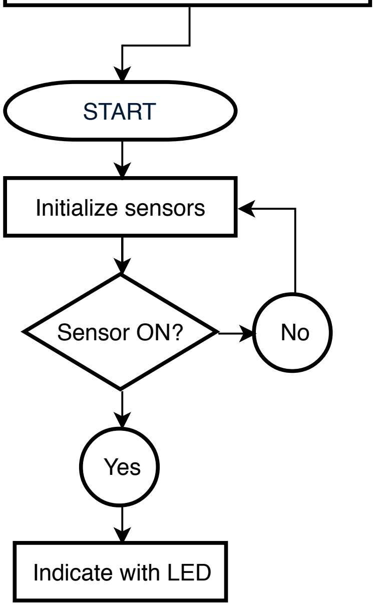
Ejection Circuit Tutorial Document

Setup()

This code will run inside the setup() method for the Arduino. Do NOT place it inside the main() loop.



The Bias

Accumulate the sensor readings over 1000 times. The bias is the average value of those accumulated sensor readings. Once the bias is determined, every subsequent sensor reading needs to be subtracted by the bias.

The Event Threshold

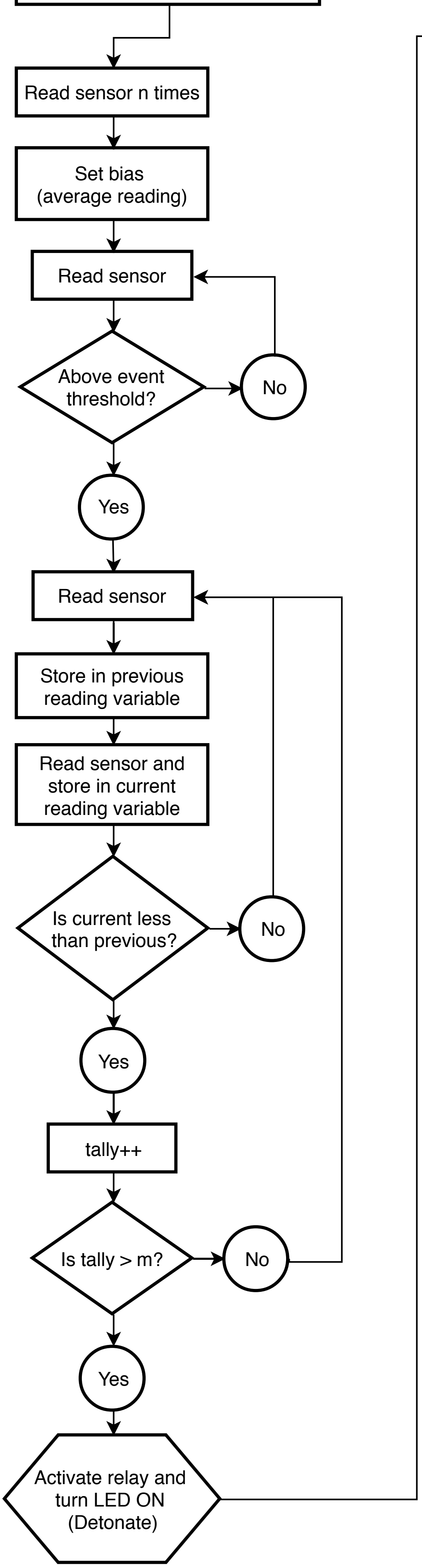
An event we are waiting for before starting the main sequence of the ejection circuit code. The main event we care about is whether the rocket has launched, in other words, has the rocket flown X amount of meters. Typical value could be 100-300 meters.

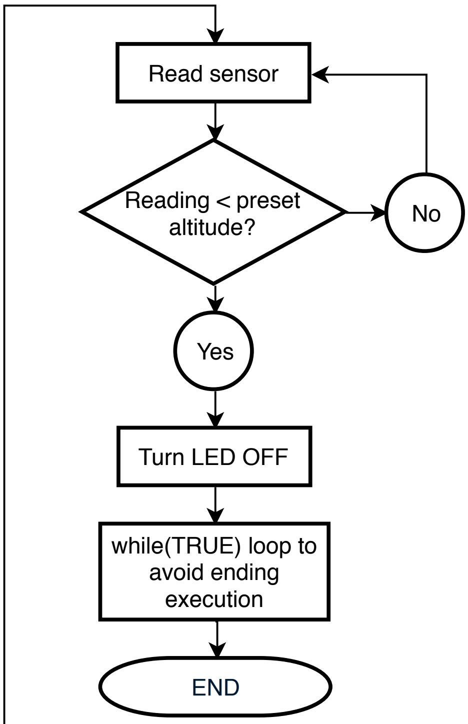
Tally

Before deploying the drogue parachute, we want to verify that we actually need to depoy it. Typical tally value could be 30. In essence, we measure the sensor reading m consecutive times to certify that the rocket is actually in descent.

Loop()

This code will run inside the main() method of the Arduino. Execution should only occur after setup().


Read sensor n times
Set bias (average reading)
Read sensor
Above event threshold?
No
Yes
Read sensor
Store in previous reading variable
Read sensor and store in current reading variable
Is current less than previous?
No
Yes
tally++
Is tally > m?
No
Yes
Activate relay and turn LED ON (Detonate)

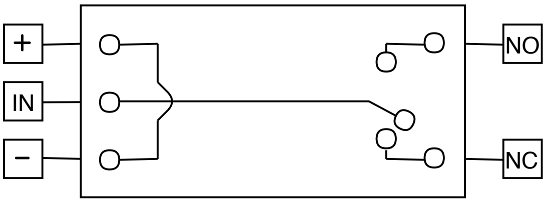

Read sensor
Reading < preset altitude?
No
Yes
Turn LED OFF
while(TRUE) loop to avoid ending execution
END

Note

This is a simplified ejection circuit. For the real ejection circuit, two relays are used for the deployment of the drogue and main parachutes. The two relays for each parachute are powered in series, each connection to a pin on the microcontroller. Thus, two HIGH states are required to cause an ejection.

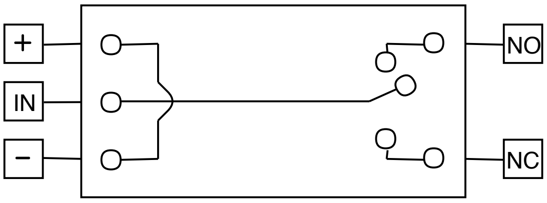
Nominal

In the nominal state, i.e. starting position, we want the relay to be nominally closed (NC). Initially, the switch should NOT allow current to flow from IN to NO. NC is the nominal position because if the relay fails to go off then we don't want it to cause a detonation later on by accident, like during recovery of the rocket for example.



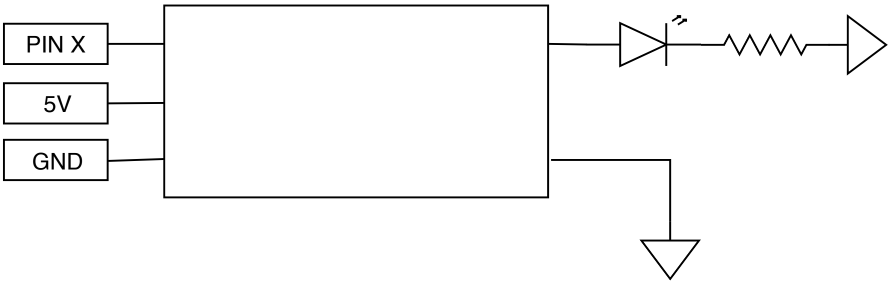
Non-Nominal

In the non-nominal state, i.e. no longer in the starting position, we want the relay to be nominally open (NO). This will flip the switch and allow current to flow from IN to NO, thus causing the parachute deployment.



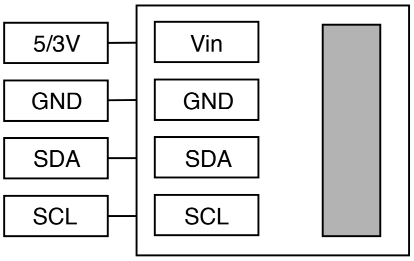
Relay

The relay will be connected according to the diagram. PIN X corresponds to any digital pin on the Arduino UNO.



BPM180 Sensor

The BPM180 is the pressure sensor you will be using to determine what altitude/pressure you are currently at. Connect the pins to their corresponding counterparts on the Arduino UNO.



Colour Coding

Follow the colour coding for convention and good practice in general, especially when you design your own circuits.

GND	⬛
PWR	🟥
CTRL	🟨
SDA	🟦
SCL	🟩