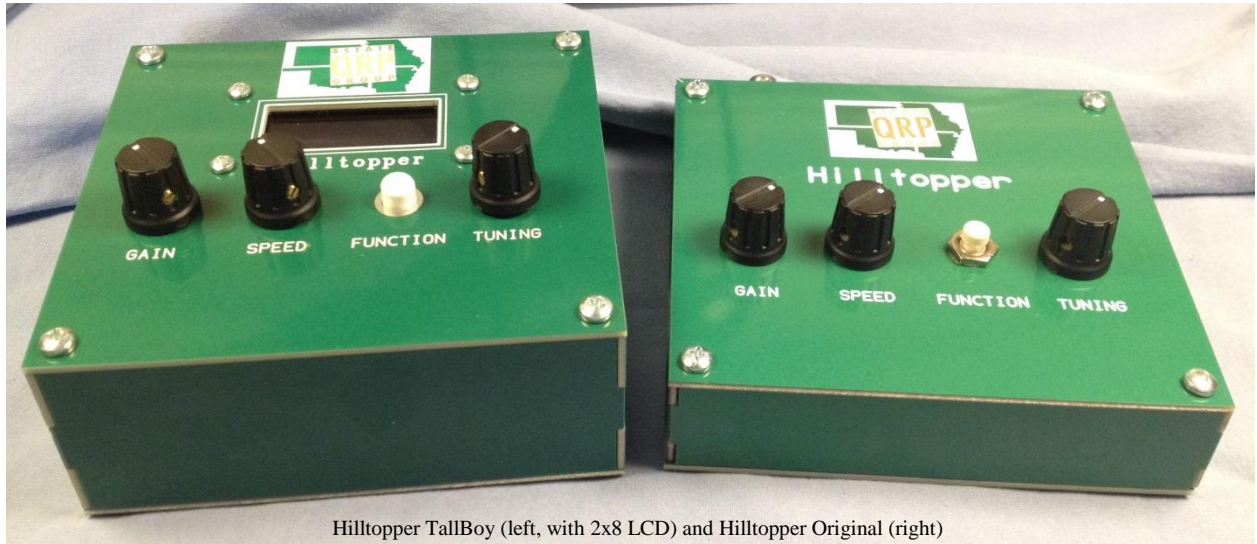


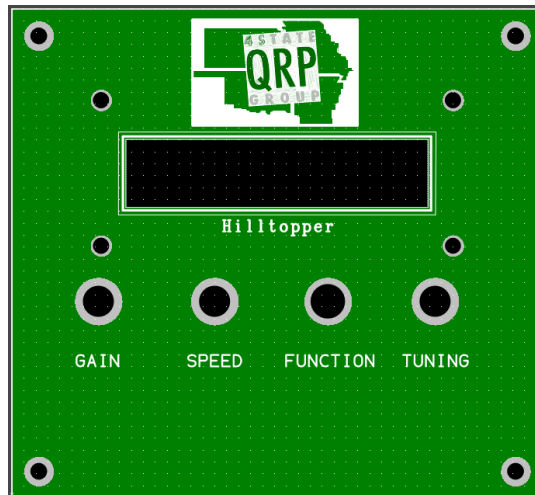
**Retrofitting an Original Hilltopper Transceiver
to become a
Hilltopper TallBoy Transceiver with Digital Display**
Jim Giammanco, N5IB



Hilltopper TallBoy (left, with 2x8 LCD) and Hilltopper Original (right)



Hilltopper TallBoy (2x8 LCD) with Touch Paddles (left) and Hilltopper Original (right)



Hilltopper TallBoy Top Cover for 2x16 LCD

Bill of Materials

Quantity	Description	Comments
1	Enclosure top cover with cutout for 2-line x 16-character LCD display	
1	Enclosure front panel	SMD touch panel circuitry on inner surface
1	Enclosure rear panel	Includes drilled openings for two optional controls
2	Enclosure side panels	
1	2-line x 16-character LCD display with attached I2C interface adapter	
1	SPST Normally open, momentary pushbutton switch	For FUNCTION pushbutton switch
1	4-pin vertical male header strip	For J6 on Hilltopper PCB
1	6-pin vertical male header strip	For J5 on Hilltopper main PCB
4	5/8" long unthreaded standoffs for #6 screws	For mounting top cover
4	#6-32 x 1" Phillips pan-head machine screws	For mounting top cover
4	#4-40 x 1/4" Phillips pan-head machine screws	For mounting LCD
2	3D printed plastic LCD mounting brackets, tapped for #4-40 threads	For mounting LCD to top cover
2	3D printed plastic shaft extenders for potentiometers	For GAIN and SPEED, marked "P"
1	3D printed plastic shaft extender for rotary encoder	For TUNING, marked "E"
1	3" length of solid copper bus wire	For FUNCTION pushbutton connection
2	Silicone rubber 1/4" diameter hole plugs	For two rear panel control openings
1	4-conductor Dupont ribbon cable, female-female, 20 cm long	To connect LCD to J6 on main PCB
1	ATMega328P microprocessor with rev8.71 or later firmware (for one selected band)	U5 on main Hilltopper PC board **static sensitive**

Instructions for disassembly of the original enclosure

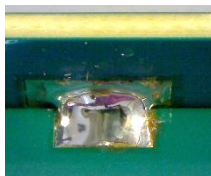
Refer to the assembly manual any of the original Hilltopper kits to refresh your memory on how the enclosure was assembled.

<http://www.4sgrp.com/Hilltopper-30.php>

- Remove the three control knobs and set them aside. Be sure that you retain their set screws
- Remove the nut on the FUNCTION pushbutton, if it is installed. Retain the nut.
- Remove the four screws attaching the top panel. Lift it off and set it aside along with the screws. You can add the panel and the screws to your *junque boxe*. They will not be needed.
- Thread the nut you had removed back onto the pushbutton switch, just finger tight.
- Turn the enclosure over, being careful not to stress the control shafts or the pushbutton.
- Remove the four screws holding the bottom cover. You may have to hold the threaded spacers on the top of the PC board to keep them from turning while you remove the screws. Retain the four unthreaded spacers, the four threaded spacers, and the four screws. They will be used when reassembling the enclosure.
- Unsolder and remove the main PC board from the front, rear, and both side panels. Once removed you can add them to your *junque boxe*, as they will no longer be needed.

There are twelve spots on the bottom side of the main PC board where it is soldered to the outer panels of the enclosure. All twelve of these solder pads must be undone in order to free the main PC board from the enclosure walls.

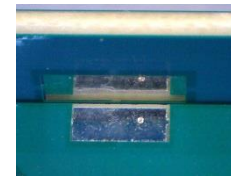
Resist the temptation to use a high-power soldering iron or gun. The same soldering tool you used to assemble the kit will be adequate. Place the tip of your iron at the junction of the mating solder pads. When you see the solder melt use a Solder



Well-soldered pads



Solder melted, leaving gap, but excess



Initially unsoldered pads

Sucker or Solder Wick to remove as much of the excess solder as possible. There is a tiny gap in the corner where the two mating pads meet. Once the excess solder is removed surface tension will probably pull the remaining solder away from the gap. Get as much as you can off, but it doesn't have to be as clean as the photo at right.

Once all twelve pairs of pads have been released the main PC board will be free. You may be able to slide the main board out of the enclosure without having to further disassemble the side panels. But if it doesn't slide out easily, don't force it. Just unsolder the pads that join one or more pairs of the outer panels together. There are eight spots where the outer panels are soldered to each other: four above the main board and four are below. The old front/rear/side panels will not be needed.

- Unsolder and remove the pushbutton switch from the main PB board. Retain the switch, but the two small spacers can be added to the junk box. A replacement switch is included in this upgrade kit, just in case the original is damaged during removal.
- Remove the microprocessor IC (U5) from its socket. Don't worry if you damage the chip, it won't be needed, but be careful not to damage the socket. You can use a small screwdriver to alternately lift the opposite ends of the chip until it pops free. If you can remove it cleanly, store it in some anti-static foam. The chip could be reprogrammed and reused in another project.

Instructions for reassembling the main PC board into the new TallBoy enclosure

Portions of the **Dry Fitting** and **Final Assembly** sections of the assembly manual for the Hilltopper TallBoy kit are reproduced here. The full manual can be found at: http://www.4sgrp.com/Hilltopper_TallBoy.php

From your original Hilltopper you will need to have retained:

- 4 ea unthreaded 1/4" long spacers, for #6 screws (goes between bottom cover and main PCB)
- 4 ea #6-32 x 5/8" Phillips pan-head machine screws (used to fasten bottom cover to main PCB)
- 4 ea threaded spacers #6-32 x 5/8" (use to fasten top and bottom covers to main PCB)
- 3 ea control knobs with setscrews

The new parts from the upgrade kit that you'll need are

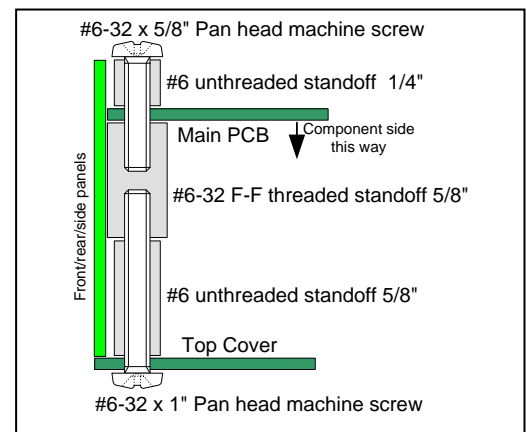
- 4 ea unthreaded 5/8" long spaces, for #6 screws
 - 4 ea #6-32 x 1" pan head Phillips machine screws
 - 1 ea 6-pin vertical make header pin strip for J5
 - 1 ea 4-pin vertical male header pin strip for J6
 - 1 ea 2-line x 16 character LCD display module
 - 2 ea plastic 3D printed mounting brackets for the LCD
 - 4 ea #4-40 x 1/4" pan head Phillips machine screws
 - 1 ea 4-conductor ribbon cable jumper, 20cm long
 - 2 ea 1/4" rubber hole plugs
 - 2 ea 3D printed plastic shaft extenders for the potentiometers
 - 1 ea 3D printed plastic shaft extenders for the rotary encoder
 - 1 piece of solid copper wire to be used connecting the pushbutton switch
 - 1 ea ATmega328P microprocessor, programmed with version 8.69 or later firmware, for the proper ham band
- If the header strip were not installed during the original assembly of the kit, do so now before beginning assembly of the enclosure. Install two male header strips – at J5 (6 pins) and J6 (4 pins). Insert the short pins through the PC board. Use a bit of tape to hold them in place while you solder only one pin on each header. Turn the board over and check that the headers are straight, square, and plumb. Reheat and adjust as needed. Then solder the remaining pins.
 - Before starting assembly of the enclosure, observe anti-static precautions and plug the new microprocessor chip into the U5 socket. The notch in the chip goes towards the rear panel.

You are now going to assemble the new, taller enclosure and install the main PC board into the enclosure. You will assemble it upside down as shown in the pictures that follow, and without the bottom cover. This will allow you to have access to the solder pads you will use to permanently connect the main PC board to the front, rear, and side panels.

Now is the time to remove the plastic protective film on the face of the LCD display if you haven't done so already.

Study the drawing at right that shows the arrangement of the hardware at each corner that will connect the top and bottom covers to the main PC board.

In the photos that follow you notice that the CAL jumper and C53 BFO trimmer are mounted on the bottom of the PC board. On your original Hilltopper board they will have been installed on the top side, and they can remain there.

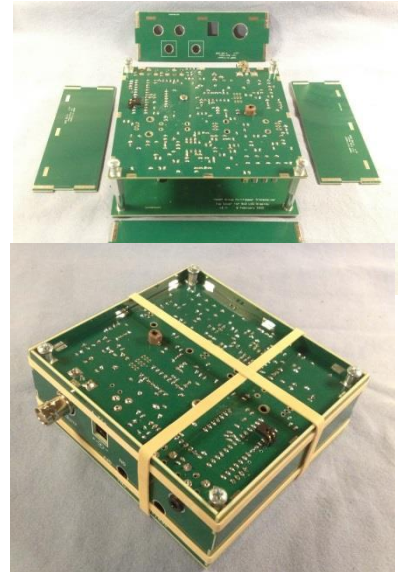


- Start with the top cover face down on a paper towel or soft cloth to prevent scratches. Assemble the 1" screws, 5/8" unthreaded standoffs, and 5/8" threaded standoffs at each corner as shown in the photos below and the "stackup" drawing above.

Place the main PC board on top of the stack, component side down, and board-mounted connectors towards the back edge as in the photo. You'll notice the CAL jumper and the C53 BFO trimmer are on the bottom side of the board in these photos of the current Hilltopper TallBoy. Yours will be on the top side, and there is no need to move them.

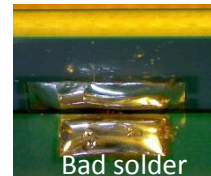
Grab some rubber bands and add the front, rear, and side panels. Now the BNC and stereo connector jacks should line up with, and protrude through, their cutouts in the rear panel. The power jack will be flush with the inner surface of the rear panel.

The silkscreen printing on the inner surface of the front, rear, and side panels will be upside down when they are in proper position.



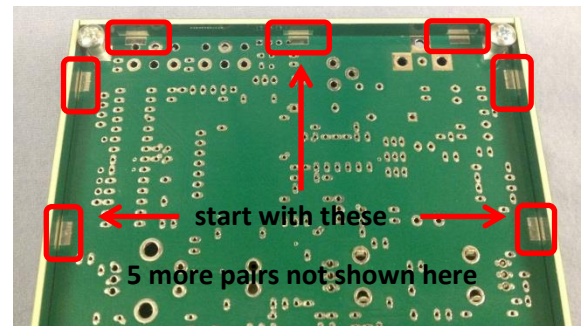
- Examine the bottom of the PC board. You'll see a series of twelve rectangular solder pads around the perimeter (bottom photo). Each one should line up adjacent to a matching pad on a front, rear, or side panel. There should be no more than a tiny gap in the corner between the matching pads. These pads are thermally isolated from the ground planes, so when you solder, the heat will be mostly contained within the small area of the pads. A soldering iron tip held in the corner touching both matching pads should heat the two pads and allow you to form a smooth solder fillet that will solidly join them, mechanically and electrically. DO NOT yield to the temptation to grab a hotter, higher power iron. The same iron you used for the components will do fine. The photos below show how a proper solder fillet should appear.

- Inspect the alignment of the front, rear, and side panels with the top cover and the main PC board. Make sure the corners are square and only a tiny gap exists. Snug up the screws. Press the front, rear, and side panels down firmly against the top cover. When you are satisfied that the alignment is good, solder only the middle pair of pads where the rear panel joins the PC board.

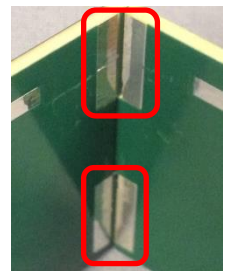


- Inspect the alignment again. If you have to, you can use solder wick or a solder sucker to free the PCB and adjust the fit. If the fit is good, continue soldering just the center pairs of pads, doing one panel at a time, and inspecting again after each one is soldered.
- Once all four sides have the middle pair of pads soldered, and they've passed your inspection for alignment and fit, proceed to solder the remaining eight pairs of pads.

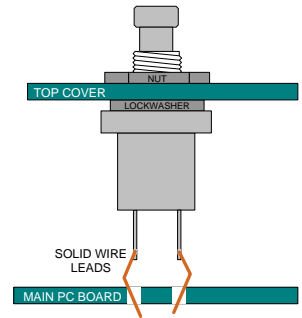
You will notice that there is another collection of those rectangular solder pads at the corners where the front, rear, and side panels join. Soldering those points gives further stiffening to the enclosure. There are pad pairs both above and below the main PC board. You'll have to temporarily remove a screw and standoff to gain access to solder these pads.



- If you are happy with the alignment of the panels so far, proceed to solder these four pairs of pads on the underside of the PC board. Do one corner at a time. Inspect the alignment after each corner. And replace the hardware each time you've soldered a corner, to keep everything snug.
- Once the four corners below the bottom of the PC board are soldered the enclosure should be pretty sturdy. Now remove the top cover and repeat the process for the four sets of corner pads above the PC board. Set the top cover aside for the moment.



PB switch installation WB6ZFG has suggested a different mounting for SW1. He used the lockwasher and nut to secure the switch to the top panel and made wire connections to the pads on the PC board. He observed that this arrangement gave better tactile feedback than the plastic extender and had the advantage of not exerting downward stress on the main PC board when the switch is pressed. Use relatively stiff solid bus wire to connect the switch to the board. Solder wires to the switch, mount the switch to the top cover, and position the top cover onto the enclosure, fishing the wires through the PCB holes and leaving just a slight bend in the leads to allow some slack. Then solder the wires to the PC board. Remove the nut and you can lift off the top cover. The stiff solid wire leads will help hold the switch in position whenever the top cover is removed and reinstalled.



- ❑ Cut the supplied 3” piece of solid copper wire in half and use the two short lengths to reinstall the pushbutton as described above.
- ❑ Make sure the protective plastic film has been removed from the face of the LCD.
- ❑ Slip the two plastic brackets onto the LCD display module and position it on the underside of the top cover as shown. The brackets have a closed-end slot and will only slide on one way.
- ❑ Observe the orientation of the LCD module and the panel. Use four #4-40 x 1/4” screws to secure the LCD brackets to the top cover. **DO NOT OVERTIGHTEN** the screws. It’s easy to strip threads in plastic

Double check the orientation of the display so it will read right-side-up, then snug up the screws if necessary.

DO NOT OVERTIGHTEN THE #4-40 SCREWS. Threads in plastic will strip easily.

You will now prepare a Dupont style ribbon cable to connect the LCD to the main PC board. A 20 cm (~6”) cable is in the parts bag.

The order of the signals at the pins of J6 are not the same as that at the header pins on the LCD display board.

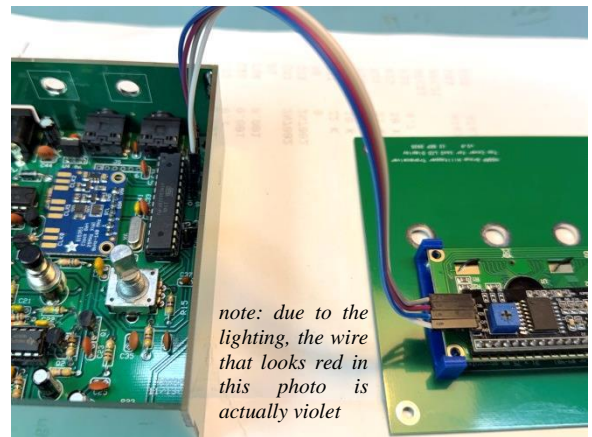
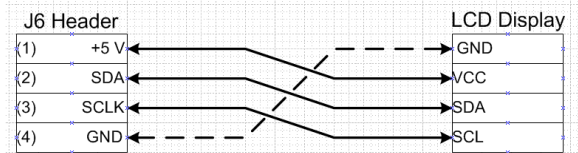
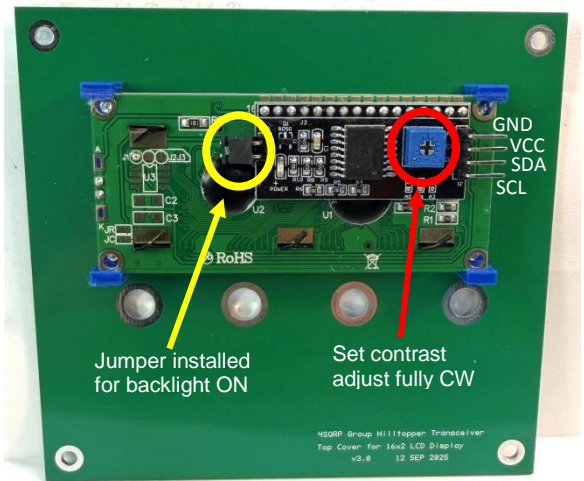
You will have to transpose the leads to match up the signals. The chart above-right shows how the two ends of the ribbon cable should be arranged. The signal names at either end correspond to the labels used on the display board and on the Hilltopper schematic diagram. Pin 1 of J6 is at the end nearest the rear panel. The connector on the LCD has printed labels for each pin. You should leave the wires in their natural order at the J6 end, and make the necessary transpositions at the LCD end.

The ribbon cable will have four wires, each of a different color. Your set is almost certain to have different colors than those in the photo at right. If you can print a copy of this page, you can write into the chart’s blank spaces the actual colors that should be arranged at each end of your cable. If you wish, wrap a narrow strip of tape to hold the plastic shells together in proper order at each end.

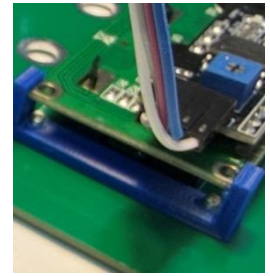
If you want to glue the shells together, cyanoacrylate cement will work, or they can be “solvent welded” using acetone (nail polish remover). But there is no requirement to glue the shells. Once they are plugged onto the header pins they will stay in position.

J6 pin	color in photo	your color	signal names
1	blue	_____	+5V -> VCC
2	violet	_____	SDA -> SDA
3	gray	_____	SCLK -> SCL
4	white	_____	GND -> GND

- ❑ Plug one end of the 4-wire ribbon cable onto the 4-pin header at J6 on the Hilltopper board as shown in the photo at right. Keep the wires at that end in their natural order.



- Making the necessary transpositions in the wire order, plug the other end onto the little “backpack” I2C adapter attached to the display. When you put the top cover into position you will fold the cable under the LCD and route it over to the J6 header strip on the main PC board. Double check that the wires are in the correct sequence at each end.



- There is a square potentiometer on the LCD board (red oval in the top photo) that controls the contrast of the display. Use your jeweler’s slotted screwdriver to set it fully **clockwise** for the moment. This will ensure that the display is visible initially. You can readjust it to your preference later.

The 2-pin jumper plug at the left of the I2C adapter (yellow oval) controls the backlight.

The backlight is disabled if the shorting jumper is removed.

- Put the control shaft extenders back onto their respective controls. The extenders will be marked “E” or “P” to distinguish the ones for the potentiometers from the one for the encoder.

Make a few emery board strokes to clean up any roughness on the plastic shafts.

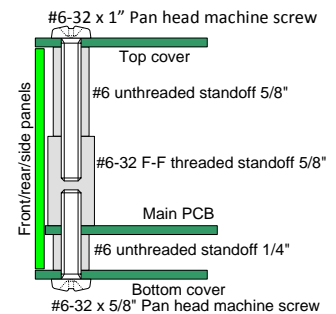


A hint for getting those unthreaded standoffs to stay put while installing the top cover. I cut some round toothpicks in half and stuck one piece (fat side down) into each **threaded** standoff. Then I slipped the unthreaded standoffs over the toothpicks. Next I dropped the top cover over the exposed toothpicks. Line up the control shaft extenders through their holes. Doing one corner at a time I carefully pulled out the toothpick and put the 1” screw in its place. The weight of the top cover kept the standoff captive.

- Replace the top cover with spacers. The drawing below at right is a reminder of the order of the standoffs and screws. Note how the top/rear/side panels fit between the top and bottom covers, with the covers overhanging the sides.

You can add the retaining nut to the pushbutton switch, but leave it loose for now, since you will have to remove the top cover to perform the calibration and BFO alignment (below) after you’ve confirmed that everything fits properly.

- Now add the bottom cover. With the unit upside down, rest it on something so controls are held above the work surface, set a 1/4” unthreaded spacer over each hole (probably don’t need the toothpick trick for these short ones). Carefully lay the cover on, then put the remaining 5/8” screws through the holes and spacers. Use a screwdriver, **first turning counter-clockwise** until you feel the screw seat itself into the threaded spacer, and then turn clockwise to tighten.
- Install knobs on the three controls, using a small screwdriver on the slotted setscrews. Space the knobs slightly above the panel to prevent rubbing. The tuning knob must be mounted just high enough to allow the pushbutton switch on the rotary encoder to function when the knob is pressed down.



You’ll find that the shaft extenders exhibit some “looseness” on the control shafts. This doesn’t affect operation, and the extenders cannot fall off the shafts when the top cover is in place. Resist the temptation to reach for the epoxy to glue the extenders onto the shafts. If you do, the chances are good that you’ll end up with the extenders rubbing against the sides of the holes. The slight looseness ensures free rotation. You could use thin paper strips as shims.

- Use the two little rubber hole plugs to cover the unused holes in the rear panel.

Congratulations, your Hilltopper Shorty is now a Tallboy.

Since the microprocessor chip has been replaced, you’ll need to repeat the **CAL** frequency calibration procedure as well as the BFO alignment. Refer to the manual for the Hilltopper TallBoy that is posted on the 4SQRP kit page:

http://www.4sqr.com/Hilltopper_TallBoy.php

That process writes the new calibration constants into the EEPROM nonvolatile memory on the processor chip.

Once the rig has been calibrated, remove power and remove the **CAL** jumper. Re-apply power to begin normal operation as described in the Hilltopper TallBoy manual.