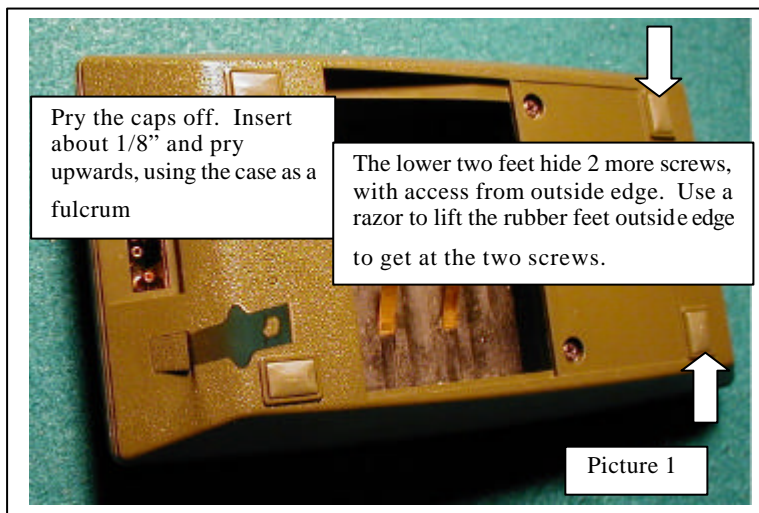


Repairing the HP67

Outline for Repair

- 1) Remove the back cover (six screws, two under the top caps, label, & under the bottom feet)
- 2) Unplug the bridge board to get at the 6 screws holding the middle assembly to the front case w/keys
- 3) Pull out the middle assembly, disconnect the main circuit board, put parts aside
- 4) Flip open the middle assembly 180 degrees to get at and remove the five black screws (not silvery ones)
- 5) Flip the middle assembly back together and remove the last card reader assembly screw
- 6) Carefully pull upwards to remove the card reader assembly, flip over 180 degrees
- 7) Pull the axle pin, place two O-rings, clean all goo residue
- 8) Test the motor & clutch before full reassembly of the calculator, reassemble when satisfied
- 9) Reassemble carefully, don't over-tighten the screws
- 10) Have fun with the calc



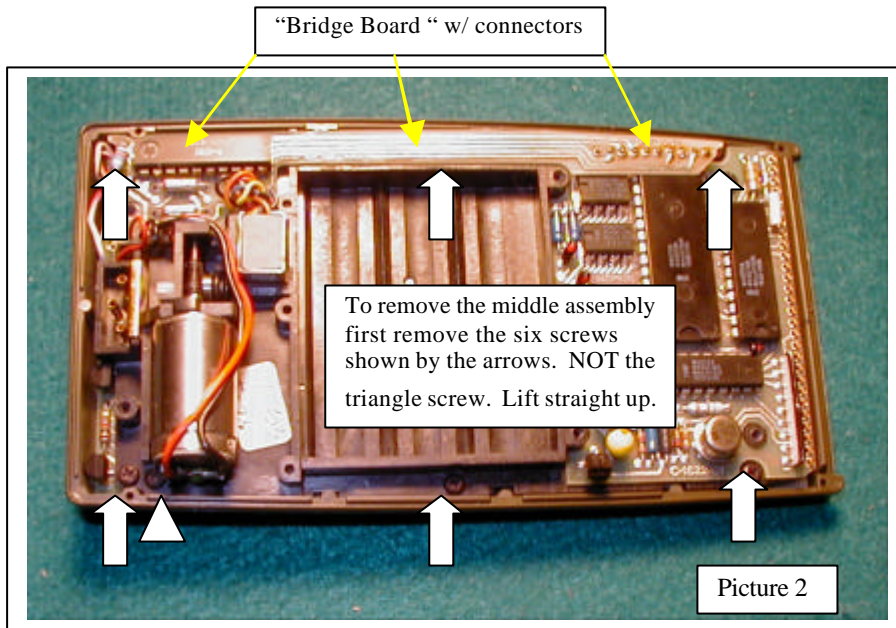
Opening the Calculator Case

There are six screws that you have to overcome and two are hidden behind the upper left and right sides of the label. Two more are behind two plastic caps that fit very tightly over the two uppermost screws. I found that the best way to remove the caps is to use an Exact-O brand blade that looks like a small chisel slightly

narrower than the width of the cap (maybe $\frac{1}{4}$ "). Carefully slip-in the little chisel perpendicular to the face of the calculator on the bottom edge of each cap. After inserting the chisel (bevel at top) about $\frac{1}{4}$ inch pry it up using the calculator back as the fulcrum. It should pop out with no damage to either the calc or the cap. (See picture below)

The lower two screws are behind the lower two feet. The screws can be accessible if you carefully pry the outside edge of the feet. The inside sides of the feet stay attached, then push your screwdriver downward onto the screws.

The label removal is more agonizing. I set the hair dryer on low and cover the rest of the calc with a dry washcloth (after removing the battery then back plate back on) and fry the label as evenly as I can for about 3-5 minutes. Look for an edge of the label that is sticking up a tiny bit. With great patience and care and the sharpest razor edge in the house, tick away at the edge to find a space to begin the pulling off part. When you do slightly misdirect the hair dryer and pull up and out. Sometimes I use the flat edge of the razor to give me a flat surface to pull on the label. This lessens some of the warping and crinkling. Keep it hot and try not to fry your fingers too much.

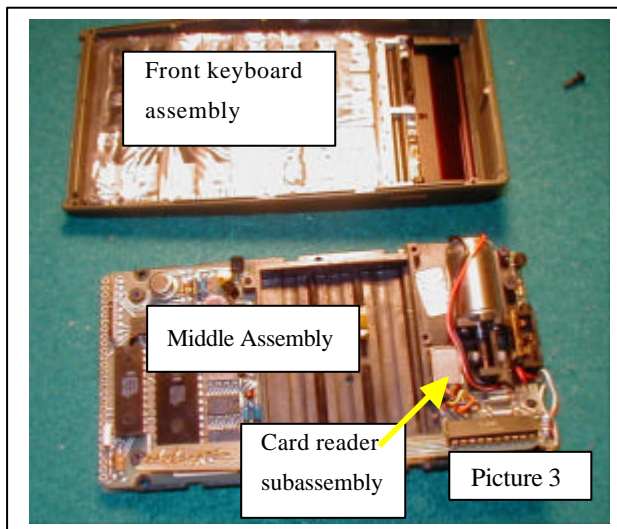


Note The locations of the six removal screws. Do not remove the screw above the white triangle as it holds the smaller card reader assembly together until a later disassembly phase

Once the label is off unwrap the calc to let it

cool. Put the sticky side of the label onto a thick clear static bag that is flat. The thicker plastic is stronger than a baggie. To get the inevitable wrinkles out put the label face down onto about 3 pieces of paper onto a very flat, smooth surface (like glass). Rub the sticky side (with the plastic still on) with a smooth slightly-curved flat surface such as a spoon. I rub it through the plastic on the back rather hard and concentrate on getting the creases out and getting the edges to curl upward, as when the label is returned, the edges will be tight to the calc plastic.

Once the back is off, to remove the middle assembly you have to remove six screws more screws. Two of the screws are under the "Bridge Board", so disconnect it from the main circuit board and remove the two screws. If they stick then push hard on the screws (via the screwdriver) to avoid stripping the Phillips head grooves. Do not use a screw driver that is too pointed as that might strip the screws. Sometimes the screws I have seen have been glued in some manner. That is depressing as you have to be able to retighten them.



Prepare your working Area

You need very bright lights and a smooth clean surface. I put a towel that is thick to "catch" any of the small white balls or rolling wheels. They jump from your hands as if they are alive. I am not sure if its static electricity or a case of bad nerves. You must never believe that they will not jump away from you. Work over the table as if they could fall at any moment. The towel will normally catch them.

I use needle nose pliers to pull the gummy wheel pin and to reset the small white balls and roller. They hold anything that needs to be gently reset. You'll need a strong set of needle-nose pliers.

You'll need space to put the back and front of the calculator and to fan-open the middle assembly. The middle assembly is the battery holder and the keyboard pad. While replacing the gummy wheel, I keep the keypad and the battery holding part of the middle assembly together while replacing the gummy wheel. The table should be at least 3 feet by 3feet. A bright light is a must and I also use a large magnifying glass mounted to an old broken adjustable arm light. The adjustable light lets me move the large magnifying glass anywhere to see the detail inside the calc.

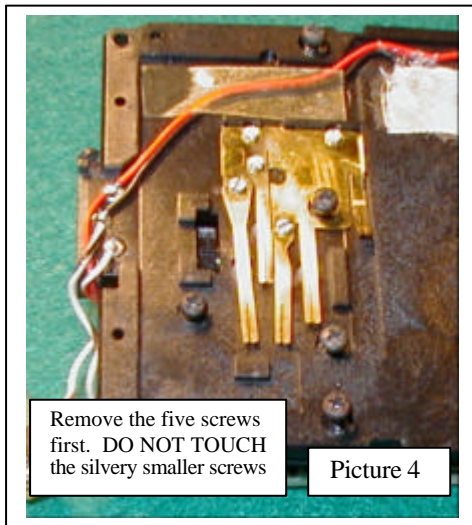
Getting to the Reader Wheel

This text is meant to augment the other HP museum fix-it articles. Next remove the circuit board and set it aside. Next unscrew the six outside screws that hold the middle assembly into the calc (Picture 2).

WARNING: There is a seventh screw next to the card reader and not at the most upper left top as you face the calc. (see first picture a bit above the black triangle) It stays as it is holding the reader together. Keep it tight. Remove only the six extremity screws as the four corners and two in the direct middle of the middle assembly.

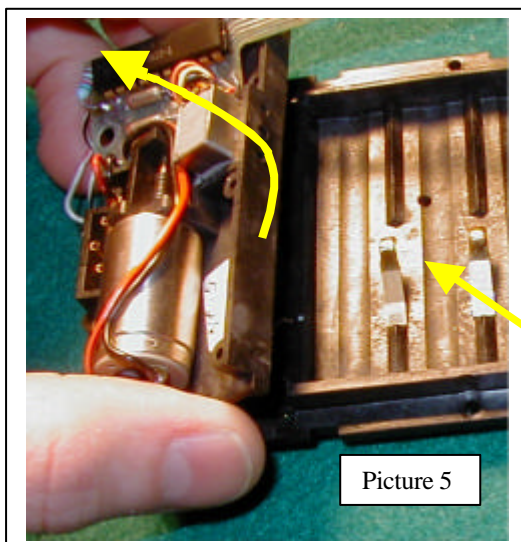
The upper left and middle left are behind the side long circuit board that connects the reader to the main processor. That pops out from the main circuit board rather easily. Gently remove the middle assembly. The plastic keys are in the front part of the calc. Pull upwards on the middle assembly keeping the front face calc portion on the table. Else wise the little plastic keys will fall everywhere. Look out for the golden slide switches for the on/off and the prg/run switches. Do NOT clean them as they have a silicon lubricant on them that needs to stay there.

Take a deep breath and set the middle assembly directly in front of you. Get all the other part out of your way so you will not bump them. Flip up the top part and set it end to end so you can see underneath the card reader. Look for five screws that are black that hold the reader to the black base. Do not think of touching the silvery screws as they hold the fussy golden switch plates. Just the black screws are to be removed (the below photo shows them as already loosened).



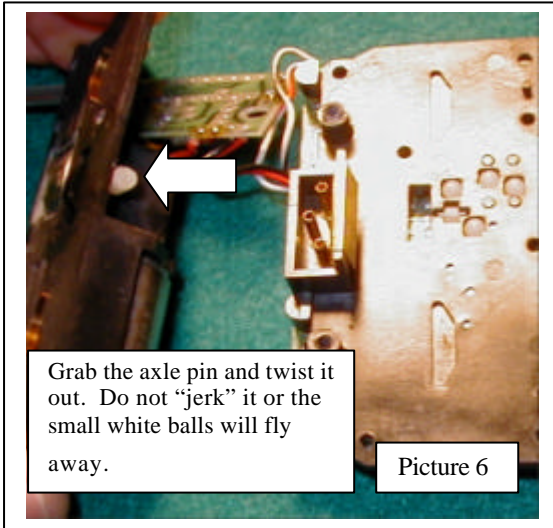
Now re-flip the middle assembly back together. With some care remove the last screw holding the card reader assembly. Now the fun part; as six tiny pieces are loosely held within the card readers inners.

WARNING: This is the time to be very calm. I have done this on the train, but you may not want to. Hold down the middle assembly and carefully pull straight up on the card reader. The fit is tight but very removable. Pull up and flip that over the top 180 degrees and then upside-down next to the top of the middle assembly. The golden clip next to the battery connection may fall away, no problem you'll get it later.



The card reader sub-assembly device is very cool. With better than average luck the two little springs will have stayed into the flipped part (do not touch them if they are still in their little slot). Sometimes the roller will stick to the gummy wheel, sometimes not. Either way pinch the roller in your fingers (remember it can fly away at anytime) and clean it with a Q-Tips dipped in rubbing alcohol. Get the goo off.

Hold down the main part of the calc and lift straight up the smaller card reader subassembly and flip 180 degrees to see the inside parts.



NOTE: Cleaning the goo for the roller is important. Try pinching it with one hand and using the end of the Q-tip spinning like a drill bit, use the spinning action to clean the roller as you very, very carefully rotate the roller as it is pinched. This seems like the safest way to still hold and yet clean the little bugger roller and not have it fly away. They are really hard to find on the basement floor.

Look at everything. Is it clean, if not clean it with Q-tips and rubbing alcohol. The little white balls should be in their place. I clean the head with a quick swabbing.

WARNING: Pulling the pin is hazardous as if you jerk the assembly, all the small parts flyaway. You may want to remove them on your first attempt till you see the amount of strength need to pull the pin. Some come out easy, while others do not.

Pull the pin that is the axle for the gummy wheel. I use a sturdy set of needle nose pliers. With the pin out, get out the gummy wheel. At last your 78% done with the hard part. I use a razor blade to clean the gummy wheel looking at it through the magnifying glass. Scrape it cleaner than clean. Look at the gear for any particles between the teeth.

Put on the two O-rings and push them all the way to the back of the axle. They will fit perfectly. Replace the wheel and replace the axle with a twisting motion of a flat headed screwdriver. Jimmy the wheel until it finds the axle then push in the axle.

NOTE: It seems logical to me now after the first O-ring is on, to place the tiniest amount of superglue as a film on the pointed part of a pin, then touch it to the axle, then quickly slip the second O-ring on pushed up to the first.

Checking Everything

You are now almost ready to put the reader sub-assembly back into the upper part of the middle assembly. First place the gold battery clip on top of the holder as it was. The reader sub-assembly will hold it in place as to reassemble. Now you can replace the upper part of the card reader back onto the middle assembly.

WARNING: Clean and rebend (a little wider) the golden clip by the battery terminal and set in place before replacing the upper part of the reader. Set the upper part top edge first (of the reader sub-assembly w/ new O-rings), then very, very gently push it back down as perpendicularly as you can. It takes a little force to push it back, then clear the ridges that let it fall back into place.

Tighten the upper side screw first then replace the five black underside screws to the sub assembly card reader. When placing back the card reader subassembly, be careful that the two curved springs stay in their slots during reassembly, they usually do stay in their slots. Reassemble the middle assembly and set it in front of you.

Now you should test the tension of the rubber against the program magnetic cards. I gently push just the first 1/8th inch to see what kind of resistance there is. It should be there, but not very hard. If you have to push hard at all, there is a problem. If there is no resistance, then that is also a problem. Consider the next section for actually testing the friction wheel. Both the clutch and the O-rings have to be properly installed. It is good to remove the motor and check the clutch as the clutches wear out or get weak rather consistently.

Testing the Clutch

On some HP67s you can pull the motor “battery terminals” out of the circuit board, on others it is soldered. After disconnecting one of the motor terminals, if you have a single AAA with very small clips, you could also run the motor by giving it power of 1.5 volts. That is enough to test the system. See if a card goes through by running the motor and slipping in a card.

Note: You should check the clutch mechanism, from experience it needs repair about half the time..

This is the safety device to between the rather strong motor and the gear drives. The clutch is designed to not damage the motor if the card gets stuck in the reader somehow and the friction wheel tries to move it. In theory the clutch will still allow the motor to spin, giving the person time to turn off the power and straighten or remove the card.

The clutch actually has two slip surfaces, one on the motor axle and the other on the aluminum sleeve that encases the larger diameter shaft-piece. I have seen both sides of the little insert be too smooth, then the friction wheel does not get power.

To disassemble the clutch loosen the two very small screws, yet let them stay in their holes. If they fall out, use the needle nose pliers to drop them back into the holes, or use a magnetic screw driver. Hold the calc so that the screws will stay in their places. Back out the motor and the worm gear and clutch will follow. There is usually enough wire that allows you to back out the motor away from the reader case without unplugging it.

After removing the motor, lightly tug on the worm gear to see if it separates from the motor shaft. If it does separate, then you need to strengthen the fit somehow. Superglue works quickly and seems to work in the short term. It is difficult to say if there could be future damage to the motor, but I doubt it if your careful with the re-assembly.

Gluing the Clutch Mechanism

If you place a thin layer of superglue on a pin point and slide it around the clutch opening then push it back on the motor (be careful not to get superglue on the motor, spin the clutch as you push it onto the motor axle).

WARNING: After pushing the clutch w/ new superglue back onto the motor shaft, keep spinning the clutch so the superglue does not adhere to the motor case. Apply about 30 seconds of spinning.

This is my only fix right now for the clutch. If the card studders through the reader it is probably a weak clutch. Gluing only the axle to the clutch may not strengthen the clutch as sometimes the outer part of the aluminum sleeve can be loose to the clutch so the motor’s force cannot be transmitted.

A better fix is to find a rubber-like replacement for the nylon insert of the clutch or to add tape wrapped around the motor axle and refit into another clutch arrangement. As these parts are so small, this is very difficult to accomplish. This will require some experimentation and I will try to get to this project in the future. I am also looking for some wire that might have the same opening and thickness as the clutch sleeve, as a replacement. Stay tuned.

WARNING: Using the superglue option is “do-able” yet beware that if the card jams be quick to turnoff the power on the calc. The error warning will also shut off the power, but you can be quicker.

Common Problems and Repair Diagnostics

1 Magnetic Card stops abruptly

The springs are loose and fell out of their slots. Disassemble and reassemble.

2 Screech at the end of a card's passing through

The clutch is starting to fail. Disassemble and try to superglue the clutch. Do not apply superglue to the motor 's shaft, in stead, by pinpoint apply superglue to the end opening of the clutch , then quickly push onto the motor shaft. Spin the cluch for 30 seconds so the glue will not stick to the motor case if there was extra glue flowing out.

3 Rumble of vibration

The gears are not meshing well and are probably worm. The pin of the gummy wheel might be not properly installed or worn. This may need some new parts. If the rumble is not too big and the calc reads OK, no problem.

4 "Error" after it appears to pass through just fine

Very many things can be wrong here. Probably the golden switches are out of alignment. Difficult to repair as there is a lot of reassembling.

5 Judders through just barely

Clutch is weak. Motor can also be weak, as I have seen them burn out. Before the repair, be careful not to try to force the cards through if there is gummy wheel symptoms.

6 Magnetic card travels too slow

Battery might be weak. The friction wheel is too tight. The card path is dirty or blocked with goo.

7 Magnetic Card travels too fast

Have not seen this too much. Diameter of the friction wheel is too small?

8 Will not start the motor at all

Golden switches are out of alignment or the white balls fell out. I have noticed that sometimes tape was placed between the two halves of the middle assembly. You do not want those two halves to be separated at all. It is not obvious as to why this was done. Also setting them back into the case sometimes they fall a bit into the case, then fall away from each other. Be careful to see that they are as close together as possible after they are in the case.

9 Red light flickers and the card barely makes it through

The battery is low and therefore the card travels slow due to not enough electrical power.