

## 2-Way Switch Causes LED Bulbs to Flicker

Sometimes customers have reported that their LED bulbs (and sometimes CFLs) will briefly flash every now and then. It may be anywhere from 10 to 30 seconds, and the flicker may not be very bright in some cases. We had our engineer investigate the issue and consult some electricians and we have come up with a reason and solution. If you just want a quick solution to this issue, then jump to the Solution section below. Otherwise please read on for an explanation on the issue.

### Background

When multiple wires run close to each other for a long distance, such as in a multi-core cable, a small amount of charge can be transferred from one wire to another. This is due to Electromagnetic Radiation and Induction which occurs when an alternating current is present in a wire (such as with Mains AC voltage). Electromagnetic Radiation is when energy in the form of an Electromagnetic field is emitted from a wire. The field rotates around the wire as shown in *Figure 1*. This field can induce a current in a neighbouring wire that is close by as shown in *Figure 2*. The direction of the field depends on the direction of the current and vice versa.

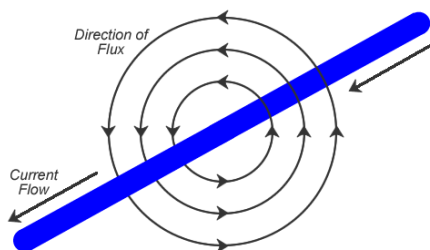


Figure 1: Electromagnetic Radiation

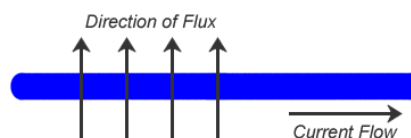
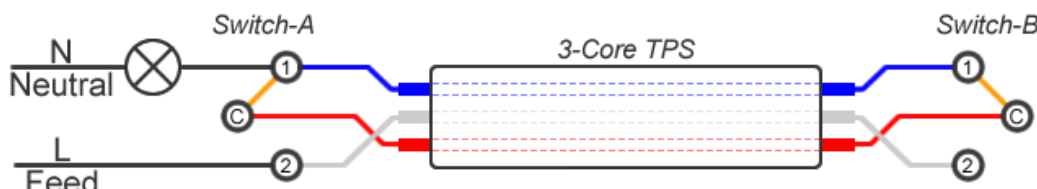


Figure 2: Electromagnetic Induction

### Cause

A dual light switch is usually wired with a 3-Wire strap using 3-Core Blue/White/Red TPS cable. If the middle wire (the white wire in this case in the TPS cable) is connected to the live feed, as shown in *Figure 3*, then this results in a wire loop (made up of the blue and red wires) running on both sides of the white wire. Due to Electromagnetic Radiation the current induced in the blue and red wires adds together and causes a transfer of charge to the lamp.

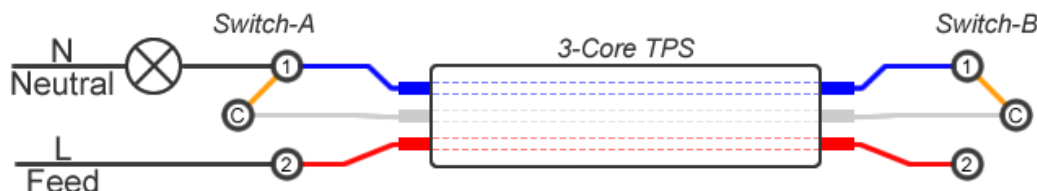


WRONG

Figure 3: Three Wire Strap (Live Middle Wire)

### Solution

The simple solution is to wire the circuit to avoid having the live wire running between the two wires connected to the lamp, and thus avoid induction into a wire loop. To do this, you can simply swap the middle wire with one of the other wires (red and white wires in this case) at both light switches as shown in *Figure 4*. Although electrically this is the same circuit, electromagnetically this is very different. The two lamp wires are on the same side of the live wire, and so the current cannot add together which prevents the charge from being transferred to the lamp.



RIGHT

Figure 4: Three Wire Strap (Live Outside Wire)

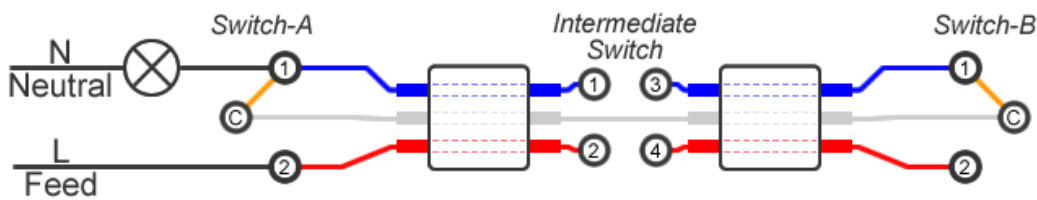
### Safety

It is recommended that any electrical work be performed by a registered electrician. If you will be attempting any work yourself, please review the NZECP 51 - Electrical Code of Practice for Homeowners document on the Energy Safety website. Go to <http://www.med.govt.nz/energysafety> and search for "ECP 51".

## What About a 3-Way Switch Setup

A 3-Way Switch (3 switches controlling the same set of lamps) is wired in the same manner as above, but the a third, specially designed switch, called an 'Intermediate Switch' is wired in the middle. In one position the Intermediate Switch passes the two switched strap wires (connected to terminals 1 and 2 on the end switches) through. In the other position, it reverses the two wires. The third wire, the common, is wired straight through.

If you have an issue with a 3-Way Switch, simply ensure that the two strap wires that pass through the Intermediate Switch are the two outer wires in the 3-Core TPS cable. In Figure 3 and Figure 4 these are the Blue and Red wires. The white wire would be wired between the two common 'C' terminals on the switches at either end.



RIGHT

Figure 5: Three Wire Strap - 3 Way Switch

The same principal applies to a 4-Way Switch setup, or more. As long as the Feed wire is only switched with an outside wire in the cable this problem will not occur.