

VRLI2 Power Force specifications

Model	Power Force VRLI2
For battery types	Lithium Polymer (LiPo), NiCd, NiMH
Nominal input voltage	6.0VDC to 14.4VDC
LEDs versus selected input voltage (V_i)	
Green LED	on at $>V_i - 0.1V$
Yellow LED	on between $V_i - 0.1V$ and $V_i - 1.4V$
Red LED	on at $<V_i - 1.4V$
Nominal output voltage	Regulated 5.0 or 6.0VDC (switchable) at 10A continuous, maximum 0.15V output dropout
Maximum output current	10A continuous at 7.4V input
Circuit board dimensions	2.54 in. (64.5mm) L x 1.44 in. (36.6mm) W
Clearance reqd. inside aircraft	1.05 in.

FMA limited warranty for voltage regulators

FMA, Inc. warrants this product to be free of manufacturing defects for the term of 1 year from the date of purchase. Should any defects covered by this warranty occur, the product shall be repaired or replaced with a unit of equal performance by FMA or an authorized FMA service station.

Limits and exclusions

This warranty may be enforced only by the original purchaser, who uses this product in its original condition as purchased, in strict accordance with the product's instructions. Units returned for warranty service to an FMA service center will be accepted for service when shipped postpaid, with a copy of the original sales receipt or warranty registration form, to the service station designated by FMA.

This warranty does not apply to:

- Consequential or incidental losses resulting from the use of this product.
- Damage resulting from accident, misuse, abuse, neglect, electrical surges, reversed polarity on connectors, lightning or other acts of God.
- Damage from failure to follow instructions supplied with the product.
- Damage occurring during shipment of the product either to the customer or from the customer for service (claims must be presented to the carrier).
- Damage resulting from repair, adjustment, or any alteration of the product by anyone other than an authorized FMA technician.
- Installation or removal charges, or damage caused by improper installation or removal.

Call (301) 668-7614 for more information about service and warranty repairs.

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Power Force VRLI2

Model VRLI2 high power voltage regulator / LED indicator for powering radio control receivers and servos from Lithium Polymer and NiCd/NiMH battery packs

Features

- Designed specifically for powering high current flight electronics (receivers and servos) in radio controlled aircraft. Can be used in sport, giant scale and electric airplanes and helicopters. Ideal for aircraft with dual radio systems.
- Accepts input from 2s to 4s LiPo pack or a 5 to 12 cell NiCd/NiMH pack. Includes heavy duty F/J input connector, as well as Deans Ultra input connector for high current applications.
- Outputs 5V or 6V (user selectable). Extremely low dropout regulator maintains maximum 0.15V drop, even if battery voltage decreases under full load (e.g., if battery outputs 4.8V, the VRLI2 outputs 4.65V minimum). Has two heavy duty F/J output connectors—connect both to one receiver or each one to a different receiver.
- Supplies up to 10A continuous current, sufficient for driving a plane-full of high torque and/or digital servos, as well as standard, micro and mini servos.
- Status LEDs provide quick indication of battery condition.
- Includes on/off switch with failsafe operation. If switch fails, the VRLI2 stays on.
- Will not drain the battery when switch is off.

Precautions

- Follow all instructions in this manual to assure safe operation.
- Observe frequency control. If someone else is operating a radio controlled model on the same channel as your transmitter, **do not turn on your transmitter—even for a short time.** Your transmitter has a channel number marked somewhere on its case. When a model receives signals from two transmitters on the same channel at the same time, it cannot be controlled and will crash—possibly causing personal injury or property damage. **For safety, most RC flying fields have formal frequency control rules. Follow them carefully.**
- Do not operate your radio control transmitter within 3 miles of a flying field. Even at a distance, your transmitter can cause interference.
- Always remove LiPo packs from a model before charging them.
- Never charge LiPo batteries with a charger designed for NiCd, NiMH or any other type of battery chemistry. LiPo cells require a special charging sequence not provided by chargers made for other battery technologies. The LiPo-502 and LiPo-103/203 chargers, available from FMA Direct, are ideal for charging LiPo battery packs.
- Follow all guidelines for charging, discharging, handling and storing LiPo cells.*

*For details, see the *Kokam/FMA Direct Lithium Polymer Cell application manual*, AN000001, available in the Support section of the FMA Web site.

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Safety precautions

Battery precautions

- You must disconnect any type pack from the VRLI2 before charging. Attempting to charge a pack while it is connected to the VRLI2 may damage the VRLI2 circuitry. Such damage is not covered by the warranty.
- You must remove a LiPo® pack from the model before charging. A hot pack may ignite wood, foam or plastic.
- You must check charging voltage. Overvoltage during charging is a common cause of lithium polymer cell damage. Severe overcharging may result in cell venting with flames.
- Never charge a pack inside a motor vehicle, or in a vehicle's engine compartment.
- Never charge a pack on a wooden workbench, or on any flammable material.
- If a pack is involved in a crash:
 1. Carefully inspect the pack for shorts in the wiring or connections. If in doubt, cut all wires from the pack.
 2. Disassemble the pack.
 3. Inspect cells for dents, cracks and splits. Dispose of damaged cells.

Note: Read and follow additional safety precautions provided with Kokam LiPo cells and packs purchased from FMA Direct.

Wiring precautions

The VRLI2 is intended for use in radio systems that draw high currents, such as giant scale aircraft with redundant receivers and multiple servos for each control surface. Design and configure your radio system—and its wiring—to handle high currents. In particular:

- Pack-to-VRLI2 and VRLI2-to-receiver wiring is especially critical. These interconnections carry the most current through the fewest wires. FMA recommends 16 gauge wire rated for at least 10A.
- Do not use servo extensions or Y-harnesses between the VRLI2 and the receiver(s). The VRLI2's output leads carry high currents and additional wiring will cause voltage drops.
- If your system has only one receiver, connect both VRLI2 output leads to it.
- The battery pack must be equipped with heavy duty wires and a connector rated for the expected current. For maximum currents, use 16 gauge wire rated for at least 10A and a Deans Ultra connector.
- Keep all wiring as short as possible.
- If you must use extensions between receiver and servos, they should be heavy duty to minimize voltage drop. Standard servo extensions may heat when carrying high currents, and if the insulation softens the wires may short. FMA recommends 22 gauge wire rated for at least 5A, such as FMA's POWERLINE Series wire.

Using the Power Force VRLI2

1. Turn on your transmitter, then turn on the VRLI2.
2. Check battery condition with no load (don't move transmitter sticks):
 - If green LED is on and yellow and red LEDs are off, battery is charged. Go to step 3.
 - If all LEDs are off, power is not reaching the VRLI2. Turn off the VRLI2 and transmitter, then correct the problem. The battery may be completely dead.
 - **CAUTION:** If the yellow LED is on, battery capacity is low. **Charge battery before flying.**
 - **CAUTION:** If the red LED is on, battery capacity is very low. **Charge battery before flying.**

Note: Do not fly if yellow or red LED is on with no load.

3. Check battery condition with load:
 - a. Move all transmitter sticks at the same time (to create a load on battery) for several seconds. Depending on the load, all three Status LEDs may turn on; this is normal.
 - b. Stop moving transmitter sticks, and see how long it takes until just the green LED is on (and yellow and red LEDs are off).
 - Fast recovery to green LED only: battery is charged.
 - Slow recovery to green LED only: battery capacity is low. **Charge battery before flying.**
 - Very slow recovery to green LED only: battery capacity is very low. **Charge battery before flying.**

Note: Recovery time depends on several factors, including battery capacity, actual load and loading time. Test your system under various conditions to see how recovery time relates to battery capacity.

Note: The VRLI2's Status LEDs provide a general indication of battery condition. For accurate battery measurements, use an expanded scale voltmeter.

Frequently asked installation questions

What is the VRLI2's maximum output current? With unlimited input current, output current depends on input voltage. The regulator dissipates power it can't use, so the more power it must dissipate (caused by input voltage higher than output voltage) the less current it can deliver. Output current ranges from about 10A at 7.4V (2s LiPo) down to about 3A at 14.8V (4s LiPo).

How many servos can the VRLI2 drive? Depends on input voltage (see previous question), output voltage, servo type, flying style and many other factors. Some guidelines are in the table to the right, but be sure to check your system to assure the VRLI2 doesn't get excessively hot.

Input voltage	No. of servos
7.4V (2s LiPo)	Up to 30
11.1 (3s LiPo)	Up to 12
14.8 (4s LiPo)	Up to 7

Why doesn't the VRLI2 have a charging jack? For safety reasons, you should always remove LiPo packs from the aircraft before charging them.

When should I use the Deans Ultra input connector? The F/J input connector handles up to 5A. Use the Deans Ultra connector if you expect higher currents. If in doubt, use the Deans.

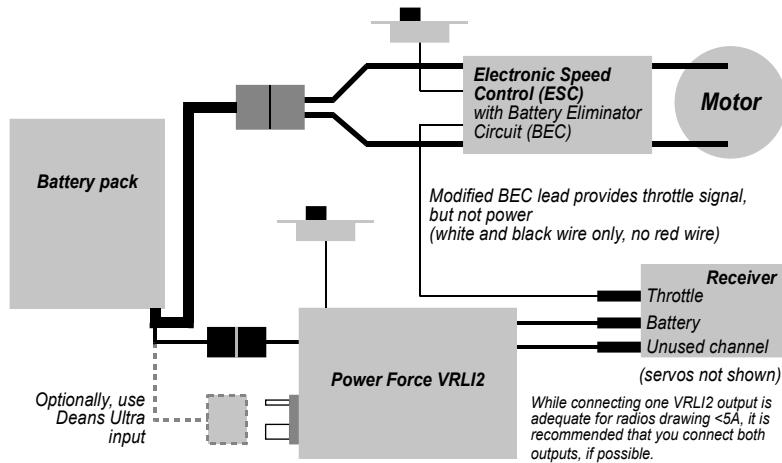
What happens if the VRLI2 fails? In the extremely rare case of failure from an extended short, reverse polarity or overload, the VRLI2's FETs short, and full battery voltage passes through to the radio. If this happens, the servos may become erratic, but the system will operate well enough to land. Unregulated output voltage, blinking LEDs and erratic servos indicate FET failure.

Typical installation: electric aircraft with one receiver and <5A total radio current

In an electric-powered aircraft, the electronic speed control (ESC) is designed to supply power to the receiver through the battery eliminator circuit (BEC). The BEC cable also routes the throttle signal from the receiver to the ESC.

In an aircraft equipped with a VRLI2, however, the VRLI2 supplies power to the receiver. To prevent power problems, you must modify the ESC's BEC cable so it does not apply voltage to the receiver, but still routes the throttle signal to the ESC.

To prepare the BEC cable: Cut the red wire in the ESC's BEC cable. Protect the ends of the red wires to prevent shorting (for example, wrap them with electrical tape).



CAUTION: In this configuration, the Deans Ultra connector is live. Protect it from shorting!

More tips

- If you experience erratic servo behavior while using the VRLI2, it may indicate:
 - The battery pack installed in the aircraft has insufficient capacity, or
 - The output is connected to the input as in set up mode.
- To determine the LiPo pack configuration that will work best in your application, use the LiPo Calc II design tool on the FMA Direct Web site (www.fmadirect.com).
- The VRLI2 can help you identify problems with the airborne part of your radio system. Since it works similar to an expanded scale voltmeter (ESV) when you move the servos, it can reveal problems such as sticky linkages or insufficient aircraft battery capacity.

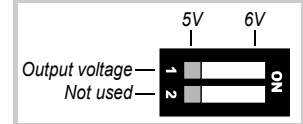
Parts

- Power Force VRLI2
 - Mounting plate with 4 machine screws, 4 spacers and 4 nuts
 - Switch mounting plate with 2 #2-56 screws, 2 lock washers and 2 #2-56 nuts
 - Hole template for mounting plate and switch plate
- You must supply:
- Battery pack with appropriate connector:
 - Pack: 2s, 3s or 4s LiPo, or 5 to 12 cell NiCd/NiMH
 - Connector: F/J for currents up to 5A, or Deans Ultra for currents up to 10A

Setting up the Power Force VRLI2

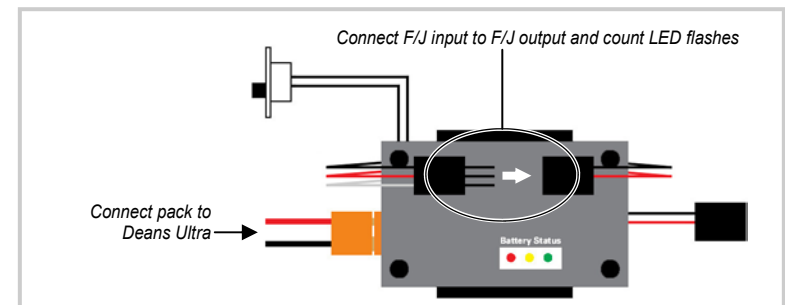
Tip: It's easiest to set up the VRLI2 outside the aircraft.

1. Set VRLI2 On/Off Switch to off.
2. Set Output Voltage Switch 1 for desired output voltage.
3. Connect battery pack outputting at **least 6.5V** to the **Deans connector** on the VRLI2.
4. From the following list, determine the number of LED flashes to look for in step 5:



Pack size and type	Flashes	Pack size and type	Flashes
2s LiPo	2	8 cell NiCd/NiMH	8
3s LiPo	3	9 cell NiCd/NiMH	9
4s LiPo	4	10 cell NiCd/NiMH	10
5 cell NiCd/NiMH	5	11 cell NiCd/NiMH	11
6 cell NiCd/NiMH	6	12 cell NiCd/NiMH	12
7 cell NiCd/NiMH	7		

5. While watching LEDs, plug VRLI2's F/J input connector to one output connector (yes, that's unusual, but it's how setup works on this product). Count LED flashes.



6. If this isn't the correct number of flashes, disconnect the input and output connectors, then repeat step 5. Keep repeating step 5 until the number of flashes corresponds to your pack (sequence is circular: 12 is followed by 2).
7. Disconnect battery pack. VRLI2 remembers pack size and type until you perform setup again.

Installing the Power Force VRLI2

Tip: Set up the VRLI2 (see previous page) before you install it.

Select a location

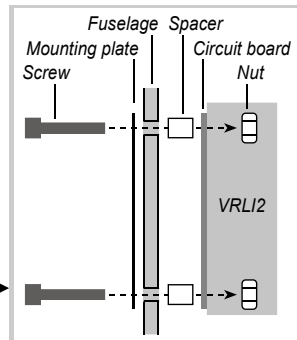
- If you want to see the VRLI2's Battery Status LEDs you can:
 - Mount the VRLI2 to the inside of a fuselage wall, with the LEDs visible through a hole in the fuselage (requires at least 1 1/8" clearance inside fuselage), or
 - Mount the VRLI2 to a tray, bulkhead or rails, with the LEDs visible through the canopy or a window.
- If you don't want to see the VRLI2's Battery Status LEDs, you can mount it anywhere inside the fuselage, as long as you can mount the On/Off Switch near the VRLI2.
- You can mount the On/Off Switch:
 - To the fuselage wall, so you can move the switch from outside the aircraft, or
 - To an internal location where you can access it through the canopy or a window.

In either case, mount the battery pack, VRLI2 and receiver(s) close together so they interconnect without extension cables. Also, components on the circuit board prevent the VRLI2 from being mounted directly to a surface; you must space it at least 3/8" away from the mounting surface

Option 1: mount the VRLI2 to the fuselage wall

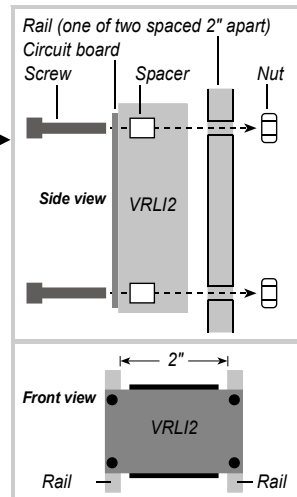
(Mount the VRLI2 to a tray in a similar manner, with or without the mounting plate.)

1. Using the VRLI2 mounting template, mark four mounting holes and a rectangular LED hole on the fuselage side. Drill four 1/8" holes, then cut out the rectangular LED hole.
2. Assemble the mounting plate and VRLI2 as shown in the diagram to the right. Position the supplied 3/8" spacers behind the fuselage to allow clearance for components on the circuit board.



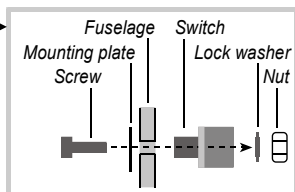
Option 2: mount the VRLI2 to rails

1. Using the VRLI2 mounting template, mark four mounting holes on two rails spaced 2" apart. Drill four 1/8" holes.
2. Mount the VRLI2 using the 3/8" spacers between the circuit board and the rails to allow clearance for the connector and switch wires. Make sure there is at least 1/4" around the black heat sink.



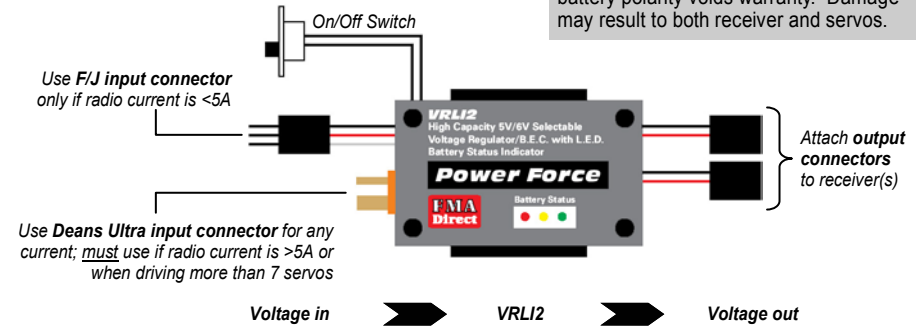
Mount the On/Off Switch

1. Using switch mounting template, mark 2 mounting holes and 1 rectangular switch hole. Drill two 3/32" holes and cut out switch hole.
2. Secure the switch as shown.



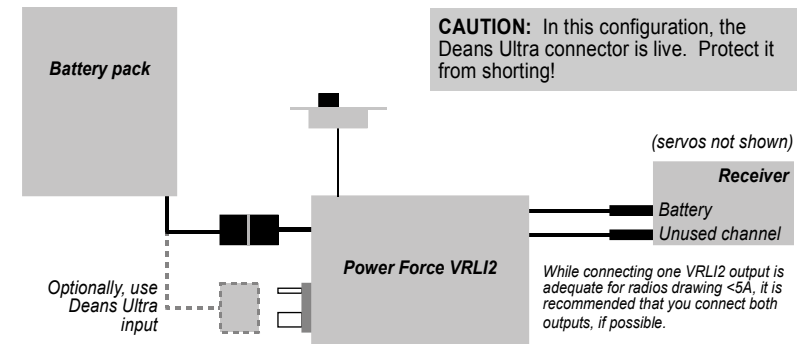
Connecting the Power Force VRLI2

VRLI2 input and output connectors



CAUTION: Failure to observe correct battery polarity voids warranty. Damage may result to both receiver and servos.

Typical installation: gas-powered aircraft with one receiver and <5A total radio current



CAUTION: In this configuration, the Deans Ultra connector is live. Protect it from shorting!

While connecting one VRLI2 output is adequate for radios drawing <5A, it is recommended that you connect both outputs, if possible.

Typical installation: gas-powered aircraft with two receivers and >5A total radio current

