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## Explaining Separate Grounds in relay circuits

There are two basic kinds of relay boards. Boards with a common ground and shared by all inputs controlling each relay and boards with optically isolated inputs which do not establish any connection between the reference ground of each input.

An opto-isolator is a special circuit that allows controlling an output from an input without having to have the input and the output share a common ground. This is called also electrical separation.

The most common way to achieve this is to have a light emitting diode embedded with a phototransistor in the same package; what controls the output is the beam of light generated by the light emitting diode which turns ON the phototransistor. In this way there is no direct connection between the input circuitry (diode) and the output circuitry (transistor).

The amount of light generated by the light emitting diode is proportional to the current going through the diode. The diode has a voltage drop, which is negligible, so a series resistor is normally added to limit the current when an input voltage is applied.

This allows a further advantage since what is seen at the input is a resistor. Any input voltage can be applied above a minimum threshold (typically 3.5 Volt) so the input circuit is very flexible in terms of input voltage, which ordinarily will span over a large band.

**Conclusion:** the input impedance is a plain resistor; any input value will be accepted within the limit of power dissipation of the resistor.

The relay by its nature separates the load from its driving circuitry; furthermore the optical insulator separates the input from the driving circuitry of the relay. There is double insulation, which allows separating the logic power supply which powers the controlling board (for example an Arduino board or Raspberry board) from the power that feeds the relay board from the power feeding the load that the relay switches.

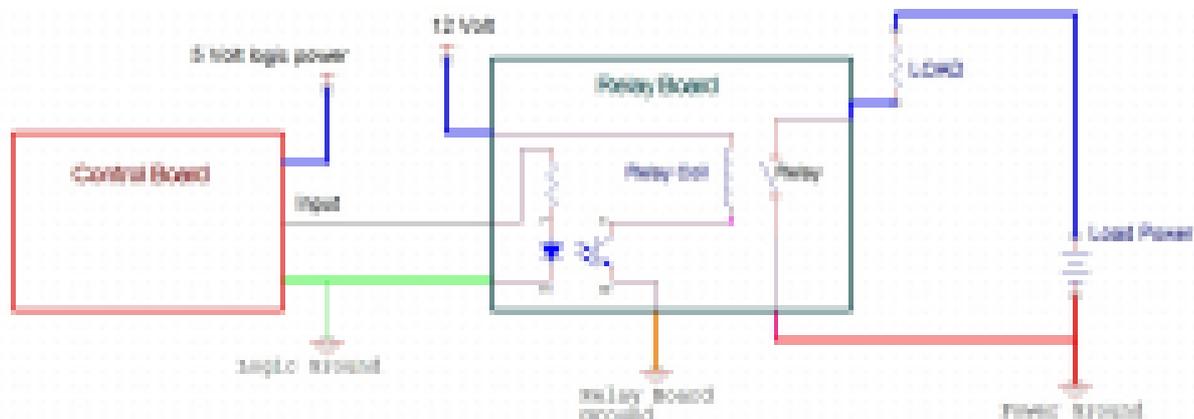


Fig. – 1. Showing how grounds are insulated from each other

## Input voltage Range

The input voltage range is fairly wide. Any voltage below 1 Volt, up to - 48 volt is logic low. Any voltage above 3 volt up to 48 volt is a logic 1.

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## Multiple input grounds

The presence of opto-couplers at the inputs allows each input to have its own separate ground.

Assuming we have multiple sensors.

If they all have a common ground, they can be connected as shown in Fig – 2, by leaving in place the jumpers on the relay board; if instead they have separate grounds, remove the relevant jumpers as shown in Fig – 3. Fig. – 2 and Fig. – 3 show as an example three sensors.

The extension up to eight sensors is obvious.

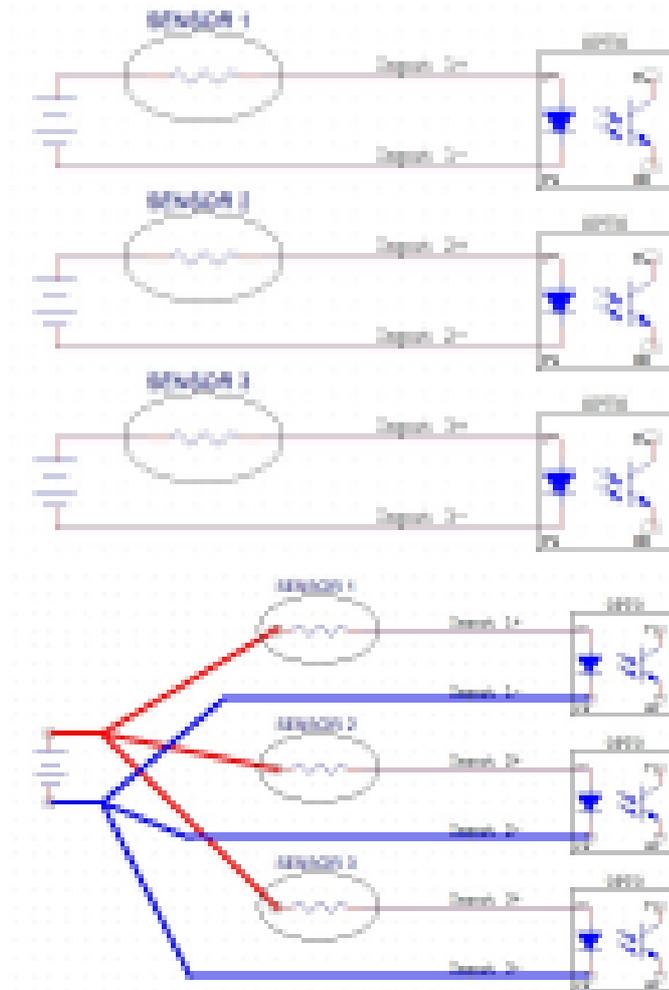


Fig. – 2 / 3