a)

CPHA = 0

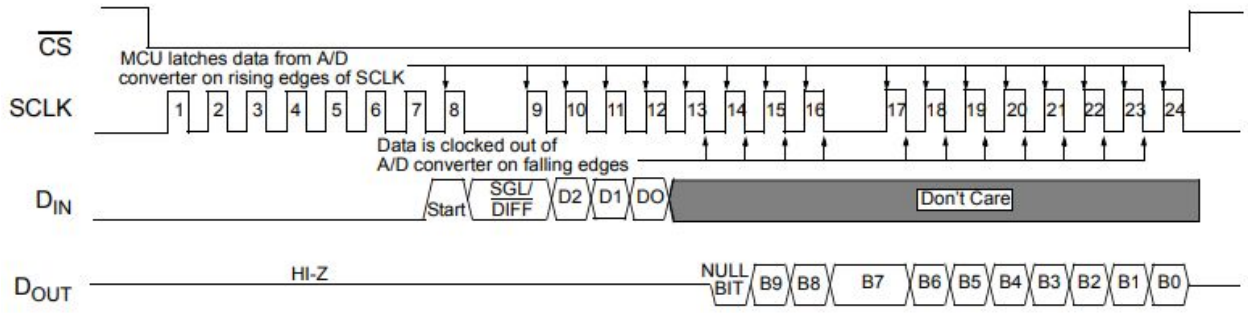


Figure 1: SPI timing diagram: CPOL:0, CPHA:0 (Cdn-shop.adafruit.com, 2018)

Assuming that the CPOL (clock polarity) and CPHA (clock phase) are both 0 by default, using the Adafruit library for SPI communication between the MCP3008 ADC and RPi3B. With CPHA = 0 then the signal is sampled on the 1st clock edge (See SCLK and DIN pulse 8) . With CPOL = 0, then the clock's idle logic state is low, see SCLK in figure 1.

b)

Interrupt:

- An interrupt is a signal to the processor sent by hardware or software indicating an event that needs immediate attention (www.tutorialspoint.com, 2018).

Threaded Call-back:

- When a condition that satisfies a user defined function is met, the function is executed and may operate on the condition, i.e call-back; this function is a subset of multiple functions that will have different conditions and as stated will only execute when these function conditions are met, i.e. multiple threads.(Forums.codeguru.com, 2018)

c)

```
def ConvertVolts(data):

    volts = (data * 3.3) / float(1023)
    volts = round(volts,1)
    return str(volts) + " V"
```

The maximum voltage across the potentiometer is 3.3V at a value of 1023 and the minimum is 0V at 0 so the voltage across is directly proportional to the value input.

d)

```
def ConvertTemp(data):

    temp = (data*(165/1023))-40
    temp = round(temp, 1)
    return str(temp) + " C"
```

As the datasheet specifies the MCP9700 as a linear thermistor with a temperature range of -40°C to 125°C. When the sensor was tested at room temperature the ADC value (0:1023) was around 400, and when this value is inserted into the function above, the output value is 24.6°C this seems correct room temperature.

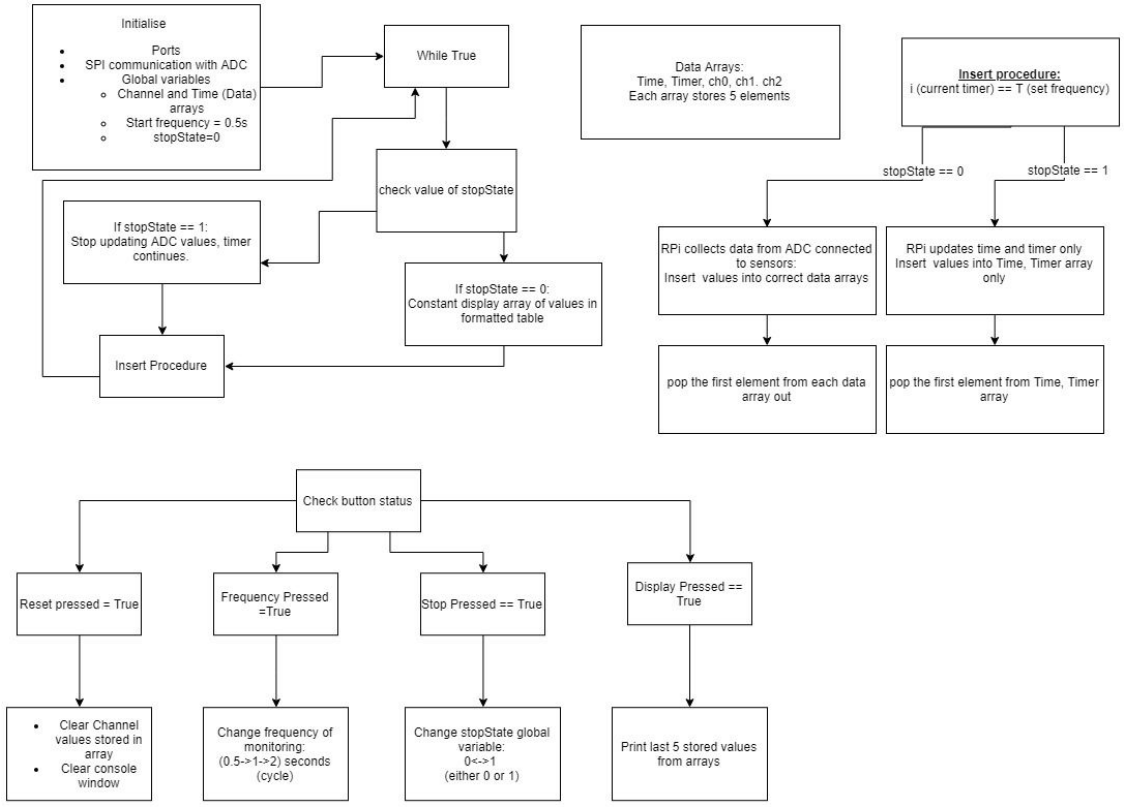
e)

```
def ConvertPercentage(data):

    percent = 100 - (data/570)*100
    percent = round(percent, 0)
    return str(percent) + " %"
```

As the LDR was in series with a 10kΩ which was in parallel with the ADC channel (i.e. voltage divider) the above values seemed ideal.

f)



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