Pressure Transducer Calibration

Tool Reference

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Pressure Transducer Calibration

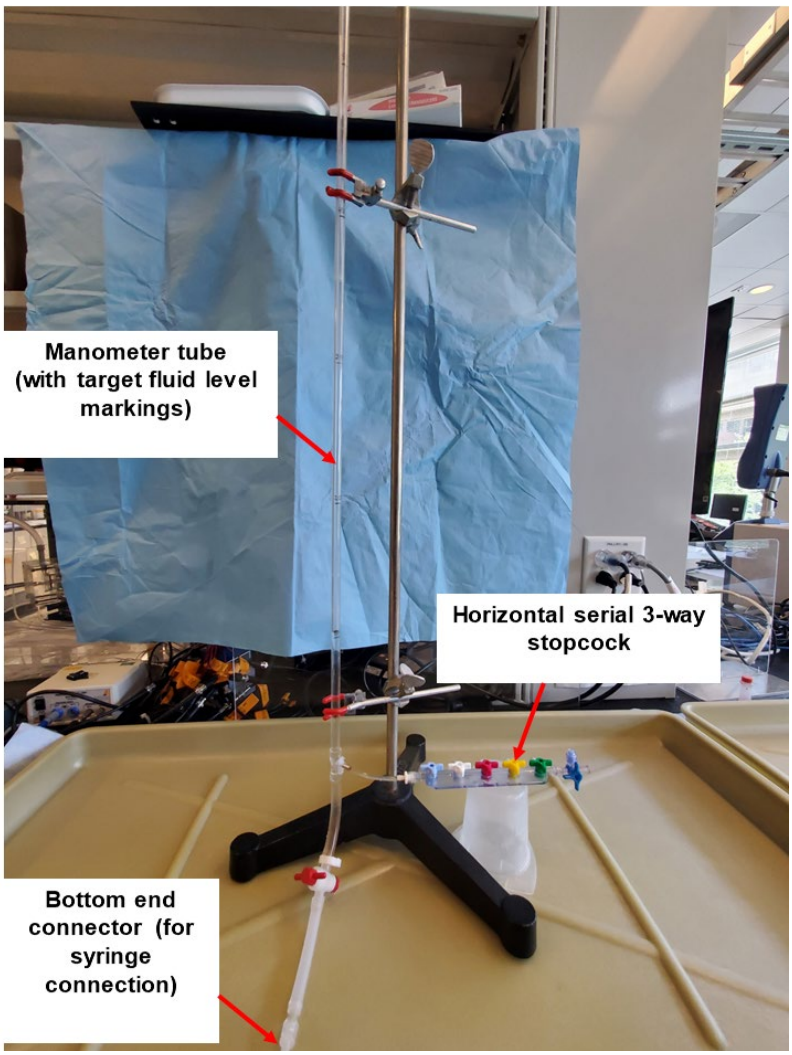
Note: The test fluid used is blood analog fluid (BAF). Please prepare the BAF by following detailed instructions outlined in the document, 'Preparation of Blood Analog Fluid (BAF)'. For preliminary or feasibility testing, De-ionized (DI) water may be used in place of BAF as the test fluid. While all test protocols in this document are written for BAF, they are also directly applicable to DI water, when used as the test fluid.

Note: The steps below list specific pressure transducers and amplifier modules used in the mock circulatory loop (MCL) described in this regulatory science tool. Please note that the calibration procedure below can be adopted for all liquid/blood contacting disposable pressure transducers that are intended for blood pressure measurement and produce a voltage output when sensing a liquid pressure input. Please note that the calibration pressure range (0 – 100 mmHg) adopted below may need to be customized when using a different make/model of pressure transducers.

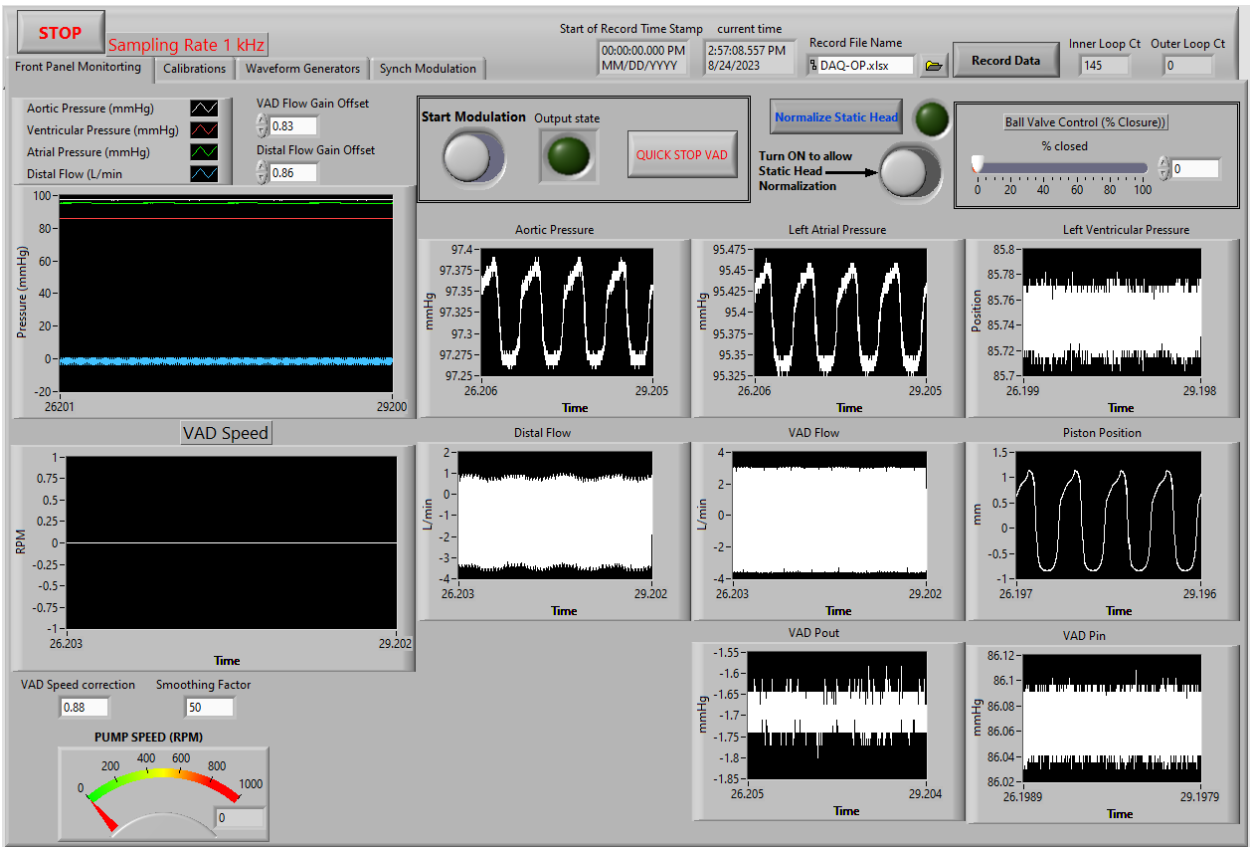
1. Make the appropriate electrical connections:
   a. Connect the three (left ventricle (LV), left atrium (LA), and aorta (Ao)) pressure transducers [Utah Medical Products Inc., Midvale, Utah] to the pressure amplifier module [Bus 21097, ViVitro Labs, Inc., Victoria, BC, Canada].
   a. Connect each of the three output channels on the amplifier to three channels on the analog input (AI) module [NI-9205, National Instruments, Austin, TX] of the data acquisition system [cDAQ-9174, National Instruments, Austin, TX] per the table below.

Instrument Channel	AI Channel on cDAQ-9174
Pressure transducer amplifier – Ao pressure channel	AI 1, NI-9205
Pressure transducer amplifier – LV pressure channel	AI 2, NI-9205
Pressure transducer amplifier – LA pressure channel	AI 3, NI-9205

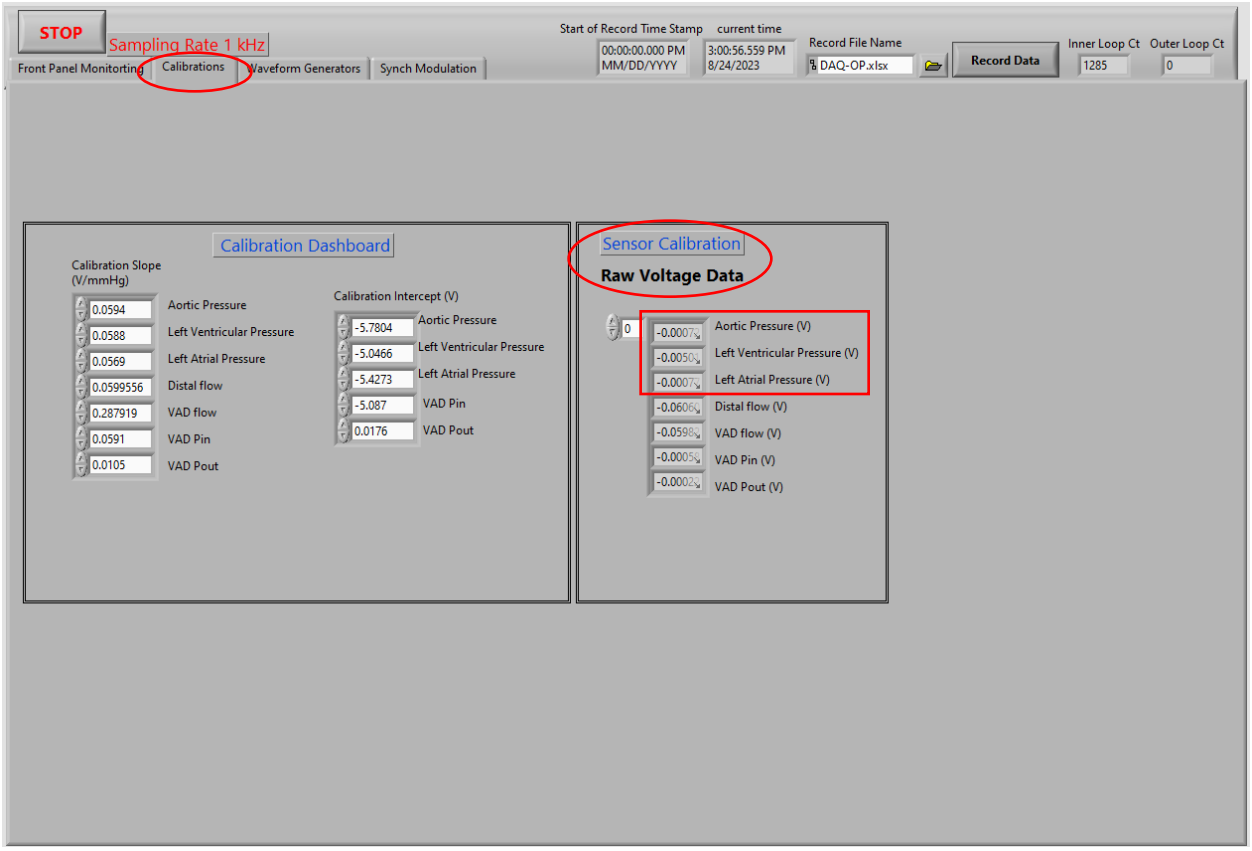
   b. Connect the USB data cable from cDAQ-9174 to the mock circulatory loop (MCL) laptop.
2. Power ON all equipment.
3. Set the low pass filter on the pressure amplifier module to 30 Hz for all three channels.
4. Connect the pressure transducer luer lock ports to the horizontal serial 3-way stopcock ports on the manometer tube. Each pressure transducer should be connected to a separate 3-way stopcock. Please refer to the image below for the static pressure transducer calibration setup.



5. Sample 60 mL – 100 mL BAF solution in a syringe and connect the syringe to the bottom end connector of the manometer tube.
6. Dispense BAF solution from the syringe to fill the horizontal serial 3-way stopcock line and pressure transducers. Bleed the pressure transducers till no air exists in the connectors and around the pressure transducer sensor.
7. Open and Run the LabVIEW VI (or Virtual Instrument) that executes the custom MCL software (snapshot graphical user interface (GUI) shown below).



8. In the software, select the Calibrations tab to read the raw voltage values (Sensor Calibration > Raw Voltage Data) corresponding to the three AI channels which the pressure transducers are connected to.



9. Dispense BAF solution from the syringe to target level markings (0, 10, 20, 30, …,100) on the manometer tube.
   <u>Note</u>: The target level markings on the manometer tube are specific to the fluid under test since the location of the markings are dependent on the fluid density. The level marking location on the tube would need to be changed if a test fluid with a different density (compared to the BAF solution) were used per the following equation: level marking height (in mm) = (13.5951 g/cm^3 x H mm) / $\rho_{test\ fluid}$ g/cm^3, where H = 0, 10, 20, 30, …,100
10. Record the voltage readings of the three pressure transducers at each level marking representing a range of 0 mmHg – 100 mmHg pressure.
11. Compute the slope and intercept of the voltage *vs.* pressure data line for each pressure transducer channel and record it in the Laboratory Notebook and MCL software (see Calibration tab snapshot above) as the pressure transducer Calibration Slope in units of V/mmHg and Calibration Intercept in units of V. Record the date of calibration.