Komodo Hobby

Building Instructions
&
Manual

KH–257 Outrunner Motor Kit

Introduction

Congratulations on your purchase of a KH-257 Outrunner Motor Kit. The KH-257 is a lightweight, high torque outrunner motor with a 22mm diameter 12-tooth stator. 16 magnets are included and the KH-257 can be built as a 10, 14 or 16 magnet pole motor. Moreover, the 12-tooth stator can also be wound using the LRK or Distributed LRK winding technique. Please take time to read through this manual before building this powerful KH-257 outrunner motor.

Warning

Radio Control Model and Outrunner Motor Kit are not toy!!! It contains sophisticated small parts and is designed for hobby use only. All parts of this outrunner motor kit have to be assembled and operated with great care. Outrunner motor can produce very high power to turn gear or spin propeller. It is capable of causing property damage and all bodily harm to operator or spectators. If you are a novis motor builder, please seek assemble and operational help from an experienced motor builder.

Be Careful!!!

If this outrunner motor kit is not assembled and operated properly, it can damage or destroy your electronic speed control, receiver, batteries and relevant equipment.

Parts List

(QTY)	Items
(1)	Pre-pressed End-Bell and Flux Ring
(1)	22mm 12-tooths Stator
(1)	Bearing Tube
(1)	3.17mm x 6.35mm Ball Bearing
(1)	3.17mm x 7.93mm Ball Bearing
(1)	3.17mm Hardened Steel Shaft
(1)	30feet, AWG #28 Enameled Magnet Wire
(16)	4 x 4 x 1.5mm N50 Magnets
(3)	Connector Pairs (Male and Female)
(7)	Shrinking Tubes
(3)	M3 x 3 Screws
(1)	C-Clip

Optional Parts: (Not included in this kit)
10 magnet spacer
14 magnet spacer
16 magnet spacer

Note: In order to prevent confusion to beginner, this manual mainly concentrated on assembling 14 magnet poles and distributed LRK winding. In appendix II, there is shown the winding method for 16 magnet poles.

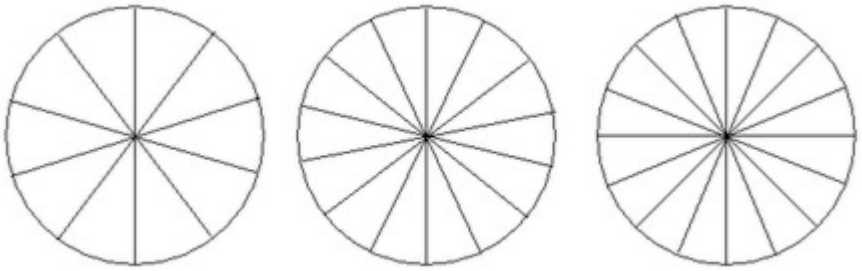
1. Marking Magnets

Stack all magnets together. This will assure all the magnet poles facing one end of the stack are the same polarity. Use a marker to mark the face of one of the end magnets, then move that magnet to the other end of the stack. Continue marking and moving magnets until all magnets have one face marked.

2. Place magnets inside the bell

Before placing magnets inside the bell, you need to choose the number of magnet poles from the table below.

The characteristics of different magnet pole set-ups			
	10 magnet poles	14 magnet poles	16 magnet poles
Magnetic Pattern	NSNSNSNSNS	NSNSNSNSNSNSNS	NSNSNSNSNSNSNSNS
RPM	High	Middle	Low
Torque	Low	Middle	High



Note: In this manual, we choose 14 magnet poles for example.

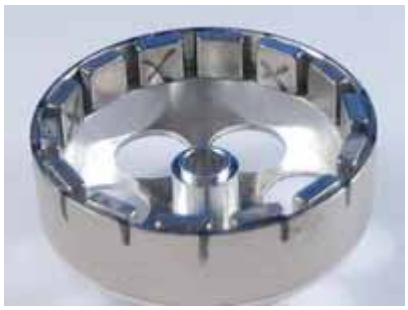
Place the endbell on the template with the center hole over the center point.

Use a marker to copy all lines onto the flux ring.

Transfer all lines to the edge of flux ring, and place seven magnets in the bell with marks facing inward.

Align the magnets with every other mark and secure them with a small drop of thin CA glue.

Place seven more magnets into the bell, but this time the marked faces will not show. They will be against the flux ring. Check to be sure every other magnet has the marked face showing and the magnets are evenly spaced. Then apply a small drop of thin CA to secure the magnets.

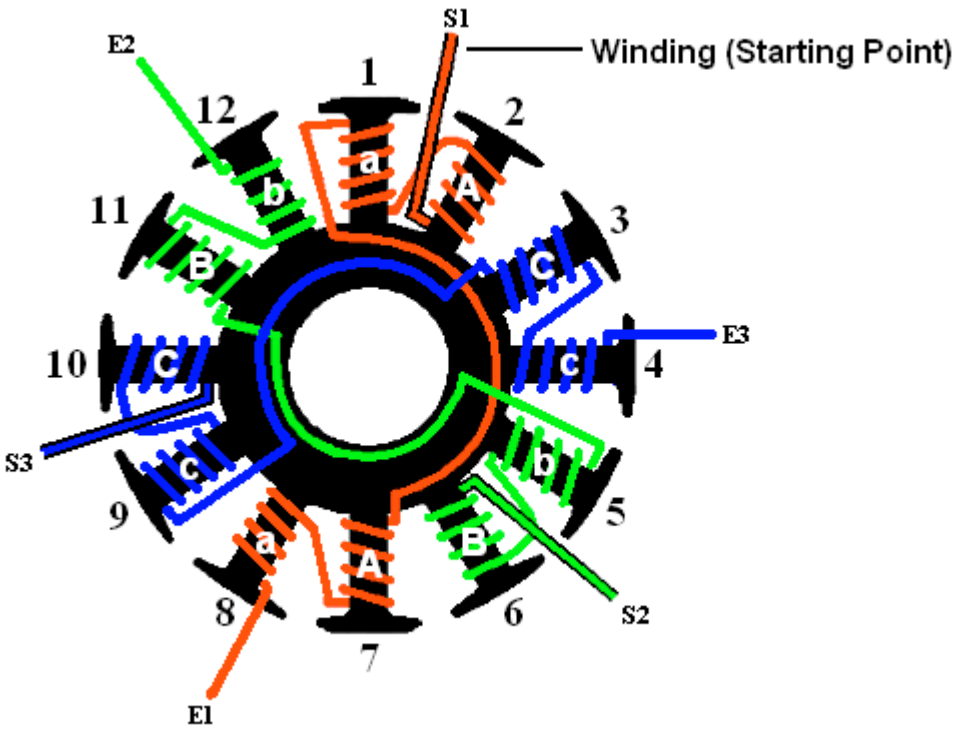


Now you have the magnets installed in the desired NSNSNSNSNSNSNS pattern.

3. Insert bearing tube into stator.

Apply a drop of Loctite (#411, 480 or equivalent) to the bearing tube and insert it in the stator. Place the stator on a flat surface and insert the bearing tube vertically into the stator hole until the end of the bearing tube is flush with the face of the stator.

4. Winding



Distributed LRK Winding Diagram (DLRK) for 10 or 14 Magnet Poles

	10 magnet poles	14 magnet poles	16 magnet poles
Magnetic Pattern	**NSNSNSNSNS**	**NSNSNSNSNSNSNS**	**NSNSNSNSNSNSNSNS**
DLRK Winding	AabBCcaABbcC	AabBCcaABbcC	ABCABCABCABC
LRK Winding	A-b-C-a-B-c	A-b-C-a-B-c	

- “A” and "a" are first phase wire S1
- “B” and "b" are second phase wire S2
- “C” and "c" are third phase wire S3
- Capital (upper case) letter means Clockwise
- Small (lower case) letter means Anti-Clockwise
- “-“ means the stator tooth not wind

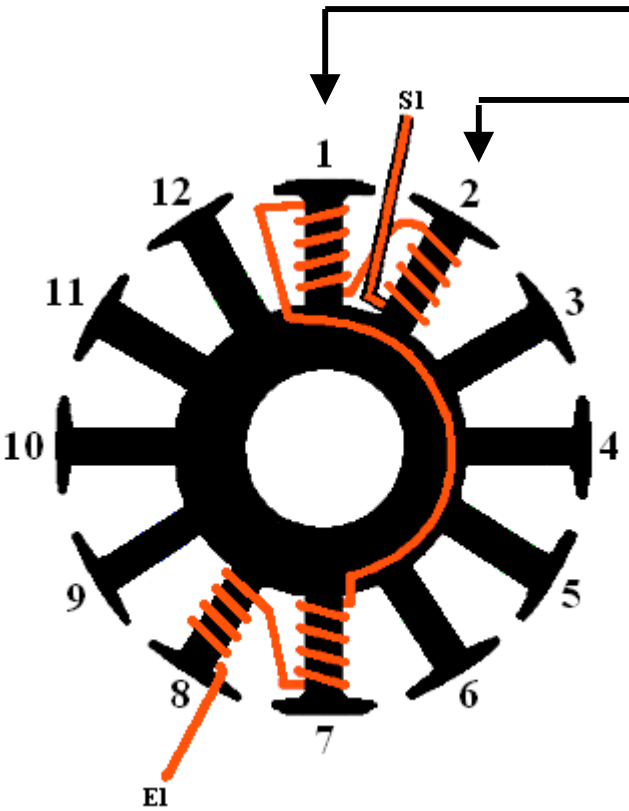
We recommend you mark the stator teeth 1-12, as shown above. It will reduce the chance of winding the wrong tooth by mistake.

Distributed LRK Winding: AabBCcaABbcC

Please note that this winding can be used for
10 magnet poles (NSNSNSNSNS)
or
14 magnet poles (NSNSNSNSNSNSNS)

It is an example of using three individual magnet wires to complete a 3-phases system. We recommend beginners to wind 25 turns for their first motor. Please make sure every coil has same number of turns.

Phase 1 (Tooth 1 & 2)



Step 1: Leave 7-8 cm for making connections, later.

Step 2: Start the first wire "S1" on tooth No. 2. Wind 25 turns in a clockwise direction.

Wind the first layer of 11 turns from the hub to the hammerhead.

Continue winding the second layer with 8 turns from the hammerhead toward the hub.

Finish this tooth with 6 turns from the hub to the hammerhead.

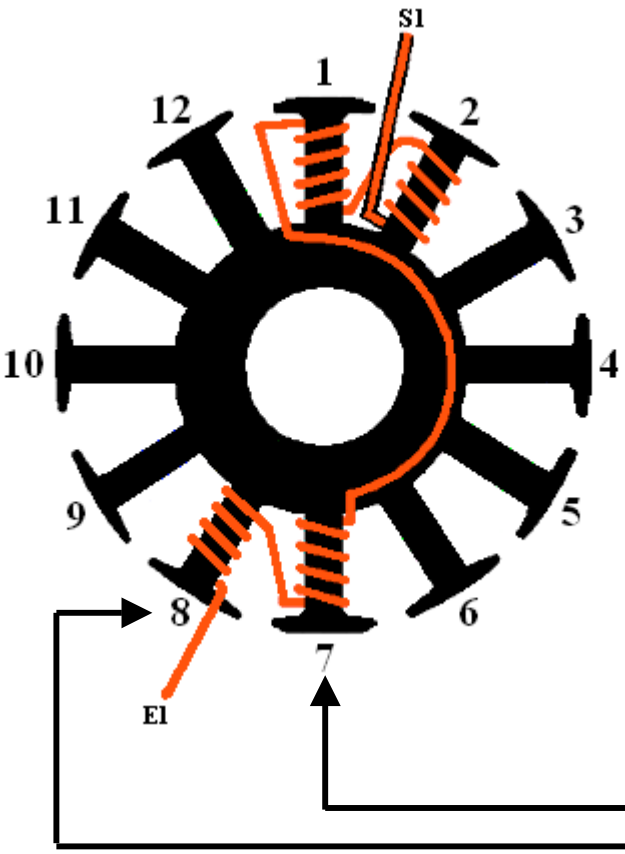
Step 3: Continue this wire to the base of tooth No. 1 and wind 25 times in the anti-clockwise direction.

Wind the first layer of 11 turns from the hub to the hammerhead.

Continue winding the second layer with 8 turns from the hammerhead toward the hub.

Finish this tooth with 6 turns from the hub to the hammerhead.

Phase 1 (Tooth 7 & 8)



Step 4: Jump to tooth No. 7 and wind 25 turns in the clockwise direction.

Wind the first layer of 11 turns from the hub to the hammerhead.

Continue winding the second layer with 8 turns from the hammerhead toward the hub.

Finish this tooth with 6 turns from the hub to the hammerhead.

Step 3: Continue this wire to the base of tooth No. 8 and wind 25 turns in the anti-clockwise direction.

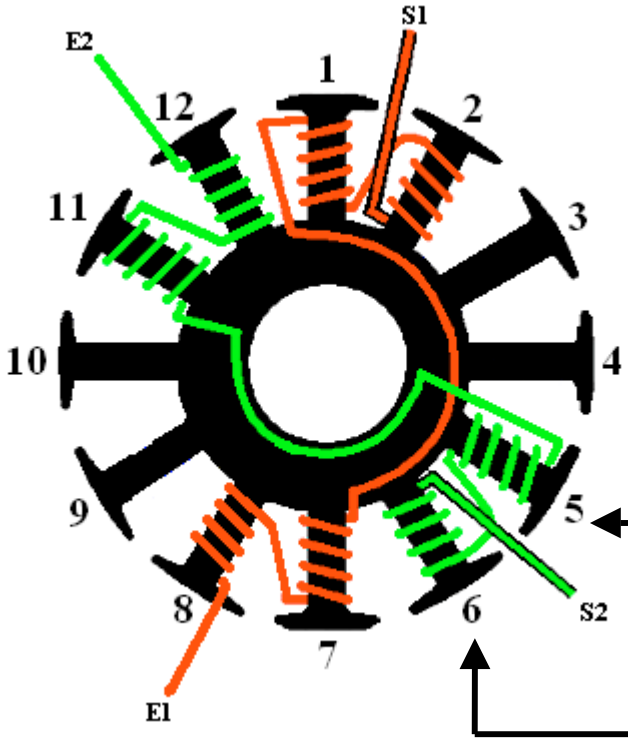
Wind the first layer of 11 turns from the hub to the hammerhead.

Continue winding the second layer with 8 turns from the hammerhead toward the hub.

Finish this tooth with 6 turns from the hub to the hammerhead.

End wire "S1" by cutting it off leaving 7-8 cm for connections.

Phase 2 (Tooth 5 & 6)



Step 6: Leave 7-8 cm for making connections, later.

Step 7: Start the second wire "S2" on tooth No. 6. Wind 25 turns in a clockwise direction.

Wind the first layer of 11 turns from the hub to the hammerhead.

Continue winding the second layer with 8 turns from the hammerhead toward the hub.

Finish this tooth with 6 turns from the hub to the hammerhead.

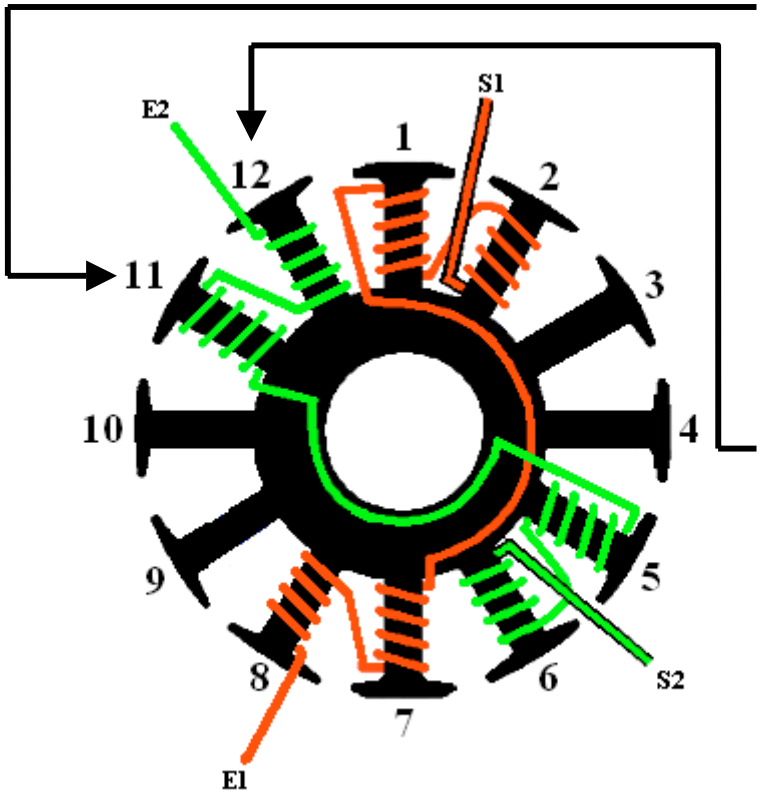
Step 8: Continue this wire to the base of tooth No. 5 and wind 25 times in the anti-clockwise direction.

Wind the first layer of 11 turns from the hub to the hammerhead.

Continue winding the second layer with 8 turns from the hammerhead toward the hub.

Finish this tooth with 6 turns from the hub to the hammerhead.

Phase 2 (Tooth 11 & 12)



Step 9: Jump to tooth No.11 and wind 25 turns in the clockwise direction.

Wind the first layer of 11 turns from the hub to the hammerhead.

Continue winding the second layer with 8 turns from the hammerhead toward the hub.

Finish this tooth with 6 turns from the hub to the hammerhead.

Step 10: Continue this wire to the base of tooth No.12 and wind 25 turns in the anti-clockwise direction.

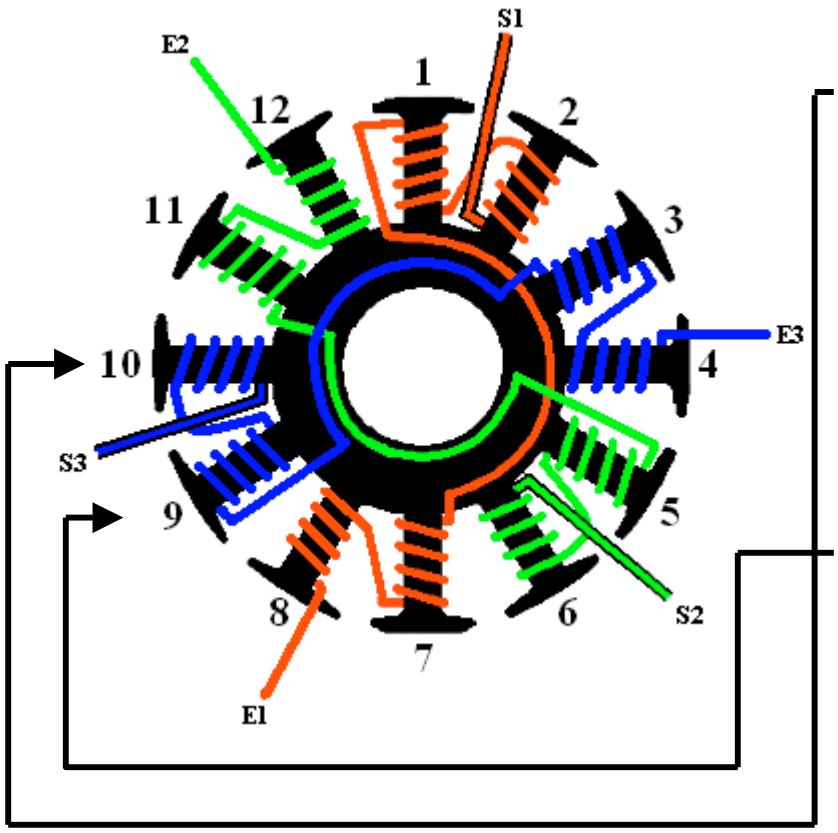
Wind the first layer of 11 turns from the hub to the hammerhead.

Continue winding the second layer with 8 turns from the hammerhead toward the hub.

Finish this tooth with 6 turns from the hub to the hammerhead.

End wire "S2" by cutting it off leaving 7-8 cm for connections.

Phase 3 (Tooth 9 & 10)



Step 11: Leave 7-8 cm for making connections, later.

Step 12: Start the first wire "S3" on tooth No.10. Wind 25 turns in a clockwise direction.

Wind the first layer of 11 turns from the hub to the hammerhead.

Continue winding the second layer with 8 turns from the hammerhead toward the hub.

Finish this tooth with 6 turns from the hub to the hammerhead.

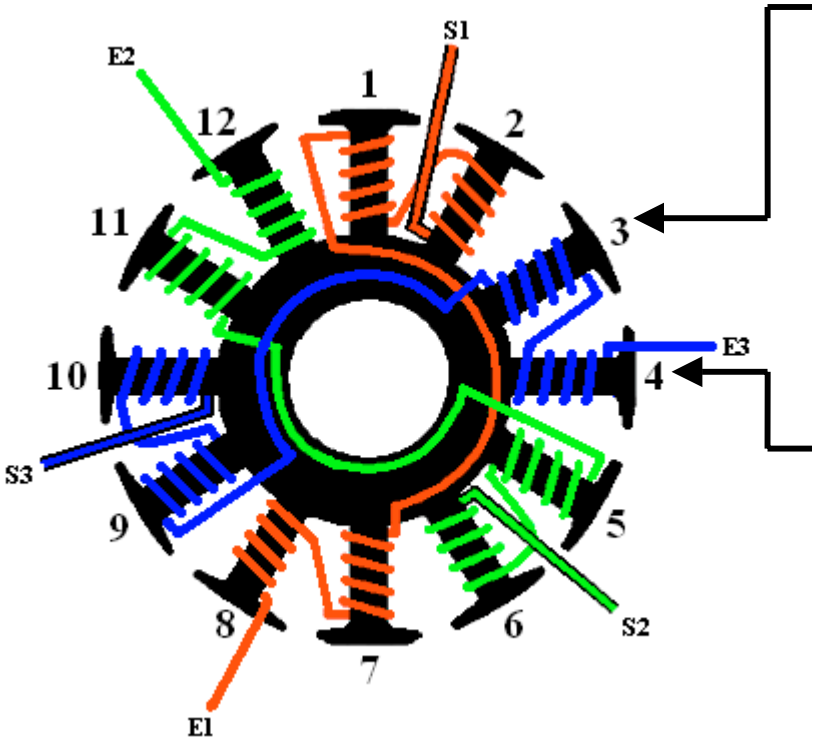
Step 13: Continue this wire to the base of tooth No.9 and wind 25 times in the anti-clockwise direction.

Wind the first layer of 11 turns from the hub to the hammerhead.

Continue winding the second layer with 8 turns from the hamme head toward the hub.

Finish this tooth with 6 turns from the hub to the hammerhead.

Phase 3 (Stator Tooth 3 & 4)



Step 14: Jump to tooth No. 3 and wind 25 turns in the clockwise direction.

Wind the first layer of 11 turns from the hub to the hammerhead.

Continue winding the second layer with 8 turns from the hammerhead toward the hub.

Finish this tooth with 6 turns from the hub to the hammerhead.

Step 15: Continue this wire to the base of tooth No. 4 and wind 25 turns in the anti-clockwise direction.

Wind the first layer of 11 turns from the hub to the hammerhead.

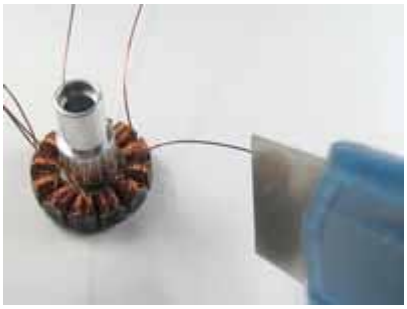
Continue winding the second layer with 8 turns from the hammerhead toward the hub.

Finish this tooth with 6 turns from the hub to the hammerhead.

End wire "S3" by cutting it off leaving 7-8 cm for connections.

Picture of a completed 25 turns winding

4. Remove the coating of magnet wires



Now you have 6 wire ends attached to the coils. Use a sharp knife to scrape off the coating from the last cm of each wire.

Now, check for any possible shorts between the stator and each wire or between wires S1, S2 and S3. If any shorts are found the wire should be removed and new wire installed. Attempting to run a motor with a short can damage your electronic speed control, battery, or receiver.

5. Connecting wires, Delta or Wye system

Now, you need to make you own decision to solder the magnet wires to either Star (wye) or Delta system.

Star vs Delta

- ✓ Star (wye) system gives more torque and uses fewer amps.
  In Star system, 1.73 less turns needs to be wound to get the same power and Kv as DELTA system does.

- ✓ Delta system gives 1.73 higher power and amps draw compare to STAR system.
  In Delta system, the Kv is 1.73 higher than Star system while the Kt (Torque) is 1.73 lower

For the winding example above (25Turns), we recommend you to make Delta system.

25Turns, Delta's Data:
1400Kv
No load current / 8v : 0.5A
No load current / 10v: 0.6A
Resistance (Ohms): 0.1786

For other constant information, please refer to Appendix I

Delta System

Point 1: Solder S1 and E3 together
Point 2: Solder S2 and E1 together
Point 3: Solder S3 and E2 together

Note: Point 1, Point 2 and Point 3 are connected to Electronic Speed Control (ESC)

Star (Wye) System

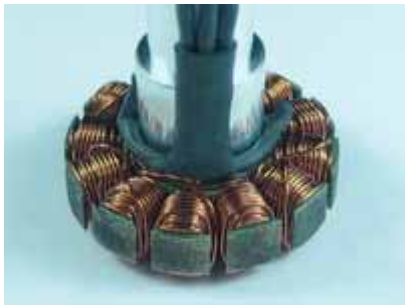
Solder E1, E2, E3 together

Note: S1, S2 and S3 are connected to ESC.

6. Insert three soldered wires to Shrinking Tubes

Now, you have three soldered wires attached to coils. Insert those soldered wires into shrinking tubes for insulating.

7. Put three insulated wires together



Put three wires together and use a short shrinking tube to secure it.

8. Place ball bearings to bearing tube.

Put a big bearing to front side and small bearing to backside.

9. Insert a main shaft to endbell and put the wound stator into the bell.

10. Put a c-clip into the slot of main shaft.

Put a C-clip to the slot of main shaft to secure whole motor system.

11. Place three screws at the end-bell.

Place three screws in the end-bell.
Place three M3 x 3 screws into the end bell to secure the position of the main shaft. Each screw must be turned a little at a time until all screws tighten up.

Congratulations!

You finished the assemble work of your KH-257 outrunner motor.

Should you have any comments on this outrunner motor kit, please feel free to contact us at enquire@komodohobby.com

For other selections of outrunner motor kit, please visit www.komodohobby.com

Firewall Motor Mount

Stick Motor Mount

Firewall Motor Mount and Stick Motor Mount for KH-257 Outrunner Motor are available at www.komodohobby.com.

Appendix I

Constants of Different Winding

Magnet: 14 Poles (NSNSNSNSNSNSNS)
Winding: Distributed LRK

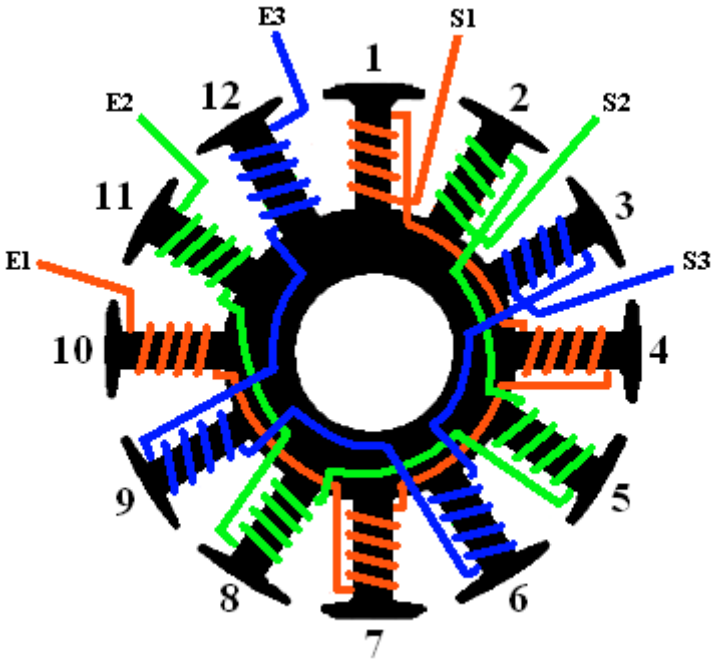
Turns	21	22	23	24	25	26	27
Wire	#28	#28	#28	#28	#28	#29	#29
Configuration	Delta	Delta	Delta	Delta	Delta	Delta	Delta
Kv	1675	1584	1530	1459	1400	1348	1297
No Load Current / 8v	0.7A	0.6A	0.5A	0.5A	0.5A	0.4A	0.4A
No Load Current / 10v	0.8A	0.7A	0.6A	0.6A	0.6A	0.5A	0.5A
Resistance (Ohms)	0.1479	0.1618	0.1669	0.1699	0.1786	0.2330	0.2590
Weight	0.80oz	0.80oz	0.80oz	0.80oz	0.82oz	0.78oz	0.80oz
	22g	22g	22g	22g	23g	21g	22g

Appendix II

Winding: ABCABCABCABC

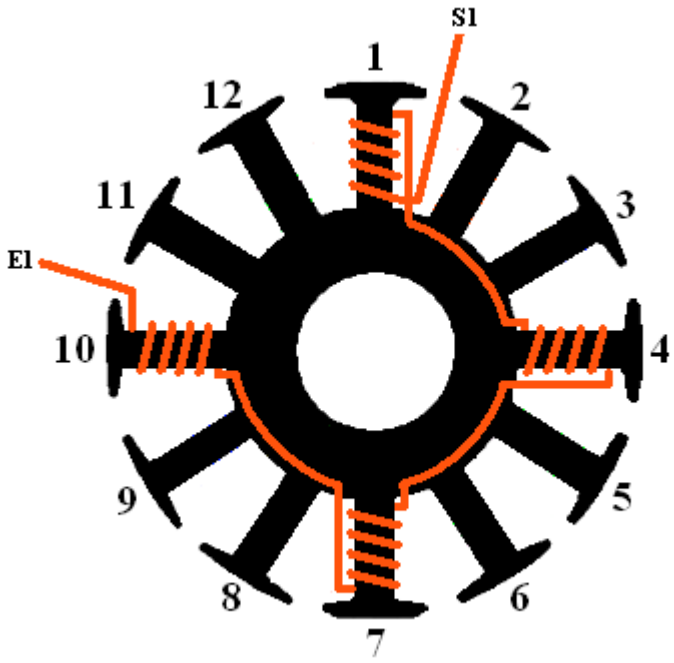
(For 16 magnet poles)

Wind magnet wire in clockwise direction on all stator teeth.

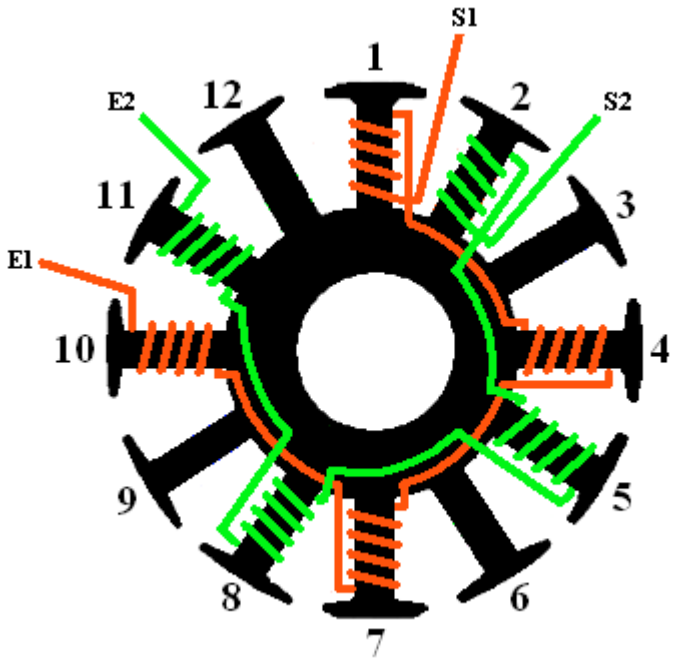


Winding Diagram for 16 Magnet Poles

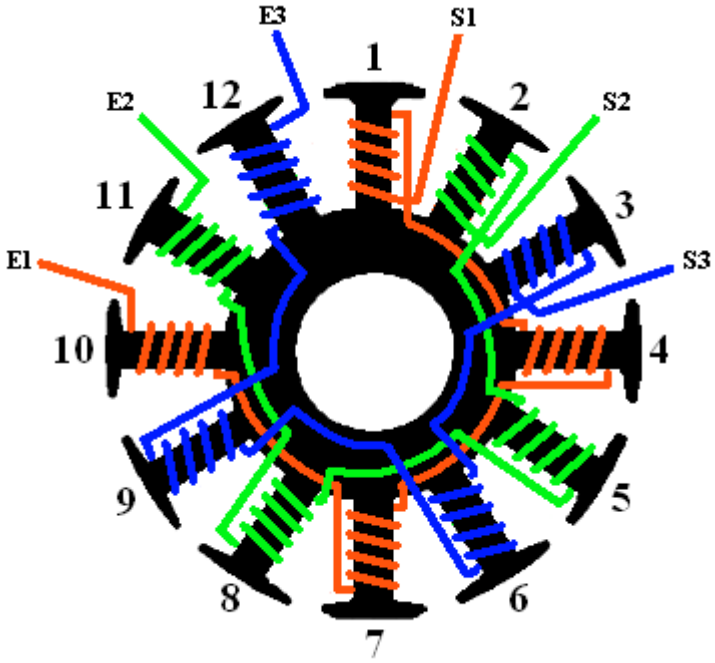
Phase 1 (Tooth 1, 4, 7 & 10)



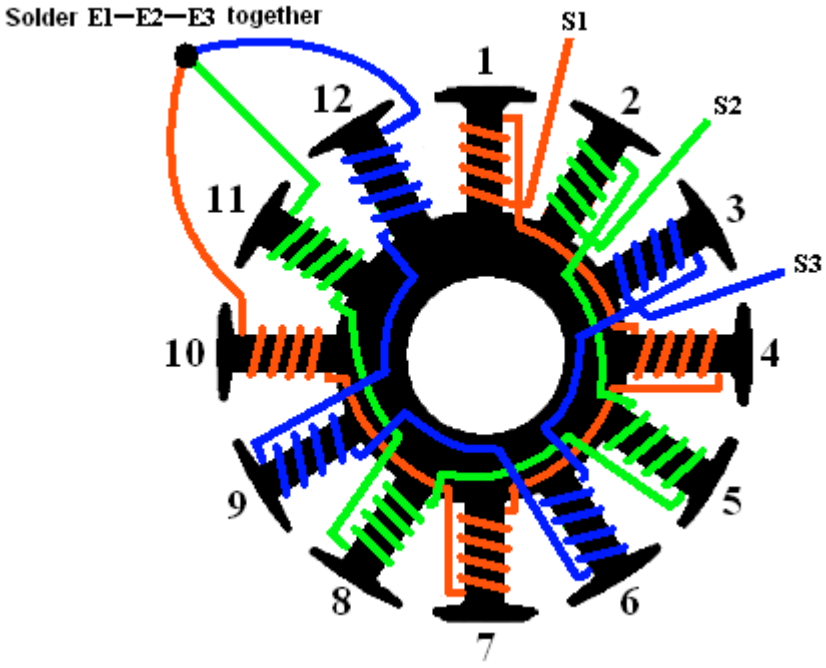
Phase 2 (2, 5, 8 & 11)



Phase 3 (3, 6, 9 & 12)



Star (Wye) System



Delta System