Pressure Concepts / Sensor Experiment (Gauge Pressure Sensor)

In this experiment the performance of an electronic pressure sensor and some basic pressure concepts will be evaluated. The pressure sensor is a MPVZ5004G device manufactured by Freescale/NXP semiconductor. A datasheet for this device is available on Canvas. A syringe will be used to control the system pressure. A water-filled manometer will be used as the reference pressure measurement instrument.

The MPVZ5004G pressure sensor produces a nominal output voltage range of 1.0V – 4.9V for an input gauge pressure range of 0 – 3.92 kPa (0 – 15.8 in H_2O). In this experiment, the transfer function for this sensor will be determined by varying the system pressure while measuring the sensor output voltage. Figure 1 shows the basic setup of the experiment.

Do not exceed 14 in H_2O positive pressure
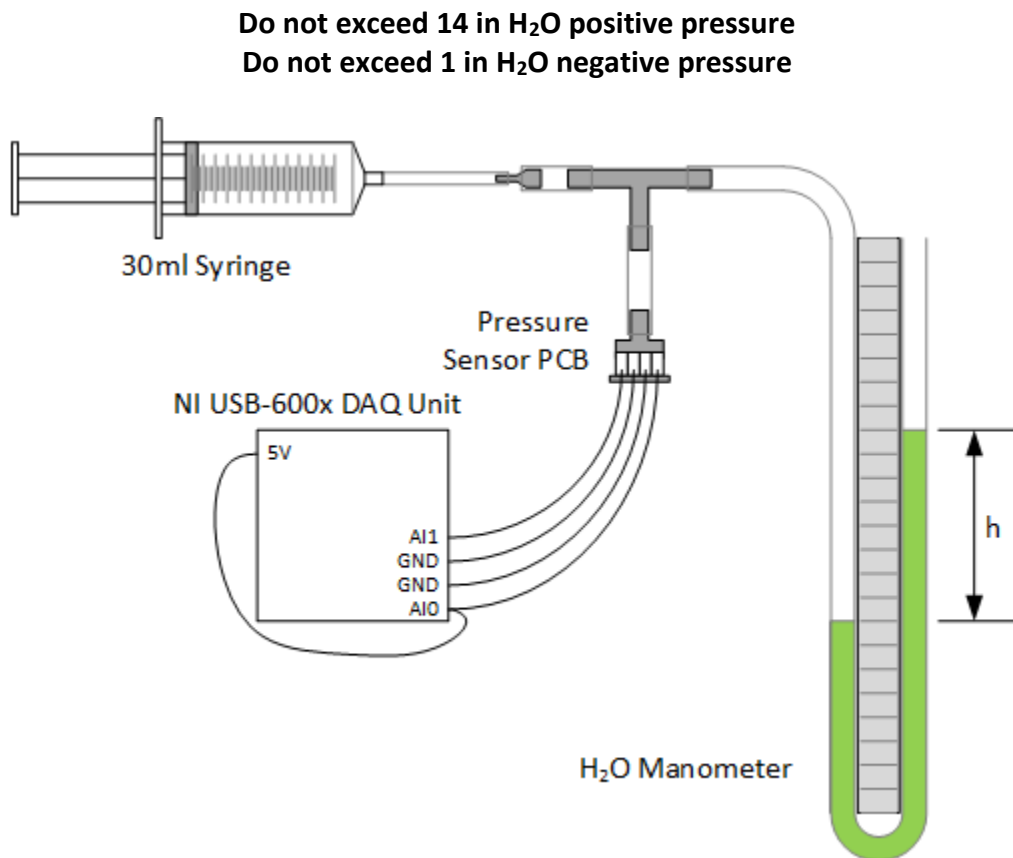**Do not exceed 1 in H_2O negative pressure**

Figure 1. Pressure Sensor Experiment Apparatus Setup

The pressure sensor requires a nominal supply voltage of +5VDC. The sensor output voltage is a function of the gauge pressure **_and_** the power supply voltage. As stated in the device datasheet, the output voltage is ratiometric with the power supply voltage provided that the power supply voltage is in the range +4.75VDC - +5.25VDC. Therefore, it is crucial that the power supply voltage be measured during the experiment.

The pressure sensor circuit board contains the external components recommended by the manufacturer to filter the input and output voltages. Additional protection components for the sensor are also on the circuit board but will not affect performance of the device. Figure 2 shows the schematic of the pressure sensor printed circuit board. Figure 3 shows the circuit board terminal connections.
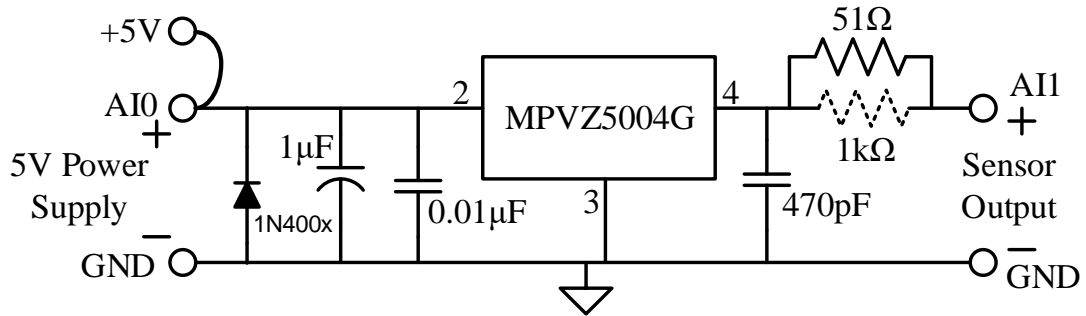
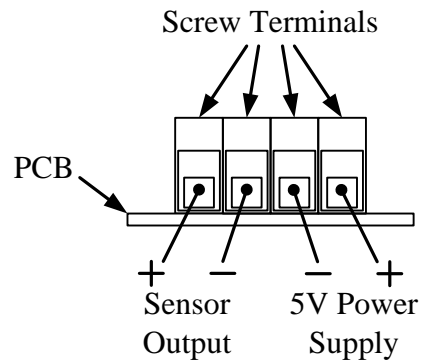Figure 2. Pressure Sensor Circuit Board Schematic

Figure 3. Pressure Sensor Circuit Board Terminal Connections

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Procedure (not detailed)

1. Connect the plumbing diagram as shown in Figure 1 **except for the pressure sensor.**

2. Set the syringe plunger such that the black rubber tip is aligned with the 30ml line.

3. Make the electrical connections to the DAQ unit and connect the pressure sensor to the plumbing system.

4. Launch the LabVIEW VI, "Ratiometric Voltage Measurement.vi"

5. Measure and record the left and right side manometer water levels (in inches), the sensor power supply voltage (nominally +5V), and the sensor output voltage for pressures of 0 to 12 in H_2O in 1 inch increments.

Do not exceed 14 in H_2O positive pressure
Do not exceed 1 in H_2O negative pressure

Results

1. Adjust the data to compensate for the measured power supply voltage not being exactly +5.00V. Refer to the "Ratiometric Sensor Analysis" .pptx file.
2. Plot the pressure sensor's transfer function.
3. Determine the sensor's static sensitivity from the plot.
4. Determine the sensor's zero-pressure offset voltage from the plot.
5. Compare the measured static sensitivity and zero-pressure offset to the data sheet values.