An Archival Phono Preamplifier - the power supply

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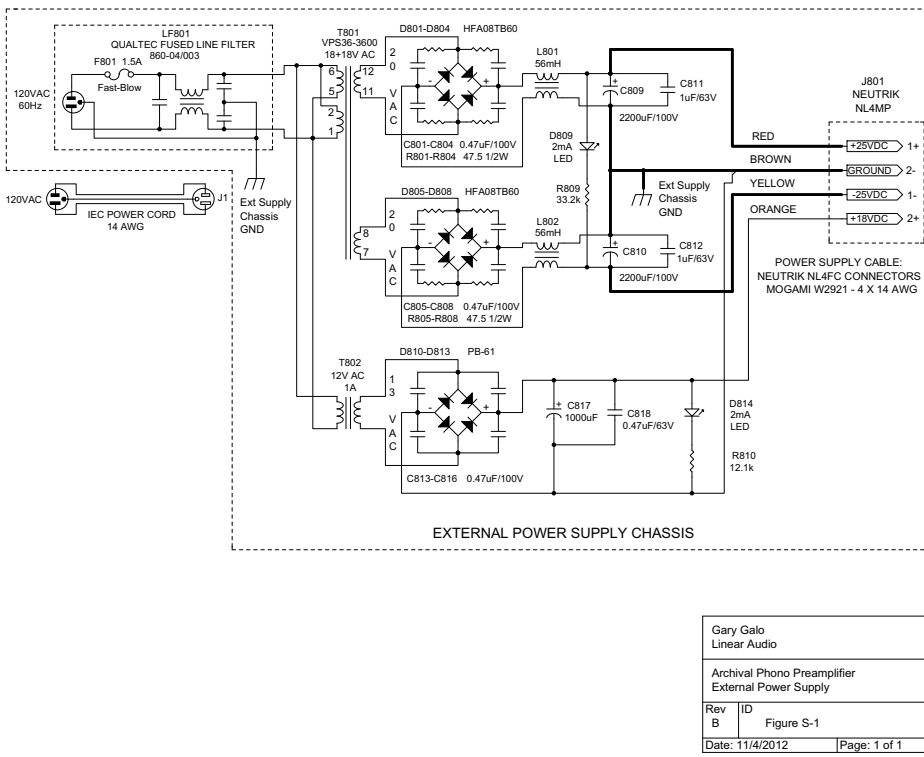
Editor's note: this online article is an addendum to Gary's archival preamp design article in Linear Audio Volume 5

Transformers and connectors

I am a firm believer in external power transformers and rectifiers, particularly for high-gain circuits such as phono preamps. The external supply for the Archival Phono Preamp is shown in **Figure S-1** and Photo S-1, and is very similar to the one I described in a follow-up to my Adcom GFP-565 modification series [1].



Gary Galo Linear Audio	
Archival Phono Preamplifier External Power Supply	
Rev B	ID Figure S-1
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Figure S-1: The external power supply houses a 130VA dual-bobbin transformer for the main power supply and a toroidal transformer for the relay supply, plus all rectifiers and raw filtering.

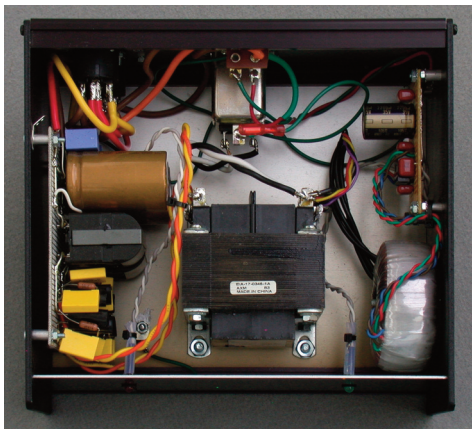

Photo S-1: Inside view of the external power supply. The main 130VA dual bobbin transformer is in the center, with rectifiers and raw filter capacitors on the left. The toroidal relay power transformer and rectifier is on the right.

It should be obvious that no wall-wart can meet most of the requirements for this supply. Good preamplifier dynamics begin with a high-current power transformer. I used a 130VA dual-bobbin transformer with separate secondary windings, which allows separate full-wave bridge rectifiers for the positive and negative rails. In my view, dual-bobbin transformers are preferable to toroidal types since their bandwidth is considerably more limited, which helps attenuate noise on the AC power line. Rick Miller supplied measurements illustrating this for an article I authored back in 1995 [2]. An Avel-Lindberg D-3022 toroidal transformer he measured was virtually flat to 200kHz, whereas a Magnetek FD7-36 dual-bobbin type was 34dB down at this frequency (such characteristics are not unique to these manufacturers, but are typical of these transformer types, regardless of brand). The disadvantage of dual-bobbin transformers is that they radiate a greater hum field than toroidals, making an external supply mandatory. To ensure the lowest noise levels on the raw DC rails, the rectifiers are high-speed, soft-recovery HexFred types with R/C snubbers, and common-mode chokes are placed between bridges and the raw filter capacitors. The relay power supply has its own transformer, rectifiers and raw filtering, also housed in the external chassis.

The Neutrik powerCON connectors would be an obvious choice for the interconnect between the external supply and the preamp chassis. Unfortunately the powerCONs have only three conductors – I needed four because of the separate relay supply. Neutrik also manufactures a connector for loudspeakers called the speakON, made with four conductors, which seemed a logical solution to my problem. However, Neutrik notes the following on their web site: "speakON is NOT to be used as an AC mains or power supply connector!" This seems very strange, since the construction, voltage and current ratings of the speakONs are similar to the powerCONs, The speakONs are rated at 30A RMS continuous, 250V, with a peak dielectric strength of 4kV DC. Puzzled about their warning about power supply usage, I contacted Neutrik America to inquire about using the speakON connectors for supply connections, and received the following response from Fred Morgenstern, Product Manager: "Power connectors require an extensive, lengthy, and costly recognition process by the UL in the United States and similar safety rating agencies in other countries. Neutrik has never submitted speakON for such recognition for power applications. Thus, it is not recognized by these agencies for use in power applications. A further consequence is that products that use speakON for their power connections cannot be UL approved." So, it really boils down to the fact the Neutrik did not

wish to go through the process of obtaining approval for the speakONs for power supply connections, which is understandable. Given the voltage and current ratings of the speakONs, and the fact the UL approval for my hand-built prototype was not an issue, I had no reservations about using them in this low-voltage, low-current application (I emphatically *do not* recommend, under any circumstances, using the speakON as an AC mains connector!). For my power supply interconnect, I use the Neutrik speakON connectors with Mogami W2921, a 4-conductor, 14 AWG cable.

The external supply has no power switch. I control power with an AC power line conditioner, but an AC switch could certainly be added to the supply. I do not recommend leaving this preamp, or any other piece of audio equipment, powered all the time.

Regulators

I am a firm believer in regulated power supplies in high-performance audio equipment. For the prototype Archival Preamplifier, I chose three-terminal, adjustable regulators with low-ESR capacitors, based on a supply I described in *Audio Amateur* back in 1990 [3]. The regulators are shown in **Figure S-2** and **Photo S-2**. I set the rail voltages at ±16VDC, a little over 10% below the absolute maximum ratings of most of the devices used in the preamp, to ensure long component life.

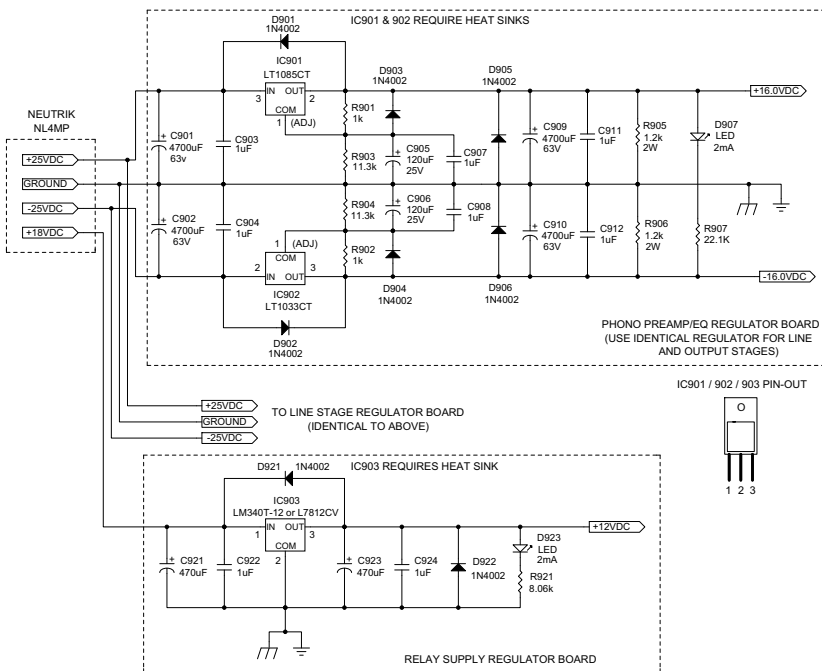

Figure S-2: The main supply regulators are built around Linear Technology LT1085CT and LT1033CT 3A, 3-terminal adjustable regulators. Separate regulators are used for the phono preamp/equalizer, and the line stage and output line amplifier. The relay supply has its own regulator based on an LM340T-12.

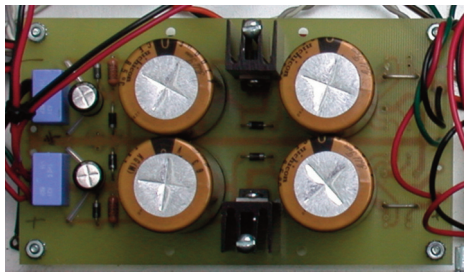

Photo S-2: One of two main power supply regulators based on LT1085CT and LT1033CT 3-terminal adjustable IC regulators.

For the best possible performance, Walt Jung's *Improved Positive/Negative Regulators* still set the standard for preamplifier supply regulation [4]. I used separate regulators for the phono preamp/equalizer and the line stage and line amplifier.

The relay supply should have its own regulator. A fixed LM340T-12 or 7812A type will be fine. If the relay supply is left unregulated, sawtooth ripple will appear on all of the relay supply lines, with both the ripple and DC level changing with loading, as relays are switched on and off. To keep hum levels as low as possible, the only AC that should appear on the audio boards is the audio itself – all supply rails should be ripple-free. The audio boards also have separate relay ground buses that connect to the main system ground only at the star, near the raw DC supply input.

References

1. Galo, Gary. "GFP-565 Preamp Follow-Up Mod" in *audioXpress*, Dec. 2004, pp. 26-33.

2. Galo, Gary. "Regulators for High-Performance Audio," Part 4 in *Audio Amateur*, 4/1995, pp. 34-43. Downloadable at: http://waltsblog.waltjung.org/?page_id=533 , along with the remaining parts by Walt Jung and Jan Didden.

3. Galo, Gary. "Preamp Power Supply" in *Audio Amateur*, Issue 4/90, pp. 47-48.

4. Jung, Walt. "Improved Positive/Negative Regulators" in *Audio Electronics*, Issue 4, 2000, pp. 8-19. Downloadable at: http://waltsblog.waltjung.org/?page_id=533