



RODDENBERRY.COM

#PRP1781

Federation Mark X Medical Tricorder Prop Kit Assembly Manual



The Roddenberry.com Federation Mark X Medical Tricorder instructions are for making a non-functioning “dummy” prop and includes a non-functioning medical scanner and the vacu-formed bottom door used to secure the scanner to the medical tricorder. The graphics included with the **Medical Tricorder Kit** include the version seen in *Star Trek: First Contact* and the seventh season of *Star Trek: Voyager*, as well as the one used on *Deep Space Nine* and on *Voyager* before the seventh season, whose graphics are identical to the **Mark IX Science Tricorder**.

Some model and prop making experience is encouraged due to the complexity of this model of tricorder prop.

To aid in adding an optional electronic circuit board to this Roddenberry.com kit either now or in the future, limited electronics preparation instructions are in italics, and some pictures reflect these modifications. No electronic parts or circuit board installation instructions are included with this kit.

PARTS INCLUDED:

- 1 Main body (clear vacu-formed)
- 1 Flap (resin casting) with Flap Cover Plate
- 1 Bottom frame (laser-cut acrylic)
- 1 Bottom door, medical version, vacu-formed to hold the scanner, includes .030 x .125" spacer strip(s)
- 1 spring retainer for scanner, with two .100 x .188" styrene strips, and black felt
- 1 each Frame Ends, left and right (resin)
- 1 Red Square (EMRG button)
- 1 each ID and Name Plates
- 2 Hinges
- 8 Screws for hinges (4 long and 4 short)
- 2 Hinge Retainers
- 4 @ 0-80 Screws for bottom door
- 1 Medical Scanner (includes main tube, acrylic tube, machined end cap, bottom cap, green LED, brass button, red and yellow graphic)
- 1 Graphics Sheet (printed vinyl sheet) to make your choice of three different science tricorders, and copper and black tapes pre-cut with graphic designs
- 1 each Front Acrylic Tube, long and short half-round front details



TOOLS NEEDED:

- Dremel moto tool with a 1/8" or smaller cutting bit
- Drill with a 1/16" drill bit, and a countersink bit
- Small flat file
- Screwdrivers (small jeweler's Philips screwdriver for the 0-80 screws, and a larger one for the hinge screws)
- Hobby knife (X-acto brand or similar)
- Plastic straightedge (a ruler or drafter's triangle – see-through is helpful but not necessary)
- Tweezers
- Artist's detail paint brush

SUPPLIES NEEDED:

- Thin acrylic solvent cement (Weld-On #3 or similar)
- Cyanoacrylate (CA) glue, medium gap filling recommended; and CA cure accelerator
- Bondo plastic filler, and automotive spot putty
- Sandpaper (220-320 grit rough sanding, 400-600 grit finish sanding)
- 5-minute epoxy glue (clear type)
- Testors Clear Parts Cement

PAINTS NEEDED:

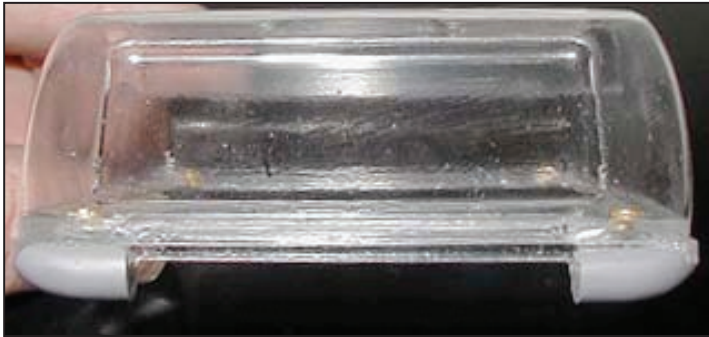
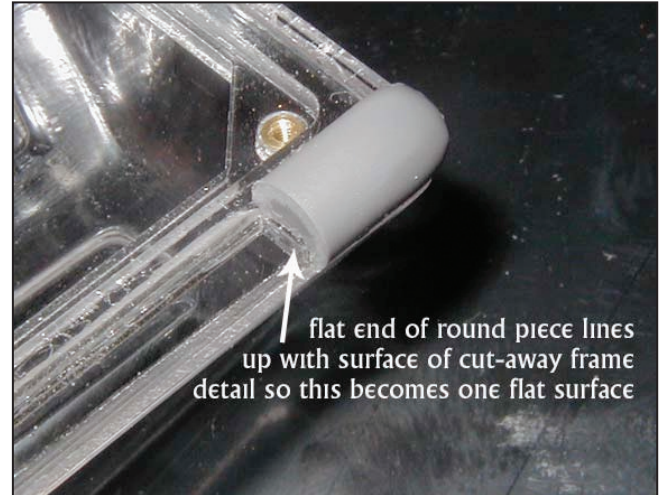
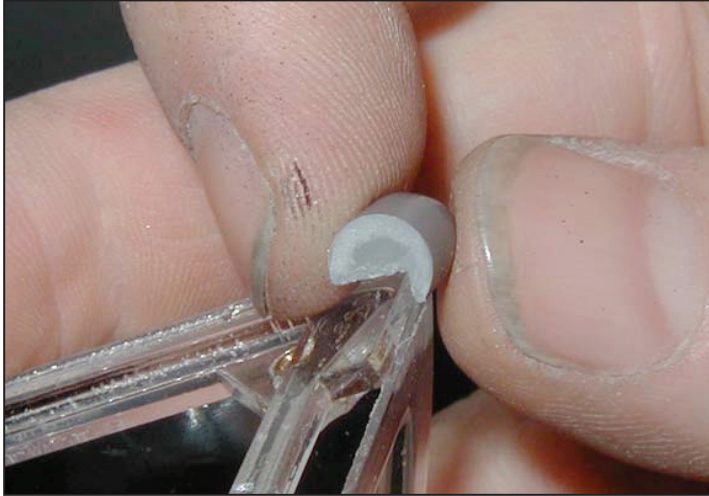
- Primer (sandable-type recommended)
- Medium grey metallic, such as Plastikote #1534 Light Smoke Metallic (big can) or GM#7173 (small can)
- Krylon Flat Black or Semi-Gloss Black
- Black brush paint (a small jar of Tamiya, Testors, or similar brands, either flat or semi-gloss)

OPTIONAL TOOLS AND MATERIALS:

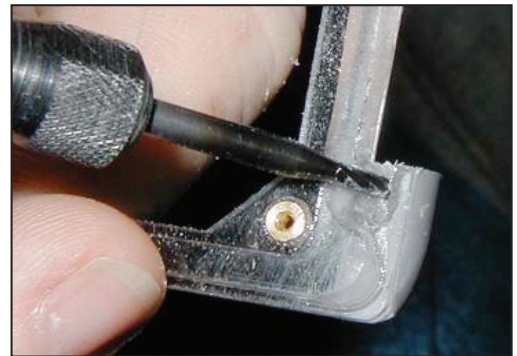
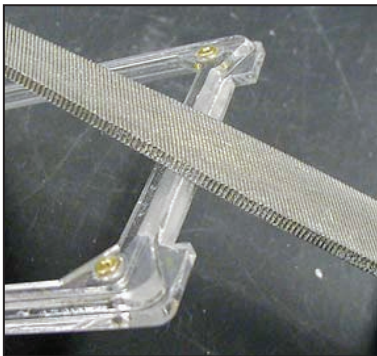
- Soldering iron with solder, wire, red surface-mount size LED (for EMRG), red (or blue) surface-mount or T-1 size LED (for ID)
- 2 @ 75 ohm resistors
- Shrink tube or something to insulate the wiring from shorting out in your tricorder
- 1/8" drill bit
- Baking soda (bicarbonate of soda)
- Double-sided tape (carpet tape or similar)
- Thick acrylic cement (Weld-On, Testors hobby cement, or similar)
- Self-healing cutting pad (available at art supply stores)



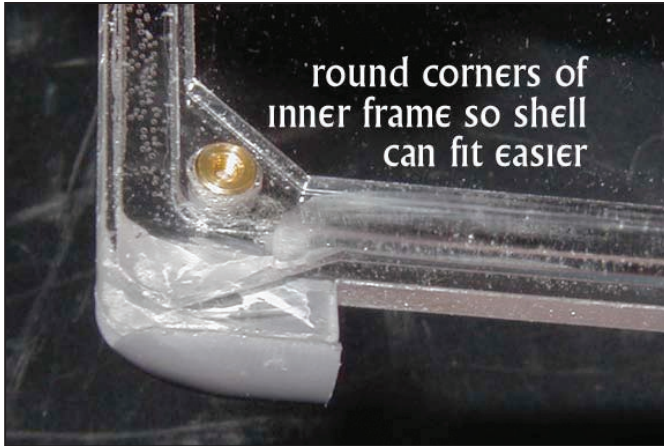
Step 1: Wash your resin parts only (not the vacu-formed clear shell) with a chlorine-based cleaner, such as Ajax or Comet brands, and rinse with water to remove traces of mold release, which might interfere with the eventual paint finish. Remove the protective sheets from the inside and outside of the main body shell if present.



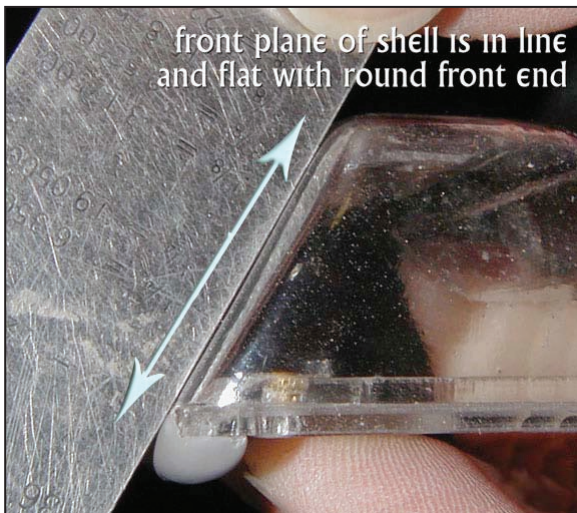
Step 2: CA glue the two front frame ends onto the acrylic frame. Note they are a left and right, and the flat end of each is lined up with the inside ends of the rectangular edge cutout to create a single flat surface.



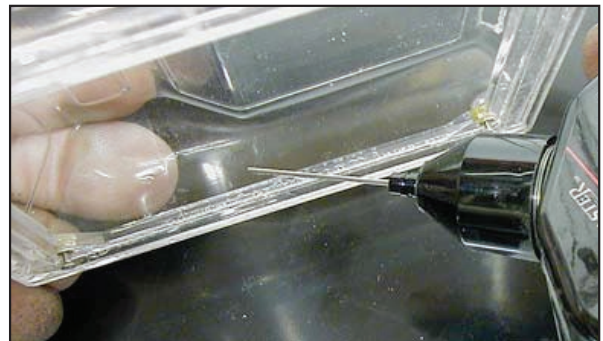
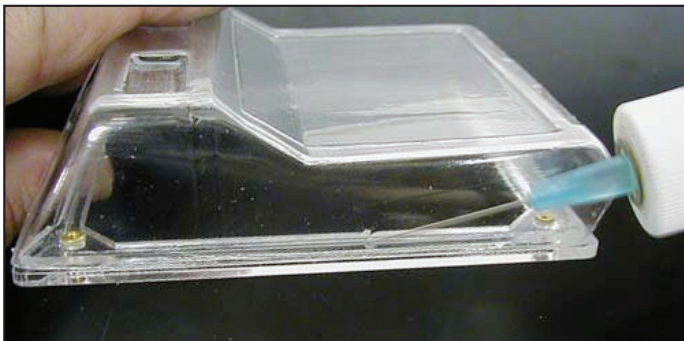
Step 3: To aid in installing an electronic circuit board on the front face (whether you're going to put one in now or are just thinking about it), file the front slot of the frame at an angle as shown, without cutting into the flats of the frame ends; and don't go so far as to sharpen the forward edge. A 1/32" to 1/16" flat edge remaining is okay. With a Dremel tool and a 1/8" or smaller cutting bit, cut slots in the two frame ends. You may or may not be cutting through the acrylic into the resin.



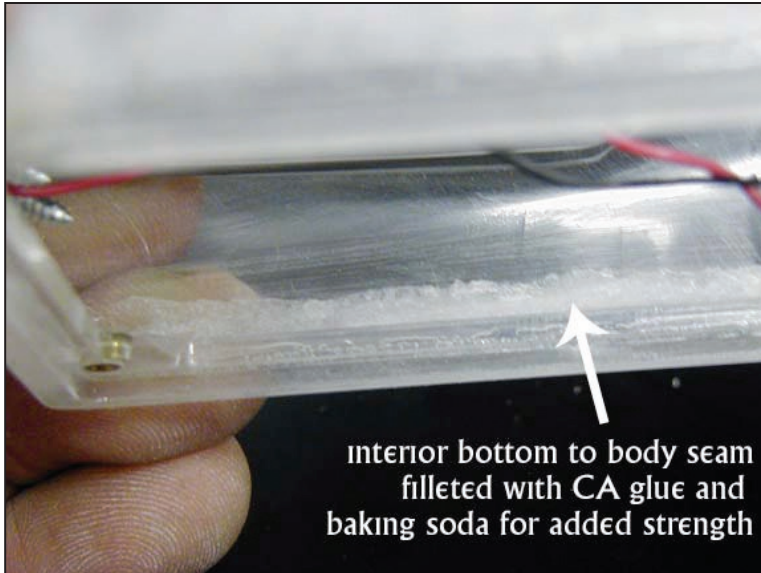
Step 4: Screw the bottom door on the frame. You may need to file the front and back corners of the smaller inner frame at angles to allow the clear shell to fit properly – test fit the shell to see if you need to remove material.



Step 5: Try to push the frame forward enough so the front end with its round protrusions lines up with the surface of the front angle of the body shell. It should appear as one “flat” surface; check with a straightedge to be sure. Note that the frame edges will stick out beyond the shell on the other three sides.

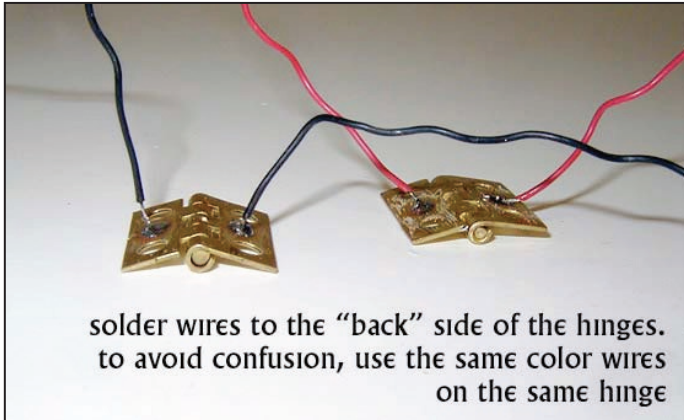


Step 6: When the shell is seated, glue together with thin Weld-On 3 acrylic cement, which will secure both the acrylic frame and the clear shell. If you can, glue your parts when placed on a flat surface to avoid twisting the tricorder body.

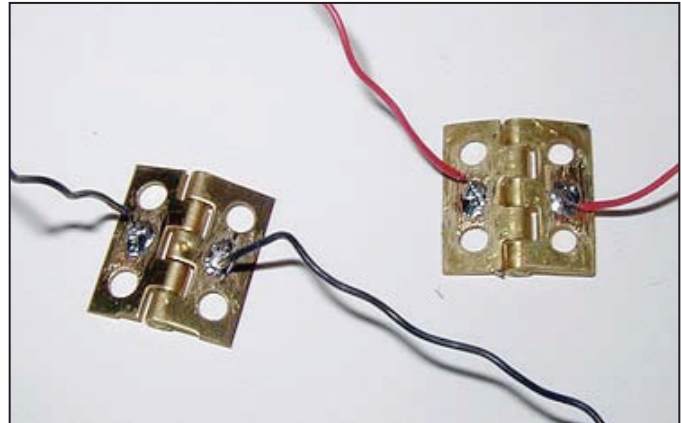


interior bottom to body seam
filleted with CA glue and
baking soda for added strength

Step 7: When cured, remove the bottom door, put a bit of masking tape in each of the screw holes (to keep glue from getting in the holes), sprinkle a little baking soda on the interior seam (don't use too much or you won't get complete glue penetration of the soda powder), and apply some CA glue to the soda. Put a fillet of glue/soda around the three sides and on the front up to the flat edge of the resin round ends – these are the weakest points of the shellframe joint. You may also do it the other way – apply a bead of glue first and then sprinkle some powder on the glue. Remove the tape when you're finished gluing.



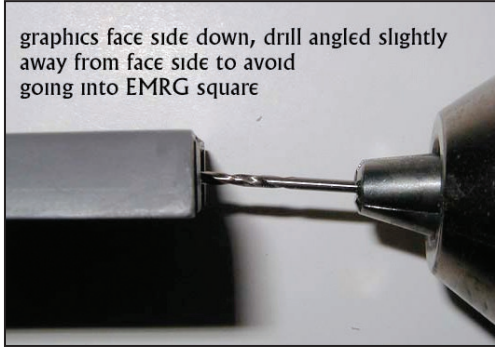
solder wires to the "back" side of the hinges.
to avoid confusion, use the same color wires
on the same hinge



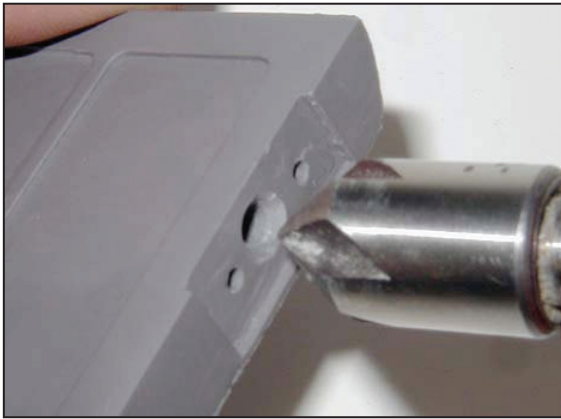
Step 8 (optional electronics preparation): Get 4 lengths of wire about 3" long for each hinge leaf – 24 gauge or smaller will work; they don't need to be very thick. To make it easier for you in wiring your tricorder, use two different colors of wire such as red and black, and be sure you'll remember which wire/color is positive and which one is negative/ground as you'll be wiring LEDs into the flap before it gets sealed, and you'll need to know the difference when wiring to your main circuit board/battery. Scrape clean the places on the hinges you'll be wiring, which will be the opposite side from where the hinge axle is. You may be scraping a protective clear lacquer from the hinge surface. Solder the wires to the hinges, being sure you use the same color wire on each hinge so one hinge will have two red wires and the other will have black, or whatever colors you wish to use.



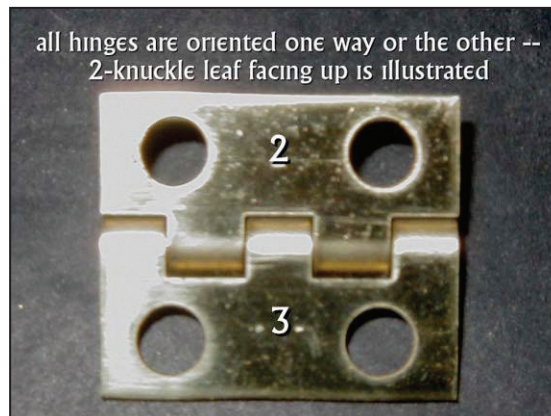
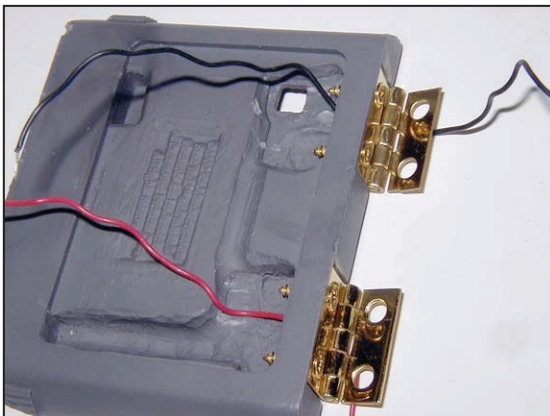
graphics face side down, drill angled slightly away from face side to avoid going into EMRG square



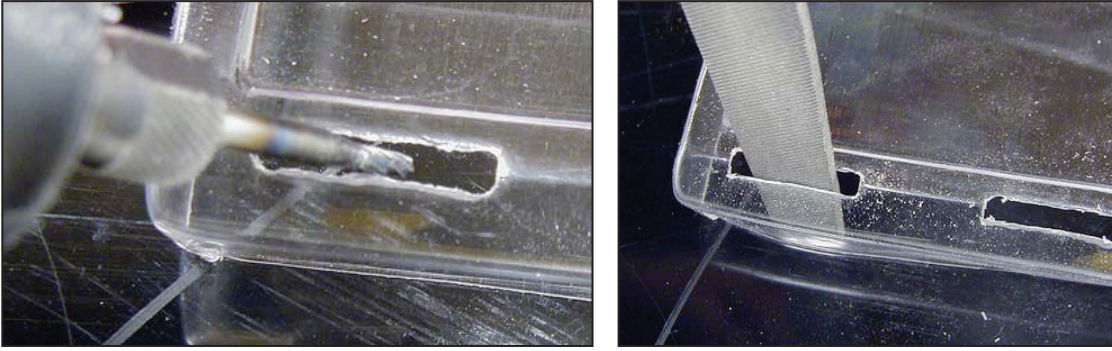
Step 9: Carefully 1/16" drill the four screw holes no more than 1/2" deep in the resin flap for the hinges, angling these holes slightly so there is no danger of the drill coming out on the outside surface – the EMRG recessed square is very thin at this point and is easy to break through with a badly angled drill bit. Don't angle it too much; otherwise the screws won't sit well in the hinge holes.



Step 10: For wired hinges, drill a 1/8" center hole in each of the hinge slots, large enough for a wire to be put through. You may also want to countersink in slight depressions in the flap where you've drilled these center holes that will make room for the wire to hinge solder joints so the hinges can sit flat in their slots.

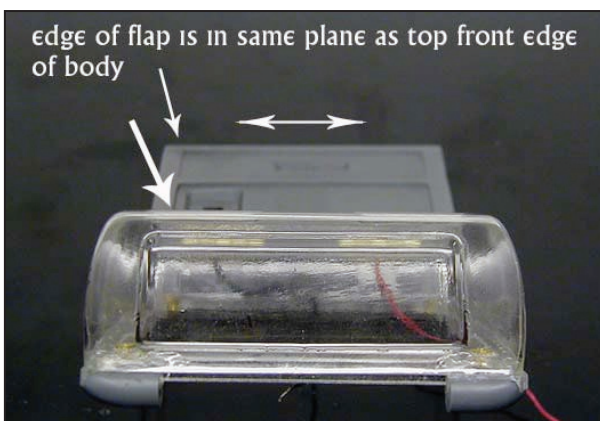
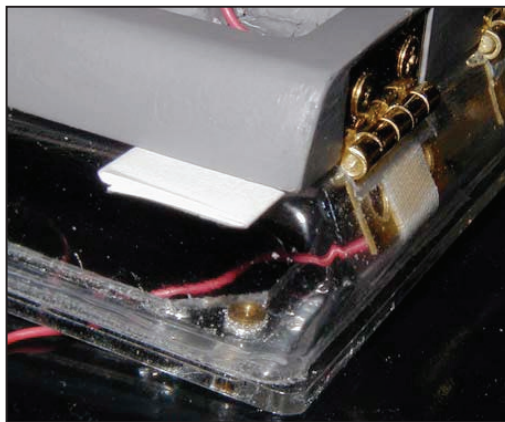
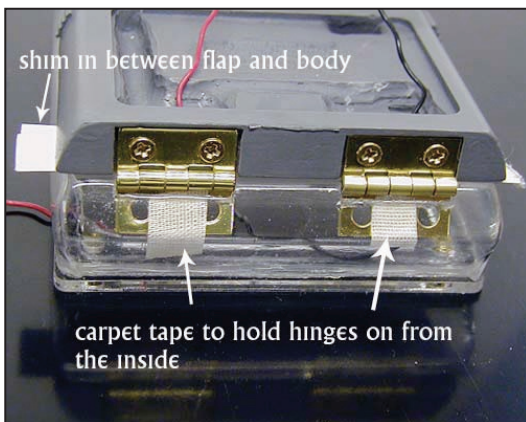


Step 11: Secure the hinges to the flap with the four long (3/8") screws, making sure they are both oriented the same way – whichever way the hinge is (the 2 side or the 3 side) to the flap should be the same on both hinges. Also make sure the hinge axles appear even on the flap; you will have a lot of problems if either hinge appears or measures "off."

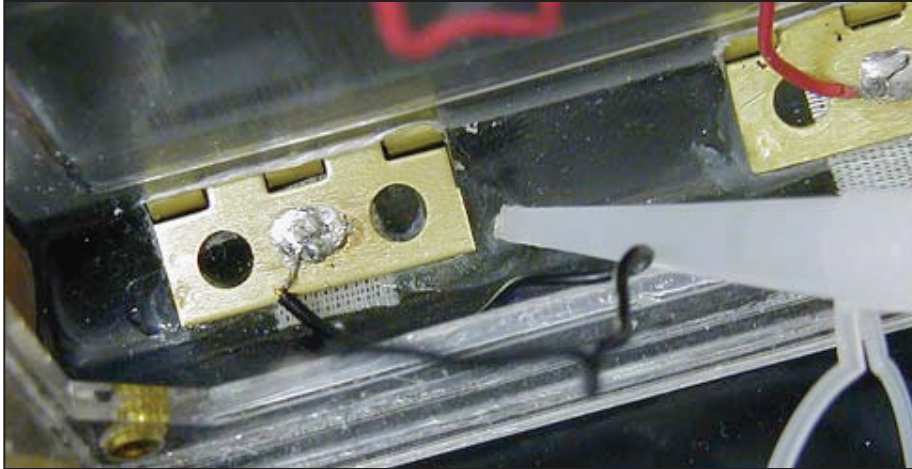


Step 12: Cut your hinge slots in the body with a Dremel tool, being really careful you don't go beyond the confines of the vacu-form depressions. When both slots have been roughed out, use a file to finish the edges nicely.

Try the flap hinges in the body, you may need to cut away a little more material in order for the hinges to go in all the way. Also file the slots in such a way that the hinge leafs will sit as flat as possible against the interior wall of the body.

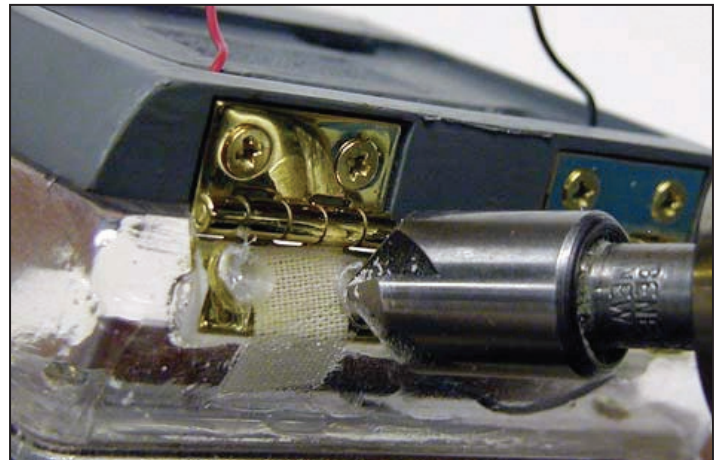
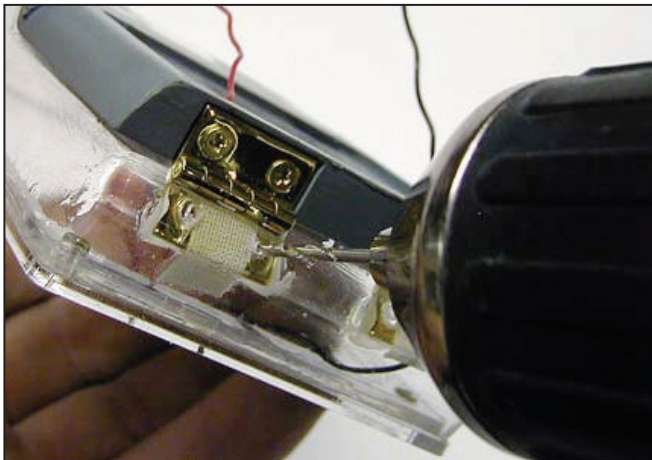


Step 13: You will need a spacer to lift the flap away from the body at the hinges. You can use 4 or 5 thicknesses of paper for this purpose, or use a shim 10-20 thousandths thick. This will keep from having the thickness of paint interfering with the proper closing of the flap against the body, which could possibly damage the paint at that area. Holding the hinges in place with your hand or with a couple pieces of carpet tape (recommended), try opening and closing the door. You will have to visually determine how the flap appears on the body in both the open and closed positions and from the front and back.



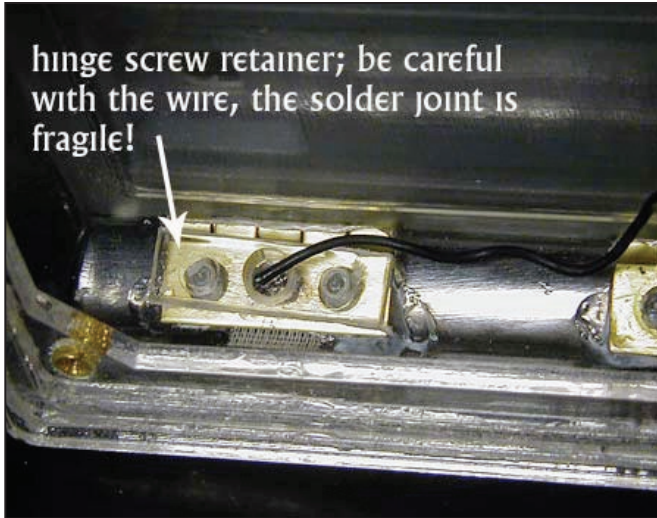
Step 14: When you think you have it right, you'll need to place a drop of CA glue on both interior hinge leafs to tack them in place, with some CA accelerator to quickly cure the glue – if you have tape in place, it's okay to leave it in. Do not use a lot of glue and be very careful you don't get any glue in the hinge axles. If you're fortunate, the flap will hinge open and close and look even in both positions – this is the one part of this kit's assembly that is more art than science and can be very difficult to accomplish. If something is tweaked in either the open or closed position, you'll need to break one or both of the joints and try again. And if you build up too much glue, you'll have to chip away the old glue and start again. And don't forget to look at the hinge leafs screwed into the flap; one of those hinges may be the part that's off.

If you get any glue in the hinge axles, you will have little choice but to get the pins out of the hinges and clean them out as best as you can, or you will have to replace the hinges; they are readily available at hardware stores (replace with a set of 3/4" x 11/16" brass or brass plated hinges).



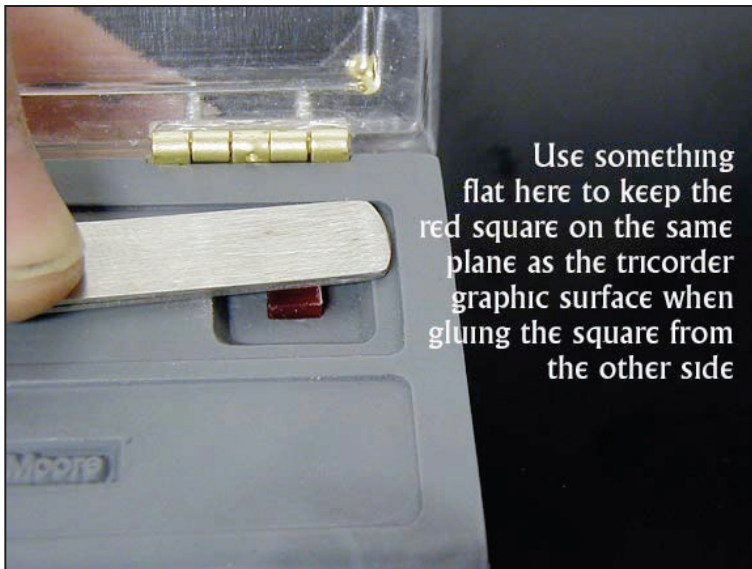
Step 15: When the flap is in the right place, you may need to add a little more glue to the inside leafs to eliminate any space between the hinge and the wall so when the screws are tightened the hinges won't get out of position. You may also use bondo if you want for this purpose. Drill four holes through the outside of the body and through the hinge holes -- this will be easy to do because you can see through the clear materials -- then countersink the holes.





Step 16: Using the hinge retainers provided, screw in the four short (1/4") screws to finish assembling the hinges to the main body shell.

Be careful with the wires when tightening the screws! If a wire should break, you'll have to remove the hinges in order to resolder them, so be sure you have good solder joints before proceeding with assembly.



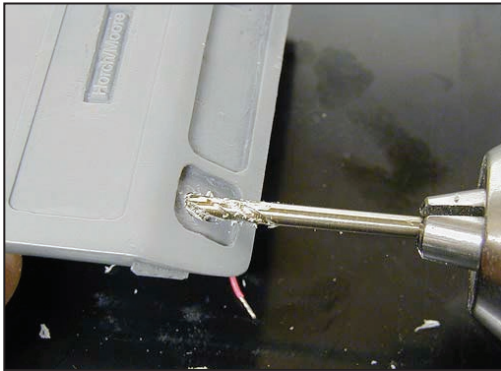
Step 17: The red EMRG square is about twice as long as it needs to be in the tricorder; it should be about 3/16" to 7/32" in length. Cut off, sand, and/or file away the excess from the opposite end of the good flat square end – this will be very glossy and either rounded or caved in compared to the rest of the surfaces. Place the red square piece into the EMRG hole in the flap, using some sort of flat tool (a scrap piece of plastic or a tool or ruler) on the outside so the square doesn't stick out beyond the plane of the flat surface. Then lightly CA glue the square in place from the inside. Once you have a seal where glue won't leak out to the outside, add more glue for strength.

See **Step 18** on the next page for an alternate option...

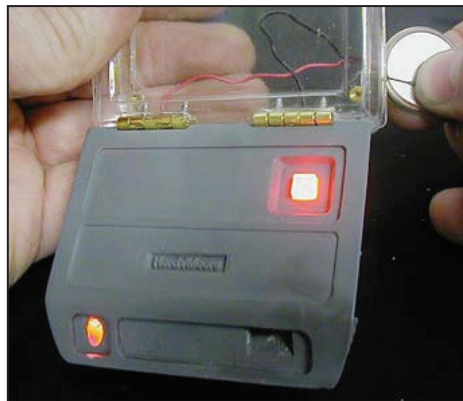


Step 18: As an alternative, you could cut away excess red square material from the inside with a Dremel tool after gluing onto the flap.

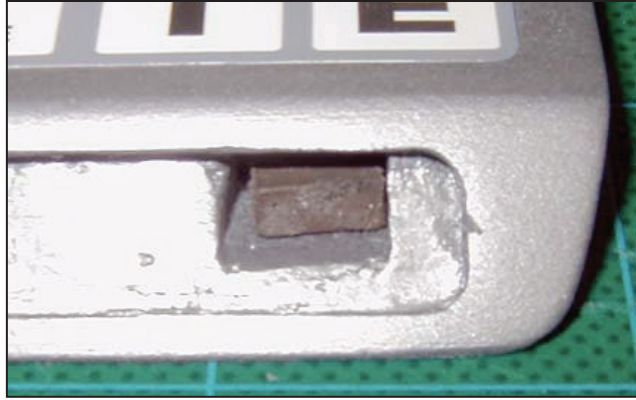
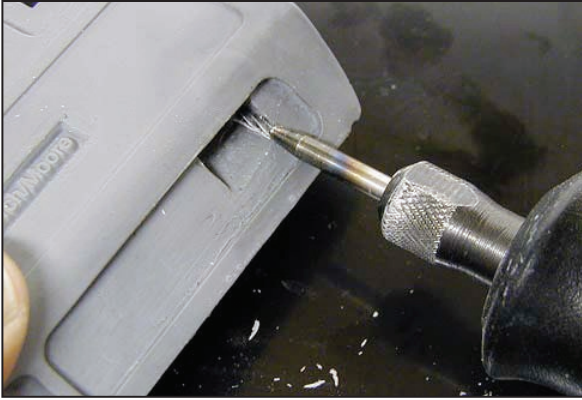
You might need to sand away more of the red square from the inside after gluing to make more room for an LED.



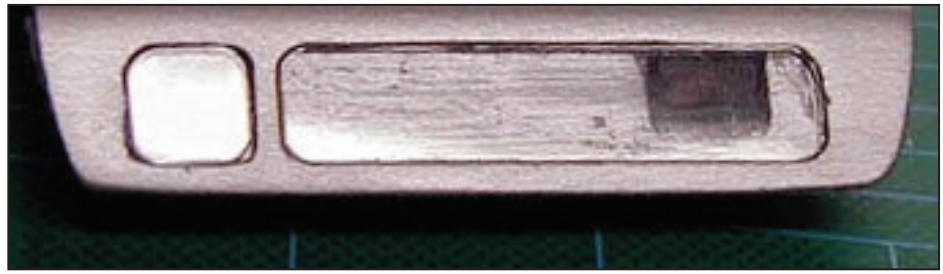
Step 19: Drill a 1/8" hole in the ID square so an LED can shine out of it.



Step 20: For wiring two LEDs in the flap, place the LEDs where you want them in the flap and glue so they don't move. Solder to one of the leads of each LED (either both the positive or the negative leads) a resistor of 75 ohms. Solder both LED positives and both LED negatives together, then solder your positive hinge wire to the positive LEDs end, and do the same for the negative hinge wire to the negative LEDs end. If you notice the picture, the red hinge wire is connected to the junction of the two resistors. Test your circuit using a 3 to 4.5V battery source with the wires and try it out with the flap open; it should light up. If it doesn't and you know the circuit is otherwise operating when directly connecting the battery source to the circuit at the flap side of the tricorder, it's possible there's something in the hinges which is preventing good electrical contact, and you'll have to work with it as best you can.



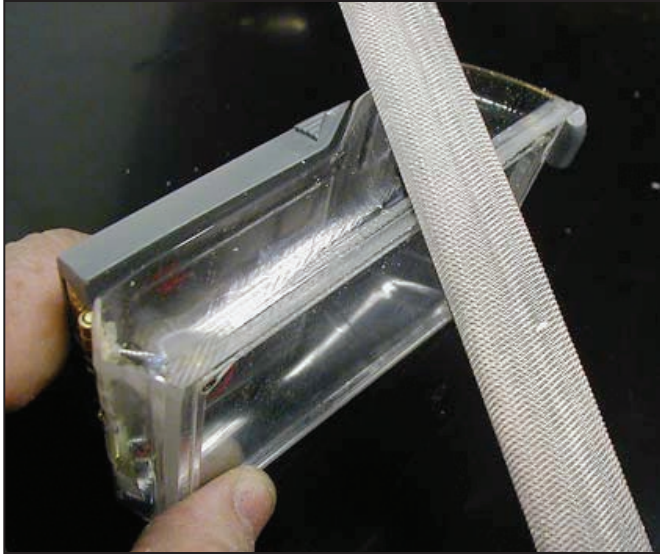
Step 21: You will also need to glue a magnet in the slot on the flap's edge if you're building up an electronic tricorder containing a reed switch, and you may need to dremel away material for the magnet to go in without it sticking out. Depending on the circuit board, you might have to make a new hole for the magnet to activate the switch.



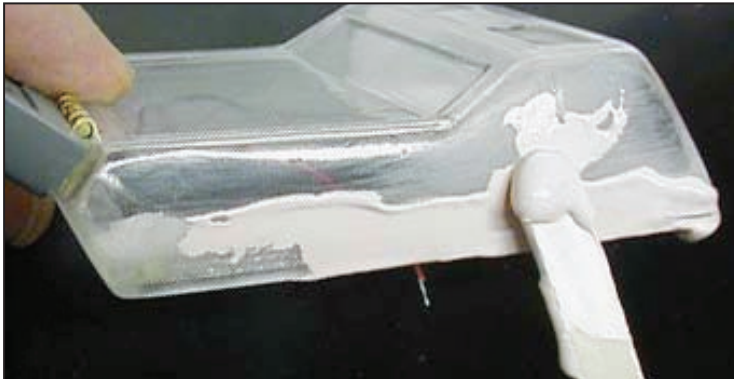
Step 22: CA glue the cover plate on the flap. You may need to sand the ID and nameplates thinner (the graphic should be slightly inset to the flap surface) before gluing these plates on. They are also irregular shapes, so test them first before permanently gluing them.



Step 23: Apply bondo on the entire surface of the flap cover plate (do not bondo the ID or tricorder name flap edge plates -- leave those alone -- they should be slightly inset) and sand until the surface is smooth and flat with a sheet of sandpaper on a flat table. Be careful you don't sand too much, especially at the flap edge. If you have any visible spots that are not filled, bondo again.

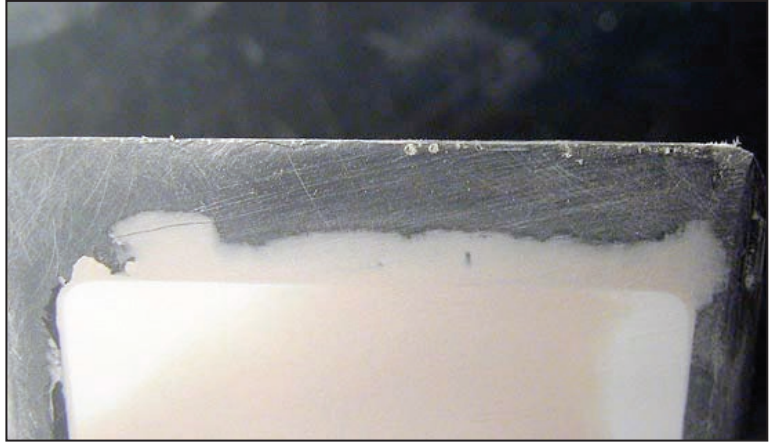


Step 24: Sand or file the protruding edge on the frame all the way around so it contours with the body nicely. 120/180-grit rough sandpaper will work nicely for this, followed by 220/320-grit. If there is any webbing present on the vacu-formed main shell that's sticking out from the rest of the surface, it will manifest itself the most on the back corners below the hinges; so you'll need to sand that away and possibly add a little CA glue/baking soda to build the wall thickness back up on the inside.

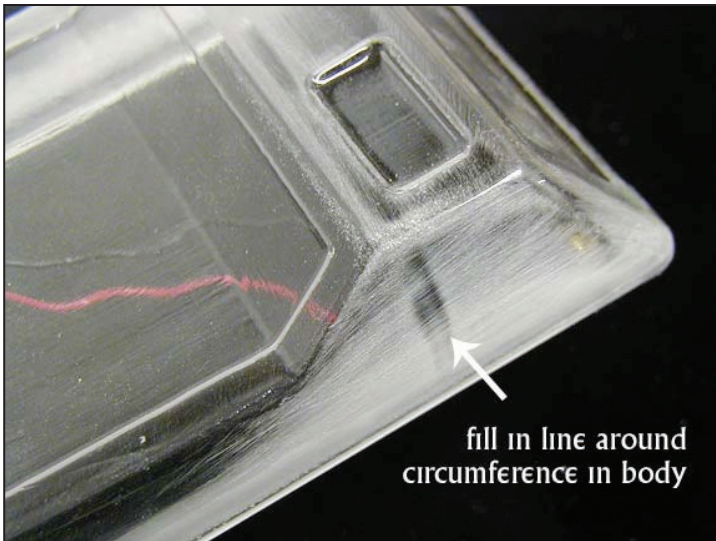


Step 25: When it all looks good, apply bondo or spot putty to the frame/shell joint all around, and sand until smooth. Put some masking tape on the hinge axles and bondo the hinge holes on the body and the hinges on the flap, making sure not to get any filler on the axles, and sand until smooth. On the front end, avoid sanding too much of the round protrusion surface. You shouldn't have any flat spots on those pieces where the round tube will go on in the front slot.





Step 26: Fill in any bad places with more bondo and sand again, and pay some attention to the pointy edge on the flap; you may need to fill in small bubbles that might be exposed after the flat sanding, and you will want to “break” the sharp edge by sanding lightly on it until it is no longer sharp to the touch, without sanding too much and losing the shape.



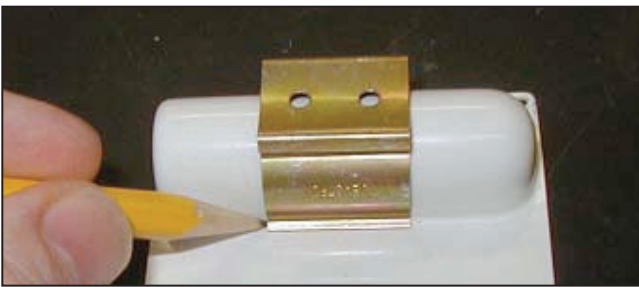
Step 27: There may be a wide line present on the body near the front of the tricorder that goes all the way around the body. You will need to scuff this surface and bondo, then sand until smooth.

Also sand the shiny surfaces you'll be painting on with 220/320-grit, without sanding any depressed areas where the graphics go.

PREPARATION OF BOTTOM DOOR:



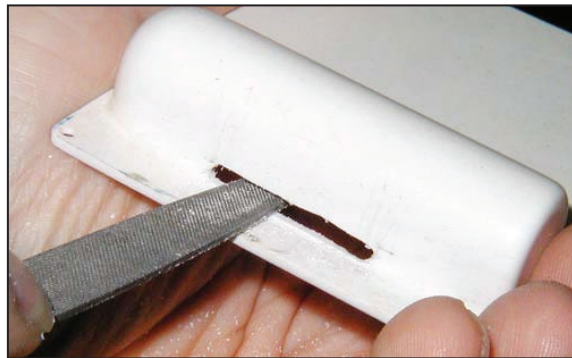
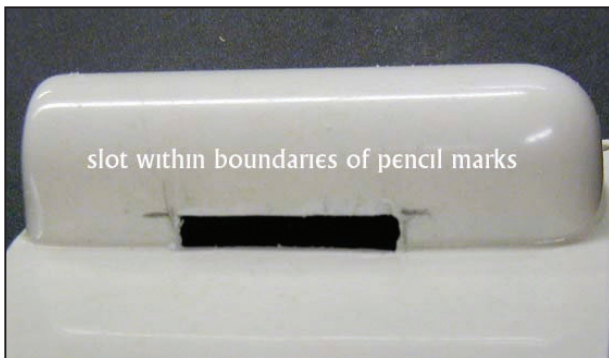
Step 28: Take the spring scanner holder and place on the door as shown, centered on the part.



Step 29: Draw lines on either side of both ends, as well as a horizontal mark about 1/8" above the corner.



Step 30: Remove the spring, and, with your Dremel tool, cut slots on both sides within the bounds of your lines and without cutting into the main outside surface – the slots should not be visible when you view the door face-on from the outside.

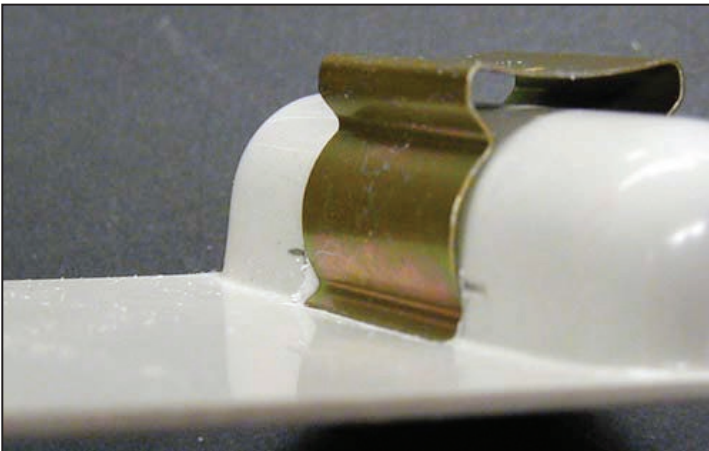


Step 31: After you've cut your rough holes, file the slots so they look good and you have no lip on the corner sides.





Step 32: Try the spring, you'll find the ends are now visible (on the outside) but will not go into the scanner slot. If you try your scanner tube, it will not be secured.



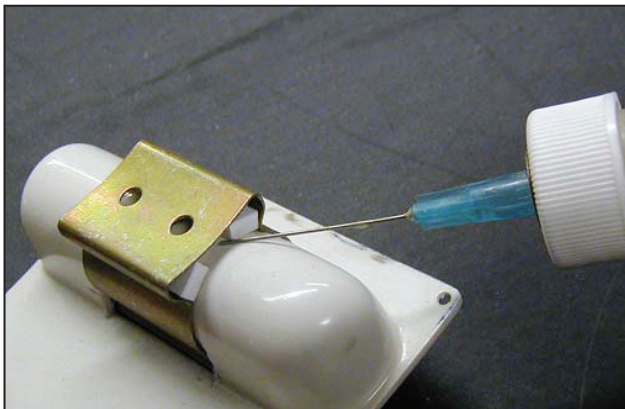
Step 33: By looking at the spring, you'll see where you need to grind more material away to get the spring to close around the scanner.



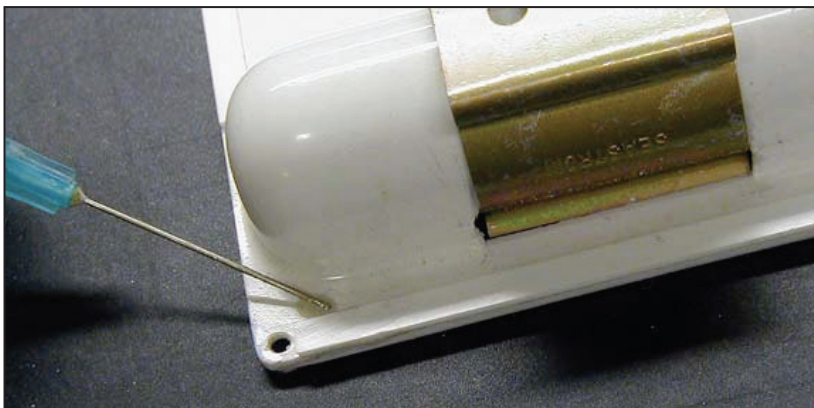
Step 34: With the Dremel, grind those areas above the slots, without making the holes bigger. Before going too far with this procedure, try the spring again and the scanner tube.



Step 35: The goal is to have the scanner easily inserted and removed from the door, yet have the spring hold the scanner in place – try shaking the door with the scanner tube in it; and if you can shake the scanner off, grind or file a little more material away until it can stay in place with the shake test. You'll also want to make the slot lips such that the spring end won't be "stuck" without springing; you need some moving spring action for the scanner to stay on the door.



Step 36: When it's okay, insert the two pieces of .100 x .188" styrene in the spring as shown and glue in place with Weld-On 3 or CA, this will keep the spring stationary without twisting or coming off.



Step 37: Because of the vacu-form process, the thickness of the plastic is thinner than the bottom tricorder frame so the door is inset instead of flat on the frame surface. Cut four strips of the .030 styrene included, and glue to the inside edges with Weld-On 3.



Step 38: When the strips are set, try it on the tricorder; the door should now be flat with the frame. If the door sticks out too much, carefully sand the .030 strips and try again until you have one flat plane.



Step 39: Sand the door surface and fill in with spot putty any imperfections, then sand flat. Next you will primer and paint with the rest of the tricorder.

PAINTING:



Step 40: Now you're ready to start the painting process. Screw the bottom door in place. If you are making a non-functioning tricorder without light effects, mask the EMRG light square with masking tape then proceed to paint your first coat of primer. If you are adding electronics or are thinking of adding them later, you will need to mask all the areas that will have lights showing through, those include the depression on the angled front, the two depressions on the top, the main body depression, and the EMRG square and ID lights on the flap. Be sure to make your masking smaller than the depression borders so you won't have ugly paint seams showing at your edges when you apply the graphics. Also put some tape in the front slot of the tricorder so paint can't get inside.



Step 41: Hang your tricorder with a thin wire hook in such a way that you can get all of the tricorder with paint – the flap will need to be partially open so you can spray the hinge area where it will hit when fully open, then spray the first primer coat. If the hinge is loose where the flap can't stay put when partly open, you'll have to spray the hinged surfaces first and let dry before spraying the rest of the tricorder.





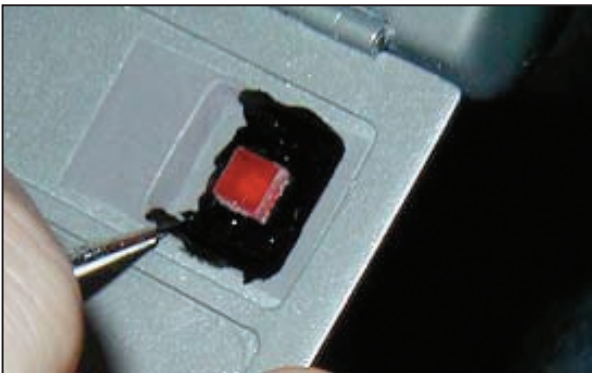
Step 42: When dry, check your surface for imperfections; use spot putty or bondo to fill in any bad areas, sand and primer again until everything looks good to you.



Step 43: Plastikote #7173 was the color originally used on the tricorders, but the manufacturer of the paint changed the formula over the years so the color is now different today than what was originally available. Any of the medium metallic grays will look good with the tricorder including the current #7173. A color that comes close to the original is Plastikote #1534 Light Smoke Metallic (in the big can) which the tricorder pictured here is painted.

Spray your first color coat with your medium metallic gray, and when dry, wet sand with 600-grit sandpaper, then spray your final coat of paint and allow to cure at least several hours or overnight.

Remove your masking tape if present. You may need to use a hobby knife on the tape edges to avoid paint on the tape lifting off paint on your prop, being careful of course not to put a knife line on your good finish!



Step 44: Brush paint the EMRG recess detail, being careful you don't paint the red square. You may go outside the recess if you like, the graphic will cover it up.



Step 45: After painting and curing, mask the med door as shown, and spray in flat black or semi-gloss black the exposed scanner slot, spring ends and all.



Step 46: When the black is cured, remove the masking tape, and apply the two felt pieces as shown just below the spring ends and your medical tricorder door is done.

MAKING THE MEDICAL SCANNER [non-functioning kit version]:



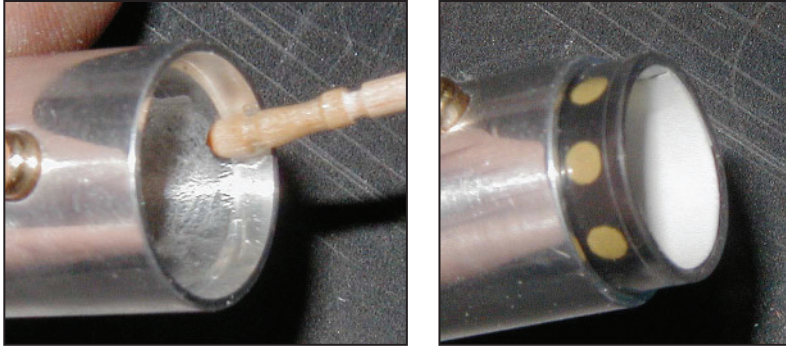
Step 47: Place the brass button in the hole with tweezers, and glue it in place with CA or 5-minute epoxy. To keep from pushing the button out, you can build up more CA and baking soda here, or glue in a piece of scrap plastic so the button can't be pushed in.



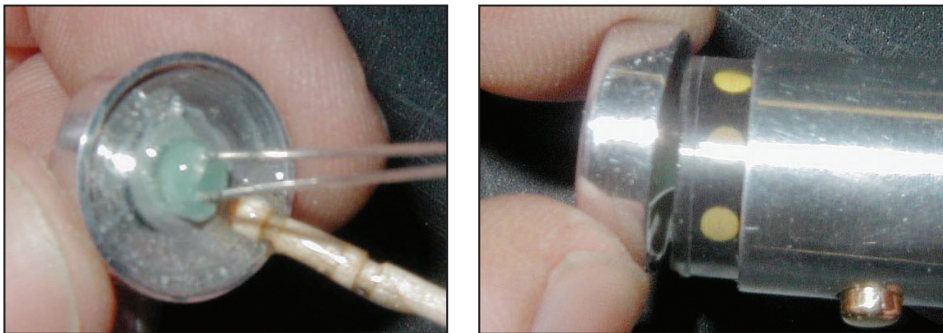
Step 48: Cut your choice of graphic strip (red was used on all Mark X medical scanners, except for the seventh season of *Voyager* and *Star Trek: Nemesis* which were yellow), insert in the clear tube placing it so the detail is visible in the tube, and secure the paper end with a drop of Testors Clear Parts Cement.



Step 49: Insert the green LED into the machined cap and make sure it sticks out a little, it does not need to stick out much beyond the outside of the cap; then glue the LED in the cap with a drop of CA, and wait a few minutes for the glue and accelerator to finish outgassing so you can keep the CA fumes from fogging up the clear tube. You can also build up a little more glue to keep from pushing in the LED – do not get glue on the inside lip at this point!



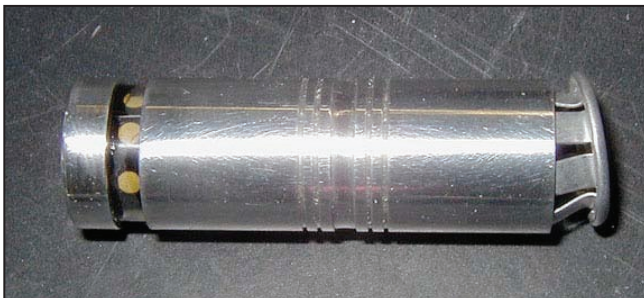
Step 50: With 5-minute epoxy, spread glue on the inside lip of the aluminum tube and insert the clear tube, making sure all of the dots on the graphic are visible. The graphic dots are off center so it will only look good one way.



Step 51: Glue the cap assembly onto the clear tube with 5-minute epoxy, wipe away any excess glue and hold in place, if necessary, until the glue hardens.

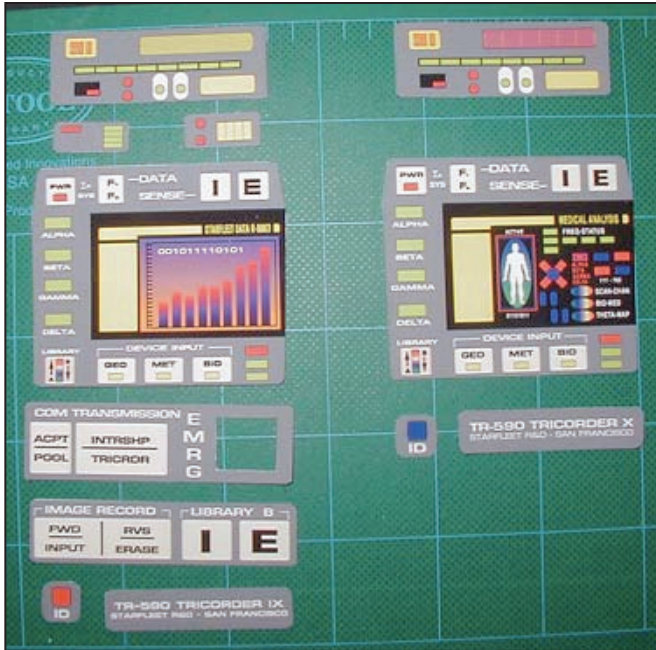


Step 52: With the bottom cap, you need to spread out the tabs with your fingers or a set of pliers so the cap will be secure in the tube.



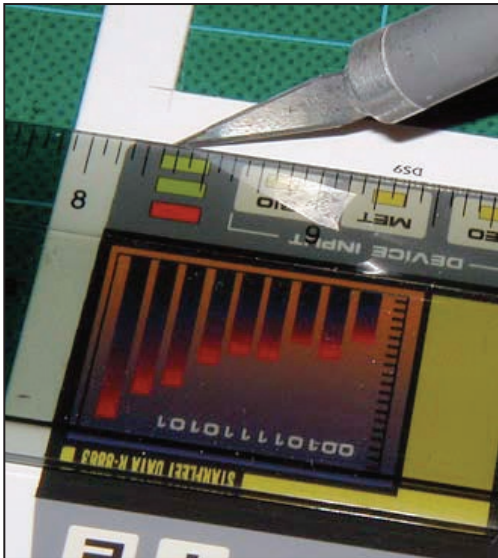
Step 49: Install the bottom cap and the scanner is finished!

GRAPHICS:



Step 53: The graphics go on next. You can apply your choice of the *First Contact/Voyager* 7th Season graphics, or the *DS9/early Voyager* version used on medical tricorders, which are the same as the graphics used on the science tricorder.

Instructions for altering the graphics for a functional tricorder are not included; they go beyond the bounds of these basic assembly instructions.



Step 54: Place your graphic sheet on a cutting board surface you won't mind putting knife lines on. A self-healing cutting pad available at art supply stores is best. With a plastic straightedge (a ruler or a drafter's triangle for example; metal rulers might damage the graphic), hold down your ruler securely and cut your graphic sheet along all edges (**cut out the EMRG white square before cutting the rest of that graphic from the sheet**), use your knife or scissors to round all the corners, and apply as pictured – **test exactly where you want them first before peeling and sticking them on permanently**. Once stuck down, you probably won't be able to remove or reposition your stickers without damaging them. Also note that the ID and nameplate graphics are drawn according to the irregular shape of the plates they get stuck to.

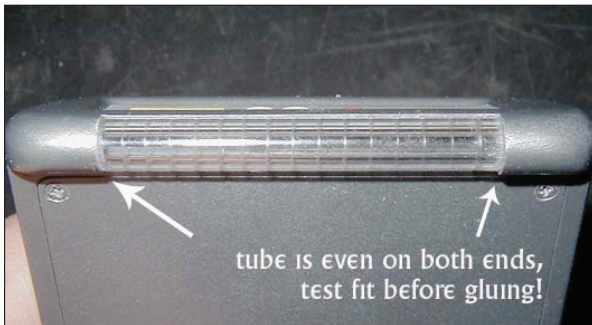


Step 55: With the main graphic, peel a little away at a time and work from the top edge, and lay it on so you can avoid leaving bubbles inside the graphic.





Step 56: Glue on the front half-round detail pieces and the acrylic tube with Testors Clear Parts Cement (recommended). CA or 5-minute epoxy could also be used, but be sure you're completely ready before you apply CA glue to anything; you won't get a second chance if the CA glue sets with the part off-location – practice placing your parts before the gluing. Clear Parts Cement will at least clean off without causing as much damage to the graphic. You may need to sand flat the bottoms of the two solid half-round pieces, and file the end(s) of the round tube until it fits in the front slot without it being loose. A little tightness is okay as long as you can avoid damaging the outer paint there.



Step 57: Glue on the front half-round detail pieces and the acrylic tube with Testors Clear Parts Cement (recommended). CA or 5-minute epoxy could also be used, but be sure you're completely ready before you apply CA glue to anything; you won't get a second chance if the CA glue sets with the part off-location – practice placing your parts before the gluing. Clear Parts Cement will at least clean off without causing as much damage to the graphic. You may need to sand flat the bottoms of the two solid half-round pieces, and file the end(s) of the round tube until it fits in the front slot without it being loose. A little tightness is okay as long as you can avoid damaging the outer paint there.



Step 58: Peel and stick on the copper-gold “I – L – square” graphic, and also the black rectangle graphic if desired.



Congratulations, you have successfully assembled a Roddenberry.com Federation Mark X Medical Tricorder!

IMPORTANT NOTES:

The physical reproduction by any means known or yet to be invented (including molding and re-casting, reverse-engineering, and stereo lithography scanning and printing) of the Roddenberry.com Federation Mark X Medical Tricorder Kit #1781, or its parts and graphics; or reproducing/replicating any pre-existing products, parts, or graphics is **expressly prohibited** under U.S. and international copyright and product protection laws.

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