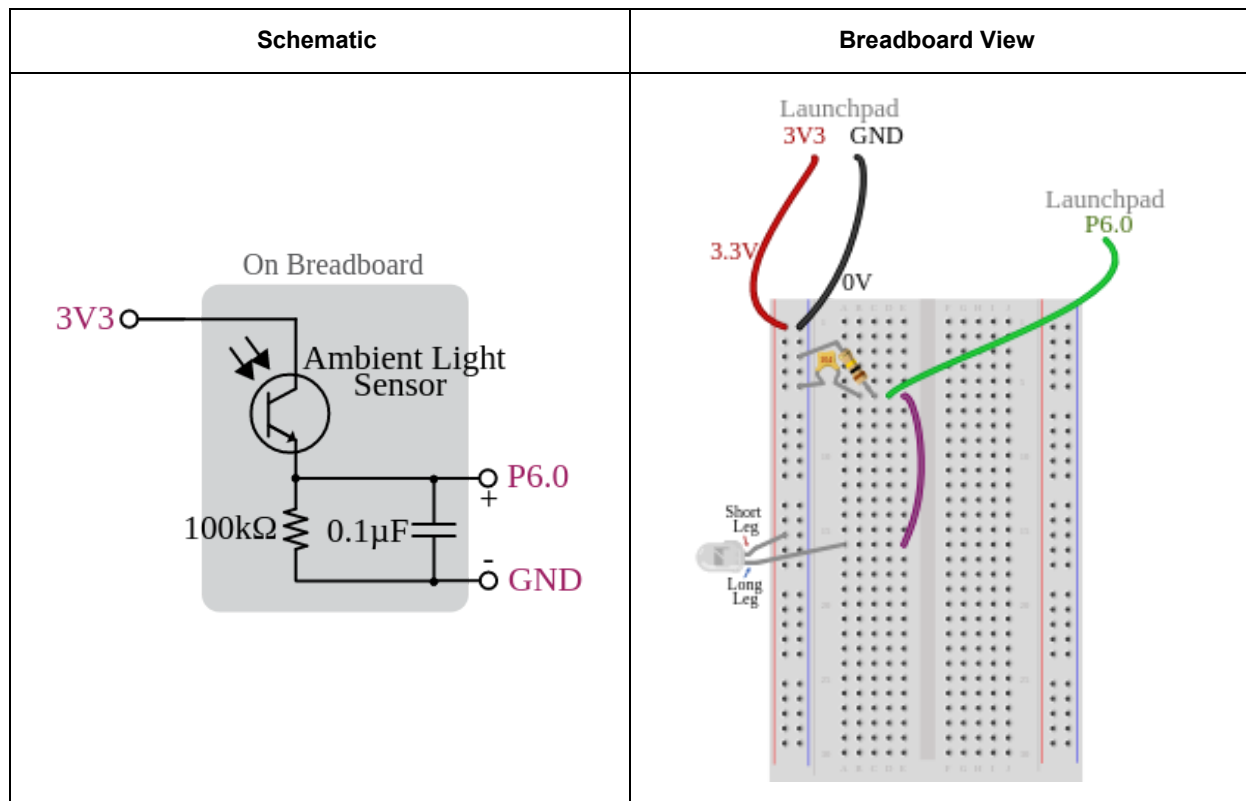


Light Sensor Breadboard Circuit - Cory 125

Build the ambient light sensor circuit on a breadboard and hook it up to the Launchpad, as you did in Imaging Lab 1. This requires the following parts:

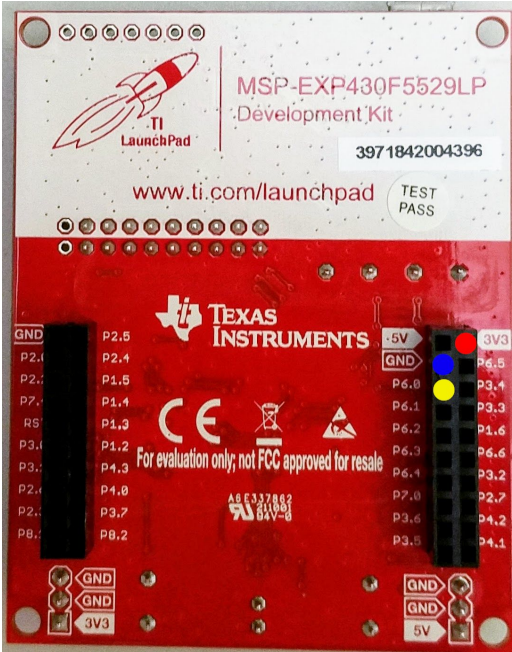
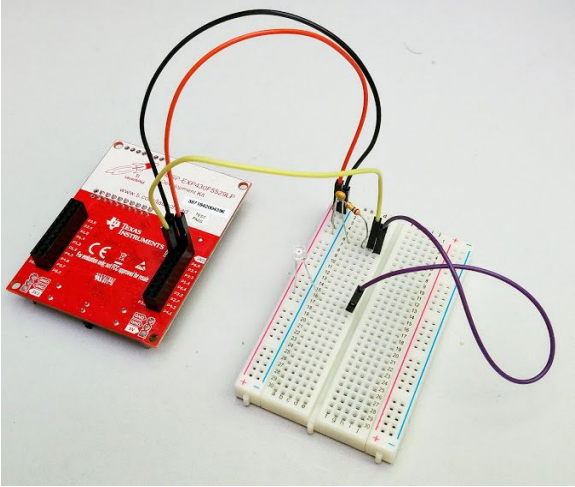
- 1x Breadboard
- 4x Male-to-Male Jumper Wires (Exposed metal connections on both ends)
- 1x Ambient Light Sensor a.k.a. Phototransistor
- 1x 0.1 μ F Capacitor (104)
- 1x 100k Ω Resistor (Brown-Black-Yellow-Gold)
- 1x TI Launchpad MSP430F5529LP
- 1x Micro-USB to USB-A Cable (Long, supplied for this lab)

The schematic that you will build is shown below. Labels in purple indicate connections to the Launchpad. Read through the following instructions to set up your single pixel imager.



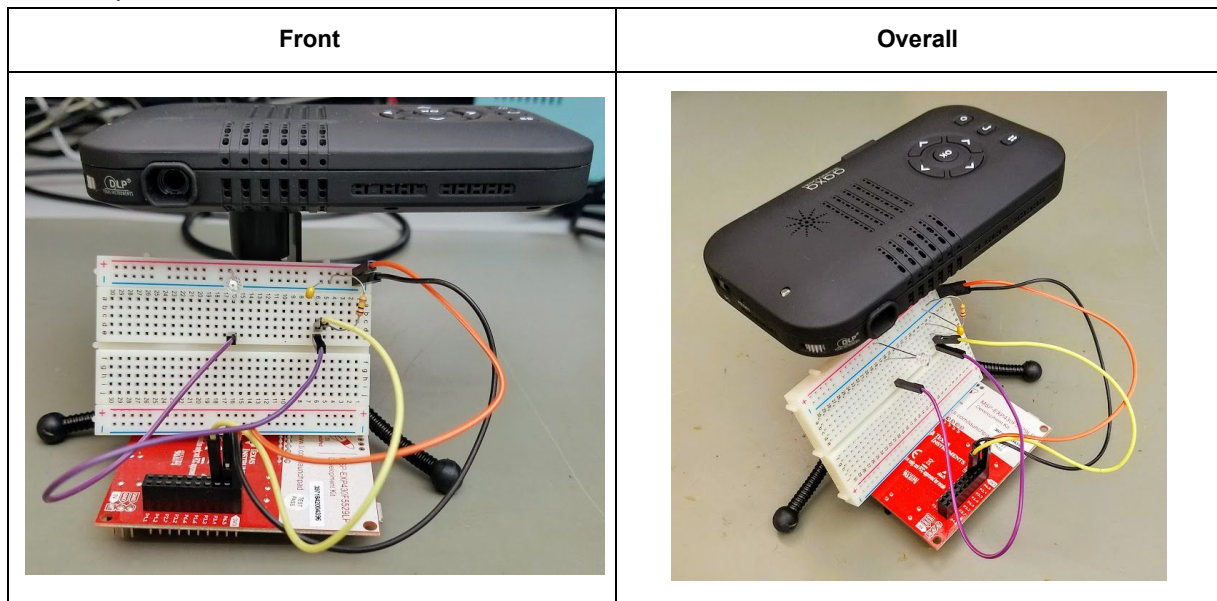
Setting up the Breadboard:

- Plug the **long leg of the ambient light sensor** into **Row 16, Column A** of the breadboard, as illustrated in the breadboard diagram above. The short leg should be plugged into the nearest hole in the **red (+) column** of the breadboard.
- Plug one leg of the **100k Ω resistor** into a hole in **Row 6** of the breadboard. Plug its other leg into a nearby hole in the **blue (-) column**.
- In a similar fashion, plug the **0.1 μ F capacitor** into a hole in **Row 6** of the breadboard. The other leg should also be plugged into the **blue (-) column**. *Warning: Make sure that none of the legs are touching each other to prevent shorting!*
- Use a **male-to-male jumper wire** to connect **Row 16, Column E** to **Row 6, Column E**.
- The Launchpad supplies 3.3V to our circuit. Use a **male-to-male jumper wire** to connect the right-most hole (~Row 1) in the **red (+) column** (3.3V supply) to **3V3 on the back of the Launchpad (red)**.
- Use a **male-to-male jumper wire** to connect the right-most hole in the **blue (-) column** (0V) to **GND on the back of the Launchpad (blue)**.
- Use a **male-to-male jumper wire** to connect **Row 6** (sensor circuit output) to **P6.0 on the back of the Launchpad (yellow)**. The Launchpad can read analog voltage values from our circuit, convert them into digital values, and then send them over to our computer.

MSP	Full Circuit
 <p>The image shows the MSP-EXP430F5529LP Development Kit, a red PCB with a white label at the top. The label includes the TI LaunchPad logo, the part number MSP-EXP430F5529LP, the text 'Development Kit', the number 3971842004396, the website www.ti.com/launchpad, and a 'TEST PASS' mark. The PCB features various pin headers labeled with P2.5 through P8.2, P6.0 through P6.6, P7.0, P3.5, and P4.1. There are also labels for GND, -5V, 3V3, and 5V. The Texas Instruments logo and 'CE' and 'FCC' marks are visible.</p>	 <p>The image shows the full circuit setup. The MSP-EXP430F5529LP Launchpad is connected to a breadboard. A male-to-male jumper wire connects the 3V3 pin on the back of the Launchpad to the right-most hole in the red (+) column of the breadboard. Another male-to-male jumper wire connects the GND pin on the back of the Launchpad to the right-most hole in the blue (-) column of the breadboard. A third male-to-male jumper wire connects Row 6, Column E of the breadboard to Row 6, Column E. The ambient light sensor is plugged into Row 16, Column A of the breadboard, with its short leg in the red (+) column. A 100k resistor and a 0.1μF capacitor are also plugged into Row 6 of the breadboard, with their other legs in the blue (-) column.</p>

Stand Setup

Unlike last week, we care about where the light sensor and other components are placed on the breadboard. **The light sensor should be facing the center of the image being captured (roughly the center of the projected display), and should not be tilted away.** No components, wires, etc. should get in its way. Therefore, everything else is carefully placed to the side. This is evidenced from the photos below:



- Take the projector and cables out of the cardboard box (if your station does not have a cardboard box or instructions were not given to you, ask your TA for an imaging setup)..
- Adjust the tripod on the projector such that it stands well.
- Place the MSP in front of the projector tripod and lean your breadboard against the tripod.
- Place the setup into the box - **Pay close attention to where the holes are in the box.** The holes are cut out to make connecting the mini-HDMI and power cables easier - if you do not choose the right orientation, you will end up bending and possibly breaking the cables. Align the holes to the back side of the projector.
- Route the barrel jack power cable and the mini-HDMI cable (should be at your lab station connected to your lab computer) through the holes and plug into the projector. **The barrel jack power connector plugs into the side of the projector, not the back. The charging port is labeled “DC”. other side and connect them both to the projector.other side and connect them both to the projector.** Take the long USB cable and route it through either hole and connect it to the MSP.
- The power cable must be plugged into an outlet - there are outlets at each station under the platform where the lab computers stand, hidden in the back. Make sure the barrel connector is fully plugged into your projector - if the connection is loose during the scan you may have issues. If there are no outlets, unplug the turquoise soldering iron
- Plug the USB 2.0 end of the USB cable into the lab computer.
- Confirm your setup with the full set up below



DC 5V Power

mini-HDMI

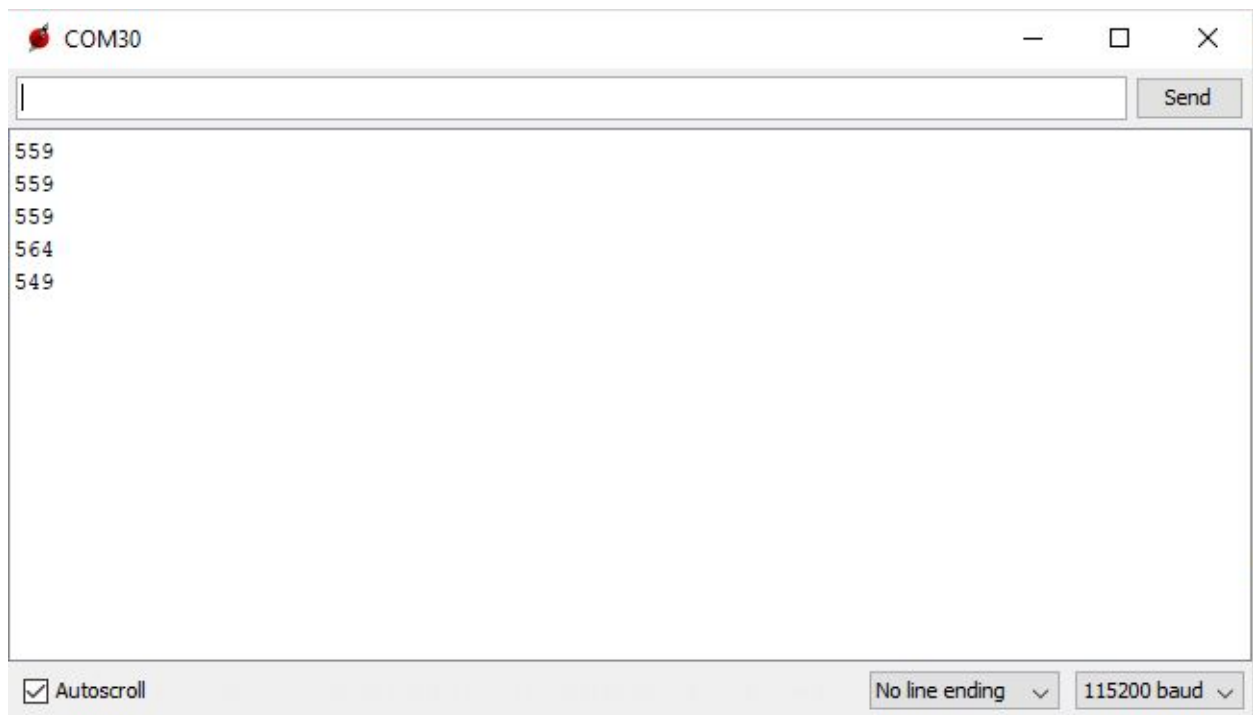
micro USB

Launchpad (MSP430) Setup

- Launch Energia (from Desktop)
- **Open the AnalogReadSerial program in Energia (File > Open). This is a different Launchpad code from last week, and can be found in the Imaging Lab 2 or 3 folder you downloaded. Select the right Serial Port (Tools > Port) by going to “Device Manager” and finding the MSP UART port. Upload the code by clicking on the Upload button (white circle with a right-pointing arrow, as shown below):**
 - If your MSP does not show up on Device Manager, try using a USB port on the back of the lab computer



- Hit the **RESET** button on your MSP (labeled **RST**).
- **To verify that the program is working, type a 6 into the serial monitor (accessed in Energia via Tools > Serial Monitor). You will need to set the Baud Rate to 115200. You should see a reading from the ambient light sensor appear.** If the numbers increase with light and decrease with less light your setup is good. **You must close this window before continuing.**



Projector Setup



1

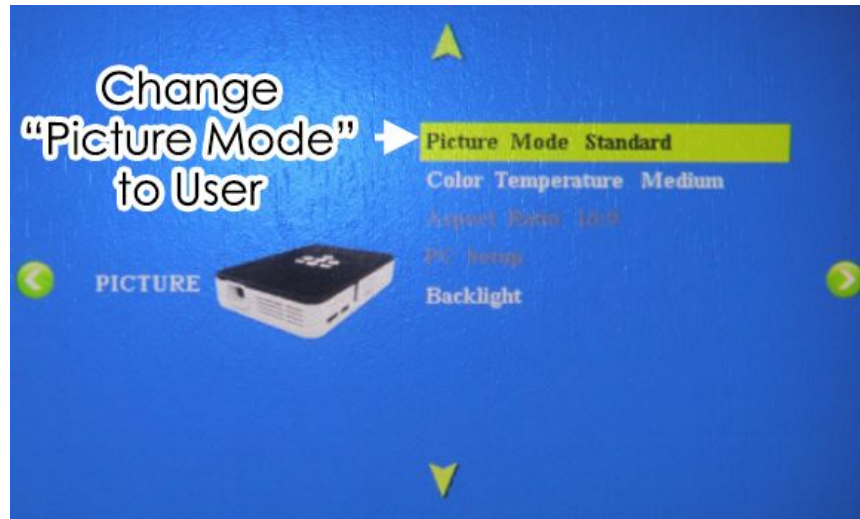
Setup the projector with the following steps:

- Turn on the projector by holding down the Power button (see the previous figure).
- Find the Focus Adjustment wheel on the side of the projector to adjust the focus of the projection onto the box. Focus it as close as possible.



- Using the left/right arrows on the Directional Pads, select HDMI on the projector's main menu. After a few seconds, you should see the Windows 10 desktop.
- If you see the Windows 10 taskbar at the bottom of the projected screen, take the following precautions:
 - Hit the **Windows key** and type **Settings**.
 - Click on the **Personalization** icon.

- Click on **Taskbar** on the left side.
- Under the **Multiple Displays** section, turn **Show taskbar on all displays** off.
- Use the **Back button** on the projector to return to displaying the **main menu**.
- Use the left/right arrows to select the **Settings** option (gears icon).



- Change the **Picture Mode** from Standard to **User**.
- **IMPORTANT:** Use the down arrow to move the cursor down to **Contrast**. Then use the right arrow to adjust the contrast to **100**.
- **IMPORTANT:** Move the cursor down to **Brightness** and use the left arrow to adjust the brightness to **0**.
- To **Confirm the Selection**, hit OK and exit the menu with the **Back button**.
- Again, select **HDMI** on the projector's **main menu** and make sure that you see the Windows 10 desktop on your projector.

MAKE SURE YOU HAVE FOLLOWED ALL THESE STEPS - IF YOU TURN OFF YOUR PROJECTOR THE SETTINGS WILL RESET