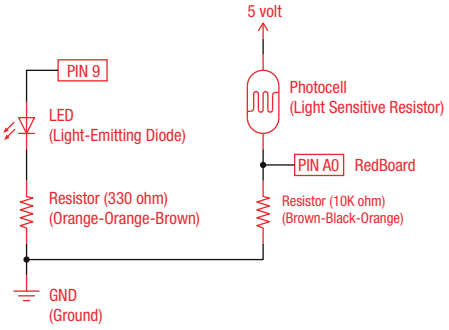
CIRCUIT #6

6

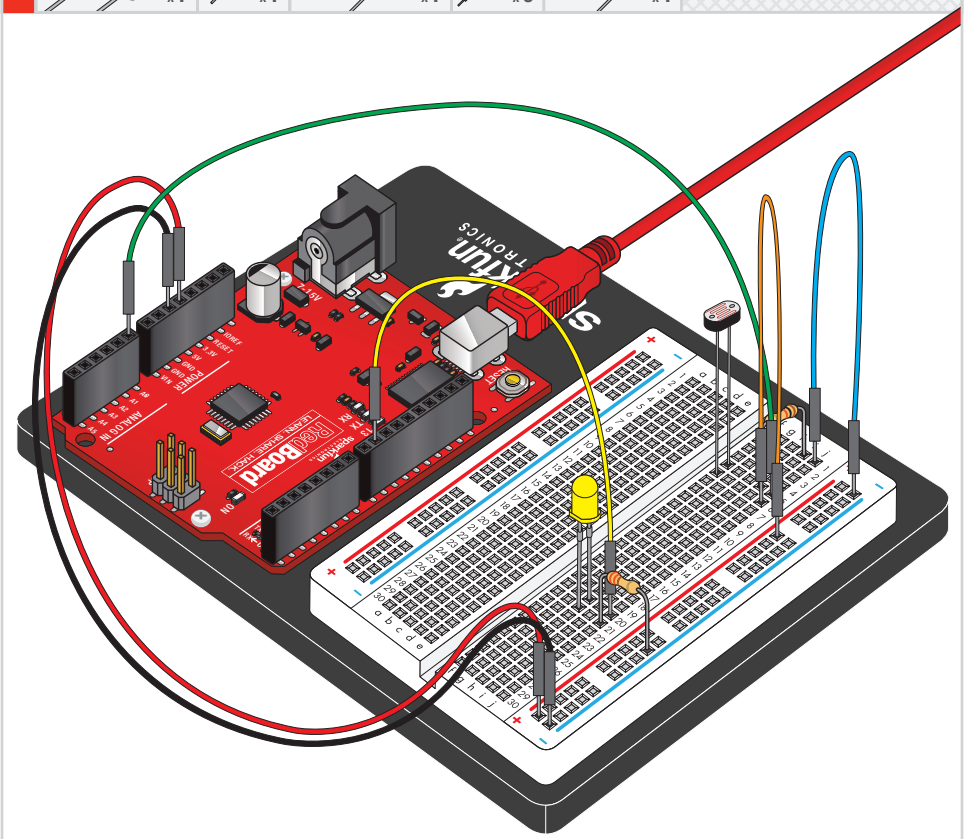
Photo Resistor

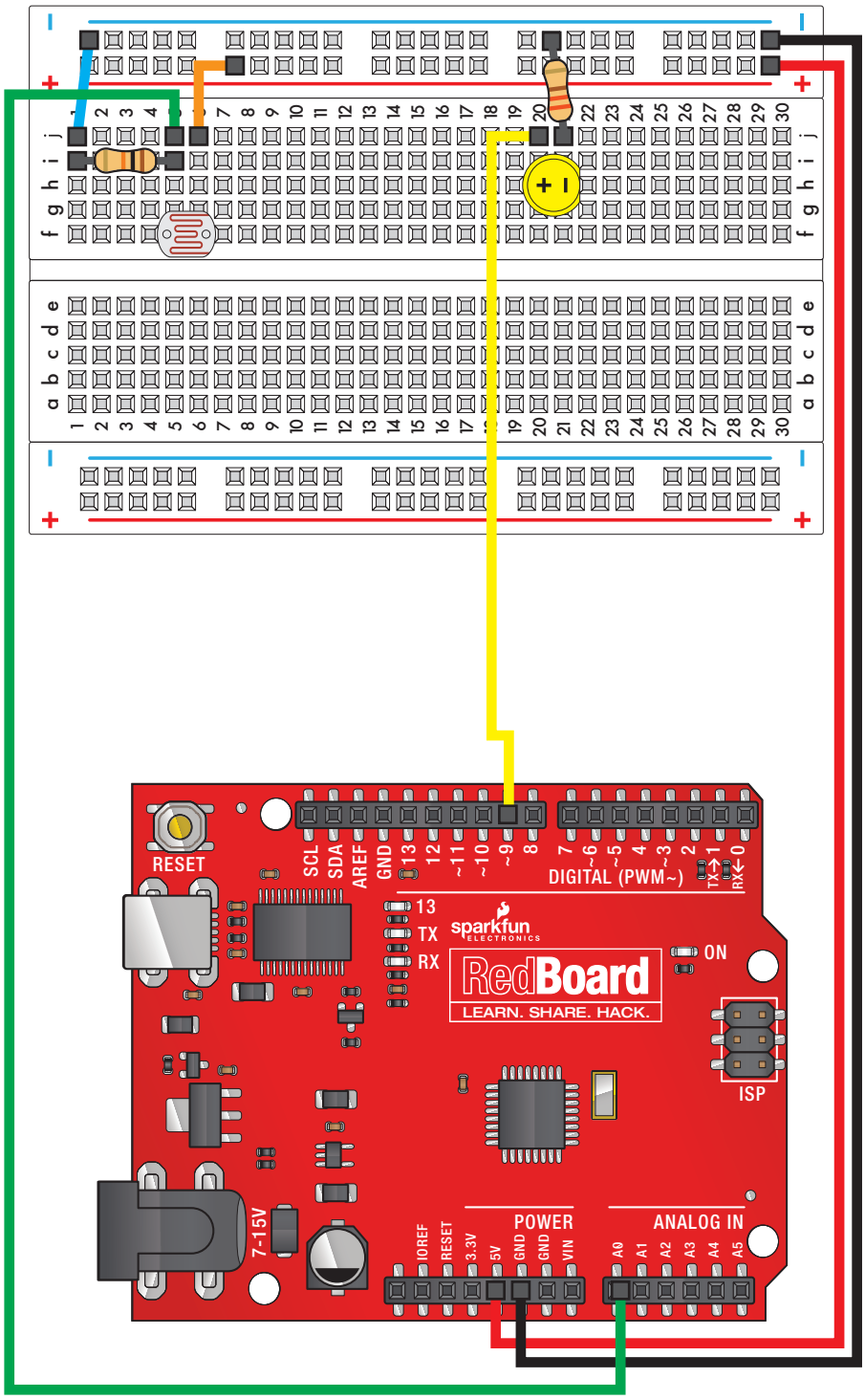


So you've already played with a potentiometer, which varies resistance based on the twisting of a knob. In this circuit, you'll be using a photo resistor, which changes resistance based on how much light the sensor receives. Since the RedBoard can't directly interpret resistance (rather, it reads voltage), we use a voltage divider to use our photo resistor. This voltage divider will output a high voltage when it is getting a lot of light and a low voltage when it is not.

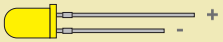
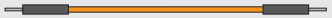
PARTS:

Photo Resistor	LED	330Ω Resistor	Wire	10KΩ Resistor
x1	x1	x1	x6	x1





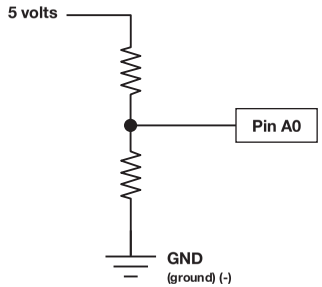
Circuit 6 : Photo Resistor

Component:	Image Reference:		
Photo Resistor ⚠			f5 - f6
LED (5mm) ⚠			h20 - h21 (+ -)
330Ω Resistor (sensor)			j21 - -
10KΩ Resistor			i1 - i5
Jumper Wire			j1 - -
Jumper Wire		A0	j5
Jumper Wire			j6 - +
Jumper Wire		Pin 9	j20
Jumper Wire		5V	+
Jumper Wire		GND	-

Measuring resistive sensors:

Many of the sensors you'll use (potentiometers, photoresistors, etc.) are resistors in disguise. Their resistance changes in proportion to whatever they're sensing (light level, temperature, sound, etc.).

The RedBoard's analog input pins measure voltage, not resistance. But we can easily use resistive sensors with the RedBoard by including them as part of a "voltage divider".



A voltage divider consists of two resistors. The "top" resistor is the sensor you'll be using. The "bottom" one is a normal, fixed resistor. When you connect the top resistor to 5 volts, and the bottom resistor to ground. The voltage at the middle will be proportional to the bottom resistor relative to the total resistance (top resistor + bottom resistor). When one of the resistors changes (as it will when your sensor senses things), the output voltage will change as well!

Although the sensor's resistance will vary, the resistive sensors (flex sensor light sensor, softpot, and trimpot) in the SIK are around 10K ohms. We usually want the fixed resistor to be close to this value, so using a 10K resistor is a great choice for the fixed "bottom" resistor. Please note the fixed resistor isn't necessarily the bottom resistor. We do that with the photodiode only so that more light = more voltage, but it could be flipped and we'd get the opposite response.

6 Arduino Code:

Open Arduino IDE // File > Examples > SIK Guide > Circuit # 6

Code to Note:

lightLevel = map(lightLevel, 0, 1023, 0, 255);

Parameters
map(value, fromLow, fromHigh, toLow, toHigh)

value: the number to map
fromLow: the lower bound of the value's current range
fromHigh: the upper bound of the value's current range
toLow: the lower bound of the value's target range
toHigh: the upper bound of the value's target range

When we read an analog signal using analogRead(), it will be a number from 0 to 1023. But when we want to drive a PWM pin using analogWrite(), it wants a number from 0 to 255. We can "squeeze" the larger range into the smaller range using the map() function.

See **http://arduino.cc/en/reference/map** for more info.

lightLevel = constrain(lightLevel, 0, 255);

Parameters
constrain(x, a, b)

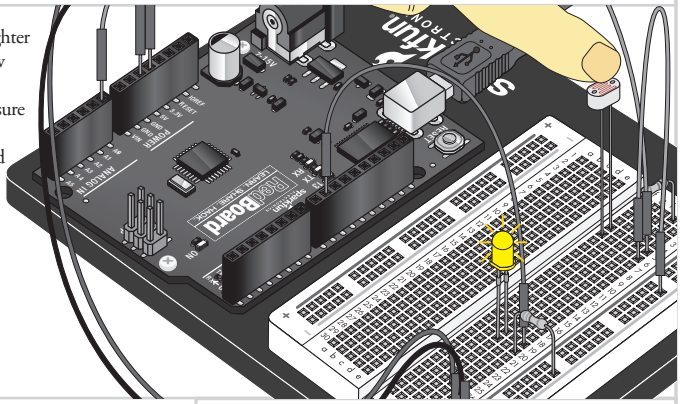
x: the number to constrain, all data types
a: the lower end of the range, all data types
b: the upper end of the range, all data types

Because map() could still return numbers outside the "to" range, we'll also use a function called constrain() that will "clip" numbers into a range. If the number is outside the range, it will make it the largest or smallest number. If it is within the range, it will stay the same.

See **http://arduino.cc/en/reference/constrain** for more info.

What You Should See:

You should see the LED grow brighter or dimmer in accordance with how much light your photoresistor is reading. If it isn't working, make sure you have assembled the circuit correctly and verified and uploaded the code to your board or see the troubleshooting tips below.



Troubleshooting:

LED Remains Dark
This is a mistake we continue to make time and time again, if only they could make an LED that worked both ways. Pull it up and give it a twist.

It Isn't Responding to Changes in Light
Given that the spacing of the wires on the photo-resistor is not standard, it is easy to misplace it. Double check it's in the right place.

Still Not Quite Working
You may be in a room which is either too bright or dark. Try turning the lights on or off to see if this helps. Or if you have a flashlight near by give that a try.

Real World Application:

A street lamp uses a light sensor to detect when to turn the lights on at night.