

Instruction Manual

ULTIMATE

ARF

120cc



Giuseppe Tommazzini

FLEX
INNOVATIONS™



BEFORE CONTINUING WITH THIS INSTRUCTION MANUAL OR THE ASSEMBLY OF YOUR AIRCRAFT, PLEASE VISIT OUR WEBSITE FOR THE LATEST PRODUCT UPDATES, FEATURE CHANGES AND MANUAL ADDENDUMS FOR THIS PRODUCT.

<https://www.flexinnovations.com/product/ultimate-120cc>

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INTRODUCTION



The Flex Innovations Ultimate 120cc is a 39% scale model of Gordon Price's famous Ultimate 10-300. Based on his 1988 Tournament of Champions (TOC) winning freestyle model, designer, and World Champion Quique Somenzini, has brought the Ultimate design into the 21st Century. A large fuselage, short wings and airfoiled tail combine with a lightweight and strong, laminated black fiber structure, to take the Ultimate to a new and unprecedented level of performance.

The perfect wing loading, and absolute minimum control coupling are the key to great 3D and XA performance; the Ultimate 120cc excels in these areas. Not only does the Flex Innovations Ultimate 120cc excel in the air, but in its looks; Quique paid close attention to the scale shape to conserve the true lines and appearance of the full-scale counterpart.

The Flex Innovations Ultimate 120cc is a natural performer and with the biplane design experience of Quique Somenzini, it's a phenomenal airplane that excels in all facets of aerobatic flight.

Specifications:

Wingspan:	85 in. (2167 mm)
Length:	99 in. (2516 mm)
Estimated Weight:	30 lb. (13.6 kg) with DA-120 or GP123 & stock mufflers
Engine Size:	120-125cc

Required Equipment:

Radio Equipment & Servos:

Transmitter:	8+ channels
Receiver:	8+ channels, high-voltage capable
Receiver Battery:	(2) 2S 2000mAh 15C+ LiPos (FPZBR20002S15 recommended)
Receiver Battery Strap:	(1) Flex Hook and Loop Strap, 200 mm long (FPMA1012)
Aileron, Rudder, Elevators	(7) Minimum 400 oz-in (28 kg-cm)
Recommended servos:	Potenza DS494010HV brushless high voltage servo recommended
Throttle Servo:	High Quality, Metal Gear Digital Servo Potenza DS19410TGHV servo recommended

Servo Arms:

Aileron, Elevator, Rudder:	(7) 2-inch Single Arm Potenza 2-inch Clamping Servo Arm (FPZA1036) recommended
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Servo Extensions:

Ailerons, wing side:	(2) 6-inch (150 mm) FPZA1043 – Top Wing
Ailerons, fuse side	(2) 30-inch (762 mm) FPZA1056 – Top Wing (2) Single MPX connector FPZA1065 – Bottom Wing (2) 18-inch (460 mm) FPZA1046 – Bottom Wing RX to MPX connector
Elevators:	(2) 48-inch (1200 mm) FPZ1049
Rudder (push/pull)	(1) 36-inch (920 mm) FPZA1048
Throttle	(1) 30-inch (762 mm) FPZA1056
Servo Extension Safety Clips:	Flex Servo Connector Safety Clips FPZA1040

Spinner:

Spinner: 6-inch (152 mm)
 Flex Innovations 6" Carbon Fiber Ultimate Spinner, Yellow/Blue
 (FPMA1078 or FPMA1083 recommended)

Gas Engine Setup

Engine: 120-125cc Two-Stroke Gasoline Engine
 Desert Aircraft DA-120 – FPMDA120 or
 GP123 – FPMGP123 recommended

Exhaust: Follow your engine manufacturer’s recommendation, as well as local
 noise restrictions in your area.
 DA stock muffler set by Slimline (FPMDA120MUFFLER)
 recommended for DA-120
 GP123 stock muffler recommended for GP123
 Other Exhaust Options: KS 3086 Canisters (Rear Exit) 90mm drop
 flexible header for the DA

Propeller: Falcon Carbon Fiber 28x9 (FMPFC2890CF) recommended for the
 DA-120 or GP123
 Follow your engine manufacturers recommendations.
 Prop choice may vary by density altitude.

Engine Standoffs: Flex/Dualsky 20MM/120cc Standoff Kit (FPZMEMDA120H20)

Ignition Regulator: Follow your engine manufacturer’s recommendation

Ignition Battery: Follow the manufacturer’s voltage requirements.
 Potenza 2S 2000mAh 15C+ Li-Po (FPZBR20002S15) recommended

RX/Ignition Battery Strap: Flex Hook and Loop Strap, 220 mm long (FPMA1013)

Fuel Tank Strap: (2) Flex Hook and Loop Strap, 400 mm long (FPMA1055)

Fuel Dot: McFueller Fuel Dot (FPMA1049)

Optional Equipment:

FPZAURA08PRO Aura 8 Professional

FPM1623 32oz Lightweight Fuel/Smoke Tank (for smoke)

DP1000 Dualsky DP1000 Brushless Smoke Pump

FPM001180012 Flex Innovations Ultimate 120cc Premium Wing and Tail Bag Set

FPM00118026A Ultimate 120cc Pilot yellow

FPM00118026B Ultimate 120cc Pilot blue

FPMA1051 120cc Smoke System Completion Pack

FPMA1028 Flex 35% Airplane Sunshade

Ultracote®/Oracover® Colors:

Yellow Scheme:

Ultracote®

Bright Yellow (HANU872)

Dark Yellow (HANU889)

True Red (HANU866)

Black (HANU874)

Flame Red (HANU883)

Oracover®

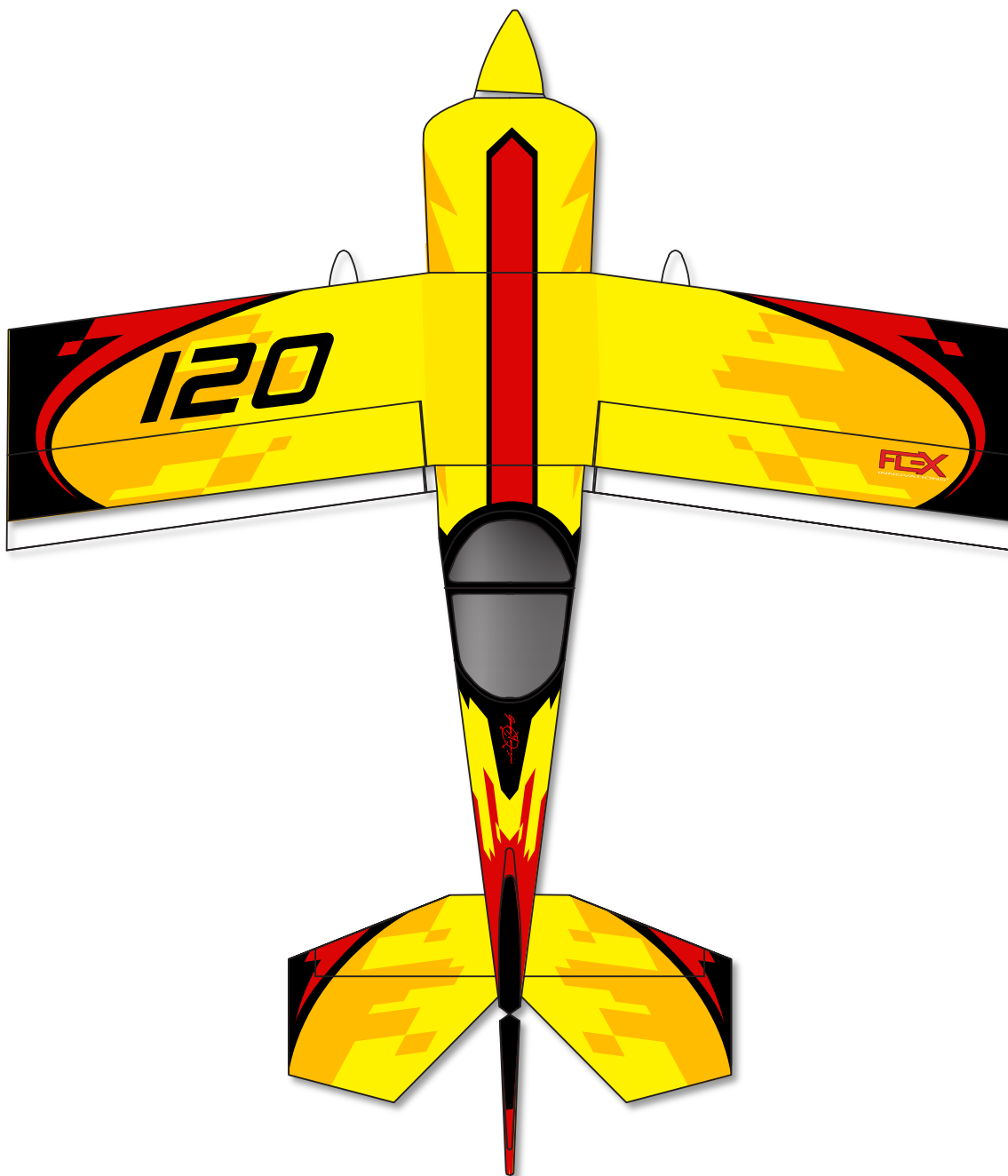
Cadmium Yellow (21-033)

Golden Yellow (21-032)

Ferrari Red (21-023)

Black (21-071)

Bright Red (21-022)



Ultracote®/Oracover® Colors:

Blue Scheme:

Ultracote®

Orange (HANU877)

Sky Blue (HANU875)

Deep Blue (HANU873)

Black (HANU874)

White (HANU870)

Oracover®

Orange (21-060)

Sky Blue (21-053)

Blue (21-050)

Black (21-071)

White (21-010)



USING THIS MANUAL

The manual is divided into sections to make the assembly of the airplane easier to follow.

Note: The squares “□” next to each step that can be checked off to help you keep track of the steps that have been completed.

ATTENTION

Read the ENTIRE instruction manual to become familiar with the features and assembly of the product before starting assembly. Failure to assemble or operate the product correctly can result in damage to the product, personal property and cause serious or fatal injury.

All instructions, warranties and other collateral documents are subject to change at the sole discretion of Flex Innovations, LLC. For up-to-date product literature, please visit our website at www.flexinnovations.com and navigate to the product page for this product.

WARNING

This is NOT a toy. This product is not intended for use by children under 14 years of age without direct adult supervision.

IMPORTANT INFORMATION REGARDING WARRANTY

Please read our Warranty and Liability section before building this product. If you as the purchaser or user are not prepared to accept the liability associated with the use of this product, you are advised to return this product immediately in new and unused condition, in the original packaging material, to the place of purchase.

SAFETY WARNINGS AND PRECAUTIONS

Protect yourself and others by following these basic safety guidelines.

1. This manual contains instructions for safety, operation, and maintenance. It is essential to read and follow all the instructions in the manual, prior to assembly, setup, or use, in order to operate correctly and avoid damage or serious injury.
2. In some cases, the written instructions may differ slightly from the photos. In those instances, the written instructions should be considered correct.
3. This model is not a toy, rather it is a sophisticated remote control hobby product and must be operated with caution and common sense. Failure to operate this product in a safe and responsible manner could result in injury, or damage to the product, or other property.
4. This model must be assembled according to these instructions. Do not alter or modify the model outside of these instructions provided by Flex Innovations, LLC, as doing so may render it unsafe and/or unflyable. You must take time to build straight, true, and strong. It is your responsibility to ensure the air worthiness of this product.
5. Use only compatible, appropriate components for the final assembly of this model. Ensure that the radio system is in functional condition, that the engine is appropriately sized for the model and that all other components are appropriate for use in this model as specified in this instruction manual. All components must be installed correctly so that they operate correctly both on the ground and in the air.
6. Inspect and check the operation of the model and all its components before every flight.
7. If you are not an experienced pilot, or have not flown a high-performance model before, it is recommended that you seek assistance from an experienced pilot in your R/C club for your

first flights. If you're not a member of a club, the Academy of Model Aeronautics (AMA) has information about clubs in your area whose membership includes experienced pilots.

8. Keep the propeller area clear from such items as loose clothing, jewelry, long hair, or tools, as they can become entangled. Keep your hands and body parts away from the propeller as injury can occur.

SPECIAL LANGUAGE DEFINITIONS

The following terms are used throughout the product literature to indicate various levels of potential harm when operating the product.

- NOTICE:** Procedures, which if not properly followed, create a possibility of physical property damage AND a liable or no possibility of injury.
- CAUTION:** Procedures, which if not properly followed, create a probability of physical property damage AND a possibility of serious injury.
- WARNING:** Procedures, which if not properly followed, create the probability of property damage, collateral damage and serious injury OR create a high probability of serious injury.

IMPORTANT BEFORE ASSEMBLY

Carefully unpack your aircraft and inspect the parts. Review the manual and gather the required tools and supplies.

- Remove all parts from their plastic bags, inventory all items and closely examine all the major airframe components for damage. If any items are missing or you find damaged components, do not proceed. Please contact customer support.
- Your aircraft has experienced many changes in temperature, density, etc. Throughout its transit from the factory, warehouse, and finally to your location. It is expected that some areas of covering will show wrinkles
- Use a covering iron with a covering sock on high heat to tighten the covering as necessary, paying special attention to the leading edges of the flying surfaces, hinge lines and stabilizer and wing saddle areas. Apply slight pressure over sheeted areas to thoroughly bond the covering to the wood. Use caution around seams to prevent inadvertently pulling them loose.
 - **Pro-Tip:** You can use a "Seal-It Pen" or clear nail polish to permanently seal any sharp edges or corners of covering that may come loose in flight.
- Use thin CA to go over any important glue joints, such as the motor box, firewall, servo mounting rails and any other pre-assembled joints that may see high stress during flight.
- Gather all the required components such as motor and radio equipment that will be used to equip the airplane. Create a new radio program in your transmitter and bind this model program to the receiver that will be used in the airplane
- To prepare for flight, it is recommended that you use the combination of an iron and heat gun to ensure all seams are sealed. Be sure to operate with safe heat settings on your iron while using an iron cover or paper towel. When using a heat gun, do not concentrate on one area for an extended period, rather distribute the heat
- Glass cleaner and paper towels work well to clean your airframe. For an additional shine, spray wax is an option.
- It is a good idea to have some isopropyl alcohol on hand throughout assembly. This can be used to help clean residual adhesives.

AIRFRAME ASSEMBLY

INTERPLANE STRUT, WING STRUT BLOCK INSTALLATION

Required for this section

Components

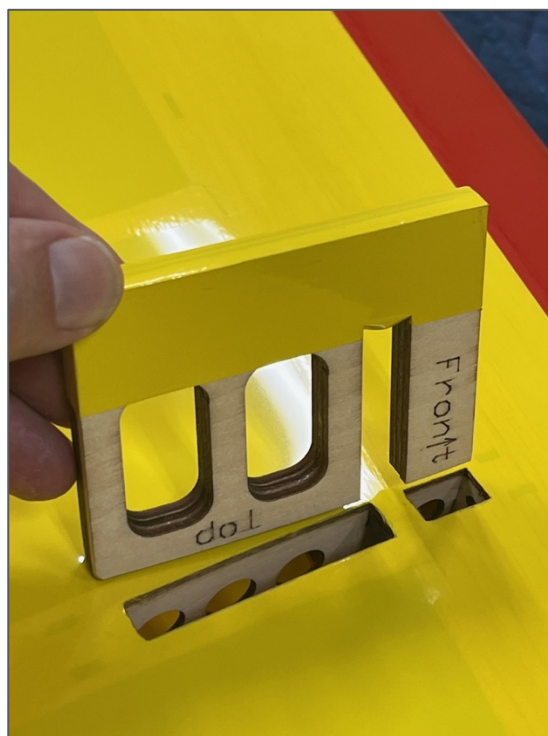
- Top Wing Panels (2)
- Bottom Wing Panels (2)
- Interplane Strut Blocks (4)
- Interplane Struts (2)
- Interplane Strut Pins (4)

Tools

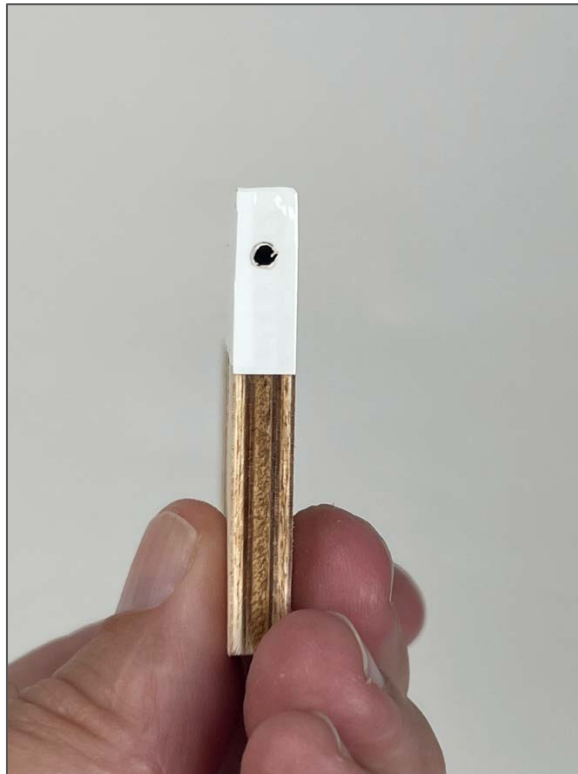
- Hobby Knife with a #11 blade
- Covering Iron/Trim Iron

Adhesives/Building Materials

- Isopropyl Alcohol
- 30-minute Epoxy
- Paper Towels
- Toothpicks
- Mixing Cups
- Mixing Sticks (something to mix epoxy with)
- Low Tack Tape



- 1. Locate the slots in the wing for the interplane strut block locations. These are installed in the top of the bottom wings, and the bottom of the top wings. Each block is clearly label. When installing it, follow the labeled directions. Use a Hobby Knife with a #11 blade to carefully cut and remove the covering from the slot, leaving $\frac{1}{8}$ -inch (3mm) extra covering on the inside of the slot. Cut the corners at a 45-degree angle and use a covering or trim iron to seal the extra covering down into the slot.



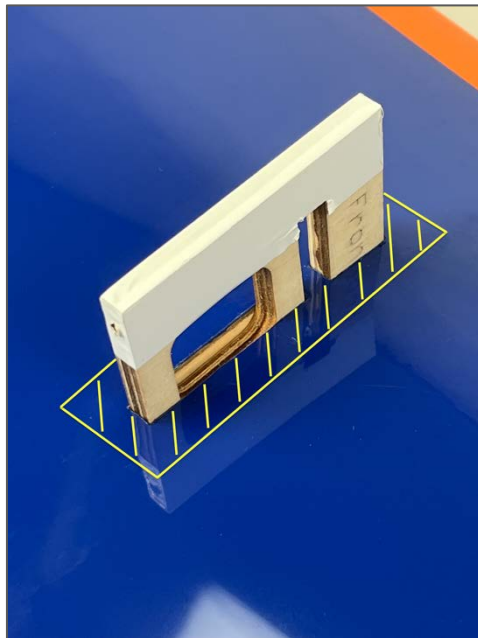
- 2. Each block needs to carefully cut and remove the covering from the holes for the mounting pin.



- 3. Take an interplane strut and assemble the corresponding block in position using the 3mm pin.



4. Do a test fit to confirm strut and block are in the correct location and fit with no issues into the slot in the wing.



5. Once the fit is OK and you are ready to bond the blocks in, apply some low-tack tape around slot to ease epoxy cleanup. Use good quality, 30-minute Epoxy to bond the blocks in. Repeat this procedure for all 4 blocks.

Quique's Tip:

While you are testing these parts, check that pin fits tight and is not loose. Pin should fit tight and might need the use of pliers to install and/or remove. If it is too loose, apply a thin layer of CA adhesive to the strut. **DO NOT USE ACCELERATOR** on the CA, let it cure naturally. If it is too tight, there may be some glue residue in the strut, clear it out with the pin or a small drill bit. Keep this tip in mind for future use, as the airplane accumulates flights it may be necessary to repeat this step.

AILERON CONTROL HORN INSTALLATION

Required for this section

Components

- Top Wing Panels (2)
- Bottom Wing Panels (2)
- Aileron Control Horns (8)
- Aileron Control Horn Base Plates (4)
- Aileron hinges (20)

Tools

- Hobby Knife with a #11 blade

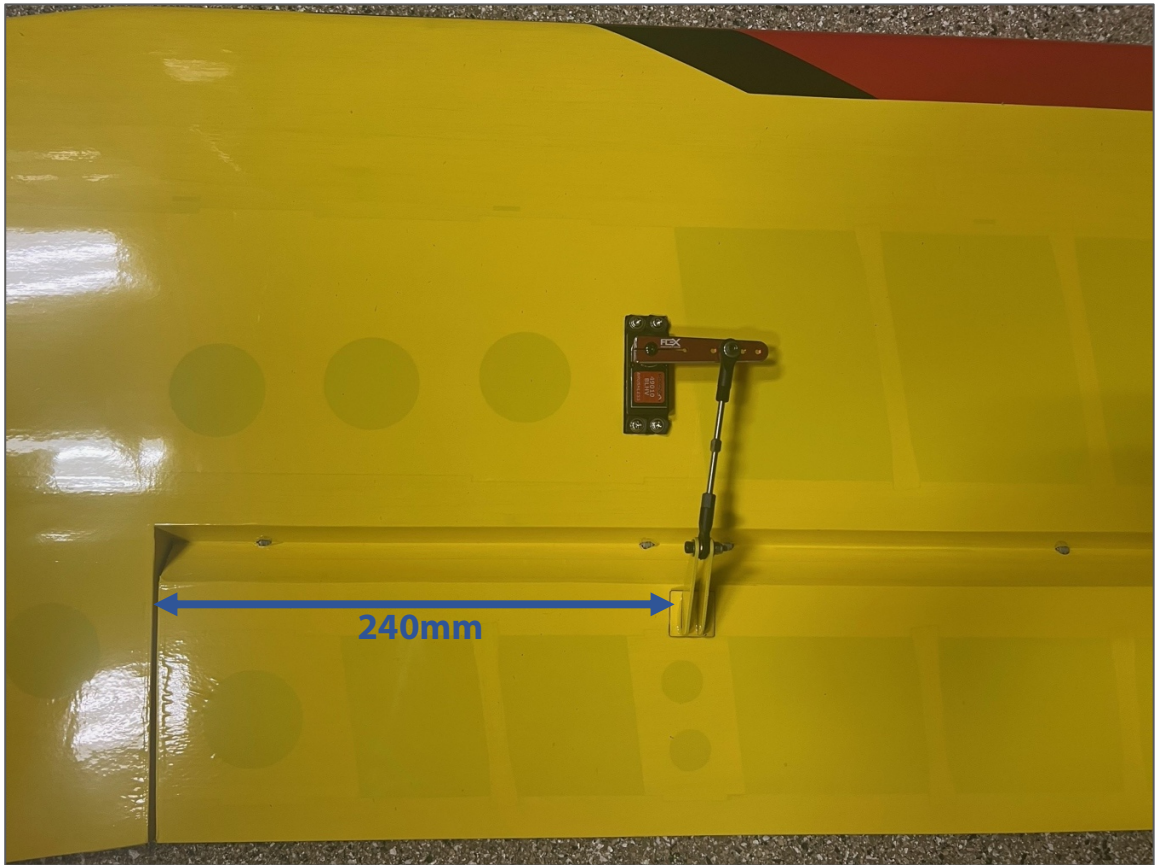
Adhesives/Building Materials

- Isopropyl Alcohol
- 30-minute Epoxy
- Petroleum Jelly
- Paper Towels
- Toothpicks
- Mixing Cups
- Mixing Sticks (something to mix epoxy with)

Control Horn Installation



1. Aileron control horns are marked with an "A".
2. Prepare the control horns by scuffing the portion of the control horn that is inserted into the control surface with medium grit sandpaper. Use isopropyl alcohol and a paper towel to clean the control horn and remove any debris left over after scuffing.



- 3. Locate the aileron control horn slots. You can find them close to the front edge of the control surface. Top and bottom wings are same distance.



- 4. Use a Hobby Knife with a #11 blade to remove the covering for the control horn as shown in the picture above. You can open up the slots first and insert an assembled control horn to trace around the base plate to note the exact area from which covering should be removed.



5. Mix an adequate amount of 30-minute epoxy. Apply epoxy to the slot in the control surface as well as the control horns. Install the control horn and check for proper alignment. Use isopropyl alcohol and a paper towel to clean up any excess epoxy before it cures. Let it sit until the epoxy cures.

Quique's Tip:

To ensure proper alignment of each control horn, you can secure the ball link to the horns and then glue the horn in place with the ball link attached. This will ensure even alignment of both control horns.

AILERON SERVOS AND LINKAGES INSTALLATION

Required for this section

Components

- Top Wing Panels (2)
- Bottom Wing Panels (2)
- Aileron Linkage (4)
- Aileron Servos (4)
- Aileron Servo Arms (4)
- Top Wing Aileron servo extensions (2)
- Ball Links (8)
- M3 x 15 Socket Head Cap Screw (8)
- M3 Washer (16)
- M3 Lock Nut (8)

Tools

- #1 Phillips Screwdriver
- 2.5mm Hex Driver
- 5.5mm Nut Driver
- Needle nose pliers

Adhesives/Building Materials

- Thin CA
- Blue Thread Lock
- Servo Connector Safety Clip

Ailerons

1. Use a #1 Phillips screwdriver to thread a servo mounting screw into each of the pre-cut holes in the servo mounting rails in the wing. Remove the screw and apply a small amount of thin CA to each of the holes to harden the threads cut by the screw. Do not use CA accelerator. Let the CA fully cure before moving forward.
2. Secure a 6-inch (150 mm) servo extension to each of the two Top Wing Aileron servos. Use Flex Servo Connector Safety Clips (FPZA1040), heat shrink tubing or thread to secure the connection.
3. Insert the aileron servo into the servo bay with the output shaft towards the leading edge of the wing. Be sure to route the servo lead out of the wing before mounting the servo. Mount the servo to the wing using the servo mounting screws provided with your servos. Be sure to install the servos with the long servo extensions in the bottom wing panels and the servos with the shorter servo extensions in the top wing panels.
4. Using a pushrod with a length of 2.5 inches (63.5mm), assemble the aileron linkages so that the total length from center of ball to center of ball is approximately 94mm. Final length will be adjusted when centering the control surface. Note that the opposite ends of each aileron linkage have opposite direction threads. Also note that top wing and the bottom wing use the same pushrod length.
5. Attach the linkage to the servo arm. The correct hole location is 1 ½-inches (38mm) from center. If using the recommended 2-inch servo arm, this is the third hole from the end of the servo arm. The order of hardware components, starting from the top of the servo is as follows:
 - M3x15 socket head cap screw
 - M3 washer
 - Ball Linkage
 - Servo Arm
 - M3 washer
 - M3 locknut
6. Use your radio system to center your aileron servos. Install your aileron servo arm onto the servo as close to parallel with the hinge line as possible. Apply blue thread lock to the servo arm screw and fully tighten the screw. If your servo arms have output shaft clamping screws, apply blue thread lock, and secure them in place as well.
7. With the radio powered-on and the servo centered so that the arm is parallel to the hinge line, adjust the linkage length so that the control surface is centered. When satisfied with the length of the linkage, secure the linkage to the control horn with the hardware in the following order:

- M3x15 Socket Head Cap Screw
- M3 Washer
- Control Horn (Side 1)
- Ball Link
- Control Horn (Side 2)
- M3 Washer
- M3 Lock Nut



After the steps above are completed and the servo and linkages are installed, the assembly should appear as shown in the picture above. Both ailerons should appear the same but mirrored accordingly.

Note: The angle of the linkage is correct. As the servo arm rotates and the control surface deflects, the linkage will straighten.

ELEVATOR INSTALLATION

Required for this section

Components

- Elevator Control Horn (4)
- Control Horn Base (2)
- Left and Right Horizontal Stabs

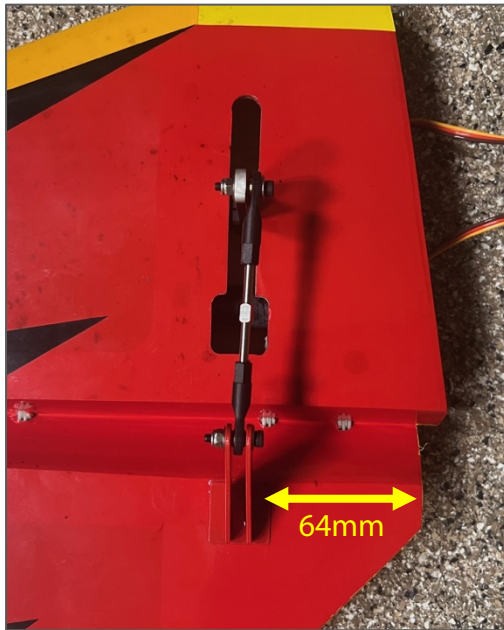
Tools

- Hobby Knife with a #11 Blade

Adhesives/Building Materials

- Isopropyl Alcohol
- 30-Minute Epoxy
- Paper Towels
- Mixing Cups
- Mixing Sticks
- Toothpicks

Control Horn Installation



1. Elevator control horns are marked with an "E".
2. Use a hobby knife with a #11 blade to remove the covering from the bottom side of the elevators in the same way as was done with the ailerons. The control horn slots are approximately 2 ½-inches (64mm) from the elevator edge as shown in the picture.
3. The elevator horns are bagged and marked. Prepare the control horns by scuffing the portion of the control horn that extends into the control surface with medium grit sandpaper. Use isopropyl alcohol and a paper towel to clean the control horn and remove any excess debris left after scuffing.
4. Mix an adequate amount of 30-minute epoxy. Apply epoxy to the control horn slots in the elevator as well as the control horn. Push the control horns into the slot, being sure to wipe away any excess epoxy with isopropyl alcohol and a paper towel.

Quique's Tip:

To better help align the control horns with one another, use the provided hardware to secure the control horns to the ball link. This will keep them aligned while they are glued in place.

ELEVATOR SERVO AND LINKAGE INSTALLATION

Required for this section

Components

- Horizontal Stabilizer Assemblies (2)
- Horizontal Stabilizer Carbon Fiber Tube
- Fuselage
- Elevator Servo (2)
- Elevator Servo Arm (2)
- Servo Extension (2)
- Left and Right Horizontal Stabs
- M3x15 Socket Head Cap Screw (8)
- M3 Washer (8)
- M3x12 Washer (4)
- M3 Lock Nut (4)

Tools

- #1 Phillips Screwdriver
- 2.5mm Hex Driver
- 5.5mm Nut Driver

Adhesives/Building Materials

- Servo Connector Safety Clip

1. Use a #1 Phillips screwdriver to thread a servo mounting screw into each of the holes in the servo mounting rails in the horizontal stabilizer. Remove the screw and apply a small amount of thin CA to each of the holes to harden the threads cut by the screw. Let the CA fully cure before moving forward.



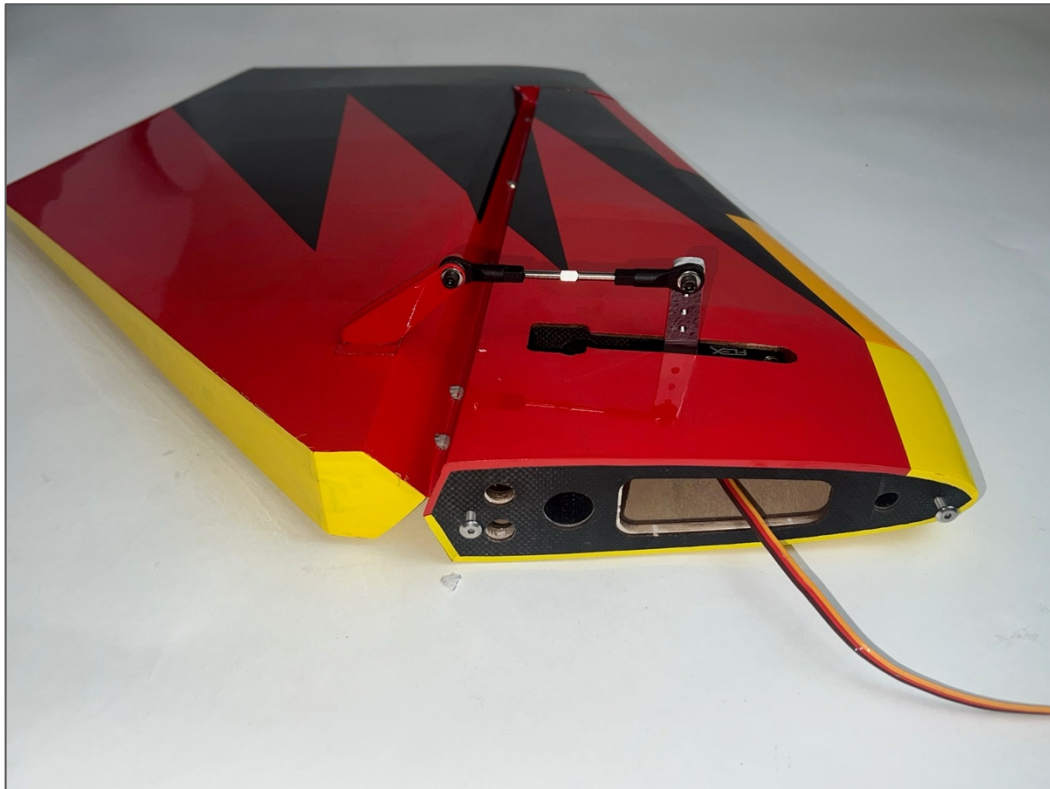
2. Insert the elevator servo into the mounting location with the output shaft towards the rear or hinge side of the stab. Mount the servo to the stab using the mounting screws provided with your servos. Note that the servo wire will exit on the leading-edge side of the stab as shown in the picture above.
3. Power on your radio system to center the servo. Install a 2-inch (50.8mm) servo arm onto the servo. Apply a small amount of blue thread lock to the servo arm screw and secure it in place. If your servo arm has clamping screws, apply blue thread lock to these screws

and secure them in place. Note that you may need to power off the model and rotate the servo arm by hand to have access to each clamping screw.

- 4. Using a pushrod of 2 $\frac{3}{4}$ -inch (70mm) length, assemble the elevator linkages and ball links so that the total length from center of ball to center of ball is approximately 3 $\frac{1}{8}$ -inches (80mm). Final length will be adjusted when centering the control surface. Note that both ends of the elevator linkages have opposite direction threads.
- 5. Attach the linkage to the servo arm. The correct hole location is 2-inches (50.8mm) from the center of the servo arm. If you are using the recommended servo arm, this is the hole at the end of the servo arm. The order of hardware components, starting from the top of the servo is as follows:
 - M3x15 socket head cap screw
 - M3 washer
 - Ball Linkage
 - Servo Arm
 - M3 washer
 - M3 locknut
- 6. Attach the linkage to the control horn. The order of hardware components, starting from the tip of the stabilizer is as follows:
 - M3x15 socket head cap screw
 - M3 washer
 - Control Horn #1
 - Ball Linkage
 - Control Horn #2
 - M3 washer
 - M3 locknut
- 7. With the radio powered on and the servo arm centered perpendicular to the servo case, adjust the linkage length so that the control surface is centered.

Quique's Tip:

For elevator centering, it is best to install the stabilizers onto the fuselage and stand approximately 10 feet (3m) behind the aircraft while sighting the two elevator halves. Using this method, you can best align the most important part of the control surface, the widest part, rather than referencing something less important, like the elevator counterbalance.



- 8. After installation is complete, your linkage setup should match the image above. Repeat the same procedure for the other horizontal stabilizer.

RUDDER, TAILWHEEL INSTALLATION

Required for this section

Components

- Fuselage
- Tail Gear Assembly
- Steering Ball Link (1)
- M3 X12mm Socket Head Cap Screw (3)
- M3 Flat Washer (3)

Tools

- Hobby Knife with #11 Blade
- 2.5mm Hex Driver
- Drill
- 4mm Drill Bit

Adhesives/Building Materials

- Thread Lock
- Isopropyl Alcohol
- 30-minute Epoxy
- Mixing Cups
- Mixing Sticks
- Paper Towels

Tail Wheel Installation

- 1. Locate the (3) holes in the bottom of the fuselage close to the tail. Use a Hobby Knife with #11 blade to remove the covering and expose the holes.
- 2. Place a flat washer on each M3 X 12mm Socket Head Cap Screw.



3. Apply Thread Lock to the screws and use a 2.5mm hex driver to mount the tail gear assembly as show in picture above.



4. With a 4mm drill bit, drill a hole in the center of the rudder bottom side. Place this hole about 3 ³/₄-inches (95mm) from the leading edge.
5. Glue the steering ball link in the hole with 30 min Epoxy. Note: when you glue the ball link make sure the ball hole is perpendicular to the rudder leading edge so the steering arm can go through.

Rudder and Rudder Control Horn Installation

Required for this section

Components

- Rudder Control Horns (2)
- Rudder Control Horn Plate
- Fuselage Assembly
- Rudder Hinge Pin

Tools

- Hobby Knife with a #11 blade

Adhesives/Building Materials

- Isopropyl Alcohol
- 30-minute Epoxy
- Mixing Cups
- Mixing Sticks
- Paper Towels
- Petroleum Jelly
- Transparent tape

Rudder Control Horn Installation

Note: This manual covers the recommended installation of a push-pull rudder setup with the servo in the tail. There may be cases when a pull-pull setup with the rudder in the fuselage are desirable such as when using a lighter engine or even when running an electric setup. For these cases, the Ultimate 120cc is prepared for this installation and supplied with all the necessary hardware, such as double-sided control horns, pull-pull cables and provides a servo mount for the rudder servo in the tray inside the fuselage. However, the installation of this system will not be covered in this manual but can be found in the Flex Ultimate 70cc manual.



1. Rudder control horns are marked with an "R".

2. Locate the rudder. This model uses a push-pull rudder setup so you will be installing a single control horn on the right side of the rudder. Use a hobby knife with a #11 blade to remove the covering from the right sides of the rudder at the location shown in the picture above, 5/8-inch (16mm) from the bottom of the rudder. You can uncover the slots first and insert an assembled control horn to trace around the base plate to note the exact area from which covering should be removed.



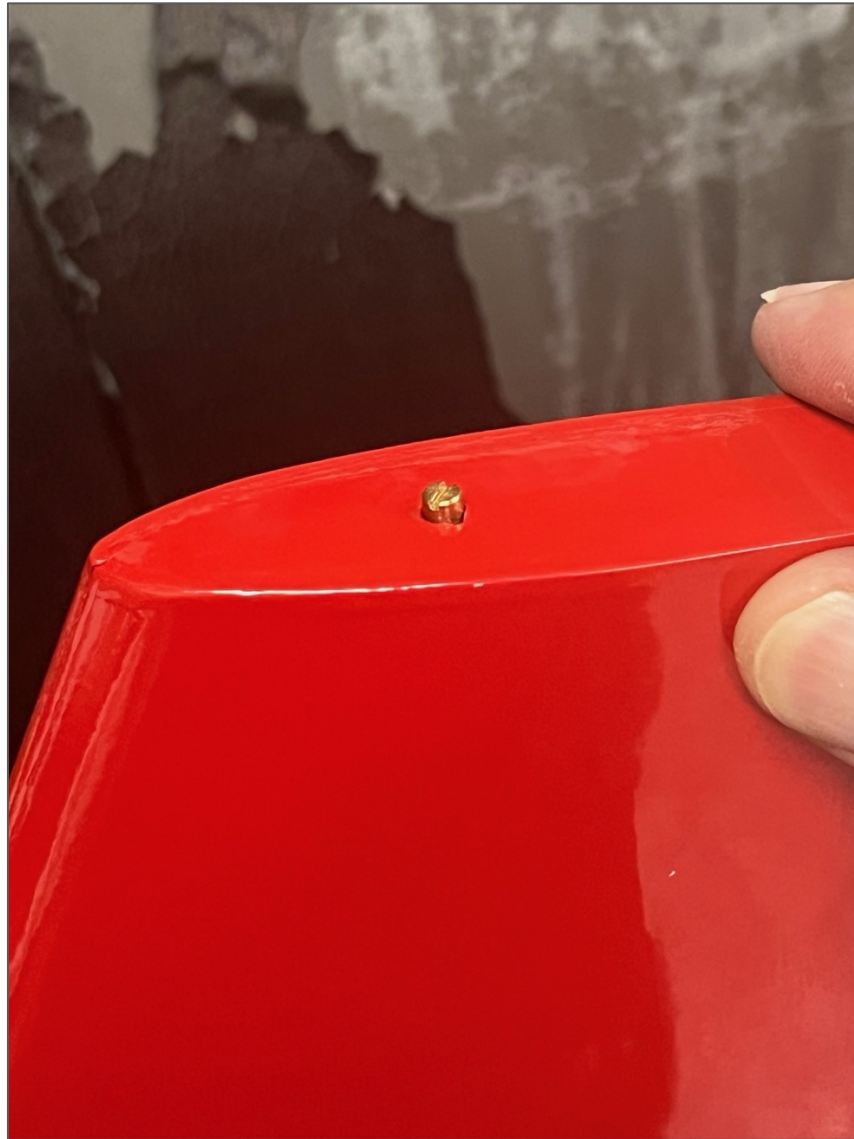
3. Prepare the control horns by sanding the portion of the control horn that extends into the control surface with medium grit sandpaper. Use isopropyl alcohol and a paper towel to clean the control horns and remove any excess debris from the control horn.
4. Mix an adequate amount of 30-minute epoxy. Apply epoxy to the control horn slots in the rudder as well as the control horn. Push the control horn into the slot, being sure to wipe away any excess epoxy with isopropyl alcohol and a paper towel. Align the control horns as shown in the picture in the previous page. Let the epoxy cure completely before proceeding with the rudder installation.

Quique's Tip:

To ensure proper alignment of each control horn, you can secure the ball link to the horns and then glue the horn in place with the ball link attached. This will ensure even alignment of both control horns.

Rudder Installation

- 1. The rudder is removable, and the hinges have been pre-installed for you at the factory.
- 2. Insert the steering rod into the ball link steering. Or if you prefer you can remove the tail gear and do the steering system later.



- 3. Partially insert the 1.5mm wire (hinge pin) into the hole on the top of the rudder. Once the hinge pin has been started, line up the hinge halves in the rudder and the fuselage and slide the wire all the way through the hinges.
- 4. Secure the hinge pin by screwing it into place with a small flat head screwdriver.

RUDDER SERVO AND LINKAGE INSTALLATION

Required for this section

Components

- Fuselage Assembly
- Rudder Servo
- 2-inch Rudder Servo Arm
- Rudder Push Rod
- Ball Link (2)
- 3mm x 15mm Socket Head Cap screw (4)
- 3mm Flat Washers (X8)
- 3mm Lock nut (X3)

Tools

- #1 Phillips Screwdriver
- 2.5mm Hex Driver
- 5.5mm Nut Driver
- Needle Nose Pliers
- Threaded or Shrink Tube

Adhesives/Building Materials

- Thin CA
- Thread Locker

1. Use a #1 Phillips screwdriver to thread a servo mounting screw into each of the pre-cut holes in the servo mounting rails in the rudder servo opening on the right side of the fuselage. Remove the screw and apply a small amount of thin CA to each of the holes to harden the threads cut by the screw. Let the CA fully cure before moving forward.



2. Assemble the rudder pushrod with the ball links to a length of 5 ½-inches (140mm) as shown in the picture above
3. Attach the rudder servo extension to the rudder servo and secure it with a servo clip. Feed the servo extension through the fiberglass tube provided in the fuselage for this purpose.
4. At this time, you can also feed the servo extensions for both the elevator servos through the same fiberglass tube.

5. Insert the rudder servo into the rudder mount in the rear of the fuselage with the output shaft towards the tail of the airplane. Mount the servo to the tray using the screws provided with your servo.
6. Center the servo using your radio system. Install the 2-inch servo arm so that is perpendicular to the servo case facing down. Apply a small drop of blue thread lock onto the servo arm screw and secure it in place. If you are using a servo arm with clamping screws, apply a drop of blue thread lock and secure them in place.



7. Install the rudder pushrod to the servo as shown in the picture above. The order of hardware is as follows:
 - M3x15 Socket Head Cap Screw
 - M3 Washer
 - Ball Link
 - Servo Arm
 - M3 Washer
 - M3 Lock Nut
8. The correct hole location is 2 inches (50.8mm) from the center of the servo arm. If you are using the recommended servo arm, this is the outermost hole (note: the picture above is showing a prototype servo arm with an extra hole).
9. Attach the linkage to the control horn. The order of hardware components, starting from the tip of the stabilizer is as follows:
 - M3x15 socket head cap screw
 - M3 washer
 - Control Horn #1
 - Ball Linkage
 - Control Horn #2
 - M3 washer
 - M3 locknut

MOUNTING THE HORIZONTAL STAB

- 1. If you did not install the elevator servo extensions when you installed the rudder servo take a minute to do this now. A fiberglass tube is provided in the fuselage for routing the extensions

Field assembly of the elevator is handled via the installed Flex Speed-locks. Details on field assembly are covered in the assembly video that is provided on the Ultimate 120cc page at:

<https://www.flexinnovations.com/product/ultimate-120cc>

MAIN LANDING GEAR INSTALLATION

Required for this section

Components

- Fuselage Assembly
- Landing Gear
- Wheel Pants (L & R)
- Main Wheel (2)
- M5x25 Socket Head Cap Screw (4)
- M5 Flat Washer (8)
- M3x15 Socket Head Cap Screw (4)
- M3 Flat Washer (4)
- Landing Gear Axle (2)
- M5 Wheel Collar (4)

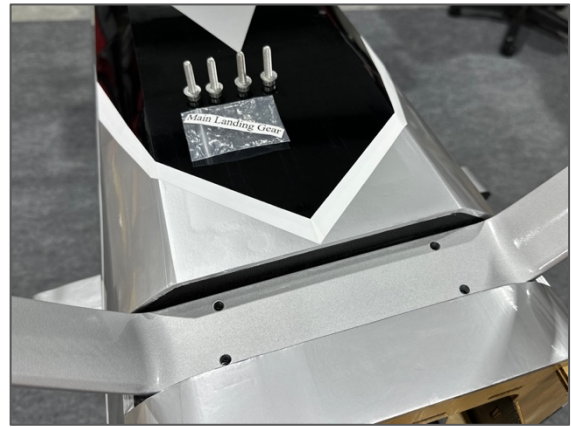
Tools

- 1.5mm Hex Driver
- 2.5mm Hex Driver
- 4mm Hex Driver
- 7mm Wrench
- 10mm Wrench
- 12mm Wrench
- Felt-Tipped Pen

Adhesives/Building Materials

- Blue Thread Lock
- Red Thread Lock
- Rubber Adhesive (e.g. GOOP)

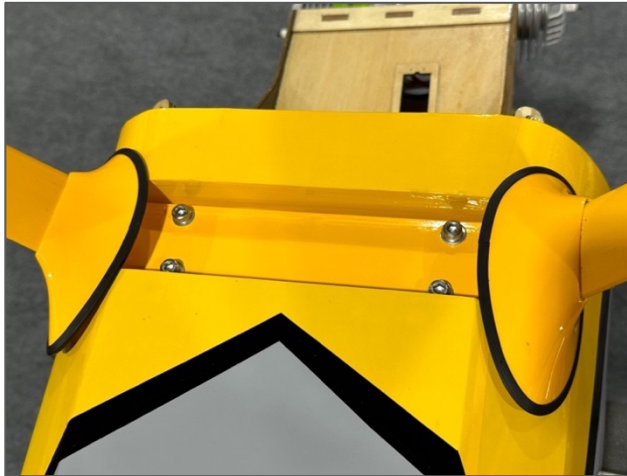
Landing Gear Installation



The landing gear is secured using four M5x25 bolts that thread from the bottom of the airplane into the blind nuts pre-installed in the fuselage.

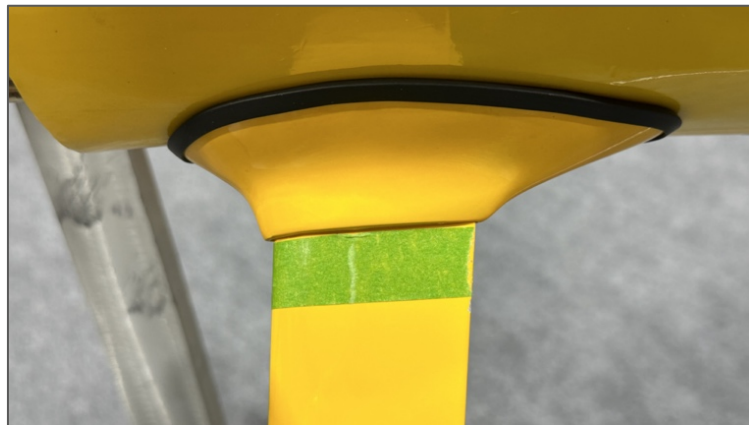
1. Place the landing gear on the fuselage so that it sweeps back and the wheels are closer to the tail of the airplane. The hole pattern is such that the landing gear can only be installed in one orientation.
2. Using blue thread lock, install the M5x25 socket head cap bolts with an M5 washer through each one of the holes in the landing gear and through the corresponding landing gear mounting hole in the fuselage. Tighten the screws using a 4mm hex driver loosely. Do not fully tighten until all four M5 screws are in place.

Landing Gear Cuff Installation

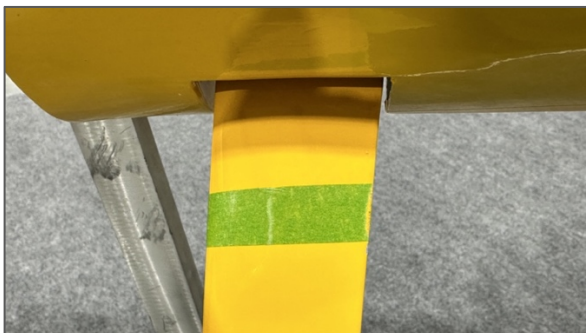


The landing gear cuffs are glued to the landing gear itself, and not the fuselage. This allows for easy removal of the landing gear.

1. Slide the gear cuff up into place against the fuselage. Apply a piece of masking tape at the bottom edge of the cuff on each side of the landing gear.



2. Slide the cuff back down and apply a bead of adhesive on each side of gear based on where you marked the bottom of the cuff. We recommend a rubberized adhesive such as GOOP.



- 3. Slide the gear cuff back up into place. Tape over the bottom of cuff to ensure no residual adhesive runs down the landing gear. Also tape the top of the cuff to the fuselage to keep it in place while the adhesive sets.



- 4. Keep airframe upright and allow the adhesive to cure for 24 hours (if using GOOP).

Wheel, Axle, and Wheel Pant Installation

The wheel, axle, and wheel pants feature a wheel pant saver system which will increase the longevity of the wheel pants when flying off grass runways for example.



- 1. Mount the axle to the landing gear by using the provided washer and locknut, use red thread lock on these nuts. Notice the flat spot on the end of the axle. To properly use the wheel pant savers, make sure this is facing towards the bottom of the airplane.



- 2. Put the wheel in place by sliding it over the axle. A collar will likely need to be installed to keep the wheel in place laterally.



- 3. Locate the wheel pant saver and mount it by aligning the set screw with the flat spot on the axle. Also thread the wood screws into the wooden piece of the wheel pant saver.



- 4. Dry fit the wheel pant in place and install the retaining bolts. Test fit the wheel pant saver by tightening the bolts. You may need to shave the wooden piece slightly to improve fitment.
- 5. Once fitment is confirmed, apply adhesive to the end of the wooden piece of the wheel pant saver. GOOP or E600 is recommended. Epoxy, for example, may be too brittle for this area.



- 6. Use blue thread lock, re-install and tighten the wheel pants for flight. Allow the adhesive to cure for at least 24



ENGINE AND THROTTLE SERVO INSTALLATION

The Ultimate 120cc is designed for a twin 120-125cc engine.

This manual covers the installation of the DA-120 or GP123

DA-120 OR GP123 ENGINE INSTALLATION

Required for this section

Components

- Fuselage Assembly
- Engine
- Flex/Dualsky
20MM/120cc Standoff Kit
- ¼-20 Lock Nut (4)
- ¼-20 x 1 ½-inch Socket
Head Screw (4)
- ¼-inch flat washer (4)
- ¼-inch fender washer (4)

Tools

- ¼-inch Hex Driver

Adhesives/Building Materials



- 1. Remove the plywood structure on the fuselage, just below the motor box and behind the throttle servo mounting location by pushing with your fingers. If this does not push out easily, you can trace the shape with a hobby knife and a sharp #11 blade to make it easier to remove. Regardless of the exhaust system used, this must be removed for proper cooling.

2. The engine mounting holes for the DA-120 or GP123 are pre-drilled into the firewall for your convenience. If using a different mounting pattern, the “+” represents the engine crankshaft, lay out and drill the mounting holes accordingly.



3. Mount the engine (without the exhaust) to the firewall using the Dualsky 20mm standoff kit, (4) ¼-20 x 1 ½-inch socket head cap screws, (4) ¼-inch flat washers, (4) ¼-inch fender washers and (4) ¼-20 Lock Nuts. The order of components is as follows:
- ¼-20 x 1 ½-inch Socket Head Cap Screw
 - ¼-inch flat washer
 - Engine
 - Dualsky 20mm Standoff Kit
 - Firewall
 - Fender washer
 - Lock nut

DA-120 or GP123 Throttle Servo and Throttle Linkage Installation

Required for this section

Components

- Fuselage Assembly
- Throttle Servo
- 30-inch (762mm) Servo Extension
- Safety Servo Clip Connector
- Throttle pushrod
- 2mm Ball Links (1)
- M2x10 Phillips Head Screw (1)
- M2 Flat Washer (2)
- M2 Lock Nut (1)
- 3mm Ball Links (1)
- M3x10 Phillips Head Screw (1)
- M3 Flat Washer (2)
- M3 Lock Nut (1)

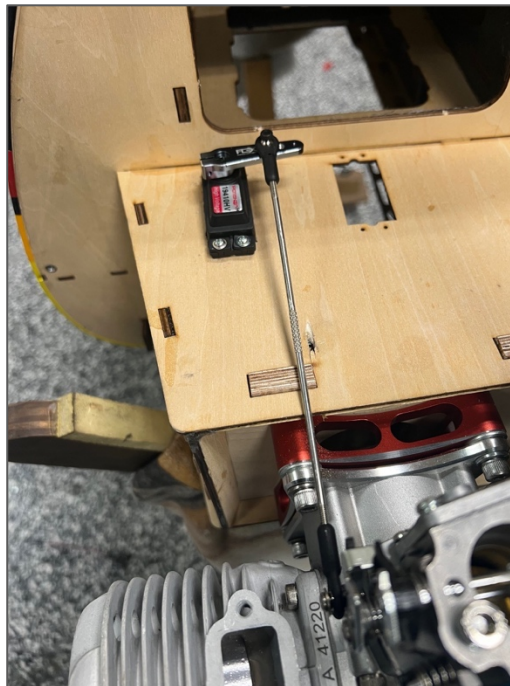
Tools

- #1 Phillips Screwdriver
- 2.5mm Hex Driver

Adhesives/Building Materials

- Thin CA
- Blue Thread Lock

1. Attach the 30-inch (762mm) servo extension to the throttle servo. Use a Servo Connector Safety Clip (FPZA1040), thread or heat shrink tubing to secure the extension in place.



2. Pre-thread a screw into the servo mounting holes, remove it and harden the wood using thin CA. Install the throttle servo with the output shaft towards the tail of the aircraft.

- 3. Use the radio system to center the servo, then install a 1-inch (25mm) servo arm onto the servo. Orient the servo arm to the side of the fuselage that provides the straightest geometry for the throttle linkage between the throttle arm on the engine and the servo. Do not secure the servo arm screw yet.
- 4. Locate the throttle pushrod, it is the only one that does not have an adjustment hex in the center and has right hand threads at both ends. Thread the 2mm ball link onto one end of the pushrod and the 3mm ball link onto the other end, ensuring that both ball links are threaded on evenly. Secure the 2mm ball link to your engine throttle arm using the 2 x 10mm screw, 2mm washers (2), and 2mm lock nut. Do not use thread lock on these parts, as it can weaken the plastic insert in the lock nut. The order of these components should be:
 - Screw
 - Washer
 - Engine Throttle Arm
 - Washer
 - Lock nut
- 5. Attach the pushrod to the servo arm using the 3mm hardware and the same hardware sequence as above. Check throttle movement and position relative to stick position and make any adjustments necessary to the length of the pushrod and to servo arm position. Once you are happy with the throttle operation, fully tighten the servo screw(s).

Quique's Tips:

- Use the shortest servo arm possible while still getting full throttle arm movement on your engine. Your throttle end points should be around 110-120% when finished with the installation. A faster servo (like the Potenza DS49010HV) with a shorter arm is preferred over a slower servo with a longer arm.
- For the most linear throttle response, adjust the throttle linkage length to balance the end points for your throttle servo. You do NOT want your end points to be mismatched (example: 60/120). Get your end points as close to one another as possible (example: 114/116) for the most linear throttle response.

IGNITION INSTALLATION

Required for this section

Components

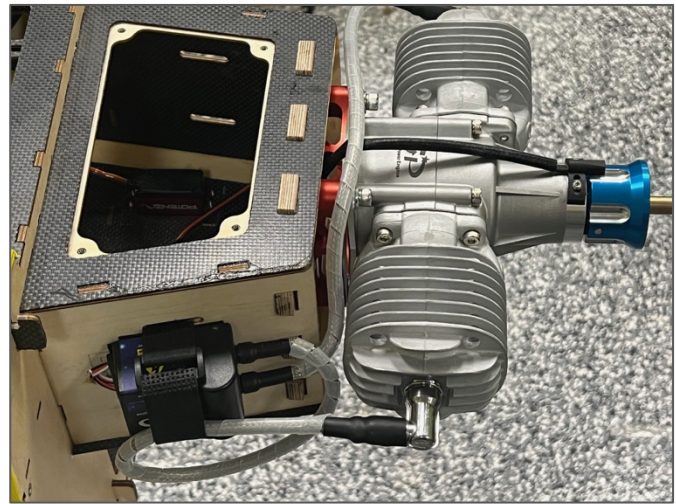
- Fuselage Assembly
- Ignition
- Ignition Switch
- Ignition Battery
- Regulator (if applicable)
- Motor Box Cover
- M3x15mm Button Head Hex Screws (4)

Tools

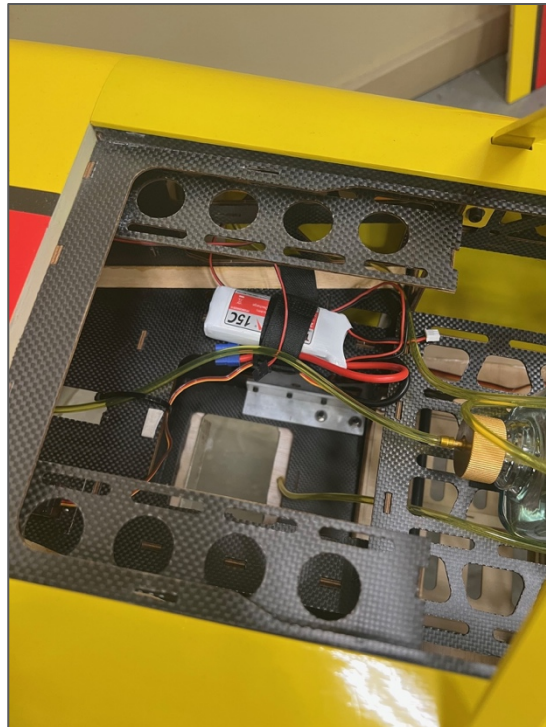
- Hobby Knife w/#11 Blade
- #1 Phillips Screwdriver
- M2 Hex Driver

Adhesives/Building Materials

- Hook and Loop Strap (2)
- Adhesive-Back Hook and Loop Tape
- Blue Thread Lock

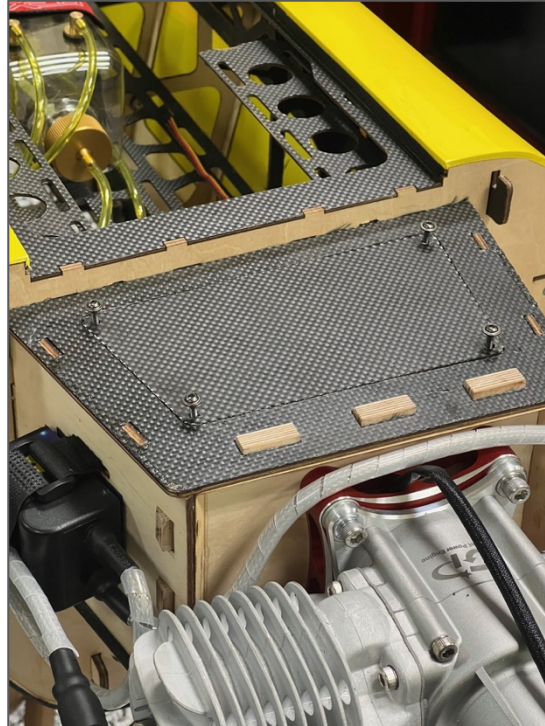


1. Locate the ignition switch hole towards the nose of the fuselage. Note that there are switch locations on both sides of the fuselage for your preference. Use a hobby knife with a #11 blade to remove the covering from the hole of your choice. Test fit your switch and modify the hole if needed. Secure it in place using the screws included with your switch. If your switch mounting screws thread into metal, be sure to apply blue thread lock. DO NOT apply blue thread lock if they thread into plastic.
2. The ignition can be mounted wherever you prefer. We have found that with the DA-120 or GP123 the above depicted location works well. There are many ways to install an ignition, and we recommend you mount it per your engine manufacturer's instructions.
3. Pass the hook and loop strap through the slots in the motor box and secure the ignition as box show in the picture above.



- 4. Place your ignition battery inside the fuselage as shown in the previous picture. Use adhesive-backed hook and loop tape between the battery and the fuselage and secure the battery with a hook and loop strap.
- 5. Route all your wiring and make all electronic connections at this time. Secure any permanent connections with Servo Safety Clips (FPZA1040). Be sure to secure the wiring so that it will not bounce around in the aircraft. Also, be sure to secure the wiring in a way the wires will not chafe over time from vibration. A typical ignition setup will be connected as follows:

Ignition Battery → Ignition Switch → Ignition Regulator → Ignition → Engine



- 6. When the installation of the ignition is complete you can install the top cover of the motor box. Install it using 4 M3x15mm button head hex screws, first applying blue thread lock to the screws.

FUEL TANK INSTALLATION

Required for this section

Components

- Fuselage Assembly
- Fuel Tank
- Fuel Line

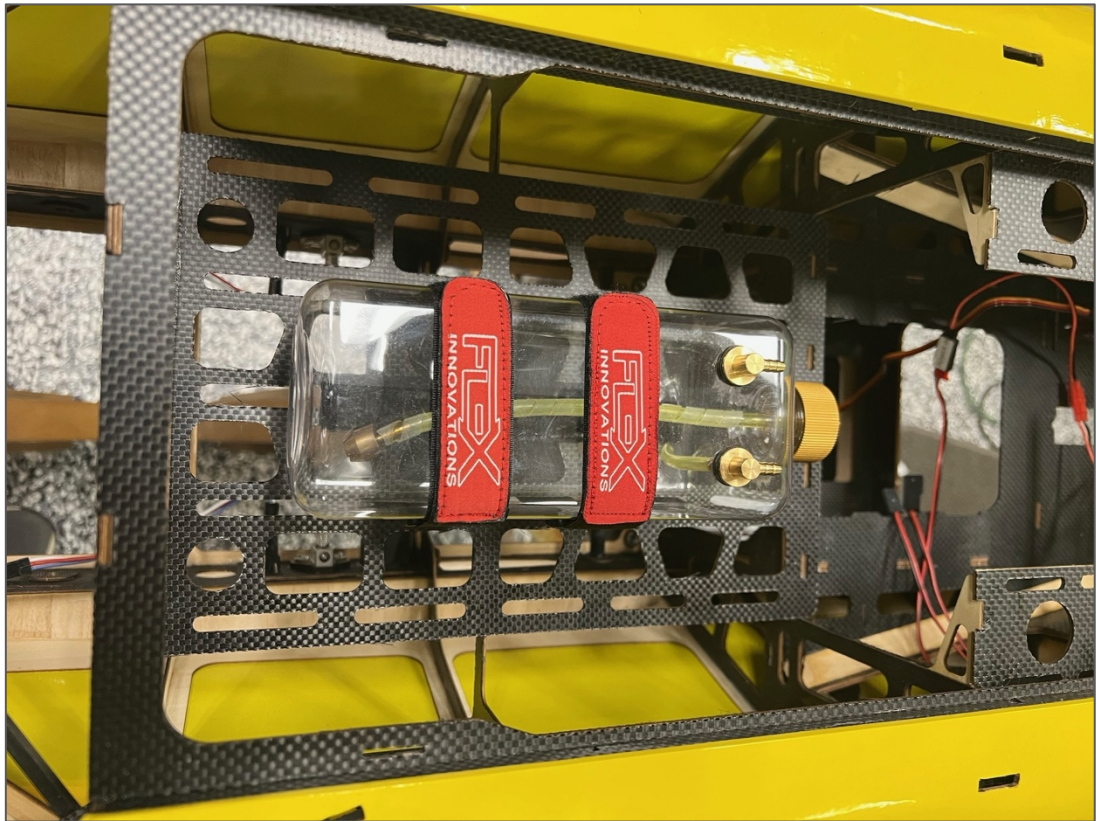
Tools

- Pliers

Adhesives/Building Materials

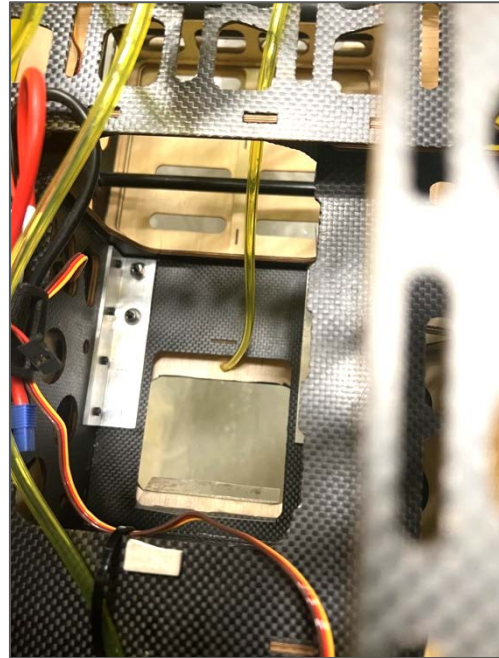
- Hook and Loop Strap (2)
- Adhesive-Back Hook and Loop Tape

The Flex Innovations Lightweight 32oz Fuel Tank is included with your Ultimate 120cc. Before installing the fuel tank check all fittings are properly installed and that the clunk line inside the tank is appropriately sized.



- 1. The fuel tank tray has plenty of room for your fuel tank. If you are using a single tank, you can place the fuel tank in the middle of the tray as shown in the image above. If you plan on using a smoke system, two of the 32oz Lightweight Fuel/Smoke tanks (FPM1623) should be used, installed side by side. One is included in your kit.

Apply adhesive-backed hook and loop tape to the bottom of your tank(s) and to the fuel tank tray. Place the tank(s) in their location and secure them with two hook and loop straps. These straps should be snug but not overly tight, as the fuel tanks are very lightweight and can be easily crushed. The hook and loop tape on the bottom of the tank(s) will prevent the tank from moving fore and aft, and the hook and loop straps will prevent the tank from pulling away from the tray.



- 2. After the tank is in position, route and trim your fuel lines appropriately. Your clunk line should go to the carburetor or throttle body. The fill line should go to your fuel dot or filling system. We recommend the McFueller Fuel Dot (FPMA1049). The vent line should wrap around the back of the tank(s) and pass back in front of the tank(s). It should then exit the bottom of the fuselage as shown in the image above. After the vent line exits the fuselage, use a cable tie around the fuel line to prevent it from slipping back into the fuselage. Don't over-tighten the cable tie, as air and fuel will need to vent from this line. Be sure to keep your fuel line away from components that get hot (like your exhaust or cylinder heads) and route it in such a way that it will not bounce around or chafe on any of the interior structure of the fuselage.

EXHAUST AND COWLING INSTALLATION

Required for this section

Components

- Fuselage Assembly
- Cowling
- Cowling Baffles
- Muffler (or Canisters/Headers)
- Exhaust Gasket (2)
- M4 x 20 socket head cap screws (2)
- M4 Flat Washer (2)
- M3 x 10mm socket head cap screws (8)
- Canister mount plate
- Silicone tubes
- M3 x 15 Socket Head Cap Screw (4)
- M3x20mm Button Head Cap Screw (4)

Tools

- 2.5mm Hex Driver
- #1 Phillips Screwdriver
- Rotary Tool
- Rotary Tool Sanding Drum
- Felt-Tipped Pen

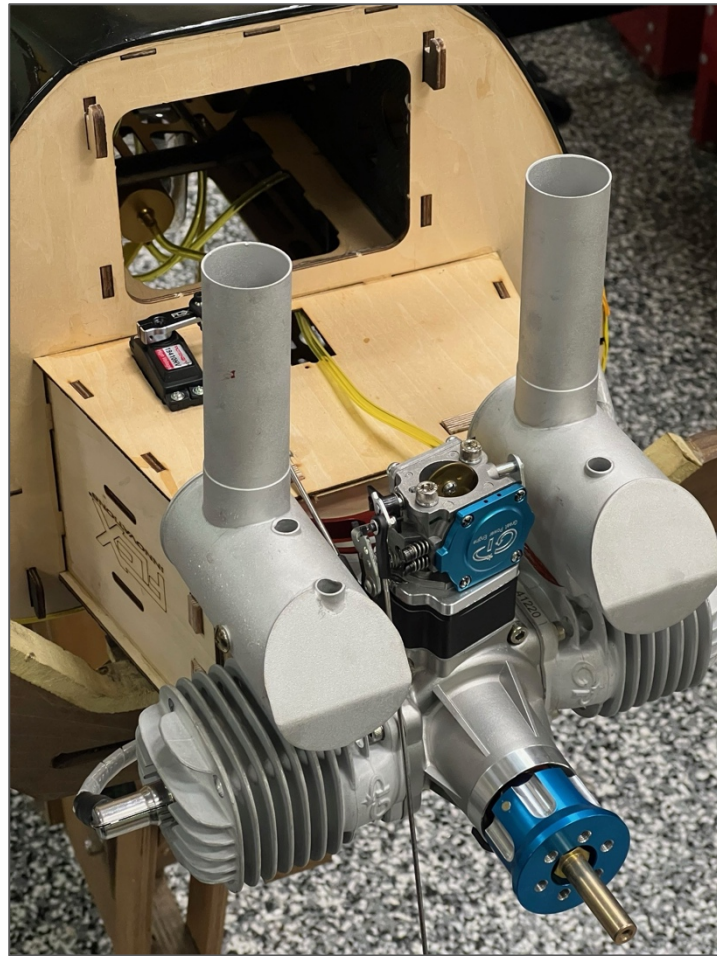
Adhesives/Building Materials

- Colored Silicone (Red typically preferred)
- Thin CA
- Medium CA
- CA Accelerator
- Blue Thread Lock
- Goop Glue
- 30 Min Epoxy
- Micro-balloons
- Mixing Cups
- Mixing Sticks
- Paper Towels

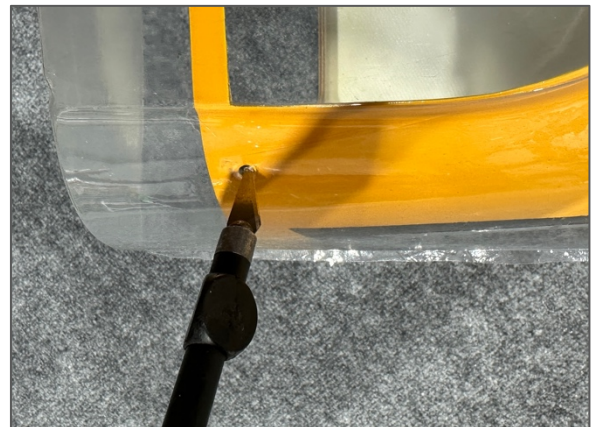
If you plan to use stock mufflers, please follow the instructions (A) below. If you plan on using canisters, please follow canister instructions (B) on the following pages. Be sure to follow the engine baffling instructions for both setups.

Muffler Installation (A)

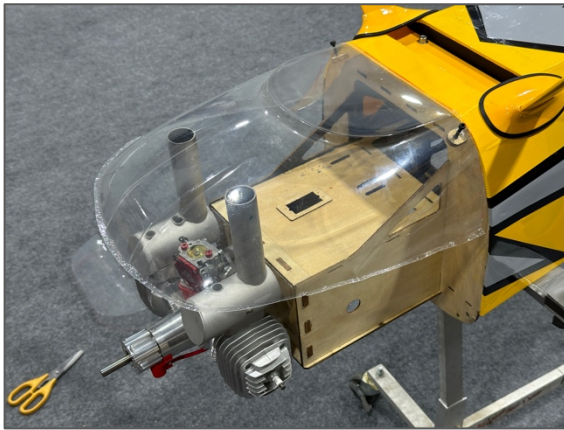
- 1A. Install the manual choke linkage using your preferred method. You could use a 2mm ball link and 2mm linkage found on many 60-class Super PNP aircraft. We leave the pushrod long until the cowling is installed and then trim it for the proper length.
- 2A. Install the mufflers on the engine using the hardware provided with your engine. Follow your engine manufacturer's installation instructions. Typically, most engines will use a gasket between the mufflers and cylinders, and the socket head cap screws will pass through a lock washer before securing the muffler to the cylinder.



- 3A. The Ultimate 120cc features a clear cowling template for simple exhaust hole mapping.
- 4A. Pre-fit the template by aligning it to the cowling itself and mark where the cowling bolts align to the template. Cut holes for the bolts and bolt the template to the fuselage.



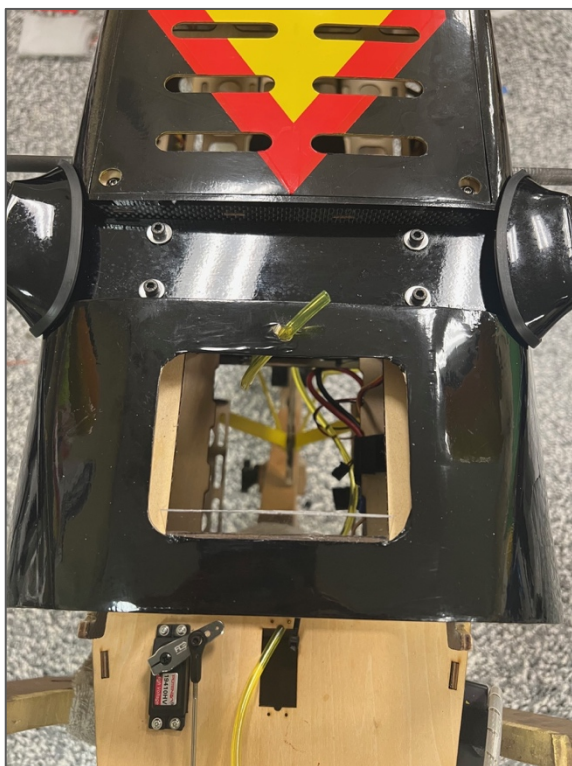
- 5A. Use the cowling bolts to align the template to the fuselage and mark where the exhaust needs to be relieved through the template.



- 6A. Cut the holes out of the template and bolt it to the cowling. You can then transfer your markings to the cowling
- 7A. Every engine and muffler choice will require different openings in the cowling. The picture below shows a GP123 with GP123 mufflers. Other engine brands and other mufflers will require different cut outs. Use a rotary tool with a sanding drum to cut the holes. Test fit the cowling to be sure there is adequate gap between the muffler and cowling. We recommend at least 1/8-inch (3mm) gap. Once baffles are clear the front of the cowling can be moved down and be removed.



- 8A. The picture above on the right shows an auxiliary opening above the circular scoop. We recommend that you open-up this additional hole to provide enough air going to the carburetor air inlet.



- 9A. The Ultimate 120cc provides plenty of openings to allow the hot air from the engine to exit on the bottom of the fuselage. The pictures above show what these openings should look like. In case any of these air exit openings come closed from the factory it is important to open them up to provide ample cooling for the engine. Use a hobby knife with a #11 blade to open the rectangular hole in the bottom front of the fuselage as well as the two half oval holes towards the bottom middle of the fuselage. Apply some epoxy to the edges of the covering to help prevent oil and debris from getting under the covering.

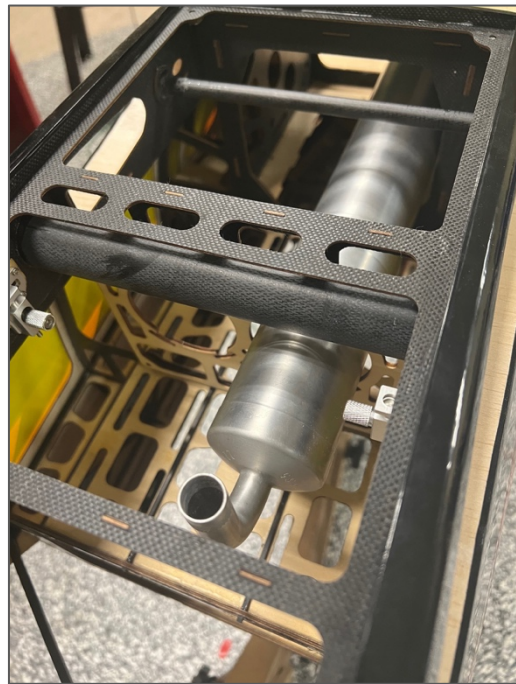
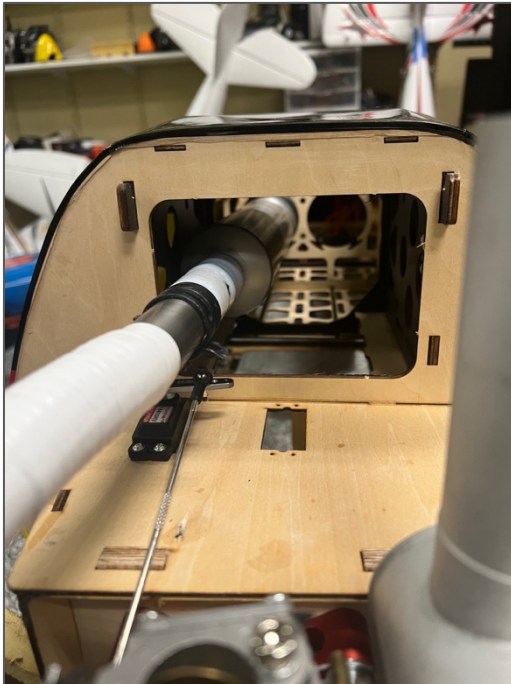
Canister Installation (B)

Header and canister installation will vary depending on your chosen installation, here we show the installation of a GP123 with two canisters, one for each cylinder.

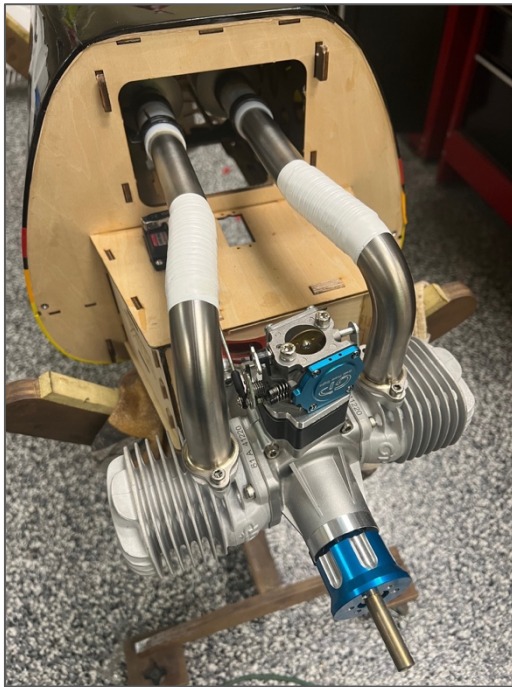
- 1B. Start by removing the bottom hatch to provide ample access for the installation. The bottom fuselage plate can be removed using the screws in the corners.
- 2B. Install the 8 silicone tubes into the canister mount plate. Place the mount plate in the location shown in the image below. Install the headers and canisters per your engine and exhaust manufacturer's instructions, placing the canisters through the mount. Once the exhaust is mounted to the engine, install the (4) M3 x 15 Socket Head Cap Screw with flat washers to secure the canister mount plate in place. Use Blue Thread Lock.



- 3B. Install the exhaust on the engine using the hardware provided with your engine. Follow your engine manufacturer's installation instructions. Typically, most engines will use a gasket between the muffler and cylinder, and the socket head cap screws will pass through a lock washer before securing the muffler to the cylinder.



- 4B. The images above and on the next page show the typical GP123 with two headers and two canisters.



- 5B. Once installation of the canisters is complete, tighten the screws on the canister mount plate as described above. Re-install the bottom hatch on the fuselage using (4) M3x20mm Button Head Cap Screws. Remember to use blue thread locker on all metal-to-metal screw installations here.

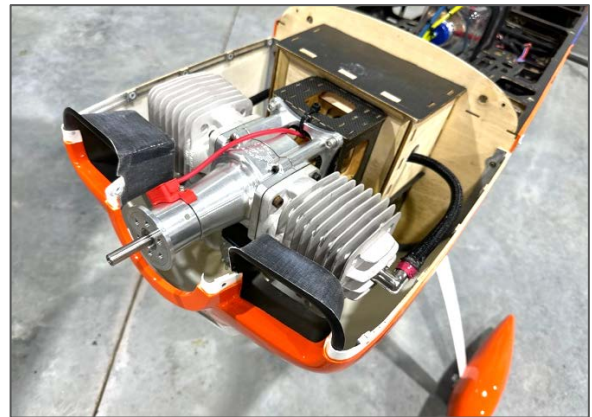


- 6B. Finally, test fit your cowling to ensure that it fits properly and open-up any holes needed for clearance. Every engine and exhaust choice might require different openings and clearances in the cowling. It is our experience that when installing the DA-120cc or GP123 with 2 independent canisters, the headers stay inside the cowling and require no additional openings cut for them.

Baffle and Final Cowling Installation



1. Locate the engine baffles, these are designed to fit the DA-120cc or GP123. Fit the baffles in place on the bottom cowling by aligning the shape of each baffle with the shape of the cooling opening in the cowling. Tack in place with CA.
2. Test fit the cowling on the fuselage, with the baffles in place, to ensure that they fit properly. You may need to trim the baffles slightly to achieve a good fit.



3. Once you are happy with the fit of the baffles, install them permanently using a flexible adhesive such as Goop. Wait for the adhesive to cure completely before proceeding with cowling installation (in the case of Goop wait 24 hours)
4. Before installing the cowling, verify that all spark-plug wires, fuel lines and any battery or servo wires are correctly installed and well-secured.
5. Once you are happy with the fit of your cowling, proceed to installing the bottom cowling. Use a 3mm hex driver, (2) M4 x 20 socket head cap screws and (2) M4 flat washers to secure it in place. The two screws are installed from the inside of the cowling, into the fuselage, near the top of the bottom cowling.
6. Installing the top half of the cowling using the (8) Hex head M3 x 10mm screws.



7. Install your propeller and spinner. For the DA-120cc and GP123, we recommend a Falcon 28x9 carbon fiber propeller and the Ultimate 120cc custom painted carbon fiber spinner (see parts listing on page 64).

CENTER WING CABANE INSTALLATION

Required for this section

Components

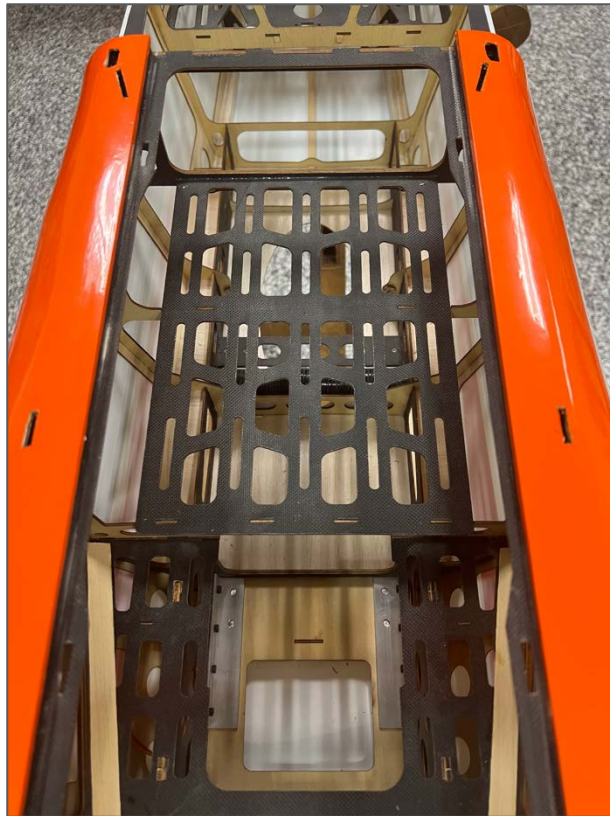
- Fuselage Assembly
- Vertical Struts (4)
- Diagonal Struts (2)
- Central Rib
- M4 x 15mm Screws (8)
- M4 Washers (4)
- M5 x 30mm Flat Head Bolts (2)
- M5 Washers (4)
- M5 Lock Nuts (2)

Tools

- 4mm Hex Driver
- 3mm Hex Driver
- 8mm Open Wrench

Adhesives/Building Materials

- Blue Thread Lock



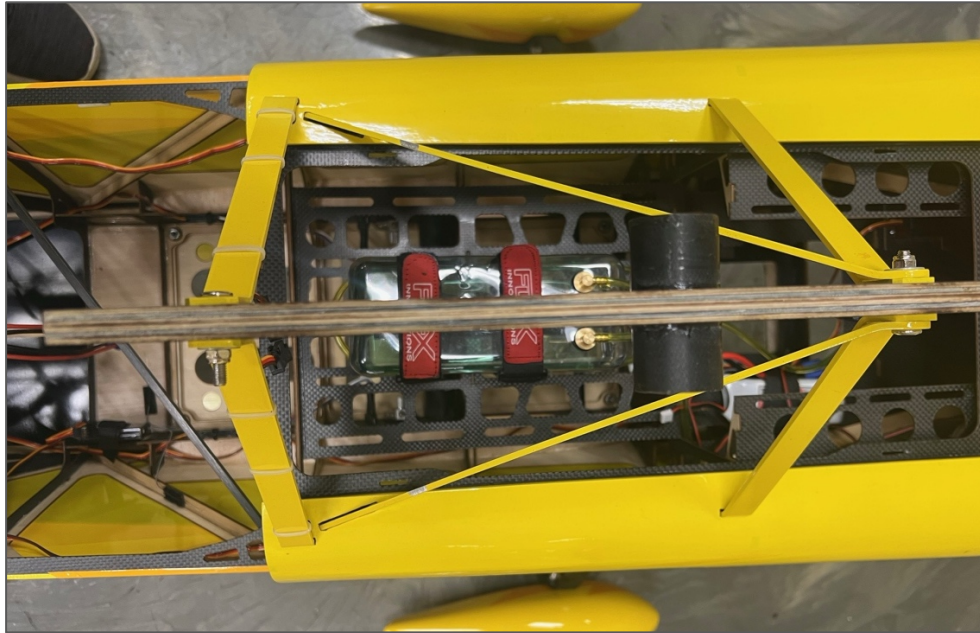
- 1. Locate the six holes in the fuselage for the center cabane struts. Remove the covering from these holes using a hobby knife with a sharp #11 blade.



- 2. Locate the 4 vertical struts. The front and rear vertical struts are identical. Take two vertical struts and loosely bolt them to the rear of the central rib. Use the following assembly sequence:
 - M5 x 30mm Socket Head Bolt
 - M5 flat washer
 - Vertical strut

- Central rib
- Vertical strut
- M5 flat washer
- M5Lock nut

Note: as you can see in the picture below, the rear bolt is inserted from the left side of the fuselage, and the nut sits on the right side whereas in the front, these are installed in the opposite direction. This is intentional and important to ensure proper operation of the wing mounting Flex Speed-lock system.



- 3. Locate the two diagonal struts. The diagonal struts are mounted over the rear vertical struts as shown in the picture above. Slide the two vertical struts thru the rear most fuselage slots. Then proceed to install each diagonal strut thru each fuselage slot next to

the rear vertical strut. Note that the diagonal strut has one end that is square and the other end round. As picture shows the square end goes on top of the vertical rear strut. Loosely mount using M4 x 15mm Screw (2) and M4 flat washer (2) to the pre-installed 4mm blind nuts. Apply blue thread lock to each screw.



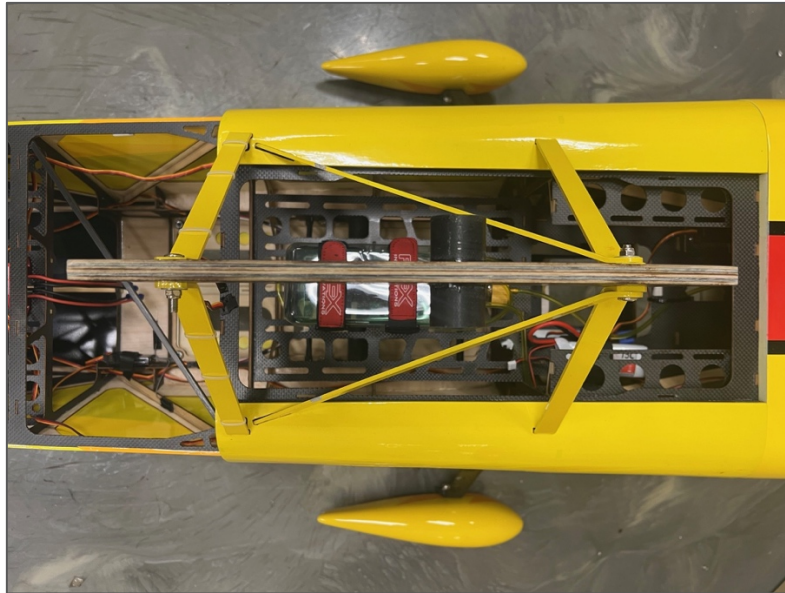
- 4. Locate the 2 front vertical struts. Mount them using M4 x 15mm Screw (2) and M4 flat washer (2) to the pre-installed 3mm blind nuts. Apply blue thread lock to each screw.



- 5. The two vertical struts and the two diagonal struts are mounted to the central rib. Use this assembly sequence:
 - M5 x 30mm Socket Head Bolt
 - M5 flat washer
 - Diagonal Strut
 - Vertical strut
 - Central rib

- Vertical strut
- Diagonal strut
- M5 flat washer
- M5 Lock nut

Note: as mentioned above, the front bolt for the central rib assembly needs to be installed from the right side of the fuselage and the nut needs to be on the left side when the assembly is complete, it should look like the picture below:



6. Return to all the bolts and tighten any that have not been tightened. Once fully assembled it should look like the picture above.

FINAL ASSEMBLY

RADIO INSTALLATION

Required for this section

Components

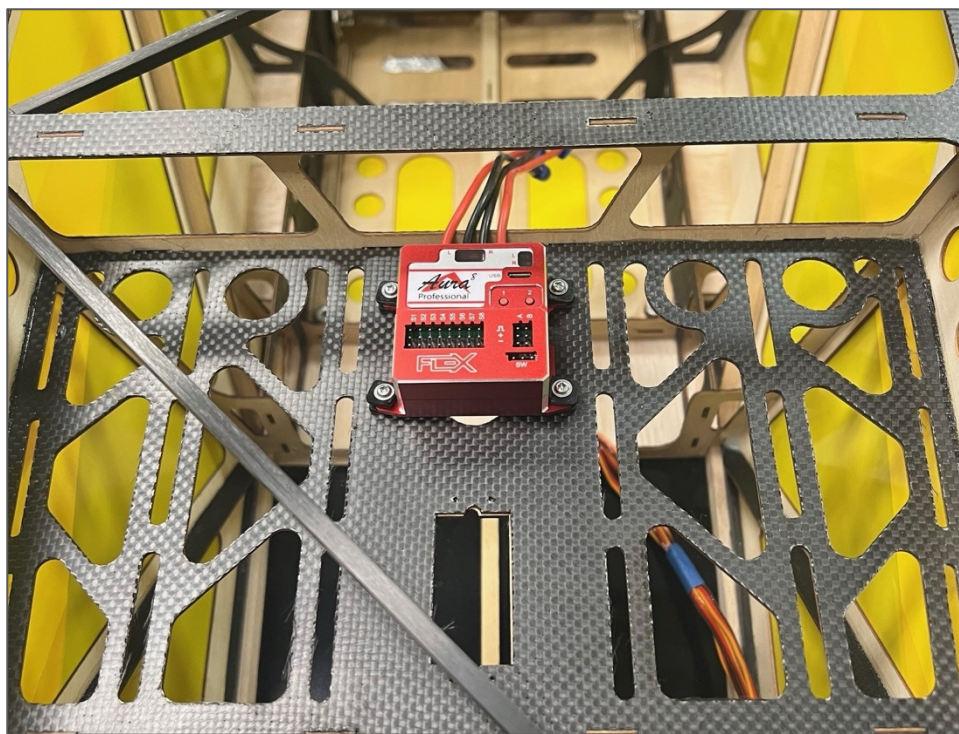
- Fuselage Assembly
- Receiver
- Receiver Switch
- Aura 8 Professional (Optional)
- Receiver Batteries
- Hook and Loop Straps
- Adhesive-Backed Hook and Loop Tape
- Tie-Wraps

Tools

- #1 Phillips Screwdriver
- Hobby Knife with #11 Blade
- 2mm Hex Driver

Adhesives/Building Materials

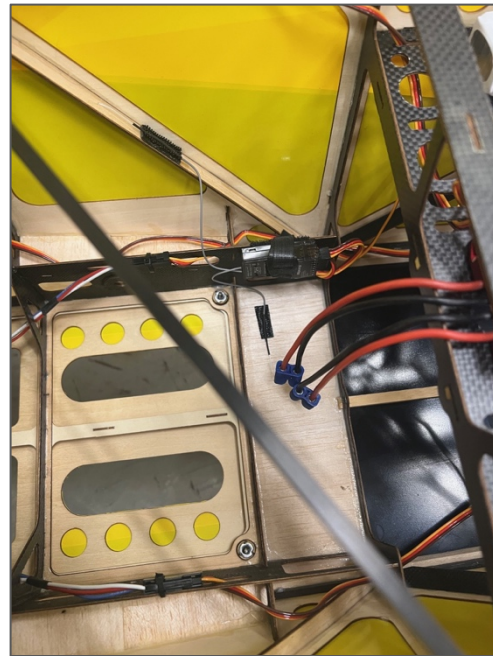
- Thin CA



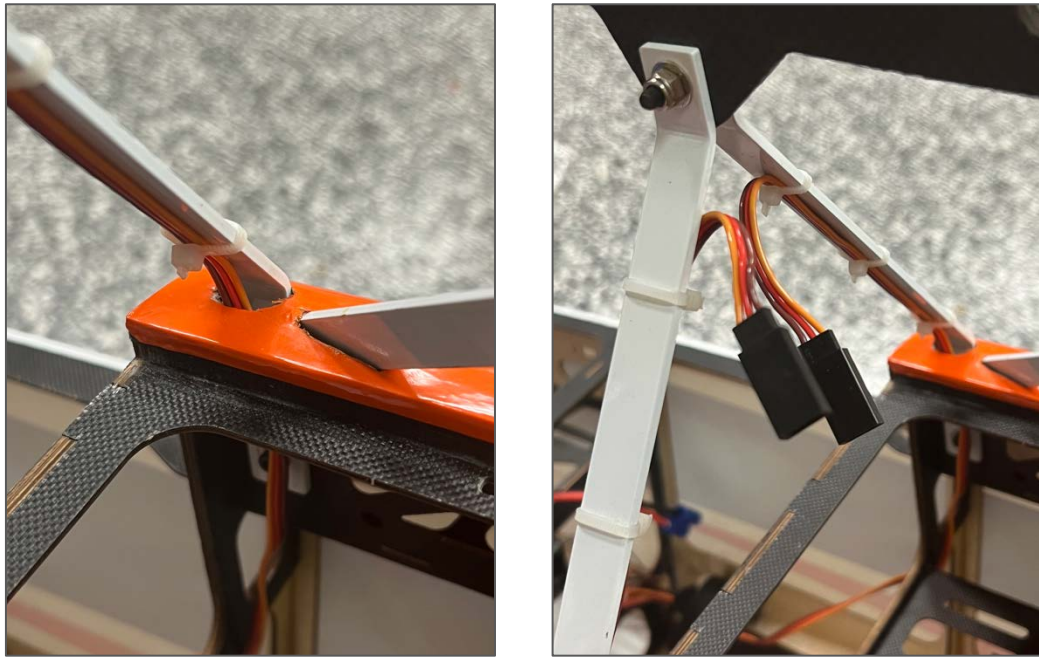
1. If you are using the Aura 8 Professional AFCS, it should be mounted forward of the rudder servo location in the center of the fuselage as shown in picture above.
2. Use a #1 Phillips screwdriver to thread an Aura mounting screw into each of the pre-cut holes in the mounting tray. Remove the screw and apply a small amount of thin CA to each of the holes to harden the threads cut by the screw. Let the CA fully cure before mounting the Aura and securing the (4) screws.



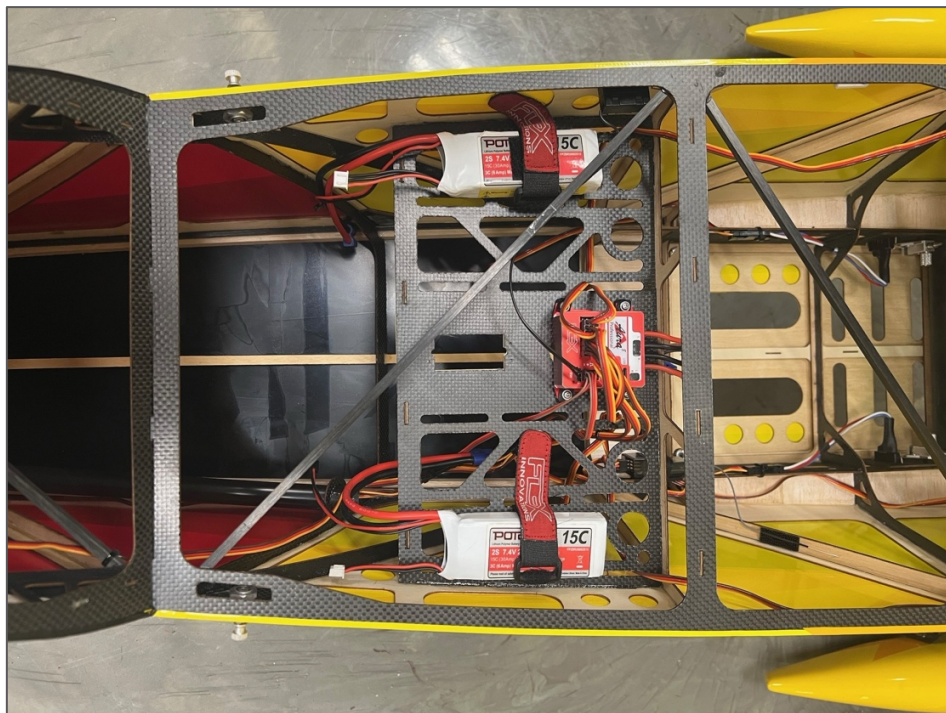
- 3. Locate the RX/Aura switch just under the canopy. Note that there are switch locations on both sides of the fuselage. Remove the covering from the hole of your choice using a hobby knife with a #11 blade and install your RX switch. Use blue thread lock if your switch uses screws with metal-to-metal contact. DO NOT use thread lock if your screws thread into plastic!



- 4. The pictures above show recommended locations for receiver installation when using the Aura 8 Professional, you can use one or both of these if running 2 receivers. If you are not using an Aura 8 Professional, you can install the receiver in the same location.



- 5. Route two 28in (710mm) heavy duty servo extensions up the rear cabane strut, and out the top wing. Secure the extension to the cabane struts using tie-wraps.



- 6. Make all the servo connections. Depending on balance (read CG section), install your (2) recommended batteries in one of the 3 tray the Ultimate has. Secure them using hook and loops straps. If you are using Aura 8 Pro your final installation would look like the picture. Note the RX's are not show in this picture as in this case the photographed sample is using dual Futaba RX's. The RX's are in the belly and turtle deck of the airplane, as shown in the pictures on the previous page, for maximum RF strength.

FIELD ASSEMBLY

Details on field assembly are covered in the assembly video that is provided on the Ultimate 120cc page at:

<https://www.flexinnovations.com/product/ultimate-120cc>



DECAL INSTALLATION

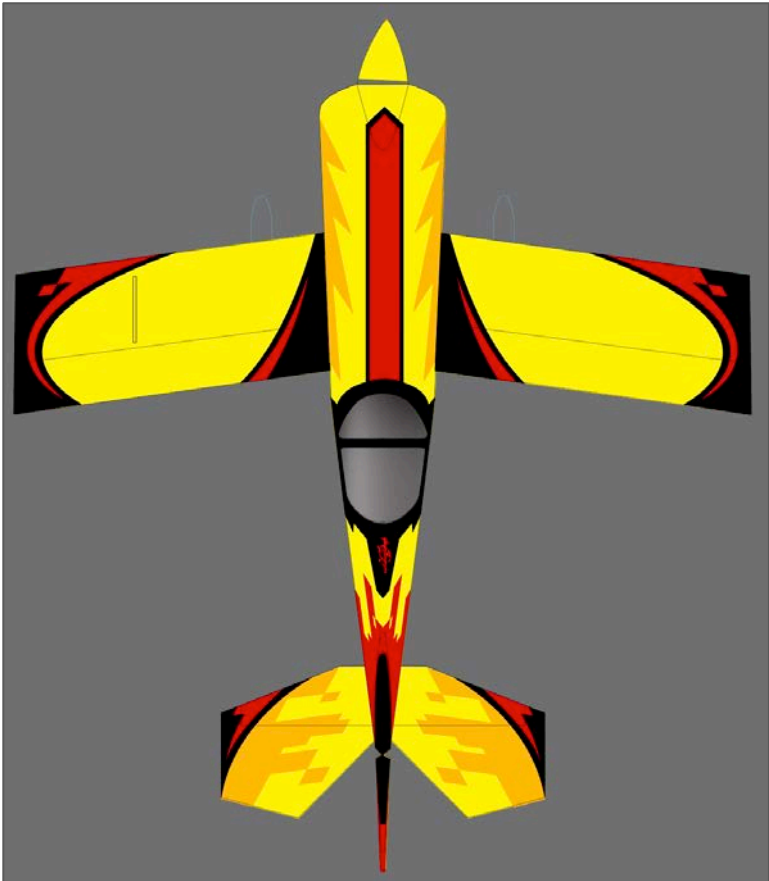
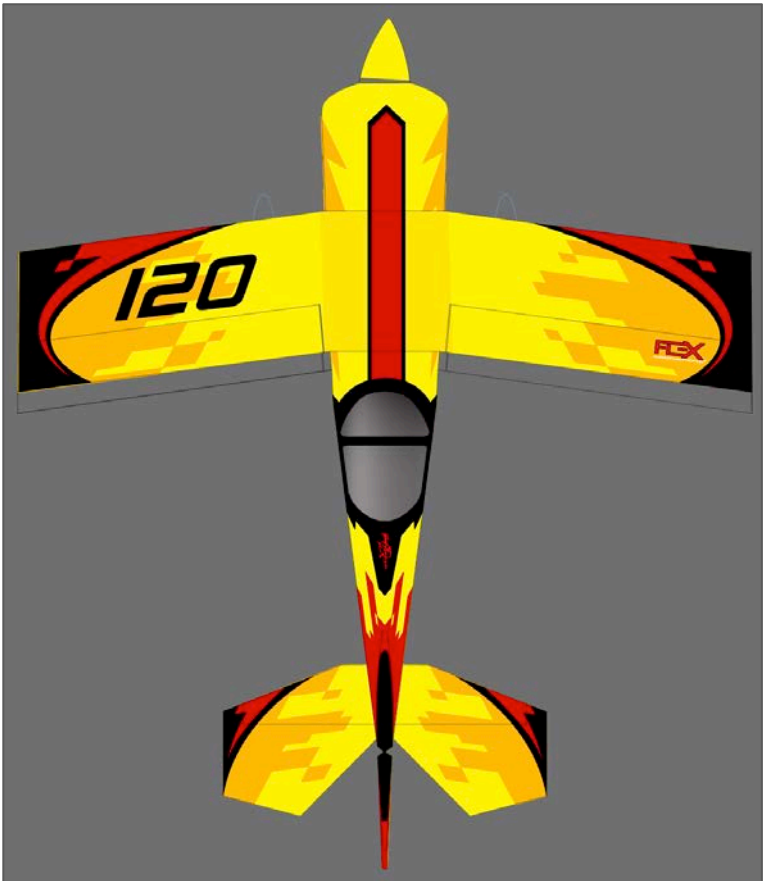
A traditional set of decals is provided with the Ultimate 120cc.

Use the drawings provided below for a guide to apply decals to your model.

1. Thoroughly clean the model to ensure it is free of oil, fingerprints, and dust.
2. Separate the decals, but do not remove the paper backing.
3. Prepare a dishpan or small bucket with a mixture of warm water and liquid dish detergent. The ratio should be approximately one teaspoon per gallon of water.
4. Submerge the decal into the water/soap mixture and gently remove the paper backing. Removing the backing under water prevents fingerprints from being visible on the back side of the decal.
5. Apply some water/soap mixture with your palm to the area desired. Once the area is saturated, position the sticker on the airplane. Even though these are not water transfer decals, using wet application methods allows the sticker to be repositioned, reduces bubbles, and eliminates fingerprints and other blemishes from being visible.
6. Hold the decal in place and use a paper towel to gently wipe most of the water away.
7. Use a soft piece of balsa or similar to squeegee out the remaining liquid from underneath the decal.
8. Repeat the process until all decals are applied. Do not move or otherwise touch the model for at least 24 hours to allow adequate time for the remaining water to evaporate.

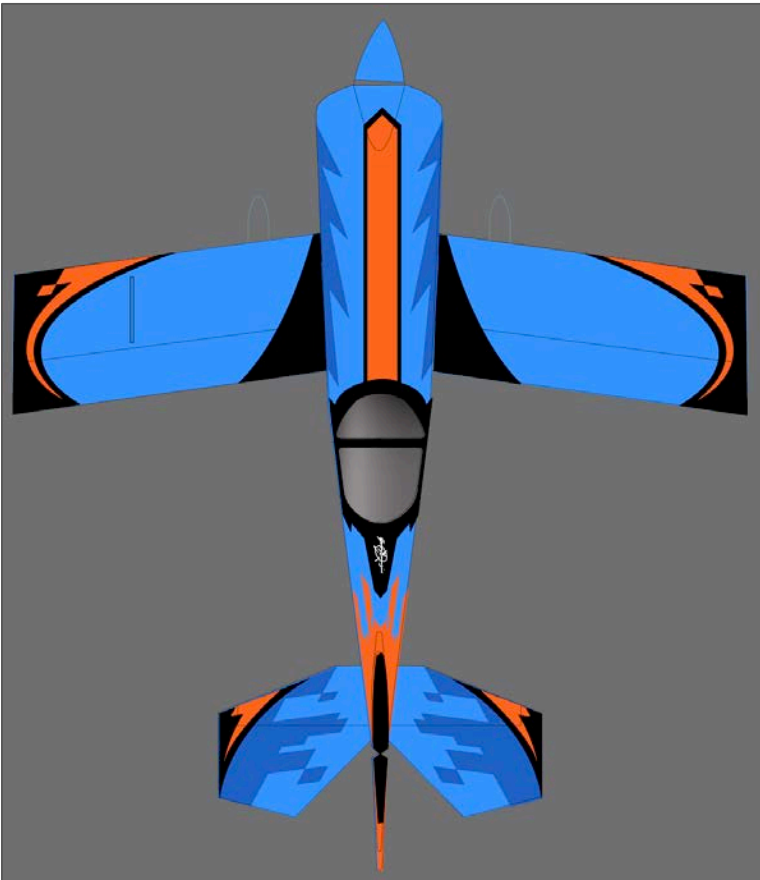
Ultimate 120cc Yellow Scheme





Ultimate 120cc Blue Scheme





FINAL SETUP AND FLYING NOTES

CENTER OF GRAVITY

Setting the center of gravity (CG) is one of the most important steps for success, particularly with a new airplane. The Flex Innovations Ultimate 120cc is a high-performance airplane with large control surface throws, and a very high thrust to weight ratio. These two factors combined make the Ultimate a very enjoyable aircraft to fly, but if the center of gravity is not within an acceptable range, it will make the airplane difficult, if not impossible, to control. To have the most success and enjoyment from your Ultimate 120cc, please follow the next few steps very carefully.

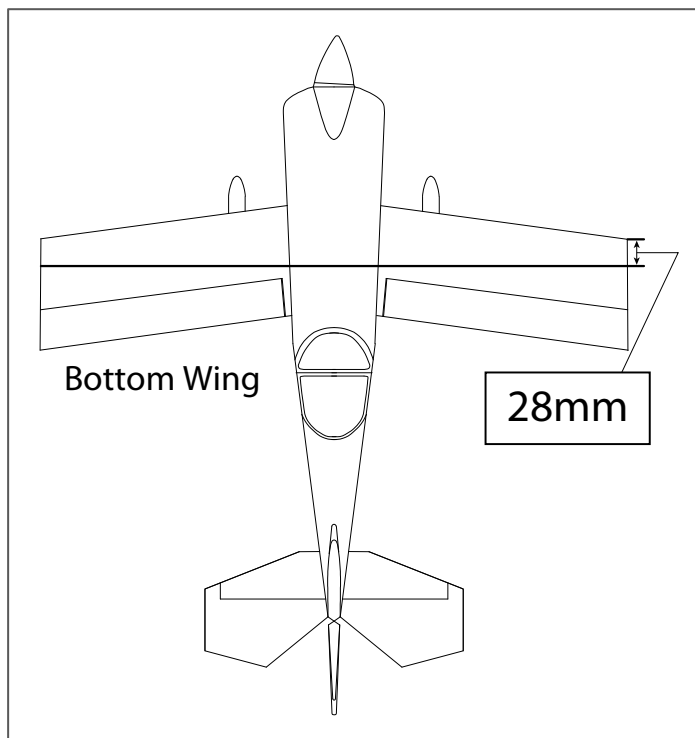
Before checking the CG of your model please ensure that all the components are installed in your airplane. This means the batteries, servos, linkages, hardware, propeller, spinner, hatches; everything. The airplane must be in ready-to-fly condition, otherwise the measurement will not be accurate.

There are several methods for determining center of gravity, from using a CG machine, to using fingers and a friend. Regardless of the method used, ensure that the tests are accurate and repeatable. If there are any inconsistencies between measurements, work to isolate the source of the error(s) making sure that the test can be repeated with the same results. If lifting the model by the wing tips, do NOT lift directly from the tip of the wing, but lift at the outboard-most wing rib location or damage to the model may result.

The location of the center of gravity for the Ultimate 120cc is 25mm to 33mm AFT from the LEADING EDGE of the BOTTOM WING at the wing tip. The optimal CG is 28mm AFT from the LEADING EDGE of the BOTTOM WING at the wing tip. It is critical that the starting point for your model be at this point. This measurement is determined from many test flights by designer and many time world aerobatic champion, Quique Somenzini.

Quique's Tip:

CG can be easily achieved using the recommended equipment and placing it in the recommended areas. However, some variance of weight between model builds is possible. For this reason, it is recommendable to leave the batteries uninstalled and finalize their installation where necessary at the time you are setting CG in the recommended location. There are three trays in the aircraft. The front tray just ahead the gas tank, the gas tank tray, and the rudder/RX tray. Use these trays to place your batteries accordingly.



AURA 8 PROFESSIONAL

If you choose to use Aura 8 Professional AFCS, you can find the information on the Ultimate 120cc Aura set-up in the Aura Config Tool and in the model setup wizard.

STARTING CONTROL SURFACE THROWS AND EXPONENTIAL

The following throws and exponential have been tested thoroughly during the development of the airplane and have been determined to be the optimal starting point for the Ultimate 120cc. As you become more familiar with the airplane, you may tweak the rates and expos to better suit your flying style, but these numbers provide a very good starting point.

NOTE: Throws are provided as angles of deflection in degrees. Special meters are available for measuring this angle, and you can certainly use one of these, but we have found that you can get an accurate enough measurement by using a phone and an angle or protractor app.

Since expo directions vary by transmitter manufacturer, all expos listed below are those that make the control feel softer around the stick's center position.

Ultimate 120cc Control Throws and Expo

	Low Rate		High Rate	
	Up or right	Down or left	Up or right	Down or left
Aileron (top & bottom wing)	25 degrees	24.5 degrees	36 degrees	35 degrees
Elevator	13 degrees	13 degrees	55 degrees	55 degrees
Rudder	35 degrees	35 degrees	50 degrees	50 degrees
Aileron Expo	40%	40%	50-70%	50-70%
Elevator Expo	35%	35%	50-70%	50-70%
Rudder Expo	35%	35%	50-70%	50-70%

High rate should be reserved for 3D aerobatics and low rate should be reserved for sport/precision flying and general aerobatics. It is highly recommended that for your first flights, take offs and landings be done in low rate.

RANGE TESTING

Carefully follow the binding and range testing instructions included with your radio equipment. If there are any issues passing the test range, please consult your transmitter and receiver manuals or contact your transmitter and receiver manufacturer to determine the appropriate solution before attempting to fly.

BEFORE FIRST FLIGHT

Before going to the field for your first flight, please go over the finished, fully assembled model at home. The key to a successful first flight is preparation and ensuring that your plane is airworthy.

- 1. For optimal performance of your model, balance your propeller and spinner. Most propellers are balanced fairly-well out of the package; however, some fine-tuning can make a mediocre propeller perform great. An out-of-balance propeller or spinner can wreak havoc on the electronic components in the airplane, as well as prematurely shorten the life span of the engine, servos or even the model itself. A balanced propeller will be quieter, generate more thrust, produce less vibration, and operate more efficiently than one that is not balanced.
- 2. Re-check all linkages and connections, including those that may have been assembled by the factory. Ensure pushrods are sufficiently threaded into ball links, ensure that all metal-to-metal connections have thread lock applied and ensure that all control surfaces move freely and in their proper direction.
- 3. Verify proper functioning, break-in, and operation of your engine choice. Ensure that the fuel-air mixture is correct, and that the engine is producing full power. If you are not familiar with gas engines, ask for the assistance of a more experienced pilot in your area or speak with your engine manufacturer.
- 4. Secure any loose wiring inside the fuselage or wings in such a way that they do not rub or chafe.
- 5. Ensure that all batteries (transmitter, receiver, ignition, or flight packs) are fully charged prior to leaving for the flying field.
- 6. Take a few moments to assemble the airplane away from commotion, talkative onlookers, or any other distractions. Ensure that all connections are properly made and secured, the wing bolts are tight and take a few minutes to plan out your first flight.
- 7. If your gas engine is new, avoid prolonged full throttle runs and vertical climbs. Limit the first few flights to a short flight time. Start off short, gradually lengthening the flight times as you become comfortable with the performance of your engine. Six minutes is a good time to limit your first flights to. As you become more familiar with the airplane and begin to fly it in a more aggressive manner, monitor the temperature of the engine and adjust the fuel-air mixture according to your engine manufacturer's recommendations.

AMA SAFETY CODE

When flying your aircraft, we recommend following the guidelines set by the Academy of Model Aeronautics (AMA). You can find their Safety handbook as well as more information on the AMA at their website, located at the address below.

<https://www.modelaircraft.org/>

REPLACEMENT PARTS

FPM001180A	Ultimate 120cc ARF Yellow Scheme
FPM001180B	Ultimate 120cc ARF Blue Scheme
FPM0011801A	Ultimate 120cc Fuselage without hatches Yellow Scheme
FPM0011801B	Ultimate 120cc Fuselage without hatches Blue Scheme
FPM00118002A	Ultimate 120cc Top Wing Set Yellow Scheme (Top, Left and Right)
FPM00118002B	Ultimate 120cc Top Wing Set Blue Scheme (Top, Left and Right)
FPM00118023A	Ultimate 120cc Bottom Wing Set (Bottom, Left and Right) Yellow Scheme
FPM00118023B	Ultimate 120cc Bottom Wing Set (Bottom, Left and Right) Blue Scheme
FPM00118003A	Ultimate 120cc Horizontal Stabilizer with Elevators Set Yellow Scheme
FPM00118003B	Ultimate 120cc Horizontal Stabilizer with Elevators Set Blue Scheme
FPM00118004A	Ultimate 120cc Rudder Yellow Scheme
FPM00118004B	Ultimate 120cc Rudder Blue Scheme
FPM00118005A	Ultimate 120cc Cowling Yellow Scheme with hardware
FPM00118005B	Ultimate 120cc Cowling Blue Scheme with hardware
FPM00118006A	Ultimate 120cc Canopy with cockpit installed, no pilot Yellow Scheme
FPM00118006B	Ultimate 120cc Canopy with cockpit installed, no pilot Blue Scheme
FPM00118007A	Ultimate 120cc C/F Landing Gear Yellow
FPM00118007B	Ultimate 120cc C/F Landing Gear Blue
FPM00118008A	Ultimate 120cc Wheel Pants with hardware Yellow Scheme
FPM00118008B	Ultimate 120cc Wheel Pants with hardware Blue Scheme
FPM00118009	Ultimate 120cc Carbon Wing Tubes (x2), Elevator joiner tube (1)
FPM00118010	Ultimate 120cc Carbon Anti-rotation Tube Set - Aileron tube (2), Elevator tube (1)
FPM001180013	Ultimate 120cc Pushrod Linkage/Control Horn Set
FPM001180014	Ultimate 120cc Hardware Set
FPM00118015A	Ultimate 120cc Decal Sheet Yellow Scheme
FPM00118015B	Ultimate 120cc Decal Sheet Blue Scheme
FPM00118016A	Ultimate 120cc Interplane Strut Set Yellow Scheme with strut-pins
FPM00118016B	Ultimate 120cc Interplane Strut Set Blue Scheme with strut-pins
FPM00118017A	Ultimate 120cc Metal cabane struts - Yellow Scheme
FPM00118017B	Ultimate 120cc Metal cabane struts - Blue Scheme
FPM00118018	Ultimate 120cc Laser Cut Wood Parts
FPM00118024A	Ultimate 120cc Hatch set Yellow (Center top fuselage, and bottom fuselage cooling hatches)

FPM00118024B	Ultimate 120cc Hatch set Blue (Center top fuselage, and bottom fuselage cooling hatches)
FPM00118025	Ultimate 120cc Fiberglass Engine Baffle Kit
FPM00118029	Ultimate 120cc G2: clear cowling template
FPM00118030A	Ultimate 120cc G2: Landing Gear Fairing Yellow Scheme
FPM00118030B	Ultimate 120cc G2: Landing Gear Fairing Blue Scheme
FPM00118031	Ultimate 120cc G2: Top wing central strut set w/ Joint Rib
FPM00118032	Ultimate 120cc G2: Removeable Rudder Wire
FPMA1073	Flex Speed-Lock Side-Knob (Ultimate 70/120cc top wing, RV-8 Vertical Fin (QTY:1))
FPMA1074	120cc Tail Wheel with Hardware
FPMA1075	120cc Main Wheel and Axle Set

OPTIONAL ACCESSORIES

FPM00118026A	Ultimate 120cc Pilot Yellow scheme
FPM00118026B	Ultimate 120cc Pilot Blue scheme
FPMA1082	6" Carbon Fiber Ultimate Spinner Blue
FPMA1072	6" Carbon Fiber Ultimate Spinner Yellow
FPMA1078	6" Ultimate Spinner Special design for Ultimate 120 Yellow
FPMA1083	6" Ultimate Spinner Special design for Ultimate 120 Blue
FPM2114	Ultimate 120cc Wing and Tail Bag Set
FPM2124	Ultimate 120cc Pilot
FPMDA120	Desert Aircraft DA-120cc Engine
FPMDA120MUFLR	DA-120cc Muffler
FPZMEMDA120H20	Flex/Dualsky 20mm/120cc Standoff Kit
FPMPCF2890CF	Falcon 28x9 Carbon Fiber Propeller
FPM1623	32oz Lightweight Fuel/Smoke Tank (for smoke)
DP1000	Dualsky DP1000 Brushless Smoke Pump
FPMA1051	120cc Smoke System Completion Pack
FPZDS49010BLHV	Potenza DS49010BLHV Brushless Servo
FPZA1036	Aluminum Servo Arm 2-in Clamping (25T)
FPZA1040	Servo Connector Safety Clip
FPZAURA08PRO	Aura 8 Professional AFCS
FPZBR20002S15	2000 mAh 2s 15C JR/EC3 Connector RX Li-Po Battery Pack
FPM00118033A	Flex Innovations Ultimate 120cc Premium Wing and Tail Bag Set
FPMA1028	Flex 35% Airplane Sunshade

LIMITED WARRANTY

Warranty Coverage

Flex Innovations LLC and its authorized resellers (“Flex”) warrant to the original purchaser that this product (the “Product”) will be free from defects in materials and workmanship at the date of purchase.

Outside of Coverage

The warranty is not transferable and does not cover:

- (a) Products with more than 45 days after the purchase date
- (b) Damage due to acts of God, accident, misuse, abuse, negligence, commercial use, or due to improper use, installation, operation, or maintenance
- (c) Damage to other components or assemblies associated with the use of the Product.
- (d) Modification of or to any part of the Product
- (e) Product not purchased from an authorized Flex Innovations dealer or distributor.
- (f) Product that has been partially, or fully assembled
- (g) Shipping damage
- (h) Cosmetic damage
- (i) Services or labor associated with the repair, use or assembly of the Product.

OTHER THAN THE EXPRESS WARRANTY ABOVE, FLEX MAKES NO OTHER WARRANTY REPRESENTATION, AND HEREBY DISCLAIMS ALL IMPLIED WARRANTIES, INCLUDING, WITHOUT LIMITATION, THE IMPLIED WARRANTIES OF NONINFRINGEMENT, MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THE PURCHASER ACKNOWLEDGES THAT THEY ALONE HAVE DETERMINED THAT THE PRODUCT WILL SUITABLY MEET THE REQUIREMENTS OF THE PURCHASER’S INTENDED USE.

Purchaser’s Remedy

Flex’s sole obligation and purchaser’s sole and exclusive remedy shall be that Flex will, at its option, either (i) service, (ii) replace any part of the Product determined by Flex to be defective, or (iii) replace the Product determined by Flex to be defective. Flex reserves the right to inspect all Product(s) involved in a warranty claim. Service or replacement decisions are at the sole discretion of Flex. Proof of purchase is required for all warranty claims. **SERVICE OR REPLACEMENT AS PROVIDED UNDER THIS WARRANTY IS THE PURCHASER’S SOLE AND EXCLUSIVE REMEDY.**

Limitation of Liability

FLEX SHALL NOT BE LIABLE FOR SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES, LOSS OF WAY, REGARDLESS OF WHETHER SUCH CLAIM IS BASED IN CONTRACT, WARRANTY, TORT, NEGLIGENCE, STRICT LIABILITY OR ANY OTHER THEORY OF LIABILITY, EVEN IF FLEX HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

Further, in no event shall the liability of Flex exceed the individual price of the Product on which liability is asserted. As Flex has no control over use, setup, assembly, modification or misuse, no liability shall be assumed nor accepted for any resulting damage and/or injury. By the act of use, setup or assembly, the user accepts all resulting liability. If you as the purchaser or user are not prepared to accept the liability associated with the use of the Product, purchaser is advised to return the Product immediately in new and unused condition to the place of purchase.

Law

These terms are governed by Florida law (without regard to conflict of law of principals). This warranty gives you specific legal rights, and you may also have other rights which vary from state to state. FLEX RESERVES THE RIGHT TO MODIFY THIS WARRANTY AT ANY TIME WITHOUT NOTICE.

Questions & Assistance

Contact us by:

E-Mail – support@flexinnovations.com

Phone – 1 (866) 310-3539

Inspection or Services

If this Product needs to be inspected or serviced and is compliant in the region you live and use the Product in, please contact your regional Flex authorized reseller. Pack the Product securely using the original shipping carton. Please note that both the inner and outer boxes need to be included. The inner box is not designed to withstand the rigors of shipping without additional protection from the outer shipping carton. Ship via a carrier that provides tracking and insurance for lost or damaged parcels, as Flex is not responsible for merchandise until it arrives and is accepted at our facility.

Warranty Requirements

For Warranty consideration, you must include your original sales receipt verifying the proof of purchase date. Provided any warranty conditions have been met, your Product or its defective parts will be replaced or serviced free of charge. Responsibility of shipping charges are as follows:

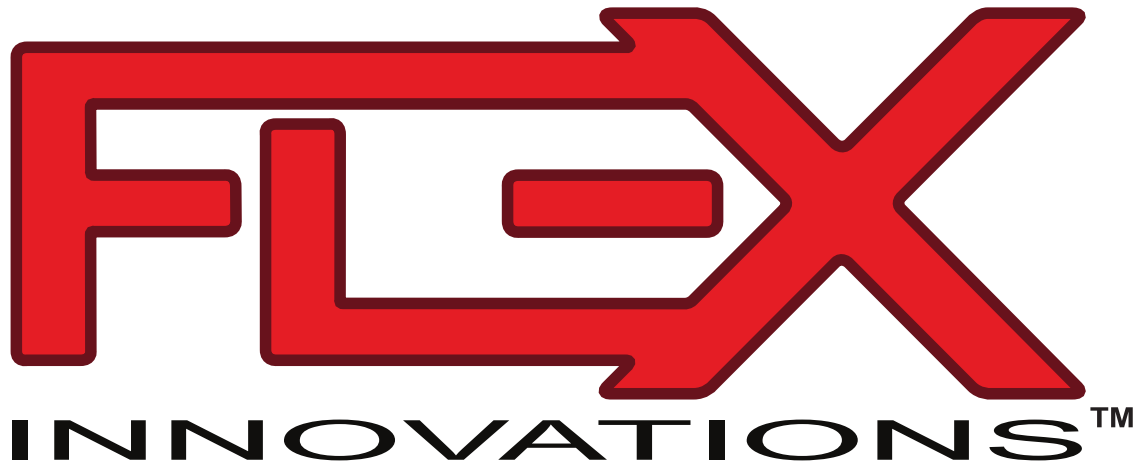
To Flex from customer, customer is responsible.

To Customer from Flex, Flex is responsible.

Service or replacement decisions are at the sole discretion of Flex.

BUILDING AND FLYING NOTES





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