ATARI SM124 Monitor Repair

originally found on http://www-ftp.lip6.fr/pub/atari/Docs/dead_mon.txt

If you have an **ATARI SM124 Mono monitor** that has recently gone belly up, read on. In particular, this pertains to those of you who have tweaked the coils and trim pots in your monitor to get a full raster display, although it's quite possible that unmodified monitors have been affected as well. Also, if you have a modified monitor that's behaving fine, you still may want to consider the suggestions described in this article, as it could save you a surprise monitor failure that (you KNOW) will definitely happen at the worst possible time.

Finally, this text describes a problem particular to the monitor manufactured by **"Gold Star Co"**, which has the Brightness, Contrast, and Off/On Volume controls recessed on the right side- panel. There may have been other manufacturers of SM124's with completely different electronics, so if ANY of the physical component layout descriptions written here do not seem to jive, then all bets are off and the information given here may or may not have any practical value. In addition, the monitor 'fix' I'm going to describe should only be done by a trained electronic technician, or at the very least a knowledgeable electronics hacker with good soldering AND de-soldering skills!

Disclaimer: You can easily get knocked squarely on your butt by the voltages present in your monitor. Weather or not it kills you probably depends on just what you fall on, your present health, and where the resulting flying monitor lands. In any case, your decision to implement the changes described herein is completely your own. I disclaim all responsibility for your health, safety, or any damage to equipment or property caused by fires, implosions or explosions, earthquakes, global flooding, or galactic imbalance resulting from your use of any information in this writing. I think that about covers it ;)

So... once upon a time, we all got our nifty HI-RES mono monitors, powered them up, and the very first thing we all said was, "Ah.. MAN!!... This monitor is screwed up". Perhaps stronger language was used, but the fact was that we all thought something had to be wrong. Alas though, the tiny picture on that screen was exactly what the ATARI mystics had intended! Of course, it wasn't long before many daring hackers boldly removed the monitor's covers, cast their warranty aside, and discovered a way to expand the tiny picture to full size. The information spread quickly through the worldwide Internets, spider nets, and fishnets, and soon all mere mortals had full screen displays and could actually read that 6 X 6 font! And so, they all lived happily ever after. But then, one day years later, a curse fell upon the land, and darkness fell upon the faces of many of these monitors.

Ok, enough with the story narrative. By now, you're beginning to get the picture (no pun intended). The modification to fill the screen does indeed place an additional stress on a portion of the monitors circuitry, which coupled with a design error quite common to many types of computer monitors, ultimately caused the failure. The good news is that I've now seen quite a few monitors with this identical failure, which is 100% repairable, and should leave you with 'good as new' results. The bad news is that you do need some technical skills, but even if you don't, finding a techie friend to help will be abundantly easier having a possible procedure for repair.

Brief technical summary

Right near the coil you adjusted to spread the horizontal width of your display, there's a **2.2 µF capacitor**. More specifically, it is a **non-polarized electrolytic capacitor, which is actually 2 polarized capacitors wired 'back to back' in a single enclosure**. As the screen is widened, the peak voltage level across this part increases, thereby causing more internal stress. This situation is further aggravated by the type of this part as well. All capacitor types have certain advantages and disadvantages and when it comes to electrolytic types, the advantage is smaller size. It's disadvantage however is, that at higher frequencies it has high 'leakage' current and acts more like a resistor. The Horizontal frequency passing through this capacitor is in fact quite high, and the resistive qualities at these frequencies cause the capacitors to generate significant heat. Over time, that heat will cause the part to fail even in un-modified monitors, but the modification certainly speeds up the process.

If your monitor has fallen victim to this failure, in a way you're lucky. There's a fair chance that the problem (as said earlier) would happen one way or another anyway, and at least now you have a possible fix.

First, you need to disconnect the monitor and open it up. If you have the chassis I'm describing there will be two screws on the upper sides, visible from the back; two more screws on the bottom; and a single screw on the back above the power plug, which is a removable 'spade' type AC connector. After removing the screws, you can remove the back cover, but be sure to be careful of the speaker connections. The speaker is mounted to the inside of the cover, and connects to the monitor's main PC board via a small removable plug. It's a bit tough to get to, but trust me, it IS removable.

Once the cover is free, there are **2 fuses to check first**. From now on, all references to right and left will assume you are behind the monitor, with the screen pointing away from you. There is a small PC board mounted vertically on the right side of the chassis, which contains a **0.75 amp fuse**. There's also a **2 amp fuse** immediately to the right of the speaker plug you removed on the main board. Check both fuses with a DVM or other suitable instrument. Most likely, you'll find that it's the 2 amp on that is gone, but either one blown is possible. You can buy these tiny fuses at Radio Shack, and while your there, you can pick up a much more modern replacement for the capacitor we mentioned earlier. There's also a **resistor** that often cooks when this failure occurs, so you might as well get all this stuff at once. If the problem turns out to be something else, at least you'll be prepared for the eventuality. In any case, read on to do a 'walk through' before buying, to make absolutely sure your chassis physically matches the one we're discussing.

At your local Radio Shack, pick up the following items:

Fuse (pkg of 4)	3/4 amp	270-1048
Fuse (pkg of 4)	2.0 amp	270-1052
Fuse (pkg of 4)	5.0 amp (optional purchase, see text)	270-1056
Capacitor buy 2!	1 µF, 200v (metalized film)	272-1055
Resistor	680 ohm, ½ watt***** (pkg of 2)	271-021

***** (Comment of Greg: my SM124 had **820 ohm** there, and the replacing 680 ohm, ½ watt burned through within half an hour!
Then I replaced it with four 3,3 kiloohm, ½ watt resistors parallel (gives me 825 ohm, 2 watt) and these still are getting hot, but for now they are doing the job.)

Since we have plenty of extra **fuses** now, start by just changing them, and setting up the monitor (still uncovered) with your ST. If the display comes up normally, leave everything powered up and wait a few hours. If all goes well, you can either make the fix we're going to describe anyway to save future grief, or put the other parts away, along with this text, in case the problem returns.

Assuming the problem did not go away (no display and/or fuse blown again), there are two paths you can take from here. You can just go ahead and change the suspected components without really knowing if they are at fault, since they'll probably need replacement eventually anyhow. The other possibility is that you don't want to do this until you're a bit more sure it's necessary. If that's the case, read the next few paragraphs. Otherwise, just skip over to "Making the Repair".

If you do want to do some checking, here is a possible (but not foolproof) procedure to see if the suspected capacitor is indeed the culprit. If the **0.75 amp fuse** on the vertical board was blown, temporarily replace it with a **2 amp**. If the **2 amp fuse** on the main board has blown, temporarily replace it with one of the **5 amp** fuses. Set up the monitor, still open, near your ATARI, and connect the monitor cable to your machine. Boot the ATARI with the monitor still off. We want to keep our 'powered up' time with the larger (wrong) fuses to a minimum. Now, hook up the power cord and turn on the monitor, being ready to instantly kill power at the first sign of any unsafe condition such as smoke or electrical arcing.

With the higher current fuses installed, the display will probably still be out, but the green pilot light on the front panel should light. If it doesn't, then either the new fuses have blown, or a problem exists somewhere else in the circuit. Of course, the pilot light could just be shot, but if the higher current fuses do actually blow, then forget about the remainder of this discussion and just try implementing the suggested repair. Also, if the screen display does appear with the larger fuses, don't be too happy yet! Twice now I've seen the 'crippled' capacitor seem to work fine for a while before the final breakdown. So whether the screen display comes up or not, proceed to the next step as long as the fuses are not blowing.

Locate **Capacitor C714**. It will be the round cylinder on the left side of the main board (from the back), in-between the coil you adjusted when you increased the width and the **flyback transformer**. The coil is the only adjustable coil on the board, so you can't miss it, and hopefully you know that the **flyback transformer** is the thing-y with the wire that goes into the top of the picture tube! Locate the capacitor... but don't touch it yet! The flyback puts out thousands of volts, and if there is a flaw in it's insulation, it could arc right into your hand. Just leave the unit powered up for a few minutes, and then turn it off. Now, with your finger, move close to, and finally touch the capacitor from the top. What you're looking for is a HOT part, so be careful! If in fact the capacitor is really hot, it probably has shorted and needs to be replaced.

Also, immediately to the right of the coil, also on the main board is a **diode (D-709)** and a **resistor (R-721)**. Take a good look at the resistor to see if it looks stressed or burnt. If you want, you can do an in-circuit check with a DVM to see if it has opened. You can make this measurement from the bottom of the board if you want since it's pretty cramped on top. Even if it has not died, you should consider replacement if it appears stressed, or the underside of the board appears burned and discolored at the location of the resistor.

Making the Repair

Making the repair is simply a matter of changing the parts, BUT... there's some special considerations here. You may or may not be aware that radio shack does have 2.2µF, 50 volt non-polarized electrolytic capacitor in stock! But using that part would be dumb since the conditions that caused it to die in the first place have not changed AND, the part was a poor design choice to begin with! **We're going to use the two 1.0 µF metalized film capacitors which are NOT electrolytic, AND have a working voltage 4 times that of the original part!** We will have to parallel both capacitors to get 2.0µF, which is reasonably close to 2.2 and in fact works just fine. First though, you'll have to de-solder the existing **C-714**, which will probably be a bit of a chore. Do that, and also get rid of the existing **R-721** if it shows the signs of heat stress (or is open) as we discussed earlier. You can just cut it out if you want, since we'll be soldering the new parts to the underside of the board.

Now, take the two **1.0µF capacitors**, and solder them together in a neat parallel arrangement, that has a pair of leads bent to accommodate the spacing of the leads on the original capacitor. Look at the underside of the board and observe the original **C-714** solder pads, as well as the clearance to the bottom when the cover is replaced. Give it a little thought and come up with a mechanically sound and visually sensible combination. The capacitors, again, are not polarized so direction does not matter. And remember... parallel, NOT series!!! Solder the parallel combination to the **C-714** pads under the board. Try to push the leads right into the holes left by the removal of the old capacitor.

R-721 can also be replaced from the bottom side of the board unless you're really patient, and have some small tools. It's much easier to just trim the leads and tack solder it in place under the board. If the board looks a bit burned in this area, you may want to clean it up a bit prior to installing the new resistor.

Finally, don't forget to put the proper fuse values back into BOTH locations. The original fuse values are important protection and do not normally blow unless there is a real problem. I definitely do not recommend leaving the larger fuses values in place. Do a bench check on the ST again, still with the cover off. You may need to re-adjust the horizontal width, or the position tabs on the neck of the picture tube to center and set up the display. Once this is done, you can put the cover back on, and you're back in business. If the fix does NOT help, just double check your soldering and connections to make sure you didn't wire something wrong.

Hope this fix was helpful. If so, I'd like you to drop me an EMAIL, since I'm curious as to just how many fried monitors out there had this problem. Also, if you're not able to make the repairs yourself and live anywhere in Islip, Long Island, NY area, send me E.Mail and maybe I can help you out. My GE mail address is R.CONSTAN, or Internet: rconstan@maestro.com . (e-mail address is obsolete meanwhile)

-Randy Constan, Elfin Magic Co.

(Comment of Greg: Randy always called the resistor **R-221**, but in this specified location I found only **R-721** with **820 ohm, ½ watt**. Besides, on the entire board there is no R-221 at all, so I changed this here in the text.)