LOGIC RAIL™ TECHNOLOGIES

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Optical Detector (OD-1)

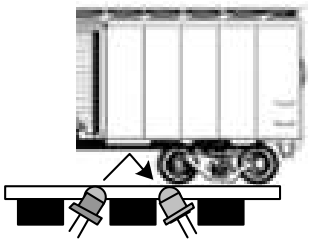
- Infrared detection version

Instructions

Revised 2/8/13

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 or OD-1-IR) provides detection using an Infrared (IR) emitter and detector. Detection is achieved when the IR beam from the emitter reflects off the underside of the train back down to the detector. **Despite the use of infrared components you could still encounter false triggering from overhead lighting. This is usually eliminated with angled sensor mounting and/or proper sensor sensitivity adjustment (page 3). This version of the OD-1 must be powered from either a 7-9V AC or 9-12V DC power source. Do NOT exceed these limits!** 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 IR beam is reflected by the train the red outputs will be activated and the green output will be deactivated. Once the IR beam no longer reflected 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.

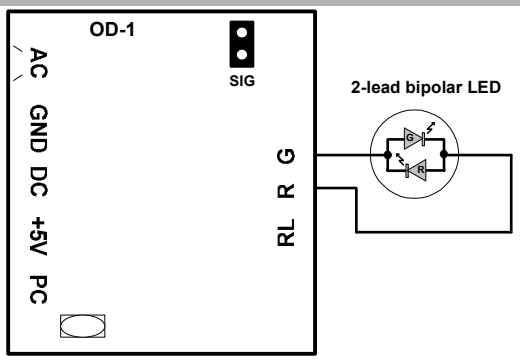


Figure 1 – 2-lead bipolar LED

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 (the smaller size one) 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.

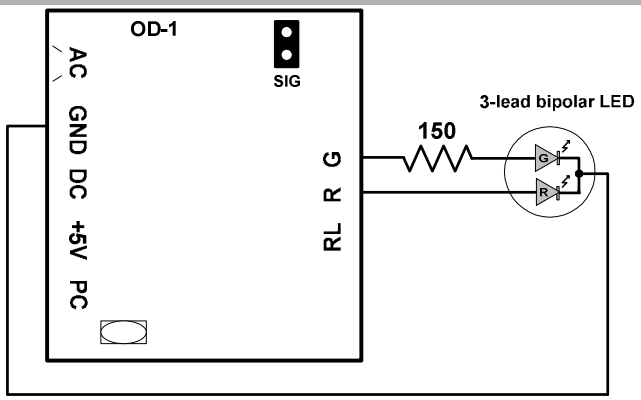


Figure 2 – 3-lead bipolar LED

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 (the smaller size one) 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.

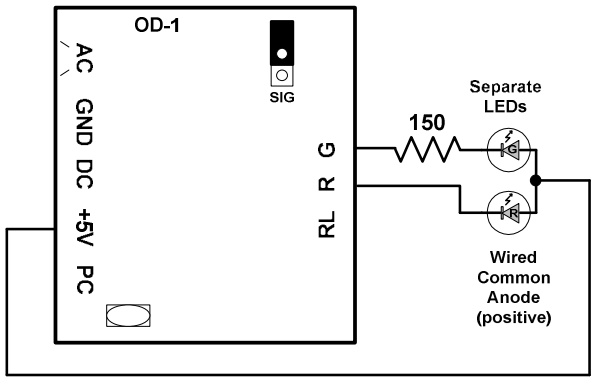


Figure 3 – Individual Red and Green LEDs (common anode)

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 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!

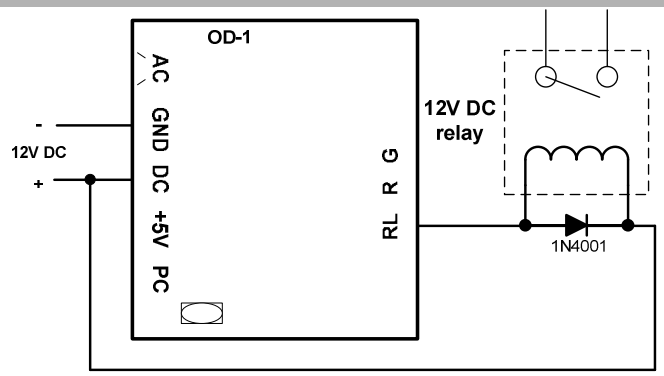


Figure 4 – Driving a relay

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.

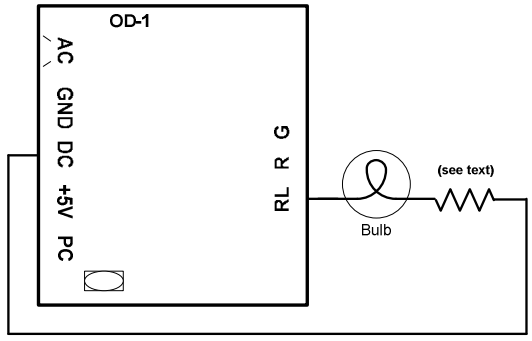


Figure 5 – Driving a lamp

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.

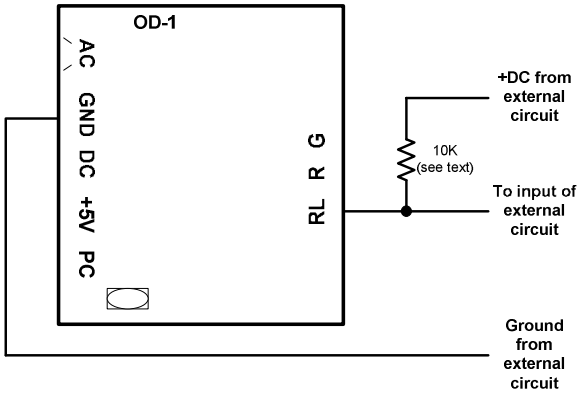


Figure 6 – Interfacing to an external circuit

Mounting and wiring the IR components

The IR components should be mounted between the rails. Drill two 11/64" holes, through the ballast, roadbed, and sub-roadbed. These holes should be located one tie apart (Figure 7a) and drilled at approximately a 45 to 60 degree angle from horizontal as illustrated in the side view in Figure 7b. The benefit of mounting them at an angle is reduced false triggering from overhead light and increased detection reliability in smaller scales or irregular bottoms on rolling stock. For the smaller scales this drilling may end up hitting the ties. Take your time so you don't mangle them! Insert the leads of one IR emitter (white and black wires) into one of the holes (it doesn't matter which one!) from the top of your layout. Repeat for the IR detector (blue and black wires). The tops of the components should sit no higher than the top of your ballast for optimal IR performance; in some cases (e.g. false triggering) it may be necessary to locate the components a little below the ballast line. You can extend the leads with similar (or larger) wire. We recommend soldering and insulating these connections. We also recommend using terminal blocks/strips since you'll have multiple DC and GND connections to make. Once you have wired the IR components and verified their operation you may wish to put a dab of white glue or silicone caulk where the wires exit the holes underneath the layout. This will help to hold the components in place; make sure you don't get any substance (e.g. ballast or glue) on the top surface of the IR components as this may prevent them from operating properly. In extreme cases where you may be getting interference from overhead lighting you can mount the IR detector in some plastic or metal tubing. You can also recess the IR detector slightly below the ties and roadbed.

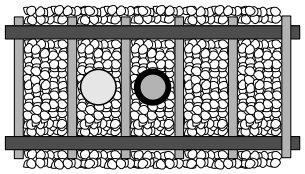


Figure 7a

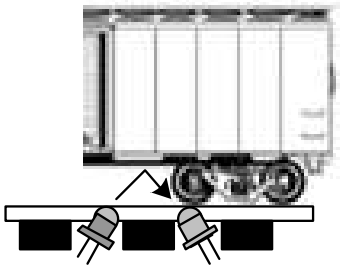


Figure 7b

Figure 8 illustrates the wiring for the IR components. The 150 ohm 1 Watt resistor (the larger one) is included with the OD-1. When properly wired the emitter will have a very faint red glow coming from it. You can also look at the emitter through a digital camera and see the infrared light! **For safety reasons do NOT point the IR emitter directly into your eye or stare at the IR emitter!!!**

You can adjust the sensitivity of the IR detector by inserting a small screwdriver in the component labeled "VR1". Turning the screwdriver clockwise will increase its sensitivity. With a piece of rolling stock covering the sensor turn the VR1 fully counter-clockwise and then slowly clockwise until the red output is activated. Then slightly turn the screwdriver a little more clockwise. Move the rolling stock away from the sensor and verify proper operation.

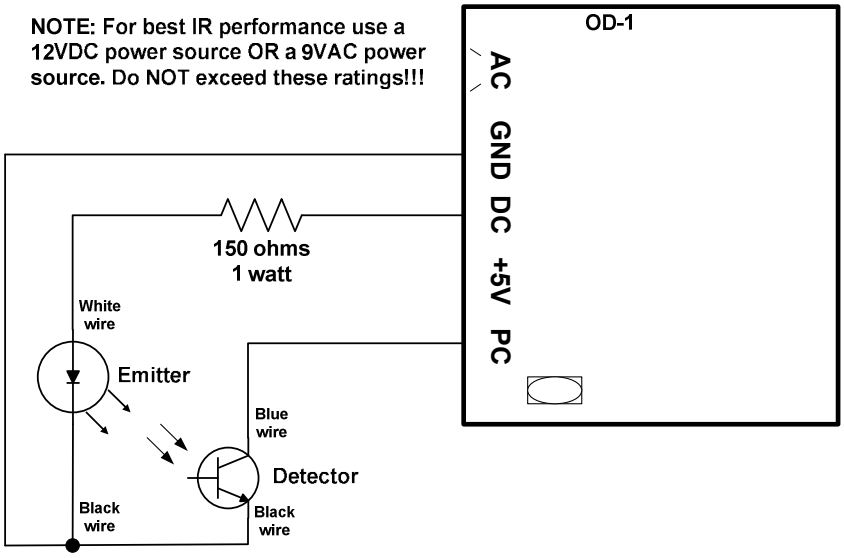


Figure 8 – IR component wiring

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 9.

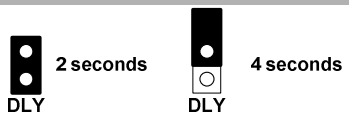


Figure 9 – Release delay

Power

The OD-1-IR accepts 7-9V AC or 9-12V DC power. Power consumption when just using the LED outputs is approximately 100mA (including the LED(s)). If you are only using a single OD-1-IR then use the TWO AC terminals to provide power (polarity doesn't matter). CAUTION: Most AC or DC accessory terminals on your throttle/power pack exceed 12V and cannot be used with the OD-1-IR! However, you can use those power sources in conjunction with our 12VPSR which will provide 12V DC. If you are using more than one OD-1-IR you can power them all from a single 9-12V **DC** source as shown in Figure 10.

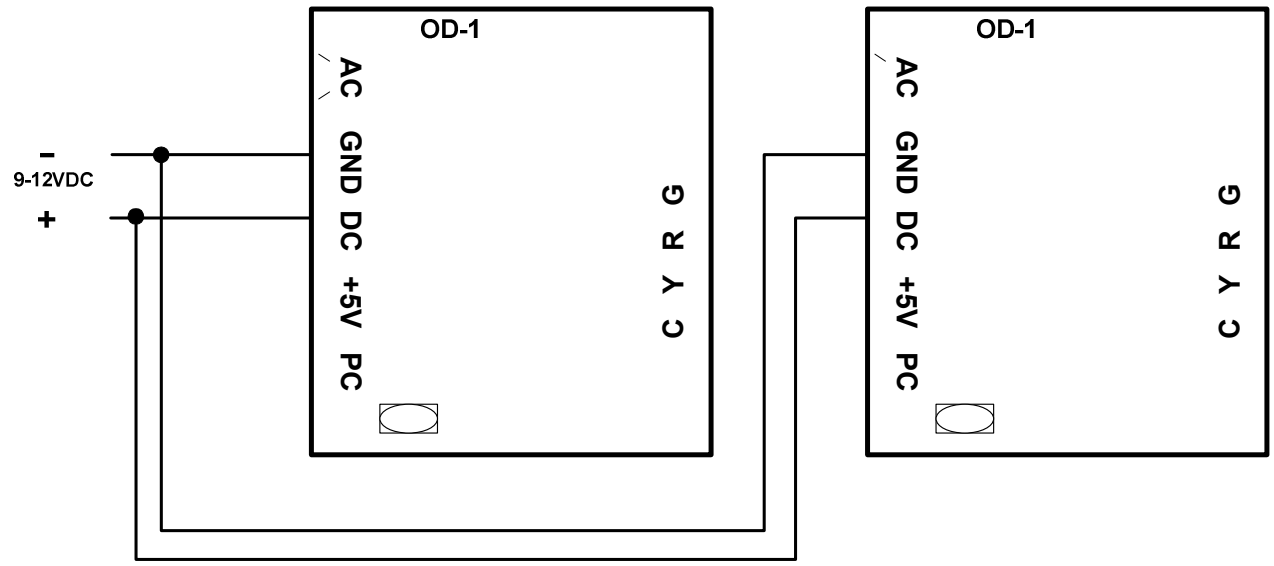


Figure 10 – DC power

Multiple IR sensor sets

If you wish to increase the zone of detection you can simply add additional sensor sets (available from us). You will wire the additional sensors the same way you did for the first set (i.e. per Figure 8). So for example, the blue wire from ALL of the detectors will connect to the PC terminal on the OD-1.

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 ($6.50 inside U.S./$15.00 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 OD-1 outputs are not changing when the sensor is activated or the red outputs stay active all the time you can perform the following tests. First, verify the sensor wiring and sensitivity adjustment previously described. If the red outputs stay active all the time then disconnect the sensor's blue wire. After the time delay the red outputs should be deactivated and the green output should be activated. If it does then there is a problem with the sensor. If the green output is never deactivated then temporarily connect a wire between the PC terminal and the GND terminal. The red outputs should immediately be activated. If not, then the OD-1 board should be returned to us for test/repair. If the red outputs were activated then disconnect the temporary wire. The OD-1 should proceed through its delay and then activate the green output. If so then the problem lies with the sensor.

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.