Evaluation Kit

LDE-type Pressure Sensors

Instruction Manual

Revision A

SENSORTECHNICS

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Instruction Manual

Table of Contents

History

Revision	Description of Changes
A	Initial release

Note

This evaluation kit is intended for quantitative evaluation of LDE-type pressure sensors – their sensitivity, noise, offset drift, pressure resolution, etc. It is assumed that the kit will be used in pilot tests to determine to what extent the sensor(s) may be applicable for a given applications.

It should be noted that the measurements of analog output of the sensor are limited to the capabilities of the Arduino's 10-bit analog-to-digital converter. For more accurate analog readings, please use appropriate measurement devices.

The accuracy and stability of the sampling rate are limited by the latency of the USB port. The evaluation kit does not provide accurate timing in communicating with the sensors, which may be important for many applications.

Sensortechnics Corp reserves the right to make changes to the product.

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1 Features

- USB connection
- No external power supply required
- Digital readout via SPI
- Analog readout
- Suitable for LDE series sensors

Supported operating system: Windows XP SP3

Windows is a registered trademark of Microsoft Corporation in the United States and other countries

2 Product Summary

The LDE Evaluation Kit is a self-contained system for testing the features of LDE-series flow sensors. The board needs no external power supply, only a connection to a Windows PC's USB port. The system allows the user to visualize the digital and analog output waveforms, apply an output filter for noise reduction, and read the sensor's digital signature.

3 Hardware

This evaluation kit contains an Arduino Uno microprocessor board and a Sensortechnics LDE demo shield, as shown in Figure 1.

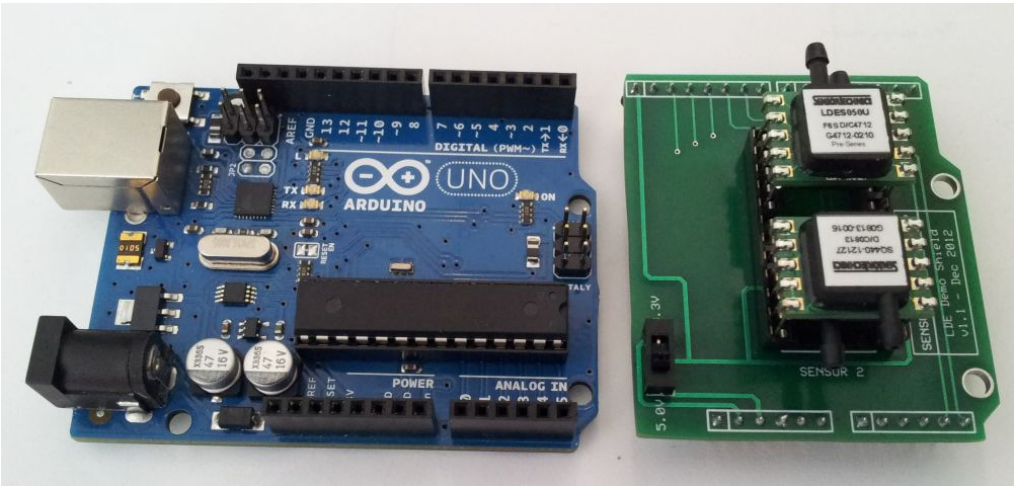

Figure 1: The Arduino Uno (left) and the LDE demo shield with two LDE sensors (right).

To assemble the evaluation kit, simply plug the LDE demo shield into the pin headers of the Arduino Uno, as shown in Figure 2.

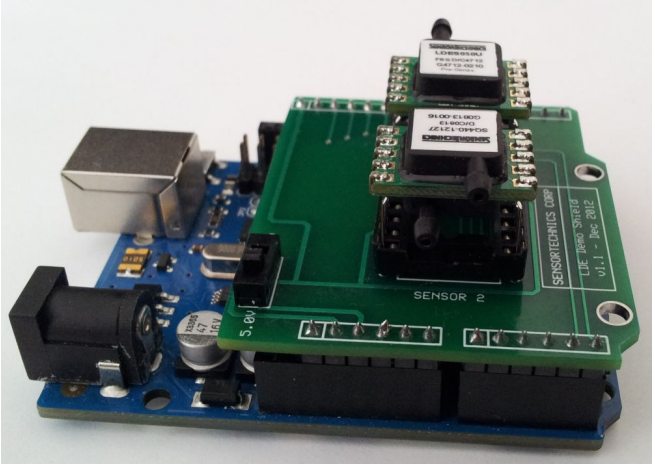

Figure 2: The assembled evaluation kit.

Ensure that the switch on the LDE demo shield is in the `5.0V` position; the `3.3V` position is reserved for 3-volt sensors. Install the LDE pressure sensors into the `Sensor 1` and `Sensor 2` sockets *before* connecting the device to the PC via USB.

4 Driver Installation and Software Setup

1. Copy the folder `LDE EVAL_KIT` to your computer and note its location.
2. Connect the evaluation kit to your PC with the included USB cable; the PC will detect new hardware (see Figure 3). Choose the option *Install from a list or specific location* to continue.

Figure 3: The Windows "Found New Hardware" wizard.

3. When prompted, choose the location of the `LDE EVAL_KIT\drivers`, as noted in step 1 (see Figure 4).

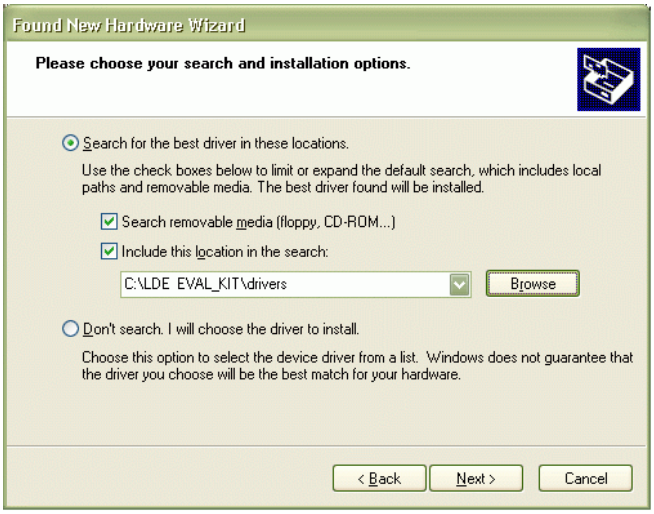

Figure 4: Enter the location of the drivers folder.

4. During the driver installation, you may be presented with a warning as in Figure 5; if so, click on *Continue Anyway*.

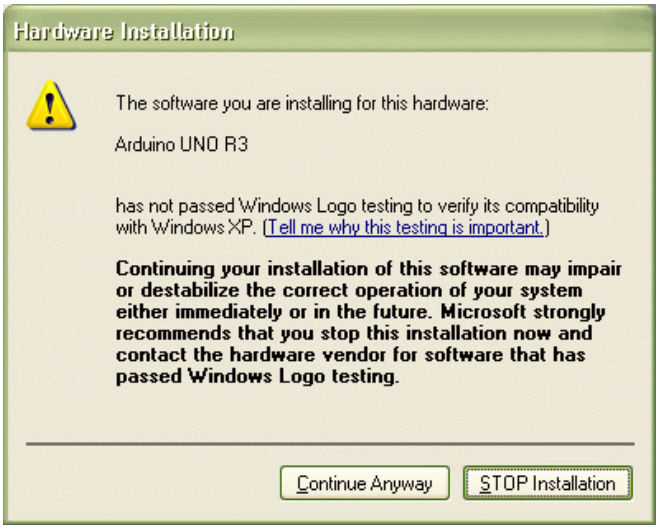

Figure 5: Choose Continue Anyway if you are warned about Windows Logo testing.

5. Upon successful installation of the driver, Windows will display a confirmation dialog as shown in Figure 6. Click on *Finish* to continue.

Figure 6: Successful installation of the driver.

6. To determine the specific COM port number that has been assigned by the PC to the evaluation kit, open the Windows Device Manager by right-clicking on *My Computer* and selecting *Properties* from the context menu, then select the *Hardware* tab, and click on *Device Manager*. Expand the *Ports (COM & LPT)* item and note the COM port number assigned to Arduino UNO R3; in Figure 7, the assigned COM port number is 10. Note this number, and then close the Device Manager and the System Properties windows.

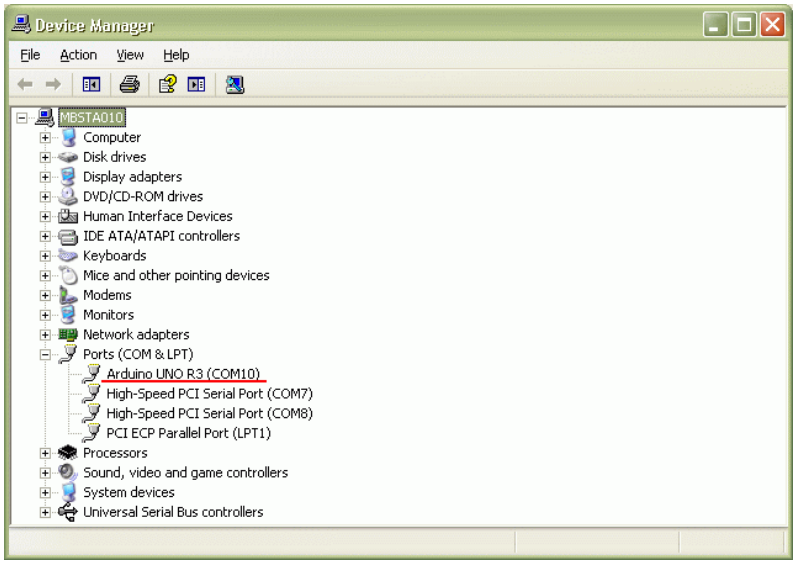

Figure 7: Determine the COM port number assigned to the Arduino UNO.

7. Launch the LDE evaluation kit software by opening the `LDE EVAL_KIT` folder and double-clicking on `LDE_EvaluationKit.exe` – the first time the software is run, an error message will be presented (see Figure 8). Click on *OK* to continue.

Figure 8: "Error opening port" message.

8. In the top-right corner of the Evaluation Kit application window, select the COM port number assigned to the device from the list of available ports, per step 6. Right-click the control and choose *Save port name* from the context menu (see Figure 9), then restart the application.

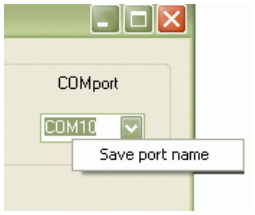

Figure 9: Selecting the COM port number.

5 User Interface

The interface for the evaluation kit software is shown in Figure 10.

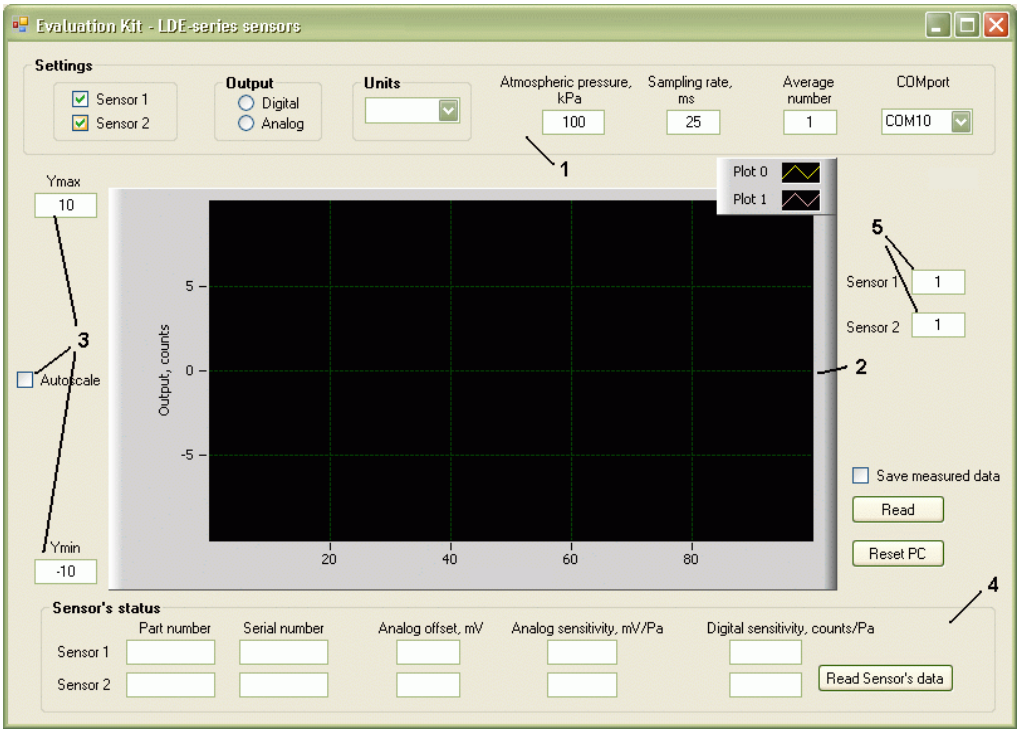

Figure 10: The application user interface.

1. The *Settings* panel is used to configure the experimental setup. One or two sensors may be used simultaneously; either the digital or analog output may be selected. In each of these cases, the output of the sensor(s) may be presented in either counts (digital) / millivlts (analog), or Pascals (both digital and analog), as shown in Figure 11.

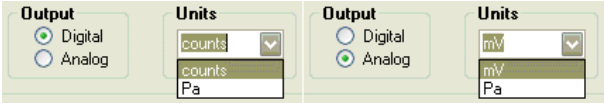

Figure 11: Selecting the units of measurement for either the digital (left) or the analog (right) output.

2. The oscilloscope window is used to visualize the output of the sensor(s). To change the color of the signal trace, click on the trace symbol (*Plot 0* or *Plot 1*) and choose any color from the palette, as shown in Figure 12.

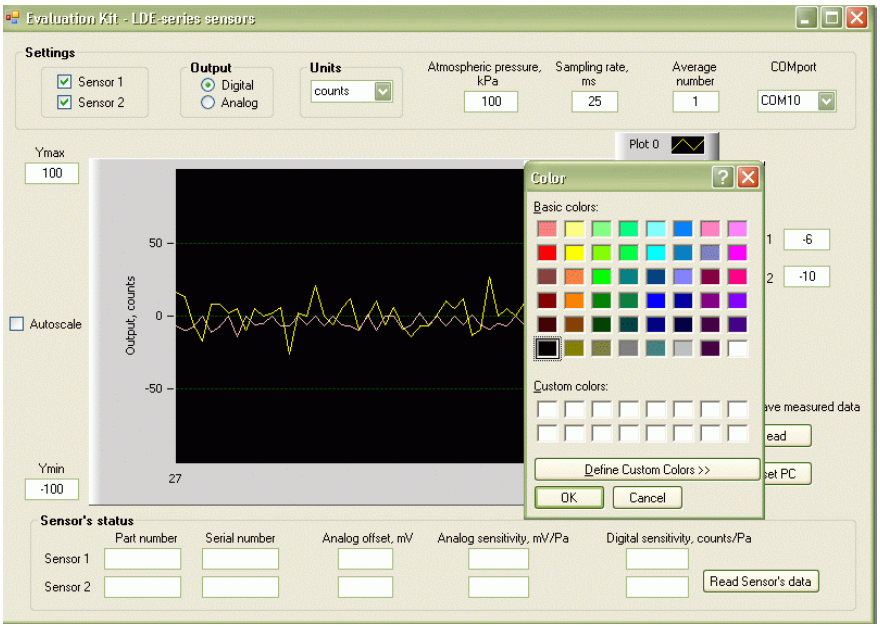

Figure 12: Selecting the signal trace color.

3. The vertical scale of the oscilloscope window can either be set to *Autoscale* mode, or by entering the minimum (*Ymin*) and maximum (*Ymax*)scale values.

4. The *Sensor's status* panel allows the reading of the sensor's electronic signature. Upon clicking the *Read Sensor's data* button, the signature of the selected sensor will be displayed (see Figure 13).

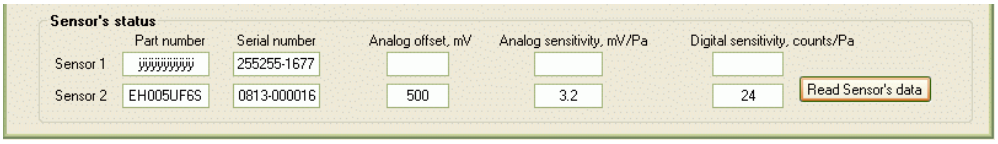

Figure 13: Reading the sensor's electronic signature.

Note that while the electronic signature is a standard feature of the LDE sensor, some pre-series sensors may not have had it written to memory. The data displayed in Figure 13 shows data from the electronic signature of sensor 2; sensor 1 has no such data available. The characters displayed in the *Part number* and *Serial number* fields have no meaning.

5. The output of the sensor(s) is also displayed to the right of the oscilloscope window, in the fields *Sensor 1* and *Sensor 2*.

6 Operation

6.1 General Use

To begin reading the sensors, simple check which sensor (1, 2, or both) you wish to read, which output (analog or digital) you wish to view, and the preferred units in the *Settings* panel, and then click on the *Read* button to the right of the oscilloscope window to begin data visualization. The button will change state and its label will be updated to *Stop*; click it again to end visualization.

6.2 Averaging

Depending on the target, different operating modes are available in the software. In addition to setting the sampling rate (with a minimum of approximately 25 ms), averaging may be adjusted to smooth the output signal.

Sliding averaging provides the calculation of average output value for the last *n* measurement points, where *n* is set in the *Average number* field of the *Settings* panel. Figures 14 and 15 show the measured signal waveforms for a “raw” signal (*n* = 1) and an “averaged” signal (*n* = 20), respectively.

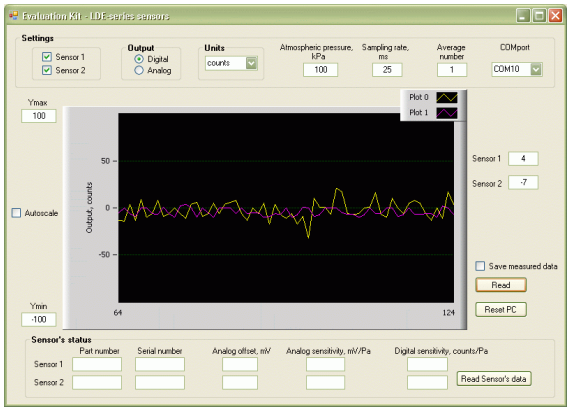

Figure 14: Raw output signal (no averaging).

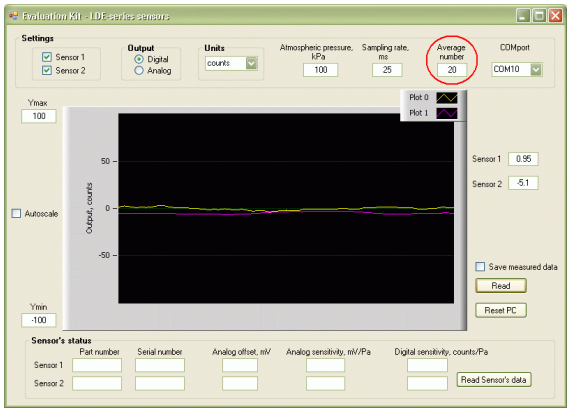

Figure 15: Output waveform with *n* = 20 averaging.

6.3 Displaying Output in Pascals

To display the output of the sensor in Pascals (Pa), the values for analog offset (in mV), analog sensitivity (in $^{mV}/_{Pa}$), and digital sensitivity (in $^{counts}/_{Pa}$) must be entered in the appropriate fields in the *Sensor’s status* panel. This may either be loaded automatically from the sensor’s electronic signature, or entered manually from information found on the sensor’s datasheet.

Note that for micro-flow sensors, sensitivity also depends on atmospheric pressure (see the LDE sensor datasheet). Thus, to provide correct pressure measurement, this value should be entered (in kPa) in the *Atmospheric pressure* field in the *Settings* panel.

6.4 Data Logging

To record measured data, check the box marked *Save measured data* to the right of the oscilloscope window before running the test. After measurements have stopped, a save-file dialog box will be automatically opened; choose a file name to save the recorded data in a text file.