Mark's Haunted Garage

http://www.markshauntedgarage.com/halloween/techinfo/outlet_relay_module.php

Outlet/Relay Module

DISCLAIMER: In this project, you will be wiring a device that uses 120VAC. This is my first 120VAC project. I do not claim to be an expert with electricity. In fact, I claim just the opposite...I am an electricity novice. I do not know if anything I recommend here violates any codes or anything like that. Use this information at your own risk.

To be able to turn a light on and off using a microcontroller such as a PIC or Basic Stamp, you can make a module consisting of an electrical outlet and a solid state relay (SSR). I got my relays at Futurlec.com. Specifically, I used this relay, which cost $10 each.

In addition to the relay, you'll need

- A double gang electrical box. Mine was plastic, but it doesn't need to be.
- An electrical outlet.
- An extension cord.
- A double-wide face plate for the box. This will probably be a plate for one outlet and one switch, or you could use one with two outlets.
- A couple of nuts and bolts to hold the relay in place.
- Some kind of connector for the signal wires (optional).

I found it necessary to use a double box because the relay was too long to fit along the bottom of the box, either horizontally or vertically. I ended up mounting the relay on the side of the box because there was a bubble sticking up from the bottom of the box that prevented the relay from laying flat on the bottom.

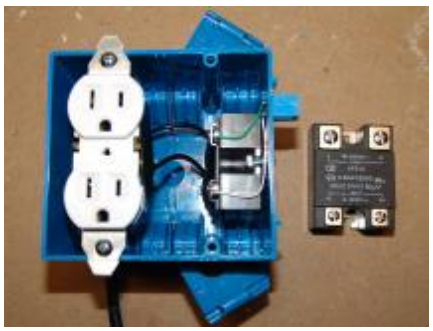
1. Put the relay in the box along the side and determine where to drill the holes for the bolts that will hold the relay. The size of the holes will depend on the bolts you are using. I have no way to say what size bolts I used. I would recommend that at least the bottom bolt be almost as long as the relay is thick. I had some problems getting the nut on the bottom bolt when I used a shorter one. I would also recommend putting the bottom hole a little bit off the bottom so that you have room to get a finger in there to hold the nut when it is time to tighten it. Once the holes are drilled, remove the relay from the box for now.
2. Cut the outlet part off the extension cord, so that you are left with just a plug attached to the two wires.

3. Feed the wire end of the cord through the bottom left hole in the box. You'll probably want between 12 and 18 inches to work with. You can always pull back the excess later.
4. Separate the two wires. I used a utility knife to cut the insulation running between the two wires. You'll probably want to separate about 12 inches.
5. Identify the wire that is attached to the wide blade on the plug. Lop off 6 to 8 inches from the end of this wire.
6. Strip off maybe 1/2 to 3/4 of an inch of insulation from each end of this 6 inch wire. Strip off a similar amount of insulation from each of the extension cord wires.
7. Attach the shorter wire of the extension cord to one of the screws on the left side of the outlet.
8. Attach the longer wire of the extension cord to one of the two screws on the A/C side of the relay, which is the top side of the relay I used. It is the side labeled "LOAD".
9. Attach one end of the 6-inch wire to the other screw on the relay.
10. Attach the other end of the 6-inch wire to a screw on the right side of the outlet. You've now formed the AC circuit.
11. Now it is time to decide what you want to do for the control wires. I will describe what I did. Note that the method I describe next will only work with a plastic electrical box. If you are using a metal box, this will not work.
12. Attach one end of a wire to one of the screws on the DC side of the relay. The wire will probably need to be 4 inches or so. I used 24AWG wire. It really doesn't matter what the gauge of the wire is since there won't be much current on this wire.
13. Repeat with a second wire connected to the other screw on the DC side. You now have a wire on each of the 4 screws on the relay.
14. Put the outlet and relay into the electrical box. I put the relay so that the AC side was at the bottom of the box and the DC side was at the top. Screw in the outlet and bolt in the relay. Pull any access extension cord out of the box.
15. Drill two small holes for the pins of the terminal block on the side of the electrical box to the side of and/or above the relay. Basically, wherever it is convenient. The pictures below give you an idea of where I put mine.
16. Insert the terminal block and solder the two wires from the DC side of the relay to the two pins on the terminal block. Take note of which wire goes to which pin. Label the two screw terminals on the terminal block based on the associated label on the relay. See the bottom picture below for an example.
17. Screw the face plate onto the box.

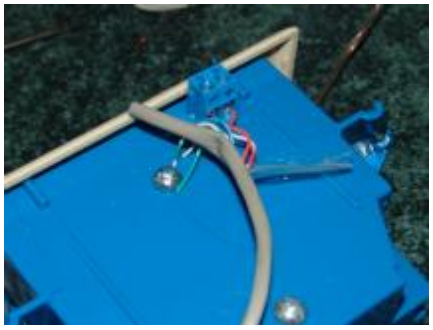
To use the module, plug your lamp into either outlet. Attach a ground line from the controlling microcontroller to the screw on the terminal block that you labeled as "-". Attach one of the output pins from the microcontroller to the screw on the terminal block labeled "+". Note that these relays use something along the lines of 20mA of current, so your microcontroller must be able to source that much current. If not, you'll need a more exotic interface, possibly using a transistor. Anyway, turn on the output pin and the light turns on. Turn the pin off and the light turns off. It's that simple.

One word of warning. You may be tempted to plug other types of devices (i.e. motors, strobe lights, etc.) into the outlets. I would not recommend this. I am told that the typical SSR is made for resistive loads only, not for inductive loads such as motors. For that, you would use a standard relay, which I will not discuss here. Only use incandescent light fixtures with the module I have just described.

Here are some pictures of the finished product. In the picture on the left, you can also see what the relay looks like.



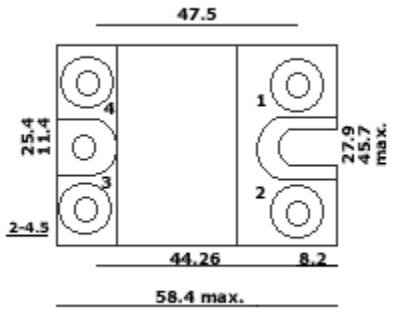
Here is the connector for the signal wires.



SSR10A - SPST 3-32VDC 10A Solid State Relay

Photograph

Pin Layout



Features

- Solid Construction with Metal Base
- Photo Isolation
- Screw Terminals

Specifications

Input

- **Input Voltage:** 3-32 VDC
- **Input current:** 15 mA

Output

- **Output Voltage:** 48-380 VAC
- **Maximum Load Current:** 10 A
- **Maximum Surge Current:** 110/150/200/250/440 Apk
- **Maximum on-state Voltage Drop:** 1.5 VAC
- **Maximum Off-state Leakage Current:** 3-10 mA
- **Minimum off-state (dv/dt):** 200 V/µS
- **Frequency Range:** 47-63 Hz
- **Max turn-on time zero-cross Turn-on:** 10 ms
- **Maximum Turn-off Time:** 10 ms

General

- **Dielectric Strength:** 4,000 VAC 1 min
- **Minimum Insulation Resistance:** 1000 Mohm@500 VDC
- **Ambient Operating Temperature Range:** -30°C to +80°C