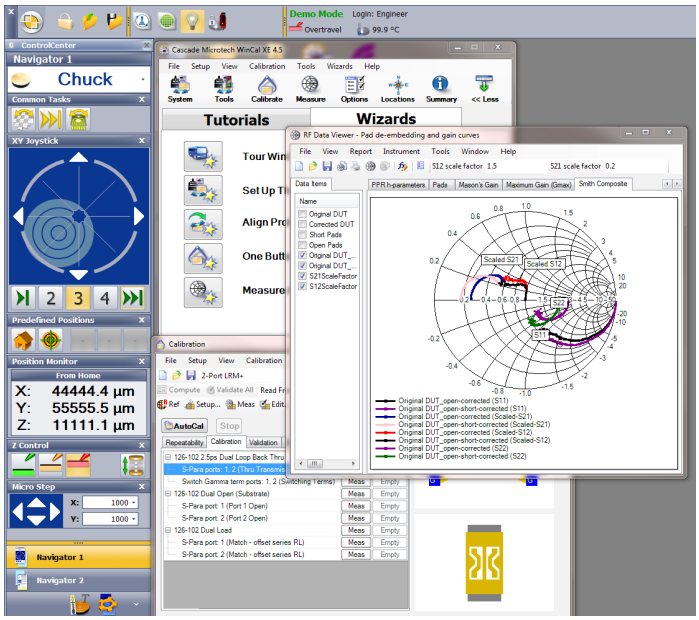
WinCal XE 4.5

Connecting to a VNA with VISA options

APPLICATION NOTES

Overview

With version 4.5, WinCal XE™ goes beyond GPIB and offers a new, more flexible form of communication with all Vector Network Analyzer (VNA) instruments that support it. For those VNAs, WinCal XE offers new a driver selection with Virtual Instrument Software Architecture (VISA). This document describes the general technology and how to utilize it with WinCal XE.



Terms and Definitions

VISA (Virtual Instrument Software Architecture):
This is an industry standard implemented by several test and measurement equipment companies, such as National Instruments, Agilent Technologies, Anritsu and Rohde & Schwarz. By using the VISA standard, test software can use the same code to send strings to instruments via various connection types (GPIB, LAN, USB, etc.) by changing how the VISA connection is initiated. All the core logic of sending and receiving strings remain the same.

LXI (LAN eXtensions for Instrumentation):
This is a standard developed by the LXI Industry Consortium, which defines the communications protocols for instrumentation and data acquisition systems using Ethernet. Ethernet is an accessible and versatile interface that must be implemented against a standard for instrumentation to communicate effectively.

VXI (VME eXtensions for Instrumentation):
The VXI bus architecture is an open standard platform for automated test based upon VMEbus. VXI-11 is a TCP/IP instrument protocol specification, which together with LXI enabled instruments enables VISA connection over LAN to instruments.

PXI (PCI eXtensions for Instrumentation):
This is a modular instrumentation platform supported by VISA, but not used by VNAs and WinCal.

SCPI (Standard Commands for Programmable Instruments):
This is a common syntax style for instruments. All new VNAs and also Nucleus™ Prober Controller Software use this syntax style for the remote command set, which is built up with strings starting with a colon, e.g., ":sense1:frequency:start?" to read start frequency)

SICL (Standard Instrument Control Library):
This was started as an HP (now Agilent Technologies) function call standard for communicating with instruments. It became popular with HP-Basic on workstations, but is not as widely used any more. It is still supported by the Agilent IO libraries.

TCP/IP (Transmission Control Protocol/Internet Protocol):
This is the most common network protocol for communication over Ethernet.

Sockets:
An internet socket is an endpoint of a bidirectional communication flow across an IP-based computer network, such as the Internet. It is also a term for an application programming interface (API) for the TCP/IP protocol stack, usually provided by the operating system as a mechanism for delivering incoming data packets to the appropriate application process or thread. A socket address is the combination of an IP address (the location of the computer) and a port (which is mapped to the application program process) into a single identity, much like one end of a telephone connection is the combination of a phone number and a particular extension.

Installation Requirements

The WinCal XE software does not install any GPIB drivers or VISA libraries, but the VISA library from either National Instruments or Agilent Technologies has to be installed on the same PC as WinCal XE for VISA communication to work. If GPIB is to be used, the IEEE 488.2 driver also needs to be installed. Both these vendors now install the VISA libraries by default when the GPIB driver is installed, but it is generally recommended to check the details. If no GPIB is to be used, only the VISA interface can be installed.

In general, it is the best to download the latest driver and VISA library together to match the version, especially if you have an older GPIB installation that might not have included the VISA library, or if it is too old. The VISA library license usually is free if you have any of the vendor's hardware installed on the PC, but it is also possible to buy only the VISA library. For downloads and licensing, see your vendor's web site (www.ni.com or www.agilent.com).

After installing the (optional) GPIB driver and VISA library, it is highly recommended to use the vendor's tool to test communication with the VNA, before involving WinCal XE. National Instruments has NI-MAX, and Agilent Technologies has tools within their IO Libraries Suite. They both can be used to test if the VNA communication works (VISA and/or GPIB) and save you time when setting up WinCal XE. A good test is to send the ID query *IDN? to see if you receive a response. This works with all the VNAs that support the new VISA connections discussed here.

General Network Issues

All newer types of VNAs run Microsoft Windows and can act like a computer with network access and USB ports. Today, they all run Windows XP, but the work is under way to switch to Windows 7.

Using network connections between your PC and the VNA runs into the same connection and security issues that all other devices on the network face.

Issues with security and firewalls

Many companies have IT security policies that prevent a new instrument (or PC) to be added to the local network and talk to other devices. This can often prevent you from connecting a new VNA via an Ethernet cable and set up VISA VXI-11 or socket communication to it.

To resolve issues with security and firewalls, request your IT administrator to add this new instrument as an accepted Windows-based computer on the local network, which may require standard virus software and downloading Windows updates.

To be safe, first confirm with the VNA vendor that downloading Windows updates are acceptable. There have been cases where a Windows Service Pack was not recommended for a certain firmware version. However, if the VNA is going to be connected to the LAN and/or internet, it is necessary to have virus checks and security updates applied to avoid computer viruses, etc., as the VNA vendors recommend.

The VNA does not have to be on any domain in order to use VISA VXI-11 or sockets. Neither is there a need to make any special user accounts on the VNA.

If you have a firewall on the VNA and/or the PC, then open up the port that the sockets use (typically 5025). Enable internet use for WinCal XE on the PC where it is installed (including if that is the VNA itself). It may vary depending on the types of the firewall, but the regular Windows Firewall is accessed from Control Panel - System and Security – Windows Firewall.

Note: WinCal XE and the first "PNA (Network)" driver uses DCOM rather than VISA and requires a user account with the same login and password on the PNA as on the calling client PC. We recommend switching to the "PNA (VISA)" driver to avoid this issue.

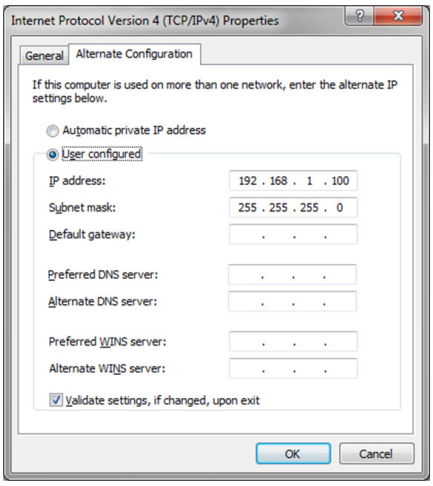
Connection via server or router that provides DNS

Most often, the VNA and the controlling PC are both connected to a LAN and use the IP address assigned by the DNS (Domain Name Server). In this case, you can open a command line window and type in "ipconfig" to see the IP address you are using on the PC in question. Repeat this step on the VNA to see its IP address and use it to setup WinCal XE. The details will be discussed later.

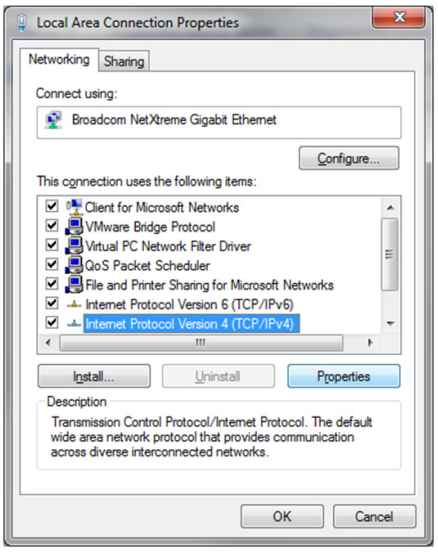
Connection via a single network cable (peer-to-peer)

In many cases, you can simply connect the PC and VNA with a single Ethernet cable (peer-to-peer). If that does not work, then connect both the PC and the VNA to a network switch. In this case, there is no DNS server and the IP addresses must be hardwired. If the PC is on the LAN at other times, use the **Alternate Configuration** in IP configurations. See the next page for the exact steps.

1. From Control Panel \ Network and Internet \ Network Connections on your PC, open up your **Local Area Connection Properties** on the PC.



2. Select **Internet Protocol Version 4** and click **Properties**



3. Select **Alternate Configuration** tab and click **User configured**. Type in the hardwired IP address you have selected. Repeat this step on the VNA if it is not already hardwired. Use those IP addresses to connect the two with a single LAN cable. If you have IT administrators, ask their advice on how to select IP addresses.

Installing WinCal XE on the VNA itself

If you install WinCal XE directly on the VNA, you do not need to setup IP addresses. Simply add **localhost**, instead of an IP address, in WinCal XE's VISA setup for the VNA in question. This applies to both VXI-11 and Sockets. Obviously, cabling is not required.

WinCal XE Setup for using VISA

Not all VNAs can use the new, more flexible VISA connections, but all the VNA vendors (Agilent Technologies, Anritsu and Rohde & Schwarz) have at least one model that can. Many VNAs have more than one driver selection in WinCal XE. Always select the one that ends with "(VISA)" for this purpose. Older VNA models that are not running Windows will not have this selection and must use GPIB.

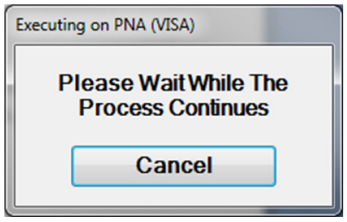
1. In WinCal XE 4.5, open **System Setup** and select the **VNA** tab. Select the VNA you are going to use.

The following VNA selections are enabled for the enhanced VISA in WinCal XE 4.5:

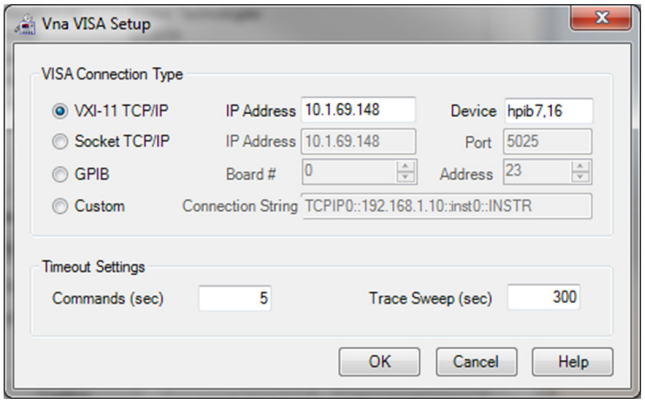
- Anritsu VectorStar (VISA)
- PNA (VISA)*
- ENA(VISA)
- ZVA / ZVB (VISA)

**"PNA (Network)" refers to the old DCOM-based connection and should not be used.*

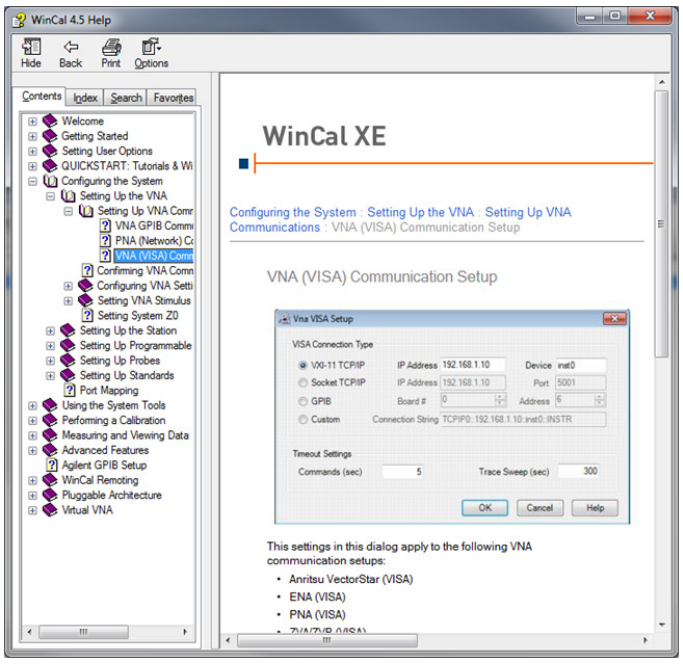
In this example, an older model of PNA, PNA 8361A, was used. When first selecting PNA (VISA), WinCal XE will attempt to make a contact to the VNA. Since it is not yet set up correctly, it will fail. You can end the communications test by clicking **Cancel**:



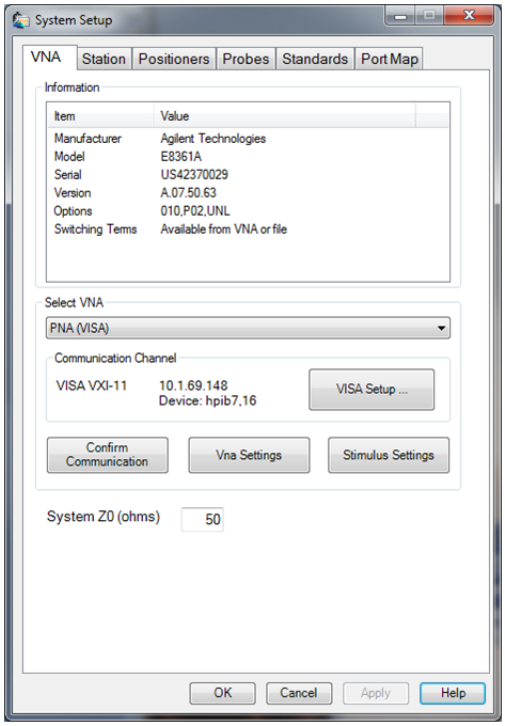
2. Press **VISA Setup** button and the following window will appear on your screen:



3. Press **Help** to open the on-line help and the following window will appear on your screen:



4. Click **OK** and you should now be connected. All other VNA settings work as before.



Excerpt from the Help file

Select a connection type in the VISA setup window according to your hardware configuration.

For GPIB connections, select board number or connection on your PC and the address of the instrument on that bus.

For custom connections, you can enter any valid VISA connection string. For instance, set up a VISA USB connection to the VNA in National Instruments' Measurement & Automation Explorer© or Agilent's IO library and then copy the string into the custom connection string field.

Connections by Instrument Type

Anritsu VectorStar (VISA)

- USB can be used
- Do not use Socket TCP/IP option

ENA (VISA)

- USB can be used
- For socket TCP/IP connection, use port number 5025

PNA (VISA)

- For A and B model PNAs, for VXI-11 TCP/IP use "hpib7,16" in the device field. For C and X models, use "inst0".
- For all PNAs, use the IP address of the instrument on your network. On the PNA, enable SICL.
- For socket TCP/IP connection, use port number 5025.

ZVA/ZVB (VISA)

- USB cannot be used
- For socket TCP/IP connection, use port number 5025

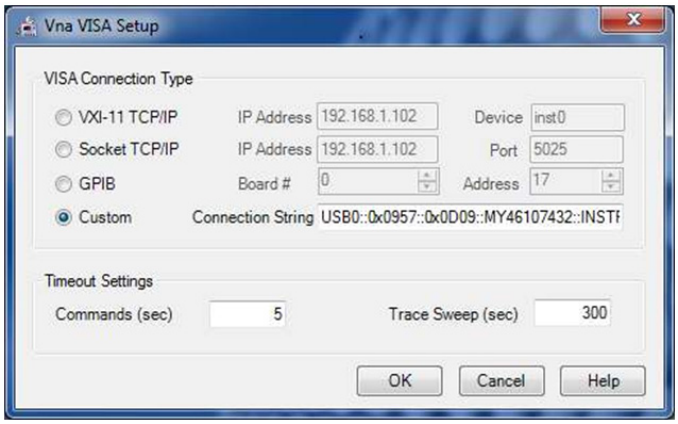
The PNA in this example is an A model and this is why you see "hpib7,16" as a Device string. For all other VNAs, you will see "inst0" as a Device string.

For GPIB

VISA still supports GPIB. In this case, it is just a matter of filling in the Board and Address fields.

For USB

The WinCal XE software does not have a direct selection or auto-sensing of USB connected VNAs. Not all VISA enabled VNAs can use USB either. In this case, use the NI-MAX or Agilent IO Library tool to get the USB VISA connection string and copy it into WinCal XE's "Custom" field. Those tools should auto-sense when the VNA is connected with USB. Below is an example of how such a connection string might look.



Conclusion

The VISA standard has opened up many new possibilities beyond just GPIB and by adhering to the VISA standard it is very easy to switch between the different communication channels. By using VISA, existing and well tested code can still be used to send the same string commands to an instrument as in the GPIB-only era, but now through different physical channels as well.

WinCal XE 4.5 is the first version to enable this more flexible use of VISA by opening up the VISA connection string to be anything. For convenience it also offers an easy fill-in form for the more common TCP/IP and GPIB cases (which internally results in a connection string as well).

The oldest GPIB-only VNAs that WinCal XE supports do not have a new VISA enabled driver. They have GPIB drivers only. We do not expect to change this since those VNAs will not ever change to support anything beyond GPIB.

Newer VNAs that add LAN and USB support also have these older GPIB-only drivers, but we recommend you switch to using the newer driver with "(VISA)" added after the VNA model name in System Setup. In the future we may end support for GPIB-only versions of those VNA drivers, since GPIB can still be used with the new VISA driver and nothing is really lost. Because LAN communication is covered by this new "PNA (VISA)" driver we may also discontinue support for the DCOM based "PNA (Network)" driver and there, too, we recommend switching to the "PNA (VISA)" driver.

WinCalXE-AN-0811

Cascade Microtech, Inc.
Corporate Headquarters
toll free: +1-800-550-3279
phone: +1-503-601-1000
email: cmi_sales@cmicro.com

Germany
phone: +49-811-60005-0
email: cmg_sales@cmicro.com

Japan
phone: +81-3-5615-5150
email: cmj_sales@cmicro.com

China
phone: +86-21-3330-3188
email: cmc_sales@cmicro.com

Singapore
phone: +65-6873-7482
email: cms_sales@cmicro.com

Taiwan
phone: +886-3-5722810
email: cmt_sales@cmicro.com