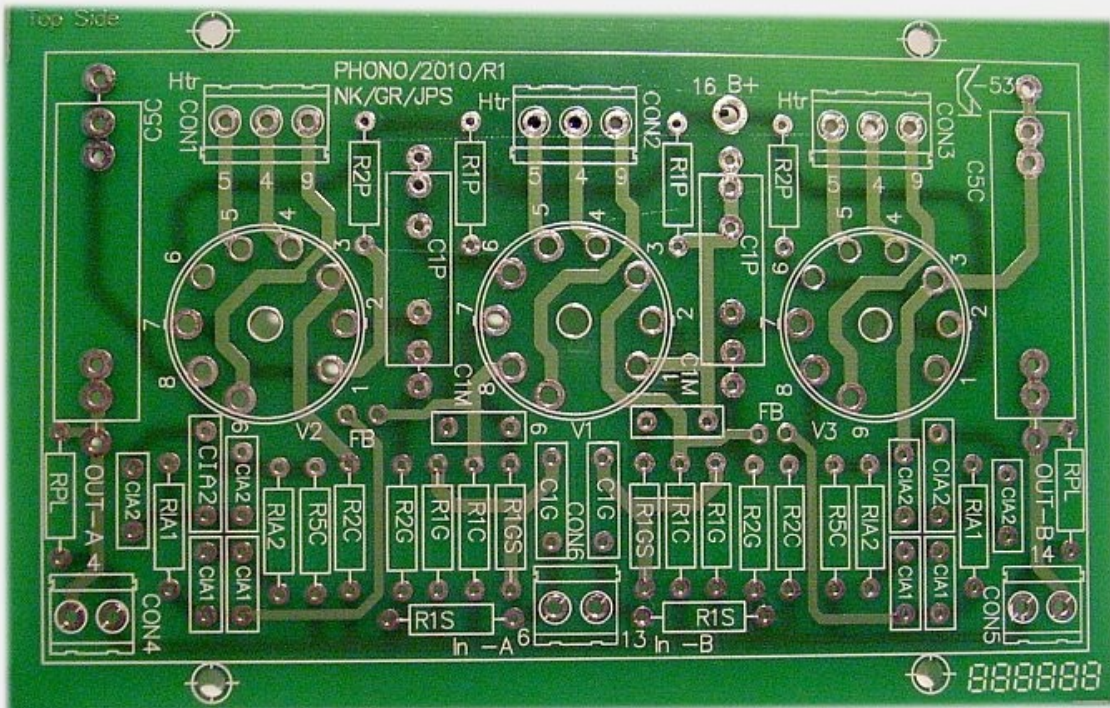


# PAS Purist Phono Stage

Designed by Norman Koren  
(aka PAS-K Phono)  
for the  
Dynaco® PAS2, PAS3, PAS3X

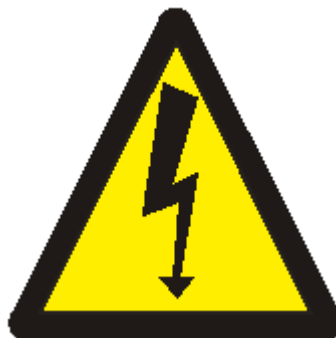


*Classic Valve Design*



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This product is designed for and use around **LETHAL VOLTAGES**. We assume the user has a reasonably competent grasp of line operated electronics at the time of sale.



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## INTRO

The Dynaco PAS series of pre-amplifiers has been one of the most successful and popular pre-amplifiers in history. They are reliable, hold their resale value and are incredibly popular “blank slates” to modify.

The PAS-K phono board is an upgrade for the original PAS series of pre amplifiers designed by Norman Koren.

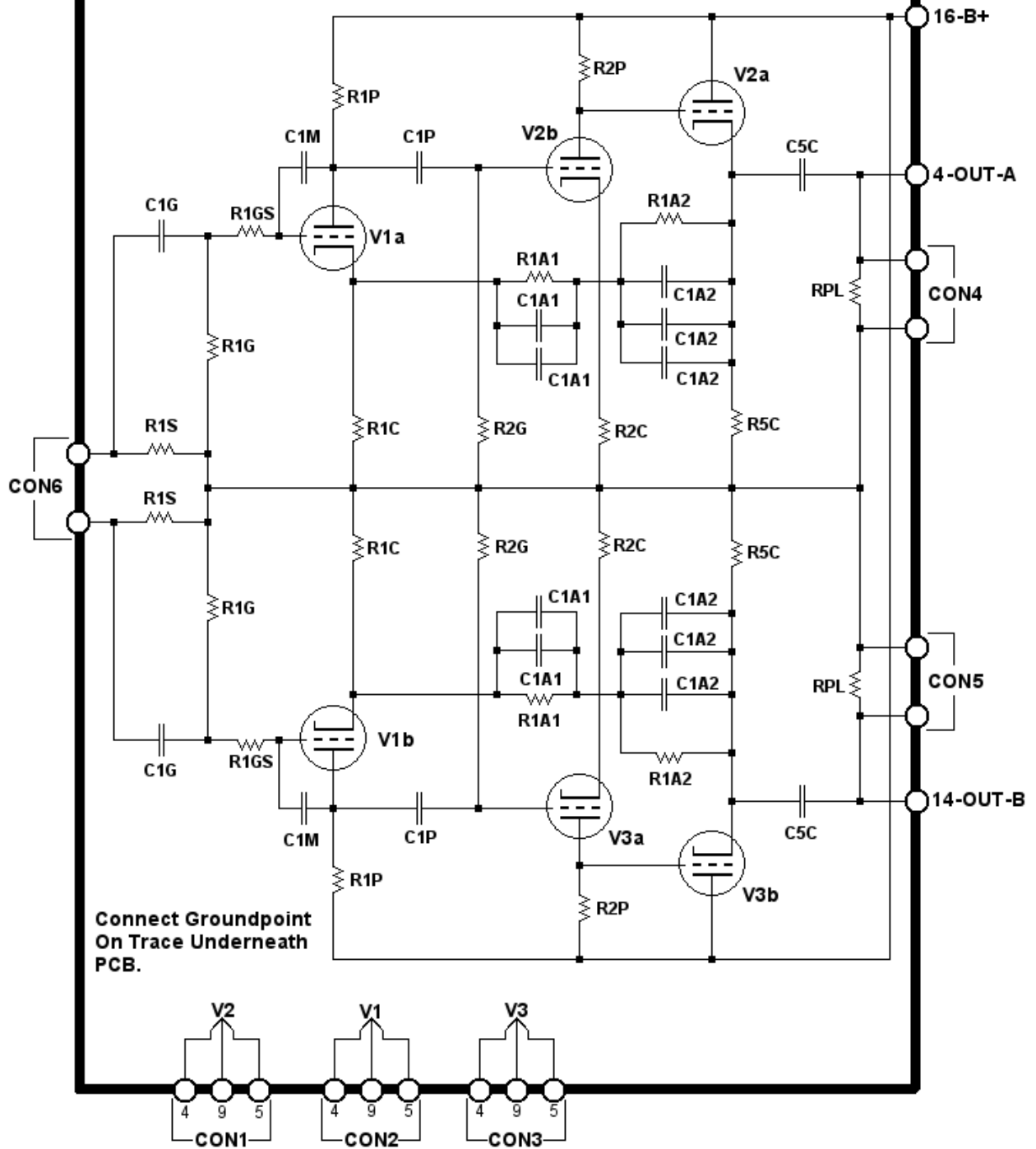
Due to the fact this board uses three instead of two tubes, it is also highly recommended that if you use your 12X4 rectifier, that you install a secondary (12.6V, 500mA - Hammond 166G12) transformer to power its heater and the pilot lamp, if you do not convert to a LED power indicator. If you convert to an LED one (order CK-57), the recommended auxiliary transformer is 12.6V @ 300mA (Hammond 166F12 or 166F12C/D is fine).

The 166F12 transformer can be mounted across the hole left by the can capacitor if you use our PAS Regulator PCB (order CK-54), or one of the many capacitor boards available on the internet. If you wish to keep the stock can capacitor, mount it on the back near the existing PA-211 power transformer (but do not block the vent holes). The 166G12 must be mounted externally (unless you're good at making fancy brackets).

The old selenium rectifier and tubular capacitor heater power supply can NOT handle the extra tubes of these board. You will need to at least upgrade the rectifiers to modern silicon rectifiers for that. The 3A rated 1N540x series (like 1N5408) are commonly available and lend themselves to that duty well (the 1A, 1N400x series (like 1N4007) can't handle the cold-heater surge of a 3+3 arrangement and would soon fail, perhaps damaging the PA-211 power transformer).

We will discuss more on heater arrangements later on in this manual, as well as some options for powering an odd-number of tube heaters.

(CK-53)



## Parts List

(numbering follows the original Koren schematic)  
(quantities for resistors and capacitors are for one channel only)

### **Resistors:**

**R1S:** 47K (cartridge load - use quality resistor)

**R1G, R2G:** 1Meg, ½W

**R1GS:** 10K, ½W

**R1C:** 1K, ½W

**R1P:** 150K, ½W

**R2C:** 750 ohms, ½W

**R2P, R5C:** 120K, ½W

**R1A1:** 86.6K, 1%

**R1A2:** 2.2Meg, 1% (2.21Meg is fine. It's the closest 1% value)

**RPL:** (volume control of PAS. If used as a separate circuit, use 100K, ½W)

### **Capacitors:**

**C1G, C1P:** 100n, 400V film

**C1M:** 39pF, 500V silver mica

**C1A1:** Parallel 820pF and 56pF, 500V silver mica

**C1A2:** Parallel 2200pF, 470pF and 180pF, 500V silver mica

**C5C:** 0.47uF, 400V polypropylene film

(capacitors with higher voltage ratings here are OK. Polystyrene for Silver Mica for C1A1 and C1A2 are OK)

### **Misc:**

**CON1, 2, 3:** Terminal blocks, 5.08mm, 3 position PCB.

**CON4, 5, 6:** Terminal blocks, 5.08mm, 2 position PCB.

(can be same as above [2 pos.] unless you are powering with 6.3V from another supply)

### **Sockets**

**Heater Balancing Resistor:** 68 ohm, 3W resistor if your PAS has an odd-number of signal tubes (like 2 on the phono board, 3 on this one = 5).

Installation/use described in "Heater Wiring".

## Assembly

Assembly is straight forward, though there is a couple items of note to make your life easier:

- 1) If you are powering the unit from the standard PAS doubler, you can use a 2 position terminal block for CON1, 2 and 3 by placing them on positions "4" and "5", ignoring "9" completely.
- 2) A large physical size of Cout can hamper installation. If you are using large capacitors for Cout, install them after you have mounted the line board on your PAS chassis.

## Heater Wiring

The Dynaco PAS uses a voltage doubler circuit to turn the 12V heater winding of the PA-211 into 24V. Dynaco then runs the heaters of the 12AX7's on each board in series and powers them with higher voltage and lower current.

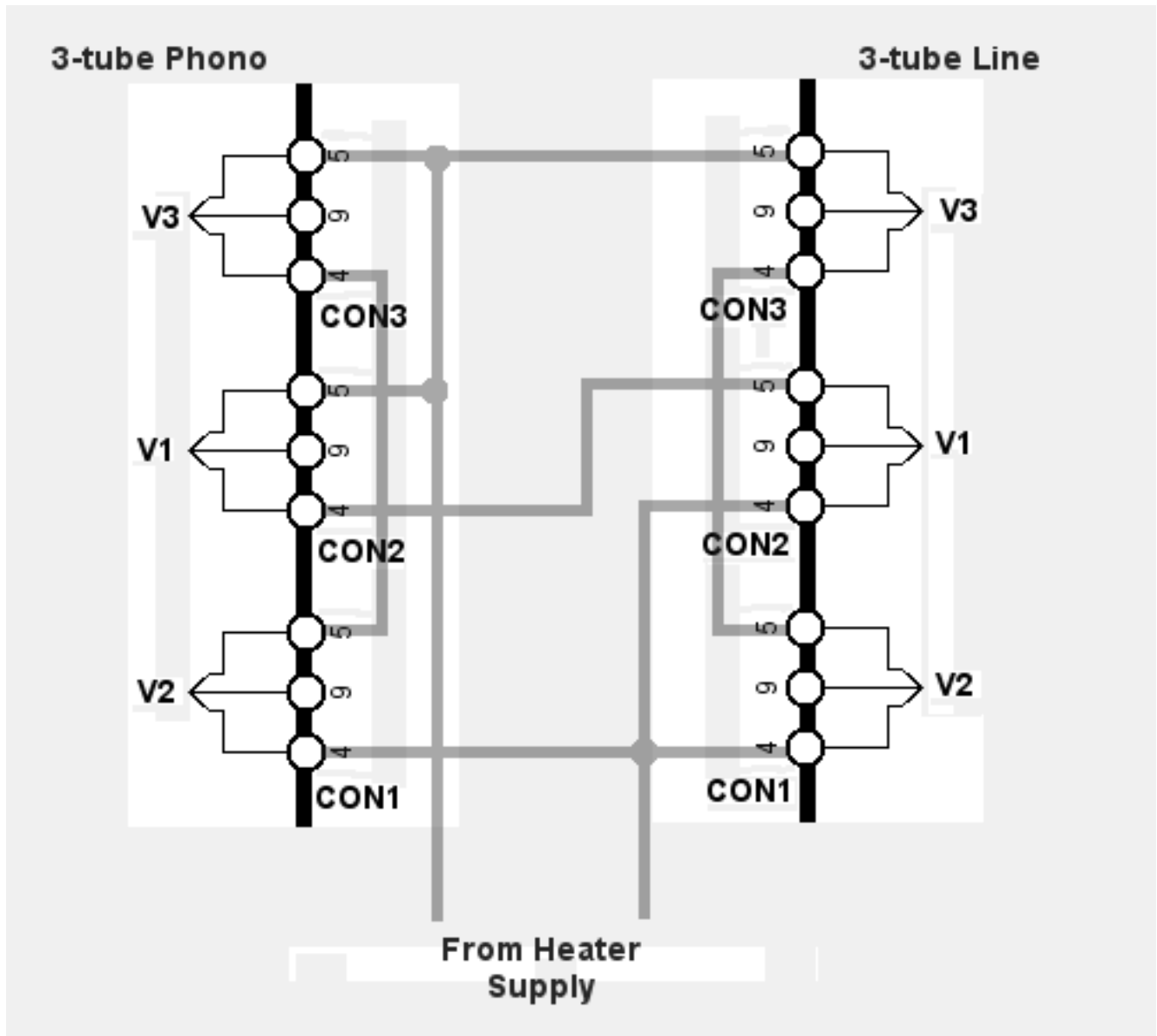
The reason for this is simple – the PAS has limited space and the PA-211 power transformer had to fit in. To have made the 12V winding for the current required by all the tube heaters, would have required a core larger than would have fit in the PAS.

Since the 12AX7 draws 150mA from 12V, putting two in series will also draw only 150mA, but require 24V. It is far easier to wind a small power transformer for higher voltage than it is for higher current.

This works well for an even number of tubes, but what about an odd number? We need to "simulate" another tube heater with a resistor. That's where the 68 ohm, 3W heater balancing resistor comes in handy.

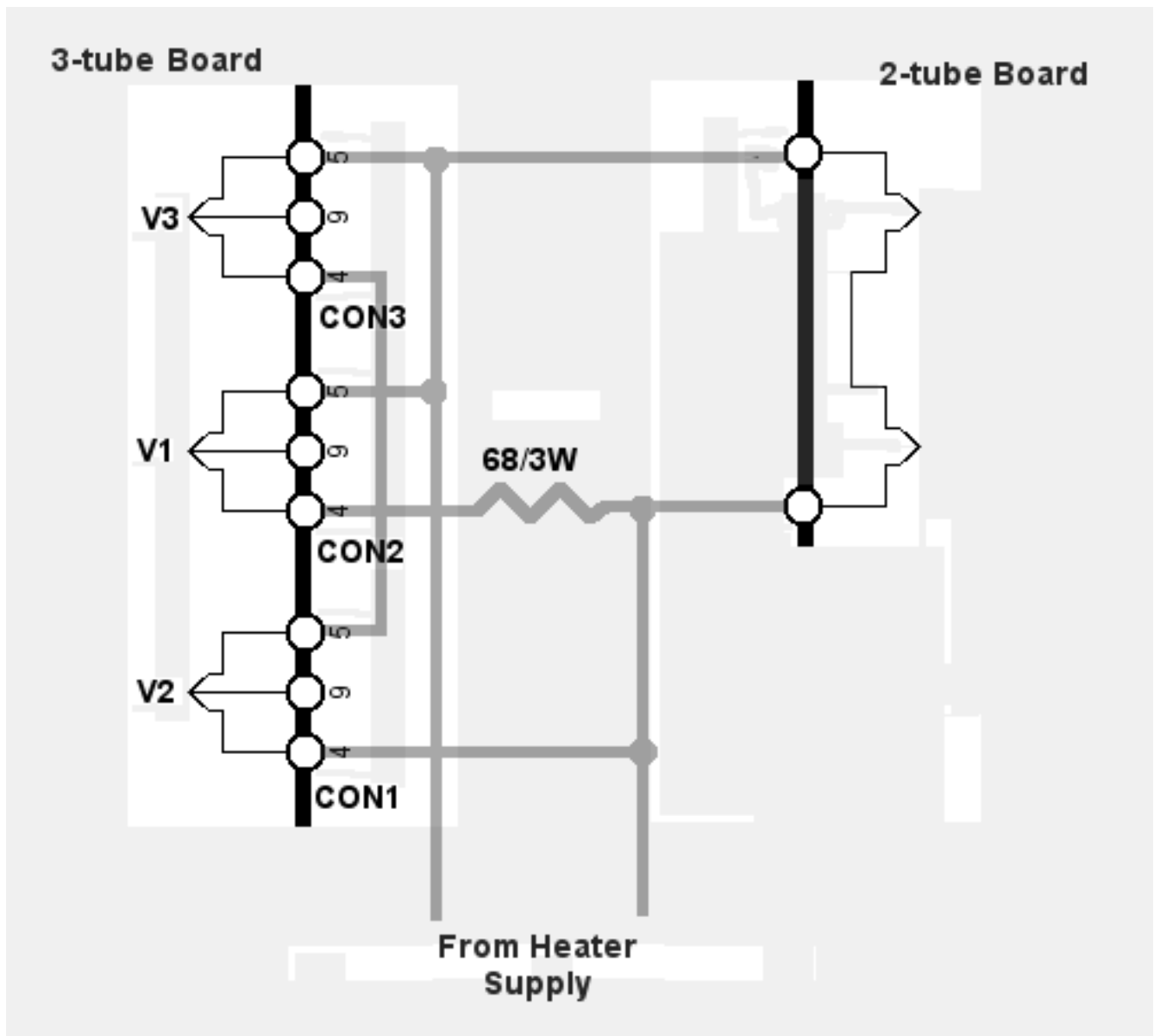
If you are using the Koren or other 3<sup>rd</sup> party phono board, the even number of signal tubes is maintained. But if you are using a two-tube linestage board, you will need the balancing resistor.

## Heater Wiring for Two 3-Tube Boards



Connector designations are for two of our Koren boards, but will vary for your type.

## Heater Wiring for Mixed 2 and 3-Tube Boards



Use of the heater balancing resistor when mixing 2 and 3 tube boards in your upgraded PAS.

Why all this fuss over heaters? Why the need for an auxiliary transformer if you want to keep your stock pilot lamp and 12X4? Let's do some math...

PA-211 12V winding rating: 800mA

Stock Dynaco:

12AX7 x 4 = 300mA (two groups of two in series)

12X4 x 1 = 300mA

#57 bulb = 240mA

**TOTAL = 840mA**

This does not include the  $I^2R$  losses of the heater voltage doubler. As we can see, the heater winding is taxed as it is.

Let us take the 12X4 and pilot lamp and give them their own transformer. Now, we can add more signal tubes.

12AX7 x 6 = 450mA (three groups of two in series)

That's it!

So, why not add the 12X4 again and use a LED pilot? You can, but with even further reduced heater voltage to your 12AX7's. With 450mA being drawn from the doubler, it's typical each heater sees .7 to 1V less than its rated 12.6V. It's just the nature of doubling and losses.

Even if you mix a 3 and a 2 tube board, current draw will remain the same (the extra "tube" power is just burned in the heater balancing resistor)