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Subject: Identical gain & tonality in double-triode tubes (ECC82)

Posted by [kasperbergholt](#) on Mon, 13 Dec 2021 16:52:23 GMT

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Dear tablers,

Inspired by the excellent feedback (e.g. on the E80 CC tube having quite different specs from the ECC82) the I got in this thread:

<https://audioroundtable.com/forum/index.php?t=msg&th=23320&goto=94872&>

some new questions have shown up in regards to gain levels for a single tube preamplifier like mine.

Which parameters determine the level og gain?

Some measurements are extremely detailed, e.g. this one from an eBay listing:

Sollwert IA [mA] fx 10,5 og 10,5  
Messwert IA [mA] fx 10,012 og 9,945  
= % vom Sollwer 95 og 95%  
S (mA/V] 1,92 og 19,96  
bei Deltage UG1 0,6 og 0m6  
D Anode [%] 6 og 6,1  
Messwer IA [mA] 7,2 og 7,13  
bei UA [V] 225,08 og 225,08

Ri [KOhm] 9,1 og 9

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A different listing for a tube in the same price range is a lot more sparse:

ECC82 TELEFUNKEN ( 12AU7 E82CC CV400 ) # <> # NOS  
gemessen auf RPM370  
12 / 12 mA 100 % = 10,5 mA

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Most list the mA values, few the Anode value.

In addition, is there a formula for calculating if the difference between values will be noticable e.g. in a 1 dB's difference in volume measured from 1 meter from the loudspeaker?

And, lastly, how about differences in tonality / frequency response. Are such inherent in the gains

measurement (or other parameters)?

Thanks again,

Kasper

## File Attachments

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1) [ecc82-tube-measurement.jpg](#), downloaded 174 times

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Subject: Re: Identical gain & tonality in double-triode tubes (ECC82)

Posted by [positron](#) on Tue, 14 Dec 2021 07:08:20 GMT

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kasperbergholt wrote on Mon, 13 December 2021 10:52Dear tablers,

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Thanks again,

Kasper

Hi Kasper,

There are a couple of ways to check for the gain of a stage.

One is:  $A_v = -\mu \times R_L / r_p + R_L$

Where  $A_v$  is the gain

$\mu$  is the mu of the tube.

$R_L$  is the plate resistor

$r_p$  is the plate resistance of the tube.

Another equation is:  $A_v = -G_m \times r_p \times R_L / r_p + R_L$

$G_m$  is the transconductance figure.

$\mu$ , Transconductance ( $G_m$  or  $ma/v$ ), Plate Resistance ( $r_p$ ), and even the plate resistance ( $R_L$ ) varies some.

Altering the  $r_p$ ,  $R_L$ ,  $A_v$  will affect the high frequency response. The extent will depend upon said values resistances, load resistance, and capacitances involved.

The cathode resistor ( $R_k$ ) will provide negative current feedback, if not bypassed, which also affects the gain and frequency response ( $fr$ ).

Hope this helps, cheers.

pos

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Subject: Re: Identical gain & tonality in double-triode tubes (ECC82)

Posted by [kasperbergholt](#) on Tue, 14 Dec 2021 17:19:37 GMT

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When you buy tubes, which parameters do you look for or ask for? And what would be considered an acceptable difference?

I see a lot of eBay listings mentioning 'balanced', 'matched' or 'measures strong', and some mentioning mA values and a few mentioning a lot of measurements like the one I mentioned previously in this thread.

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Subject: Re: Identical gain & tonality in double-triode tubes (ECC82)

Posted by [positron](#) on Tue, 14 Dec 2021 23:44:14 GMT

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kasperbergholt wrote on Tue, 14 December 2021 11:19positron wrote on Tue, 14 December 2021 01:08kasperbergholt wrote on Mon, 13 December 2021 10:52Dear tablers,

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Thanks again,

Kasper

I check for  $r_p$ ,  $G_m$ ,  $thd$ , and purchasing/listening in signal tubes.

$R_p$  and  $R_L$  are important for frequency response ( $fr$ ). If the  $r_p$  becomes too high, say above 5k ohms, then  $R_L$  has to be large in order to obtain necessary gain. Combine the high resistances with the following stages input Miller capacitance, and  $fr$  is significantly degraded.

Some use a cathode follower or similar to lower the output impedance ( $Z$ ). However, the additional stage degrades the music. Minimal without being too simple is optimum. If one can get by with one stage, that is preferable, unless some long high capacitance ics are necessary.

Solid state almost always has to include music robbing emitter/source followers for low impedance to the next stage/output stage.

I wanted low  $thd$  for sure as that is perceptible, especially when combined with other stages/tubes with their distortions. (Same for ss devices as well.)

All tubes produce some 2nd and 3rd HD plus some higher orders, which means problems.

One incredible tube for low distortion is the JJ E88cc, 12xx7 types. All have incredibly low THD. For instance, the E88cc has  $\sim 1/9$ th the distortion of any other tube numbers, including the 6sn7s and exotic number types.

However, these tubes are incredibly difficult to design around or simply use due to their transparency. Many will view them average or just good, mainly because they expose the associated poor designs and poor parts used.

For instance, with just two stages/tubes/ss devices, 2nd and 2nd combine to create 4th order, 2nd and 3rd create 6th order, and 3rd and 3rd create 9th order harmonics. 3rd and 4th order creates 12th order and 3rd and 5th creates 15th order. Although low in value, the higher the harmonic, the much easier to perceive.

Attached is a graph of a typical vacuum tube, KT88, 300b etc following the  $3/2$  law. Notice the 5th and 7th orders. To make this seem smaller, lower the OPT primary to 2k to increase the 2nd order to astronomical levels.

"Strong" means used tube that measure close to new or new. When ordering tubes, I virtually always order tubes matched, like 2 or 4 tubes matched for similar characteristics. At the manufacturer, tubes can vary by 25% or so. Tubes with two internal triodes, I matched the sections as well. I also order low noise as well for signal tubes.

cheers

pos



## File Attachments

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- 1) [3 to 2 Tube Distortion 600.pdf](#), downloaded 186 times
  - 2) [300b curves 1.jpg](#), downloaded 378 times
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Posted by [kasperbergholt](#) on Fri, 17 Dec 2021 11:20:16 GMT

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Thank you! I'll try to find a TT ECC82 - are they the ones made by TAD?

Which value is a tube's noise levels measured?

I've bought a new IE Yugoslavia to see if there's variation in comparison to the first one.

I've also placed a bid on NOS Siemens triple Mica ribbed with stated measurements of 106% / 107%, which was the closest matching tube I could find on eBay (from a seller with excellent reviews / ratings).

Thanks again! :)

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Subject: Re: Identical gain & tonality in double-triode tubes (ECC82)

Posted by [positron](#) on Mon, 20 Dec 2021 04:53:54 GMT

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Thanks again! :)

No idea concerning TAD.

Generally speaking, the noise level is determined by the rp which is associated with Gm and Mu.

Cathode temperature is a factor.

Associated with the tube, the quality and voltages across the resistors.

Good luck with your endeavor.

pos