Cambridge Reverb Repair Board

Repairs models V1031, V1032, V1081, V1082, V1021, V1022, and V1011

Table of Contents

Illustration Index

Cambridge Reverb Repair Board

The Cambridge Reverb repair board is designed to completely replace the internal circuit board of all of what I call the “suitcase amplifiers” from Thomas Organ:

- **Cambridge Reverb**
- **Pacemaker**
- **Pathfinder**

which are both “defunctioned” versions of the Cambridge, and the **Berkeley II**, which is identical to the Cambridge electronically, but in a head/cabinet format.

The design follows Thomas Organ's concept of using a single PCB pattern as a “master board” with all of these variations printed in the copper patterns. Adapting it to a specific amplifier needs only to leave off and/or change a few components. This design is not the same as the original Thomas Vox copper pattern, but is instead a completely new layout adapted to modern parts and materials, while still fitting in the original position in the amplifier chassis.

The Cambridge (V1031) and Berkeley (V1081) circuit boards have three inputs to a single channel preamp, about 15W output power, and effects consisting of reverb, tremolo, and mid range boost (MRB). I have never seen one, but I understand that there exists a V1032 Cambridge and V1082 Berkeley 2 which adds in the E-tuner feature. This board will accommodate those models.

The Pacemaker V1021 is identical, excepting that reverb is deleted. The Pacemaker 1022 adds an E-tuner to the Pacemaker V1021.

The Pathfinder V1011 is identical to the Pacemaker V1021, excepting that it deletes MRB and makes a few minor component value changes.

As I noted, the circuit board that Thomas Organ used is the same in all of these cases. All they did was to leave parts on or off the PCB, and change the wiring to the controls to match.

The repair board was designed to fit in the case the same way the originals did. The wiring on the originals was a problem for any repairs – it was fine-gauge solid wire, and prone to breakage. Equally bad, the wires ran all over the circuit aboard and connected to two of the edges, so that the boards in the original amps are difficult to repair if they do break. The repair board was designed to move all the wiring to one edge of the board so that the board could be flexed up to access the bottom side of the PCB for repairs without endangering wires that were not part of the repair process.

The models that used MRB have a toroidal inductor measuring about 1Henry. If you are refitting an existing board and the inductor is not open, you can unsolder it and use it on the repair board. If the inductor is open, you can replace the 1H inductor with two 0.5H wah inductors or two 1K:8ohm signal transformers. The layout on the PCB supports all three options.

Uh – but wait! Is this … original?

First off, the signal circuits are all unchanged. All of the parts and connections that the audio goes

through, from the input jack out to the speaker outputs are taken directly from the Thomas originals. So the audio path is the same as replacing all the parts on an original board with new, modern parts. I made some minor changes in the power supplies to use modern parts that are smaller and have better performance, or are more available and cheaper for the same performance. So yes, …

… the signal path is original.

I added some options for populating the power supply circuits on page 13 of the drawings. The changes are to make the amps quieter than stock, or more reliable. Think of the changes as performance "mods" and this will seem better.

I like regulated power for signal circuits, so I have provided the option to use a voltage regulator for the +18V nominal supply to the preamp stages. I have also provided the option to put in the original dropping resistor. The two different population options are shown at the top of page 13.

The original amplifiers had their power rectifiers and filter caps mounted on the chassis. I had a lot of spare room inside the original PCB outline, so I put the power rectifiers and filters on the PCB. The original chassis-mount caps are usually due for replacement; putting them all on the main PCB makes the wiring simpler. The original caps can be left on the chassis but disconnected, leaving the original look, but upgrading the electrical performance of the amp. The new main filter cap is C33.

I added several options for upgrading the power supply. First, I used a 3A integrated rectifier bridge (FWB1) to replace the original discrete diodes. In addition to being cheap, this enables the use of JP1 and JP2 to use either the original power transformer (with JP2) or to replace the original transformer with a 24Vac/1.5A new one if the original power transformer dies (by using JP1).

I also added positions for diode-snubbing capacitors (C101-104) to help eliminate any hum caused by diode turnoff transients.

I added two PCB mounted fuses (F1 and F2) to protect the power transformer. These are purely optional. They're about $0.40 each. But they should protect the power transformer against shorted output devices. Cheap insurance, but maybe not needed if the original transformer has already lived 50 years. You can just use jumper wires if you don't want to use the fuses, and have the original circuit. Works for the alternate replacement transformer too.

First thoughts: should you even be doing this at all?

You need to do some clear-eyed self evaluation. If you have experience building through-hole PCBs, soldering, working inside amplifiers and following wiring diagrams, and know how to work inside an amplifier chassis with the AC power plugged in and turned on, you're probably OK.

If you're missing any of these, especially the last (working in chassis with AC power on, without getting yourself electrocuted) do not try to assemble and install one of these. There is a good chance of mucking up a vintage amp worse, and even getting yourself electrocuted. Paying a qualified tech to work on your amp for you is much cheaper than paying for a funeral or find another of these old amps to work on. Don't try it unless you have the skills.

Population

I designed the PCB to allow easy modifications so that the lower-range models can be accommodated. It's simple to order the base parts list common to all models, and then the unique parts for your model. In some cases, parts are left off, and in others they are replaced with jumpers. You will need some care in picking parts and inserting them because of the many-fold nature of the PCB.

Options, options, what to do with the options!

The many-amps nature of the Thomas Organ design led naturally into designing in some choices that will make application to these amps easier today. Think about what options, if any, you're going to put in.

Power Options:

1. **Power Transformers – Use the original transformer unless you know it's damaged.** The original transformer had a 48Vct power transformer. This required only two diodes to get full wave rectification. Modern practice would be to use a single, non-center-tapped secondary and a full wave bridge. Full wave bridge assemblies are cheap and readily available. What's not often noticed is that if you simply ignore the (-) terminal on a full wave bridge, it's exactly the circuit of a full wave center tapped rectifier, two diodes with their cathodes connected. So I put a bridge assembly on the PCB, and ran the (+) terminal to the first filter cap positive terminal, and the center tap pad to the first filter cap negative terminal. I then realized that if you had a 24V NON-CT transformer and connected the secondary to the same wire pads, leaving the CT wire pad open, you only had to connect the bridge rectifier (-) terminal to the first filter cap negative terminal and the 24V transformer would do the same job as the original, and is much easier to find. So I put jumper J1 and J2 on the board to make it easy to replace the power transformer if needed.

For the original power transformer, use jumper J2, leave jumper J1 off. If you have to replace the power transformer, you can use a 24V transformer with no center tap, but use a jumper in the J1 position, not the J2 position. Do NOT use a jumper in both positions at the same time, nor leave both jumpers off. You need one and only one, to match your transformer. But, let me repeat – use the original transformer if it's still working OK, and use jumper J2.

2. Fuses F1 and F2 – I had some space on the PCB. It is good practice to fuse the secondary of power transformers, as this protects the transformer. A fuse only in the primary is intended to prevent fires, not save the transformer. So I put spaces for board-mount fuses. You don't have to use them. If you choose not to, put jumper wires where the fuses would go.

3. Rectifier snubbing capacitors – Capacitors C101-C104 do not appear in the original amplifiers. We have found out in the last 50 years that ordinary rectifiers may cause a burst of RF noise every time they turn off. This causes a buzzy hum sound that cannot be fixed any way other than quieting the rectifiers. That's what these caps do. You don't have to use them, but you can if you want. If you do, use good solid ceramic 10nF, 100V or higher rated caps.

4. Extra filter caps – C34 and C34A are wired in parallel. The original circuits only used C34. There is room for a second cap to make the power supply quieter. You don't have to use two caps here, but you can . If you use only one of them, it doesn't matter which position you put it in. And you

can add a second one later if you want.

5. Regulated or non-regulated +18V – I like regulated power supplies for low noise. There was space on the board to put a regulator, U1, to do that. If you want to be completely original, leave off U1, D101, and R103, but put in R103A, 680 ohms, 2W metal oxide.

Signal Options:

6. C9 – NP electro or film. You can put an NP electrolytic capacitor in for C9 as in the originals. But today there are film 1uF/50V caps which are only about twice the size. If you like film type, there's space for it. And film caps do not slowly degrade over time like electrolytic caps do.

7. MRB Inductor – If you're replacing your old board, unsolder the inductor from the original board and solder it into the positions across the ends of L1 and L2. If it reads open, you have a problem. It's very difficult to find similar inductors. So I put places on the PCB to use two 0.5H wah inductors in series, and also the primary inductances of a miniature 1kCT transformer, which is about 0.5H too. This gives you way to repair a broken inductor.

Model Options:

All of the previous stuff is of course independent of the differences between model numbers. The five models use different mixes of parts to get their features. The repair board contains all of the possible places for components used. I gets complicated. Here's an overview, free of the minutae of the bills of materials.

1. To make a Cambridge Reverb V1031 or Berkeley 2 V1081, which are electronically identical, you put all the parts on the PCB, excepting the parts involved with the E-tuner, which these models do not have. This amounts to leaving off three resistors and one capacitor, then putting a jumper in one of the three resistor spaces.

2. To make a V1032 Cambridge or V1082 Berkeley board, you add the three resistors and one capacitor needed for the E-tuner to the base V1031/V1081 board above.

3. To make a Pacemaker, V1021, you leave off all the parts related to reverb, which the Pacemaker does not have, and install one jumper, which connects the volume control to the power amp input in the absence of the reverb. The parts relating to the E-tuner are left out as in the Cambridge V1031. Input resistor R2 – R2 is wired differently on the V1021 and V1022 than on the Cambridge V1031. For the V1021/1022, the “north” end of R2 should be bent back along the resistor body and inserted in the spare hole beside the “south” end of R3. This is illustrated in the three diagrams regarding R2 and R3 on page 13 of the drawings. Watch this carefully, as it's easy to miss.

4. To make a Pacemaker, V1022, you install as per the Pacemaker V1021, but add to it the three resistors and one capacitor needed for the E-tuner to operate.

5. To make a Pathfinder V1011, you populate as for the V1021 Pacemaker, but leave off all of the parts related to Mid Range Boosting (MRB), Install a couple of jumpers to make things work again with parts left off, and change certain values of resistors and capacitors. Also, the V1011 does not

use R52 for the pilot light, so that is replaced with a jumper.

The bills of materials, parts population diagrams and wiring diagrams should make the details clear.

Bills of Material

When you're working with several different versions of something that is almost identical from version to version, it's easy to get details crossed up. Well, it is for me anyway. I had to pick a way to distinguish parts from one model to the next. A part number is a “reference designator”, and “R18” tells you what part on a schematic goes in what holes on the PCB. It “maps” the parts in a schematic to the physical location, as the math people love to say.

Here's what I decided. There is ONE pcb. The parts that go on it have ONE part number, which tells you where they go on the board. Exactly what part value (i.e. 6.8K versus 10K) may be the same from model to model or different. R18 may be 6.8K in one amp, but 10K in another amp, but whatever value that amp model needs goes in the “R18” position on the board. Some amps may not use R18 at all, or may use a wire jumper to replace it. So with reference to this PCB,

THE PART NUMBER IS A PHYSICAL PLACE ON THE PCB.

Part numbers also have to tell you what part is what on the schematic. I used the biggest, fullest, and most complete schematic+PCB as the reference: the Cambridge Reverb. The physical placement part numbers and the part numbers on the Thomas Vox service literature match each other for the Cambridge Reverb amplifier.

When Thomas Organ drew up the lesser-populated models like the Pacemaker, which, for instance, leaves reverb off the Cambridge Reverb, they renumbered all the parts. So that a Pacemaker schematic and Pacemaker PCB diagram match each other, but only accidentally match the Cambridge Reverb, which is where it came from to start with. This did not confuse Thomas Organ's manufacturing, because they would make maybe 1000 of one model, then change over to 1000 of the others, and there was no one wondering whether “R18” was the same from Cambridge to Pacemaker. We do not have that advantage, as it will be very unusual for someone to work on more than one amplifier from this PCB.

So I used the Cambridge Reverb as the master reference, and just deleted parts from that to make the lesser-populated models, but I kept the Cambridge Reverb part numbers. To help people who will insist on referring to the original Thomas Organ schematics (and I know they will do this!) I concocted a cross reference so that one could find out that the resistor in the “R18” position in the Cambridge is 6.8K, but is a 10K in the Pacemaker, and not even inserted into the PCB at all in a Pathfinder, and that furthermore, it is called “R14” in the Pacemaker.

Appendix A is a parts cross reference bill of materials. It shows the part numbers on this PCB, and how that applies across the seven (!) amplifier models you can use this PCB in. The part number on this PCB and under the V1031 Cambridge heading matches the designation on the original Cambridge schematic where that is possible.

The p/n in the other columns under V1021, V1022, and V1011 lists the part number used on the

original schematics for that model from Thomas Vox if you are referring to the original schematics. I suggest that you don't do this unless you have some overwhelming need other than just getting this PCB to work and getting your amp running again.

An “=” character means the **part value** is the same as in the Cambridge/Berkeley. If the part value is different, as with C7 in the Pathfinder, the correct value for that model is listed there. A “-” character means that this part does not occur in this model.

It's complicated, I know. Pick the model you are fixing, and ignore all the rest. A good way is to print out these three pages, then cover the columns for models you're NOT building with masking tape, including the original part number on all but the Cambridge/Berkeley, which matches the part number on the PCB.

Remember: a part number like “R18” or “C15” is a PHYSICAL POSITION on this PCB. Use the correct set of parts for your amp model, and put the indicated part value in the indicated holes and you'll be OK. Start trying to reverse-guess yourself and go back to the Thomas Vox schematics and you'll get very confused.

By the way, the “R18” and “C15” and 6.8K, 10K, etc. values I just used to explain this are purely made up. They are not what is in the parts list. USE WHAT'S IN THE PARTS LIST.

BOM for Ordering Parts

You need a different set of information for ordering parts than you need for relating part values to schematics. For ordering parts, you need to know how many 10K 1/4W resistors to order, and what size capacitor will fit in the holes on the PCB without breaking something, not so much where they go on the PCB. The only place that these two different purposes overlap is that you need to know that, for instance, R7, R22, and R45 are all 22K, and you need to order three of them, all the same size.

SIZE MATTERS! IF YOU GET THE WRONG SIZE PART, IT WON'T FIT THE PCB

Resistors are very standardized, but capacitors are not to the same degree, and especially electrolytic capacitors. The following table lists information about the body size and lead spacing for all of the parts. Pay particular attention to the electrolytic capacitors. If you get the wrong body size, it won't fit the hole spacing on the PCB, which can stress the leads at the body and lead to early failure of the cap.

In doing the PCB layout, looked up every part at a mail order supplier (Mouser) and chose body sizes where there were multiple parTs available that fit the electrical specifications AND the physical size. Parts **are** available that fit.

The big electros, C22, C33, C34, C34A, and C35 deserve some notes. C33 is the main power supply filter. The Cambridge/Berkeley specs 5000uF/35V. I picked the modern standard, 4700uF/35V. The Pacemakers and Pathfinder specify a 2000uF/35. You can certainly go that low, but I recommend using the 4700uF value. It will just reduce power supply ripple and noise. The others are all 470uF/35V. You can skip C34A, but I recommend putting it in for a quieter amp.

Appendix B details the physical characteristics of every single part, one by one.

Considerations Common to All Models

There are some necessary decisions to make which are common to all the possible models. These split into issues of the power supply and the power amp.

Power Supply

The power supplies for all models were nearly identical, using the same power transformer, rectifier, and filter cap setups. There were minor differences in capacitor and resistor values, but not much.

Modern power components are much, much better 50 years after these amps were designed, and I took advantage of that. Also, there are newer design techniques that make the power supply more reliable and quieter, and I used those.

The main power filter capacitor in all the amps is an aluminum can, about 1.5” in diameter and 3” tall. It mounts on the chassis. This cap is probably dying or dead in any of these amps, and worse yet, no one makes this kind of capacitor body any more. You really only have two options in replacing this cap: (1) hide a smaller modern cap inside the chassis or (2) hollow out the can and stick a smaller modern replacement inside the aluminum can.

I have made this decision easy for you. There is a space on the main PCB for a modern capacitor that does this function. Just leave the old capacitor can in place for original looks, but disconnect all wires leading to it.

Similarly, the originals had semiconductor rectifier diodes wired from terminal strips to the capacitor to rectify the power transformer's AC power to DC. I put modern rectifiers on the PCB, so the power transformer secondary wires can now go directly to the PCB, not the terminal strip. You can leave the old diodes in place, and just re-route the transformer secondary wires.

The power transformers on these amps are quite durable, but in doing the PCB, I noticed that it is easy to replace them if needed. Don't go here unless you absolutely know the power transformer is dead. But it is possible.

I used a modern full wave bridge (FWB) module to replace the two silicon diodes in the original. This was overkill, but it only cost about $0.25 more than two diodes, and allowed the very simple replacement of the power transformer, in addition to being designed for the job. It is possible to use two diodes just like the original circuits, but I recommend using the FWB.

I added two fuses soldered into the PCB. These are in series with the secondary windings of the power transformer. You must decide whether to use them or not. They can be replaced with a cut-off resistor lead if you choose not to use them. The fuses cost about $0.80 together, and add a huge safety factor to the power transformer. I recommend using them.

I also added small ceramic capacitors, C101-104, in parallel with the rectifier diodes. These capacitors suppress any turn-off noise on the diodes, and may reduce total hum in the amplifier. I recommend using them, but you can simply leave them off. They cost about $0.10 each.

On the PCB, I added C34A in parallel with C34. It adds some more filtering and makes the amplifier quieter. It's not strictly needed, but I recommend it.

Finally, I like regulated power supplies for preamp sections. The original amplifiers used a simple

resistor-capacitor filter (R103/C35) for the first preamp circuits. I added the option to replace this with a regulated power supply by leaving off R103/C35 and replacing them with U1/D101/R103A. This provides a quieter +18V to the preamp stage. It is purely optional. Pick which you'd rather do.

Power Output Stage

The original power transistors on these amplifiers are germanium types. Power germanium devices in TO-3 packages are quite difficult to find, and even if you find them, they are somewhat fragile.

Your first decision here is whether to mess with the original devices. If you can determine that the power output stage of your amplifier is working OK, don't mess with them. Only consider replacing them if you can determine that they are malfunctioning.

If you do decide they need replacing, use PNP silicon devices, not “original” germaniums. Modern PNP devices will be much more capable devices, with better specifications on all the characteristics that matter in this application. Moreover, they’re cheap. You can get silicon PNPs that fit right in and work for under $2.50 each easily, and there re many options that fit the original sockets for about $5 at the time of this writing. Germanium devices will be quite expensive if you can find them.

Perhaps the best replacement is the MJ2955 PNP in the TO-3 metal case. Here are some others: 2N5883, 2N5884, 2N3791, MJ15004. These devices should drop right into the existing mounting scheme.

If you are willing to tinker with the physical mounting a little bit, there exist a number of silicon PNPs in the TO-220 package that will work fine, and may cost $1.00 each or less. The only changes that need made if you go to silicon PNP is that you need to change the value of two biasing resistors.

Changing R32 and R34 to 13 ohms will make the silicon PNPs bias correctly. No other changes are needed.

However, metal TO-3 packages are also being phased out by the electronics industry. These amplifiers can work very well with transistors in the TO-220 plastic package. Some types that ought to work include: MJE2955, BD244A/B/C, D45H8, D45H11. These will need insulating wafers and mounting hardware to isolate them from the heat sink electrically. In the larger TO-3P package, there are many, many choices, but mounting and wiring both TO-220 and TO-3P will be harder. But with these options, the amplifier can still be kept operating.

Cambridge V1031, V1032 and Berkeley II V1081, V1082

The V1031 and V1081 are electronically identical. The only real difference is that the Cambridge is mounted inside a combo cab with a single 10” speaker, while the Berkeley II is a head-and-cab arrangement with a pair of 10” speakers.

The BOM at right is sorted and arranged for ease of populating the PCB. It continues on the next page.

My preference is to populate a PCB by height: that is, put the parts on the PCB in groups of all-matching-heights, lowest height group first. So in this case, I would first put all the wire jumpers on the PCB; then the ¼ W resitstors, which lie flat against the PCB; then the lowest-height capacitors, and so on.

In the parts list, notice that R55, R56, R57, and C36 are used only on the V1032 and V1082 models with E-tuners. You can put them into the V1031 an V1081, and they will do no harm, but serve no function.

R55 (E-tuner)	2.7R	1/4W LS 0.4”	¼ W film
R103A	68R	1/4W LS 0.4”	¼ W film
R19	82R	1/4W LS 0.4”	¼ W film
R8 R13 R38 R53A R53B R53C R53D	100R	1/4W LS 0.4”	¼ W film
R16	150R	1/4W LS 0.4”	¼ W film
R31	330R	1/4W LS 0.4”	¼ W film
R30	560R	1/4W LS 0.4”	¼ W film
R23 R40	680R	1/4W LS 0.4”	¼ W film
R9 R27 R50 R51	1K	1/4W LS 0.4”	¼ W film
R10 R18	1.5k	1/4W LS 0.4”	¼ W film
R42 R48 R49	2.2K	1/4W LS 0.4”	¼ W film
R25 R28	3.9K	1/4W LS 0.4”	¼ W film
R56 (E-tuner)	4.7k	1/4W LS 0.4”	¼ W film
R29	6.8K	1/4W LS 0.4”	¼ W film
R41, R57(E-tuner)	18K	1/4W LS 0.4”	¼ W film
R7 R22 R45	22K	1/4W LS 0.4”	¼ W film
R15	27K	1/4W LS 0.4”	¼ W film
R39	47K	1/4W LS 0.4”	¼ W film
R6	33K	1/4W LS 0.4”	¼ W film
R1 R2 R3	68K	1/4W LS 0.4”	¼ W film
R4 R5	100K	1/4W LS 0.4”	¼ W film
R21 R46	150K	1/4W LS 0.4”	¼ W film
R17	330K	1/4W LS 0.4”	¼ W film
R20	560K	1/4W LS 0.4”	¼ W film
R26 R47	1M	1/4W LS 0.4”	¼ W film
R44	2.7M	1/4W LS 0.4”	¼ W film
R36 R37	0.33R	1W LS 0.6”	1W mtl oxide
R32 R34	3.3R 1W	1W LS 0.6”	1W mtl oxide
R33 R35	470 1W	1W LS 0.6”	1W mtl oxide
R103	680R 1W	1W LS 0.6”	1W mtl oxide
R52	100R 2W	2W LS 0.6”	2W mtl oxide
C2	18pF	0.2”/5mm	cap ceramic
C14 C23	180pF	0.2”/5mm	cap ceramic
C12	270pF	0.2”/5mm	cap ceramic
C10	1nF	0.2”/5mm	cap film
C27	1.2nF	0.2”/5mm	cap film
C6	5.6nF	0.2”/5mm	cap film
C8	6.8nF	0.2”/5mm	cap film
C17	22nF	0.2”/5mm	cap film
C21	33nF	0.2”/5mm	cap film
C15	47nF	0.2”/5mm	cap film
C7	68nF	0.2”/5mm	cap film
C1 C28	0.1uF	0.2”/5mm	cap film
C18	0.22uF	0.2”/5mm	cap film
C4	0.33uF	0.2”/5mm	cap film
C24 C25 C26	0.47uF	0.2”/5mm	cap film

Take special notice of the parts noted as “Optional”, and of the references to the text. If you have not already done that, go read ”Options, options, what to do with the options!” on page 3.

The Control Pots are mounted to the chassis, and are listed here just because they are listed as ordinary “Rxx” numbers in the factory service literature. You do not have to buy new ones and replace the existing pots unless you have tested them and found that they are defective. Likewise, Q8 and Q9 are the two output transistors on the chassis heat sink, and are listed just for completeness. Do not replace them unless you know they are defective.

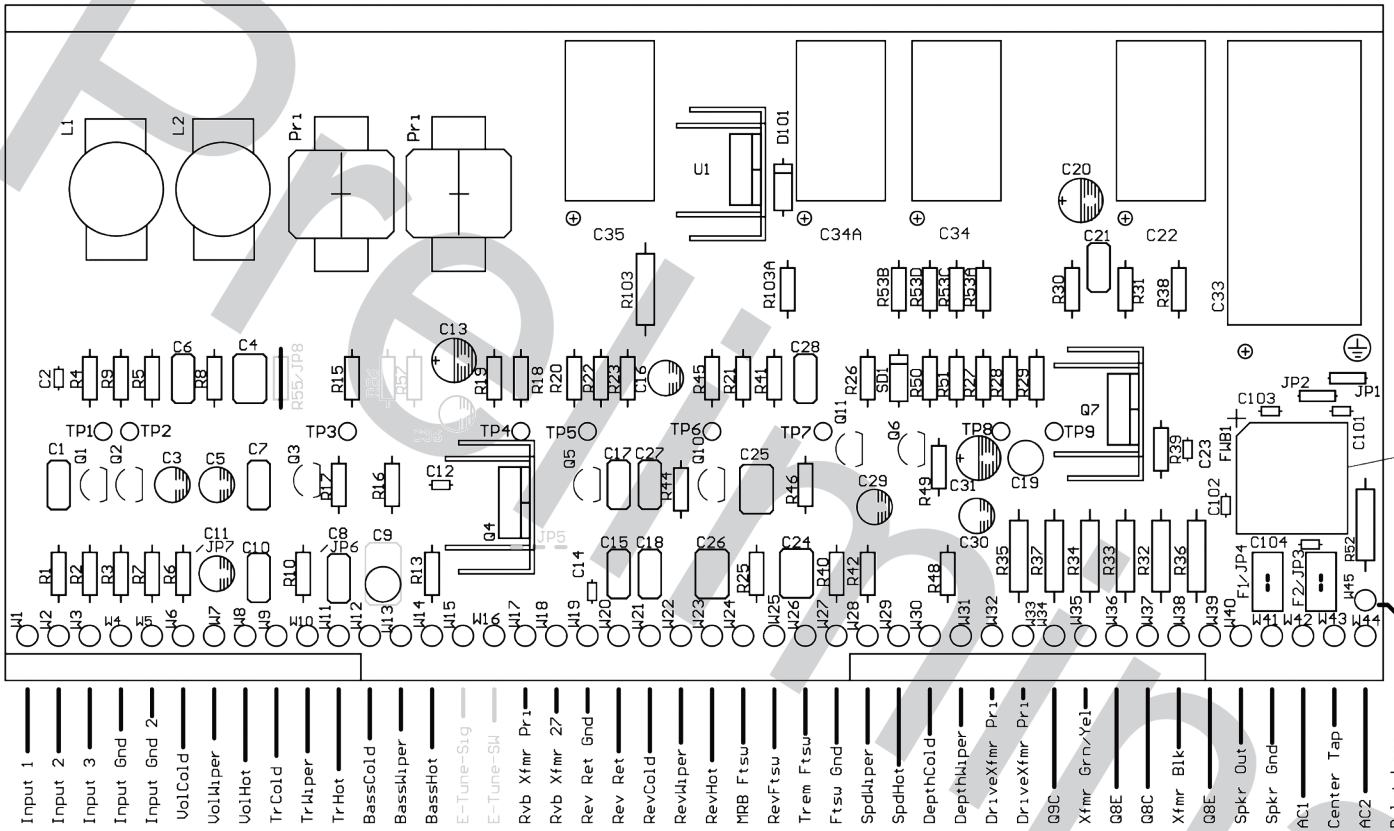
Do NOT use jumper J1 unless you are replacing your original power transformer with a modern 24Vac replacement. Use J2 for the original power transformer.

Use the original toroidal transformer from your amplifier's original PCB for L1 and L2 unless they are open. This will save you some money over buying new wah inductors.

Cambridge V1031 Berkeley V1081 (cont'd)				
C9	1uF NP	LS 2mm/dia 5mNP electro		
C19	4.7uF NP	LS 2mm/dia 5mNP electro		
C5 C11	2.2uF 25V	LS 2mm/dia 5mCap-electro		
C30	4.7uF 25V	LS 2mm/dia 5mCap-electro		
C3 C16 C29	10uf 25V	LS 2mm/dia 5mCap-electro		
C36 (E-tuner)	22uF	LS 2mm/dia 5mCap-electro		
C13 C20 C31	220uF 10V	LS 0.1” /dia 6m Cap-electro		
C22 C34 C34A C35	470uF 35V	LS 0.2” / dia 10 Cap-electro		
C33	4700uF 35V	LS7.5/0.3” dia 1Cap-electro		
SD1	1N4004	LS 0.4”	1A diode	
Q1 Q2 Q3 Q5 Q6				
Q10 Q11	2N5088	TO92W-123	EIA Style, base in middle	
Q4	KSC2073	TO220		
Q7	KSC2073	TO220		
U1	7818	TO220	18V regulator	Optional
JP2 * see text	JUMPER	LS 0.3” / 7.5mm	Jumper	
L1 L2 * see text	500mH	WAH INDUCTOR		
FWB1	3A/100V	FWB-3A	Diode Bridge	
C101 C102 C103				
C104	1nF	LS 0.2” / 5mm	cap ceramic	Optional
D101	1N4004	LS 0.4”	Diode	Optional
F1 F2	2A		Fuse	Optional
JP1 * see text	JUMPER	LS 0.3” / 7.5mm	Jumper	Optional
Original parts listed for reference				
R11	B10K	Control pot – on chassis		
R12	B10K	Control pot – on chassis		
R14	A10K	Control pot – on chassis		
R43	50K	Control pot – on chassis		
Q8		Output transistor, on chassis		
Q9		Output transistor, on chassis		
R54 – NUMBER NOT USED				

The next four pages contain the parts population diagrams and wiring diagrams. The first two are the V1031 and V1081. The third and fourth are for the V1032 and V1082, which add the E-tuner to the earlier models.

Cambridge V1031 and Berkeley II V1081 (no E-tuner)



Note: After soldering, glue down body on C33, 34, 34A, 35 with GE Silicone II or other non-corrosive curing RTV (”non-corrosive” = “doesn’t smell like vinegar”)

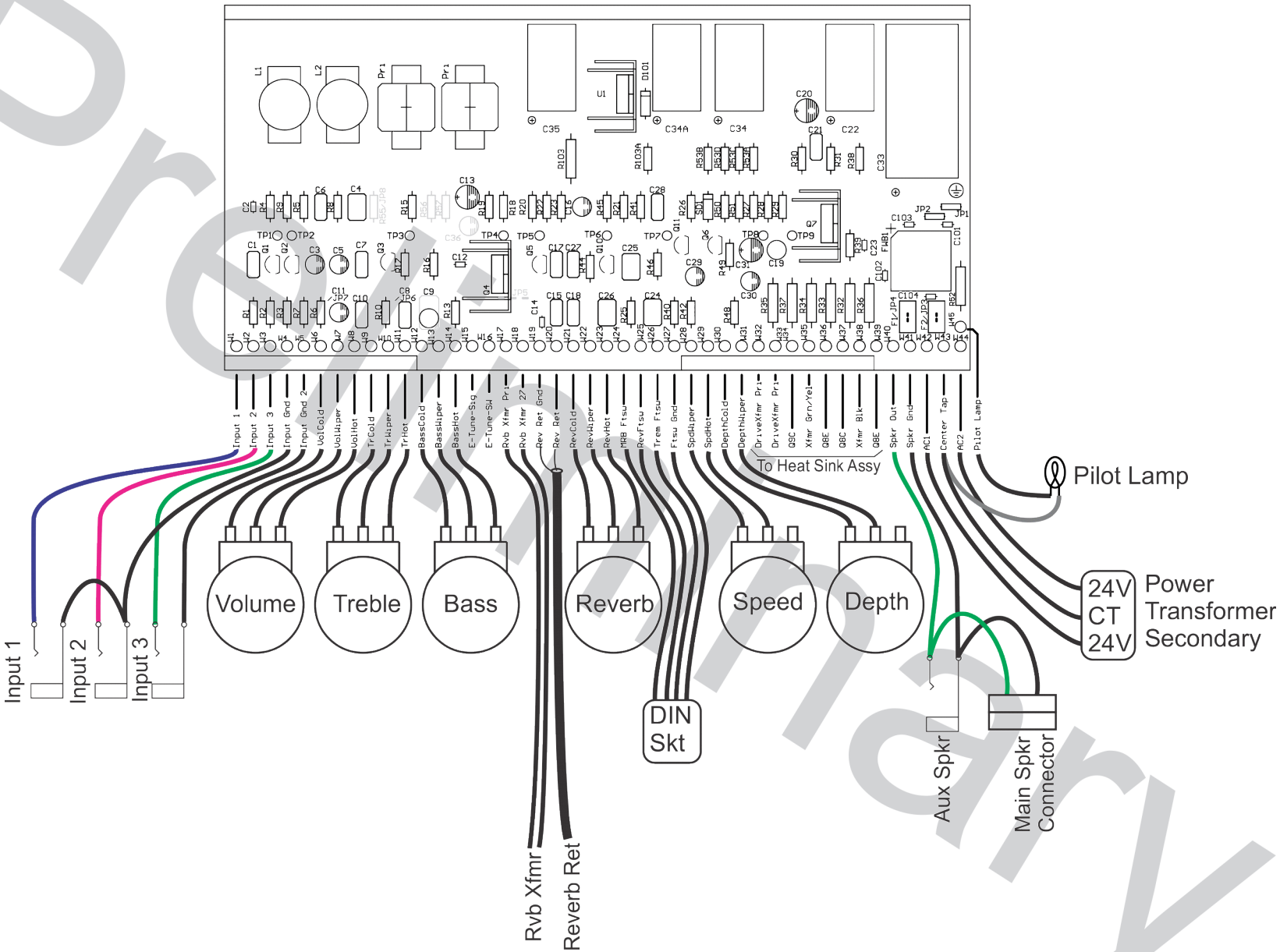
Note: Use JP1 for 24Vac transformer Use JP2 for 48Vct transformer. Use only one of these jumpers.

Full wave bridge rectifier, >100V, > 2A. Rectron BR32 is ideal, others in same package will work too.

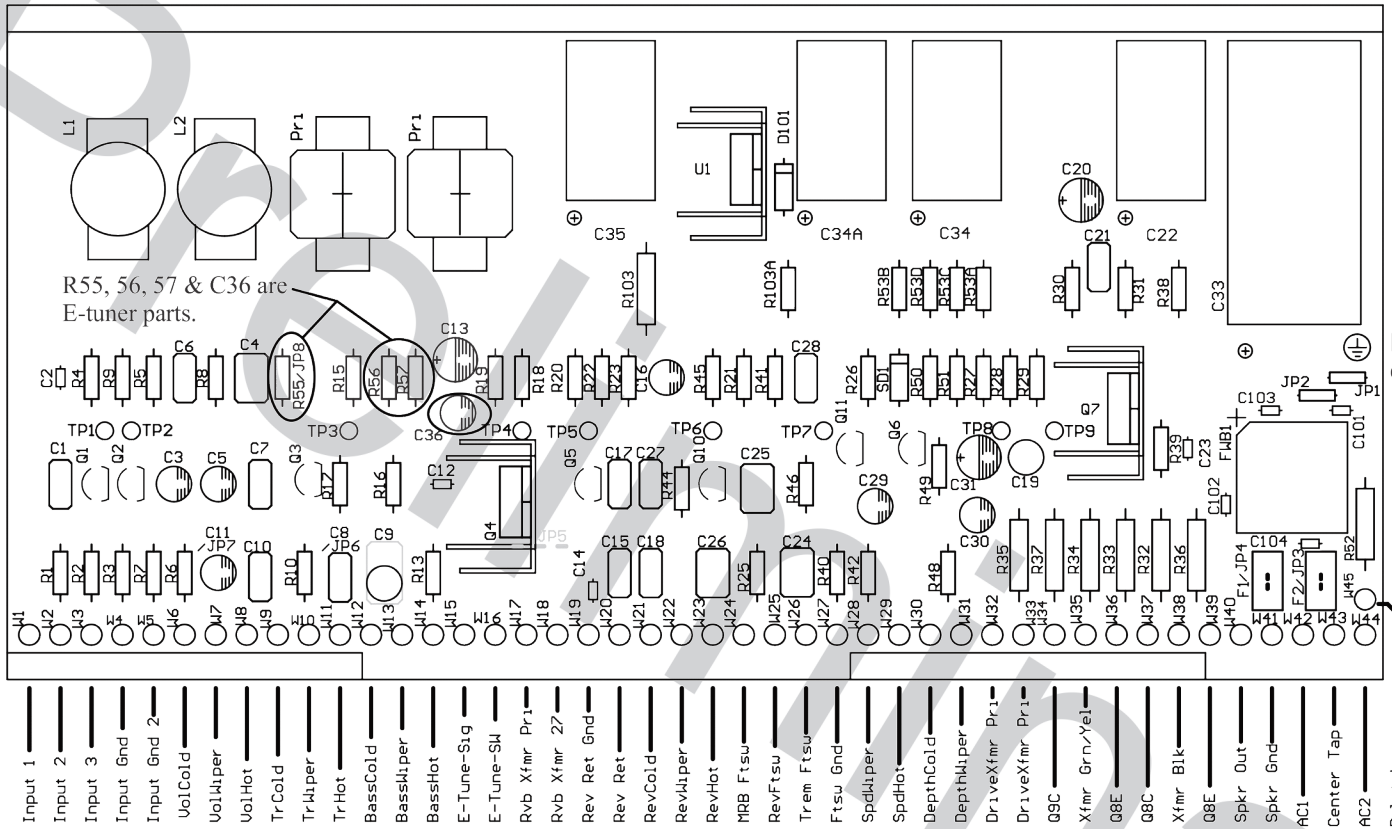
Population Notes:
Check the BOM for your particular model!

1. R56, R57, C36 not used. R55 may be 2.7R or a jumper.
2. JP5 is not used.
3. C9 is 2uF NP.
4. L1/L2 and Pr1/Pr1 are optional inductors for the MRB. The best thing to do is to remove the original inductor from your old PCB and put it in here. See the special section on MRB inductors.
5. C34A is optional; put it in if you want to have more filtering.
6. R103 and C35 are the original +18V circuit. If you use them, leave out U1, D101, and R103A. If you want regulated +18V, leave out R103 and C35, and put in U1, D101, and R103A.
7. JP1 and JP2 select which kind of power transformer you have. If you use the original transformer, use JP2 and NOT JP1.
8. Fuse F1 and F2, and capacitors C101-C104 are optional. You may leave them out or put them in. If you leave out F1 and F2, replace them with a jumper wire.

Cambridge Reverb V1031 and Berkeley II V1081 Repair Board - Wiring



(Pots shown from back side, not shaft side)



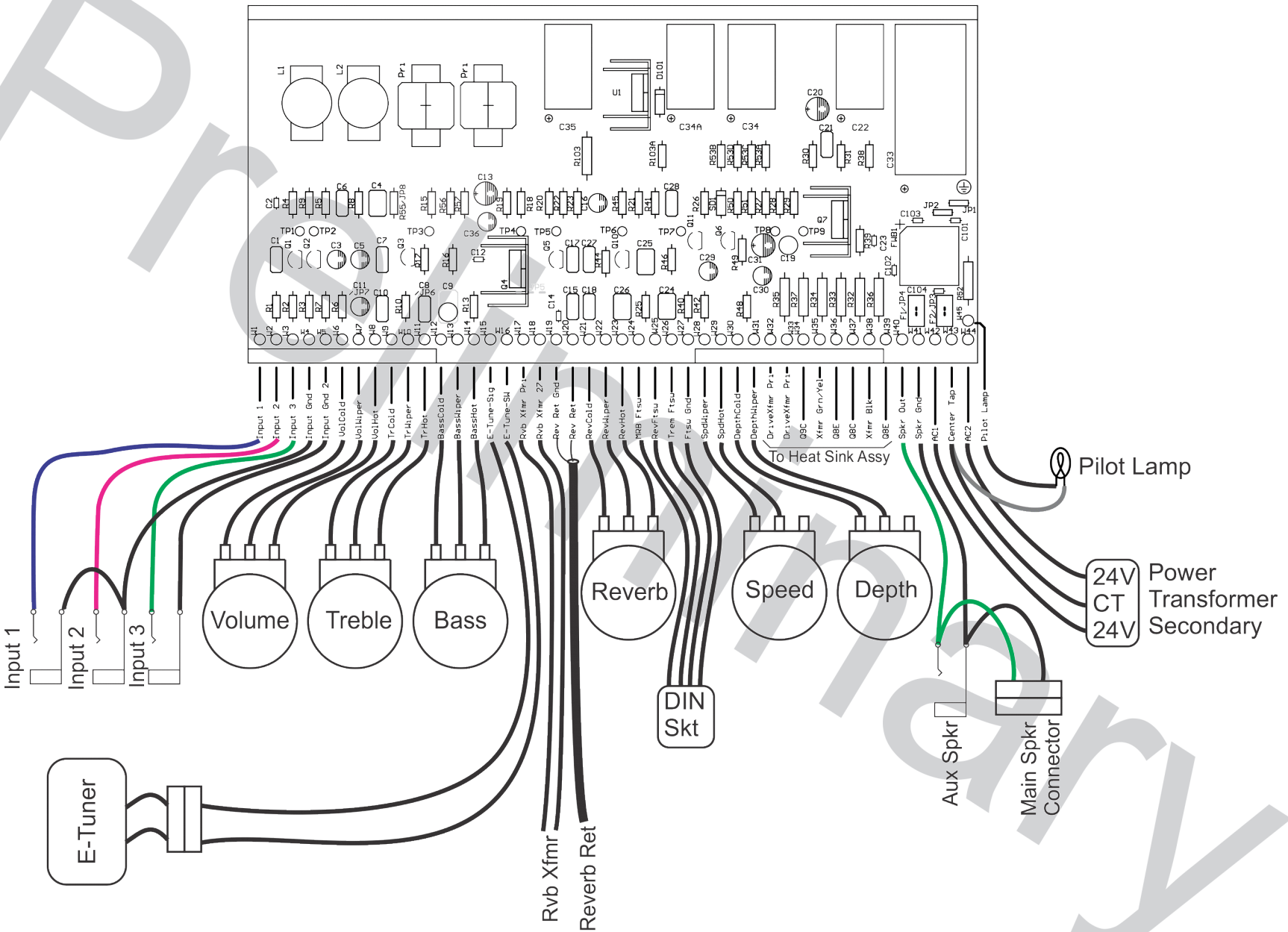
Note: After soldering, glue down body on C33, 34, 34A, 35 with non-corrosive RTV ("non-corrosive" = "doesn't smell like vinegar")

Note: Use JP2 for original transformer.

Population Notes:
Check the BOM for your particular model!

1. R55, R56, R57, C36 used.
2. JP5 is not used.
3. C9 is 2uF NP.
4. L1/L2 and Pr1/Pr1 are optional inductors for the MRB. The best thing to do is to remove the original inductor from your old PCB and put it in here. See the special section on MRB inductors.
5. C34A is optional; put it in if you want to have more filtering.
6. R103 and C35 are the original +18V circuit. If you use them, leave out U1, D101, and R103A. If you want regulated +18V, leave out R103 and C35, and put in U1, D101, and R103A.
7. JP1 and JP2 select which kind of power transformer you have. If you use the original transformer, use JP2 and NOT JP1.
8. Fuse F1 and F2, and capacitors C101-C104 are optional. You may leave them out or put them in. If you leave out F1 and F2, replace them with a jumper wire.

Cambridge Reverb V1032 and Berkeley II V1082 Repair Board - Wiring



(Pots shown from back side, not shaft side)

Pacemaker V1021 and V1022

The V1021 is a lesser-populated version of the Cambridge Reverb: reverb is left out!

It is a similar combo cab with a single 10” speaker.

The BOM at right is sorted and arranged for ease of populating the PCB. It continues on the next page. Notice that the part numbers here refer to the part numbers on this PCB, not on the original Vox service schematics. It's possible to get yourself seriously confused trying go back to the original schematics and then use thes part numbers. Use these part numbers on this PCB. It's a difference in naming only, but humans are heavily dependent on naming!

My preference is to populate a PCB by height: that is, put the parts on the PCB in groups of all-matching-heights, lowest height group first. So in this case, I would first put all the wire jumpers on the PCB; then the ¼ W resitstors, which lie flat against the PCB; then the lowest-height capacitors, and so on.

In the parts list, notice that R55, R56, R57, and C36 are used only on the V1022 with an E-tuner. You can put them into the V1021 and they will do no harm, but serve no function.

R55 (E-tuner)	2.7R	1/4W LS 0.4”	¼ W film
R103A	68R	1/4W LS 0.4”	¼ W film
R8 R13 R38 R53A R53B R53C R53D	100R	1/4W LS 0.4”	¼ W film
R31	330R	1/4W LS 0.4”	¼ W film
R30	560R	1/4W LS 0.4”	¼ W film
R40	680R	1/4W LS 0.4”	¼ W film
R9 R27 R50 R51	1K	1/4W LS 0.4”	¼ W film
R10	1.5k	1/4W LS 0.4”	¼ W film
R42 R48 R49	2.2K	1/4W LS 0.4”	¼ W film
R28	3.9K	1/4W LS 0.4”	¼ W film
R56 (E-tuner)	4.7k	1/4W LS 0.4”	¼ W film
R29	6.8K	1/4W LS 0.4”	¼ W film
R41, R57(E-tuner)	18K	1/4W LS 0.4”	¼ W film
R7 R45	22K	1/4W LS 0.4”	¼ W film
R6	33K	1/4W LS 0.4”	¼ W film
R39	47K	1/4W LS 0.4”	¼ W film
R1 R2 R3	68K	1/4W LS 0.4”	¼ W film
R4 R5	100K	1/4W LS 0.4”	¼ W film
R46	150K	1/4W LS 0.4”	¼ W film
R26 R47	1M	1/4W LS 0.4”	¼ W film
R44	2.7M	1/4W LS 0.4”	¼ W film
R36 R37	0.33R	1W LS 0.6”	1W mtl oxide
R32 R34	3.3R 1W	1W LS 0.6”	1W mtl oxide
R33 R35	470 1W	1W LS 0.6”	1W mtl oxide
R103	680R 1W	1W LS 0.6”	1W mtl oxide
R52	100R 2W	2W LS 0.6”	2W mtl oxide
C2	18pF	0.2”/5mm	cap ceramic
C23	180pF	0.2”/5mm	cap ceramic
C10	1nF	0.2”/5mm	cap film
C27	1.2nF	0.2”/5mm	cap film
C6	5.6nF	0.2”/5mm	cap film
C8	6.8nF	0.2”/5mm	cap film
C21	33nF	0.2”/5mm	cap film
C7	68nF	0.2”/5mm	cap film
C1 C28	0.1uF	0.2”/5mm	cap film
C18	0.22uF	0.2”/5mm	cap film
C4	0.33uF	0.2”/5mm	cap film
C24 C25 C26	0.47uF	0.2”/5mm	cap film

Take special notice of the parts noted as “Optional”, and of the references to the text. If you have not already done that,go read ”Options, options, what to do with the options!” on page 3.

The Control Pots are mounted to the chassis, and are listed here just because they are listed as ordinary “Rxx” numbers in the factory service literature. You do not have to buy new ones and replace the existing pots unless you have tested them and found that they are defective. Likewise, Q8 and Q9 are the two output transistors on the chassis heat sink, and are listed just for completeness. Do not replace them unless you know they are defective.

Do NOT use jumper J1 unless you are replacing your original power transformer with a modern 24Vac replacement. Use J2 for the original power transformer.

Use the original toroidal transformer from your amplifier's original PCB for L1 and L2 unless they are open. This will save you some money over buying new wah inductors.

Pacemaker V1021 and 1022 (cont'd)

C9	1uF NP	LS 2mm/dia 5m	NP electro	
C19	4.7uF NP	LS 2mm/dia 5m	NP electro	
C5	2.2uF 25V	LS 2mm/dia 5m	Cap-electro	
C30	4.7uF 25V	LS 2mm/dia 5m	Cap-electro	
C3 C29	10uf 25V	LS 2mm/dia 5m	Cap-electro	
C36 (E-tuner)	22uF	LS 2mm/dia 5m	Cap-electro	
C20 C31	220uF 10V	LS 0.1” /dia 6m	Cap-electro	
C22 C34 C34A	470uF 35V	LS 0.2” / dia 10	Cap-electro	
C33	4700uF 35V	LS7.5/0.3” dia 1	Cap-electro	
SD1	1N4004	LS 0.4”	1A diode	
Q1 Q2 Q3 Q5 Q6				
Q10 Q11	2N5088	TO92W-123	EIA Style, base in middle	
Q4	KSC2073	TO220		
Q7	KSC2073	TO220		
U1	7818	TO220	18V regulator	Optional
JP2 * see text	JUMPER	LS 0.3” / 7.5mm	Jumper	
L1 L2 * see text	500mH	WAH INDUCTOR		
FWB1	3A/100V	FWB-3A	Diode Bridge	
C101 C102 C103				
C104	1nF	LS 0.2” / 5mm	cap ceramic	Optional
D101	1N4004	LS 0.4”	Diode	Optional
F1 F2	2A		Fuse	Optional
JP1 * see text	JUMPER	LS 0.3” / 7.5mm	Jumper	Optional

Original parts listed for reference

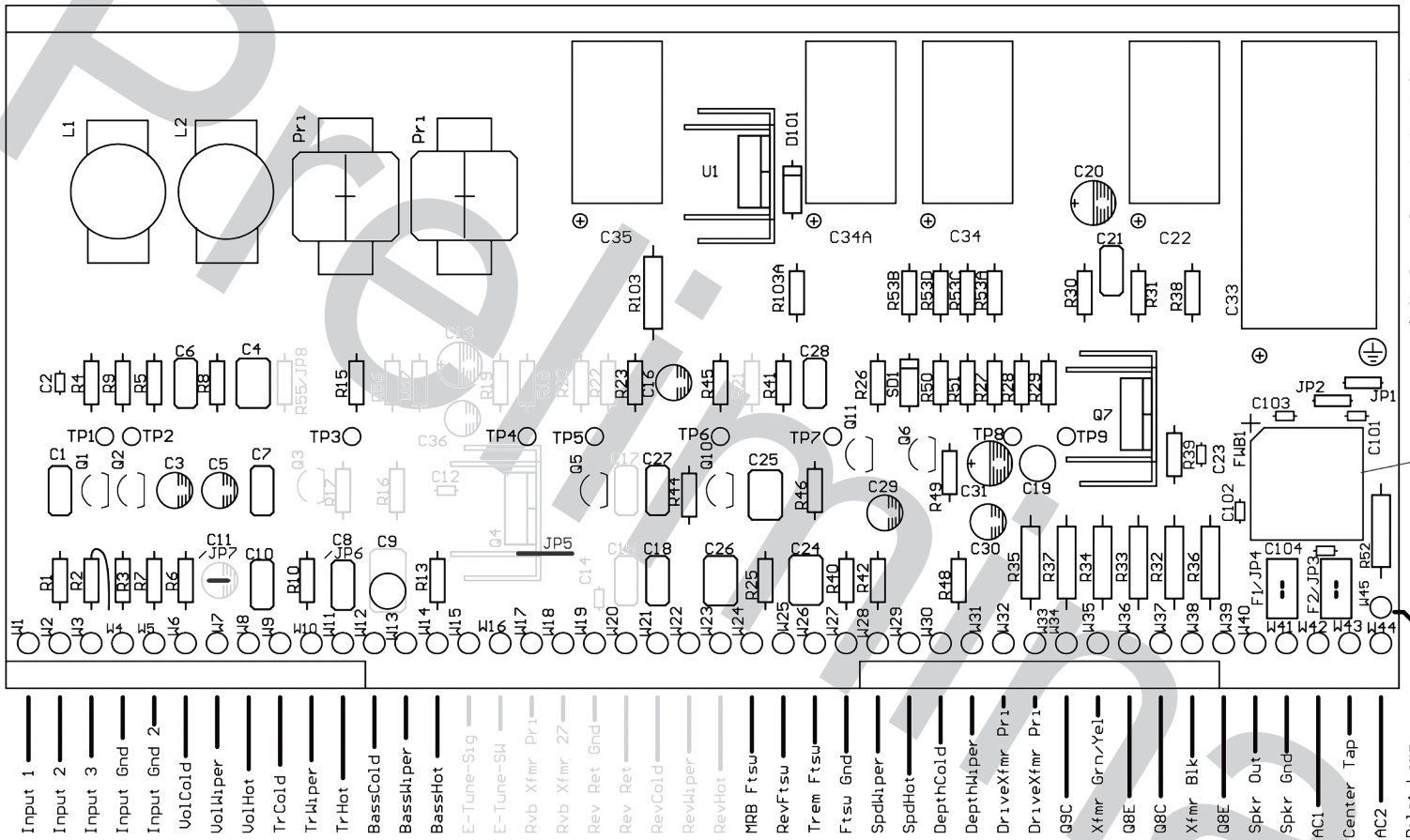
R11	B10K	Control pot – on chassis
R12	B10K	Control pot – on chassis
R14	A10K	Control pot – on chassis
R43	50K	Control pot – on chassis
Q8		Output transistor, on chassis
Q9		Output transistor, on chassis

R54 – NUMBER NOT USED

The next four pages contain the parts population diagrams and wiring diagrams. The first two are the V1021. The third and fourth are for the V1022, which add the E-tuner to the earlier model.

Pacemaker Repair Board - V1021

= Cambridge Reverb V1031 minus all of reverb; Volume wiper connects to old “reverb wiper” wire pad



Note: After soldering, glue down body on C33, 34, 34A, 35 with GE Silicone II or other non-corrosive curing RTV (”non-corrosive” = “doesn’t smell like vinegar”)

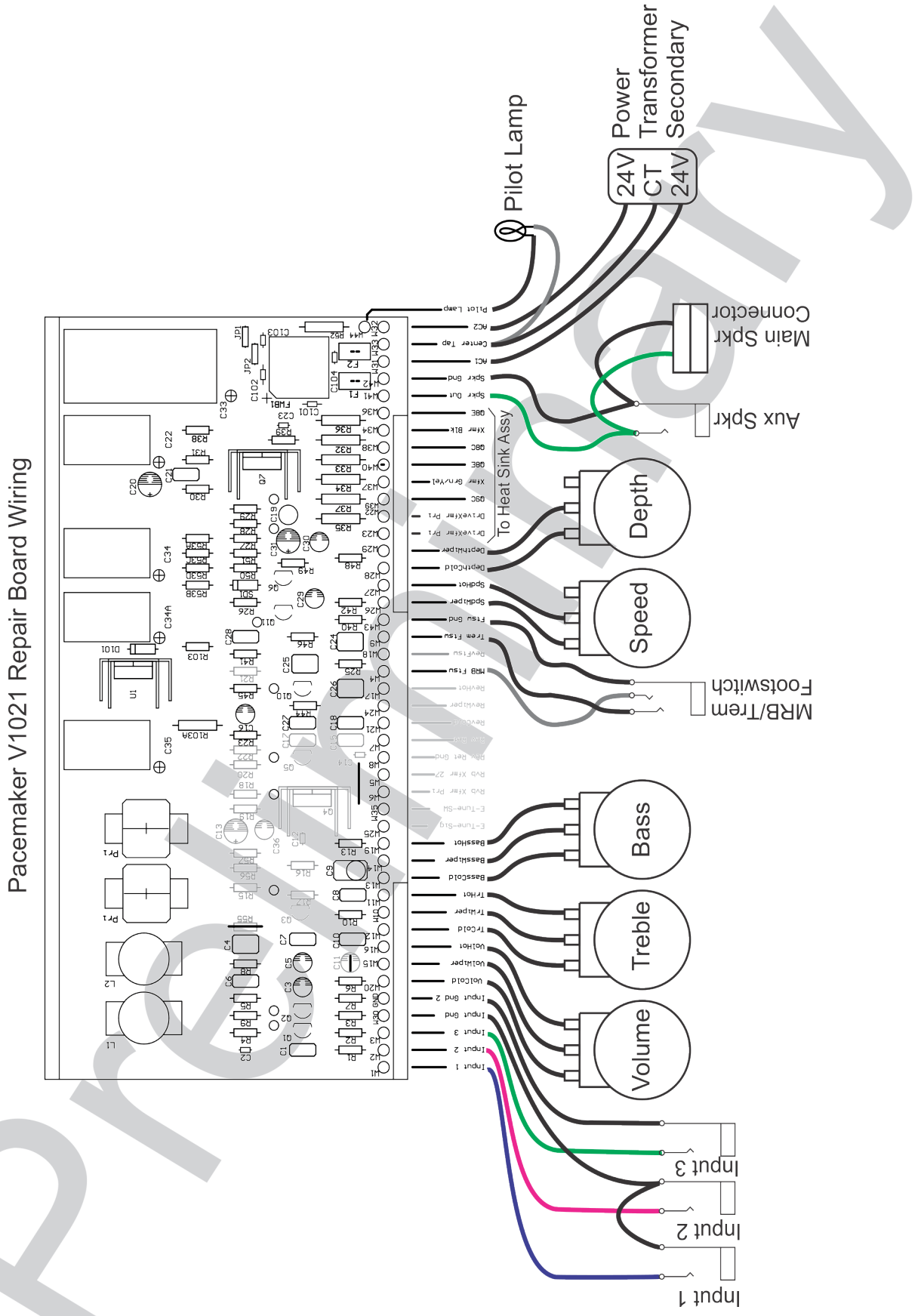
Use JP2 for original Transformer!

Full wave bridge rectifier, >100V, > 2A. Rectron BR32 is ideal, others in same package will work too.

Population Notes:

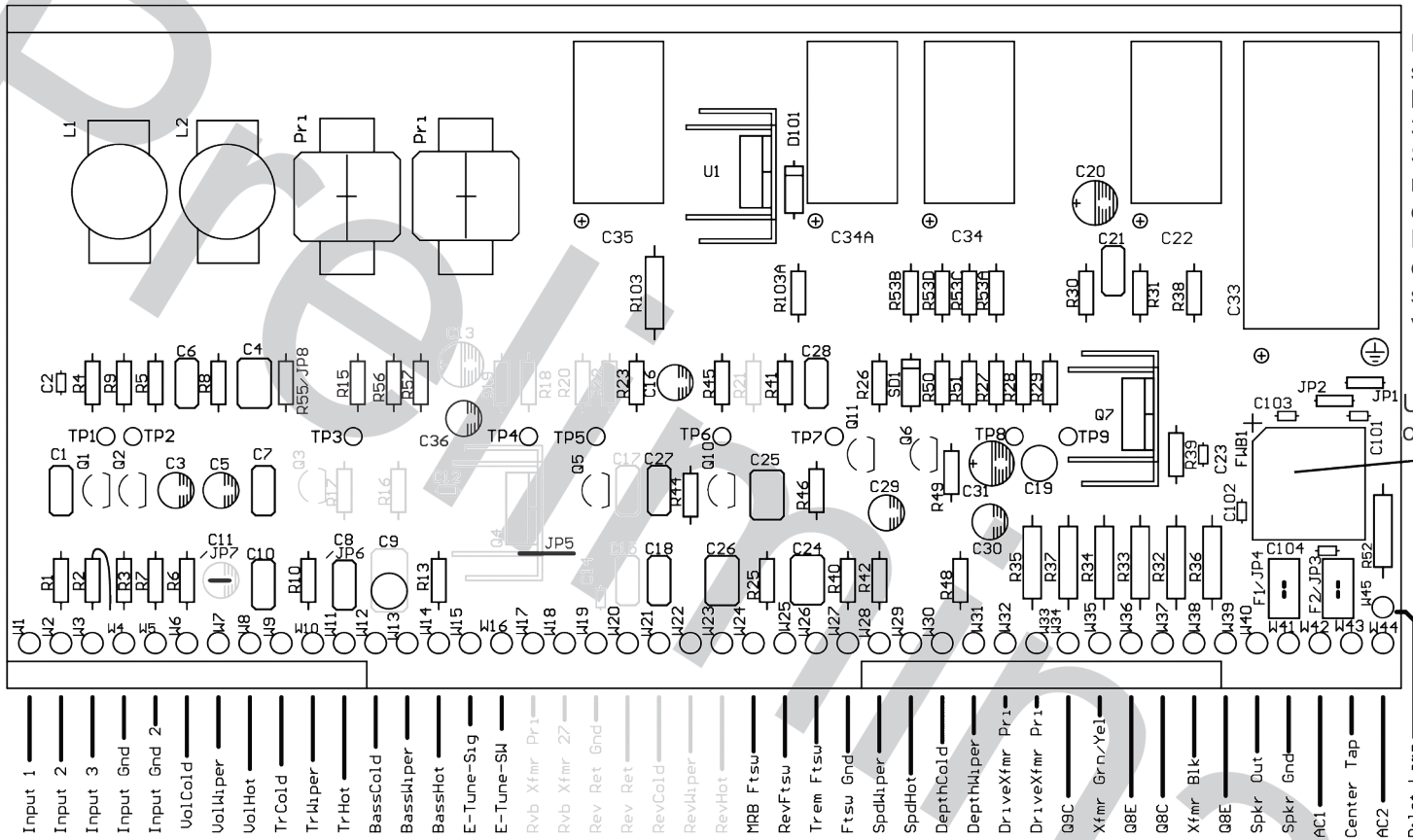
Check the BOM for your particular model!

1. R56, R57, C36 not used. R55 may be 2.7R or a jumper.
2. Q3, Q4, Q5, C12-C17, R15-R25 not used.
3. C11 not used; replace with jumper JP7.
4. JP5 *is* used.
5. C9 is 2uF NP.
6. Resistor R2 has top lead bent to alternate hole.
7. L1/L2 and Pr1/Pr1 are optional inductors for the MRB. The best thing to do is to remove the original inductor from your old PCB and put it in here. See the special section on MRB inductors.
8. C34A is optional; put it in if you want to have more filtering.
9. R103 and C35 are the original +18V circuit. If you use them, leave out U1, D101, and R103A. If you want regulated +18V, leave out R103 and C35, and put in U1, D101, and R103A.
10. JP1 and JP2 select which kind of power transformer you have. If you use the original transformer, use JP2 and NOT JP1.
11. Fuse F1 and F2, and capacitors C101-C104 are optional. You may leave them out or put them in. If you leave out F1 and F2, replace them with a jumper wire.



Pacemaker Repair Board - V1022, with E-tuner

= Cambridge Reverb V1032 minus all of reverb; Volume wiper connects to old “reverb wiper” wire pad



Note: After soldering, glue down body on C33, 34, 34A, 35 with GE Silicone II or other non-corrosive curing RTV (”non-corrosive” = “doesn’t smell like vinegar”)

Use JP2 for original Transformer!

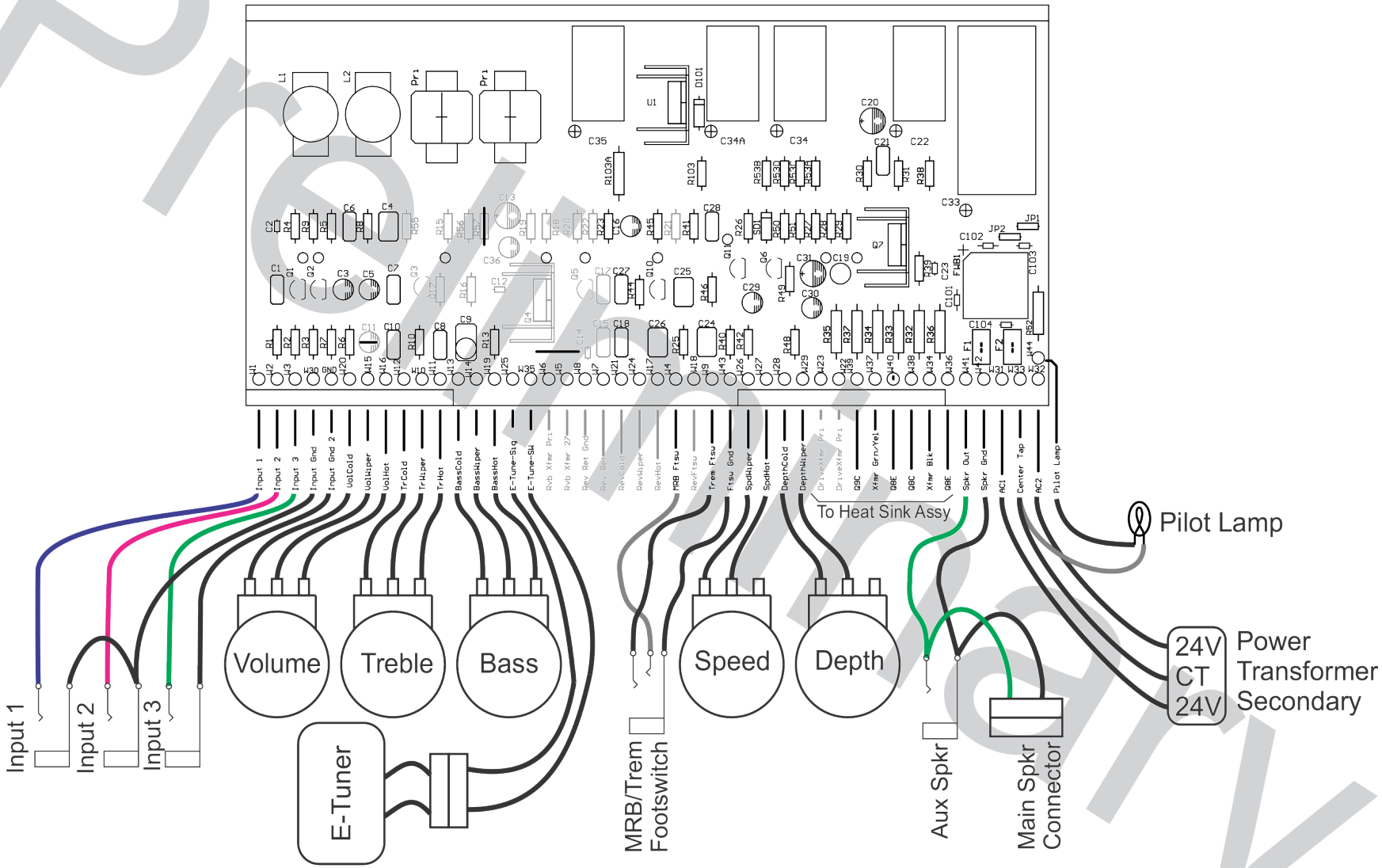
Full wave bridge rectifier, >100V, > 2A. Rectron BR32 is ideal, others in same package will work too.

Population Notes:

Check the BOM for your particular model!

1. R56, R57, C36 not used. R55 may be 2.7R or a jumper.
2. Q3, Q4, Q5, C12-C17, R15-R25 not used.
3. C11 not used; replace with jumper JP7.
4. JP5 *is* used.
5. C9 is 2uF NP.
6. Resistor R2 has top lead bent to alternate hole.
7. L1/L2 and Pr1/Pr1 are optional inductors for the MRB. The best thing to do is to remove the original inductor from your old PCB and put it in here. See the special section on MRB inductors.
8. C34A is optional; put it in if you want to have more filtering.
9. R103 and C35 are the original +18V circuit. If you use them, leave out U1, D101, and R103A. If you want regulated +18V, leave out R103 and C35, and put in U1, D101, and R103A.
10. JP1 and JP2 select which kind of power transformer you have. If you use the original transformer, use JP2 and NOT JP1.
11. Fuse F1 and F2, and capacitors C101-C104 are optional. You may leave them out or put them in. If you leave out F1 and F2, replace them with a jumper wire.

Pacemaker V1022 Repair Board Wiring



Pathfinder V1011

The V1011 is a lesser-populated version of the Pacemaker, as it leaves off MRB as wll as reverb. A few parts values are changed in the circuit, and only two inputs are available, which makes sense in what is definitely a single-user amplifier.

It is also a similar combo cab with a single 10” speaker.

The BOM at right is sorted and arranged for ease of populating the PCB. It continues on the next page. Notice that the part numbers here refer to the part numbers on this PCB, not on the original Vox service schematics. It's possible to get yourself seriously confused trying go back to the original schematics and then use thes part numbers. Use these part numbers on this PCB. It's a difference in naming only, but humans are heavily dependent on naming!

My preference is to populate a PCB by height: that is, put the parts on the PCB in groups of all-matching-heights, lowest height group first. So in this case, I would first put all the wire jumpers on the PCB; then the ¼ W resitstors, which lie flat against the PCB; then the lowest-height capacitors, and so on.

R103A R8 R13 R38 R53A R53B R53C R53D	100R	1/4W LS 0.4”	¼ W film
R31	330R	1/4W LS 0.4”	¼ W film
R30	560R	1/4W LS 0.4”	¼ W film
R40	680R	1/4W LS 0.4”	¼ W film
R9 R27 R51	1K	1/4W LS 0.4”	¼ W film
R10	1.5k	1/4W LS 0.4”	¼ W film
R50	1.8K	1/4W LS 0.4”	¼ W film
R42 R48 R49	2.2K	1/4W LS 0.4”	¼ W film
R28	3.9K	1/4W LS 0.4”	¼ W film
R29	6.8K	1/4W LS 0.4”	¼ W film
R41	18K	1/4W LS 0.4”	¼ W film
R7 R45	22K	1/4W LS 0.4”	¼ W film
R6	33K	1/4W LS 0.4”	¼ W film
R39	47K	1/4W LS 0.4”	¼ W film
R1 R2 R3	68K	1/4W LS 0.4”	¼ W film
R4 R5	100K	1/4W LS 0.4”	¼ W film
R46	150K	1/4W LS 0.4”	¼ W film
R26 R47	1M	1/4W LS 0.4”	¼ W film
R44	2.7M	1/4W LS 0.4”	¼ W film
R36 R37	0.33R	1W LS 0.6”	1W mtl oxide
R32 R34	3.3R 1W	1W LS 0.6”	1W mtl oxide
R33 R35	470 1W	1W LS 0.6”	1W mtl oxide
R103	680R 1W	1W LS 0.6”	1W mtl oxide
C2	18pF	0.2”/5mm	cap ceramic
C23	180pF	0.2”/5mm	cap ceramic
C10	1nF	0.2”/5mm	cap film
C27	1.2nF	0.2”/5mm	cap film
C6	5.6nF	0.2”/5mm	cap film
C8 replaced by JP6			
C21	33nF	0.2”/5mm	cap film
C7	3.9nF	0.2”/5mm	cap film
C1 C28	0.1uF	0.2”/5mm	cap film
C18	0.22uF	0.2”/5mm	cap film
C4	0.33uF	0.2”/5mm	cap film
C24 C25 C26	0.47uF	0.2”/5mm	cap film

Take special notice of the parts noted as “Optional”, and of the references to the text. If you have not already done that,go read ”Options, options, what to do with the options!” on page 3.

The Control Pots are mounted to the chassis, and are listed here just because they are listed as ordinary “Rxx” numbers in the factory service literature. You do not have to buy new ones and replace the existing pots unless you have tested them and found that they are defective. Likewise, Q8 and Q9 are the two output transistors on the chassis heat sink, and are listed just for completeness. Do not replace them unless you know they are defective.

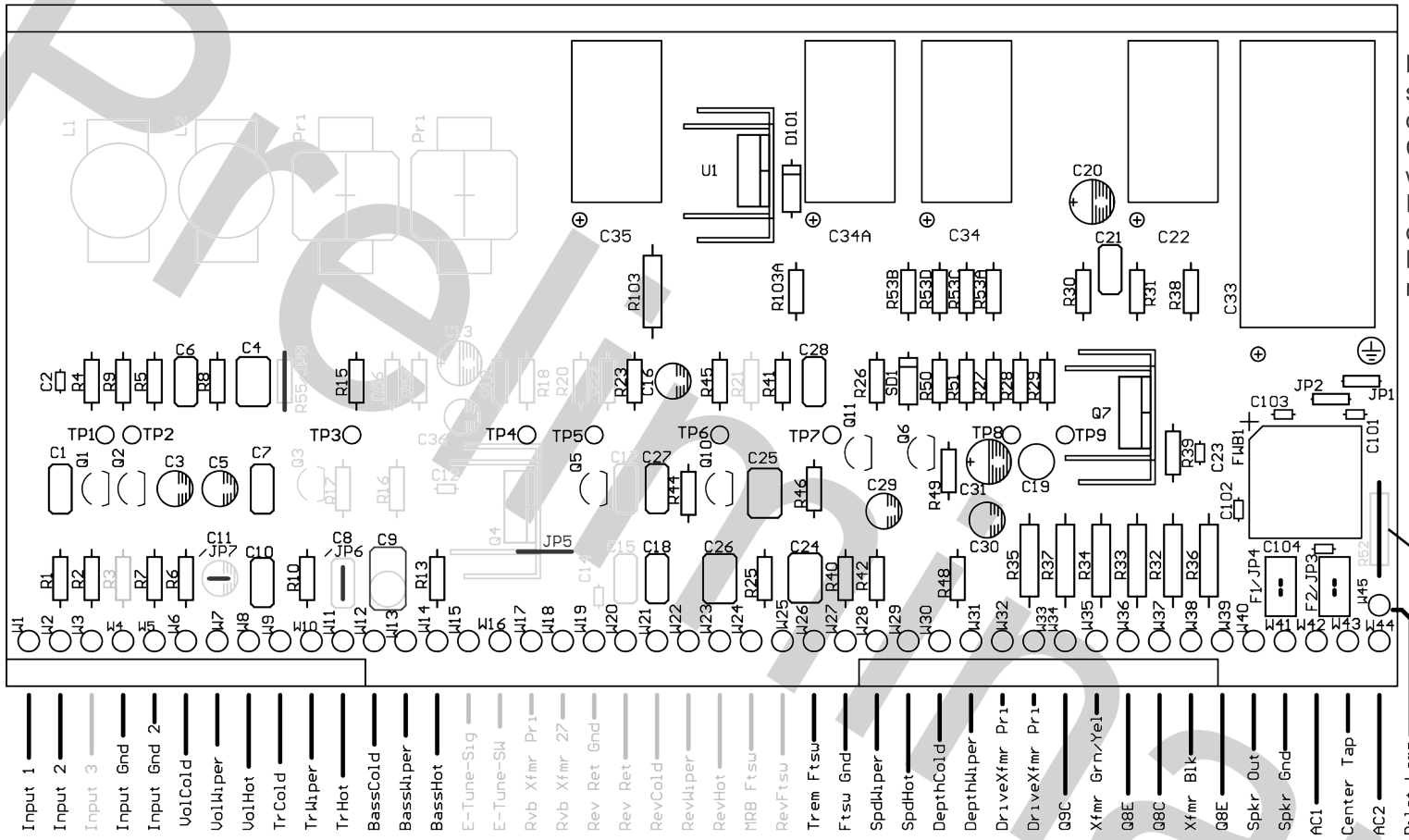
Do NOT use jumper J1 unless you are replacing your original power transformer with a modern 24Vac replacement. Use J2 for the original power transformer.

The next two pages contain the parts population diagrams and wiring diagrams.

Pathfinder V1011				
C9	270nF	LS 2.5mm/0.2”	cap film	
C19	4.7uF NP	LS 2mm/dia 5n	NP electro	
C5	2.2uF 25V	LS 2mm/dia 5n	Cap-electro	
C30	4.7uF 25V	LS 2mm/dia 5n	Cap-electro	
C3 C29	10uf 25V	LS 2mm/dia 5n	Cap-electro	
C36 (E-tuner)	22uF	LS 2mm/dia 5n	Cap-electro	
C20 C31	220uF 10V	LS 0.1” /dia 6m	Cap-electro	
C22 C34 C34A	470uF 35V	LS 0.2” / dia 10	Cap-electro	
C33	4700uF 35V	LS7.5/0.3” dia 1	Cap-electro	
SD1	1N4004	LS 0.4”	1A diode	
Q1 Q2 Q6 Q10 Q11	2N5088	TO92W-123	EIA Style, base in middle	
Q7	KSC2073	TO220		
U1	7818	TO220	18V regulator	Optional
JP2 * see text	JUMPER	LS 0.3” / 7.5mm	Jumper	
FWB1	3A/100V	FWB-3A	Diode Bridge	
C101 C102 C103				
C104	1nF	LS 0.2” / 5mm	cap ceramic	Optional
D101	1N4004	LS 0.4”	Diode	Optional
F1 F2	2A		Fuse	Optional
JP1 * see text	JUMPER	LS 0.3” / 7.5mm	Jumper	Optional
Original parts listed for reference				
R11	B10K	Control pot – on chassis		
R12	B10K	Control pot – on chassis		
R14	A10K	Control pot – on chassis		
R43	50K	Control pot – on chassis		
Q8		Output transistor, on chassis		
Q9		Output transistor, on chassis		
R54 – NUMBER NOT USED				

PathfinderV1011 Repair Board

= Pacemaker - inductors and MRB wiring, changed values in preamp tone stack, C8, R52 = jumper



Note: After soldering, glue down body on C33, 34, 34A, 35 with GE Silicone II or other non-corrosive curing RTV ("non-corrosive" =

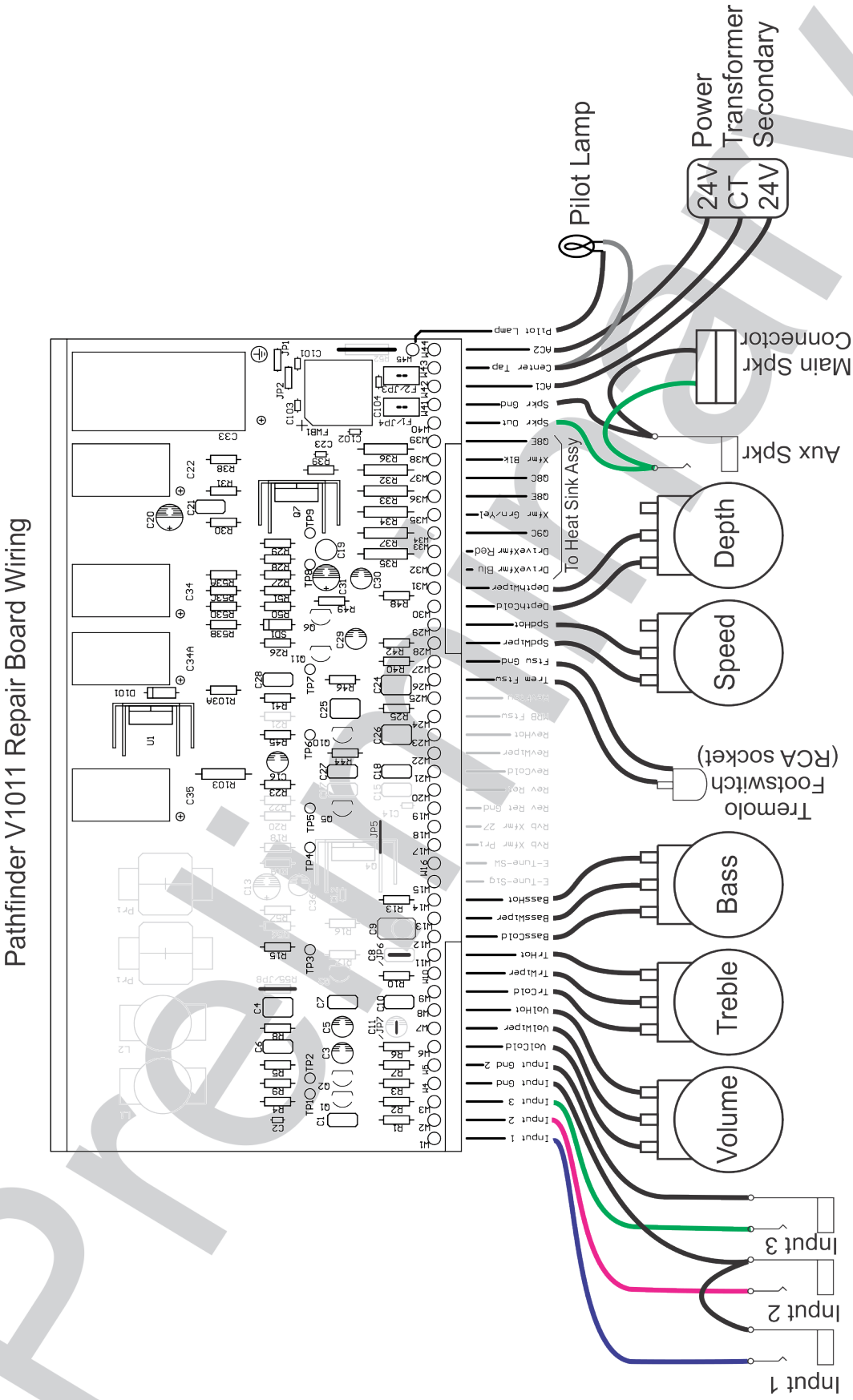
READ THE TEXT about JP2 and JP1

R52 replaced by jumper on V1011

Population Notes:

Check the BOM for your particular model!

1. R56, R57, C36 not used. R55 may be 2.7R or a jumper.
2. Q3, Q4, Q5, C12-C17, R3, R15-R25 not used.
3. C11 not used; replace with jumper JP7.
4. JP5 *is* used.
3. C9 is 2uF NP.
4. C8 replaced with jumper JP6.
5. R52 not used; replace with jumper.
6. L1/L2 and Pr1/Pr1 not used.
7. C34A is optional; put it in if you want to have more filtering.
8. R103 and C35 are the original +18V circuit. If you use them, leave out U1, D101, and R103A. If you want regulated +18V, leave out R103 and C35, and put in U1, D101, and R103A.
7. JP1 and JP2 select which kind of power transformer you have. If you use the original transformer, use JP2 and NOT JP1.
8. Fuse F1 and F2, and capacitors C101-C104 are optional. You may leave them out or put them in. If you leave out F1 and F2, replace them with a jumper wire.



Appendix A: Bill of Materials Cross Reference To Thomas Vox Numbers

✓	V1031 Cambridge/ V1081 Berkeley		V1021 Pacemaker		V1022 Pacemaker		V1011 Pathfinder		Build Notes
	Q8		Q5	=	Q5	=	Q5	=	
	Q9		Q6	=	Q6	=	Q6	=	
	Q10	2N5088	Q7	=	Q7	=	Q7	=	
	Q11	2N5088	Q8	=	Q8	=	Q8	=	
	R1	68K	R1	=	R1	=	R1	=	
	R2	68K	R2	=	R2	=	R2	=	
	R3	68K	R3	=	R3	=	-	-	
	R4	100K	R4	=	R4	=	R3	=	
	R5	100K	R5	=	R5	=	R4	=	
	R6	33K	R6	=	R6	=	R5	=	
	R7	22K	R7	=	R7	=	R6	=	
	R8	100R	R8	=	R8	=	R7	=	
	R9	1K	R9	=	R9	=	R8	=	
	R10	1.5k	R10	=	R10	=	R9	4.7K	
	R11	B10K	R11	=	R11	=	R10	=	
	R12	B10K	R12	=	R12	=	R11	=	
	R13	100R	R13	=	R13	=	R12	330R	
	R14	A10K	R14	=	R14	=	R13	=	
	R15	27K	-	-	-	-	-	-	
	R16	150R	-	-	-	-	-	-	
	R17	330K	-	-	-	-	-	-	
	R18	1.5K	-	-	-	-	-	-	
	R19	82R	-	-	-	-	-	-	
	R20	560K	-	-	-	-	-	-	
	R21	150K	-	-	-	-	-	-	
	R22	22K	-	-	-	-	-	-	
	R23	680R	-	-	-	-	-	-	
	R25	3.9K	-	-	-	-	-	-	
	R26	1M	R15	=	R15	=	R14	=	
	R27	1K	R16	=	R16	=	R15	=	
	R28	3.9K	R17	=	R17	=	R16	=	
	R29	6.8K	R18	=	R18	=	R17	=	
	R30	560R	R19	=	R19	=	R18	=	
	R31	330R	R20	=	R20	=	R19	=	
	R32	3.3R	R21	=	R21	=	R20	=	
	R33	470 1W	R22	=	R22	=	R21	=	
	R34	3.3R	R23	=	R23	=	R22	=	
	R35	470 1W	R24	=	R24	=	R23	=	
	R36	0.33R	R25	=	R25	=	R24	=	
	R37	0.33R	R26	=	R26	=	R25	=	
	R38	100R	R27	=	R27	=	R26	=	
	R39	47K	R28	=	R28	=	R27	=	
	R40	680R	R30	=	R30	=	R29	=	
	R41	18K	R29	=	R29	=	R28	=	
	R42	2.2K	R31	=	R31	=	R30	=	
	R43	50K	R32	=	R32	=	R31	=	
	R44	2.7M	R33	=	R33	=	R32	=	

✓	V1031 Cambridge/ V1081 Berkeley		Original V1021 Pacemaker		Original V1022 Pacemaker		Original V1011 Pathfinder		Build Notes
✓	P/N	Value	P/N	Value	P/N	Value	P/N	Value	
	C1	0.1uF	C1	=	C1	=	C1	=	
	C2	18pF	C2	=	C2	=	C2	=	
	C3	10uf 25v	C3	=	C3	=	C3	=	
	C4	0.33uF	C4	=	C4	=	C5	=	
	C5	2uF 25v	C5	=	C5	=	C6	=	
	C6	5.6nF	C6	=	C6	=	C4	=	
	C7	68nF	C7	=	C7	=	C7	3.9nF	
	C8	6.8nF	C8	=	C8	=	-	-	
	C9	1uF NP	C9	=	C9	=	C8	0.27uF	
	C10	1nF	C10	=	C10	=	C9	=	
	C11	2.2uF 25V	-	-	-	-	-	-	
	C12	270pF	-	-	-	-	-	-	
	C13	220uf 10v	-	-	-	-	-	-	
	C14	180pF	-	-	-	-	-	-	
	C15	47nF	-	-	-	-	-	-	
	C16	10uF 25V	-	-	-	-	-	-	
	C17	22nF	-	-	-	-	-	-	
	C18	0.22uF	C11	=	C11	=	C10	=	
	C19	4.7uF NP	C12	=	C12	=	C11	=	
	C20	220uF 10V	C13	=	C13	=	C12	=	
	C21	33nF	C14	=	C14	=	C13	=	
	C22	470uF 35V	C15	=	C15	=	C14	=	
	C23	180pF	C16	=	C16	=	C15	=	
	C24	0.47uF	C17	=	C17	=	C16	=	
	C25	0.47uF	C18	=	C18	=	C17	=	
	C26	0.47uF	C19	=	C19	=	C18	=	
	C27	1.2nF	C20	=	C20	=	C19	=	
	C28	0.1uF	C21	=	C21	=	C20	=	
	C29	10uF	C22	=	C22	=	C21	=	
	C30	4.7uF	C23	=	C23	=	C22	=	
	C31	220uF 10V	C24	=	C24	=	C23	=	
	C33	4700uF 35V	C26	2200uF	C26	2200uF	C25	2200uF	
	C34	470uF 35V	C27	=	C27	=	C26	470uF	
	C34A	470uF 35V	C28	=	C28	=	C27	470uF	
	C35	470uF 35V	-	-	-	-	-	-	
	C36	22uF	-	-	-	-	-	-	
	L1	500mH					L1	=	
	L2	500mH					L2	=	
	Q1	2N5088	Q1	=	Q1	=	Q1	=	
	Q2	2N5088	Q2	=	Q2	=	Q2	=	
	Q3	2N5088	-	-	-	-	-	-	
	Q4	KSC2073	-	-	-	-	-	-	
	Q5	2N5088	-	-	-	-	-	-	
	Q6	2N5088	Q3	=	Q3	=	Q3	=	
	Q7	KSC2073	Q4	=	Q4	=	Q4	=	

✓	V1031 Cambridge/ V1081 Berkeley		V1021 Pacemaker		V1022 Pacemaker		V1011 Pathfinder		Build Notes
	R45	22K	R34	=	R34	=	R33	=	
	R46	150K	R35	=	R35	=	R34	=	
	R47	1M	R36	=	R36	=	R35	=	
	R48	2.2K	R37	=	R37	=	R36	=	
	R49	2.2K	R38	=	R38	=	R37	=	
	R50	1K	R39	=	R39	=	R38	1.8K	
	R51	1K	R40	=	R40	=	R39	=	
	R52	100R 2W	R41	=	R41	=	-	-	
	R53A	100R	R42A	=	R42A	=	R40A	=	
	R53B	100R	R42B	=	R42B	=	R40B	=	
	R53C	100R	R42C	=	R42C	=	R40A	=	
	R53D	100R	R42D	=	R42D	=	R40B	=	
	R54		R43		R43				
	R55	2.7R	-	-	R48	=	-	-'	
	R56	4.7k	-	-	R46	=	-	-	
	R57	18K	-	-	R47	=	-	-	
	SD1	1N4004	SD1		SD1			=	
	U1	7818							
	C101	1nF	C101		C101		C101		
	C102	1nF	C102		C102		C102		
	C103	1nF	C103		C103		C103		
	C104	1nF	C104		C104		C104		
	F1	2A	F1		F1		F1		
	F2	2A	F2		F2		F2		
	D101	DIODE	D101		D101		D101		
	FWB1	3A/100V	FWB1		FWB1		FWB1		
	JP1	JUMPER	JP1		JP1		JP1		
	JP2	JUMPER	JP2		JP2		JP2		
	R103	680R 1W	-		-				
	R103A	68R	-		-				

Appendix B: Bill Of Materials with parts size per part number

PCB part number/value		Lead Spacing	Body/Size	Notes
P/N	Value			
C1	0.1uF	0.2”/5mm	Radial Box	
C2	18pF	0.2”/5mm	Radial Dipped	
C3	10uf 25v	0.08”/2mm	D x L = 5x11mm	
C4	0.33uF	0.2”/5mm	Radial Box	
C5	2uF 25v	0.08”/2mm	D x L = 5x11mm	
C6	5.6nF	0.2”/5mm	Radial Box	
C7	68nF	0.2”/5mm	Radial Box	Pathfinder 3.9nF
C8	6.8nF	0.2”/5mm	Radial Box	Jumper on V1011
C9	1uF NP	0.08”/2mm or 0.2”/5mm	D x L = 5x11mm	Pathfinder 270nF
C10	1nF	0.2”/5mm	Radial Box	
C11	2.2uF 25V	0.08”/2mm	D x L = 5x11mm	Only on Cambridge
C12	270pF	0.2”/5mm	Radial Dipped	Only on Cambridge
C13	220uf 10v	0.1”/2.54mm	D x L = 6x11mm	Only on Cambridge
C14	180pF	0.2”/5mm	Radial Dipped	Only on Cambridge
C15	47nF	0.2”/5mm	Radial Box	Only on Cambridge
C16	10uF 25V	0.08”/2mm	D x L = 5x11mm	Only on Cambridge
C17	22nF	0.2”/5mm	Radial Box	Only on Cambridge
C18	0.22uF	0.2”/5mm	Radial Box	
C19	4.7uF NP	0.08”/2mm	D x L = 5x11mm	
C20	220uF 10V	0.1”/2.54mm	D x L = 6x11mm	
C21	33nF	0.2”/5mm	Radial Box	
C22	470uF 35V	0.2”/5mm	D x L = 10x20mm	
C23	180pF	0.2”/5mm	Radial Dipped	
C24	0.47uF	0.2”/5mm	Radial Box	
C25	0.47uF	0.2”/5mm	Radial Box	
C26	0.47uF	0.2”/5mm	Radial Box	
C27	1.2nF	0.2”/5mm	Radial Box	
C28	0.1uF	0.2”/5mm	Radial Box	
C29	10uF	0.08”/2mm	D x L = 5x11mm	
C30	4.7uF	0.08”/2mm	D x L = 5x11mm	
C31	220uF 10V	0.1”/2.54mm	D x L = 6x11mm	
C33	4700uF 35V	0.3”/7.6mm	D x L = 18x38mm	4700uF OK for all
C34	470uF 35V	0.2”/5mm	D x L = 10x20mm	
C34A	470uF 35V	0.2”/5mm	D x L = 10x20mm	Optional, recommended
C35	470uF 35V	0.2”/5mm	D x L = 10x20mm	Only on Cambridge
C36	22uF	0.08”/2mm	D x L = 5x11mm	Only on Cambridge
L1	500mH		WAH INDUCTOR	Not on V1011
L2	500mH		WAH INDUCTOR	Not on V1011
Q1	2N5088	0.1”/2.54mm inline	Std TO-92	
Q2	2N5088	0.1”/2.54mm inline	Std TO-92	
Q3	2N5088	0.1”/2.54mm inline	Std TO-92	Only on Cambridge
Q4	KSC2073	0.1”/2.54mm inline	Std TO-220	Only on Cambridge
Q5	2N5088	0.1”/2.54mm inline	Std TO-92	Only on Cambridge
Q6	2N5088	0.1”/2.54mm inline	Std TO-92	
Q7	KSC2073	0.1”/2.54mm inline	Std TO-220	

PCB part number/value		Lead Spacing	Body/Size	Notes
Q8			TO-3	On chassis heatsink
Q9			TO-3	On chassis heatsink
Pcb heat sink		Wakefield 274-1AB (3 ea)		Attach to Q4, Q7, U1
P/N	Value			
Q10	2N5088	0.1”/2.54mm inline	Std TO-92	
Q11	2N5088	0.1”/2.54mm inline	Std TO-92	
R1	68K	0.4”/10.1mm	Std 1/4W	
R2	68K	0.4”/10.1mm	Std 1/4W	
R3	68K	0.4”/10.1mm	Std 1/4W	
R4	100K	0.4”/10.1mm	Std 1/4W	
R5	100K	0.4”/10.1mm	Std 1/4W	
R6	33K	0.4”/10.1mm	Std 1/4W	
R7	22K	0.4”/10.1mm	Std 1/4W	
R8	100R	0.4”/10.1mm	Std 1/4W	
R9	1K	0.4”/10.1mm	Std 1/4W	
R10	1.5k	0.4”/10.1mm	Std 1/4W	
R13	100R	0.4”/10.1mm	Std 1/4W	
R15	27K	0.4”/10.1mm	Std 1/4W	Only on Cambridge
R16	150R	0.4”/10.1mm	Std 1/4W	Only on Cambridge
R17	330K	0.4”/10.1mm	Std 1/4W	Only on Cambridge
R18	1.5K	0.4”/10.1mm	Std 1/4W	Only on Cambridge
R19	82R	0.4”/10.1mm	Std 1/4W	Only on Cambridge
R20	560K	0.4”/10.1mm	Std 1/4W	Only on Cambridge
R21	150K	0.4”/10.1mm	Std 1/4W	Only on Cambridge
R22	22K	0.4”/10.1mm	Std 1/4W	Only on Cambridge
R23	680R	0.4”/10.1mm	Std 1/4W	Only on Cambridge
R25	3.9K	0.4”/10.1mm	Std 1/4W	Only on Cambridge
R26	1M	0.4”/10.1mm	Std 1/4W	
R27	1K	0.4”/10.1mm	Std 1/4W	
R28	3.9K	0.4”/10.1mm	Std 1/4W	
R29	6.8K	0.4”/10.1mm	Std 1/4W	
R30	560R	0.4”/10.1mm	Std 1/4W	
R31	330R	0.4”/10.1mm	Std 1/4W	
R32	3.3R	0.6” 15.2mm	Std 2W Mtl Ox	
R33	470 1W	0.6” 15.2mm	Std 2W Mtl Ox	
R34	3.3R	0.6” 15.2mm	Std 2W Mtl Ox	
R35	470 1W	0.6” 15.2mm	Std 2W Mtl Ox	
R36	0.33R	0.6” 15.2mm	Std 2W Mtl Ox	
R37	0.33R	0.6” 15.2mm	Std 2W Mtl Ox	
R38	100R	0.4”/10.1mm	Std 1/4W	
R39	47K	0.4”/10.1mm	Std 1/4W	
R40	680R	0.4”/10.1mm	Std 1/4W	
R41	18K	0.4”/10.1mm	Std 1/4W	
R42	2.2K	0.4”/10.1mm	Std 1/4W	
R43	50K	0.4”/10.1mm	Std 2W Mtl Ox	
R44	2.7M	0.4”/10.1mm	Std 1/4W	
R45	22K	0.4”/10.1mm	Std 1/4W	

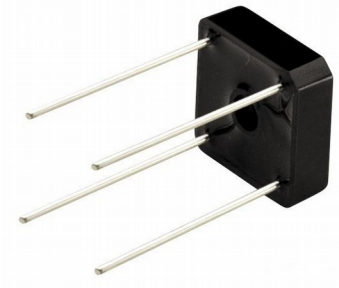
PCB part number/value		Lead Spacing	Body/Size	Notes
R46	150K	0.4”/10.1mm	Std 1/4W	
R48	2.2K	0.4”/10.1mm	Std 1/4W	
R49	2.2K	0.4”/10.1mm	Std 1/4W	
R50	1K	0.4”/10.1mm	Std 1/4W	Pathfinder 1.8K
P/N	Value			
R51	1K	0.4”/10.1mm	Std 1/4W	
R52	100R2w	0.6” 15.2mm	Std 2W Mtl Ox	Not on V1011
R53A	100R	0.4”/10.1mm	Std 1/4W	
R53B	100R	0.4”/10.1mm	Std 1/4W	
R53C	100R	0.4”/10.1mm	Std 1/4W	
R53D	100R	0.4”/10.1mm	Std 1/4W	
R55	JUMPER	0.4”/10.1mm	Std 1/4W	2.7R on V1022
R56	-	0.4”/10.1mm	Std 1/4W	Only on V1022
R57	-	0.4”/10.1mm	Std 1/4W	Only on V1022
SD1	1N4004	0.4”/10.1mm	Std DO-41	
U1	7818	0.1”/2.54mm inline	Std TO-220	voltage regulator option
C101	1nF	0.2”/5mm	Radial Dipped	Optional
C102	1nF	0.2”/5mm	Radial Dipped	Optional
C103	1nF	0.2”/5mm	Radial Dipped	Optional
C104	1nF	0.2”/5mm	Radial Dipped	Optional
F1	2A	0.2”/5mm	Radial Box	Optional
F2	2A	0.2”/5mm	Radial Box	Optional
D101	DIODE	0.4”/10.1mm	Std DO-41	Use with U1 Vreg
FWB1	3A/100V		Integrated Bridge	Optional
JP1	JUMPER	0.3”/7.6mm	Wire	Optional
JP2	JUMPER	0.3”/7.6mm	Wire	Optional
R103A	68R	0.4”/10.1mm	Std 1/4W	Use with U1 Vreg
R103	680R	0.6” 15.2mm	Std 2W Mtl Ox	When U1 not used
JP3	JUMPER	0.2”/5mm	Wire	Alt for F1
JP4	JUMPER	0.2”/5mm	Wire	Alt for F2

Notes on Parts

Use U1, D101, and R103A if you want regulated preamp power. If you want to go original, leave them off but put in R103 (680R 1W).

Fuses F1 and F2 are optional. They protect the transformer secondary, and cost about $0.50 each. If you leave them off, put jumpers J3 and JP4 in their place. The PCB placement is sized for the Bussman/Eaton SS-5H-2.5A-APH, which is a 2.5A/300V fuse. Mouser Electronics has these for $0.44 each at the time of this writing. There are other companies which make equivalent parts.

Capacitors C101-104 are optional, but the amp may have less hum if you put them in.



An integrated full wave bridge rectifier is a tidy way to do the power rectification in a small space, and is designed for the job. You CAN use diodes instead of the integrated full wave bridge, but you won't save much money. See the population diagrams on page 13 of the drawings for how to do this.

There are several makers of diode bridges that fit this same position. Two examples are the Rectron BR-3 and BR-6 packages, and the Vishay GBPC1. The body is 0.620” square and the pins are in a rectangle, 0.425” nominal on each side. Get 200V or more and 3A or 6A current rating.

If you use your original power transformer, put in jumper J2. If you must replace it, ut is much easier to find a 24V/1-2 A transformer that's about the same physical size and use it. If you do this, put in jumper JP1. This connects up the negative side of the bridge rectifier and makes the 24V transformer work. Do NOT put in both JP1 and JP2 under any circumstances.

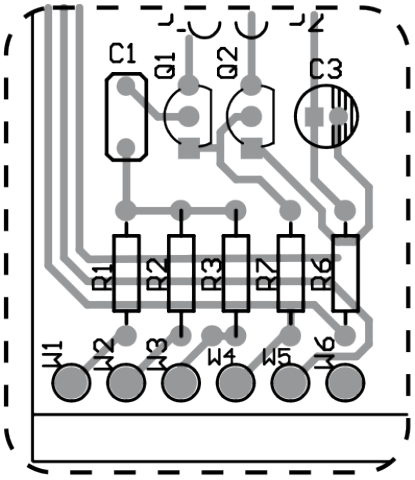
Jumpers JP5 through JP8 are used for customizing across model numbers.

Resistors R14, R12, R11, R24, R43, and R47 are the Thomas Organ designators for the control pots on the chassis front panel. They are included here for completeness. In most cases, these will be fine in an amp you're repairing, and will not need to be changed with the PCB.

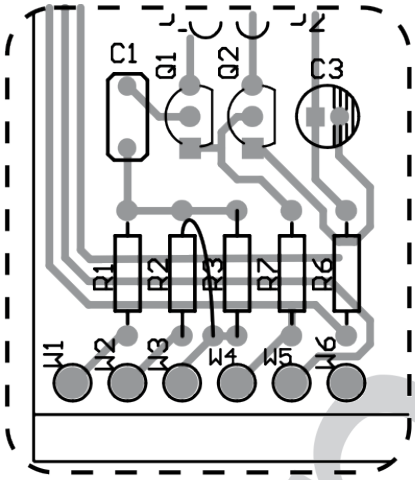
Capacitors C33, C34, C34A, C35, and C23 where used are radial-style electrolytic caps used lying down on their side. Ideally, they would have been axial lead capacitors, but one of the quirks of modern electronic manufacturing is that axial-style caps are very expensive for the same capacitance and voltage as a radial lead capacitor. So I did what the big boys do and specified radial-style capacitors, but lying down. This leaves the cap vulnerable to vibrations unless the body is held down some way, so again I took a note from the pros, and I recommend that you put a dab of silicon rubber compound under the non-lead end of these capacitors to make them more mechanically stable. At one time, you could only get “RTV” compound that smelled strongly of vinegar – that is, acetic acid. That's been fixed, and you can get one of a number of non-acetic-acid curing types. GE “Silicone II” is one of these. If it smells of vinegar, do not use it. It will corrode your circuit board eventually.

Appendix C: Optional Population Diagrams

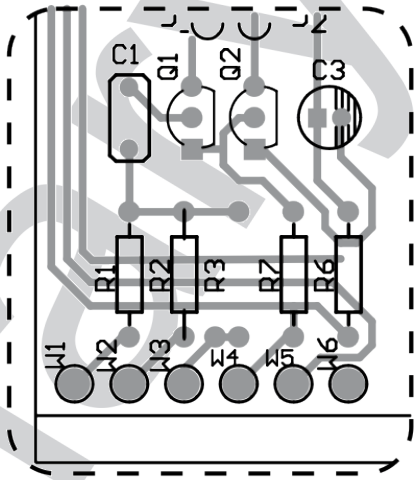
Here are some pictures of how to do the various options on population.



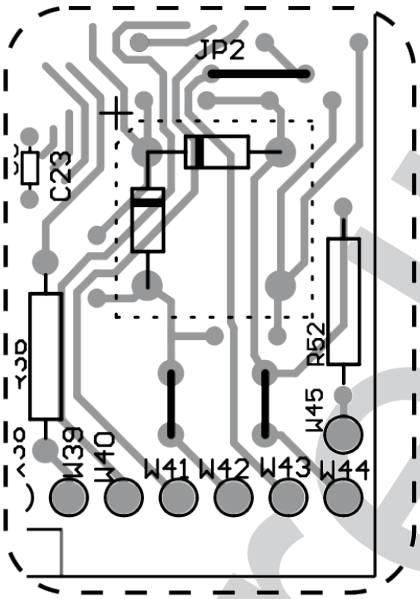
R2, R3 in V1031, V1081, V1032, V1082



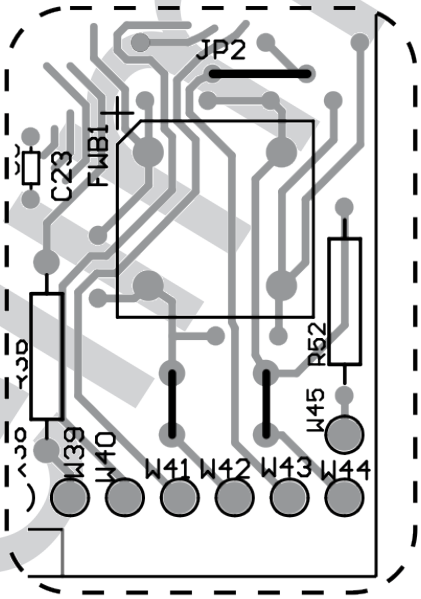
R2, R3 in V1021, V1022



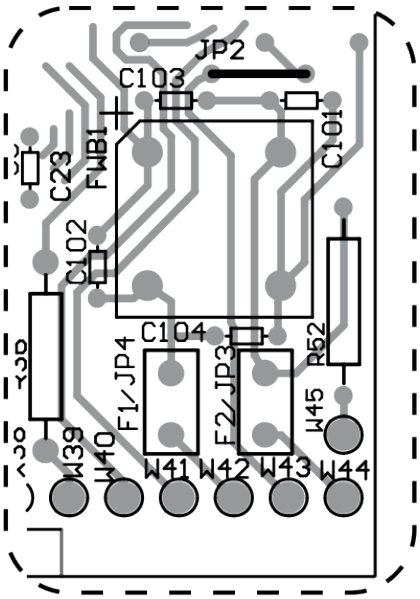
R2 in V1011; R3 is not used.



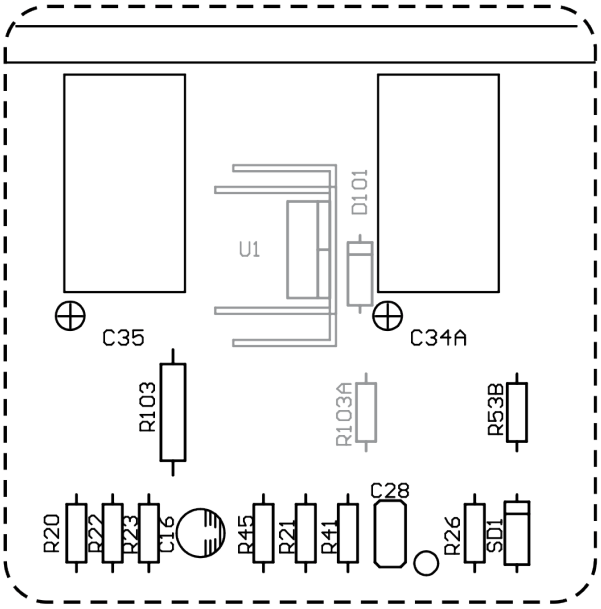
Original Power Supply no fuses, original xfmr, two diodes instead of bridge rectifier.



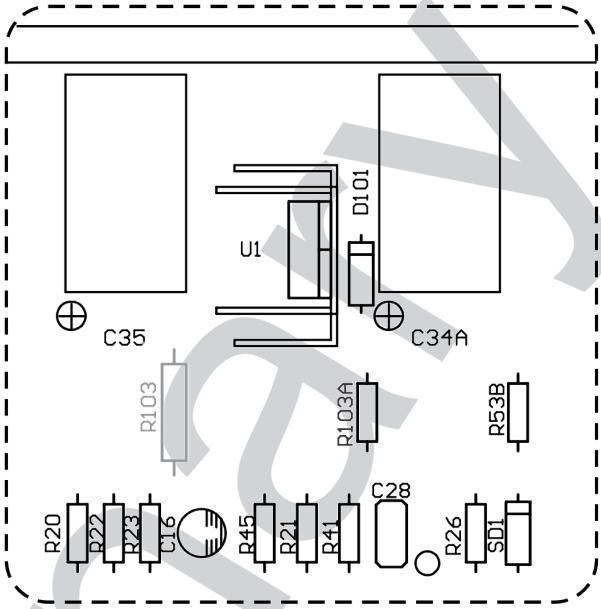
Original Power Supply no fuses, original xfmr, with Bridge Rectifier



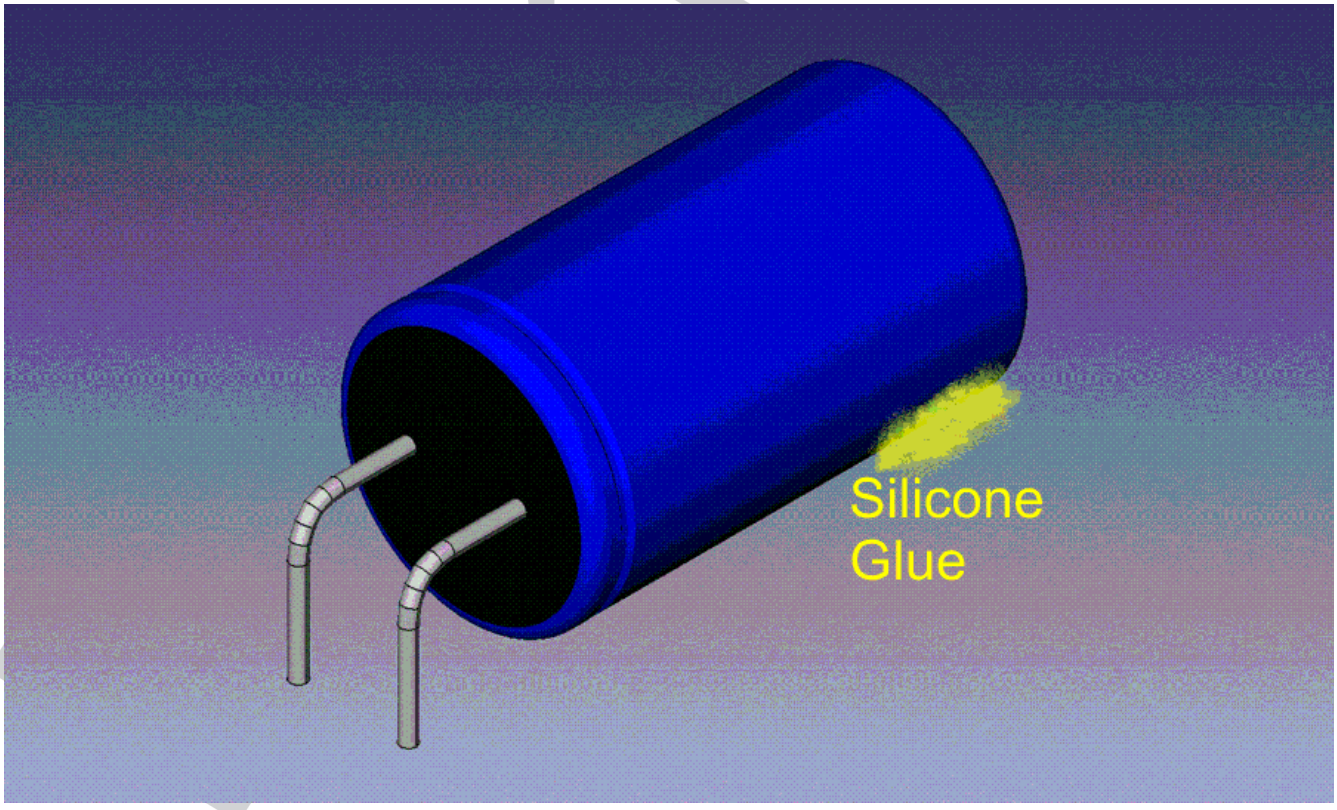
Power supply with fuses and snubbing capacitors



Population diagram for original un-regulated 17V/18V supply



Population diagram for regulated 17V/18V supply



Heat Sink Assembly Wiring