LOGIC RAIL™ TECHNOLOGIES

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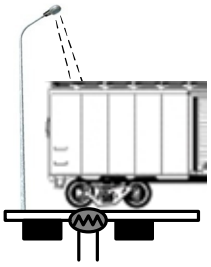
Optical Detector (OD-1) Instructions

Revised 4/13/09

Getting started

Thank you for purchasing a ***Logic Rail Technologies*** product! Please read all instructions prior to installing this board.



The Optical Detector (hereafter referred to as the OD-1) provides detection using a photocell as a sensor. There are three outputs: two red (covered) outputs and one green output (uncovered). One red output and the green output can drive different types of LEDs. The other red output is used for driving higher power devices such as lamps or relays.

Whenever the sensor is covered the red outputs will be activated and the green output will be deactivated. Once the sensor is uncovered the OD-1 will delay (2 or 4 seconds; see below) before deactivating the red outputs and activating the green output. A bipolar (red/green) is included and already connected to the OD-1; you may disconnect this LED and mount it where it may be more convenient to see. **You MUST use resistors with LEDs! The OD-1 contains a 150 ohm resistor on its red LED output. Refer to the appropriate section below for specific wiring instructions for the type of LED(s) that you will be using.**

You should make all of the connections to the OD-1 before applying power to it. You can mount the board anywhere it is convenient underneath your layout using the four mounting holes provided. The holes will accept #4 screws; do not enlarge the holes as damage to the circuit board can result and your warranty will be voided!

Wiring a 2-lead bipolar LED

The OD-1 includes a 2-lead bipolar LED as a status indicator. The OD-1 is preconfigured for this type of LED. Specifically, the "jumper" is installed over both pins on the "2-pin header" labeled "SIG" on the circuit board. This is illustrated in Figure 1 along with the wiring. You may elect to use this LED or replace it with one of your choosing. The OD-1 contains a 150 ohm resistor on the red LED output so there is no need to add an external resistor when using a 2-lead bipolar LED. The LED outputs can supply up to 25mA of current. We do not recommend connecting more than one 2-lead bipolar LED to the OD-1. Note that the longer lead on the included LED connects to the OD-1's G terminal.

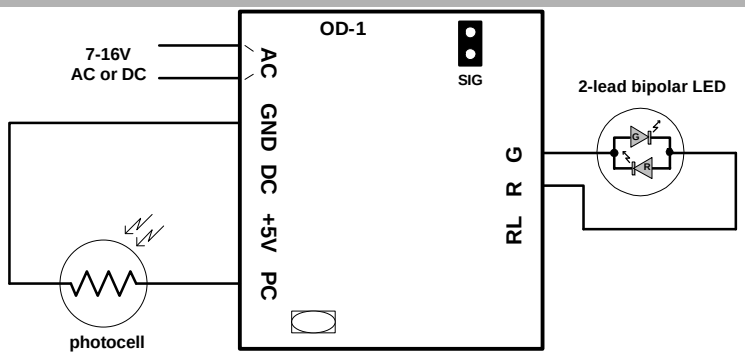


Figure 1 – 2-lead bipolar LED

Wiring a 3-lead bipolar LED

If you choose to use a 3-lead bipolar LED as a status indicator you'll need to wire it as shown in Figure 2. You must install the "jumper" over both pins on the "2-pin header" labeled "SIG" on the circuit board. This is also illustrated in Figure 2. Since the OD-1 already contains a 150 ohm resistor on the red LED output you will need to add an external 150 ohm resistor on the green LED output as shown. We have included this resistor in the OD-1 package for your convenience. The LED outputs can supply up to 25mA of current. We do not recommend connecting more than one 3-lead bipolar LED to the OD-1.

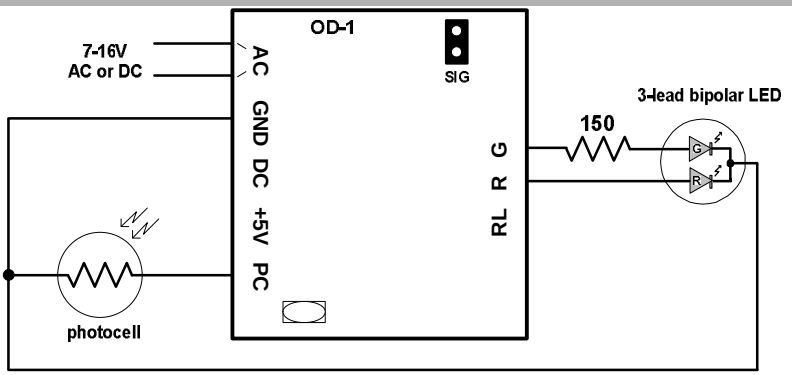


Figure 2 – 3-lead bipolar LED

Wiring a pair of individual red and green LEDs

You may choose to use individual red and green LEDs as status indicators. Of course, you may elect to only use a single red LED to indicate that the sensor is covered. In that case you may ignore the connections associated with the green LED.

There are three ways to wire a pair of LEDs. First, you may elect to wire them just like the 2-lead bipolar LED previously described and shown in Figure 1. You will simply connect the two individual LEDs in a "reverse polarity" configuration as shown. That means, the anode/positive side of the green LED connects to the cathode/negative side of the red LED and vice versa.

Second, you may elect to wire them in a common cathode (negative) configuration. If so, wire them just like the 3-lead bipolar LED previously described and shown in Figure 2. You will simply connect the cathode/negative side of the two individual LEDs together.

Third, you may elect to wire them in a common anode (positive) configuration. If so, wire them as shown in Figure 3 and install the "jumper" over one or the other (NOT both!) pins on the "2-pin header" labeled "SIG" on the circuit board. This is also illustrated in Figure 3. Since the OD-1 already contains a 150 ohm resistor on the red LED output you will need to add an external 150 ohm resistor on the green LED output as shown. We have included this resistor in the OD-1 package for your convenience. The LED outputs can supply up to 25mA of current. We do not recommend connecting more than one LED to each of the OD-1 R or G outputs.

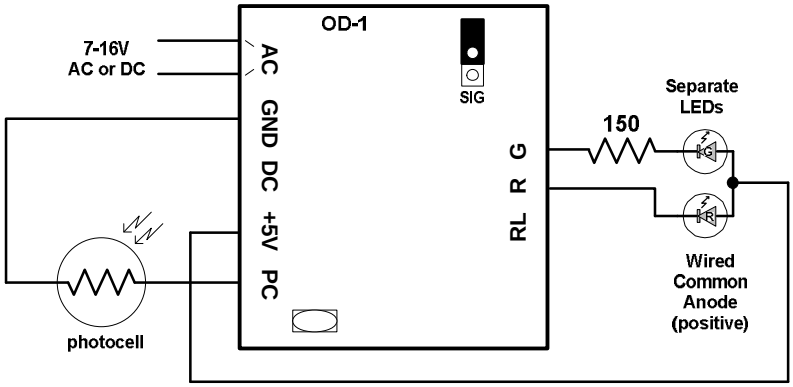


Figure 3 – Individual Red and Green LEDs (common anode)

Wiring relays, lamps, or other devices

The OD-1's RL output can be used to drive a relay, lamps (light bulbs) or interface to other circuitry. Note that using this output is totally independent of your use of the G & R LED outputs. Also, the SIG header has no affect on the RL output. The RL output is known as an "open-collector" type. This means that when it is active/on the voltage on it is approximately 0 to 0.7 volts and can "sink" up to 150mA of current. This is sufficient for most low voltage relays, lamps, and other interface circuits.

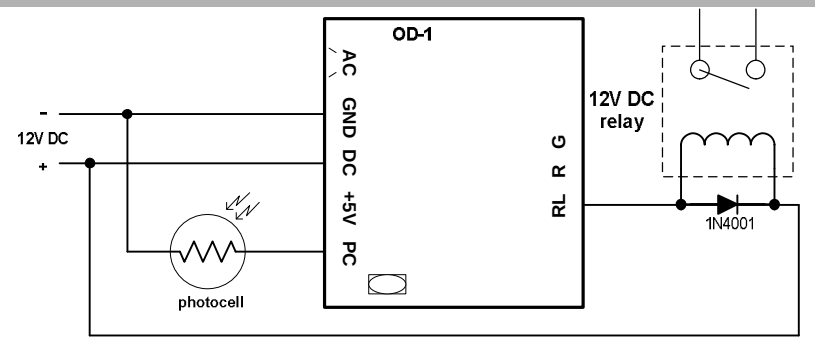


Figure 4 – Driving a relay

Figure 4 shows you how to connect a relay to the RL output. You will need to use a DC power source for the OD-1 and the voltage must match the voltage of the relay's coil. For example, you could use Radio Shack's #275-241. You will also need a diode (Radio Shack #276-1101) wired across the relay coil as shown; make sure the band of the diode (cathode) is connected to the DC terminal on the OD-1!

Figure 5 shows the wiring for a lamp. You will need the current limiting resistor if the voltage rating of the bulb is lower than the input voltage to the OD-1. For example, if the input voltage is 16V and the bulbs are rated at 12V we would suggest a resistor value of 100 ohms (e.g Radio Shack #271-1311. If the input voltage is equal to or slightly lower than that of the bulb then no resistor is needed.

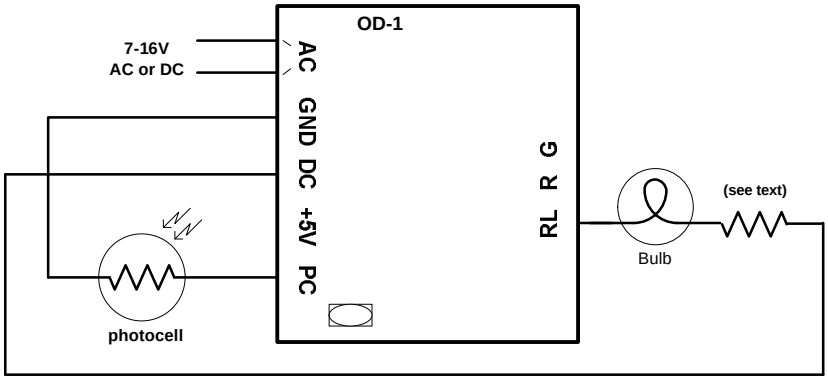


Figure 5 – Driving a lamp

Figure 6 shows the wiring for an external circuit. For example, you may wish to use the OD-1 in conjunction with a computer interface card such as the C/MRI. The 10K ohm "pull-up" resistor is required if the external circuit does not contain one or is not expecting an open-collector connection. NOTE: you must NOT use the same power source to power the OD-1 and the external circuit; contact us if this presents a problem for you.

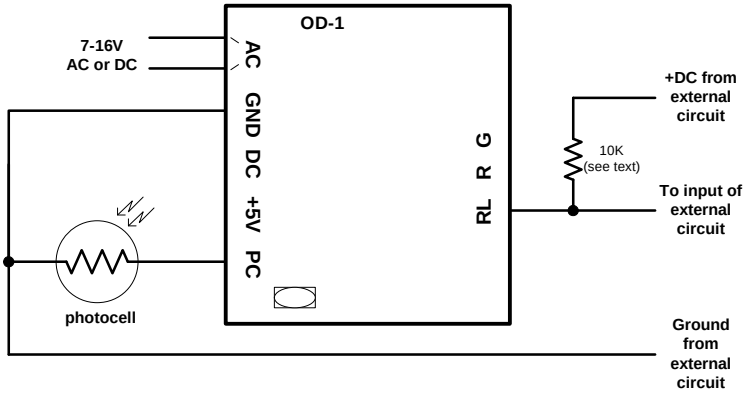


Figure 6 – Interfacing to an external circuit

The Photocell

The photocell should be mounted between the rails in the general area where you will locate the signal. Drill a 9/64" hole through the ballast, roadbed, and sub-roadbed. For the smaller scales this drilling may end up hitting the ties. Take your time so you don't mangle them! Figure 7 illustrates the placement of the photocell in between the rails. Insert the leads of the photocell into the hole from the top of your layout. One of the photocell leads has a piece of insulation on it so be sure the two leads don't touch each other (you won't damage anything if they do but the circuit won't work properly!).

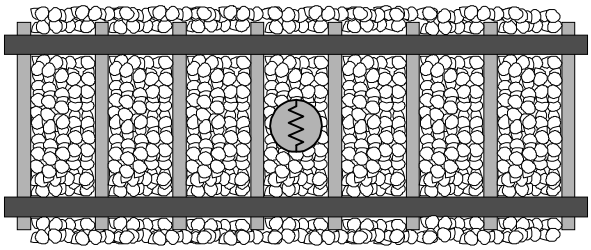


Figure 7 – photocell placement

If the leads do not protrude enough from the underside of your layout then it will be necessary to extend the leads; soldering wires to them is the most common method; make sure you insulate any connections you make to the photocell leads so that they don't short out. Once you have wired the photocell to the OD-1 and verified its operation you may wish to put a dab of white glue or silicone caulk under the photocell to hold it in place; make sure you don't get glue on the top surface of the photocell as this may prevent it from operating properly.

The photocell requires a light source above it to function properly. On most layouts the room lighting should be sufficient. However, if the photocell is located in an area that doesn't get much overhead lighting or if you have simulated "nighttime" operations then it will be necessary to locate a light source on the layout near the photocell. Street lights and yard lights are common light sources. Locate the light source slightly to the left or right of the photocell and not directly over it; this will allow the OD-1 to still properly detect a train that has stopped over the photocell with the gap between cars over the photocell. You can adjust the sensitivity of the photocell on the circuit board using a small slotted head screwdriver. Insert the screwdriver in the component labeled "VR1". Turning the screwdriver clockwise will compensate for lower light levels. With nothing blocking the photocell turn the screwdriver counter-clockwise until the red LED (or lamp or relay) is activated/on. Then slightly turn the screwdriver clockwise; verify that the red output is deactivated. Repeat if necessary.

Detector release delay

When the sensor is cleared by the train the OD-1 will delay either 2 or 4 seconds before releasing/deactivating the red outputs and activating the green output. Choose the value based on your own personal preference. To select 2 seconds the jumper must be installed over both pins on the block "DLY"; for 4 seconds the jumper must only cover one pin (it doesn't matter which one). You can change this as you wish even when the power to the OD-1 is on. The two options are illustrated in Figure 8.

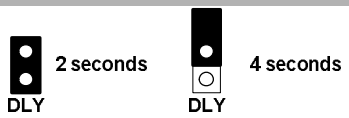


Figure 8 – Release delay

Power

The OD-1 accepts AC or DC power (7 - 16V). Power consumption when just using the LED outputs is approximately 30mA (including the LED(s)). If you are only using a single OD-1 then you can use the **two** AC terminals with an AC or a DC power source. If you are using more than one OD-1 you can power them all from a single **DC** source (such as our 12VPSR) as shown in Figure 9. Although you can use the accessory terminals on your throttle/power pack we would recommend using our 12VPSR with it. Power packs typically don't provide regulated and well-filtered outputs; the 12VPSR provides a fixed 12V DC output.

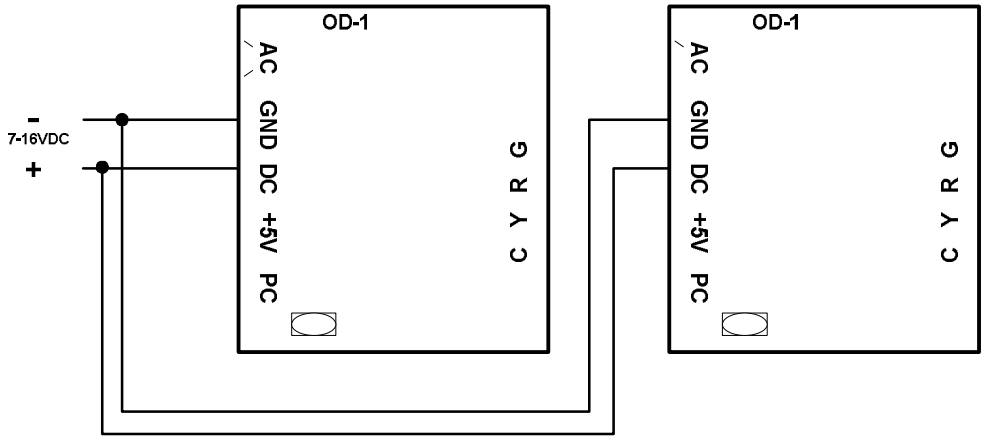


Figure 9 – DC power

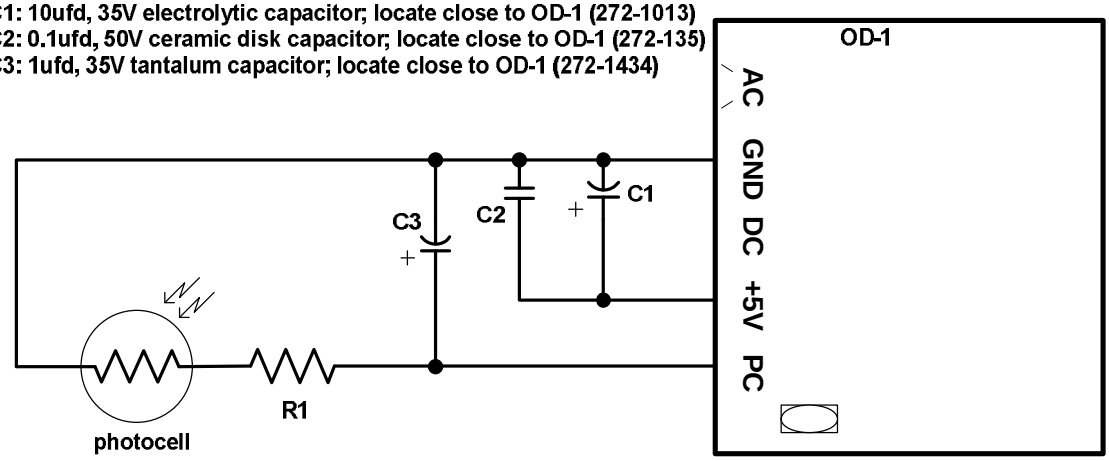
Multiple photocells

An additional photocell (available from us at a cost of $2.00) can be used in order to increase the zone of detection. Wire the two photocells in series (i.e. connect one lead from photocell #1 to the GND terminal, connect the other lead from photocell #1 to one lead of photocell #2, connect the remaining lead of photocell #2 to the PC terminal).

Minimizing electrical noise effects from other sources that may cause false triggering

Switch machines, switch motors and electrical uncouplers are notorious for generating electrical noise when they are energized. Such noise can be inadvertently coupled onto the OD-1's photocell connections which can then lead to false triggering. The first remedy to try is to make sure that wiring for those devices is kept apart from the photocell wiring. Adding decoupling/filter components to the OD-1 circuit will usually eliminate the false triggering. The drawing below illustrates what needs to be done. Note that capacitors C1 and C3 are polarized so make sure you connect them correctly; C2 has no polarity. Also, pay attention to the component location as outlined below in the parts list. The numbers in parentheses are Radio Shack part numbers.

R1: 100 ohm, 1/4W resistor; locate close to photocell (271-1311)
C1: 10ufd, 35V electrolytic capacitor; locate close to OD-1 (272-1013)
C2: 0.1ufd, 50V ceramic disk capacitor; locate close to OD-1 (272-135)
C3: 1ufd, 35V tantalum capacitor; locate close to OD-1 (272-1434)



It may also be necessary to add filtering to the power source for the "offending" item. For example, if you are using switch motors powered by a DC (unipolar or bipolar) power source you may need to add filter capacitors to that power source. We suggest a 0.1ufd/50V ceramic disk capacitor (such as C2 above) in parallel with a 100ufd/35V electrolytic capacitor (similar to C1 above, but obviously a higher value). Connect them similar to the way C1 & C2 are connected above (i.e. positive lead to positive power output; negative lead to the negative power output or ground).

Finally, if noise problems still exist you may need to use coaxial cable for the photocell connections. Connect the shield of such a cable to GND terminal on the OD-1 and connect the center wire to the PC terminal.

Warranty

This product is warranted to be free from defects in materials or workmanship for a period of one year from the date of purchase. ***Logic Rail Technologies*** reserves the right to repair or replace a defective product. The product must be returned to ***Logic Rail Technologies*** in satisfactory condition. This warranty covers all defects incurred during normal use of this product. This warranty is void under the following conditions:

1) If damage to the product results from mishandling or abuse.
2) If the product has been altered in any way (e.g. soldering).
3) If the current or voltage limitations of the product have been exceeded.

Requests for warranty service must include a dated proof of purchase, a written description of the problem, and return shipping and handling ($6.00 inside U.S./$10.00 outside U.S. - U.S. funds only). Except as written above, no other warranty or guarantee, either expressed or implied by any other person, firm or corporation, applies to this product.

Troubleshooting

If the red output(s) is not on when the photocell is covered or stays on all the time you can perform the following tests. First, disconnect the photocell. With no photocell connected the OD-1 will turn on the red outputs and keep them on. If the green output stays on then the photocell might be faulty. You can also temporarily connect the GND terminal to the PC terminal. The OD-1 will turn on the green output and keep it on. If none of these tests yield the expected results then the OD-1 might be faulty and should be returned for repair.

Technical Support

We hope the preceding instructions are sufficient for answering any questions you might have about the installation of this product. However, technical support is available should you need it. We would ask that you first contact your place of purchase for assistance. If you still need further assistance then please do not hesitate to contact us. You can reach us via phone, mail and email; our contact information can be found on the top of page 1.