Selection of Digital Output Pressure Sensors for the Hall A GEM Detectors

Brian Eng, Mary Ann Antonioli, Peter Bonneau, Aaron Brown, Pablo Campero, George Jacobs, Mindy Leffel, Tyler Lemon, Marc McMullen, and Amrit Yegneswaran
Physics Division, Thomas Jefferson National Accelerator Facility, Newport News, VA 23606
March 3, 2020

This note presents the evaluation, selection, and integration of digital output pressure sensors for the Hall A GEM gas distribution system.

In the Hall A GEM gas distribution system (1), pressure sensors measure the pressure before and after the pressure regulator on the gas panel. These pressure sensors ensure proper functioning of the system and aid in troubleshooting—too high or too low a pressure before the regulator indicates a problem with the gas supply; too high or too low a pressure after the regulator indicates a problem with the setting or functioning of the regulator.

To be integrated in the regulator panel, the pressure sensors need to have digital output, their measurement needs to be in psig, and they need to use a ¼" NPT fitting. The pressure sensors selected are from the M3200 series (2) from Measurement Specialties, a subsidiary of TE Connectivity.

The digital readout of the pressure sensor is performed via I²C protocol. Since the pre-configured I²C pins on the Raspberry Pi were being used for the gas flow sensor readout (3), virtual I²C ports were created via a Linux device tree overlay, which maps selected pins to an I²C bus.

Figure 1 shows the test setup for the pressure sensors. When integrating the pressure sensors into the existing Python codebase, it was found that the specific command needed to initiate readout of the pressure sensors—sending a 0-byte I²C read command—was not possible with the Python smbus library selected. Changing to a different library, smbus2, that allowed the creation of custom messages, allowed for all functionality of the pressure sensors to be used, including temperature readout.

The selected pressure sensors have been added to the prototype BigBite gas system.

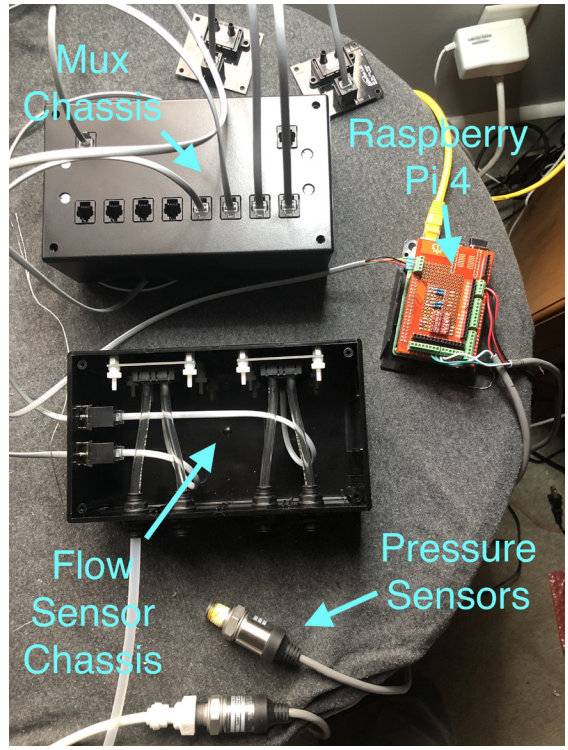

FIG. 1. Pressure sensor test setup.

[1] G. Jacobs, et al., *Design of the Gas Distribution System for the Hall A GEM Detectors*, DSG Note 2019-33, 2019.
[2] TE Connectivity, *M3200 Pressure Transducer*, Datasheet, 2020.
[3] B. Eng, et al., *Development of Readout Electronics for Gas Flow Sensors for the Hall A GEM Detectors*, DSG Note 2020-20, 2020.