Futaba®

Brushless Electronic Speed controller for helicopter/airplane

Designed for 450-500 Class helicopter

MC-980H/A Instruction manual

NOTE: Always read this manual before using the MC-980H/A ESC.

Before using the MC-980H/A

* Improper handling of the LiPo battery is extremely dangerous. Use the battery in accordance with the instruction manual supplied with it.
* Some commercial motors may not match advance timing adjustment, etc. of the MC-980H/A.
* Always solder the MC-980H/A battery connection cord to a connector matched to the battery used. Do not use the ESC in a temporarily connected state.

Mounting precautions

⚠WARNING

❗ **Always use the MC-980H/A within the operating conditions range given in the specifications.**

❗ **Be sure that the battery polarity is correct.**
Reverse connection will cause sparking and immediate destruction or burning inside the ESC.

🚫 **Never short circuit even places where there is no battery, motor, receiver, or connector.**
Short circuits will cause sparking and immediate destruction or burning inside the ESC.
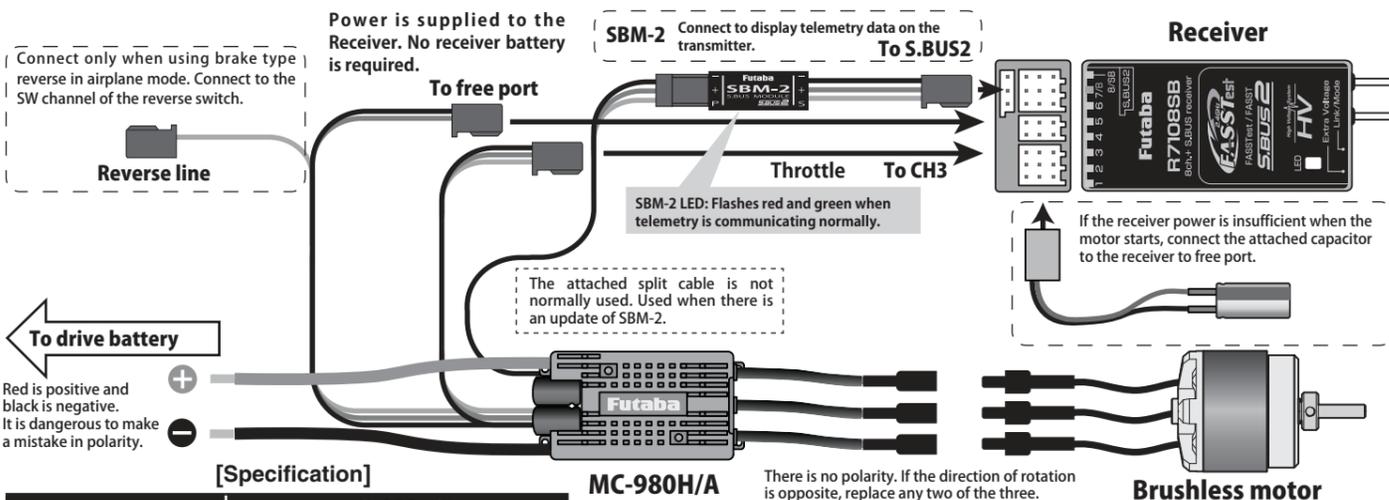Mount the ESC so that the soldered part of the cord does not touch conductive parts.

❗ **Mount the receiver and receiver antenna away from the MC-980H/A, motor cord, power cord, drive battery and other parts through which a large current flows.**
If the receiver is overwhelmed by noise, control will be lost and can be extremely dangerous.

❗ **Insert the connectors fully.**
If a connector works loose due to vibration, control will be lost and is extremely dangerous.

❗ **Mount the MC-980H/A where it will not be exposed to oil, grease, and water.**

❗ **Mount the MC-980H/A to the fuselage where there is an ample flow of cool air.**

🚫 **Do not wrap the MC-980H/A body in aluminum foil.**
Such wrapping will cause a loss of cooling effect and the specified performances will not be obtained.

❗ **Install the motor securely. Also secure all the cables.**

⚠CAUTION

🚫 **Do not disassemble the ESC. Do not open the case of the product.**
Opening the case will damage the interior. In addition, repair will become impossible.

Operating precautions

⚠WARNING

❗ **Be careful that no part of your body touches parts that rotate during operation.**
Unexpected rotation may cause serious injury.
Depending on the receiver, the motor may rotate the instant the power is turned on.

🚫 **Do not fly in rainy weather.**
If water drops enter the ESC, control will be lost due to erroneous operation and is extremely dangerous. It may also cause an accident. If the ESC operates erroneously due to the entry of water, repair and inspect it.

❗ **Always turn the power switches ON and OFF in the following order:**
ON: Set the throttle stick to the stop position and turn on the power switches in transmitter → receiver order.

OFF: Set the throttle stick to the stop position and turn off the power switches in receiver → transmitter order.
If performed in reverse, the propeller may rotate unexpectedly and is extremely dangerous.

❗ **Always remove the battery when not using the ESC.**
If the switch is turned on erroneously, the propeller will rotate unexpectedly or a fire may start.

❗ **Before flying, check operation of the ESC and all the control surfaces.**
When not set properly and when a different model is selected, control will be lost and is extremely dangerous.
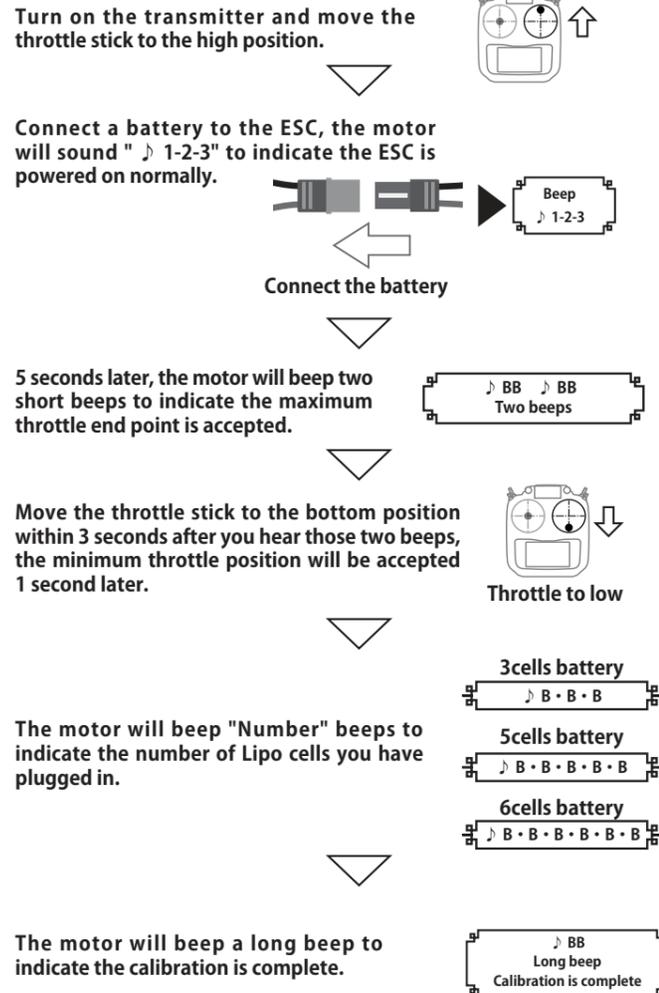
⚠CAUTION

🚫 **Do not touch the motor and ESC immediately after flight.**
It will cause a burn.

■ Connections

Connect only when using brake type reverse in airplane mode. Connect to the SW channel of the reverse switch.

Reverse line

Power is supplied to the Receiver. No receiver battery is required.
To free port

SBM-2 Connect to display telemetry data on the transmitter.
To S.BUS2

Receiver

SBM-2 LED: Flashes red and green when telemetry is communicating normally.

Throttle   To CH3

The attached split cable is not normally used. Used when there is an update of SBM-2.

If the receiver power is insufficient when the motor starts, connect the attached capacitor to the receiver to free port.

To drive battery

Red is positive and black is negative. It is dangerous to make a mistake in polarity.

MC-980H/A

There is no polarity. If the direction of rotation is opposite, replace any two of the three.

Brushless motor

If the temperature becomes high, attach the attached fan with two screws as shown in the figure after the ESC has cooled down for bettercooling performance in future flights.

When using SBM-2, connect to a free port of Receiver

[Specification]

	MC-980H/A
Function	Auto recognition of cell
Peak current	80 A
Size	84.3 x 38.2 x 20.4 mm
Weight	96.5 g
Cell	LiPo 3~6 cells 11.1 ～ 22.2 V
BEC	5~8 V / 10 A

⚠ **Reverse the throttle channel (CH3) of the Futaba transmitter.**
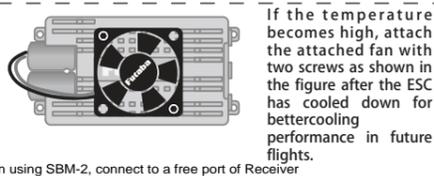
ESC/Transmitter Calibration

Perform this calibration when using for the first time or when changing transmitter. Let the ESC read the operating range of throttle.

⚠ Before calibration, set the throttle curve of the transmitter to a straight line of -100% to 100%, and set all throttle-related mixing to INH. Make sure that the throttle amount corresponding to the maximum throttle endpoint and the minimum throttle endpoint of the transmitter is 100% and 0%, respectively.

Turn on the transmitter and move the throttle stick to the high position.

Connect a battery to the ESC, the motor will sound " ♪ 1-2-3" to indicate the ESC is powered on normally.

Beep ♪ 1-2-3

Connect the battery

5 seconds later, the motor will beep two short beeps to indicate the maximum throttle end point is accepted.

♪ BB ♪ BB
Two beeps

Move the throttle stick to the bottom position within 3 seconds after you hear those two beeps, the minimum throttle position will be accepted 1 second later.

Throttle to low

The motor will beep "Number" beeps to indicate the number of Lipo cells you have plugged in.

3cells battery ♪ B·B·B
5cells battery ♪ B·B·B·B·B
6cells battery ♪ B·B·B·B·B·B

The motor will beep a long beep to indicate the calibration is complete.

♪ BB
Long beep
Calibration is complete

Precautions about Battery F/S

The BEC voltage (voltage supplied to the receiver) of this ESC is output at about 5.0 V for a few seconds at startup, and then the BEC voltage set by the user is output. Therefore, if the battery fail-safe voltage of the FASSTest and T-FHSS Air receiver is set to 5.0 V or higher, the Battery F/S function works even though the battery is sufficient.

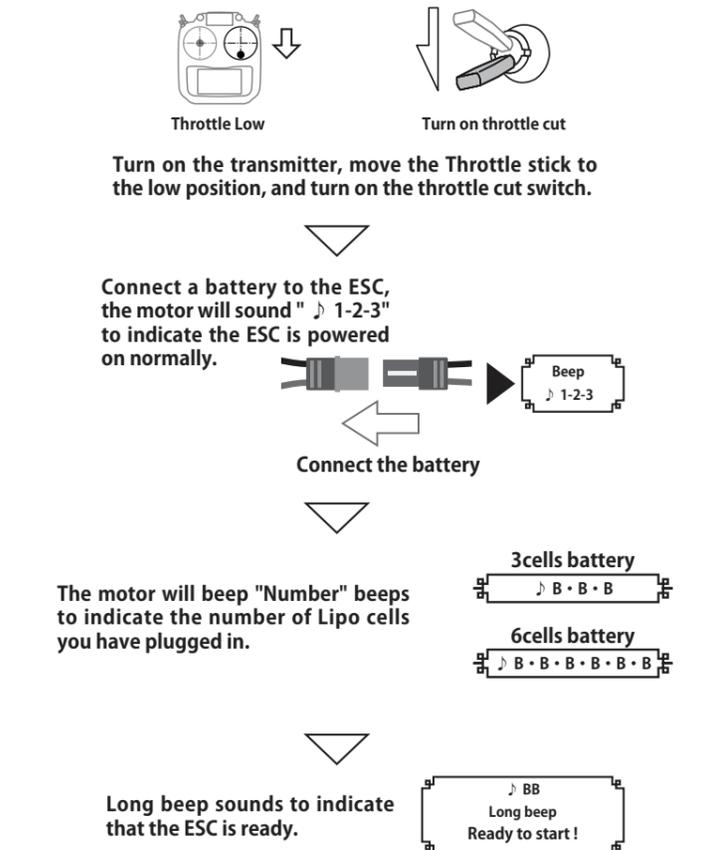* The battery fail-safe voltage of FASST and S-FHSS receivers is fixed at 3.8 V, so there is no problem.

When using with FASSTest or T-FHSS Air, make one of the following settings.
1. Reduce the battery fail-safe voltage to 4.8 V or less.
2. Turn off the battery fail-safe setting.

* As a method of monitoring the battery voltage, check the voltage of the receiver with a telemetry alarm.

Start-up procedure

If you are in governor mode on a helicopter or use the brakes on an airplane, set the throttle cut switch on the transmitter. Be sure to connect the drive battery in the throttle cut state. Release the throttle cut at the start. After landing, stop the motor with a throttle cut and then remove the battery.

Throttle Low   **Turn on throttle cut**

Turn on the transmitter, move the Throttle stick to the low position, and turn on the throttle cut switch.

Connect a battery to the ESC, the motor will sound " ♪ 1-2-3" to indicate the ESC is powered on normally.

Beep ♪ 1-2-3

Connect the battery

The motor will beep "Number" beeps to indicate the number of Lipo cells you have plugged in.

3cells battery ♪ B·B·B
6cells battery ♪ B·B·B·B·B·B

Long beep sounds to indicate that the ESC is ready.
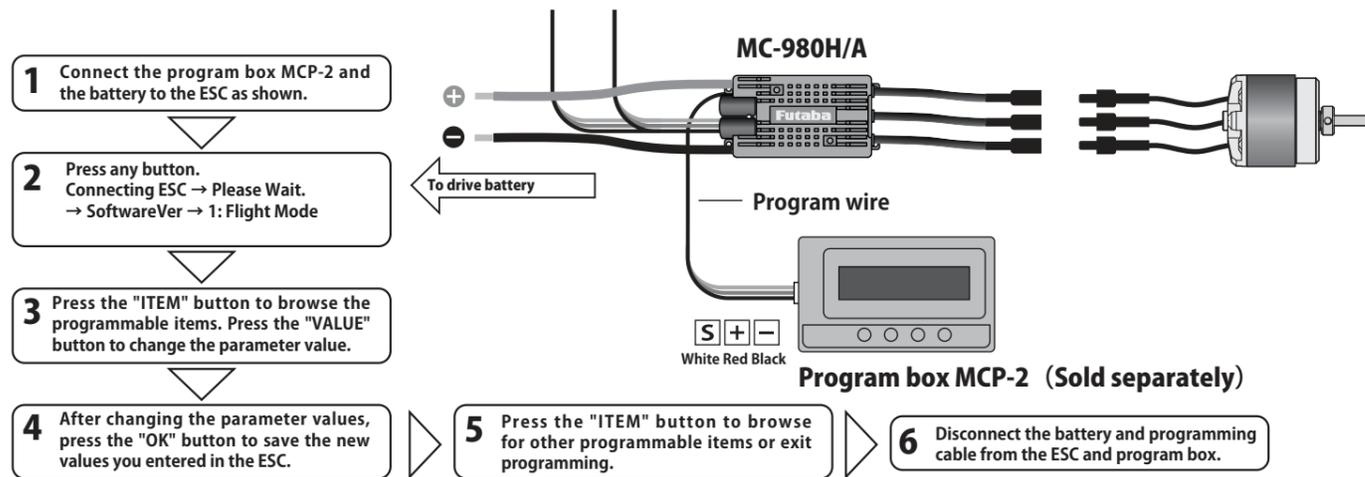
♪ BB
Long beep
Ready to start !

Alarm

1.Power-on Abnormal Voltage Protection：
The ESC will measure the input voltage when it's connected to a battery or power supply. If the input voltage is not within the regulated range, it will take the voltage as an abnormal voltage and then activate the protection, flash Red LED and beep a series of beeps.

2.Throttle Signal Loss Protection：
When the ESC detects loss of signal for over 0.25 second, it will cut off the output immediately to avoid an even greater loss which may be caused by the continuous high-speed rotation of propeller. The ESC will resume the corresponding output after normal signals are received.

3.Throttle stick is not at the bottom position：
The motor will beep "B-B-B-B-" when the throttle stick is not moved to the bottom position.

4.Throttle range is too narrow：
The motor will beep "B-B-B-B-" when the throttle range you set is too narrow (when designing this ESC, it requires that the entire throttle range you set cannot be less than 50% of the whole throttle range available on the transmitter.) The warning tone indicates the throttle range you set is void and you need to set it again.

Flight Mode

	Mode		
🚁	Heli ElfGov : ELF Governor	Use batteries with different numbers of cells	RPM standardization starts every time
🚁	Heli StoGov : Store Governor	Recommended mode for using heli governor	RPM standardization only for the first time
✈	Fixed-wing : Air plane		
✈	Ext.Gov : Linear throttle（No Governor）	Throttle curve needs to be set	

ESC Programming

MC-980H/A

1 Connect the program box MCP-2 and the battery to the ESC as shown.

2 Press any button.
Connecting ESC → Please Wait.
→ SoftwareVer → 1: Flight Mode

To drive battery

Program wire

3 Press the "ITEM" button to browse the programmable items. Press the "VALUE" button to change the parameter value.

Program box MCP-2 （Sold separately）

White Red Black

4 After changing the parameter values, press the "OK" button to save the new values you entered in the ESC.

5 Press the "ITEM" button to browse for other programmable items or exit programming.

6 Disconnect the battery and programming cable from the ESC and program box.

ESC has four flight modes. See the table below to see what is programmable in each mode.

Flight Mode	Air plane	Helicopter		
		Linear Throttle	Elf Governor	Store Governor
LiPo Cells	Adjustable	Adjustable	Adjustable	Adjustable
Cutoff Type	Adjustable	Adjustable	Adjustable	Adjustable
Cutoff Volt	Adjustable	Adjustable	Adjustable	Adjustable
BEC Voltage	Adjustable	Adjustable	Adjustable	Adjustable
Start-up Time	Adjustable	Adjustable when soft start is enabled / disabled	Adjustable	Adjustable
Gov Param P	—	—	Adjustable	Adjustable
Gov Param I	—	—	Adjustable	Adjustable
AR time Autorotation restart time	—	—	Adjustable	Adjustable
Restart Accel Restart acceleration time	—	—	Adjustable	Adjustable
Brake Type	Adjustable	—	—	—
Brake Force	Adjustable	—	—	—
Timing	Adjustable	Adjustable	Adjustable	Adjustable
Motor Rotate	Adjustable	Adjustable	Adjustable	Adjustable
Active FW Regenerative brake	Adjustable	Adjustable	Valid (Not adjustable)	Valid (Not adjustable)
Startup Power	Adjustable	Adjustable	Adjustable	Adjustable

Program items

○：Default

ITEM	Setting items
1. Flight Mode	● Fixed-wing　Air plane ● Ext.Gov　Heli linear ○ Heli ElfGov　Elf Governor ● Heli StoGov　Store Governor
2. LiPo Cells	○ Auto Calc ● 3-6 cells
3. Cutoff Type	○ Soft Cutoff ● Hard Cutoff
4. Cutoff Volt	● Disabled ● 2.8 V~3.8 V (○ Default 3.0 V)
5. BEC Voltage	● 5 V~8 V　(○ Default 6.0V)
6. Start-up Time	● 0~21 (○ Default 11)
7. Gov Param P	● 0~9　(○ Default 4)
8. Gov Param I	● 0~9　(○ Default 5)
9. AR time Autorotation restart time	● 0 s~90 s　(○ Default 25 s)
10. Restart Accel Restart acceleration time	● 1 s~3 s　(○ Default 1.5 s)
11. Brake Type	○ Disabled ● Normal ● Proportiona ● Reverse
12. Brake Force	● 0~100%　(○ Default 0%)
13. Timing	● 0°　~30°　(○ Default 15°　)
14. Motor Rotate	○ CW ● CCW
15. Active FW Regenerative brake	○ Enabled ● Disabled
16. Startup Power	● 1~7　(○ Default 3)
17. Restore Default	Press OK to reset to Default.

RPM standardization （When using a helicopter governor ）

1. Theory of RPM Standardization

During the RPM standardization, the ESC will establish a "Motor RPM-Throttle" curve by itself based on the actual battery voltage and the actual KV rating of the motor. Therefore, you need to standardize the speed with a fully-charged battery, and ensure the main blade pitch is 0° (in order to make the helicopter not take off). In general, people use the default "Throttle Curve & Pitch Curve" of the transmitter (as shown below) when they standardize the speed.

Attention! Please ensure the main blade pitch is 0° and the throttle amount is above 40% (we recommend using 50%) when standardizing the speed.

2. Procedures of RPM Standardization

• We recommend using the default "Throttle Curve & Pitch Curve". (If you don't want to use the default setting, then please ensure the throttle amount is 50%and the main blade pitch is 0° when the motor rotates.

• Turn on the transmitter, move the throttle stick to the bottom position and then wait for the ESC completing the self detection.

• If you've set the "throttle cut" function, please lock the "throttle cut", and then move the throttle stick to the 50% position and then unlock the "throttle cut". If there is no "throttle cut", then you can move the throttle stick to the 50% position directly.

• The ESC drives the motor to rotate, the main blades start to accelerate slowly (because the main blade pitch is 0°, so the helicopter won't take off, but you still needs to be careful), you need to wait for the acceleration completing and the speed getting stable, and then lock the "throttle cut" or move the throttle stick to the bottom position.

• The ESC will stop driving the motor, the main blades start to slow down and then stop rotating.

• he RPM standardization completes.

Attention! Please calibrate the throttle range before the RPM standardization. There will be no need if you've carried out the ESC/Radio Calibration when the first time you used this ESC or you didn't restore the settings to factory defaults after the calibration (changing the transmitter & receiver is an exception).

Program items

1. Flight Mode

1-1 Fixed-wing
In "Fixed-wing" mode, the motor will start up when the throttle amount reaches 5% or above. There is no soft start-up, the motor responds to the throttle increase rapidly.

1-2 Helicopter Linear Throttle
In "Helicopter (Linear Throttle)" mode, the motor will start up when the throttle amount reaches 5% and it will start up in a soft way with the throttle (from 0 to 100%) acceleration time is fixed to 3.5 seconds. It will accelerate to the RPM corresponds to the specific throttle amount at the fixed rate.

1-3 Helicopter Elf Governor
In "Helicopter (Elf Governor)" mode, the motor will start up when the throttle amount reaches 40% or above. And it will complete the speed standardization and enter the speed-governing operation in the preset start-up time. In this mode, the motor will standardize its speed every time it starts up. Due to different discharge rates/capabilities of different batteries, the RPM you standardize each time may be a little different. In consequence, at the same throttle amount, the RPM may be a bit different when using different batteries, but this won't affect the speed-governing effect.

1-4 Helicopter Store Governor
In "Helicopter (Store Governor)" mode, the motor will start up when the throttle amount reaches 40% or above. It will also start up in a very soft way. And it will also complete the speed standardization and enter the speed-governing operation in the preset start-up time. In this mode, the motor will only standardize its speed the first time when it starts up. When performing RPM standardization for the first time, we recommend using a fully-charged battery with good discharge capability. After the RPM standardization, change another battery to fly your aircraft. At the same throttle amount, the RPM should be the same as the RPM of the first flight. For consistent control feel, we recommend using this mode.

2. LiPo Cells
The ESC will automatically calculate the number of LiPo cells you have plugged in as per the "3.7V/Cell" rule if "Auto Calc." is selected. Or user can set this item manually.

3. Cutoff Type
The ESC will gradually reduce the output to 50% of the full power in 3 seconds after the voltage cutoff protection is activated, if soft mode is selected. It will immediately cut off all the output when hard mode is selected.

4. Cutoff Volt
2.8 V-3.8 V (custom), 3.0 V (default).

5. BEC Voltage BEC
5-8 V (adjustable), 0.1V (step), 6 V (default).

6. Start-up Time
0-21(adjustable), 11 (default). Note: It only functions in Helicopter Store Governor and Helicopter Elf Governor.

7. Gov Param P
Governor correction response proportional control adjustment. Increasing the value will improve the correction response. The correction when the rotation drops is faster, but the rotation speed becomes easier to hunting. In that case, lower the value.

8. Gov Param I
Governor correction response Integral control adjustment. Use this when you want to make further adjustments by adjusting the governor parameter p. Increasing the value will improve the correction response, but the number of revolutions will hunting. In that case, lower the value.

9. AR time Autorotation restart time
This is a function only for the governor. Throttle works in the range of 5% to 40%. The motor can be restarted quickly when the autorotation descent is interrupted. If you set the value to 10 seconds and want to instantly cancel the autorotation descent, turn off the HOLD switch and increase the throttle to 40%, and the motor will rotate immediately. (It will reach full power from rest in 1.5 seconds.) If the Throttle HOLD switch is turned on for 10 seconds or longer, this function will not work.

● If the autorotation landing is successful within 10 seconds, never turn off the hold switch before out of battery. If the hold switch is turned off, there is a danger that the motor will rotate at full speed in 1.5 seconds, which may cause an accident. For example, if the IDLE-UP switch is ON and the HOLD switch is turned OFF after landing, the blades of the main rotor will rotate at high speed, and there is a danger that the helicopter will suddenly surface or tip over.

● If this function is not used in governor mode, the motor will only start slowly even if the hold switch is turned off.

10. Restart Accel
1-3s (adjustable), 0.5s (step), 1.5s (default). This item controls the time the motor will cost to restart and accelerate to the full speed. (This function only effects in "Helicopter Governor Elf/Store" mode)

11. Brake Type
Proportional Brake： when the throttle range on the transmitter is between 20% and 100%, the corresponding ESC throttle output is between 0% and 100%.When the throttle range on the transmitter is between 20% and 0%, the corresponding brake force is between 0 and 100%

Reverse： Set the reverse switch (ON-OFF) on the transmitter. When the Reverse line is connected to that channel and the amount of operation exceeds 20%, the reverse function is activated. When the power of ESC is started, ESC will not start unless the reverse switch is OFF. When the reverse switch is turned on, the throttle stick is raised and the motor reverses linearly.

12. Brake Force
0-100% (adjustable), 1% (step), 0 (default).
Note: this function only effects in "Normal Brake" mode.

13. Timing
0-30° (adjustable), 1° (step), 15° (default).

14. Motor Rotate
CW/CCW. User can adjust this item via a program box.

15. Active FW Regenerative brake
It can be set in "Air plane" mode or "Helicopter: Linear Throttle" mode. It cannot be set in store governor and ELF governor modes. When the propeller is in free rotation, such as during diving, the generated power from the motor is regenerated to charge the battery. At the same time, the effect of braking the aircraft will occur.

16. Startup Power
This item is for adjusting the start-up force of the motor (during the start-up process). The higher the value, the larger the start-up force. It's adjustable between 1 and 7 (and it's 3 by default).

17. Restore Default
Press OK to reset to Default.

Transmitter settings

Throttle Cut settings
When using the governor with ESC, set the throttle cut function on the transmitter. Set the Throttle to be fixed in the stopped state when the throttle cut switch is turned on. Be sure to perform connect the battery in the state of throttle cut. When the throttle cut switch is turned off, the motor starts (it starts to rotate slowly to the specified number of revolutions) and is ready for flight. After landing, throttle cut to stop the motor.

Throttle Cut

Throttle curve setting

Normal curve　　　Idle-up 1　　　Idle-up 2
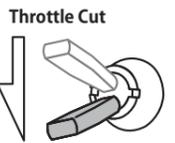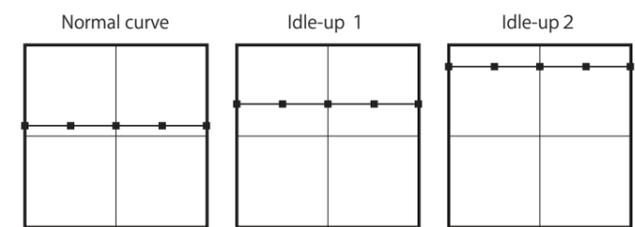
In governor mode, set the throttle curve to a horizontal straight line. Set the value according to the rotor speed.

EX： ● Normal : 55% ● Idle-up1 : 70% ● Idle-up 2 : 80%

Be sure to connect the battery with Throttle Cut ON.
When Throttle Cut is turned off, the motor starts and starts waiting.
After landing, turn on Throttle Cut to stop the motor.

Each protection function

1. Start-up Protection
The ESC will monitor the motor speed (RPM) during the start-up process. When the speed stops increasing or the speed increase is not stable, the ESC will take it as a start-up failure. At that time, if the throttle amount is less than 15%, then the ESC will automatically try to restart up; if it is larger than 20%, then you need to move the throttle stick back to the bottom position and then restart up the ESC.

(Possible causes of this problem: poor connection/ disconnection between the ESC and motor wires, propellers are blocked, etc.)

2. ESC Thermal Protection
The ESC will gradually reduce the output but won't cut it off completely when the ESC temperature goes above 110 . For ensuring the motor can still get some power and won't cause crashes, so the maximum reduction is about 50% of the full power. The ESC will gradually resume its maximum power after the temperature lowers down. In addition, the ESC temperature cannot exceed 70 when it's powered on. Otherwise, it cannot be started up but flashes Blue LED and beeps a series of beeps to indicate the ESC temperature is too high. (Here we are describing the ESC's reaction in the "Soft Cutoff" mode, while if in the "Hard Cutoff" mode; it will immediately cut off the power.)

3. Thermal protection of capacitors
The ESC activates this protection when the operating temperature of the capacitor exceeds 130 °C. This protects the capacitor in the same way that ESC thermal protection does for ESC.

4. Throttle Signal Loss Protection
When the ESC detects loss of signal for over 0.25 second, it will cut off the output immediately to avoid an even greater loss which may be caused by the continuous high-speed rotation of propeller. The ESC will resume the corresponding output after normal signals are received.

5. Overload Protection
The ESC will cut off the power/output and automatically restart itself when the load suddenly increases to a very high value. If the load still remains high or the motor still remains out of sync, then it will completely cut off the power/output.

6. Over-current Protection
During use, the ESC will cut off the output immediately if the current exceeds the regulated value and then resume it quickly; the ESC will cut off the output completely and won't resume it if the regulated value is exceeded again.