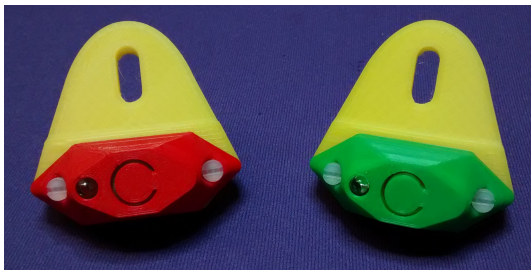


# Smart Avionics Rotor Tip LEDs

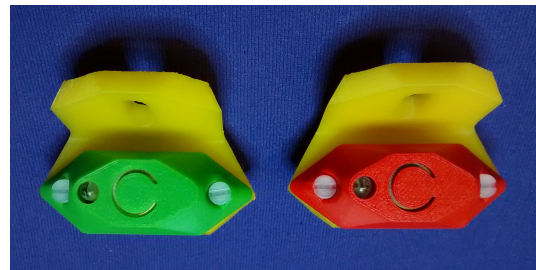
## Usage and Safety Information

This note provides some guidance on using the Smart Avionics rotor tip LEDs. The idea is simple, a different coloured light is attached to the underside of each rotor blade tip so that it is visible to the pilot. When the rotor rotates, each light appears as a line due to the persistence of vision. If the rotor tips are all flying at the same height, the lines should coincide, if not, you can see which line(s) are high or low compared to the other(s). You can then adjust the tracking of your rotor to make the lines coincide. Currently, five colours are available (red, green, blue, orange and white).

Each tip LED is contained within a lightweight enclosure that is attached to the rotor blade using a bracket. Two standard brackets are available: a flat bracket which is suitable for blades that have a flat end cap with a tapped hole and an 'L' shaped bracket which is suitable for blades that have a tapped hole on the bottom surface of the rotor blade.



*Tip LEDs mounted on flat brackets*



*Tip LEDs mounted on 'L' shaped brackets*

The LEDs turn on automatically when the rotor speed passes through approximately 100 RPM. Pressing the middle of the enclosure will light the LED so it's easy to test the battery. The battery life varies depending on the brand of battery used and also the colour of the LED but you should expect a battery to last for several hours of operation. The LED brightness will stay constant for most of the battery life but towards the end, the brightness will reduce.

A widely available 3V Lithium battery is used, type CR1/3N. To replace the battery, undo the screws that attach the enclosure to the bracket. The case should now come apart and the circuit board can be removed. The old battery can be pulled from its holder or if you can't get a good grip on the battery, push it from underneath by pressing a small diameter (< 2mm) object through the hole in the bottom of the board. The new battery is inserted into the holder with the end marked with a + away from the board. Reassemble the case and reattach to the bracket.

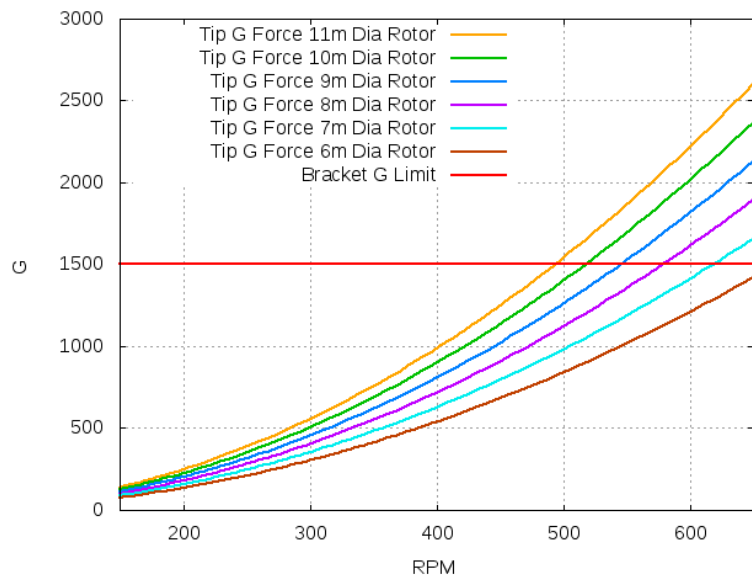
Each bracket has a mounting slot suitable for an M6 fastener but smaller fasteners may be used as long as they are of adequate strength. A large washer (ideally, 25mm dia.) should be installed under the head of the fastener to spread the load across the width of the bracket. The fastener should not be tightened so much that the plastic bracket is deformed or cracked. The uppermost edge of the sloping portion of the flat bracket should lie against the bottom surface of the rotor blade to stop the bracket rotating due to drag forces.

The pull force exerted by the tip LED and its bracket depends on the rotor diameter and RPM. At the tip of an 8.8m diameter rotor rotating at 400 RPM, the acceleration is equivalent to nearly 800G. The tip LED and bracket together weigh around 25gm and so they will exert about 20Kg of pull on the fastener and associated tapped fixture in the blade which must be robust enough to withstand the load. For a 7.2m diameter rotor at 600 RPM, the force is approaching 40Kg.

The brackets are rated at 1500G. This graph shows the G force plotted against rotor RPM for various rotor diameters along with the bracket load limit.

Satisfactory tracking can be achieved during pre-rotation (gyros) or in the hover (helicopters). It is possible to fly with the tip LEDs installed but due to the high level of vibration that would occur in the event of a tip LED becoming detached, it is recommended that only experienced pilots consider flying with the tip LEDs attached.

If you intend to use the tip LEDs at a high airspeed, work up to that speed in stages. Keep the airspeed low at first and inspect the tip LEDs and brackets for any sign of damage before increasing the airspeed substantially.



## IMPORTANT SAFETY INFORMATION



- Before each flight, inspect the tip LEDs to ensure that the enclosures are not damaged, that the brackets are not cracked or deformed and that the brackets are still securely attached to the rotor tips. *Smart Avionics will replace enclosures or brackets damaged through normal use free of charge.*
- To avoid personal injury and damage to property, take care to ensure that the aircraft is operated sufficiently far away from people and property such that if a tip LED became detached from the rotor, the tip LED would fall harmlessly to the ground. Do not allow anyone to stand close to the aircraft when the rotor is turning!
- If a tip LED did become detached, the pilot would experience a very large amount of vibration and so they should be mentally prepared for that eventuality before taking off. In that situation, the pilot should land immediately.
- Due to the drag produced by the enclosures and brackets, rotor RPM may be reduced. Pay special attention to the rotor RPM to ensure that it does not become dangerously low.
- The tip LEDs should only be used when the ambient temperature is in the range -10 to +40 °C. Furthermore, the strength of the plastic enclosures and brackets will be substantially reduced while their temperature exceeds approx 60 °C (so don't expose them to strong sunshine with little or no ventilation).
- The tip LEDs are not intended to be permanently installed, they must be removed once the tracking has been tested/adjusted.

Please email [support@smartavionics.com](mailto:support@smartavionics.com) if you have any questions or comments.