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RetroActiveSynth

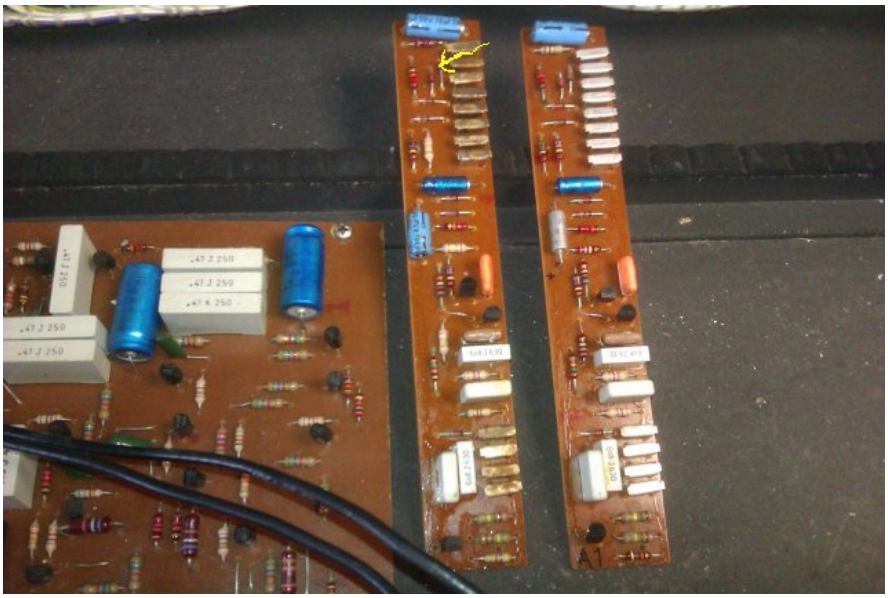
Synthesizer repairs & synth info

The Crumar Multiman-S

This was sent to us by an existing client who likes to buy rare and unusual things on Ebay and then inflict the mess upon us in the hope of a big profit further down the line. This was another one of those, like all Italian machines of the mid and late seventies, it sort of worked but not properly. There was no smoke or bangs but parts of the synth would switch on and off in functionality at random, and others would just be flaky all the time. The synth was in pretty good cosmetic condition, it had all it's original sliders and even the slider caps, the chassis wasn't rusty and only a few details of the screws holding it together were incorrect which was easily rectified. Finding out why many parts of it were flaky led to something akin to Alice in Wonderland, we went through the rabbit hole and kept on discovering more and more issues. The connectors keeping it all together are of a type we have not seen before, they are like normal multipole connectors but without the plastic housings, think of a Molex but no plastic, These were all black as they are Silver plated and Silver tarnishes, and needs cleaning, and there are hundreds of them, and Isopropanol doesn't clean this, Silver polish and hundreds of cotton buds and Isopropanol to clear the residue of the Silver polish does, and this is massively time consuming, we went through 500 cotton buds on this alone. This improved things but a couple of problems wouldn't go away, and this was starting to look like bad solder joints on the aforementioned connectors to their circuit boards, as without the plastic connector housings on modern connectors, all blades and housings were soldered to either mini pcb's or the main circuit boards they were connected to.

There were intermittent problems with the Upper Piano and the lower strings which were cured by resoldering all of the connectors, both male and female ends, so for a short period of time we had a fully working synth. When we say resolder we don't mean heating up the solder joints and adding more solder, our experience is that this is an unreliable way of dealing with the issue, we remove all the old solder, reseat the connector and solder as if we were building it for the first time and this usually works. Until after another switch-on we had a cacophony of noise from the left side of the split keyboard, as if all notes were playing simultaneously when one key was pressed. Hunting this problem down became something of a nightmare, it defied all logic, the Piano and Clav worked fine, so it couldn't be the Tone generators, but the Brass and Strings exhibited this issue and rechecking all the work that had been done showed that no mistakes had been made, or at least no obvious or apparent ones. All the tone generating boards (there is one under each key) were removed three times, it had to be here logically but as soon as more than one TG card was replaced the issue recurred depending on how many TG cards were replaced. While checking out all possibilities we found a dead transistor on one of the string chorus delay line cards, it was in the output low-pass filter so it made the Strings a bit brighter, certainly not unpleasant but just not quite right although it sounded fine, a nice spikiness on the strings that showed up on a scope, sounded like a Juno with the filter opened up fully.

Finding the issue with the left side of the keyboard took a tremendous amount of time, we were looking for a single point of failure, one failed component or assembly, it worked fine one day and not at all the next so it had to be something big and obvious, had a loose screw found it's way under the keyboard mechanism, had a transistor failed in one of the tone mixing sections? All of these possibilities were investigated and found to be not the case. We were very close to admitting defeat on this one even after the tremendous amount of time spent on it. We had the service documentaion for this synth but it is badly laid out and very confusing, every in and out of a pcb is referred to another drawing number, and every connection has an unexplained acronym, so navigating through it all is very tedious and difficult.



The two boards on the middle right of the photo are the tone generator boards. They take the two frequencies per note from the TOG's and do some signal processing on them, the Piano and Clavi sounds combine the square waves from the the TOG's and accept the keyboard Gate signals along with the Sustain voltage which is fed in parallel to all 61 tone generators. The rest of the circuitry turns the TOG's square waves into Sawtooth waves for the Strings and Brass, each board has active filter circuitry to do the waveshaping, but the component values change across the keyboard as the frequencies increase to maintain the correct wave shape, so this required labelling each board with where it came from. Actually the component values change every three boards or so, but marking is cheap and you know where you

think you are.

The left of the TG boards is badly tarnished, the right hand one has been polished, these are the female connectors, the male connectors are like a bent back L shape to fit into the females, they are not a bad connector apart from being silver plated, and the fact that if you don't mate them correctly, the male blade can slip sideways and short to the next socket of the connector. This didn't happen but it was something we kept a very close eye on, and was one of our chief suspects in the hunt for our problem, but it wasn't that...

Getting to the point, we took out the tone cards for the left hand side of the keyboard for the third time, and checked through all seven diodes and three transistors on each card, and lo and behold, we found shorted D7's on a lot of the cards, D7 is the component pointed to with the worlds worst yellow arrow. From the 26 tone cards on the left side of the keyboard, twelve of them had gone short, and replacement with 1N4148's sorted the problem, we found an out of spec transistor on one card and replaced that. We still don't know why a whole bunch of diodes decided to commit suicide on switch on one day, but the signs were that this might be a common failure on the Multiman as some of the diodes had been replaced previously, and we had to replace some of these again.

Now the synth worked again, but a weird artifact on the lower strings had us hunting back in the chorus system again, and we eventually tracked down a faulty transistor in the 3-Phase LFO board which was replaced. Strangely enough all transistor failures were due to open circuit base-emitter junctions rather than the usual short circuits that failed transistors normally exhibit, perhaps something that late 70's transistors do.

This is the finished result, the Strings are glorious, the Piano surprisingly useable, and as for the rest, it's a matter of taste.

The Crumar Performer

We have had two of these in the last couple of months, both in reasonable physical condition but with a differing variety of faults. The Performer is a stripped down version of the Multiman, it doesn't have the Piano or Clav and doesn't have a tone generator board under each key, and only a 4 Octave keyboard, but a lot of the circuitry is similar, the standout feature for us is the String chorus circuitry which while being a bit smaller is of an identical electronic design to the Multiman and still lives on 4 pcb's screwed to the chassis under the keyboard assembly. One interesting thing (amongst many others) is that the Service Documents describe a Moog style Ladder filter and discrete Contour Generator for the Brass filter, but both of the Performers that passed through recently had a Brass Filter board with some rare and valuable SSM chips on it, an SSM2040 for the filter and an SSM2050 for the EG. The late and great Jurgen Haible posted a hand drawn diagram of this circuit as no Crumar documentation seems to have ever included the changed pcb, as at one time he owned one. The Crumar Schematics are a little more intelligible than the Multiman but not by much.

The first Performer wasn't too bad but wouldn't stay in tune. It became immediately apparent that the Master Tuning pot on the rear panel was totally shot. Not a problem you would think but this pot was a low resistance value and was physically huge, the rear pot body was more than 30mm in diameter, the size of the mounting threads was also large and not Metric, as the Pot was British made. Finding any kind of Pot to replace this in the 9mm and 16mm Pot age was difficult, and it took some time to find anything suitable. The pot was a sealed type and couldn't be rebuilt so a substitute had to be found, and eventually was. There were a few other issues with the first Performer, but the faulty tuning pot was the biggie on this one.

The second Performer had a few more problems, the main one was a Brass On/Off switch that wouldn't latch,and the other obvious problem was that the Octave transpose switch was missing. This is a particular kind of slide switch that is still being manufactured by C & K, but is inordinately expensive for what it does and is. Unfortunately nothing else would fit properly so we had to buy one. The Brass on/off switch was a completely different issue, the latching system was just missing and as this is a push button switch with 18 pins behind it (it is a 6 pole double throw latching push switch) and of a type which seems to be completely unobtainable from any source, this seemed like a game-stopper, the thinking was about how to find a way of replacing this switch with something that worked and didn't compromise the overall useage of the synth, crazy things like multiple Relays or CMOS analogue switches on Veroboard were considered, and then rejected as far too much hassle. Our solution wasn't perfect but it was partly elegant as most of the extra parts of the switch need never have been switched at all, if you have the Brass turned off, no Brass appears at the outputs, so why were all the gate signals made switchable on a few poles of the switch along with a few other Brass gating things. To cut a long story short we fitted a normal 6 pin latching switch and rewired the rest of the switch mounting board accordingly.

The only downside of our mod is that the Brass LED is on regardless of switch setting, but in every other way it works perfectly. This particular synth had dirty sliders which is slightly unusual for the Spanish made Piher components used, as the slider track is perpendicular to the circuit board. To envisage what we mean, if you look at most synths close up that have sliders, you can see the tracks of the slider from above and dust and dirt can fall in there quite easily, but Piher sliders (as well as the sliders in most Russian equipment) are at right angles to the horizontal and while not immune to contamination problems are at least a bit more resistant to them.
These faders look and feel very similar to the CTS brand sliders used in ARP products, and indeed in the past they may have been just blatant copies, but there are some differences. CTS sliders are a real pain to remove from an ARP circuit board due to the metal support guides which also hold the two sides of the slider together. These seem to be made of an alloy which is solderable but at this age is as brittle as die-cast zinc alloy, so taking it apart will destroy the tangs of alloy which hold it together, and other means have to be found to hold the rebuilt and cleaned slider together. The Piher sliders are ultrasonically welded together, breaking them apart will ruin them with no remedy. Thankfully a Pipette full of Isopropanol drbbled gently through the left hand side of the sliders and some consequent excercising of the sliders made these good again.
This machine was good to go but the usual Italian synth things had to be dealt with, tarnished connectors, including all the output Jacks, the keyboard Bus bars etc...

Amazingly we took no photo's of either of these, so we apologise for that omission, just Google the synth and you'll have all the pictures you need of how a Performer should look, both of these left here looking like that.

And now for something completely different- the Juno 106

It's not Italian, it is not rare, it is not exotic, but it is a much loved and popular Analogue hybrid synth and we still see one at least every two weeks with failing voices (usually, but by no means exclusively) and as the information on many Forums is sometimes confusing and incongruous, we thought we might try to make the testing for failure as simple as possible, so you can say with confidence that Filter module X is faulty and these days Oscillator module Y may be faulty. There are 9 hybrid modules on a 106 Voice board, 6 of these are the Filter and VCA's for the synth, and the other 3 are Oscillator modules (each of which handles 2 Voices). The Oscillator modules convert the Digital note signals from the CPU into analogue style waveforms to feed into the filters. They generate the Square and PWM, Sawtooth and SubOctave for each voice, and when they fail, any one of those three outputs can be lost, and which of these die seems to be quite random.

Module failures manifest themselves in a variety of ways, for example our latest Juno 106 had two voices totally dead on switch on, but after 10 minutes two others were burbling away and producing random noises without any keys being pressed, and further testing showed the Sawtooth waveform missing on one of the voices which was one of those with a faulty filter module (sometimes identifying the fault can be tricky).

Everyone who has a 106 knows how to put it in test mode, hold the Key Transpose button down while powering up the synth, hold the button down long enough until the letter C shows on the central digital display and then release it. The display should show something like this -- _ in test mode the patch buttons serve no purpose but the bank select buttons do, and the usual most useful button to select is bank 3, this slams all the filters into resonance where most Filter faults will be spotted, burbling or crackling or wild frequency fluctuations can all be heard in this setting. In basic test mode, the keyboard assigner is Mono, all 6 voices are played with each key. The solution is to hold down both Poly1 and Poly2 buttons in the keyboard assigner section until both Poly LED's light up. Now the synth will play in normal mode and show the voice number on the right hand digit of the display, you can play and listen to individual resonance notes and identify them. The pitch of the notes heard will normally vary by as much as a semitone as you play a key and cycle through the voices, but unless the differences between voices is huge, this is fixed by the calibration routines described in the Service Documents.

Anyone considering buying a Juno 106 should run the following sequence of tests to check for bad voices, it is not the only issue that these can have, but it is the most common and also most likely to render the synth unuseable.

Switch on the synth holding down the Key Transpose button until the letter C appears and release the button a couple of seconds later, you should see the offset bars in the display as described above, then press the Poly 1 and Poly 2 buttons until both LED's light, then walk away for at least ten minutes, as some voice faults take a little time to appear as the modules warm up. The Bank buttons 2 through 6 all give useful information as to the condition of the synth's voicing circuitry, Bank 2 turns on just the Suboctave oscillator, a common failure mode of the MC5534 Oscillator module, if all 6 voices sound the same here, then move on to Bank 4 which turns on the Sawtooth waveform, failures here are rarer but not unheard of, Bank 5 switches on the Square wave from the DCO, again a rare failure but we have seen it, all voice Square waves should be at similar levels and have a 50% duty cycle, moving the PWM slider with the modulation switch set to manual should change the Pulse width from 50% to about 95% for all voices. The Bank 6 button turns on the Noise generator, not usually a problem but worth checking. The Bank 7 button just seems to produce a low level sine wave and Bank 8 just produces a blip noise when keys are pressed. These are not part of the calibration routine and don't seem useful for testing functionality. Bank 1 switch is used for the VCA voltage offset calibration and you won't hear anything playing keys in this setting. The most important Bank is 3, this shows up faults in the 80017A filter and VCA modules, any notes you hear when no keys are pressed are due to faulty voice modules (probably the VCA section) any warbling or rapid fluctuation in the tone produced when pressing a key indicates that the filter part of the voice is faulty.

We received a 106 a few weeks ago which we were told had voice issues, when we ran the test routine two voices were immediately dead, and 10 minutes later two more were burbling away at random, and the suboctave on voice 5 was missing. Filter problems were on voices 2,3,4 and 5. With 5 dodgy modules out of 9 we recommended the client to replace them all with analoguerenaissance modules, which he agreed to and we promptly did. This is expensive but at least the spectre of an unreliable 106 when you need it most is put to bed for good (we have never had a problem with these modules and have installed hundreds).

The above picture is of the aforementioned 106 with 9 new modules fitted and full recalibration done, the volume pot stripped and cleaned along with the Bender sliders. This one is done and going back to it's owner shortly.
The analoguerenaissance modules are on a white pcb whereas the original Roland modules have a black epoxy coating on them, so they should be instantly recognisable. That's all for August !