Example Photo Circuits

Build an LED Emitter:

Build a Digital Photodetector:

Build a Digital Photodetector with latch and reset:

With the 638-PD333-2C/H0L2 photodiodes, $R_C$ is 10 kΩ.
With the alternate photodiodes, $R_C$ is 100 Ω.
If you are using a different photodiode, you might have to experiment with $R_C$ to get the appropriate results. In general, we want $V_C \to 0$ as it sees more light, and $V_C \to 5V$ when it’s in the dark.
For both circuits, the 100 Ω resistors attached to the transistor base “B” isn’t strictly necessary.
Analog Photodiode Detector, Version 2:

This circuit generates an output voltage as follows:

“Dark” $\rightarrow$ 5.00 volts.
“Bright” $\rightarrow$ 0.05 volts.

For this circuit, the numerical value of $R_B$ is pretty unimportant. I’ve tested it with values between 100$\Omega$ and 10k$\Omega$.

For this circuit, the choice of $R_C$ affects the kind of illumination you can easily detect.

If $R_C$ is large (e.g., 10 k$\Omega$), then generic room lighting creates an output voltage of about 1.0 V. If $R_C$ is small (e.g., 1 k$\Omega$), then generic room lighting creates an output voltage of about 4.0 V. These numbers assume that you’re using the 638-PD333-2C/H0L2 photodiodes. See the note on the previous page if you’re using a different kind.

You should adjust $R_C$ (possibly using a potentiometer) so that the bulk of the illumination range you want (whether darker levels than background, or brighter) occupy most of the output voltage space. So, if you want to measure differences in light that is generally pretty bright, then use a small $R_C$. If you want to measure differences in light that is generally pretty dark, then use a larger $R_C$.

Parts List:

1. Photodiodes: Mouser # 638-PD333-2C/H0L2
2. Bright Red LEDs: Mouser # 638-333-2SURCS5306
3. 100 ohm resistors: Mouser # 791-RC1/4-101JB
4. 10 kohm resistors: Mouser # 791-RC1/4-103JB
5. NPN Transistors: Mouser # 610-PN2222A
6. Alternate Photodiodes: Mouser # 512-QSD2030, 710-1540051EA3590
7. Alternate Bright LED: Mouser # 638-333-2USOC/S530-A6