A CW Adapter for the Radio Shack HTX-10 Ten Meter AM/FM/SSB Transceiver

Jim Giammanco, N5IB   *9451 Corsica Ave., Baton Rouge, LA*   *email: n5ib@juno.com*

Introduction

The HTX-10 gives good performance-per-dollar on the phone modes, but many operators have bemoaned the lack of CW mode in this popular rig. Fortunately, adding a provision for CW is not a difficult undertaking. The circuit shown below connects to the HTX-10 microphone jack and can be easily completed in a weekend. I built it in the "traditional" Altoids® tin using "ugly construction"—see **Fig. 1**. With the exception of the 6-pin CB-style microphone connector and possibly the relay, all the parts can be obtained from Radio Shack.

Circuit Description

The adapter schematic is shown in **Fig. 2**. It operates by injecting a pure sinusoidal audio tone of about 800 Hz into the microphone input. As long as carrier and opposite sideband suppression are up to specifications, the result will be a "nearly pure" carrier. Power output can be controlled by adjusting the transceiver's microphone gain control. The frequency of the tone effectively sets the offset between transmit and receive frequency.

The circuit is a combination and adaptation from several sources, with little or no original design by this writer. References are given for those who would like more details on the "parents" of this little device.

Figure 1. Prototype CW adapter built into an Altoids tin.

Q1 functions as a twin-T audio oscillator [1][a]. This oscillator configuration was chosen because it produces a particularly pure sine wave, and requires no bulky inductors. The frequency determining elements are the pair of RC networks connected between the base and collector. The component values shown will yield a tone of between 750 and 800 Hz. Small changes in the .047 and .022 microfarad capacitors (or the 18K and 1500 Ohm resistors) can be made to change that frequency to the operators preference. Don't meddle too much with the 18K values, as those set the bias for Q1.

An emitter follower buffer is implemented by Q2, whose input signal is picked up across the middle capacitor of one of Q1's RC networks. This is a point where the distortion of the signal is minimum, but this point must not be loaded very heavily if distortion is to be avoided. The emitter follower provides a nice high impedance load to protect the purity of the waveform. Output is taken from the wiper of a trimpot in the emitter circuit of Q2. About 10 to 20 mV RMS are needed at the wiper to drive the transceiver to full output.

Q3 is the keying transistor. The RC network in its base circuit shapes the keying to minimize clicks [2]. In an earlier version of this circuit the oscillator (Q1) was allowed to run all the time and the buffer (Q2) was keyed, but the key clicks were troublesome. So, at the risk of now having chirp instead of click, a change was made to key the
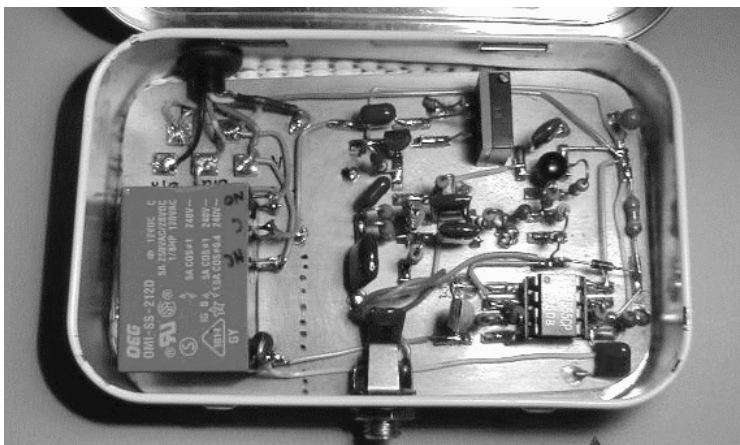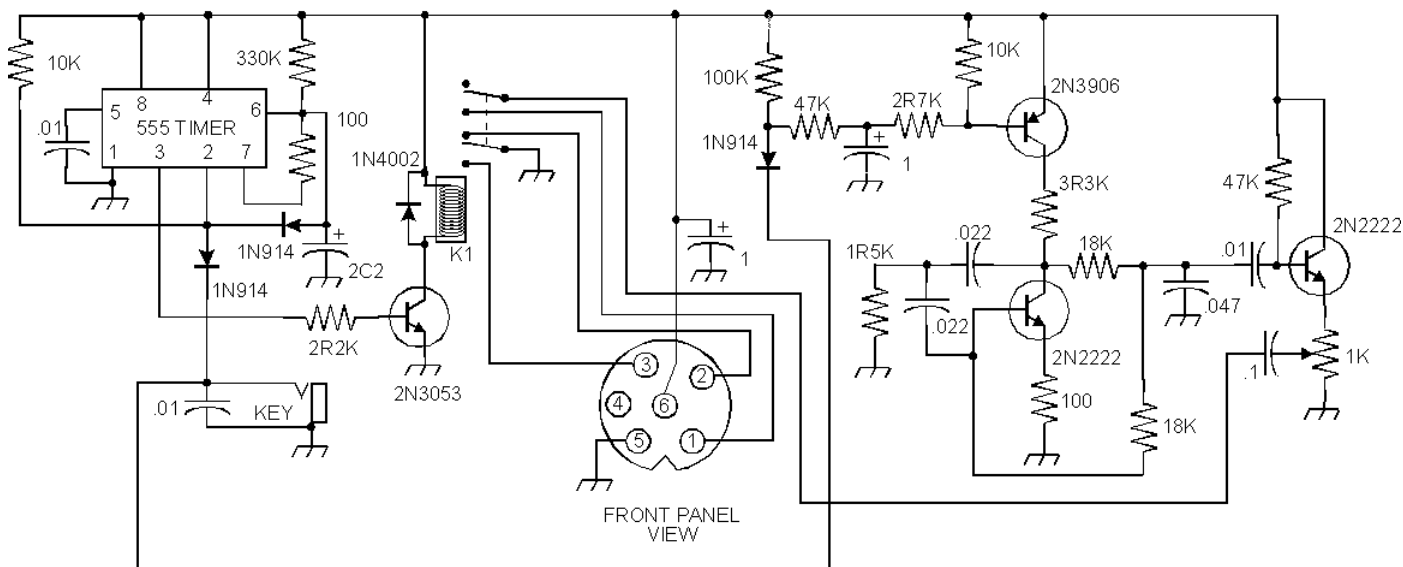

Figure 2. CW Adapter Schematic. The connector is a Vanco JCB C-6.

[a] References are listed at the end of the article.

oscillator and allow the buffer to run all the time. The result was a substantial reduction in clicks, and, surprisingly, no objectionable chirp.

Transmit/receive switching is provided by relay K1 and its driver, Q4 [3]. The relay should be a DIP-style, low coil-current type. The one used in the prototype drew only about 12 mA. Operation of the relay is controlled by the timer, U1. When the key is first depressed, U1 turns on Q4 and energizes K1. As long as the key remains depressed, U1 is not allowed to begin "timing out." As soon as the key is released, U1 begins a timing sequence, whose length is set by the 330K resistor and 2.2 microfarad capacitor. In the prototype circuit shown, these are fixed values, but a pot could be used in place of, or in series with, the fixed resistor to allow adjustment of T/R delay. The fixed values shown are satisfactory for casual (non- contest) operating at 15-20 WPM.

A word should be said about the function of the circuit inside the HTX-10 microphone, shown in **Fig. 3**. Part of this circuit must be emulated by the CW adapter. The PTT switch on the microphone does double duty. One pole is used to switch the audio line, disconnecting the mic from the rig when in receive mode. The other pole grounds a control line to place the rig in transmit or receive mode. In receive mode, it grounds the common side of the speaker, thus serving as a receive mute. The control line that places the rig into transmit mode can easily be switched by a bipolar transistor, rather than a relay, but the speaker common must be grounded through a quite low (1 Ohm or less) impedance if audio output quality is to be preserved. Hence the choice of relay switching, although a MOSFET switch might also do the job.
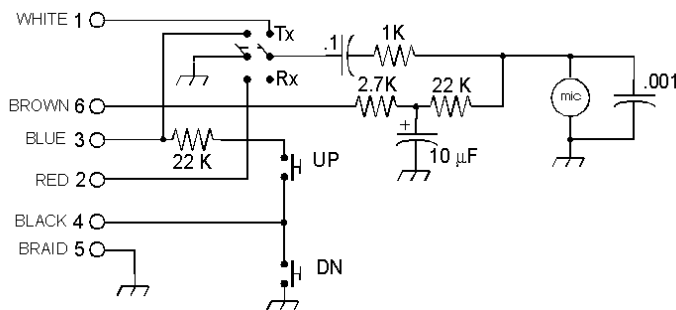

Figure 3. Radio Shack HTX-10 Microphone.

Operation

Operation is simple. Unplug the microphone and plug in the CW adapter. All needed power is derived from the HTX-10. Tune a CW signal so that its audio pitch is approximately the same frequency as the adapter's audio oscillator. Press the key to transmit. Adjust the rig's mic gain control for desired power output. Either sideband may be selected for operation. This fact may require some explanation:

Suppose you wish to call a station transmitting exactly on 28060.0 kHz. To obtain an audio note of about 800 Hz when in the upper

sideband mode you would have to tune the HTX-10 to a frequency below the station, that is, 28059.2 kHz. This places the received frequency within the passband of the if filters. On transmit, the adapter injects an 800 Hz tone. The modulation produces three signals - the *carrier* at 28059.2 kHz, the *lower sideband* at 28058.4 kHz, and the *upper sideband* at 28060.0 kHz. The carrier and lower sideband are suppressed by the balanced modulator and filter circuits. Only the upper sideband signal (28060.0 kHz) is transmitted, which is on the same frequency as the station being called. You are zero beat with the station you are calling.

If lower sideband had been chosen, you would have to tune to 28060.8 kHz to obtain the 800 Hz audio note. The three generated frequencies would now be the carrier at 28060.8 kHz, the upper sideband at 28061.6 kHz, and the lower sideband at 28060.0 kHz. If everything is working to Riley Hollingsworth's satisfaction, the only thing that makes it out of the rig without being suppressed is the lower sideband signal at 2806.0 kHz. You are still zero beat.

Note that you may be able to take advantage of the fact that there is more space in the filter passband above 800 Hz than below. It may be possible to minimize nearby QRM by changing sideband selection to place the interfering signal further away from the center of the if passband.

Because the circuit that keys the oscillator is controlled by the same key line that controls the timer/relay circuit, the first code element of a transmission sequence will be shortened and will have a discernable chirp. This designer has not yet become clever enough to eliminate this shortcoming. The rest of the transmission, while the relay stays pulled in, will be free of such artifacts.

Conclusion

The prototype does not include provision for a side tone. Many users will pair the unit with a keyer that has integral sidetone. If this is not the case, there is enough room in an Altoids tin to include a TIC keyer or one of the similar PIC-based circuits. All of these include a sidetone provision. Alternatively, a dual timer chip could be used, with one of the two timers used as an astable multivibrator to generate sidetone.

Quite a number of contacts, at 5 W or less, have been made with the prototype in casual operation. No one has yet reported a noticeable click or chirp other than that described above.

References

[1] **1999 ARRL Radio Amateur's Handbook**, page 26.19.

[2] Douglas Camopbell, N1CWR, "A Morse Code Adapter for FM Transceivers," **QST** *Hints and Kinks,* January 1998, p. 78.

[3] Doug DeMaw and Wes Hayward, **Solid State Design for the Radio Amateur**, page 177.