

Latching Circuits

Overview: Once you've made the Pressure Sensor burglar alarm, you might be wondering how to make the alarm stay on after it has been triggered, the way the Trip Wire Sensor does naturally. That's what we're going to do today using another type of switch and a more complex circuit.

What to Learn: A relay is a switch you can turn on and off using electricity. It uses an electromagnet to activate the switch inside of it.

Materials

- relay (you'll want one that has a coil voltage of 12V DC or less)
- your completed Pressure Sensor circuit
- 3 AA battery packs with 6 AA batteries
- 7 additional alligator clip wires
- Optional: SPST switch

Lab Time

1. Hook up your battery packs like this: connect the positive lead from battery pack #1 to the negative lead on battery pack #2 using an alligator clip wire. Connect the positive lead from #2 to the negative of #3 using a second alligator wire. You should now have two free ends: the negative from #1 and the positive from #3. Those are the two you are going to use to power your relay in the next step. (If you use your DMM set to 20 volts and DC, you'll find you have about 9V between those two leads. That's usually enough to get the relay to click.
2. Connect the alligator lead from battery pack #1 to one side of the relay coil. The coil terminals are usually the two tabs that are orientated differently than the rest. Touch (don't connect) the alligator lead from battery pack #3 to the other coil terminal. Tap it a few times to hear the relay click. If you don't get a click, stop and redo your wiring until you do before moving on.
3. Connect the alligator clip lead from battery pack #3 (in the video, it's white) to one side of the SPST switch. You can use your index card SPST switch if you like, or simply skip the switch and connect it to a free alligator clip lead (in the video, this one is yellow).
4. Connect the switch to the pressure sensor using another alligator clip lead (yellow in the video).
5. Connect the other paperclip of the pressure sensor to the relay coil (a second white wire in the video).
6. Connect the other side of the relay coil to the batteries (in the video, it's green).
7. Recheck your connections: You should have the relay connected to the SPST to the pressure sensor and back to the relay, like a big loop.
8. Squeeze the pressure sensor – do you hear the relay click once? If not, redo steps #3-9.
9. The video uses a buzzer. You can use your LED instead (it's a much quieter lab if you do). Connect one alligator wire to each lead of the LED (in the video, they are green and white). Connect each of the alligator wires from the LED to the coil, one on each terminal, right on top of the ones that are already clipped on.
10. Connect a fresh alligator clip lead to one side of the pressure sensor right onto the paper clip (red wire in the video). The other side of this alligator clip goes to the middle contact on the relay.

11. Connect another new alligator clip lead to either the top or the bottom contact. Here's how to tell which one: look at your relay. Do you see which contact (top or bottom) the small metal lever is touching when it's not activated? That's not the one you want. Choose the other one and clip the wire onto that terminal. The other end of this alligator wire (white in the video) goes to the other side of your pressure sensor right onto the paperclip. You should have two wires on each paperclip.
12. Press the sensor to trigger the LED, and the relay should also click on. Does the LED stay lit? If not, go back and try hooking up your circuit again, carefully following the steps in the video.

Reading

A relay is switch you can turn on and off using electricity. It uses an electromagnet to active the switch inside of it. We'll talk more about how the relay works when we discuss Magnetism.

Once you've made the Pressure Sensor burglar alarm, you might be wondering how to make the alarm stay on after it has been triggered, the way the Trip Wire Sensor does naturally.

The reason this isn't as simple as it seems is that the trip wire is a normally closed (NC) switch while the pressure sensor is a normally open (NO) switch. This means that the trip wire is designed to allow current to flow through the tacks when there's no paper insulating them, while the pressure sensor stops current flowing in its un-squished state. It's just the nature of the two different types of switches.

However, we can build a circuit using a relay which will "latch on" when activated and remain on until you reset the system (by cutting off the power). This super-cool latching circuit video will show you everything you need to know

Exercises

1. What is a relay?
2. What does the relay do in this circuit?
3. Draw out a picture that shows how everything is connected in your circuit:

Answers to Exercises: Latching Circuits

1. What is a relay? (A relay is a switch you can turn on and off using electricity.)
2. What does the relay do in this circuit? (The relay keeps the electricity flowing to the LED after the pressure sensor shuts it off. The SPST switch resets the relay.)
3. Draw out a picture that shows how everything is connected in your circuit: