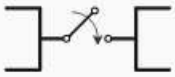
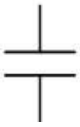
DEBOUNCING VIA RC FILTER

Using Resistors and Capacitors to Debounce

Introduction

In the Debouncing via Software project, we learned how to debounce a button in a circuit with software. Other solutions to this problem also exist. In this project, we will examine how to debounce the button circuit using a resistor and capacitor to make an RC filter (resistive capacitive filter). The key component here is the capacitor, which is a device that stores energy using electrical charge. It is important to understand how a capacitor works before we begin, so there is more reading on capacitors available via the link to the right. A capacitor works so well for debouncing because it limits how quickly the voltage can change over a period of time. Essentially, the capacitor quickly charges and discharges over every voltage spike, smoothing out the button bounce. Depending on how quickly the capacitor can charge, the button bounce should be mitigated.

Inventory:

Qty	Description	Typical Image	Schematic Symbol	Breadboard Image
1	LED			
1	Two-Port Button			
1	220 Ω Resistor			
2	10 kΩ resistor			
1	10 µF Electrolytic Capacitor			

Step 1: Planning the Circuit

To debounce the button circuit properly, we cannot use a capacitor alone; we must use a resistor as well. The combination of a resistor and capacitor in this circuit is referred to as an RC filter. RC filters can be used to filter out different frequencies of electrical variation. A properly designed RC filter could be used to filter out specific sound frequencies (represented as electrical signals) being sent to a speaker. This, however, is a bit beyond the scope of our project.

Instead, we are going to be focusing on the charge and discharge time of our RC circuit. We can control the rate at which the voltage changes by choosing our resistor and capacitor values properly to get a viable time constant . For this project, we will use a 10 kΩ resistor and a 10 μF capacitor. For more information regarding time constants and how the R and C values were determined from it, visit the orange link provided in the Related Material section above.

Step 2: Building the Circuit

Having chosen our resistor and capacitor values, we can begin putting the circuit together. We will be using the same circuit we first used in Debouncing via Software. In that project, the button bounce caused “noise” that occasionally made the LED glow dimly instead of blinking. The addition of our RC filter remedies this problem. Refer to Fig. 1, which illustrates the individual steps for modifying the circuit.

Modifying the Circuit

1. Connect the wire from pin 7 to the button's right side.
    - NOTE: The right side of the button corresponds here to the “top” of the button. This means that the two button legs that are always electrically

connected are oriented vertically so that they span the valley between the columns.

2. Connect the 5V source to the button's current-limiting resistor.
3. Connect a 10 µF capacitor and 10 kΩ resistor to the right side of the button.
4. Connect the ground pin (GND) to the right side of the capacitor and resistor.

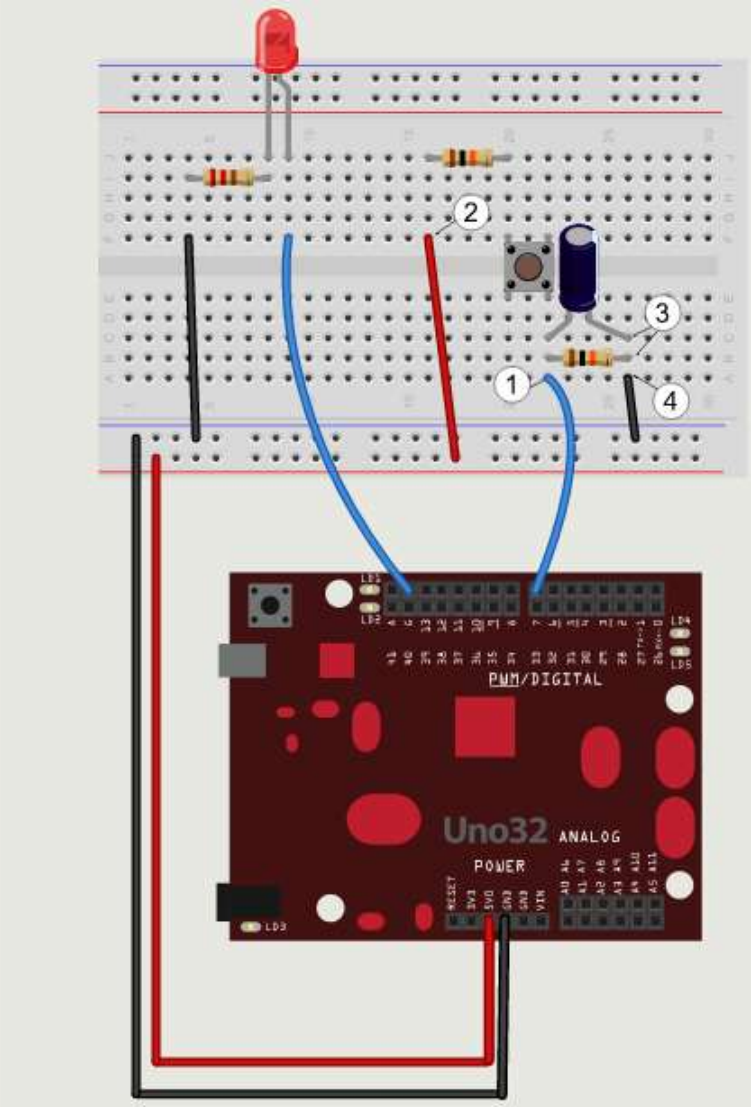


Figure 1. Circuit with trainable delay featuring an RC filter. Made in Fritzing.

Source: https://learn.digilentinc.com/Documents/258