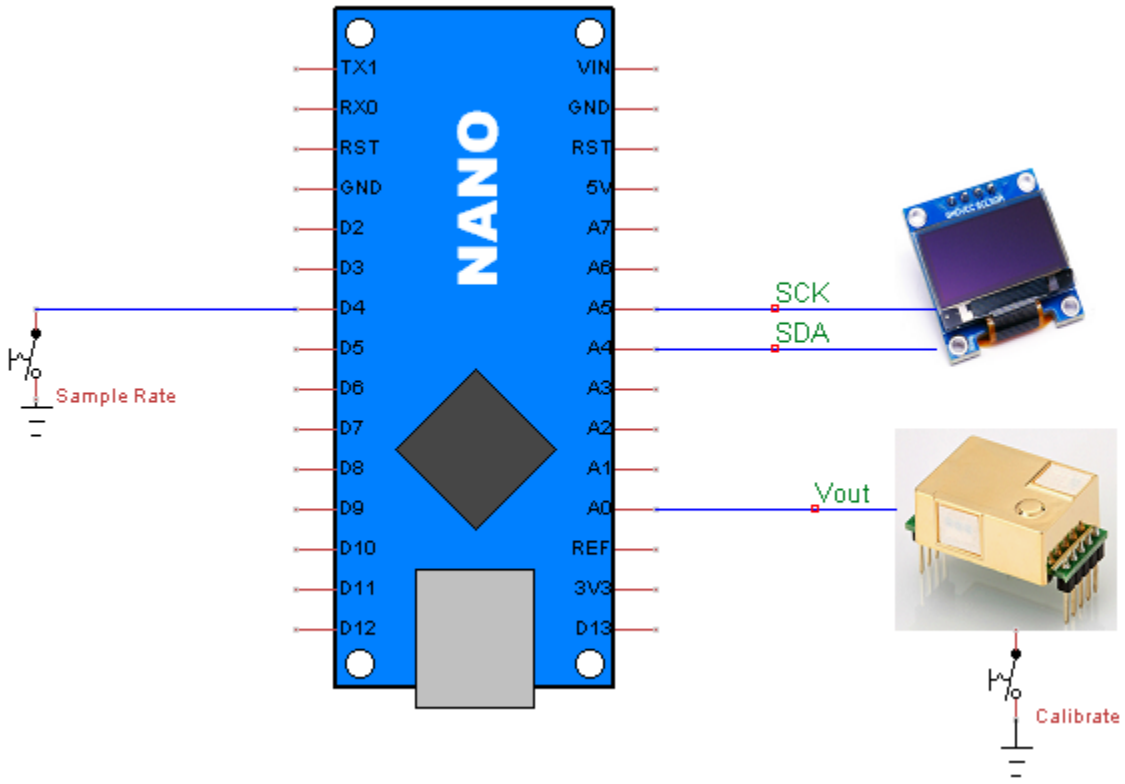
Simple Interface MHZ19 Carbon Dioxide Monitor with Historical Graph Trending

The MHZ19 is a quality CO2 sensor with three methods provided to interface to a processor. The first is serial communication using a standard UART interface. Requiring further software libraries, using this method allows for configuring and reading the device parameters and the CO2 measurement. The other two methods use a one bit interface, either digital (PWM) or analog voltage to read the CO2 measurement only. The easiest method to use, software wise, is the analog voltage method.

The following is the circuit for this project. The I2C connected display is 128x64 OLED monochrome.



Aside from the analog voltage signal from the MHZ19 to the processor and the I2C bus signals to the display, there are two user momentary switches.

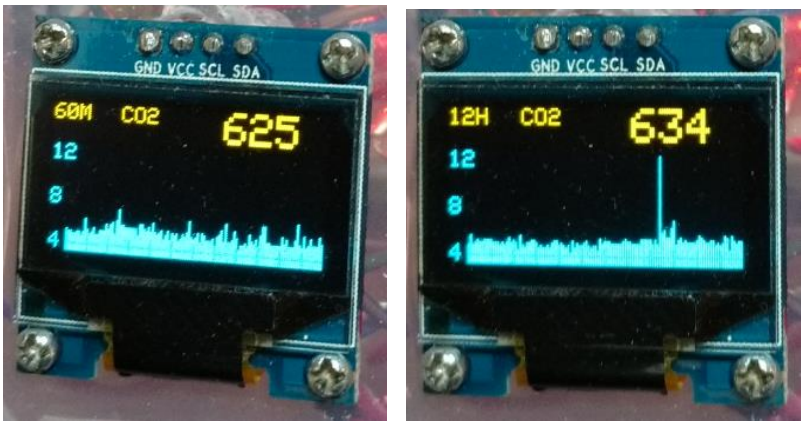
The Sample Rate switch is sensed by the program for changing the primary sample rate of the data collection for the display of historical values. A set of integer timing values allows for data collection sample rates of 10 ,20, 30 or 60 seconds which gives time lengths of 20, 40, 60 or 120 minutes and 6, 8, 12 and 24 hours on the minute and hour graphs, respectively.

The calibrate switch allows for manual user calibration (typically outdoors at night) of the sensor (hold the switch for 7 seconds minimum). The Auto-Calibration feature of the MHZ19 should be turned off when using manual calibration.

The analog value is straight forward in use. The range of the CO2 sensor can be 0-5000 PPM (default) or can be set to 0-2000 PPM. The default is used here. Then the analog voltage span is 2.0V for the 5000 PPM span of the sensor. The offset of the analog voltage provided by the sensor is 0.4V, which represents 0 PPM. Therefore the range of the analog value is from 0.4V to 2.4V, corresponding to the range of the sensor values, which is 0 to 5000 PPM. Linearity is assumed.

Integer arithmetic is used to convert the analog value voltage data to CO2 PPM values, which are stored as integers also. (For the 10 bit ADC of the Nano processor, 0.4V gives a value very close to 82 decimal, while 2.4V gives a value very close to 328 decimal). The range of PPM values used here is actually 400 PPM to 1600 PPM, since we cannot expect values lower than 400 PPM under normal atmospheric conditions and 1600 PPM was a convenient high limit for the small display used here.

The following are the consecutively displayed (every 10 seconds) historical graphs using a sample rate of 30 seconds, give history for 60 minutes and averaged history for 12 hours. Note that data is stored (120 values for each history set) as byte length data to save space – otherwise stability problems will occur with the software. In fact, the value range of this byte data is limited to values from 0 to 60, which is actually the line length (no. of pixels) for drawing the graphs on the 64 pixel vertical size of the display.



The following is the prototype packaged hardware.