

## PROPER DIG OPERATION

Please follow the steps below to ensure that your M2 Dig 3S speed control is adjusted properly and that the front & rear Digs are operating correctly:

### 1. TURN ON THE TRANSMITTER & ESC'S POWER

#### 2. CONFIRM BASIC ESC FUNCTION

- When the Transmitter's AUX/3rd channel switch or dial is in the center or neutral position, the ESC's Blue & Red Dig indicator LEDs should be OFF.
- Apply a small amount of throttle to confirm that both front & rear drives are functioning properly. **Both front & rear motors should run, and should both be rotating the proper direction.**

#### 3. CONFIRM FRONT & REAR DIGS OPERATE PROPERLY

- Position the transmitter's AUX/3rd channel switch/dial to the left or right end point.
- Apply a small amount of throttle to confirm that **ONLY** the front or rear motor is running and the opposite end's Dig is engaged. One of the Dig indicator LEDs will illuminate. *The Dig power may not feel that strong at this point--refer to the CUSTOM PROGRAMMING section to adjust.*
- Now position the transmitter's AUX/3rd channel switch/dial to the opposite end point.
- Apply a small amount of throttle to confirm that **ONLY** the opposite motor of Step 3C is running and the other end's Dig is engaged (reverse of Step 3B). The other Dig indicator LED will illuminate.

*The Dig feature allows you to lock one drive axle while driving the other to let you navigate around obstacles or turn tighter as needed. The amount of Dig Power applied to the motor that is being "locked" is independently adjustable from the Hill/Drag Brake power to give you finer tuning and better performance than typical two speed control installations with an auxiliary dig unit.*

## VOLTAGE CUT-OFF CIRCUITRY

The M2 Dig 3S speed control features Novak's Smart-Stop Voltage Cut-Off Circuitry built-in. When used properly, the Voltage Cut-Off circuitry will allow you to safely use LiPo and LiFe batteries, without letting the cells drop below their critical safety voltage.

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

**Note:** Whenever the speed control's One-Touch Programming is performed, the Voltage Cut-Off circuitry will revert back to the default setting, which is the LiPo battery setting.

**DO NOT USE LIPo/LiFe BATTERIES WITH VOLTAGE CUT-OFF TURNED OFF**

## TEMPERATURE MONITORING

The M2 Dig 3S ESC has a built-in diagnostic temperature monitoring feature that lets you quickly and easily check the speed control's operating temperature at any time, without the need for a temperature gun.

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.

**BLUE** flashing LED = normal operating temperature.

**YELLOW** flashing LED = medium operating temperature.

**GREEN** flashing LED = hot operating temperature.

**RED** flashing LED = hottest operating temperature.

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 temperature.

Your ESC is now about to thermally shut-down.

--Reduce pinion size to avoid overheating and potential ESC damage--

## 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.
- Make sure ESC is plugged into the throttle channel of receiver. Check wiring color sequence of receiver signal harness (Refer to STEP 1 in Basic Set-Up Guide).

### Receiver Glitches/Throttle Stutters During Acceleration

- Receiver or antenna too close to ESC, power wires, battery, or motor.
- Low voltage to receiver—Try Novak Glitch Buster capacitor on receiver to help retain power during high current draw situations (Novak accessory #5626).
- PowerCap damaged/missing—Replace PowerCap.
- Battery pack damaged or weak—Try a different battery pack.
- Excessive current to motor—Use a milder motor or a smaller pinion gear.
- Untidy wiring or signal and power wired bundled together. Input harness and servo wires should be bundled separately from power wires. 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 ratio/Reduce pinion (refer to 'PROPER GEAR SELECTION').
- Motor is damaged—Try a different motor.

### ESC Is Melted Or Burnt/ESC Runs With Switch Off

- Internal damage—Refer to Service Procedures.

### BEC and/or Receiver Cuts Out Under High Steering Load

- Using very high-power servos—Use an external BEC to power servos & receiver.
- Steering end points set too high—Reduce steering travel to prevent servo from pulling excessive current when steering is at full lock position.
- Operating on 3S LiPo/LiFe—Use an external BEC to power servos & receiver.

### No Power to the BEC

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

## ERROR CODES

- Green & Red status LEDs on solid—Check input signal harness connections at ESC and receiver. Check input signal harness wiring sequence—Refer to STEP 1.
- 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 to regain motor control. LEDs will continue to blink until system is cooled down.
- Green & Red status LEDs blinking on and off. LiPo/LiFe Safety Cut-Off voltage reached. Remove and charge/replace battery pack.

Check Novak's web site for additional information.

## PROPER GEAR SELECTION

### Motor & ESC operating temperature is the proper way to set the vehicle gearing

The motor and Speed Control should not exceed 160°F at any time during a run!

Change the gearing to avoid overheating.

With the extreme loads that can be encountered during Crawling, high current draw can produce excessive speed control & motor heating. Always check the operating temperature of the ESC after initial vehicle set-up and again after making any gearing adjustments or drive train modifications to avoid overheating.

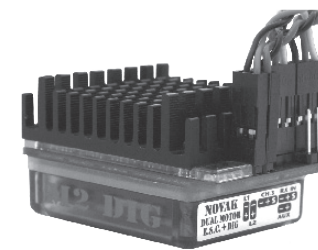


## M2 DIG FIELD GUIDE

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The M2 Dig 3S Dual Brush ESC is factory loaded with programmable features, which may appear to be overwhelming at first glance, but this Field Guide was designed as a quick-reference guide to help you tackle adjusting any of the M2's crawling functions in the field.



Take some time to read through this guide thoroughly before operation.

Most importantly, enjoy all of the technical benefits and features that the M2 Dig has to offer!

# M2 DIG

## ESC PARAMETERS

- Hill/Drag Brake (1 of 10) ..... 5-97%
- Dig Power (1 of 10)..... 30-97%
- Dead Band (1 of 5) ..... 2-8%
- Minimum Drive (1 or 5)..... 2-12%
- Drive Frequency (1 of 10)..... 1.0-7.3KHz
- Voltage Cut-Off (1 of 3) ..... OFF-LiPo-LiFe
- Profile (1 of 3)..... Dig, Proportional Dig, Single Output Mode

The above speed control parameters are adjustable via the ESC's One-Touch/Programming button and the on-board status LEDs. The speed control can also be programmed via the optional NovaLink PC interface (Part #5440), and some of the parameters can also be finetuned with more adjustability on the NovaLink software.

## APPLICATIONS

In addition to rock crawling applications, the M2 Dig is ideal for dual drive applications such as robot, boat, tank, and submarine. For these applications, the ESC should be operated in Throttle Profile 2 so that variable power can be applied to the motors.

The main difference in the wiring of this type of dual-motor application will be the following:

In STEP 1: CONNECT INPUT HARNESS, the RX AUX input signal harness from the ESC will need to connect to the ST/Ch.1 of the receiver. The variable control from the left to the right motor will be controlled using the steering control from the transmitter.

In STEP 3: WIRE ESC TO BATTERY & MOTOR, the motor power wire connections may need to be reversed, depending on gearing configurations, drive train, etc.

## SINGLE OUTPUT MODE

The Single Output Mode is for use with either single or dual motor applications when using a two-channel transmitter—the Dig feature is not available in this Mode.

**FOR SINGLE MOTOR APPLICATIONS** Either set of motor wires may be used, or both sets may be used for increased performance. When using both sets of motor wires, both yellow wires connect to the positive terminal of the motor and both blue wires will connect to the negative terminal. Refer to Figure 4 on Basic Set-Up Guide for wiring diagram. In this Mode you will use Throttle Profile 3 (refer to Throttle Profile Selection on P6 of Field Guide). **Change the ESC to Throttle Profile 3 before doing the One-Touch Set-Up Programming.**

**FOR DUAL MOTOR APPLICATIONS** The M1 motor wires will connect to the front motor, and M2 motor wires will connect to the rear motor. Use Throttle Profile 3.

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## ONE-TOUCH PROGRAMMING

With ESC connected to (at least) a receiver and a charged battery pack, and the transmitter's Aux/3rd channel (3Ch required for Dig) set to its middle position:

- TURN ON THE TRANSMITTER'S POWER**
- PRESS & HOLD ESC'S ONE-TOUCH/SET BUTTON**
- 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.
- CONTINUE HOLDING SET BUTTON UNTIL RED LED COMES ON**
- RELEASE SET BUTTON AS SOON AS LED TURNS RED**
- PULL TRANSMITTER THROTTLE TO FULL-ON POSITION**  
Hold it there until the green status LED turns solid green. (Note: Motor will not run)
- PUSH TRANSMITTER THROTTLE TO FULL-BRAKE/REVERSE**  
Hold it there until the green status LED blinks green.
- RETURN TRANSMITTER THROTTLE TO NEUTRAL**  
The blue & red status LEDs will turn on solid, indicating that speed control is now ready to program the Aux/3rd channel that is used for the Dig feature. (Note: If using the Single Output Mode without Dig, ESC will exit programming here)
- CHANGE TRANSMITTER'S AUX/3rd CHANNEL TO ONE END POINT**  
The blue & green status LEDs will turn on solid.
- CHANGE TRANSMITTER'S AUX/3rd CHANNEL TO OTHER END POINT**  
The blue status LED will turn on solid & the green LED will blink.
- RETURN TRANSMITTER'S AUX/3rd CHANNEL TO NEUTRAL**  
The blue, yellow, & red status LEDs will turn on solid, indicating that speed control is at neutral and that proper programming has been completed.

**NOTE:** If transmitter settings are changed, One-Touch Programming must be repeated. If you experience any problems, turn off ESC and repeat One-Touch.

**NOTE:** Whenever the One-Touch Programming set-up is performed, the speed control will automatically revert back to the factory-default settings.

## TRANSMITTER ADJUSTMENTS

Transmitter adjustments may not be needed to program and operate the M2 Dig 3S ESC. However, if you have any problems with ONE-TOUCH PROGRAMMING, adjust the transmitter as follows and repeat the ONE-TOUCH PROGRAMMING step.

### THROTTLE CHANNEL ADJUSTMENTS

- Set HIGH ATV or EPA to maximum setting. [the amount of throw at full throttle]
- Set LOW ATV, EPA, or ATL to maximum setting. [the amount of throw at full brakes]
- Set THROTTLE CHANNEL EXPONENTIAL to zero setting. [throttle channel linearity]
- Set THROTTLE CHANNEL REV. SWITCH to either position.
- Set THROTTLE CHANNEL TRIM to middle setting. [adjusts neutral position]
- Set ELECTRONIC TRIGGER THROW ADJUSTMENT to 50% throttle and 50% brake throw—best for reversible ESCs. [adjusts trigger throw electronic/digital pistol-grip transmitters]
- Set MECHANICAL TRIGGER THROW ADJUSTMENT to position with 1/2 throttle and 1/2 brake throw.

### AUX OR 3rd CHANNEL ADJUSTMENTS

- Set AUX/3rd CHANNEL EXPONENTIAL to zero setting. [aux/3rd channel linearity]
- Set AUX/3rd CHANNEL REV. SWITCH to either position.
- Set AUX/3rd CHANNEL TRIM to middle setting.

## GOOD QUALITY RADIO SYSTEM SUGGESTED

With the greater demand of high-end electronics, undesirable radio system noise may occur when used with lower quality radio systems. 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.**



# THROTTLE PROFILE SELECTION

The M2 Dig 3S Dual Brush speed control is equipped with 3 user-selectable Throttle Profiles, as shown below:

- PROFILE 1 – Dig Mode** – When the AUX/3rd switch/dial is thrown, the dig function for either the front or rear motor (depending on the switch position) will be engaged. The transmitter must have either a proportional AUX switch or a simple three-position AUX switch.
- PROFILE 2 – Proportional Dig Mode** – In this mode, the amount of dig power applied to each motor is directly proportional to the position of the AUX/3rd channel. The transmitter must have an AUX/3rd channel and must have a proportional-style switch or control similar to a dial or knob.
- PROFILE 3 – Single Output Mode** – This mode is used for standard two-channel operation with either single or dual-motor control. There is no dig function in this profile. A third channel is required for dig operation. See **STEP 1** for proper input harness connections and **STEP 3** for proper motor connections.

**NOTE:** The M2 Dig has the ability to run on either 2S or 3S LiPo or LiFe batteries via Novak's auto detect software. When the appropriate voltage cut-off circuitry is active (see programming on reverse side to turn ON/OFF), the ESC automatically switches to the proper cut-off voltage for the battery pack you connect.

## M2 DIG THROTTLE PROFILES

### BRUSHED MOTOR PROFILES

	<u>1</u> Dig	<u>2</u> Proportional Dig	<u>3</u> Single Output
Reverse	100%	100%	100%
Programmable	yes	yes	yes
Drag/Hill Brake	40%	40%	40%
Dig Power	70%	70%	N/A
Dead Band	5%	5%	5%
Minimum Drive	3%	3%	3%
Drive Frequency	2.5kHz	2.5kHz	2.5kHz
Voltage Cut-Off	LiPo	LiPo	LiPo

**NOTE:** The M2 Dig is factory set to Profile #1

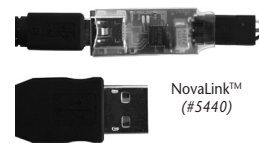
### SELECTING THROTTLE PROFILES:

With ESC on & connected to a charged battery (transmitter ON or OFF):

- IF TRANSMITTER IS OFF, DISCONNECT ESC FROM RECEIVER**  
To avoid possible radio interference, remove the ESC's input signal harness from the receiver--Green LED will stay on to indicate no signal from receiver.
- PRESS & HOLD THE ESC'S ONE-TOUCH SET BUTTON**  
Continue to hold SET button on ESC until all LEDs turn on.  
*Note: You will continue holding past all the LED programming indicators in the ESC's software as shown in the flow chart on this sheet.*
- RELEASE SET BUTTON AS SOON AS ALL LEDs COME ON**  
Once released, the four status LEDs will flash to indicate what Throttle Profile is currently selected. The number of times the LEDs flash indicates the Brushless Throttle Profile selection (1 of 3).
- QUICK PRESS (& release) SET BUTTON TO CHANGE SELECTION**  
Each press will change to the next consecutive Throttle Profile.
- STORE SELECTION & EXIT TO NEUTRAL**  
Once the desired profile is selected, press and hold the SET button for 1-2 seconds. When the LEDs begin to scroll off, release the SET button and the blue, yellow, & red LEDs will turn on solid. At this point, the ESC is at neutral and ready to go.

## NOVALINK INTERFACE

In addition to on-board programming, the M2 Dig 3S ESC can be fine-tuned via Novak's fully adjustable PC interface, the Novalink™ Programming Interface (#5440). The Novalink includes an ESC adaptor module to plug into the input harness, a USB cord to connect the adaptor to the computer, and a Novalink CD to install the required PC software.



Users can input the desired ESC parameter values or utilize user-friendly graphic controls to customize. Each personalized set of ESC parameters can be stored on the PC and recalled later. These custom parameter sets can be shared with other drivers to collaborate and find the best set-up for given courses, vehicles, and conditions. It is easy to keep your ESC and the Novalink up-to-date, thanks to software & firmware updates available for download from the Novak web site.

# CUSTOM PROGRAMMING OPTIONS -- ADVANCED

## M2 DIG SOFTWARE FLOW CHART

The M2 Dig 3S ESC features several parameters that can be customized to fine-tune the speed control's feel & response to your liking.

The flow chart below and the adjustment steps to the right describe the different parameters and how they effect the ESC.

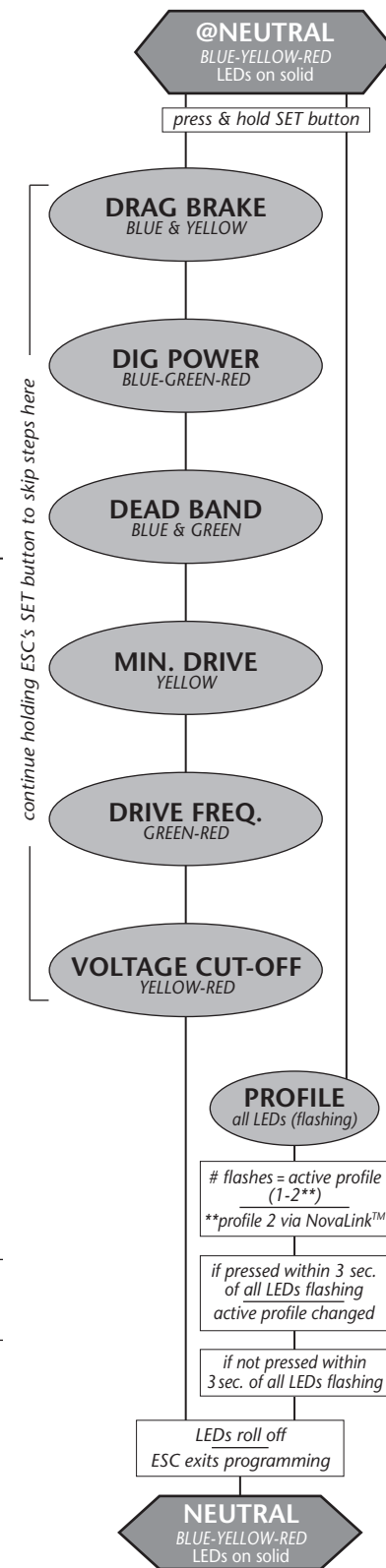
One-Touch Programming must be completed before customization of parameters, as all ESC parameters except Throttle Profile are defaulted back to the factory settings whenever the One-Touch Programming is performed.

**DEFAULT SETTINGS FOR THE ESC PARAMETERS ARE LISTED IN BOLD IN THE TABLES TO THE RIGHT**

TO CHANGE PARAMETER SETTINGS:

- CONNECT THE ESC TO A RECEIVER AND A CHARGED BATTERY PACK**
- SLIDE THE ESC'S ON/OFF SWITCH TO 'ON' POSITION**
- 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.
- SELECT PARAMETER VALUE**  
*LED flashes to indicate active setting (refer to tables at right). Quick press & release SET button to select desired setting.*
- PRESS & HOLD SET BUTTON TO STORE NEW SELECTION**  
When SET button is pressed and held for about 1-2 seconds, 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.**



## DRAG/HILL BRAKE

### #1 DRAG/HILL BRAKE SETTINGS (1 of 10) BLUE & YELLOW LEDs

Drag or Hill Drag is the amount of braking being applied while the transmitter throttle is at neutral.

>> **Increasing this setting makes the motor slow the vehicle down more. You can adjust this setting to give the vehicle the desired amount of creep down the incline when the transmitter's trigger is released.**

Setting (# of flashes)	1	2	3	4	5	6	7	8	9	10
Drag/Hill Brake (%):	5	10	20	30	35	40	<b>50</b>	70	80	97

## DIG POWER

### #2 DIG POWER SETTINGS (1 of 10) BLUE-GREEN-RED LEDs

Dig Power is the amount of braking or dig power being applied to lock either the front or rear motor.

>> **Increasing this setting applies more braking power to the motor that the Dig function is telling to lock. By locking either the front of rear motor, the vehicle is able to perform a "Dig" maneuver that can allow you to navigate around obstacles or perform a tighter turning radius by dragging the rear wheels.**

Setting (# of flashes)	1	2	3	4	5	6	7	8	9	10
Dig Power (%):	30	40	50	60	65	70	<b>75</b>	80	85	97

## DEAD BAND

### #3 DEAD BAND SETTINGS (1 of 5) BLUE & GREEN LEDs

Dead Band is the space between Minimum Brake and Minimum Drive, with Neutral in the middle.

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

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

## MINIMUM DRIVE

### #4 MINIMUM DRIVE SETTINGS (1 of 10) YELLOW LED

Minimum Drive is the amount of forward drive that is applied to the motor with first pulse of throttle information sent by the transmitter.

>> **Increasing starts forward drive at a higher level. Minimizes trigger throw required before effective drive is applied with heavy vehicles.**

Setting (# of flashes)	1	2	3	4	5
Minimum Drive (%):	2	<b>3</b>	5	8	12

## DRIVE FREQUENCY

### #5 DRIVE FREQUENCY SETTINGS (1 of 10) GREEN & RED LEDs

Drive frequency is how the speed control's throttle response feels with respect to the transmitter's throttle trigger input.

>> **Increasing the Drive Frequency makes the throttle response feel smoother and more controllable, similar to the way an exponential throttle curve feels.**

Setting (# of flashes)	1	2	3	4	5	6	7	8	9	10
Drive Freq. (KHz):	1	2	<b>2.5</b>	3	3.3	4	5	5.5	6.3	7.3

## VOLTAGE CUT-OFF

### #6 VOLTAGE CUT-OFF SELECTION (1 of 3) YELLOW & RED LEDs

>> **Changing this setting enables or disables the ESC's Smart Stop voltage cut-off circuitry, and also sets the voltage cut-off point based on what type of batteries are being used in the vehicle's main battery pack.**

**DO NOT USE LiPo/LiFe BATTERIES WITH VOLTAGE CUT-OFF TURNED OFF**

Setting (# of flashes)	1	2	3
Voltage Cut-Off Type:	OFF (NiMH/NiCd)	<b>LiPo</b>	LiFe

## THROTTLE PROFILE

### #7 THROTTLE PROFILE SELECTION (1 of 3) ALL LEDs

>> **Changing this setting changes the speed control's active Throttle Profile giving you different features and options.**

**Note: When using Profile #3, the Single Output Mode, you must change the ESC to Profile #3 BEFORE performing the One-Touch Programming.**

Setting (# of flashes)	1	2	3
Throttle Profile:	<b>Dig</b>	Proportional Dig	Single Output Mode

## RESTORING FACTORY DEFAULTS

**Every time you perform the One-Touch Set-Up, the speed control will automatically revert back to Throttle Profile #1, and the factory default settings are restored for each of the ESC parameters.**

