Using The Modeltrainsounds Auto-reversing System on O scale 3 rail Track

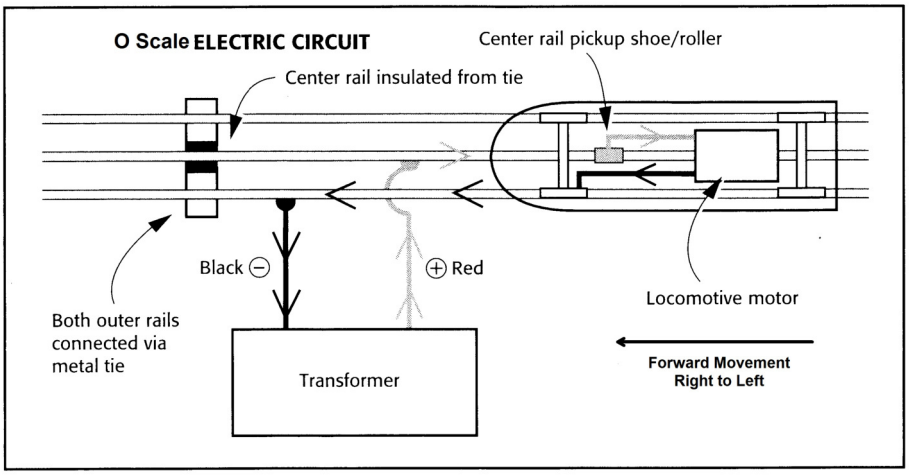
modeltrainsounds.com *June 2024*

The modeltrainsounds (MTS) Auto-Reversing System (AR) can be used on O scale 3 rail track with certain restrictions and requirements. These include the following along with suggestions.

1) **The AR only works in DC mode** ,(Direct Current Mode) and will not work when track current is AC (Alternating Current) . This can be overcome by using a separate train controller for the point to point layout and having it separated or electrically isolated from the main layout.

2) The locomotive or trolley (loco) motor must be able to handle DC current. and be able to reverse without having to flip a switch on the locomotive. Most O scale locos operate in DC mode but use the AC current from the track. A diode is used to filter the AC so that the motor only receives half the wave of positive direct current. When the switch is flipped the wave is reversed so the loco moves back. By removing the diode and operating the locomotive with a DC controller the locomotive will move back and forth depending on the direction of the controller setting , forward or backward. It will however no longer operate with an AC controller and the motor be damaged if tried. Instead a small variable DC controller that are commonly available in HO and N scale can be used.

3). In **O scale with 3 rails the middle rail is set up as the Positive rail.** When the Lionel controller is set in the forward direction the Locomotive moves forward from Right to Left. But when a standard HO/N controller is used an is set in the forward setting the O scale locomotive moves backwards (Left to Right)



Other scales such as N, HO and S conform to a different standard which requires the locomotive to move forward when the controller is set in the forward direction. (NMRA Standard 9) . So if you use a standard HO controller with a Lionel DC loco you will note that the loco moves backward when facing to forward. This is because the polarity of the motor is the opposite to that of other gauges. This can be changed by de-soldering the wire connections at the motor and reversing the connections. An alternative is to accept the situation and if using a standard HO controller and let the forward movement of the loco be right to left and label the controllers dial in reverse. With the auto-reverse system the controller is used primarily to set the speed of the loco while the diode settings determine direction you want forward motion to be.

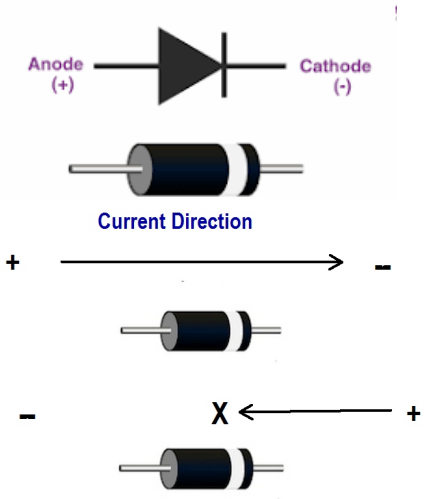
4) **Amperage Restrictions.** The Auto-Reversing relay board is rated to handle a current of up to 2 amps. For this reason the use of traction motors that draw more amperage is not recommended. Some older and larger scale motors will draw much more than 1 amp of current requiring a higher rated diode. You can measure the amperage draw by using a multimeter set up in the circuit. Refer to this link. (https://www.wikihow.com/Measure-Amperage)..

For most of the newer small locomotives (1980's on) and Trolleys or handcars that use CAN type motors in O, S and G scales operating in DC mode the current draw should be less than 2 amps and these can be used on a dedicated track. Some examples might include.

		
Atlas O Trolley	**Lionel Diesel Switcher**	**Lionel Small 0-4-0 steam**

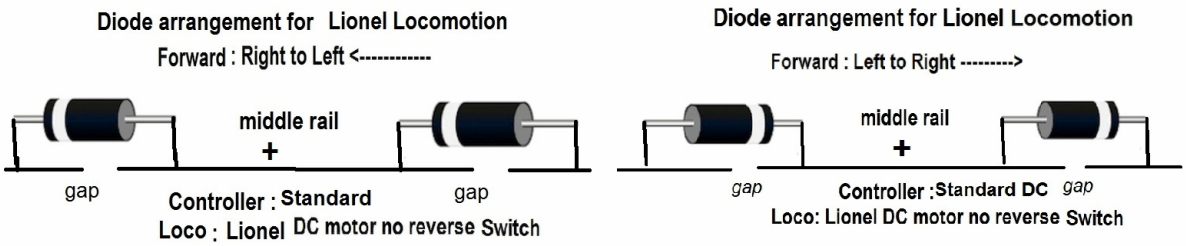
Also make sure accessories that take current from the track to operate including switches signals and others do not cause the 2 amp draw to be exceeded which might damage the AR board.. These accessories should be powered by a separate source other than track power.

5) The diodes used for HO and N scale are 1N001, rated for 50 V and 1 amp. These diodes have fine wire leads which are easier to solder to small track. Since voltage and current draw limits of the HO and N locos do not exceed these limits these diodes are not a problem. Higher amperage rated diodes such as 2 amp diodes have a wider diameter wire lead which is soldered across the insulated rail joint or cut gap of the larger scale track.



6) **Diode setup.** The diode only allows for current to flow in one direction from Anode (+) to Cathode (-) . It is this principle that causes the stopping of the loco at the end of the track. The grey band on the diode indicates the direction of allowed current flow from the un-banded side toward the grey band. With the AR setup both diodes must face in the same direction. When current direction is reversed the loco will move in the opposite direction. The changing of direction current is controlled by the timing set on the AR relay board.

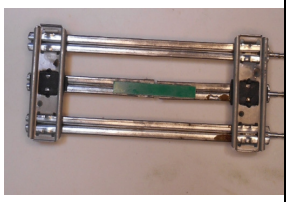
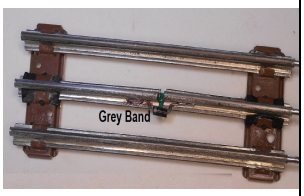
7) Controller, Diode and Loco Setup. You must be are using a loco with a DC motor that can operate in both directions. With a Lionel loco you can set the diodes (in the same direction) based on the direction you want forward movement of the loco. You can use any small train HO controller with the Positive terminal of the variable DC identified.(see Step9). The diode and gap are positioned on the middle rail.



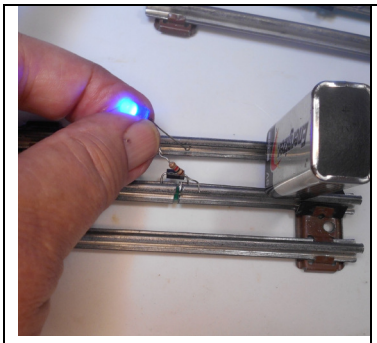
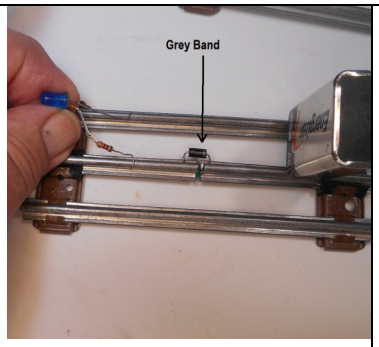
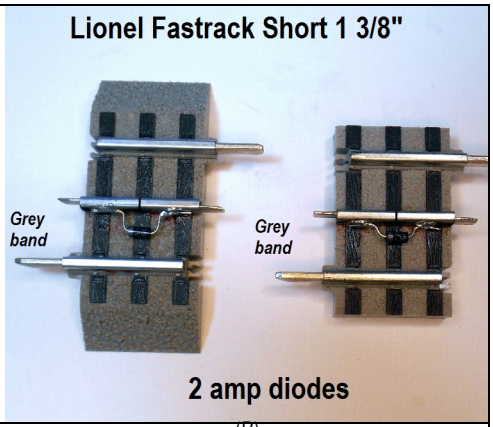
If you want your Lionel loco to have the front move form Right to Left use diode Setup 1. If you want it to run Left to Right you will use Setup 2. You could reverse the entire track layout

if Setup1 is used as the rail joiners prevent the end stop rails from simply being reversed. For Trolleys, Trams , hand cars etc with no obvious front this may not a consideration.
I prefer Setup 1 as maintains Lionel's requirement for middle rail Positive and forward movement is Right to Left, (<-----) .

8**. Preparing the insulated gap.** The insulation gap at both ends of the layout across which the diodes are soldered is made on the middle track. You can place the diodes across an insulated rail joiner or a cut a gap in a single piece of rail. This latter method eliminates the need for two pieces of track to make one diode connection.
When using 2 pieces of track remove the middle rail joiner and insert either an insulated rail joiner or piece of insulated material in the joiner holes to keep the track aligned. (I use a Q tip with the cotton cut off and cut the rod the size of the rail joiner removed) . Connect the two pieces of track and solder the diode across the insulated joint.
The second method is to take two half straight tracks (5") * and cut a rail gap in the middle rail away from the track ties. Maintain the alignment of the track by glueing some plastic or wood to the underside of the track and solder the diodes across the gap facing the same direction.

			
Select 2 short sections	Cut the gap in the middle rail Use a hacksaw rotary disc.	Join with insulated material Glued underneath	Solder the diodes across the gap. Band same side

Test the gap using a voltage source, such as a 9 V battery, and an LED with 1 K resistor soldered to the positive pin of the LED..

		
Test the gap with a 9 V battery and LED with a 1 K resistor attached	LED should not light with the grey band on the battery positive side	* If using FasTrack (R) use the 1 3/8" track to cut the gaps.This Track can be reversed for both setup 1 & 2

9.**Testing the system**

a) The stopping rails are set at each end of the layout track set with the grey bands pointing in the same direction using Options 1 or 2**.**

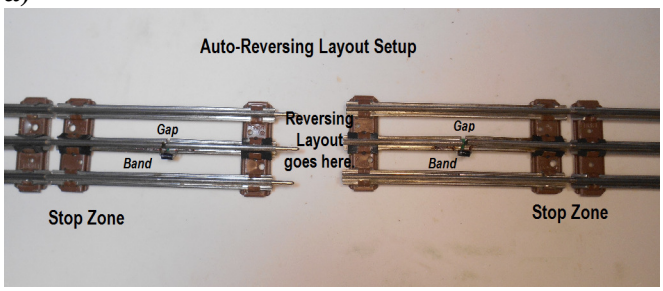
b) Select a train controller with variable DC output. Identify the Positive terminal when the controller is dialed or switch is set to FORWARD. Check the terminals using a voltmeter and mark the Positive terminal screw with a marker, preferably red.

c) Connect the wires from the controller to the track with the positive wire going to the middle rail.

d) Place the loco on the track facing to the left if Setup 1 is used. Turn the dial with the controller to forward. The loco should move left to right and stop once it crosses the gap. The loco has traveled backward. Now turn the dial to Reverse the LIONEL loco will move from right to left in it's forward state. If you place the locos in the right forward position and operate the controller the loco will run off the end of the track. If you do want the loco to operate forward from left to right use Setup 2 for the diodes or you can , if setup 1 is used simply turn the entire layout around.

Once you have the setup operating so that in back and forward movement of the loco stops at the rail gap you are ready to install the AR board.

a)



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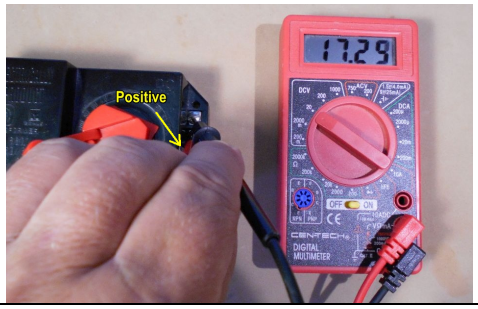

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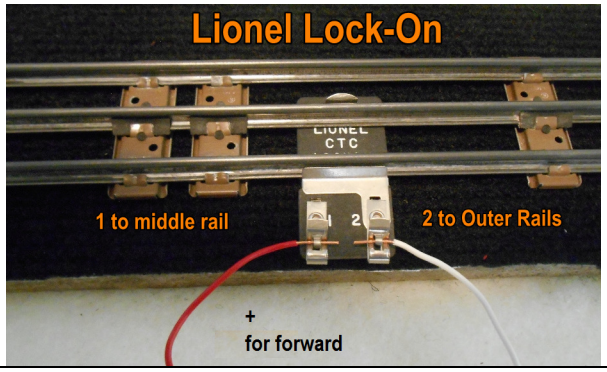
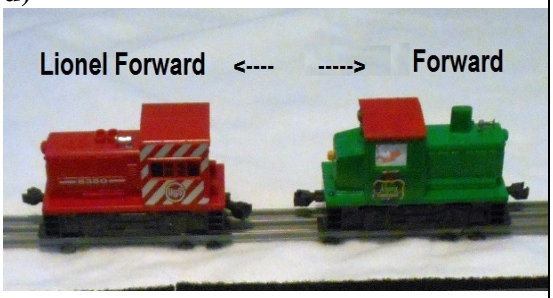
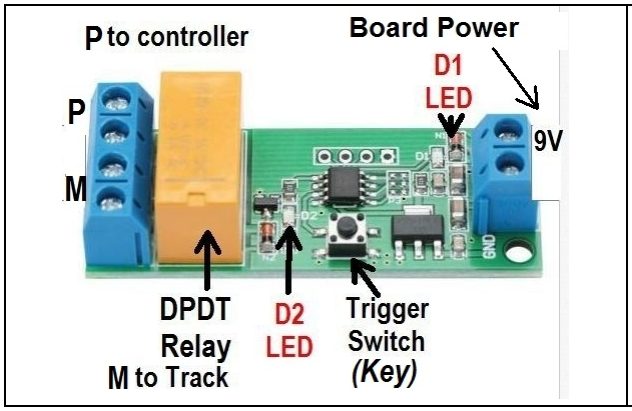


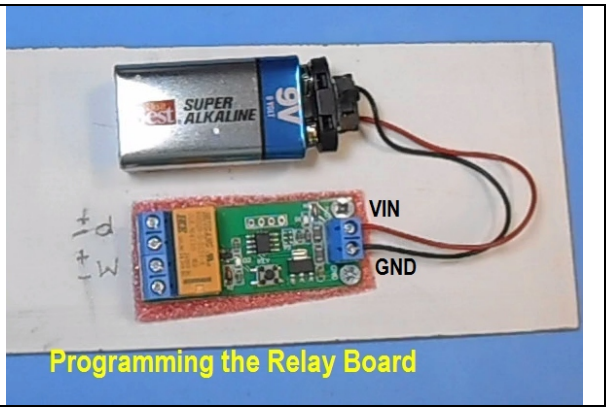
d)



10. **Setting up and Programming the Auto-Reversing Board**. Once the layout, controller and forward movement of the loco has been determined you need to establish the travel time and stop time for the loco moving in each direction. Take the forward travel time and add the stop time in seconds. This will be the OFF time. Now measure the time it takes to move backward and add the stopping time together and this will be the ON time to be set on the Auto-Reversing Board.

Follow the directions below to set the ON and OFF time on the board using the Trigger switch (Key) and the two LEDs D1 and D2.





Programming the Auto-Reverse Relay Board.

Connect up the 9 Volt battery power pack to the board only.
(Positive battery lead (Red) to VIN and Negative lead (Black) to GND)

1)Turn the switch ON (D1 blinks) Board enters the working mode.

2) With D2 OFF, Press & Hold till D1 comes ON Board is in SETUP mode

3) Press KEY twice (D1 goes out - D2 is already out)

4) Press KEY again (D1 blinks rapidly, let it blink for time desired)

5) Press KEY to stop (The OFF time is now programmed)

6) Press and Hold KEY again till both D1 & D2 light.

7) Press KEY twice (D1 goes out but D2 stays on)

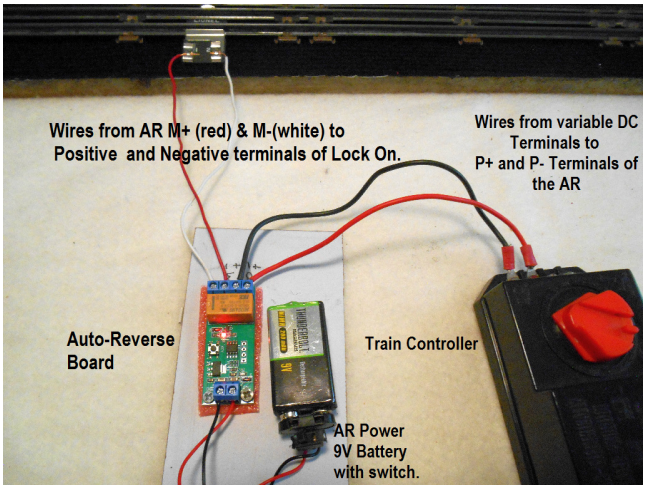
8) Press KEY again (D1 blinks rapidly, Let it Blink for ON time desired)

9) Press KEY to STOP. (ON time is now programmed)

10) TURN battery switch OFF then ON

D2 now cycles OFF then ON to new programmed times in working mode.

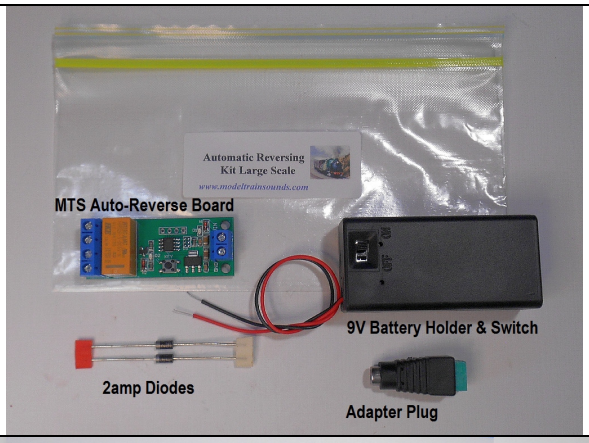
11) **Install the AR board. Connect** the + and -- wires from the Controller to the P+ and P- ports of the Auto-Reversing Board. Connect the wires from the M+ and M- ports of the Auto-Reversing Board to the Track . If using a Lionel LockON the middle track is #1 and connects to M+ , M- goes to the outside tracks. Be sure that all of the Polarity is correct.
Turn on the AR Board battery and watch that it begins to cycle with D2 going off then on.
Place the loco on the track facing the direction for forward travel and turn the dial on the controller.



The loco will move toward the end and the relay will take over the timing. Set the desired speed with the controller dial. .
When it reaches the end will stop and after a short period return to the other end in reverse based on the OFF and ON times programmed.

If you wish to change the timing simply turn the controller and AR Board off. Turn the board back on and go through the programming procedure once again. There is no need to disconnect the board from the track.

Items and accessories for Large Scale S, O and G Scales

Large Scale Auto-Reversing Kit includes 1. The MTS Auto Reversing Board 2. A 9 Volt battery Holder with switch *(battery not included)* 3. Two Diodes rated for 2 amps 4. An Adapter plug for use of a 9-12 Volt DC transformer for powering the Board	
Variable DC Train Controller 1. Speed controller with 3 way switch for Forward, Reverse and Track power Off , 0-100% speed 2. A transformer : 12 VDC 2 amp current 3 . Adapter plug and connection wires.	
Power options for the Auto-Reverse Board 1. A 9 VDC , 110 VAC wall Transformer 2. A 12VAC to 9VDC converter Board for use with the AC output from a standard HO train controller .