

CRUSHER FIELD GUIDE

CRAWLING MODE (#4)

#55-1834P-C1 Rev.1

7-2014

This Brushless ESC is equipped with **Novak's Simple-Tuner firmware** and factory loaded with programmable features. This Field Guide is for programming the Crawling Modes (profile 4). Refer to the Crusher Standard Mode Field Guide for programming profiles #1-3.

This **Field Guide** is designed to be used as a quick-reference and help walk you through the programming of all of the speed control's features.

Take the time to thoroughly read through this programming guide before attempting to make any programming adjustments so you fully understand the different ESC parameters, and how they can be used to fine tune your ESC's feel and performance. Most importantly, enjoy all of the technical benefits and features the ESC has to offer.

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ESC PARAMETERS

The following parameters (Crawling Profile #4) are adjustable to help fine-tune the feel and response of the speed control to your liking.

1. Drag/Hill Brake (1 of 10) 0-95% (plus 5 Power Hold Brake settings)
2. Brake Frequency (1 of 10) 1.5-8KHz
3. Rock Boost (1 of 2)..... OFF/ON
4. Dead Band (1 of 5) 2-8%
5. Drive Frequency (1 of 10) 8-36KHz
6. Minimum Drive (1 of 10) 0-15%
7. Motor Rotation (1 of 2)..... CCW/CW
8. Voltage Cut-Off (1 of 2) OFF/LiPo
9. Default Data Reset Keep/Reset

Auto Detect Motor Feature: In order for the Crusher to activate the Crawling Mode, a Novak Crawling Brushless Motor must be connected. The Crusher will sense for crawling or standard sensor information and adjust the firmware based on the motor connected. The Crawling Mode offers unique braking and forward/reverse operation that has no reverse delay- allowing for instant reverse. This mode also features Novak's exclusive *Drag/Hill Brake* and *Rock Boost*.

For added versatility, a Novak crawling motor can be run in standard mode (refer to 'Crusher Field Guide- Standard Modes'.

Drag/Hill Brake: Novak's exclusive hill/hold/drag brake for the strongest automatic neutral point brakes, and allow the heaviest of vehicles to hold on the steepest of inclines.

Novak Rock Boost: Adds electronic timing advance to the motor at full speed giving the motor more RPM and wheel speed. This feature is available with 2S LiPo packs.

PROPER GEAR SELECTION

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

The Motor and Speed Control should not exceed **160°F MAX** at any time during run!

Change the gearing to avoid overheating!

DO NOT FREE-REV MOTOR!

Free-running your brushless motor in a no-load condition can cause rotor failure & ESC transistor damage that will not be covered by the product's warranty.

Because of the potential danger of overheating and ESC/motor damage and failure, **you must start with VERY small pinion sizes** and check the speed control and motor operating temperatures at multiple times throughout the initial runs after installation. This is the only way to ensure that you are not causing excessive heating.

If ESC & motor temperatures remain low & stable, you can slowly increase the pinion size while again monitoring the temperatures to determine the safe gearing for your vehicle, motor, and climate/track conditions. Because these variables can change or be modified, **you MUST continually monitor ESC & motor temperatures** to protect your electronics from damage.

ONE-TOUCH SET-UP

With at least 2 of the Motor Power Wires disconnected & the ESC connected to a charged battery pack, the receiver, & the motor's sensor harness:

1. WITH THE ESC OFF, TURN ON THE TRANSMITTER'S POWER
2. **PRESS & HOLD** ESC'S ONE-TOUCH/SET BUTTON
3. TURN ON THE SPEED CONTROL'S POWER
With transmitter throttle at neutral, and still pressing the SET button, slide the ESC's ON/OFF switch to **ON position**.
4. CONTINUE HOLDING SET BUTTON UNTIL RED LED COMES ON
5. RELEASE SET BUTTON AS SOON AS RED LED TURNS ON
6. PULL TRANSMITTER THROTTLE TO FULL-ON POSITION
Hold it there until the green status LED **turns solid green**.
Note: Motor will not run during programming even if connected.
7. PUSH TRANSMITTER THROTTLE TO FULL-BRAKE/REVERSE
Hold it there until the green status LED **blinks green**.
8. RETURN TRANSMITTER THROTTLE TO NEUTRAL
The red status LED will **turn solid red**, indicating that the ESC is at neutral and that proper programming has been completed.

If transmitter settings are changed, the One-Touch Set-Up must be repeated. If you experience any problems, turn off ESC and repeat One-Touch.

NOTE: ESC will NOT revert back to the factory-default settings when the One-Touch set-up is performed. Refer to 'Data Reset' in Custom Programming.

TRANSMITTER ADJUSTMENTS

Transmitter adjustments may not be required to properly complete the ESC's One-Touch Set-Up. However, should you have any problems completing the **ONE-TOUCH SET-UP**, adjust the following settings on your transmitter, then repeat the **ONE-TOUCH SET-UP** as described above.

THROTTLE CHANNEL ADJUSTMENTS

- A. Set **HIGH ATV** or **EPA** to **100%**. [amount of throw at full throttle]
- B. Set **LOW ATV**, **EPA**, or **ATL** to **100%**. [amount of throw at full brakes]
- C. Set **EXPONENTIAL** to **zero** setting. [throttle channel linearity]
- D. Set **THROTTLE CHANNEL REV. SWITCH** to **either** position.
- E. Set **THROTTLE CHANNEL TRIM** to **middle** setting.
[adjusts neutral position/increases or decreases coast brakes]
- F. Set **ELECTRONIC TRIGGER THROW ADJUSTMENT** to **70% throttle** and **30% brake** throw (or 7:3)—best for racing ESCs. Set to 50% throttle and 50% brake for full time use with reverse to get the best performance in reverse.
[adjusts trigger throw on electronic/digital pistol-grip transmitters]
- G. Set **MECHANICAL TRIGGER THROW ADJUSTMENT** to position with **2/3 throttle** and **1/3 brake** throw.
[adjusts trigger throw on mechanical/analog pistol-grip transmitters]

•NOT ALL TRANSMITTERS HAVE ALL OF THESE ADJUSTMENTS•

GOOD QUALITY RADIO SYSTEM SUGGESTED

With the higher performance of brushless systems, undesirable radio system noise may occur when used with lower quality radio systems. good quality 2.4GHz radio systems are the best to use. FM radio systems are acceptable, as long as the system is high quality. **AM radio systems are not recommended.**



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CUSTOM PROGRAMMING-CRAWLING MODE

SIMPLE-TUNER FLOW CHART

This speed control features Novak's Simple-Tuner programming interface with numerous ESC parameters that can be customized to fine-tune the ESC's feel & response to your liking.

The flow chart and the descriptions to the right show the order of the different parameters and how they effect the ESC's feel or response.

One-Touch Set-Up (page 1) should be completed before customization of ESC parameters that are based off percentages of the trigger's full-throttle and full-brake position.

Note: ESC parameters do NOT default back to the factory settings when the One-Touch Programming is performed.

THE ESC PARAMETERS LISTED IN BOLD IN THE PARAMETER TABLES ARE THE DEFAULT SETTINGS FOR PROFILE #4

The sequence that the status LEDs of the ESC goes through in the Simple-Tuner software is easier than ever to follow. Common ESC parameters are grouped together, and the LEDs also light up in order from left to right on the ESC.

The first two adjustable items are the ESC's brake adjustments (Drag/Hill Brake and Brake Frequency), then Rock Boost, followed by three forward Drive settings, and then finished up with Motor Rotation, LiPo ON/OFF, Data Reset, and a motor test mode to check the hall sensors & harness connections.

ESC STATUS LED ORDER:



TO CHANGE PARAMETER SETTINGS:

1. CONNECT THE ESC TO A FULLY CHARGED BATTERY PACK, A RECIEVER, AND THE MOTOR'S SENSOR HARNESS
2. SLIDE THE ESC'S ON/OFF SWITCH TO 'ON' POSITION
3. WITH ESC AT NEUTRAL, PRESS & HOLD SET BUTTON
Release ESC's SET button once LEDs are lit for the desired setting.

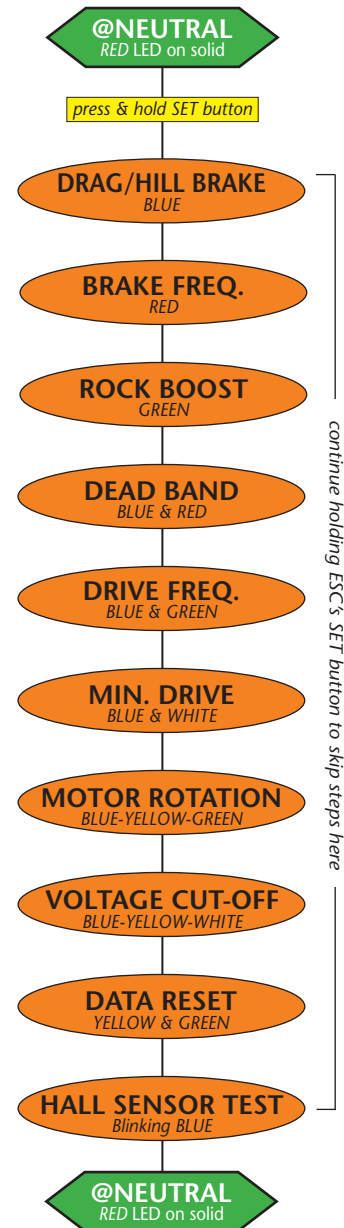
To skip a parameter, continue to press & hold SET button until desired parameter is reached.

4. SELECT PARAMETER VALUE
LED flashes to indicate active setting (refer to tables for each adjustable parameter). Quick press & release SET button to select desired setting.

5. PRESS & HOLD SET BUTTON TO STORE NEW SELECTION
When SET button is pressed and held for about 1 second, *the new selection is stored* in ESC's memory—*Status LEDs will scroll across to indicate ESC is exiting programming & ESC returns to neutral.*

There is no time constraint during selection of custom parameters.

THERE IS ALSO A CRUSHER PROFILE THROTTLE PROFILE CHEAT SHEET AVAILABLE ON OUR WEBSITE.



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DRAG/HILL BRAKE

#1 DRAG/HILL BRAKE SETTINGS (1 of 10) BLUE LED

Amount of braking being applied while transmitter is at neutral- commonly referred to as 'hold' brakes.

>> **Settings 1-5 are Standard Drag Brake settings--Lower braking levels good for bashing or crawling (setting #1 applies no braking at neutral).**

>> **Settings 6-10 are Power Hill Brake settings (power applied to the motor to 'hold' its position)--Very strong Hill/Hold brakes for rock crawling.**

Setting (# of flashes)	1	2	3	4	5	6*	7*	8*	9*	10*
Drag Brake (%):	0	20	45	75	95	P1	P2	P3	P4	P5

BRAKE FREQUENCY

#2 BRAKE FREQUENCY SETTINGS (1 of 10) RED LED

How the ESC's braking response feels with respect to the transmitter's trigger input.

>> **Increasing Frequency makes the brakes feel smoother and more controllable.**

Setting (# of flashes)	1	2	3	4	5	6	7	8	9	10
Brake Freq. (KHz):	1.5	2	2.2	2.5	3	3.5	4.5	6	7	8

CUSTOM PROGRAMMING-CRAWLING MODE

ROCK BOOST

#3 ROCK BOOST

GREEN LED

Changing this setting activates or deactivates ESC's Boost Timing. This feature is available with 2S LiPo and not with 3S or 4S LiPo packs.

>> **When OFF**, ESC's throttle response is linear from neutral to full throttle with no electronic motor timing advancement being applied.

>> **When ON**, ESC still has linear response throughout throttle range, then when transmitter is held at full throttle, RPM Boost Timing is engaged & ESC electronically advances the motor timing for increased top speeds.

White LED will be ON when RPM Boost Timing is being applied

Setting (# of flashes)	1	2
RPM Boost Timing:	OFF	ON

DEAD BAND

#4 DEAD BAND SETTINGS (1 of 5)

BLUE & RED LEDs

The space between Minimum Brake and Minimum Drive, with Neutral in the middle.

>> **Increasing this setting increases amount of 'free play', or distance the transmitter's trigger must move before forward drive or braking begins.**

Setting (# of flashes)	1	2	3	4	5
Dead Band (%):	2	3	4	5	8

DRIVE FREQUENCY

#5 DRIVE FREQUENCY SETTINGS (1 of 10)

BLUE & GREEN LEDs

How the ESC's throttle response feels with respect to the transmitter's trigger input.

>> **Increasing the Drive Frequency makes the throttle response feel smoother and more controllable.**

Setting (# of flashes)	1	2	3	4	5	6	7	8	9	10
Drive Freq. (KHz):	8	10	12	14	16	21	23	26	32	36

MINIMUM DRIVE

#6 MINIMUM DRIVE SETTINGS (1 of 10)

BLUE & WHITE LEDs

Amount of forward drive applied with first pulse of transmitter throttle information.

>> **Increasing this setting starts the forward drive at a stronger level.** This is useful to compensate for heavier vehicles to minimize the amount of trigger throw required before effective drive is applied.

Setting (# of flashes)	1	2	3	4	5	6	7	8	9	10
Minimum Drive (%):	0	1	2	3	4	6	8	10	12	15

MOTOR ROTATION

#7 MOTOR ROTATION SELECTION (1 of 2)

BLUE-YELLOW-GREEN LEDs

>> **Changing this setting changes the rotation direction of the motor's output/pinion shaft.**

Counter-clockwise rotation is standard in most vehicles.

Note: Newer Novak Ballistic Crawler motors come factory-timed to 0° mechanical timing and perform equally well in both directions of rotation. Older Ballistic Crawler motors **MUST** have the motor's mechanical timing adjusted to 0° for crawling or reverse rotation setups--Do this by aligning the sensor harness connector opening of the motor's back bearing cap directly in-line with the center (Phase B) solder tab.

Setting (# of flashes)	1	2
Rotation Direction:	CCW ↺	CW ↻

VOLTAGE CUT-OFF

#8 VOLTAGE CUT-OFF (1 of 2)

BLUE-YELLOW-WHITE LEDs

>> **Changing this setting enables or disables the built-in Auto-Detect Smart Stop voltage cut-off circuitry, and also sets the voltage cut-off point based on the number of cells in the vehicle's main battery pack.**

DO NOT USE LiPo BATTERIES WITH THE ESC'S VOLTAGE CUT-OFF CIRCUITRY TURNED OFF

Setting (# of flashes)	1	2
Voltage Cut-Off Type:	OFF (NiMH/NiCd)	LiPo

DATA RESET

#9 DEFAULT DATA RESET

YELLOW & GREEN LEDs

>> **This feature resets the ESC's adjustable parameters to factory default values for all throttle profiles. Select setting #2 then Push & Hold to RESET.**

Setting (# of flashes)	1	2
Data Reset:	KEEP DATA	RESET ALL DATA

HALL SENSOR TEST

#10 MOTOR SENSOR TEST

Blinking BLUE LED

>> **This is a diagnostic feature that allows you to easily check the functionality of your brushless motor's hall effect sensors & sensor harness and its connections at the speed control and motor. Once activated, slowly rotate the motor's output/pinion shaft and the appropriate LED will light up if a signal is received for its sensor in the motor. Refer to 'MOTOR HALL SENSOR TEST' section on next page.**

Motor Hall Sensor	A	B	C
LED Color:	BLUE	YELLOW	RED

MOTOR HALL SENSOR TEST

The Hall Sensor Test diagnostic feature in this ESC allows you to easily check the sensors in the brushless motor connected to it to determine if they are operating normally. This will help you pinpoint the cause of problems in your system, and hopefully reduce the down time and expenses associated with sending your product in for service when you can resolve the issue yourself.

To access this feature, simply follow these steps:

1. Follow the steps in the 'CUSTOM PROGRAMMING OPTIONS' section to access the Hall Sensor Test option via the ESC's SET button.
2. Slowly rotate the motor's output/pinion shaft. *If motor is installed in a vehicle, slowly rotate the drive train so that the motor also rotates.*
3. The status LEDs on the speed control should cycle through illuminating the BLUE, YELLOW, and RED status LEDs.

If the BLUE, YELLOW, and RED LEDs light up one after another as the motor's shaft is rotated, the Hall Sensors in the motor are operating normally.

If any one of the BLUE, YELLOW, or RED status LEDs do not light while rotating the motor's shaft, there is either a problem with the Sensor Harness Cable (or its connections either at the motor end or the ESC end) or with the actual Hall Effect Sensors in the motor's timing section.

If your motor has a user-replaceable double-ended sensor harness, replace it with another one to determine if this is the problem. If, after replacing the harness, all 3 of the LEDs still do not light up, it would appear that one of the motor's sensors has been damaged--replace the timing section of your motor, or if your motor is not user-rebuildable, send it in the manufacturer for the appropriate service.

VOLTAGE CUT-OFF CIRCUITRY

This speed control features Novak's Smart-Stop Voltage Cut-Off Circuitry built-in, and when used properly will allow you to safely use LiPo type batteries, without letting the cells drop below their critical safety voltage during operation.

The default setting in the speed control is that the Voltage Cut-Off is turned ON and is set to LiPo. If you are using NiMH or NiCd cells, you will need to switch the Voltage Cut-Off feature OFF.

Note: Whenever the speed control's One-Touch Programming is performed, this setting will revert to the LiPo default setting.

DO NOT USE LiPo BATTERIES WITH VOLTAGE CUT-OFF TURNED OFF

TEMPERATURE MONITORING

This ESC has a built-in diagnostic temperature monitoring feature that lets you quickly check the ESC's operating temperature at any time.

While connected to a battery and powered ON, *simply tap the ESC's SET button and one of the on-board LED lights will flash 4 times* to indicate the operating temperature of the speed control.

WHITE flashing LED = normal operating temp--under 135°F (57°C).

BLUE flashing LED = medium operating temp--136-147°F (58-64°C).

YELLOW flashing LED = hot operating temp--148-167°F (65-75°C).

GREEN flashing LED = hotter operating temp--168-194°F (76-90°C).

RED flashing LED = *hottest* operating temp--195-215°F (91-102°C).

You are now pushing the ESC extremely hard and should be very careful to avoid overheating and possible thermal shut-down.

All LEDs flashing = DANGEROUS operating temp--216-239°F (103-115°C).

Your ESC is now about to thermally shut-down.

Reduce the pinion size/check drive train to avoid ESC overheating that could result in potential damage.

EXTERNAL BEC CONNECTION

Using a Novak External BEC

Connect the Novak BEC's main power input leads (*heavier gauge silicone wires*) to ESC's Positive & Negative battery solder tabs (*RED to Positive, BLACK to Negative*).

Plug the BEC's receiver power output lead into any open channel of your receiver.

Remove the *RED* wire from the plug plastic on the ESC's receiver input signal harness--insulate removed wire to avoid short circuits, as it is "live".

Turn *ON* the BEC's power switch, then turn *ON* the ESC's power switch.

Turn the system's power *OFF* in the reverse order--ESC then BEC.

Using a Non-Novak External BEC

To use a non-Novak BEC with this ESC, follow the BEC manufacturer's instructions. Remove the *RED* wire from the plug plastic on the ESC's receiver input signal harness. Turn *ON* the BEC's power switch, then turn *ON* the ESC's power switch.

TROUBLE-SHOOTING GUIDE

Steering Channel Works But Motor Will Not Run

- Possible receiver damage—Check operation with a different receiver.
- Possible internal damage—Refer to 'SERVICE PROCEDURES' section.
- Check motor or motor connections.
- Check ESC is plugged into receiver's throttle channel. Check signal harness wire sequence.

Receiver Glitches/Throttle Stutters During Acceleration

- Receiver or antenna too close to ESC, power wires, battery, or motor.
- Bad motor sensors, sensor harness, or connections—Check wiring, sensor harness, & connections, perform hall sensor test (Refer to 'MOTOR HALL SENSOR TEST' section).
- Low voltage to receiver—Try Novak Glitch Buster (#5626) on receiver to retain power.
- PowerCaps damaged—On-board PowerCaps (or external modules) must be replaced.
- Battery pack damaged or weak—Try a different battery pack.
- Motor magnet weak or overheated—Replace rotor (Refer to motor manufacturer's website).
- Excessive current to motor—Use a milder motor or a smaller pinion gear.
- Untidy wires or signal and power wired bundled together. Input harness and servo wires should be bundled separately. Power wires should be as short as possible.

Motor and Steering Servo Do Not Work

- Check wires, receiver signal harness wiring & color sequence, radio system, crystals, battery/motor connectors, & battery pack.
- Possible receiver damage—Check operation with a different receiver.
- Possible internal damage—Refer to Service Procedures.

Motor Runs Backward

- Reverse motor rotation direction—Refer to 'CUSTOM PROGRAMMING OPTIONS' section.
- Improper One-Touch set up—Refer to 'ONE-TOUCH PROGRAMMING' section.

Speed Control Runs Excessively Hot

- Gear ratio too low—Increase gear ratio/Reduce pinion (refer to 'PROPER GEAR SELECTION').
- Motor is damaged—Try a different motor.

Model Runs Slowly/Slow Acceleration

- Gear ratio too high—Reduce gear ratio/Increase pinion (refer to 'PROPER GEAR SELECTION').
- Check battery & connectors—Check battery pack & connectors. Replace if needed.
- Incorrect transmitter/ESC adjustment—Refer to 'TRANSMITTER ADJUSTMENTS'.
- PowerCaps damaged—On-board PowerCaps (or external modules) must be replaced.

ESC Is Melted Or Burnt/ESC Runs With Switch Off

- Internal damage—Refer to Service Procedures.

No Power to the BEC

- Check power wire connections to your battery, ESC and BEC unit.
- Check BEC input harness is plugged into receiver & ESC's red wire is removed from harness.
- Be sure that the BEC unit switch is turned ON.

ERROR/LED CODES

- **Red & Green status LEDs on solid**—Check input signal harness connections at ESC and receiver. Check input signal harness wiring sequence—Refer to STEP 3.
- **Red status LED on solid & Green LED blinking**—Check motor sensor harness connection. Possible internal motor damage.
- **Blue & Green status LEDs both blinking**. Misfire shut-down—return throttle to neutral position to regain motor control—check drive train for free operation.
- **Blue & Red status LEDs blinking**. Possible ESC thermal shut-down—Check gear ratio & free operation of drive train for possible overloading/ESC is being severely over-loaded—allow system to cool & return throttle to neutral position to regain motor control. *LEDs will continue to blink until system is cooled down.*
- **Blue & Yellow status LEDs blinking**. Possible Motor thermal shut-down—Check gear ratio & free operation of drive train for possible overloading/Motor is being severely over-loaded—allow system to cool & return throttle to neutral position to regain motor control. *LEDs will continue to blink until system is cooled down.*
- **Blue & Green (Misfire Detection), Blue & Red (ESC Thermal Shut-Down), or Blue & Yellow (Motor Thermal Shut-Down) status LEDs blinking**. ESC may have shut-down & ESC's neutral point is too far off to sense that transmitter throttle has been returned to neutral (Refer to 'ONE-TOUCH' & 'TRANSMITTER ADJUSTMENTS').
- **Red & Yellow status LEDs toggling**. LiPo Cut-Off voltage reached. Recharge battery.

SERVICE PROCEDURES

Before sending your product in for service, review the **Trouble-Shooting Guide**. Product may appear to have failed when other problems exist. After reviewing instructions, if you feel that you require service, obtain the most current service options & pricing as follows:

WEB: Print out the **PRODUCT SERVICE FORM** from CUSTOMER SERVICE section of the web site. Fill out required information on form and return it with the product requiring service.

WARRANTY SERVICE: You *MUST CLAIM WARRANTY* on **PRODUCT SERVICE FORM** & include a valid receipt with purchase date, dealer name, and phone number on it, or a

TRADE-IN PROGRAM: Novak offers a trade-in program for non-warranty items toward current and discontinued products. You can replace, exchange, or upgrade Novak products as listed within the trade-in program. Complete a Non-Warranty Service Form to be eligible.

ADDITIONAL NOTES:

- Dealers/distributors aren't authorized to replace products thought to be defective.
- If a hobby dealer returns your product for service, submit a completed **PRODUCT SERVICE FORM** to the dealer and make sure it is included with product.
- Novak R/C, Inc. does not make any internal electronic components (*transistors, resistors, etc.*) available for sale.