

Mods for the OHR 100A

Here's how to make a popular QRP rig even better.

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The Oak Hills Research Model OHR 100A monoband CW transceiver kit is extremely well designed, easy to build and align, and puts a solid five watts on the air. Unusual for a QRP rig, the 100A has five knobs on the panel: Tuning, Bandwidth, AF Gain, RIT, and RF Gain (actually, IF Gain).

The tuning range is in excess of 70 kHz. IF bandwidth can be varied from >1.1 kHz to <400 Hz. RIT is variable up and down >1.5 kHz. Two audio amplifiers are included: an LM380N-8 for phones, which drives an LM380 for an external speaker. The rig draws less than 90 mA on receive, and less than one ampere with five watts out using a +13.8 VDC supply. A drive control accessible from the rear deck allows reducing power down into the microwatt level.

The 100A includes a twin-T sine wave sidetone oscillator variable in frequency and level. Because I prefer sampling the RF output for sidetone (being congenitally unable to match two pitches), I considered changing the circuit to use the RF output for sidetone instead. Inspecting the schematic, I discovered not one but *three* receiver

mute transistors—Q104, Q107, and Q111. I could not determine why such apparently redundant muting was deemed necessary, and I'm not about to try to second-guess Dick Witzke KE9KL, the designer, so this is one change I did not attempt.

However, by including an audio peak circuit and tuning for the loudest signal, I'm guaranteed to be transmitting into the center of the other ham's receive filter, and I don't have to match two pitches. More about this circuit later.

While most hams might not think much if anything would really be needed to make the 100A even better, I saw an opportunity to make this excellent kit into a superior one, much easier to use and practically idiotproof. It is now impossible to tune onto the wrong sideband. Noise is greatly reduced, and the minimum discernible signal (MDS) is dropped into the cellar. I am unable to measure MDS but it is considerably better than stock.

Because my kit is for 30 meters, I restricted the tuning range to approximately 32 kHz to cover just the CW portion of the band with a small overlap at each end. I also replaced the 10 k

pot supplied for tuning with a Bourns 10 k 10-turn pot (\$3.95 from Electronic Goldmine). Additionally, I built the KIMG LCD Dial/UTC Clock kit (available from Mike Gide K1MG, Blue Sky Engineering Company, 400 Blossom Hill Road, Los Gatos CA 95032, \$29.95 plus \$5.05 S/H, as this is written; prices may change in the future, so check before you order).

Although all the changes I made are described here, you are, of course, invited to pick and choose, incorporating only those changes you wish. At first glance it may seem that I gutted the rig—the final rig has but two knobs on the panel (Tuning and AF Gain), a push-button to activate the clock function of the LCD dial, and a toggle switch to insert or remove the peak circuit from the audio chain—I did not make any real circuit changes beyond those which can be duplicated by turning the Bandwidth and RF Gain (actually, IF Gain) controls fully clockwise. Both were mechanically programmed as if they were both clockwise because both had to be removed to make room for the LCD Dial/Clock.

There are two minor additions better made beneath the circuit board. There

is very little headroom beneath the board, about one quarter of an inch, so use care.

Solder a 4.7 μF tantalum capacitor between pin 8 (+) and pin 4 (-) of U107, an LM380N-8. Be sure there are no shorts. This may not be necessary, but it is generally recommended because it decouples the internal circuitry from the DC supply.

Locate the trace along the rear of the bottom of the circuit board which connects the center conductor (+) of the DC jack J104 and the center pin of P100. Cut this trace, and scrape the solder masking off a section on either side of the cut. Tin these spots. Then solder a 1N5818 or 1N5819 Schottky diode across the cut, making sure the anode faces J104 and the cathode faces P100.

The Schottky diode has a very low forward voltage drop and will have almost no effect on the DC voltage. In addition, an accidental reverse voltage applied will have no effect whatsoever. However, D100 (1N4007) on top of the circuit board is in shunt with the applied DC and reverse biased. This would have sufficed for reverse voltage protection if you have a one-amp fuse upstream. I don't, so this is why I installed the Schottky diode.

All the remaining changes and additions will be done on top of the circuit board and on the front and rear panels.

With the front of the circuit board facing you, locate D100 just to the right of J104 at the right rear. Although it is no longer necessary for protection, it will provide terminals for the bypassing to be applied on the DC line to prevent any electrical trash from

entering or leaving the 100A. Again, this may not always be necessary, but it is always valuable insurance.

Parallel-connect a 10 μF 16 volts or higher, a 0.1 μF , and a 0.001 μF capacitor together and solder their leads, cutting off the extra leads and leaving just two: positive and negative. Because there is very limited space around D100, a tantalum capacitor is preferred over an aluminum electrolytic. Slide the leads from this parallel combination under the leads of D100, making certain the positive lead is at the end facing the inside of the circuit board. Solder both connections and remove extra lead lengths. Check very carefully so you are certain there is no danger of a short circuit.

To make room for the LCD Dial/Clock, both the Bandwidth and RF Gain (actually, IF gain) controls must be removed. P103 (Bandwidth) must have the center and right-hand pins shorted together. A jumper may be used if you have any, or you can solder them together with a short piece of wire. See Fig. 1 for details of changes to plugs on top of the circuit board. This connection mechanically programs the IF bandpass to its narrowest point.

On P101 (IF Gain), solder a short wire from the center pin to the left end of R129, which is just forward of P101. This DC grounds pin 5 of the IF amplifier U101 (1350P) which is already bypassed by C135. This programs the IF stage at its maximum gain.

Because the RIT will have no function once the peak circuit is added, it can be removed at this time. Note the detail in Fig. 1. The jack is cut off the wires to the RIT pot and the insulation stripped from all three. Connect a 2.4 k resistor to the short end of the red wire at the jack and bend the resistor down toward the bottom. Solder another 2.4 k resistor to the short blue wire and bend it down the same way. Bend the white wire down between the two resistors and solder the leads from both resistors to the white wire. Plug the jack just prepared into P102, with the resistors on the rear side of the jack.

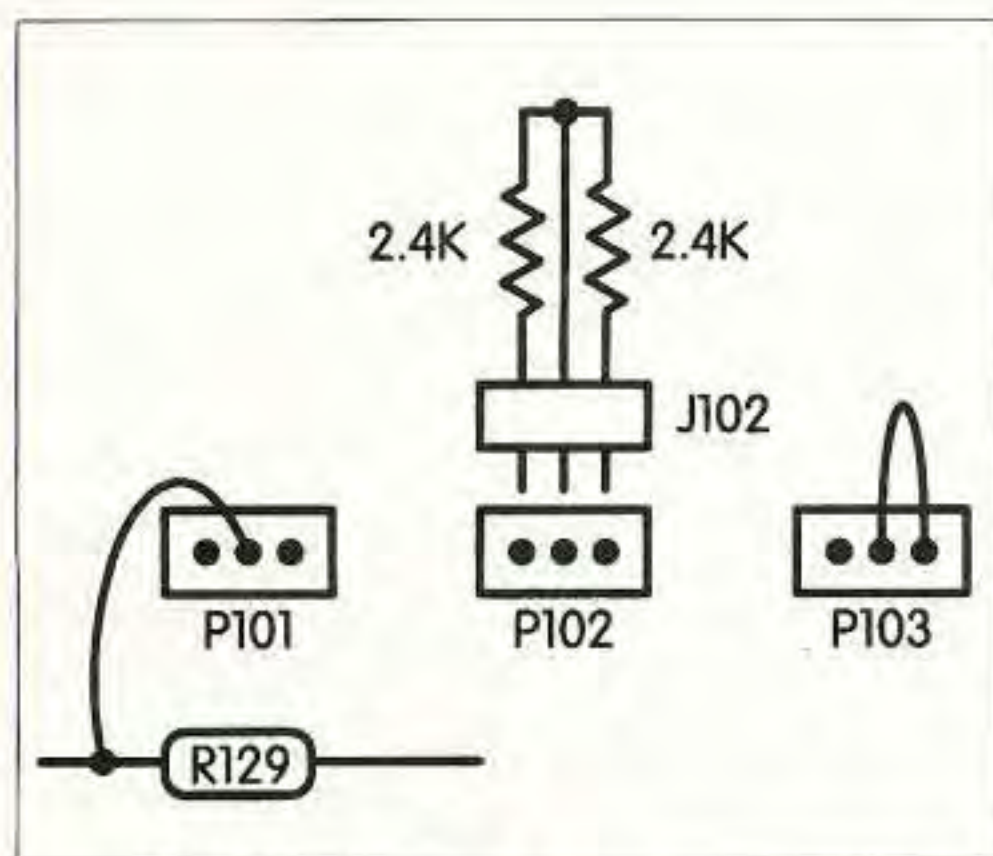
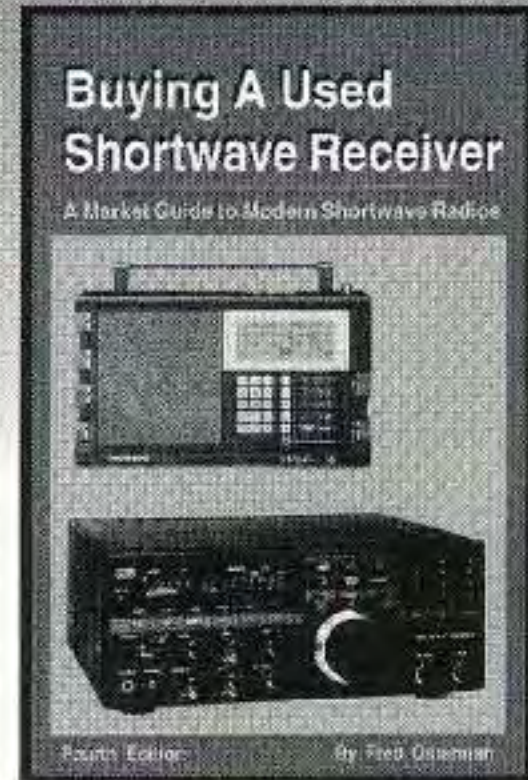


Fig. 1. Programming board connectors.

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The peak circuit is illustrated in Fig. 2 and includes the wiring to the toggle switch and the AF Gain pot and J105. It can be constructed on a small piece of perfboard. The back-to-back diodes across the input must be germanium type, not silicon. Their function is to prevent high signal levels from overloading the peak circuit.

The peak circuit itself is a simple controlled positive feedback circuit. Gain is established at 20 dB by the circuit components. The 10 k trimpot enables tuning the peak from about 300 to over 1000 Hz. The peak is 160 Hz wide at the -6 dB points and 360 Hz at -12 dB. Because of the narrow

bandwidth and the high gain, even signals otherwise down in the noise can be put completely in the clear. The narrow bandwidth also eliminates a great deal of white noise as well as nearby QRM, and results in a very low MDS.

Because the circuit board is opaque, I could not determine if there were any hidden traces where I wished to mount a standoff just forward of C152, so I did not drill a hole there. Instead, I epoxied a 4-40 threaded brass standoff one-quarter-inch high at the edge of the circuit board forward of C152, and with a long 4-40 screw and hollow standoff, I mounted the peak circuit constructed on perfboard at one corner at the brass standoff. The SPST toggle switch is mounted in the hole from which the RIT control was removed.

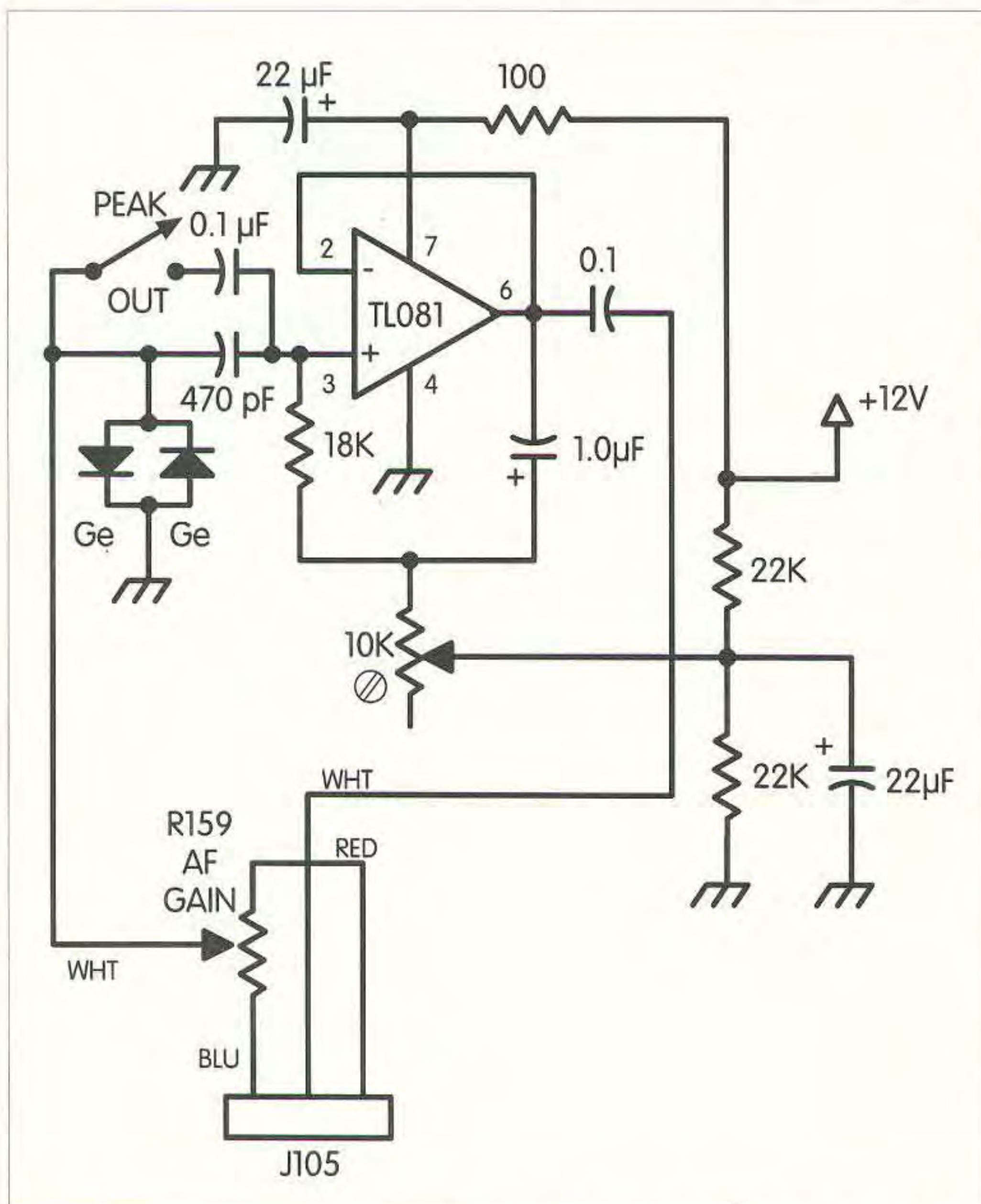


Fig. 2. Peak circuit, with switching and connections to AF circuit, designed by Jim Pepper W6QIF. Opening the switch activates the peak circuit. Closed, the switch prevents peak from working.

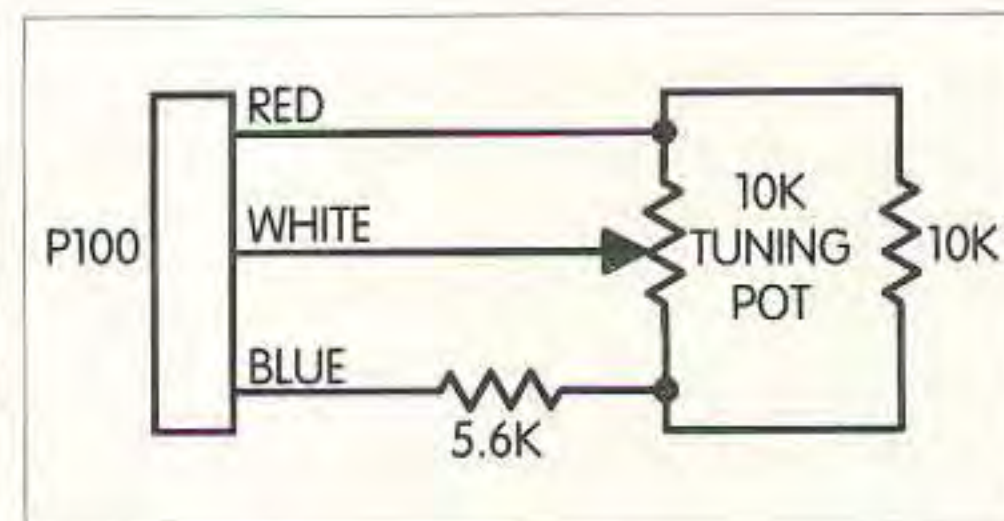


Fig. 3. Restricting tuning range.

If the LCD Dial/Clock and peak circuit are to be installed, you will want to eliminate a number of black silk-screened calibration marks and control identifications from the panel. Fortunately, this is very easy to do as long as you are extremely careful.

With a sharp knife with a very sharp point—a small penknife is preferred, or possibly an X-Acto® knife with a number eleven blade in it—use a light touch, and slowly and carefully scrape very lightly until the unwanted black marks disappear.

Done carefully, the markings will come off without affecting the cream paint finish on the panel. If you also intend to use the dial and/or a 10-turn pot, or restrict your tuning range, the calibration markings around the tuning pot must also be removed. When you are finished, you may be able to see a very faint “ghost” image of the marks removed, but they will be difficult to see unless you are looking hard for them. Be sure to leave intact the markings associated with the AF Gain control, and the manufacturer and model number on the panel.

If you have rub-on letters, you may wish to put “UTC” over the top of the hole from which the Bandwidth control was removed, and “Peak” or “PK” above the hole formerly occupied by the RIT control.

If you decide to restrict the tuning range by using a smaller value pot, or by shunting the existing pot with a resistor, make sure that the total resistance between the red and blue wires connecting the pot with P104 has essentially the same value as before making this change to avoid upsetting the circuit and the designer’s intent. Fig. 3 shows how I reduced the tuning range of my 30-meter 100A from over 75 kHz to about 32 kHz.

You will probably want to change the connector provided for your key. A board-mounted RCA jack (J102) at the rear panel is supplied. Because it would be difficult to remove from the board, I drilled a hole in the rear deck above J104, installed a standard 3.5 mm mono jack, and wired it in parallel with J104.

The four-digit LCD Dial/Clock is actually a microprocessor-controlled frequency meter with a maximum input frequency of 32 MHz, combined with the functions of a 24-hour clock. It operates at a clock frequency of 32,768 Hz and at 5 V to VCC to prevent RF hash when mounted in a receiver. It is supported by a comprehensive 58-page manual, step-by-step instructions similar to the old Heathkit manuals, and clear illustrations. It is three and one-half inches by one and one-half inches and normally mounts one-quarter inch behind the panel. The display is viewed by a horizontal rectangular cutout in the panel.

As many as 31 different offsets can be mechanically programmed into the dial/clock, so it is suited to multiband rigs. However, with monobanders only a single offset need be programmed. Offsets are retained in nonvolatile memories and no backup battery is needed except for the clock function. The clock requires a 6 V lithium battery for backup to keep the clock on time when the rig is not being powered. This battery is not supplied with the kit.

Default and normal readout show three digits of kHz, a decimal point, and a single digit of hertz, with a resolution of 100 Hz. A MHz button supplied displays two MHz and two kHz digits momentarily. I omitted this because I know I'm on 30 meters with my 100A.

The Clock button displays UTC in two digits on either side of a colon in a 24-hour format. Up and Down buttons on the rear of the dial/clock are used both to set the offset and to adjust the clock to the correct time.

RF to this dial is taken from the junction of C211 and C212 through a short piece of RG174/U coax.

Adjusting the peak circuit

The peak circuit must be tuned to the offset you use. Radiate a 100 kHz signal from a crystal marker generator to the OHR 100A. Be sure the peak circuit is switched off. Adjust C146 as suggested in the 100A manual for the offset you prefer while listening on the lower sideband. Then, without touching the tuning dial, adjust C103 while transmitting into a dummy load and measuring the output frequency at the SO-239 with a frequency counter.

Unkey the rig when you have an output frequency of 10.100,000. Now switch the peak circuit into the audio channel. With a small screwdriver adjust the 10 k trimpot on the peak circuit for the *loudest* signal by ear. This assumes you have not touched the tuning knob and are still listening to the marker generator signal. You will probably have to adjust the AF Gain control to reduce the signal level because of the high gain of the peak circuit.

Now your audio peak is and will remain at the offset frequency you selected. Your transmitter is offset high by this amount. When you tune in a signal at its loudest while using the peak circuit, your transmitter will automatically be zero beat with the transmitter providing the received signal, and your signal will be in the center of the other receiver passband.

Final dial adjustment

Now that your transmitter is set at exactly 10.100,000 MHz, the LCD display should indicate 100.0. If it is off a few digits, use the Up and Down buttons to display the correct frequency. Refer to the manual for the LCD Dial/Clock to make certain you have the correct offset programmed into nonvolatile memory.

A final comment

If you have made all these changes, now you not only know where you are in the band, but you also can tune in any signal for its loudest level in headphones or speaker and know that when you touch the key you will bore a QRP hole in the center of the other guy's or gal's receive filter. And you will always have the correct UTC time for your log!

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