



# LABVIEW™ VIRTUAL INSTRUMENT FOR WLD3393 (WLD3343 Laser Diode Driver Evaluation Board)

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## INTRODUCTION

This application note discusses the setup and use of the LabVIEW™ Virtual Instrument (VI) code for the WLD3393 (Evaluation Board for the WLD3343 Laser Diode Driver). The WLD3393 includes circuitry required to incorporate a WLD3343 as a component in a laser diode based instrument. It supports every possible operating configuration and function. This note describes how to implement a laser characterization instrument using the WLD3393 and Wavelength's LabVIEW™ code. The user need provide only a PC with a multifunction data acquisition (DAQ) card, the diode laser and other optical equipment such as an external photodetector with appropriate mounting equipment, and a suitable DC power source.

The instrument produces a data file recording of the IMON voltage proportional to the laser drive current, the voltage across the photodiode (PD) sense resistor,  $R_1$ , and the voltage across the external photodetector resistor,  $R_2$ . From this data, one can determine the internal PD sensitivity (current vs. output power). Since this can easily vary by a factor of 30 or more, for any given laser diode type, it is often necessary to obtain these values prior to setting up for operation in constant power mode.

The LabVIEW™ VI controls the WLD3393 via a multifunction DAQ card. Virtual instruments are available for both National Instruments and Keithley multifunction DAQ boards. This free code may be downloaded from:  
<http://www.teamWavelength.com>.

The virtual instrument code is modular and can be modified by the end user.

## SYSTEM REQUIREMENTS

These virtual instruments were created with LabVIEW™ version 6.0.2. Operation of these virtual instruments was verified on a standard desktop PC running Windows 2000 and a National Instruments PCI-6052 E-series multifunction DAQ board and on a notebook computer running Windows 98 and a Keithley KPCMCIA-16AIAO DAQ card. The virtual instrument code can be modified to operate on any DAQ board equipped with three A/D channels with 16-bit resolution and one D/A channel with at least 12-bit resolution.

The following section illustrates connections between the DAQ board and the WLD3393. Figure 1 shows a typical configuration for a Type A laser diode. For Type C lasers, the placement of the photodiode sense resistor  $R_1$  mandates the use of differential measurements by the A/D system. Connect power supply returns to PGND. The COM connection on the WLD3393 is reserved for measurements only.

The user must ensure that the voltage limits of the DAQ board are not exceeded. For example, the PCI-6052E board input is limited to no more than 11 V. The  $V_{DD}$  supply should not exceed this limit. The  $V_S$  supply may be set to a higher voltage, if necessary, without risk to the control and measurement electronics. Higher  $V_S$  voltages may be necessary to drive some lasers.

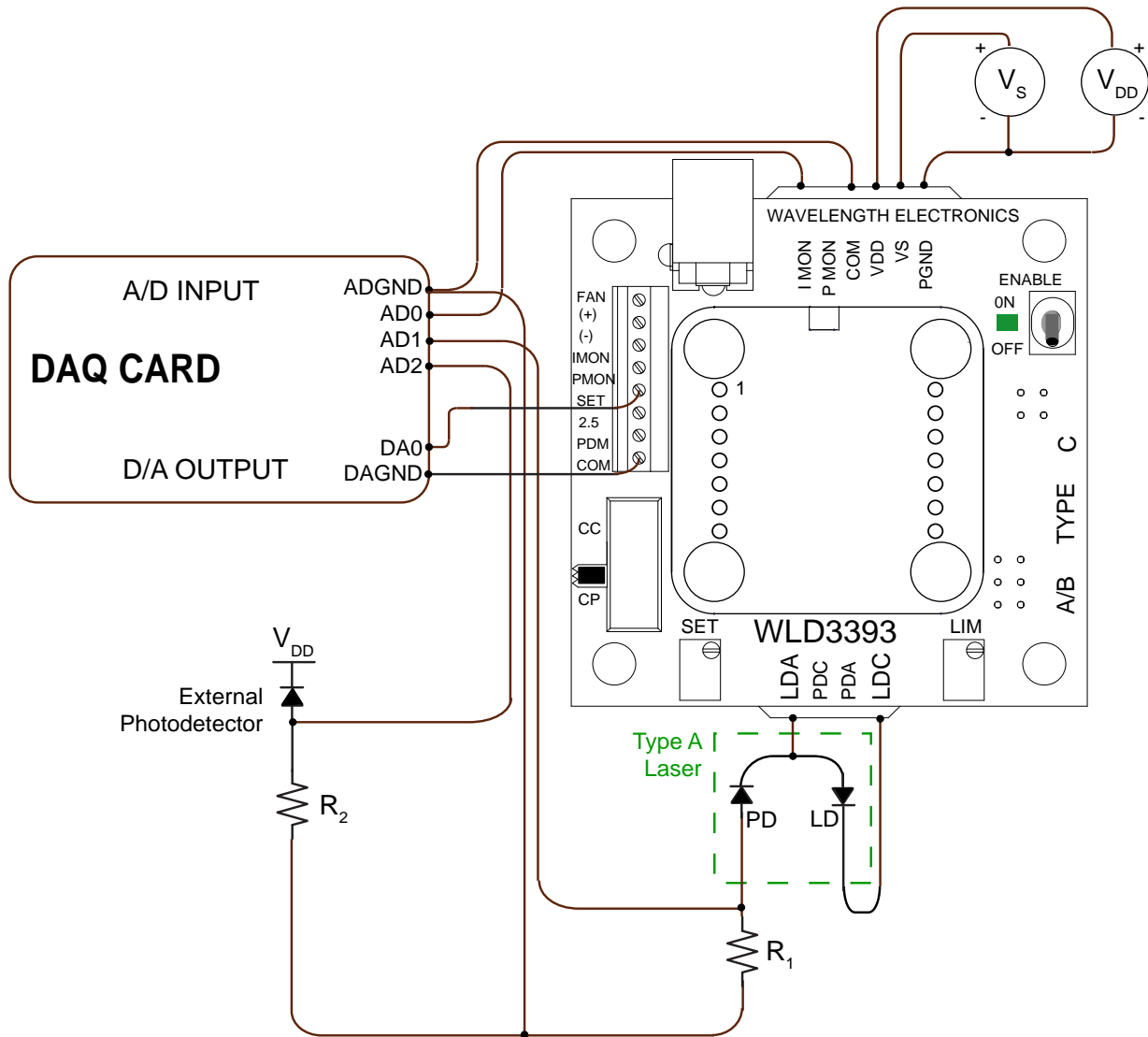
The user is responsible for obtaining and installing the correct DAQ driver and LabVIEW™ support software packages for the desired implementation.

**Table 1: Instrument Compatibility**

For DAQ Board Type:	Virtual Instrument:
National Instruments E-Series DAQ	WLD Eval LI Curve.vi
Keithley KPCMCIA-16AIAO	WLD Eval LI Curve KI.vi

## TYPICAL HARDWARE CONFIGURATION

Figure 1: Typical Wiring of DAQ Card to WLD3393 -- Type A Laser Diode



## HARDWARE OPERATION

The proper WLD3393 configuration should be selected based on the type of laser and maximum laser drive current. See the WLD3343 and WLD3393 datasheets for details. The mode switch should be set for constant current (CC) operation. Move the PD jumper to the appropriate range. The LIM I potentiometer should be set for the maximum drive current desired.

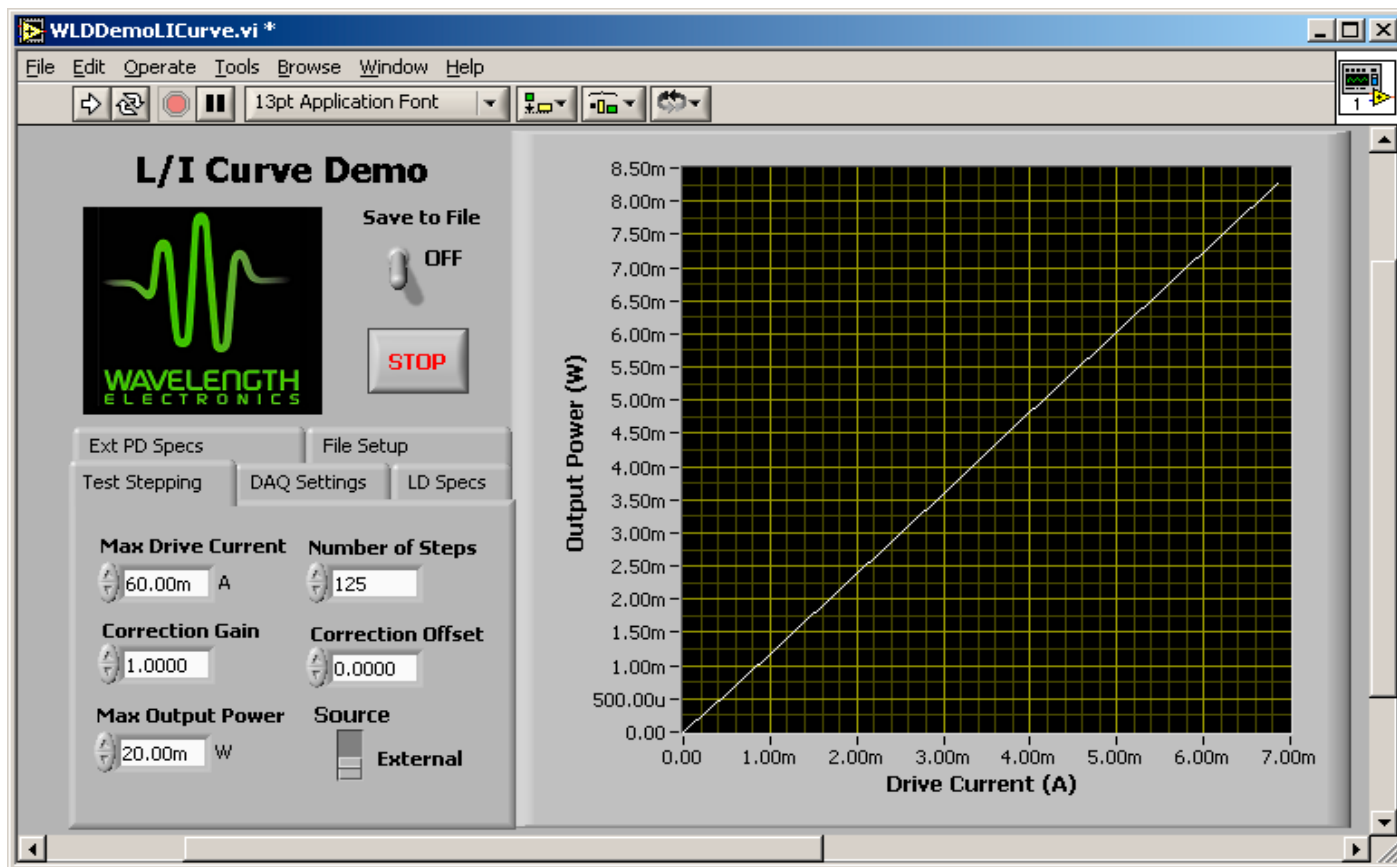
The SET I potentiometer should be turned fully CCW (OFF) to limit the initial bias current. The enable switch should be OFF until ready to run tests.

The VI front panel defaults to the Test Stepping tab. See Figure 2, lower left corner.

On the Test Stepping tab, enter the maximum drive current desired and the maximum allowable output power. On the Ext PD Specs tab, enter the sensitivity of the external photodetector and the value of  $R_2$ .

The program assumes that the sensitivity of the external photodetector has been obtained via some calibration method. The calibration needs to take into account the optics (e.g. collimation lenses) as well as the geometry of the setup. It is best to select resistor values that produce voltages in the range 0.1 – 2 V, for best accuracy in the measurement process.

Figure 2: Screenshot of National Instruments E-Series DAQ LabVIEW™ Driver -- Test Stepping Tab



## SOFTWARE OPERATION

The program starts by determining the size of the current step and calculates the  $V_{SET}$  voltages for these desired currents. It sets the output voltage  $V_{SET}$  and waits for the system to settle.

It then measures the voltages across the resistors and logs these values along with the IMON voltage to the data file. At each step, it checks to make sure that the maximum output power (as measured from the external photodetector) is not exceeded.

## INTERNAL PD CALIBRATION

From the data collected, it is straightforward to determine the internal photodiode monitor current versus output power.

Output power is computed by: 
$$P = \frac{V_2}{R_2 * S_2}$$

The monitor current is 
$$I_{PD} = \frac{V_1}{R_1}$$

Internal PD sensitivity is computed by:

$$S_1 = \left( \frac{V_2}{V_1} \right) \left( \frac{R_1}{R_2} \right) S_2$$

at the desired output power; where  $V_1$  and  $V_2$  are the voltages across  $R_1$  and  $R_2$ , respectively, and  $S_1$  and  $S_2$  are the sensitivities of the internal and external PDs.

By then plotting  $I_{PD}$  vs.  $P$ , one obtains the monitor current vs. output power curve.

An example Excel spreadsheet created from the LabVIEW™ data log file is available for download along with the virtual instrument software to aid in doing these calculations.

## TRANSFER FUNCTION SETTINGS

With revision C of the WLD3393 Evaluation Board (red PCB, not black), a different sense resistor is used to allow full drive current from the WLD3343. When performing laser characterizations, the R SENSE value must be adjusted in the LabVIEW™ WLDEvalLICurve.vi control panel.

From the front panel of the virtual instrument, change the active tab to LD Specs (see Figure 3). In the R SENSE field, enter the appropriate value from Table 2.

**Table 2: R<sub>SENSE</sub> Settings**

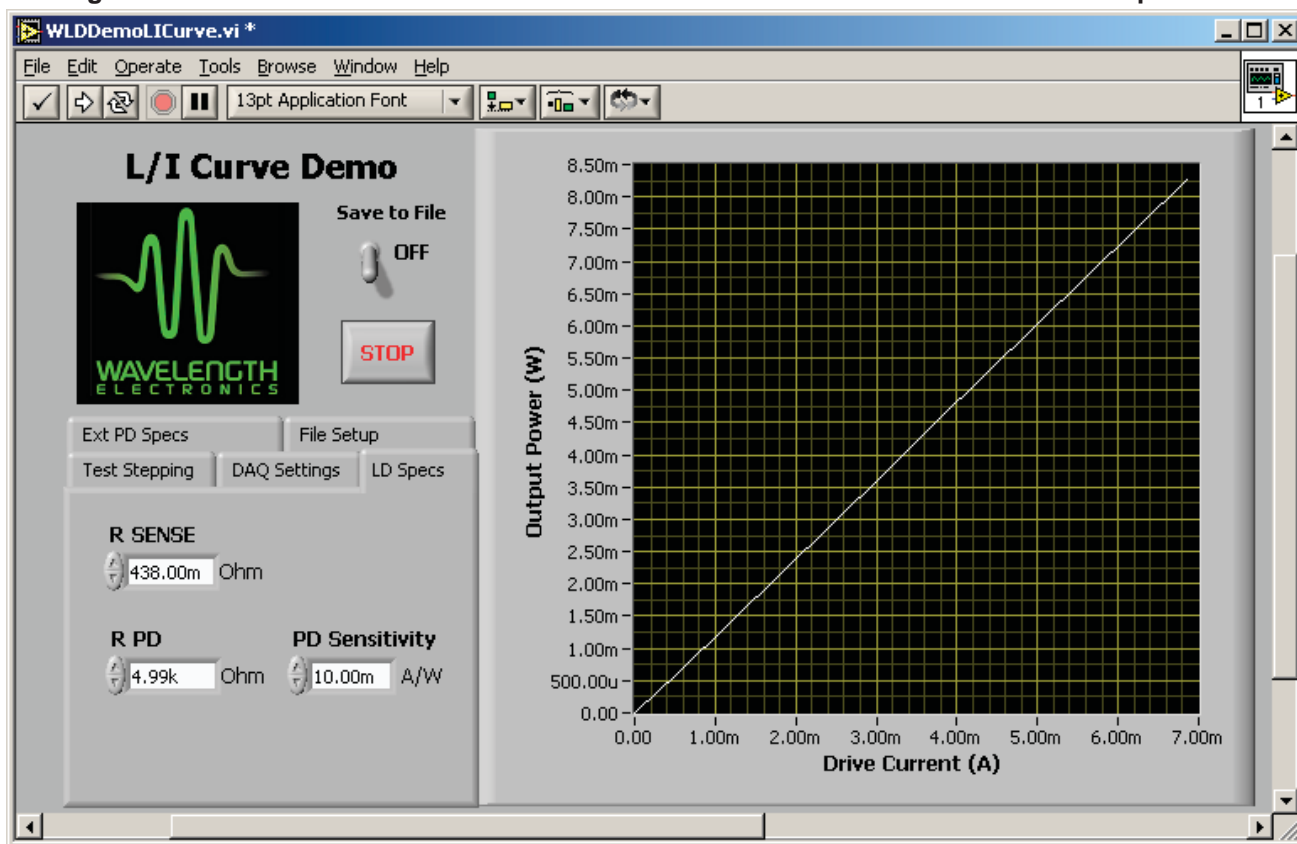
LD Range Setting	R <sub>SENSE</sub> (Rev. C)	R <sub>SENSE</sub> (Rev. A&B)
2.0 A	438 mΩ	500 mΩ
200 mA	5.01 Ω	5.1 Ω

Again, this only applies to revision C or later of the WLD3393 (red PCB, not black).

## APPLICATION TO CONSTANT POWER OPERATION

For actual operation of the laser diode in constant power mode, read off the photodiode monitor current ( $I_{PD}$ ) for the desired output power. Set up the WLD3393 in constant power mode and select the appropriate range of monitor current (200 μA or 2 mA) jumper setting. The appropriate setpoint voltage value for operation is then  $V_{SET} = 2 * I_{PD} * R_{PD}$ , where  $R_{PD}$  is 4.99 kΩ for 200 μA and 499 Ω for 2 mA settings.

**Figure 3: Screenshot of National Instruments E-Series DAQ LabView™ Driver -- LD Specs Tab**



## KEYWORDS

Laser diode, laser diode driver, laser diode drivers, laser diodes, V/I characterization, LabView, virtual instrument, WLD3343

## REVISION HISTORY

REV	DATE	NOTES
B	13-Mar-02	Initial Release
C	30-Apr-10	Added transfer function settings to reflect changes in WLD3393 Eval. Rev.C and later

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