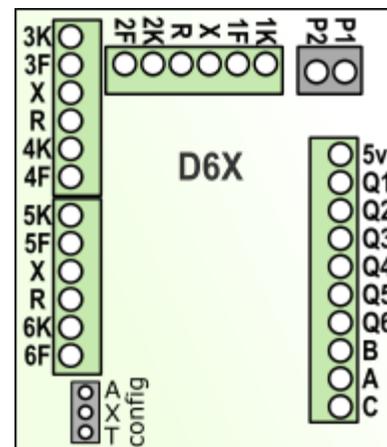


What it is: The D6X is a six-channel model train detector. It detects model trains at up to six different locations on the layout and can activate up to six remote LEDs, one for each detector. (Remote LEDs are not included.)

An on-board auxiliary relay can be used to turn on signals or other circuits depending on the sequence of sensor activations.

Kit contents:

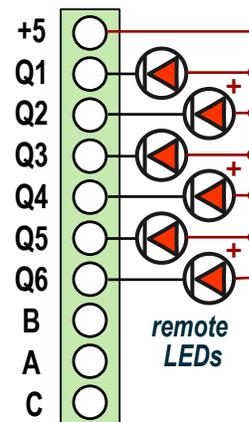
- ★ Circuit board
- ★ IR (infrared) LEDs with red & white wire leads
- ★ IR receivers with blue & yellow wire leads
- ★ Plastic mounting tubes. The tubes are for protection of the sensor leads and to provide mounting support. They are not essential for detector operation and may be shortened or removed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



How it works: Trains are detected by IR (infrared) 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. On-board yellow LEDs show the status of the detectors -- lit if the circuit is detecting an object, off if no object is detected. A red LED turns on when the auxiliary output relay is active.

Remote Indicators for Detectors

For all operating modes, the D6X will light a remote LED for each of the six detectors when a train is being detected. On-board resistors are included, so no other resistors are needed. An external resistor may be wired in series with each remote LED if you want to reduce the brightness. Connect the positive side (anode) of all remote LEDs to the +5 terminal. Connect the negative side (cathode) of each individual LED to one of the LED outputs, Q1 - Q6.



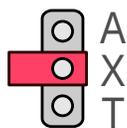
To switch higher currents or to achieve electrical isolation between the D6X and other circuits, use opto-isolators or solid state relays. The input of an opto-isolator or solid state relay connects to the D6X in the same way as a remote LED.

Auxiliary Relay Operation

On-board relay contacts are rated for a maximum of 0.35 amp and 24 volts.

Choose one of these three operating modes:

Grade Crossing Signal Trigger

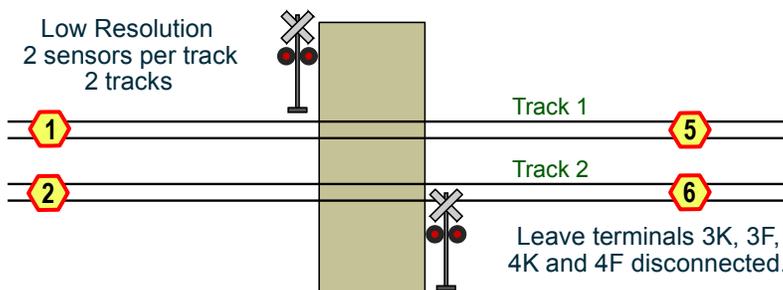


Place the Config jumper (small jumper block) on one pin only, or remove it entirely. When a train approaches the road crossing, the red 'B' LED turns on and the on-board relay connects terminal B to terminal C. This can be used to turn on a signal device or activate another circuit. After the train clears the crossing, terminal B is disconnected from C, and the on-board relay connects terminal A to C.

Place the sensors at track locations according to the these track plans. Sensor numbers are important! Connect sensor #1 to terminals 1K and 1F. Connect sensor #2 to 2K and 2F, etc. See page 3 for sensor installation details.

Two sensors per track,

single or double tracks: Signal turns on when a train on track 1 moves from left to right and triggers sensor #1. Signal stays on as long as the train is on either sensor 1 or sensor #5. If a short train leaves sensor #1 before reaching sensor #5 the signals will stay on for up to 30 seconds. Once the train clears sensor #5, the signals will turn off.

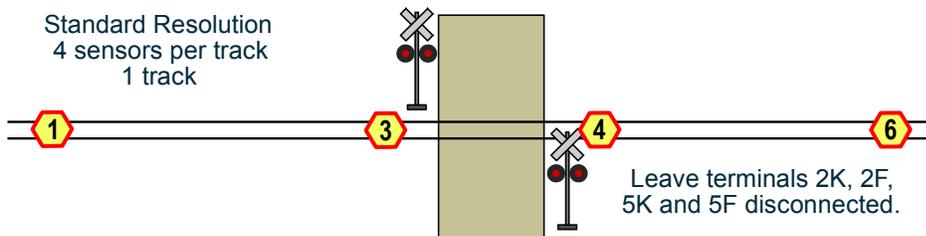


Similar operation happens if the train on track 1 moves from right to left, encountering sensor #5 first. Sensors #2 and #6 on track 2 operate in the same way as the sensors

on track 1.

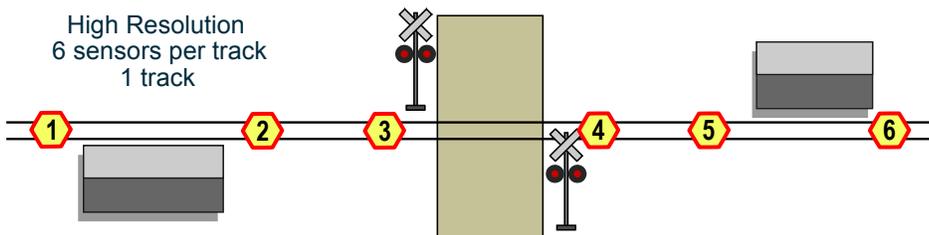
Four sensors, single track:

Signal turns on when a train moving left to right is detected by sensor #1. If the train does not reach sensor #3 within 30 seconds, whether it is still on sensor #1 or not, the signal will turn off. When the train does reach sensor #3, the signal remains on as long as the train is on either sensor #3 or #4. When the train clears both sensor #3 and sensor #4 the signal will turn off. Similar operation occurs when a train travels from right to left.



Five or six sensors, single track:

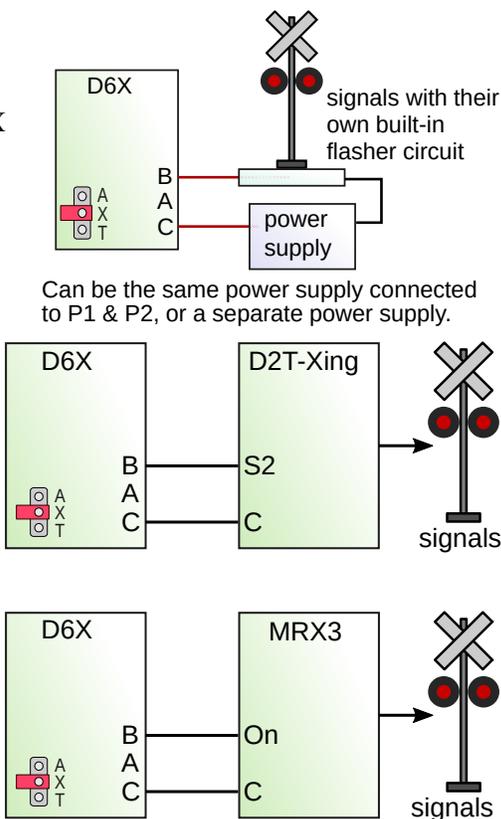
High resolution mode improves signal operation where trains stop or change direction within the crossing detection zone, or when trains of vastly different speeds use the same track. Signal turns on when a train moving left to right is detected by sensor #1. The train has 30 seconds to reach sensor #2 to keep the signal on. If the train stops before it reaches sensor #2, the signal will turn off even if part of the train remains on sensor #1. When the train starts again and moves toward the crossing, it trips sensor #2, which will turn the signals on again. The train has another 30 seconds to reach sensor #3, or else the signals will turn off. While the train is on either sensor #3 or sensor #4 the signal will stay on. Once the train clears sensors #3 and #4 the signal will turn off. Similar operation occurs when a train travels from right to left.



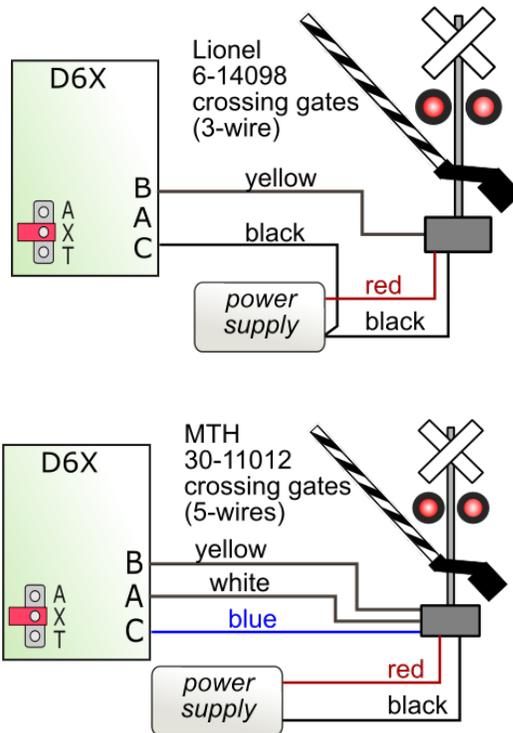
For signals that have their own built-in operating mechanism and only need to have power applied, the D6X can be connected directly to these signals.

The signal power supply can be the same power supply that is connected to D6X terminals P1 & P2, or it can be a separate power supply.

One or more D6X circuits can be used with an Azatrax D2T-Xing or MRX3 crossing controller to add protection for additional parallel tracks at the crossing.



Crossing configurations with turnouts are shown on page 6.



Hidden Track Occupancy Signal



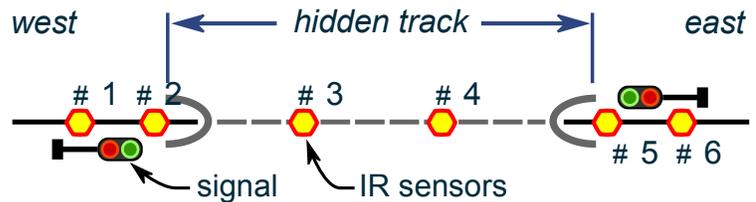
Place the Config jumper (small jumper block) so it bridges pins **T** and **X**. Two-light green/red signals can show whether a tunnel or other section of hidden track is occupied. Place two IR sensor sets at each end of the tunnel. The signals turn

red when a train enters the tunnel, and will turn green after a train exits the tunnel.

Two additional sensor sets can be placed within the tunnel to detect rolling stock that is in the tunnel when power is turned on, or that may have uncoupled from the rest of the train.

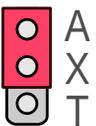
Spacing between sensors #1 & #2 should be about the length of the shortest locomotive. Similar spacing for sensors #5 & #6. See below for sensor installation details.

- Sensor 1, west entrance, outer
- Sensor 2, west entrance, inner
- Sensor 3, inside west (optional)
- Sensor 4, inside east (optional)
- Sensor 5, east entrance, inner
- Sensor 6, east entrance, outer



When power is turned on, the red signal will flash if none of the sensors are detecting a train. This tells you that the occupancy of the tunnel is uncertain. Normal signal operation begins after a train travels all the way through the tunnel.

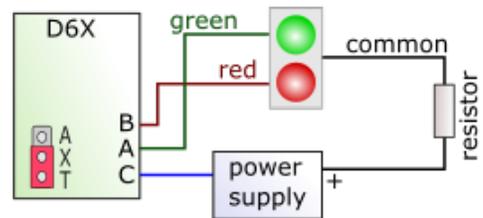
Any Detector Occupied



Place the Config jumper (small jumper block) so it bridges pins **A** and **X**. If any of the six detectors is occupied, the on-board relay connects terminal **B** to terminal **C**. Terminal **A** will be disconnected.

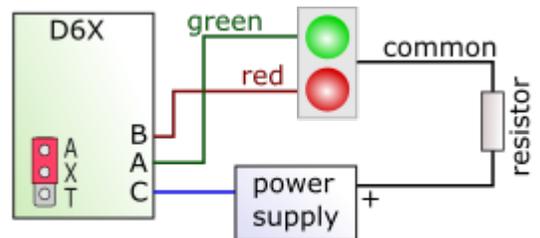
If all six detectors are vacant, the on-board relay connects terminal **A** to terminal **C**. Terminal **B** will be disconnected.

For LED signals, use resistors that are included with the signal, or add a resistor in series with the 'common' wire. Start with 1,000 ohms (1k) and adjust up or down for acceptable brightness.



Can be the same power supply connected to P1 & P2, or a separate power supply.

Use resistors included with the signal, or add a 1,000 ohm resistor to the common wire and adjust for brightness.

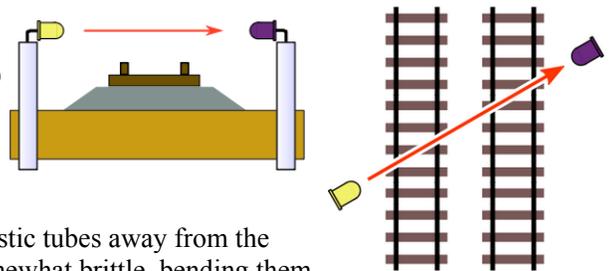


Can be the same power supply connected to P1 & P2, or a separate power supply.

Sensor Installation

Each sensor set may be installed in one of two different ways - 'Across the Track' or 'Reflective.' Choose locations according to how you will use the detectors. (See the three operating modes above.)

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 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.



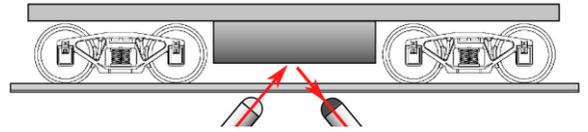
Tip #1 - If mounting the sensors vertically as shown here, slide the plastic tubes away from the sensor then carefully bend the leads to a right angle. The leads are somewhat brittle, bending them more than two or three times may cause a break.

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 set. Additional sensor

sets 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, O and larger scales as long as there is no structure above the track such as a bridge. Angling the IR LED and its 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 point at the same spot on 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.

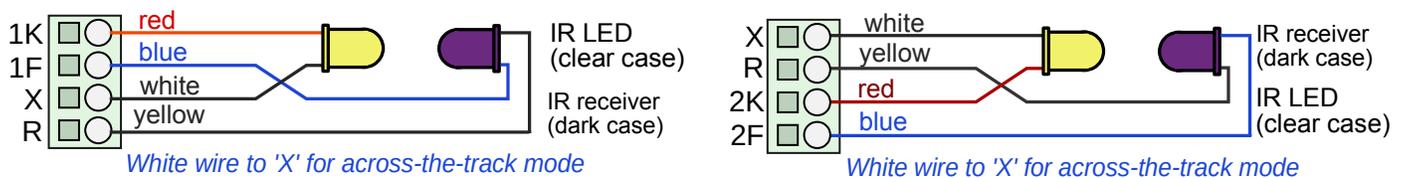
Connecting wires to the terminal blocks: The D6X has 'spring cage' terminal blocks. Connections are made as follows:

- ♣ Strip 3/8 inch (1 cm) of insulation off the end of the wire. You can measure with the strip gauge printed near the edge of the circuit board.
- ♣ Use a small screwdriver to push down (push, do not turn) the terminal's button. Push firmly.
- ♣ While the button is pushed in, 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.



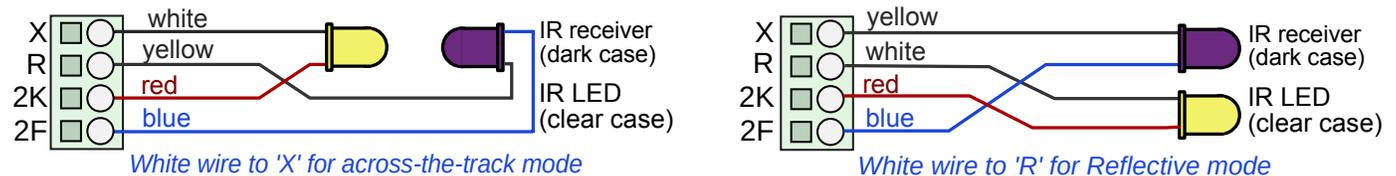
Connect sensor set 1: Connect the red wire from the IR LED to terminal 1K. Connect the blue wire from the IR receiver to terminal 1F. How you connect the white and yellow wires to the D6X will determine whether Detector 1 will operate in 'Across the Track' or 'Reflective' mode. See the diagrams below.

If using your own IR LEDs and receivers: The 'orange' wire is the LED cathode (-), the white wire is the anode (+). The green wire is the phototransistor (receiver) emitter (-), the yellow wire is the collector (+).



Add connections for sensor set 2: (If used -- not all configurations use sensor #2.) Connect the red wire from the IR LED to terminal 2K. Connect the blue wire from the IR receiver to terminal 2F. As with sensor set #1, how you connect the 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 sets are wired to the D6X, there will be two white (or yellow) wires in 'X' and two white (or yellow) wires in 'R.' Twist the ends of the wires together for a more reliable connection.

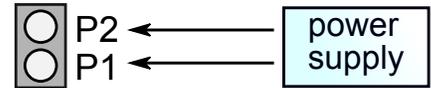


Additional wire may be spliced to the sensor leads if needed. Use similar twisted pair wire for a length up to 26 ft (8 m).

➡ 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 sets 1 & 2 as follows before connecting the rest of the sensors:

Connect power to the D6X: Connect an accessory power supply of 9 to 16 volts AC or DC to terminals P1 & P2. The red LED will briefly flash to show that power is on and the circuit is working.



Adjust the sensors:

With no trains in any of the detection zones, all of the yellow LEDs on the D6X module should be off. If any yellow LED is on, correct the false sensing condition.

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

1. Verify that the sensor set 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 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 or LED bulb if possible.

To fix false sensing for Reflective mode:

1. Verify that the sensor set is wired correctly.
2. Pull the IR LED and its 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 the sensors down below the tops of the ties. Thick black or brown paint or nail polish can be applied to the sides of the IR LED, ties and mounting holes to block the light path.
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 LED #1 does not light, correct sensor set #1 for a false clear condition.

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

1. Verify that the sensor set 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 set 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. 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 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 #2 does not light, adjust sensor set #2 for a false clear condition (same process as above for sensor set #1).

Repeat for the remaining sensor sets that are used with your configuration.

Sensor set 3:

- IR LED red wire to 3K. IR LED white wire to X (for across-the-track) or R (for reflective mode).
- IR receiver blue wire to 3F. IR receiver yellow to R (across-the-track) or X (reflective).

Sensor set 4:

- IR LED red wire to 4K. IR LED white wire to X (for across-the-track) or R (for reflective mode).
- IR receiver blue wire to 4F. IR receiver yellow to R (across-the-track) or X (reflective).

Sensor set 5:

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

Sensor set 6:

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

Grade crossings with a turnout nearby: *cont. from pg. 2*

When a track turnout is near the grade crossing, the D6X can adjust the signal operation according to the position of the turnout points (which way the train will go).

To make the D6X aware of the turnout position, the turnout points or the switch machine must have an electrical switch or contact that closes (makes contact) when the turnout is in the Reverse (diverging) position. This is called "feedback."

BluePoint and Caboose Industries have manual turnout mechanisms with built-in contacts. Tortoise and Cobalt are examples of powered switch machines that have built-in contacts.

If your powered switch machine does not have built-in contacts, Azatrax offers latching relays that can be used to provide position feedback to the D6X or to other signal controllers.

