Manual of Sensorless Brushless Motor Speed Controller

This manual is ONLY suitable for Pentium-80A-HV and Pentium-90A-HV Electronic Speed Controller!

Thank you for purchasing our Electronic Speed Controller (ESC). High power system for RC model can be very dangerous, we strongly suggest you reading this manual carefully. In that we have no control over the correct use, installation, application, or maintenance of our products, no liability shall be assumed nor accepted for any damages, losses or costs resulting from the use of the product. Any claims arising from the operating, failure or malfunctioning etc. will be denied. We assume no liability for personal injury, property damage or consequential damages resulting from our product or our workmanship. As far as is legally permitted, the obligation to compensation is limited to the invoice amount of the affected product.

Features:

◆ Extreme low resistance PCB used on power output section, the thickness of copper sheet is more than 0.7mm, so the whole ESC has super current endurance capability.

◆ Military standard capacitor with extreme low resistance used on voltage input section, this will increase the ability to prevent unwanted RF Noise/ Interference.

◆ The best quality MOSFET (Famous Brand: IR in USA) supports the powerful output.

◆ Full protection features: Low-voltage cutoff protection / over-heat protection / throttle signal lost protection.

◆ 3 startup modes: Normal / Soft / Super-Soft, compatible with fixed-wing aircraft and helicopter models.

◆ Throttle range can be configured, fully compatible with all market available transmitters.

◆ Smooth and accurate speed control, excellent throttle linearity.

◆ Highest motor speed supported: 210000 RPM (2 poles), 70000 RPM (6 poles), 35000 RPM (12 poles).

◆ Program Card in a very small size can be purchased additionally for easily programming the ESC on field.

Specification:

Class	Model	Continues Current	Burst Current (>10s)	BEC Mode	BEC Output	Battery Cell		User Programmable	Weight	Size L*W*H
						Li-ion Li-poly	NiMH NiCd			
80A	Pentium-80-HV	80A	100A	N/A	N/A	2-12	5-36	Available	125g	78*55*15
90A	Pentium-90-HV	90A	110A	N/A	N/A	2-12	5-36	Available	125g	78*55*15

Wiring Diagram:
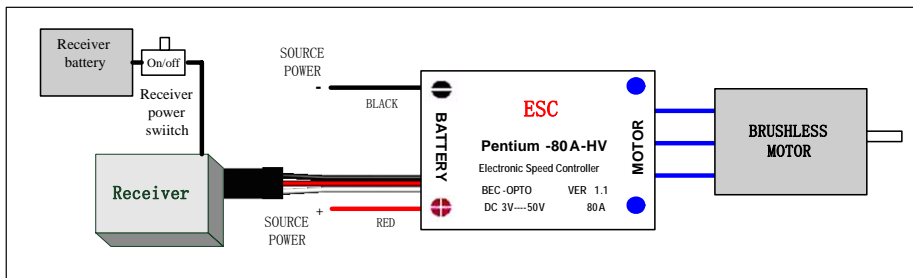
Remark: For HV controller, the processor gets its power supply from the receiver, so if you want to restart the HV controller, you should take the control wires out of the receiver and then plug the wires into the receiver again. The reconnection of main source power cannot restart the HV controller.

Feature Explanation:

1. **Brake Settings**：Brake Enabled / Brake Disabled, default is Brake Disabled
2. **Battery Type**：Li-xx(Li-ion or Li-poly) / Ni-xx(NiMh or Nicd)，default is Li-xx.
3. **Low Voltage Protection Mode(Cutoff Mode)**：Reduce / Cutoff output power, default is Reduce the output power gradually.
4. **Low Voltage Protection Threshold(Cutoff Threshold)**：Low / Medium / High, default is Medium.
   ◆ For Li-xx battery，number of battery cells are calculated automatically，low / medium / high cutoff voltage for each cell are: 2.6V/2.85V/3.1V. For example: 5 cells Lipo, when medium cutoff voltage is set, the cutoff voltage is: 2.85*5=14.25V.
   ◆ For Ni-xx battery, low / medium / high cutoff voltages are 0%/45%/60% of the startup voltage (i.e. the initial voltage of battery pack), 0% means the low voltage protection function is disabled. For example:10 cells NiMH battery, fully charged voltage is 1.44*10=14.4V, when "medium" value is set, the cutoff voltage is : 14.40*45%=6.48V。
5. **Startup Mode**：Normal /Soft /Super-soft, default is Normal startup.
   Normal is suitable for fixed-wing aircraft. Soft and Super-soft are suitable for helicopters. The initial speed of soft / super-soft mode is very slow, 1 second (soft startup) / 2 seconds (super-soft startup) from startup to full speed. But if throttle is closed (throttle stick is moved to bottom) and opened again (throttle stick is moved upwards) within 3 seconds after the first startup, the restart will be temporarily changed to normal mode to get rid of the chances of crash caused by slow throttle response in aerobatic fly.
6. **Timing**：Low / Medium / High, default is Low.
   In normal cases, low or medium timing can be used for most motors.
   For higher speed, **High** timing could be chose.
   Attention: After you changing the timing setting, please test your RC model on ground firstly!

Begin To Use Your New ESC

Before using your new ESC, please check all the connections to make sure that they are reliable, and then start up the ESC in the following sequence:

1. Move the throttle stick to bottom, and then switch on the transmitter.
2. Connect receiver battery pack (4-6V) to receiver, and then connect the power system battery pack to ESC, the ESC begins the self-test process, and the motor will emit several "beep" tones to present the quantity of lithium battery cells. After 2 seconds a long "beep------"tone should be emitted, which means the self-test is OK, and now the RC model is ready to go flying.
   ◆ If nothing is happened, please check your battery packs and all the connections;

Manual of Sensorless Brushless Motor Speed Controller

- ◆ If a special tone "567i̇2" is emitted after 2 beep tones (beep-beep-), means the ESC has entered the program mode, i.e. the throttle channel of your transmitter is reversed, please set it correctly;
- ◆ If a very rapid "beep-beep-, beep-beep-" tone 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 2------"Throttle Range Setting".

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

Protection Function
1. Start up protection: If the motor failed to start up in 2 seconds while the throttle stick is being moved up, the ESC will cut off the output power. In this case, the throttle stick **MUST** be moved to bottom again to restart the motor. (Such a situation happens in the following cases: The connection between ESC and motor is not reliable, propeller is blocked, gearbox is damaged, etc.)
2. Over-heat protection: When the temperature of ESC is over 110℃, the ESC will reduce the output power.
3. Throttle signal lost protection: The ESC will reduce output power if throttle signal is lost for 1 second, further lost for totally 2 seconds will cause its output to be cut off.

Program example
Setting startup mode to "super-soft", i.e. value #3 in program item #5

1. Enter Program Mode Switch on transmitter, move throttle stick to top, connect battery packs to receiver and ESC, wait for 2 seconds, "beep-beep" tone should be emitted. Then wait another 5 seconds, special tone like "567i̇2"should be emitted, means program mode is entered.
2. Select Programmable Items Now you'll hear 8 tones in loop. When a long "beep------" tone is emitted, move throttle stick to bottom to enter the "Startup 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, then a special tone "i̇5i̇5" is emitted, now you have set the "Startup Mode" item to the value of "Super-soft Startup"
4. Exit Program Mode After the special tone "i̇5i̇5", move throttle stick to bottom within 2 seconds.

Normal startup procedure:

Switch on transmitter, move throttle stick to bottom	Connect battery pack to ESC, special tone like "♪123" means power supply is OK	Several "beep-" tones should be emitted, presenting the quantity of lithium battery cells	When self-test is finished, a long "beep-----"tone should be emitted	Ready to go flying now

Throttle range setting: (Throttle range should be reset when 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	"Beep-beep-" tone should be emitted, means throttle range highest point has been correctly confirmed	Move throttle stick to the bottom, several "beep-" tones should be emitted, presenting the quantity of battery cells	A long "Beep-" tone should be emitted, means throttle range lowest point has been correctly confirmed

Manual of Sensorless Brushless Motor Speed Controller

Program ESC with transmitter (4 Steps):

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

1. Enter program mode

1) Switch on transmitter, move throttle stick to top position, 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 " 567í2 " should be emitted, which means program mode is entered

2. Select programmable items:

After entering program mode, you can hear 8 tones in a loop in the following sequence. If you move the throttle stick to bottom within 3 seconds after one kind of tones, then 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-----beep-"   timing   (1 long 1 short)
7. "beep-----beep-beep-"   set all to default (1 long 2 short)
8. "beep-----beep-----"   exit   (2 long tone)

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

3. Set item value:

You will hear 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 "í5í5" emits which means the value is set and saved. (Keeping the stick at top, you will go back to step 2 and you can select other items; Moving the stick to bottom within 2 seconds, you will exit the programming mode directly)

Items \ Tones	beep- 1 short tone	beep-beep- 2 short tones	beep-beep-beep 3 short tones	beep-beep-beep... N short tones
Brake	Off	On		
Battery type	Li-ion / Li-poly	NiMh / Nicd		
Cutoff mode	Reduce power	Shut down		
Cutoff threshold	Low	Medium	High	
Startup mode	Normal	Soft	Super soft	
Timing	Low	Medium	High	
Li-poly cells number	Auto detect	2 cells	3 cells	N cells

4. Exit program mode

There are 2 ways to exit programming:

1. In step 3, after special tone "í5í5", move throttle stick to bottom within 2 seconds.
2. In step 2, after tone "beep-----beep-----" (Item #9), move throttle stick to bottom within 3 seconds.

Remark:

1. It very important to set the Li-Poly cells number correctly, otherwise the ESC will mistakenly calculate the cut off voltage.

2. In "Li-Poly cells number" setting, 1 long "beep-----" = 5 short "beep-". For example, 2 long "beep-----" plus 2 short "beep-" means a 12 cells lithium battery pack, 1 long "beep-----" plus 1 short "beep-" means a 6 cells lithium battery pack.

3. If you are using more than 4 cells lithium battery pack, you'd better set the "Li-Poly cells number" manually. We don't recommend you set it to "auto detect". The voltage of a full charged lithium battery cell is greatly different from that of a used battery pack, the more cells a battery pack have, the more difficult for the ESC to detect the cells number accurately.

Manual of Sensorless Brushless Motor Speed Controller

Use a program card to program the Pentium-80A-HV and Pentium-90A-HV ESC

When you use a program card to set the programmable value of Pentium-80A-HV or a Pentium-90A-HV ESC, the "Y" cable is necessary for powering the program card. For detail information, please read the user manual of program card.
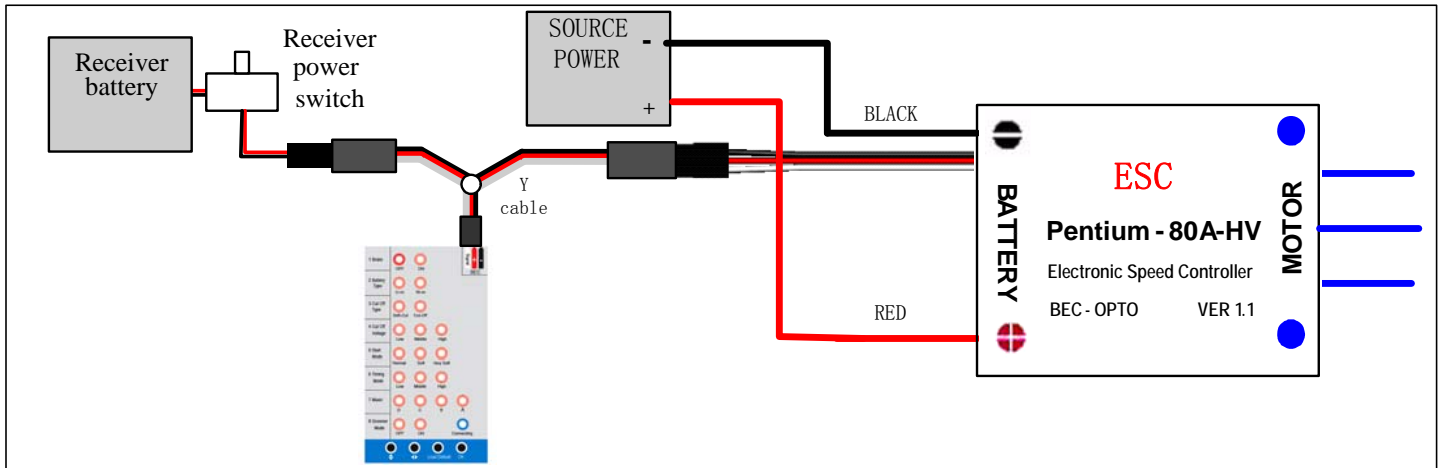
When you are using a program card to program the Pentium-80A-HV ESC, the "Music/Li-Po cell" item now means the lithium battery cells number.   (● = LED is lighting)

LED				Li-Poly Cells Number	LED				Li-Poly Cells Number
D	C	B	A		D	C	B	A	
○	○	○	○	Auto detect	●	○	○	○	9 CELLS (33.3V)
○	○	○	●	2 CELLS (7.4V)	●	○	○	●	10 CELLS (37.0V)
○	○	●	○	3 CELLS (11.1V)	●	○	●	○	11 CELLS (40.7V)
○	○	●	●	4 CELLS (14.8V)	●	○	●	●	12 CELLS (44.4V)
○	●	○	○	5 CELLS (18.5V)	●	●	○	○	Auto detect
○	●	○	●	6 CELLS (22.2V)	●	●	○	●	Auto detect
○	●	●	○	7 CELLS (25.9V)	●	●	●	○	Auto detect
○	●	●	●	8 CELLS (29.6V)	●	●	●	●	Auto detect

Trouble Shooting

Trouble	Possible Reason	Action
After power on, motor can't work, no sound is emitted	The connection between battery pack and ESC is not OK	Check the power connection. Replace the connector.
After power on, motor can't work, such an alert tone is emitted: "beep-beep-, beep-beep-,beep-beep-" (Every "beep-beep-" has a time interval about 1 second)	Input voltage is abnormal, too high or too low	Check the voltage of battery pack
After power on, motor can't work, such an alert tone is emitted: "beep-, beep-, beep- "(Every "beep-" has a time interval about 2 seconds)	Throttle signal is abnormal	Check the receiver and transmitter Check the cable of throttle channel
After power on, motor can't work, such a alert tone is emitted: "beep-, beep-, beep-" (Every "beep-" has a time interval about 0.25 second)	Throttle stick is not in bottom(lowest) position	Move the throttle stick to bottom
After power on, motor can't work, a special tone "5671̇2̇" is emitted after 2 beep tone (beep-beep-)	The direction of throttle channel is reversed, so the ESC has entered the program mode	Set the direction of throttle channel correctly
The motor runs in opposite direction	The connection between ESC and the motor need to be changed.	Swap any two wire connections between ESC and motor
The motor stop running while in working state	Throttle signal is lost	Check the receiver and transmitter Check the cable of throttle channel
	ESC has entered Low Voltage Protection mode	Land RC model as soon as possible, and then replace the battery pack
	Some Connections are not reliable	Check all the connections: battery pack connection, throttle signal cable, motor connections, etc.