# User's Guide

## Thermoelectric Temperature Controller
## LDT-5900C
## LabView Driver

**ILX Lightwave**

A Newport Corporation Brand

# Table of Contents

# Chapter 1 :
# Introduction and Specifications

This chapter is an introduction to the LDT-5910C LabVIEW Instrument Driver. This chapter also includes:

- ✓ LabVIEW Instrument Driver Overview
- ✓ USB Communication Overview
- ✓ GPIB Communication Overview

## LDT-5900C LabVIEW Instrument Driver Overview

The LDT-5900C LabVIEW Instrument Driver is a collection of Virtual Instruments (VIs) that allow for remote control of the instrument.  These VI's can be used either independently or as building blocks for a larger, more complex VI.  Remote control can be accomplished using VISA sessions over either of the two communication channels listed below.

## USB Communication

The USB connector is located on the rear panel of the instrument. This USB connector is the square "B"-style connector. A standard USB A/B cable is required.

## GPIB Communication

 The GPIB connector is also located on the rear panel of the instrument. See the LDT-5910C Product Manual for instructions on setting the GPIB address using the front panel controls.

# Chapter 2 :
# Operation

This chapter is an introduction to the LabVIEW software and the LDT-5900C LabVIEW Instrument Driver. This chapter also includes:

- ✓ Common Instrument Driver Features
- ✓ LDT-5900C Sub-VI Descriptions
- ✓ LDT-5900C VI Descriptions

## Front Panel vs. Block Diagram

The Front Panel appears when a sub-VI is opened. The Front Panel for every sub-VI includes VISA session IN and OUT ports, as well as error IN and OUT ports. Additionally, there are inputs and outputs relating to the specific operation the VI.

To open the Block Diagram of the sub-VI, select **Window** in the toolbar of the Front Panel and choose **Show Block Diagram**. The Block Diagram displays the code that communicates with the instrument. The information required by the code appears as a labeled icon in the Block Diagram and is input by the user on the Front Panel. The information output by the code also appears as a labeled icon and is displayed on the Front Panel.

The Front Panel and the Block Diagram of a sub-VI are two different views of the same code.

## VISA Session IN and OUT

The VISA Session box on the Front Panel provides a drop down menu of the remote addresses available. The VISA Session OUT outputs the VISA Session address that was input to the sub-VI. Although this seems redundant inside of the sub-VI, it creates flow between sub-VIs. See the example below.
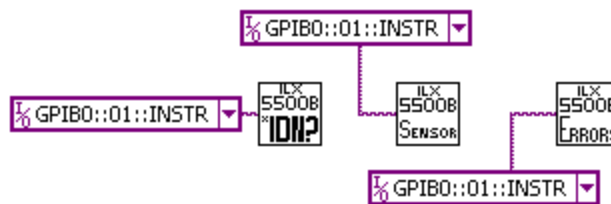


Figure 2.1 Three sub-VIs without VISA Session IN/OUT are controlling the same instrument.



Figure 2.2 Three sub-VIs with VISA Session IN/OUT are controlling the same instrument. The VISA Sessions OUT make it possible to input the address once and reduce the clutter.

## Updating the Sub-VI

Press the white arrow located in the toolbar of the Front Panel and the Block Diagram to execute the sub-VI.  To execute a sub-VI means to update the instrument with values input by the user or query the instrument.  If there is not a white arrow, but a broken gray arrow, see the Errors section in Chapter 3.

# LDT-5900C Sub-VI Descriptions

## LDT-5900C Read Autotune
Reads the Auto PID tuning and returns a string describing the state of the autotune function. Possible outputs are "Idle", "Running", "Pass", and "Fail".

## LDT-5900C Read Current Limits
Reads the high or low current limit in Amps and returns it as a floating point number. An enumerated input determines if the high or low limit is returned.

## LDT-5900C Read Current Setpoint
Reads the current setpoint in Amps and returns it as a floating point number.

## LDT-5900C Read Current
Reads the latest current measurement in Amps and returns it as a floating point number.

## LDT-5900C Read Errors
Reads the instrument's error queue and returns it as a string.  See the LDT-5900C Manual for more information.

## LDT-5900C Read ICI Constants
Reads the ICI calibration constants Slope and Offset and returns them as floating point numbers.

## LDT-5900C Read ICV Constants
Reads the ICV calibration constants Slope and Offset and returns them as floating point numbers.

## LDT-5900C Read Instrument ID
Queries the instrument with the IEEE 488.2 command *IDN? and returns the manufacturer, model number, serial number and firmware version number as a string.

## LDT-5900C Read Mode
Reads the operation mode and returns it as an enumerated value. Possible outputs are Temperature, $I_{TE}$, and Resistance.

## LDT-5900C Read Output State
Reads the state of the output and returns it as a Boolean value, with a return value of true meaning the output is on and a return value of false meaning the output is off.

## LDT-5900C Read PID Constants
Reads the current PID constant setting and returns the values for the P, I, and D terms as floating point numbers.

## LDT-5900C Read Resistance Limits
Reads the high or low resistance limit in Ohms and returns it as a floating point number. An enumerated input determines if the high or low limit is returned.

## LDT-5900C Read Resistance Setpoint
Reads the resistance setpoint in Ohms and returns it as a floating point number.

## LDT-5900C Read RTD Constants
Reads the RTD constants $R_0$, A, B, and C and returns them as floating point numbers.

## LDT-5900C Read Sensor Type
Reads the temperature sensor type and returns it as an enumerated value. Possible outputs are 100uA Thermistor, 10 uA Thermistor, Linear, Thermistor Auto, 1 mA RTD, 2.5 mA RTD, IC-I, and IC-V.

## LDT-5900C Read Sensor
Reads the latest sensor measurement and returns it as a floating point number.

## LDT-5900C Read Temperature Limits
Reads the high or low temperature limit in degrees Celsius and returns it as a floating point number. An enumerated input determines if the high or low limit is returned.

## LDT-5900C Read Temperature Setpoint
Reads the temperature setpoint in degrees Celsius and returns it as a floating point number.

## LDT-5900C Read Temperature
Reads the latest temperature measurement in degrees Celsius and returns it as a floating point number.

## LDT-5900C Read Thermistor Constants
Reads the thermistor constants C1, C2, and C3 and returns them as floating point numbers.

## LDT-5900C Read Tolerance Setpoint
Reads the tolerance window value for the current mode in units based on the mode and returns it as a floating point number.

## LDT-5900C Read Voltage
Reads the latest voltage measurement in Volts and returns it as a floating point number.

## LDT-5900C Set Autotune
Sets the Autotune function to either Run or Stop based on the value of an enumerated input with values RUN and STOP.

## LDT-5900C Set Current Limits
Sets the high or low current limit in Amps to a value specified by a floating point number input. An enumerated input determines if the high or low limit is set.

## LDT-5900C Set Current Setpoint
Sets the current setpoint in Amps to a value specified by a floating point number input.

## LDT-5900C Set ICI Constants
Sets the ICI calibration constants Slope and Offset to values specified by floating point number inputs.

## LDT-5900C Set ICV Constants
Sets the ICV calibration constants Slope and Offset to values specified by floating point number inputs.

## LDT-5900C Set Mode
Sets the operation mode based on the value of an enumerated input with values Temperature, $I_{TE}$, and Resistance.

## LDT-5900C Set Output State
Sets the state of the output based on the value of a Boolean input, with an input value of true setting the output to on and an input value of false setting the output to off.

## LDT-5900C Set PID Constants
Sets the PID constants to values specified by floating point number inputs.

## LDT-5900C Set PID Preset
Sets the PID constants to preset values based on the value of an enumerated input with values GAIN1, GAIN3, GAIN10, GAIN30, GAIN100, GAIN300, LDM4405, LDM4407, LDM4409, LDM4412, LDM4980, and LDM4990.

## LDT-5900C Set Resistance Limits
Sets the high or low resistance limit in Ohms to a value specified by a floating point number input. An enumerated input determines if the high or low limit is set.

## LDT-5900C Set Resistance Setpoint
Sets the resistance setpoint in Ohms to a value specified by a floating point number input.

## LDT-5900C Set RTD Constants
Sets the RTD constants $R_0$, A, B, and C floating point values.

## LDT-5900C Set Sensor Type
Sets the temperature sensor type using an enumerated value [100uA Thermistor, 10 uA Thermistor, Linear, Thermistor Auto, 1 mA RTD, 2.5 mA RTD, IC-I, IC-V.

## LDT-5900C Set Temperature Limits
Sets the high or low temperature limit in degrees C to a value specified by a floating point number input. An enumerated input determines if the high or low limit is set.

## LDT-5900C Set Temperature Setpoint
Sets the temperature setpoint in degrees Celsius to a value specified by a floating point number input.

### LDT-5900C Set Thermistor Constants
Sets the thermistor constants C1, C2, and C3 to values specified by floating point number inputs.

### LDT-5900C Set Tolerance Setpoint
Sets the tolerance window value for the current mode in units based on the mode to a value specified by a floating point number input.

# LDT-5900C Example VI Description

### LDT-5900C Example
A simple virtual front panel that can be used to setup and initialize an LDT-5900C instrument; monitor and set current, temperature, and resistance; alter PID settings; and monitor voltage, current, and remote communication status information.

# Chapter 3 :
# Errors and Troubleshooting

This chapter is an introduction to the <P/N or Series #> LabVIEW Instrument Driver's common errors. This chapter also includes:

- ✔ Troubleshooting
- ✔ NI Spy

## Errors

*Broken Gray Arrow*:  If a broken gray arrow appears in the toolbar (where the white arrow should be) and the white arrow is not there, this indicates an error in the code.  Click on the broken arrow to see a list of the errors in the sub-VI.  Enter the Block Diagram to correct these errors.

## Troubleshooting

***I do not see the USB or GPIB address in Measurement & Automation Explorer.***

In Measurement & Automation Explorer (MAX), select **View** and then **Refresh.** If you are using USB connection, the USB address for the instrument will appear under **My System → Devices and Interfaces.** For GPIB, the device will appear in the pull-down menu under the GPIB bus name, which is listed under under **My System → Devices and Interfaces.**

***The VISA address that I want to select in a sub-VI does not appear in the drop down menu of the Front Panel.***

Select **Refresh** at the bottom of the drop down list and the VISA address will appear.

### NI Spy
NI Spy is a free program that is available on the National Instruments website.  When the application is opened and the capture is started, every interaction between the computer and the instrument is recorded.  All errors are documented and explained.