# Verification of a working remote communications connection using NI - MAX

November 19, 2018

Automating a test can dramatically increase the productivity, throughput, and accuracy of a process. Automating a setup involves connecting a computer to the test instrumentation using a standard communications bus like USB or LAN and then utilizing code entered via a software layer (like LabVIEW, .NET, Python, etc..) to sequence the specific instrument commands and process data.

This process normally goes quite smoothly, but if there are problems, there are some basic troubleshooting steps that can help get your test up-and-running quickly.

In this note, we are going to show how to use NI-MAX to test the communications connection between an instrument and a remote computer using both a USB and a LAN connection to ensure that they are working properly. Once the connection is verified, you can begin to work on the control software.

National Instruments Measurement and Automation Explorer (NI-MAX) is a free communications tool provided with NI's VISA library.

You can learn more here: http://digital.ni.com/public.nsf/allkb/71544521BDE34FFB86256FCF005F4FB6

#### **USB Connections**

1. Power on and connect the instrument via USB cable to the computer. On a computer running Windows, the first time you connect the USB from an instrument should open a dialog box or show a notification of a new device being connected.



🔿 🖬 🖬 📓 🔽 🖬 💻 !	<b>k X</b> €	Driver File	2 Details	
<ul> <li>&gt; Batteries</li> <li>&gt; Bluetcoth</li> <li>&gt; Computer</li> <li>&gt; Disk drives</li> <li>&gt; Display adapters</li> <li>&gt; DVD/CD-ROM drives</li> <li>&gt; Muman Interface Devices</li> </ul>		Events Device	USB Test and Measurement Device s: /INDOWS\System32\Drivers\ausbtr	
<ul> <li>IDE ATA/ATAPI controllers</li> <li>Imaging devices</li> <li>Intel WiUSB</li> <li>Keyboards</li> <li>Mice and other pointing devices</li> <li>Monitors</li> <li>Network adapters</li> <li>Print queues</li> <li>Print queues</li> <li>Software devices</li> <li>Sound, video and game controllers</li> <li>Storage controllers</li> <li>System devices</li> <li>Universal Serial Bus controll</li> </ul>	Update Driver	IVI Foundation, I 8/14/2013 16.3.17614.0 Microsoft Windor Publisher Provider To view details abo File vers To update the drive Copyrigh Digital S f the device fails af back to the previou	sion: 80.3.17614.00 ht: © IVI Foundation, Inc. All rig	
<ul> <li>Generic USB Hub</li> <li>Intel(R) USB 3.0 eXtensib</li> <li>Mobile 5th Generation In</li> <li>Realtek USB 2.0 Card Rea</li> <li>USB Composite Device</li> <li>USB Root Hub</li> <li>USB Root Hub</li> <li>USB Root Hub (xHCl)</li> <li>USB Test and Measurement</li> <li>USB Test and Measurement</li> </ul>	Devices	To uninstall the driver vouvance	uj. Cancel	

You can check the status of the USB connections by opening Device Manager located in the Control Panel menu of most Windows Operating systems and expanding the driver information as shown below in this Windows 10 example:

This indicates that the operating system recognizes the connected instrument as a test instrument.

If the device manager reports the USB connection as some other type of device (printer, camera, unknown, etc.), there is likely a problem linking the proper driver (ausbtmc.sys) to the instrument. One possible solution to this is to disable the driver, disconnect the USB cable, verify that ausbtmc.sys exists, and then reconnect the USB cable.

2. Run NI-MAX by left-clicking on the icon on the desktop or finding it via the start menu





3. This will open the main window, as shown below:



4. Expand the "Devices and Interfaces" menu. You should see the instruments attached via USB with a brief description as shown for an SDS2000X oscilloscope below:



V 🛄 My System		
Devices and Interfaces	🖬 Save 💦 Refresh	
CASELIO::INSTR "LPT1"	6	
SDS2102X "USB0::0xF4EC::0xEE3A::SDS2XHA2160547::INSTR"	System Settings	
> 🛓 Network Devices	Hostname	DE
> 😫 Remote Systems	DNS Name	DE

This indicates that a software application (NI-MAX) has correctly identified a test and measurement device (the oscilloscope) over the USB connection.

5. By left-clicking on the instrument, you can see additional information about it:

✓ ■ My System ✓ ∰ Devices and Interfaces	🔛 Save 💦 Refresh 🛛 💥 O	pen VISA Test Panel
SDS2102X "USB0::0xF4EC::0xEE3A::SDS2XHA2160547::INSTR"  Network Devices	Settings	
> 5 Software	Name	
😫 Remote Systems	Vendor	Siglent Technologies Co,. Ltd.
	Model	SDS2102X
	Serial Number	SDS2XHA2160547
	Status	Present
	USB Interface Number	0
	488.2 Compliant	$\checkmark$
	VISA Resource Name	USB0::0xF4EC::0xEE3A::SDS2XHA2160547::INSTF

6. To further test the connection, right-click on the instrument and select Open VISA Test Panel or select it from the side bar:



Results and the second second

<ul> <li>My System</li> <li>My Bevices and Interfaces</li> </ul>	🖬 Save 🏾 🔀 Refresh 🛛 🕍 C	open VISA Test Panel
ASEL 10-INSTR "LPT1"     SDS2102X "USB0::0xF4EC::0xEE3A::SDS2     Rename     Network Devices     Software	Name	
Sol Software Open VISA Te	Vendor	Siglent Technologies
	Model	SDS2102X
	Serial Number	SDS2XHA2160547
	Status	Present
	USB Interface Number	0
	488.2 Compliant	~
	VISA Resource Name	USB0::0xF4EC::0xEE3A

The VISA Test Panel window shows some helpful information, including the instrument manufacturer, model, serial number, and the USB identifier (VISA Address) along the top.

VSB0::0xF4EC	C::0xEE3A::SDS2	2XHA2160547::INSTR -	VISA Test Pane	el			8.		×
	guration	Input/Outp	ut Ö	Advanced	NI I/O Trace	Help	M	NATION. ISTRUM	AL IENTS
USB Settings	I/O Settings	View Attributes				Return Data	3		
USB Inform		Manufacturer Siglent Technologies ( Model SDS2102X (0xEE3A) Serial Number SDS2XHA2160547	Co,. Ltd. (0xF4E	:C)		No Error			~
				Refresh	Apply Changes				

7. Another useful item in the VISA Test Panel is the Input/Output function. This mode allows you to send



specific instrument commands and receive instrument responses.

This is especially helpful when you are planning a specific test sequence, the effect of delays/timing, or troubleshooting a command. You can send each command one-at-a-time and check the performance of the instrument.

Select Input/Output > Basic I/O > and Enter the command in the text window:

– \*IDN? is a common identification string query (question or information request) that returns the information from the connected instrument

- /n is a termination character that represents a new line. This is the standard termination character for SIGLENT instrumentation.

- Write will send the command to the instrument
- Read will pull data from the instrument
- Query will perform a read and then a write command to request and return data from the instrument

USB0::0xF4EC::0xEE3A::SDS2XHA2160547::INSTR - VISA Test Panel		_	×
Configuration Input/Output Advanced NI I/O Trac	e Help	MIN	AL IENTS
Basic I/O Line Control USB Control	Return Data	a	
Select or Enter Command *IDN?\n *IDN?\n Write Query Read Read Status Byte Clear View mixed ASCII/hexadecimal 1: Write Operation (*IDN?\n) Return Count: 6 bytes 2: Read Operation Return Count: 40 bytes	Read Oper No Error	ation	
*IDN\sSIGLENT, SD52102X, SD52XHA2160547, 1.2.2.1\sR9\n			
Copy to Clipboard Clear Buffer			

#### **USB Checklist**

- Is the USB port configured properly on the instrument? Some instruments feature USB ports that can be configured as TMC (Test and Measurement) or Printer communication ports. The USB port should be set to USBTMC or similar for remote control.

- Try a direct connection to the controlling computer. USB hubs or long connections may cause issues.
- Try a different USB cable. Connectors can go bad or prove to be faulty.
- Try a different USB port on the computer.

- On machines running Windows, check the Device Manager. Test instrumentation should appear as USB Test and Measurement Device (IVI) and use the AUSBTMC.SYS driver

#### Lan Connections

1. Power on and connect the instrument via LAN cable to a LAN network connected to the computer you wish to use.

You can check the status of the LAN connection by using a software tool like NMAP: https://nmap.org/



NMAP allows you to scan networks and identify IP addresses.

First, identify the LAN connection for the instrument. This is typically located in the System menu under IO or LAN settings.

Here is the IO information for an SDS2000X oscilloscope:

Enable
192 168 . 0 . 87
255 . 255 . 255 . 0
192 . 168 . 0 . 1
00:27:80:08:17:08

DHCP Enabled will automatically configure the instrument connection settings and apply a valid IP address. With DHCP enabled, the IP address may change over time. It is recommended to check the instrument IP address and then confirm that it is visible on the network using NMAP:



Zenmap

	Profile: Ping scan
ommand: nmap -sn	92.168.0.0/24
Hosts Services	Nmap Output Ports / Hosts Topology Host Details Scans
S    Host	nmap -sn 192.168.0.0/24
192.168.0.1	
192,168.0.2	Starting Nmap 7.40 ( https://nmap.org ) at 2017-04-21 12:39 Eastern Daylight Time
192,168.0.3	Nmap scan report for <b>192.168.0.1</b> Host is up (0.0010s latency).
	MAC Address: 14:B7:F8:0E:D3:C5 (Technicolor CH USA)
192.168.0.5	Nmap scan report for <b>192.168.0.2</b> Host is up (0.00s latency).
192.168.0.7	MAC Address: 58:60:87:86:5F:08 (Cisco-Linksys)
192.168.0.8	Nmap scan report for 192.168.0.3
192,168.0.10	Host is up (0.0010s latency). MAC Address: 14:B7:F8:0E:D3:C6 (Technicolor CH USA)
	Made scan report for 192.168.0.5
192.168.0.86	Host is up (0.037s latency).
192.168.0.87	MAC Address: 70:81:EB:B8:68:C4 (Apple) Nmap scan report for 192.168.0.7
	Host is up (0.031s latency).
	MAC Address: 28:18:78:6F:71:54 (Microsoft)
	Nmap scan report for 192.168.0.8
	Host is up (0.053s latency). MAC Address: 40:0E:85:76:DF:4F (Samsung Electro-mechanics(thailand))
	Nmap scan report for 192.168.0.10
	Host is up (0.027s latency).
	Nmap scan report for 192.168.0.87
	Host is up (0.00105 latency).
	MAL Address: 00:27:80:08:17:08 (Unknown)
	Host is up.
	Nost 15 up.

Here, we are performing a Ping (short scan to identify what IP addresses are being used) over the range of IP addresses that may match the instrument.

This can be performed by setting the target using the "/24" extension. This scans 24 bits For example, 192.168.10.0/24 would scan the 256 hosts between 192.168.10.0 and 192.168.10.255

Here is more information from NMAP: https://nmap.org/book/man-target-specification.html

For example, to ping all IP addresses that start with 192.168.0., set the target as follows:



Target: 1	92.168.0.0/24						
Command:	nmap -sn 19	2.168.0.0/24					
Hosts	Services	Nmap Output	Ports / Hosts	Topology	Host Details	Scans	
OS 4   lost		nmap -sn 192.1	68.0.0/24				
📝 192.	168.0.1						
😼 192.	168.0.2	Starting Nm Nmap scan r				2017-04-21 1	2:39
💓 192. <sup>-</sup>	168.0.3	Host is up	(0.0010s la	tency).			
192.	168.0.5	MAC Address	710 NO. 12 NO. 10 NO.		and the second s	or CH USA)	
192.	168.0.7	Host is up MAC Address	(0.00s late	ncy).		(5V5)	
💓 192.	168.0.8	Nmap scan r	eport for 1	92.168.0.			
-	160.0 10	Host is up	(0.0010s la	tency).			

Note the IP address and MAC address that identify your instrument.

2. Run NI-MAX by left-clicking on the icon on the desktop or finding it via the start menu



This will open the main window, as shown below:





3. Unlike USB, there is not an easy way to identify all of the instruments connected via LAN.

In many cases, you will have to manually add the LAN instrumentation. Recall from Step 2, our instrument IP address is 192.168.0.87

Right-click on Network Devices, and select Create New VISA TCP/IP Resource:



4. Select Manual Entry of LAN:



5. Enter the IP address and press Validate

## **SIGLENT**

🔀 Create New		? ×
Enter the LAN resource detail		TIONAL RUMENTS
	Tree the TCP/IP address of your VISA network resource in the om of xxx.xxx.xxx.xxx, the hostname of the device, or a computer@some.domain. The LAN device name is often "inst0" or "gpib0,1".	
	dostname or IP address	
	AN <u>D</u> evice Name Validate	ŕ
	< <u>B</u> ack <u>N</u> ext > <u>F</u> inish	Cancel
Measurement & Automation Explorer	×	
Successfully opened a VISA	session to "TCPIP0::192.168.0.87::INSTR"	
	ОК	

6. After successfully creating a TCP/IP connection, select finish

## **SIGLENT**

🔀 Create New		? ×
Enter the LAN resource	details.	
	Enter the TCP/IP address of your VIS form of xxx.xxx.xxx, the hostname computer@some.domain. The LAN o or "gpib0,1". <u>H</u> ostname or IP address 192.168.0.87	of the device, or a
	LAN <u>D</u> evice Name	Validate
	< <u>B</u> ack <u>N</u> ext	> <u>Einish</u> <u>C</u> ancel

7. After the system updates it's configuration, the instrument will appear in the Network Devices menu:

My System  Devices and Interfaces	🔚 Save 🛛 Refresh 🛛 😹 Open VISA Test Panel			
ASRL10::INSTR "LPT1"     Network Devices     Sos TCPIP0::192.168.0.87::inst0::INSTR	Settings			
Software	Name			
Remote Systems	Hostname	192.168.0.87		
	IFv4 Address	192.168.0.87		
	Status	Present		
	LAN Device Name	inst0		
	VISA Resource Name	TCPIP0::192.168.0.87::inst0::INSTR		

8. To further test the connection, right-click on the instrument and select Open VISA Test Panel or select it from the side bar:



My System	🔚 Save 🚷 Refresh 🔀 O	open VISA Test Panel
ASRL10::INSTR "LPT1"  A Letwork Devices  TCPIP0 101 100 007	Settings	
> 💭 Sof ware Rename Remot : Systems 🗙 Delete	Name	
Open VISA Test Panel	Hostname IPv4 Address	192.168.0.87 192.168.0.87
	Status	Present
	LAN Device Name	inst0
	VISA Resource Name	TCPIP0::192.168.0.87::inst0::INSTR

The VISA Test Panel window shows some helpful information, including the TCP/IP identifier (VISA Address) along the top.

_		R - VISA Test Panel	-											
Configur	ation	Input/Output	Advanced	NI I/O Trace	Help	INST	IONAL RUMENT							
TCP/IP Settings	I/O Settings	View Attributes		R	eturn Data									
TCP/IP Settings		Packet Settings		No Error		^								
Hos	stname													
192.168.0.87 Device Name inst0 Address		No Packet Delay Keep Alive Packets												
							192	2.168.0.87						
							Buffer Operati							
								Transmit Buffer		Receive Buffer				
	0		0											
		Set Size	Set Size											
	FI	lush Buffer	Flush Buffer											
			Refresh A	pply Changes										

9. Another useful item in the VISA Test Panel is the Input/Output function. This mode allows you to send specific instrument commands and receive instrument responses.

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- Write will send the command to the instrument

- Read will pull data from the instrument

- Query will perform a read and then a write command to request and return data from the instrument

Configuration Input/Output	NI I/O Trace	
c I/O		Return Data
*IDN?\n       *IDN?\n       Write     Query       Read     Read Status Byte	Bytes to Read 1024	Read Operation No Error
View mixed ASCII/bevadecima 1: Write Operation (*IDN?\n) Return Count: 6 bytes		
2: Read Operation Return Count: 48 bytes *IDN\sSIGLENT,SDS2102X,SDS2XHA2160547,1.2.2.1\sR9\n	U I	
Copy to Clipboard	Clear Buffer	

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