LB5900 Series Power Sensor

Option LAN

Getting Started Guide

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Notices

DISCLAIMER

The information contained in this document is subject to change without notice. There is no guarantee as to the accuracy of the material presented or its application. Any errors of commission or omission will be corrected in subsequent revisions or made available by errata.

Additional Resources Available

- LB5900 Series LAN Programming Guide
- LB5900 Sensors Programming Guide
- LB5900 Series Programmatic Examples Guide
- Security Options
- Product Data Sheet

What is covered in this manual

This manual provides information to get the LAN based LB5900 series power sensor up and running. Please refer to the Programming guide, user manual and additional LAN documents for other application information.

Overview

Usability

LadyBug LAN interfaced power sensors can be used in a wide variety of applications and environments such as:

- Using a web browser and the sensor's internal web power meter with Interactive IO
- Applications utilizing HiSLIP (High Speed LAN Instrument Protocol)
- Automated Test Environments such as LabVIEW, MATLAB etc.

The power sensors utilize standard SCPI commands.

Power Source

LadyBug LAN sensors are powered by the Ethernet connection (PoE – Power over Ethernet), and require a PoE enabled connection. A PoE injector can be used when connecting to a non-powered port. Additional information and options are covered in the Get Started section.

URL / Browser character information

Browsers may not accept some characters such as space and quote that are often used in the context of this document and LAN interfacing. In all cases, it is safe to replace *spaces* with *%20* and quotes with *%22*.

IP Address: Self-Assign, Static, DHCP

LadyBug power sensors with LAN interface support both DHCP and static IP addressing. The factory default setting is DHCP, however if no DHCP server if found after 60 seconds, the sensor will self-assign a static IP address. This configuration allows for flexible deployment in various network environments, ensuring that users can connect to the sensors regardless of their network setup. Once connected, the configuration can be changed.

The default Self-Assign static IP address is: 169.254.22.22
PoE source specification: IEEE 802.3af or higher

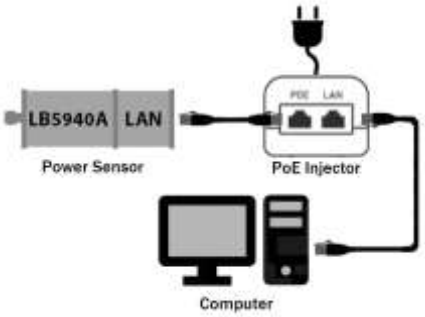
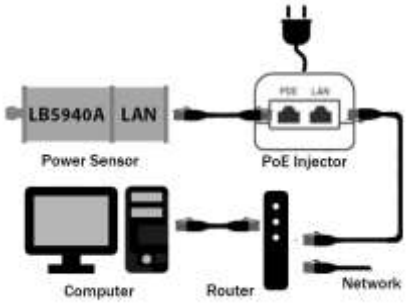
Boot & Connection information

It can take up to 60 seconds for the sensor to boot-up when set to DHCP, during this time, the sensor will flash blue indicating a DHCP search is in process. Boot-up is complete when the LAN connector indicators are green and orange, and the sensor indicator is green, however the green indicator only indicates a successful boot-up of the sensor and does not indicate that a Static or DHCP connection has been established.

Setting↓	Condition→	A DHCP Server is available	No DHCP server available
DHCP (Factory Default)		Connect DHCP within 20 sec	Self-assign IP address within 60 seconds
Set to Static IP Address		Connect static addr ~15 sec	Connect static addr ~ 15 Sec
Self-Assign		Connect static, using self-assign addr ~15 sec	Connect static, using self-assign addr ~15 sec

Once boot-up is complete and a connection is established, the connection method and static IP address can be changed through the System Settings menu using the sensor's internal web page. Refer to the additional information in this document or the LAN programming guide for further details.

The following guidelines are intended to assist with the initial configuration to get your system up and running. Please note that these guidelines may not be suitable for all situations.

Use Static IP When	USE DHCP When
No router is present, such as a direct connection to a computer	Connecting within a network controlled by a router
Using an Ethernet switch when no router is controlling the network	Using a Ethernet switch when a network is controlled by a router
Security concerns require it	DHCP connections may be required in large networks for central control
Specific control over connections is needed	
	 Router may be located elsewhere in building

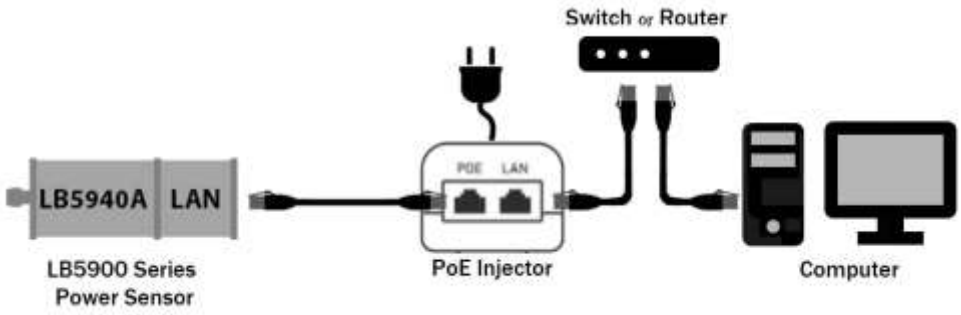
Get Started

This section covers recommended steps to get your LB5900 series LAN sensor up and running quickly.

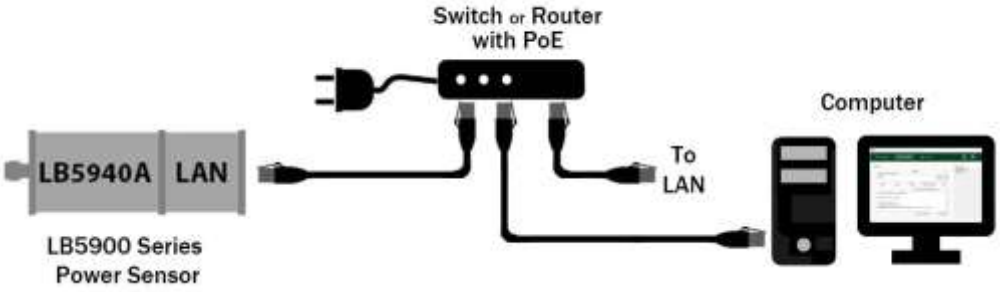
Make Sure Power is Available

LB5900 Series Power Sensors with Option LAN, are powered through the Ethernet cable using PoE (Power over Ethernet). Most computer Ethernet ports *do not* supply power, in which case a PoE injector or a router / switch with PoE should be utilized as shown in the images below.

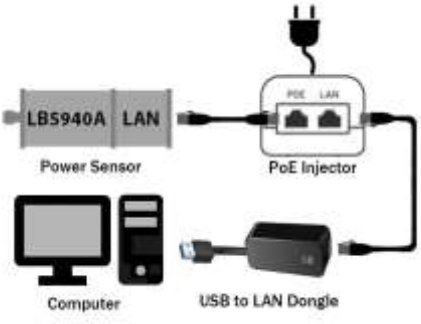
PoE source specification: IEEE 802.3af or higher.



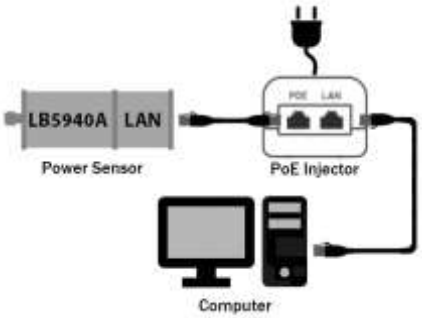
Using a Poe Injector with a Switch or Router



Using a Switch or Router that supplies power (PoE)



Using a USB to LAN dongle & PoE Injector



Direct connection to an Ethernet port & PoE Injector

Locate the IP Address

The following assumes that LAN power sensor is set to its default settings.

Upon power-up, the LED indicator will flash blue to indicate a DHCP search. If unsuccessful after 45 seconds, the sensor will default to its self-assigned static address. In either case, the sensor's indicator will show green, indicating a successful self-test.

After the sensor is successfully connected to the web browser, we recommended setting the sensor to either DHCP or to Static using your desired IP address. This will reduce the boot-up time to a few seconds.

- If the sensor is inside of a Network, continue on to **DHCP - Locate the IP address** section.
- Static address, continue on to section **Use Static IP Address** section. In this case, the sensor may be connected directly to an Ethernet port on a computer; to a switch that is not part of a network; To a USB dongle. The sensor will use its static address. During the boot-up process, the blue LED on the sensor should have flashed for about 30 seconds prior to turning green.

DHCP - Locate the IP address

DHCP (Dynamic Host Configuration Protocol) is a network protocol that automatically assigns IP addresses and other configuration information to devices when they connect to a network. Networks are typically managed by routers, which often provide DHCP services. This technology eliminates the need for manually configuring individual network devices such as LAN-based power sensors. While this automatic configuration can be useful in many situations, the primary disadvantage is that the IP address may not always remain the same, which can add complexities in automated test systems with multiple devices.

DHCP.

- The sensor has a fixed number called its MAC address (Media Access Control) this is a device specific address assigned at the factory and is listed on the sensors label.
- When using DHCP, the sensor's IP address is dynamically assigned by the router or DHCP server.
- To find the sensor's current IP address, you can query the router. After logging into the router, locate the DHCP Client List and find the sensor using its MAC address (Figure 1).

Figure 1 - Router Client List Screen

- Alternatively, to locate the IP address of a LadyBug power sensor on a Windows PC, you can use either of two methods: the Address Resolution Protocol (ARP) or the nslookup tool. Here's how to access these tools:

  Open a command prompt or Windows PowerShell:
  - Press the Windows key + R
  - Type "cmd" or "powershell" and press Enter

  Use the ARP command (Figure 2):
  - Type "arp -a" and press Enter
  - Look for the sensor's MAC address in the list of devices
  - The corresponding IP address will be displayed next to the MAC address

  Use the nslookup tool Figure 3):
  - Type "nslookup [sensor_hostname]" and press Enter
  - Replace [sensor_hostname] with the actual hostname of your LadyBug sensor. Note: LB59040A must be entered as LB-5940A or lb-5940a), follow the model number by a space then the serial number as shown, and then a period.
  - The tool will display the IP address associated with the hostname

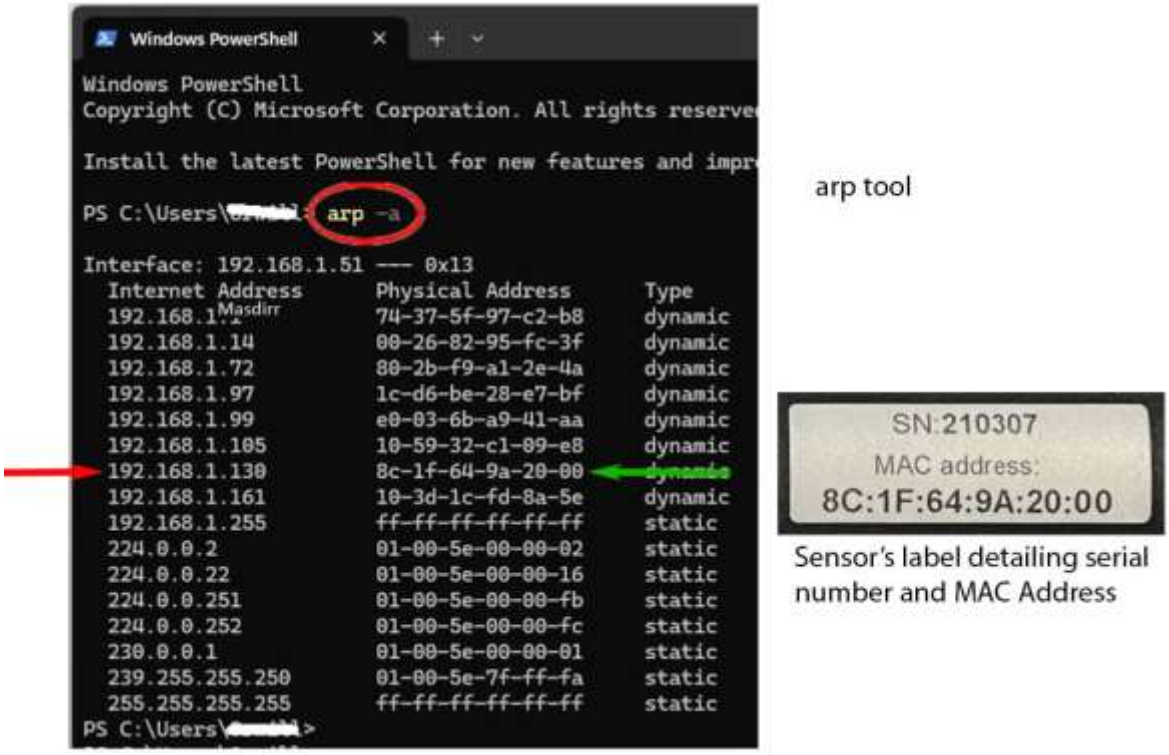


Figure 2 – Windows Power Shell showing ARP Table

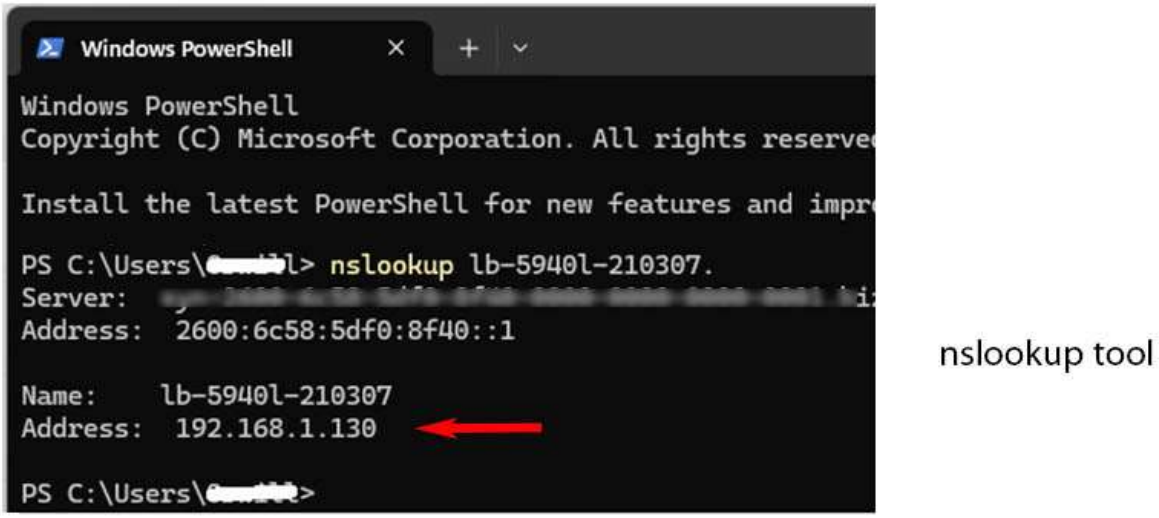


Figure 3 - Using the nslookup tool

Note: After locating the IP address, note it for future use.

Use Static IP Address

A static IP address is an IP address that is set in the LAN device and doesn't change. Once your power sensor is assigned a static IP address, the sensor will always use that number. This can be beneficial in test systems with many devices, and is the often the best final choice for your power sensor in your test system. One disadvantage, is the devices must be managed to avoid duplication of IP addresses.

Static IP Connection Summary (from factory default settings)

- When a LadyBug LAN power sensor is first attached to the Ethernet port, it is ready to accept a DHCP address, this will occur if a router is present, and a Static IP address will NOT be available.
- If no router is present, the sensor will attempt to connect by DHCP, however it will default to its self-assigned static address because no DHCP connection is available. Use the default static address to connect to the sensors internal web power meter to change the boot up and static IP address settings.
- Once settings are set to Static, the sensor will boot up using the defined static address with no DHCP search delay, no DHCP services will be accepted. The static IP address must be noted since it will be the only way to connect, without resetting the sensors LAN interface.
- Default static IP address and resetting information are listed in General Specifications and Information.

Connect to the Sensor and Test

Once the sensor's IP address has been identified, various software applications can interact with it. However, any device seeking to access the sensor must be within the same LAN (Local Area Network). While connections outside of the LAN are possible, the subject is beyond the scope of this Guide.

Using a Web Browser

The sensor's internal measurement system generates a webpage that can be viewed on a web browser running on a computer or portable device, such as a cell phone. As previously mentioned, the device must be within the same LAN, unless configured otherwise.

To access the sensor's internal power meter webpage, open a new browser window or tab. Enter the IP address into the browser's navigation bar (not the search engine input area), as illustrated in Figure 4.

Figure 4 - Browser

While most browsers are typically set to search from the navigation bar, they will locate resources when specifically requested. Using a search engine will likely perform a web search and may overlook other resources.

Upon successful entry of the IP address, the sensor will deliver an internal power meter webpage to the browser, as demonstrated in Figure 8. There are three main sections to the web power meter.

- Power meter (left image) capable of making a variety of measurements. To make a simple measurement, set the frequency, change Measure to Continuous, click Commit Settings and finally select click Take Measurement.
- Interactive IO (center image) Type a standard SCPI command into the input area such as *IDN? and then click Send.
- System Settings (right image) has various utilities to test and edit settings.

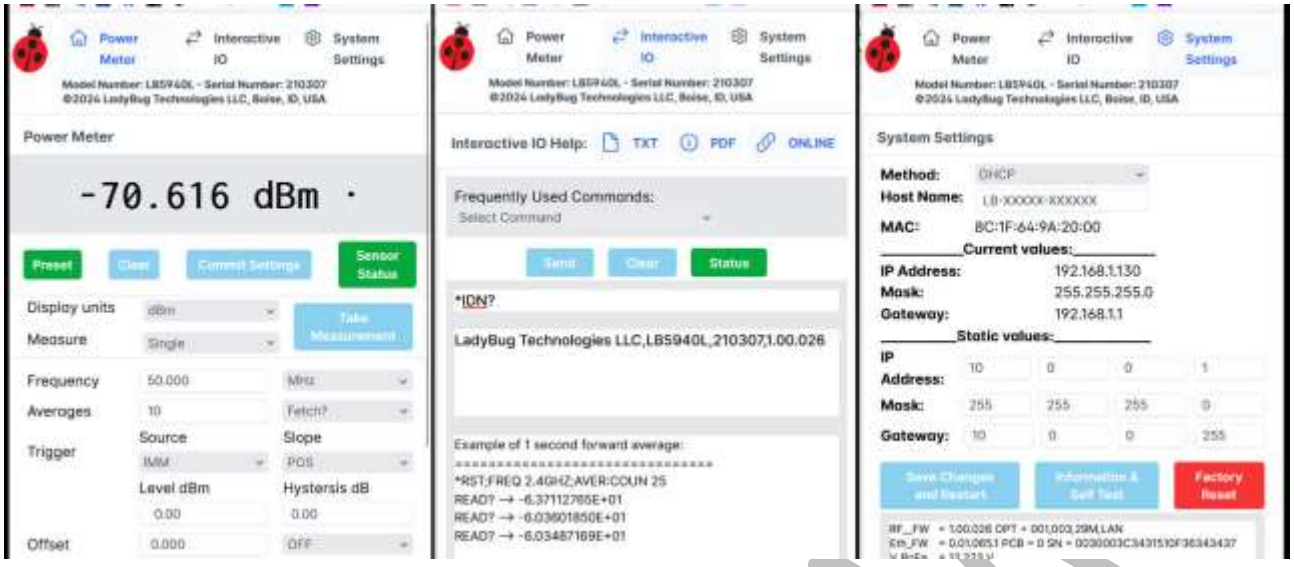


Figure 5 – Left Power Meter Web Page, Center Interactive IO, Right System Settings

Change Sensor Connection Mode (DHCP, Static, Self-Assign)

Once the power sensor is connected and the web power meter is functioning, changes can be made to the LAN connectivity options. This example details changing the sensor from its default DHCP setting, to a static address. Refer to Figure 6

Step 1. Referring to Figure 6 left, the sensor starts with a DHCP assigned address, use the Method dropdown and change from DHCP to Self-Assign, then click Save Changes and Restart.

Step 2. Referring to Figure 6 center, change the Method from Self-Assign to Static.

Step 3. Again referring to Figure 6 center, Copy all of the address values from the Current values section to the Static values section (these are the Self Assigned static values). In this case the last digit was changed making the static address different than the self-assigned address. Save and restart using the new static address.

Figure 6 – Changing to Static Address

Note: If the IP address is inadvertently set to a non-locatable value, or the address is lost, refer to Sensor LAN Reset section of General Specifications and Information to reset the LAN address.

Using NI-VISA Interactive Control

Note, the images and examples here were done using NI MAX Version 2023 Q4

Referring to Figure 7, 0pen NI Max, and from the main window, under *My System* at left, open the *Devices and Interfaces* dropdown and select *Network Devices*. Look for the sensor in the right window under the *Add Network Device* dropdown. If it is not listed, select the *Add Network Device* dropdown arrow and select *VISA TCP/IP Resource…* then select *Manual Entry of LAN Instrument* radio button, then *Next>* at the bottom. A new screen, *Create New…* will appear.

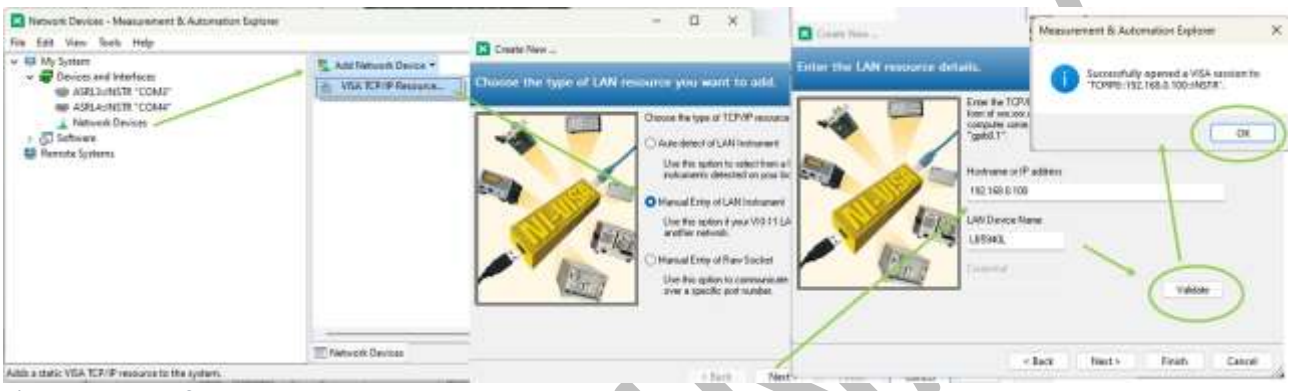


Figure 7 - NI-MAX Setup

In the *Create New …* window, Enter the IP address in the *Hostname or IP address* box. In the *LAN Device Name* box, enter the sensor's name, this it is not necessary, however it will cause the name to be shown later adding clarity. Click *Validate*, a popup window will appear detailing the added sensor. Click *OK* in the window, then select *Finish* at the bottom.

The device properties will show in the large window detailing the sensor's basic information as shown in Figure 8.

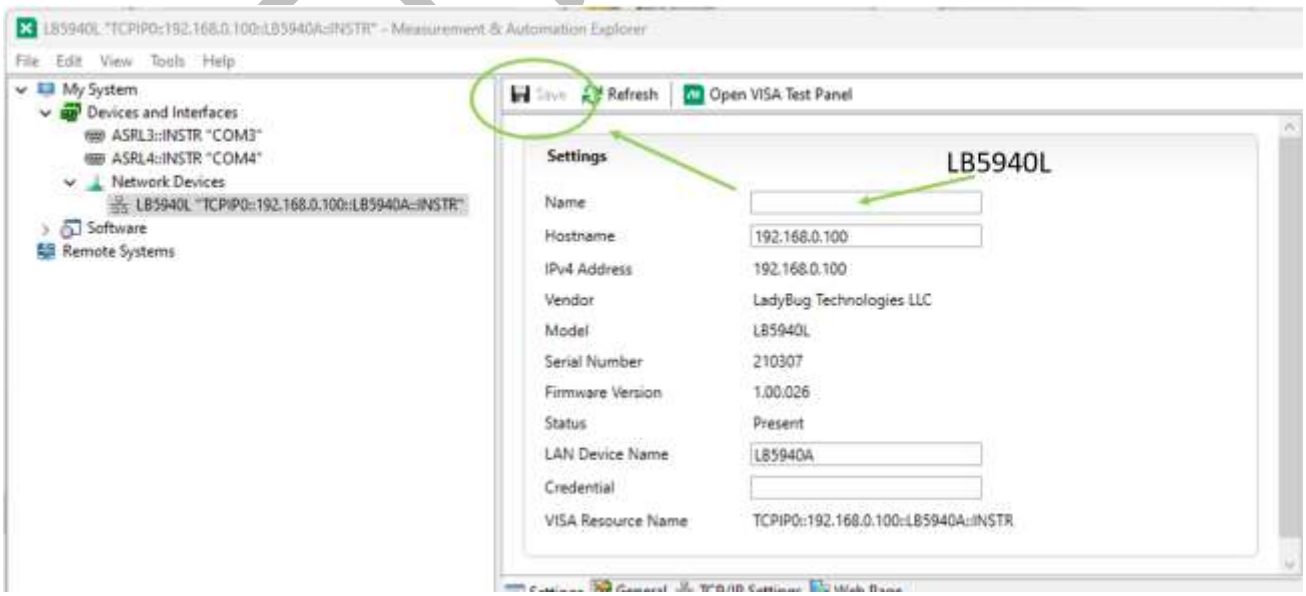


Figure 8 - NI- MAX final setup screen

If a LAN Device name was added previously it will appear in the *LAN Device Name* box lower in the window. The entire resource can be renamed by completing the *Name* box at the top, enter LB5940L again, then select *Save* directly above the window. The sensor is now available for use in the NI MAX system.

To interact with the sensor, from the main NI Max top toolbar select the *Tools* dropdown then *NI-VISA -> Visa Interactive Control* and select it. The sensor will be listed in the TCP/IP Instrument Resources area. If a name was given when the sensor was added it will appear in the TCP/IP string, otherwise it will be shown only by the IP address, refer to Figure 9.

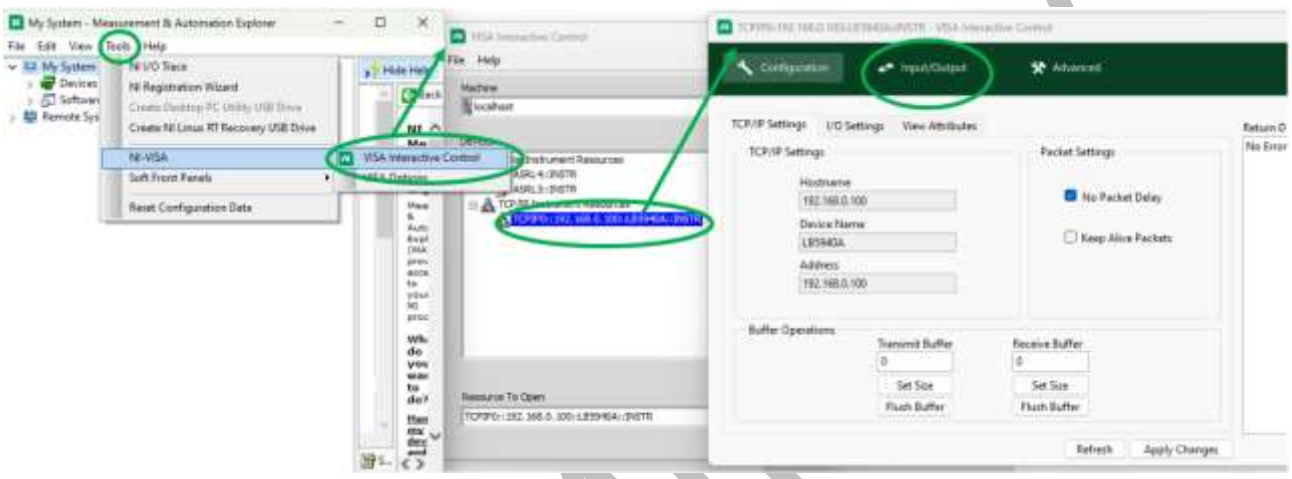


Figure 9 - NI MAX IO Control

Click on the sensor (line in the list), and an Interactive IO control will open, displaying the Sensor details. Navigate to the *Input/Output* tab at the top of the *VISA Interactive Control* window. *The Basic I/O* tab will open, as illustrated in Figure 10. The IO control presents a default query, '*idn?\n'. Click on the *Query* button, and the sensor will respond with its identification string. It's important to note that '\n' represents a 'New Line' character to be sent. However, by default, NI MAX will automatically add the character if it is not present. Additionally, the NI-MAX VISA IO control defaults to displaying the character in the sensor returns.

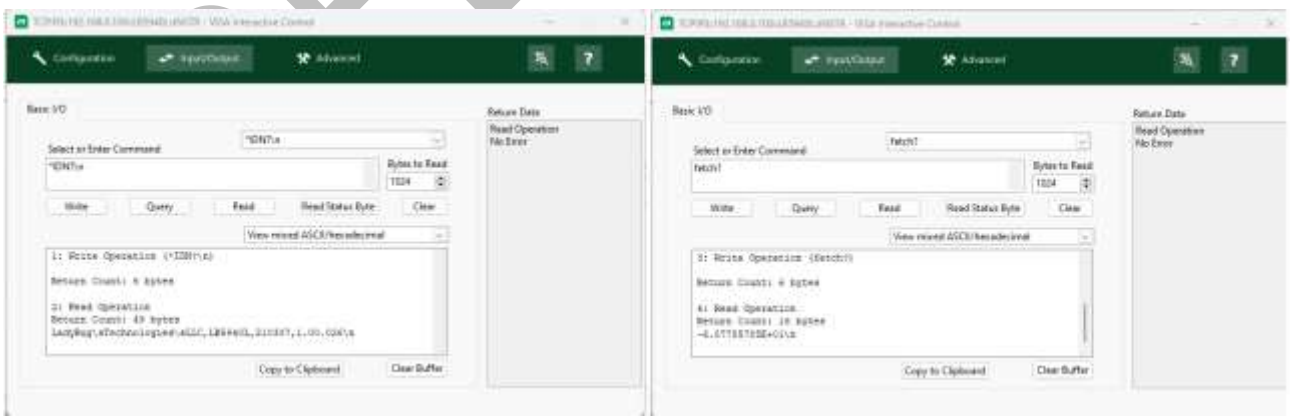


Figure 10 - Sensor Interactions

Enter 'fetch?' into the *Select or Enter Command* box and choose *Query*. It's worth noting that the '\n' was not entered, but the command was successful. As mentioned earlier, this is due to the IO Control automatically adding the '\n' in the background; otherwise, the sensor would have issued an error. The resulting power level is -68.79 dBm, returned as an exponential value.

General Specifications & Information

Default static IP Address
169.254.22.22

Default Connection Setting
DHCP (Attempts to connect by DHCP for 45 seconds; assigns the Default static IP address if it fails)

PoE Specification
IEEE 802.3af or higher

LED Indicators details
There are 3 indicators, 2 located on the Ethernet connector and 1 on the sensor itself.

Ethernet connector LED's: Solid green indicates connection established, flashing green indicates activity. Amber indicates connection speed.

Sensor LED: Flashing blue indicates an attempt to connect by DHCP, solid green indicates ready.

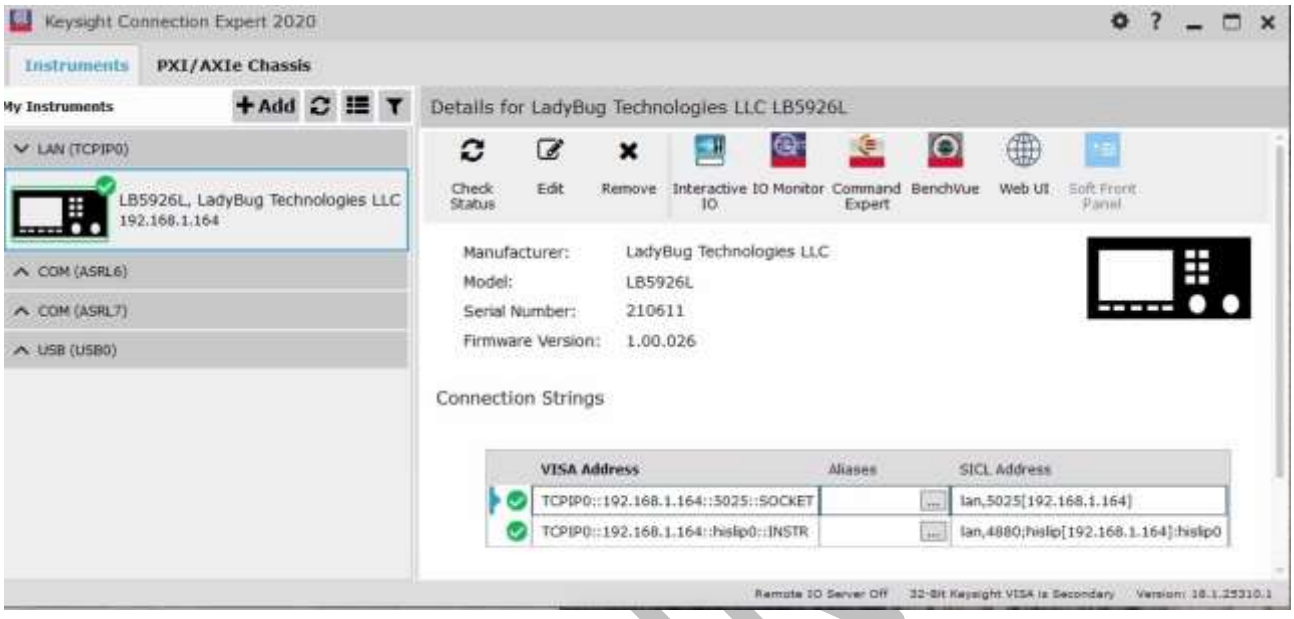
If the sensor becomes green and both Ethernet connectors are off, the sensor is ready, however no LAN connection has been established.

Sensor LAN Reset
In the event that a static address is assigned and the address was not noted or for some reason the sensor is not accessible, the LAN interface can be reset.

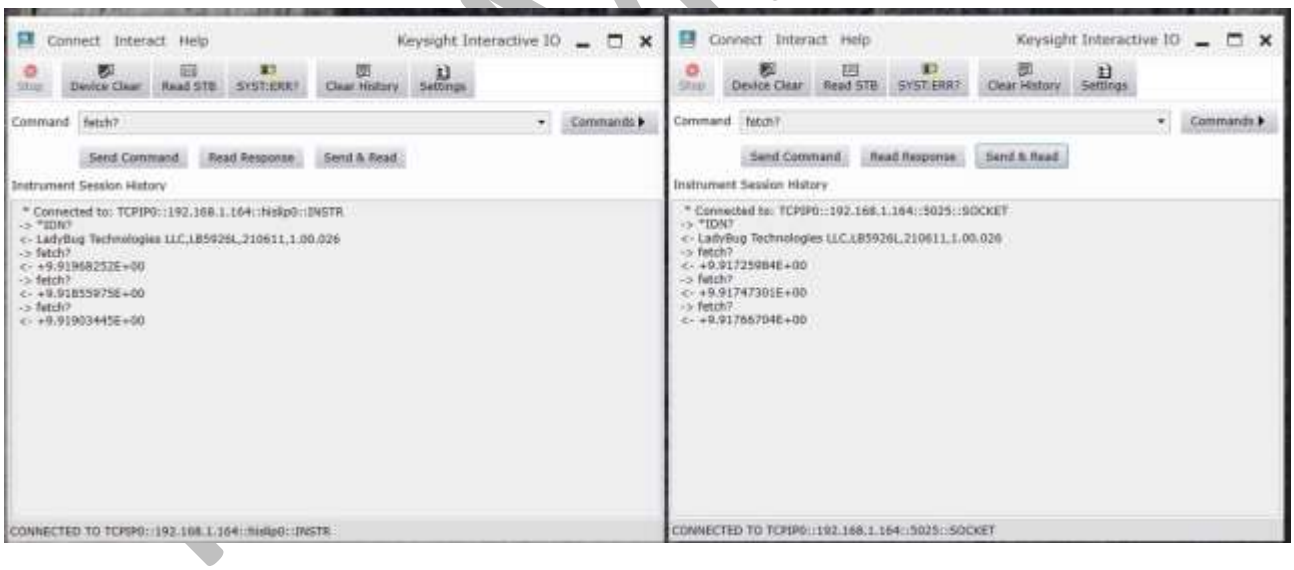
To reset the LAN interface, disconnect the sensor from power, insert the supplied "SD" size card as shown at right, then power up the sensor using a PoE enabled device. The sensor will revert to DHCP mode with self-assign fallback after 1 minute.

Other Connection Examples

Keysight Connection Expert Setup

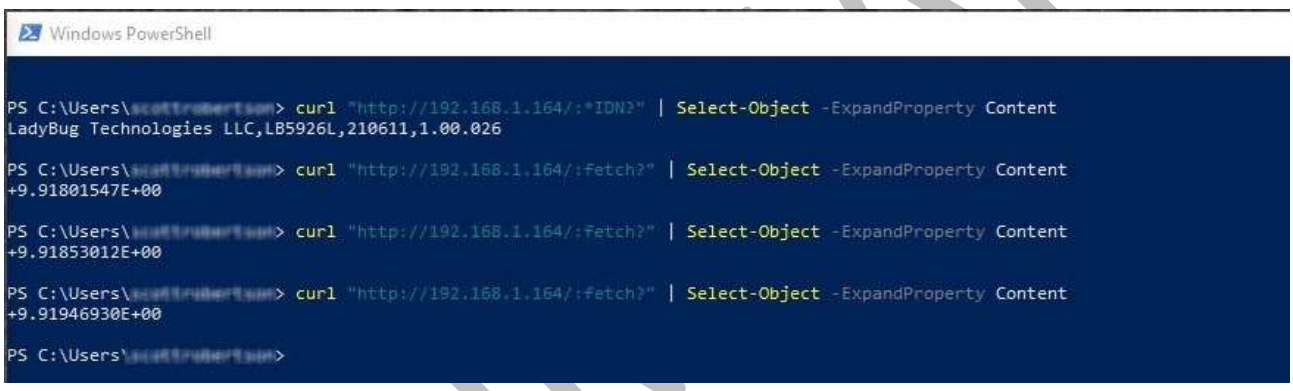


Keysight Interactive IO



Windows Command Prompt

Windows Power Shell



Linux & Mac