# Manual of Brushless Motor Speed Controller

## Specifications

<table>
<thead>
<tr>
<th>Class</th>
<th>Model</th>
<th>Cont. Current (A)</th>
<th>Burst Current (A)</th>
<th>REC Mode Output</th>
<th>BESC Output</th>
<th>Battery Cell</th>
<th>User Programmable</th>
<th>Balance Discharge Protection</th>
<th>Weight</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>12A</td>
<td>Esc-12</td>
<td>12A</td>
<td>15A</td>
<td>Switch 5V/2A</td>
<td>2.4-5.12</td>
<td>Available</td>
<td>N/A</td>
<td>19g</td>
<td>45x24x9</td>
<td></td>
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<tr>
<td>18A</td>
<td>Esc-18</td>
<td>18A</td>
<td>22A</td>
<td>Switch 5V/2A</td>
<td>2.4-5.12</td>
<td>Available</td>
<td>N/A</td>
<td>19g</td>
<td>45x25x11</td>
<td></td>
</tr>
<tr>
<td>25A</td>
<td>Esc-25</td>
<td>35A</td>
<td>35A</td>
<td>Switch 5V/2A</td>
<td>2.4-5.12</td>
<td>Available</td>
<td>N/A</td>
<td>22g</td>
<td>45x25x11</td>
<td></td>
</tr>
<tr>
<td>30A</td>
<td>Esc-30</td>
<td>40A</td>
<td>40A</td>
<td>Switch 5V/2A</td>
<td>2.4-5.12</td>
<td>Available</td>
<td>N/A</td>
<td>25g</td>
<td>45x25x11</td>
<td></td>
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<tr>
<td>40A</td>
<td>Esc-40</td>
<td>55A</td>
<td>55A</td>
<td>Switch 5V/2A</td>
<td>2.6-5.18</td>
<td>Available</td>
<td>N/A</td>
<td>35g</td>
<td>55x32x12</td>
<td></td>
</tr>
<tr>
<td>50A</td>
<td>Esc-50</td>
<td>80A</td>
<td>80A</td>
<td>Switch 5V/2A</td>
<td>2.6-5.18</td>
<td>Available</td>
<td>N/A</td>
<td>40g</td>
<td>70x31x14</td>
<td></td>
</tr>
<tr>
<td>60A</td>
<td>Esc-60</td>
<td></td>
<td></td>
<td>Switch 5V/2A</td>
<td>2.6-5.18</td>
<td>Available</td>
<td>N/A</td>
<td>50g</td>
<td>70x31x14</td>
<td></td>
</tr>
<tr>
<td>70A</td>
<td>Esc-70</td>
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<td>Switch 5V/2A</td>
<td>2.6-5.18</td>
<td>Available</td>
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<td>62g</td>
<td>70x31x14</td>
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<tr>
<td>80A</td>
<td>Esc-80</td>
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<td></td>
<td>Switch 5V/2A</td>
<td>2.6-5.18</td>
<td>Available</td>
<td>N/A</td>
<td>62g</td>
<td>70x31x14</td>
<td></td>
</tr>
</tbody>
</table>

## Writing Diagram

![Writing Diagram](image)

## Programmable Items

1. **Brake Setting**: Enabled / Disabled, default is Disabled
2. **Battery Type**: Lixx (Lixx-ion or Lixx-poly) / Next(NHM or NC), default is Lixx
3. **Low Voltage Protection Mode (Cut-Off Mode)**: Soft Cut-Off (Gradually reduce the output power) or Cut-Off (Immediately stop the output power). Default is Soft Cut-Off.
4. **Low Voltage Protection Threshold (Cut-Off Threshold)**: Low / Medium / High, default is Medium.
   - **NOT**: When using balance discharge monitoring and protection function (i.e., not plugging the balance charge connector into the BDMP socket on the Guard series ESC, the ESC only monitors the voltage of the whole battery pack.)
   1. For lithium batteries, the number of battery cells is calculated automatically. Low / Medium / High cut-off voltage for each cell is 2.8V±0.3/1.5V. For example: For a 3 cells lithium pack, when "Medium" cut-off threshold is set, the cut-off voltage will be 2.95±0.35V.
   2. For nickel batteries, low / medium / high cut-off voltages are 0.1/45/60% of the startup voltage (i.e., the initial voltage of the battery pack), and 0% means the low voltage cut-off function is disabled. For example: For a 10 cells NiMh battery, fully charged voltage is 14.4±0.1V, when "Medium" cut-off threshold is set, the cut-off voltage will be 14.4/45/60V.
   - **When using balance discharge monitoring and protection function (i.e., plugging the balance charge connector on battery pack into the BDMP socket on the Guard series ESC, the ESC monitors not only the voltage of the whole battery pack but also the voltage of each cell). For lithium battery, low / medium / high cut-off for each cell is 2.8V±0.35/1.5V. When the voltage of any cell battery pack is below the cut-off threshold, the protection function is activated.
5. **Start-Up Mode**: Normal / Soft / Super-Soft, default is Normal.
   - Normal is preferred for build-up aircraft. Soft or Super-Soft are preferred for helicopters. The initial acceleration of the Soft and Super-Soft modes are slower in comparison, usually taking 1 second for Soft startup or 2 seconds for Super-Soft startup from initial throttle advance to full throttle. If the throttle is closed (throttle stick moved to bottom) and opened again (throttle stick moved to top) within 3 seconds of the initial startup, the restart-up will be temporarily changed to normal mode to get rid of the chances of a crash caused by slow throttle response. This special design is very suitable for aerobatic flight when quick throttle response is needed.
6. **Timing**: Low / Medium / High, default is Low. Normally, low timing value can be used for most motors. We recommend the Low timing value for 2 poles motor and Medium timing value for motors with more than 6 poles to get a high efficiency. For higher speed, high timing value can be chosen.

## Troubleshooting

<table>
<thead>
<tr>
<th>Trouble</th>
<th>Possible Reason</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>After power on, motor does not work, no sound</td>
<td>The connection between battery pack and ESC is not correct</td>
<td>Check the power connection. Replace the connector.</td>
</tr>
<tr>
<td>After power on, motor does not work, such an alert tone is emitted: beep-beep-beep-beep-beep</td>
<td>The balance charge connector is not properly located in the BDMP adapter</td>
<td>Check the voltage of battery pack</td>
</tr>
<tr>
<td>After power on, motor does not work, such an alert tone is emitted: beep-beep-beep-beep-beep</td>
<td>The balance charge connector is not properly located in the BDMP adapter</td>
<td>Check the balance charge connector and the BDMP adapter.</td>
</tr>
<tr>
<td>After power on, motor does not work, such an alert tone is emitted: beep-beep-beep-beep-beep</td>
<td>The throttle signal is not in the bottom (lowest) position</td>
<td>Move the throttle stick to position</td>
</tr>
<tr>
<td>After power on, motor does not work, such an alert tone is emitted: beep-beep-beep-beep-beep</td>
<td>Direction of the throttle channel is reversed, so the ESC has entered the program mode</td>
<td>Set the direction of throttle channel correctly</td>
</tr>
<tr>
<td>The motor runs in the opposite direction</td>
<td>The connection between ESC and the motor need to be changed</td>
<td>Swap any two wire connections between ESC and motor</td>
</tr>
<tr>
<td>The motor stop running while in working state</td>
<td>Throttle signal is lost</td>
<td>Check the receiver and transmitter Check the cable of throttle channel</td>
</tr>
<tr>
<td>After power on, motor does not work, a special tone <em>J 56715</em> is emitted after 2 beep tone beep-beep-beep</td>
<td>The ESC has entered Low Voltage Protection mode</td>
<td>ESC has entered Low Voltage Protection mode Land RC model as soon as possible, and then replace the battery pack</td>
</tr>
<tr>
<td>Some connections are not reliable</td>
<td>Check all the connections: battery pack connection, throttle signal cable, motor connections, etc.</td>
<td></td>
</tr>
<tr>
<td>Random stop or restart or irregular working state</td>
<td>There is strong electro-magnetic interference in flying field.</td>
<td>Reset the ESC to resume normal operation. If the function could not resume, you might need to move to another area to fly.</td>
</tr>
</tbody>
</table>

## Program Example

**Setting "Start Mode" to "Super-Soft", i.e. value #3 in the programmable item #5**

1. **Enter Program Mode**
   - Switch on transmitter, move throttle stick to top position, connect battery pack to ESC, wait for 2 seconds, "beep-beep" tone should be emitted. Then wait for another 5 seconds, special tone like *J 15191* should be emitted, which means program mode is entered.
2. **Select Programmable Items**
   - Now you'll hear 8 tones in a loop. When a long "beep" tone is emitted, move throttle stick to bottom to enter the "Start Mode".
3. **Set Item Value (Programmable Value)**
   - "beep", wait for 3 seconds; "beep-beep", wait for another 3 seconds; then you'll hear "beep-beep-beep", move throttle stick to top position, then a special tone *J 15191* is emitted, now you have set the "Start Mode" item to the value of "Super-Soft".
4. **Exit Program Mode**
   - After the special tone *J 15191*, move throttle stick to bottom within 2 seconds.
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Specifications

- If a special tone *J 1671* is emitted after 2 beep tones ("beep-beep"), means the ESC has entered the program mode, it is because the throttle channel of your transmitter is reversed, please set it correctly.
- If the very rapid "beep-beep", "beep-beep" tones is emitted, means the input voltage is too low or too high, please check your battery's voltage.

3. VERY IMPORTANT! Because different transmitter has different throttle range, we strongly suggest you using the "Throttle Range Setting Function" to calibrate throttle range. Please read the instruction on page 4 — "Throttle Range Setting Function".

Alert Tone
- Input voltage is abnormal: The ESC begins to check the voltage when the battery pack is connected, if the voltage is not in the acceptable range, such an alert tone will be emitted: "beep-beep", "beep-beep", "beep-beep"- "beep-beep". (Every "beep-beep" has a time interval of about 1 second.)
- Thrust signal is abnormal: When the ESC can't detect the normal thrust signal, such as an alert tone will be emitted: "beep-beep", "beep-beep", "beep-beep". (Every "beep-beep" has a time interval of about 2 seconds)
- Thrust signal is not in the bottom position: When the throttle stick is not in bottom (lowest) position, a very rapid alert tone will be emitted: "beep-beep", "beep-beep", "beep-beep". (Every "beep-beep" has a time interval of about 0.25 second.)

Protection Function
- Abnormal start up protection: If the motor fails to start within 2 seconds of throttle application, the ESC will cut off the output power. If the motor has not started within 5 seconds after the battery pack is connected, the motor will be disabled, the motor will not start until the battery pack is replaced.
- Over-heat protection: When the temperature of the ESC is over 110 Celsius degrees, the ESC will reduce the output power.
- Thrust signal loss protection: The ESC will reduce the output power if throttle signal is lost for 1 second, further loss for 2 seconds will cause its output to be cut off completely.

Program Example
- Setting "Start Mode" to "Super-Soft", i.e., value #3 in the programmable item #5

1. Enter Program Mode
   - Switch on transmitter, move the throttle stick to top position, connect battery pack to ESC, wait for 2 seconds, "beep-beep" tone should be emitted. Then wait for another 5 seconds, special tone like *J 1671* should be emitted, which means program mode is entered.

2. Select Programmable Items
   - Now you'll hear 8 tones in a loop. When a long "beep" tone is emitted, move throttle stick to bottom to enter the "Start Mode".

3. Set Item Value (Programmable Value)
   - "Beep"- wait for 3 seconds, "beep-beep"- wait for another 3 seconds, then you'll hear "beep-beep", beep-throttle stick to top position, then a special tone *J 1671* is emitted, now you have set the "Start Mode" item to the value of "Super-Soft"

4. Exit Program Mode
   - After the special tone *J 1671*, move the throttle stick to bottom within 2 seconds.

Trouble Shooting
- Trouble: After power on, motor does not work, no sound or heat.
- Possible Reason: The connection between battery pack and ESC is not correct.
- Action: Check the power connection. Replace the connector.

- Trouble: After power on, motor does not work, such an alert tone is emitted: "beep-beep", "beep-beep", "beep-beep", "beep-beep". (Every "beep-beep" has a time interval of about 1 second)
- Possible Reason: The balance charge connector is not located properly in BDPM adapter.
- Action: Check the balance charge connector and the BDPM adapter.

- Trouble: After power on, motor does not work, such an alert tone is emitted: "beep", "beep", "beep", "beep". (Every "beep" has a time interval of about 2 seconds)
- Possible Reason: The throttle signal is lost.
- Action: Check the receiver and transmitter.

- Trouble: After power on, motor does not work, such an alert tone is emitted: "beep", "beep", "beep", "beep". (Every "beep" has a time interval of about 0.25 second)
- Possible Reason: The throttle stick is not in the bottom (lowest) position
- Action: Move the throttle stick to bottom position.

- Trouble: After power on, motor does not work, special tone *J 1671* is emitted after 2 beep tones ("beep-beep")
- Possible Reason: Direction of the throttle channel is reversed, so the ESC has entered the program mode.
- Action: Set the direction of the throttle channel correctly.

- Trouble: The motor runs in the opposite direction
- Possible Reason: The connection between ESC and the motor needs to be changed.
- Action: Swap any two wire connections between ESC and motor.

- Trouble: The motor stop running while in working state
- Possible Reason: The throttle signal is lost.
- Action: Check the receiver and transmitter.

- Trouble: Random stop or restart or irregular working state
- Possible Reason: Some connections are not reliable.
- Action: Check all the connections: battery pack connection, throttle signal cable, motor connections, etc.

Begin To Use Your New ESC
- Please start the ESC in the following sequences:
  - Move the throttle stick to the bottom position and then switch on the transmitter.
  - Connect the battery pack to the ESC, the ESC begins the test process, a special tone *J 123* is emitted, which means the voltage of the battery pack is normal range, and then a N "beep-beep" tones will be emitted, means the number of lithium battery cells.
  - Finally a long "beep" tone will be emitted, which means self-test is OK, the arrcarthe/clipper is ready to go flying.

- If nothing is happened, please check the battery pack and all the connections,
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**Normal startup procedure:**

- Move throttle stick to bottom and then switch on transmitter.
- Connect battery pack to ESC, special tone like "J123" means power supply is OK.
- Several "beep" tones should be emitted, presenting the number of lithium battery cells.
- When self-test is finished, a long "beep" tone should be emitted.
- Move throttle stick upwards to go flying.

**Throttle range setting:** (Throttle range should be reset whenever a new transmitter is being used)

- Switch on transmitter, move throttle stick to top.
- Connect battery pack to ESC, and wait for about 2 seconds.
- A long "beep" tone should be emitted, means throttle range lowest point has been correctly confirmed.
- Move throttle stick to the bottom, several "beep" tones should be emitted, presenting the number of battery cells.
- Move throttle to the top, several "beep" tones should be emitted, means throttle range highest point has been correctly confirmed.

**Program the ESC with your transmitter (4 steps):**

1. Enter program mode
2. Select programmable items
3. Set item's value (Programmable value)
4. Exit program mode

**1. Enter program mode:**

1) Switch on transmitter, move throttle stick to top, connect the battery pack to ESC.
2) Wait for 2 seconds, the motor should emit special tone like "beep-beep-".
3) Wait for another 5 seconds, special tone like "J171" should be emitted, which means program mode is entered.

**2. Select programmable items:**

After entering program mode, you will hear 8 tones in a loop with the following sequence. If you move the throttle stick to bottom within 3 seconds after one kind of tones, this item will be selected.

1. "beep" brake (1 short tone)
2. "beep-beep-" battery type (2 short tone)
3. "beep-beep-beep-" cutoff mode (3 short tone)
4. "beep-beep-beep-beep-" cutoff threshold (4 short tone)
5. "beep-" startup mode (1 long tone)
6. "beep-" timing (1 long, 1 short)
7. "beep-" set all to default (1 long 2 short)
8. "beep-" exit (2 long tone)

Note: 1 long "beep-" = 5 short "beep-"

**3. Set item's value (Programmable value):**

You will hear several tones in loop. Set the value matching to a tone by moving throttle stick to top when you hear the tone, then a special tone "J171" emits, means the value is set and saved. (Keeping the throttle stick at top, you will go back to step 2 and you can select other items; Moving the stick to bottom within 2 seconds will exit program mode directly)

<table>
<thead>
<tr>
<th>Item</th>
<th>&quot;beep&quot;</th>
<th>&quot;beep-beep-&quot;</th>
<th>&quot;beep-beep-beep-&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brake</td>
<td>Off</td>
<td>On</td>
<td></td>
</tr>
<tr>
<td>Battery type</td>
<td>Li-ion/Li-poly</td>
<td>NMH/NiCd</td>
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<tr>
<td>Cutoff mode</td>
<td>Soft-Cut</td>
<td>Cut-Off</td>
<td></td>
</tr>
<tr>
<td>Cutoff threshold</td>
<td>Low</td>
<td>Medium</td>
<td>High</td>
</tr>
<tr>
<td>Start mode</td>
<td>Normal</td>
<td>Soft</td>
<td>Super soft</td>
</tr>
<tr>
<td>Power</td>
<td>Low</td>
<td>Medium</td>
<td>High</td>
</tr>
</tbody>
</table>

**4. Exit program mode:**

There are 2 ways to exit program mode:

1. In step 3, after special tone "J171" emits, please move throttle stick to the bottom position within 2 seconds.
2. In step 2, after tone "beep-" (i.e. The item #6), move throttle stick to bottom within 3 seconds.
How to enter the programming mode of the brushless ESC with the 2.4Ghz radio system:
(Warning: Please disconnect the motor from the ESC before starting the following procedure)

1) Turn on the transmitter, then connect battery to the receiver, let the normal auto binding process completed. (Both LED lights on transmitter and receiver should flash rapidly at the same time for this process to succeed)

2) Disconnect the receive power; **do not turn off the transmitter.**

3) Move the throttle stick to the top position.

4) Toggle the safety switch (on the upper left hand corner of the transmitter). Then make sure the safety switch is at the off position (the tip of the switch is set toward the back of the transmitter)

5) Connect battery to the receiver; now you are ready to enter the programming mode (please see the ESC manual for programming instruction).

If unable to enter the programming mode, please repeat the above procedure again.