



# BRUSHLESS MOTOR INSTRUCTIONS

55-3400-1 Rev.6

## SENSOR-BASED DESIGN BENEFITS

- **Constant Rotor Position Knowledge**--Because the ESC & motor are continuously synchronized via the motor harness, the sensor-based system provides instantaneous throttle response & smooth transitions from neutral to drive--*NO COGGING*.
- **Smooth & Controlled Low Speed Driveability**--Always knowing the rotor angle is key to smooth acceleration without delivering abrupt and uncontrolled bursts of power.
- **Strong/Consistent Brakes & Starting Torque**--Rotor position knowledge results in consistent starts & stops, without hesitation or inconsistent lag times before acceleration or braking--this translates to consistent lap times.
- **Locked Rotor & Thermal Protection**--Position & temperature sensors inside the motor provide unparalleled protection when used with Novak brushless ESCs, letting you to run pack after pack without worrying about overheating the motor, ESC, or magnets.

## PRECAUTIONS

**NEVER FREE-REV THE MOTOR** *Free-running your brushless motor in a no-load condition can result in rotor failure and ESC transistor damage & will void the product's warranty!*

*Never free-rev your system to "see how it runs", or you may not get to drive it again!*

- **WATER & ELECTRONICS DON'T MIX** Never allow water, moisture, or other foreign materials to get inside motor, or on PCBs.
- **CHECK MOTOR SCREWS** Remember to check all motor screws for loosening after a few runs of the motor.
- **NOVAK MOTORS & ESCs FOR BEST RESULTS** Use Novak sensored motors with Novak Brushless speed controls for best performance. Only use motors with the proper number of turns to match the ESC's rating. Do NOT use Velociti motors with XBR, Super Sport series, or Mongoose ESCs.
- **INSULATE WIRES** Always insulate exposed wiring with heat shrink tubing to prevent short circuits.
- **NO SOLVENTS** Do NOT expose the motor to any type of solvents.
- **SET GEAR MESH PROPERLY** Too tight of a gear mesh can result in motor pinion shaft breakage--be sure to adjust mesh properly.

## MOTOR MAINTENANCE

- **CHECK MOTOR SCREWS**  
Check all motor screws for loosening at regular intervals, just like other hardware on your vehicle. *Note: The 3 main socket head screws that hold the motor together may require tightening after a few runs of the motor.* On 540/550-size motors, also check the 3 flat head screws securing the end cap on the back of the motor.
- **CHECK MOTOR BEARING WEAR**  
After extensive use, your motor's bearings may need replacement. The motor's closed design will keep most dirt & debris out, but some will get in and eventually cause wear. If the shaft does not spin freely, you may need bearing replacement (*replacement front end bell with factory-installed bearing & rear bearing are available in Novak accessory kits--If you feel uncomfortable changing the bearing & end bell, contact our Customer Service Dept. for assistance*). A small drop of light oil on the bearings periodically can help extend bearing life--*however, too much oil will attract dirt and will cause problems, so apply sparingly.*
- **CLEAN INSIDE MOTOR**  
Periodically remove the front end bell of your motor, remove the rotor, and blow out the inside of the motor with compressed air. *Be sure not to lose any small shim washers that may be on the ends of the rotor shaft & keep them in the correct location.*

## NOVAK ELECTRONICS, INC.

Monday-Friday: 8am-5pm (PST) • (949) 833-8873 • FAX (949) 833-1631

e-mail: [cs@teammovak.com](mailto:cs@teammovak.com) web: [www.teammovak.com](http://www.teammovak.com)

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## ACCESSORIES

- 5100 5mm Mod 1 Pinion Gear--11T--Hardened steel pinion gear for HV 5mm motors.
- 5101 5mm Mod 1 Pinion Gear--12T--Hardened steel pinion gear for HV 5mm motors.
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- 5200 1/8" Mod 0.6 Pinion Gear Set--11T/12T/13T--Anodized aluminum 1/8" pinion gears.
- 5201 1/8" Mod 0.6 Pinion Gear Set--14T/15T/16T--Anodized aluminum 1/8" pinion gears.
- 5202 1/8" Mod 0.6 Pinion Gear Set--17T/18T/19T--Anodized aluminum 1/8" pinion gears.
- 5210 1/8" Mod 0.5 Pinion Gear Set--11T/12T/13T--Anodized aluminum 1/8" pinion gears.
- 5211 1/8" Mod 0.5 Pinion Gear Set--14T/15T/16T--Anodized aluminum 1/8" pinion gears.
- 5412 1/8" Mod 0.5 Pinion Gear Set--17T/18T/19T--Anodized aluminum 1/8" pinion gears.
- 5413 HV Brushless Motor Heat Sink--Large slide on heat sink for any 550-size motors.
- 5414 Velociti Heat Sink Motor Sleeve--Black--V Logo/Replaces Novak 540 motor sleeve.
- 5415 Velociti Heat Sink Motor Sleeve--Purple--V Logo/Replaces Novak 540 motor sleeve.
- 5416 Velociti Heat Sink Motor Sleeve--Blue--V Logo/Replaces Novak 540 motor sleeve.
- 5420 540-Size Novak Brushless Motor Sleeve--Black--Novak replacement sleeve.
- 5421 540-Size Novak Brushless Motor Sleeve--Blue--Novak replacement sleeve.
- 5422 540-Size Novak Brushless Motor Sleeve--Gold--Novak replacement sleeve.
- 5423 540-Size Novak Brushless Motor Sleeve--Purple--Novak replacement sleeve.
- 5508 14GA Brushless Wire Set--2 pieces each of 9" silicone blue, yellow, orange, black, & red.
- 5509 16GA Brushless Wire Set--2 pieces each of 9" silicone blue, yellow, orange, black, & red.
- 5530 12GA Super-Flex Wire--Black & Red--3 ft each color, silicone.
- 5535 12GA Super-Flex Wire--Blue & Red--3 ft each color, silicone.
- 5647 Black Cooling Fan--25x25x10mm--All purpose cooling fan with 2-pin JST connector.
- 5648 Clear Cooling Fan--30x30x6mm--GTB replacement fan with 2-pin JST connector.
- 5720 2mm Power Connectors--2 pair--Gold plated low-loss connectors for 16-20G wire.
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- 5810 Gold Battery Cross Bars--7pcs--Gold plated oxygen-free copper battery bars.
- 5820 Silver Battery Cross Bars--7pcs--Oxygen-free copper battery bars, plated for easy soldering.
- 5825 Micro Battery Cross Bars--7pcs--Gold plated oxygen-free copper micro battery bars.
- 5826 Silver Battery Cross Bars--28pcs--Gold plated oxygen-free copper micro battery bars.
- 5831 Lead-Free 3% Silver Racing Solder--6g--Low-resistance, high-conductivity solder.
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- 5840 Double-Sided Mounting Tape--10pcs--1"x1" high-performance clear mounting tape.
- 5905 EX/SS4300/SS5800 Bearings & End Bell--Replacement bearings & front end bell.
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## SERVICE PROCEDURES

After reviewing the instructions, if you feel the motor requires service (*motor may appear to have failed when other problems exist*), obtain the most current product service options & pricing by one of the following methods:

**WEBSITE:** Print a copy of the product **SERVICE FORM** from the SERVICE section of the Novak website. Fill out the needed information & return it with the Novak product.

**PHONE/FAX/E-MAIL:** Contact our customer service department by phone, fax, or e-mail, and they will supply you with current service options.

**WARRANTY SERVICE:** You **MUST CLAIM WARRANTY** on product **SERVICE FORM** & include a valid, itemized cash register receipt with the purchase date on it, or an invoice from previous service work. *If warranty provisions have been voided, there will be service charges.*

### ADDITIONAL NOTES:

- Dealers/distributors are not authorized to replace products thought to be defective.
- If a hobby dealer returns your product for service, submit a completed product **SERVICE FORM** to dealer & make sure it's included with items.

## PRODUCT WARRANTY

Novak Brushless motors are guaranteed to be free from defects in materials or workmanship for a period of 120 days from the original date of purchase (*verified by dated, itemized sales receipt*). Warranty does not cover incorrect installation, components worn by use, cross-connection of battery/motor power wires, overheating solder tabs, damage resulting from thermal overload, splices to sensor harness, damage from disassembling motor, tampering with internal electronics, allowing water, moisture, or any other foreign material to enter motor or get onto the PCB board, allowing exposed wiring or solder tabs to short-circuit, free-revving motor, or any damage caused by a crash, flooding, or act of God. In no case shall our liability exceed the product's original cost. We reserve the right to modify warranty provisions without notice. Because Novak Electronics, Inc. has no control over the connection & use of motor or other related electronics, no liability may be assumed nor will be accepted for damage resulting from the use of this product. Every motor is thoroughly tested and cycled before leaving our facility and is, therefore, considered operational. *By the act of connecting/operating speed control, the user accepts all resulting liability.*



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## INSTALLATION INSTRUCTIONS

### 1. NO MOTOR CAPACITORS & SCHOTTKY NEEDED

Novak brushless motors do not need motor capacitors or external Schottky diodes--**Schottky diode usage will damage ESC.**

### 2. CHECK MOTOR SCREW LENGTH & INSTALL MOTOR

- Insert the motor mounting screws that came with your vehicle through the motor mounting plate. **540 & 550-size motors need no more than 1/8" of screw extending past the vehicle's mounting plate (2-4mm)**--Too little can strip the motor's threads, too much will cause internal motor damage & will void warranty.
- Attach motor to vehicle's motor mount using one of the sets of threaded mounting holes--**select a mounting position that keeps the solder tabs clear of conductive surfaces like aluminum or graphite.**

### 3. INSTALL PINION GEAR (see GEAR SELECTION on back)

Install pinion on motor and test fit in vehicle to align pinion and spur gears. Tighten pinion's set screw on the flat of motor shaft.

### 4. ADJUST MOTOR FOR PROPER GEAR MESH

- Adjust the motor position for proper amount of free play. **You NEED to have a small amount of play between the pinion gear and the spur gear (about the thickness of piece of paper)--check the free play at several positions around the spur gear to ensure a proper mesh (just in case the gears are out of round).**

#### MAKE SURE THE PINION/SPUR GEAR MESH IS NOT TOO TIGHT!

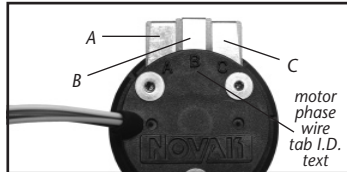
If gear mesh is too tight, motor shaft breakage can occur.

- Tighten motor mounting screws--Avoid using excessive force, as the threaded holes in motor could become stripped.

### 5. SOLDER 540/550 MOTOR WIRES & CONNECT SENSOR HARNESS

- Determine the best routing in vehicle for sensor harness & power wires. **Prepare ends of motor power wires** by stripping 1/8-1/4" of insulation from end of wire. Tin wire ends with solder.
- Lay tinned end of the wire flat on the solder tab and solder wires to proper tabs of the motor (see photo below).** Apply heat with soldering iron to the power wire and solder tab--begin adding solder to tip of iron and to wire--**Add just enough solder to form a clean & continuous joint from the solder tab up onto the wire.**

WARNING: Be sure no wire strands have strayed to an adjacent solder tab--this will cause short-circuiting, damage electronics, & void product's warranty.

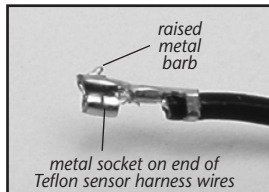
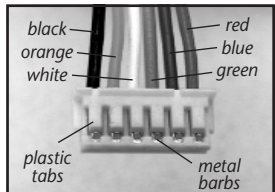


Be sure to solder wires to matching tabs at ESC & Motor (A/B/C)

**IMPORTANT NOTE: DO NOT OVERHEAT SOLDER TABS**  
Prolonged/excessive heating of solder tabs will damage PCB & void warranty.

## SENSOR HARNESS WIRING

Should any of the 26G Teflon wires pull out of the motor's sensor harness connector, re-insert them in the connector's appropriate slot as shown below. There is a small plastic tab that grabs a small raised barb on the back of the metal socket crimped onto the Teflon wire's end. Check the plastic tab to make sure it has not deformed excessively before inserting the socket into the plastic connector housing with the barb toward the plastic tabs.



## GEAR SELECTION (Important)

### Motor operating temperature is the ONLY way to properly set the vehicle gearing

The motor should be 160-175°F MAX at end of run!

Above this temperature will weaken the magnet!

Change the gearing to avoid overheating.

### Gearing Starting Points for 6-Cell (2S LiPo) Use:

- Velociti 3.5R motor**  
4 teeth lower pinion than normally used on 7-turn brush motor.
- Velociti 3.5L (Light) motor**  
5 teeth lower pinion than normally used on 7-turn brush motor.
- Velociti 4.5R motor**  
4 teeth lower pinion than normally used on 8-turn brush motor.
- Velociti 4.5L (Light) motor**  
5 teeth lower pinion than normally used on 8-turn brush motor.
- Velociti 5.5R motor**  
3 teeth lower pinion than normally used on 9 or 10-turn brush motor.
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- Velociti 7.5R motor**  
1 tooth lower pinion than normally used on 12 or 13-turn brush motor.
- Velociti 7.5L (Light) motor**  
2 teeth lower pinion than normally used on 12 or 13-turn brush motor.
- SS-Pro 8.5 motor**  
1-2 teeth lower pinion than normally used on 15-turn brush motor.
- SS-Pro 10.5 motor**  
1-2 teeth lower pinion than normally used on 19-turn brush motor.
- SS-Pro 13.5 motor**  
1-2 teeth lower pinion than normally used on 27-turn brush motor.
- SS-Pro 17.5 motor**  
1-2 teeth **bigger** pinion than normally used on 27-turn brush motor.
- SS-Pro 21.5 motor**  
2-3 teeth **bigger** pinion than normally used on 27-turn brush motor.
- EX 8.5 or SS5800 motor**  
3-4 teeth lower pinion than normally used on 15-turn brush motor.
- EX 10.5 or SS4300 motor**  
3-4 teeth lower pinion than normally used on 19-turn brush motor.
- EX 13.5 motor**  
3-4 teeth lower pinion than normally used on 27-turn brush motor.

If you do not change gearing after switching to brushless, you will be over-gear and will have slow acceleration & excessive temperatures!

Because of the broad power band of brushless, you can go 1-2 teeth higher pinion than the above recommendations for more top speed, but remember any higher will produce excessive ESC & motor heating. Check motor's operating temperature after making gearing adjustments--motors are designed to operate from 160°F-175°F.

### Crawler Brushless Motors

When properly geared for use with gear reduction transmissions found in rock crawling vehicles, your brushless crawler motor and ESC should not get very hot--if you notice excessive temperatures, check motor & drive train for free operation or adjust gearing to lower temperature.

### Three-80 Micro Pro Brushless Motors

A safe starting point for gearing is 3-5 teeth smaller than the stock pinion gear that came with your micro vehicle. When properly geared, your Three-80 system should not get excessively hot--if you notice high temperatures, check motor & drive train for free operation or adjust gearing to lower temperature.

### HV (550-size high-voltage) Brushless Motors

Novak HV motors should be geared based on the end-of-run motor & ESC temperatures--adjust gearing so the temperatures do not exceed 160-170°F.

If installing in the Traxxas® E-Maxx™, start with the following:

Original E-Maxx™: 72 spur gear 12T pinion  
New version E-Maxx™: 68 spur gear (stock) 12T pinion

See our website for updated gearing recommendations, final drive ratios, or if your motor does not appear above.

## INSTALLATION INSTRUCTIONS

### 1. NO MOTOR CAPACITORS & SCHOTTKY NEEDED

Novak brushless motors do not need motor capacitors or external Schottky diodes--**Schottky diode usage will damage ESC.**

### 2. CHECK MOTOR SCREW LENGTH & INSTALL MOTOR

- Insert the motor mounting screws that came with your vehicle through the motor mounting plate. **540 & 550-size motors need no more than 1/8" of screw extending past the vehicle's mounting plate (2-4mm)**--Too little can strip the motor's threads, too much will cause internal motor damage & will void warranty.
- Attach motor to vehicle's motor mount using one of the sets of threaded mounting holes--**select a mounting position that keeps the solder tabs clear of conductive surfaces like aluminum or graphite.**

### 3. INSTALL PINION GEAR (see GEAR SELECTION on back)

Install pinion on motor and test fit in vehicle to align pinion and spur gears. Tighten pinion's set screw on the flat of motor shaft.

### 4. ADJUST MOTOR FOR PROPER GEAR MESH

- Adjust the motor position for proper amount of free play. **You NEED to have a small amount of play between the pinion gear and the spur gear (about the thickness of piece of paper)--check the free play at several positions around the spur gear to ensure a proper mesh (just in case the gears are out of round).**

#### MAKE SURE THE PINION/SPUR GEAR MESH IS NOT TOO TIGHT!

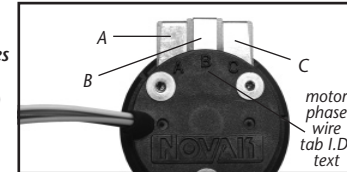
If gear mesh is too tight, motor shaft breakage can occur.

- Tighten motor mounting screws--Avoid using excessive force, as the threaded holes in motor could become stripped.

### 5. SOLDER 540/550 MOTOR WIRES & CONNECT SENSOR HARNESS

- Determine the best routing in vehicle for sensor harness & power wires. **Prepare ends of motor power wires** by stripping 1/8-1/4" of insulation from end of wire. Tin wire ends with solder.
- Lay tinned end of the wire flat on the solder tab and solder wires to proper tabs of the motor (see photo below).** Apply heat with soldering iron to the power wire and solder tab--begin adding solder to tip of iron and to wire--**Add just enough solder to form a clean & continuous joint from the solder tab up onto the wire.**

WARNING: Be sure no wire strands have strayed to an adjacent solder tab--this will cause short-circuiting, damage electronics, & void product's warranty.

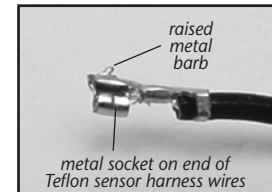
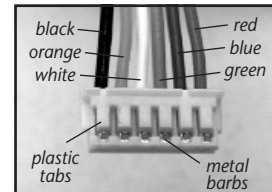


Be sure to solder wires to matching tabs at ESC & Motor (A/B/C)

**IMPORTANT NOTE: DO NOT OVERHEAT SOLDER TABS**  
Prolonged/excessive heating of solder tabs will damage PCB & void warranty.

## SENSOR HARNESS WIRING

Should any of the 26G Teflon wires pull out of the motor's sensor harness connector, re-insert them in the connector's appropriate slot as shown below. There is a small plastic tab that grabs a small raised barb on the back of the metal socket crimped onto the Teflon wire's end. Check the plastic tab to make sure it has not deformed excessively before inserting the socket into the plastic connector housing with the barb toward the plastic tabs.



## GEAR SELECTION (Important)

### Motor operating temperature is the ONLY way to properly set the vehicle gearing

The motor should be 160-175°F MAX at end of run!

Above this temperature will weaken the magnet!

Change the gearing to avoid overheating.

### Gearing Starting Points for 6-Cell (2S LiPo) Use:

- Velociti 3.5R motor**  
4 teeth lower pinion than normally used on 7-turn brush motor.
- Velociti 3.5L (Light) motor**  
5 teeth lower pinion than normally used on 7-turn brush motor.
- Velociti 4.5R motor**  
4 teeth lower pinion than normally used on 8-turn brush motor.
- Velociti 4.5L (Light) motor**  
5 teeth lower pinion than normally used on 8-turn brush motor.
- Velociti 5.5R motor**  
3 teeth lower pinion than normally used on 9 or 10-turn brush motor.
- Velociti 5.5L (Light) motor**  
4 teeth lower pinion than normally used on 9 or 10-turn brush motor.
- Velociti 6.5R motor**  
2 teeth lower pinion than normally used on 10 or 11-turn brush motor.
- Velociti 6.5L (Light) motor**  
3 teeth lower pinion than normally used on 10 or 11-turn brush motor.
- Velociti 7.5R motor**  
1 tooth lower pinion than normally used on 12 or 13-turn brush motor.
- Velociti 7.5L (Light) motor**  
2 teeth lower pinion than normally used on 12 or 13-turn brush motor.
- SS-Pro 8.5 motor**  
1-2 teeth lower pinion than normally used on 15-turn brush motor.
- SS-Pro 10.5 motor**  
1-2 teeth lower pinion than normally used on 19-turn brush motor.
- SS-Pro 13.5 motor**  
1-2 teeth lower pinion than normally used on 27-turn brush motor.
- SS-Pro 17.5 motor**  
1-2 teeth **bigger** pinion than normally used on 27-turn brush motor.
- SS-Pro 21.5 motor**  
2-3 teeth **bigger** pinion than normally used on 27-turn brush motor.
- EX 8.5 or SS5800 motor**  
3-4 teeth lower pinion than normally used on 15-turn brush motor.
- EX 10.5 or SS4300 motor**  
3-4 teeth lower pinion than normally used on 19-turn brush motor.
- EX 13.5 motor**  
3-4 teeth lower pinion than normally used on 27-turn brush motor.

If you do not change gearing after switching to brushless, you will be over-gear and will have slow acceleration & excessive temperatures!

Because of the broad power band of brushless, you can go 1-2 teeth higher pinion than the above recommendations for more top speed, but remember any higher will produce excessive ESC & motor heating. Check motor's operating temperature after making gearing adjustments--motors are designed to operate from 160°F-175°F.

### Crawler Brushless Motors

When properly geared for use with gear reduction transmissions found in rock crawling vehicles, your brushless crawler motor and ESC should not get very hot--if you notice excessive temperatures, check motor & drive train for free operation or adjust gearing to lower temperature.

### Three-80 Micro Pro Brushless Motors

A safe starting point for gearing is 3-5 teeth smaller than the stock pinion gear that came with your micro vehicle. When properly geared, your Three-80 system should not get excessively hot--if you notice high temperatures, check motor & drive train for free operation or adjust gearing to lower temperature.

### HV (550-size high-voltage) Brushless Motors

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