

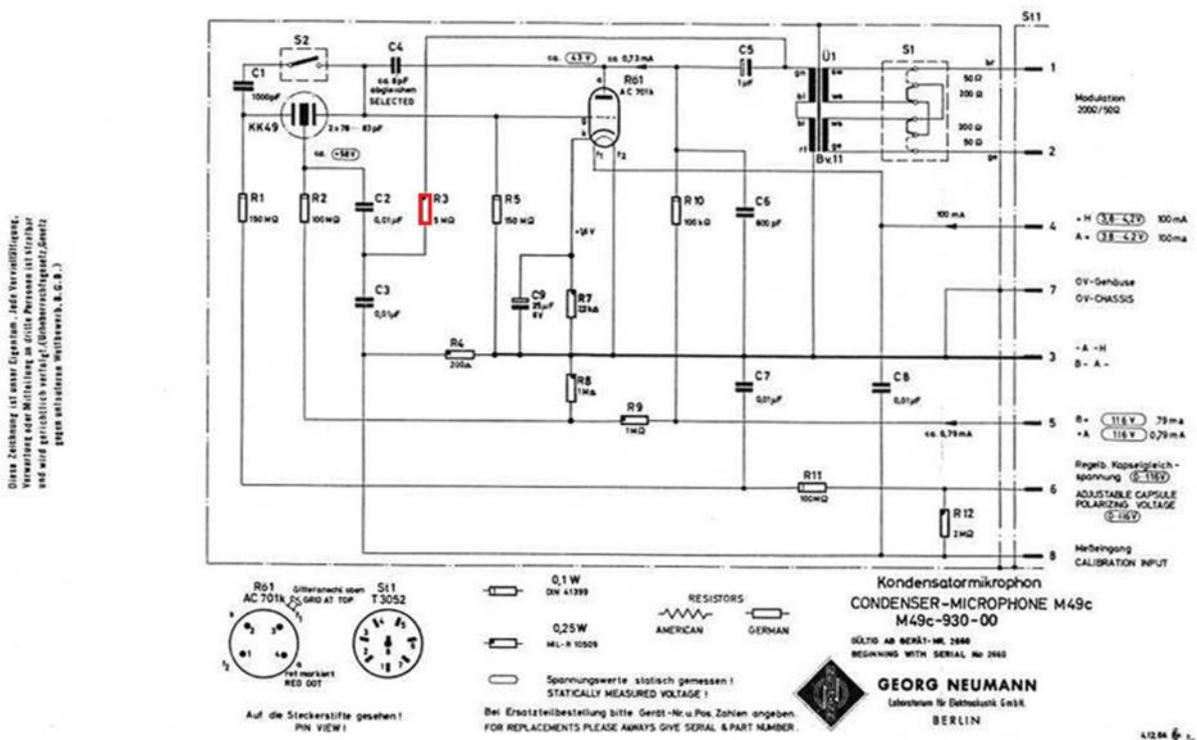
# Service sheet AC701.1

**Phaedrus Audio AC701 electronic tube in Neumann M49(c) microphone initially caused instability.**

It has been noticed that, in one case, the substitution of an old AC701 tube with a new Phaedrus Audio AC701 in an M49 microphone (with the cathode-bias "c" version circuit), caused the onset of LF instability (around 3Hz).

Although this type of "motorboating" type instability is often power-supply related, modification by the customer to add decoupling to the HT and bias lines did not cure the effect.

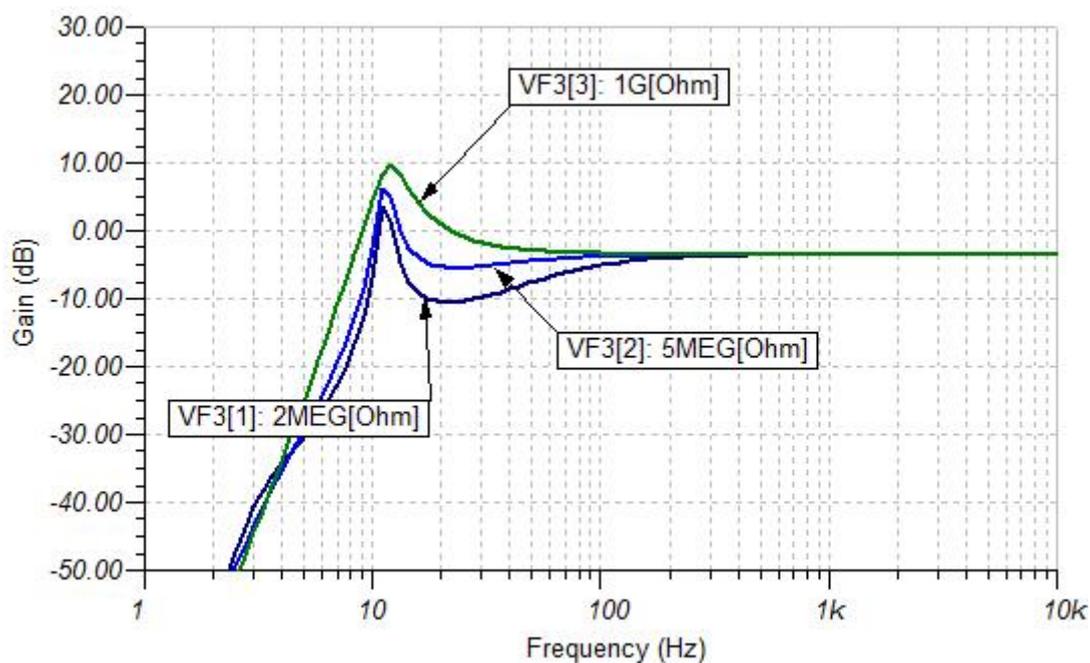
The problem was eventually traced to the positive feedback at LF which is incorporated in this circuitry via resistor R3 (as marked up in the diagram below). Output voltage from the amplifier is transported by this resistor to the low pass filter R3/C3 [which has a breakpoint of  $(2 \times \pi \times 5M \times 0.1\mu F)^{-1} = 3Hz$ ] and is introduced in inverted phase via the backplate of the capsule via C2.



The Phaedrus Audio AC701 has rather better LF characteristics than many Telefunken AC701s (due to the absence of initial-velocity current which is

inevitable in a tube). This extra gain at LF is enough that when the phase-shift due to the LPF R3/C3 reaches 45 degrees, instability results.

The cure is to remove R3 (or, at least, un-hook it). The existence of the instability indicates that the LF response of the microphone is already excellent with the Phaedrus Audio AC701 on its own and this palliative positive-feedback is unnecessary to prop-up LF response with the new tube fitted. In fact, measurements here in the workshop have shown the positive feedback causes the dip in the frequency response prior to the resonance frequency and the removal of R3 guarantees a maximally flat response (see below).



It's worth pointing out that other M49s have not demonstrated this problem. Given that the positive feedback is taken off the junction of C5 and the output-transformer, it is quite possible that the age/version/ variation of the output-transformer has a significant bearing on whether or not the Phaedrus Audio AC701 provokes instability when substituting an original Telefunken tube since the voltage at this point demonstrates very significant phase-shift at LF.

RAB 29th May 2017