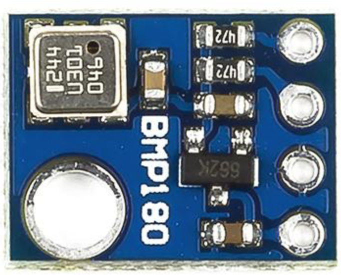
Sensor: BMP180

The BMP180 is a multifunction sensor. It can detect barometric pressure and temperature. This is not by chance, but because barometric pressure varies with temperature, so providing both sensors in a single package makes sense.
The included sensor module is actually a ‘breakout’ board, which contains the Bosch sensor and some minimal support circuitry, including a Voltage Regulator, allowing the BMP180 to operate with 5V, instead of it’s 1.8-3.6V normal range.

Reading the data from the sensor requires several steps, essentially implementing a state machine. A temperature query command is sent, you wait for a period of time based on the resolution of reading you requested, then, you read the temperature. The ask-wait-read process is then repeated for pressure. Lastly, some simple calculations are required to convert the values you read into standard units for pressure and temperature.

Of course, as usual, an implementation already exists to perform all of these operations, and we simply need to reference and use it.



There are two potential uses for temperature compensated barometric pressure. If the current height above sea level is known, then the exact relative pressure can be determined and, when watched over time, a weather forecast can be established.

Alternatively, one can start with a baseline sea level pressure and determine the approximate height above sea level that the sensor is located. Of course, regional weather related changes may alter the reading slightly, but you can get an approximate altitude, and you can certainly get a moving reading over time, and thus determine if the device is going up or down in the atmosphere.

The BMP180 uses I2C to exchange data with the microcontroller, just as the OLED display did. It is popular for many types of devices because it is simple both in implementation and in the physical connection.

I2C is considered a ***bus***, short for omnibus, which is latin meaning ‘for all’. Practically, that means that multiple devices can be connected over the same set of wires. There are many different types of hardware/software busses, some more complicated than the others, but many share similar properties.

Without going in to too much detail, I2C is a master-slave style bus, in that one device, in our case the microcontroller, acts as a master by initiating all communications. Other slave devices on the bus simply respond to these requests. Each device is given a unique address (a 7 bit binary number), and then listens for commands but only responds to those which contain its address. Likewise, it puts its address in any replies, allowing the master to map incoming data to the originating device.

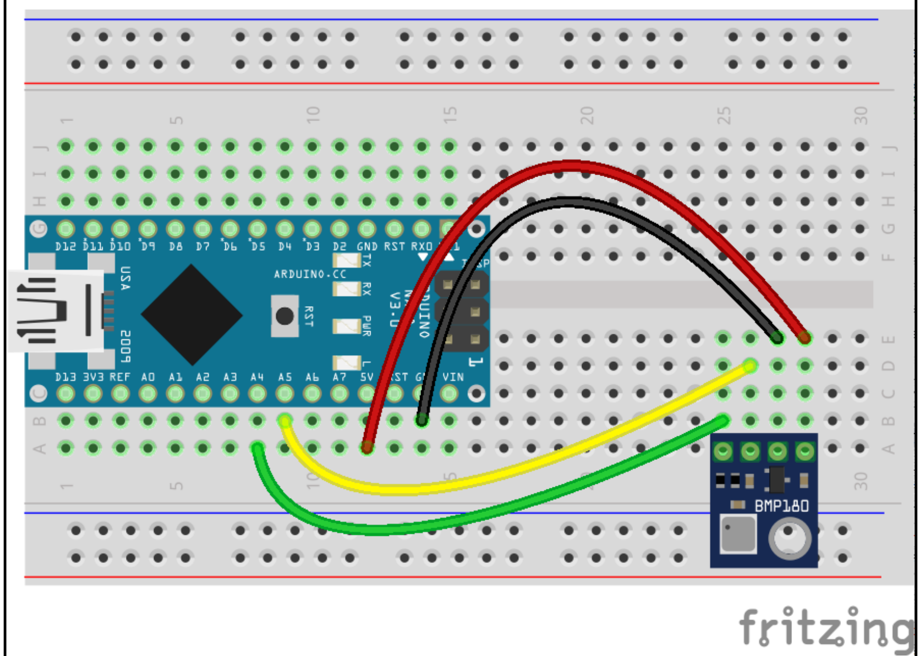
Most I2C devices have a single address burned into their firmware. Some allow for changing of that address by moving a resistor on a board, or using a ***jumper*** between some pins. Occasionally some devices may violate the bus rules and listen on any/all addresses, causing confusion.

In your kit, both this BMP180 and the OLED screen use I2C and each have unique addresses. You may notice that the OLED allows for device address changes by moving a small SMD resistor on the back side of it’s board.

In addition to a basic bit of sample code which you can use to validate the operation of the BMP180, there are two additional programs. One is an I2C bus scanner, which simply attempts to find all the devices on the bus, and display info about them out the serial port. Another requires the connection of the OLED display and the BMP 180 on the bus at the same time, and displays some information from the BMP on the OLED display. No wiring diagram is provided for the latter example, determining the correct hookup is up to you.

The BMP180 is inexpensive, small, low power, and easy to use, but it is not the perfect sensor. For example it only has a temperature accuracy of +/- 2C, which is not terribly useful for many measurements. And of course the BMP180 is not waterproof.

There are many components out there, often with similar function, but variances in connectivity, packaging, price, performance. Choosing the right one often means research and ***datasheet*** reading.

Components	**Wiring Diagram**
✓Nano ✓BMP180	

Connection Instructions
The legend for the pins of the breakout board are on the ‘bottom’. Connect as shown, making sure not to reverse the polarity and that the SCL pin down to A5 on the nano and SDA to A4. You can consult the pinout diagram to verify which pins provide the hardware I2C interface.

Sketch(es)	bmp180.ino

Analysis Questions
can you think of some automotive uses for an atmospheric pressure sensor?

Programming Tasks
The sample code provides some output to the serial port. Perhaps you can use some of your other components to provide other means of output?