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Subject: PC-900

Posted by [cassent5150](#) on Wed, 08 Feb 2012 01:52:21 GMT

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Got a real brain teaser here. I cant get rid of the + voltage at output. I get 11 to 13 volts positive. I'm good at Q902 (2n4249) and everthing goes cowshit after that. It seems positive around everything to the Q907 (2N3638). I replaced every cap and noted direction to the schematic and double checked them to a good working boart in my K100. I replaced every transistor twice. All the diodes seem to work fine and still cant get rid of the darn + voltage. Anyone have ideas before I start pulling every one of the resistors and checkeing them? I'm pretty flustered with it for now so I'll sleep on it and see what I can try from the feed back. Oh by the way I thought I'd mention that I have nearly 8 volts either way coming from the regulators so they seem to be working fair. I'd like to see 10 on them myself with no load like this. Steve C

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Subject: Re: PC-900

Posted by [cassent5150](#) on Wed, 08 Feb 2012 02:04:18 GMT

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I thought I'd also mention how its acting or performing. It has a definite hum at power up for a couple seconds then fades but still audible and Q904 (38736) and the 1 Ohm 5W resistor are heating up and its ajoined output transistor Q-1 gets hot quick. If someone has a schematic in front of them I should be seeing + 1.2 volts at the base of Q904 and its registers + 12. Also, I had the pre amps connected at first and played a guitar through it and it sounded pretty fair other than a slight hum and lifted the chassis to see how the outputs were doing and thats when I noticed the one output transistor was HOT!!!. It was back to the drawing board from there if you know what I mean!!! Steve C

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Subject: Re: PC-900

Posted by [chicagobill](#) on Wed, 08 Feb 2012 03:46:45 GMT

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If you have 12 volts at the base of the driver, I'd guess that's why there is 12 volts on the output.

I would suggest leaving the speaker disconnected until you fix the problem, or you risk burning out the voice coils. You also risk doing more damage to the rest of the circuit as well.

What is the voltage at the other end of the bias diode string?

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Subject: Re: PC-900

Posted by [cassent5150](#) on Wed, 08 Feb 2012 18:44:58 GMT

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goes in a + 12.9 and out at + 11.1. Yes your right about the speaker. I dont use it for the most part in diagnostic work, but I've been known to give a little on and off test with a speaker just to see if a

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signal is passing through. Steve C

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Subject: Re: PC-900

Posted by [stevem](#) on Thu, 09 Feb 2012 11:13:47 GMT

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Check that you have no bridged solder connections on the driver board!

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Subject: Re: PC-900

Posted by [cassent5150](#) on Thu, 09 Feb 2012 21:39:54 GMT

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I started to do that last night and I'll try to get back on it again tonight. The board is in pretty good shape compared to some I get with these BIG GLOBS of solder and burned up board around the solder traces where I think some tried to use a propane torch to solder with, you probably see that yourself sometimes. I got those figures above on the Diode string and typed the info on the computer and left the darn amp powered up. When I went back and noticed it, I checked the speaker output . It was +40 friggin volts!!! I got all - volts around the drivers and I get continuity from emitter to collector on both so its back to the drawing board after I replace them and check all the caps, diodes and all the other transistors to see what else I screwed up. I'm having fun now, you got to love electronics!!!

Steve C

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Subject: Re: PC-900

Posted by [chicagobill](#) on Thu, 09 Feb 2012 22:41:44 GMT

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Do you have a light bulb limiter? It might help you until you find the problem.

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Subject: Re: PC-900

Posted by [cassent5150](#) on Fri, 10 Feb 2012 06:10:37 GMT

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No, but it sounds like something I can make and use. Are we talking like putting a bulb in the supply line to the board? I guess what I need to know is can I make one and how is it used? I dont know all the tricks to the trade but that could be another tool like that guitar cord signal tracer stevem showed me how to make to trace the signal through the board which has proved valuable to me. Thanks guys as always ya'll are wonderful to help out.

Steve C

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Subject: Re: PC-900

Posted by [chicagobill](#) on Fri, 10 Feb 2012 17:38:31 GMT

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The light bulb limiter that I'm talking about is just a 60-100 watt light bulb wired in series with the ac line. They are sometimes called fuse savers.

If the amp that you are working on has a problem and draws too much current, the light bulb turns on and limits the amount of current that is available to the amp. They aren't perfect, but in many cases, they will save your new parts when you have missed something on a power amp rebuild.

Try Google-ing Light bulb current limiter. I'll bet that there are quite a few sites that give construction details.

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Subject: Re: PC-900

Posted by [cassent5150](#) on Fri, 10 Feb 2012 20:37:42 GMT

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Great !! I look into it.

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Subject: Re: PC-900

Posted by [cassent5150](#) on Thu, 16 Feb 2012 22:50:55 GMT

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OK, heres the deal. I cannot get rid of the + voltage in the output period!!!!!! I've checked all the traces, resoldered every resistor, checked every diode replaced all the transistors again and did a full cap job, double checked the polarity of the caps. I still have the same results +37 volts in the output. I have +37 volts all around Q904 and Q905 has +37 volts at base and emitter while the collector is -41 V. I give up I am at my wits end with this confounded piece of crap. Will any of you be willing to take a look at it if I mailed you the board? Steve C

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Subject: Re: PC-900

Posted by [stevem](#) on Fri, 17 Feb 2012 11:34:50 GMT

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I will look at it for you if need be, but first let me look at a schematic over the weekend and come up with something more for you to check.

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Subject: Re: PC-900

Posted by [cassent5150](#) on Fri, 17 Feb 2012 16:04:10 GMT

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Thanks stevem, I did some diagnostics this morning after I cooled down from last night and regulators are working fine at 8 volts each way. Coming from the preamp inputs we're looking good at Q901 and at Q902 it all goes cowshit. The emitter and collector are good, but the base is +37.

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Subject: Re: PC-900

Posted by [chicagobill](#) on Fri, 17 Feb 2012 16:52:23 GMT

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If you don't mind telling us, please start the history at the beginning. What was wrong with the amp when you started working on it? What have you done so far to get it to where it's at?

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Subject: Re: PC-900

Posted by [cassent5150](#) on Sat, 18 Feb 2012 01:42:53 GMT

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It all started with an EBay purchase I had made for a K100C-8 Chassis "Not Working as is for parts or repair". I received and upon evaluation I noticed the fuse had been blown. I unhooked the output board power sources + and -. I replaced the fuse and fired it up to check voltages and could hear sizzling and then "POP!!!", burnt the fuse. One of the power filter caps was warm so I unhooked them from the rectifier, replaced the fuse and fired it up again and all was well with AC and DC voltages "SPOT ON THE MONEY". I replaced the two power filter caps and hooked them back to the rectifier and all was well with the voltages. I didn't have the 2500uf caps so I used what I had which were 6000 uf 100 volt which is the same as my test station I built for working on these and have yet to have a problem with either PC900 or 703 or 5065. I then unhooked the preamps from the driver board and hooked the supply wires + and - back to the Caps. Upon power up I had my meter clipped to the speaker output tab to see if I had any DC voltage. A quick on and off gave me my answer (+39). I pulled the driver board out and started checking transistors and caps as well as the diodes. I checked the diodes first and all seemed to block one way and allow the other with resistance. Then I tested the transistors starting with the outputs and found Q1 shorted, Both drivers Q904 and 905 open, The rest seemed fine. Then I tested the caps and found C908 shorted as well as C912. I recapped the entire board and replaced the bad transistors and hooked it up in my test station and it had plus voltage in the outputs and Q1 got hot "QUICK!!!" as well as its driver Q904. I thought maybe a bad ceramic cap was bad so I replaced those with no help. I got some Figures to post on the the questions above and as I stated I forgot to turn the darn thing off and it popped Q1 and both drivers. I replaced all the transistors from the preamp inputs forward as well as both outputs and checked the caps and diodes again and all tested good, but still 37 to 39 + volts in the outputs. I took a spare working board I have for a pattern and followed all the traces and no bridging going on that I could see so I resoldered every resistor from the regulator section forward powered it up and did some voltage testing and while I was testing popped the Q1 and its driver again. We're talking less than a minute of testing and results were the same + 39 in the speaker output as well as all around Q904 and 905 with the exception of the collector on 905 being -38.5. There you have it, any ideas? Steve C

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Subject: Re: PC-900

Posted by [chicagobill](#) on Mon, 20 Feb 2012 21:50:43 GMT

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Well the good news is that you are at least back to where the amp was in the first place, blowing out the drivers and one output transistor. Well actually you're better off, because you've replaced the bad filter caps.

When you got the amp, did it look like someone had been working on it before? You've seen enough of these amps to know what the original factory wiring looks like, so you should be able to tell if it had been messed with by somebody.

And now that you have changed a bunch of parts you will need to first double check all of the stuff that you did just to be sure that you didn't accidentally install a wrong part or a part with the wrong pin placement, polarity, etc.

You should also check to see that in addition to not having any solder bridges that there are no broken pc traces.

Double check the bias diode string to be sure that all three diodes are ok and that they all are connected between the bases of the driver transistors. Be especially careful to check the diode that mounts to the heatsink. The leads on those diodes are very easily broken and can also crack their solder joints as well.

The fact that you have positive voltages all over the place means that either the positive side of the circuit is not being controlled or that the negative side is not being turned on. Check the voltages around Q906, Q905 and Q2.

You said that you resoldered all of the resistors, did you check them all to see if they read somewhat close to their marked values?

There isn't all that much to these power amps, so just take your time and check everything and you should be able to solve it.

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Subject: Re: PC-900

Posted by [cassent5150](#) on Tue, 21 Feb 2012 03:22:50 GMT

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Thanks, I took a break from it at the moment to explore the theory of running a 2 ohm load with these output boards by playing with the emitter resistor and output transistors. I'll give it another go and take my time part for part with the schematic. It has been worked on by someone before and maybe they put something in there wrong and couldn't figure it out themselves so that's why I wound up with it. Thanks Again. Steve C

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Subject: Re: PC-900

Posted by [stevem](#) on Tue, 21 Feb 2012 12:23:25 GMT

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As far as a 2 ohm load goes another part needs to be up rated/changed also if you want the amp have its normal level of dynamics and punch.

This part is the power transformer!

When you halve the load impedance and double pretty much the amps wattage, the needed current to make that wattage must come from somewhere and this somewhere is the power transformer.

On amps designed to handle a constant 2 ohm load the power supply is speced to have the needed current to do so!

All I can tell you is that the loss of clean head room with a stock PT when run at 2 ohms will probably negate the added output wattage once the amps is once again at the 100 watt RMS output level of a stock amp when driving a 4 ohm load!

Why not do what Kustom did when they made the K400 model?

There is enough room in the 200s to place another PT, driver and output section in there if you use a verticle mount heat sink section for the 4 output transistors.

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Subject: Re: PC-900

Posted by [C4ster](#) on Tue, 21 Feb 2012 13:45:17 GMT

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Agreed on the PT issue but what is the wattage/current rating of the PT? Physically, the PT has the appearance of a larger wattage PT. Moreover, the voltage is a limiting factor. Cassent5150 and I have been going back and forth on this and I am only comparing the ratings of a K200 to a Sunn SA21 power amp. You would be surprised at the size of the PT in the Sunn. The discussion originated after I got the K200-A4 for Christmas with 2 - 4 ohm cabinets. Hence the 2 ohm load discussion. Cassent5150 had the opportunity to try my theory before I did.

Conrad

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Subject: Re: PC-900

Posted by [cassent5150](#) on Tue, 21 Feb 2012 18:48:17 GMT

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I might add that the first thing mounted in the test rig was a upgraded transformer running at I believe 39 volts AC and testing out at 44 volts + and - DC to give me 88 volts across the rails which I thought to be sufficient with 9000 uf 100 Volt filter caps. I then used the 5065 output board for first test this theory out cause it was already equiped with the .51 emitter resistors. I don't have the higher rated MJ5022's yet and curiosity got the best of me so I tried it with the 3055's and I believe with a little heatsink and a cooling fan it would be fine for normal situations. It may not be so in the extreme full output for a length of time, but the thermal protection hopefully would answer that question. It has a limiting diode mounted in the heat sink with the 3055's that helps pull back base current if I understand some of the basic principles of this design correctly. I think it was called thermal runaway protection. I'm not a tech with a degree in electrical engineering so I'm

probably way off there, but thats the way I understood it to work.

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Subject: Re: PC-900

Posted by [C4ster](#) on Tue, 21 Feb 2012 20:02:26 GMT

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I had a great response and then something happened and, poof, it was gone. Here goes again.

The 2N3055 transistors are rated at 115 watts @ 60 volts and 15 amps. The MJ15022 transistors are rated at 200 watts @ 200 volts and 16 amps. I can see how the 2N3055 transistors would not get too hot. If my quick calculation is correct, the peak current through each transistor would be 11 amps.

Also, a solid state device's voltage changes with the temperature. Most SS devices have a positive temperature coefficient. That is , the voltage across it goes up with the temperature. The diode attached to the heat sink will adjust the bias for a change in temperature. This keeps the amp bias from "running away".

Conrad

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Subject: Re: PC-900

Posted by [chicagobill](#) on Tue, 21 Feb 2012 20:40:38 GMT

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Running a 2N3055 at 40-45 volts is fine as long as there are no problems in the circuit. When one shorts out then there will be 80-90 volts on the complementary side transistors. This and defeated fusing is often the reason for massive total meltdown of the power amp.

Modern designs with higher rated devices that can deal with the full voltage across the supply rails seem to hold up better when a single device fails.

Another thing to check is whether or not the power transformer starts to get hot or not. And I suppose the rectifier bridge as well.

The bias diode that is thermally connected to the heatsink will lower the current in the output transistors as they heat up, but it can't really compensate for high temperatures. That's the reason for the thermal cutoff switch.

One more thing that needs to be looked at is the fact that the newer transistors have better frequency responses and can cause oscillation in the original circuit designs unless there are frequency limiting components added like snubber caps and Zobel networks.

Just my 2 cents.

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Subject: Re: PC-900

Posted by [C4ster](#) on Tue, 21 Feb 2012 20:54:48 GMT

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Hi Bill,

If you have been following the 2 ohm mods Steve C and I have been discussing in the other thread, it is based off of a Sunn SA21 power amp. These amps have the MJ15022 and MJ15023 complimentary pairs in the output. Your suggestion is well taken and I agree that the PT needs to be watched for overheating. The intent was not to increase power, just have a 2 ohm amp for the speakers that I have for my A4. Besides, I have always known that a 100 watt amp for guitar is WAY more than necessary. I am really thinking that a series connection might work better. But it doesn't hurt to experiment a little. If that works, though, I may build a K200 for my son's bass amp. I actually have a second PT and output board and was thinking about a dual amp bridged configuration.

Conrad

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Subject: Re: PC-900

Posted by [pleat](#) on Tue, 21 Feb 2012 22:21:15 GMT

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I'm not tech and have be fasinated with all the tech talk. Bob Brinkman who was the head tech at Kustom for years and I talked quite a bit over the years I was a kustom dealer. Bob once told me that with cabs that have horns, you don't really figure the horn driver, since it's not always in use because of the crossover cap. This of couse was from conversations that are now 35+ years ago. So my question is with Conrads K200A-4 head and the one 2x15 JBL cab and the JBL cab with the horn, Is there much danger of running both cabs on one head?

pleat

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Subject: Re: PC-900

Posted by [chicagobill](#) on Wed, 22 Feb 2012 07:23:25 GMT

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Pleat, you have remembered your discussions correctly. With the two cabs that you mentioned, the load resistance would be 3-8 ohm speakers in parallel, which would be 2.66 ohms.

The horn/siren speaker is isolated from the circuit by the crossover cap and is not figured into the load.

You know, I'd guess that through the years hundreds or thousands of Kustom heads have been run with lower than "correct" speaker loads and most have survived.

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Subject: Re: PC-900

Posted by [stevem](#) on Wed, 22 Feb 2012 11:28:33 GMT

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You can always parrallel another output transistor in each rail/side to gain a lower heat load per transistor.

This does not require any added drive signal, just chassis room.

This is almost manditory on the mid 60s Vox SS amps made here in the US that put out more than 18 watts RMS.

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Subject: Re: PC-900

Posted by [C4ster](#) on Wed, 22 Feb 2012 13:43:27 GMT

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Agreed on the horn discussion but I won't be using the horn for guitar, though. As the frequency goes up, the crossover cap passes more signal to the horn and the speakers tend to roll off a bit keeping the impedance somewhat the same. I suppose the amp can handle 2 ohms if not driven too hard. And with 100 watts on tap, the average room couldn't handle that volume to begin with.

Kustoms are too bright as they are, then add a horn and my ears would be bleeding. I want to replace the horn with another D130 and add the aluminum ports to the cabinet. I have a set of ports from a different cab that I replaced with chrome ports.

The easiest way to get more power is to use a power amp after the Kustom and hide it behind your stack. More power has not been my intention. I just wanted a stable amp if I ran both cabinets for some reason. When I play out, I mic everything and I use in ear monitors. A loud stage is difficult to manage by the sound man and I haven't played an ampitheater since Woodstock. (just kidding).

Conrad

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Subject: Re: PC-900

Posted by [Kustom\\_Bart](#) on Wed, 22 Feb 2012 16:19:03 GMT

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Why not just use a Direct in box to the PA and use a low stage volume for a monitor?

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Subject: Re: PC-900

Posted by [C4ster](#) on Wed, 22 Feb 2012 17:14:43 GMT

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I mic the cabinets and keep the volume as low as possible. I DI the bass amp and mic the drums. All acoustic guitars are sent straight to the board and returned to the in-ear monitors. We are still balancing the monitors but it can be tough when every venue is different.

Conrad

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