Putting the Music Angel 845 into Action

… after modding and soldering … approaching music

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… well, congrats! You have done all the soldering and installation work and now here comes the sequence for putting the amp into action. Before we can speak of "action", we need to put it "into service". I shall take it as given, that you checked all connections for several times and that you checked for bad soldering spots too (pls. use a magnifying glass!). If in doubt, solder once more! Please also check the glossary in behind. Here some additional hints are published, as well as some tips for the fine-tuning. All testing points will be shown and named according the schematic (201611-01-BEG).

Precautions on your personal safety:

- Please remind the chapter about safety from the modding article.
- Putting a DHT-SEA-amp into service needs to measure and work on an amp with voltage applied. Your amp will show up to 1000V inside and this voltage is absolutely lethal. Pls. keep that in mind and act really very careful.
- You must make it your personal habit, to put one hand into your pocket when f.e. attaching a probe by the other hand.
- Always discharge the main caps (C17 – C20) fully before you put your hands on and always test for residual voltage! Two filament lamps 230V/100W in series are the best means to do so: You see the flash of the discharge and use the PTC effect of filament lamps. This will discharge better and quicker than any other resistor.
- Never switch-on the amp without a proper dummy load at the output. A DHT-SEA without overall NFB acts like a current transformer and its output voltage will rise into direction of infinity without a load. Pls. keep in mind that such an amp converts input voltage to amplified output current! Output voltage is defined by $U_{out} = I_{out} * R_{load}$
- If you do not feel comfortably with working under power, ask a skilled and experienced colleague to do the putting into service sequence for you.

Necessary equipment:

- ✓ A DMM, capable of 1000VDC; best use one measuring TrueRMS. Two properly insulated (≥3000V) probes and one additional probe with an insulated alligator clip at one end (for GND-connection).
- ✓ A signal generator (sine-, triangle-, square-wave) of at least 5Vrms output voltage; int. impedance 50Ω.
- ✓ Two shorted RCA-plugs for to short the inputs.

- ✓ A scope; dual-channel; better than 10MHz and ≤10V/div. Two probes, switchable 1:1 and 10:1 plus one 100:1 for inspection of the plate-signal of the 845.
- ✓ 2 dummy loads 8Ω. You best build each from 7# 56Ω 5W in parallel (totally 8Ω /35W) with banana plugs/wires at both ends. 4# 33Ω 10W in parallel will do too (totally 8,25Ω / 40 W). Then you need to take the increased resistance into account at calculations. Finally check total resistance by DMM for actual value and write it to a label you can attach to the dummy load.
- ✓ 2 filament lamps 230V/100W connected in series, installed on an insulating base (f.e. wood) with a probe attached at its hot end. Other wire with an insulated alligator clip at its end (for GND-connection). This assembly is needed for discharging of the main caps.

Getting started

Take out all tubes. Switch-on the mains-switch. Let the circuit become stable – wait for at least 2 minutes. No signs of excessive heat or even smoke? Then it is OK and you can carry on, otherwise switch-off immediately and search for the failure[1].

Measure B+, B1+, all heaters and all other checkpoints with no load (and write down the values, make a table (!) ... that's necessary for all steps, but I shall not repeat this for further steps). All voltages will be a bit bigger than from the schematic due to no load.

Sequence A

Testing points with DMM in DC-range:

1. C19 (+) ... B+; C19 (-) ... B+/2
2. C17 (+) ... B+; C17 (-) ... B+/2
3. Q1 (drain) ... B1+ (must read at least app. 10V less than B+/2 ... even w/o load!)
4. V1.1 plate (pin #2) ... B1+
5. V1.2 plate (#5) ... B1+ * 0,28
6. V2.1 and V2.2 plate ... B1+
7. V3 plate ... B+
8. V3 grid ... neg. BIAS (app. –120V). Now turn the pot at the supply PCB to both ends and write down the end values. Set the biggest neg. value possible.
9. V1.1 cathode and grid (#3 and #1) ... GND
10. V1.2 cathode and grid (#6 and #4) ... GND
11. V2.1 and V2.2 cathode and grid (#3,1,6,4) ... B1+ * 0,28
12. -> do the same for the second channel!

<u>If everything is OK you can carry on, otherwise switch-off immediately and search for the failure!</u>

Now you need to check the testing points of the heaters with DMM in AC-range:

1. All 6SN7GT heaters (#7 and #8) ... 6,5V
2. V1 heater vs. GND (#7 or #8 vs- GND) ... 3,25V

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[1] You find some tips for trouble-shooting in the back of this article.

3. V2 heater vs. GND (#7 or #8 vs- GND) ... no indication, 0V. Maybe some flickering but must be stable 0V after 10 seconds.
4. V3 heater ... 11V (in DC-mode)

Sequence B

If everything is OK until here, switch-off, discharge the el.caps, plug-in the small 6SN7GT tubes and switch-on again.

Check again for excessive heat (... and smoke?) and wait for at least 5 minutes.

Repeat test **sequence A** and write down the values in a new column.

1. C19 (+) ... B+; C19 (-) ... B+/2
2. C17 (+) ... B+; C17 (-) ... B+/2
3. Q1 (drain) ... B1+ (must read app. 15V > drop >10V compared to B+/2, now with load!)
4. V1.1 plate (pin #2) ... app. B1+/2
5. V1.2 plate (#5) ... app. B1+/2
6. V2.1 and V2.2 plate (#5, #2) ... B1+
7. V1.1 cathode (#3) ... app. 15V
8. V1.2 cathode (#6) ... app. 15V
9. V2.1 and V2.2 cathode (#3,#6) ... app. B1+/2
10. -> do the same for the second channel!

Repeat tests for the heaters of **sequence A** and write down the values for the loaded heaters.

Sequence C

Connect a signal-generator to the input. Set its output (input voltage of the amp) to 100mVrms @ 1kHz. Waveform: SINE. If you kept the volume-pot at the input, set it fully clockwise.

Repeat test **sequence B** and write down the values in a new column. Set the DMM to AC-mode from point 4. Check for real good, undistorted sine-wave via scope in AC-mode. Connect channel A of the scope to the input and compare each step carefully. The signal must only become bigger - step by step.

If you have a THD-meter, you should measure THD now and write it down in the table. Values for 100mVrms input must be less than 0,2%.

1. C19 (+) ... B+; C19 (-) ... B+/2
2. C17 (+) ... B+; C17 (-) ... B+/2
3. Q1 (drain) ... B1+ (must read app. 15V > drop >10V compared to B+/2)
4. V1.1 plate (pin #2) ... app. 800mVAC_rms
5. V1.2 plate (#5) ... app. 6,4VAC_rms
6. V1.1 cathode (#3) ... app. 800mVAC_rms
7. V1.2 cathode (#6) ... app. 6,4VAC_rms
8. V2.1 and V2.2 cathode (#3,#6) ... app. 6,4VAC_rms
9. do the same for the second channel!

Sequence D

Keep the signal generator at the input. Set its outptut (input voltage of the amp) to 1000mVrms @ 1kHz. Waveform: SINE. Repeat the test **sequence C** and write down the values in a new column. DMM in AC-mode. Check for real good, undistorted sine-wave via scope in AC-mode.

V2.1 and V2.2 cathode (#3,#6) ... app. 64VAC_rms

If the waveform is not satisfying, check from top, at which point it starts distorting.

If everything stays OK until here, change the waveform to TRIANGLE and repeat the **sequence**. Have an eye esp. on the straightness of the rising and falling signal and check for no spikes or rounding at the turning points of the trace (by scope).

Now change to waveform SQUARE (50% dutycycle) and check for similar symptoms as with the triangle wave from before.

Repeat the whole **sequence D** at several frequencies from 50Hz to 10kHz.

Sequence E

If everything went satisfying until here, insert the DHT (V3) and connect the dummy loads.

Connect the DMM to R19 (10R) and set a quiescent ("idling") current (Iq) of 80mA by the BIAS-pot (R26) at the supply PCB. The voltage drop across R19 (normally 10Ω, but pls. check, as we found 12Ω and 15Ω too !!!) should read 800mVDC (= 80mA*10Ω). Test B+ and write down. Wait for 15 minutes and check the BIAS again. Write down the neg. BIAS voltage at the grid of V3 and write down the value of B+ too. Again wait for 1 hour and recheck idling current (BIAS) and B+. Check for hot spots (well, the tubes will become hot!). Do not forget the transformers at the top side!

Repeat the whole **sequences C/D** at several frequencies from 50Hz to 10kHz. Testing point is in parallel to the dummy load.

Sequence F

Increase the output voltage of the signal generator in SINE mode until the waveform in parallel to the dummy load (U_{ACout}) shows a bit of distortion.

Now you need to calculate:

$B_{+} * I_{q} = P_{V}$ -> static power loss at the DHT 845

According to your version of the 845, the calculated value of P_v must never exceed the maximum P_v of the tube (please refer to its datasheet!). It is better to allow only 90% of the max. value for prolonged tube life. But please note, that this will reduce the max. output power (P_{out}) of the amp concurrently.

$$\frac{U_{ACout}^{2}}{R_{load}} = P_{out}$$

Sequence G

Now we shall get rid of the heater induced hum.

Take out all small 6SN7GT tubes (V1, V2 and V4, V5). Be sure, both of the dummy loads are connected to the output posts and connect the DMM (in AC-mode) in parallel to the dummy load. Switch-on the amp and read the AC-voltage at the output. Now try to diminish the AC-hum at the output by adjusting pot R20 at the cathode of V3. Wait some minutes and try again. It will take some attempts to get the hum to a minimum. Afterwards repeat the **sequence** for the second channel.

Now insert the 6SN7GT tubes again and plug-in the shorted RCA-plugs at the inputs of the amp. Again try to diminish the hum at the output by turning/adjusting the multi-turn trim-pots R27 and R28. Start with R27, followed by R28. Here too some attempts will be necessary to find a minimum. Afterwards repeat the **sequence** for the second channel.

After all, the hum at the output should be less than 5mVrms and inaudible.

Sequence H

If you are pretty sure, that your amp now works as it should, switch-off the power, exchange the dummy loads for the speakers, take away the shorted plugs and play music.

Please remind that such a DHT-SEA will need app. 30 hrs. for breaking-in. Therefore you should judge its performance only after this period. At first it will sound a bit sharp, but after only 3 hours it will become softer and warmer in sound. Always keep an eye on your modded amp during break-in. Most failures in electronics take place in the early hours of service. You do not want to burn down your house due to a burning amp – right?

GOOD LUCK … !

If you have any further question, you can contact me via support@tubeclinic.com .