

# A BFO for Your SW Rx

*With a \$10 Ten-Tec kit.*

*Ever since I graduated from elementary school back in the days when the air was clean and sex was dirty, shortwave listening has had a special place in my heart. My graduation gift way back then was a Zenith Transoceanic portable radio (weighed in at about 25 pounds), complete with a huge battery, earphones, and vacuum tubes.*

For those of you not familiar with the term vacuum tubes, think transistors or integrated circuits, surrounded by a glass envelope and requiring awesome amounts of electricity to operate. You could tell when the receiver was on, especially at night, when its inner workings doubled as a night light, also known as the vacuum tubes glowing. But that was then, and now is obviously somewhat later. The vacuum tube has given way to a minute device called an integrated circuit, and the costly shortwave radio can be yours for as little as \$39.95 at your local mass merchandiser discount house.

Like the Internet, shortwave listening brought the world to your door. In a single day, you might hear news from dozens of countries, fine music and mysteries from the BBC in London, and even the current propaganda from what was then, and still is, Radio Moscow. Today, the listening fare is similar and even more diverse, with the opportunity to learn about other countries and maybe even a foreign language or two.

But this is a ham magazine not a travelogue, and for many of you shortwave listening is not the central point

in your day. You are interested in a cheap receiver that will let you monitor a band or two, and listen for WWV time hacks and the like. Sorry, Charlie: The bulk of the inexpensive shortwave radios on the market today are AM only, and they don't receive SSB or CW signals — that is, unless you can find a way to introduce a tone using something all old receivers had, the BFO (beat frequency oscillator).

Naturally, adding this circuit has to be: (1) simple, and (2) cheap. We aren't going to take sides — real home-brewers versus appliance operators or other such feuds — but rather present a simple and cheap circuit that can be added to virtually any shortwave radio available today which does not have SSB or CW capabilities. In fact, Ten-Tec actually has available a kit of all of the parts and a predrilled, etched PC board; it sells for less than \$10 plus shipping. Without getting too technical, it's a given that most, if not all, modern radio receivers have an (IF) intermediate frequency of 455 kHz, and if we can create a "beat frequency" using a small oscillator very near this IF, we will be able to receive both SSB and CW signals.

The circuit shown in **Fig. 1** uses a standard 455 kHz IF transformer and its internal capacitor to form what is called a traditional Hartley oscillator with transistor Q1 and associated parts. The oscillator relies on the center tap of the IF transformer coil; the other winding is shown as not connected and is not used. The frequency of the oscillator is varied over a wide range by turning the slug adjustment inside the IF "can." In theory, this would be a one-time adjustment and should only require changing if you are using the BFO with another receiver — if then.

The potentiometer is used to "fine tune" the oscillator during actual use, and varies the voltage applied to two ordinary silicon diodes, D1 and D2, which actually take on the role of a varactor (a voltage variable capacitor). This fine tuning function allows you to adjust the pitch of CW signals or the clarity of SSB signals. A zener diode sets the operating voltage at 6.8 volts and ensures a reasonable frequency stability during operation from voltage sources of 8–15 VDC.

## Test and hookup

The best way to test your BFO is

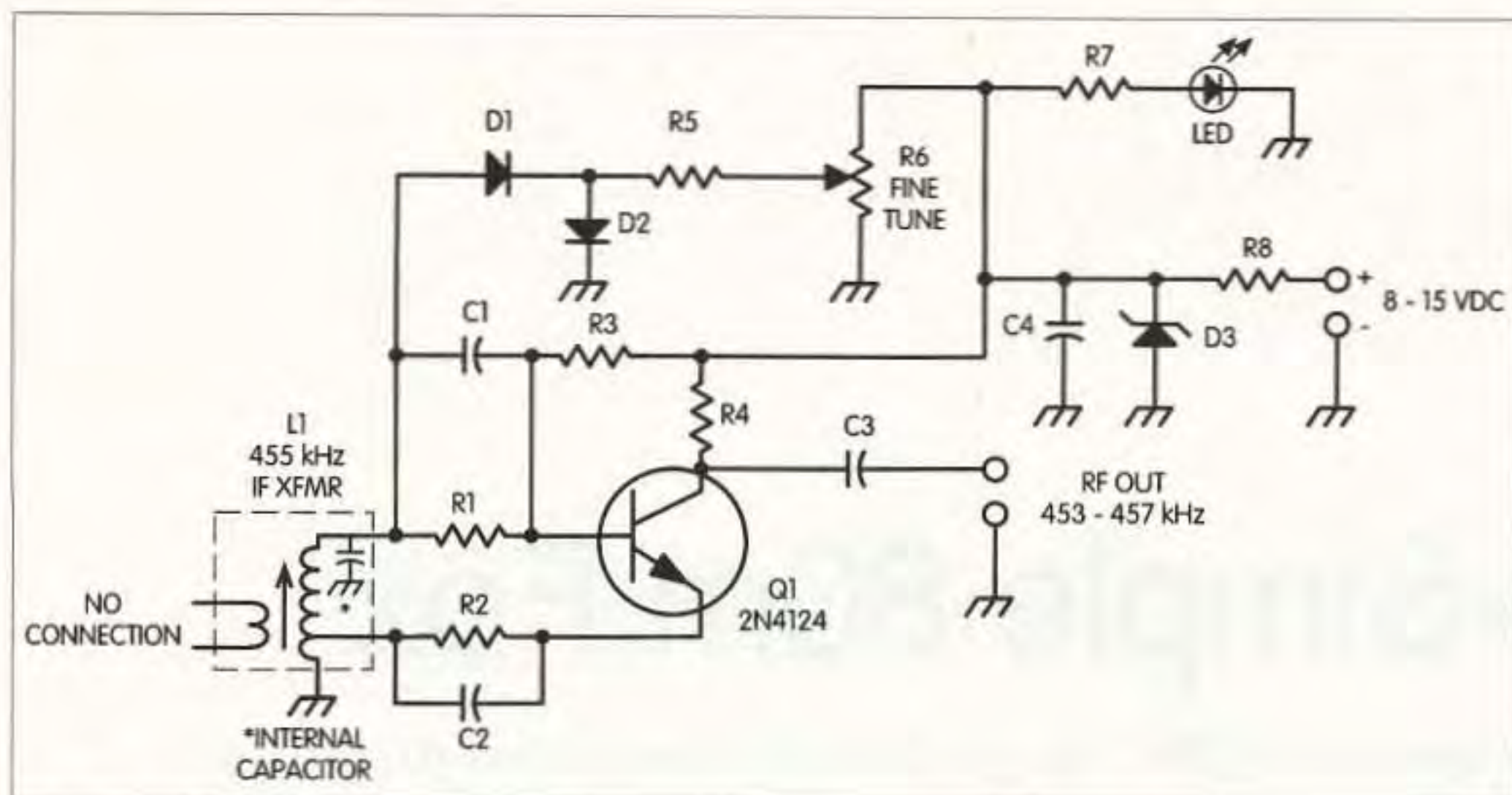


Fig. 1. BFO schematic.

by using the general coverage receiver in your transceiver, or actually using the shortwave radio that you have purchased.

1. Apply power to your BFO. For this test, you can use a standard 9 V battery.

2. Place the output wire from your BFO near the antenna connector of the receiver. If your receiver has a whip antenna, the wire may be clipped to the antenna.

3. Set the BFO fine tuning control to the middle position.

4. Tune your receiver to 455 kHz, and, using the alignment tool, adjust the slug in L1 until you hear the BFO signal. Your BFO is now ready for use with any AM-only shortwave receiver.

5. If you are using the BFO with your AM-only shortwave radio, tune the radio to any frequency where there will obviously be CW, RTTY, or SSB signals, then adjust the slug in L1 (refer to step 4) until you hear the background hiss, and beeps and whistles characteristic of CW/RTTY reception.

We used the Ten-Tec kit, and installed the approximately 1.5-inch-square PC board inside a small minibox, adding an on/off switch and battery holder. Our connection to our Drake

SW1 was made using the screw terminals marked as antenna connection, with our actual receiving antenna connected to the SO-239 coax connector. There is a remote possibility that you will not obtain satisfactory BFO operation by coupling the oscillator's output to the receiver's antenna. In this case, it may be necessary to try a direct connection to the receiver's 455 kHz IF section through a low value (10 pF or less) capacitor.

Considering the fact that many excellent AM-only shortwave receivers are available for less than \$50 from 73 advertisers or locally at your mall, the addition of a \$10 BFO makes them even more useful, especially for monitoring for band openings. The choice is yours: Either scrounge around, or waste gas going from here to there for the parts, or pay \$9 plus shipping to Ten-Tec for the kit. Either way, it's one heck of a value-added addition to an AM-only shortwave radio.

By the way, if you do order the Ten-Tec kit, be sure to tell them you read about it in *73 Amateur Radio Today!*

A complete kit of materials, including the etched and drilled printed circuit board, is available as the T-Kit 1050 BFO from Ten-Tec Corporation, 1185 Dolly Parton Parkway, Sevierville TN 37862-3710; 1 (800) 833-7373; [www.tentec.com].

| Part No. | Description            |
|----------|------------------------|
| R1       | 15k 1/8 W              |
| R2       | 470 ohm 1/8 W          |
| R3       | 22k 1/8 W              |
| R4       | 100 ohm 1/8 W          |
| R5       | 330k 1/8 W             |
| R6       | 10 pot                 |
| R7       | 1k 1/8 W               |
| R8       | 220 ohm 1/8 W          |
| C1       | 47 pF                  |
| C2, C3   | 100 pF                 |
| C4       | 0.1 $\mu$ F            |
| L1       | 455 kHz IF transformer |
| Q1       | 2N4124 NPN transistor  |
| D1, D2   | 1N4002 silicon diode   |
| D3       | 6.8 V zener diode      |
| LED1     | LED diode              |

Required but not listed:  
 DC power source, well-filtered, 8-15 V;  
 Hookup wire or minicoax to couple BFO to receiver;  
 Solder, soldering iron, hand tools, and alignment tool for L1

Table 1. Parts list.

## Ham Mall

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