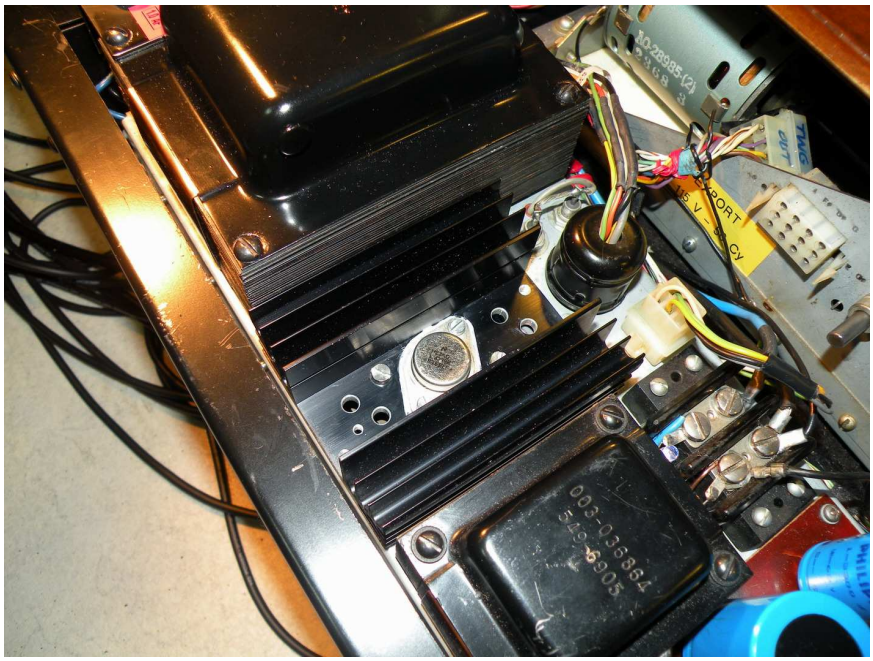
Improving the Power Supply Unit of Hammond® X-66

by Dan.Vigin



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" Improving the Hammond X-66 PSU "

1. Forewords – Purpose of this chapter

In fact, this chapter is simply the extension of the preceding chapter ' Protecting you Hammond X-66 ' but mostly intended to be realized by experienced technicians or real 'X-66 purists'.

When renewing my X-66 Power Supply Unit (PSU for short) after replacement of the power transformer, in the finalization phase, naturally, it was necessary to perform accurate measurements and tests. During those checks, I noticed that the level of residual ripple was still excessive at the + 28 Vdc terminal even after filtering.

Since this + 28 Vdc voltage is feeding the most important circuits of the X-66 console, it was decided to eliminate that residual ripple.

The next questions is : **' Why to do this ? '**.

... and the answers are:

- because, the elimination of this residual ripple will reduce the overall hum level of the X-66 console and it does (*)

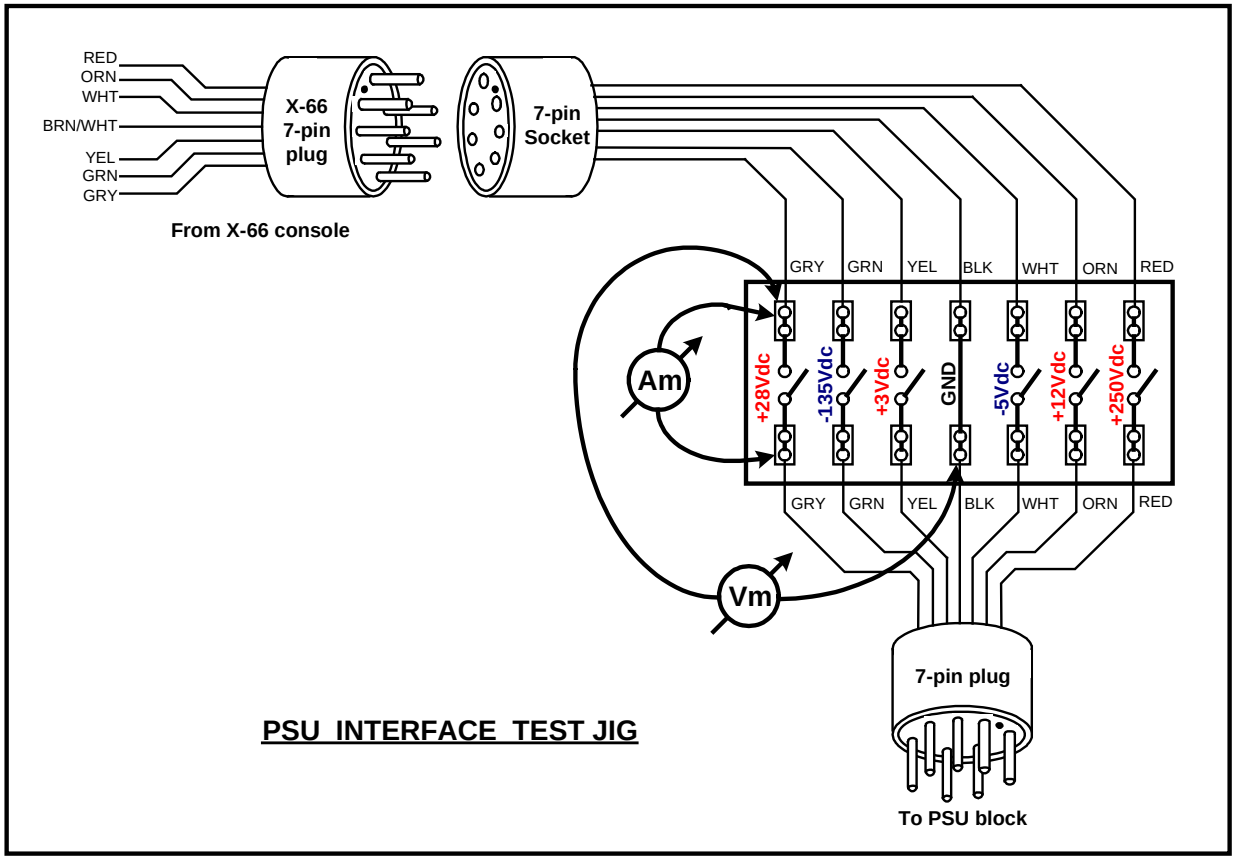
- secondly, the +28 Vdc voltage available from PSU will remain so absolutely stable and will confer a better stability to all circuits fed via this regulated +28Vdc voltage.

That's exactly the purpose of this chapter.

* After having worked a long time in the Hi-Fi business with Marantz, I have been always fighting against any form of hum, hiss, background noise, motor noise, rumble, spikes, ventilator noise, etc...

2. Technical overview.

For easiness of measurements of the various voltages available at the terminals of the power supply receptacle, a dedicated ' Interface Test Jig ' has been specially developed since when operating it is not convenient to measure voltages and currents as such.



While being quite basic but very helpful, this test jig allows measurements in a simple way of both DC voltages and DC currents.

Each DC voltage (Vm) can be measured between GND and any other terminal of the test jig. Six switches are installed in series with each lead and remain normally closed. Measurements of DC currents (Am) are available with the Ammeter by opening the concerned switch after switching ON the X-66 console. See picture on next page.

Excessive ripple level was found during those tests exhibiting a voltage in the range of 300 mVpp and the idea to improve that particular + 28Vdc voltage output was decided.

X-66 Interface Test Jig.

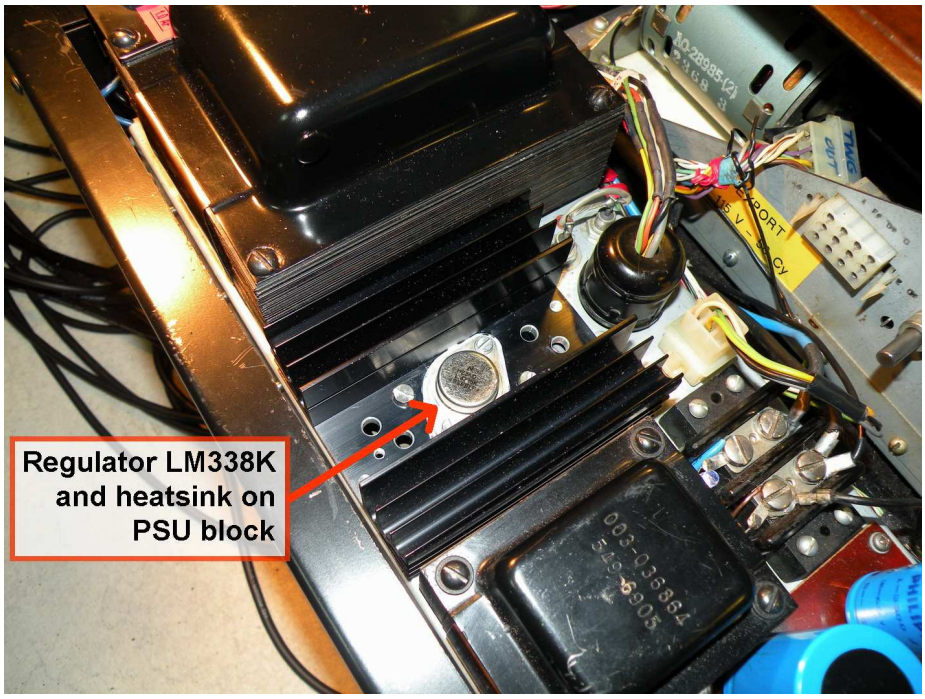
3. +28Vdc Regulation .

To eliminate the residual ripple in a simple way it is necessary to remove the Choke-Coil CH-2 from the PSU chassis and replace it with an adjustable regulator LM338K (from National SemiConductor) mounted on heatsink.
To be honest this heatsink is absolutely not needed because the current flow is only 0.5 A with a Vin - Vout voltage of 6 V, this means 3 Watts.
In fact this regulator may operate up to 5 A, so we are 10 times below max. ratings.

However, in order 'to fill the gap', this means to cover the big hole in the PSU chassis where the choke-coil CH-2 was installed, the TO-3 regulator was finally installed on heatsink while a 80 mm x 95 mm aluminium plate of 3 mm would also do the job.

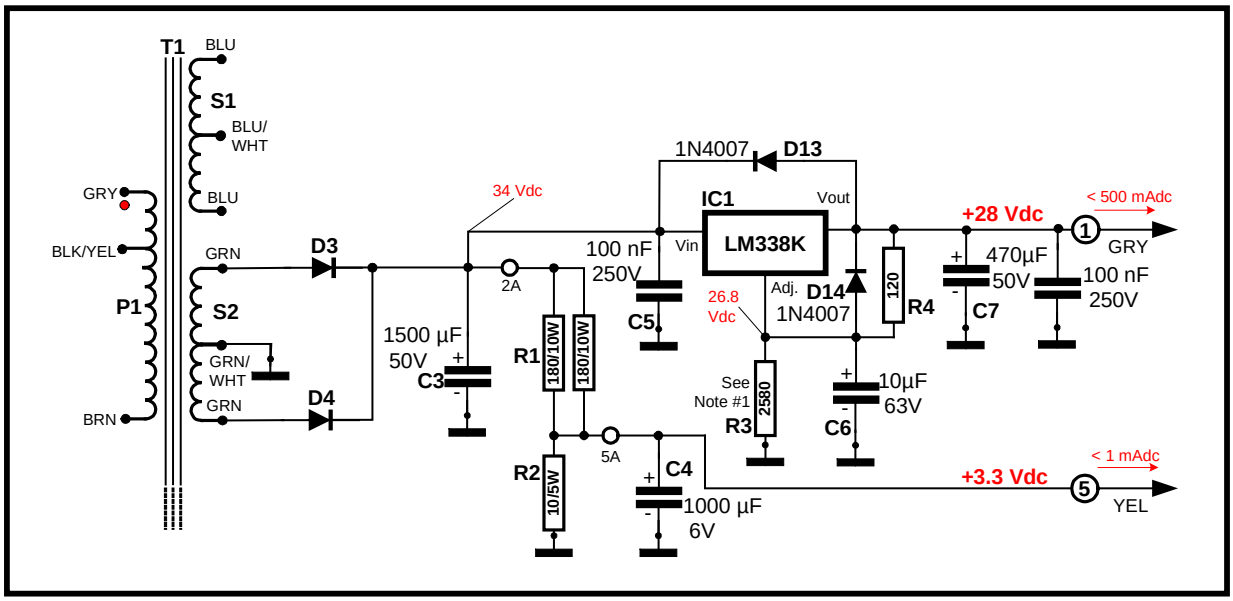
The LM338K regulator circuit is based on datasheet supplied by National SemiConductor – Fig.3, Page 6.
(see: http://www.datasheetcatalog.com/datasheets_pdf/L/M/3/3/LM338K.shtml for details).

Installation on PSU block.



Refer to schematic diagram. Vin of LM338K is connected to the positive terminal of C3 and decoupled by 100 nF capacitor. One elco of 470 µF is now sufficient (i.s.o. C5 = 1500 µF/50V) at Vout since ripple rejection and regulation is assured by the regulator LM338K. One 100 nF decoupling capacitor is inserted between +28 Vdc output and ground. The role of diodes D13 and D14 is to protect the LM338K regulator as recommended in the datasheet (Fig.3).

4. Schematic Diagram.

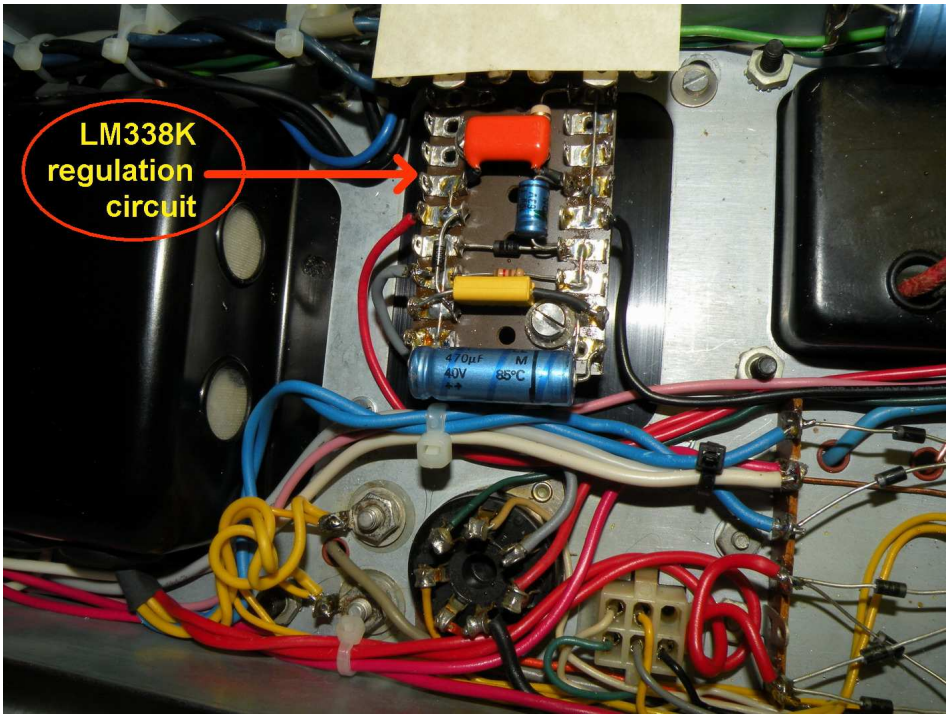


Note #1 : 2.2 K + 380 ohm

In order to get exactly +28Vdc at Vout, the Adj. voltage must be 26.8 Vdc. To achieve this voltage, the value of R3 resistor must be 2.580 ohm. This can be done by selecting properly resistors of 2.2K/1W and 380 ohm wired in series.
The role of capacitor C6 is to improve the ripple rejection at its best.
The other part of the circuit connected at Pt.2A remains unchanged and provides + 3.3 Vdc.

5. Realization.

Wiring of LM338K regulator in the PSU block itself is quite simple. All needed components are wired on a bakelite plate installed on the heatsink in order to shorten the connections to the LM338K regulator. Quite easy to realize.



6. Conclusions.

After having implemented this LM338K regulator in the PSU block, the level of ripple was no more measurable at the oscilloscope hence improving so the residual hum level of the X-66 console and providing an excellent +28Vdc voltage stability to all concerned circuits.
Trust having been of some help.

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