTE Only calibration kits marked as **AVAILABLE** in Calibration Kits Management will be displayed in the CALIBRATION KIT drop-down list. If the calibration kit is missing, add the kit and its description.



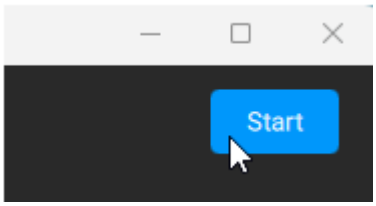
NOTE The wizard automatically checks if the selected port connector type and gender match the calibration kit standard. If there is a discrepancy, e.g. there is no suitable standard in the calibration kit, the  icon will appear next to the group name. Hover the mouse over the icon to see where the discrepancies occur. The calibration procedure cannot begin if there are any discrepancy messages present. A duplicate icon appears near the corresponding line in the calibration kit or ACM fields.

5 If optional directivity calibration to increases the accuracy is required, toggle **Load** ON.

NOTE If the option is disabled, there will be no optional LOAD measuring step while measuring.

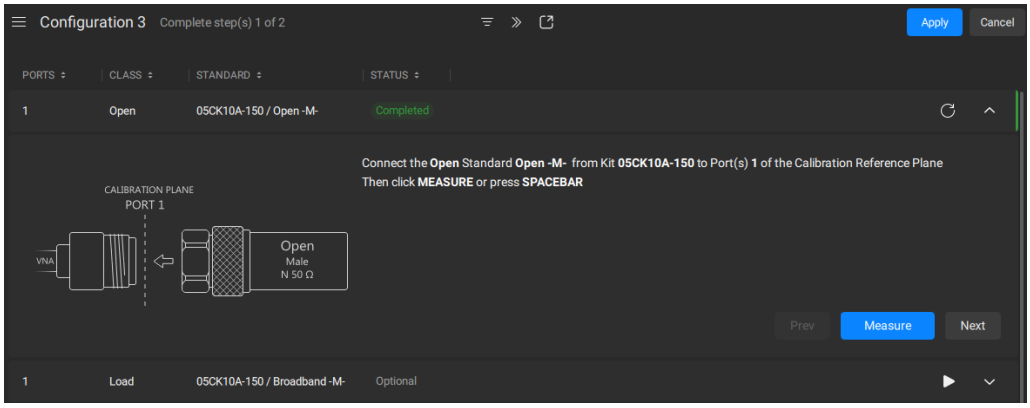


6 Click on the **Start** button.



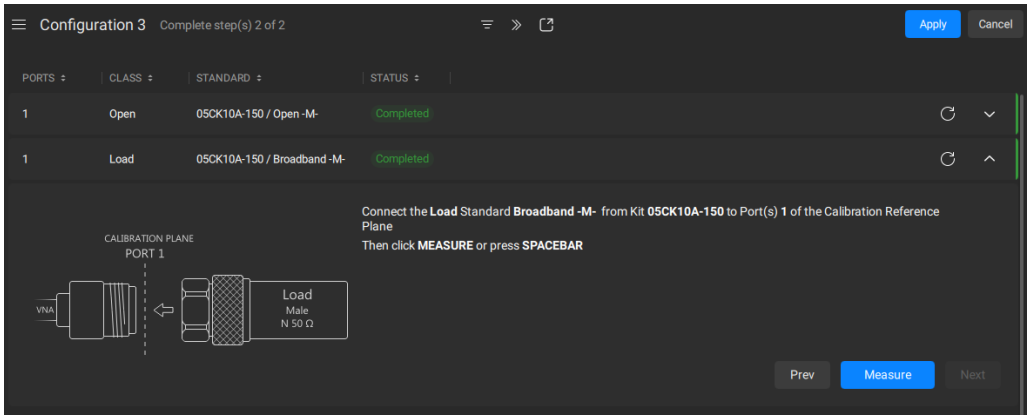
7 Connect the standard SHORT or OPEN to the port.

Click on **Measure** or press **SPACEBAR** in the corresponding calibration step. Wait until the measurement is completed (**Completed** appears in the Status field).



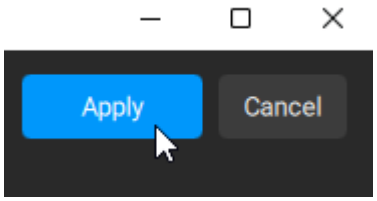
8 Step is optional. The step will be present if toggle **Load** is ON.

Connect the LOAD standard to the port. Click on **Measure** in the corresponding calibration step. Wait until the measurement is completed (**Completed** appears in the Status field).



9 Click on the **Apply** button.

NOTE The **Apply** button is available only after all calibration steps (except optional step) are completed.



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SENSe:CORRection:CONFiguration:CONNection

SENSe:CORRection:CONFiguration:GROup:CKIT:SELect

SENSe:CORRection:CONFiguration:GROup:LOAD:ENABle:ALL

SENSe:CORRection:CONFiguration:GROup:LOAD:DISable:ALL

SENSe:CORRection:COLLect:STARt

SENSe:CORRection:COLLect:STEP:MEASure

SENSe:CORRection:COLLect:STEP:ACQuire:OPEN

SENSe:CORRection:COLLect:STEP:ACQuire:SHORt

SENSe:CORRection:COLLect:STEP:ACQuire:LOAD

SENSe:CORRection:COLLect:SAVE

NOTE When calibration is applied, the **RO** or **RS** calibration status is displayed in the trace manager (see Trace Manager).

Transmission Normalization

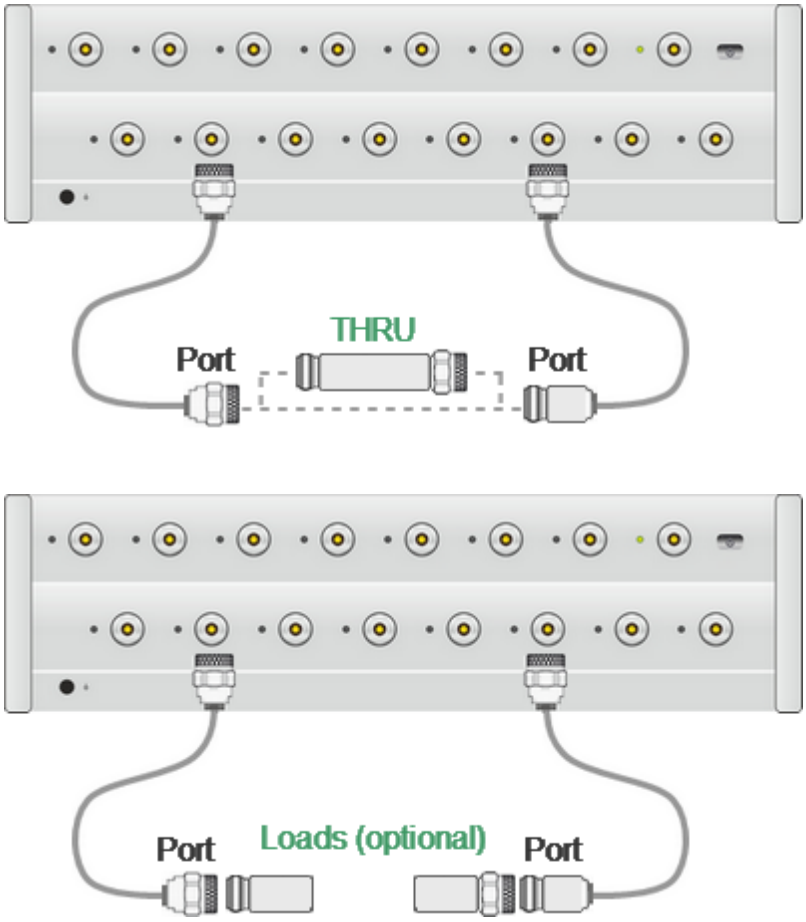
Transmission normalization is the simplest calibration method used for Sji or Sij transmission coefficient measurements, where indexes i and j have a value from 1 to N and N is 6/8/10/12/14/16 (depending on the Analyzer model, see corresponding datasheet). Measurement of one THRU standard is enough to perform this type of calibration (see figure below). This method is called normalization because the measured S-parameter at each frequency point is divided (normalized) by the corresponding S-parameter of the calibration standard. Transmission normalization corrects the transmission tracking error (**Et)** only. This constrains the accuracy of the method.

NOTE Transmission normalization can also be referred to as response thru calibration.

An optional isolation calibration can be performed by measuring two LOAD standards connected to both test ports of the analyzer. In this case, the isolation error (**Ex**) is additionally corrected in the transmission normalization. An optional isolation calibration is OFF by default.

NOTE Isolation calibration is not recommended for normal measurements, as the uncorrected isolation between the measurement ports is quite good. Isolation calibration can be useful when using fixtures that do not have good insulation.

In case of isolation calibration, to improve the measurement accuracy, set the IF bandwidth to a narrow and keep the accessory cables stationary during the calibration and measurements.

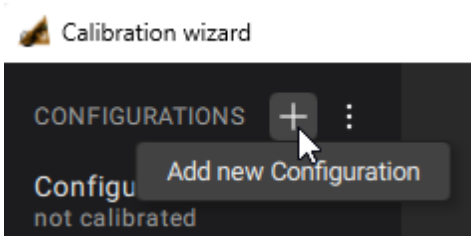


Transmission Normalization

Setting up and Performing Transmission Normalization

1. Run Calibration Wizard. Click on the **Calibration > Calibrate** buttons in the sidebar (see Starting Calibration Wizard Pop-up Window).

2. Create a configuration. Click on the + icon in the configuration list. (see Adding New Configuration).

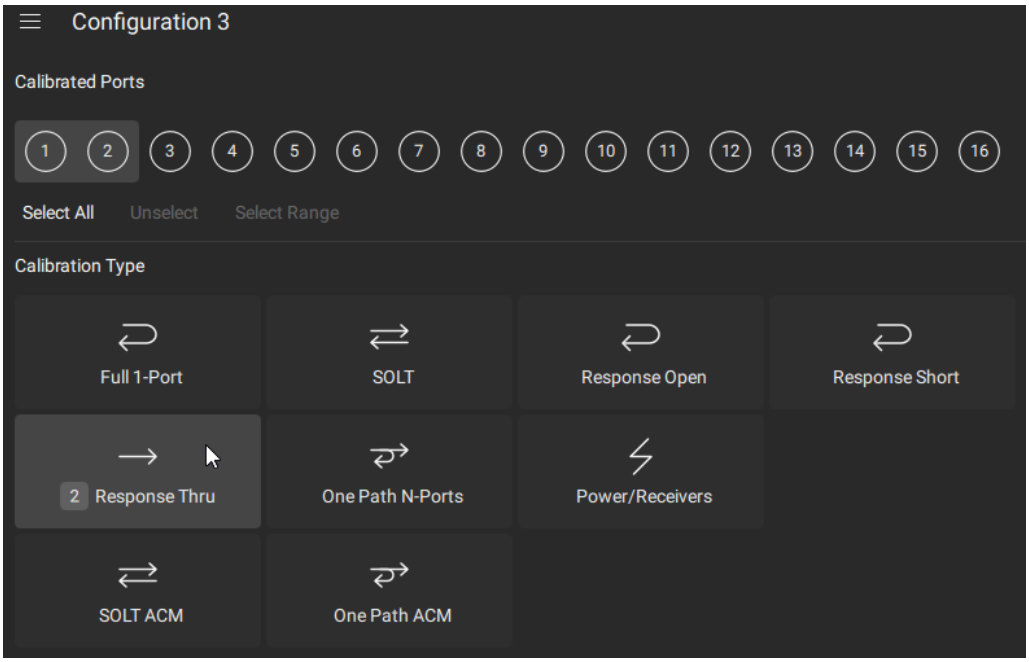


NOTE You can use an existing configuration (see Editing a Configuration).

3. Add ports to a group by clicking on the port number icons in the Calibrated Ports area.

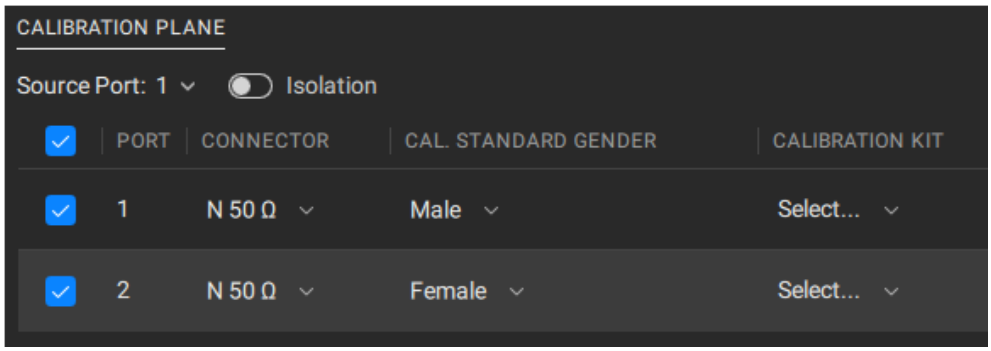
Click on **Response Thru** button in the Calibration Type (see Creating a New Ports Group).

NOTE You can add more than one port to the group and perform calibration for multiple ports at once for your convenience.



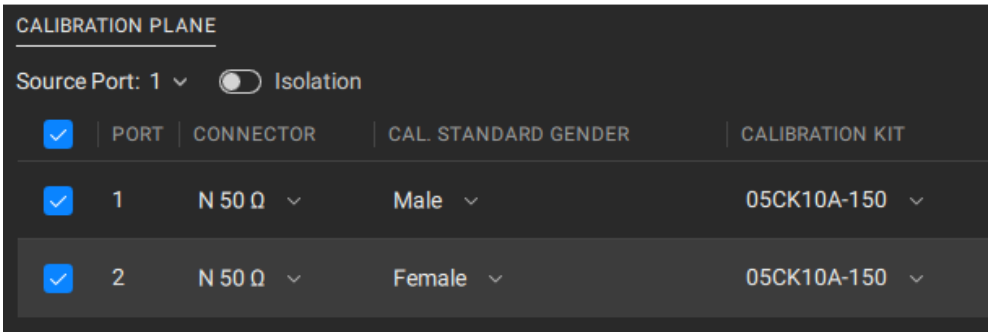
4 Select the calibration plane (see Selecting Calibration Plane):

- Select the type and gender of the calibration plane connector in the corresponding fields CONNECTOR and CAL. STANDARD GENDER.



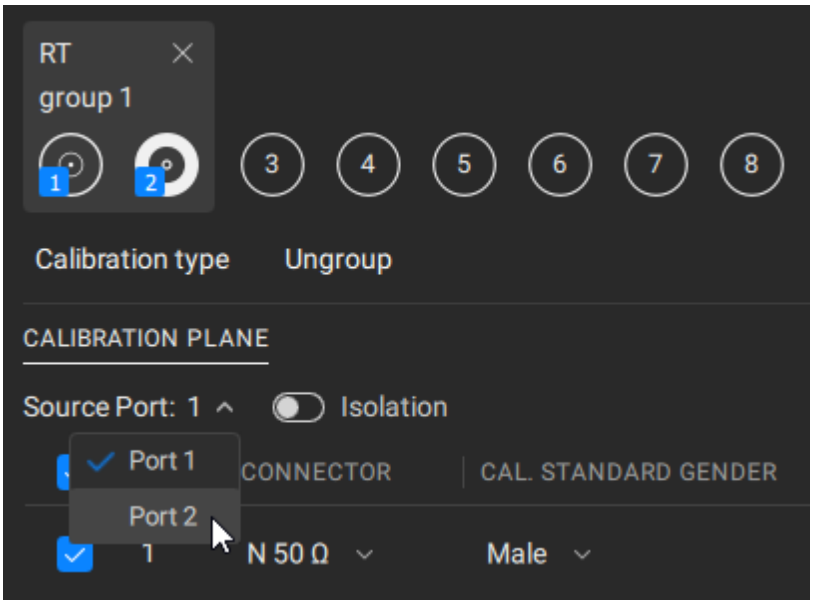
- Select calibration kit from the CALIBRATION KIT drop-down list.

NOTE Only calibration kits marked as **AVAILABLE** in Calibration Kits Management will be displayed in the CALIBRATION KIT drop-down list. If the calibration kit is missing, add the kit and its description.



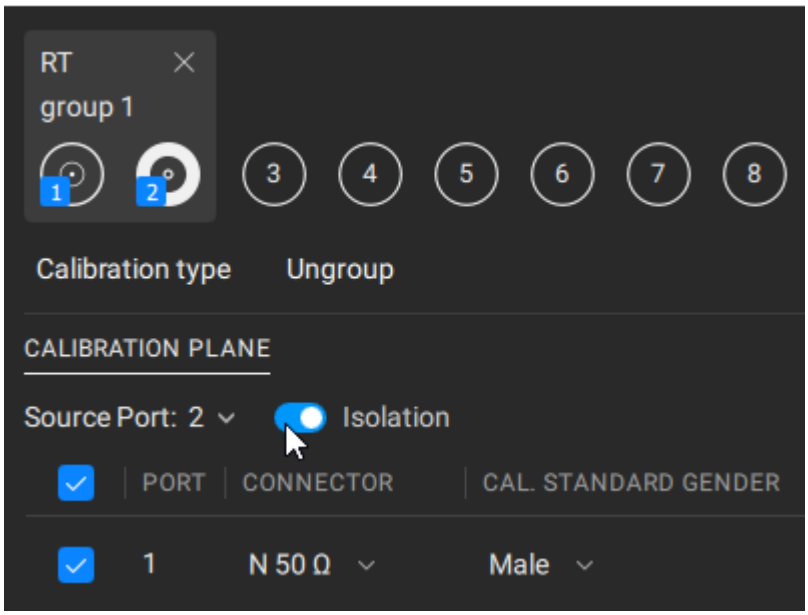
NOTE The wizard automatically checks if the selected port connector type and gender match the calibration kit standard. If there is a discrepancy, e.g. there is no suitable standard in the calibration kit, the  icon will appear next to the group name. Hover the mouse over the icon to see where the discrepancies occur. The calibration procedure cannot begin if there are any discrepancy messages present. A duplicate icon appears near the corresponding line in the calibration kit or ACM fields.

5 Select the direction of the calibration by clicking on the **Source Port** drop-down list.

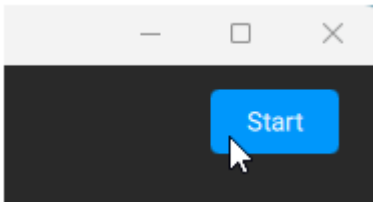


6 If optional isolation calibration is required, toggle **Isolation** ON.

NOTE If the option is disabled, there will be no optional Isolation measuring step while measuring.

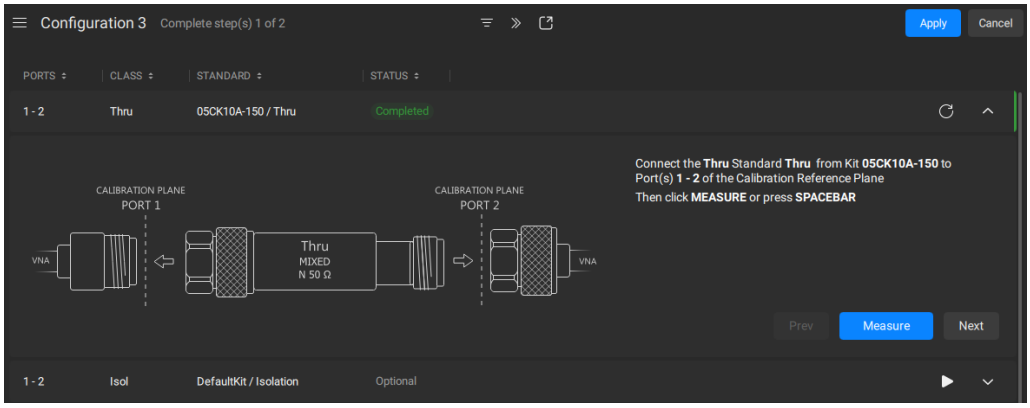


7 Click on **Start** at the top right corner of the wizard.



8 Connect a THRU standard between the test ports.

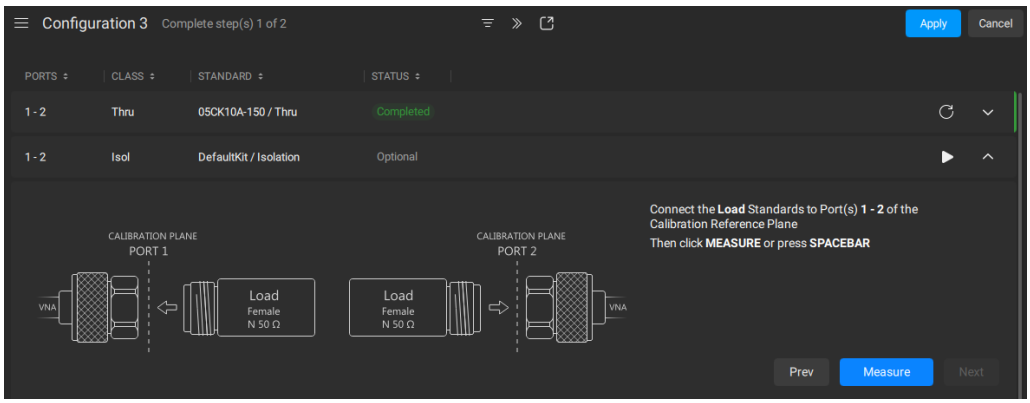
Click on **MEASURE** or press **SPACEBAR** in the corresponding calibration step. Wait until the measurements are completed (**Completed** appears in the Status field).



9 Step is optional. The step will be present if toggle **Isolation** is ON.

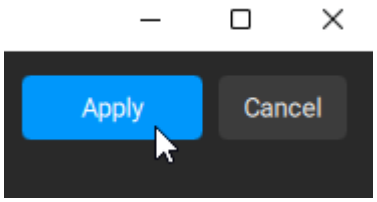
Connect the LOAD standards to the ports.

Click on **Measure** in the corresponding calibration step. Wait until the measurements are completed (**Completed** appears in the Status field).



10 Click on **Apply**.

NOTE The **Apply** button is available only after all calibration steps (except optional step) are completed.



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SENSe:CORRection:CONFiguration:CONNection

SENSe:CORRection:CONFiguration:GROup:CKIT:SELect

SENSe:CORRection:CONFiguration:GROup:PORT:SOURce

SENSe:CORRection:CONFiguration:GROup:ISOLation:ENABle:ALL

SENSe:CORRection:CONFiguration:GROup:ISOLation:DISable:ALL

SENSe:CORRection:COLLect:STARt

SENSe:CORRection:COLLect:STEP:MEASure

SENSe:CORRection:COLLect:STEP:ACQuire:THRU

SENSe:CORRection:COLLect:STEP:ACQuire:ISOL

SENSe:CORRection:COLLect:SAVE

NOTE When calibration is applied, the **RT** calibration status is displayed in the trace manager (see Trace Manager).

One-Path N-Port Calibration

A one-path N-port calibration combines full one-port calibration with transmission normalization. This method allows for a more accurate estimation of transmission tracking error (**Et**) than using transmission normalization.

One-path N-port calibration involves the connection of the three standards to the source port of the Analyzer (just as in one-port calibration) and a THRU standard connection between the calibrated source port and the other receiver port (see figure below).

One-path N-port calibration allows for correction of **Ed**, **Es**, and **Er** error terms of the source port and a transmission tracking error term (**Et**). This method does not derive source match error term (**El**) of a two-port error model.

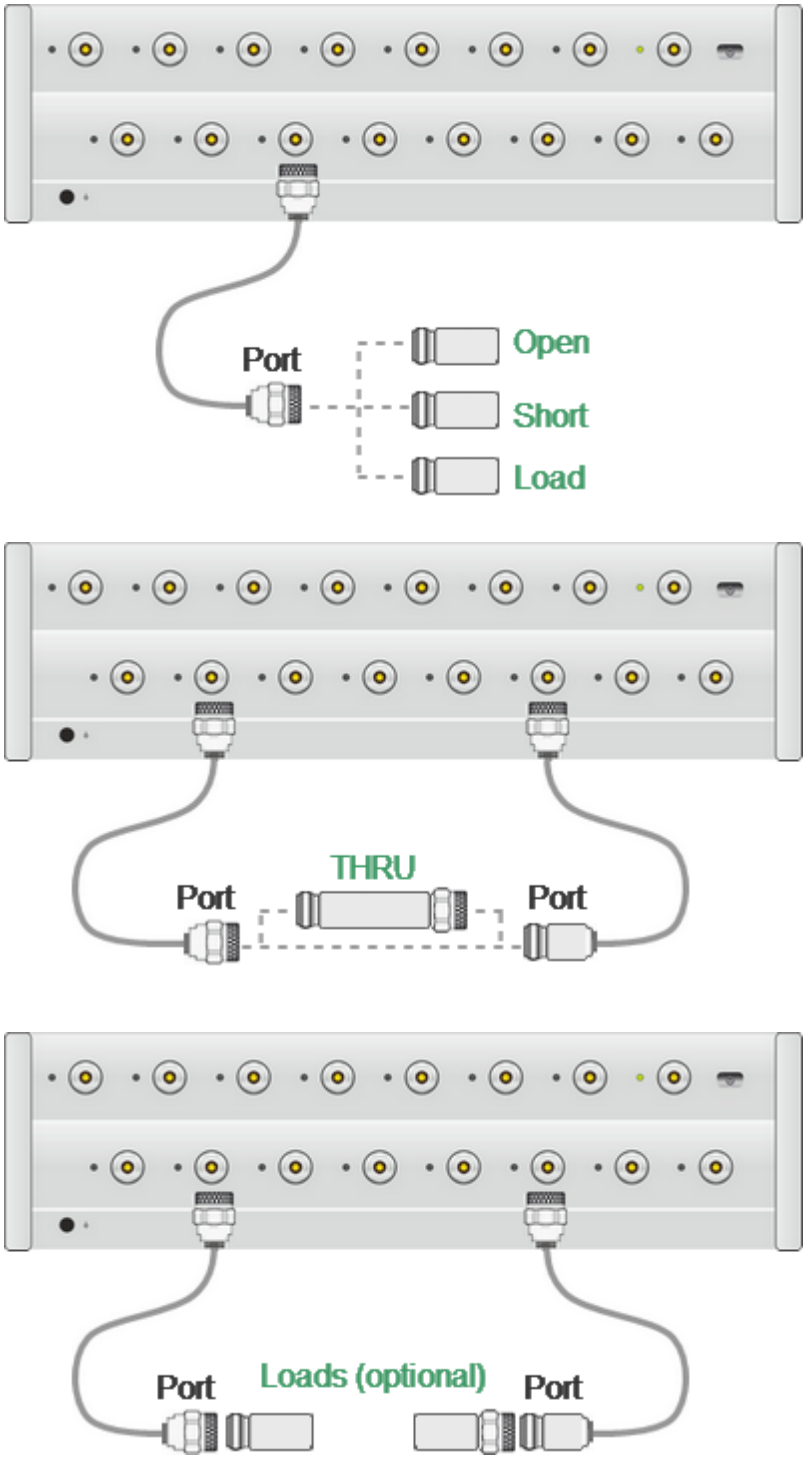
An optional isolation calibration can be performed by measuring two LOAD standards connected to both test ports of the Analyzer. In this case, the isolation error (**Ex**) is additionally corrected in the one-path N-port calibration. An optional isolation calibration is ON by default.

NOTE

Isolation calibration is not recommended for normal measurements, as the uncorrected isolation between the measurement ports is quite good. Isolation calibration can be useful when using fixtures that do not have good insulation.

In case of isolation calibration, to improve the measurement accuracy, set the IF bandwidth to a narrow and keep the accessory cables stationary during the calibration and measurements.

For example, one-path two-port calibration is used for the measurement of the parameters of a non-reciprocal DUT, such as amplifiers in one direction, e.g. S11 and S21.

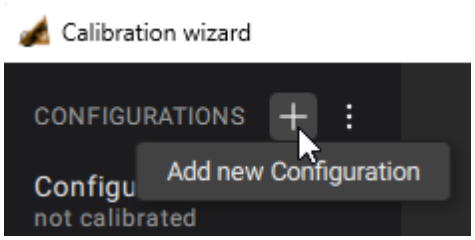


One-path Two-port Calibration

Setting up and Performing One Path N-Port Calibration

1. Run Calibration Wizard. Click on the **Calibration > Calibrate** buttons in the sidebar (see Starting Calibration Wizard Pop-up Window).

2. Create a configuration. Click on the + icon in the configuration list. (see Adding New Configuration).

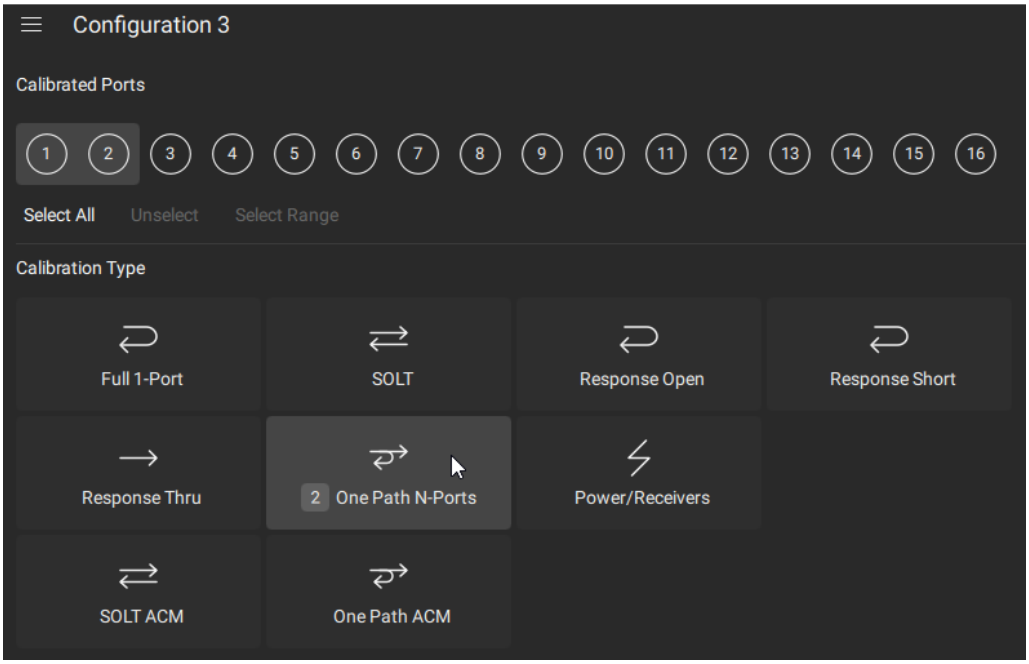


NOTE You can use an existing configuration (see Editing a Configuration).

3. Add ports to a group by clicking on the port number icons in the Calibrated Ports area.

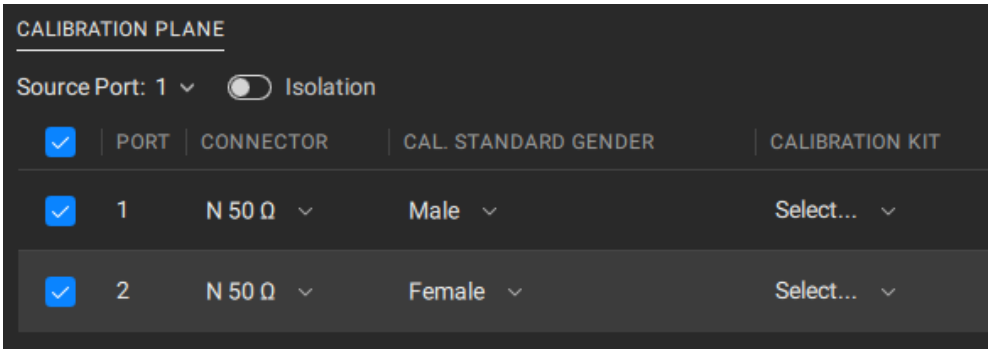
Click on **One Path N-Ports** button in the Calibration Type (see Creating a New Ports Group).

NOTE You can add more than one port to the group and perform calibration for multiple ports at once for your convenience.



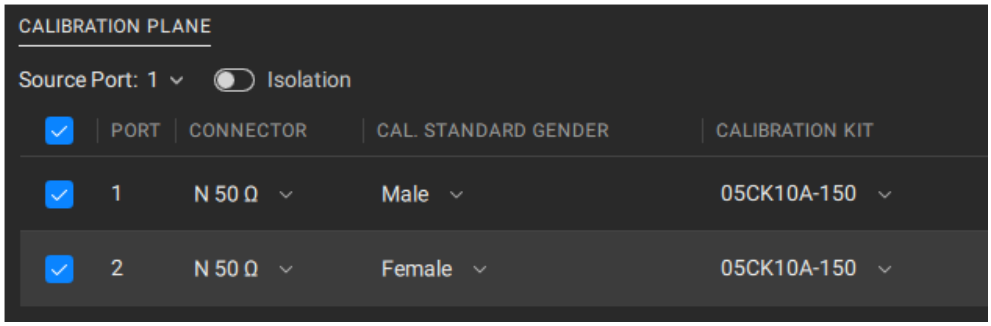
4 Select the calibration plane (see Selecting Calibration Plane):

- Select the type and gender of the calibration plane connector in the corresponding fields CONNECTOR and CAL. STANDARD GENDER.



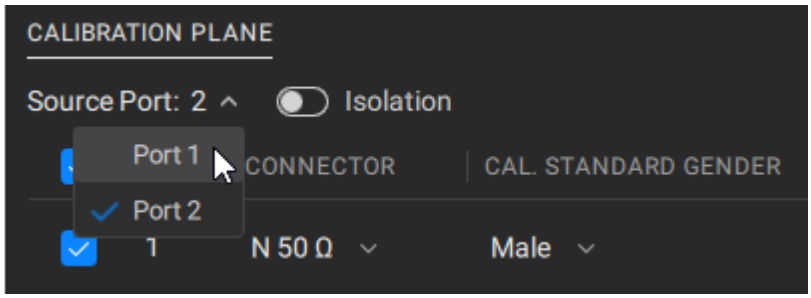
- Select calibration kit from the CALIBRATION KIT drop-down list.

NOTE Only calibration kits marked as **AVAILABLE** in Calibration Kits Management will be displayed in the CALIBRATION KIT drop-down list. If the calibration kit is missing, add the kit and its description.



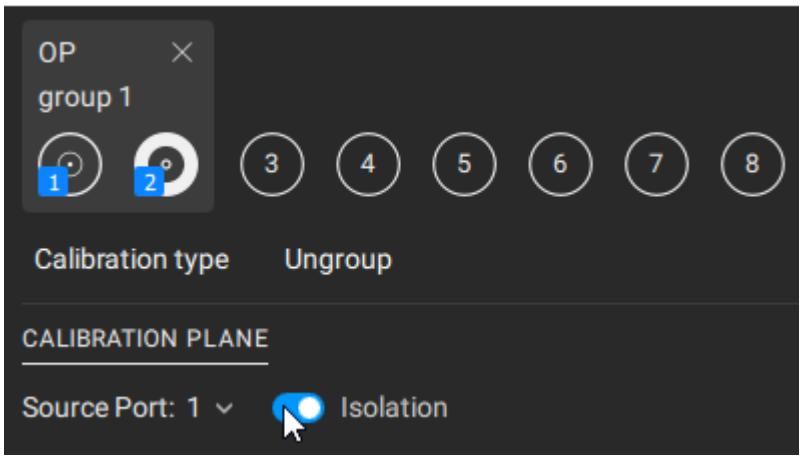
NOTE The wizard automatically checks if the selected port connector type and gender match the calibration kit standard. If there is a discrepancy, e.g. there is no suitable standard in the calibration kit, the  icon will appear next to the group name. Hover the mouse over the icon to see where the discrepancies occur. The calibration procedure cannot begin if there are any discrepancy messages present. A duplicate icon appears near the corresponding line in the calibration kit or ACM fields.

5 Select the direction of the calibration by clicking on the **Source Port** drop-down list.

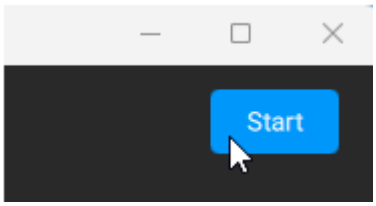


6 If optional isolation calibration is required, toggle **Isolation** ON.

NOTE If the option is disabled, there will be no optional Isolation measuring step while measuring.

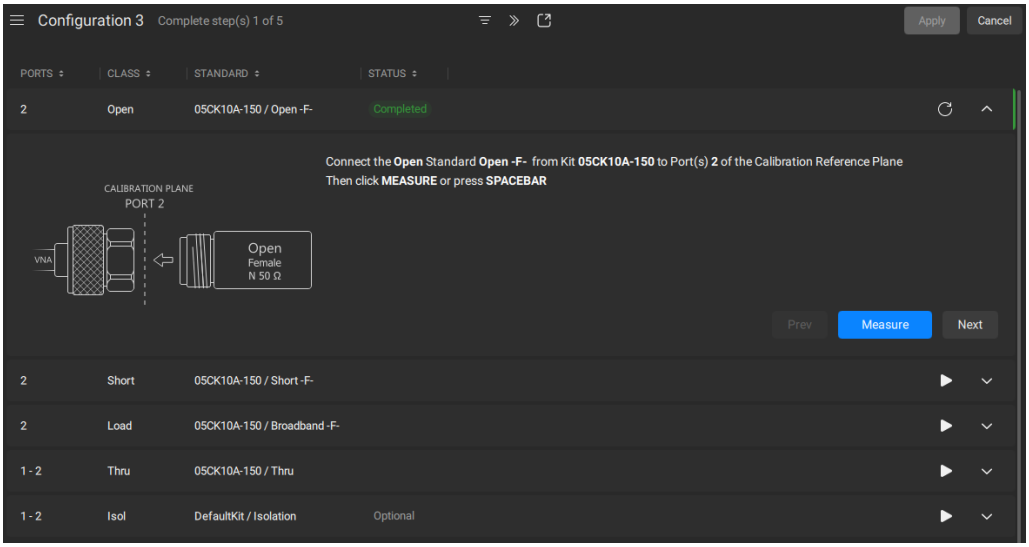


7 Click on **Start**.



8 Connect the standard to the port.

Click on **Measure** or press **SPACEBAR** in the corresponding calibration step. Wait until the measurements are completed (**Completed** appears in the Status field).

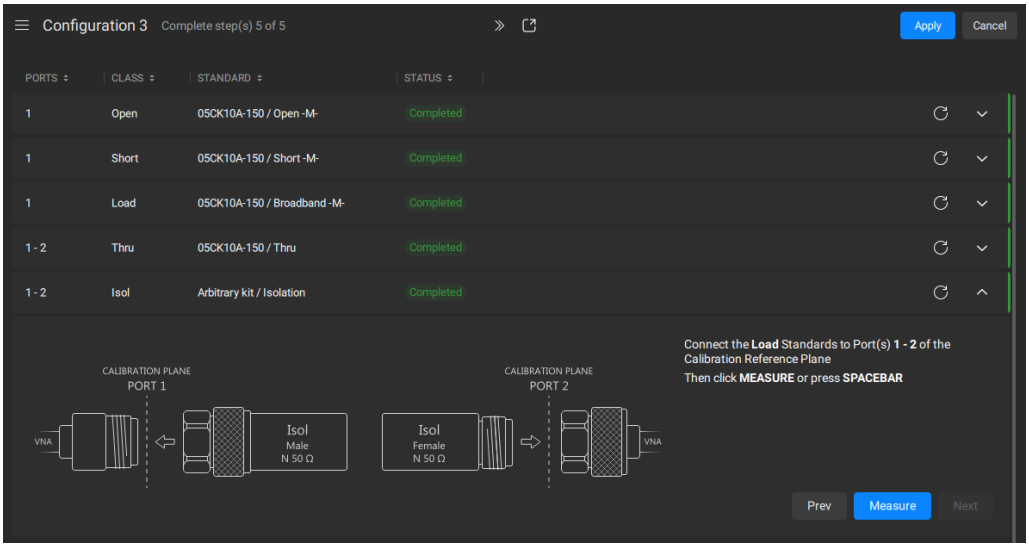


9 Measure the remaining standards using the corresponding wizard calibration steps.

10 Step is optional. The step will be present if toggle **Isolation** is ON.

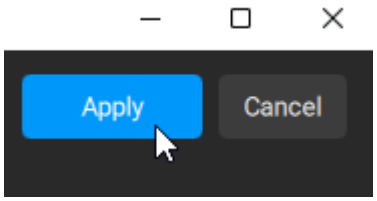
Connect the LOAD standards to the ports.

Click on **Measure** or press **SPACEBAR** in the corresponding calibration step. Wait until the measurements are completed (**Completed** appears in the Status field).



11 Click on **Apply**.

NOTE The **Apply** button is available only after all calibration steps (except optional step) are completed.



SCPI [SENSe:CORRection:CONFiguration:GROup:CREate](#)

[SENSe:CORRection:CONFiguration:CONNection](#)

[SENSe:CORRection:CONFiguration:GROup:CKIT:SELect](#)

[SENSe:CORRection:CONFiguration:GROup:PORT:SOURce](#)

[SENSe:CORRection:CONFiguration:GROup:ISOLation:ENABle:ALL](#)

SENSe:CORRection:CONFiguration:GROup:ISOLation:DISable:ALL

SENSe:CORRection:COLLect:STARt

SENSe:CORRection:COLLect:STEP:MEASure

SENSe:CORRection:COLLect:STEP:ACQuire:OPEN

SENSe:CORRection:COLLect:STEP:ACQuire:SHORt

SENSe:CORRection:COLLect:STEP:ACQuire:LOAD

SENSe:CORRection:COLLect:STEP:ACQuire:THRU

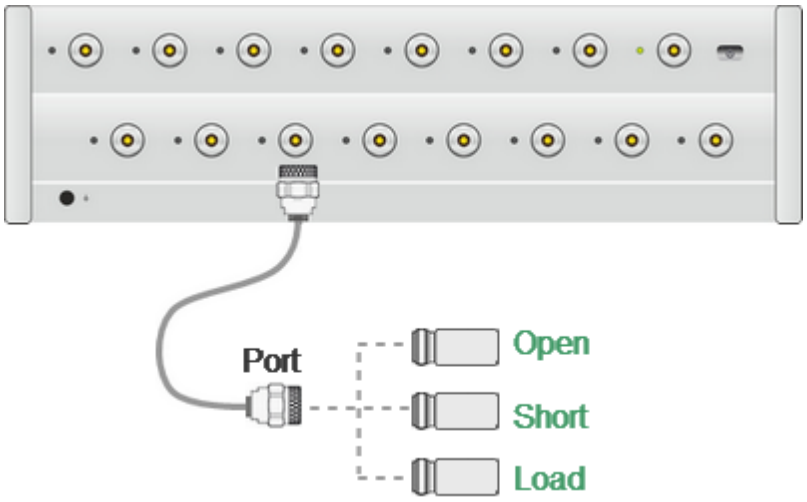
SENSe:CORRection:COLLect:STEP:ACQuire:ISOL

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NOTE When calibration is applied, the **OP** calibration status displays in the trace manager (see Trace Manager).

Full One-Port Calibration (SOL)

Full one-port calibration (SOL) is used for Sii reflection coefficient measurements, where index i has a value from 1 to N and N is 6/8/10/12/14/16 (depending on the Analyzer model, see corresponding datasheet). The three calibration standards (SHORT, OPEN, LOAD) are measured (see figure below) in the process of this calibration. Measurement of the three standards allows acquisition of all the three error terms (**Ed**, **Es**, and **Er**) of a one-port model. Full one-port calibration is a highly accurate method for one-port reflection measurements.

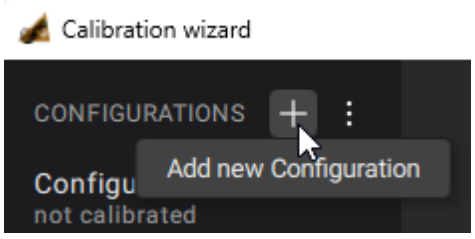


Full one-Port Calibration

Setting up and Performing Full One-Port Calibration (SOL)

1. Run Calibration Wizard. Click on the **Calibration > Calibrate** buttons in the sidebar (see Starting Calibration Wizard Pop-up Window).

2. Create a configuration. Click on the + icon in the configuration list (see Adding New Configuration).

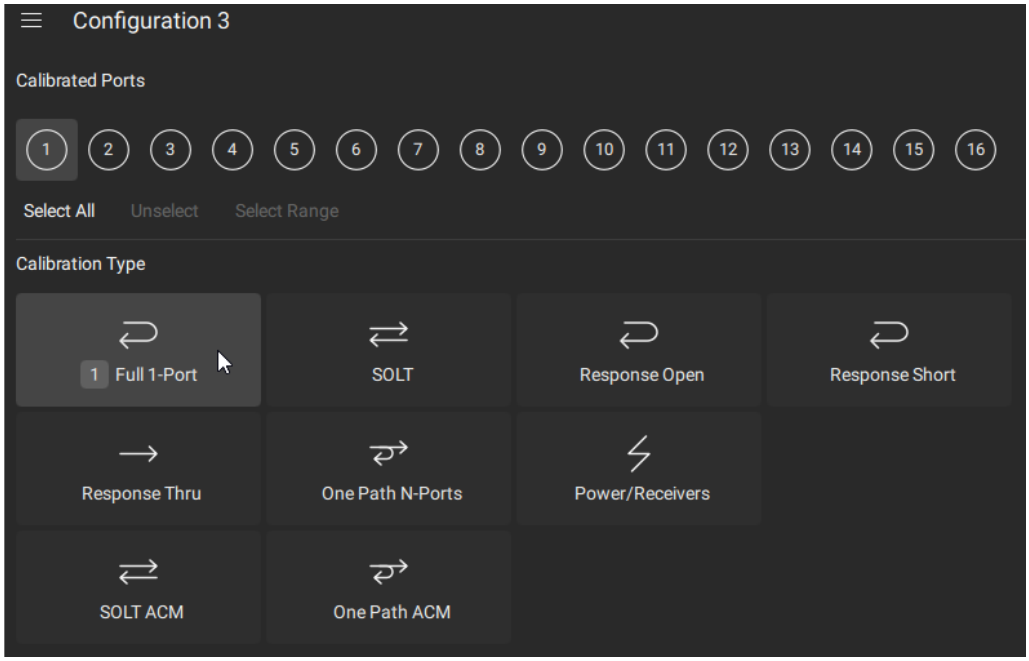


NOTE You can use an existing configuration (see Editing a Configuration).

3 Add a port to a group by clicking on the port number icons in the Calibrated Ports area.

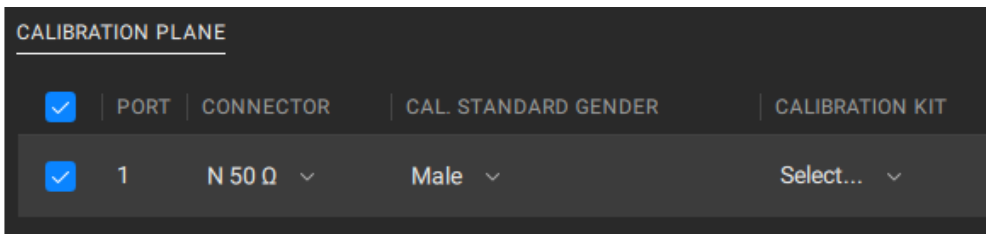
Click on **Full 1-Port** button in the Calibration Type (see Creating a New Ports Group).

NOTE You can add more than one port to the group and perform calibration for multiple ports at once for your convenience.



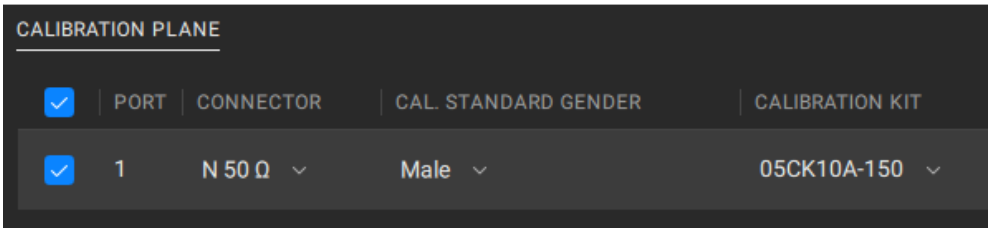
4 Select the calibration plane (see Selecting Calibration Plane):

- Select the type and gender of the calibration plane connector in the corresponding fields CONNECTOR and CAL. STANDARD GENDER.



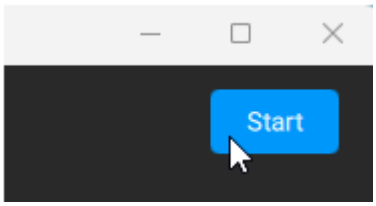
- Select calibration kit from the CALIBRATION KIT drop-down list.

NOTE Only calibration kits marked as **AVAILABLE** in Calibration Kits Management will be displayed in the CALIBRATION KIT drop-down list. If the calibration kit is missing, add the kit and its description.



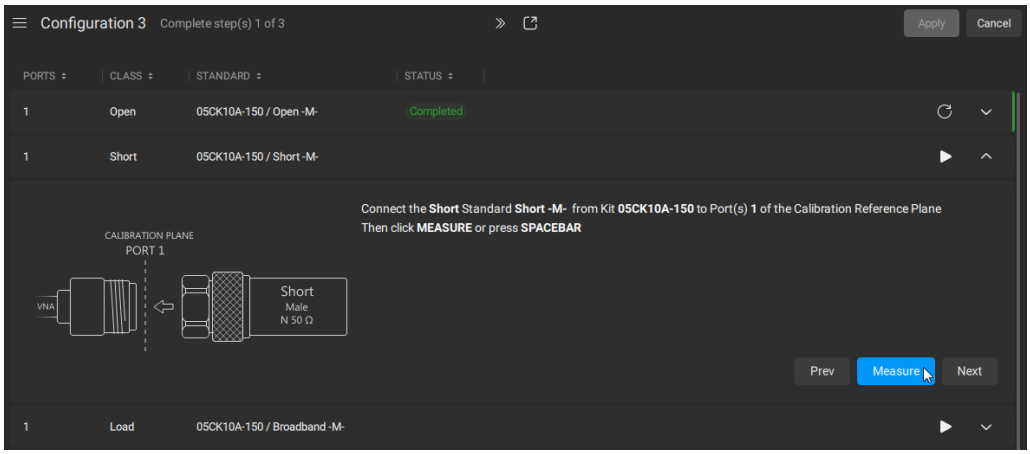
NOTE The wizard automatically checks if the selected port connector type and gender match the calibration kit standard. If there is a discrepancy, e.g. there is no suitable standard in the calibration kit, the  icon will appear next to the group name. Hover the mouse over the icon to see where the discrepancies occur. The calibration procedure cannot begin if there are any discrepancy messages present. A duplicate icon appears near the corresponding line in the calibration kit or ACM fields.

5 Click on **Start**.



6 Connect the standard to the port.

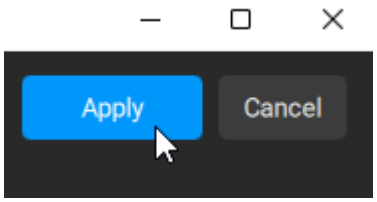
Click on **Measure** or press **SPACEBAR** in the corresponding calibration step. Wait until the measurements are completed (**Completed** appears in the Status field).



7 Measure the remaining standards using the corresponding wizard calibration steps.

8 Click on **Apply**.

NOTE The **Apply** button is available only after all calibration steps are completed.



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SENSe:CORRection:CONFiguration:GROup:CKIT:SELect

SENSe:CORRection:COLLect:STARt

SENSe:CORRection:COLLect:STEP:MEASure

SENSe:CORRection:COLLect:STEP:ACQuire:OPEN

SENSe:CORRection:COLLect:STEP:ACQuire:SHORt

SENSe:CORRection:COLLect:STEP:ACQuire:LOAD

SENSe:CORRection:COLLect:SAVE

NOTE When calibration is applied, the **F1** calibration status displays in the trace manager (see Trace Manager).

Full N-Port Calibration (SOLT)

A full N-port calibration (SOLT) combines N full one-port calibrations for each port with measurements of a THRU standard between each test port pair, which provides transmission measurements. Index N is the number of ports involved in the calibration, where N has a value from 2 to 6/8/10/12/14/16 (depending on the Analyzer model, see corresponding datasheet).

If additional isolation calibration is required, connect individual pairs of ports to LOAD standards in all combinations. An optional isolation calibration is OFF by default.

NOTE

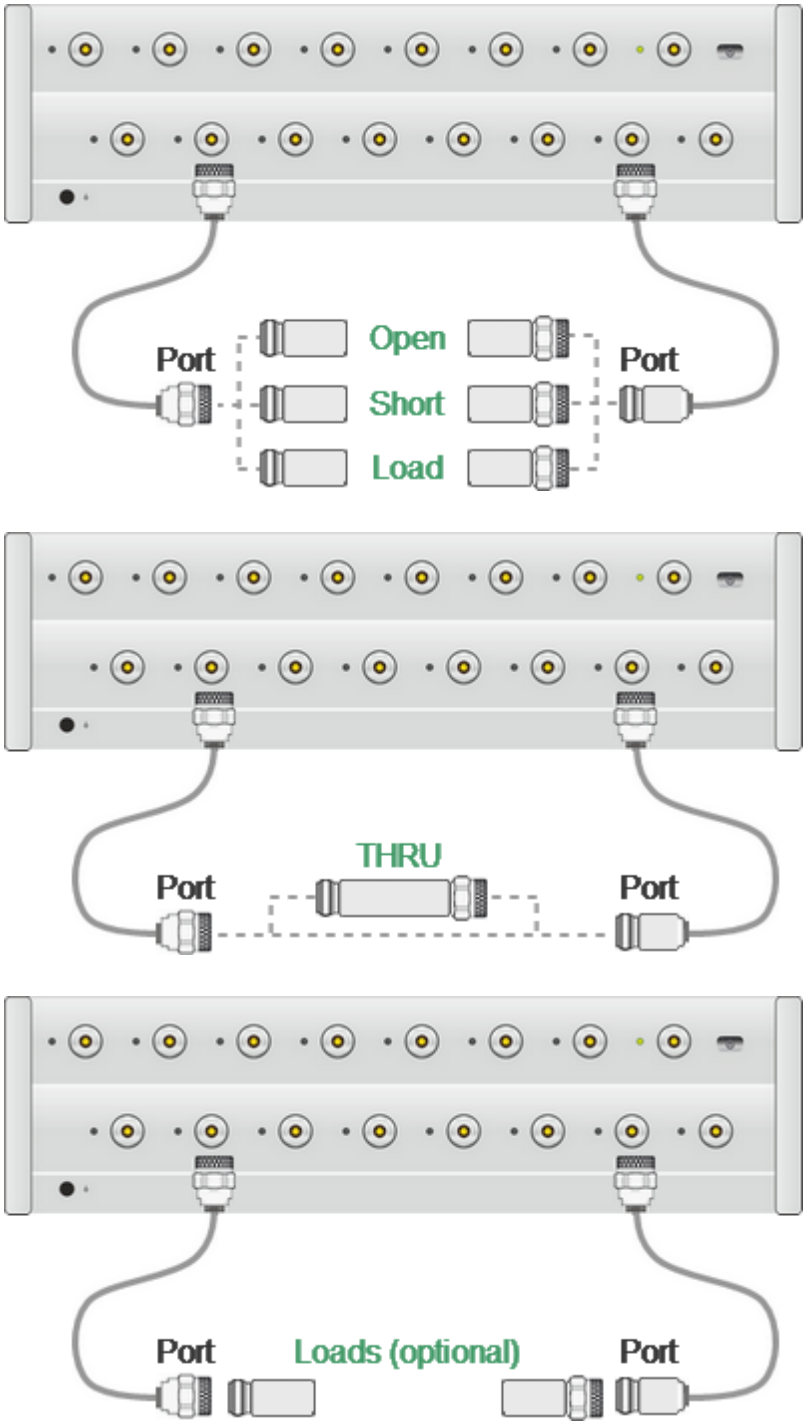
Isolation calibration is not recommended for normal measurements, as the uncorrected isolation between the measurement ports is quite good. Isolation calibration can be useful when using fixtures that do not have good insulation.

In case of isolation calibration, to improve the measurement accuracy, set the IF bandwidth to a narrow and keep the accessory cables stationary during the calibration and measurements.

Full N-port calibration allows correction of all the (3·N·N) error terms of an N-port error model. For a detailed description, see N-Port Error Model.

Full N-port calibration is a highly accurate method of calibration for N-port DUT measurements.

As an example, the figure below shows how to perform a full two-port calibration. This calibration combines two one-port calibrations for each test port with measurement of a THRU standard in both directions, which involves seven standard connections and allows correction of all twelve error terms of a two-port error model: **Ed1, Ed2, Es1, Es2, Er1, Er2, Et1, Et2, El1, El2, Ex1, Ex2** (correction of **Ex1, Ex2** can be omitted). Full two-port calibration is a highly accurate method of calibration for two-port DUT measurements.



Full Two-port Calibration

Full three-port calibration involves twelve standard connections. This calibration combines three full one-port calibrations for each port with measurements of a THRU standard between three port pairs, which provides three transmission measurements. Therefore, this calibration allows correction of all twenty seven error terms of a three-port error model (acquisition of isolation terms can be omitted). For a detailed description, see Three-Port Error Model.

A full four-port calibration involves eighteen standard connections. This calibration combines four full one-port calibrations for each port with measurements of a THRU standard between each test port pair, which provides six transmission measurements. Full four-port calibration allows correction of all forty eight error terms of a four-port error model (acquisition of isolation terms can be omitted). For a detailed description, see Four-Port Error Model.

Simplified Full N-Port Calibration

Part of THRU measurements can be omitted in the full N-port calibration. Since the calibration coefficients are calculated while omitting part of the THRU measurement data, the effect of errors when acquiring calibration data becomes larger than in the normal full N-port calibration.

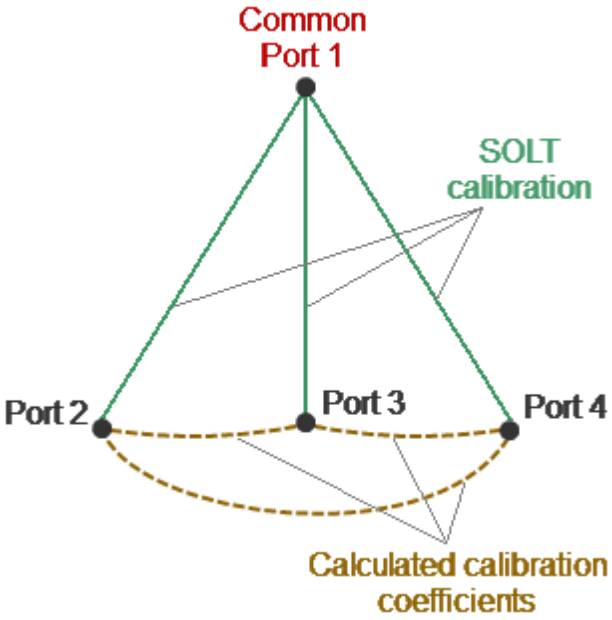
In simplified N-port calibration select one common port (topology star) and perform N-1 THRU measurement. However, if the topology is other than star, it is recommended to perform a minimum of N measurement to enhance the calibration accuracy. Compared with full N-port calibration, where it is necessary to perform N·(N-1)/2 THRU measurement, the simplified N-port calibration can significantly reduce the number of connections and calibration time.

Simplified full N-port calibration is ON by default.

Example Simplified Four-port Calibration

In the Simplified four-port calibration, the topology of THRU connection is star, three out of six measurements of THRU are omitted. For example, if common port is 1, you have to perform 1-2, 1-3, 1-4 measurements (see figure below). The simplified calibration can be finished.

However, if the topology is other than star (with one common port), it is recommended to perform the fourth measurement to enhance the calibration accuracy.



Simplified Full Four-Port Calibration

NOTE

Unlike in the calibration using full set of calibration standards, in the simplified calibration the quality of measurements is more critical. Observe the following instructions:

- Use calibration standards with good stability and repeatability.
- Make sure the standard model is defined correctly: do not omit the THRU definition if it is not a zero-length THRU (not flush THRU).
- High quality cables with small phase/amplitude change on bends.
- Use precision connectors.

Unknown Thru Calibration

The Unknown Thru calibration or SOLR (Short-Open-Load-Reciprocal) is analogous to SOLT calibration, where UNKNOWN THRU is used instead of DEFINED THRU. Unknown Thru calibration is performed if there is no suitable DEFINED THRU in the calibration kit(s). Any two-port network satisfying the reciprocal condition (Sji= Sij) can be used as UNKNOWN THRU. Most passive, linear microwave networks will turn out to be reciprocal. Combined transmission loss of UNKNOWN THRU and calibration setup should not exceed 40 dB. The UNKNOWN THRU can be a wide class of two-port network, including DUT, if it meets the specified conditions. For a detailed description, see Unknown Thru Requirements.

The SOLR calibration procedure is similar to the SOLT calibration procedure. All you have to do is to toggle **Unknown Thru** ON in wizard when setting up. This will replace all DEFINED THRU to Unknown Thru in the wizard steps.

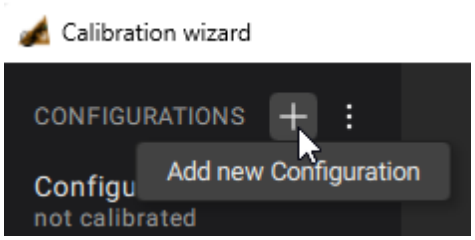
You can use the Unknown Thru calibration to measure a non-insertable device (see Unknown Thru Calibration).

Setting up and Performing Full N-Port Calibration (SOLT) or Simplified N-Port Calibration

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1. Run Calibration Wizard. Click on the **Calibration > Calibrate** buttons in the sidebar (see Starting Calibration Wizard Pop-up Window).

2. Create a configuration. Click on the  icon in the configuration list (see Adding New Configuration).

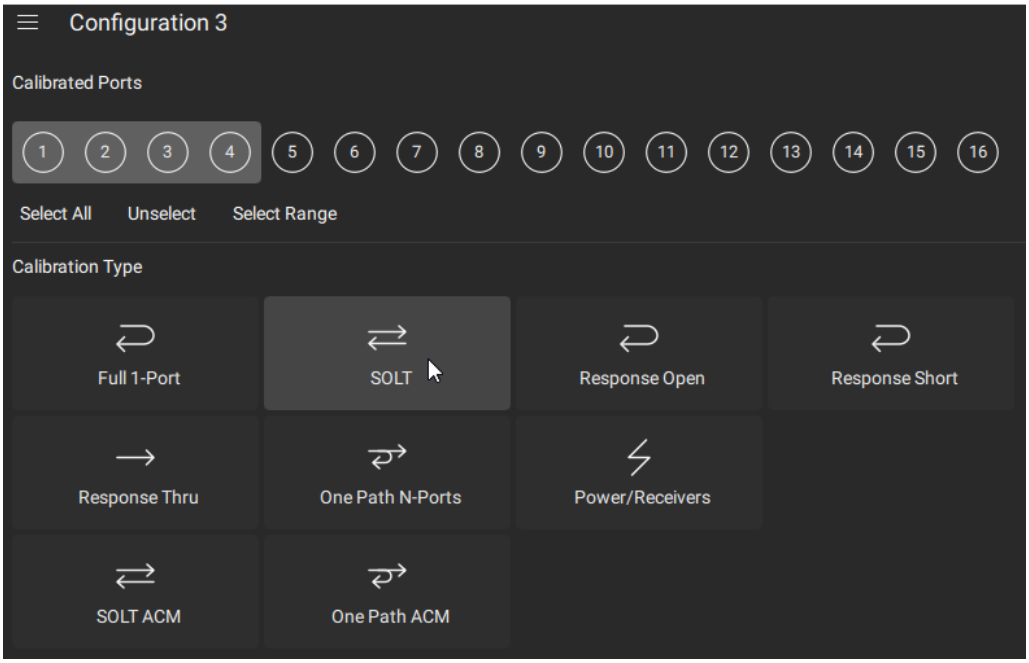


NOTE You can use an existing configuration (see Editing a Configuration).

3 Add the ports to a group by clicking on the port number icons in the Calibrated Ports area.

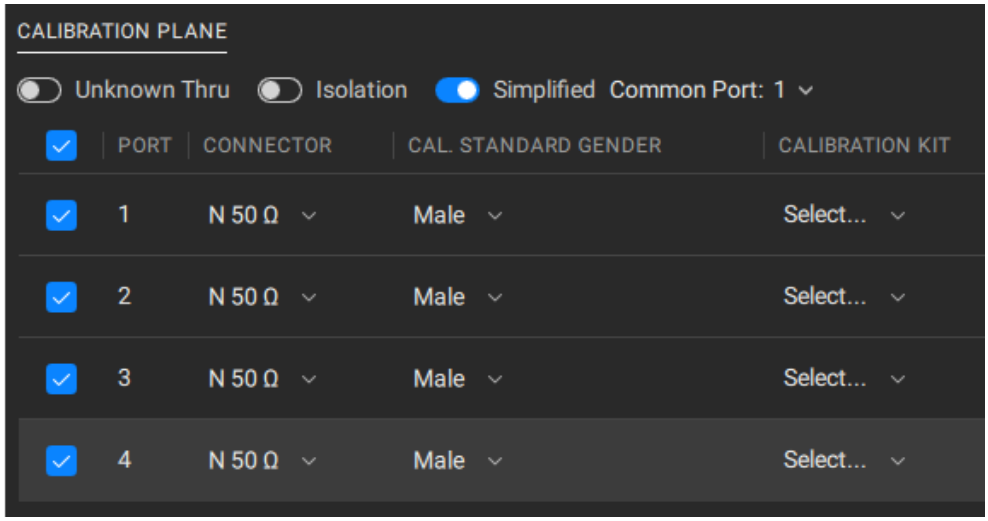
Click on **SOLT** button in the Calibration Type (see Creating a New Ports Group).

NOTE You can add more than one port to the group and perform calibration for multiple ports at once for your convenience.



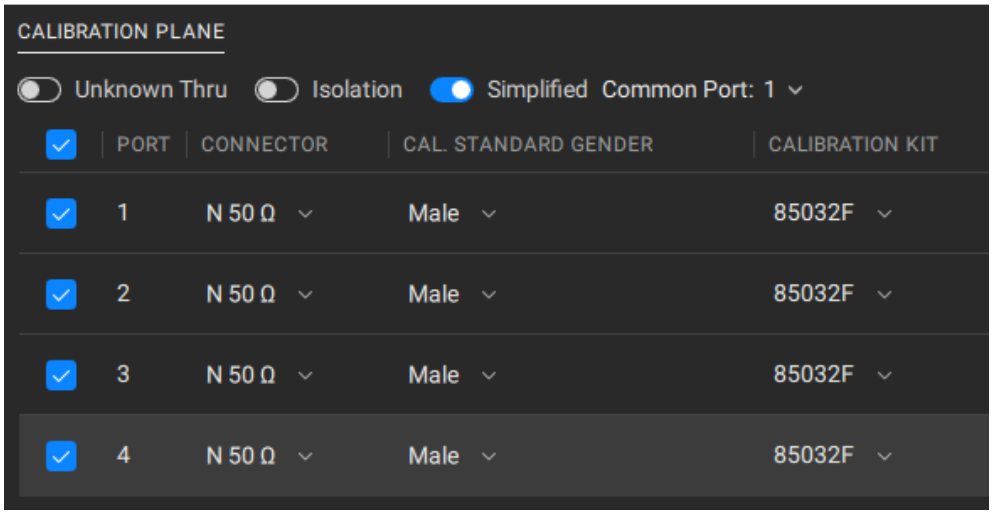
4 Select the calibration plane (see Selecting Calibration Plane):

- Select the type and gender of the calibration plane connector in the corresponding fields CONNECTOR and CAL. STANDARD GENDER.



- Select calibration kit from the CALIBRATION KIT drop-down list.

NOTE Only calibration kits marked as **AVAILABLE** in Calibration Kits Management will be displayed in the CALIBRATION KIT drop-down list. If the calibration kit is missing, add the kit and its description.

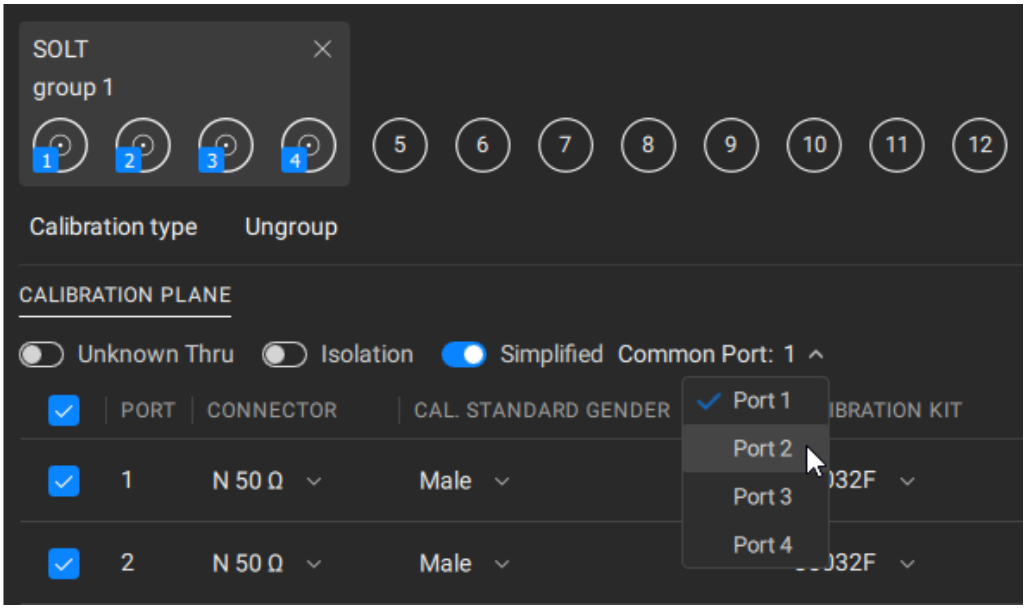


NOTE The wizard automatically checks if the selected port connector type and gender match the calibration kit standard. If there is a discrepancy, e.g. there is no suitable standard in the calibration kit, the  icon will appear next to the group name. Hover the mouse over the icon to see where the discrepancies occur. The calibration procedure cannot begin if there are any discrepancy messages present. A duplicate icon appears near the corresponding line in the calibration kit or ACM fields.

5 If you want to perform a simplified N-port calibration, toggle **Simplified** ON in the submenu. Then, click on the **Common port** drop-down list and select the common port number.

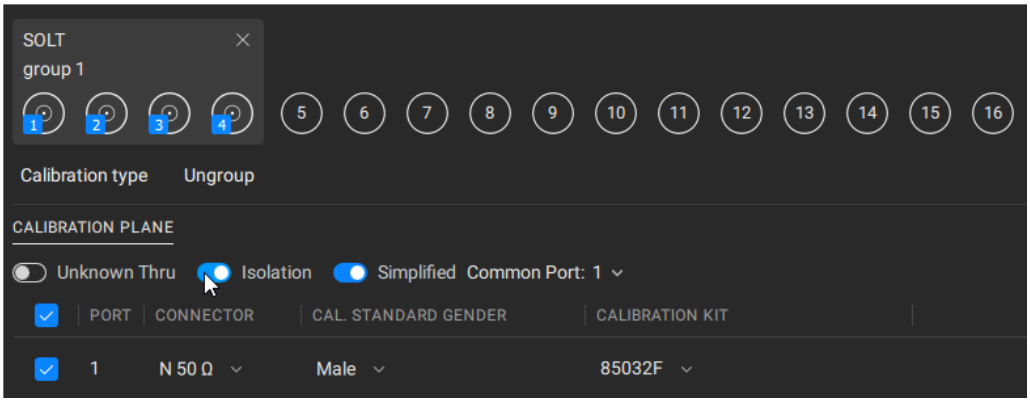
If you want to perform a full N-port calibration, toggle **Simplified** OFF in the submenu.

NOTE It is possible to complete the calibration without going through all the steps if the minimum required number of THRU measurements have been made.

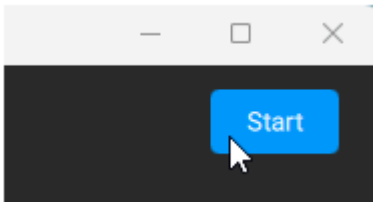


6 If optional isolation calibration is not required, toggle **Isolation** ON.

NOTE If the option is disabled, there will be no optional Isolation measuring step while measuring.

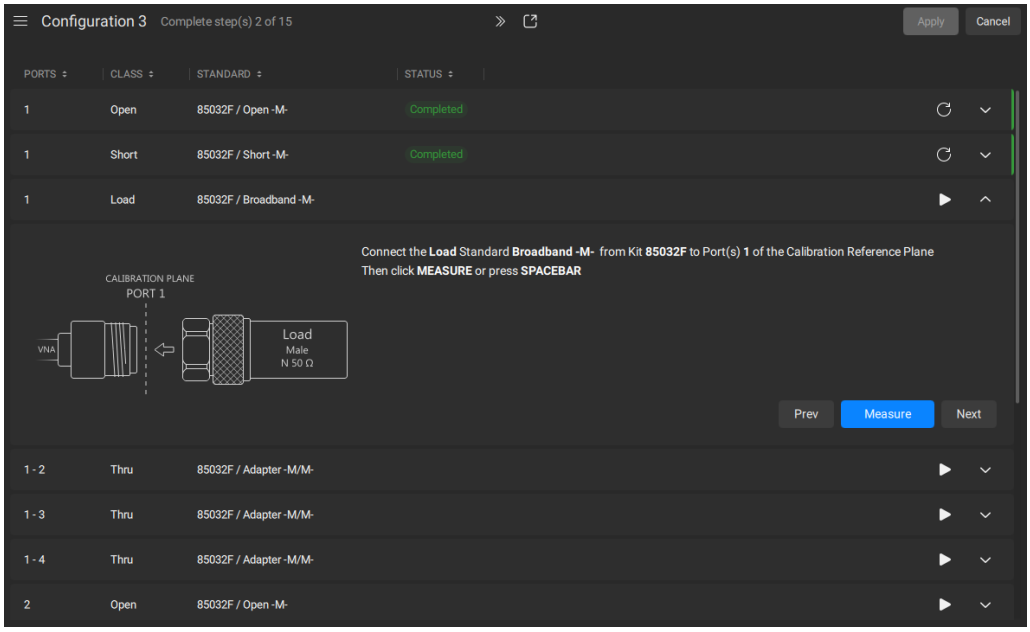


7 Click on **Start**.



8 Connect the standard to the port.

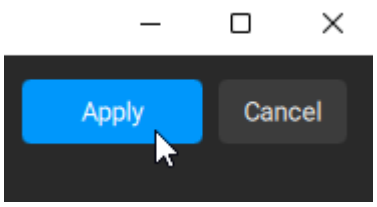
Click on **Measure** or press **SPACEBAR** in the corresponding calibration step. Wait until the measurements are completed (**Completed** appears in the Status field).



9 Measure the remaining standards using the corresponding wizard calibration steps.

10 Click on **Apply**.

NOTE The **Apply** button is available only after all calibration steps (except the optional step) are completed.



SCPI SENSe:CORRection:CONFiguration:GROup:CREate

SENSe:CORRection:CONFiguration:CONNection

SENSe:CORRection:CONFiguration:GROup:CKIT:SELect

SENSe:CORRection:CONFiguration:GROup:SIMPlified

SENSe:CORRection:CONFiguration:GROup:PORT:COMMon

SENSe:CORRection:CONFiguration:GROup:ISOLation:ENABle:ALL

SENSe:CORRection:CONFiguration:GROup:ISOLation:DISable:ALL

SENSe:CORRection:COLLect:STARt

SENSe:CORRection:COLLect:STEP:MEASure

SENSe:CORRection:COLLect:STEP:ACQuire:OPEN

SENSe:CORRection:COLLect:STEP:ACQuire:SHORt

SENSe:CORRection:COLLect:STEP:ACQuire:LOAD

SENSe:CORRection:COLLect:STEP:ACQuire:THRU

SENSe:CORRection:COLLect:STEP:ACQuire:ISOL

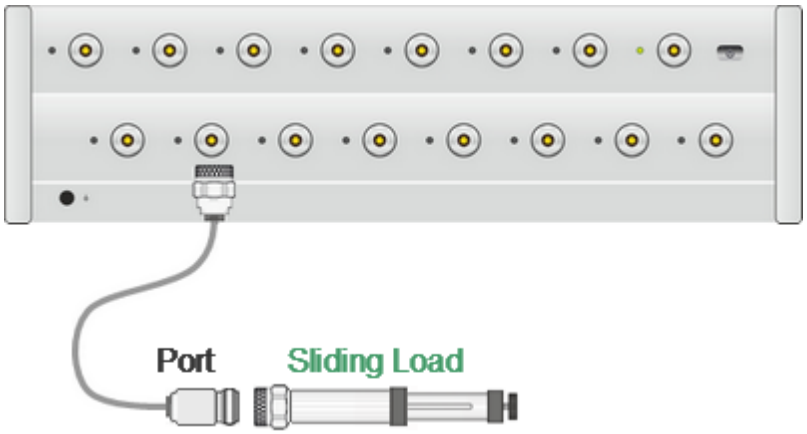
SENSe:CORRection:COLLect:SAVE

NOTE When calibration is applied, the trace manager displays the calibration status of **F2** or **F3**, or ... **F16** depending on the number of ports involved in the calibration (see Trace Manager).

Sliding Load Calibration

In calibrations with mechanical calibration kit, it is possible to employ a Sliding Load calibration standard instead of a fixed one. The use of the SLIDING LOAD standard allows for significant increase in calibration accuracy at high frequencies compared to the FIXED LOAD standard.

The Sliding Load calibration involves a series of measurements in different positions of the sliding element to compensate for reflection from the dissipation component.



Sliding Load Calibration

To activate the sliding load calibration algorithm, the user should:

- Mark a calibration kit containing a calibration standard of SLIDING LOAD type as **AVAILABLE** in Calibration Kits Management. If the calibration kit is missing, add the kit and its description.
- When defining the calibration plane, select the calibration kit containing the calibration standard of the SLIDING LOAD type and also select the gender of the standard corresponding to the connector type of the SLIDING LOAD standard in the selected kit.

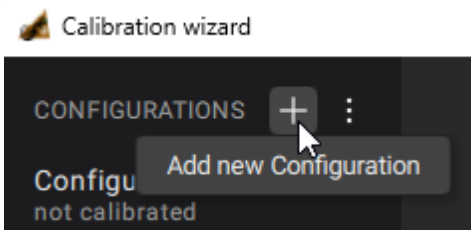
In this case, when performing calibration in the calibration wizard, in addition to the FIXED LOAD calibration step, the SLIDING LOAD measurement step will appear, which includes a series of measurements in several positions of the sliding element. The minimum number of measurements is 5, the maximum number of measurements is 10.

NOTE The Sliding Load calibration is not suitable for low frequencies. To eliminate this limitation, use a FIXED LOAD standard in the lower part of the frequency range. For combined calibration with SLIDING and FIXED LOADS. The number of SLIDING and FIXED LOADS steps in the wizard depends on the number of suitable LOAD and SLIDING LOAD standards in the user-selected calibration kit.

Setting up and Performing Sliding Load Calibration

1. Run Calibration Wizard. Click on the **Calibration > Calibrate** buttons in the sidebar (see Starting Calibration Wizard Pop-up Window).

2. Create a configuration. Click on the + icon in the configuration list (see Adding New Configuration).

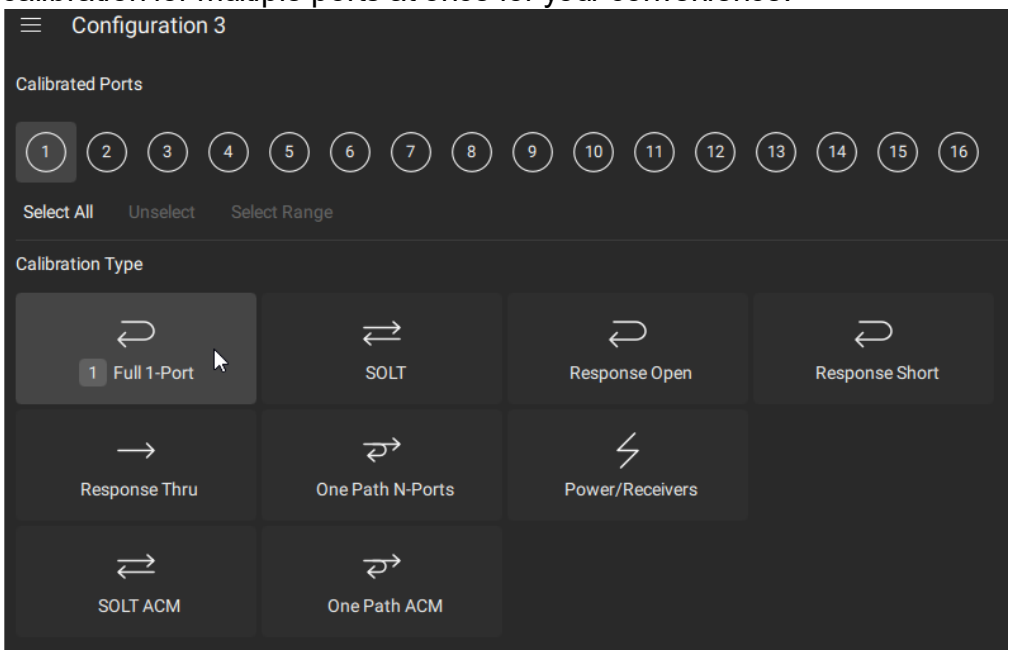


NOTE You can use an existing configuration (see Editing a Configuration).

3. Add the ports to a group by clicking on the port number icons in the Calibrated Ports area.

   Click on **Response Open, Response Short, Full 1-Port,** or **One Path N-Ports | SOLT** button the Calibration Type (see Creating a New Ports Group).

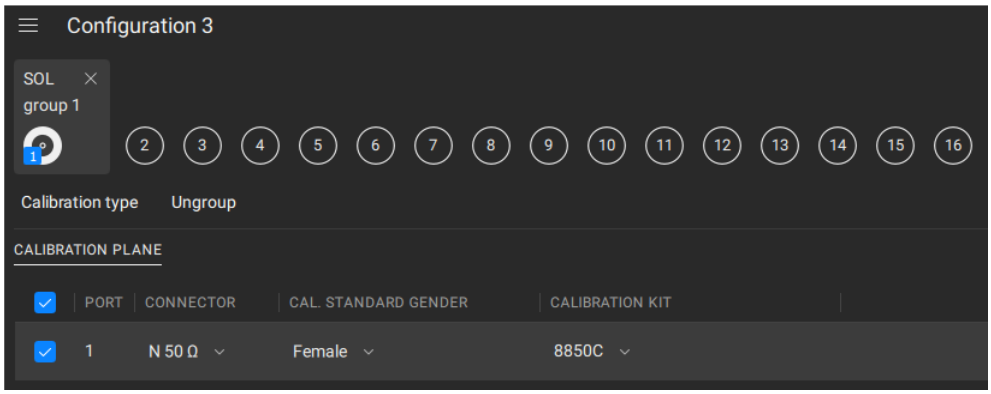
NOTE You can add more than one port to the group and perform calibration for multiple ports at once for your convenience.



4 Select the calibration plane (see Selecting Calibration Plane):

- Select the type and gender of the calibration plane connector in the corresponding fields CONNECTOR and CAL. STANDARD GENDER.
- Select calibration kit containing SLIDING LOAD from the CALIBRATION KIT drop-down list.

NOTE Only calibration kits marked as **AVAILABLE** in Calibration Kits Management will be displayed in the CALIBRATION KIT drop-down list. If the calibration kit is missing, add the kit and its description.

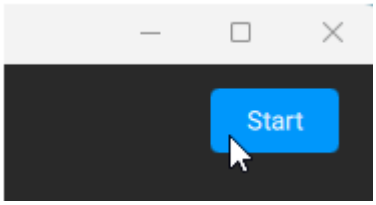


- Select plane calibration settings depending on the selected calibration type:
  - Reflection Normalization

- Transmission Normalization
- Full One-Port Calibration
- Full N-Port Calibration

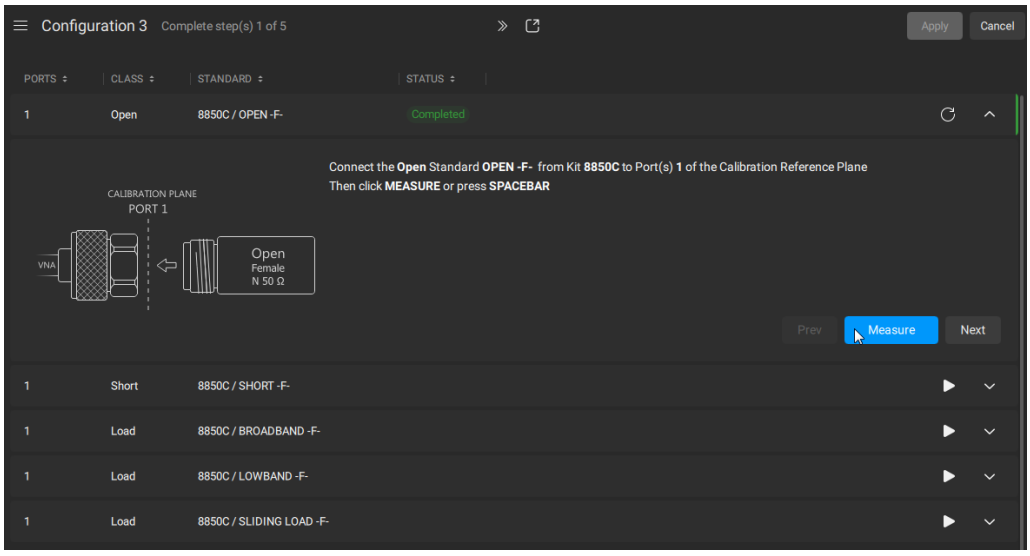
NOTE The wizard automatically checks if the selected port connector type and gender match the calibration kit standard. If there is a discrepancy, e.g. there is no suitable standard in the calibration kit, the  icon will appear next to the group name. Hover the mouse over the icon to see where the discrepancies occur. The calibration procedure cannot begin if there are any discrepancy messages present. A duplicate icon appears near the corresponding line in the calibration kit fields.

5 Click on **Start**.



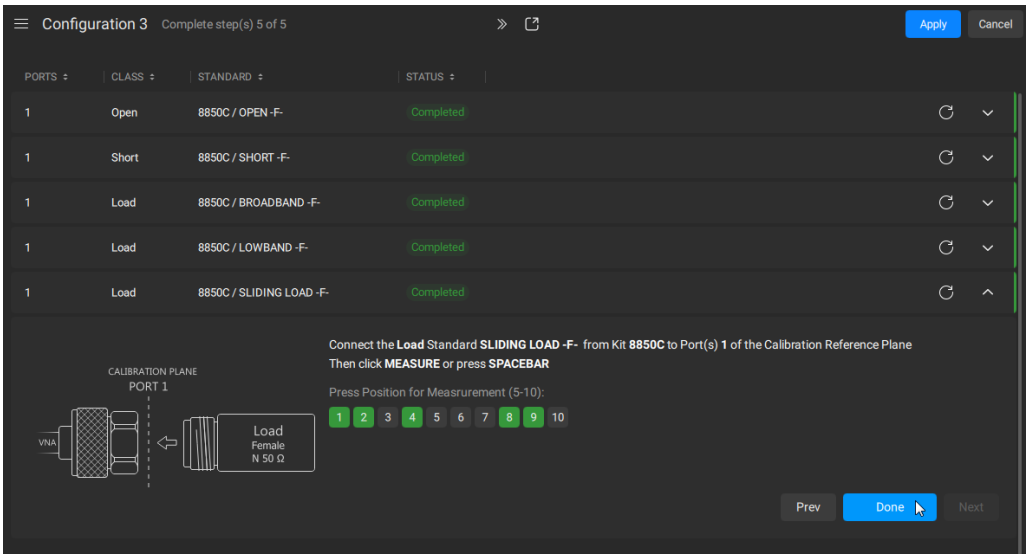
6 Connect the FIXED standard to the port.

Click on **Measure** or press **SPACEBAR** in the corresponding calibration step. Wait until the measurements are completed (**Completed** appears in the Status field).



7 Connect the SLIDING LOAD standard to the port.

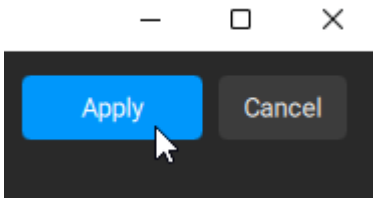
Perform a series of measurements in different positions of the sliding element. Click on **1 | 2 | ... | 9 | 10** button in the corresponding calibration step. To complete the step, perform minimum number of measurements which is 5. After that **Completed** appears in the Status field and **DONE** button is available. Click on **DONE** button.



8 Measure the remaining standards using the corresponding wizard calibration steps.

9 Click on **Apply**.

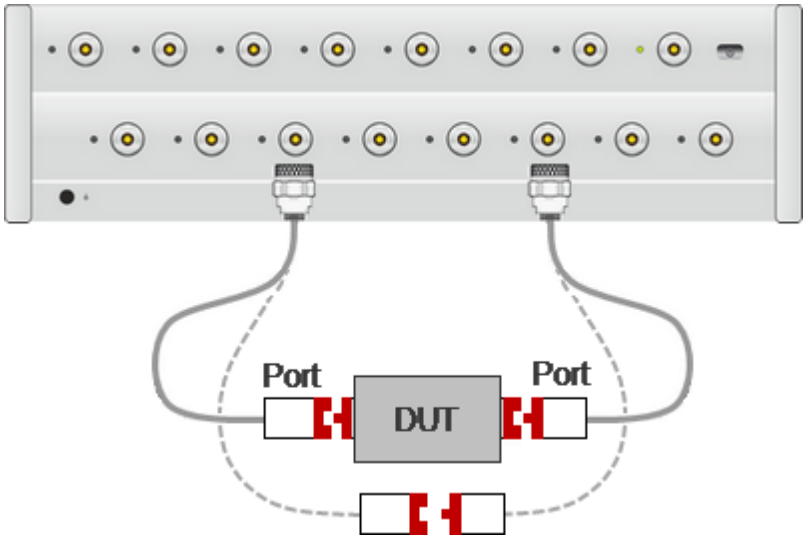
NOTE The **Apply** button is available only after all calibration steps (except the optional step) are completed.



Non-Insertable Device Measuring

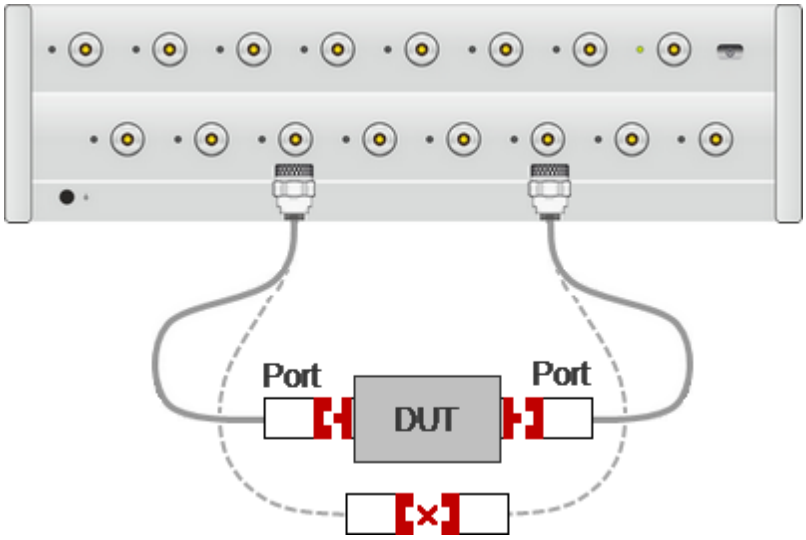
The two-port SOLT calibration procedure includes direct connection of test port cables with each other. Such connection is called Zero length THRU or Flush THRU and means that THRU has zero electrical length. However, it is not always possible to connect test port cables directly to each other. According to this criterion, DUTs are divided into insertable and non-insertable devices:

- An insertable device is one whose connectors could match together. They have the same type of connector and opposite or no gender. Test port cables can be matched together (see figures below), therefore a two-port SOLT calibration can be performed for such a measurement setup.



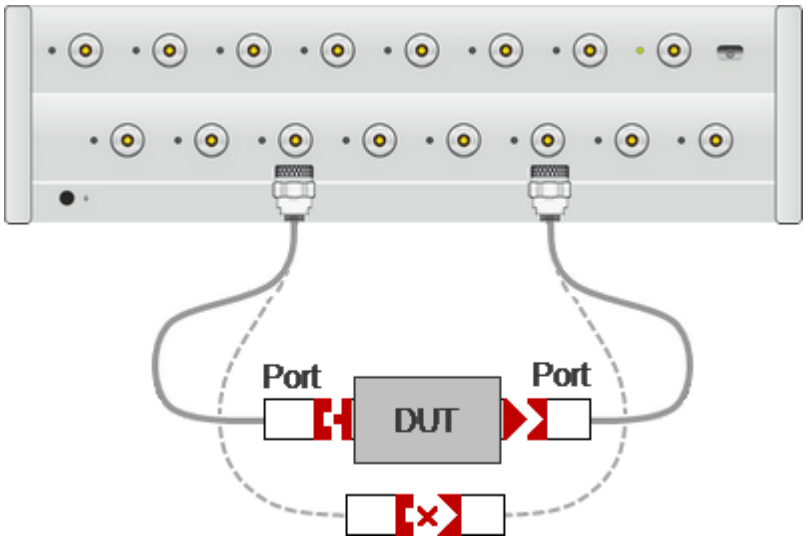
Insertable Device

- A non-insertable device is one whose connectors could not match together. This also means that the test port cables would not match each other. In the simplest case, a non-insertable device has connectors of the same type, for example, N50, and of the same gender (see figures below).



Non-insertable Device (Connectors of the Same Type)

In practice, there are often more complex cases of non-insertable device measurements — devices having ports of different types and/or having different characteristic impedances, for example, N50 – 3.5, N50 – N75, N50 – Waveguide (see figures below).



Non-insertable Device (Connectors of Different Types)

The following calibration methods are used for a non-insertable device:

- DEFINED THRU
- UNKNOWN THRU calibration

Defined Thru

This method uses physical (not null) DEFINED THRU in two-port SOLT calibration (See Full N-Port Calibration (SOLT)). Parameters of the DEFINED THRU must be defined in the calibration kit. If the definition of DEFINED THRU is not included in the calibration kit, it must be added manually using one of two methods: parameters of calibration standard model or S-parameters. For a detailed description, see Standard Definition.

Unknown Thru Calibration

This method uses physical (not null) UNKNOWN THRU in two-port calibration. Such calibration is called SOLR (Short-Open-Load-Reciprocal).

Any two-port network satisfying the reciprocal condition (Sji= Sij) can be used as UNKNOWN THRU. Most passive, linear microwave networks will turn out to be reciprocal. Combined transmission loss of UNKNOWN THRU and calibration setup should not exceed 40 dB. The UNKNOWN THRU can be a wide class of two-port network, including DUT, if it meets the specified conditions. For a detailed description, see Unknown Thru Requirements.

This method is applicable when the test ports cannot be calibrated with DEFINED THRU from the desired calibration kit(s). For example, test ports of the same type (N50), and of the same gender (male). You want to use the KeySight 85054B calibration kit, which has one DEFINED THRU with male-female connector types. In this case, either use another calibration kit with a suitable DEFINED THRU or perform Unknown Thru calibration. For a detailed description, see Unknown Thru Calibration. For a detailed description, see Unknown Thru Calibration.

Accuracy of Methods

- Unknown Thru calibration (SOLR) is potentially most accurate method and is preferable method for non-insertable device measurement.
- Defined Thru is usually not as accurate as Unknown Thru method.

Unknown Thru Requirements

An arbitrary two-port device with unknown parameters can be used as an UNKNOWN THRU in 2-port SOLR (Short-Open-Load-Reciprocal) calibration. An UNKNOWN THRU should satisfy next requirements:

- The UNKNOWN THRU must be Reciprocal (Sji = Sij), which holds for most passive linear network.
- The combined transmission loss of the UNKNOWN THRU and calibration path is not recommended to exceed 40 dB.
- The number of points must be enough to correctly auto-detect the electrical delay of the UNKNOWN THRU.

Requirements for automatic detection of electrical delay

The analyzer automatically detect the electrical delay of the UNKNOWN THRU during the calibration procedure.

For the Analyzer to correctly automatically detect the UNKNOWN THRU delay, the following condition must be met:

$$\frac{Span}{N-1} < \frac{1}{2 \cdot \tau_0},$$

where $Span$ — frequency span of calibration,

N — number of points,

τ_0 — delay of a UNKNOWN THRU,

In other words, the number of points must be enough to correctly auto-detect the electrical delay of the UNKNOWN THRU:

$$N > 2 \cdot \tau_0 \cdot \ Span + 1$$

Example An example of calculating the number of points enough for the correct automatic determination of UNKNOWN THRU delay by the Analyzer.

Let the UNKNOWN THRU is a coaxial cable having approximate length $l_0 \approx 100mm$. The approximate delay of the cable will be $\tau_0 \approx 477ps$, providing the velocity factor of the cable equals $1/\sqrt{\varepsilon} \approx 0.7$.

Let us the Span is 8 GHz.

For the analyzer to correctly automatically detect the UNKNOWN THRU delay, the number of points must be:

$$N > 2 \cdot \ 477 \cdot \ 10^{-12} \cdot \ 8 \cdot 10^9 + 1; N > 9.$$

Unknown Thru Calibration

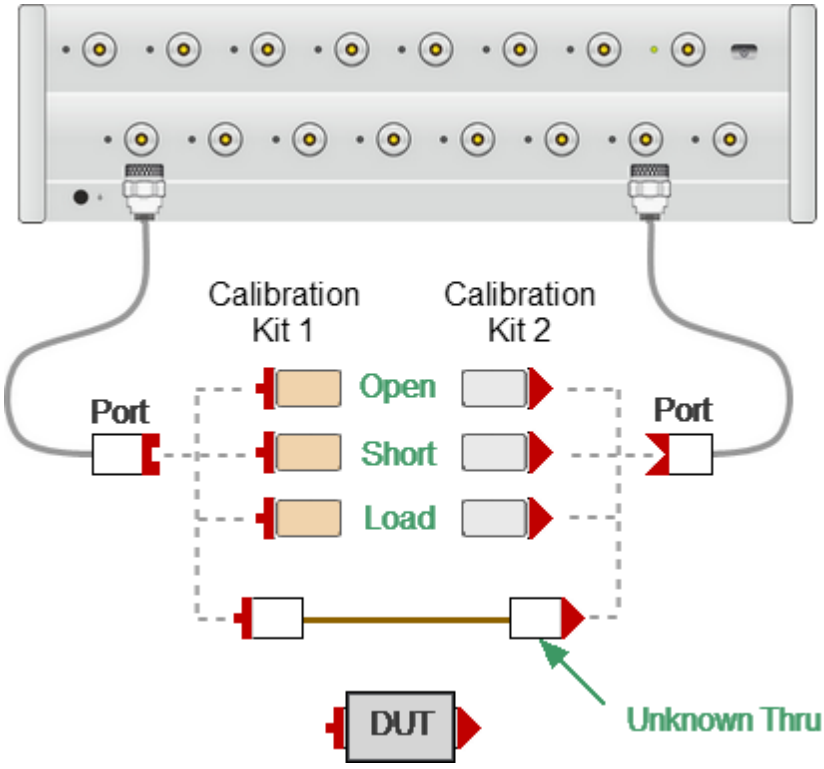
Unknown Thru Calibration or SOLR (Short-Open-Load-Reciprocal) is analogous to SOLT calibration, where UNKNOWN THRU is used instead of DEFINED THRU (see figures below). This method is used when:

- DUT connecting with connectors of the same type, and of the same gender. One calibration kit can be used to calibrate both ports.
- DUT connecting with connectors of various types, up to a combination of coaxial type and waveguide type ports. In this case, one predefined calibration kit cannot be used for calibration of both ports.

Unknown Thru calibration includes:

- One-port calibration of each port performed using a suitable calibration kit(s).
- Connecting of the ports directly using an appropriate UNKNOWN THRU (satisfying requirements) and perform the measurements.

The figure below shows an example of SOLR calibration for DUTs with various types of connectors.

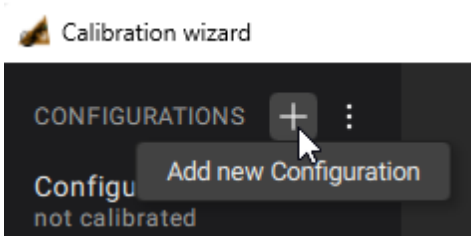


Unknown Thru Calibration (DUT with Connectors Various Type)

Setting up and Performing Unknown Thru Calibration

1. Run Calibration Wizard. Click on the **Calibration > Calibrate** buttons in the sidebar (see Starting Calibration Wizard Pop-up Window).

2. Create a configuration. Click on the + icon in the configuration list (see Adding New Configuration).

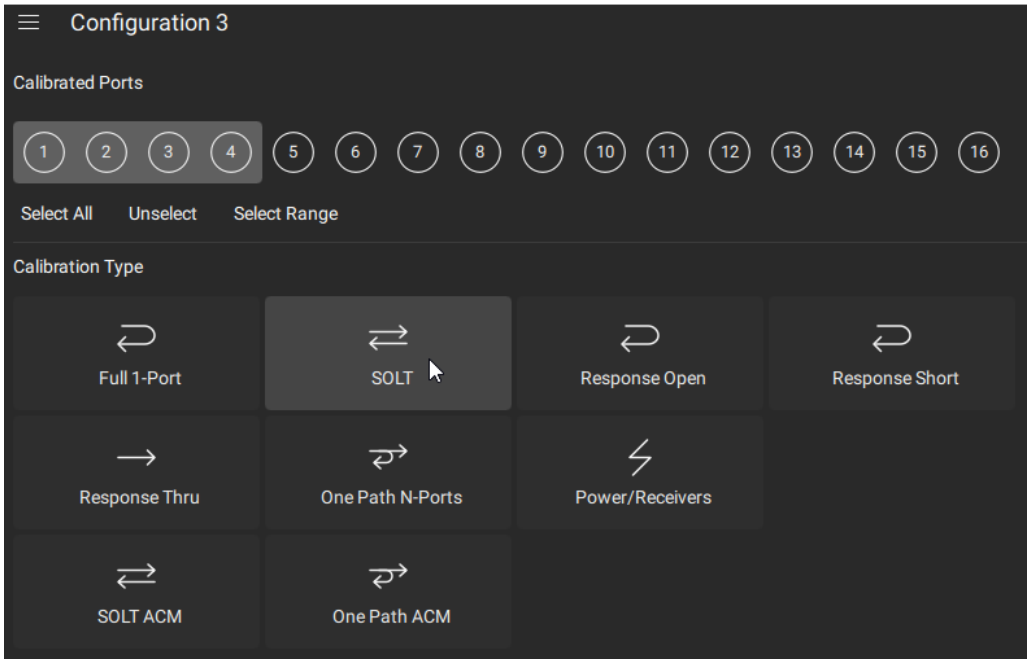


NOTE You can use an existing configuration (see Editing a Configuration).

3. Add the ports to a group by clicking on the port number icons in the Calibrated Ports area.

Click on **SOLT** in the Calibration Type (see Creating a New Ports Group).

NOTE For comfortable working, you can add more than one port to the group and perform normalization for several ports at once.

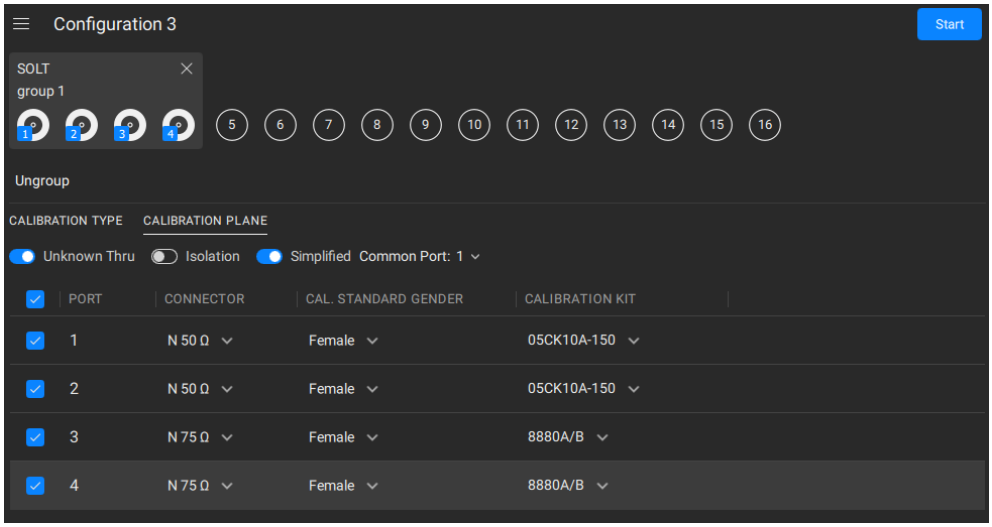


4 Select the calibration plane (see Selecting Calibration Plane):

- Select the type and gender of the calibration plane connector in the corresponding fields CONNECTOR and CAL. STANDARD GENDER. In the given example, ports 1 and 2 have N50, female connector type, while ports 3 and 4 have N75, female connector type (see figure below).
- Select the calibration kit with N50 connector for ports 1 and 2, and N75 connector for ports 3 and 4 in the CALIBRATION KIT drop-down list.
- If the calibration kit(s) does not contain a suitable THRU standard to calibrate a pair of ports, a mismatch message will appear (the icon).

In this case you can use Unknown Thru algorithm, by toggling **Unknown Thru** ON.

NOTE Enabling Unknown Thru algorithm, all THRUs will be measured as unknown, even if there are suitable ones in the calibration kit.



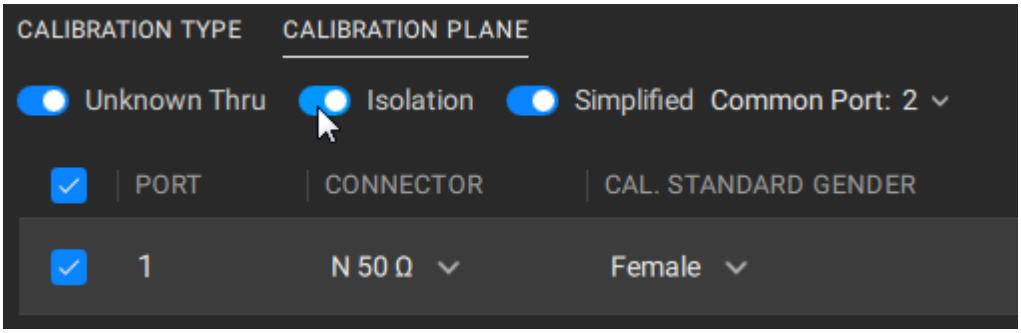
5 If you want to perform simplified N-port calibration, toggle **Simplified** OFF in the submenu. Then, click on the **Common port** drop-down list end select the common port number.

If you want to perform full N-port calibration, toggle **Simplified** ON in the submenu.

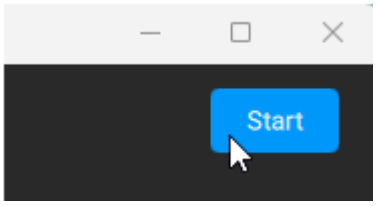
NOTE It is possible to complete the calibration without going through all the steps if the minimum required number of THRU measurements have been made.

6 If optional isolation calibration is not required, toggle **Isolation** ON.

NOTE If the option is disabled, there will be no optional Isolation measuring step while measuring.

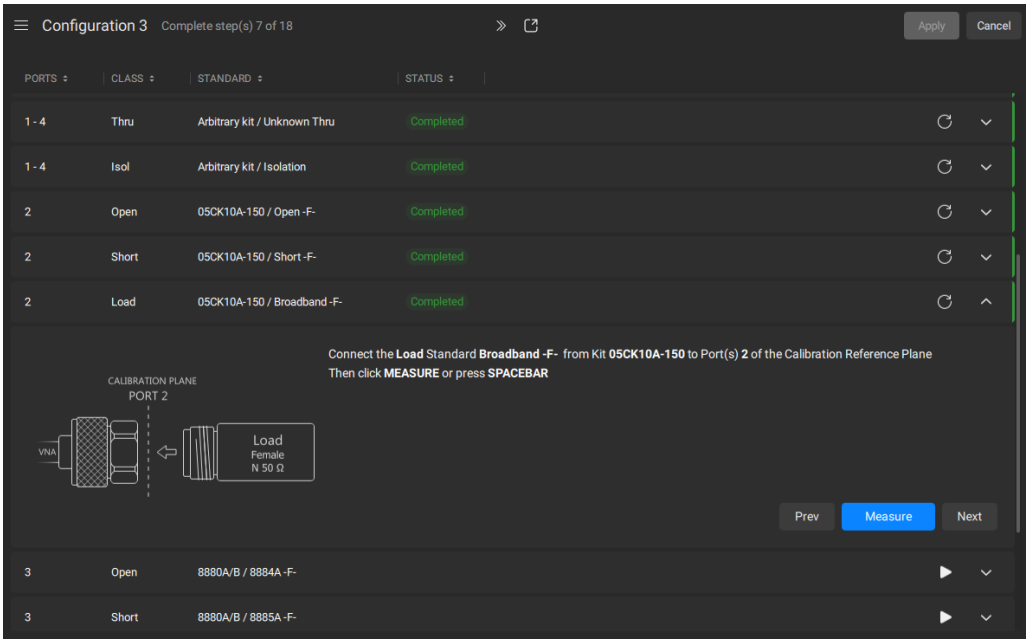


7 Click on **Start**.



8 Connect the standard to the port.

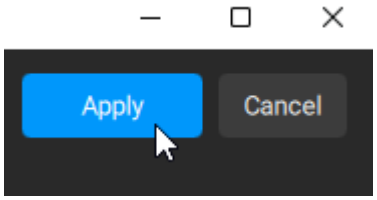
Click on **Measure** or press **SPACEBAR** in the corresponding calibration step. Wait until the measurements are completed (**Completed** appears in the Status field).



9 Measure the remaining standards using the corresponding wizard calibration steps.

10 Click on **Apply**.

NOTE The **Apply** button is available only after all calibration steps (except the optional step) are completed.



SCPI SENSe:CORRection:CONFiguration:GROup:CREate

SENSe:CORRection:CONFiguration:CONNection

SENSe:CORRection:CONFiguration:GROup:UTHRu:ENABle:ALL

SENSe:CORRection:CONFiguration:GROup:UTHRu:DISable:ALL

SENSe:CORRection:CONFiguration:GROup:CKIT:SELect

SENSe:CORRection:CONFiguration:GROup:PORT:COMMon

SENSe:CORRection:CONFiguration:GROup:ISOLation:ENABle:ALL

SENSe:CORRection:CONFiguration:GROup:ISOLation:DISable:ALL

SENSe:CORRection:CONFiguration:GROup:UTHRu:ENABle:ALL

SENSe:CORRection:COLLect:STARt

SENSe:CORRection:COLLect:STEP:MEASure

SENSe:CORRection:COLLect:STEP:ACQuire:OPEN

SENSe:CORRection:COLLect:STEP:ACQuire:SHORt

SENSe:CORRection:COLLect:STEP:ACQuire:LOAD

SENSe:CORRection:COLLect:STEP:ACQuire:THRU

SENSe:CORRection:COLLect:STEP:ACQuire:ISOL

SENSe:CORRection:COLLect:SAVE

NOTE You can also perform Unknown Thru Calibration with the help of ACM, to do this toggle **Resolve Missing Thrus** ON (see Calibration with the Automatic Calibration Module).

NOTE When calibration is applied, the trace manager displays the calibration status of **F2** or **F3**, or ... **F16** depending on the number of ports involved in the calibration (see Trace Manager).

Calibration with the Automatic Calibration Module

Automatic calibration modules (ACMs) are special devices that automate the process of calibration. The ACM model is selected according to the parameters of the calibrated Analyzer: the working frequency range, the number of measuring ports, and the type of RF connectors. One of the models is shown in the image below.



Automatic Calibration Module

All ACM models and their specifications are available on the Copper Mountain Technologies website. The operating manual of ACM see in ACM Operating manual.

The ACM offers the following advantages over the traditional SOLT calibration, which uses a mechanical calibration kit:

- Reduces the number of standard connections. Instead of connecting seven standards, it only requires connecting two ACM connectors.
- Reduces the calibration time.
- Reduces human error probability.
- Provides higher accuracy potentially.

Depending on the model, the ACM has two or four RF connectors for Analyzer test port connection, as well as a USB connector for control. The ACM contains electronic switches, which switch between different reflection and transmission impedance states, as well as memory, which stores precise S-parameters of these impedance states.

After connecting the ACM to the Analyzer, the Analyzer software performs the calibration procedure automatically, i.e. switches between different ACM states, measures them, and computes calibration coefficients using the data stored in the ACM memory.

Automatic Calibration Module Features

Feature	Description
Calibration Types	The ACM allows the Analyzer software to perform full one-port, one-path n-port, or full n-port calibration.
Characterization	Characterization is a table of S-parameters for all states of ACM switches and stored in the ACM memory. There are two types of characterization: user characterization and factory characterization. The ACM has two memory sections. The first one is write-protected and contains factory characterization. The second memory section can store up to three user characterizations. Factory characterization or any of the user characterizations stored in the ACM memory can be selected before calibration. The user characterization option is provided for saving new S-parameters of the ACM after connecting adapters to the ACM ports. The software can perform user characterization and save the data to the ACM with the click of a button (see User Characterization Procedure). The Analyzer test ports should be calibrated in configuration compatible with the ACM ports.
Automatic Orientation	The position of the ACM ports to the test ports of the Analyzer. While the Analyzer test ports are indicated by numbers, the ACM ports are indicated by the letters A and B for two-port ACMs, and A, B, C, D for four-port ACMs.
Unknown Thru	The Thru implemented by the electronic switches inside the ACM introduces losses. That is why the exact parameters of the Thru should be known, otherwise an Unknown Thru algorithm should be used to achieve the specified calibration accuracy. The software allows for both options. The ACM memory stores S-parameters of the Thru, which are used to compute calibration coefficients. If an Unknown Thru algorithm is applied, such parameters are disregarded.
Thermal Compensation	The most accurate calibration is achieved if the ACM temperature is equal to the temperature at which it was characterized. When this temperature changes, certain ACM state parameters may deviate from the

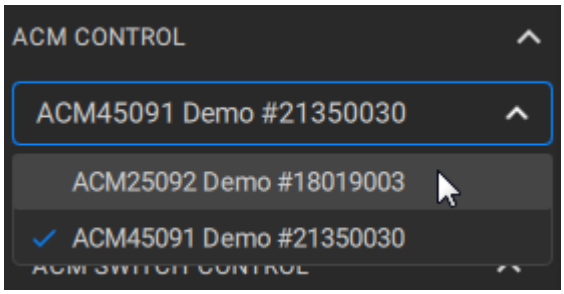
Feature	Description
	parameters stored in the memory. This results in a reduction of the ACM's calibration accuracy. To compensate for the thermal error, the ACM features a thermal compensation function. Thermal compensation is a software function of the ACM S-parameter correction based on its temperature dependence and the data from the temperature sensor inside the ACM. The temperature dependence of each ACM is determined at the factory and saved into its memory. Thermal compensation can be enabled or disabled. Thermal compensation is ON by default.
Confidence Check	The ACM also includes an additional mode, in which an attenuator not used in calibration can be switched in. The attenuator is used to check the calibration quality with a function called a *confidence check*, which allows to compare the measured S-parameters of the attenuator with the S-parameters recorded in the module memory (see Confidence Check Procedure). In confidence check mode, the factory measurement of the attenuator is loaded into the memory trace, which may be compared to the measurement being performed by the active trace. Their differences can be evaluated to determine the accuracy of the calibration performed. The math (division) function can be used for data and memory for a detailed comparison.

Showing ACM Detailed Information

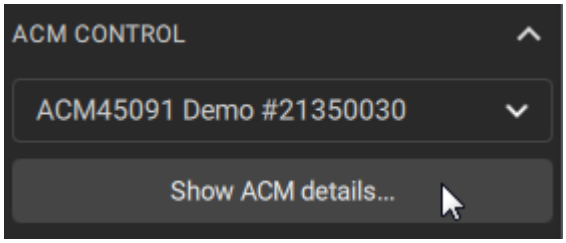
1. Connect the USB port of the ACM to the USB port of the PC.

2. Click on **Devices** in the main menu.

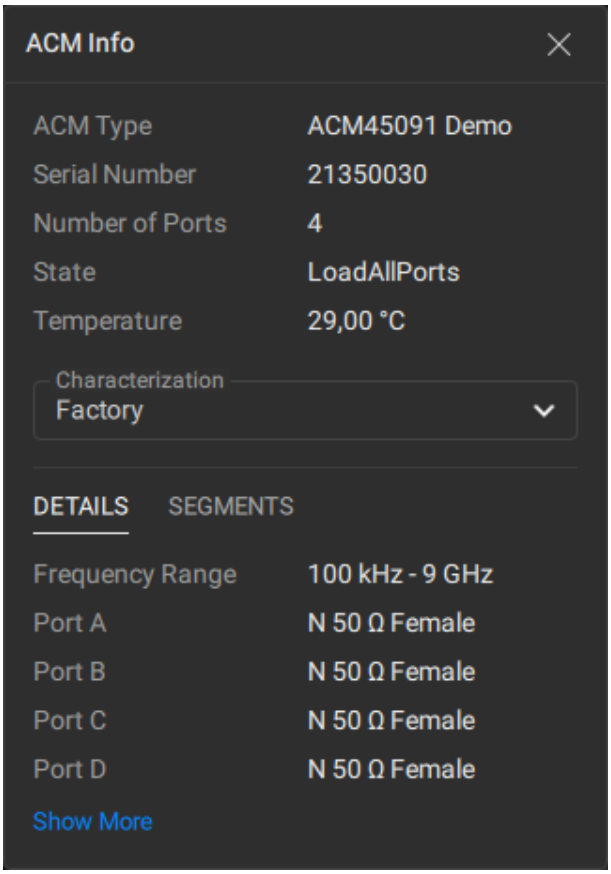
3. Select the desired ACM in the ACM CONTROL drop-down list.



4. Click on **Show ACM details...** button in submenu to open the pop-up windows.



5. Select a characterization from the **Characterization** list. To view all information about characterization, expand the window by clicking on the **Show more** button. Click on **Segments** in the segments selector at the bottom of the dialog window to show the number of characterization points in each frequency range.



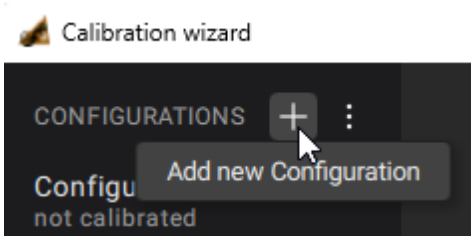
SCPI SYSTem:COMMunicate:ECAL:TEMPerature:SENSor?

SYSTem:COMMunicate:ECAL:LIST?

Setting up and Performing Calibration with the ACM

1. Run Calibration Wizard. Click on the **Calibration > Calibrate** buttons in the sidebar (see Starting Calibration Wizard Pop-up Window).

2. Create a configuration. Click on the + icon in the configuration list (see Adding New Configuration).

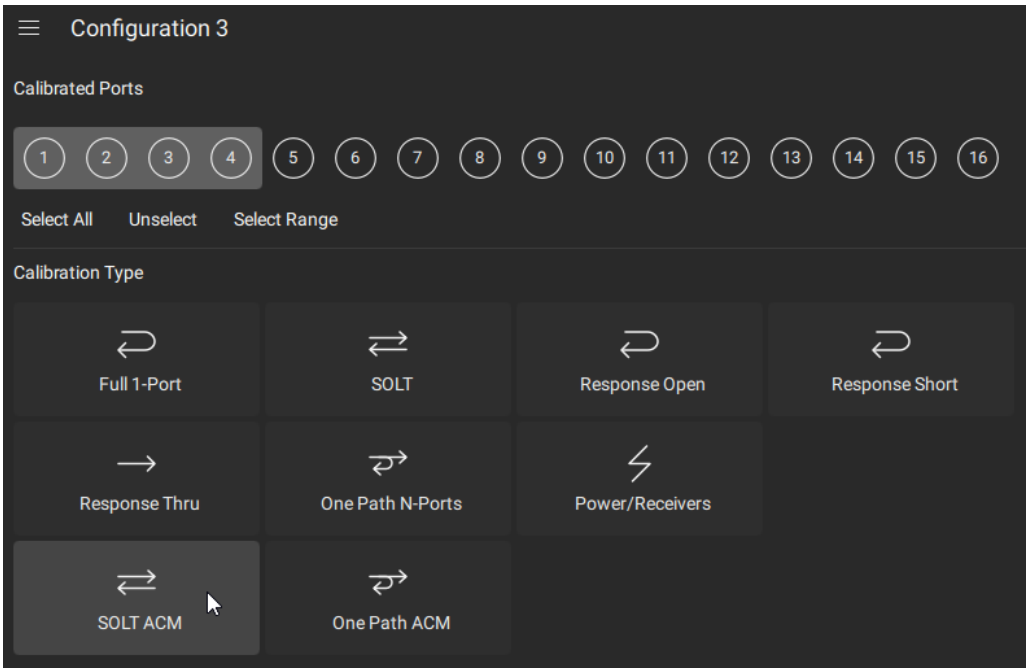


NOTE You can use an existing configuration (see Editing a Configuration).

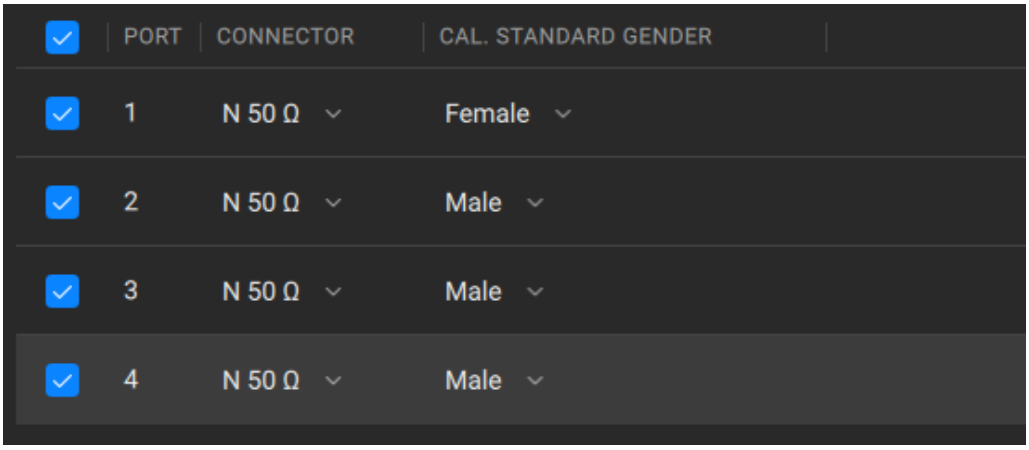
3. Add ports to a group by clicking on the port number icons in the Calibrated Ports area.

Click on the **SOLT ACM** button for full N-port calibration, or the **One Path ACM** button for one-path N-port calibration in the Calibration Type area (see Creating a New Ports Group).

NOTE You can add more than one port to the group and perform calibration for multiple ports at once for your convenience.

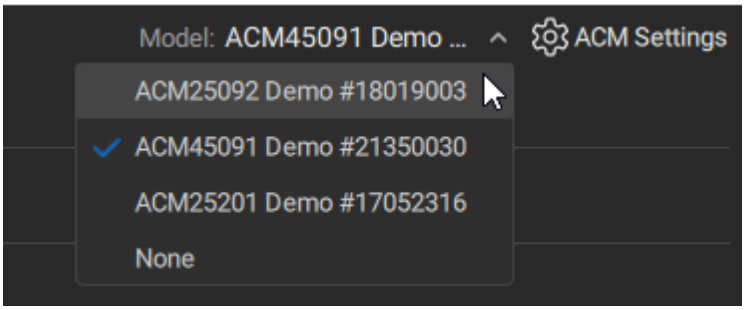


4 Select the calibration plane (see Selecting Calibration Plane). Select the type(s) and gender(s) of the DUT connector(s) in the corresponding fields CONNECTOR and CAL. STANDARD GENDER.

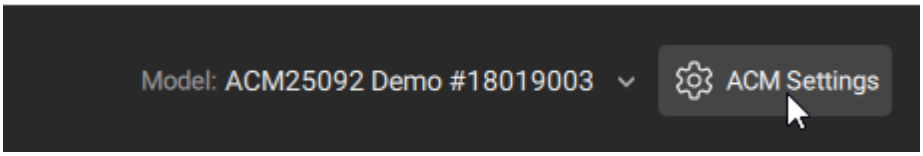


5 Connect USB port of the ACM to the USB port of the PC.

6 Select the connected ACM in **ACM** drop-down list.


Model: ACM45091 Demo ...
ACM Settings
ACM25092 Demo #18019003
ACM45091 Demo #21350030
ACM25201 Demo #17052316
None

7 If necessary, show the ACM information or disable the thermal compensation function by pressing the **ACM Settings** button. Make sure that the ACM information is displayed.

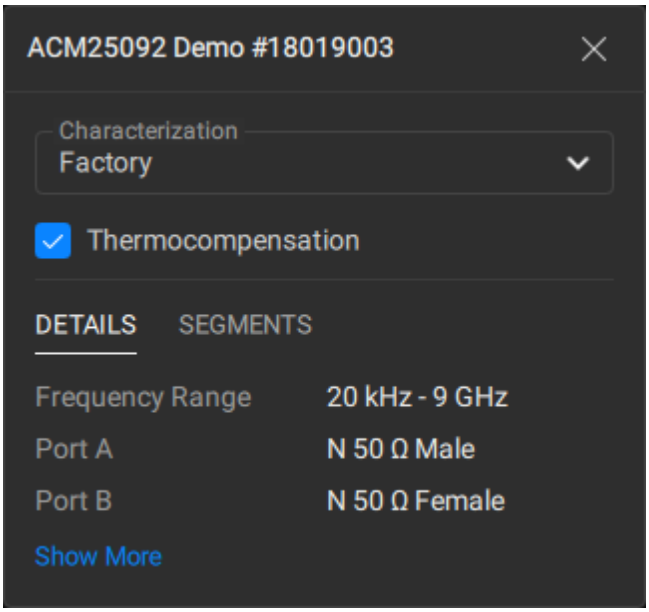


Select a characterization from the **Characterization** list.

NOTE If a user characterization has not been performed, then only the **Factory** option will be available in the list.

To view all information about characterization, expand the window by clicking on the **Show more** button at the bottom of the dialog window. Click on the **SEGMENTS** section to show the number of characterization points in each frequency range.

If it is necessary to disable thermal compensation, clear the **Thermocompensation** checkbox.

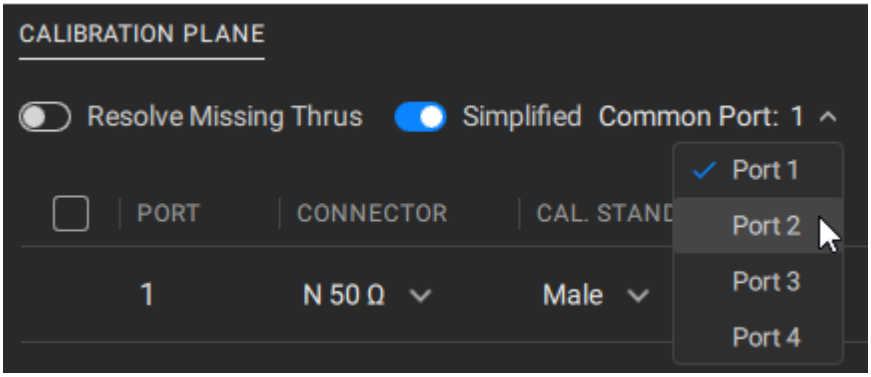


8 If you want to perform a full N-port calibration, toggle **Simplified** OFF in the submenu.

If you want to perform a simplified N-port calibration, toggle **Simplified** ON in the submenu. Then, click on the **Common port** drop-down list and select the common port number.

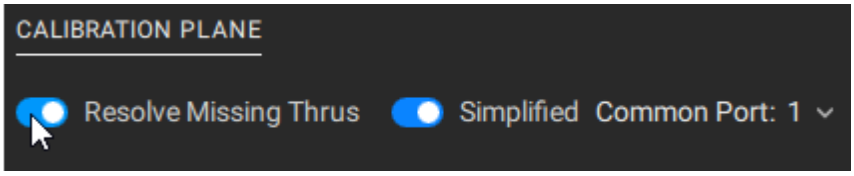
NOTE You can complete the calibration without going through all the steps if the minimum required number of THRU measurements have been performed.

For more information on simplified calibration, refer to Simplified Full N-Port Calibration.

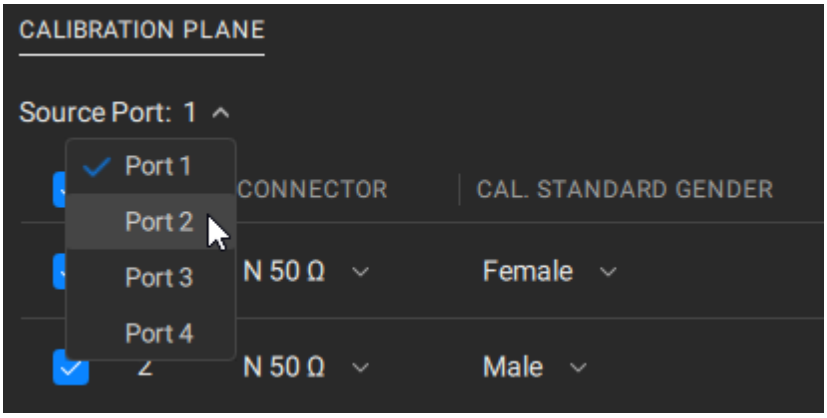


If a pair of ports cannot be connected to the ACM at the same time, a mismatch message will appear (the icon).

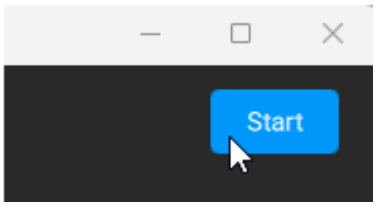
In this case, you can use external Unknown Thru, by toggling **Resolve Missing Thrus** ON.



9 If you need to perform one-path N-port calibration, select the calibration direction from the **Source Port** drop-down list.



10 Click on **Start**.



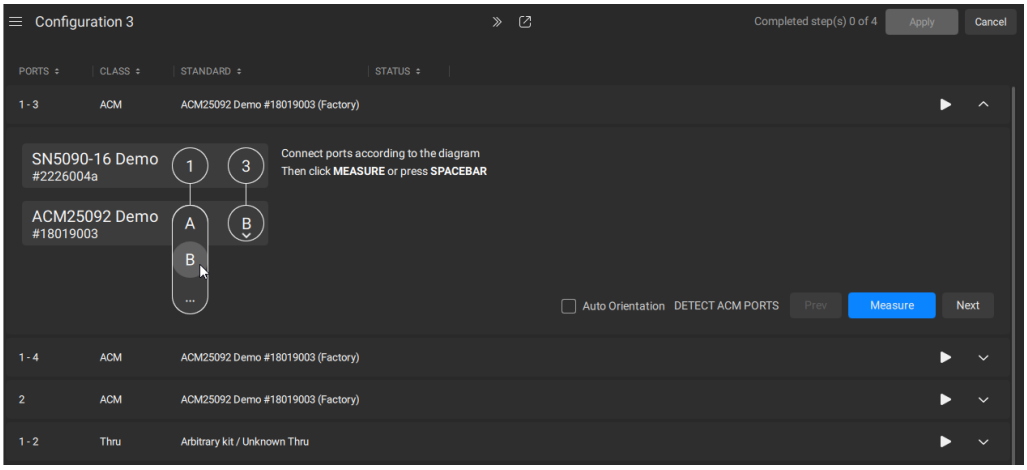
11 Connect the ACM port(s) to the test port(s).

12 If you want to turn off automatic orientation:

- Clear the **AUTO ORIENTATION** checkbox.
- Relate the analyzer test port(s) with the ACM port(s) as shown in figure below.

NOTE You can also detect ACM ports in manual orientation mode by clicking the **Detect ACM Ports** button.

NOTE Automatic orientation is recommended.



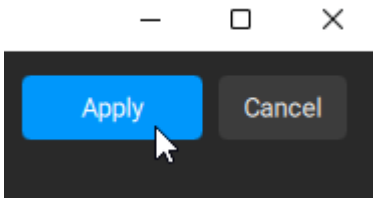
13 Click on **Measure** or press **SPACEBAR** in the corresponding calibration step. Wait until the measurements are completed (**Completed** appears in the Status field).

If the number of ports to be calibrated is greater than the number of ports on the ACM, connect the ACM to the following ports and measure using the appropriate step of the Calibrate Wizard.

NOTE An error message will appear if the ports are not assigned, or the ACM is connected to the wrong VNA ports with auto-orientation enabled. Calibration will not be performed.

14 Click on **Apply**.

NOTE The **Apply** button is available only after all calibration steps (except the optional step) are completed.



SCPI

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SENSe:CORRection:CONFiguration:CONNection

SENSe:CORRection:CONFiguration:GROup:ECAL:SELect

SENSe:CORRection:CONFiguration:GROup:SIMPlified

SENSe:CORRection:CONFiguration:GROup:PORT:COMMon

SENSe:CORRection:CONFiguration:GROup:UTHRu:ENABle:ALL

SENSe:CORRection:CONFiguration:GROup:UTHRu:DISable:ALL

SENSe:CORRection:COLLect:STARt

SENSe:CORRection:COLLect:STEP:ECAL:ORIentation:STATe

SENSe:CORRection:COLLect:STEP:MEASure

SENSe:CORRection:COLLect:STEP:ACQuire:ECAL

SENSe:CORRection:COLLect:SAVE

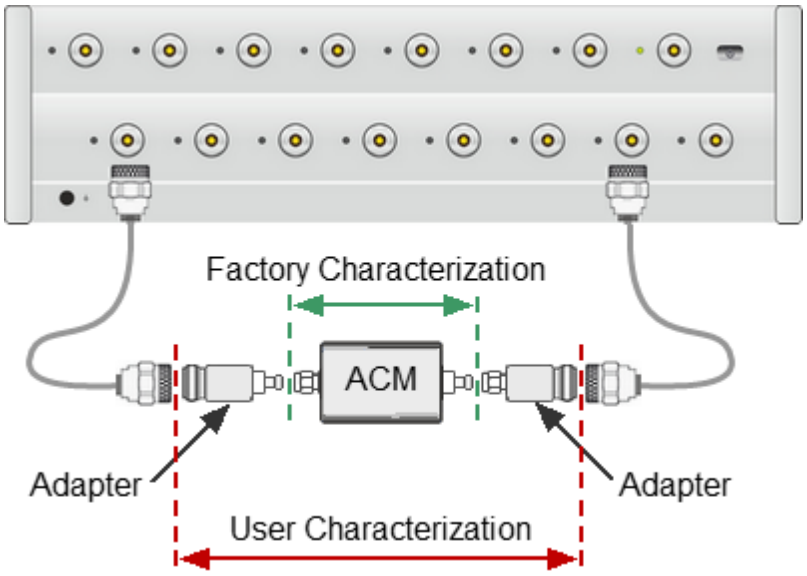
NOTE When full N-port calibration is applied, the status **F1** or **F2** or **F3**, or ... **F16** will be displayed in the trace manager,

depending on the number of ports involved in the calibration. When one-path N-port calibration is applied, the status **OP** will be displayed in the trace manager (see Trace Manager).

User Characterization Procedure

User characterization of ACM is required when modifying ACM connectors with adapters. A new device is characterized: ACM plus adapters. To ensure calibration accuracy, it is not recommended to disconnect and reconnect the adapters back after characterization until calibration is complete.

A necessary condition for user characterization is pre-calibration of the Analyzer with a port configuration compatible with the ACM port configuration. Before performing the user characterization of the two-port ACM, perform full two-port calibration of the Analyzer with a port configuration compatible with the ACM port configuration. Before performing the user characterization of the four-port ACM, perform full four-port calibration of the Analyzer with a port configuration compatible with the ACM port configuration.



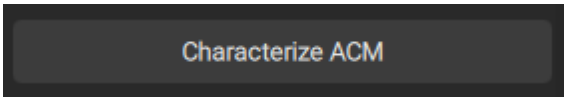
Factory and User Characterization of ACM with Two Adapters

NOTE User characterization cannot be performed in the demo mode of the software.

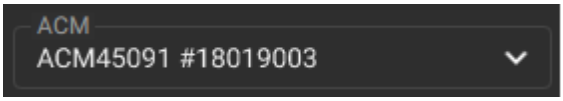
Setting Up and Executing User Characterization

1. Perform a full N-port calibration of the Analyzer ports (see Full N-Port Calibration (SOLT)).
2. Connect the ACM with adapters to the Analyzer ports and connect the USB port of the ACM to the USB port of the PC.

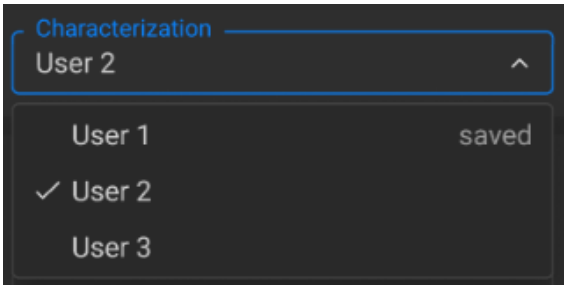
3. Click on the buttons **Calibration > Characterize ACM** in the sidebar.



4. Select ACM from the **ACM** list in the ACM Characterization window.



5. Select a user characterization from the **Characterization** list in the ACM Characterization window.

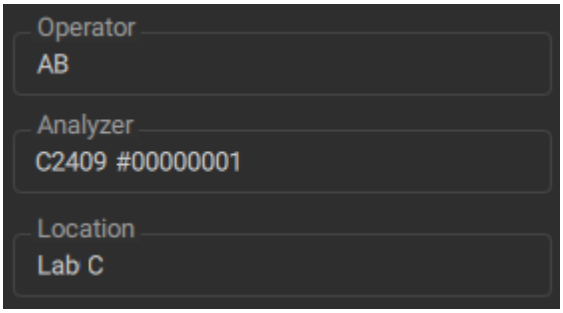


6. In the **Correction Data** list in the ACM Characterization window, select the configuration of ports with the completed calibration to which the ACM is connected.



7. Fill in the information fields:

- **Operator** – operator name;
- **Analyzer** – Analyzer name;
- **Location** – location of the characterization.

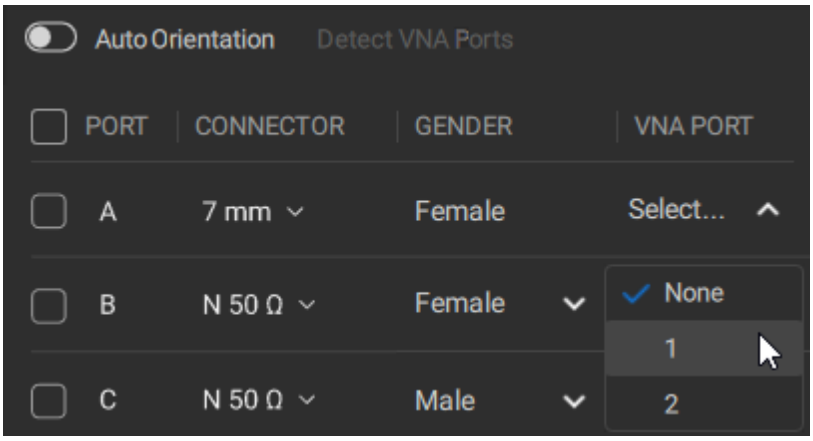


8 If it is necessary to disable automatic orientation:

- Toggle the **Auto Orientation** button OFF in the ACM Characterization window;
- Match the ACM port(s) in the PORT field with the analyzer measurement port(s) in the VNA PORT field as shown in the figure below.

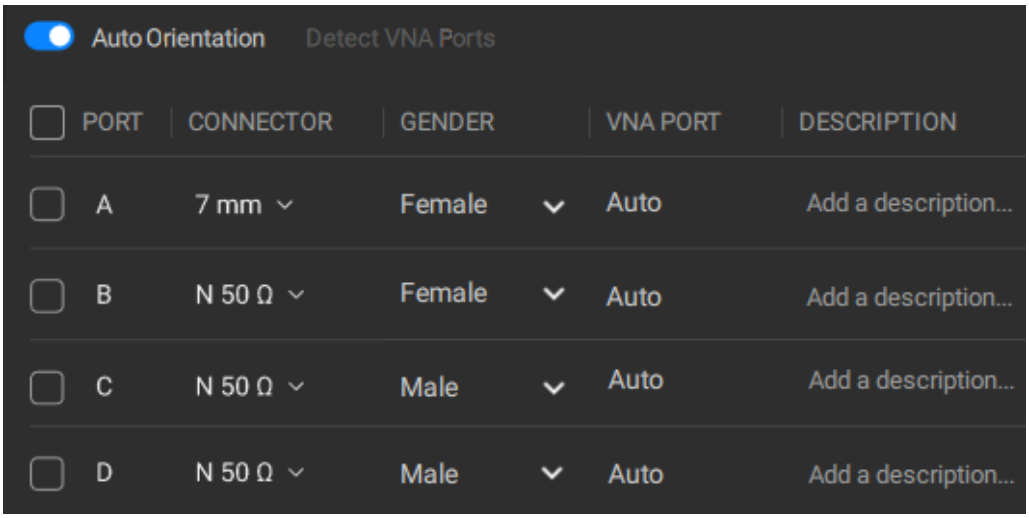
NOTE To define the ports of the VNA and ACM in the manual orientation mode (single, by clicking the button), click on the button **Detect VNA ports**.

NOTE It is recommended to use automatic orientation. The **Auto Orientation** toggle button is disabled.

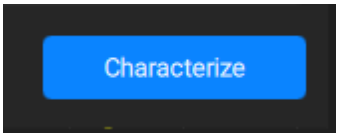


9 Select calibration plane (see section Selecting Calibration Plane):

- Select the connector type and connector type of the adapters screwed onto the ACM in the corresponding CONNECTOR and GENDER fields for each ACM port ;
- Add a description of the adapters screwed onto the ACM to the DESCRIPTION field.

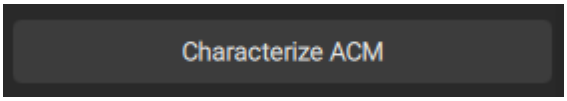


10 To perform characterization, click on the **Characterize** softkey in the ACM Characterization window.

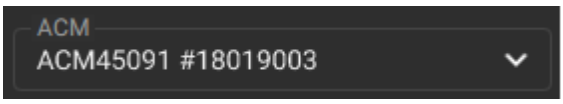


Deleting User Characterization

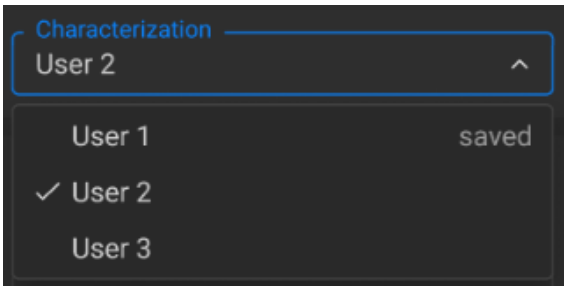
1 Click on the buttons **Calibration > Characterize ACM** in the sidebar.



2 Select ACM from the **ACM** list in the ACM Characterization window.

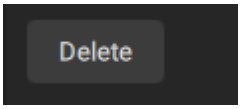


3 Select a user characterization from the **Characterization** list in the ACM Characterization window.



4 Click on the button **Delete**.

NOTE The **Delete** button is not active if the ACM does not contain a characterization under the selected number.



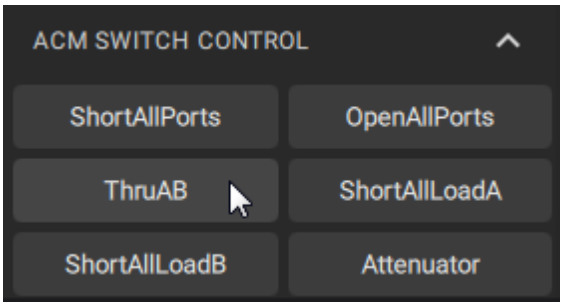
NOTE Use the function to delete a previously recorded user characterization of the ACM.

Manual Switch Control

The software allows to manage the ACM switches directly. The ACM states are selected from the list of possible states and switched by pressing the desired state button. The number of switches and states of each ACM are described in the block diagrams of modules.

Manage ACM Switches

1. Connect the ACM to the Analyzer test ports and connect the USB port of the ACM to the USB port of the PC.
2. Click on **Devices** in the main menu.
3. Click on the button with the required ACM state in the ACM SWITCH CONTROL accordion.

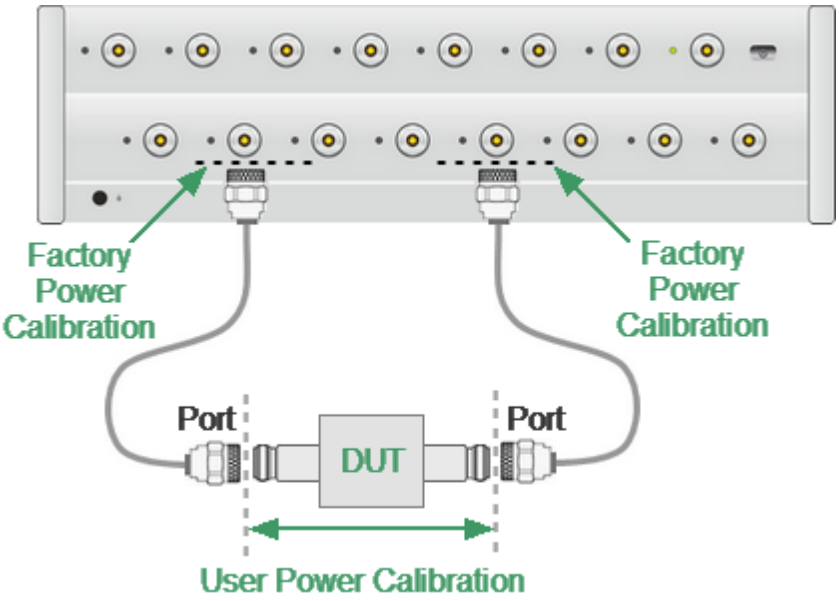


CAUTION This function is intended for advanced users, it is not used in standard ACM work.

Power Calibration

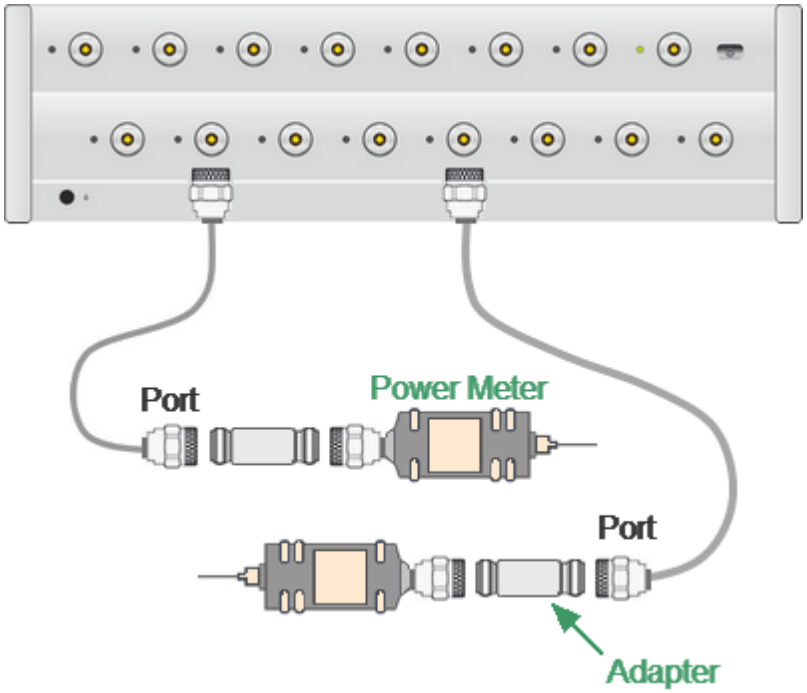
The Analyzer ensures a steady power level at the test port with the specified accuracy. The power level is defined between the instrument's minimum and maximum output power level.

A DUT is connected to the Analyzer by cables (see figure below), which have losses. Power calibration helps to maintain a more accurate power level at a DUT input, adjusted to the use of the cables.



Power Calibration

Power calibration is performed by an external power meter connected to the cables' ends, which are later connected to the DUT. Power correction automatically turns on after the power calibration is completed.



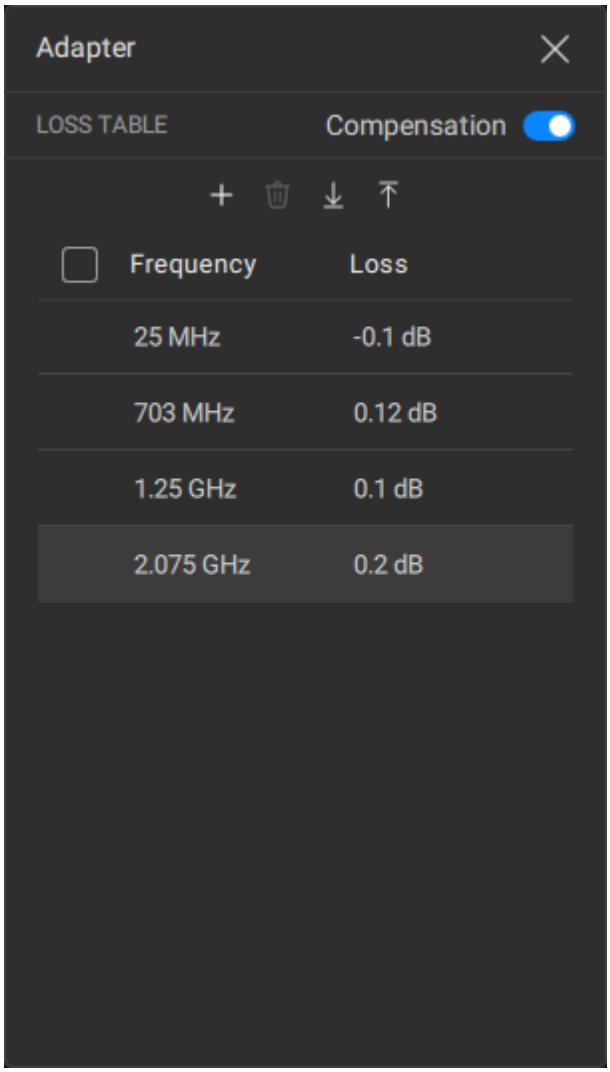
Power Calibration with External Power Meter

NOTE If an adapter or other accessory is used when connecting the power meter to the measurement port, the losses introduced by the adapter or accessory are compensated by the Loss Compensation function.

Loss Compensation Table

The loss compensation function allows to apply compensation for unwanted losses produced between the power meter and the calibrated port in the process of power calibration. Define the losses, which are needed to compensate in the table specifying frequency and losses in the Adapter pop-up window (see figure below).

Linear interpolation will be applied to the losses in the intermediary frequency points. The loss compensation table is defined for each ports group individually.



Adapter Pop-up Window

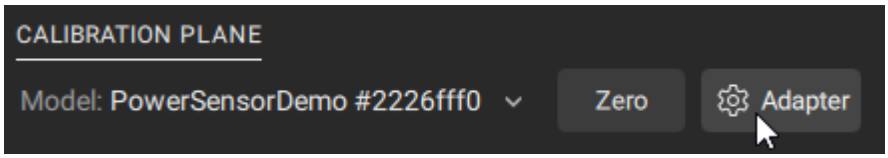
Filling out Loss Compensation Table

To have the losses compensated, fill out the table manually or download from a file for each port group before starting the power calibration procedure and enable this function.

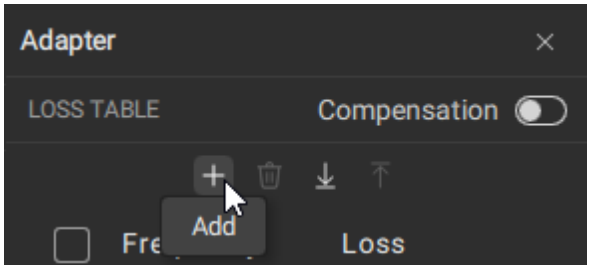
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1. Create and configure a configuration with power calibration (see Power Calibration Procedure).

2. Select the group of ports and click on the **Adapter** button in CALIBRATION BUTTON tab.



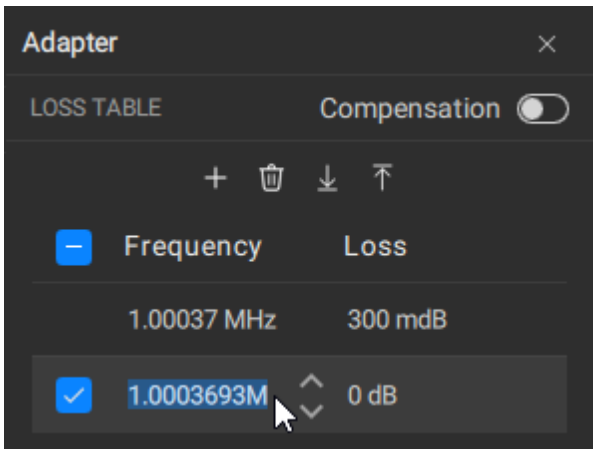
3. Add a line to the table by clicking on  icon in the pop-up window.



3. Enter the required frequency and loss values.

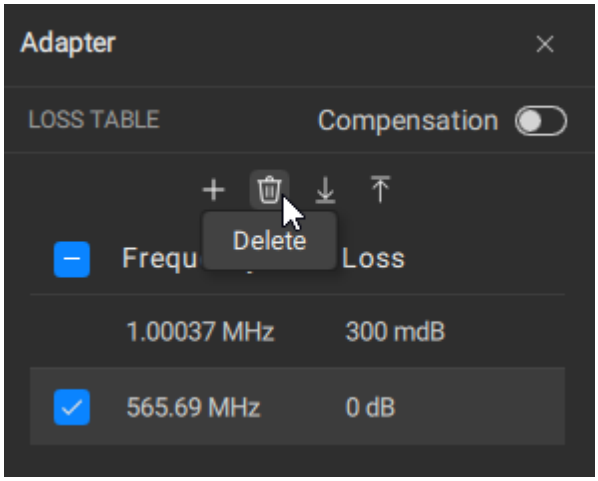
4. Add the next line and enter the frequency and loss values.

NOTE The newline frequency value cannot be set less than the previous one.



NOTE

To delete lines in a table, highlight the lines and click on icon in the Adapter pop-up window.



Import or Export Loss Compensation Table

The loss compensation table can be saved into a *.LCT file to a hard disk and later recalled.

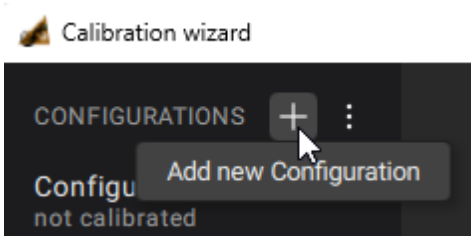
1. Importing the loss compensation table:
   - Click on icon in Adapter pop-up window.
   - Then, select the directory and enter the file name in the dialog that appears.
2. Exporting the loss compensation table:
   - Click on icon in the pop-up window.
   - Then, select the directory and enter the file name in the dialog that appears.

   NOTE When loading a loss table from the file, the current table will not be saved.

Power Calibration Procedure

1. Run Calibration Wizard. Click on the **Calibration > Calibrate** buttons in the sidebar (see Starting Calibration Wizard Pop-up Window).

2. Create a configuration. Click on the + icon in the configuration list (see Adding New Configuration).

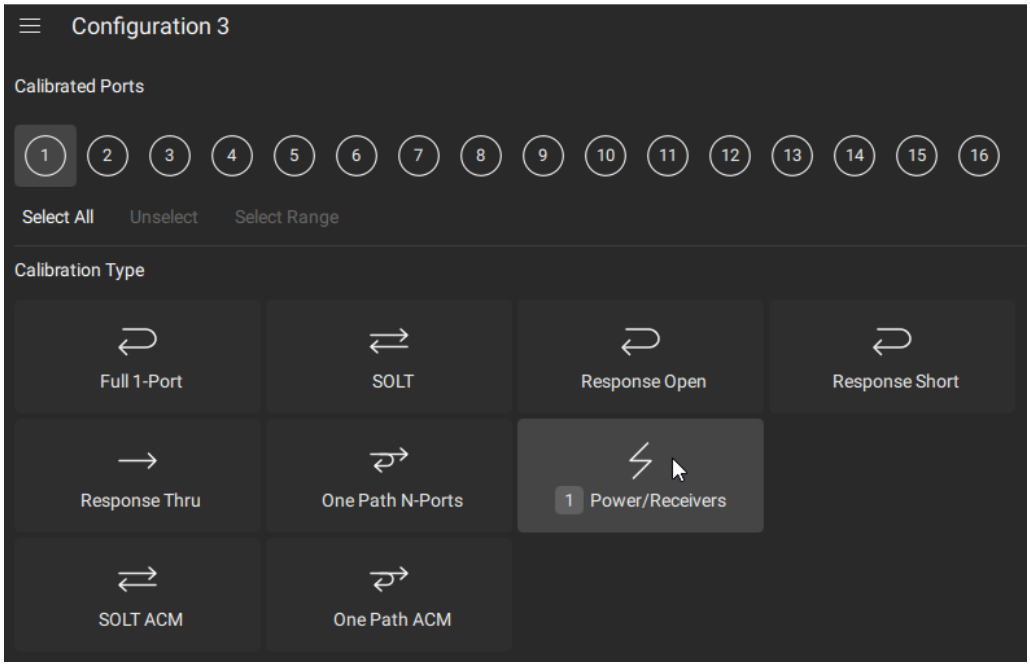


NOTE You can use an existing configuration (see Editing a Configuration).

3. Add ports to a group by clicking on the port number icons in the Calibrated Ports area.

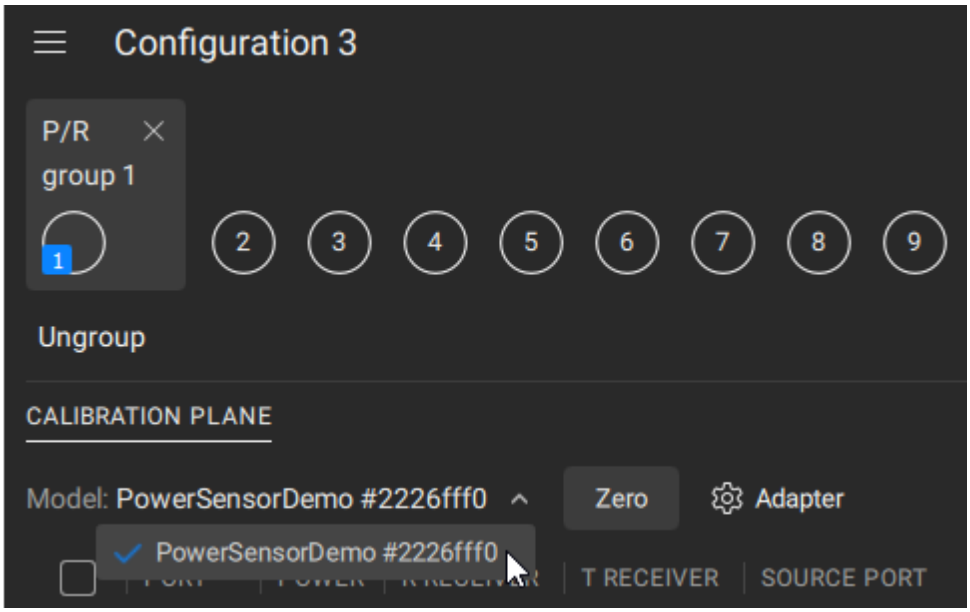
Click on **Power/Receivers** button in the Calibration Type (see Creating a New Ports Group).

NOTE You can add more than one port to the group and perform calibration for multiple ports at once for your convenience.



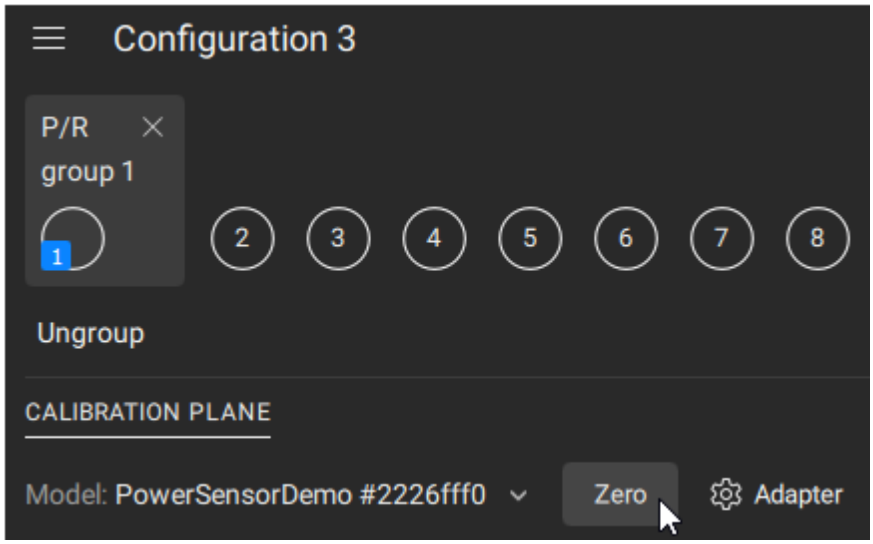
4. Connect the external power meter to the PC.

5. Click on the **Model** drop-down list and select the required power meter in the drop-down list.



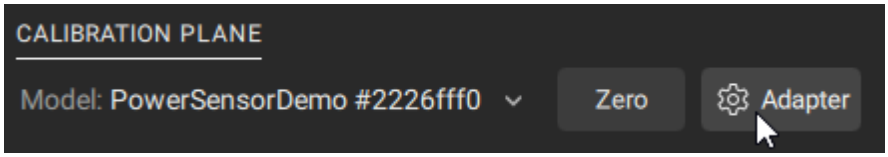
6. If you want to perform zero correction, click on **Zero** button.

NOTE You can also perform zero correction in the calibration step.

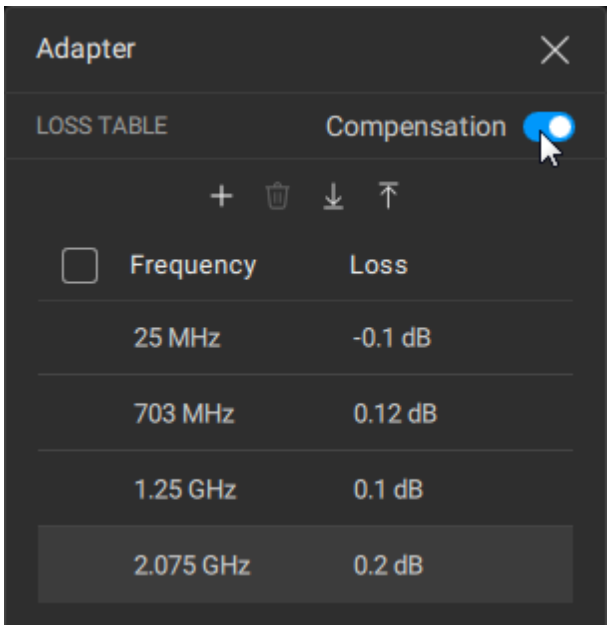


7. If you want to compensate for the loss between the power meter and the calibrated test ports for each port group:

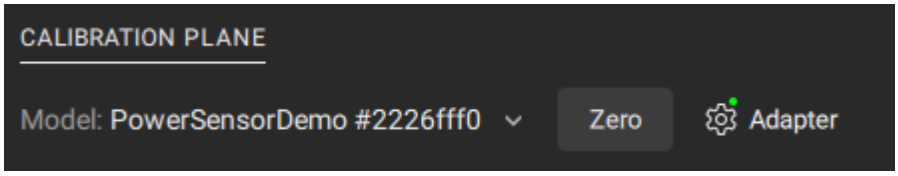
    1. Click on the **Adapter** button in CALIBRATION BUTTON tab.



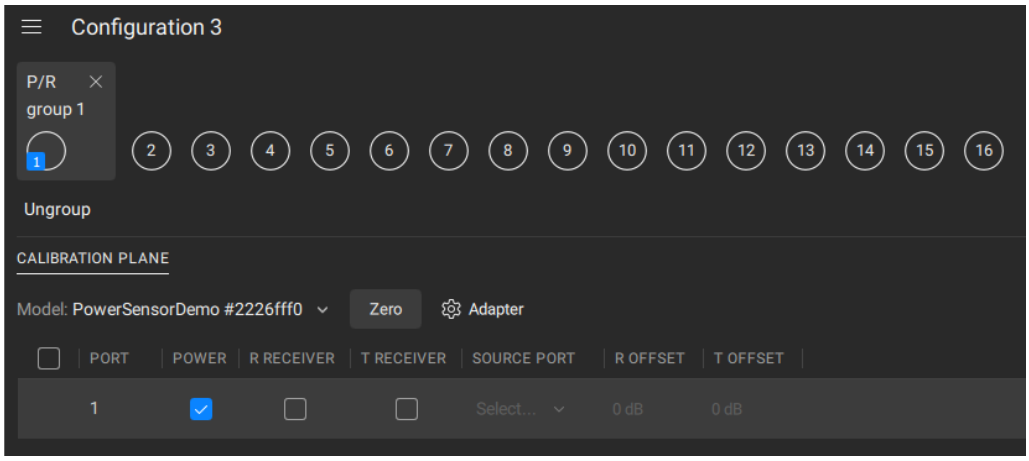
2. If the loss compensation table is not completed, fill it in manually (see Filling out Loss Compensation Table) or load it from the file (see Import or Export Loss Compensation Table).
3. Toggle **Compensation** ON.



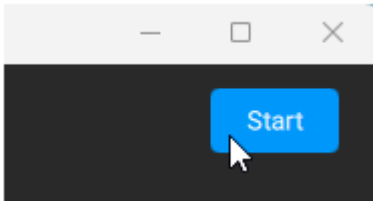
NOTE If loss compensation is enabled, a green dot will appear next to the icon in the **Adapter** button.



8 By default, the checkbox(es) for the selected port group are already selected in the POWER field of the table. Do not clear the checkbox(es).

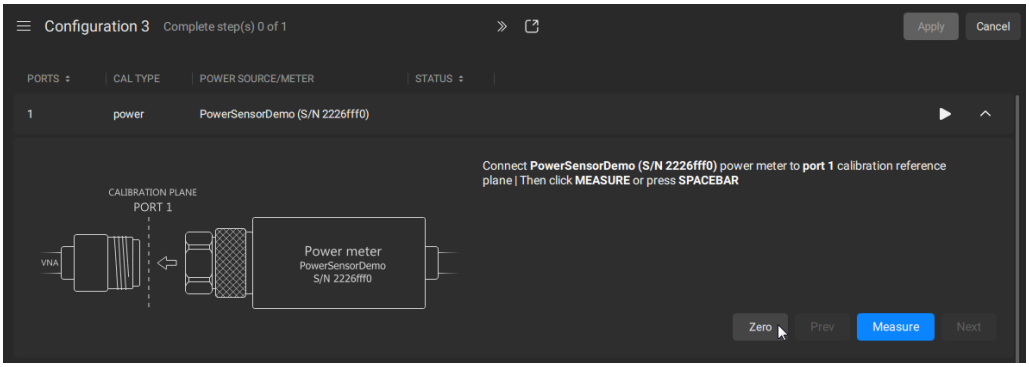


9 Click on **Start** button.



10 Connect the external power meter to desired port. If you want to perform zero correction, click on **Zero** button.

NOTE The power meter sensor can be connected to the port, as during zero setting the output signal of the port is turned off.

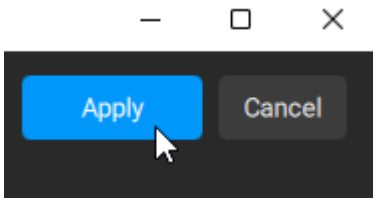


11 Click on **Measure** or press **SPACEBAR** in the corresponding calibration step. Wait until the measurements are completed (**Completed** appears in the Status field).

12 If you are calibrating for more than one port, connect an external power meter to the next port and measure the appropriate step.

13 Click on **Apply** button.

NOTE The **Apply** button is available only after all calibration steps are completed.



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SENSe:CORRection:CONFiguration:GROup:PSENsor:SELect

SENSe:CORRection:CONFiguration:GROup:PSENsor:ZERO

SENSe:CORRection:CONFiguration:GROup:POWer:STATe

SENSe:CORRection:COLLect:STARt

SENSe:CORRection:COLLect:STEP:POWer:ZERO

SENSe:CORRection:COLLect:STEP:MEASure

SENSe:CORRection:COLLect:STEP:ACQuire:POW

SENSe:CORRection:COLLect:SAVE

NOTE

After the power calibration is completed, power correction automatically turns on for the calibrated port(s). When calibration is applied, the **PC** calibration status is displayed in the trace manager (see Trace Manager).

Displaying the Absolute Power Trace

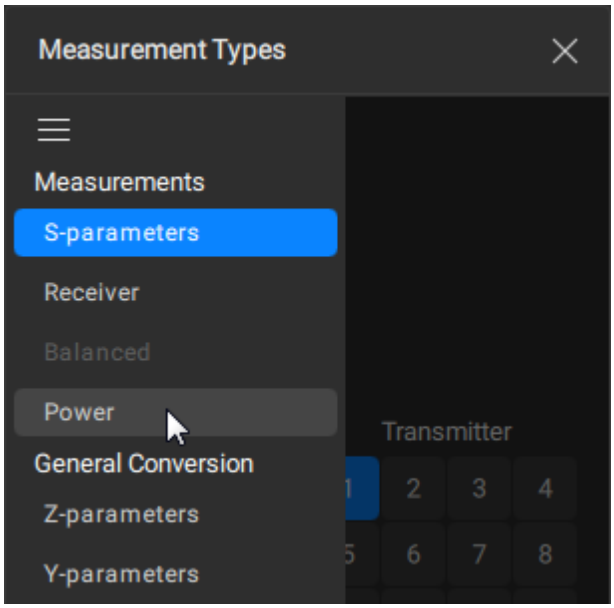
1. Select power meter (see Power Meter Settings) by clicking on **Devices** button in the main menu. Click on the drop-down list in POWER METER accordion in the submenu and select the required power meter.

2. Add a trace (see Adding a Trace).

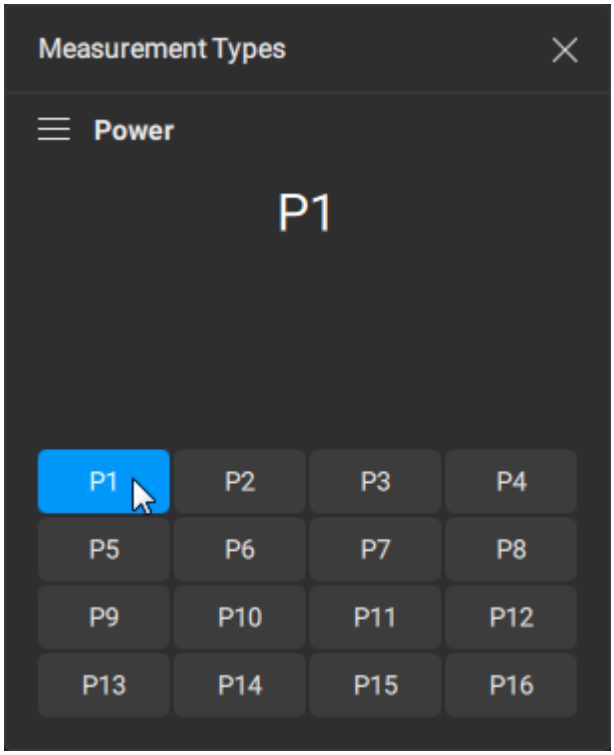
3. Click on **Trace > More Measurement** buttons in the sidebar.

4. In the **Measurement Types** pop-up window (see figure below):

   - Click on the icon and select **Power** in the list.



   - Click on the button with the number of the calibrated port.



Enabling or Disabling Power Correction

1. Select the channel (see Selection of Active Trace, Diagram, Channel).

2. Click on **Channel** button in the main menu.

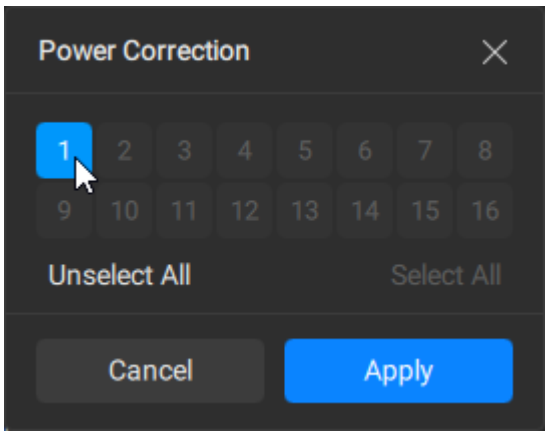
3. Click on **Power Correction** field in the submenu.



4. Click on the button with the port number in the **Power Correction** window.

NOTE Only ports for which power calibration has been performed can be turned ON/OFF.

NOTE To unselect all ports, click on **Unselect All** at the bottom of the window; to select all ports, click on the **Select All** button.



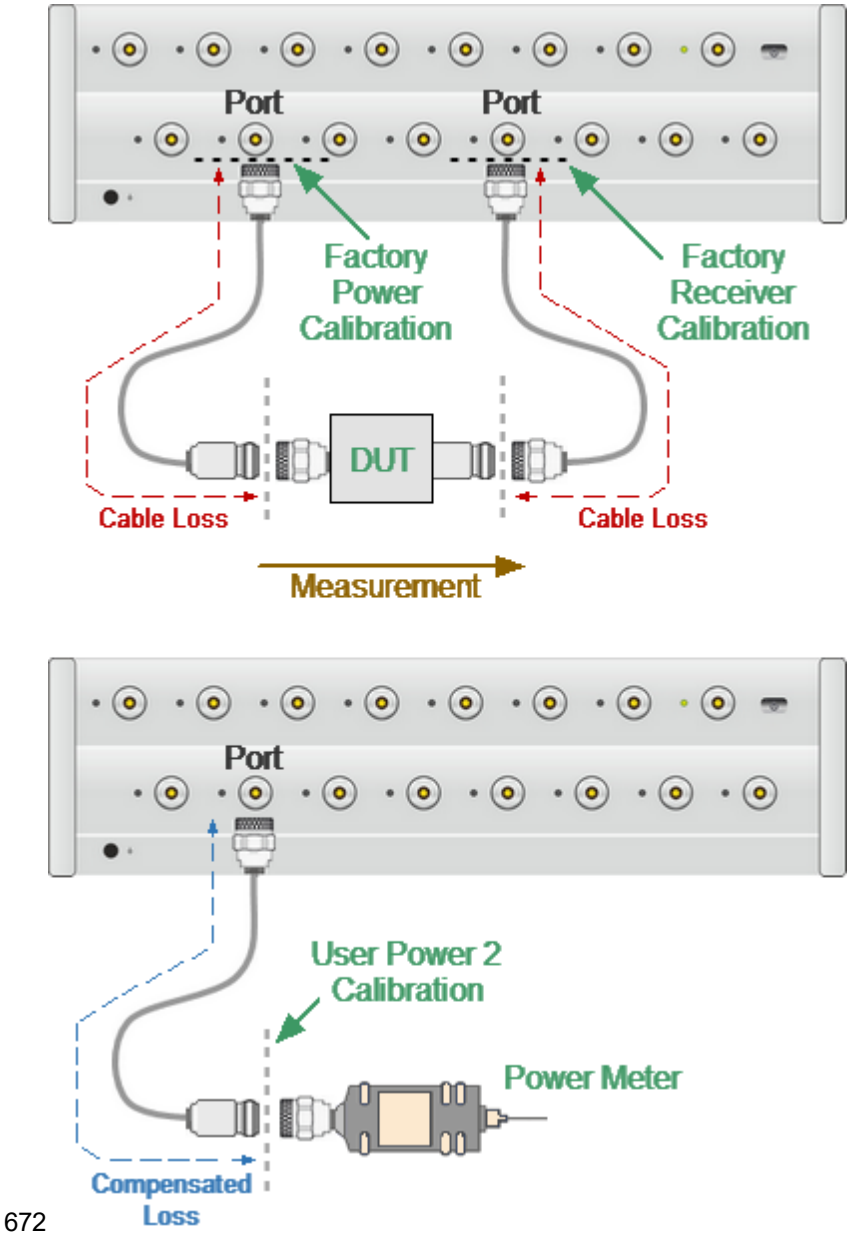
5 Click on **Apply** button.

Receiver Calibration

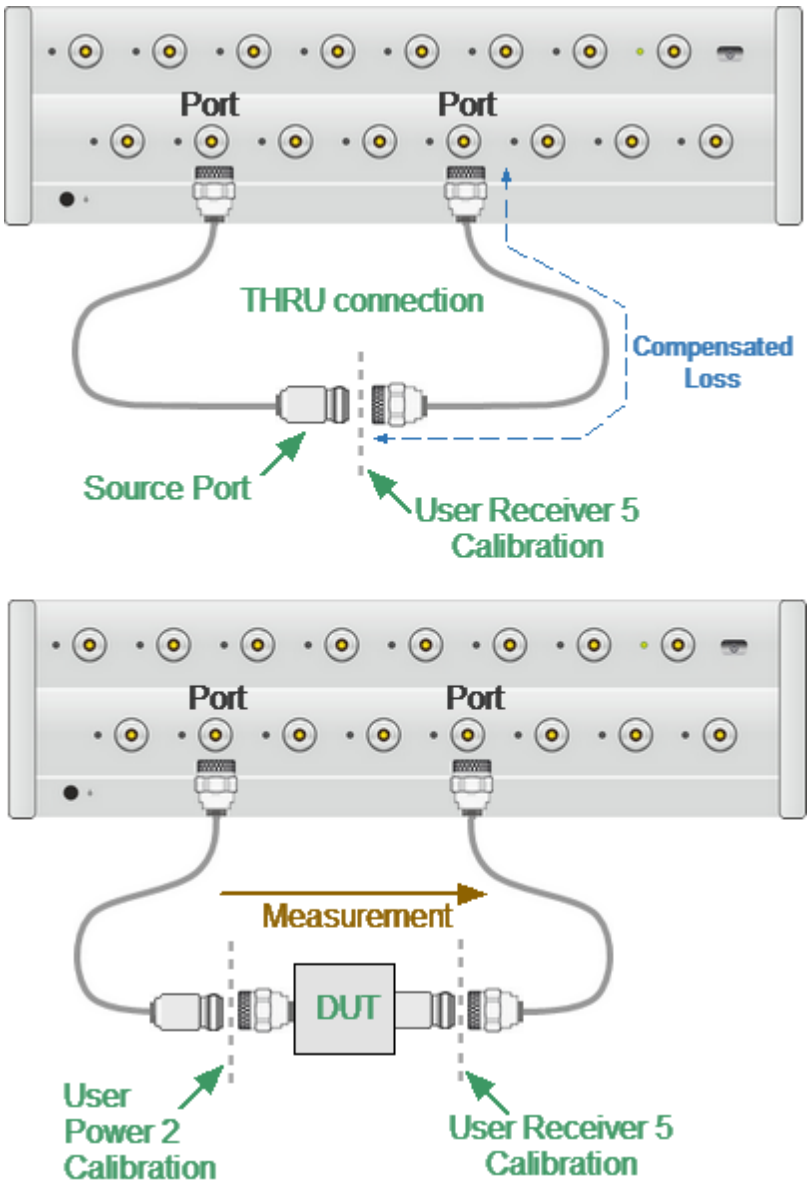
Receiver calibration is only used for absolute measurements. The receiver calibration is divided into the test receiver calibration T1, T2, ... T16 and the reference receiver calibration R1, R2, ... R16 (see Analyzer Block Diagram). The calibration procedure is different for these receivers.

1. Test receiver calibration

When performing absolute power measurements (see Absolute Measurements), the gain of receivers is factory calibrated to test port on the front panel.



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Receiver Calibration

In practice, the power is measured at test port inputs made by the fixture producing losses. The test receiver calibration allows to measure the power at port inputs with higher accuracy.

The receiver calibration is performed by sending the calibration signal from the source port to the calibrated port input. The receiver calibration requires the connection between the both test ports using THRU connection.

To make the receiver calibration most accurate, first perform power calibration on the source port. If the source power calibration was not performed, the calibrated port needs to be connected to the source port on the front panel.

2. Reference receiver calibration

When performing a receiver calibration on a reference receiver, no connection is necessary as the receiver is internally connected to the source.

3. Receiver offset

It is possible to specify the receiver offset value before calibration. As a result, the receiver readings will be offset by this value.

4. General comments

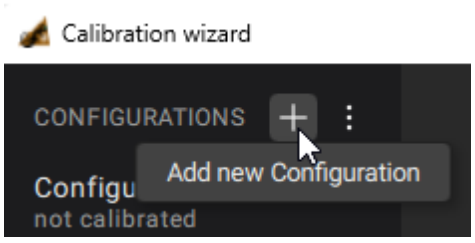
After the receiver calibration is completed, receiver correction automatically turns on. Later it is possible to disable or enable again the receiver correction function.

The receiver calibration is performed for each port and each channel individually.

Receiver Calibration Procedure

1. Run Calibration Wizard. Click on the **Calibration > Calibrate** buttons in the sidebar (see Starting Calibration Wizard Pop-up Window).

2. Create a configuration. Click on the + icon in the configuration list (see Adding New Configuration).

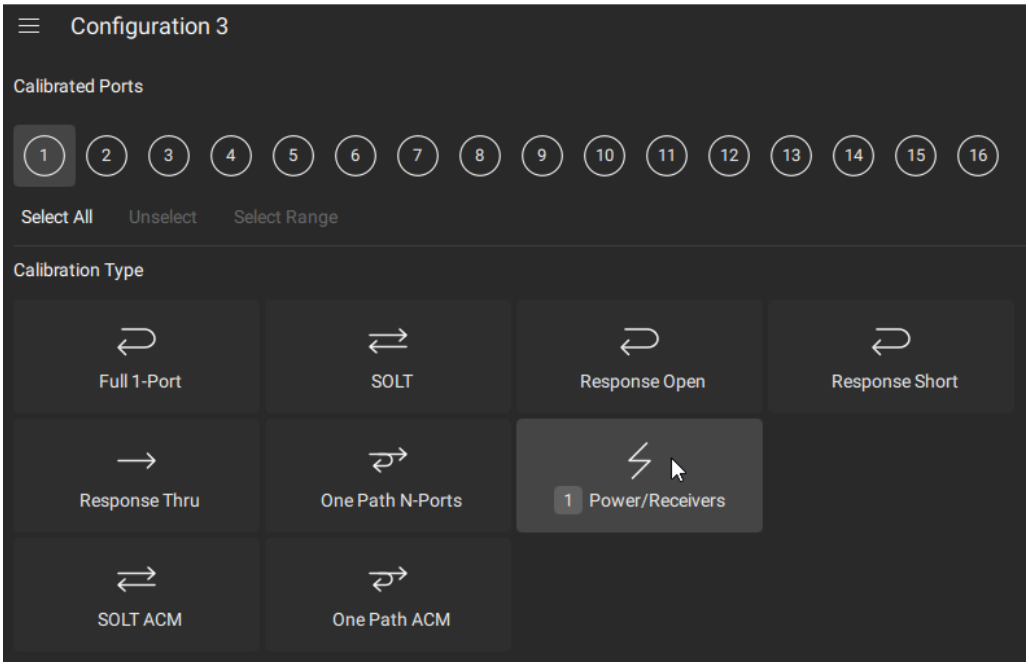


NOTE You can use an existing configuration (see Editing a Configuration).

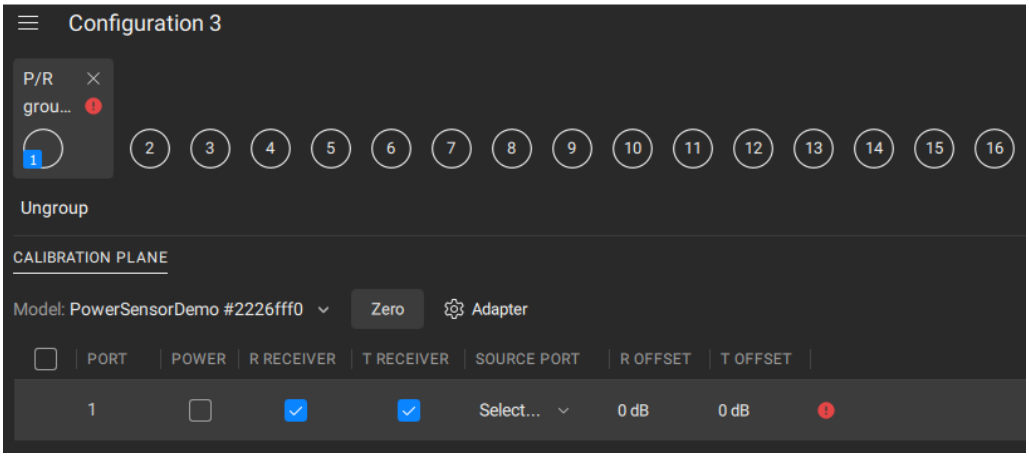
3. Add ports to a group by clicking on the port number icons in the Calibrated Ports area.

   Click on the **Power/Receivers** button in the Calibration Type (see Creating a New Ports Group).

NOTE You can add more than one port to the group and perform calibration for multiple ports at once for your convenience.



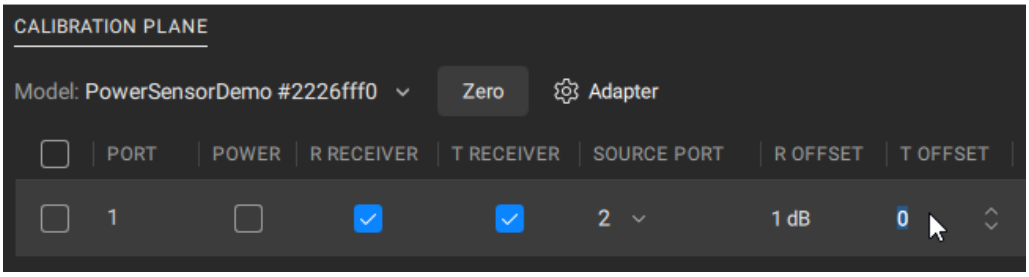
4 Select **R RECEIVER** and **T RECEIVER** checkboxes, clear **POWER** checkbox in the corresponding fields in the table.



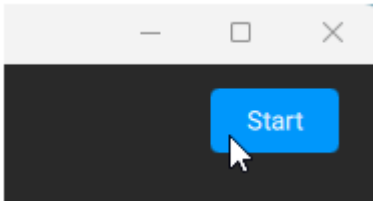
5 Click on **SOURCE PORT** drop-down list and select the port number.

NOTE The selected port will be the source for test receiver calibration. The port number cannot be the same as the port being calibrated. Make sure the selected port is power calibrated if you are not making a direct connection to that port in the factory calibration plane.

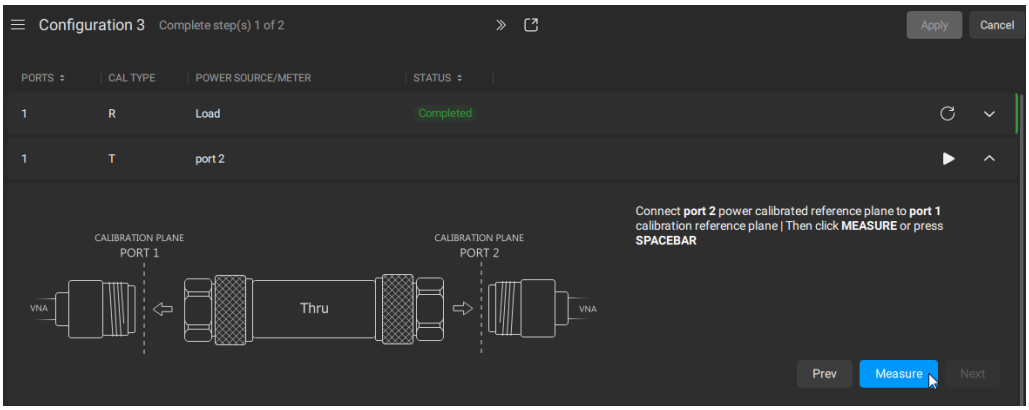
6 Click on **R OFFSET** and(or) **T OFFSET** textboxes and enter the receivers offset values.



7 Click on the **Start** button.

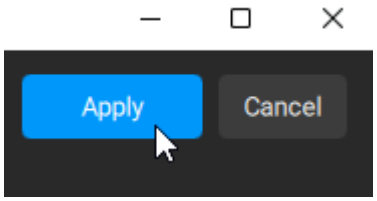


8 Connect standards to desired ports. Click on **Measure** or press **SPACEBAR** in the corresponding calibration step. Wait until the measurements are completed (**Completed** appears in the Status field).



9 Click on the **Apply** button.

NOTE The **Apply** button is available only after all calibration steps (except the optional step) are completed.



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SENSe:CORRection:CONFiguration:GROup:TCHannel:SOURce

SENSe:CORRection:CONFiguration:GROup:RCHannel:STATe

SENSe:CORRection:CONFiguration:GROup:TCHannel:STATe

SENSe:CORRection:CONFiguration:GROup:RCHannel:OFFSet

SENSe:CORRection:CONFiguration:GROup:TCHannel:OFFSet

SENSe:CORRection:COLLect:STARt

SENSe:CORRection:COLLect:STEP:MEASure

SENSe:CORRection:COLLect:STEP:ACQuire:RCH

SENSe:CORRection:COLLect:STEP:ACQuire:TCH

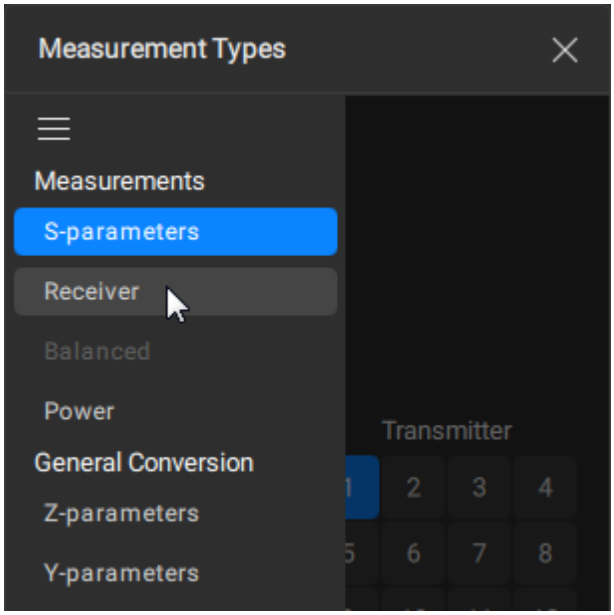
SENSe:CORRection:COLLect:SAVE

NOTE

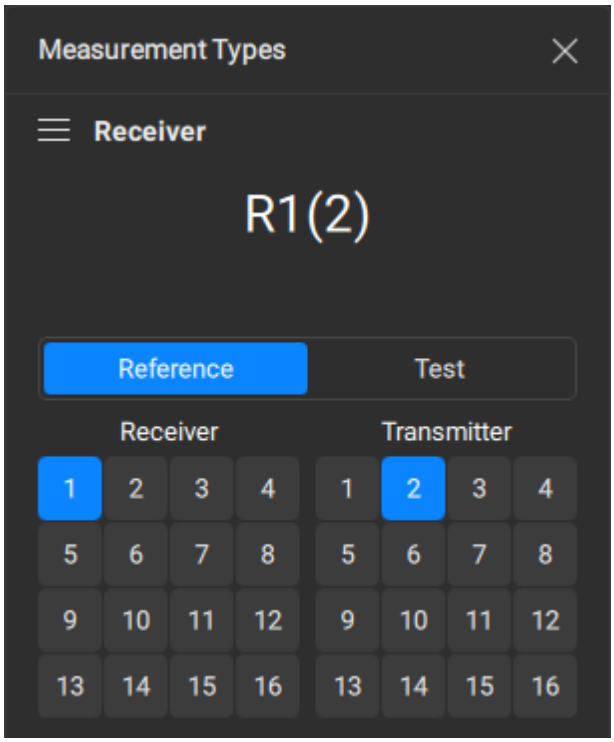
After the receiver calibration is complete, receiver correction automatically turns on. When calibration is applied, the **RC** calibration status is displayed in the trace manager (see Trace Manager).

Displaying the Absolute Receiver Trace

1. Add a trace (see Adding a Trace).
2. Click on **Trace > More Measurement** buttons in the sidebar.
3. In the **Measurement Types** pop-up window (see figure below):
   - Click on the  icon and select **Receiver** in the list.



- Click on the **Reference** or **Test** button in the segment switch.
- Click on the port number button in the **Receiver** and **Transmitter** areas.

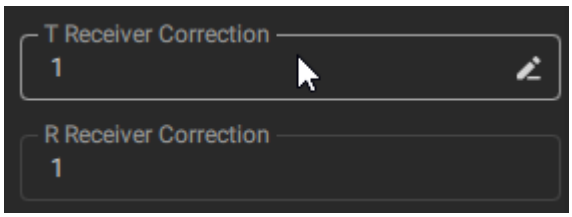


Enabling or Disabling Receiver Correction

1. Select the channel (see Selection of Active Trace, Diagram, Channel)

2. Click on **Calibration** button in the main menu.

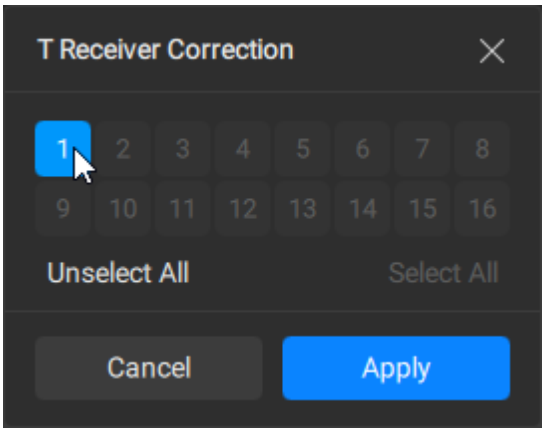
3. Click on **T Receiver Correction** or **R Receiver Correction** field in the submenu.



4. Click on the button with the port number in the **T Receiver Correction** or **R Receiver Correction** window.

NOTE Only ports for which receiver calibration has been performed can be turned ON/OFF.

NOTE To unselect all ports, click on **Unselect All** at the bottom of the window; to select all ports, click on the **Select All** button.



5. Click on **Apply** button.

Confidence Check Procedure

Perform a confidence check if the reliability of the current calibration needs to be verified. This function can be used to check the accuracy of either calibration performed with an ACM or with a mechanical calibration kit.

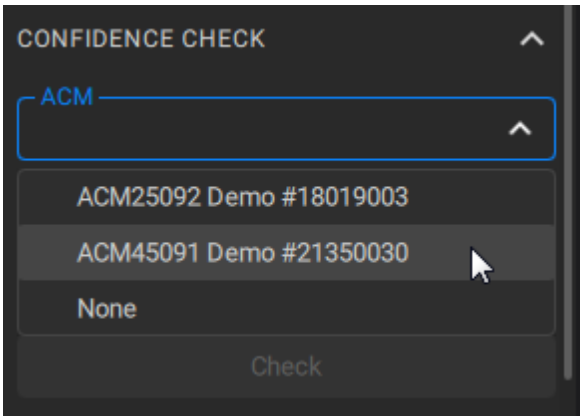
After the measurement is completed, two traces for each S-parameter will be displayed. The measured parameters will be shown as the data trace, and the ACM or mechanical calibration kit parameters will be shown as the memory trace.

Compare the data trace and the memory trace of the same parameter, for example, S21. To perform more accurate comparison, enable the function of math operations between data and memory traces (see Mathematical Operations). In the logarithmic magnitude or phase format, use the Data/Memory operation. In the linear magnitude format, use the Data-Memory operation.

The conclusion on whether the current calibration provides enough accuracy or not is made by the user.

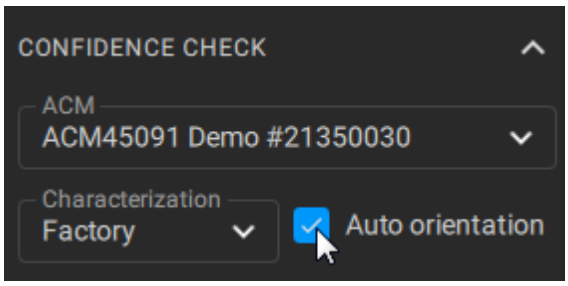
Performing Confidence Check

1. Enable the display of the data trace for the needed parameter (see S-Parameters), for example, S31. It is possible to enable several data traces simultaneously, for example, S11, S13, S31, S13.
2. Connect the ACM to the Analyzer test ports and connect the USB port of the ACM to the USB port of the PC.
3. Click on **Calibration** in the main menu.
4. Select the ACM by clicking on the **ACM** drop-down list in the CONFIDENCE CHECK accordion in the submenu.

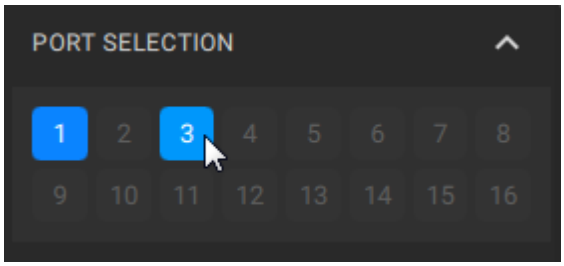


5 If you want to turn off automatic orientation:

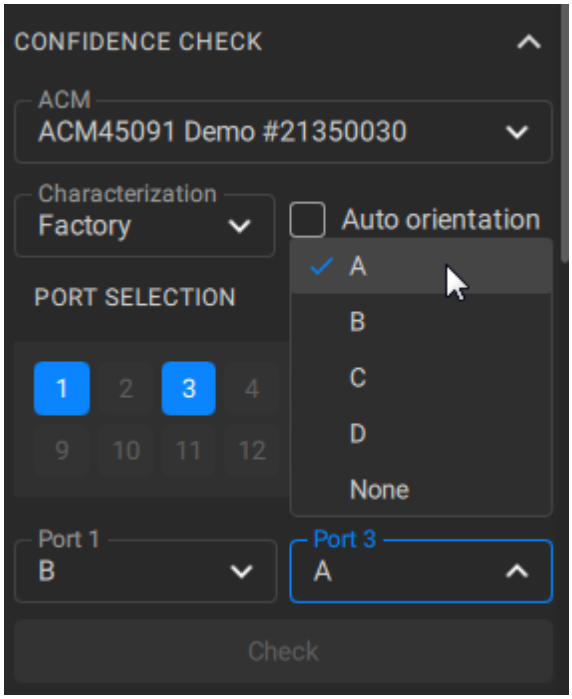
- Clear the **Auto Orientational** checkbox.



- Select the analyzer port to which the ACM is connected by clicking on the corresponding number in the area in PORT SELECTION accordion.

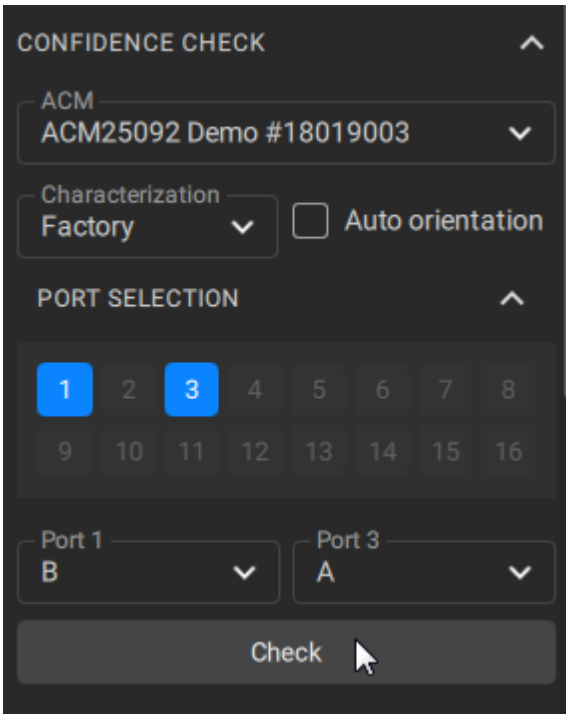


- Match the ACM port(s) to Analyzer port(s) in the corresponding **Port n** drop-down list (see figure below).



NOTE Automatic orientation is recommended.

6 Click on **Check**.



Error Correction Status

The error correction status is indicated for each trace individually in the trace manager. A general status of error correction is also available for all traces of a channel in the channel status bar.

General error correction status

The general error correction status for all S-parameter traces of a channel is indicated in the specific field on a channel status bar. For a description of the channel status bar, see Channel Status Bar.

Symbol	Definition
Cor	Error correction is enabled. The stimulus settings are the same for the measurement and the calibration.
C?	Error correction is enabled. The stimulus settings are not the same for the measurement and the calibration. Interpolation is applied.
C!	Error correction is enabled. The stimulus settings are not the same for the measurement and the calibration. Extrapolation is applied.
None	Error correction is turned OFF.
	No calibration data. No calibration was performed.

Trace error correction status

The error correction status for each individual trace is indicated in the FUNCTIONS field in the Trace Manager. The table below shows the possible statuses.

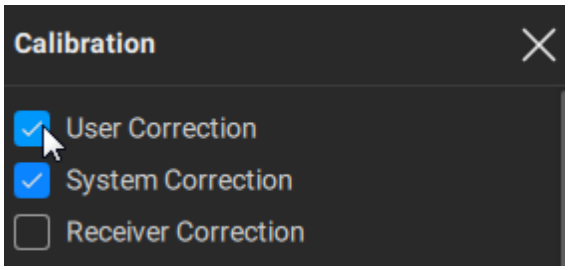
Symbols	Definition
RO	OPEN response calibration
RS	SHORT response calibration
RT	THRU response calibration
OP	One-path N-port calibration
F1	Full one-port (SOL) calibration
F2, F3, F4, F5, F6, F7, F8, F9, F9, F10, F11, F12, F13, F14, F15, F16	Full N-port SOLT calibration (N take a value from 2 to 6/8/10/12/14/16. N depending on the Analyzer model, see corresponding datasheet).

Enabling or Disabling Error Correction

This feature disables the error correction function, which automatically becomes enabled after completion of calibration by any method.

1. Click on the **Calibration** button in the main menu.

2. Select or clear the **User Correction** checkbox in the submenu.



SCPI SENSe:CORRection:STATe

System Correction

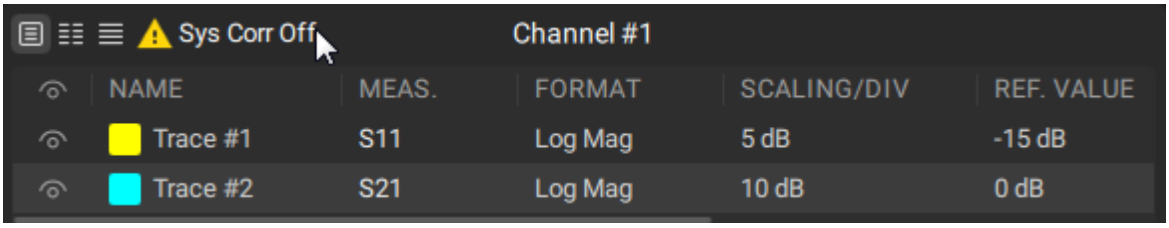
The Analyzer is supplied by the manufacturer calibrated, with calibration coefficients stored in its non-volatile memory. The factory calibration is used by default for the initial correction of the measured S-parameters. Such calibration is referred to as system calibration, and error correction is referred to as system correction.

System correction confirms the initial values of the measured S-parameters before the Analyzer is calibrated by the user. System calibration is performed on the plane of the physical port connectors and does not account for the cables and other fixtures used to connect the DUT. The measurement accuracy of the Analyzer with a user setup prior to calibration is not rated.

Normally, disabling the system correction setting is **not required** for calibration and further measurements.

System correction can be disregarded only when a proper calibration has been performed. If user calibration has been performed, the measurement accuracy of the Analyzer is determined by the user calibration and does not depend on the system correction status. If user calibration has not been performed, then enabling/disabling system calibration would have an impact on measurements.

You can disable system correction of channels in the trace manager (see figure below). Correction is enabled by default.

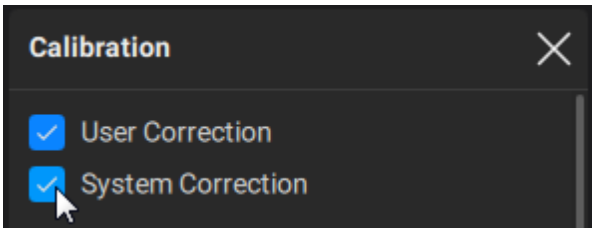


Indication of System Correction Being Disabled

Enabling or Disabling System Correction for Channel

1. Select the channel (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Calibration** in the main menu.

3 Select or clear the **System Correction** checkbox.



SCPI SYSTem:CORRection

System Impedance Z0

Z0 is the system impedance of a measurement network. Normally, it is equal to the impedance of the calibration standards used for calibration. The Z0 value should be specified before calibration, as it is used for calibration coefficient calculations.

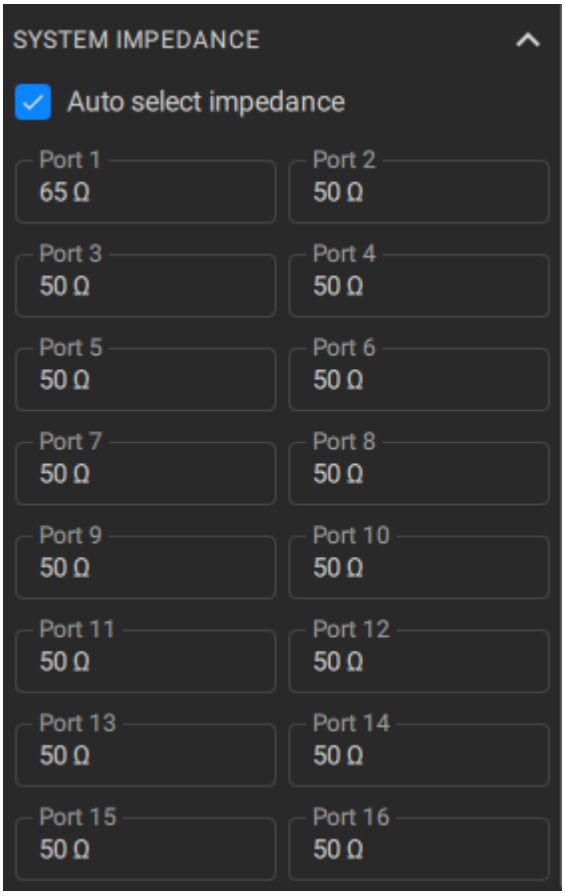
For waveguide calibration, the system impedance must be set to 1 Ω.

The impedance of all test ports is the same for most of measurement types. The Analyzer can perform measurements when Z0 values of the test ports are different, for example, Type N50 – Waveguide. For such measurements, use different impedance settings for the test ports.

NOTE To calibrate the Analyzer with different port impedances, Z01, Z02, ... Z0N (N take a value from 6/8/10/12/14/16, N depending on the Analyzer model, see corresponding datasheet), the Unknown Thru method is provided (described in Non-Insertable Device Measuring).

Manual Z0 Setting

1. Select channel (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Calibration** button in the main menu.
3. Click on the **Port 1**, **Port 2**, etc. textboxes in the SYSTEM IMPEDANCE accordion and enter the numerical value.



SCPI SENSe:CORRection:IMPedance

Automatic Z0 Selecting

The automatic system impedance selecting function sets Z0 during the process of calibration standard measurement, using data from the definition of the calibration standard in a calibration kit. Z0 of the corresponding port is set when measuring one-port standards. Z0 of the two ports is set when measuring two-port standards. The UNKNOWN THRU standard does not make any changes in Z0 of the ports. By default, the function is enabled, but it can be disabled.

Enabling or Disabling Automatic Z0 Selecting

1. Select channel (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Calibration** in the main menu.
3. Select or clear the **Auto select impedance** checkbox in the submenu.

Calibration Trigger Source

The function sets the trigger source to start measuring the calibration standards. If an Internal source is selected, the calibration starts immediately. If the source is System, the system trigger is used to start the calibration.

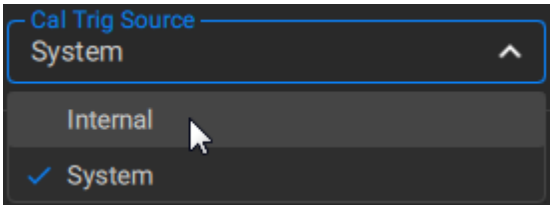
If a system trigger is used, the averaging trigger function and the external trigger event function set On Point affect the start of the calibration in the same way as during regular measurements. When using a system trigger, the trigger source Bus should not be used, otherwise the software may be blocked.

NOTE This function does not apply to calibration using the ACM, power calibration, receiver calibration. In these calibrations, the internal trigger is always used.

Selecting Calibration Trigger Source

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1. Select the source of the system trigger (see Trigger Source).
2. Select channel (see Selection of Active Trace, Diagram, Channel).
3. Click on the **Calibration** in the main menu.
4. Select required calibration trigger source in the **Cal Trig Source** drop-down list.



Measurement Data Analysis

The following section describes the process of measurement data analysis using the Analyzer.

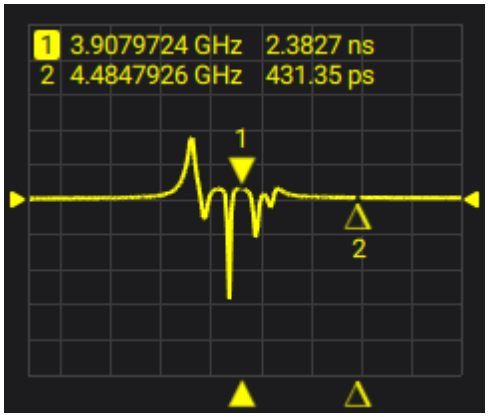
Special software marker tools are used to read and look up the numerical values of the stimulus and the measured value on selected points on the graph. For a detailed description, see Markers.

This section also contains information about various functions and tools used to analyze measurements.

- Memory Trace Function is used to save data traces and perform mathematical operations between memory and data traces.
- Trace Hold is used to hold the maximum or minimum values of the trace.
- Fixture Simulation is used to simulate measurement conditions that differ from real measurement conditions.
- Time Domain is used to convert the measured characteristics in the frequency domain into the circuit response in the time domain.
- Time Domain Gating is used to eliminate unwanted responses in the time domain.
- A function of pass/fail determination for the trace of the measurement data according to various criteria:
    1. Limit Test is used to compare the trace of the measured value with the limit line.
    2. Ripple Limit Test is used to check the value of the ripple trace with user-defined ripple limits.
    3. Peak Limits Test is used to check if the peak of the trace of the set polarity falls within the limits for the peak.

Markers

A marker is a tool for numerical readout of a stimulus value and value of the measured parameter in a specific point on the trace. Up to 64 markers can be activated on each trace. A trace with two markers is shown in the figure below.

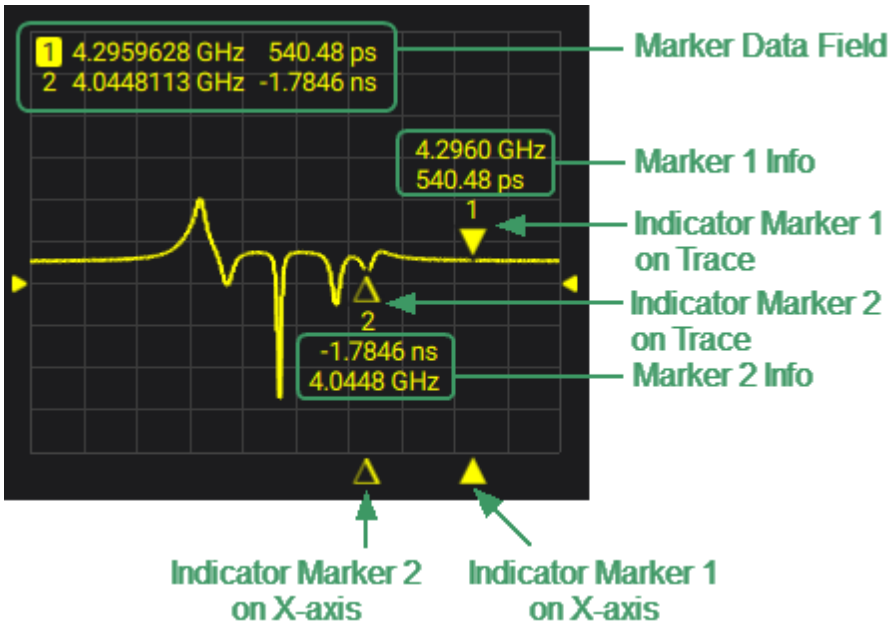


Trace With Two Markers

The markers allow to perform the following tasks:

- Reading absolute values of a stimulus and a measured parameter in selected points on the trace.
- Reading relative values of a stimulus and a measured parameter related to the reference point.
- Search for specific points on the trace (minimum, maximum, target level, etc.).
- Determining trace parameters (statistics, bandwidth, etc.).
- Editing stimulus parameters using markers.

Each marker has the following indication on the chart (see figure below):

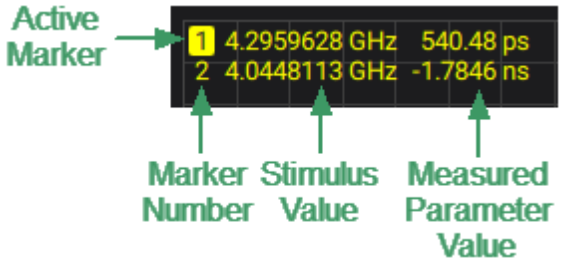


Markers Display in Diagram

- Indicator on the trace and the X-axis (by default, the indicator is displayed in a triangular format. If you want to change the appearance of the indicator, see Marker Styles):

1 ▼	Symbol and number of the active marker on a trace.
Δ 1	Symbol and number of the inactive marker on a trace.
▲	Symbol of the active marker on a stimulus X-axis.
Δ	Symbol of the inactive marker on a stimulus X-axis.

- One row for each marker in the Marker Data Field. The rows in the field are listed in the order the markers were added. Each row contains the marker number and information about its stimulus value (X-axis value) and measured parameter value (Y-axis value). By default, the Marker Data Field is displayed in the upper left corner of the diagram, but you can move it around the diagram to any convenient place. The number of the active marker is highlighted in an inverse color (see figure below).



Marker Data Field

- Marker Info duplicates the information in the Marker Data Field about the stimulus value and the measured parameter value on the indicator. By default, Marker Info is hidden. To enable the Marker Info display, see Marker Styles.

The color of marker matches the user-selected trace color (see Color Picker of Trace).

The value of the measured parameter (Y-axis value) of the marker in Markers Data Field and Marker Info contents vary depending on the display format (rectangular or circular):

- In the rectangular format, the marker shows the measurement parameter value plotted along Y-axis in the active format (see the table below).

Format Type Description	Label	Data Type (Y-axis)	Measurement Unit (Y-axis)
Logarithmic Magnitude	**Log Mag**	S-parameter logarithmic magnitude: $20 \cdot \log\|S\|$, $\|S\| = \sqrt{a^2 + b^2}$	Decibel (dB)
Voltage Standing Wave Ratio	**SWR**	$\frac{1+\|S\|}{1-\|S\|}$	Dimensionless value
Phase	**Phase**	S-parameter phase from –180° to +180°: $\frac{180}{\pi} \cdot arctg\frac{b}{a}$	Degree (°)
Expanded Phase	**Ex Phase**	S-parameter phase, measurement range expanded to from below –	Degree (°)

Format Type Description	Label	Data Type (Y-axis)	Measurement Unit (Y-axis)
		180° to over +180°	
Group Delay	**Delay**	Signal propagation delay within the DUT: $-\frac{d\varphi}{d\omega}$, $\varphi = arctg\frac{b}{a},\ \omega = 2\pi \cdot f$	Second (sec.)
Linear Magnitude	**Lin Mag**	S-parameter linear magnitude: $\sqrt{a^2 + b^2}$	Dimensionless value
Real Part	**Real**	S-parameter real part: $a = re(S)$	Dimensionless value
Imaginary Part	**Imag**	S-parameter imaginary part: $b = im(S)$	Dimensionless value

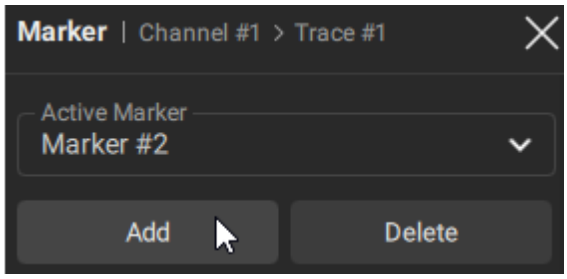
- In the circular format, the marker shows two or three values listed in the table below.

Label	Marker Readings (Measurement Unit)		
	Reading 1	**Reading 2**	**Reading 3**
Smith (Lin)	Linear magnitude	Phase (°)	—
Smith (Log)	Logarithmic magnitude (dB)	Phase (°)	—
Smith (Re/Im)	Real part	Imaginary part	—
Smith (R + jX)	Resistance (Ω)	Reactance (Ω)	Equivalent capacitance or inductance (F/H)
Smith (G + jB)	Conductance (S)	Susceptance (S)	Equivalent capacitance or inductance (F/H)

Label	Marker Readings (Measurement Unit)		
	Reading 1	Reading 2	Reading 3
Polar (Lin)	Linear magnitude	Phase (°)	—
Polar (Log)	Logarithmic magnitude (dB)	Phase (°)	—
Polar (Re/Im)	Real part	Imaginary part	—

Marker Addition

1. Select the channel and trace (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Marker** button in the main menu.
3. Click on the **Add** button in the submenu.

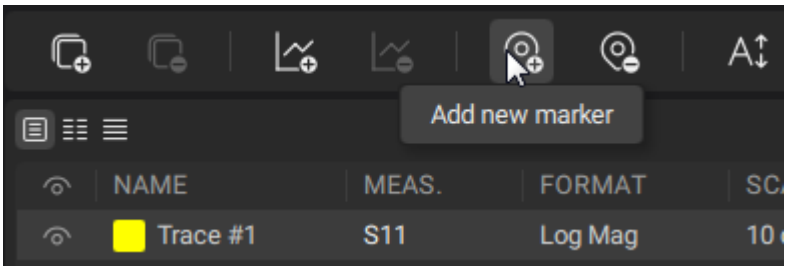


SCPI CALCulate:MARKer

NOTE The new marker appears as the active marker in the middle of the stimulus axis.

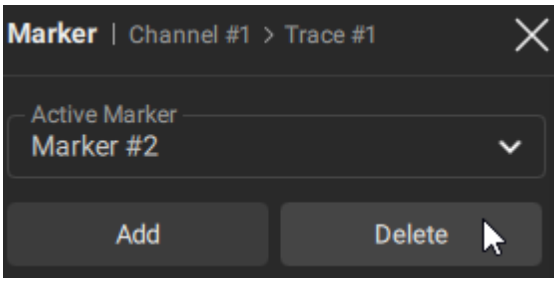
NOTE

You can quickly add marker with the help of the Quick Access Toolbar:



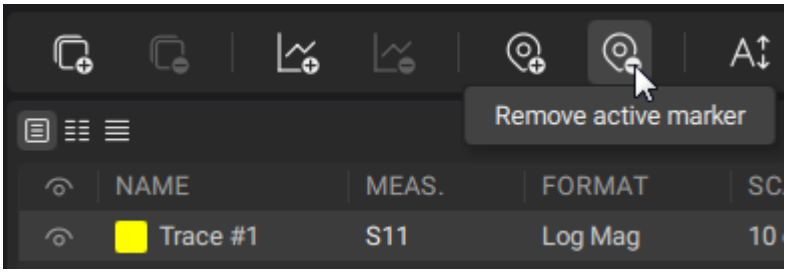
Marker Deletion

1. Select the channel and trace (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Marker** button in the main menu.
3. Click on the **Delete** button in the submenu.



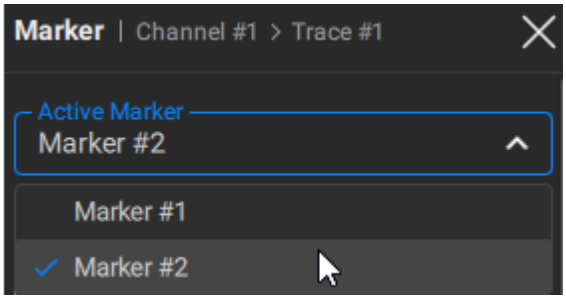
NOTE

You can quickly delete marker with the help of the Quick Access Toolbar:



Marker Activation

1. Select the channel and trace (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Marker** button in the main menu.
3. Click on the **Active Marker** drop-down list in the submenu.
4. Select the marker in the drop-down list.



SCPI CALCulate:MARKer:ACTivate

NOTE A marker can be activated by clicking on it or on the desired marker in the marker data field.

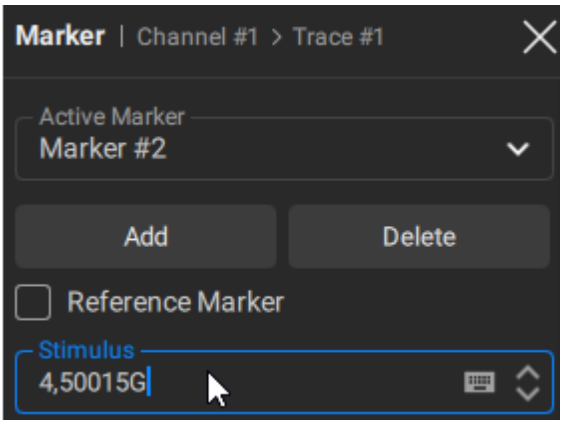
Marker Stimulus Value Setting

The stimulus value must be set by entering the numerical value from the keyboard, by arrows, by dragging the marker using the mouse or by enabling the search function (see Marker Position Search Functions).

1. Select the channel and trace (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Marker** button in the main menu.
3. Click on the **Active Marker** drop-down list in the submenu.

4. Select the marker in the drop-down list.

5. Click on the **Stimulus** textbox in the submenu and enter the numerical values (see figure above).

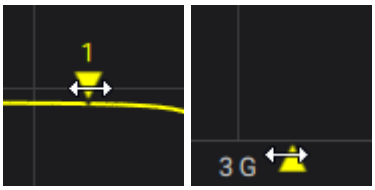


SCPI CALCulate:MARKer:X

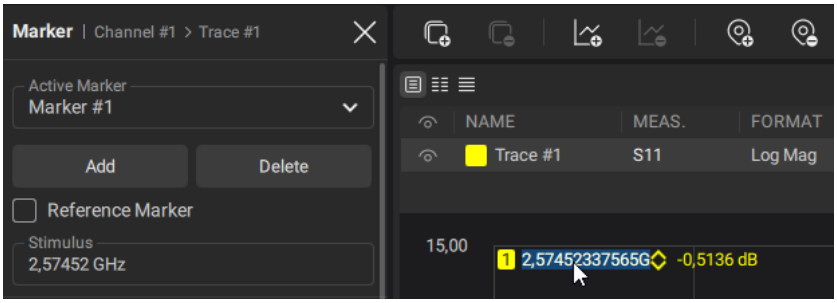
NOTE

The marker stimulus value can be set by either a click and drag operation, or by entering the value using numerical keys of the keyboard.

To drag the marker, first move the mouse pointer on one of the marker indicators until it becomes as shown in the figures below:

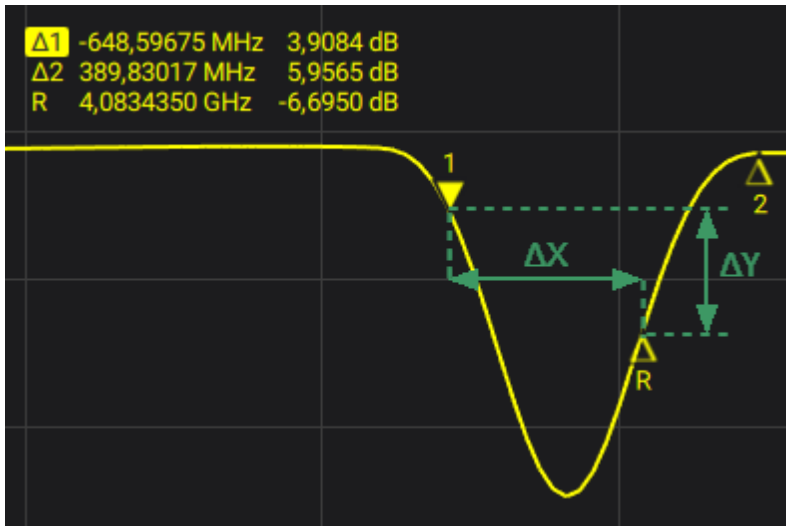


To enter the numerical value of the stimulus, activate its field by clicking it in the marker data line:



Reference Marker Feature

The reference marker feature allows to view the data relative to the reference marker. Other markers readings are represented as delta relative to the reference marker. The reference marker shows the absolute data and is indicated with «R» symbol instead of a number (see figure below). Enabling of a reference marker turns all the other markers to relative display mode.



Reference Marker

Reference marker can be indicated on the trace as follows:

R ▼	Symbol of the active reference marker on a trace.
Δ R	Symbol of the inactive reference marker on a trace.

The reference marker displays the stimulus and measurement absolute values. The rest of the markers display the relative values:

- Stimulus value (ΔX in the figure above) is the difference between the absolute stimulus values of this marker and the reference marker.
- Measured value (ΔY in the figure above) is the difference between the absolute measurement values of this marker and the reference marker.

Enabling Reference Marker

1. Select the channel and trace (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Marker** button in the main menu.
3. Select **Reference Marker** checkbox in the submenu.

SCPI CALCulate:MARKer, CALCulate:MARKer:ACTivate, CALCulate:MARKer:REFerence

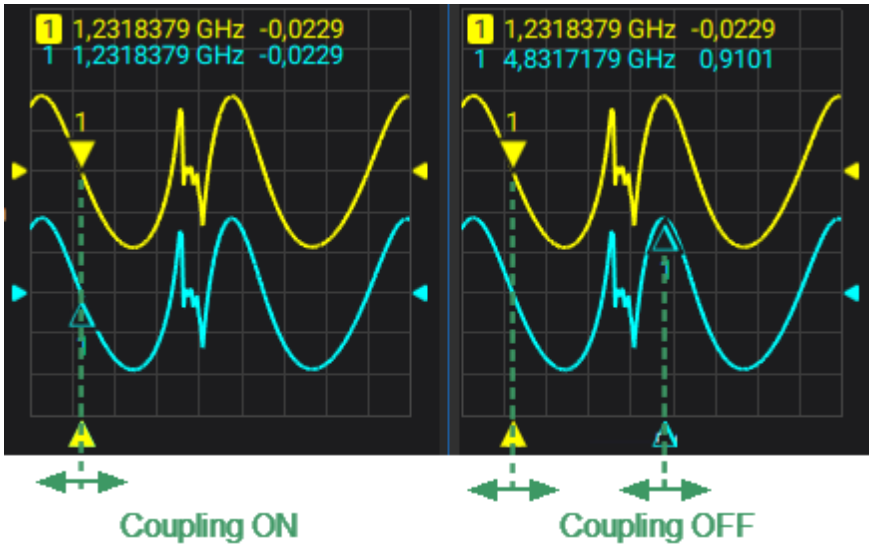
Marker Properties and Styles

The following section describes marker properties and styles:

- Marker Coupling Feature is the function that determines the coupling of markers with the same numbers on different traces.
- Marker Data Arrangement is the ability to rearrange the marker data display on the screen.
- Marker Data Alignment is the ability to align the marker data display on the screen.
- Marker Data of Active Trace is the ability to enable display of the marker data for the active trace.
- Memory Trace Value Display is the ability to turn on the memory trace marker values if a memory trace is available.
- Marker Discrete Mode is the moving of the marker only between actual measurement points.
- Marker Styles is the section, that provides the ability to display marker data on a trace as well as the inclusion of a line corresponding to the value of the marker.
- Marker Value Indication Capacity adjusts the capacity of numeric values on markers.

Marker Coupling Feature

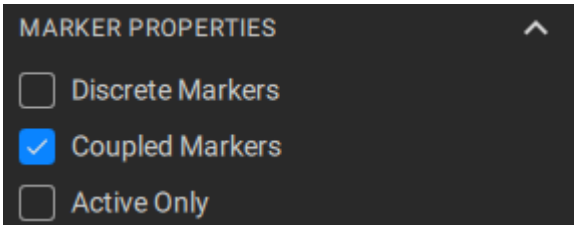
The marker coupling feature enables/disables coupling of markers with the same numbers on different traces. If the feature is turned on, the markers with the same numbers will move along the X-axis synchronously on all the traces. If the coupling feature is off, the position of the markers with same numbers along X-axis will be independent (see figure below).



Marker Coupling Feature

Enabling Marker Coupling Feature

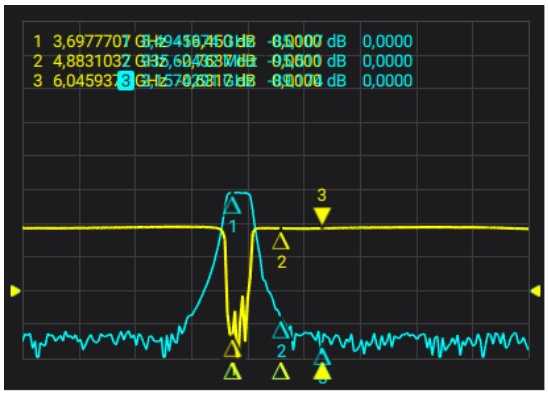
1. Select the channel and trace (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Marker** button in the main menu.
3. Select the **Coupled Markers** checkbox in MARKER PROPERTIES accordion in the submenu.



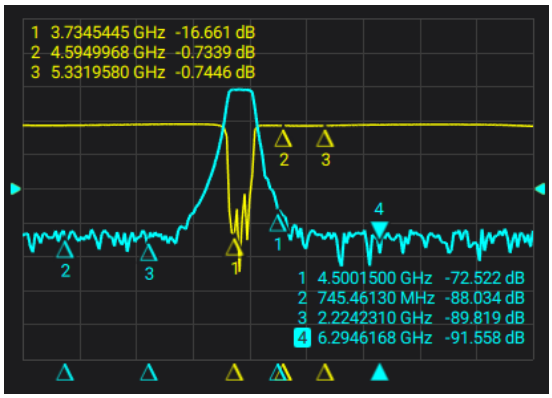
SCPI CALCulate:MARKer:COUPle

Marker Data Arrangement

By default, marker data is displayed in the upper left corner of the screen. If several traces are placed on the diagram, then when adding markers to each trace, the marker data field will overlap each other. The marker data display can be rearranged on the screen (see figure below).



Default Arrangement of Marker Data When Markers are Added (Marker Data is Overlapped)



User Arrangement of Marker Data (Marker Data is not Overlapped)

NOTE If you need to arrange marker data compactly on the diagram, use coupling feature, marker data alignment, or displaying marker data of active trace.

Arranging Marker Data

1. Click on a marker data field and drag it to the required position on the diagram.

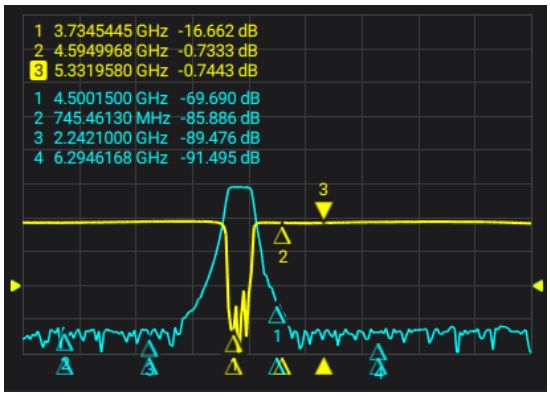
SCPI DISPlay:WINDow:TRACe:ANNotation:MARKer:POSition:X

DISPlay:WINDow:TRACe:ANNotation:MARKer:POSition:Y

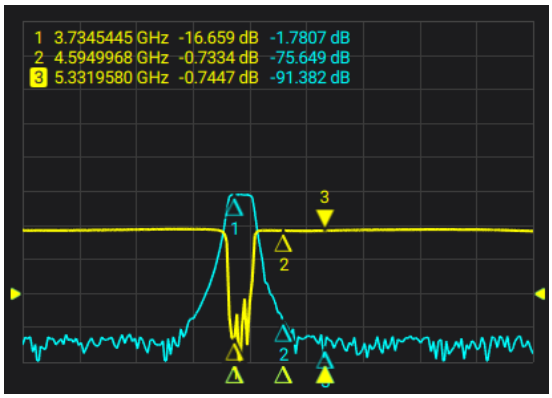
Marker Data Alignment

If there are multiple traces on the diagram, marker data displaying can be aligned relatively to the diagram:

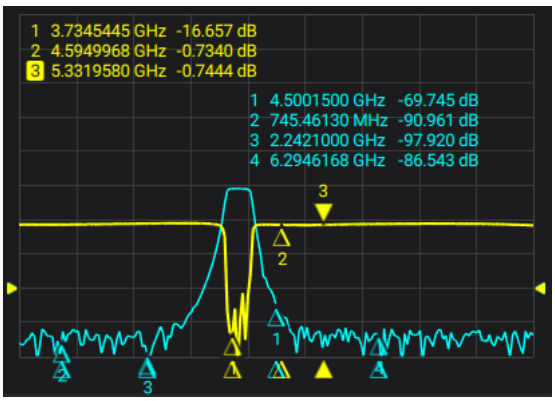
- Vertical — marker data of different traces are displayed one under another without the option to move separate marker data along the diagram.
- Horizontal (when marker coupling feature is enabled) — marker data of different traces are displayed in a line (marker data are aligned in relation to the first trace, and the stimulus value is displayed only for the first trace).
- Disabled — marker data are placed on the diagram independently, allowing you to move each marker data along the diagram.



Vertical Alignment



Horizontal Alignment

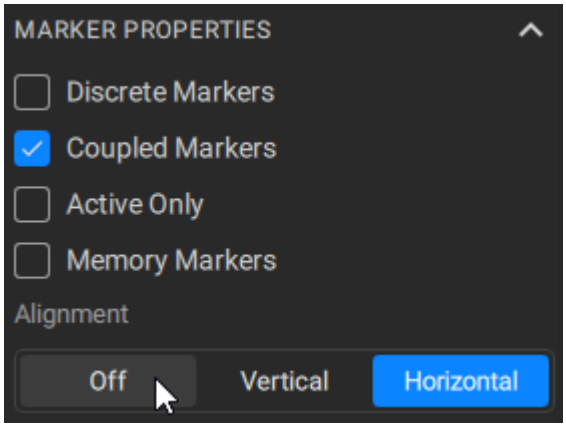


Alignment is Disabled (marker data of trace 2 has been moved)

Setting the Marker Data Alignment

1. Select the channel and trace (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Marker** button in the main menu.
3. Click on the **Off | Vertical | Horizontal** button in the alignment segment switch in MARKER PROPERTIES accordion in the submenu.

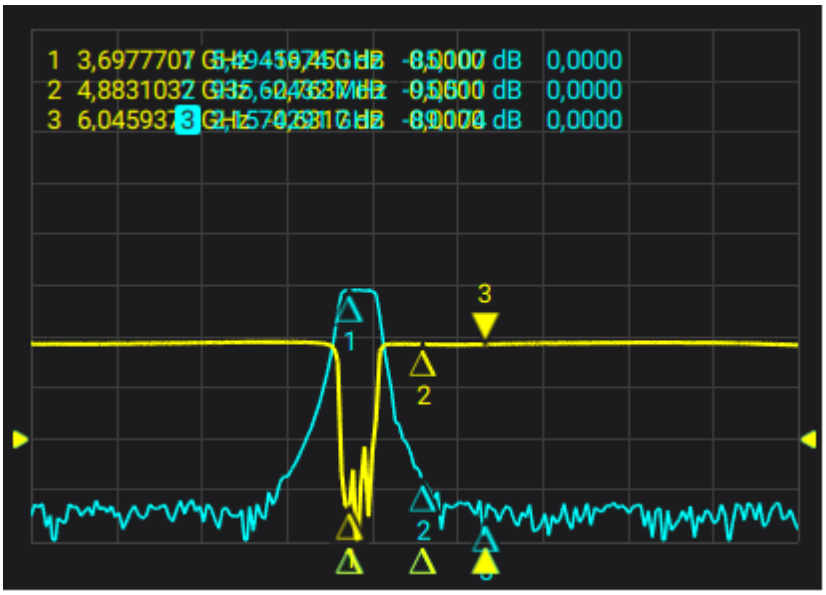
NOTE Horizontal data alignment is only available for coupled markers.



SCPI DISPlay:WINDow:ANNotation:MARKer:ALIGn

Marker Data of Active Trace

By default, marker data is aligned horizontally (see Marker Data Arrangement). When marker data arrangement is disables, the marker data field will overlap each other or cover the traces.

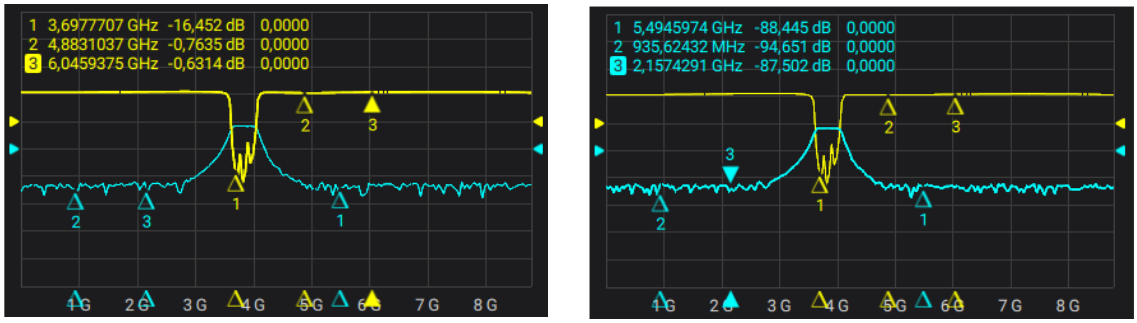


Overlapping Marker Data Fields for Two Traces



Overlapping Marker Data Fields Over the Traces

You can turn on the display of the marker data for the active trace only, or rearrange the marker data field to any convenient place (see Marker Data Arrangement). The markers for different traces can be distinguished by color. Each marker will be the same color as its trace.

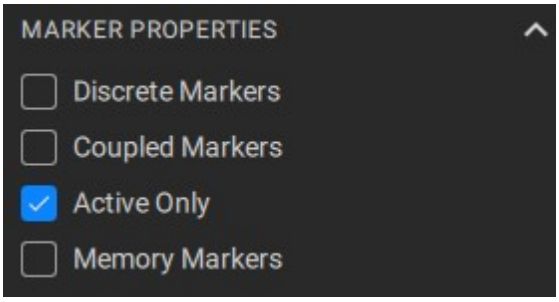


Active Trace 1 Active Trace 2

Displaying Marker Data Field Only Active Trace

Displaying Marker Data Field Only for Active Trace

1. Select the channel and trace (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Marker** button in the main menu.
3. Select the **Active Only** checkbox in MARKER PROPERTIES accordion in the submenu.

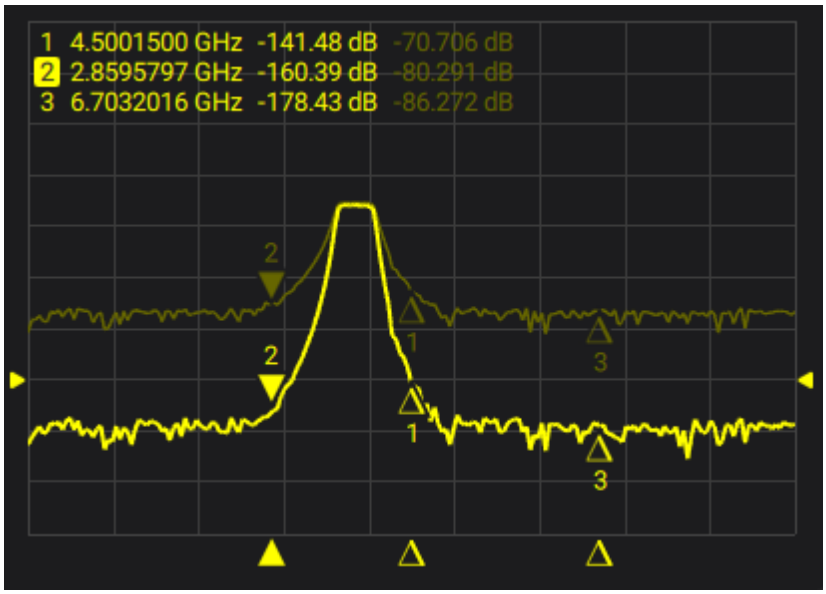


SCPI DISPlay:WINDow:ANNotation:MARKer:SINGle

Memory Trace Value Display

By default, the marker values of the data traces (not memory traces) are displayed on the screen. The display of memory trace maker values can be enabled, if a memory trace is available.

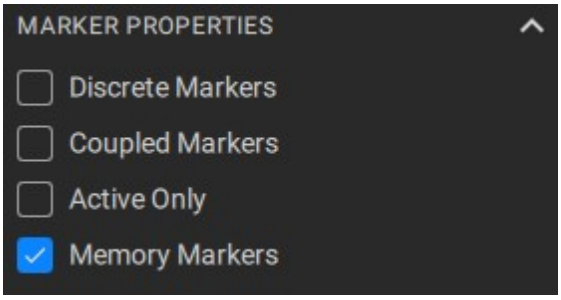
The memory trace marker is displayed in the same color as the main data trace, but it is half as bright (see figure below).



Memory Trace Value Display

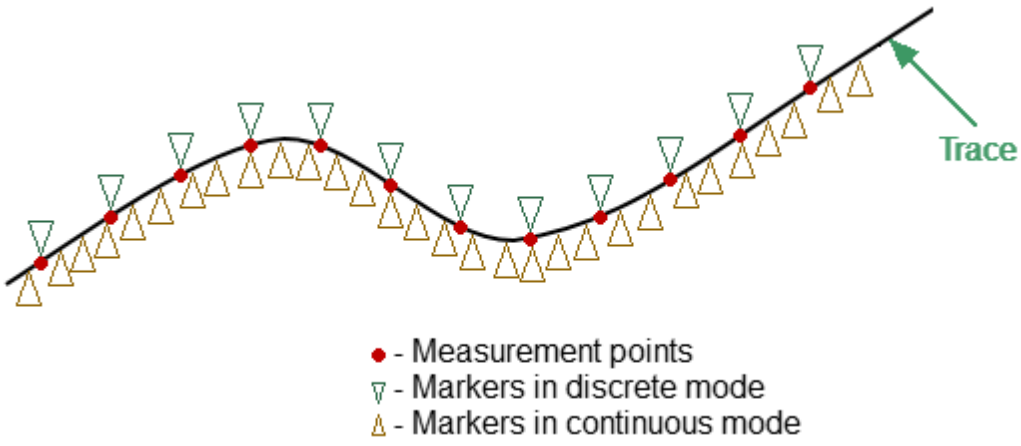
Enabling Memory Markers

1. Select the channel and trace (see Selection of Active Trace, Diagram, Channel).
2. Add memory trace (see Memory Trace Function).
3. Click on the **Marker** button in the main menu.
4. Select the **Memory Markers** checkbox in MARKER PROPERTIES accordion in the submenu.



Marker Discrete Mode

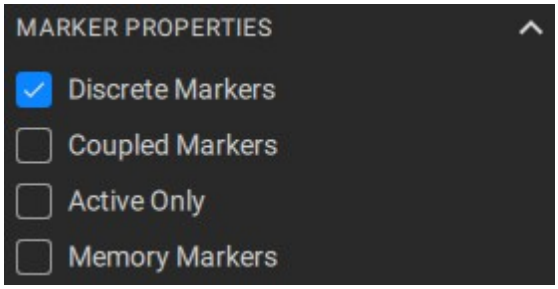
By default, the marker can be moved along the values interpolated between measurement points. To move the marker only between actual measurement points, enable the marker discrete mode.



Marker Discrete and Continuous Modes

Enabling Marker Discrete Mode

1. Select the channel and trace (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Marker** button in the main menu.
3. Select the **Discrete Markers** checkbox in MARKER PROPERTIES accordion in the submenu.

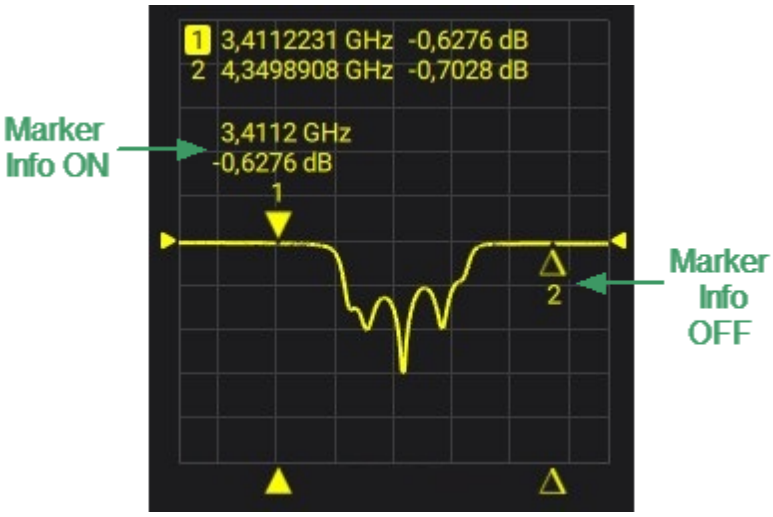


SCPI CALCulate:MARKer:DISCrete

Marker Styles

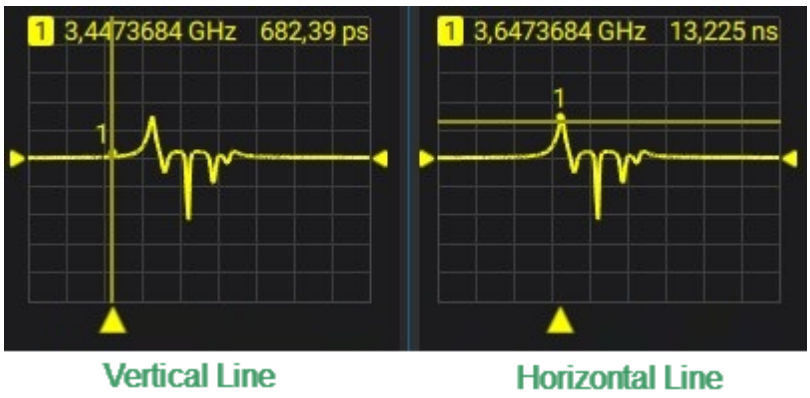
By default, marker data is displayed in the top left corner of the active channel window. Marker styles section provides user an ability to change marker indicator and the marker data layout on the screen.

Marker Info feature is the ability to attach the marker data to the marker position on a trace.



Marker Info Feature

By default, the triangle is set as a marker indicator (see figure above). When changing the marker indication feature, the marker indicator can be displayed as a corresponding horizontal or vertical line (see figure below).



Changing Marker Indicator Feature

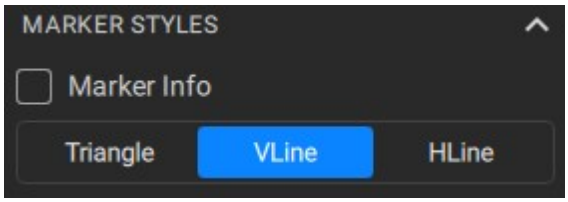
Enabling Marker Info

1. Select the channel and trace (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Marker** button in the main menu.
3. Select the marker (see Marker Activation).
4. Select the **Marker Info** checkbox in MARKER STYLES accordion in the submenu.



Changing the Marker Indicator

1. Select the channel and trace (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Marker** button in the main menu.
3. Select the marker (see Marker Activation).
4. Click on the **Triangle | VLine | HLine** button in segment switch in MARKER STYLES accordion in the submenu.



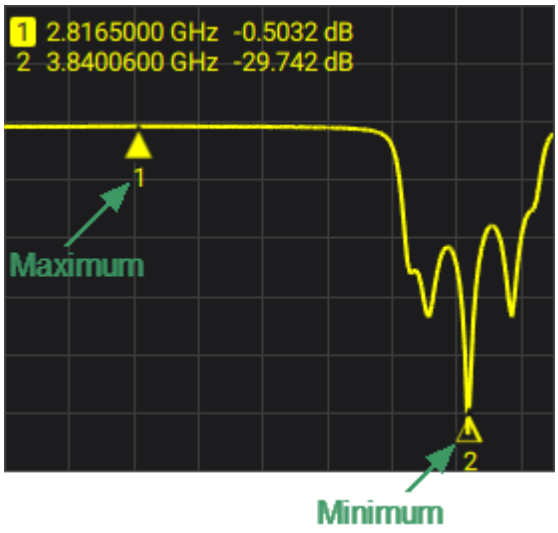
Marker Position Search Functions

The marker position search function allows to find the following values on a trace:

- Maximum value
- Minimum value
- Peak value
- Target level

Maximum and Minimum Search Functions

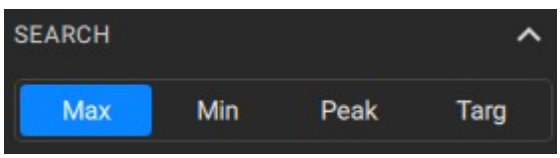
Maximum and minimum search functions are used to determine the maximum and minimum values of the measured parameter and move the marker to these positions on the trace (see figure below).



Maximum and Minimum Search

Finding Maximum and Minimum Values on a Trace

1. Select the channel and trace (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Marker** button in the main menu.
3. Click on the **Active Marker** drop-down list in the submenu and select the marker in the drop-down list.
4. Click on **Max** or **Min** button in the segment switch in SEARCH accordion for a single search.



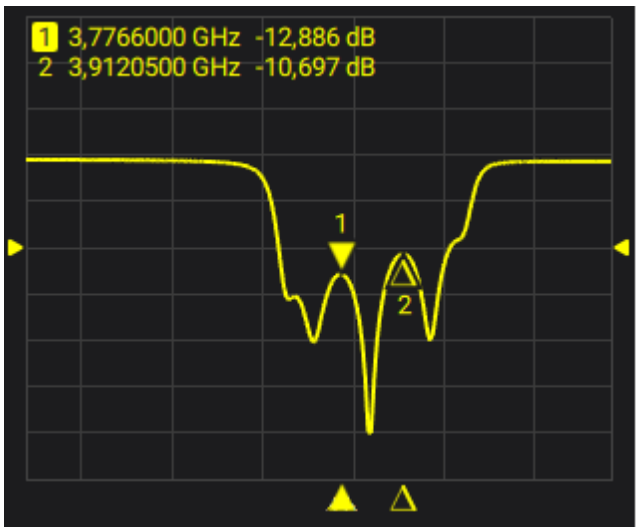
SCPI CALCulate:MARKer:FUNCtion:EXECute, CALCulate:MARKer:FUNCtion:TYPE

Search for Peak

The peak search function is used to determine the peak value of the measured parameter and move the marker to this position on the trace.

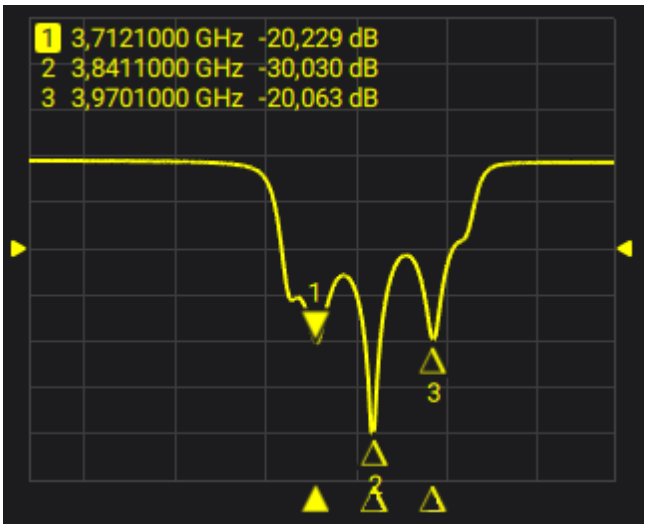
Peak is a local extreme of the trace.

Peak is considered **positive** if the value of the peak is greater than the values of the adjacent points (see figure below).



Positive Peaks

Peak is considered **negative** if the value of the peak is smaller than the values of the adjacent points (see figure below).



Negative Peaks

Peak excursion is the smallest of the absolute differences between the response values in the peak point and the two adjoining peaks of the opposite polarity.

The peak search is executed only for the peaks meeting the following conditions:

- The peaks must have the polarity (positive, negative, or both) specified by the user.
- The peaks must have a peak deviation no less than the value assigned by the user.

The following options for the peak search are available:

- search for the nearest peak
- search for the greatest peak
- search for left peak
- search for right peak

The nearest peak is a peak that is located most near to the current position of the marker along the stimulus axis.

The greatest peak is a peak with maximum or minimum value, depending on the current polarity settings of the peak.

NOTE

Finding the greatest peak is different form finding the maximum or minimum, as the peak cannot be located at the trace's limit points, even if those points have a maximum or minimum value.

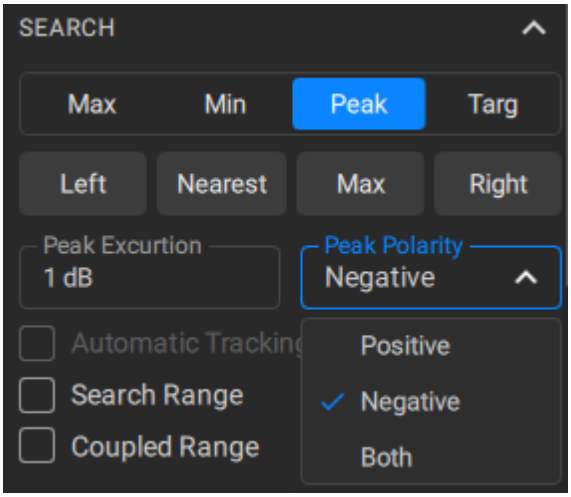
Setting Parameters and Activating the Peak Search Function

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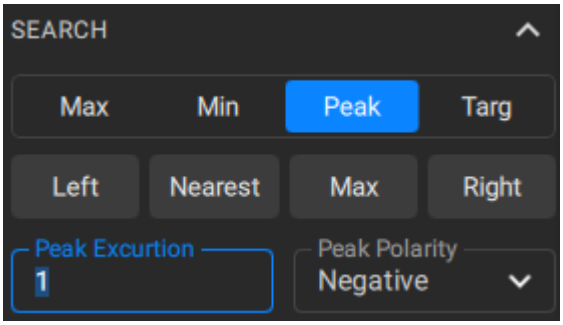
1. Select the channel and trace (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Marker** button in the main menu.
3. Click on the **Active Marker** drop-down list in the submenu and select the marker in the drop-down list.

4. Click on **Peak** button in segment switch in SEARCH accordion in the submenu.

5. Click on the **Peak Polarity** drop-down list and select the polarity (see figures above).

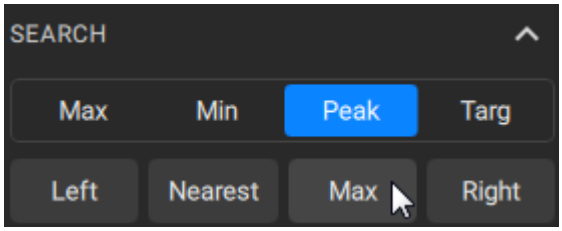


6. Click on the **Peak Excursion** textbox and enter the numerical value.



7. Click on one of the buttons under the segment switch for a single search:

- **Left** — search for left peak.
- **Nearest** — search for the nearest peak.
- **Max** — search for the greatest peak.
- **Right** — search for right peak.



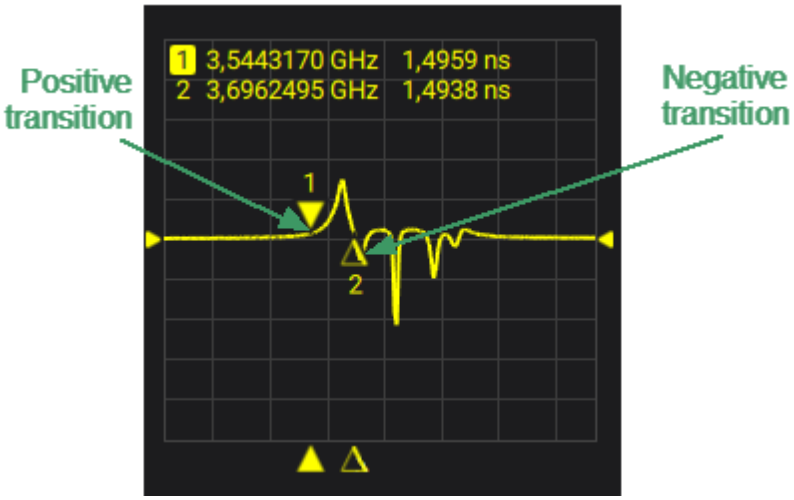
SCPI CALCulate:MARKer:FUNCtion:EXECute, CALCulate:MARKer:FUNCtion:PPOLarity, CALCulate:MARKer:FUNCtion:PEXCurtion, CALCulate:MARKer:FUNCtion:TYPE

Search for Target Level

The target level search function is used to locate the marker with the given level of the measured parameter (see figure below).

The trace can have two types of transition at the points where the target level crosses the trace:

- Transition type is positive if the function derivative (trace slope) is positive at the intersection point with the target level.
- Transition type is negative if the function derivative (trace slope) is negative at the intersection point with the target level.



Target Level Search

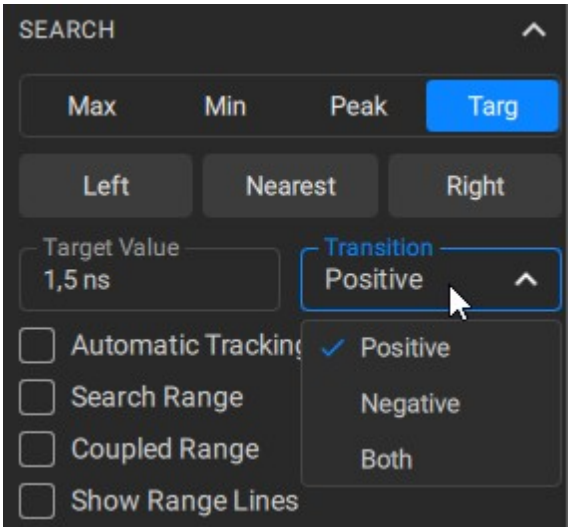
Target level search is performed only for intersection points that have a user-selected specific transition polarity (positive, negative, or both).

The following options for the target level search are available:

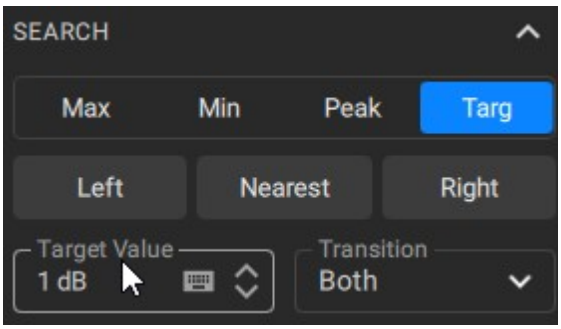
- search for the nearest target
- search for left target
- search for right target

Setting Parameters and Activating the Search for Target Level Function

1. Select the channel and trace (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Marker** button in the main menu.
3. Click on the **Active Marker** drop-down list in the submenu and select the marker in the drop-down list.
4. Click on the **Targ** button in segment switch in SEARCH accordion submenu.
5. Click on the **Transition** drop-down list and select the polarity.

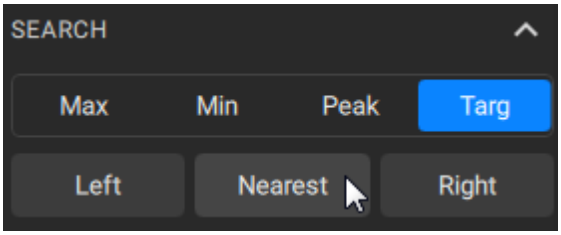


6. Click on the **Target Value** textbox and enter the numerical value.



7 Click on one of the buttons below the segment switch for a single search:

- **Left** — search for left target.
- **Nearest** — search for the nearest target.
- **Right** — search for right target.

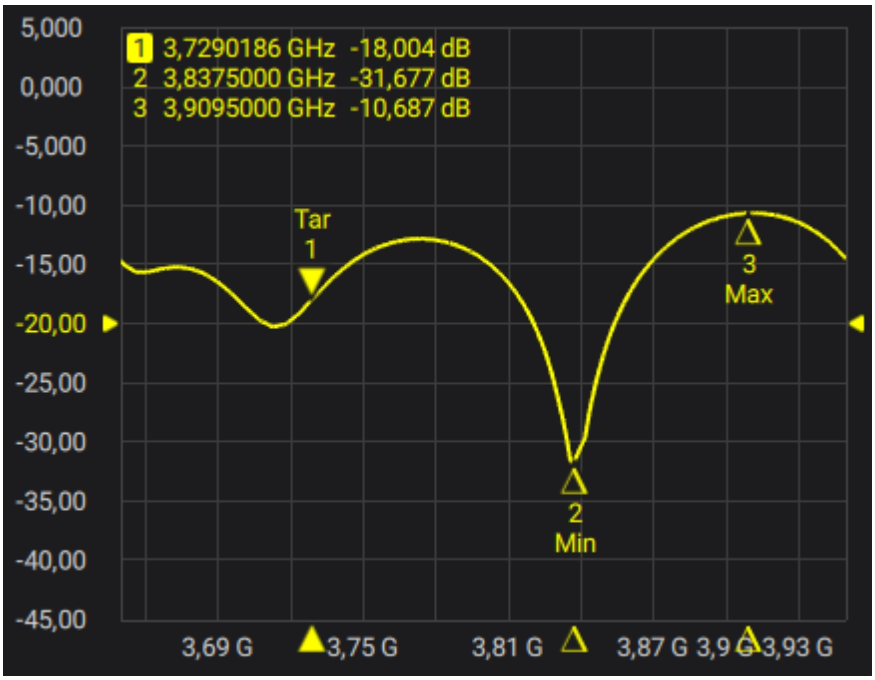


SCPI CALCulate:MARKer:FUNCtion:TTRansition, CALCulate:MARKer:FUNCtion:TARGet, CALCulate:MARKer:FUNCtion:TYPE

Automatic Tracking Mode

The marker position search function, by default, can be initiated by any click on the search button. Automatic tracking mode performs continuous marker position search, until this mode is disabled.

When automatic tracking mode is enabled, the corresponding search type will appear next to the marker number in the diagram (see figure below).



Automatic Tracking Indicators on the Markers

NOTE Automatic tracking mode is unavailable for use in Search for Peak function.

Enabling Automatic Tracking Mode

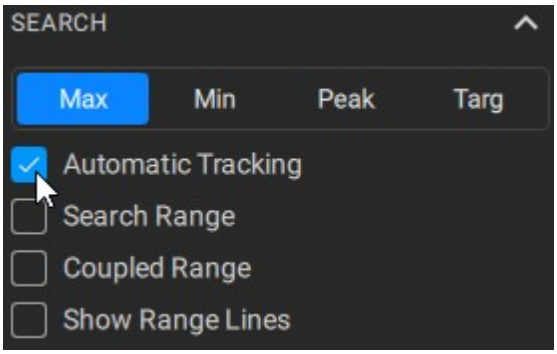
1. Select the channel and trace (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Marker** button in the main menu.
3. Click on the **Active Marker** drop-down list in the submenu and select the marker in the drop-down list.

4. Click on the **Max | Min | Targ** button in segment switch in SEARCH accordion in the submenu.

   NOTE Set parameters of search for target level function (see Search for Target Level).

   NOTE Automatic tracking mode is unavailable for **Peak** button (see Search for Peak).

5. Select the **Automatic Tracking** checkbox in SEARCH accordion.

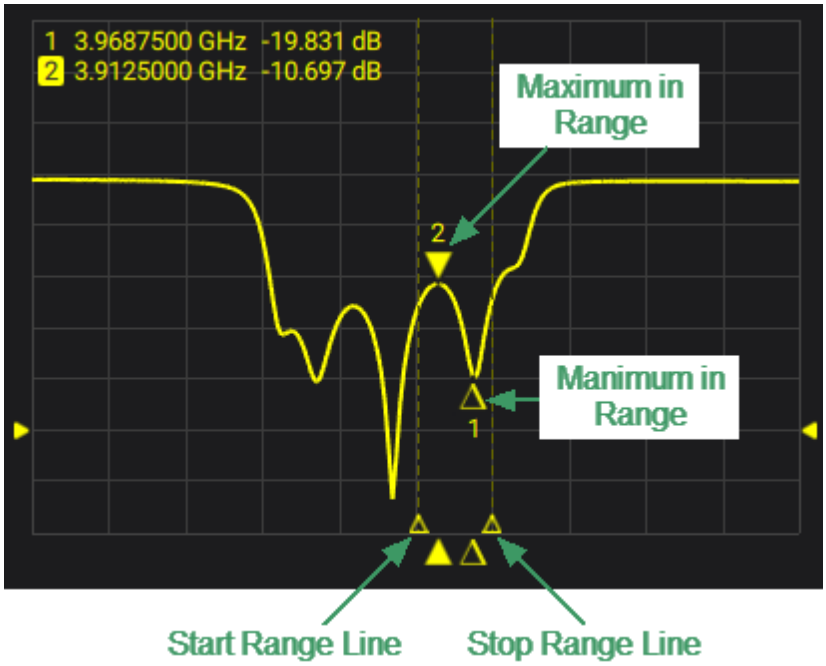


SCPI CALCulate:MARKer:FUNCtion:TRACking

Search Range

The search range for the marker position search can be set by setting the stimulus limits. This function includes the following additional features:

- Search range coupling, which allows to define the same search range for all the traces of a channel.
- Vertical line indication of the search range limits.



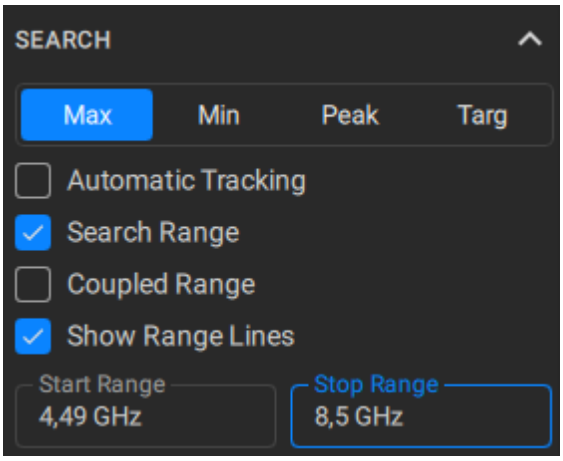
Search Range

Setting Parameters and Activating the Search Range Function

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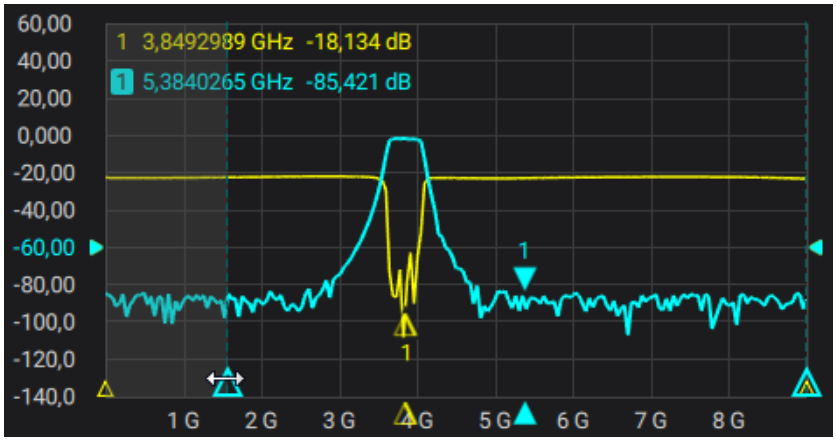
1. Select the channel and trace (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Marker** button in the main menu.
3. Select the **Search Range** checkbox in SEARCH accordion in the submenu.
4. Click on the **Start Range** and **Stop Range** textboxes and enter the numerical values of the range limits.

5. Select the **Show Range Lines** checkbox.



SCPI CALCulate:MARKer:FUNCtion:DOMain, CALCulate:MARKer:FUNCtion:DOMain:STARt, CALCulate:MARKer:FUNCtion:DOMain:STOP

NOTE You can quickly set search range limits on the diagram. Move the mouse pointer to the indicator on the horizontal graticule label as shown in figure below, then drag the indicator to the side. The figure displays the start range setting for Trace 2:



Enabling Search Range Coupling

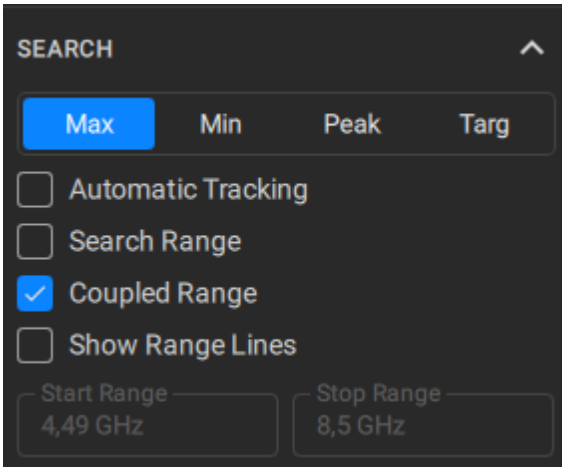
Use this function to define the same search range for all traces of a channel.

---

1. Select the channel (see Selection of Active Trace, Diagram, Channel).

2. Click on the **Marker** button in the main menu.

3. Select the **Coupled Range** checkbox in SEARCH accordion in the submenu.



4. Select the **Search Range** checkbox for the desired channel traces.

5. Click on the **Start Range** and **Stop Range** textboxes at any of the previously selected traces and enter the numerical values of the range limits.

   NOTE You can quickly set the start and stop range on the diagram. Move the mouse pointer to the indicator on the horizontal graticule label as shown in figure, then drag the indicator to the side.

6. Select the **Show Range Lines** checkbox for the desired channel traces.

SCPI CALCulate:MARKer:FUNCtion:DOMain:COUPle

Marker Math Functions

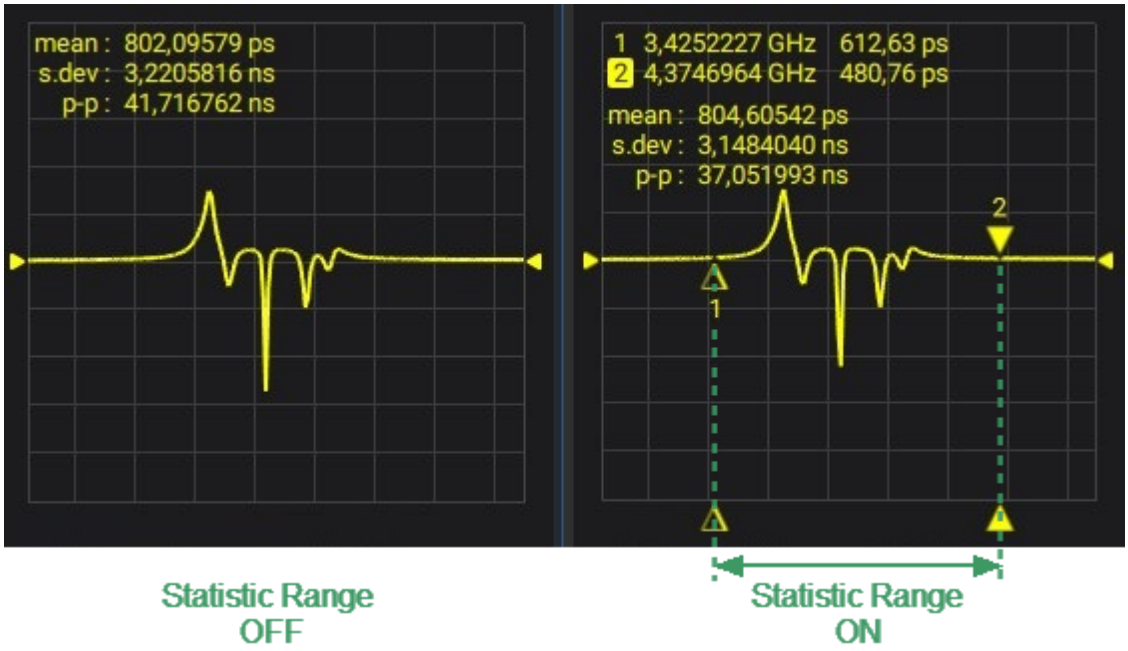
Marker math functions use markers to calculate various trace characteristics. Four marker math functions are available:

- Marker Statistics
- Bandwidth Search
- Flatness Evaluation
- RF Filter Statistics

Marker Statistics

The marker statistics feature allows to determine and view trace parameters, such as mean, standard deviation, and peak-to-peak.

The range of marker statistics can be defined by two markers (see figure below).



Trace Statistics

Marker Statistics Parameter

Symbol	Definition	Formula
mean	Arithmetic mean	$M = \frac{1}{N} \cdot \sum_{i=1}^{N} x_i$
s.dev	Standard deviation	$\sqrt{\frac{1}{N-1} \cdot \sum_{i=1}^{N} (x_i - M)^2}$
p-p	Peak-to-Peak: difference between the maximum and minimum values	Max – Min

Enabling and Setting Parameters Marker Statistics Function

1. Select the channel and trace (see Selection of Active Trace, Diagram, Channel).

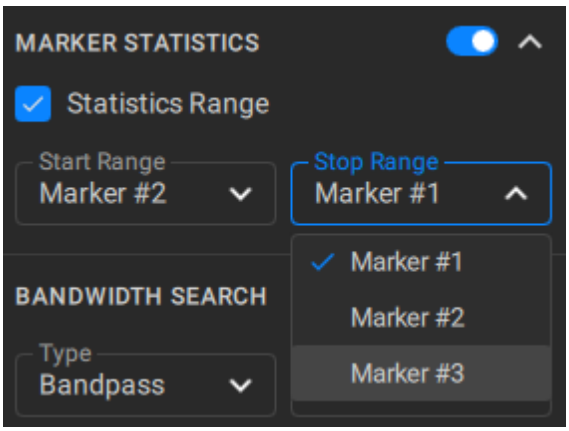
2. Click on the **Marker Math** button in the main menu.

3. Toggle **MARKER STATISTICS** ON/OFF in MARKER STATISTICS accordion in the submenu.

   NOTE If toggle button is ON, all marker statistic parameters will be displayed on the diagram (see figure above).

4. To set the statistics range using two markers:

   - Add at least 2 markers (see Marker Addition) and set the required range with the marker stimulus value (see Marker Stimulus Value Setting).
   - Click on the **Start Range** and **Stop Range** drop-down lists and select the markers for determining statistics range in the MARKER STATISTICS accordion in the submenu.
   - If you want to display a statistic range defined by two markers, select the **Statistics Range** checkbox.



SCPI CALCulate:MSTatistics, CALCulate:MSTatistics:DOMain

CALCulate:MSTatistics:DOMain:STAR, CALCulate:MSTatistics:DOMain:STOP

Disable Marker Statistics Function

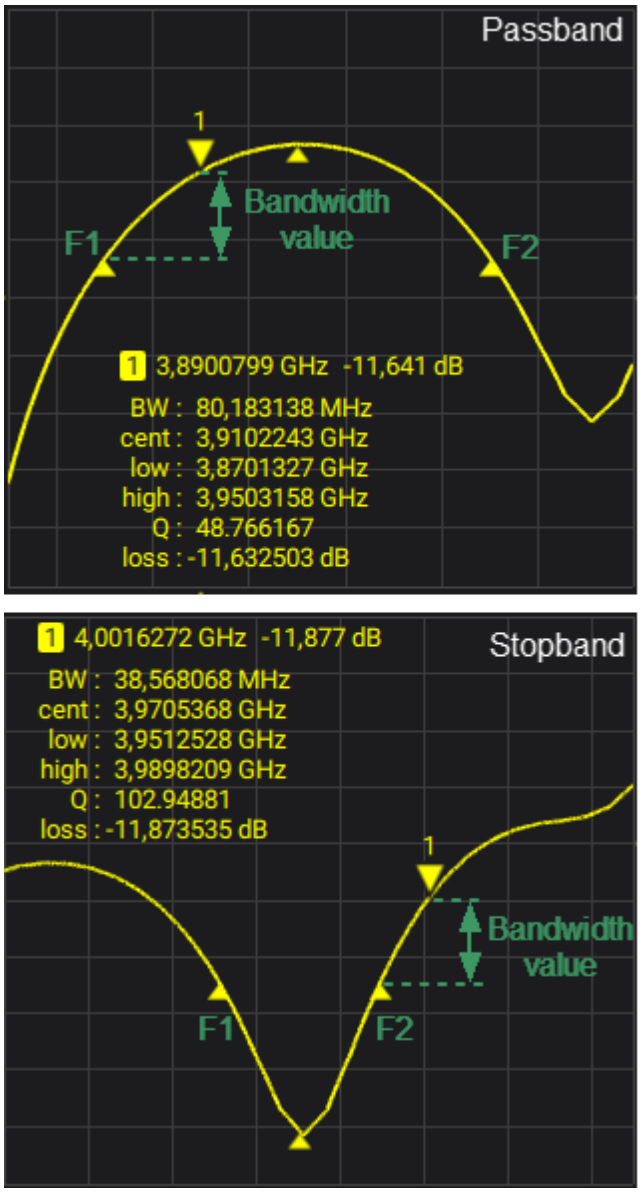
1. Select the channel and trace (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Marker Math** button in the main menu.
3. Toggle **MARKER STATISTICS** OFF in MARKER STATISTICS accordion in the submenu.

SCPI CALCulate:MSTatistics

Bandwidth Search

The bandwidth search function is used to determine and view the following parameters of a passband or a stopband: bandwidth, center frequency, lower frequency, higher frequency, Q value, and insertion loss (see figure below).

The bandwidth search is executed from the reference point. The active marker or the maximum or minimum value of the trace can be selected as the reference. The bandwidth search function detects lower and higher cutoff frequencies that differ from the reference point response by a user-specified bandwidth value (usually – 3 dB).



F1 and F2 are the lower and higher cutoff frequencies of the band respectively

Bandwidth Search

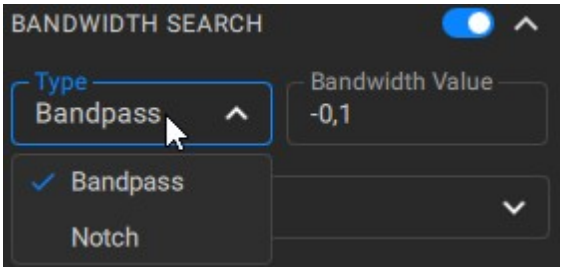
Bandwidth Parameters

Parameter Description	Symbol	Definition	Formula
Bandwidth	**BW**	The difference between the higher and lower cutoff frequencies.	F2 – F1
Center Frequency	**cent**	The midpoint between the higher and lower cutoff frequencies.	(F1+F2)/ 2
Lower Cutoff Frequency	**low**	The lower frequency point of the intersection of the bandwidth cutoff level and the trace.	F1
Higher Cutoff Frequency	**high**	The higher frequency point of the intersection of the bandwidth cutoff level and the trace.	F2
Quality Factor	**Q**	The ratio of the center frequency to the bandwidth.	cent/BW
Loss	**loss**	The trace measured value in the reference point of the bandwidth search.	—

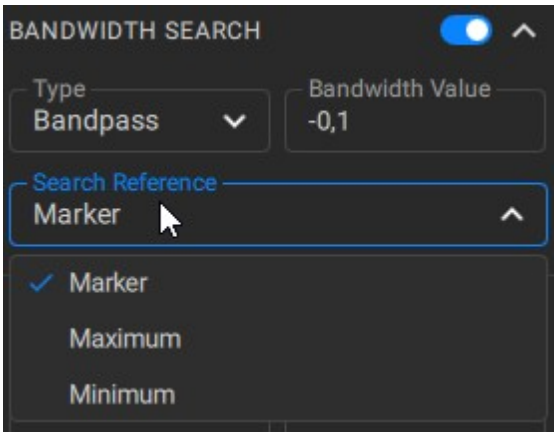
Enabling and Setting Parameters Bandwidth Search Function

1. Select the channel and trace (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Marker Math** button in the main menu.
3. Toggle **BANDWIDTH SEARCH** ON in BANDWIDTH SEARCH accordion in the submenu.

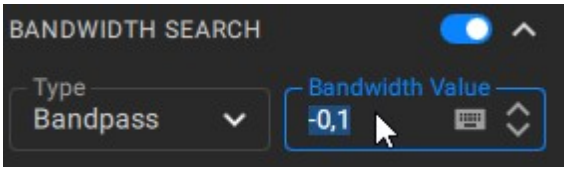
   NOTE If toggle button is ON, all bandwidth parameters will be displayed on the diagram (see figure above).
4. Click on the **Type** drop-down list and select the bandwidth search type between **Bandpass | Notch.**



5 Click on the **Search Reference** drop-down list and select search reference point between **Marker | Maximum | Minimum**.



6 Click on the **Bandwidth Value** textbox in BANDWIDTH SEARCH accordion in the submenu and enter the numerical value.



SCPI CALCulate:MARKer:BWIDth, CALCulate:MARKer:BWIDth:TYPE, CALCulate:MARKer:BWIDth:REFerence, CALCulate:MARKer:BWIDth:THReshold

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Disable Bandwidth Search Function

---

1 Select the channel and trace (see Selection of Active Trace, Diagram, Channel).

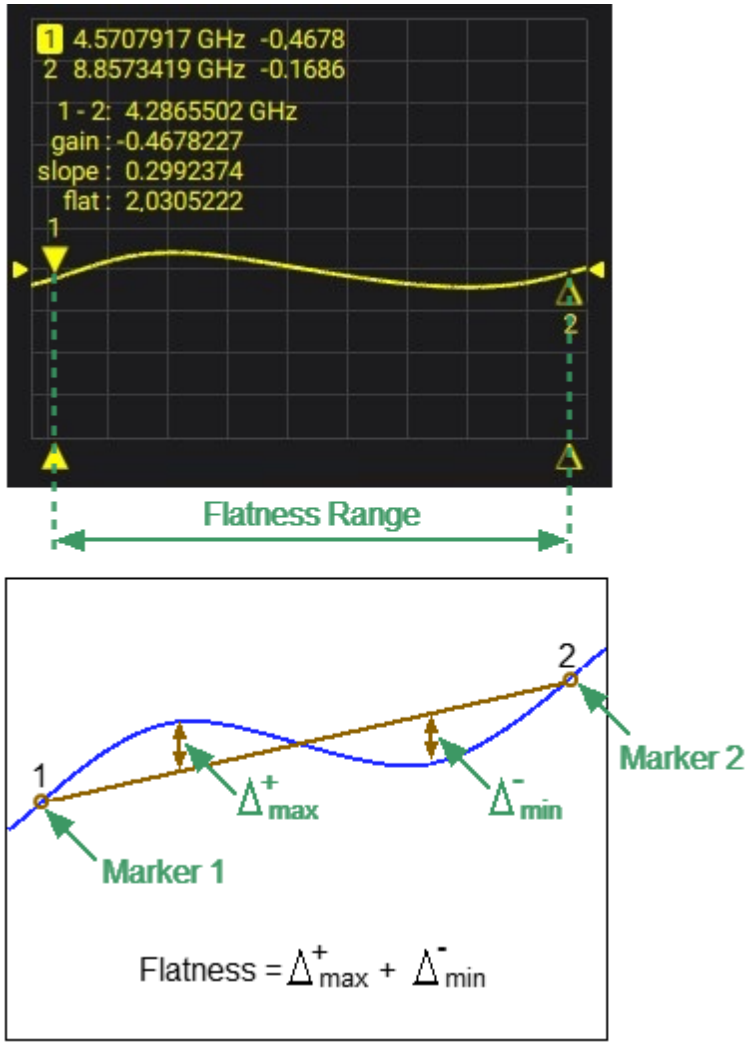
2 Click on the **Marker Math** button in the main menu.

3 Toggle **BANDWIDTH SEARCH** OFF in BANDWIDTH SEARCH accordion in the submenu.

SCPI CALCulate:MARKer:BWIDth

Flatness Evaluation

The flatness evaluation function is used to determine and view the following trace parameters: gain, slope, and flatness (see figure below).



Flatness Evaluation

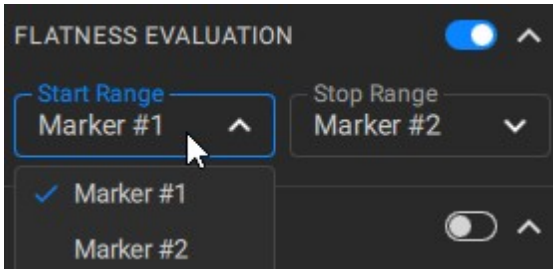
Flatness Parameters

Parameter Description	Symbol	Definition
Gain	**gain**	Marker 1 value.
Slope	**slope**	Difference between marker 2 and marker 1 values.
Flatness	**flat**	Sum of “positive” and “negative” peaks of the trace, which are measured from the line connecting marker 1 and marker 2 (see figure above).

Enabling and Setting Parameters Flatness Evaluation Function

1. Select the channel and trace (see Selection of Active Trace, Diagram, Channel).
2. Add at least 2 markers (see Marker Addition) and set the required range with the marker stimulus value (see Marker Stimulus Value Setting).
3. Click on the **Marker Math** button in the main menu.
4. Toggle **FLATNESS EVALUATION** ON in FLATNESS EVALUATION accordion in the submenu.

   NOTE If toggle button is ON, all flatness parameters will be displayed on the diagram (see figure above).
5. Click on the **Start** and **Stop Range** drop-down lists and select the marker.



SCPI CALCulate:MARKer:MATH:FLATness:STATe, CALCulate:MARKer:MATH:FLATness:STARt, CALCulate:MARKer:MATH:FLATness:STOP

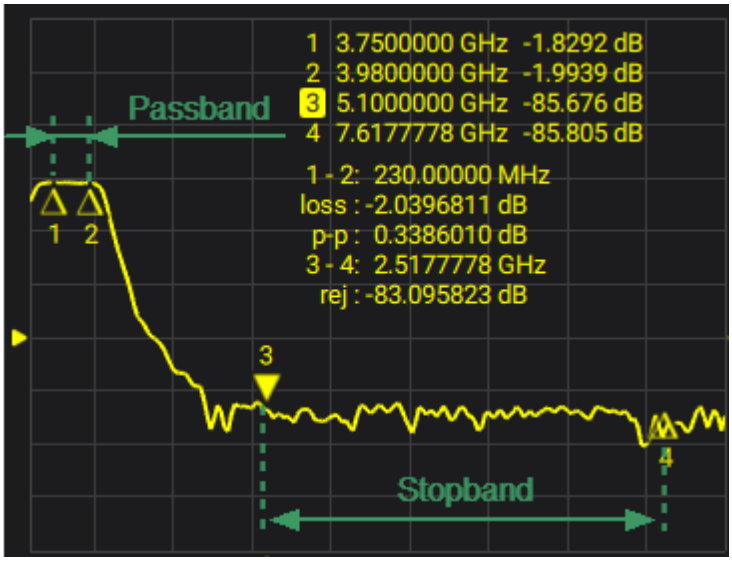
Disable Flatness Evaluation Function

1. Select the channel and trace (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Marker Math** button in the main menu.
3. Toggle **FLATNESS EVALUATION** OFF in FLATNESS EVALUATION accordion in the submenu.

SCPI CALCulate:MARKer:MATH:FLATness:STATe

RF Filter Statistics

The RF filter statistics function allows to determine and view the following filter parameters: loss, peak-to-peak in a passband, and rejection in a stopband. The passband is specified by the first pair of markers, and the stopband is specified by the second pair of markers (see figure below).



RF Filter Statistics

RF Filter Statistics Parameters

Parameter Description	Symbol	Definition
Loss in passband	**loss**	Minimum value in the passband.
Peak-to-peak in passband	**p-p**	Difference between maximum and minimum in the passband.
Reject	**rej**	Difference between maximum in stopband and minimum in passband.

Enabling and Setting Parameters RF Filter Statistics Function

1. Select the channel and trace (see Selection of Active Trace, Diagram, Channel).

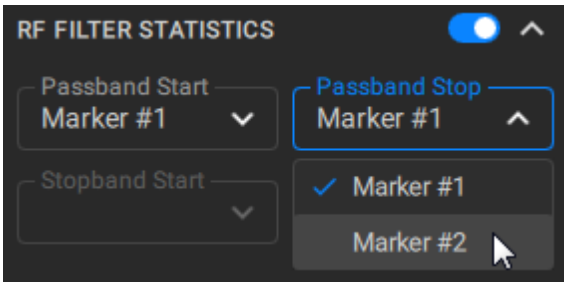
2. Add at least 4 markers (see Marker Addition) and set the required range with the marker stimulus value (see Marker Stimulus Value Setting).

3. Click on the **Marker Math** button in the main menu.

4. Toggle **RF FILTER STATISTICS** ON in RF FILTER STATISTICS accordion in the submenu.

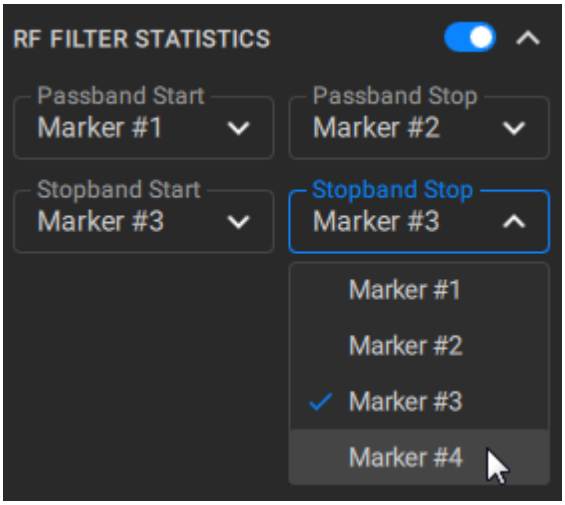
   NOTE If toggle button is ON, all filter statistics parameters will be displayed on the diagram (see figure above).

5. Click on the **Passband Start** and **Passband Stop** drop-down lists and select the markers.



6. Click on the **Stopband Start** and **Stopband Stop** drop-down lists and select the markers.

NOTE If less than four markers are added, stopband RF filter statistics is not active.



Disable RF Filter Statistics Function

---

1. Select the channel and trace (see Selection of Active Trace, Diagram, Channel).

2. Click on the **Marker Math** button in the main menu.

3. Toggle **RF FILTER STATISTICS** OFF in RF FILTER STATISTICS accordion in the submenu.

Marker Functions

The following parameter settings can be set using the current position of a marker:

- stimulus start
- stimulus stop
- stimulus center
- electrical delay
- reference level
- reference marker

Setting Start, Stop or Center Stimulus Value of Active Channel by Marker

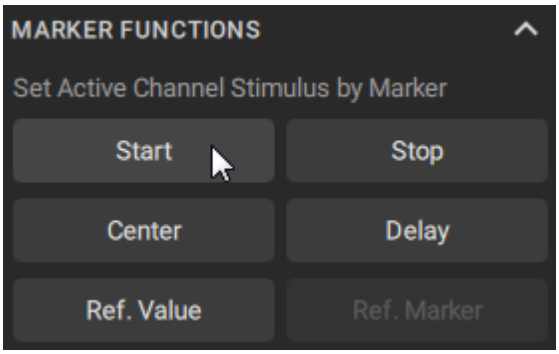
---

1. Select the channel and trace (see Selection of Active Trace, Diagram, Channel).

2. Click on the **Marker** button in the main menu.

3. Click on the **Active Marker** drop-down list and select the marker.

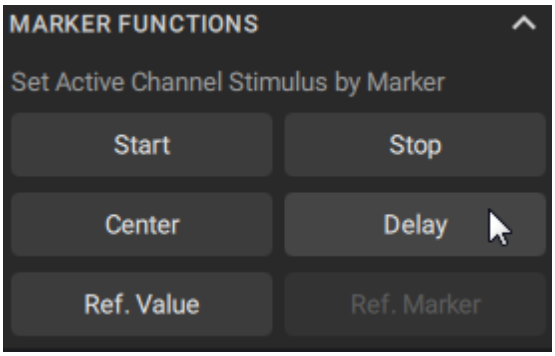
4. Click on the **Start | Stop | Center** button in MARKER FUNCTIONS accordion in the submenu.



SCPI CALCulate:MARKer:SET

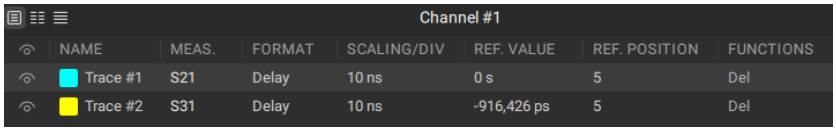
Setting the Electrical Delay or Reference Level Value of Active Trace by Marker

1. Select the channel and trace (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Marker** button in the main menu.
3. Click on the **Active Marker** drop-down list and select the marker.
4. Click on the **Delay** or **Ref. Value** button in MARKER FUNCTIONS accordion in the submenu.



SCPI CALCulate:MARKer:SET

NOTE When function is applied, the **Del** status is displayed in the trace manager (see Trace Manager):



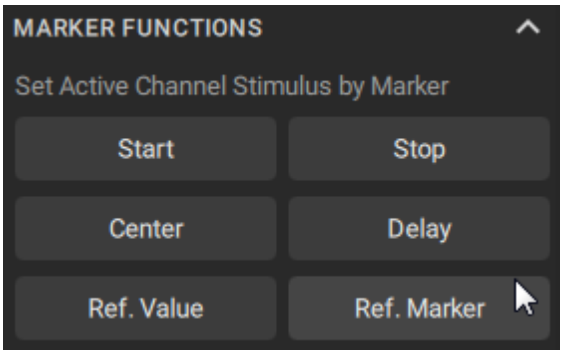
Setting Active Channel Stimulus by Marker

1. Select the channel and trace (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Marker** button in the main menu.

3. Click on the **Active Marker** drop-down list and select the marker.

4. Select **Reference Marker** checkbox in the submenu.

5. Click on the **Ref. Marker** button in MARKER FUNCTIONS accordion in the submenu.



Memory Trace Function

An associated memory trace can be created for each data trace. The memory trace is saved at the moment when the corresponding button is pressed or a program command is received. After saving the memory trace, the screen displays two traces — data and memory. The following settings of the memory and traces display can be performed:

Trace Display	Trace status field	Trace Display Setting
Data and memory	**Data & Memory**	**Show Data** and **Show Memory** checkboxes are selected.
Memory only	**Memory**	**Show Memory** checkbox is selected.
Data only	**Data**	**Show Data** checkbox is selected.
Data and memory OFF	**Off**	**Show Data** and **Show Memory** checkboxes are cleared.

NOTE

Use the memory buffer function to increase the number of memory traces for each data trace. Use the memory buffer function to increase the number of memory traces for each data trace. Up to 10 memory traces can be created for each data trace. For a detailed description, see Memory Buffer.

The memory trace is displayed in the same color as the main data trace, but it is half as bright (color of data traces can be customized, see Color Picker of Trace).

The memory trace is used for displaying and mathematical operations with data trace. For a detailed description, see Math Operations.

Complex measurement data is saved in memory, not in their graphical representation. Consequently:

- Mathematical operations are carried out between the current and stored S-parameters.
- The memory trace changes similar to an associated data trace when the settings are changed, such as Format, Electrical Delay, Time Domain, etc.

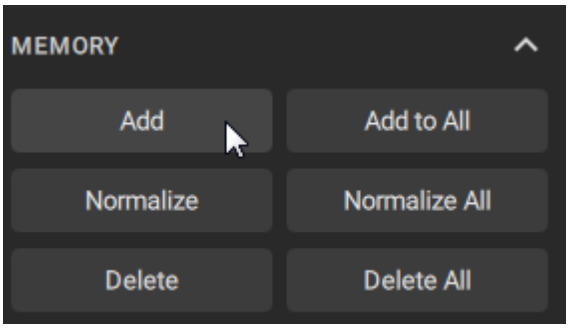
NOTE The memory trace cannot be extrapolated or interpolated, so when the frequency range or sweep type are changed, the memory contents are rendered incorrect. When the number of points is changed, the memory is automatically cleared.

The function of saving data traces into memory is applied to an individual trace or to all traces of the channel at once.

Saving Data Trace into Memory

---

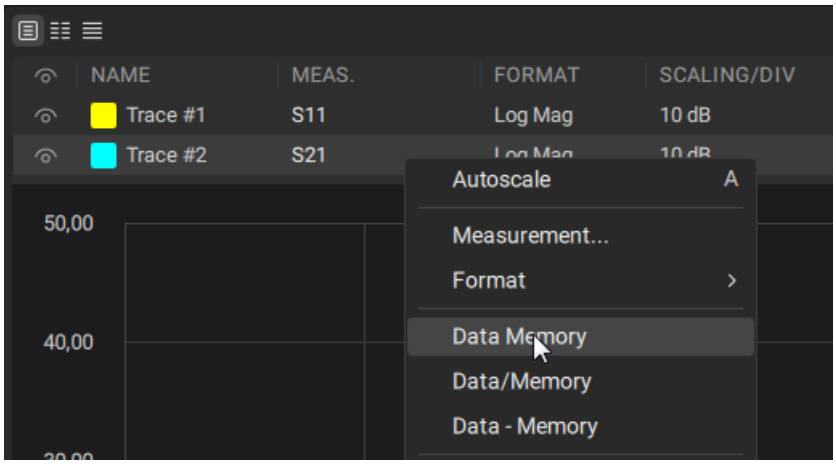
1. Select the channel and trace (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Trace** button in the main menu.
3. Click on the **Add** button in MEMORY accordion in the submenu.



SCPI CALCulate:MATH:MEMorize

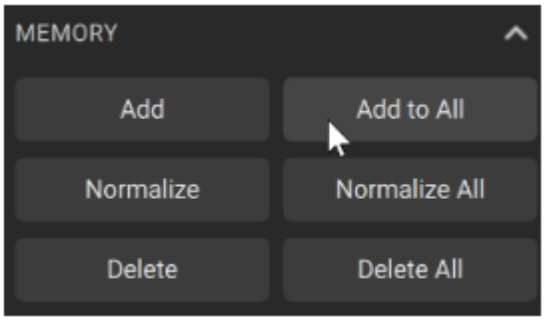
NOTE

You can quickly add the memory trace with the help of the trace manager. Right click the highlighted trace and click on **Data Memory** button in the pop-up window:



Saving All Data Traces into Memory

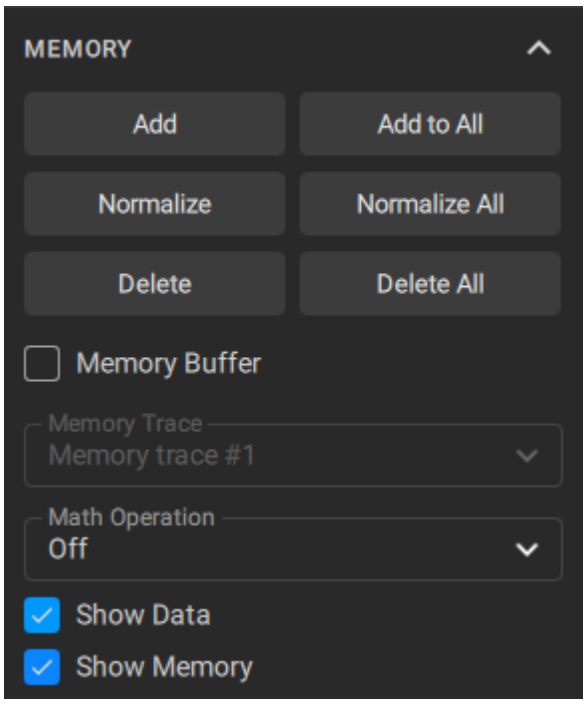
1. Select the channel (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Trace** button in the main menu.
3. Click on the **Add to All** button in MEMORY accordion in the submenu.



SCPI CALCulate:MATH:MEMorize

Trace Display Setting

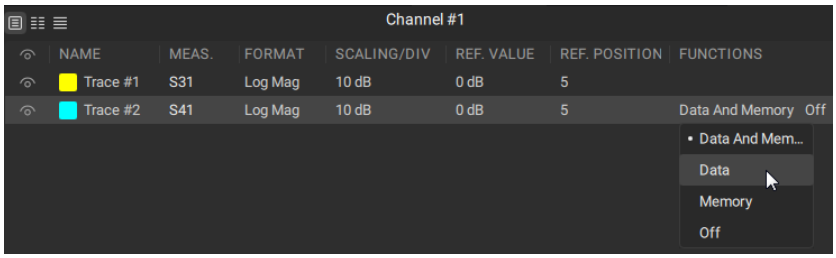
1. Select the channel and trace (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Trace** button in the main menu.
3. Set or remove **Show Data** and **Show Memory** in MEMORY accordion in the submenu (see trace display setting in the table above).



SCPI DISPlay:WINDow:TRACe:MEMory, DISPlay:WINDow:TRACe:STATe

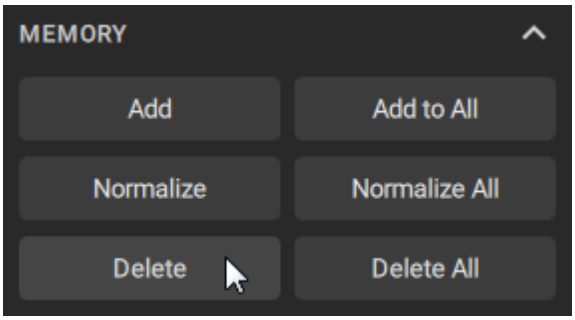
NOTE

You can quickly select the trace display with the help of the trace manager. Left click on the respective field in the trace manager and select the desired trace display in the pop-up window:



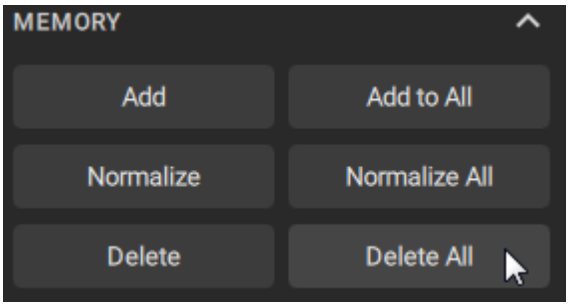
Deleting Memory Trace

1. Select the channel and trace (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Trace** button in the main menu.
3. Click on the **Delete** button in MEMORY accordion in the submenu.



Deleting All Memory Traces of Active Trace

1. Select the active trace (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Trace** button in the main menu.
3. Click on the **Delete All** button in MEMORY accordion in the submenu.



Memory Buffer

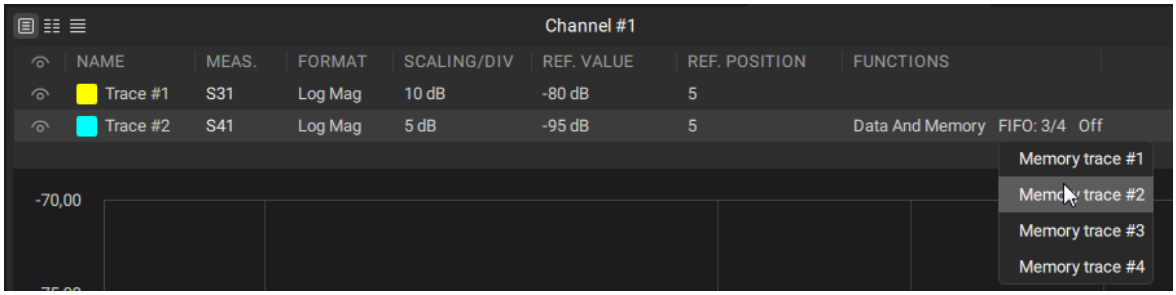
The memory buffer function increases the number of memory traces for each data trace. Memory traces are saved in a buffer. Up to 10 memory traces can be created for each data trace.

By default, the memory buffer function is disabled, the queue depth is 1, so there is only 1 memory trace associated with each data trace. It is Memory Trace Function.

When the memory buffer function is enabled, the queue depth increases, so multiple memory traces can be recorded for each data trace.

Memory traces are saved in chronological order each time by clicking on the **Add** button in MEMORY accordion. The new memory trace is numbered 1, and the numbers of the previous memory traces are increased by one.

The number of traces currently saved in buffer is displayed in the trace manager (see figure below).



The Number of Traces Saved in Memory Buffer

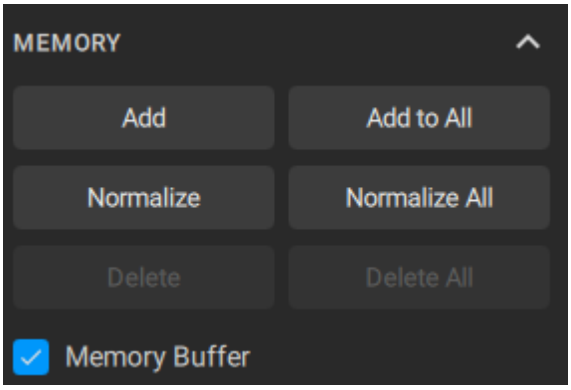
All memory traces contained in the memory buffer are displayed simultaneously.

Only one memory buffer trace is used for math operations (this is an active trace). By default, the newest memory trace is active. Any trace in the memory buffer can be activated if necessary.

Enabling the Memory Buffer Function and Adding Memory Trace in Buffer

1. Select the channel and trace (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Trace** button in the main menu.

3. Select the **Memory Buffer** checkbox in MEMORY accordion in the submenu.

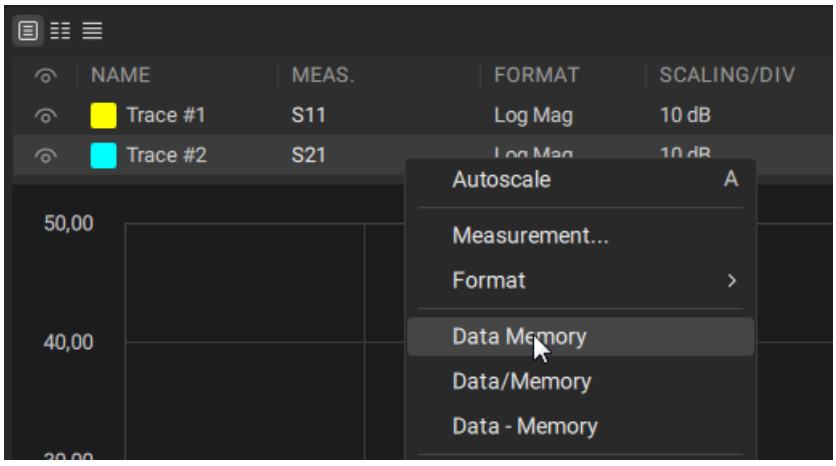


4. Click on **Add** button in MEMORY accordion in the submenu. Each click on the **Add** button adds a new trace to the buffer.

NOTE If the memory buffer function is enabled for multiple traces in a channel, you can add memory traces to all those traces simultaneously using the **Add to All** button in MEMORY accordion in the submenu.

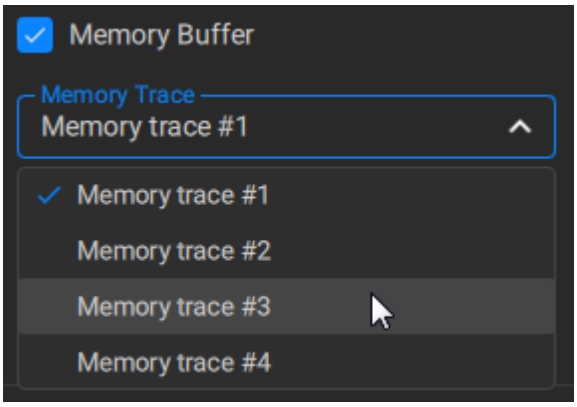
NOTE When the user adds 10 memory traces, the button is disabled. To add the next memory trace, it is necessary to erase the trace in the buffer.

NOTE You can quickly add the memory trace with the help of the trace manager. Right click on the highlighted trace and click on **Data Memory** button in the pop-up window:



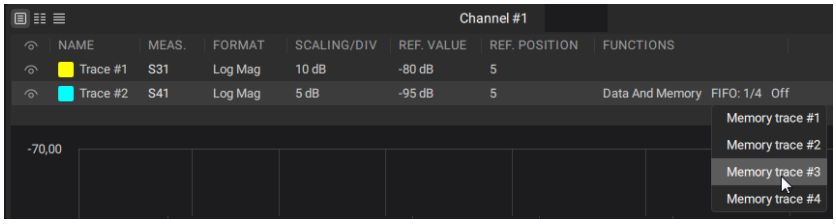
Assigning Memory Trace as Active

1. Select the channel and trace (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Trace** button in the main menu.
3. Click on the **Memory Trace** drop-down list in MEMORY accordion in the submenu and select the desired memory trace.



NOTE

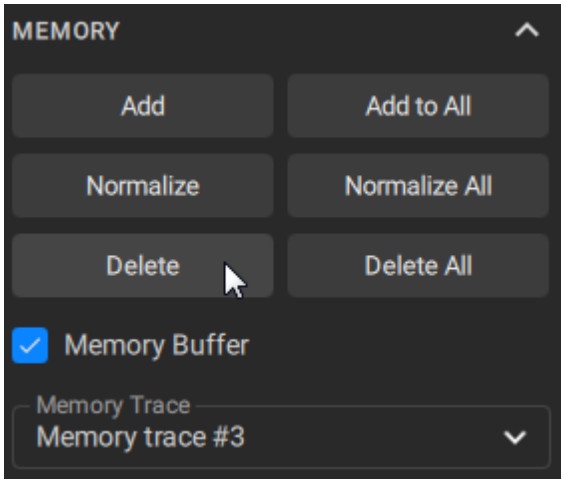
You can quickly select the memory trace with the help of the trace manager. Left click on the respective field in the trace manager and select the desired memory trace in the pop-up window:



Erasing Memory Trace in Buffer

1. Select the channel and trace (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Trace** button in the main menu.
3. Click on the **Memory Trace** drop-down list in MEMORY accordion in the submenu and select the memory trace.

4. Click on the **Delete** button.



Erasing All Memory Traces in Buffer

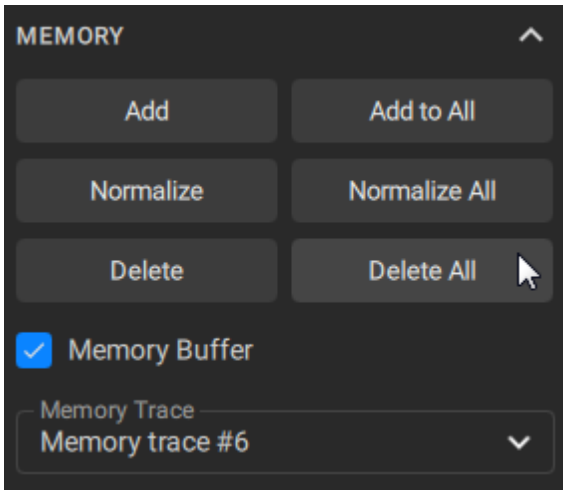
---

1. Select the channel and trace (see Selection of Active Trace, Diagram, Channel).

2. Click on the **Trace** button in the main menu.

3. Click on the **Memory Trace** drop-down list in MEMORY accordion in the submenu and select the memory trace.

4. Click on the **Delete All** button in MEMORY accordion in the submenu.



Math Operations

The memory trace can be used for mathematical operations with the data trace. The mathematical operations are performed on complex values before they are formatted for display. The result of math operation replaces the data trace. The following mathematical operations can be performed:

Data / Memory	Divides the measured data by the memory data. The trace status field indicates: **Data / Mem**.
Data * Memory	Multiplies the measured data by the memory data. The trace status field indicates: **Data * Mem**.
Data – Memory	Subtracts a memory data from the measured data. The trace status field indicates: **Data – Mem**.
Data + Memory	Adds the measured data to the memory data. The trace status field indicates: **Data + Mem**.
Normalization	Clicking on the **Normalization** softkey performs 3 steps in sequence: 1. Saves the current data into memory. 2. Turns on the math operation **Data/ Memory** (normalizes the measured data). 3. Turns on "data only" display type. The trace status field indicates: **Data Data / Mem .**

Mathematical operations **Data/Mem** and **Data–Mem** are applied to data in linear format before formatting is applied to them. However, if the data is presented in logarithmic format, it is not always clear which operation should be used. It should be noted that dividing data in linear format is equivalent to subtracting data in logarithmic format.

Example

Use **Data/Memory** mathematical operation to compare S21 traces before and after making changes or conducting noise measurements without a useful signal. Below is a table showing the difference between division and subtraction operations in

logarithmic format. **Data/Memory** operation highlights differences between the compared traces, while the results of **Data–Mem** operation may be less obvious.

Compared S21 values (Log Mag format)	Data/Mem	Data – Mem
0,4 dB and 0,5 dB	0,1 dB	-38 dB
0,4 dB and 0,7 dB	0,3 dB	-29 dB

Example

Use **Data–Mem** mathematical operation to indicate the relative difference between two small values of S11 trace. In this case, **Data–Mem** operation shows equal values of 6 dB. However, the second pair of compared values has a better S11 value, as indicated by **Data–Mem** operation.

Compared S11 values (Log Mag format)	Data/Mem	Data – Mem
-12 dB and -18 dB	6 dB	-18 dB
-30 dB and -36 dB	6 dB	-36 dB

The mathematical operations **Data*Mem** and **Data+Mem** allow performing mathematical calculations on an active data trace based on custom formulas and algorithms, rather than measurement data.

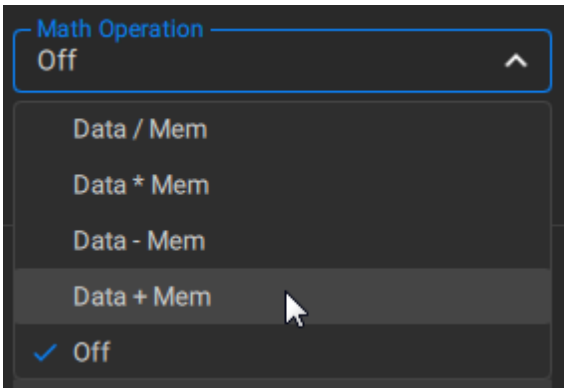
Example

To simulate the inclusion of an amplifier with a known calculated frequency response before the DUT:

- Use the amplifier frequency response calculation algorithm or its datasheet to calculate the values at corresponding data trace points
- Load the calculated frequency response values into the analyzer's memory using the CALC:DATA:FMEM SCPI command.
- Enable the Data*Mem function for the active trace to display the results of the DUT measurement considering the inclusion of the amplifier with specified parameters.

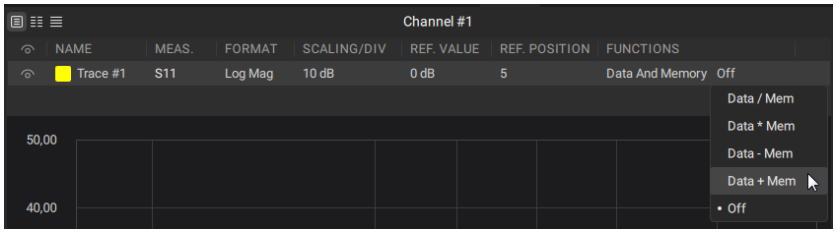
Accessing Math Operations

1. Select the channel and trace (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Trace** button in the main menu.
3. Click on the **Math Operation** drop-down list in MEMORY accordion in the submenu and select the operation.



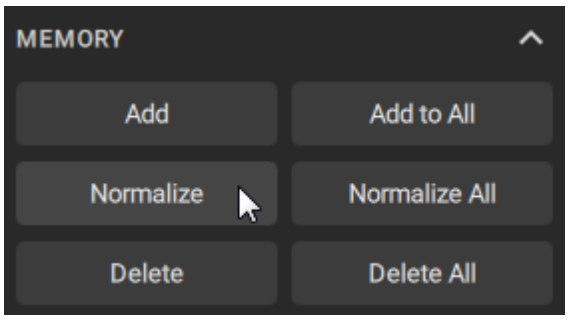
SCPI CALCulate:MATH:FUNCtion

NOTE You can quickly set the math operation with the help of the trace manager. Left click on the respective field in the trace manager and select the desired trace display in the pop-up window:



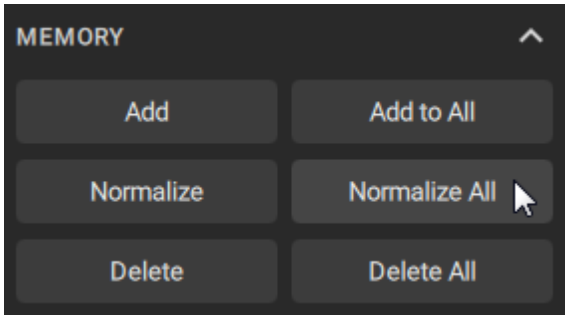
Activating the Normalization Function

1. Select the channel and trace (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Trace** button in the main menu.
3. Click on the **Normalize** button in MEMORY accordion in the submenu.



NOTE

If there are multiple traces in a channel, you can perform normalization for all traces at once using the **Normalize All** button.



NOTE

If the memory buffer function is turned on, check if the active memory trace is the desired trace for the math operation (see Memory Buffer).

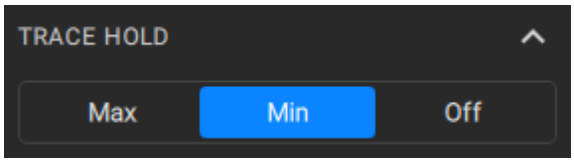
Trace Hold

The trace hold function is used to hold the maximum or minimum values of the trace. When the function is enabled, the inscription **[Max]** or **[Min]** appears in the trace manager (see Trace Manager).

Enabling or Disabling Trace Hold Function

1. Select the channel and trace (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Average** button in the main menu.
3. Click on **Max | Min | Off** button on segment switch in TRACE HOLD accordion in submenu.

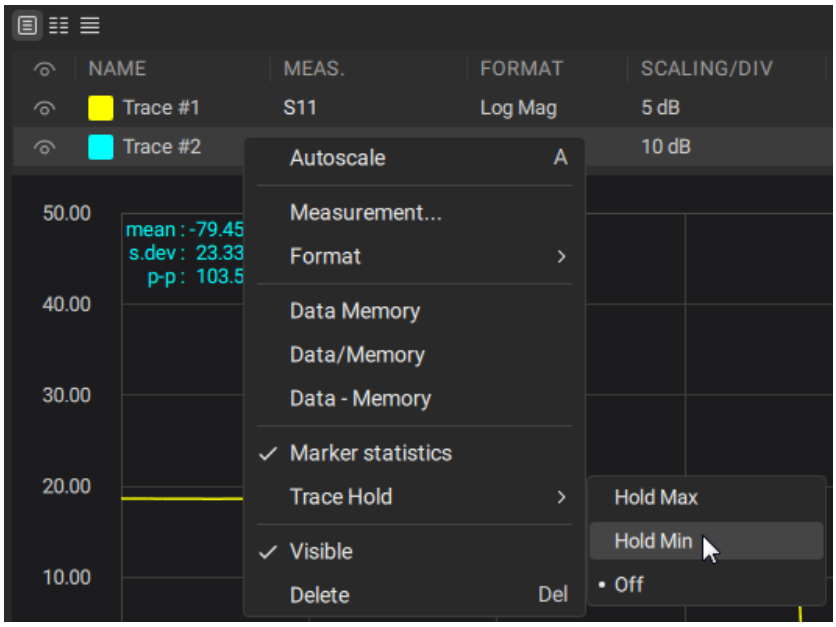
   NOTE Clicking the **Max | Min** button again restarts the trace hold.



SCPI CALCulate:HOLD:TYPE, CALCulate:HOLD:CLEar

NOTE

You can quickly enable/disable the trace hold with the help of the trace manager. Right click the highlighted trace and click on **Data Memory** button in the pop-up window:

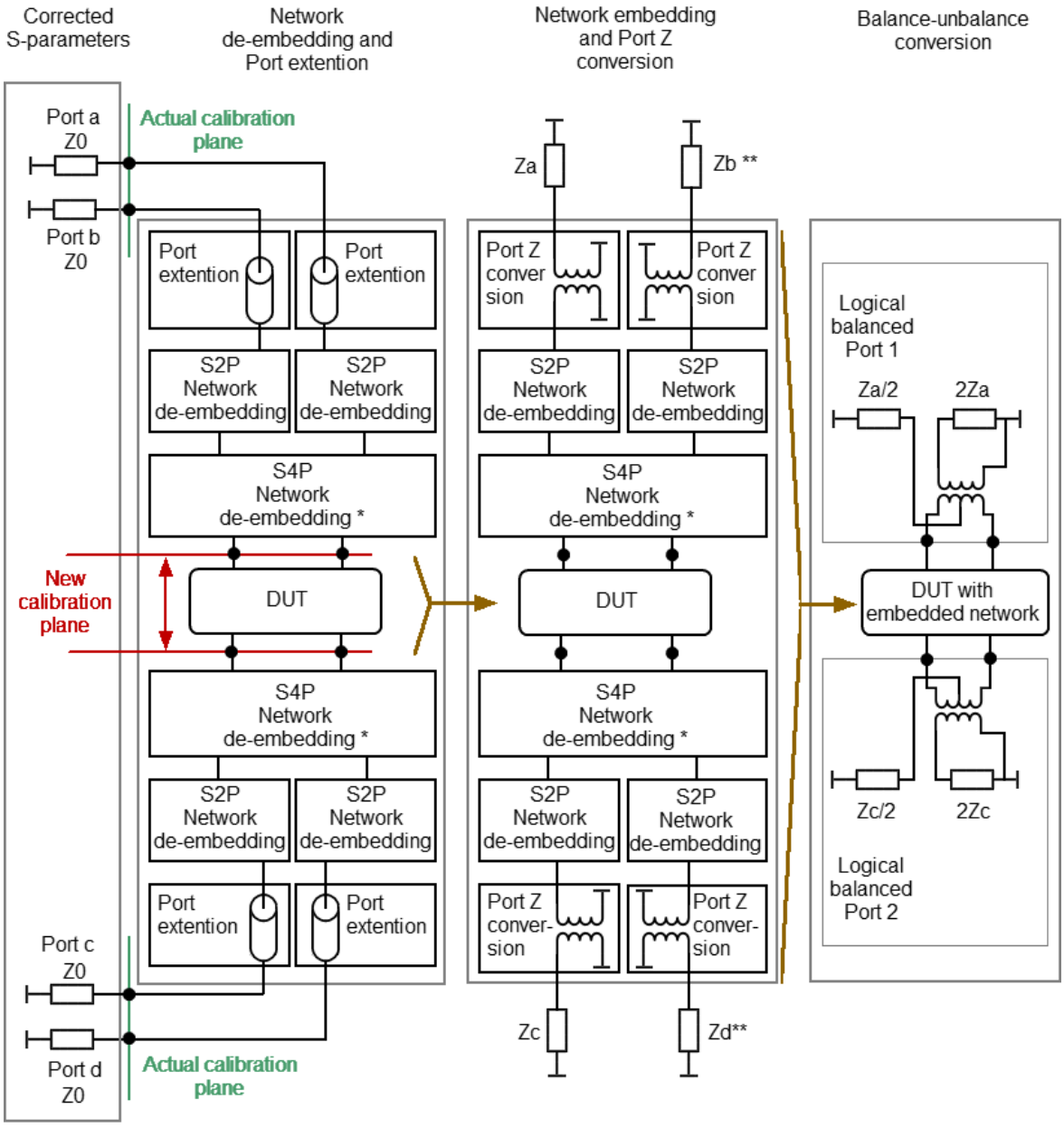


Fixture Simulation

The fixture simulation functions are a set of software functions for mathematically simulating measurement conditions that are different from the actual measurement conditions. The following conditions can be simulated:

1. For single-ended circuits:
    - Port Extension or Automatic Port Extension
    - Port Reference Impedance (Z) Conversion
    - Circuit De-embedding
    - Circuit Embedding
    - Four-Port Network De-embedding
2. For balanced circuits:
    - Differential Port Matching
    - Port Reference Impedance Conversion for Balanced Connection

The logic diagram of the fixture simulation function is shown in the figure below.

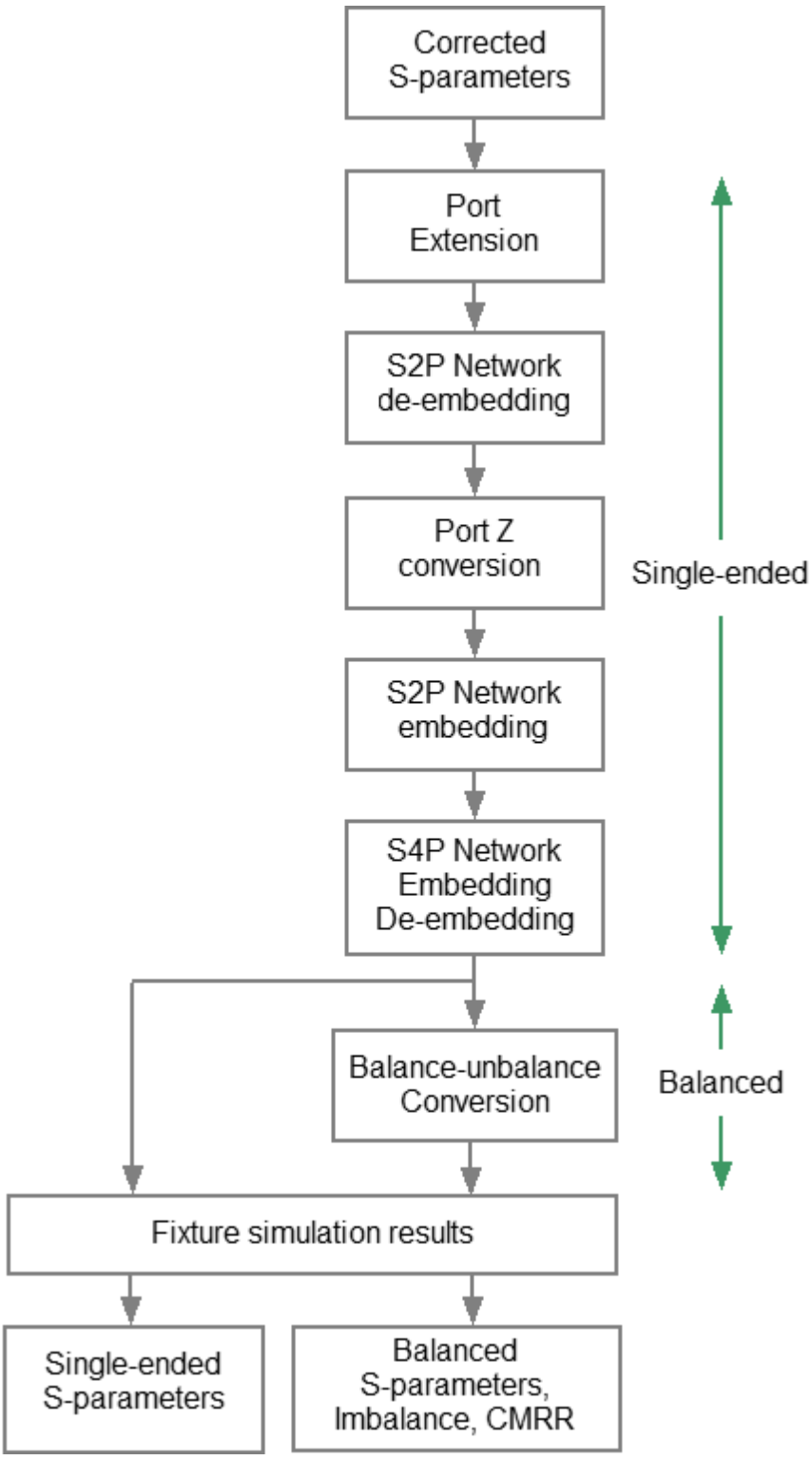


* S4P embedding and de-embedding are mutually exclusive operations.

** If balance-unbalance conversion is active, then condition mast be met: Za=Zb, Zc=Zd

Logic Diagram of Fixture Simulation Function

The data processing flow diagram of the fixture simulation feature is shown in the figure below.



Data Processing Flow Diagram of Fixture Simulation Function

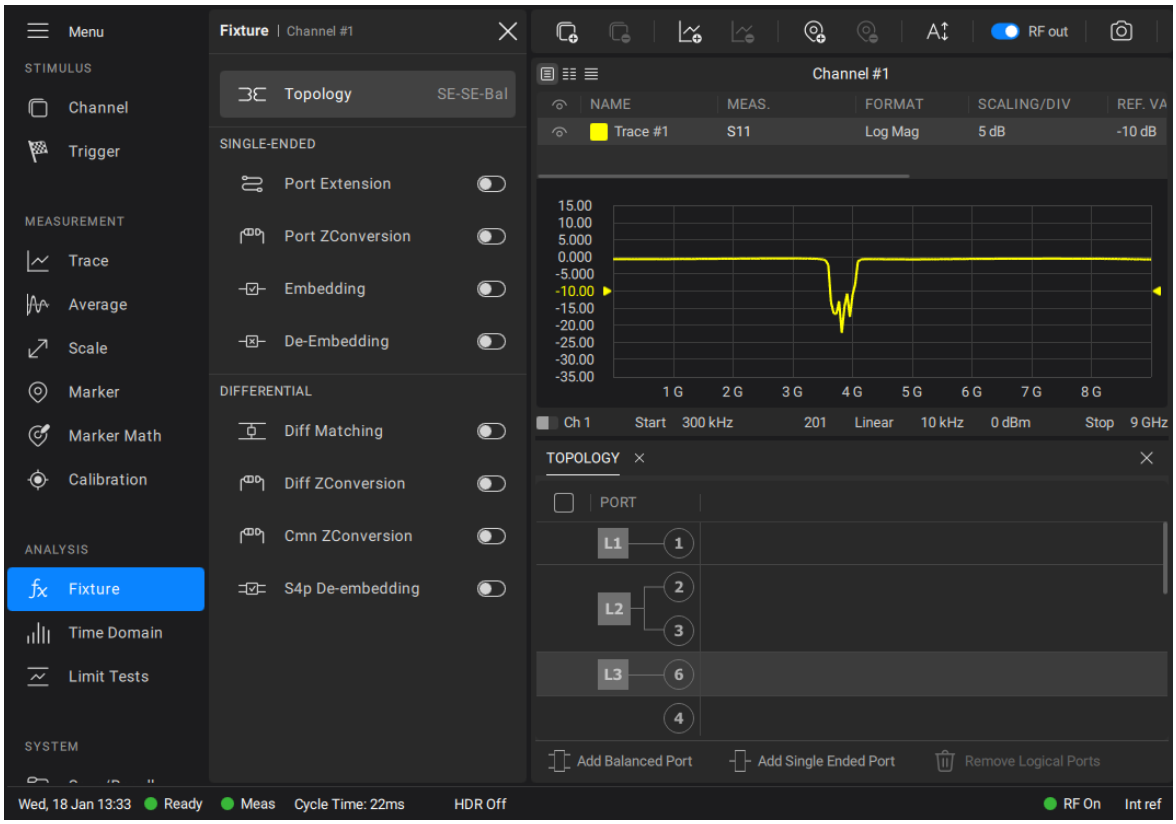
Topology

NOTE The section applies to all fixture simulation functions except S4p embedding/de-embedding. For this function, the topology is set in a wizard (see S4p Network Embedding/De-embedding).

Combine the analyzer ports into balanced (logical) ports before applying the fixture modeling functions. There are two possible assignment options: Single-Ended (SE) or Balanced (Bal). Balanced requires two analyzer ports. Each assigned logical port is assigned a number (L1, L2, ..., LN).

The topology of the ports is set in the table at the bottom of the channel window (see figure below). After defining the topology, use the Topology button to display the number of both types of ports. In the example in the figure below, the button is showing **SE-SE-Bal**, which corresponds to two Single-Ended ports and one Balanced port.

It is possible to configure the fixture simulation functions settings without defining the topology for Single-Ended ports and S4p Network Embedding/De-embedding for Balanced ports.

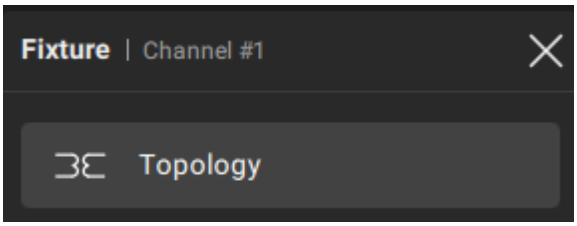


Topology (Example)

Showing or Hiding Topology Table

1. Select the channel (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Fixture** button in the main menu.
3. Click on the **Topology** button in the submenu.

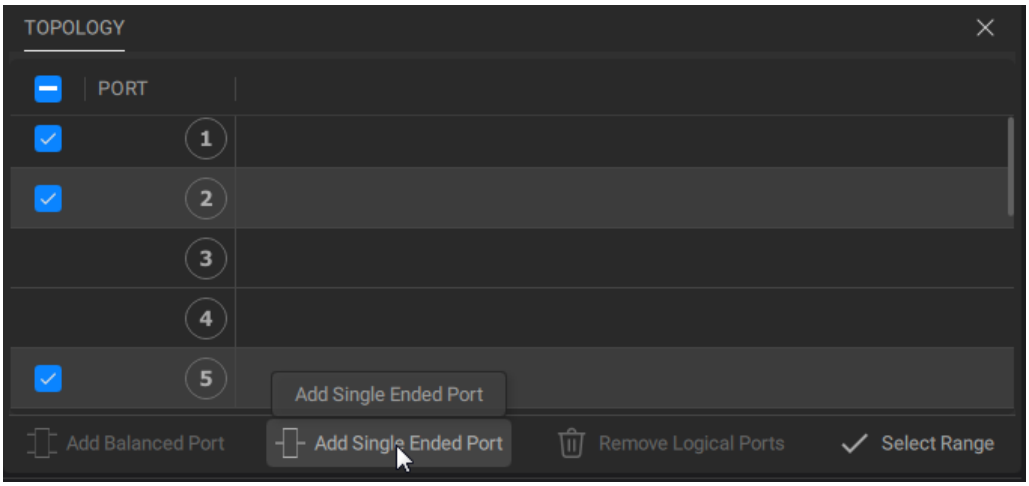
   NOTE By default, the topology table is hidden and the button is not highlight. The figure below shows the state of the button when the table is showing.



NOTE All topology settings are saved when the table is hidden.

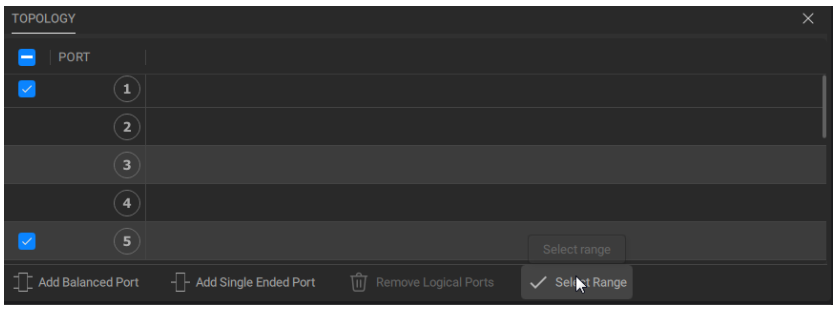
Configuring the Single-Ended Port (SE)

1. Show topology table (see Showing Topology Table).
2. Select the checkboxes of the desired ports and click on the **Add Single Ended Port** button at the bottom of the table.



SCPI CALCulate:FSIMulator:BALun:DEVice

NOTE You can quickly assign all ports between a selected pair as single-ended. To do this, select the starting and ending port number (see figure below) and click the Select Range at the bottom of the table.

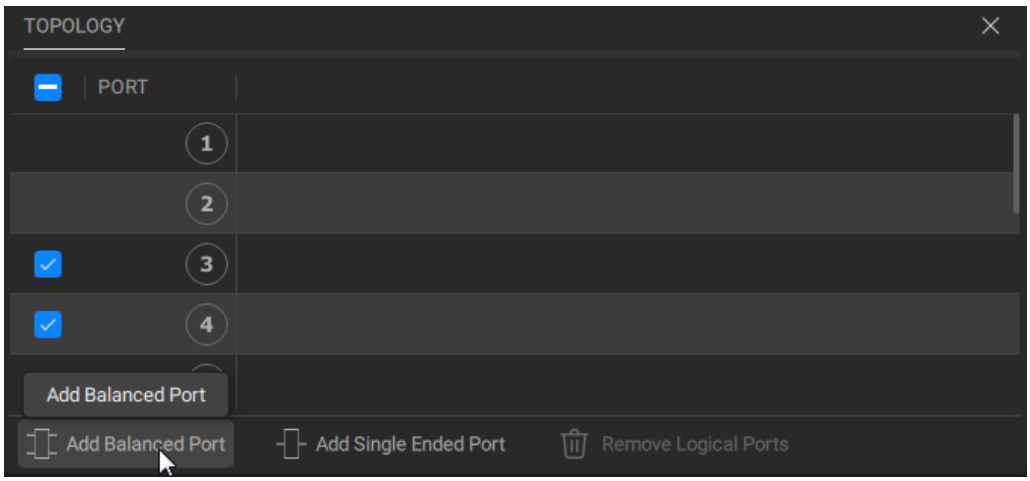


Configuring the Balance Port (Bal)

1. Show topology table (see Showing Topology Table).

2. Select the checkboxes of the two ports and click on the **Add Balanced Port** button at the bottom of the table.

   NOTE The **Add Balanced Port** button is only active if 2 ports are selected. The button is inactive in all other cases.

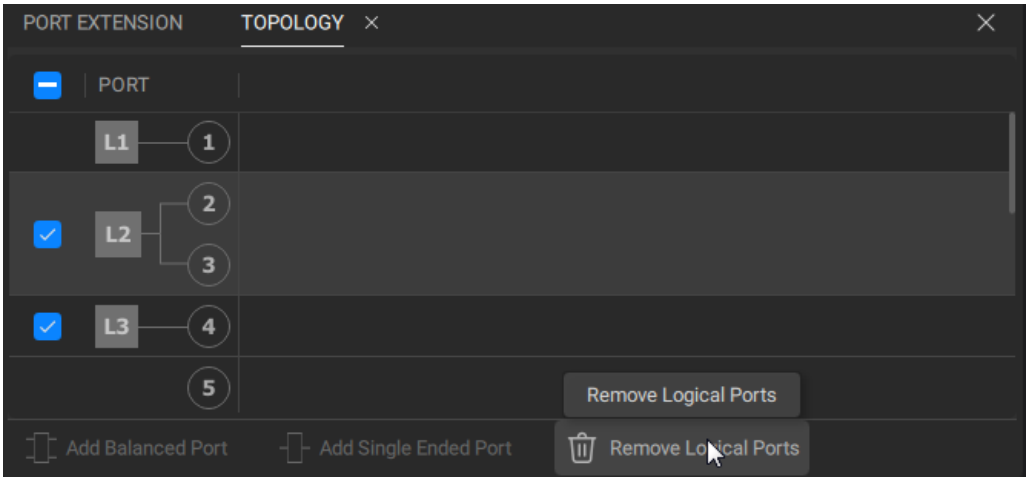


SCPI CALCulate:FSIMulator:BALun:DEVice

Deleting the Port

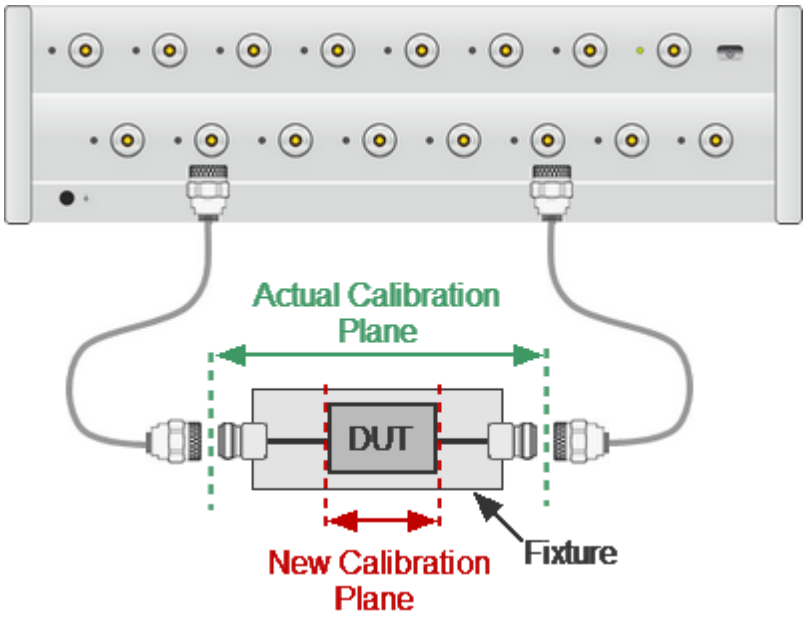
1. Show topology table (see Showing Topology Table).

2. Select the checkboxes of the desired ports and click on the **Remove Logical Ports** button at the bottom of the table.



Port Extension

The port extension function moves the calibration plane toward the DUT terminals by the specified electrical delay value. The function is useful when a fixture is used for the DUT connecting and the calibration cannot be performed at the DUT terminals. The calibration plane can be established at coaxial connectors of the fixture and then moved to the DUT terminals using the port extension function (see figure below).



Port Extension

The function uses the model of the perfectly matched transmission line with loss with parameters:

- The phase incursion in the line is

$$\Delta\varphi = e^{-j\cdot 2\pi\cdot f\cdot\tau},$$

where f — frequency, Hz,

τ — electrical delay, sec.

- The loss of the line $L(f)$ can be specified by one of the following methods:

1. Frequency-independent loss at DC (L_0)

$$L(f) = L_0.$$

2. Loss determined by the losses in two frequency points (L_0 at DC, and L_1 at frequency F_1)

$$L(f) = L_0 + (L_1 - L_0)\sqrt{\frac{f}{F_1}}$$

3. Loss determined by the losses in three frequency points (L_0 at DC, L_1 at frequency F_1 and L_2 at frequency F_2)

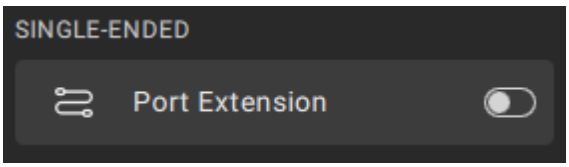
$$L(f) = L_0 + (L_1 - L_0)(\frac{f}{F_1})^n ,$$

$$n = \frac{log|\frac{L_1}{L_2}|}{log\frac{F_1}{F_2}} .$$

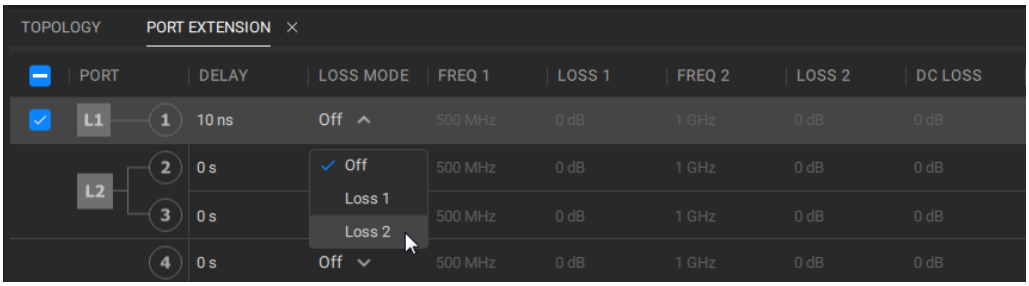
NOTE The accuracy of the port extension method depends on the fixture used. The closer the fixture parameters are to the model of a perfectly matched transmission line, the higher the accuracy.

Setting Port Extension Function Parameters

1. Select the channel (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Fixture** button in the submenu.
3. Click on the **Port Extension** button in the main menu. The figure below shows the state of the button when the table is showing.

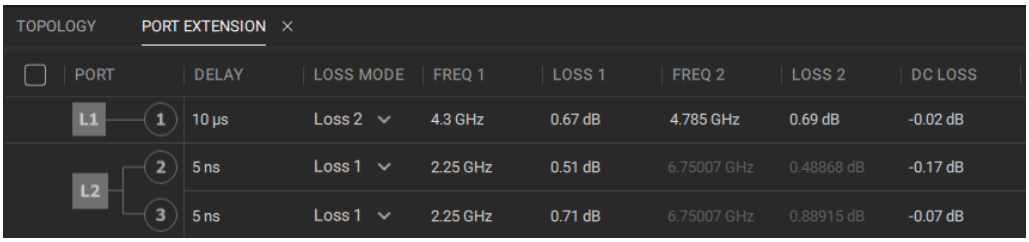


4. Click on the DELAY field in the table in bottom of the channel window and enter the numerical value.
5. Click on the LOSS MODE drop-down list in the table in bottom of the channel window and select desired loss mode from the list.



5 If **Loss 1** or **Loss 2** mode is selected, click on the FREQ 1, LOSS 1, FREQ 2, LOSS 2 and DC LOSS fields in the table in bottom of the channel window and enter the numerical values.

NOTE FREQ 2, LOSS 2 fields are only available if **Loss 2** mode is selected.



SCPI

SENSe:CORRection:EXTension:PORT:TIME

SENSe:CORRection:EXTension:PORT:INCLude

SENSe:CORRection:EXTension:PORT:FREQuency

SENSe:CORRection:EXTension:PORT:LOSS

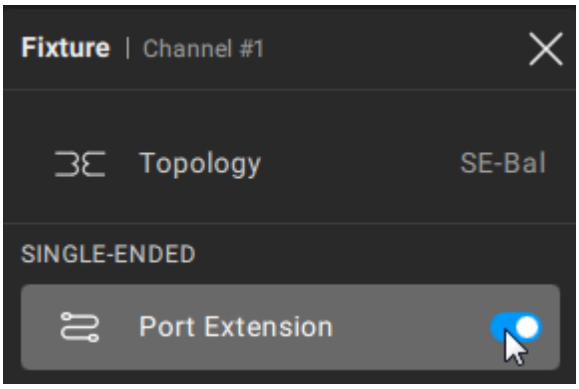
SENSe:CORRection:EXTension:PORT:LDC

Enabling or Disabling Port Extension Function

1 Select the channel (see Selection of Active Trace, Diagram, Channel).

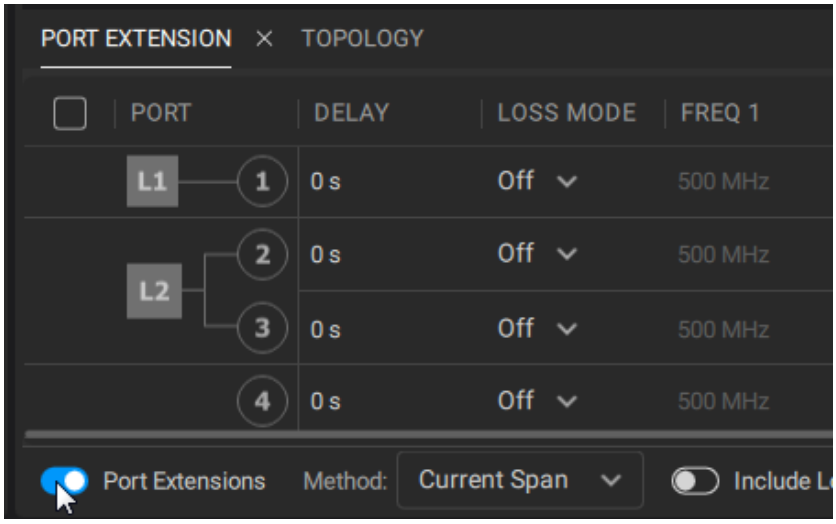
2 Click on the **Fixture** button in the main menu.

3 Toggle **Port Extension** ON or OFF in the submenu.



SCPI SENSe:CORRection:EXTension

NOTE You can also enable or disable the function in the port extension parameter table in bottom of the channel window (if the table is showing). Toggle **Port Extension** ON or OFF in the lower left corner of the table.



NOTE The port extension function affects all channel traces with the corresponding type of measurement. After port extension is applied, the trace manager displays the **Pxt** status in the matching trace (see Trace Manager).

Automatic Port Extension

The auto port extension function allows for automatic calculation of port extension parameters by measuring a SHORT or an OPEN standard. It is also possible to measure both standards; in this case the average value will be used.

The auto port extension function can be used simultaneously for any number of ports from 1 to the number of actual instrument ports. First select the number of ports and then connect SHORT or OPEN standards to the chosen ports.

In the auto port extension menu, specify the frequency range, which will be considered when calculating the port extension parameter. There are three methods of setting the frequency range (see table below).

Method	Description
Current Span [default]	Current frequency range. Include Loss and Adjust Mismatch options are available.
User Span	User-defined frequency range (within current range). Include Loss and Adjust Mismatch options are available. The user can also set the Start and Stop of the measuring range.
Active Marker	User-defined frequency point (selected with active marker). Include Loss and Adjust Mismatch options are available. The user can also set the Start and Stop of the measuring range.

The result of the auto port extension function is the calculation of the electrical delay value. After auto port extension completes, this delay value appears in the corresponding field of the **Port Extension** table, and the port extension function is automatically enabled, if it was disabled.

If the **Include Loss** option is enabled prior to the auto port extension function running, the loss values **Loss 1**, **Loss 2** at the respective frequency values **Freq 1**, **Freq 2** will be calculated and applied. The **Freq 1**, **Freq 2** values are calculated as ¼ and ¾ of the frequency range set by one of the following two methods: current or user defined. If the frequency range is defined by a marker, frequency point **Freq 2** is not calculated.

If the **Adjust Mismatch** option is enabled prior to the auto port extension function running, the frequency-independent loss at DC, the **DC Loss** value, is also set. The

value of loss at the lower frequency of the current range is used as the **Loss at DC** value.

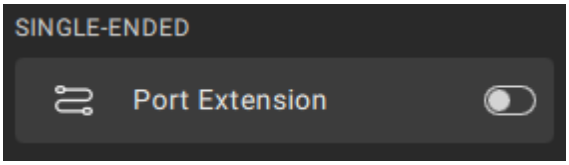
Automatic Port Extension Activation

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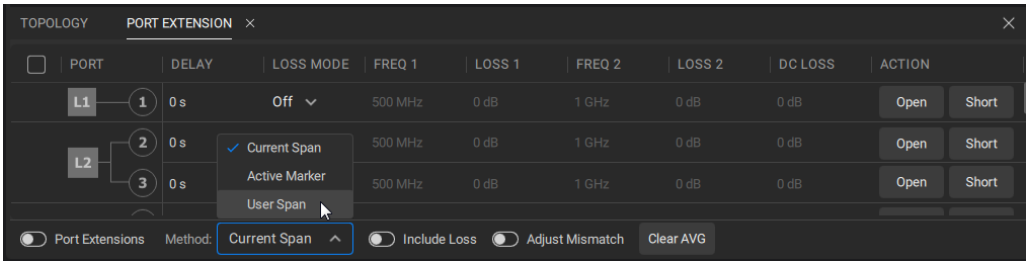
1. Select the channel (see Selection of Active Trace, Diagram, Channel).

2. Click on the **Fixture** button in the main menu.

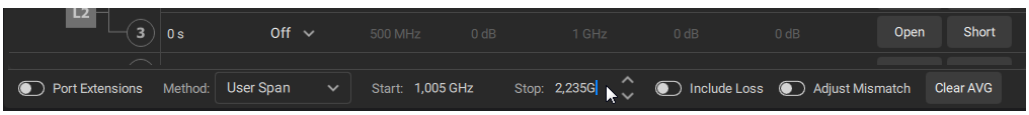
3. Click on the **Port Extension** button in the main menu. The figure below shows the state of the button when the table is showing.



4. Click on the **Method** drop-down list in the table in bottom of the channel window and select methods of setting the frequency range.



5. If **User Span** method is selected, click on the Start and Stop textboxes in the table at the bottom of the channel window and enter the numerical values.

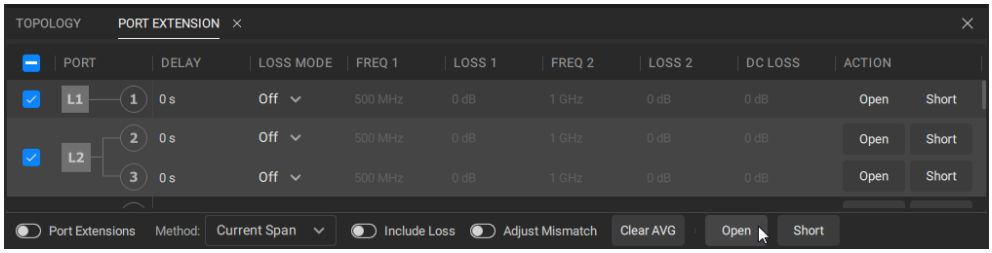


6. If you want to include losses, toggle **Include Loss** ON in the table at the bottom of the channel window.

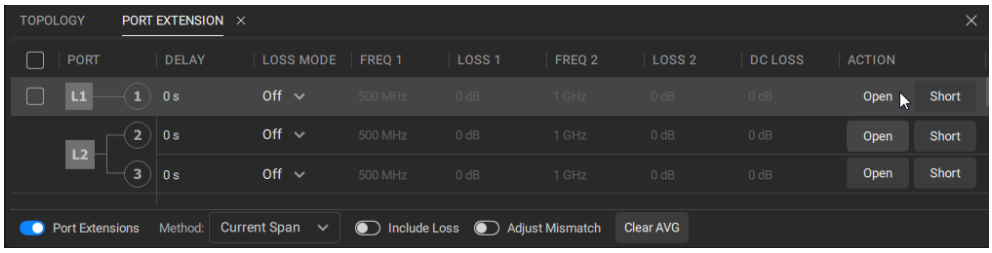
7. If you want to adjust mismatch at DC, toggle **Adjust Mismatch** ON in the table at the bottom of the channel window.

8 You can perform the measurement:

1. Connect all SHORTs or OPENs standards at once to the desired ports. Then highlight all rows in the Port Extension table and click on the **Open** or **Short** button below the table.



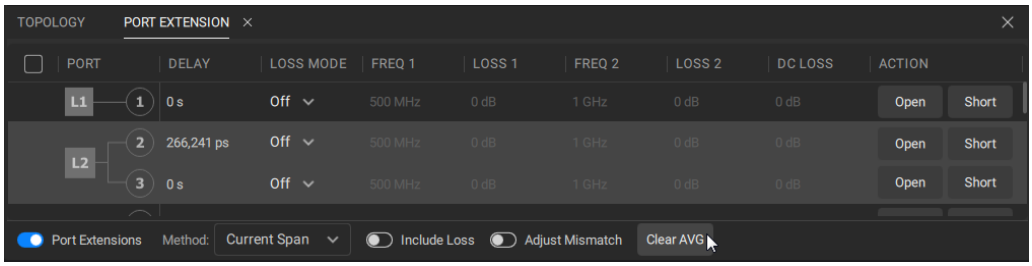
2. Connect the SHORT or OPEN standard to the port step-by-step. Click on the **Open** or **Short** button on the line that corresponds to the port.



After auto port extension completes, this delay value appears in the corresponding field of the **Port Extension** table, and the port extension function is automatically enabled, if it was disabled.

NOTE If both measurements have been performed, the result will appear as the average value of the two.

9 If it is necessary to clear the last calculated data for all ports, click the **Clear AVG** button in the table at the bottom of the channel window.



SCPI SENSe:CORRection:EXTension:AUTO:CONFig

SENSe:CORRection:EXTension:AUTO:STARt

SENSe:CORRection:EXTension:AUTO:STOP

SENSe:CORRection:EXTension:AUTO:LOSS

SENSe:CORRection:EXTension:AUTO:DCOFfset

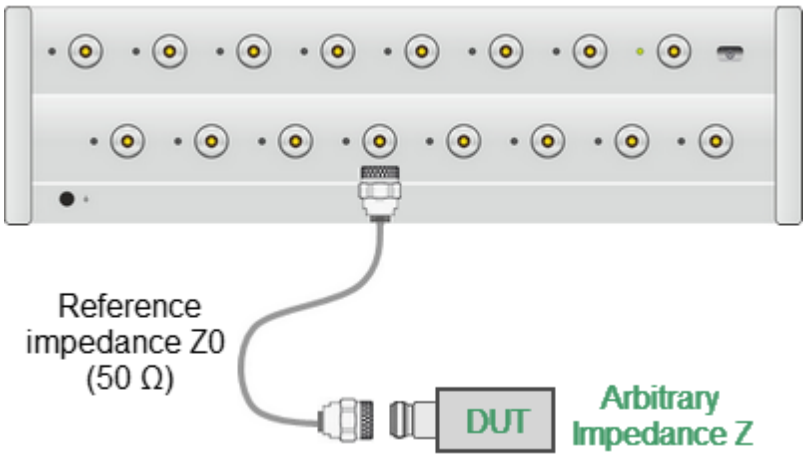
SENSe:CORRection:EXTension:AUTO:MEASure

SENSe:CORRection:EXTension:AUTO:PORT

NOTE The auto port extension function affects all channel traces with the corresponding type of measurement. After auto port extension is applied, the trace manager displays the **Pxt** status in the matching trace (see Trace Manager).

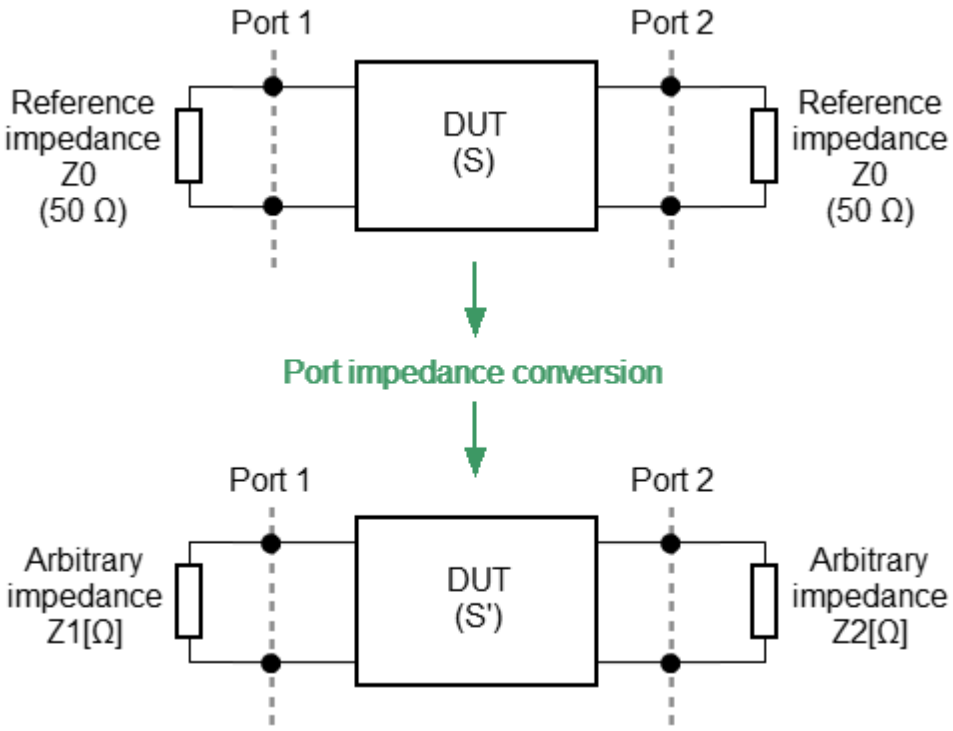
Port Reference Impedance (Z) Conversion

The default reference impedance of a port is equal to the impedance of the connectors (50 Ω). But in the process, it is often required to measure DUT with arbitrary impedance (see example in the figure below), not equal to the impedance of a port. In this case, it is possible to convert the reference impedance to an arbitrary impedance value using the software.



Example of measuring a DUT with an arbitrary impedance by the Analyzer with reference impedance 50 Ω

Port reference impedance conversion is a function that mathematically converts the matrix of S-parameters measured at the reference impedance of port Z0 to the matrix of S-parameters measured at an arbitrary impedance of port Z1 (see figure below). The function is also referred to as the renormalization transformation of S-parameters.



Port reference impedance conversion

Renormalization can be based on two alternative microwave circuit theories, whose conversion formulas may yield different results if the reference impedance of at least one test port has a non-zero imaginary part. The first theory is "A General Waveguide Circuit Theory" (R.B.Marks and D.F.Williams). The second theory is the "Power waves and the Power Scattering Matrix" (K.Kurokawa).

NOTE

The source value of the Z0 port reference impedance (commonly 50 Ω) is defined in the process of the calibration. It is determined by the characteristic impedance of the calibration kit and its value is entered as described in System Impedance Z0.

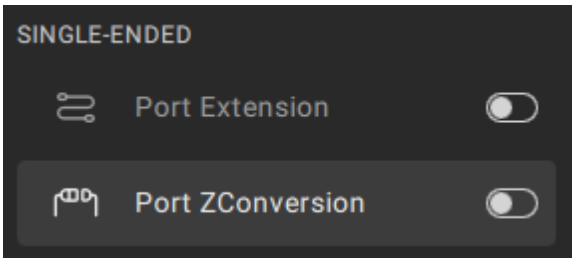
Setting Port Reference Impedance Conversion Function Parameters

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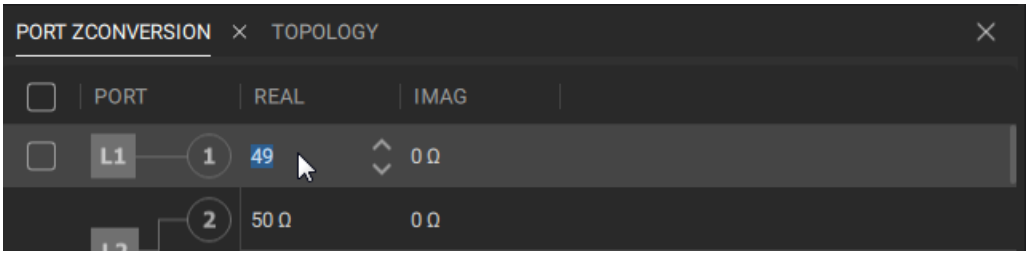
1. Select the channel (see Selection of Active Trace, Diagram, Channel).

2. Click on the **Fixture** button in the main menu.

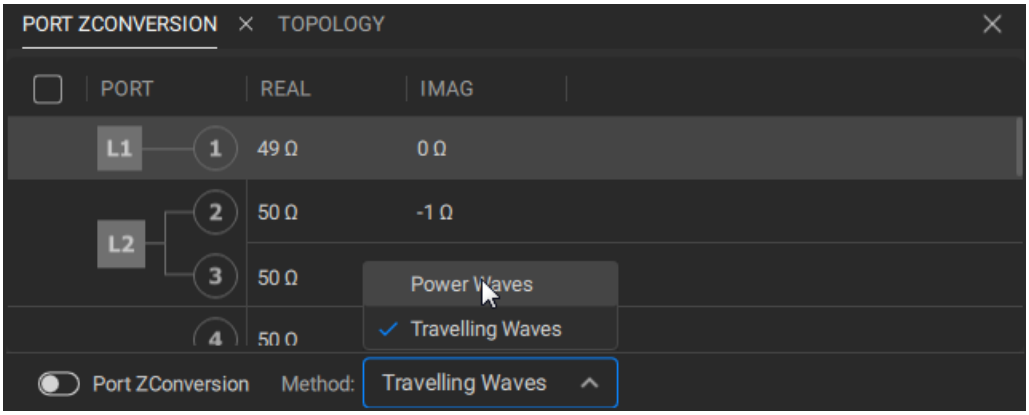
3. Click on the **Port ZConversion** button in the main menu. The figure below shows the state of the button when the table is showing.



4 Click on the REAL and IMAG fields in the table in bottom of the channel window and enter the numerical value.



5 Click on the **Method** drop-down list in the table in bottom of the channel window and select methods of methods of theory according to which the renormalization of S-parameters.



SCPI CALCulate:FSIMulator:SENDed:ZCONversion:PORT:Z0

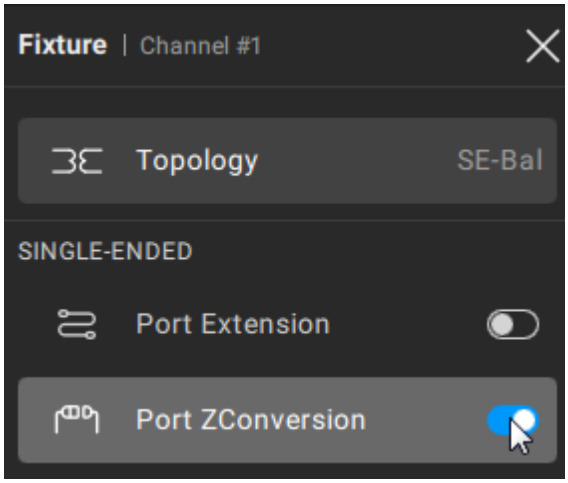
CALCulate:FSIMulator:SENDed:ZCONversion:PORT:Z0:REAL

CALCulate:FSIMulator:SENDed:ZCONversion:PORT:Z0:IMAGinary

CALCulate:FSIMulator:SENDed:ZCONversion:THEory

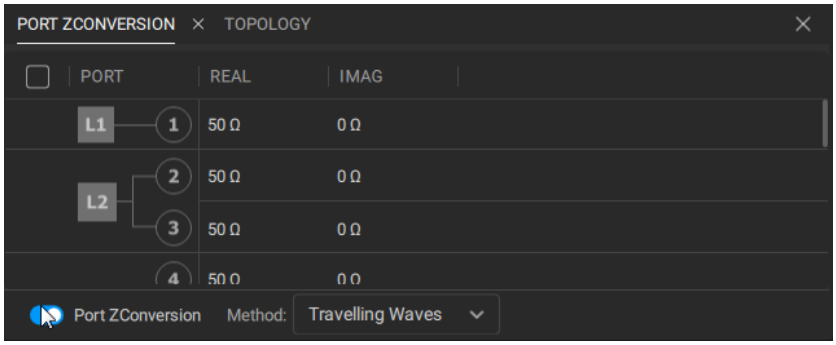
Enabling or Disabling Port Reference Impedance Conversion Function

1. Select the channel (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Fixture** button in the main menu.
3. Toggle **Port ZConversion** ON or OFF in the submenu.



SCPI CALCulate:FSIMulator:SENDed:ZCONversion:STATe

NOTE You can also enable or disable the function in the port reference impedance conversion table in bottom of the channel window (if the table is showing). Toggle **Port ZConversion** ON or OFF in the lower left corner of the table.



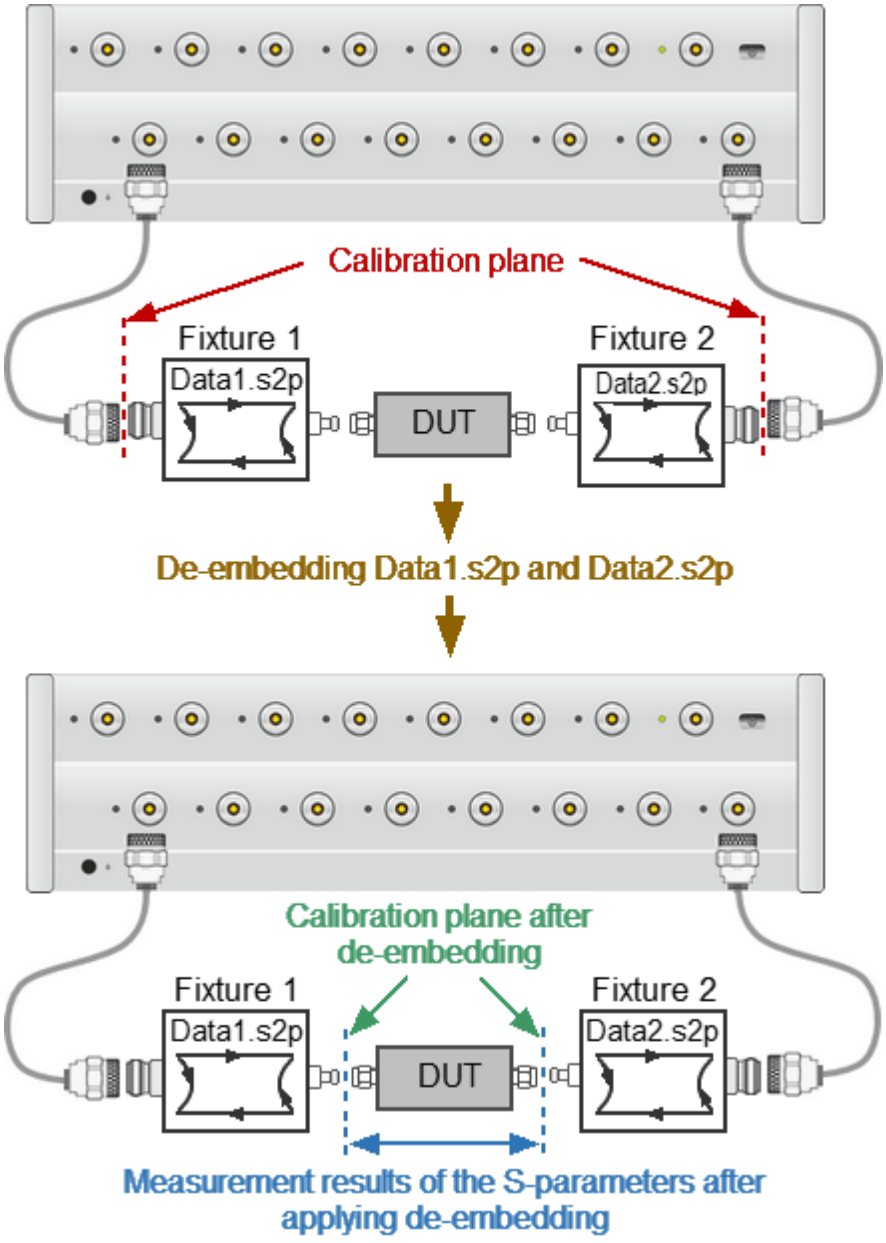
NOTE	The port reference impedance conversion function affects all channel traces. After port reference impedance conversion is applied, the trace manager displays the **Z0** status in the all traces (see Trace Manager).

De-Embedding

De-embedding is used to transform the S-parameter by eliminating some circuit effects from the measurement results.

The de-embedding function mathematically excludes the effect of the fixture circuit existing between the calibration plane and the DUT in the real network from the measurement results. The fixture is used for DUTs that cannot be directly connected to the test ports.

The de-embedding function shifts the calibration plane closer to the DUT, as if the calibration has been executed on the network with this circuit removed (see figure below).



Measuring the DUT Using De-Embedding Function

The circuit being removed should be defined in the data file containing S-parameters of that circuit. The circuit should be described as two-port in Touchstone file (extension *.S2P), which contains the S-parameter table: S11, S21, S12, and S22 for a number of frequencies.

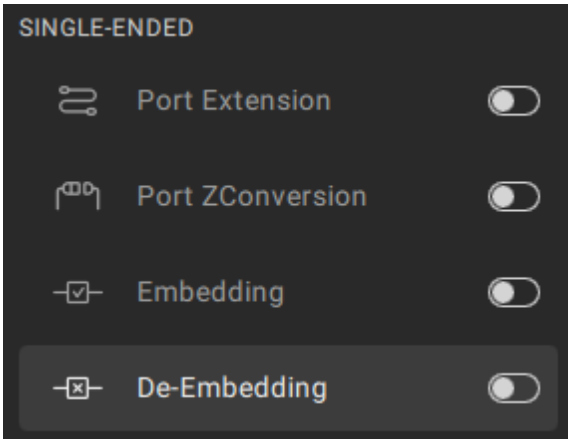
NOTE The S-matrices of all de-embedding circuits are oriented so that the S11 is directed to the Analyzer port and the S22 is directed to the DUT. Ports can be inverted.

Setting De-Embedding Function Parameters

1. Select the channel (see Selection of Active Trace, Diagram, Channel).

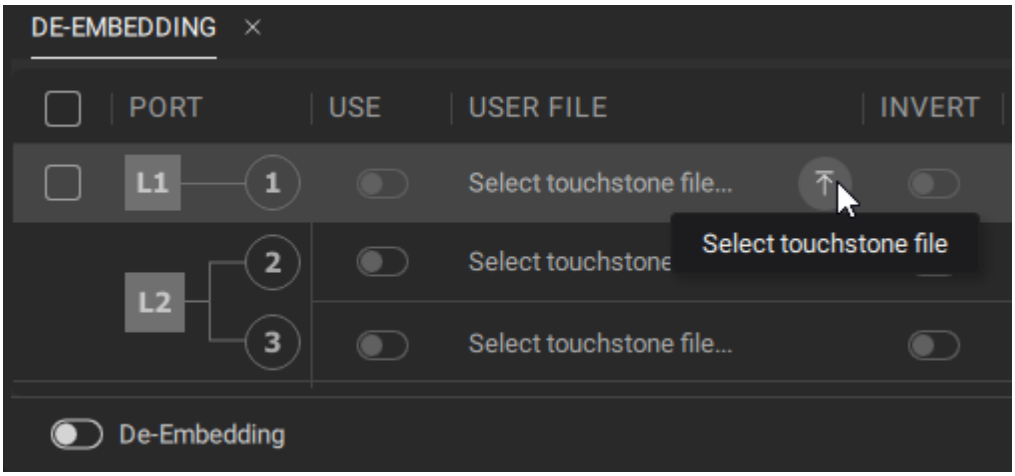
2. Click on the **Fixture** button in the main menu.

3. Click on the **De-Embedding** button in the main menu. The figure below shows the state of the button when the table is showing.

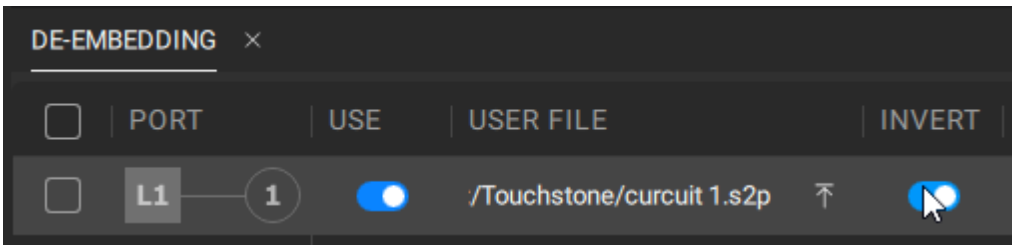


4. Click on the USER FILE field in the table at the bottom of the channel window. Select the directory and the Touchstone file name of the de-embedded circuit S-parameters of the port. When the file is selected, the directory and the name of the selected file will display in USER FILE field.

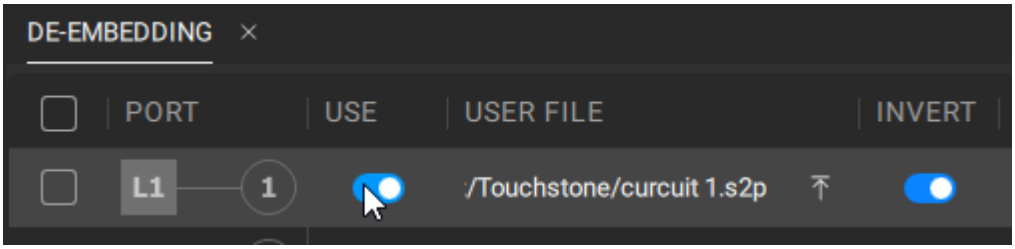
   NOTE When the file is selected, the de-embedding function is automatically enabled, if it was disabled (the toggle button in the USE field in table is ON in this case).



5 If you want to invert the ports of the embedding circuit, toggle **INVERT** ON in the required field of the table.



6 Toggle the USE field ON or OFF for the desired port(s) on the corresponding row in the table.

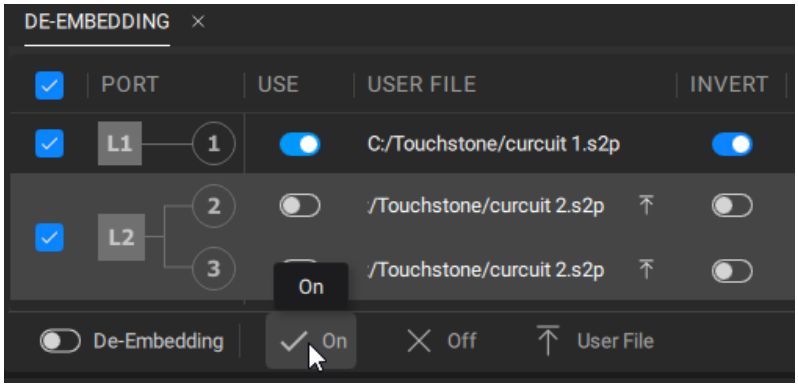


SCPI CALCulate:FSIMulator:SENDed:DEEMbed:PORT:USER:FILename

CALCulate:FSIMulator:SENDed:DEEMbed:PORT:STATe

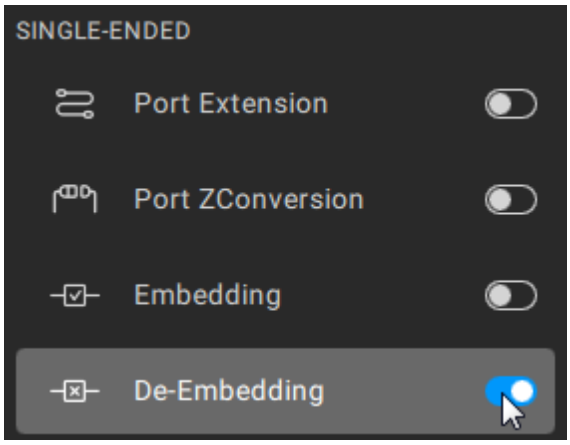
NOTE You can quickly enable/disable the de-embedding function for several ports, or select the Touchstone file name. Select the checkboxes by the required ports in the table. Then, the following buttons will appear at the bottom of the table:

- Click on the **User File** button and select the directory and the Touchstone file name.
- Click on the **On** or **Off** button to enable or disable the de-embedding function.



Enabling or Disabling De-Embedding Function

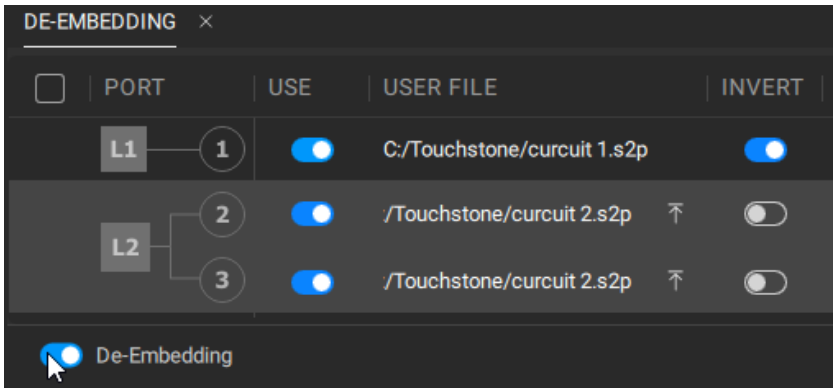
1. Select the channel (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Fixture** button in the main menu.
3. Toggle the **De-Embedding** button ON or OFF in submenu.



SCPI CALCulate:FSIMulator:SENDed:DEEMbed:STATe

NOTE You can also enable or disable the function in the de-embedding parameter table at the bottom of the channel

window (if the table is showing). Toggle the **De-Embedding** button ON or OFF in the lower left corner of the table.



NOTE

The de-embedding function affects all channel traces. After de-embedding is applied, the trace manager displays the **Dmb** status in the all traces (see Trace Manager).

Embedding

Embedding is a function that performs S-parameter transformation via integration of some virtual circuit into the real network (see figure below).

The embedding function mathematically simulates the DUT parameters after adding the fixture circuits.

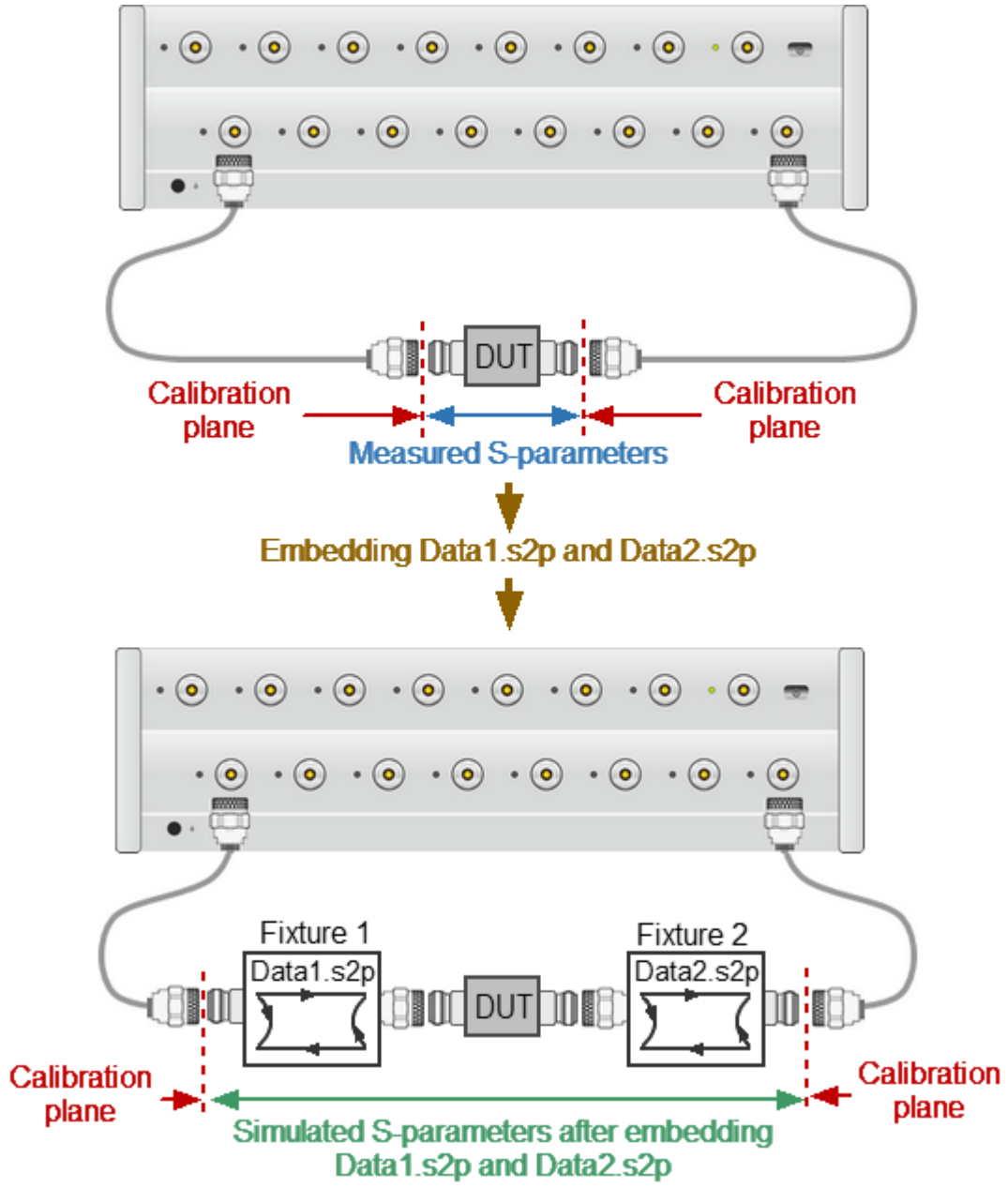
The embedding function is an inverted de-embedding function.

Example

Use the embedding function to evaluate and simulate the effects of incorporating a virtual circuit on the S-parameters of the DUT.

Example

Use the embedding function in cases where fixtures were used during calibration to connect calibration standards. However, for measuring DUT parameters, fixtures are not required.



Simulating S-Parameters of the DUT Using Embedding Function

The circuit being integrated should be defined in the data file containing S-parameters of that circuit. The circuit should be described as a two-port in the Touchstone file (extension *.S2P), which contains the S-parameter table: S11, S21, S12, and S22 for a number of frequencies.

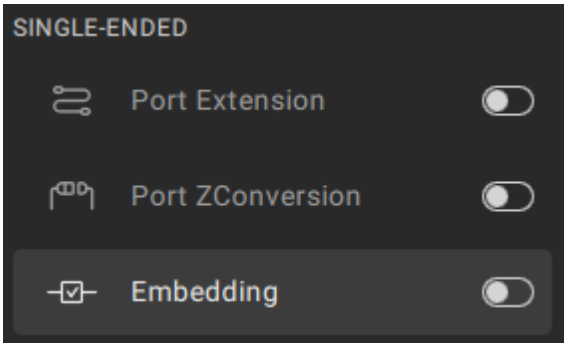
NOTE The S-matrices of all embedding circuits are oriented so that the S11 is directed to the Analyzer port and the S22 is directed to the DUT. Ports can be inverted.

Setting Embedding Function Parameters

1. Select the channel (see Selection of Active Trace, Diagram, Channel).

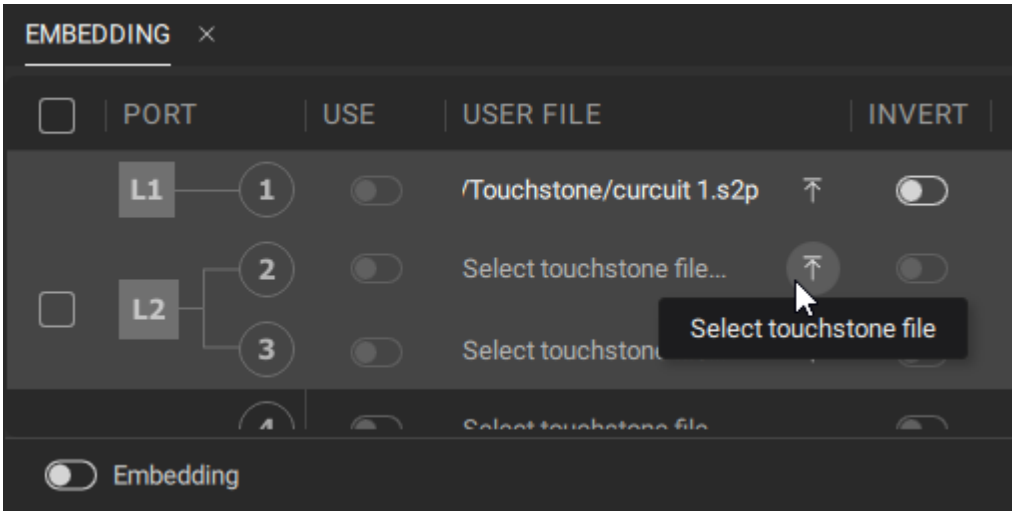
2. Click on the **Fixture** button in the main menu.

3. Click on the **Embedding** button in the main menu. The figure below shows the state of the button when the table is showing.

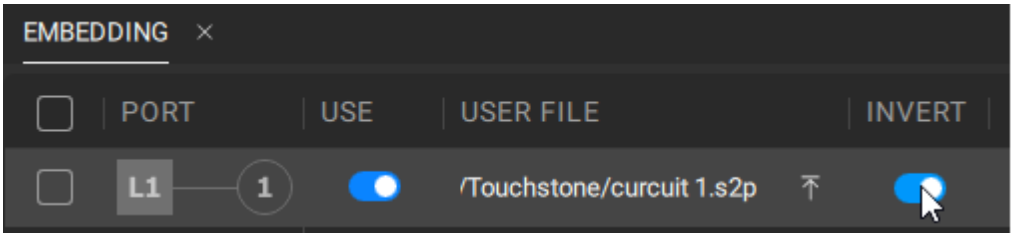


4. Click on the USER FILE field in the table at the bottom of the channel window. Select the directory and the Touchstone file name of the embedded circuit S-parameters of the port. When the file is selected, the directory and the name of the will display in USER FILE field.

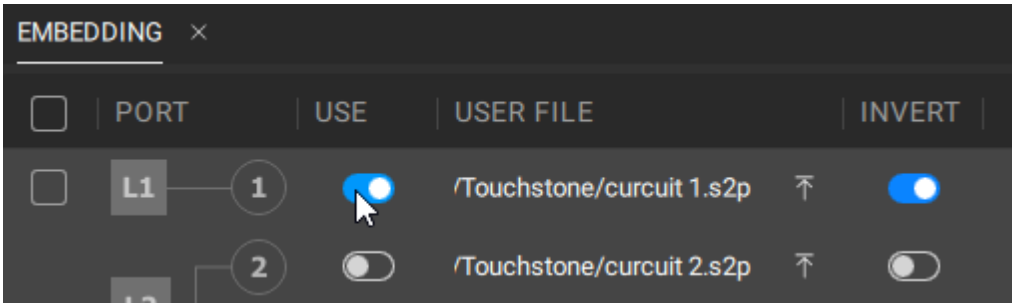
NOTE When the file is selected, the embedding function is automatically enabled, if it was disabled (the toggle button in the USE field in table is set to ON).



5. If you want to invert the ports of the embedding circuit, toggle **INVERT** ON in the required field of the table.



6 If necessary, toggle the button in USE field ON or OFF in the table at the bottom of the channel window.

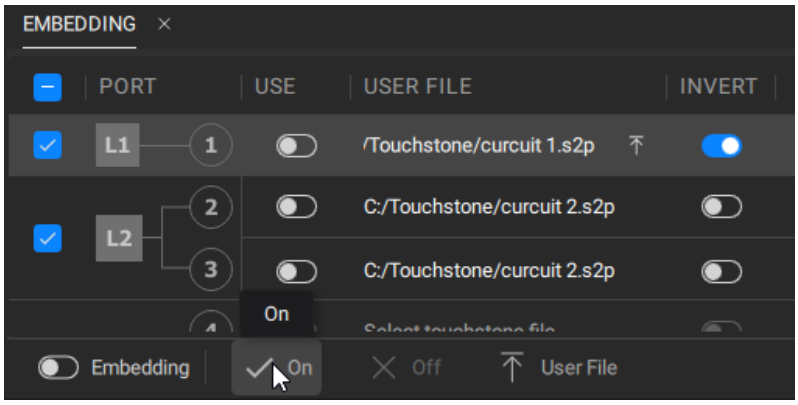


SCPI CALCulate:FSIMulator:SENDed:PMCircuit:PORT:USER:FILename

CALCulate:FSIMulator:SENDed:PMCircuit:PORT:STATe

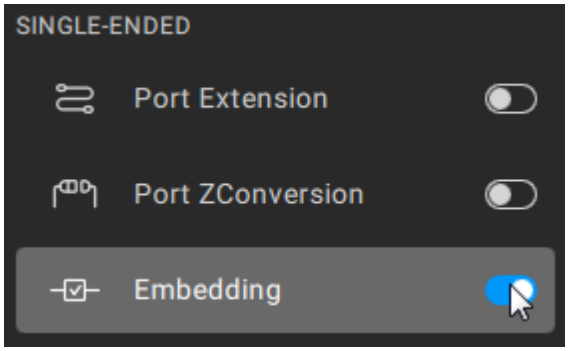
NOTE You can quickly enable/disable the embedding function for several ports, or select the Touchstone file name. Select the checkboxes by the required ports in the table. Then, the following buttons will appear at the bottom of the table:

- Click on the **Use File** button and select the directory and the Touchstone file name.
- Click on the **On** or **Off** button to enable or disable embedding function.



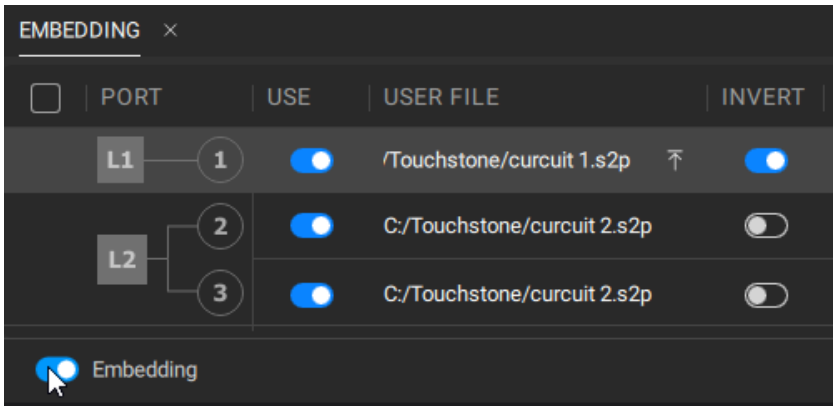
Enabling or Disabling Embedding Function

1. Select the channel (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Fixture** button in the main menu.
3. Toggle **Embedding** ON or OFF in the submenu.



SCPI CALCulate:FSIMulator:SENDed:PMCircuit:STATe

NOTE You can also enable or disable the function in the embedding parameter table at the bottom of the channel window (if the table is showing). Toggle **Embedding** ON or OFF in the lower left corner of the table.

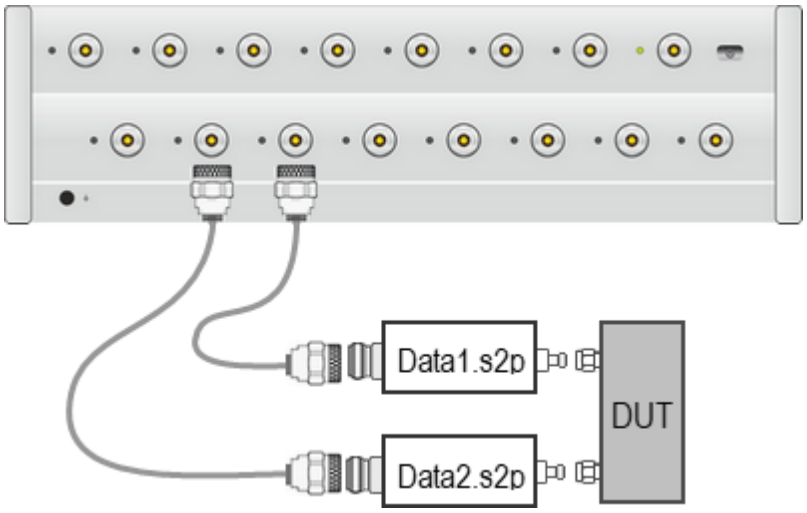


NOTE The embedding function affects all channel traces. After embedding is applied, the trace manager displays the **Emb** status in the all traces (see Trace Manager).

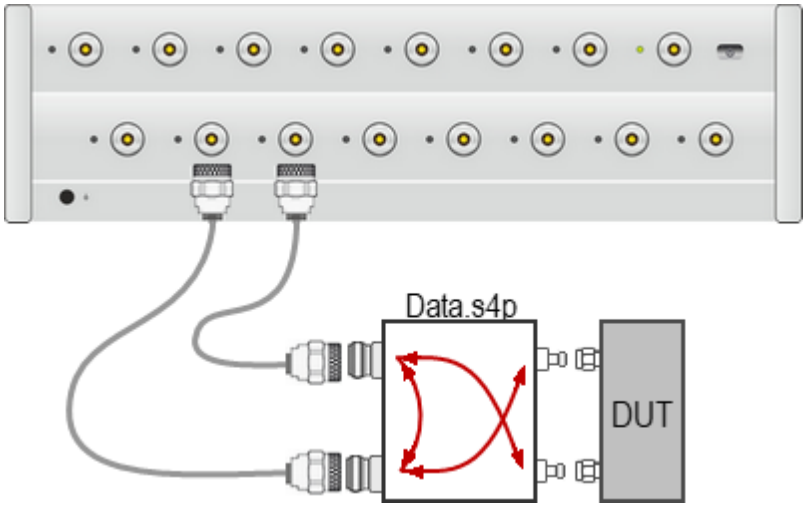
S4p Network Embedding/De-Embedding

S4p network embedding/de-embedding is a function that performs S-parameter conversion using a four-port network as an embedded or de-embedded network. The network is a Touchstone file (with the .S4P extension), containing an S-parameter table of S11, S21, S31, S41, … S44 for a number of frequencies. The embedding and de-embedding operations of this function are mutually exclusive.

Unlike two-port de-embedding and embedding function (see De-Embedding and Embedding), the four-port network embedding/de-embedding function allows for taking into account the influence of crosstalk between the ports of the device (see figure below).



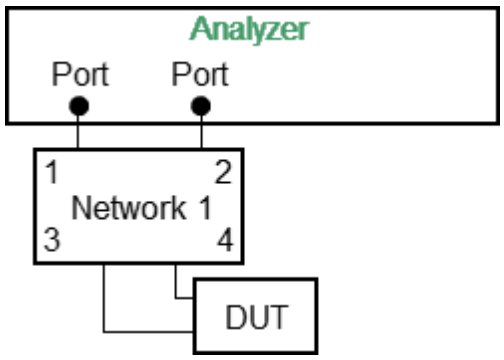
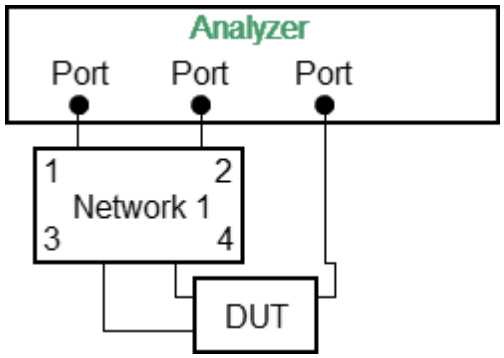
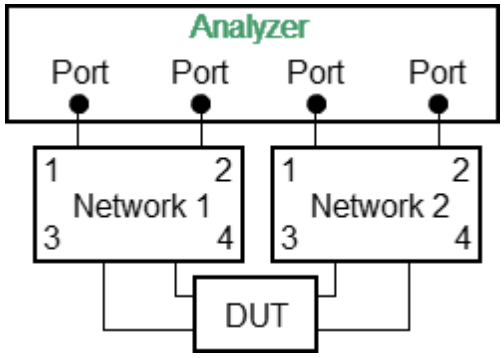
Two-Port Embedding/De-Embedding



Four-Port Embedding/De-Embedding

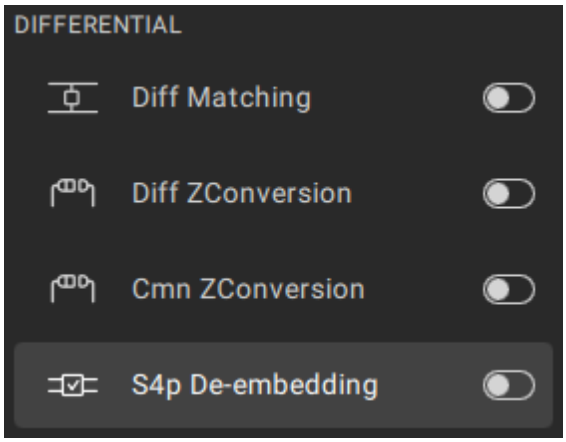
Comparison of Two-Port and Four-Port Embedding/De-embedding

Determine the topology type of the port connections in the wizard before applying S4p network embedding/de-embedding functions. The following topology types are shown in the table below.

Topology Type	Circuit Based on Topology
Two-ports (Bal)	
Three-ports (Bal-SE)	
Four-ports (Bal-Bal)	

Displaying or Hiding S4p Embedding/De-embedding Wizard

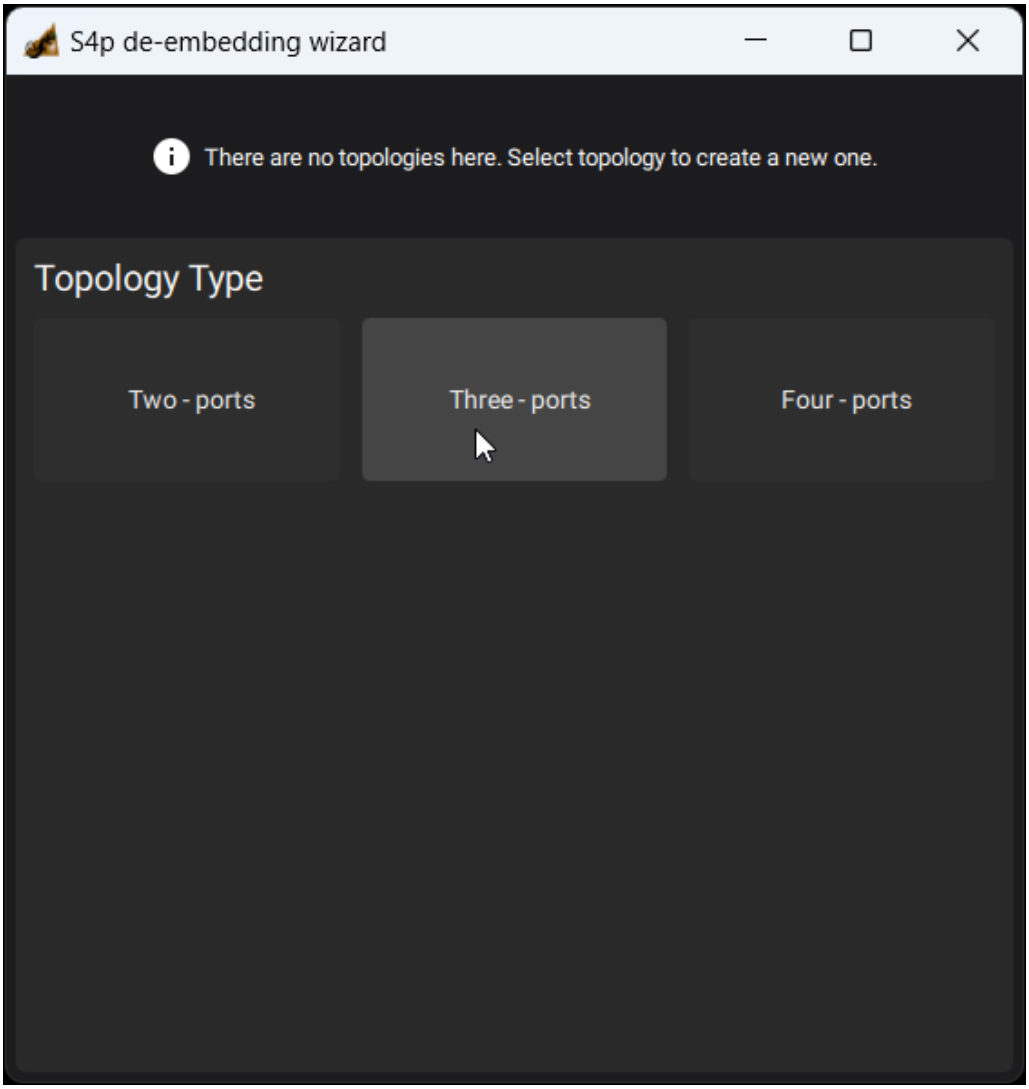
1. Select the channel (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Fixture** button in the main menu.
3. Click on the **S4p De-embedding** button in the submenu.



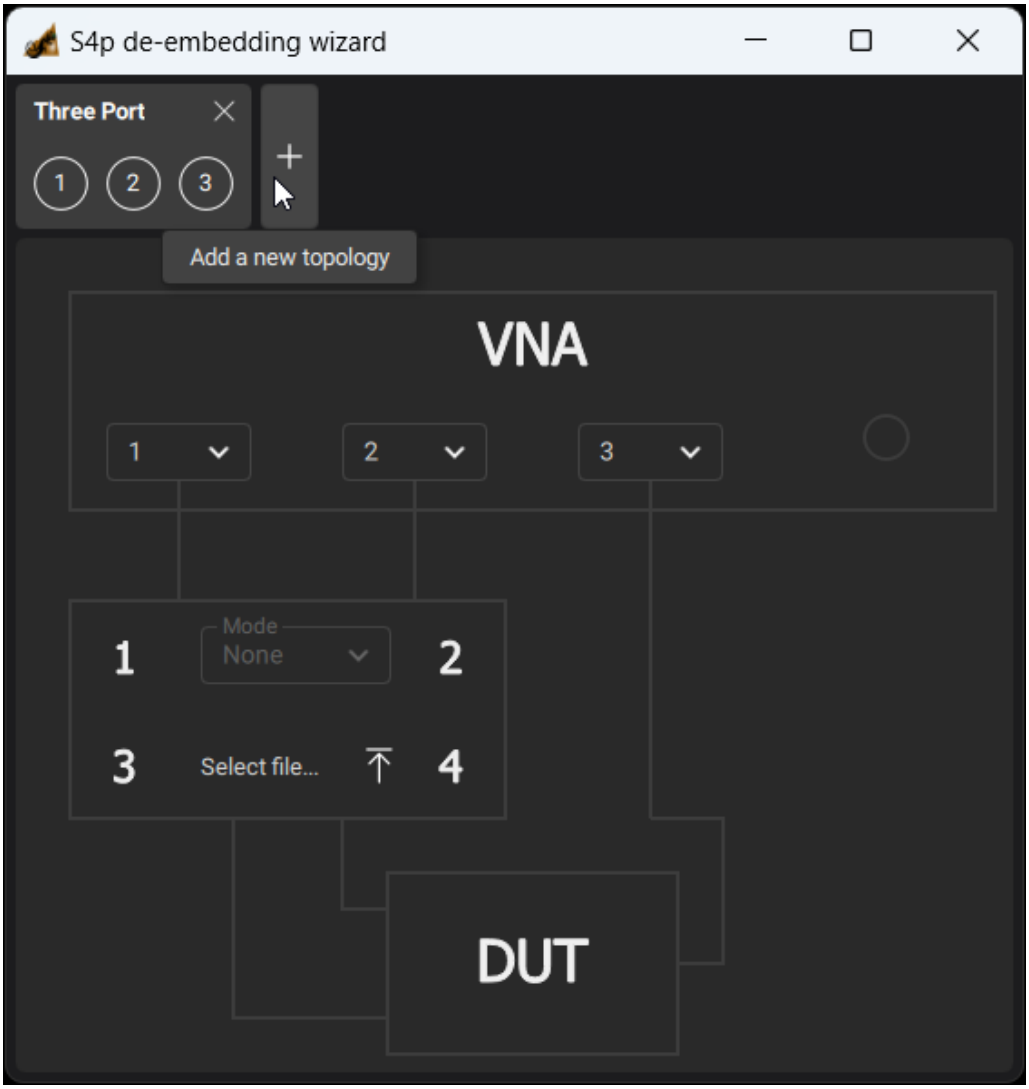
Configuring the S4p Embedding/De-embedding Network Topology

1. Open the S4p de-embedding wizard (see Displaying or Hiding S4p Embedding/De-embedding Wizard).

2. Click one of the three buttons in the **Topology Type** area.



3 If another topology has to be created, click on + button at the top of wizard and select topology type.



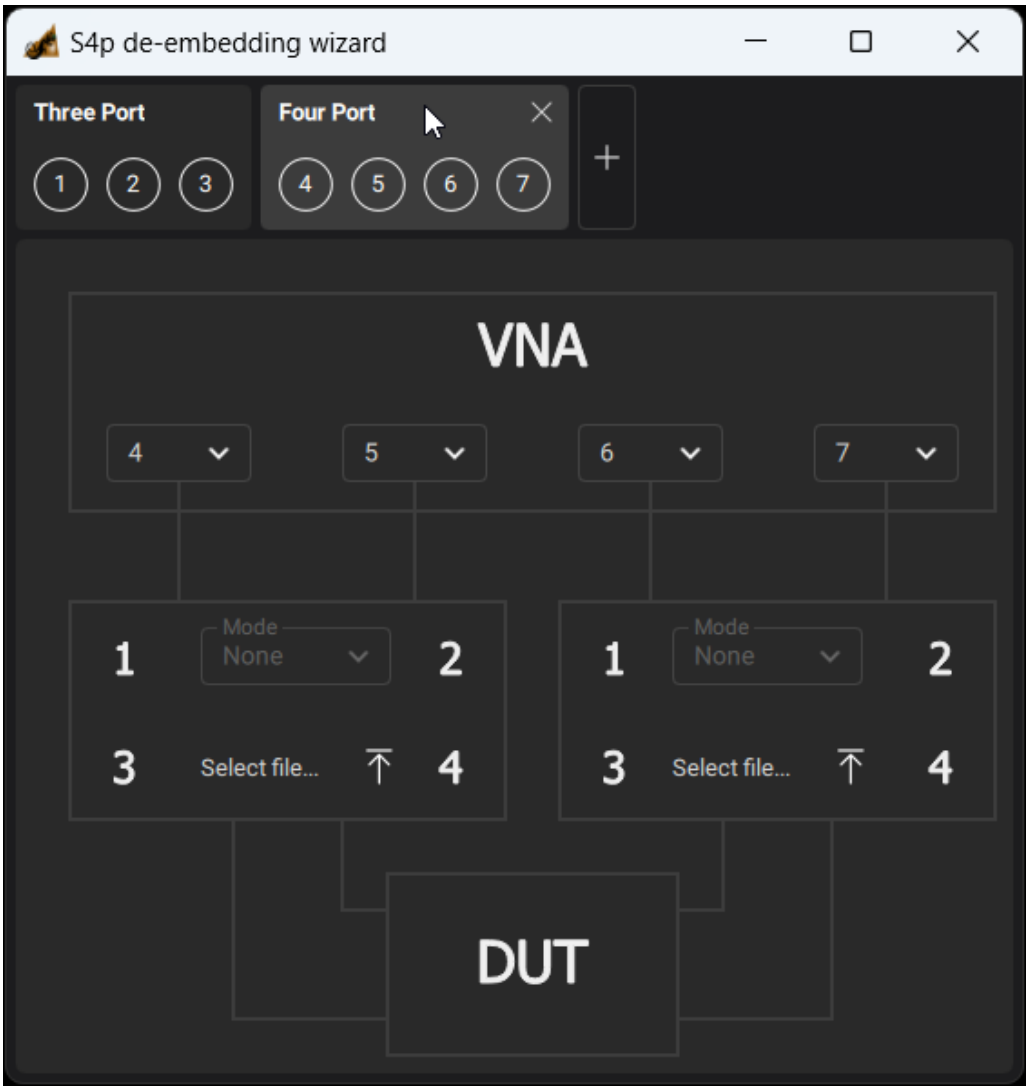
SCPI CALCulate:FSIMulator:EMBed:TYPE

CALCulate:FSIMulator:EMBed:ADD

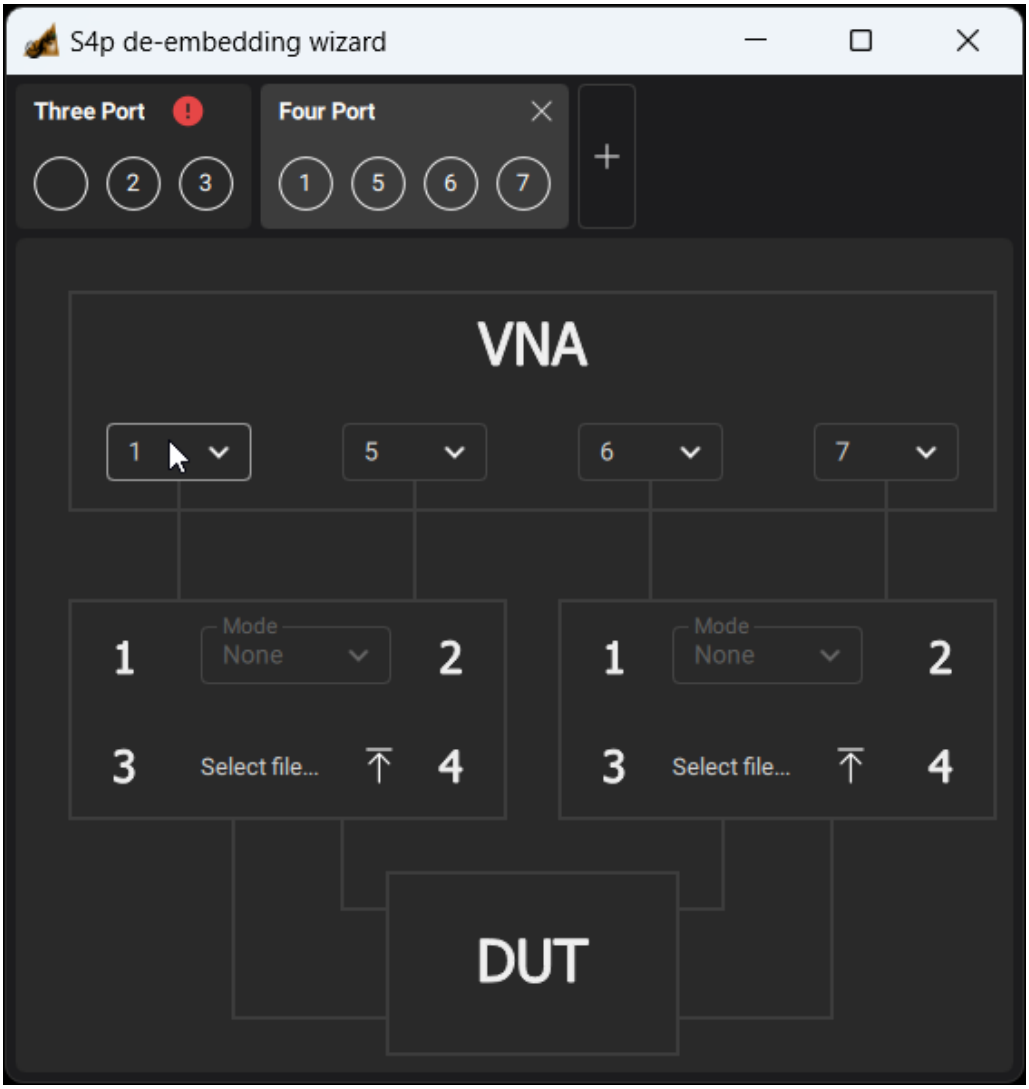
Setting S4p Embedding/De-embedding Function Parameters

1. Open the S4p de-embedding wizard (see Displaying or Hiding S4p Embedding/De-embedding Wizard).

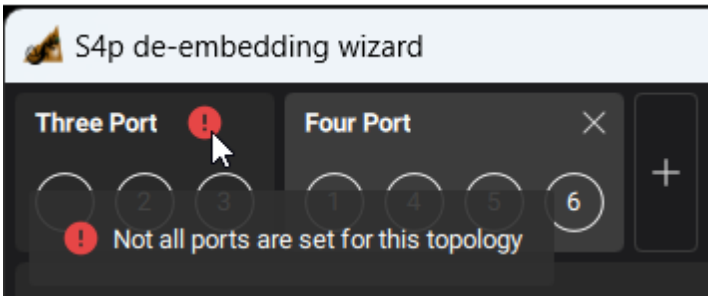
2. If more than one topology is created, highlight the desired topology at the top of the wizard.



3 Click on drop-down lists in VNA area and select the numbers of ports, connected to the embedded or de-embedded network.



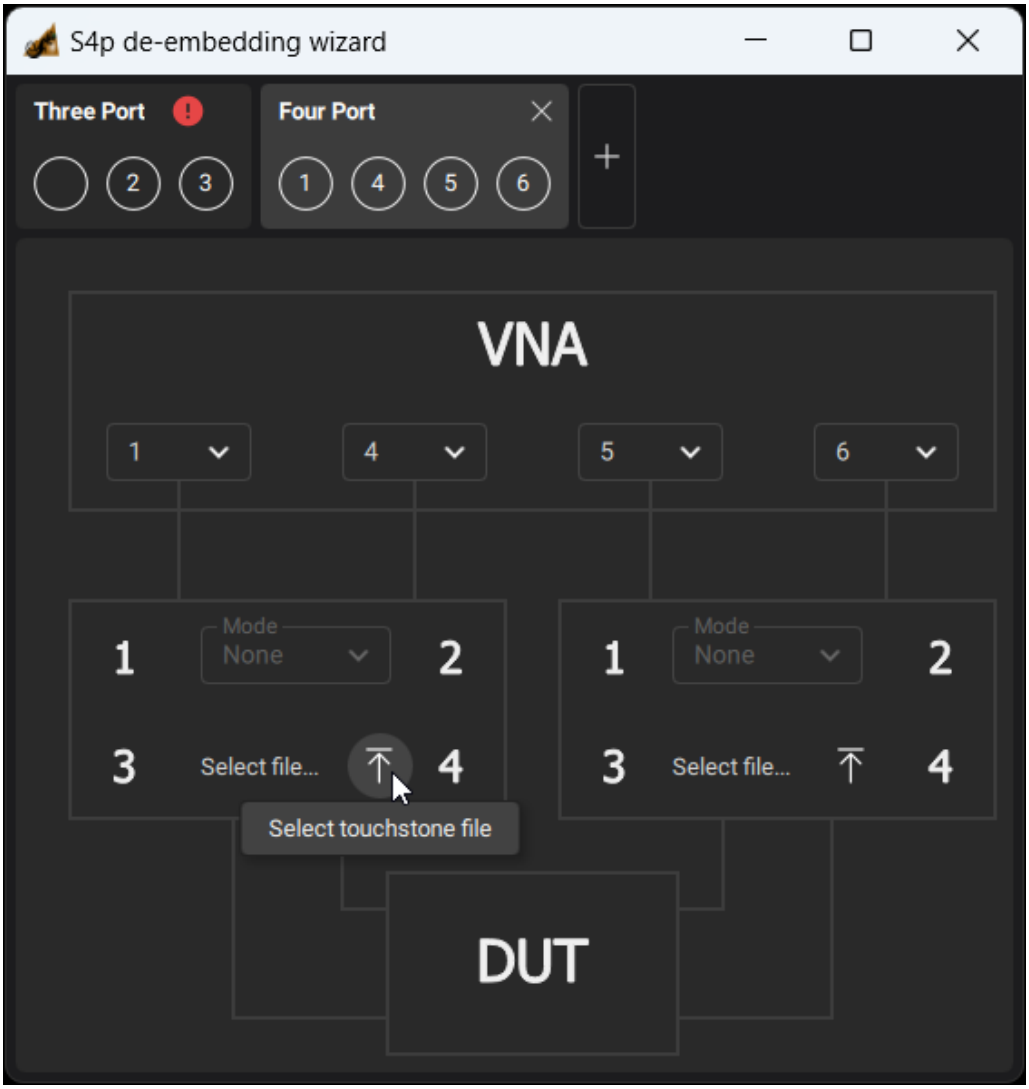
NOTE The ports in the topologies are assigned in order and are not repeated. When a port is reassigned, the software checks to see if the port is being used elsewhere. If the port is being used, the previously assigned port is set to **None**. The topology header will show the icon.



4

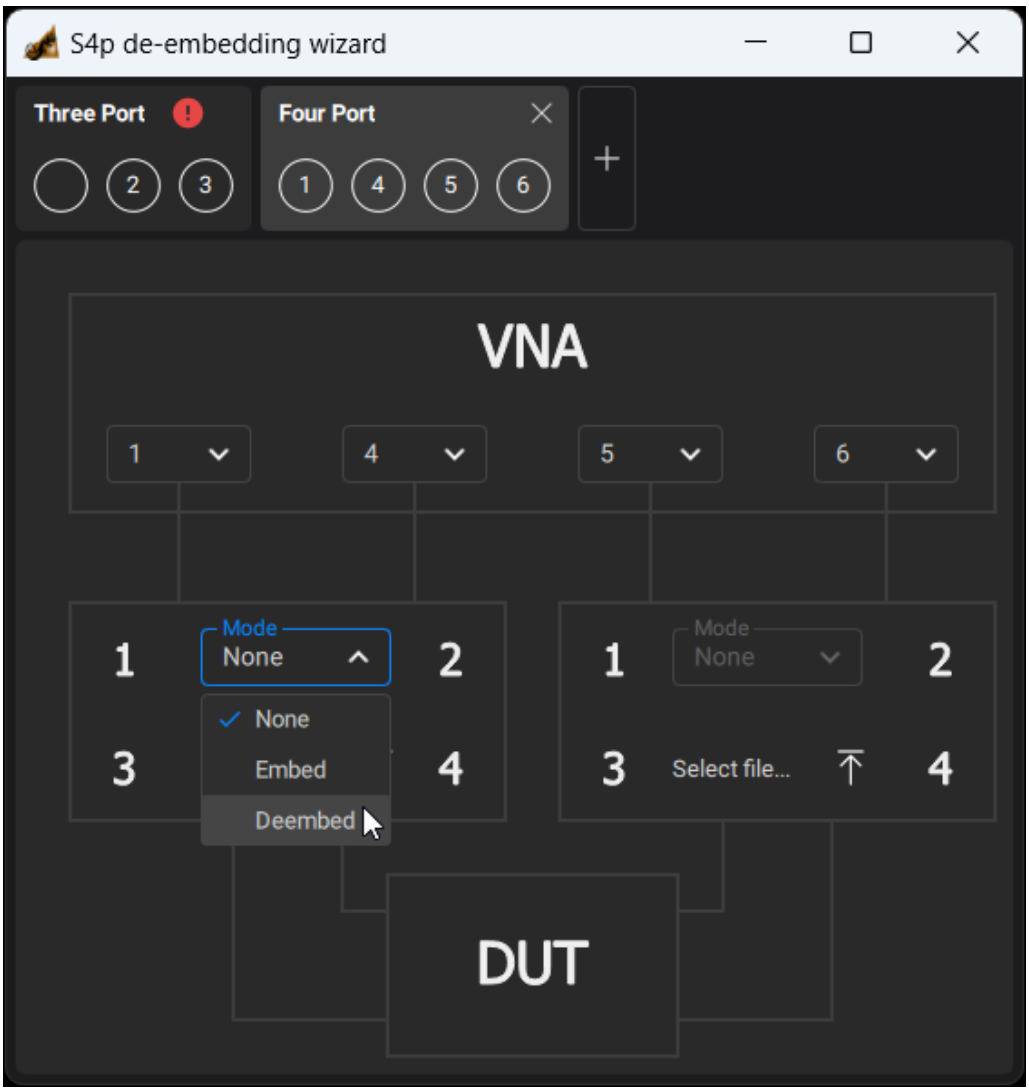
Click on the  button in network area. Select the directory and the Touchstone file name of the embedded or de-embedded circuit S-parameters of the port.

NOTE If you want to see the path and name of the file, hover your cursor over the **Select file** label.



5 Click on the **Mode** drop-down list and operation with the network.

NOTE The drop-down list is not available if no Touchstone file is selected.



SCPI

CALCulate:FSIMulator:EMBed:TOPology:A:PORTs

CALCulate:FSIMulator:EMBed:TOPology:B:PORTs

CALCulate:FSIMulator:EMBed:TOPology:C:PORTs

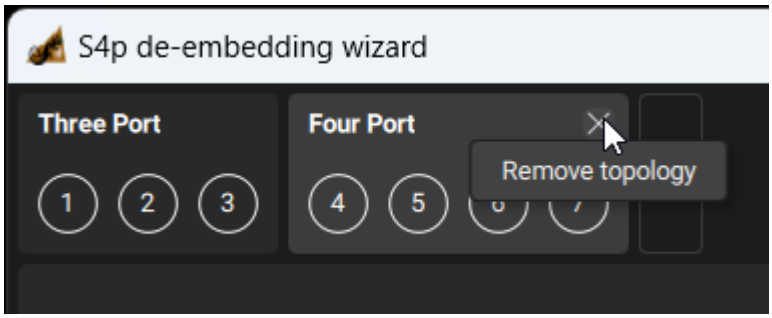
CALCulate:FSIMulator:EMBed:NETWork:FILename

CALCulate:FSIMulator:EMBed:NETWork:TYPE

Deleting the S4p Embedding/De-embedding Network Topology

1. Open the S4p de-embedding wizard (see Displaying or Hiding S4p Embedding/De-embedding Wizard).

2. Click on the  icon at the top of the wizard in the topology you want to delete.



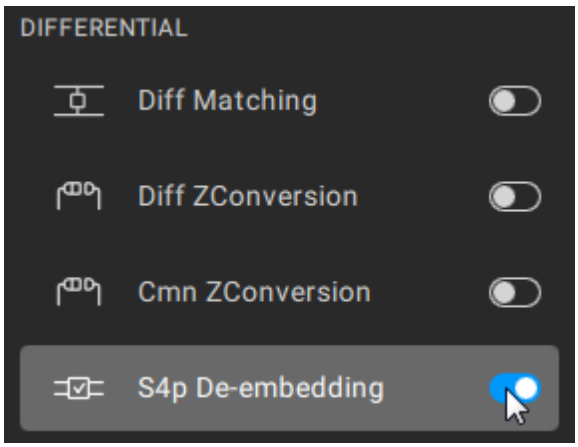
SCPI CALCulate:FSIMulator:EMBed:DELete

Enabling or Disabling the S4p Embedding/De-embedding Function

1. Select the channel (see Selection of Active Trace, Diagram, Channel).

2. Click on the **Fixture** button in the main menu.

3. Toggle **S4p De-Embedding** ON or OFF in the submenu.



SCPI CALCulate:FSIMulator:EMBed:STATe

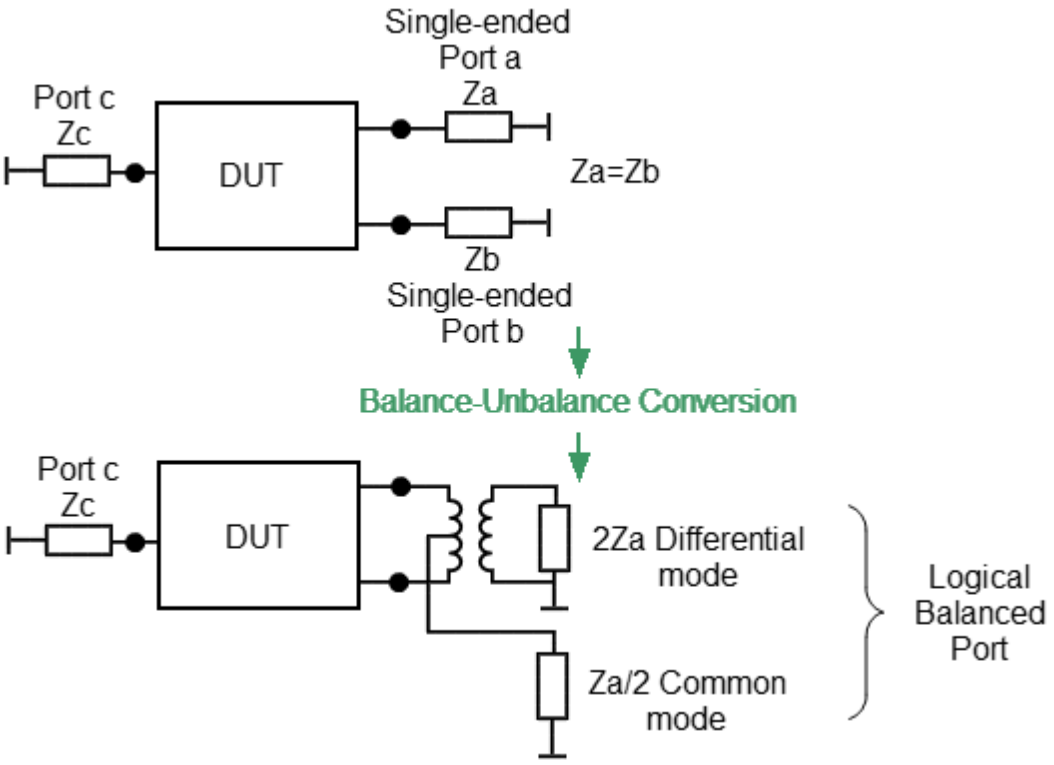
Measurement of Balanced Devices

The following section describes the measurement of balanced devices:

- Balance-Unbalance Conversion simulates measurements in the balanced circuits using the results of unbalanced measurements.
- Description of the Balanced Parameters calculated and displayed in the balance-unbalance conversion function.
- The Differential Port Matching function simulates the embedding of a matching circuit in a balanced port generated by a balance-unbalance conversion function.
- The Port Reference Impedance Conversion for Balanced Connection function changes the reference impedance for each test logical balanced port to an arbitrary value.

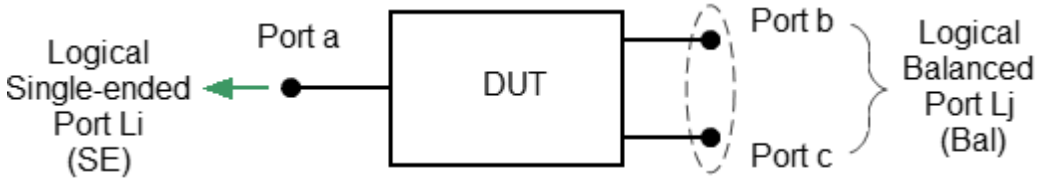
Balance-Unbalance Conversion

Balance-unbalance conversion simulates measurements in the balanced circuits using the results of unbalanced measurements. This allows evaluating balanced parameters of balanced devices. The diagram of balance-unbalance conversion is shown in figure below.

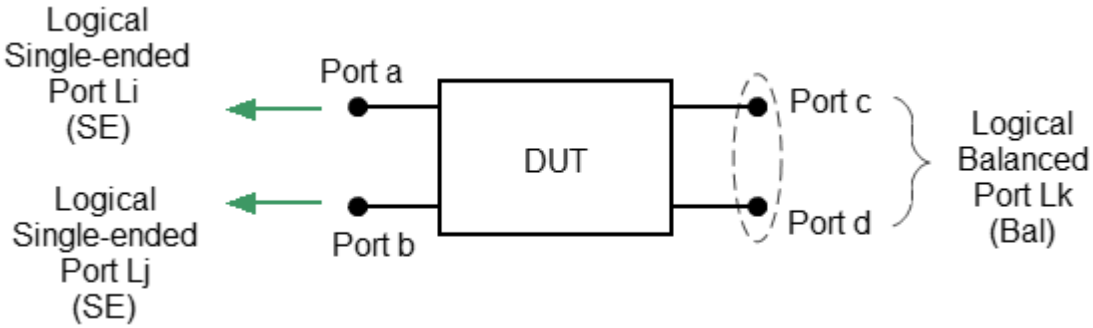


Balance-unbalance Conversion Diagram

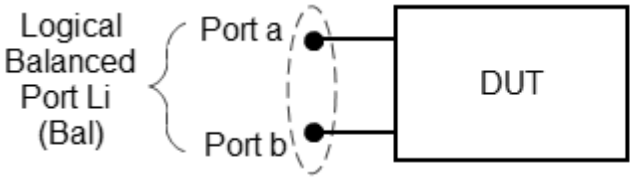
The types of evaluated balanced devices are shown in figures below. Logic port are designated as Li, Lj, Lk (i, j and k can take values from 1 to 16, depending on the Analyzer model and topology ports).



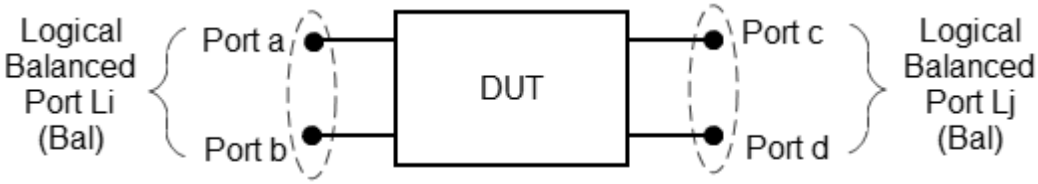
Single-ended – Balanced Devices (Se-Bal)



Single-ended – Single-ended – Balanced Devices (Se-Se-Bal)



Balanced Devices (Bal)



Balanced – Balanced Devices (Bal-Bal)

Types of Balanced Devices

Performing Balance-unbalance Conversion

1. Configuring the topology for the analyzer ports (see Topology).
2. Select balanced parameter for the trace (see Balanced Parameters).

Balanced Parameters

The balance-unbalance conversion function calculates and displays the following parameters:

- Mixed mode S-parameters.
- Imbalance parameters.
- Common mode rejection ratio (CMRR).

Mixed Mode

Notation of mixed mode S-parameters:

- **S_{xyAB}**, where:

  B — Stimulus logical port number.

  A — Response logical port number.

  y — Stimulus logical port measurement mode.

  x — Response logical port measurement mode.

- **x** and **y** represent logical ports measurement modes (see Balance-Unbalance Conversion):

  s — Single-ended measurement mode (unbalanced).

  d — Differential measurement mode (balanced).

  c — Common measurement mode (balanced).

Thus,

$$S_{xyAB} = \frac{x\ mode\ signal\ output\ on\ Port\ A}{y\ mode\ signal\ input\ on\ Port\ B}$$

The types of mixed mode S-parameters depend on the DUT and desired the type of balanced device. Below are the definitions of the mixed mode S-parameters for balanced devices (see Balance-Unbalance Conversion). Logic port are designated as Li, Lj, Lk (i, j and k can take values from 1 to 16, depending on the Analyzer model and topology ports).

The Mixed Mode S-parameters for Single-ended – Balanced Devices (SE-Bal)

Logical port mode	Stimulus	Single-ended (S)	Differential (D)	Common (C)
Response	**Logical port number**	**Li**	**Lj**	**Lj**
Single-ended (S)	**Li**	**Sss**ii	**Ssd**ij	**Ssc**ij
Differential (D)	**Lj**	**Sds**ji	**Sdd**jj	**Sdc**jj
Common (C)	**Lj**	**Scs**ji	**Scd**jj	**Scc**jj

The Mixed Mode S-parameters for Balanced – Balanced Devices (Bal-Bal)

Logical port mode	Stimulus	Differential (D)		Common (C)	
Response	**Logical port number**	**Li**	**Lj**	**Li**	**Lj**
Differential (D)	**Li**	**Sdd**ii	**Sdd**ij	**Sdc**ii	**Sdc**ij
	Lj	**Sdd**ji	**Sdd**jj	**Sdc**ji	**Sdc**jj
Common (C)	**Li**	**Scd**jj	**Scd**ij	**Scc**ii	**Scc**ij
	Lj	**Scd**ji	**Scd**jj	**Scc**ji	**Scc**jj

The Mixed Mode S-parameters for Single-ended – Single-ended – Balanced Devices (SE-SE-Bal)

Logical port mode	Stimulus	Single-ended (SS)		Differential (D)	Common (C)
Response	**Logical port number**	**Li**	**Lj**	**Lk**	**Lk**
Single-ended (SS)	**Li**	**Sss**ii	**Sss**ij	**Ssd**ik	**Ssc**ik
	Lj	**Sss**ji	**Sss**jj	**Ssd**jk	**Ssc**jk
Differential (D)	**Lk**	**Sds**ki	**Sds**kj	**Sdd**jj	**Sdc**kk
Common (C)	**Lk**	**Scs**ki	**Scs**kj	**Scd**jj	**Scc**kk

The Mixed Mode S-parameters for Balanced Bevices (Bal)

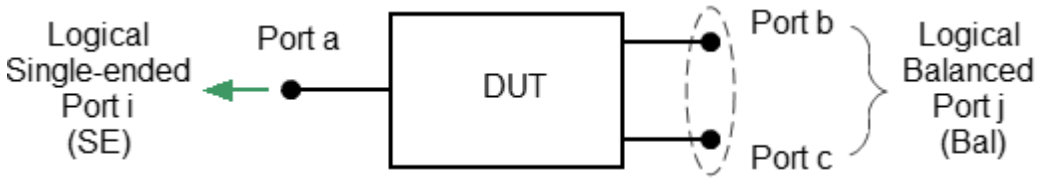
Logical port mode	Stimulus	Differential (D)	Common (C)
Response	**Logical port number**	**Li**	**Li**
Differential (D)	**Li**	**Sdd**ii	**Sdc**ii
Common (C)	**Li**	**Scd**ii	**Scc**ii

Imbalance Parameters and CMRR

The balanced devices measurement results can be also represented as imbalance parameters. Note that imbalance parameters are calculated only using data of single-ended devices.

A convenient way of evaluating balanced devices parameters is their representation using common mode rejection ratio (CMRR). This ratio is calculated after balance-unbalance conversion of mixed mode S-parameters.

The figures below shows the functions of imbalance parameter (Imb) and CMRR calculation for the following three types of balanced devices. Logic port are designated as Li, Lj, Lk (i, j and k can take values from 1 to 16, depending on the Analyzer model and topology ports).



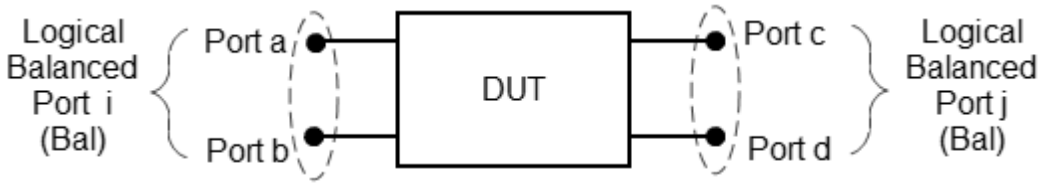
Imbji= – Sba/Sca

Imbij= – Sab/Sac

CMRRji = Sdsji / Scsji

CMRRij = Ssdij / Sscij

Single ended – Balanced Devices (Se-Bal)

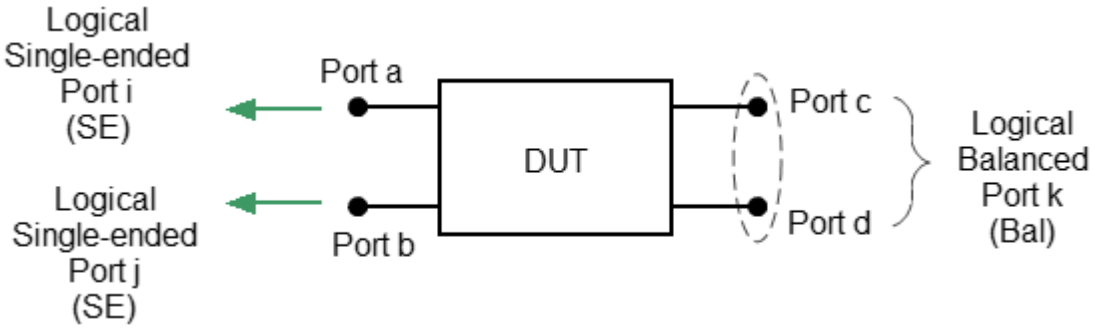


Imbji= – (Sca–Scb)/(Sda–Sdb), for i ≠ j

Imbij = (Sac–Sad)/(Sbc–Sbd)

CMRRji = Sddji/Sccji

Balanced – Balanced Devices (Bal-Bal)



lmbi-jk= – (Sac–Sad)/(Sbc–Sbd)

lmbjk-i= – (Sca–Scb)/(Sda–Sdb)

Single ended – Single ended – Balanced Devices (Se-Se-Bal)

lmbalance Parameters and CMRR

Setting the Balance Parameters

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1. Select the channel and trace (see Selection of Active Trace, Diagram, Channel).

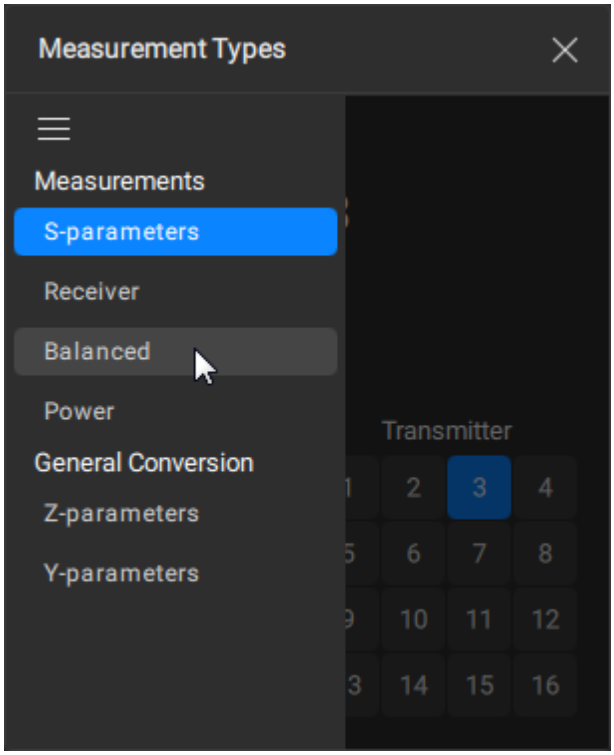
2. Configure the topology (see Topology).

3. Click on **Trace > More measurement** buttons in sidebar or click on measured parameter in trace manager.

4. In the opened **Measurement Types** pop-up window (see figure below):

   1. Click on the  icon and select the **Balanced** in list if it is not selected.

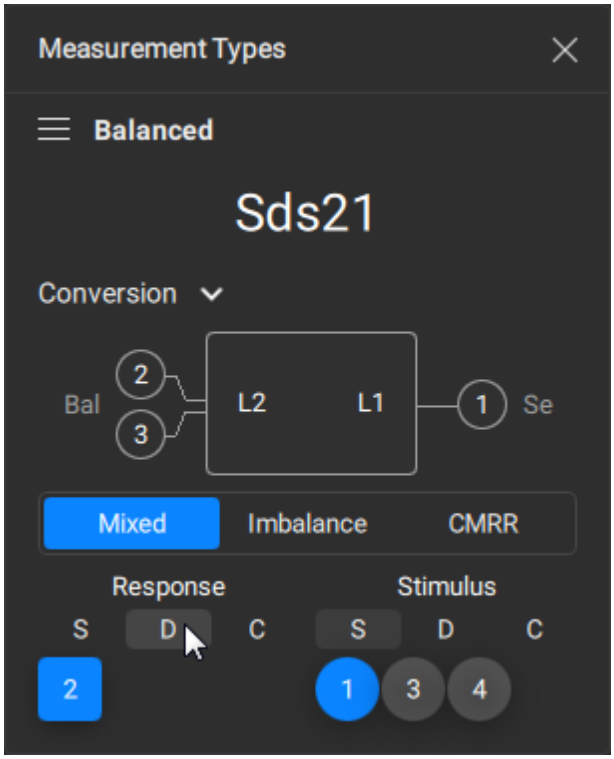
      NOTE The **Balanced** is active only if the logical port topology is configured.



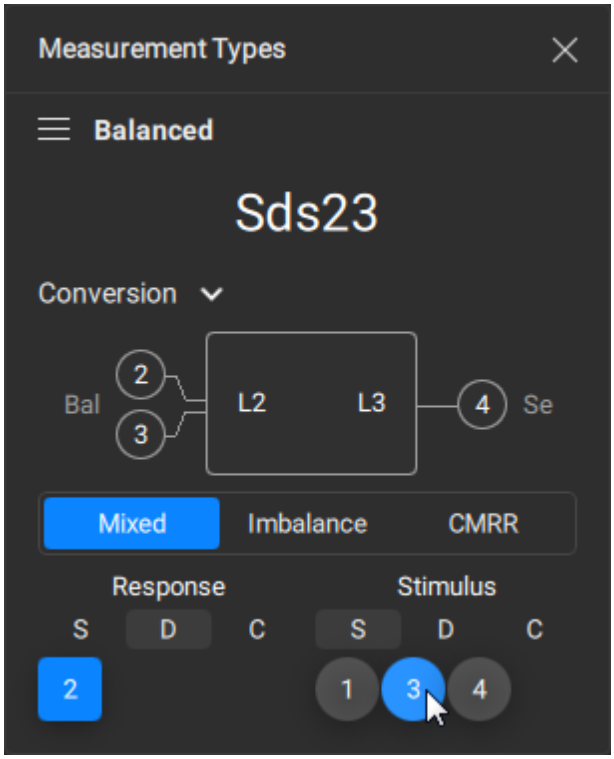
2. Select the balanced parameter mode. Click on the **Mixed | Imbalance | CMRR** button in the segment switch.

3. Select logical ports mode of receiver and stimulus logical ports. Click on the button in the **Response** and **Stimulus** segment switches. Buttons in the segment switches change depending on the selected balanced parameter mode (see tables below):

   - **Mixed**:
     i. **S** — Single-ended
     ii. **D** — Differential
     iii. **C** — Common
   - **Imbalance**:
     i. **S** — Single-ended
     ii. **SS** — Single-ended – Sengle-ended
     iii. **D** — Differential
   - **CMRR**:
     i. **S** — Single-ended
     ii. **D** — Differential



4. Select the numbers of the logical ports from the possible ones. Click on the desired button(s) with the number under the **Response** and **Stimulus** segment switches.

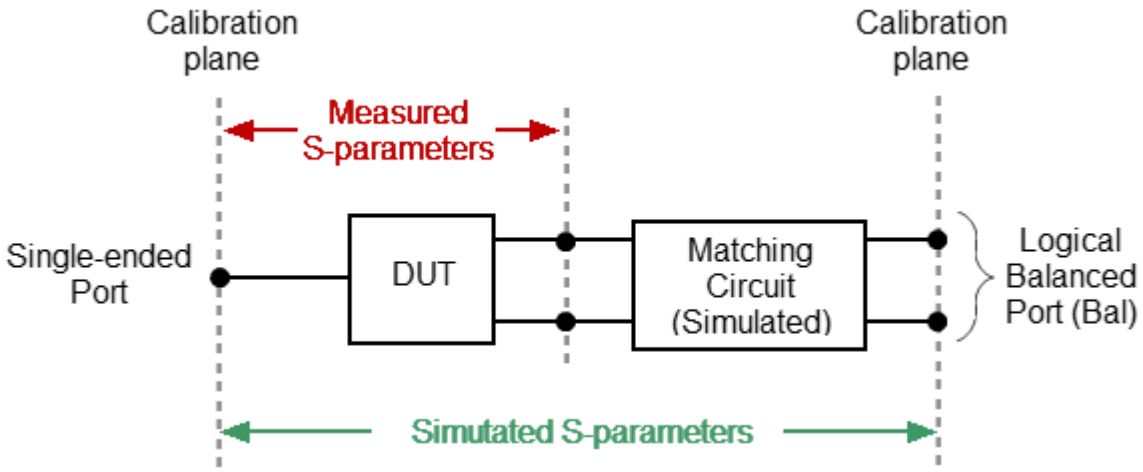


NOTE The selected balanced device type and the balanced S-parameter for it will be displayed in the central part of the **More measurement** pop-up window.

NOTE The balance-unbalance conversion affects all channel traces with the corresponding type of measurement.

Differential Port Matching

Differential port matching function allows simulating to embedding a matching circuit in a balanced port. This balanced port must be formed by the balance-unbalance conversion function. Modeling occurs due to the mathematical change in the matrix of S-parameters of the mixed mode (Single-ended – Balanced devices).

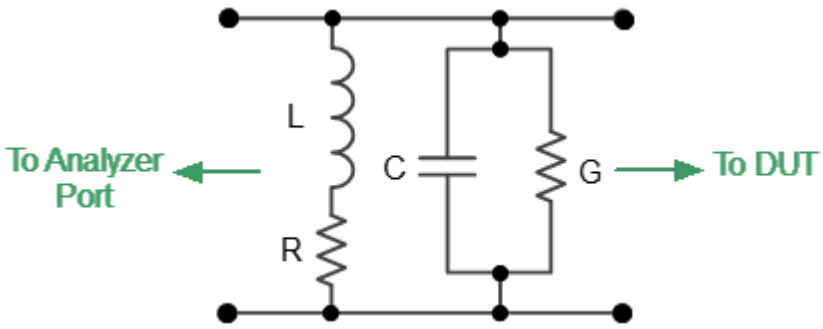


Differential Port Matching Function

NOTE The differential balance matching function applies only to balanced ports.

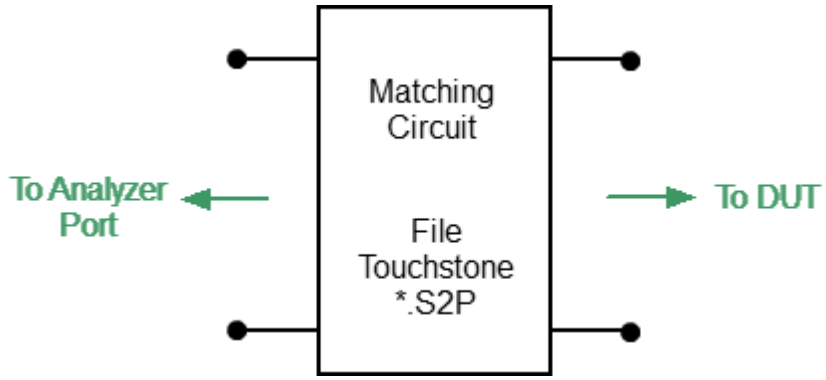
The embedded simulated matching circuit may be:

- A predefined circuit for parallel connection of inductance and capacitance (see figure below). Parameters of elements must be specified in the software.



Predefined Matching Circuit

- User matching circuit (see figure below) with parameters defined by a file in Touchstone format (* .S2P).



User Matching Circuit

Setting Differential Port Matching Function Parameters

The differential balance matching function applies only to balanced ports.

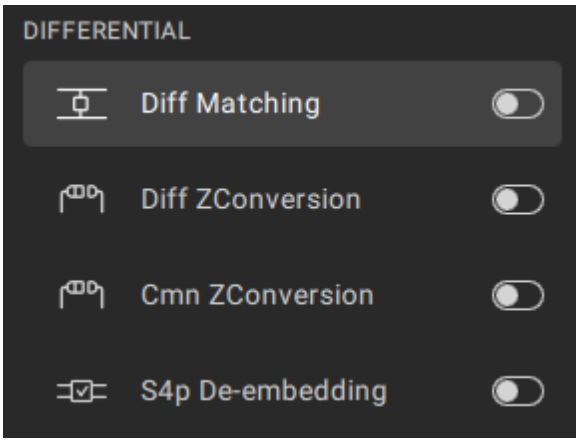
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1. Select the channel (see Selection of Active Trace, Diagram, Channel).

2. Setting the Balance Parameters (see Balanced Parameters).

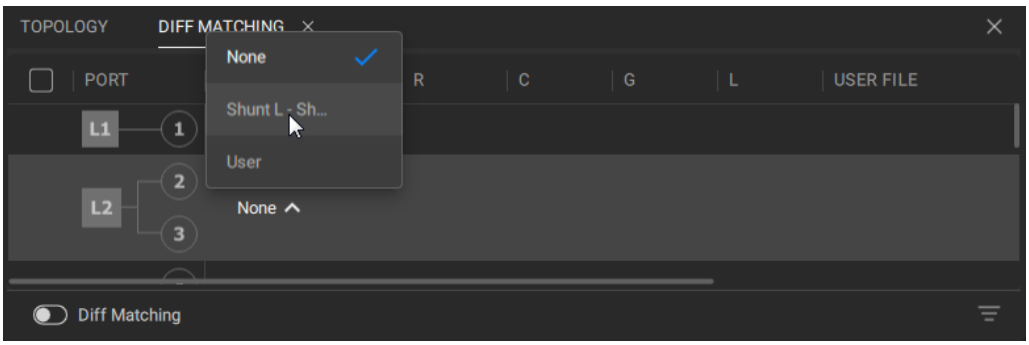
3. Click on the **Fixture** button in the main menu.

4. Click on **Diff Matching** button in the submenu (the figure below shows the state of the toggle when the table is showing).

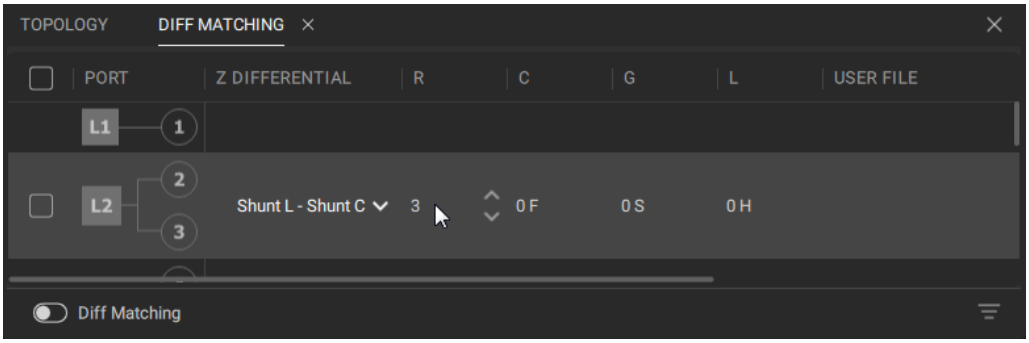


5 Click on Z DIFFERENTIAL field in the table at the bottom of the channel window and select matching circuit from drop-down list:

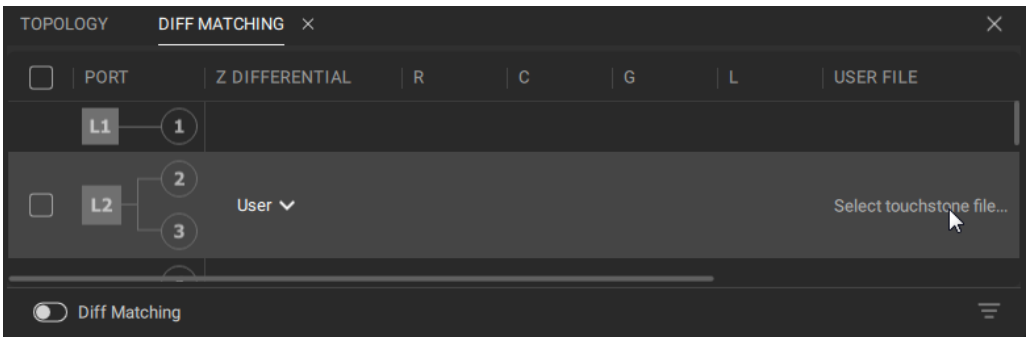
- **None**
- **Shunt L – Shunt C** — Predefined circuit for parallel connection of inductance and capacitance.
- **User** — User matching circuit with parameters defined by a file in Touchstone format (* .S2P)



6 If select **Shunt L – Shunt C** matching circuit, click on R, C, G, L fields and enter numerical value.



If select **User** matching circuit, click on USER FILE fields and select the directory and the file name in the dialog that appears.



SCPI

CALCulate:FSIMulator:BALun:DMCircuit:BPORt:TYPE

CALCulate:FSIMulator:BALun:DMCircuit:BPORt:USER:FILename

CALCulate:FSIMulator:BALun:DMCircuit:BPORt:PARameters:R

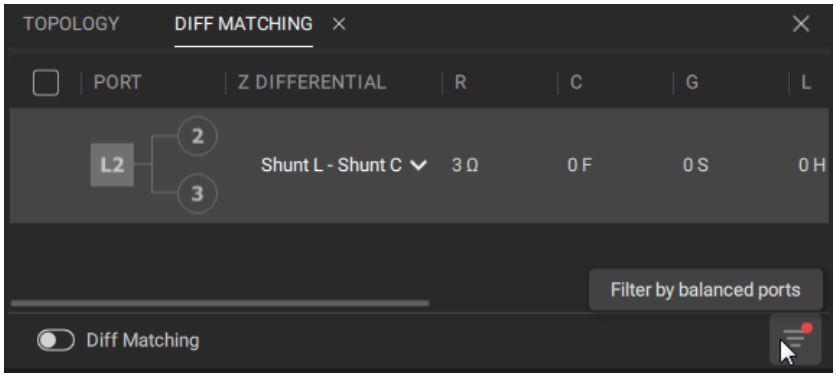
CALCulate:FSIMulator:BALun:DMCircuit:BPORt:PARameters:C

CALCulate:FSIMulator:BALun:DMCircuit:BPORt:PARameters:G

CALCulate:FSIMulator:BALun:DMCircuit:BPORt:PARameters:L

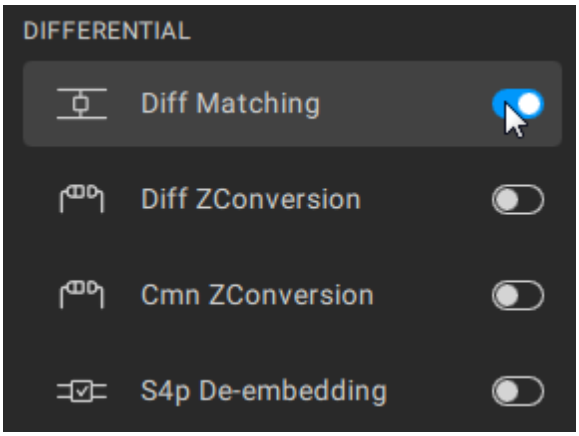
NOTE

You can filter out only balanced ports in table. Click the  icon in the lower right corner of the table.



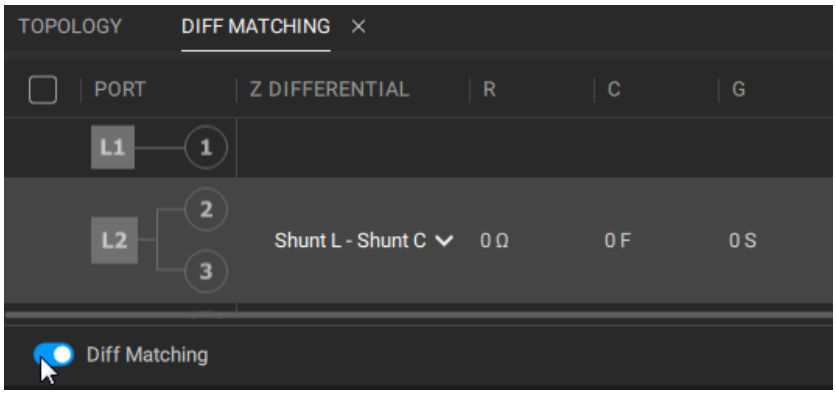
Enabling or Disabling Differential Port Matching Function

1. Select the channel (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Fixture** button in the main menu.
3. Toggle **Diff Matching** ON or OFF in the submenu.



SCPI CALCulate:FSIMulator:BALun:DMCircuit:STATe

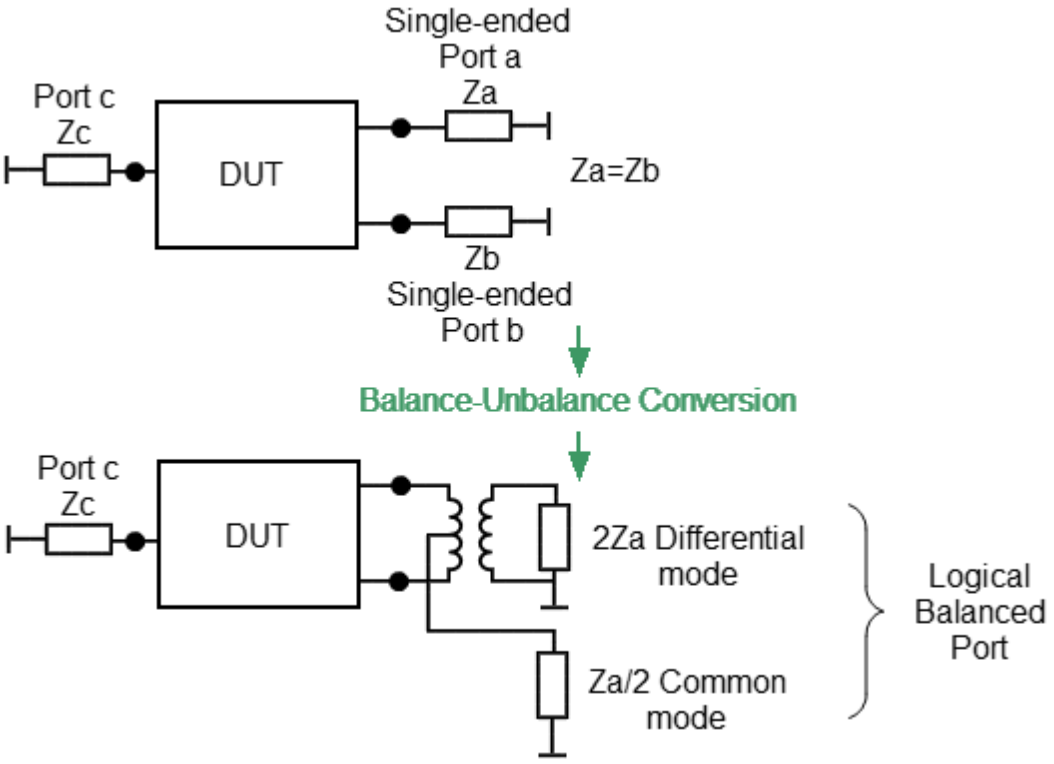
NOTE You can also enable or disable the function in the differential matching port parameter table at the bottom of the channel window (if the table is showing). Toggle **Diff Matching** ON or OFF in the lower left corner of the table.



NOTE The differential port matching function affects all channel traces with the corresponding type of measurement.

Port Reference Impedance Conversion for Balanced Connection

As a result of balance-unbalance conversion, the reference impedance of the balanced port in differential mode is equal to twice the impedance of the unbalanced port before conversion. The reference impedance of the balanced port in common mode is equal to half the impedance of the unbalanced port before conversion (see figure below).



Balance-unbalance Conversion Diagram

Using the function of converting the reference impedance of the port for a balanced connection, you can change the reference impedance for each logical balanced port to an arbitrary value. In this simulation, the mathematical transformation of the S-parameters measured at the reference impedance Z0 into S-parameters corresponding to a given arbitrary value of the reference impedance Zn will be performed.

NOTE The source value of the Z0 port reference impedance (commonly 50 Ω) is defined in the process of the calibration. It is determined by the characteristic impedance of the calibration kit and its value is entered by the user as described in System Impedance Z0.

Setting Diff ZConversion or Cmn ZConversion Function Parameters

The port reference impedance conversion for balanced connection function applies only to balanced ports.

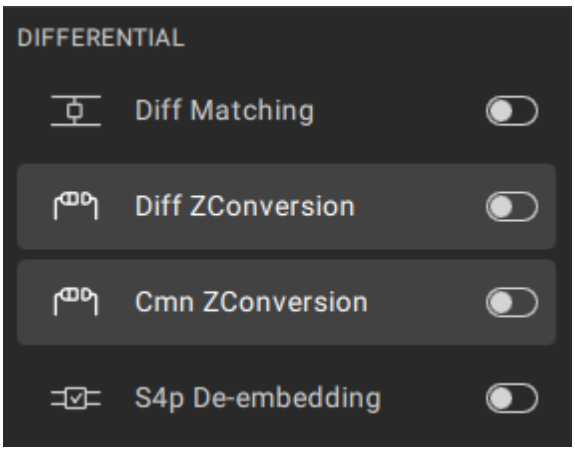
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1. Select the channel (see Selection of Active Trace, Diagram, Channel).

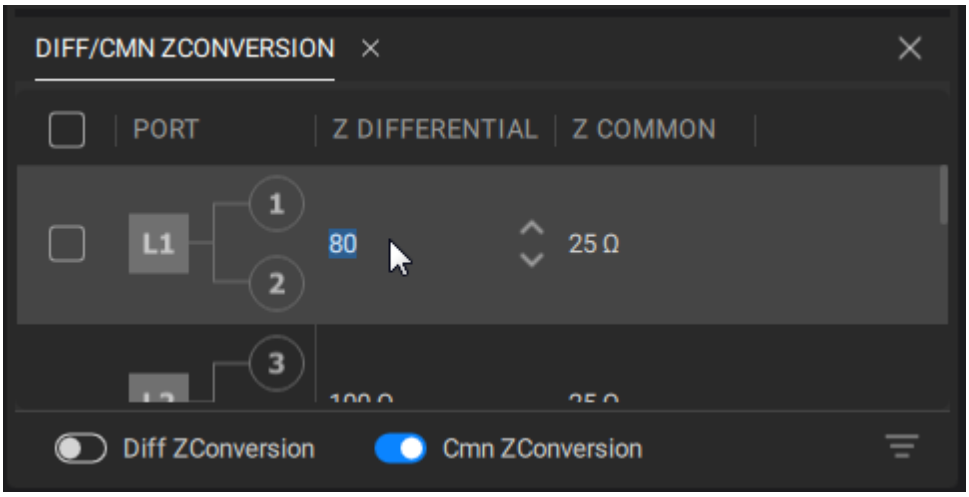
2. Set the Balance Parameters (see Balanced Parameters).

3. Click on the **Fixture** button in the main menu.

4. Click on **Diff ZConversion** (or) **Cmn ZConversion** button in the submenu (the figure below shows the state of the toggle when the table is showing).



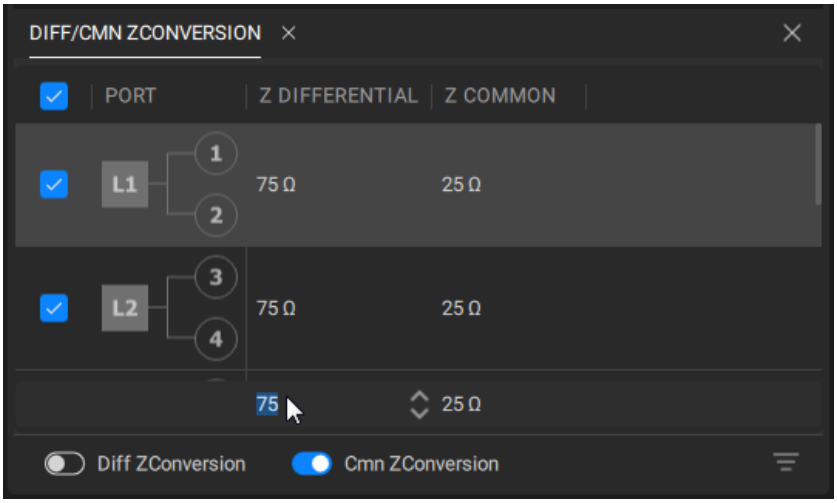
5 Click on Z DIFFERENTIAL or Z COMMON field in the table at the bottom of the channel window and enter the impedance numerical value.



SCPI CALCulate:FSIMulator:BALun:DZConversion:BPORt:Z0

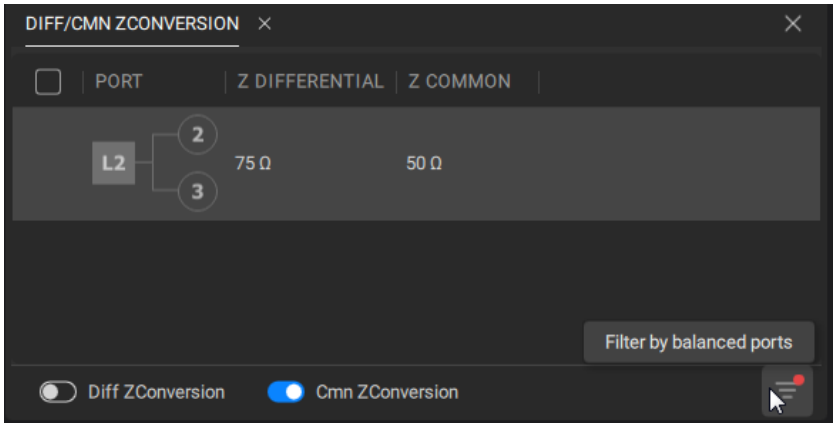
CALCulate:FSIMulator:BALun:CZConversion:BPORt:Z0

NOTE You can quickly set the **Z DIFFERENTIAL** and(or) **Z COMMON** values for several ports. Select checkboxes of the required ports in the table. Then enter the desired impedance values in the line below the table:



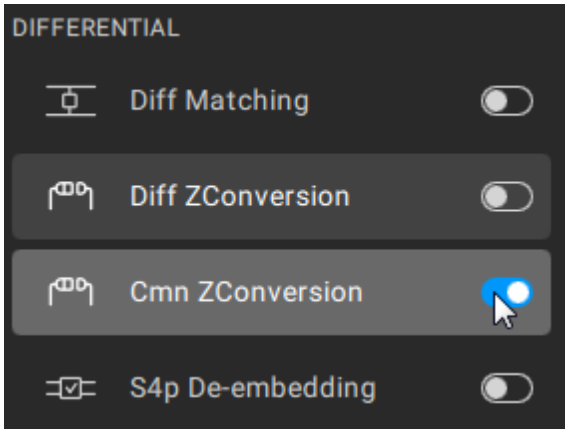
NOTE

You can filter out only balanced ports in table. Click the  icon in the lower right corner of the table.



Enabling or Disabling Diff ZConversion or Cmn ZConversion Functions

1. Select the channel (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Fixture** button in the main menu.
3. Toggle **Diff ZConversion** and(or) **Cmn ZConversion** ON or OFF in the submenu.

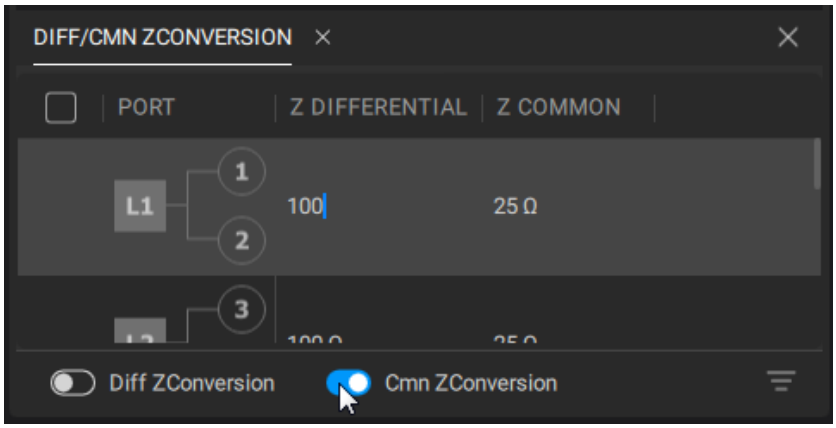


SCPI CALCulate:FSIMulator:BALun:DZConversion:STATe

CALCulate:FSIMulator:BALun:CZConversion:STATe

NOTE

You can also enable or disable the function in the port reference impedance conversion parameter table at the bottom of the channel window (if the table is showing). Toggle **Diff ZConversion** and(or) **Cmn ZConversion** ON or OFF in the lower left corner of the table.



NOTE

The port reference impedance conversion for balanced connection function affects all channel traces with the corresponding type of measurement.

Time Domain

The Analyzer measures parameters of the DUT in the frequency domain. Time domain transformation is a function of mathematical transformation of the measured parameters in order to obtain the time domain representation.

The time domain function simulates time-domain reflectometry. This influences the DUT with a pulsed or step signal, followed by the analysis of the reflected signal. The magnitude, duration, and shape of the reflected signal determine the nature of the impedance variation in the DUT. The Analyzer does not affect the DUT in either pulses or steps. Instead, a Chirp-Z transformation algorithm is used to calculate time information from the frequency measurements. The Chirp-Z transformation is a generalization of the Fourier transformation that allows setting arbitrary transformation start and stop values.

Transformation Types

The time domain function supports the following transformation types:

- **Bandpass** mode simulates the response of the bandpass network to the impulse.
- **Lowpass Impulse** mode simulates the response of the lowpass network to the impulse.
- **Lowpass Step** mode simulates the response of the lowpass network to the unit step function.

The time domain resolution in lowpass mode is twice as high as in bandpass mode. The bandpass mode determines the distance to the discontinuity, but does not provide information about the nature of the discontinuity. Lowpass mode determines the distance to the discontinuity and provides information on the nature of the discontinuity (open or short circuit, for example). Lowpass step mode is useful for measuring impedance along the distance.

Bandpass mode is applied to DUTs that do not operate with a DC current, such as band pass filters. The frequency settings in bandpass mode can be arbitrary.

Lowpass mode is applied to DUTs that operate with a DC current, such as cables.

The frequency settings in lowpass mode are required to be a harmonic frequency grid, where the frequency value at each frequency point is a multiple integer of the start frequency. The Analyzer can set the harmonic frequency grid from the current frequency settings with one click.

The value of the DUT response at DC must be known in lowpass mode. The DC value cannot be measured directly by the Analyzer. The Analyzer offers two options: the DC value can be automatically extrapolated or manually set. The latter option is

used when the DUT response at DC is known — for example, for a low loss cable, the DC value is:

- 1 for open-ended cable
- –1 for a short-circuited cable
- 0 for a cable terminated with a matched load

Transformation Unambiguity Range

The time domain response is a periodic function due to the discrete nature of the frequency response. The time domain unambiguity range is determined by the step in the frequency domain:

$$\Delta T = \frac{1}{\Delta F}, \quad \Delta F = \frac{F_{max} - F_{min}}{N-1}$$

Windowing

The time domain response has a ringing due to the finite nature of the frequency response. Windowing is applied to the frequency response to reduce the ringing. The time domain transformation function applies the Kaiser window function. The window function selection is a tradeoff between ringing reduction and time domain resolution.

The Kaiser window is defined by the β parameter, which smoothly fine-tunes the window shape from minimum (rectangular) to maximum. You can fine-tune the window shape, or select one of the three pre-programmed windows:

- **Minimum** (rectangular)
- **Normal**
- **Maximum**

Pre-Programmed Window Types

Window	Lowpass Impulse		Lowpass Step	
	Side Lobes Level	Pulse Width	Side Lobes Level	Edge Width
Minimum	– 13 dB	$\frac{0.6}{F_{max}-F_{min}}$	– 21 dB	$\frac{0.45}{F_{max}-F_{min}}$
Normal	– 44 dB	$\frac{0.98}{F_{max}-F_{min}}$	– 60 dB	$\frac{0.99}{F_{max}-F_{min}}$
Maximum	– 75 dB	$\frac{1.39}{F_{max}-F_{min}}$	– 70 dB	$\frac{1.48}{F_{max}-F_{min}}$

X-axis Representation

The X-axis units can be set in seconds or distance units (meters or feet). When the distance units are selected, the velocity factor is used to compute the distance from time. The velocity factor setting is located in the cable correction function (see Cable Correction Function).

The two types of reflection can be selected: round trip or one way. The round trip setting shows the total time or distance that the signal travels in both directions along the DUT. The one-way setting shows the time or distance the signal travels in one direction along the DUT.

NOTE As the time domain transformation can be applied for separate traces of a channel, the x-axis units and round trip/one-way type depends on the active trace selected.

The time domain transformation is applied for separate traces of a channel.

NOTE Time domain transformation function is accessible only in linear frequency sweep mode.

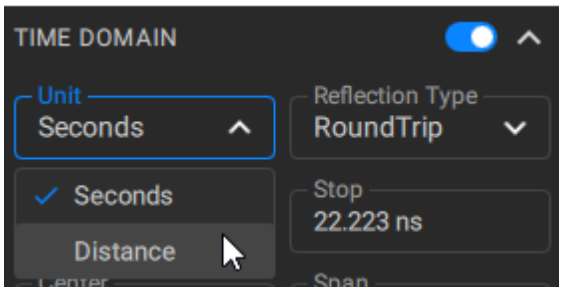
Enabling and Setting Time Domain Transformation Parameters

1. Select the channel and trace (see Selection of Active Trace, Diagram, Channel).

2. Click on the **Time Domain** button in the main menu.

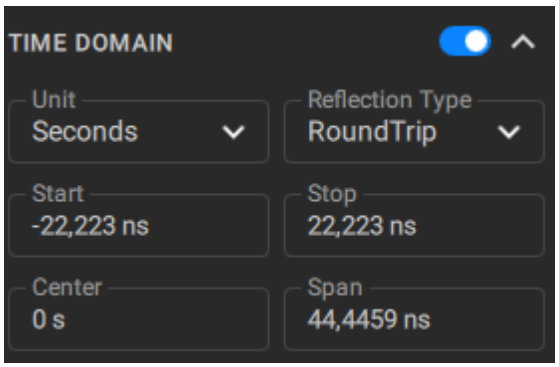
3. Toggle **TIME DOMAIN** ON in the TIME DOMAIN accordion in the submenu.

4. Click on the desired time domain unit in **Unit** drop-down list in the TIME DOMAIN accordion in the submenu.

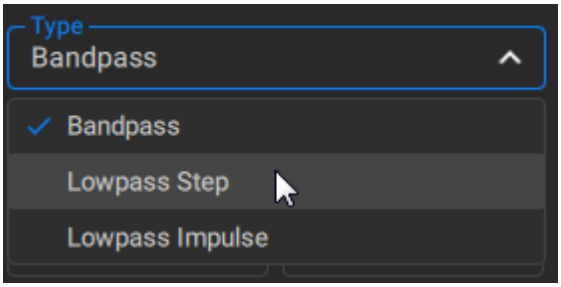


NOTE When selecting **Distance** from the list, the unit selected in the appearance settings is applied (see Decimal Unit).

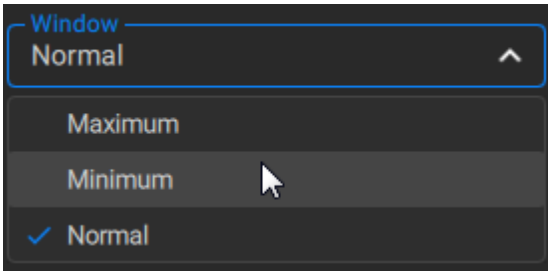
5. Set the time domain span. Click on the **Start** and **Stop** textboxes or the **Center** and **Span** textboxes in the TIME DOMAIN accordion in the submenu and enter the numerical values.



6 Click on the desired transformation type in the **Type** drop-down list in the TIME DOMAIN accordion in the submenu.



7 Click on the desired window shape in the **Window** drop-down list in the TIME DOMAIN accordion in the submenu.



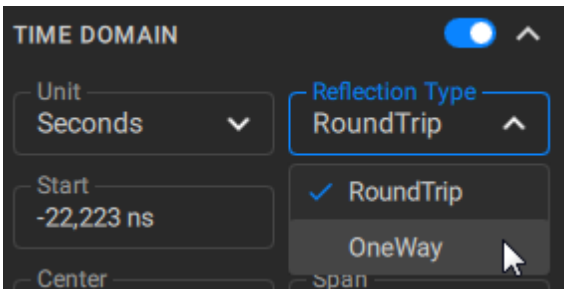
Or set the window shape with specific impulse width (front edge width) or the specific β-parameter of the Kaiser-Bessel filter. Click on the **Impulse Width** or **Kaiser Beta** textbox and enter the numerical value. The available β values are from 0 to 13:

- "0" corresponds to **Minimum** window.
- "6" corresponds to **Normal** window.
- "13" corresponds to **Maximum** widow.

NOTE The impulse width and β of the Kaiser-Bessel filter are the dependent parameters. When setting one of the parameters the other one will be adjusted automatically.



8 Click on the desired type of reflection in the **Reflection Type** drop-down list in TIME DOMAIN accordion in the submenu.



SCPI

CALCulate:TRANsform:TIME:STATe

CALCulate:TRANsform:TIME:STARt,
CALCulate:TRANsform:TIME:STOP

CALCulate:TRANsform:TIME:CENTer,
CALCulate:TRANsform:TIME:SPAN

CALCulate:TRANsform:TIME,
CALCulate:TRANsform:TIME:STIMulus

CALCulate:TRANsform:TIME:IMPulse:WIDTh,
CALCulate:TRANsform:TIME:STEP:RTIMe

CALCulate:TRANsform:TIME:KBESsel

Cable Correction Settings

When the length units are selected, the velocity factor setting of the cable correction function affects the X-axis scale (see Cable Correction Function).

Lowpass Mode Settings

If lowpass mode is used, the frequency range must be set to a harmonic grid. The frequency values in measurement points are integer multiples of the start frequency.

In lowpass mode, the value of the DUT response at DC is extrapolated from the first few frequency points, or manually set. Set the DC value manually if the response of DUT is well known. For example, if the DUT is a cable then DC value is:

- "1" for open-ended cable.
- "-1" for a short-circuited cable.
- "0" for a cable terminated with a matched load.

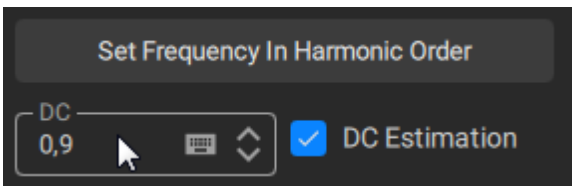
---

1. Select the **Lowpass Step** or **Lowpass Impulse** in Type drop-down list in TIME DOMAIN accordion or **Lowpass DUT** checkbox in GATING accordion in the submenu (see Time Domain Gating).

2. Click on the **Set Frequency In Harmonic Order** button in the COMMON accordion in the submenu.

3. Select the DC Estimation:

   - For automatic extrapolation of the DC value, select **DC Estimation** checkbox in the COMMON accordion in the submenu.
   - For manually setting, clear **DC Estimation** checkbox and enter the numerical value in **DC** textbox in the COMMON accordion in the submenu.



SCPI CALCulate:TRANsform:TIME:LPFRequency

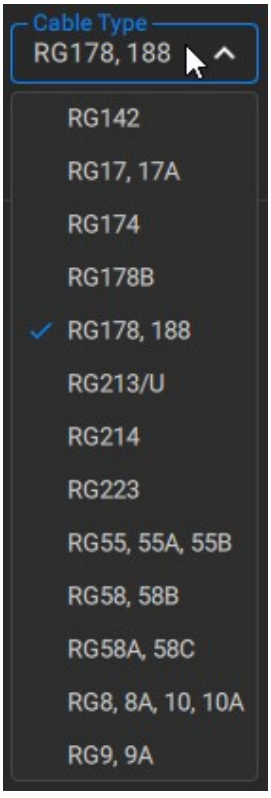
Cable Correction Function

The cable correction function is used to consider the influence of cable characteristics during transform in the time domain. This function contains the cable velocity factor and the cable loss in dB/m. The cable loss value is indicated at the specified frequency. The velocity factor is used to convert the time units to the distance units. The cable loss value — together with the frequency — are used to compensate for the attenuation in the cable, so that, for example, the response to an open circuit is unity. The cable correction function is disabled by default.

The software contains the predefined list of cables (see figure below). Each cable contains the following parameters:

- The velocity factor is used to calculate distance along a cable from the cable delay value. If the cable correction function is disabled, the software assumes it to be equal to 1. To obtain the accurate mismatch location in a cable, set the right velocity factor for the cable.
- The cable loss value is used to compensate the signal attenuation in a cable. The cable loss value is set in dB per meter.
- Cable frequency at which the cable loss is specified.

All cable parameters can be edited. When you change the cable type, the cable parameters are reset to their default values.

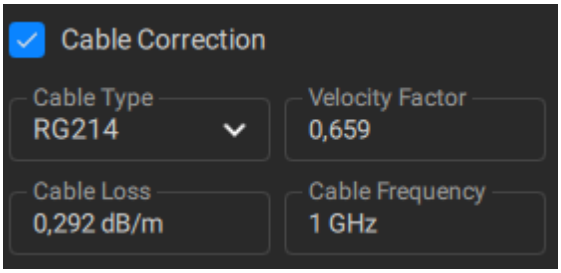


Cable List

Cable Correction Activation, Setting Cable and Cable Parameters

1. Click on the **Time Domain** button in the main menu.
2. Toggle TIME DOMAIN ON in TIME DOMAIN accordion in the submenu.
3. Select **Cable Correction** checkbox in TIME DOMAIN accordion in the submenu.
4. Click on the **Cable Type** drop-down list in TIME DOMAIN accordion in the submenu and select the cable from the list (see figure above).
5. Click on the **Velocity Factor**, **Cable Loss**, **Cable Frequency** textboxes in TIME DOMAIN accordion in the submenu and enter the numeric values.

NOTE When you change the cable type, the cable parameters are reset to their default values.



SCPI SENSe:CORRection:TRANsform:TIME:STATe,
SENSe:CORRection:TRANsform:TIME:RVELocity,
SENSe:CORRection:TRANsform:TIME:LOSS,
SENSe:CORRection:TRANsform:TIME:FREQuency

Time Domain Gating

Time domain gating is a function that mathematically removes unwanted responses in the time domain. This function performs a time domain transformation, selects the region in the time domain, deletes the response inside (or outside) the selected region, and transforms back to the frequency domain. This function allows to remove spurious effects of the fixture in the frequency domain, if the useful signal and spurious signal are separable in the time domain.

The recommended procedure is as follows:

1. Use the time domain function for viewing the layout of useful and spurious responses.

2. Enable the time domain gating and set the gate position to remove as much of spurious response as possible.

3. Disable the time domain function and view the response without spurious effects in frequency domain.

The function involves two types of time gate:

- **Bandpass** — removes the response outside the time gate span.
- **Notch** — removes the response inside the time gate span.

The sharp gate shape leads to a ringing effect in the frequency domain. The gate shape can be smoothed to reduce the ringing. The following gate shapes are offered:

- **Maximum**
- **Normal**
- **Wide**
- **Minimum**

The minimum window has a sharp shape. The maximum window has a more smoothed shape. From minimum to maximum window shape, the sidelobe level decreases, at the same time the gate resolution decreases. The choice of window shape is always a trade-off between the gate resolution and the level of spurious sidelobes. The parameters of different window shapes are represented in the table below.

Window Shape	Bandpass Sidelobe Level	Gate Resolution (Minimum Gate Span)
Minimum	–48 dB	$\frac{2.8}{F_{max}-F_{min}}$
Normal	–68 dB	$\frac{5.6}{F_{max}-F_{min}}$
Wide	–57 dB	$\frac{8.8}{F_{max}-F_{min}}$
Maximum	–70 dB	$\frac{25.4}{F_{max}-F_{min}}$

DUT Low Pass Settings

The Time Domain Gating function has a setting to distinguish between the frequency lowpass DUT and the frequency bandpass DUT. The lowpass DUTs can operate with DC current such as cables or lowpass filters. The bandpass DUTs cannot operate with DC current such as band pass filters or high pass filers.

When the Lowpass DUT setting is OFF:

- The gating function makes no assumption about the DUT response at DC.
- The frequency settings can be arbitrary.

When the Lowpass DUT setting is ON:

- The value of the DUT response at DC is required to be known to the gating function.
- The frequency settings are required to be a harmonic frequency grid, where the frequency value at each frequency point is an integer multiple of the start frequency.

The DC value cannot be measured directly by the Analyzer. The Analyzer offers two options: the DC value can be automatically extrapolated or manually set. The latter option is used when the DUT response at DC is known. For example, for a low loss cable the DC value is:

- 1 for open-ended cable

- –1 for a short-circuited cable
- 0 for a cable terminated with a matched load

The Analyzer can set the harmonic frequency grid from the current frequency settings with one click.

NOTE

The following settings of the gating function also set the corresponding settings of the Time Domain function (see Time Domain): Set Frequency in Harmonic order, DC Estimation, and DC value.

Enabling and Setting Time Domain Gating Parameters

---

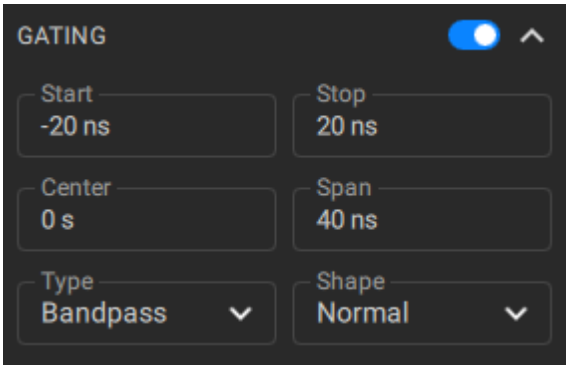
1. Select the channel and trace (see Selection of Active Trace, Diagram, Channel).

2. Click on the **Time Domain** button in the main menu.

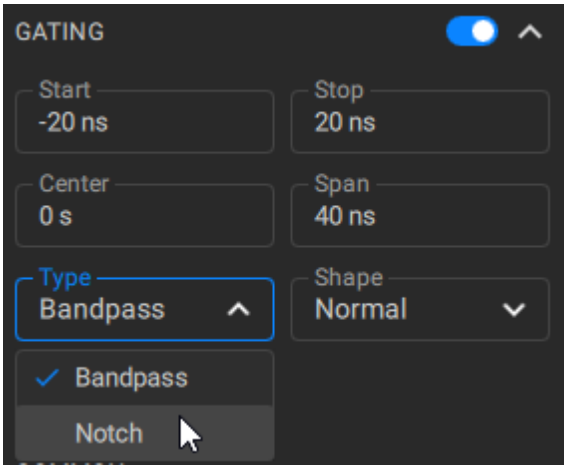
3. Toggle **GATING** ON in GATING accordion in the submenu.



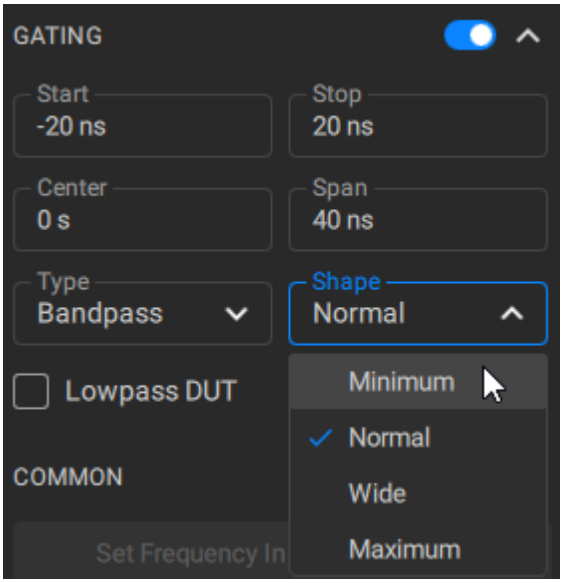
4. Set the time domain gating span. Click on the **Start** and **Stop** textboxes or the **Center** and **Span** textboxes in GATING accordion in the submenu and enter the numerical values.



5. Click on the desired transformation type in **Type** drop-down list in GATING accordion in the submenu.



6 Click on the desired gating shape in **Shape** drop-down list in GATING accordion submenu.



7 If you want to perform automatic conversion of the current frequency range to a harmonic grid, select the **Lowpass DUT** checkbox in GATING accordion submenu. **Lowpass DUT** setting is described in DUT Low Pass.

SCPI

CALCulate:FILTer:TIME:STATe

CALCulate:FILTer:TIME:STARt, CALCulate:FILTer:TIME:STOP

CALCulate:FILTer:TIME:CENTer, CALC:FILT:TIME:SPAN

CALCulate:FILTer:TIME

CALCulate:FILTer:TIME:SHAPe

Limit Test

The limit test is a function of automatic pass/fail judgment for the trace of the measurement result. The judgment is based on the comparison of the trace to the limit line, and is set by the user.

The limit line can consist of one or several segments (see figure below). Each segment checks the measured value for failure, whether it is an upper or lower limit. The limit line segment is defined by specifying the coordinates of the beginning (X0, Y0) and the end (X1, Y1) of the segment, and the type of the limit. The MAX or MIN limit types check if the trace falls outside of the upper or lower limit respectively.



Limit Line

The limit lines are set by the user in the limit table. Each row in the table describes one segment of the line. In editing mode, the limit table will appear in the lower part of the screen (see figure below). The table can be saved into a *.LIM file.

Parameters of the Limit Test Segment

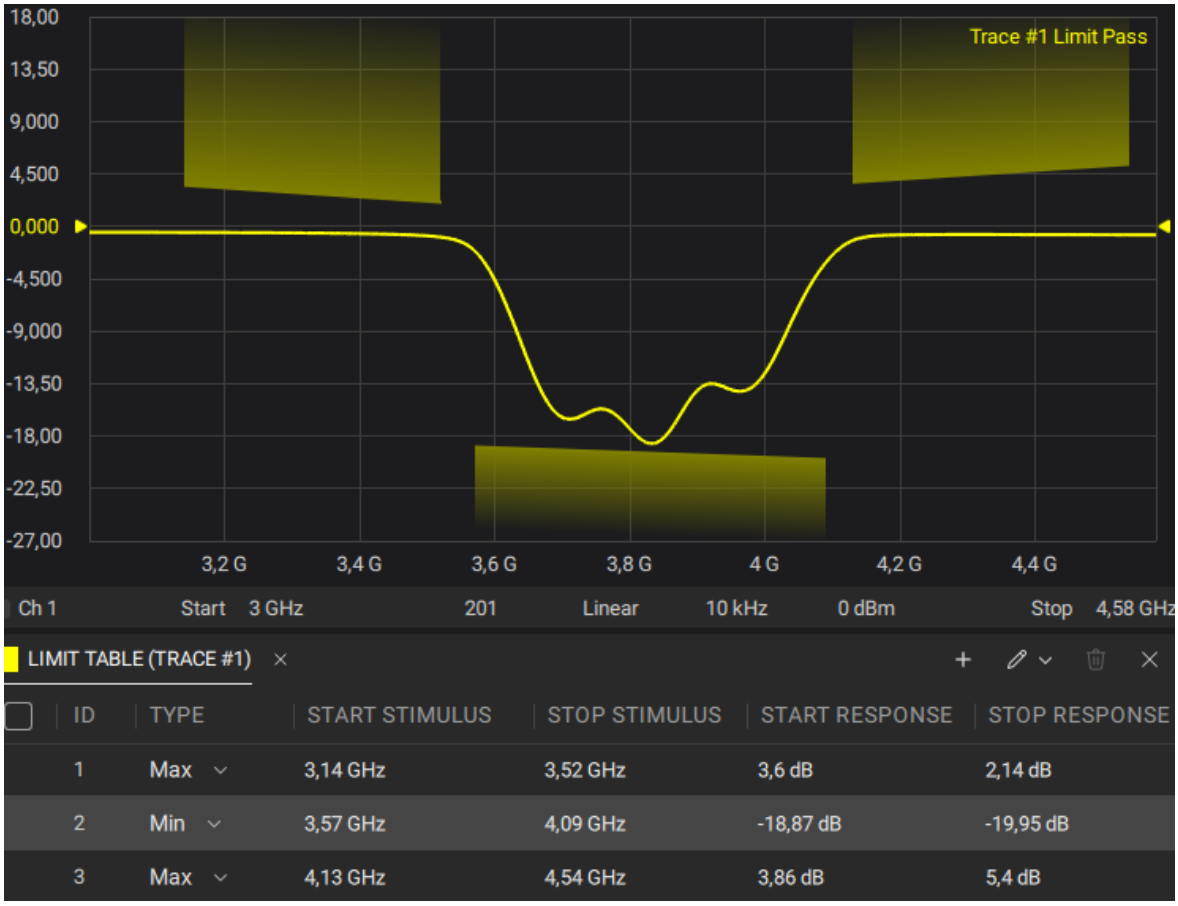
TYPE	Select the segment type among the following: • **Min** — lower limit. • **Max** — upper limit. • **Single**— upper and lower limits in one frequency point. • **Off** — segment not used for the limit test.
START STIMULUS	Stimulus value in the beginning point of the segment.
STOP STIMULUS	Stimulus value in the ending point of the segment.
START RESPONSE	Response value in the beginning point of the segment.
STOP RESPONSE	Response value in the ending point of the segment.

The display of the limit lines on the screen can be turned ON/OFF independently of the status of the limit test function.

The result of the limit test is indicated in the upper right corner of the diagram:

- If the measurement result passed the limit test, the trace number and the result will be seen: **Trace X Limit Pass**, where **Trace X** is name of trace (see figure above).
- If the measurement result failed, the result will be indicated in the following ways (see figure below):
  - **Trace X Limit Fail** (where **Trace X** is name of trace) will be displayed in the upper right corner of the diagram.
  - Fail sign will be displayed in red in the center of the window.
  - The points of the trace, which failed the test will be highlighted in red.
  - A beep will be heard.

The fail sign and the beep can be disabled using the Fail Sign softkey. For beep deactivation, see Beeper Settings.



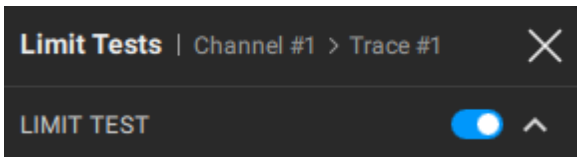
Test Non-fail Indication



Test Fail Indication

Enabling or Disabling Limit Test

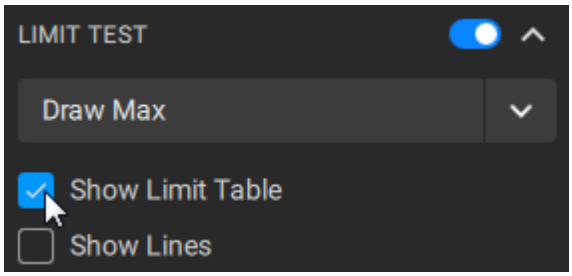
1. Select the channel and trace (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Limit Tests** button in the main menu.
3. Toggle LIMIT TEST ON or OFF in LIMIT TEST accordion in the submenu.



SCPI CALCulate:LIMit

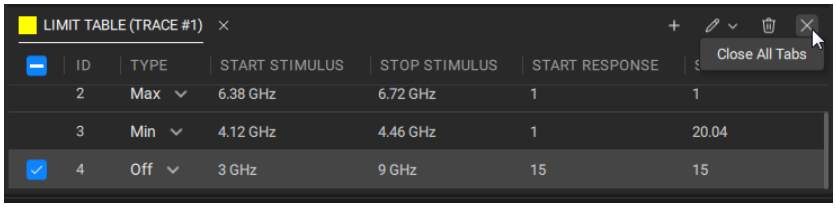
Displaying or Closing Limit Table

1. Select the channel and trace (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Limit Tests** button in the main menu.
3. Select the **Show Limit Table** checkbox in the submenu to show the limit table, or clear the checkbox in the submenu to hide the limit table.



NOTE

You can quickly close the limit table by clicking on the button in the upper right corner of the table.



Showing or Hiding Limit Lines

1. Enable limit test (see Enabling or Disabling Limit Test).

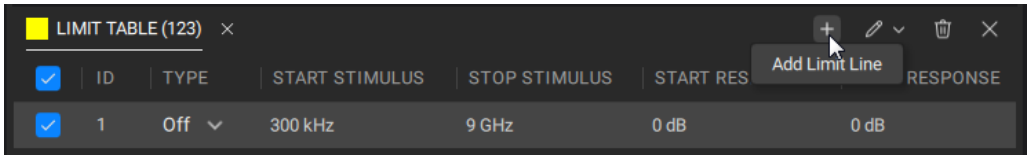
2. Select or clear **Show Lines** checkbox in LIMIT TEST accordion in the submenu.



SCPI CALCulate:LIMit:DISPlay

Limit Line Addition

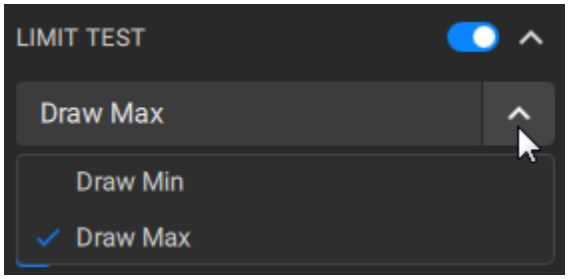
1. Enable limit test (see Enabling or Disabling Limit Test).
2. Select **Show Limit Table** checkbox in LIMIT TEST accordion in the submenu.
3. Click on the + button in the LIMIT TABLE below the channel window.



SCPI CALCulate:LIMit:DATA

NOTE You can quickly add a limit line(s) by drawing on the diagram. Activate drawing in the submenu:

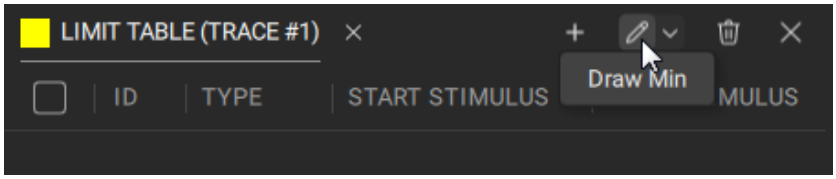
1. Click on the button and select type of limits between **Draw Max** or **Draw Min** in the drop-down list.



2. Click on **Draw Max** (or **Draw Min**) button.



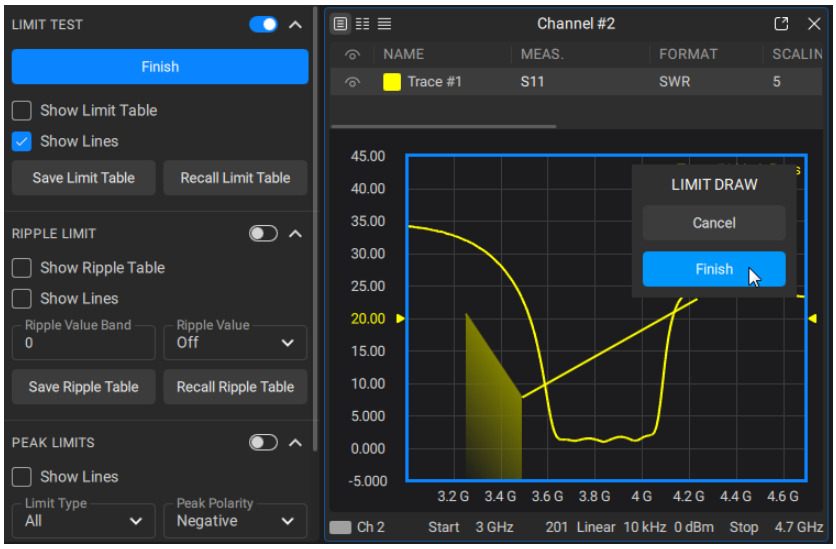
You can also activate limit line drawing in the limit table. Select the limit line by clicking on button, and activate drawing by clicking on button:



After that, the **Draw Max** (or **Draw Min**) button name will change to the **Cancel**, and the diagram area will be highlighted in blue and the LIMIT DRAW dialog will appear.

Draw the limit line(s) on the diagram. After that, the **Cancel** button name will change to **Finish**.

Click on the **Finish** button in the LIMIT DRAW dialog or in LIMIT TEST accordion in the submenu.

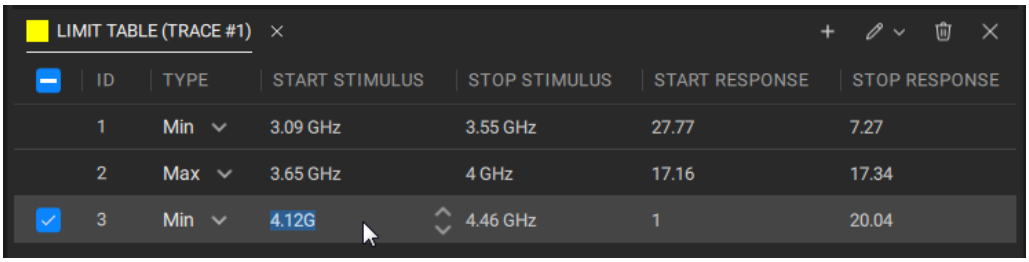


Limit Line Editing

1. Enable limit test (see Enabling or Disabling Limit Test).

2. Select **Show Limit Table** checkbox in LIMIT TEST accordion in the submenu.

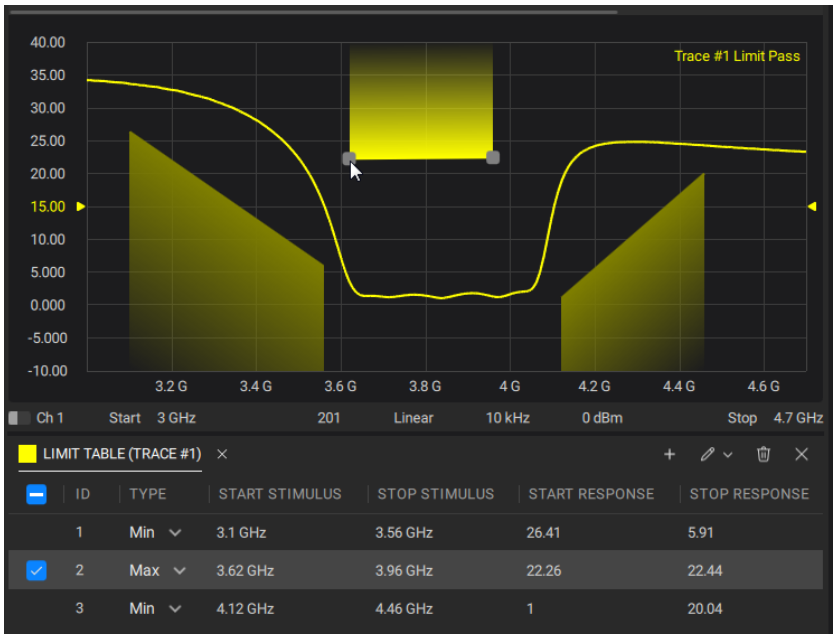
3 Click on the field in the limit table and enter the value.



NOTE

You can quickly change the coordinates of a limit line in a diagram, such as start stimulus and start response, stop stimulus and stop response.

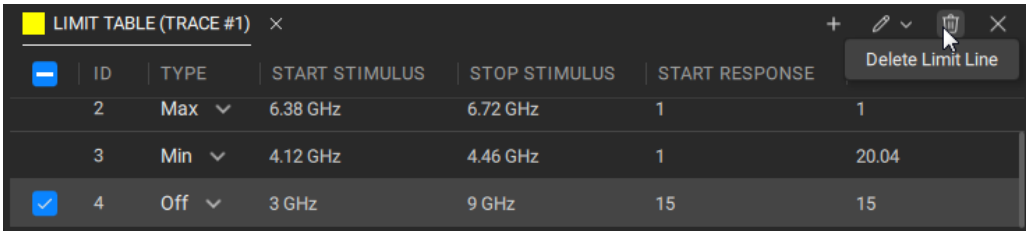
Highlight the desired line in the table or trace. Gray dots should appear on the borders of the line, as shown in the figure below. Hover over the gray dot and move it to the desired position.



You can also move the entire limit line in any direction. To do this, point the courses to the line and move it.

Limit Line Deletion

1. Enable limit test (see Enabling or Disabling Limit Test).
2. Select **Show Limit Table** checkbox in LIMIT TEST accordion in the submenu..
3. Highlight the line in the limit table.
4. Click on the button in the limit table.



SCPI CALCulate:LIMit:DATA

NOTE You can quickly delete all or a number of limit lines, highlight them by selecting a checkbox on the left side of a limit line ID in the limit table. After selecting, click button in limit table.

Enabling or Disabling Fail Sign

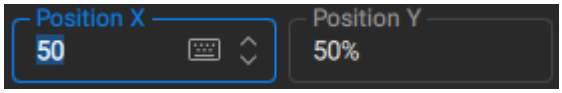
1. Enable limit test (see Enabling or Disabling Limit Test).

2. Toggle FAIL SIGN ON or OFF in LIMIT TEST accordion in the submenu.



3. Click on the Position X and Position Y field and enter the values.

NOTE The position of the Fail Sign is set as a percentage of the screen height and width.



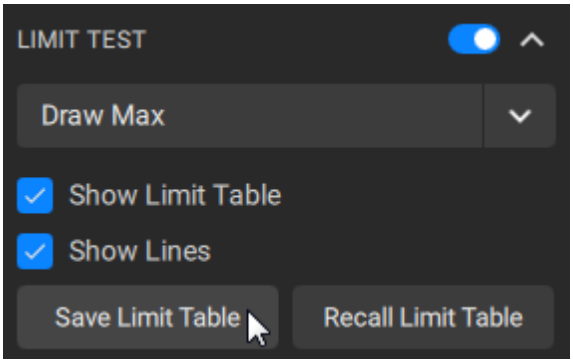
SCPI DISPlay:FSIGn

Saving Limit Table

1. Click on the **Limit Tests** button in the main menu.

2. Click on the **Save Limit Table** button in LIMIT TEST accordion in the submenu. Then, select the directory and the file name in the dialog that appears.

NOTE The limit table can be saved into a *.LIM file to a hard disk.



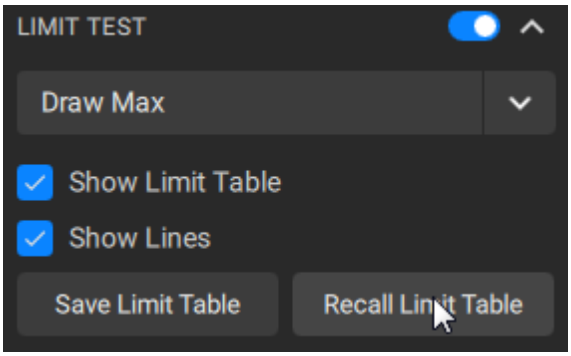
SCPI MMEMory:STORe:LIMit

Recall Limit Table

1. Click on the **Limit Tests** button in the main menu.

2. Click on the **Recall Limit Table** button in LIMIT TEST accordion in the submenu. Then, select the directory and the file name in the dialog that appears.

   NOTE The limit table can be recall from a *.LIM file on a hard disk.



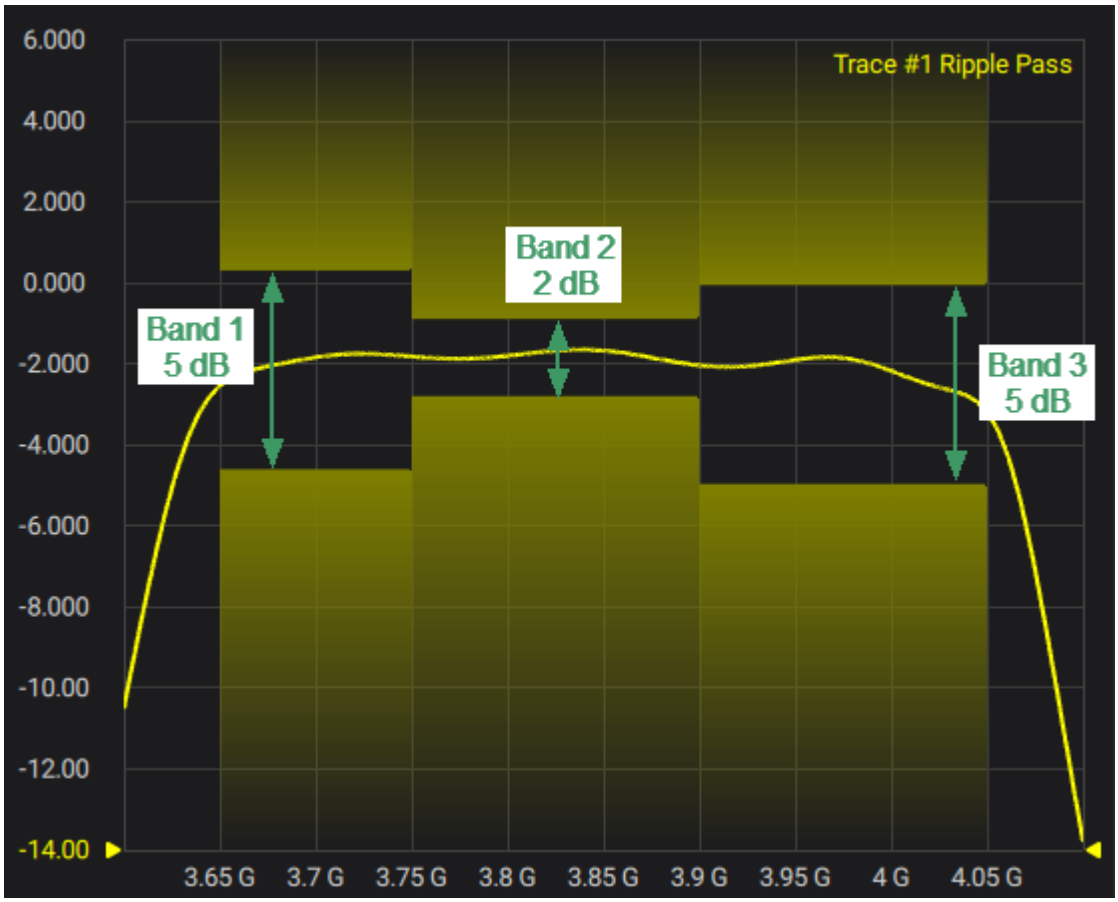
SCPI MMEMory:LOAD:LIMit

Ripple Limit Test

The ripple limit test is an automatic pass/fail check of the measured trace data. The trace is checked against the maximum ripple value (ripple limit). The ripple value is the difference between the maximum and minimum response of the trace in the trace frequency band.

The ripple limit can include one or more segments (see figure below). Each segment provides the ripple limit for the specific frequency band. A segment is set by the frequency band and the ripple limit value.

The ripple limit lines are set by the user in the ripple limit table. Each row in the table describes one band of the ripple limit value. In editing mode, the ripple limit table will appear in the lower part of the screen (see figure below). The table can be saved into a *.RLM file.



Ripple Limits

Parameters of a ripple limit test segment

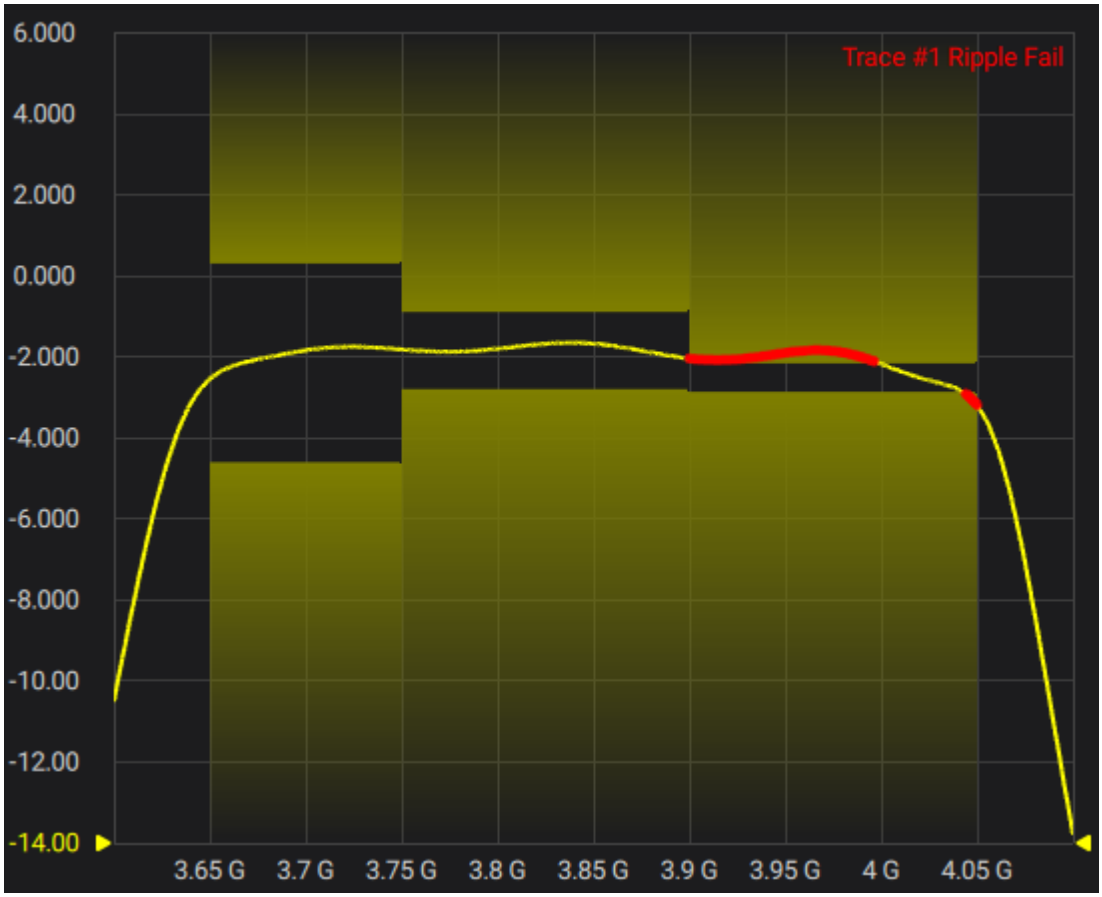
TYPE	Select the segment type among the following: • **ON** — band used for the ripple limit test. • **OFF** — band not used for the limit test.
BEGIN STIMULUS	Stimulus value at the beginning point of the segment.
END STIMULUS	Stimulus value at the ending point of the segment.
RIPPLE LIMIT	Ripple limit value.

The display of the limit lines on the screen can be turned ON/OFF independently of the status of the ripple limit test function.

The result of the ripple limit test is indicated in the upper right corner of the diagram:

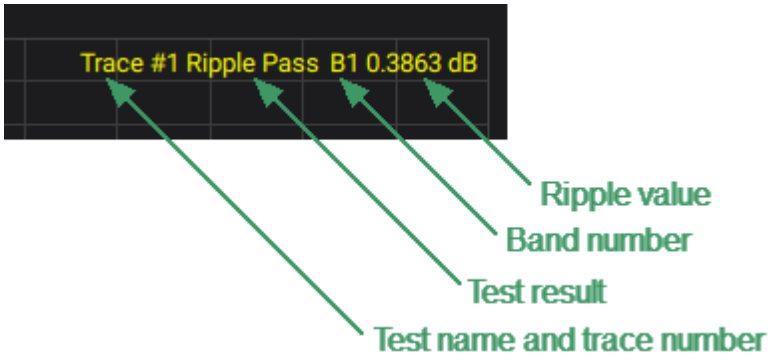
- If the measurement result passed the limit test, the trace number and the result will be seen: **Trace X Ripple Pass**, where **Trace X** is name of trace (see figure above).
- If the measurement result failed, the result will be indicated in the following ways (see figure below):
  - **Trace X Ripple Fail** (where **Trace X** is name of trace) will be displayed in upper right corner of the diagram.
  - Fail sign will be displayed in red in the center of the window, see Enabling or Disabling Fail Sign.
  - The points of the trace, which failed the test will be highlighted in red.
  - A beep will be heard.

The fail sign and the beep can be disabled using the Fail Sign softkey. For beep deactivation, see Beeper Settings.



Test Fail Indication

The display of the ripple value can be enabled/disabled in the ripple limit test status line in the upper right corner of the diagram (see figure below). The ripple value is displayed for the band selected by the user. The ripple value can be represented as an absolute value or as a margin to the limit.



Ripple Limit Test Status Line

Enabling or Disabling Ripple Limit

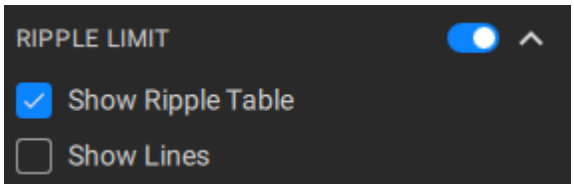
1. Select the channel and trace (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Limit Tests** button in the main menu.
3. Toggle RIPPLE LIMIT ON or OFF in RIPPLE LIMIT accordion in the submenu.



SCPI CALCulate:RLIMit

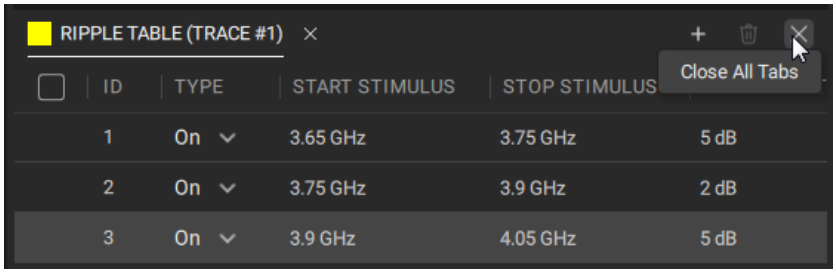
Displaying or Closing Ripple Limit Table

1. Select the channel and trace (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Limit Tests** button in the main menu.
3. Select or clear the **Show Ripple Table** checkbox in RIPPLE LIMIT accordion in the submenu.



NOTE

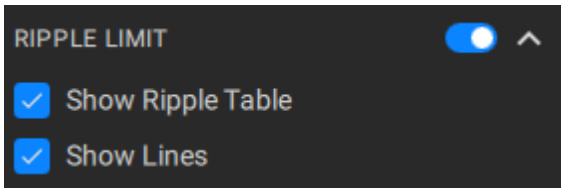
You can quickly close the ripple limit table click on the button in the upper right corner of the table.



Showing or Hiding Ripple Limit Line

1. Enable ripple limit (see Enabling or Disabling Ripple Limit).

2. Select or clear **Show Lines** checkbox in RIPPLE LIMIT accordion in the submenu.



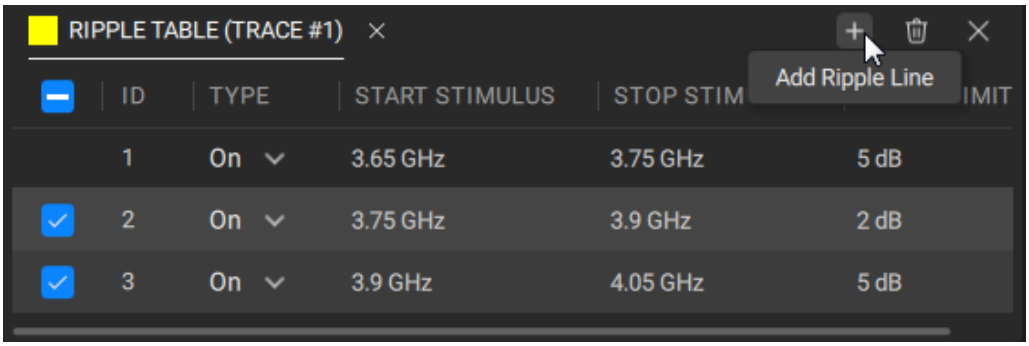
SCPI CALCulate:RLIMit:DISPlay:LINE

Ripple Limit Line Addition

1. Enable ripple limit (see Enabling or Disabling Ripple Limit).

2. Select **Show Ripple Table** checkbox in RIPPLE LIMIT accordion in the submenu.

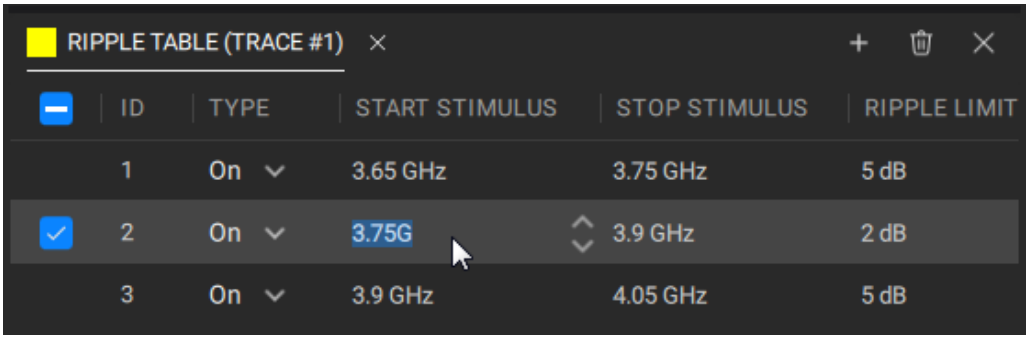
3. Click on the + button in the ripple limit table below the channel window.



SCPI CALCulate:RLIMit:DATA

Ripple Limit Line Editing

1. Enable ripple limit (see Enabling or Disabling Ripple Limit).
2. Select **Show Ripple Table** checkbox in RIPPLE LIMIT accordion in the submenu.
3. Click on the field in the ripple limit table and enter the value.

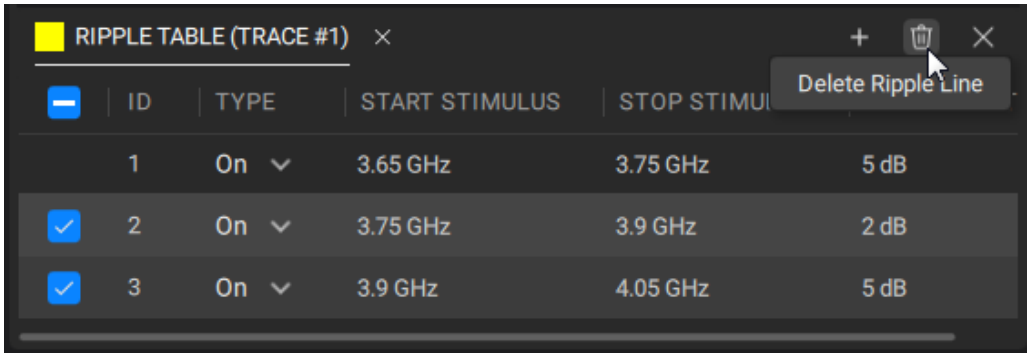


Ripple Limit Line Deletion

1. Enable ripple limit (see Enabling or Disabling Ripple Limit).
2. Select **Show Ripple Table** checkbox in RIPPLE LIMIT accordion in the submenu.

3. Highlight the line in the ripple limit table.

4. Click on the button in the ripple limit table.



SCPI CALCulate:RLIMit:DATA

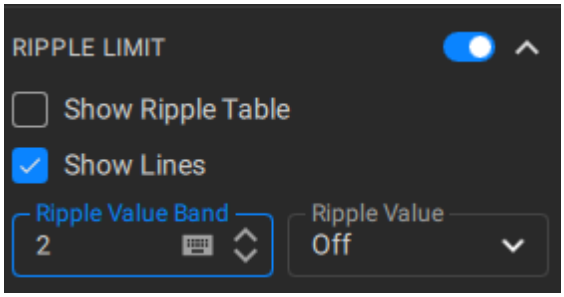
NOTE You can quickly delete all or a number of ripple limit lines, highlight them by selecting a checkbox on the left side of a limit line ID in the ripple limit table. After selecting, click button in ripple limit table.

Displayed Ripple Value Band

1. Enable ripple limit (see Enabling or Disabling Ripple Limit).

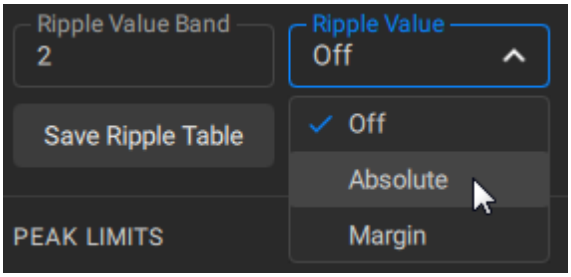
2. Click on the **Ripple Value Band** textbox and enter the number of ripple band.

   NOTE When entering a non-existent band number, the nearest limit value will be automatically set.



3 Click on the **Ripple Value** drop-down list and select the desired ripple value.

NOTE The ripple value type is set for all ripple bands.



SCPI CALCulate:RLIMit:DISPlay:SELect

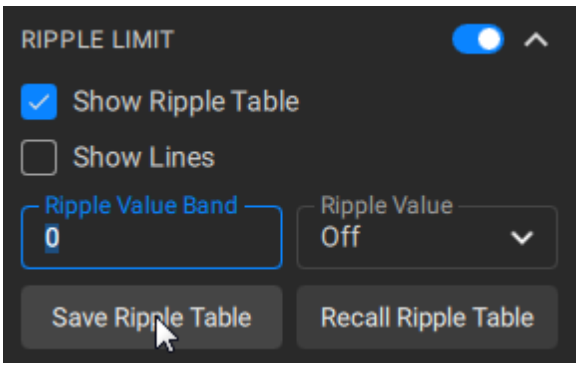
CALCulate:RLIMit:DISPlay:VALue

Saving Ripple Limit Table

1 Click on the **Limit Tests** button in the main menu.

2 Click on the **Save Ripple Table** button in RIPPLE LIMIT accordion in the submenu. Then, select the directory and the file name in the dialog that appears.

NOTE The ripple limit table can be saved into a *.RLM file to a hard disk.



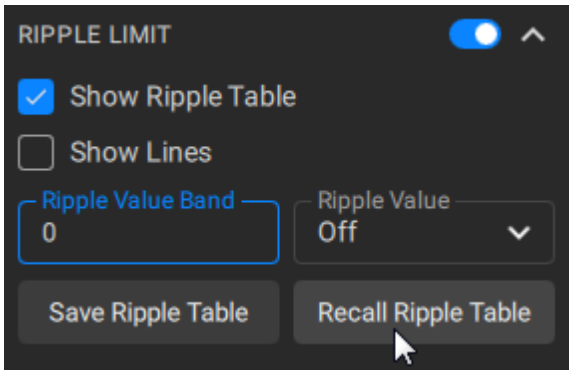
SCPI MMEMory:STORe:RLIMit

Recall Ripple Limit Table

1. Click on the **Limit Tests** button in the main menu.

2. Click on the **Recall Ripple Table** button in RIPPLE LIMIT accordion in the submenu. Then, select the directory and the file name in the dialog that appears.

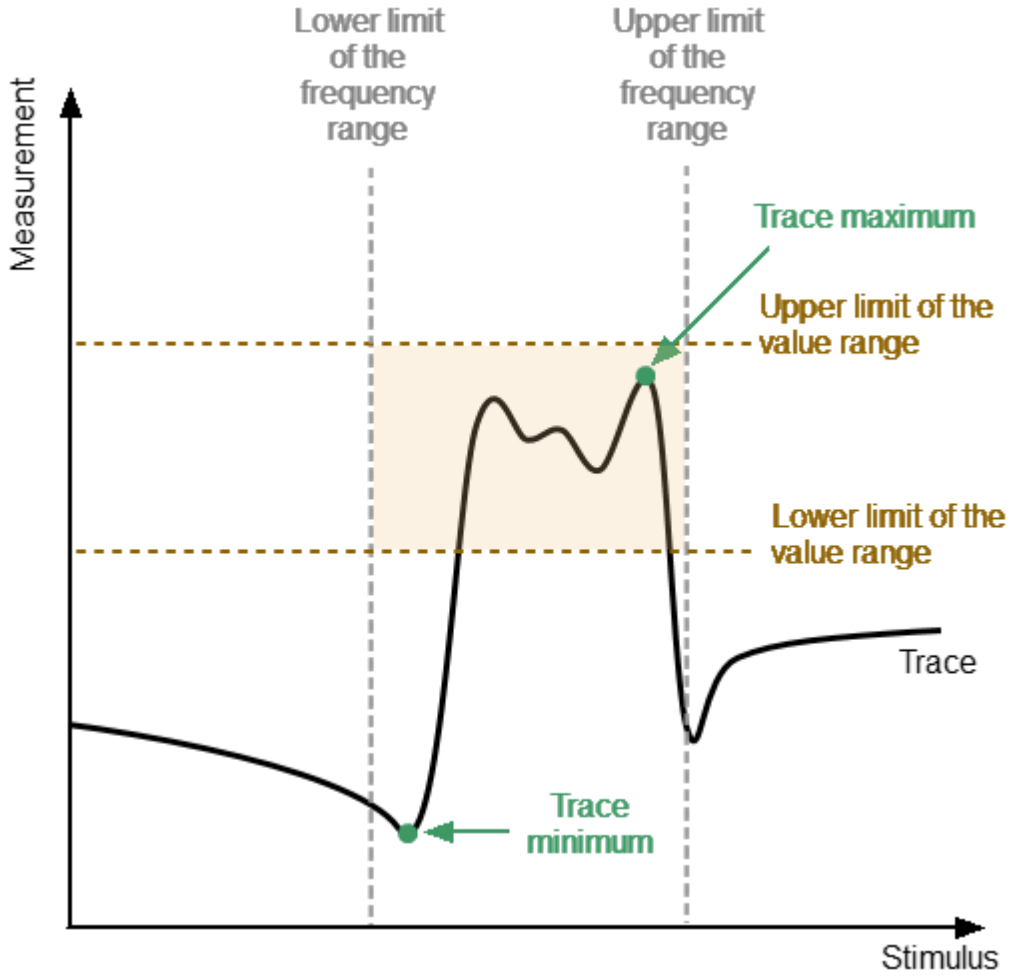
   NOTE The ripple limit table can be recalled from a *.RLM file on a hard disk.



SCPI MMEMory:LOAD:RLIMit

Peak Limits Test

The peak limits test function checks whether the trace point with the minimum (or maximum) value of the measured value falls within the specified limits of the frequency range and/or value range (see figure below). If the trace point minimum (or maximum) falls within the specified limits, the test is passed (test result "pass"). Otherwise, the test is failed (test result "fail").



Peak Limits Test

Peak Limit Test Parameters

A description of the parameters of the peak limits test function in the software is shown in the table below.

Parameter	Definition
Limit Type	Selects the type of limit (one of the limits or both at the same time). Possible values: • **Stimulus** — checks whether the maximum (or minimum) point of the trace is within the specified frequency bandwidth. • **Response** — checks whether the maximum (or minimum) point of the trace falls within the value range. • **All** — checks the maximum (or minimum) trace point simultaneously within the frequency band and within the value range of the measured value.
Peak Polarity	Selects a trace point for inspection: • **Positive** — trace maximum. • **Negative** — trace minimum.
Stimulus Start	Lower bandwidth limit.
Stimulus Stop	Upper bandwidth limit.
Response Start	Lower limit of the value range.
Response Stop	Upper limit of the value range.

NOTE The peak limit test for the **Stimulus** limit type can only be performed in the frequency domain.

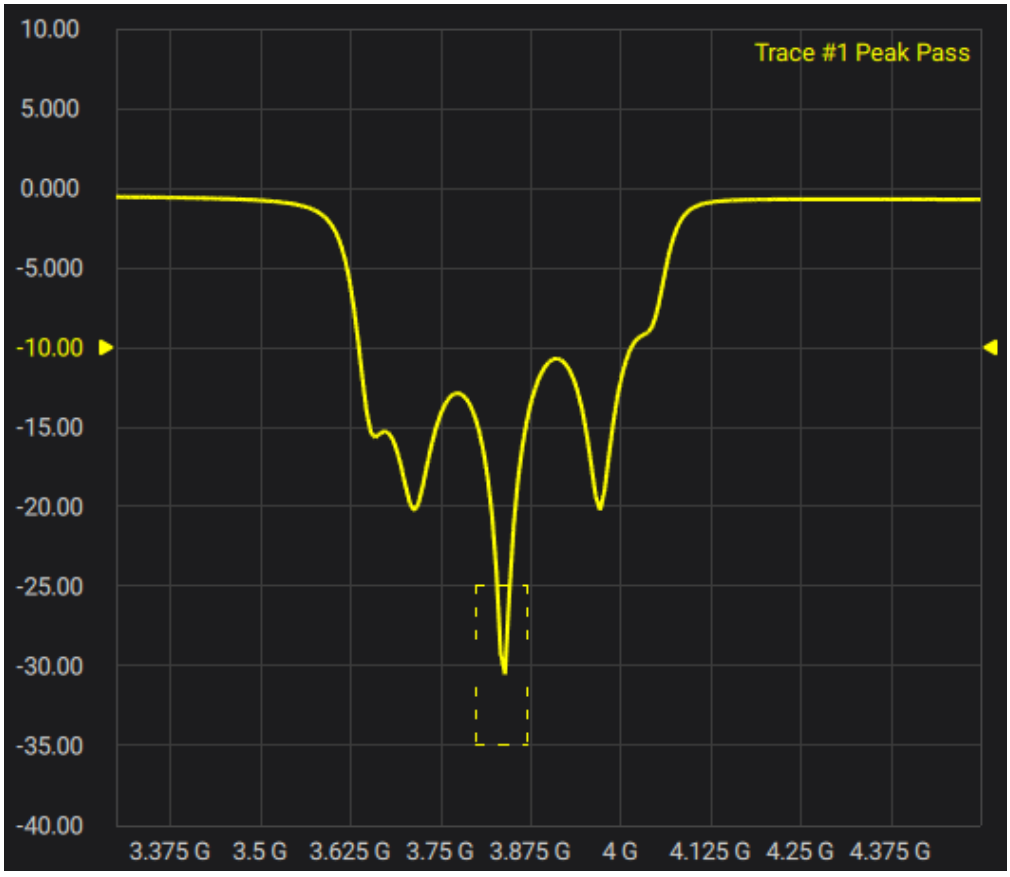
The display of the peak limits lines on the screen can be turned ON/OFF independently of the status of the peak limits test function.

The result of the peak limits test is indicated in the upper right corner of the diagram:

- If the measurement result passed the limits test, the trace number and the result will be seen: **Trace X Peak Pass**, where **Trace X** is name of trace (see figure above).
- If the measurement result failed, the result will be indicated in the following ways (see figure below):
  - **Trace X Peak Fail** (where **Trace X** is name of trace) will be displayed in upper right corner of the diagram.
  - Fail sign will be displayed in red in the center of the window, see Enabling or Disabling Fail Sign.
  - The points of the trace, which failed the test will be highlighted in red.
  - A beep will be heard.

The fail sign and the beep can be disabled using the Fail Sign softkey. For beep deactivation, see Beeper Settings.

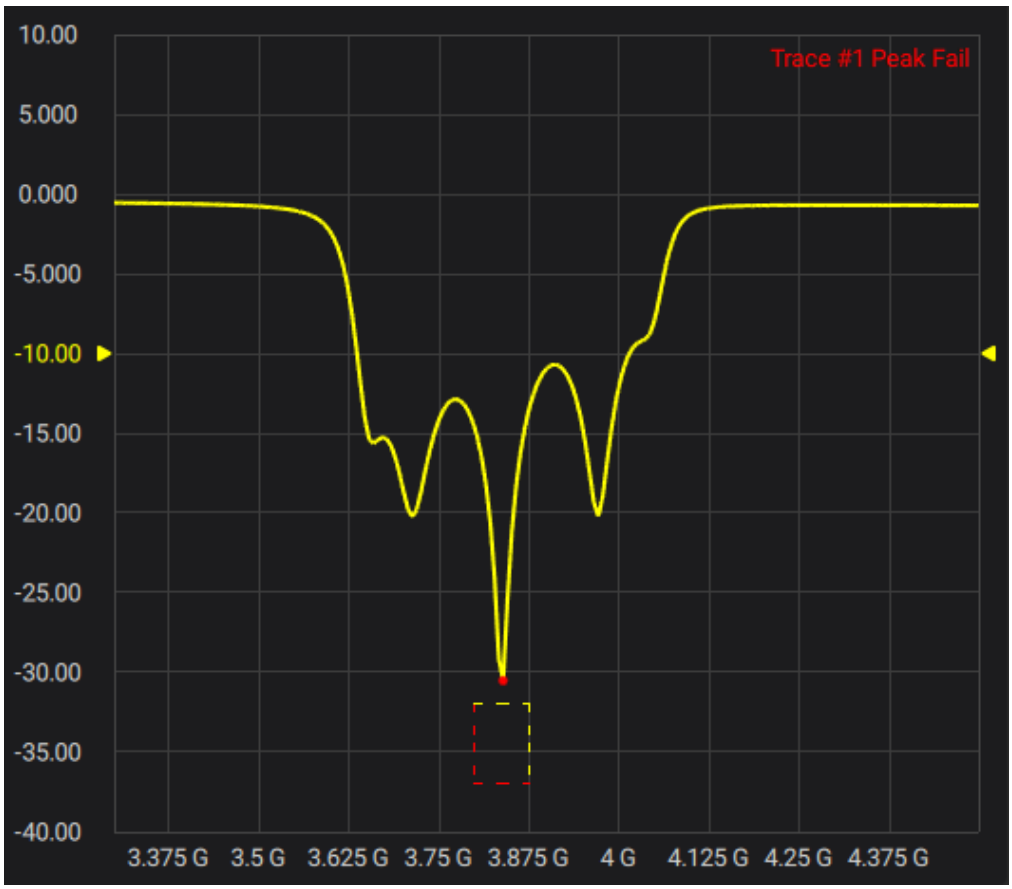
The figure below shows an example of the trace minimum point falling within the value range (test result "pass").



Limit Type: All, Peak Polarity: Negative

Example of the Trace Minimum Value Falling Within the Range of Values

The figure below shows an example of the trace minimum point being out of the value range (test result "fail").



Limit Type: All, Peak Polarity: Negative

Example of the Minimum Trace Point Value Being Outside the Value Range

Enabling or Disabling Peak Limits

1. Select the channel and trace (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Limit Tests** button in the main menu.
3. Toggle PEAK LIMITS ON in the PEAK LIMITS accordion in the submenu.



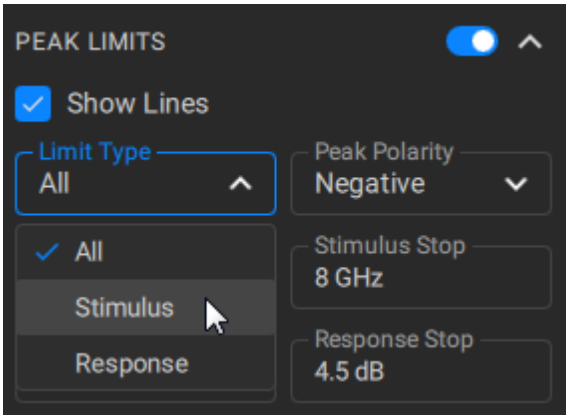
Showing or Hiding Peak Limit Lines

1. Select the channel and trace (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Limit Tests** button in the main menu.
3. Select **Show Lines** checkbox in the PEAK LIMITS accordion in the submenu.

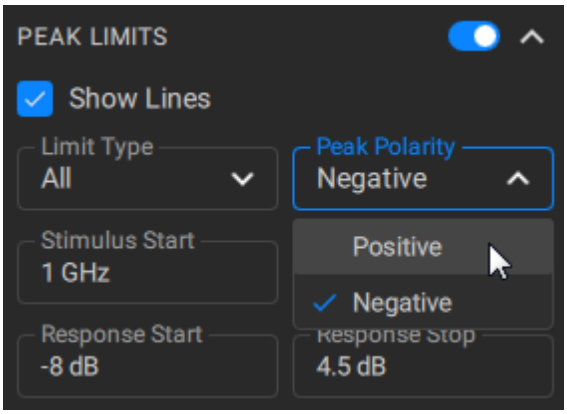


Setting Peak Limit Line Parameters

1. Select the channel and trace (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Limit Tests** button in the main menu.
3. Click on the **Limit Type** drop-down list in the PEAK LIMITS accordion in the submenu and select peak limit type.



4. Click on the **Peak Polarity** drop-down list in the PEAK LIMITS accordion in the submenu and select peak polarity.

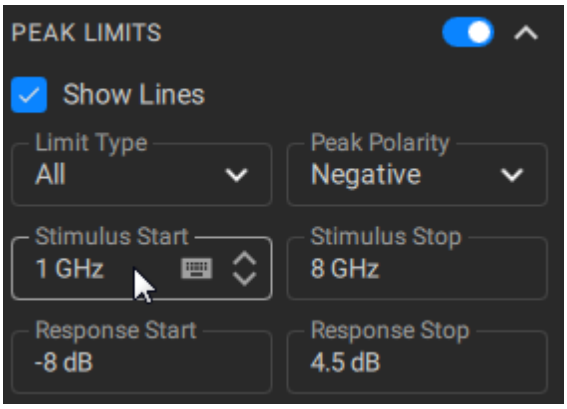


5 Click on the **Stimulus Start** and **Stimulus Stop** textbox in the PEAK LIMITS accordion in the submenu and enter the numerical value.

NOTE These fields are not available if the **Response** limit type is selected.

6 Click on the **Response Start** and **Response Stop** textbox in the PEAK LIMITS accordion in the submenu and enter the numerical value.

NOTE These fields are not available if the **Stimulus** limit type is selected.



State Saving and Data Output

The following section describes the processes of saving and recalling:

- The set parameters of the Analyzer, calibration, measured and stored data in a state file (see User States).
- Channel calibration data in a *.CCF file (see Channel Calibration Data).
- DUT S-parameters in a Touchstone file (see Trace Data Touchstone Files).
- Trace data in a *.CSV file (see Trace Data CSV Files).
- Data displayed on the application start (see Start State Config).

User States

The Analyzer state, calibration and measured data can be saved on the hard disk to a user state file or into the software memory (up to 10 states), and later uploaded back into the software. The four types of saving are available:

State	The Analyzer settings.
State & Correctors [default]	The Analyzer settings and applicable kit of calibration coefficients.
State & Data & Memory Trace	The Analyzer settings, data and memory traces.
All	The Analyzer settings and the applicable calibrations for specific ports configuration and memory.
1 When recalling the state with saved data traces, the trigger mode will be automatically set to **Hold** so that the recalled traces are not erased by currently measured data.	

The Analyzer settings that are saved on the hard disk to a user state file or into the Analyzer memory are parameters that can be set in the following submenu:

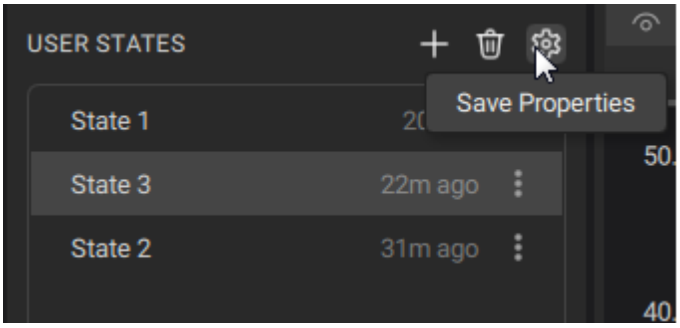
- All the parameters in the **Channel**.
- All the parameters in the **Trigger**.
- All the parameters in the **Trace**.
- All the parameters in the **Average**.
- All the parameters in the **Scale**.
- All the parameters of the **Marker**.
- All the parameters of the **Marker Math**.
- All the parameters of the **Calibration**.
- All the parameters of the **Fixture**, **Time Domain**, **Limit Test**.
- All the parameters in the **Appearance**.
- All the parameters in the **Settings**.
- **Reference Source** parameter and type of instrument in the **Devices**.

You can add up to 10 user states which by default are created in the list of states with the following names: **State 1**, **State 2**,... **State 10**. If necessary, you can recall, rewrite or delete the user states. The states are not cleared when the software is turned off.

Selecting Types of Saving

1. Click on the **Save/Recall** button in the main menu.

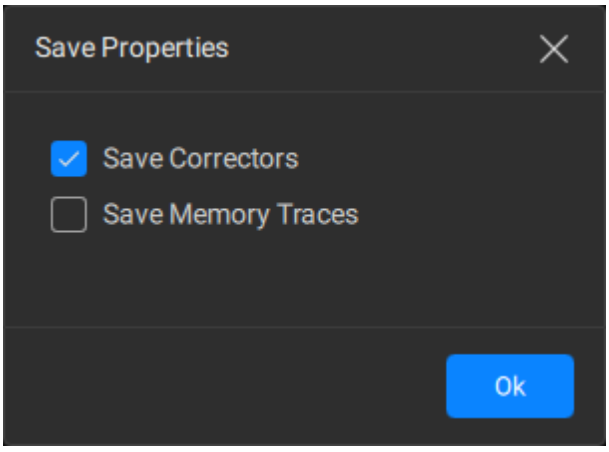
2. Click on  button in the USER STATES area in the submenu.



3. Select the type of saving in the **Save Properties** pop-up window:

   - **State** — Both checkboxes are cleared.
   - **State & Correctors** — **Save Corrector** checkbox is selected.
   - **State & Memory Traces** — **Save Memory Traces** checkbox is selected.
   - **All** — Both checkboxes are selected.

NOTE The default type of saving is **State & Correctors**.



4. Click on the **OK** button.

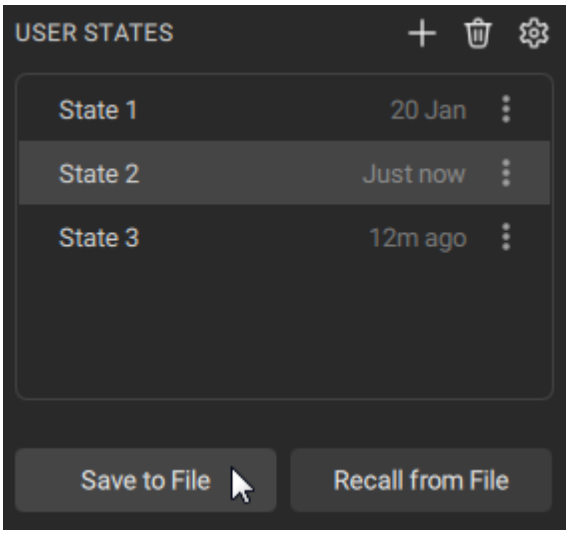
SCPI MMEMory:STORe:STYPe

Saving Analyzer State in File

1. Click on the **Save/Recall** button in the main menu.

2. Select type of saving (see Selection Types of Saving).

3. Click on the **Save to File** button in submenu and select the directory and enter the file name in the dialog that appears.



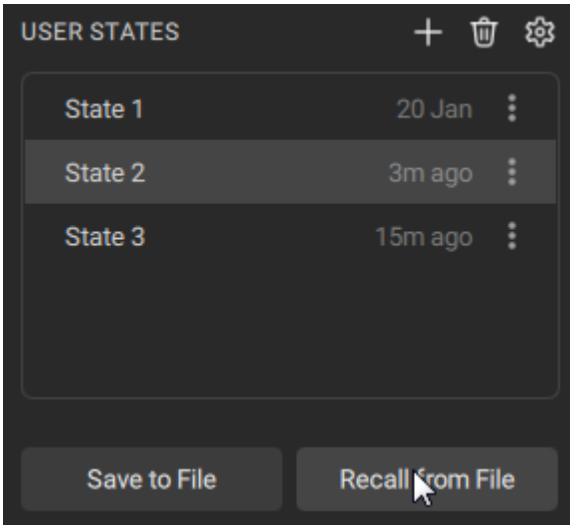
SCPI MMEMory:STORe

Recall Analyzer State from File

1. Click on the **Save/Recall** button in the main menu.

2. Click on the **Recall from File** button in submenu and select the directory and the file name in the dialog that appears.

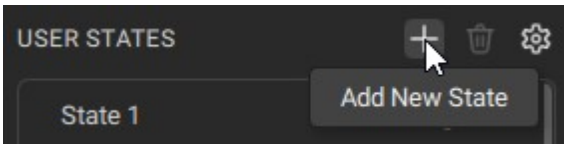
NOTE The current state of the analyzer will be changed.



SCPI MMEMory:LOAD

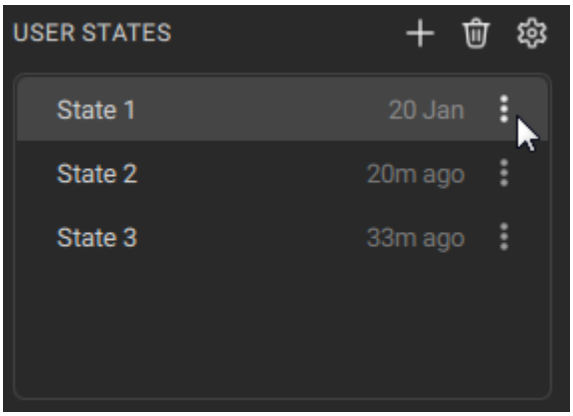
Adding User State

1. Click on the **Save/Recall** button in the main menu.
2. Select type of saving (see Selection Types of Saving).
3. Click on the + button in the USER STATES area in the submenu.



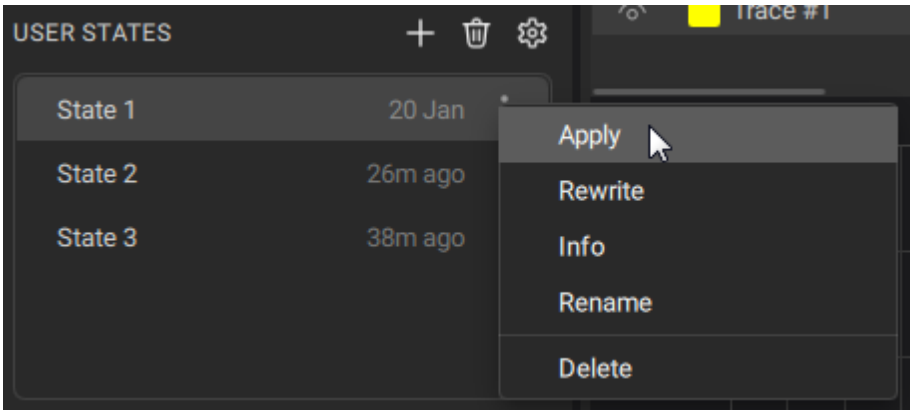
User State Appliance

1. Click on the **Save/Recall** button in the main menu.
2. Click on vertical-ellipsis button ⋮ at the desired state in the USER STATES area in the submenu.



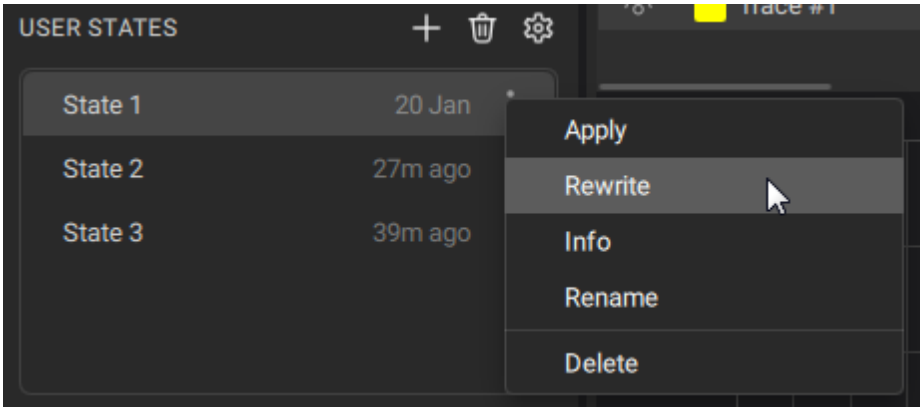
3 Select **Apply** value on the list.

NOTE The current state of the analyzer will be erased.



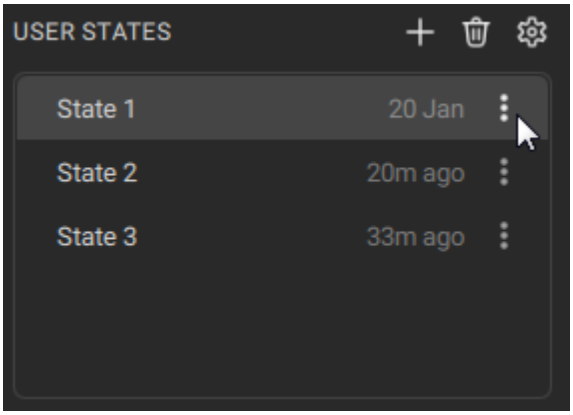
Rewriting Current State in Saved State

1. Click on the **Save/Recall** button in Main Menu.
2. Select type of saving (see Selection Types of Saving).
3. Click on vertical-ellipsis button ⋮ at the desired state in the USER STATES area in the submenu.
4. Select **Rewrite** value on the list.



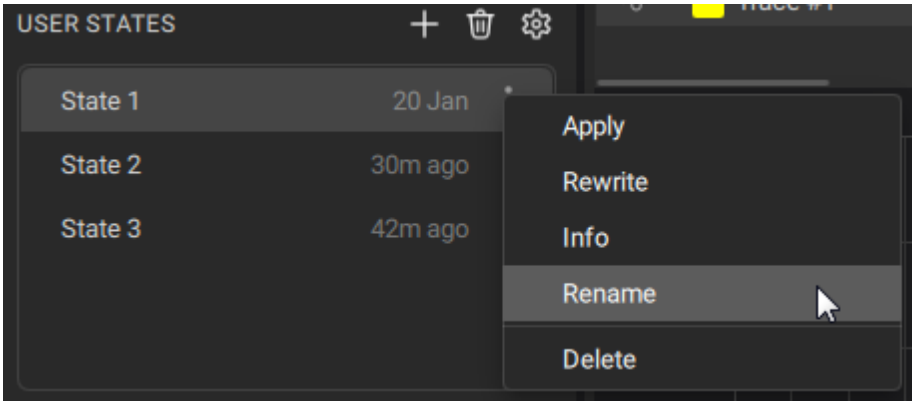
Renaming User State

1. Click on the **Save/Recall** button in the main menu.
2. Click on vertical-ellipsis button ⋮ at the desired state in the USER STATES area in the submenu.



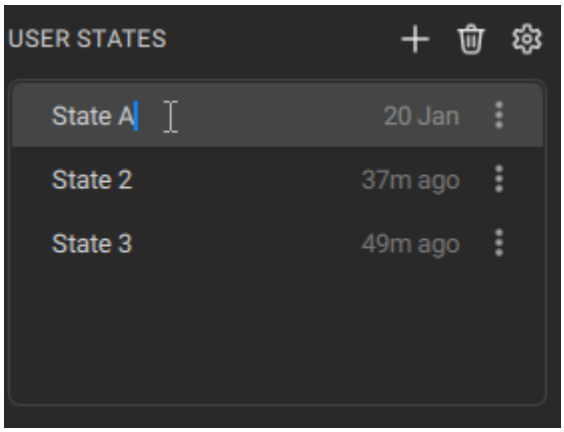
3. Select **Rename** value on the list.

NOTE The name of the state should not exceed 20 characters.



4. Enter symbols in the state name textbox with the keyboard

NOTE You can quickly rename a state. Click on name of a state in the USER STATES area and enter a new name.

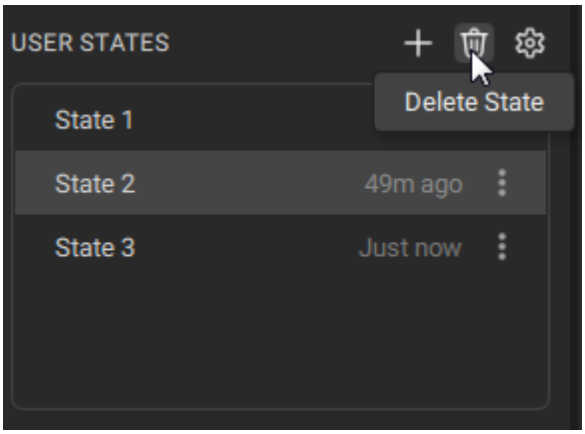


User State Deletion

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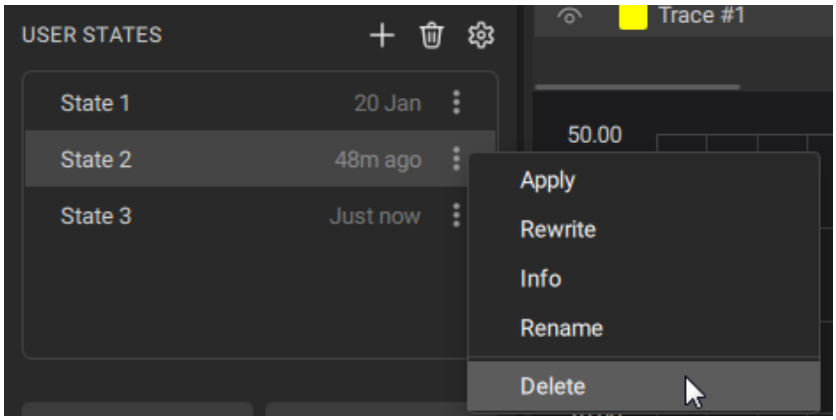
1. Click on the **Save/Recall** button in the main menu.

2. Highlight the state in the list and click on  button in the USER STATES area in the submenu.



NOTE

You can also delete a state by clicking on vertical-ellipsis button ⋮ at the desired state in the USER STATES area in the submenu and select **Delete** value on the list.

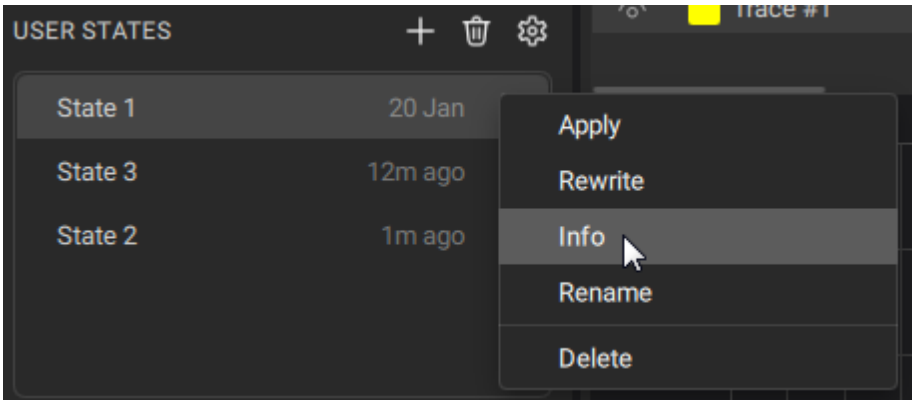


Showing User State Info

1. Click on the **Save/Recall** button in the main menu.

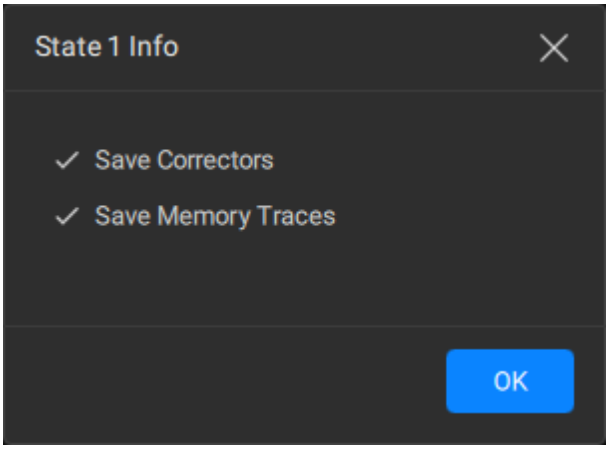
2. Click on vertical-ellipsis button ⋮ at the desired state in the USER STATES area in the submenu.

3 Select **Info** value on the list.



4 Click on the **OK** button.

NOTE The dialog contains information about the types of saving for the state.



Channel Calibration Data

Channel calibration data can be saved to a file or loaded from a file into the channel. The file contains frequency data, calibration coefficients, and calibration information. Files have the *.CCF extension and are saved in the \State directory of the software.

Saving Channel Calibration

1. Select the channel (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Save/Recall** button in the main menu.
3. Click on the **Save** button in the CHANNEL CALIBRATION PARAMETERS area in the submenu.



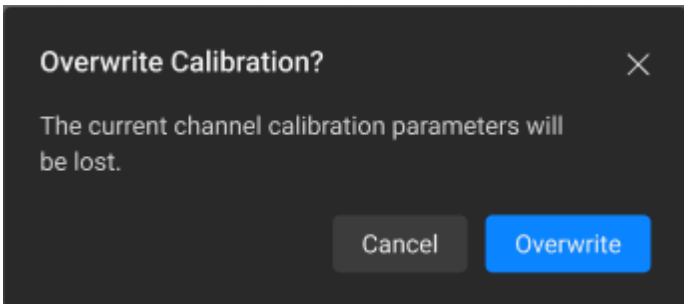
4. Select the directory and enter the file name in the dialog that appears.
5. Click on the **Save** button.

Recalling Channel Calibraiton

1. Select the channel (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Save/Recall** button in the main menu.
3. Click on the **Recall** button in the CHANNEL CALIBRATION PARAMETERS area in the submenu.



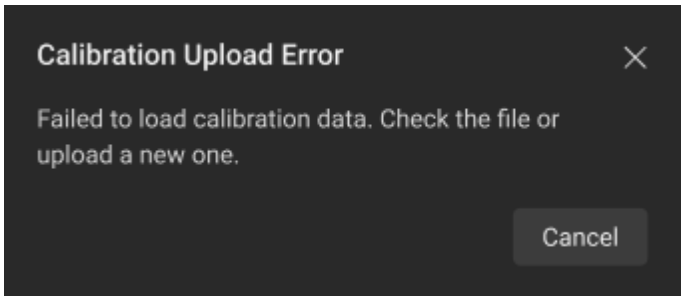
NOTE If the loaded channel calibration does not match the current calibration, the software will prompt you to overwrite the existing calibration. The current calibration state will not be saved.



4 Select the directory and the file name in the dialog that appears.

5 Click on the **Open** button.

NOTE If an incorrect file is uploaded, the following message will appear:



Touchstone Data

The Analyzer supports saving S-parameters to a Touchstone file and recalling data from the Touchstone files.

Files in this format are typical for most circuit simulator programs. The Touchstone file contains frequency values and S-parameters.

NOTE If a channel does not have all the S-parameter traces, only available S-parameter responses will be represented. For example, if one S11 trace is enabled, the S21 response will be represented, and the S12 and S22 responses will not be represented. The missing S-parameters are displayed as zeroes in the file.

The Touchstone file contains header, and trace data lines. The header starts from the # symbol.

The *.S1P Touchstone file for one-port measurements:

# Hz S FMT R Z0		
F[0]	{S11}’	{S11}”
F[1]	{S11}’	{S11}”
	. . .	
F[n]	{S11}’	{S11}”

The *.S2P Touchstone file for two-port measurements:

# Hz S FMT R Z0								
F[0]	{S11}’	{S11}”	{S21}’	{S21}”	{S12}’	{S12}”	{S22}’	{S22}”
F[1]	{S11}	{S11}”	{S21}’	{S21}”	{S12}’	{S12}”	{S22}’	{S22}”
. . .								
F[n]	{S11}’	{S11}”	{S21}’	{S21}”	{S12}’	{S12}”	{S22}’	{S22}”

The *.SNP Touchstone file for N-port measurements. N is the number of selected ports to save (N is from 3 to 6/8/10/12/14/16, depending on the Analyzer model):

# Hz S FMT R Z0							
F[0]	{S11}’	{S11}”	{S12}’	{S12}”	. . .	{S1N}’	{S1N}”
	{S21}’	{S21}”	{S22}’	{S22}”	. . .	{S2N}’	{S2N}”
	. . .						
	{SN1}’	{SN1}”	{SN2}’	{SN2}”	. . .	{SNN}’	{SNN}”
F[1]	{S11}’	{S11}”	{S12}’	{S12}”	. . .	{S1N}’	{S1N}”
	{S21}’	{S21}”	{S22}’	{S22}”	. . .	{S2N}’	{S2N}”
	. . .						
	{SN1}’	{SN1}”	{SN2}’	{SN2}”	. . .	{SNN}’	{SNN}”
. . .							
F[n]	{S11}’	{S11}”	{S12}’	{S12}”	. . .	{S1N}’	{S1N}”
	{S21}’	{S21}”	{S22}’	{S22}”	. . .	{S2N}’	{S2N}”
	. . .						
	{SN1}’	{SN1}”	{SN2}’	{SN2}”	. . .	{SNN}’	{SNN}”

FMT — data format:

RI — Real and imaginary parts.

MA — Linear magnitude and phase in degrees.

DB — Logarithmic magnitude in dB and phase in degrees.

Z0 — Reference impedance value.

F[n] — Frequency at measurement point n:

{…}' — {real part (RI) | linear magnitude (MA) | logarithmic magnitude (DB)}.

{…}" — {imaginary part (RI) | phase in degrees (MA) | phase in degrees (DB)}.

Advanced Mapping

If necessary, you can select the sequence of saving ports into the Touchstone file. By default, the Touchstone file contains ports from 1 to N (N is the number of selected ports to save). For example, when saving ports 3, 7 and 8, you can select the following sequence of port mapping in the Touchstone file:

VNA port 3 → file port 2,

VNA port 7 → file port 1,

VNA port 8 → file port 3.

Touchstone File Saving

The Touchstone file saving function is applied to individual channels.

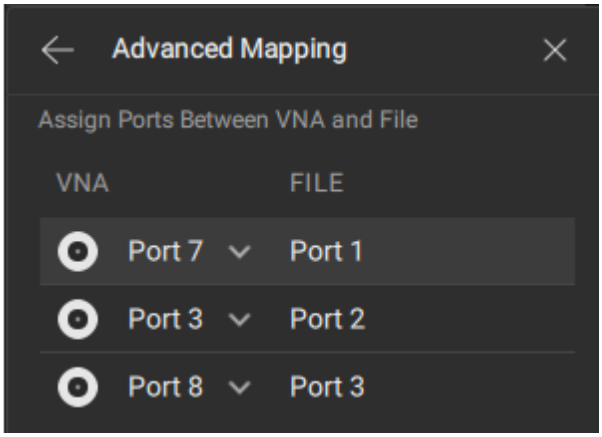
---

1. Click on the **Save/Recall** button in the main menu.
2. Click on the **Save .sNp** button in the submenu.
3. Select the channel in the **Channel** drop-down list in the Save .sNp pop-up window.
4. Select the port numbers that need to be saved in the **Select VNA Ports** area in the Save .sNp pop-up window.

5 If you do not want to change the port mapping, select the **Default Mapping** checkbox in the Save .sNp pop-up window.

If you want to change the sequence of port mapping in the Touchstone file:

1. Clear the **Default Mapping** checkbox in the Save .sNp pop-up window.
2. Click on the **Advanced Mapping** button in the Save .sNp pop-up window.
3. Select the mapping between VNA ports and Touchstone file ports in the **Assign Ports Between VNA and File** mapping table in the Advanced Mapping pop-up window.

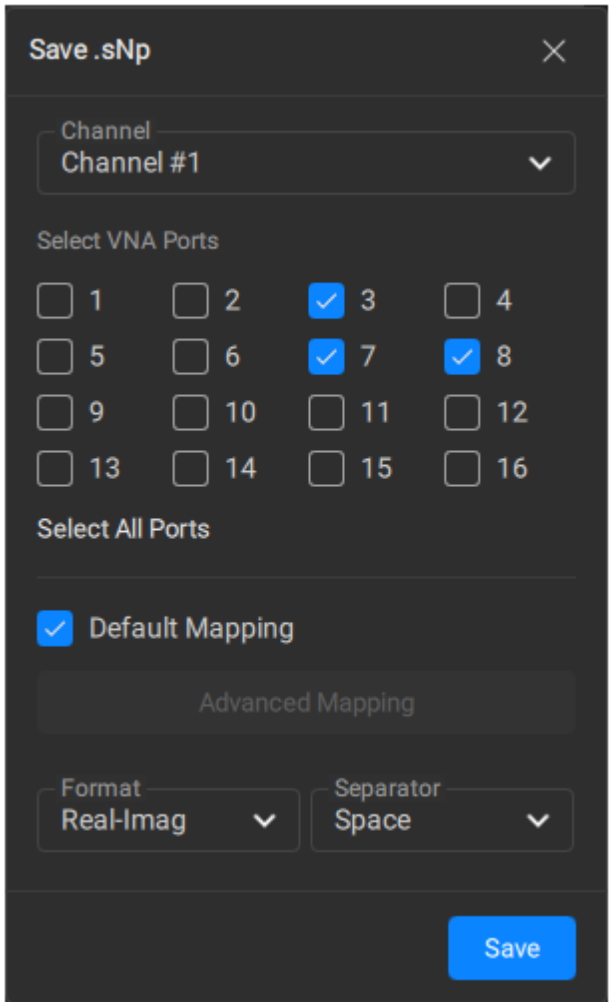


6 Click on the **Format** drop-down list in the Save .sNp pop-up window and select the required data format from the list:

- **Real - Imag** — Real and imaginary parts.
- **Magnitude - Angle** — Linear magnitude and phase in degrees.
- **dB - Angle** — Logarithmic magnitude in dB and phase in degrees.

7 Click on the **Separator** drop-down list in the Save .sNp pop-up window and select the required separator type between **Tab** and **Space.**

8 Click on the **Save** button in the Save .sNp pop-up window and select the directory and enter the file name in the dialog that appears.



SCPI

MMEMory:STORe:SNP:TYPE:S1P,
MMEMory:STORe:SNP:TYPE:S2P,
MMEMory:STORe:SNP:TYPE:S3P

MMEMory:STORe:SNP:TYPE:S4P, MMEMory:STORe:SNP:TYPE?,
MMEMory:STORe:SNP:TYPE:SNP

MMEMory:STORe:SNP

MMEMory:STORe:SNP:SEParator

Touchstone File Recalling

Data can be loaded to memory traces or to data traces.

---

1. Click on the **Save/Recall** button in the main menu.

2. Click on the **Recall .sNp** button in the submenu.

3. Select the directory and the file with *.S1P, *.S2P, *.S3P, *.S4P, ... *.S16P extension.

4. Select the channel in the **Channel** drop-down list in the Recall .sNp pop-up window.

5. Click on the **Recall to** drop-down list in Recall .sNp pop-up window and select the data loading method from the list:

   - **Active Trace Memory** — Loading data to the active trace memory.
   - **All Traces Memory** — Loading data to the memory of all traces.
   - **S-Parameters** — Loading data to all data traces of the channel.

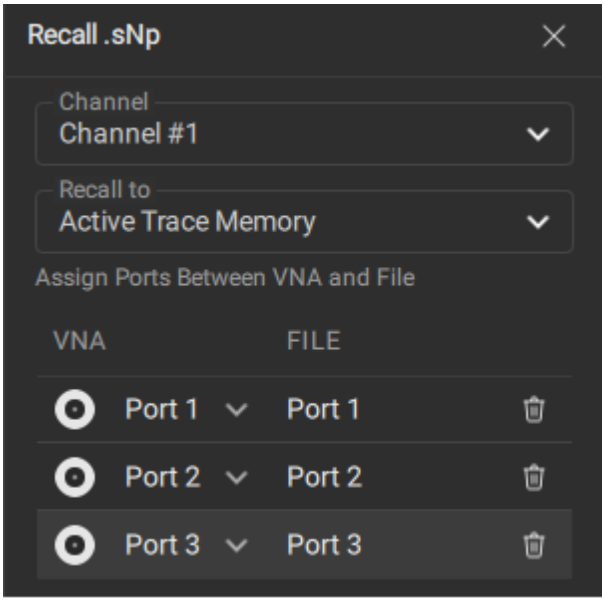
   NOTE When loading data to data traces, the Analyzer switches to hold mode to avoid writing over the recalled data with current data.

   NOTE When loading data to the memory traces, the sweep hold does not occur.

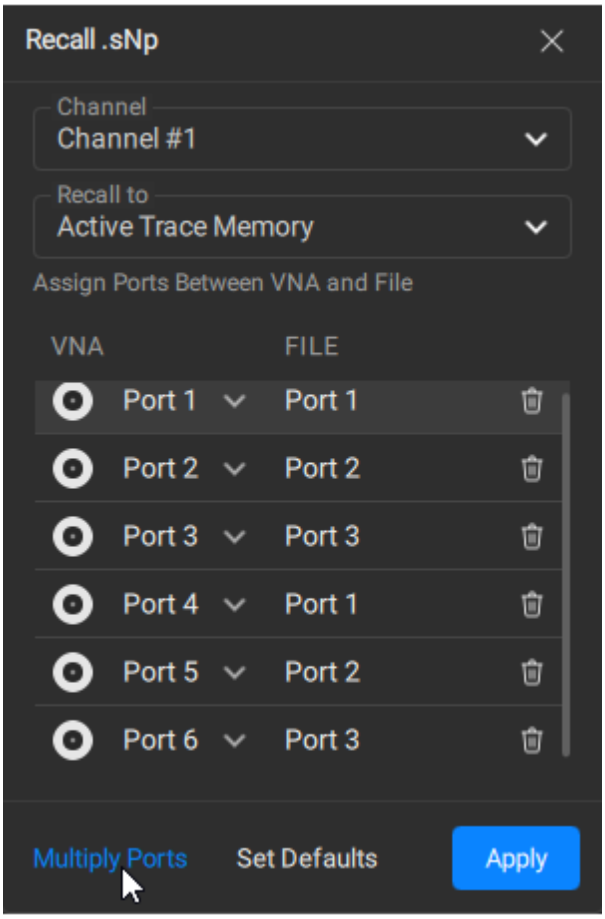
6 Select the mapping between VNA ports and Touchstone file ports in the **Assign Ports Between VNA and File** mapping table in the Advanced Mapping pop-up window.

NOTE The number of ports appeared in the port mapping table depend on the *.SNP file.

NOTE It is possible to delete ports while mapping by clicking on the icon.



7 Click on the **Multiply ports** button in Recall .sNp pop-up window to upload the same file to several ports (duplicate to other ports). More VNA port lines with the same file ports will appear. Select the mapping between VNA ports and Touchstone file ports.



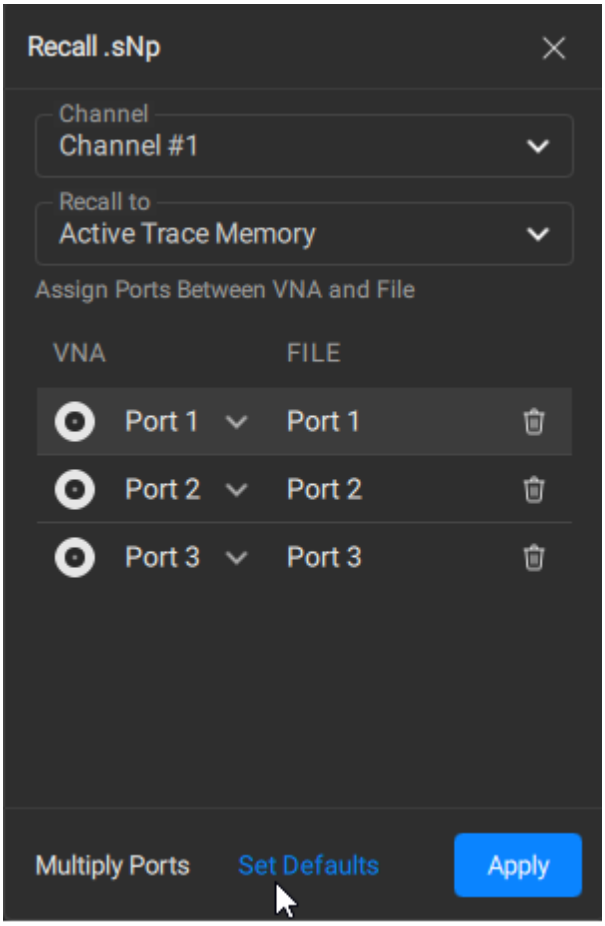
8 Click on the **Set Defaults** button in Recall .sNp pop-up window to restore the mapping table to its default state.

NOTE The default state has the following mapping:

VNA port 1 → file port 1,

VNA port 2 → file port 2,

VNA port 3 → file port 3, etc.



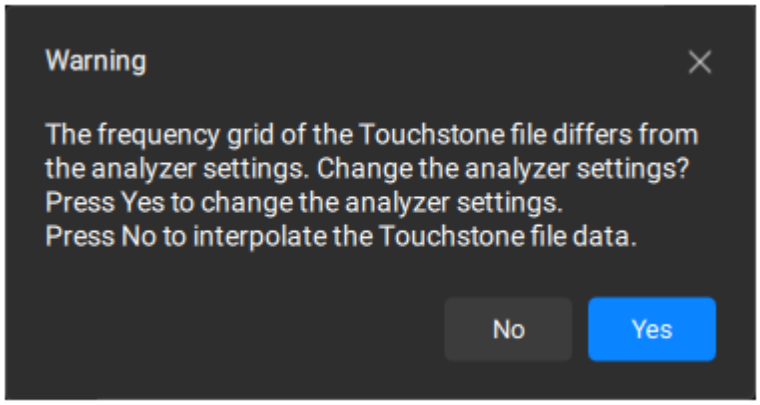
9 Click on the **Apply** button in Recall .sNp pop-up window.

SCPI MMEMory:LOAD:SNP

MMEMory:LOAD:SNP:TRACe:MEMory

NOTE

If the frequency scale of the Touchstone file does not correspond with the current frequency settings of the selected channel for recalling, the user is prompted to choose between interpolating the data upon recall or changing the Analyzer settings. The following message appears:



Trace Data

Trace data can be saved as a *.CSV file (comma separated values). The *.CSV file contains comment and trace data lines. Comments start from the ! symbol.

Before saving the *.CSV file, set the trace type, value delimiter type, and other parameters (see the table).

Parameter	Definition
Scope	Type of trace to be saved: • **Active Trace**. • **All Traces of channel** — all traces of the active channel.
Format	Data save format: • **Displayed** — the format in which the trace is set (See Format Setting). • **Real-Imag** — real and imaginary parts. • **db-Angle** — logarithmic magnitude in dB and phase in degrees.
Header	Enable/disable the entry in the comment file. The comment contains 3 lines: 1. Model, serial number, software version. 2. Date timestamps (in the dd.mm.yyyy hh:mm:ss format). 3. The name of the saved parameters and their dimensionality.
Stimulus	Enable/disable recording to the file frequency at measurement point.
Decimal Separator	The type of delimiters between stored values, as well as the type of decimal separator: • **Local** — operating system settings. • **Point** — decimal separator is point, value separator is comma.

The trace data is saved to *.CSV in the following format:

! Header		
F[0],	Data1,	Data2
F[1],	Data1,	Data2
. . .		
F[n],	Data1,	Data2

F[n] — frequency at measurement point n.

Data1 — trace response in rectangular format, real part in Smith chart and polar format.

Data2 — absent in rectangular format, imaginary part in Smith chart and polar format.

CSV File Editing Parameters and Saving

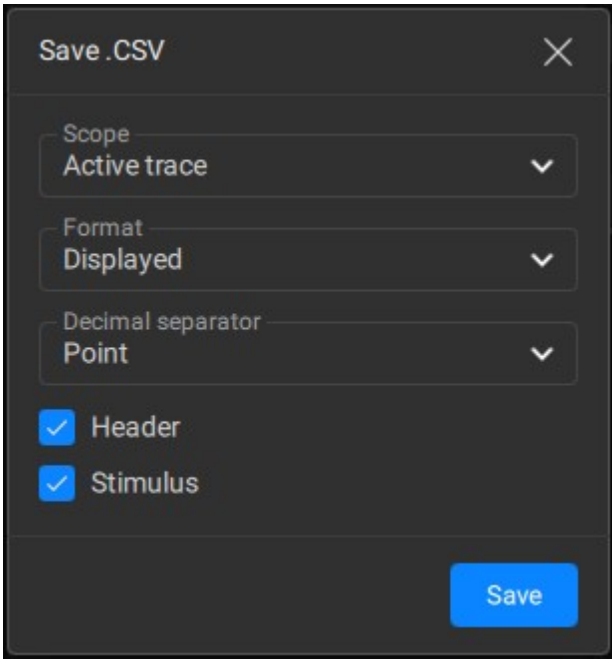
---

1. Select the channel (see Selection of Active Trace, Diagram, Channel).
2. Click on the **Save/Recall** button in the main menu.
3. Click on the **Save .CSV** button in the submenu.
4. Click on the **Scope** drop-down list in the Save .CSV pop-up menu and select the required type of trace between **Active trace** and **All traces of channel.**
5. Click on the **Format** drop-down list in the Save .CSV pop-up menu and select the required data format from the list:
   - **Displayed**— the format in which the trace is set (see Format Setting).
   - **Real-Imag** — real and imaginary parts.
   - **db-Angle** — logarithmic magnitude in dB and phase in degrees.
6. Click on the **Decimal separator** drop-down list in the Save .CSV pop-up menu and select the type of separators between **Local** and **Point**.

7. Select or clear the **Header** checkbox in the Save .CSV pop-up menu and enable/disable recording in the header file.

8. Select or clear the **Stimulus** checkbox in the Save .CSV pop-up menu and enable/disable writing to a file frequency at measurement point.

9. Click on the **Save** button in the Save .CSV pop-up menu to save the trace data and select the directory and enter the file name in the dialog that appears.



SCPI

MMEMory:STORe:FDAT:SCOPe

MMEMory:STORe:FDAT:FORMat

MMEMory:STORe:FDAT:SEParator

MMEMory:STORe:FDAT:COMMent

MMEMory:STORe:FDAT:STIMulus

MMEMory:STORe:FDAT

Start State Config

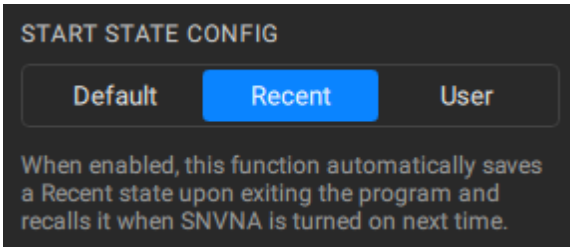
Start state config function allows to select the data to be displayed on the application start.

Start State Config	Function
Default	The software restores the default state when the software is turned on next time (see Default Settings Table).
Recent [default]	The software restores a recent state when the software is turned on next time.
User	The software restores a user state when the software is turned on next time. User config is unavailable without saved user states (see User States).

Selecting Start State Config

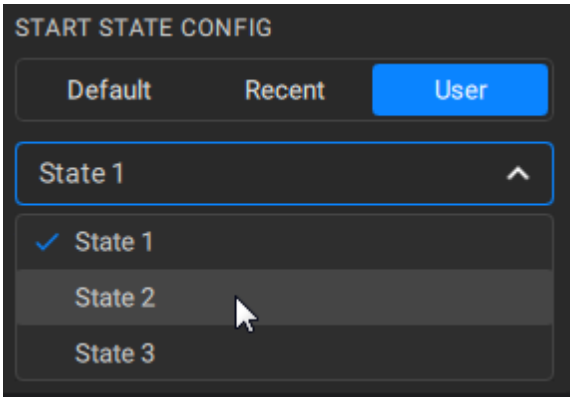
1. Click on the **Save/Recall** button in the main menu.

2. Click on one of the buttons in the segment switch in START STATE CONFIG area.



3 If **User** config selected, click on the drop-down list below the segment switch and select state from list.

NOTE **User** config is unavailable without saved user states (see User States).



System Settings

Analyzer Presetting

The Analyzer presetting feature allows to restore the default settings of the Analyzer. The default settings of the Analyzer are specified in Default Settings Table.

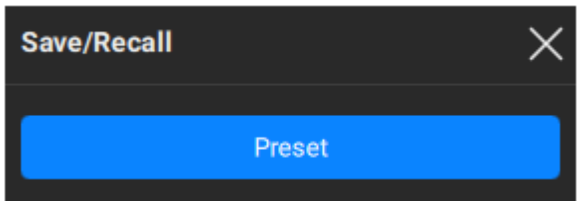
NOTE

When the analyzer is set to the default settings, it doesn't affect the following items:

- All changes in Calibration Kits and Connectors tables (see Calibration Kits Management and Description of Connectors).
- All created configurations in the Calibration Wizard (see Calibration Wizard).
- All User States, created in the Analyzer memory (see User States).

Presetting the Analyzer

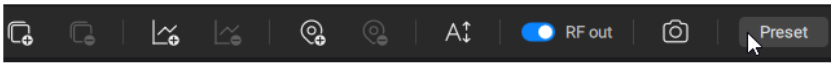
1. Click on the **Save/Recall** button in the main menu.
2. Click on the **Preset** button in the submenu.



SCPI SYSTem:PRESet

NOTE

You can quickly reset the Analyzer to the initial condition by clicking on **Preset** button in the Quick Access Toolbar.



Graph Printing

This section describes the print/save procedures for graph data.

The graphs can be printed and saved using different applications:

- MS Word.
- Image Viewer for Windows.
- Print Wizard of the Analyzer.

NOTE The MS Word application must be installed on the Windows system.

NOTE The Print Wizard requires at least one printer to be installed in Windows.

Print color can be selected before the image is transferred to the printing application:

- Color (no changes).
- Gray scale.
- Black & white.

The image can also be inverted before it is transferred to the printing application.

The current date and time can be added before the image is transferred to the printing application.

Using Templates for Printing Graphs

It is possible to use MS Templates while printing graphs.

The template can include additional information about the test performed, DUT, operator name, company logo, etc. The template must have the *.DOCX extension. Example template is included as PrintTemplateExample.docx (file path is C: \VNA\SNVNA\Report\PrintTemplateExample.docx). Templates can also be created from scratch in MS Word.

The MS Word template for printing graphs can contain keywords, which will contain data during printing. Keywords are enclosed by brackets.

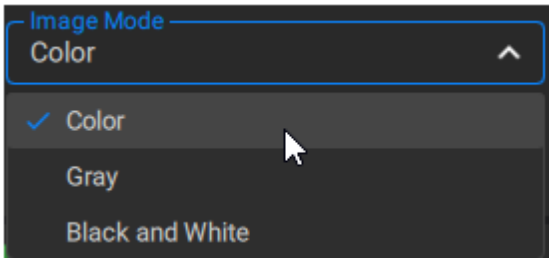
<Image>	Placement of the graph image within the document. If omitted, the graph will be placed at the end of the document.
<Model>	Placement of the analyzer model within the document.
<SerialNum>	Placement of the serial number of the analyzer within the document.

Selecting Printing Options

1. Click on the **Save/Recall** button in the main menu.

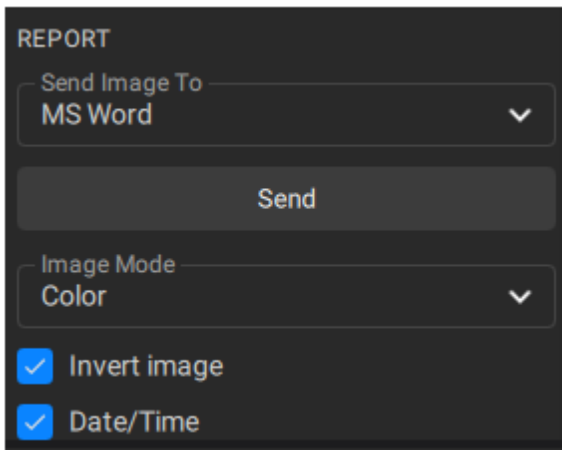
2. If you want to configure the print color, click on the **Image Mode** drop-down list in the REPORT area in the submenu and select the required option from the list.

   NOTE By default, the image printing color is set to **Color**.



3. If you want to invert the image, select the **Invert image** checkbox in the REPORT area in the submenu.

4. If you want to add the current date and time printout, select the **Date/Time** checkbox in the REPORT area in the submenu.

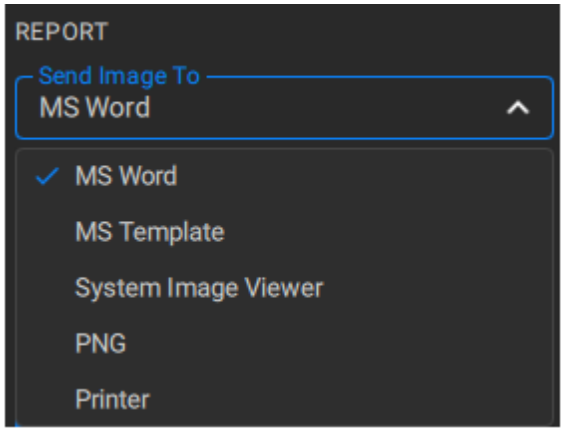


SCPI	HCOPy:PAINt
	HCOPy:IMAGe
	HCOPy:DATE:STAMp

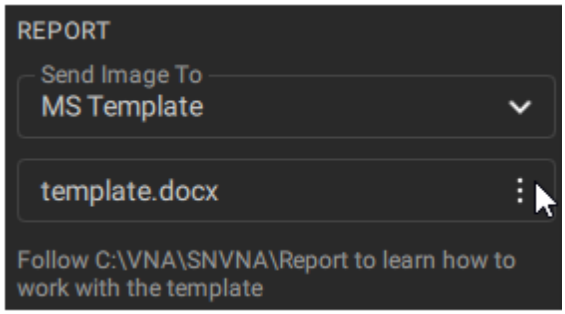
Printing a Graph

1. Click on the **Save/Recall** button in the main menu.

2. Click on the **Send Image To** drop-down list in the REPORT area in the submenu and select the required printing method from the list.

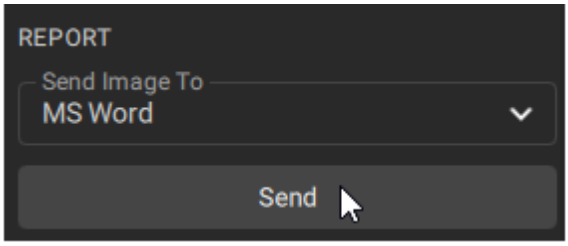


If **MS Template** printing method is selected, click on the vertical-ellipsis button and select the directory and the desired MS template file with *.DOCX extension in the dialog that appears.



3. Select image printing options (see Selecting Printing Options)

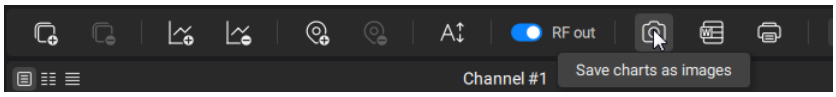
4. Click on the **Send** button in the REPORT area in the submenu. Select the directory and enter the name of the file in the dialog that appears.

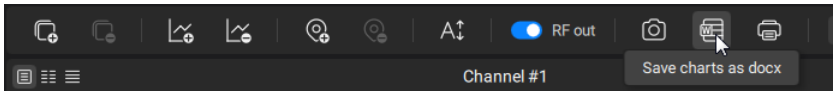


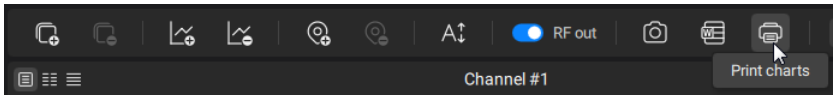
SCPI MMEMory:STORe:IMAGe

HCOPy

NOTE You can quickly save the graph as an image or as a document by clicking on the **Save charts as images** or **Save charts as docs** or **Print Chart icon** in the Quick Access Toolbar.



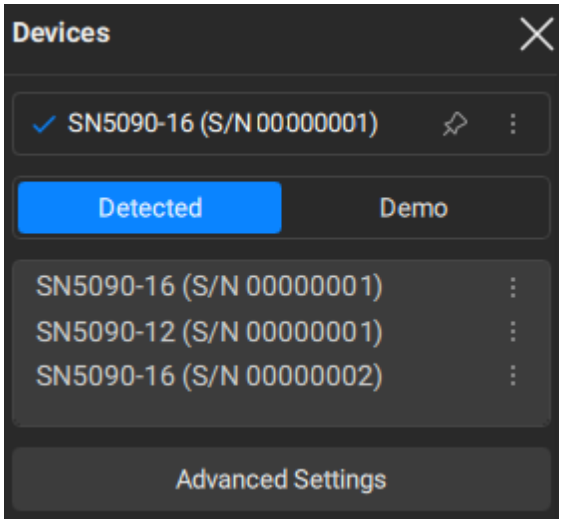




Analyzer Model and Serial Number

When running the Analyzer software, all connected Analyzers (model and serial number) are detected automatically and displayed in the Devices list (see figure below). After that, the required Analyzer is connected to the Analyzer software. You can select the required Analyzer model and serial number manually.

When the Analyzer is selected, it becomes priority Analyzer (a priority value is applied and an icon  appears next to the Analyzer in the textbox). In this case, when running the Analyzer software, it awaits for the connection of the priority Analyzer (other Analyzers are ignored).



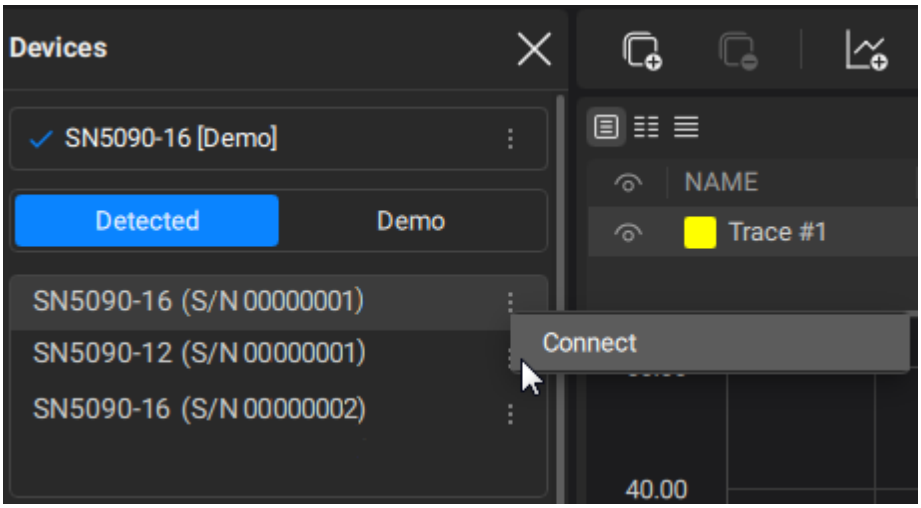
Automatically Detected Analyzer Model and Serial Number

Connecting Detected Analyzer

1. Click on the **Devices** button in the main menu.
2. Click on the **Detected** button in segment switch in the submenu.

3. Click on the vertical-ellipsis button ⋮ at the desired detected Analyzer in the Devices list, and then click on the **Connect** value.

NOTE When the Analyzer is selected, priority value is automatically applied to this particular model.

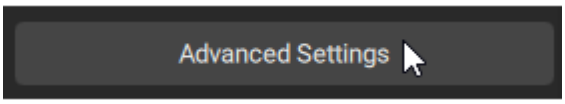


Selecting Analyzer Model and Serial Number Manually

1. Click on the **Devices** button in the main menu.

2. Click on the **Detected** button in segment switch in the submenu.

3. Click on the Advanced Settings button Devices under the list in the submenu.



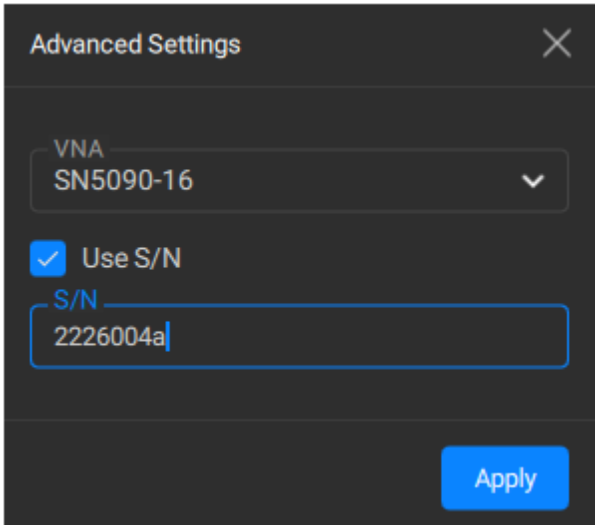
4. Click on the **VNA** drop-down list in the Advanced Settings pop-up window and select the required Analyzer model from the list.

5. If you want to set the serial number of the analyzer, select **Use S/N** checkbox in the Advanced Settings pop-up window. Detected serial number will display in the **S/N** field.

   If you want to set the serial number other than detected, enter the 8-digit serial number of the Analyzer in the **S/N** textbox in the Advanced Settings pop-up window.

6 Click on the **Apply** button in the Advanced Settings pop-up window.

NOTE When the model is selected, priority value is automatically applied to this particular model.



SCPI SYSTem:CONNect:SERial:NUMBer

Setting Priority Analyzer

By default, when setting the Analyzer model and serial number manually or connecting the Analyzer from the list of detected devices, it becomes a priority Analyzer automatically. You can set or remove the priority value of the selected Analyzer manually. If the priority value is removed, the first Analyzer from the list of detected devices will be connected when running the software.

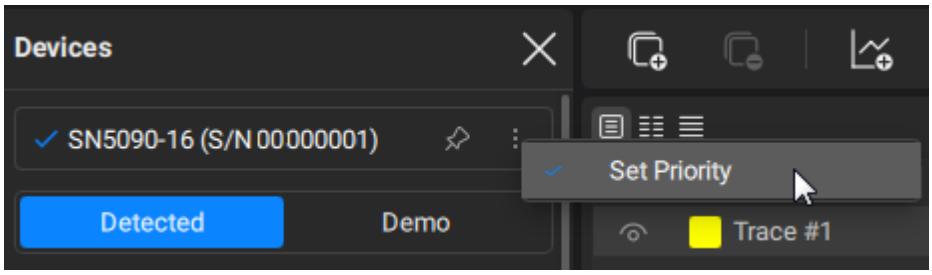
There are two ways to select the priority Analyzer:

- **Advanced Settings** pop-up window allows you to select a specific Analyzer with an indication of the model and serial number.
- **Set priority** function allows you to select the priority Analyzer model from the list of detected devices.

1 Click on the **Devices** button in the main menu.

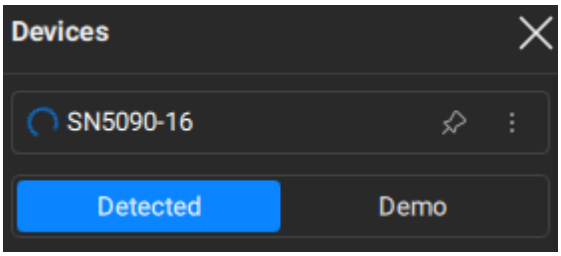
2 Click on the vertical-ellipsis button  at the selected Analyzer textbox, and then click on the **Set Priority** value.

NOTE If the Analyzer is set as priority Analyzer, a pinned icon will be displayed to the right of the model and the serial number.



WARNING

The message **Not Ready** appears in the state status bar if the manually entered Analyzer model or serial number do not match the connected device model and serial number (an icon appears to the left of the selected Analyzer). The Analyzer software goes into standby mode and awaits for the Analyzer of this specific model and serial number. Further operation of the Analyzer is not possible.



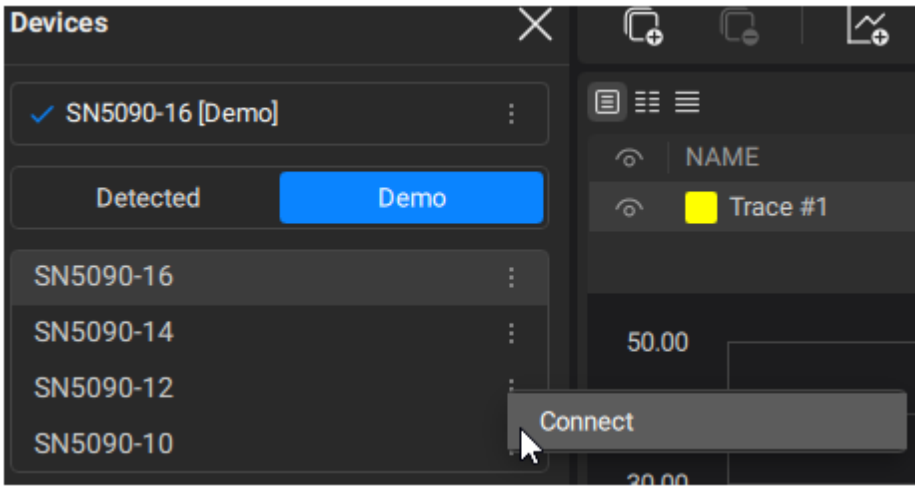
Demo Mode

Demo mode is designed to simulate DUT measurement. The measurement results of the DUT are pre-recorded in the software memory. SN5090 Analyzer models can be selected from the list of supported devices in demo mode (see Analyzer Model).

NOTE The simulation of the Analyzer in demo mode may differ from the real measurements of the analyzer. For example, the accuracy of the sweep time dependence on the IF filter setting is not guaranteed.

Enabling Demo Mode

1. Click on the **Devices** button in the main menu.
2. Clock on the **Demo** button in segment switch in the submenu.
3. Click on the vertical-ellipsis button at the desired Analyzer model in the Devices list and then click on the **Connect** value. The following n-port Analyzer models are available: SN5090-6/8/10/12/14/16.



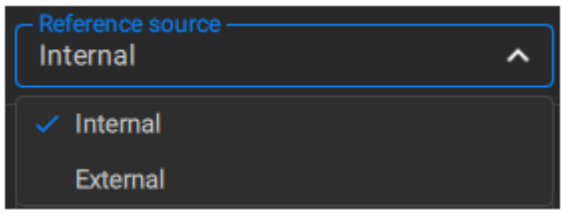
Reference Frequency Oscillator Selection

The Analyzer can operate either with an internal or external reference frequency (10 MHz) oscillator. By default, the Analyzer is set to operate using the internal source of the reference frequency. An external high stability oscillator can be used if more accuracy and frequency stability is required. Connect the external oscillator through the 10MHz Ref In connector on the rear panel (see Rear Panel). Select the source of reference frequency oscillator in the software.

Selecting Reference Frequency Oscillator

1. Click on the **Devices** button in the main menu.

2. Click on the **Reference source** drop-down list in the submenu and select the required reference frequency oscillator between **Internal** and **External**.



Power Meter Settings

The Analyzer can operate with an external power meter. An external power meter has two main functions:

- Power calibration. Using an external power meter to provide reference values for a power calibration ensures that the Analyzer delivers the correct power levels to the DUT, resulting in accurate and reliable measurements of the DUT's characteristics (see Power Calibration).
- Absolute power measurement. An external power meter is used to measure the absolute power level of a signal at a specific frequency and power level, independent of any reference or calibration values (see Absolute Power Measurement with an External Power Meter).

The list of power meters supported by the Analyzer is shown in the table below.

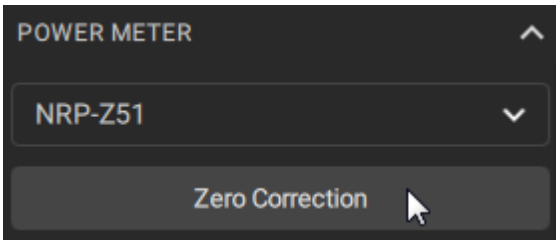
Supported Power Meters

Power Sensor	Designation in the VNA Software	Connection Type	Additional Software
R&S®NRP-Z Power Sensors	NPR-Z21, NPR-Z51	USB	• R&S®NRP-Toolkit for Windows • VXIplug&play x64 or x86 driver rsnrpz

Selecting and Zero Correction Power Meter

1. Connect the power meter to the PC directly via USB port (see figure above). Then, install the power meter software.
2. Click on the **Devices** button in the main menu.
3. Click on the drop-down list in POWER METER accordion in the submenu and select the required power meter.
4. Click on the **Zero Correction** button in POWER METER accordion in the submenu.

   NOTE The power meter sensor can be connected to the port, as during zero setting the output signal of the port is turned off.



SCPI SYSTem:COMMunicate:PSENsor:LIST?

SYSTem:COMMunicate:PSENsor:ZEROing

User Interface Setting

The Analyzer software allows to adjust the following user interface settings:

- Invert color mode between dark and light (see Invert Color Mode).
- The application scaling of all displayed items (see Application Scaling).
- Change Y-axis or X-axis labels (see Y-axis Label or X-axis Label).
- Enable/disable sweep mark (see Sweep Mark).
- Change the number of decimal points of marker data (see Marker Value Indication Capacity).
- Enable/disable date and time on status bar (see System Date and Time).
- Enable/disable cycle time (see Cycle Time).
- Change decimal units of distance (see Decimal Units).

The user interface settings are automatically saved and do not require adjustment every time the analyzer is turned on.

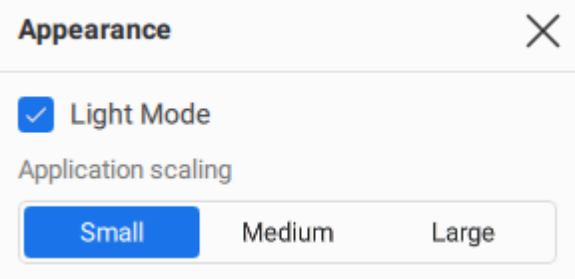
Invert Color Mode

By default, the Analyzer software is in dark color mode. The color mode can be switched to light mode.

Color Mode Inverting

1. Click on the **Appearance** button in the main menu.

2. Select the **Light Mode** checkbox in the submenu.



SCPI DISPlay:IMAGe

Application Scaling

The application scaling of all displayed items can be selected between three standard sizes. The default application scaling for all items is small.

NOTE

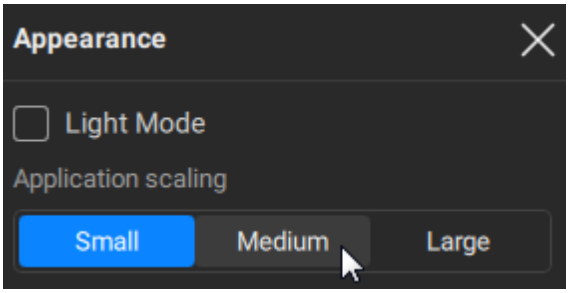
The display scaling change will take effect after software restart. Before changing the application scaling, make sure to save all necessary data or it will be lost. To save data, follow the steps described in State Saving and Data Output.

Application Scaling Setting

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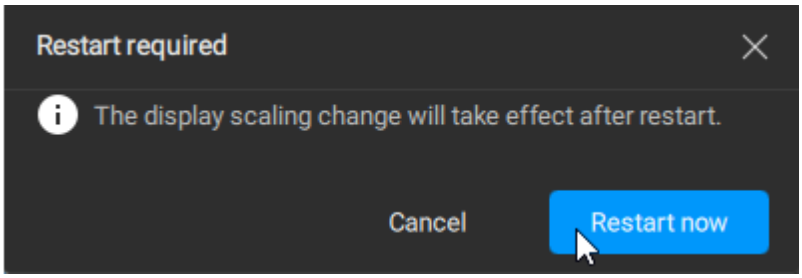
1. Click on the **Appearance** button in the main menu.

2. Click on the **Small | Medium | Large** button in the Application scaling segment switch in the submenu.



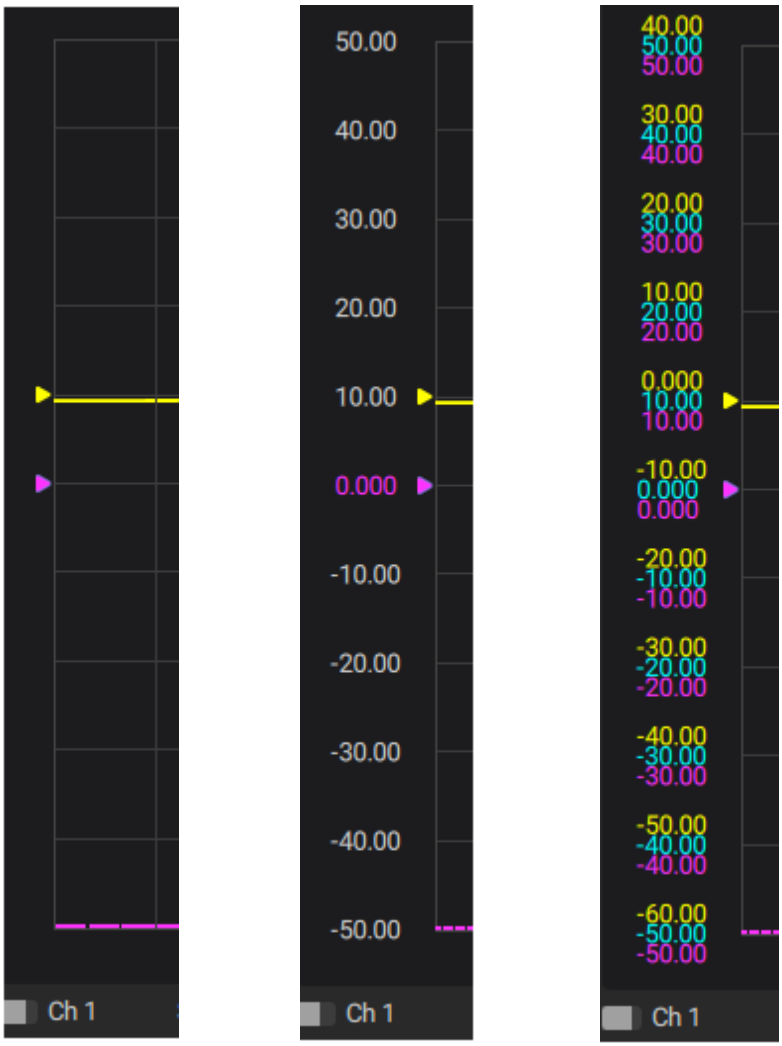
3. Click on the **Restart now** button in the pop-up window.

   WARNING After clicking on the **Restart now** button, the software will restart and all unsaved data will be lost.



Y-axis Label

Y-axis label (vertical graticule label) is located at the left of the diagram in the channel window (see figure below). By default, the vertical axis numeric data for active trace is displayed. The data for all traces can be displayed or hidden to gain more screen space for the trace display (see figure below).



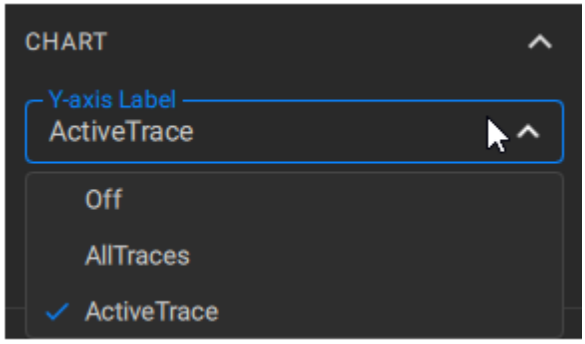
OFF Active Trace All Traces

Setting Vertical Graticule Label

1. Click on the **Appearance** button in the main menu.

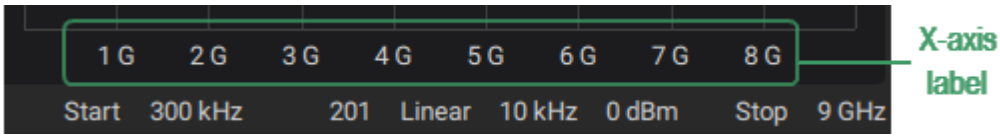
2. Click on the **Y-axis Label** drop-down list in CHART accordion in the submenu and select the required display type of Y-axis label from the list:

   - **OFF**
   - **AllTraces**
   - **ActiveTrace**

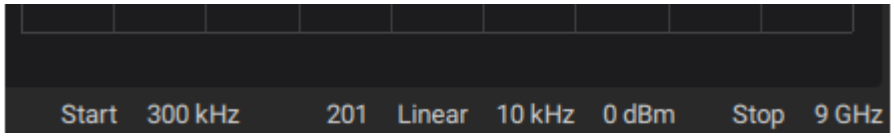


X-axis Label

Y-axis label (horizontal graticule label) is located at the bottom of the diagram in the channel window (see figure below). It displays stimulus axis numeric data (frequency, power level or time). X-axis label can be displayed or hidden.



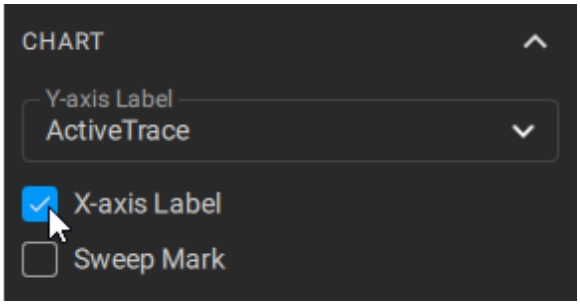
X-axis Label ON



X-axis Label OFF

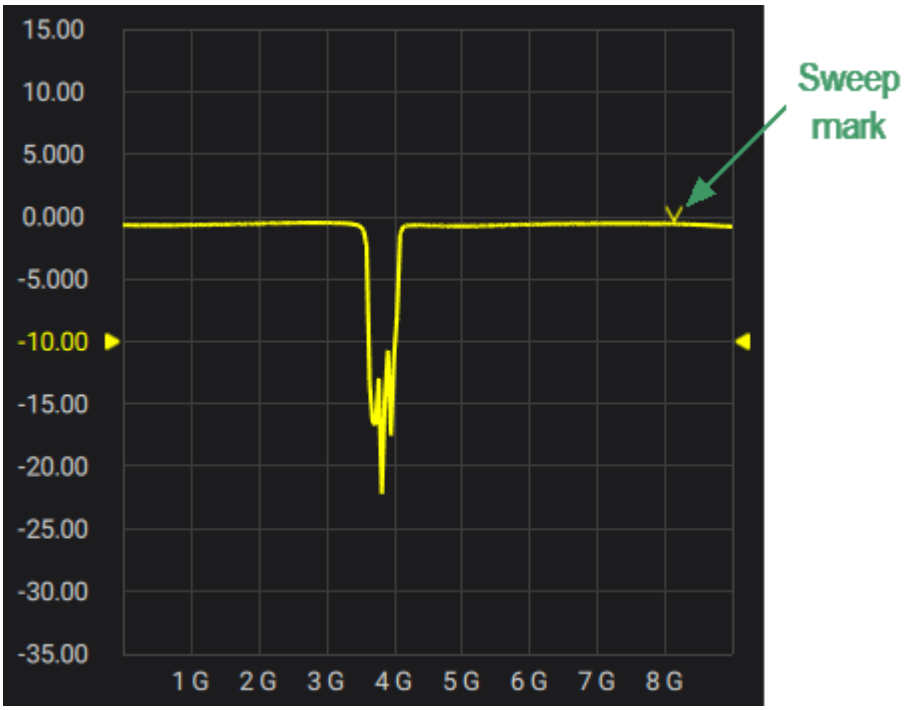
Hiding or Showing X-axis Label

1. Click on the **Appearance** button in the main menu.
2. Select or clear the **X-axis Label** checkbox in CHART accordion in the submenu.



Sweep Mark

The sweep mark is visible during measurement if the measurement cycle time is long, due to a narrow IF filter bandwidth or a large number of measurement points (see figure below). The sweep mark can be displayed or hidden.

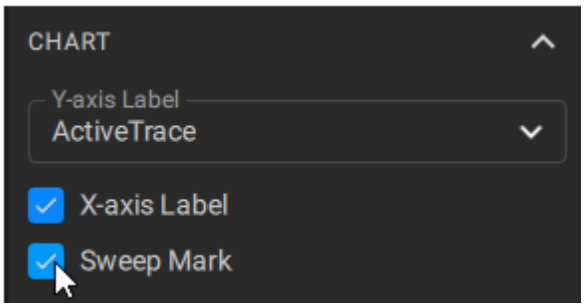


Sweep Mark

Hiding or Showing Sweep Mark

1. Click on the **Appearance** button in the main menu.

2. Select or clear the **Sweep Mark** checkbox in CHART accordion in the submenu.



Marker Value Indication Capacity

By default, value marker data is displayed with the following precision: stimulus — 8 decimal points, measurement — 5 decimal points. These settings can be changed. It is possible to configure the number of decimal points:

- Stimulus — from 5 to 13 decimal points.
- Measurement — from 3 to 8 decimal points.

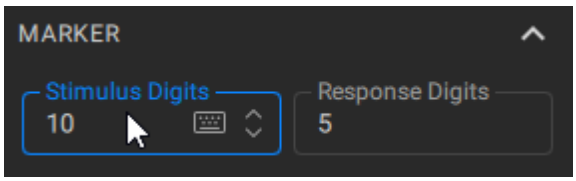
Marker Value Indication Capacity Setting

---

1. Click on the **Appearance** button in the main menu.

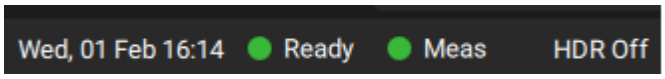
2. Click on the **Stimulus Digits** textboxes in the MARKER accordion and enter the numerical value.

3. Click on the **Response Digits** textboxes in the MARKER accordion and enter the numerical value.

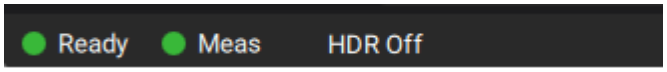


System Date and Time

System date and time display is located in the analyzer status bar. If necessary, date and/or time can be turned OFF.



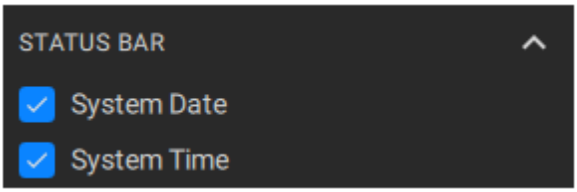
System Date and Time Shown in the Analyzer Status Bar



System Date and Time Hidden in the Analyzer Status Bar

Enabling/Disabling Date and/or Time

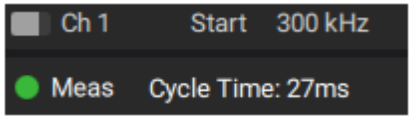
1. Click on the **Appearance** button in the main menu.
2. Select or clear the **System Date** checkbox in the STATUS BAR accordion in the submenu.
3. Select or clear the **System Time** checkbox in the STATUS BAR accordion in the submenu.



Cycle Time

The cycle time is the interval between the start of two adjacent sweeps. By default, the cycle time is displayed in the Analyzer status bar (see Sweep time). It can be disabled if necessary.

The relation between the cycle time function and the sweep time function are shown in this table.

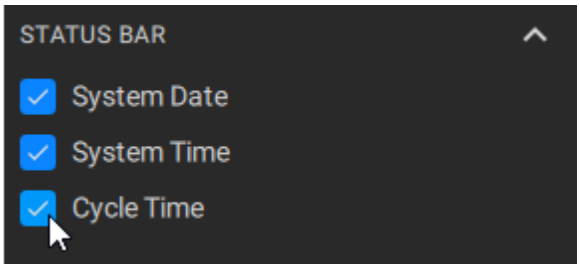


Cycle Time

Enabling/Disabling Cycle Time

1. Click on the **Appearance** button in the main menu.

2. Select or clear the **Cycle Time** checkbox in the STATUS BAR accordion in the submenu.



SCPI SYSTem:CYCLe:TIME:MEASurement?

Decimal Unit

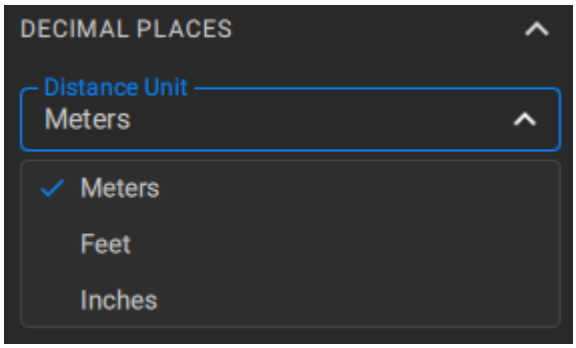
The function allows you to select the units of display and distance setting in the software. You can choose between meters, feet, and inches. By default, the setting is determined by the region on the user's PC.

Decimal Unit Setting

1. Click on the **Appearance** button in the main menu.

2. Click on the **Distance Unit** drop-down list in DECIMAL PLACES accordion in the submenu and select the required units of equivalent distance from the list:

   - **Meters**
   - **Feet**
   - **Inches**



SCPI CALCulate:CORRection:EDELay:DISTance:UNIT

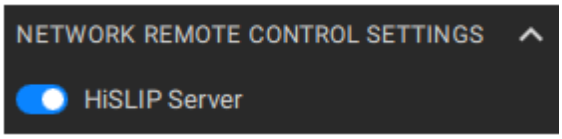
Network Settings

Network settings are used to enable remote control of the Analyzer.

It is possible to enable remote control of the Analyzer via a network using HiSLIP protocol or TCP/IP Socket protocol.

Enabling or Disabling Network Remote Control Using HiSLIP Protocol

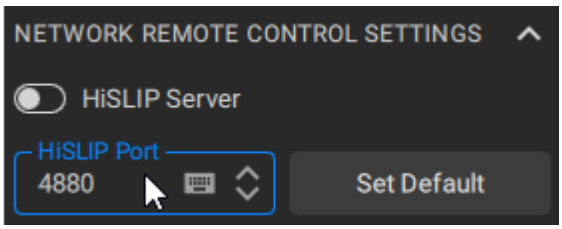
1. Click on the **Settings** button in the main menu.
2. Toggle **HiSLIP Server** ON or OFF in NETWORK REMOTE CONTROL SETTINGS accordion in the submenu.



Setting HiSLIP Port Number

1. Click on the **Settings** button in the main menu.
2. Toggle **HiSLIP Server** OFF in NETWORK REMOTE CONTROL SETTINGS accordion in the submenu.
3. Click on the **HiSLIP Port** textbox in the submenu and enter the numerical value.

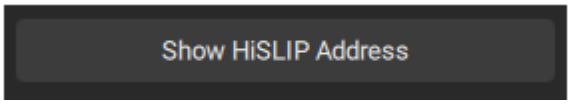
NOTE The HiSLIP port number can be reset to the default value 4880 by clicking on the **Set Default** button in the submenu.



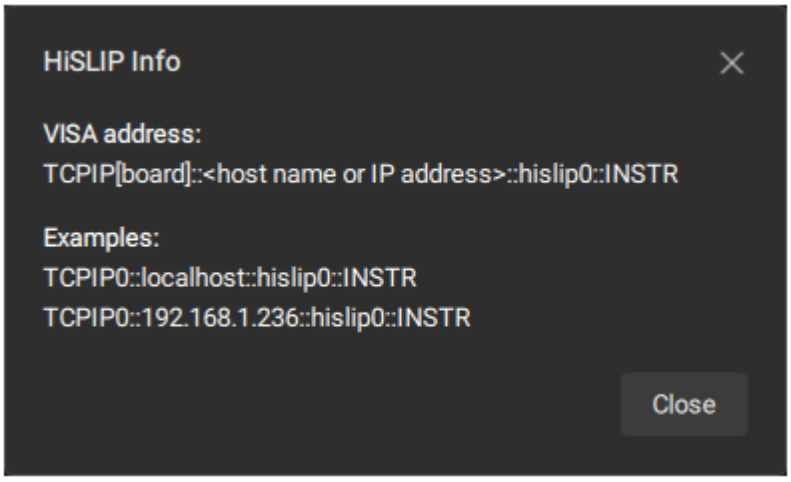
Querying HiSLIP VISA Address

1. Click on the **Settings** button in the main menu.

2. Click on the **Show HiSLIP Address** button in NETWORK REMOTE CONTROL SETTINGS accordion the submenu.



Such a window will be displayed in response:



Enabling or Disabling Network Remote Control Using TCP/IP Protocol

1. Click on the **Settings** button in the main menu.

2. Toggle **Socket Server** ON or OFF in NETWORK REMOTE CONTROL SETTINGS accordion in the submenu.



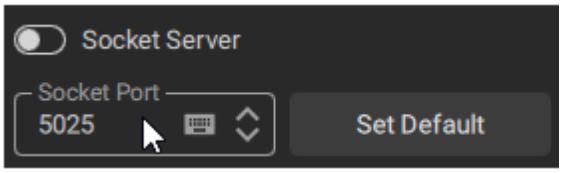
Setting Socket Port Number

1. Click on the **Settings** button in the main menu.

2. Toggle **Socket Server** OFF in NETWORK REMOTE CONTROL SETTINGS accordion in the submenu.

3. Click on the **Socket Port** textbox in the submenu and enter the numerical value.

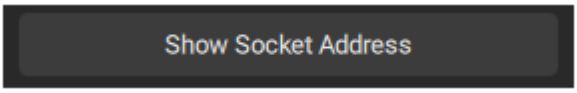
   NOTE The socket port number can be reset to the default value 5025 by clicking on the **Set Default** button in the submenu.



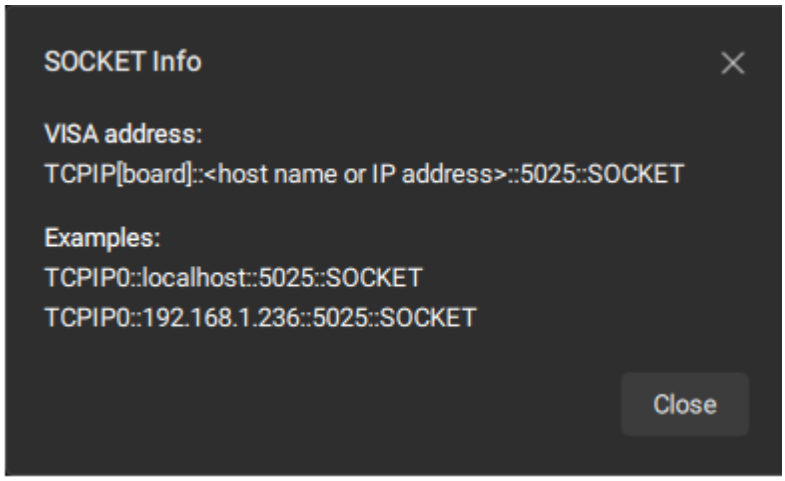
Querying Socket VISA Address

1. Click on the **Settings** button in the main menu.

2. Click on the **Show Socket Address** button in NETWORK REMOTE CONTROL SETTINGS accordion the submenu.



Such a window will be displayed in response:



NOTE

Remote control of the Analyzer is not possible using two interfaces simultaneously. A Socket or network must be selected.

When specifying the port number, make sure that it is not busy performing another process.

For more information about remote control of the Analyzer, see Programming.

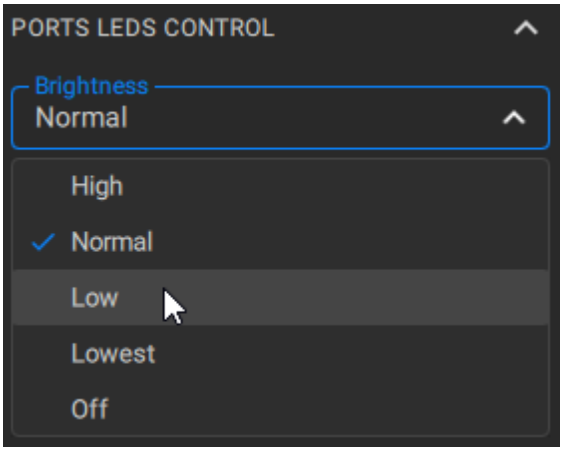
Port LED brightness

The software allows to adjust the brightness of the port LEDs (see Front panel). It is possible to choose from 5 brightness options: high, normal, low, lowest or off. The default LED brightness is set to Normal.

Selecting Port LED brightness

1. Click on the **Settings** button in the main menu.

2. Click on the **Brightness** drop-down list in PORTS LEDS CONTROL accordion in the submenu and select the required brightness from the list.



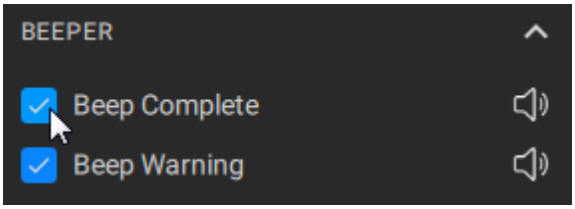
Beeper Settings

The Analyzer features two available beeper settings, which can be toggled on/off independently from each other:

- Operation complete beeper — informs about normal completion of standard measurements during calibration.
- Warning beeper — informs about an error or a fail limit test result.

Enabling or Disabling and Test Operation Complete Beeper

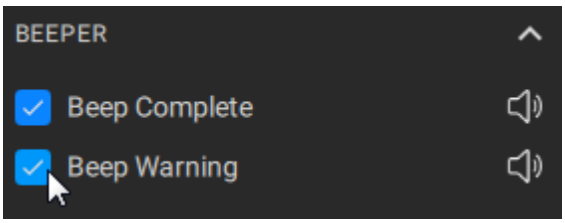
1. Click on the **Setting** button in the main menu.
2. Select or clear the **Beep Complete** checkbox in BEEPER accordion in the submenu.



SCPI SYSTem:BEEPer:COMPlete:STATe

Enabling\Disabling and Test Warning Beeper

1. Click on the **Setting** button in the main menu.
2. Select or clear the **Beep Warning** checkbox in BEEPER accordion in the submenu.



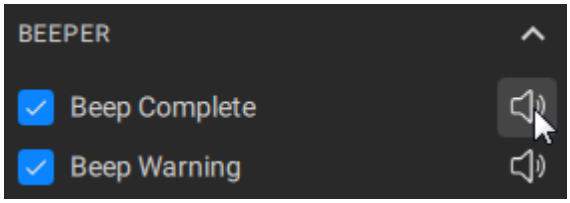
SCPI SYSTem:BEEPer:WARNing:STATe

Test Beeper

1. Click on the **Setting** button in the main menu.

2. Click on  icon to the right of the **Beep Complete** or **Beep Warning** checkboxes in BEEPER accordion in the submenu.

   NOTE A beep should sound.

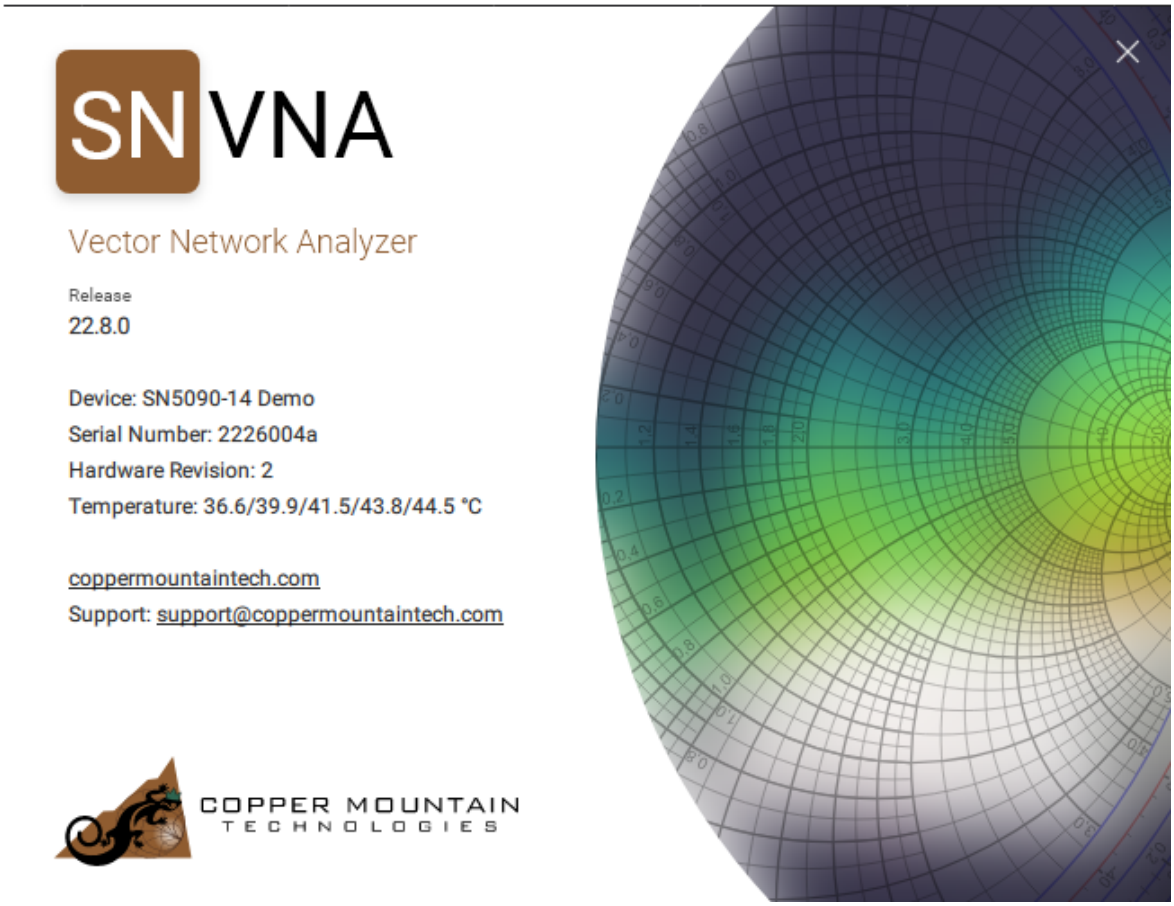


SCPI SYSTem:BEEPer:COMPlete:IMMediate, SYSTem:BEEPer:WARNing:IMMediate

About

The Analyzer model name, serial number, software and hardware versions, the temperature can be found in the **About** button in the Quick Access Toolbar (see figure below).

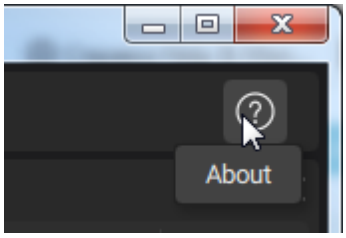
NOTE The **About** button appears in Full Screen Mode or when the submenu is collapsed or the Analyzer window is extended.



About

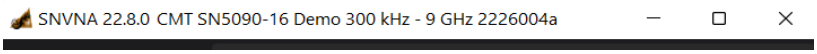
Requesting Information

1. Click on the **About** button in the Quick Access Toolbar.



NOTE

The About information is also shown at the top line of the Analyzer software.



Programming

This section describes programming of the Analyzer using SCPI commands.

SCPI (Standard Commands for Programmable Instruments) defines a standard for syntax and commands to use in controlling programmable instruments. SCPI commands are ASCII textual strings that are sent to the analyzer program over the LAN physical layer using the HiSLIP or TCP/IP Socket network protocol. These protocols can also be used within a single PC when using the IP address 127.0.0.1 or *localhost*.

HiSLIP (High-Speed LAN Instrument Protocol) is a network protocol intended for remote control of measuring and testing equipment and is based on the TCP/IP network protocol. HiSLIP is developed by the consortium IVI Foundation as the successor to GPIB and VXI-11 protocols. The user program relies on the implementation of the HiSLIP protocol in the VISA library.

TCP/IP Socket is a general-purpose network protocol. The user program can connect to the Analyzer using the TCP/IP Socket protocol both directly and through the VISA library.

VISA (Virtual Instrument Software Architecture) library is a widely used software input-output interface for measuring and testing equipment. It is a library of functions for C/C++, C#, Visual Basic, MATLAB, LabVIEW and others. The VISA library unifies access to all measuring instruments, regardless of the protocol and physical layer used. The VISA library is available on the websites of many companies for free download. There are versions of VISA library for Windows, Linux, Mac OS.

References

Standard Commands for Programmable Instruments (SCPI), High-Speed LAN Instrument Protocol (HiSLIP), and VISA specifications,
http://www.ivifoundation.org/specifications

Connection Setup

To enable remote control of the Analyzer, turn on the HiSLIP server and/or Socket server in the settings of the analyzer's program. The default TCP/IP port number of each protocol can be changed optionally.

HiSLIP is a TCP/IP-based protocol specially designed for measuring and test equipment. TCP/IP Socket is a general-purpose protocol.

Typically, the user program (client) uses VISA library to establish the connection. When using the VISA library, the client selects the protocol by specifying it in the VISA address of the Analyzer.

The VISA library hides the details of protocol implementation from the client and provides a uniform I/O interface. Nevertheless, there are some minor differences in programming methods when using the HiSLIP and TCP/IP Socket protocols, which are described later in Differences in Use of HiSLIP and Socket Protocols.

After a connection has been established by the client, the latter can send SCPI commands and read the results of the measurements. The command set is the same for both protocols and is described in Command Reference.

The client must specify the Analyzer's PC IP address or network name in the VISA address string. The Analyzer and user programs can be run on the same PC. In this case, the client specifies the IP address as 127.0.0.1 or *localhost*.

Multiple analyzer programs can be executed on the same PC (when several USB blocks are connected). In this case, the user must specify a unique TCP/IP port number in the settings of each analyzer program.

One analyzer program does not limit the number of simultaneously connected clients. Clients themselves are responsible for the absence of conflicts in the remote control of the Analyzer. The HiSLIP protocol supports the exclusive or shared lock of the Analyzer by the client. For more details about locks, see the VISA manual.

Analyzer Setting

For remote access to the Analyzer, make the following settings in its program:

- Enable HiSLIP server and/or Socket server.
- Configure the TCP/IP port number (optional).

For more details about remote access settings, see the Network Settings.

NOTE Configuring the TCP/IP port number is necessary only where several analyzer programs are simultaneously executed on the same PC, and these programs require remote control. In other cases, leave the default TCP/IP port number: for the HiSLIP server — 4880, and for the Socket server — 5025.

Client Setting

Typically, the client uses the VISA library to establish connection to Analyzer software. The easiest way to configure the network connection with the Analyzer is using a special utility from VISA package (for example, NI-MAX, Keysight Connection Expert).

Following the manual for the above utilities, add a new network device — specifying the network name or IP address of the Analyzer's PC — and the protocol. Once successfully connected to the Analyzer, the VISA address of the Analyzer will be automatically generated and displayed. Use this VISA address in the client program in order to open the connection.

The format of the VISA address for the HiSLIP and Socket protocols

HiSLIP	TCPIP[board]::*host address*[::*HiSLIP device name[,HiSLIP port*]][::INSTR]
Socket	TCPIP[board]::*host address*::*port*::SOCKET

Examples of VISA address for HiSLIP and Socket protocols

HiSLIP	TCPIP0::192.168.0.1::hislip0::INSTR TCPIP0::localhost::hislip0::INSTR
Socket	TCPIP0::192.168.0.1::5025::SOCKET TCPIP0::localhost::5025::SOCKET

If the client is a user program that does not use the VISA library, then the only available protocol is the TCP/IP Socket protocol. In this case, the user program establishes a connection using the IP address of the Analyzer's Socket server.

The format of the IP address of the analyzer's Socket server

Socket	*host address:port*

Examples of the IP address of the analyzer's Socket serve

Socket	192.168.0.1:5025 localhost:5025

VISA Library

Using the VISA (Virtual Instrument Software Architecture) library is the most common approach. The VISA library is a widely used software input-output interface in the field of testing and measurement for controlling devices from a PC. It is a library of functions for C/C ++, C #, Visual Basic, MATLAB, LabVIEW and others.

The VISA Library unifies access to all measuring instruments, regardless of the protocol and equipment used.

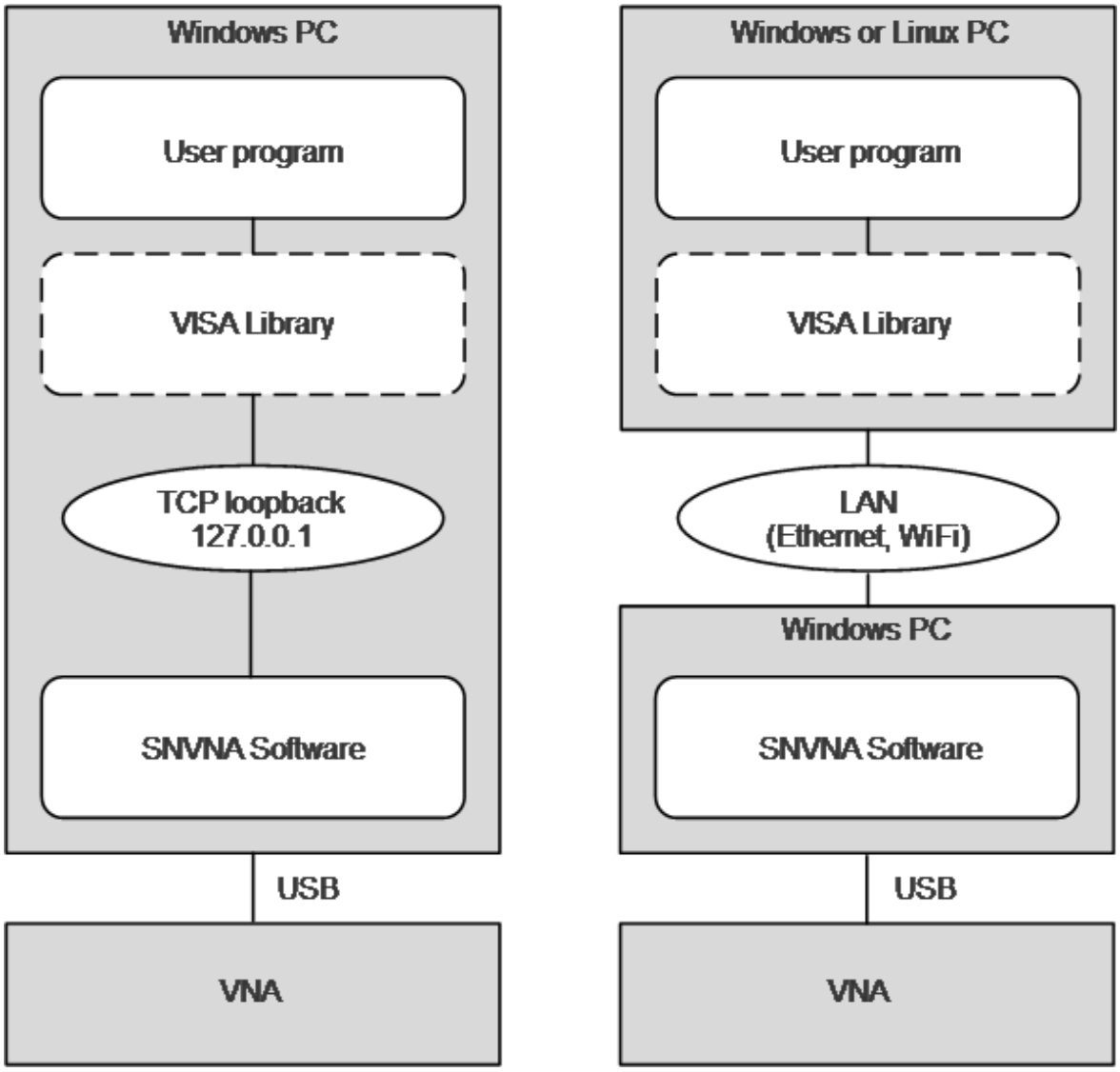
The VISA library is installed on the client side, on the PC where the user program is executed. The VISA library is available on the websites of many companies for free download. There are versions for Linux, Mac OS, Windows.

Network and Local Configuration

A network configuration involves executing a user program and the Analyzer program on different PCs connected by a local area network.

The local configuration involves executing the user program and the Analyzer program on the single PC.

The figure below shows the local configuration on the left and the network configuration on the right.



Network and Local Configuration

Local configuration is possible due to the standard TCP/IP stack function — TCP loopback. The TCP loopback function allows network applications to communicate in a standard way within a single PC. The most widely used IP address in the TCP

loopback mechanism is 127.0.0.1. It is also possible to use the symbolic name *localhost i*nstead of the numeric address 127.0.0.1.

NOTE The network configuration does not restrict the client in choice of OS. The local configuration limits the client in choice of OS — only Windows.

Differences in Use of HiSLIP and Socket Protocols

The section describes the differences in the methods of writing user programs due to the use of different HiSLIP and TCP/IP Socket protocols. It is assumed that the user program works through the VISA library.

The brief list of differences is given below:

1. The terminal character <newline> in the commands sent to the Analyzer.
2. The terminal character <newline> in the analyzer's responses.
3. Determine the interrupted violation of the message exchange protocol of IEEE488.2.
4. Support for the IEEE488.2 *Status Reporting System*.
5. Support the transfer of binary data.

Then, a detailed description of each item is given.

Terminal Character in Messages to Analyzer

The user program sends variable-length text messages to the Analyzer. The end of the message, according to IEEE488.2, is terminated either by protocol means (not by a symbol), or by the symbol <*newline*> ('\n', 0x0A, 10), or both methods together.

The HiSLIP has a mechanism for transmitting the end of the message by protocol means, while the Socket protocol does not. This creates the following requirements for programs sending commands to analyzer:

- Programs using the Socket protocol **shall** send a <*newline*> character at the end of the message.
- Programs using the HiSLIP protocol **may** send the <*newline*> symbol at the end of the message.

NOTE *For the graphical language LabVIEW when using the Socket protocol* to be able to enter the symbol <*newline*> at the end of the message, right-click on the string constant and enable **'\' Codes Display**. The <*newline*> character is entered as **'\n'**.

NOTE *For the textual languages* it is recommended to use to the symbol <*newline*> at the end of the message regardless of the protocol used.

Terminal Character in Analyzer Responses

When using the HiSLIP protocol, the analyzer terminates messages with the symbol <newline> + the protocol defined end of message (not symbolic).

When using the Socket protocol, the analyzer terminates messages only with the <newline> symbol, since the Socket protocol does not have the protocol defined end of message.

Depending on the protocol used, the following settings for the VISA library should be made so that it correctly determines the end of the message from the analyzer:

- When using the HiSLIP protocol — no settings are required, the VISA library functions normally with default settings.
- When using the Socket protocol, the user program must set the attribute VI_ATTR_TERMCHAR_EN to TRUE (completion of the read operation when the <newline> character is received).

Examples of setting up the VISA library using the Socket protocol

C/C++	viSetAttribute(instr, VI_ATTR_TERMCHAR_EN, VI_TRUE);
LabVIEW	

Interrupted Error

The HiSLIP protocol meets the requirements of the IEEE Std 488.2 message exchange protocol to detect an interrupted error. The interrupted error indicates that the Analyzer received an incoming message (command or query) before the client accepted a response from the previous request. In other words, the client is required to read the result of each query before sending the next query or command. If the client fails to do so, the protocol generates an error message and the response from the previous query is cleared by the protocol.

The Socket protocol does not detect the interrupted error. Multiple queries can be sent to the analyzer without a read operation between them. Answers from queries will be returned in the order in which they were sent. The client determines from which request a specific answer has been received.

IEEE488.2 Status Reporting System

The HiSLIP protocol fully supports the analyzer's IEEE488.2 Status Reporting System described in the appendix, while the Socket protocol supports it only partially. The Socket protocol does not support the following functions:

- The MAV (message available) bit in the Status Byte.
- SRQ (service request) generation — request from the Analyzer, implemented by callback functions in the VISA library.
- Read the Status Byte using the dedicated function — viReadSTB.

Transfer of Binary Data

By default, data from the Analyzer is sent in text form. To increase the speed of the data exchange, the user has the option to enable binary data transfer. The transfer of binary data is enabled by the FORMat:DATA command and is effective for commands that transfer large data amounts. A list of such commands is given in the description of the FORMat:DATA command.

The HiSLIP protocol supports VISA formatted input of the binary data, since it provides the protocol defined end of message (not symbolic).

The Socket protocol does not always support VISA formatted input of the binary data (depends on VISA realization), since it uses the <*newline*> byte as the end of the message, which can occur in binary data.

SCPI Overview

The Analyzer implements a set of commands based on the standard SCPI-1999 (Standard Commands for Programmable Instruments). This is a set of instructions for the exchange of textual messages.

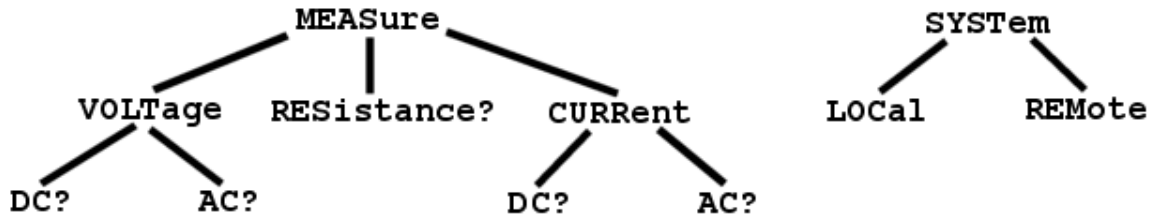
SCPI was developed by the SCPI Consortium (currently supported by the IVI Foundation). The main details of the SCPI standard are described further on. More information about the SCPI standard can be downloaded from the IVI Foundation website.

Messages

The SCPI is a text message-oriented protocol. The commands are sent as character messages. One message can contain one or several commands. The answer from the instrument is read out as a text message by default. Optionally, an instrument can be programmed to output binary data.

Command Tree

The SCPI commands are organized in a tree structure. For example:



Each tree structure forms a functional system. The base of the tree is called the root, e.g. MEASure and SYSTem. Each functional system can have subsystems of lower level. The final nodes are called leaves. The entire sequence from root to leaf makes up the command. For example, part of the SOURCe functional system looks as follows:

```
:SOURce
        :POWer
                :CENTer
                        :STARt
                        :SPAN
                        :STOP
                        [:LEVel]
                                :SLOPe
                                [:DATA]
                                        :STATe
```

This SOURce branch has several levels, where CENTer, STARt, SPAN, STOP, DATA, STATe are the leaves, which represent the following six commands:

```
:SOURce:POWer:CENTer
:SOURce:POWer:STARt
:SOURce:POWer:SPAN
:SOURce:POWer:STOP
:SOURce:POWer[:LEVel]:SLOPe[:DATA]
:SOURce:POWer[:LEVel]:SLOPe:STATe
```

The tree can contain subsystems and leaves with the same names if they belong to different branches, e.g. CENTer leaf is on the tips of different branches:

:SOURce :SENSe

:POWer :FREQuency

:CENTer :CENTer

Subsystems

A colon (':') separates the subsystems. The subsystems which follow the colon are on a lower level. For example, in command:

:SOURce:POWer:STARt

the start power STARt is a part of the POWer subsystem, which is a part of the SOURce subsystem. The stop power is also a part of the :SOURce:POWer subsystem. It is specified by:

:SOURce:POWer:STOP

The first colon in the line can be omitted, for example:

SOURce:POWer:STOP

Optional Subsystems

Some subsystems can be specified as optional, if omission of such a subsystem will not lead to ambiguity. This means that the subsystem can be omitted in the command line. The optional subsystems are bracketed ("[]"). For example, if the full command specification is written as:

SOURce:POWer[:LEVel]:SLOPe[:DATA]

subsystems LEVel and DATA are optional. Therefore, both commands are valid:

SOURce:POWer:LEVel:SLOPe:DATA

SOURce:POWer:SLOPe

Long and Short Formats

Each keyword in a command specification has a long format and a short format. The short format of a command is indicated by capital letters. For example, a command specification:

SENSe:FREQuency:CENTer

can be written as:

SENS:FREQ:CENT

SENS:FREQ:CENTer

Only one form can be used at a time, as combining forms will be incorrect. For example, the following specification is incorrect:

:SENS:FREQuen:CEN

Case Sensitivity

The commands are not case sensitive. Upper case and lower case letters are only used to indicate the long and short formats of a command specification. For example, the following commands are equivalent:

SENS:FREQ:STAR

sens:freq:star

Parameters

The commands can have parameters. The parameters are separated from the command by a space. If a command has several parameters, they are separated by commas (',').

Numeric Values

The numeric values are integers or real numbers. These parameters can have measurement units. For example:

SENS:FREQ 1000000000

SENS:FREQ 1000 MHz

SENS:FREQ 1 GHz

SENS:FREQ 1E9

Multiplier Prefixes

The SCPI standard allows specification of the numeric values with multiplier prefix to the measurement units.

Prefix	Multiplier
A	1e-18
F	1e-15
P	1e-12
N	1e-9
U	1e-6
M	1e-3
K	1e3
MA	1e6
G	1e9
T	1e12
PE	1e15
EX	1e18

There are two exceptions to the above designation: prefix M in combination with HZ or OHM means 1e6 (Mega), and not 1e–3 (milli), i.e. MHZ means Megahertz, same as MAHZ.

Notations

The SCPI standard allows numeric value specification in different notations. Decimal notation is used by default. To use other notations, specify the numeric values in the following way:

Notation	Prefix	Example
Binary	**#B**	#B11001010 = 202_{10}
Octal	**#Q**	#Q107 = 71_{10}
Hexadecimal	**#H**	#H10FF = 4351_{10}

Booleans

The Booleans can assume two values: logical yes and logical no (ON and OFF), and are specified in command as:

ON or 1 — logical yes

OFF or 0 — logical no

For example:

DISPlay:ENABle OFF

DISPlay:ENABle 0

Character Data

The SCPI standard allows specification of parameters as character data, as in the following command:

TRIGger:SOURce {BUS|IMMediate|EXTernal}

where "BUS", "IMMediate", "EXTernal" is the possible values of the character data.

The character data has a long and short format, and the formats are specified in accordance with the same rules as described in Long and Short Formats.

Apart from that, the character data can be combined with numerical parameters. For example:

SENSe:FREQuency:STARt {MINimum|MAXimum|<value>}

The following specifications are acceptable:

SENSe:FREQuency:STARt MIN

SENSe:FREQuency:STARt maximum

SENSe:FREQuency:STARt 1000000

String Parameters

In some cases, the Analyzer can accept parameters made of character strings. Such strings are enclosed with single quotes (') or double quotes ("). For example, the file name in the state saving command:

```
MMEMory:STORe "state01.sta"
```

Numeric Lists

The numeric lists (<numeric list>) are used to specify a variable number of numerical parameters, for example:

CALC:LIMit:DATA 2,1,1E9,3E9,0,0,2,1E9,3E9,–3,–3

Query Commands

The query commands read out the parameter values from the Analyzer. After a query command has been sent, the response should return via remote control interface.

The query commands have a question mark ('?') at the end of the command. Many of the commands have two forms. The form with a question mark writes the parameter, the form without a question mark reads out the parameter. For example:

SENSe:FREQuency:STARt 1MHz

SENSe:FREQuency:STARt?

Numeric Suffixes

The Analyzer contains several items of the same type, such as 16 channels, each of which in turn contains 16 traces, etc. A numeric suffix is used to denote the item number in a command. The suffix is added to the keyword of the item (channel, trace, etc.). For example, in the following specification the channel number <Ch> and trace number <Tr> indicate the channel and trace, to which this command is addressed:

CALCulate<Ch>:PARameter<Tr>:DEFine

According to this specification, the command referred to the trace 2 of the channel 1 will be written as follows:

CALC1:PAR2:DEF

The numeric suffix can be omitted. In this case, it is 1 by default. For example, the following commands are equivalent:

CALC:PAR:DEF

CALC1:PAR1:DEF

Compound Commands

It is possible to enter more than one command in the same command line. The commands in the line are separated by a semicolon (';'). The specification of the first command is valid for the following command, except for the last leaf before the semicolon. For example:

SENS:FREQ:STAR 1 MHZ;STOP 2MHZ

To start the next command from the highest level of the structure, begin the command using a colon (':'):

SENS:FREQ:STAR 1 MHZ;:CALC:PAR:DEF S21

IEEE488.2 Common Commands Overview

A SCPI compatible Analyzer must support a set of common commands of the IEEE488.2 standard. These commands start with an asterisk ('*'). The list of such commands can be seen below:

*IDN?*OPC?

*RST

*TRG

*TST?

*WAI

These commands are used for resetting, state queries, etc.

For additional information of functions see IEEE488.2 Common Commands.

Command Reference

Conventions

The following conventions are used throughout this section.

Syntax

The following symbols are used in command syntax:

<>	Identifiers enclosed in angular brackets indicate that a particular type of data must be specified.
[]	Parts enclosed in square brackets can be omitted.
{}	Parts enclosed in curly brackets indicate that you must select one of the items in this part. Individual items are separated by a vertical bar "|".
Space	Space separates commands from parameters.
,	Comma separates adjacent parameters.
…	Ellipses indicate that parameters in that part are omitted.

Identifiers

Identifier	Parameter	Description
<numeric>	Number	{<integer>|<real>}
<frequency>	Frequency	<numeric>{[HZ]|KHZ|MHZ|GHZ}
<power>	Power	<numeric>{[DBM]|DBMW|DBW|KW|W|MW|UW|NW}
<time>	Time	<numeric>{[S]|MS|US|NS|PS|FS}
<phase>	Phase	<numeric>{[DEG]|MADEG|KDEG|MDEG|UDEG}
<stimulus>	Stimulus	{<frequency>|<power>|<time>}

Identifier	Parameter	Description
<numeric list>	Numeric List	<numeric 1>,<numeric 2>,...<numeric N>
<bool>	Boolean parameter	{0|1|ON|OFF}
<char>	Character parameter	Predefined set of character strings without quotes
<port>	Port Number	<integer>
<string>	String parameter	Quoted string

IEEE488.2 Common Commands

The set of common commands of IEEE488.2 standard. These commands start with an asterix ("*").

Command	Description	
*IDN?		Identify
*OPC?		Operation complete query
*RST		Reset
*TRG		Trigger signal
*TST?		Result of self-test query
*WAI		Wait

*IDN?

SCPI Command

*IDN?

Description

Reads out the Analyzer identification string.
query only

Target

Analyzer

Query Response

The identification string in format: <manufacturer>, <model>, <serial number>, <software version>/<hardware version>.

For example: COPPER MOUNTAIN TECHNOLOGIES, SN0916, 36bf004a, 24.8.0-123-d588829

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to IEEE488.2 Common Commands

*OPC?

SCPI Command

*OPC?

Description

Reads out the "1" at the completion of all pending operations. The query blocks the execution of the user program until execution of all previous instructions.

The query *OPC? can be used for waiting for the end of a sweep initiated by the command TRIG:SING.

query only

Target

Analyzer

Query Response

1

Related Commands

TRIG:SING

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to IEEE488.2 Common Commands

*RST

SCPI Command

*RST

Description

Restores the default settings of the Analyzer.

There is difference from presetting the Analyzer with SYST:PRES command – in this case all channels are set to Hold.

command only

Target

Analyzer

Related Commands

SYST:PRES

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to IEEE488.2 Common Commands

*TRG

SCPI Command

*TRG

Description

Generates a trigger signal and initiates a sweep under the following conditions.

1. Trigger source is set to the BUS (set by the command TRIG:SOUR BUS), otherwise an error occurs and the command is ignored.
2. Analyzer must be in the trigger waiting state, otherwise (the analyzer is in the measurement state or hold state) an error occurs, and the command is ignored.

The command is completed immediately after the generation of the trigger signal.

command only

Target

Analyzer

Related Commands

TRIG:SOUR

INIT

INIT:CONT

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to IEEE488.2 Common Commands

*TST?

SCPI Command

*TST?

Description

Reads out the analyzer self-test result. 0 indicates no failures found. A non-zero value indicates one or more of failure conditions exist. The SYST:TEST? query returns a textual description of the failures.

Note the query returns a non-zero value when it is issued until the instrument is ready.

query only

Target

Instrument

Query Response

<numeric>

Related Commands

SYST:TEST?

SYST:READy?

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to IEEE488.2 Common Commands

*WAI

SCPI Command

*WAI

Description

Waits till the completion of all pending commands. The only command that can be pending is the TRIG:SING command.

In absence of a pending command TRIG:SING the command *WAI is equivalent to an empty operation.

A query that follows the command *WAI blocks the execution of the user program till the completion of the command TRIG:SING, similarly to the query *OPC?.

command only

Target

Analyzer

Related Commands

TRIG:SING

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to IEEE488.2 Common Commands

ABOR

SCPI Command

ABORt

Description

Aborts the sweep. The channels in the Single trigger initiation mode transfer to the Hold state. The channels in the Continuous trigger initiation mode transfer to the trigger waiting state. If the trigger source is set to Internal, the channel immediately starts a new sweep.

command only

Related Commands

INIT:CONT

Related Section of Operating Manual

Channel Initiation Mode

Related Controls of User Interface

Trigger > Restart

CALCulate

Command	Description	
CALC:CONV	S-parameter Conversion	Conversion ON/OFF
CALC:CONV:FUNC		Conversion type
CALC:CORR:EDEL:DIST	Electrical Delay	Equivalent distance
CALL:CORR:EDEL:DIST:UNIT		Distance units
CALC:CORR:EDEL:MED		Media
CALC:CORR:EDEL:RVEL		Velocity factor
CALC:CORR:EDEL:TIME		Electrical delay
CALC:CORR:EDEL:WAV:CUT		Waveguide cutoff frequency
CALC:CORR:OFFS:PHAS	Phase Offset	Value of the phase offset
CALC:CORR:STAT?	Misc Calibration Commands	Interpolation/extrapolation status of the error correction
CALC:DATA:FDAT	Data Transfer	Formatted data array
CALC:DATA:FMEM		Formatted memory array

Command	Description	
CALC:DATA:SDAT		Corrected data array
CALC:DATA:SMEM		Corrected memory array
CALC:DATA:XAX?		X-axis values array
CALC:FILT:TIME	Gating	Gate type
CALC:FILT:TIME:CENT		Gate center
CALC:FILT:TIME:SHAP		Gate shape
CALC:FILT:TIME:SPAN		Gate span
CALC:FILT:TIME:STAR		Gate start
CALC:FILT:TIME:STAT		Gating function ON/OFF
CALC:FILT:TIME:STOP		Gate stop
CALC:FORM	Channel and Trace Settings	Trace format
CALC:PAR:COUN		Number of traces in the channel
CALC:PAR:SEL		Active trace number (write)

Command	Description	
CALC:FSIM:BAL:CZC:BPOR:Z0	Balanced Port Impedance Conversion	Common Z value
CALC:FSIM:BAL:CZC:STAT		Common Z conversion ON/OFF
CALC:FSIM:BAL:DZC:BPOR:Z0		Differential Z value
CALC:FSIM:BAL:DZC:STAT		Differential Z conversion ON/OFF
CALC:FSIM:BAL:DMC:BPOR:PAR:C	Differential Matching	Capacitance of C element
CALC:FSIM:BAL:DMC:BPOR:PAR:G		Conductance of G element
CALC:FSIM:BAL:DMC:BPOR:PAR:L		Inductance of L element
CALC:FSIM:BAL:DMC:BPOR:PAR:R		Resistance of R element
CALC:FSIM:BAL:DMC:BPOR:TYPE		Type of the differential matching circuit
CALC:FSIM:BAL:DMC:BPOR:USER:FIL		Name of *.S2P touchstone file
CALC:FSIM:BAL:DMC:STAT		Differential matching ON/OFF
CALC:FSIM:BAL:DEV	Balance-Unbalance Convercion	Type of balanced device
CALC:FSIM:BAL:PAR:BAL		Parameter for BALanced device

Command	Description	
CALC:FSIM:BAL:PAR:BBAL		Parameter for BBALanced device
CALC:FSIM:BAL:PAR:SBAL		Parameter for SBALance device
CALC:FSIM:BAL:PAR:SSB		Parameter for SSBalance device
CALC:FSIM:BAL:PAR:STAT		Balance-Unbalance ON/OFF
CALC:FSIM:BAL:TOP:BAL		Assigned ports for "BALance" type
CALC:FSIM:BAL:TOP:BBAL		Assigned ports for "BBALance" type
CALC:FSIM:BAL:TOP:SBAL		Assigned ports for "SBALance" type
CALC:FSIM:BAL:TOP:SSB		Assigned ports for "SSBalance" type
CALC:FSIM:EMB:NETW:FIL	Four-port Network Embedding/ De-embedding	Name of *.S4P Touchstone file
CALC:FSIM:EMB:NETW:TYPE		Processing type
CALC:FSIM:EMB:STAT		Embedding/De-embedding ON/OFF
CALC:FSIM:EMB:TOP:A:PORT		Test port assignment (Topology=A)
CALC:FSIM:EMB:TOP:B:PORT		Test port assignment (Topology=B)

Command	Description	
CALC:FSIM:EMB:TOP:C:PORT		Test port assignment (Topology=C)
CALC:FSIM:EMB:TYPE		Topology (A|B|C)
CALC:FSIM:EMB:ADD		Adds a new topology configuration
CALC:FSIM:EMB:DEL		Delete topology configuration
CALC:FSIM:EMB:LIST?		Reads out the list of topology configurations
CALC:FSIM:SEND:DEEM:STAT	Two-port Network De-embedding	De-embedding ON/OFF
CALC:FSIM:SEND:DEEM:PORT:STAT		De-embedding for specified port ON/OFF
CALC:FSIM:SEND:DEEM:PORT:USER:FIL		Name of *.S2P touchstone file of the de-embedded circuit
CALC:FSIM:SEND:PMC:STAT	Two-port Network Embedding	Embedding ON/OFF
CALC:FSIM:SEND:PMC:PORT:STAT		Embedding for specified port ON/OFF
CALC:FSIM:SEND:PMC:PORT:USER:FIL		Name of *.S2P Touchstone file of the embedded circuit

Command	Description	
CALC:FSIM:SEND:ZCON:PORT:Z0	Port Impedance Conversion	Z0 Real part, Imaginary part is "0"
CALC:FSIM:SEND:ZCON:PORT:Z0:REAL		Z0 Real part
CALC:FSIM:SEND:ZCON:PORT:Z0:IMAG		Z0 Imaginary part
CALC:FSIM:SEND:ZCON:STAT		Port Z conversion ON/OFF
CALC:FSIM:SEND:ZCON:THE		Theory of Port Z Conversion
CALC:FUNC:DATA?	Trace Analysis	Analysis result data array
CALC:FUNC:DOM		Arbitrary sweep range ON/OFF
CALC:FUNC:DOM:COUP		Coupling range ON/OFF
CALC:FUNC:DOM:STAR		Analysis range start
CALC:FUNC:DOM:STOP		Analysis range stop
CALC:FUNC:EXEC		Execute analysis
CALC:FUNC:PEXC		Lower limit for the peak excursion value
CALC:FUNC:POIN?		Number of points (data pairs)

Command	Description	
CALC:FUNC:PPOL		Peak polarity
CALC:FUNC:TARG		Target level
CALC:FUNC:TTR		Transition type
CALC:FUNC:TYPE		Analysis type
CALC:HOLD:TYPE	Trace Hold	Trace hold type
CALC:HOLD:CLE		Trace hold restart
CALC:LIM	Limit Test	Limit test ON/OFF
CALC:LIM:DATA		Limit line table
CALC:LIM:DISP		Limits display ON/OFF
CALC:LIM:FAIL?		Limit test result
CALC:LIM:REP:ALL?		Limit test result report
CALC:LIM:REP:POIN?		Failed points
CALC:LIM:REP?		Stimulus values of failed points

Command	Description	
CALC:MARK	Marker Properties	Marker ON/OFF
CALC:MARK:ACT		Sets active marker
CALC:MARK:COUN		Number of markers
CALC:MARK:COUP		Coupling of markers ON/OFF
CALC:MARK:DATA?		Response and stimulus values of all marker
CALC:MARK:DISC		Marker discrete mode ON/OFF
CALC:MARK:REF		Reference marker ON/OFF
CALC:MARK:X		Stimulus value of marker
CALC:MARK:Y?		Response value of marker
CALC:MARK:BWID	Bandwidth Search	Bandwidth search ON/OFF
CALC:MARK:BWID:DATA?		Bandwidth search result
CALC:MARK:BWID:REF		Reference of search
CALC:MARK:BWID:THR		Bandwidth threshold value

Command	Description	
CALC:MARK:BWID:TYPE		Type of search
CALC:MARK:FUNC:DOM	Marker Search	Arbitrary search range ON/OFF
CALC:MARK:FUNC:DOM:COUP		Coupling of marker search ranges ON/OFF
CALC:MARK:FUNC:DOM:STAR		Start of the marker search range
CALC:MARK:FUNC:DOM:STOP		Stop of the marker search range
CALC:MARK:FUNC:EXEC		Executes search
CALC:MARK:FUNC:PEXC		Peak excursion value
CALC:MARK:FUNC:PPOL		Peak polarity
CALC:MARK:FUNC:TARG		Target value
CALC:MARK:FUNC:TRAC		Marker search tracking ON/OFF
CALC:MARK:FUNC:TTR		Type of target transition
CALC:MARK:FUNC:TYPE		Search type
CALC:MARK:MATH:FLAT:DATA?	Flatness	Flatness function data

Command	Description	
CALC:MARK:MATH:FLAT:STAT		Marker flatness ON/OFF
CALC:MARK:MATH:FLAT:DOM:STAR		Marker specifying start of frequency range
CALC:MARK:MATH:FLAT:DOM:STOP		Marker specifying stop of frequency range
CALC:MARK:SET	Marker Functions	Sets item value according to the position of the marker
CALC:MATH:FUNC	Memory Trace Function	Math operation
CALC:MATH:MEM		Data => Memory
CALC:MST	Statistic	Math statistics ON/OFF
CALC:MST:DATA?		Math statistics data
CALC:MST:DOM		Partial frequency range ON/OFF
CALC:MST:DOM:STAR		Marker specifying start of frequency range
CALC:MST:DOM:STOP		Marker specifying stop of frequency range
CALC:PAR:SPOR	Measurement Setting	Number of the stimulus port for an absolute measurements

Command	Description	
CALC:RLIM	Ripple Limit Test	Ripple limit test ON/OFF
CALC:RLIM:DATA		Ripple limit line table
CALC:RLIM:DISP:LINE		Ripple Limit line display ON/OFF
CALC:RLIM:DISP:SEL		Number of band for ripple value display
CALC:RLIM:DISP:VAL		Display type of ripple value
CALC:RLIM:FAIL?		Ripple limit test result
CALC:RLIM:REP?		Ripple limit test result report
CALC:SMO	Smoothing	Trace smoothing ON/OFF
CALC:SMO:APER		Smoothing aperture
CALC:TRAN:TIME	Setting Time Domain Parameters	Selects Band-pass/Low-pass type
CALC:TRAN:TIME:CENT		Time domain center
CALC:TRAN:TIME:DC:VAL		DC value
CALC:TRAN:TIME:EXTR:DC		DC extrapolation ON/OFF

Command	Description	
CALC:TRAN:TIME:IMP:WIDT		Impulse Width
CALC:TRAN:TIME:KBES		Kaiser-Bessel β
CALC:TRAN:TIME:LPFR		Sets requency Low-Pass
CALC:TRAN:TIME:REFL:TYPE		Selects One way/Round trip
CALC:TRAN:TIME:SPAN		Time domain Span
CALC:TRAN:TIME:STAR		Time domain Start
CALC:TRAN:TIME:STOP		Time domain Stop
CALC:TRAN:TIME:STAT		Time domain transformation ON/OFF
CALC:TRAN:TIME:STEP:RTIM		Step rise time
CALC:TRAN:TIME:STIM		Selects Impulse/Step type
CALC:TRAN:TIME:UNIT		Time domain Unit

CALC:CONV

SCPI Command

CALCulate<Ch>[:SELected]:CONVersion[:STATe] {OFF|ON|0|1}

CALCulate<Ch>[:SELected]:CONVersion[:STATe]?

Or

CALCulate<Ch>:TRACe<Tr>:CONVersion[:STATe] {OFF|ON|0|1}

CALCulate<Ch>:TRACe<Tr>:CONVersion[:STATe]?

Description

Turns the S–parameter conversion function ON/OFF.
command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

{ON|1} ON

{OFF|0} OFF

Query Response

{0|1}

Preset Value

0

Related Commands

CALC:CONV:FUNC

Related Section of Operating Manual

S-Parameters and Conversion Function

Related Controls of User Interface

Trace > More Measurement > S-parameters > Conversion {Off} — OFF (drop-down list in the Measurement Types pop-up window)

Trace > More Measurement > S-parameters > Conversion {1/S | Conj | Zr | Zt | Ztsh | Yr | Yt | Ytsh} — ON (drop-down list in the Measurement Types pop-up window)

Back to CALCulate

CALC:CONV:FUNC

SCPI Command

CALCulate<Ch>[:SELected]:CONVersion:FUNCtion <char>

CALCulate<Ch>[:SELected]:CONVersion:FUNCtion?

Or

CALCulate<Ch>:TRACe<Tr>:CONVersion:FUNCtion <char>

CALCulate<Ch>:TRACe<Tr>:CONVersion:FUNCtion?

Description

Sets or reads out the S-parameter conversion function type.
command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

<char> Specifies parameter:

ZREFlection	Reflection equivalent impedance
ZTRansmit	Transmission equivalent impedance
YREFlection	Reflection equivalent admittance
YTRansmit	Transmission equivalent admittance

INVersion	Inverse S-parameter
ZTSHunt	Shunt equivalent impedance
YTSHunt	Shunt equivalent admittance
CONJugation	S-parameter conjugate

Query Response

{ZREF|ZTR|YREF|YTR|INV|ZTSH|YTSH|CONJ}

Preset Value

ZREF

Related Section of Operating Manual

S-Parameters and Conversion Function

Related Controls of User Interface

Trace > More Measurement > S-parameters > Conversion {1/S | Conj | Zr | Zt | Ztsh | Yr | Yt | Ytsh} (drop-down list in the Measurement Types pop-up window)

Back to CALCulate

CALC:CORR:EDEL:DIST

SCPI Command

CALCulate<Ch>[:SELected]:CORRection:EDELay:DISTance <numeric>

CALCulate<Ch>[:SELected]:CORRection:EDELay:DISTance?

Or

CALCulate<Ch>:TRACe<Tr>:CORRection:EDELay:DISTance <numeric>

CALCulate<Ch>:TRACe<Tr>:CORRection:EDELay:DISTance?

Description

Sets or reads out the value of the equivalent distance in the electrical delay function.

command/query

Description

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

<numeric> the distance value.

Unit

meter, feet or **inches** depending on the CALC:CORR:EDEL:DIST:UNIT command.

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

0

Related Section of Operating Manual

Electrical Delay Settings

Related Controls of User Interface

Scale > Distance (textbox in ELECTRICAL DELAY accordion)

Back to CALCulate

CALC:CORR:EDEL:DIST:UNIT

SCPI Command

CALCulate<Ch>[:SELected]:CORRection:EDELay:DISTance:UNITs <char>

CALCulate<Ch>[:SELected]:CORRection:EDELay:DISTance:UNITs?

Or

CALCulate<Ch>:TRACe<Tr>:CORRection:EDELay:DISTance:UNITs <char>

CALCulate<Ch>:TRACe<Tr>:CORRection:EDELay:DISTance:UNITs?

Description

Sets or reads out the distance units in the electrical delay function.

command/query

Description

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

<char> Specifies parameter:

METer	Meters
FEET	Feet
INCHes	Inches

Query Response

{MET|FEET|INCH}

Preset Value

METer

Related Section of Operating Manual

Decimal Unit

Related Controls of User Interface

Appearance > Distance Unit > {Meters | Feet | Inches} (drop-down list in DECIMAL PLACES accordion)

Back to CALCulate

CALC:CORR:EDEL:MED

SCPI Command

CALCulate<Ch>[:SELected]:CORRection:EDELay:MEDia <char>

CALCulate<Ch>[:SELected]:CORRection:EDELay:MEDia?

Or

CALCulate<Ch>:TRACe<Tr>:CORRection:EDELay:MEDia <char>

CALCulate<Ch>:TRACe<Tr>:CORRection:EDELay:MEDia?

Description

Sets or reads out the type of media in the electrical delay function.
command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

<char> Specifies parameter:

COAXial	Coaxial type of media
WAVeguide	Waveguide type of media

Query Response

{COAX|WAV}

Preset Value

COAX

Related Section of Operating Manual

Electrical Delay Settings

Related Controls of User Interface

Scale > Media > {Coax | Waveguide} (drop-down list in ELECTRICAL DELAY accordion)

Back to CALCulate

CALC:CORR:EDEL:RVEL

SCPI Command

CALCulate<Ch>[:SELected]:CORRection:EDELay:RVELocity <numeric>

CALCulate<Ch>[:SELected]:CORRection:EDELay:RVELocity?

Or

CALCulate<Ch>:TRACe<Tr>:CORRection:EDELay:RVELocity <numeric>

CALCulate<Ch>:TRACe<Tr>:CORRection:EDELay:RVELocity?

Description

Sets or reads out the value of the velocity factor used to calculate between delay and distance in the electrical delay function.
command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

<numeric> the velocity factor value from 0 to 1.

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

0

Related Section of Operating Manual

Electrical Delay Settings

Related Controls of User Interface

Scale > Velocity Factor (textbox in ELECTRICAL DELAY accordion)

Back to CALCulate

CALC:CORR:EDEL:TIME

SCPI Command

CALCulate<Ch>[:SELected]:CORRection:EDELay:TIME <time>

CALCulate<Ch>[:SELected]:CORRection:EDELay:TIME?

Or

CALCulate<Ch>:TRACe<Tr>:CORRection:EDELay:TIME <time>

CALCulate<Ch>:TRACe<Tr>:CORRection:EDELay:TIME?

Description

Sets or reads out the value of the electrical delay.
command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

<time> the electrical delay value from –10 to 10

Unit

sec (second)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

0

Related Section of Operating Manual

Electrical Delay Settings

Related Controls of User Interface

Scale > Electrical Delay (texbox in ELECTRICAL DELAY accordion)

Back to CALCulate

CALC:CORR:EDEL:WAV:CUT

SCPI Command

CALCulate<Ch>[:SELected]:CORRection:EDELay:WAVeguide:CUToff <numeric>

CALCulate<Ch>[:SELected]:CORRection:EDELay:WAVeguide:CUToff?

Or

CALCulate<Ch>:TRACe<Tr>:CORRection:EDELay:WAVeguide:CUToff <numeric>

CALCulate<Ch>:TRACe<Tr>:CORRection:EDELay:WAVeguide:CUToff?

Description

Sets or reads out the value of the waveguide cutoff frequency in the electrical delay function if the type of media set to the "WAVeguide" by the command CALC:CORR:EDEL:MED.

command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

<numeric> the cutoff frequency 0 to 999e9.

Unit

Hz (hertz)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

0

Related Section of Operating Manual

Electrical Delay Settings

Related Controls of User Interface

Scale > WG Cutoff (textbox in ELECTRICAL DELAY accordion)

Back to CALCulate

CALC:CORR:OFFS:PHAS

SCPI Command

CALCulate<Ch>[:SELected]:CORRection:OFFSet:PHASe <phase>

CALCulate<Ch>[:SELected]:CORRection:OFFSet:PHASe?

Or

CALCulate<Ch>:TRACe<Tr>:CORRection:OFFSet:PHASe <phase>

CALCulate<Ch>:TRACe<Tr>:CORRection:OFFSet:PHASe?

Description

Sets or reads out the value of the phase offset.
command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

<phase> the phase offset value from –360 to 360

Unit

° (degree)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

0

Related Section of Operating Manual

Phase Offset Setting

Related Controls of User Interface

Scale > Phase Offset (textbox in ELECTRICAL DELAY accordion)

Back to CALCulate

CALC:CORR:STAT?

SCPI Command

CALCulate<Ch>[:SELected]:CORRection:STATus?

Or

CALCulate<Ch>:TRACe<Tr>:CORRection:STATus?

Description

Reads out the interpolation/extrapolation status of the error correction.

query only

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Query Response

Trace represents S-parameter:

NONE	Correction not applied
COR	Correction applied exactly
C?	Correction interpolated
C!	Correction extrapolated

Trace represents absolute parameter:

NONE	Correction not applied

RC	Correction applied exactly
RC?	Correction interpolated
RC!	Correction extrapolated

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to CALCulate

CALC:DATA:FDAT

SCPI Command

CALCulate<Ch>[:SELected]:DATA:FDATa <numeric list>

CALCulate<Ch>[:SELected]:DATA:FDATa?

Or

CALCulate<Ch>:TRACe<Tr>:DATA:FDATa <numeric list>

CALCulate<Ch>:TRACe<Tr>:DATA:FDATa?

Description

Reads out or writes the formatted data array.

The formatted data array is the data, whose processing is completed including the formatting as the last step. Such data represent the data trace values as they are shown on the screen.

The array size is 2N, where N is the number of measurement points.

For the n-th point, where n from 1 to N:

<numeric 2n–1> Value 1 depends on the trace format (see table below);

<numeric 2n> Value 2 depends on the trace format (see table below).Reads out or writes the formatted data array.

Trace Format	Value 1	Value 2
Log Mag	Logarithmic magnitude, dB	0
SWR	Voltage standing wave ratio	0
Phase	Phase, deg	0
Expand Phase	Expanded phase, deg	0

Trace Format	Value 1	Value 2
Group Delay	Group delay, sec	0
Lin Mag	Linear magnitude	0
Real	Real part	0
Imag	Imaginary part	0
Smith (Log/Phase)	Logarithmic magnitude, dB	Phase, deg
Smith (Lin/Phase)	Linear magnitude	Phase, deg
Smith (Real/Imag)	Real part	Imaginary part
Smith (R + jX)	Impedance (real part), Ohm	Impedance (imaginary part), Ohm
Smith (G + jB)	Admittance (real part), S	Admittance (imaginary part), S
Polar (Log/Phase)	Logarithmic magnitude, dB	Phase, deg
Polar (Lin/Phase)	Linear magnitude	Phase, deg
Polar (Real/Imag)	Real part	Imaginary part

Note When data is being written it is recommended to hold the sweep before and update the screen after write.

command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Query Response

<numeric 1>, <numeric 2>, …<numeric 2N>

Related Commands

CALC:FORM

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to CALCulate

CALC:DATA:FMEM

SCPI Command

CALCulate<Ch>[:SELected]:DATA:FMEMory <numeric list>

CALCulate<Ch>[:SELected]:DATA:FMEMory?

Or

CALCulate<Ch>:TRACe<Tr>:DATA:FMEMory <numeric list>

CALCulate<Ch>:TRACe<Tr>:DATA:FMEMory?

Description

Reads out or writes the formatted memory array.

The formatted memory array is the data, whose processing is completed including the formatting as the last step. Such data represent the memory trace values as they are shown on the screen.

The array size is 2N, where N is the number of measurement points.

For the n-th point, where n from 1 to N:

<numeric 2n–1> Value 1 depends on the trace format (see table below);

<numeric 2n> Value 2 depends on the trace format (see table below).

Trace Format	Value 1	Value 2
Log Mag	Logarithmic magnitude, dB	0
SWR	Voltage standing wave ratio	0
Phase	Phase, deg	0
Expand Phase	Expanded phase, deg	0

Trace Format	Value 1	Value 2
Group Delay	Group delay, sec	0
Lin Mag	Linear magnitude	0
Real	Real part	0
Imag	Imaginary part	0
Smith (Log/Phase)	Logarithmic magnitude, dB	Phase, deg
Smith (Lin/Phase)	Linear magnitude	Phase, deg
Smith (Real/Imag)	Real part	Imaginary part
Smith (R + jX)	Impedance (real part), Ohm	Impedance (imaginary part), Ohm
Smith (G + jB)	Admittance (real part), S	Admittance (imaginary part), S
Polar (Log/Phase)	Logarithmic magnitude, dB	Phase, deg
Polar (Lin/Phase)	Linear magnitude	Phase, deg
Polar (Real/Imag)	Real part	Imaginary part

Note When data is being written it is recommended to hold the sweep before and update the screen after write.

command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Query Response

<numeric 1>, <numeric 2>, …<numeric 2N>

Related Commands

CALC:MATH:MEM

CALC:FORM

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to CALCulate

CALC:DATA:SDAT

SCPI Command

CALCulate<Ch>[:SELected]:DATA:SDATa <numeric list>

CALCulate<Ch>[:SELected]:DATA:SDATa?

Or

CALCulate<Ch>:TRACe<Tr>:DATA:SDATa <numeric list>

CALCulate<Ch>:TRACe<Tr>:DATA:SDATa?

Description

Reads out or writes the corrected data array.

The corrected data array is the data, whose processing is completed excluding the formatting as the last step. Such data represent S–parameter complex values.

The array size is 2N, where N is the number of measurement points.

For the n-th point, where n from 1 to N:

<numeric 2n–1> the real part of corrected measurement;

<numeric 2n> the imaginary part of corrected measurement.

Note When data is being written it is recommended to hold the sweep before and update the screen after write.

command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Query Response

<numeric 1>, <numeric 2>, …<numeric 2N>

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to CALCulate

CALC:DATA:SMEM

SCPI Command

CALCulate<Ch>[:SELected]:DATA:SMEMory <numeric list>

CALCulate<Ch>[:SELected]:DATA:SMEMory?

Or

CALCulate<Ch>:TRACe<Tr>:DATA:SMEMory <numeric list>

CALCulate<Ch>:TRACe<Tr>:DATA:SMEMory?

Description

Reads out or writes the corrected memory array.

The corrected memory array is the data, whose processing is completed excluding the formatting as the last step. Such data represent S–parameter complex values.

The array size is 2N, where N is the number of measurement points.

For the n-th point, where n from 1 to N:

<numeric 2n–1> the real part of corrected measurement memory;

<numeric 2n> the imaginary part of corrected measurement memory.

command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Query Response

<numeric 1>, <numeric 2>, …<numeric 2N>

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to CALCulate

CALC:DATA:XAX?

SCPI Command

CALCulate<Ch>[:SELected]:DATA:XAXis?

Or

CALCulate<Ch>:TRACe<Tr>:DATA:XAXis?

Description

Reads out the X-axis values array.

The X-axis values array is the frequency, power or time values array depending on the trace setup. The array contains real values.

The array size is N, where N is the number of measurement points.

For the n-th point, where n from 1 to N:

<numeric n> the X-axis value.

query only

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Query Response

<numeric 1>, <numeric 2>, …<numeric N>

Related Commands

SENS:SWE:TYPE

CALC:TRAN:TIME:STAT

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to CALCulate

CALC:FILT:TIME

SCPI Command

CALCulate<Ch>[:SELected]:FILTer[:GATE]:TIME[:TYPE] <char>

CALCulate<Ch>[:SELected]:FILTer[:GATE]:TIME[:TYPE]?

Or

CALCulate<Ch>:TRACe<Tr>:FILTer[:GATE]:TIME[:TYPE] <char>

CALCulate<Ch>:TRACe<Tr>:FILTer[:GATE]:TIME[:TYPE]?

Description

Sets or reads out the gate type of the gating function.
command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

<char> Specifies the gate type:

BPASs	Bandpass type
NOTCh	Notch type

Query Response

{BPAS|NOTC}

Preset Value

BPAS

Related Section of Operating Manual

Time Domain Gating

Related Controls of User Interface

Time Domain > Type {Bandpass | Notch} (drop-down list in GATING accordion)

Back to CALCulate

CALC:FILT:TIME:CENT

SCPI Command

CALCulate<Ch>[:SELected]:FILTer[:GATE]:TIME:CENTer <time>

CALCulate<Ch>[:SELected]:FILTer[:GATE]:TIME:CENTer?

Or

CALCulate<Ch>:TRACe<Tr>:FILTer[:GATE]:TIME:CENTer <time>

CALCulate<Ch>:TRACe<Tr>:FILTer[:GATE]:TIME:CENTer?

Description

Sets or reads out the gate center value of the gating function.
command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

<time> the center value of the gate, the range varies depending on the frequency span and the number of points.

Unit

sec (second)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

0

Related Section of Operating Manual

Time Domain Gating

Related Controls of User Interface

Time Domain > Center (textbox in GATING accordion)

Back to CALCulate

CALC:FILT:TIME:SHAP

SCPI Command

CALCulate<Ch>[:SELected]:FILTer[:GATE]:TIME:SHAPe <char>

CALCulate<Ch>[:SELected]:FILTer[:GATE]:TIME:SHAPe?

Or

CALCulate<Ch>:TRACe<Tr>:FILTer[:GATE]:TIME:SHAPe <char>

CALCulate<Ch>:TRACe<Tr>:FILTer[:GATE]:TIME:SHAPe?

Description

Sets or reads out the gate shape of the gating function.

command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

<char> Specifies the gate shape:

MAXimum	Maximum shape
WIDE	Wide shape
NORMal	Normal shape
MINimum	Minimum shape

Query Response

{MAX|WIDE|NORM|MIN}

Preset Value

NORM

Related Section of Operating Manual

Time Domain Gating

Related Controls of User Interface

Time Domain > Shape {Minimum | Normal | Wide | Maximum} (drop-down list in GATING accordion)

Back to CALCulate

CALC:FILT:TIME:SPAN

SCPI Command

CALCulate<Ch>[:SELected]:FILTer[:GATE]:TIME:SPAN <time>

CALCulate<Ch>[:SELected]:FILTer[:GATE]:TIME:SPAN?

Or

CALCulate<Ch>:TRACe<Tr>:FILTer[:GATE]:TIME:SPAN <time>

CALCulate<Ch>:TRACe<Tr>:FILTer[:GATE]:TIME:SPAN?

Description

Sets or reads out the gate span value of the gating function.
command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

<time> the span value of the gate, the range varies depending on the frequency span and the number of points

Unit

sec (second)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

2e–8

Related Section of Operating Manual

Time Domain Gating

Related Controls of User Interface

Time Domain > Span (textbox in GATING accordion)

Back to CALCulate

CALC:FILT:TIME:STAR

SCPI Command

CALCulate<Ch>[:SELected]:FILTer[:GATE]:TIME:STARt <time>

CALCulate<Ch>[:SELected]:FILTer[:GATE]:TIME:STARt?

Or

CALCulate<Ch>:TRACe<Tr>:FILTer[:GATE]:TIME:STARt <time>

CALCulate<Ch>:TRACe<Tr>:FILTer[:GATE]:TIME:STARt?

Description

Sets or reads out the gate start value of the gating function.
command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

<time> the start value of the gate, the range varies depending on the frequency span and the number of points

Unit

sec (second)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

-1e–8

Related Section of Operating Manual

Time Domain Gating

Related Controls of User Interface

Time Domain > Start (textbox in GATING accordion)

Back to CALCulate

CALC:FILT:TIME:STAT

SCPI Command

CALCulate<Ch>[:SELected]:FILTer[:GATE]:TIME:STATe {OFF|ON|0|1}

CALCulate<Ch>[:SELected]:FILTer[:GATE]:TIME:STATe?

Or

CALCulate<Ch>:TRACe<Tr>:FILTer[:GATE]:TIME:STATe {OFF|ON|0|1}

CALCulate<Ch>:TRACe<Tr>:FILTer[:GATE]:TIME:STATe?

Description

Turns the gating function ON/OFF.
command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

{ON|1} ON

{OFF|0} OFF

Query Response

{0|1}

Preset Value

0

Related Section of Operating Manual

Time Domain Gating

Related Controls of User Interface

Time Domain > GATING {ON | OFF} (toggle button in GATING accordion)

Back to CALCulate

CALC:FILT:TIME:STOP

SCPI Command

CALCulate<Ch>[:SELected]:FILTer[:GATE]:TIME:STOP <time>

CALCulate<Ch>[:SELected]:FILTer[:GATE]:TIME:STOP?

Or

CALCulate<Ch>:TRACe<Tr>:FILTer[:GATE]:TIME:STOP <time>

CALCulate<Ch>:TRACe<Tr>:FILTer[:GATE]:TIME:STOP?

Description

Sets or reads out the gate stop value of the gating function.
command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

<time> the stop value of the gate, the range varies depending on the frequency span and the number of points

Unit

sec (second)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

+1e–8

Related Section of Operating Manual

Time Domain Gating

Related Controls of User Interface

Time Domain > Stop (textbox in GATING accordion)

Back to CALCulate

CALC:FORM

SCPI Command

CALCulate<Ch>[:SELected]:FORMat <char>

CALCulate<Ch>[:SELected]:FORMat?

Or

CALCulate<Ch>:TRACe<Tr>:FORMat <char>

CALCulate<Ch>:TRACe<Tr>:FORMat?

Description

Sets or reads out the trace format.
command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

<char> Specifies the trace format:

MLOGarithmic	Logarithmic magnitude
PHASe	Phase
GDELay	Group delay time
SLINear	Smith chart format (Lin)

SLOGarithmic	Smith chart format (Log)
SCOMplex	Smith chart format (Real/Imag)
SMITh	Smith chart format (R + jX)
SADMittance	Smith chart format (G + jB)
PLINear	Polar format (Lin)
PLOGarithmic	Polar format (Log)
POLar	Polar format (Real/Imag)
MLINear	Linear magnitude
SWR	Voltage standing wave ratio
REAL	Real part
IMAGinary	Imaginary part
UPHase	Expanded phase

Query Response

{MLOG|PHAS|GDEL|SLIN|SLOG|SCOM|SMIT|SADM|PLIN|PLOG|POL|MLIN|SWR|REAL|IMAG|UPH}

Preset Value

MLOG

Related Section of Operating Manual

Format Setting

Related Controls of User Interface

Trace > Format {Log Mag | SWR | Phase | Ex Phase | Delay | Lin Mag | Real | Imag | Smith(Log) | Smith(Lin) | Smith(Re/Im) | Smith(R+jX) | Smith(G+jB) | Polar{Log} | Polar{Lin} | Polar{Re/Im}} (drop-down list in the submenu)

Back to CALCulate

CALC:FSIM:BAL:CZC:BPOR:Z0

SCPI Command

CALCulate<Ch>:FSIMulator:BALun:CZConversion:BPORt<Bpt>:Z0[:R] <numeric>

CALCulate<Ch>:FSIMulator:BALun:CZConversion:BPORt<Bpt>:Z0[:R]?

Description

Sets or reads out the impedance value for the common impedance conversion function of the balanced port. The impedance is real. The default impedance value equals to 25 Ω.

command/query

Target

Balanced Port <Bpt> of channel <Ch>,

<Ch>={[1]|2|...32}

<Bpt>={[1]|2}, 1 or 2 for the Bal-Bal topology, always 1 for the SE-Bal, SE-SE-Bal and Bal topology.

Parameter

<numeric> the new value of the common impedance of the balanced port from 1 mΩ to 10 MΩ.

Unit

Ω (Ohm)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

25 Ω

Related Commands

CALC:FSIM:BAL:DEV

Related Section of Operating Manual

Port Reference Impedance Conversion for Balanced Connection

Related Controls of User Interface

Fixture > Cmn ZConversion > Z COMMON (textbox)

(When balanced port topology is configured by the following buttons: **Topology > Add Balanced Port**)

Back to CALCulate

CALC:FSIM:BAL:CZC:STAT

SCPI Command

CALCulate<Ch>:FSIMulator:BALun:CZConversion:STATe {OFF|ON|0|1}

CALCulate<Ch>:FSIMulator:BALun:CZConversion:STATe?

Description

Turns the common impedance conversion function of the balanced port ON/OFF.

command/query

Target

The channel <Ch>={[1]|2|...32}

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

0

Related Section of Operating Manual

Port Reference Impedance Conversion for Balanced Connection

Related Controls of User Interface

Fixture > Cmn ZConversion {ON | OFF} (toggle button in the submenu)

Back to CALCulate

CALC:FSIM:BAL:DEV

SCPI Command

CALCulate<Ch>:FSIMulator:BALun:DEVice <char>

CALCulate<Ch>:FSIMulator:BALun:DEVice?

Description

Selects the type of balanced device of the balance-unbalance fixture simulation function
command/query

Target

The channel <Ch>={[1]|2|...32}

Parameter

<char> Specifies type of the balanced device:

SBALanced	Unbalance-Balance (3 ports)
BBALanced	Balance-Balance (4 ports)
SSBalanced	Unbalance-Unbalance-Balance (4 ports)
BALanced	Balance (2 ports)

Query Response

{SBAL|BBAL|SSB|BAL}

Preset Value

BBAL

Related Section of Operating Manual

Topology

Related Controls of User Interface

Fixture > Topology > Add Balanced Port > Add Single Ended Port

Back to CALCulate

CALC:FSIM:BAL:DMC:BPOR:PAR:G

SCPI Command

CALCulate<Ch>:FSIMulator:BALun:DMCircuit:BPORt<Bpt>:PARameters:G <numeric>

CALCulate<Ch>:FSIMulator:BALun:DMCircuit:BPORt<Bpt>:PARameters:G?

Description

Sets or reads out the conductance value of the G element of the differential matching circuit.
command/query

Target

Balanced Port <Bpt> of channel <Ch>,

<Ch>={[1]|2|...32}

<Bpt>={[1]|2}, 1 or 2 for the Bal-Bal topology, always 1 for the SE-Bal, SE-SE-Bal and Bal topology.

Parameter

<numeric> the conductance value of the G element of the differential matching circuit from 1e–18 to 1e18.

Unit

S (Siemens)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

0

Related Commands

CALC:FSIM:BAL:DEV

Related Section of Operating Manual

Differential Port Matching

Related Controls of User Interface

Fixture > Diff Matching > G (textbox)

(When balanced port topology is configured by the following buttons: **Topology > Add Balanced Port**)

Back to CALCulate

CALC:FSIM:BAL:DMC:BPOR:PAR:C

SCPI Command

CALCulate<Ch>:FSIMulator:BALun:DMCircuit:BPORt<Bpt>:PARameters:C <numeric>

CALCulate<Ch>:FSIMulator:BALun:DMCircuit:BPORt<Bpt>:PARameters:C?

Description

Sets or reads out the capacitance value of the C element of the differential matching circuit.

command/query

Target

Balanced Port <Bpt> of channel <Ch>,

<Ch>={[1]|2|...32}

<Bpt>={[1]|2}, 1 or 2 for the Bal-Bal topology, always 1 for the SE-Bal, SE-SE-Bal and Bal topology.

Parameter

<numeric> the capacitance value of the C element of the differential matching circuit from 1e–18 to 1e18.

Unit

F (Farad)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

0

Related Commands

CALC:FSIM:BAL:DEV

Related Section of Operating Manual

Differential Port Matching

Related Controls of User Interface

Fixture > Diff Matching > C (textbox)

(When balanced port topology is configured by the following buttons: **Topology > Add Balanced Port**)

Back to CALCulate

CALC:FSIM:BAL:DMC:BPOR:PAR:L

SCPI Command

CALCulate<Ch>:FSIMulator:BALun:DMCircuit:BPORt<Bpt>:PARameters:L <numeric>

CALCulate<Ch>:FSIMulator:BALun:DMCircuit:BPORt<Bpt>:PARameters:L?

Description

Sets or reads out the inductance value of the L element of the differential matching circuit.

Note If both elements L and R are equal to zero, then L and R elements are omitted in the scheme. If any element L or R is not zero, then zero value of the rest element means short circuit.

command/query

Target

Balanced Port <Bpt> of channel <Ch>,

<Ch>={[1]|2|...32}

<Bpt>={[1]|2}, 1 or 2 for the Bal-Bal topology, always 1 for the SE-Bal, SE-SE-Bal and Bal topology.

Parameter

<numeric> the inductance value of the L element of the differential matching circuit from 1e–18 to 1e18.

Unit

H (Henry)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

0

Related Commands

CALC:FSIM:BAL:DEV

Related Section of Operating Manual

Differential Port Matching

Related Controls of User Interface

Fixture > Diff Matching > L (textbox)

(When balanced port topology is configured by the following buttons: **Topology > Add Balanced Port**)

Back to CALCulate

CALC:FSIM:BAL:DMC:BPOR:PAR:R

SCPI Command

CALCulate<Ch>:FSIMulator:BALun:DMCircuit:BPORt<Bpt>:PARameters:R <numeric>

CALCulate<Ch>:FSIMulator:BALun:DMCircuit:BPORt<Bpt>:PARameters:R?

Description

Sets or reads out the resistance value of the R element of the differential matching circuit.

Note If both elements L and R are equal to zero, then L and R elements are omitted in the scheme. If any element L or R is not zero, then zero value of the rest element means short circuit.

command/query

Target

Balanced Port <Bpt> of channel <Ch>,

<Ch>={[1]|2|...32}

<Bpt>={[1]|2}, 1 or 2 for the Bal-Bal topology, always 1 for the SE-Bal, SE-SE-Bal and Bal topology.

Parameter

<numeric> the resistance value of the R element of the differential matching circuit from 1e–18 to 1e18.

Unit

Ω (Ohm)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

0

Related Commands

CALC:FSIM:BAL:DEV

Related Section of Operating Manual

Differential Port Matching

Related Controls of User Interface

Fixture > Diff Matching > G (textbox)

(When balanced port topology is configured by the following buttons: **Topology > Add Balanced Port**)

Back to CALCulate

CALC:FSIM:BAL:DMC:BPOR:TYPE

SCPI Command

CALCulate<Ch>:FSIMulator:BALun:DMCircuit:BPORt<Bpt>:TYPE <char>

CALCulate<Ch>:FSIMulator:BALun:DMCircuit:BPORt<Bpt>:TYPE?

Description

Selects the type of the differential matching circuit for the specified balanced port number Bpt of the channel Ch.

command/query

Target

Balanced Port <Bpt> of channel <Ch>,

<Ch>={[1]|2|...32}

<Bpt>={[1]|2}, 1 or 2 for the Bal-Bal topology, always 1 for the SE-Bal, SE-SE-Bal and Bal topology.

Parameter

<char> Specifies the differential matching circuit:

NONE	No-circuit
PLPC	Shunt L – Shunt C
USER	User defined circuit by touchstone file

Query Response

{NONE|PLPC|USER}

Preset Value

NONE

Related Commands

CALC:FSIM:BAL:DEV

Related Section of Operating Manual

Differential Port Matching

Related Controls of User Interface

Fixture > Diff Matching > Z DIFFERENTIAL > {None | Shunt L - Shunt C | User} (drop-down list)

(When balanced port topology is configured by the following buttons: **Topology > Add Balanced Port**)

Back to CALCulate

CALC:FSIM:BAL:DMC:BPOR:USER:FIL

SCPI Command

CALCulate<Ch>:FSIMulator:BALun:DMCircuit:BPORt<Bpt>:USER:FILename <string>

CALCulate<Ch>:FSIMulator:BALun:DMCircuit:BPORt<Bpt>:USER:FILename?

Description

Specifies a file defining the two-port network which is used in the differential matching circuit, for the specified balanced port number Bpt of the channel Ch. The *.S2P file contains the circuit S-parameters in Touchstone format.

command/query

Target

Balanced Port <Bpt> of channel <Ch>,

<Ch>={[1]|2|...32}

<Bpt>={[1]|2}, 1 or 2 for the Bal-Bal topology, always 1 for the SE-Bal, SE-SE-Bal and Bal topology.

Parameter

<srting>, up to 256 characters

Related Commands

CALC:FSIM:BAL:DEV

CALC:FSIM:BAL:DMC:BPOR:TYPE

Related Section of Operating Manual

Differential Port Matching

Related Controls of User Interface

Fixture > Diff Matching > User File

(When balanced port topology is configured by the following buttons: **Topology > Add Balanced Port**)

Back to CALCulate

CALC:FSIM:BAL:DMC:STAT

SCPI Command

CALCulate<Ch>:FSIMulator:BALun:DMCircuit:STATe {OFF|ON|0|1}

CALCulate<Ch>:FSIMulator:BALun:DMCircuit:STATe?

Description

Turns the differential matching circuit function ON/OFF.

command/query

Target

The channel <Ch>={[1]|2|...32}

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

0

Related Section of Operating Manual

Differential Port Matching

Related Controls of User Interface

Fixture > Diff Matching {ON | OFF} (toggle button in the submenu)

Back to CALCulate

CALC:FSIM:BAL:DZC:BPOR:Z0

SCPI Command

CALCulate<Ch>:FSIMulator:BALun:DZConversion:BPORt<Bpt>:Z0[:R] <numeric>

CALCulate<Ch>:FSIMulator:BALun:DZConversion:BPORt<Bpt>:Z0[:R]?

Description

Sets or reads out the impedance value for the differential impedance conversion function of the balanced port. The impedance is real. The default impedance value equals to 100 Ω.

command/query

Target

Balanced Port <Bpt> of channel <Ch>,

<Ch>={[1]|2|...32}

<Bpt>={[1]|2}, 1 or 2 for the Bal-Bal topology, always 1 for the SE-Bal, SE-SE-Bal and Bal topology.

Parameter

<numeric> the new value of the differential impedance of the balanced port from 1 mΩ to 10 MΩ.

Unit

Ω (Ohm)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

100 Ω

Related Commands

CALC:FSIM:BAL:DEV

Related Section of Operating Manual

Port Reference Impedance Conversion for Balanced Connection

Related Controls of User Interface

Fixture > Diff ZConversion > Z DIFFERENTIAL (textbox)

(When balanced port topology is configured by the following buttons: **Topology > Add Balanced Port)**

Back to CALCulate

CALC:FSIM:BAL:DZC:STAT

SCPI Command

CALCulate<Ch>:FSIMulator:BALun:DZConversion:STATe {OFF|ON|0|1}

CALCulate<Ch>:FSIMulator:BALun:DZConversion:STATe?

Description

Turns the differential impedance conversion function of the balanced port ON/OFF.
command/query

Target

The channel <Ch>={[1]|2|...32}

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

0

Related Commands

CALC:FSIM:BAL:DEV

Related Section of Operating Manual

Port Reference Impedance Conversion for Balanced Connection

Related Controls of User Interface

Fixture > Diff ZConversion {ON | OFF} (toggle button in the submenu)

Back to CALCulate

CALC:FSIM:BAL:PAR:BAL

SCPI Command

CALCulate<Ch>:FSIMulator:BALun:PARameter<Tr>:BALanced[:DEFine] <char>

CALCulate<Ch>:FSIMulator:BALun:PARameter<Tr>:BALanced[:DEFine]?

Description

Selects the measurement parameter of the fixture simulation function when the device type is "BALanced".

command/query

Target

Trace <Tr> of channel <Ch>,

<Tr> = {[1]|2|...64}

<Ch>={[1]|2|...32}

Parameter

<char> Specifies the measurement parameter:

SDDii

SCDii

SDCii

SCCii

where i can take value from 1 to 16, depending on the Analyzer model and topology ports.

Query Response

{SDD11|...|SDD88|SCD11|...|SCD88|SDC11...|SDC88|SCC11|...|SCC88}

Preset Value

SDD11

Related Commands

CALC:FSIM:BAL:DEV

Related Section of Operating Manual

Balanced Parameters

Related Controls of User Interface

Trace > More Measurement > Balanced > {Sdd11|...}

(When balanced port topology is configured by the following buttons: **Topology > Add Balanced Port**)

Back to CALCulate

CALC:FSIM:BAL:PAR:BBAL

SCPI Command

CALCulate<Ch>:FSIMulator:BALun:PARameter<Tr>:BBALanced[:DEFine] <char>

CALCulate<Ch>:FSIMulator:BALun:PARameter<Tr>:BBALanced[:DEFine]?

Description

Selects the measurement parameter of the fixture simulation function when the device type is "BBALanced".

command/query

Target

Trace <Tr> of channel <Ch>,

<Tr> = {[1]|2|...64}

<Ch>={[1]|2|...32}

Parameter

<char> Specifies the measurement parameter:

SDDii

SDDij

SDDji

SDDjj

SCDii

SCDij

SCDji

SCDjj

SDCii

SDCij

SDCji

SDCjj

SCCii

SCCij

SCCji

SCCjj

IMBji Imbalance1 (i ≠ j)

IMBij Imbalance1 (i ≠ j)

CMRRji Sddji/Sccji

where i, j can take values from 1 to 8, depending on the Analyzer model and topology ports.

Query Response

{SDD11|SDD21|SDD31|...|SDD87|SCD11|SCD21|SCD31|...|SCD87|SDC11|SDC21| SDC31|...|SDC87|SCC11|SCC21|SCC31|...|SCC87|IMB21|IMB31|...|IMB87|CMRR12...|CMRR87}

Preset Value

SDD11

Related Commands

CALC:FSIM:BAL:DEV

Related Section of Operating Manual

Balanced Parameters

Related Controls of User Interface

Trace > More Measurement > Balanced > {Sdd11|…}

(When balanced-balanced port topology is configured by the following buttons: **Topology > Add Balanced Port > Add Balanced Port**)

Back to CALCulate

CALC:FSIM:BAL:PAR:SBAL

SCPI Command

CALCulate<Ch>:FSIMulator:BALun:PARameter<Tr>:SBALanced[:DEFine] <char>

CALCulate<Ch>:FSIMulator:BALun:PARameter<Tr>:SBALanced[:DEFine]?

Description

Selects the measurement parameter of the fixture simulation function when the device type is "SBALanced".

command/query

Target

Trace <Tr> of channel <Ch>,

<Tr> = {[1]|2|...64}

<Ch>={[1]|2|...32}

Parameter

<char> Specifies the measurement parameter:

SSSii

SDSji

SSDij

SCSji

SSCij

SDDjj

SCDjj

SDCjj

SCCjj

Imbji Imbalance (i ≠ j)

Imbij Imbalance (i ≠ j)

CMRRji Sdsji / Scsji

CMRRij Ssdij / Sscij

where i, j can take values from 1 to 15, depending on the Analyzer model and topology ports.

Query Response

{SSS11|SSS22...|SDS21|SDS31...|SSD12|SSD13...|SCS21|SCS31...|SSC12|SSC13...|SDD22|SDD33...|SCD22|SCD33...|SDC22|SDC33...|SCC22|SCC33...|IMB12|IMB13...|CMRR12|CMRR13...}

Preset Value

SSS11

Related Commands

CALC:FSIM:BAL:DEV

Related Section of Operating Manual

Balanced Parameters

Related Controls of User Interface

Trace > More Measurement > Balanced > {Sss11|…}

(When balanced-unbalanced port topology is configured by the following buttons: **Topology > Add Single Ended Port > Add Balanced Port**)

Back to CALCulate

CALC:FSIM:BAL:PAR:SSB

SCPI Command

CALCulate<Ch>:FSIMulator:BALun:PARameter<Tr>:SSBalanced[:DEFine]?

Description

Selects the measurement parameter of the fixture simulation function when the device type is "SSBalanced'.

command/query

Target

Trace <Tr> of channel <Ch>,

<Tr> = {[1]|2|...64}

<Ch>={[1]|2|...32}

Parameter

<char> Specifies the measurement parameter:

SSSii

SSSji

SSSij

SSSjj

SDSki

SDSkj

SSDik

SSDjk

SCSki

SCSkj

SSCik

SSCjk

SDDkk

SCDkk

SDCkk

SCCkk

Imbi-jk Imbalance1

Imbjk-i Imbalance2

where i, j and k can take values from 1 to 14, depending on the Analyzer model and topology ports.

Query Response

{SSS11|...|SSS21|...|SSS12|...|SSS22|...|SDS31|...|SDS32|...|SSD13|...|SSD23|...|SCS31|...|SCS32|...|SSC13|SSC23|...|SDD33|...|SCD33|...|SDC33...|SCC33|...|IMB1-23|...}

Preset Value

SSS11

Related Commands

CALC:FSIM:BAL:DEV

Related Section of Operating Manual

Balanced Parameters

Related Controls of User Interface

Trace > More Measurement > Balanced > {Sss11|…}

(When balanced-unbalanced-unbalanced port topology is configured by the following buttons: **Topology > Add Single Ended Port > Add Single Ended Port > Add Balanced Port**)

Back to CALCulate

CALC:FSIM:BAL:PAR:STAT

SCPI Command

CALCulate<Ch>:FSIMulator:BALun:PARameter<Tr>:STATe {OFF|ON|0|1}

CALCulate<Ch>:FSIMulator:BALun:PARameter<Tr>:STATe?

Description

Turns the balun function for the specified trace ON/OFF.

command/query

Target

Trace <Tr> of channel <Ch>,

<Tr> = {[1]|2|...64}

<Ch>={[1]|2|...32}

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

0

Related Section of Operating Manual

Topology

Related Controls of User Interface

Fixture > Topology > Add Balanced Port

Back to CALCulate

CALC:FSIM:BAL:TOP:BAL

SCPI Command

CALCulate<Ch>:FSIMulator:BALun:TOPology:BALanced[:PPORts] <port1>,<port2>

CALCulate<Ch>:FSIMulator:BALun:TOPology:BALanced[:PPORts]?

Description

Sets or reads out the ports assigned to the balanced device when its type is "BALance".

command/query

Target

The channel <Ch>={[1]|2|...32}

Parameter

<port1>	First port number
<port2>	Second port number

Query Response

<port1>, <port2>

Preset Value

1, 2

Related Commands

CALC:FSIM:BAL:DEV

Related Section of Operating Manual

Topology

Related Controls of User Interface

Fixture > Topology > Add Balanced Port

Back to CALCulate

CALC:FSIM:BAL:TOP:BBAL

SCPI Command

CALCulate<Ch>:FSIMulator:BALun:TOPology:BBALanced[:PPORts]
<port1>,<port2>, <port3>,<port4>

CALCulate<Ch>:FSIMulator:BALun:TOPology:BBALanced[:PPORts]?

Description

Sets or reads out the ports assigned to the balanced device when its type is "BBALance".

command/query

Target

The channel <Ch>={[1]|2|...32}

Parameter

<port1>	First port number
<port2>	Second port number
<port3>	Third port number
<port4>	Fourth port number

Query Response

<port1>, <port2>, <port3>, <port4>

Preset Value

1, 2, 3, 4

Related Commands

CALC:FSIM:BAL:DEV

Related Section of Operating Manual

Topology

Related Controls of User Interface

Fixture > Topology > Add Balanced Port > Add Balanced Port

Back to CALCulate

CALC:FSIM:BAL:TOP:SBAL

SCPI Command

CALCulate<Ch>:FSIMulator:BALun:TOPology:SBALanced[:PPORts]
<port1>,<port2>, <port3>

CALCulate<Ch>:FSIMulator:BALun:TOPology:SBALanced[:PPORts]?

Description

Sets or reads out the ports assigned to the balanced device when its type is "SBALance".

command/query

Target

The channel <Ch>={[1]|2|...32}

Parameter

<port1> First port number

<port2> Second port number

<port3> Third port number

Query Response

<port1>, <port2>, <port3>

Preset Value

1, 2, 3

Related Commands

CALC:FSIM:BAL:DEV

Related Section of Operating Manual

Topology

Related Controls of User Interface

Fixture > Topology > Add Balanced Port > Add Single Ended Port

Back to CALCulate

CALC:FSIM:BAL:TOP:SSB

SCPI Command

CALCulate<Ch>:FSIMulator:BALun:TOPology:SSBalanced[:PPORts]
<port1>,<port2>, <port3>, <port4>

CALCulate<Ch>:FSIMulator:BALun:TOPology:SSBalanced[:PPORts]?

Description

Sets or reads out the ports assigned to the balanced device when its type is "SSBalance".

command/query

Target

The channel <Ch>={[1]|2|...32}

Parameter

<port1>	First port number
<port2>	Second port number
<port3>	Third port number
<port4>	Fourth port number

Query Response

<port1>, <port2>, <port3>, <port4>

Preset Value

1, 2, 3, 4

Related Commands

CALC:FSIM:BAL:DEV

Related Section of Operating Manual

Topology

Related Controls of User Interface

Fixture > Topology > Add Single Ended Port > Add Single Ended Port > Add Balanced Port

Back to CALCulate

CALC:FSIM:BAL:TOP:PROP:STAT

SCPI Command

CALCulate<Ch>:FSIMulator:BALun:TOPology:PROPerty:STATe {OFF|ON|0|1}

CALCulate<Ch>:FSIMulator:BALun:TOPology:PROPerty:STATe?

Description

Turns the BalUn property indication on the screen ON/OFF.
command/query

Target

The channel <Ch>={[1]|2|...32}

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

0

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to CALCulate

CALC:FSIM:EMB:ADD

SCPI Command

CALCulate<Ch>:FSIMulator:EMBed<cfg>:ADD

Description

Adds a new topology configuration for the 4-port network embedding/de-embedding feature. The new configuration is added to the list of topology configurations received by the CALC:FSIM:EMB:LIST? command with the topology type specified by the CALC:FSIM:EMB:TYPE command. If the type is not specified by the CALC:FSIM:EMB:TYPE command, the configuration gets a two-port topology type by default.

command only

Target

The channel <Ch>={[1]|2|...32}

Parameter

<cfg+1> the number of topology configurations received by the command CALC:FSIM:EMB:LIST? plus a new configuration to be added.

Related Commands

CALC:FSIM:EMB:LIST?

CALC:FSIM:EMB:TYPE

Related Section of Operating Manual

S4p Network Embedding/De-embedding

Related Controls of User Interface

Fixture > S4p De-embedding > {Two-ports | Three-ports | Four-ports}

Fixture > S4p De-embedding > Add a new topology (icon  at the top of S4p de-embedding wizard)

Back to CALCulate

CALC:FSIM:EMB:DEL

SCPI Command

CALCulate<Ch>:FSIMulator:EMBed<cfg>:DELete

Description

Deletes the topology configuration specified by the <cfg> parameter from the 4-port network embedding/de-embedding feature.

command only

Target

The channel <Ch>={[1]|2|...32}

Parameter

<cfg> the number of the topology configuration to be deleted

Related Section of Operating Manual

S4p Network Embedding/De-embedding

Related Controls of User Interface

Fixture > S4p De-embedding > Remove topology (icon  at the top of S4p de-embedding wizard)

Back to CALCulate

CALC:FSIM:EMB:LIST?

SCPI Command

CALCulate<Ch>:FSIMulator:EMBed:LIST?

Description

Reads out the list of topology configurations for the 4-port network embedding/de-embedding feature.

query only

Target

The channel <Ch>={[1]|2|...32}

Query response

<cfg> the number of topology configurations in SNVNA.

Related Section of Operating Manual

S4p Network Embedding/De-embedding

Related Controls of User Interface

None

Back to CALCulate

CALC:FSIM:EMB:NETW:FIL

SCPI Command

CALCulate<Ch>:FSIMulator:EMBed<cfg>:NETWork<Nk>:FILename <string>

CALCulate<Ch>:FSIMulator:EMBed<cfg>:NETWork<Nk>:FILename?

Description

Sets or reads out the name of 4-port touchstone file (*.S4P) of the 4-port network embedding/de-embedding feature. The file contains the circuit S-parameters in Touchstone format.

Note For integration with the old system of commands for S4VNA, a parameter <cfg> should not be used. As in the S4VNA, all previous topology configurations will be deleted in this case.

command/query

Target

The channel <Ch>={[1]|2|...32},

The Network <Nk>={[1]|2}

Parameter

<cfg> the number of the topology configuration

<srting>, up to 256 characters

Related Section of Operating Manual

S4p Network Embedding/De-embedding

Related Controls of User Interface

Fixture > S4p De-embedding > Select touchstone file (button in the VNA area)

Back to CALCulate

CALC:FSIM:EMB:NETW:TYPE

SCPI Command

CALCulate<Ch>:FSIMulator:EMBed<cfg>:NETWork<Nk>:TYPE <char>

CALCulate<Ch>:FSIMulator:EMBed<cfg>:NETWork<Nk>:TYPE?

Description

Selects the processing type of the 4-port network embedding/de-embedding feature.

Note For integration with the old system of commands for S4VNA, a parameter <cfg> should not be used. As in the S4VNA, all previous topology configurations will be deleted in this case.

command/query

Target

The channel <Ch>={[1]|2|...32},

The Network <Nk>={[1]|2}

Parameter

<cfg> the number of the topology configuration

<char> specifies processing type:

NONE	No processing
EMBed	Embedding
DEEMbed	De-Embedding

Query Response

{NONE|EMB|DEEM}

Preset Value

NONE

Related Section of Operating Manual

S4p Network Embedding/De-embedding

Related Controls of User Interface

Fixture > S4p De-embedding > Select touchstone file (button in VNA area) **> Mode {None| Embed| De-Embed}** (drop-down list in VNA area)

Back to CALCulate

CALC:FSIM:EMB:STAT

SCPI Command

CALCulate<Ch>:FSIMulator:EMBed:STATe {OFF|ON|0|1}

CALCulate<Ch>:FSIMulator:EMBed:STATe?

Description

Turns the 4-port network embedding/de-embedding feature ON/OFF.

command/query

Target

The channel <Ch>={[1]|2|...32}

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

0

Related Section of Operating Manual

S4p Network Embedding/De-embedding

Related Controls of User Interface

Fixture > S4p De-embedding {ON | OFF} (toggle button in the submenu)

Back to CALCulate

CALC:FSIM:EMB:TOP:A:PORT

SCPI Command

CALCulate<Ch>:FSIMulator:EMBed<cfg>:TOPology:A:PORTs <port1>,<port2>

CALCulate<Ch>:FSIMulator:EMBed<cfg>:TOPology:A:PORTs?

Description

Sets or reads out the test port assignment when the Topology is set to A (two-ports), for the 4-port network embedding/de-embedding feature.

Note For integration with the old system of commands for S4VNA, a parameter <cfg> should not be used. As in the S4VNA, all previous topology configurations will be deleted in this case.

command/query

Target

The channel <Ch>={[1]|2|...32}

Parameter

<cfg> the number of the topology configuration

<port1>	First port number
<port2>	Second port number

Query Response

<port1>, <port2>

Preset Value

1,2

Related Commands

CALC:FSIM:EMB:TYPE

Related Section of Operating Manual

S4p Network Embedding/De-embedding

Related Controls of User Interface

Fixture > S4p De-embedding > Two-ports > select the port number from 1 to n in the drop-down lists in the VNA area

Back to CALCulate

CALC:FSIM:EMB:TOP:B:PORT

SCPI Command

CALCulate<Ch>:FSIMulator:EMBed<cfg>:TOPology:B:PORTs
<port1>,<port2>,<port3>

CALCulate<Ch>:FSIMulator:EMBed<cfg>:TOPology:B:PORTs?

Description

Sets or reads out the test port assignment when the Topology is set to B (three-ports), for the 4-port network embedding/de-embedding feature.

Note For integration with the old system of commands for S4VNA, a parameter <cfg> should not be used. As in the S4VNA, all previous topology configurations will be deleted in this case.

command/query

Target

The channel <Ch>={[1]|2|...32}

Parameter

<cfg> the number of the topology configuration

<port1> First port number

<port2> Second port number

<port3> Third port number

Query Response

<port1>, <port2>, <port3>

Preset Value

1,2,3

Related Commands

CALC:FSIM:EMB:TYPE

Related Section of Operating Manual

S4p Network Embedding/De-embedding

Related Controls of User Interface

Fixture > S4p De-embedding > Three-ports > select the port number from 1 to n in the drop-down lists in VNA area

Back to CALCulate

CALC:FSIM:EMB:TOP:C:PORT

SCPI Command

CALCulate<Ch>:FSIMulator:EMBed<cfg>:TOPology:C:PORTs
<port1>,<port2>,<port3>, <port4>

CALCulate<Ch>:FSIMulator:EMBed<cfg>:TOPology:C:PORTs?

Description

Sets or reads out the test port assignment when the Topology is set to C (four-ports), for the 4-port network embedding/de-embedding feature.

Note For integration with the old system of commands for S4VNA, a parameter <cfg> should not be used. As in the S4VNA, all previous topology configurations will be deleted in this case.

command/query

Target

The channel <Ch>={[1]|2|...32}

Parameter

<cfg> the number of the topology configuration

<port1> First port number

<port2> Second port number

<port3> Third port number

<port4> Fourth port number

Query Response

<port1>, <port2>, <port3>, <port4>

Preset Value

1,2,3,4

Related Commands

CALC:FSIM:EMB:TYPE

Related Section of Operating Manual

S4p Network Embedding/De-embedding

Related Controls of User Interface

Fixture > S4p De-embedding > Four-ports > select the port number from 1 to n in the drop-down lists in VNA area

Back to CALCulate

CALC:FSIM:EMB:TYPE

SCPI Command

CALCulate<Ch>:FSIMulator:EMBed<cfg>:TYPE <char>

CALCulate<Ch>:FSIMulator:EMBed<cfg>:TYPE?

Description

Selects the topology type for the 4-port network embedding/de-embedding feature.

Note For integration with the old system of commands for S4VNA, a parameter <cfg> should not be used. As in the S4VNA, all previous topology configurations will be deleted in this case.

command/query

Target

The channel <Ch>={[1]|2|...32}

Parameter

<cfg> the number of the topology configuration

<char> Specifies topology type:

A	Two - ports topology
B	Three - ports topology
C	Four - ports topology

Query Response

{A|B|C}

Preset Value

A

Related Section of Operating Manual

S4p Network Embedding/De-embedding

Related Controls of User Interface

Fixture > S4p De-embedding > Two - ports | Three - ports | Four - ports (buttons in the Topology Type area in S4p de-embedding wizard)

Back to CALCulate

CALC:FSIM:SEND:DEEM:STAT

SCPI Command

CALCulate<Ch>:FSIMulator:SENDed:DEEMbed:STATe {OFF|ON|0|1}

CALCulate<Ch>:FSIMulator:SENDed:DEEMbed:STATe?

Description

Turns the 2-port network de–embedding function ON/OFF.

command/query

Target

The channel <Ch>={[1]|2|...32}

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

0

Related Section of Operating Manual

De-Embedding

Related Controls of User Interface

Fixture > De–Embedding {ON | OFF} (toggle button in the submenu)

Back to CALCulate

CALC:FSIM:SEND:DEEM:PORT:STAT

SCPI Command

CALCulate<Ch>:FSIMulator:SENDed:DEEMbed:PORT<Pt>:STATe {OFF|ON|0|1}

CALCulate<Ch>:FSIMulator:SENDed:DEEMbed:PORT<Pt>:STATe?

Description

Turns the 2-port network de–embedding function for specified port ON/OFF.
command/query

Target

Port <Pt> of channel <Ch>,

<Ch>={[1]|2|...32}

<Pt>={[1]|2|...P}, where P is 6/8/10/12/14/16 (depending on the Analyzer model, see corresponding datasheet).

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

0

Related Section of Operating Manual

De-Embedding

Related Controls of User Interface

Fixture > De–Embedding > select checkbox at the desired port **> USE {ON | OFF}**

Back to CALCulate

CALC:FSIM:SEND:DEEM:PORT:USER:FIL

SCPI Command

CALCulate<Ch>:FSIMulator:SENDed:DEEMbed:PORT<Pt>:USER:FILename <string>

CALCulate<Ch>:FSIMulator:SENDed:DEEMbed:PORT<Pt>:USER:FILename?

Description

Sets or reads out the name of the *.S2P file of the de-embedded circuit of the 2-port network de-embedding function. The file contains the circuit S-parameters in Touchstone format.

command/query

Target

Port <Pt> of channel <Ch>,

<Ch>={[1]|2|...32}

<Pt>={[1]|2|...P}, where P is 6/8/10/12/14/16 (depending on the Analyzer model, see corresponding datasheet).

Parameter

<srting>, up to 256 characters

Related Section of Operating Manual

De-Embedding

Related Controls of User Interface

Fixture > De–Embedding > select checkbox at the desired port **> USER FILE > Select touchstone file...**

Back to CALCulate

CALC:FSIM:SEND:PMC:STAT

SCPI Command

CALCulate<Ch>:FSIMulator:SENDed:PMCircuit:STATe {OFF|ON|0|1}

CALCulate<Ch>:FSIMulator:SENDed:PMCircuit:STATe?

Description

Turns the 2-port network embedding function ON/OFF.
command/query

Target

The channel <Ch>={[1]|2|...32}

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

0

Related Section of Operating Manual

Embedding

Related Controls of User Interface

Fixture > Embedding {ON | OFF} (toggle button in the submenu)

Back to CALCulate

CALC:FSIM:SEND:PMC:PORT:STAT

SCPI Command

CALCulate<Ch>:FSIMulator:SENDed:PMCircuit:PORT<Pt>:STATe {OFF|ON|0|1}

CALCulate<Ch>:FSIMulator:SENDed:PMCircuit:PORT<Pt>:STATe?

Description

Turns the 2-port network embedding function for each port ON/OFF.
command/query

Target

Port <Pt> of channel <Ch>,

<Ch>={[1]|2|...32}

<Pt>={[1]|2|...P}, where P is 6/8/10/12/14/16 (depending on the Analyzer model, see corresponding datasheet).

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

0

Related Section of Operating Manual

Embedding

Related Controls of User Interface

Fixture > Embedding > select checkbox at the desired port **> USE {ON | OFF}**

Back to CALCulate

CALC:FSIM:SEND:PMC:PORT:USER:FIL

SCPI Command

CALCulate<Ch>:FSIMulator:SENDed:PMCircuit:PORT<Pt>:USER:FILename <string>

CALCulate<Ch>:FSIMulator:SENDed:PMCircuit:PORT<Pt>:USER:FILename?

Description

Sets or reads out the name of the *.S2P file of the embedded circuit of the 2-port network embedding function. The file contains the circuit S-parameters in Touchstone format.

command/query

Target

Port <Pt> of channel <Ch>,

<Ch>={[1]|2|...32}

<Pt>={[1]|2|...P}, where P is 6/8/10/12/14/16 (depending on the Analyzer model, see corresponding datasheet).

Parameter

<srting>, up to 256 characters

Related Section of Operating Manual

Embedding

Related Controls of User Interface

Fixture > Embedding > select checkbox at the desired port **> USER FILE > Select touchstone file...**

Back to CALCulate

CALC:FSIM:SEND:ZCON:PORT:Z0

SCPI Command

CALCulate<Ch>:FSIMulator:SENDed:ZCONversion:PORT<Pt>:Z0[:R] <numeric>

CALCulate<Ch>:FSIMulator:SENDed:ZCONversion:PORT<Pt>:Z0[:R]?

Description

Sets or reads out the value of the impedance of the port impedance conversion function. The function sets the real part and zeroes the imaginary part of the port impedance.

command/query

Target

Port <Pt> of channel <Ch>,

<Ch>={[1]|2|...32}

<Pt>={[1]|2|...P}, where P is 6/8/10/12/14/16 (depending on the Analyzer model, see corresponding datasheet).

Parameter

<numeric> the impedance value from 1e–6 to 1e10

Unit

Ω (Ohm)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

50 Ω

Related Section of Operating Manual

Port Reference Impedance (Z) Conversion

Related Controls of User Interface

Fixture > Port ZConversion > select checkbox at the desired port **> REAL** (textbox)

Fixture > Port ZConversion > select checkbox at the desired port **> IMAG** (textbox)

Back to CALCulate

CALC:FSIM:SEND:ZCON:PORT:Z0:REAL

SCPI Command

CALCulate<Ch>:FSIMulator:SENDed:ZCONversion:PORT<Pt>:Z0:REAL <numeric>

CALCulate<Ch>:FSIMulator:SENDed:ZCONversion:PORT<Pt>:Z0:REAL?

Description

Sets or reads out the real part of the impedance of the port impedance conversion function.
command/query

Target

Port <Pt> of channel <Ch>,

<Ch>={[1]|2|...32}

<Pt>={[1]|2|...P}, where P is 6/8/10/12/14/16 (depending on the Analyzer model, see corresponding datasheet).

Parameter

<numeric> the impedance value from 1e–6 to 1e10.

Unit

Ω (Ohm)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

50 Ω

Related Section of Operating Manual

Port Reference Impedance (Z) Conversion

Related Controls of User Interface

Fixture > Port ZConversion > select checkbox at the desired port **> REAL** (textbox)

Back to CALCulate

CALC:FSIM:SEND:ZCON:PORT:Z0:IMAG

SCPI Command

CALCulate<Ch>:FSIMulator:SENDed:ZCONversion:PORT<Pt>:Z0:IMAGinary <numeric>

CALCulate<Ch>:FSIMulator:SENDed:ZCONversion:PORT<Pt>:Z0:IMAGinary?

Description

Sets or reads out the imaginary part of the impedance of the port impedance conversion function.

command/query

Target

Port <Pt> of channel <Ch>,

<Ch>={[1]|2|...32}

<Pt>={[1]|2|...P}, where P is 6/8/10/12/14/16 (depending on the Analyzer model, see corresponding datasheet).

Parameter

<numeric> the impedance value from 1e–6 to 1e10.

Unit

Ω (Ohm)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

0

Related Section of Operating Manual

Port Reference Impedance (Z) Conversion

Related Controls of User Interface

Fixture > Port ZConversion > select checkbox at the desired port **> IMAG** (textbox)

Back to CALCulate

CALC:FSIM:SEND:ZCON:STAT

SCPI Command

CALCulate<Ch>:FSIMulator:SENDed:ZCONversion:STATe {OFF|ON|0|1}

CALCulate<Ch>:FSIMulator:SENDed:ZCONversion:STATe?

Description

Turns the port impedance conversion function ON/OFF.
command/query

Target

The channel <Ch>={[1]|2|...32}

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

0

Related Section of Operating Manual

Port Reference Impedance (Z) Conversion

Related Controls of User Interface

Fixture > Port ZConversion {ON | OFF} (toggle button in the submenu)

Back to CALCulate

CALC:FSIM:SEND:ZCON:THE

SCPI Command

CALCulate<Ch>:FSIMulator:SENDed:ZCONversion:THEory {TRAVelling | POWer}

CALCulate<Ch>:FSIMulator:SENDed:ZCONversion:THEory?

Description

Selects the method of the S-parameters Re-normalization (Port Z Conversion).

command/query

Target

The channel <Ch>={[1]|2|...32}

Parameter

<char> Specifies Theory:

TRAVelling	The travelling waves method
POWer	The power waves method

Query Response

{TRAV|POV}

Preset Value

TRAV

Related Section of Operating Manual

Port Reference Impedance (Z) Conversion

Related Controls of User Interface

Fixture > Port ZConversion > Method {Travelling Waves | Power Waves}

Back to CALCulate

CALC:FUNC:DATA?

SCPI Command

CALCulate<Ch>[:SELected]:FUNCtion:DATA?

Or

CALCulate<Ch>:TRACe<Tr>:FUNCtion:DATA?

Description

Reads out the data array, which is the CALC:FUNC:EXEC command analysis result.

The array size is 2N, where N is the number of points.

For the n-th point, where n from 1 to N:

<numeric 2n–1> the response value in n-th measurement point;

<numeric 2n> the stimulus value in n-th measurement point. Always set to 0 for the analysis of mean value, standard deviation, and peak-to-peak value.

query only

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Query Response

<numeric 1>, <numeric 2>, …<numeric 2N>

Related Commands

CALC:FUNC:EXEC

CALC:FUNC:POIN?

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to CALCulate

CALC:FUNC:DOM

SCPI Command

CALCulate<Ch>[:SELected]:FUNCtion:DOMain[:STATe] {OFF|ON|0|1}

CALCulate<Ch>[:SELected]:FUNCtion:DOMain[:STATe]?

Or

CALCulate<Ch>:TRACe<Tr>:FUNCtion:DOMain[:STATe] {OFF|ON|0|1}

CALCulate<Ch>:TRACe<Tr>:FUNCtion:DOMain[:STATe]?

Description

Specifies whether an arbitrary range or the entire sweep range is used when the CALC:FUNC:EXEC command is executed.

command/query

Target

All traces of channel <Ch> (if the coupling is set to ON by the CALC:FUNC:DOM:COUP command),

Or

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

Select the following:

{ON|1}	Arbitrary range
{OFF|0}	Entire sweep range

Query Response

{0|1}

Preset Value

0

Related Commands

CALC:FUNC:EXEC

CALC:FUNC:DOM:COUP

Related Section of Operating Manual

None

Related Controls of User Interface

None

CALC:FUNC:DOM:COUP

SCPI Command

CALCulate<Ch>[:SELected]:FUNCtion:DOMain:COUPle {OFF|ON|0|1}

CALCulate<Ch>[:SELected]:FUNCtion:DOMain:COUPle?

Or

CALCulate<Ch>:TRACe<Tr>:FUNCtion:DOMain:COUPle {OFF|ON|0|1}

CALCulate<Ch>:TRACe<Tr>:FUNCtion:DOMain:COUPle?

Description

If the arbitrary range is turned ON by the CALC:FUNC:DOM command, specifies whether all traces of the channel use the same range (coupling) or if each trace uses an individual range when the CALC:FUNC:EXEC command is executed.

command/query

Target

All traces of channel <Ch>,

<Ch>={[1]|2|...32}

Parameter

{ON|1} ON

{OFF|0} OFF

Query Response

{0|1}

Preset Value

0

Related Commands

CALC:FUNC:EXEC

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to CALCulate

CALC:FUNC:DOM:STAR

SCPI Command

CALCulate<Ch>[:SELected]:FUNCtion:DOMain:STARt <stimulus>

CALCulate<Ch>[:SELected]:FUNCtion:DOMain:STARt?

Or

CALCulate<Ch>:TRACe<Tr>:FUNCtion:DOMain:STARt <stimulus>

CALCulate<Ch>:TRACe<Tr>:FUNCtion:DOMain:STARt?

Description

Sets the start value of the analysis range of the CALC:FUNC:EXEC command.
command/query

Target

All traces of channel <Ch> (if the coupling is set to ON by the CALC:FUNC:DOM:COUP command),

Or

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

<stimulus> the start value of analysis range

Unit

Hz |s |dBm

Query Response

<numeric>

Preset Value

0

Related Commands

CALC:FUNC:DOM

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to CALCulate

CALC:FUNC:EXEC

SCPI Command

CALCulate<Ch>[:SELected]:FUNCtion:EXECute

Or

CALCulate<Ch>:TRACe<Tr>:FUNCtion:EXECute

Description

Executes the analysis specified by the CALC:FUNC:TYPE command.

The analysis result can be read out by the CALC:FUNC:DATA? command.

command only

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Related Commands

CALC:FUNC:TYPE

CALC:FUNC:DATA?

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to CALCulate

CALC:FUNC:DOM:STOP

SCPI Command

CALCulate<Ch>[:SELected]:FUNCtion:DOMain:STOP <stimulus>

CALCulate<Ch>[:SELected]:FUNCtion:DOMain:STOP?

Or

CALCulate<Ch>:TRACe<Tr>:FUNCtion:DOMain:STOP <stimulus>

CALCulate<Ch>:TRACe<Tr>:FUNCtion:DOMain:STOP?

Description

Sets the stop value of the analysis range of the CALC:FUNC:EXEC command.
command/query

Target

All traces of channel <Ch> (if the coupling is set to ON by the CALC:FUNC:DOM:COUP command),

Or

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

<stimulus> the start value of analysis range

Unit

Hz |s |dBm

Query Response

<numeric>

Preset Value

0

Related Commands

CALC:FUNC:DOM

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to CALCulate

CALC:FUNC:PEXC

SCPI Command

CALCulate<Ch>[:SELected]:FUNCtion:PEXCursion <numeric>

CALCulate<Ch>[:SELected]:FUNCtion:PEXCursion?

Or

CALCulate<Ch>:TRACe<Tr>:FUNCtion:PEXCursion <numeric>

CALCulate<Ch>:TRACe<Tr>:FUNCtion:PEXCursion?

Description

Sets the lower limit for the peak excursion value when executing the peak search with the CALC:FUNC:EXEC command.

command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

<numeric> the lower limit of the peak excursion value, varies depending on the data format

Unit

dB |° |s

Query Response

<numeric>

Preset Value

3.0

Related Commands

CALC:FUNC:EXEC

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to CALCulate

CALC:FUNC:POIN?

SCPI Command

CALCulate<Ch>[:SELected]:FUNCtion:POINts?

Or

CALCulate<Ch>:TRACe<Tr>:FUNCtion:POINts?

Description

Reads out the number of points (data pairs) of the analysis result by the CALC:FUNC:EXEC command.

Always reads out 1, when the search is executed for the maximum, minimum, mean, standard deviation, peak, and peak-to-peak values. The actual number of points is read out, when the search is executed for all peak or all targets.

query only

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Query Response

<numeric>

Related Commands

CALC:FUNC:EXEC

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to CALCulate

CALC:FUNC:PPOL

SCPI Command

CALCulate<Ch>[:SELected]:FUNCtion:PPOLarity <char>

CALCulate<Ch>[:SELected]:FUNCtion:PPOLarity?

Or

CALCulate<Ch>:TRACe<Tr>:FUNCtion:PPOLarity <char>

CALCulate<Ch>:TRACe<Tr>:FUNCtion:PPOLarity?

Description

Selects the polarity when performing the peak search with the CALC:FUNC:EXEC command.

command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

<char> Specifies the polarity:

POSitive	Positive peaks
NEGative	Negative peaks
BOTH	Both positive peaks and negative peaks

Query Response

{POS|NEG|BOTH}

Preset Value

POS

Related Commands

CALC:FUNC:EXEC

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to CALCulate

CALC:FUNC:TARG

SCPI Command

CALCulate<Ch>[:SELected]:FUNCtion:TARGet <numeric>

CALCulate<Ch>[:SELected]:FUNCtion:TARGet?

Or

CALCulate<Ch>:TRACe<Tr>:FUNCtion:TARGet <numeric>

CALCulate<Ch>:TRACe<Tr>:FUNCtion:TARGet?

Description

Selects the target level when performing the search for the trace and the target level crosspoints with the CALC:FUNC:EXEC command.

command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

<numeric> the target value, varies depending on the data format.

Unit

dB |° |s

Query Response

<numeric>

Preset Value

0

Related Commands

CALC:FUNC:EXEC

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to CALCulate

CALC:FUNC:TTR

SCPI Command

CALCulate<Ch>[:SELected]:FUNCtion:TTRansition <char>

CALCulate<Ch>[:SELected]:FUNCtion:TTRansition?

Or

CALCulate<Ch>:TRACe<Tr>:FUNCtion:TTRansition <char>

CALCulate<Ch>:TRACe<Tr>:FUNCtion:TTRansition?

Description

Selects the transition type when performing the search for the trace and the target level crosspoints with the CALC:FUNC:EXEC command.

command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

<char> Specifies the transition:

POSitive	Positive peaks
NEGative	Negative peaks
BOTH	Both positive peaks and negative peaks

Query Response

{POS|NEG|BOTH}

Preset Value

POS

Related Commands

CALC:FUNC:EXEC

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to CALCulate

CALC:FUNC:TYPE

SCPI Command

CALCulate<Ch>[:SELected]:FUNCtion:TYPE <char>

CALCulate<Ch>[:SELected]:FUNCtion:TYPE?

Or

CALCulate<Ch>:TRACe<Tr>:FUNCtion:TYPE <char>

CALCulate<Ch>:TRACe<Tr>:FUNCtion:TYPE?

Description

Selects the type of analysis executed with the CALC:FUNC:EXEC command.
command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

<char> Specifies the transition:

PTPeak	Peak–to–peak (difference between the maximum value and the minimum value)
STDEV	Standard deviation
MEAN	Mean value

MAXimum	Maximum value
MINimum	Minimum value
PEAK	Search for peak
APEak	Search for all the peaks
ATARget	Search for all targets

Query Response

{PTP|STDEV|MEAN|MAX|MIN|PEAK|APE|ATAR}

Preset Value

PTP

Related Commands

CALC:FUNC:EXEC

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to CALCulate

CALC:HOLD:TYPE

SCPI Command

CALCulate<Ch>[:SELected]:HOLD:TYPE <char>

CALCulate<Ch>[:SELected]:HOLD:TYPE?

Or

CALCulate<Ch>:TRACe<Tr>:HOLD:TYPE <char>

CALCulate<Ch>:TRACe<Tr>:HOLD:TYPE?

Description

Sets the type of the trace hold function. The function holds the trace at the maximum or minimum point.

command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

<char> Specifies the type of the trace hold function:

OFF	Turns off the trace hold function
MAXimum	Maximum hold
MINimum	Minimum hold

Query Response

{OFF|MAX|MIN}

Preset Value

OFF

Related Commands

CALC:HOLD:CLEar

Related Section of Operating Manual

Trace Hold

Related Controls of User Interface

Average > Max | Min | Off (buttons in TRACE HOLD accordion)

Back to CALCulate

CALC:HOLD:CLE

SCPI Command

CALCulate<Ch>[:SELected]:HOLD:CLEar

Or

CALCulate<Ch>:TRACe<Tr>:HOLD:CLEar

Description

This command restarts the trace hold function.
command only

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Related Commands

CALC:HOLD:TYPE

Related Section of Operating Manual

Trace Hold

Related Controls of User Interface

Average > Max | Min (buttons in TRACE HOLD accordion)

Back to CALCulate

CALC:LIM

SCPI Command

CALCulate<Ch>[:SELected]:LIMit[:STATe] {OFF|ON|0|1}

CALCulate<Ch>[:SELected]:LIMit[:STATe]?

Or

CALCulate<Ch>:TRACe<Tr>:LIMit[:STATe] {OFF|ON|0|1}

CALCulate<Ch>:TRACe<Tr>:LIMit[:STATe]?

Description

Turns the limit test ON/OFF.
command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

{ON|1} ON

{OFF|0} OFF

Query Response

{0|1}

Preset Value

0

Related Section of Operating Manual

Limit Test

Related Controls of User Interface

Limit Tests > LIMIT TEST {ON | OFF} (toggle button in LIMIT TEST accordion)

Back to CALCulate

CALC:LIM:DATA

SCPI Command

CALCulate<Ch>[:SELected]:LIMit:DATA <numeric list>

CALCulate<Ch>[:SELected]:LIMit:DATA?

Or

CALCulate<Ch>:TRACe<Tr>:LIMit:DATA <numeric list>

CALCulate<Ch>:TRACe<Tr>:LIMit:DATA?

Description

Sets the data array, which is the limit line in the limit test function.

The array size is 1 + 5N, where N is the number of limit line segments.

For the n-th point, where n from 1 to N:

<numeric 1> the number of limit line segments N is from 0 to 100. Setting 0 clears the limit line.

<numeric 5n–3> type of the n-th limit line segment:

0: Off.

1: Upper limit

2: Lower limit

3: Single Point limit

<numeric 5n–2> the stimulus value in the start point of the n-th segment

<numeric 5n–1> the stimulus value in the end point of the n-th segment

<numeric 5n–0> the response value in the start point of the n-th segment

<numeric 5n+1> the response value in the end point of the n-th segment

Note If the array size is not 1 + 5N, where N is <numeric 1>, an error occurs. If <numeric 5n–3> is less than 0 or more than 2, an error occurs. When <numeric 5n–2>, <numeric 5n–1>, <numeric 5n–0>, and <numeric 5n+1> elements are out of allowable range, the value is set to the limit, which is closer to the specified value.

command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Query Response

<numeric 1>, <numeric 2>, …<numeric 5N+1>

Related Section of Operating Manual

Limit Test

Related Controls of User Interface

Limit Tests > Show Limit Table (checkbox in LIMIT TEST accordion) **> Add Limit line** (icon  in the LIMIT TABLE in the window channel)

Back to CALCulate

CALC:LIM:DISP

SCPI Command

CALCulate<Ch>[:SELected]:LIMit:DISPlay[:STATe] {OFF|ON|0|1}

CALCulate<Ch>[:SELected]:LIMit:DISPlay[:STATe]?

Or

CALCulate<Ch>:TRACe<Tr>:LIMit:DISPlay[:STATe] {OFF|ON|0|1}

CALCulate<Ch>:TRACe<Tr>:LIMit:DISPlay[:STATe]?

Description

Turns the limit line display of the limit test function ON/OFF.
command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

{ON|1} ON

{OFF|0} OFF

Query Response

{0|1}

Preset Value

0

Related Section of Operating Manual

Limit Test

Related Controls of User Interface

Limit Tests > Show Lines (checkbox in LIMIT TEST accordion)

Back to CALCulate

CALC:LIM:FAIL?

SCPI Command

CALCulate<Ch>[:SELected]:LIMit:FAIL?

Or

CALCulate<Ch>:TRACe<Tr>:LIMit:FAIL?

Description

Reads out the limit test result.
query only

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

1	Fail
0	Pass

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to CALCulate

CALC:LIM:REP:ALL?

SCPI Command

CALCulate<Ch>[:SELected]:LIMit:REPort:ALL?

Or

CALCulate<Ch>:TRACe<Tr>:LIMit:REPort:ALL?

Description

Reads out the limit test result report.

The array size is 4N, where N is the number of measurement points.

For the n-th point, where n from 1 to N:

<numeric 4n–3> the stimulus value in the n-th point;

<numeric 4n–2> the limit test result in the n-th point;

–1: No limit

0: Fail

1: Pass

<numeric 4n–1> the upper limit value in the n-th point (0 — if there is no limit)

<numeric 4n–0> the lower limit value in the n-th point (0 — if there is no limit)

query only

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Query Response

<numeric 1>, <numeric 2>, …<numeric 4N>

Related Commands

FORM:DATA

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to CALCulate

CALC:LIM:REP:POIN?

SCPI Command

CALCulate<Ch>[:SELected]:LIMit:REPort:POINts?

Or

CALCulate<Ch>:TRACe<Tr>:LIMit:REPort:POINts?

Description

Reads out the number of the measurement points that failed the limit test.

The stimulus data array of these points can be read out by the CALC:LIM:REP? command.

query only

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Query Response

<numeric>

Related Commands

CALC:LIM:REP?

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to CALCulate

CALC:LIM:REP?

SCPI Command

CALCulate<Ch>[:SELected]:LIMit:REPort[:DATA]?

Or

CALCulate<Ch>:TRACe<Tr>:LIMit:REPort[:DATA]?

Description

Reads out the data array, which is the stimulus values of the measurement points that failed the limit test.

The array size is set by the CALC:LIM:REP:POIN? command.

query only

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Query Response

<numeric 1>, <numeric 2>,…<numeric N>

Related Commands

CALC:LIM:REP:POIN?

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to CALCulate

CALC:MARK

SCPI Command

CALCulate<Ch>[:SELected]:MARKer<Mk>[:STATe] {OFF|ON|0|1}

CALCulate<Ch>[:SELected]:MARKer<Mk>[:STATe]?

Or

CALCulate<Ch>:TRACe<Tr>:MARKer<Mk>[:STATe] {OFF|ON|0|1}

CALCulate<Ch>:TRACe<Tr>:MARKer<Mk>[:STATe]?

Description

Turns the marker ON/OFF.

Turning ON a marker with the number from 1 to 63 will turn ON all the markers of smaller numbers. Turning OFF a marker with the number from 1 to 63 will turn OFF all the markers of greater numbers (except of the reference marker with number 64). Turning ON/OFF the reference marker with number 64 does not turn ON/OFF the markers with the numbers from 1 to 63, but switches these markers between relative and absolute measurement mode.

command/query

Target

Marker <Mk> of the active trace of channel <Ch>,

Or

Marker <Mk> of the trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

<Mk> = {[1]|2|...64}

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

0

Related Section of Operating Manual

Markers

Related Controls of User Interface

Marker > Add | Delete

Marker > Reference Marker (checkbox)

Back to CALCulate

CALC:MARK:ACT

SCPI Command

CALCulate<Ch>[:SELected]:MARKer<Mk>:ACTivate

Or

CALCulate<Ch>:TRACe<Tr>MARKer<Mk>:ACTivate

Description

Sets the active marker.

If the marker is not ON, this function will turn the marker ON. Turning ON a marker with the number from 1 to 63 will turn ON all the markers of smaller numbers. Turning ON the reference marker with number 64 does not turn ON the markers with the numbers from 1 to 63, but switches these markers to the relative measurement mode.

command only

Target

Marker <Mk> of the active trace of channel <Ch>,

Or

Marker <Mk> of the trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

<Mk> = {[1]|2|...64}

Related Commands

SERV:CHAN:TRAC:MARK:ACT?

Related Section of Operating Manual

Markers

Related Controls of User Interface

Marker > Add > Active Marker > Marker n (drop-down list)

Marker > Reference Marker (checkbox)

Back to CALCulate

CALC:MARK:BWID

SCPI Command

CALCulate<Ch>[:SELected]:MARKer:BWIDth[:STATe] {OFF|ON|0|1}

CALCulate<Ch>[:SELected]:MARKer:BWIDth[:STATe]?

Or

CALCulate<Ch>:TRACe<Tr>:MARKer:BWIDth[:STATe] {OFF|ON|0|1}

CALCulate<Ch>:TRACe<Tr>:MARKer:BWIDth[:STATe]?

Description

Turns the bandwidth search function ON/OFF.
command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

{ON|1} ON

{OFF|0} OFF

Query Response

{0|1}

Preset Value

0

Related Section of Operating Manual

Bandwidth Search

Related Controls of User Interface

Marker Math > BANDWIDTH SEARCH {ON | OFF} (toggle button in BANDWIDTH SEARCH accordion)

Back to CALCulate

CALC:MARK:BWID:DATA?

SCPI Command

CALCulate<Ch>[:SELected]:MARKer<Mk>:BWIDth:DATA?

Or

CALCulate<Ch>:TRACe<Tr>:MARKer<Mk>:BWIDth:DATA?

Description

Reads out the bandwidth search result.

The bandwidth search can be performed relatively to the marker <Mk>, or relatively to the absolute maximum value of the trace (in this case the number of the marker is ignored), what is set by the CALC:MARK:BWID:REF command.

The data include 4 elements:

<numeric 1> Bandwidth;

<numeric 2> Center frequency;

<numeric 3> Q value;

<numeric 4> Loss.

Note If the bandwidth search is impossible, all the read-out values are 0. If the search is performed relatively to a maker, which is OFF, an error occurs.

query only

Target

Marker <Mk> of the active trace of channel <Ch>,

Or

Marker <Mk> of the trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

<Mk> = {[1]|2|...64}

Query Response

<numeric 1>, <numeric 2>, …<numeric 4>

Related Commands

CALC:MARK:BWID:REF

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to CALCulate

CALC:MARK:BWID:REF

SCPI Command

CALCulate<Ch>[:SELected]:MARKer:BWIDth:REFerence <char>

CALCulate<Ch>[:SELected]:MARKer:BWIDth:REFerence?

Or

CALCulate<Ch>:TRACe<Tr>:MARKer:BWIDth:REFerence <char>

CALCulate<Ch>:TRACe<Tr>:MARKer:BWIDth:REFerence?

Description

Selects the reference for the bandwidth search function: reference marker or absolute maximum value of the trace.

command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

<char> Choose from:

MARKer	Bandwidth search relative to the reference marker
MAXimum	Bandwidth search relative to the absolute maximum of the trace
MINimum	Bandwidth search relative to the absolute minimum of the trace

Query Response

{MAX|MARK|MIN}

Preset Value

MAX

Related Section of Operating Manual

Bandwidth Search

Related Controls of User Interface

Marker Math > Search Reference {Marker | Maximum | Minimum} (drop-down list in BANDWIDTH SEARCH accordion)

Back to CALCulate

CALC:MARK:BWID:THR

SCPI Command

CALCulate<Ch>[:SELected]:MARKer<Mk>:BWIDth:THReshold <numeric>

CALCulate<Ch>[:SELected]:MARKer<Mk>:BWIDth:THReshold?

Or

CALCulate<Ch>:TRACe<Tr>:MARKer<Mk>:BWIDth:THReshold <numeric>

CALCulate<Ch>:TRACe<Tr>:MARKer<Mk>:BWIDth:THReshold?

Description

Sets the bandwidth search threshold value.
command/query

Target

Marker <Mk> of the active trace of channel <Ch>,

Or

Marker <Mk> of the trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

<Mk> = {[1]|2|...64}

Parameter

<numeric> the bandwidth definition value, the range varies depending on the data format.

Unit

dB |° |s

Query Response

<numeric>

Preset Value

-3.0

Related Section of Operating Manual

Bandwidth Search

Related Controls of User Interface

Marker Math > Bandwidth Value (textbox in BANDWIDTH SEARCH accordion)

Back to CALCulate

CALC:MARK:BWID:TYPE

SCPI Command

CALCulate<Ch>[:SELected]:MARKer:BWIDth:TYPE <char>

CALCulate<Ch>[:SELected]:MARKer:BWIDth:TYPE?

Or

CALCulate<Ch>:TRACe<Tr>:MARKer:BWIDth:TYPE <char>

CALCulate<Ch>:TRACe<Tr>:MARKer:BWIDth:TYPE?

Description

Sets the type of the bandwidth search function.

command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

<char> Specifies the type of the bandwidth:

BPASs	Bandpass
NOTCh	Notch

Query Response

{BPAS|NOTC}

Preset Value

BPAS

Related Section of Operating Manual

Bandwidth Search

Related Controls of User Interface

Marker Math > Type {Bandpass | Notch} (drop-down list in BANDWIDTH SEARCH accordion)

Back to CALCulate

CALC:MARK:COUN

SCPI Command

CALCulate<Ch>[:SELected]:MARKer:COUNt <numeric>

CALCulate<Ch>[:SELected]:MARKer:COUNt?

Or

CALCulate<Ch>:TRACe<Tr>:MARKer:COUNt <numeric>

CALCulate<Ch>:TRACe<Tr>:MARKer:COUNt?

Description

Sets the number of turned ON markers.

Note Choosing 64 turns on the reference marker and sets the markers 1 to 63 to the relative values.

command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

<numeric>, range from 0 to 64

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

0

Related Section of Operating Manual

Markers

Related Controls of User Interface

None

Back to CALCulate

CALC:MARK:COUP

SCPI Command

CALCulate<Ch>[:SELected]:MARKer:COUPle {OFF|ON|0|1}

CALCulate<Ch>[:SELected]:MARKer:COUPle?

Or

CALCulate<Ch>:TRACe<Tr>:MARKer:COUPle {OFF|ON|0|1}

CALCulate<Ch>:TRACe<Tr>:MARKer:COUPle?

Description

Turns the marker coupling between traces ON/OFF. When coupled, the markers of different traces but with the same number track the X-axis position.

command/query

Target

All the traces of channel <Ch>,

<Ch>={[1]|2|...32}

Parameter

{ON|1} ON

{OFF|0} OFF

Query Response

{0|1}

Preset Value

1

Related Section of Operating Manual

Marker Coupling Feature

Related Controls of User Interface

Marker > Add > Coupled Markers (checkbox in MARKER PROPERTIES accordion)

Back to CALCulate

CALC:MARK:DATA?

SCPI Command

CALCulate<Ch>[:SELected]:MARKer:DATA?

Or

CALCulate<Ch>:TRACe<Tr>:MARKer:DATA?

Description

Reads out the data array of all turned ON markers.

The array size is 3N+1, where N is the number of turned ON markers including the reference marker. If the reference marker is turned ON the last three elements of array contain the reference marker data and the rest elements of array contain the relative values.

For the n-th marker, where n from 1 to N:

<numeric 1> the number of turned ON markers including the reference marker (N);

<numeric 3n-1> the stimulus value of the n-th marker;

<numeric 3n> the real data in rectangular format, real part in polar and Smith chart formats of the n-th marker;

<numeric 3n+1> 0 in rectangular format, imaginary part in polar and Smith chart formats of the n-th marker.

query only

Target

CALCulate<Ch>[:SELected] — All markers of the active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr>— All markers of the trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

All markers of the active trace of channel <Ch>,

<Ch>={[1]|2|...32}

Query Response

<numeric 1>, <numeric 2>, …<numeric 3N+1>

Related Commands

CALC:MARK:COUN

FORM:DATA

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to CALCulate

CALC:MARK:DISC

SCPI Command

CALCulate<Ch>[:SELected]:MARKer:DISCrete {OFF|ON|0|1}

CALCulate<Ch>[:SELected]:MARKer:DISCrete?

Or

CALCulate<Ch>:TRACe<Tr>:MARKer:DISCrete {OFF|ON|0|1}

CALCulate<Ch>:TRACe<Tr>:MARKer:DISCrete?

Description

Turns the marker discrete mode ON/OFF.
command/query

Target

All traces of channel <Ch> (if the marker coupling is set to ON by the CALC:MARK:COUP command),

Or

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

{ON|1} ON

{OFF|0} OFF

Query Response

{0|1}

Preset Value

1

Related Section of Operating Manual

Marker Discrete Mode

Related Controls of User Interface

Marker > Add > Discrete Markers (checkbox in MARKER PROPERTIES accordion)

Back to CALCulate

CALC:MARK:FUNC:DOM

SCPI Command

CALCulate<Ch>[:SELected]:MARKer:FUNCtion:DOMain[:STATe] {OFF|ON|0|1}

CALCulate<Ch>[:SELected]:MARKer:FUNCtion:DOMain[:STATe]?

Or

CALCulate<Ch>:TRACe<Tr>:MARKer:FUNCtion:DOMain[:STATe] {OFF|ON|0|1}

CALCulate<Ch>:TRACe<Tr>:MARKer:FUNCtion:DOMain[:STATe]?

Description

Turns the state of the arbitrary range when executing the marker search ON/OFF. If the state of an arbitrary range is ON, marker search is performed in the range specified by the CALC:MARK:FUNC:DOM:STAR, CALC:MARK:FUNC:DOM:STOP commands. Otherwise, the search is performed over the entire sweep range.

command/query

Target

All traces of channel <Ch> (if the marker search range coupling is set to ON by the CALC:MARK:FUNC:DOM:COUP command),

Or

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

{ON|1}	Arbitrary range
{OFF|0}	Entire sweep range

Query Response

{0|1}

Preset Value

0

Related Section of Operating Manual

Search Range

Related Controls of User Interface

Marker > Add > Search Range (checkbox in SEARCH accordion)

Back to CALCulate

CALC:MARK:FUNC:DOM:COUP

SCPI Command

CALCulate<Ch>[:SELected]:MARKer:FUNCtion:DOMain:COUPle {OFF|ON|0|1}

CALCulate<Ch>[:SELected]:MARKer:FUNCtion:DOMain:COUPle?

Or

CALCulate<Ch>:TRACe<Tr>:MARKer:FUNCtion:DOMain:COUPle {OFF|ON|0|1}

CALCulate<Ch>:TRACe<Tr>:MARKer:FUNCtion:DOMain:COUPle?

Description

Turns the state of the marker search range coupling for different traces ON/OFF. If the arbitrary search range turned ON by the CALC:MARK:FUNC:DOM command, specifies whether (coupling) or each trace uses individual range when the marker search is performed.

command/query

Target

All the traces of channel <Ch>,

<Ch>={[1]|2|...32}

Parameter

Specifies the state of the marker search range coupling:

{ON|1} All traces of channel use the same range

{OFF|0} Each trace uses individual range

Query Response

{0|1}

Preset Value

1

Related Section of Operating Manual

Search Range

Related Controls of User Interface

Marker > Add > Coupled Range (checkbox in SEARCH accordion)

Back to CALCulate

CALC:MARK:FUNC:DOM:STAR

SCPI Command

CALCulate<Ch>[:SELected]:MARKer:FUNCtion:DOMain:STARt <stimulus>

CALCulate<Ch>[:SELected]:MARKer:FUNCtion:DOMain:STARt?

Or

CALCulate<Ch>:TRACe<Tr>:MARKer:FUNCtion:DOMain:STARt <stimulus>

CALCulate<Ch>:TRACe<Tr>:MARKer:FUNCtion:DOMain:STARt?

Description

Sets or reads out the start value of the marker search range.

command/query

Target

All traces of channel <Ch> (if the marker search range coupling is set to ON by the CALC:MARK:FUNC:DOM:COUP command),

Or

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

<stimulus> the start value of the marker search.

Unit

Hz | s | dBm

Query Response

<numeric>

Preset Value

Lower limit of the analyzer frequency range.

Related Section of Operating Manual

Search Range

Related Controls of User Interface

Marker > Add > Search Range (select checkbox in SEARCH accordion) **> Start Range**

Back to CALCulate

CALC:MARK:FUNC:DOM:STOP

SCPI Command

CALCulate<Ch>[:SELected]:MARKer:FUNCtion:DOMain:STOP <stimulus>

CALCulate<Ch>[:SELected]:MARKer:FUNCtion:DOMain:STOP?

Or

CALCulate<Ch>:TRACe<Tr>:MARKer:FUNCtion:DOMain:STOP <stimulus>

CALCulate<Ch>:TRACe<Tr>:MARKer:FUNCtion:DOMain:STOP?

Description

Sets or reads out the stop value of the marker search range.
command/query

Target

All traces of channel <Ch> (if the marker search range coupling is set to ON by the CALC:MARK:FUNC:DOM:COUP command),

Or

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

<stimulus> the stop value of the marker search.

Unit

Hz | s | dBm

Query Response

<numeric>

Preset Value

Upper limit of the analyzer frequency range.

Related Section of Operating Manual

Search Range

Related Controls of User Interface

Marker> Add > Search Range (select checkbox in SEARCH accordion) **> Stop Range**

Back to CALCulate

CALC:MARK:FUNC:EXEC

SCPI Command

CALCulate<Ch>[:SELected]:MARKer<Mk>:FUNCtion:EXECute

Or

CALCulate<Ch>:TRACe<Tr>:MARKer<Mk>:FUNCtion:EXECute

Description

Executes the marker search according to the specified criterion. The type of the marker search is set by the CALC:MARK:FUNC:TYPE command.

command only

Target

Marker <Mk> of the active trace of channel <Ch>,

Or

Marker <Mk> of the trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

<Mk> = {[1]|2|...64}

Related Commands

CALC:MARK:FUNC:TYPE

CALC:MARK:FUNC:DOM

Related Section of Operating Manual

Marker Position Search Functions

Related Controls of User Interface

Marker > Max | Min (buttons in SEARCH accordion)

Marker > Peak > **Left | Nearest | Max | Right** (buttons in SEARCH accordion)

Marker > Targ > Left | Nearest | Right (buttons in SEARCH accordion)

Back to CALCulate

CALC:MARK:FUNC:PEXC

SCPI Command

CALCulate<Ch>[:SELected]:MARKer<Mk>:FUNCtion:PEXCursion <numeric>

CALCulate<Ch>[:SELected]:MARKer<Mk>:FUNCtion:PEXCursion?

Or

CALCulate<Ch>:TRACe<Tr>:MARKer<Mk>:FUNCtion:PEXCursion <numeric>

CALCulate<Ch>:TRACe<Tr>:MARKer<Mk>:FUNCtion:PEXCursion?

Description

Sets or reads out the peak excursion value when the marker peak search is performed by the CALC:MARK:FUNC:EXEC command.

command/query

Target

Marker <Mk> of the active trace of channel <Ch>,

Or

Marker <Mk> of the trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

<Mk> = {[1]|2|...64}

Parameter

<numeric> the peak excursion value, the range varies depending on the data format.

Unit

dB | ° | s

Query Response

<numeric>

Preset Value

1

Related Section of Operating Manual

Search for Peak

Related Controls of User Interface

Marker > Add > Peak (button in SEARCH accordion) **> Peak Excursion** (textbox)

Back to CALCulate

CALC:MARK:FUNC:PPOL

SCPI Command

CALCulate<Ch>[:SELected]:MARKer<Mk>:FUNCtion:PPOLarity <char>

CALCulate<Ch>[:SELected]:MARKer<Mk>:FUNCtion:PPOLarity?

Or

CALCulate<Ch>:TRACe<Tr>:MARKer<Mk>:FUNCtion:PPOLarity <char>

CALCulate<Ch>:TRACe<Tr>:MARKer<Mk>:FUNCtion:PPOLarity?

Description

Selects the peak polarity when the marker peak search is performed by the CALC:MARK:FUNC:EXEC command.

command/query

Target

Marker <Mk> of the active trace of channel <Ch>,

Or

Marker <Mk> of the trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

<Mk> = {[1]|2|...64}

Parameter

<char> Specifies the peak polarity:

POSitive	Positive polarity
NEGative	Negative polarity
BOTH	Both positive polarity and negative polarity

Query Response

{POS|NEG|BOTH}

Preset Value

NEG

Related Commands

CALC:MARK:FUNC:EXEC

Related Section of Operating Manual

Search for Peak

Related Controls of User Interface

Marker > Add > Peak (button in SEARCH accordion) **> Peak Polarity {Both | Negative | Positive}** (drop-down list in SEARCH accordion)

Back to CALCulate

CALC:MARK:FUNC:TARG

SCPI Command

CALCulate<Ch>[:SELected]:MARKer<Mk>:FUNCtion:TARGet <numeric>

CALCulate<Ch>[:SELected]:MARKer<Mk>:FUNCtion:TARGet?

Or

CALCulate<Ch>:TRACe<Tr>:MARKer<Mk>:FUNCtion:TARGet <numeric>

CALCulate<Ch>:TRACe<Tr>:MARKer<Mk>:FUNCtion:TARGet?

Description

Sets or reads out the target value when the marker target search is performed by the CALC:MARK:FUNC:EXEC command.

command/query

Target

Marker <Mk> of the active trace of channel <Ch>,

Or

Marker <Mk> of the trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

<Mk> = {[1]|2|...64}

Parameter

<numeric> the peak excursion value, the range varies depending on the data format.

Unit

dB | ° | s

Query Response

<numeric>

Preset Value

0

Related Section of Operating Manual

Search for Target Level

Related Controls of User Interface

Marker > Add > Targ (button in SEARCH accordion) **> Target Value** (textbox in SEARCH accordion)

Back to CALCulate

CALC:MARK:FUNC:TRAC

SCPI Command

CALCulate<Ch>[:SELected]:MARKer<Mk>:FUNCtion:TRACking {OFF|ON|0|1}

CALCulate<Ch>[:SELected]:MARKer<Mk>:FUNCtion:TRACking?

Or

CALCulate<Ch>:TRACe<Tr>:MARKer<Mk>:FUNCtion:TRACking {OFF|ON|0|1}

CALCulate<Ch>:TRACe<Tr>:MARKer<Mk>:FUNCtion:TRACking?

Description

Turns the marker search tracking ON/OFF.
command/query

Target

Marker <Mk> of the active trace of channel <Ch>,

Or

Marker <Mk> of the trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

<Mk> = {[1]|2|...64}

Parameter

{ON|1} ON

{OFF|0} OFF

Query Response

{0|1}

Preset Value

0

Related Section of Operating Manual

Automatic Tracking Mode

Related Controls of User Interface

Marker > Add > Automatic Tracking (checkbox in SEARCH accordion)

Back to CALCulate

CALC:MARK:FUNC:TTR

SCPI Command

CALCulate<Ch>[:SELected]:MARKer<Mk>:FUNCtion:TTRansition <char>

CALCulate<Ch>[:SELected]:MARKer<Mk>:FUNCtion:TTRansition?

Or

CALCulate<Ch>:TRACe<Tr>:MARKer<Mk>:FUNCtion:TTRansition <char>

CALCulate<Ch>:TRACe<Tr>:MARKer<Mk>:FUNCtion:TTRansition?

Description

Selects the type of the target transition when the marker transition search is performed by the CALC:MARK:FUNC:EXEC command.

command/query

Target

Marker <Mk> of the active trace of channel <Ch>,

Or

Marker <Mk> of the trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

<Mk> = {[1]|2|...64}

Parameter

<char> Specifies the type of the target transition:

POSitive	Positive target transition
NEGative	Negative target transition

BOTH	Both positive target transition and negative target transition

Query Response

{POS|NEG|BOTH}

Preset Value

BOTH

Related Commands

CALC:MARK:FUNC:EXEC

Related Section of Operating Manual

Search for Target Level

Related Controls of User Interface

Marker > Add > Targ (button in SEARCH accordion) **> Transition {Positive | Negative | Both}** (drop-down list in SEARCH accordion)

Back to CALCulate

CALC:MARK:FUNC:TYPE

SCPI Command

CALCulate<Ch>[:SELected]:MARKer<Mk>:FUNCtion:TYPE <char>

CALCulate<Ch>[:SELected]:MARKer<Mk>:FUNCtion:TYPE?

Or

CALCulate<Ch>:TRACe<Tr>:MARKer<Mk>:FUNCtion:TYPE <char>

CALCulate<Ch>:TRACe<Tr>:MARKer<Mk>:FUNCtion:TYPE?

Description

Selects the type of the marker search, which is performed by the CALC:MARK:FUNC:EXEC command.

command/query

Target

Marker <Mk> of the active trace of channel <Ch>,

Or

Marker <Mk> of the trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

<Mk> = {[1]|2|...64}

Parameter

<char> Specifies the type of the marker search:

MAXimum	Maximum value search
MINimum	Minimum value search

PEAK	Peak search
LPEak	Peak search to the left from the marker
RPEak	Peak search to the right from the marker
TARGet	Target search
LTARget	Target search to the left from the marker
RTARget	Target search to the right from the marker

Query Response

{MAX|MIN|PEAK|LPE|RPE|TARG|LTAR|RTAR}

Preset Value

MAX

Related Commands

CALC:MARK:FUNC:EXEC

Related Section of Operating Manual

Marker Position Search Functions

Related Controls of User Interface

Marker > Add > Max | Min (buttons in SEARCH accordion)

Marker > Add > Peak > Left | Nearest | Max | Right (buttons in SEARCH accordion)

Marker > Add > Targ > Left | Nearest | Right (buttons in SEARCH accordion)

Back to CALCulate

CALC:MARK:MATH:FLAT:DATA?

SCPI Command

CALCulate<Ch>[:SELected]:MARKer:MATH:FLATness:DATA?

Or

CALCulate<Ch>:TRACe<Tr>:MARKer:MATH:FLATness:DATA?

Description

Reads out the FLATNESS function data array. The FLATNESS function is applied within the range determined by two markers.

The array includes 4 elements:

<numeric 1> Span;

<numeric 2> Gain;

<numeric 3> Slope;

<numeric 4> Flatness.

query only

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Query Response

<numeric 1>, <numeric 2>,...<numeric 4>

Related Commands

CALC:MARK:MATH:FLAT:DOM:STAR

CALC:MARK:MATH:FLAT:DOM:STOP

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to CALCulate

CALC:MARK:MATH:FLAT:STAT

SCPI Command

CALCulate<Ch>[:SELected]:MARKer:MATH:FLATness:STATe {OFF|ON|0|1}

CALCulate<Ch>[:SELected]:MARKer:MATH:FLATness:STATe?

Or

CALCulate<Ch>:TRACe<Tr>:MARKer:MATH:FLATness:STATe {OFF|ON|0|1}

CALCulate<Ch>:TRACe<Tr>:MARKer:MATH:FLATness:STATe?

Description

Turns the marker flatness function ON/OFF.
command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

{ON|1} ON

{OFF|0} OFF

Query Response

{0|1}

Preset Value

0

Related Section of Operating Manual

Flatness Evaluation

Related Controls of User Interface

Marker Math > FLATNESS EVALUATION {ON | OFF} (toggle button in FLATNESS EVALUATION accordion)

(When at least two markers are added by the buttons **Marker > Add**)

Back to CALCulate

CALC:MARK:MATH:FLAT:DOM:STAR

SCPI Command

CALCulate<Ch>[:SELected]:MARKer:MATH:FLATness:STARt <numeric>

CALCulate<Ch>[:SELected]:MARKer:MATH:FLATness:STARt?

Or

CALCulate<Ch>:TRACe<Tr>:MARKer:MATH:FLATness:STARt <numeric>

CALCulate<Ch>:TRACe<Tr>:MARKer:MATH:FLATness:STARt?

Description

Sets or reads out the number of the marker, which specifies the start frequency of the flatness function domain.
command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

<numeric> marker number from 1 to 64.

Query Response

<numeric>

Preset Value

1

Related Section of Operating Manual

Flatness Evaluation

Related Controls of User Interface

Marker Math > Start Range (drop-down list in FLATNESS EVALUATION accordion)

(When at least two markers are added by the buttons **Marker > Add**)

Back to CALCulate

CALC:MARK:MATH:FLAT:DOM:STOP

SCPI Command

CALCulate<Ch>[:SELected]:MARKer:MATH:FLATness:STOP <numeric>

CALCulate<Ch>[:SELected]:MARKer:MATH:FLATness:STOP?

Or

CALCulate<Ch>:TRACe<Tr>:MARKer:MATH:FLATness:STOP <numeric>

CALCulate<Ch>:TRACe<Tr>:MARKer:MATH:FLATness:STOP?

Description

Sets or reads out the number of the marker, which specifies the stop frequency of the flatness function domain.

command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

<numeric> marker number from 1 to 64.

Query Response

<numeric>

Preset Value

2

Related Section of Operating Manual

Flatness Evaluation

Related Controls of User Interface

Marker Math > Stop Range (drop-down list in FLATNESS EVALUATION accordion)

(When at least two markers are added by the buttons **Marker > Add**)

Back to CALCulate

CALC:MARK:REF

SCPI Command

CALCulate<Ch>[:SELected]:MARKer:REFerence[:STATe] {OFF|ON|0|1}

CALCulate<Ch>[:SELected]:MARKer:REFerence[:STATe]?

Or

CALCulate<Ch>:TRACe<Tr>:MARKer:REFerence[:STATe] {OFF|ON|0|1}

CALCulate<Ch>:TRACe<Tr>:MARKer:REFerence[:STATe]?

Description

Turns the reference marker ON/OFF. When the reference marker is turned ON, all the values of the other markers turn to relative values.

command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

{ON|1} Reference marker ON

{OFF|0} Reference marker OFF

Query Response

{0|1}

Preset Value

0

Related Section of Operating Manual

Reference Marker Feature

Related Controls of User Interface

Marker > Reference Marker (checkbox)

Back to CALCulate

CALC:MARK:SET

SCPI Command

CALCulate<Ch>[:SELected]:MARKer<Mk>:SET <char>

Or

CALCulate<Ch>:TRACe<Tr>:MARKer<Mk>:SET <char>

Description

Sets the value of the specified item to the value of the position of the marker.
command only

Target

Marker <Mk> of the active trace of channel <Ch>,

Or

Marker <Mk> of the trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

<Mk> = {[1]|2|...64}

Parameter

<char> Specifies the type of the marker search:

STARt	Sweep start value set to the stimulus value of the marker position.
STOP	Sweep stop value set to the stimulus value of the marker position.
CENTer	Sweep center value set to the stimulus value of the marker position.
RLEVel	Reference value set to the response value of the marker position.
DELay	Delay value set to the response value of the marker position.

Related Section of Operating Manual

Marker Functions

Related Controls of User Interface

Marker > Add > Start | Stop | Center | Ref. Value | Delay (buttons in MARKER FUNCTIONS accordion)

Back to CALCulate

CALC:MARK:X

SCPI Command

CALCulate<Ch>[:SELected]:MARKer<Mk>:X <stimulus>

CALCulate<Ch>[:SELected]:MARKer<Mk>:X?

Or

CALCulate<Ch>:TRACe<Tr>:MARKer<Mk>:X <stimulus>

CALCulate<Ch>:TRACe<Tr>:MARKer<Mk>:X?

Description

Sets or reads out the stimulus value of the marker.
command/query

Target

Marker <Mk> of the active trace of channel <Ch>,

Or

Marker <Mk> of the trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

<Mk> = {[1]|2|...64}

Parameter

<stimulus> the stimulus value of the marker, the range is from the stimulus start value to the stimulus stop value currently set.

Unit

Hz | s | dBm

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

Stimulus center value

Related Section of Operating Manual

Markers

Related Controls of User Interface

Marker > Add > Stimulus (textbox in the submenu)

Back to CALCulate

CALC:MARK:Y?

SCPI Command

CALCulate<Ch>[:SELected]:MARKer<Mk>:Y?

Or

CALCulate<Ch>:TRACe<Tr>:MARKer<Mk>:Y?

Description

Reads out the response value of the marker.

If the reference marker is turned ON, the values of the markers from 1 to 63 are read out as relative values to the reference marker.

The data include 2 elements:

<numeric 1> real number in rectangular format, real part in polar and Smith chart formats;

<numeric 2> 0 in rectangular format, imaginary part in polar and Smith chart formats.

query only

Target

Marker <Mk> of the active trace of channel <Ch>,

Or

Marker <Mk> of the trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

<Mk> = {[1]|2|...64}

Query Response

<numeric 1>, <numeric 2>

Related Commands

CALC:MARK:REF

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to CALCulate

CALC:MATH:FUNC

SCPI Command

CALCulate<Ch>[:SELected]:MATH:FUNCtion <char>

CALCulate<Ch>[:SELected]:MATH:FUNCtion?

Or

CALCulate<Ch>:TRACe<Tr>:MATH:FUNCtion <char>

CALCulate<Ch>:TRACe<Tr>:MATH:FUNCtion?

Description

Selects the math operation between the data trace and the memory trace. The math result replaces the data trace. If the memory trace does not exist, the command is ignored.

command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

<char> Specifies the math operation:

DIVide	Division Data / Mem
MULTiply	Multiplication Data x Mem
ADD	Addition Data + Mem

SUBTract	Subtraction Data – Mem
OFF	No math

Query Response

{OFF|DIV|MULT|SUBT|ADD}

Preset Value

OFF

Related Commands

CALC:MATH:MEM

Related Section of Operating Manual

Math Operations

Related Controls of User Interface

Trace > Math Operation {Data / Mem | Data * Mem | Data - Mem | Data + Mem | OFF} (drop-down list in MEMORY accordion)

Back to CALCulate

CALC:MATH:MEM

SCPI Command

CALCulate<Ch>[:SELected]:MATH:MEMorize

Or

CALCulate<Ch>:TRACe<Tr>:MATH:MEMorize

Description

Copies the measurement data to the memory trace. Automatically turns on the memory trace on the display.

command only

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Related Section of Operating Manual

Memory Trace Function

Related Controls of User Interface

Trace > Add (button in MEMORY accordion)

Trace > Add to All (button in MEMORY accordion)

Back to CALCulate

CALC:MST

SCPI Command

CALCulate<Ch>[:SELected]:MSTatistics[:STATe] {OFF|ON|0|1}

CALCulate<Ch>[:SELected]:MSTatistics[:STATe]?

Or

CALCulate<Ch>:TRACe<Tr>:MSTatistics[:STATe] {OFF|ON|0|1}

CALCulate<Ch>:TRACe<Tr>:MSTatistics[:STATe]?

Description

Turns the math statistics display ON/OFF.
command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

{ON|1} Reference marker ON

{OFF|0} Reference marker OFF

Query Response

{0|1}

Preset Value

0

Related Section of Operating Manual

Marker Statistics

Related Controls of User Interface

Marker Math > MARKER STATISTICS {ON | OFF} (toggle button in MARKER STATISTICS accordion)

Back to CALCulate

CALC:MST:DATA?

SCPI Command

CALCulate<Ch>[:SELected]:MSTatistics:DATA?

Or

CALCulate<Ch>:TRACe<Tr>:MSTatistics:DATA?

Description

Reads out the math statistics values.

The statistics function is applied either over the whole range, or within the range specified by the CALC:MST:DOM command (the range limits are determined by two markers).

The data include 3 elements:

<numeric 1> Mean value;

<numeric 2> Standard deviation;

<numeric 3> Peak–to–peak (difference between the maximum value and the minimum value).

query only

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Query Response

<numeric 1>, <numeric 2>, numeric 3>

Related Commands

CALC:MST

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to CALCulate

CALC:MST:DOM

SCPI Command

CALCulate<Ch>[:SELected]:MSTatistics:DOMain[:STATe] {OFF|ON|0|1}

CALCulate<Ch>[:SELected]:MSTatistics:DOMain[:STATe]?

Or

CALCulate<Ch>:TRACe<Tr>:MSTatistics:DOMain[:STATe] {OFF|ON|0|1}

CALCulate<Ch>:TRACe<Tr>:MSTatistics:DOMain[:STATe]?

Description

Selects either the partial frequency range or the entire frequency range to be used for math statistic calculation. The partial frequency range is limited by two markers.

command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

Choose from:

{ON|1} Partial frequency range

{OFF|0} Entire frequency range

Query Response

{0|1}

Preset Value

0

Related Commands

CALC:MST:DOM:STAR

CALC:MST:DOM:STOP

Related Section of Operating Manual

Marker Statistics

Related Controls of User Interface

Marker Math > Statistics Range (checkbox in MARKER STATISTICS accordion)

(When at least two markers are added by the buttons **Marker > Add**)

Back to CALCulate

CALC:MST:DOM:STAR

SCPI Command

CALCulate<Ch>[:SELected]:MSTatistics:DOMain[:MARKer]:STARt <numeric>

CALCulate<Ch>[:SELected]:MSTatistics:DOMain[:MARKer]:STARt?

Or

CALCulate<Ch>:TRACe<Tr>:MSTatistics:DOMain[:MARKer]:STARt <numeric>

CALCulate<Ch>:TRACe<Tr>:MSTatistics:DOMain[:MARKer]:STARt?

Description

Sets or reads out the number of the marker, which specifies the start frequency of the math statistics range.

command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

<numeric> marker number from 1 to 64.

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

1

Related Section of Operating Manual

Marker Statistics

Related Controls of User Interface

Marker Math > Start Range (drop-down list in MARKER STATISTICS accordion)

(When at least two markers are added by the buttons **Marker > Add**)

Back to CALCulate

CALC:MST:DOM:STOP

SCPI Command

CALCulate<Ch>[:SELected]:MSTatistics:DOMain[:MARKer]:STOP <numeric>

CALCulate<Ch>[:SELected]:MSTatistics:DOMain[:MARKer]:STOP?

Or

CALCulate<Ch>:TRACe<Tr>:MSTatistics:DOMain[:MARKer]:STOP <numeric>

CALCulate<Ch>:TRACe<Tr>:MSTatistics:DOMain[:MARKer]:STOP?

Description

Sets or reads out the number of the marker, which specifies the stop frequency of the math statistics range.

command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

<numeric> marker number from 1 to 64.

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

2

Related Section of Operating Manual

Marker Statistics

Related Controls of User Interface

Marker Math > Stop Range (drop-down list in MARKER STATISTICS accordion)

(When at least two markers are added by the buttons **Marker > Add**)

Back to CALCulate

CALC:PAR:COUN

SCPI Command

CALCulate<Ch>:PARameter:COUNt <numeric>

CALCulate<Ch>:PARameter:COUNt?

Description

Sets or reads out the number of traces in the channel.
command/query

Target

The channel <Ch>,

<Ch>={[1]|2|...32}

Parameter

<numeric> The number of the traces in the channel from 1 to 64.

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

1

Related Section of Operating Manual

Traces and Diagram Allocation

Related Controls of User Interface

Trace > Add Trace | Delete Trace

Back to CALCulate

CALC:PAR:DEF

SCPI Command

CALCulate<Ch>:PARameter<Tr>:DEFine <char>

CALCulate<Ch>:PARameter<Tr>:DEFine?

Description

Selects the measurement parameter of the trace.

Note The port number selected by the signal source for absolute measurements is set by the CALC:PAR:SPOR command.

command/query

Targetы

Trace <Tr> of channel <Ch>,

<Tr> = {[1]|2|...64}

<Ch>={[1]|2|...32}

Parameter

<char> Specifies parameter:

S11, S12, ..., S0110, S0111, ..., S1616	S-parameters
Z11, Z21, ..., Z0110, Z0210, ..., Z1616	Z-parameters
Y11, Y21, ..., Y0110, Y0210, ..., Y1616	Y-parameters
T1(1), T2(1), .., T01(10), T01(11), ..., T16(16)	Test receiver
R1(1), R2(1), ..., R01(10), R01(10), ..., R16(16)	Reference receiver
P1, P2, ..., P16	Power

NOTE The number of digits in the port numbers should be equal. For example, for measuring S-parameters between the

receiver port 1 and source port 16, the parameter <char> should be written as S0116, with both port numbers having the same number of digits (in this case, two).

Query Response

{S11|S21|S31|...S0110|S0111|S0112|...S1416|S1516|S1616|R1(1)|R2(1)|R3(1)|
...R01(10)|R02(10)R03(10)...R14(16)|R15(16)R16(16)|T1(1)|T2(1)|T3(1)|...T01(10)|
T02(10)T03(10)...T14(16)|T15(16)T16(16)}

Preset Value

Depends on the trace number.

Related Commands

CALC:PAR:SPOR

Related Section of Operating Manual

S-Parameters and Conversion Function

Absolute Measurements

Related Controls of User Interface

Trace > More Measurement > S-Parameters > S11 | S21 | … S1616

Trace > More Measurement > Z-Parameters > Z11 | Z21 | … Z1616

Trace > More Measurement > Y-Parameters > Y11 | Y21 | … Y1616

Trace > More Measurement > Receiver > Test > T1(1) | T2(1) | … T16(16)

Trace > More Measurement > Receiver > Reference > R1(1) | R2(1) | … R16(16)

Trace > More Measurement > Power > P1 | P2 | ... | P16

Back to CALCulate

CALC:PAR:SEL

SCPI Command

CALCulate<Ch>:PARameter<Tr>:SELect

Description

Selects the active trace in the channel.

Note If the trace number is greater than the number of the traces displayed in the channel, an error occurs, and the command is ignored.

command only

Target

Trace <Tr> of channel <Ch>,

<Tr> = {[1]|2|...64}

<Ch>={[1]|2|...32}

Related Commands

CALC:PAR:COUN

SERV:CHAN:TRAC:ACT?

Related Section of Operating Manual

Selection of Active Trace, Diagram, Channel

Related Controls of User Interface

Trace > Active Trace

Back to CALCulate

CALC:PAR:SPOR

SCPI Command

CALCulate<Ch>:PARameter<Tr>:SPORt <port>

CALCulate<Ch>:PARameter<Tr>:SPORt?

Description

Sets or reads out the number of the stimulus port when performing absolute measurements.
command/query

Target

Trace <Tr> of channel <Ch>,

<Tr> = {[1]|2|...64}

<Ch>={[1]|2|...32}

Parameter

<port> the number of the stimulus port.

Out of Range

Error occurs. The command is ignored.

Query Response

<port>

Preset Value

1

Related Section of Operating Manual

Absolute Measurements

Related Controls of User Interface

None

Back to CALCulate

CALC:RLIM

SCPI Command

CALCulate<Ch>[:SELected]:RLIMit[:STATe] {OFF|ON|0|1}

CALCulate<Ch>[:SELected]:RLIMit[:STATe]?

Or

CALCulate<Ch>:TRACe<Tr>:RLIMit[:STATe] {OFF|ON|0|1}

CALCulate<Ch>:TRACe<Tr>:RLIMit[:STATe]?

Description

Turns the ripple limit test ON/OFF.
command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

Choose from:

{ON|1} ON

{OFF|0} OFF

Query Response

{0|1}

Related Section of Operating Manual

Ripple Limit Test

Preset Value

0

Related Controls of User Interface

Limit Tests > RIPPLE LIMIT {ON | OFF} (toggle button in RIPPLE LIMIT accordion)

Back to CALCulate

CALC:RLIM:DATA

SCPI Command

CALCulate<Ch>[:SELected]:RLIMit:DATA <numeric list>

CALCulate<Ch>[:SELected]:RLIMit:DATA?

Or

CALCulate<Ch>:TRACe<Tr>:RLIMit:DATA <numeric list>

CALCulate<Ch>:TRACe<Tr>:RLIMit:DATA?

Description

Sets the data array, which is the limit line for the ripple limit function.

The array size is 1 + 4N, where N is the number of limit line segments.

For the n-th point, where n from 1 to N:

<numeric 1> the number of limit line segments N is the integer from 0 to 12. Setting 0 clears the limit line.

<numeric 4n–2> type of the n-th limit line segment

0: Off.

1: On

<numeric 4n–1> the stimulus value in the beginning point of the n-th segment

<numeric 4n–0> the stimulus value in the end point of the n-th segment

<numeric 4n+1> the ripple limit value of the n-th segment.

Note If the array size is not 1 + 4N, where N is <numeric 1>, an error occurs. If <numeric 4n–2> is less than 0 or more than 1, an error occurs. When <numeric 4n–1>, <numeric 4n–0>, and <numeric 4n+1> elements are out of allowable range, the value is set to the limit, which is closer to the specified value.

command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Query Response

<numeric 1>, <numeric 2>, …<numeric 4N+1>

Related Section of Operating Manual

Ripple Limit Test

Related Controls of User Interface

Limit Tests > Show Ripple Table (checkbox in RIPPLE LIMIT accordion) **> Add Ripple line** (icon  in quick access toolbar in the LIMIT TABLE)

Back to CALCulate

CALC:RLIM:DISP:LINE

SCPI Command

CALCulate<Ch>[:SELected]:RLIMit:DISPlay:LINE {OFF|ON|0|1}

CALCulate<Ch>[:SELected]:RLIMit:DISPlay:LINE?

Or

CALCulate<Ch>:TRACe<Tr>:RLIMit:DISPlay:LINE {OFF|ON|0|1}

CALCulate<Ch>:TRACe<Tr>:RLIMit:DISPlay:LINE?

Description

Turns the ripple limit line display ON/OFF.
command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

Choose from:

{ON|1} ON

{OFF|0} OFF

Query Response

{0|1}

Preset Value

0

Related Section of Operating Manual

Ripple Limit Test

Related Controls of User Interface

Limit Test > Show Lines (checkbox in RIPPLE LIMIT accordion)

Back to CALCulate

CALC:RLIM:DISP:SEL

SCPI Command

CALCulate<Ch>[:SELected]:RLIMit:DISPlay:SELect <numeric>

CALCulate<Ch>[:SELected]:RLIMit:DISPlay:SELect?

Or

CALCulate<Ch>:TRACe<Tr>:RLIMit:DISPlay:SELect <numeric>

CALCulate<Ch>:TRACe<Tr>:RLIMit:DISPlay:SELect?

Description

Sets or reads out the number of the ripple limit test band selected for the ripple value display.
command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

<numeric>, range from 1 to 12.

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

1

Related Section of Operating Manual

Ripple Limit Test

Related Controls of User Interface

Limit Tests > Ripple Value Band (textbox in RIPPLE LIMIT accordion)

Back to CALCulate

CALC:RLIM:DISP:VAL

SCPI Command

CALCulate<Ch>[:SELected]:RLIMit:DISPlay:VALue <char>

CALCulate<Ch>[:SELected]:RLIMit:DISPlay:VALue?

Or

CALCulate<Ch>:TRACe<Tr>:RLIMit:DISPlay:VALue <char>

CALCulate<Ch>:TRACe<Tr>:RLIMit:DISPlay:VALue?

Description

Selects the display type of the ripple value in the specified band.

command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

<char> Specifies the math operation:

OFF	Ripple value display OFF
ABSolute	Absolute value
MARgin	Margin (difference between the ripple limit and the absolute value)

Query Response

{OFF|ABS|MAR}

Preset Value

OFF

Related Section of Operating Manual

Ripple Limit Test

Related Controls of User Interface

Limit tests > Ripple Value {Off | Absolute | Margin} (drop-down list in RIPPLE LIMIT accordion)

Back to CALCulate

CALC:RLIM:FAIL?

SCPI Command

CALCulate<Ch>[:SELected]:RLIMit:FAIL?

Or

CALCulate<Ch>:TRACe<Tr>:RLIMit:FAIL?

Description

Reads out the ripple limit test result.
query only

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

1 Fail

0 Pass

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to CALCulate

CALC:RLIM:REP?

SCPI Command

CALCulate<Ch>[:SELected]:RLIMit:REPort[:DATA]?

Or

CALCulate<Ch>:TRACe<Tr>:RLIMit:REPort[:DATA]?

Description

Reads out the data array, which is the ripple limit test result.

The array size is 1+3N, where N is the number of ripple limit bands.

For the n-th point, where n from 1 to N:

<numeric 1> N total number of the bands

<numeric 3n–1> n number of the band

<numeric 3n–0> Ripple value in the n-th band

<numeric 3n+1> Ripple limit test result in the n-th band:

0 — Pass

1 — Fail

query only

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Query Response

<numeric 1>, <numeric 2>, …<numeric 3N+1>

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to CALCulate

CALC:SMO

SCPI Command

CALCulate<Ch>[:SELected]:SMOothing[:STATe] {OFF|ON|0|1}

CALCulate<Ch>[:SELected]:SMOothing[:STATe]?

Or

CALCulate<Ch>:TRACe<Tr>:SMOothing[:STATe] {OFF|ON|0|1}

CALCulate<Ch>:TRACe<Tr>:SMOothing[:STATe]?

Description

Turns the trace smoothing ON/OFF.
command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

Choose from:

{ON|1} ON

{OFF|0} OFF

Query Response

{0|1}

Preset Value

0

Related Section of Operating Manual

Smoothing Setting

Related Controls of User Interface

Average > TRACE SMOOTHING {ON | OFF} (toggle button in TRACE SMOOTHING accordion)

Back to CALCulate

CALC:SMO:APER

SCPI Command

CALCulate<Ch>[:SELected]:SMOothing:APERture <numeric>

CALCulate<Ch>[:SELected]:SMOothing:APERture?

Or

CALCulate<Ch>:TRACe<Tr>:SMOothing:APERture <numeric>

CALCulate<Ch>:TRACe<Tr>:SMOothing:APERture?

Description

Sets or reads out the smoothing aperture when performing smoothing function.
command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

<numeric> the smoothing aperture from 0.01 to 20.

Unit

% (percent)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

1

Related Section of Operating Manual

Smoothing Setting

Related Controls of User Interface

Average > Smoothing Aperture (textbox in TRACE SMOOTHING accordion)

Back to CALCulate

CALC:TRAN:TIME

SCPI Command

CALCulate<Ch>[:SELected]:TRANsform:TIME[:TYPE] <char>

CALCulate<Ch>[:SELected]:TRANsform:TIME[:TYPE]?

Or

CALCulate<Ch>:TRACe<Tr>:TRANsform:TIME[:TYPE] <char>

CALCulate<Ch>:TRACe<Tr>:TRANsform:TIME[:TYPE]?

Description

Selects the transformation type for the time domain transformation function: bandpass or lowpass.

command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

<char> Specifies the transformation type:

BPASs Bandpass

LPASs Lowpass

Query Response

{BPAS|LPAS}

Preset Value

BPAS

Related Section of Operating Manual

Time Domain

Related Controls of User Interface

Time Domain > Type {Bandpass | Lowpass Step | Lowpass Impulse} (drop-down list in TIME DOMAIN accordion)

Time Domain > Lowpass DUT (select/remove checkbox in GATING accordion)

Back to CALCulate

CALC:TRAN:TIME:CENT

SCPI Command

CALCulate<Ch>[:SELected]:TRANsform:TIME:CENTer <time>

CALCulate<Ch>[:SELected]:TRANsform:TIME:CENTer?

Or

CALCulate<Ch>:TRACe<Tr>:TRANsform:TIME:CENTer <time>

CALCulate<Ch>:TRACe<Tr>:TRANsform:TIME:CENTer?

Description

Sets or reads out the time domain center value when the time domain transformation function is turned ON.
command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

<time> the time domain center value, the range varies depending on the specified frequency range and the number of points.

Unit

sec (second)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

1

Related Commands

CALC:TRAN:TIME:UNIT

Related Section of Operating Manual

Time Domain

Related Controls of User Interface

Time Domain > Center (textbox in TIME DOMAIN accordion)

Back to CALCulate

CALC:TRAN:TIME:DC:VAL

SCPI Command

CALCulate<Ch>[:SELected]:TRANsform:TIME:DC:VALue <numeric>

CALCulate<Ch>[:SELected]:TRANsform:TIME:DC:VALue?

Or

CALCulate<Ch>:TRACe<Tr>:TRANsform:TIME:DC:VALue <numeric>

CALCulate<Ch>:TRACe<Tr>:TRANsform:TIME:DC:VALue?

Description

Sets or reads out the DC value used in the lowpass type of the time domain transformation, when the DC extrapolation is OFF.

command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

<numeric> the DC value, from -1.0 to 1.0.

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

1.0

Related Commands

CALC:TRAN:TIME:EXTR:DC

Related Section of Operating Manual

Time Domain

Related Controls of User Interface

Time Domain > DC (textbox in COMMON accordion)

Back to CALCulate

CALC:TRAN:TIME:EXTR:DC

SCPI Command

CALCulate<Ch>[:SELected]:TRANsform:TIME:EXTRapolate:DC[:STATe] {OFF|ON|0|1}

CALCulate<Ch>[:SELected]:TRANsform:TIME:EXTRapolate:DC[:STATe]?

Or

CALCulate<Ch>:TRACe<Tr>:TRANsform:TIME:EXTRapolate:DC[:STATe] {OFF|ON|0|1}

CALCulate<Ch>:TRACe<Tr>:TRANsform:TIME:EXTRapolate:DC[:STATe]?

Description

Turns ON/OFF the DC extrapolation, when the time domain transformation function is turned ON. The DC value is used in the lowpass type of transformation. When the DC extrapolation is OFF the DC value set by the CALC:TRAN:TIME:DC:VAL command is used.

command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

1

Related Section of Operating Manual

Time Domain

Related Controls of User Interface

Time Domain > DC Estimation (checkbox in COMMON accordion)

Back to CALCulate

CALC:TRAN:TIME:IMP:WIDT

SCPI Command

CALCulate<Ch>[:SELected]:TRANsform:TIME:IMPulse:WIDTh <time>

CALCulate<Ch>[:SELected]:TRANsform:TIME:IMPulse:WIDTh?

Or

CALCulate<Ch>:TRACe<Tr>:TRANsform:TIME:IMPulse:WIDTh <time>

CALCulate<Ch>:TRACe<Tr>:TRANsform:TIME:IMPulse:WIDTh?

Description

Sets or reads out the impulse width (time domain transformation resolution), coupled with the Kaiser-Bessel window shape β parameter. The impulse width setting changes the β parameter and setting of β parameter changes the impulse width.

command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

<time> the impulse width, the allowable range varies depending on the specified frequency range.

Unit

sec (second)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Related Section of Operating Manual

Time Domain

Related Controls of User Interface

Time Domain > Impulse Width (textbox in TIME DOMAIN accordion)

Back to CALCulate

CALC:TRAN:TIME:KBES

SCPI Command

CALCulate<Ch>[:SELected]:TRANsform:TIME:KBESsel <numeric>

CALCulate<Ch>[:SELected]:TRANsform:TIME:KBESsel?

Or

CALCulate<Ch>:TRACe<Tr>:TRANsform:TIME:KBESsel <numeric>

CALCulate<Ch>:TRACe<Tr>:TRANsform:TIME:KBESsel?

Description

Sets or reads out the β parameter, which controls the Kaise-Bessel window shape when performing the time domain transformation.

command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

<numeric> β parameter from 0 to 13.

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

6

Related Section of Operating Manual

Time Domain

Related Controls of User Interface

Time Domain > Kaiser Beta (textbox in TIME DOMAIN accordion)

Back to CALCulate

CALC:TRAN:TIME:LPFR

SCPI Command

CALCulate<Ch>[:SELected]:TRANsform:TIME:LPFRequency

Or

CALCulate<Ch>:TRACe<Tr>:TRANsform:TIME:LPFRequency

Description

Changes the frequency range to the harmonic grid in order to match with the lowpass type of the time domain transformation function.
command only

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Related Section of Operating Manual

Time Domain

Time Domain Gating

Related Controls of User Interface

Time Domain > Set Frequency In Harmonic Order (button in COMMON accordion)

(When in Lowpass Step or Lowpass Impulse in TIME DOMAIN accordion is selected or **Lowpass DUT** checkbox in GATING accordion is selected)

Back to CALCulate

CALC:TRAN:TIME:REFL:TYPE

SCPI Command

CALCulate<Ch>[:SELected]:TRANsform:TIME:REFLection:TYPE <char>

CALCulate<Ch>[:SELected]:TRANsform:TIME:REFLection:TYPE?

Or

CALCulate<Ch>:TRACe<Tr>:TRANsform:TIME:REFLection:TYPE <char>

CALCulate<Ch>:TRACe<Tr>:TRANsform:TIME:REFLection:TYPE?

Description

Selects the reflection distance either one way or round trip for the time domain transformation function.

command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

<char> Choose from:

RTRip Round Trip

OWAY One Way

Query Response

{RTR|OWAY}

Preset Value

RTR

Related Section of Operating Manual

Time Domain

Related Controls of User Interface

Time Domain > Reflection Type {RoundTrip | OneWay} (drop-down list in TIME DOMAIN accordion)

Back to CALCulate

CALC:TRAN:TIME:SPAN

SCPI Command

CALCulate<Ch>[:SELected]:TRANsform:TIME:SPAN <time>

CALCulate<Ch>[:SELected]:TRANsform:TIME:SPAN?

Or

CALCulate<Ch>:TRACe<Tr>:TRANsform:TIME:SPAN <time>

CALCulate<Ch>:TRACe<Tr>:TRANsform:TIME:SPAN?

Description

Sets or reads out the time domain span value when the time domain transformation function is turned ON.
command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

<time> the time domain span value, the range varies depending on the specified frequency range and the number of points.

Unit

sec (second)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

2e-8

Related Commands

CALC:TRAN:TIME:UNIT

Related Section of Operating Manual

Time Domain

Related Controls of User Interface

Time Domain > Span (textbox in TIME DOMAIN accordion)

Back to CALCulate

CALC:TRAN:TIME:STAR

SCPI Command

CALCulate<Ch>[:SELected]:TRANsform:TIME:STARt <time>

CALCulate<Ch>[:SELected]:TRANsform:TIME:STARt?

Or

CALCulate<Ch>:TRACe<Tr>:TRANsform:TIME:STARt <time>

CALCulate<Ch>:TRACe<Tr>:TRANsform:TIME:STARt?

Description

Sets or reads out the time domain start value when the time domain transformation function is turned ON.
command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

<time> the time domain start value, the range varies depending on the specified frequency range and the number of points.

Unit

sec (second)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

-1e-8

Related Commands

CALC:TRAN:TIME:UNIT

Related Section of Operating Manual

Time Domain

Related Controls of User Interface

Time Domain > Start (textbox in TIME DOMAIN accordion)

Back to CALCulate

CALC:TRAN:TIME:STOP

SCPI Command

CALCulate<Ch>[:SELected]:TRANsform:TIME:STOP <time>

CALCulate<Ch>[:SELected]:TRANsform:TIME:STOP?

Or

CALCulate<Ch>:TRACe<Tr>:TRANsform:TIME:STOP <time>

CALCulate<Ch>:TRACe<Tr>:TRANsform:TIME:STOP?

Description

Sets or reads out the time domain stop value when the time domain transformation function is turned ON.
command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

<time> the time domain stop value, the range varies depending on the specified frequency range and the number of points.

Unit

sec (second)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

+1e-8

Related Commands

CALC:TRAN:TIME:UNIT

Related Section of Operating Manual

Time Domain

Related Controls of User Interface

Time Domain > Stop (textbox in TIME DOMAIN accordion)

Back to CALCulate

CALC:TRAN:TIME:STAT

SCPI Command

CALCulate<Ch>[:SELected]:TRANsform:TIME:STATe {OFF|ON|0|1}

CALCulate<Ch>[:SELected]:TRANsform:TIME:STATe?

Or

CALCulate<Ch>:TRACe<Tr>:TRANsform:TIME:STATe {OFF|ON|0|1}

CALCulate<Ch>:TRACe<Tr>:TRANsform:TIME:STATe?

Description

Turns the time domain transformation function ON/OFF.
command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

{ON|1} ON

{OFF|0} OFF

Query Response

{0|1}

Preset Value

0

Related Section of Operating Manual

Time Domain

Related Controls of User Interface

Time Domain > TIME DOMAIN {ON | OFF} (toggle button in TIME DOMAIN accordion)

Back to CALCulate

CALC:TRAN:TIME:STEP:RTIM

SCPI Command

CALCulate<Ch>[:SELected]:TRANsform:TIME:STEP:RTIMe <time>

CALCulate<Ch>[:SELected]:TRANsform:TIME:STEP:RTIMe?

Or

CALCulate<Ch>:TRACe<Tr>:TRANsform:TIME:STEP:RTIMe <time>

CALCulate<Ch>:TRACe<Tr>:TRANsform:TIME:STEP:RTIMe?

Description

Sets or reads out the rise time of the step signal (time domain transformation resolution), coupled with the Kaiser-Bessel window shape β parameter. The impulse width setting changes the β parameter and setting of β parameter changes the impulse width.

command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

<time> the impulse width, the allowable range varies depending on the specified frequency range.

Unit

sec (second)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Related Section of Operating Manual

Time Domain

Related Controls of User Interface

Time Domain > Impulse Width (textbox in TIME DOMAIN accordion)

Back to CALCulate

CALC:TRAN:TIME:STIM

SCPI Command

CALCulate<Ch>[:SELected]:TRANsform:TIME:STIMulus <char>

CALCulate<Ch>[:SELected]:TRANsform:TIME:STIMulus?

Or

CALCulate<Ch>:TRACe<Tr>:TRANsform:TIME:STIMulus <char>

CALCulate<Ch>:TRACe<Tr>:TRANsform:TIME:STIMulus?

Description

Selects the stimulus type for the time domain transformation function: impulse or step. The stimulus type is valid for the lowpass devices. For the bandpass devices the impulse type is always used.

command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

<char> Specifies the stimulus type:

IMPulse	Impulse
STEP	Step

Query Response

{IMP|STEP}

Preset Value

IMP

Related Section of Operating Manual

Time Domain

Related Controls of User Interface

Time Domain > Type {Bandpass | Lowpass Step | Lowpass Impulse} (drop-down list in TIME DOMAIN accordion)

Back to CALCulate

CALC:TRAN:TIME:UNIT

SCPI Command

CALCulate<Ch>[:SELected]:TRANsform:TIME:UNIT <char>

CALCulate<Ch>[:SELected]:TRANsform:TIME:UNIT?

Or

CALCulate<Ch>:TRACe<Tr>:TRANsform:TIME:UNIT <char>

CALCulate<Ch>:TRACe<Tr>:TRANsform:TIME:UNIT?

Description

Selects the transformation unit for the time domain transformation function: seconds, meters and feet.
command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Parameter

<char> Choose from:

SEConds	Seconds
METers	Meters
FEET	Feet

Query Response

{SEC|MET|FEET}

Preset Value

SEC

Related Section of Operating Manual

Time Domain

Related Controls of User Interface

Time Domain > Unit > {Seconds | Distance} (drop-down list in TIME DOMAIN accordion)

(When selecting **Distance** from the list, the unit selected in the appearance settings is applied: **Appearance > Distance Unit > {Meters | Feet | Inches}**)

Back to CALCulate

DISPlay

Command	Description	
DISP:COL:TRAC:DATA	Color Settings	Data trace color
DISP:COL:TRAC:MEM		Memory trace color
DISP:IMAG		Colors inversion
DISP:GLAB	Interface Settings	Graticule Label state
DISP:HIDE		Hides the Analyzer window
DISP:MAX		Maximizes the channel window ON/OFF
DISP:SHOW		Shows the Analyzer window
DISP:WIND:MAX		Maximizes the trace in channel ON/OFF
DISP:WIND:TITL:DATA		Channel title label
DISP:FSIG	Limit Test, Ripple Limit Test, Peak Limits Test	"Fail" sign display ON/OFF
DISP:WIND:ANN:MARK:ALIG	Marker Properties	Marker annotation alignment

Command	Description	
DISP:WIND:ANN:MARK:SING		Active marker only ON/OFF

Command	Description	
DISP:WIND:TRAC:ANN:MARK:POS:X		X-position of marker annotation
DISP:WIND:TRAC:ANN:MARK:POS:Y		Y-position of marker annotation
DISP:SPL	Channel and Trace Settings	Number and Layout of channels
DISP:WIND:ACT		Active channel number (write)
DISP:WIND:SPL		Allocation of traces in the channel window
DISP:WIND:TRAC:MEM	Memory Trace Function	Memory trace display ON/OFF
DISP:WIND:TRAC:STAT		Data trace display ON/OFF
DISP:WIND:TRAC:Y:AUTO	Scale	Auto scale
DISP:WIND:TRAC:Y:PDIV		Scale per division
DISP:WIND:TRAC:Y:RLEV		Reference line value
DISP:WIND:TRAC:Y:RLEV:AUTO		Auto Reference Level
DISP:WIND:TRAC:Y:RPOS		Reference line position
DISP:WIND:Y:DIV		Number of the scale divisions

DISP:COL:TRAC:DATA

SCPI Command

DISPlay:COLor:TRACe<Tr>:DATA <numeric 1>,<numeric 2>,<numeric 3>

DISPlay:COLor:TRACe<Tr>:DATA?

Description

Sets or reads out the data trace color.
command/query

Target

Trace <Tr>,

<Tr> = {[1]|2|...64}

Parameter

<numeric 1>	Red value R from 0 to 255
<numeric 2>	Green value G from 0 to 255
<numeric 3>	Blue value B from 0 to 255

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric 1>, <numeric 2>, <numeric 3>

Preset Value

Varies depending on the trace number.

Related Section of Operating Manual

Traces and Diagram Allocation

Related Controls of User Interface

Trace > Color Picker > Palette | RGB (pop-up window in DISPLAY SETTINGS accordion)

Back to DISPlay

DISP:COL:TRAC:MEM

SCPI Command

DISPlay:COLor:TRACe<Tr>:MEMory <numeric 1>,<numeric 2>,<numeric 3>

DISPlay:COLor:TRACe<Tr>:MEMory?

Description

Sets or reads out the memory trace color.
command/query

Target

Trace <Tr>,

<Tr> = {[1]|2|...64}

Parameter

<numeric 1>	Red value R from 0 to 255
<numeric 2>	Green value G from 0 to 255
<numeric 3>	Blue value B from 0 to 255

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric 1>, <numeric 2>, <numeric 3>

Preset Value

Varies depending on the trace number.

Related Section of Operating Manual

Traces and Diagram Allocation

Related Controls of User Interface

Trace > Color Picker > Palette | RGB (pop-up window in DISPLAY SETTINGS accordion)

Back to DISPlay

DISP:ENAB

SCPI Command

DISPlay:ENABle {OFF|ON|0|1}

DISPlay:ENABle?

Description

Turns the display update ON/OFF.
command/query

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

1

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to DISPlay

DISP:FSIG

SCPI Command

DISPlay:FSIGn {OFF|ON|0|1}

DISPlay:FSIGn?

Description

Turns the "Fail" sign display ON/OFF when performing limit test, ripple limit test or peak limits test.

command/query

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

0

Related Section of Operating Manual

Limit Tests

Ripple Limit Test

Peak Limits Test

Related Controls of User Interface

Limit Tests > FAIL SIGN (toggle in FAIL SIGN accordion)

Back to DISPlay

DISP:GLAB

SCPI Command

DISPlay:GLABel <char>

DISPlay:GLABel?

Description

Sets/gets the graticule (Y-axis) Label state.
command/query

Parameter

Specifies the Graticule Label state:

OFF	Graticule (Y-axis) label is OFF
ACTive	Only active trace has graticule (Y-axis) label
ALL	All traces have graticule (Y-axis) label

Query Response

<char>

Preset Value

ACTive

Related Section of Operating Manual

Y-axis Label

Related Controls of User Interface

Appearance > Y-axis Label { Off | All Traces | Active Trace } (drop-down list in CHART accordion)

Back to DISPlay

DISP:IMAG

SCPI Command

DISPlay:IMAGe <char>

DISPlay:IMAGe?

Description

Turns the inversion of display colors of the Analyzer interface ON/OFF.
command/query

Parameter

<char> Choose from:

NORMal	Normal display (Dark Mode)
INVert	Inverted color display (Light Mode)

Query Response

{NORM|INV}

Preset Value

NORM

Related Section of Operating Manual

Invert Color Mode

Related Controls of User Interface

Appearance > Light Mode (checkbox in the submenu)

Back to DISPlay

DISP:HIDE

SCPI Command

DISPlay:HIDE

Description

Blanks the Analyzer window, displaying the label "Remote Control".
command only

Related Commands

DISP:SHOW

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to DISPlay

DISP:MAX

SCPI Command

DISPlay:MAXimize {OFF|ON|0|1}

DISPlay:MAXimize?

Description

Turns the maximization of the active channel window ON/OFF.
command/query

Target

The active channel set by the command DISP:WIND:ACT.

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

0

Related Commands

DISP:WIND:ACT

Related Section of Operating Manual

Trace/Channel Window Maximizing

Related Controls of User Interface

Channel > Add > Active Channel (drop-down list) **> Maximize Channel** (checkbox in the submenu)

Back to DISPlay

DISP:SHOW

SCPI Command

DISPlay:SHOW

Description

Shows the Analyzer window hidden by the DISP:HIDE command.
command only

Related Commands

DISP:HIDE

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to DISPlay

DISP:SPL

SCPI Command

DISPlay:SPLit <numeric>

DISPlay:SPLit?

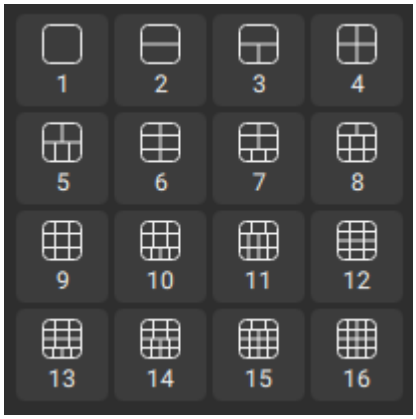
Description

Sets or reads out the number of channels and channel layout on the screen. The channel layout on the screen is shown below.

Note When the main window display is enabled, up to 32 channels are supported. If the main window is hidden with the DISP:HIDE command, up to 200 channels are supported. Enabling display mode with the DISP:SHOW command removes channels over 32.

command/query

Channel Window Layout on the Screen (from 1 to 32)



Parameter

<numeric> the code of the channel window layout from 1 to 32. (up to 200 if the main window is hidden with the DISP:HIDE command)

NOTE	The layout code does not correspond to the number of channels.

Query Response

<numeric>

Preset Value

1

Related Section of Operating Manual

Channel Allocation

Related Controls of User Interface

Channel > Allocate

Back to DISPlay

DISP:UPD

SCPI Command

DISPlay:UPDate[:IMMediate]

Description

Updates the display once when the display update is set to OFF by the DISP:ENAB command.
command only

Related Commands

DISP:ENAB

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to DISPlay

DISP:WIND:ACT

SCPI Command

DISPlay:WINDow<Ch>:ACTivate

Description

Sets the active channel.

Note Trying to set an active channel that is not displayed with the DISP:SPL command will produce an error.

command only

Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Related Commands

DISP:SPL

SERV:CHAN:ACT?

Related Section of Operating Manual

Selection of Active Trace, Diagram, Channel

Related Controls of User Interface

Channel > Active Channel

Back to DISPlay

DISP:WIND:ANN:MARK:ALIG

SCPI Command

DISPlay:WINDow<Ch>:ANNotation:MARKer:ALIGn[:TYPE] <char>

DISPlay:WINDow<Ch>:ANNotation:MARKer:ALIGn[:TYPE]?

Description

Sets or reads out the alignment of the marker annotation when the active marker only feature is turned OFF by the DISP:WIND:ANN:MARK:SING command.

command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Parameter

<char> Choose from:

VERTical	Vertical alignment
HORizontal	Horizontal alignment
NONE	No alignment

Query Response

{NONE|VERT|HOR}

Preset Value

NONE

Related Commands

DISP:WIND:ANN:MARK:SING

Related Section of Operating Manual

Marker Data Alignment

Related Controls of User Interface

Marker > Alignment > Off | Vertical | Horizontal (Alignment segment switch in MARKER PROPERTIES accordion)

Back to DISPlay

DISP:WIND:ANN:MARK:SING

SCPI Command

DISPlay:WINDow<Ch>:ANNotation:MARKer:SINGle[:STATe] {OFF|ON|0|1}

DISPlay:WINDow<Ch>:ANNotation:MARKer:SINGle[:STATe]?

Description

Selects display of either the active trace markers or all trace markers.

command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Parameter

<char> Choose from:

{ON|1}	Active trace markers
{OFF|0}	All trace markers

Query Response

{0|1}

Preset Value

1

Related Section of Operating Manual

Marker Data of Active Trace

Related Controls of User Interface

Marker > Active Only (checkbox in MARKER PROPERTIES accordion)

Back to DISPlay

DISP:WIND:MAX

SCPI Command

DISPlay:WINDow<Ch>:MAXimize {OFF|ON|0|1}

DISPlay:WINDow<Ch>:MAXimize?

Description

Turns the active trace maximization inside the specified channel ON/OFF.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

0

Related Section of Operating Manual

Trace/Channel Window Maximizing

Related Controls of User Interface

Trace > Add Trace > Active trace (drop-down list) **> Maximize Trace** (checkbox in DISPLAY SETTINGS accordion)

Back to DISPlay

DISP:WIND:SPL

SCPI Command

DISPlay:WINDow<Ch>:SPLit <numeric>

DISPlay:WINDow<Ch>:SPLit?

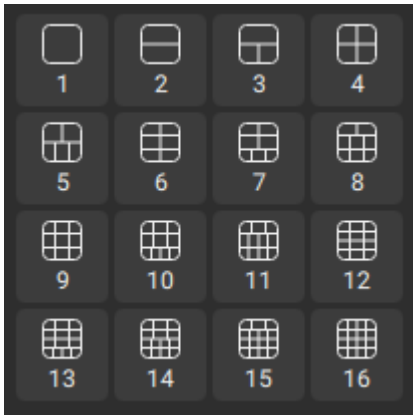
Description

Sets or reads out the number of the diagram in the channel window. The graph layout in the channel window is shown below.

Note This function does not determine the number of traces in the channel window; the CALC:PAR:COUN command sets the number of traces.

command/query

Diagram Layout in the Channel Window (from 1 to 32)



Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Parameter

<numeric> the number of the diagram from 1 to 64.

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

1

Related Section of Operating Manual

Traces and Diagram Allocation

Related Controls of User Interface

Trace > Allocate

Back to DISPlay

DISP:WIND:TITL:DATA

SCPI Command

DISPlay:WINDow<Ch>:TITLe:DATA <string>

DISPlay:WINDow<Ch>:TITLe:DATA?

Description

Sets or reads out the channel title label.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Parameter

<string>, up to 256 characters.

Query Response

<string>

Preset Value

Empty string

Related Section of Operating Manual

Channel Title Bar

Related Controls of User Interface

Corresponds to the heading name area at the top of the channel window (double click)

Back to DISPlay

DISP:WIND:TRAC:ANN:MARK:POS:X

SCPI Command

DISPlay:WINDow<Ch>:TRACe<Tr>:ANNotation:MARKer:POSition:X <numeric>

DISPlay:WINDow<Ch>:TRACe<Tr>:ANNotation:MARKer:POSition:X?

Description

Sets or reads out the display position of the marker annotation on the X-axis by a percentage of the display width.

command/query

Target

Trace <Tr> of channel <Ch>,

<Tr> = {[1]|2|...64}

<Ch>={[1]|2|...32}

Parameter

<numeric> the display position of the marker value on the X–axis from 0 to 100.

Unit

% (percent)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

0

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to DISPlay

DISP:WIND:TRAC:ANN:MARK:POS:Y

SCPI Command

DISPlay:WINDow<Ch>:TRACe<Tr>:ANNotation:MARKer:POSition:Y <numeric>

DISPlay:WINDow<Ch>:TRACe<Tr>:ANNotation:MARKer:POSition:Y?

Description

Sets or reads out the display position of the marker annotation on the Y-axis by a percentage of the display height.

command/query

Target

Trace <Tr> of channel <Ch>,

<Tr> = {[1]|2|...64}

<Ch>={[1]|2|...32}

Parameter

<numeric> the display position of the marker value on the Y–axis from 0 to 100.

Unit

% (percent)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

0

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to DISPlay

DISP:WIND:TRAC:MEM

SCPI Command

DISPlay:WINDow<Ch>:TRACe<Tr>:MEMory[:STATe] {OFF|ON|0|1}

DISPlay:WINDow<Ch>:TRACe<Tr>:MEMory[:STATe]?

Description

Turns the memory trace display ON/OFF.

Note If the memory trace does not exist, an error occurs, and the command is ignored.

command/query

Target

Trace <Tr> of channel <Ch>,

<Tr> = {[1]|2|...64}

<Ch>={[1]|2|...32}

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

0

Related Section of Operating Manual

Memory Trace Function

Related Controls of User Interface

Trace > Show Memory (checkbox in MEMORY accordion)

Back to DISPlay

DISP:WIND:TRAC:STAT

SCPI Command

DISPlay:WINDow<Ch>:TRACe<Tr>:STATe {OFF|ON|0|1}

DISPlay:WINDow<Ch>:TRACe<Tr>:STATe?Description

Turns the data trace display ON/OFF.
command/query

Target

Trace <Tr> of channel <Ch>,

<Tr> = {[1]|2|...64}

<Ch>={[1]|2|...32}

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

1

Related Section of Operating Manual

Memory Trace Function

Related Controls of User Interface

Trace > Show Data (checkbox in MEMORY accordion)

Back to DISPlay

DISP:WIND:TRAC:Y:AUTO

SCPI Command

DISPlay:WINDow<Ch>:TRACe<Tr>:Y[:SCALe]:AUTO

Description

Executes the auto scale function for the trace. The function automatically sets both the PDIVision and the RLEVel values.

command only

Target

Trace <Tr> of channel <Ch>,

<Tr> = {[1]|2|...64}

<Ch>={[1]|2|...32}

Related Commands

DISP:WIND:TRAC:Y:PDIV

DISP:WIND:TRAC:Y:RLEV

Related Section of Operating Manual

Automatic Scaling

Related Controls of User Interface

Scale > Autoscale

Scale > Autoscale All

Back to DISPlay

DISP:WIND:TRAC:Y:PDIV

SCPI Command

DISPlay:WINDow<Ch>:TRACe<Tr>:Y[:SCALe]:PDIVision <numeric>

DISPlay:WINDow<Ch>:TRACe<Tr>:Y[:SCALe]:PDIVision?

Description

Sets or reads out the trace scale. Sets the scale per division when the data format is in the rectangular format. Sets the full-scale value when the data format is in the Smith chart format or the polar format.

command/query

Target

Trace <Tr> of channel <Ch>,

<Tr> = {[1]|2|...64}

<Ch>={[1]|2|...32}

Parameter

<numeric> the value of the trace scale.

Out of Range

Sets the value of the limit, which is closer to the specified value.

Unit

dB |° |s

Out of Range

<numeric>

Query Response

<numeric>

Preset Value

Varies depending on the format.

Logarithmic Magnitude: 10 dB/Div

Phase: 45 °/Div

Expand Phase: 800 °/Div

Delay: 10e–9 s/Div

Smith Chart, Polar, SWR: 1 /Div

Linear Magnitude: 0.1 /Div

Real part, Imaginary part: 0.2 /Div

Related Section of Operating Manual

Rectangular Scale

Related Controls of User Interface

Scale > Scaling (textbox in the submenu)

Back to DISPlay

DISP:WIND:TRAC:Y:RLEV

SCPI Command

DISPlay:WINDow<Ch>:TRACe<Tr>:Y[:SCALe]:RLEVel <numeric>

DISPlay:WINDow<Ch>:TRACe<Tr>:Y[:SCALe]:RLEVel?

Description

Sets or reads out the value of the reference line (response value on the reference line). For the rectangular format only.

command/query

Target

Trace <Tr> of channel <Ch>,

<Tr> = {[1]|2|...64}

<Ch>={[1]|2|...32}

Parameter

<numeric> the value of the reference line.

Out of Range

Sets the value of the limit, which is closer to the specified value.

Unit

dB |° |s

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

0 (except for SWR: 1)

Related Section of Operating Manual

Rectangular Scale

Related Controls of User Interface

Scale > Ref. Value (textbox in the submenu)

Back to DISPlay

DISP:WIND:TRAC:Y:RLEV:AUTO

SCPI Command

DISPlay:WINDow<Ch>:TRACe<Tr>:Y[:SCALe]:RLEVel:AUTO

Description

Executes the auto reference function for the trace. The function automatically sets the RLEVel value. For the rectangular format only.

command only

Target

Trace <Tr> of channel <Ch>,

<Tr> = {[1]|2|...64}

<Ch>={[1]|2|...32}

Related Commands

DISP:WIND:TRAC:Y:RLEV

Related Section of Operating Manual

Reference Level Automatic Selection

Related Controls of User Interface

Scale > Autoref.

Scale > Autoref. All

Back to DISPlay

DISP:WIND:TRAC:Y:RPOS

SCPI Command

DISPlay:WINDow<Ch>:TRACe<Tr>:Y[:SCALe]:RPOSition <numeric>

DISPlay:WINDow<Ch>:TRACe<Tr>:Y[:SCALe]:RPOSition?

Description

Sets the position of the reference line. For the rectangular format only.
command/query

Target

Trace <Tr> of channel <Ch>,

<Tr> = {[1]|2|...64}

<Ch>={[1]|2|...32}

Parameter

<numeric> the reference line position from 0 to the number of the scale divisions (set by the DISP:WIND:Y:DIV command, 10 by default).

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

5

Related Section of Operating Manual

Rectangular Scale

Related Controls of User Interface

Scale > Ref. Position (textbox in the submenu)

Back to DISPlay

DISP:WIND:Y:DIV

SCPI Command

DISPlay:WINDow<Ch>:Y[:SCALe]:DIVisions <numeric>

DISPlay:WINDow<Ch>:Y[:SCALe]:DIVisions?

Description

Sets the number of the vertical scale divisions. For the rectangular format only.

command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Parameter

<numeric> the number of the vertical scale divisions from 2 to 40.

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

10

Resolution

2

Related Section of Operating Manual

Rectangular Scale

Related Controls of User Interface

Scale > Divisions (textbox in the submenu)

Back to DISPlay

FORMat

Command	Description	
FORM:BORD	Data Transfer	Byte order
FORM:DATA		Text or binary transfer format
FORM:PUSH		Push and set byte order and transfer format
FORM:POP		Pop byte order and transfer format

FORM:BORD

SCPI Command

FORMat:BORDer <char>

FORMat:BORDer?

Description

Sets or reads out the transfer order of each byte in data when the binary data transfer format is set by the FORM:DATA command.

Note The x86 compatible processors use the little-endian format.

command/query

Parameter

<char> Choose from:

NORMal	Normal (big-endian format)
SWAPped	Swapped (little-endian format)

Query Response

{NORM|SWAP}

Preset Value

NORM

Related Commands

FORM:DATA

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to FORMat

FORM:DATA

SCPI Command

FORMat:DATA <char>

FORMat:DATA?

Description

Sets or reads out the data transfer format when responding to the following queries:

CALC:DATA:FDAT?	SENS:DATA:CORR?
CALC:DATA:FMEM?	SENS:DATA:RAWD?
CALC:DATA:SDAT?	SENS:FREQ:DATA?
CALC:DATA:SMEM?	SENS:SEGM:DATA?
CALC:DATA:XAX?	SOUR:POW:PORT:CORR:COLL:TABL:LOSS:DATA?
CALC:LIM:DATA?	SOUR:POW:PORT:CORR:DATA?
CALC:LIM:REP?	
CALC:LIM:REP:ALL?	
CALC:MARK:DATA?	
CALC:RLIM:DATA?	
CALC:RLIM:REP?	
SENS:CORR:COEF?	

Note The command is applicable with the TCP/IP HiSLIP protocol. The command is NOT applicable with the TCP/IP Socket protocol.

command/query

Parameter

<char> Choose from:

ASCii	Character format
REAL	Binary format (IEEE–64 floating point)
REAL32	Binary format (IEEE–32 floating point)

Query Response

{ASC|REAL|REAL32}

Preset Value

ASC

Related Commands

FORM:BORD

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to FORMat

FORM:PUSH

SCPI Command

FORMat:PUSH <format>,<border>

Description

Saves the current settings and sets new values for the data transfer format and byte order.

Note The x86 compatible processors use the little-endian format.

command only

Parameter

<char> Choose from:

ASCii	Character format
REAL	Binary format (IEEE-64 floating point)
REAL32	Binary format (IEEE-32 floating point)

<border> Choose from:

NORMal	Normal (big-endian format)
SWAPped	Swapped (little-endian format)

Related Commands

FORM:POP

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to FORMat

FORM:POP

SCPI Command

FORMat:POP

Description

Restores the settings for the data transfer format and byte order saved by the preceding FORM:PUSH command.
command only

Related Commands

FORM:PUSH

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to FORMat

HCOPy

Command	Description	
HCOP	Printing	Quick print
HCOP:ABOR		Aborts the printout
HCOP:DATE:STAM		Date and time stamp ON/OFF
HCOP:IMAG		Inverted color of image
HCOP:PAIN		Color chart for image printout

HCOP

SCPI Command

HCOPy[:IMMediate]

Description

Prints out the image displayed on the screen without previewing.
command only

Related Section of Operating Manual

Graph Printing

Related Controls of User Interface

Save/Recall > Send Image To {Printer} (drop-down list in the REPORT area) > **Send**

Back to HCOPy

HCOP:ABOR

SCPI Command

HCOPy:ABORt

Description

Aborts the printout.
command only

Related Section of Operating Manual

Graph Printing

Related Controls of User Interface

None

Back to HCOPy

HCOP:DATE:STAM

SCPI Command

HCOPy:DATE:STAMp {OFF|ON|0|1}

HCOPy:DATE:STAMp?

Description

Turns the date and time printout in the upper right corner of the image ON/OFF.
command/query

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

1

Related Section of Operating Manual

Graph Printing

Related Controls of User Interface

Save/Recall > Date/Time (checkbox in the REPORT area)

Back to HCOPy

HCOP:IMAG

SCPI Command

HCOPy:IMAGe <char>

HCOPy:IMAGe?

Description

Sets or reads out the inverted color image printout.
command/query

Parameter

<char> Choose from:

NORMal	Normal printout
INVert	Inverted color printout

Query Response

{NORM|INV}

Preset Value

NORM

Related Section of Operating Manual

Graph Printing

Related Controls of User Interface

Save/Recall > Invert image (checkbox in the REPORT area)

Back to HCOPy

HCOP:PAIN

SCPI Command

HCOPy:PAINt <char>

HCOPy:PAINt?

Description

Sets or reads out the color chart for the image printout.
command/query

Parameter

<char> Choose from:

COLor	Color printout
GRAY	Grayscale printout
BW	Black&white printout

Query Response

{COL|GRAY|BW}

Preset Value

COLor

Related Section of Operating Manual

Graph Printing

Related Controls of User Interface

Save/Recall > Image Mode {Color | Gray | Black and White} (drop-down list in the REPORT area)

Back to HCOPy

INITiate

Command	Description	
INIT	Trigger	Initiates channel once
INIT:CONT		Continuous channel initiation mode ON/OFF
INIT:CONT:ALL		Continuous channel initiation mode for all channels ON/OFF

INIT

SCPI Command

INITiate<Ch>[:IMMediate]

Description

Puts the channel into the Trigger Waiting state for one trigger event. The channel should be in the hold state, otherwise an error occurs, and the command is ignored. The channel goes into Hold as a result of the command INIT:CONT OFF.

If the Internal trigger source is selected by the command TRIG:SOUR INT, then the command initiates a sweep in the single channel, otherwise the channel goes to Waiting for a Single Trigger mode.

Upon receipt of a trigger from the selected source, the sweep starts for the channels awaiting trigger. On completion of the sweep the channel goes to the Hold state.

command only

Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Related Commands

TRIG:SOUR

INIT:CONT

Related Section of Operating Manual

Channel Initiation Mode

Related Controls of User Interface

Trigger > Single

Back to INITiate

INIT:CONT

SCPI Command

INITiate<Ch>:CONTinuous {OFF|ON|0|1}

INITiate<Ch>:CONTinuous?

Description

Turns the continuous trigger initiation mode for the channel <Ch> ON/OFF.

When the continuous initiation mode is turned ON:

- If the Internal trigger source is selected by the command TRIG:SOUR INT, then the channel continuously sweeps;
- If the trigger source selected is one other than the internal, then the channel goes to the trigger waiting state. Upon receipt of a trigger from the selected source, the sweep starts for the channels awaiting trigger. On completion of the sweep the channel goes to the trigger waiting state.

When the continuous trigger initiation mode is turned OFF the channel is in the Hold state, to initiate a sweep use the INIT command.

command /query

Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Parameter

Specifies the continuous trigger initiation mode:

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

1

Related Commands

TRIG:SOUR

INIT

Related Section of Operating Manual

Channel Initiation Mode

Related Controls of User Interface

Trigger > Continuous

Back to INITiate

INIT:CONT:ALL

SCPI Command

INITiate:CONTinuous:ALL {OFF|ON|0|1}

Description

Turns the continuous trigger initiation mode for all channels ON/OFF.
command only

Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Parameter

Specifies the continuous trigger initiation mode:

{ON|1}	ON
{OFF|0}	OFF

Preset Value

1

Related Commands

INIT:CONT

Related Section of Operating Manual

Channel Initiation Mode

Related Controls of User Interface

Trigger > Apply to All Channels (checkbox)

Back to INITiate

MMEMory

Command	Description	
MMEM:CAT?	Disk Operations	Information about the hard drive
MMEM:COPY		Copies the file
MMEM:DEL		Deletes the file
MMEM:MDIR		Creates a directory
MMEM:TRAN?		Transfers the contents of the file
MMEM:LOAD	Save/Recall Analyzer State, Calibration	Recalls the Analyzer state
MMEM:STOR		Saves the Analyzer state
MMEM:STOR:STYP		Saving type
MMEM:LOAD:CKIT	Calibration Kit Management	Recalls calibration kit definition from the file
MMEM:STOR:CKIT		Save calibration kit definition to the file
MMEM:LOAD:LIM	Limit Test	Recalls limit table from file
MMEM:STOR:LIM		Saves limit table into file

Command	Description	
MMEM:LOAD:RLIM	Ripple Limit Test	Recalls ripple limit table from file
MMEM:STOR:RLIM		Saves ripple limit table into file
MMEM:LOAD:SEGM	Stimulus Settings	Recalls the segment table file
MMEM:STOR:SEGM		Saves the segment table to a file
MMEM:LOAD:SNP	Save S-parameters to Touchstone File	Loads file to S-parameters
MMEM:LOAD:SNP:TRAC:MEM		Loads file to the memory trace
MMEM:LOAD:SNP:FREQ		Enables the frequency setting from a Touchstone file when it loaded
MMEM:STOR:SNP		Saves channel data
MMEM:STOR:SNP:SEP		Separator of touchstone file
MMEM:STOR:SNP:TYPE?		Save type query
MMEM:STOR:SNP:TYPE:S1P		Sets 1-port file type and port number
MMEM:STOR:SNP:TYPE:S2P		Sets 2-port file type and ports number

Command	Description	
MMEM:STOR:SNP:TYPE:S3P		Sets 3-port file type and ports number
MMEM:STOR:SNP:TYPE:S4P		Sets 4-port file type and ports number
MMEM:STOR:SNP:TYPE:SNP		Sets N-port file type and ports number
MMEM:STOR:FDAT	Save Trace Data to CSV File	Saves CSV file
MMEM:STOR:FDAT:SCOP		Saving scope
MMEM:STOR:FDAT:FORM		Data format
MMEM:STOR:FDAT:COMM		Comment ON/OFF
MMEM:STOR:FDAT:STIM		Stimulus data ON/OFF
MMEM:STOR:FDAT:SEP		Decimal and value separators
MMEM:STOR:IMAG	Saving Display Image	Saves the screen to JPG or PNG file

MMEM:CAT?

SCPI Command

MMEMory:CATalog? <string>

Description

This command reads out the following information on the hard drive:

- Space in use.
- Available space.
- Name and size of all files (including directories) in the specified directory.

query only

Parameter

<string> Directory name

Query Response

Format:

("{A},{B},{Name 1},,{Size 1},{Name 2},,{Size 2}, ... ,{Name N},,{Size N}")

Where: N is the number of all files in the specified directory and n is an integer between 1 and N,

{A} is space in use of the hard drive (byte),

{B} is available space of the hard drive (byte),

{Name n} is name of the n-th file (directory),

{Size n} is size (byte) of the n-th file (directory). Always 0 for directories.

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to MMEMory

MMEM:COPY

SCPI Command

MMEMory:COPY <string1>,<string2>

Description

Copies a file.
command only

Parameter

<string1> Source file name

<string2> Destination file name

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to MMEMory

MMEM:DEL

SCPI Command

MMEMory:DELete <string>

Description

Deletes a file.
command only

Parameter

<string> File name

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to MMEMory

MMEM:LOAD

SCPI Command

MMEMory:LOAD[:STATe] <string>

Description

Recalls the specified Analyzer state file. The file must be saved by the MMEM:STOR command.

Note The Analyzer state file has *.STA extension by default.

command only

Parameter

<string> File name

Related Section of Operating Manual

User States

Related Controls of User Interface

Save/Recall > Recall from File

Back to MMEMory

MMEM:LOAD:CKIT

SCPI Command

MMEMory:LOAD:CKIT<Ck> <string>

Description

Recalls the definition file for the calibration kit. The file must be saved using the MMEM:STOR:CKIT command.

Note The limit table file has *.NCK extension by default.

command only

Target

Calibration kit <Ck>,

<Ck>={[1]|2|...50}

Parameter

<string> File name

Related Section of Operating Manual

Calibration Kits Management

Related Controls of User Interface

Calibration > Calibration Kits > Load from File (icon  in the Calibration Kits pop-up window)

Back to MMEMory

MMEM:LOAD:LIM

SCPI Command

MMEMory:LOAD:LIMit <string>

Description

Recalls the limit table file. The file must be saved using the MMEM:STOR:LIM command.

Note The limit table file has *.LIM extension by default.

command only

Target

Active trace of the active channel, set by the CALC:PAR:SEL command.

Parameter

<string> File name

Related Section of Operating Manual

Limit Test

Related Controls of User Interface

Limit Tests > Recall Limit Table (button in LIMIT TEST accordion)

Back to MMEMory

MMEM:LOAD:RLIM

SCPI Command

MMEMory:LOAD:RLIMit <string>

Description

Recalls the ripple limit table file. The file must be saved using the MMEM:STOR:RLIM command.

Note The ripple limit file has *.RLM extension by default.

command only

Target

Active trace of the active channel, set by the CALC:PAR:SEL command.

Parameter

<string> File name

Related Section of Operating Manual

Ripple Limit Test

Related Controls of User Interface

Limit Tests > Recall Ripple Table (button in RIPPLE LIMIT accordion)

Back to MMEMory

MMEM:LOAD:SEGM

SCPI Command

MMEMory:LOAD:SEGMent <string>

Description

Recalls the segment table file. The file must be saved using the MMEM:STOR:SEGM command.

Note The segment file has *.INI extension by default.

command only

Target

Active channel, set by the DISP:WIND:ACT command.

Parameter

<string> File name

Related Section of Operating Manual

Segment Table Editing

Related Controls of User Interface

Channel > Sweep Type {Segment} (drop-down list in the submenu) **> Import Table**

Back to MMEMory

MMEM:LOAD:SNP

SCPI Command

MMEMory:LOAD:SNP[:DATA] <string>

Description

Loads the touchstone file with the specified name to the measured S–parameters of the active channel. The touchstone file types 1, 2, 3, 4 or n-port (file extensions *.S1P, *.S2P, *.S3P, *.S4P or *.SNP) are supported. On completion of the command, the channel goes to the hold state.

command only

Target

The active channel set by the DISP:WIND:ACT command.

Parameter

<string> File name

Related Section of Operating Manual

Touchstone Data

Related Controls of User Interface

Save/Recall > Recall .sNp

Back to MMEMory

MMEM:LOAD:SNP:FREQ

SCPI Command

MMEMory:LOAD:SNP:FREQuency[:STATe] {OFF|ON|0|1}

MMEMory:LOAD:SNP:FREQuency[:STATe]?

Description

Determines whether frequency is set from touchstone file or not when the file is loaded by the command MMEM:LOAD:SNP. If this setting is OFF then the touchstone file data is interpolated or extrapolated.

command/query

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

0

Related Section of Operating Manual

Touchstone Data

Related Controls of User Interface

None

Back to MMEMory

MMEM:LOAD:SNP:TRAC:MEM

SCPI Command

MMEMory:LOAD:SNP:TRACe<Tr>:MEMory <string>

Description

Loads the Touchstone file with the specified name to the memory trace.The touchstone file types 1, 2, 3, 4 or n-port (file extensions *.S1P, *.S2P, *.S3P, *.S4P or *.SNP) are supported. The current measured S-parameter of data trace selects the appropriate S-parameter from the Touchstone file. After loading, the display of memory trace is automatically switched on.

command only

Target

The specified memory trace <Tr> of active channel,

<Tr> = {[1]|2|...64}

Active channel set by the DISP:WIND:ACT command.

Parameter

<string> File name

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to MMEMory

MMEM:MDIR

SCPI Command

MMEMory:MDIRectory <string>

Description

Creates a new directory.
command only

Parameter

<string> Directory full name

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to MMEMory

MMEM:STOR

SCPI Command

MMEMory:STORe[:STATe] <string>

Description

Saves the Analyzer state into a file.

Note The state file has *.STA extension by default.

command only

Parameter

<string> File name

Related Section of Operating Manual

User States

Related Controls of User Interface

Save/Recall > Save to File

Back to MMEMory

MMEM:STOR:CKIT

SCPI Command

MMEMory:STORe:CKIT<Ck> <string>

Description

Saves the definition file for the calibration kit.

Note The calibration kit definition file has *.NCK extension by default.

command only

Target

Calibration kit <Ck>,

<Ck>={[1]|2|...}

Parameter

<string> File name

Related Section of Operating Manual

Calibration Kits Management

Related Controls of User Interface

Calibration > Calibration Kits > Save to File (icon  in the Calibration Kits pop-up window)

Back to MMEMory

MMEM:STOR:FDAT

SCPI Command

MMEMory:STORe:FDATa <string>

Description

Saves the data of one or several traces to a CSV file. The trace number and the file settings can be configured using the MMEM:STOR:FDAT:XXXX commands.

Note The file has *.CSV extension by default.

command only

Target

Depending on the MMEM:STOR:FDAT:SCOPe setting, the active trace or all traces of the active channel.

Parameter

<string> File name

Related Section of Operating Manual

Trace Data

Related Controls of User Interface

Save/Recall > Save .CSV > Save

Back to MMEMory

MMEM:STOR:FDAT:SCOP

SCPI Command

MMEMory:STORe:FDAT:SCOPe {ACTive|ALL}

MMEMory:STORe:FDAT:SCOPe?

Description

Sets whether the active trace or all traces of the active channel will be saved using the MMEM:STOR:FDAT command.

command/query

Parameter

<char> Choose from:

ACTive	Active trace only
ALL	All traces of the active channel

Query Response

{ACT|ALL}

Preset Value

ACT

Related Section of Operating Manual

Trace Data

Related Controls of User Interface

Save/Recall > Save .CSV > Scope {Active trace | All traces of channel} (drop-down list in Save.CSV pop-up window)

Back to MMEMory

MMEM:STOR:FDAT:FORM

SCPI Command

MMEMory:STORe:FDAT:FORMat {DB|RI|DISPlayed}

MMEMory:STORe:FDAT:FORMat?

Description

Sets the data format when the CSV file is saved using the MMEM:STOR:FDAT command.

command/query

Parameter

<char> Choose from:

DB	dB/Angle format
RI	Real/Imag format
DISPlayed	Currently displayed trace format

Query Response

{DB|RI|DISP}

Preset Value

DB

Related Section of Operating Manual

Trace Data

Related Controls of User Interface

Save/Recall > Save .CSV > Format {Displayed | Real-Imag | dB-Angle} (drop-down list in Save.CSV pop-up window)

Back to MMEMory

MMEM:STOR:FDAT:COMM

SCPI Command

MMEMory:STORe:FDAT:COMMent[:STATe] {OFF|ON|0|1}

MMEMory:STORe:FDAT:COMMent[:STATe]?

Description

Turns the comment strings at the beginning of the CSV file saved with the MMEM:STOR:FDAT command ON/OFF. The comment string starts with the '!' character.

command/query

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

0

Related Section of Operating Manual

Trace Data

Related Controls of User Interface

Save/Recall > Save .CSV > Header (checkbox in Save.CSV pop-up window)

Back to MMEMory

MMEM:STOR:FDAT:STIM

SCPI Command

MMEMory:STORe:FDAT:STIMulus[:STATe] {OFF|ON|0|1}

MMEMory:STORe:FDAT:STIMulus[:STATe]?

Description

Turns the column with the stimulus data in the CSV file saved with the MMEM:STOR:FDAT command ON/OFF. The stimulus column is located at the leftmost position.

command/query

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

0

Related Section of Operating Manual

Trace Data

Related Controls of User Interface

Save/Recall > Save .CSV > Stimulus (checkbox in Save.CSV pop-up window)

Back to MMEMory

MMEM:STOR:FDAT:SEP

SCPI Command

MMEMory:STORe:FDAT:SEParator {POINt|LOCal}

MMEMory:STORe:FDAT:SEParator?

Description

Sets the separators used when the CSV file is saved with the MMEM:STOR:FDAT command.

command/query

Parameter

<char> Choose from:

POINt	Uses point ('.') as decimal separator and comma (',') as value separator
LOCal	Uses separators from the Windows locale

Query Response

{POIN|LOC}

Preset Value

POINt

Related Section of Operating Manual

Trace Data

Related Controls of User Interface

Save/Recall > Save .CSV > Decimal separator > {Point | Local} (drop-down list in Save.CSV pop-up window)

Back to MMEMory

MMEM:STOR:IMAG

SCPI Command

MMEMory:STORe:IMAGe <string>

Description

Saves the display image in JPG or PNG format into a file.

Note If the file has *.PNG extension, the file has PNG format, in all the other cases the file has JPG format.

command only

Parameter

<string> File name

Related Section of Operating Manual

Graph Printing

Related Controls of User Interface

Save/Recall > Send Image To {PNG} (drop-down list in the Report area) > **Send**

Or

Save charts as image (icon  in Quick Access Toolbar)

Back to MMEMory

MMEM:STOR:LIM

SCPI Command

MMEMory:STORe:LIMit <string>

Description

Saves the limit table into a file.

Note The file has *.LIM extension by default.

command only

Target

Active trace of the active channel, set by the CALC:PAR:SEL command.

Parameter

<string> File name

Related Section of Operating Manual

Limit Test

Related Controls of User Interface

Limit Tests > Save Limit Table (button in LIMIT TEST accordion)

Back to MMEMory

MMEM:STOR:RLIM

SCPI Command

MMEMory:STORe:RLIMit <string>

Description

Saves the ripple limit table into a file.

Note The ripple limit file has *.RLM extension by default.

command only

Target

Active trace of the active channel, set by the CALC:PAR:SEL command.

Parameter

<string> File name

Related Section of Operating Manual

Ripple Limit Test

Related Controls of User Interface

Limit Tests > Save Ripple Table (button in RIPPLE LIMIT accordion)

Back to MMEMory

MMEM:STOR:SEGM

SCPI Command

MMEMory:STORe:SEGMent <string>

Description

Saves the segment table into a file.

Note The segment file has *.INI extension by default.

command only

Target

Active channel, set by the DISP:WIND:ACT command.

Parameter

<string> File name

Related Section of Operating Manual

Segment Table Editing

Related Controls of User Interface

Channel > Sweep Type {Segment} (drop-down list in STIMULUS area) **> Export Table**

Back to MMEMory

MMEM:STOR:SNP

SCPI Command

MMEMory:STORe:SNP[:DATA] <string>

Description

Saves the measured S–parameters of the active channel into a Touchstone file. The file type (1-port to n-port) is set by the following commands: MMEM:STOR:SNP:TYPE:S1P, MMEM:STOR:SNP:TYPE:S2P, MMEM:STOR:SNP:TYPE:S3P, MMEM:STOR:SNP:TYPE:S4P, MMEM:STOR:SNP:TYPE:SNP.

Note The file has *.SNP extension by default.

command only

Target

Active channel, set by the DISP:WIND:ACT command.

Parameter

<string> File name

Related Section of Operating Manual

Touchstone Data

Related Controls of User Interface

Save/Recall > Save .sNp > Save

Back to MMEMory

MMEM:STOR:SNP:FORM

SCPI Command

MMEMory:STORe:SNP:FORMat <char>

MMEMory:STORe:SNP:FORMat?

Description

Sets or reads out the data format for the S-parameter saved using the MMEM:STOR:SNP command.

command/query

Parameter

<char> Choose from:

DB	Logarithmic Magnitude / Angle format
MA	Linear Magnitude / Angle format
RI	Real part /Imaginary part format

Query Response

{RI|DB|MA}

Preset Value

RI

Related Section of Operating Manual

Touchstone Data

Related Controls of User Interface

Save/Recall > Save .sNp > Format {Real-Imag | Magnitude-Angle | dB-Angle}
(drop-down list in the Save .sNp pop-up window)

Back to MMEMory

MMEM:STOR:SNP:SEP

SCPI Command

MMEMory:STORe:SNP:SEParator <char>

MMEMory:STORe:SNP:SEParator?

Description

Sets or reads out the Touchstone file separator symbol when the S–parameters are saved using the MMEM:STOR:SNP command.

command/query

Parameter

<char> Choose from:

TAB	Tab symbol (0x09)
SPACe	Space symbol (0x20)

Query Response

{TAB|SPAC}

Preset Value

TAB

Related Section of Operating Manual

Touchstone Data

Related Controls of User Interface

Save/Recall > Save .sNp > Separator {Space | Tab} (drop-down list in the Save .sNp pop-up window)

Back to MMEMory

MMEM:STOR:SNP:TYPE?

SCPI Command

MMEMory:STORe:SNP:TYPE?

Description

Reads out the type of Touchstone file (*.S1P, *.S2P, *.S3P, *.S4P or *.SNP) to be used when saving S–parameters with the MMEM:STOR:SNP command.

query only

Query Response

<string>

{S1P|S2P|S3P|S4P|SNP}

Related Section of Operating Manual

Touchstone Data

Related Controls of User Interface

Save/Recall > Save .sNp > Select VNA Ports (select port numbers in the Save .sNp pop-up window)

Back to MMEMory

MMEM:STOR:SNP:TYPE:S1P

SCPI Command

MMEMory:STORe:SNP:TYPE:S1P <port>

MMEMory:STORe:SNP:TYPE:S1P?

Description

Sets or reads out the 1-port Touchstone file type (*.S1P) and the port number when saving S–parameters using the MMEM:STOR:SNP command.

command/query

Parameter

<port> port number from 1 to n.

Query Response

<numeric>

Preset Value

1

Related Section of Operating Manual

Touchstone Data

Related Controls of User Interface

Save/Recall > Save .sNp > Select VNA Ports (select the number of the port in the Save .sNp pop-up window)

Back to MMEMory

MMEM:STOR:SNP:TYPE:S2P

SCPI Command

MMEMory:STORe:SNP:TYPE:S2P <port1>,<port2>

MMEMory:STORe:SNP:TYPE:S2P?

Description

Sets or reads out the 2-port Touchstone file type (*.S2P) and the port number when saving S–parameters using the MMEM:STOR:SNP command.

command/query

Parameter

<port1> First port number

<port2> Second port number

<port> port number from 1 to n.

Query Response

<numeric1>, <numeric2>

Related Section of Operating Manual

Touchstone Data

Related Controls of User Interface

Save/Recall > Save .sNp > Select VNA Ports (select port numbers in the Save .sNp pop-up window)

Back to MMEMory

MMEM:STOR:SNP:TYPE:S3P

SCPI Command

MMEMory:STORe:SNP:TYPE:S3P <port1>,<port2>,<port3>

MMEMory:STORe:SNP:TYPE:S3P?

Description

Sets or reads out the 3-port Touchstone file type (*.S3P) and the port number when saving S–parameters using the MMEM:STOR:SNP command.

command/query

Parameter

<port1> First port number

<port2> Second port number

<port3> Third port number

<port> port number from 1 to n.

Query Response

<numeric1>, <numeric2>, <numeric3>

Related Section of Operating Manual

Touchstone Data

Related Controls of User Interface

Save/Recall > Save .sNp > Select VNA Ports (select port numbers in the Save .sNp pop-up window)

Back to MMEMory

MMEM:STOR:SNP:TYPE:S4P

SCPI Command

MMEMory:STORe:SNP:TYPE:S4P <port1>,<port2>,<port3>,<port4>

MMEMory:STORe:SNP:TYPE:S4P?

Description

Sets or reads out the 4-port Touchstone file type (*.S4P) and the port number when saving S-parameters using the MMEM:STOR:SNP command.

command/query

Parameter

<port1>	First port number
<port2>	Second port number
<port3>	Third port number
<port4>	Fourth port number

<port> port number from 1 to n.

Query Response

<numeric1>, <numeric2>, <numeric3>, <numeric4>

Related Section of Operating Manual

Touchstone Data

Related Controls of User Interface

Save/Recall > Save .sNp > Select VNA Ports (select port numbers in the Save .sNp pop-up window)

Back to MMEMory

MMEM:STOR:SNP:TYPE:SNP

SCPI Command

MMEMory:STORe:SNP:TYPE:SNP <port1>, ... <portN>

MMEMory:STORe:SNP:TYPE:SNP?

Description

Sets or reads out the N-port Touchstone file type (*.SNP) and the port number when saving S-parameters using the MMEM:STOR:SNP command.

command/query

Parameter

<portN> Port number from 1 to n

<port> number of port.

Query Response

<numeric1>, ... <numericN>

Related Section of Operating Manual

Touchstone Data

Related Controls of User Interface

Save/Recall > Save .sNp > Select VNA Ports (select port numbers in the Save .sNp pop-up window)

Back to MMEMory

MMEM:STOR:STYP

SCPI Command

MMEMory:STORe:STYPe <char>

MMEMory:STORe:STYPe?

Description

Selects the type of the Analyzer or channel state saving using the MMEM:STOR command.

command/query

Parameter

<char> Choose from:

STATe	Measurement conditions
CSTate	Measurement conditions and calibration
DSTate	Measurement conditions and data
CDSTate	Measurement conditions, calibration, data and memory
CMSTate	Measurement conditions, calibration and memory

Query Response

{STAT|CST|DST|CDST|CMST}

Preset Value

CST

Related Section of Operating Manual

User States

Related Controls of User Interface

Save/Recall > Save Properties (icon  in the USER STATES area) **> Save Correctors | Save Memory Traces** (checkboxes in the Save Properties pop-up window)

Back to MMEMory

MMEM:TRAN?

SCPI Command

MMEMory:TRANsfer? <string>

Description

Transfers the contents of a specified file from the Analyzer to the external PC.

Note The command is not applicable with the TCP/IP Socket protocol. The file must be 20 Mbytes or less.

command/query

Parameter

<string> the file name with the full path.

Query Response

Block data transfer format. For example:

#6001000<binary block 1000 bytes>

#6	Symbol # introduces the data block. The next number indicates how many of the following digits describe the length of the data block;
001000	Length of the data block;

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to MMEMory

OUTP

SCPI Command

OUTPut[:STATe] {OFF|ON|0|1}

OUTPut[:STATe]?

Description

Turns the RF signal output ON/OFF. Measurements cannot be performed when the RF signal output is turned OFF.

command/query

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

1

Related Section of Operating Manual

RF Out Function

Related Controls of User Interface

Channel > RF Out {ON | OFF} (toggle button in the submenu)

SENSe

Command	Description	
SENS:AVER	Averaging	Averaging ON/OFF
SENS:AVER:CLE		Restart averaging
SENS:AVER:COUN		Averaging factor
SENS:BAND	IFBW	IF bandwidth
SENS:BWID		IF bandwidth
SENS:CORR:CLE	Misc Calibration Commands	Clears the table of calibration factors
SENS:CORR:COLL:CLE		Clears data of calibration standards
SENS:CORR:STAT		S-parameter error correction state
SENS:CORR:TYPE?		Information about trace (calibration type, number of ports)
SENS:CORR:COEF	Read/Write Calibration Coefficients	Calibration coefficient data
SENS:CORR:COEF:METH:ERES		Selects one-path two-port method
SENS:CORR:COEF:METH:OPEN		Selects Response Open method

Command	Description	
SENS:CORR:COEF:METH:SHOR		Selects Response Short method
SENS:CORR:COEF:METH:SOLT		Selects full N-port method
SENS:CORR:COEF:METH:THRU		Selects Response Thru method
SENS:CORR:COEF:SAVE		Enables calibration coefficients
SENS:CORR:COLL:CKIT	Calibration Kit Management	calibration kit selection
SENS:CORR:COLL:CKIT:LAB		calibration kit label
SENS:CORR:COLL:CKIT:RES		Remove or restore a calibration kit
SENS:CORR:COLL:CKIT:STAN:ARB	Calibration Standard Definition	Arbitrary impedance (Load)
SENS:CORR:COLL:CKIT:STAN:C0		Capacitance C0 (Open)
SENS:CORR:COLL:CKIT:STAN:C1		Capacitance C1 (Open)
SENS:CORR:COLL:CKIT:STAN:C2		Capacitance C2 (Open)
SENS:CORR:COLL:CKIT:STAN:C3		Capacitance C3 (Open)
SENS:CORR:COLL:CKIT:STAN:COUN?		Number of standards in the calibration kit

Command	Description	
SENS:CORR:COLL:CKIT:STAN:DATA		S-parameters of the data-based calibration standard
SENS:CORR:COLL:CKIT:STAN:DEL		Offset delay
SENS:CORR:COLL:CKIT:STAN:FMAX		Max frequency
SENS:CORR:COLL:CKIT:STAN:FMIN		Min frequency
SENS:CORR:COLL:CKIT:STAN:L0		Inductance L0 (Short)
SENS:CORR:COLL:CKIT:STAN:L1		Inductance L1 (Short)
SENS:CORR:COLL:CKIT:STAN:L2		Inductance L2 (Short)
SENS:CORR:COLL:CKIT:STAN:L3		Inductance L3 (Short)
SENS:CORR:COLL:CKIT:STAN:LAB		Standard label
SENS:CORR:COLL:CKIT:STAN:LOSS		Offset loss
SENS:CORR:COLL:CKIT:STAN:TYPE		Standard type
SENS:CORR:COLL:CKIT:STAN:Z0		Offset Z0

Command	Description	
SENS:CORR:COLL:ISOL	Measurement of Calibration Standards	Isolation
SENS:CORR:COLL:LOAD		Load
SENS:CORR:COLL:OPEN		Open
SENS:CORR:COLL:SHOR		Short
SENS:CORR:COLL:THRU		Thru
SENS:CORR:CONF:DATA?	Configurations	Number and list of calibration configuration names
SENS:CORR:CONF:CRE		Creating a configuration
SENS:CORR:CONF:DEL		Deleting the configuration
SENS:CORR:CONF:DEL:ALL		Deleting the all configurations
SENS:CORR:CONF:SEL		Selecting a configuration.
SENS:CORR:CONF:GRO:DATA?	Ports Groups	Number and list of port group names
SENS:CORR:CONF:GRO:CRE		Creating a group of ports
SENS:CORR:CONF:GRO:METH?		Calibration type for the selected ports group

Command	Description	
SENS:CORR:CONF:GRO:PORT:LIST?		List of ports for the selected ports group
SENS:CORR:CONF:GRO:SEL		Active ports group
SENS:CORR:CONF:GRO:DEL		Deleting an active ports group.
SENS:CORR:CONF:GRO:SIMP	Configuring a Ports Group	Simplified calibration mode ON/OFF
SENS:CORR:CONF:GRO:PORT:COMM		Common port for simplified calibration
SENS:CORR:CONF:GRO:ISOL:ENAB:ALL		Calibration isolation ON
SENS:CORR:CONF:GRO:ISOL:DIS:ALL		Calibration isolation OFF
SENS:CORR:CONF:GRO:PORT:SOUR		Source port
SENS:CORR:CONF:GRO:LOAD:ENAB:ALL		Load standard ON
SENS:CORR:CONF:GRO:LOAD:DIS:ALL		Load standard OFF
SENS:CORR:CONF:GRO:UTHR:ENAB:ALL		Unknown Thru ON

Command	Description	
SENS:CORR:CONF:GRO:UTHR:DIS:ALL		Unknown Thru OFF
SENS:CORR:CONF:GRO:ECAL:SEL		ACM for the selected ports group
SENS:CORR:CONF:GRO:ECAL:UCH		ACM characterization type for an active group of port
SENS:CORR:CONF:GRO:ECAL:THER:COMP		Thermal compensation mode for the ACM
SENS:CORR:CONF:GRO:PSEN:SEL		Power meter sensor for the active group of ports
SENS:CORR:CONF:GRO:PSEN:ZERO		Executes the zeroing
SENS:CORR:CONF:GRO:POW:STAT		State of the necessity to perform port power calibration
SENS:CORR:CONF:GRO:RCH:STAT		State of the necessity to perform the receiver calibration of the reference receiver
SENS:CORR:CONF:GRO:TCH:STAT		State of the necessity to perform the receiver calibration of the test receiver
SENS:CORR:CONF:GRO:TCH:SOUR		Source port for the test receiver calibration
SENS:CORR:CONF:GRO:RCH:OFFS		Offset level for the reference receiver

Command	Description	
SENS:CORR:CONF:GRO:TCH:OFFS		Offset level for the test receiver
SENS:CORR:CONF:CONN		Type and gender of the connector
SENS:CORR:CONF:GRO:CKIT:SEL		Reads the installed kit for the active group of ports
SENS:CORR:COLL:STAR	Data Collection Management	Starts the calibration process
SENS:CORR:COLL:STOP		Exits the mode of collecting data steps
SENS:CORR:COLL:STEP:COUN?		Reads the number of the generated steps.
SENS:CORR:COLL:STEP:SEL?		Reads the type of the calibration step and the Analyzer ports.
SENS:CORR:COLL:STEP:SEL:OPEN		Selects the calibration step with the OPEN class.
SENS:CORR:COLL:STEP:SEL:SHOR		Selects the calibration step with the SHORT class.
SENS:CORR:COLL:STEP:SEL:LOAD		Selects the calibration step with the LOAD class.
SENS:CORR:COLL:STEP:SEL:THRU		Selects the calibration step with the THRU class.
SENS:CORR:COLL:STEP:SEL:ISOL		Selects the calibration step with the ISOL class.

Command	Description	
SENS:CORR:COLL:STEP:SEL:ECAL		Selects the ACM calibration step.
SENS:CORR:COLL:STEP:ECAL:ORI:EXEC		Executes the auto-orientation procedure
SENS:CORR:COLL:STEP:ECAL:TABL		ACM commutation table
SENS:CORR:COLL:STEP:SEL:RCH		Selects the step of collecting data for the reference channel of the receiver
SENS:CORR:COLL:STEP:SEL:TCH		Selects the step of collecting data for the test channel of the receiver
SENS:CORR:COLL:STEP:SEL:POW		Selects the step of collecting power data.
SENS:CORR:COLL:STEP:POW:ZERO		Performs zeroing the power step.
SENS:CORR:COLL:STEP:SEL:RPOW		Selects the combined power and reference receiver data collection step.
SENS:CORR:COLL:STEP:MEAS		Performs the measurement of the selected calibration step.
SENS:CORR:COLL:STEP:ACQ:OPEN		Performs the measurement of the calibration step with the OPEN class

Command	Description	
SENS:CORR:COLL:STEP:ACQ:SHOR		Performs the measurement of the calibration step with the SHORT class
SENS:CORR:COLL:STEP:ACQ:LOAD		Performs the measurement of the calibration step with the LOAD class
SENS:CORR:COLL:STEP:ACQ:THRU		Performs the measurement of the calibration step with the THRU class
SENS:CORR:COLL:STEP:ACQ:ISOL		Performs the measurement of the calibration step with the ISOL class
SENS:CORR:COLL:STEP:ACQ:ECAL		Performs the measurement of the ACM calibration
SENS:CORR:COLL:STEP:ACQ:RCH		Performs the measurement of the reference receiver calibration step.
SENS:CORR:COLL:STEP:ACQ:TCH		Performs the measurement of the test receiver calibration step.
SENS:CORR:COLL:STEP:ACQ:POW		Performs the measurement of the power calibration step.
SENS:CORR:COLL:STEP:ACQ:RPOW		Performs the measurement of power and reference receiver calibration step.

Command	Description	
SENS:CORR:COLL:SAVE	Calibration Completion	Calibration completion
SENS:CORR:EXT	Port Extension	Port extension ON/OFF
SENS:CORR:EXT:PORT:FREQ		Values of "Frequency1" and "Frequency2"
SENS:CORR:EXT:PORT:INCL		Loss compensation ON/OFF
SENS:CORR:EXT:PORT:LDC		Value "Loss at DC"
SENS:CORR:EXT:PORT:LOSS		Loss compensation ON/OFF
SENS:CORR:EXT:PORT:TIME		Extension Port n
SENS:CORR:EXT:AUTO:CONF	Auto Port Extension	Frequency range configuration
SENS:CORR:EXT:AUTO:DCOF		"Loss at DC" value ON/OFF
SENS:CORR:EXT:AUTO:LOSS		"Loss1" and "Loss2" values ON/OFF
SENS:CORR:EXT:AUTO:MEAS		Measurement of Short or Open
SENS:CORR:EXT:AUTO:PORT		Auto port extension for the specified port ON/OFF
SENS:CORR:EXT:AUTO:STAR		Start frequency of user span

Command	Description	
SENS:CORR:EXT:AUTO:STOP		Stop frequency of user span
SENS:CORR:IMP	System Impedance Setting	System Z0
SENS:CORR:IMP:SEL:AUTO		Auto-select Z0 ON/OFF
SENS:CORR:TRAN:TIME:FREQ	Cable Correction	Frequency at which cable loss specified
SENS:CORR:TRAN:TIME:LOSS		Cable loss
SENS:CORR:TRAN:TIME:RVEL		Cable velocity factor
SENS:CORR:TRAN:TIME:STAT		Cable correction ON/OFF
SENS:DATA:CORR?	Data Transfer	Corrected S-parameter data or corrected receiver data
SENS:DATA:RAWD?		Raw S-parameter data or raw receiver data
SENS:FREQ:DATA?		Stimulus data
SENS:FREQ	Stimulus Settings	Fixed frequency for a power sweep
SENS:FREQ:CENT		Center frequency

Command	Description	
SENS:FREQ:SPAN		Span frequency
SENS:FREQ:STAR		Start power
SENS:FREQ:STOP		Stop power
SENS:SEGM:DATA		Segment sweep table
SENS:SWE:POIN		Number of points
SENS:SWE:POIN:TIME		Point delay
SENS:SWE:TYPE		Sweep type

SENS:AVER

SCPI Command

SENSe<Ch>:AVERage[:STATe] {OFF|ON|0|1}

SENSe<Ch>:AVERage[:STATe]?

Description

Turns the measurement averaging function ON/OFF.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

0

Related Commands

SENS:AVER:COUN

Related Section of Operating Manual

Averaging Setting

Related Controls of User Interface

Average > CHANNEL AVERAGE {ON | OFF} (toggle button in the submenu)

Back to SENSe

SENS:AVER:CLE

SCPI Command

SENSe<Ch>:AVERage:CLEar

Description

Restarts the averaging process when the averaging function is turned on.
command only

Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Related Commands

SENS:AVER

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to SENSe

SENS:AVER:COUN

SCPI Command

SENSe<Ch>:AVERage:COUNt <numeric>

SENSe<Ch>:AVERage:COUNt?

Description

Sets or reads out the averaging factor when the averaging function is turned on.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Parameter

<numeric> the averaging factor from 1 to 200.

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

10

Related Commands

SENS:AVER

Related Section of Operating Manual

Averaging Setting

Related Controls of User Interface

Average > Average Factor (textbox in CHANNEL AVERAGE accordion)

Back to SENSe

SENS:BAND

SCPI Command

SENSe<Ch>:BANDwidth[:RESolution] <frequency>

SENSe<Ch>:BANDwidth[:RESolution]?

Description

Sets or reads out the IF bandwidth.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Parameter

<frequency> the IF bandwidth value.

Unit

Hz (Hertz)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

10 kHz

Resolution

In steps of 1, 1.5, 2, 3, 5, 7

Related Commands

SENS:BWID — similar command

Related Section of Operating Manual

Segment Table Editing

Sweep Type

Related Controls of User Interface

Channel > Sweep Type {Segment} (drop-down list in STIMULUS area) **> IFBW** (clear checkbox) > **IFBW** (textbox)

Back to SENSe

SENS:BWID

SCPI Command

SENSe<Ch>:BWIDth[:RESolution] <frequency>

SENSe<Ch>:BWIDth[:RESolution]?

Description

Sets or reads out the IF bandwidth.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Parameter

<frequency> the IF bandwidth value.

Unit

Hz (Hertz)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

10 kHz

Resolution

In steps of 1, 1.5, 2, 3, 5, 7

Related Commands

SENS:BAND — similar command

Related Section of Operating Manual

Segment Table Editing

Sweep Type

Related Controls of User Interface

Channel > Sweep Type {Segment} (drop-down list in STIMULUS area) **> IFBW** (clear checkbox) > **IFBW** (textbox)

Back to SENSe

SENS:CORR:CLE

SCPI Command

SENSe<Ch>:CORRection:CLEar

Description

Clears the calibration coefficient table.
command only

Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to SENSe

SENS:CORR:COEF

SCPI Command

SENSe<Ch>:CORRection:COEFficient[:DATA]
<char>,<rcvport>,<srcport>,<numeric list>

SENSe<Ch>:CORRection:COEFficient[:DATA]? <char>,<rcvport>,<srcport>

Description

Writes or reads out the calibration coefficient data array.

The array size is 2N, where N is the number of measurement points. For the n-th point, where n from 1 to N:

<numeric 2n–1> real part of the calibration coefficients;

<numeric 2n> imaginary part of the calibration coefficients.

Note The written calibration coefficients become effective only after the SENS:CORR:COEF:SAVE command is executed.

command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Parameter

<char> Specifies the Error term:

ER	Reflection tracking
ED	Directivity
ES	Source match
ET	Transmission tracking
EX	Isolation
EL	Load match

<rcvport> the number of the receiver port from 1 to n

<srcport> the number of the source port from 1 to n

<numeric list> the calibration coefficient array

When ES, ER, or ED is used, the numbers of the ports <rcvport> and <srcport> must be the same. When EL, ET, or EX is used, the numbers of the ports <rcvport> and <srcport> must be different.

Query Response

<numeric 1>, <numeric 2>, …<numeric 2N>

Related Commands

SENS:CORR:COEF:SAVE

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to SENSe

SENS:CORR:COEF:METH:ERES

SCPI Command

SENSe<Ch>:CORRection:COEFficient:METHod:ERESponse <rcvport>,<srcport>

Description

Selects the ports and sets the 1-path two-port calibration type when the written calibration coefficients are made effective by the SENS:CORR:COEF:SAVE command.

command only

Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Parameter

<rcvport>	The number of the receiver port from 1 to 6/8/10/12/14/16 (depending on the Analyzer model, see corresponding datasheet).
<srcport>	The number of the source port from 1 to 6/8/10/12/14/16 (depending on the Analyzer model, see corresponding datasheet).

Out of Range

If the same port numbers are specified, an error occurs.

Related Commands

SENS:CORR:COEF:SAVE

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to SENSe

SENS:CORR:COEF:METH:OPEN

SCPI Command

SENSe<Ch>:CORRection:COEFficient:METHod[:RESPonse]:OPEN <port>

Description

Selects the port and sets the response calibration (Open) type when the written calibration coefficients are made effective by the SENS:CORR:COEF:SAVE command.

command only

Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Parameter

<port>	The number of the port from 1 to 6/8/10/12/14/16 (depending on the Analyzer model, see corresponding datasheet).

Related Commands

SENS:CORR:COEF:SAVE

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to SENSe

SENS:CORR:COEF:METH:SHOR

SCPI Command

SENSe<Ch>:CORRection:COEFficient:METHod[:RESPonse]:SHORt <port>

Description

Selects the port and sets the response calibration (Short) type when the written calibration coefficients are made effective by the SENS:CORR:COEF:SAVE command.

command only

Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Parameter

<port>	The number of the port from 1 to 6/8/10/12/14/16 (depending on the Analyzer model, see corresponding datasheet).

Related Commands

SENS:CORR:COEF:SAVE

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to SENSe

SENS:CORR:COEF:METH:SOLT

SCPI Command

SENSe<Ch>:CORRection:COEFficient:METHod:SOLT<N> <port1>, ... <portN>

Description

Selects the port and sets the full N-port calibration type when the written calibration coefficients are made effective by the SENS:CORR:COEF:SAVE command.

command only

Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Parameter

<port>	The number of the port from 1 to 6/8/10/12/14/16 (depending on the Analyzer model, see corresponding datasheet).
<N>	The number of ports from 1 to n.

Related Commands

SENS:CORR:COEF

SENS:CORR:COEF:SAVE

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to SENSe

SENS:CORR:COEF:METH:THRU

SCPI Command

SENSe<Ch>:CORRection:COEFficient:METHod[:RESPonse]:THRU <rcvport>, <srcport>

Description

Selects the ports and sets the response calibration (Thru) type when the written calibration coefficients are made effective by the SENS:CORR:COEF:SAVE command.

command only

Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Parameter

<rcvport>	The number of the receiver port from 1 to 6/8/10/12/14/16 (depending on the Analyzer model, see corresponding datasheet).
<srcport>	The number of the source port from 1 to 6/8/10/12/14/16 (depending on the Analyzer model, see corresponding datasheet).

Out of Range

If the same port numbers are specified, an error occurs.

Related Commands

SENS:CORR:COEF:SAVE

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to SENSe

SENS:CORR:COEF:SAVE

SCPI Command

SENSe<Ch>:CORRection:COEFficient:SAVE

Description

Enables the written calibration coefficients depending on the selected calibration type. On completion of the command, the error correction automatically turns ON.

Executing this command before all necessary calibration coefficients have been written will result in an error and the command will be ignored.

command only

Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Related Commands

Calibration type selection:

SENS:CORR:COEF:METH:ERES

SENS:CORR:COEF:METH:OPEN

SENS:CORR:COEF:METH:SHOR

SENS:CORR:COEF:METH:THRU

SENS:CORR:COEF:METH:SOLT

Calibration coefficient writing:

SENS:CORR:COEF

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to SENSe

SENS:CORR:COLL:CKIT

SCPI Command

SENSe:CORRection:COLLect:CKIT[:SELect] <numeric>

SENSe:CORRection:COLLect:CKIT[:SELect]?

Description

Sets or reads out the number of the selected calibration kit in the table of calibration kits. The selected calibration kit is used in the subsequent calibration and is used for editing by the commands SENS:CORR:COLL:CKIT:XXXX.

command/query

Parameter

<numeric> the number of the calibration kit from 1 to 64.

Query Response

<numeric>

Preset Value

1

Related Section of Operating Manual

Calibration Kits Management

Calibration Wizard

Related Controls of User Interface

Calibration > Calibration Kits > select checkbox at the required calibration kit in the Calibration Kits pop-up window

Back to SENSe

SENS:CORR:COLL:CKIT:LAB

SCPI Command

SENSe:CORRection:COLLect:CKIT:LABel <string>

SENSe:CORRection:COLLect:CKIT:LABel?

Description

Sets or reads out the calibration kit label.
command/query

Target

Selected calibration kit.

Parameter

<string>, up to 254 characters.

Query Response

<string>

Related Section of Operating Manual

Calibration Kits Management

Related Controls of User Interface

Calibration > Calibration Kits > select checkbox at the required calibration kit **> MODEL | MANUFACTURER** (textboxes)

Back to SENSe

SENS:CORR:COLL:CKIT:RES

SCPI Command

SENSe:CORRection:COLLect:CKIT:RESet

Description

Resets the calibration kit to the factory settings. Restores the predefined calibration kit. Removes the user defined calibration kit.
command only

Target

Selected calibration kit.

Related Section of Operating Manual

Calibration Management

Related Controls of User Interface

Calibration > Calibration Kits > select calibration kit **> Restore** (icon  at the top area of the Calibration Kits pop-up window)

Back to SENSe

SENS:CORR:COLL:CKIT:STAN:ARB

SCPI Command

SENSe:CORRection:COLLect:CKIT:STAN<Std>:ARBitrary <numeric>

SENSe:CORRection:COLLect:CKIT:STAN<Std>:ARBitrary?

Description

Sets or reads out the value of the arbitrary impedance for the load standard.

command/query

Target

Standard <Std> of the calibration kit,

<Std>={[1]|2|...N}, where N — the number of the standards in the calibration kit.

Parameter

<numeric> the arbitrary impedance value from –1E18 to 1E18.

Unit

Ω (Ohm)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

50 or 75 Ω, depending on the selected calibration kit.

Related Section of Operating Manual

Circuit Model Standards

Related Controls of User Interface

Calibration > Calibration Kits > select calibration kit **>** select standard **> Type {LOAD | SLIDING LOAD}** (drop-down list in the Circuit Model sidebar in the Calibration Kits pop-up window) **> Terminal Imp. Ω** (textbox in the Equivalent Circuit Model area in the Calibration Kits pop-up window)

Back to SENSe

SENS:CORR:COLL:CKIT:STAN:C0

SCPI Command

SENSe:CORRection:COLLect:CKIT:STAN<Std>:C0 <numeric>

SENSe:CORRection:COLLect:CKIT:STAN<Std>:C0?

Description

Sets or reads out the C0 value for the open calibration standard.
command/query

Target

Standard <Std> of the calibration kit,

<Std>={[1]|2|...N}, where N — the number of the standards in the calibration kit.

Parameter

<numeric> the C0 value from –1E14 to 1E14.

Unit

1E–15 F (Farad)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Related Section of Operating Manual

Circuit Model Standards

Related Controls of User Interface

Calibration > Calibration Kits > select calibration kit **>** select standard **> Type {OPEN}** (drop-down list in the Circuit Model segment switch in the Calibration Kits pop-up window) **> C0×1e–15 F** (textbox in the equivalent circuit model area in the Calibration Kits pop-up window)

Back to SENSe

SENS:CORR:COLL:CKIT:STAN:C1

SCPI Command

SENSe:CORRection:COLLect:CKIT:STAN<Std>:C1 <numeric>

SENSe:CORRection:COLLect:CKIT:STAN<Std>:C1?

Description

Sets or reads out the C1 value for the open calibration standard.
command/query

Target

Standard <Std> of the calibration kit,

<Std>={[1]|2|...N}, where N — the number of the standards in the calibration kit.

Parameter

<numeric> C1 value from –1E14 to 1E14

Unit

1E–27 F/Hz (Farad/Hertz)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Related Section of Operating Manual

Circuit Model Standards

Related Controls of User Interface

Calibration > Calibration Kits > select calibration kit **>** select standard **> Type {OPEN}** (drop-down list in the Circuit Model segment switch in the Calibration Kits pop-up window) **> C1×1e–27 F/Hz** (textbox in the equivalent circuit model area in the Calibration Kits pop-up window)

Back to SENSe

SENS:CORR:COLL:CKIT:STAN:C2

SCPI Command

SENSe:CORRection:COLLect:CKIT:STAN<Std>:C2 <numeric>

SENSe:CORRection:COLLect:CKIT:STAN<Std>:C2?

Description

Sets or reads out the C2 value for the open calibration standard.
command/query

Target

Standard <Std> of the calibration kit,

<Std>={[1]|2|...N}, where N — the number of the standards in the calibration kit.

Parameter

<numeric> the C2 value from –1E14 to 1E14.

Unit

1E–36 F/Hz2 (Farad/Hertz^2)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Related Section of Operating Manual

Circuit Model Standards

Related Controls of User Interface

Calibration > Calibration Kits > select calibration kit **>** select standard **> Type {OPEN}** (drop-down list in the Circuit Model segment switch of Standard pop-up window) **> C2×1e–36 F/Hz^2** (textbox in the equivalent circuit model area of the Standard pop-up window)

Back to SENSe

SENS:CORR:COLL:CKIT:STAN:C3

SCPI Command

SENSe:CORRection:COLLect:CKIT:STAN<Std>:C3 <numeric>

SENSe:CORRection:COLLect:CKIT:STAN<Std>:C3?

Description

Sets or reads out the C3 value for the open calibration standard.
command/query

Target

Standard <Std> of the calibration kit,

<Std>={[1]|2|...N}, where N — the number of the standards in the calibration kit.

Parameter

<numeric> the C3 value from –1E18 to 1E18.

Unit

1E–45 F/Hz3 (Farad/Hertz^3)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Related Section of Operating Manual

Circuit Model Standards

Related Controls of User Interface

Calibration > Calibration Kits > select calibration kit **>** select standard **> Type {OPEN}** (drop-down list in the Circuit Model sidebar in the Calibration Kits pop-up window) **> C3×1e–45 F/Hz^3** (textbox in the Equivalent Circuit Model area in the Calibration Kits pop-up window)

Back to SENSe

SENS:CORR:COLL:CKIT:STAN:COUN?

SCPI Command

SENSe:CORRection:COLLect:CKIT:STANdard:COUNt?

Description

Reads out the count of standards in the selected calibration kit.
query only

Target

Query Response

<number>

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to SENSe

SENS:CORR:COLL:CKIT:STAN:DATA

SCPI Command

SENSe:CORRection:COLLect:CKIT:STAN<Std>:DATA <numeric list>

SENSe:CORRection:COLLect:CKIT:STAN<Std>:DATA?

Description

Writes or reads out the data array of the data-based calibration standard. The first element of the array is 1 or 2 and determines the number of ports of the calibration standard. The array format is as follows.

When the first element of the array is 1 :

<1>,<freq1>,<S11.re1>,<S11.im1>,

<freq2>,<S11.re2>,<S11.im2>,

…

<freqN>,<S11.reN>,<S11.imN>

When the first element of the array is 2:

<2>,<freq1>,<S11.re1>,<S11.im1>,<S21.re1>,<S21.im1>,

<S12.re1>,<S12.im1>,<S22.re1>,<S22.im1>,

…

<freqN>,<S11.reN>,<S11.imN>,<S21.reN>,<S21.imN>,

<S12.reN>,<S12.imN>,<S22.reN>,<S22.imN>

command/query

Target

Standard <Std> of the selected calibration kit,

<Std>={[1]|2|...N}, where N — the number of the standards in the calibration kit

Query Response

<numeric 1>, <numeric 2>, …<numeric N>

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to SENSe

SENS:CORR:COLL:CKIT:STAN:DEL

SCPI Command

SENSe:CORRection:COLLect:CKIT:STAN<Std>:DELay <numeric>

SENSe:CORRection:COLLect:CKIT:STAN<Std>:Delay?

Description

Sets or reads out the offset delay value for the calibration standard.
command/query

Target

Standard <Std> of the calibration kit,

<Std>={[1]|2|...N}, where N — the number of the standards in the calibration kit.

Parameter

<numeric> the offset delay value from –1E18 to 1E18.

Unit

s (second)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Related Section of Operating Manual

Circuit Model Standards

Related Controls of User Interface

Calibration > Calibration Kits > select calibration kit **>** select standard **> Offset Units {Seconds}** (drop-down list in the Circuit Model segment switch in the Calibration Kits pop-up window) **> Delay** (textbox in the Equivalent Circuit Model area in the Calibration Kits pop-up window)

Calibration > Calibration Kits > select calibration kit **>** select standard **> Offset Units {Distance}** (drop-down list in the Circuit Model segment switch in the Calibration Kits pop-up window) **> Length** (textbox in the Equivalent Circuit Model area in the Calibration Kits pop-up window)

Back to SENSe

SENS:CORR:COLL:CKIT:STAN:FMAX

SCPI Command

SENSe:CORRection:COLLect:CKIT:STAN<Std>:FMAXimum <numeric>

SENSe:CORRection:COLLect:CKIT:STAN<Std>:FMAXimum?

Description

Sets or reads out the maximum frequency limit of the calibration standard.
command/query

Target

Standard <Std> of the calibration kit,

<Std>={[1]|2|...N}, where N — the number of the standards in the calibration kit.

Parameter

<numeric> the maximum frequency limit from 0 to 1E14.

Unit

Hz (Hertz)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Related Section of Operating Manual

Circuit Model Standards

Related Controls of User Interface

Calibration > Calibration Kits > select calibration kit **>** select standard **> Maximum Frequency** (textbox in the Circuit Model sidebar in the Calibration Kits pop-up window)

Back to SENSe

SENS:CORR:COLL:CKIT:STAN:FMIN

SCPI Command

SENSe:CORRection:COLLect:CKIT:STAN<Std>:FMINimum <numeric>

SENSe:CORRection:COLLect:CKIT:STAN<Std>:FMINimum?

Description

Sets or reads out the minimum frequency limit of the calibration standard.
command/query

Target

Standard <Std> of the calibration kit,

<Std>={[1]|2|...N}, where N — the number of the standards in the calibration kit.

Parameter

<numeric> the minimum frequency limit from 0 to 1E14.

Unit

Hz (Hertz)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Related Section of Operating Manual

Circuit Model Standards

Related Controls of User Interface

Calibration > Calibration Kits > select calibration kit **>** select standard **> Minimum Frequency** (textbox in the sidebar of Standard pop-up window)

Back to SENSe

SENS:CORR:COLL:CKIT:STAN:INS

SCPI Command

SENSe:CORRection:COLLect:CKIT:STAN<Std>:INSert

Description

Inserts the calibration standard into the selected calibration kit. The existing standards with indices greater than or equal to <std> are shifted by +1.
command only

Target

Standard <Std> of the selected calibration kit,

<Std>={[1]|2|...N}, where N — the number of the standards in the calibration kit.

Related Section of Operating Manual

Standards Management in Calibration Kit

Related Controls of User Interface

Calibration > Calibration Kits > select calibration kit **> Add Standard**

Back to SENSe

SENS:CORR:COLL:CKIT:STAN:L0

SCPI Command

SENSe:CORRection:COLLect:CKIT:STAN<Std>:L0 <numeric>

SENSe:CORRection:COLLect:CKIT:STAN<Std>:L0?

Description

Sets or reads out the L0 value for the short calibration standard.
command/query

Target

Standard <Std> of the calibration kit,

<Std>={[1]|2|...N}, where N — the number of the standards in the calibration kit.

Parameter

<numeric> the L0 value from –1E15 to 1E15.

Unit

1E–12 H (Henry)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Related Section of Operating Manual

Circuit Model Standards

Related Controls of User Interface

Calibration > Calibration Kits > select calibration kit **>** select standard **> Type {SHORT}** (drop-down list in the Circuit Model segment switch in the Calibration Kits pop-up window) **> L0×1e–12 H** (textbox in the Equivalent Circuit Model area in the Calibration Kits pop-up window)

Back to SENSe

SENS:CORR:COLL:CKIT:STAN:L1

SCPI Command

SENSe:CORRection:COLLect:CKIT:STAN<Std>:L1 <numeric>

SENSe:CORRection:COLLect:CKIT:STAN<Std>:L1?

Description

Sets or reads out the L1 value for the short calibration standard.
command/query

Target

Standard <Std> of the calibration kit,

<Std>={[1]|2|...N}, where N — the number of the standards in the calibration kit.

Parameter

<numeric> the L1 value from –1E18 to 1E18.

Unit

1E–24 H/Hz (Henry/Hertz)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Related Section of Operating Manual

Circuit Model Standards

Related Controls of User Interface

Calibration > Calibration Kits > select calibration kit **>** select standard **> Type {SHORT}** (drop-down list in the Circuit Model segment switch in the Calibration Kits pop-up window) **> L1×1e–24 H/Hz** (textbox in the Equivalent Circuit Model area in the Calibration Kits pop-up window)

Back to SENSe

SENS:CORR:COLL:CKIT:STAN:L2

SCPI Command

SENSe:CORRection:COLLect:CKIT:STAN<Std>:L2 <numeric>

SENSe:CORRection:COLLect:CKIT:STAN<Std>:L2?

Description

Sets or reads out the L2 value for the short calibration standard.
command/query

Target

Standard <Std> of the calibration kit,

<Std>={[1]|2|...N}, where N — the number of the standards in the calibration kit.

Parameter

<numeric> the L2 value from –1E18 to 1E18.

Unit

1E–33 H/Hz^2 (Henry/$Hertz^2$)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Related Section of Operating Manual

Circuit Model Standards

Related Controls of User Interface

Calibration > Calibration Kits > select calibration kit **>** select standard **> Type {SHORT}** (drop-down list in the Circuit Model segment switch in the Calibration Kits pop-up window) **> L2×1e–33 H/Hz^2** (textbox in the Equivalent Circuit Model area in the Calibration Kits pop-up window)

Back to SENSe

SENS:CORR:COLL:CKIT:STAN:L3

SCPI Command

SENSe:CORRection:COLLect:CKIT:STAN<Std>:L3 <numeric>

SENSe:CORRection:COLLect:CKIT:STAN<Std>:L3?

Description

Sets or reads out the L3 value for the short calibration standard.
command/query

Target

Standard <Std> of the calibration kit,

<Std>={[1]|2|...N}, where N — the number of the standards in the calibration kit.

Parameter

<numeric> the L3 value from –1E18 to 1E18.

Unit

1E–42 H/Hz^3 (Henry/$Hertz^3$)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Related Section of Operating Manual

Circuit Model Standards

Related Controls of User Interface

Calibration > Calibration Kits > select calibration kit **>** select standard **> Type {SHORT}** (drop-down list in the Circuit Model segment switch in the Calibration Kits pop-up window) **> L3×1e–42 H/Hz^3** (textbox in the Equivalent Circuit Model area in the Calibration Kits pop-up window)

Back to SENSe

SENS:CORR:COLL:CKIT:STAN:LAB

SCPI Command

SENSe:CORRection:COLLect:CKIT:STAN<Std>:LABel <string>

SENSe:CORRection:COLLect:CKIT:STAN<Std>:LABel?

Description

Sets or reads out the label for the calibration standard.
command/query

Target

Standard <Std> of the calibration kit,

<Std>={[1]|2|...N}, where N — the number of the standards in the calibration kit.

Parameter

<string>, up to 50 characters.

Query Response

<string>

Related Section of Operating Manual

Circuit Model Standards

Related Controls of User Interface

Calibration > Calibration Kits > select calibration kit **>** select standard **> Label** (textbox in the Circuit Model sidebar in the Calibration Kits pop-up window)

Back to SENSe

SENS:CORR:COLL:CKIT:STAN:LOSS

SCPI Command

SENSe:CORRection:COLLect:CKIT:STAN<Std>:LOSS <numeric>

SENSe:CORRection:COLLect:CKIT:STAN<Std>:LOSS?

Description

Sets or reads out the offset loss value for the calibration standard.
command/query

Target

Standard <Std> of the calibration kit,

<Std>={[1]|2|...N}, where N — the number of the standards in the calibration kit.

Parameter

<numeric> the offset loss value from –1E18 to 1E18.

Unit

Ω/s (Ohm/second)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Related Section of Operating Manual

Circuit Model Standards

Related Controls of User Interface

Calibration > Calibration Kits > select calibration kit **>** select standard **> Type {OPEN | SHORT | LOAD | THRU/DELAY }** (drop-down list in the Circuit Model segment switch in the Calibration Kits pop-up window) **> Loss** (textbox in the Equivalent Circuit Model area in the Calibration Kits pop-up window)

Back to SENSe

SENS:CORR:COLL:CKIT:STAN:REM

SCPI Command

SENSe:CORRection:COLLect:CKIT:STAN<Std>:REMove

Description

Deletes the calibration standard into the selected calibration kit. The existing standards with indices greater than the <std> are shifted by –1.

command only

Target

Standard <Std> of the selected calibration kit,

<Std>={[1]|2|...N}, where N — the number of the standards in the calibration kit.

Related Section of Operating Manual

Standards Management in Calibration Kit

Related Controls of User Interface

Calibration > Calibration Kits > select calibration kit **>** select standard **> Delete** (icon  in the top area of the Calibration Kits pop-up window)

Back to SENSe

SENS:CORR:COLL:CKIT:STAN:TYPE

SCPI Command

SENSe:CORRection:COLLect:CKIT:STAN<Std>:TYPE <char>

SENSe:CORRection:COLLect:CKIT:STAN<Std>:TYPE?

Description

Sets or reads out the type of calibration standard.
command/query

Target

Standard <Std> of the calibration kit,

<Std>={[1]|2|...N}, where N — the number of the standards in the calibration kit.

Parameter

<char> Specifies the type of calibration standard:

OPEN	Open
SHORt	Short
LOAD	Load
THRU	Thru
SLID	Sliding Load
DATA	Data Based
NONE	Not defined

Query Response

{OPEN|SHOR|LOAD|THRU|SLID|DATA|NONE}

Related Section of Operating Manual

Circuit Model Standards

Related Controls of User Interface

Calibration > Calibration Kits > select calibration kit **>** select standard **> Type {OPEN | SHORT | LOAD | THRU/DELAY | SLIDING LOAD}** (drop-down list in the Circuit Model segment switch in the Calibration Kits pop-up window)

Calibration > Calibration Kits > select calibration kit **>** select standard **> Databased** (segment switch in the Calibration Kits pop-up window)

Back to SENSe

SENS:CORR:COLL:CKIT:STAN:Z0

SCPI Command

SENSe:CORRection:COLLect:CKIT:STAN<Std>:Z0 <numeric>

SENSe:CORRection:COLLect:CKIT:STAN<Std>:Z0?

Description

Sets or reads out the offset Z0 value for the calibration standard.
command/query

Target

Standard <Std> of the calibration kit,

<Std>={[1]|2|...N}, where N — the number of the standards in the calibration kit.

Parameter

<numeric> the offset Z0 value from –1E18 to 1E18.

Unit

Ω (Ohm)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

50 or 75 Ω, depending on the selected calibration kit

Related Section of Operating Manual

Circuit Model Standards

Related Controls of User Interface

Calibration > Calibration Kits > select calibration kit **>** select standard **> Z0 Ω** (textbox in sidebar/field in the equivalent circuit model area of Standard pop-up window)

Back to SENSe

SENS:CORR:COLL:CLE

SCPI Command

SENSe<Ch>:CORRection:COLLect:CLEar

Description

Clears the measurement data of the calibration standards.
command only

Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to SENSe

SENS:CORR:COLL:ISOL

SCPI Command

SENSe<Ch>:CORRection:COLLect[:ACQuire]:ISOLation <rcvport>,<srcport>

Description

Measures the isolation calibration data between the receiver port <rcvport> and the source port <srcport>.
command only

Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Parameter

<rcvport>	The number of the receiver port from 1 to 6/8/10/12/14/16 (depending on the Analyzer model, see corresponding datasheet).
<srcport>	The number of the source port from 1 to 6/8/10/12/14/16 (depending on the Analyzer model, see corresponding datasheet).

Out of Range

If the same port numbers are specified, an error occurs.

Related commands

SENS:CORR:CONF:CRE

SENS:CORR:CONF:SEL

Related Controls of User Interface

Calibration > Calibrate > SOLT | Response Thru | One Path N-Ports (button in Calibration Type area) **> Isolation** (toggle button ON) **> Start > Measure** (Isol calibration step) **> Apply**

Back to SENSe

SENS:CORR:COLL:LOAD

SCPI Command

SENSe<Ch>:CORRection:COLLect[:ACQuire]:LOAD <port>

Description

Measures the calibration data of the load standard for the specified port.
command only

Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Parameter

<port>	The number of the port from 1 to 6/8/10/12/14/16 (depending on the Analyzer model, see corresponding datasheet).

Related commands

SENS:CORR:CONF:CRE

SENS:CORR:CONF:SEL

Related Controls of User Interface

Calibration > Calibrate > Response Open | Response Short (button in Calibration Type area) **> Load** (toggle button ON) **> Start > Measure** (Load calibration step) **> Apply**

Back to SENSe

SENS:CORR:COLL:OPEN

SCPI Command

SENSe<Ch>:CORRection:COLLect[:ACQuire]:OPEN <port>

Description

Measures the calibration data of the open standard for the specified port.
command only

Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Parameter

<port>	The number of the port from 1 to 6/8/10/12/14/16 (depending on the Analyzer model, see corresponding datasheet).

Related commands

SENS:CORR:CONF:CRE

SENS:CORR:CONF:SEL

Related Controls of User Interface

Calibration > Calibrate > Full 1-Port | SOLT | Response Open | One Path N-Ports (button in Calibration Type area) **> Start > Measure** (Open calibration step) **> Apply**

Back to SENSe

SENS:CORR:COLL:SAVE

SCPI Command

SENSe:CORRection:COLLect:SAVE

Description

Saves calibration coefficients. Completes the data collection process, calculates and applies calibration coefficients.
command only

Related Section of Operating Manual

Applying a Configuration

Related Controls of User Interface

Corresponds to the **Apply** button in the Calibration Wizard.

Programming Example

SOLT3 Calibration Example

User Power Calibration Example

User Test/Reference Receiver Calibration Example

User Power And Receiver Calibration Example

Back to SENSe

SENS:CORR:COLL:SHOR

SCPI Command

SENSe<Ch>:CORRection:COLLect[:ACQuire]:SHORt <port>

Description

Measures the calibration data of the short standard for the specified port.
command only

Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Parameter

<port>	The number of the port from 1 to 6/8/10/12/14/16 (depending on the Analyzer model, see corresponding datasheet).

Related commands

SENS:CORR:CONF:CRE

SENS:CORR:CONF:SEL

Related Controls of User Interface

Calibration > Calibrate > Full 1-Port | SOLT | Response Short | One Path N-Ports (button in Calibration Type area) **> Start > Measure** (Short calibration step) **> Apply**

Back to SENSe

SENS:CORR:COLL:STAR

SCPI Command

SENSe:CORRection:COLLect:STARt

SENSe:CORRection:COLLect:STARt?

Description

Starts the calibration process based on the selected configuration or reads out the name of the currently running configuration.
command/query

Query Response

<Conf> the name of the configuration or an empty string if there is no running configuration.

Related Section of Operating Manual

Starting Configuration

Related Controls of User Interface

Corresponds to the **Start** button in the Calibration Wizard.

Programming Example

Configuration Management

Full N-Port (SOLT) Calibration Example

User Power Calibration Example

User ACM Calibration Example

User Test/Reference Receiver Calibration Example

User Power And Receiver Calibration Example

Back to SENSe

SENS:CORR:COLL:THRU

SCPI Command

SENSe<Ch>:CORRection:COLLect[:ACQuire]:THRU <rcvport>,<srcport>

Description

Measures the calibration data of the thru standard between the receiver port <rcvport> and the source port <srcport>.

command only

Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Parameter

<rcvport>	The number of the receiver port from 1 to 6/8/10/12/14/16 (depending on the Analyzer model, see corresponding datasheet).
<srcport>	The number of the source port from 1 to 6/8/10/12/14/16 (depending on the Analyzer model, see corresponding datasheet).

Out of Range

If the same port numbers are specified, an error occurs.

Related commands

SENS:CORR:CONF:CRE

SENS:CORR:CONF:SEL

Related Controls of User Interface

Calibration > Calibrate > SOLT | Response Thru | One Path N-Ports (button in Calibration Type area) **> Start > Measure** (Thru calibration step) **> Apply**

Back to SENSe

SENS:CORR:COLL:STEP:ACQ:ECAL

SCPI Command

SENSe:CORRection:COLLect:STEP:ACQuire:ECAL <ports>

Description

Performs the measurement of the ACM calibration step. Selects the calibration step (SENS:CORR:COLL:STEP:SEL:ECAL) and collects data for the step (SENS:CORR:COLL:STEP:MEAS).

command only

Parameter

<ports> ACM port numbers, separated by a comma.

Related Commands

SENS:CORR:COLL:STEP:SEL:ECAL

SENS:CORR:COLL:STEP:MEAS

Related Section of Operating Manual

Calibration with the Automatic Calibration Module

Related Controls of User Interface

Corresponds to the **Measure** button with the "ACM" class in the calibration step table.

Back to SENSe

SENS:CORR:COLL:STEP:ACQ:ISOL

SCPI Command

SENSe:CORRection:COLLect:STEP:ACQuire:ISOL <rcvport>, <srcport> [, <standardLabel>, [calibrationKit]]

Description

Performs the measurement of the calibration step with the Isolation class. Selects the calibration step (SENS:CORR:COLL:STEP:SEL:ISOL) and collects data for the step (SENS:CORR:COLL:STEP:MEAS).

command only

Parameter

<rcvport>, <srcport> the number of the receiver port and the test port, separated by a comma.

<standardLabel> the name of the standard.

<calibrationKit> the name of the calibration kit.

Related Commands

SENS:CORR:COLL:STEP:SEL:ISOL

SENS:CORR:COLL:STEP:MEAS

Related Section of Operating Manual

Transmission Normalization

One-Path Two-Port Calibration

Full N-Port Calibration (SOLT)

Related Controls of User Interface

Corresponds to the **Measure** button with the "Isol" class in the calibration step table.

Back to SENSe

SENS:CORR:COLL:STEP:ACQ:LOAD

SCPI Command

SENSe:CORRection:COLLect:STEP:ACQuire:LOAD <port> [, <standardLabel>, [calibrationKit]]

Description

Performs the measurement of the calibration step with the LOAD class. Selects the calibration step (SENS:CORR:COLL:STEP:SEL:LOAD) and collects data for the step (SENS:CORR:COLL:STEP:MEAS).

command only

Parameter

<port> the number of the VNA port.

<standardLabel> the name of the standard.

<calibrationKit> the name of the calibration kit.

Related Commands

SENS:CORR:COLL:STEP:SEL:LOAD

SENS:CORR:COLL:STEP:MEAS

Related Section of Operating Manual

Reflection Normalization

Full One-Port Calibration (SOL)

Full N-Port Calibration (SOLT)

Related Controls of User Interface

Corresponds to the **Measure** button with the "Load" class in the calibration step table.

Programming Example

Full N-Port (SOLT) Calibration Example

Back to SENSe

SENS:CORR:COLL:STEP:ACQ:OPEN

SCPI Command

SENSe:CORRection:COLLect:STEP:ACQuire:OPEN <port> [, <standardLabel>, [calibrationKit]]

Description

Performs the measurement of the calibration step with the OPEN class. Selects the calibration step (SENS:CORR:COLL:STEP:SEL:OPEN) and collects data for the step (SENS:CORR:COLL:STEP:MEAS).

command only

Parameter

<port> the number of the VNA port.

<standardLabel> the name of the standard.

<calibrationKit> the name of the calibration kit.

Related Commands

SENS:CORR:COLL:STEP:SEL:OPEN

SENS:CORR:COLL:STEP:MEAS

Related Section of Operating Manual

Reflection Normalization

One-Path Two-Port Calibration

Full One-Port Calibration (SOL)

Full N-Port Calibration (SOLT)

Related Controls of User Interface

Corresponds to the **Measure** button with the "Open" class in the calibration step table.

Programming Example

Full N-Port (SOLT) Calibration Example

Back to SENSe

SENS:CORR:COLL:STEP:ACQ:POW

SCPI Command

SENSe:CORRection:COLLect:STEP:ACQuire:POWer <port>

Description

Performs the measurement of the power calibration step. Selects the calibration step (SENS:CORR:COLL:STEP:SEL:POW) and collects data for the step (SENS:CORR:COLL:STEP:MEAS).

command only

Parameter

<port> the number of the port.

Related Commands

SENS:CORR:COLL:STEP:SEL:POW

SENS:CORR:COLL:STEP:MEAS

Related Section of Operating Manual

Power Calibration

Related Controls of User Interface

Corresponds to the **Measure** button with the "power" calibration type in the calibration step table.

Programming Example

User Power Calibration Example

Back to SENSe

SENS:CORR:COLL:STEP:ACQ:RPOW

SCPI Command

SENSe:CORRection:COLLect:STEP:ACQuire:RPOWer <port>

Description

Performs the measurement of power and reference receiver calibration step. Selects the calibration step (SENS:CORR:COLL:STEP:SEL:RPOW) and collects data for the step (SENS:CORR:COLL:STEP:MEAS).

command only

Parameter

<port> the number of the port.

Related Commands

SENS:CORR:COLL:STEP:SEL:RPOW

SENS:CORR:COLL:STEP:MEAS

Related Section of Operating Manual

Power Calibration

Receiver Calibration

Related Controls of User Interface

Corresponds to the **Measure** button with the "power + R" calibration type in the calibration step table.

Programming Example

User Power And Receiver Calibration Example

Back to SENSe

SENS:CORR:COLL:STEP:ACQ:RCH

SCPI Command

SENSe:CORRection:COLLect:STEP:ACQuire:RCHannel <port>

Description

Performs the measurement of the reference receiver calibration step. Selects the calibration step (SENS:CORR:COLL:STEP:SEL:RCH) and collects data for the step (SENS:CORR:COLL:STEP:MEAS).

command only

Parameter

<port> the number of the port.

Related Commands

SENS:CORR:COLL:STEP:SEL:RCH

SENS:CORR:COLL:STEP:MEAS

Related Section of Operating Manual

Receiver Calibration

Related Controls of User Interface

Corresponds to the **Measure** button with the "R" calibration type in the calibration step table.

Programming Example

User Test/Reference Receiver Calibration Example

Back to SENSe

SENS:CORR:COLL:STEP:ACQ:SHOR

SCPI Command

SENSe:CORRection:COLLect:STEP:ACQuire:SHORt <port> [, <standardLabel>, [calibrationKit]]

Description

Performs the measurement of the calibration step with the SHORT class. Selects the calibration step (SENS:CORR:COLL:STEP:SEL:SHOR) and collects data for the step (SENS:CORR:COLL:STEP:MEAS).

command only

Parameter

<port> the number of the VNA port.

<standardLabel> the name of the standard.

<calibrationKit> the name of the calibration kit.

Related Commands

SENS:CORR:COLL:STEP:SEL:SHOR

SENS:CORR:COLL:STEP:MEAS

Related Section of Operating Manual

Reflection Normalization

One-Path Two-Port Calibration

Full One-Port Calibration (SOL)

Full N-Port Calibration (SOLT)

Related Controls of User Interface

Corresponds to the **Measure** button with the "Short" class in the calibration step table.

Programming Example

SOLT3 Calibration Example

Back to SENSe

SENS:CORR:COLL:STEP:ACQ:TCH

SCPI Command

SENSe:CORRection:COLLect:STEP:ACQuire:TCHannel <port>

Description

Performs the measurement of the test receiver calibration step. Selects the calibration step (SENS:CORR:COLL:STEP:SEL:TCH) and collects data for the step (SENS:CORR:COLL:STEP:MEAS).

command only

Parameter

<port> the number of the port.

Related Commands

SENS:CORR:COLL:STEP:SEL:TCH

SENS:CORR:COLL:STEP:MEAS

Related Section of Operating Manual

Receiver Calibration

Related Controls of User Interface

Corresponds to the **Measure** button with the "T" calibration type in the calibration step table.

Programming Example

User Test/Reference Receiver Calibration Example

User Power And Receiver Calibration Example

Back to SENSe

SENS:CORR:COLL:STEP:ACQ:THRU

SCPI Command

SENSe:CORRection:COLLect:STEP:ACQuire:THRU <rcvport>, <srcport> [, <standardLabel>, [calibrationKit]]

Description

Performs the measurement of the calibration step with the THRU class. Selects the calibration step (SENS:CORR:COLL:STEP:SEL:THRU) and collects data for the step (SENS:CORR:COLL:STEP:MEAS).

command only

Parameter

<rcvport>, <srcport> the number of the receiver port and the test port, separated by a comma.

<standardLabel> the name of the standard.

<calibrationKit> the name of the calibration kit.

Related Commands

SENS:CORR:COLL:STEP:SEL:THRU

SENS:CORR:COLL:STEP:MEAS

Related Section of Operating Manual

Transmission Normalization

One-Path Two-Port Calibration

Full N-Port Calibration (SOLT)

Related Controls of User Interface

Corresponds to the **Measure** button in the THRU calibration step.

Programming Example

SOLT3 Calibration Example

Calibration with the Automatic Calibration Module

Back to SENSe

SENS:CORR:COLL:STEP:COUN?

SCPI Command

SENSe:CORRection:COLLect:STEP:COUNt?

Description

Reads out the number of generated steps.
query only

Query Response

The number of steps.

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to SENSe

SENS:CORR:COLL:STEP:ECAL:ORI:EXEC

SCPI Command

SENSe:CORRection:COLLect:STEP:ECAL:ORIentation:EXECute

Description

Executes the auto-orientation procedure for the ACM step selected by the command SENS:CORR:COLL:STEP:SEL:ECAL.
command only

Related Commands

SENS:CORR:COLL:STEP:SEL:ECAL

Related Section of Operating Manual

Calibration with the Automatic Calibration Module

Related Controls of User Interface

Corresponds to the button **Detect ACM Ports** in the ACM step in the calibration step table.

Programming Example

User ACM Calibration Example

Back to SENSe

SENS:CORR:COLL:STEP:ECAL:ORI:STAT

SCPI Command

SENSe:CORRection:COLLect:STEP:ECAL:ORIentation:STATe {OFF|ON|0|1}

SENSe:CORRection:COLLect:STEP:ECAL:ORIentation:STATe?

Description

Sets or read out the auto-orientation state of the ACM step selected by the command SENS:CORR:COLL:STEP:SEL:ECAL.

command/query

Parameter

{ON|1} ON

{OFF|0} OFF

Query Response

{0|1}

Preset Value

0

Related Commands

SENS:CORR:COLL:STEP:SEL:ECAL

Related Section of Operating Manual

Calibration with the Automatic Calibration Module

Related Controls of User Interface

Corresponds to the checkbox **Auto Orientation** in the ACM step in the calibration step table.

Programming Example

User ACM Calibration Example

Back to SENSe

SENS:CORR:COLL:STEP:ECAL:TABL

SCPI Command

SENSe:CORRection:COLLect:STEP:ECAL:TABLe <ecalPorts>

SENSe:CORRection:COLLect:STEP:ECAL:TABLe?

Description

Sets or reads out the commutation table of the analyzer test ports and ACM ports for the ACM step selected by the command SENS:CORR:COLL:STEP:SEL:ECAL.

command/query

Parameter

<ecalPorts> the ports of the ACM, separated by a comma (A, B, C, D). The order of the ACM ports should correspond to the order of the VNA ports.

Query Response

<ecalPorts> the ports of the ACM, separated by a comma (A, B, C, D).

Related Commands

SENS:CORR:COLL:STEP:SEL:ECAL

Related Section of Operating Manual

Calibration with the Automatic Calibration Module

Related Controls of User Interface

Corresponds to the port mapping table in the ACM step in the calibration step table.

Programming Example

User ACM Calibration Example

Back to SENSe

SENS:CORR:COLL:STEP:MEAS

SCPI Command

SENSe:CORRection:COLLect:STEP:MEASure

Description

Performs the measurement of the selected calibration step.
command only

Related Section of Operating Manual

Step-by-Step Configuration Execution

Related Controls of User Interface

Corresponds to the **Measure** button in the selected step in the calibration step table.

Back to SENSe

SENS:CORR:COLL:STEP:POW:ZERO

SCPI Command

SENSe:CORRection:COLLect:STEP:POWer:ZERO <port>

Description

Executes zeroing procedure of the power step.
command only

Parameter

<port> the number of the port.

Related Section of Operating Manual

Power Calibration

Related Controls of User Interface

Corresponds to the **Zero** button in the selected step in the calibration step table.

Back to SENSe

SENS:CORR:COLL:STEP:SEL?

SCPI Command

SENSe:CORRection:COLLect:STEP:SELected?

Description

Reads out the type of the step and the VNA ports.

query only

Query Response

<ports> the list of port numbers separated by a comma,

<stepType> specifies the type of the calibration step:

OPEN	Open
SHORt	Short
LOAD	Load
THRU	Response thru
ISOL	Isolation
ECAL (ACM)	ACM
RRCV	Reference receiver
TRCV	Test receiver
POW	Power
RPOW	Power + reference receiver

Related Controls of User Interface

None

Related Controls of User Interface

None

Back to SENSe

SENS:CORR:COLL:STEP:SEL:ECAL

SCPI Command

SENSe:CORRection:COLLect:STEP:SELect:ECAL <ports>

Description

Selects the ACM calibration step.
command only

Parameter

<ports> the list of ACM ports, separated by a comma.

Related Commands

SENS:CORR:COLL:STEP:ACQ:ECAL

Related Section of Operating Manual

Calibration with the Automatic Calibration Module

Related Controls of User Interface

Corresponds to the ACM calibration step in the calibration step table.

Programming Example

User ACM Calibration Example

Back to SENSe

SENS:CORR:COLL:STEP:SEL:ISOL

SCPI Command

SENSe:CORRection:COLLect:STEP:SELect:ISOL <rcvport>, <srcport> [, <standardLabel>, [calibrationKit]]

Description

Selects the calibration step with the ISOL class.

Note The command performs a search for a suitable step in the calibration step table. If the search result contains more than one element, an error occurs.

command only

Parameter

<rcvport>, <srcport> the number of the VNA port.

<standardLabel> the name of the standard.

<calibrationKit> the name of the calibration kit.

Related Commands

SENS:CORR:COLL:STEP:ACQ:ISOL

Related Section of Operating Manual

Transmission Normalization

One-Path Two-Port Calibration

Full N-Port Calibration (SOLT)

Related Controls of User Interface

Corresponds to the Isolation calibration step in the calibration step table.

Back to SENSe

SENS:CORR:COLL:STEP:SEL:LOAD

SCPI Command

SENSe:CORRection:COLLect:STEP:SELect:LOAD <port> [, <standardLabel>, [calibrationKit]]

Description

Selects the calibration step with the LOAD class.

Note The command performs a search for a suitable step in the calibration step table. If the search result contains more than one element, an error occurs.

command only

Parameter

<port> the number of the VNA port.

<standardLabel> the name of the standard.

<calibrationKit> the name of the calibration kit.

Related Commands

SENS:CORR:COLL:STEP:ACQ:LOAD

Related Section of Operating Manual

Reflection Normalization

Full One-Port Calibration (SOL)

Full N-Port Calibration (SOLT)

Related Controls of User Interface

Corresponds to the LOAD calibration step in the calibration step table.

Back to SENSe

SENS:CORR:COLL:STEP:SEL:OPEN

SCPI Command

SENSe:CORRection:COLLect:STEP:SELect:OPEN <port> [, <standardLabel>, [calibrationKit]]

Description

Selects the calibration step with the OPEN class.

Note The command performs a search for a suitable step in the calibration step table. If the search result contains more than one element, an error occurs.

command only

Parameter

<port> the number of the VNA port.

<standardLabel> the name of the standard.

<calibrationKit> the name of the calibration kit.

Related Commands

SENS:CORR:COLL:STEP:ACQ:OPEN

Related Section of Operating Manual

Reflection Normalization

One-Path Two-Port Calibration

Full One-Port Calibration (SOL)

Full N-Port Calibration (SOLT)

Related Controls of User Interface

Corresponds to the OPEN calibration step in the calibration step table.

Back to SENSe

SENS:CORR:COLL:STEP:SEL:POW

SCPI Command

SENSe:CORRection:COLLect:STEP:SELect:POWer <port>

Description

Selects the step of collecting power data.
command only

Parameter

<port> the number of the port.

Related Commands

SENS:CORR:COLL:STEP:ACQ:POW

Related Section of Operating Manual

Power Calibration

Related Controls of User Interface

Corresponds to the power calibration step in the calibration step table.

Back to SENSe

SENS:CORR:COLL:STEP:SEL:RPOW

SCPI Command

SENSe:CORRection:COLLect:STEP:SELect:RPOWer <port>

Description

Selects the combined power and reference receiver data collection step.
command only

Parameter

<port> the number of the port.

Related Commands

SENS:CORR:COLL:STEP:ACQ:RPOW

Related Section of Operating Manual

Power Calibration

Receiver Calibration

Related Controls of User Interface

Corresponds to the power and reference receiver calibration step in the calibration step table.

Back to SENSe

SENS:CORR:COLL:STEP:SEL:RCH

SCPI Command

SENSe:CORRection:COLLect:STEP:SELect:RCHannel <port>

Description

Selects the step of collecting data for the reference channel of the receiver.
command only

Parameter

<port> the number of the port.

Related Commands

SENS:CORR:COLL:STEP:ACQ:RCH

Related Section of Operating Manual

Receiver Calibration

Related Controls of User Interface

Corresponds to the reference receiver calibration step in the calibration step table.

Back to SENSe

SENS:CORR:COLL:STEP:SEL:SHOR

SCPI Command

SENSe:CORRection:COLLect:STEP:SELect:SHORt <port> [, <standardLabel>, [calibrationKit]]

Description

Selects the calibration step with the SHORT class.

Note The command performs a search for a suitable step in the calibration step table. If the search result contains more than one element, an error occurs.

command only

Parameter

<port> the number of the VNA port.

<standardLabel> the name of the standard.

<calibrationKit> the name of the calibration kit.

Related Commands

SENS:CORR:COLL:STEP:ACQ:SHOR

Related Section of Operating Manual

Reflection Normalization

One-Path Two-Port Calibration

Full One-Port Calibration (SOL)

Full N-Port Calibration (SOLT)

Related Controls of User Interface

Corresponds to the SHORT calibration step in the calibration step table.

Back to SENSe

SENS:CORR:COLL:STEP:SEL:TCH

SCPI Command

SENSe:CORRection:COLLect:STEP:SELect:TCHannel <port>

Description

Selects the step of collecting data for the test channel of the receiver.
command only

Parameter

<port> the number of the port.

Related Commands

SENS:CORR:COLL:STEP:ACQ:TCH

Related Section of Operating Manual

Receiver Calibration

Related Controls of User Interface

Corresponds to the test receiver calibration step in the calibration step table.

Back to SENSe

SENS:CORR:COLL:STEP:SEL:THRU

SCPI Command

SENSe:CORRection:COLLect:STEP:SELect:THRU <rcvport>, <srcport> [, <standardLabel>, [calibrationKit]]

Description

Selects the calibration step with the THRU class.

Note The command performs a search for a suitable step in the calibration step table. If the search result contains more than one element, an error occurs.

command only

Parameter

<rcvport>, <srcport> the number of the VNA port.

<standardLabel> the name of the standard.

<calibrationKit> the name of the calibration kit.

Related Commands

SENS:CORR:COLL:STEP:ACQ:THRU

Related Section of Operating Manual

Transmission Normalization

One-Path Two-Port Calibration

Full N-Port Calibration (SOLT)

Related Controls of User Interface

Corresponds to the THRU calibration step in the calibration step table.

Back to SENSe

SENS:CORR:COLL:STOP

SCPI Command

SENSe:CORRection:COLLect:STOP

Description

Exits the mode of collecting data steps.
command only

Related Section of Operating Manual

Applying a Configuration

Related Controls of User Interface

Corresponds to the **Cancel** button in the Calibration Wizard.

Programming Example

Configuration Management

Back to SENSe

SENS:CORR:CONF:CONN

SCPI Command

SENSe:CORRection:CONFiguration:CONNection <portNumber>, <type>, [<gender>]

SENSe:CORRection:CONFiguration:CONNection? <portNumber>

Description

Sets or reads out the type and gender of the connector for the current group of ports.
command/query

Parameter

<portNumber> the number of the port.

<type> a string that indicates the type of a connector. The resistance symbol is replaced with "Ohm". For example, N50 Ohm.

<gender> gender of the connector. Gender is not applicable (and ignored) for genderless connector types.

MALE	Male gender
FEMale	Female gender

Query Response

<type>, <gender>

Related Commands

SENS:CORR:CONF:CRE

SENS:CORR:CONF:SEL

Related Controls of User Interface

Selecting Calibration Plane

Related Controls of User Interface

Calibration > Calibrate > select Calibration Type **> CONNECTOR {N50 Ω | N75 Ω | ... }** (drop-down list in the CALIBRATION PLANE area)

Calibration > Calibrate > select Calibration Type **> CAL. STANDARD GENDER {Male | Female}** (drop-down list in the CALIBRATION PLANE area)

Programming Example

Full N-Port (SOLT) Calibration Example

User ACM Calibration Example

Back to SENSe

SENS:CORR:CONF:CRE

SCPI Command

SENSe:CORRection:CONFiguration:CREate <string>

Description

Creates the configuration. The created configuration is automatically selected.
command only

Parameter

<string> the name of the configuration, up to 50 symbols.

Related Section of Operating Manual

Configuration List

Related Controls of User Interface

Calibration > Calibrate > Add new Configuration (icon  in the configuration list)

Programming Example

Configuration Management

Full N-Port (SOLT) Calibration Example

User Power Calibration Example

User ACM Calibration Example

User Test/Reference Receiver Calibration Example

User Power And Receiver Calibration Example

Back to SENSe

SENS:CORR:CONF:DATA?

SCPI Command

SENSe:CORRection:CONFiguration:DATA?

Description

Gets the number and list of calibration configuration names in quotation marks separated by commas, e.g.:

3, "Configuration 1", "Configuration 2", "Configuration 3".

no query

Query Response

<numeric>, <string>, <string>, … <string>, where:

<numeric> the number of configurations,

<string> the name of the configuration, up to 50 symbols.

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to SENSe

SENS:CORR:CONF:DEL

SCPI Command

SENSe:CORRection:CONFiguration:DELete

Description

Deletes the selected configuration.
command only

Related Section of Operating Manual

Configuration List

Related Controls of User Interface

Calibration > Calibrate > Delete (button in the  vertical-ellipsis button to the right of the configuration name)

Programming Example

Configuration Management

Back to SENSe

SENS:CORR:CONF:DEL:ALL

SCPI Command

SENSe:CORRection:CONFiguration:DELete:ALL

Description

Deletes the all configurations.
command only

Related Section of Operating Manual

Configuration List

Related Controls of User Interface

Calibration > Calibrate > Delete All (button in the  vertical-ellipsis button to the right of the configuration list)

Back to SENSe

SENS:CORR:CONF:GRO:CKIT:SEL

SCPI Command

SENSe:CORRection:CONFiguration:GROup:CKIT:SELect <portNumber>, <ckit>

SENSe:CORRection:CONFiguration:GROup:CKIT:SELect? <portNumber>

Description

Sets or reads out the calibration kit for the current group of ports.
command/query

Parameter

<portNumber> the port number.

<ckit> the name of the calibration kit.

Query Response

<ckit>

Related Commands

SENS:CORR:CONF:CRE

SENS:CORR:CONF:SEL

Related Controls of User Interface

Selecting Calibration Plane

Related Controls of User Interface

Calibration > Calibrate > CALIBRATION KIT (drop-down list in the CALIBRATION PLANE area)

Programming Example

Full N-Port (SOLT) Calibration Example

Back to SENSe

SENS:CORR:CONF:GRO:CRE

SCPI Command

SENSe:CORRection:CONFiguration:GROup:CREate <name>, <method>, <port>

Description

Sets or reads out the group of ports with the specified calibration type. The created group is automatically selected.

command/query

Parameter

<name> the name of the configuration,

<port> the list of port numbers separated by a comma,

<method> specifies the type of the calibration:

ERES	One-path two-ports calibration
OPEN	Response open
SHOR	Response short
SOL	Full 1-port calibration
SOLT	Full N-port calibration
THRU	Response thru
PREC (POWER/ RECV)	Power calibration/receiver calibration
SOLECAL	One-port calibration using ACM
SOLTECAL	N-port calibration using ACM

Query Response

<name>, <port>, <method>

Related Command

SENS:CORR:CONF:CRE

SENS:CORR:CONF:SEL

Related Section of Operating Manual

Grouping Ports

Related Controls of User Interface

Calibration > Calibrate > Full 1-Port | SOLT | Response Open | Response Short | ResponseThrough | One Path 2-Ports | Power/Receivers | ACM (buttons in the Calibration Type area)

Programming Example

Configuration Management

SOLT3 Calibration Example

User Power Calibration Example

User ECal (ACM) Term Calibration Example

User Test/Reference Receiver Calibration Example

User Power And Receiver Calibration Example

Back to SENSe

SENS:CORR:CONF:GRO:DATA?

SCPI Command

SENSe:CORRection:CONFiguration:GROup:DATA?

Description

Reads out the number and list of port group names in quotes (as a string type) for the selected configuration:

<numeric>, <string>, <string>, … <string>

<numeric> the number of port groups

<string> the name of the port group, up to 50 symbols

E.g.:

2, “Group 1”, “Group 2”

query only

Query Response

N, <groupName1>, <groupName2>, …<groupNameN>

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to SENSe

SENS:CORR:CONF:GRO:DEL

SCPI Command

SENSe:CORRection:CONFiguration:GROup:DELete

Description

Deletes the active group of ports.
command only

Related Section of Operating Manual

Grouping Ports

Related Controls of User Interface

Corresponds to the **Close**  icon in the active Ports Group Tab.

Back to SENSe

SENS:CORR:CONF:GRO:ECAL:SEL

SCPI Command

SENSe:CORRection:CONFiguration:GROup:ECAL:SELect <acmModel>, [<acmSerial>]

SENSe:CORRection:CONFiguration:GROup:ECAL:SELect?

Description

Sets or reads out the ACM for the selected group of ports.

Note Applicable for ACM calibration type.

command/query

Parameter

<acmModel> the model of the ACM.

<acmSerial> the serial number of the ACM.

Related Commands

SENS:CORR:CONF:CRE

SENS:CORR:CONF:SEL

Related Controls of User Interface

Calibration with the Automatic Calibration Module

Related Controls of User Interface

Calibration > Calibrate > ACM (button in the Calibration Type) **> Select ACM** (drop-down list)

Programming Example

User ECal (ACM) Term Calibration Example

Back to SENSe

SENS:CORR:CONF:GRO:ECAL:THER:COMP

SCPI Command

SENSe:CORRection:CONFiguration:GROup:ECAL:THERmo:COMPensation[:STATe] {OFF|ON|0|1}

SENSe:CORRection:CONFiguration:GROup:ECAL:THERmo:COMPensation[:STATe]?

Description

Sets or reads out thermal compensation mode for an ACM.

Note Applicable for ACM calibration type.

command/query

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

0

Related Commands

SENS:CORR:CONF:CRE

SENS:CORR:CONF:SEL

Related Controls of User Interface

Calibration with the Automatic Calibration Module

Related Controls of User Interface

Calibration > Calibrate > ACM (button in the Calibration Type) **> Select ACM** (drop-down list) **> ACM Settings > Thermocompensation** (select checkbox in the pop-up window)

Programming Example

User ECal (ACM) Term Calibration Example

Back to SENSe

SENS:CORR:CONF:GRO:ECAL:UCH

SCPI Command

SENSe:CORRection:CONFiguration:GROup:ECAL:UCHar <char>

SENSe:CORRection:CONFiguration:GROup:ECAL:UCHar?

Description

Sets or reads out the ACM characterization type for an active group of ports.

Note Applicable for ACM calibration type.

command/query

Parameter

<char> Specifies the stimulus type:

CHAR0 Factory characterization

CHAR1 User characterization 1

CHAR2 User characterization 2

CHAR3 User characterization 3

Query Response

{CHAR0|CHAR1|CHAR2|CHAR3}

Related Commands

SENS:CORR:CONF:SEL

Related Controls of User Interface

Calibration with the Automatic Calibration Module

Related Controls of User Interface

Calibration > Calibrate > ACM (button in the Calibration Type) **> Select ACM** (drop-down list) **> ACM Settings > Characterization** (drop-down list in the pop-up window)

Programming Example

User ECal (ACM) Term Calibration Example

Back to SENSe

SENS:CORR:CONF:GRO:ISOL:ENAB:ALL

SCPI Command

SENSe:CORRection:CONFiguration:GROup:ISOLation:ENABle:ALL

Description

Turns calibration isolation ON for the selected group of ports.

Note Applicable for SOLT, Response Through, One-path two-ports calibration types.

command only

Preset Value

Isolation is not applied.

Related Commands

SENS:CORR:CONF:CRE

SENS:CORR:CONF:SEL

Related Section of Operating Manual

Full N-Port Calibration (SOLT)

Transmission Normalization

One-Path Two-Port Calibration

Related Controls of User Interface

Calibration > Calibrate > SOLT | Response Through | One Path 2-Ports (button in the Calibration Type area) **> Isolation {ON}** (toggle button in the submenu)

Back to SENSe

SENS:CORR:CONF:GRO:ISOL:DIS:ALL

SCPI Command

SENSe:CORRection:CONFiguration:GROup:ISOLation:DISable:ALL

Description

Turns calibration isolation OFF for the selected group of ports.

Note Applicable for SOLT, Response Through, One-path two-ports calibration types.

command only

Preset Value

Isolation is not applied.

Related Commands

SENS:CORR:CONF:CRE

SENS:CORR:CONF:SEL

Related Section of Operating Manual

Full N-Port Calibration (SOLT)

Transmission Normalization

One-Path Two-Port Calibration

Related Controls of User Interface

Calibration > Calibrate > SOLT | Response Through | One Path 2-Ports (button in the Calibration Type area) **> Isolation {OFF}** (toggle button in the submenu)

Programming Example

SOLT3 Calibration Example

Back to SENSe

SENS:CORR:CONF:GRO:LOAD:ENAB:ALL

SCPI Command

SENSe:CORRection:CONFiguration:GROup:LOAD:ENABle:ALL

Description

Turns the load standard ON for the selected group of ports.

Note Applicable for Response Open, Response Short calibration types.

command only

Preset Value

Load is not applied.

Related Commands

SENS:CORR:CONF:CRE

SENS:CORR:CONF:SEL

Related Section of Operating Manual

Reflection Normalization

Related Controls of User Interface

Calibration > Calibrate > Response Open | Response Short (button in the Calibration Type area) **> Load {ON}** (toggle button in the submenu)

Back to SENSe

SENS:CORR:CONF:GRO:LOAD:DIS:ALL

SCPI Command

SENSe:CORRection:CONFiguration:GROup:LOAD:DISable:ALL

Description

Turns the load standard ON/OFF for the selected group of ports.

Note Applicable for Response Open, Response Short calibration types.

command only

Preset Value

Load is not applied.

Related Commands

SENS:CORR:CONF:CRE

SENS:CORR:CONF:SEL

Related Section of Operating Manual

Reflection Normalization

Related Controls of User Interface

Calibration > Calibrate > Response Open | Response Short (button in the Calibration Type area) **> Load {OFF}** (toggle button in the submenu)

Back to SENSe

SENS:CORR:CONF:GRO:METH?

SCPI Command

SENSe:CORRection:CONFiguration:GROup:METHod?

Description

Reads out the calibration type for the selected group of ports.

query only

Query Response

<method> specifies the type of the calibration:

ERES	One-path two-ports calibration
OPEN	Response open
SHOR	Response short
SOL	Full 1-port calibration
SOLT	Full N-port calibration
THRU	Response thru
PREC (POWER/ RECV)	Power calibration/receiver calibration
SOLECAL	One-port calibration using ACM
SOLTECAL	N-port calibration using ACM

Related Commands

SENS:CORR:CONF:GRO:CRE

Related Section of Operating Manual

Grouping Ports

One-Path Two-Port Calibration

Reflection Normalization

Full One-Port Calibration (SOL)

Full N-Port Calibration (SOLT)

Transmission Normalization

Power Calibration

Receiver Calibration

Calibration with the Automatic Calibration Module

Related Controls of User Interface

Calibration > Calibrate > Full 1-Port | SOLT | Response Open | Response Short | ResponseThrough | One Path 2-Ports | Power/Receivers | ACM (button in the Calibration Type area)

Back to SENSe

SENS:CORR:CONF:GRO:PORT:COMM

SCPI Command

SENSe:CORRection:CONFiguration:GROup:PORT:COMMon <commonPort>

SENSe:CORRection:CONFiguration:GROup:PORT:COMMon?

Description

Sets or reads out the common port for simplified calibration for the selected group of ports.

Note Applicable for SOLT, ACM calibration types.

command/query

Parameter

<commonPort> the number of the common port.

Query Response

<commonPort>

Preset Value

First port of the group.

Related Commands

SENS:CORR:CONF:CRE

SENS:CORR:CONF:SEL

Related Section of Operating Manual

Full N-Port Calibration (SOLT)

Calibration with the Automatic Calibration Module

Related Controls of User Interface

Calibration > Calibrate > SOLT | ACM > Simplified {ON} (toggle button) > **Common port** (drop-down list in the CALIBRATION PLANE area)

Programming Example

SOLT3 Calibration Example

User ECal (ACM) Term Calibration Example

Back to SENSe

SENS:CORR:CONF:GRO:PORT:LIST?

SCPI Command

SENSe:CORRection:CONFiguration:GROup:PORT:LIST?

Description

Reads out the list of ports for the selected group of ports.
query only

Query Response

<ports> the list of port numbers separated by a comma.

Related Commands

SENS:CORR:CONF:GRO:CRE

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to SENSe

SENS:CORR:CONF:GRO:PORT:SOUR

SCPI Command

SENSe:CORRection:CONFiguration:GROup:PORT:SOURce <sourcePort>

SENSe:CORRection:CONFiguration:GROup:PORT:SOURce?

Description

Sets or reads out the source port for the selected group of ports.

Note Applicable for Response Through, One-path two-ports calibration types.

command/query

Parameter

<sourcePort> the number of the source port.

Query Response

<sourcePort>

Preset Value

First port of the port group.

Related Commands

SENS:CORR:CONF:CRE

SENS:CORR:CONF:SEL

Related Section of Operating Manual

Transmission Normalization

One-Path Two-Port Calibration

Related Controls of User Interface

Calibration > Calibrate > Response Through | One Path 2-Ports > Source Port
(drop-down list in the CALIBRATION PLANE area)

Back to SENSe

SENS:CORR:CONF:GRO:POW:STAT

SCPI Command

SENSe:CORRection:CONFiguration:GROup:POWer:STATe <portNumber>, {OFF|ON|0|1}

SENSe:CORRection:CONFiguration:GROup:POWer:STATe? <portNumber>

Description

Turns power calibration for the port ON|OFF or reads out its state.

Note Applicable for Power calibration.

command/query

Parameter

{ON|1}	ON
{OFF|0}	OFF

<portNumber> the number of the port.

Query Response

{0|1}

Preset Value

0

Related Commands

SENS:CORR:CONF:CRE

SENS:CORR:CONF:SEL

Related Section of Operating Manual

Power Calibration

Related Controls of User Interface

Calibration > Calibrate > Power/Receivers (button in the Calibration Type) **> POWER** (select checkbox at the required port)

Programming Example

User Power Calibration Example

User Test/Reference Receiver Calibration Example

User Power And Receiver Calibration Example

Back to SENSe

SENS:CORR:CONF:GRO:PSEN:SEL

SCPI Command

SENSe:CORRection:CONFiguration:GROup:PSEN:SELect <powerSensorModel>, [powerSensorSerial>]

SENSe:CORRection:CONFiguration:GROup:PSEN:SELect?

Description

Sets or reads out the power sensor for the active group of ports.

Note Applicable for Power calibration.

command/query

Parameter

<powerSensorModel> the model of the power meter sensor.

<powerSensorSerial> the serial number of the power sensor.

Related Commands

SYST:COMM:PSEN:LIST?

SENS:CORR:CONF:CRE

SENS:CORR:CONF:SEL

Related Section of Operating Manual

Power Calibration

Related Controls of User Interface

Calibration > Calibrate > Power/Receivers (button in the Calibration Type) **> Model** (drop-down list in the CALIBRATION PLANE area)

Programming Example

User Power Calibration Example

User Power And Receiver Calibration Example

Back to SENSe

SENS:CORR:CONF:GRO:PSEN:ZERO

SCPI Command

SENSe:CORRection:CONFiguration:GROup:ECAL:SELect <acmModel>, [<acmSerial>]

Description

Executes zeroing procedure of the selected power sensor for the active group of ports.

Note Applicable for Power calibration.

Note The power meter sensor can be connected to the port, since during this procedure, the output signal of the port is turned off the RF power.

command only

Related Commands

SYST:COMM:PSEN:ZERO

SENS:CORR:CONF:CRE

SENS:CORR:CONF:SEL

Related Section of Operating Manual

Power Calibration

Related Controls of User Interface

Calibration > Calibrate > Power/Receivers (button in the Calibration Type) **> Model** (drop-down list in the submenu) **> Zero**

Programming Example

User Power Calibration Example

User Power And Receiver Calibration Example

Back to SENSe

SENS:CORR:CONF:GRO:RCH:OFFS

SCPI Command

SENSe:CORRection:CONFiguration:GROup:RCHannel:OFFSet <portNumber>, <offset>

SENSe:CORRection:CONFiguration:GROup:RCHannel:OFFSet? <portNumber>

Description

Sets or reads out the offset level for the reference receiver of the specified port.

Note Applicable for ACM calibration type.

command/query

Parameter

<portNumber> the port number.

<offset> offset level of the test receiver of the port.

Query Response

<offset>

Related Commands

SENS:CORR:CONF:CRE

SENS:CORR:CONF:SEL

Related Section of Operating Manual

Receiver Calibration

Related Controls of User Interface

Calibration > Calibrate > Power/Receivers > R RECEIVER (select checkbox at the required port) **> R OFFSET** (textbox in the CALIBRATION PLANE area)

Programming Example

User Test/Reference Receiver Calibration Example

User Power And Receiver Calibration Example

Back to SENSe

SENS:CORR:CONF:GRO:RCH:STAT

SCPI Command

SENSe:CORRection:CONFiguration:GROup:RCHannel:STATe <portNumber>, {OFF|ON|0|1}

SENSe:CORRection:CONFiguration:GROup:RCHannel:STATe? <portNumber>

Description

Turns reference receiver calibration of the specified port ON|OFF or reads out its state.

Note Applicable for Receivers calibration.

command/query

Parameter

{ON|1} ON

{OFF|0} OFF

<portNumber> the number of the port

Query Response

{0|1}

Preset Value

0

Related Commands

SENS:CORR:CONF:CRE

SENS:CORR:CONF:SEL

Related Section of Operating Manual

Receiver Calibration

Related Controls of User Interface

Calibration > Calibrate > Power/Receivers > R RECEIVER (textbox in the CALIBRATION PLANE area)

Programming Example

User Test/Reference Receiver Calibration Example

User Power And Receiver Calibration Example

Back to SENSe

SENS:CORR:CONF:GRO:SEL

SCPI Command

SENSe:CORRection:CONFiguration:GROup:SELect <name>

SENSe:CORRection:CONFiguration:GROup:SELect?

Description

Sets or reads out the active group of ports.
command/query

Parameter

<name> the name of the selected port group.

Query Response

<name>

Related Section of Operating Manual

Grouping Ports

Related Controls of User Interface

Corresponds to the ports indicated grouped together in the Port Group Tab

Programming Example

User ACM Calibration Example

Back to SENSe

SENS:CORR:CONF:GRO:SIMP

SCPI Command

SENSe:CORRection:CONFiguration:GROup:SIMPlified {OFF|ON|0|1}

SENSe:CORRection:CONFiguration:GROup:SIMPlified?

Description

Turns the simplified calibration mode ON/OFF for the selected group of ports.

Note Applicable for SOLT, ACM calibration types.

command/query

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

1

Related Commands

SENS:CORR:CONF:CRE

SENS:CORR:CONF:SEL

Related Section of Operating Manual

Full N-Port Calibration (SOLT)

Calibration with the Automatic Calibration Module

Related Controls of User Interface

Calibration > Calibrate > SOLT | ACM (button in the Calibration Type area) **> Simplified {ON | OFF}** (toggle button)

Programming Example

Full N-Port (SOLT) Calibration Example

User ACM Calibration Example

Back to SENSe

SENS:CORR:CONF:GRO:TCH:OFFS

SCPI Command

SENSe:CORRection:CONFiguration:GROup:TCHannel:OFFSet <portNumber>, <offset>

SENSe:CORRection:CONFiguration:GROup:TCHannel:OFFSet? <portNumber>

Description

Sets or reads out the offset level for the test receiver of the specified port.

Note Applicable for Receivers calibration type.

command/query

Parameter

<portNumber> the port number.

<offset> offset level of the reference receiver of the port.

Query Response

<offset>

Related Section of Operating Manual

Receiver Calibration

Related Controls of User Interface

Calibration > Calibrate > Power/Receivers > T RECEIVER (select checkbox at the required port) **> T OFFSET** (textbox in the CALIBRATION PLANE area)

Programming Example

User Test/Reference Receiver Calibration Example

User Power And Receiver Calibration Example

Back to SENSe

SENS:CORR:CONF:GRO:TCH:PORT:SOUR

SCPI Command

SENSe:CORRection:CONFiguration:GROup:TCHannel:PORT:SOURce <portNumber>, <sourcePort>

SENSe:CORRection:CONFiguration:GROup:TCHannel:PORT:SOURce? <portNumber>

Description

Sets or reads out the source port for test receiver calibration of the specified port.

Note Applicable for Receivers calibration type.

command/query

Parameter

<portNumber> the port number.

<sourcePort> the source port.

Query Response

<sourcePort>

Related Section of Operating Manual

Receiver Calibration

Related Controls of User Interface

Calibration > Calibrate > Power/Receivers > T RECEIVER (select checkbox at the required port) **> SOURCE PORT** (drop-down list in the CALIBRATION PLANE area)

Programming Example

User Test/Reference Receiver Calibration Example

User Power And Receiver Calibration Example

Back to SENSe

SENS:CORR:CONF:GRO:TCH:STAT

SCPI Command

SENSe:CORRection:CONFiguration:GROup:TCHannel:STATe <portNumber>, {OFF|ON|0|1}

SENSe:CORRection:CONFiguration:GROup:TCHannel:STATe? <portNumber>

Description

Turns test receiver calibration of the specified port ON|OFF or reads out its state.

Note Applicable for ACM calibration type.

command/query

Parameter

{ON|1} ON

{OFF|0} OFF

<portNumber> the number of the port.

Query Response

{0|1}

Preset Value

0

Related Commands

None

Related Section of Operating Manual

Receiver Calibration

Related Controls of User Interface

Calibration > Calibrate > Power/Receivers > T RECEIVER (select checkbox at the required port in the CALIBRATION PLANE area)

Programming Example

User Test/Reference Receiver Calibration Example

User Power And Receiver Calibration Example

Back to SENSe

SENS:CORR:CONF:GRO:UTHR:ENAB:ALL

SCPI Command

SENSe:CORRection:CONFiguration:GROup:UTHRu:ENABle:ALL

Description

Turns Unknown Thru ON for the selected group of ports.

Note Applicable for SOLT calibration type.

command only

Preset Value

Unknown Thru is not applied.

Related Section of Operating Manual

Unknown Thru Calibration

Related Controls of User Interface

Calibration > Calibrate > SOLT (button in the Calibration Type area) **> Unknown Thru {ON}** (toggle button)

Programming Example

SOLT3 Calibration Example

User ECal (ACM) Term Calibration Example

Back to SENSe

SENS:CORR:CONF:GRO:UTHR:DIS:ALL

SCPI Command

SENSe:CORRection:CONFiguration:GROup:UTHRu:DISable:ALL

Description

Turns Unknown Thru OFF for the selected group of ports.

Note Applicable for SOLT calibration type.

command only

Preset Value

Unknown Thru is not applied.

Related Section of Operating Manual

Unknown Thru Calibration

Related Controls of User Interface

Calibration > Calibrate > SOLT (button in the Calibration Type area) **> Unknown Thru {OFF}** (toggle button)

Programming Example

User ECal (ACM) Term Calibration Example

Back to SENSe

SENS:CORR:CONF:SEL

SCPI Command

SENSe:CORRection:CONFiguration:SELect <Conf>

SENSe:CORRection:CONFiguration:SELect?

Description

Sets or reads out the configuration.

query only

Parameter

<Conf> the name of the configuration, up to 50 symbols.

Query Response

<string> the name of the configuration.

Related Section of Operating Manual

Configuration List

Related Controls of User Interface

Calibration > Calibrate > select a configuration from the list in the Calibration wizard pop-up window

Programming Example

Configuration Management

User Power Calibration Example

User Test/Reference Receiver Calibration Example

User Power And Receiver Calibration Example

Back to SENSe

SENS:CORR:EXT

SCPI Command

SENSe<Ch>:CORRection:EXTension[:STATe] {OFF|ON|0|1}

SENSe<Ch>:CORRection:EXTension[:STATe]?

Description

Turns the port extension function ON/OFF.

command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

0

Related Section of Operating Manual

Port Extension

Related Controls of User Interface

Fixture > Port Extension {ON | OFF} (toggle button in the submenu)

Back to SENSe

SENS:CORR:EXT:AUTO:CONF

SCPI Command

SENSe<Ch>:CORRection:EXTension:AUTO:CONFig {CSPN|AMKR|USPN}

SENSe<Ch>:CORRection:EXTension:AUTO:CONFig?

Description

Specifies the frequency range used for calculation of the results of the Auto Port Extension function.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Parameter

CSPN	Uses current frequency span.
AMKR	Uses the frequency of the active marker. This is applied to Loss 1 and Loss 2 is ignored.
USPN	Uses arbitrary frequency range.

Query Response

{CSPN|AMKR|USPN}

Preset Value

CSPN

Related Section of Operating Manual

Automatic Port Extension

Related Controls of User Interface

Fixture > Port Extension > Method {Current span | Active Marker | User Span}
(drop-down list in the PORT EXTENSION table at the bottom of the channel window)

Back to SENSe

SENS:CORR:EXT:AUTO:DCOF

SCPI Command

SENSe<Ch>:CORRection:EXTension:AUTO:DCOFfset {OFF|ON|0|1}

SENSe<Ch>:CORRection:EXTension:AUTO:DCOFfset?

Description

Turns the usage of "Loss at DC" value for the results of the auto port extension function ON/OFF.

command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

0

Related Section of Operating Manual

Automatic Port Extension

Related Controls of User Interface

Fixture > Port Extension > Adjust Mismatch (toggle button ON | OFF in the PORT EXTENSION table at the bottom bottom of the channel window)

Back to SENSe

SENS:CORR:EXT:AUTO:LOSS

SCPI Command

SENSe<Ch>:CORRection:EXTension:AUTO:LOSS {OFF|ON|0|1}

SENSe<Ch>:CORRection:EXTension:AUTO:LOSS?

Description

Turns the usage of "Loss1"and "Loss2" values for the results of the auto port extension function ON/OFF.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

0

Related Section of Operating Manual

Automatic Port Extension

Related Controls of User Interface

Fixture > Port Extension > Include Loss {ON | OFF} (toggle button in the PORT EXTENSION table at the bottom of the channel window)

Back to SENSe

SENS:CORR:EXT:AUTO:MEAS

SCPI Command

SENSe<Ch>:CORRection:EXTension:AUTO:MEASure {SHORt|OPEN}

Description

Performs measurement of the standard "SHORT" or "OPEN", automatically calculates and sets the parameters of the Port Extension.

The set of ports for which this command is executed is determined by the SENS:CORR:EXT:AUTO:PORT command.

When two consecutive measurements of "SHORT" and "OPEN" are performed the results of these measurements are averaged.

command only

Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Parameter

SHORt	Measures "SHORT" standard
OPEN	Measures "OPEN" standard

Related Section of Operating Manual

Automatic Port Extension

Related Controls of User Interface

Fixture > Port Extension > Open | Short (buttons in the PORT EXTENSION table at the bottom of the channel window)

Back to SENSe

SENS:CORR:EXT:AUTO:PORT

SCPI Command

SENSe<Ch>:CORRection:EXTension:AUTO:PORT<Pt> {OFF|ON|0|1}

SENSe<Ch>:CORRection:EXTension:AUTO:PORT<Pt>?

Description

Turns the status of the auto port extension for the Port number <Pt> ON/OFF.

command/query

Target

Port <Pt> of channel <Ch>,

<Ch>={[1]|2|...32}

<Pt>={[1]|2|...P}, where P is 6/8/10/12/14/16 (depending on the Analyzer model, see corresponding datasheet).

Parameter

{ON|1} ON

{OFF|0} OFF

Query Response

{0|1}

Preset Value

1

Related Section of Operating Manual

Automatic Port Extension

Related Controls of User Interface

Fixture > Port Extension > Port (select checkbox at the required port in the PORT EXTENSION table at the bottom of the Channel window)

Back to SENSe

SENS:CORR:EXT:AUTO:STAR

SCPI Command

SENSe<Ch>:CORRection:EXTension:AUTO:STARt <frequency>

SENSe<Ch>:CORRection:EXTension:AUTO:STARt?

Description

Sets or reads out the start value of the user span of the auto port extension function.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Parameter

<frequency> the user span start.

Unit

Hz (Hertz)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

The Analyzer's lowest frequency.

Related Commands

SENS:CORR:EXT:AUTO:CONF

Related Section of Operating Manual

Automatic Port Extension

Related Controls of User Interface

Fixture > Port Extension > Method {User Span} (drop-down list in the PORT EXTENSION table at the bottom of the channel window)

Fixture > Port Extension > Start

Back to SENSe

SENS:CORR:EXT:AUTO:STOP

SCPI Command

SENSe<Ch>:CORRection:EXTension:AUTO:STOP <frequency>

SENSe<Ch>:CORRection:EXTension:AUTO:STOP?

Description

Sets or reads out the stop value of the user span of the auto port extension function.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Parameter

<frequency> the user span stop.

Unit

Hz (Hertz)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

The Analyzer's lowest frequency.

Related Commands

SENS:CORR:EXT:AUTO:CONF

Related Section of Operating Manual

Automatic Port Extension

Related Controls of User Interface

Fixture > Port Extension > Method {User Span} (drop-down list in the PORT EXTENSION table at the bottom of the channel window) **> Stop** (textbox in the PORT EXTENSION table at the bottom of the channel window)

Back to SENSe

SENS:CORR:EXT:PORT:INCL

SCPI Command

SENSe<Ch>:CORRection:EXTension:PORT<Pt>:INCLude{[1]|2}[:STATe] {OFF|ON|0|1}

SENSe<Ch>:CORRection:EXTension:PORT<Pt>:INCLude{[1]|2}[:STATe]?

Description

Turns the loss compensation of loss 1 and loss 2 for the port extension function ON/OFF.

command/query

Target

Port <Pt> of channel <Ch>,

<Ch>={[1]|2|...32}

<Pt>={[1]|2|...P}, where P is 6/8/10/12/14/16 (depending on the Analyzer model, see corresponding datasheet).

Parameter

{ON|1} ON

{OFF|0} OFF

Query Response

{0|1}

Preset Value

0

Related Section of Operating Manual

Port Extension

Related Controls of User Interface

Fixture > Port Extension > LOSS MODE {Off | Loss 1 | Loss 2} (drop-down list in the PORT EXTENSION table at the bottom of the channel window)

Back to SENSe

SENS:CORR:EXT:PORT:FREQ

SCPI Command

SENSe<Ch>:CORRection:EXTension:PORT<Pt>:FREQuency{[1]|2} <frequency>

SENSe<Ch>:CORRection:EXTension:PORT<Pt>:FREQuency{[1]|2}?

Description

Sets or reads out the values of the frequency 1 and frequency 2 to calculate the loss for the port extension function.

command/query

Target

Port <Pt> of channel <Ch>,

<Ch>={[1]|2|...32}

<Pt>={[1]|2|...P}, where P is 6/8/10/12/14/16 (depending on the Analyzer model, see corresponding datasheet).

Parameter

<frequency> the frequency value within the frequency limits of the analyzer.

Unit

Hz (Hertz)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

1E9

Related Section of Operating Manual

Port Extension

Related Controls of User Interface

Fixture > Port Extension > LOSS MODE {Loss 1 | Loss 2} (drop-down list in the PORT EXTENSION table at the bottom of the channel window) **> FREQ 1 | FREQ 2** (textboxes in the PORT EXTENSION table at the bottom of the channel window)

Back to SENSe

SENS:CORR:EXT:PORT:LDC

SCPI Command

SENSe<Ch>:CORRection:EXTension:PORT<Pt>:LDC <numeric>

SENSe<Ch>:CORRection:EXTension:PORT<Pt>:LDC?

Description

Sets or reads out the loss value at DC for the port extension function.
command/query

Target

Port <Pt> of channel <Ch>,

<Ch>={[1]|2|...32}

<Pt>={[1]|2|...P}, where P is 6/8/10/12/14/16 (depending on the Analyzer model, see corresponding datasheet).

Parameter

<numeric> the loss value from –200 to 200.

Unit

dB (decibel)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

0

Related Section of Operating Manual

Port Extension

Related Controls of User Interface

Fixture > Port Extension > LOSS MODE {Loss 1 | Loss 2} (drop-down list in the PORT EXTENSION table at the bottom of the channel window) **> DC LOSS** (field in the PORT EXTENSION table at the bottom of the channel window)

Back to SENSe

SENS:CORR:EXT:PORT:LOSS

SCPI Command

SENSe<Ch>:CORRection:EXTension:PORT<Pt>:LOSS{[1]|2} <numeric>

SENSe<Ch>:CORRection:EXTension:PORT<Pt>:LOSS{[1]|2}?

Description

Sets or reads out the values of loss 1 and loss 2 for the port extension function.
command/query

Target

Port <Pt> of channel <Ch>,

<Ch>={[1]|2|...32}

<Pt>={[1]|2|...P}, where P is 6/8/10/12/14/16 (depending on the Analyzer model, see corresponding datasheet).

Parameter

<numeric> the loss value from –200 to 200.

Unit

dB (decibel)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

0

Related Section of Operating Manual

Port Extension

Related Controls of User Interface

Fixture > Port Extension > LOSS MODE {Loss 1 | Loss 2} (drop-down list in the PORT EXTENSION table at the bottom of the channel window) **> LOSS 1 | LOSS 2** (textboxes in the PORT EXTENSION table at the bottom of the channel window)

Back to SENSe

SENS:CORR:EXT:PORT:TIME

SCPI Command

SENSe<Ch>:CORRection:EXTension:PORT<Pt>:TIME <time>

SENSe<Ch>:CORRection:EXTension:PORT<Pt>:TIME?

Description

Sets or reads out the electrical delay value for the port extension function.
command/query

Target

Port <Pt> of channel <Ch>,

<Ch>={[1]|2|...32}

<Pt>={[1]|2|...P}, where P is 6/8/10/12/14/16 (depending on the Analyzer model, see corresponding datasheet).

Parameter

<time> the electrical delay value from –10 to 10

Unit

sec (second)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

0

Related Section of Operating Manual

Port Extension

Related Controls of User Interface

Fixture > Port Extension > DELAY (textbox in the PORT EXTENSION table at the bottom of the channel window)

Back to SENSe

SENS:CORR:IMP

SCPI Command

SENSe:CORRection:IMPedance[:INPut][:MAGNitude] <numeric>

SENSe:CORRection:IMPedance[:INPut][:MAGNitude]?

Description

Sets or reads out the system impedance Z0 of all Analyzer ports.
command/query

Parameter

<numeric> the Z0 value from 0.001 to 1000.

Unit

Ω (Ohm)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

50 Ω

Related Controls of User Interface

Calibration > Port 1|Port 2|, ...,|Port 16 (textbox in SYSTEM IMPEDANCE accordion)

Back to SENSe

SENS:CORR:IMP:SEL:AUTO

SCPI Command

SENSe:CORRection:IMPedance[:INPut]:SELect:AUTO {OFF|ON|0|1}

SENSe:CORRection:IMPedance[:INPut]:SELect:AUTO?

Description

Turns the auto select Z0 function ON/OFF. When enabled the function sets the port impedance Z0 to the corresponding value of measuring calibration standard.

command/query

Parameter

{ON|1} ON

{OFF|0} OFF

Query Response

{0|1}

Preset Value

0

Related Controls of User Interface

Calibration > Auto select impedance (checkbox in SYSTEM IMPEDANCE accordion)

Back to SENSe

SENS:CORR:STAT

SCPI Command

SENSe<Ch>:CORRection:STATe {OFF|ON|0|1}

SENSe<Ch>:CORRection:STATe?

Description

Turns the S-parameter error correction ON/OFF.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

0

Related Section of Operating Manual

Error Correction Status

Related Controls of User Interface

Calibration > User Correction (checkbox in the submenu)

Back to SENSe

SENS:CORR:TRAN:TIME:FREQ

SCPI Command

SENSe<Ch>:CORRection:TRANsform:TIME:FREQuency <frequency>

SENSe<Ch>:CORRection:TRANsform:TIME:FREQuency?

Description

Sets or reads out the frequency value at which the cable loss is specified for the cable correction function when the time domain transformation function is turned on.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Parameter

<frequency> the frequency value.

Unit

Hz (Hertz)

Query Response

<numeric>

Preset Value

1 GHz

Related Section of Operating Manual

Cable Correction Function

Related Controls of User Interface

Time Domain > Cable Frequency (textbox in TIME DOMAIN accordion)

Back to SENSe

SENS:CORR:TRAN:TIME:LOSS

SCPI Command

SENSe<Ch>:CORRection:TRANsform:TIME:LOSS <numeric>

SENSe<Ch>:CORRection:TRANsform:TIME:LOSS?

Description

Sets or reads out the cable loss value for the cable correction function when the time domain transformation function is turned ON.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Parameter

<numeric> the cable loss value.

Unit

dB/m (decibell / meter)

Query Response

<numeric>

Preset Value

0 dB/m

Related Section of Operating Manual

Cable Correction Function

Related Controls of User Interface

Time Domain > Cable Loss (textbox in TIME DOMAIN accordion)

Back to SENSe

SENS:CORR:TRAN:TIME:RVEL

SCPI Command

SENSe<Ch>:CORRection:TRANsform:TIME:RVELocity <numeric>

SENSe<Ch>:CORRection:TRANsform:TIME:RVELocity?

Description

Sets or reads out the cable relative wave speed velocity for the cable correction function, when the time domain transformation function is turned ON.

command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Parameter

<numeric> the cable velocity factor.

Query Response

<numeric>

Preset Value

1.0

Related Section of Operating Manual

Cable Correction Function

Related Controls of User Interface

Time Domain > Velocity Factor (textbox in TIME DOMAIN accordion)

Back to SENSe

SENS:CORR:TRAN:TIME:STAT

SCPI Command

SENSe<Ch>:CORRection:TRANsform:TIME:STATe {OFF|ON|0|1}

SENSe<Ch>:CORRection:TRANsform:TIME:STATe?

Description

Turns the cable correction ON/OFF when the time domain transformation function is turned ON.

command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

0

Related Section of Operating Manual

Cable Correction Function

Related Controls of User Interface

Time Domain > Cable Correction (checkbox in TIME DOMAIN accordion)

Back to SENSe

SENS:CORR:TYPE?

SCPI Command

SENSe<Ch>:CORRection:TYPE<Tr>?

Description

Reads the information about the calibration type and the number of ports to which the calibration is applied for the specified trace. The response format is as follows.

query only

Target

Trace <Tr> of channel <Ch>,

<Tr> = {[1]|2|...64}

<Ch>={[1]|2|...32}

Query Response

<Type>,<Port1>…,<PortN>

Where <Type> is:

RESPO	Response (Open)
RESPS	Response (Short)
RESPT	Response (Thru)
SOLTN	Full n-port calibration
1PATH	One path two-port calibration
NONE	Not defined

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to SENSe

SENS:DATA:CORR?

SCPI Command

SENSe<Ch>:DATA:CORRdata? <char>

Description

Reads out the corrected S-parameter data array or the corrected receiver data array. The type of the array entries is a complex number.

The array size is 2N, where N is the number of measurement points. For the n-th point, where n from 1 to N:

<numeric 2n–1> the real part of corrected measurement

<numeric 2n> the imaginary part of corrected measurement

Note To ensure the update of the data, the corresponding stimulus port must be active. For example, when reading the S12 parameter at least one trace with the stimulus port 2 must present or SOLT2 calibration must be active.

query only

Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Parameter

<char> Specifies the S-parameter:	**S11, S12, S13, S14, S21, … S1616**
<char> Specifies the Test Receiver:	**T11, T12, T13, T14, T21, … T1616** where the first index is the receiver port number, and the second index is the source port number. The following notations are also available: **T1(1), T1(2), T1(3), T1(4), T2(1), … T16(16)**

<char> Specifies the Reference Receiver:	**R11, R12, R13, R14, … R1616** where the first index is the receiver port number, and the second index is the source port number. The following notations are also available: **R1(1), R1(2), R1(3), R1(3), … R16(16)**

Query Response

<numeric 1>, <numeric 2>, …<numeric 2N>

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to SENSe

SENS:DATA:RAWD?

SCPI Command

SENSe<Ch>:DATA:RAWData? <char>

Description

Reads out the raw S-parameter data array or the raw receiver data array. The type of the array entries is a complex number.

The array size is 2N, where N is the number of measurement points. For the n-th point, where n from 1 to N:

<numeric 2n–1> the real part of raw measurement;

<numeric 2n> the imaginary part of raw measurement.

Note To ensure the update of the data, the corresponding stimulus port must be active. For example, when reading the S12 parameter at least one trace with the stimulus port 2 must present or SOLT2 calibration must be active.

query only

Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Parameter

<char> Specifies the S-parameter:	**S11, S12, S13, S14, … S1616**
<char> Specifies the Test Receiver:	**T11,T12, T13, T14, … T16** where the first index is the receiver port number, and the second index is the source port number. The following notations are also available: **T1(1), T1(2), T1(3), T1(4), … T16(16)**

<char> Specifies the Reference Receiver:	**R11, R12, R13, R14, … R1616** where the first index is the receiver port number, and the second index is the source port number. The following notations are also available: **R1(1), R1(2), R1(3), R1(4), … R16(16)**

Query Response

<numeric 1>, <numeric 2>, …<numeric 2N>

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to SENSe

SENS:FREQ

SCPI Command

SENSe<Ch>:FREQuency[:CW] <frequency>

SENSe<Ch>:FREQuency[:FIXed] <frequency>

SENSe<Ch>:FREQuency[:CW]?

SENSe<Ch>:FREQuency[:FIXed]?

Description

Sets or reads out the fixed frequency value when the power sweep type is selected.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Parameter

<frequency> the frequency value within the frequency limits of the analyzer.

Unit

Hz (Hertz)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

The minimum frequency limit of the analyzer.

Related Section of Operating Manual

Sweep Type

Constant Frequency

Related Controls of User Interface

Channel > Sweep Type {Power} (drop-down list in STIMULUS area) **> Constant Frequency** (textbox in STIMULUS area)

Back to SENSe

SENS:FREQ:DATA?

SCPI Command

SENSe<Ch>:FREQuency:DATA?

Description

Reads out the frequency array of the measurement points.

The array size is N, where N is the number of measurement points.

For the n-th point, where n from 1 to N:

<numeric n> the frequency value at the nh measurement point

query only

Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Query Response

<numeric 1>, <numeric 2>, …<numeric N>

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to SENSe

SENS:FREQ:CENT

SCPI Command

SENSe<Ch>:FREQuency:CENTer <frequency>

SENSe<Ch>:FREQuency:CENTer?

Description

Sets or reads out the stimulus center value of the sweep range for linear or logarithmic sweep type.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Parameter

<frequency> the stimulus center value within the frequency limits of the analyzer.

Unit

Hz (Hertz)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

The center frequency of the analyzer

Related Section of Operating Manual

Sweep Type

Sweep Range

Related Controls of User Interface

Channel > Sweep Type {Linear | Logarithm} (drop-down list in STIMULUS area)
> Span (textbox in STIMULUS area)

Back to SENSe

SENS:FREQ:SPAN

SCPI Command

SENSe<Ch>:FREQuency:SPAN <frequency>

SENSe<Ch>:FREQuency:SPAN?

Description

Sets or reads out the stimulus span value of the sweep range for linear or logarithmic sweep type.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Parameter

<frequency> the stimulus span value from 0 to the maximum frequency span of the analyzer.

Unit

Hz (Hertz)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

The maximum frequency span of the analyzer

Related Section of Operating Manual

Sweep Type

Sweep Range

Related Controls of User Interface

Channel > Sweep Type {Linear | Logarithm} (drop-down list in STIMULUS area)
> Span (textbox in STIMULUS area)

Back to SENSe

SENS:FREQ:STAR

SCPI Command

SENSe<Ch>:FREQuency:STARt <frequency>

SENSe<Ch>:FREQuency:STARt?

Description

Sets or reads out the stimulus start value of the sweep range for linear or logarithmic sweep type.

command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Parameter

<frequency> the stimulus start value within the frequency limits of the analyzer.

Unit

Hz (Hertz)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

The minimum frequency span of the analyzer.

Related Section of Operating Manual

Sweep Type

Sweep Range

Related Controls of User Interface

Channel > Sweep Type {Linear | Logarithm} (drop-down list in STIMULUS area)
> Span (textbox in STIMULUS area)

Back to SENSe

SENS:FREQ:STOP

SCPI Command

SENSe<Ch>:FREQuency:STOP <frequency>

SENSe<Ch>:FREQuency:STOP?

Description

Sets or reads out the stimulus stop value of the sweep range for linear or logarithmic sweep type.

command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Parameter

<frequency> the stimulus stop value within the frequency limits of the analyzer.

Unit

Hz (Hertz)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

The maximum frequency limit of the analyzer.

Related Section of Operating Manual

Sweep Type

Sweep Range

Related Controls of User Interface

Channel > Sweep Type {Linear | Logarithm} (drop-down list in STIMULUS area)
> Span (textbox in STIMULUS area)

Back to SENSe

SENS:SEGM:DATA

SCPI Command

SENSe<Ch>:SEGMent:DATA <numeric list>

SENSe<Ch>:SEGMent:DATA?

Description

Sets or reads out the array of the segment sweep table.

The array has the following format:

{<Buf>, <Flag1>, <Flag2>, <Flag3>, <Flag4>, <Flag5>, <N>,
<Start 1>, <Stop 1>, <NOP 1> [,<IFBW 1>] [,<Pow 1>] [,<Del 1>] [,<Time 1>],
<Start 2>, <Stop 2>, <NOP 2> [,<IFBW 2>] [,<Pow 2>] [,<Del 2>] [,<Time 2>],
…
<StartN>, <StopN>, <NOP N> [,<IFBW N>] [,<Pow N>] [,<Del N>] [,<TimeN>]}
<Buf> : Always 5,
<Flag1> : Stimulus start setting (0 — start/stop, 1 — center/span),
<Flag2> : Setting of the <IFBW> field (0 — disabled, 1 — enabled),
<Flag3> : Setting of the <Pow> field (0 — disabled, 1 — enabled),
<Flag4> : Setting of the <Del> field (0 — disabled, 1 — enabled),
<Flag5> : Setting of the <Time> field (0 — disabled, 1 — enabled),
<N> : Number of segments,
<Start n> : Start value of the n-th segment,
<Stop n> : Stop value of the n-th segment,
<NOP n> : Number of points of the n-th segment,
<IFBW n> : IF bandwidth of the n-th segment (if enabled),
<Pow n> : Power of the n-th segment (if enabled),
<Del n> : Measurement delay of the n-th segment (if enabled),
<Time n> : Reserved for future use (if enabled)

command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Query Response

<numeric 1>,<numeric 2>,…<numeric 7+M×N>

Where:

N – the number of the segments,

M – depends on the values of the flags:

M = 3 + <Flag2> + <Flag3> + <Flag4> + <Flag5>

Related Controls of User Interface

Channel > Sweep Type {Segment} (drop-down list in STIMULUS area) **> Show Segment Table** (checkbox in STIMULUS area)

Back to SENSe

SENS:SWE:POIN

SCPI Command

SENSe<Ch>:SWEep:POINts <numeric>

SENSe<Ch>:SWEep:POINts?

Description

Sets or reads out the number of measurement points.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Parameter

<numeric> the number of measurement points from 2 to maximum limit of the analyzer.

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

201

Related Section of Operating Manual

Sweep Type

Number of Points

Related Controls of User Interface

Channel > Sweep Type {Linear | Logarithm | Power} (drop-down list in STIMULUS area) **> Points** (textbox in STIMULUS area)

Back to SENSe

SENS:SWE:POIN:TIME

SCPI Command

SENSe<Ch>:SWEep:POINt:TIME <time>

SENSe<Ch>:SWEep:POINt:TIME?

Description

Sets or reads out the delay before measurement in each measurement point.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Parameter

<time> the measurement delay value from 0 to 100 sec.

Unit

sec (second)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

0

Related Section of Operating Manual

Measurement Delay

Related Controls of User Interface

Channel > Meas Delay (textbox in the STIMULUS area)

(When **Delay** checkbox is removed)

Back to SENSe

SENS:SWE:TYPE

SCPI Command

SENSe<Ch>:SWEep:TYPE <char>

SENSe<Ch>:SWEep:TYPE?

Description

Sets or reads out the sweep type.

command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Parameter

<char> Specifies the sweep type:

LINear	Linear frequency sweep
LOGarithmic	Logarithmic frequency sweep
SEGMent	Segment frequency sweep
POWer	Power sweep

Query Response

{LIN|LOG|SEGM|POW}

Preset Value

LIN

Related Section of Operating Manual

Sweep Type

Related Controls of User Interface

Channel > Sweep Type {Linear | Logarithm | Segment | Power} (drop-down list in the STIMULUS area)

Back to SENSe

SERVice

Command	Description	
SERV:CHAN:ACT?	Channel and Trace Settings	Active channel number (read)
SERV:CHAN:TRAC:ACT?		Active trace number (read)
SERV:CHAN:COUN?	Analyzer Capabilities	Maximum number of channels
SERV:CHAN:TRAC:COUN?		Maximum number of traces in the channel
SERV:PORT:COUN?		Ports number
SERV:SWE:FREQ:MAX?		Upper limit of frequency
SERV:SWE:FREQ:MIN?		Lower limit of frequency
SERV:SWE:POIN?		Maximum number of points
SERV:SWE:POW:MAX?		Upper limit of source power
SERV:SWE:POW:MIN?		Lower limit of source power
SERV:CHAN:TRAC:MARK:ACT?	Marker Properties	Gets active marker

SERV:CHAN:ACT?

SCPI Command

SERVice:CHANnel:ACTive?

Description

Reads out the active channel number.
query only

Query Response

<numeric> from 1 to 32

Related Commands

DISP:WIND:ACT

Related Sections of Operating Manual

None

Related Controls of User Interface

None

Back to SERVice

SERV:CHAN:COUN?

SCPI Command

SERVice:CHANnel:COUNt?

Description

Reads out the maximum number of the Analyzer channels.
query only

Query Response

<numeric>

Related Sections of Operating Manual

None

Related Controls of User Interface

None

Back to SERVice

SERV:CHAN:TRAC:ACT?

SCPI Command

SERVice:CHANnel<Ch>:TRACe:ACTive?

Description

Reads out the active trace number of the channel.
query only

Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Query Response

<numeric> from 1 to 64

Related Sections of Operating Manual

None

Related Controls of User Interface

None

Back to SERVice

SERV:CHAN:TRAC:COUN?

SCPI Command

SERVice:CHANnel:TRACe:COUNt?

Description

Reads out the maximum number of traces in the channel.
query only

Query Response

<numeric>

Related Sections of Operating Manual

None

Related Controls of User Interface

None

Back to SERVice

SERV:CHAN:TRAC:MARK:ACT?

SCPI Command

SERVice:CHANnel<Ch>:TRACe<Tr>:MARKer:ACTive?

Description

Gets the active marker number of the specified trace of the specified channel.
query only

Target

Trace <Tr> of channel <Ch>,

<Ch>={[1]|2|...32}

<Tr> = {[1]|2|...64}

Query Response

<numeric>

Related Commands

CALC:MARK:ACT

Related Sections of Operating Manual

None

Related Controls of User Interface

None

Back to SERVice

SERV:PORT:COUN?

SCPI Command

SERVice:PORT:COUNt?

Description

Reads out the number of Analyzer ports.
query only

Query Response

<numeric>

Related Sections of Operating Manual

None

Related Controls of User Interface

None

Back to SERVice

SERV:SWE:FREQ:MAX?

SCPI Command

SERVice:SWEep:FREQuency:MAXimum?

Description

Reads out the upper limit of the Analyzer measurement frequency.
query only

Query Response

<numeric>

Unit

Hz (Hertz)

Related Sections of Operating Manual

None

Related Controls of User Interface

None

Back to SERVice

SERV:SWE:FREQ:MIN?

SCPI Command

SERVice:SWEep:FREQuency:MINimum?

Description

Reads out the lower limit of the Analyzer measurement frequency.
query only

Query Response

<numeric>

Unit

Hz (Hertz)

Related Sections of Operating Manual

None

Related Controls of User Interface

None

Back to SERVice

SERV:SWE:POIN?

SCPI Command

SERVice:SWEep:POINts?

Description

Reads the maximum number of Analyzer measurement points.
query only

Query Response

<numeric>

Related Sections of Operating Manual

None

Related Controls of User Interface

None

Back to SERVice

SERV:SWE:POW:MAX?

SCPI Command

SERVice:SWEep:POWer:MAXimum?

Description

Reads out the upper limit of the source power.
query only

Query Response

<numeric>

Unit

dBm (decibels above 1 milliwatt)

Related Sections of Operating Manual

None

Related Controls of User Interface

None

Back to SERVice

SERV:SWE:POW:MIN?

SCPI Command

SERVice:SWEep:POWer:MINimum?

Description

Reads out the lower limit of the source power.
query only

Query Response

<numeric>

Unit

dBm (decibels above 1 milliwatt)

Related Sections of Operating Manual

None

Related Controls of User Interface

None

Back to SERVice

SOURce

Command	Description	
SOUR:POW	Stimulus Settings	Power level for a frequency sweep
SOUR:POW:CENT		Center power
SOUR:POW:PORT		Power level of each port
SOUR:POW:PORT:COUP		Port power coupling ON/OFF
SOUR:POW:SLOP		Power slope value
SOUR:POW:SLOP:STAT		Power slope ON/OFF
SOUR:POW:SPAN		Span power
SOUR:POW:STAR		Start power
SOUR:POW:STOP		Stop frequency

SOUR:POW

SCPI Command

SOURce<Ch>:POWer[:LEVel][:IMMediate][:AMPLitude] <power>

SOURce<Ch>:POWer[:LEVel][:IMMediate][:AMPLitude]?

Description

Sets or reads out the power level for the frequency sweep type.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Parameter

<power> the power level within the power limits of the analyzer.

Unit

dBm (decibels above 1 milliwatt)

Resolution

0.05 dBm

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

0 dBm

Related Commands

SOUR:POW:PORT:COUP

Related Sections of Operating Manual

Sweep Type

Stimulus Power and Power Slope Feature

Related Controls of User Interface

Channel > Sweep Type {Linear | Logarithm | Segment} (drop-down list in STIMULUS area) **> Coupled** (button in segment switch in the submenu) **> Power** (textbox)

Back to SOURce

SOUR:POW:CENT

SCPI Command

SOURce<Ch>:POWer:CENTer <power>

SOURce<Ch>:POWer:CENTer?

Description

Sets or reads out the center value of the power sweep type.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Parameter

<power> the power level within the power limits of the analyzer.

Unit

dBm (decibels above 1 milliwatt)

Resolution

0.05 dBm

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

Depends on the Analyzer

Related Sections of Operating Manual

Sweep Type

Sweep Range

Related Controls of User Interface

Channel > Sweep Type {Power} (drop-down list in STIMULUS area) **> Center** (textbox)

Back to SOURce

SOUR:POW:PORT

SCPI Command

SOURce<Ch>:POWer:PORT<Pt>[:LEVel][:IMMediate][:AMPLitude] <power>

SOURce<Ch>:POWer:PORT<Pt>[:LEVel][:IMMediate][:AMPLitude]?

Description

Sets or reads out the power level of each port for the frequency sweep type when the port couple feature is set to OFF by the SOUR:POW:PORT:COUP command.

command/query

Target

Port <Pt> of channel <Ch>,

<Ch>={[1]|2|...32}

<Pt>={[1]|2|...P}, where P is 6/8/10/12/14/16 (depending on the Analyzer model, see corresponding datasheet).

Parameter

<power> the power level within the power limits of the analyzer.

Unit

dBm (decibels above 1 milliwatt)

Resolution

0.05 dBm

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

0

Related Commands

SOUR:POW:PORT:COUP

Related Section of Operating Manual

Sweep Type

Stimulus Power and Power Slope Feature

Related Controls of User Interface

Channel > Sweep Type {Linear | Logarithm | Segment} (drop-down list in STIMULUS area) **> Uncoupled** (toggle button in the submenu) **> Arbitrary Power > POWER**

Back to SOURce

SOUR:POW:PORT:CORR:COLL:TABL:LOSS:DATA

SCPI Command

SOURce<Ch>:POWer:PORT<Pt>:CORRection:COLLect:TABLe:LOSS:DATA <numeric list>

SOURce<Ch>:POWer:PORT<Pt>:CORRection:COLLect:TABLe:LOSS:DATA?

Description

Sets/gets the loss compensation table used when the power calibration is executed.

Note If the array size is not 1 + 2N, where N is equal to <numeric 1>, an error occurs. If the <numeric 2n> and <numeric 2n+1> values are out of the allowable range, the value of the limit, which is closer to the specified value will be set.

command/query

Target

Port <Pt> of channel <Ch>,

<Ch>={[1]|2|...32}

<Pt>={[1]|2|...P}, where P is 6/8/10/12/14/16 (depending on the Analyzer model, see corresponding datasheet).

Parameter

The array size is 1+2N, where N is the number of measurement points.

For the n-th point, where n from 1 to N:

<numeric 1> the number of the table rows N integer from 0 to 10001;

<numeric 2n> the frequency of the n-th row of the table;

<numeric 2n+1> the loss compensation value of the n-th row of the table from –100 to +100 dB.

Query Response

<numeric 1>, <numeric 2>, …<numeric 2N+1>

Related Commands

SENS:CORR:CONF:CRE

SENS:CORR:CONF:SEL

Related Section of Operating Manual

Power Calibration

Related Controls of User Interface

Calibration > Calibrate > Power/Receivers > Adapter

Back to SOURce

SOUR:POW:PORT:CORR:DATA

SCPI Command

SOURce<Ch>:POWer:PORT<Pt>:CORRection:DATA <numeric list>

SOURce<Ch>:POWer:PORT<Pt>:CORRection:DATA?

Description

Sets or reads out the power correction array.

Note If the array size is not 1 + 2N, where N is equal to <numeric 1>, an error occurs. If the <numeric 2n> and <numeric 2n+1> values are out of the allowable range, the value of the limit, which is closer to the specified value will be set.

command/query

Target

Port <Pt> of channel <Ch>,

<Ch>={[1]|2|...32}

<Pt>={[1]|2|...P}, where P is 6/8/10/12/14/16 (depending on the Analyzer model, see corresponding datasheet).

Parameter

The array size is NOP, where NOP is the number of measurement points.

For the n-th point, where n from 1 to NOP:

<numeric n> power correction value of the n-th point

Query Response

<numeric 1>, <numeric 2>, …<numeric NOP>

Related Commands

None

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to SOURce

SOUR:POW:PORT:COUP

SCPI Command

SOURce<Ch>:POWer:PORT:COUPle {OFF|ON|0|1}

SOURce<Ch>:POWer:PORT:COUPle?

Description

Turns the port power couple ON/OFF. Setting the port power couple to OFF allows independent power level setting for each port.

command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

1

Related Section of Operating Manual

Sweep Type

Stimulus Power and Power Slope Feature

Related Controls of User Interface

Channel > Sweep Type {Linear | Logarithm | Segment} (drop-down list in STIMULUS area) **> Coupled | Uncoupled** (button in segment switch in the submenu)

Back to SOURce

SOUR:POW:SLOP

SCPI Command

SOURce<Ch>:POWer[:LEVel]:SLOPe[:DATA] <numeric>

SOURce<Ch>:POWer[:LEVel]:SLOPe[:DATA]?

Description

Sets or reads out the power slope value for the frequency sweep type.

command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Parameter

<numeric> the power slope value from –2 to +2

Unit

dB/GHz (decibel/gigahertz)

Resolution

0.1

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

0

Related Section of Operating Manual

Sweep Type

Stimulus Power and Power Slope Feature

Related Controls of User Interface

Channel > Sweep Type {Linear | Logarithm | Segment} (drop-down list in STIMULUS area) **> Coupled** (button in segment switch in the submenu) **> Slope** (textbox)

Back to SOURce

SOUR:POW:SLOP:STAT

SCPI Command

SOURce<Ch>:POWer[:LEVel]:SLOPe:STATe {OFF|ON|0|1}

SOURce<Ch>:POWer[:LEVel]:SLOPe:STATe?

Description

Turns the power slope ON/OFF. The power slope is valid for the frequency sweep type: Linear, Logarithmic, Segment.

command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Parameter

{ON|1} ON

{OFF|0} OFF

Query Response

{0|1}

Preset Value

0

Related Section of Operating Manual

Sweep Type

Stimulus Power and Power Slope Feature

Related Controls of User Interface

None

Back to SOURce

SOUR:POW:SPAN

SCPI Command

SOURce<Ch>:POWer:SPAN <power>

SOURce<Ch>:POWer:SPAN?

Description

Sets or reads out the power span when the power sweep type is active.

command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Parameter

<power> the power sweep span value from 0 to maximum limit of the analyzer.

Unit

dBm (decibels above 1 milliwatt)

Resolution

0.05 dBm

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

Depends on the analyzer

Related Section of Operating Manual

Sweep Type

Sweep Range

Related Controls of User Interface

Channel > Sweep Type {Power} (drop-down list in STIMULUS area) **> Span** (textbox)

Back to SOURce

SOUR:POW:STAR

SCPI Command

SOURce<Ch>:POWer:STARt <power>

SOURce<Ch>:POWer:STARt?

Description

Sets or reads out the power sweep start value when the power sweep type is active.

command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Parameter

<power> the power sweep start value within the power limits of the analyzer.

Unit

dBm (decibels above 1 milliwatt)

Resolution

0.05 dBm

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

Depends on the analyzer

Related Section of Operating Manual

Sweep Type

Sweep Range

Related Controls of User Interface

Channel > Sweep Type {Power} (drop-down list in STIMULUS area) **> Start** (textbox)

Back to SOURce

SOUR:POW:STOP

SCPI Command

SOURce<Ch>:POWer:STOP <power>

SOURce<Ch>:POWer:STOP?

Description

Sets or reads out the power sweep stop value when the power sweep type is active.

command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...32}

Parameter

<power> the power sweep stop value within the power limits of the analyzer.

Unit

dBm (decibels above 1 milliwatt)

Resolution

0.05 dBm

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

Depends on the analyzer

Related Section of Operating Manual

Sweep Type

Sweep Range

Related Controls of User Interface

Channel > Sweep Type {Power} (drop-down list in STIMULUS area) **> Stop** (textbox)

Back to SOURce

SYSTem

Command	Description	
SYST:BEEP:COMP:IMM	Analyzer Parameters	Generates completion beep
SYST:BEEP:COMP:STAT		Completion beeper ON/OFF
SYST:BEEP:WARN:IMM		Generates warning beep
SYST:BEEP:WARN:STAT		Warning beeper ON/OFF
SYST:CORR		System correction ON/OFF
SYST:CYCL:TIME:MEAS?		Measured cycle
SYST:DATE		Current date
SYST:READ?		Analyzer readiness status
SYST:TEMP:SENS?		Reads the Analyzer temperature
SYST:TERM		Analyzer software shutdown
SYST:TIME		Current time
SYST:CAP:IFBW:MAX?	Analyzer Capabilities	Upper limit of IFBW

Command	Description	
SYST:CAP:IFBW:MIN?		Lower limit of IFBW
SYST:CONN:SER:NUMB		Analyzer Serial N
SYST:COMM:ECAL:CHEC	Automatic Calibration Module	"CHECK" module state
SYST:COMM:ECAL:DATA?		Characterization data of AutoCal module
SYST:COMM:ECAL:FREQ:DATA?		Characterization frequency array of AutoCal module
SYST:COMM:ECAL:POIN?		Number of characterization points of AutoCal module
SYST:COMM:ECAL:IMP		Impedance state of module port
SYST:COMM:ECAL:READ?		Module readiness status
SYST:COMM:ECAL:LIST?		Reads the list of the ACM.
SYST:COMM:ECAL:TEMP:SENS?		Module temperature
SYST:COMM:ECAL:THRU		"THRU" module state
SYST:COMM:PSEN:LIST?	Power Calibration	Reads the list of power meter sensors
SYST:COMM:PSEN:ZERO		Zeroes the power sensor

Command	Description	
SYST:ERR?	Status System	Reads the error message queue
SYST:TEST?		Textual description of Analyzer self-test
SYST:HIDE	Interface Settings	Minimizes the Analyzer window
SYST:LOC		Sets the local mode
SYST:REM		Sets the remote mode
SYST:RWL		Sets the remote mode with lock
SYST:SHOW		Restores the Analyzer window
SYST:PRES	Presets	Reset to default settings

SYST:BEEP:COMP:IMM

SCPI Command

SYSTem:BEEPer:COMPlete:IMMediate

Description

Generates a beep to notify of the completion of the operation.
command only

Related Section of Operating Manual

Beeper Settings

Related Controls of User Interface

Settings > Beep Complete (icon  in BEEPER accordion)

Back to SYSTem

SYST:BEEP:COMP:STAT

SCPI Command

SYSTem:BEEPer:COMPlete:STATe {OFF|ON|0|1}

SYSTem:BEEPer:COMPlete:STATe?

Description

Turns the beeper denoting completion of the operation ON/OFF.
command/query

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

1

Related Section of Operating Manual

Beeper Settings

Related Controls of User Interface

Setting > Beep Complete (checkbox in BEEPER accordion)

Back to SYSTem

SYST:BEEP:WARN:IMM

SCPI Command

SYSTem:BEEPer:WARNing:IMMediate

Description

Generates a beep to signify a warning.
command only

Related Section of Operating Manual

Beeper Settings

Related Controls of User Interface

Settings > Beep Warning (icon  in BEEPER accordion)

Back to SYSTem

SYST:BEEP:WARN:STAT

SCPI Command

SYSTem:BEEPer:WARNing:STATe {OFF|ON|0|1}

SYSTem:BEEPer:WARNing:STATe?

Description

Turns the beeper signifying a warning ON/OFF.
command/query

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

1

Related Section of Operating Manual

Beeper Settings

Related Controls of User Interface

Settings > Beep Warning (checkbox in BEEPER accordion)

Back to SYSTem

SYST:CAP:IFBW:MAX?

SCPI Command

SYSTem:CAPability:IFBW:MAXimum?

Description

Reads out the upper limit of the IFBW.
query only

Query Response

<numeric>

Unit

Hz (Hertz)

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to SYSTem

SYST:CAP:IFBW:MIN?

SCPI Command

SYSTem:CAPability:IFBW:MINimum?

Description

Reads out the lower limit of the IFBW.
query only

Query Response

<numeric>

Unit

Hz (Hertz)

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to SYSTem

SYST:COMM:ECAL:CHEC

SCPI Command

SYSTem:COMMunicate:ECAL:CHECk

Description

Sets the CHECK state of the ACM.
command only

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to SYSTem

SYST:COMM:ECAL:DATA?

SCPI Command

SYSTem:COMMunicate:ECAL:DATA? <path>, <impedance> [,<characterization>]

Description

Reads out the ACM characterization data. One command call returns one S-parameter array according to the specified parameters.

The array size is 2N, where N is the number of points of the specified characterization (See the SYST:COMM:ECAL:POIN? command). For the n-th point, where n is from 1 to N:

<*numeric 2n–1*> real part of S-parameter at the n-th characterization point

<*numeric 2n*> imaginary part of S-parameter at the n-th characterization point

query only

Parameter

<path>: {A|B|C|D|AB|AC|AD|BC|BD|CD|CHECk} specifies the port number or port pair or check state

<impedance>: {SHORt|OPEN|LOAD|OPEN2|LOAD2|S11|S12|S21|S22|…|S44} specifies the impedance state or S-parameter

<characterization>: {[FACTory]|USER1|USER2|USER3} specifies the name of the characterization, if omitted the factory characterization is used

The allowable combinations of parameter <path> and parameter <impedance> are as follows:

<path>	<impedance>	Description
A, B, C, D	**SHORt, OPEN, LOAD, OPEN2, LOAD2**	S11-parameter of the reflection state
AB, AC, AD, BC, BD, CD	**S11, S21, S12, S22**	S-parameter of the THRU state
CHECk	• **S11, S21 ... SNN (N - the number of ACM ports)**	S-parameter of the CHECK state

Query Response

<numeric 1>, <numeric 2>, …<numeric 2N>.

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to SYSTem

SYST:COMM:ECAL:FREQ:DATA?

SCPI Command

SYSTem:COMMunicate:ECAL:FREQuency:DATA? [<characterization>]

Description

Reads out the ACM characterization frequency array.

The array size is N, where N is the number of points of the specified characterization (See the SYST:COMM:ECAL:POIN? command). For the n-th point, where n is from 1 to N:

<numeric n> frequency value at the n-th characterization point

query only

Parameter

<characterization>: {[FACTory]|USER1|USER2|USER3} specifies the name of the characterization, if omitted, the factory characterization is used

Query Response

<numeric 1>, <numeric 2>, …<numeric N>.

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to SYSTem

SYST:COMM:ECAL:POIN?

SCPI Command

SYSTem:COMMunicate:ECAL:POINts? [<characterization>]

Description

Reads out the ACM characterization point number. If the characterization does not exist then returns 0.

query only

Parameter

<characterization>: {[FACTory]|USER1|USER2|USER3} specifies the name of the characterization, if omitted, the factory characterization is used

Query Response

<numeric>

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to SYSTem

SYST:COMM:ECAL:IMP

SCPI Command

SYSTem:COMMunicate:ECAL:IMPedance <port>,<char>

SYSTem:COMMunicate:ECAL:IMPedance? <port>

Description

Sets or reads out the impedance state of the specified port of the ACM.
command/query

Parameter

<port> : Port number of the ACM

<char> Specifies the impedance state:

OPEN	OPEN impedance state
SHORt	SHORT impedance state
LOAD	LOAD impedance state
LOAD2	LOAD2 impedance state
OPEN2	OPEN2 impedance state

Query Response

{OPEN|SHOR|LOAD|THRU|LOAD2|OPEN2}

Preset Value

LOAD

Related Section of Operating Manual

Manual Switch Control

Related Controls of User Interface

Devices > ShortAllPorts | OpenAllPorts | LoadAllPorts | ShortAllLoadA | ShortAllLoadB | ShortAllLoadC | ShortAllLoadD ShortAllPorts | OpenAllPorts | ShortAllLoadA | ShortAllLoadB | ...| ThruAB |...| Attenuator ... (buttons in ACM SWITCH CONTROL accordion)

NOTE The set of buttons depends on the specific ACM (see ACM Operating Manual).

Back to SYSTem

SYST:COMM:ECAL:LIST?

SCPI Command

SYSTem:COMMunicate:ECAL:LIST?

Description

Reads out the list of ACMs.
query only

Query Response

<ecal1Model>, <ecal1Serial>, <ecal2Model>, <ecal2Serial>

Related Section of Operating Manual

Calibration with the Automatic Calibration Module

Related Controls of User Interface

Devices > ACM CONTROL (drop-down list in ACM CONTROL accordion)

Programming Example

User ACM Calibration Example

Back to SYSTem

SYST:COMM:ECAL:READ?

SCPI Command

SYSTem:COMMunicate:ECAL:READy?

Description

Reads out the readiness status of the ACM. 1 indicates that the ACM is ready.
query only

Query Response

{0|1}, 1 — the module is ready.

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to SYSTem

SYST:COMM:ECAL:TEMP:SENS?

SCPI Command

SYSTem:COMMunicate:ECAL:TEMPerature:SENSor?

Description

Reads out the temperature of the ACM connected to the Analyzer.
query only

Target

ACM

Unit

°C (degrees Celsius)

Query Response

<numeric>

Related Section of Operating Manual

Calibration with the Automatic Calibration Module

Related Controls of User Interface

Devices > Show ACM details... (button in ACM CONTROL accordion)

Back to SYSTem

SYST:COMM:ECAL:THRU

SCPI Command

SYSTem:COMMunicate:ECAL:THRU <port1>,<port2>

Description

Sets the THRU state between the specified 2 ports of the ACM.
command only

Parameter

<port1>	The first port number of the ACM
<port2>	The second port number of the ACM

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to SYSTem

SYST:COMM:PSEN:LIST?

SCPI Command

SYSTem:COMMunicate:PSENsor:LIST?

Description

Reads out the list of power meter sensors.
query only

Query Response

<powerSensor1Model>, <powerSensor1Serial>, <powerSensor2Model>, <powerSensor2Serial>, ... <powerSensorNModel>, <powerSensorNSerial>

Related Section of Operating Manual

Power Meter Setting

Related Controls of User Interface

Devices > POWER METER (drop-down list in POWER METER accordion)

Programming Example

User Power Calibration Example

User Power And Receiver Calibration Example

Back to SYSTem

SYST:COMM:PSEN:ZERO

SCPI Command

SYSTem:COMMunicate:PSENsor:ZEROing

Description

Executes the zeroing procedure of the power meter sensor.

Note The power meter sensor can be connected to the port, since during this procedure, the output signal of the port is turned off the RF power.

command only

Related Commands

SYST:COMM:PSEN:LIST?

Related Section of Operating Manual

Power Meter Setting

Related Controls of User Interface

Devices > POWER METER (drop-down list in POWER METER accordion) **> Zero Correction** (button in POWER METER accordion)

Back to SYSTem

SYST:CONN:SER:NUMB

SCPI Command

SYSTem:CONNect:SERial:NUMBer <string>

SYSTem:CONNect:SERial:NUMBer?

Description

Connects the current program instance to the analyzer with specified serial number. If there is no analyzer with the specified serial number, the program goes into the NOT READY state. In order to allow the program to connect to the analyzer with any serial number, write 0 with this command.

The query returns the serial number of the connected analyzer. If the program is in NOT READY state the query returns the value set by previous command.

command/query

Parameter

<string> serial number of 8 digits, or 0 (auto-detect)

Query Response

string of 8 digits, or 0

Preset Value

0 (auto-detect)

Related Section of Operating Manual

Analyzer Model and Serial Number

Related Controls of User Interface

Devices > Detected > Advanced settings > S/N (textbox in Advanced Settings pop-up window)

Back to SYSTem

SYST:CORR

SCPI Command

SYSTem:CORRection[:STATe] {OFF|ON|0|1}

SYSTem:CORRection[:STATe]?

Description

Turns the system correction ON/OFF. The system correction is the factory full one-port calibration performed at the port connectors.

command/query

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

1

Related Section of Operating Manual

System Correction

Related Controls of User Interface

Calibration > System Correction (checkbox in the submenu)

Back to SYSTem

SYST:CYCL:TIME:MEAS?

SCPI Command

SYSTem:CYCLe:TIME:MEASurement?

Description

Reads out the measured cycle time. The cycle time is the interval between the start of two adjacent sweeps. The cycle time is averaged by an exponential window with a time constant of about 0.5 sec. If the cycle time is changed more than 100 usec in comparison with the averaged time, the averaging starts anew.

query only

Target

Analyzer

Unit

sec (second)

Query Response

<numeric>

Related Commands

None

Related Section of Operating Manual

Cycle Time

Related Controls of User Interface

Appearance > Cycle Time (checkbox in STATUS BAR accordion)

Back to SYSTem

SYST:DATE

SCPI Command

SYSTem:DATE <numeric 1>,<numeric 2>,<numeric 3>

SYSTem:DATE?

Description

Sets or reads out the current date.
command/query

Parameter

<numeric 1>	Year from 1900 to 2100
<numeric 2>	Month from 1 to 12
<numeric 3>	Day from 1 to 31

Query Response

<numeric 1>, <numeric 2>, <numeric 3>

Related Section of Operating Manual

System Date and Time

Related Controls of User Interface

Appearance > System Date (checkbox in STATUS BAR accordion)

Back to SYSTem

SYST:ERR?

SCPI Command

SYSTem:ERRor[:NEXT]?

Description

Reads out the error message when executing SCPI commands, from the FIFO (First In First Out) error queue stored in the Analyzer. The read-out error is deleted from the error queue. The maximum size of the queue is 100 messages.

query only

Query Response

<numeric>, <string>

Where:

<numeric> — error code,

<string> — error message.

If there is no error in the queue, "0, No error" is read out.

Related Section of Operating Manual

None

Related Controls of User Interface

None

Programming Example

Configuration Management

Back to SYSTem

SYST:HIDE

SCPI Command

SYSTem:HIDE

Description

Hides the Analyzer main window, removing it from the desktop.
command only

Related Commands

SYST:SHOW

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to SYSTem

SYST:LOC

SCPI Command

SYSTem:LOCal

Description

Sets the Analyzer to the local operation mode, when all the keys on the front panel, mouse, and touch screen are active.
command only

Related Commands

SYST:REM

SYST:RWL

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to SYSTem

SYST:PRES

SCPI Command

SYSTem:PRESet

Description

Resets the Analyzer to default settings.

Note The difference from the *RST: command is that the trigger is set to the Continuous trigger mode.

command only

Related Commands

*RST

Related Section of Operating Manual

Analyzer Presetting

Related Controls of User Interface

Save/Recall > Preset

Back to SYSTem

SYST:READ?

SCPI Command

SYSTem:READy[:STATe]?

Description

Reads out the Analyzer readiness status. 1 indicates that the Analyzer is ready. 0 indicates that the Analyzer is not ready. The state is ready after the initialization is completed. Initialization occurs after connecting and turning on the Analyzer hardware or after starting the software. Initialization takes about 10-15 sec.

query only

Query Response

{0|1}, 1 — the Analyzer is ready, 0 — the Analyzer is not ready.

Related Section of Operating Manual

Instrument Status Bar

Related Controls of User Interface

None

Back to SYSTem

SYST:REM

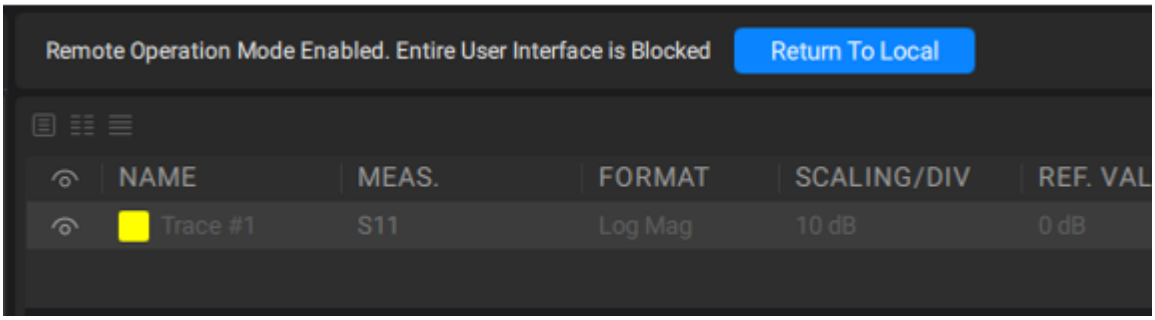
SCPI Command

SYSTem:REMote

Description

Sets the Analyzer to the remote operation mode, when all the keys on the front panel, mouse, and the touch screen are not active, except for one key labeled "Return To Local". Pushing this button will reset the Analyzer to the local operation mode.

command only



Button to turn off the remote operation mode in the user interface

Related Commands

SYST:LOC

SYST:RWL

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to SYSTem

SYST:RWL

SCPI Command

SYSTem:RWLock

Description

Sets the Analyzer to the remote operation mode, when all the keys on the front panel, mouse, and touch screen are not active. Only SYST:LOC or SYST:REM command can release this remote operation mode.

command only

Related Commands

SYST:LOC

SYST:REM

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to SYSTem

SYST:SHOW

SCPI Command

SYSTem:SHOW

Description

Restores the Analyzer window hidden by SYST:HIDE command.
command only

Related Commands

SYST:HIDE

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to SYSTem

SYST:TEMP:SENS?

SCPI Command

SYSTem:TEMPerature:SENSor<Idx>?

Description

Reads out the specified sensor temperature inside the Analyzer. The sensor number is specified by <Idx>:

<Idx> = 1 specifies the RF block;

<Idx> = 2 specifies the LO block.

query only

Target

Analyzer

Unit

°C (degrees Celsius)

Query Response

<numeric>

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to SYSTem

SYST:TEST?

SCPI Command

SYSTem:TEST?

Description

Reads out a textual description of the Analyzer self-test. If no failure conditions exist, "No failures" is read, otherwise the failures description string is read. The string contains substrings separated with semicolon.

Note The query returns **Not ready** when it is issued until the Analyzer is ready.

query only

Target

Instrument

Query Response

<string>

Related Commands

*TST?

SYST:READy?

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to SYSTem

SYST:TERM

SCPI Command

SYSTem:TERMinate

Description

Terminates the Analyzer software.
command only

Related Section of Operating Manual

None

Related Controls of User Interface

None

Back to SYSTem

SYST:TIME

SCPI Command

SYSTem:TIME <numeric 1>,<numeric 2>,<numeric 3>

SYSTem:TIME?

Description

Sets or reads out the current time.
command/query

Parameter

<numeric 1>	Hours from 0 to 23
<numeric 2>	Minutes from 0 to 59
<numeric 3>	Seconds from 0 to 59

Query Response

<numeric 1>, <numeric 2>, <numeric 3>

Related Section of Operating Manual

System Date and Time

Related Controls of User Interface

Appearance > System Time (checkbox in STATUS BAR accordion)

Back to SYSTem

TRIGger

Command	Description	
TRIG	Trigger Settings	Generates the trigger signal
TRIG:AVER		Averaging trigger ON/OFF
TRIG:SING		Generates the trigger signal. The command is pending until the sweep end
TRIG:SCOP		Trigger scope
TRIG:SOUR		Trigger source
TRIG:STAT?		Current state of the trigger system
TRIG:WAIT		Waits for the specified trigger state to be reached
TRIG:EXT:DEL	External Trigger Settings	Response delay to the external trigger
TRIG:EXT:SLOP		Trigger polarity
TRIG:EXT:POS		Trigger position
TRIG:POIN		Point trigger ON/OFF

Command	Description	
TRIG:OUTP:FUNC	Trigger Output Settings	Trigger output function
TRIG:OUTP:POL		Trigger polarity
TRIG:OUTP:STAT		Trigger output ON/OFF

TRIG

SCPI Command

TRIGger[:SEQuence][:IMMediate]

Description

Generates a trigger signal and initiates a sweep under the following conditions:

1. Trigger source is set to BUS (set by the command TRIG:SOUR BUS), otherwise an error occurs and the command is ignored.
2. Analyzer must be in the trigger waiting state, otherwise (the Analyzer is in the measurement state or in the hold state) an error occurs, and the command is ignored.

The command is completed immediately after the generation of the trigger signal (does not wait the end of a sweep).

command only

Related Commands

TRIG:SOUR BUS

INIT:CONT

INIT

Related Section of Operating Manual

Trigger State Diagram

Trigger Source

Related Controls of User Interface

None

Back to TRIGger

TRIG:AVER

SCPI Command

TRIGger[:SEQuence]:AVERage {OFF|ON|0|1}

TRIGger[:SEQuence]:AVERage?

Description

Turns the averaging trigger function ON/OFF. The function executes a sweep the number of times specified by the averaging factor with a single trigger for the channels with the averaging enabled.

The averaging process begins again with each trigger.

Note The point trigger function has priority against this command. When the point trigger is enabled, the number of pulses equal to (number of points) x (averaging factor) is needed to complete the averaging.

command/query

Parameter

Specifies the averaging trigger function state:

{ON|1} ON

{OFF|0} OFF

Query Response

{0|1}

Preset Value

0

Related Section of Operating Manual

Averaging Trigger

Related Commands

SENS:AVER

Related Controls of User Interface

Trigger > Averaging Trigger (checkbox in the submenu)

Back to TRIGger

TRIG:EXT:DEL

SCPI Command

TRIGger[:SEQuence]:EXTernal:DELay <time>

TRIGger[:SEQuence]:EXTernal:DELay?

Description

Sets or reads out the response delay with respect to the external trigger signal.
command/query

Parameter

<time> the delay value from 0 to 100 sec.

Unit

sec (second)

Query Response

<numeric>

Preset Value

0

Out of Range

Sets the value of the limit, which is closer to the specified value.

Related Commands

TRIG:SOUR EXT

Related Section of Operating Manual

Trigger Delay

Related Controls of User Interface

Trigger > Trigger Delay (textbox in EXTERNAL TRIGGER accordion)

Back to TRIGger

TRIG:EXT:SLOP

SCPI Command

TRIGger[:SEQuence]:EXTernal:SLOPe <char>

TRIGger[:SEQuence]:EXTernal:SLOPe?

Description

Sets or reads out the polarity of the external trigger.
command/query

Parameter

<char> Choose from:

POSitive	Positive edge
NEGative	Negative edge

Query Response

{POS|NEG}

Preset Value

NEG

Related Commands

TRIG:SOUR

Related Section of Operating Manual

Trigger Polarity

Related Controls of User Interface

Trigger > Polarity {Negative edge | Positive edge} (drop-down list in EXTERNAL TRIGGER accordion)

Back to TRIGger

TRIG:EXT:POS

SCPI Command

TRIGger[:SEQuence]:EXTernal:POSition <char>

TRIGger[:SEQuence]:EXTernal:POSition?

Description

Selects the position of the external trigger. The Analyzer waits for external trigger:

- Before sampling, when the frequency of the stimulus port has been set.
- Before the frequency setup and subsequent measurement. The frequency change of the stimulus port begins when the external trigger arrives.

Depending on the command TRIG:POIN the external trigger wait occurs before each point or before the first point of the full sweep cycle.

command/query

Parameter

<char> Choose from:

BSAM	Before sampling
BSET	Before frequency setup

Query Response

{BSAM|BSET}

Preset Value

BSAM

Related Commands

TRIG:SOUR

Related Section of Operating Manual

Trigger Position

Related Controls of User Interface

Trigger > Position {Before Sampling | Before Setup} (drop-down list in EXTERNAL TRIGGER accordion)

Back to TRIGger

TRIG:OUTP:FUNC

SCPI Command

TRIGger:OUTPut:FUNCtion <char>

TRIGger:OUTPut:FUNCtion?

Description

Selects the trigger output function. The trigger output outputs various waveforms depending on the setting of the Output Trigger Function (see the Trigger Output Function).

command/query

Parameter

<char> Choose from:

BSAM	Before sampling pulse
BSET	Before frequency setup pulse
ASAM	After sampling pulse
RTRG	Ready for trigger signal
ESWP	End of sweep pulse
MEAS	Measurement sweep signal

Query Response

{BSET|BSAM|ASAM|RTGR|ESWP|MEAS}

Preset Value

BSAM

Related Commands

TRIG:OUTP:STAT

TRIG:OUTP:POL

Related Section of Operating Manual

Function Output Trigger

Related Controls of User Interface

Trigger > Function Output Trigger {Before Sampling | Before Setup | After Sampling | Ext Trigger Ready | End of Scan | Full Scan} (drop-down list in TRIGGER OUTPUT accordion)

Back to TRIGger

TRIG:OUTP:POL

SCPI Command

TRIGger:OUTPut:POLarity <char>

TRIGger:OUTPut:POLarity?

Description

Sets or reads out the polarity of the trigger output.
command/query

Parameter

<char> Choose from:

POSitive	Positive edge
NEGative	Negative edge

Query Response

{POS|NEG}

Preset Value

POS

Related Commands

TRIG:OUTP:FUNC

TRIG:OUTP:STAT

Related Section of Operating Manual

Trigger Output Polarity

Related Controls of User Interface

Trigger > Polarity {Negative Edge | Positive Edge} (drop-down list in TRIGGER OUTPUT acordion)

Back to TRIGger

TRIG:OUTP:STAT

SCPI Command

TRIGger:OUTPut:STATe {OFF|ON|0|1}

TRIGger:OUTPut:STATe?

Description

Turns the trigger output ON/OFF.
command/query

Parameter

Specifies the trigger output function state:

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

0

Related Commands

TRIG:OUTP:FUNC

TRIG:OUTP:POL

Related Section of Operating Manual

Enabling Trigger Output

Related Controls of User Interface

Trigger > TRIGGER OUTPUT {ON | OFF} (toggle button in TRIGGER OUTPUT accordion)

Back to TRIGger

TRIG:POIN

SCPI Command

TRIGger[:SEQuence]:POINt {OFF|ON|0|1}

TRIGger[:SEQuence]:POINt?

Description

Turns the point trigger feature ON/OFF.

When the point trigger is turned ON, the external trigger response is the single point. When the point trigger feature is turned OFF, the external trigger response is the entire sweep.

command/query

Parameter

Specifies the point trigger function state:

{ON|1} ON

{OFF|0} OFF

Query Response

{0|1}

Preset Value

0

Related Commands

TRIG:SOUR EXT

Related Section of Operating Manual

Trigger Event

Related Controls of User Interface

Trigger > Event {On Point} - ON (drop-down list in EXTERNAL TRIGGER accordion)

Trigger > Event {On Sweep} - OFF (drop-down list in EXTERNAL TRIGGER accordion)

Back to TRIGger

TRIG:SING

SCPI Command

TRIGger[:SEQuence]:SINGle

Description

Generates a trigger signal and initiates a sweep under the following conditions.

- Trigger source is set to the BUS (set by the command TRIG:SOUR BUS), otherwise an error occurs and the command is ignored.
- Analyzer must be in the trigger waiting state, otherwise (the Analyzer is in the measurement state or in the hold state) an error occurs, and the command is ignored.

As opposed to the TRIG command this command is pending till the end of the sweep. The end of the sweep initiated by the TRIG:SING command can be waited using the *OPC? query.

command only

Related Commands

TRIG:SOUR

*OPC?

INIT:CONT

INIT

Related Section of Operating Manual

Trigger State Diagram

Trigger Source

Related Controls of User Interface

None

Back to TRIGger

TRIG:SCOP

SCPI Command

TRIGger[:SEQuence]:SCOPe <char>

TRIGger[:SEQuence]:SCOPe?

Description

Sets or reads out the trigger scope. The trigger scope determines the response on the trigger signal arrival: either starts a sweep of all waiting channels in turn or starts a sweep in the active channel only.

command/query

Parameter

<char> Choose from:

ALL	All channels
ACTive	Active channel

Query Response

{ALL|ACT}

Preset Value

ALL

Related Commands

TRIG

TRIG:SING

*TRG

Related Section of Operating Manual

Trigger Scope

Related Controls of User Interface

Trigger {Active Channel | All Channels} (drop-down list in TRIGGER SCOPE accordion)

Back to TRIGger

TRIG:SOUR

SCPI Command

TRIGger[:SEQuence]:SOURce <char>

TRIGger[:SEQuence]:SOURce?

Description

Selects the trigger source (See options below).

If the continuous trigger initiation mode is enabled with the command INIT:CONT ON, the INTernal choice leads to continuous sweep. The choice of another option switches the analyzer to the trigger waiting state from the corresponding source.

If the continuous trigger initiation mode is disabled with the command INIT:CONT OFF, the reaction to INIT command is different. Selecting INTernal leads to a single sweep in response to the command INIT, selection another option puts the analyzer in a single trigger waiting state in response to the INIT command.

command/query

Parameter

<char> Choose from:

INTernal	Internal
EXTernal	External (hardware trigger input)
MANual	Manual (user interface)
BUS	Bus (program)

Query Response

{INT|EXT|MAN|BUS}

Preset Value

INT

Related Commands

INIT

INIT:CONT

TRIG:SING

*TRG

Related Section of Operating Manual

Trigger Source

Related Controls of User Interface

Trigger > Source {Internal | External | Bus | Manual} (drop-down list in the submenu)

Back to TRIGger

TRIG:STAT?

SCPI Command

TRIGger[:SEQuence]:STATus?

Description

Reads out the current state of the Analyzer trigger system.
query only

Parameter

HOLD	Stop
MEAS	Measurement Cycle
WAIT	Waiting for trigger

Related Section of Operating Manual

Trigger State Diagram

Related Controls of User Interface

None

Back to TRIGger

TRIG:WAIT

SCPI Command

TRIGger[:SEQuence]:WAIT <char>

Description

Delays the execution of the next command until the specified state of the analyzer trigger system is reached (see options below).

The analyzer trigger system can be "Stop", "Waiting for Trigger", or "Measurement Cycle". When the continuous initiation mode is turned OFF (INIT:CONT OFF), the trigger system transits between all three states. When the continuous initiation mode is turned ON (INIT:CONT ON), the trigger system transits between the "Waiting for Trigger" and "Measurement Cycle" states.

This command is useful for waiting for a sweep end initiated by the TRIG, *TRG commands or initiated by the external trigger signal, because the *OPC? command cannot be used. (The *OPC? command can wait the sweep end initiated by the TRIG:SING command only).

command only

Parameter

<char> Choose from:

HOLD	Waits for the "Stop" state
MEASure	Waits for the "Measurement Cycle" state
WAIT	Waits for the "Waiting for Trigger" state

Related Commands

TRIG

*TRG

TRIG:SOUR EXT

Related Section of Operating Manual

Trigger State Diagram

Related Controls of User Interface

None

Back to TRIGger

Programming Tips

This section gives recommendations for programming in certain specific situations.

Program Sweep Initiation and Waiting

The simplest method of program sweep initiation and waiting for sweep completion can be implemented by using the commands TRIG:SING and *OPC?.

The command TRIG:SING generates a trigger signal and starts sweeping under the following conditions:

- The program trigger source is selected by command TRIG:SOUR BUS.
- The Analyzer should be in the trigger waiting state, otherwise (Analyzer is sweeping, or Analyzer is in the hold state) an error occurs, and the command is ignored.

The transition of the Analyzer to the trigger waiting state depends on the state of the continuous initiation mode, which is set by command INIT:CONT. Provided that the continuous initiation mode is ON, the Analyzer automatically transits to the trigger waiting state when the program trigger source has been selected, and then each time at the end of a sweep. Provided that the continuous initiation mode is OFF, the Analyzer transits to the trigger waiting state for single time upon receiving the command INIT.

The command TRIG:SING remains pending until the end of sweep. This allows use the *OPC? query for the waiting the end of sweep.

Example 1. Program starts sweeping in all channels and waits for completion. The channels are swept one by one in turn. The continuous initiation mode must be enabled (after PRESET, for example).

TRIG:SOUR BUS <loop>: TRIG:SING *OPC? ...	Selects the program trigger source and transits the analyzer to the trigger waiting state. Starts sweep. Waits for the end of the sweep.

After sweep completion the Analyzer returns to the trigger waiting state, and then the next trig:sing command can be sent.

Example 2. The program starts the sweep in one channel and waits for completion, then starts a sweep in another channel and waits for completion. The number of channels must be set to 2.

TRIG:SOUR BUS	Selects the program trigger source.
INIT1:CONT OFF	Puts channel 1 to the hold state.
INIT2:CONT OFF	Puts channel 2 to the hold state.
<loop>:	Puts channel 1 to the trigger waiting state.
INIT1	Starts sweep in channel 1.
TRIG:SING	Waits for the end of the sweep.
*OPC?	Puts channel 2 to the trigger waiting state.
...	Starts sweep in channel 2.
INIT2	Waits for the end of the sweep.
TRIG:SING	
*OPC?	
...	

After sweep completion on one channel the Analyzer returns to the hold state and sweep initiation for another channel is then available.

Using External Trigger

If the trigger source is set to External by the command TRIG:SOUR EXT, the sweep starts at the arrival of the signal on the external trigger input.

The Analyzer must be in the trigger waiting state when the trigger signal arrives, otherwise the signal is ignored but no error is detected.

When using the external trigger input, the hardware trigger output can also be used to determine the end of the sweep. The TRIG:WAIT command can be used if there is a need to determine the end of the sweep using the program.

Example 3. The program puts the Analyzer into external trigger waiting. Then program waits for the sweep completion. The continuous initiation mode must be enabled (after PRESET, for example).

TRIG:SOUR EXT <loop>: TRIG:WAIT ENDM *OPC? ...	Selects the external trigger source and transits the Analyzer to the trigger waiting state. Waits for the end of the sweep. Any query is required to block program.

After sweep completion the Analyzer returns to the trigger waiting state, and then the next external trigger signal starts a new sweep.

Waiting for Calibration Commands

Depending on the sweep settings the calibration commands may have a long execution time, as they start the sweep and wait for it to complete. These commands are:

SENS:CORR:COLL:XXXX

The user program can stop execution until the end of these commands using any query, the *OPC? for example.

VISA Timeout Considerations

Using the *OPC? or any other query when waiting for an operation to complete can lead to VISA timeout. The program must set the timeout to a value no less than the expected sweep time. For example:

```
viSetAttribute(instr, VI_ATTR_TMO_VALUE, 5000);
```

If a timeout has occurred, the analyzer remains in the waiting state and does not respond to the next commands. The program must check the timeout condition and recover the Analyzer in case of the timeout. The recover code must include the Device Clear operation (viClear). The viClear function clears the device input and output buffers. Optionally, the recover code can include other operations, for example abort the current sweep or clear reporting status system.

```
status = viQueryf(instr, "TRIG:SING;*OPC?\n", "%*t");

if (status == VI_ERROR_TMO)

{

    viClear(instr);

    viPrintf(instr, "ABORt\n");

    viPrintf(instr, "*CLS\n");

}
```

NOTE The timeout recover using viClear function is possible with the HiSLIP protocol.

Receiving Data Arrays in Text Format

By default, the data from the Analyzer is transmitted in text form. The VISA library has built-in facilities for receiving an array of data from the Analyzer. The example assumes that the size of the array is sufficient to receive a number of elements equal to twice the number of points.

Example of receiving a data array in text format:

```
double data[NOP * 2];

ViUInt32 retCount;

...

retCount = sizeof(data) / sizeof(double);

viQueryf(instr, "CALC:DATA:SDAT?\n", "%,#lf", &retCount, data);

    // retCount now contains the actual number of elements
```

Receiving Data Arrays Binary Format

The binary transfer format reduces the number of bytes transmitted and therefore reduces the transmission time. The binary transfer format is supported by HiSLIP protocol only. To enable the binary transfer format, use the FORM:DATA command. Use the FORM:BORD command to determine the byte order in the 32-bit word or in the 64-bit word. The x86 architecture uses the little endian byte order. When using the x86 architecture, setting the little endian byte order with the command FORM:BORD SWAP further improves throughput. The list of commands that support the binary transfer format is given in the description of the FORM:DATA command.

Binary data is transmitted as a block having a header followed by data. Block format:

#	8	<Data Size>	<Binary Data>

where **#** — the character '#',

8 — the character '8',

<Data Size> — 8 bytes, the symbolic representation of the number of bytes in binary data.

For example:

#800003216<Binary Data>

The VISA library has built-in tools for receiving binary data from the analyzer. The example assumes that the size of the array is sufficient to receive a number of elements equal to twice the number of points.

Example. Receiving array of doubles (x86 architecture):

```
double data[NOP * 2];

ViUInt32 retCount;

...

viPrintf(instr, "FORM:DATA REAL\n");

viPrintf(instr, "FORM:BORD SWAP\n");

retCount = sizeof(data);

viQueryf(instr, "SENS:DATA:CORR? S11\n", "%#b", &retCount, data);

// retCount now contains the actual number of bytes
```

Example. Receiving array of doubles (architecture independent):

```
double data[NOP * 2];

ViUInt32 retCount;

...

viPrintf(instr, "FORM:DATA REAL\n");

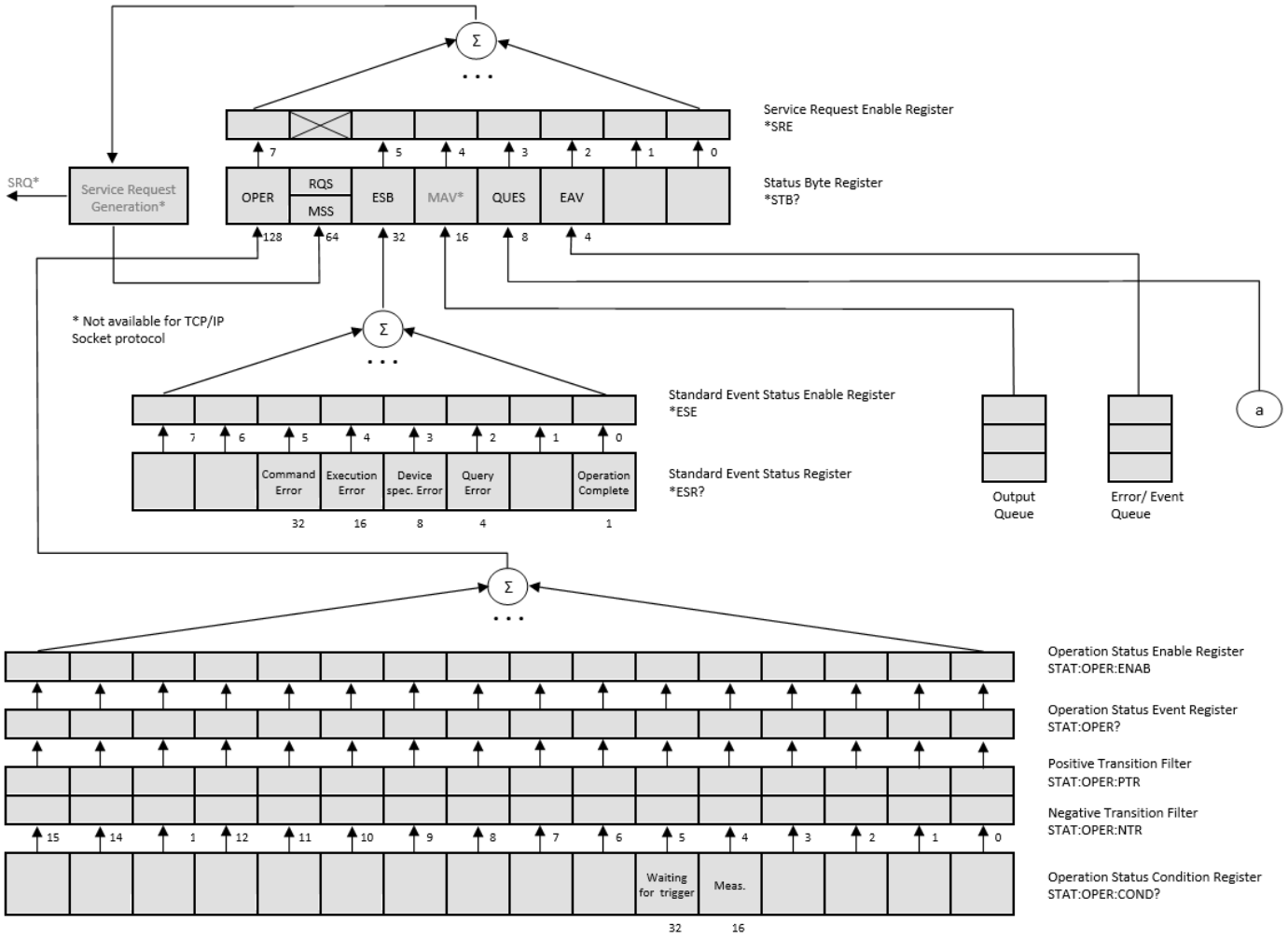
viPrintf(instr, "FORM:BORD NORM\n");

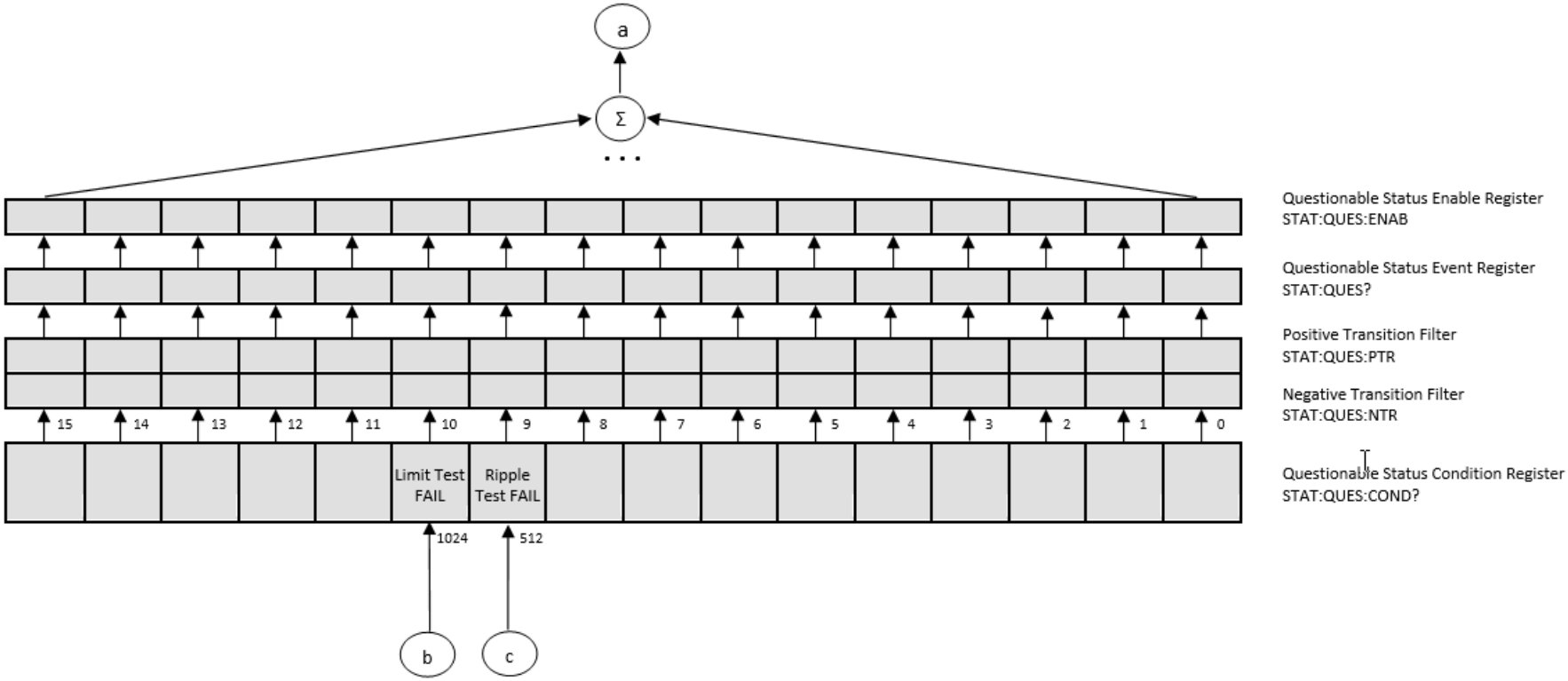
retCount = sizeof(data)/sizeof(double);

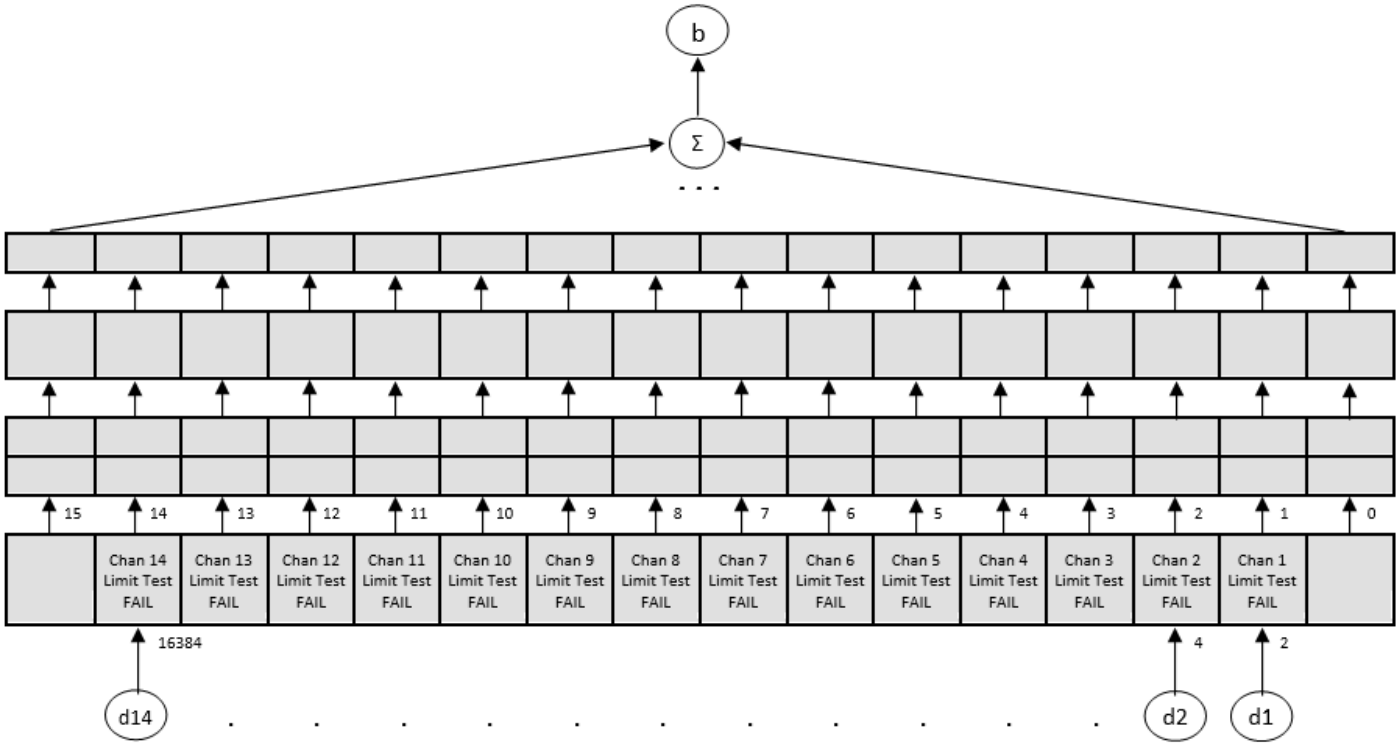
viQueryf(instr, "SENS:DATA:CORR? S11\n", "%#Zb", &retCount, data);

// retCount now contains the actual number of elements
```

IEEE488.2 Status Reporting System




a
Σ
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
Limit Test FAIL
Ripple Test FAIL
1024
512
b
c
Questionable Status Enable Register
STAT:QUES:ENAB
Questionable Status Event Register
STAT:QUES?
Positive Transition Filter
STAT:QUES:PTR
Negative Transition Filter
STAT:QUES:NTR
Questionable Status Condition Register
STAT:QUES:COND?



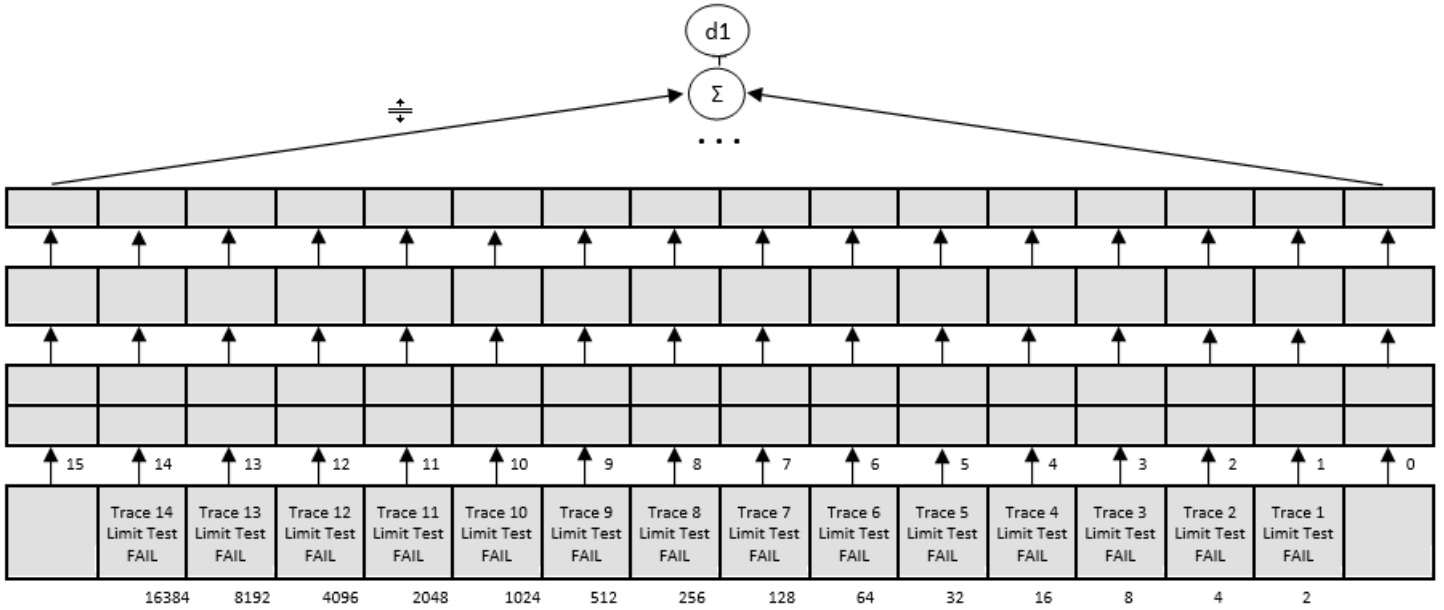
Questionable Limit Status Enable Register
STAT:QUES:LIM:ENAB

Questionable Limit Status Event Register
STAT:QUES:LIM?

Positive Transition Filter
STAT:QUES:LIM:PTR

Negative Transition Filter
STAT:QUES:LIM:NTR

Questionable Limit Status Condition Register
STAT:QUES:LIM:COND?



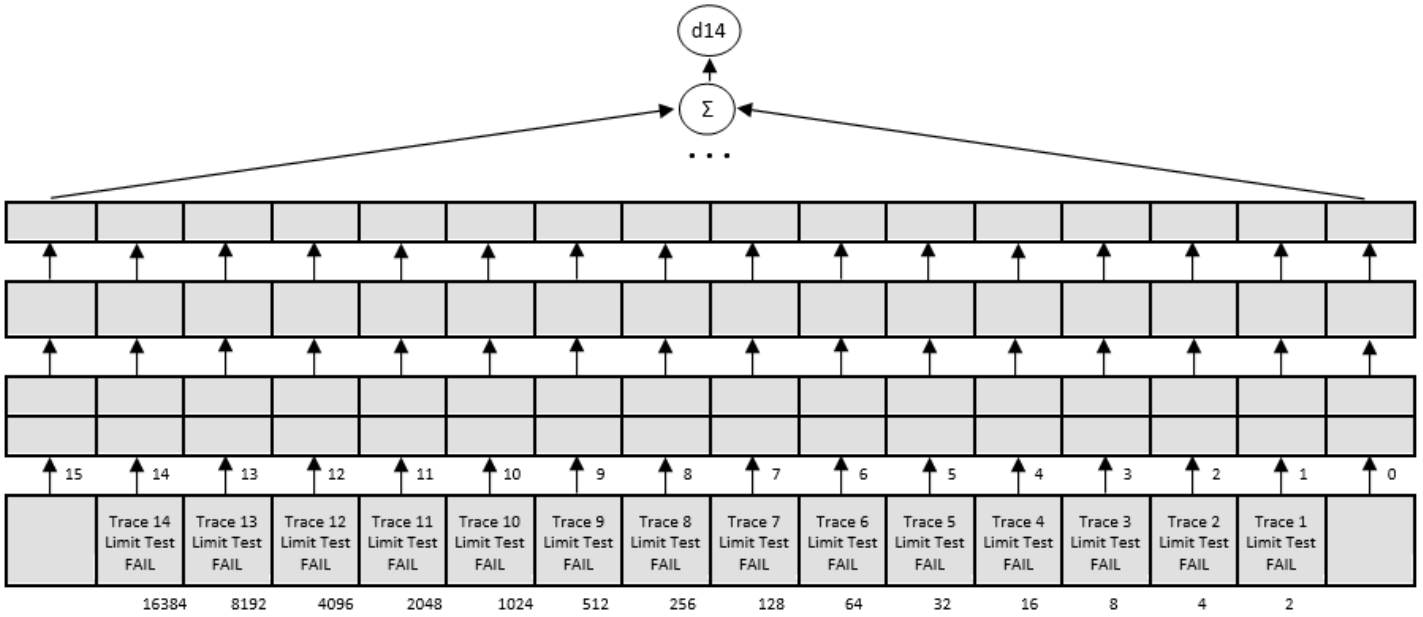
Questionable Limit Channel 1 Status Enable Register
STAT:QUES:LIM:CHAN1:ENAB

Questionable Limit Channel 1 Status Event Register
STAT:QUES:CHAN1:LIM?

Positive Transition Filter
STAT:QUES:LIM:CHAN1:PTR

Negative Transition Filter
STAT:QUES:LIM:CHAN1:NTR

Questionable Limit Channel 1 Status Condition Register
STAT:QUES:LIM:CHAN1:COND?



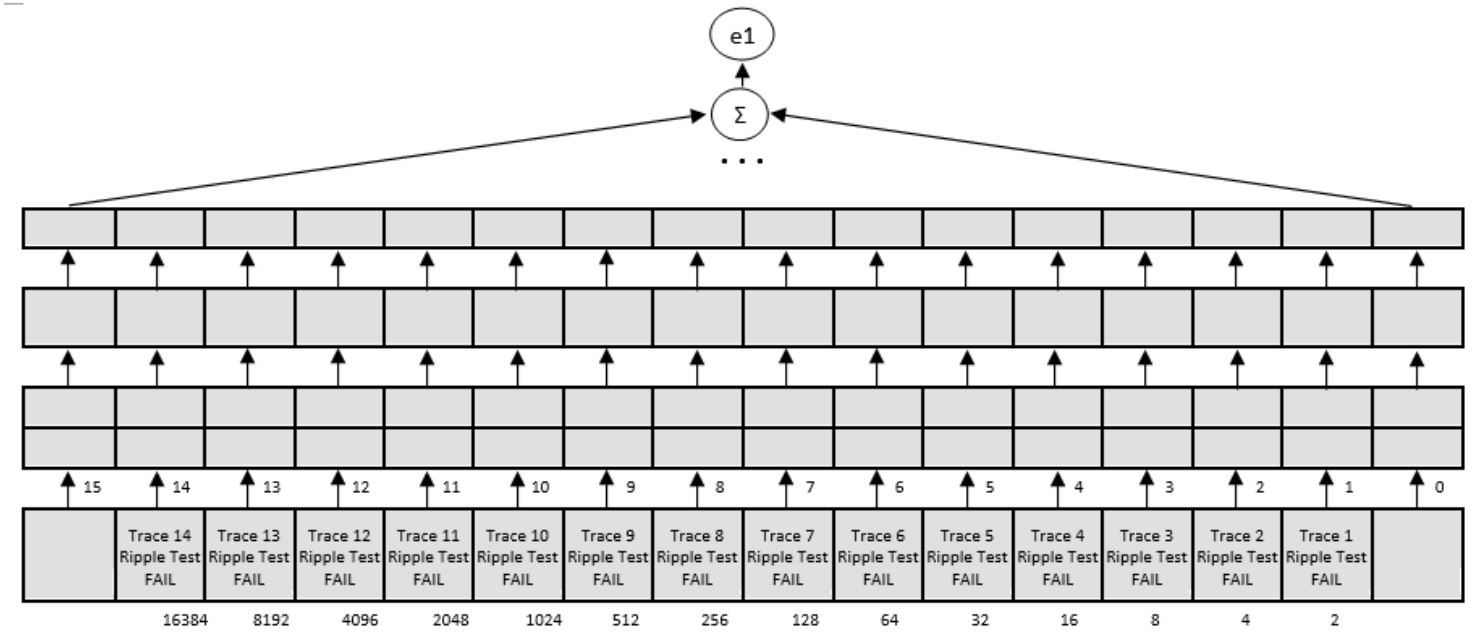
Questionable Limit Channel 14 Status Enable Register
STAT:QUES:LIM:CHAN14:ENAB

Questionable Limit Channel 14 Status Event Register
STAT:QUES:CHAN14:LIM:?

Positive Transition Filter
STAT:QUES:LIM:CHAN14:PTR

Negative Transition Filter
STAT:QUES:LIM:CHAN14:NTR

Questionable Limit Channel 14 Status Condition Register
STAT:QUES:LIM:CHAN14:COND?



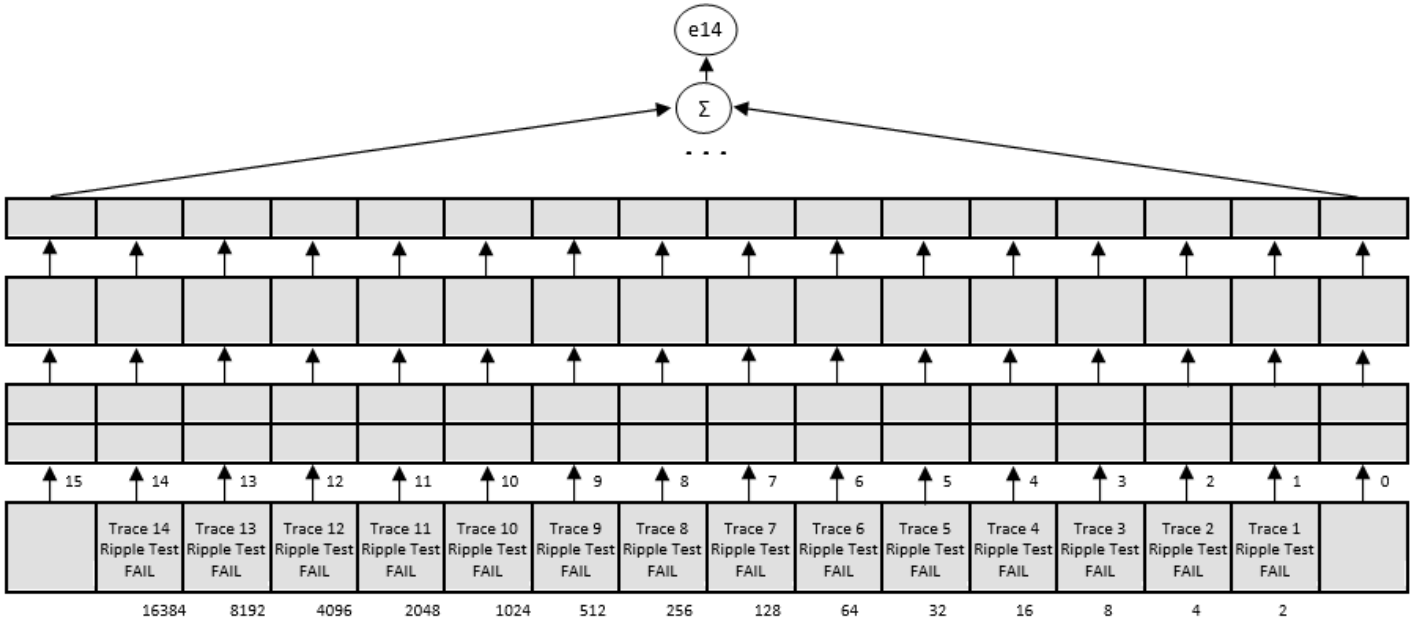
Questionable Ripple Limit Channel 1
Status Enable Register
STAT:QUES:RLIM:CHAN1:ENAB

Questionable Ripple Limit Channel 1
Status Event Register
STAT:QUES:CHAN1:RLIM?

Positive Transition Filter
STAT:QUES:RLIM:CHAN1:PTR

Negative Transition Filter
STAT:QUES:RLIM:CHAN1:NTR

Questionable Ripple Limit Channel 1
Status Condition Register
STAT:QUES:RLIM:CHAN1:COND?



Questionable Ripple Limit Channel 14 Status Enable Register
STAT:QUES:RLIM:CHAN14:ENAB

Questionable Ripple Limit Channel 14 Status Event Register
STAT:QUES:CHAN14:RLIM:?

Positive Transition Filter
STAT:QUES:RLIM:CHAN14:PTR

Negative Transition Filter
STAT:QUES:RLIM:CHAN14:NTR

Questionable Ripple Limit Channel 14 Status Condition Register
STAT:QUES:RLIM:CHAN14:COND?

VNA Calibration Using SCPI Commands

This section contains examples of using SCPI commands for calibrating the VNA.

Configuration Management

The following set of SCPI commands illustrates the algorithm of configuration management process.

```
// Create the configuration

SENSe:CORRection:CONFiguration:CREate "3 port SOLT calibration"


// Create the configuration

SENSe:CORRection:CONFiguration:CREate "1 port USER POWER calibration"


// Select the configuration

SENSe:CORRection:CONFiguration:SELect "1 port USER POWER calibration"


// Create 1-port POWER group "USERPWR" for port 2

SENSe:CORRection:CONFiguration:GROup:CREate "USERPWR", PREC, 2


// Select the configuration

SENSe:CORRection:CONFiguration:SELect "3 port SOLT calibration"


// Create 3, 4, 5 ports SOLT group

SENSe:CORRection:CONFiguration:GROup:CREate "DUT", SOLT, 3, 4, 5


// Select the configuration

SENSe:CORRection:CONFiguration:SELect "1 port USER POWER calibration"
```

```
// Start the calibration process
SENSe:CORRection:COLLect:START

// Check if the selected configuration is executing
SENSe:CORRection:COLLect:START?

// Delete the selected configuration
SENSe:CORRection:CONFiguration:DELete

// Check for the error: currently executing configuration is not removable
SYSTem:ERRor?

// Stop currently executing configuration
SENSe:CORRection:COLLect:STOP

// Select the configuration
SENSe:CORRection:CONFiguration:SELect "3 port SOLT calibration"

// Delete the selected configuration
SENSe:CORRection:CONFiguration:DELete

// Select the configuration
```

```
SENSe:CORRection:CONFiguration:SELect "1 port USER POWER calibration"


// Delete the selected configuration

SENSe:CORRection:CONFiguration:DELete
```

Full N-Port (SOLT) Calibration Example

The following set of SCPI commands performs calibration of a group of three ports by means of the full N-port (SOLT) calibration method.

Example description:

1. Creates a configuration.
2. Creates a group of ports.
3. Sets up the calibration plane for the configuration.
4. Configures ports.
5. Sets up calibration kits.
6. Starts calibration process.
7. Collects data for ports and thrus.
8. Saves calibration coefficients.

```
// Create the configuration

SENSe:CORRection:CONFiguration:CREate "3 port SOLT calibration"


// Create 3,4,5 ports SOLT group

SENSe:CORRection:CONFiguraiton:GROup:CREate "DUT", SOLT, 3,4,5


// Enable simplified calibration

SENSe:CORRection:CONFiguration:GROup:SIMPlified ON


// Configure the common port

SENSe:CORRection:CONFiguration:GROup:PORT:COMMon 5


// Disable isolation measurement

SENSe:CORRection:CONFiguration:GROup:ISOLation:DISable:ALL


// Enable unknown thrus
```

```
SENSe:CORRection:CONFiguration:GROup:UTHRu:ENABle:ALL

// Configure the ports

SENSe:CORRection:CONFiguration:CONNection 3, "N 50 Ohm", Male

SENSe:CORRection:CONFiguration:CONNection 4, "N 50 Ohm", Male

SENSe:CORRection:CONFiguration:CONNection 5, "N 50 Ohm", Male

// Set the calibration kits

SENSe:CORRection:CONFiguration:GROup:CKIT:SELect 3, "05CK10A-150"

SENSe:CORRection:CONFiguration:GROup:CKIT:SELect 4, "05CK10A-150"

SENSe:CORRection:CONFiguration:GROup:CKIT:SELect 5, "05CK10A-150"

// Start the calibration process

SENSe:CORRection:COLLect:START

// Check if the selected configuration is executing

SENSe:CORRection:COLLect:STARt?

// Collect data for port 3

SENSe:CORRection:COLLect:STEP:ACQuire:OPEN 3

SENSe:CORRection:COLLect:STEP:ACQuire:SHORt 3

SENSe:CORRection:COLLect:STEP:ACQuire:LOAD 3

// Collect data for port 4

SENSe:CORRection:COLLect:STEP:ACQuire:OPEN 4

SENSe:CORRection:COLLect:STEP:ACQuire:SHORt 4
```

```
SENSe:CORRection:COLLect:STEP:ACQuire:LOAD 4

// Collect data for port 5

SENSe:CORRection:COLLect:STEP:ACQuire:OPEN 5

SENSe:CORRection:COLLect:STEP:ACQuire:SHORt 5

SENSe:CORRection:COLLect:STEP:ACQuire:LOAD 5

// Collect data for thrus

SENSe:CORRection:COLLect:STEP:ACQuire:THRU 3, 5, "Unknown Thru",
"Arbitrary kit"

SENSe:CORRection:COLLect:STEP:ACQuire:THRU 4, 5, "Unknown Thru",
"Arbitrary kit"

// Save calibration coefficients

SENSe:CORRection:COLLect:SAVE
```

User Power Calibration Example

The following set of SCPI commands performs user power calibration.

Example description:

1. Creates and selects a configuration.
2. Create a port group.
3. Selects and zeroes power sensor.
4. Selects a port to be calibrated.
5. Starts calibration process.
6. Collects power data for a port.
7. Saves calibration coefficients.

```
// Request the list of power sensors

SYSTem:COMMunicate:PSENsor:LIST?


// Create the configuration

SENSe:CORRection:CONFiguration:CREate "1 port USER POWER calibration"


// Select the configuration (if the configuration has not been selected)

SENSe:CORRection:CONFiguration:SELect "1 port USER POWER calibration"


// Create 1-port POWER group "USERPWR" for Port 2

SENSe:CORRection:CONFiguration:GROup:CREate "USERPWR", PREC, 2


// Select the power sensor

SENSe:CORRection:CONFiguration:GROup:PSEN:SELect
<powerSensorModel>
```

```
// Perform zeroing procedure of the power sensor
SENSe:CORRection:CONFiguration:GROup:PSEN:ZERO

// Select port 2 to be calibrated
SENSe:CORRection:CONFiguration:GROup:POWer:STATe 2, ON

// Start the calibration process
SENSe:CORRection:COLLect:START

// Collect power data for port 2
SENSe:CORRection:COLLect:STEP:ACQure:POWer 2

// Save calibration coefficients
SENSe:CORRection:COLLect:SAVE
```

User ACM Calibration Example

The following set of SCPI commands performs user ECal (ACM) term calibration example.

Example description:

1. Creates a configuration.
2. Creates and selects groups of ports.
3. Sets up a calibration plane for the groups of ports.
4. Configures ports.
5. Sets up an ACM for the groups.
6. Starts calibration process.
7. Selects and runs calibration steps for ports.
8. Selects and runs calibration steps for unknown thrus.
9. Saves calibration coefficients.

```
// Example for combined preset containing a couple of F3-groups

// Group 1 "DUT0F3" F3(3,4,5) simplified(3), without resolving unknown thrus

// Group 2 "DUT1F3" F3(6,7,8) with resolving unknown thrus

// Two ACMs are connected:

// ACM0: 2509.2, NF-NM, #00000001

// ACM1: 2509.2, 3.5F-3.5M, #00000002


// Create the configuration

SENSe:CORRection:CONFiguration:CREate "ACM calibration"


// Create 3, 4, 5 ports SOLT group

SENSe:CORRection:CONFiguration:GROup:CREate "DUT0F3", SOLTECAL, 3,
4, 5


// Create 6, 7, 8 ports SOLT group
```

```
SENSe:CORRection:CONFiguration:GROup:CREate "DUT1F3", SOLTECAL, 6, 7, 8

// Select the first group "DUT0F3"

SENSe:CORRection:CONFiguration:GROup:SELect "DUT0F3"

// Enable simplified calibration for DUT0F3

SENSe:CORRection:CONFiguration:GROup:SIMPlified ON

// Configure the common port

SENSe:CORRection:CONFiguration:GROup:PORT:COMMon 3

// Disable Unknown Thrus for DUT0F3

SENSe:CORRection:CONFiguration:GROup:UTHRu:DISable:ALL

// Configure the ports

SENSe:CORRection:CONFiguration:CONNection 3, "N 50 Ohm", Female

SENSe:CORRection:CONFiguration:CONNection 4, "N 50 Ohm", Male

SENSe:CORRection:CONFiguration:CONNection 5, "N 50 Ohm", Male

// Retrive ACM list

SYSTem:COMMunicate:ECAL:LIST?

// <- "ACM25092","19039010","ACM25092 Demo","18019003","ACM45091 Demo","21350030"

// Set the ACM for a group

SENSe:CORRection:CONFiguration:GROup:ECAL:SELect "ACM25092", "19039010"
```

```
// Select the ACM characterization unit

SENSe:CORRection:CONFiguration:GROup:ECAL:UCHar CHAR0


// Enable Thermocompensation

SENSe:CORRection:CONFiguration:GROup:ECAL:THERmo:COMPensation:ST
ATe ON


// Select the second group "DUT1F3"

SENSe:CORRection:CONFiguration:GROup:SELect "DUT1F3"


// Disable simplified calibration for DUT0F3

SENSe:CORRection:CONFiguration:GROup:SIMPlified OFF


// Enable Unknown Thrus for DUT0F3

SENSe:CORRection:CONFiguration:GROup:UTHRu:ENABle:ALL


// Configure the ports

SENSe:CORRection:CONFiguration:CONNection 6, "3.5 50 Ohm", Female

SENSe:CORRection:CONFiguration:CONNection 7, "3.5 50 Ohm", Female

SENSe:CORRection:CONFiguration:CONNection 8, "3.5 50 Ohm", Female


// Set the ACM for a group

SENSe:CORRection:CONFiguration:GROup:ECAL:SELect       "ACM8000T_v1",
"X4038390"


// Select the ACM characterization unit

SENSe:CORRection:CONFiguration:GROup:ECAL:UCHar FACTory
```

```
// Enable Thermocompensation

SENSe:CORRection:CONFiguration:GROup:ECAL:THERmo:COMPensation:STATe ON


// Start the calibration process

SENSe:CORRection:COLLect:START


// Select the calibration step for 3-4 ports

SENSe:CORRection:COLLect:STEP:SELect:ECAL 3, 4


// Disable auto-orienation

SENSe:CORRection:COLLect:STEP:ECAL:ORIentation:STATe OFF


// Perform single orientation

SENSe:CORRection:COLLect:STEP:ECAL:ORIentation:EXECute


// Check the result of orientation

SENSe:CORRection:COLLect:STEP:ECAL:TABLe?


// Collect data for 3-4 ports

SENSe:CORRection:COLLect:STEP:MEASure


// Select the calibration step for 3-5 ports

// Not SENSe:CORRection:COLLect:STEP:ACQuire:ECAL as it is necessary to setup ORIENTATION (for example)

SENSe:CORRection:COLLect:STEP:SEL:ECAL 3, 5


// Enable auto-orienation
```

```
SENSe:CORRection:COLLect:STEP:ECAL:ORIentation:STATe ON

// Collect data for 3-5 ports

SENSe:CORRection:COLLect:STEP:MEASure

// Select and run the step for 6 port

// Not SENSe:CORRection:COLLect:STEP:SELect:ECAL as it is not necessary to setup ORIENATION (for example)

SENSe:CORRection:COLLect:STEP:ACQuire:ECAL 6

// Select and run the step for 7 port

// Not SENSe:CORRection:COLLect:STEP:SELect:ECAL as it is not necessary to setup ORIENATION (for example)

SENSe:CORRection:COLLect:STEP:ACQuire:ECAL 7

// Select and run the step for 8 port

// Not SENSe:CORRection:COLLect:STEP:SELect:ECAL as it is not necessary to setup ORIENATION (for example)

SENSe:CORRection:COLLect:ACQuire:ECAL 8

// Select and run the step for unknown thru 6-8 ports

SENSe:CORRection:COLLect:STEP:ACQuire:THRU 6, 7

// Select and run the step for unknown thru 6-8 ports

SENSe:CORRection:COLLect:STEP:ACQuire:THRU 7, 8

// Select and run the step for unknown thru 6-8 ports

SENSe:CORRection:COLLect:STEP:ACQuire:THRU 6, 8
```

```
// Save calibration coefficients

SENSe:CORRection:COLLect:SAVE
```

User Test/Reference Receiver Calibration Example

The following set of SCPI commands performs user test/reference receiver calibration.

Example description:

1. Creates and selects a configuration.
2. Creates a port group.
3. Turns off power calibration for ports.
4. Sets up test and reference receivers calibration for ports 1 and 2.
5. Sets up offsets of the test and reference receivers for ports 1 and 2.
6. Sets up source port for ports.
7. Selects a configuration and starts calibration process.
8. Collects test and reference receiver data for ports.
9. Saves calibration coefficients.

```
// Create the configuration

SENSe:CORRection:CONFiguration:CREate "User receiver calibration"


// Select the configuration

SENSe:CORRection:CONFiguration:SELect "User receiver calibration"


// Create 2-port group "RCV" for ports 1, 2

SENSe:CORRection:CONFiguration:GROup:CREate "RCV", PREC, 1, 2


// Turn power calibration for port 1 OFF

SENS:CORR:CONF:GROup:POWer:STATe 1, OFF


// Turn reference receiver calibration for port 1 ON

SENSe:CORRection:CONFiguration:GROup:RCHannel:STATe 1, ON
```

```
// Set reference receiver offset for port 1

SENSe:CORRection:CONFiguration:GROup:RCHannel:OFFSet 1, 1

// Turn test receiver calibration for port 1 ON

SENSe:CORRection:CONFiguration:GROup:TCHannel:STATe 1, ON

// Set test receiver offset for port 1

SENSe:CORRection:CONFiguration:GROup:TCHannel:OFFSet 1, 1

// Select the source port for port 1

SENSe:CORRection:CONFiguration:GROup:TCHannel:PORT:SOURce 1, 2

// Turn power calibration for port 2 OFF

SENSe:CORRection:CONFiguration:GROup:POWer:STATe 2, OFF

// Turn reference receiver calibration for port 2 OFF

SENSe:CORRection:CONFiguration:GROup:RCHannel:STATe 2, OFF

// Turn test receiver calibration for port 2 ON

SENSe:CORRection:CONFiguration:GROup:TCHannel:STATe 1, ON

// Select the source port for port 2

SENSe:CORRection:CONFiguration:GROup:TCHannel:PORT:SOURce 2, 1

// Set test receiver offset for port 2

SENSe:CORRection:CONFiguration:GROup:TCHannel:OFFSet 2, 2
```

```
// Select the configuration

SENSe:CORRection:CONFiguration:SELect "User receiver calibration"

// Start the calibration process

SENSe:CORRection:COLLect:START

// Collect reference receiver data for port 1

SENSe:CORRection:COLLect:STEP:ACQuire:RCHannel 1

// Collect test receiver data for port 1

SENSe:CORRection:COLLect:STEP:ACQuire:TCHannel 1

// Collect test receiver data for port 2

SENSe:CORRection:COLLect:STEP:ACQuire:TCHannel 2

// Save calibration coefficients

SENSe:CORRection:COLLect:SAVE
```

User Power And Receiver Calibration Example

The following set of SCPI commands performs user power and receiver calibration.

Example description:

1. Creates and selects a configuration.
2. Creates a port group.
3. Selects and zeroes power sensor.
4. Sets up power, test and receiver calibration for a port.
5. Sets up test and reference receiver offsets.
6. Sets source port.
7. Starts calibration process.
8. Collects data for a port.
9. Saves calibration coefficients.

```
// Request the list of power sensors

SYSTem:COMMunicate:PSENsor:LIST?


// Create the configuration

SENSe:CORRection:CONFiguration:CREate "1 port USER Power+Receiver calibration"


// Select the configuration

SENSe:CORRection:CONFiguration:SELect "1 port USER POWER calibration"


// Create 1-port POWER group "USERPWR" for port 2

SENSe:CORRection:CONFiguration:GROup:CREate "PREC", PREC, 2


// Select the power sensor

SENSe:CORRection:CONFiguration:GROup:PSEN:SELect <powerSensorModel>
```

```
// Perform zeroing procedure of the power sensor

SENSe:CORRection:CONFiguration:GROup:PSEN:ZERO


// Turn power calibration for port 2 ON

SENSe:CORRection:CONFiguration:GROup:POWer:STATe 2, ON


// Turn reference receiver calibration for port 2 ON

SENSe:CORRection:CONFiguration:GROup:RCHannel:STATe 2, ON


// Turn test receiver calibration for port 2 ON

SENSe:CORRection:CONFiguration:GROup:TCHannel:STATe 2, ON


// Set reference receiver offset for port 2

SENSe:CORRection:CONFiguration:GROup:RCHannel:OFFSet 2, 0 dB


// Set test receiver offset for port 2

SENSe:CORRection:CONFiguration:GROup:TCHannel:OFFSet 2, 0 dB


// Set the source port 9 for port 2

SENSe:CORRection:CONFiguration:GROup:TCHannel:PORT:SOURce 2, 9


// Start the calibration process

SENSe:CORRection:COLLect:STEP:INIT "1 port USER Power+Receiver
calibration"


// Collect power + reference data for port 2

SENSe:CORRection:COLLect:STEP:ACQuire:RPOWer 2
```

```
// Collect test receiver data for port 2

SENSe:CORRection:COLLect:STEP:ACQuire:TCHannel 2


// Save calibration coefficients

SENSe:CORRection:COLLect:SAVE
```

Programming Examples

Example. Program Written in C

The following program shows the control over the Analyzer using the C language with the VISA library.

The Analyzer address is passed as a parameter in the command line at the start of the program. For more detail on VISA Resource Name, see the VISA library documentation.

Program description:

1. Sets up communication with the Analyzer.

2. Reads out and displays the Analyzer information string.

3. Sets some parameters for the Analyzer.

4. Triggers the measurement and waits for sweep completion.

5. Reads out the measurement data and the frequency values at the measurement points.

6. Displays the measurement data

```
// Example.cpp

//

// VISA Header: visa.h (must be included)

// VISA Library: visa32.lib (must be linked with)

#include "stdafx.h"

#include "visa.h"

int main(int argc, char* argv[])

{

        ViStatus status; // Error checking

        ViSession defaultRM, instr; // Communication channels
```

```
ViUInt32 retCount; // Return count from string I/O

ViByte buffer[255]; // Buffer for string I/O

ViUInt32 temp;

int NOP = 21; // Number of measurement points

const int maxCnt = 100; // Maximum reading count

double Data[maxCnt*2]; // Measurement data array

double Freq[maxCnt]; // Frequency array

if (argc < 2)

{

        printf("\nUsage: Example <VISA address>\n\n");

        printf("VISA address examples:\n");

        printf(" TCPIP::nnn.nnn.nnn.nnn::5025::SOCKET\n");

        printf(" TCPIP::hostname::5025::SOCKET\n");

        return –1;

}

status = viOpenDefaultRM(&defaultRM);

if (status < VI_SUCCESS)

{

        printf("Can't initialize VISA\n");

        return –1;

}

        status = viOpen(defaultRM, argv[1], VI_NULL, VI_NULL, &instr);

if (status < VI_SUCCESS)
```

```
        {
                printf("Can't open VISA address: %s\n", argv[1]);
                return –1;
        }
        //
        // Set the answer timeout
        //
        viSetAttribute(instr, VI_ATTR_TMO_VALUE, 5000);
        //
        // Enable the terminal character
        //
        viSetAttribute(instr,          VI_ATTR_TERMCHAR_EN,          VI_TRUE);
viSetAttribute(instr, VI_ATTR_TERMCHAR, '\n');
        //
        // Read ID string from Analyzer
        //
        viPrintf(instr, "*IDN?\n");
        viRead(instr, buffer, sizeof(buffer), &retCount);
        printf("*IDN? Returned %d bytes: %.*s\n\n", retCount, retCount, buffer);
        //
        // Set up the Analyzer
        //
        viPrintf(instr, "SYST:PRES\n");
```

```
viPrintf(instr, "SENS:SWE:POIN %d\n", NOP);
viPrintf(instr, "CALC:PAR1:DEF S21\n");
viPrintf(instr, "CALC:PAR1:SEL\n");
viPrintf(instr, "CALC:FORM MLOG\n");
viPrintf(instr, "SENS:BAND 10\n");
//
// Trigger measurement and wait for completion
//
viPrintf(instr, ":TRIG:SOUR BUS\n");
viPrintf(instr, ":TRIG:SING\n");
viQueryf(instr, "*OPC?\n", "%d", &temp);
//
// Read out measurement data
//
retCount = maxCnt * 2;
viQueryf(instr, "CALC:DATA:FDAT?\n", "%,#lf", &retCount, Data);
retCount = maxCnt;
viQueryf(instr, "SENS:FREQ:DATA?\n", "%,#lf", &retCount, Freq);
//
// Display measurement data
//
printf("%20s %20s %20s\n", "Frequency", "Data1", "Data2");
for (int i = 0; i < NOP; i++)
```

```
{
        printf("%20f %20f %20f\n", Freq[i], Data[i*2], Data[i*2+1]);
}
status = viClose(instr);
status = viClose(defaultRM);
return 0;
}
```

Example. Program Written in LabView

The following program shows the control over the Analyzer using LabView language with the VISA library.

Seen below is the block diagram of the program and front panel of the program with the program execution result.

The front panel contains the entry field for the Analyzer name "VISA Resource Name". For more detail on VISA Resource Name see the VISA library documentation.

The user must enter the Analyzer address, select the trace format in the "Format" field, and click the "Run" button. As the result of the program, the Analyzer information string will be displayed, and the measurement trace will be plotted.

Program description:

1. Sets up communication with the Analyzer.

2. Reads out and displays the Analyzer information string.

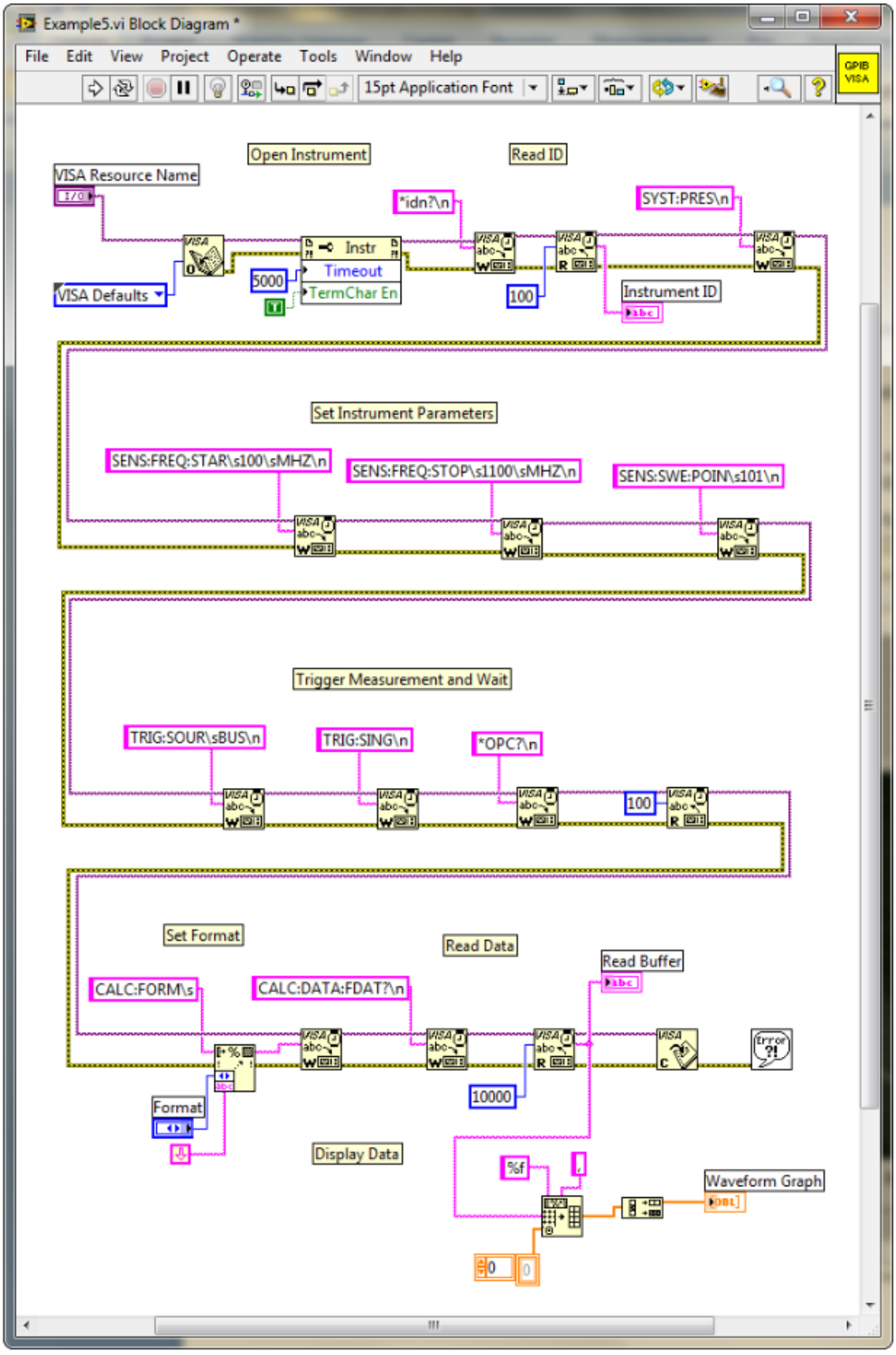
3. Sets some parameters of the Analyzer.

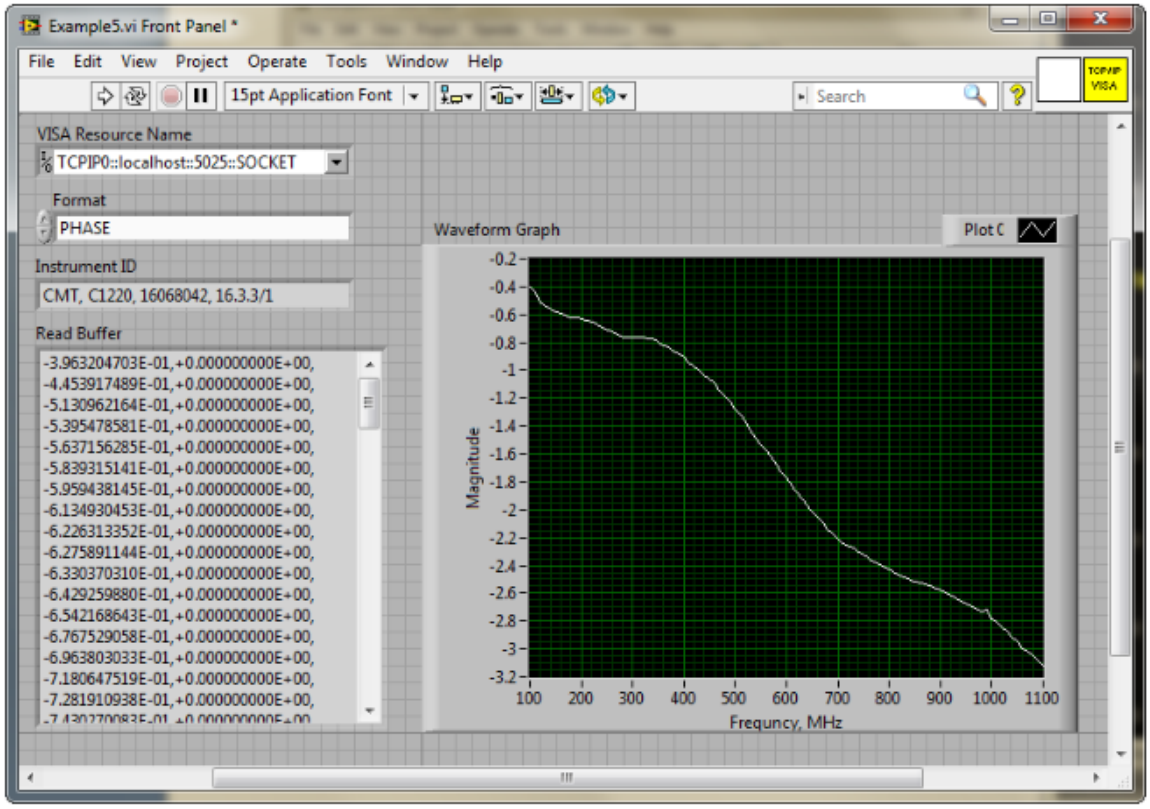
4. Generates the trigger and waits for the sweep completion.

5. Sets the trace format to the format entered by the user in the "Format" field.

6. Reads out the measurement data.

7. Displays the measurement data.


Example5.vi Block Diagram *
File Edit View Project Operate Tools Window Help
15pt Application Font
GPIB VISA
Open Instrument
Read ID
VISA Resource Name
*idn?\n
SYST:PRES\n
Instr
Timeout
TermChar En
5000
VISA Defaults
100
Instrument ID
Set Instrument Parameters
SENS:FREQ:STAR\s100\sMHZ\n
SENS:FREQ:STOP\s1100\sMHZ\n
SENS:SWE:POIN\s101\n
Trigger Measurement and Wait
TRIG:SOUR\sBUS\n
TRIG:SING\n
*OPC?\n
100
Set Format
Read Data
Read Buffer
CALC:FORM\s
CALC:DATA:FDAT?\n
Format
10000
Display Data
%f
Waveform Graph
0


Example5.vi Front Panel *
File Edit View Project Operate Tools Window Help
15pt Application Font
Search
TCP/IP VISA
VISA Resource Name
TCPIP0::localhost::5025::SOCKET
Format
PHASE
Instrument ID
CMT, C1220, 16068042, 16.3.3/1
Read Buffer
-3.963204703E-01,+0.000000000E+00,
-4.453917489E-01,+0.000000000E+00,
-5.130962164E-01,+0.000000000E+00,
-5.395478581E-01,+0.000000000E+00,
-5.637156285E-01,+0.000000000E+00,
-5.839315141E-01,+0.000000000E+00,
-5.959438145E-01,+0.000000000E+00,
-6.134930453E-01,+0.000000000E+00,
-6.226313352E-01,+0.000000000E+00,
-6.275891144E-01,+0.000000000E+00,
-6.330370310E-01,+0.000000000E+00,
-6.429259880E-01,+0.000000000E+00,
-6.542168643E-01,+0.000000000E+00,
-6.767529058E-01,+0.000000000E+00,
-6.963803033E-01,+0.000000000E+00,
-7.180647519E-01,+0.000000000E+00,
-7.281910938E-01,+0.000000000E+00,
Waveform Graph
Plot 0
Magnitude
-0.2
-0.4
-0.6
-0.8
-1
-1.2
-1.4
-1.6
-1.8
-2
-2.2
-2.4
-2.6
-2.8
-3
-3.2
100 200 300 400 500 600 700 800 900 1000 1100
Frequncy, MHz

Maintenance and Storage

The following section describes the proper maintenance and storage procedures for the analyzer.

Maintenance Procedures

This section describes the guidelines and procedures of maintenance, which will ensure fault-free operation of the analyzer.

The maintenance of the Analyzer consists of cleaning the instrument, factory calibrations, and regular performance tests.

Instrument Cleaning

This section provides the cleaning instructions required for maintaining proper operation of the Analyzer.

To remove contamination from parts other than test ports or any connectors of the Analyzer, wipe them gently with a soft cloth that is dry or wetted with a small amount of water and wrung tightly.

It is essential to always keep the test ports clean, as any dust or stains on them can significantly affect the measurement capabilities of the instrument. To clean the test ports (as well as other connectors of the Analyzer), use the following procedure:

- Using compressed air, remove or loosen the contamination particles.
- Clean the connectors using a lint-free cleaning cloth wetted with a small amount of ethanol and isopropyl alcohol (when cleaning a female connector, avoid snagging the cloth on the center conductor contact fingers by using short strokes).
- Dry the connector with low-pressure compressed air.

Always completely dry a connector before using it.

Never use water or abrasives for cleaning any connectors on the Analyzer. Do not allow alcohol contact on the surface of the connector.

When connecting male-female coaxial connectors, always use a calibrated torque wrench.

WARNING	Never perform cleaning of the instrument if the power cable is connected to the power outlet. Never clean the internal components of the instrument.

Factory Calibration

Factory calibration is a regular calibration performed by the manufacturer or an authorized service center. It is recommended sending the Analyzer for factory calibration every three years.

Factory calibration is a full one-port Analyzer calibration. It can be performed in two following modes: with high output power and with low output power. The calibration coefficients employed during the Analyzer operation correspond to the selected mode of the output power.

The factory calibration of the Analyzer allows performing measurement without additional calibration and reduces the measurement error for reflection normalization.

Storage Instructions

Before first use, store the Analyzer in the factory package at a temperature from -50 ºC to+70 ºC (-58 °F to 158 °F) and relative humidity up to 90% at 25 ºC (77 °F).

After the analyzer has been removed from the factory packaging and while being used, it should be stored at a temperature from+5 ºC to+40 ºC and relative humidity up to 90% at 25 ºC (1 °F to 104 °F).

Be sure to keep the storage facilities free from dust, acidic or alkaline fumes, volatile gases, and other chemicals, which can cause corrosion.

Annexes

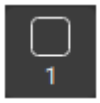
Default Settings

Default values defined in the process of the initial factory setup.

Parameter Description	Default Setting	Parameter Setting Object
Channel		
Active Channel Number	1	Analyzer
Active Channel Title Name	Channel #1	Channel
Allocation of Channels		Analyzer
Sweep Type	Linear Frequency	Channel
Sweep Range Setting	Start / Stop	Channel
Stimulus Start Frequency	300 kHz	Channel
Stimulus Stop Frequency	9 GHz	Channel
Stimulus Center Frequency	4.50015 GHz	Channel
Stimulus Span Frequency	8.9997 GHz	Channel
Number of Points	201	Channel
Stimulus IF Bandwidth	10 kHz	Channel
Sweep Measurement Delay	0 s	Channel

Parameter Description	Default Setting	Parameter Setting Object
RF Out Function	ON	Analyzer
Port Couple Function	ON	Channel
Stimulus Power Level	0 dBm	Channel
Stimulus Power Slope	OFF	Channel
Number of Segments	1	Channel
Points per Segment	2	Channel
Segment Start Frequency	300 kHz	Channel
Segment Stop Frequency	9 GHz	Channel
Segment Sweep Power Level	0 dBm	Channel
Segment Sweep IF Bandwidth	10 kHz	Channel
Segment Sweep Measurement Delay	0 s	Channel
Segment Sweep Range Setting	Start / Stop	Channel
Stimulus Start Power Level	-50 dBm	Channel
Stimulus Stop Power Level	10 dBm	Channel
Stimulus Constant Frequency	600 MHz	Channel

Parameter Description	Default Setting	Parameter Setting Object
Trigger		
Trigger Mode	Continuous	Channel
Apply Mode for All Channels	OFF	Channel
Trigger Signal Source	Internal	Analyzer
Averaging Trigger	OFF	Analyzer
External Trigger Event	On Sweep	Analyzer
External Trigger Polarity	Positive Edge	Analyzer
External Trigger Position	Before Setup	Analyzer
External Trigger Delay	0 s	Analyzer
Trigger Scope	All Channels	Analyzer
Trigger Output	OFF	Analyzer
Trigger Output Polarity	Positive Edge	Analyzer
Function Output Trigger	Before Setup	Analyzer

Parameter Description	Default Setting	Parameter Setting Object
Trace		
Traces per Channel	1	Channel
Active Trace Number	1	Channel
Active Trace Title Name	Trace #1	Channel
Allocation of Traces		Channel
Trace Display Format	Logarithmic Magnitude (dB)	Trace
Measurement Parameter	S11	Trace
S-parameter Conversion	OFF	Trace
S-parameter Conversion Function	OFF	Trace
Data Math	OFF	Trace
Trace Display Mode	Data and Memory	Trace
Memory Trace	ON	Trace
Memory Buffer	OFF	Trace
Average		
Channel Average	OFF	Channel
Averaging Factor	10	Channel

Parameter Description	Default Setting	Parameter Setting Object
Smoothing	OFF	Trace
Smoothing Aperture	1%	Trace
Trace Hold Function	OFF	Trace
Scale		
Trace Scale	10 dB / div	Trace
Vertical Divisions	10	Channel
Automatic Scaling Trace	OFF	Trace
Reference Level Value	0 dB	Trace
Reference Level Position	5	Trace
Reverence Level Tracking	OFF	Trace
Reverence Level Tracking Method	Minimum	Trace
Electrical Delay	0 s	Trace
Transmission Line	Coaxial	Trace
Velocity Factor	1	Trace
Waveguide Cutoff	0 Hz	Trace
Phase Offset	0°	Trace
Marker and Marker Math		

Parameter Description	Default Setting	Parameter Setting Object
Number of Markers	0	Trace
Reference Marker Display	OFF	Trace
Marker Data Display	OFF	Analyzer
Marker Indicator	Triangle	Channel
Marker Discrete Mode	OFF	Trace
Marker Coupling	OFF	Trace
Marker Data of Active Trace	OFF	Channel
Memory Trace Marker Display	OFF	Trace
Marker Data Alignment	OFF	Trace
Marker Search	Minimum	Trace
Marker Search Target	1 dB	Trace
Marker Search Target Transition	Both	Trace
Marker Search Peak Excursion	1 dB	Trace
Marker Search Peak Polarity	Negative	Trace
Marker Tracking	OFF	Trace

Parameter Description	Default Setting	Parameter Setting Object
Marker Search Range	OFF	Trace
Marker Coupled Range	ON	Trace
Marker Search Start Range	300 kHz	Trace
Marker Search Stop Range	9 GHz	Trace
Marker Statistics	OFF	Channel
Bandwidth Search	OFF	Trace
Bandwidth Search Type	Bandpass	Trace
Bandwidth Parameter Search	OFF	Trace
Marker Search Bandwidth Value	-3 dB	Trace
Search Reference Point	Marker	Trace
Flatness Evaluation	OFF	Trace
RF Filter Statistics	OFF	Trace
Calibration		
Error Correction	OFF	Channel
System Correction	ON	Analyzer
Receiver Correction	OFF	Channel

Parameter Description	Default Setting	Parameter Setting Object
Power Correction	OFF	Channel
Calibration Wizard	Not specified	Analyzer
Calibration Kits Table	Table of predefined kits	Analyzer
Connectors Table	Table of predefined connectors	Analyzer
Automatic Impedance Selecting	ON	Analyzer
Port x Impedance	50 Ω	Analyzer
Fixture Simulation		
Port Topology	Not specified	Analyzer
Port Extension Function	OFF	Channel
Port x Extension Delay	0 s	Channel
Port x Extension Loss Mode	OFF	Channel
Port x Extension Frequency 1	500 MHz	Channel
Port x Extension Loss 1	0 dB	Channel
Port x Extension Frequency 2	1 GHz	Channel
Port x Extension Loss 2	0 dB	Channel

Parameter Description	Default Setting	Parameter Setting Object
Port x Extension Loss DC	0 dB	Channel
Port x Extension Method	Current Span	Channel
Port x Extension Include Loss	OFF	Channel
Port x Extension Adjust Mismatch	OFF	Channel
Port Z Conversion	OFF	Channel
Port x Z Conversion Real	50 Ω	Channel
Port x Z Conversion Imag	0 Ω	Channel
De-embedding	OFF	Channel
Port x De-embedding	OFF	Channel
Port x De-embedding S-parameter File	Empty	Channel
Embedding	OFF	Channel
Port x Embedding	OFF	Channel
Port x Embedding User File	Empty	Channel
Differential Port Matching	OFF	Channel
Port Reference Impedance	OFF	Channel

Parameter Description	Default Setting	Parameter Setting Object
Conversion		
S4p Network Embedding/De-embedding	OFF	Channel

Parameter Description	Default Setting	Parameter Setting Object
Time Domain		
Time Domain Transformation	OFF	Trace
Time Domain Transformation Unit	Seconds	Trace
Time Domain Transformation Reflection Type	Round Trip	Trace
Time Domain Transformation Start	–22.223 ns	Trace
Time Domain Transformation Stop	22.223 ns	Trace
Time Domain Transformation Center	0 s	Trace
Time Domain Transformation Span	44.4459 ns	Trace
Time Domain Transformation Type	Bandpass	Trace
Time Domain Transformation Window	Normal	Trace
Time Domain Impulse Width	216.8 ps	Trace
Time Domain Kaiser-Beta	6	Trace
Cable Correction Function	OFF	Trace

Parameter Description	Default Setting	Parameter Setting Object
Cable Correction Cable Type	RG9, 9A	Trace
Cable Correction Velocity Factor	1	Trace
Cable Correction Cable Loss	0 (dB/m or dB/in or dB/ft, specified by the region on PC)	Trace
Cable Correction Cable Frequency	1 GHz	Trace
Time Domain Gating	OFF	Trace
Time Domain Gating Start	–20 ns	Trace
Time Domain Gating Stop	20 ns	Trace
Time Domain Gating Center	0 s	Trace
Time Domain Gating Span	40 ns	Trace
Time Domain Gating Type	Bandpass	Trace
Time Domain Gating Shape	Normal	Trace
Limit Tests		
Limit Test	OFF	Trace
Limit Line Display	OFF	Trace

Parameter Description	Default Setting	Parameter Setting Object
Defined Limit Lines	Empty	Trace
System		
Reference Frequency Source	Internal	Analyzer
Data Saving Type	State and Calibration	Analyzer
User State Table	Not specified	Analyzer
Start State Config	Recent state is automatically saved	Analyzer
Touchstone Data Format	Real-Imaginary	Analyzer
Invert Color Mode	OFF	Analyzer
Y-axis label	Active Trace	Analyzer
X-axis label	ON	Analyzer
Sweep Mark	ON	Analyzer
System Data	ON	Analyzer
System Time	ON	Analyzer
Cycle Time	ON	Analyzer
Decimal Unit	Specified by the region on PC	Analyzer
HiSLIP Server	OFF	Analyzer
Socket Server	OFF	Analyzer

Parameter Description	Default Setting	Parameter Setting Object
Beeper	ON	Analyzer
Port LED brightness	Normal	
Trace Manager		
Trace Manager Displays	Tabular	Analyzer
Channel Title Bar	ON	Channel

Connector Care

When working at frequencies above a few tens of megahertz, the quality and reliability of connections should be monitored more carefully than at lower frequencies. At radio frequencies (RF) and above, the integrity of the transmission line must be maintained throughout the connection, which highlights the importance of the mechanical and electrical compatibility of the connectors.

RF connectors are designed to join devices together as seamlessly as possible. To mate properly, the outer conductor mating surfaces must be clean and flat, and the inner conductor surfaces should come very close together. Even perfectly clean, unused connectors can cause trouble if they are mechanically outside the scope of the specifications. Using a connector gauge is essential, since the critical tolerance in precision microwave connectors is very small.

CAUTION Damaged or dirty connectors can significantly degrade measurements.

To continue to get the best performance from equipment and extend the life of the connectors, perform regular inspections, gauge mechanical tolerances, and clean the RF connectors.

CAUTION A damaged or out-of-spec connector can destroy the other good connector in just one connection.

No device should be used if the connectors are found to be out of the specification.

This document contains operating and maintenance instructions for RF connectors:

- Handling and storage
- Cleaning
- Gauging
- Connecting and disconnecting

NOTE Explore this document and the documentation for gauging before beginning operation with RF connectors.

Handling and Storage

Connectors need to be handled carefully. They should be stored in a safe environment. Always install protective plastic end caps on the connectors of the device when they are not in use.

Keep connectors clean (see Cleaning). Avoid touching the connector mating surfaces with your fingers. Use gloves when working with the connectors to avoid contamination from dirt or grease and to improve accuracy of measurement.

CAUTION Do not touch mating plane surfaces. Grease and microscopic dirt particles are difficult to remove from these surfaces.

Inspect connectors before mating using a magnifying glass. Check for scratches on the plating, worn mating surfaces, metal particles in the threads or on the mating surfaces, and bent or misaligned conductor centers.

CAUTION No device should be used if the center connector conductor is bent or broken.

No device should be used if the connector has deformed threads.

Holding the connector in your hand or cleaning the connector with compressed air can significantly change its temperature. Wait for the connector temperature to stabilize before using it for calibration or measurement.

Wear a grounding wrist strap and cover the working table with a grounded, conductive mat. This helps to protect devices from electrostatic discharge (ESD).

Connector lifetime:

- All connectors have a limited lifetime. This means that connectors can become defective due to wear during normal use. For best results, all connectors should be inspected and maintained to maximize their lifetime.
- A visual inspection should be performed each time the connectors are mated. Metal particles from connector threads often find their way onto the mating surface during connection or disconnection.

Cleaning

Cleaning off any contamination on the connector mating plane surfaces and threads can extend the lifetime of the connector and improve the quality of calibration and measurement.

Remove loose particles from threads and mating surfaces of the connectors with low-pressure air or nitrogen. Using a compressor is not recommended (air filtration is required), it is safer to use a can. Compressed air is the safest method for cleaning connectors with air dielectrics. Wear safety glasses when cleaning.

If further cleaning is required, a lint-free cleaning swab can be moistened with isopropyl alcohol and applied lightly. If desired, you may clean the connector with a dry cleaning swab without alcohol first. If contamination is still present, use alcohol. Use minimum amount of alcohol.

Only clean connectors with alcohol when there is no power cord connected, ensuring that the instrument is in a well-ventilated area. Allow all residual alcohol moisture to evaporate, and the fumes to dissipate prior to powering up the instrument.

If the connector is still contaminated, use a very small toothpick with a small amount of alcohol applied. Use a magnifying glass when using a toothpick to clean, and apply extreme care to avoid damaging the connector.

CAUTION

Never use any metal objects or any abrasives to clean the connectors.

Never use high pressure air (>60 psi).

Never allow alcohol into connector support beads. If alcohol unintentionally enters connector support beads, allow the connector to dry for at least 8 hours.

Avoid using too much pressure on the center conductor, as swab fibers can become tangled in the center of the female conductor. When the alcohol evaporates, use compressed air to ensure that the surface is clean.

CAUTION

Never apply lateral force to the center conductor.

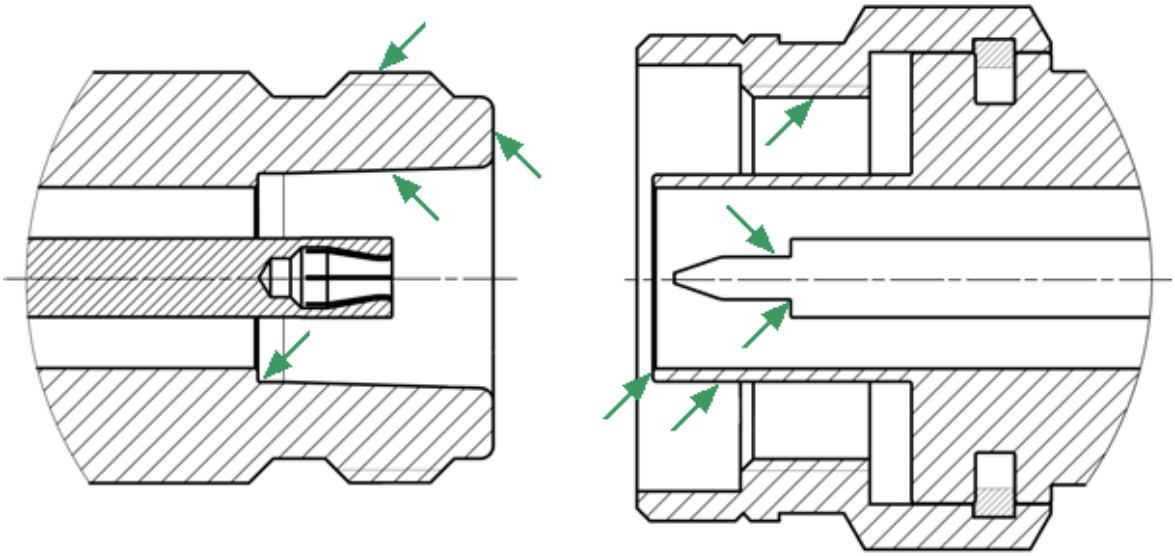
Never wipe the center conductors of the female connectors. They should be cleaned with compressed air.

Connector cleaning should be performed as follows:

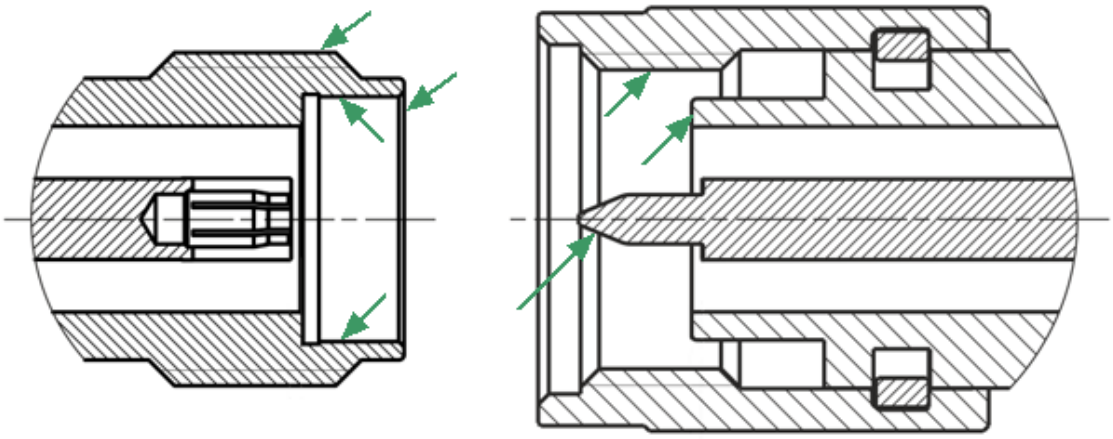
1. Wipe the connector surfaces with the swab moistened with alcohol as shown by arrows (See figures below).
2. Use compressed air to clean the other internal connector surfaces.
3. Let the alcohol evaporate.
4. Visually inspect the connectors to make sure that no particles or residue remain.
5. Repeat the cleaning procedure if necessary.
6. If cleaning does not correct any issues, the connector should not be used for measurements.

When cleaning connectors:

- Always use protective eyewear when using compressed air or nitrogen.
- Keep isopropyl alcohol away from heat, sparks, and flame. Use with adequate ventilation. Avoid contact with eyes, skin, and clothing.
- Avoid electrostatic discharge (ESD). Wear a grounding wrist strap (with a 1 MOhm series resistor) when cleaning connectors.



Type-N Connectors (female and male)



3.5 mm NMD Connectors (female and male)

Procedure for Cleaning Connectors

Gauging

Gauging connectors not only provides assurance of proper mechanical tolerances, and thus connector performance, but also indicates when there is potential for causing damage to another connector.

Connector gauging should be performed before the instrument is first used, and during regular operation.

The first gauging of connectors obtains the pin depth, which can be used during operation with the module to evaluate its changes.

Gauge the connectors if:

- the device (instrument, calibration standard, cable, adapter, attenuator, or other RF item with coaxial connectors) is being used for the first time.
- visual inspection of the Analyzer calibration suggests that the connector may have defects or damage.
- the connectors of the device used with the Analyzer are damaged, or their pin depth values are out of the range for this type of connector.
- the device is shared with someone else.
- after every 100 connections or as often as experience suggests.

The procedure for connector gauging is as follows (See figure):

1. Select the proper gauge for your connector.

2. Inspect and clean the gauge, the gauge master, and the connectors to be gauged.

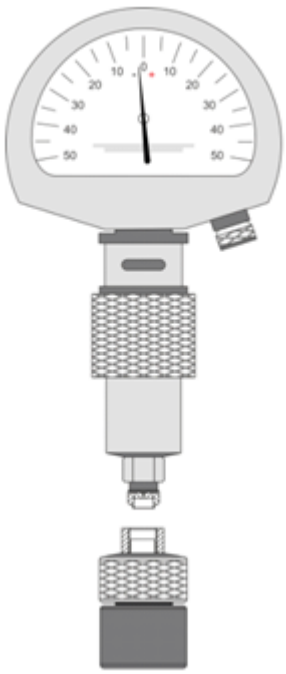
3. Zero the connector gauge before use (according to the gauge documentation).

4. Gauge the connector: while holding the gauge by the barrel, carefully connect the connector under test to the gauge. Read the gauge indicator dial value to determine recession or protrusion and compare the readings with the device specifications (See the figure and table below).

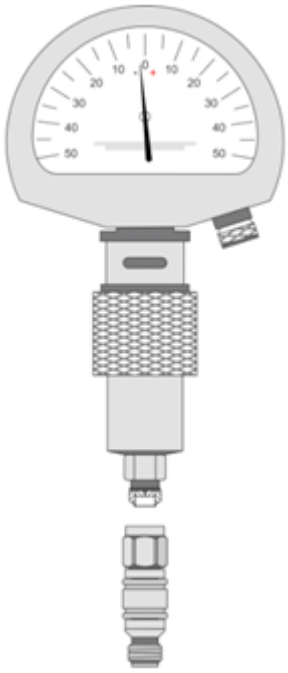
NOTE Use multiple measurements and keep records of readings.

NOTE Never use an out of specification connector.

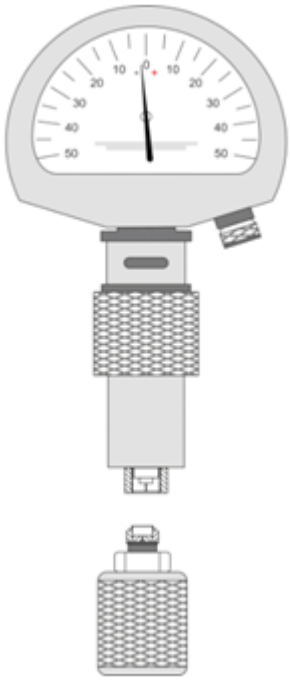
Do not hold connector gauge by the dial.



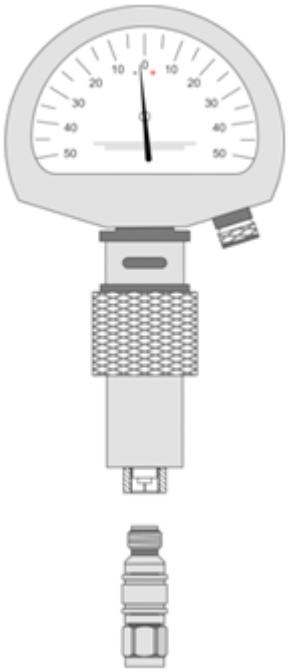
Gauge Master, male



Connectors, male

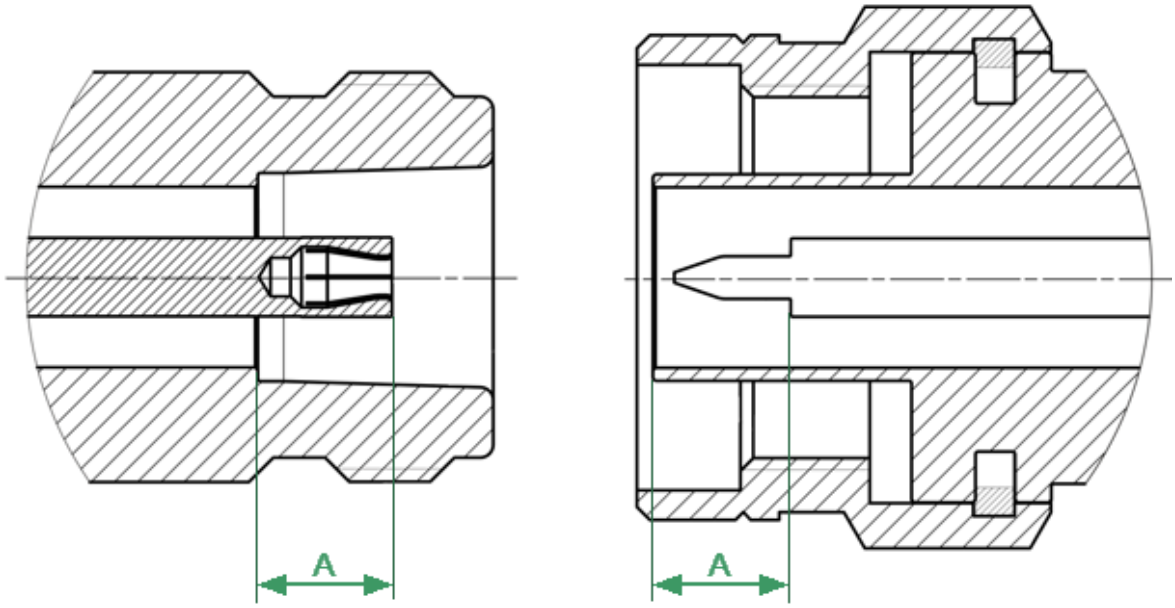


Gauge Master, female

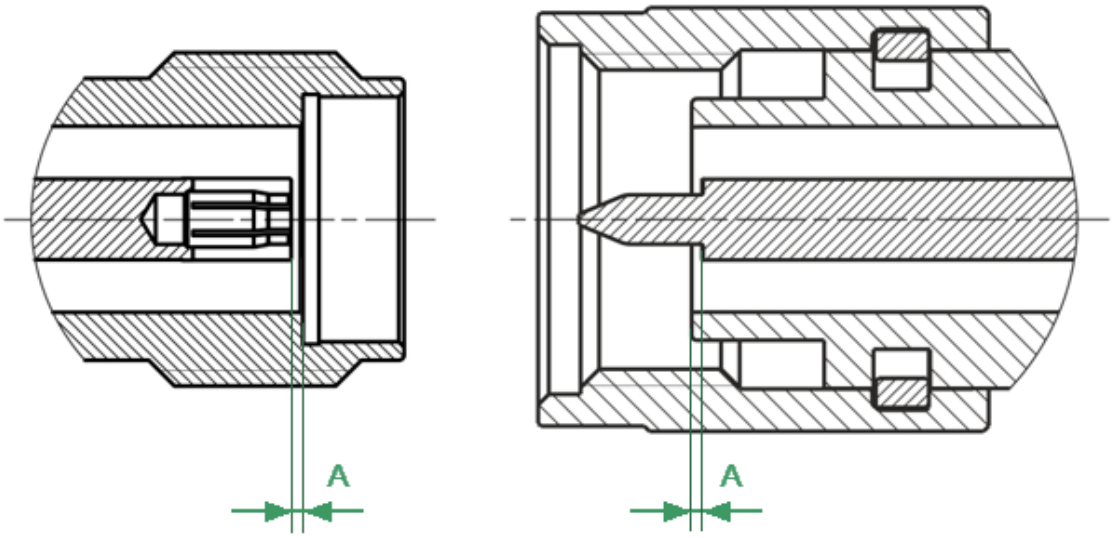


Connectors, female

Example of Gauging Connectors



Type-N Connectors (female and male)



3.5 mm NMD Connectors (female and male)

Mechanical Requirements for Measured Connectors

The A pin depth value of connector

Connector type	A pin acceptable depth range
Type-N, female	5.18 to 5.26 mm
Type-N, male	5.28 to 5.36 mm
2.4 mm NMD, female 3.5 mm NMD, female	-0.08 to 0.00 mm
2.4 mm NMD, male 3.5 mm NMD, male	-0.08 to 0.00 mm

If the pin depth values of the gauged connectors are out of the acceptable range, the connectors may be eligible to be sent in for repair.

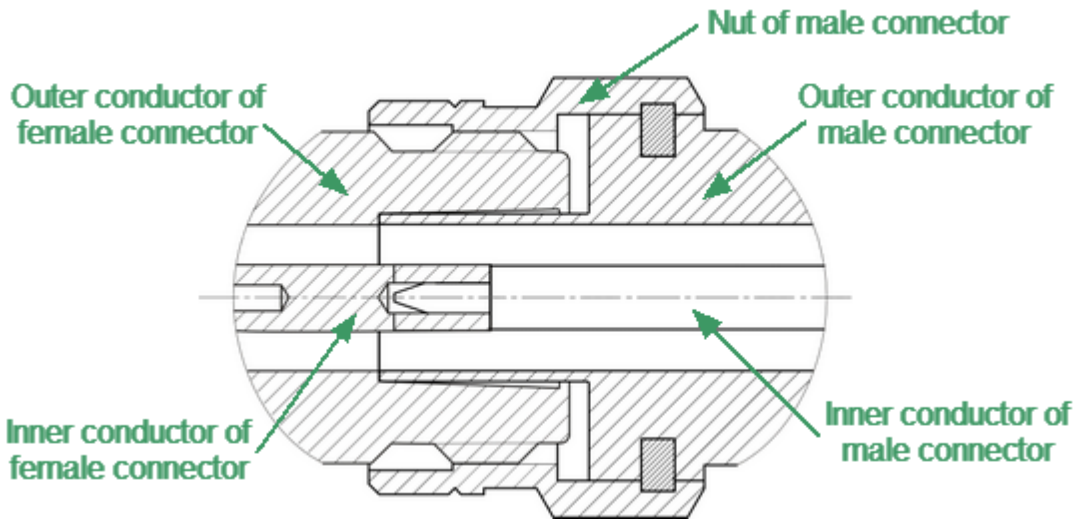
Connecting and Disconnecting

When operating the Analyzer, it is often necessary to connect various devices to each other: cables to analyzer measurement ports, junctions to cables, calibration tools to junctions or analyzer ports, devices under test to ports, etc.

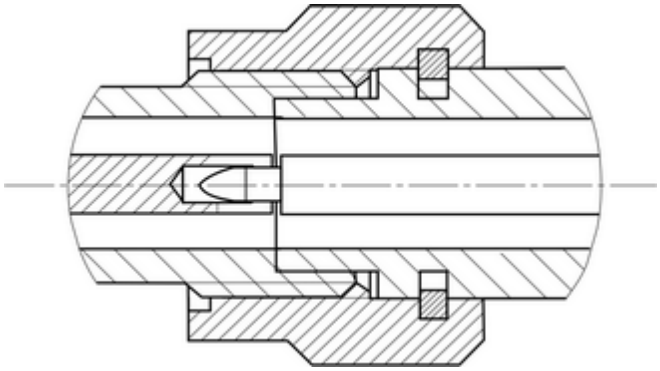
Connecting

Connect devices with coaxial connectors in the following sequence to ensure maximum repeatability of measurement results, as well as to prevent breakage:

1. Carefully align the connectors of the devices being connected.
2. While holding the device that is being connected, tighten the male connector nut manually. The mating plane surfaces of the center conductors and the outer conductors must make uniform light contact, as shown in figure below.



Type-N connectors (female on the left, and male on the right)

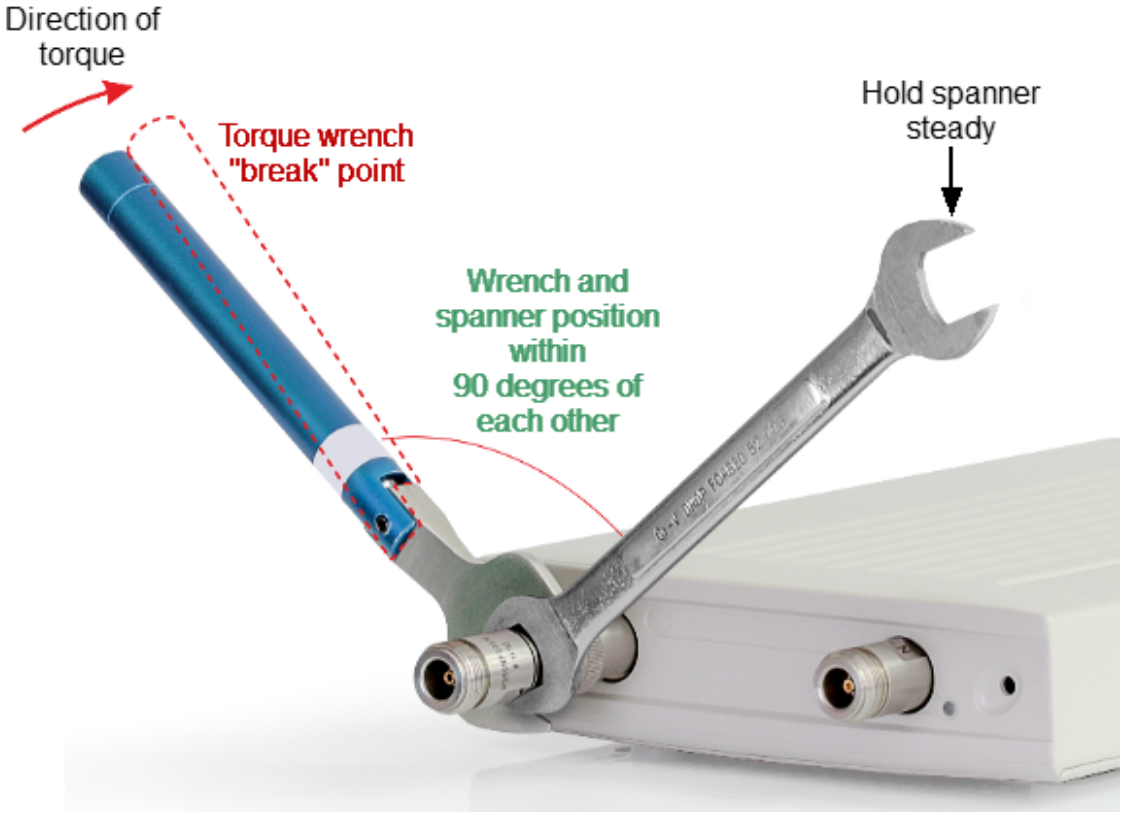


3.5 mm NMD connectors (female on the left, and male on the right)

Connecting example

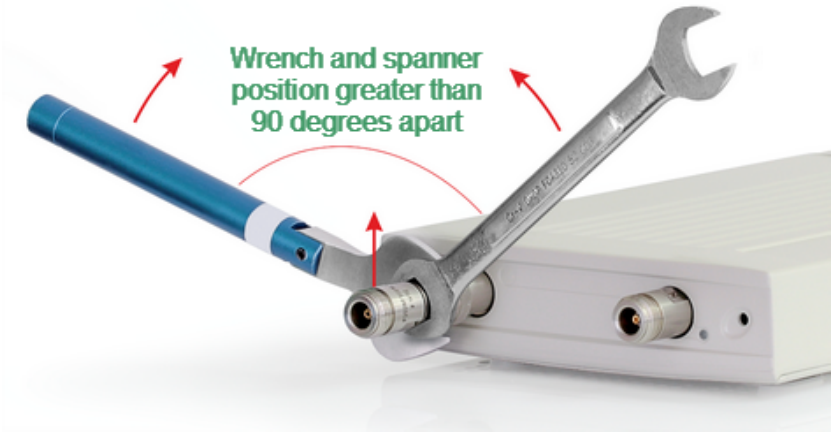
3. Tighten the male connector nut using the appropriate torque wrench while holding the device being connected, or hold the device by using an open-end spanner to keep it from rotating. Position the wrench and spanner within 90 degrees of each other before applying force. Finally, tighten the male connector nut by holding the wrench at the end of the handle. Tighten the connection just to the torque wrench “break” point (See figures below).

Hold the torque wrench by the end of the handle when tightening. The torque value depends on the connector type (See table below).



Correct torque wrench and spanner positions

CAUTION The wrench and spanner should not be positioned more than 90 degrees apart. A larger degree of separation can cause excessive misalignment of the connectors.



Incorrect usage of torque wrench and spanner (too much lift on connection).

Recommended Torque Values

Connector type	Recommended torque values
Type-N	1.1 to 1.7 N·m (12 in. lbs)
2.4 mm NMD, 3.5 mm NMD, 1.85 mm NMD	0.8 to 1.0 N·m (8 in. lbs)
SMA	0.56 N·m (5 in. lbs)

CAUTION The jumper cables will be damaged if more than 0.9 N·m of torque is applied to their SMA connectors.

Do not exceed the permissible torque value.

CAUTION	When making and breaking connections, connector mating surfaces should not rotate. Rotate the nut of the male connector only. Avoid rotating the devices. Use a suitable torque wrench.

CAUTION	Never cross-thread the connection. Never twist the connector body to make the connection. Never mate the connectors of incompatible types.

Disconnecting

Disconnect the connectors in the following order:

1. Using the torque wrench used for tightening, loosen the male connector nut while holding the device, or hold the device with an open-end wrench to prevent it from turning.

2. Turn the male connector nut while holding the device so that the connector center conductor remains in the same straight line position as it was connected. Pull the connectors straight apart.

ACM Operating manual

This Operating Manual contains information on design, specifications, functional overview, and detailed operation procedures of the Copper Mountain Technologies Automatic Calibration Modules (hereinafter referred to as Modules). Use the navigation tools on the left of the window to access the sections.

General Overview

The Module is designed for calibration (error correction) of Vector Network Analyzers in automatic mode.

Calibration is performed by automatically connecting the reflection and transmission impedance states to the VNA test ports.

Calibration determines systematic errors in accordance with the VNA model. The process of mathematical compensation (numerical reduction) for measurement systematic errors is called error correction.

Using the Module instead of a mechanical calibration kit has several advantages, which ensure high measurement accuracy and a longer service life of the VNA test ports. The measurement accuracy is achieved using precision Module standards (states) descriptions, by the stability of the selected configuration, and by the application of temperature drift functions and self-diagnosis in the form of confidence check. Single module connection during calibration allows to:

- Extend the VNA ports service life.
- Reduce technical staff workload and risk of human error.
- Make the measurement process most efficient.

The Module control protocol is based on the USBTMC-USB488 standard.

Modification

The Module differ in operating frequency range and in the number of ports. Their functional features are briefly described in the table below.

During calibration, the Modules are controlled by the VNA software installed on the connected PC. The USB 2.0 interface is used for control.

The Modules feature several hardware configurations depending on the connector types of PORT A, PORT B and, if available, PORT C and PORT D. To view the possible connector type front and side views for each Module, click on the name of the desired Module in the table below.

The Module delivery package is specified in Delivery Kit.

Functional Features

Module	Frequency range	Supported calibrations	Features
50 Ohm two-port Modules			
ACM2506	20 kHz to 6.5 GHz	Full one-port One-path two-port Full two-port	Unknown thru Thermal compensation User characterization Automatic orientation Confidence check
ACM2509	20 kHz to 9 GHz		
ACM2520	100 kHz to 20 GHz		
ACM2543	10 MHz to 44 GHz		
ACM6000T	20 kHz to 6 GHz		
ACM8000T	100 kHz to 8 GHz		
75 Ohm two-port Modules			
ACM2708	20 kHz to 8 GHz	Full one-port One-path two-port Full two-port	Unknown thru Thermal compensation User characterization

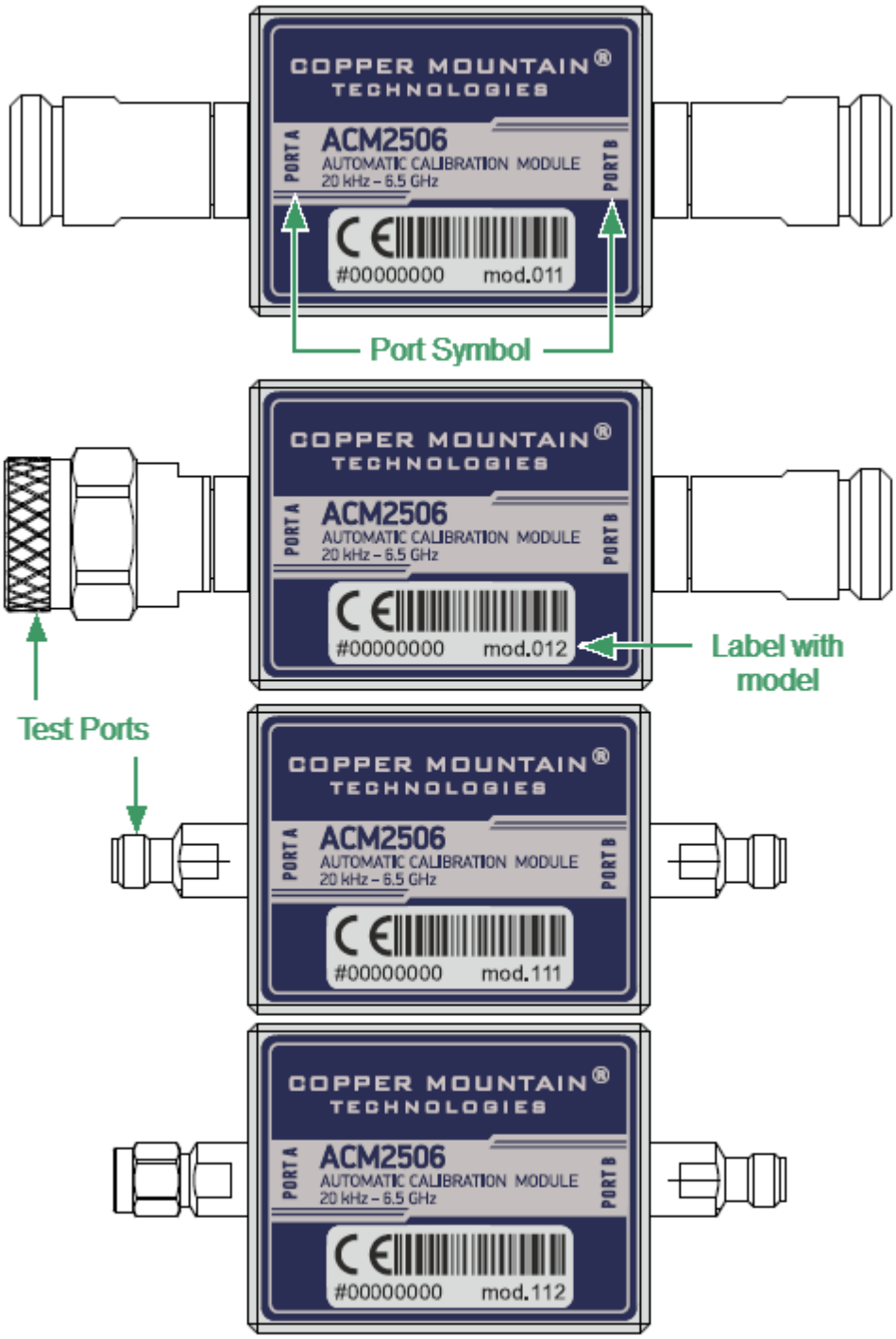
Module	Frequency range	Supported calibrations	Features
ACM4000T	20 kHz to 4 GHz		Automatic orientation Confidence check
50 Ohm four-port Modules			
ACM4509	100 kHz to 9 GHz	Full one-port One-path two-port Full two-port Full three-port Full four-port	Unknown thru Thermal compensation User characterization Automatic orientation Confidence check
ACM4520	100 kHz to 20 GHz		
ACM8400T	100 kHz to 8 GHz		

1 The upper frequency point of ACM2520 and ACM4520 with type N connectors is 18 GHz.

2 The upper frequency point of ACM2543 with 2.92 mm connectors is 40 GHz.

ACM2506

The front panels of the different models of ACM2506 are shown in the figure below.



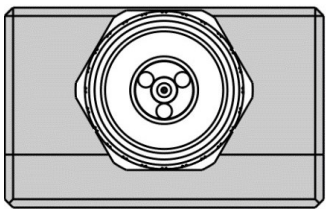
Front panel ACM2506

Parts of the ACM2509

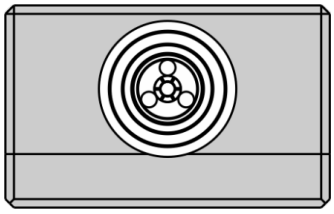
Test Port

The test ports are designed for connection to VNA being calibrated. The VNA connectors, the cross sections of which were calibrated, are referred to as its test ports.

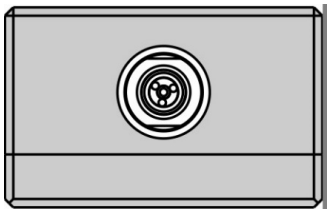
The Modules connectors are shown in figures below.



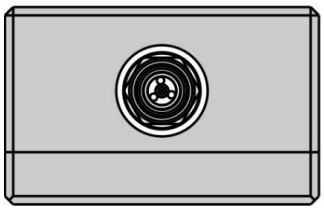
Type N, male



Type N, female

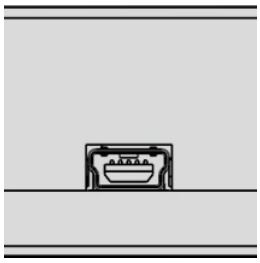


3.5 mm, male



3.5 mm, female

Mini USB Connector (on side panel)



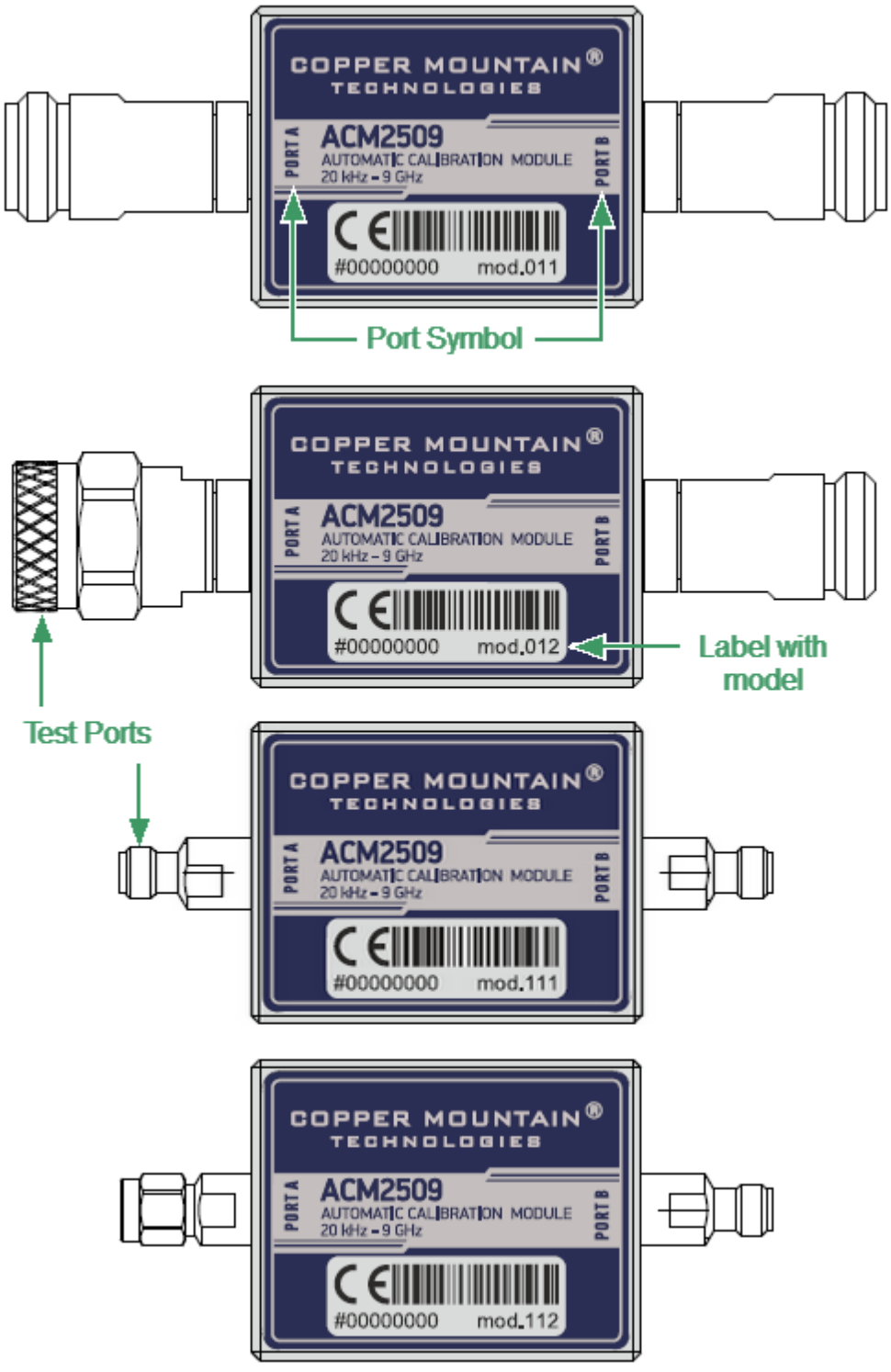
The mini USB connector is located at the side panel of the Module and is intended for the Module connection to the controlling PC. The Module is powered using the USB cable.

Hardware Configurations

Model	Connector type	
	Port A	Port B
ACM2506-011	type N, female	type N, female
ACM2506-012	type N, male	type N, female
ACM2506-111	3.5 mm, female	3.5 mm, female
ACM2506-112	3.5 mm, male	3.5 mm, female

ACM2509

Front panel of different models of ACM2506 are shown in figure below.



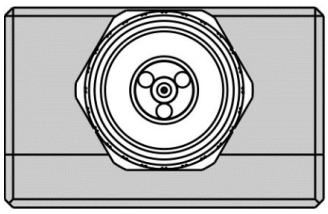
Front panel ACM2509

Parts of Module

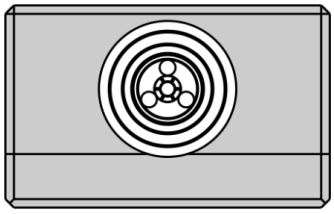
Test Port

The test ports are designed for connection to VNA being calibrated. The VNA connectors, the cross sections of which were calibrated, are referred to as its test ports.

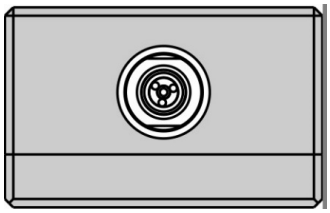
The Modules connectors are shown in figures below.



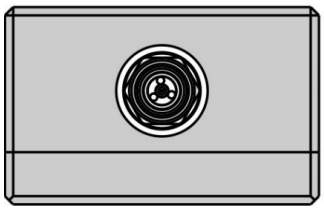
Type N, male



Type N, female

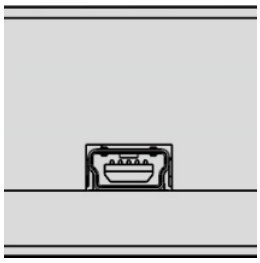


3.5 mm, female



3.5 mm, male

Mini USB Connector (on side panel)



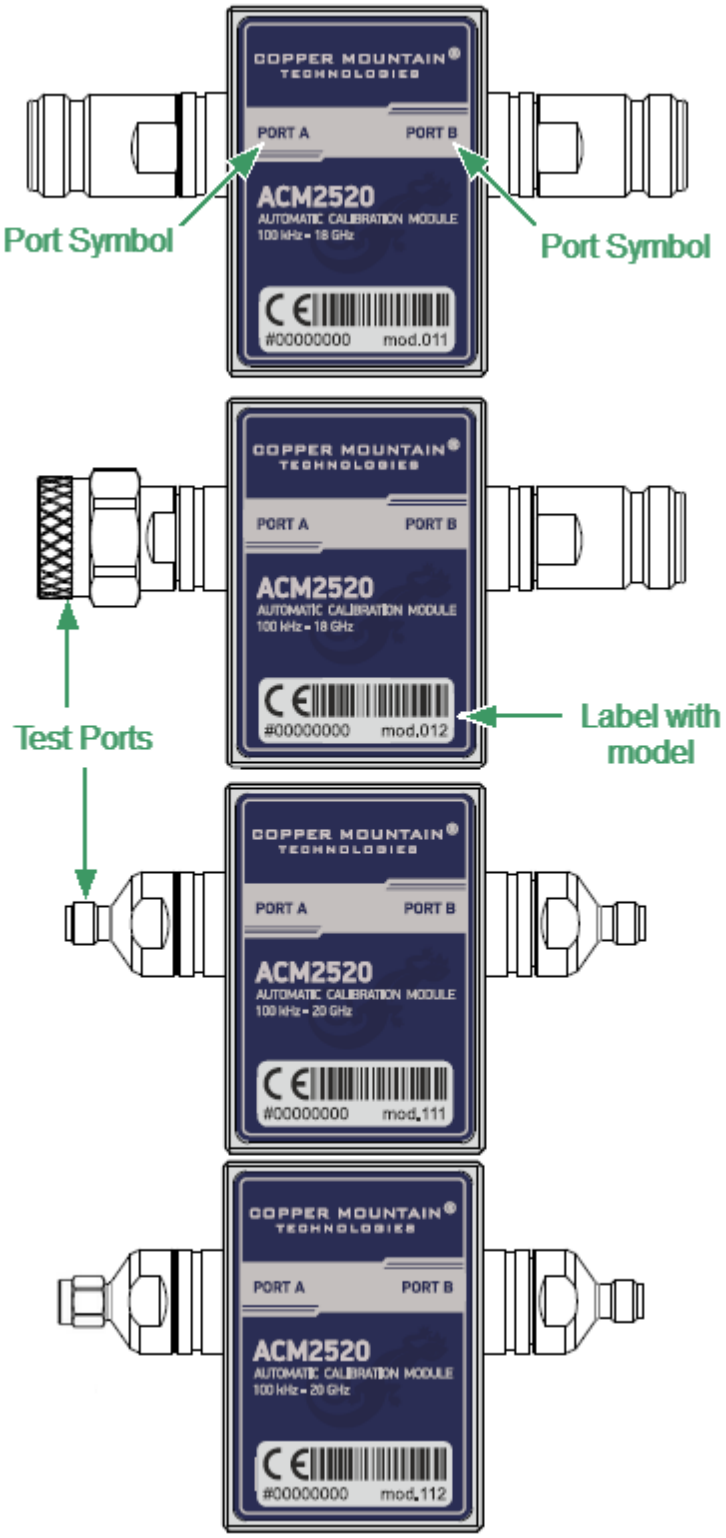
The mini USB connector is located on the side panel of the Module and is intended for the Module connection to the controlling PC. The Module is powered using the USB cable.

Hardware Configurations

Model	Connector type	
	Port A	Port B
ACM2509-011	type N, female	type N, female
ACM2509-012	type N, male	type N, female
ACM2509-111	3.5 mm, female	3.5 mm, female
ACM2509-112	3.5 mm, male	3.5 mm, female

ACM2520

The front panels of the different models of ACM2520 are shown in the figure below.



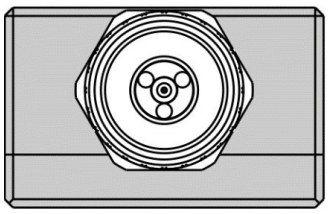
Front panel ACM2520

Parts of Module

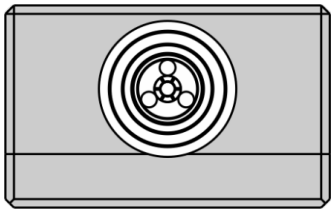
Test Port

The test ports are designed for connection to VNA being calibrated. The VNA connectors, the cross sections of which were calibrated, are referred to as its test ports.

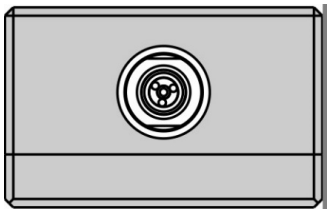
The Modules connectors are shown in figures below.



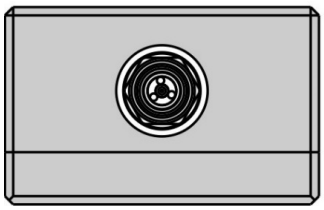
Type N, male



Type N, female



3.5 mm, female



3.5 mm, male

Connector (on side panel)



The connector is located on the top of the Module and is intended for the Module connection to the controlling PC. The Module is powered using the USB cable.

LED Status Indicator (on rear panel)

NOTE	LED Status Indicator is located under the label and is visible only during operation.

The LED indicates the following statuses:

- Blinking green and red LED mean testing LED and indicating external power supply voltage presence.

- Red LED indicator means warm-up mode of the Module. The time required for operating mode setting is automatically counted from the moment of the Module connection using USB. If the Module is disconnected during setting and reconnected again, then the countdown counter starts from the beginning.

  Additional red LED may indicate the Module connection loss with the PC. In this case, check the Module connection with software (the **Autocalibration** softkey should be active), if there is no connection, disconnect the USB cable from the Module and repeat the connection.

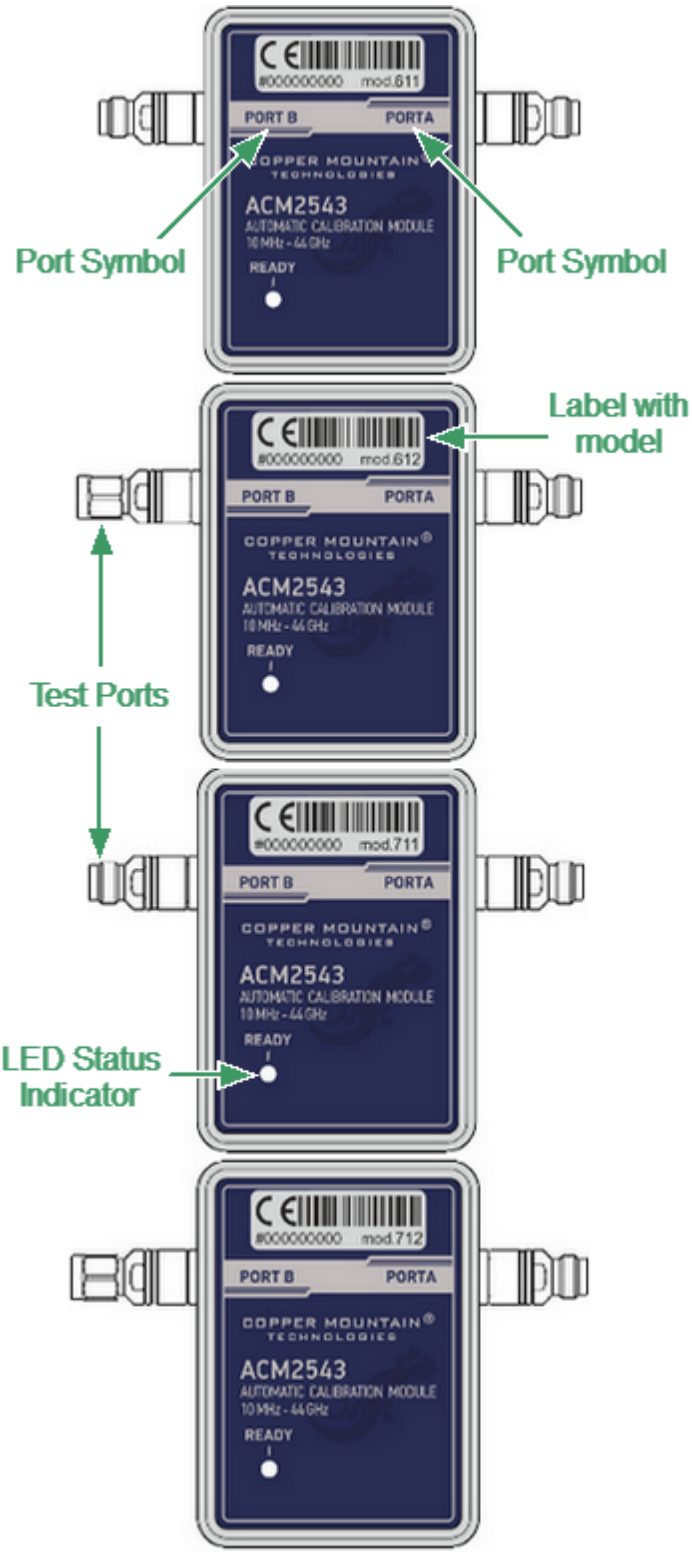
- Green LED indicator means the Module is ready for operation.

Hardware Configurations

Model	Connector type	
	Port A	Port B
ACM2520-011	type N, female	type N, female
ACM2520-012	type N, male	type N, female
ACM2520-111	3.5 mm, female	3.5 mm, female
ACM2520-112	3.5 mm, male	3.5 mm, female

ACM2543

The rear panels of the different models of ACM2543 are shown in the figure below.

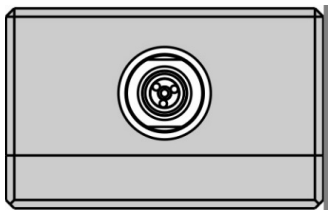


Rear panel ACM2543

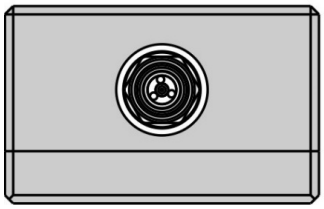
Parts of Module

Test Port

The test ports are designed for connection to VNA being calibrated. The VNA connectors, the cross sections of which were calibrated, are referred to as its test ports. The Modules connectors are shown in figures below.



2.4 mm (2.92 mm), female



2.4 mm (2.92 mm), male

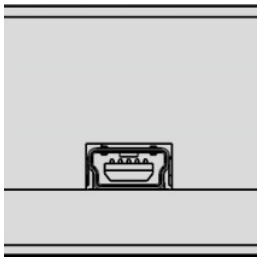
LED Status Indicator

The LED indicates the following statuses:

- Blinking green and red LED mean testing LED and indicating external power supply voltage presence.
- Red LED indicator means warm-up mode of the Module. The time required for operating mode setting is automatically counted from the moment of the Module connection using USB. If the Module is disconnected during setting and reconnected again, then the countdown counter starts from the beginning.

  Additional red LED may indicate the Module connection loss with the PC. In this case, check the Module connection with software (the **Autocalibration** softkey should be active), if there is no connection, disconnect the USB cable from the Module and repeat the connection.
- Green LED indicator means the Module is ready for operation.

Mini USB Connector (on side panel)



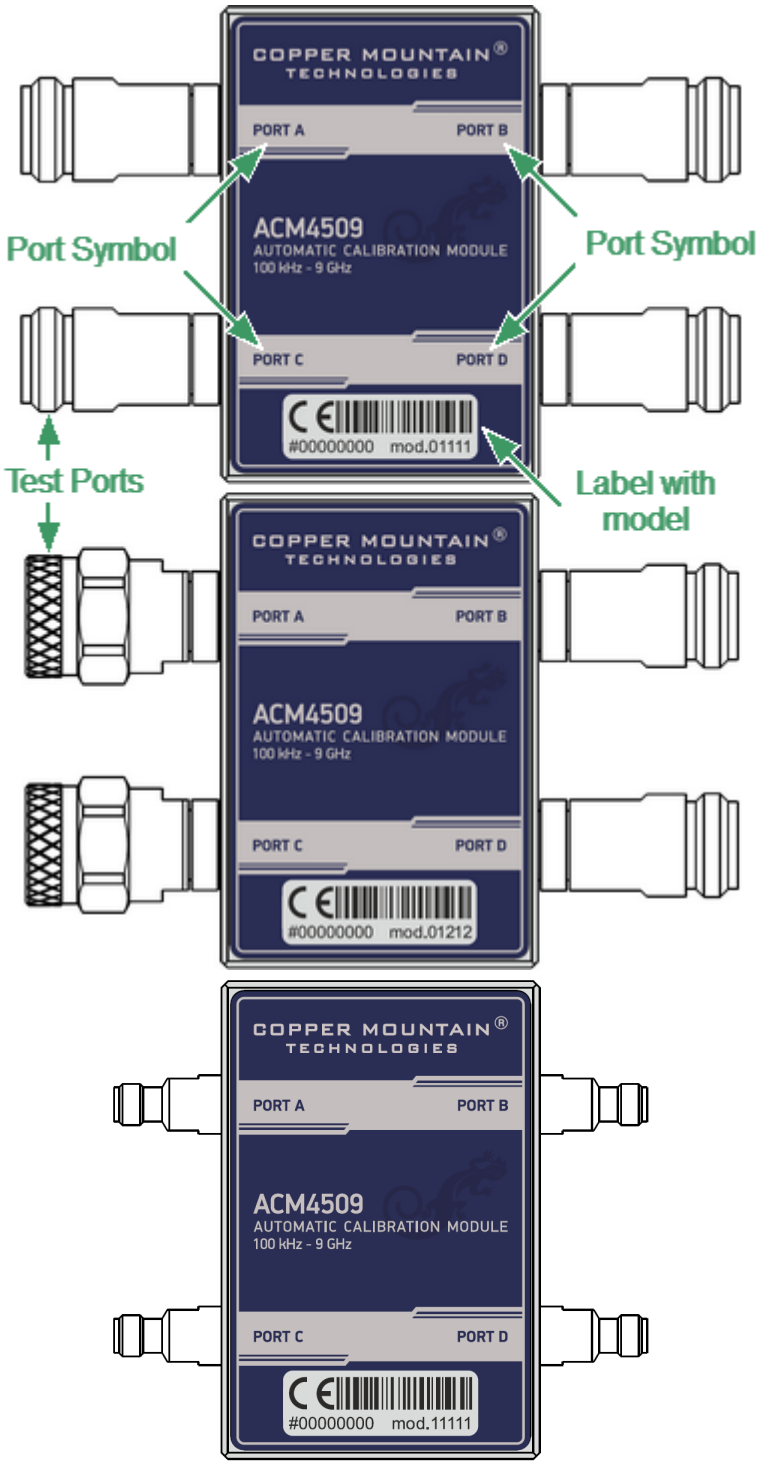
The connector is located on the top of the Module and is intended for the Module connection to the controlling PC. The Module is powered using the USB cable.

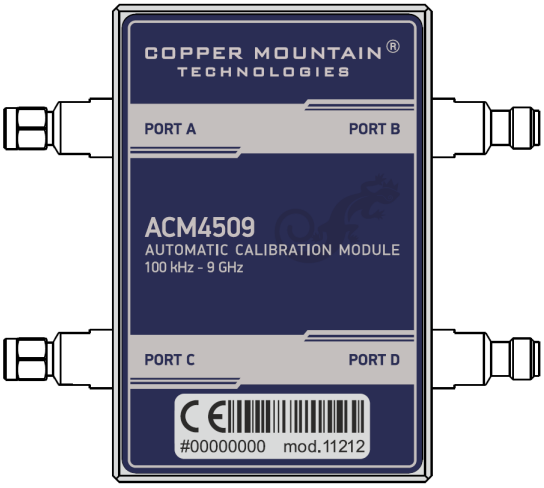
Hardware Configurations

Model	Connector type	
	Port A	Port B
ACM2543-611	2.92 mm, female	2.92 mm, female
ACM2543-612	2.92 mm, male	2.92 mm, female
ACM2543-711	2.4 mm, female	2.4 mm, female
ACM2543-712	2.4 mm, male	2.4 mm, female

ACM4509

The front panels of the different models of ACM4509 are shown in the figure below.





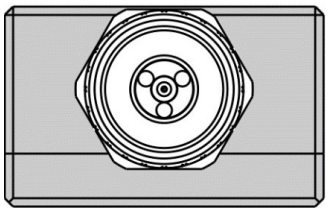
Front panel ACM4509

Parts of Module

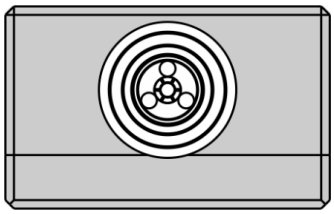
Test Port

The test ports are designed for connection to VNA being calibrated. The VNA connectors, the cross sections of which were calibrated, are referred to as its test ports.

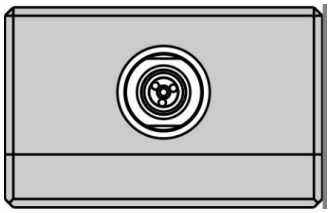
The Modules connectors are shown in figures below.



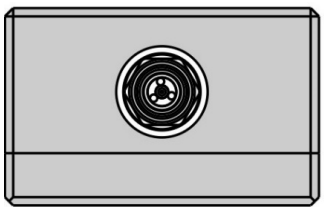
Type N, male



Type N, female

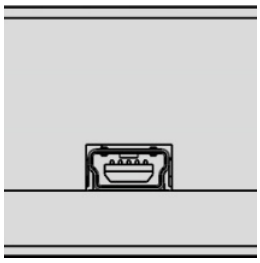


3.5 mm, female



3.5 mm, male

Mini USB Connector (on side panel)



The mini USB connector is located on the bottom of the Module and is intended for the Module connection to the controlling PC. The Module is powered using the USB cable.

LED Status Indicator (on rear panel)

NOTE LED Status Indicator is located under the label and is visible only during operation.

The LED indicates the following statuses:

- Blinking green and red LED mean testing LED and indicating external power supply voltage presence.
- Red LED indicator means warm-up mode of the Module. The time required for operating mode setting is automatically counted from the moment of the Module connection using USB. If the Module is disconnected during setting and reconnected again, then the countdown counter starts from the beginning.

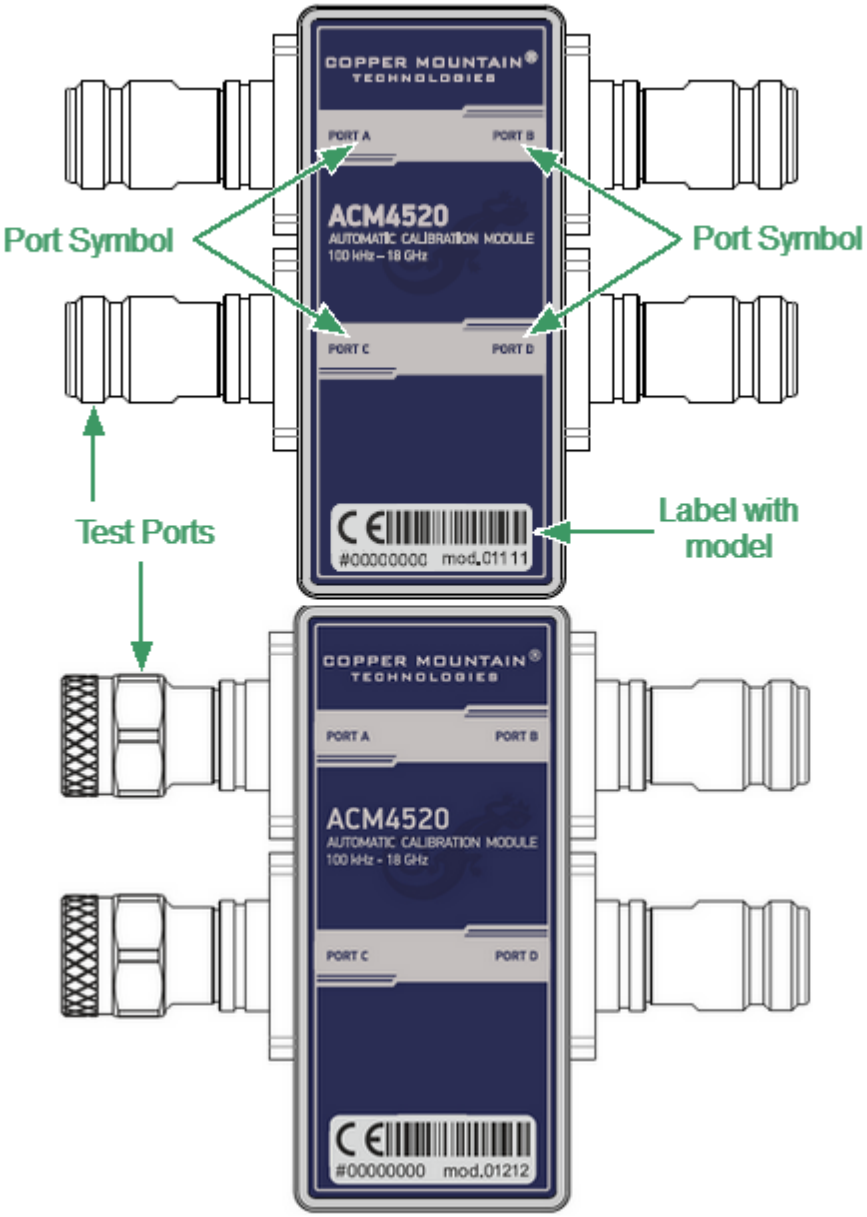
  Additional red LED may indicate the Module connection loss with the PC. In this case, check the Module connection with software (the **Autocalibration** softkey should be active), if there is no connection, disconnect the USB cable from the Module and repeat the connection.
- Green LED indicator means the Module is ready for operation.

Hardware Configurations

Model	Connector type	
	Port A/C	Port B/D
ACM4509-01111	type N, female	type N, female
ACM4509-01212	type N, male	type N, female
ACM509-11111	3.5 mm, female	3.5 mm, female
ACM4509-11212	3.5 mm, male	3.5 mm, female

ACM4520

The front panels of the different models of ACM4520 are shown in the figure below.





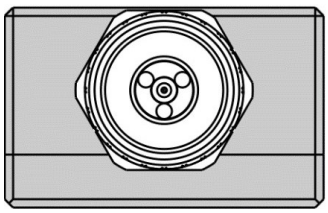
Front panel ACM4520

Parts of Module

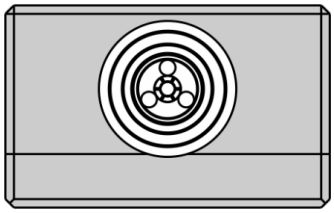
Test Port

The test ports are designed for connection to VNA being calibrated. The VNA connectors, the cross sections of which were calibrated, are referred to as its test ports.

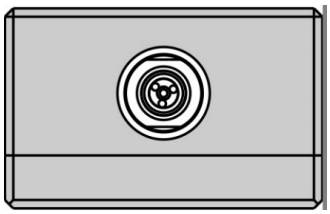
The Modules connectors are shown in figures below.



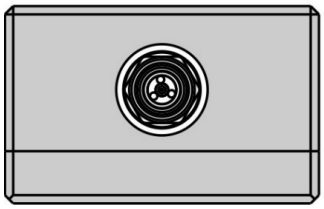
Type N, male



Type N, female

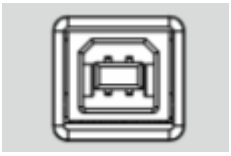


3.5 mm, female



3.5 mm, male

Connector (on side panel)



The connector is located on the bottom of the Module and is intended for the Module connection to the controlling PC. The Module is powered using the USB cable.

LED Status Indicator (on rear panel)

NOTE	LED Status Indicator is located under the label and is visible only during operation.

The LED indicates the following statuses:

- Blinking green and red LED mean testing LED and indicating external power supply voltage presence.
- Red LED indicator means warm-up mode of the Module. The time required for operating mode setting is automatically counted from the moment of the Module connection using USB. If the Module is disconnected during setting and reconnected again, then the countdown counter starts from the beginning.

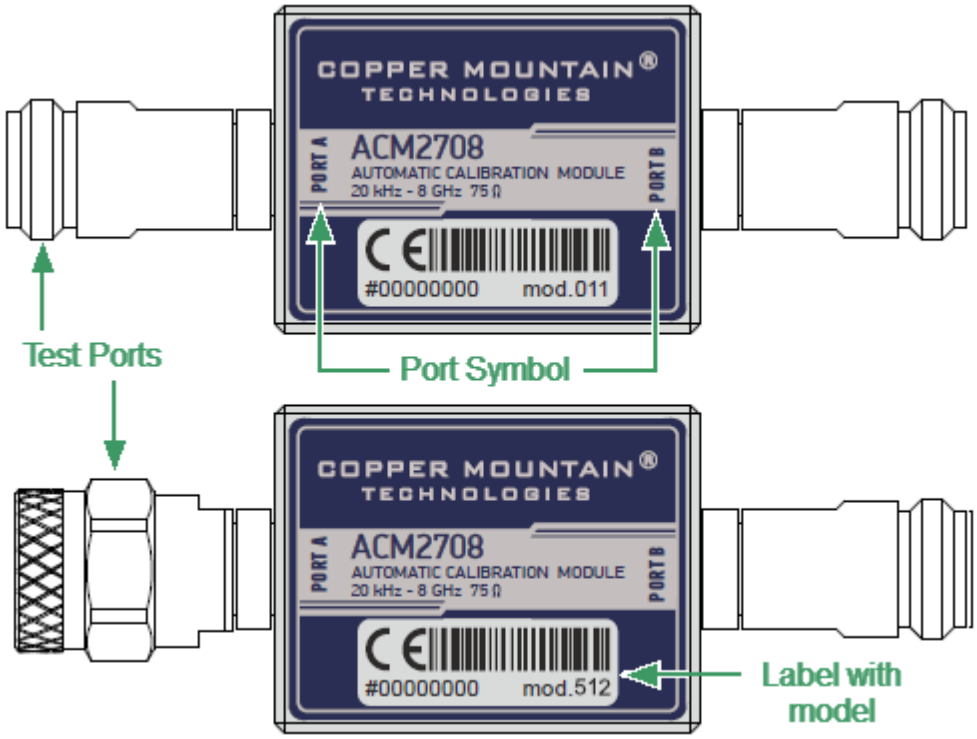
  Additional red LED may indicate the Module connection loss with the PC. In this case, check the Module connection with software (the **Autocalibration** softkey should be active), if there is no connection, disconnect the USB cable from the Module and repeat the connection.
- Green LED indicator means the Module is ready for operation.

Hardware Configurations

Model	Connector type	
	Port A/C	Port B/D
ACM4520-01111	type N, female	type N, female
ACM4520-01212	type N, male	type N, female
ACM4520-11111	3.5 mm, female	3.5 mm, female
ACM4520-11212	3.5 mm, male	3.5 mm, female

ACM2708

The front panels of the different models of ACM2708 are shown in the figure below.



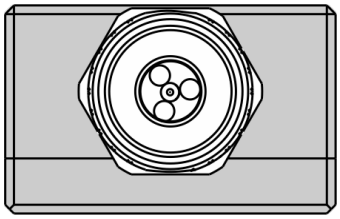
Front panel ACM2708

Parts of Module

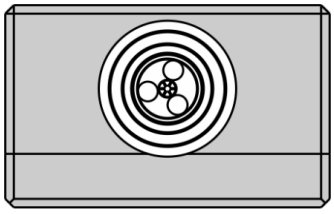
Test Port

The test ports are designed for connection to VNA being calibrated. The VNA connectors, the cross sections of which were calibrated, are referred to as its test ports.

The Modules connectors are shown in figures below.

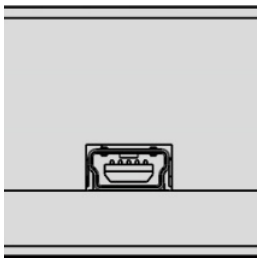


Type N 75, male



Type N 75, female

Connector (on side panel)



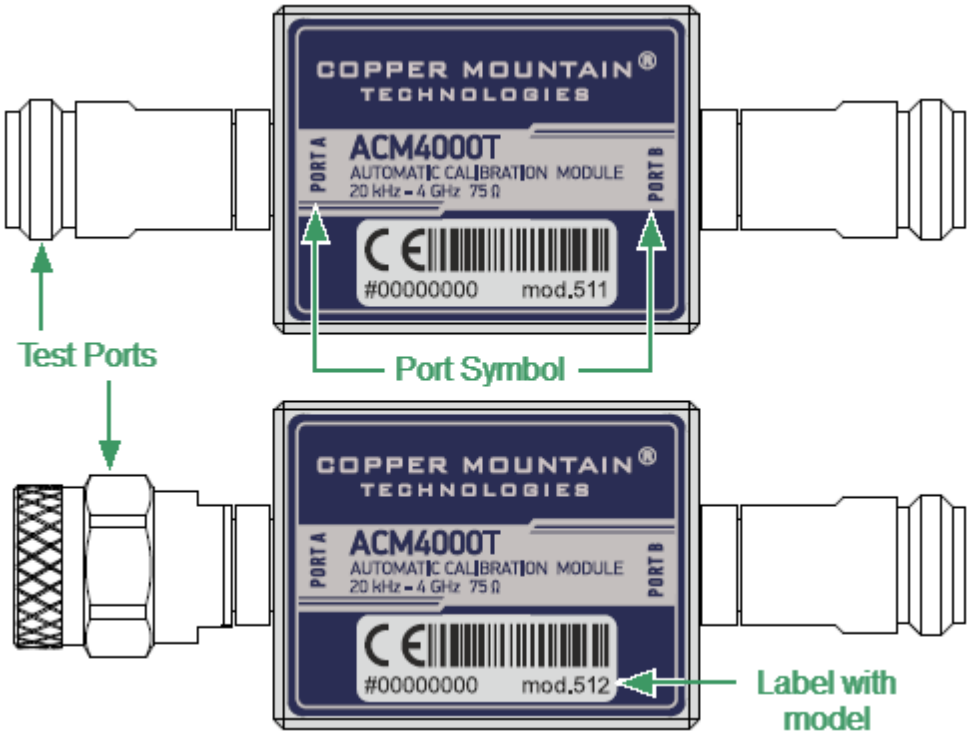
The connector is located on the bottom of the Module and is intended for the Module connection to the controlling PC. The Module is powered using the USB cable.

Hardware Configurations

Model	Connector type	
	Port A	Port B
ACM2708-511	type N 75, female	type N 75, female
ACM2708-512	type N 75, male	type N 75, female

ACM4000T

The front panels of the different models of ACM4000T are shown in the figure below.



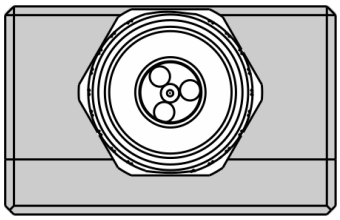
Front panel ACM4000T

Parts of Module

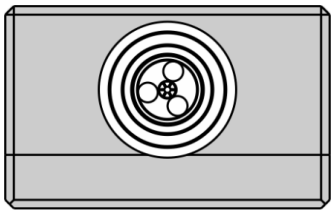
Test Port

The test ports are designed for connection to VNA being calibrated. The VNA connectors, the cross sections of which were calibrated, are referred to as its test ports.

The Modules connectors are shown in figures below.

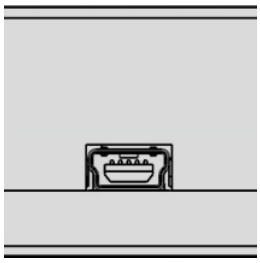


Type N 75, male



Type N 75, female

Connector (on side panel)



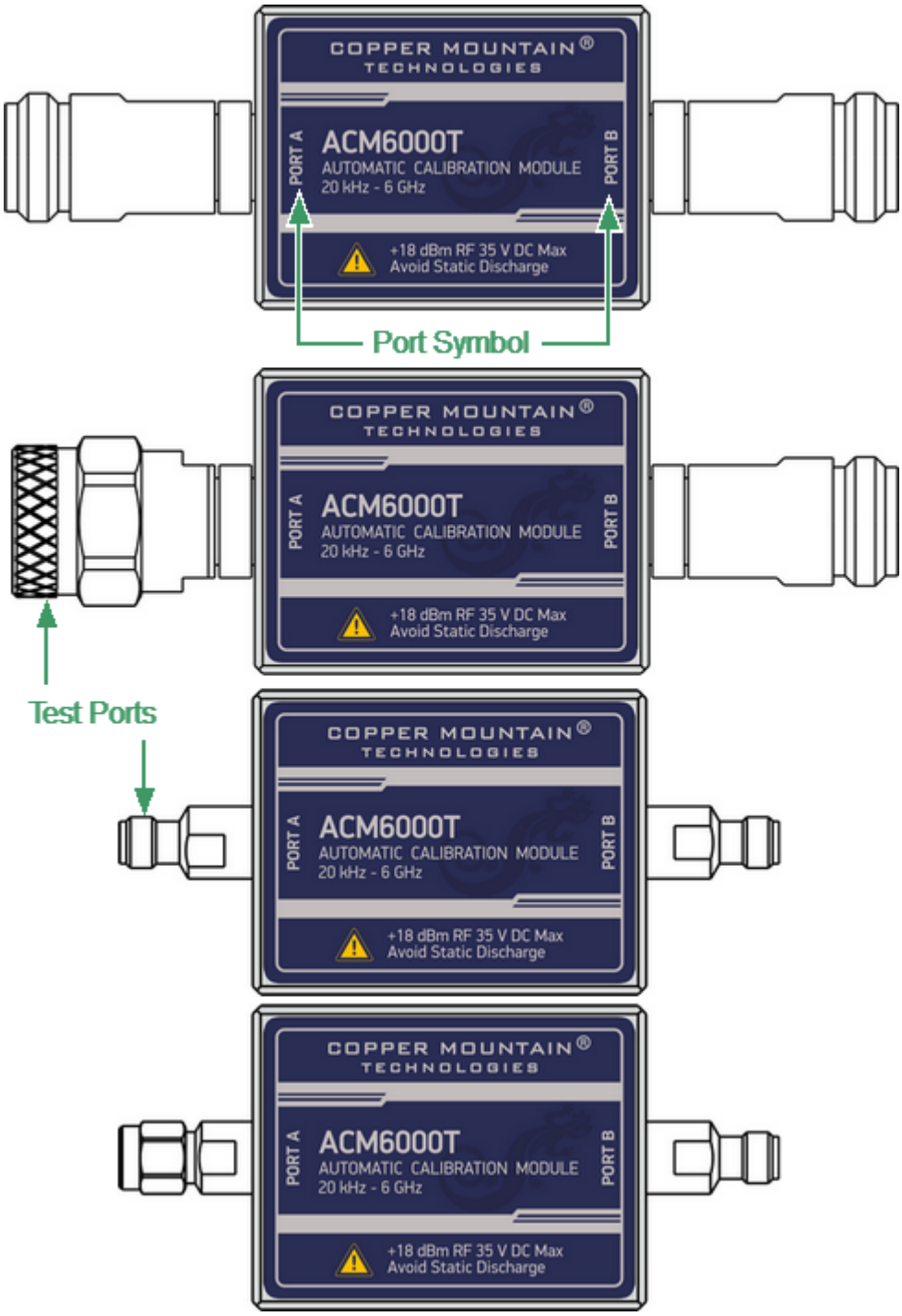
The connector is located on the bottom of the Module and is intended for the Module connection to the controlling PC. The Module is powered using the USB cable.

Hardware Configurations

Model	Connector type	
	Port A	Port B
ACM4000T-511	type N 75, female	type N 75, female
ACM4000T-512	type N 75, male	type N 75, female

ACM6000T

The front panels of the different models of ACM6000T are shown in the figure below.



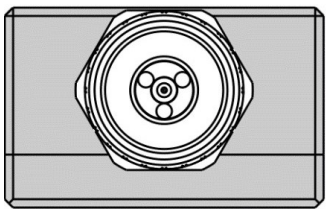
Front panel ACM6000T

Parts of Module

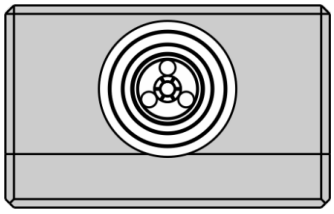
Test Port

The test ports are designed for connection to VNA being calibrated. The VNA connectors, the cross sections of which were calibrated, are referred to as its test ports.

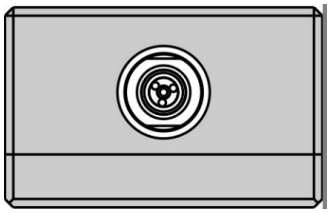
The Modules connectors are shown in figures below.



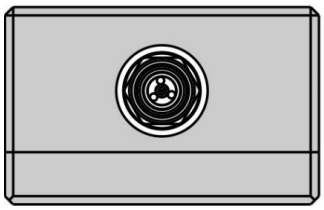
Type N, male



Type N, female

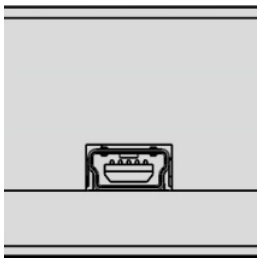


3.5 mm, female



3.5 mm, male

Connector (on side panel)



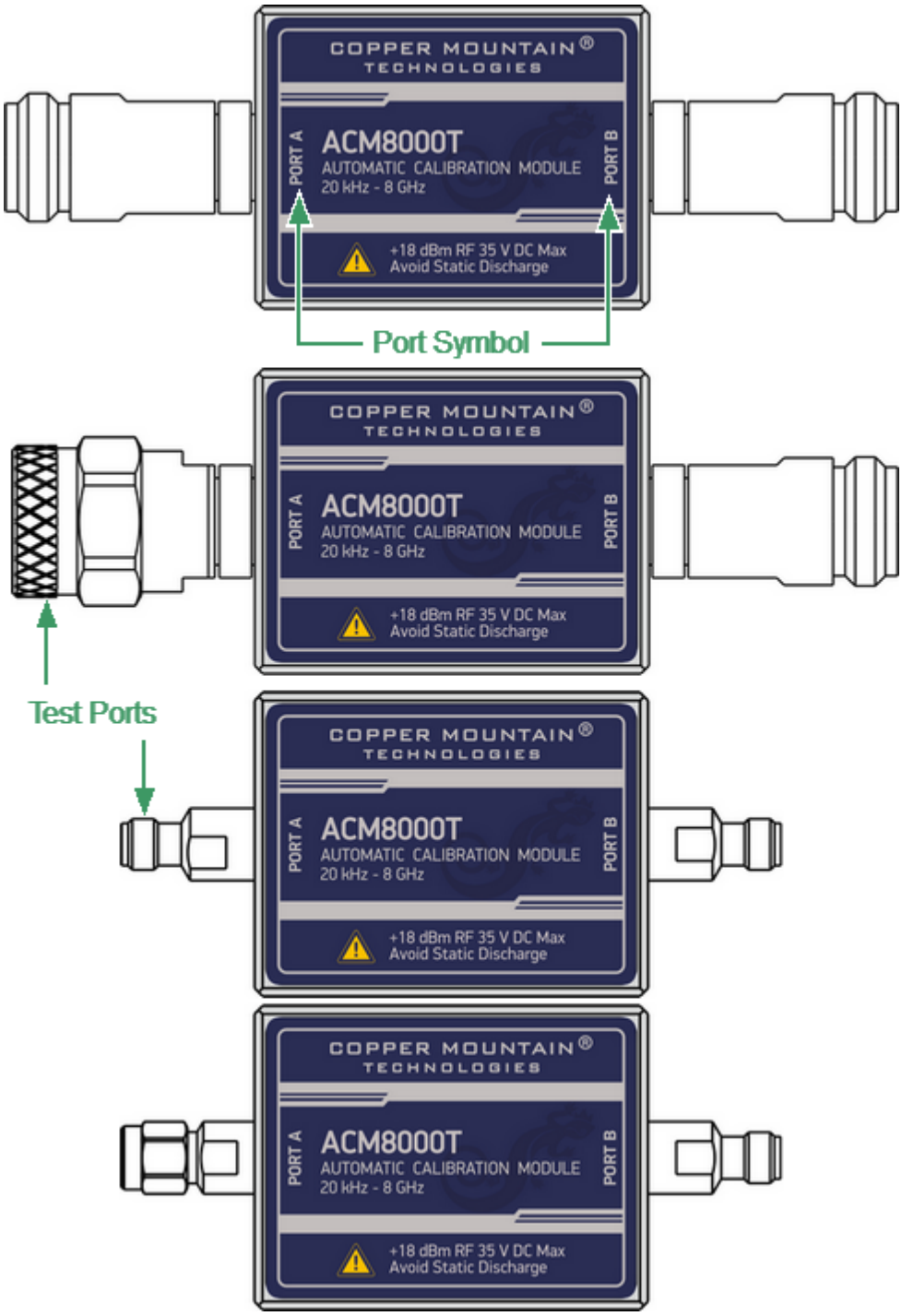
The connector is located on the bottom of the Module and is intended for the Module connection to the controlling PC. The Module is powered using the USB cable.

Hardware Configurations

Model	Connector type	
	Port A	Port B
ACM6000T-011	type N, female	type N, female
ACM6000T-012	type N, male	type N, female
ACM6000T-111	3.5 mm, female	3.5 mm, female
ACM6000T-112	3.5 mm, male	3.5 mm, female

ACM8000T

The front panels of the different models of ACM8000T are shown in the figure below.



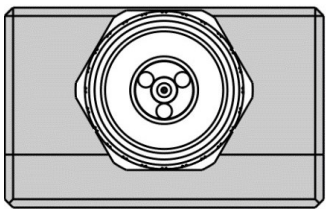
Front panel ACM8000T

Parts of Module

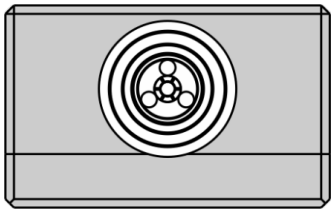
Test Port

The test ports are designed for connection to VNA being calibrated. The VNA connectors, the cross sections of which were calibrated, are referred to as its test ports.

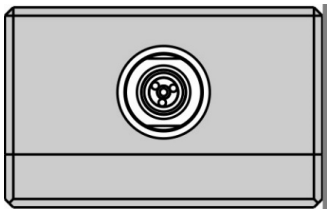
The Modules connectors are shown in figures below.



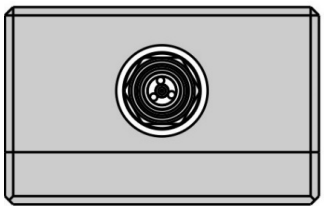
Type N, male



Type N, female

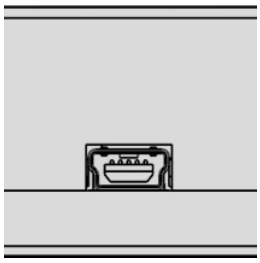


3.5 mm, female



3.5 mm, male

Connector (on side panel)



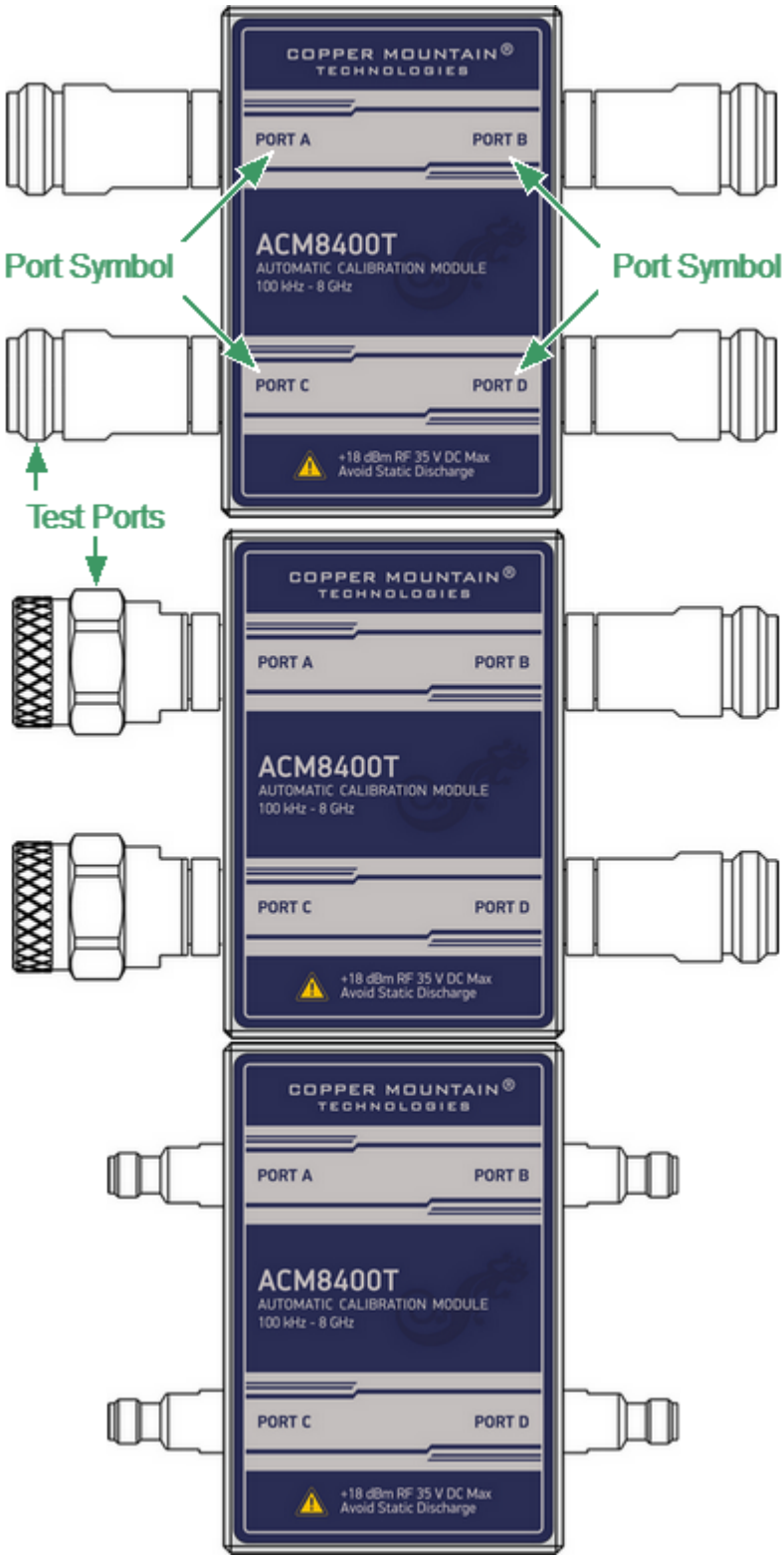
The connector is located on the bottom of the Module and is intended for the Module connection to the controlling PC. The Module is powered using the USB cable.

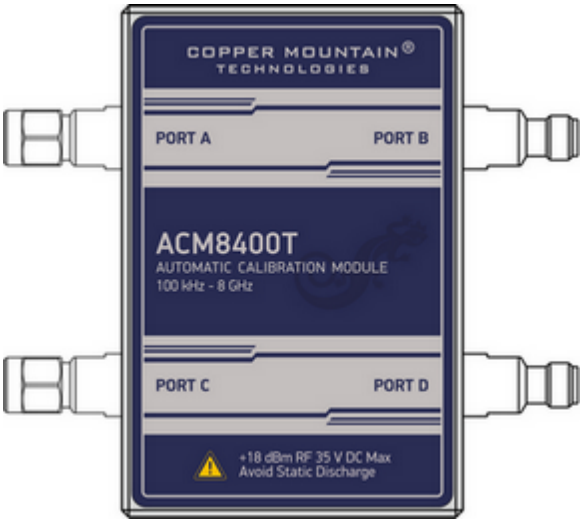
Hardware Configurations

Model	Connector type	
	Port A	Port B
ACM8000T-011	type N, female	type N, female
ACM8000T-012	type N, male	type N, female
ACM8000T-111	3.5 mm, female	3.5 mm, female
ACM8000T-112	3.5 mm, male	3.5 mm, female

ACM8400T

The front panels of the different models of ACM8400T are shown in the figure below.





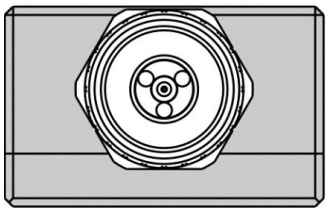
Front panel ACM8400T

Parts of Module

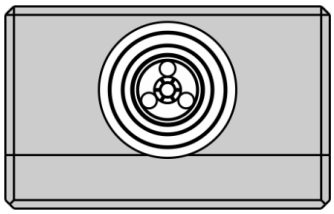
Test Port

The test ports are designed for connection to VNA being calibrated. The VNA connectors, the cross sections of which were calibrated, are referred to as its test ports.

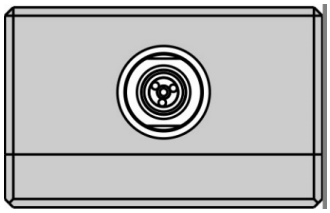
The Modules connectors are shown in figures below.



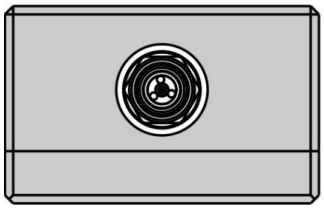
Type N, male



Type N, female

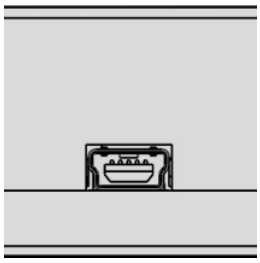


3.5 mm, female



3.5 mm, male

Connector (on side panel)



The connector is located on the bottom of the Module and is intended for the Module connection to the controlling PC. The Module is powered using the USB cable.

LED Status Indicator (on rear panel)

NOTE LED Status Indicator is located under the label and is visible only during operation.

The LED indicates the following statuses:

- Blinking green and red LED mean testing LED and indicating external power supply voltage presence.
- Red LED indicator means warm-up mode of the Module. The time required for operating mode setting is automatically counted from the moment of the Module connection using USB. If the Module is disconnected during setting and reconnected again, then the countdown counter starts from the beginning.

  Additional red LED may indicate the Module connection loss with the PC. In this case, check the Module connection with software (the **Autocalibration** softkey should be active), if there is no connection, disconnect the USB cable from the Module and repeat the connection.
- Green LED indicator means the Module is ready for operation.

Hardware Configurations

Model	Connector type	
	Port A/C	Port B/D
ACM8400T-01111	type N, female	type N, female
ACM8400T-01212	type N, male	type N, female
ACM8400T-11111	3.5 mm, female	3.5 mm, female
ACM8400T-11212	3.5 mm, male	3.5 mm, female

Protective Housing

The protective housing is designed to protect the test ports and the USB connector of the automatic calibration module (ACM) from mechanical influences.

The protective housing is removable. The collapsible design allows for quick installation.

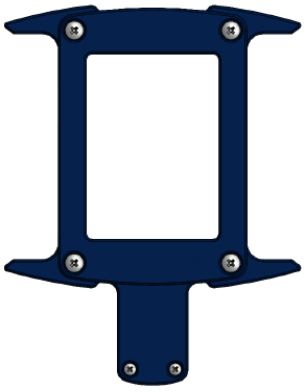
The protective housing is non-repairable.

NOTE The protective housing is not intended for use in extreme environments. Do not bend or stretch the protective housing during use.

The appearance of the protective cover is determined by the modification of the module (See table below).

ACM Protective Housing

Housing Model	Compatible ACM models
ACM2509 	ACM2506-111, ACM2506-112, ACM2509-111, ACM2509-112, ACM6000T-111,ACM6000T-112, ACM8000T-111, ACM8000T-112
ACM2509 	ACM2506-011, ACM2506-012, ACM2509-011, ACM2509-012, ACM2708-011, ACM2708-111, ACM6000T-011,ACM6000T-012, ACM8000T-011, ACM8000T-012, ACM4000T-511, ACM4000T-512

Housing Model	Compatible ACM models
ACM2520 	ACM2520-011, ACM2520-012, ACM2520-111, ACM2520-112
ACM2543 	ACM2543-611, ACM2543-612, ACM2543-711, ACM2543-712
ACM4509 	ACM4509-01111, ACM4509-01212, ACM4509-11111, ACM4509-11212, ACM84000T-01111, ACM84000T-01212, ACM84000T-11111, ACM84000T-11212

Housing Model	Compatible ACM models
ACM4520 	ACM4520-01111, ACM4520-01212, ACM4520-11111, ACM4520-11212

Delivery Kit

The delivery kit for the Module is represented in table below.

Name	Quantity, pcs
Automatic calibration module	1
USB cable	1
Envelope with ACM certificate of calibration and statement of calibration due date	1
Protective housing	1
1. A specific model of Module is selected in the order. 2. The operating manual is not included in the delivery kit , and can be accessed at www.coppermountaintech.com. 3. The protective housing can be ordered separately.	

NOTE Use the protective housing to protect the test port and USB connector of the Module from mechanical influences (see Protective Housing).

Specifications

The specifications of each Module can be found in its datasheet.

Measurement Capabilities

The VNA software controlling the Module features a wide range of functions. They are briefly described below. See the VNA operating manual for more detailed information.

Automatic Calibration

Calibration	Calibration of a test setup (which includes the VNA, cables, and adapters) significantly increases the accuracy of measurements. Calibration allows for correction of errors caused by imperfections in the measurement system: system directivity, source and load match, tracking, and isolation.
Automatic calibration of VNA	The Module enables calibration in one click. The calibration is performed fully automatically, including switching between different module states, their measurements, and calibration coefficients calculation, as the software uses the data stored in the Module memory.
Calibration methods	All Modules support the following calibration methods: • Full one-port calibration. • Full two-port calibration. Four-port Modules support the following additional calibration methods: • Full three-port calibration. • Full four-port calibration.
Full one-port calibration	The method of calibration performed for one-port reflection measurements. It ensures high accuracy.
Full two-port calibration	The method of calibration performed for full S parameter matrix measurement of a two-port DUT. This method is also known

	as SOLT: Short, Open, Load, Thru. It ensures high accuracy.
Full three-port calibration	The method of calibration performed for full S parameter matrix measurement of a three-port DUT. It ensures high accuracy.
Full four-port calibration	The method of calibration performed for full S parameter matrix measurement of a four-port DUT. It ensures high accuracy.
Unknown thru	The usage of a reciprocal two-port device with loss values of no more than 10 dB for full N-port calibration enables correction of VNA parameters for measuring parameters of non-insertion devices. Non-insertion devices are the devices that have same-gender connectors of any type, and different-gender or same-gender connectors of different types. The Module memory stores S-parameters of the thru which are used for calibration coefficients calculation. The said parameters are not applied for the Unknown Thru algorithm.

Characterization

Characterization	Characterization is a table of S-parameters of all the states of the Module switches, stored in its memory. The Module has two memory sections. The first one is write-protected and contains factory characterization. The second memory section allows to store up to three user characterizations. Before calibration, it is possible to select factory characterization or one of the user characterizations.
Factory characterization	Factory characterization is performed during the Module manufacturing. The factory characterization data is stored in the write-protected section of the Module memory.

Automatic Orientation

Orientation	Orientation refers to the Module ports in relation to the test ports of the VNA. While the VNA ports are indicated by numbers, the Module ports are indicated by the letters A, B, C and D.
Orientation method	Manual or automatic orientation method can be selected.
Automatic orientation	For automatic orientation, the VNA software determines the Module orientation each time prior to its calibration or characterization.

Thermal Compensation

Thermal compensation	Thermal compensation is a software function of S-parameters correction based on known temperature dependence data and the temperature sensor data inside the Module. Temperature dependence of each Module with factory characterization is determined during its manufacture and stored in its memory. It is possible to enable or disable thermal compensation function.
Thermal compensation of user characterization	Thermal compensation of user characterization is based on coefficients obtained during the Module manufacture. If the operating frequency range and/or the number of frequency points of the user and factory characterization are not the same, linear interpolation of thermal compensation coefficients is used for user characterization data.

Confidence Check

Confidence check	The confidence check is a test of the current calibration, performed either by the Module, or by any other method. The confidence check features simultaneous indication of attenuator S-parameters measured and stored in the Module memory. Math (division) function for data and memory is used for a detailed comparison.

Automation

Operating modes	The Module is controlled using the USB interface. CMT's VNA software or VISA library must be installed at the controlling PC. The VISA comprehensive library allows controlling measurement equipment in almost all programming languages, i.e. C/C++, Visual Basic, MATLAB, LabVIEW, etc. The Module features the USBTMC USB488 standard control protocol. The Programming Manual includes descriptions of commands used for controlling.

Principle of Operation

The Module contains several different transmission and reflection impedance states, as well as electronic changeover switches, two or four RF connectors, and a USB connector. RF connectors are intended for connecting to VNA test ports, and a USB connector is intended for controlling.

Module	States
ACM2506, ACM2509, ACM2708, ACM4000T, ACM6000T	6 reflection states (three for each port), a THRU, and an attenuator.
ACM2520	8 reflection states (four for each port), a THRU, and an attenuator.
ACM2543, ACM8000T	10 reflection states (five for each port), a THRU, and an attenuator.
ACM4509, ACM8400T	16 reflection states (four for each port), a THRU, and an attenuator.
ACM4520	12 reflection states (three for each port), a THRU, and an attenuator.

Calibration is performed by automatically connecting internal transmission and reflection impedance states to the VNA test ports.

Calibration allows determining systematic errors according to the VNA model. The data obtained after calibration is used to correct S-parameter measurement results to increase measurement accuracy.

Block diagrams of Modules are represented in Module Block Diagrams.

Types of Calibration Standards

Calibration standards are physical devices with known parameters used for VNA calibration, with the purpose of calculating systematic errors and further correcting the measurement results.

OPEN, SHORT, and LOAD are the reflection standards, and THRU is the transmission standard (transmission connection).

The Module includes four types of calibration standards:

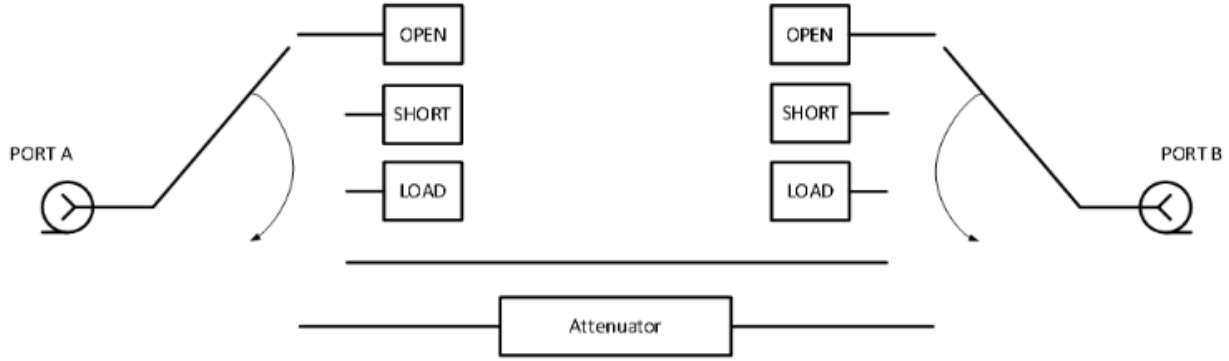
- OPEN
- SHORT
- LOAD
- THRU

Attenuator

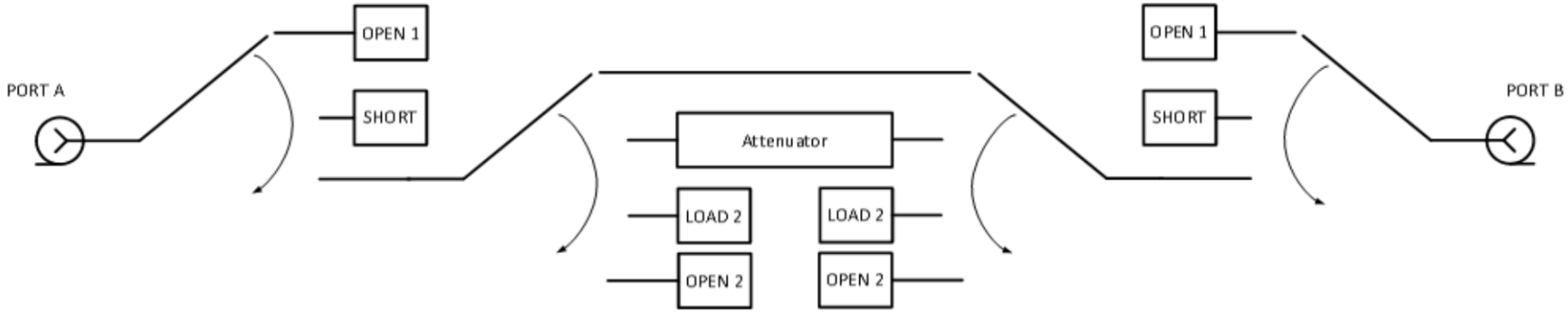
The Module features additional attenuator state, which is not used during calibration. The attenuator is used for checking calibration quality using a special confidence check function, which allows for comparing of the measured S-parameters of attenuator with the parameters stored in the Module memory.

Module Block Diagrams

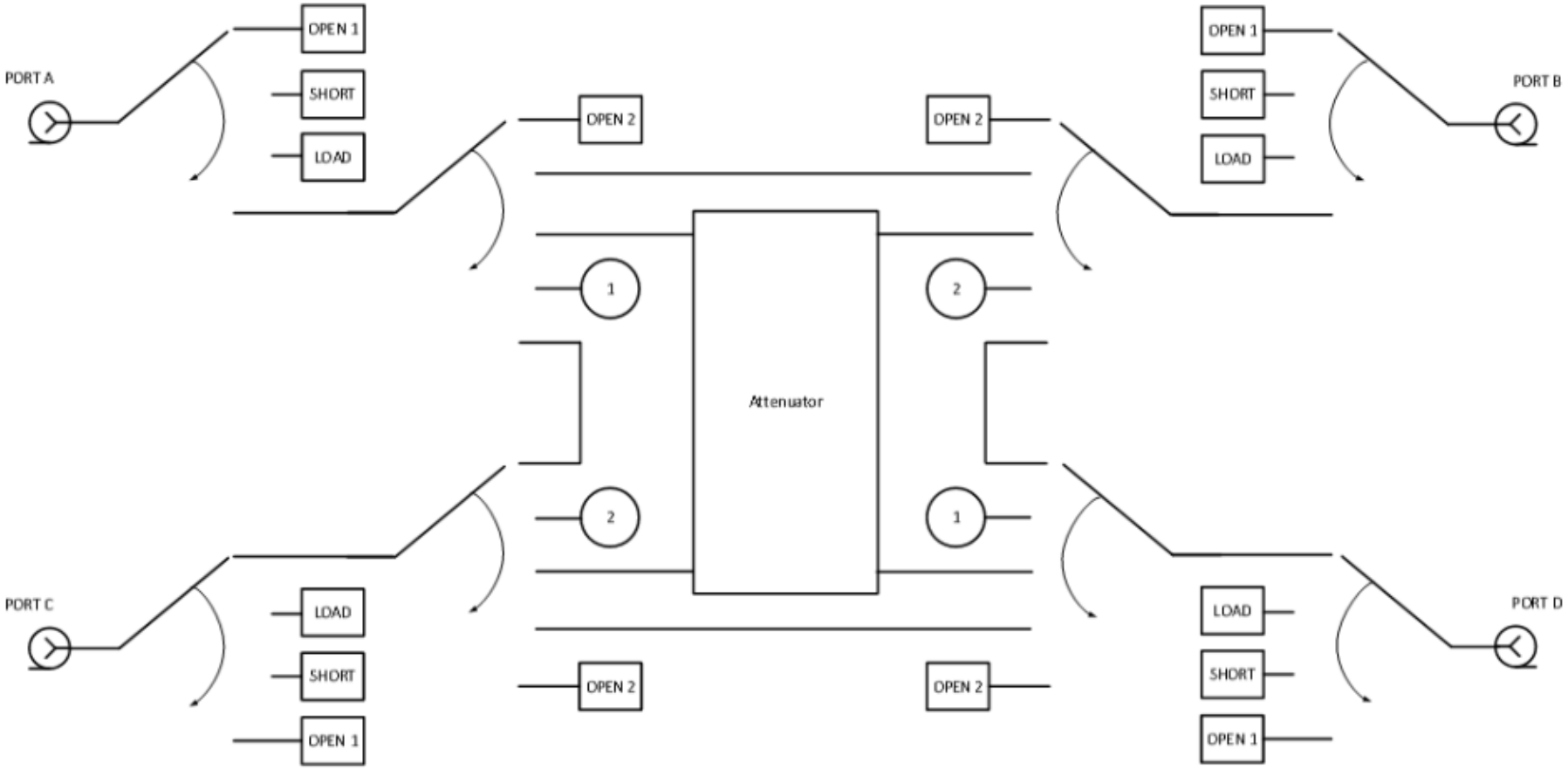
Module block diagrams are shown in figures below.



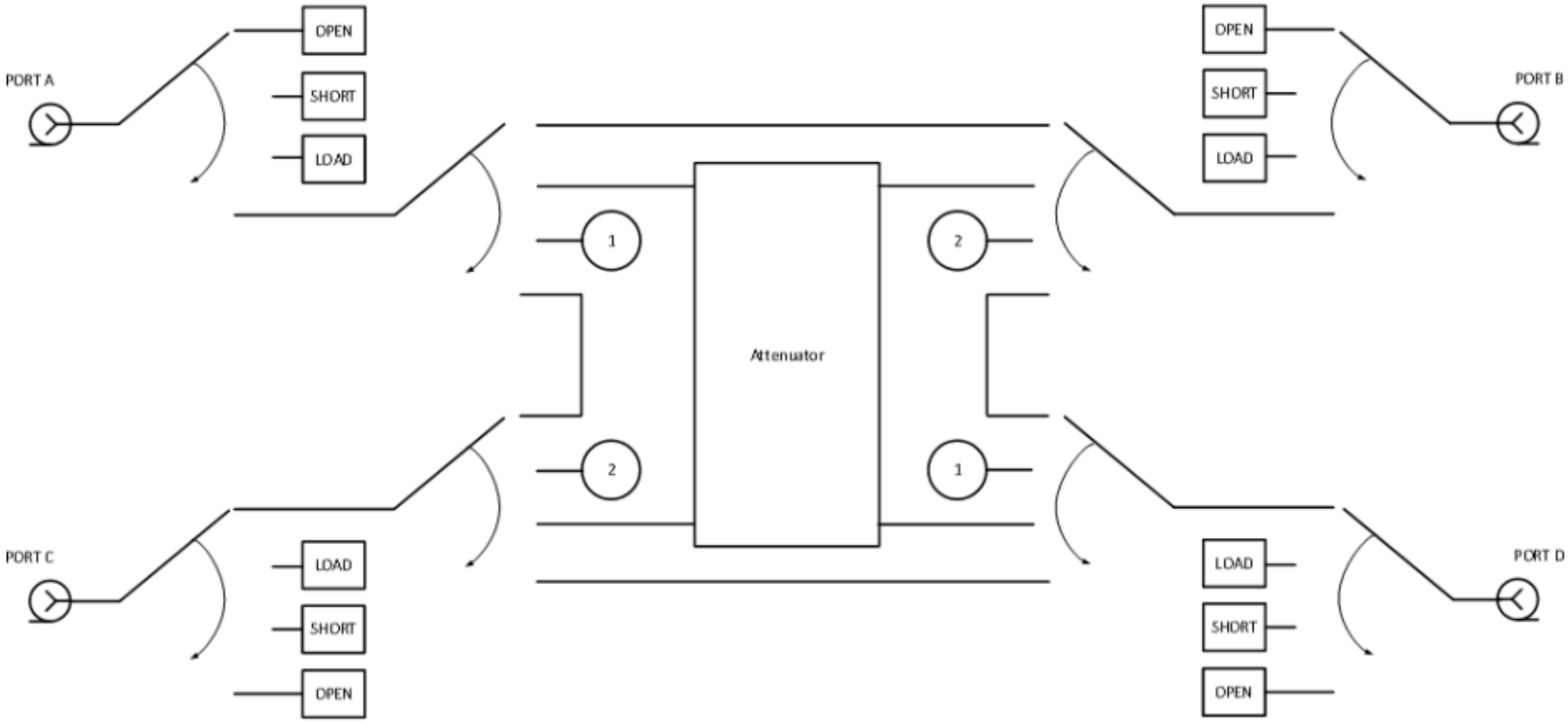
Block diagram of ACM2506 and ACM2509



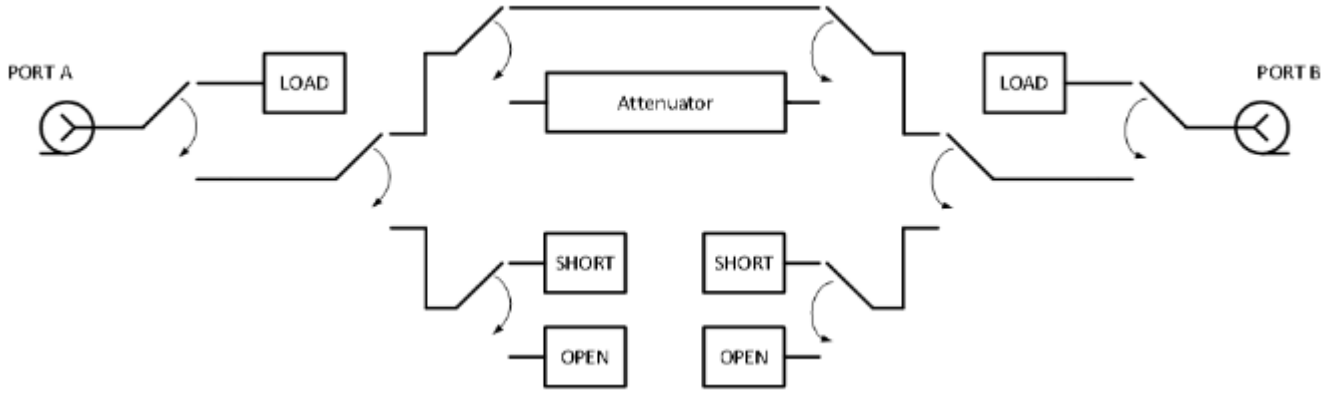
Block diagram of ACM2520



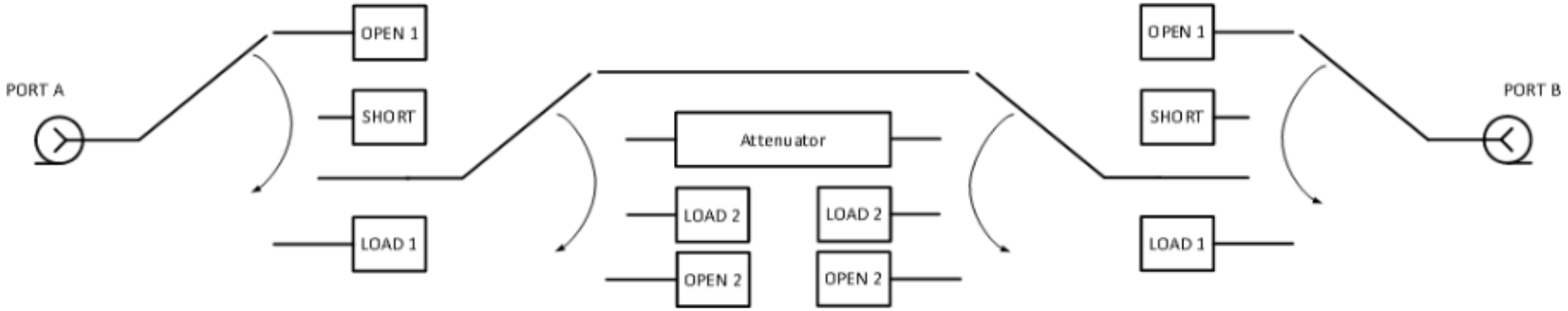
Block diagram of ACM4509 and ACM8400T



Block diagram of ACM4520



Block diagram of ACM2708, ACM4000T and ACM6000T



Block diagram of ACM8000T and ACM2543

Preparation for Use

Unpack the Module and other accessories.

CAUTION	Please keep packaging to safely ship the instrument for annual calibration!

The following section describes the process of preparing the ACM for use:

- Operating Restrictions.
- Installation.
- Software.

Operating Restrictions

The accuracy of calibration using the Module largely depends on proper handling of the Module while preparing it for use. Keep all connectors clean and undamaged to increase the Module's service life. Dirty or damaged connector can deteriorate accuracy characteristics and materially affect the VNA calibration results.

Before starting operation, perform the following activities to prevent the Module damage:

- Visually inspect the connectors, the Module housing, and the USB cable from the delivery kit for damages and contamination. If foreign particles are detected on the connectors, perform cleaning according to the procedure in Cleaning Connectors. Do not operate the Module if mechanical connector damage is detected. Damaged Modules should be discarded to prevent further damage of other good connectors.
- Visually inspect the connectors, which will be connected to the Module, for damages and contamination. If foreign particles are detected on the connectors, perform cleaning according to the procedure in Cleaning Connectors.
- If necessary, gauge the connectors using the procedure described in Gauging Connectors, which describes connection of the Module and devices connected to it.

Pay special attention to the connection sequence. Proper connection sequence prevents central and external conductors damage, ensures maximum measurement results repeatability, and excludes the most common VNA measurement error, i.e. bad connection. The recommended connection sequence is shown in Connecting and Disconnecting Devices.

The main cause of measurement accuracy deterioration is the change of ambient conditions between the calibration and DUT measurement. The ambient conditions are described in Ambient Conditions Control.

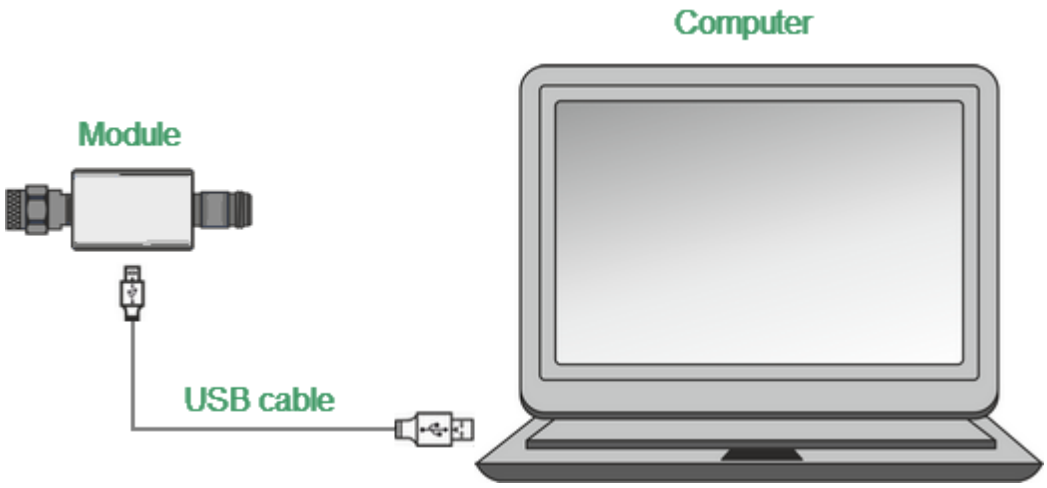
Installation

Unpack the Module and place the Module in the work area.

Take necessary precautions to protect against electrostatic discharge in the work area.

Keep the Module in operating conditions for no less than two hours if it was stored in any other ambient conditions.

Connect the Module using the USB cable. Warm the Module up for no less than 15 minutes. The warm-up connection procedure is shown in the figure below.



Module Connection to PC

Typical Module connection diagrams for VNA calibration are shown in Connection Diagrams.

Software

The Module is controlled by the Copper Mountain Technologies VNA software. Minimum technical requirements to the PC and the description of software installation are described in the VNA Operating Manual.

The VNA software automatically detects the connected Module and makes the Autocalibration menu available. Special Module selection is not generally required.

If the menu is not active:

1. Shut down all the open VNA software windows.
2. Disconnect the Module from the USB cable for one minute, then reinsert the cable.
3. Restart the VNA software, making sure that the VNA software functions properly according to the VNA Operating Manual.
4. Connect the Module again, making sure that the model and serial number match the Module connected.

Driver Installation

The USB driver is automatically installed when the Module is first connected to the USB port.

Operation Procedure

This section describes how to work with the Module:

- Connection diagrams to perform calibration.
- Module work session.
- Parameters setting.

Connection Diagrams

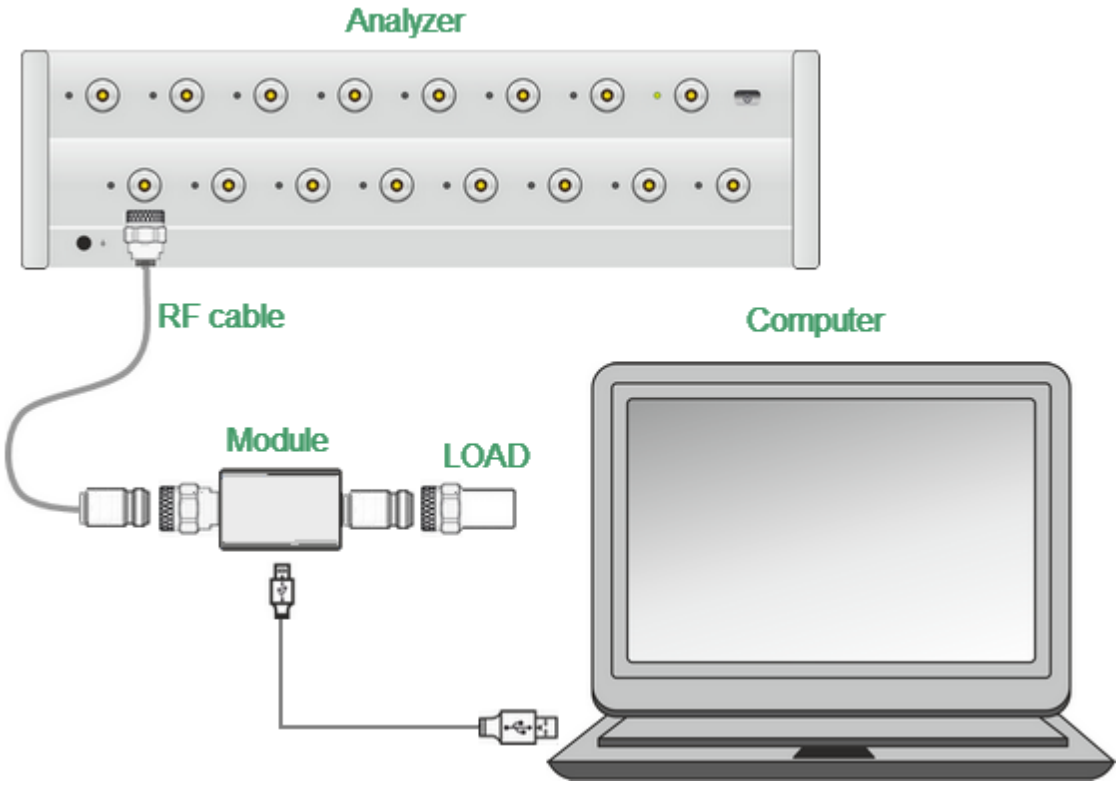
The following are connection diagrams for calibrations:

- Full One-Port Calibration
- Full Two-Port Calibration
- Full Three-Port Calibration
- Full Four-Port Calibration

Full One-Port Calibration

In order to perform calibration, it is recommended to connect a LOAD to a free port of the Module. The LOAD is not included in the delivery kit.

Typical connection diagram for full one-port calibration is shown in figure below.



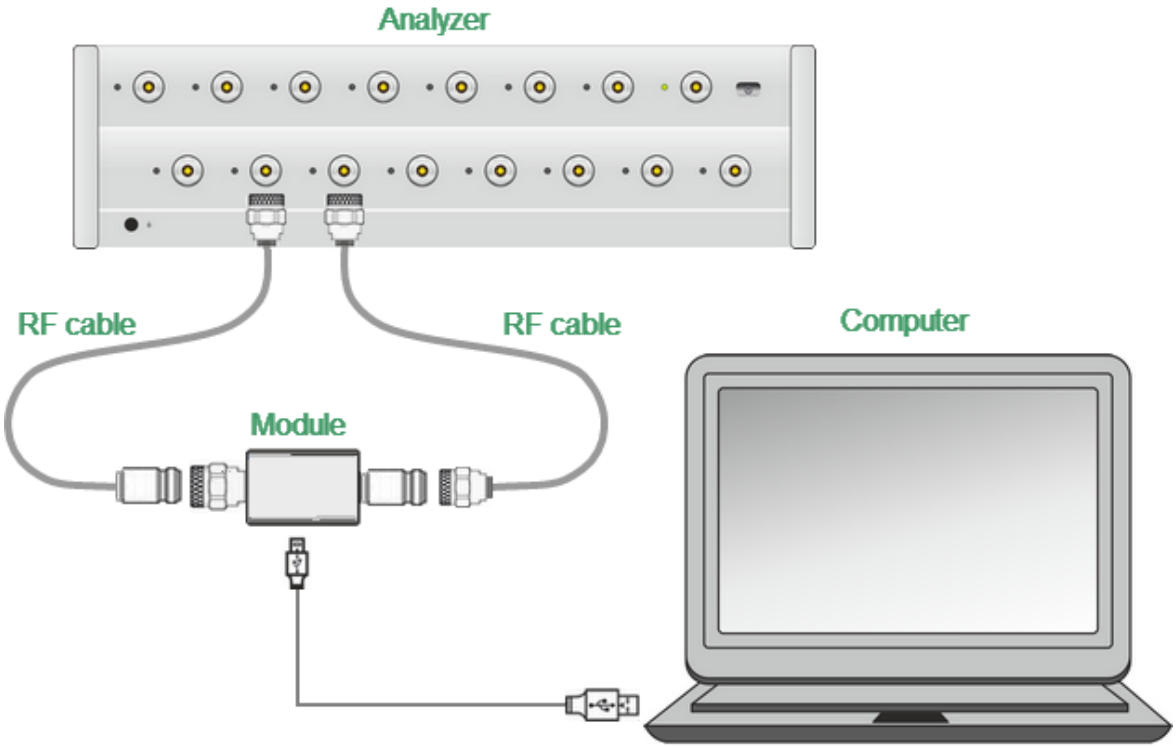
Module Connection Diagram for Performing Full One-port Calibration

To prevent the cable from damage and improve the stability, it is recommended to use additional protection metrology-grade adapters (these adapters are not shown in figure).

WARNING	Use a torque wrench to tighten the male connector nut. Use a spanner to prevent the connected devices from rotation.

Full Two-Port Calibration

Typical connection diagram for full two-port calibration is shown in figure below.



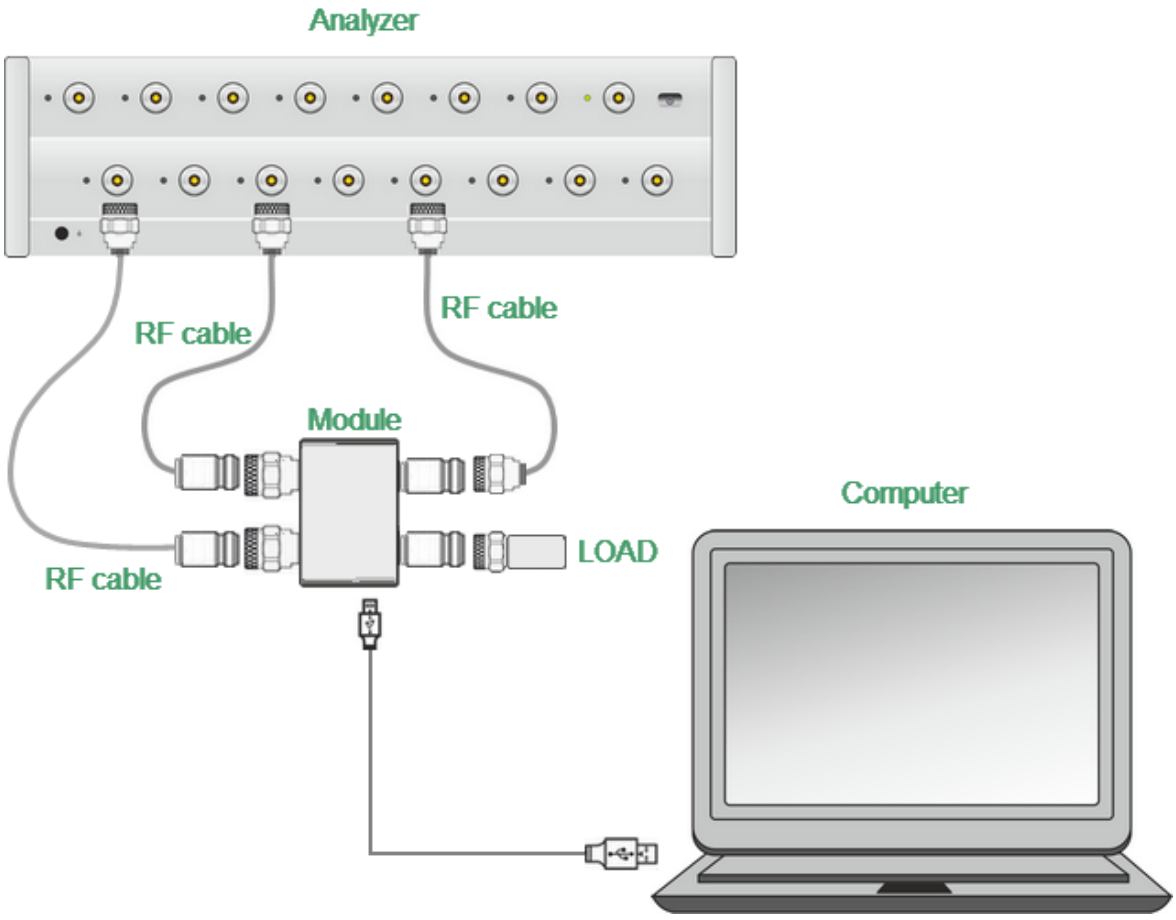
Module Connection Diagram for Performing Full Two-port Calibration

To prevent the cable from damage and improve the stability, it is recommended to use additional protection metrology-grade adapters (these adapters are not shown in figure).

WARNING	Use a torque wrench to tighten the male connector nut. Use a spanner to prevent the connected devices from rotation.

Full Three-Port Calibration

In order to perform calibration, connect a LOAD to a free port of the Module. A typical connection diagram for performing full three-port calibration is shown in the figure below.



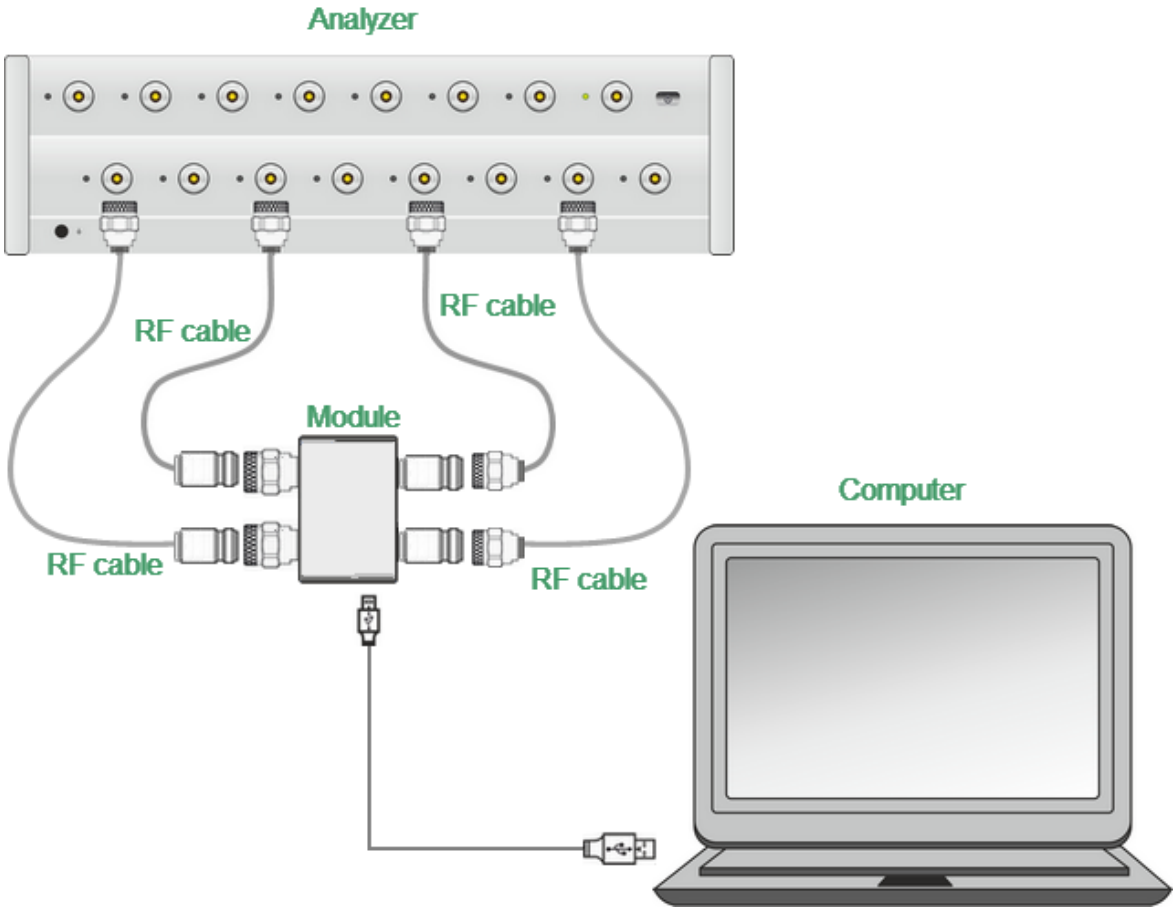
Module Connection Diagram for Performing Full Three-port Calibration

To prevent the cable from damage and improve the stability, it is recommended to use additional protection metrology-grade adapters (these adapters are not shown in figure).

WARNING	Use a torque wrench to tighten the male connector nut. Use a spanner to prevent the connected devices from rotation.

Full Four-Port Calibration

A typical connection diagram for performing full four-port calibration is shown in the figure below.



Module Connection Diagram for Performing Full Four-port Calibration

To prevent the cable from damage and improve the stability, it is recommended to use additional protection metrology-grade adapters (these adapters are not shown in figure).

WARNING	Use a torque wrench to tighten the male connector nut. Use a spanner to prevent the connected devices from rotation.

Module Work Session

This section includes the example of the Module work session. Perform the following activities to calibrate all types of VNAs:

- Locate the Module at the work site and warm it up for at least 15 minutes.
- Set up the VNA parameters, at which calibration and DUT parameters measurement will be performed.
- Assemble a test setup.
- Connect the Module (typical connection diagrams are shown in Connection Diagrams).
- Perform the required calibration.
- Disconnect the Module and connect the DUT in its place.

Module Preparation for Calibration

Locate the Module on the work bench, switch it on, and warm it up for at least the period of time indicated in the datasheet. If the model used is equipped with an LED status indicator, wait until the LED is green.

WARNING	The technical specifications will correspond to the stated specifications only after the operating mode setup time is over.

Module readiness indication	The VNA software can automatically detect the connected Module. After the Module connection, the VNA software makes the Autocalibration menu available.

Parameters Setting

Before starting measurements and calibration, set up the following VNA parameters:

- Set up default parameters.
- Select the traces and assign measured S-parameters to them.
- Set up the frequency range and the number of frequency points.
- Set up the output power level at no more than -5 dBm.
- Set up the IF bandwidth.

These parameters are set up in the VNA software. The setting procedure is described in detail in the VNA Operating Manual.

Calibration

The following section describes the process of calibrating ACMs.

Module Advantages

Calibration involving the Module has several advantages compared to conventional calibration with a kit of mechanical calibration standards:

- Only one connection required.
- Reduced calibration time.
- Less probability of operator’s mistakes.
- Less wear of VNA test ports connectors.

Measurement Errors

Different measurement errors affect the results of VNA S-parameter measurements. The measurement errors can be divided into two categories:

- Systematic errors.
- Random errors.

Random errors are:

- Noise fluctuations and thermal drift in electronic components.
- Changes in the mechanical dimensions of cables and connectors subject to temperature drift.
- Repeatability of connections and cable bends.

Random errors are unpredictable and hence cannot be estimated and eliminated in calibration. Certain measures can be taken to reduce the random error:

- Proper source power selection.
- Narrower IF bandwidth.
- Constant ambient temperature.
- Proper warm-up time.
- Careful handling of connectors.
- Fewer cable bends after calibration.
- Sage of torque wrench to tighten the male connector nut and spanner to prevent the connected devices from rotation.

Systematic errors occur when the test setup components are not in ideal conditions. They are repeatable, and their characteristics do not change in time. Systematic errors can be calculated, and their value can be reduced mathematically by measurement results correction.

Calibration Types

The Modules enable three types of calibration:

- Full one-port calibration
- Full two-port calibration

Four-port Modules additionally enable two types of calibration:

- Full three-port calibration
- Full four-port calibration

The calibration procedure is described in Calibration Procedure.

Full One-Port Calibration

The three calibration standards are measured in the process of this calibration:

- SHORT
- OPEN
- LOAD

Full one-port calibration features high accuracy.

Full Two-Port Calibration

Full two-port calibration requires connection of seven calibration standards:

- Two OPEN calibration standards.
- Two SHORT calibration standards.
- Two LOAD calibration standards.
- One two-port THRU calibration standard.

This calibration type combines two one-port calibrations for each test port with the measurement of transmission and reflection of a THRU standard in both directions.

Full two-port calibration features high accuracy.

Full Three-Port Calibration

Full three-port calibration requires the connection of 12 calibration standards. It combines full one-port calibrations for each test port with measurement of transmission and reflection of a THRU standard in both directions for each couple of ports.

Full three-port calibration features high accuracy for three-port measurements.

Full Four-Port Calibration

Full four-port calibration requires the connection of 18 calibration standards. It combines full one-port calibrations for each test port with measurement of transmission and reflection of a THRU standard in both directions for each couple of ports.

Full three-port calibration features high accuracy for four-port measurements.

Unknown Thru

UNKNOWN THRU is used in full two-port calibration. The calibration type with an UNKNOWN THRU is called SOLR, which refers to Short, Open, Load, Reciprocal.

Any arbitrary reciprocal two-port device with unknown parameters can be used as an UNKNOWN THRU.

There are two basic requirements to the UNKNOWN THRU:

- The first requirement applies to the transmission coefficient of the THRU. It should satisfy the reciprocity condition (S21 = S12), which holds for almost any passive network. Do not use a THRU with a loss higher than 20 dB, as it can reduce the calibration accuracy.
- The second requirement is knowledge of the approximate electrical length of the UNKNOWN THRU within an accuracy of 1/4 of the wavelength at the maximum calibration frequency. This requirement, however, can be omitted if the following frequency step size condition is met:

$$\Delta F < \frac{1}{4 \cdot \tau_0},$$

where τ_0 is a delay of reciprocal two-port device.

In this case, the VNA software can automatically determine electrical length (delay) of a reciprocal two-port device.

A thru, implemented inside the Module using an electronic switch, features loss. Make sure the exact thru parameters are known, or use an UNKNOWN THRU algorithm to obtain the required calibration accuracy.

The Module allows the use of both variants. Its memory stores S-parameters of the thru, which are used for calculation of calibration coefficients. The above parameters are not used if the UNKNOWN THRU algorithm is applied.

Thermal Compensation

Thermal compensation is a software function of the Module parameters correction using the data of internal temperature sensor and data on temperature dependence.

The Module temperature dependence data are the thermal compensation coefficients of magnitude and phase of reflection or transmission coefficients for different Module states stored in its memory.

The compensated magnitude value M_c, dB, is calculated using the following formula:

$$M_c = M \cdot k_m \cdot (T_{char} - T)$$

where M — magnitude before compensation, dB,

k_m — thermal compensation coefficient magnitude, dB/ºC,

T_{char} — temperature at Module characterization, ºC,

T — current temperature inside the Module housing, ºC.

Compensated phase value, P_cº , is calculated using the following formula:

$$P_c = P \cdot k_p \cdot (T_{char} - T) \ ,$$

where P — phase value before compensation, º

k_p — thermal compensation coefficient phase, º/ºC,

T_{char} — temperature at Module characterization, ºC,

T — current temperature inside the Module housing, ºC,

Temperature dependence of S-parameters of each Module is measured at the factory and stored in its memory.

Thermal compensation can be applied to the factory or user characterization data.

The thermal compensation function can be enabled or disabled.

Calibration Procedure

Calibration is performed in fully automatic mode.For a description of calibration procedure see Automatic Calibration.

The calibration will be performed automatically: the standards from the Module set will be connected to VNA in sequence under the VNA software control. Then the calibration coefficients table will be calculated and stored in the VNA memory.

When calibration is completed, certain icons will be indicated in the status bars of reflection and transmission coefficients traces:

- **[F1]**, **[F2]**, **[F3]**, **... [F16]** — full one\two\three\...sixteen-port calibration.

Detailed information on calibration using the Module and the names of all softkeys for all VNAs can be found in the VNA Operating and Programming Manual.

Confidence Check

Confidence check is a test of current calibration performed either using the Module or any other method.

The Module features an additional attenuator state that is not used during calibration. The attenuator is intended for checking calibration by means of a special software function, which enables comparison of measured attenuator S-parameters and the values stored in the Module memory.

For a description of Confidence check procedure see Confidence Check Procedure.

Automation

The Module supports remote control using third party software. The control function is implemented by means of USB protocol. The VISA library must be installed on the PC for interaction.

The library allows for controlling of measuring equipment in almost any programming language, i.e. C/C++, Visual Basic, MATLAB, LabVIEW, etc. The VISA laboratory supports multiple interfaces and protocols, including USBTMC-USB488 based protocol implemented in the Module.

For detailed information on control functions, see the VNA Operating and Programming Manual.

Maintenance

This section establishes the procedure and rules of maintenance, enabling constant Module operational readiness.

The purpose of Module maintenance is to control its performance parameters and secure its service life.

Maintenance Procedure

The Maintenance Procedure is as follows:

- Maintenance Activities
- Cleaning Connectors
- Gauging Connectors
- Connecting and Disconnecting Devices
- Cleaning and Care of the Protective Housing
- Ambient Conditions Control
- Verification

Maintenance Activities

The Module maintenance includes the following activities:

- Inspection.
- Functional test.

The inspection should be done every time before and after the Module is used.

The inspection comprises:

- Checking components against the delivery kit list.
- Cleaning dust and dirt from external surfaces of the Module. To clean the Module's external surfaces, use dry or slightly wet cloth. Do not clean the Module inside.
- Cleaning connectors as described in Cleaning Connectors.

Functional test should be carries out once per 100 connections.

The functional test includes:

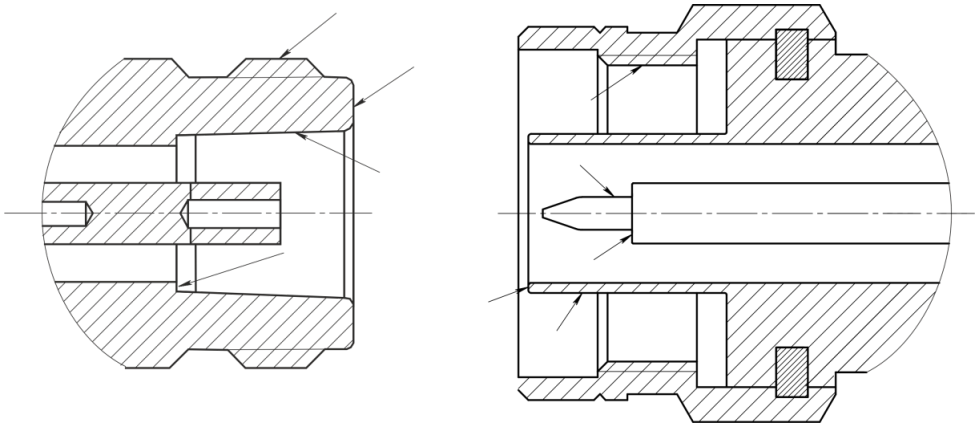
- Inspection.
- Module connectors gauging as described in Gauging Connectors.
- Confidence check.

Cleaning Connectors

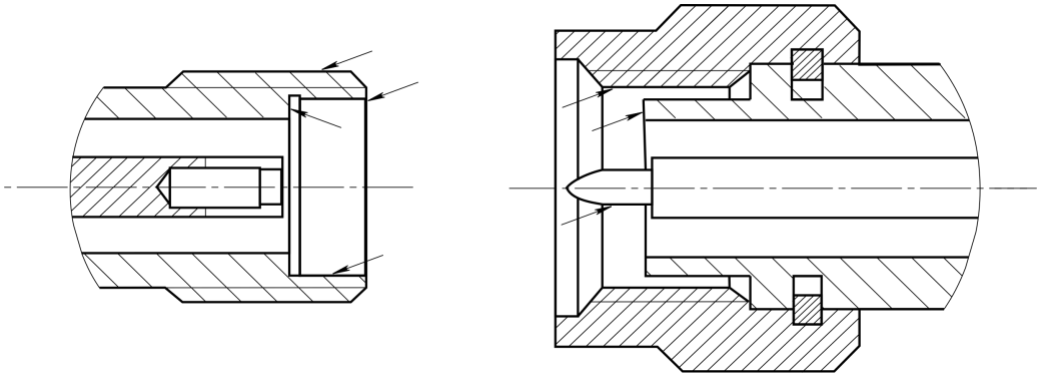
Clean the connectors before and after connecting the Module.

The procedure of cleaning connectors:

1. Wipe the connector surfaces as shown by the arrows in the figures below with a swab dipped in alcohol.



Type N connectors



2.4 mm, 2.92 mm, 3.5 mm connectors

2. Use compressed air to clean another internal connector surface.
3. Let the alcohol dry on the connector surfaces.
4. Visually inspect the connectors to make sure that no particles or residue remain.
5. Repeat the cleaning procedure if necessary.

WARNING

NEVER use metal items for cleaning connectors.

NEVER wipe the center conductors of female connectors. They should be blown with compressed air.

Gauging Connectors

Gauge the connectors before using the Module for the first time, and regularly during operation.

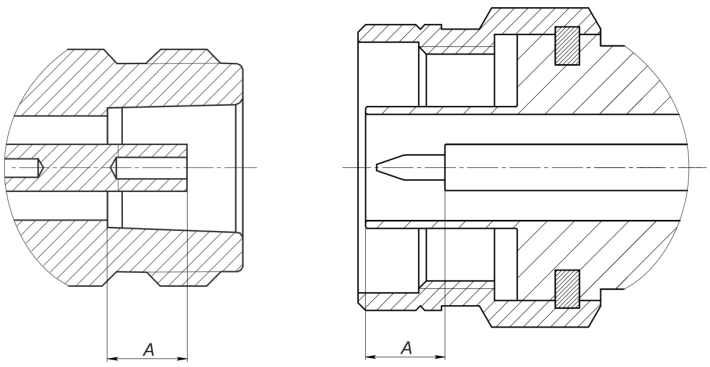
The first gauging of connectors obtains pin depth, which can be used during the Module operation to evaluate its changing.

Gauge the connectors again if:

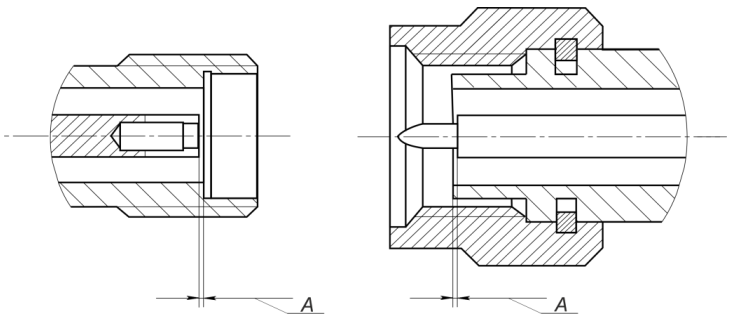
- A visual inspection or Module calibration results suggest that the connector may have defects or damages.
- The device connectors used with the Module are damaged or their pin depth values are out of range for this type of connectors.
- After every 100 connections.

Use gauges for coaxial connectors in compliance with their operating instructions or use multi-purpose tools for linear measurements (for example, micrometer, dial indicator, etc.) to gauge the connectors.

The pin depth of the connectors “PORT A”, “PORT B” and, if available, “PORT C” and “PORT D” are subject to verification. Only measure the A pin depth of type N connectors and 3.5 mm connectors (See figures below).



Type N connectors (female and male)



2.4 mm, 2.92 mm, 3.5 mm connectors (female and male)

The A pin depth value of Module ports connectors must be within the following ranges:

Connectors type	Pin depth range
Type N, female	5.18 to 5.26 mm
Type N, male	5.28 to 5.36 mm
2.4 mm, 2.92 mm, 3.5 mm, male	- 0.08 to 0.00 mm
2.4 mm, 2.92 mm, 3.5 mm, female	- 0.08 to 0.00 mm

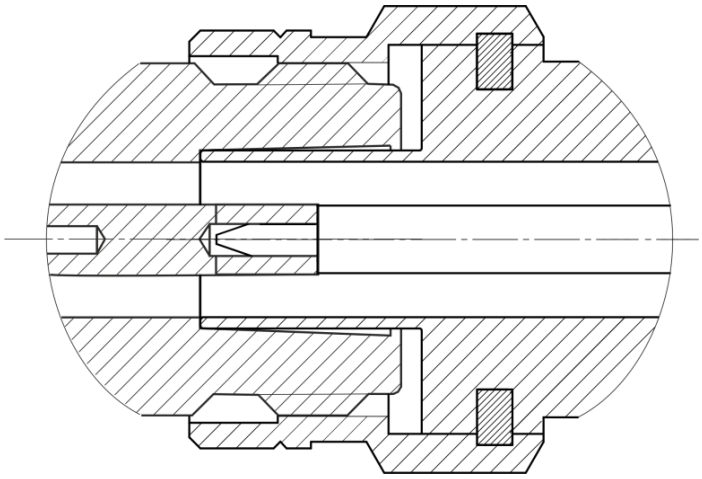
The A pin depth value ranges for connectors of other devices are be indicated in their operating manuals.

WARNING If the pin depth values of the gauged connectors are out of the specified range, such connectors are subject to repair (See Routine Repairs). A device with such connectors is discarded.

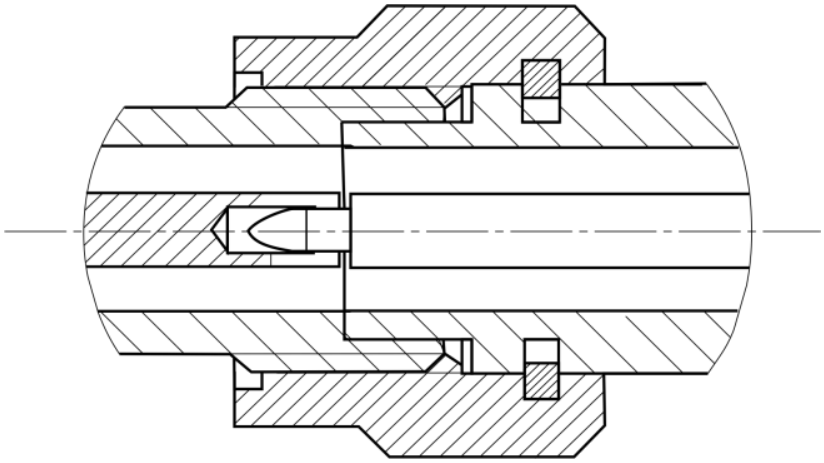
Connecting and Disconnecting Devices

The Module connectors should be connected in the following order:

1. Fix the housing of one of the devices being connected. This is necessary to avoid its displacement during connection. Fix the device by any of the following ways:
    - By clamps or wrenches.
    - By weight or configuration of the device itself.
    - By holding the device by hand
2. Carefully align the connectors of the connected devices.
3. While holding the device being connected, tighten the male connector nut finger tight. Mating plane surfaces of center conductors and outer conductors have to make uniform light contact as shown in the figures below.
4. Tighten the male connector nut using the appropriate torque wrench (the torque value depends on the connector type), while holding the device being connected manually or by using an open-end wrench to keep it from turning. Finally, tighten the male connector nut by holding the wrench at the end of the handle. Tighten the connection just to the torque wrench break point.



Type N connectors (female on the left, male on the right)



2.4 mm, 2.92 mm, 3.5 mm connectors (female on the left, male on the right)

Disconnect the connectors in the following order:

1. Using the torque wrench, which was used for tightening, loosen the male connector nut, while holding the device by hand or an open-end wrench to prevent it from turning.

2. While holding the device so that the connector's center conductor was at the same straight line as it was connected, turn the male connector nut. Pull the connectors straight apart.

WARNING Do not use alcohol, alkali, or acid for cleaning.

Cleaning and Care of the Protective Housing

The protective housing is not intended for use in extreme environments. Do not bend or stretch the protective housing during use.

Clean the protective housing with a lint-free cloth, slightly dampened with water. Clean the protective housing when it is disassembled.

WARNING Do not use alcohol, alkali, or acid for cleaning.

Ambient Conditions Control

The measurement accuracy can be severely affected by the change of environmental conditions (especially ambient temperature) between the VNA calibration and the DUT measurements.

The measurements should be performed at an ambient temperature within ±1 °C of the temperature at the time VNA calibration.

Verification

Copper Mountain Technologies recommends following the industry's best practices and user quality policies to determine the ACM verification period. Consider frequency of use, environmental conditions, and storage procedures. The suggested verification interval is 1-3 years.

Routine Repairs

Only authorized routine repair or repair by the licensed company is permitted. The repair method is non-differential.

Routine repairs	Repairs performed to enable or restore the device performance, which includes replacement and/or recovery of separate parts.
Non-differential method	The method of repairs at which the restored constituent parts do not belong to the specific device instance.

Storage Instructions

Module can be stored in the factory packaging at -50 to +70 ºC (-58 °F to 158 °F), a relative humidity of 90% at 25 ºC (77 °F). After the Module has been removed from the factory packaging and while being used, it should be stored at a temperature from+5 ºC to+40 ºC and relative humidity up to 90% at 25 ºC (1 °F to 104 °F).

Keep the storage facilities free from dust, fumes of acids and alkalis, aggressive gases, and other chemicals, which can cause corrosion.

Transportation

Load and unload the Module packages carefully, avoiding shock and packaging damage. Use the markings on the package to place the Modules correctly during transportation.

The Modules must be shipped in any closed vehicle at temperature from -50 to +70 ºC (-58 °F to 158 °F), a relative humidity of 90% at 25 ºC (77 °F).

The Modules can be shipped in packages in conditions excluding any exposure to mechanical or package damage during transportation.

Cargo holds, railway cars, containers, and truck beds, utilized for shipment of the Module should be free from any traces of cement, coal, chemicals, etc. When shipped by air, the products should be kept in aircraft sealed compartments.

Instruction for Use of the Protective Housing

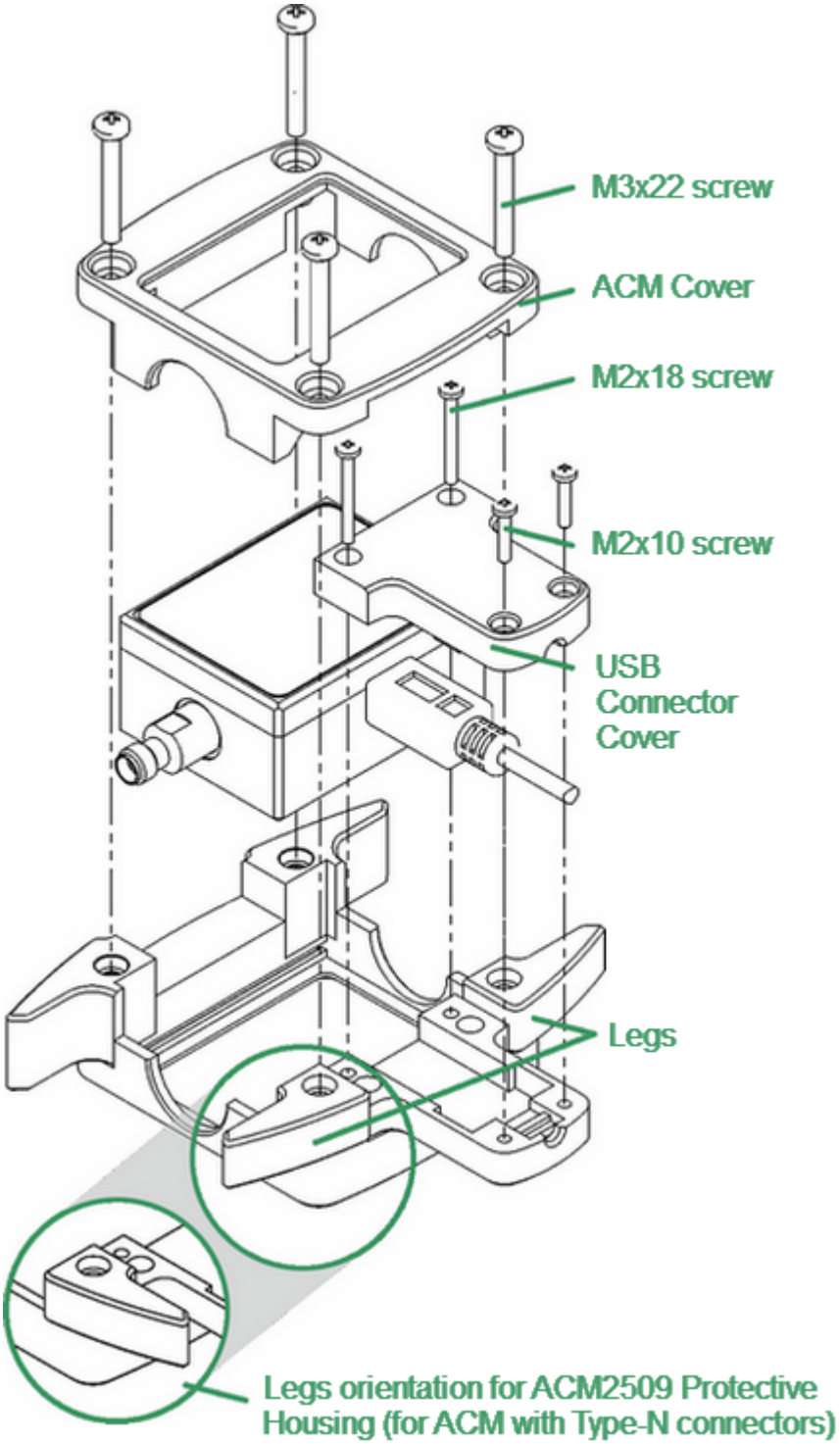
Procedure for installing (removing) the protective housing:

1. Unscrew using a PH1(PZ1) screwdriver:
   - 4 pcs. M3×22 screws on the ACM cover. Remove the ACM cover (See figure below).
   - 2 pcs. M2×18 screws and 2pcs. M2×10 screws on the USB connector cover. Remove the cover.
2. Install (remove) the ACM with the USB cable plugged in. The USB cable must be disconnected from the computer. The orientation of the instrument and the legs of the housing must comply with the figure below.

NOTE	For the ACM2509, turn the legs over for convenient wrench access to the Type-N connectors.

3. Install the USB connector cover, then the ACM cover, using the same screws.

NOTE	The head of the screw should be slightly recessed. Tighten without using force, making sure not to allow the material to bulge on opposite side.



Example of Housing Installation (for ACM2509-011)

Glossary

Prefixes

µ	micro (10^{-6})
m	milli (10^{-3})
k	kilo (10^{3})
M	Mega (10^{6})
G	Giga (10^{9})

Number / Symbols

Ω	ohm
dB	decibel
dBm	decibels above 1 milliwatt
W	Watt
F	Farad
H	Henry
Hz	Hertz
m	meter
sec	second
V	Volt

ACM	Automatic Calibration Module
CMT	Copper Mountain Technologies
CW	Continuous Wave
DC	Direct Current
DSP	Digital Signal Processor
DUT	Device Under Test
IF	Intermediate Frequency
LED	Light-emitting diode
PC	Personal Computer
RF	Radio Frequency
SCPI	Standard Commands for Programmable Instruments
S-parameters	Scattering parameters of linear electrical network
SOLT	Short-Open-Load-Through Calibration
SWR	Standing Wave Ratio
USB	Universal Serial Bus
VNA	Vector Network Analyzer

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