Tech Corner – 40-meter CW transmitter

First, you've probably been looking for an actual radio that you can actually build. Second, you've probably been looking for a kit that's easy to build in a reasonably short time, yet will work during an emergency. Third, you want something compact, that doesn't weigh a lot, or take up too much room. If so, this might be your next project.

To work this little radio, you'll need to supply the 9V battery, a Morse code (straight) key (with a mono 1/8" plug), 40-meter antenna (with BNC-M connector), and a good ground connection. For transparency, and to make sure you aren't blindsided, this transmitter has the following caveats, which might be important to you:

- Unable to receive, only transmit
- Transmits only one frequency (7.030 MHz)
- Maximum transmit power is 300 mW (QRP)
- Has very little filtering
- Requires Morse code to use it
- Accepts only a straight key (not paddle)

To be clear, this device is not a ***transceiver***, because it possesses no receiver, leaving the receiving function to some other device, such as a shortwave radio or the WebSDR. The Optional parts are for installing the circuit board in a nice, little enclosure, if you want, including external connectors.

Parts list

One 2″ x 2″ prototype circuit board

One 9V battery connector

One SPST rocker switch

One 7.030 MHz crystal

One 2N3904 transistor

2 feet 22 AWG hookup wire

Two 1 MΩ ¼ W resistors

One 10 kΩ ¼ W resistor

One 100 nF capacitor

One 22 pF capacitor

Optional parts

One 83 mm x 58 mm x 33 mm enclosure

Four each M3 pan head screws and nuts

One 3.5 mm (1/8") mono jack

One BNC-F panel-mount connector

Four 3.1 mm x 6 mm x 6 mm standoffs

The construction

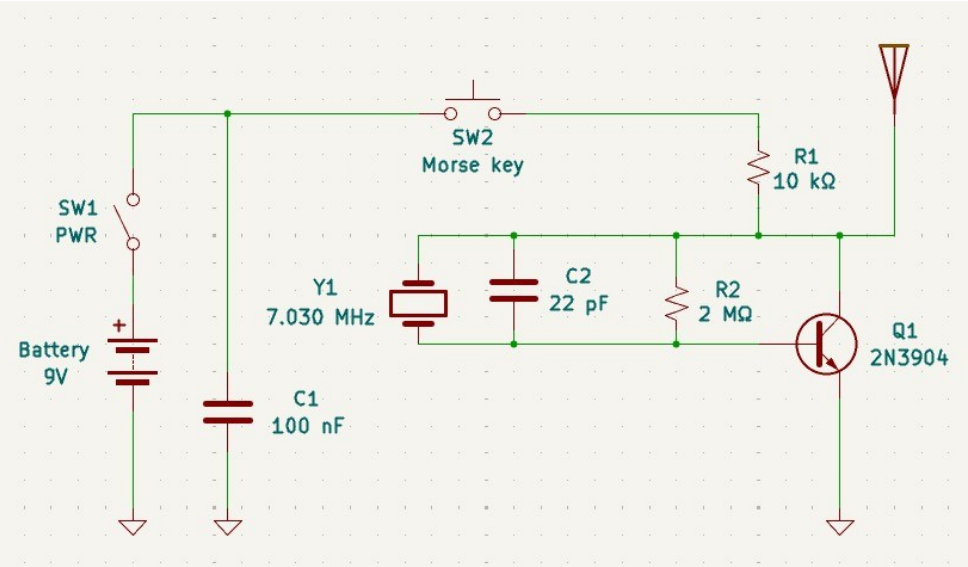
Wire the components together according to the schematic on the next page. 2 MΩ resistors are not nearly as common as 1 MΩ values, so just wire two 1 MΩ resistors in series. None of the components are very static-sensitive, so a wrist strap is not necessary for this project. If you're unsure about your soldering skills, it might help to wire up this circuit on a breadboard before committing it to a PCB (printed circuit board). If you have trouble following the schematic, or have questions about anything in the circuitry, please feel free to reach out and ask.

Obvious to the casual observer, this "transmitter" is actually nothing more than a crude oscillator, crude because I'm trying to keep it really simple. I mean, it's about the simplest transmitter you can make, but it does work (transmits) as designed.

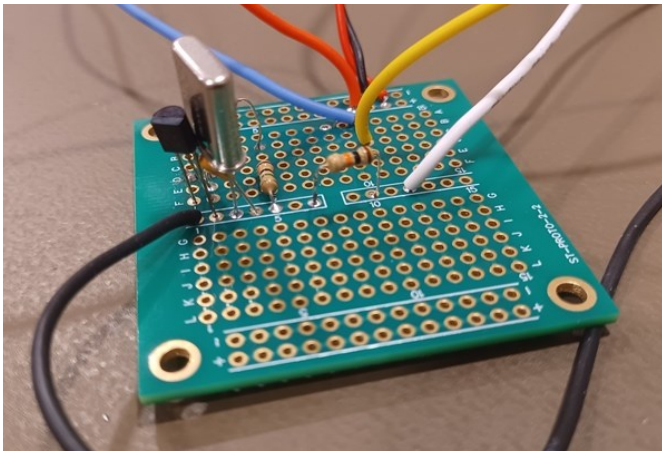
Optional construction

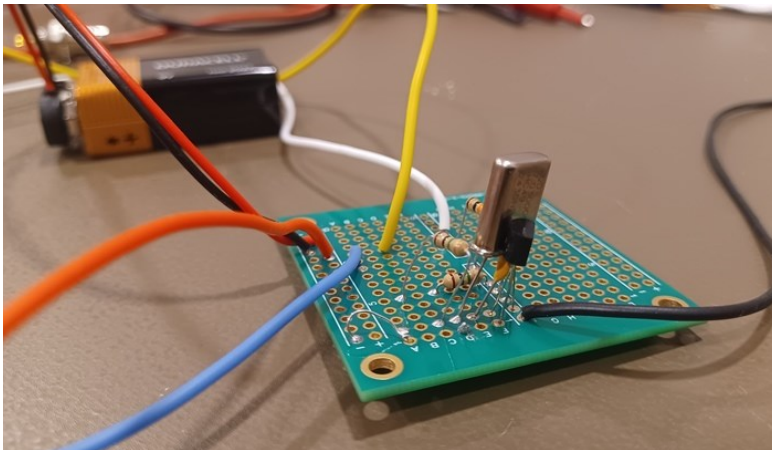
If you want to package this little transmitter in a nice-looking box, drill appropriately sized holes for the BNC connector and mono jack in convenient places on the enclosure. Drill holes on the bottom for the screws. Connect the collector of the transistor to the center conductor of the BNC connector and the circuit signal

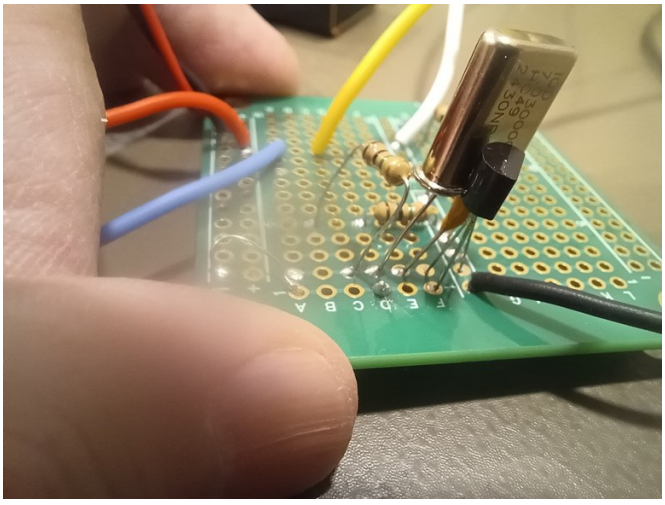
40-meter CW transmitter, cont'd



ground to the outer conductor of the BNC connector. Connect the mono jack in place of the Morse key, then install a mono plug onto your straight key.







The rocker switch is also optional, since the straight key turns on the power to the circuit with each key-up. Ok, that's not exactly superior engineering, but it does minimally work. So, the transmitter circuit doesn't actually produce any signal until you key up, because the straight key enables power to the oscillator in series with the power switch. To install the rocker switch, cut a 19 mm x 12.5 mm x 11 mm rectangular hole in the enclosure.

Testing the transmitter

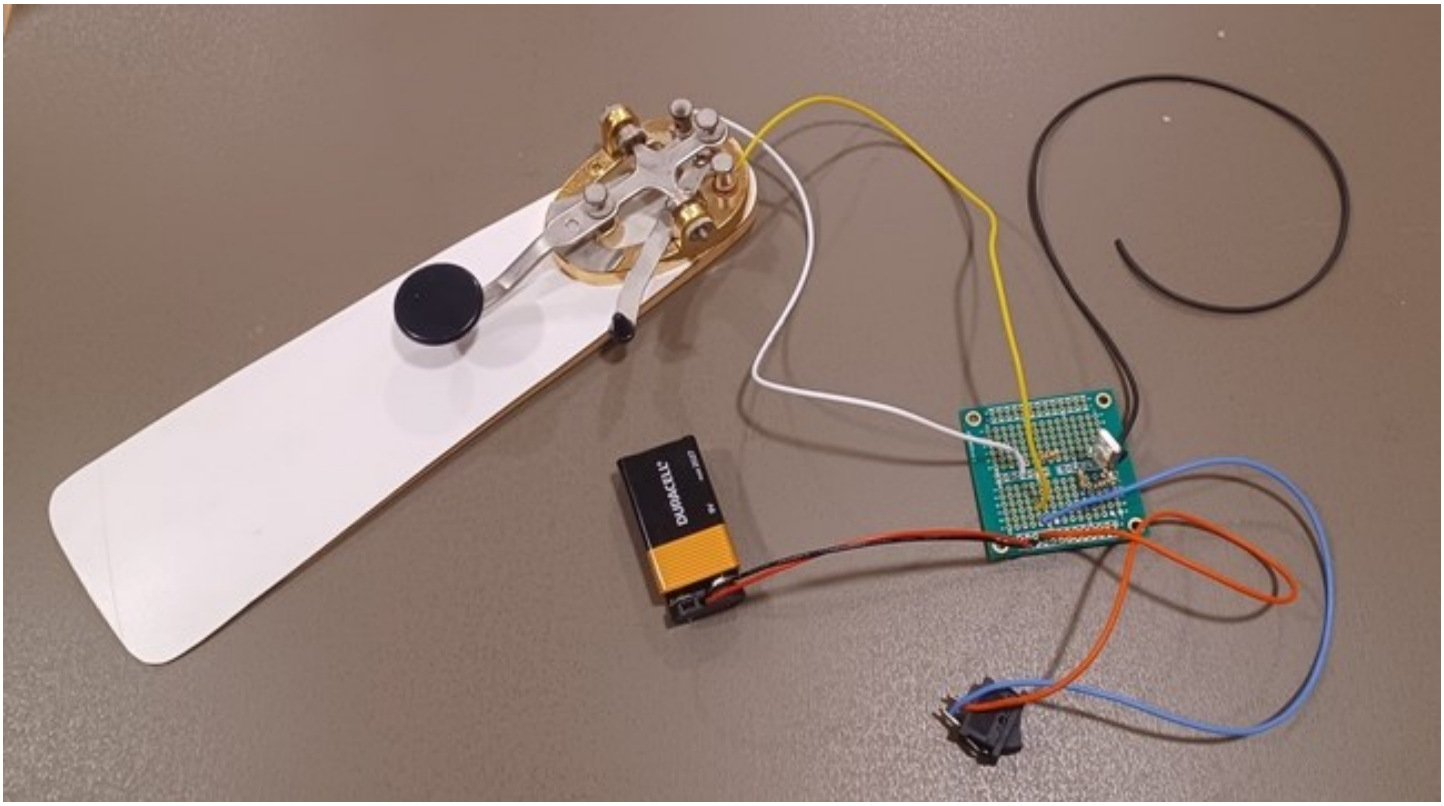
Using my trusty Yaesu FT-100D as my receiver, I powered it with an SLA (sealed lead-acid) battery, turned on the rig, and tuned to 7.030 MHz. Using CW as the mode, and no filtering, I monitored as I flipped on the power switch to my oscillator circuit. And when I keyed up, I heard CW loud and clear from my HF rig, so the transmitter worked.

Then, I dialed around to see how wide my signal was, and it turned out that my Yaesu received the signal clearly from 7.0273 MHz through 7.0305 MHz, a 3.2 kHz bandwidth, which is both encouraging and a little

40-meter CW transmitter, cont'd

concerning. The lower Technician portion for CW of the 40-meter band spans 7.025 MHz to 7.075 MHz, so both the carrier (7.030 MHz) and the entire bandwidth of my transmitter falls safely within that range, allowing Technician class licensees to use this transmitter. Typically, a CW signal does not need to take up more than 400 Hz to 500 Hz, while my signal takes up 3200 Hz. That's not a clear FCC violation, since there is not bandwidth limit for CW, but the rules (Part 97.307.a) do state that we shouldn't occupy more bandwidth than is necessary for the communication. So, a gray area.

I didn't take the time and trouble to pull out my spectrum analyzer or wattmeter to measure the power output, but I'm pretty sure this transmitter output falls well within the 200-watt limit for this portion of the 40-meter band.



Finally

This simple transmitter project has a few shortcomings, but it also has a lot of potential. If you're concerned that you aren't able to enjoy this device because it can only transmit CW, then it might just be time for you to learn Morse code. This little guy is missing two major sections that could make it into a more robust transmitter: an output PA (power amplifier) and a LPF (low-pass filter), simple schematics for both of which could easily be found by an online search. A PA (made only from a biased 2N2222A transistor) would help boost the signal to 600 mW or more, and the LPF would confine the bandwidth better and prevent spurs (spurious emissions) on harmonics. I leave the enclosure work to you, for cosmetic appeal.

Noji Ratzlaff KNØJI

P.S. This article is dedicated to "Crab" Mike Chambers KN6KRB.