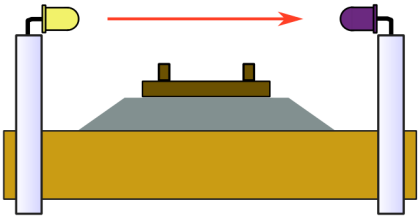
HexDetex™ Model Train Detector, Azatrax MRD6

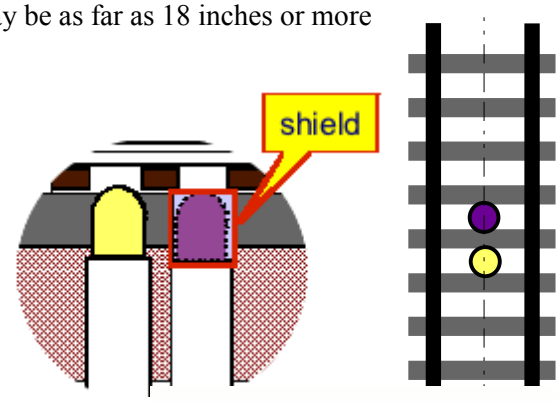
Installation Instructions

This circuit uses invisible infrared light beams to sense the presence of model trains at six different places on the track. The circuit is designed to operate the six inputs of an Azatrax MRX1 or MRXP crossing signal controller. It can also drive electronic logic circuits (+5 volts DC max) or LEDs, see the **Output Circuit** section below.
A pair of optical elements -- an infrared light emitting diode (IrLED) and a phototransistor -- are placed on the layout where trains are to be sensed. These can be arranged in two different ways:



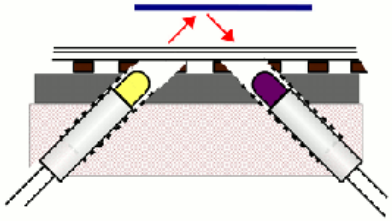
1. Across-the-track sensing: The light beam shines across the track(s), and a train is sensed when the light beam is blocked. The IrLED and phototransistor should be placed so that the light shines across the track at an angle. This will minimize flickering caused by the gap between the cars of a slow moving train. The phototransistor may be as far as 18 inches or more from the IrLED.

Adjust the height of the IrLED and photosensor so any piece of rolling stock, even an empty flat car, will block the light. It may help to shield the phototransistor from sunlight or bright incandescent room lighting by concealing it with a structure or scenery.

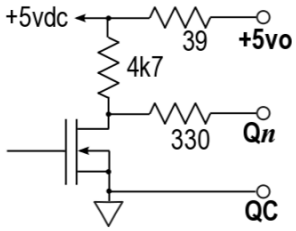


2. Reflective sensing: Light from the IrLED is reflected off a train and sensed by the phototransistor. Typically, the IrLED and phototransistor are placed in the roadbed, centered between the rails.

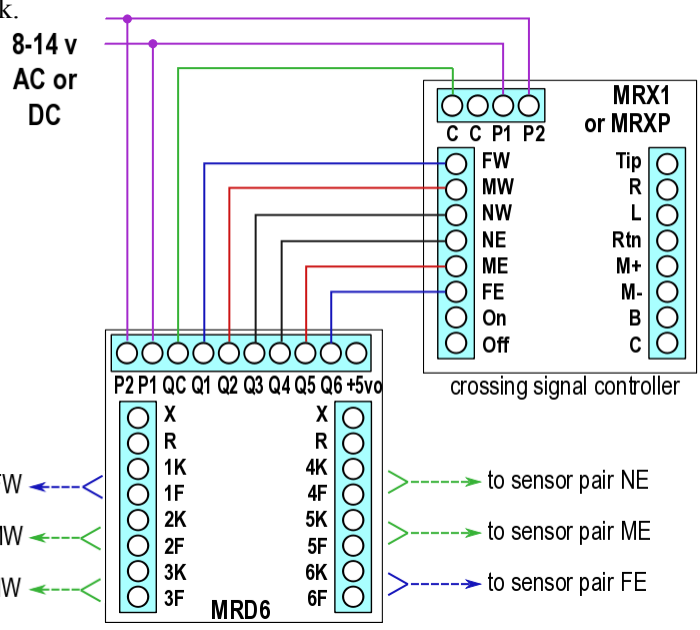
Drill two #12 (4.8mm) holes, approx. 0.25 to 0.5 in. apart (6 to 13mm), on the track centerline. 3/16 in. holes usually work, but can be quite snug.
Insert the IrLED and the phototransistor, with the two plastic tubes provided as shown. The tops of the IrLED and phototransistor must be below the top of the ties, and the roadbed material must be dense enough to prevent light from the IrLED from reaching the phototransistor directly.



N Scale Tip: When the IrLED and phototransistor are very close to each other, place a 1/4 inch length of 3/16 inch metal tubing over the IrLED or phototransistor. This will prevent light leakage that can cause false detections. Pushing the pointed end of a hobby knife blade between the two sensors often works also.
Drilling the holes at an angle as shown here has two advantages:
1 - Improved sensing of very close objects, such as N scale locomotives,
2 - Reduces false detections caused by structures above the track.



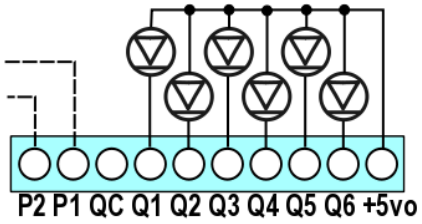
Output Circuit: Each output circuit (**Q1 - Q6**) is an 'open-drain' transistor circuit with a 4.7k pull-up resistor to +5 volts, in series with a 330 ohm resistor. **QC** is the logic 'common' connection. When a detector senses a train, its output transistor conducts, and its output terminal is pulled low.
When a detector does not sense a train, its output floats high.



Connecting to MRX1 or MRXP crossing controller:
Connect **QC** from the detector to any **C** terminal on the controller. Connect **Q1** through **Q6** from the detector to the sensor inputs on the controller (**FE, ME, NE, NW, MW** and **FW**).

LEDs: Six amber LEDs on the circuit module illuminate when their respective detectors are sensing a train, and are off when a train is not sensed. The red '**M**' LED indicates module status. It flashes once when power is applied. It will also flash if any of the six phototransistors are being saturated by bright room lighting (only for detectors that are wired for "Across the Track" operation). See Installation Tips below to fix this.

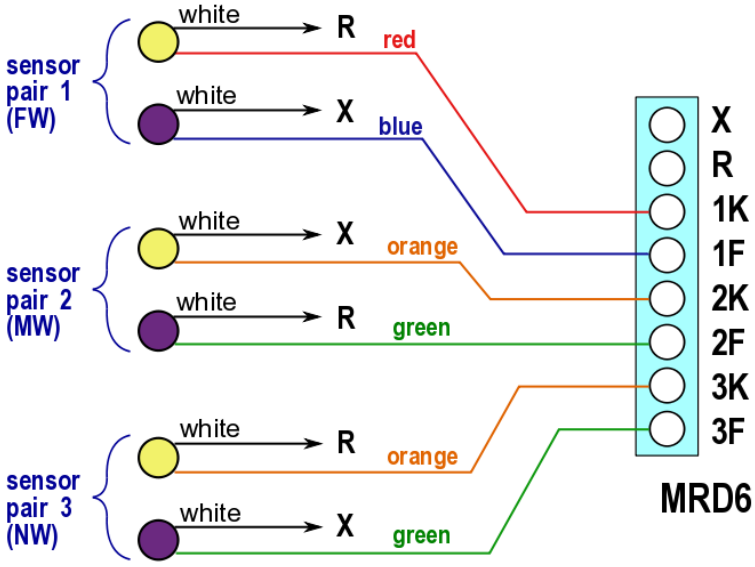
Remote LED Indicators: Rather than connecting to a logic circuit, outputs **Q1 - Q6** can drive remote LED indicators. Connect all LED anodes (+), usually the long lead, to the **+5vo** terminal. Connect the individual LED cathodes (-), usually the short lead, to outputs **Q1 - Q6**. Note that each output can ***not*** operate another logic circuit ***and*** a remote LED at the same time.



Power Supply: Connect a power source of 8 - 14 volts AC or DC to terminals P1 and P2.

Sensor Wiring: Each IrLED has a red or orange wire connected to its cathode (**K**), and a white wire connected to its anode. Each phototransistor has a blue or green wire connected to its emitter (**F**), and a white wire connected to its collector. Blue and red wires indicate 6-foot wire length, orange and green wires indicate 2-foot wire length.

How you wire a sensor pair to the MRD6 module determines reflective or across-the-track operation. For each **sensor pair**, connect the **red** or **orange wire** from the IrLED to a '**K**' terminal (1K, 2K, 3K, etc.). Connect the **blue** or **green wire** from the phototransistor to the corresponding '**F**' terminal.
For **Reflective Mode** operation, connect the **white wire** from the IrLED to the '**R**' terminal, and the **white wire** from the phototransistor to the **'X'** terminal.
For **Across-the-Track** operation, connect the **white wire** from the IrLED to the '**X**' terminal, and the **white wire** from the phototransistor to the **'R'** terminal.



In the example shown here, sensor pairs 1 & 3 are wired for Reflective Mode operation, and sensor pair 2 is wired for Across-the-Track operation.
This is only an example. ***You may wire any sensor pair for Reflective or Across-the-Track operation.***

Connect sensor pairs 4, 5 & 6 in similar fashion to the opposite terminal block on the MRD6.
Three white wires will be connected to each **X** terminal. For reliable connections, *twist the ends of these wires together* before inserting in the terminal block. Do the same for the three white wires that go to each **R** terminal.

Installation Tips

Room lighting normally will not interfere with detector operation, but to be sure --
Across-the-track mode: Use scenery or structures to shield the phototransistor from sunlight or bright incandescent room lights. Bright ambient light can cause a false 'train is present' indication. If the phototransistor is pointing toward the bright light source, try swapping the positions of the IrLED and phototransistor, so the phototransistor points away from the bright light source.
Reflective mode: When the IrLED and phototransistor are in the track roadbed, the train will shade the phototransistor from the room lights. However, some cars such as tank cars may allow enough light from sources to the side of the track to saturate the phototransistor and prevent sensing the train. In this case, try: 1) pushing the phototransistor lower into the roadbed, 2) changing the light source from incandescent to fluorescent, 3) creating shade with scenery or structures, or 4) using across-the-track sensing instead of reflective sensing.

More information and assistance is available from the Azatrax website: www.azatrax.com