2015



Interfacing Potentiometer with Raspberry Pi using MCP3008



Author: Palani K

Introduction:

Raspberry Pi is a credit card sized computer that plugs into a computer monitor or TV, and uses standard keyboard and mouse. It's capable of doing everything you'd expect a desktop computer to do, from browsing the internet and playing high-definition video, to making spreadsheets, word-processing, and playing games. Here we are going to do interface with Potentiometer with Raspberry pi by using MCP 3008(ADC)IC.

Hardware Requirements:

- 1. Raspberry Pi board.
- 2. Tenet Power supply breakout board
- 3. Hookup wires.
- 4. MCP3008 IC (ADC).
- 5. Tenet Potentiometer breakout board.

MCP 3008 IC:

The MCP3008 10-bit Analog-to-Digital Converter (ADC) combines high performance and low power consumption in a small package, making it ideal for embedded control applications. The MCP3008 features a successive approximation register (SAR) architecture and an industry-standard SPI serial interface. The MCP3008 features 200k samples/second, 8 input channels, low power consumption (5nA typical standby, 425μ A typical active), and is available in 16-pin PDIP and SOIC packages. Applications for the MCP3008 include data acquisition, instrumentation and measurement, multi-channel data loggers, industrial PCs, motor control, robotics, industrial automation, smart sensors, portable instrumentation and home medical appliances.

Pin diagram:

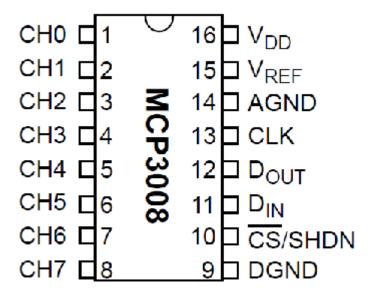


Figure 1

Tenet Potentiometer breakout board:

Adjustable potentiometer can open up many interesting user interfaces. Turn the pot and the resistance changes. Connect VCC to an outer pin, GND to the other, and the center pin will have a voltage that varies from 0 to VCC depending on the rotation of the pot. Hook the center pin to an MCP 3008 channel 0.

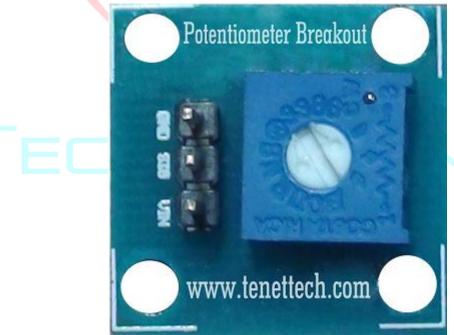


Figure 2

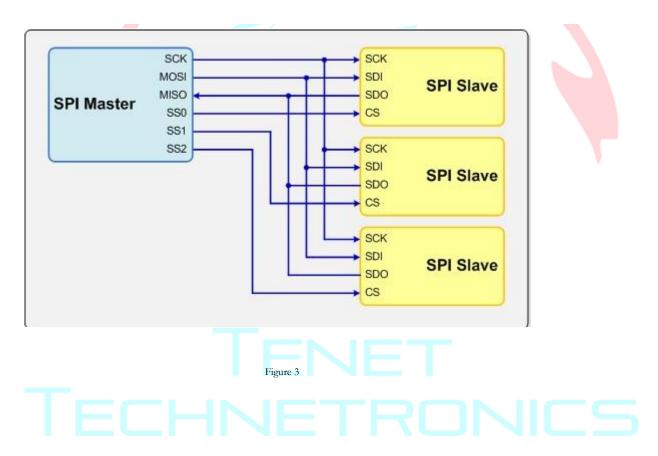
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SPI Interface:

The Serial Peripheral Interface (SPI) bus was developed by Motorola to provide full-duplex synchronous serial communication between master and slave devices. The SPI bus is commonly used for communication with flash memory, sensors, real-time clocks (RTCs), analog-to-digital converters, and more.

As shown in Figure, standard SPI masters communicate with slaves using the serial clock (SCK), Master Out Slave In (MOSI), Master In Slave Out (MISO), and Slave Select (SS) lines. The SCK, MOSI, and MISO signals can be shared by slaves while each slave has a unique SS line.



Enabling SPI on raspberry pi:

Step 1: Start by running the following command:

Sudo raspi-config

Step 2: This will launch the raspi-config utility. Select option 8 "Advanced Options".

```
âââââââââââââ⤠Raspberry Pi Software Configuration Tool (raspi-config) âââââââââââââââââââ
â Setup Options
â
    1 Expand Filesystem
                                         Ensures that all of the SD card storage
    2 Change User Password
                                         Change password for the default user (p
â
    3 Enable Boot to Desktop/Scratch
                                         Choose whether to boot into a desktop e
â
    4 Internationalisation Options
                                         Set up language and regional settings t
                                         Enable this Pi to work with the Raspber
Add this Pi to the online Raspberry Pi
â
    5 Enable Camera
    6 Add to Rastrack
â
â
    7 Overclock
                                         Configure overclocking for your Pi
    8 Advanced Option
                                         Information about this configuration to
â
    9 About raspi-config
â
                        <Select>
                                                       <Finish>
```

Figure 4

Step 3: Select the "SPI" option.

```
ââââââââââââââa Raspberry Pi Software Configuration Tool (raspi-config) âââââââââââââââââ
â Advanced Options
â
â
    Al Overscan
                                     You may need to configure overscan if b
â
    A2 Hostname
                                     Set the visible name for this Pi on a n
                                                                              â
                                     Change the amount of memory made availa
    A3 Memory Split
                                     Enable/Disable remote command line acce
    A4 SSH
                                     Enable/Disable automatic loading of SPI
â
    A5 SPI
â
                                      Force audio out through HDMI or 3.5mm j
    A6 Audio
                                     Update this tool to the latest version
â
    A7 Update
â
â
â
â
â
                      <Select>
                                                  <Back>
```

Figure 5

Step 4: Set the option to "Yes".

```
â
â Would you like the SPI kernel module to be loaded by
                                      â
default? Current setting: no
                                      â
                                      â
â
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â
                                      0 0 0 0 0 0 0 0 0 0 0 0
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â
â
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â
â
â
                                      â
          <Yes>
â
                         <No>
```

Figure 6

Step 5: Select "OK".

```
â SPI kernel module will now be loaded by default
                               â
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```

Figure 7

```
ââââââââââââââa Raspberry Pi Software Configuration Tool (raspi-config) âââââââââââââââââââ
â Setup Options
    1 Expand Filesyster
                                      Ensures that all of the SD card storage
    2 Change User Password
                                       Change password for the default user (p
    3 Enable Boot to Desktop/Scratch
                                       Choose whether to boot into a desktop e
    4 Internationalisation Options
                                      Set up language and regional settings t
                                      Enable this Pi to work with the Raspber
   5 Enable Camera
    6 Add to Rastrack
                                       Add this Pi to the online Raspberry Pi
    7 Overclock
                                       Configure overclocking for your Pi
   8 Advanced Options
                                      Configure advanced settings
    9 About raspi-config
                                      Information about this configuration to
                      <Select>
                                                    <Finish>
```

Figure 8

Step 7: Reboot for the changes to take effect.

Sudo reboot

SPI is now enabled.

Step 8: In order to read data from the SPI bus in Python we can install a library called 'py-spidev'. To install it we first need to install 'python-dev'.

Sudo apt-get install python2.7-dev

Step 9: Then to finish we can download 'py-spidev' and compile it ready for use.

wget https://github.com/Gadgetoid/py-spidev/archive/master.zip unzip master.zip

rm master.zip
cd py-spidev-master
sudo python setup.py install
cd ..

Coding:

```
File Edit Tabs Help

GNU nano 2.2.6 File: potentio.py

Maport spidev
from time import sleep
start=spidev. SpiDev()
start.open(0,0)
while 1:

try:

r=start.xfer2([1,(8+0)<<4,0])
potentiometer_value=((r[1]&3)<<8)+r[2]
voltage=((3.3*potentiometer_value)/1023)
print("potentiometer_value:{} \t potentiometer_voltage : {} ".format(potentiometer_value,voltage))
except KeyboardInterrupt:
quit()
```

```
Figure 9
                                            //Importing spidev to access SPI
Import spidev
                                            //import sleep for giving delay
From time import sleep
Start=spidev.SpiDev()
                                            //creating object with name start
Start.open(0,0)
                                            //(BUS,channel) since one channel and Bus
While 1:
                                            //creating function
       try:
              r=start.xfer2([1,(8+0)<<4,0]) //enabling SPI and 3 bytes of data stored in r
              potentiometer_value=((r[1]&3)<<8)+r[2] //Retrieving last 10 bit
              voltage=((3.3*potentiometer_value)/1023) //Converting to Voltage
              print("potentiometer_value:{}\tpotentiometer_voltage
              {}".format(potentiometer_value,voltage))
                                                                       //printing values
       excepy KeyboardInterrupt:
                                                   //when CTRL+C is pressed terminate it
              GPIO.cleanup()
              quit()
```

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Circuit diagram:

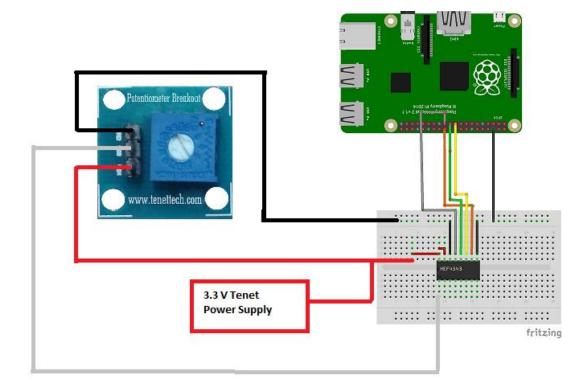
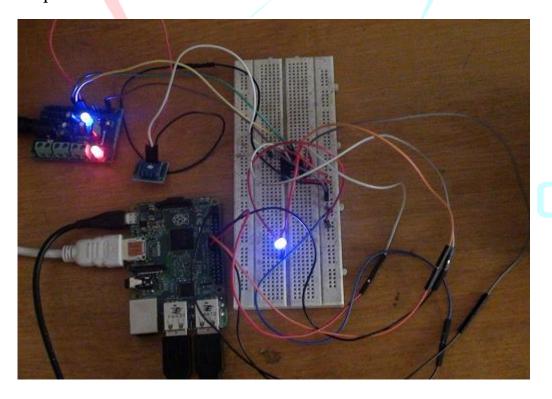


Figure10

Output:



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Output on the screen:

```
Cpi@raspberrypi ~ $ sudo python potentio.py
otentiometer_value:1023
                                   potentiometer voltage : 3.3
otentiometer value:1023
                                   potentiometer voltage : 3.3
otentiometer value:1023
                                   potentiometer voltage : 3.3
otentiometer value:1023
                                    potentiometer voltage :
otentiometer value:1023
                                    potentiometer voltage :
otentiometer_value:1020
otentiometer_value:1016
                                   potentiometer_voltage : 3.29032258065
potentiometer_voltage : 3.27741935484
otentiometer_value:1023
                                    potentiometer_voltage : 3.3
otentiometer_value:1023
                                    potentiometer_voltage : 3.3
otentiometer_value:963
                                    potentiometer_voltage : 3.1064516129
otentiometer_value:872
                                   potentiometer voltage : 2.81290322581
otentiometer value:872
                                   potentiometer voltage: 2.81290322581
otentiometer value:873
                                   potentiometer voltage : 2.81612903226
otentiometer value:868
                                    potentiometer voltage :
                                    potentiometer_voltage :
otentiometer value:868
                                                              2.8
                                    potentiometer_voltage : 2.79677419355
potentiometer_voltage : 2.8064516129
otentiometer_value:867
otentiometer_value:870
otentiometer_value:755
                                    potentiometer_voltage : 2.43548387097
otentiometer_value:762
                                    potentiometer_voltage : 2.45806451613
otentiometer_value:733
                                    potentiometer_voltage : 2.36451612903
otentiometer value:736
                                    potentiometer voltage : 2.37419354839
otentiometer value:736
                                    potentiometer_voltage : 2.37419354839
otentiometer value:735
                                    potentiometer voltage : 2.37096774194
```

Figure 12

For product link:

- 1. http://tenettech.com/product/7021/raspberry-pi-2-model-b-basic-kit-tt-sp-19022015
- **2.** http://www.tenettech.com/product/6068/power-supply-breakout-board.
- **3.**http://www.tenettech.com/product/2985/mcp3008-8-channel-10-bit-adc-with-spi-interface
- 4. http://www.tenettech.com/product/5094/breadboard-trim-potentiometer

For more information please visit: www.tenettech.com

For technical query please send an e-mail: info@tenettech.com