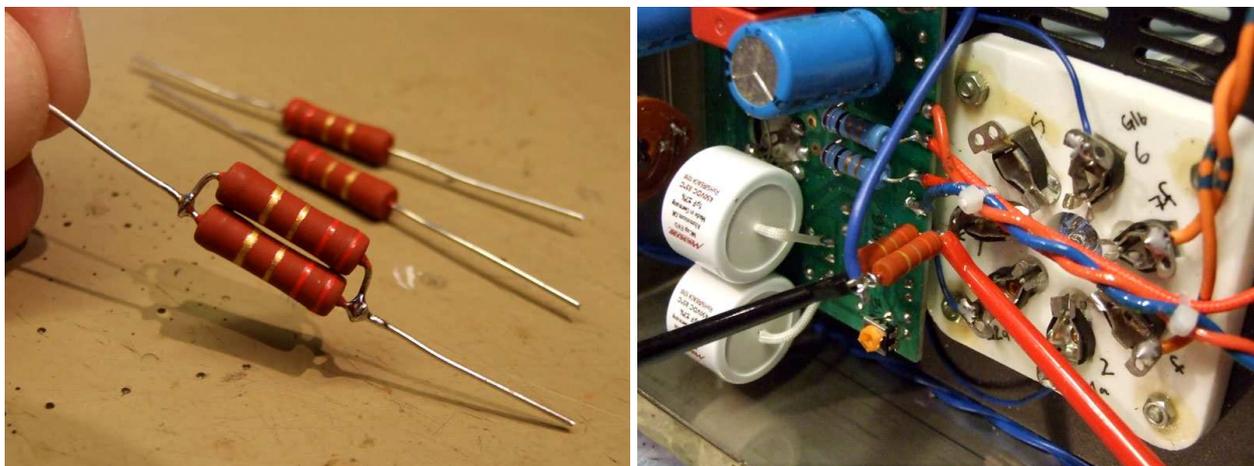


I simply put in a cathode resistor on each tube, this resistor is normally already in the circuit, but not in this amp. The resistor is harmless and there is no need to remove it after adjustment is done.

The value of the resistors does not matter, 1-10ohm is suitable, the resistor only added to get something to measure voltage drop over. When using 1,1Ω the voltage over the resistor should read 0,055V when current is 50mA = 25mA per section when the tube is in balance. ($I = U/R = 0,055/1,1 = 0,050 = 50\text{mA}$)

The pictures below shows the added cathode resistor making and placement on the pin4 on tube socket. The cathode current for the tube is calculated by measuring voltage drop over a known resistance using ohms law.



Making and placement of added cathode resistors

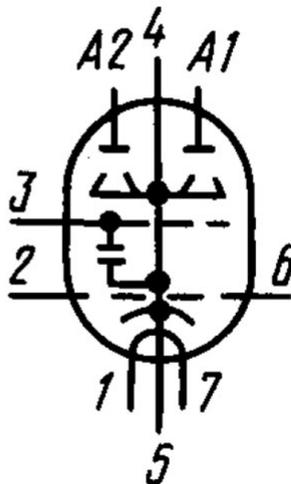
About the Gu-29 Double tetrode Beam tube.

The double tetrode FU/GU-29 is using one common cathode for the both tetrode sections - This is why you cant measure idle cathode current per section, the cathode current is for both sections, the 1,1Ω (2x 2,2Ω in parallel) resistor is added to be able to measure voltage drop, then its only to calculate cathode current, The resistor is going from pin4 (The big, index pin) directly to ground using the standard wires in the amp.



GU-29 pinout

ГЕНЕРАТОРНЫЙ ТЕТРОД ГУ-29



In original the pin4 on each tube goes to ground Also, note! The pin 4 and 5 is internally connected to each other, The thick index pin is pin4 (Beam grid) it's interconnected inside the tube to Pin 5 (Cathode).

Tube balance

The tube balance is measured from top anod (TP2) to top anod (TP3) on each section. It should read as close to zero(0) as possible.

The trick is to get the balance stable, i start with one tube, reducing current to minimum, adjusting balance, observing balance closely, increasing current, adjusting balance, increasing current, adjusting balance and so on, until i am satisfied. When this is done you need to monitor balance for at least an hour or two, as slow, slow change in balance might cause one of the sections to rush and you damage the tube with over heated 'redplated' anode. Not good.

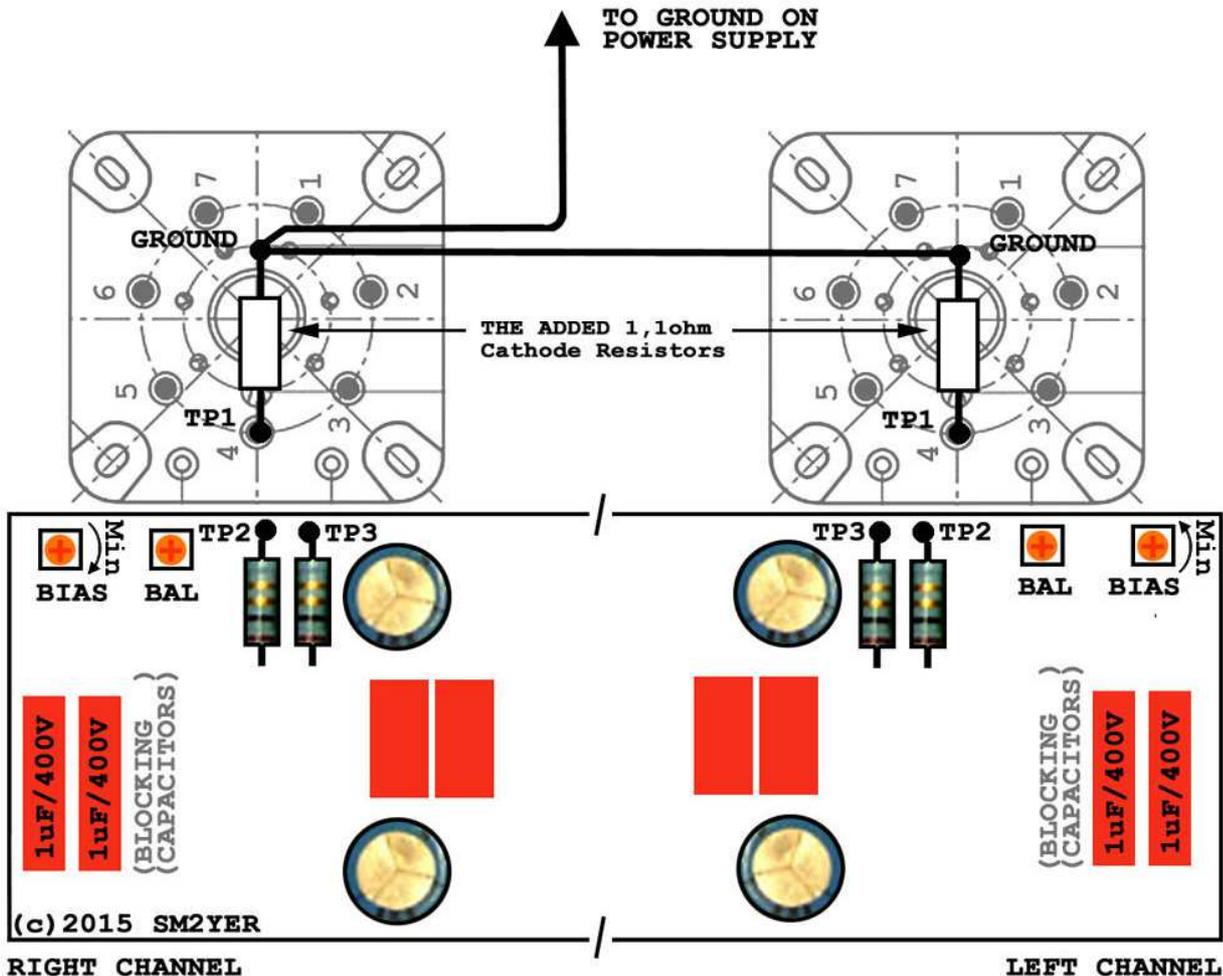
Measuring and Adjusting Balance and BIAS

For each tube (Channel) there is one BALANCE trim-pot and one BIAS trim-pot. There is also tree measurement points for each tube (Channel).

- TP1 on Cathode/Beam grid Pin 4/5 on tube socket
- TP2 Top Anod lead on first tetode section
- TP3 Top Anod lead on second tetode section

PINOUT på 'SEPTAR' sockel ΓY-29 & FU-29

Pin	Elektrod	Anm
1	Heater	Fillament 6,3V AC/DC
2	G1b	Grid 1 / Sektion 2 (-20V)
3	G2	G2 (Both sektionen) (+200V)
4	Beam Grid (Index)	Connented to Cathode (Ground)
5	Katod	Connected to Ground
6	G1a	Grid 1 / Sektion 1 (-20V)
7	Heater	Fillament 6,3V AC/DC
A1	Anod 1	Top anod sektion 1
A2	Anod 2	Top anod sektion 2



measurement points and trim pot's in the amlifier

Preparation

- A. Start the adjustment with one tube, **leave the other with the original tube in place****.
- B. Start with the power off, amplifier resting on the side, bottom cover removed.
- C. Hook up one volt meter over the added resistor TP1=Pin4 and Ground.
- D. Hook up the other volt meter from anode resistor TP2 to the other anode resistor TP3.
- E. When i do the adjustment i start by reducing BIAS current to minimum = BIAS pot to min position.

Adjusting

1. Power on and observe tube balance, adjust balance as the tube heats up.
2. Increase BIAS Current a bit, notice the tube balance, adjust balance if needed.
3. Repeat p.2. until you get the BIAS current correct (50mA) and the tube is in balance (0V).
4. Leave the amplifier powered on for at least one hour, observe tube balance, adjust if needed, the balance will 'wobble' a bit +/- around zero, this is normal, you need to observe and adjust balance so the tube is steady around Zero, if not you could notice a slow but steady decrease/increase of voltage different causing one tube section to rush uncontrolled whit red anod plate, this in not good.

****Hint**

Also, when starting with the output tubes, do not change the tubes at first, start measuring with original tubes still in place. try to adjust, observing changes in voltage drop / difference on the original tubes, because you know the tubes are working, and that they probably are adjusted correct from factory. With the Russian NOS tubes, start by replacing only one tube at the time, you can't adjust both tubes at the same time.

Finaly

The Fu-29 is not the most easy tube to BIAS and Balance, as this is your first tube amplifier i suggest you start with replacing the input/drive tubes and the four blocking capacitors