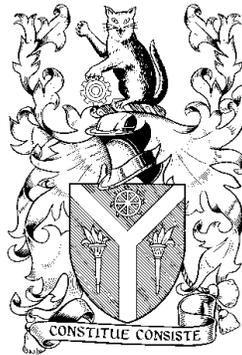


South Herts Models



ADVANCED GLOWSWITCH and ACCESSORIES HANDBOOK

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1. Who Needs On-Board Glow Support?

Glow engine reliability depends on keeping the glowplug at the correct heat under all engine conditions. That, in turn, depends on supplying the right fuel-air mixture at all times. This is not easy to do. In the first place the tank position and 'plumbing' may not be ideal, but that is often determined by the space within the aircraft so there's not much can be done to change it – specially in a scale model. Secondly, in flight, the model's attitude and altitude is constantly changing, so unless the fuel is pumped and pressure regulated, the mixture delivered by the carburettor will constantly be changing. Again, as the fuel is consumed the tank level goes down and the mixture weakens.

Pre-flight, we open the throttle and lean out for maximum RPM then raise the nose and check that there is no loss of RPM. That leaves the mixture slightly rich for straight and level flight, but safely within the working range of the engine. As the aircraft climbs, air pressure and temperature start to fall and we get more cooling from the slipstream. Under these conditions the engine may be operating close to its limits so a reduction in power setting could allow the glowplug temperature to fall close to or even below its safe operating level. More importantly when power is increased again the surge of cold fuel-air mixture going into a relatively cool combustion chamber is often enough to quench the glow.

If the glow plug can be re-heated briefly at those critical moments then the engine will continue to run. As 'flameout' problems tend to occur at the bottom to mid power range some manufacturers provide a control to apply battery power to the plug at low power settings. This solution goes part way to solving the problem, but it has drawbacks:

A large support battery is needed because it is always turned on at low throttle settings even when not needed.

It turns off above 25-30% throttle which is not much help in an overshoot.

It can shorten plug life by heating the glow plug when it is already hot enough thereby damaging the platinum glow wire.

The AGS works differently. *It actually monitors the glow-wire temperature!* As the glow-wire temperature changes, its resistance changes minutely, and this change is monitored by the AGS's microprocessor. If the temperature drops below a pre-set value the AGS will switch on the support battery for as long as it takes to get the wire temperature back to the pre-set level – whatever the throttle setting!

The AGS can be adjusted to suit the engine and, once set, there is no need for further adjustment unless you have made major changes (glow-plug, fuel or propeller).

In an attempt to improve mid-range performance you may be tempted to change to a 'hotter' glow plug. This can sometimes improve reliability in some cases, but it will always have the effect of advancing the ignition timing thus reducing power output at the top end. *OS clearly state that a 'cold' plug will deliver more power than a 'hot' plug.*

You might consider converting your glow engine to petrol, but that's a very laborious way of achieving reliability. You would need a new tank and fuel tubing and a new head gasket. Then you would need to fit a timing magnet into the prop driver and a detector to the front of the engine. You'll also need a spark plug and the electronic ignition pack itself plus a 4 or 5 cell battery pack to power it. The weight of all that is going to be over 250g. Compare that with a 12g AGS-1, a 10g plug connector and a support battery weighing as little as 30g and a simple electrical hook up to install it.

The AGS:

- ✓ Lets you use a 'colder' plug and get more power without losing bottom end performance.
- ✓ Will not cause pre-ignition (detonation) or power loss by over advancing the ignition timing.
- ✓ Will not damage your glowplug by turning it on when it is already hot
- ✓ Needs only a small on-board battery.
- ✓ Stays in operation in an overshoot so you can climb away safely to re-join the circuit.
- ✓ Allows the use of low or no nitro fuel (lower cost, less corrosion).
- ✓ Actually adjusts, continuously, for the changing voltage of the support battery.

2. Battery Recognition.

The AGS is compatible with Rx battery voltages from 4.0V to 7.2V and support batteries from 1.2 to 4.2V. The AGS will check the support battery voltage when you switch on the Rx. If the voltage is 2.8V* or more then Lithium (or other high voltage battery system providing 2.8V up to 4.2V) is assumed and this will be indicated by the LED lighting continuously for 5 seconds. If a voltage of less than 2.8V is found then it will be indicated by blinking the LED for 5 seconds. If no voltage is detected then the AGS will assume the battery is switched off and will wait until it is switched on before indicating. A very short flash of the LED every second will indicate that the AGS is waiting for the battery to be switched on.

It is important to check that the indication agrees with the battery fitted so that, for instance, a flat LiPo or LiFe is not treated as a normal NiMH or Lead-Acid cell. Low battery indications will be based on the voltage detected at switch-on. **NB** *The reference voltage has been changed from 2.5V (green terminal blocks). And now switches over at 2.8V as stated above and has grey terminal blocks for identification.*

A remarkable feature of the AGS is that it adjusts its output constantly as the battery voltage changes. For instance, an NiMH cell starts out fully charged at 1.4V but soon drops to 1.3V then 1.2V and finally falls to less than 1V. During that time the AGS will be adjusting its power output so that, when called for, exactly the same heating will be applied to the glowplug regardless of the battery level.

3. Battery protection.

If Lithium or high voltage batteries have been detected then a repeating double flash will indicate that the voltage has dropped below 3V. Power will be cut off if the voltage drops below 2.8V.

If NiMH or Lead-Acid batteries have been detected then the low voltage double flash will occur when the voltage drops below 1V and Power will be cut off below 0.8V.

4. Installing the AGS.

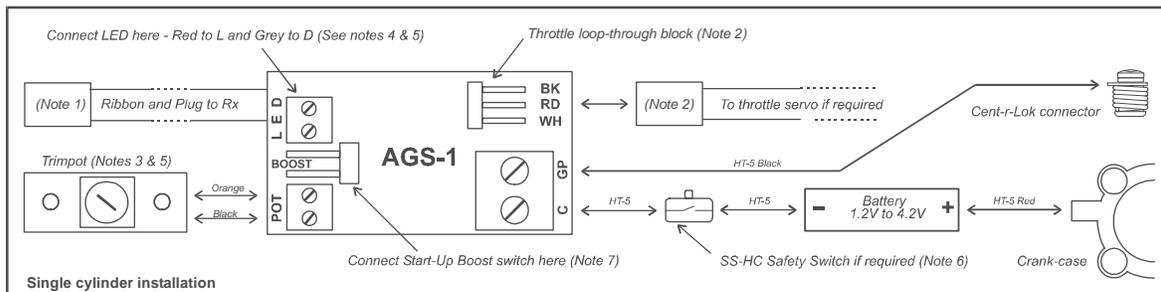
First choose which of the three modes of operation you require for your model:

A) Auto disable mode. The AGS will provide glow support except at max and min throttle settings or when the Rx is switched off. When you switch on you should cycle the throttle stick trims to set full power and throttle cut positions. Once you have done this the AGS will be disabled (after 3 seconds) when you fully close the throttle and when you fully open it for priming. The AGS will only store these min/max values until the receiver is switched off so you should do this every time you switch on the Tx/Rx.

B) Continuous mode. If you don't want to use the automatic disable feature, then it is only necessary to disconnect the white signal wire from the AGS's flying lead. You won't have to cycle the throttle stick for every flight, just plug the AGS into a spare Rx output. This way the AGS will remain enabled as long as the Rx is switched on, so don't forget to fit a safety switch!

C) Remote control mode. If you want to enable/disable the AGS from the Tx independently of the throttle, leave the white wire connected and plug into an output controlled by a slider or 3-position switch – min and max positions will disable the AGS, anywhere else it will be enabled. If you are using a switch channel set the mid-position to provide about mid-position output. You will need to cycle the switch from max to min as you do in mode A.

Connect the AGS as shown in the circuits. Make sure the crankcase connection is made to battery **positive**. Many chargers and glow clips are wired the *other way round* and if connected that way the AGS will be damaged. (There are very good technical reasons why we operate a positive crankcase system).



Notes

- 1 Depending on the mode you have chosen, plug the AGS flying lead into the Rx as follows:
For mode A, into the throttle channel.
For mode B, into a spare channel.
For mode C, into a channel controlled by a slider or switch.
- 2 For mode A, plug the throttle servo into the AGS loop-through block. For modes B and C the throttle servo should be plugged directly into the Rx
- 3 Mount the Trimpot panel in a suitable position. Two mounting holes are provided for fixing. Connect the wires as shown; they may be extended if required.

- 4 Mount the LED in a suitable position and connect the wires following the colour codes shown in the figure. These wires may be extended if required.
- 5 To clamp the delicate LED and Trimpot wires securely, strip off 5mm of insulation and fold the bare wires back over the insulation, then clamp them in the terminal block. This method ensures that the conductors are protected from vibration and strain. But do make sure that you have made a good connection and not just clamped to the insulation!
- 6 We recommend the use of a safety switch as shown in the circuits. This ensures that the glowplug will not go live unexpectedly when priming or making adjustments to the model.
- 7 The two-pin header block is provided for connection of the **Helping Hand Start-Up Boost** (HH-SB) switch. If you want an extra-hot glow for starting then this switch will provide it.

5. Setting Up the AGS

Turn the trimpot fully clockwise to maximum and switch on the Tx and Rx.

Verify that the AGS recognizes the battery correctly (See battery recognition above).

Then:

If you have selected Mode A operation: Cycle the throttle from maximum to throttle cut.

If Mode B: No action is needed.

If Mode C: Cycle the slider or switch through min and max conditions and then back to the mid (enabled) position.

Move the throttle stick to the usual starting position and start the engine. Select your tick-over setting and slowly turn the trimpot anti-clockwise to find the position just before the engine starts to falter. When adjusting twin or multi-cylinder engines make small adjustments to each in turn so as to maintain a balance between the cylinders.

You may need to close the throttle more than usual because the glow support may raise the RPM. Repeat the adjustments until you are satisfied with the tick-over. When satisfied, snap the throttle fully open after a longish period at tick-over. The engine should pick up easily and quickly to full RPM. If not, add a little more glow support by turning the trimpot clockwise a *little* and repeat the test. *Always aim for the lowest practical trimpot setting as this will not only ensure maximum battery life but will also ensure maximum engine power.*

After switch on the AGS uses the LED to signal its status as follows:

A single short flash every second: The AGS is waiting for the support battery to be switched on.

Flickering: The LED will flicker when the AGS is testing the glow and will brighten when it is heating it.

A single or occasional repeating flash: No significance – this can happen even when the engine is not running. It just means that continuous power is not needed to maintain the plug temperature.

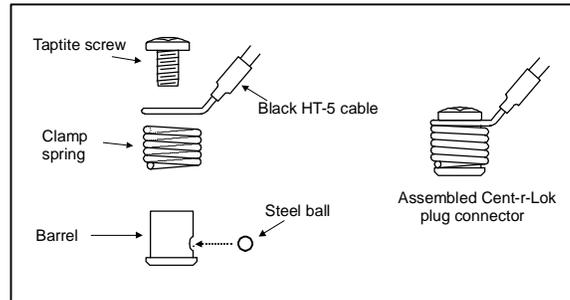
A double repeating flash: The AGS is seeing a low voltage from the support battery. The support battery may be flat, faulty or switched off, or the wiring (or glowplug) could be faulty or damaged.

The AGS turns off when the Rx is switched off, so you can leave everything permanently connected, ready for next time.

The AGS will not need further adjustment unless a major fuel, propeller or glow plug change is made. Just switch on, verify that the battery has been correctly recognized, cycle the throttle if mode A or C, and start the engine.

6. The Cent-r-Lok Glow-Plug Connector

Don't risk having a poor plug connection, it will cost glow power and *can also cause radio interference*.



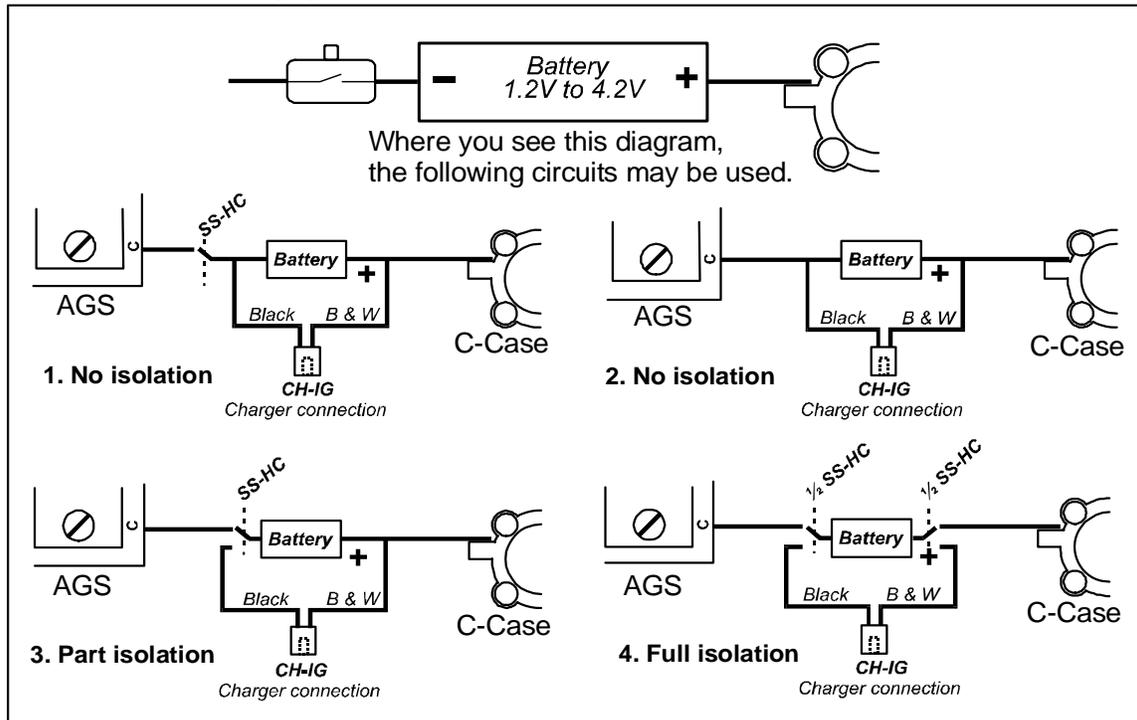
The Cent-r-Lok assembly.

The Cent-r-Lok glow-plug connector comes as a set of parts ready for assembly complete with 500mm of black Aero-HT cable and a red Aero-HT cable for the crank-case connection. The assembled Cent-r-Lok fits securely, without the use of tools, to OS and YS plugs.

7. On-Board Battery Charging

The easiest way to charge your support battery while in the model (not advisable for LI-Pos) is to connect the CH-IG to the AGS terminal block – black to C and black/white to GP with the **safety switch (if fitted) turned ON** and the Rx **OFF**. **Warning: Although this is the easiest way it has its drawbacks; under no circumstances should the above switch settings be changed as damage to the AGS or the charger could result.**

Alternative on-board charging circuits are shown below.



Alternative on-board charging arrangements

Circuit number 1 corresponds to the diagram at the top. Any of the above circuits may be used for charging the on-board battery. If charging the support battery and the Rx battery at the same time be sure that the negative sides of both are linked together so that no voltage can develop between them. If in doubt use one of the isolating circuits shown.

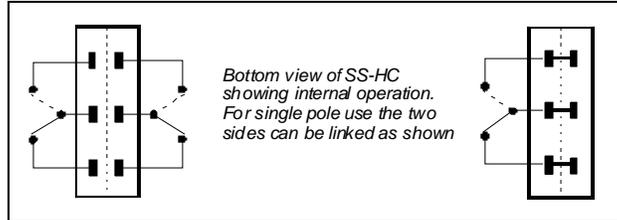
The fully-isolated circuit (4) should be used if it is intended to charge Rx and support batteries concurrently using a multiple output charger unless you are sure that the negative outputs are linked internally.

The CH-OC connector can be used to connect the charger to the on-board connector (CH-IG).

The charge rate should be set according to the battery manufacturer's instructions.

8. Use of a Safety Switch

When making adjustments to the model or priming the engine it is advisable to ensure that the glow is disabled with our SS-HC safety switch. This will preserve battery life and prevent accidents due to the engine firing unexpectedly. A secondary use is as shown in the circuits above where it is used in different ways to suit various charging arrangements.



The SS-HC safety switch can handle high currents with negligible loss of power. Do not use the switches supplied with radio systems as they are not intended for high currents, will not handle the power needed and will soon fail.

9. Support Battery Selection

It is very difficult to predict precisely the support battery size you will need as it depends on the engine set-up and your flying style. A rough guide is given below. You will need about half these capacities with battery voltage above 2.75V.

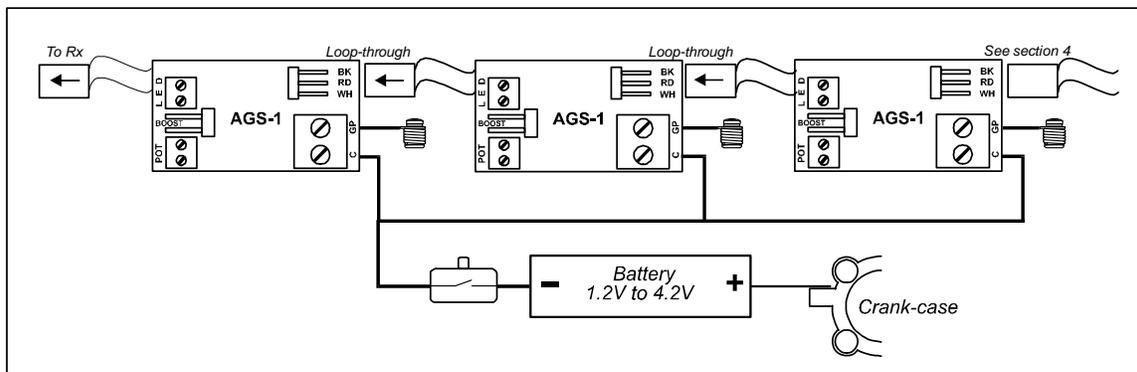
Work Load (Including Starting)	Single	Twin
Adequate for a normal club day	1500 mAh	2000 mAh
For a busy flying day	3000 mAh	5000 mAh
For a flying weekend	5000 mAh	10000 mAh

10. Multi-Cylinder Engines and Twins

A combination of AGS-1s and AGS-2s can be used for multi-cylinder engines by 'daisy-chaining' the AGSs to build up the requisite number of glow plug drives.

Setting up is done the same as before, by making small adjustments to each plug in turn.

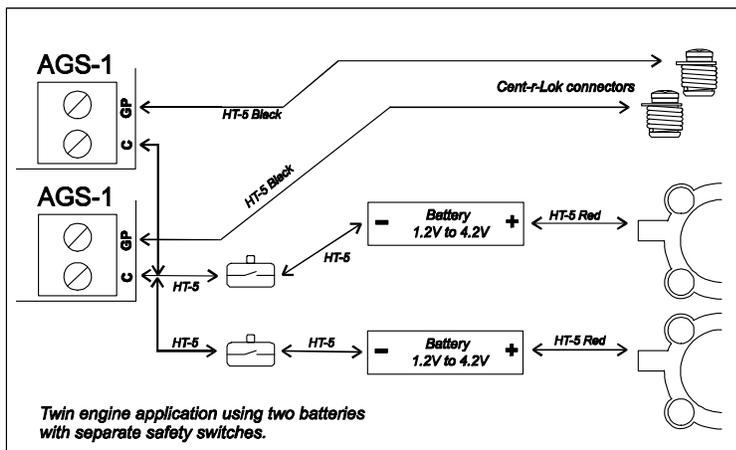
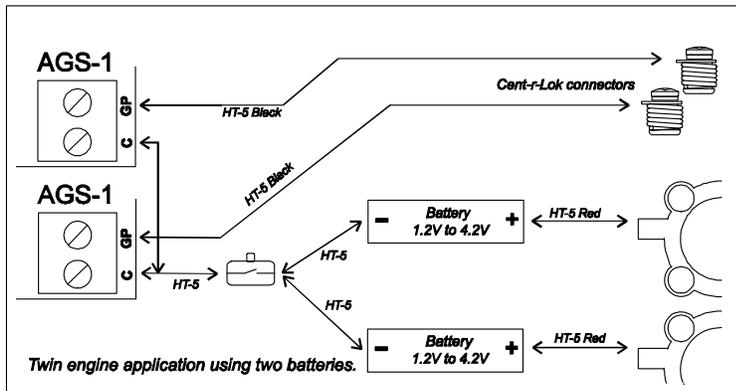
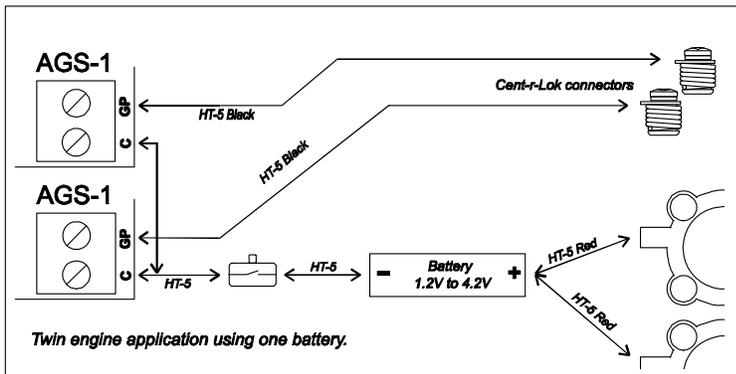
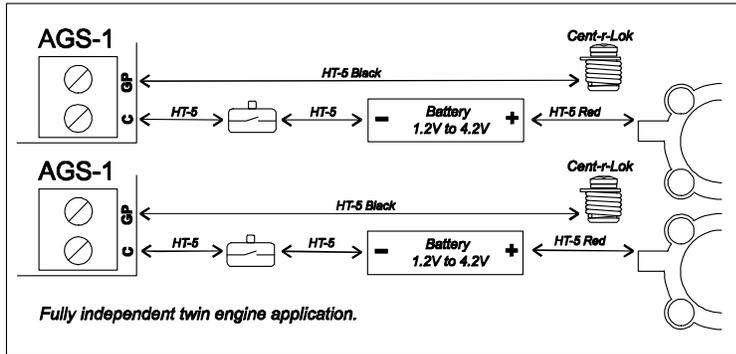
NB. Do not power the AGSs independently – use only a single battery station as shown otherwise the AGSs will not operate correctly.



Multi-cylinder daisy-chain application

South Herts Models Advanced Glowswitch and Accessories Handbook

Twin engined aircraft leave you with a number of choices:



11. Start-Up Boost

If you want an extra-hot glow for starting then the Helping Hand Start-Up Boost is the answer. All AGSs are provided with a two-pin header for connection to the HH-SB start-up boost switch.

The HH-SB switch is fitted inside the model and, when operated by a magnet from the outside, turns the AGS fully on, ignoring the trimpot setting. A powerful disc magnet HH-DM is also available. Ideally it should be fitted to a finger ring, thimble, glove etc so that it operates the boost when you hold the model for starting. NB the boost switch is most sensitive at its tip.

No danger of leaving it switched to boost after starting and no interference with the appearance of the model. The operating range is approximately 13mm (1/2") when using the HH-DM magnet and is not affected by the usual construction materials such as wood or plastic.

Making a magnet finger ring: Cut a strip of 16g aluminium about 3mm wide and form it into a ring to fit your finger. Roughen up one face of the magnet and epoxy it to the ring in the centre. Cover the bare ends with heat-shrink.

If you prefer not to use the magnetic switch, you can replace it with any small momentary action switch of your choice.

12. Power Panels and External Starting Batteries

There is no need to use a 'ground-start' with the AGS. In fact we advise against it. If a 'hot' start suits your purpose, then use the Start-Up Boost option. If, however, you wish to go down the ground-start route please consult us first. We are always happy to help with special applications.

13. Interference

There are no known interference problems arising from the use of the Intelligent Glowswitch. In fact AGS installations have been tested to the standards required to meet the rigorous EU legislation on that issue. Generally whenever high currents are being used there will be an increased risk of interference. This applies more often to electric powered models, but can apply whenever the 'signal to noise' ratio is poor. A model flying at a distance may play up, while back at the flying site a range check proves OK. [How many times has that happened?]

Here are some 'Best Practice' rules for aircraft installations:

- i) Keep power cables separate as far as possible from control cables. Don't bundle them all together – it may look neater, but it encourages capacitive cross-coupling.
- ii) Twist power carrying cables together into twisted pairs or triplets – this reduces their external magnetic field.
- iii) Twist signal cables together into twisted pairs or triplets – this will reduce their sensitivity to magnetic cross-coupling.
- iv) In models where a lot of electrical noise is present or the aerial tuning is compromised (by an all aluminium skin for example) it will help to 'de-couple' potential noise carriers. This can be done by passing a suspect cable (this could be a servo cable or a power cable) two or three times through an **FC-GM** ferrite toroid. These toroids are large enough to feed a servo cable through up to five turns, the more the better, without removing the plug (but even once through will help). FC-GM chokes so formed will cut down noise without affecting the wanted signal. Place them near to noise sources or near to the Rx or even both.
- v) **DO A RANGE CHECK** as recommended by the radio manufacturer.

14. Miscellaneous Technical

The AGS is compatible with Rx battery voltages in the range 4.0V to 7.2V.

The current draw of the **AGS-1** from the Rx battery is 10mA, rising to 15mA when the LED and glow output are both continuously on. Current draw on the glow battery when not boosting the glow is equivalent to being on for 0.6 sec in every 60 (ie 1% of the time).

The approximate weight of the AGS-1 is 15gm.

15. Disclaimer

The information provided in this handbook is offered in good faith for general guidance only. Details given are correct to the best of our knowledge at the time of printing, but subject to change without notice as a result of manufacturing variation and design improvement.

16. Warranty Terms

Products returned as faulty within 12 months of purchase:

If due to a manufacturing fault: Free repair or replacement.

If no fault found there will be an inspection and return postage charge.

Out of warranty and damaged units: If repairable we can quote for the repairs.

 The **AGS-1** has been tested in typical installations (without the use of filters) and was found to comply with EN 61000-6-1: 2007 and EN 61000-6-3: 2007 and therefore complies with the emission and immunity requirements of the EC directive 2004/108/EC.

As with any change or addition to an r/c system, you are strongly advised to carry out a range and performance check before operating the equipment.