

For the latest instruction manual revisions, software updates, liability policy, and warranty information, visit the KDE Direct website at: <http://www.KDEDirect.com>.

All technical inquiries, review the [KDE Resource Center](#).

**IMPORTANT: To reduce the risk of fire, bodily injury, and damage to the equipment, read through Instruction Manual before operating ESC and always follow all instructions.**

- ⚠ KEEP OUT OF THE REACH OF CHILDREN.
- ⚠ Pay attention to the maximum voltage allowed:
 

<b>KDE-UAS LV Series</b>	7.4V (2S LiPo) – 26.1V (6S LiHV)	26.5V Max.
<b>KDE-UAS XF Series</b>	7.4V (2S LiPo) – 34.8V (8S LiHV)	35V Max.
<b>KDE-UAS HVC Series</b>	11.1V (3S LiPo) – 52.2V (12S LiHV)	55V Max.

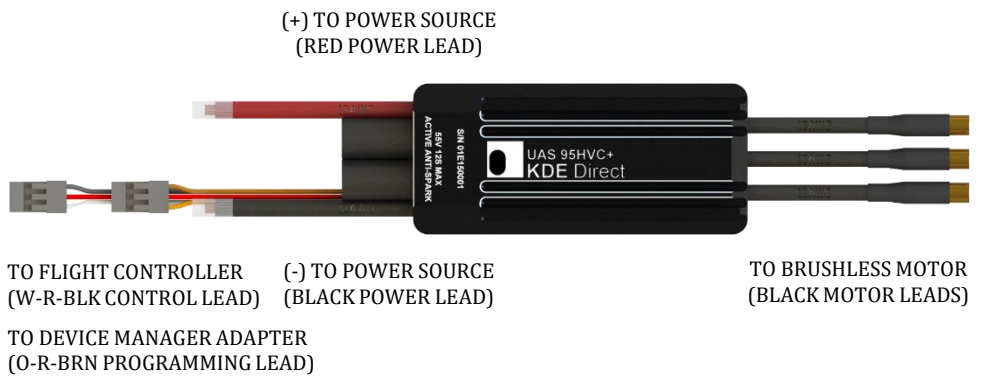
If model is not listed, maximum voltage is stated in specifications.  
Operating outside of the listed voltage voids warranty.

- ⚠ All KDE Direct ESCs are opto-isolated and do not provide BEC power output for the peripheral equipment and requires 5 to 12V applied to the control lead.
- ⚠ Never operate the ESC beyond the specifications stated on hardware. Serious injury or property damage can result from misuse.
- ⚠ Ensure the polarity is correct with the power supply to the ESC power source leads. Reverse polarity may cause fire and serious injury and will immediately damage the ESC beyond warranty coverage.
- ⚠ Ensure the ESC is installed in a safe location and protected to prevent any exposed connections and solder-locations from contacting conductive areas.
- ⚠ Always use electronics-grade solder and make sure to use proper soldering techniques and equipment. Poor soldering technique is a common cause of in-flight failure and ESC damage. Ensure all connectors are protected with insulation and heat-shrink to prevent unwanted conduction and shorts.
- ⚠ Check all connectors for secure connection before flight. Disconnection due to vibration and flight-conditions can result in a dangerous loss of control and potential damage and serious injury.
- ⚠ Do not disassemble or open the ESC or DMA. Opening of the case or removal of shrink-wrap may cause damage to the internal components, void all warranty claims, and yield unsafe operation.
- ⚠ Install the ESC in a location with adequate airflow to maintain cool temperatures and achieve the maximum performance rating.
- ⚠ An electric motor that is connected to the ESC can start unexpectedly and can cause serious injuries. Always remove the propeller and disengage all gearing when working on the system with power applied.

- ⚠ Do not allow full submersion of the ESC in water. Water can damage the ESC and cause malfunction and failure of the electrical components.
- ⚠ KDE Direct is not responsible for the use of this Product(s) or for any damages or injuries caused or sustained by its usage. Always observe all laws and instructions regarding the use of this Product(s), and operation of devices using this Product(s).
- ⚠ This is a high-power, electromechanical device with the potential to be very dangerous – always handle with caution and be aware of proper operation.
- ⚠ This product may contain chemicals known to the State of California to cause cancer and/or birth defects or other reproductive harm. Do not ingest or attempt to ingest this product.
- ⚠ Disconnect brushless motor from ESC motor leads before programming ESC. An electric motor that is connected to the ESC can start unexpectedly and cause serious injuries or damage.
- ⚠ Before flight, ensure that all ESCs are operating on the same settings and firmware.
- ⚠ Extending the ESC power leads is at your own risk and voids the warranty.
- ⚠ At low load we recommend you turn off Synchronous Rectification, low load may result in discontinuity with the motor RPM.

**The KDE Direct UAS ESC (Electronic Speed Controller) Series is specifically designed for multi-rotor applications, and utilizes a proprietary algorithm for up to 600Hz refresh rate communication and high-speed response for optimal flight performance.**

### ESC INSTALLATION AND WIRING



Pay close attention to proper wiring as shown in the diagram above. Ensure the polarity is correct and proper soldering techniques are used when connecting the power source and-brushless-motor-to prevent damaging the ESC.

## ESC THROTTLE CALIBRATION

The UAS ESC Series is optimized for the [KDE Direct UAS Brushless Motor Series](#) and will not require additional programming for most flight applications. **Throttle calibration is not required** – the ESCs are factory-calibrated and the proprietary control algorithm will dynamically adjust to the receiver (RX) and/or flight controller for simple plug-and-play operation. If manual throttle calibration is desired, this option can be selected via the [KDE Direct Device Manager Adapter](#) (DMA) programming kit (sold-separately).

1. Ensure the ESC control lead is connected to the throttle channel on your receiver (RX) or flight controller, confirming correct orientation of plugs.
2. Turn on the transmitter (TX) and set the throttle-stick position to zero or low (0% throttle signal) to arm the ESC circuitry.
3. Connect the battery or power system to the ESC power source leads. The ESC will remain disarmed until a 0% throttle signal is received. An arming-tone will be heard and the number of LiPo battery cells will be heard as individual tones, followed by additional and final arming tones.
4. If arming tones are not heard, adjust the transmitter throttle end-points (ATV/AFR) values until the arming sequence is heard. Check the operation of the ESC with the receiver (RX) throttle channel for correct direction and reverse if necessary (reverse direction for Futaba systems).
  - ⚠ If the arming throttle signal (0%) is not applied when the power source is first connected to the ESC, short tones will continuously sound after approximately five (5) seconds. To remove this warning tone move the throttle to 0% or disconnect power.
5. Check for proper rotation direction of each ESC/motor combination. To change rotation direction, swap ANY two brushless motor lead connections.

## COMPATIBILITY AND OPTIMIZATIONS

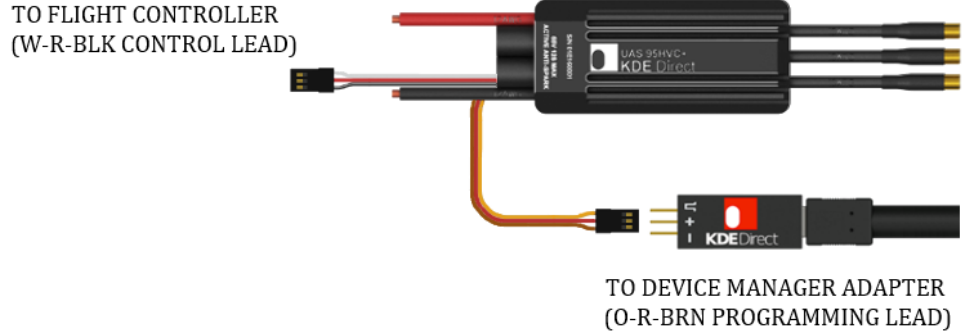
New technologies incorporated into the latest production designs include:

- **Regenerative Braking** – active braking during motor deceleration phase, providing instantaneous response to the flight controller commands and matched-response to acceleration profiles (less “float” during flight).
- **Temperature-Controlled Synchronous Rectification** – new proprietary algorithm for smooth-running motors at low-throttle and improved, faster response under high-peak loads; all while significantly increasing flight-time efficiency and reducing operating temperatures.

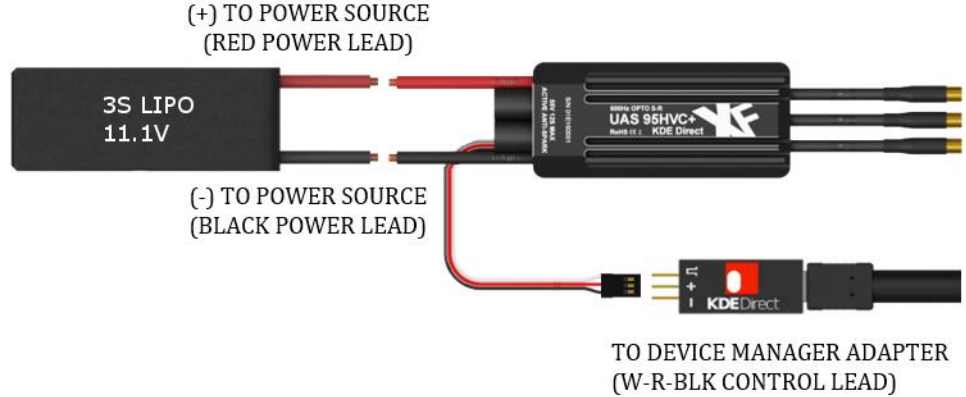
A wide-range of [KDE Direct UAS Brushless Motors](#) are available to suit your UAS and multi-rotor applications; ranging from smaller 180-class (2S+) tuned motors, up to industrial 1400-class (14S+) and larger motors.

The KDE Direct DMA provides the ability to update and program the [KDE Direct UAS Brushless ESC Series](#) to the latest production firmware releases, and customize advanced options for multiple applications. Advanced technologies, such as Synchronous Rectification and Regenerative Braking, can be enabled for enhanced performance and optimized control algorithms.

## DEVICE INSTALLATION AND WIRING



Pay close attention to proper wiring as shown in the diagrams. The ESC is automatically powered via the USB DMA when using the Programming Lead (orange-red-brown cable). External power is NOT required to properly arm and program the microcontroller in most cases.



If the ESC does not include the dedicated Programming Lead or does not connect, a 9V to 12V power source (2S or 3S LiPo preferred, 25V maximum) is required for powering the ESC during programming. Once external power is properly applied to the ESC, the microcontroller is programmed via connection of the DMA to the Control Lead (white-red-black cable).

## DEVICE MANAGER SOFTWARE INSTALLATION

1. Download and install the Device Manager software from the KDE Direct Device Manager Adapter (DMA) webpage at:  
[www.kdedirect.com/products/kdexf-dma](http://www.kdedirect.com/products/kdexf-dma)
2. Complete installation of the software (and all prerequisites), and run the KDEDevice application from the Windows start menu or desktop shortcut.
3. Connect the Device Manager Adapter to an available USB port.
  - Adapter will be recognized via an activated “red” LED signal.
  - Adapter will change to a “green” LED signal upon recognition by the KDEDevice application and proper installation.
4. Connect the ESC to the Device Manager Adapter, ensuring proper orientation of the 3-wire plug (see diagrams in Device Installation and Wiring).
  - Adapter will NOT be damaged with incorrect orientation. Software will simply not recognize device until proper installation.
  - Detection of the ESC via the Device Manager software may take up to five (5) seconds to properly boot the internal microprocessor and download current settings.

## ESC PROGRAMMING AND FIRMWARE UPDATE

1. Download the latest production firmware file (make sure to choose the appropriate version for your ESC model) from the KDE Direct website at:  
[www.kdedirect.com/products/kdexf-dma](http://www.kdedirect.com/products/kdexf-dma)
2. Update the ESC to the latest production firmware release by pressing the “UPDATE FIRMWARE” button in the Device Manager software and selecting the downloaded firmware file (.kde).
  - ⚠ Do not disrupt power or connection to the ESC or Adapter during the update process, or corruption of the firmware and permanent-failure of the ESC can occur (*ESC can be restored in most cases via the “REPAIR MODE” feature*).
3. When update is completed, the default settings will be automatically applied to the ESC and confirmed (allow up to five (5) seconds for this to complete).
  - Default Settings can be reapplied by pressing the “DEFAULT SETTINGS” button, followed by pressing the “SEND SETTINGS” button in the Device Manager software (allow five (5) seconds to pass before unplugging). (additional changes may be required for optimal perrf)
4. Disconnect power from the ESC (if required), then disconnect the Adapter from the ESC Programming Lead or Control Lead to complete the update.

## ESC PROGRAMMING AND ADVANCED SETTINGS

**NOTE:** The Device Manager Software allows for modification of control algorithms and tuned ESC operation – in rare instances will the Advanced Settings need to be changed for proper UAS and multi-rotor flight application.  
*\* Bold indicates default settings*

STARTUP POWER	
<b>DYNAMIC</b>	Dynamically adjusts to the startup-requirements of the motor, optimal for most setups and KDE Direct brushless motors.
HIGH (HARD)	Increases the startup-power for high-cogging torque motors or high-stall loading setups.

DRIVE FREQUENCY	
PRECISION (30 kHz – 32 kHz)	Fastest PWM drive frequency to the motor, providing the smoothest/quietest operation (increases ESC temperature).
<b>DYNAMIC</b> (16 kHz – 18 kHz)	Dynamically adjusts the PWM drive frequency to the motor, providing the best overall balance of performance.
BALANCED (8 kHz – 10 kHz)	Lowers the PWM drive frequency to the motor, reducing ESC temperatures (increases motor commutation noise).

SYNCHRONOUS RECTIFICATION (ACTIVE-FREEWHEELING)	
<b>ENABLED</b>	Enables synchronous rectification (also termed active-freewheeling) for improved efficiency and regenerative braking algorithms ideal for UAS and multi-rotor operation.
DISABLED	Disables synchronous rectification for improved light-loading operation (such as motor bench-testing) and minimal-brake activation ideal for specific single-rotor applications.

S.R. BRAKING ACTIVATION (REGENERATIVE-BRAKING)	
PRECISION	Enables synchronous rectification immediately, ideal for FPV racing and light multi-rotor applications. Provides immediate response at spool-up and flight take-off.
<b>DYNAMIC</b>	Enables synchronous rectification upon reaching optimal ESC temperatures, allowing for smooth operation during initial motor spool-up and flight take-off.
BALANCED	Enables synchronous rectification upon reaching higher ESC temperatures, allowing for smooth operation during initial motor spool-up and further into initial flight.

## THROTTLE CALIBRATION MODE

**DYNAMIC** Factory-calibrated, automatic throttle calibration to the flight controller for simple, drop-in installation (ideal for most UAS and multi-rotor applications, such as the DJI™ A2/A3 series).

**MANUAL** <sup>1</sup>Enables manual (fixed) throttle calibration. After selection, throttle calibration will proceed upon next power-up:

- Turn on the transmitter and move throttle stick to maximum upper position (100% throttle). Apply power to ESC.
- Motor will emit dual tones, memorizing upper position.
- Quickly move throttle stick to low position (0% throttle).
- Motor will emit tones, memorizing lower position and arming.
- Calibration is now complete and ready for operation.

**RANGE** <sup>1</sup>Allows direct input of the throttle calibration, via the MIN(LOW) and MAX(HIGH) range. When selected, values can be typed into the THROTTLE CALIBRATION RANGE textboxes:

- Allowable value for MIN(LOW): 800 to 1250 [μs].
- Allowable value for MAX(HIGH): 1750 to 2200 [μs].

## VOLTAGE CUTOFF

**ON** <sup>2</sup>Enables voltage-cutoff for specific applications, resulting in a 50% RPM limit reduction when reaching the target cell voltage (selectable with pull-down menu, i.e. 3.2V/CELL).

**OFF** Disables voltage-cutoff, **highly-recommended** and default setting for UAS and multi-rotor flight applications to prevent power stall and potential loss of flight control.

## ADVANCE TIMING

**DYNAMIC** Dynamically adjusts advance timing (15° to 22°) to the brushless motor, providing higher efficiency and balance of power.

**PRECISION** Dynamically adjusts advance timing (22° to 30°) for maximum thrust output and acceleration response (at a slight loss of efficiency), best for high-pole count motors and heavy-lift.

## MOTOR DIRECTION

**FORWARD** Default motor direction, determined by the motor windings and motor lead connection order.

**REVERSE** Alternate motor direction (opposite of Forward setting), reversing the rotational direction for ease of installation.

## ARMING TONES

**STANDARD** Initialization of the ESC will emit voltage count tones (number of LiPo battery cells), followed by final arming tones.

- Safety warning tones will emit until arming signal is received.

**ARM ONLY** Initialization of the ESC will emit final arming tones only.

- Safety warning tones will emit until arming signal is received.

**INITIALIZE** <sup>3</sup>Initialization of the ESC will emit final arming tones only.

- Safety warning tones will not emit before arming signal.

## PROPELLER HOLD

**ENABLED** <sup>4</sup>Enables an active-brake to the propeller when minimum throttle position (0%) is received, providing a rapid propeller-stop and hold to position (ideal for emergency parachute recovery).

**DISABLED** Disables an active-brake to the propeller, allowing free-spool of the propeller when minimum throttle position (0%) is received.

## MOTOR EDITION

**DEFAULT** Enables motor-drive control-algorithm optimizations for simple compatibility to the widest range of motors – ideal for the KDE5215XF and smaller series brushless motors.

KDE6213XF-185  
↓ ↑  
KDE8218XF-120

Enables motor-drive control algorithm optimizations for specific KDE Direct motor editions, ideal for the industrial heavy-lift brushless motor series (KDE6213XF and larger).

## ACCELERATION RATE

**MEDIUM** Optimizes the maximum acceleration/deceleration control profiles for smooth reaction-rates and safety in industrial-heavy lift applications (dynamic reduction up to 20%).

**MEDIUM-HIGH** Optimizes the maximum acceleration/deceleration control profiles for balanced operation in commercial aerial-cinematography applications (dynamic reduction up to 15%).

**HIGH** Optimizes the maximum acceleration/deceleration control profiles for increased stability in adverse weather conditions and long-endurance flights (dynamic reduction up to 10%).

**ULTRA-HIGH** Maximizes the acceleration/deceleration control profiles for high-speed applications, where fast-reaction rates and tight-control to the flight-controller commands is required.

## OVERLOAD PROTECTION

ULTRA-HIGH	<sup>5</sup> ESC will enable overload protection when witnessing a three (3) second continuous-current duration above 175% of the continuous amperage rating (i.e., 170A for the 95A ESC).
STANDARD	ESC will enable overload protection when witnessing a three (3) second continuous-current duration above 150% of the continuous amperage rating (i.e., 145A for the 95A ESC).
DISABLED	Overload protection is disabled. <b>Use with caution</b> - overload protection is designed to protect the internal electronics from high continuous-current situations and circuit damage.

<sup>1</sup>Default calibration for Manual and Range mode is 1100 $\mu$ s to 1940 $\mu$ s and changes will be stored in the EEPROM memory. When changing the Throttle Calibration Mode, EEPROM memory will automatically reset to this default range for safety before calibration.

<sup>2</sup>Voltage-cutoff should always be "OFF" for UAS and multi-rotor flight applications, or a potential loss of flight stability and control can occur during low-voltage events. Voltage-cutoff is advantageous for single-rotor and fixed-wing applications as desired.

<sup>3</sup>Arming tones are provided as three notifications: (1) power application to the ESC via the power-input leads and failsafe-operation state, (2) voltage supplied to the ESC via LiPo cell count, and (3) receipt of flight-controller and/or receiver arming signal for armed and ready-operation state. The arming tones selection of "INITIALIZE" will not provide the failsafe-operation state tones, so special care is needed to ensure safe operation before the appropriate arming signal is received to the ESC for ready-operation state.

<sup>4</sup>Propeller Hold rapidly decelerates and stops the propeller when the throttle reaches minimum value (0% position). Make sure this throttle value does not occur during flight in multi-rotor applications, or an immediate loss of flight control can occur. Propeller Hold is designed for emergency parachute recovery systems and/or operation in high-wind conditions (for quick deceleration of the propeller after landing) and activated via minimum throttle-hold position, to prevent propeller blade rotation and parachute cord strike. Also applicable for fixed-wing applications – allowing for propeller blade fold-back and aerodynamic-drag reduction. KDE Direct is not responsible for damages or injuries when using this specialized function – make sure to understand the requirements for proper operation before enabling.

<sup>5</sup>Overload Protection will decrease the maximum current output to the continuous rating of the ESC (i.e., 95A for the 95A ESC) when triggered over a five (5) second interval. The ESC will not allow amperage higher than the rating until the next initialization or power-cycle (reboot).

<sup>6</sup>Repair Mode provides the ability to force upload firmware to the ESC, in the case of data corruption from a power-outage or other unusual event. Upon connecting the ESC to the Device Manager Adapter, turn on Repair Mode by selecting the available checkbox and wait for the software to reconnect to the ESC. Once the DEVICE STATUS has turned green solid-fill, press the UPDATE FIRMWARE button to upload the correct firmware file. Upon completion, unselect the Repair Mode checkbox and the software will again reconnect and read the parameters for the Advanced Settings from the internal MCU.

⚠ Repair Mode allows the install of any firmware file edition – make sure the appropriate version is selected before installation, or incorrect operation of the ESC can occur and potential damage beyond warranty coverage.

## LIMITED WARRANTY

KDE Direct, LLC (KDE Direct) warrants to the original purchaser that the Product(s) will be free from defects in materials and workmanship for a period of one (1) year from the date of purchase. This warranty does not cover abuse, neglect, or damage to the Product(s) from preventable failure methods, such as incorrect wiring, reverse polarity, voltage exceeding the maximum specification, incompatible system components, or amperages exceeding the maximum specification (overloading).

The full definition and terms of this limited warranty are available at: <https://www.kdedirect.com/pages/warranty-and-returns-policy>.

## LIMITS OF LIABILITY

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**KDE DIRECT SHALL NOT BE LIABLE FOR SPECIAL, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, LOSS OF PROFITS OR PRODUCTION OR COMMERCIAL LOSS IN ANY WAY, REGARDLESS OF WHETHER SUCH CLAIM IS BASED IN CONTRACT, WARRANTY, TORT, NEGLIGENCE, STRICT LIABILITY, OR ANY OTHER THEORY OF LIABILITY, EVEN IF KDE DIRECT HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. FURTHER, IN NO EVENT SHALL THE LIABILITY OF KDE DIRECT EXCEED THE INDIVIDUAL PRICE OF THE PRODUCT(S) ON WHICH LIABILITY IS ASSERTED.** As KDE Direct has no control over use, setup, final assembly, modification, or misuse, no liability shall be assumed nor accepted for any resulting damage or injury. **By the act of use, setup, or assembly, the user accepts all resulting liability.** If the purchaser or users are not prepared to accept the liability associated with the use of the Product(s), purchaser or users are advised to return the Product(s) immediately in new and unused condition to the authorized dealer or KDE Direct.

Always observe all laws and instructions regarding the use of this product, and the operation of devices using this product.

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