piRover Builds with K2

Digital Inputs – signal conditioning Rev 1.0

Overview:

In this activity, the instructor will provide an overview of signal conditioning used for digital inputs. You will review concepts from EET103 and EET204 and analyze how input circuitry is used to enable digital signals to be read by a microcontroller while also providing protection from electrical noise and failures.

Prerequisites:

Prior to beginning the instruction provided in this lesson you must have completed the following:

1. Digital Inputs - Introduction

Performance Outcomes:

1. Describe hysteresis and its application to digital inputs
2. Use an internal pull-up or pull-down resistor on a Pi input
3. Identify clipping diodes and describe their function
4. Review additional filters and conditioners used for digital inputs

Resources:

1. Raspberry Pi GPIO Electrical Specification
2. raspberry-gpio-python / Wiki / Inputs (sourceforge.net)
3. Protecting Inputs in Digital Electronics | DigiKey

Materials:

1. piRover with fully charged battery
2. RAM155 Digital Multimeter
3. RAM205 Parts Kit

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Directions:

1. The instructor will review the Equivalent Circuit diagram below.

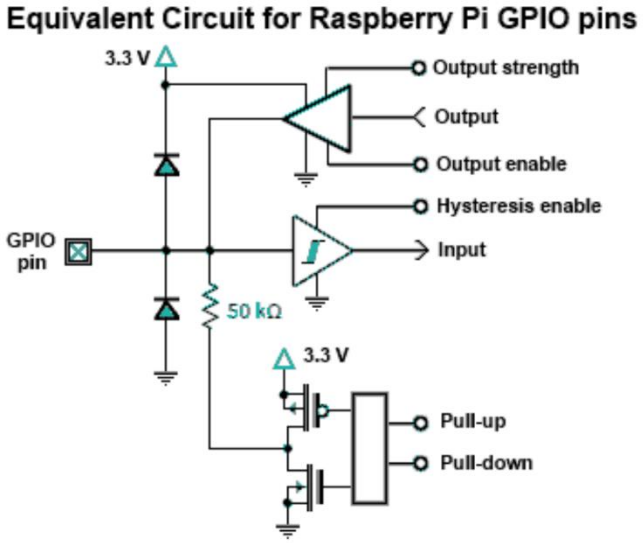


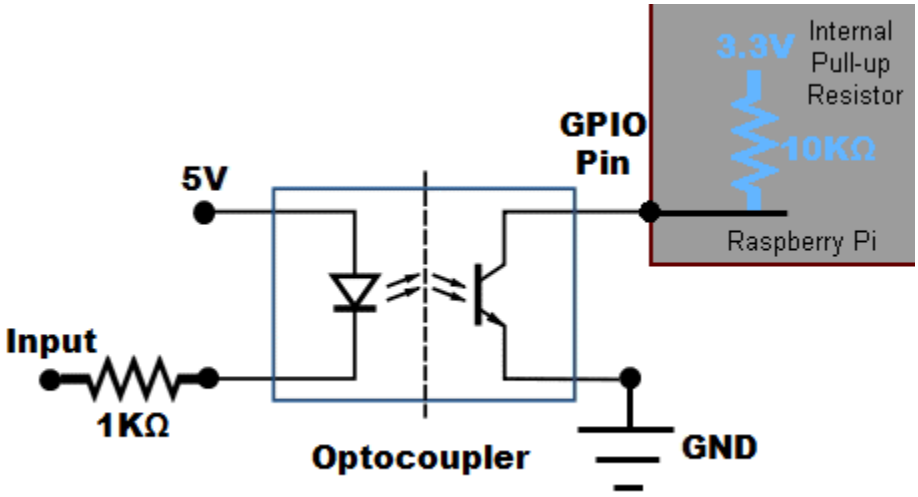
Figure 1

2. What is Hysteresis? How does this relate to your home thermostat? Why is this an important feature when sensing digital inputs.
3. Note the option for a 50K ohm pull up resistor. Add the following optional parameter to the switch setup. Remove the 10K resistors from the circuit so that switch is the only connection and pulls the signal down to ground when the switch is made. The instructor will diagram the circuit.

```
15    GPIO.setup(BUZZER_PIN, GPIO.OUT)
16    GPIO.setup(SWITCH_PIN, GPIO.IN, pull_up_down=GPIO.PUD_UP)
17    GPIO.output(BUZZER_PIN, True)
```

4. Test your digital switch using this new configuration.
5. Is using the pull-down resistor an option? Diagram the circuit and discuss with the class.

6. Review the circuit diagram of figure 1 and not the two diodes attached to the input. What voltage level on the input will for forward bias D1 (the top diode)? What voltage level on the input will forward bias D2 (the bottom diode)? Why are these diodes called clipper diodes?
7. The instructor will review additional signal conditioning circuity using the Digi-Key document available via the link in the resource section.
8. The instructor will review the use of an opt-coupler as an input protection device.



Assessment:

There is no assessment associated with this in-class presentation.