

Overview

WinCal XE™ goes beyond GPIB and offers a more flexible form of communication with all Vector Network Analyzer (VNA) instruments that support it. For those VNAs, WinCal XE offers 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, Keysight 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):

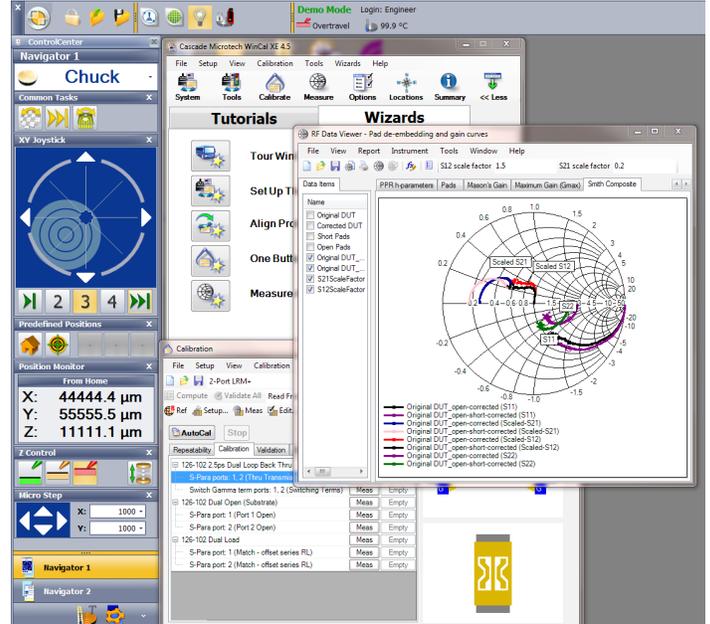
This is a standard developed by the LXI Industry Consortium, which defines the communications protocols for instrumentation and data acquisition systems using Ethernet. Ethernet is an accessible and versatile interface that must be implemented against a standard for instrumentation to communicate effectively.

HiSLIP (High-Speed LAN Interface Protocol)

HiSLIP is the latest and fastest TCP/IP-based protocol for remote instrument control of LAN-based test and measurement instruments. It was specified by the IVI Foundation and is intended to replace the older VXI-11 protocol. Like VXI-11, HiSLIP is normally used via a library that implements the VISA API. Version 1.4 of the LXI standard recommends HiSLIP. Not all VNAs support HiSLIP. Please check the model you are using. If supported, this is the recommended connection type.

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 and is used by some Keysight PNA models. You can use the HiSLIP VISA interface to communicate with those.

SCPI (Standard Commands for Programmable Instruments):

This is a common syntax style for instruments. All new VNAs 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 (later Agilent, now Keysight 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 Keysight 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 Keysight 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 needs to 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.

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 Keysight 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.

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 HiSLIP, 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.

WinCal XE – Connecting to a VNA with VISA Options

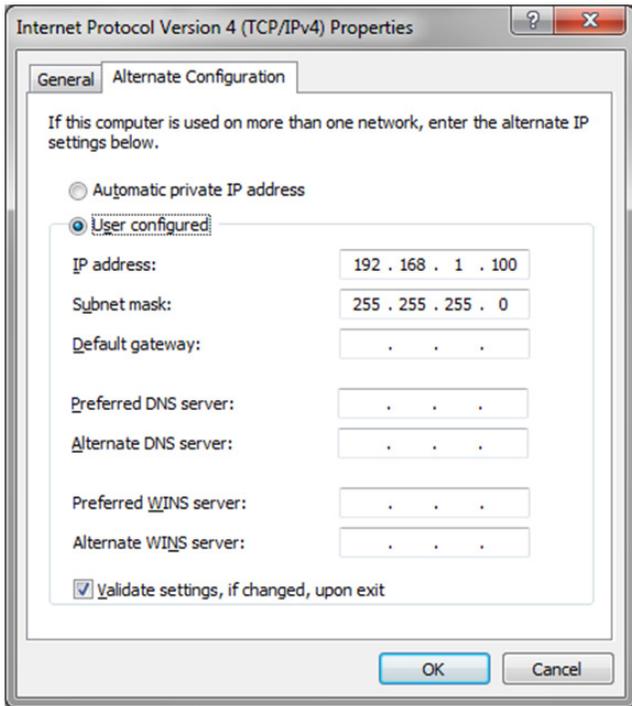
Connection via server or router that provides DNS

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.

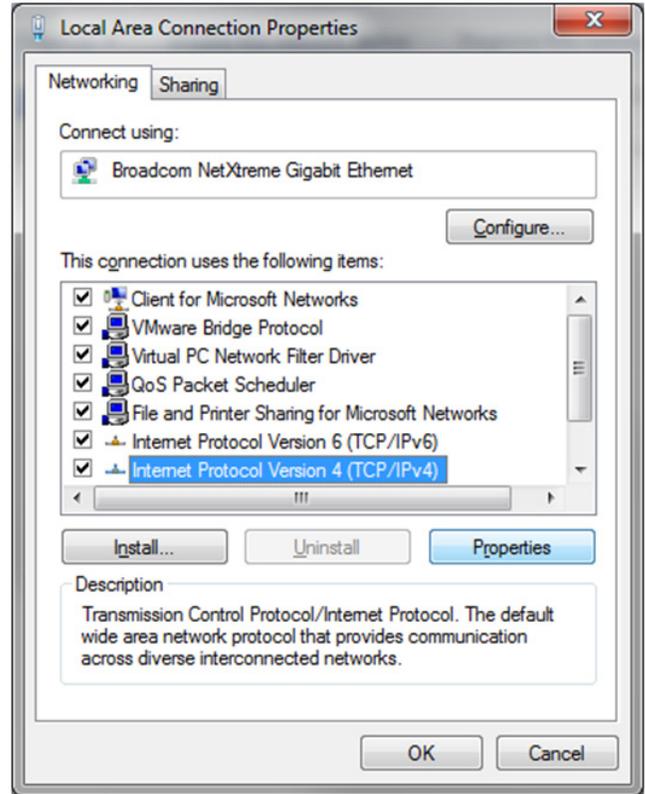
Connection via a single network cable (peer-to-peer)

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 HiSLIP, VXI-11 and Sockets. Obviously, cabling is not required.

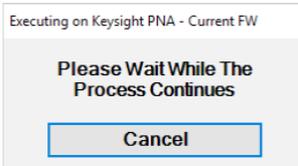
WinCal XE – Connecting to a VNA with VISA Options

WinCal XE Setup for using VISA

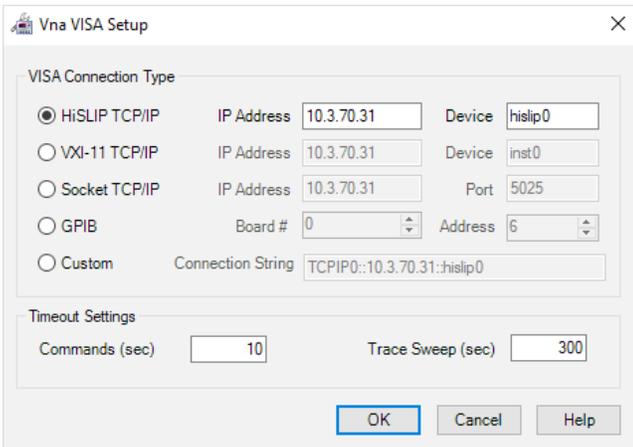
Not all VNAs can use the new, more flexible VISA connections, but all the VNA vendors (Keysight Technologies, Anritsu and Rohde & Schwarz) have at least one model that can. Many VNAs have more than one driver selection in WinCal XE. Older VNA models that are not running Windows will not have this selection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

1. In WinCal XE, open **System Setup** and select the **VNA** tab. Select the VNA you are going to use. All VNAs, except those who's driver name ends in (GPIB only) supports a VISA connection.

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**:

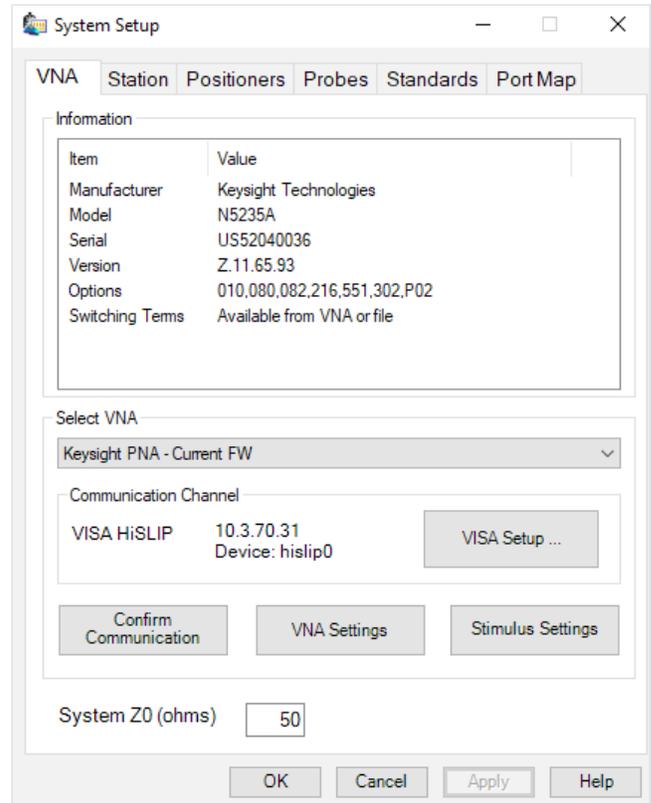


2. Press **VISA Setup** button and the following window will appear on your screen:



3. Press **Help** to open the on-line help for more information.

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



What VISA protocol a particular VNA supports varies. Newer FW versions may add more options, so always check with the VNA vendor directly to find out what VISA communications method they support for any particular model and FW version. Also check WinCal's Manual/Help and readme file for some hints and late news.

For GPIB

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

WinCal XE – Connecting to a VNA with VISA Options

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 Keysight 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.

Vna VISA Setup

VISA Connection Type

HiSLIP TCP/IP IP Address: 10.3.88.37 Device: hislip0

VXI-11 TCP/IP IP Address: 10.3.88.37 Device: inst0

Socket TCP/IP IP Address: 10.3.88.37 Port: 5025

GPIB Board #: 1 Address: 16

Custom Connection String: USB1::0x2A8D::0x0001::MY55401786::INST1

Timeout Settings

Commands (sec): 10 Trace Sweep (sec): 300

OK Cancel Help

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 enables 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.