MERG **West of Scotland Area Group**

Tip of the month - September 2019

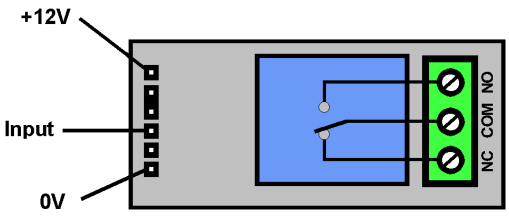
Using relay modules

Relays are an easy way to interface electronic modules to the outside world.
For example, a train detector will spot a train entering an industrial site – but cannot provide sufficient current to control a large motor operating a conveyor belt.
However, a relay can sit between the detector and the motor. Problem solved!

Examples of use
There are many uses for relays in model railways:

- Switching high currents (e.g. motors, LED strips)
- Switching high voltages (e.g. 24V motors or even 240V if you are brave/mad enough)
- Frog switching for electrofrog points
- Section switching
- Switching between different audio speakers (as used in Uppen Doon)

Here is a simple relay module.
On the left hand side there are connections for the power (+12V and 0V).
There is also an input connection.
When the input is at a high voltage, the COM (common) screw terminal is connected to the NC (normally closed) terminal.



When you take the input pin down to 0V, the relay operates and the COM terminal connects instead to the NO (normally open) terminal.

Module types
Although you can buy a bare relay and put it on a board along with other components, completed modules are available on eBay, etc. ready built (and often cheaper than buying the parts yourself).

Relay module are available in many different configurations:

- SPST (a single change-over)
- DPDT (two change-overs in the same relay)
- Boards with one, two, four or eight independent relay circuits on them
- 5v or 12V relays on board.

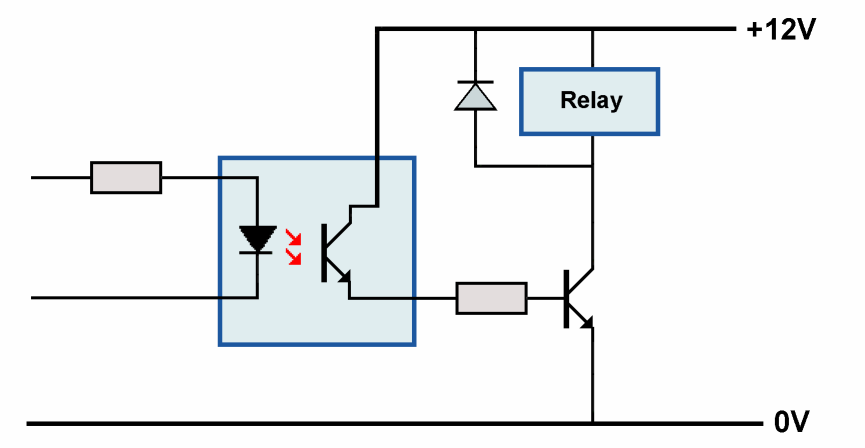
The best modules use opto-isolators.

Why opto-isolators?

Optoisolators (or optocouplers) are devices that keep different modules electrically isolated from each other. There is no electrical connection between the device that is operating the relay module and the components on the relay module board itself. It is commonly used to interface devices that use different voltage levels (e.g. a 5V output interfacing to a 12V circuit).

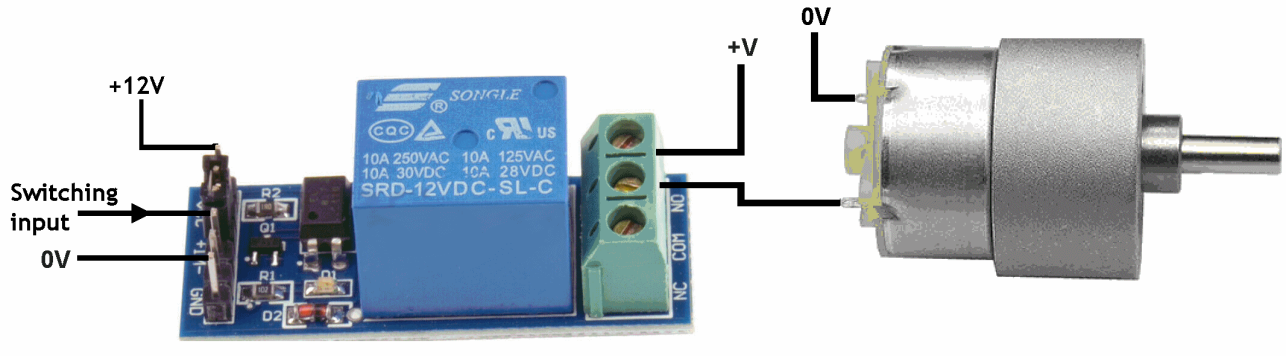
The *'opto'* part means that it uses light to transmit a binary state between its input and output.

Here is a simple example of a relay module with an opto-isolator. The train detector, or whatever, will switch the light source on. The light is detected by a photo-transistor and this switches a transistor to switch the relay.



Controlling motors

This example shows a relay operating a heavy current motor or a high voltage motor.



The top pin (labelled as VCC) is connected to +12V and the bottom pin (labelled asGND) is connected to 0V. The third pin from the bottom is the input to the module and it connects to whaterver you are using to switch the circuit.

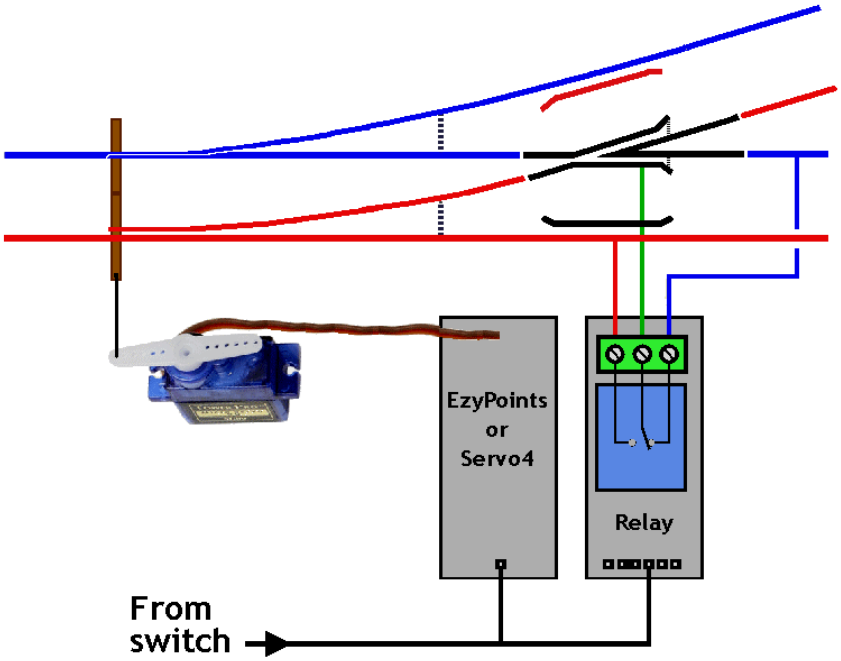
The motor has one lead connected to 0V and the other lead connected to the COM terminal. The NO terminal connects to the voltage required by the motor (e.g connect 12V for a 12V motor, 24V for a 24V motor, etc.).

Normally, the relay is switched off and no power is connected to the motor.
When the relay's input is taken to 0V, the relay switches power on to the motor.

The motor can be replaced by any other high voltage or high current device (e.g. a LED strip).

Frog switching

This example shows a suitably modified point having its frog automatically switched when the point operates.
The switch brings the input to the point operator (e.g. an EzyPoint or a Servo4) down low, operating the point. The switch also triggers the relay, switching the frog from one rail to the other.



Switching with a positive voltage

Most relay modules only have three terminals on the input side, one each for the positive voltage, zero volts and the input. It can only switch when its input is taken down to 0V.
There are ocassions when a relay is needed that switches when its input goes high.
For exmple, devices on cars are all earthed to 0V and are energised when switched with a higher voltage.
The relay shown can be operated in either active-low or active-high mode – i.e. it can be switched by a high voltage or a low voltage depending on the position of the jumper.
This image shows the jumper setting for switching to a high incoming state.