

Illustrating illumination: A relatively low-cost LED light can make a significant improvement to the standard lighting fitted to vehicles and machinery. This 600mm straight lightbar fitted to a side-by-side provides more than adequate lighting for both depth and side vision. Photos: Bruce McAndrew, Josh Giumelli and Central Wheatbelt Imports



Shedding light on LEDs

While they have been with us for mere decades, LED lights have revolutionised a range of applications across electronics, home and vehicle lighting. By Josh Giumelli

While they have been with us for mere decades, LED lights have revolutionised a range of applications across electronics, home and vehicle lighting.

The humble light-emitting diode comes in many forms but has a range of benefits over traditional incandescent bulbs or fluorescent lighting. For a start, they use significantly less current to produce the same level of illumination and have no warm-up period.

For their size and current draw, LED lights produce a bright, intense light in a range of colour options, making them ideal for instrumentation in vehicles, warning lights and traffic signals.

One of the standout features of LED lights is their robust construction and reliable operation. They have operating lifespans many times that of competitive technologies and will lose little brightness over their lifetime. They are far more resistant to vibration than filament-style bulbs, and can be switched on and off multiple times without adverse effect.

The first LEDs appeared commercially during the 1970s in low-output

applications, mainly seven-segment digital displays on early digital calculators and clocks. Today, with a wide range of colours and brightness, LEDs are found virtually everywhere. The development of the white-light LED was a turning point in LED development, leading to a rapid growth in applications where traditional light sources were normally used.

LEDs are incredibly efficient, using relatively little current to produce a bright light source. This makes them particularly suitable for adding additional lighting to equipment without overloading wiring or alternators, or replacing existing lights with brighter LED units without running new wiring.

The fact the LEDs run cool and don't require bulb replacement mean they can be encased in fully sealed plastic housings, protecting electrical connections from moisture and dust ingress, making them ideal for the farm.

On the farm, they offer a flexible solution to increasing lighting on machinery, while reducing the current consumption of OEM systems. Blue-light systems are used to illuminate booms for

night-time spraying. Indicator, warning lights and flashing beacons are now being replaced with LEDs due to their increased brightness and reliability.

THE MAGIC BEHIND LEDs

The science behind LED lighting is relatively complex, but put simply they create light by the electroluminescence of certain semiconductor materials when an electrical current is passed through the diode. By varying the composition of the semiconductor material different light colours are created, including non-visible infra-red and ultra-violet light.

Because an LED is a form of diode, it has the electrical property analogous to a one-way or check valve, in that current can only flow one way through the diode. For that reason, LEDs have a polarity, and unlike a standard incandescent bulb, can only be connected to a direct current power supply in one direction.

PRICE VERSUS QUALITY

A quick search on an internet auction site will reveal just how many LED light assemblies there are available. While some



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lights are undoubtedly good quality, many are not and may suffer reduced service life from board failure or dust and moisture ingress.

A real issue Kondinin Group engineers have found is incorrect or missing current ratings, which makes designing a new lighting system pretty difficult when matching load to the vehicle's electrical system.

Craig Gorfin, Central Wheatbelt Imports, advises against buying the cheapest LED lights from sites such as ebay.

"You have no idea what you are getting. You only have to feel the light weight of some of these units to realise they won't stand up to farm conditions."

For farmers looking to improve the illumination on farm machinery, Craig

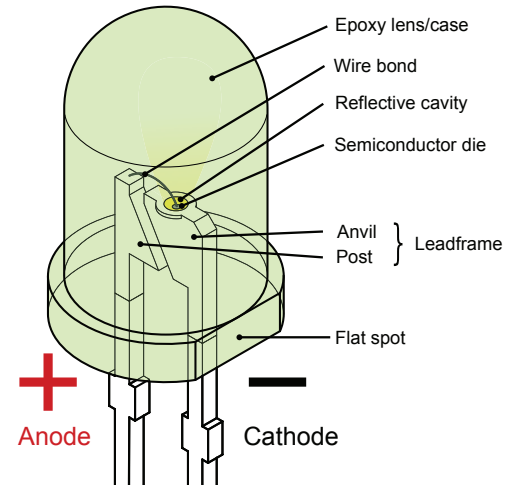
recommends farmers look at replacing the original lighting with custom-made LED light units before simply attaching additional LED lights.

"Some of the lights on these machines may be 10 or 20 years old, and an update to LED units will provide all the light they need. There is also such a thing as too much light. If you have two or more machines operating in a paddock at night time with large lighbars attached, it can be quite irritating for other operators."

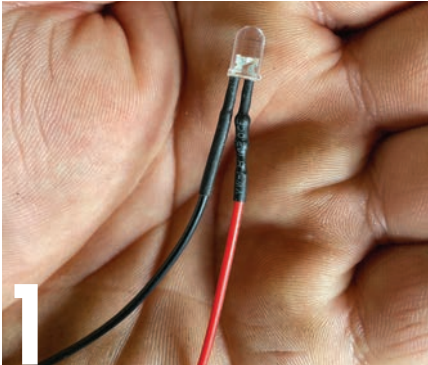
Acknowledgments:

Thanks to Craig Gorfin, CWI
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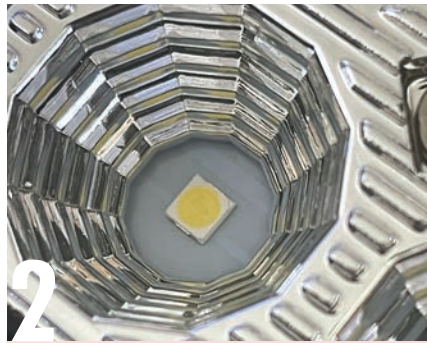
Figure 1. LED basics



TYPES OF LEDs



Single LEDs have a positive side, called an anode, and a negative side called a cathode (see figure 1). The anode is marked by the longer connection or 'leg'. Single LEDs (top) are not overly useful by themselves and will generally require a resistor to limit current. They are usually available in 3mm, 5mm and 10mm diameters, and maximum voltage drop varies between 1.8 to 3.3V. Single LEDs incorporating a resistor with wires attached are available at low cost (bottom). The unit pictured operates off a more convenient voltage of 12V.



While small torches may use a single LED, most applications use several LEDs in a single module, known as a 'chip on board', or COB. Most COBs will comprise nine or more miniaturised LEDs plus a driver circuit. The yellow dot visible in an LED module is an example of a COB.



The variety of LED lights for 12V and 24V applications is endless. Small, low wattage LED lights such as these units are ideal for incidental lighting such as ute trays, additional reversing lights or even egress lighting on machinery.



LEDs are available in both flexible and rigid strips, making them ideal for illumination inside ute canopies, toolboxes or other enclosures. Flexible LED strips can be simply cut to the desired length and have a self-adhesive backing. Rigid LED strip lights are more robust and generally better suited to the farming environment. The unit pictured only uses 8W.

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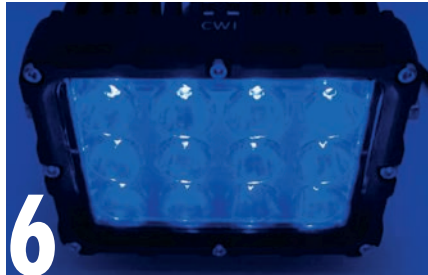


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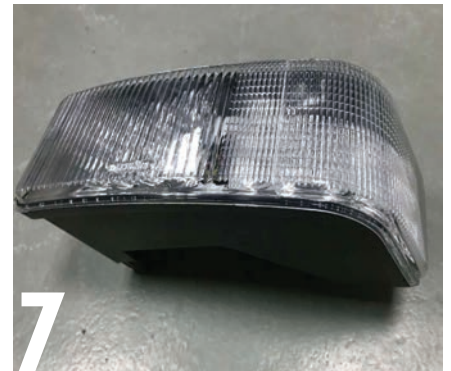
5

LEDs light assemblies are available in both spot (top) and flood (bottom) designs. Use spot lights where distance is required, and flood for casting a wider beam over a closer area. Flood LEDs will have a more opaque, textured lens than spots which will usually feature a clear lens. Both these LED units are ideal for additional lighting for farm machinery, with 65W or 4.9A at 12V, and are rated at IP67. They cost \$132 from CWI.



6

Blue LED lighting has been a great benefit to night-time spraying, with the blue colour providing the highest contrast enabling the clearest vision of the spray pattern across the boom. While there are systems in use with LED lights for individual nozzles, there are also specific blue-light LED units which can be fitted at the boom centre pointing outwards, meaning only one unit per side is required. At a cost of only a few hundred dollars it is a worthwhile low-cost modification for the average boom spray. Just make sure you purchase a specific blue LED unit designed for the job, and not just a light with a blue lens. The unit pictured produces a blue light when powered up, using 60W or 4.8A at 12V or 2.4A at 24V, and costs \$187 from CWI.



7

Specialist agricultural light retailers may be able to supply LED retrofit lights to upgrade existing lights. It is worth checking out if replacing a broken light assembly as the upgraded units may be cheaper than the cost of an OEM light, and provide more light as a bonus. The lights pictured fit a Case IH Patriot, and older STX and Magnum tractors and cost \$561 from CWI.



8

Lightbars have proven immensely popular for farm machinery and four wheel drives alike. Curved light bars, a more recent innovation, are perfect for tractors, sprayers and harvesters, providing an impressive depth and wide field of view. Craig Gorfin from CWI sells units with both Osram and CREE chips, stating the Osram-equipped bars will produce more light for the same current input than the CREE units. The largest 50 inch curved bar is fitted with Osram LED chips and uses 288W or 17.7A at 12V, and costs \$550.



9



Light bars are often easier to mount to vehicles than individual spotlights and can fit in tight spaces in bullbars. Spotlights will generally provide better distance depth, but a large, powerful set can be more difficult to fit to the front of a vehicle and may interrupt airflow to the radiator. Australian Design Rule ADR13 which covers lighting technical requirements for road-going vehicles has been updated in recent years to cater for light bars. There is no need for a 'separating strip' in the centre of the bar. All that is required is the bar is mounted symmetrically at the front of the vehicle and is wired into the high beam circuit so that it shuts off when the headlights are dimmed. While state interpretation may vary somewhat, light bars mounted above bullbars are illegal.

WIRING INDICATORS



1

LED taillights are a popular conversion for trucks, trailers and other farm vehicles due to their reliability, brightness and flexible mounting options due to the large range on the market. Individual lights for tail, indicator, stop and reverse can be installed, or combined units as pictured above. While installation is relatively simple, there are a couple of key points that need to be taken into account otherwise the indicators may not flash correctly.



2

Another option is to fit bulb-replacement LED lights to existing housings. While this may be a cheaper option and less work than changing the taillight assemblies, it will still cost in the order of \$90-\$100 to put quality bulbs in a pair of taillights (including reverse lights). The best option is still to change over the entire assembly if possible.



3

When converting an existing incandescent taillight, purchase a quality LED unit that fits within the rear mounting of the vehicle. Don't forget the reversing lights - combined taillights won't necessarily include a clear reversing light (for example, trailer units). Another popular option is to mount a separate LED light which can be aimed more accurately for reversing purposes.



4

If you are fitting the lights to a vehicle such as truck with a 24V electrical system, ensure the unit is compatible with 24V. Fortunately, most LEDs for this application are dual voltage.



5

Start by removing the original taillight. Cut the wires, noting their colour and position (it may help to take a quick photo with your phone).



6

The existing taillight has a separate earth wire to each bulb assembly. This can be removed as we will only need a single earth wire.



7

It is probably a good idea to sort out the mounting of the light assembly before continuing on with the electrical installation. In this situation we have simply added a couple of pre-drilled flat bar struts to sit behind the existing bracket.



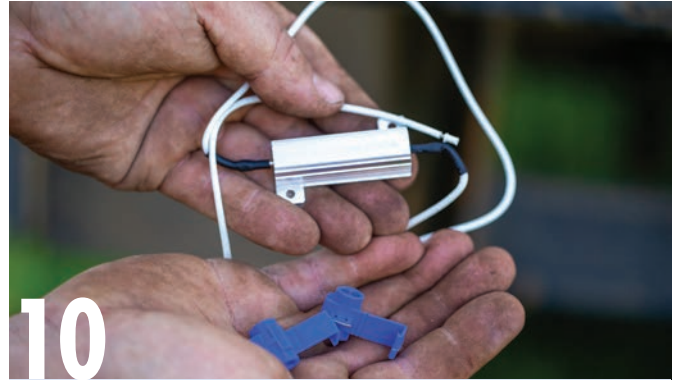
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Strip back the wires on both the vehicle wiring and the taillight. It may be necessary to cut the taillight harness to length if it was supplied with an overly long cable.



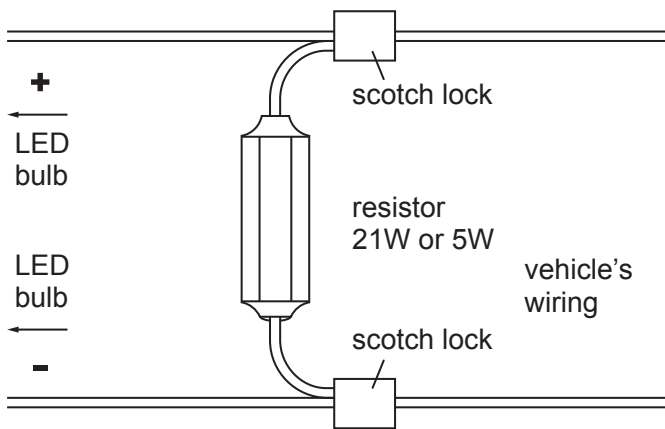
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At this point, it pays to run a quick test by temporarily connecting the flashing circuit and turning on the indicator. You may have noticed LED indicators on vehicles flashing incorrectly or too fast. Due to the low current draw of the LED indicator, some flashing circuits react as if there is a blown globe by flashing quickly. On some modern vehicles, there may even be a warning on the dash of an indicator fault. The vehicle's flashing unit relies on load to detect a faulty globe - but the new LED light does not load the system enough.

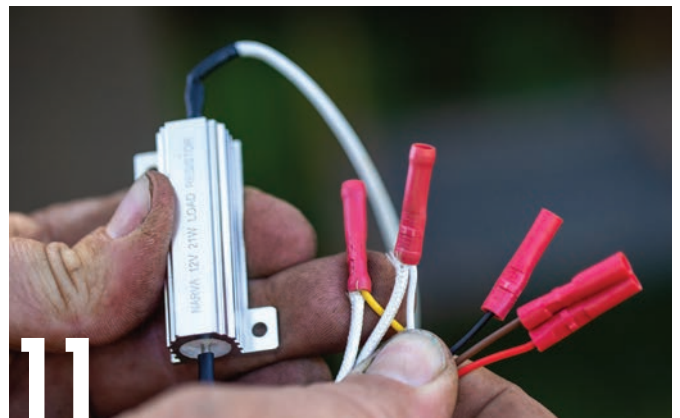


10

While incorrect flashing can be corrected by changing the flashing module on older vehicles, most modern vehicles have the flashing circuit integrated into the computer. A simpler solution is to simply add a LED load resistor to the flashing circuit, which are readily available from LED light suppliers. You will need one for each of the main indicator lights, and they cost about \$25 each.

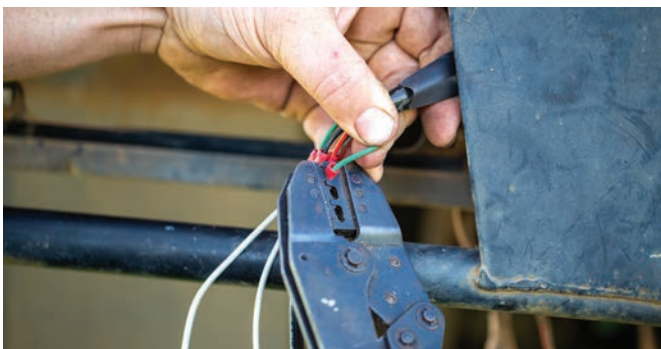


LED load resistors are easily added to wiring after LED lights have been installed by connecting the unit across the earth and positive supply to the indicator. The unit supplied included scotch locks for the purpose. The resistor wires can be installed either way round. It is rated at 12V and 21W with a resistance of 8 ohms, and a different resistor will be necessary for 24V systems.



11

The resistor is best installed when wiring the LED light as the wiring can be connected in a more reliable manner than simply using scotch locks. Here we have connected the resistor wires into the indicator circuit using crimp connectors as the new taillight wiring is connected to the vehicle's wiring. Note the resistor produces heat during operation, and while it has a heat sink on the external casing, it will need to be screwed to a metal surface (not plastic).



12

Connect up the remainder of the wires and tidy up with insulation tape or a heat-shrink sleeve as pictured. While the LED taillight is more reliable than an incandescent unit, poor wiring connections may lead to failure.



13

Install the light and tidy the wires behind the assembly. Note the resistor which has been riveted to the taillight bracket (top). Now run a final check on the indicator, stop, tail and reversing light circuits.



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