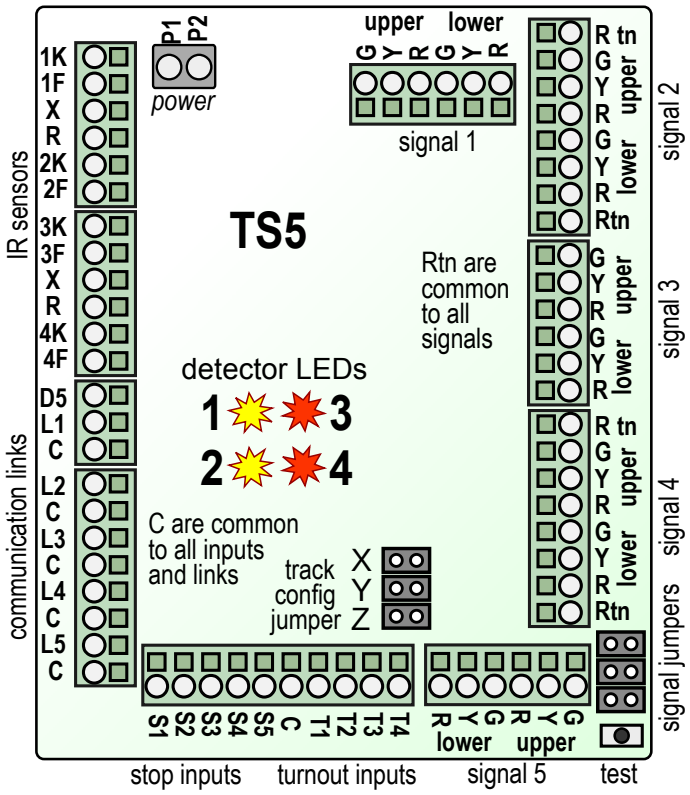
What it is: The TS5 operates up to five trackside signals, each with one or two heads, at a **control point** on a dual track mainline. A control point can be a single or dual crossover, or the end of a shared passing siding. Track configurations where the TS5 can be used are listed below. The TS5 can also control four intermediate signals on a dual-track mainline between control points.



Kit contents:

★ Circuit board
★ Four IR (infrared) light-emitting diodes (IR LEDs) with white and red leads
★ Four IR receivers with yellow and blue leads
★ Plastic mounting tubes for protection of the sensor leads and mounting support. Tubes are not essential for detector operation and may be shortened or removed entirely. Use caution to avoid damaging the leads.
★ 1,000 ohm resistors for interlocking functions (pg. 9)

Trains are sensed at the control point using IR (infrared) sensors that are independent of the room lighting. The TS5 does not require the rail to be cut into isolated blocks and does not require resistor wheel sets on the train cars.

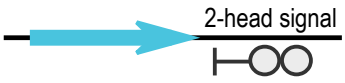
The TS5 includes four sensor pairs for detecting trains at four locations. **Some control point configurations need a 5th train detector**, designated as **D5** on the diagrams. An Azatrax MRD1-NV circuit can be used as this 5th detector. See page 6 for connection instructions.

TS5 circuits may be linked to up to five other Azatrax TSx series signal circuits so that successive block signals along the track will be properly coordinated.

"**TSx**" refers to any Azatrax circuit in the TS2, TS3, ... series.	Signals with incandescent bulbs need solid state relays such as Azatrax model SSR6 between the TS5 and the signals. See the Azatrax.com website for help.

Most types of LED block signals may be used. The TS5 automatically adjusts to the polarity of the signals (common anode vs. common cathode).

All signals must be of the same polarity.

This symbol represents a signal facing trains that are moving left to right.	
This symbol represents a signal facing trains that are moving right to left.	

Limitations: The TS5 only senses trains as they pass the detectors. Two TSx's, one at each end of a block, tell each other when a train enters or leaves a block, so they can deduce when the block is occupied or clear. Because the TS5 does not actually sense the physical presence of a train in the block, it can give false indications if part of a train becomes uncoupled and is left behind in the block, or if a train enters or leaves the block by some route other than the two ends that are monitored by TSx circuits. To compensate for this, see '**Interlocking Functions**' on pg. 9.

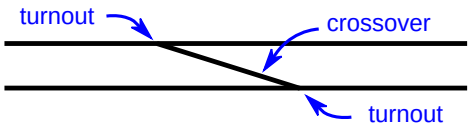
The star symbol shows the location of the designated IR sensor pair.	

Turnouts, whether manually or electrically operated, must have an electrical contact (switch) that indicates the turnout's position. The contact must be 'open' ('off') when the turnout is in the Normal (main route) position, and 'closed' ('on') when the turnout is Reversed (branch or diverging route). Turnout connections are shown on page 4.

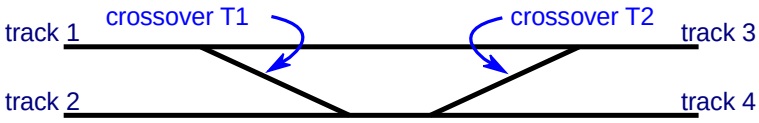
Some electric switch machines such as Tortoise, Cobalt and Kemtron have built-in contacts. If your switch machines do not

have built-in contacts, a relay can be connected to the switch machine. Relays for this purpose are available from Azatrax, see azatrax.com Manual switch throws with electrical contacts are available from Caboose Industries, BluePoint and others.

Crossover Turnouts -- The two turnouts of a crossover track should be mechanically or electrically linked so that they always work together. The TS5 assumes that both turnouts will be lined for the main (Normal) route, or that both will be lined for the crossover (Reverse) route.



Crossover labels, T1 & T2 -- Crossover T1 takes trains from track 1 to track 4. Crossover T2 takes trains from track 2 to track 3.



Select a track configuration:

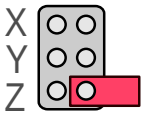
Find the track configuration that matches your control point and set the **'track config' jumper** (small rectangular connector block, or 'shunt') on the TS5 as shown below.

On the following diagrams, note carefully the track, sensor and signal numbers, and how they are arranged.

Mark all track numbers, signal and sensor locations directly on your layout with temporary tags. Compare your layout markings with the diagram. Rotate or flip the diagram as needed. When everything matches, then begin the installation.

Full page planning diagrams in multiple orientations can be downloaded from azatrax.com/cp

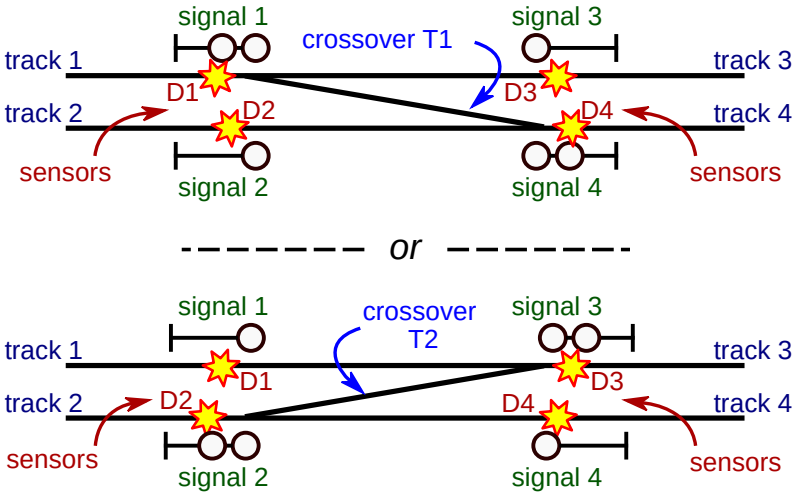
Single Crossover.



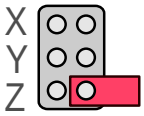
Track config jumper is off, or on one pin only.

Crossover T1 takes trains from track 1 to track 4.
Crossover T2 takes trains from track 2 to track 3.

Same jumper setting is used for intermediate signals where there are no crossovers.

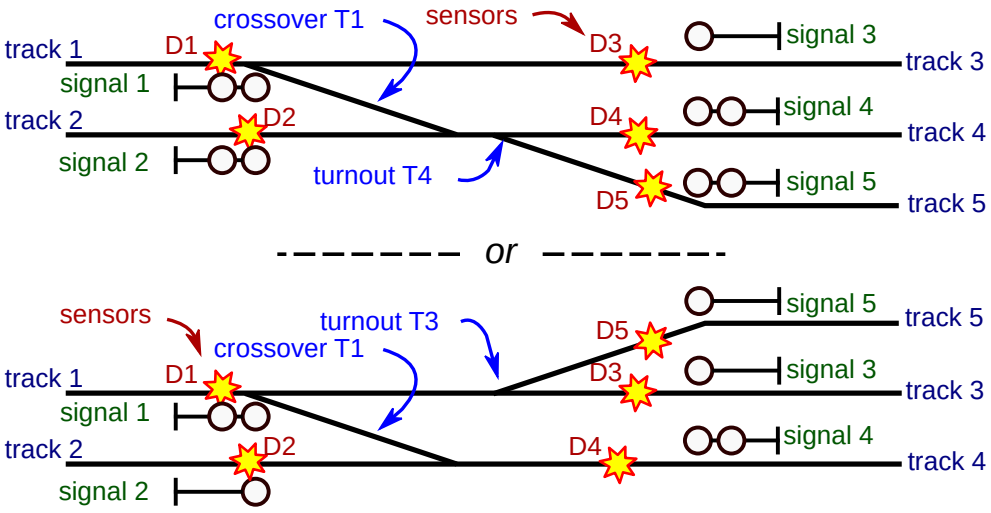


Single Crossover with a signaled branch.

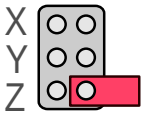


Track config jumper is off, or on one pin only.

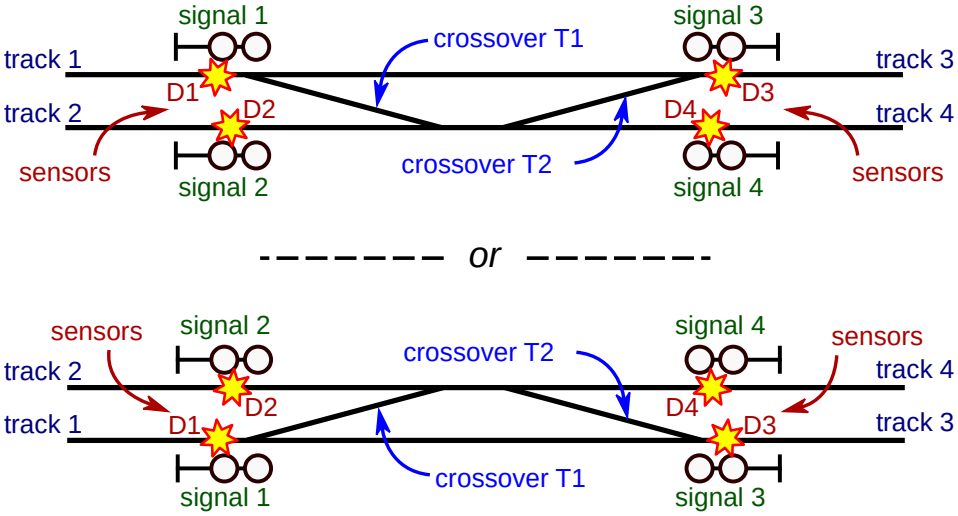
Same as the single crossover above, with a signaled branch joining track 4 at turnout T4, or joining track 3 at turnout T3.



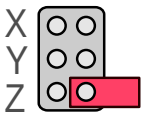
Dual Crossover.



Track config jumper is off, or on one pin only.

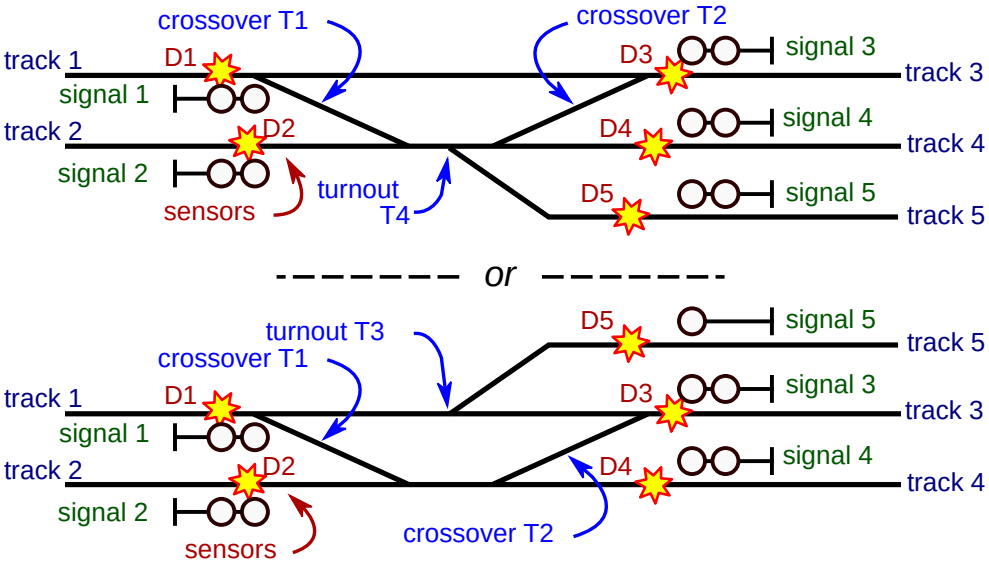


Dual Crossover with a signaled center branch.

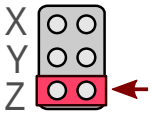


Track config jumper is off, or on one pin only.

The branch line joins main line track 3 or 4 at a turnout between the crossovers.

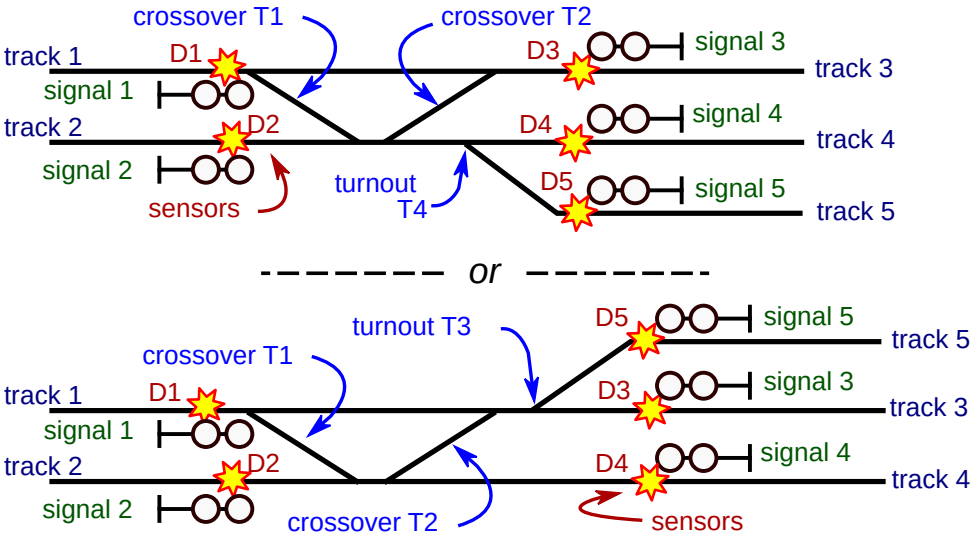


Dual Crossover with a signaled offset branch.

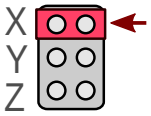


Place the track config jumper across both 'Z' pins.

The branch line joins main line track 3 or 4 at a turnout outside of the crossovers.

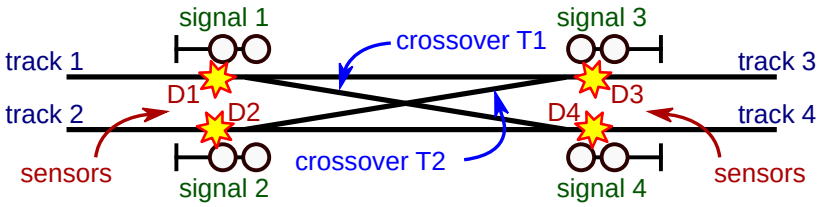


Scissors Crossover.

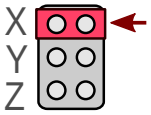


Place the config jumper across the two 'X' pins.

See Note X below.



Scissors Crossover with signaled branch.

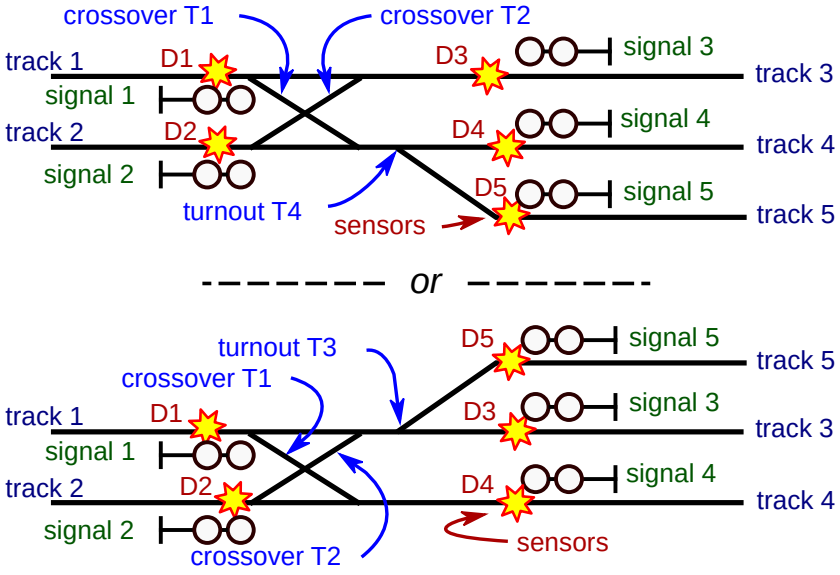


Place the config jumper across the two 'X' pins.

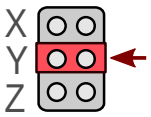
Note X: If both crossovers are lined for diverging route, the 'at rest' aspect of each signal will be 'stop' if there is another TSx controller linked on that track, or 'diverging approach' if the link is open.

The first train to approach the control point will get a 'clear' signal. All other signals will show 'stop' until the first train passes through the control point.

This prevents collisions at the crossing.

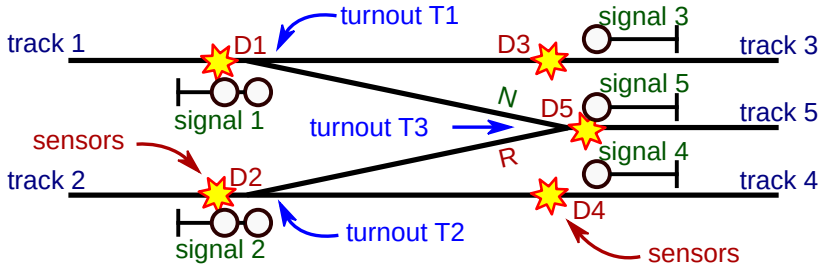


Shared Passing Siding.



Place the config jumper across the two 'Y' pins.

Track 5 is a passing siding shared by both main tracks. Use a second TS5 to control signals at the opposite end of the siding.



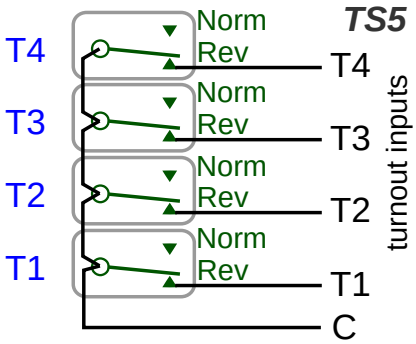
Turnout T3 indication -- Normal position is toward Track 1. Reverse position is toward track 2.

Turnout connections are required:

♦ Switch machine contacts or latching relays must be connected to the TS5 turnout inputs so the TS5 can be aware of turnouts that are set for a diverging route (Reverse).

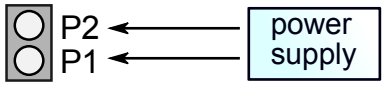
♦ For crossovers T1 & T2, only one contact is needed for each crossover, it may be linked to either turnout on that crossover. The contact must close (be 'on') when the crossover turnouts are lined for the crossover (Reverse), and must open (be 'off') when the turnouts are lined for the main line (Normal).

♦ For turnouts T1 & T2 (shared passing siding) and turnout T3 or T4, one contact is needed for each turnout. The contact must close (be 'on') when the turnout is lined for the crossover (Reverse), and must open (be 'off') when the turnout is lined for the main line (Normal).



♦ The four turnout/crossover inputs are not all used at the same time. Only connect the inputs called for in your track configuration diagram. Unused inputs are left open (no connection).

Connect power to the TS5: Connect an accessory power supply of **9 to 16 volts** AC or DC to terminals P1 & P2. The yellow and red LEDs will briefly flash to show that power is on and the circuit is working.

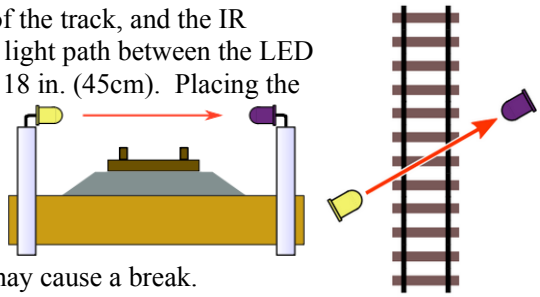


Turn power off before changing any connections.

Install the sensors: Each sensor pair (one IR LED and one IR receiver) may be installed in one of two different ways - 'Across-Track' or 'Reflective.'

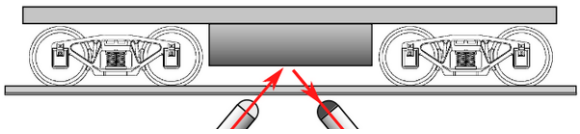
Place sensor pair **D1** just ahead of the turnout point rails on Track 1. Place sensor pair **D2** on Track 2, sensor pair **D3** on Track 3, and sensor pair **D4** on Track 4.

Across-Track sensing: The IR LED is positioned horizontally on one side of the track, and the 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 IR LED and its receiver can be up to 18 in. (45cm). Placing the sensors at an angle across the track avoids possible detector flickering caused by the gaps between cars.



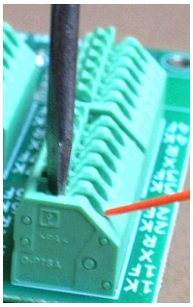
Tip #1 - If mounting the sensors vertically as shown here, slide the plastic tubes away from the sensor then carefully bend the leads to a right angle. The leads are somewhat brittle, bending them more than two or three times may cause a break.
Tip #2 - Locate the IR receiver so it faces away from bright lights or sunny windows. Use scenery or structures to conceal the sensors and shade them from bright light.

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 3/16-inch (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 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 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 use a dental pick or similar tool to remove ballast from the sensors. An opening of just 1 or 2 mm is required.

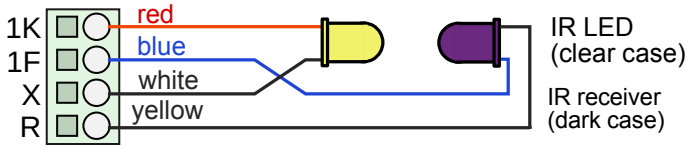


Connecting wires to the terminal blocks: The TS5 has 'spring cage' quick-connect terminal blocks.

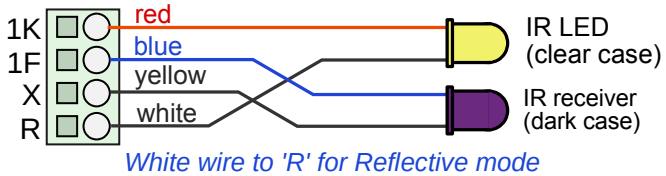
- Strip 3/8 inch (1 cm) of insulation off the end of the wire.
- Use a small screwdriver to push down (push, do not turn) the terminal's button. Push firmly.
- While the button is pushed in, hold the wire at a 45 degree angle to the terminal block and push it in. About 3/8 inch of wire should go into the terminal block.
- Release the button. Tug on the wire to make sure it is secure.

When two wires are connected to the same terminal, twist the bare ends of the wires together.

Connect D1 sensor pair: With power off, connect the red wire from the IR LED to terminal 1K. Connect the blue wire from the IR receiver to terminal 1F. Now, how you connect the white and yellow wires to the TS5 will determine whether the D1 detector will operate in 'Across-Track' or 'Reflective' mode.



White wire to 'X' for across-the-track mode

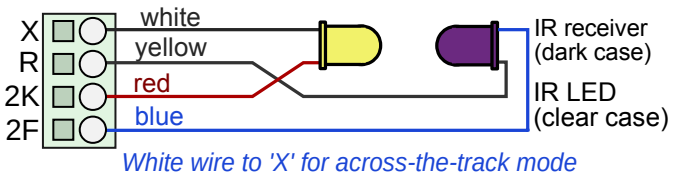


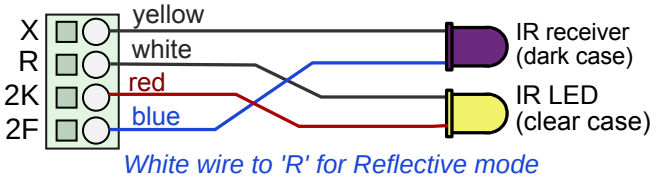
White wire to 'R' for Reflective mode

Test D1 before connecting the next sensor pair. Turn on power. When all sensors are clear of objects, all detector LEDs on the TS5 circuit board should be off. Place a rail car at sensor D1. Detector LED 1 should light. Remove the railcar and verify that LED 1 turns off. If not, see Sensor Troubleshooting below.

Connect D2 sensor pair: With power off, 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 D1, how you connect the white and yellow wires will determine whether the D2 detector will operate in 'Across-Track' or 'Reflective' mode.

When both sensor pairs are connected, there will be two yellow (or white) wires in 'X' and two white (or yellow) wires in 'R.' Where two wires share the same terminal, twist the bare wire ends together to ensure a reliable connection.



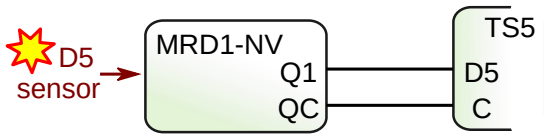


Test D2 before connecting the next sensor pair. Turn on power. When all sensors are clear of objects, all detector LEDs on the TS5 circuit board should be off. Place a rail car at sensor D2. Detector LED 2 should light. Remove the railcar and verify that LED 2 turns off. If not, see Sensor Troubleshooting below.

➽ **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. The IR LED that is connected to 2K must be paired with the IR receiver that is connected to 2F. Additional wire may be spliced to the sensor leads if needed. Use similar twisted pair wire for total length up to 26 ft (8m).

Install and test detectors D3 and D4 in the same manner as D1 and D2 above. The D3 sensors connect to terminals 3K, 3F, X and R. The D4 sensors connect to terminals 4K, 4F, X and R.

Detector D5, if needed, is an external detector circuit such as an Azatrax MRD1-NV. Install the infrared sensor and connect it to the MRD1-NV according to the MRD1-NV instructions. Then connect the MRD1-NV to the TS5 as shown here. The same power supply used for the TS5 may also be used for the MRD1-NV.



Sensor Troubleshooting:

With trains clear of all sensors, the detector LEDs on the TS5 should be off. If any LED is on, correct the false sensing condition.

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

1. Verify that the sensor pair is wired correctly.
2. Make sure the IR LED and 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 pair 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 IR 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 object flat black. Or use across-the-track sensing.

If a detector LED does not light when a train is present at the corresponding detector, correct the false clear condition.

To fix a false clear indication for *Across-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 the IR receiver.

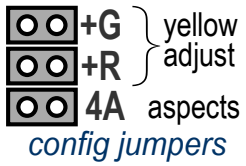
To fix a false clear indication for *Reflective* mode:

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 shade it with scenery or a structure. Change the nearby light from incandescent to a fluorescent or LED bulb.

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

Sensors must be working correctly before continuing the installation.

Signal configuration jumpers



config jumpers

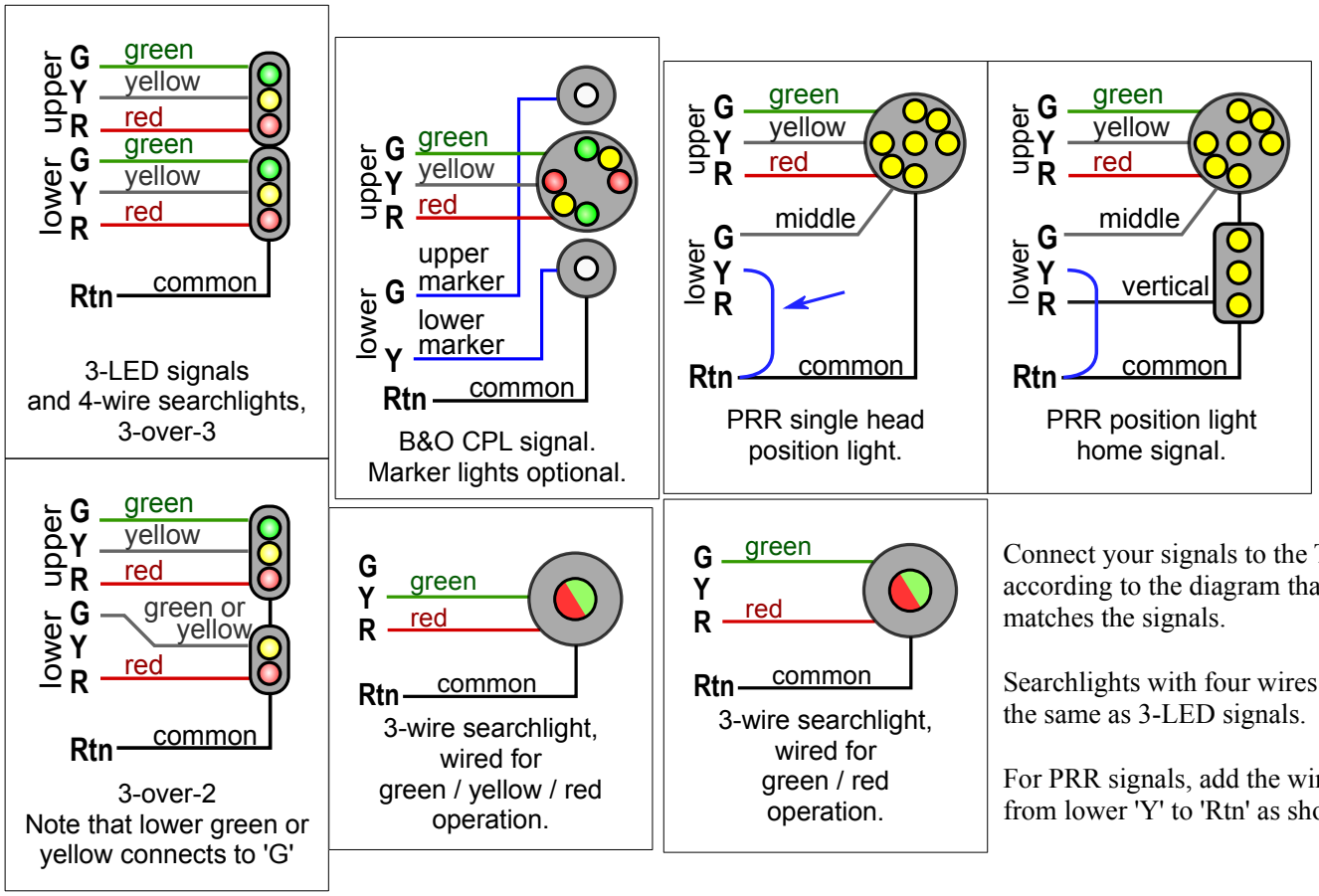
Two configuration **jumpers** (small rectangular connector blocks, or 'shunts') are supplied with the TS5 for adjusting signal characteristics. Three pairs of pins can accept these jumpers. To enable a configuration feature, place a jumper across both of the pins. To disable a feature, remove the jumper or park it on one pin.

Yellow adjust jumpers are only for searchlight signals with one bi-color (red/green) LED. To produce a yellow color, the red and green internal LED chips are illuminated together. The quality of the yellow light is variable, depending on the viewing angle, ambient light and the LED itself.
+G: If the 'yellow' color looks too reddish, place a jumper across the two **+G** pins to increase the green intensity.
+R: If the 'yellow' color looks too greenish, place a jumper across the two **+R** pins to increase the red intensity.
A 'middle' yellow is produced when both jumpers are off.

4A: A jumper across this pair of pins enables **four aspect** signaling (clear / advance approach / approach / stop). Removing the 4a jumper selects **three aspect** signaling (clear / approach / stop).

Signal Connections

The following types of signals may be used with the TS5. Single-head signals connect to "upper" terminals.



Connect your signals to the TS5 according to the diagram that matches the signals.

Searchlights with four wires are the same as 3-LED signals.

For PRR signals, add the wire from lower 'Y' to 'Rtn' as shown.

With very fine signal wires, it is best to attach larger wires (AWG #26 or #24, such as wire from phone or LAN cables) to the fine signal leads, then insert the larger wire in the terminal block.

Only change connections when power is off.

Connect any signal "common" to any "Rtn" terminal.

Note that **resistors are not required** because resistors are built in to the TS5 circuit board.

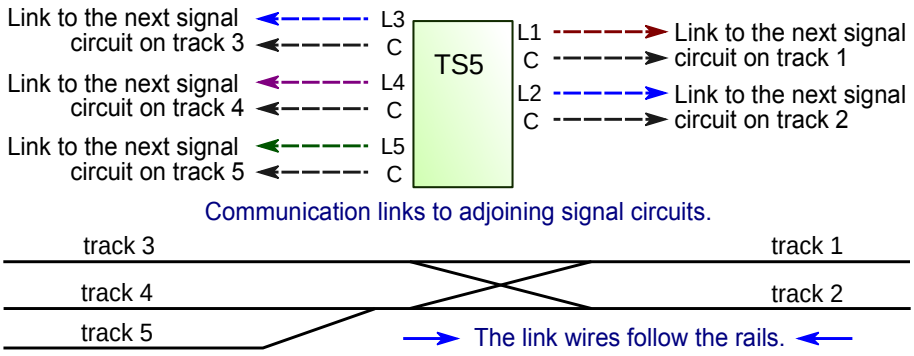
If your signals are pre-assembled with resistors, first connect the signals with their resistors. If the signal LEDs are too dim, remove the resistors and re-connect the signals.

If an individual color is too bright, a resistor may be wired in series with that LED's wire. Use up to a 1000 ohm resistor. Increasing the resistance value decreases the brightness.

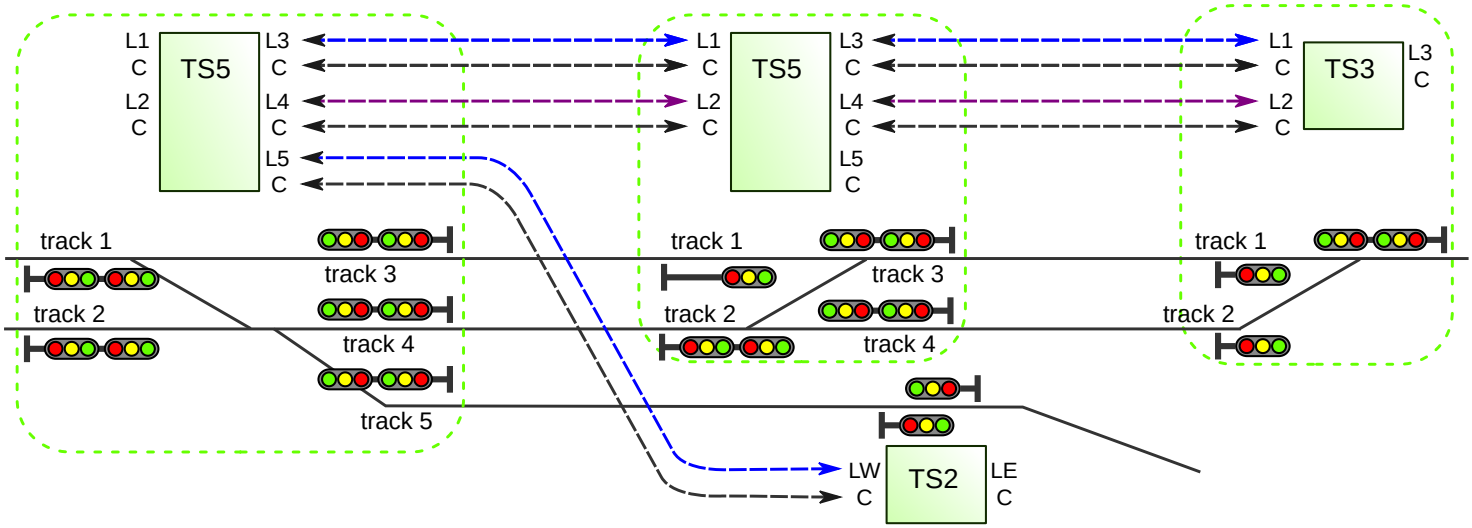
When power is turned on, the TS5 does not know if a block is occupied or not, because a train may have been added or removed from the track while power was off. The signals will show 'approach' (yellow) (or red for 2-aspect signals). Visually check the track and proceed with caution! Normal indications begin once the first train passes the IR sensors.

When the TS5 is linked to other Azatrax TSx circuits, the TSx circuits tell each other when a train enters or leaves the block between them. When a train enters a block, the block is 'occupied' until a train exits the block. The block is then considered to be 'clear.'

Connect a 'Link' terminal of one TSx to a 'Link' terminal of the TSx at the opposite end of the block. Connect 'C' of one TSx to 'C' on the other TSx. Use twisted pair wire such as found in telephone or ethernet (LAN) cable, AWG #26 or #24. To avoid interference from high power or high frequency currents, keep these link wires away from track power wires.



One example of linked signal circuits:



If a TS5 link is not connected to another Azatrax TSx circuit down the track: **For Links 1-4**, that track operates in a **timed mode**. The track beyond the signal becomes a 'virtual' block. When a train passes the signal and enters the virtual block, the signal shows a 'stop' aspect (red) to indicate the virtual block is occupied. After several seconds the signal changes to 'approach.' After another delay the signal changes to 'clear' (green). The delay time is not adjustable.

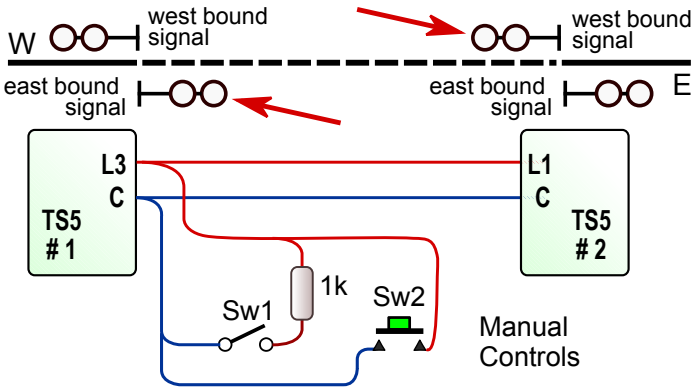
If Link 5 is not connected, then signal S1 or S2, whichever track is lined into Track 5 (via turnout T3 or T4) will show a restricting aspect. This is typical of yard leads and other non-signaled track (TS5 rev. 3.0 and later).

Interlocking functions

To force a block to 'occupied' status even when no train is in the block, connect a 1,000 ohm (1k) resistor between the 'Link' terminal (L1 - L5) and a 'C' terminal. This can be connected via a dispatcher's switch, or a switch linked to a drawbridge, a switch machine, etc.

In the example at right, the dashed line is a track block between TS5 #1 at the west end, and TS5 #2 at the east end.

The red arrows point to the signals at the west and east entrances to the block. These two signals will show 'stop' if switch Sw1 is closed ('on'), connecting the 1k resistor across the Link wire and 'C'.



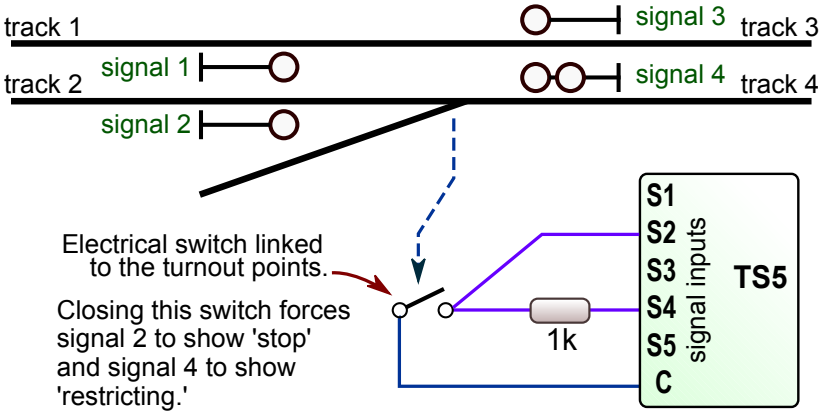
To manually clear an 'occupied' block, momentarily connect the 'Link' terminal (L1 - L5) directly to a 'C' terminal. This may need to be done after a train leaves the block through a turnout onto a siding or branch line, or if it is removed from the track by hand.

In the example above, when Sw2 is momentarily closed, shorting the Link wire to 'C', the two signals indicated by the red arrows will change to 'clear.'

Signal override with Stop inputs

Using Stop inputs S1 - S5, any of the five signals controlled by a TS5 can be forced to show 'stop' or 'restricting' indication. This can be useful when the control point has turnouts to uncontrolled sidings.

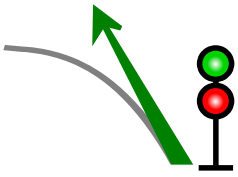
To force Signal 1 to show 'stop', connect terminal 'S1' to any 'C' terminal. To limit Signal 1 to 'restricting,' connect terminal 'S1' to a 1,000 ohm (1k) resistor, and connect the other end of the resistor to any 'C' terminal.
The default restricting aspect is red over yellow. This can be changed to flashing red, see pg 10.

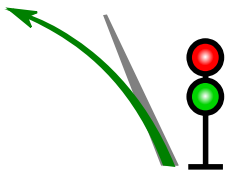


Use terminal S2 to control Signal 2 in a similar fashion. Use 'S3' for Signal 3, 'S4' for Signal 4, and 'S5' for Signal 5.
In this example, a turnout to an uncontrolled siding is between signals 2 and 4. An electrical contact is linked to the turnout points. This contact closes ('on') when the turnout is lined for the siding. This connects terminal 'S2' to 'C', causing Signal 2 to show 'stop.' This also connects 'S4' via a 1k resistor to 'C', causing Signal 4 to show 'restricting.'

Signal indications and single vs. dual head signals

A single head signal shows track conditions ahead on a single track without turnouts.
A **'stop' indication** (red) means the track block immediately beyond the signal has a train in it, or an open drawbridge or other hazard. An **'approach' indication** (yellow) means it is safe to enter the block, but the following signal is at 'stop,' so slow down and be prepared to stop at the next signal. If 4-aspect signaling is in use (see the signal config jumpers on page 7) an **'advance approach' indication** (flashing yellow) means it is safe to enter the block, but the next signal is at 'approach,' so reduce speed accordingly. A **'clear' indication** (green) means the track ahead is clear and trains may run at up to the posted speed limit ('track speed' or 'normal speed').





"Route Signaling" systems use a dual head signal ahead of a turnout.
If the lower head indicates 'stop,' then the turnout is in the Normal position and the upper head indicates the condition of the main track ahead.
If the upper head indicates 'stop,' then the turnout is in the Reverse position and the lower head indicates the condition of the diverging track ahead.
Trains use lower speeds while negotiating the turnout.

When the turnout is lined for the main route, the lower head shows red (except approach medium or approach slow). The upper head indicates the condition of the main track. indicates flashing	 main clear	 main advance approach	 main approach	 stop
When the turnout is lined for the diverging route, the upper head shows red. The lower head indicates the condition of the diverging track. The 'stop' indication does not provide route information. It does not matter because the train is supposed to stop, not taking either route.	 diverging clear	 diverging adv. approach	 diverging approach	 stop
These aspects indicate that the **next** signal shows a diverging aspect. **Approach medium** means the track ahead is clear, but be prepared to pass the next signal at a reduced ('medium') speed. **Approach slow** means the track ahead is clear, but the next signal is 'diverging approach.' Be prepared to pass the next signal at a 'slow' speed. The next signal must be controlled by an Azatrax TS3 or TS5, and linked to this TS5.			 approach medium	 approach slow

If a signal is showing a diverging aspect, the signal preceding it will not show 'clear.' A preceding double-head signal will show 'approach medium' or 'approach slow.' A single-head signal will show 'approach' or 'advance approach.'

Restricting Aspect

Restricting means "Proceed and be able to stop in half the visual distance ahead." To change the aspect for a 2-head signal, temporarily connect a wire from L2 to C. Press and hold the test button (see below) until an on-board LED starts blinking.

If yellow LED1 is blinking, restricting aspect is red over yellow. If red LED2 is blinking, restricting aspect is red over flashing red. To change, press and release the test button. To keep the selection, remove the temporary wire from L2 and C.

"Speed Signaling" systems are used by some railroads instead of the Route Signaling described above. Rather than giving turnout direction information to the train crew, speed signaling uses multiple heads to indicate maximum allowable speed, usually through a control point. The upper head indicates Normal speed, the second head indicates Medium speed, and if there is a third head it indicates Slow speed.

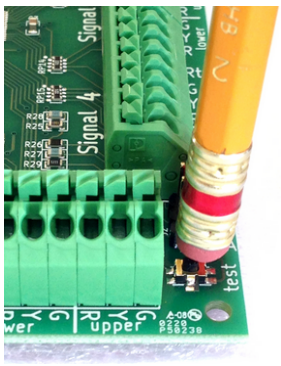
Signal test button

Check signal operation with the 'test' button. The button is very small, it is best to use the eraser end of a pencil or other non-conductive tool to press it.

1. Hold the test button down for 2-3 seconds until the **yellow on-board LED 1** starts flashing. Release the button. Signal 1 upper head should show 'clear,' all others signals will be dark.
2. Press and release the button. If the '4a' config jumper is in place the signal will change to 'advance approach,' otherwise it will show 'approach.'
3. Repeat pressing the button for 'approach' and 'stop.'
4. Press again. If the lower head of signal 1 is connected, repeat the above steps to show 'diverging clear,' 'diverging approach,' etc.
5. Press again and the **yellow on-board LED 2** will flash. Repeat the above steps for Signal 2.
6. Press again and the **red on-board LED 3** will flash. Repeat the above steps for Signal 3.
7. Press again and the **red on-board LED 4** will flash. Repeat the above steps for Signal 4.
8. Press again and the **yellow LED 1 and red LED 4** will flash. Repeat the above steps for Signal 5.

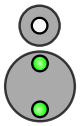
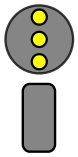
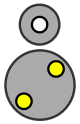
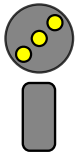
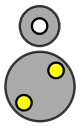
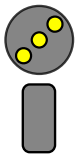
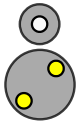
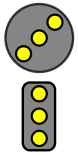
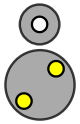
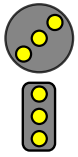
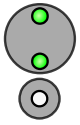
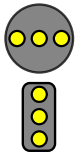
To end the test sequence early at any time, hold down the test button until the on-board LEDs stop flashing.

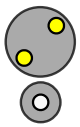
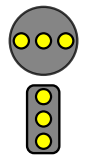
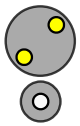
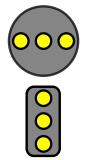
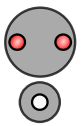
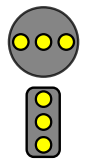
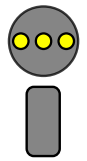
When the on-board LEDs stop flashing, the TS5 is back to normal operation.



Use a non-conductive tool to press the test button.

How the TS5 displays track conditions depending on type of signal connected.

Condition	Name	2-head	1-head	B&O	PRR
Main route. Proceed at normal speed.	clear				
Main route. 2nd signal ahead is 'stop.' Indicates flashing	advance approach*				
Main route. Next signal ahead is 'stop' or 'restricting.'	approach				
Main route. Next signal ahead is 'diverging clear' or 'diverging advance approach.' (control circuit for next signal must be Azatrax TS3 or TS5)	approach medium				
Main route. Next signal ahead is 'diverging approach.' (control circuit for next signal must be Azatrax TS3 or TS5)	approach slow				
Diverging route. Proceed at prescribed speed.	diverging clear (medium clear)				

Diverging route. 2nd signal ahead is 'stop.'	diverging advance approach* (medium approach)				
Diverging route. Next signal ahead is 'stop' or 'restricting.'	diverging approach				
Entering non-signaled territory. Must be able to stop within half the visible distance ahead.	restricting (note A)				
Route blocked by a train or by a turnout in the control point.	stop				

* To enable advance approach aspects, push the "4a" jumper onto both pins (see TS5 installation guide, pg 7).

Note A - to change, see pg 10 of TS5 installation guide.

To use with a triple head signal, signal must be common-anode (common +). One head will always show red. Connect the red wire of the always-red head to a resistor, and the other end of the resistor to any "C" terminal. Use a 1/8 or 1/4 watt resistor of 240 ohms or higher. Some signals have separate "return" wires for each head, others will have a single return wire. Color wires may have individual resistors.