

# Meade LX200 Classic Capacitor Replacement

This document describes the replacement process for 5 capacitors in this telescope's electronic circuits.

These capacitors all have the same role in the circuitry; to reduce perturbations in the power supply voltage as received by each of the 5 printed circuit boards in the telescope. There is one on each board.

## Why do they need replacement?

They need to be replaced because using the telescope with a power supply voltage greater than 12v exceeds the voltage derating guidelines for their type of Tantalum "bead" capacitor. When operated at more than 50% of their rated voltage, which is 25v in the LX200, their MTBF is greatly reduced. This reduction worsens as the voltage goes up, such that at 18v for example, the MTBF is shortened by orders of magnitude. There is also a voltage surge at power-on in some scopes. Many users have experienced these failures, usually at the time they switch the telescope on.

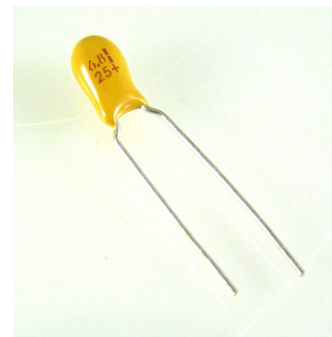
The failure mode in these cases is a short circuit across the power supply, which runs a large current through the capacitor. These capacitors have a coating that is very flammable when heated up to a high enough temperature, which the short circuit will often do. They burn up and destroy components around them, especially the flexible ribbon connector in the hand controller's keypad.

## Where are they?

The capacitors look like this:

They might not be yellow; some are blue, or other colors. Note that there are many of these in the LX200 that do **not** need to be replaced; only these five particular ones need to be.

There is one on the hand controller PCB, the PCB behind the front panel, the main PCB in the base, and one each on the DEC and RA motor assembly PCBs.

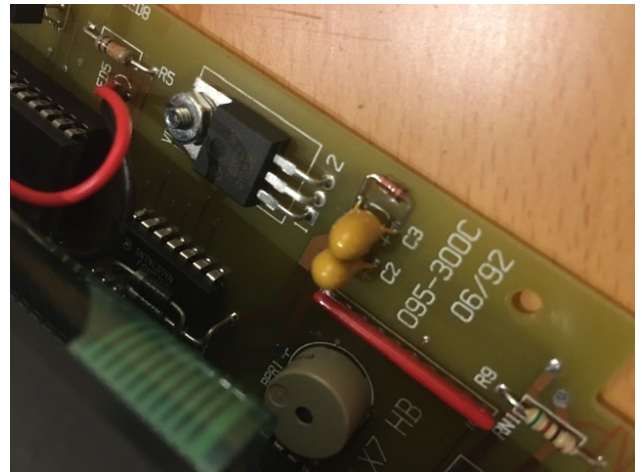


## Hand Controller PCB

It is most urgent to replace this one, since it can badly damage the hand controller. You will need to open up the case and remove the four screws that hold the PCB. You will also need to be careful to not bend the LEDs or damage the ribbon connector.

In the image to the right, you can see two yellow tantalum bead capacitors labeled “C2” and “C3”.

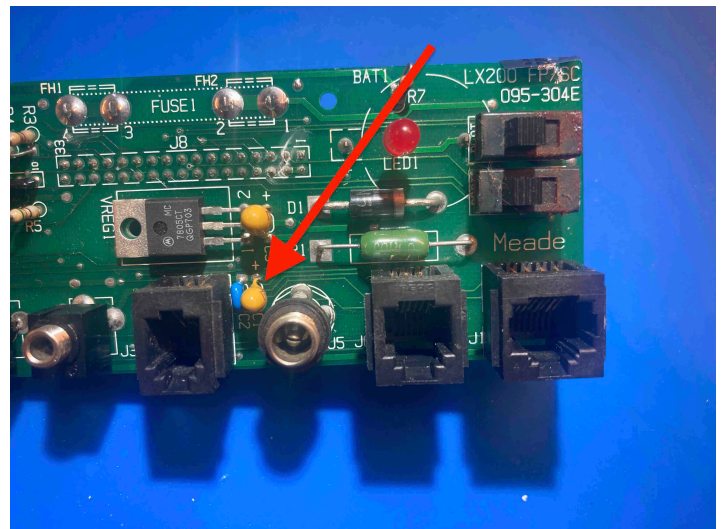
Only **C2** should be replaced.



## Front Panel PCB

This is the PCB behind the front panel where the power supply plugs in.

The red arrow points to **C1**, the one to replace. C3 is above it in the photo, and should not be replaced.

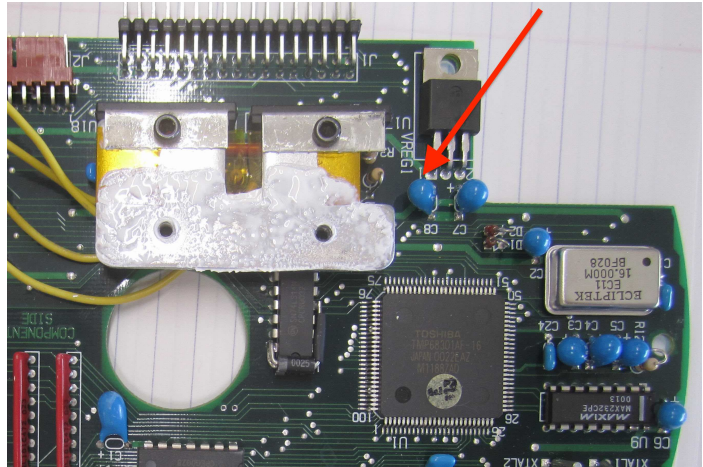


## Main PCB

This is the round PC board inside the base of the telescope. When opening up the bottom of the base, be careful to observe that two small screws in the middle need to be removed as they hold the aluminum heat-sink plate which needs to stay with the PCB. Two other screws hold that plate to the tabs on two ICs on the PCB. These are visible through two holes in the base plate, but they should not be removed.

You will probably need to remove the PCB from the base to work on it easily.

The red arrow points to **C8**, the one to replace. C7 should not be replaced.



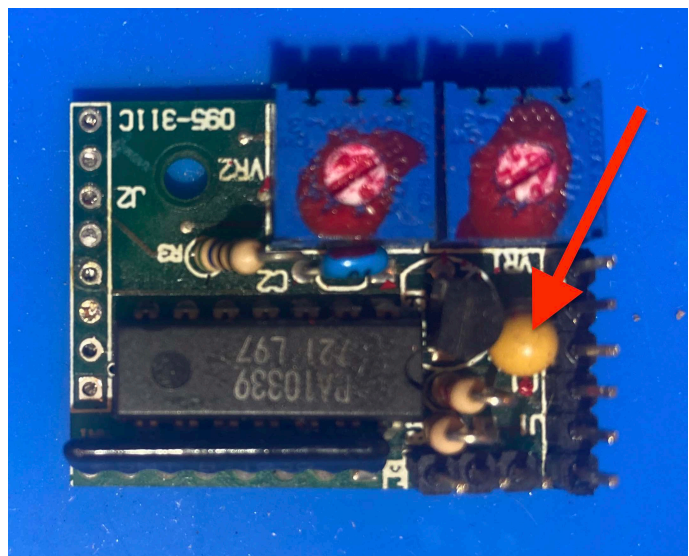
## Motor Assembly PCBs (x2)

A small PCB is part of each motor assembly. The RA assembly is in the base, and the DEC assembly is in the fork arm. These are the hardest places to make the capacitor replacement due to the tight PCB layout.

There is only one tantalum bead capacitor on these PCBs, so finding them is easy.

Be careful not to damage or peel the copper traces on this PCB when removing.

If you find this one daunting, you might want to replace the entire PCB with a new one instead.



## Replacement Capacitors

Replacement capacitors can have values of 6.8, 8.2 or even 10 microfarads, all will work fine in their role as bypass capacitors. A more important specification is voltage rating. This should be at least 25V for electrolytic caps, and 35V for tantalum caps.

These capacitors are polarized and must be installed with the positive lead in the positive mounting hole only. Tantalum caps will have the positive lead marked with some sign on the coating, like a line or a plus sign. Electrolytic caps, in contrast, often have the negative lead marked on the case with a thick white line that has small minus signs running along it. In both types the positive lead should be the longer one.

You can source these many places, but it is recommended to use an authorized parts distributor since other web storefronts may not specify complete and accurate information. Some examples are: Digikey, Mouser, Newark, Arrow, Jameco in the US, Farnham in Europe.

Specify either:

- Aluminum Electrolytic Capacitor, 6.8 uF, 25V, through-hole
- Tantalum Capacitor, 6.8 uF, 35V, through-hole

In both cases you can increase the voltage rating if desired, these are the minimums you should consider

## General Procedure

Removing these capacitors can be frustrating because they usually have a small bend in the lead on the back side, so melting the solder and pulling up from the top might not work. In that case you can snip off the capacitor from the leads, leaving a bit of lead left over. Then, you can pull them out from the bottom, or simply solder the new one onto the old leads. This is not as mechanically strong but can be made to work, and is much easier.

To remove the lead completely, you will probably find that it is hard to get the solder to melt since the two terminals of the capacitor are connected to power traces which tend to be large and hard to heat up, especially with a low power soldering iron. You can sometimes help this by adding a bit of new solder to the connection, in order to enhance the heat transfer to the old solder.

If you do remove the old leads, you should use a solder-sucker or solder wick to remove old solder from the mounting hole, so that the hole is clean and open enough to accept the lead from the new capacitor.

Note carefully the positive and negative leads of the new capacitor, and make sure to put the positive lead in the hole marked with the "+" (plus sign).

Finally, this procedure is not a good one for beginners to try. If you do not have some experience soldering and desoldering electronics, you can damage your PCBs and in the case of the main CPU PCB, there is no replacement available. You should carefully consider getting help in this from an electronics repair technician, hobbyist friend, or LX200 repair service provider.