

Input Voltage Conditioner for the FT-817
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With amended parts list as supplied in the kit by N1BQ (n1bq@wulfden.org)

Introduction

The Yaesu FT-817 has no fusing and no reverse battery protection. Further, there have been reports that some switching power supplies put out momentary voltage spikes up to 18 volts when they are turned on. Since the finals aren't disconnected from the DC input when the radio is turned off, a voltage spike exceeding the 15-volt maximum spec of the FT-817 could be bad even if the FT-817 is turned off! Therefore I wanted to condition the input power supply voltage to ensure it could not harm the radio in any way. Also, I wanted to do something about that little 4mm x 1.7mm power connector interface.

Some interesting observations lead to a plan

The FT-817 draws the same current across most of the useful voltage range for a given output power. I.e., at 5-watts, the FT-817 draws 1.9 amps typically no matter whether the supply voltage is 9.6 volts or 13.8 volts! So at the higher voltages, you're dissipating unnecessary power inside the radio (8-watts more from 9.6 volts to 13.8 volts!). Therefore, I started carrying around 9.6V 3AH R/C NiMH battery sticks for portable operation (two packs plus a smart charger is \$55 from www.batteryspace.com). Two of these sticks, plus my internally charged W4RT OPP gave me a huge amount of operating time. Therefore, I decided to limit the voltage to the FT-817 to 9.6 volts when external power is applied. Additionally, I added DC input low- and high-frequency decoupling along with reverse polarity protection, 15-volt over-voltage protection, and an in-line fuse. Finally, I changed the power supply interface to an Anderson Powerpole connector.

The Electrical Design

The circuit (Figure 1) is based on the STM LD1085V low drop-out adjustable voltage regulator. This regulator is packaged in a TO-220 case, and is rated at 3-amps. And at the full 3-amp current limit, this device only needs a 1.2-volt drop input/output differential voltage, so your radio is easily run from an external 12-volt power supply. The voltage drop is closer to 1-volt at the 2-amps normally drawn by the FT-817 at 5-watts output power. You can adjust the regulator output for other voltages if you wish, by adjusting the value of the two resistors.

For over-voltage and reverse-voltage protection, a 15 volt 600 watt voltage transient suppressor diode is used. This transient suppressor diode limits any voltage transients over 15 volts. Also, when reverse voltage is applied, this transient suppressor diode looks like a forward biased diode, and will blow the fuse. The fuse is a miniature leaded fuse soldered in place. I included a switch to bypass the regulator when using voltages less than 10.5 volts, like the 9.6 volt NiMH R/C batteries, or if a higher voltage (+13.8V) is needed for charging internal NiMH batteries from the internal FT-817 charger.

The Mechanical Design

I found a nice little plastic box that mounts nicely up against the back of the FT-817. Drill two holes as shown in Figure 2 on the bottom of the plastic box. The larger 5/16" diameter hole fits over the ground post on the FT-817. The smaller 3/16" diameter hole should be a tight fit to the threaded shaft of the 4mm x 1.7mm DC plug. You may have to enlarge this hole slightly, but keep the fit snug. Discard the plastic thread-on collar, and thread this plug partially into the 3/16" diameter hole. Keeping the plug as straight as possible, insert the plug/plastic box assembly so the plug mates with the DC jack on the FT-817. Adjust the length of the plug (by screwing it in or out of the plastic box) so the plug fully mates with the jack when the bottom of the box is flush with the back of the FT-817. Once you've determined the correct length, epoxy both sides of the 4mm x 1.7 mm plug to the plastic box. See Figure 3 and photo "Plug & Epoxy".

The last two items to be mounted on the box are the slide switch and the Powerpole connector. The cutout dimensions shown for the Powerpole connector ensure it slides securely in place on the box. Since the box is soft plastic, the rectangular cut-outs are easily made with a hobby knife, assuming you have a little patience. Figure 4 shows the cover mounting locations for the switch and the screw hole necessary for holding the assembly to the FT-817. Figure 5 shows the information on mounting the Powerpole connector on the box.

Internal Wiring and Assembly

To wire everything up, first temporarily mount the TO-220 voltage regulator with a screw, nut, and washers to simulate the height of the heat sink post it will eventually be mounted to. Then wire-up everything point-to-point. One of the 0.01uf capacitors is soldered directly across the 4mm x 1.7mm plug terminals. I found that this eliminated the need for the external ferrite required by earlier FT-817 radios when externally powered and using the attached whip antenna on 440 MHz. Refer to Figure 6 for the component locations of the major parts, primarily the 47 uf and 22 uf electrolytic capacitors. When finished, remove the temporary hardware from the regulator, and then mount the regulator as shown in Figure 7 and photo "InsideWiring.jpg". The regulator tab must be electrically insulated from the FT-817 ground post, so use the TO-220 mica insulator kit and heat-sink grease as shown in Figure 7. Verify that the tab is insulated from ground with an ohmmeter, just to be sure. I used a 3mm x 25mm screw with the head cut off to mount the regulator. This creates a 3mm x 25mm stud for mounting the regulator, plus it extends through the cover to hold the entire assembly to the FT-817 chassis. And there is enough length left to add another nut and lockwasher should you wish to still use this for a ground connection. With the regulator mounted directly to the FT-817 heat sink, power that was normally dissipated internal to the FT-817 due to higher voltages is now dissipated directly into the heat sink! Photo "Mounted" shows the complete assembly mounted in place on the back of the FT-817. Photo "Mounted" shows the assembly with a Powerpole plug connected to it. And photo "TopView" shows the FT-817 with the voltage conditioner assembly mounted to the back. All labeling is done using Casio "white-on-clear" labeling tape (Casio XR-9Axs).

Operation

Just connect your Powerpole DC input to the Powerpole on the voltage conditioner. If your input voltage is below 10.5 volts, flip the switch to the “< 10.5V” position as this will bypass the 9.6-volt regulator. You will also need to use this switch position if you are using the internal FT-817 charger to charge an internal battery pack (+13.8 volts is needed to have sufficient current to charge internal batteries). For input voltages greater than 10.5 volts, put the switch in the “> 10.5V” position. In both cases, the over-voltage, reverse voltage, and fusing is on-line and protecting your FT-817. Remember that the FT-817 automatically switches to 2.5 watts output power when the input voltage is below about 11 volts. However, you can easily set the output power to 5-watts through the FT-817 menu (Function row 9) when the voltage is below 11 volts. Also, be aware the even when an external power supply is used, with the regulator in-line, you will draw current from the internal battery until its voltage drops below the 9.6 volt regulator output. So always charge the internal battery before going out to operate battery-portable.

Summary

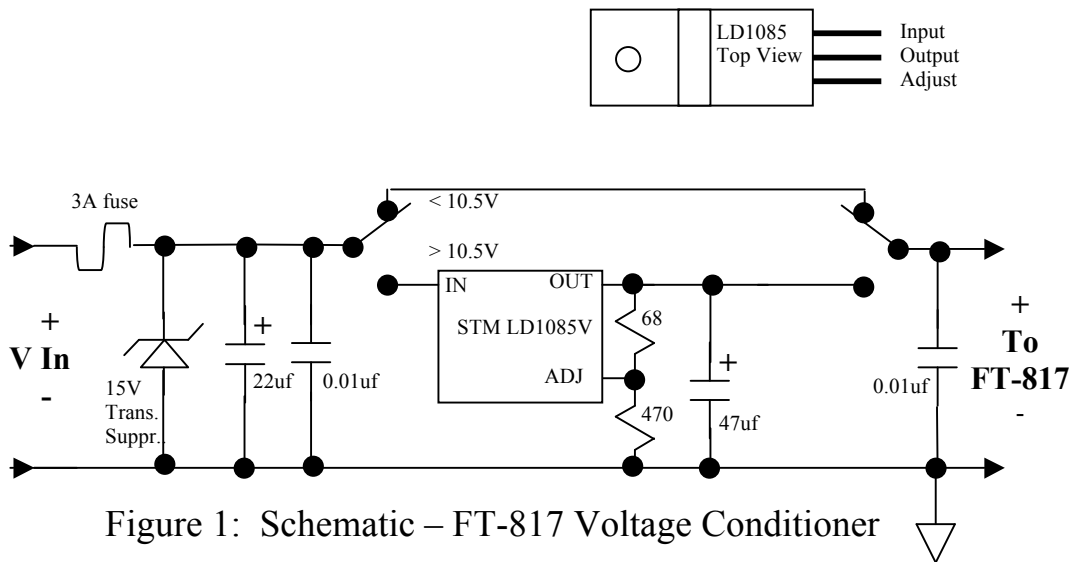
This bolt-on input voltage conditioner assembly for the FT-817 is compact, yet provides over-voltage and reverse voltage protection, fusing, and improved power dissipation at voltages over 10.5 volts. Additionally, the DC interface is now the standard Anderson Powerpole connector. Build one of these units for your FT-817 and sleep a little easier!

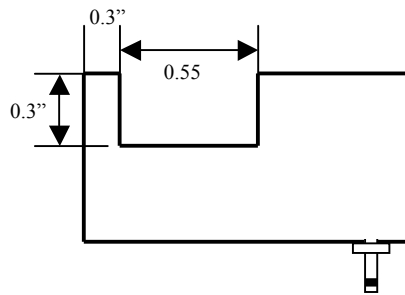
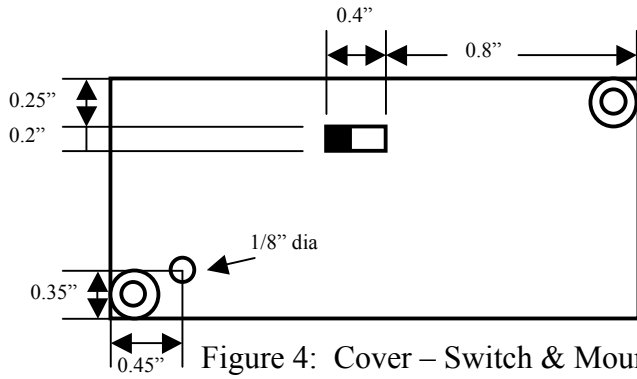
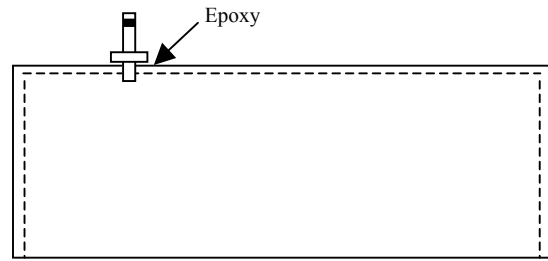
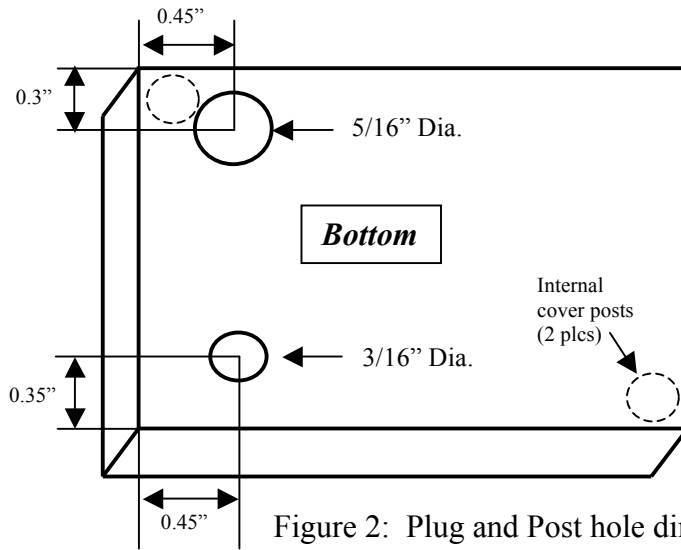
Parts List (as supplied by N1BQ)

<u>QTY</u>	<u>Description</u>	<u>Source</u>
1	STM voltage regulator	Mouser PN 511-LD1085V
2	3-amp fuse	Mouser 576-0251003.M
1	15V/600W Volt.Prot.Device	Mouser 511-P6KE15A
1	47uf 16V elec. capacitor	Mouser 140-HTRL16V47-TB
1	22uf 16V elec. Capacitor	Mouser 140-HTRL16V22-TB
2	0.01uf 50V capacitor	Mouser 80-C315C153K5R
1	4x1.7mm DC plug	Mouser 171-3219
1	470 ohm 1/4-watt resistor	Mouser 71-CCF07-J-470
1	68 ohm 1/4-watt res.	Mouser 71-CCF07-J-68
1	1.97"x1.38"x0.67" box	Mouser 546-1551GBK
1	DPDT 3A slide switch	Mouser 629-GF1263011
1 pr	Anderson Powerpole	Quicksilver Radio
1	TO-220 mica mtg kit	Mouser 534-4724
1	M3 x 25mm screw	Fastener Express - all hardware
2	M3 nuts	
4	#4 lock washers	
2	4-40 x 1/2" pan head screws	
2	4-40 nuts	

suggested user purchase

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|---|-----------------|----------------------|
| 1 | Heatsink grease | Radio Shack 276-1372 |
|---|-----------------|----------------------|





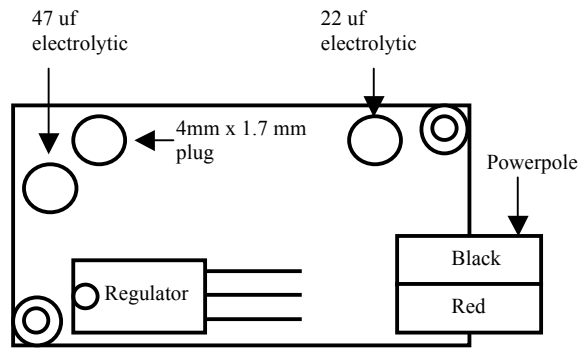


Figure 6: Internal Component Mounting (Top View)

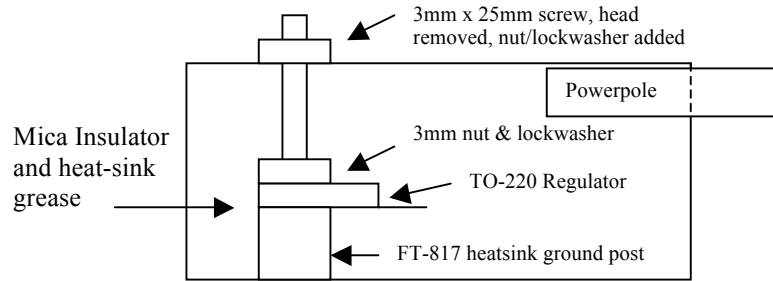


Figure 7: Regulator mounting – Side View



Plug & Epoxy



Inside Wiring



Mounted on Back



Top View