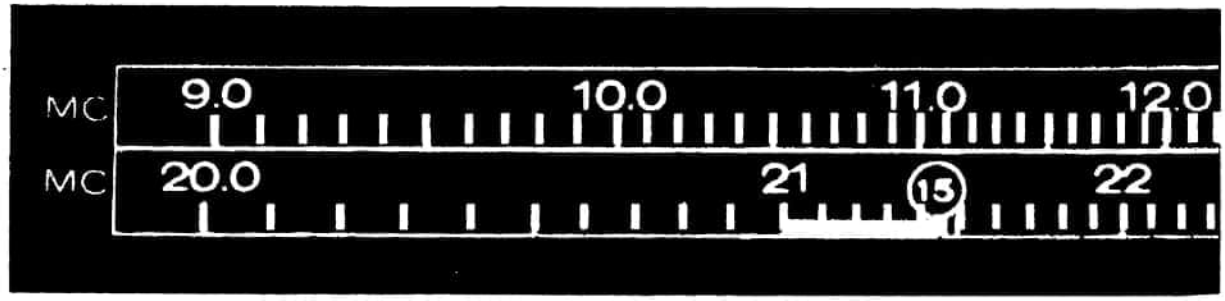
A MODULATED CRYSTAL CALIBRATOR

By Herb Cenan



. . . for 100-kc markers that really stand out.

ANY ham or SWL will tell you that you can't beat a 100-kc crystal calibrator to determine exactly where you are when checking the calibration of communications receivers, converters and oscillators. And they'll also tell you that it is often virtually impossible to spot the output of most calibrators in the all-too-common messes of noise on a crowded band.

But EI's crystal calibrator is different from the others—its output can be modulated to produce the most raucous of sounds. Its markers will stand out like your howl when you put your thumb on a hot soldering iron. What's more, you can adjust the Calibrator's output frequency slightly to zero-beat it with WWV. This will get the markers exactly where they should be.

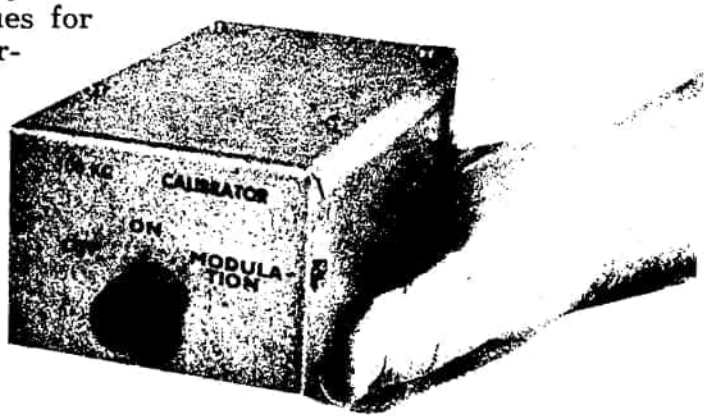
The Calibrator, which uses two transistors and costs less than $15, produces markers every 100 kc from 100 kc to 30 mc. Since the markers are harmonics of 100 kc, they naturally will be weaker at higher frequencies.

Most of the Calibrator's components are mounted on a small piece of perforated board, which could be mounted permanently inside a receiver.

Construction

The unit shown is built on a 2⅝x3⅝-inch piece of perforated board which is mounted in the main section of a 5¼x3x2⅛-inch Minibox. Make certain the board does not exceed the specified dimensions or the Minibox cover will not fit in place.

Follow the pictorial closely and *do not* substitute different values for any of the frequency-determining components—C2, C5 and L1. Plug the crystal in its socket and mount it near the edge of the board



Author's model is in 5¼x3x2⅛-inch Minibox. Switch selects modulated or unmodulated outputs.

by strapping it down with a piece of hook-up wire. Twist the wire ends together under the board and apply a drop of solder.

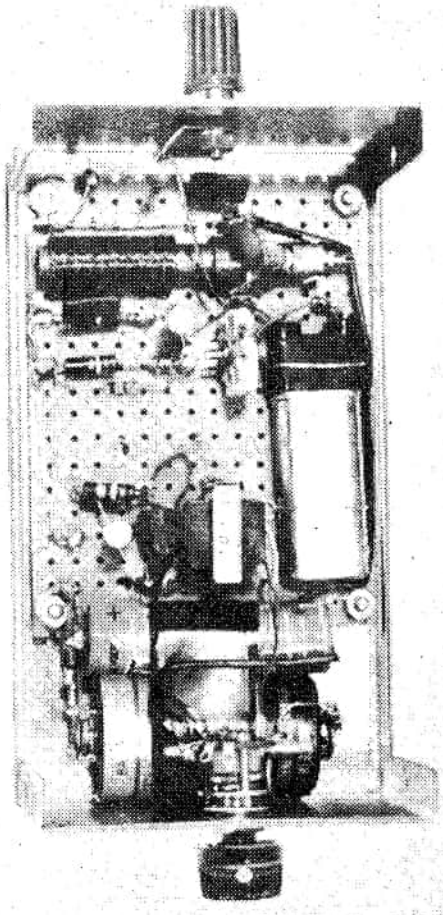
T1 should be mounted by soldering a flea clip to each of its mounting tabs and then jamming the clips into the perforated board. The tabs are so spaced that the clips should line up exactly with the holes. Cut off T1's green and yellow leads near the frame. L1 is held in place by two flea clips near the crystal socket. If possible, position L1 so one terminal touches the lug on the crystal socket near the center of the board. Put a short length of wire through the crystal socket terminal and through the flea clip to which one side of L1 is soldered.

Solder one lug of C5, the trimmer capacitor, to a flea clip in the board and connect the other lug to the outside lug on the crystal socket. Solder the remaining parts to flea clips but do not install C3 yet.

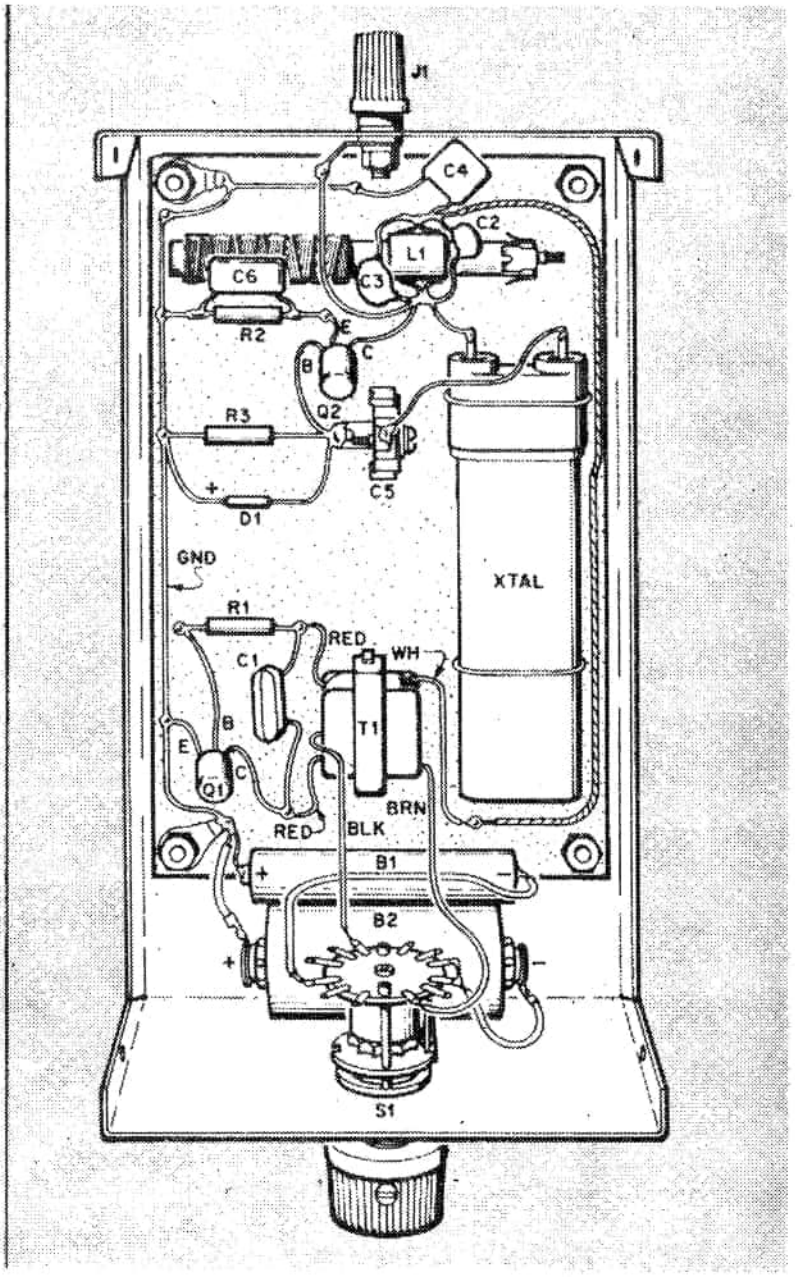
Diode D1 is required only if you want markers up to 30 mc. If you do not need markers above 20 mc, don't install D1. Cut Q1's and Q2's leads as short as possible and hold them with pliers to prevent heat damage when soldering.

A miniature switch was chosen for S1 to save space and to allow room for the batteries. The first set of contacts on S1 is the *off* position and should not be used.

After all parts are mounted on the perforated board, place a ¼-inch spacer

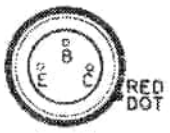


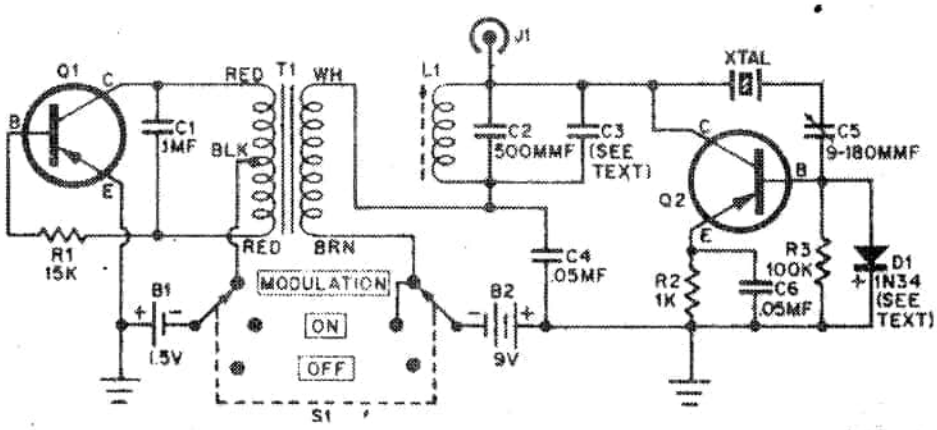
Wire the circuit board completely before mounting it in the cabinet. Keep the leads in the RF section (C2, C3, C4, C6, L1, R2, Q2) of the circuit as short and direct as possible. To prevent D1, Q1 and Q2 from being damaged, hold the leads with a pair of pliers when soldering in place.



PARTS LIST

Resistors: ½ watt, 10%.
R1—15,000 ohms; R2—1,000 ohms;
R3—100,000 ohms.
Capacitors: Ceramic disc, 75 V or higher.
C1—.1 mf; C2—500 mmf;
C3—250 mmf (see text).
C4,C6—.05 mf.
C5—180 mmf trimmer capacitor (ARCO 463 or equiv.).
T1—Audio-output transformer (Lafayette TR-112).
D1—1N34A diode (see text).
Q1,Q2—2N237 transistor.
J1—5-way binding post.
L1—2.18 mh TV width coil (Miller No. 6314).
S1—2 pole, 3-position rotary switch (Lafayette SW-78 or equiv.).
B1—1.5-volt battery.
B2—9-volt battery.
XTAL—100 kc crystal, 0.093-inch diameter pins. (Texas Crystals, 1000 Crystal Drive, Ft. Myers, Fla. Type TX-100, $4.80 postpaid.)
Misc.—Perforated board, flea clips, crystal socket, Minibox.





Output of RF oscillator, consisting of L1, C2, Q2, XTAL and C5, is modulated by audio oscillator Q1. In on position, S1 applies power to RF oscillator. In modulation position, S1 applies power to Q1 also.

or stack of washers between the board and the Minibox to prevent the protruding flea clips from being shorted by the Minibox.

Since the current drawn by the circuit is very low, you can expect to get the full shelf life out of B1 and B2. They, therefore, can be soldered in the circuit. Don't solder the negative leads yet.

Checkout and Tune-up

Adjust L1's slug so it is halfway in. Connect a 0-5 (or higher range) ma meter in series with B2's negative lead and set S1 to *on* (no modulation). The meter should indicate slightly less than 1.5 ma. If the meter indicates considerably less current (say, 100 microamperes), the circuit is not oscillating. Rotate L1's slug clockwise—as you do, the current should climb to the range of 1.5 to 2 ma. If you cannot obtain this current even with the slug all the way in, connect C3, a 250 mmf capacitor across C2. L1's range of adjustment is very broad so you probably won't get a peak setting with the slug. Consider the adjustment complete if the current is more than 1.5 ma and the slug is in enough for you to get the cover in place. Remove the meter and solder B2's negative lead to S1.

Now connect the meter between B1's negative lead and S1. When S1 is set to *modulation*, the meter should indicate approximately 5 ma. If the current is greater, there is a wiring error.

If you don't need accurate 100 kc markers, tighten C5's screw completely and the Calibrator is ready for use. For accurate markers, it will be necessary to beat the Calibrator's output with one of WWV's stronger frequencies (2.5 or 5 mc).

Connect a short wire to J1 and put the other end near your radio's antenna terminals. Turn the Calibrator on but *do not* set S1 to *modulation*. Tune the receiver so you hear WWV at 2.5 or 5 mc. You should hear a whistle caused by the heterodyning of the Calibrator's signal and WWV's signal. Adjust C5 with an insulated alignment screwdriver. The pitch of the whistle should fall, become inaudible, then rise again. At the point where the whistle is inaudible, the output is 100 kc.

To find the Calibrator's signals quickly on a receiver, set S1 to *modulation*. The markers will be raucous and can't be missed. Make adjustments to the receiver for either maximum volume or maximum S-meter indication. For the final precision adjustment of the receiver, turn the modulation off. If the Calibrator's signal overloads the receiver, merely place its output lead *near* the receiver's antenna terminals.