HOW TO TRIM THE ENDPOINT VOLATGE ON AN ELCON HF/PFC 1.5KW CHARGER.

Problem:

I have a custom Elcon 1.5KW battery charger that is set to the end point voltage of 81V (custom design), however I stuffed up and should have set it to 87V. How do I change he end voltage?

This would probably also work for most of the Elcon chargers, as I bet they all use the same controller boards. So it may work on the following units as well (and perhaps others).

TCCH-24-40 , TCCH-36-33, TCCH-48-25, TCCH-60-20, TCCH-72-16, TCCH-84-14, TCCH-96-12, TCCH-120-10, TCCH-144-08, TCCH-156-08, TCCH-192-6.2, TCCH-240-05

TCCH-H35-40, TCCH-H51-33, TCCH-H65-25, TCCH-H90-20, TCCH-H104-16, TCCH-H114-14, TCCH-H130-12, TCCH-H161-10, TCCH-H203-08, TCCH-H217-08, TCCH-H258-6A2, TCCH-H320-05

There is discussion later about how this may apply to other voltages.

Warning:

Opening the top of the Elcon exposes you to both dangerous voltages and lethal high currents, if you don't know what you are doing, then do not try this at home.

Be careful and follow some basic rules like:

1) Disconnect the power and the batteries before working on the unit!
2) Keep your face clear of the circuit (it could explode!), wear protective glasses!
3) Always use one hand only if any power in connect, the other should be behind your back!
4) Wait at least 30 seconds after isolating the power before touching anything!
5) Use an earth leakage circuit breaker output (you can but these at the end of an extension lead)!
6) Always have easy access to isolate the mains and the battery quickly. You will appreciate this when there is smoke coming out (@$%#^!)!
7) Always work with someone else, preferable someone who knows how to resuscitate you!
8) Be carful, check and re-check before doing anything!

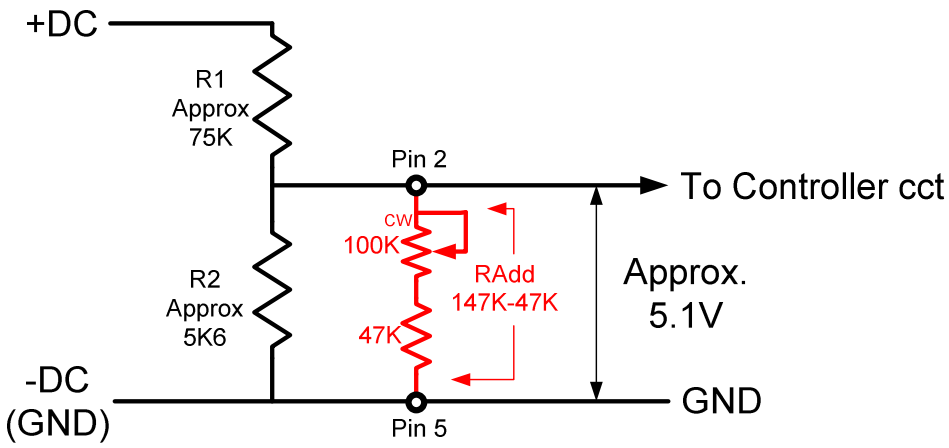
OK, after all that, if you re game to go on, then here is some info about how to do it.

Thinking:

The circuit must have some resistors that scale the end +DC voltage to something more reasonable for the microcontroller to handle.. It was impossible to reverse engineer the circuit (covered in black paint, surface mount, and all assembled onto the heat-sink). So a few hours of measurements and I determine that pin 2 (see later photos) is the scaled voltage sense pin into the controller board.

OK so I should be able to scale the feedback to trick the controller so that it thinks that the voltage is slightly less than 81V and thus scale it up to above 81V (i.e. 87V) cut off end point.

I measured the two resistor (note both are in circuit, so it is all a bit rough!!!) as about 75K (DC+ to pin 2) and 5K6 (GND to Pin 2). Note that I did not subtract the parallel impedance and the DC+ impedance. If you ratio these two resistors you get quite close to the measured 5.1V at pin 2 (not exactly). I also checked this to find that the +DC voltage scales linearly with the controller input voltage at pin 2 (Excellent – It is nailed!!!). Here is a simplified diagram of my understanding of circuit:



So all we need to do is add a parallel resistance (RAdd) across the R2 (5K6) between Pin 2 to Pin 5 and we can change the divide ratio. I did this with a 47K resistor and 100K pot shown in **red** above.

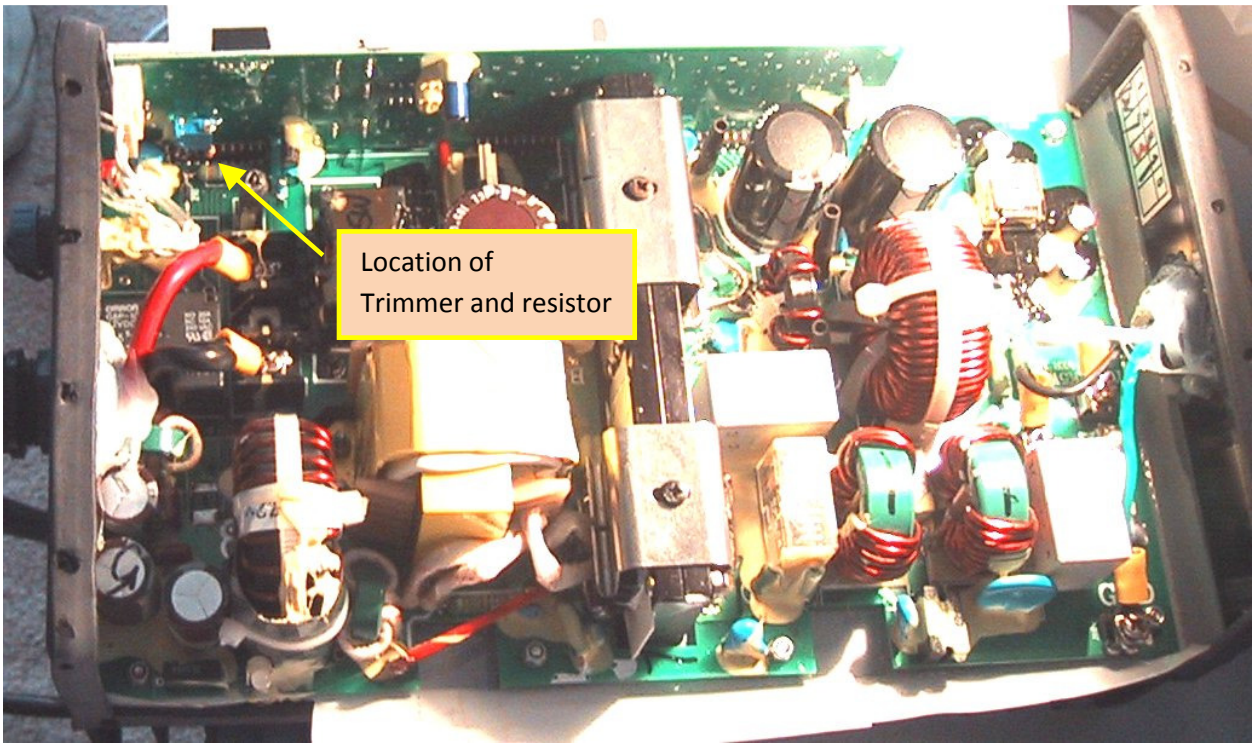
Yes I agree it is a bit rough, I could not find the individual resistors R1 and R2 so I measured them in circuit. If you calculate the ratios, and use the 81V then you don't get 5.1V (you actually get 5.6V). But that's why I used a trim pot not absolute values.

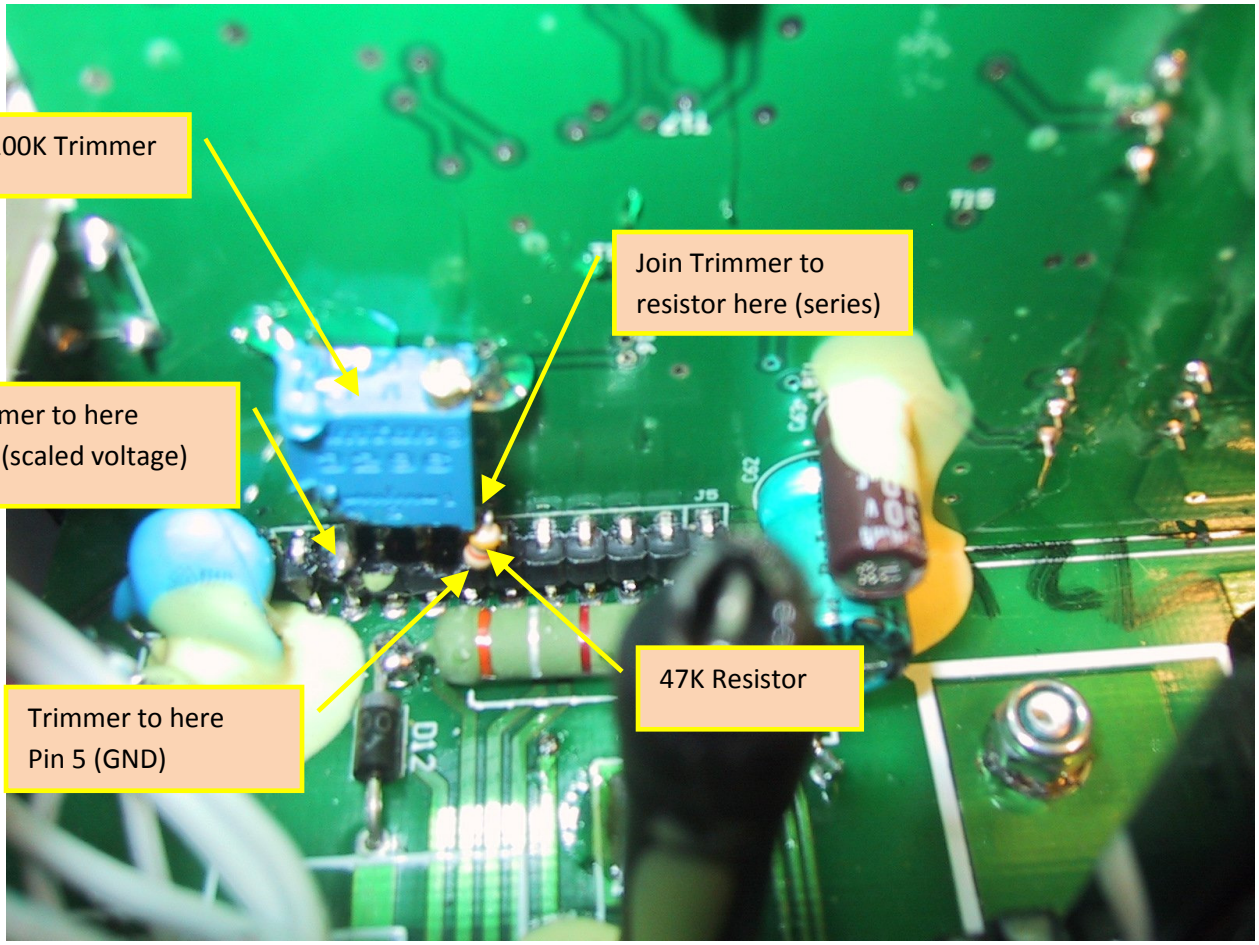
Disclaimer:

I want to make it very clear that I do not take any responsibility for this modification, or anything that you may damage (including yourself), as you try this out. The techniques are a bit rough, and not formally tried out under all situations. Proceeded with caution, and check that it actually works correctly in your case. Most of all don't kill yourself or others in the process!!!!

Modification Procedure:

1) Locate the controller pins that interface between the main power board and the Controller board. See photos below:


Location of
Trimmer and resistor


100K Trimmer
Join Trimmer to
resistor here (series)
Trimmer to here
Pin2 (scaled voltage)
47K Resistor
Trimmer to here
Pin 5 (GND)

2) Add a 100K trimmer and a 47K resistor in series between pin 2 and pin 5 as shown. Arrange trimmer so that clock wise is shorted to the wiper and then connect this to pin 2. *i.e. increasing the trimmer clockwise will make the R2 (5K6) resistance lower and hence increase the end point voltage.*
3) Glue the Trimmer to the Controller (I used hot glue - could be a bad move if it gets too hot!!!).
4) You may want to add some plastic insulation between the PCB and the trimmer so that a metal screwdriver does not short out anything (or you are in trouble).
5) Start with the trimmer at fully anti-clockwise.
6) You can only adjust the end point when you are at end of charge, so iterate there slowly (say one turn at a time), checking each time if the end point in actually changing. DON'T continue if it is not. Certainly don't be tempted to wind the trimmer fully clockwise if it is not working (smoke ay result if you stuffed it)

Learning from my mistakes:

Soldering the components to pin 2 and 5 is a bit tricky. So I recommend tinning all the four solder points (pins, resistor and the Trimmer legs) first. After swearing a few times and burning my finger, I got it there. But thinking about this, it would be better to mount this on two wires and glue the pot in a more accessible location. Oh well next time %^^%@#@&^!

PS: if you look at my photo the corner of the trimmer shows the heat marks of my soldering iron…

Different voltages and ranges:

This should work OK at other voltages as well, I would recommend that you keep the end of change to be less than 20% of the original as the design parameters will start to be compromised, and you may end up with the horrible sound of burning batteries!!!!! That costs much more than purchasing the proper charger!!!!

Trim Range (Increasing it only):

1) Figure out the Upper Voltage and Lower Voltage adjustment trim range points for the trim pot. Vmax and Vin
2) Work out the ratio of the Vmax (83V) and Vmin (90V) relative to the original voltage (Vorig).
   RatioMax = Vorig/ Vmax (in this case 81V/83V = 0.962 V/V)
   RatioMin = Vorig/ Vmin (in this case 81V/90V = 0.9 V/V)
3) Work out (approx only) the new parallel resistor value that you need to reduce the R2 (5K6) to trick the controller.
   RPmax = RatioMax X R2 (in this case 0.975 X 5K6 = 5.82K)
   RPMin = RatioMin X R2 (in this case 0.9 X 5K6 = 5.04K)
4) Work out the resistor that you need to add in parallel (RAdd) to get this value
   RAddmax = 1/(1/RPmax - 1/R2) (in this case Rmax = 1/(1/5.82 – 1/5.6) = 150K)
   RAddmin= 1/(1/RPmin - 1/R2) (in this case Rmin = 1/(1/5.04 – 1/5.6) = 50.4K)
5) Set the pot value to be Rmax – Rmin (in this case 100K – Find a good compromise)
6) Set the series resistor to be Rmin (in this case 47K).

Trim Range (Decreasing it only):

Note I only tried this quickly on my unit, it seemed to work, but tread carefully.

In this case you want to make R1 a bit smaller so you will add a large parallel resistor between Pin 2 and DC+ (see the following photo).

1) Measure the upper resistor R1 (between pin DC+ and pin 2).
2) RatioMax = Vmax/ Vorig
   RatioMin = Vmin / Vorig

3) Parallel Resistor total for R1 (in this case)
   RPmax = RatioMax X R1
   RPMin = RatioMin X R1

4) RAddmax = 1/(1/RPmax - 1/R1)
   RAddmin= 1/(1/RPmin - 1/R1)

   I think I got that right!!! It should end up a resistor about 10 times R1 for a 10% reduction.

   The simplest place I found to access DC+ is the large pad next to the long heatshrink covered vertical inductor, but watch out the pad needs a lot of heat to solder as it is so large. See the following photo.

Good Luck,

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