



AMMO 12mm POWER SYSTEM

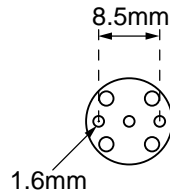
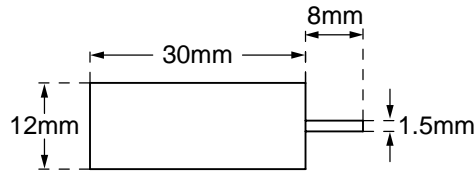


Congratulations, you have just purchased the Ammo 12mm power system components. All the components are sold separately to allow you to customize your power system to your airplane. The components needed to assemble your Ammo 12mm power system are: Ammo 12mm motors, a 12mm stick mount gearbox, propeller, propeller adapters and brushless speed control. This instruction sheet explains how to determine what you will need and how to assemble each component.

MOTORS

Model	Stock #
12-30-3850.....	GPMG5105
12-30-4110.....	GPMG5110

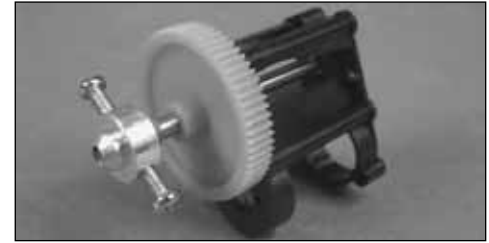
The Ammo motors are labeled to provide the most information at a glance. For example: the 12-30-3850kV is 12mm in diameter, 30mm long and has a kV (rpm-per-volt) of 3850 rpm.



Motor Output Shaft Diameter and Length: 1.5x8mm [.06" x .32"]

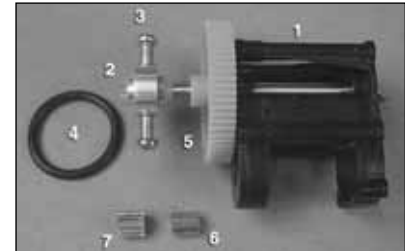
Weight: 14g [.49oz.]

GEARBOX



The ElectriFly Ammo motors have high kVs, meaning that they like to run at very high rpm. A gear drive is used in order to reduce the rpm allowing a larger, more efficient propeller to be used. Great Planes ElectriFly offers an **IPS (Indoor Power System) Small Gear Drive (GPMG0495)** which comes with two pinions that allow for the following gear ratios: **6.4:1** and **7.1:1**.

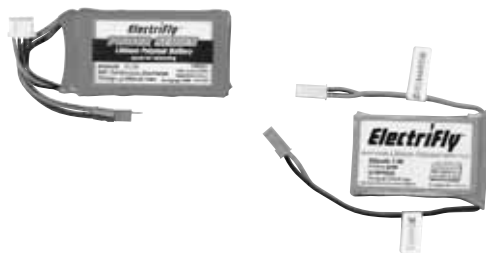
The IPS Gear Drive is designed to fit the 5x8mm motor mounting stick that is common on most of today's small IPS planes.



1. Gear Drive Body (1)
2. Prop Saver Hub (1)
3. 2.5x7mm Machine Screw (2)
4. Rubber O-Ring (1)
5. 64 Tooth Spur Gear (1)
6. 9 Tooth Pinion Gear (1)
7. 10 Tooth Pinion Gear (1)

BATTERIES: CHEMISTRY

The Ammo Motor/Silver Series ESC combination can use NiMH or LiPo batteries. Typically, NiMH batteries are heavier but much more affordable for the same capacity as LiPo batteries. If you want a very light, high-performance airplane, you might want to use LiPo batteries, but if weight is not a concern, then NiMH batteries might be for you.



BATTERIES: NUMBER OF CELLS

Cells can be connected in series or in parallel. Usually batteries are labeled as 8-cell NiMH or 3-cell LiPo. This means the cells are connected in SERIES (S). Arranging batteries in series gives you more power (higher voltage).

- Each NiMH cell has 1.2V, so an 8-cell NiMH battery has $1.2 \times 8 = 9.6V$
- Each LiPo battery has 3.7V, so a 3-cell LiPo battery has $3.7 \times 3 = 11.1V$

If a battery is arranged in PARALLEL it might be labeled as (P). Arranging the batteries in parallel will provide more duration (more capacity).

ElectriFly offers a full line of NiMH and LiPo batteries. Airplanes that use the Ammo 12mm motors will typically use batteries with a capacity of 340mAh to 640mAh, with the higher capacity batteries delivering more flying time but also being heavier. Most of the batteries have connectors that fit the recommended ESCs. We have also listed the connector adapters needed for certain batteries.

Due to the constantly changing battery technology, check out the ElectriFly web site at www.electrifly.com for the most up-to-date listing of the ElectriFly battery line.

PROPELLER ADAPTERS

The IPS Gear Drive uses a 3mm collet type prop adapter (GPMQ4959) or 3mm set screw type prop adapter (GPMQ4930). If you will be using the Ammo 12mm Motor without a gear drive, it requires a 1.5mm collet type prop adapter (GPMQ4950).



GPMQ4930 3mm Set Screw Type



GPMQ4950 1.5mm Collet Type
GPMQ4959 3mm Collet Type



GPMQ4620 3mm Prop Saver
(Included with Gearbox)

PROPELLERS



There is a wide selection of propellers available for electric use. The 12mm motors use mainly low-power electric type props such as the Great Planes PowerFlow™ props and the APC Slo Flyer props. The larger the propeller used, the more current your motor will draw. The smaller the propeller, the less current the motor will draw.

Shown are a few of the recommended electric props. Due to the large range of propellers and the constant addition of new sizes, visit our web sites at www.electrifly.com and www.greatplanes.com for the most up-to-date listing of electric type props.



GPMQ6630	.....9x4.5S	PowerFlow
GPMQ6655	.....10x3.5S	PowerFlow
APCQ4960	.....7x4SF	Slo-Flyer
APCQ5010	.....9x4.7SF	Slo-Flyer
APCQ5016	.....10x3.8SF	Slo-Flyer

ELECTRONIC SPEED CONTROL (ESC)

An ESC is basically the device that controls your motor through your radio system. Do not try to run any of the Ammo 12mm motors with a brushed ESC. It will not work and you may damage both the motor and the ESC. You need to use a brushless ESC. Great Planes ElectrIFly offers the Silver Series Brushless ESC SS-8 that will work with the Ammo 12mm



*ElectriFly Silver Series 8 (SS-8) ESC
(GPMM1800)*

for 8A maximum constant current draw

motors.

This ESC comes with 2mm female bullet connectors that plug directly into the 2mm male connectors installed on the Ammo 12mm motors, so no soldering is required. Also, this ESC comes with a Deans® Micro battery connector that matches the connectors that

<u>Stock #</u>	<u>Voltage</u>	<u>Capacity</u>	<u>Weight</u>	<u>Battery Type</u>	<u># of Cells</u>
GPMP0800	7.4V	350mAh	.88oz (25g)	LiPo	2
GPMP0800	7.4V	350mAh	.88oz (25g)	LiPo	2
GPMP0801	11.1V	350mAh	1.2oz (35g)	LiPo	3
GPMP0600	7.4V	640mAh	1.3oz (37g)	LiPo	2
GPMP0601	11.1V	640mAh	2.0oz (58g)	LiPo	3
GPMP0065	9.6V	300mAh	2.4oz (69g)	NiMH	8
GPMP0067	9.6V	350mAh	2.3oz (65g)	NiMH	8

DETERMINE WHAT YOU NEED TO BUILD YOUR POWER SYSTEM

Now that you have a component for your power system, there are several different ways to select the rest of the components of your power system. In time, experience will help you to determine what works best for you, but an easy way to determine what you need now is the following.

PROCEDURE #1: If you know the size of the propeller you want to turn and the rpm, then look at the chart included in the packaging and:

- ❑ 1. Find the combination in the motor/prop chart that delivers the closest performance to what you want.
- ❑ 2. Note the gear ratio you need.
- ❑ 3. Note the recommended battery voltage.
- ❑ 4. Determine if you want to use LiPo or NiMH batteries based on the desired ready-to-fly airplane weight. Select the number of cells based on the recommended voltage shown on the chart.
- ❑ 5. Determine the battery capacity needed based on the current draw of your system and your desired flight time.
- ❑ 6. Determine the ESC you need based on the system current draw shown on the motor/prop chart. See the ESC section.

PROCEDURE #2: If you know the approximate weight of your airplane, including the motor and battery, and the performance you want from it, answer the questions below to determine the correct power system for your plane. You may need to make more than one calculation using different motors and battery combinations. See the battery section for some of the battery weights for the suggested batteries.

- ❑ 1. Perform the following calculation to determine the wattage required:
 - If you expect trainer-like performance then multiply **75 x Airplane Weight (lbs)**
 - If you expect aerobatic or high speed-like performance then multiply **100 x Airplane Weight (lbs)**
 - If you expect 3D or extreme performance multiply **150 x Airplane Weight (lbs)**
- ❑ 2. The number you get is the minimum wattage you will need for your plane to perform as you wish. Look at the chart and determine what combination gives you the performance you want based on wattage and maximum propeller size that will fit on the plane.
- ❑ 3. Note the gear ratio you need.
- ❑ 4. Note the recommended battery voltage.

- ❑ 5. Determine if you want to use LiPo or NiMH batteries based on the desired ready to fly airplane weight. Select the number of cells based on the recommended voltage shown in the chart.
- ❑ 6. Determine the battery capacity needed based on the current draw of your system and your desired flight time.
- ❑ 7. Determine the ESC you need based on the system current draw.

In addition to these two procedures, you can also visit the Great Planes ElectriFly web site for descriptions of the power systems recommended for our line of electric and glow airplanes as well as more detailed explanation on the subject.

UNDERSTANDING MOTORS

kV (rpm/volt): This is a number that gets thrown around quite a bit when talking electrics and it is important to know what it is. kV is the number of rpm a motor will spin per each volt applied (rpm/volt) under no load.

This means that basically a motor that has a kV of 1000 when connected to a 12V battery will try to spin at 12,000rpm (1000x12) under no load. Likewise a 3500kV motor will try to spin at 42,000rpm (3500x12) under no load.

When a propeller is attached to the motor, the motor will try to spin the prop at the rated kV. Depending on the diameter and pitch of the propeller (the larger the diameter or higher the pitch, the harder it is to spin), the motor's current draw can be increased or decreased. There are meters available from your hobby dealer that measure current and voltage.

Because every motor has a maximum current it can take based on its design and cooling ability, the maximum size of propeller that can be used with each motor can be determined. Too large of a propeller and the motor will spin at a much lower rpm than its rated kV, causing it to draw a lot of current and overheat. If the propeller/fan is too small, it will require little effort (current) to turn the prop at the rated kV.

Ideally the motor should be matched with a propeller that causes the motor to draw 80-100% of its rated maximum constant current. Once a power system is set up, it can be fine-tuned by adjusting the propeller size and measuring the amount of current the motor is drawing.

Please note that the kV of a motor does not change with voltage, but if a higher voltage is applied to the motor, it will try to spin the same propeller at a higher rpm. This will cause the motor to draw more current and possibly exceed the maximum rated current of the motor. So, if a battery with

lower voltage is replaced with one with a higher voltage, it is recommended that a smaller propeller be used to keep the current in check. If a higher voltage battery is replaced by a lower voltage battery, the size of the propeller can be increased to keep the motor at its rated current.

Another possibility to fine tune the power system's performance is to use another motor with higher kV to increase the current or a lower kV to lower the current.

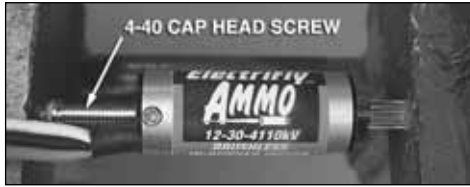
ASSEMBLE YOUR POWER SYSTEM

INSTALL THE PINION GEAR

Once you have determined the gear ratio you need, the brass pinion gear will need to be installed on the motor shaft. If the brass pinion gear fits loose on the motor shaft, the pinion gear will need to be secured to the motor shaft using a retaining compound such as Great Planes' (GPMA6062). For the most secure fit, roughen the motor shaft with 320-grit to 400-grit sandpaper. Clean the motor shaft and the inside of the pinion gear with denatured alcohol. Apply a thin film of retaining compound on the motor shaft and inside the pinion gear. Slide the pinion gear on the motor shaft and allow the retaining compound to set. Usually 1-2 hours.

If the brass pinion gear fits tight on the motor shaft it will need to be pressed on. Never force the pinion gear on the shaft without supporting the other end of the motor shaft. A small cap head screw works well for supporting the motor shaft. If you have a drill press the motor can be placed in a vice with the motor shaft supported on a small cap head screw. Use a small micro torch to heat the pinion gear and use the drill chuck of the drill press to press the pinion onto the shaft.

INSTALL THE PINION GEAR



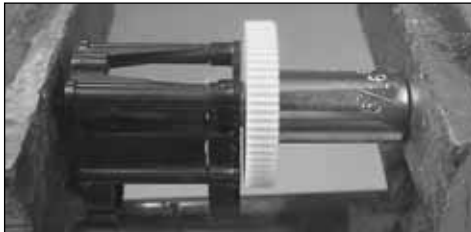
If you do not have a drill press a small vise can also be used. Place the motor between the jaws of the vise with the end of the motor shaft supported with a 4-40 cap head screw, tack glued to one jaw of the vise, and the pinion gear centered on the motor shaft. Use a small micro torch to heat the pinion gear and use the vise to carefully press the pinion onto the shaft.

REMOVAL OF THE PINION GEAR

Whether the pinion gear is glued on or pressed on, the best method of removing the pinion gear is by heating it with a micro torch and using a pinion puller to carefully pull the gear off.

REPLACING THE SPUR GEAR

The spur gear is simply pressed over a spline on the output shaft. Due to crashes and other unfortunate mishaps, the teeth on the spur gear may be damaged or the spur gear may twist off of the spline. If this happens, remove the damaged spur gear and press a new gear over the spline.



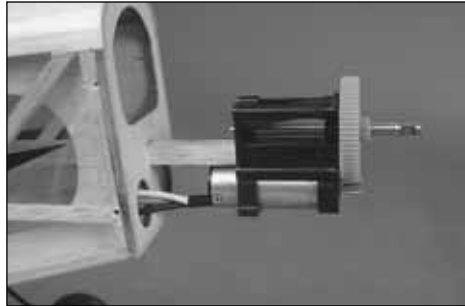
To accomplish this, use a tube or socket placed over the output shaft and against the new spur gear. Place this assembly in a vise and press the gear over the spline.

MOUNT THE MOTOR TO THE GEAR DRIVE



Mount the motor to the gear drive body with two 1.6x6mm machine screws.

MOUNT THE GEAR DRIVE TO THE PLANE



The Great Planes Stick Mount Gear Drive is designed to be mounted on a 5x8mm stick. Slide the Gear Drive over the stick. If the gear drive fits loosely on the stick, a drop of CA or a small self-tapping screw can be used to hold it in position.

INSTALL THE BRUSHLESS ESC

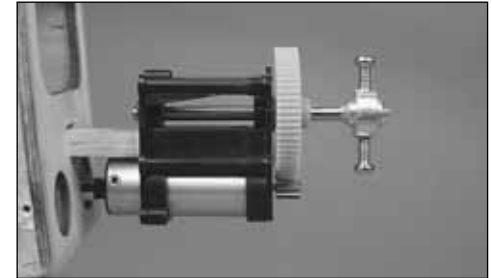
The ElectrIFly SS-8 (GPMM1800) works great with the Ammo 12mm motor and gear drive. Use the instructions included with the ESC to correctly connect the ESC.

INSTALL THE PROP ADAPTER AND PROP

The prop saver prop adapter is included with the IPS Gear Drive. If you prefer to use the collet type prop adapter or set screw type prop adapter, you will need the:

GPMQ4959 3mm Collet-Type Prop Adapter
GPMQ4930 3mm Set Screw-Type Prop Adapter

PROP SAVER PROP ADAPTER INSTALLATION



Install the cowling if the plane comes with one. Note that on the prop saver hub the center protrusions have different diameters on each side of the hub. Determine which diameter fits the prop you are using. Then, install the prop saver hub on the output shaft of the gear drive with the correct diameter facing outward. Tighten the two 2.5x7mm machine screws against the output shaft, in the prop saver hub.



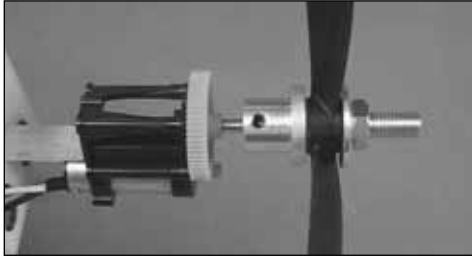
Install the prop on the prop hub and secure it with a rubber o-ring looped over both of the machine screws.

COLLET-TYPE PROP ADAPTER INSTALLATION



Slide the 3mm prop shaft over the output shaft of the gear drive. Next slide the prop shaft retainer over the prop shaft. Note that the hole through the retainer is tapered. Make sure that the side with the larger diameter hole is installed first. Install the spinner backplate (if used, **not included**), the prop, prop washer and then the prop nut. Tighten the prop nut against the prop. This will cause the tapered hole in the prop shaft retainer to squeeze the prop shaft around the output shaft. Carefully pull on the prop to make sure it is securely attached to the output shaft of the gear drive.

SET SCREW TYPE PROP ADAPTER INSTALLATION



Slide the 3mm prop adapter over the output shaft of the gear drive. Align one of the set screws with the flat on the output shaft of the gear drive. Apply a drop of Great Planes **Threadlocker (GPMR6060)** to the set screw and install it in the prop adapter, tightening it against the flat of the gear drive output shaft. Remove the second set screw that does not tighten onto the flat. When installing the prop adapter onto a shaft that does not have a flat spot, tighten both of the set screws against the shaft. Install the spinner backplate (if used, **not included**), the prop, prop washer and then the prop nut. Tighten the prop nut against the prop. Carefully pull on the prop to make sure it is securely attached to the output shaft of the gear drive.

AMMO MOTOR MAINTENANCE

Ammo brushless motors require virtually no maintenance. There are no brushes to wear out and replace. The precision bearings have a very long service life and should last a very long time. The internal parts of the motor should not require any cleaning.

IMPORTANT PRECAUTIONS

- Once the battery is connected to the ESC, stay clear of the motor and prop.
- DO NOT apply an input voltage that exceeds the maximum specification of each motor.
- DO NOT apply currents to the motor that exceed the maximum specifications of each motor.
- DO NOT allow the input connectors to accidentally touch each other while power is applied to the motor. Make sure all input connections are insulated electrically.
- DO NOT allow water or moisture to enter the motor, as it can cause permanent damage to the motor and possibly short out the attached ESC.
- DO NOT cut the wires from the motor. The wires are part of the windings and are coated with an insulating material and cannot be soldered without removing the coating, which is very difficult. If you must remove the bullet connectors, unsolder them.
- Allow the motor to cool after each flight.
- The motor shaft of the motor will rotate at very high rpm. DO NOT attempt to touch the shaft while it is rotating. If setting up the motor/ESC on the workbench, make sure the motor is securely attached and that nothing is attached to the motor shaft BEFORE applying power.
- Never attempt to use a damaged motor (having mechanical or electrical defects).

ElectriFly carries a complete line of Ammo (in-runner style) and Rimfire (out-runner style) brushless motors, gear drives, motor mounts, prop adapters and speed controls. For a complete list of these products, check out our web site at:

www.greatplanes.com
www.electrifly.com

or visit your nearest hobby shop that carries the full line of Great Planes and ElectriFly products.