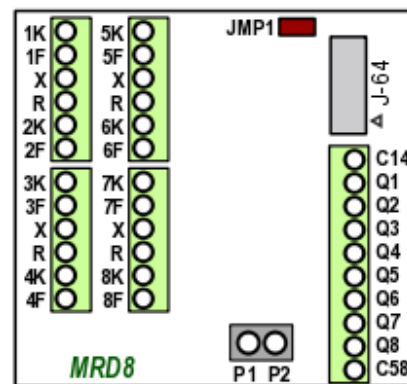


What it is: The MRD8 is an eight-channel model train detector. It can detect model trains at eight different locations on the layout and activate eight different electrical circuits.

Kit contents:

- ★ Circuit board
- ★ Eight infrared light-emitting diodes (IR LEDs) with orange & white (2 ft length) or red & white (6 ft length) wire leads
- ★ Eight infrared receivers with green & yellow (2 ft length) or blue & yellow (6 ft length) wire leads
- ★ 16 plastic mounting tubes. The tubes are for protection of the sensor leads and to provide mounting support. They are not essential for detector operation and may be shortened or removed entirely to best fit your situation. Just use caution to avoid damaging the leads.
- ★ Mounting screws



How it works: Trains are detected by infrared (IR) light, invisible to the human eye. There are two sensing elements at each track location - an IR LED light source paired with an IR receiver. The output relay contacts are electrically isolated from the detector electronics. Yellow LEDs on the MRD8 show the status of the detectors -- on if the circuit is detecting an object, off if no object is being detected.

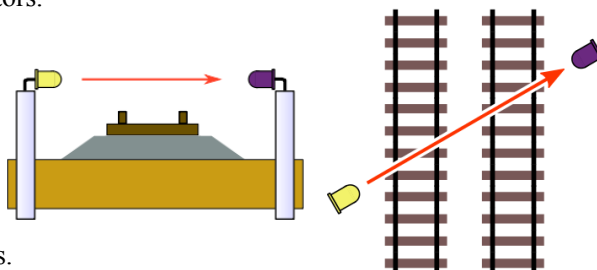
The output relay contacts are normally open ('N.O.'), they close when the corresponding detector is sensing an object.

Installation

There are four installation steps: Sensor installation, Power connection, Sensor adjustment, and Output connection.

First, install the sensors: Each sensor pair may be installed in one of two different ways - 'Across the Track' or 'Reflective.' Choose locations according to how you will use the detectors.

Across the Track sensing: The IR LED is positioned horizontally on one side of the track(s), and the IR receiver is placed on the opposite side. A train is detected when it blocks the light path between the IR LED and its receiver. The distance between the LED and receiver can be up to 18 in. (46cm), or more with careful alignment. Placing the sensors at an angle across the track(s) creates a longer detection zone and avoids possible detector flickering caused by the gaps between cars.

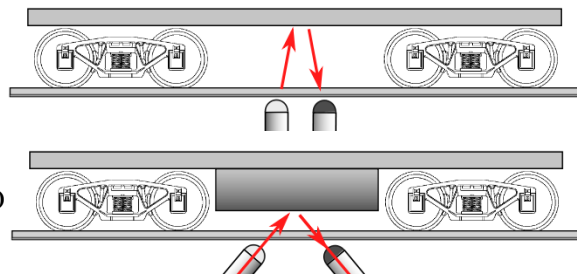


Tip #1 - If mounting the sensors vertically as shown here, slide the plastic tubes away from the sensor then carefully bend the leads to a right angle. The leads are somewhat brittle, bending them more than two or three times may cause a break.

Tip #2 - Locate the IR receiver so it faces away from bright lights or sunny windows. Use scenery or structures to conceal the sensors and shade them from room lighting.

Tip #3 - The detection zone of each detector can be expanded by adding a second IR LED/ receiver pair. Additional sensor pairs may be purchased from Azatrax, see the website www.azatrax.com for details.

Reflective sensing: Trains are detected when light from the IR LED is reflected off a train and sensed by the IR receiver. Typically the sensors are mounted in two #12 (3/16 inch or 4.8mm) holes drilled in the roadbed as shown here. Vertical installation works for S and larger scales as long as there is no structure above the track such as a bridge. Angling the IR LED and receiver toward each other is best for N and HO scale where the trains are close to the rail head, and in places where an object above the track might otherwise cause false detections. Angle the IR LED and receiver so their centerlines intersect at the height of the bottom of your rolling stock.



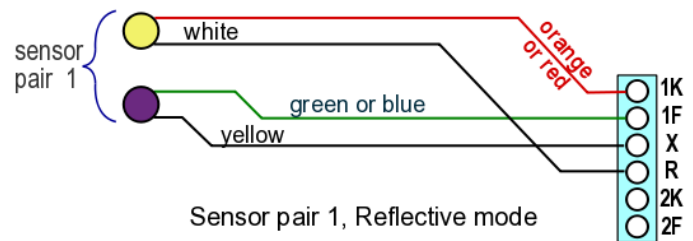
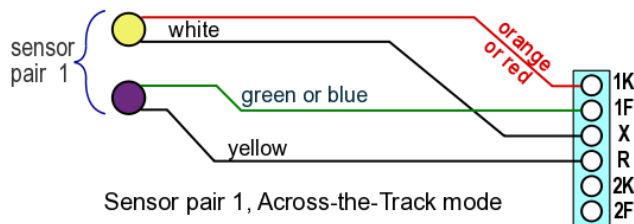
Tip #4 - You can ballast your track after sensors are installed. Cover each sensor with a bit of transparent tape. Apply ballast. When the glue has dried use a dental pick or similar tool to remove ballast from the sensors. An opening of just 1 or 2 mm is required.

Connecting wires to the terminal blocks: The MRD8 has 'spring cage' terminal blocks. Connections are made as follows:

- ♣ Strip 3/8 inch (1 cm) of insulation off the end of the wire. You can measure with the handy strip gauge printed on the edge of the circuit board.
- ♣ Use a small screwdriver to push down (push, do not turn) the terminal's button. Push firmly.
- ♣ Hold the wire at a 45 degree angle to the terminal block, and push it in. About 3/8 inch of wire should go into the terminal block.
- ♣ Release the button. Tug on the wire to make sure it is secure.

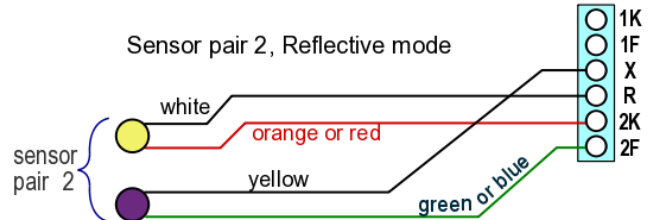


Connect sensor pair 1: Connect the orange (or red) wire from the IR LED to terminal 1K. Connect the green (or blue) wire from the IR receiver to terminal 1F. Now, how you connect the two white and yellow wires to the MRD8 will determine whether Detector 1 will operate in 'Across the Track' or 'Reflective' mode. See the diagrams below.



Add connections for sensor pair 2: Connect the orange (or red) wire from the IR LED to terminal 2K. Connect the green (or blue) wire from the IR receiver to terminal 2F. As with sensor pair 1, how you connect the two white and yellow wires will determine whether Detector 2 will operate in 'Across the Track' or 'Reflective' mode. Detector 2 can operate in the same mode as Detector 1, or in a different mode.

Note that when both sensor pairs are wired to the MRD8, there will be two white or yellow wires in 'X' and two white or yellow wires in 'R.'



Additional wire may be spliced to the sensor leads if needed. Use similar twisted pair wire for total length up to 25 ft (7.5m).

➡ **Pairing is important!** The IR LED that is connected to 1K must be paired on the layout with the IR receiver that is connected to 1F. And the IR LED that is connected to 2K must be paired on the layout with the IR receiver that is connected to 2F.

Test and adjust sensor pairs 1 & 2 as follows before connecting the rest of the sensors:

Connect power to the MRD8: Connect an accessory power supply of 8 to 15 volts AC or DC to terminals P1 & P2. The yellow LEDs will briefly flash to show that power is on and the circuit is working.

Adjust the sensors:

With no trains in any of the eight detection zones, all of the yellow LEDs on the MRD2 module should be off. If any LED is on, correct the false sensing condition.

To fix false sensing for Across-the-Track mode:

1. Verify that the sensor pair is wired correctly.
2. Make sure the IR LED and IR receiver are pointed at each other, and nothing is between them.
3. Shade the IR receiver from bright lights, and point it away from windows or other strong light sources.
4. Change the nearby room light from incandescent to a fluorescent bulb if possible.

To fix false sensing for Reflective mode:

1. Verify that the sensor pair is wired correctly.
2. Pull the IR LED and receiver a bit deeper into the roadbed.
3. Infrared light may be 'leaking' through the roadbed material from the IR LED to the receiver. Push a metal shim, such as the tip of a hobby knife blade, vertically into the roadbed between the IR LED and its receiver.
4. Is there an object above the sensor, such as a bridge, or an upper layout level? Mount the IR LED and its receiver at a shallower angle, or paint the object flat black. Or use across-the-track sensing.

Are all detectors now off? Now **test for train detection**. Place a locomotive or car in the detection zone of Detector 1. Yellow LED#1 should light. If yellow LED#2 also lights, re-adjust sensor pair 2 for false detection (see above). If LED#1 does not light, correct sensor pair 1 for a false clear condition.

To fix a false clear indication for Across-the-track mode:

1. Verify that the sensor pair is wired correctly.
2. Adjust the sensor height so the train is fully blocking the light path from the IR LED to its receiver.

To fix a false clear indication for Reflective mode:

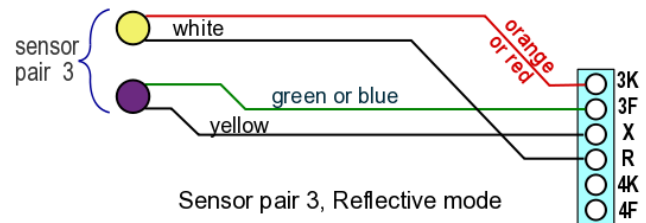
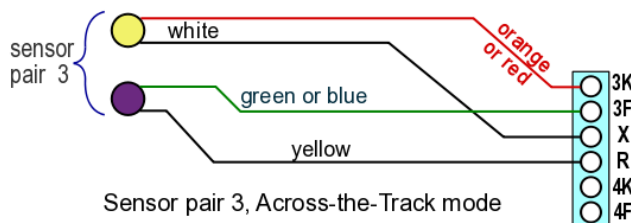
1. Verify that the sensor pair is wired correctly.
2. Adjust the sensors higher or lower in the roadbed.
3. A bright light source above and to the side of the track may be saturating the IR receiver. Try pulling it deeper into the roadbed or create shade with scenery or a structure. Change the nearby light from incandescent to a fluorescent bulb.

Test with several types of rolling stock and adjust the sensors as needed.

Remove the train from Detector 1's detection zone, make sure LED#1 goes out.

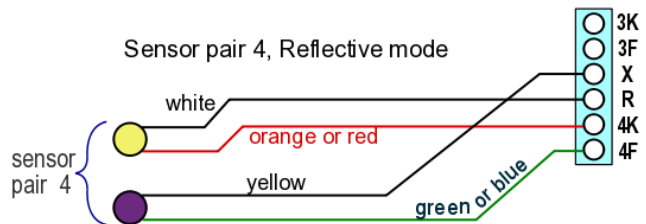
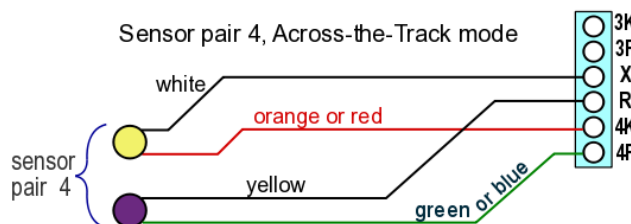
Place a train in Detector 2's detection zone. The yellow LED#2 should light. If LED#1 also turns on, adjust sensor pair 1 for false detection (see above). If LED#2 does not light, adjust sensor pair 2 for a false clear condition (same process as above for sensor pair 1).

Connect sensor pair 3: Turn off the power. Move on to the next input terminal block. Connect the orange (or red) wire from the IR LED to terminal 3K. Connect the green (or blue) wire from the IR receiver to terminal 3F. Again, how you connect the white and yellow wires to the MRD8 will determine whether Detector 3 will operate in 'Across the Track' or 'Reflective' mode. See the diagrams below.



Connect sensor pair 4: Connect the orange (or red) wire from the IR LED to terminal 4K. Connect the green (or blue) wire from the IR receiver to terminal 4F. As with the previous sensor pairs, how you connect the two white (or yellow) wires will determine whether Detector 4 will operate in 'Across the Track' or 'Reflective' mode. Detector 4 can operate in the same mode as Detector 3, or in a different mode.

When both sensor pairs are connected, there will be two white (or yellow) wires in 'X' and two white (or yellow) wires in 'R.'



Turn on power to test and adjust sensor pairs 3 & 4 the same way you tested sensor pairs 1 & 2 (see pg. 2). Once sensor pairs 1 - 4 are working properly, connect the remaining sensors in the same way.

Sensor pair 5:

IR LED orange (or red) wire to 5K. IR LED white wire to X (for across-the-track) or R (for reflective mode).
 IR receiver green (or blue) wire to 5F. IR receiver yellow wire to R (across-the-track) or X (reflective).

Sensor pair 6:

IR LED orange (or red) wire to 6K. IR LED white wire to X (for across-the-track) or R (for reflective mode).
 IR receiver green (or blue) wire to 6F. IR receiver yellow wire to R (across-the-track) or X (reflective).

Turn on power. Test and adjust sensor pairs 5 & 6, then turn off power.

Sensor pair 7:

IR LED orange (or red) wire to 7K. IR LED white wire to X (for across-the-track) or R (for reflective mode).
 IR receiver green (or blue) wire to 7F. IR receiver yellow wire to R (across-the-track) or X (reflective).

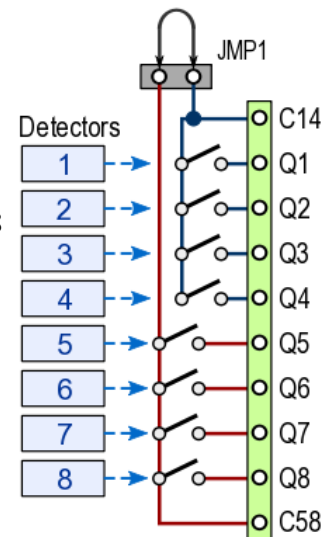
Sensor pair 8:

IR LED orange (or red) wire to 8K. IR LED white wire to X (for across-the-track) or R (for reflective mode).
 IR receiver green (or blue) wire to 8F. IR receiver yellow wire to R (across-the-track) or X (reflective).

Turn on power. Test and adjust sensor pairs 7 & 8.
 Congratulations! All of your sensors are connected and working.

Output connection

Terminals C14, Q1 - Q8 and C58 are the output connections. C14 is a 'common' connection to relays 1-4. C58 is a common connection to relays 5-8. C14 and C58 can be connected together by placing a shorting jumper on the two pins of JMP1. This jumper is installed when the MRD8 leaves the factory.



When detector circuit #1 senses an object, it turns on LED #1 and closes the Q1 relay contact. When detector #1 is not sensing an object, it turns off LED #1 and opens the Q1 relay contact. When detector circuit #2 senses an object, it turns on LED #2 and closes the Q2 relay contact. When detector #2 is not sensing an object, it turns off LED #2 and opens the Q2 relay contact.

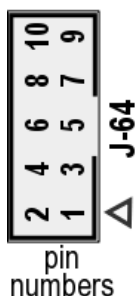
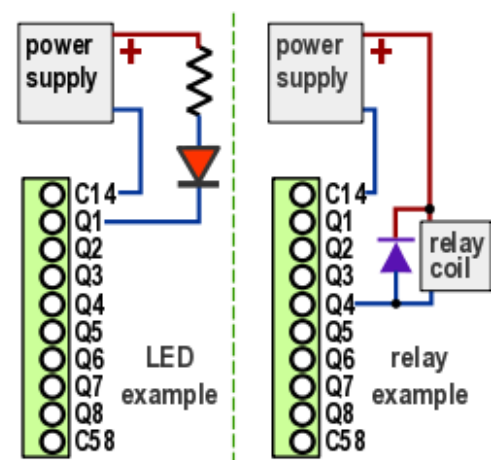
The other detector circuits operate in a similar manner.

The relays are solid state, not mechanical. When a relay contact is closed there is a measurable amount of resistance from the Qx terminal to either C14 or C58. The max specified resistance is 10 ohms, typically it is 2 - 3 ohms. Each relay can handle a maximum current of 200 mA (0.2 amps).

Note that the outputs do not provide any power, they are simply switches. The circuits to which they are connected must include a power supply.

The example on the left shows detector 1 controlling an LED signal. LEDs require a series resistor to limit current, otherwise the LED burns out quickly.

The second example shows detector 4 controlling a relay. A relay will allow the MRD8 to control higher current accessories. An inductive load like a relay or solenoid requires a diode to be connected across the coil. The diode will suppress the high reverse voltage that is generated when the coil current is switched off. Azatrax #MRAPR power relays have this diode built in, so an external diode is not needed with Azatrax relays.



| pin# | = | signal |
|------|---|--------|
| 10 | = | Q1 |
| 9 | = | Q2 |
| 8 | = | Q3 |
| 7 | = | Q4 |
| 6 | = | none |
| 5 | = | C14 |
| 4 | = | Q5 |
| 3 | = | Q6 |
| 2 | = | Q7 |
| 1 | = | Q8 |

Output connections are also available on connector J-64, which is compatible with RR-CirKits Tower 64™. When using the J-64 connector, make sure jumper JMP1 is in place so that all relay 'commons' will be connected to C14 (pin 5).

For more information see the Azatrax website, www.azatrax.com
 Tower 64 is a trademark of RR-CirKits, Waxhaw, NC.