How to Set up Parallax 2 Axis Joystick with BeagleBone Green

By Nicholas Fador, Lawrence Yu and Rishi Dholliwar

The parallax 2 axis joystick consists of two separate potentiometers, one for each axis. It is a 5V component, so you must be very careful when connecting it to the ADC pins of the beaglebone which can handle a maximum of 1.8V. A voltage divider is required so that the input to the ADC pins does not exceed 1.8V. This can easily be achieved with a simple calculation and a series of resistors. Once the voltage divider is set up, two adc pins on the beaglebone can be selected to receive the output.

Parts Needed:
- Parallax 2-axis joystick [https://www.parallax.com/product/27800]
- 6 10k Ohm resistors
- 9 female to male jumper wires
- 2 male to male jumper wires
- breadboard

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**Voltage Divider:**

From the formula $V_{out} = V_{in} \times \frac{R_2}{R_1 + R_2}$ the desired maximum output voltage from the joystick can be determined.

\[
\begin{align*}
\text{Joystick Output} & & \text{Input to ADC} & & \text{Ground} \\
10 \, \text{k}\Omega & & 10 \, \text{k}\Omega & & \text{10 k}\Omega
\end{align*}
\]

$R_1 = 20\, \text{kOhm}, \quad R_2 = 10\, \text{kOhm}$

$V_{out} = 5\, \text{V} \times \frac{10\, \text{k}}{10\, \text{k} + 20\, \text{k}} = 1.66\, \text{V}$

You will need to set up two of these, one for each axis of the joystick.
ADC Input Selection:

7 analog inputs (1.8V)

From: [http://beagleboard.org/support/bone101](http://beagleboard.org/support/bone101)

In order to enable ADC on the beaglebone green, follow the steps in the A2D Guide: [https://www.cs.sfu.ca/CourseCentral/433/bfraser/other/A2DGuide.pdf](https://www.cs.sfu.ca/CourseCentral/433/bfraser/other/A2DGuide.pdf)

AIN0 has been set up for use in the potentiometer of the Zen cape. This leaves AIN1, AIN2, AIN3, AIN4, AIN5 and AIN6 as possible inputs for the joystick. Choose any two of these.

In the following images AIN2 and AIN3 were used.
Wiring:


- BeagleBone: Brown=DGND, Red=SYS_5V, Yellow=AIN3, Orange=AIN2

Make sure that your beaglebone is powered down before attempting this.

- Connect SYS_5V, which will be pin 7 or 8 on the P9 header, to a red breadboard rail.

- Connect the L/R+ and U/D+ of the joystick to the red breadboard rail.

- One ground connection is required, choose any DGND pin and connect it to a blue breadboard rail.

- Connect the ends of each voltage divider to the ground rail with the male to male jumper wires.

- Each Output (A/D2 and A/D3) will have to be connected to its own voltage divider. The output of each voltage divider will be connected to the one of the two ADC pins selected above.

- Connect the GND of the joystick to the blue breadboard rail.
Reading the Joystick Input:

Once everything is wired correctly (be very careful) you can check the input on each of the ADC pins that you selected previously (in the following examples AIN2 and AIN3). ADC cape must be loaded (see A2D guide).

To get the input on AIN2:

```
# cat /sys/bus/iio/devices/iio:device0/in_voltage2_raw
```

To get the input on AIN3:

```
# cat /sys/bus/iio/devices/iio:device0/in_voltage3_raw
```
When the joystick is centered the value will be close to the midpoint, as the joystick is moved to one end or the other the value will increase toward the maximum or decrease toward zero. The expected values will be close to those output below but there will be fluctuations.

**Joystick Centered**

<table>
<thead>
<tr>
<th>Command</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>cat /sys/bus/iio/devices/iio:device0/in_voltage2_raw</code></td>
<td>1742</td>
</tr>
<tr>
<td><code>cat /sys/bus/iio/devices/iio:device0/in_voltage3_raw</code></td>
<td>1754</td>
</tr>
</tbody>
</table>

**Joystick Down / Up**

<table>
<thead>
<tr>
<th>Command</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>cat /sys/bus/iio/devices/iio:device0/in_voltage2_raw</code></td>
<td>22</td>
</tr>
<tr>
<td><code>cat /sys/bus/iio/devices/iio:device0/in_voltage2_raw</code></td>
<td>3779</td>
</tr>
</tbody>
</table>

**Joystick Right / Left**

<table>
<thead>
<tr>
<th>Command</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>cat /sys/bus/iio/devices/iio:device0/in_voltage3_raw</code></td>
<td>3802</td>
</tr>
<tr>
<td><code>cat /sys/bus/iio/devices/iio:device0/in_voltage3_raw</code></td>
<td>14</td>
</tr>
</tbody>
</table>

**Troubleshooting:**

- If when you check the value of your selected ADC pins and it is 0 or 1 and the wiring is correct, then you might have connected the power to VDD_5V. Shutdown the beaglebone and connect the red breadboard rail to SYS_5V.
- If when you try to check the value of a pin and you get an error saying file not found, then the ADC cape is probably not enabled. Follow the steps in the A2D guide to enable the cape.

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