Repair Project: Ryobi BC-1400L 14.4V Lithium Ion Battery Charger

This battery charger was brought to me by a customer, who claimed it was not working. The cover was already open, and the customer claimed that he'd only had a look at it, and hadn't touched anything.

1. Initial Inspection.

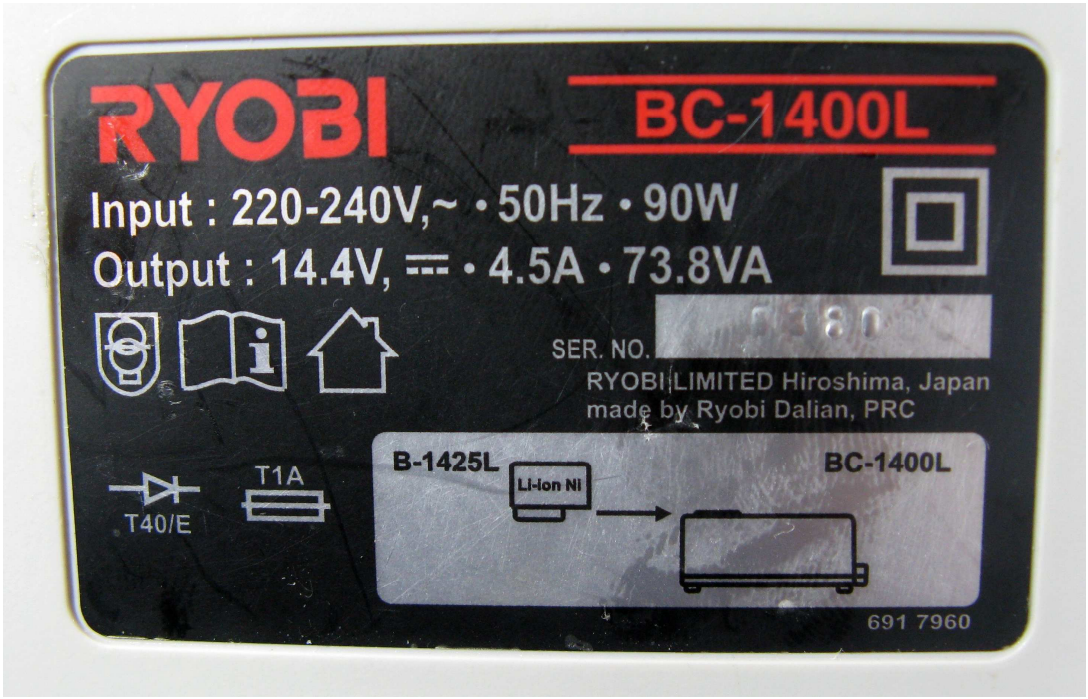
Apart from a dirty and greasy casing, there was no visual indication of any component damage. On the PCB solder side, I noticed some dry joints at the large blue toroid, but nothing else unusual.

2. Resoldering all Joints

At this point, there was no benefit in connecting power, until after I had resoldered all the joints with old-fashioned poisonous leaded solder – with correct ventilation. Now that I was certain that current would flow correctly, then it was ready for its first connection to AC Power.

3. Initial Diagnosis

Of course, the absolute first step before working on any SMPS unit is to remove the Fuse, and replace it with a suitable wattage incandescent light bulb – in this case 100W, being that the unit is rated at 90W.



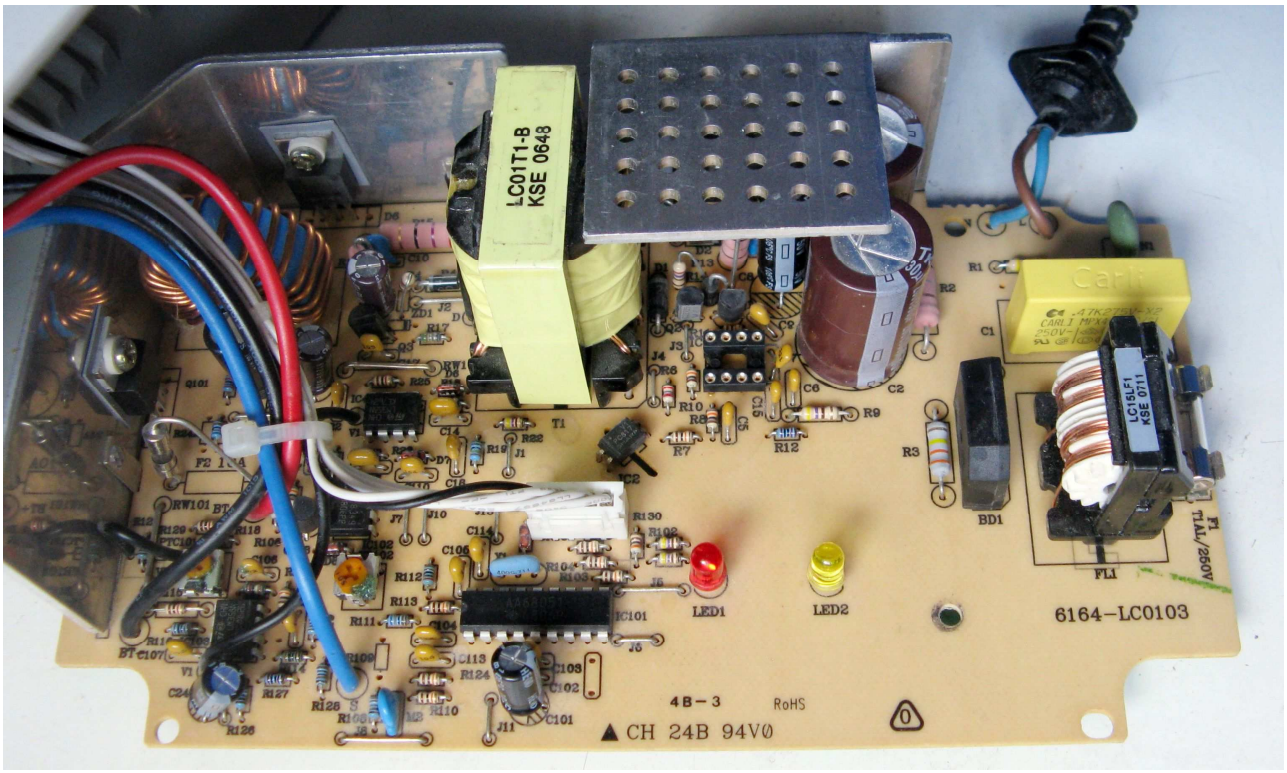
Bottom Label showing Power Ratings

The normal indication of a healthy SMPS is a momentary illumination of the light bulb (indicating a momentary short at initial inrush current), and then no illumination at all (indicating normal stable current flow).

The light did not illuminate at all, which indicated a problem, but NOT a short in the Primary Power section. Therefore I started troubleshooting in the Secondary Power section.

4. Troubleshooting

I checked ESR on all the electrolytic capacitors, and due to marginally high ESR, replaced all caps except the 2 main filter units.



New capacitors and DIP-8 Socket installed

I connected AC power again, but still no momentary illumination, therefore even though the caps tested marginal, they were not the main problem.

Having replaced the marginal capacitors, I remained in the Secondary Power section of the PCB.

I checked the FQP27P06 MosFET, and it was shorted. I replaced it, and applied AC power but still no bulb illumination. Then I checked for any type of output voltage at the charging terminals – absolutely 0VDC.

I checked all the Transistors and Diodes in the Secondary Power section, and all checked OK. I was a little concerned, because one of the IC controllers (Agamem AA68051 DIP-18) has absolutely no data available on the web, and I had no way to determine whether it was faulty or not.

So, I started diagnosing the Primary Power section. I removed the 2SK2654 MosFET, and 2 terminals showed open. I replaced this component, and applied AC power, but still no bulb illumination.

The other components in the MosFET circuit are 2 medium power transistors (BC327-25 NPN and BC337-25 PNP), and a UC3844B Current Mode Controller. All 3 were shorted.

I installed a DIP Socket for the UC3844B, replaced these 3 components, and also the PC817 OptoController.

5. Final Testing

I applied AC power, and now the bulb illuminated momentarily, and then extinguished. Success.

I did not replace the fuse at this point – I wanted to confirm correct operation through the various charging cycles.

I connected my voltmeter to the charging terminals to monitor DC Voltage, and installed a Ryobi Li-Ion Battery.

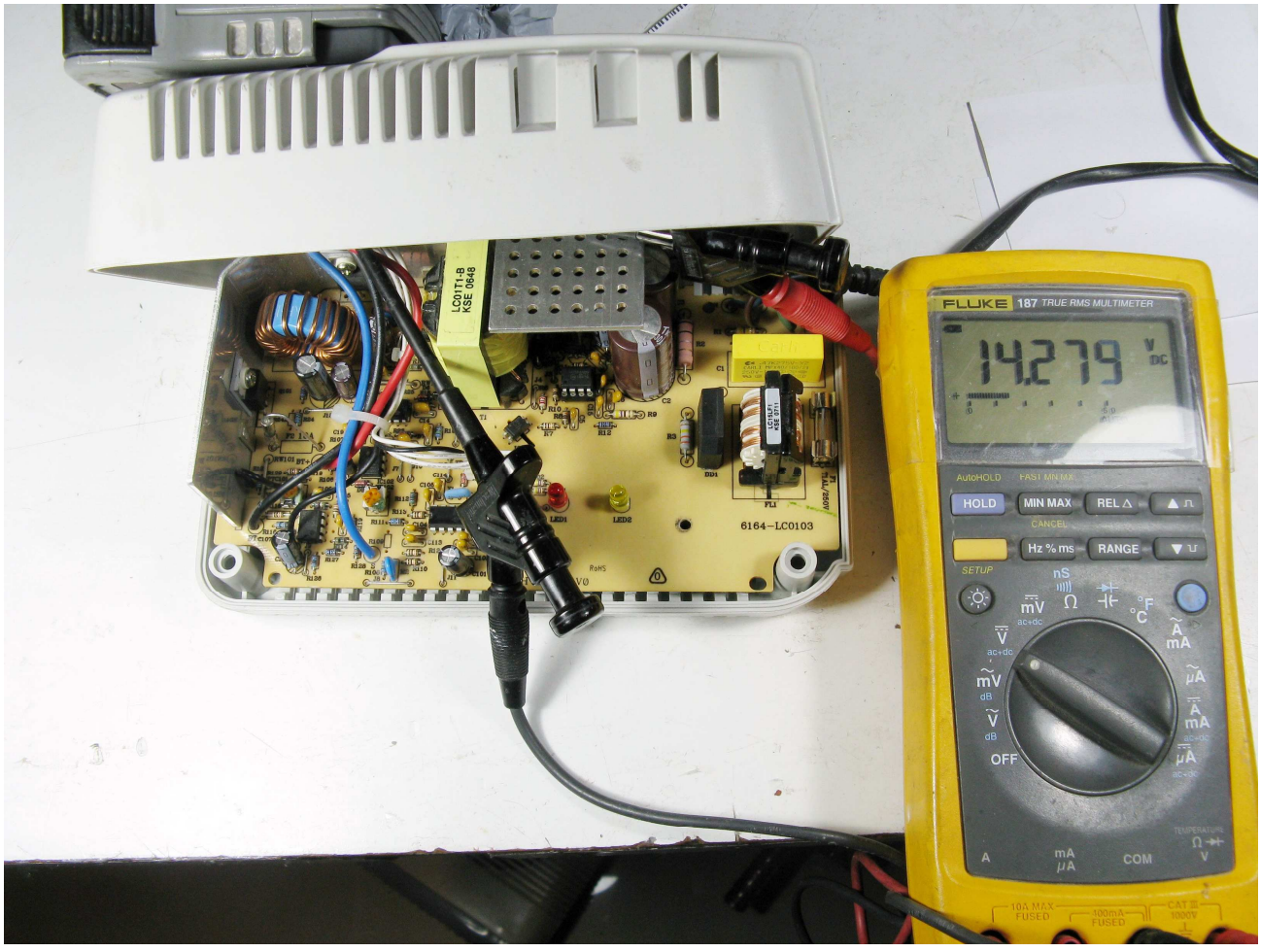
The voltmeter showed a quick rise through 3VDC upwards to about 10VDC, while the Red LED flashed slowly, indicating "Initial Charging".

Then I noticed that the 100W light bulb was flashing on and off intermittently, and I looked quickly at the MultiMeter Voltage 11.6VDC.

No problem – from previous experience on SMPS units, I know that a flashing light bulb indicates that the unit is cycling due to insufficient power input (which the light bulb resistance is causing), and that it is now OK to replace the fuse.

I replaced the fuse, and over about 20 minutes, observed the steady "Charging" Red LED and the charging voltage rise to about 14.3VDC.

Then the Red LED started flashing quickly, indicating a "Charged" condition.



Charged Condition

I removed the Ryobi Li-Ion battery, and checked its voltage – 16VDC – a very healthy battery, a healthy charger now operating correctly, and indicating a successful repair.

Parts for this restoration

Parts and advice are available for owners who wish to tackle this project by themselves.

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