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Subject: negative feedback in Cathode follower amplifier output stages

Posted by [Manualblock](#) on Sun, 19 Sep 2004 00:25:09 GMT

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Must beg the indulgence of our resident electronics guru's. In my post earlier concerning feedback in cathode follower output stages I claimed out of ignorance that the by-pass capacitor in parallel with the cathode resistor caused a feedback loop. Please excuse my ignorance but it seems that the cap actually removes the feedback applied through the cathode by the resistor. Referring to chap. 5.02 of the Tube Audio Design book, it states, "The cathode follower applies 100% negative voltage feedback by virtue of its configuration. The voltage controlling the tube is that between the grid and the cathode. The input voltage is applied between the grid and ground. The net voltage controlling the tube is therefore the grid voltage minus the cathode voltage. This is how you add the output voltage to the input voltage without a separate feedback loop. Eg is the input,  $i_p R_k$  is the output. The latter is subtracted from the former because the feedback is negative." He goes on to state, "If you desire no feedback, then you can bypass  $R_k$  with a capacitor, effectively taking it out of the circuit." Goes to show how a little knowledge is a dangerous thing, so I guess I am a dangerous thing. Thanks, J.R.

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Subject: Re: negative feedback in Cathode follower amplifier output stages

Posted by [Roy G Biv](#) on Sun, 19 Sep 2004 06:26:26 GMT

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Yep, you're right. The cathode resistor sets DC levels but also provides negative feedback of the AC signal. A bypass capacitor removes negative feedback while retaining the DC stability offered by the cathode resistor. The same thing goes for the emitter resistor in a transistor amp. Unbypassed (or partially bypassed) cathode/emitter resistors provide local feedback in a single gain stage.

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Subject: Roll off those lows, hold the feedback-- it is hurting my ears!

Posted by [martinleewin](#) on Thu, 23 Sep 2004 01:15:11 GMT

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I don't know what circuit you were referring to, but I do know the purpose of cathode bypass capacitors. THEY CONTROL (limit) THE LOW END FREQUENCY RESPONSE! If you had some negative feedback signal applied at that point, it would also be rolled off. That effect may be desirable and intentional, but is not why the cap is there. A capacitor across the cathode resistor bypasses mid to high frequency signals--effectively making a short to ground for stronger bias and amplification. Low frequencies cannot pass through the bypass cap, must flow through the resistor, and are amplified less. Hence, low frequency rolloff. The book passages you refer to are describing why cathode follower circuits are inherently lower distortion than plate coupled circuits.

The cathode resistor and/or the plate resistor determine the DC grid-to-cathode voltage and thus the gain and the quiescent (idle) current. A cathode follower has an electrical feedback effect within that stage-- but totally confusing when lay people only hear of interstage feedback. Cathode followers can not be used for all circuits and tube types, so lets not start a purist movement on that horse, please. Negative feedback is often injected back to a preceeding stage tube cathode because that is the easiest way to accomplish "global" feedback for reduced distortion. Most amps feed back from the output transformer secondary to the phase splitter cathode. This keeps distortion down in those two tube stages. Quick and dirty and it works (unless you are a minimalist/SE purist, yata yata yata), with some loss of damping factor and transient response. Any primary amplification frequency shaping at that point takes design precedence over feedback signal rolloff. You could compensate by shaping the feedback signal before it gets there. Guitar amp techs play around with cathode bypass cap values to tweak the sound (fatness, drive, growl) in the 80-160Hz range since that is the lowest octave played. Rolloff corner frequency is like 60-100Hz in this scenario. Harp players want even less low end since their range starts an octave higher. Audio amps usually have their frequency shaping set as low as it can be and still stable. But with the electrolytic caps one can find +80/-20% new values that make audible differences on low end response. Older/cheaper caps could make an even bigger difference. Just clearing the air, Martin W.

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