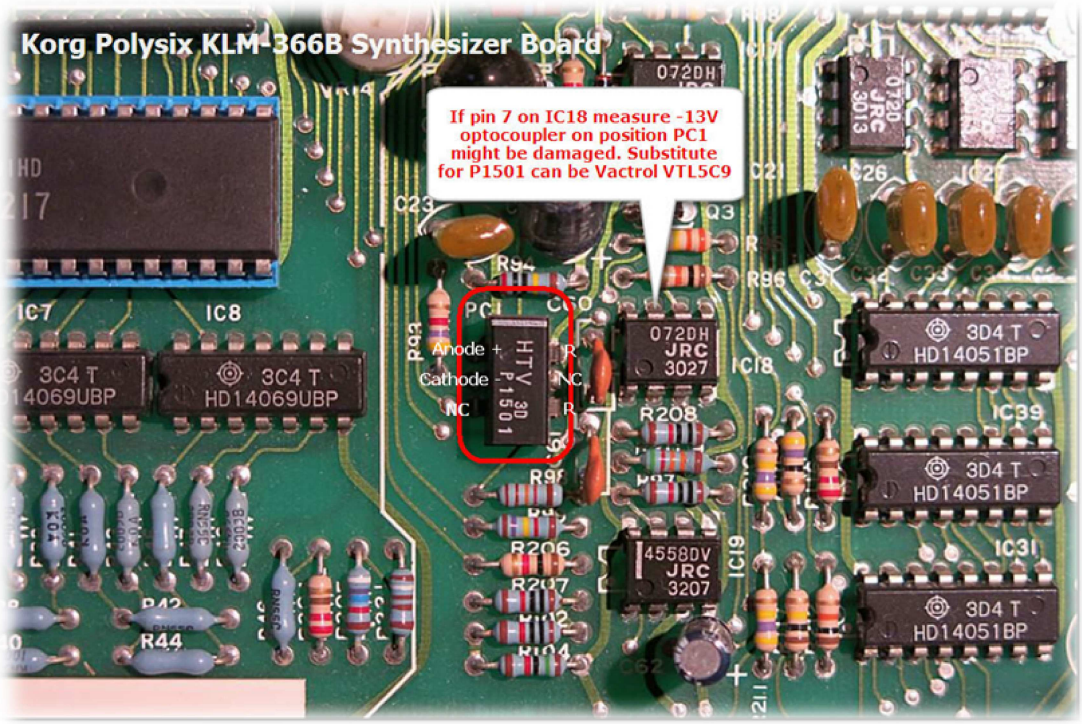
Tuning tips for your Polysix after service

It has been days since I've replaced the infamous PC1 photo isolator with a VTL5C9. Although I can read out what seems to be correct measurement around the corresponding circuit I still can't play my lovely Polysix. It's been standing there with its lid open teasing me with all its variable resistors and out of tune notes. This post is partly an assembly of my notes making head from tails working this beast into a musical instrument again.



First thing fist. DO NOT UNDER ANY CIRUMSTANSES TURN ANY TUNING VR before you have tried playing the synth after a successful repair. But if you are reading this I guess this advice is probably coming your way too late? Yeah, like you I also read the instruction telling me to start with centering all VR's. And why not, this analog synth is 30 years old and surely in need for a recalibration. Only problem with this instruction is that nearly every setting on the tuning VR's are interconnected. If one turn one knob one also move the reference for several other adjustment points. It can take forever to get adjustments into a ballpark where we can fine tune from.

If you have adjusted any of the common tuning knobs VR1, VR2, VR3, VR14, VR15 but know for sure you have VR10 and VR11 on one of the voices untouched try to tune the common VR's back to a working position with this voice channel as reference.

Johannes (member on the yahoo polysix mailing list) have recommended to first tune one single channel on the Polysix. I can tell for sure that this is a sane advice. But I will also tell you that at some point you will fail to check if D10 is lid on the intended voice unit. I've lost count on how many times I've turned the wrong VR. Or more often, - correct VR, but have the wrong voice playing. This project once again made me understand my love for monophonic synthesizers.

After banging all the C keys to my ears bleed I realized there is no Grammy on my way and decided some diversity was needed. After some testing I found that playing the A key at 220Hz made adjusting the middle reference on VR15 much easier. I also early on realized I don't need to hear the synth play while tuning which made room for some nice and calming music on my stereo while twisting variable resistors and repetitive pressing A and C keys.

Another important part for success is to understand the graph listed under the tuning section in the service manual. Its labeled "PS-6 VCO octave deviation standards at the final inspection at our factory". What it essential tells you is that you will not be able to tune P6 over more than 4 octaves. Failing to read and understand this drained yet another battery in my blue Peterson Stomp while trying to stretch the VCO interval longer than even the designers tried to do. Although the Peterson Stomp set to EQU Normal Chromatic Tuning is great for accurate tuning I now felt the need for another tool to check if I was able to bring the lower and upper octaves in the ballpark Korg initial designed these VCO for.

I found that my PC sound card connected directly to TP-1 SIG OUT was able to trigger the free version of Visual Analyzer 2011. P6 VCO drift a few cents when playing. So to simplify readings I used the Statistics function on the frequency counter. Just remember to press Reset when changing key. If you already have a decent software tuner installed that can show frequency I guess you are better off with that tool.

Sengpiel Audio has an excellent cent to frequency calculator here at http://www.sengpielaudio.com/calculator-centsratio.htm
With this calculator I made the reference table below. What you see marked in green are all valid factory values. As you can see a virtual strobe on a precision tuner will run wild with these settings.
Max frequency range on a typical instrument tuner are often limited. Peterson Stomp tuning range is 8-1975Hz (A#5 in this setting) which I accidently made to a useful range the way I ended up tuning the synth.

Key	Hz ref A=440Hz	1 cent	5 cent	10 cent	my result
C0	32.70325	32.722	32.798	32.893	32.81
C1	65.4065	65.444	65.596		65.36
C2	130.813	131.191			130.55
C3	261.626	262.383			261.67
C4	523.252	523.554			523.19
C5	1046.504	1047.109	1049.531	1052.566	1047.27
C6	2093.008	2094.217	2099.062	2105.133	2096.22
C7	4186.016	4188.435	4198.123	4210.265	4185.34

Please note that table abowe use C0-C7 with reference to the service manual. In other setting we will normally see the table shifted one octave down with C0 at 16,351625Hz.

With this reference chart at hand, and the frequency counter hocked up I'm ready to start from scratch for the x time. Please note that all VR's in my P6 has been turned at some time and I now start from center position on all knobs.

Here is how I finally got around all the tuning knobs. In principle it is rather simple. Sett outer parameters with VR10 and VR11 on the leftmost voice labeled Unit 0. Then center range with global VR15. But in reality the practical implementation is rather more complicated as adjusting one of the variable resistors also moves the reference value for the other two. Every single time you twist one of them!!!!

All VR, switches and Test Point (TP) are located on KLM366 PCB.
Initial settings:
1: Hock up the frequency counter to TP-1 SIG OUT and TP-5 GROUND. And/Or a precision tuner to LINE OUT.
2: Turn on the Polysix and leave it on for minimum 10 minutes before turning any VR. Better say 30 minutes.
3: Adjust knobs on front panel to "Normal Setting" as described in the service manual (SM from now on). All adjustments are done with VCO OCTAVE set to middle position at 8 foot and TUNE knob at center position.
4: Set switch SW1 to Back position.
5: Center VR1. If possible do not turn VR2 and VR3. But if you know they're already out of position center them now.
6: Center VR10 and VR11 on voice channel Unit 0

Initial tuning:
7: Play C5 repeatedly until LED D10 on Unit 0 is lid. Adjust VR11 on Unit 0 to 0 cent
8: Play C1 repeatedly until LED D10 on Unit 0 is lid. Adjust VR1 (not VR10) to 0 cent

Balance and stretch:
9: Play C5 repeatedly until LED D10 on Unit 0 is lid. Adjust VR11 on Unit 0 to 0 cent. You want VR11 to obtain 0 cent near center position. If it its far out either way adjust VR2. This ensure you have some head room when it's time to adjust the rest of the voices.
10: Play C1 repeatedly until LED D10 on Unit 0 is lid. Adjust VR10 on Unit 0 to 0 cent. You want VR10 to obtain 0 cent near center position. If it its far out either way adjust VR3. This ensure you have some head room when it's time to adjust the rest of the voices.
11: Play A2 (220Hz) repeatedly until LED D10 on Unit 0 is lid. Adjust VR15 to 0 cent. If you're lucky VR15 don't need adjustment. If it does you are now going into a loop…
12: Repeat step 9 to 11 until you have all keys from C1 to C5 at 0 cent. When you're starting to get theses setting close verify that VR14 is tuned to a half a step between D#4/D4
You might noticed how VR10, VR11 and VR 15 interact. Try to repeat Step 9 to 11 in different orders. On my unit I noticed that VR 15 would interact a little more on VR11 (key C5) than on VR10 (key C1). You will experience that you need to balance your adjustment and not take it to 0 cent until you have all three notes (C1, A2, C5) almost in tune. I found it easier to fist have both C1 and C5 a few cent sharp and adjust A2 at 0 cent as reference. Then stretch the difference at both ends.

Tune voices on Unit 1 to Unit 5. Replace x with actual Unit number:
13: Play C5 repeatedly until LED D10 on Unit x is lid. Adjust VR11 on Unit x.
14: Play C1 repeatedly until LED D10 on Unit x is lid. Adjust VR10 on Unit x.
15: Repeat step 13 and 14 until both C5 and C1 are 0 cent.
16: Check that notes between C1-C5 are close to how Unit 0 performs.

Finishing:
17: Set OCTAVE to 16 foot and check that bottom C0 is within 10 cents
18: Set OCTAVE to 4 foot and check that top C7 is within 10 cents
19: Set SW1 to Front position.
20: Congratulation!!! You have now successfully tuned your Polysix to fabric specification. Now its finally time to have some real fun playing this great instrument!!!!

NOTE: If you are not able to adjust VR10 or VR11 in step 13 or 14 course the VR are at one of its ends you need to go back to step 9 and 10. But this time use Unit x with the problem as reference to adjust VR2 and VR3.

I hope this information in some way can help someone out there. I nearly got lost in this project and welcomed any distraction that could calm me down in between battles. Now playing the beast it was all worth it. But will surely think twice before leaving this problem with a friend without proper warning it might cost him his sanity. And if you tech tells you he will charge to 2-3 hours for a job like this you lucky to get this fiddly job done cheaply. Seriously, I've can't remember doing anything more frustrating since paying my former mechanic for repairing our car breaks for the third time in the same year.

Best to you!
Kind regards Hans