

LVR3E Installation Notes Revised March 20, 2000

Software version 3.4 Nov. 7, 1999

You will notice that your LVR3 has three wires (red, yellow, and black) soldered onto the PCB. Page 2 of the schematic has 3 wiring examples. These wires connect up as follows:

RED wire	connect to battery positive	node BAT	BATTERY+ & BULB +
BLACK wire	connect to battery negative	node GND	BATTERY-
YELLOW wire	connect to other side of bulb	node BULB	BULB-

Note that since the BULB+ is the same connection as BATTERY+ you must be careful not to have the BULB- shorted to the BATTERY- through common metal frame connection, which can happen with some lighting systems. In other words the LVR3E has a positive common, NOT negative.

The LVR3E has reverse polarity protection (reset-able Poly-Fuse and diode) which prevents damage to the LVR3E in most cases. However, this does not protect your bulb from too much voltage! If you use polarized plugs on your battery this should not be a problem. The maximum input voltage is 16 volts limited by C1, unless you bought a 12 volt output unit in which increases the maximum to 30 volts.

The LVR3E has internal programming that will warn you when the battery is getting to low, by slightly dimming the bulb about once per second. Connect a switch in place of the On/Off button do disable the warning feature. Also, the LVR3E has an optional low battery cutoff feature which will turn the LVR3E off once the battery gets below this programmed set point. It also can be disable with the same switch (as above). Both of these features are set to specific voltages depending on what type of unit you ordered and can not be changed later. The LVR3E is designed to dim up the bulb when the power is connected to the LVR3E or when the bulb is connected. If you are using more than one bulb on a single LVR3E, then only the first bulb turned on will be dimmed up.

The following list the specifications for your order. The input voltage range is by design the bulb voltage to 2.5 times the bulb voltage. The maximum current is continuous peak current, which is only approximately related to average bulb current. Warning flashing normally begins when the input voltage is 2% above the bulb voltage, but this may be optionally different. Low battery cutoff is a programmed option for rechargeable batteries to prevent cell reverse damage should the lighting system be left turn on.

Model	Bulb (Output) Voltage	Maximum Peak FET Current	Input Voltage Range (for full regulation)	Warning Flashing	Low Battery Cutoff
		2 Amps SMD 10 Amps TO-220	Bulb to volts	6% above bulb	

The auto sensing ON/OFF feature then the LVR3E will automatically switch on and off when the bulb is connected or disconnected from it. This allows the LVR3E to always be connected to the battery without draining the battery excessively while the bulb is disconnected. (See configuration #4) Short of that, I recommend using a power switch between the LVR3E and the battery, but not having the bulb current go through this switch. (See configuration #1) This configuration provides zero off current and no bulb current power loss through the ON/OFF switch. Make sure that the external 1K ohm resistor is in place. Another good option is to wire a momentary button to the ON/OFF button pads on the PCB. This button will turn your headlamp on or off each time you hold the button down for about 1 second.

The LVR3E does not need a large capacitor in parallel with the battery for most applications. However, you may need a capacitor for high power bulbs, because the voltage sags greatly upon startup causing the LVR3E to reset the microprocessor. If you specify higher power bulbs when you order, it will be shipped with an appropriate capacitor.

The standard LVR3E has a SMD power FET, which can handle up to 2 Amps peak. Above that you should have ordered the LVR3E with the optional TO-220 power FET which can handle 10 amps peak and up with heat sinks. Above 7 amps I recommend a small TO-220 heat sink for the power FET. If the power is connected backwards, the SMD FET may be damaged even with reverse polarity protection, depending on the bulb and battery combination, however the TO-220 FET will not be damaged.

If you have any problems, questions, comments, please feel free to contact me at: willie@cs.indiana.edu

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LVR3E READ THIS! March 20, 2000

IF YOU THINK YOUR UNIT MIGHT GET WET, PROTECT IT!

The LVR3E must be protected from water. It can be put in a box (battery case) or potted. If it is potted, use a material designed for electrical potting or a material that you know has been tested. Standard silicone rubber will corrode the unit. However, Plasti-Dip tool handle coating material works well for this purpose and is available at most hardware stores. This is what I use to coat LVR's if purchased it with the optional water resistant coating.

If you chose not to coat or pot your unit you should put it into some sort of enclosure. Headlamps like a Petzl provide a nice enclosure which keeps direct water off of the unit. The box you choose need not be watertight if you know you can keep water from getting directly on the printed circuit board. One problem with a "water tight" box is that if it is not completely water tight, water will tend to build up in it, where as a non sealed box it will evaporate and dry out. Condensation in a non-sealed box can potentially be a problem, but distilled water has very high resistivity and as such I haven't noticed this to be a problem. For water immersion use like caving, potting or a sealed box is needed. For diving, a pressure vessel must be used.

RELIABILITY

I have been selling these units for 6 years now and the most failures have been either broken wires, water damage, shorted output or power hooked up reversed on older LVR's that did not have reverse protection (reverse protection is standard on the LVR3E). Less than 5 have had component failures. The electronics are very reliable, much more so than most of the rest of the lighting system.

USE A GOOD QUALITY BATTERY HOLDER

If you are using an after market battery holder, you will be much happier down the road if you use a good quality holder. The cheap plastic holders that are sold at Radio Shack will not last long before the plastic case splits out. Also, these holders can not handle much current before the wiring gets hot and melts into the plastic. Mouser Electronics and Digikey both sell metal battery holders made by Keystone Electronics. These are the best holders I know of, and are still reasonably priced. For caving applications, I recommend soldering to the batteries. I have found it to be the only reliable battery connection.

CAUTIONS ABOUT USE

The LVR3E is not protected from short circuits. If you short the output the power FET can easily be damaged, which in turn can damage the microprocessor.

If the power is connected backwards to the LVR3E, your bulb may blow out and the SMD FET may be damaged! The power FET has an internal diode that will send the battery voltage to the bulb less the 0.7 volt drop. This small drop can damage the SMD FET, but rarely the big FET. If you are using a 6 volt bulb on a 12 volt battery the bulb will get over 11 volts and blow out instantly. So if you have battery connectors that can be plugged in backwards, be careful or replace them with polarized plugs. Also, some battery holder allows for the cells to be installed backwards. My favorite Keystone Electronics holders allow this. **BE CAREFUL!**

If you are using lead acids or NiCad's you may want a fuse in series with the battery located near the battery. These batteries can deliver high enough current to melt your wiring if shorted. If the battery pack is under clothing, this could prove painful if the wire melted into your skin. However, fuses do have resistance and some power is lost in the fuse.

Although the warning flashing will tell you when you are at the end of the battery life, some battery and bulb combination may go out very fast once the battery has been depleted. If you need to know how much battery life you have left, I suggest measuring your batteries with a voltmeter. If your application is critical, a small digital volt meters can be connected to the battery and provide a continuous display of the battery condition.

Since the LVR3E is a switching regulator some radio frequency noise is generated. Although the emissions are well within FCC guidelines, there is still a possibility of interference with AM, FM, or two-way radios. If interference is suspected, try turning off your headlamp. Interference from the regulator would be noticed as a 250 Hz whine.

WARRANTY

I can not and do not make any warranty claims whatsoever. You must assume any risk should the LVR3E fail during use. You must assume any risk of injury or death cause by the failure of the LVR3E during activities such as but not limited to caving, cycling, climbing, diving, or mountaineering. If you use this unit in activities where lighting is life critical, you should have completely independent backup lights available. If you are not willing to accept this risk please send the unit back and I will refund your money.

However, I will repair a broken unit, normally for free, depending on what happened to it.