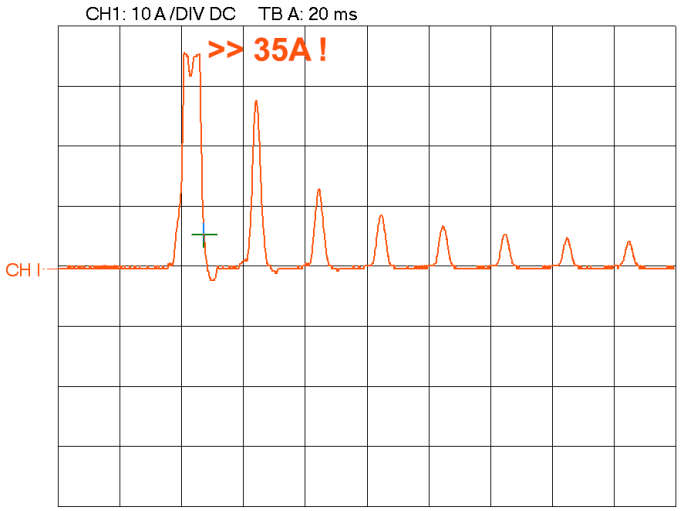
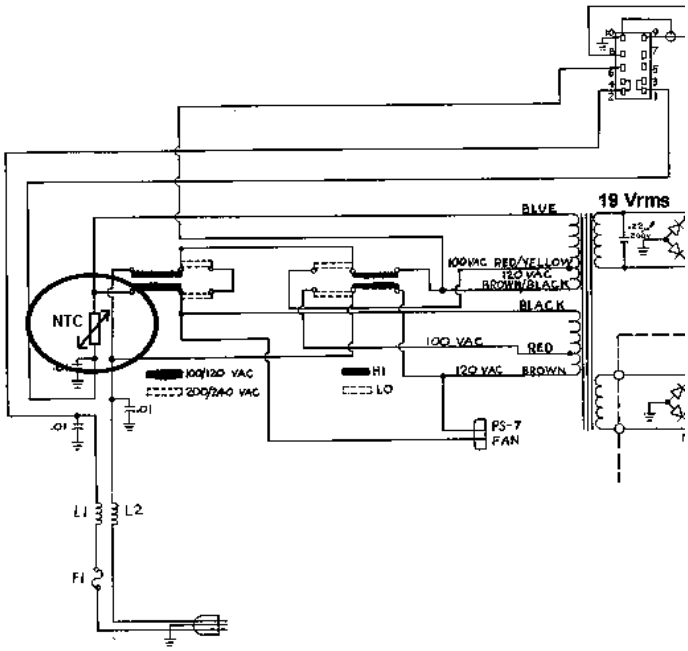
Limitation of Inrushcurrent of the PS-7

The Inrushcurrent of the PS7 is rather high and may damage the ON-switch in the TR7 or blow the internal fuse (picture 1). My electronic currentprobe used for this measurement was overdriven by the inrushcurrent, so it can be assumed, that the actual peak was much higher than 35A ! My mains voltage is 230VAC, 50Hz.



Picture 1: Inrushcurrent before modification

A limitation of this inrushcurrent is highly recommended. My proposal is to use a NTC in series to the mains supply for this purpose. This NTC limits the current and when getting hotter some seconds after switching on, it is (nearly) full conducting (picture 2).

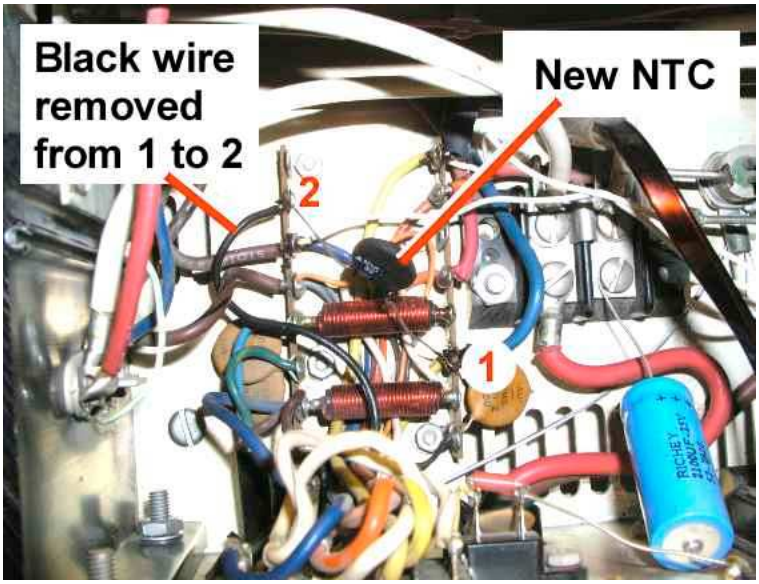


Picture 2: NTC

Selection of the NTC for mains 230VAC:
The normal operating current of the PS7 (TR7 in receive mode) is app. 0,4 A rms.
When transmitting, the current increases up to 1,5 A rms (= 350W input @ 230VAC).
Therefore, the NTC has to carry 1,5A continously.
I´ve chosen a NTC, type EPCOS, B 57237-S330-M. It has a dimater of 15mm, the resistance @ 25 degree celsius is 33 Ohms and the maximum current is 2,5A [1]. The thermal timeconstant is 90 s. Any NTC with similar data will be OK. Look for NTC´s, designed especially for currentlimitation.
It is important, that the NTC´s maximum current isn´t much higher than the operating current of the PS7; otherwise the NTC won´t become hot enough for good conductivity!
Don´t oversize the NTC!

Selection of the NTC for mains 115VAC:
I´ve no experience with 115VAC, but electrical rules tell me, that half voltage means double current and therefore a quarter of impedance!
So i propose a NTC with not more than 8 Ohms @ 25 degrees Celsius, carrying 5 A continously.

Installation of the NTC (DL7MAJ):
Picture 3 shows the installation, the black wire coming from the switch in the TR-7 is desoldered from point 1 and soldered to the spare point at 2. The NTC is soldered between points 1 and 2.
Important! The surface and the leads of the NTC get hot! Keep them away from all wires inside the PS-7, in doubt, fix the wires! Solder carefully!



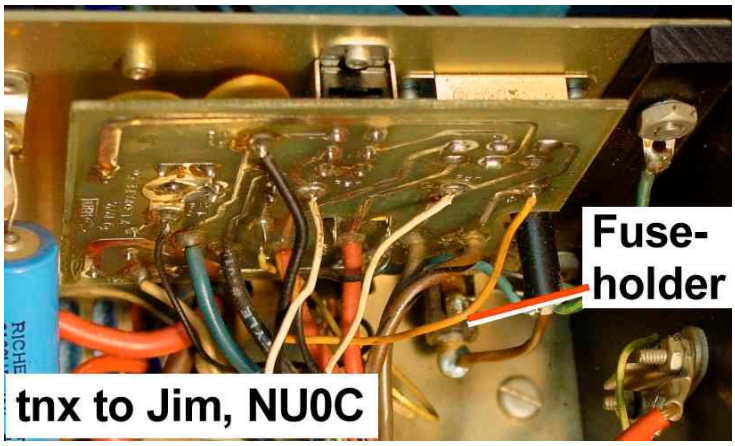
Picture 3: Installation of the NTC (earlier model of PS-7)

Please check your version of the PS-7 and compare with pictures 2 and 3. Maybe there are differences. In all cases, the NTC has to be in series with the mains supply.

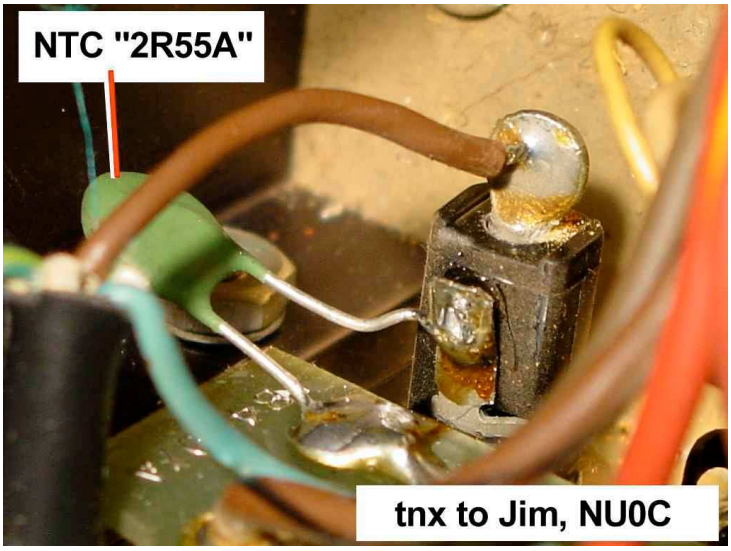
Installation of the NTC (NU0C):
Jim, NU0C gave me informations via zerobeat.net / drake mailing list about his modification, which are added here.

„ .... I have found, in a dead PC power supply in my shop that has been a parts donor for several radios already, two NTCs marked "2R55A". The data sheet was found at http://www.voltts.com.br/produtos/tks-termistor-ntc.pdf using Google.
This part is specified 2.5 Ohms resistance @ 25C, 5 Amps maximum steady state current.
It should work for a PS7 configured to run from 120 Volts. I will try one in mine.
Later models of the PS7 differ from your picture, Stefan. (see picture 4).
Input circuitry is mounted on a printed circuit board that is attached to the cabinet rear....“

„ .... I installed one of the 2R55A devices in my PS7, and it seems to work fine (see picture 5). There was a very noticable "thump" from the top cover (which I did not have screwed down) before, and no thump after. Voltage drop across the NTC while in RX mode is about .6 volts after warmup. I was able to install it by lifting the fuseholder contact up from where it was soldered to the circuit board, and placing the NTC across the opened connection....“
-Jim NU0C Dec. 26th, 2008 and Jan. 1st, 2009.

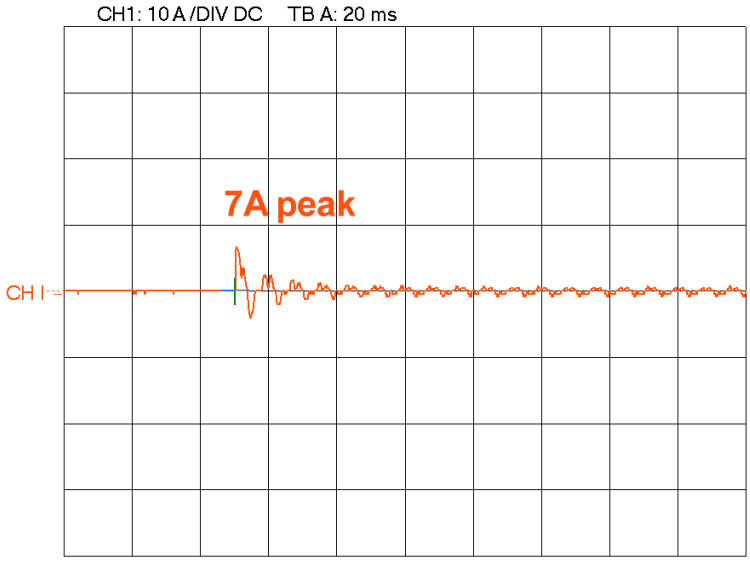


Picture 4: PCB in PS-7, later model



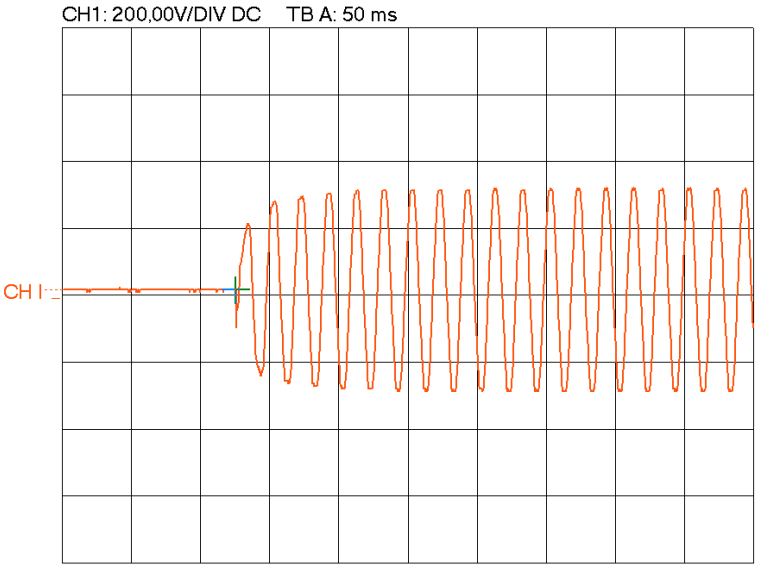
Picture 5: Installation of the NTC

Measurements 230VAC (DL7MAJ):
The measured voltage drop across this NTC is less than 2 V during RX and when transmitting, this drop increases for a second up to 5 V and then decreases down to 2 V (the NTC gets hotter in this case).
Picture 6 shows the inrushcurrent after the modification (same scale as in picture 1). The peak is app. 7A, which can also be calculated from the AC-peak of 230Vrms times SQR(2) = 325V and the resistance of the NTC (33 Ohms). During switch on the transformer in the PS-7 is not magnetized and therefore the impedance is only some ohms. The current-peak depends also upon the momentary phase of the AC-voltage when switching on and varies therefore.



Picture 6: Limited inrushcurrent after modification

Picture 7 shows the increasing voltage at the transformer in the PS-7 during switching on. The voltage increases because of the decreasing resistance of the NTC.



Picture 7: Voltage across transformer during switching on

Operation:
For optimum operation of the NTC, it is necessary that the NTC is „cold“, i.e. at ambient temperature of app. 25 degree Celsius.

If for example, the PS-7 is switched off after longer operation and then immediately switched on again, the NTC is still hot and electrically not existing!
You will hear the well known „big bang“ from the PS-7.

Note:
The time constant of the NTC for cooling is app. 90 seconds. You should wait at least 10 seconds, when switching on again.

Improvement (Idea):
It would be a solution, to bypass the NTC after switching on by a relais. This bypass should be delayed app. 1 s. With this bypass, the NTC would carry no continous current and therefore wouldn´t become hot.
Maybe, i´ll realise this idea anytime.....

[1] www.epcos.com (look for „S237“)
[2] http://www.voltts.com.br/produtos/tks-termistor-ntc.pdf

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