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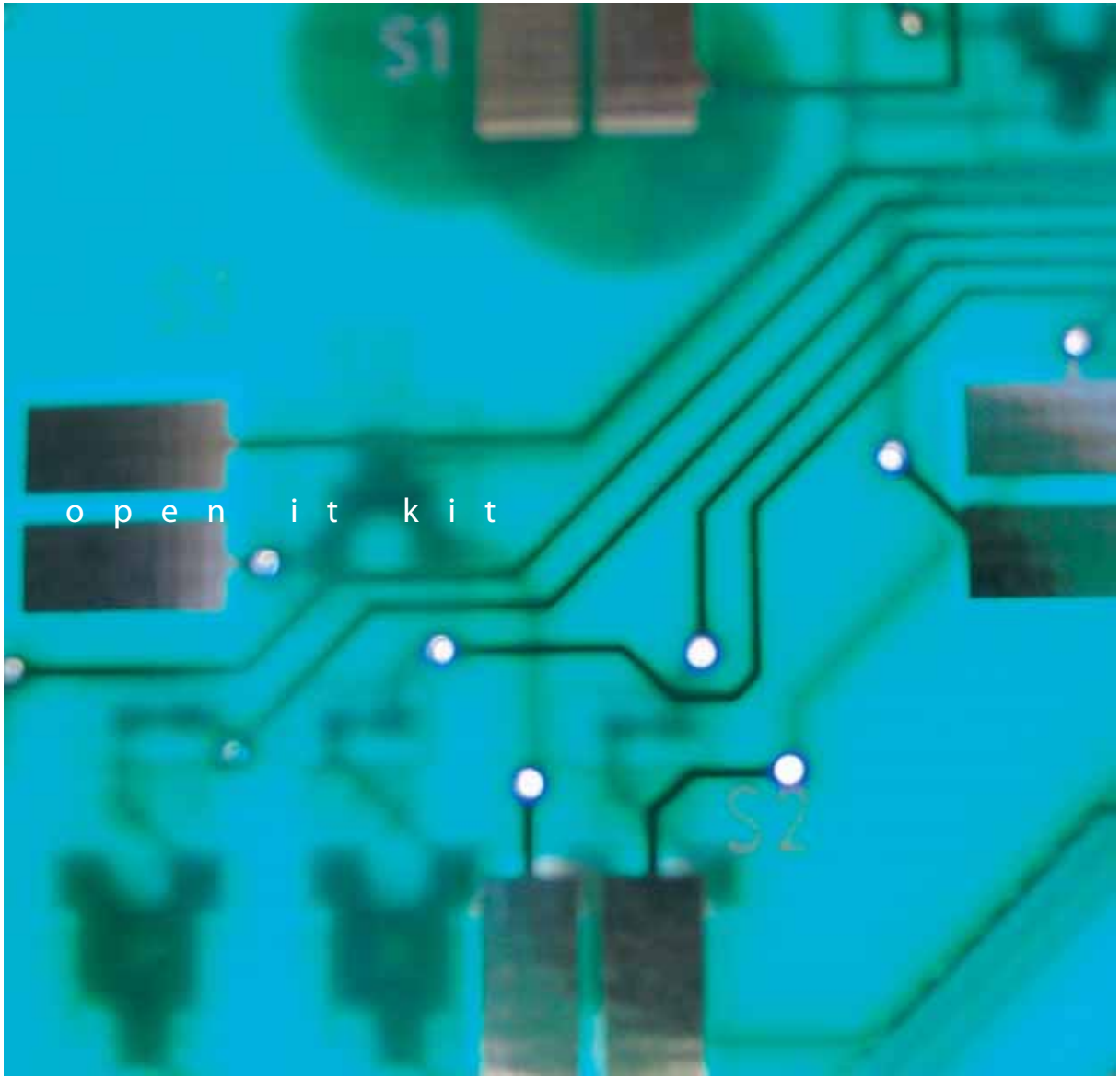


Documentation of an OIK-project by
Anne-Marie Skriver

Original hack of a Thrustmaster Game Controller by
Jorgen Brinkman
STEIM

Content:

Content:

Hacking Information:

You can open up any USB device and turn it into your own device. Apply sensors to it's inputs and use them as continous controllers.

USB-devices such as gamecontrollers and joysticks connected to the computer are working with 0-5 V.

A gamecontroller such as the wireless Thrustmaster Firestorm is working with 3 V (sensor-input 2.5V). You can hook up any sensor to the game controller that is working with 2.5 V.

You can order sensors and electronics through the Farnell magazine or visit the web-pages:

www.digikey.com
www.mouser.com

The next pages give an example of how to open up the Thrustmaster Firestorm controller and hack it into a wireless sensor system.

Tools:

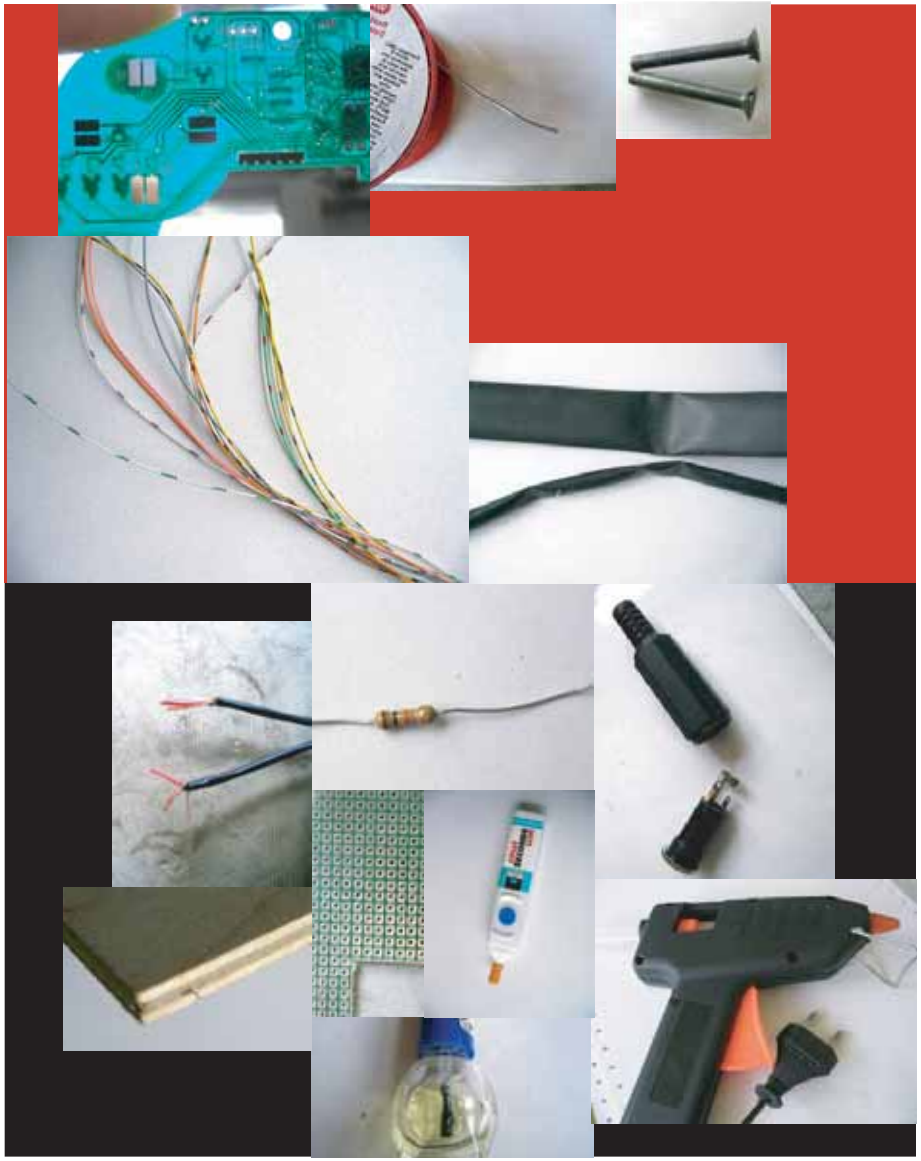
Soldering Iron
Solder wick
Drillmashine
Drills 3mm 5mm
Tweecer
Razor blade
File
Vise
Saw
Heat gun for shrink wrap
Tap

Ingredients:

The circuitboard of a Wireless Thrustmaster Gamecontroller
Mini-jack 3,5 mm
A piece of generic circuit board
Small wires
Solder
Screws
Superglue
Hotglue
Nail polish
A piece of wood
Shrink wrap
Resistors

Sensors + jack and resistors:

Ordinary button: 1 mini-jack (3-contact)
Linear Potentiometer: 1 mini-jack (3-contact) + one 5-10k resist.
Infrared sensor: 1 mini-jack (3-contact)
Pressure sensor: 1 mini-jack (3-contact)
STEIM Accellerometer: 1 mini-jack (4-contact)



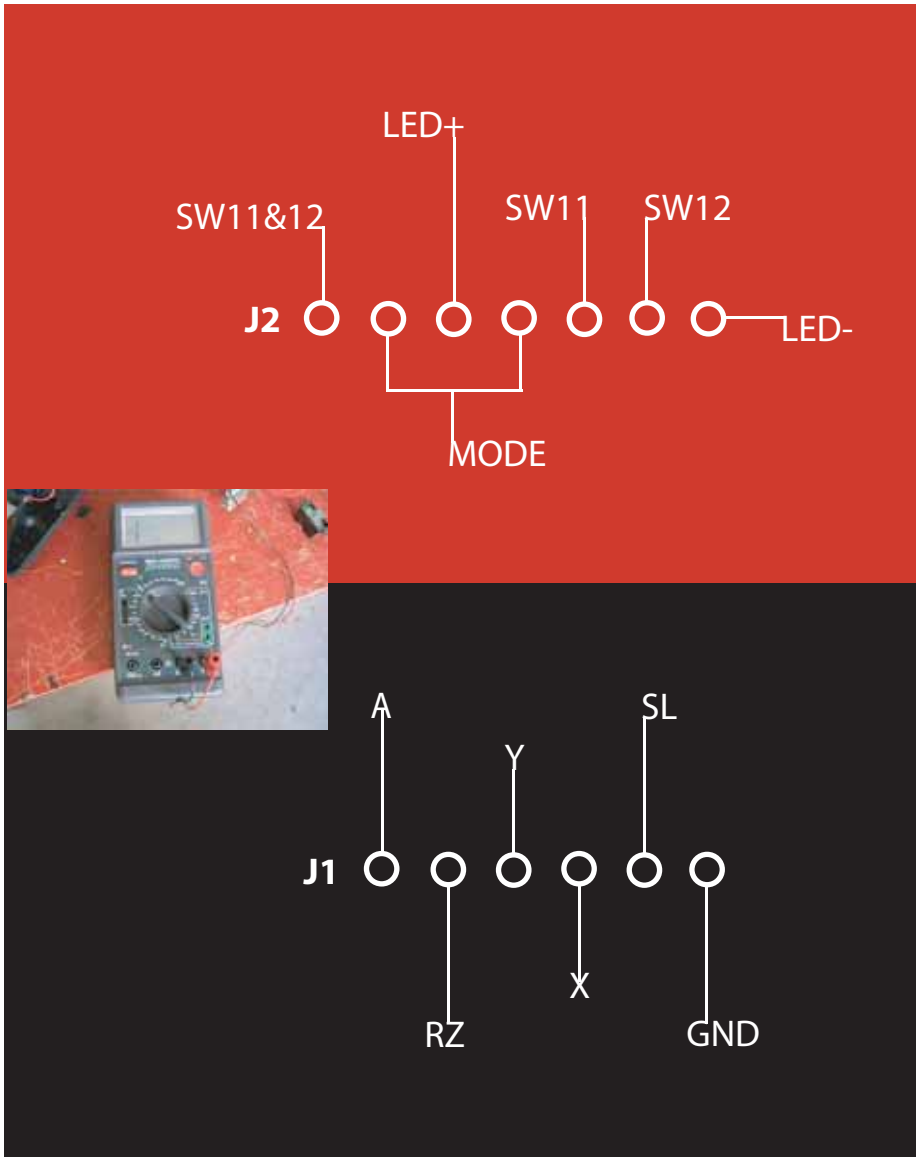
Schematic of a Thrustmaster game controller:

To route the signal from a sensor to the game controller you have to know about electronics. With a simple multimeter you can figure out how the electronic signals are routed inside the device.

This is a schematic of a Thrustmaster game controller.
The sensors can be soldered directly to the inputs on J1.
The following pages will give a specific example of this.

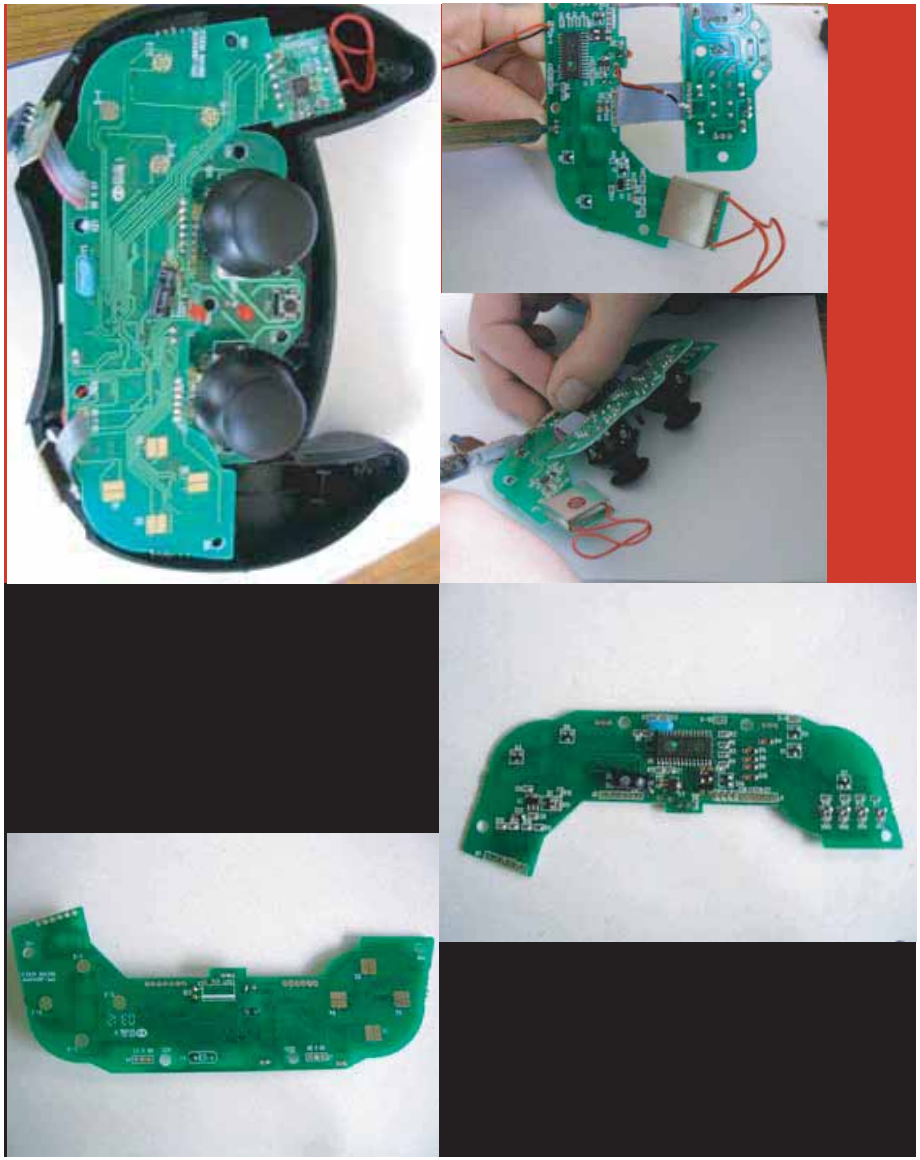
The Thrustmaster game controller can have 4 different analogue sensors attached to it at the same time, as well as a number of buttons.

If you want to be able to connect different sensors to the inputsthen wire up the input to a mini-jack. The mini-jack solution makes your device stronger and you can plug and unplug a variety of sensors to each input.



Opening up the game controller 1:

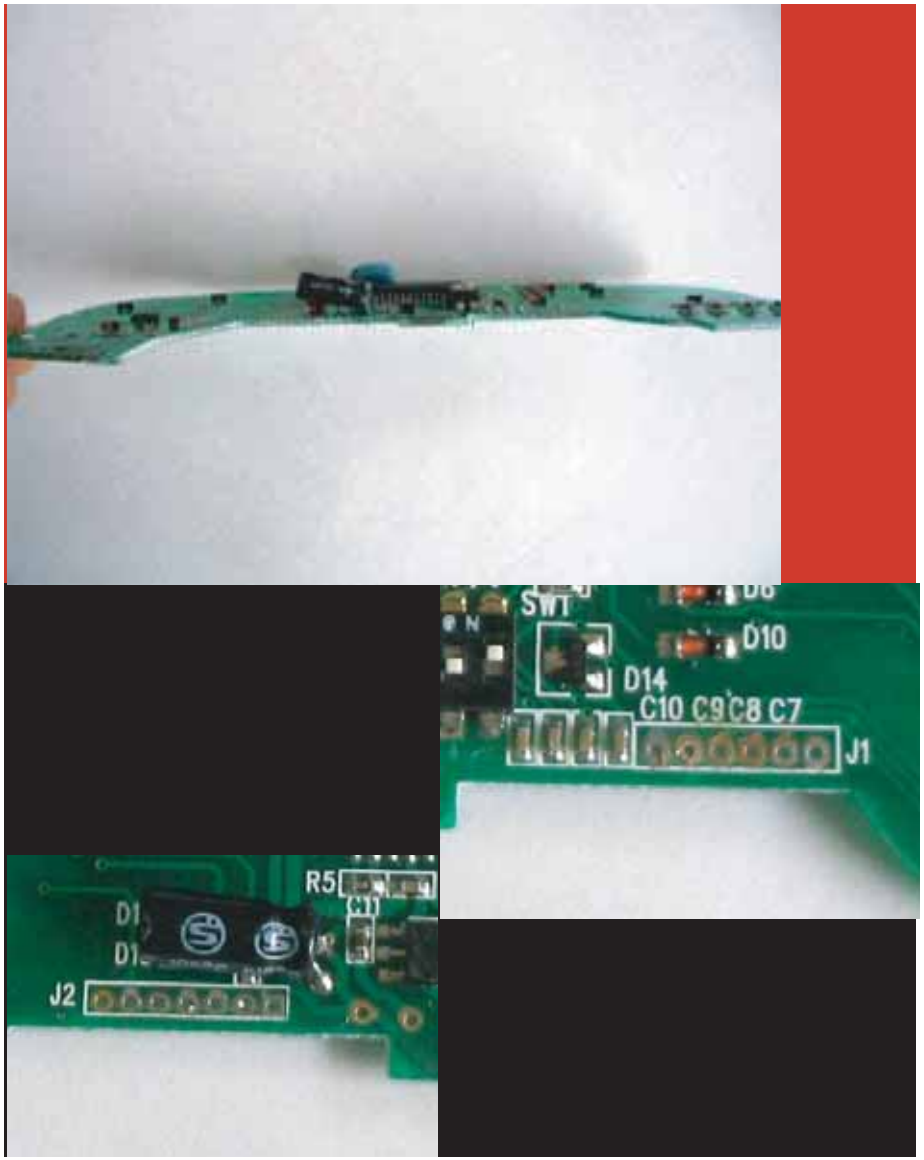
Open the game controller and loosen the battery and all the buttons from the cirquit board with the solder wick. If the solder is old it can be difficult to take off - put new solder on the old solder and try to loosen it again.



Opening up the game controller 2:

It is a good idea to flatten one side of the circuit board. This makes it is easier to mount in a box or shrink wrap it.

To flatten the circuit board: Move all the parts to the side where the micro-chip is. Make sure that you put all the parts back in the same orientation.



Use the battery holder

You can still use the battery holder for your device.

Cut out the battery from the plastic. Keep the opening and closing holes intact. If you are planning to shrink wrap your device then soften the plastic edges with a file.

Make the circuit board smaller:

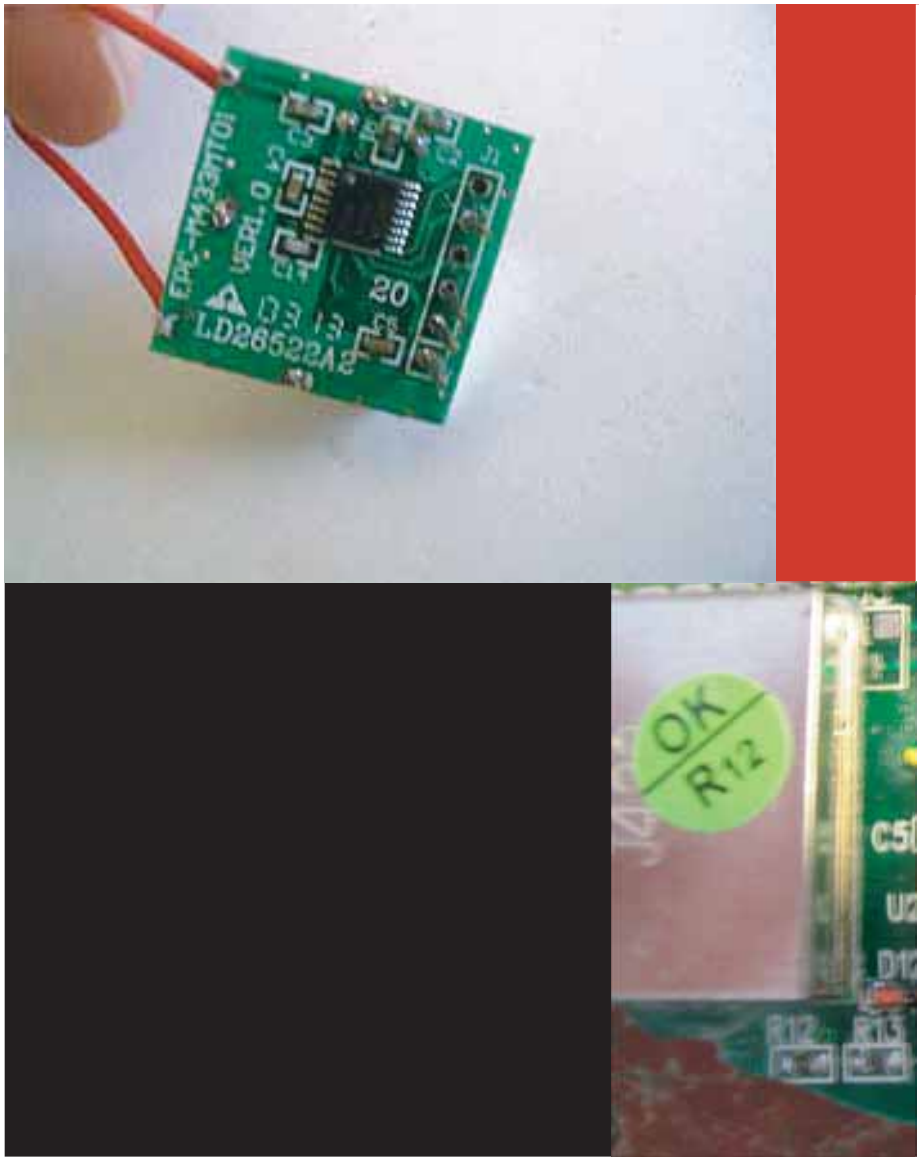
You can choose to make the circuit board smaller. To make it smaller loosen the transmitter and rewire it on the circuit board, but be carefull. If you wire it up wrong you can blow it up ...

You have to mount the transmitter where the S-3 button is, so S-3 has to be cut off with the razor blade. Cut off also the green wires that connect to it. Remove D3 too.

Look carefully at the circuit board holding it up against some light. There is a free area with no wires inside the circuit board.

There you can mount the transmitter. Press it against the circuit board and draw dots where the pins are. Drill holes and press the pins of the transmitter into the holes.

Bend the pins and make them flat. Put hot glue between the transmitter and the circuit board. See next page.



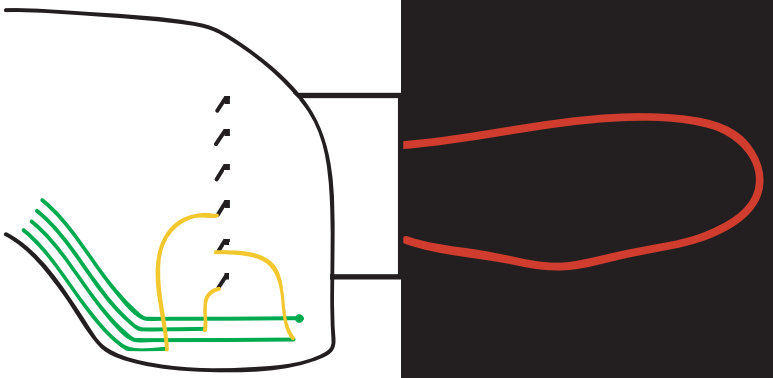
Rewire the transmitter 1:

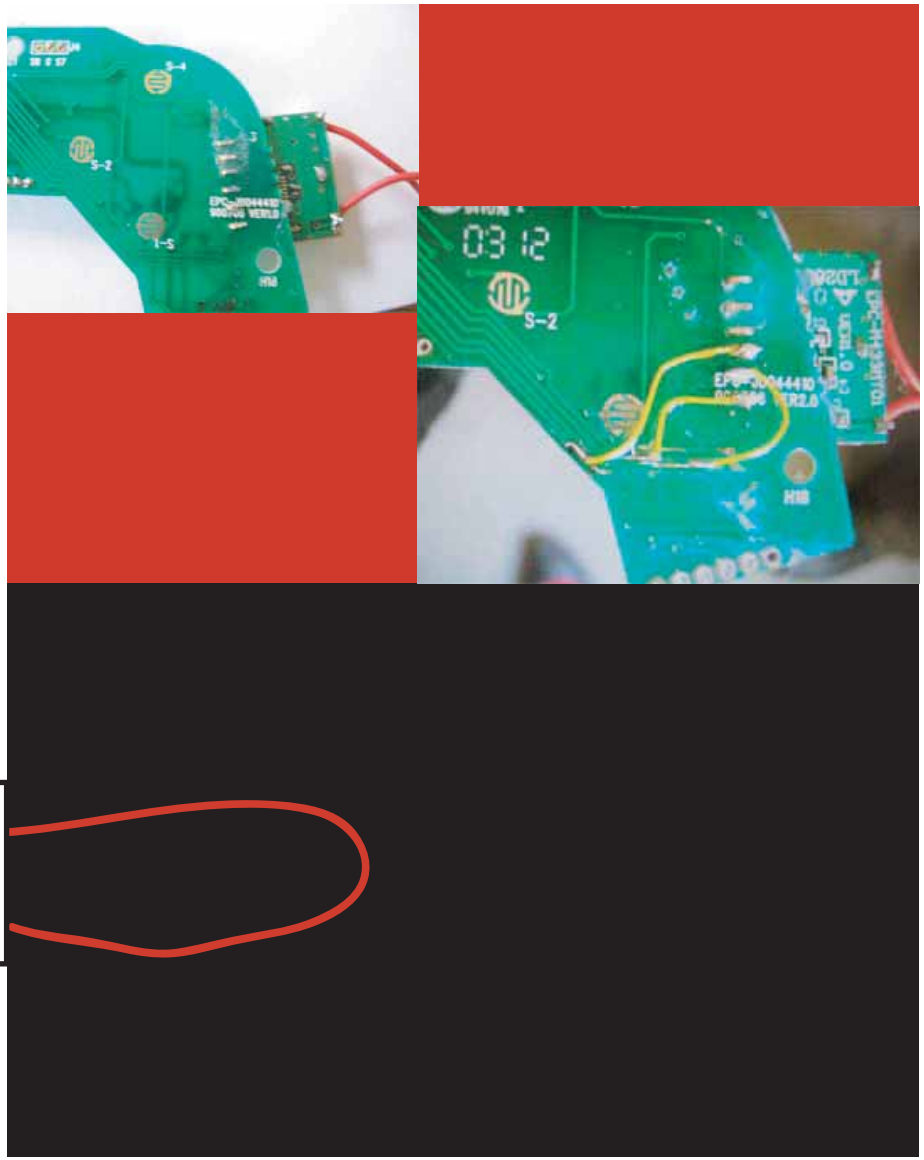
Now you can cut off the part where the transmitter was mounted. Cut it in a line under the row of R12, R13, R14 and B2 and soften the edges with a file.

To rewire the transmitter take a razor blade cut off the green plastic of the wires that were running down to the transmitter. The metal parts should not interfere with each other. See the photo.

To rewire the first half of the transmitter look at the illustration.

Take care ! If you connect the wires wrong way you can blow it up !



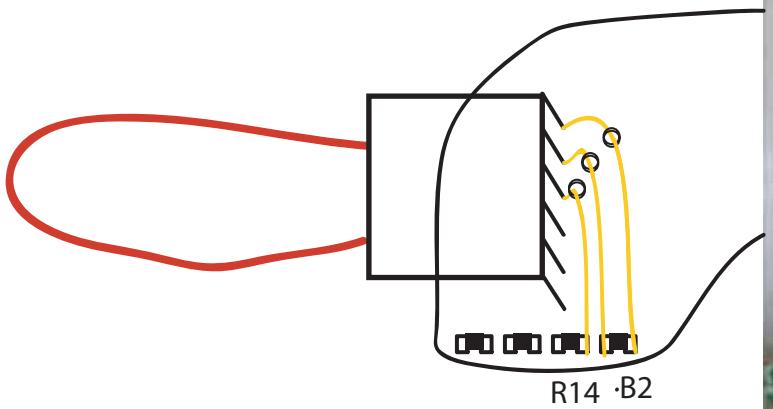


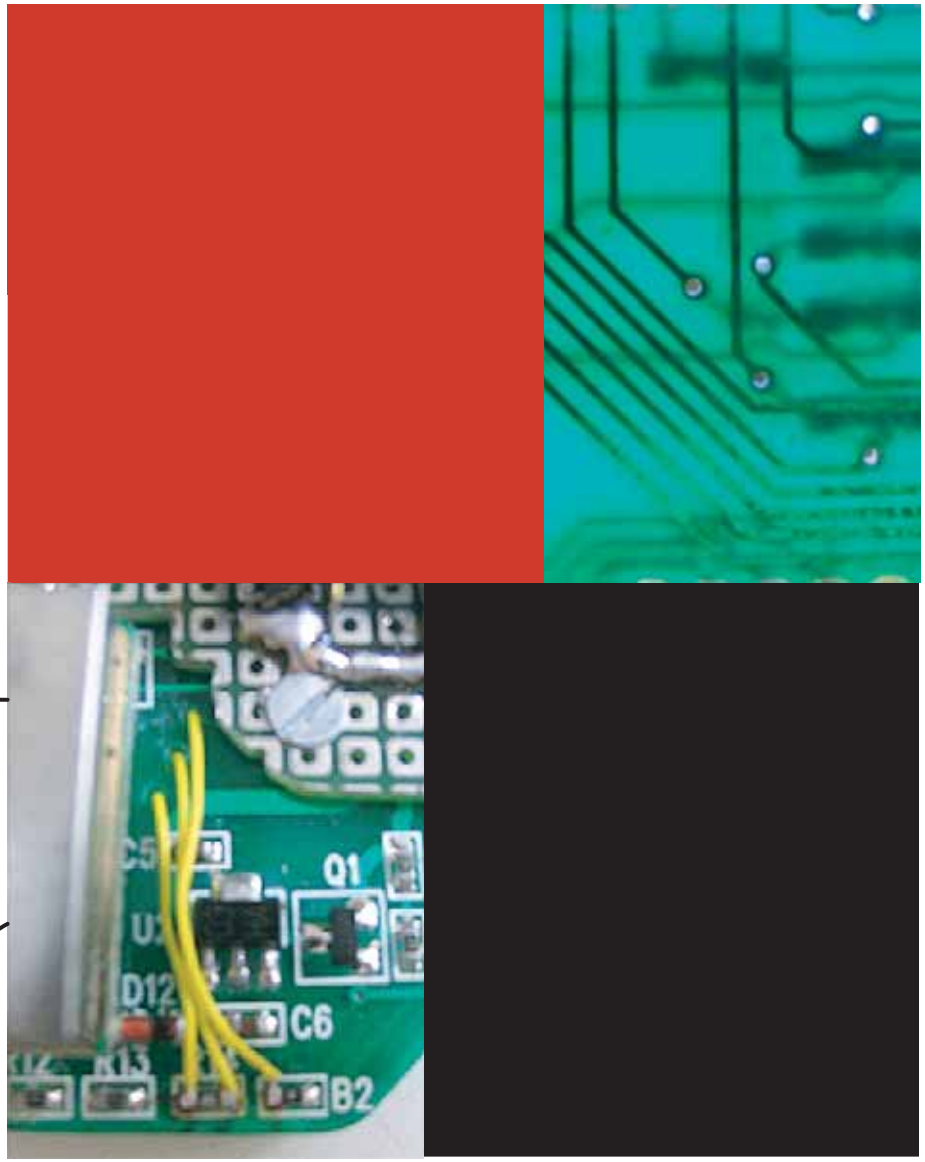
Rewire the transmitter 2:

The second half of the transmitter is ready to be connected. Hold the circuit board up against some light -there is free space where D3 was mounted.

Drill 3 holes through the circuit board under D3 just next to the transmitter.

Then solder the first wire from the left pin of B2, lead it through the top hole and and solder it to the first pin of the transmitter.The second wire goes from the right pin of R14 through the middle hole to the second pin of the transmitter. The third wire goes from the left pin of R14 through the bottom hole to the third pin of the transmitter.

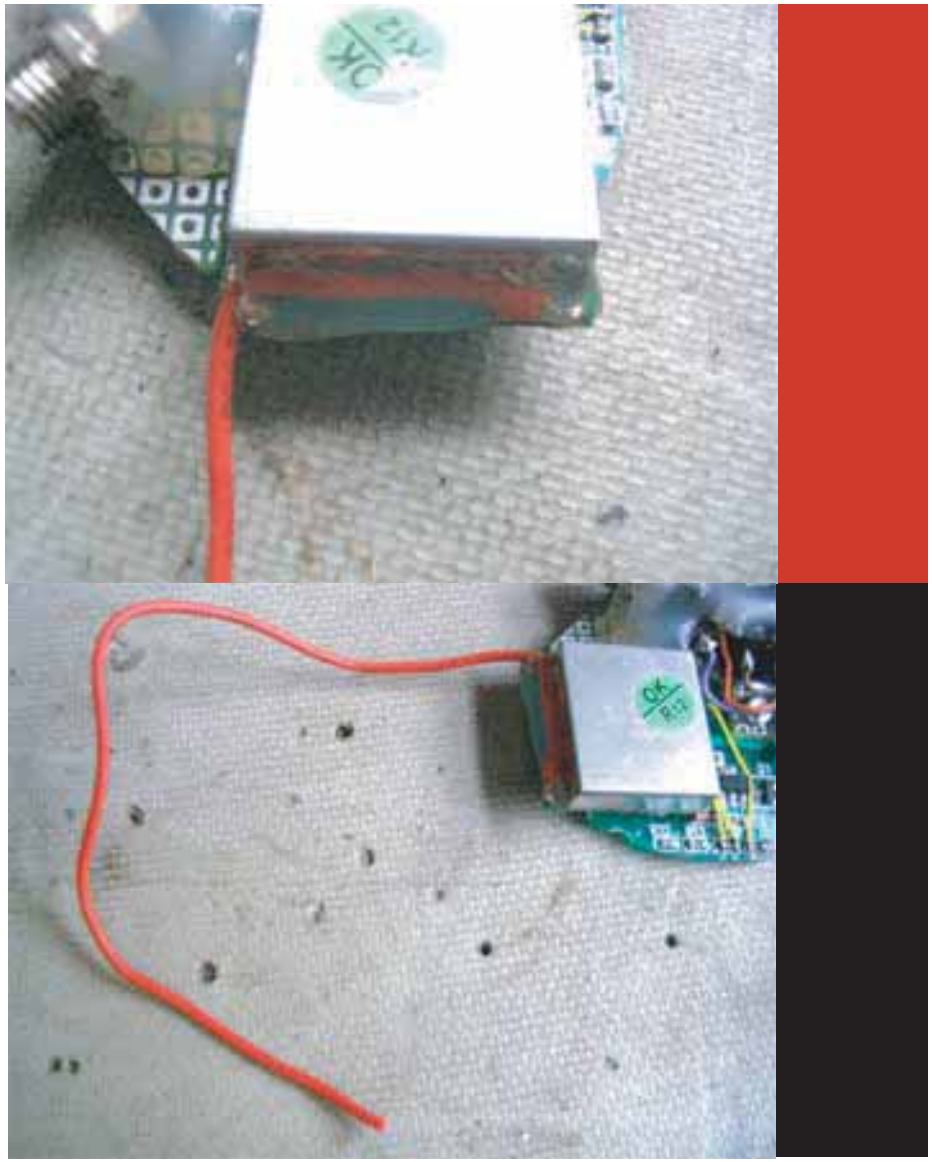




The Transmitter wire:

The transmitter wire is a bit fragile. To make it stronger it is a good idea to rewire and hotglue it. It only needs to be soldered to the transmitter in one of the ends.

Look at the transmitter circuit board. Two green wires are running to one of the corners. Solder the transmitter wire to that corner and hot glue it.



Mounting the plugs 1:

If you want to connect sensors to your device you can do it with mini-jacks. In the corner of the circuit board just above the transmitter there is room for mounting a couple of plugs.

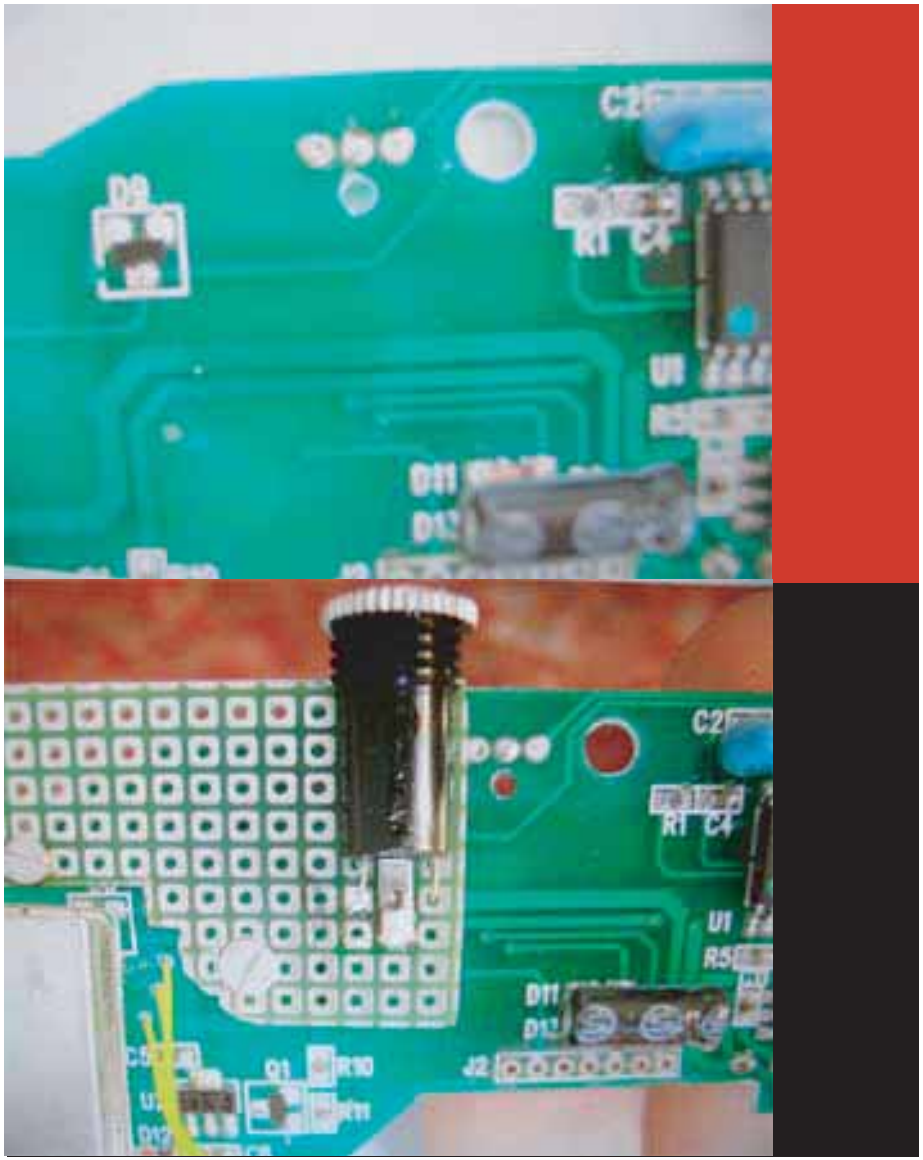
To mount the jacks you need to cut out a piece of a circuit board and screw it to the game controller's circuit board.

First take off D9 and D1 to make room for the jacks. Hold the circuit board up against some light and find a free space to drill two holes for screws that can fasten your circuit board piece to the game controller.

Drill another hole for the battery just under the three holes in the top corner.

File the circuit board piece so it fits in the corner of the game controller and screw it to the game controller board.

Before you glue the plug to the circuit board it is a good idea to flatten it with a file. Glue the plugs to the board with super glue.



Mounting the plugs 2:

The next pages give an example of how to mount 3 plugs for two sensors and a button. The fourth mini-jack is a 4-way plug, because another sensor -the accellerometer has two inputs.

The battery holder is to be mounted on top of the plugs. You can place a small wooden block between the plugs -it lifts up the battery holder so that it can be fastened to the circuit board in a solid way.

Mount another plug directly on the game controller's circuit board. This plug is for a button input.

The other two plugs: Solder a line between those two. That line is the GROUND line.

Adjustment of the battery holder:

The battery holder can be mounted beautifully on top of the plugs. Cut and file it so it fits.

Drill a hole with the size of a led in the battery holder right in the middle between the two screw holes.

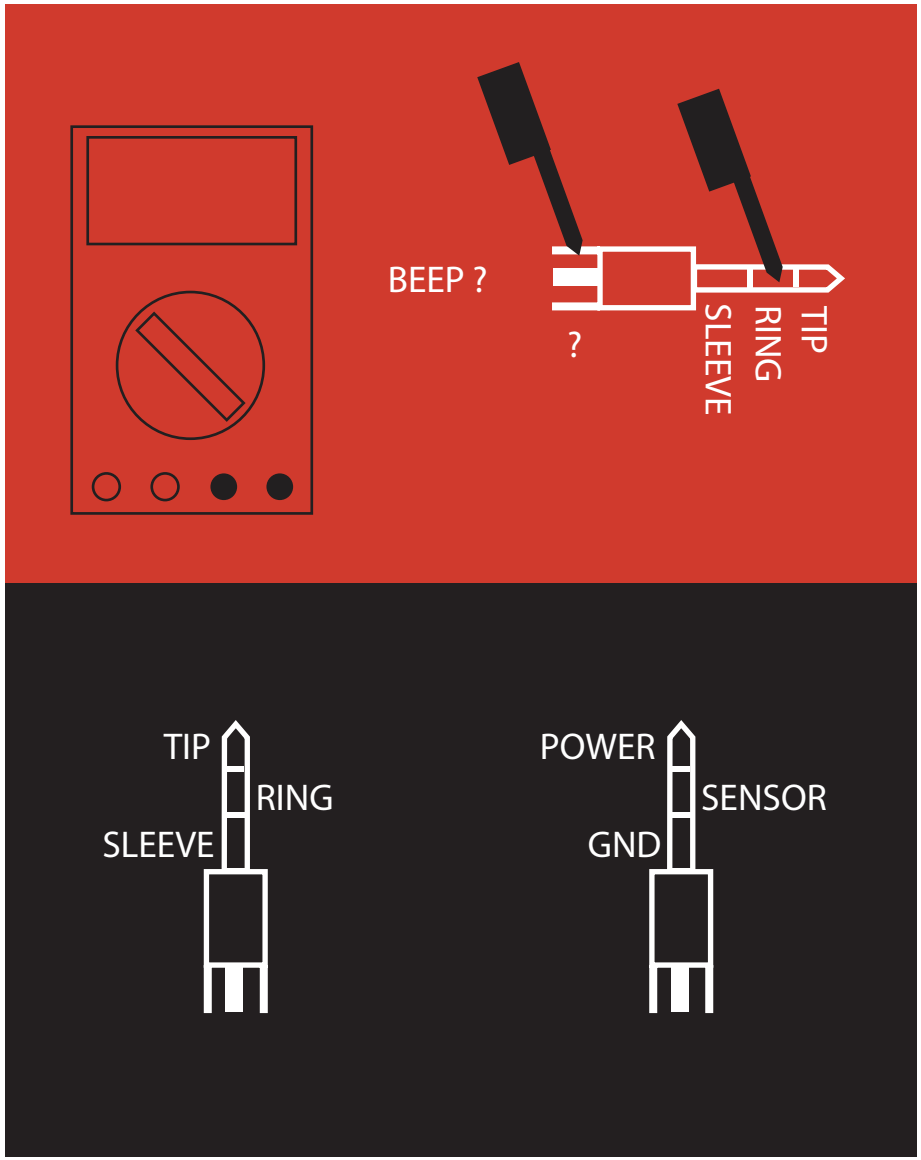
When your device is finished the led in the battery holder is indicating if a sensor is working.

Test the jack:

The mini-jacks can be different depending on manufacturer. Find out with a multimeter what is tip sleeve and ring. Put the multimeter in beep mode and test where the connections are.

The jack of any sensor can be organized this way:

Sleeve: GND
Ring: Sensor input
Tip: Power

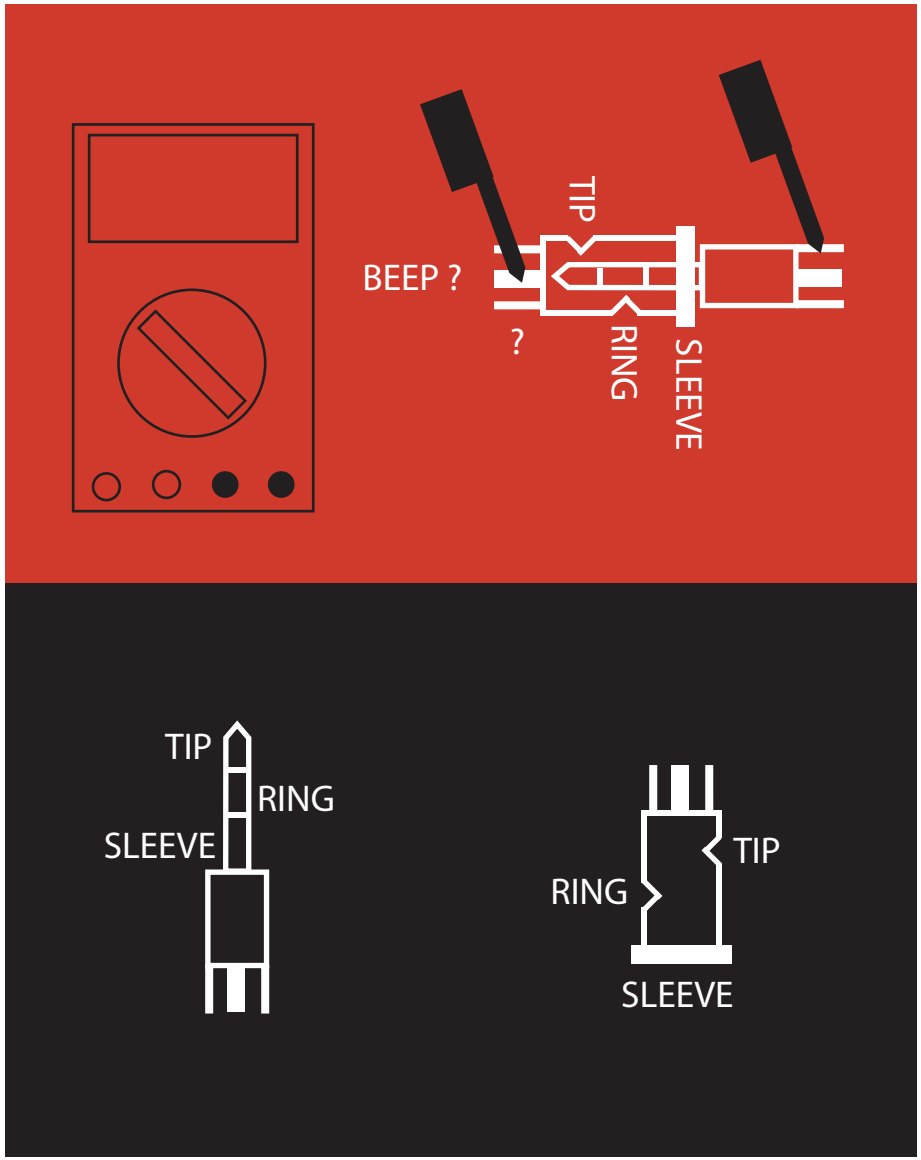


Test the plugs:

The mini-jacks consists of two parts: The male (jack) and the female (plug). The jacks are connected to the end of the sensorwire and the plugs are mounted on the game controller.

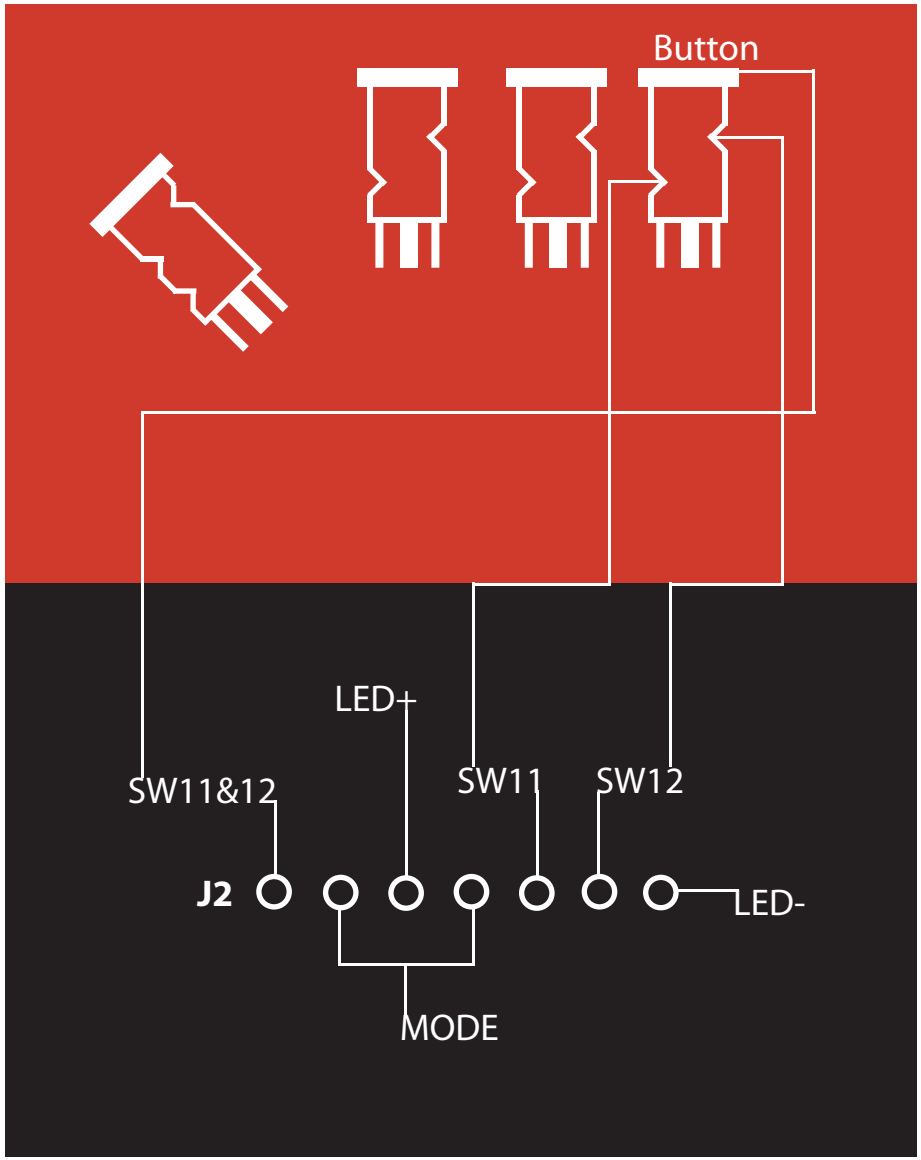
The mini-jacks can be produced differently, so first you have to test the plugs so you know what is tip, ring and sleeve.

Plug the jack into the plug and test it with the multimeter. Put the multimeter in beep mode and find out where the connections are.



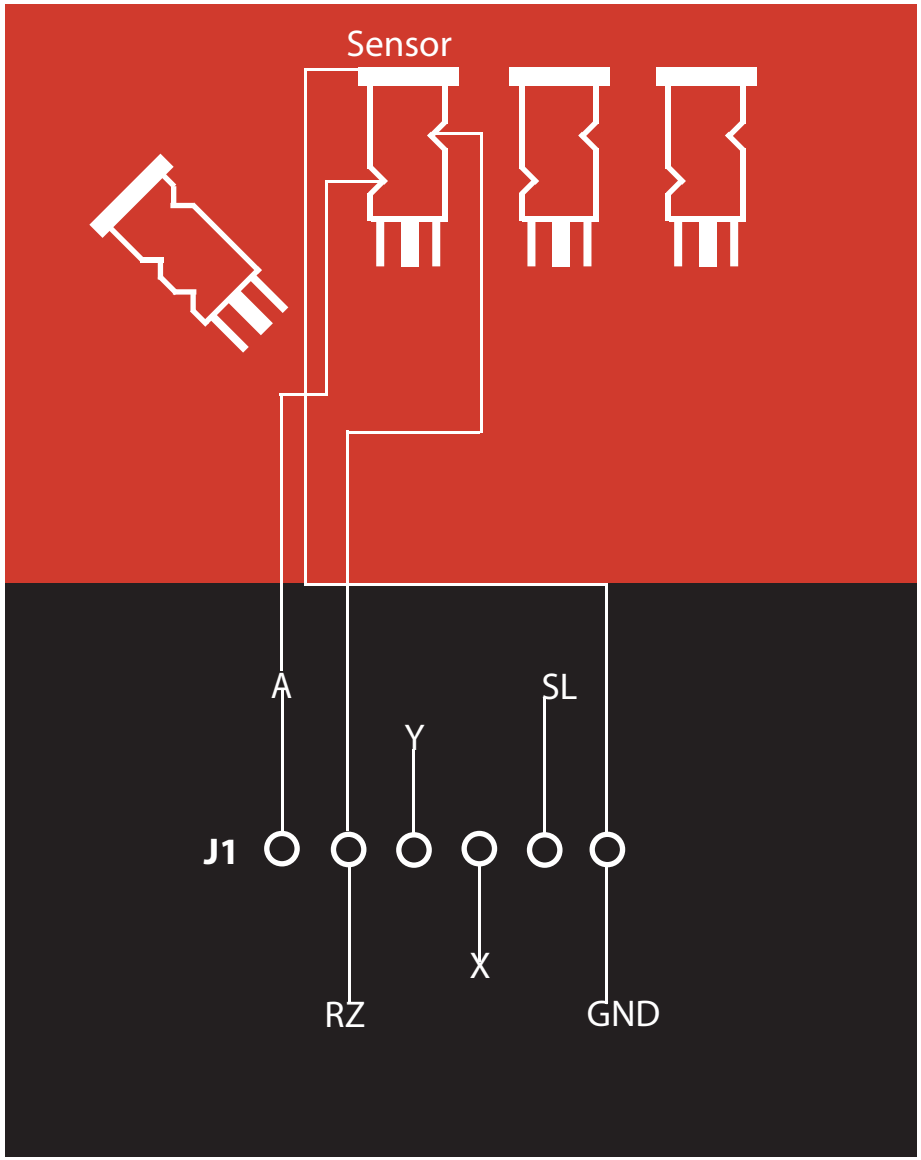
Schematic of the button:

The button is hooked up to SW 11 and SW 12 in J2. It means that you can have two buttons plugged at the same time.



Schematic of the sensor input:

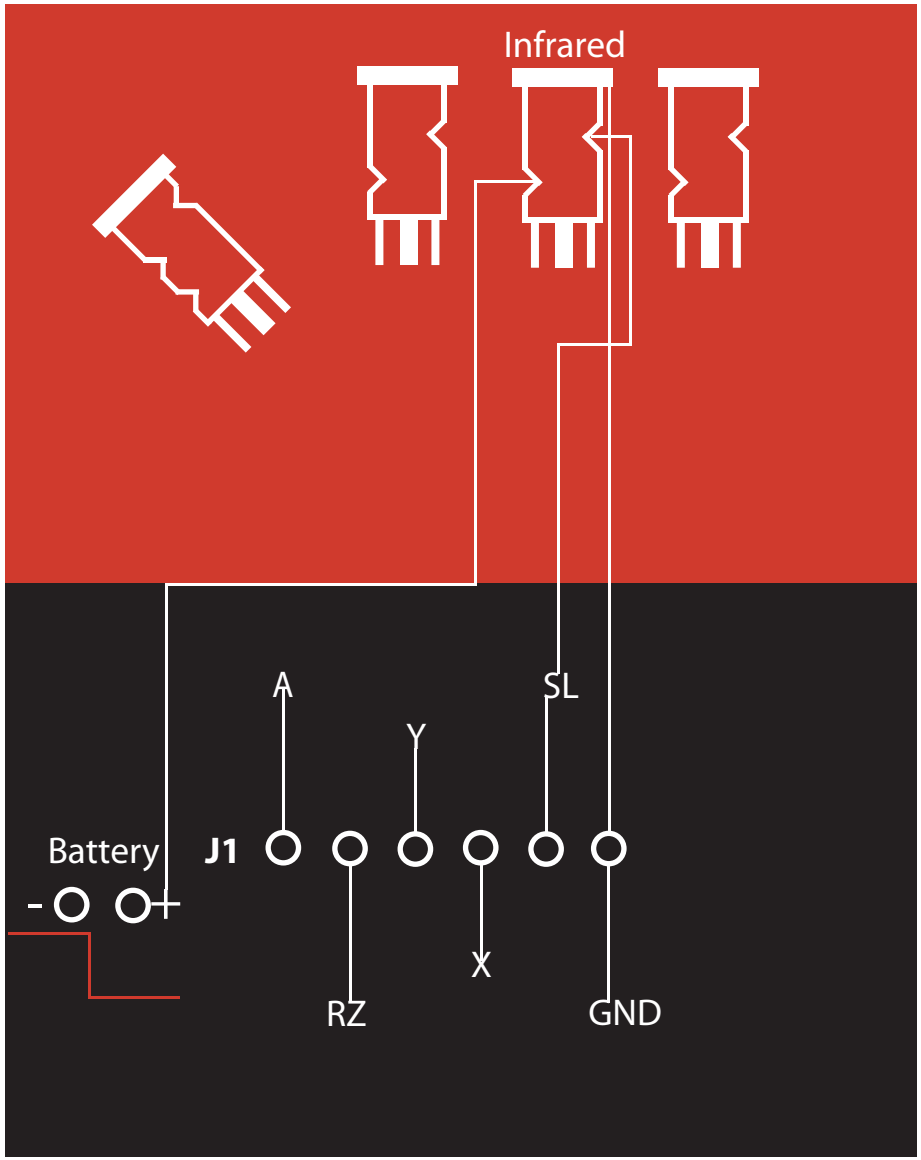
The sensor plug: Sleeve connects to GND, Ring connects to RZ, which is an analogue input. Tip connects to A that provides 2.5 V.



Schematic of the infrared sensor:

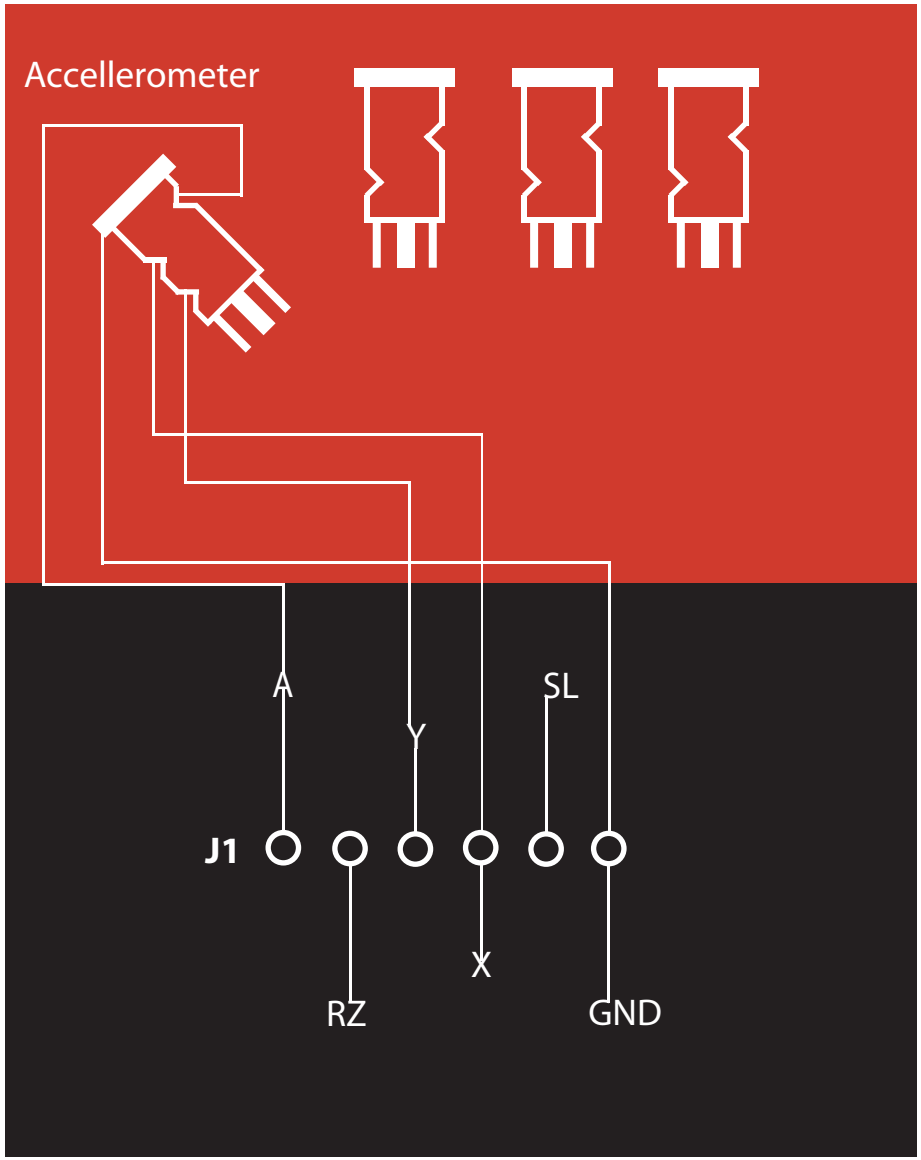
The infrared is hooked a little bit different that a normal sensor.It needs 3V directly from the battery to be able to show it's sensor data. In fact it needs 5V to show sensor data in it's full length, but it works with 3V.

Connect tip to + side of the battery. Sleeve to GND and ring to SL.



Schematic of the accellerometer:

Since the accelerometer has 2 analog outputs it uses a special mini-jack that has a 4-way connection. The middle two connections are the x-axis and y-axis values and sleeve goes to GND, tip goes to A that provides 2.5 V.



Wired up:

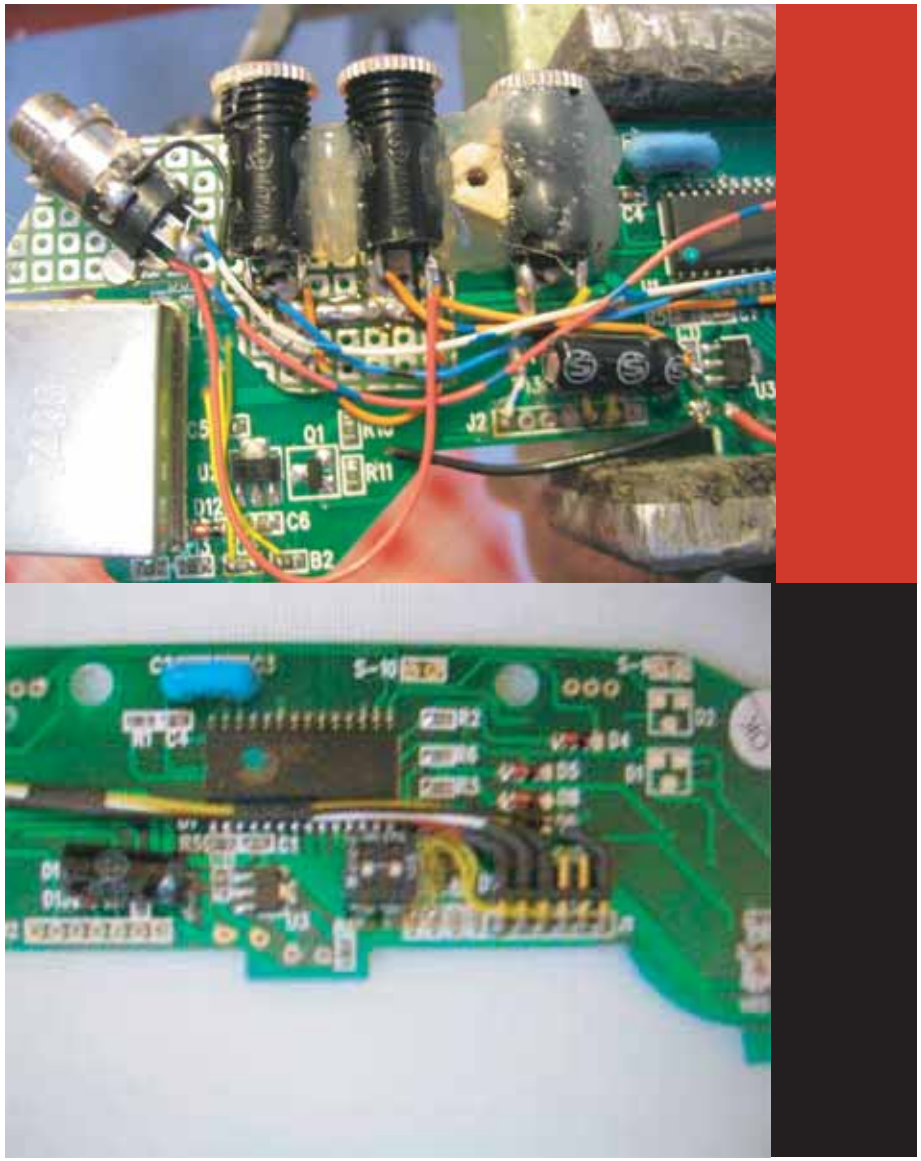
To make all the wires fit. Collect them in groups and shrink wrap them. It is very important that the wires are not too long -they are too long at this photo …

The 3 sensor plugs need to be soldered to GND. It is a good idea to solder a ground line between the plugs.

Test if the plugs are working. Solder the two battery wires to the battery box and the circuit board -see the next page. Do not glue the box to the board yet.

Try with one of your sensors if they work. If they do not work there must be a bad connection somewhere. Check all the soldering parts if the wires are connected correctly.

If all the plugs are working you can hot glue around the plugs to make the board more solid.

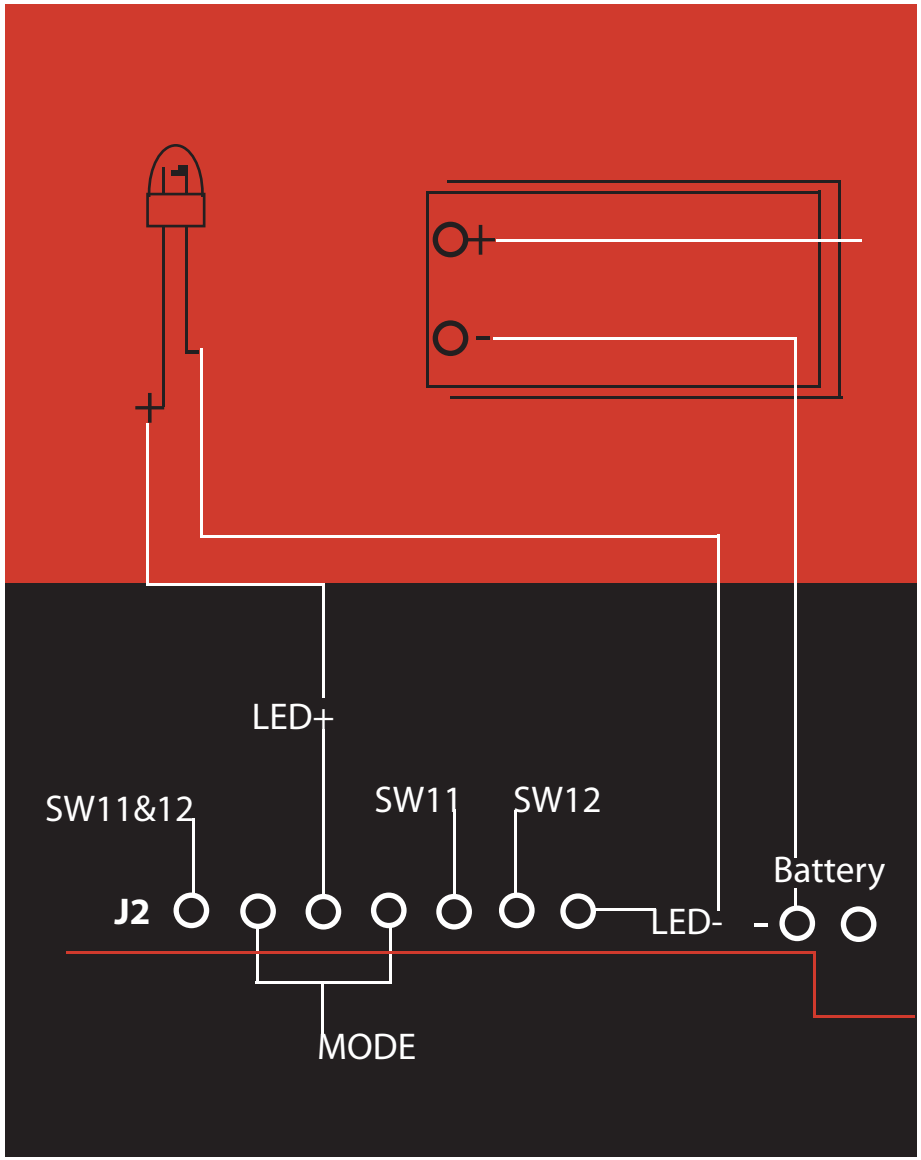


Schematic of the battery and the led:

Use the led that originally was mounted on the cirquit board. Solder the led to LED+ and LED- on J2.

Solder the battery box to + and - on the circuit board where it originally was mounted. Take care ! If you solder it wrong you can blow up the circuit board.

When the battery box and the led are soldered to the circuit board you can screw and hot glue the battery box to the circuitboard.



Mounted in a box or shrink wrapped ?

Here is an example of a shrink wrapped device. It fits perfectly into e.g. clothing.

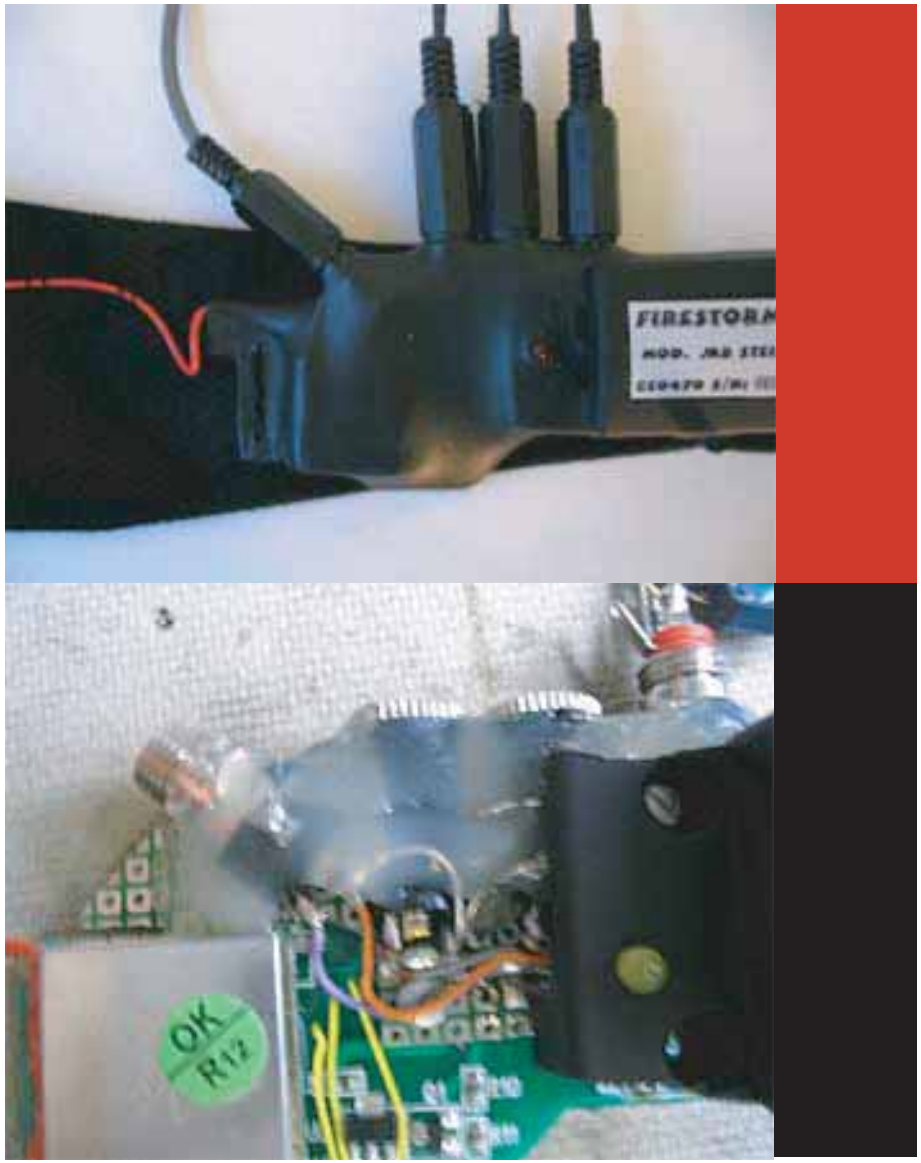
It is a bit risky to schrink wrap your device, because if you heat itup too much while shrink wrapping it the inside parts can melt.

You can also choose to put your device in a box.

If you shrink wrap your device it is very important to heat it upcarefully. Let it wait if it gets too hot. If the shrink wrap breaks while wrapping the circuit board you better start all over.

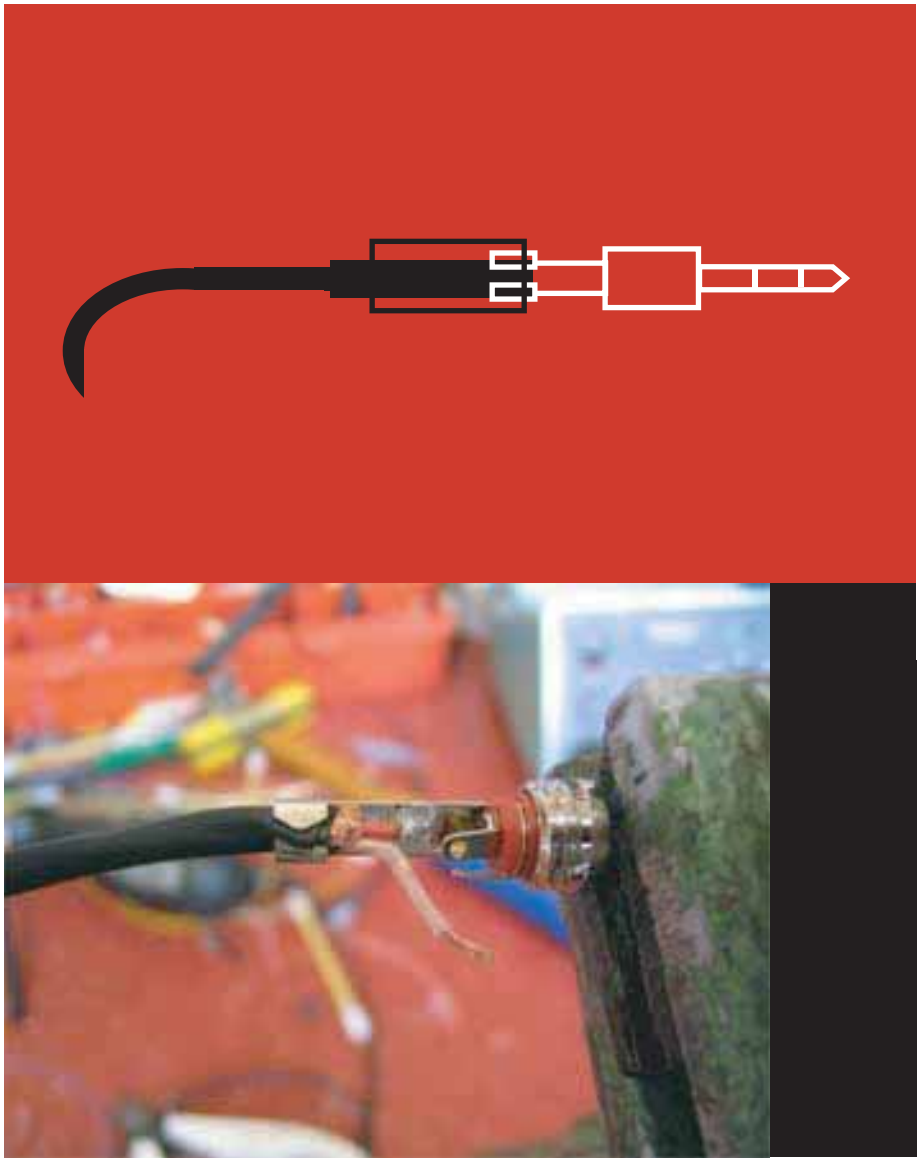
The ends of the shrink wrap can be heated up and melted together.

Use a razor blade to cut off the parts covering the plugs and the battery.



The jack:

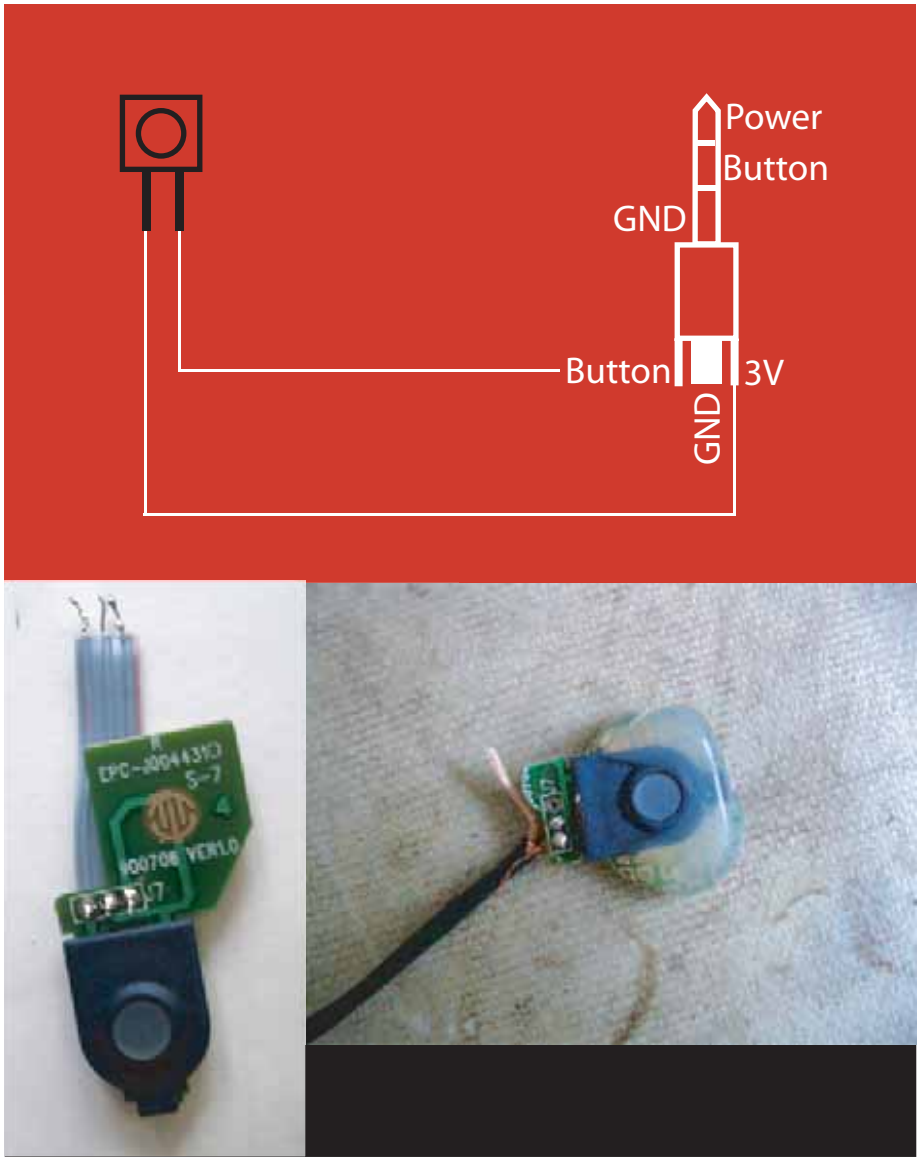
To make the jack strong use shrink wrap at the end of the wire where it connects to the jack. Make the wires inside as short as possible because they have to fit inside the plastic part covering the jack.



Buttons:

It is possible to connect 12 buttons to the game controller. Just use the same holes where the buttons are attached when you open the game controller.

You can use the buttons from the game controller. A button is just on and off -it only needs two wires.



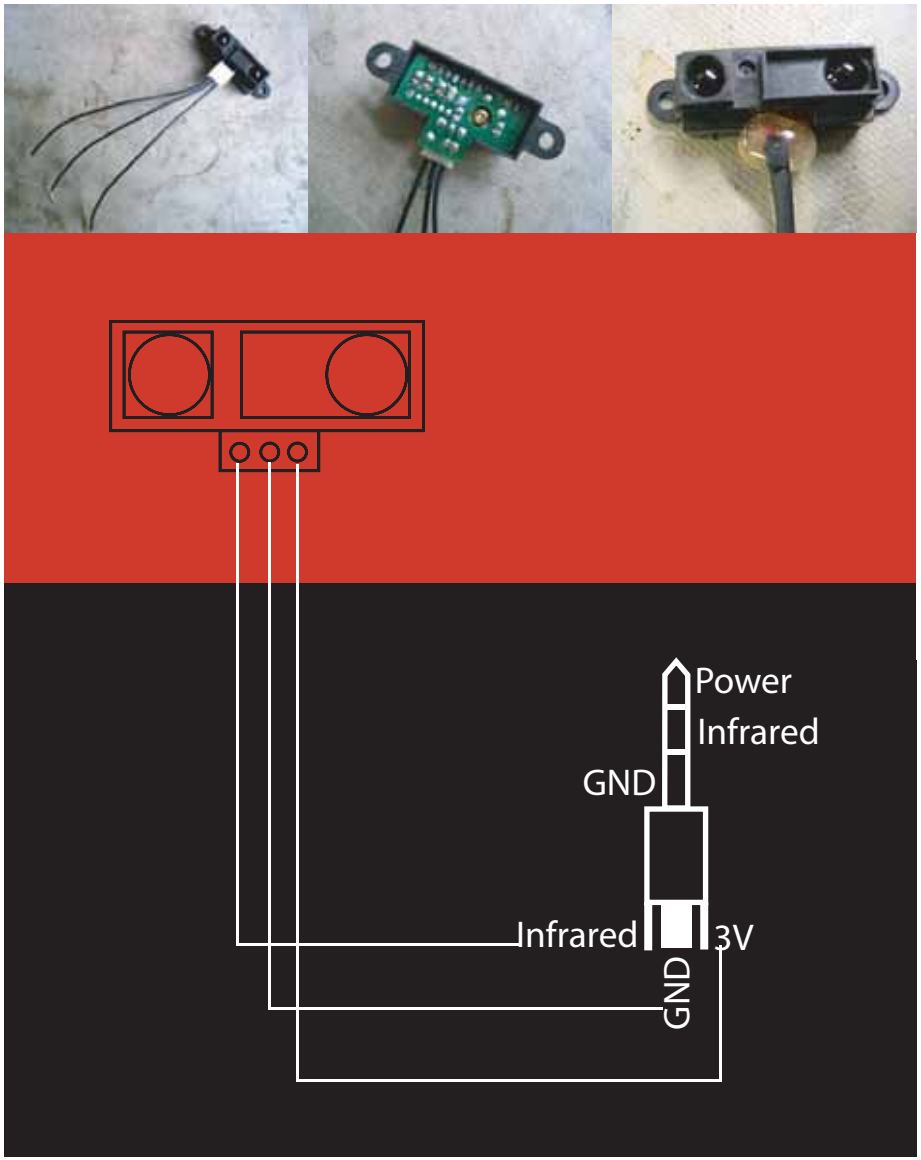
The infrared sensor:

You can use it as it is, but to make it more solid take off the wires and the white plastic and open up a wire with 3 wires inside.

Solder the 3 wires directly to the board of the sensor. Make the wire stronger with a little piece of shrink wrap just under the sensor. Hot glue the connection area or shrink wrap it.

The 3 holes in the circuit board: The first is the sensor output thatconnects to the sensor input on the jack. The second one connects to GND, the third one connects to power.

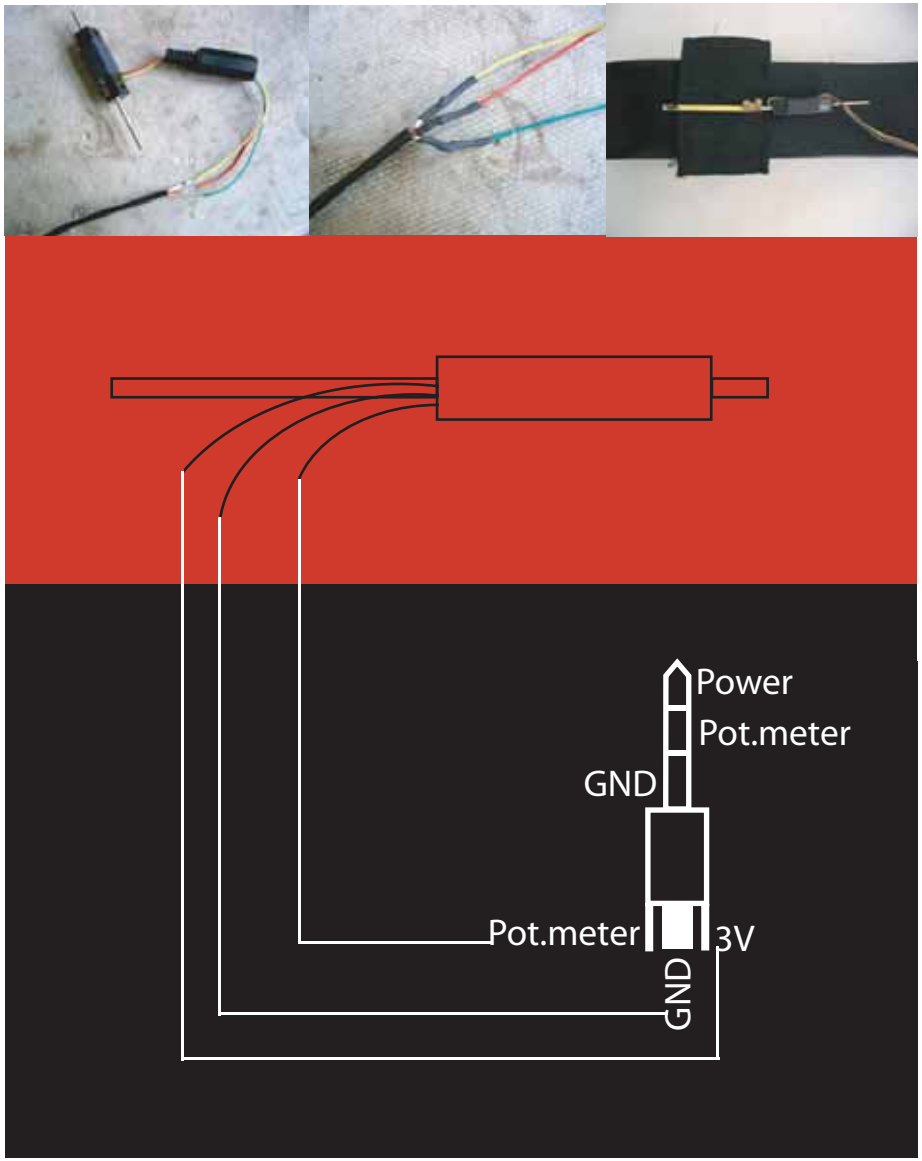
You have to check the schematic of each sensor that you want tohook up to a jack, because each sensor has its own connections. When you buy the sensor be sure that you get this information.



Linear potentiometer:

Connect the 3 wires to a wire. Use shrink wrap to make it strongerinside.

The wires of the potentiometer are color coded. Yellow goes tothe power, green goes to GND and red goes to the sensor input.

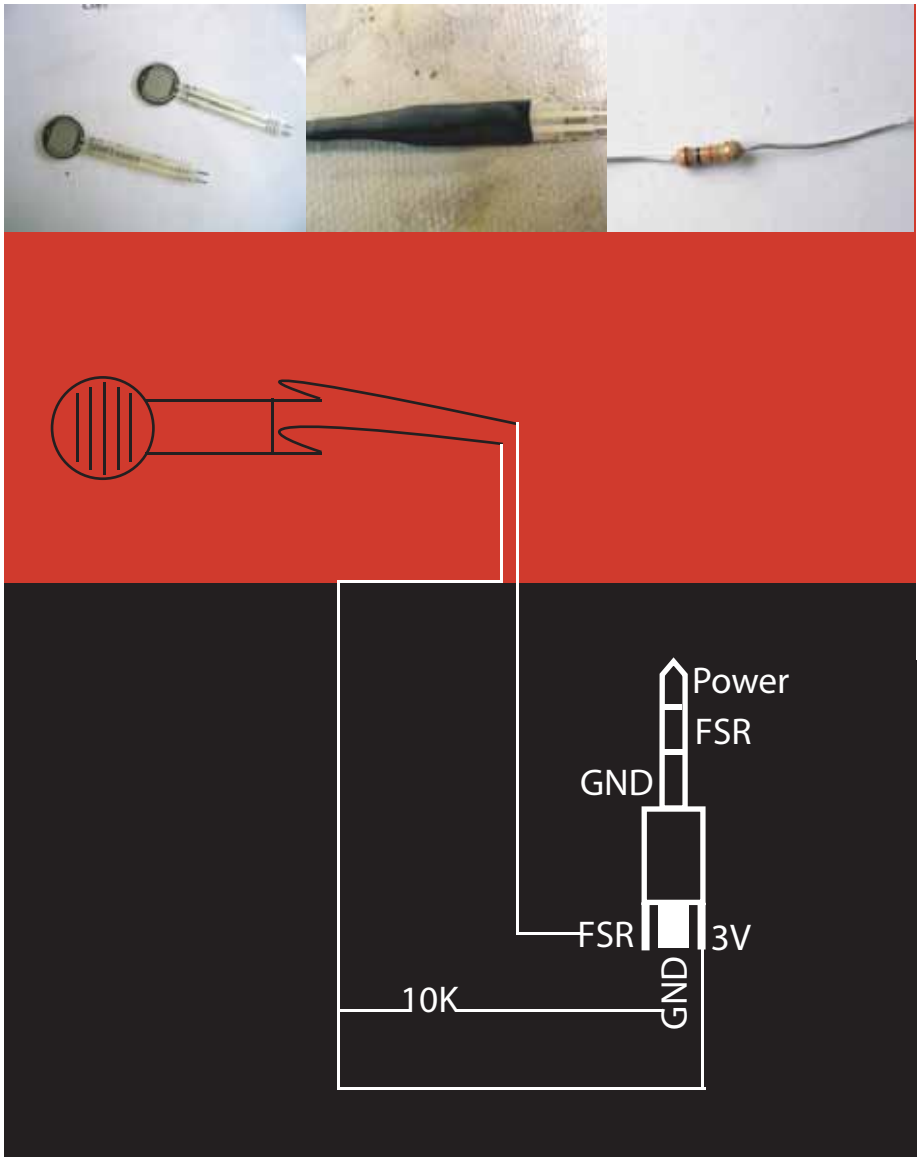


The FSR:

The FSR is fragile. To make a strong connection between the sensor and the wire solder the wires as the illustration shows below. If it is soldered in that way you will not pull on the soldered connection when the sensor is in use.

To make it even stronger you can hot glue a little bit around the connection and shrink wrap it. -see the photo.

Solder the 10K resistor between GND and sensor input in orderto form a voltage divider.



The accellerometer:

The accellerometer is a sensor made by STEIM. It peaks in the X and Y directions when you move.

The accellerometer sends information about two things at the same time, so it needs to be connected to a jack that has two inputs -the 4-way jack.

Connect - on the accellerometer to GND, + to Power and the two sensor output to the two sensor inputs in the jack.

Shrink wrap the whole sensor.