

paX – Construction Guide

Success almost inevitable

Jan Didden

Below I will give a recommended way to build and test the amp step by step so that success becomes almost inevitable. I do assume that at the very least you have a multimeter to perform the simple voltage tests described at each step. If you don't have a multimeter, now may be a good time to get one!



The paX error correction amplifier is not particularly difficult to build. You can, of course, build it up completely, connect the power supply, the source and your speakers, and turn it on. But if you would have made a small error somewhere during construction, the consequences could be expensive. Even if they are not, it is much more difficult to find faults in completed amplifiers than in a small part of it. So, to avoid unnecessary problems, it is best to proceed in an orderly manner, and to test each part when completed. As you saw in Part 1 of the article series, there are two pairs of output devices. Each pair has its own bias current source and bias setting trimmer. The best way is to build up a single pair, then complete

and check the amplifier, and lastly put in the 2nd pair.

Connections to the power supply, in- and outputs as well as between the amplifier and the output/protection module are given in **Figure 1**.

Power supply

Build up the power supply using the following components:

Mains switch, filter, varistor and transformer;
Rectifiers, reservoir capacitors.

When the power supply is completed, insert a 3 amps slow-blow fuse in the

fuse holder. Connect a multimeter between the pos and neg supply voltage (not to ground), set the scale to 100 V. Turn on the power switch with an eye to the multimeter. You should see a DC voltage between 80 and 90 V. If the output voltage of the power supply is much lower or higher, turn off the power switch again. Repeat the check measuring first the positive supply and then the negative supply against ground. Each should indicate between 40 and 50 V. If any part is wrong or you see other indications of problems like smoke or a burning smell, turn off the power immediately. Carefully check all connection and parts orientations: the transformer connections, the diode polarities as well as the capacitor

polarity. Check the secondary voltages directly on the transformer for correct AC voltage. In any case, make sure you have an error-free power supply before proceeding to the power amp boards. If this is OK, set aside the power supply and start with the amplifier boards.

Power amplifier

Output stage, 1st pair. Mount a single pair of output devices and all related components:

Q11, Q18, Q19, Q20;
 R40, R41, R42, R43, R44, R19, R20;
 R35, R36, R37, R38, R21, R22, R23, R24;
 C11, C12, C17, C18;
 Q15, Q16, R54, R55;
 C15, C16; D10, D11;
 R34, R60, R25;
 C3, C6, C7, C8, C13;
 RV1, C9, R64, R65, C10, L1;
 IC socket U4 (do not yet insert U4);
 D7, D8.

Check off each completed step on the circuit diagram so you keep track of what is done. Make sure you orient RV1 exactly as shown in the stuffing guide and turn it completely clockwise (you hear a ticking sound at the end of the wiper travel). Be sure to use isolation pads for the power transistors, and verify with the multimeter that none of the transistor leads has a short to

The author

Audio has been a lifelong consuming hobby for the author, Jan Didden. Finally, he has now enough time to complete all those projects he started a long time ago. The completion of the paX amplifier has taken 10 years from the very first ideas.



ground or to the metal of the chassis or heatsink.

Make the output inductor L1 from 3 layers of 8 windings of 1.5 mm magnet wire, for an inductance of around 5 μ H. Make sure to scrape off the insulation of the wire ends and tin them to get a good solder connection.

Do NOT insert U4 at this time, but ground pin 6 of the U4 socket with a jumper to the power supply ground. Connect a load resistor (50 to 100 Ω is fine) to the amplifier output. Connect the power supply (observe correct polarity!) positive and negative leads via a resistor of 10 Ω /5 W. Connect the DC multimeter to the output. Switch on the power supply and verify that the output of the amplifier is less than a volt, and that there are no signs of smoke or heat. Verify that the voltage to ground at pins 4 and 7 of U4 is around +15 and -15 V respecti-

vely. Next, switch the supply off and connect the multimeter to the Vbias test pins shown in the stuffing guide. Switch on and turn up RV1 (counter-clockwise) to get an indication of around 24 mV on the multimeter; this is not critical as we will fine tune it at the end. If all is well, switch off again, remove the jumper from pin 6 and insert U4. Ground the end of R25 shown as Vdrive on the schematic, switch on and verify that the output is at only a few mVDC, and that the voltage at Vbias is still around 24 mV.

Voltage amplifier stage

Mount all the components shown in Figure 4 of Part II, plus the sockets for U2 and U3 (Part II Figure 5).

When finished with the Vas, insert U1 in its socket. Do NOT insert U2 or U3. Ground pin 6 of U2 via a jumper wire.

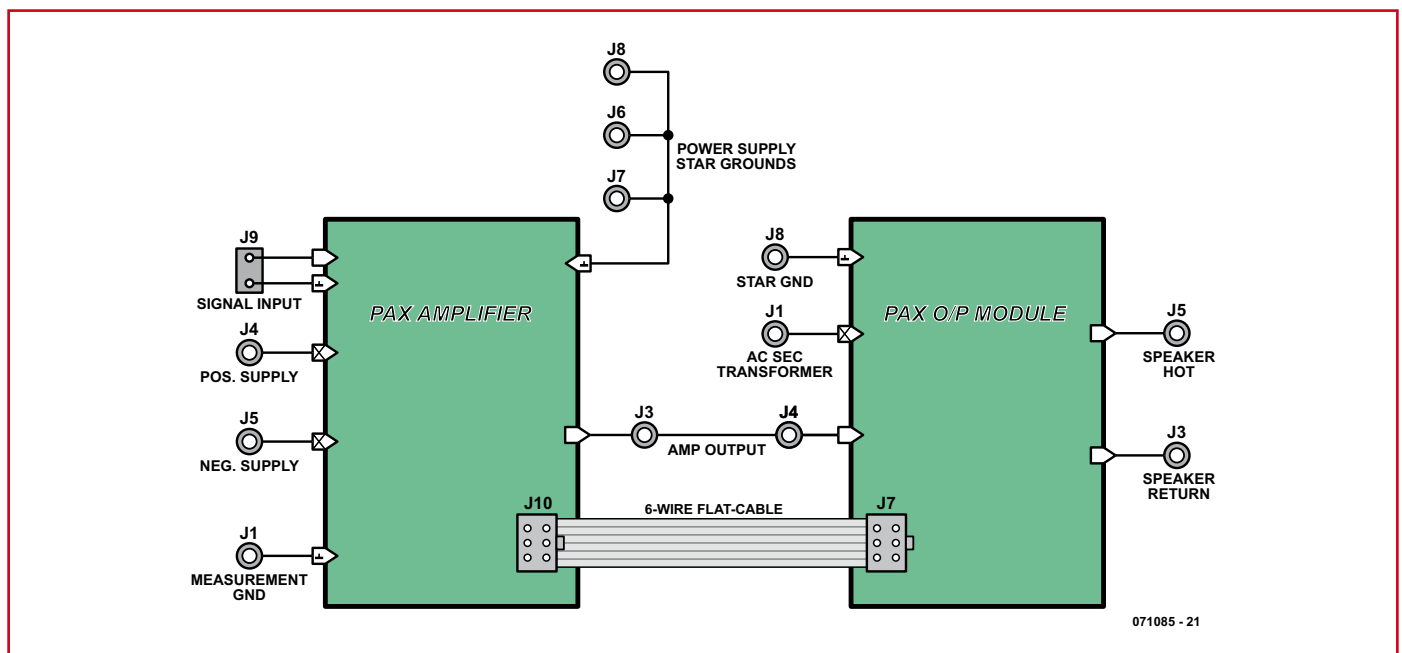


Figure 1. Input/output, power supply and interconnection guide.

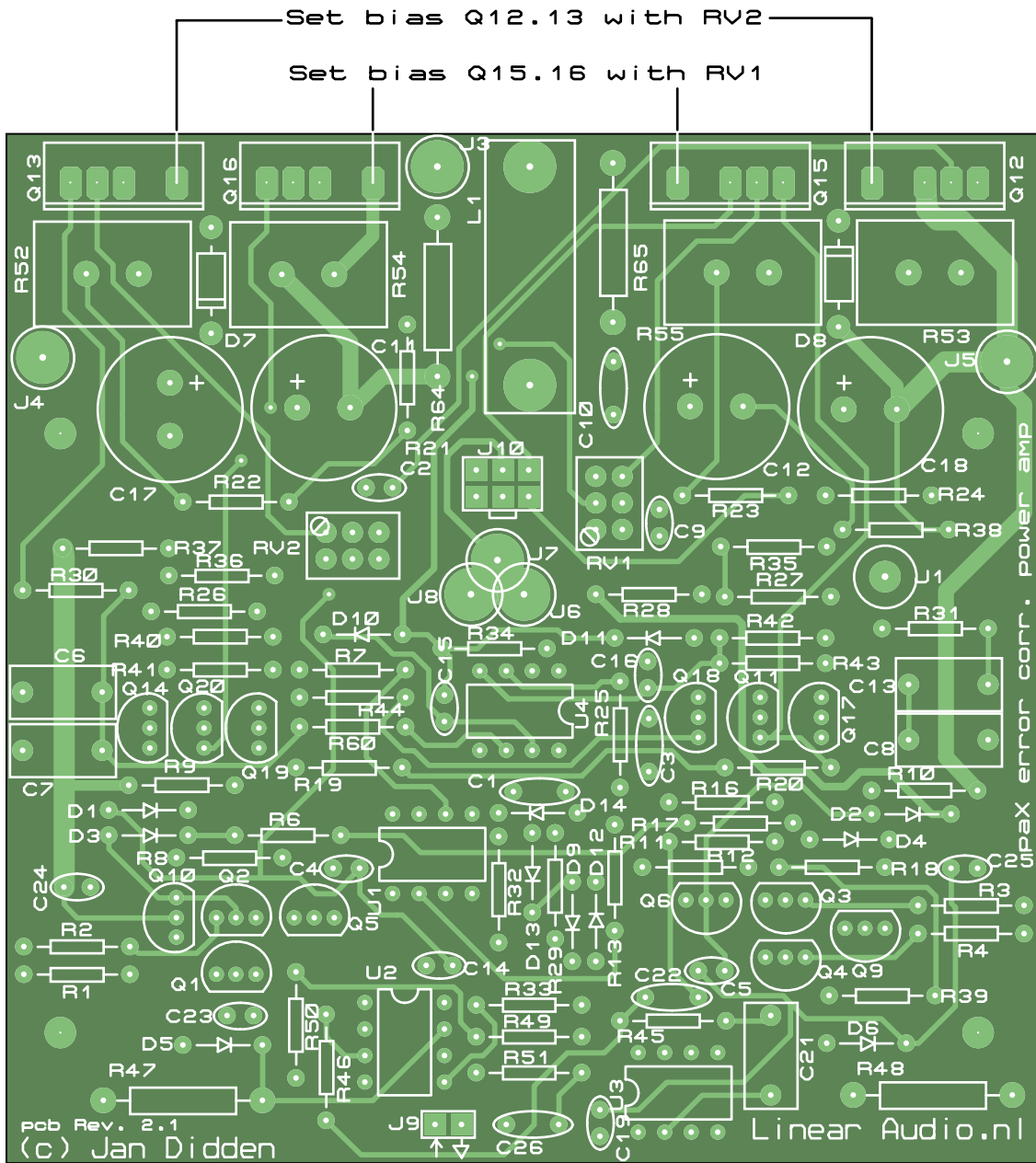


Figure 2. Amplifier board stuffing guide.

Switch on the amplifier and verify that the output DC voltage is not more than a few 100 mV. Verify that the voltage at pin 7 and pin 4 of U1 is about +15 and -15 V respectively.

Input buffer and servo

Mount all the components shown in Figure 5 of Part II. Insert U2 and U3 in their sockets. Ground the amplifier input. Switch on

the amplifier. Verify that the output DC is not more than a few mV. Verify that the voltage at pin 7 and pin 4 of U2 and U3 is about +15 and -15 V respectively.

If all is good, switch off the amplifier. If you have a tone generator and a scope, connect an input signal of about 100 mV, 1 kHz to the input, switch on the amplifier and observe the output signal, which should be a nice sine wave at around 3 V peak.

We're almost done. Next, mount the remaining components for the second output pair:

Output stage, 2nd pair. Mount a single pair of output devices and all related components:

- Q14, Q17, Q12, Q13;
- R30, R31, R52, R53, R26, R27;
- RV2, C2

Make sure you orient RV2 exactly as

shown in the stuffing guide and turn it completely clockwise (you hear a ticking sound at the end of the wiper travel). Be sure to use isolation pads for the power transistors, and verify with the multimeter that none of the transistor leads has a short to ground or to

the metal of the chassis or heatsink. Switch on the amplifier and verify that the output voltage (no signal) is still only a few mV. Connect the multimeter across the bias sense points for the 2nd pair (see stuffing guide). Turn up the preset for an indication of around 24 mV.

Lastly, after some warm-up time, do the final adjustment of the bias for each pair as described above to 24 mV. This completes the construction of the power amp.

(071085-B)

COMPONENTS LIST

Resistors

(0.25W metal film)

R1-R4,R6,R8,R17,R18 = 47Ω

R7 = 220Ω

R9,R10,R12,R25,R34 = 4kΩ

R11 = 249Ω

R13 = 2kΩ

R16 = 5kΩ

R19,R20,R30,R31 = 2kΩ

R21-R24,R60 = 100Ω

R26,R27,R33,R40-R43,R46,R51 = 1kΩ

R28 = 10Ω

R29 = 3kΩ

R32 = 33Ω

R35,R36 = 619Ω

R37,R38 = 680Ω

R39,R45 = 1MΩ

R44 = 7kΩ

R47,R48 = 1kΩ

R49,R50 = 10 kΩ

R52-R55 = 0Ω

R64 = 1Ω

R65 = 6Ω

RV1, RV2 = 200Ω multiturn preset

R5,R14,R15,R56-R59, R61-R63 = not fitted

Capacitors

C1,C3,C23 = 150pF polypropylene

C2, C4,C5,C9,C14-C16,C19,C22,

C24,C25 = 100nF ceramic

C6-C8,C13,C21 = 1μF 63V foil

C10 = 220nF 50V ceramic

C11,C12,C17,C18 = 470μF 63V

C26 = 1nF foil

Inductors

L1 = 5μH (see text)

Semiconductors

D1, D2, D5,D6,D10,D11 = zener diode 15V 0.5W

D3,D4,D9,D12,D13,D14 = 1N4148

D7,D8 = 1N4003

Q1,Q2,Q9 = 2SA1208

Q3,Q4,Q10 = 2SC2910

Q5,Q11,Q17,Q18 = BC546B

Q6,Q14,Q19,Q20 = BC556B

Q13,Q16 = STD03N (+ isolation washer & mounting hardware)

Q12,Q15 = STD03P (+ isolation washer & mounting hardware)

U1,U2,U4 = AD844AN

U3 = TL051CP

Miscellaneous

J9 = header 2 x 1 pin (signal input)

J10 = header 2 x 3 pin (+ flatcable)

4 IC sockets DIL08

PCB, ref. 071085-1 from www.thepcbshop.com

Construction kits and PCBs for the amplifier available through the author.