

Assembly guide Mugen Hybrid power amplifier

version: 10.07B

Disclaimer: please be aware that this guideline is just a guideline. If you build this amplifier project, it's up to you to get it working. If you don't have the experiences don't blame me. I can take no responsibility what so ever for you making it work and I can't go into too much detail to help you to get it to work, though I will try to answer any of your questions. And maybe most important, this project is developed and tested with care, so you should experience no problems in getting this amplifier to work. And please be aware of the high voltages, these can be very dangerous for your health and can be deadly. Please take some serious and careful precautions and think twice if you are not sure what should be done next and this of course before switching power.

Assembly guide:

1. First thing to do is to check for updates or any errors regarding the Mugen design. You might like to check out the Elektor website at <http://www.elektor.com/magazines/2007/october/mugen-a-hybrid-audio-amplifier.254273.lynkx?tab=1>
You might also check:
<http://www.wimdehaan.nl/hybrid/mugen/mugenelektor/index.html>
2. Next thing is to collect all the necessary components like resistors, capacitors, diodes, transistors and for example the enclosure.
For components availability you might like to check out <http://www.wimdehaan.nl/hybrid/mugen/partcompon/index.html> as well.
3. Before starting with the PCB assembly, do print the complete component list. Using this list you can mark which component is soldered onto the PCB yes or no.
Do notice that R11 should read 18K and not as mentioned in the original component list [48 ~~ohm~~].
4. Start with the PCBs assembly; start with the small component like resistors and for example diodes. Check resistors with a DVM for correct value before soldering them onto the PCB. Read carefully labels of transistors and diodes before soldering them. Check carefully capacitors for value, voltage and polarity before soldering. Last thing to mount is heatsink and driver/output transistors (refer to article).
5. the Mugen amplifier can be divided into five sections:
 - mains circuitry [mains socket, mains switch, fuses and mains transformers]
 - powersupply [PSU PCB]
 - tube section [amplifier main PCB]
 - powerstage section containing the power transistors [amplifier main PCB]
 - DC / delay circuitry [amplifier main PCB]
6. Amplifier can be build and tested conform bullet 5.
7. For assembly and testing at least one DVM (digital volt meter) is necessary, preferable is a number of two. A DVM of 15 Euro like the Velleman DVM33 can do the job.
Also preferable (read: a must) is a so-called Variac. Using this variac the mains voltage can easily be adjusted from 0V to 230V (or 0V to 110V if you are in the US). In this way any mistakes or faults can easily be noticed without destroying any components. Price indication for such device is about 50 euros. You might like to check out the Education section at <http://www.wimdehaan.nl/>
8. Accordingly start with assembly and connecting of the mains circuitry. Connect mains chassis, mains switch, fuses and the mains transformers.
Do check if circuitry is working correctly.
Be aware of high lethal voltages, check twice before using your fingers/hands to check for something. Using a variac the circuitry can be tested safely with no danger for destroying any component.
9. Connect the assembled powersupply PSU PCB to the mains circuitry. Before powering up, do check polarity and voltages of the capacitors. Again, using a variac the circuitry can be tested safely with no danger for destroying any component.

10. Connect amplifier main PCB to the powersupply boards, do check the PSU connections and the different ground connections. Do check if the correct tube is in the correct socket. Be sure the potentiometers of the output section are installed correctly and set according the Elektor article before-powering-up-the-very-first-time position/value.
11. Connect a DVM to measure the voltage across one of the emitter resistors (bias current) and one to the output for checking DC. If just one DVM is available first check the bias current and than the output. If you are sure everything is okay, you could power-up. Do check the original article for additional info on adjustments.
The use of a variac welcome, using a variac you will notice that the current source of the ECC83 only starts to work at a certain voltage. Using a variac the 6,3V heater is also turned on slowly, so best is to connect the 6,3V directly without interference of the variac. To give you an idea: if the variac is at a quarter at 55 VAC out, the amplifier runs at approx. +/-10 VDC with the heater at approx. 1,5 VAC.
12. Be aware of the delay of the DC/ delay circuitry which is controlling the output relay, for this reason a LS (loudspeaker) direct output terminal is available on the PCB.
13. Checking your amplifier a functiongenerator like the ELV SG1000 can be used, but also a CD player with variable output can do the job (do use a test CD with 1 kHz signal). Do connect a cheapo loudspeaker at first test run like a passive computer loudspeaker. Never connect you real speakers for a very first test run. An oscilloscope and a 5 ohm load are welcome for testing purposes.
14. Let the amplifier run a few hours with some test music and some low budget speakers, do check adjustments once more after this hours. After this the amp will be ready for the real work.

About this document

This document is prepared by Wim de Haan, the author of the Mugen Hybrid amplifier; do check <http://www.wimdehaan.nl/> for more info on the Mugen Hybrid amplifier.

Troubleshooting

- disconnect main amplifier PCB.
- check components for value and check for any defective components.
- check powersupply for correct voltages
- do connect high voltage, 6,3VAC, -38 VDC and ground only to the tube section of the main amplifier PCB, remove jumpers from coupling capacitors to transistor power section, do not connect +/- 38 VDC ⁽¹⁾.
- power-up and check voltages and for signals long-tail ECC83 and for same across cathode resistor of the ECC88 ⁽¹⁾.
- accordingly place removed jumpers and connect +/-38 VDC.
- measure at LS direct out terminal for correct output signal, doing so the DC / delay circuitry is not used ⁽¹⁾.
- do measure bias current by measuring the DC voltage across the emitter resistors, do check for DC at the output as well ⁽¹⁾.
- next the output should be measured, keeping in mind that you hear the relay click, output signal should be available on the loudspeaker terminal.

⁽¹⁾ do check bullet 9-14

For testing use the correct safety precautions and measuring devices, use a 5 ohm power resistor as load.

Never connect your expensive loudspeakers to the amplifier if amplifier is under test.

Further info available on request.