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Low Voltage Probe, LVP-1 (#30019)

The Networked Robotics Low Voltage Probe enables the remote data collection of positive DC voltage via standard computer networks. It is useful for real-time data collection from a wide variety of voltage sources including the voltage outputs of some types of scientific instruments and many types of analog sensors. The probe is used in conjunction with the Networked Robotics NTMS (Network Telemetry Monitoring System) hardware and with Networked Robotics Tempurity™ System software. Tempurity is designed for network-based data collection and monitoring of real-time scientific data in FDA-regulated environments.

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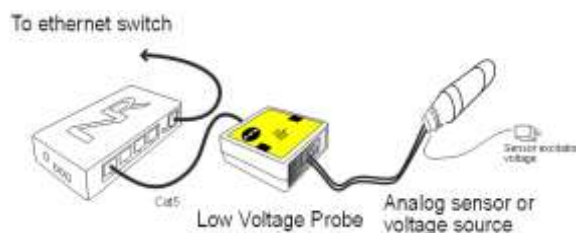
Description

This product enables data collection of any DC voltage from 0 to 10 Volts. One of the primary uses of this hardware will be to collect voltage from any analog sensor, transducer, or scientific instrument with positive voltage outputs. Sensors registering pressure, level, humidity, rotation, force, strain, position, load, temperature, and a variety of other types are supported by this product.

As shown in the figure above, one side of the LVP connects to one of the four measurement ports of the NTMS and the other side connects to a compatible (0 - 10 Volt output range) analog sensor or transducer, or any other low voltage source. The figure above shows how data collection is enabled with this type of Networked Robotics interface. For most sensors a means of excitation voltage must be provided separately. DC wall power supplies may be appropriate as excitation voltage sources.

The product is available for 4-20 milliamp data collection from scientific instruments and sensors as Networked Robotics product number 30019A.

Packing List

This package includes the basic hardware you will need to connect the Low Voltage Probe to the NTMS.

- (1) Low Voltage Probe, LVP-1
- (1) CAT5E Cable

- (1) RJ45 Coupler for Extensions

Data Collection from Any Combination of Monitored Devices

Because each NTMS4 unit has 4 "universal" measurement ports, data from any combination of Networked Robotics interfaces to scientific instruments and sensors can be collected with a single unit. Only one connection, an LVP connected to a pressure sensor, is shown in the figure above.

Installation

The Networked Robotics Low Voltage Probe is attached to a voltage source and to the Networked Robotics NTMS network hardware as shown in the diagram above. There are three major steps in the installation of this product:

1) Physical installation
2) Configuration of Networked Robotics NTMS hardware to which the voltage source is attached
3) Manual testing of data collection via the network

Each of these steps should be performed successfully before attempting to configure and monitor real-time voltage via the Tempurity System. Detailed information on configuring data collection in Tempurity is available in the Tempurity Systems User's Guide (Networked Robotics document number "Tempurity-04-0006.5)" on the Networked Robotics web site.

1. Physical Installation

The customer should consult the manual for their analog transducer to determine the appropriate physical installation for the transducer. Additional information about this is provided under the "Transducer Compatibility" heading in the reference section. Physical connections will be similar to the diagram on the first page. The wiring connections vary according to the transducer brand and model, but for many transducers they will be as illustrated below.

The Low Voltage Probe unit can be installed as far as 100 meters from the Networked Robotics NTMS network hardware and connections are easily made and extended with CAT5 cable and the included couplers. You may wish to install the Networked Robotics NTMS hardware in a network closet, and then "patch' to the Low Voltage Probe at the monitored site via your company's network cable plant.

The Networked Robotics Low Voltage Probe is not designed to be subject to extreme temperature ranges and should be placed in a location removed from possible exposure to high temperature, liquids, or other harsh environmental conditions.

You will need a small Phillips-head screwdriver for installation.

First turn the unit over and remove the two screws on the back, which hold the case together.

Next locate the green screw terminals at the bottom of the board. This is a green two-position screw terminal as shown in the figure below. Wiring connections for common transducer/sensor models are shown below. Excitation voltage for analog sensors is not supplied via this product. You will need to provide the correct excitation voltage, usually via DC power supply, for your transducer.
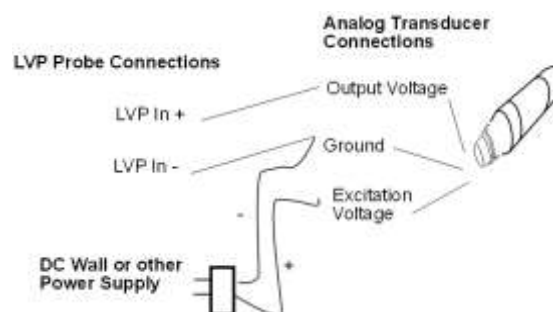

Transducer output is connected to the Low Voltage Probe as shown below:

Low Voltage (LVP) Probe
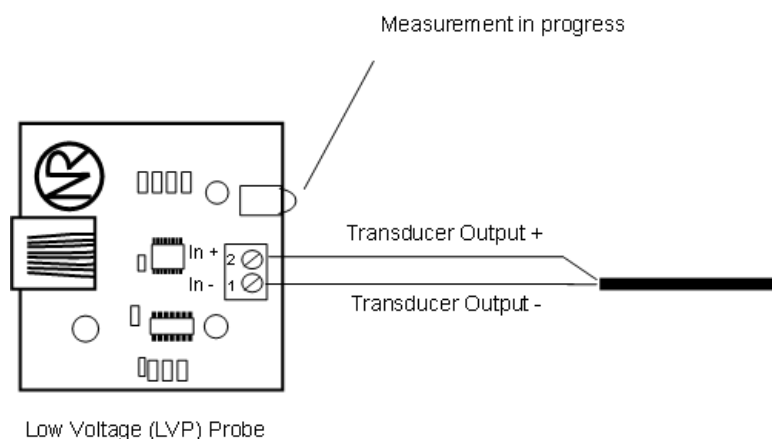
Most analog sensors will have pre-stripped wires. If not, strip approximately ¼" of insulation from the wire. Insert the wires into the screw terminal, and tighten down with a small Phillips-head screwdriver. You should pre-feed the element wire through the hole in the case end-panel before connecting the wires to the

terminals. You may need to bend the end panels slightly to remove, and replace them.
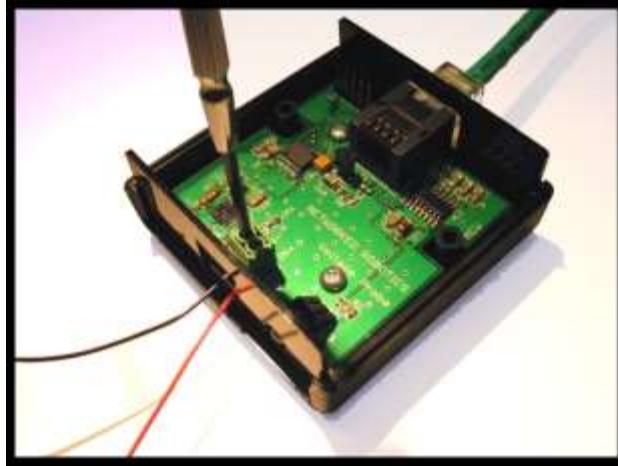
Attach the negative or ground wire of the sensor's output voltage to the screw terminal labeled (IN-) on the Voltage Probe board. This is the leftmost pin when facing the LEDS.

Attach the positive wire of the sensor's output voltage to the screw terminal labeled (IN+) on the Voltage Probe. This is the rightmost pin when facing the LEDS. Take care to avoid attaching the transducer excitation voltage to the voltage inputs of the LVP probe.

In order to confirm that the probe is connected properly, you may wish to test data collection before replacing the cover. Use the provided CAT5E cable to connect the LVP to any of the four measurement probe ports on the NTMS.

Follow the "Configure the NTMS" and "Testing through the Network" instructions below. When you are satisfied that the connection to the voltage source has been made correctly, replace the cover and its screws to close the LVP.

If the NTMS is powered on, and the CAT5E cable connection is made correctly between the LVP and the NTMS, the yellow LED on the LVP will illuminate while it does an internal calibration. Then it will go out when it is ready to be polled. Every time the LVP probe is polled by the NTMS, the LED will come on briefly.

Secure the LVP unit to a convenient permanent location using the dual-lock provided on the back. The dual-lock sticks best to metal (except aluminum) or plastic surfaces. It may not adhere as well to surfaces such as drywall or wood, or to porous materials such as concrete. The probe can be removed from its dual-lock base for maintenance or cleaning.

2. Configuring the NTMS

Configure your NTMS network hardware for data collection from this instrument. This is done by running the latest version of the NTMS Configuration Wizard 🔍 from any PC that is on the same subnet as the NTMS to be configured. You can obtain the configuration wizard from the "download" section of the Networked Robotics web page.

New sensor and interface types are being added periodically to the wizard so the screens below may change.

1. Run the wizard and verify that the NTMS to which the interface is attached is discovered. This NTMS must be running firmware revision 2.0 or higher. If it is not, stop the installation and upgrade your NTMS hardware's firmware with the NTMS Upgrade Wizard available from the Networked Robotics download-page. There are special precautions needed when upgrading an NTMS running firmware version 1.x to firmware version 2.0 or higher.

2. Select the NTMS to which the interface is attached, and proceed to the "NEXT" screen. (IP addresses must be set properly for your institution. If you are uncertain about the IP address to use, check with your network administrator.)

3. Click on the NTMS measurement port where the probe is connected, and under the "Device Type" drop down, select "DCP Dry Contact Probe" or "Low Voltage Probe".
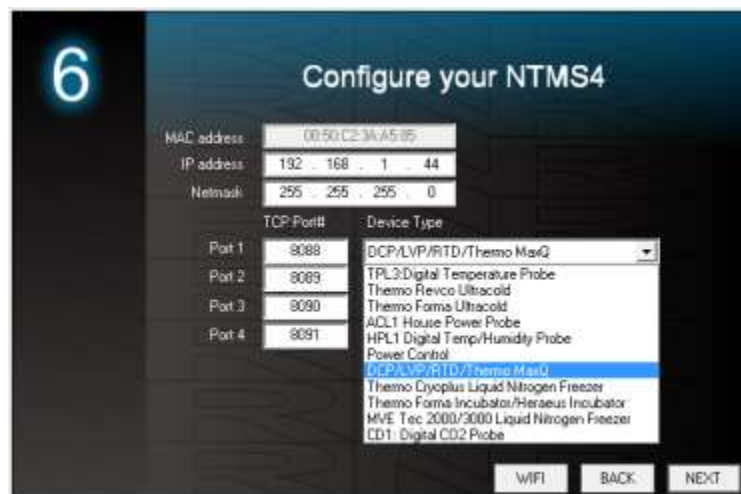
4. Click "NEXT" to complete the NTMS configuration.

Note: If the NTMS measurement port is configured as the incorrect interface type (The correct type is "DCP" or "LVP") in the NTMS Configuration Wizard, then the yellow light

will never activate despite having the correct physical connection to both the NTMS and the voltage source.

3. Testing Data Collection through the Network

Once the configuration is complete as described above we recommend testing the ability to make network temperature and other measurements by using the "Telnet" utility from any PC. This commonly-used network utility sends simple network commands that will elicit a voltage reading from the probe.

Windows 7,8,10 clients may need to enable the Telnet utility as follows: 1 Start. 2 Control Panel. 3 Programs and Programs and Features. 4 Turn Windows Features on or off (upper right of screen). 5 Check "Telnet Client". 5 Press Ok.

1. From Windows choose "START", then "RUN", and then type "CMD" and press return.
2. In the black screen type "Telnet" IP Port, where IP is the IP address and Port is the network port address as selected by your use of the NTMS Configuration Wizard as described above.
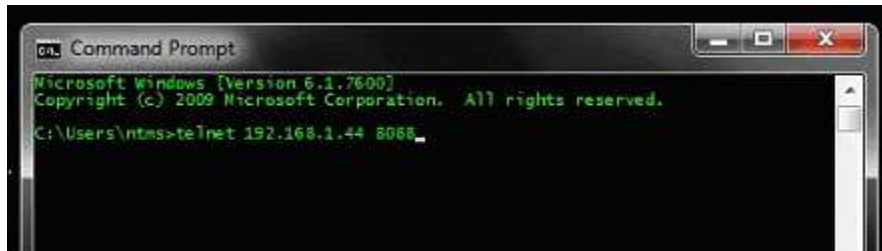
3. If you are successfully connected through the network you will see a blank screen.
4. Type a capital "T", the command character for this device. A voltage and the associated checksum value should be returned. For more about debugging network connections to monitored devices see the Tempurity System User's Guide.

For use with the Tempurity System, you will need to add the network address (IP address and network port address) of the new monitored device (the voltage probe) to the Tempurity Server configuration. See the Tempurity System User's Guide section on server configuration for more information.

The control character for this interface is "T".

If a voltage is not returned, check network parameters, network ports, firewalls and connections and try again before attempting to configure data collection using Tempurity System software.

Procedure for Determining the Appropriate High and Low Voltage Thresholds in the Tempurity System
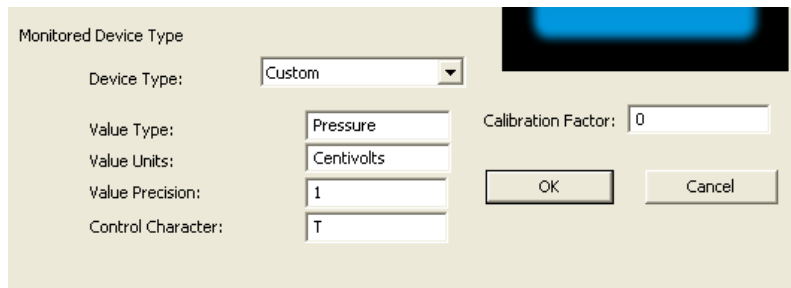
For analog sensors that report, for example pressure, you will need to set the allowable minimum and maximum limits in the Tempurity System based on the voltage at those pressure levels that is reported by the transducer.

To determine the appropriate minimum threshold voltage, set the appropriate physical parameter of the transducer (e.g. pressure, position, or strain level) to the minimum level and note the

voltage recorded by Tempurity (or a Telnet reading as described in the section on testing above). Then set the physical parameter to the maximum level and note that voltage. Use these voltage readings (they will be in centivolt units) as the minimum and maximum threshold voltages values that are entered into the "Monitored Device ID, Network Source, and Alarm Criteria" screen of the Tempurity Server Configuration Utility 🔧. In Version 2.0 of the Tempurity System the threshold values must be entered as integers. Thus the alarm limits when used with this product must be entered to the nearest 10 millivolts.
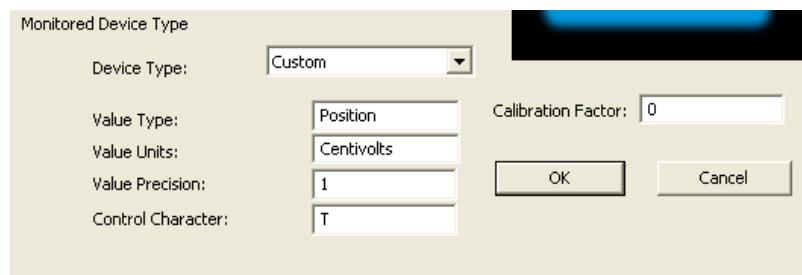
Configuring Data Collection in the Tempurity Server Configuration Utility 🔧

Use of the Low Voltage Probe usually requires definition of a monitored device of type "Custom" in the Tempurity Server Configuration Utility. See the Tempurity System User's Guide, especially pages 38 and 39 of the Version 2 User's Guide (NR Document Number Tempurity 04 0006.5) and the section on Tempurity Server configuration for more information. The control character to acquire voltages from a Low Voltage Probe is "T". The figure below shows a potential configuration for a pressure sensor attached to the Networked Robotics Low Voltage Probe.

A similar configuration for an LVDT position sensor connected to the Low Voltage Probe might be:

Operation

The Networked Robotics' NTMS network hardware continually reads voltages from the LVP at approximately 4 second intervals. The most recent value collected by the NTMS is available for network requests by the Tempurity System which by default collects remote data at one minute intervals.

During normal operation, the yellow LED will occasionally blink. The blink indicates an active data read by the NTMS. If the yellow LED does not activate, either the configuration of the NTMS port

has been changed and is no longer correct for an LVP probe or the connection to the NTMS is lost and the cables or NTMS status should be checked.

Recorded Voltages

The Low Voltage Probe reports voltage values in centivolts, (100ths of a volt), with a single digit after the decimal point; thus the LVP reports to 1 millivolt precision. As an example, 5.000 volts on the LVP input will be reported as 500.0 by the Tempurity System. The maximum voltage that can be reported is 9.999 Volts.

The Low Voltage Probe reports only positive voltage values. This product is not designed to accept negative input voltages.

Reference

Power Supply

The Low Voltage Probe derives its power from the regulated 5 volts DC supplied by the Networked Robotics NTMS hardware.

Transducer Compatibility

This Networked Robotics interface product should be used with transducers with output voltages in the ranges of 0-10, 0-1, or 0-5 Volts. 4-20 milliamp transducers are also common, but are not directly appropriate for use with this product. Transducers that produce negative output voltages are never appropriate for use with this product.

The required excitation voltage to an analog sensor is not relevant in order to determine compatibility with the Low Voltage Probe however high excitation voltages are capable of damaging the unit if they are accidentally attached to the LVP inputs. Do not attach the excitation voltage for analog transducers to the voltage inputs of the LVP as this may damage the unit.

When using sensors with smaller voltage ranges (0 to 1 Volt or 0 to 5 Volts instead of 0 to 10 Volts) the effective precision in physical units (e.g. mmHg) is lower in these sensors. A 0-10 Volt sensor has 10000 possible readings, a 0-5 Volt sensor has 5000 possible readings and a 0-1 Volt sensor has 1000 possible readings. The precision in terms of the units of your transducer are equal to Full Scale Range/# of possible readings. A pressure transducer with 0 to 500 Pascal full scale range but a 0 to 1 Volt output, has an effective precision of ½ a Pascal when used with the LVP. Because in Tempurity System Version 2.0, limits must be entered as integers, the precision of limits (for pressure in this case) is 5 Pascal.

Unique IDs

All Networked Robotics hardware holds electronic globally unique IDs. LVP IDs are of the format:

09:0000:0000:0002

Where 9 indicates the product number, and the other characters indicate the electronic ID of the unit. Electronic IDs can be read through a Windows computer using the Networked Robotics "Probe ID Unit" (Networked Robotics part number #30010) hardware through a USB connection.

Communications Specifications

The LVP communicates with the NTMS using RS-232 at 1200bps 8N1. You can collect data through this product via the serial port of a personal computer. See the Networked Robotics Support section of our web page for more information.

Physical Specifications

Weight:	59 grams (2.1 ounces)
Length:	67.22 mm (2.647 inches)
Width:	66.22 mm (2.607 inches)
Height:	28 mm (1.102 inches)

Performance and Accuracy

The LVP probe measurement capability is built around the Analog Devices A/D 7793 integrated circuit. The A/D 7793 is a 24-bit Analog to Digital converter, and thus is highly accurate relative to the 1 millivolt reporting precision of the voltage probe.

Support

If you need assistance with your LVP or other products, contact Networked Robotics by phone at 877-FRZ-TEMP (877-379-8367) or by email at support@networkedrobotics.com