Tech - Aero Designs

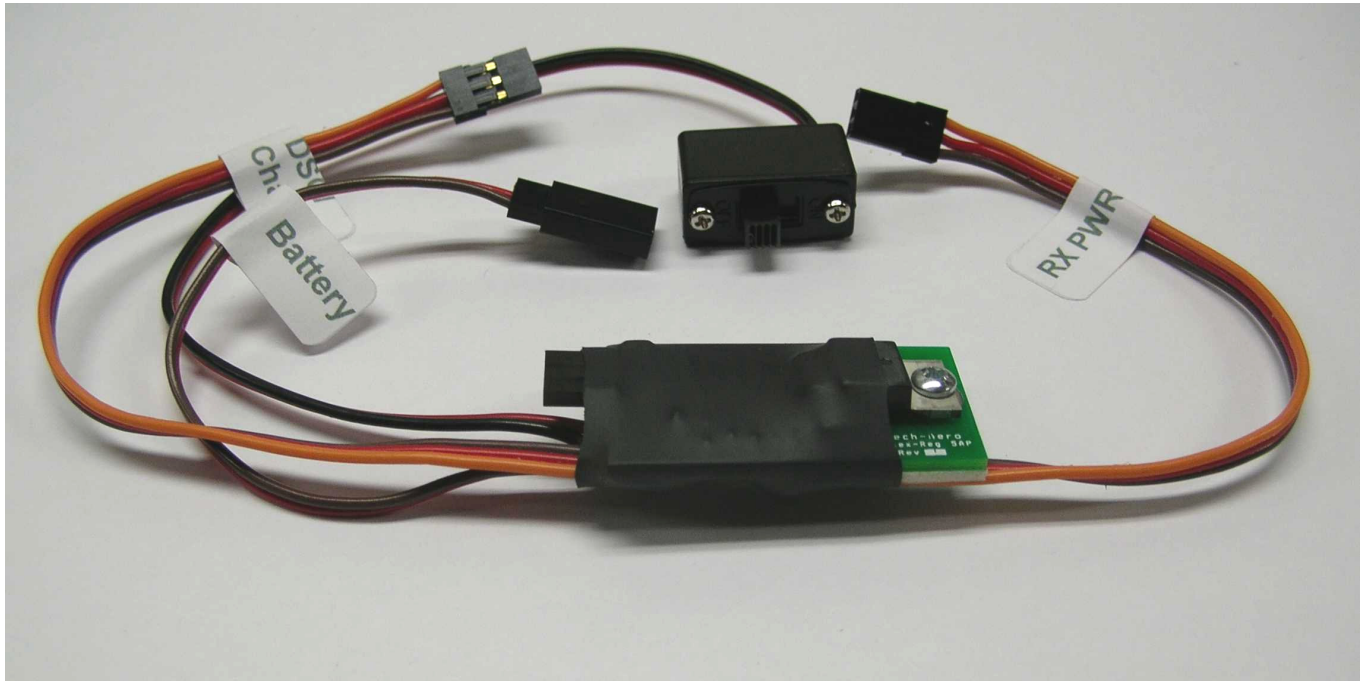## "FlexReg" Precision Programmable Regulator and Failsafe Switch Users Manual

Figure 1 - Standard PLR5

"FlexReg" Model PLR5 Features

- Failsafe Switch Design assures continued operation even if switch contacts ever fail.
- Less than 30 micro amps current draw when switched off. Batteries can be left connected for months without significant drain when the unit is switched off.
- 5A maximum current rating.*
- 3 pin up/down adjustment port provides 32 programmable output voltages.
- High reliability Surface Mount components reduce weight and size.
- Ideal for redundant power applications.
- Low dropout voltage design.
- For 2 cell LiPo / LiIon or 5 cell NiMh / NiCad applications.
- Programmable voltage ranges from 5.75V to 6.65V (factory adjusted to 6.2V). **
- Multiple battery / multiple regulator configuration support for either concurrent or failover redundancy.
- Battery voltage monitoring/charge port / DSC connection lead is standard (Figure 1)
- Integrated Switch and Battery voltage monitoring/charge port / DSC connection option (Figure 2)
- Customized output voltage ranges and adjustment increments available by special order.
- Heavy duty 22 gauge power extensions and gold plated pin connectors.

*Normal flight operation with up to 6 high torque digital servos per regulator will not require additional heat sink when operational guidelines are followed.
** Available "E-Z Set" programming box with integrated digital voltmeter is recommended for best adjustment results.
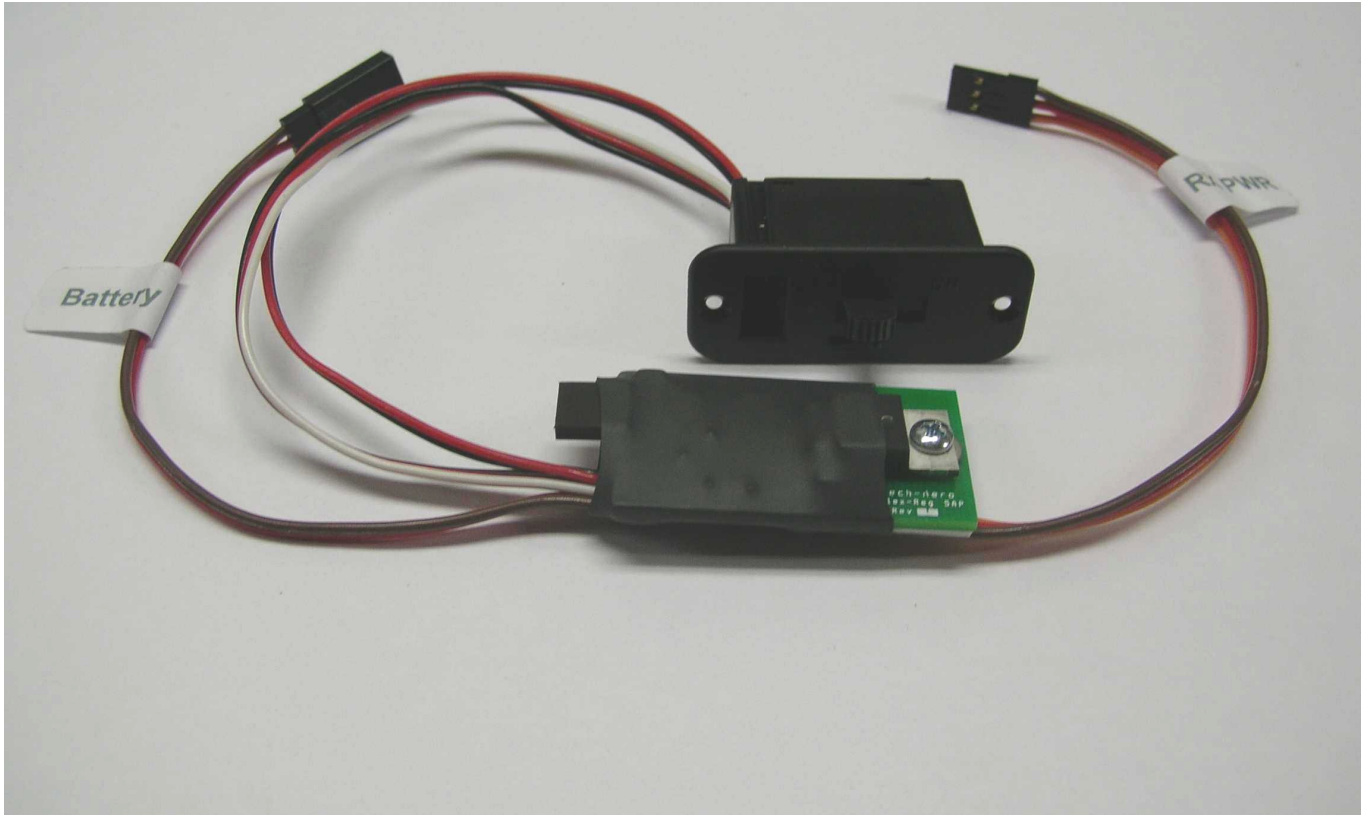
Figure 2 - PLR5-I with integrated switch & DSC/Charger jack

Thank you for purchasing the Tech-Aero Designs "FlexReg". The FlexReg models PLR5 and PLR5-I feature an up/down programmable output that stores any of 32 points over an adjustment range from 5.75 to 6.65 volts. This provides very fine control of the regulated voltage to the receiver and servos for single or multiple battery/regulator configurations. This is important to assure balanced current draw among battery packs in redundant battery and regulator installations. Programming is simple and secure, with selectable voltage output settings that are automatically saved in non-volatile memory. The memory chip in the PLR5 is rated for 100 years or more of non-volatile storage and up to 100,000 programming cycles, meaning that you never have to worry about wearing it out by changing settings or be concerned about your settings being lost.

High quality surface mount components and a fast transient response, 1% accuracy linear regulator maintains accuracy under widely varying servo load and changing battery voltage conditions. The regulator is protected from voltage spikes and safely handles voltages exceeding the programmed output voltage (up to 16V) without *any* reverse flow to the battery taking place, making it ideal for redundant power applications. The low 0.5V dropout voltage rating assures continuous operation even if battery voltage drops below the programmed output voltage, providing the best possible safety margin. For example, a 5 cell NiMH battery that is in a partially discharged condition may dip below the programmed output setting, especially under a large servo load, but the PLR5 would still deliver a safe and usable voltage to the flight pack for as long as the battery charge has not been exhausted.

Connecting the PLR5

Refer to Figure 3, which depicts the standard PLR5 and Figure 4 for the PLR5-I. The male lead extending from the right side connects to the receiver to supply regulated voltage. The female lead extends from the left side and connects directly to the to the battery pack. The PLR5 with separate On/Off switch and battery voltage monitor/DSC connection has an additional male lead for use with radio systems that support DSC (Direct Servo Connection). Note that The PLR5-I with integrated On/Off switch and battery voltage monitor/DSC connection has the battery voltage monitor / charge jack/DSC connection is integrated into the switch housing.

For basic operation of the PLR5, simply plug the RX PWR connector into the battery power connection on your receiver and plug the battery into the Battery connector to the flight pack battery. Power to the receiver is controlled by the PLR5 On/OFF switch; no other switch is necessary.

When using the DSC function of your radio, be sure to connect the RX PWR lead to the receiver power connector that also supports the DSC function. Not every radio supports DSC, so please check with the instructions provided by the manufacturer. When additional, redundant supply PLR5's are used, plug to RX PWR connector into any other unused servo channel on the receiver, but note that you should not attempt to use the DSC function through that particular PLR5 connector. Use DSC only with the PLR5 that is plugged into the receiver's DSC connection. The DSC cord from your radio transmitter plugs into the PLR5 DSC/Charger connection.
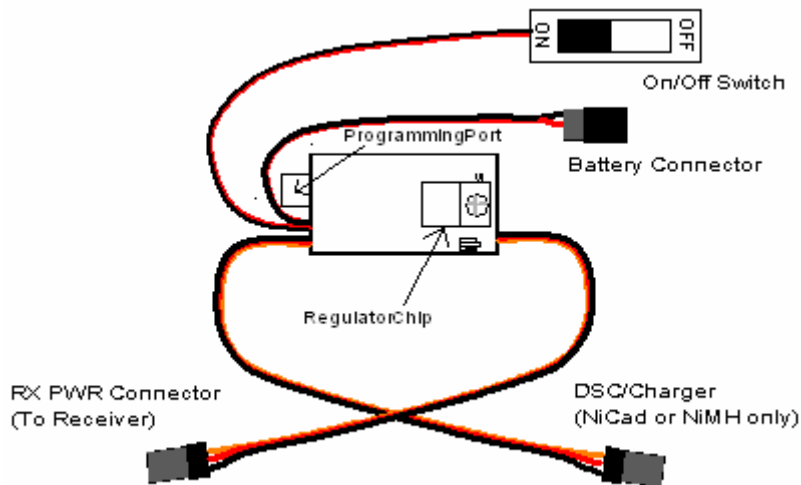

Figure 3 - Standard PLR5 connections

The DSC/Charger connection may also be used to directly monitor the unregulated battery voltage, which is useful when performing pre-flight checks of the battery condition. You may use a typical hobby type expanded scale voltmeter (ESV) or you may use the Tech-Aero "E-Z Set" Programmer for doing pre-flight checks. As a convenience function, the DSC/Charger connection may also be used to directly connect a battery charger that you have appropriately matched to the battery technology (NiCad or NiMH), battery voltage and capacity, to allow charging of the NiCad or NiMH batteries while still connected to the PLR5. The PLR5 must be switched off during any battery charging operations. However it is vital that you follow all of the safety precautions and battery charging instructions for both the battery and the battery charger that you are using. If the manufacturer or distributor of the battery or

battery charger you are using advises against charging while connected to the model flight pack or while installed in the model, then please disconnect the battery from the FlexReg and remove the battery from the model prior to charging.
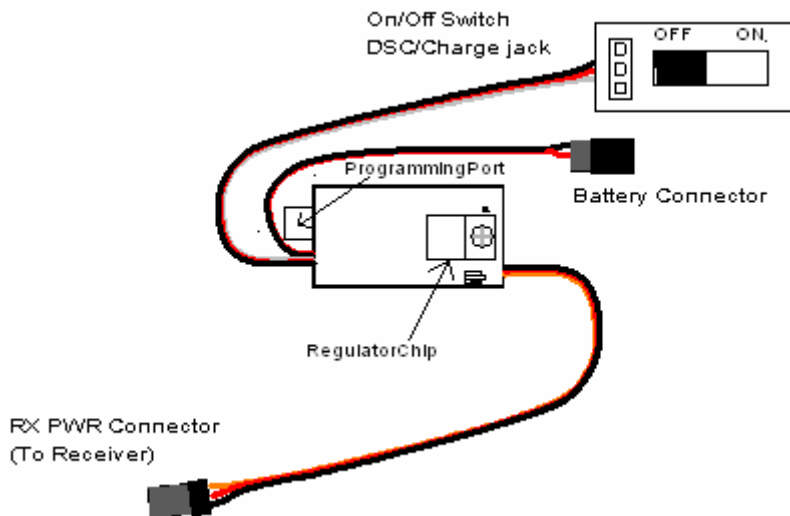

Figure 4 - PLR5-I connections 1

Additional Usage Guidelines

Mounting the PLR5 should be done with the same type of care needed for other airborne electronics such as the receiver in the model. The topside of the PLR5 has the exposed regulator chip, which should always be allowed unobstructed air ventilation in the cabin of the model. Use a piece of ¼" or thicker foam padding placed underneath the unit and fasten with a Velcro strip around the mid-section. Do not over tighten the Velcro strip! Make it just snug enough to press the unit lightly into the foam padding beneath and also be sure that the strap does not cover up the body of the regulator chip.

The FlexReg PLR5 is designed with a regulator chip that is rated at 5A (amps) DC output over a programmable voltage output range of 5.75V to V, +- 1% accuracy. For use in typical models up to about 84" wingspan, weighing less than 15 lbs and utilizing 6 or fewer digital servos, one PLR5 is sufficient to handle the power demands of the system. For models of this size with unusually large control surfaces (3D capable) or for models up to about 105" and 25 lbs weight, a 2nd PLR5 is required to handle the additional load. A 2nd PLR5 is also required if more than 6 high torque (more than 120 oz-in) servos are used.

Two or more PLR5's can also be used whenever power system redundancy is required. The number of PLR5 units that can be ganged this way is limited only by the number of available power connections to your receiver. A separate battery should be used for each PLR5, which would normally mean that for each battery there would also be a failsafe switch to mount on the model. To minimize the number of switches in redundant power configurations, but still fully benefit from the failsafe switch design and precision regulated voltage matching capabilities, custom switch wiring configurations can be accommodated by special order.

Some modelers may prefer to use a 2nd PLR5 in a "backup power" mode, where they rely on one main battery to power the flight pack and have another on "hot standby" in the event that the main battery fails or reaches a predetermined discharge point. If used in this way, the backup or hot standby battery and regulator will automatically supply power whenever the output voltage level of the main PLR5 drops below that of the hot standby unit. For example, the PLR5 for the main battery may be set to 6.31 volts, while the backup is set to 6.28 volts. The moment the output of the main unit drops down to or below 6.28 volts (due to a discharged or failing battery), the backup unit supplies power at 6.28V. This happens instantaneously and seamlessly. In all case, it is recommended that the condition of all airborne battery packs be checked prior to flight, assuring that you know what you are operating with.

Please note that if unusual conditions exist in the model setup, such as control surfaces that are severely binding, or ganged servo configurations that are fighting each other, then the power dissipation can exceed what is expected and may lead to overheating and will also cause the flight pack batteries to be consumed at a high rate. Problems like this can also be damaging to the servos and shorten their lifespan. Typical causes of excessive current draw with ganged servo configurations are mismatched control linkage geometry or mismatched servo travel. Proper care in selecting your configuration and regular care and maintenance of your setup is required for reliable and safe operation your model.

While any mAh capacity rating battery deemed suitable for your model may be used with the PLR5, care should be used in selecting the number of battery cells per pack. With NiCad or NiMh battery packs, use only 5 cell battery packs. When using Lithium Ion (LiIon) or Lithium Polymer (LiPo) battery packs, use only 2 cell battery packs. Use of battery packs with more than the recommended number of cells has no benefit and in fact wastes power, adds dead weight to the model and may cause the PLR5 to operate at higher than necessary temperatures.

Programming the PLR5

Programming the PLR5 is easily accomplished with the E-Z Set combination programmer, since it combines an integrated 3 ½ digit digital voltmeter, two programming buttons and all the connections necessary to easily program PLR5. However, it is also possible to program the PLR5 with your own digital voltmeter (DVM) and some means of making momentary electrical contact between the correct programming port pins. The latter method is a bit more cumbersome, but can be accomplished. You may send email Tech-Aero Support at support@tech-aero.net for instructions on how to do programming without the E-Z Set.

Simply connect the E-Z Set PROG plug to the Programming port of the PLR5 as shown in figure 5. Connect the PLR5 RX PWR connector to the E-Z Set Monitor plug and connect a battery to the PLR5 Battery connector. When the PLR5 is switched on, the E-Z Set will display the voltage setting.

Simply tap the "UP" button once for each voltage step up you wish to go and note the corresponding change on the digital voltage readout. When the unit reaches the maximum voltage or last step up, it will simply not respond to further "UP" button requests. To go down in voltage, simply tap the E-Z Set down button once for each step down needed. A similar rule applies; the PLR5 will stop responding to "DOWN" requests at 5.75V. Also note that if you press and hold either the up or down programming button for about 2 seconds or longer, the voltage change will operate in "fast forward"

mode, which is useful if you want to quickly make a larger voltage range change. After fast forwarding, release the button and use single button taps up or down to again fine tune the voltage.

At any time during this programming operation, you may simply shut off the power or disconnect the battery to the PLR5. The last setting displayed on the EZ-Set will be automatically saved in its memory when the power is removed through either method.
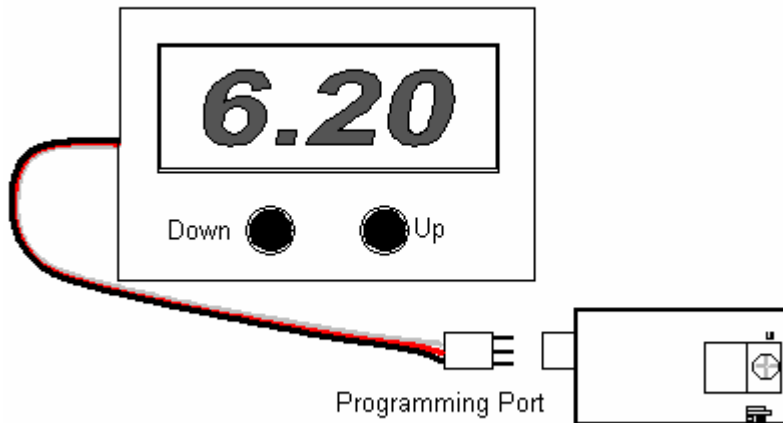

Figure 5

Safety Advisory for Charging LiIon or LiPo Batteries

Most, if not all manufacturers and distributors of LiIon and LiPo batteries and battery chargers will typically advise against charging batteries that are installed in the model, due to the potential fire hazard that is associated with these battery technologies. Tech-Aero Designs advises that you the follow the instructions and safety precautions for battery charging from the manufacturers or distributors of those products. Disconnect LiIon or LiPo batteries from the "FlexReg" and remove them from the model and place into a safe charging environment before commencing charging operations. Also, do not exceed the safe discharge rates of your batteries by allowing a short circuit condition or excessive servo load (due to binding control surfaces etc.) to occur. It is your responsibility to follow the instructions provided with the battery, battery charger and charging cord combination(s) you have selected for your use. Tech-Aero Designs assumes no responsibility or liability for product misuse or neglect.