Train-Tech
Model Technology Made Easy

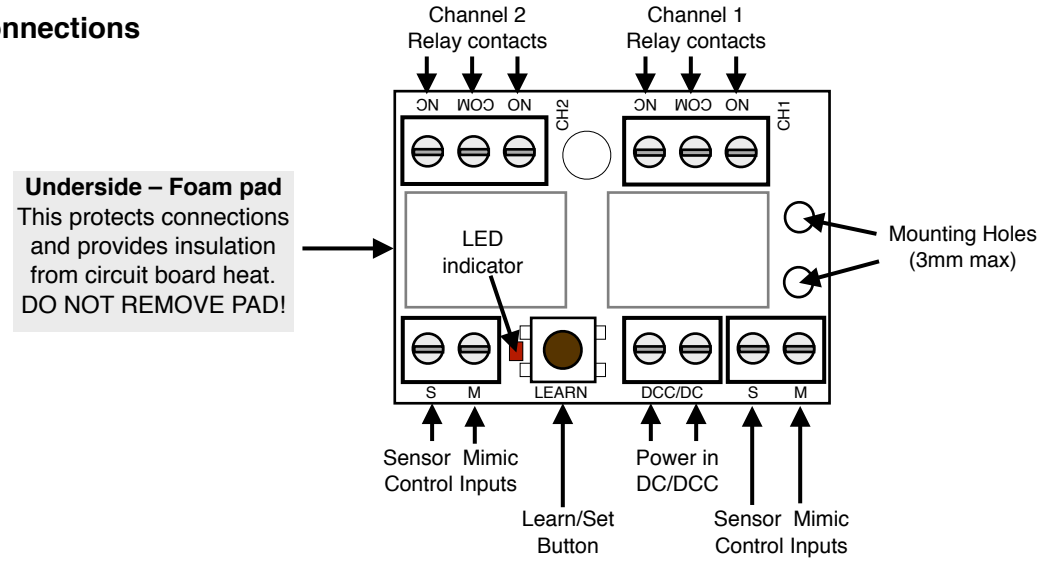
RL1 Relay Controller

Please handle carefully & read these instructions fully before using!!

Overview

The Train-Tech RL1 Relay Controller incorporates two built in relays to switch high power low voltage loads controlled by Track Sensors, Sensor Signals, Mimic Switches or DCC Accessory commands. Please read these instructions carefully.

Connections



Instruction manual contents:

Caution - only ever connect with all power turned off and ensure you never touch any other connections or components otherwise permanent damage will result.

Troubleshooting

This product is designed to be easy to connect and use but here are a few tips which may help should you have problems following installation. Remember only ever wire and install with all power turned OFF.

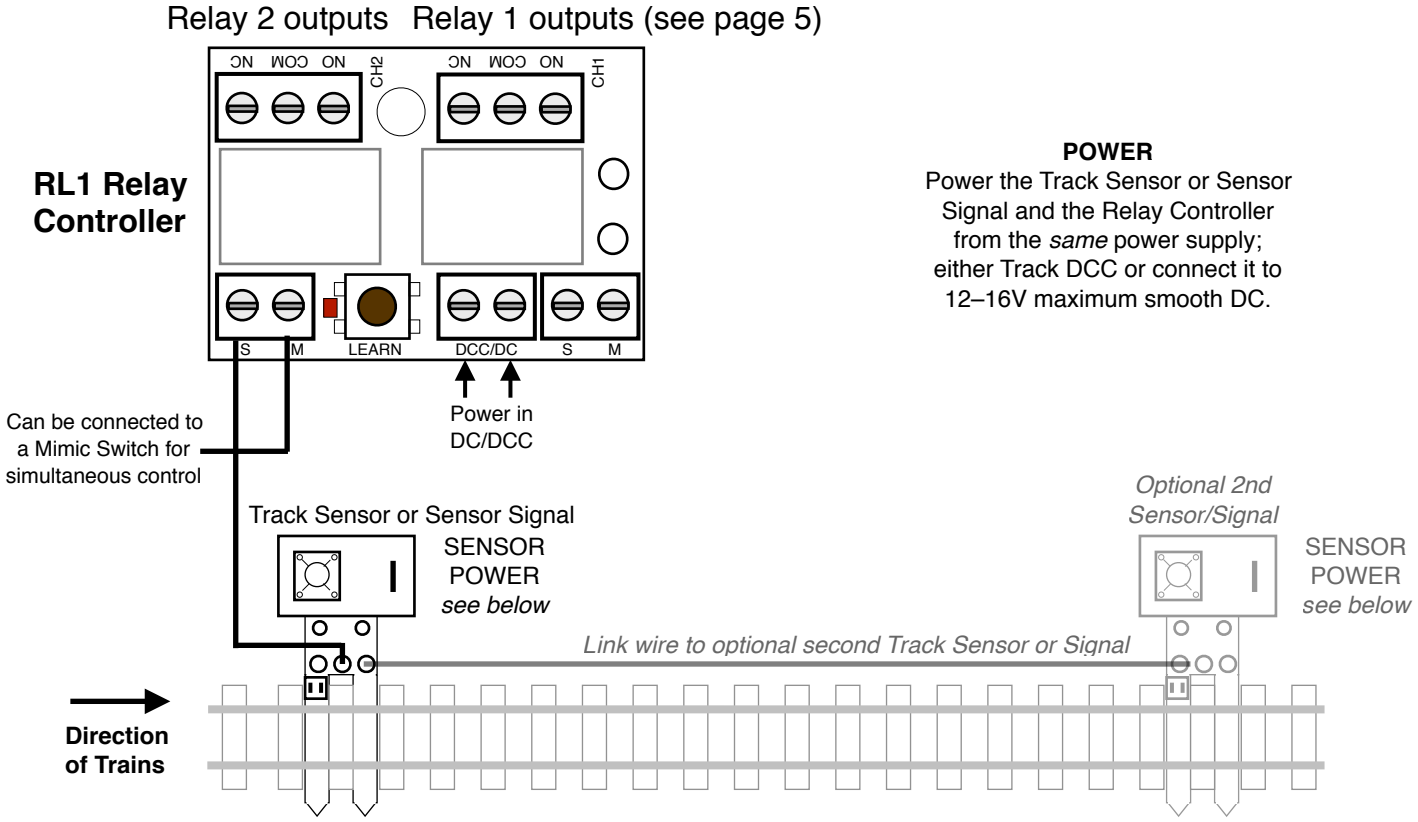
- If wishing to control Relays using DCC Accessory addresses you must first set your DCC controller to accessory command mode to set up and use it – refer to your controller manufacturers instructions.
- Use adequate thickness cables to connect Relay outputs to the models it is controlling.
- Please note that it is normal for the base of the Relay Controller to get very warm – do not remove the foam base which is fitted for protection and allow space for adequate airflow.
- Note that you should include appropriate suppression particularly for trains, motors and solenoids using capacitors, chokes etc to prevent interference to other train control products and domestic appliances
- ABC braking technology is complex and setting up CV commands and wiring Diode modules correctly varies between DCC decoder manufacturers, so refer to their detailed instructions for specific decoders.

Document Ref D779766/2 DP300420

•Relay Control using Track Sensors/Sensor Signals (DC/DCC)

You can use a Track Sensor or Sensor Signal to change a relay when a train passes it.

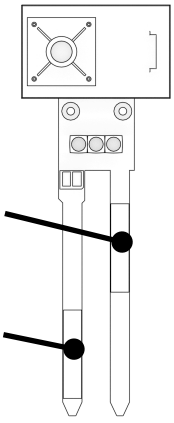
Just a single wire is needed to link between one of the **S** input of the Relay Controller and the centre socket of a Track Sensor or Sensor Signal – solid core 1/0.6mm wire is ideal as it just plugs into the sensor/signal and is as supplied by Train-Tech (WP2/WP3) or model or electrical stores. The Relay Controller and Track Sensors/Sensor Signals can be powered either by DCC or smooth DC – see the pictures at the bottom of this page to show how to power the Track Sensors/Signals. Track Sensors can be used at the same time as Mimic Switch control and DCC accessory control - priority is the device which sent the most recent control command, ie Track Sensor, Mimic or DCC.



Using one Track Sensor or Sensor Signal the relay will close as soon as the train passes it and then open again about 7 seconds after the last part of the train has passed the sensor. However if you use a second Track Sensor/Signal and link it to the first as shown above, then the relay will close as the train passes the first sensor but not open until the train passes the second sensor, so in this way you can make something operate while a train is located in a particular section of track.

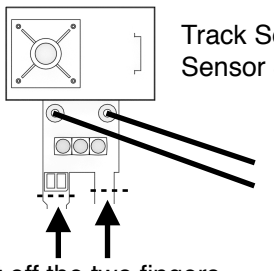
Power by sliding sensor into track – for DCC

If using DCC you can power the sensor from the track by sliding these two 'fingers' under the rails into the slots in some types of track, like a power clip. ***ensure good connections!***



Track Sensor or Sensor Signal

Power by wiring to sensor – for DC or DCC



Track Sensor or Sensor Signal

To power using DC or DCC solder 2 wires into the holes shown

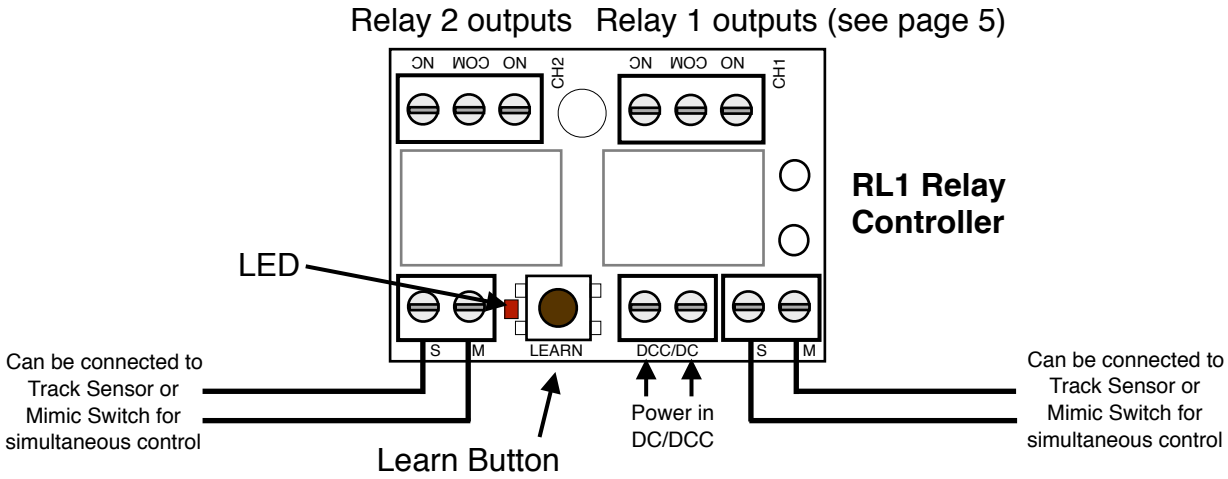
Cut off the two fingers with sharp cutters where marked – – -

Using Track Sensors with N Gauge: The Track sensor is designed primarily for OO gauge track, however we have found that it can be used with N gauge if the fingers are removed, some parts of sleepers trimmed and the sensor is placed close to (but not touching) the rail.

• Relay control using DCC accessory commands (DCC only)

The Relay Controller can be used to switch relatively high power low voltage devices using standard DCC accessory commands.
The two relay outputs can each be given a unique DCC accessory address so that they can be turned on or off using a single command from your DCC controller. Accessory commands are different from the Loco commands used to control the trains, but most DCC controllers can also control accessories*. Controllers usually have a DCC accessory mode button marked ACC or have an icon of a point or similar – find out by referring to your particular controllers instruction manual.

Connections
Wiring is easy, with just two wire connections from your standard DCC track output to the DCC/DC terminals on the RL1. Connect whatever you are controlling to the Relay contact outputs (page 5).



Controlling the relays using DCC Accessory commands
You can control a relay on the Relay Controller by assigning it an Accessory address and sending a command. Note that unlike loco commands, Accessory commands have just two 'states' usually referred to as on or off (or on some controllers 1 or 2 or left or right direction).

To assign an accessory address to each of your Relays connect the RL1 to the standard DCC track power output, set your DCC controller to Accessory control mode and turn on DCC power.

To set up the address for Relay channel 1 (CH1):

- Enter the address you want to give to Relay CH1
- Press the Learn button on the relay controller once – the red LED should single flash
- Press your DCC controller on or off button (or 1 or 2, or left or right)

The red LED will then stop flashing and you can control Relay CH1 using that accessory address

To set up the address for Relay channel 2 (CH2):

- Enter the address you want to give to Relay CH2
- Press the Learn button on the relay controller Twice – the red LED should double flash
- Press your DCC controller on or off button (or 1 or 2, or left or right)

The red LED will then stop flashing and you can control Relay CH2 using that accessory address

Note that you can give more than one device the same DCC accessory address, so for example you can change a relay and a point or signal using one command at a single address.
DCC accessory control can be used at the same time as Mimic Switch and Track Sensor control - priority is the device which sent the most recent control command, ie Track Sensor, Mimic or DCC.

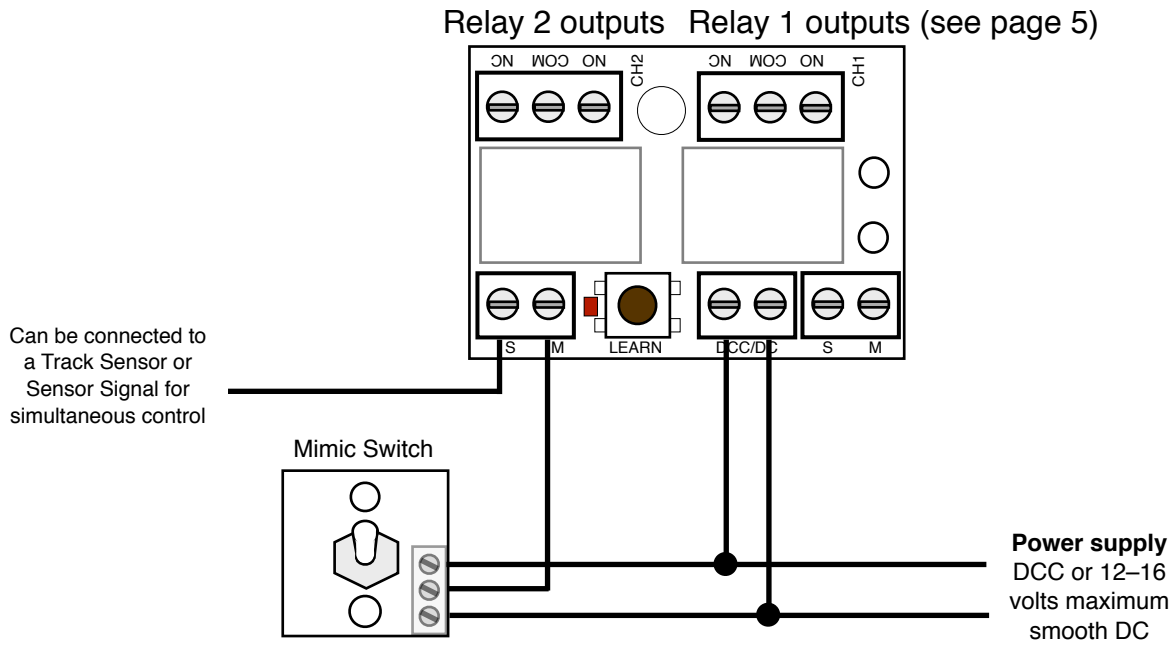
*NB Note that a few DCC controllers are not able to control DCC accessories, including the basic Bachmann EZ command controller supplied in some Bachmann train sets and the Gaugemaster Prodigy Express, both of which can only control DCC Locos. Refer to your controller instructions.

• Relay control using a Mimic switch (DC or DCC)

The relays in the Relay Controller can be controlled using Train-Tech Mimic Switches to manually control a relay; the dual colour red/green LED (LED A) supplied with each Mimic will also light and indicate the state of the relay.

Mimic Switches can be used in addition to Track Sensor control and DCC accessory control previously described and so can be used to manually override a relay. Control priority is given to the device which sent the most recent control signal, ie Track Sensor, Mimic Switch or DCC command.

Wiring is easy with just a single wire linking the M terminal of the Mimic Switch to the M terminal of the Relay Controller.
The Mimic Switch should be powered by the same DC or DCC power as the Relay controller.



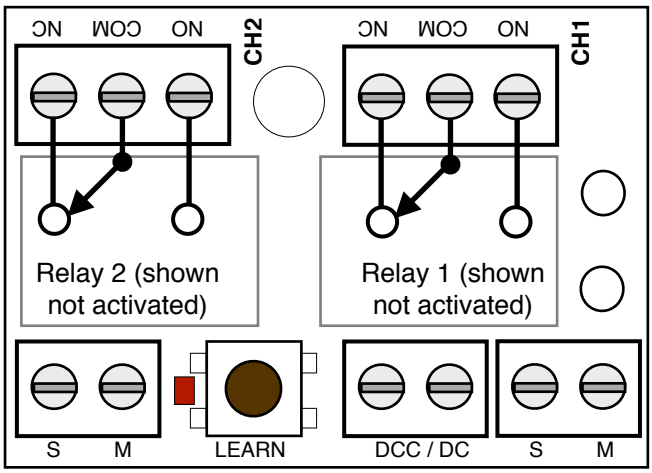
Tip

Note that a useful feature is that if a Mimic Switch is connected to an RL1 as well as a Track Sensor or Sensor Signal to the same relay, then the occupancy LED (LED B) on the Mimic Switch will light as a Train passes the sensor (see Mimic switch instructions for more details).

• Connecting to the Relay output contacts

The RL1 contains two relays, each of which has single pole changeover contacts to control motors, lamps etc. The contacts can be used to switch up to 24 volts AC or DC at up to 3 amps.

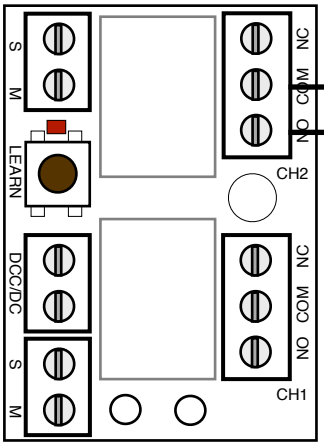
They should be connected in the same way as you would connect a switch, so wired in series with (in between) power and whatever you are controlling. The drawing below shows the internal relay contacts inside the RL1 so that you can see how they relate to a switch. The common (COM) terminal is the contact which moves and the other two terminals are Normally Open (NO), which means it is only connected to the COM terminal when the relay is activated, and Normally Closed (NC), which means it is connected to COM when the relay is not activated.
These type of relay (or switch) contacts are called changeover contacts.



• How does a relay work?
A relay is an electrically activated switch and consists of a coil of wire wrapped around a metal bar which forms an electro-magnet or solenoid which, when energised, moves an electrical contact to make or break connection with other contacts. The main benefits of a relay are that you can use relatively low power to energise the coil to control much higher amounts of power, and also the output terminals are not electrically connected to the coil input terminals and so are safely isolated.

• Simple on-off control using the Relay Controller

Connect these inputs to DC or DCC power and optionally also to Mimic Switches or Track Sensors to control the relays.



Control this via the relay by DCC accessory commands, Track Sensors or Mimic switch

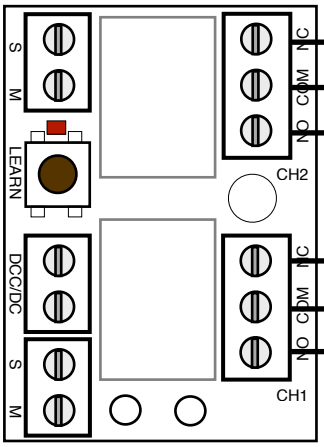
AC or DC power to suit what is being controlled

Motor, Lamp, Solenoid, etc

Note that you may need to use suppressors particularly on motors and solenoids to prevent interference (these are usually fitted to loco motors)

• Reversing a DC Train or motor using the Relay Controller

Connect these inputs to DC or DCC power and optionally also to Mimic Switches or Track Sensors to control the relays.



DC Motor

eg Loco

This example shows how you can use both relays in an RL1 to control the on-off power & direction of a DC motor – this could be the motor in a train on an automatic shuttle line for example.
If both relays are off or both are on then the motor will not turn, but switching either output on will make motor run in one direction or the other.
This could be controlled by track sensors or DCC.

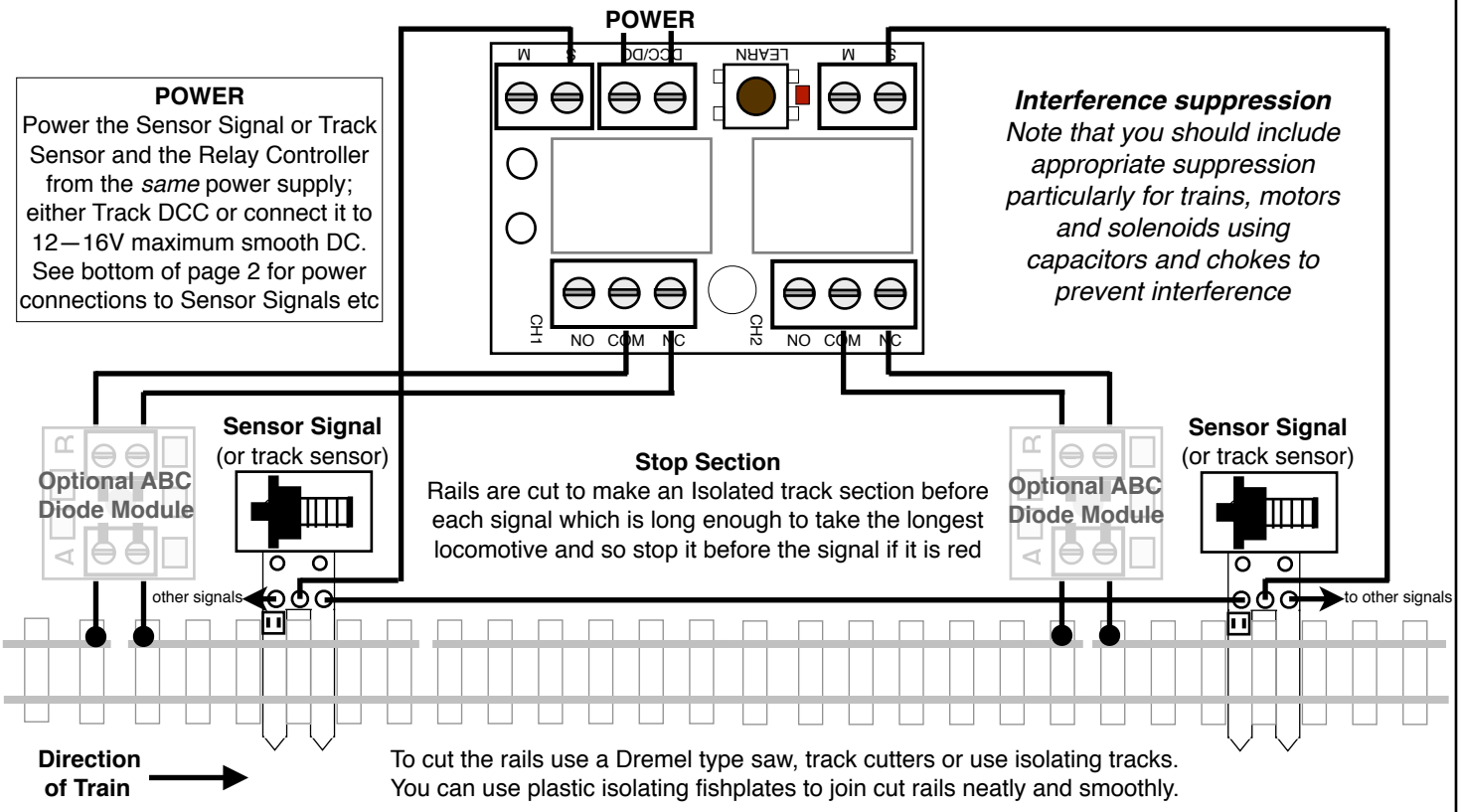
12 volts DC

Note that you may need to use suppressors particularly on motors and solenoids to prevent interference (these are usually fitted to loco motors)

• Automatic Train Control for multiple trains (DCC or DC)

On the real railway train drivers have to drive to signals and stop at red and although that is also nice to do on model railways, most people operate their layouts by themselves and have too much to do driving trains, changing points and standing back and enjoy it!
Train-Tech's Sensor Signals (or the SC100 Signal controller for automating existing signals or N gauge etc) are Automatic and work just like the real railway's Block Section signalling, normally showing green but changing to red as soon as a train goes past it and staying red until the train clears the following signal after the next section. However a red signal cannot stop the train on its own, but by making an isolated track section just before the Sensor signal and linking the signal to a Relay Controller to control the track section, trains approaching a red signal will stop until the signal displays green and makes it safe for the model train to proceed into the next section. In this way you can have a completely automatic model railway with several trains 'chasing' each other but never colliding as they will be held at least a section away by Sensor Signals working with Relays.

Although this sounds complex, it is actually relatively easy to wire thanks to the technology already in the Sensor signals and Layout Link, which is a single wire control system which links the signals and relays together. The illustration below shows how to wire two Sensor Signals and two stop sections to an RL1 to stop trains when they come up against a red signal. This shows just two stop sections, but it can be scaled to many more in the same way, either end to end or continuous ovals.



The Sensor Signals are all powered and linked together as normal (explained in signal instructions) and a single wire from each Signal goes to the S input of the Relay Controller. A Relay Controller has two relays, so each can control two track sections and each isolated track section is connected to the Normally Closed (NC) relay output so that when the relay is not activated by the signal (ie when signal is red) it connects power to the track section as normal. You can use this system on either analogue DC or DCC track power layouts, but note that the loco's will come to a sudden stop once they are are fully inside an isolated track section unless they are DCC-ABC decoder fitted locos and optional ABC diode modules are fitted as shown – see page 7 for more on ABC braking.

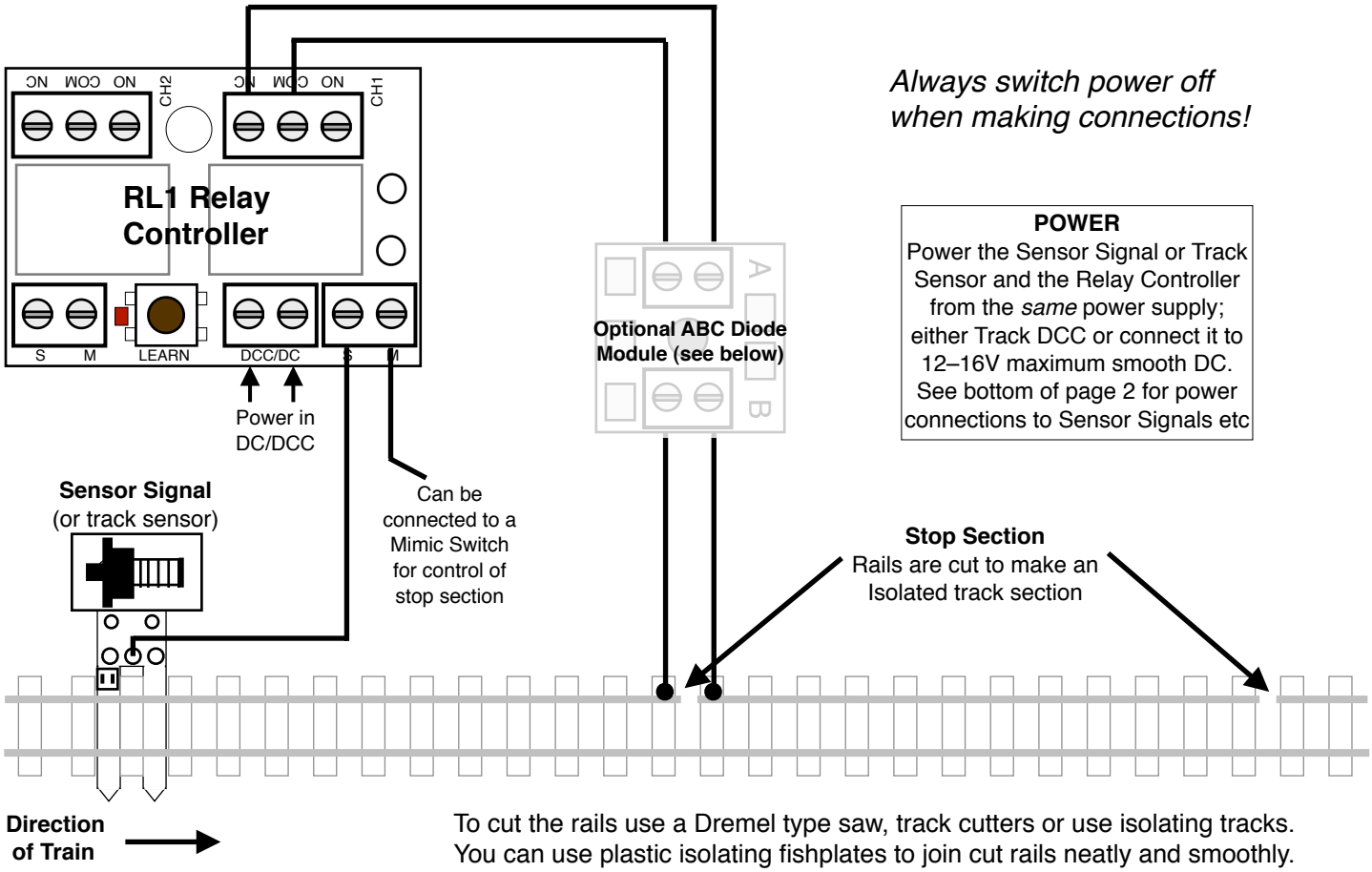
Manual override
Trains can be released manually from the stop section using either Mimic switches connected to the 'M' input of the RL1 (page 4) or DCC commands to override the RL1 (page 3) or Sensor Signal.

Semaphores Although not strictly prototypical to the real railway, it is possible to control Dapol Semaphore signals using Track Sensors with Train-Tech SC300/400 modules and to stop trains in a similar way to the colour light signals by also connecting the Track Sensor output to RL1 as above.

• Automatic Train Control for a single short stop (DCC or DC)

This project shows how you can use one Train-Tech Automatic Sensor Signal (or a Track Sensor) to stop a train for a short time just after a signal at a platform etc, then automatically set off again.

A Sensor signal is normally green until a train goes past it, when it will turn red and stay red until 7 seconds after the last part of the train passes. In this project as the signal turns red the relay will operate and isolate the stop section from power so that when the locomotive or driving car passes into the isolated section it will stop* and wait until the signal leaves red when it will start again. Note that while 7 seconds is quite a short time & is not adjustable (because the time is fixed in the signal), the stop can also be controlled by an optional Mimic Switch or DCC accessory command to keep the relay on and the section isolated – on DCC the signal can also be manually overidden. The project works on DC or DCC layouts, though note that if using DCC Sound locos they will stop and the sound go off suddenly unless they are fitted with ABC braking chips (see below). Care should be taken when planning the length of the stop section and its distance from the signal because the isolated section will only stop the train for 7 seconds after it has passed the signal.

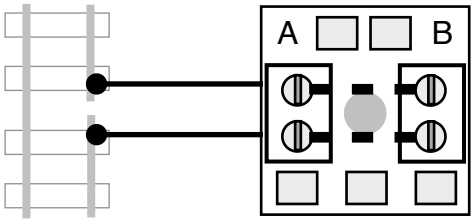


To cut the rails use a Dremel type saw, track cutters or use isolating tracks. You can use plastic isolating fishplates to join cut rails neatly and smoothly.

• Smooth stopping for DCC locos with ABC Braking* (DCC)

Some DCC loco decoders have technology called 'ABC' built in which enables locomotives to slow down gradually and stop when it comes to a section of track with an ABC diode module fitted in series with the DCC power, and these can be used with the Automatic Train Control projects for RL1 so that trains slow down instead of suddenly stopping. However note that the ABC diode modules only work with DCC locos fitted with configured ABC decoders and *none-ABC chip fitted locos will not slow down or stop in isolated sections where ABC diode modules are installed*. The ABC diode modules are made by a number of manufacturers including Train-Tech (part ref ABC1).

The Train-Tech ABC Diode modules have 2 pairs of terminals, A and B. They are internally connected together so either may be used. Connect the track section break to A or B terminals and RL1 output to the other terminals.



Note that ABC loco decoders must be configured using the instructions from the decoder manufacturer. Some require ABC diode modules to be connected a particular way round, so be sure to carefully follow instructions.