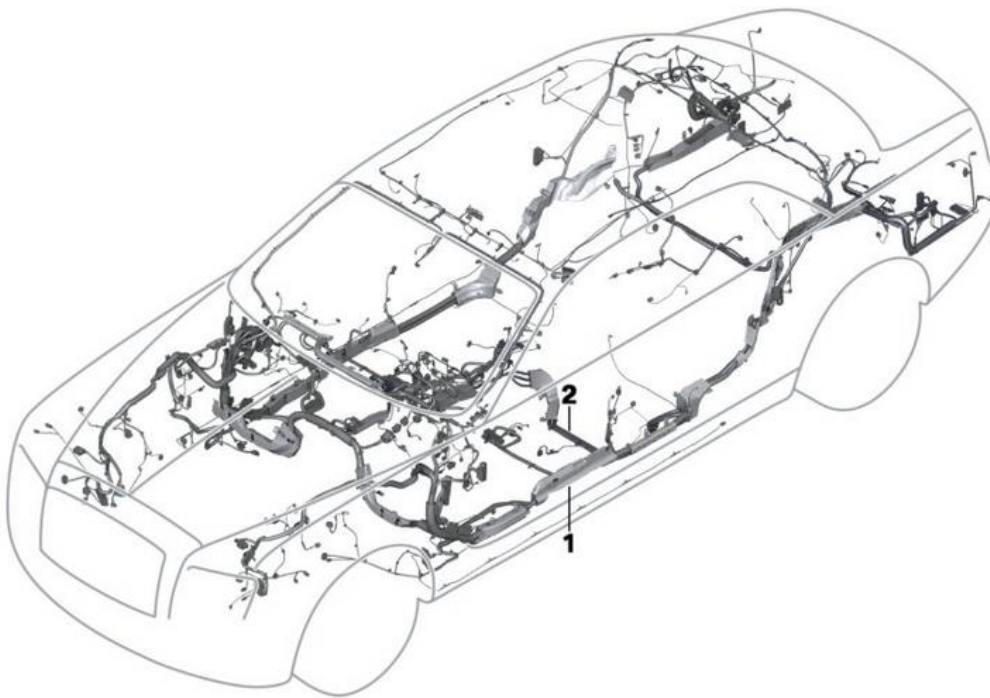


## COMMON-ANODE & COMMON-CATHODE LED WIRING

The words common-anode and common-cathode are often new terms which modellers may be unfamiliar with. This short note should help to explain what they mean and why they are used.

### Common Connection

Most will be familiar with common connection.



All vehicles now use a common negative ground, with the battery negative terminal connected to the chassis of the vehicle. Vehicle bulbs all have one side permanently connected to chassis as well. They only need one wire from the light switch to the other side of the bulb to complete the circuit and operate the light.

This reduces the wiring significantly.

## Led Wiring

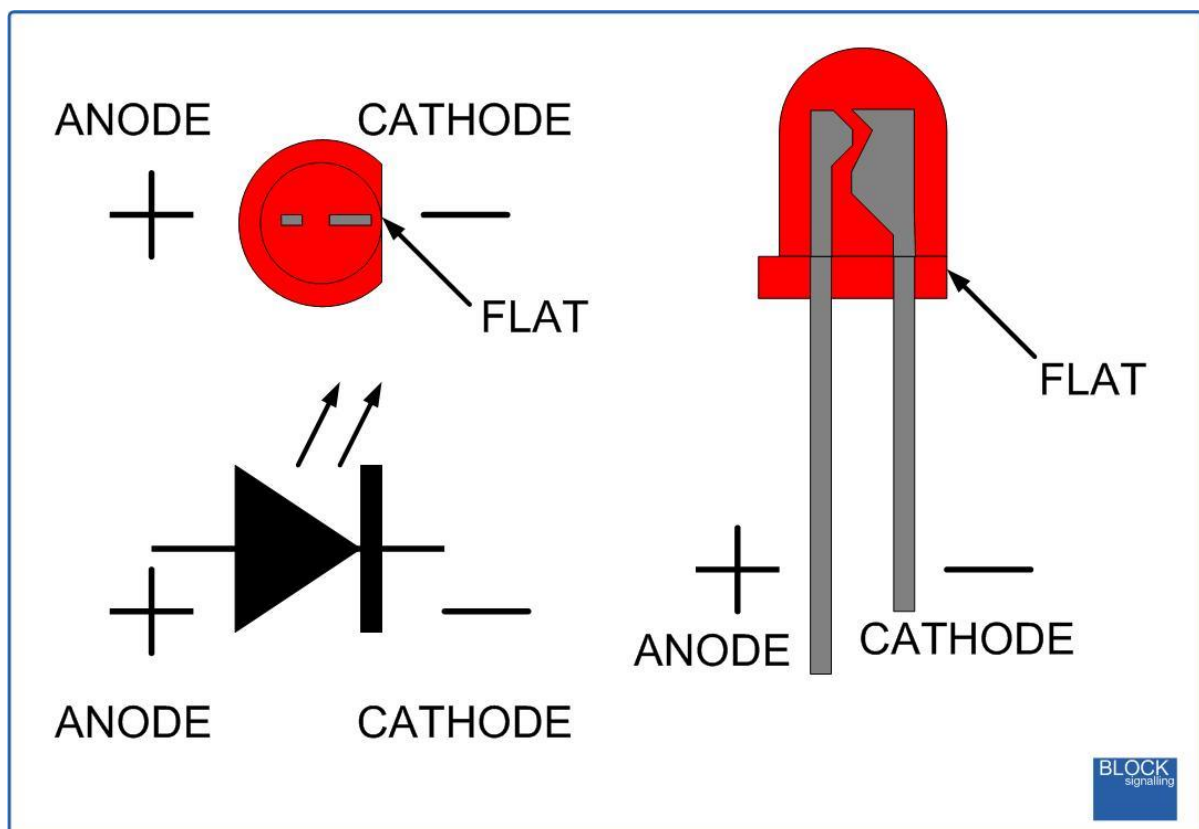
A similar wiring method is used with model railway signals to reduce wiring.

The only difference with leds is that, unlike filament lamps, they will only work when wired one way around.

You have to connect the positive lead of the led to the positive of the supply and negative lead of the led to the negative supply otherwise the led will not light (and could be damaged). To help with this the led leads are identified by their different lengths.

## Led Connection

The negative lead (called the cathode) is identified by having a shorter lead, and often a flat on the side of the led body.



## Leds and Resistors

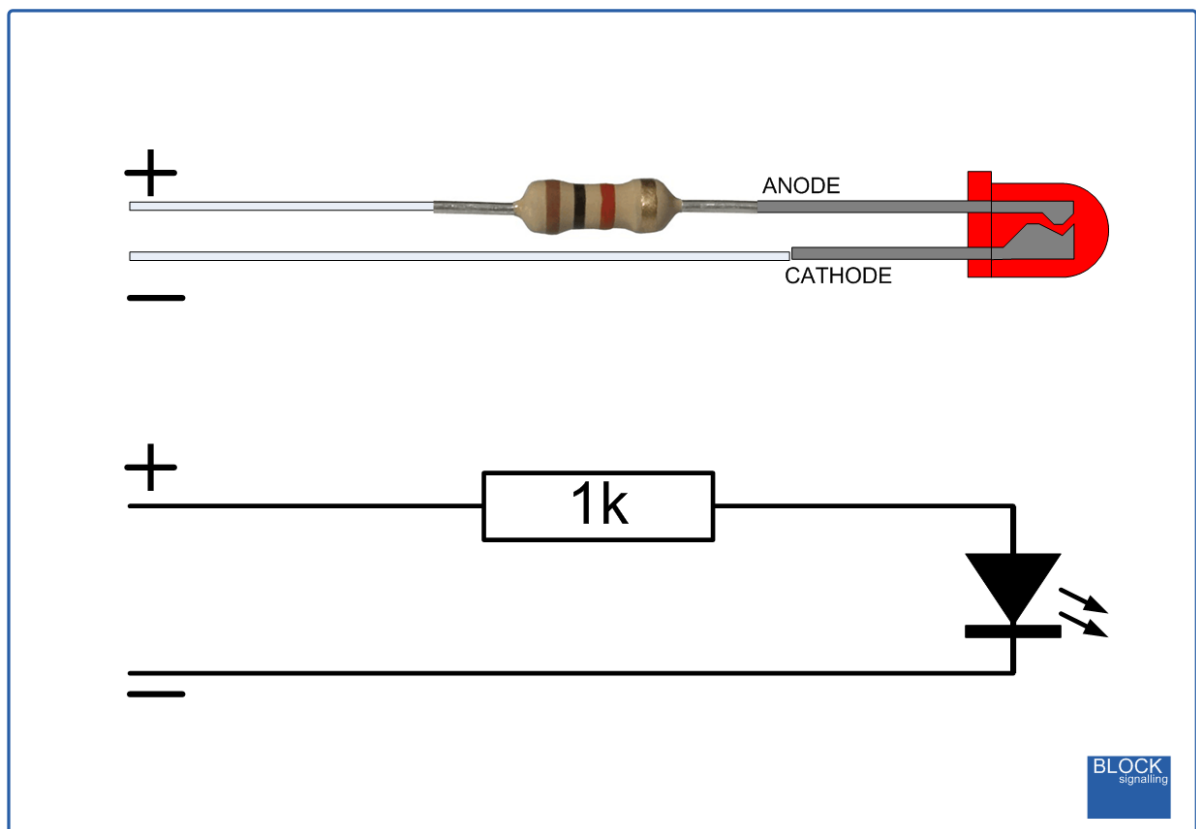
With bulbs we are used to choosing a 6V bulb and connecting a 6V battery and everything works fine. Connect 12V and the bulb will glow much brighter, and probably no last that long.

Leds behave in a different way. They are designed for voltages around 1.5V to 3V depending on the colour.

If you connect a red led to 2V it will light at normal brightness. Increase it to 4V and the current will increase and burn the led out in a few seconds. So how do you use one with 12V?

The answer is to use resistor in series with the led, as a kind of fixed dimmer. It will limit the current to prevent damage to the led.

In most cases a 1k ohms (1000 ohm) resistor is suitable when connecting to 12V DC supplies.



In most instances on model railways, a 1k resistor will suffice for any supply voltage between 5V and 12v, as we don't want the leds to be very bright as it generally will not suit modelling environment.

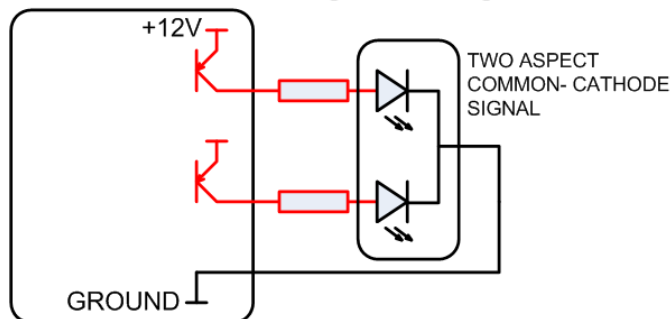
## What about multiple leds in model railway signals?

When a manufacturer makes a signal head for a model railway, unless they common either all the anodes or all the cathodes they will end up with an excess of wires, which will probably not fit down the pole.

They solve this by grouping all the anodes (positive connections) or all the cathodes (negative connections) together and connecting them to one wire.

In the diagram below, the signal heads on the right use common wiring of either the cathodes or anodes. A separate resistor is shown for each led, although in practice a single resistor is usually wired in the common lead.

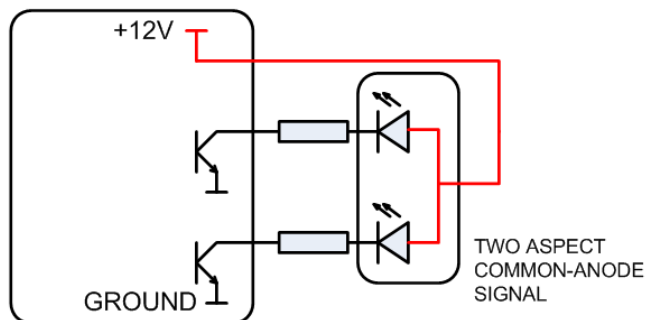
### Common Cathode Signal Wiring



Common cathode signals have each of the negative (cathode) side of their leds connected together (commoned).

These are designed to operate with modules which have channels which switch to the positive supply.

### Common Anode Signal Wiring

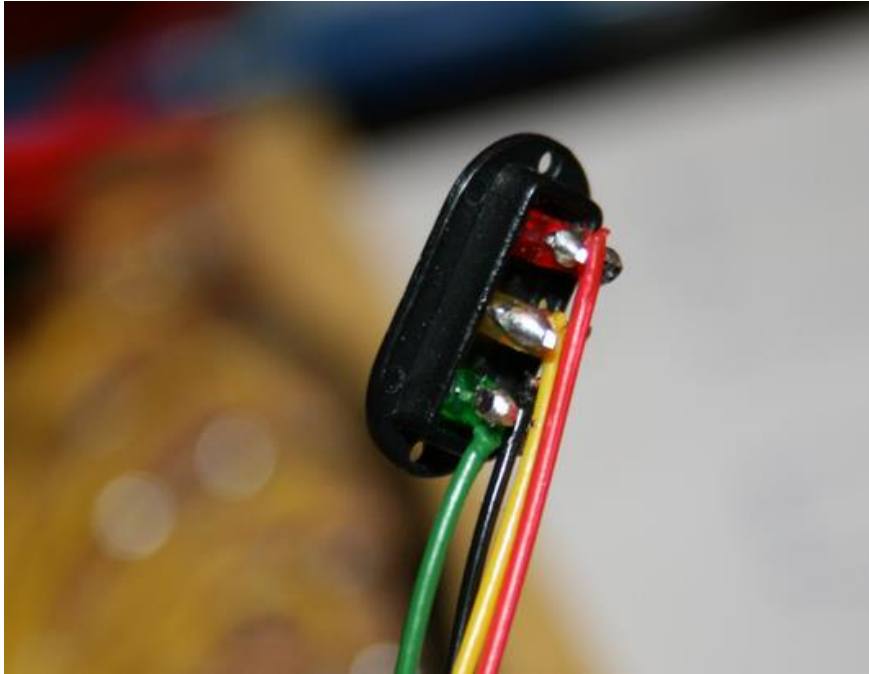


Common anode signals have each of the positive (anode) side of their leds connected together (commoned).

These are designed to operate with modules which have channels which switch to ground.

Here is an example for wiring in a signal head where the black common wire connects to all three leds.

Note: It is not possible to tell from the wiring colours whether a signal is wired as common-anode or common-cathode as a black wire is often used for the common-anode wire and so should be connected to the positive side of the supply !



In general, UK manufacturers use common-cathode wiring. These include Berko, Eckon, Train tech, CR Signals and Absolute Aspects.



In the rest of the world, common-anode wiring has generally been chosen. The reason for this is most likely that electronics to switch leds wired with this arrangement have historically been cheaper and simpler.



Always check the instructions with your signals to confirm the wiring or talk to your supplier if you are unsure of your signal wiring.

## **Why is it important to know which way the signals are wired?**

When we design circuits to drive signals, we make a choice of whether to offer them in designs to suit common-anode, common-cathode or both types of signal.

It is therefore important when choosing a control module that the correct type is selected to match the signal wiring, otherwise the signal or the module may be damaged. Most often the leds will not operate at all or will stay only showing one aspect.

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