Casio PG-300 MIDI guitar electrolytic capacitor replacement

(V 1.0 March 2007)

Contents

1.0 Introduction

I purchased a Casio PG-300 and, although I was told that it was in perfect working order, I experienced a number of major problems with the on-board guitar MIDI hardware. A quick search on the Internet[1] revealed that this was a well documented problem associated with Casio PG-type MIDI guitars and that replacement of the electrolytic capacitors would sort the problem(s) out. In particular, the problems I experienced were an un-responsive guitar that required the strings to be plucked relatively hard to trigger the MIDI hardware, the 6th (E) and 5th (A) strings did not trigger any signal at all, signals staying on until I either changed sounds and/or pitch, very poor tracking and, when connected to an external MIDI device, constant 'MIDI-on' signal swamping the sound device with data therefore requiring a re-boot of the sound module. Based on the information provided to me by Greg Malecha[2] (see also information posted by Rolf Meurer[3] and Jun Tomisawa[4]), I decided to replace the capacitors (after seeking advice from a friend who is a highly experienced professional electronics engineer).

On opening up the guitar compartments housing the electronics (see later), I found that a number of the surface mounted type (SMT) capacitors did show significant signs of corrosion (Figure 1a & 1b). There were also three printed circuit boards (PCBs); whereas most of the write-ups and newsgroups only concentrated on one or two PCBs. There was also little information on how to locate and extract the PCBs from the guitar. I therefore decided to write a more comprehensive document on how to replace almost all the electrolytic capacitors with a sort of 'step-by-step' guide. For ease, I have split the work up into three sections, PCB1, PCB2 and PCB3, each of which deals with one of the PCBs to be repaired and I have included some general information to help with the process.

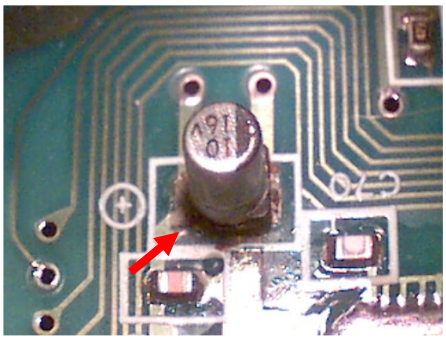


Figure 1a. *Corrosion of SMT capacitors (arrow highlights corrosion and residue on PCB)*

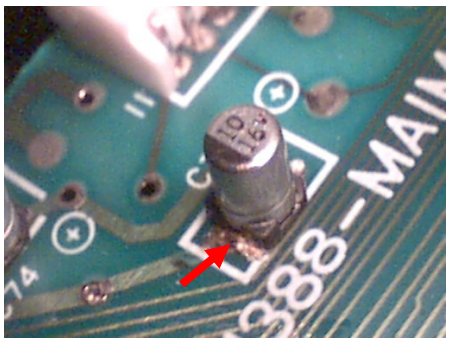


Figure 1b. *Corrosion of SMT capacitors (arrow highlights corrosion and residue on PCB)*

[1] http://jpsongs.com/troubadortech/sick380.htm#capacitors
[2] http://launch.groups.yahoo.com/group/midiguitar/message/3049
[3] http://www.midisoft.de/studio2005/CasioPG380.htm
[4] http://www2.tba.t-com.ne.jp/cheaptrill/subpg.htm#prg

2.0 General information

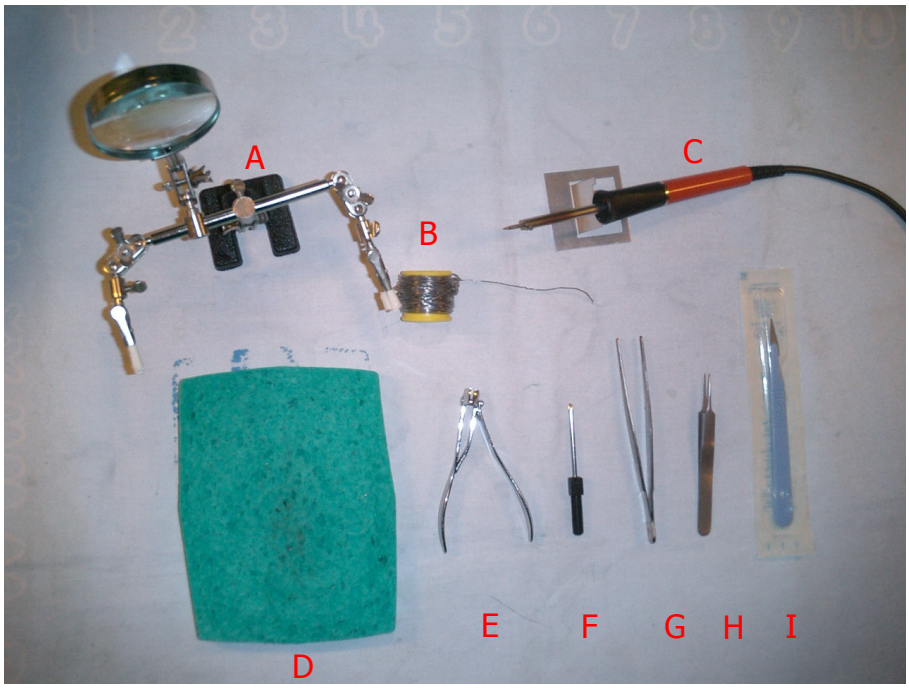
2.1 Background information

I purchased most of the parts and equipment from RS Components (http://rswww.com), although any other good electronic component supplier (*e.g.* Maplins UK) will do just as well. I have included the United Kingdom price and the number of units required to complete the job in order to give an idea of the costs involved. For any items that can be found routinely, I have not included any further details. I did not replace one capacitor (on PCB3, 16V 33 µF) since it was in very good condition as judged by eye. I carried out the replacements over a couple of nights, spending approximately 6-7 h in total. I think it could be done a bit faster, but I was being very careful since this was the first time I had done anything like this. Please make sure that when using the soldering iron you do not expose the PCB to excessive heat, this may damage the PCB. Also, when removing debris and the old capacitors be gentle and take your time.

Description (Manufacturer)	RS Components part number	Number required	Total price (UK£)
Soldering iron (Weller; 12W, 0.65 mm tip)	232-8580	One	12.10
Solder [general]			
Sponge [domestic cleaning sponge]		One	<0.20
Scalpel [disposable]		One	<0.20
Tweezers [blunt-end]		One	~2-3
Tweezers [sharp-end]		One	~2-3
16V, 10 µF electrolytic capacitor (Nichicon) §	475-8781	Twenty$^{\Phi}$	1.00
16V, 100 µF electrolytic capacitor (Nichicon)	475-8826	Five$^{\Phi}$	0.35
50V, 1 µF electrolytic capacitor (Nichicon)	475-9009	Five$^{\Phi}$	0.25
6.3V, 4.7 µF electrolytic capacitor (Nichicon)§	475-8680	Five$^{\Phi}$	0.25

$^{\Phi}$these units are sold in packs of five

§this should strictly be a 4V unit, but I could not find the exact equivalent from RS components. After seeking advice, I was told that a higher voltage unit can replace the 4V unit but a lower voltage equivalent must **not** be used as a substitute.



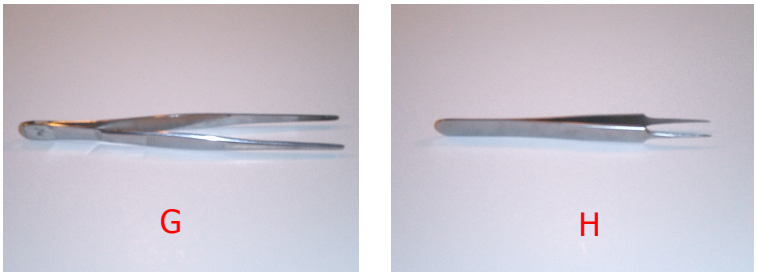


Figure 2. *Basic equipment required for capacitor replacement. A: 'third-hand' (to hold circuits while soldering); B: ready-fluxed solder; C: soldering iron; D: sponge (clean-off soldering iron tip during soldering); E: nail clippers; F: small 'Philips' (cross-head) screwdriver; G: blunt-end tweezers; H: sharp-end tweezers & I: scalpel.*

2.2 General techniques

Make sure the soldering iron (C) is allowed to get to temperature and when soldering with routine cleaning of the tip on the wetted sponge (see relevant information on the Internet regarding the 'ins and outs' of soldering). The capacitors can usually be clearly identified from the numbers on the top, signifying the voltage and capacitance (*e.g.* in Figure 4 it's a 16V 10 µF unit). I found that the old capacitors in general took very little effort to come off and in many cases left a significant residue behind (Figures 5 & 6). I used the nail clippers (E) to cut the electrodes of the capacitors to the required length. The sharp-end tweezers (H) were used to bend the capacitor electrodes into shape. The scalpel (I) was used to clean off the residue from the PCB and clean up the capacitor PCB electrode. I found a scalpel was better than other items (*e.g.* wire wool, wire brush, *etc.*) since I could carefully restrict the area that was cleaned, being careful not to unnecessarily expose other areas of the PCB. In all cases the capacitors were soldered with enough electrode length so that they could be set in place on their sides. During the whole process I did not use any solvents or cleaning solutions on the PCBs.

Figure 3a. *Main body of guitar (front)*

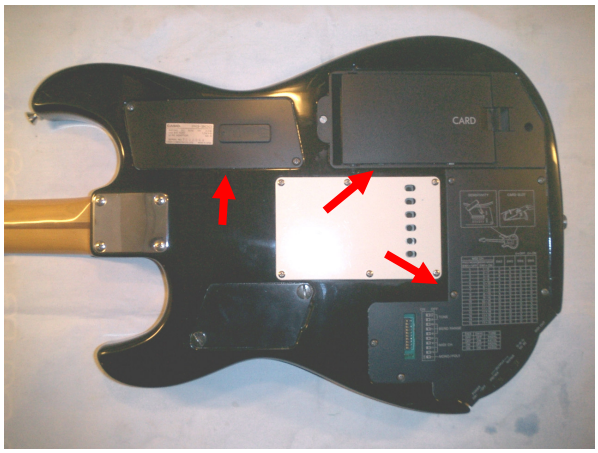


Figure 3b. *Main body of guitar (back). Arrows mark three compartments housing PCBs to be repaired.*

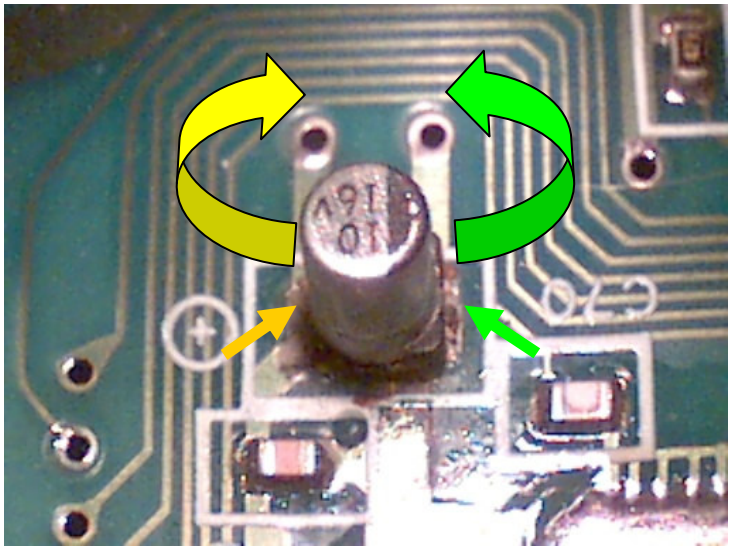


Figure 4. *Removal of the old SMT capacitors.*

Using the blunt-end tweezers, gently but firmly grip to the top of the capacitor and apply the tip of the soldering iron at the base electrode of the capacitor whilst gently twisting the capacitor in the direction of the equivalent colour arrow (*e.g.* yellow arrows). Repeat this on the opposite side (*e.g.* green arrows), slowly lifting the capacitor off the PCB in a step-by-step manner. The capacitor should lift off fairly easily. Do not apply excessive heat to the PCB, try and keep the tip exactly on the contacts. Where there is significant corrosion, the capacitor may lift off easily and leave behind a residue mound (see Figures 5 & 6).

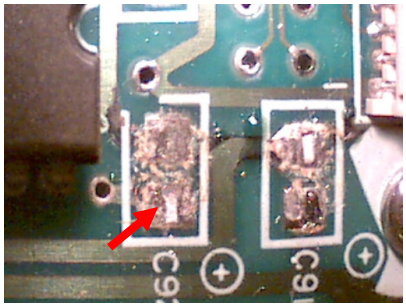


Figure 5a. *Residue left behind by capacitors that degraded and lifted off the PCB with very little application of heat.*

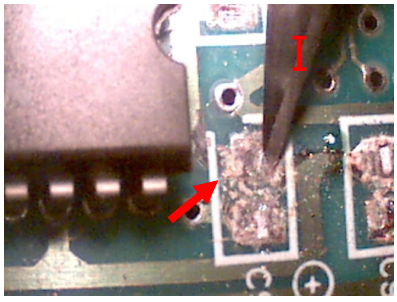


Figure 5b. *Use the end of the scalpel to remove loose debris and clean up the contact area. Please be gentle and take your time. Do not remove any of the green PCB material.*

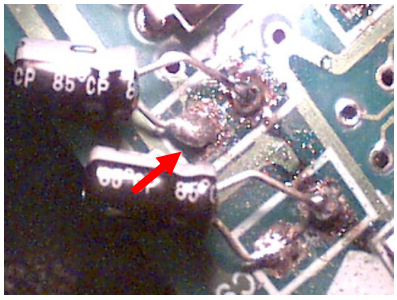


Figure 5c. *Final result of soldering new capacitors onto the existing cleaned areas. Note that the capacitors are laid down on their sides.*

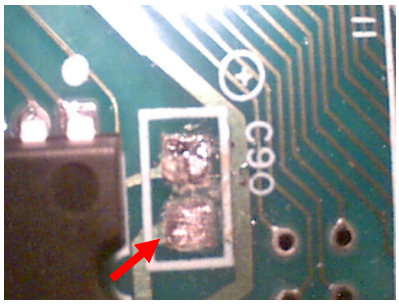


Figure 6a. *After the old capacitor has been removed the area has been cleaned with the scalpel*

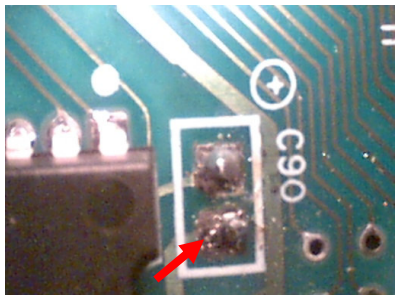


Figure 6b. *New solder is applied to the cleaned mounting area*

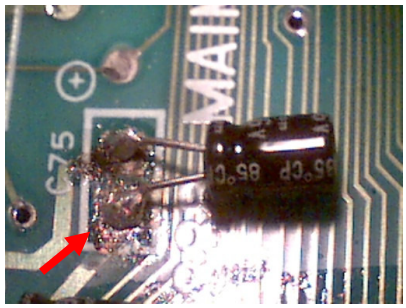


Figure 6c. *New capacitors are soldered into position while held 'standing up' with tweezers and the laid down on their sides by gently pushing them down with the end of the finger*

3.0 Extraction of the PCBs from the guitar

3.1 Extraction of PCB1

Figure 7a. *Remove the cover by unscrewing the panel.*

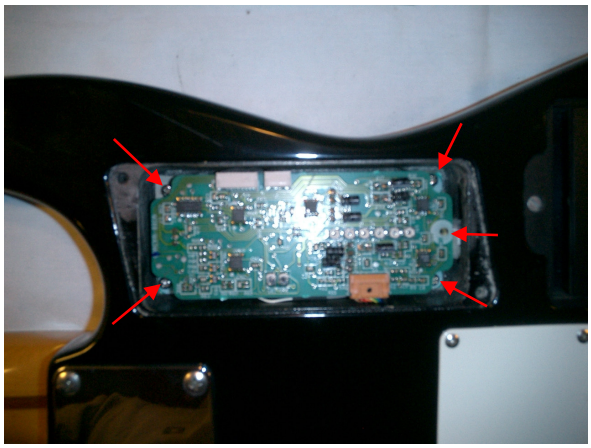


Figure 7b. *This compartment contains two PCBs, one on top of the other and connected to each other electrically as well as physically. Remove the five screws marked by the red arrows.*

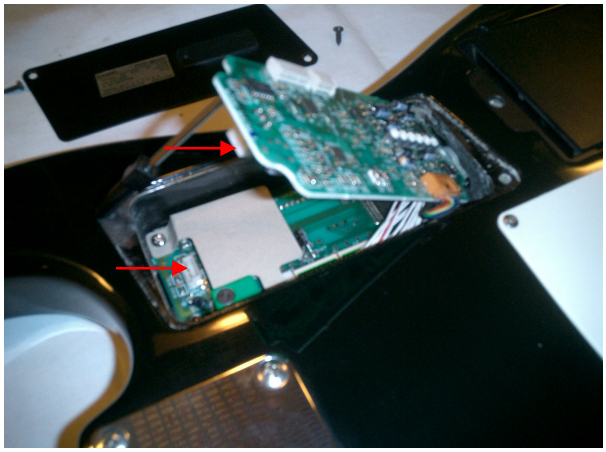


Figure 7c. *Carefully lift off the top PCB (PCB1). Please note that there is an electrical connector between the top PCB and the bottom (marked by arrows). Also please note the small screwdriver holding the two PCBs apart.*

Figure 7d. *Separate the two PCBs. ALTERNATIVELY YOU CAN TAKE OUT THE TWO PCBs TOGETHER AND THEN SEPARATE THEM ONCE THEY ARE CLEAR OF THE GUITAR BODY (THIS IS SLIGHTLY EASIER)*

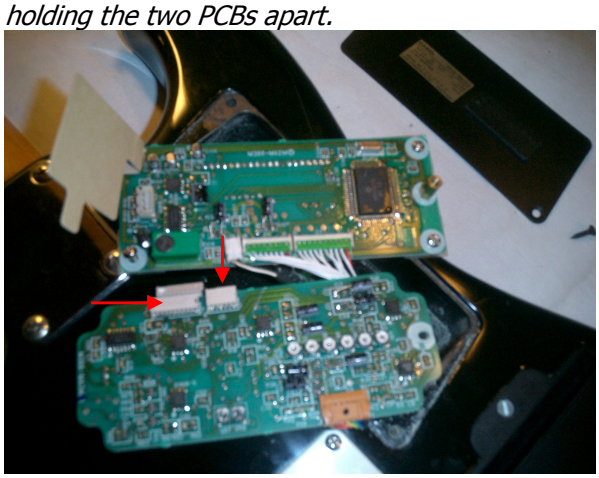


Figure 7e. *Once separated, remove the electrical connectors (grey-coloured; arrowed) from the top PCB (PCB1). This can be done using the sharp-end tweezers to carefully separate the cables from the PCB1 connector.*

Figure 7f. *Detach the final connector (orange-coloured) from the wiring, again using the sharp-ended tweezers. This should leave PCB1 free.*

Mount the freed PCB1 onto the 'third-hand' (Figure 2, A) and follow the procedure for removing the old capacitors and cleaning the connectors as described in the General information section.

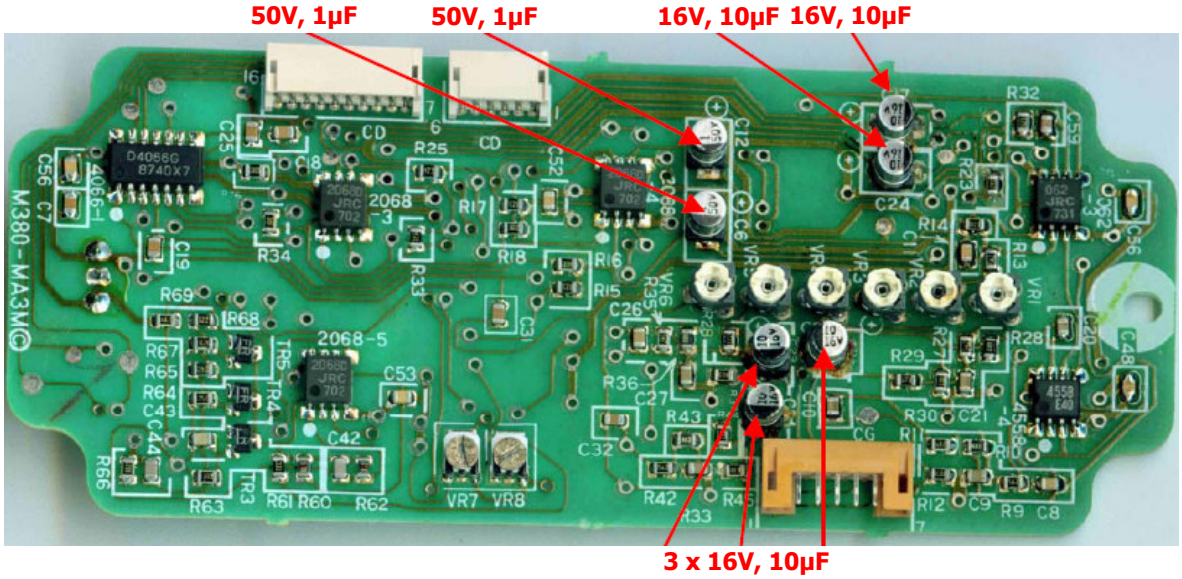


Figure 8. *Top view of PCB1, replace these capacitors as marked*

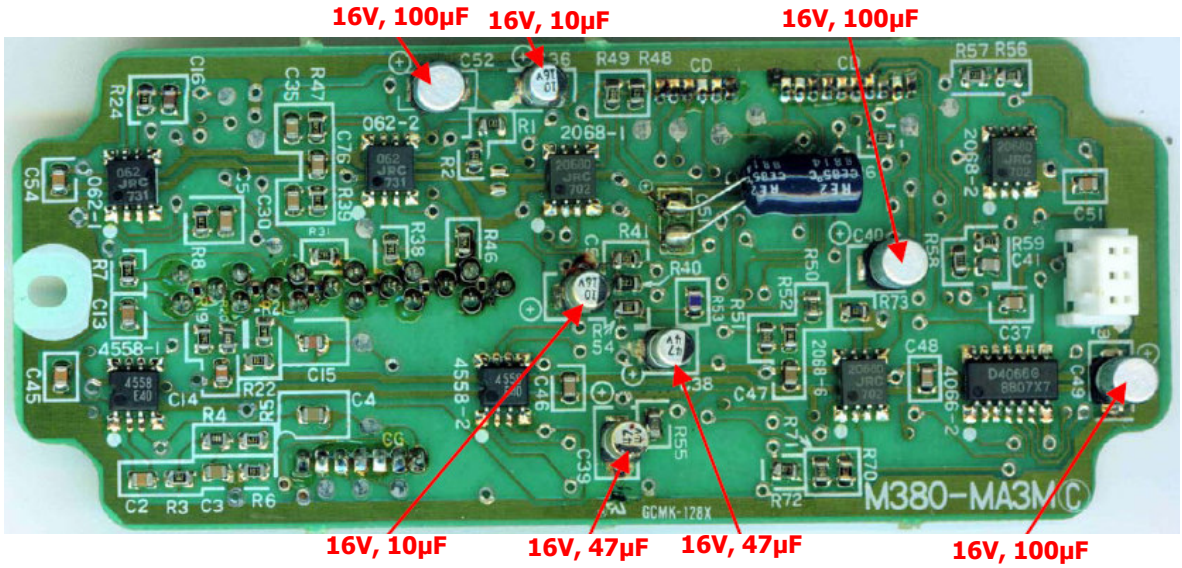


Figure 9. *Bottom view of PCB1, replace these capacitors as marked*

3.2 Extraction of PCB2

I carried out this replacement without disconnecting the PCB from the guitar. I made sure the PCB was secure and carried out the replacements as before; making sure that I left enough length on the capacitor electrodes to lay the capacitors down and out of the way.

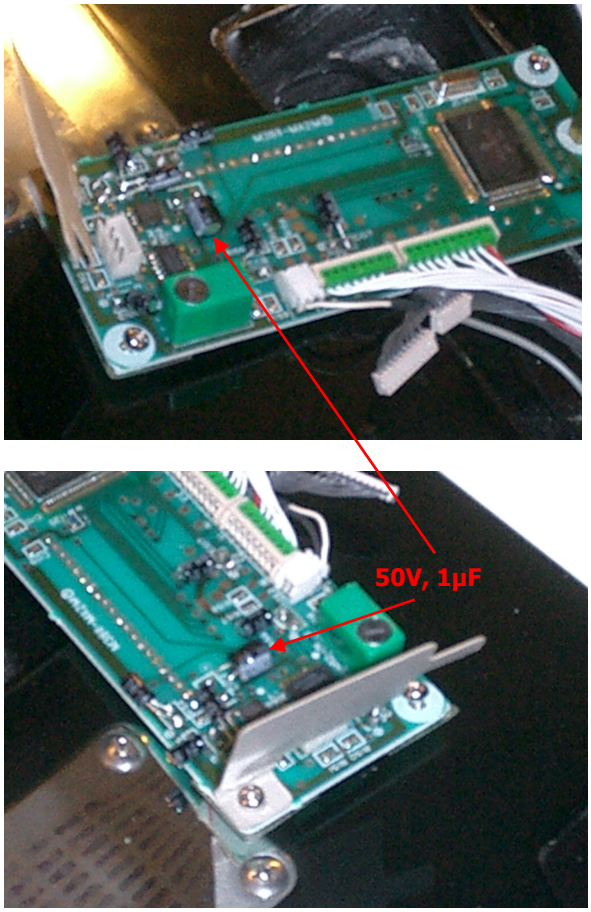


Figure 10. *These photos were taken after the capacitor replacements. All but one (marked) of the capacitors was of the 16V, 10 µF type.*

3.3 Extraction of PCB3

Figure 11. *Remove the ROM card housing. A requires a regular flat-headed screwdriver.*

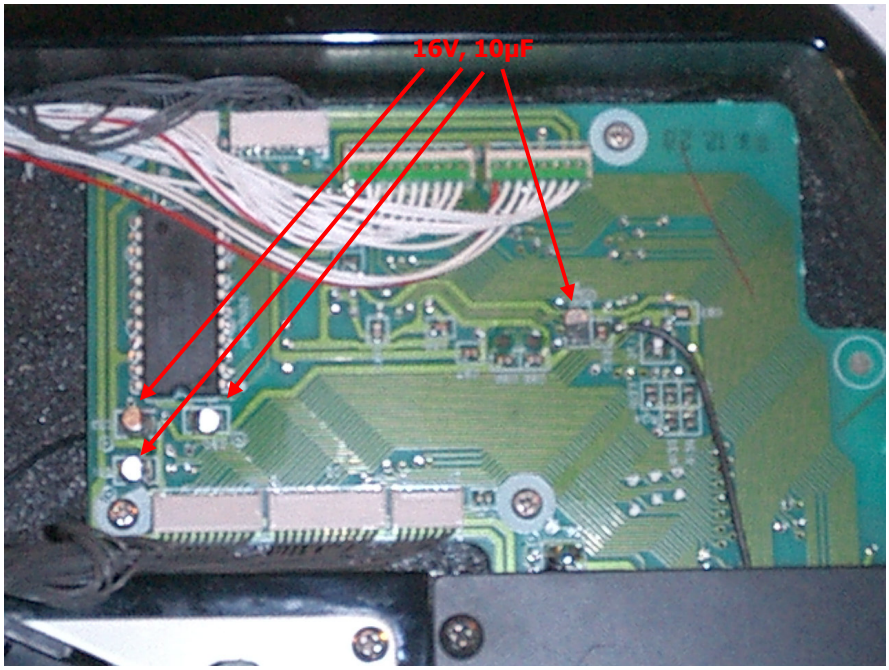


Figure 12. *Replace these capacitors as before.*

Figure 13. *Remove the remaining back cover to expose the remainder of PCB3*

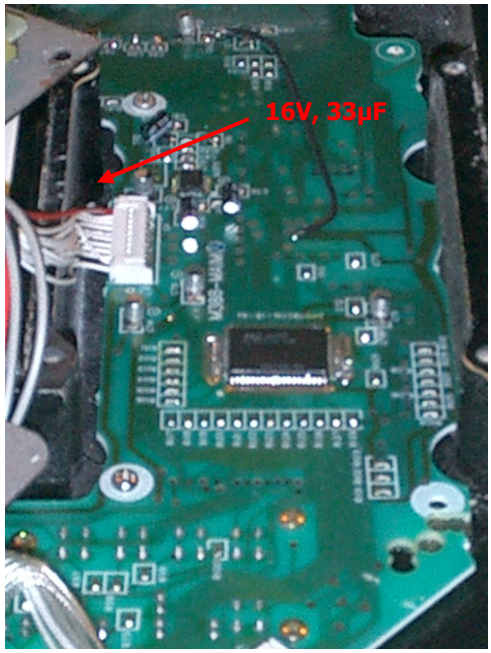


Figure 14. *Bottom part of PCB3. Again all but one of the capacitors was of the 16V, 10 µF type. In my case the 16V, 33 µF capacitor was not replaced because it and the contacts were in good condition.*

4.0 Results

Once I had replaced the capacitors the MIDI function was restored.

1. The MIDI hardware was very sensitive and responsive (to touch, pitch-bends and slides)
2. External MIDI triggering was restored to as expected
3. The E (6^{th}) and A (5^{th}) string were now working the MIDI hardware and just as sensitive as the other strings
4. Relatively light plucking was required to trigger the MIDI hardware
5. No notes sticking
6. Works like a dream!

5.0 Disclaimer

Because we live in an ever complicated world I have to include this bit! Although I, Manoj Ramjee, have taken all reasonable attempts to provide accurate, current and reliable information, you should recognize the possibility that errors may exist in the information I have provided and that I expressly deny any warranty of the accuracy, reliability or timeliness of any information made available in this document, and shall not be held liable for any losses, damages or injury caused by reliance upon the accuracy, reliability or timeliness of this information. Any person who relies upon the information made available in this document does so at the person's own risk. Before following any advice or installing any hardware recommended or mentioned in this document, you are strongly encouraged to carry out a full assessment of the work and a health and safety risk assessment in order to prevent injury to yourself or others by your actions. Under no circumstances will I be held responsible for any third-party losses, damages or injury as a result of you following this document.

6.0 Acknowledgements

I would like to thank Greg Malecha for sending me information on his repair instructions. I am indebted to John Dallaway for guiding and advising me on how to tackle the 'electronics' of the capacitor replacement.