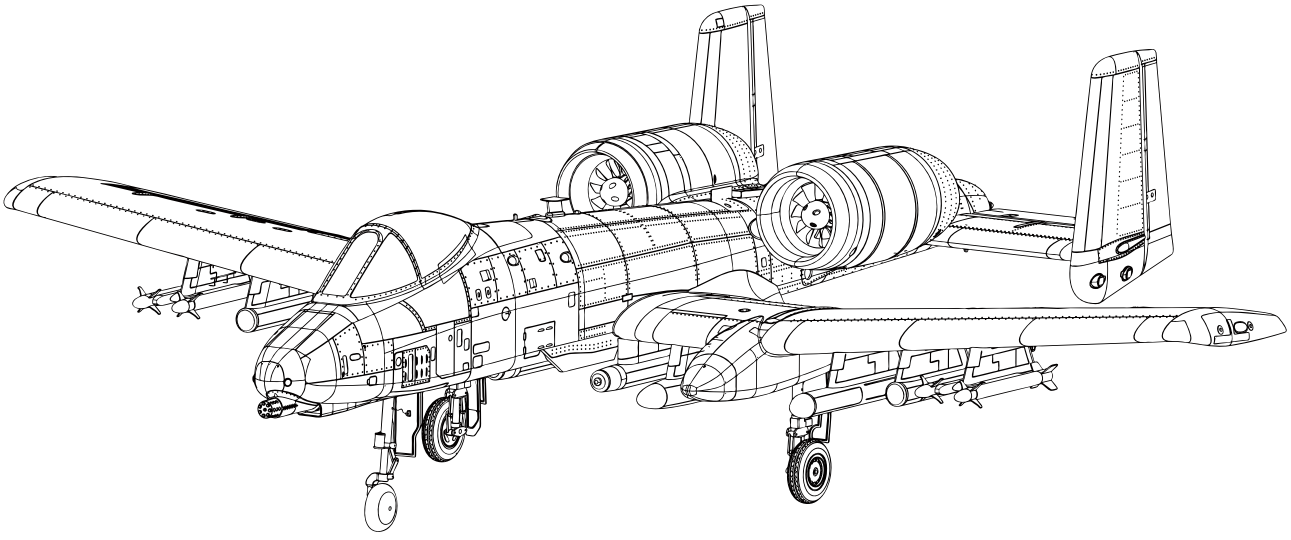
70MM A-10 Thunderbolt II

Operating Manual



REALISTIC
- RETRACT & FLAPS INSTALLED

RIGID
- STRONG DURABLE EPO

STABLE
- SMOOTH FLYING PERFORMANCE

FMSMODEL.COM

WARNING

⚠

WARNING: Read the ENTIRE instruction manual to become familiar with the features of the product before operating. Failure to operate the product correctly can result in damage to the product,personal property and cause serious injury.

This is a sophisticated hobby product and NOT a toy. It must be operated with caution and common sense and failure to do so could result in injury or damage to the product or other property. This product is not intended for use by children without direct adult supervision.

This manual contains instructions for safety operation and maintenance. It is essential to read and follow all the instructions and warnings in the manual prior to assembly, setup or use, in order to operate and avoid damage or serious injury.

Safety Precautions and Warnings

As the user of this product, you are solely responsible for operating in a manner that does not endanger yourself and others or result in damage to the product or the property of others. This model is controlled by a radio signal subject to interference from many sources outside your control. This interference can cause momentary loss of control so it is advisable to always keep a safe distance in all directions around your model, as this margin will help avoid collisions or injury.

Age Recommendation: Not for children under 14 years. This is not a toy.

·Never operate your model with low transmitter batteries.
·Always operate your model in an open area away from cars, traffic or people.
·Avoid operating your model in the street where injury or damage can occur.
·Never operate the model in populated areas for any reason.
·Carefully follow the directions and warnings for this and any optional support equipment you use (chargers, rechargeable battery packs, etc.)
·Keep all chemicals, small parts and anything electrical out of the reach of children.
·Moisture causes damage to electronics. Avoid water exposure to all equipment not specifically designed and protected for this purpose.
·Never lick or any place of any your model in your mouth as it could cause serious injury or even death.

Safety

Lithium Polymer (Li-Po) Battery Warning

CAUTION: Always follow the manufacturer's instructions for safe use and disposal of batteries. Fire, property damage, or serious injury can result from the mishandling of Li-Po batteries.

- By handling, charging or using a Li-Po Battery you assume all risks associated with lithium batteries. If at any time the batteries begin to swell or balloon, discontinue use immediately!
- Always store the batteries at room temperature in a dry area to extend the life of the battery. Always transport or temporarily store the battery in a temperature range of 40-120F. Do not store the battery or model in a car or in direct sunlight. If stored in a hot car, the battery can be damaged or even catch fire.
- Never use a Ni-Mh Charger to charge Li-Po Batteries. Failure to charge the battery with a Li-Po compatible charger may cause fire resulting in personal injury and property damage.
- Never discharge Li-Po Cells below 3V.
- Never leave charging batteries unattended.
- Never charge damaged batteries.

Charging the Flight Battery Warning

- Use a battery charger that is designed to safely charge the Li-Po Battery. Read the charger instructions care fully before use. When charging the battery, make certain the battery is on a heat resistant surface. It is also highly recommended to place the Li-Po Battery inside a fire resistant charging bag readily available at hobby shops or online.

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Introductions

New from FMS, the new and highly detailed A-10 Thunderbolt II

The Fairchild Republic A-10 Thunderbolt II is a single–seat, twin turbofan engine, straight wing jet aircraft developed by Fairchild-Republic for the United StatesAir Force (USAF).
Commonly referred to by its nicknames Warthog or Hog, its official name comes from the Republic P-47 Thunderbolt, a World War II fighter that was effective at attacking ground targets.

FMS is proud to bring to you this new and highly detailed Twin ducted fan version of the A-10. Incorporating many of the new and advanced construction and assembly features such as the optimized screw based assembly, ball links and a heavy duty wing spar and latest multi-connect technology. The “Hog” will assembly quickly. In addition the A-10 uses our newest locked-rotor mode E-retract system coupled with our refined and oriented CNC-processed metal landing gear set for resisting those not-too-perfect landings. The power system utilizes our new and improved twin 70mm 12-blade EDF V2, KV1850 inner-running motor system provides tremendous power and speed when couple with a 6S battery.

This highly detailed A-10 has to be seen to fully appreciate the detail FMS has undertaken. From all-around rivets and panel lines, detachable bomb and missile sets and pilot figure, the A-10 is an absolute must have for any pilot.

Key Features:

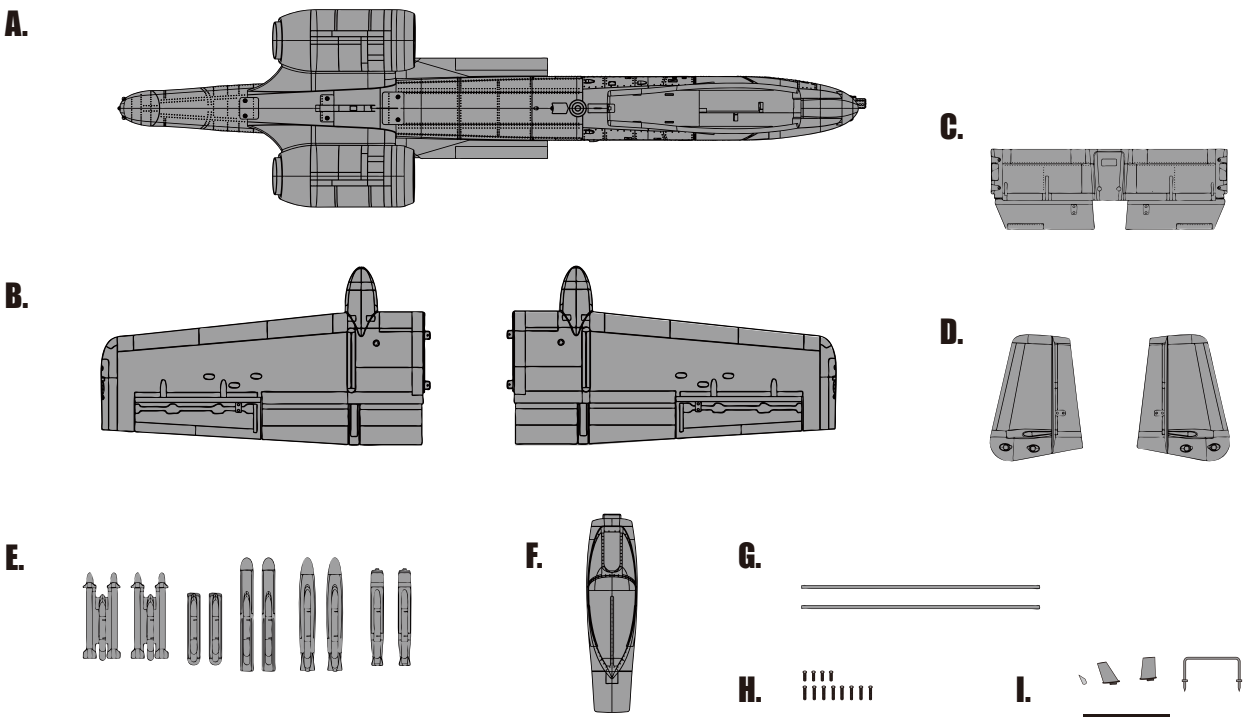
- Powerful twin inner running motors with the latest 70mm 12-blade EDF, plus the high-quality Predator 70A ESC
- Super highscale detail throughout:
    - Scaled CNC-processed metal landing gear set
    - Detachable bomb and missile set
    - Pilot figure
    - Panel lines and rivets
- The latest high-brightness LED set
- Thelatest locked-rotor mode E-retract with overcurrent protection
- Multi-connector for one-step installation
- Metal digital servos for excellent controlling capacity
- Bearings in wheel hub for better performance
- Button Type canopy hatch
- Large battery compartment
- Pre-installed, newly designed ball link style control horns for more throw

Specifications

Wingspan: 1500mm (59.1in)
Overall Length: 1368mm (53.9in)
Flying Weight: Around 4100g (144.6oz)
Motor Size: Brushless 2860-KV1850*2
Wing Load: 113.2 g/dm² (0.26oz/in²)
Wing Area: 36.2 dm² (561 sq.in)
ESC: 70A*2
Servo: 9g metal digital * 5 17g metal digital * 4
Recommended Battery: 22.2V 5000mAh 45C

Contents of Kit

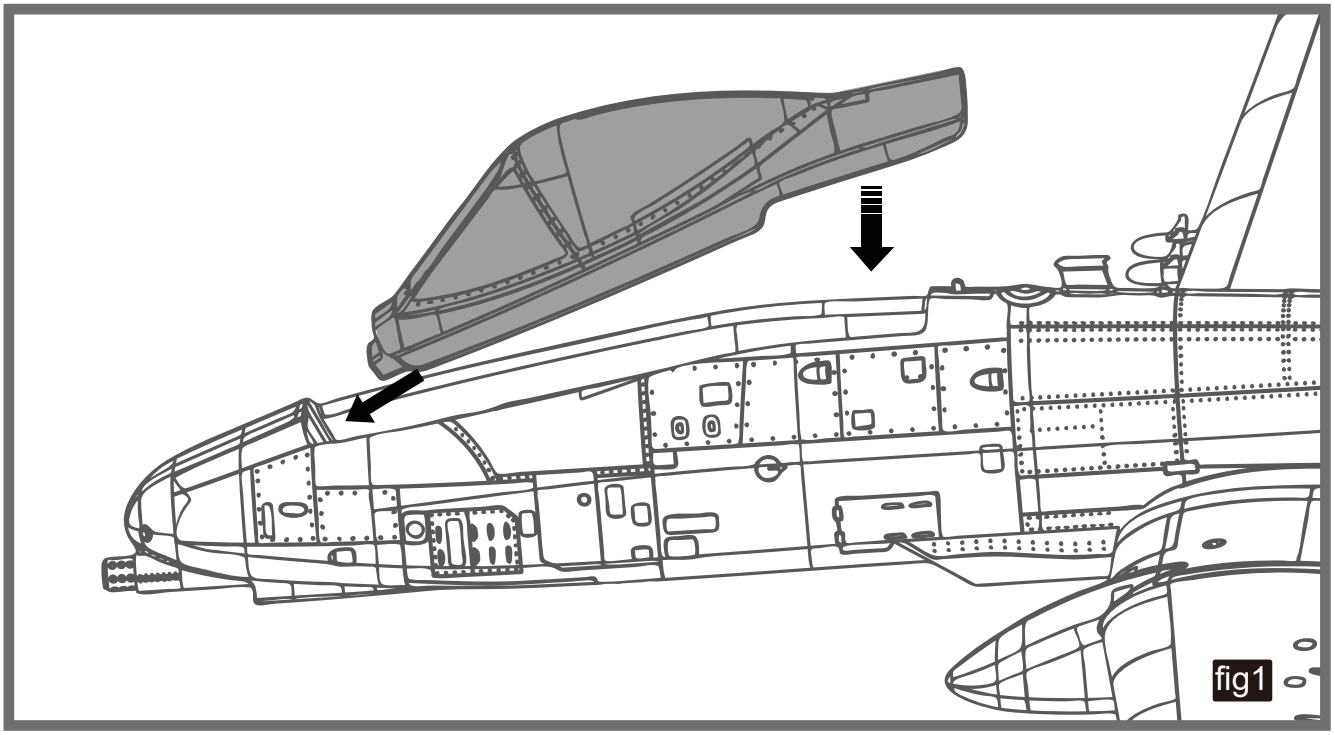
Before assembly, please inspect the contents of the kit. The photo below details the contents of the kit and labels. If any parts are missing or defective, please indentify the name or part number (refer to the spare parts list near the end of the manual) then contact your local shop or email us: support@fmsmodel.com



A: Fuselage
B: Main wing (Left and right)
C: Horizontal Stabilizer
D: Vertical Stabilizer (Left and Right)
E: Missile Set
F: Canopy Hatch
G: Fiber Pipe
H: Screws
(4-HKM3.0*16, 8-HKM3.0*20)
I : Ventral Fins and Airspeed Tube

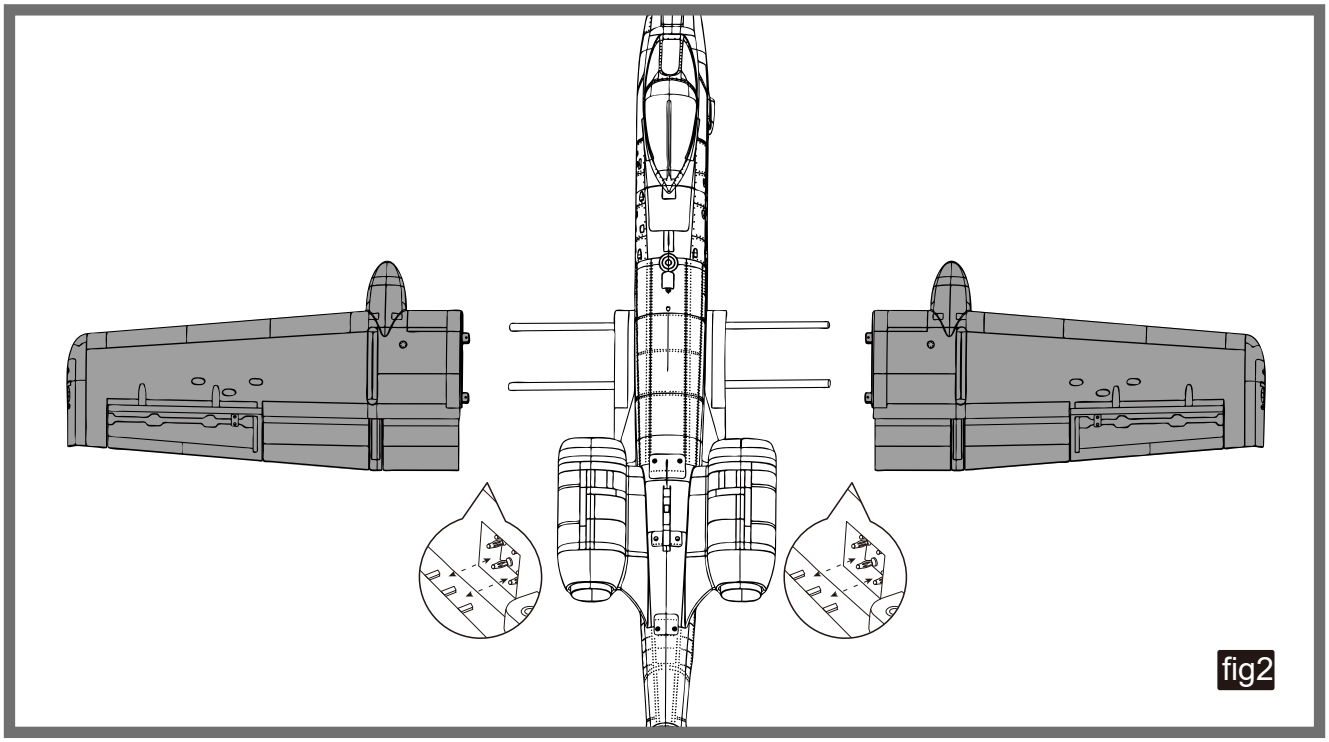
Canopy Hatch Installation

1. Install the canopy hatch as shown (fig1).

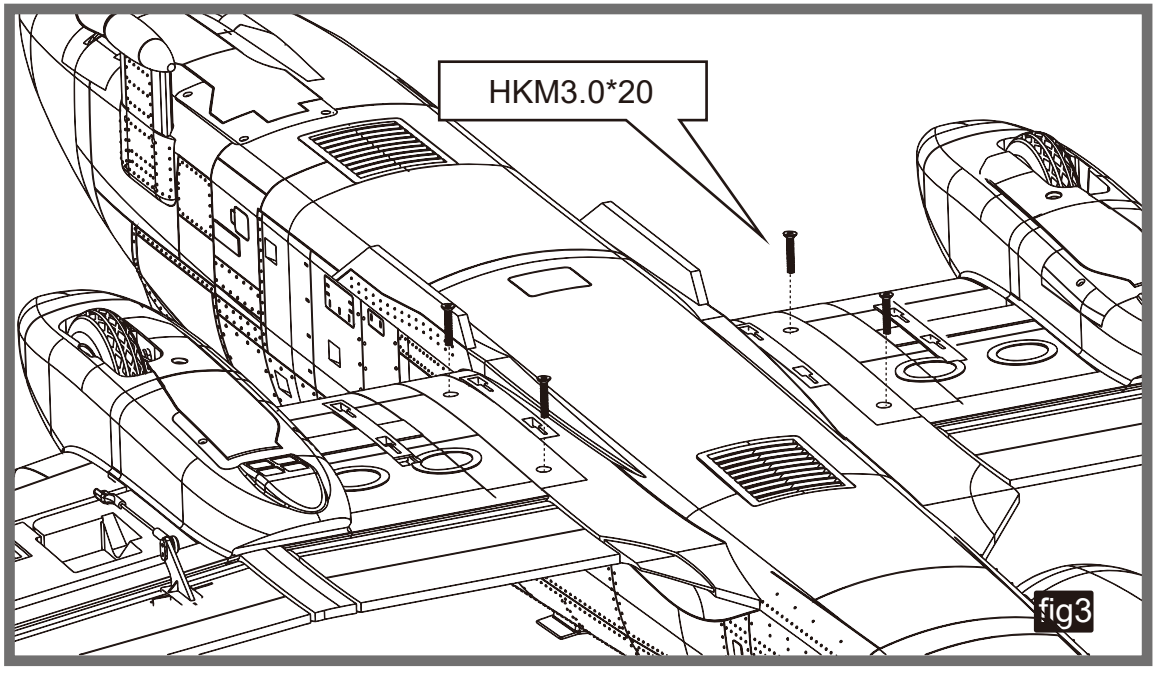


Main Wing Installation

1.Slide the wing tube into the fuselage (fig2).
2. Install the left and right wing over the wing tube and into the wing slot of the fuselage.
Notice: The connectors on both sides should be attached precisely and firmly.



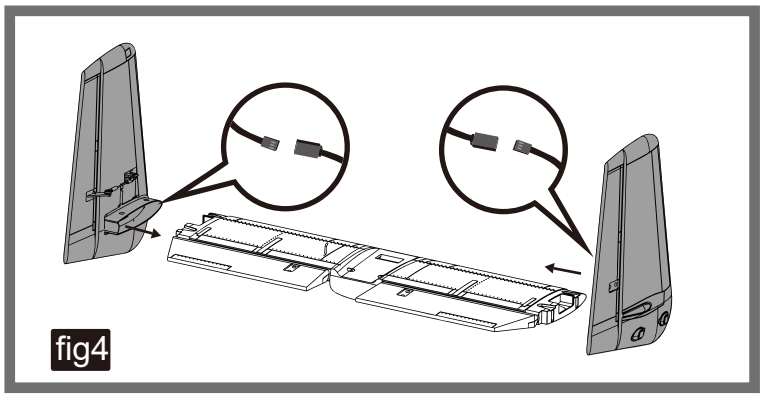
3. Secure the left and right wings to the fuselage using the 4 screws included (fig3).



Model Assembly

Horizontal and Vertical Stabilizer Installation

1. Connect the rudder servo connectors to the servo extensions in the elevator .
2. Carefully slide the two vertical tail pieces (left and right) into the slots of horizontal tail as shown (fig4).
3. Secure the two vertical tail pieces (left and right) in place using the 4 screws included (fig5).


fig4

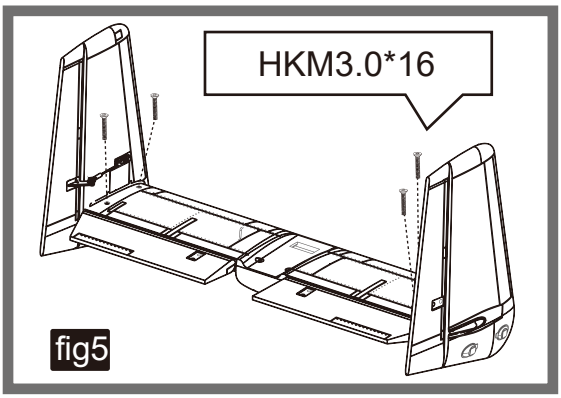


fig5

4. Connect the elevator servo connectors and rudder servo connectors to the servo extensions in the fuselage.
5. Install the assembled horizontal tail and vertical tail to fuselage using the 4 screws included. Make sure it is tightened enough.

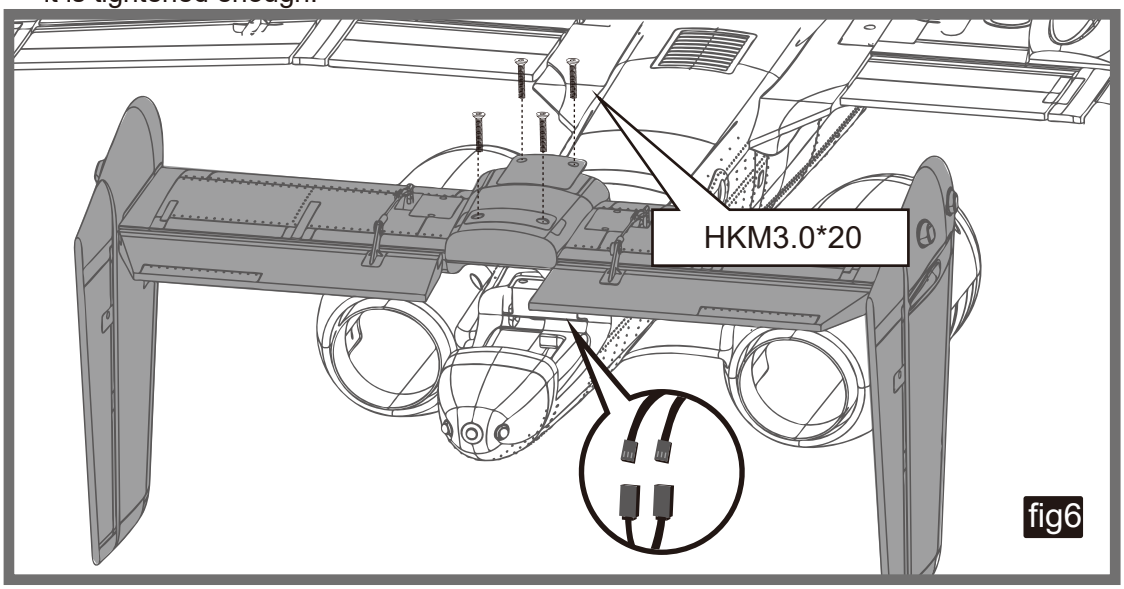
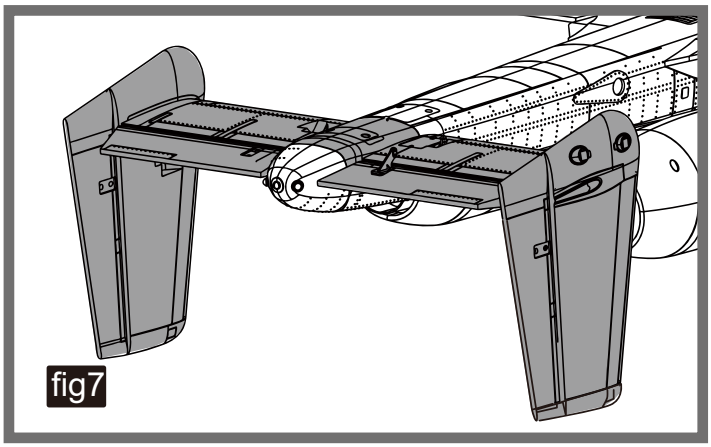


fig6


fig7

Model Assembly

Missile Set, Ventral Fins, and Airspeed tube Installation

Required Adhesives:



Foam Safe Medium CA

1. Screw the air speed tube in place (fig8).
2. Slide ventral fins into the rails (fig9).

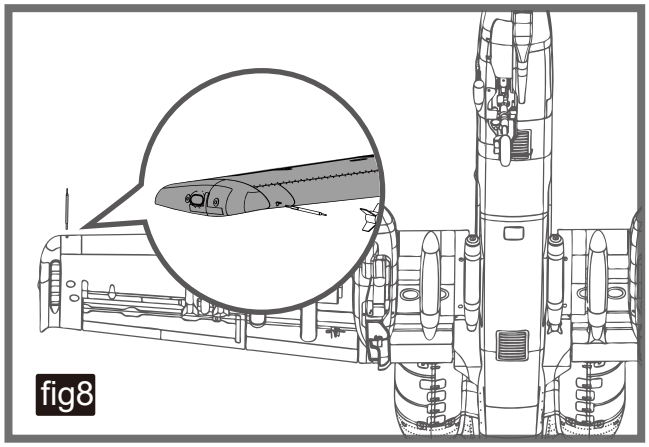


fig8

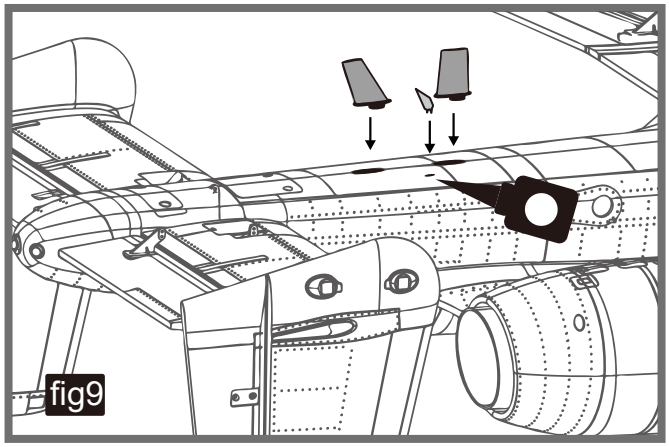


fig9

3. Slide the missiles into the rails.

Note: to fit different anhedrals, separate right and left missiles are required. Please install the missiles as shown (fig10).

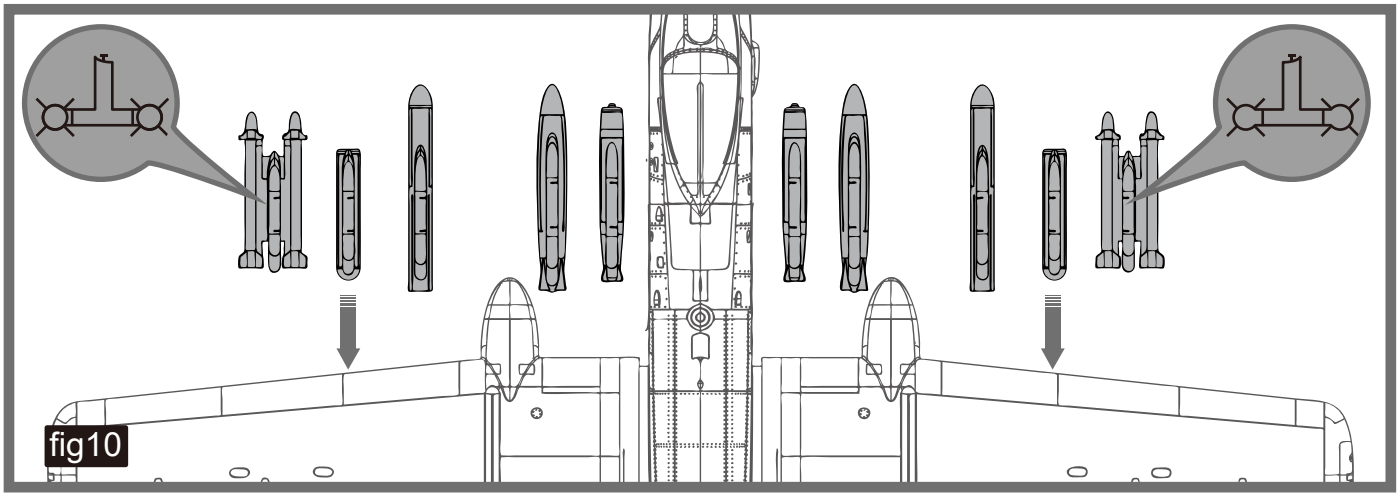


fig10

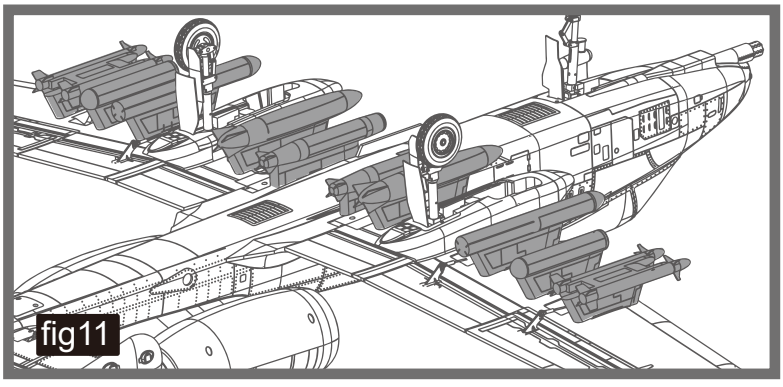
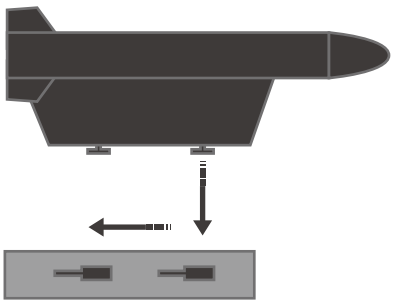
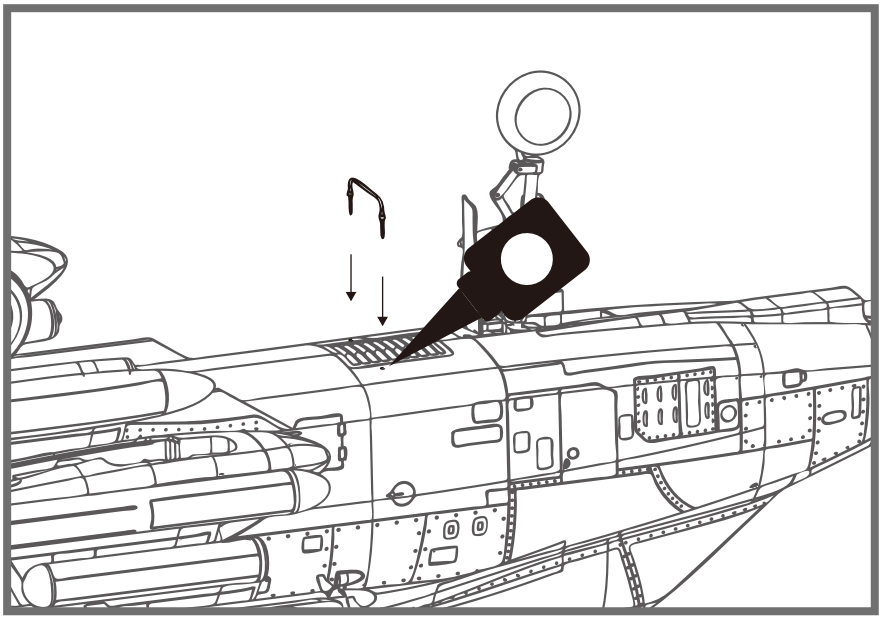


fig11



Other Accessories Installation

1. Insert the plastic part by CA as shown.

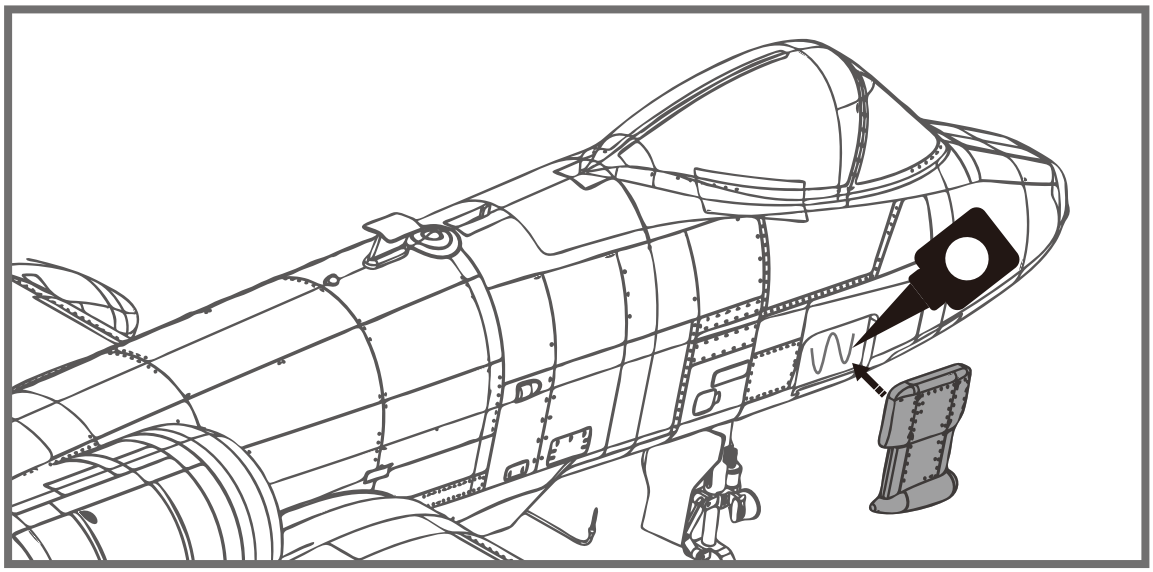


Required Adhesives:



Foam Safe Medium CA

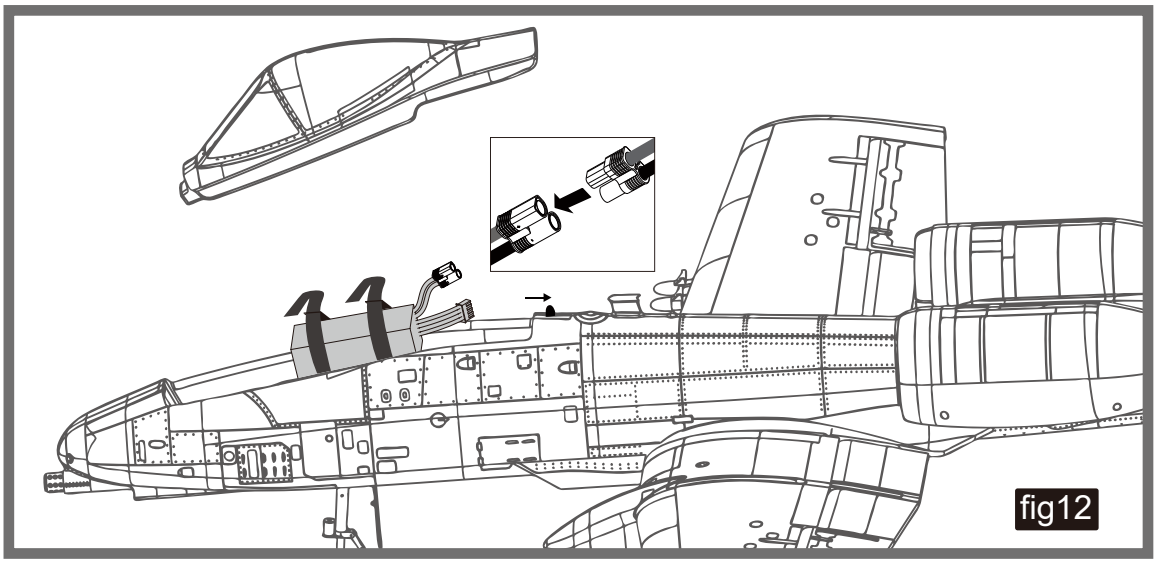
3. Insert the foaming part by CA as shown.



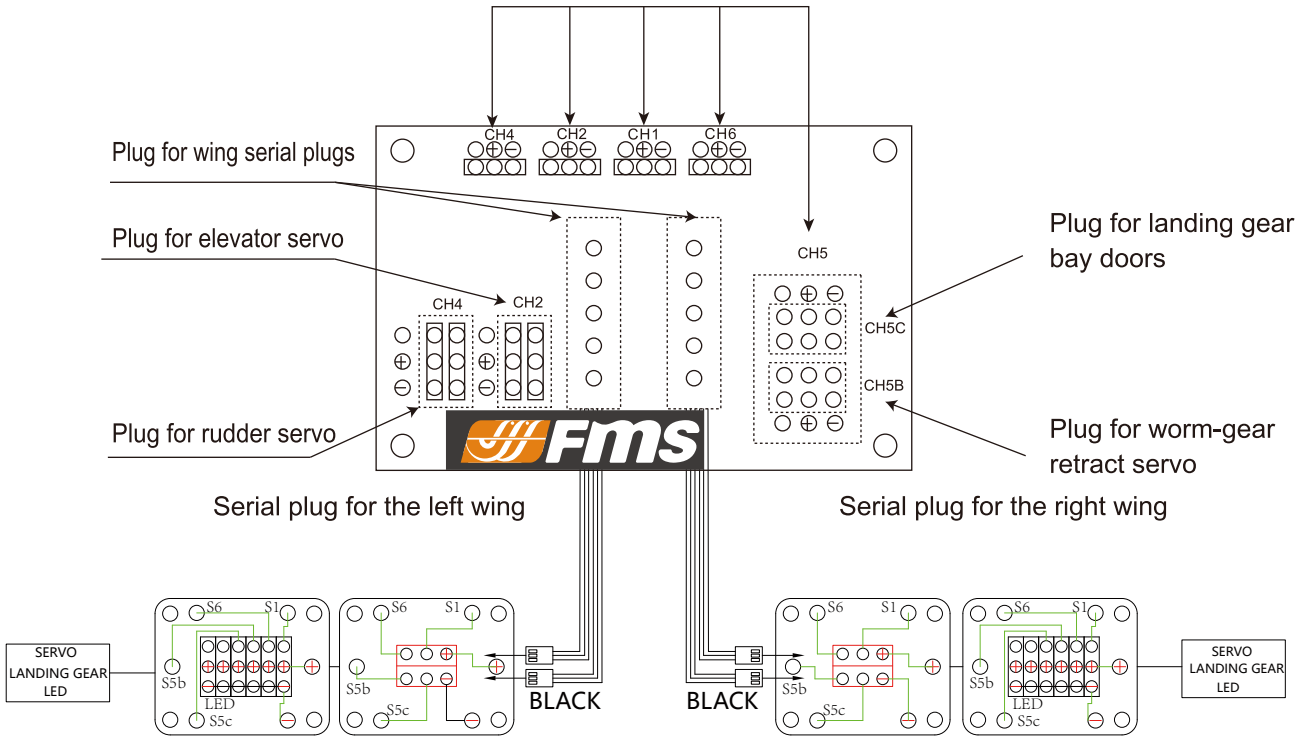
Battery and radio installation

1. Apply the hook strap to your battery as shown.
2. Carefully lift the canopy hatch to remove.
3. Install the full charged battery in the battery compartment with the power supply cable toward the rear end of the plane.

Note: you may need to relocate the battery position to achieve the correct CG for your model.



Connectors Diagram



CAUTION:When connecting the single plug, make sure the positive and negative terminals are in the right direction. An incorrect connection will burn the electronic equipment.

Get your model ready to fly

Important ESC and model information

1. The ESC included with the model has a safe start. If the motor battery is connected to the ESC and the throttle stick is not in the low throttle or off position, the motor will not start until the throttle stick is moved to the low throttle or off position. Once the throttle stick is moved to the low throttle or off position, the motor will emit a series of beeps. Several beeps with the same tune means the ESC has detected the cells of the battery. The count of the beeps equals the cells of the battery. The motor is now armed and will start when the throttle is moved.
2. The motor and ESC come pre-connected and the motor rotation should be correct. If for any reason the motor is rotating in the wrong direction, simply reverse two of the three motor wires to change the direction of rotation.
3. The motor has an optional brake setting. The ESC comes with brake switched off and we recommend that the model be flown with the brake off. However, the brake could be accidentally switched on if the motor battery is connected to the ESC while the throttle stick is set at full throttle. To switch the brake off, move the throttle stick to full throttle and plug in the motor battery. The motor will beep one time. Move the throttle stick to low throttle or the off position. The motor is ready to run and the brake will be switched off.
4. Battery Selection and Installation. We recommend the 22.2V 5000mAh 45C Li-Po battery. If using another battery, the battery must be at least a 22.2V 5000mAh 45C battery. Your battery should be approximately the same capacity, dimension and weight as the 22.2V 5000mAh 45C Li-Po battery to fit the fuselage without changing the center of gravity significantly.

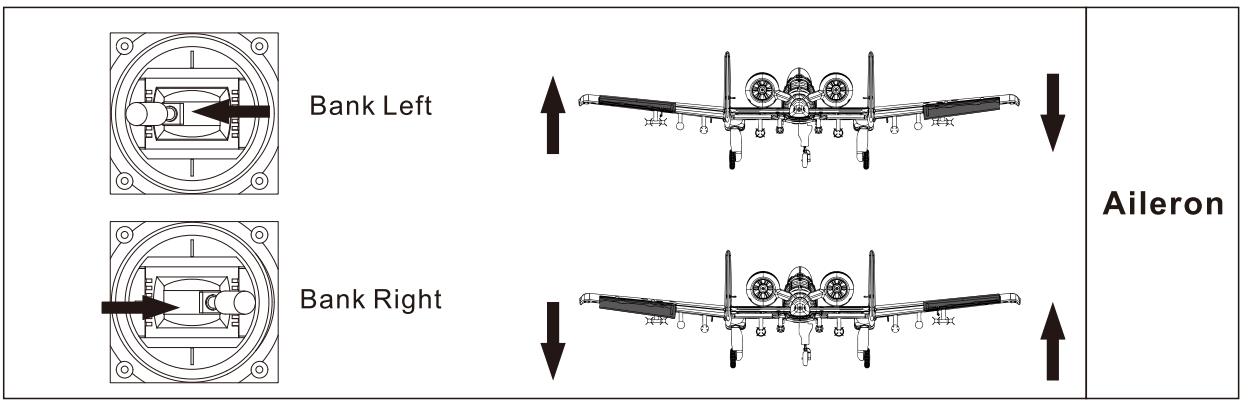
The transmitter and model setup

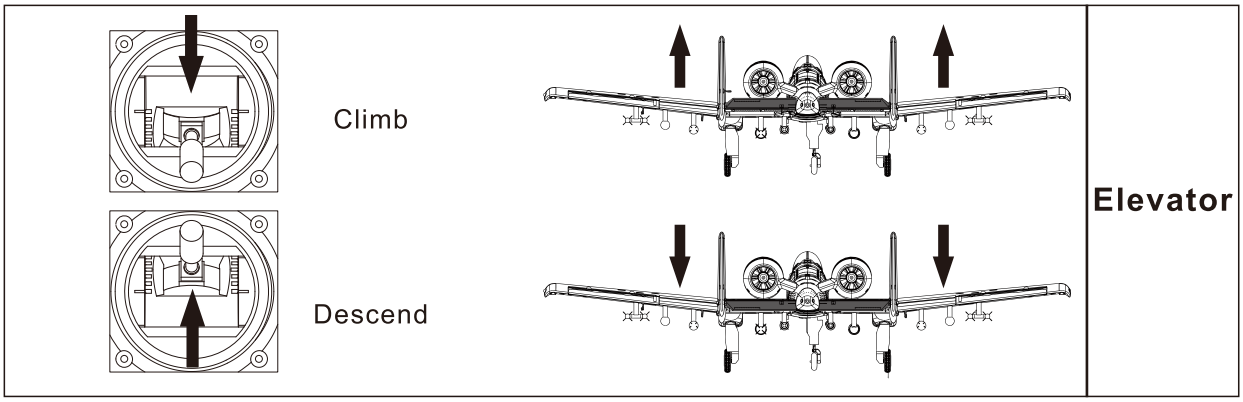
Before getting started, bind your receiver with your transmitter. Please refer to your Transmitter Manual for proper operation

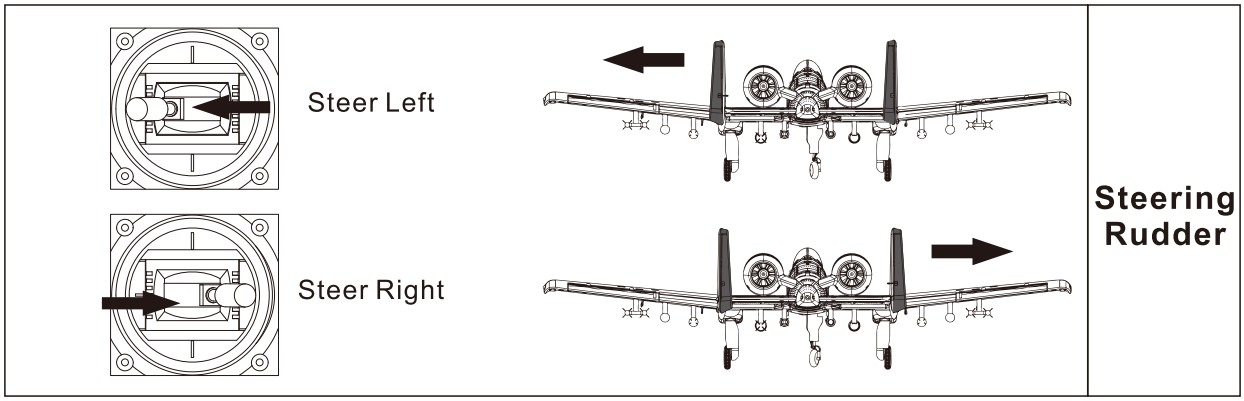
CAUTION: To prevent personal injury, DO NOT install the propeller assembly onto the motor shaft while testing the control surfaces. DO NOT arm the ESC and do not turn on the transmitter until the Transmitter Manual instructs you to do so.

Tips: Make sure all control sticks on your radio are in the neutral position (rudder, elevator, ailerons) and the throttle is in the OFF position. Make sure both ailerons move up and down (travel) the same amount. This model tracks well when the left and right ailerons travel the same amount in response to the control stick.

1. Move the controls on the transmitter to make sure the aircraft control surface moves correctly. See diagrams below.







Check the control throws

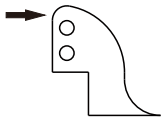
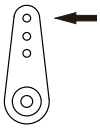
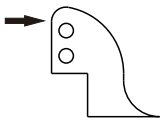
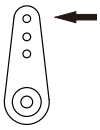
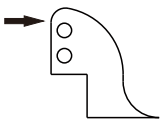
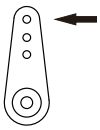
The suggested control throw setting for FMS MODEL are as follows (dual rate setting):

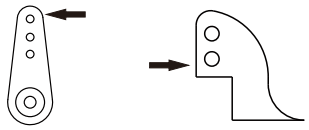
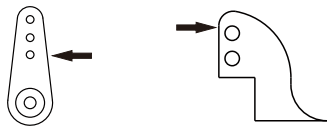
	High Rate	Low Rate
Elevator	20mm up/down	15mm up/down
Aileron	23mm up/down	18mm up/down
Rudder	20mm left/right	15mm left/right

Tips: On first flight, fly the model in low rate. The first time you use high rates, be sure to fly at low to medium speeds. High rate, as listed, is only for EXTREME maneuvering.

Control Horn and Servo Arm Settings

The table shows the factory settings for the control horns and servo arms. Fly the aircraft at the factory settings before making changes.
After flying, you may choose to adjust the linkage positions for the desired control response. See the table to the below

	Horns	Arms
Elevator		
Rudder		
Ailerons		

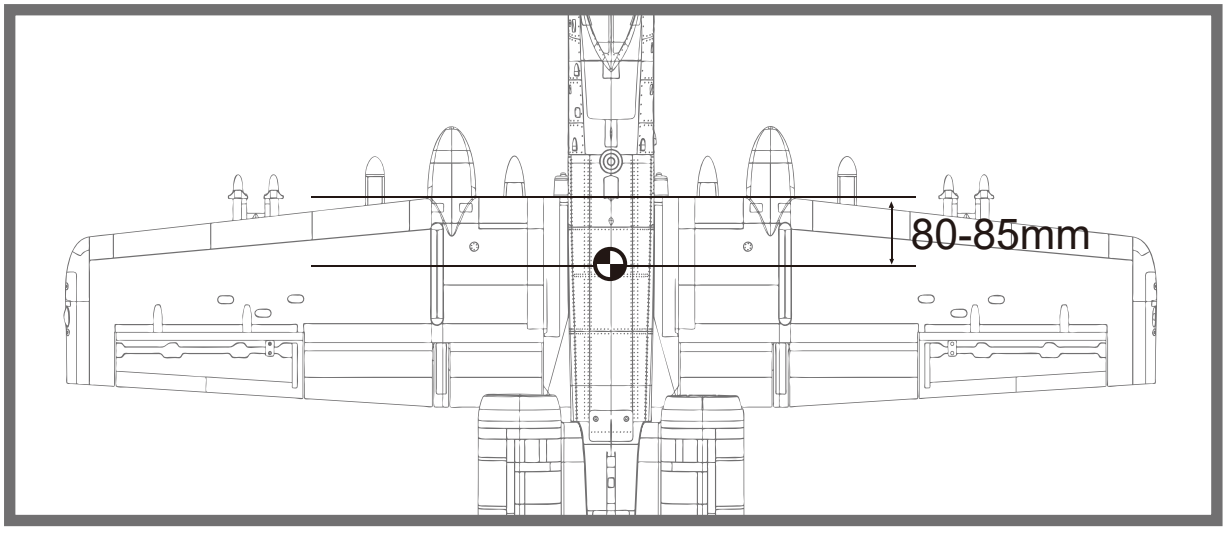
More control throw

Less control throw


Check the C.G. (Center of Gravity)

When balancing your model, adjust the motor battery as necessary so the model is level or slightly nose down. This is the correct balance point for your model. After the first flights, the CG position can be adjusted for your personal preference.

1. The recommended Center of Gravity (CG) location for your model is (80-85mm) from the leading edge of the main wing (as shown) with the battery pack installed. Mark the location of the CG on top of the wing.

2. When balancing your model, support the plane at the marks made on the bottom of the main wing with your fingers or a commercially available balancing stand. This is the correct balance point for your model. Make sure the model is assembled and ready for flight before balancing.



Before flying the model

Find a suitable flying site

Find a flying site clear of buildings, trees, power lines and other obstructions. Until you know how much area will be required and have mastered flying your plane in confined spaces, choose a site which is at least the size of two to three football fields - a flying field specifically for R/C planes is best. Never fly near people - especially children, who can wander unpredictably.

Perform the range check for your plane

As a precaution, an operational ground range test should be performed before the first flight each time you go out. Performing a range test is a good way to detect problems that could cause loss of control such as low batteries, defective or damaged radio components, or radio interference. This usually requires an assistant and should be done at the actual flying site you will be using.

First turn on the transmitter, then install a fully-charged battery into the fuselage. Connect the battery and install the hatch.

Remember, use care not to bump the throttle stick. Otherwise, the propeller/fan will turn and possibly cause damage or injury.

Note: Please refer to your Transmitter Manual that came with your radio control system to perform a ground range check. If the controls are not working correctly or if anything seems wrong, do not fly the model until you correct the problem. Make certain all the servo wires are securely connected to the receiver and the transmitter batteries have a good connection.

Monitor your flight time

Monitor and limit your flight time using a timer (such as on a wristwatch or in your transmitter if available). When the batteries are getting low you will usually notice a performance drop before the ESC cuts off motor power, so when the plane starts flying slower you should land. Often (but not always) power can be briefly restored after the motor cuts off by holding the throttle stick all the way down for a few seconds.
To avoid an unexpected dead-stick landing on your first flight, set your timer to a conservative 4 minutes. When your alarm sounds you should land right away.

Flying Course

Take off

While applying power, slowly steer to keep the model straight. The model should accelerate quickly. As the model gains flight speed you will want to climb at a steady and even rate. It will climb out at a nice angle of attack (AOA).

Flying

Always choose a wide-open space for flying your plane. It is ideal for you to fly at a sanctioned flying field. If you are not flying at an approved site always avoid flying near houses, trees, wires and buildings. You should also be careful to avoid flying in areas where there are many people, such as busy parks, schoolyards, or soccer fields. Consult laws and ordinances before choosing a location to fly your aircraft. After takeoff, gain some altitude. Climb to a safe height before trying technical manoeuvres, including high speed passes, inverted flight, loops, and point rolls.

Landing

Land the model when you hear the motor pulsing (LVC) or if you notice a reduction in power. If using a transmitter with a timer, set the timer so you have enough flight time to make several landing approaches.
Recharge the battery and repair the model as needed .The model's three point landing gear allows the model to land on hard surfaces. Align model directly into the wind and fly down to the ground. Fly the airplane down to the ground using 1/4-1/3 throttle to keep enough energy for proper flare. Before the model touches down, always fully decrease the throttle to avoid damaging the propeller or other components. The key to a great landing is to manage the power and elevator all the way to the ground and set down lightly on the main landing gear. After a few flights you will find the model can be set down lightly on the mains and you can hold the nose wheel off balancing the model on the mains until it slows and gently settles the nose.

Maintenance

Repairs to the foam should be made with foam safe adhesives such as hot glue, foam safe CA, and 5min epoxy. When parts are not repairable, see the Spare Parts List for ordering by item number.
Always check to make sure all screws on the aircraft are tightened. Pay special attention to make sure the spinner is firmly in place before every flight.

Troubleshooting

Problem	Possible Cause	Solution
Aircraft will not respond to the throttle but responds to other controls.	- ESC is not armed. - Throttle channel is reversed.	- Lower throttle stick and throttle trim to lowest settings. - Reverse throttle channel on transmitter.
Extra propeller noise or extra vibration.	- Damaged spinner, propeller, motor, or motor mount. - Loose propeller and spinner parts. - Propellor installed backwards.	- Replace damaged parts. - Tighten parts for propeller adapter, propeller and spinner.
Reduced flight time or aircraft underpowered.	- Flight battery charge is low. - Propeller installed backward. - Flight battery damaged.	- Remove and install propeller correctly. - Completely recharge flight battery. - Replace flight battery and follow flight battery instructions.
Control surface does not move, or is slow to respond to control inputs.	- Control surface, control horn, linkage or servo damage. - Wire damaged or connections loose.	- Replace or repair damaged parts and adjust controls. - Do a check of connections for loose wiring.
Controls reversed.	Channels are reversed in the transmitter.	Do the Control Direction Test and adjust controls for aircraft and transmitter.
- Motor loses power. - Motor power pulses then motor loses power.	- Damage to motor, or battery. - Loss of power to aircraft. - ESC uses default soft Low Voltage Cutoff(LVC).	- Do a check of batteries, transmitter, receiver, ESC, motor and wiring for damage (replace as needed). - Land aircraft immediately and recharge flight battery.
LED on receiver flashes slowly.	Power loss to receiver.	- Check connection from ESC to receiver. - Check servos for damage. - Check linkages for binding.

Spare parts list content

FMSPV101	Fuselage
FMSPV102	Main Wing Set
FMSPV103	Vertical Stabilizer
FMSPV104	Horizontal Stabilizer
FMSPV105	Cockpit
FMSPV106	Bomb and Missile Set
FMSPV107	Twin Engine Compartment
FMSPV108	Foam part (Laser racker)
FMSPV109	Foam part (fin)
FMSPV110	Scale Plastic Parts Set
FMSPV111	Control Horns
FMSPV112	Linkage Rod
FMSPV113	Screw Set
FMSPV114	LED
FMSPV115	Front Landing Gear Set
FMSPV116	Main Landing Gear Set
FMSPV117	Front Landing Gear System
FMSPV118	Main Landing Gear System
FMSPV119	Pipe
FMSPV120	Front Landing Gear Door
FMSPV121	Wheel Set
FMSPV122	Decal Sheet
FMSCON003	Multi Connector System
FMSRE027	E-retract
FMSDF12B70	Ducted fan (12-blade)
PRKV1850	2860-KV1850 motor
PRESC012-1	70A ESC×2
FMSSER9MGDP	9g digital metal gear servo positive
FMSSER9MGDR	9g digital metal gear servo reverse
FMSSER17MGD	17g digital metal gear servo

Visit our website to see photos of this product: www.fmsmodel.com

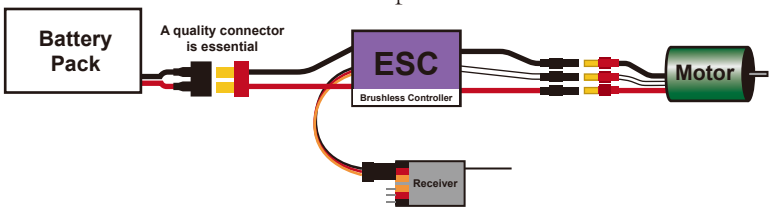
ESC instruction

Wires Connection:

The electronic speed controller can be connected to the motor by soldering directly, or with high quality connectors.
Always use new connectors, which should be soldered carefully to the cables and insulated with heat shrink tubes.
The maximum length of the battery pack wires should be within 6 inches.

- Solder controller to the motor wires.
- Solder appropriate connectors to the battery wires.
- Insulate all solder connectors with heat shrink tubes.
- Plug the "JR" connector into the receiver throttle channel.
- Speed Controller Red and Black wires connect to battery pack Red and Black wires respectively.

Brushless Speed Controller



Model#	Cont. Current(A)	Burst Current(A)10s	Battery cell NiXX/Lipo	Weight(g)	BEC Output	Size(mm) W*L*H	User Program
6A	6A	8A	5-10 NC \ 2-3 Lipo	5	5volts / 2amps	13 x 21 x 4	yes
12A	12A	16A	5-12 NC \ 2-4 Lipo	8	5volts / 1amps	21 x 22 x 4	yes
20A	20A	30A	5-12 NC \ 2-4 Lipo	18	5volts / 3amps	13 x 21 x 4	yes
30A	30A	40A	5-12 NC \ 2-4 Lipo	30	5volts / 3amps	23 x 43 x 6	yes
35A	35A	45A	5-12NC \ 2-4 Lipo	47	5volts / 4amps	28 x 38 x 8	yes
40A	40A	50A	5-12 NC \ 2-4 Lipo	44	5volts / 3amps	28 x 38 x 8	yes
45A	45A	55A	5-12 NC \ 2-4 Lipo	42	5volts / 3amps	31 x 58 x11	yes
50A	50A	70A	5-18NC \ 2-6 Lipo	45	5.5volts / 5amps	31 x 58 x 11	yes
60A	60A	70A	5-12NC \ 2-4Lipo	50	5.5volts / 3amps	36 x 50 x 8	yes
65A	65A	85A	5-18NC \ 2-6Lipo	58	5.5volts / 5amps	30 x 56 x 11	yes
70A	70A	75A	5-12NC \ 2-6 Lipo	56	5.5volts / 5amps	34 x 52 x 14	yes
85A	85A	100A	5-18NC \ 2-6Lipo	63	5.5volts / 5amps	34 x 52 x 14	yes

Features:

- Extremely low internal resistance
- Super smooth and accurate throttle linearity
- Safety thermal over-load protection
- Auto throttle shut down in signal loss situation
- Supports high RPM motors
- Power arming protection (prevents the motor from accidentally running when switched ON)
- New advanced programming software

Our ESC allows you to program parameters to fit your specific needs:

1. User programmable brake setting (we recommend using brake for only folding props applications)
2. User programmable battery type (LiPo or NiCd/NiMh)
3. User programmable low voltage cutoff setting
4. User programmable factory default setting restore
5. User programmable timing settings (to enhance ESC efficiency and smoothness)
6. User programmable soft acceleration start ups (for delicate gearbox and helicopter applications)
7. User programmable governor mode (for helicopter applications)
8. User programmable motor rotation (clockwise\counterclockwise)
9. User programmable switching frequency
10. User programmable low voltage cutoff type (power reduction or immediate shutdown)

Settings:

1. Brake: ON/OFF

* ON-Sets the propeller to the brake position when the throttle stick is at the minimum position (Recommended for folding props).
* OFF-Sets the propeller to freewheel when the throttle stick is at the minimum position.

2. Battery type: LiPo or NiCad/NiMh

* NiCad/NiMh – Sets Low Voltage protection threshold for NiCad/NiMh cells.
* LiPo – Sets Low voltage protection threshold for LiPo cells and automatically detects the number of cells within the pack.

Note: Selecting the NiCad/NiMh option for the battery type, triggers the ESC to automatically set the cutoff threshold to the factory default of 65%. The cutoff threshold can then be subsequently altered through the Low Voltage protection function, if required. The ESC will read the initial voltage of the NiCad/NiMh pack once it is plugged in and the voltage read will then be used as a reference for the cutoff voltage threshold.

3. Low Voltage Protection Threshold (Cutoff Threshold):

Low / Medium / High

1) For Li-xx packs- number of cells are automatically calculated and requires no user input apart from defining the battery type. This ESC provides 3 setting options for the low voltage protection threshold; Low (2.8V)/ Medium (3.0V)/ High (3.2V). For example: the voltage cutoff options for an 11.1V/ 3 cell Li-Po pack would be 8.4V (Low)/ 9.0V (Med)/ 9.6V (High)

2) For Ni-xx packs-low / medium / high cutoff voltages are 50%/65%/65% of the initial voltage of the battery pack. For example: A fully charged 6 cell NiMh pack's voltage is 1.44V x 6=8.64V,when "LOW" cutoff voltage is set, the cutoff voltage is: 8.64V x 50%=4.3V and when "Medium" or "High" is set, the cutoff voltage is now 8.64V X 65%=5.61V.

4. Restore factory setup defaults:

Restore - Sets the ESC back to factory default settings;

Brake:	Off
Battery type Detect:	LiPo with Automatic Cell
Low voltage cutoff threshold:	Medium (3.0V/65%)
Timing setup:	Automatic
Soft Acceleration Start Up:	Medium
Governor mode:	OFF
Frequency:	16kHz
Low voltage cutoff type:	Reduce power

5. Timing setup: Automatic / Low / High.
* Automatic – ESC automatically determines the optimum motor timing
* Low (7-22 deg) – Setting for most 2 pole motors.
* High (22-30 deg)-setting for motors with 6 or more poles.

In most cases, automatic timing works well for all types of motors. However for high efficiency we recommend the Low timing setting for 2 pole motors (general in-runners) and high timing for 6 poles and above (general outrunners). For higher speed, High timing can be set. Some motors require different timing setups therefore we suggest you follow the manufacturer recommended setup or use the automatic timing setting if you are unsure.
Note: Run your motor on the ground first after making any changes to your motor timing!

6. Soft Acceleration Start ups: Very Soft / Soft Acceleration/ Start Acceleration
* Very Soft – Provides initial slow 1.5 sec ramp-up from start to full rpm intended to protect delicate gears from stripping under instant load. This setting is recommended for either fixed wing models equipped with gearboxes and / or helicopters.
* Soft Acceleration- Provides initial slow 1 sec ramp-up from start to full rpm. This setting is recommended for either fixed wing models equipped with gearboxes and or helicopters.
* Start Acceleration – Provides quick acceleration start ups with a linear throttle response. This is recommended for fixed wing models fitted with direct drive setups.

7. Active RPM Control (Heli Governor Mode)
* RPM control off
* First range: There will be a 5-second delay from start to full rpm, but if the throttle is cutoff after starting, then the next start will be as normal start.
* Second range: There will be a 15-second delay from start to full rpm, but if the throttle is cutoff after starting, then the next start will be as normal start.

Note: Once the Governor Mode is enabled, the ESC's Brake and Low Voltage Cutoff Type settings will automatically be reset to No Brake and Reduce Power respectively regardless of what settings they were previously set.

8. Motor Rotation: Reverse
In most cases motor rotation is usually reversed by swapping two motor wires. However, in cases where the motor cables have been directly soldered to the ESC cables, motor rotation can be reversed by changing the value of setting on the ESC.

9. Switching Frequency: 8 kHz/16kHz
* 8 kHz – Sets ESC switching frequency for 2 pole motors, e.g. in-runners.
* 16 kHz – Sets ESC switching frequency for motors with more than 2 poles, e.g. out-runners.

Although 16 kHz is more efficient with our Thrust motors, the setup
default is 8 kHz due to the higher RF noises caused at 16 kHz.

10. Low Voltage Cutoff Type: Reduce Power / Hard cutoff
* Reduce Power – ESC reduces motor power when the pre-set (recommended).
* Hard Cutoff – ESC instantly cuts motor power when the pre-set Low Voltage Protection Threshold value is reached.

Programming Mode Audible Tones

Programming Mode Audible Tones

Programming Mode Audible Tones	ESC Functions
0 Throttle Calibration (within the first 4 Sec) ● ● ● ●	
1 Brake	
_ * _ * _ * _ *	Brake On /Off
2 Battery type	
~ ~ ~ ~	NiCad
~~ ~~ ~~ ~~	LiPo
3 Low Voltage Cutoff Threshold	
* _ * * _ * * _ * * _ *	Low2.8V/50%
* _ _ _ * * _ _ _ * * _ _ _ *	Medium3.0V/60%
* _ _ _ _ * * _ _ _ _ * * _ _ _ _ * * _ _ _ _ *	High3.2V/65%
4 Restore Factory Setup Defaults	
— — — —	Restore
5 Timing Setup	
_ _ _ _	Automatic (7-30°)
_ _ _ _ _ _ _ _	Low (7-22°)
_ _ _ _ _ _ _ _ _ _ _ _	High (22-30°)
6 Soft Acceleration Start Ups	
V V V V V V V V	Very Soft
V V V V	Soft Acceleration
V V V V V V V V V V V V	Start Acceleration
7 Governor Mode	
* * * *	Rpm off
** ** ** **	Heli first range
*** *** *** ***	Heli second range
8 Motor Rotation	
W W W W	Positive/Reverse
9 Switching Frequency	
// // // //	8kHz
\\ \\ \\ \\	16kHz
10 Low Voltage Cutoff Type	
_ _ _	Reduce Power
_ _ _ _ _ _ _ _	Hard Cut Off

Using Your New ESC

Improper polarity or short circuit will damage the ESC therefore it is your responsibility to double check all plugs for proper polarity and firm fit BEFORE connecting the battery pack.

Alert Tones

The ESC is equipped with audible alert tones to indicate abnormal conditions at power up.

If the ESC can't enter into working mode after powering up, it indicates that you have not setup throttle calibration.

1. Continuous beeping tone (****) – Indicates that throttle stick is not in the minimum position.
2. Single beeping tone followed by a one second pause (* * * *) – Indicates that the battery pack voltage is not within the acceptable range. (The ESC automatically checks and verifies the battery voltage once the battery is connected).
3. A single beeping tone followed by a short pause (* * * *) – Indicates that the ESC is unable to detect the normal throttle signal from the receiver.

Built-in Intelligent ESC Safety Functions

1. Over-heat protection: When the temperature of ESC exceeds 110 deg C, the ESC will reduce the output power to allow it too cool.
2. Lost Throttle signal protection: The ESC will automatically reduces output power to the motor when it detects a lost of throttle signal for 2 second, a subsequent loss of throttle signal beyond 2 seconds, will cause the ESC automatically to cut power to the motor.

Powering up the ESC for the first time and setting the Automatic Throttle Calibration

The ZTW ESC features Automatic Throttle Calibration to attain the smoothest throttle response and resolution throughout the entire throttle range of your transmitter. This step is done once to allow the ESC to “learn and memorize” your Transmitter’s throttle output signals and only repeated if you change your transmitter.

1. Switch your Transmitter ON and set the throttle stick to its maximum position.
2. Connect the battery pack to the ESC. Wait for about 2 seconds, the motor will beep for twice, then put the throttle in the minimum position, the motor will also beep, which indicates that your ESC has got the signal range of the throttle from your transmitter.

The throttle is now calibrated and your ESC is ready for operation.

Normal ESC start up procedure:

1.Switch your Transmitter **ON** and set the throttle to its **minimum** position.
2.Connect the battery pack to the ESC.
3.When the ESC is first powered up, it emits two sets of audible tones in succession indicating the status of its programming state.
 * The first set of tones denotes the number of cells in the LiPo pack connected to the ESC. (Three beeps (***) indicates a 3 cell LiPo pack while 4 beeps (****) indicates a 4 cell LiPo pack).
 * The second set denoting Brake status. One beep (*) for Brake “ON” and two beeps (**) for Brake “OFF”.
 *The ESC is now ready for use.

Entering the Programming Mode:

1.Switch your Transmitter **ON** and set the throttle to its **maximum** position.
2.Connect the battery pack to the ESC.
3.Wait until you hear two short beeps (_ _**) confirming that the ESC has now entered the program ming mode.
4.If within 5 seconds, the throttle stick is lowered to its **minimum** position, an audible tone is emitted confirming that the throttle calibration setting has changed. If the throttle stick is left in the **maximum** position beyond 5 seconds, the ESC will begin the sequence from one function and its associated setting options to another. (Please refer to the table below to cross reference the functions with the audible tones).
5.When the desired tone for the function and setting option is reached, move the throttle stick down to its **minimum** position. ESC will emit two beeps (**) confirming the new setting has been stored.
6.The ESC only allows the setting of one function at a time.
 Therefore should you require making changes to other function, disconnect the battery pack and wait 5 seconds to reconnect the battery and repeat the above steps.

General Safety Precautions

Do not install the propeller (fixed wing) or drive pinion (helicopter) on the motor when you test the ESC and motor for the first time to verify the correct settings on your radio. Only install your propeller or pinion after you have confirmed that the settings on your radio is correct.

●Never use ruptured or punctured battery cells.
●Never use battery packs that are known to overheat.
●Never short circuit battery or motor terminals.
●Always use proper insulation material for cable insulation.
●Always use proper cable connectors.
●Do not exceed the number of cells or servos specified by the ESC.

Wrong battery polarity will damage the ESC and void the warranty.

●Install the ESC in a suitable location with adequate ventilation for cooling. This ESC has a built-in over heat cutoff protection feature that will immediately cut power to the motor once the ESC temperature exceeds the 230 Deg F/ 110 Deg C high temperature limit.
●Use only batteries that are supported by the ESC and ensure the correct polarity before connecting.
●Switch your Transmitter ON and ensure the throttle stick is in the minimum position before connecting the battery pack.
●Never switch your transmitter **OFF** while the battery is connected to your ESC.
●Only connect your battery pack just before flying and do not leave your battery pack connected after flying.
●Handle your model with extreme care once the battery pack is connected and keep away from the propeller at all times. Never stand in-line or directly in front of any rotating parts.
●Do not immerse the ESC underwater while powered up.
●Do fly at a designated flying site and abide by the rules and guidelines set by your flying club.

Issue	Possible Reason	Action
Motor doesn't work, but there are audible tones of automatically detection of the number of cells after powering up ESC.	The ESC throttle calibration has not set up.	Set up the ESC throttle calibration.
Motor doesn't work and no audible tone emitted after connecting the battery. Servos are not working either.	Poor/loose Connection between battery Pack and ESC.	Clean connector terminals or replace connector.
	No power	Replace with a freshly charged battery pack.
	Poor soldered connections (dry joints)	Re-solder the cable connections.
	Wrong battery cable polarity	Check and verify cable polarity.
	ESC throttle cable connected to receiver in the reverse polarity	Check the ESC cable connected to the ESC to ensure the
	Faulty ESC	Replace ESC
Motor doesn't work and no audible tone emitted after connecting the battery BUT servos are working. Motor doesn't work after powering up the ESC. An alert tone with two beeping bones followed by a short pause (** ** ** **) is emitted.	Poor / loose connection between ESC and motor	Clean connector terminals or replace connectors
	Burnt motor coils	Replace motor
	Poor soldered connections(dry joints) The battery pack voltage is not within the acceptable range.	Re-solder the cable connections Replace with a freshly charged battery pack Check battery pack voltage

Motor doesn't work after powering up the ESC. An alert tone with a single beeping tone followed by a short pause (* * * *) is emitted.	The ESC is unable to detect the normal throttle signal from the receiver	Check and verify that the ESC cable is connected to the Throttle channel on the receiver. Check the transmitter and receiver to verify that there is throttle signal output. (Connect a spare servo to verify throttle channel operation)
Motor doesn't work after powering up the ESC .An alert tone with continuous beeping tones (****) is emitted.	The throttle stick is not in the minimum position at power up.	Move the throttle stick to the minimum position.
Motor doesn't work after powering up the ESC. ESC emits two long audible tones followed by two short beeps(_ _ * *)	Reversed throttle channel caused the ESC to enter the programming mode.	Enter the servo reverse menu on your transmitter and reverse the throttle channel. Note: For Futaba radios set the throttle channel to Reverse.
Motor runs in reverse rotation Motor stops running in flight.	Wrong cables polarity between the ESC and the motor.	Swap any two of the three cable connections between the ESC and the Motor or access the Motor Rotation function via the ESC programming mode and change the pre-set parameters.
	Lost throttle signal	Check proper operation of the radio equipment. Check the placement of the ESC and the Receiver and check the route of the receiver's aerial and ESC cables to ensure there is adequate separation to prevent RF interference. Install a ferrite ring on the ESC's throttle cable.
Motor stop running.	Battery Pack voltage has reached the Low Voltage Protection threshold.	Land the model immediately and replace the battery pack.
	Possible bad cable connection	Check and verify the integrity of the cable connections
Motor restarts abnormally ESC Overheats	Possible RF Interference at the flying field.	The normal operation of the ESC may be susceptible to surrounding RF interference. Restart the ESC to resume normal operation on the ground to verify recurrence. If the problem persists, test the operation of the ESC at a different flying field.
	Inadequate Ventilation	Relocate the ESC to allow better ventilation
	Servos drawing too much current and over loading the ESC.	Use servos that are adequately sized for the ESC. The maximum BEC current drawn should be within the BEC limits.
	Over sized motor or prop	Prop down or resize the motor

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