



TECHNICAL  
OVERVIEW

# P93xxB Streamline Series Vector Network Analyzer (VNA)

Compact Form. Zero Compromise.

## Keysight Streamline Series VNA

The freedom of portable network analysis doesn't have to mean a compromise in performance. P93xxB Series is an affordable vector network analyzer (VNA) which dramatically reduces your size of test. The VNA is packaged in a compact chassis and controlled by an external computer with powerful data processing capabilities and functionalities. P93xxB provides excellent performance in general-purpose network analysis for passive components. With software applications like enhanced time domain analysis with TDR and automatic fixture removal, you can easily characterize passive components with the same performance of a benchtop setup. Choose from 2-port P937xB models up to 44 GHz or 4-port P938xB models up to 20 GHz.



The Streamline Series VNA utilizes the same measurement science as other Keysight VNAs such as the PNA, ENA and PXI VNA. A common software platform makes it easy to choose the right level of performance to match budget and measurement needs. This commonality guarantees measurement consistency, repeatability, and a common remote-programming interface across multiple instruments in R&D and manufacturing.

### Why choose P93xxB Streamline Series VNA?

- Most compact VNA for easy sharing between test locations
- Weights less than 2 kg (2-port models)
- Wide choice of frequency ranges up to 44 GHz
- Ability to extend the number of test ports (max 8-ports)
- Measurements, automate code compatibilities, calibration metrology and intuitive GUI are the same as trusted Keysight VNAs
- No data storage devices for measurements in classified environment
- Support of Electronic Calibration (ECal) modules for easy and quick calibration



**P937xB: 2-port VNA**

- P9370B: 2-port, 9 kHz to 4.5 GHz
- P9371B: 2-port, 9 kHz to 6.5 GHz
- P9372B: 2-port, 9 kHz to 9 GHz
- P9373B: 2-port, 9 kHz to 14 GHz
- P9374B: 2-port, 9 kHz to 20 GHz
- P9375B: 2-port, 100 kHz to 26.5 GHz
- P9377B: 2-port, 100 kHz to 44 GHz



**P938xB: 4-port VNA**

- P9372B: 4-port, 9 kHz to 9 GHz
- P9374B: 4-port, 9 kHz to 20 GHz

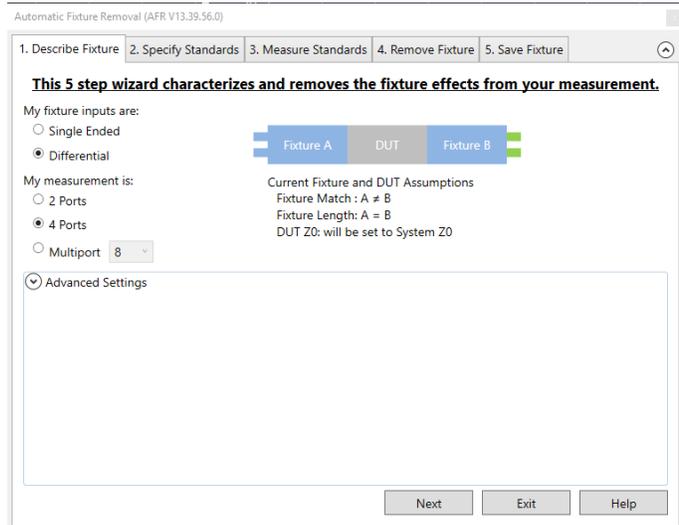
### Choose application software that meets your needs

Software applications for Keysight Streamline Series Vector network analyzer enable you to investigate, characteristic, and troubleshoot your designs in a variety of measurement applications. Features are field-upgradeable and are added via software license keys.

## Automatic fixture removal (S97007B)

Many of today's devices do not have coaxial connectors and are put in fixtures in order to measure them in a coaxial environment. Accurately removing the effects of the fixture is required to get a good measurement of the device under test (DUT). Previously complicated modeling in EM simulation software or multiple calibration standards fabricated on board were needed to characterize and remove a fixture.

Automatic fixture removal (AFR) is the fastest way to de-embed a fixture from the measurement. The application adds a powerful application wizard to guide you through characterizing a fixture and removing it from the measurement. Devices can be single-ended or differential. Files can be saved in a variety of formats for later use in Streamline Series VNA.



## Time domain analysis (S97010B)

This application enables the analyzer to view reflection and transmission responses in time or distance. Use time domain to tune filters, gate out the response of fixtures and cables, characterize the impedance of transmission lines and more.

## Enhanced time domain analysis with TDR (S97011B)

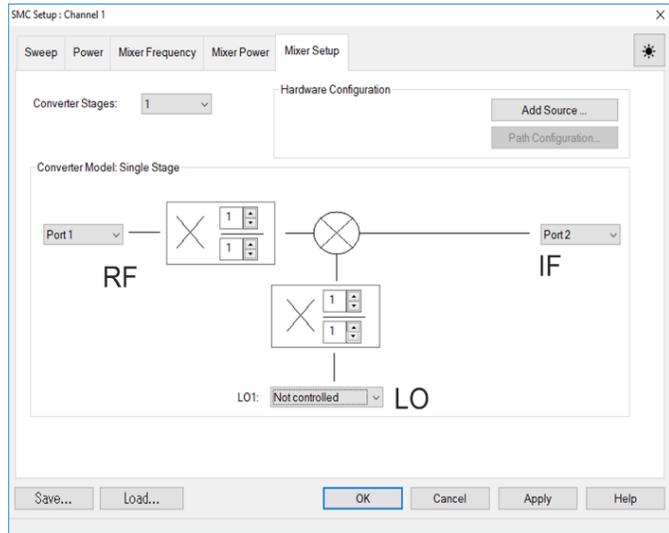
This application enables the analyzer to perform enhanced time domain analysis for high-speed data applications. All functionalities of the S97010B are included (TDR/TDT mode). In addition, the S97011B enables more detailed measurements and evaluations, such as eye-diagram/mask modes. Jitters and/or emphasis/equalization capabilities enables simulation of real-world signals and environment. When used with 44 GHz P9377B, S97011B covers up to 44 GHz bandwidth with 10.2 psec rise time. Full calibration is available and automatic deskew ensures easy removal of fixture and probe effects. To get the best accuracy, mechanical calibration kits or ECal with DC option (i.e. N443xD or N469xD with Option 0DC) are recommended.



## Scalar mixer/converter measurements (S97082B)

The S97082B provides frequency offset mode (FOM) to set the frequency of the VNA's internal source independently from where the receivers are tuned, and to configure external sources.

With a simple setup and calibration, this application delivers the highest accuracy for scalar conversion-loss/gain measurements by combining one-port and power-meter calibrations to remove mismatch errors. S97082B provides an intuitive and easy-to-use user interface for setting up mixer and converter measurements, with single or dual conversion stages. It can control external signal generators for use as LO signals.



## Multiple instrument measurements (S97551B)

Keysight Streamline Series VNA offers a capability to extend the number of ports for your measurements by using up to two VNA instruments. The instruments may be identified as one VNA by the firmware on an external host PC. At least one VNA instrument connected to your PC must have one S97551B license to maintain multiport capabilities with multiple instruments.

Each instrument is connected into the array with Keysight cables. A Y1701A Multiple USB instruments configuration kit must be ordered separately for connection of two 2-port P937xBs with Y1701A Option 002, or two 4-port P938xB with Y1701A Option 002 or 003.



All models of P937xB and P938xB Series can be connected for multiport configurations.

## Multiport calibration assistant (S97552B)

This application software provides a tool to flexibly create and manage cal sets for multiport measurements. For example, two cal sets with independent test ports can be combined as one cal set with a greater number of test ports. The software also offers a way to re-calibrate using a certain set of test ports to refresh the cal set.

At least one ECal module is required for the operation of S97552B.

## Multiport calibrated measurements with switch instruments (S97553B)

This application provides a macro which enables full multiport error correction and measurement capabilities using external switch instruments such as the P9164A/B or P9165A/B USB Solid-state Switch Matrix. The software delivers an easy-to-use measurement wizard that simplifies measurement procedures and reduces the setup time of complicated multiport measurements. Measured multiport S-parameters are displayed in the VNA viewer. Multiport configurations using up to two Streamline Series VNAs and up to two switch matrices are supported.



Only the 4-port ECal modules (i.e. N4431/32/33D) are supported for multiport calibration with the S97553B.

## Vector Network Analyzer (VNA) simulator (S9405xB)

VNA simulator runs on your PC and simulates operations of Keysight's latest VNAs (PNA/ENA/PXI or Streamline Series VNA), eliminating the need for a VNA for your test program development. The simulator has standard and advanced versions. The standard version (S94050B) supports operations of standard S-parameter measurement class. The advanced version (S94051B) gives access to all advanced capabilities with S97xxxB software (ex. enhanced time domain analysis with TDR) except S97007B, S97552B or S97553B software for Streamline Series VNAs.

S9405xB is available on subscription licenses only.

## N1500A Materials measurement suite

N1500A materials measurement suite streamlines the process of measuring complex permittivity and permeability with a vector network analyzer. Various type of measurements, such as transmission line and free space, arch reflectivity, resonant cavity, and coaxial probe are available as options. The easy-to-use software guides the user through setup and measurement, instantly converting S-parameter network analyzer data into the data format of your choice and displaying the results within seconds. Results can be charted in a variety of formats:  $\epsilon_r'$ ,  $\epsilon_r''$ ,  $\tan\delta$ ,  $\mu_r'$ ,  $\mu_r''$ ,  $\tan\delta_\mu$ , and Cole-Cole.

## Configuration in Brief

See the Keysight Streamline Series VNA Configuration Guide ([3121-1254.EN](#)) for complete information of standard configurations, options, accessories, and compatible peripherals.

Model number	Description
<b>Vector Network Analyzer (with Thunderbolt 3 Interface)</b>	
P9370B	Vector network analyzer, 9 kHz to 4.5 GHz, 2-port, 3.5 mm (female)
P9371B	Vector network analyzer, 9 kHz to 6.5 GHz, 2-port, 3.5 mm (female)
P9372B	Vector network analyzer, 9 kHz to 9 GHz, 2-port, 3.5 mm (female)
P9373B	Vector network analyzer, 9 kHz to 14 GHz, 2-port, 3.5 mm (female)
P9374B	Vector network analyzer, 9 kHz to 20 GHz, 2-port, 3.5 mm (female)
P9375B	Vector network analyzer, 100 kHz to 26.5 GHz, 2-port, 3.5 mm (female)
P9377B	Vector network analyzer, 100 kHz to 44 GHz, 2-port, 2.4 mm (female)
P9382B	Vector network analyzer, 9 kHz to 9 GHz, 4-port, 3.5 mm (female)
P9384B	Vector network analyzer, 9 kHz to 20 GHz, 4-port, 3.5 mm (female)
<b>Application Software <sup>1,2</sup></b>	
S97007B	Automatic removal software
S97010B	Time domain analysis
S97011B	Enhanced time domain analysis with TDR
S97082B	Scaler mixer/converter measurements
S97551B	Multiple instruments measurements
S97552B	Multiport calibration assistant
S97553B	Multiport calibrated measurements with switch instruments
S94050B <sup>3</sup>	Vector Network Analyzer (VNA) simulator – Standard
S94051B <sup>3</sup>	Vector Network Analyzer (VNA) simulator – Advanced

1. Node-locked license is the only license type for S97xxxB.
2. Select perpetual license (R-A5C-001-A) + support (ex. R-A6C-001-L), or subscription license and support (ex. R-A4C-001-L).
3. S9405xB runs on your PC and simulates VNA functions without VNA hardware. Perpetual license is not provided for S9405xB (Support license only).

<b>VNA Activation Software <sup>1,2,3,4</sup></b>	
Option 001	VNA activation software

1. VNA activation software enables basic VNA functionalities of P937xB and P938xB Streamline Series VNAs. The software ensures compatibility with newly added features and keeps your instrument up to date.
2. Option 001 for P937xB and P938xB (ex. P9370B-001) includes node-locked, perpetual license of S9724xB-1FP (for P937xB, x = 0 to 5, or 7) or S9725xB-1FP (for P938xB, x = 2 or 4). This option is mandatory at the time of purchase of P937xB and P938xB Streamline Series VNAs.
3. The upgrade product is required to access newly added features of VNA firmware. Order S9724xBU for P937xB (x = 0 to 5, or 7), or S9725xBU for P938xB (x = 2 or 4).
4. Upgrading VNA firmware for bug fixes does not need the S9724xBU/S9725xBU upgrade product.

Accessories for P937xB and P938xB	
Y1700A	Rack mount kit <ul style="list-style-type: none"> <li>• Order Option 001 for 2-port P937xB</li> <li>• Order Option 002 for 4-port P938xB</li> </ul>
Y1701A	Includes interconnect cables for configurations using two VNAs. Add one kit for each additional VNAs. <ul style="list-style-type: none"> <li>• Order Option 002 for P93xxB up to 20 GHz</li> <li>• Order Option 003 for P93xxB greater than 20 GHz.</li> </ul>
Y1701A	Includes Thunderbolt 3 cable assembly with USB Type-C connectors for connection with a host PC. <ul style="list-style-type: none"> <li>• Order Option 400 with one 500-mm cable and one retainer or,</li> <li>• Order Option 401 with one 800-mm cable and one retainer</li> </ul>
Y1710A	Hard transit case <ul style="list-style-type: none"> <li>• Order Option 001 for 2-port P937xB</li> <li>• Order Option 002 for 4-port P938xB</li> </ul>
Y1740A	Cable Assembly <ul style="list-style-type: none"> <li>• Option 100: 3.5 mm (male) to 3.5 mm (male), 26.5 GHz, 36 inch</li> <li>• Option 200: 2.92 mm (male) to 2.92 mm (male), 40 GHz, 36 inch</li> <li>• Option 300: 2.4 mm (male) to 2.4 mm (male), 50 GHz, 36 inch</li> <li>• Option 310: 2.4 mm (male) to 2.92 mm (male), 40 GHz, 36 inch</li> </ul>
Electronic calibration (ECal) modules	
N4690D	Electronic calibration module (ECal), 18 GHz, Type-N, 50 ohm, 2-port <a href="http://www.keysight.com/find/n4690d">http://www.keysight.com/find/n4690d</a>
N4691D	Electronic calibration module (ECal), 26.5 GHz, 3.5 mm, 50 ohm, 2-port <a href="http://www.keysight.com/find/n4691d">http://www.keysight.com/find/n4691d</a>
N4692D	Electronic calibration module (ECal), 40 GHz, 2.92 mm, 50 ohm, 2-port <a href="http://www.keysight.com/find/n4692d">http://www.keysight.com/find/n4692d</a>
N4693D	Electronic calibration module (ECal), 50 GHz, 2.4 mm, 50 ohm, 2-port <a href="http://www.keysight.com/find/n4693d">http://www.keysight.com/find/n4693d</a>
N4431D	Electronic calibration module (ECal), 13.5 GHz, 50 ohm, 4-port <a href="http://www.keysight.com/find/n4431d">http://www.keysight.com/find/n4431d</a>
N4433D	Electronic calibration module (ECal), 26.5 GHz, 50 ohm, 4-port <a href="http://www.keysight.com/find/n4433d">http://www.keysight.com/find/n4433d</a>
N7552A	Economy Electronic calibration module (ECal), 9 GHz, 50 ohm, 2-port <a href="http://www.keysight.com/find/n7552a">http://www.keysight.com/find/n7552a</a>
N7555A	Economy Electronic calibration module (ECal), 26.5 GHz, 50 ohm, 2-port <a href="http://www.keysight.com/find/n7555a">http://www.keysight.com/find/n7555a</a>

## Specifications in Brief

See the Keysight P93xxB Streamline Series VNA Data Sheet ([3121-1235.EN](#)) for the technical specifications and typical performance.

### **Specification (spec)**

Warranted performance. Specifications include guardbands to account for the expected statistical performance distribution, measurement uncertainties, and changes in performance due to environmental conditions. All specifications and characteristics apply over a  $25\text{ °C} \pm 5\text{ °C}$  range (unless otherwise stated) after a 60-minute warm up period. The instrument must be within its calibration cycle.

### **Typical (typ.)**

Expected performance of an average unit at a stable temperature between  $25\text{ °C} \pm 5\text{ °C}$  for 60 minutes prior to turn-on and during operation; does not include guardbands. It is not covered by the product warranty. The instrument must be within its calibration cycle.

Model	P9370 / 71 / 72 / 73 / 74B P9382 / 84B	P9375B / 77B
<b>System dynamic range <sup>1</sup> (spec): 10 Hz IF bandwidth</b>		
At 4 GHz	115 dB	115 dB
At 20 GHz	105 dB	110 dB
At 40 GHz	-	102 dB
<b>Maximum output power (spec)</b>		
At 4 GHz	+8 dBm	+8 dBm
At 20 GHz	+4 dBm	+7 dBm
At 40 GHz	-	+2 dBm
<b>Power sweep range (typ.)</b>		
At 4 GHz	-60 to +7 dBm	-60 to +10 dBm
At 20 GHz	-60 to +7 dBm	-60 to +10 dBm
At 40 GHz	-	-50 to +5 dBm
<b>Test port noise floor <sup>2</sup> (spec)</b>		
At 4 GHz	-107 dBm	-107 dBm
At 20 GHz	-101 dBm	-103 dBm
At 40 GHz	-	-100 dBm
<b>Receiver compression at test port (spec)</b>		
At 4 GHz	0.2 dB (mag) / 5 degree (phase), at +8 dBm input power at test port	0.2 dB (mag) / 5 degree (phase), at +8 dBm input power at test port
At 20 GHz	0.2 dB (mag) / 5 degree (phase), at +4 dBm input power at test port	0.2 dB (mag) / 5 degree (phase), at +8 dBm input power at test port
At 40 GHz	-	0.2 dB (mag) / 5 degree (phase), at +2 dBm input power at test port
<b>Trace noise <sup>3</sup> (spec)</b>		
At 4 GHz	0.0015 dB rms / 0.01 degree rms	0.0018 dB rms / 0.024 degree rms
At 20 GHz	0.003 dB rms / 0.03 degree rms	0.0036 dB rms / 0.032 degree rms
At 40 GHz	-	0.0072 dB rms / 0.048 degree rms
<b>Temperature stability (typ.)</b>		
At 4 GHz	0.005 dB/deg.C (mag) / 0.1 degree/deg.C (phase)	0.005 dB/deg.C (mag) / 0.1 degree/deg.C (phase)
At 20 GHz	0.02 dB/deg.C (mag) / 0.4 degree/deg.C (phase)	0.01 dB/deg.C (mag) / 0.2 degree/deg.C (phase)
At 40 GHz	-	0.03 dB/deg.C (mag) / 0.8 degree/deg.C (phase)
<b>Damage level</b>		
-	+27 dBm or ± 35 VDC (Warranted)	

1. System dynamic range = source maximum output power minus receiver noise floor at 10 Hz IF bandwidth. Does not include crosstalk effects.

2. Noise floor in a 10 Hz IF bandwidth. Measured with 30 kHz IF bandwidth. Test port terminated.

3. Transmission and reflection trace noise in a 10 kHz IF bandwidth for ≥ 10 MHz. At maximum specified power.

## General information

Model	P9370 / 71 / 72 / 73 / 74 / 75 / 77B	P9382 / 82B
<b>Physical size and weight</b>		
Dimension H x W x D	48 x 176 x 333 mm	68 x 176 x 333 mm
Weight	1.88 kg (P9370 to P9374B)	2.82 kg
	2.02 kg (P9375B / 77B)	
<b>External PC system requirements</b>		
Operating systems	Windows 10 (64-bit only) Version 1909 or later	
Available memory	16 GB recommended; 4 GB minimum	
Available disk space	2 GB available disk space minimum	
Available memory	Display resolution	
Connection with VNA	Thunderbolt 3	
Recommended CPU	Intel Core i7 10 <sup>th</sup> Generation or later	
<b>Instrument Drivers</b>		
Keysight IO Libraries	IO Libraries Suite 2021 Update 1 (Release date: 2021-07-23) or later	
<b>Rear panel information</b>		
Thunderbolt 3 Ports	USB Type-C, 2 ports (for connection with a host PC)	
USB Ports	Type A female (USB 2.0 only), 2-ports (for connection with USB peripherals)	

## Resources

Related literatures	Publication number
P93xxB Vector Network Analyzer, Data Sheet	<a href="#">3121-1235.EN</a>
P93xxB Vector Network Analyzer, Configuration Guide	<a href="#">3121-1254.EN</a>
Keysight Vector Network Analyzer, Selection Guide	<a href="#">5989-7603EN</a>
Electronic Calibration (ECal) Modules, Technical Overview	<a href="#">5963-3743E</a>

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