4 Circuit Enhanced Optical Position Detector

Introduction:

The 4 Circuit Enhanced Optical Position Detector (4xEOPD) is similar to our Enhanced Optical Position Detector and Geoff Bunza's Differential Adaptive Position Detector from which it is derived. The differences between the EOPDs and the DAPD are the 3 second timeout and higher current drive via open collector/drain. The 4xEOPD's output is via 2N7002 FETs and can sink a maximum of 115mA @ up to 48VDV, so it is suitable for up to 11 LEDs at 10mA, 2 incandescent bulbs at 40 mA each and a variety of relays (be sure to use appropriate diode protection for inductive devices).

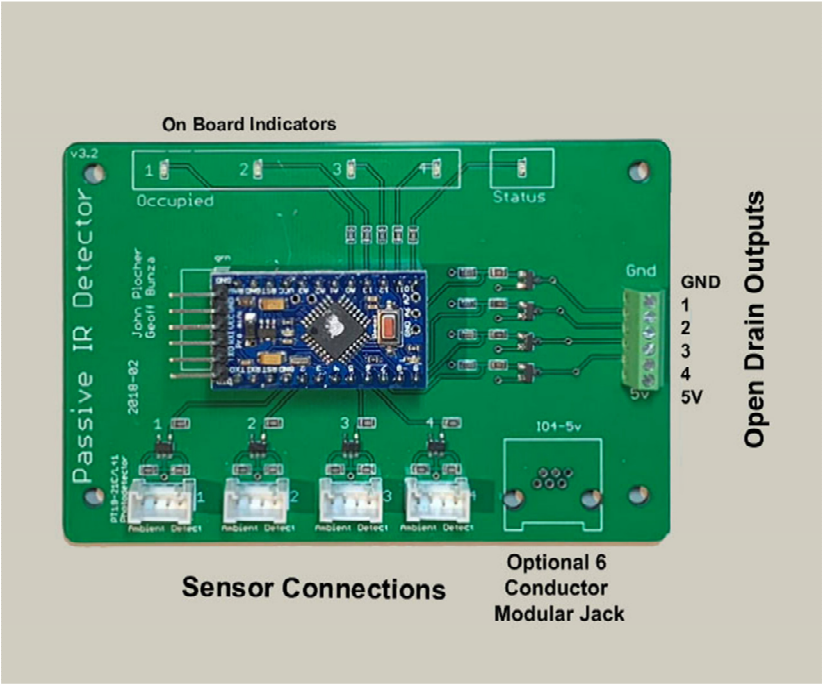

Figure 1- 4xEOPD Connections

Preliminary Installation Instructions:

Sensors:

Sensors are connected with 2mm "Grove" connectors, available from Seeed Studio. https://www.seeedstudio.com/Grove-Universal-4-Pin-Buckled-20cm-Cable-5-PCs-pack.html We provide a pair of 50 CM (~20") double ended cables with the 4xEOPD, you can cut them as needed and solder to either the "Fingah" detector or discrete photodetectors. (if you need a mix, note it when you order and we'll adjust). The Fingah is intended to be placed between ties in N, TT or HO track. You'll probably want to solder the leads to the bottom of the Fingah for an unobtrusive installation. The idea is that the

reference sensor will not be shaded by the rolling stock to be detected by the under-track sensor. You can also use discrete photo transistors, or IR photo transistors and emitters. Our standard discrete photo transistor is the PT-19 which looks like a 3mm LED. Use two for each circuit, one for reference and one for detection.

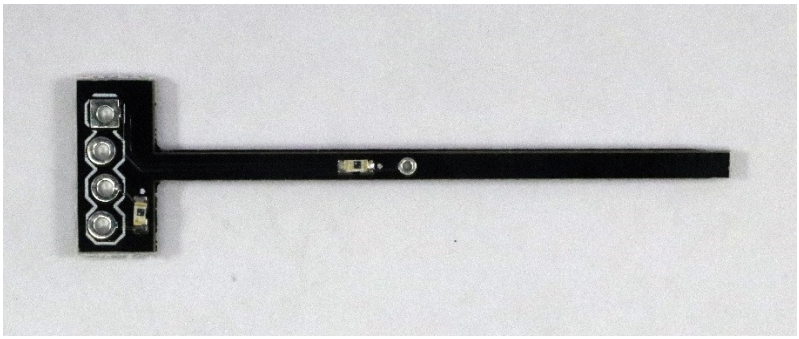

Figure 2- Da Fingah

Note the reference sensor next to the connections and detection sensor in the middle of the finger. The connections are on 0.100 centers, if you want to mount a sensor. Seeed makes 2mm to 0.100 (2.54mm) jumpers https://www.seeedstudio.com/Grove-4-pin-Female-Jumper-to-Grove-4-pin-Conversion-Cable-5-PCs-per-PAck.html.

The 4xEOPD needs some light to work but it adapts over a wide range of light levels and flicker conditions. Be sure that the reference sensor will not be shaded by the cars you are trying to detect!

Power and Output Connections

We provide a 6 position 0.100 screw terminal block. If you want another 0.100 connector, let us know when you order, standard options are no connector (supply your own) and male headers. The 4xEOPD also has pads and mounting holes for a female 6-position (6p6c, RJ25) modular connector, which we can substitute for the terminal block.

Connect regulated 5V and Ground to the terminals marked and then connect your outputs to the outputs marked 1-4. Most connections will either be to a digital input such as a cpNode, IOX or SMINI. (Be sure the Arduino has it's internal pull up turned on!) or LEDs on a control panel for hidden track such as staging or a helix. In the indicator application, you can use any handy DC supply up to 48V and use a suitable limiting resistor to set the brightness of the LEDs. Here are suggested starting values in ohms, use ¼ Watt resistors:

	Current in mA	5V	12V	24V
Red	10	330	1,000	2,200
Yellow	15	220	680	1,500
Green	12	270	680 or 1K	1,800 or 2K
White	2	680	4,700	10K

Table 1- typical value for LED limiting resistors

If you are doing an installation over a small area, it's probably easiest to use the same 5V supply for the 4xEOPD and the LEDs, just make sure that total current of all the LEDs and the 4xEOPD (max 40mA) doesn't exceed the capacity of your supply. If the LEDs are at some distance, you may want to use your layout auxiliary bus (usually 12V). Make sure the 4xEOPD ground is connected to the Aux Bus ground.

Testing:

Plug a sensor cable (with sensors attached) into the appropriate connector and turn the power on. After a few seconds (for the Arduino which does the timing to boot up), look at the indicator corresponding to the input you connected. With nothing obstructing the sensor, the indicator should be dark. Carefully cover the detection sensor and not the reference sensor. The indicator should come on, if not, check your connections, swap the sensor to make sure it is good, and check the overall light level.

Once the sensor is known to work, connect to your output. If using a digital device you might want to test first with an LED to make sure everything is working. Again, Carefully cover the detection sensor and not the reference. The output should turn on (ground the output terminal). The output will stay on for about 3 seconds after the input goes away (and the on-board indicator turns off). This is to debounce the output. If nothing is happening, check your wiring, make sure the load or digital input is connected to the same ground as the 4xEOPD, for digital inputs make sure the input has a pull up (Arduinos have a weak internal pull up of about 10K which h should be fine, if applying an external pull up 4.7K ohms is a good value to start).

Software

The software is pretty simple and the most recent Arduini Sketch is posted on the product page, you can change the timing by modifying the following #define variables:

HYSTERESIS is the turn off delay and is defaulted to 3000 mS (3 Seconds) for compatibility with EOPX, cpOD and DCC_OD, so your system software can treat all current and optical detection the same.

These variables affect all 4 circuits.

The sketch uses the elapsedmillis library, add it using sketch/Include Library/Library Manager