ADDING INTERFACE CAPABILITY TO RADIOSHACK 15-100 REMOTES

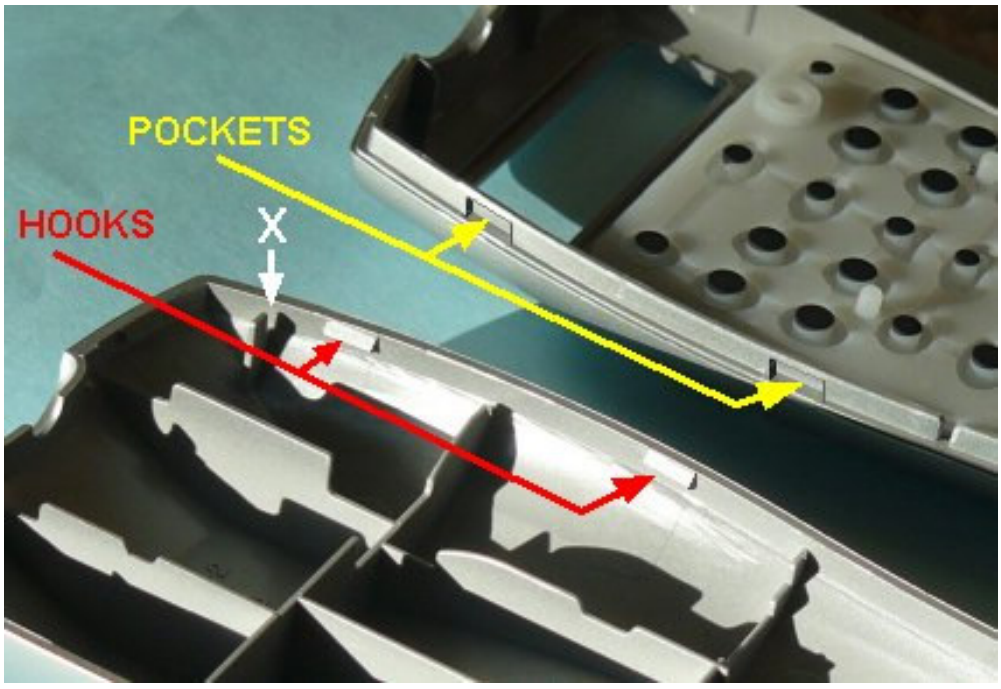
Tommy N. Tyler 29 October 2007

1. BACKGROUND. The RadioShack Model 15-100 is an 8-in-one JP1.3 remote with backlit keypad and LCD display, PVR controls, macros, learning, and many other goodies. It's a pretty versatile remote, but unfortunately it lacks one thing most other JP1.3 remotes have . . . a place to plug in your interface. Not only was the 6-pin connector omitted, the remote was diabolically designed so there's almost no place to add one unless you hack ugly holes in the side or end of the case. One might think they didn't want us to be able to upgrade this bad boy. In July, Jim Herrick submitted a number of a posts with a basic idea that offered a solution. This article picks up where he left off and develops his approach in a way that accommodates a standard JP1.X interface. There are enough details that anyone with a moderate amount of experience using a soldering iron should be able to make the modification successfully.

2. TOOLS AND MATERIALS REQUIRED. Here's what you will need:

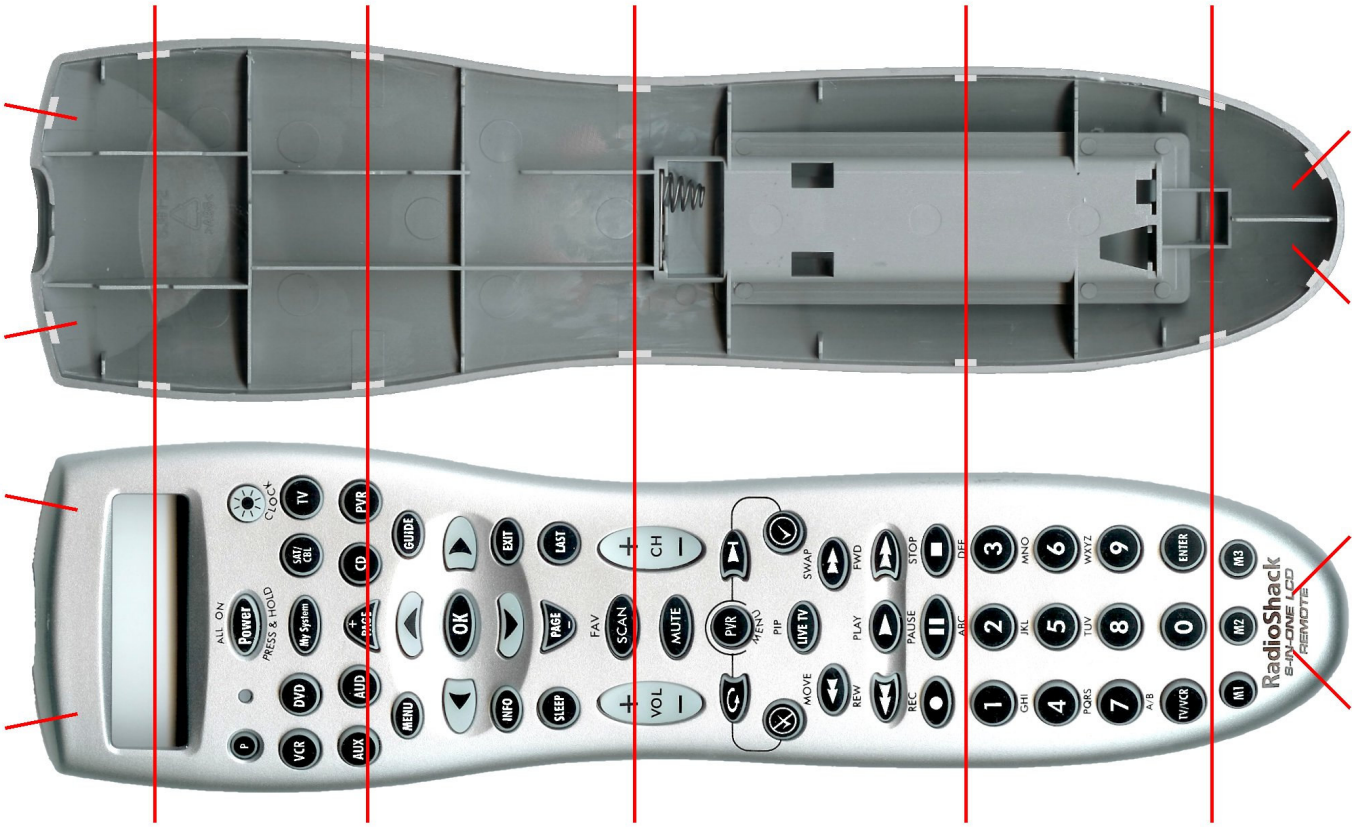
Soldering iron, preferably one with a 1/32" or smaller pointed tip, but at any rate no larger than 1/16"
Hand drill or electric drill with 1/8" drill bit
Small wire cutters and strippers
One 6-pin header, like the one an interface cable connects to
About one foot of flat ribbon cable having five conductors
A short piece of 1/4" diameter heat-shrink sleeving

3. OPENING UP THE REMOTE. Each new UEI model remote seems to be designed and built so it is assembled tighter and harder to open than the last one. In fact, they no longer even bother to put one or two screws inside the battery compartment of many models because the snap-latches by themselves are so effective. The gray plastic case of the 15-100 is painted silver and has a very thin space between the upper and lower halves. Opening it without denting or scratching the paint is a challenge. It helps to know what the latches look like, and where they are located. Hopefully, the following information will enable you to open the remote with a minimum of cosmetic damage.



Each snap-latch consists of a hook on the upper inside edge of the lower case, and a corresponding pocket in the lower outside edge of the upper case, as shown above. The general procedure is to pry open these latches one at a time with a thin blade, using shims to hold them open until the case can be separated. Easier said than done. For example, ribs in the lower case (such as "X" above) can interfere with inserting or sliding the blade.

You will need a ***thin*** knife blade or spatula of some sort for the main prying tool. The best blade to use presents a dilemma. On one hand, you want the edge to be sharp, like a pocket knife, so it enters the crack easily. But on the other hand, sharp knives are dangerous and can damage the case much easier than a dull blade, like a butter knife. Only your trial-and-error experience can decide what works best for you. You will also need about a half-dozen shims, which you can make by cutting an old credit card (or equivalent piece of plastic) into strips about 1/4" to 1/2" wide.



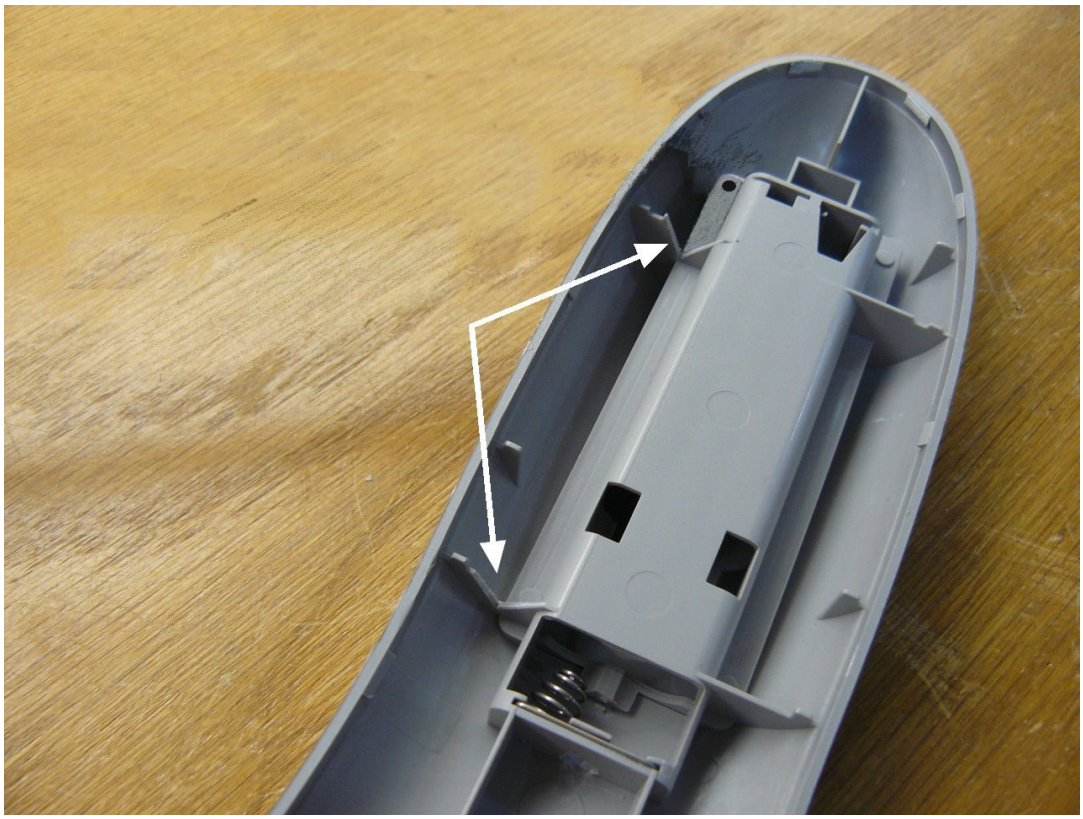
Remove the battery cover and batteries. The picture above shows locations of the 14 latches around the perimeter, in relation to the button layout. Place the remote on a firm surface, face up, and begin by inserting the blade directly in line with the "—" on the **CH** button. Start with the blade nearly flat. Ease it into the crack, and tip it up as you maintain pressure, until it slides down into the lower case. You won't be able to actually slide the blade into the unit while it is flat, because of that short skirt that extends down from the upper case. (That's a good thing, because it prevents you from damaging components on the circuit board inside.) The trick is to get the tip of the blade into the crack until it butts against the skirt, then tip it up to get over the edge of the lower case.

Once the blade is inside, use it as a pry bar to spread the lower case until the latch comes loose. With a flashlight you should be able to see the hook. Insert one of the plastic shims vertically between the hook and upper case, to hold that spot unhooked. Now remove the blade and repeat the procedure at a point between the **FWD** and **STOP** buttons. You'll find that it gets easier as you go, and the case will begin separating gradually so that shims are no longer needed. When you have released all the latches on the right side, work around the lower end and up the left side. Don't worry about breaking anything; the plastic case is remarkably tough and resilient. Concentrate more on minimizing dents and scratches.

When you open the unit the keypad will usually remain with the upper case, and the circuit board with the lower case. Lift up on the rear end of the circuit board to slide the battery springs out of their slots so you can take the board out of the case. The LED backlight spreader is a clear plastic plate with reflector-edged holes that distributes light from eight surface mount LEDs to all the translucent buttons. It may be stuck lightly to the keypad when you open the unit. Place it over the circuit board to help protect the pads of the key switches and keep them clean while you work on the other side of the board. Wrap a piece of masking tape around the two to hold them together temporarily. Also wrap a piece of masking tape around the LCD window and board. The window is snapped into place, but falls off easily. If it comes off, snap it back in place with the notch over the infrared LED.

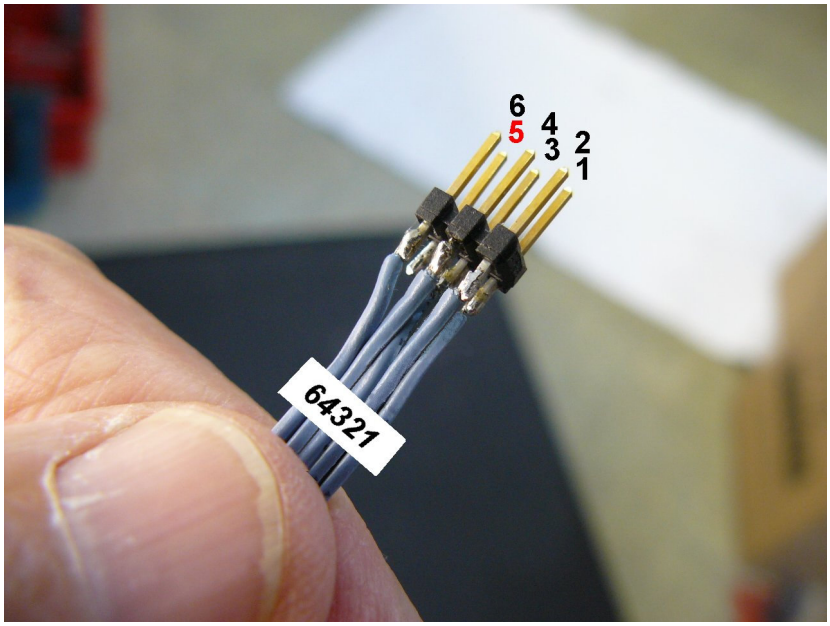
4. MODIFICATIONS TO LOWER CASE. When you look into the battery compartment you will see a shoulder running full length along both sides. Using a hand drill or electric drill with a 1/8" bit, drill vertically through the shoulder

to make a hole at the right rear corner of the battery compartment, as shown in the picture above. Hold the bit against the corner as you drill, so that the hole is as close to the corner as possible. Remove burrs or sharp edges around the hole with a knife, a small file, or whatever.

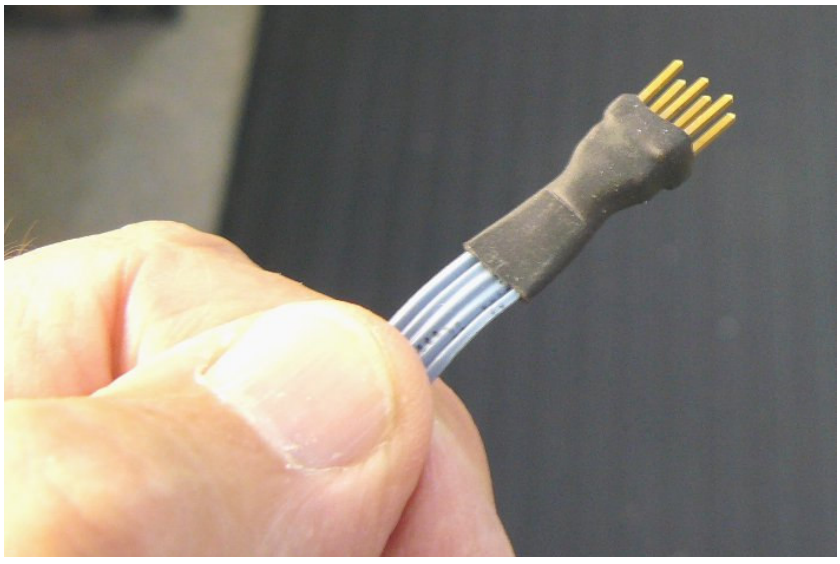


Cut "V" shaped notches in the two ribs on the cable side of the lower case, as shown in the picture above.

5. BUILDING THE TETHER CABLE. Start with a piece of 5-conductor flat ribbon cable about 12 inches long. Strip and tin all wires at one end about 1/16" to 1/8", and split the insulation back about 1/2". If wire number 1 is not already color stripped, mark it with a spot at both ends using a Sharpie pen. As always, my standard recommendation when soldering ***any*** 6-pin header is to plug it into a mating connector during soldering, to keep the pins aligned and straight, because the heat of the soldering iron softens the plastic. Use your interface connector if you have nothing else.

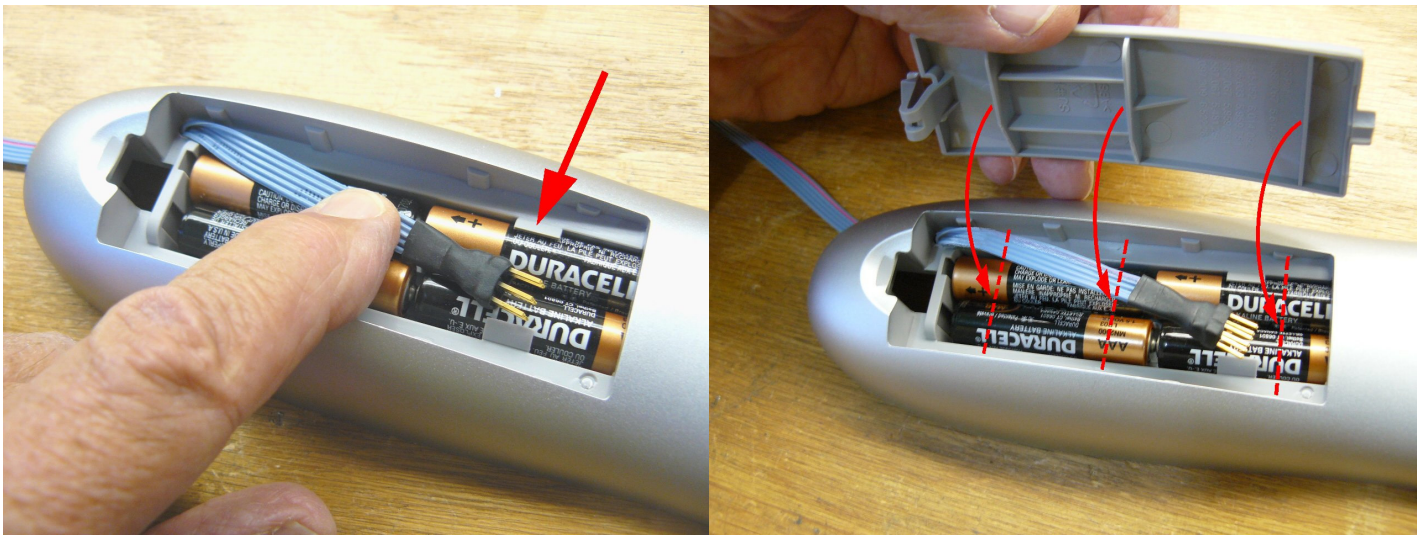


Apply a small amount of solder to each pin of the 6-pin header, then attach the cable wires to pins 1 through 4 and 6, as shown above. ***DO NOT DEVIATE FROM THE PIN POSITIONS SHOWN IN THE PICTURE.*** Also note that the fifth wire is actually attached to pin #6, and pin #5 is unused. Just lay the wires against the pins when you solder them. Don't try to wrap them around the pins. After double-checking your soldering work, slide a 3/4" long piece of 1/4" heat shrink sleeving over the cable until it extends just slightly beyond the plastic of the header. If the ends of the header are rough where it was broken off from a longer piece, smooth them with a sharp knife so the cable can enclose the entire plastic header. Shrink the tubing with a hot air gun or hair dryer. If you don't have such fancy tools you can use the time-honored cigarette lighter method. Just make sure you have spare heat shrink in case it goes up in flames.



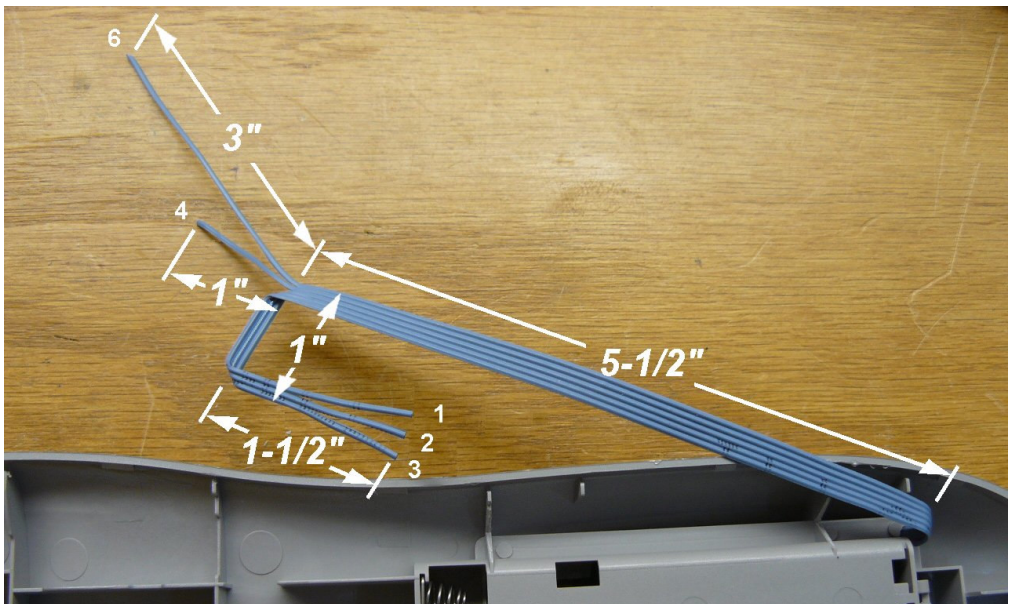
The final step is to place the end of the heat shrink over the edge of a table while it is still hot and soft, and press down with something smooth to flatten it tightly against the ribbon cable. If you do a really nice job it may look as good as mine, shown above. This is a good time to mark the corner where pin #1 is located, using a spot of fingernail polish.

6. INSTALLING AND TRIMMING THE TETHER CABLE. Lay batteries in the battery compartment, then feed the tether cable into the drilled hole until the tips of the connector pins lie somewhere within the area of the forward tabs



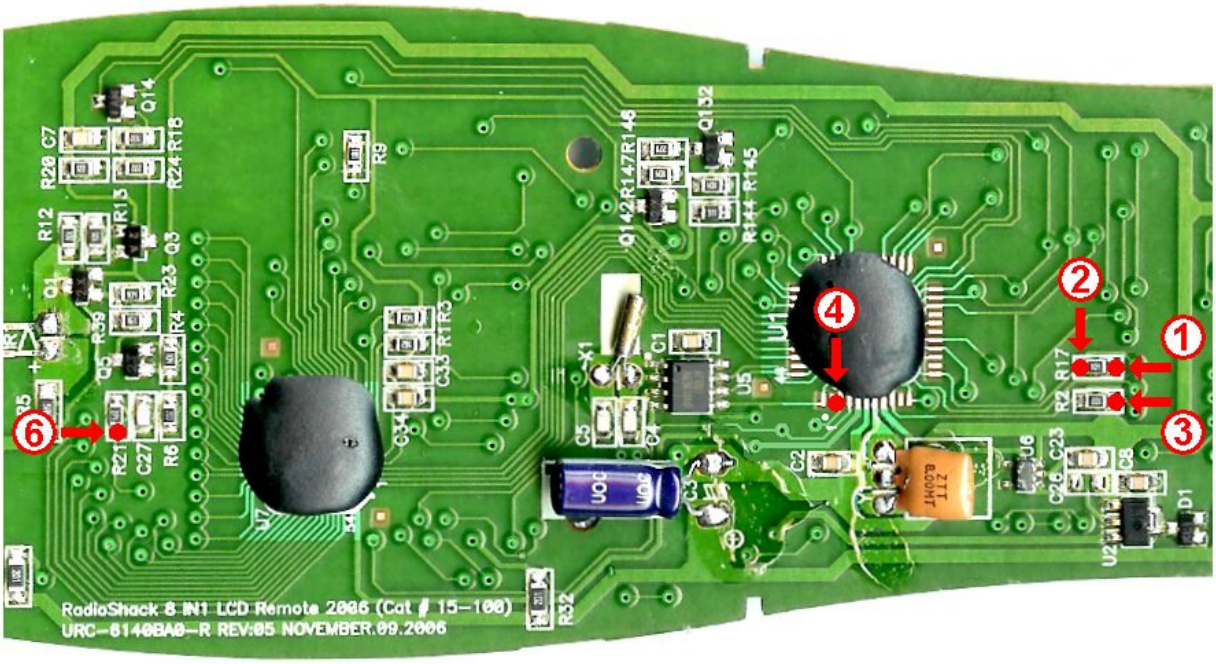
when the cable is held against the batteries, as shown in the left picture above. When the battery cover is replaced, the forward rib must be a little past the connector, and the center rib must be a little behind the heat shrink sleeve, as shown in the right picture above. Experiment with the position of the cable until you are satisfied you will be able to close the cover without it bulging. If you can't close the cover satisfactorily, try clipping off a small amount from the corner of the rear cover rib on the cable side. Once you develop the knack of placing the cable in the right location, you'll be able to close the battery cover without any trouble.

Turn the remote over, and lay the cable out flat so you can split, trim, and bend the wires to form the shape shown in the picture below. Make sure the cable is oriented with wire #6 toward the outside. If you have to rotate it in the hole to obtain this, recheck the length and location of the connector inside the battery compartment.

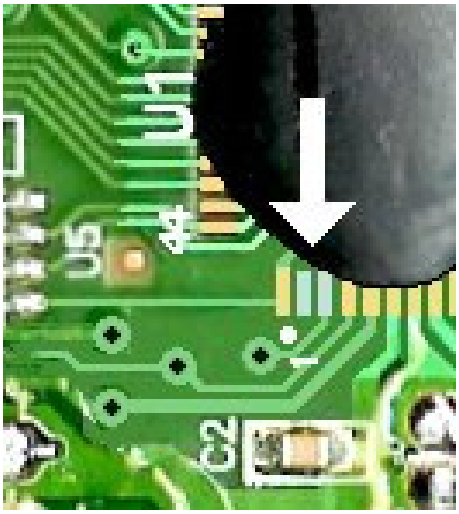


Start by cutting the entire cable about 8-1/2" from the point where it comes through the hole in the battery compartment. Separate wires #4 and #6 for a distance of about 3 inches from the end. (Ribbon cable wires separate easily if you make a starting slit and peel them apart.) Leave wire #6 full length, and cut wire #4 to a length of about 1", as shown. Make a 45 degree fold in the other three wires so they run laterally about 1", then fold them again so they run back parallel to the main cable. Cut all three about 1-1/2" from the second fold, and separate them about 3/4" back from the ends. Finally, strip and tin all five wires about 1/16" to 1/8".

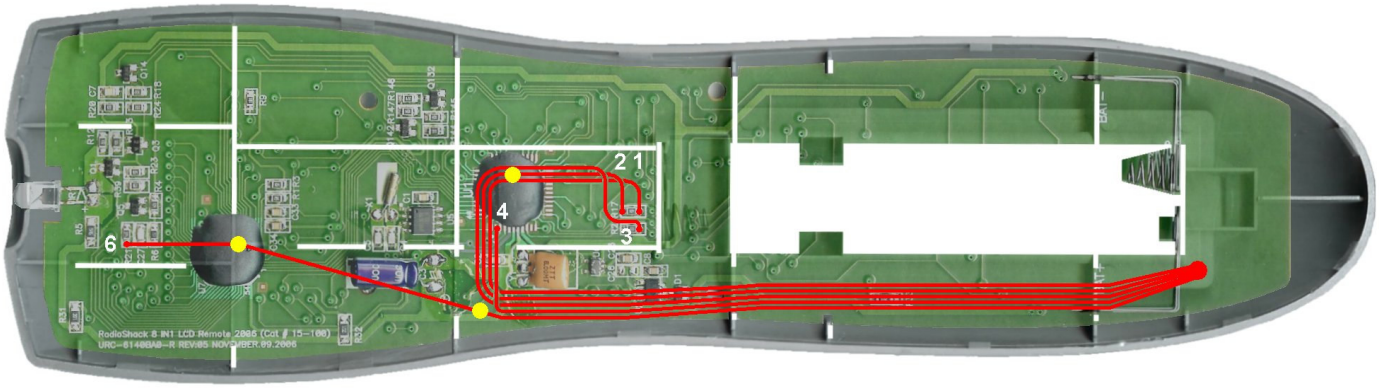
7. SOLDERING TETHER CABLE TO CIRCUIT BOARD. The picture below shows the five locations where the cable wires will be attached. Wires #1 and #2 go to the right and left ends respectively of resistor R17. Wire #3 goes to the right end of resistor R2. Wire #6 goes to the bottom end of resistor R21. Wire #4 is a special case.



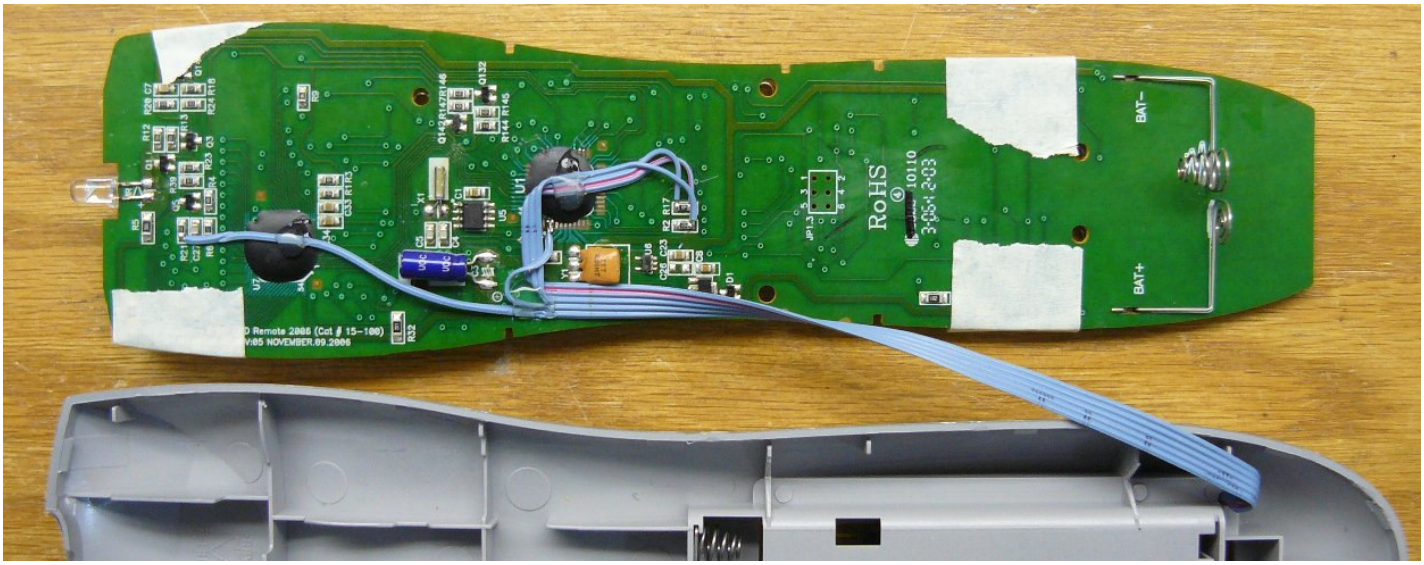
You may be wondering why we don't use the 6-pin hole pattern in the board for cable attachment. The reason is that all wiring has to be on the underside of the board, away from the keypad, and those six pads are located directly beneath the battery compartment where there's no room for wires. And we are deliberately avoiding making connections to the pads of any of those tiny feed-through holes, because they are covered and filled with solder resist ink, and there's too much danger of damaging or lifting a pad while trying to scratch off the ink. Soldering wires to components generally provides a safer and stronger connection.



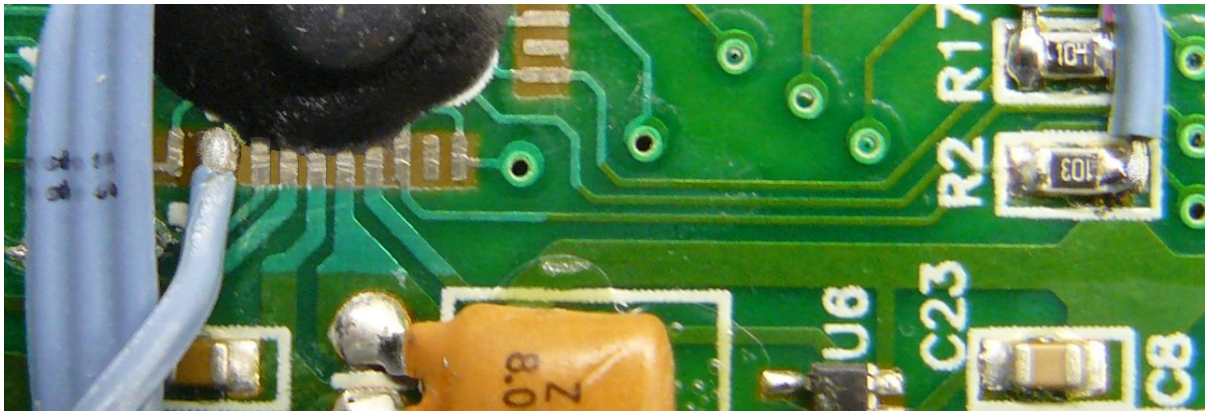
Here's a blow-up of the corner of the main processor (U1) showing pin 1 marked with a dot. The pins are numbered counterclockwise to 44 (also marked). Notice that pin 2 is unused. We're going to solder wire #4 to both pins 2 and 3, for a stronger connection. So you can prepare them by putting a nice little ball of solder on each. If you accidentally get a little solder on pins 1 or 4 that's OK. But if solder bridges across between 1 and 2 or between 3 and 4 you'll have to remove that. Solder wick is the best way to remove unwanted solder, but you can also do it by wiping quickly with a paper towel while the solder is melted.



In the picture above, you are looking down at the circuit board through a ghost image of the lower case, so you can see roughly how the cable will be routed. The white areas show the footprint of the ribs which support the circuit board, and you must route the cable so it clears them. The yellow dots are recommended points to anchor the cable to the board with hot glue. They're not absolutely necessary, but help to keep the cable from shifting and straining the solder joints.

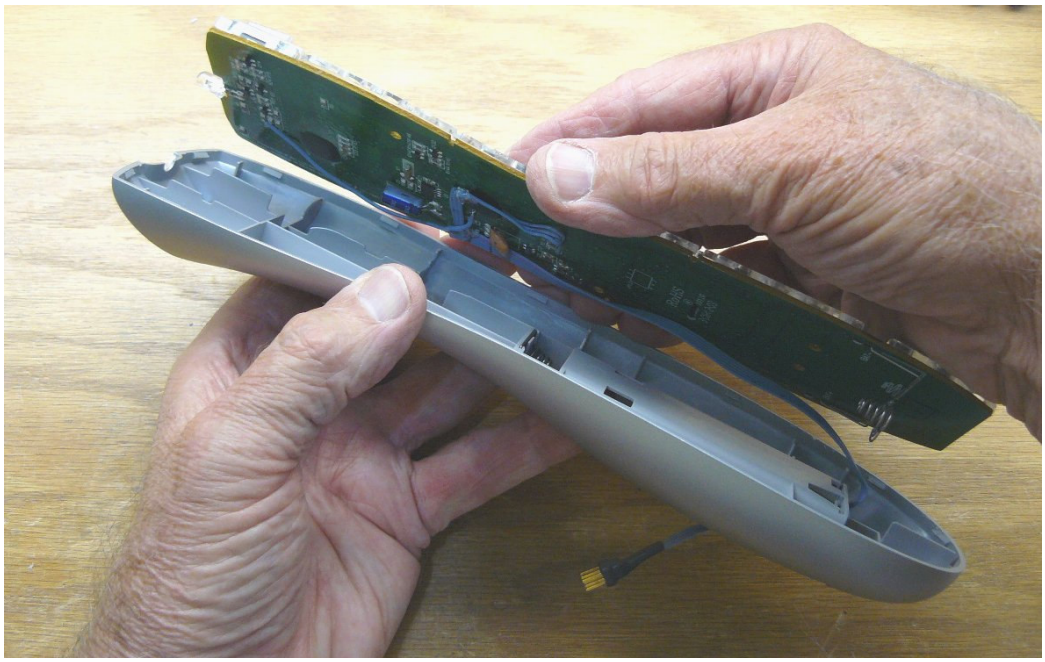


Lay the circuit board beside the lower case, and give the cable a half twist so it looks like the above picture. Start by soldering wire #6 to the bottom end of R21. If there is not a generous amount of solder on the resistor already, add some. Pass wire #4 either over or under the group of three, lay the end in the space between the two fingers you previously tinned, and solder it to both of them, as shown below.



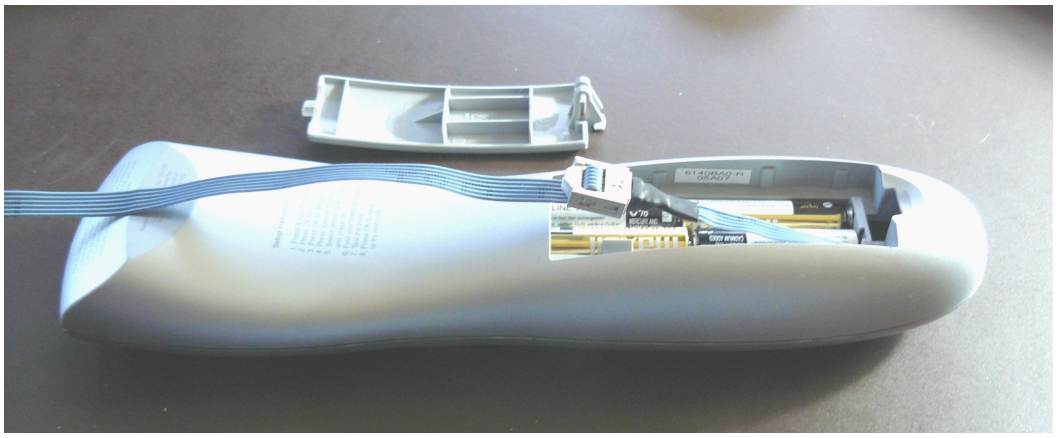
Position the main body of the cable over against the side of the resonator (that big orange component) as close as possible. Refer to the picture that shows the rib footprint often while routing the wires. For example, the folded corner in the group of three wires should lie somewhere directly over U1. After soldering wires #1, #2, and #3 to R17 and R2, anchor the cable to the board with hot melt glue in the three places previously shown.

8. BUTTONING UP. Remove all masking tape and place the board back into the lower case, starting with the two battery springs at the rear. Pay particular attention that the main body of the cable lies within the notches cut in the two



side ribs, and that no part of the cable is pinched between the board and the lower case. If the board doesn't feel firm against the case, it is probably because one or more wires are caught between the board and one of the ribs. Work on this until you are convinced the board is resting solidly on all portions of the ribs that are level with the surface of the battery compartment.

With the upper case upside down, make sure all buttons are hanging free in their holes. Slowly roll the case over and position it on the lower case. There are six pins that will hold the keypad to the upper case if you don't jostle it. Once you have everything lined up and are all set to snap it shut -- **WAIT**. Insert batteries and run a test first. You don't want to have to go to all the trouble of opening the case again.



Here's what the final result looks like, all hooked up to a standard JP1.x interface and ready to upload/download.