## Wiring up the KeeLoq Controller:

The KeeLoq controller is a 5V device which receives the code transmitted by the FOB. The FOB has four buttons which activate each of the four features available on the controller. When the controller receives a valid code, it activates the output that corresponds to the button that has been pressed. The diagram below is from the Circuit Specialists website. The original can be found here https://www.circuitspecialists.com/blog/using-the-circuit-specialists-rxd4140-434-rf-modules/.
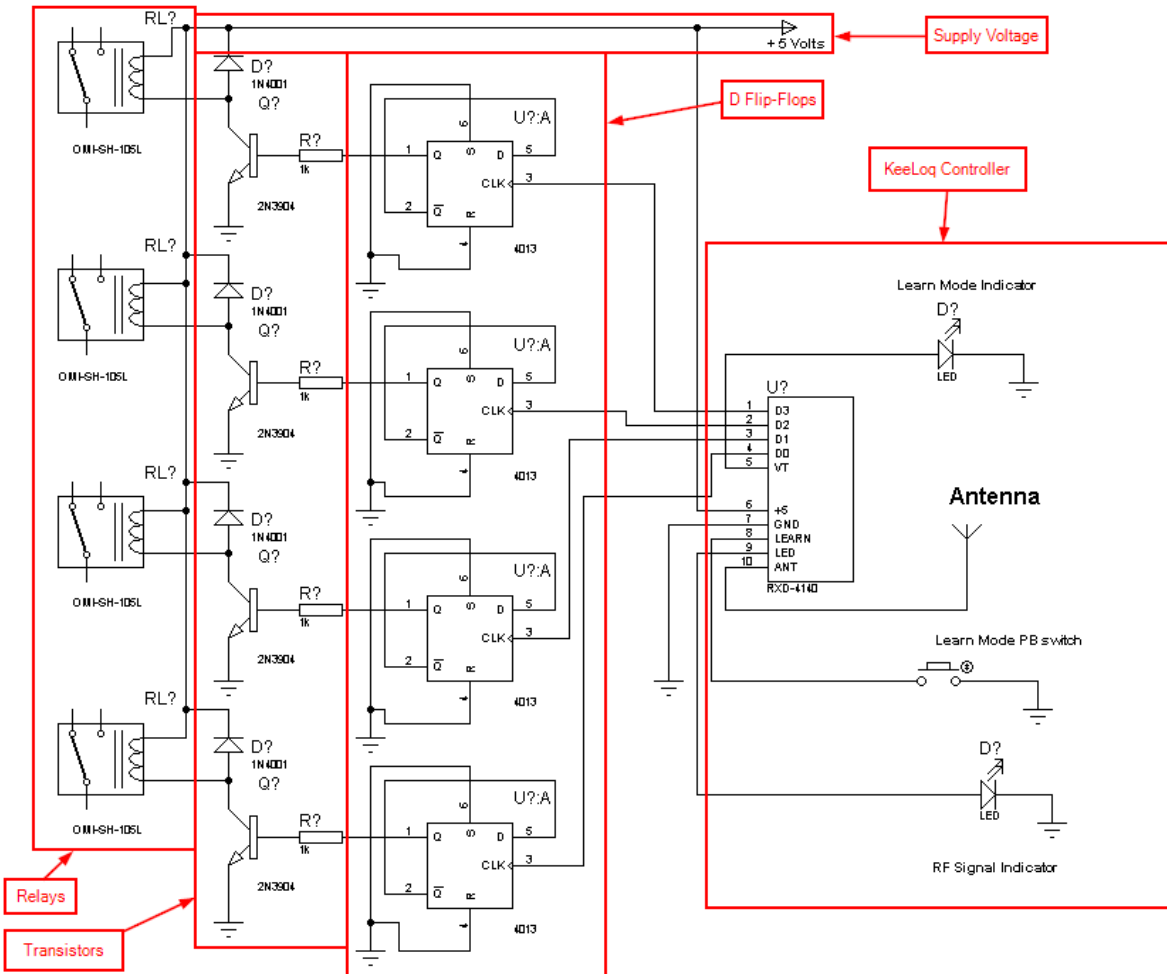
In this diagram, the device is wired up to four D flip-flops, one for each output, that simply serve to remember the state of the output. The outputs of the flip-flops are then connected to transistors that supply current to a relay. The relay is used to connect the 5V device to the 12V circuitry of the vehicle and activate the intended feature.

For the purposes of this lab, we will be simplifying the circuitry on the left side of the diagram and replacing the components with light emitting diodes (LEDs) to indicate whether the received code was correct.

To construct the circuit, first place the YwRobot power supply onto the mini breadboard as seen below.
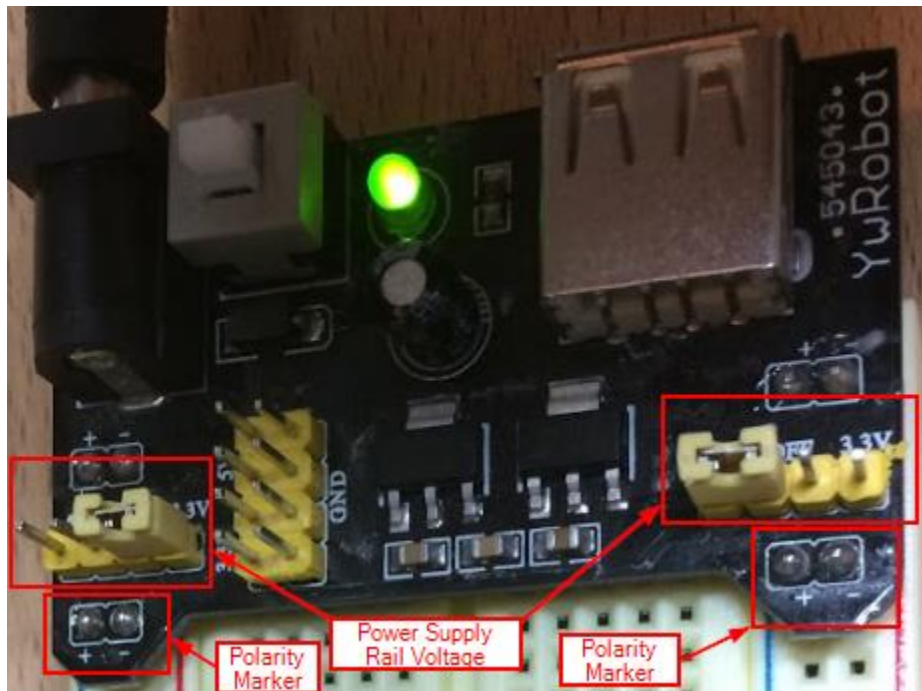
The jumpers in the image above should be set to 5V. This controls the voltage placed on the supply rails. Notice polarity markers on the power supply rails. As you are constructing the circuit you must be careful to connect the Vcc and Ground connections properly. On this particular breadboard, the blue side of the rail is Vcc (5V) while the red side of the rail is Ground.

If you have not used a breadboard before, it is important to understand how the device is organized. Typically, power supply rails are located on the far edges of the board. These rails are vertical busses. This means that a pin inserted into any of the holes is physically connected to any pin in the same vertical line. These make power and ground easily available to any of the internal busses.

In the diagram below, these are identified by the vertical bars with red and blue stripes. The breadboard may be marked with polarity but this only identifies convention. It is important to understand what is actually present on the bus before trying to use it.

The interior of the breadboard consists of horizontal busses separated into two halves of a single plane. While the numbers on both sides of the plane correspond, they are not connected. In the diagram below, columns a-e in each row are connected to one another and columns f-j are connected to one another as well. However the gap in the middle isolates the two sides.
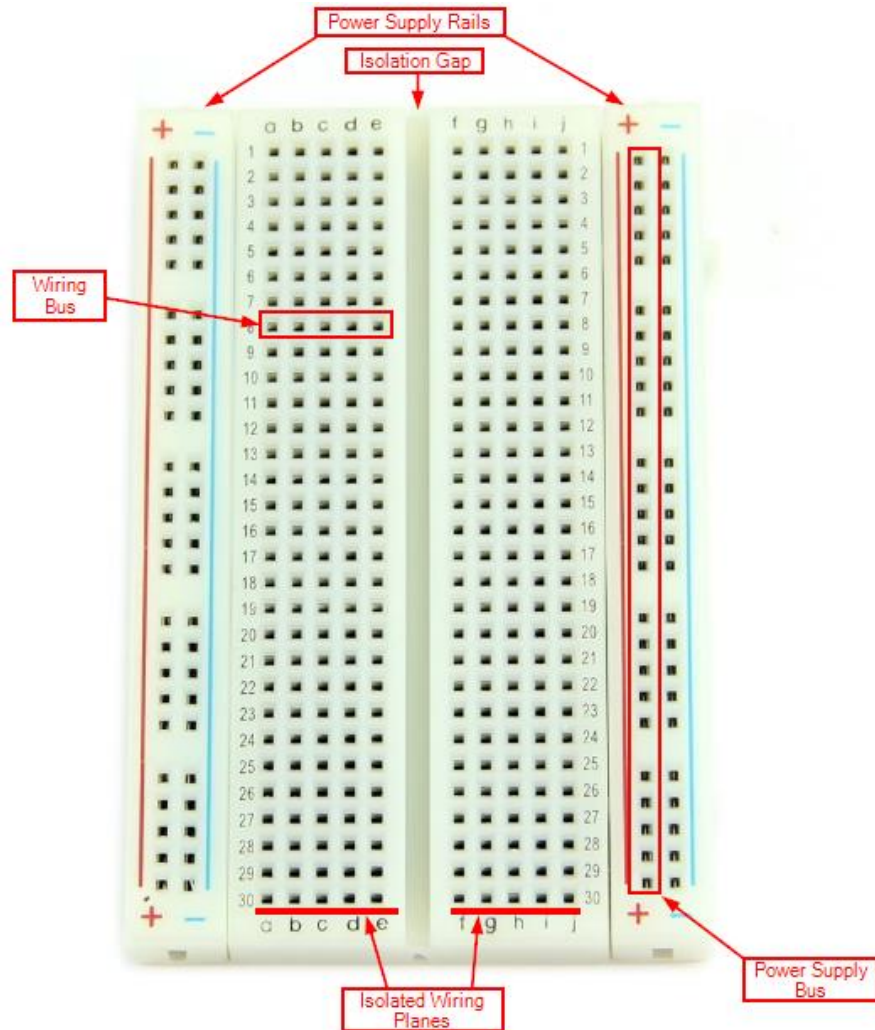
The isolation gap is used to accommodate Dual In-line Package integrated circuit components like the one seen below. This allows a circuit designer to easily isolate the pins on the chip and provide discrete inputs to each.
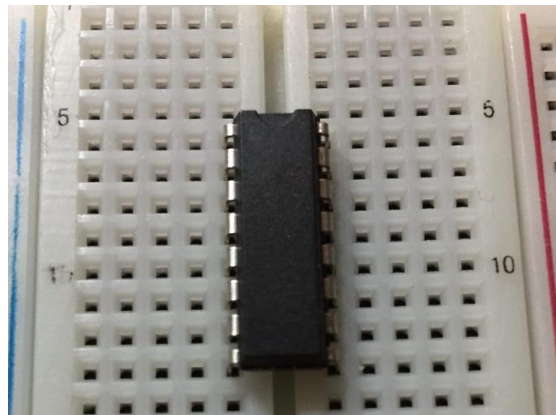
With a basic understanding of breadboard organization, you can begin wiring up the KeeLoq circuit. Insert the KeeLoq controller into the pins column H on the mini breadboard. This isolates the pins from one another and allows us to connect other components to the inputs and outputs of the device.
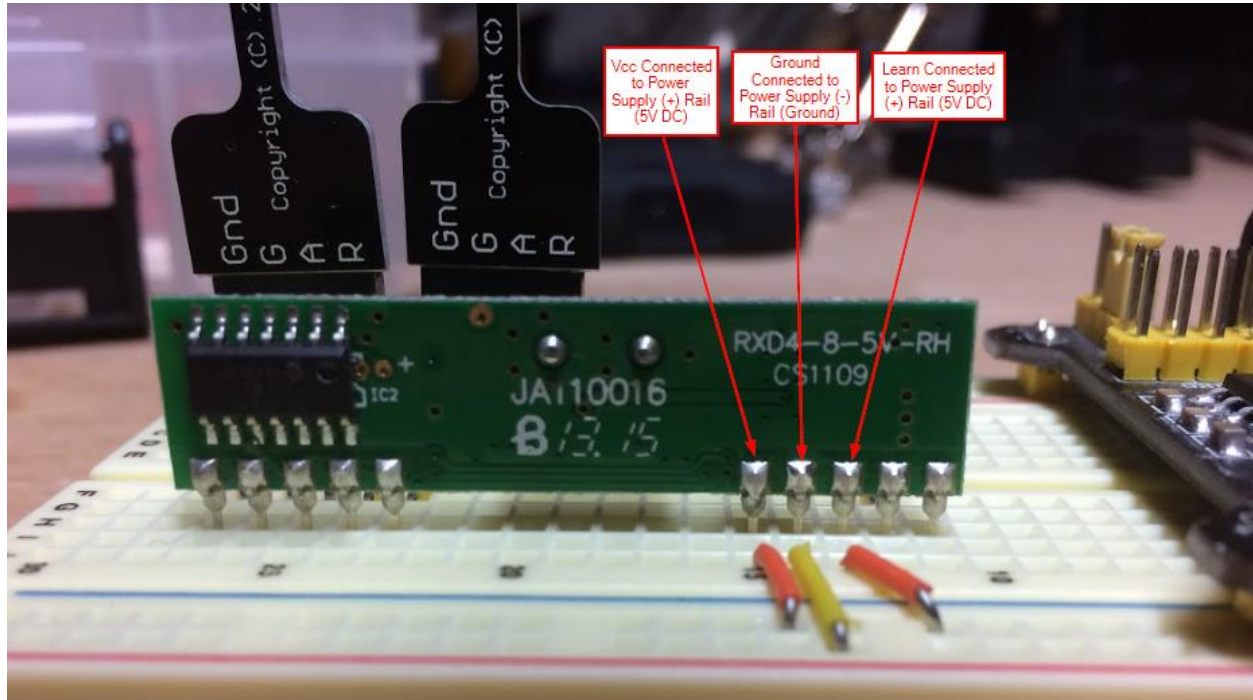

On the reverse side of the KeeLoq device, connect the three inner pins as identified above. These are Vcc, Ground and Learn. Vcc provides power to the device and should be connected to the power supply + rail. Ground allows current to exit the circuit and should be connected to the power supply - rail. The learn input is not used for our purposes. However, this input is "active low" meaning that it must be held at 5V to avoid being placed into learning mode.

Next, break 9 pins off of your 40 pin header and insert them into column C on the breadboard across from the D0-D3 outputs on the controller. 9 pins are used because the Pi-Stop LEDs need a gap to accommodate the base of the device and it makes the connecting the devices more stable. These devices have internal resistors (on the face of the base) so external resistors are not necessary to limit the current passing through the devices. Wire the individual pins according to the diagram below.
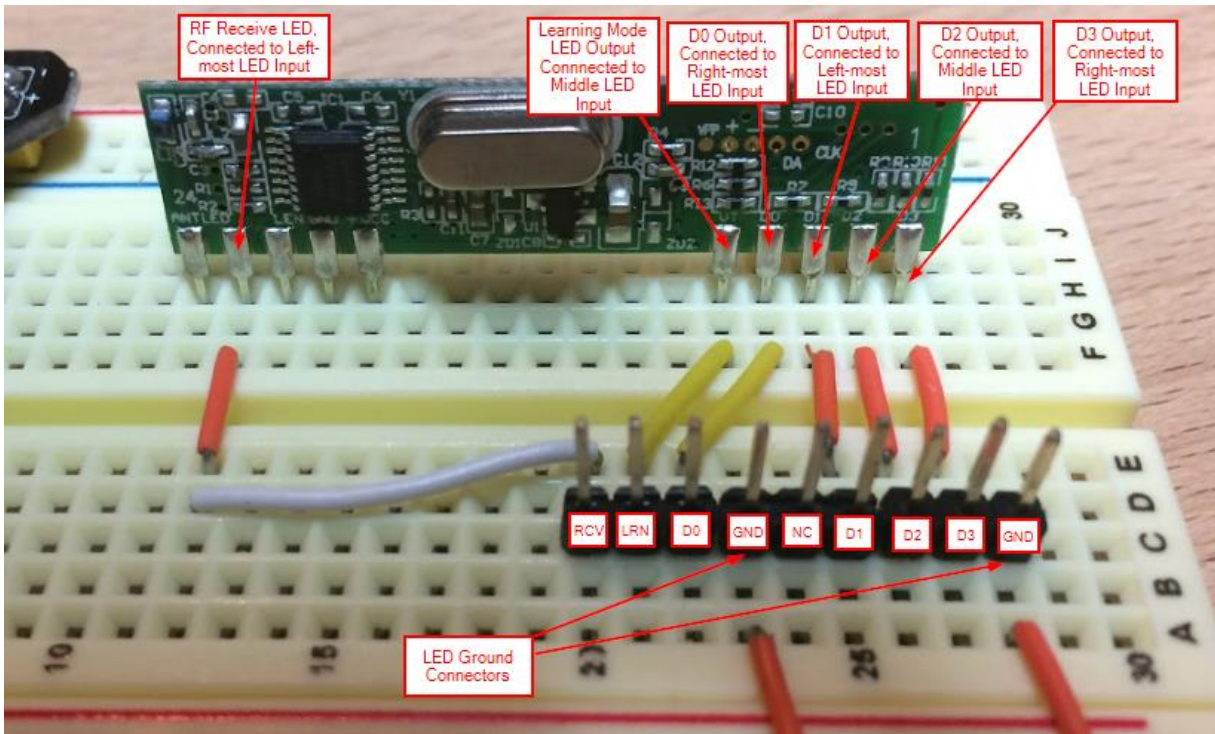
Finally, connect the Pi-Stop LEDs to the exposed headers with the Gnd pin to the right as you are facing the header with column C of the breadboard closest to you.
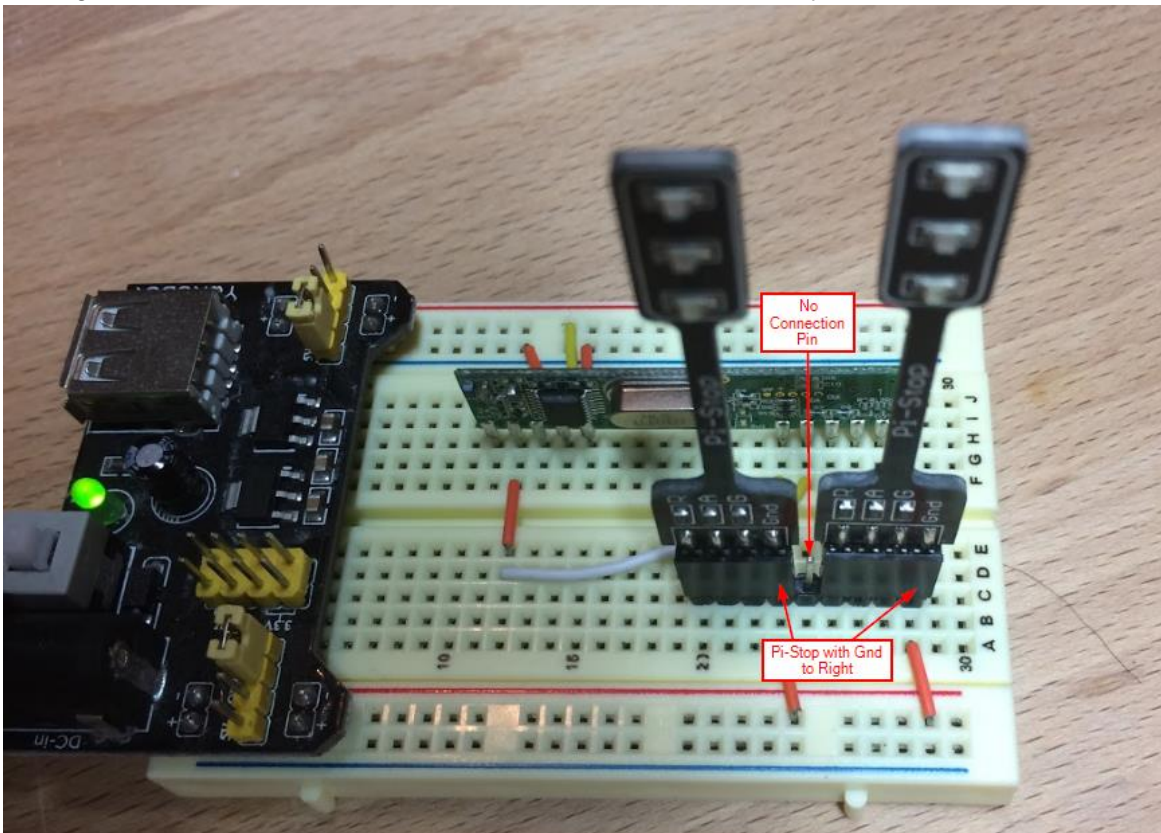
After checking each of the connections, you should be able to power on the breadboard and use the key FOB to activate each of the LEDs on the Pi-Stop.