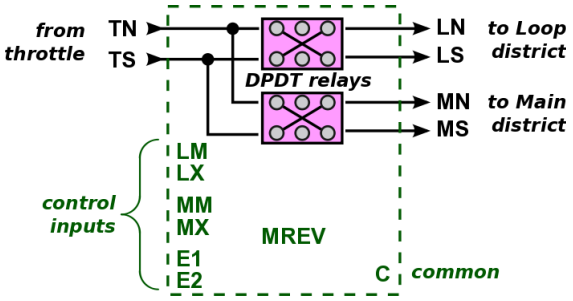
Azatrax MREV Polarity Controller Module for Two-Rail Model Railroad Layouts

What it is, how it works and how to install it

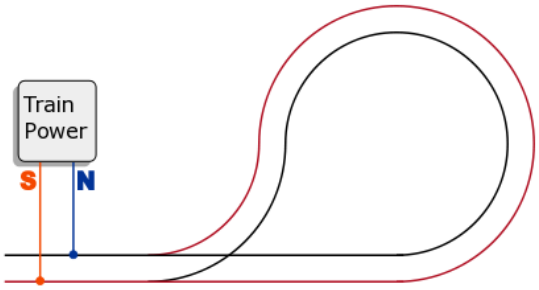


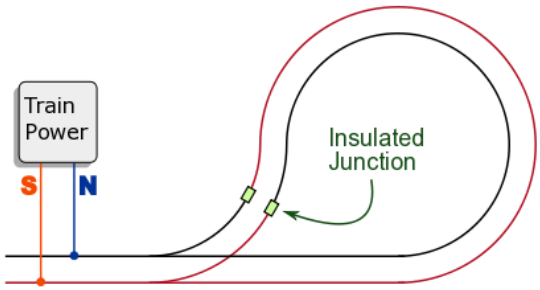
What it is - The MREV module has two DPDT (double pole, double throw) relays and electronic circuits to control them. Power from a model train controller (or 'throttle') is routed through the MREV to two electrically isolated districts on the layout. The two relays on the MREV automatically control the electrical polarity of the two track districts so a train can cross from one district to the other without interruption and without causing a short circuit. The relay contacts are rated for 8 amps.

The MREV module has track power connections and control connections.

Track power: For two-rail electric train layouts, we will label one rail as "North" and the other rail "South." We also label the two connections to the train controller as "North" and "South." Power from the train controller is brought into the MREV via terminals TS (Throttle South) and TN (Throttle North). Power goes out from the MREV to the track via terminals MS (Main district South), MN (Main district North), LS (Loop district South) and LN (Loop district North).

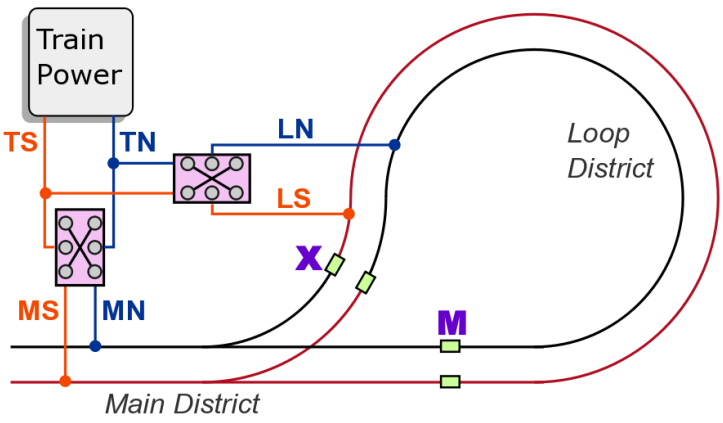
Prepare the Layout - Start by identifying all the reversing track sections. One way to do this is to draw the layout plan, drawing each rail with a different color. In this simplistic example we use black and red.
If the two colors meet, as they do here at the turnout, then there is a problem. Why? Because if we connect a train power supply (throttle) to the rails, the electric current will flow from one side of the throttle, around the loop rails and back to the other side of the throttle. This is a short circuit. The train will not receive any power and the throttle's circuit breaker will trip off.





Prevent the short circuit by placing an insulated rail joint in each rail as shown in the figure at left. This stops the unwanted current flow. But if a train crosses the insulated rail joints, the metal wheels and trucks of the locomotive will create a conducting path around the insulated joints, and the short circuit will happen again.

We need a way to align the power polarity of the rails when a train is ready to cross the insulated junction. Divide the track into two power districts by adding a second insulated junction as shown at right (the new junction is labeled 'M'). Separate reversing switches for each district enable us to align the track power polarity at either insulated junction, to allow trains to cross from one district to the other.



The distance from one insulated junction to the next must be longer than the longest train that will travel that district.

➔ This next step is key:

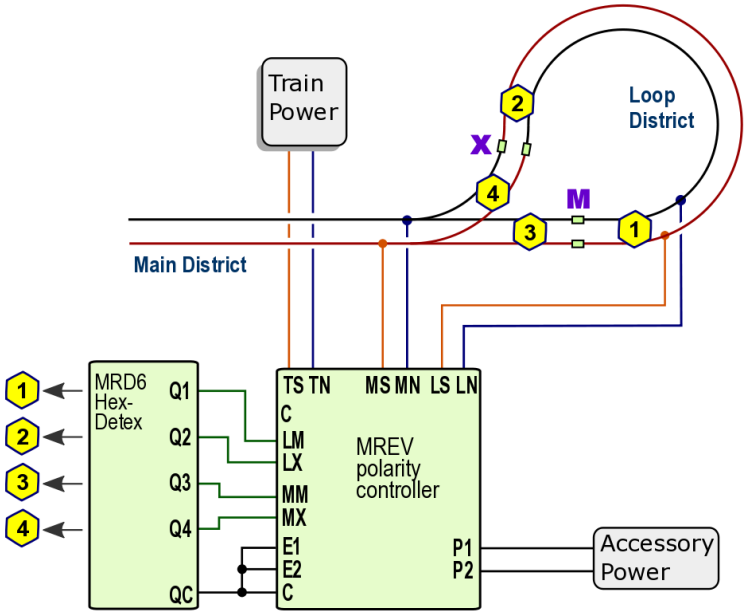
Label the insulated junctions.

Where the rail connected to MN joins the rail connected to LN (black-to-black), label the junction **'M'**.
Where the rail connected to MN joins the rail connected to LS (black-to-red), label the junction **'X'**.

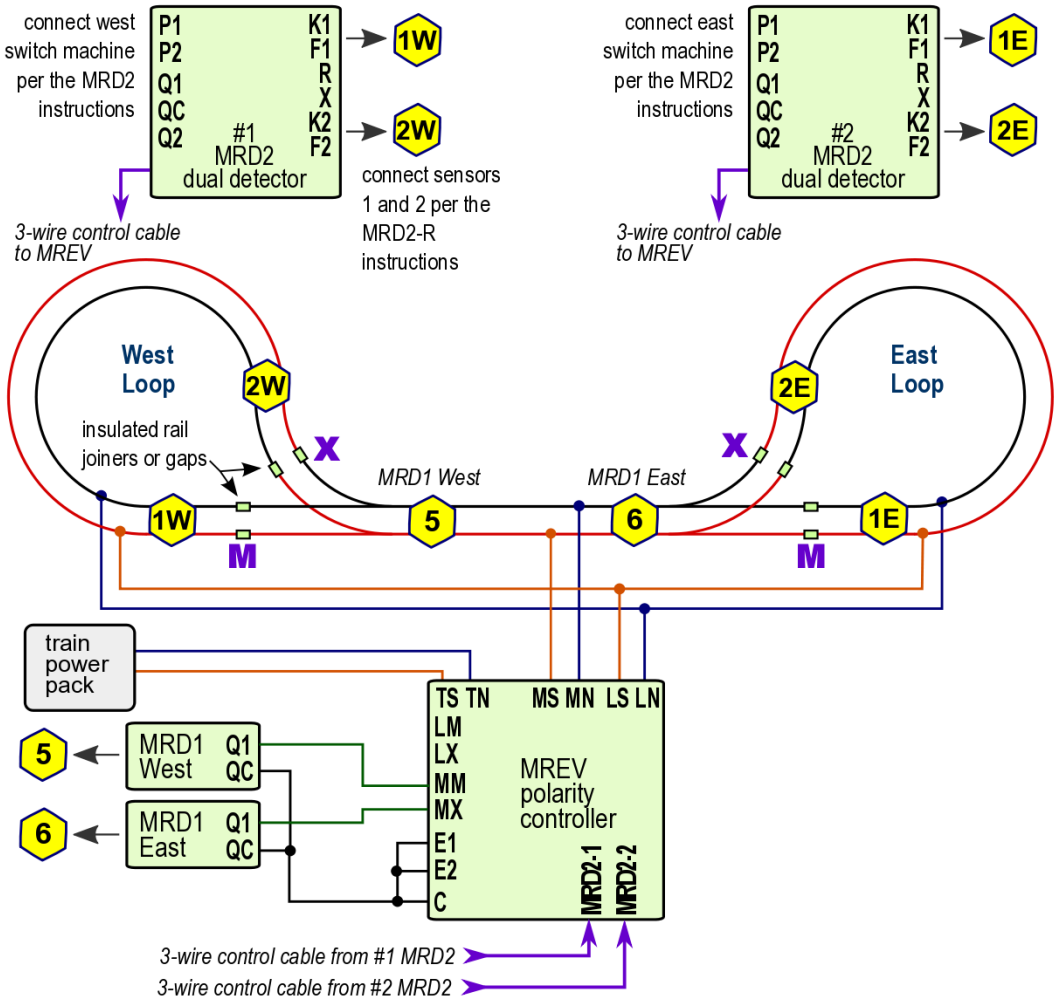
Adding the MREV, *without* turnout control - Place two train detectors at each insulated junction, one detector on the Main district side of the junction, the other on the Loop district side. Connect the detector outputs to the MREV control inputs as follows (remember, at 'M' the Main North rail meets the Loop North rail, at 'X' the Main North rail is across from the Loop North rail):

Loop district M detector →input LM
Loop district X detector →input LX
Main district M detector →input MM
Main district X detector →input MX

Connect all detector 'commons' to C on the MREV.
Connect E1 and E2 to C, unless multiple cab controls are being used.
Connect an **accessory power supply** to P1 and P2. Power should be **8-14 volts AC or DC**, may be the same power supply used by the detectors.
In the example at right, four of the six detectors from an Azatrax MRD6 HexDetex are used. Four single detectors could be used instead.
If the turnout has an electrical contact, then detectors 3 & 4 can be replaced by one detector placed to the left of the turnout points. Route the output of that detector through the turnout contacts so the detector is connected to the MM input when the turnout is aligned with the 'M' junction, and connected to the MX input when the turnout is aligned with the 'X' junction.



Adding the MREV, *with* turnout control - An Azatrax MRD2 dual train detector controls the turnout and provides Loop district detection for the MREV. Main district detection is provided by a single train detector. Install the MRD2 dual detector according to its instructions. Place the sensors for Detector 1 on the branch with the 'M' insulated junction. Place the sensors for Detector 2 on the branch with the 'X' junction. 'M' is where the Main North rail meets the Loop North rail. 'X' is where the Main North rail is across from the Loop North rail. Plug one end of the 3-wire control cable into the MRD2 module, and the other end into the MRD2-1 connector on the MREV module. Install a single train detector, such as an Azatrax MRD1, ahead of the turnout points (detector 5 in the diagram at left). Connect its output Q1 to the MM input on the MREV. Connect QC on the MRD1 to C on the MREV.
A second MRD2 can be connected to the MREV to



control both ends of a twin-loop 'dog bone' layout. Install the second MRD2 in the same manner as the first, and connect its 3-wire control cable to the MRD2-2 connector on the MREV.

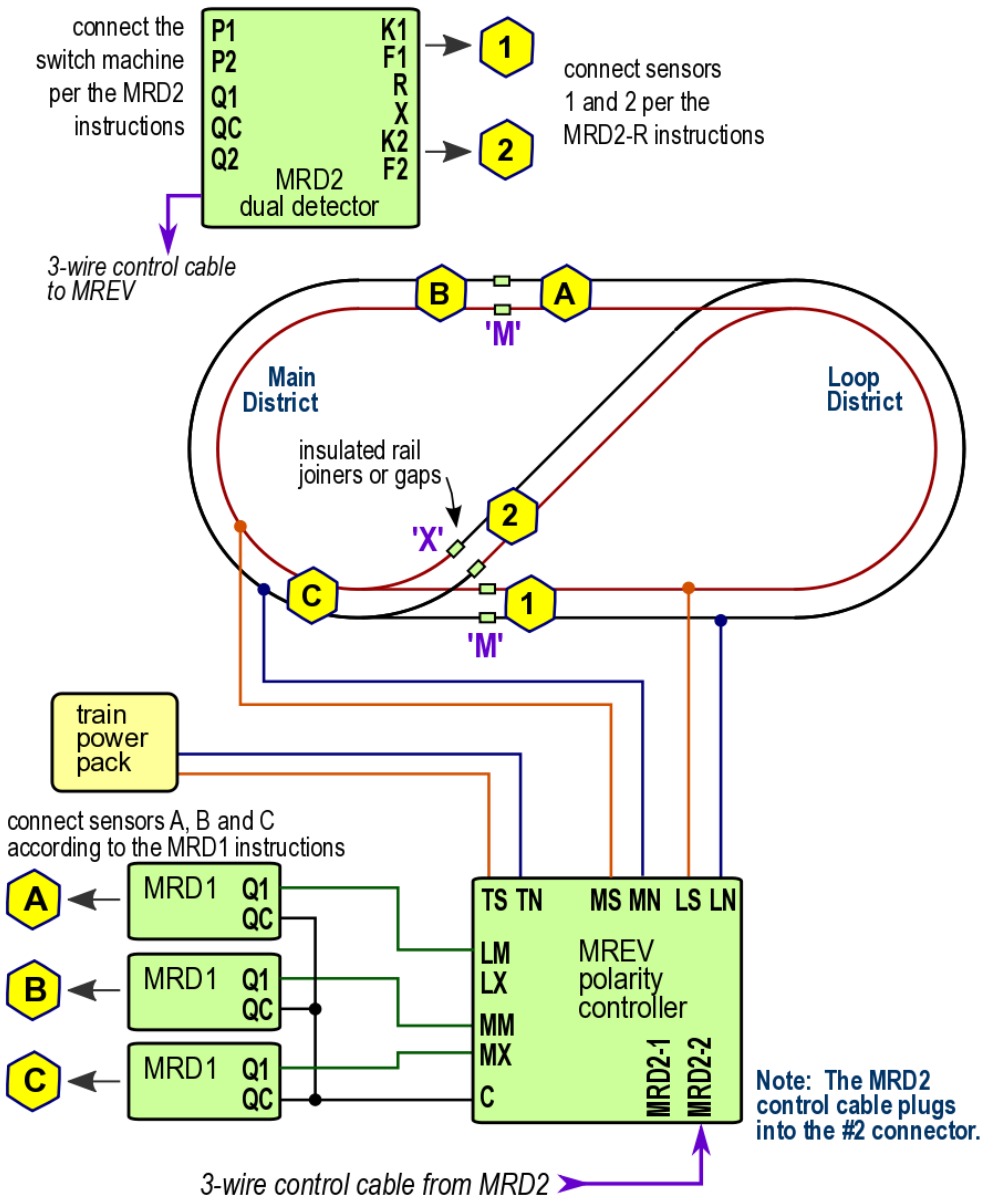
The second MRD1 single detector (detector 6 in this diagram) is connected to the MX input on the MREV.

Oval with Crossover - Another example of a common reversing track is the oval with a crossover track. Routing a train through the crossover changes its direction around the loop.

The illustration at right shows an MREV controlling track polarity (in this example, the 'Main district' is left side of the layout, and the 'Loop district' is the right side). An MRD2 dual detector automates the turnout at the lower left and lets the MREV know when a train is about to enter the Main district.

The two MRD1 single detectors marked 'A' and 'B' alert the MREV when a train may be crossing the boundary between the Main and Loop districts at the top of the layout.

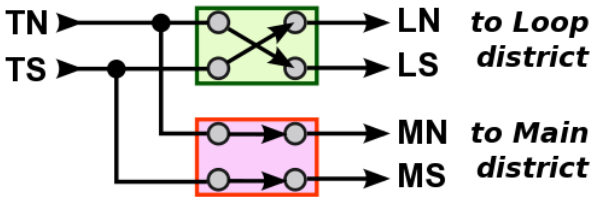
The MRD1 detector labeled 'C' tells the MREV when a train is about to cross from the Main district into the loop district at the turnout.



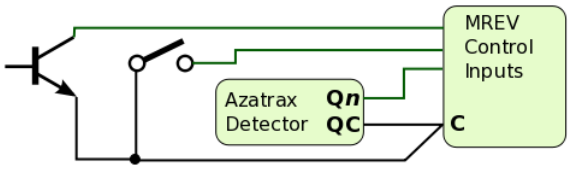
The second turnout at the upper right may be manually controlled, or it may be automated with another MRD2 dual detector. The additional MRD2 would not connect to the MREV polarity control system.

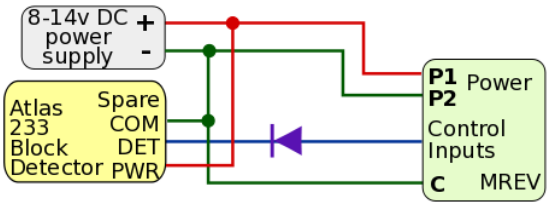
How the MREV works - When the Main district's relay is 'off,' the North side of the throttle (TN) is connected to the North rail of the Main district track (MN), and the South side of the throttle (TS) is connected to the South rail (MS). The throttle connections 'match' the rail connections.

When the Main district's relay is 'on,' the North side of the throttle (TN) is connected to the South rail of the Main district track (MS), and the South side of the throttle (TS) is connected to the North rail (MN). The throttle connections and the rail connections are 'crossed.' Same goes for the Loop district relay. In the figure here, the Loop relay is 'on' and the Main relay is 'off.'



Control inputs are triggered by connecting them to either of the two 'C' terminals. This can be done via a switch or relay contact, with a transistor or with any Azatrax infrared train detector. Examples are shown at right.





The triggering circuit must **not** push a positive voltage into the MREV. If a detector such as the Atlas #233 block detector does put out a positive voltage, then a diode must be placed in series with the control input as shown. Use a 1N4001, 1N914, Radio Shack 276-1620 or equivalent.

What the **control inputs** do when triggered:

LM	Causes the Main relay to change state, if necessary, to **match** the Loop relay's state. If the Loop relay is **on**, then the Main relay will turn **on**. If the Loop relay is **off**, then the Main relay will be turned **off**. The MN and LN rails will be connected to the **same side** of the throttle power. MS and LS rails will connect to the other side of throttle power.
LX	Causes the Main relay to change state, if necessary, to be **opposite** the Loop relay's state. If the Loop relay is **on**, then the Main relay will be turned **off**. If the Loop relay is **off**, then the Main relay will turn **on**. The MN and LN rails will be connected to **opposite sides** of the throttle power. Likewise for the MS and LS rails.
MM	Causes the Loop relay to change state, if necessary, to **match** the Main relay's state. If the Main relay is **on**, then the Loop relay will turn **on**. If the Main relay is **off**, then the Loop relay will be turned **off**. The MN and LN rails will be connected to the **same side** of the throttle power. MS and LS rails will connect to the other side of throttle power. If an MRD2 turnout controller is connected to the MRD2-1 three-pin connector, then triggering the MM input will cause the Loop relay to change depending on the position of the turnout points.
MX	Causes the Loop relay to change state, if necessary, to be **opposite** the Main relay's state. If the Main relay is **on**, then the Loop relay will be turned **off**. If the Main relay is **off**, then the Loop relay will turn **on**. The MN and LN rails will be connected to **opposite sides** of the throttle power. Likewise for the MS and LS rails. If an MRD2 turnout controller is connected to the MRD2-2 three-pin connector, then triggering the MM input will cause the Loop relay to change depending on the position of the turnout points.
E1	Enables the LM, MM and MRD2-1 inputs. If E1 is **not** connected to C, then the LM, MM and MRD2-1 inputs are **ignored**. If your layout has one throttle, connect E1 to C with a wire. Otherwise, wire E1 to C via a block selector switch so that E1 and C are connected when the throttle is connected to the track block that has the MM sensor.
E2	Enables the LX, MX and MRD2-2 inputs. If E2 is **not** connected to C, then the LX, MX and MRD2-2 inputs are **ignored**. If your layout has one throttle, connect E2 to C with a wire. Otherwise, wire E2 to C via a block selector switch so that E2 and C are connected when the throttle is connected to the track block that has the MM sensor.

More examples are available at `www.azatrax.com`, click on the 'Reversing Tracks' link.