Changing to LED Indicators (Turn Signals) by Rob Bird

Background

Having various classic Japanese bikes on which the indicators can be a bit iffy (mainly on the 6V bikes), prompted me to look into the process of changing them over to LED. After researching via Google (where else!), I knew that I wanted a full LED system including a solid-state flasher relay and didn't want to add ballast resistors, as the point of moving to LED, was to lower the load on the electrical system, working with less current and hence more reliably.

Although initially this was for the 6V bikes which were far more temperamental, the same also applies to the 12V bikes (obviously using 12V LEDs, instead of 6V!).

The best technical information I found was on a Triumph forum, which had a lot more in-depth technical information but in my view wasn't a complete how to. If you want to see the original technical guide, then Google *"turn signals - all you need to know by ripper"* - Ripper, if you ever see this, thanks for your article and the inspiration it gave me.

Components Required

You will need:

1 * Solid state 6V-12V 2 pin indicator relay

4 * BA15S LED "Bulbs"

2 * 1N4007 Diodes
(for bikes with only a single warning light)

Optional: 1 or 2 BA9S LED Bulbs
180Ω 0.5W resistor (for 6V circuits) **or**
330Ω 1W resistor (for 12V circuits)

As expected, all these were on Ebay or Aliexpress and all were from China, apart from the diodes and resistors which you can pick up in your local country (I used Switch Electronics in the UK). Make sure you buy the voltage required for your bike, either 6V or 12V. ***If you have a 2 warning light circuit (see Circuit Descriptions later) then you will not need the diodes.*** If you have a single dash warning light or want to use LED warning lights in a dual warning light setup, you may have to cut and join wires or create an intermediate wiring harness, so I would suggest a soldering iron, solder, shrink wrap, loom tape, connectors as required and wire, just don't twist the wires together and put insulation tape around them!

The relay was spec'ed for 6 to 12V and the Ebay description (to help you search) was *"6V-12V Motorcycle 2-Pin LED Indicator Flasher Relay Beeper"*. All the ones I found also incorporated a beeper, for an audible warning. As I didn't want that, I opened the unit and cut the wires to the speaker, so mine are silent.

The indicators will most probably use BA15S type bulbs (but check to make sure). The Ebay / Aliexpress description was *"DC 6V 1156 P21W BA15S 3030 15 LED Indicator Turn Signal Light Bulb"*. ***Note*** twice I have bought 6V bulbs but the seller sent 12V. I suggest you test all bulbs on the correct battery to make sure they are the correct voltage and

working before starting the conversion process. The LED Bulb pictured was one type I used, as they are very low profile and worked well for me. There are other types with LEDs at the sides. You might have to experiment with different types depending on your existing lens and see what works for you.

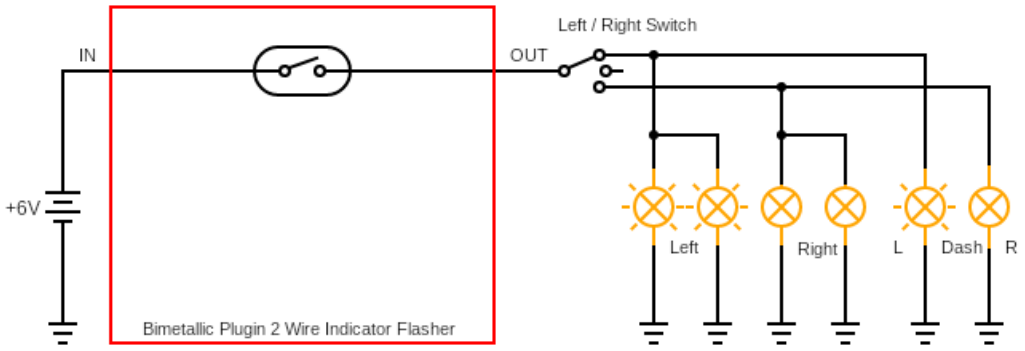
Check the warning light bulb type, mine were BA9S and again there are different styles. The Ebay / Aliexpress description was *"Ba9s T4w Car LED Side Light Bulbs Interior Lighting Parking 6V Warm White"* to help you with searching. Check they rated correctly (6V or 12V) before installing just in case you have been sent the wrong ones.

The diodes are just general purpose 1N4007 and only required if you have a bike with just one warning light (see circuit descriptions regarding this). Note: most of the 1N400x range would do voltage wise, I just went for the highest.

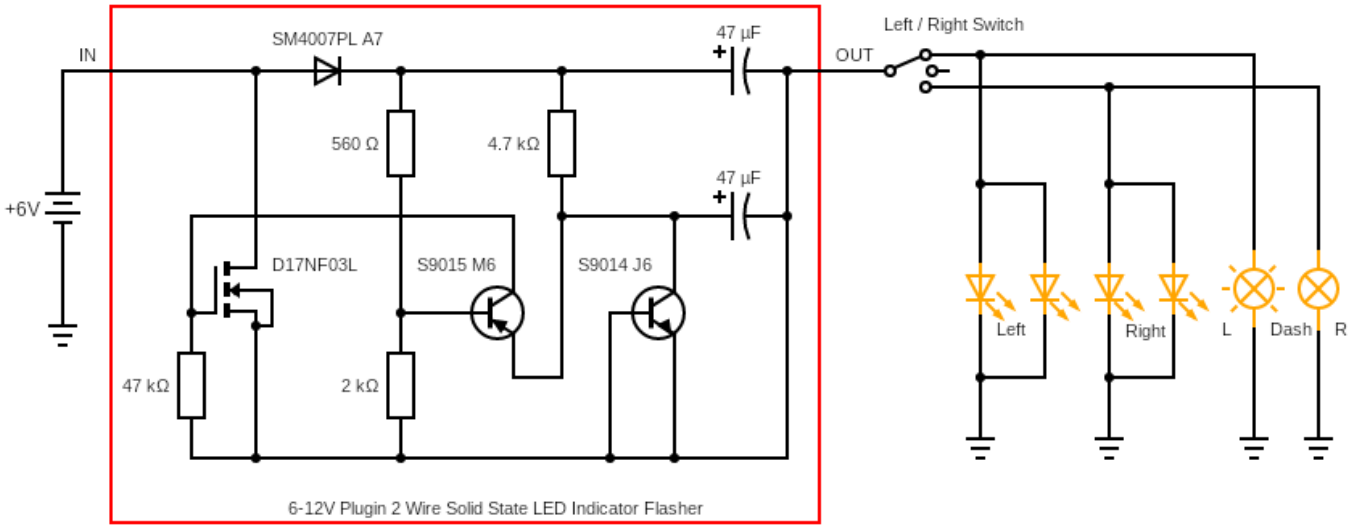
Circuit Description 1- Separate Left and Right Warning Lights (using 3w warning bulbs ***not*** LED)

If you have a bike with separate left and right dash warning lights then you are lucky, as this is the easiest setup to convert to LED. You can see from the circuit diagram below, when you activate the indictor switch to either the left or right positions, the voltage is passed to the relevant bulbs for the right side or left side, with each bulb being earthed, including the dash. Just unplug the existing relay and bulbs, plug in the new components and away you go!

Note 1: If you want to change the warning bulb to LED then please see *Circuit Description 3*, else leave as a 3W bulb.
Note 2: If one of the normal 3W warning bulbs fail, most likely the indicators on the same side will stop working until it is changed, as the "load" it creates is required to drain the 47uF capacitors in the solid-state relay to make it work.

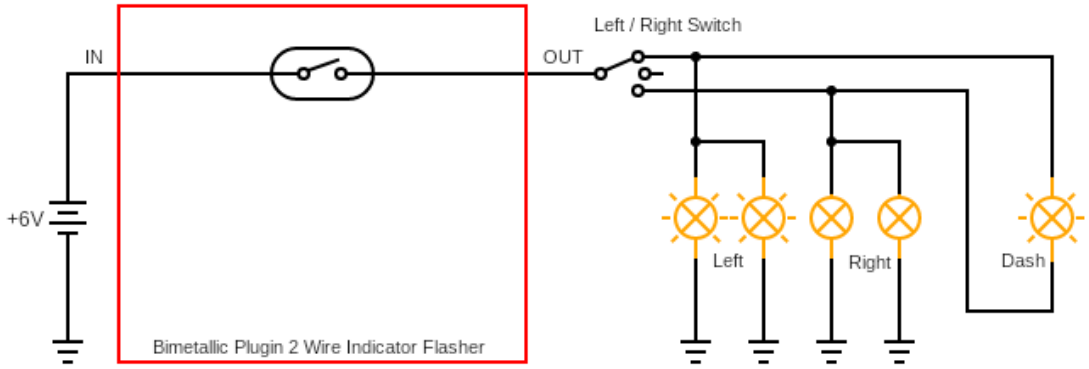


This should give you the following (I have shown the relay internal circuit for reference, for the device I was sent).

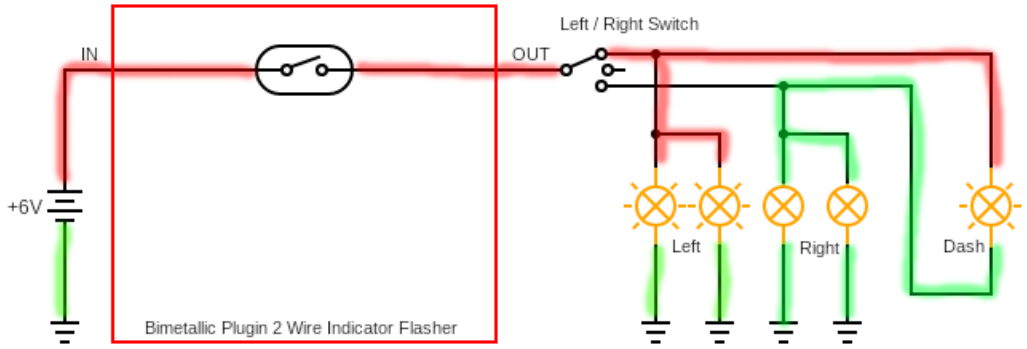


Circuit Description 2- Single Warning Light (leave as a 3w bulb ***not*** LED)

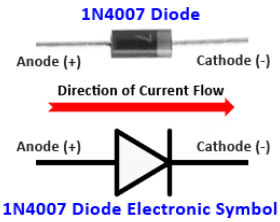
From my experience this is the most common setup for indicators. Because of the way it functions, it does require a little more work to covert to LED. Looking at the circuit below you can see that the 4 indictors are the same as in the previous section, with a live feed and earth. However, you can see the warning light appears to have no earth.



So how does the warning bulb light up with no earth? Well, it uses the earth of the bulbs of the opposite side to the way you are turning. E.g. When you turn left the warning light earths through the right-side bulbs and when you turn right, it earths through the left side bulbs, as shown in the next circuit diagram. Why this works and the "earthing" bulbs don't light, is in simple terms, because the low wattage (typically 3W) warning light only requires mA to light, which isn't enough to light the 21W indicator bulbs.



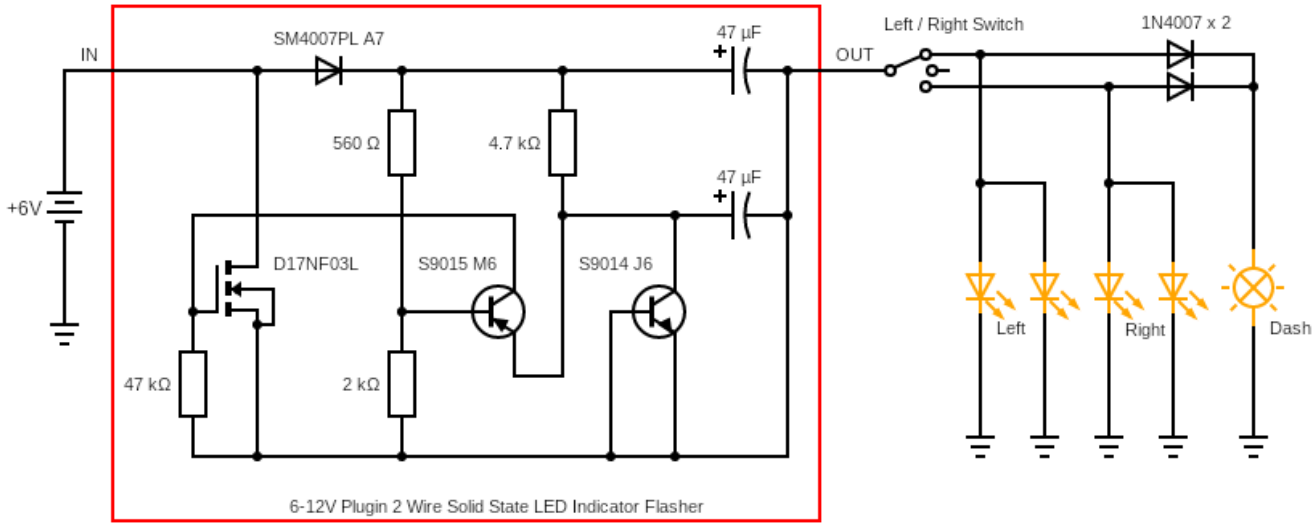
Moving to LED bulbs will cause issues as you don't have the difference in resistances, plus if you decide to use an LED for the warning light, it will only flow one way - LED = **L**ight **E**mitting **D**iode, and a diode is like a one way valve, current will only flow from Anode (+) to the Cathode (-). The image below shows the diode and its electrical symbol.



The single warning light setup is the issue that makes moving to LED more complicated.

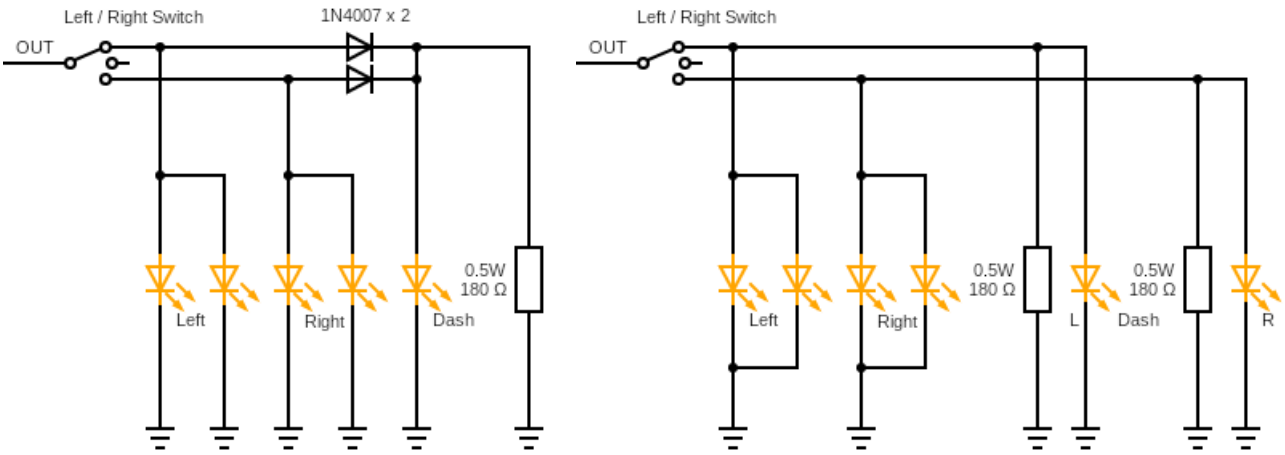
The solution is to find the 2 wires that go to the warning light, take the one from the "outside" of the warning light bulb holder and join it to the bikes earth. Then join the incoming left indictor wire to the anode of one of the 1N4007 diodes, join the incoming right indicator wire to the anode of the other 1N4007 diode and join both diode "cathodes" together, then join the cathode side to the wire coming from the centre contact of the warning light bulb holder. The next diagram shows the circuit you should have (I have shown the relay internal circuit for reference, for the device I was sent, others may differ). The same 2 Notes as in Circuit Description 1 also apply, which to recap are:

Note 1: If you want to change the warning bulb to LED then please see *Circuit Description 3*, else leave as a 3W bulb.
Note 2: If the normal 3W warning bulb fails, most likely the indicators will stop working until it is changed, as the "load" it creates is required to drain the 47uF capacitors in the solid-state relay to make it work.



Circuit Description 3 – Changing the Warning Light to LED

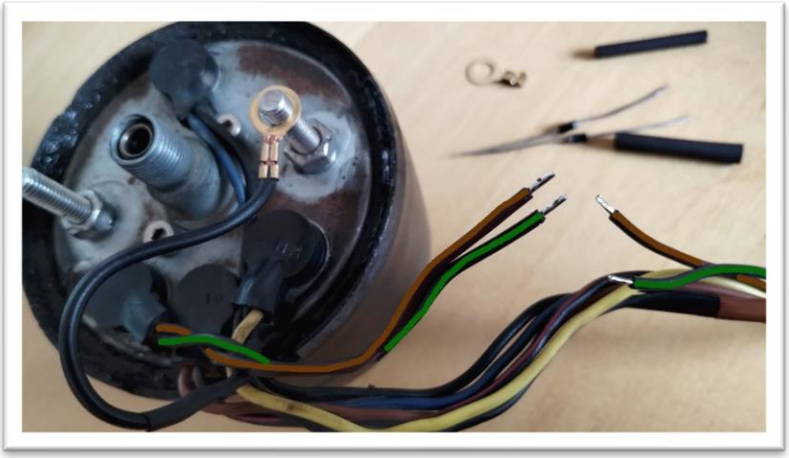
The solid-state relay needed a small load on the output to help drain the internal 47uF capacitors. Leaving the 3W warning bulb creates this load so all works well. However, if you use an LED for the warning light, there is no load and I have my flasher unit would not work. The solution is to put a small load resistor in parallel with the warning LED. We know the voltage (V) is 6V and the bulb is 3W (P) so using Ohms Law of $R = V^2/P$ the resistance (R) required would be 12Ω. This would also need a 5W resistor, which really is too big for these tight spaces. A few calculations and a little trial and error and I ended up using a 180Ω 0.5W resistor which is a much smaller package. Although not tested at time of writing, for a 12V circuit, I would try a 330Ω 1W resistor. If you lower the resistance you can also alter the flash rate a little to your tastes. Remember to use $P = V^2/R$ though to calculate the power rating of the resistor required. Your Output circuits then look like one of these depending on whether you have a 1 or 2 warning LEDs:



Example 1: Installation on a Yamaha GT80 (6V Electrics, Single Warning Light Left as a 3W Bulb)

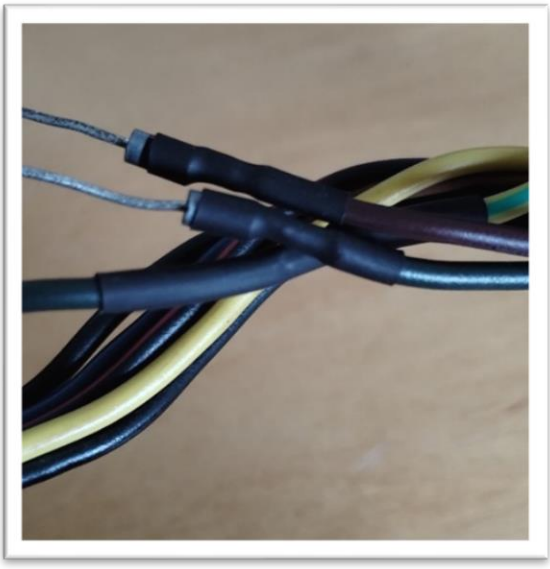
My little Yamaha GT80 didn't come with indicators but after picking up some similar Yamaha ones up at a local Auto Jumble I thought I would add them, as the bike already had LED head and taillights. Obviously whether to cut and splice in or make an intermediate hardness will vary from bike to bike and person to person. Check your wiring and decide what's right for you and your bike.

1: The stock Yamaha GT80 clock with single warning light for the indicator (TURN) on the right ...

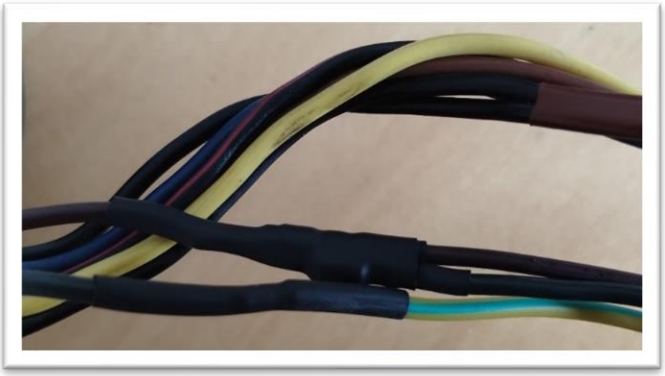


2: Flipping the clock over, the holder for the warning light is on the left now. The indicator wires on this bike are dark green and brown (I have highlighted the wires in the image). I had to remove the bulb holder from the clock to check which wire was on the outside of the bulb holder (dark green) as that would go to earth and which wire went to the bottom centre contact (brown). As this bike has one harness for all wires from the clocks, ending in a 6 way connector, I decided to splice in the new cabling. I removed the old loom tape from the wiring that went from the clock to the 6 way connector that joined the main loom in the headlight shell. You can see that the high beam light is earthed via a ring termination on one of the mounting posts. I cut the wires half way along their length and “tinned” the ends.

3: Next, you can see the anodes of the 2 diodes soldered to the incoming (from the main wiring hardness) left and right indicator wires, with heat shrink ready to be shrunk! Note the diode polarity as it’s important – don’t get them the wrong way! Behind those 2 wires you can see the dark green wire (from the outside of the warning light holder) already joined with a new yellow/green “earth” wire on the right, with the heat shrink ready again (I didn’t have any dark green wire or black for that matter so used a piece of earth wire stripped from an electrical cable!). The second image shows the heat shrink in place and we are ready to solder the 2 cathodes together.



4: The 2 cathode ends of the diodes joined together, then joined to the brown wire coming from the warning light holder centre contact, and then heat shrink applied to make a safe, insultated join. The earth wire has a ring connector the same as the one used on the highbeam light.



5: Lastly, because the earth wire from the bulb holder was coming away from the clocks "down" the bundle of wires, the yellow/green wire had to turn through 180 degrees to come back up the wires towards the clock again. I could have cut the wire near the holder, but I wanted to keep it neater and have both wires cut and joined at the same location, halfway along the harness. I then wrapped the wires in proper loom tape (NO insulation tape please!).

Once complete, the indicators worked great straight off the battery, even without the engine running –hard to show that in a still image! Here's the little GT80 with its new indicators fitted.

Example 2: Intermediate Harness (Suzuki FR80 with LED warning light)

The next bike to convert was my Suzuki FR80. The warning light for this was joined to the main hardness via 2 standard 3.9mm bullets. As I keep these types of connectors in stock, it made sense to build an intermediate harness which also incorporated the load resistor and is easy to just plug in. Below shows the completed intermediate harness and hopefully, if you have followed OK so far, you can see how it came together.