

MODEL AIRPLANE ENGINEERING
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<http://www.M-A-E.com/Manuals/Penguin.pdf>



Penguin Micro

Aerobatic Indoor Flyer

Instruction Manual

SPECIFICATIONS

Wing Span:	12 inches		
Wing Area:	85.9 sq in	Wing Loading:	1.77 ounce/sq. ft.
Length:	12.9 inches		
Weight:	30 Grams with 130-1S Lipo		
Motor:	4-Site Brushed or 5g Brushless Outrunner		
Servo:	1.5g—1.7g ParkZone or equivalent (1 required)		
ESC:	Built-in (brushed) or XP-3A (brushless)		
Receiver:	PZ: AR6400 or AR6400L		
Battery:	130-1S to 240-1S Lipo, 15C or greater		

INTRODUCTION

Thank you for purchasing our *Penguin Micro*! *Penguin Micro* will do amazing 3D and sport aerobatics indoors! She will also slow down virtually to a crawl! *Penguin Micro* can also be flown outdoors in a light breeze.

Penguin Micro has been engineered for strength, lightness, and great flying fun. The plane assembles very quickly using non-toxic glue. This model was designed to give you an affordable replacement airframe for your used up Parkzone™ or E-Flite™ ultra-micro BNF planes, such as the 4-Site, P-51, Sukhoi, etc.

Penguin Micro was designed specifically for the ParkZone™ and Eflite™ Bind & Fly (BNF) 2.4Ghz ultra-micro radio equipment.

WHAT YOU WILL NEED

- Glue: RC-56 Canopy Glue or GWS Glue or Craft glue or Foam-safe CA, and regular Thin CA
- #11 X-Acto Knife or equivalent
- Cellophane tape for hinges (29 cents per roll at Walmart)
- 4-chnl transmitter with DSM2 2.4 Ghz & Elevon mixing (or can fly rudder-elevator-throttle)
- AR6400 or AR6400L ultra-micro receiver
- (1) 1.5 gram or 1.7 gram ultra-micro servo
- XP-3A ESC (only if using a brushless motor)
- 4-Site motor or brushless outrunner (other ultra-micro motors will work, but you may have to lengthen motor wires)
- P51 or Sukhoi gearbox if using a brushed motor
- Propeller: GWS 5x3 HD and 1.5mm prop adapter (nylon collet adapter recommended)
- Battery: 130-1S to 240-1S Lipoly, 15C minimum
- Charger: LiPoly capable of charging 1S, or use an adapter for 1S with conventional lipo charger

KIT CONTENTS

- 1 ea Assembly Manual (see website for PDF download)
- 1 ea 3mm Depron-Aero machine-cut Fuselage Top w/Rudder, pre-beveled and pre-hinged
- 1 ea 3mm Depron-Aero machine-cut Fuselage Bottom
- 1 ea 3mm Depron-Aero Wing w/Elevons, pre-beveled and pre-hinged
- 1 ea .015 in. x 18 in. Music Wire for control rods

Parts Bag:

- 1 ea Laser-cut Ply Control Horn Set
- 1 ea 1/2 in. x 1 in. Thin Velcro for battery attachment
- 1 ea 3/64 in. x 1-1/2 in. HST (heat shrink tubing) for control rods
- 2 ea 1/64 in. x 1/8 in. x 1-1/2 in Ply for Fuse Reinforcement
- 1 ea 0.8mm x 4-1/2 in. CF Control Rod for Rudder
- 2 ea 0.8mm x 3-1/4 in. CF Rod for Nose Supports
- 2 ea 6mm Depron-Aero Motor Mounts
- 1 ea 3mm Depron-Aero for fabricating custom motor cut-outs if using brushless motor
- 1 ea 3/32 in. sq. x 2 in. Balsa for Receiver & Servo Mount Pads

THINGS TO KNOW

Make sure your kit is complete and undamaged.

Follow the step sequence given here for best results. Check off each step when completed to insure that none are skipped.

Detailed instructions complete with pictures is available in PDF format for download from our website. You are invited to download and view or print them as desired. The Assembly Manual can be downloaded at <http://www.M-A-E.com/Manuals/Penguin.pdf>

Construction photos and updates to these instructions will be added to our website as the need dictates. Please visit us at www.M-A-E.com for the latest information. Construction photos are at http://www.M-A-E.com/Sub_Pages/Pictures-Videos/Penguin_BuildPics.htm

STEPS IN A NUTSHELL

1. Prepare all foam parts & apply any desired graphics.
2. Mount motor and prop assembly.
3. Mount receiver brick.
4. Attach bottom fuselage.
5. Attach top fuselage.
6. Mount elevon servo.
7. Make control rods.
8. Connect receiver/servos to rudder and elevons.
9. Add tape, carbon fiber, and plywood reinforcements.
10. Mount battery & balance model.
11. Set control throws.
12. Go fly!

GENERAL CONSTRUCTION COMMENTS

Gluing your model together: We use RC-56 Canopy Glue for most of the assembly. This forms a strong yet flexible joint, but takes longer to dry than GWS or CA glues. Apply glue to one surface, then press parts together. Separate parts and let dry for 5 minutes. Now press parts together again. Tape or weight if necessary until thoroughly dry.

For faster assembly, use GWS glue or foam-safe CA. If using GWS glue, smear the glue on both surfaces to be joined and wait 7-8 minutes. Then carefully press the parts together. GWS Glue is a contact cement, so make sure parts are in proper alignment before pressing them together. Do not apply this glue to surfaces that must slide by one another during assembly, such as the sides of tabs and slots.

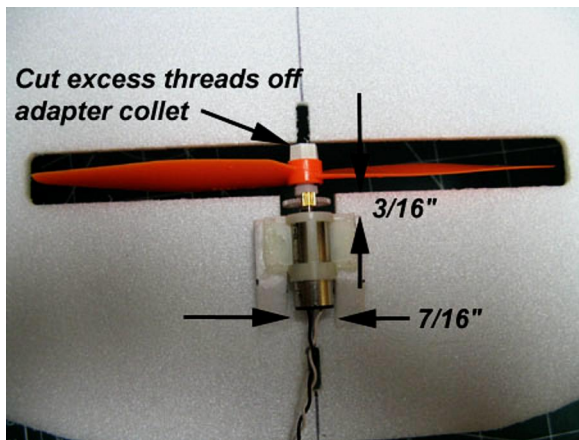
DETAILED INSTRUCTIONS

1. Prepare Foam Parts and Apply any desired Graphics:

Clean your foam parts by carefully vacuuming them or using a tack-rag to remove any foam dust. Your *Penguin Micro* has been air-brushed, so additional graphics are not needed or recommended. If used, additional graphics should be applied sparingly to save weight. Vinyl gets heavy in a hurry, so I do not recommend using it.

2. Mount Motor and Prop Assembly:

First choose between a brushed or brushless motor. If you need help with this, contact me and I will try to help you. If you are using a brushed motor from a ParkZone™ plane, the length of the motor wires is different for each model. The best brushed motor for this application is the 4-Site motor which has the most power and the motor wires do not require any alteration. The P51 motor has equal power but shorter motor wires. The original Sukhoi motor is less powerful and has the shortest wires. All these motors can work, but just make sure you are aware of the various limitations. If necessary, lengthen your motor wires so they reach from the motor around the prop to the receiver. They need to be 5-7/8 inches, minimum. Again, the 4-Site motor works without any required alteration.



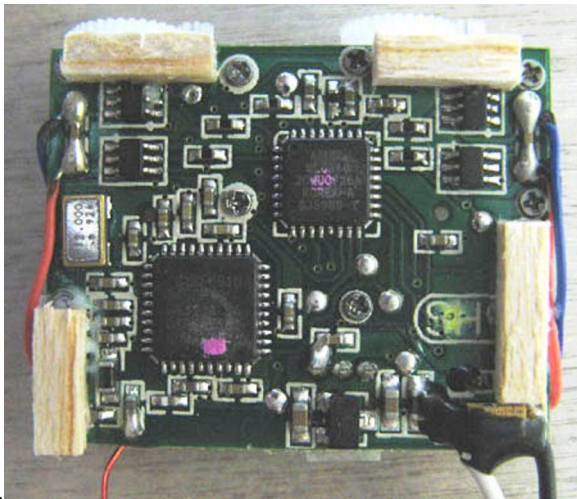
2A: Begin by drawing a center-line full length of the wing on bottom of wing.

2B: Glue the two 6mm Depron motor mounts to the bottom of wing as shown, 7/16 inch apart, equidistant from wing centerline.

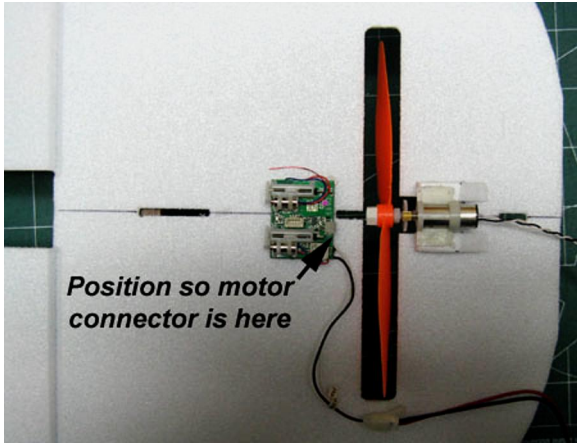
2C: Assemble prop to prop-shaft as shown. Make sure the numbers on the prop face forward. You should cut off the protruding collet so it is flush with the prop nut to avoid interference with wing cutout.

2D: Cut off the 4 spikes on the gearbox frame, and then carefully glue the motor/gearbox in place as shown, ensuring that the prop is centered in the wing opening. Also make sure that the prop blades are perpendicular to wing when they are vertical.

3. Mount Receiver Brick:

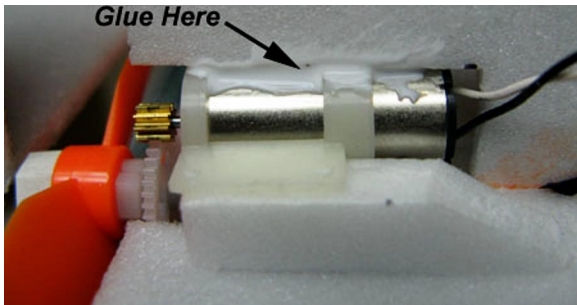
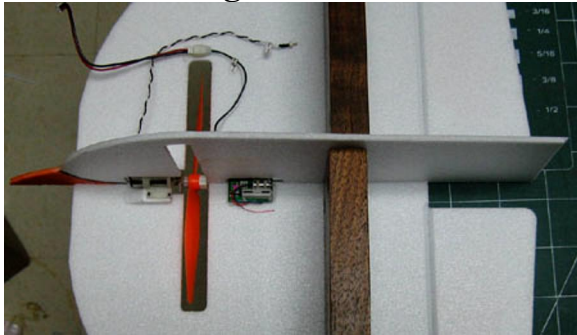


3A: Using the 3/16 inch square balsa supplied, make mounting feet as shown and glue them to the bottom of your receiver brick. Do not use CA glue here, as it could damage the electronics. I recommend a flexible white glue such as RC56 canopy glue.



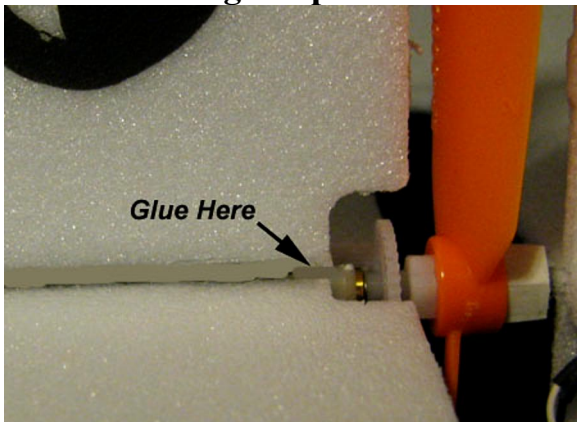
3B: Glue the receiver brick to the wing as shown. Correct orientation is very important. The front edge of your brick should be just behind the fuselage tab slot in the center of the wing, and the motor connector should be off-center so that it will clear the fuselage bottom when it is glued in place. In other words, make sure you can plug your motor lead into the connector when the fuselage bottom is in place.

4. Attach Fuselage Bottom:



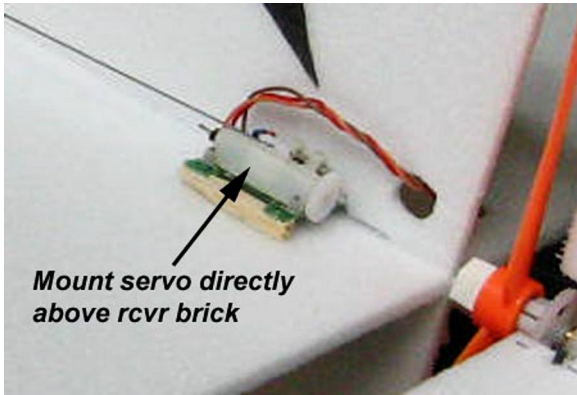
4: Test-fit the fuselage bottom, ensuring that the motor just contacts the foam where they come together. Apply glue to edge of fuselage bottom wherever it will contact the wing or motor bottom. Picture shows using squared wood blocks to ensure vertical alignment of the fuselage bottom while glue dries. Before the glue dries, check both vertical and horizontal prop alignment to ensure there are NO unwanted thrust offsets. Orient wires from motor and receiver as shown, so they will be on the correct side of plane during final assembly.

5. Attach Fuselage Top:



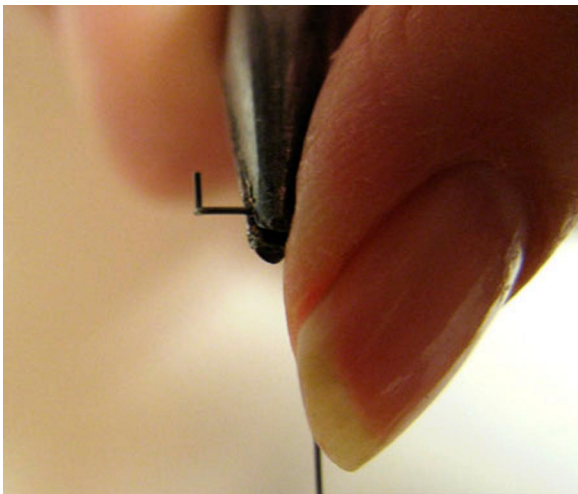
5: No magic here. Just be careful to not get any glue into the gearbox. However, you DO want to glue the propshaft housing to the fuselage top as shown. Also, be sure to put glue on the fuselage top tabs so they become glued to the tabs from the fuselage bottom when both halves are in place. Don't forget to glue the fuselage halves together in front of and behind the wing.

6. Mount Elevon Servo:

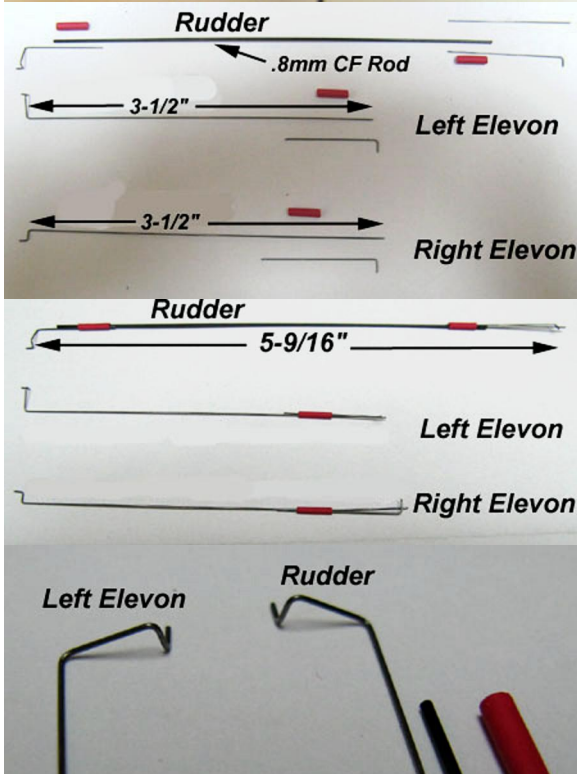


6: Using the 3/16 inch square balsa supplied, make a single mounting pad as shown and glue it to the bottom of your servo. Do not use CA glue here, as it could damage the electronics. I recommend a flexible white glue such as RC56. When you have aligned your servo directly above your receiver on the right side of fuselage, press it into the foam fuselage until the two servo mounting lugs are buried in the fuselage. Now glue the balsa pad to the wing and the servo mounting lugs (opposite side of servo) into the dents you made in the fuselage.

7. Make Control Rods:



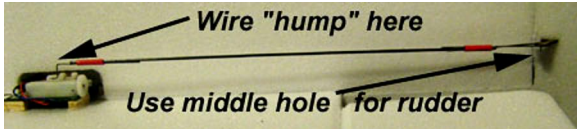
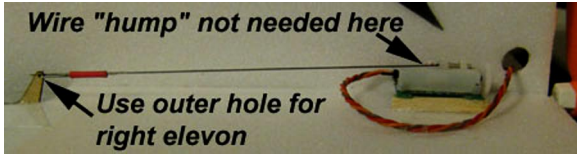
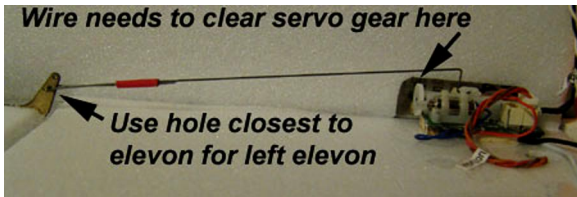
7A: Bending the .015 music wire is very easy, using a pair of needle-nose pliers as shown. Grasp the wire firmly with the pliers right where you want the bend to occur. Then simply bend the wire with your finger.



7B: Using the .015 music wire and the .8mm x 4.5 inch CF rod supplied, make 3 control rods as shown. The Z-bend goes into the center-hole in the servo output arm. The L-bend is attached to the opposite end of the control rod using a 3/8-inch length of heat-shrink (supplied). Go ahead and shrink the tubing with a soldering iron or heat gun. This will hold the L-bend snug, but still allow it to be adjusted to the correct length in Step 8 below.

NOTES: Be careful and take your time! Study each control rod and its proper orientation relative to its respective servo and control surface. Before making a bend, make sure you are bending in the correct direction. Notice how the servo-end bends are in opposite directions for the Left Elevon and the Rudder (see picture at left). If you do happen to make an error, there is approximately 4 inches of extra music wire in your 18-inch piece. Also note that the offset required (for servo gear clearance) in the Left Elevon and Rudder control rods is 3/16 inch.

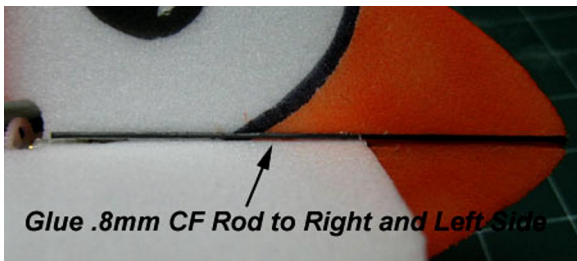
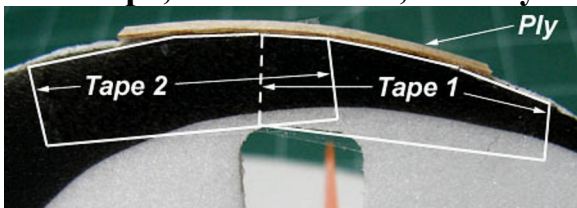
8. Connect Servos to Rudder and Elevons:



8A: Glue ply control horns to inside edge of each elevon and to slot in rudder. You may wish to apply thin CA to control horns prior to their installation, to strengthen the wood.

8B: Now when you attach the control rods to their respective flight surface control horn, center each flight surface to neutral and slide the L-bend to precisely the correct length. Next you can remove the control rod and permanently set the L-bend by wicking some thin CA at each end of the heat-shrink tubing.

9. Add Tape, Carbon Fiber, and Plywood Reinforcements:



9A: Place cellophane tape (29c/roll, Walmart) on both sides of fuselage, top and bottom as shown.

9B: Place small strips of cellophane tape along the hinge line of each control surface (not shown).

9C: Glue the 0.8mm x 3-1/4 inch carbon fiber rods, one on each side of fuselage as shown. Apply glue to entire length of rod.

9D: Glue the 1/8 inch x 1-1/2 inch plywood reinforcements to top and bottom of fuselage as shown. Center these on the prop cut-out.

10. Mount Battery and Balance Model:



10: Your model should balance with the battery mounted as shown. Balance point is right at the hole behind the prop cut-out on fuselage top. Lipos from 130mah to 240mah have been tested with excellent results. Weight differences in the batteries will cause slight changes in flight characteristics, but not enough to make anything objectionable. We are getting 6-min flights on 130, 8-min on 160, and 12-min on 240. The extra battery weight of the 240 enables better penetration in a breeze.

11. **Set Control Throws:**

Use the middle hole in rudder control horn with AR6400L receiver, or inside hole with AR6400 receiver.

Exponential: -70% recommended on all surfaces

Low Rates: We do not use low rates, just expo. If you use low rates, set them to 60% of high rates.

12. **Go Fly:**

Flying your *Penguin Micro* is easy and enjoyable. I use an under-hand release at about half-throttle.

Once airborne, the sky is the limit. Just putt-putting around is most enjoyable. A close friend confided that he has never flown anything like it in his 30+ years of flying! The slow-speed stability is absolutely incredible! Spins, rolls, and tumbles are easily performed as well. If you do happen to dork your *Penguin Micro*, you will find it to be extremely resistant to crash damage.