



PicoVNA[®]

Vector Network Analyzer

Quick Start Guide

Distribution in the UK & Ireland



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1. Introduction

Thank you for purchasing a PicoVNA vector network analyzer.

The following models are available:

- **PicoVNA 106:** a 6 GHz two-port VNA with built-in bias-T networks
- **PicoVNA 108:** an 8.5 GHz two-port VNA with built-in bias-T networks, mixer measurements and save on trigger

For further setup information following basic installation, see the *User's Guide* supplied with the PicoVNA 2 [108: PicoVNA 3]* software.

For detailed specifications see the *PicoVNA Data Sheet*.

* Unless otherwise stated, information in this guide applies to all models in the PicoVNA series. Information that applies exclusively to the PicoVNA 108 is written like this: "[108: <information>]".

2. Safety information

To prevent possible electrical shock, fire, personal injury, or damage to the product, carefully read this safety information before attempting to install or use the product. In addition, follow all generally accepted safety practices and procedures for working with and near electricity.

This instrument and its accessories have been designed to meet the requirements of EN 61010-1 (*Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use*).

The following safety descriptions are found throughout this guide:

A **WARNING** identifies conditions or practices that could result in injury or death.

A **CAUTION** identifies conditions or practices that could result in damage to the product or equipment to which it is connected.



WARNING

This product is for professional use by trained and qualified technicians only. To prevent injury or death, use the product only as instructed and use only accessories that have been supplied or recommended by Pico Technology. Protection provided by the product may be impaired if used in a manner not specified by the manufacturer.

2.1 Symbols

These safety and electrical symbols may appear on the product or in this guide.

Symbols	Description
	Earth (ground) terminal
	Chassis terminal
	Possibility of electric shock
	Caution
	Do not dispose of this product as unsorted municipal waste

This terminal can be used to make a measurement ground connection. It is NOT a safety or protective earth.

Appearance on the product indicates a need to read this safety and operation manual.

2.2 Maximum input and output ranges



WARNING

To prevent electric shock, do not attempt to measure or apply signal levels outside the specified maxima below.

The table below indicates the maximum voltage of the outputs and the overvoltage protection range for input on the VNA and its calibration accessories. The overvoltage protection ranges are the maximum voltages that can be applied without damaging the instrument or accessory.

Instrument connectors	Maximum operating voltage (output or input)	Overvoltage or overcurrent protection
Ports 1 and 2	+10 dBm (about 710 mV RMS)	+20 dBm (about 2.2 V RMS)
Bias-Ts 1 and 2	±15 V DC	250 mA
Trigger and reference in		±6 V pk
Trigger and reference out	0 V to +5 V	Do not apply a voltage
Calibration accessory connectors		Overvoltage protection
SOLT-PREM and SOLT-STD ports		+20 dBm
SOLT-AUTO ports A/B		+20 dBm



WARNING

Signals exceeding the voltage limits in the table below are defined as “hazardous live” by EN 61010.

Signal voltage limits of EN 61010-1:2010+A1:2019		
±60 V DC	30 V AC RMS	± 42.4 V pk max.

**WARNING**

To prevent electric shock, take all necessary safety precautions when working on equipment where hazardous live voltages may be present.

**WARNING**

To avoid equipment damage and possible injury, do not operate the instrument or an accessory outside its rated supply voltages or environmental range.

**CAUTION**

Exceeding the overvoltage protection range on any connector can cause permanent damage to the instrument and other connected equipment.

To prevent permanent damage, do not apply an input voltage to the trigger or reference output of the VNA.

2.3 Grounding

**WARNING**

The instrument's or SOLT-AUTO E-Cal module's ground connection through the USB cable is for functional purposes only. The instrument and accessories do not have protective safety grounds.

To prevent injury or death, or permanent damage to the instrument, never connect the ground of an input or output (chassis) to any electrical power source. To prevent personal injury or death, use a voltmeter to check that there is no significant AC or DC voltage between the instrument's ground and the point to which you intend to connect it.

**CAUTION**

To prevent signal degradation caused by poor grounding, always use the high-quality USB cable supplied with the instrument.

2.4 External connections

**WARNING**

To prevent injury or death, use only the power adaptor supplied with the instrument. This is approved for the voltage and plug configuration in your country.

PicoVNA model	USB connection	External power supply		
		Voltage	Current	Total power
PicoVNA 106	USB 2.0 Compatible with USB 3.0	12 to 15 V DC	1.85 A pk	22 W
PicoVNA 108				25 W
SOLT-AUTO E-Cal module		N.A.		



WARNING

Containment of radio frequencies

The instrument contains a swept or CW radio frequency signal source (300 kHz to 6.02 GHz at +6 dBm max. [108: 300 kHz to 8.50 GHz at +6 dBm max.]) The instrument and supplied accessories are designed to contain and not radiate (or be susceptible to) radio frequencies that could interfere with the operation of other equipment or radio control and communications. To prevent injury or death, connect only to appropriately specified connectors, cables, accessories and test devices, and do not connect to an antenna except within approved test facilities or under otherwise controlled conditions.

2.5 Environment



WARNING

This product is suitable for indoor or outdoor use, in dry locations only. The product's external mains power supply is for indoor use only.



WARNING

To prevent injury or death, do not use the VNA or accessory in wet or damp conditions, or near explosive gas or vapor.



CAUTION

To prevent damage, always use and store your VNA or accessory in appropriate environments.

	Storage	Operating
Temperature	-20 °C to +50 °C	+5 °C to +40 °C
Humidity	Up to 80% RH (non-condensing)	
Altitude	2000 m	
Pollution degree	2	



CAUTION

Do not block the air vents at the back of the instrument as overheating will cause damage.

Do not insert any objects through the air vents as internal interference will cause damage.

2.6 Care of the product

The product and accessories contain no user-serviceable parts. Repair, servicing and calibration require specialized test equipment and must only be performed by Pico Technology or an approved service provider. There may be a charge for these services unless covered by the Pico three-year warranty.



WARNING

To prevent injury or death, do not use the VNA or accessory if it appears to be damaged in any way, and stop use immediately if you are concerned by any abnormal behavior.

**CAUTION**

Regularly inspect the instrument and all probes, connectors, cables and accessories before use for signs of damage or contamination.

To prevent damage to the device or connected equipment, do not tamper with or disassemble the instrument, case parts, connectors, or accessories.

When cleaning the product, use a soft cloth and a solution of mild soap or detergent in water, and do not allow liquids to enter the casing of the instrument or accessory.

Take care to avoid mechanical stress or tight bend radii for all connected leads, including all coaxial leads and connectors. Mishandling will cause deformation of sidewalls, and will degrade performance. In particular, note that test port leads should not be formed to tighter than 5 cm (2") bend radius.

To prevent measurement errors and extend the useful life of test leads and accessory connectors, ensure that liquid and particulate contaminants cannot enter. Always fit the dust caps provided and use the correct torque when tightening. Pico recommends: 1 Nm (8.85 inch-lb) for supplied and all stainless steel connectors, or 0.452 Nm (4.0 inch-lb) when a brass or gold-plated connector is interfaced.

3. System requirements

To ensure that the PicoVNA vector network analyzer and PicoVNA software operate correctly, you must use a computer with the system requirements and one of the operating systems shown in the table below.

Processor, memory, free disk space	As required by the operating system
Operating system	Microsoft Windows 7, 8 or 10. 32-bit or 64-bit
Ports	USB 2.0 (also compatible with USB 3.0)
Display resolution	1280 x 720 minimum

4. Contents of your PicoVNA kit

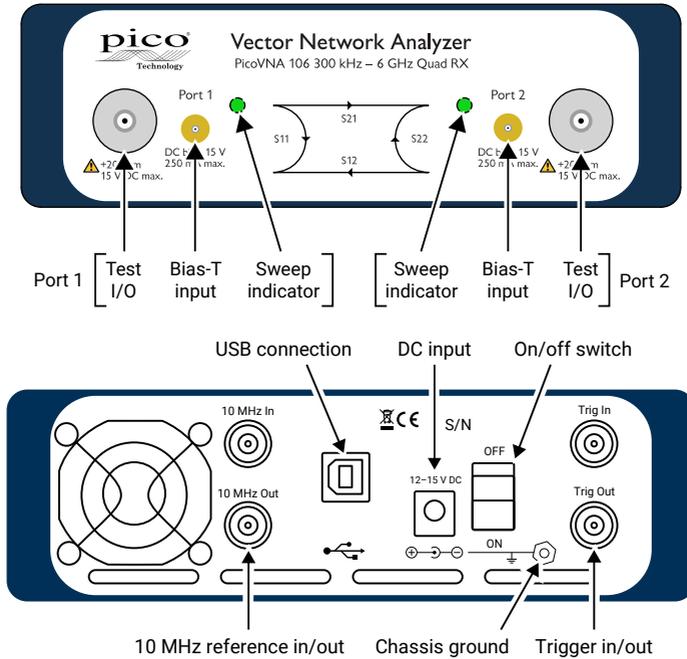
The PicoVNA vector network analyzer kit contains the following items:

- PicoVNA 106 [108: PicoVNA 108] vector network analyzer
- PicoVNA 2 [108: PicoVNA 3] USB flash drive
- DC power supply with four international plug adaptors
- USB 2.0 cable, 1.8 m
- SMA/PC3.5/2.92 and N-type fixed multi-wrench
- Quick Start Guide
- Storage and carry case

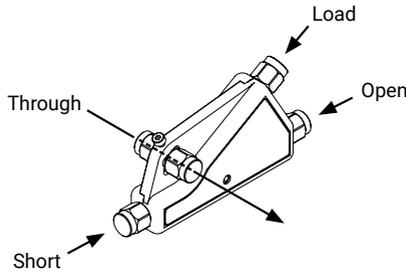
Some product packs may contain additional items. For a full list of all available kits and additional accessories, see the *User's Guide* or visit www.picotech.com.

5. External connections

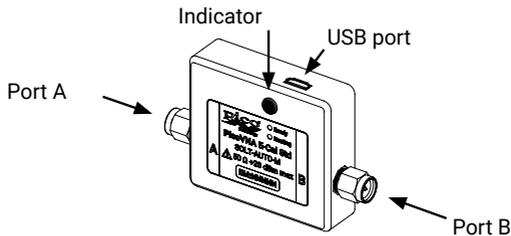
5.1 PicoVNA 106 and 108 vector network analyzers



5.2 SOLT-STD-M/F and SOLT-PREM-M/F manual calibration standards



5.3 SOLT-AUTO-M/F automatic (E-Cal) calibration standards



6. Installing the PicoVNA vector network analyzer

6.1 Installing the software

1. Obtain the PicoVNA 2 [108: PicoVNA 3] software installer from the USB flash drive supplied with your VNA or from:
www.picotech.com/downloads.
2. Run the installer (right-click and **Run as administrator**) and ensure that the installation was successful.
3. Connect the PicoVNA unit to the computer and wait while Windows automatically installs the driver.

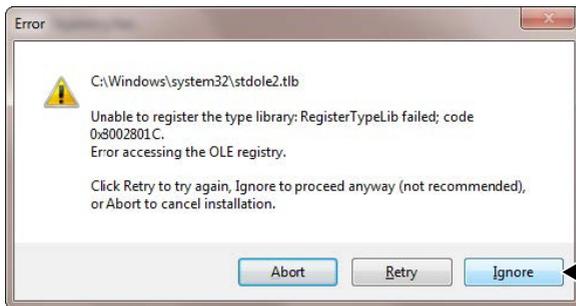
The installer creates a support directory at:

C:\Users\\Documents\Pico Technology\PICOVNA2
[108: C:\Users\\Documents\Pico Technology\PICOVNA3]

This directory contains the following files (PicoVNA 106 example shown):

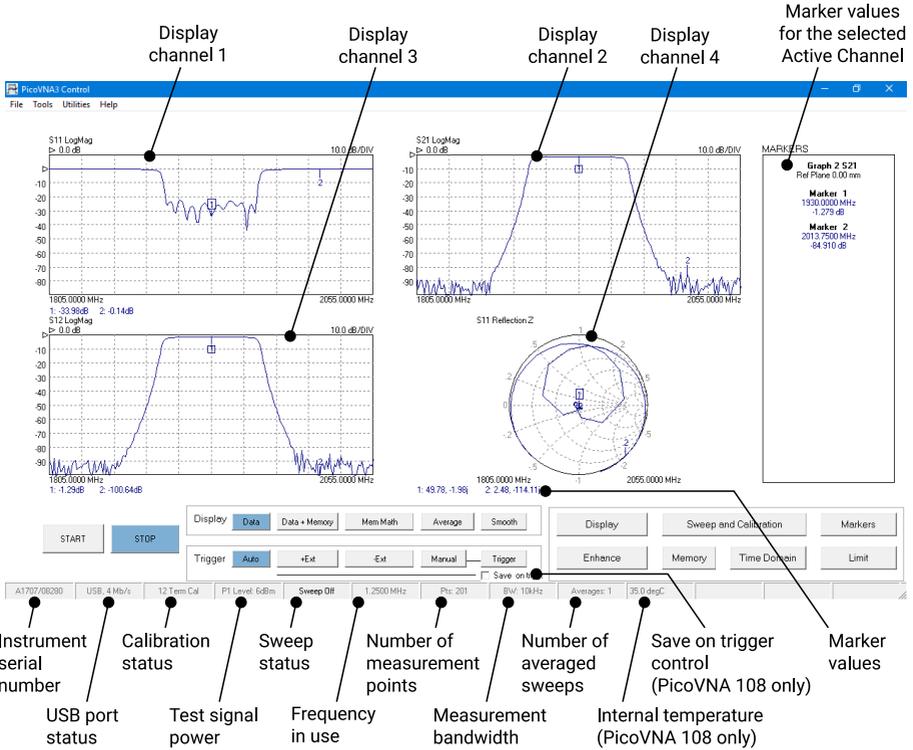
- xxxx-log.txt This is the status log file. 'xxxx' is the serial number
- CalKits\DefUnc.dat Default measurement uncertainty values
- DefCal.cal Default calibration data (last used calibration)
– will appear after first connection to a VNA device
- FactoryDefaults.cal Backup calibration data from factory

On Windows 7 machines it is common to see the following error message:

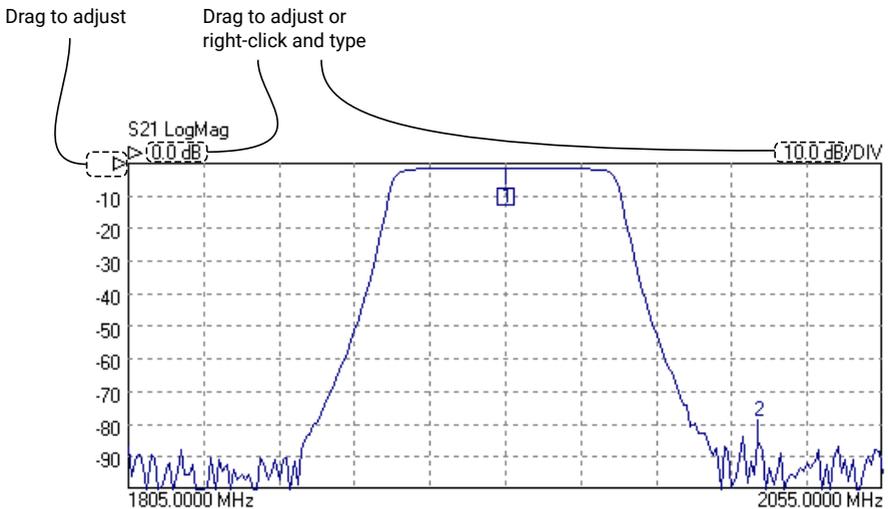


It is safe to click **Ignore** to continue

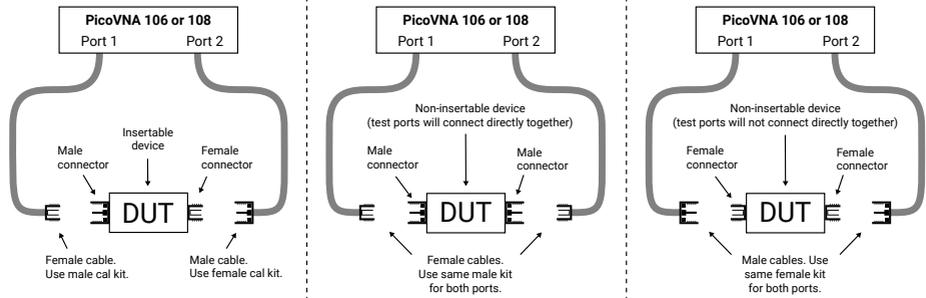
6.2 The PicoVNA 2 [108: PicoVNA 3] main window



You can adjust the vertical scale of any of the rectangular plots in the above window, as follows:



6.3 Loading the calibration kit(s)



Calibrate using fixed manual calibration standards:

SOLT-STD-F and SOLT-STD-M
or
SOLT-PREM-F and SOLT-PREM-M

Or calibrate with PicoVNA 108 and automatic E-Cal Standard:

SOLT-AUTO-F
or
SOLT-AUTO-M

Calibrate using fixed manual calibration standards:

SOLT-STD-M
or
SOLT-PREM-M

Or calibrate with PicoVNA 108 and automatic E-Cal Standard:

SOLT-AUTO-M

Calibrate using fixed manual calibration standards:

SOLT-STD-F
or
SOLT-PREM-F

Or calibrate with PicoVNA 108 and automatic E-Cal Standard:

SOLT-AUTO-F

For a manual SOLT calibration:

- Run the PicoVNA 2 [108: PicoVNA 3] software
- In the main menu, select **Tools > Calibration kit**
- Click **Load P1 kit**, locate the data file for your Port 1 cal kit (on the USB flash drive supplied with the cal kit) and then click **Apply**
- If a different cal kit is to be used on Port 2, click **Load P2 kit**, select the data for your Port 2 kit and then click **Apply**

Select the calibration kit(s) required depending on the device to be tested. For quicker access in future, you may wish to copy the cal kit data to your

C:\Users\\Documents\Pico Technology\PICOVNA2\CalKits\
[108: C:\Users\\Documents\Pico Technology\PICOVNA3\CalKits\]

folder. You can do this using the **Save Kit** button in the **Cal Kit Editor**.

For the PicoVNA 108 and an automated calibration:

- Run the PicoVNA 3 software.
- Connect the E-Cal module to a spare USB port on the controlling PC.
- In the main menu, select **Tools > Calibration kit**.
- Click **Electronic Cal kit**.
- Select the E-Cal module and Port Adapter arrangement to suit the Test Ports.
- Connect the E-Cal module, port adapter and test ports to exactly match the selected configuration.
- Click **Find** and load EasyCal data.
- Upon completion select **Exit**.
- Click **Apply** in the **Calibration Kit Parameters** menu.

6.4 Setting the resolution

Before proceeding with a calibration, click **Enhance** in the main window to set the minimum resolution bandwidth that you need the calibration to support. Lower values will result in a slower calibration.

Measurement	Calibration bandwidth	Calibration averaging	Calibration power	Comments
Fastest speed	10 kHz	None	+0 dBm	Set bandwidth to 140 kHz during measurement
Best accuracy and ~100 dB dynamic range	100 Hz	None	-3 dBm	Leave bandwidth set to 100 Hz during measurement
General use, fast speed, ~90 dB dynamic range	1 kHz	None	+0 dBm	Leave bandwidth set to 1 kHz during measurement
Best dynamic range	10 Hz	None	+6 dBm	Leave bandwidth set to 10 Hz during measurement

6.5 Setting up calibration parameters

Click **Calibration** to open the **Calibration** window:

The screenshot shows the 'Calibration' window with the following settings and annotations:

- 1. Set sweep parameters:** Points to the 'Set Sweep Frequency' section where Start is 4.1504, Stop is 8493.9987, Step is 4.1504, and Sweep Points is 2048 (TD).
- 2. After setting the required sweep bandwidth, apply values:** Points to the 'Apply' button at the bottom of the sweep frequency section.
- 3. Select measurement required:** Points to the 'Measurement' section where 'Insertable DUT (2 cal kits)' is selected.
- 4. Perform required calibration steps. Any sequence is possible, but down-then-across order usually minimizes the number of connection steps.** Points to the 'Reflection' and 'Transmission' sections, specifically the 'Isolation' button.
- 5. IMPORTANT! On completion, apply calibration:** Points to the 'Apply Cal' button at the bottom of the window.

Additional annotations include: 'The cal kits that you have loaded' pointing to the 'Cal Kit Loaded' section, and 'Info' pointing to the 'Info' button in the transmission section.

6.6 Setting up display parameters

Click **Display** in the main window to open the **Display Set Up** window:

The screenshot shows the 'Display Set Up' dialog box with the following settings and callouts:

- 3. Select channel to set up:** Points to the 'Select' section where 'CH1' is selected.
- 1. Select one-channel, two-channel or four-channel view:** Points to the 'Display Channels' section where 'ALL' is selected.
- 2. Select channel to show in the Markers panel:** Points to the 'Active Channel' dropdown menu which is set to '3'.
- 4. Check to show vertical scale values on graphs:** Points to the 'Display values on graph' checkbox, which is checked.
- 5. Apply settings before selecting next channel:** Points to the 'Apply' button.

Other visible settings in the dialog include: Parameter: S11, Graph: LogMag, Vertical Axis Units: dB, Reference: 0, Ref Position: 2, Sensitivity: 10, and an 'Autoscale' button.

When finished, click **Start** in the main window to begin measurements.

6.7 Running in demo mode

Demo mode allows you to explore the PicoVNA 2 [108: PicoVNA 3] software without the need to have an instrument running.

- To enter demo mode, run the PicoVNA 2 [108: PicoVNA 3] software with no instrument connected.
- Click **Ignore** in the dialog that appears.

PicoVNA 2 [108: PicoVNA 3] will then offer you a selection of demonstration measurements.

7. Further information

7.1 Free newsletter

Pico Technology sends out a free monthly newsletter by email. This gives news of product launches, software upgrades and application notes, as well as hints and advice. We treat your e-mail address and other details as confidential and will not pass them to any third party. To subscribe, visit:

www.picotech.com/signup

7.2 Software updates and replacement

The latest versions of all Pico software and manuals can be downloaded free of charge at:

www.picotech.com/downloads

If you require a new software disk, please contact Pico Technology or your distributor. There may be a small charge for this service.

7.3 Writing your own software

Code examples in MATLAB and MATLAB RF toolbox, LabVIEW, C, C# and Python are available on GitHub (github.com/picotech). Examples include multiple instrument addressing and control.

7.4 User's and programmer's guides

The *PicoVNA User's Guide* and *PicoVNA Programmer's Guide* are available on the USB flash drive supplied and from:

www.picotech.com/downloads

7.5 Specifications

The *User's Guide* and *Data Sheet* contain the latest specifications for your PicoVNA vector network analyzer.

7.6 Technical support

Regularly updated technical support information can be found in the Pico Technology support forum:

www.picotech.com/tech-support

7.7 Warranty and returns

These PicoVNA vector network analyzers are supplied with a three-year return-to-manufacturer warranty. For full terms and conditions, see the *PicoVNA User's Guide*.



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