adafruit learning system

Using the BMP085 with Raspberry Pi

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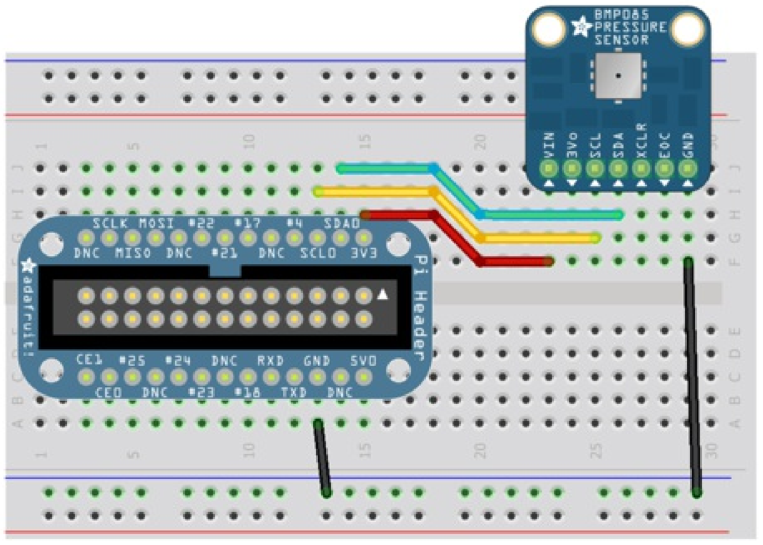
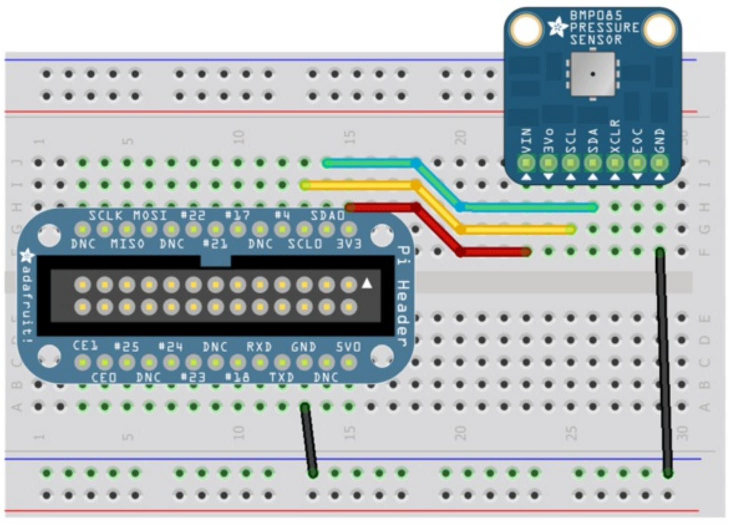


Guide Contents

Overview



The Raspberry Pi includes support for Python, which makes it easy to get access to a lot of low-level hardware and software stacks -- USB, TCP/IP, multiple file systems etc. This is a good thing since it means you don't need to wrap your head around all the obscure details that go along with these complex stacks or the implementation details of various serial buses: you can focus on getting your data off your sensor and into your project as quickly as possible. Hurray for abstraction!

Most sensors tend to communicate with other devices based on one of three well-defined mechanisms: **I2C**, **SPI** or good old **analog output**. There are dozens of other serial buses and communication protocols out there (CAN, 1-Wire, etc.), and they all have their strengths and weaknesses, but I2C, SPI and analog cover the overwhelming majority of sensors you're likely to hook up to the Pi.

I2C is a particularly useful bus with the pin-limited Pi for two main reasons:

- It only requires two shared lines: **SCL** for the clock signal, and **SDA** for the bi-direction data transfers.
- Each I2C device uses a unique 7-bit address, meaning you can have more than 120 unique I2C devices sharing the bus, and you can freely communicate with them one at a time on an as-needed basis.

This tutorial will show you how you can read data from the I2C-based BMP085 Barometric Pressure Sensor using Python and the pins available on the Raspberry Pi.

A Note on Distributions

Please note that this tutorial is based on Occidentalis (http://adafru.it/aNv), Adafruit's own educational Linux distro for the Raspberry Pi. It should work just as well with the latest Wheezy distro, etc., but it hasn't yet been tested on anything else.

Configuring the Pi for I2C

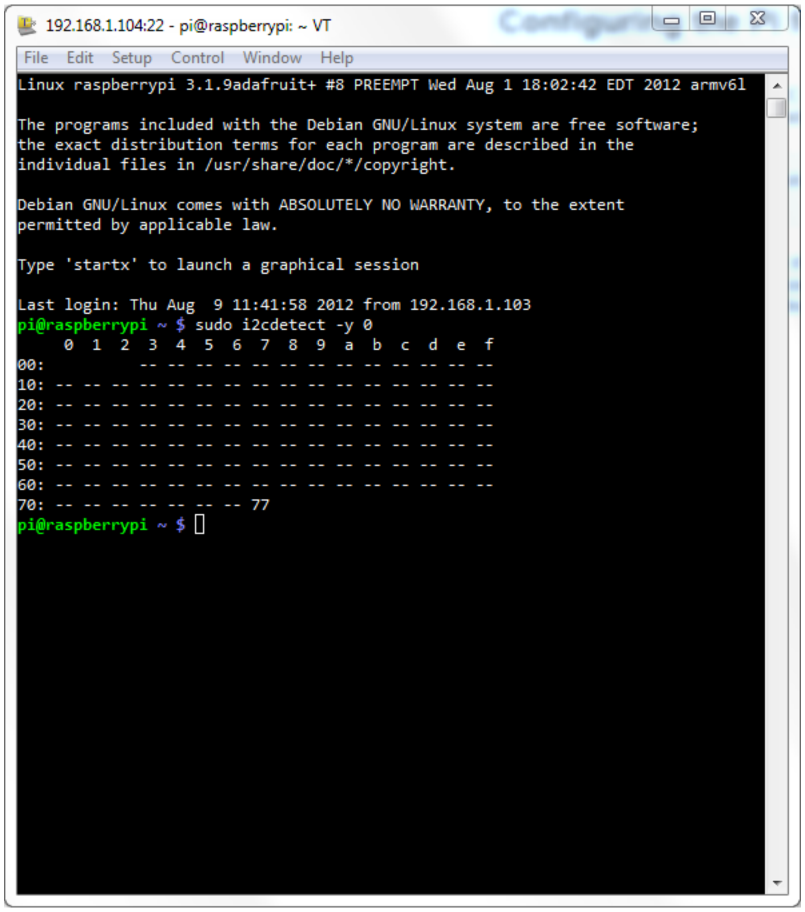
Before you can get started with I2C on the Pi, you'll need to run through a couple quick steps from the console.
Check out this tutorial for more details and follow it completely

http://learn.adafruit.com/adafruits-raspberry-pi-lesson-4-gpio-setup/configuring-i2c (http://adafru.it/aTI)

When you're done, run

```
sudo i2cdetect -y 0 (if you are using a version 1 Raspberry Pi)
sudo i2cdetect -y 1 (if you are using a version 2 Raspberry Pi)
```

This will search /dev/i2c-0 or /dev/i2c-1 for all address, and if an Adafruit BMP085 Breakout is properly connected it should show up at 0x77 as follows:

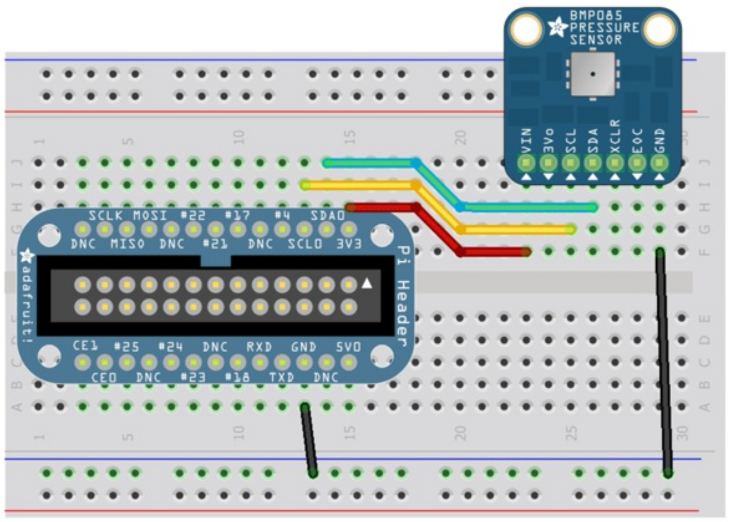

192.168.1.104:22 - pi@raspberrypi: ~ VT
File Edit Setup Control Window Help

```
Linux raspberrypi 3.1.9adafruit+ #8 PREEMPT Wed Aug 1 18:02:42 EDT 2012 armv6l

The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.

Type 'startx' to launch a graphical session

Last login: Thu Aug  9 11:41:58 2012 from 192.168.1.103
pi@raspberrypi ~ $ sudo i2cdetect -y 0
     0  1  2  3  4  5  6  7  8  9  a  b  c  d  e  f
00:          -- -- -- -- -- -- -- -- -- -- -- -- --
10: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
20: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
30: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
40: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
50: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
60: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
70: -- -- -- -- -- -- -- 77
pi@raspberrypi ~ $
```

Once both of these packages have been installed, you have everything you need to get started accessing I2C and SMBus devices in Python.

Hooking Everything Up

To hook your Adafruit BMP085 Breakout up to the Pi, you can use a Pi Cobbler as seen in the following wiring diagram:



Make sure that you connect the VIN pin on the BMP085 to 3V3, NOT 5V0! Connecting VIN to the 5V supply will cause the board to use 5V logic, which is perfect for the Arduino, but may damage the sensitive 3.3V inputs on the Raspberry Pi.

Using the Adafruit BMP085 Python Library

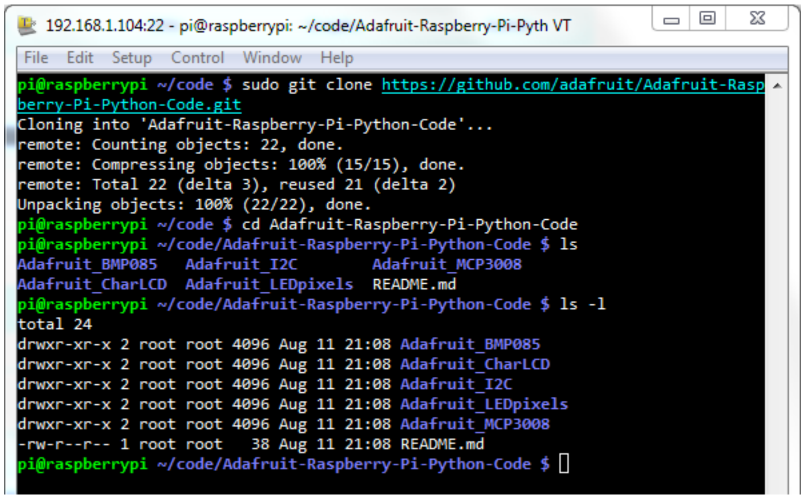
The BMP085 Python code for Pi is available on Github at https://github.com/adafruit/Adafruit-Raspberry-Pi-Python-Code (http://adafru.it/aOg)

While many of these drivers and classes are works in progress -- we're still trying to figure out how we can make accessing HW as painless as possible on the Pi -- the current code should serve as a good starting point to understanding how you can access SMBus/I2C devices with your Pi, and getting some basic data out of your BMP085.

Downloading the Code from Github

The easiest way to get the code onto your Pi is to hook up an Ethernet cable, and clone it directly using 'git', which is installed by default on most distros. Simply run the following commands from an appropriate location (ex. "/home/pi"):

```
$ git clone https://github.com/adafruit/Adafruit-Raspberry-Pi-Python-Code.git
$ cd Adafruit-Raspberry-Pi-Python-Code
$ cd Adafruit_BMP085
```


192.168.1.104:22 - pi@raspberrypi: ~/code/Adafruit-Raspberry-Pi-Pyth VT
File Edit Setup Control Window Help

```
pi@raspberrypi ~/code $ sudo git clone https://github.com/adafruit/Adafruit-Rasp
berry-Pi-Python-Code.git
Cloning into 'Adafruit-Raspberry-Pi-Python-Code'...
remote: Counting objects: 22, done.
remote: Compressing objects: 100% (15/15), done.
remote: Total 22 (delta 3), reused 21 (delta 2)
Unpacking objects: 100% (22/22), done.
pi@raspberrypi ~/code $ cd Adafruit-Raspberry-Pi-Python-Code
pi@raspberrypi ~/code/Adafruit-Raspberry-Pi-Python-Code $ ls
Adafruit_BMP085   Adafruit_I2C        Adafruit_MCP3008
Adafruit_CharLCD  Adafruit_LEDpixels  README.md
pi@raspberrypi ~/code/Adafruit-Raspberry-Pi-Python-Code $ ls -l
total 24
drwxr-xr-x 2 root root 4096 Aug 11 21:08 Adafruit_BMP085
drwxr-xr-x 2 root root 4096 Aug 11 21:08 Adafruit_CharLCD
drwxr-xr-x 2 root root 4096 Aug 11 21:08 Adafruit_I2C
drwxr-xr-x 2 root root 4096 Aug 11 21:08 Adafruit_LEDpixels
drwxr-xr-x 2 root root 4096 Aug 11 21:08 Adafruit_MCP3008
-rw-r--r-- 1 root root   38 Aug 11 21:08 README.md
pi@raspberrypi ~/code/Adafruit-Raspberry-Pi-Python-Code $ 
```

Testing the Library

If you're using a version 2 Pi (512 M) then you'll have to change the I2C bus as it flipped from #0 to #1 in the version 2.
Edit Adafruit_I2C.py with **nano Adafruit_I2C.py** and change this line

> **def __init__(self, address, bus=smbus.SMBus(0), debug=False):**

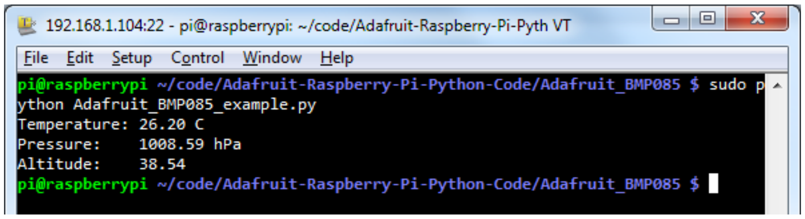
to

> **def __init__(self, address, bus=smbus.SMBus(1), debug=False)**

Once the code has be downloaded to an appropriate folder, and you have your BMP085 properly connected, you can start reading some data via the following command (the driver includes a simple demo program):

```
sudo python Adafruit_BMP085_example.py
```

Which should give you something similar to the following:


192.168.1.104:22 - pi@raspberrypi: ~/code/Adafruit-Raspberry-Pi-Pyth VT
File
Edit
Setup
Control
Window
Help

```
pi@raspberrypi ~/code/Adafruit-Raspberry-Pi-Python-Code/Adafruit_BMP085 $ sudo p
ython Adafruit_BMP085_example.py
Temperature: 26.20 C
Pressure:    1008.59 hPa
Altitude:    38.54
pi@raspberrypi ~/code/Adafruit-Raspberry-Pi-Python-Code/Adafruit_BMP085 $
```

Modifying the Code

The BMP085 library is organized as two seperate classes. There is one class to handle the low-level SMBus/I2C calls (Adafruit_I2C), and another class that handles the BMP085-specific functionality.

The library includes the basic example shown above, but you can also customize the code a bit to provide full debug output if you're having any problems, change the address, or use the BMP085 in one of it's four different modes (ULTRALOWPOWER, STANDARD, HIRES, and ULTRAHIRES), as seen in the commented out initializors in the sample code below:

```
#!/usr/bin/python

from Adafruit_BMP085 import BMP085

# ==========================================================================
# Example Code
# ==========================================================================

# Initialise the BMP085 and use STANDARD mode (default value)
# bmp = BMP085(0x77, debug=True)
bmp = BMP085(0x77)

# To specify a different operating mode, uncomment one of the following:
# bmp = BMP085(0x77, 0)  # ULTRALOWPOWER Mode
# bmp = BMP085(0x77, 1)  # STANDARD Mode
# bmp = BMP085(0x77, 2)  # HIRES Mode
# bmp = BMP085(0x77, 3)  # ULTRAHIRES Mode

temp = bmp.readTemperature()
pressure = bmp.readPressure()
altitude = bmp.readAltitude()
```

```
print "Temperature: %.2f C" % temp
print "Pressure:    %.2f hPa" % (pressure / 100.0)
print "Altitude:    %.2f" % altitude
```

FAQs

Can I use multiple BMP085s on the same Pi?

Because each I2C device on the bus needs to have it's own unique address, you normally can only have one device at address 0x77 (etc.). If you require several I2C devices at the same address, and if the devices have a reset pin (like the BMP085 does), then you CAN use multiple devices at the same address ... but at the expense of one GPIO pin per device. What you can do is hold the other devices in reset by pulling the XCLR (Reset) pin low, and letting XCLR go high on the one device that you do want to read, releasing it from reset and causing it to respond to any request on the I2C bus.