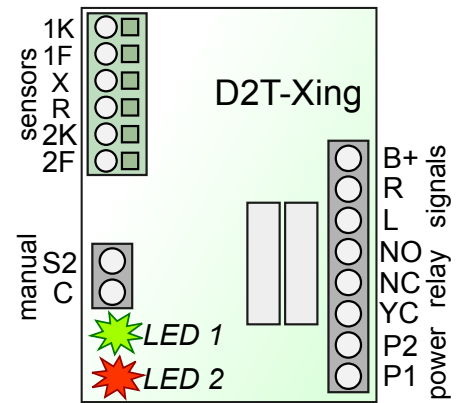


**What it is:** The D2T-Xing is a two-channel model train detector using advanced infrared ('IR') technology. It detects trains moving across its two IR sensors and can activate road crossing signals and related accessories at a highway grade crossing.

**Kit contents:**

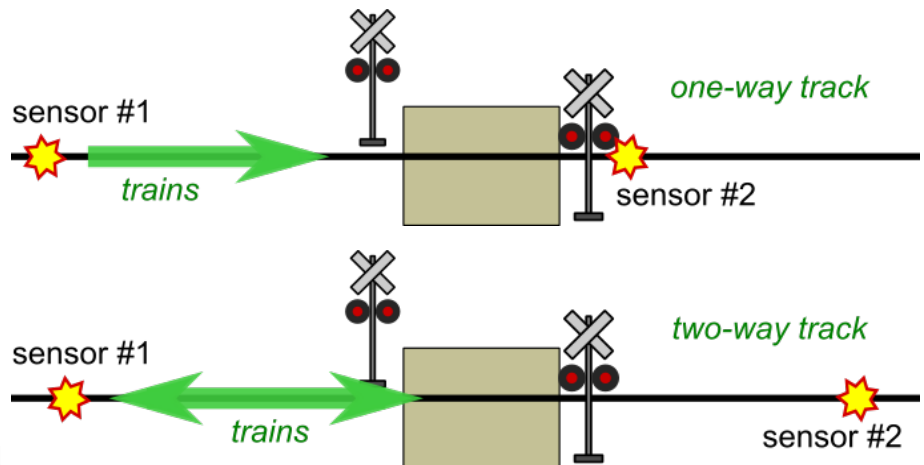
- ★ Circuit board
- ★ Two infrared light sources (IR LEDs) with red & white wire leads
- ★ Two IR receivers with blue & yellow wire leads
- ★ Four plastic mounting tubes. The tubes are for protection of the sensor leads and to provide mounting support. They are not essential for detector operation and may be shortened or removed entirely to best fit your situation. Use caution, do not damage the leads.



**How it works:** Trains are detected by infrared (IR) light, invisible to the human eye. There are two sensing elements at each sensor location - an IR LED light source paired with an IR receiver.

Green and red LEDs on the D2T show the status of the detectors and whether the crossing is 'clear' (green) or 'hot' (red).

**One-way train traffic:** When an approaching train triggers the first sensor the crossing signals will begin operating. Place IR sensor #1 far enough from the crossing to ensure sufficient warning time. Place IR sensor #2 just past the edge of the road.



As long as either sensor is detecting a train, the signals will be on. When the end of the train clears the second sensor, the signals will turn off. If the end of a short train clears the first sensor before the front of the train reaches the second sensor, the signals will stay on for 12 seconds to give the train time to reach the second sensor.

**Two-way train traffic:** Place the second sensor farther away from the road so a train approaching in the opposite direction will turn on the signals with sufficient warning time. In this case the signals remain on for a longer time after the train clears the highway. In some layout situations this is an acceptable tradeoff for the reduced effort of installing only two IR sensors.

For more sophisticated two-way operation that turns off the signals as soon as the train clears the highway in either direction, use an Azatrax MRX3 crossing signal controller with four or even six IR sensors.

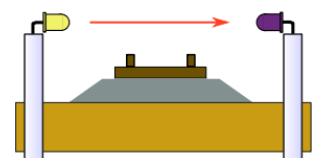
What if a train trips the first sensor, then stops and backs up? If the second sensor does not detect a train within 15 seconds after the first sensors clears, the D2T will reset itself and will be ready to activate the signals when another train arrives.

**For this reason, place the two IR sensors close enough to each other so that a short, slow train will not leave the two IR sensors 'vacant' for more than 15 seconds.**

Install the sensors

Each sensor pair may be installed in one of two ways - 'Across the Track' or 'Reflective.'

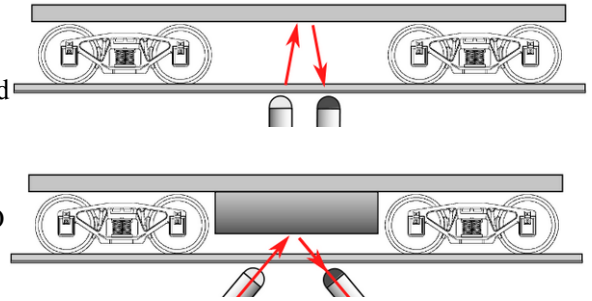
**Across the Track sensing:** The IR LED is positioned horizontally on one side of the track(s), and its IR receiver is placed on the opposite side. A train is detected when it blocks the light path between the LED and receiver. The distance between the LED and its receiver can be up to 18 in. (46 cm). With careful alignment longer distances can be achieved.



**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 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.

**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, O and larger scales as long as there is no structure above the track such as a bridge.



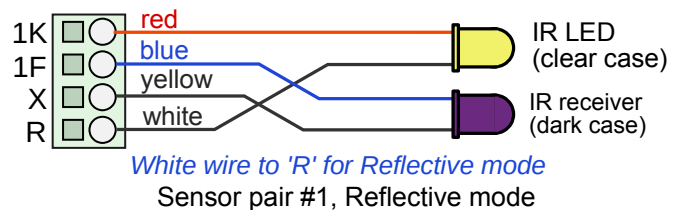
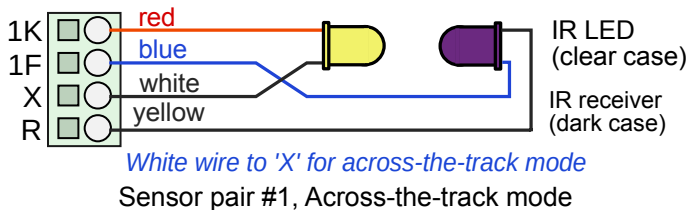
Angling the IR LED and receiver toward each other is best for N and HO scale where the trains are close to the rail head, and in places where an object above the track might otherwise cause false detections. Angle the IR LED and receiver so their centerlines intersect at the height of the bottom of your rolling stock.

**Tip #3** - 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, pick off ballast from the sensors. An opening of only 1 or 2 mm is required.

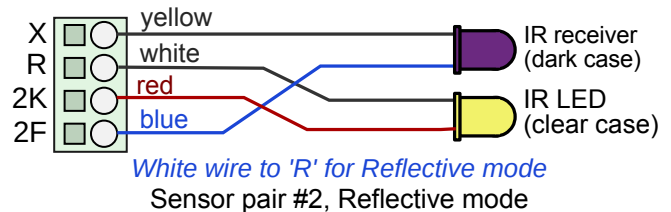
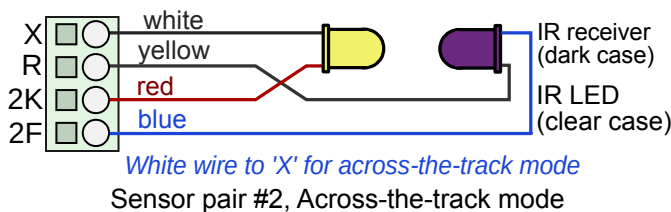
Connect the sensors to the D2T circuit board

**Connect sensor pair 1:** How you connect the IR LED and its receiver to the D2T module determines whether Detector #1 operates in 'Across the Track' or 'Reflective' mode. Strip the end of the sensor wire. Firmly push down the square button on the terminal block and insert the wire at a 45° angle. Release the button and tug on the wire to verify it is secure.

Red wires connect to 'K.' Blue wires connect to 'F.'



**Add connections for sensor pair 2:** 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 D2T, there will be two white or yellow wires in terminals 'R' and 'X.' Additional wire may be spliced to the sensor leads if needed. Use similar twisted pair wire for total length up to 26 ft (8 m).



**On-board LEDs:** A green and a red LED show the status of the sensors.

A flashing green LED indicates that IR sensor pair #1 is detecting a train or other object.

A flashing red LED indicates that IR sensor pair #2 is detecting a train or other object.

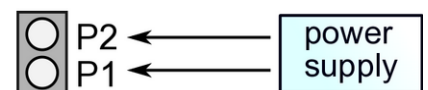
A steady green LED indicates the sensors are clear and the crossing is clear.

A steady red LED indicates the train cleared the first sensor pair but has not yet cleared the second sensor pair, and the signals should be active.



Power Connection

Connect an accessory power supply to terminals 'P1' & 'P2.' Voltage should be 9 to 16 volts AC or DC, +/- polarity does not matter.



**Always turn power off before making connections to the D2T-Xing.**

Adjust the sensors / troubleshooting:

With no trains in either detection zone, the green and red LEDs on the D2T should not be flashing. If either LED is flashing, 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 its receiver are pointed at each other, and nothing is between them.
3. Shade the 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 or LED 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 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 overhead object black. Or use across-the-track sensing.

If both detectors are off, **test for train detection.** Place a locomotive or car in the detection zone of IR sensor pair #1. The on-board green LED #1 should flash. If the red LED #2 also flashes, re-adjust IR sensor pair #2 for false detection (see above). If the green LED does not flash, 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. Pull the receiver deeper into the roadbed or create shade with scenery or a structure. Or change the nearby light to a fluorescent or LED bulb.

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

Remove the train from IR sensor #1's detection zone, make sure the green LED stops flashing.

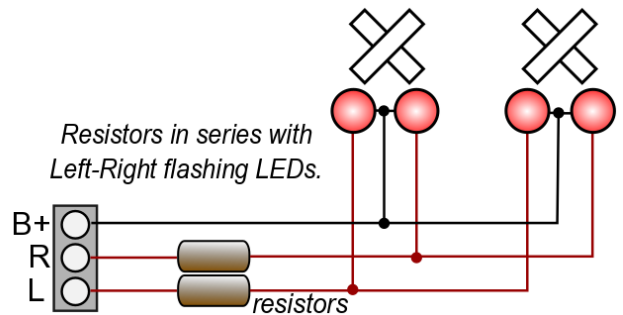
Place a train in IR sensor #2's detection zone. The on-board red LED should flash. If the red LED does not flash, adjust sensor pair #2 for a false clear condition (same as above for sensor pair #1).

Signal Connections

Flashing signals with LEDs or with small incandescent bulbs can be connected to the D2T terminals 'L,' 'R' and 'B+.' The D2T can supply up to 0.5 amp (500 mA) of current to the lamps.

**LED signals must be wired in 'common anode' (+) configuration.**

Most commercially made LED signals are wired this way, including those made by Tomar, NJ International and Walthers.

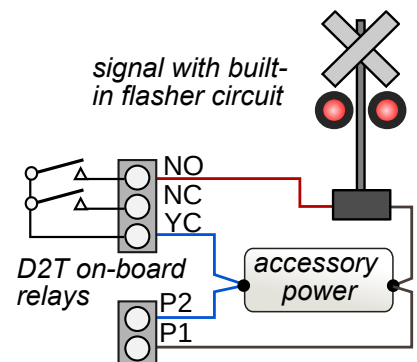


**LED signals must have resistors wired in series to limit the LED current.** A resistor may be wired in series with the L and R signal wires (two resistors total). Or one resistor may be wired in series with the 'base' ('common') signal wire.

If the LEDs seem too bright, use higher value (more ohms) resistors, or a third resistor may be wired in series with the 'base' lead.

Lights connected to 'L' and 'R' will flash alternately. 'B+' is the 'base' or the 'common' connection to the signals.

The D2T has two single pole (SPST) relays on board. The contact of the 'normally open' relay is connected to terminals 'YC' and 'NO.' This relay is 'on' when the crossing signals are active.

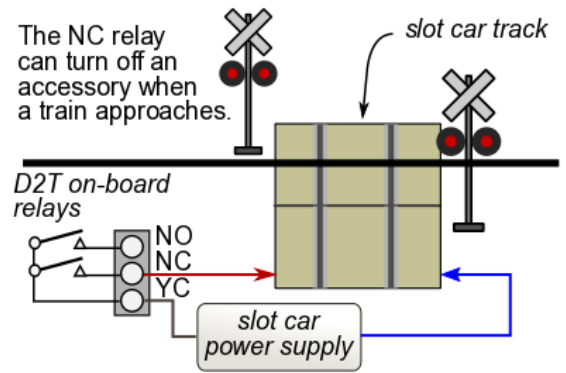


The contact of the 'normally closed' relay is connected to terminals 'YC' and 'NC.' This relay is 'on' when the signals are off. Terminal 'YC' is common to both relays.

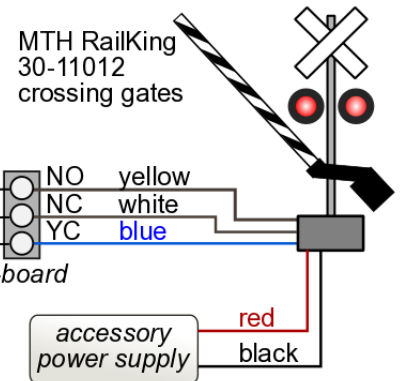
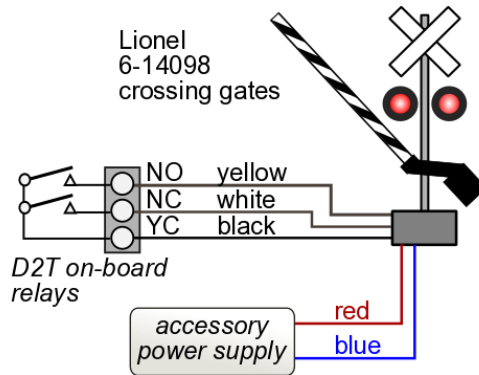
Both relay contacts are open when power to the D2T is off.

These relay contacts act as electrical switches, they 'make' (connect) or 'break' (disconnect) a circuit. *No voltage is provided by the D2T at these terminals.* Your circuit must include a power supply appropriate for the accessory you are controlling.

A note about railroad and slot car crossings: Use the D2T to shut off power only to the section of slot car track that approaches the crossing. Make sure the roadway at the crossing itself always has power. You do not want to stop the slot cars when they are on the track!



**Lionel® 6-14098 crossing gates and MTH RailKing® 30-11012 crossing gates** have built-in gate motors and flasher circuits. They connect to all three relay terminals on the D2T circuit.

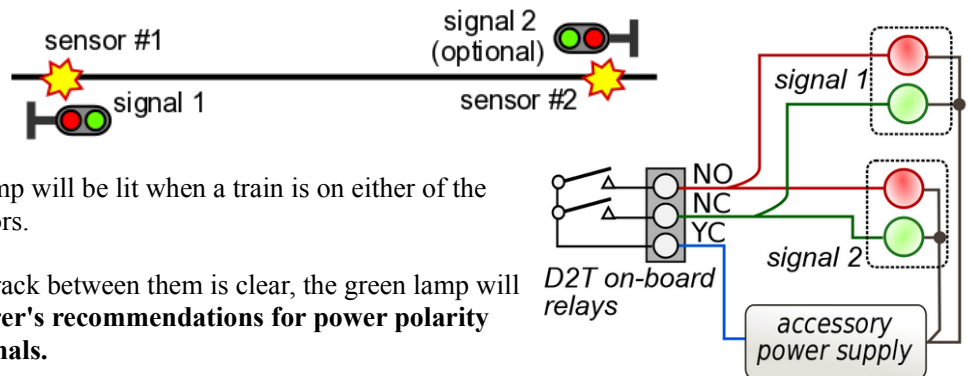


These crossing gates can

operate from a 12 to 16 volt power supply, DC or AC. This can be the same power supply that connects to D2T terminals P1 & P2, or it can be a separate supply.

### Block signal control

An alternate application of the on-board relays is to control green/red block occupancy signals. When connected as shown, the red signal lamp will be lit when a train is on either of the IR sensors, or in between the IR sensors.



When both sensors are clear and the track between them is clear, the green lamp will be lit. **Follow the signal manufacturer's recommendations for power polarity and the use of resistors for LED signals.**

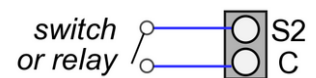
What if a train trips the first sensor, then stops and backs up? As with the crossing signals, if the second sensor does not detect a train within 15 seconds after the first sensors clears, the D2T will reset itself and will be ready to activate the signals when another train arrives.

***For this reason, place the two IR sensors close enough to each other so that a short, slow train will not leave the two IR sensors 'vacant' for more than 15 seconds.***

### Manual or remote activation

The crossing signals may be turned on remotely by a toggle switch or by a relay controlled by another circuit.

Connect the remote switch or relay contact to D2T-Xing terminals 'S2' and 'C'. When the switch is closed ('on'), the crossing signals will be activated. When the switch is open ('off') the D2T-Xing will resume its automatic operation.



### D2T-Xing circuit ratings:

Input power at P1 & P2: 9 to 16 volts ac or dc  
Flashing lamp current at L, R & B+: up to 0.5 amp (500mA), same voltage as applied to P1 & P2  
Relay contacts at YC, NC & NO: able to switch up to 3 amps, 28 volts max