eMate Hinge/Cable repair

Title:	eMate hinge and screen cable repair
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I had been following messages on the NewtonTalk list <http://www.newtontalk.net> regarding damage to the eMate display cable with only theoretical interest until my Nephew presented me with exactly this fault.

The symptoms include the loss of the touch screen so the eMate no longer responds to your stylus input and/or lines appearing on the screen or breakup of the screen image. Damage to the display cable can be responsible for all of these problems and is easily visible as a puncture or deformation.

When I examined the hinges of the eMate (and you have to remove the motherboard to do this), I found that one leg of the inner spring (which acts as a clutch) had popped out from under the black countersunk screw that retains it and had pierced both layers of the flexible PCB that is the display cable (**Fig.6**). It cut four conductors which disabled the touch screen, leaving (in this case) the bitmap display intact.

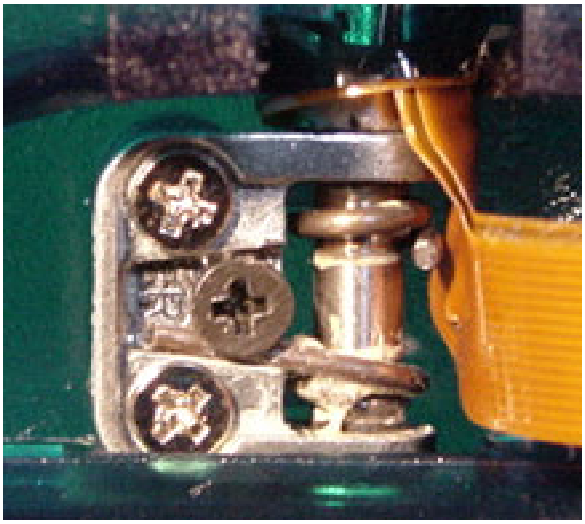


Fig.1 One spring leg has popped out from under the retaining screw and punctured the cable.

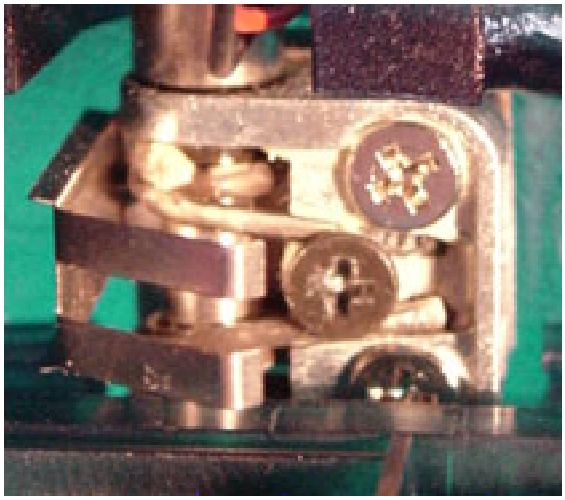


Fig.2 A good hinge shows both spring legs of the correct length - no danger here.

The faulty machine (**Fig.1**) has one of the inner springs cut too short and is therefore not properly secured by the countersunk screw.

When I saw this I immediately checked out my own two eMates and it's clear that there is a manufacturing error in the one that failed. Fortunately, my machines have springs that have long tails on all four springs and there is no possibility that they can come free (**Fig.2**) .

There is no need to abandon an otherwise working machine for only a detached spring when just placing a small washer under the screw will retain the spring well enough to restore complete articulation to the screen and never allow it to come out again. This is the easy part...

Notes on dismantling the eMate

Before you start, remove any cards from the eMate while it's running then turn it off and remove the battery.

Work on a clean, soft surface that is not static-prone (like a thin cotton cushion) to protect the case and the LCD which will be exposed during the repair. You will need a good light to work by - some of the parts are quite small.

If you have an earthing wrist strap, slip it on now. Otherwise touch an earthed surface periodically while you work.

The Screen

Open the screen and lay it flat. Gently remove the four rubber plugs at the corners of the screen with a toothpick or similar non-metallic tool. Remove the screws.

Insert something like a plastic letter opener into the groove dividing the two halves of the lid assembly beginning at the hinge edge and carefully prise them apart. There are two catches to unhook along that edge. Work your way around up both sides towards the top and the bezel will then lift up from the bottom and unhook at the top.

Note! Be very careful about articulating the screen when the bezel is removed because the lid casing will catch on the switch that wakes and sleeps the machine and it could be damaged - keep it flat.

You can then slowly lift the LCD screen off the posts that support it and disconnect the display cable from the board underneath.

Seat the LCD back on its mountings and secure it with a couple of its screws at opposite corners to stop it falling out while you do other things.

The Motherboard

Remove the rubber plugs on the base of the eMate and remove the screws. Don't forget the one in the handle.

Prise the casing apart starting at the area near the ports being careful about the card slot eject button.

You will probably need to remove the small screw holding the plastic door assembly around the ports.

Take note of the location and polarity of the two black/red power cables and desolder them. Disconnect the display cable from its connector noting the route that it takes in the case. Disconnect the keyboard connector.

Remove the screws retaining the motherboard and lift it out of the casing. Place it where static will not affect it and where it won't be disturbed.

You can now see the two hinges as photographed above.

Hinge Repair

With the eMate resting upside down and the motherboard removed, you can see the square metal hinge assemblies either side of the screen. There are two silver screws that retain the hinge in the case and a central black screw that traps the two legs of the spring in place in the centre of the clutch.

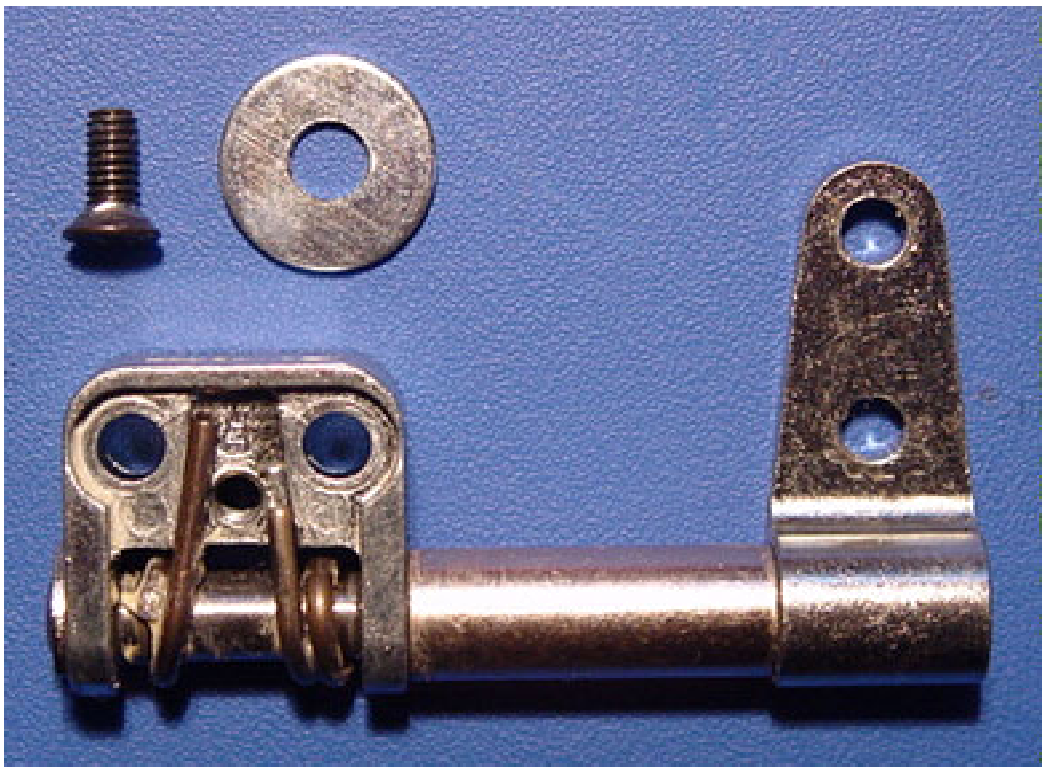


Fig.3

Here you can see the faulty hinge with the short spring leg (**Fig.3**). This is clearly a manufacturing error and not a break because the end of the spring is well finished and the same colour as the rest of the wire.

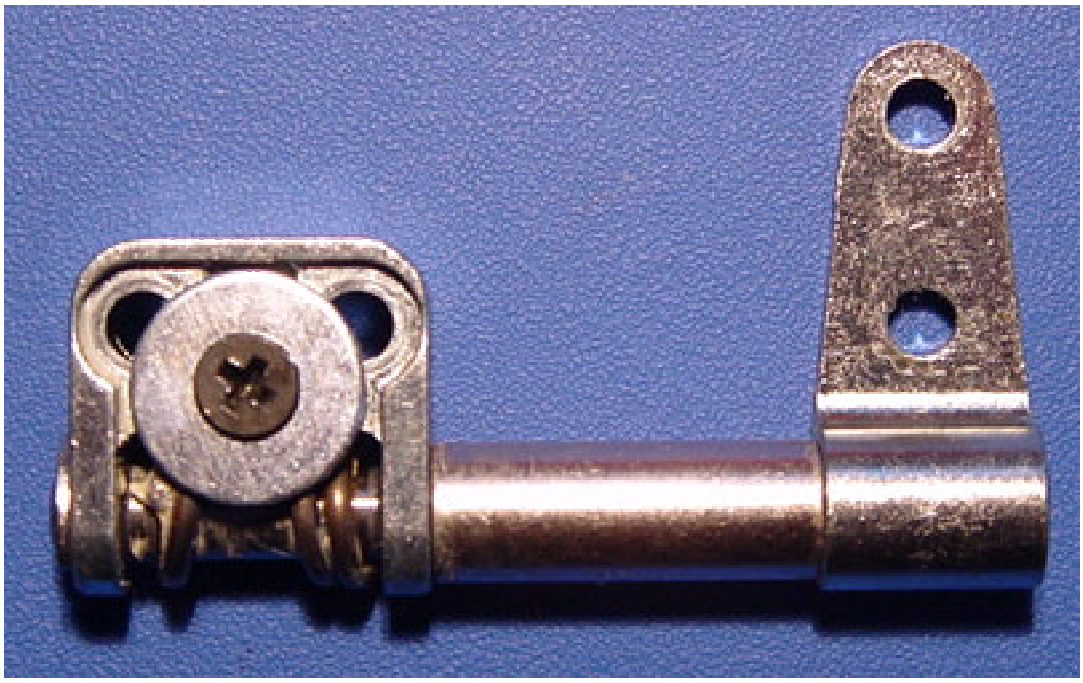
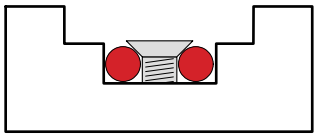


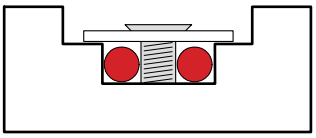
Fig.4

It is under the black screw that you place a steel, zinc plated washer (10mm diameter, hole 3.4mm, thickness 0.9-1.0mm) to adequately trap the shorter spring leg - there is plenty of thread to allow for this (**Fig.4**). This simple fix may result is some slight play in the screen as the spring is not so tightly trapped but it does prevent the problem occurring again.

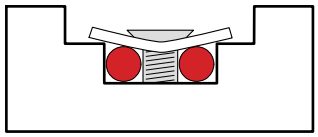
[In the drawings below, the hinge springs are indicated in red. The two larger screws retain the hinge assembly in the eMate and the central screw (shown here) retains the spring legs].



Standard setup - just a screw



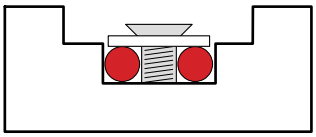
Simple - washer across the top



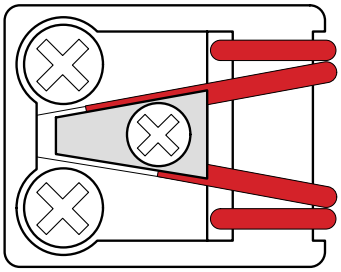
Creased washer for better fit

Alternatively you might wish to experiment with putting a gentle crease across the middle of the washer so that it sits a little closer to the spring legs instead of just bridging the gap across the top, as shown above.

A classier solution (though a more difficult one) is to cut a small triangular part from 18 gauge aluminium that is the same shape as the channel in the hinge for the spring legs and drill a hole for the screw. This will hold them tightly in place and the screen will feel as normal.



Triangular part in direct contact with springs



Plan view with part in place - note shorter spring

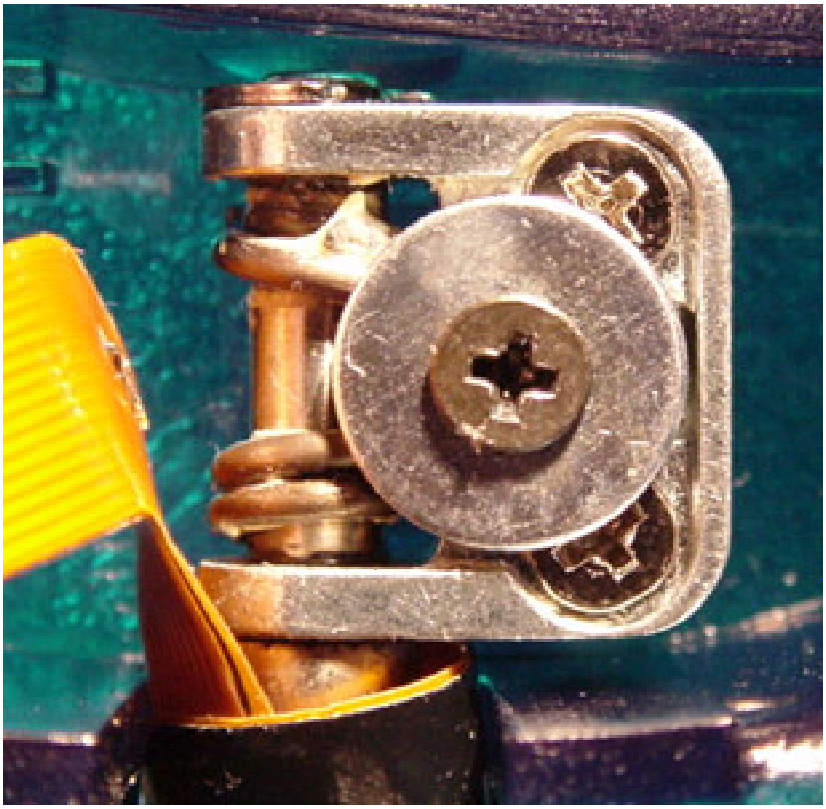


Fig.5

This is the repaired hinge and cable in situ (**Fig.5**). It has been in use for two months so far (at the time of writing) and is working fine. Tape has yet to be applied to protect the repair.

Cable Repair

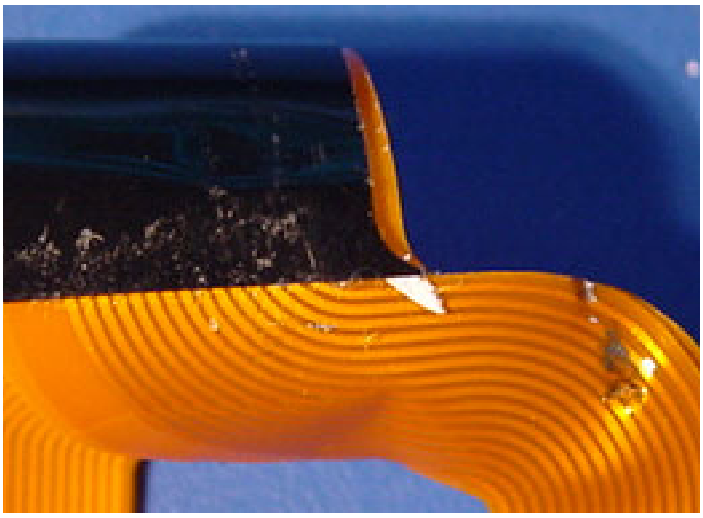


Fig.6

The damage to the cable is clearly visible. As the cable is folded over on itself, the puncture affects four conductors in this instance. One other is only scratched (I hope).

The black tape is to protect the cable from abrasion as it wraps around the hinge.

I proceeded to amaze myself by actually fixing the flexible PCB by scraping away the lamination with a scalpel (under a magnifier) to reveal the copper traces beneath and soldering some very fine copper wire across the gaps (**Fig.7**). There are products available for the repair of PCB's such as Silver-loaded paints but I feel these would not be suitable for use on a flexible substrate.

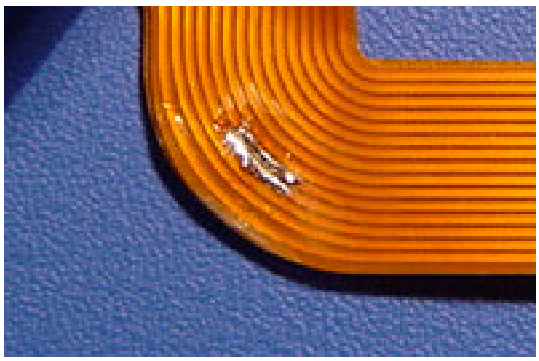


Fig.7

Two fine, solid copper wires soldered across the gaps of the two pairs of conductors either side.

Skill or luck? I favour the latter.

Frankly, I believe I was very lucky because the trace separation is only 0.5mm and bridging the traces was almost inevitable, but hey, sometimes it works. I also don't know how long this fix will last in such a difficult position where the cable is bending but, whatever, one less eMate is lost to the world.

I used a battery powered soldering iron (Wahl Iso Tip) for this job as it can be fitted with a very fine tip and helps to control the temperature to prevent damage to the substrate. If you have access to a temperature-controlled soldering station, you could certainly use that but mine (Skylab) does not have a tip fine enough. Low temperature solder is also helpful here as it will reduce the damage to the PCB and, because it contains some Silver, has better wetting of the less than ideal surfaces.

Finish by protecting the repair with good quality PVC insulating tape wrapped around the cable.

The original cable may be a fancy shape but it might be possible to source a more prosaic replacement that would do the same job - I'll have a look and see what I can find.

Fixing the spring clutches is a no-brainer if your eMate is unfortunate enough to have this manufacturing defect and will save the display cable being punctured. Fixing the cable is basically crazy as it's so fine, but might be worth a try - there's nothing to lose, and if it doesn't work - laugh! (in a deranged sort of way…)

Reassembly

- You might wish to clean the hinge and springs with a cotton bud to remove dried grease and dirt. Rubbing alcohol can be useful for this but only use a small amount. Lubricate again with a light, general purpose grease suitable for metals - this is usually available in small dispensers from electronics stores. If you can find the white grease (which is more resistant to drying out) all the better but it's not critical.

  Teflon-based greases are also a good choice - Triflon or SuperLube are good products.

- Check that the red/black power cable that threads past the left-hand hinge (looking at the eMate from the front) is not trapped or fouling the hinge.

- If you have compressed air or an aerosol duster, gently blow the dust off all components.

- When you reconnect the battery and boot the machine, remember that the clock will need to be reset.

If you have any experiences with this repair or suggestions to make it better, please let me know and I might incorporate them into an updated version of this guide. <joel@inventors-emporium.co.uk>

Thanks to Mimi Cipollone & Frank Gruendel for their suggestions to improve this document.

All images were taken hand-held with a Sony CyberShot DSC-F505 in macro mode under tungsten lighting at medium resolution (1024 x 768), from which portions were cropped.

Coming soon - Visit the Inventors Emporium web site at <http://www.inventors-emporium.co.uk> for more Newton related topics.