

The MRX-40 Mini Receiver

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Here's a 40-meter receiver you can build in a single evening!

After exploring very low power (QRPP) communication by building a 40 meter Micronaut CW transmitter,¹ I took on the challenge of constructing a tiny 40 meter companion receiver. Not only did I think the receiver would complement the Micronaut, I thought it might also have potential as a kit project for my hometown group, the CQRP (Columbus, Ohio, QRP) Club. The final push to action came from the discovery that there were 93 licensed amateurs in my neighborhood ZIP code. Visions of a local mini-milliwatt net flashed through my imagination!

The result is the MRX-40, a 40 meter CW receiver barely larger than a half dollar. You don't need to have a Micronaut transmitter to use the MRX-40. This receiver can be paired with *any* 40 meter transmitter—low power or otherwise.

Design Details

The main design objectives for the MRX-40 were small size and simplicity. I arbitrarily decided to limit the size of the printed

¹Notes appear on page 00.

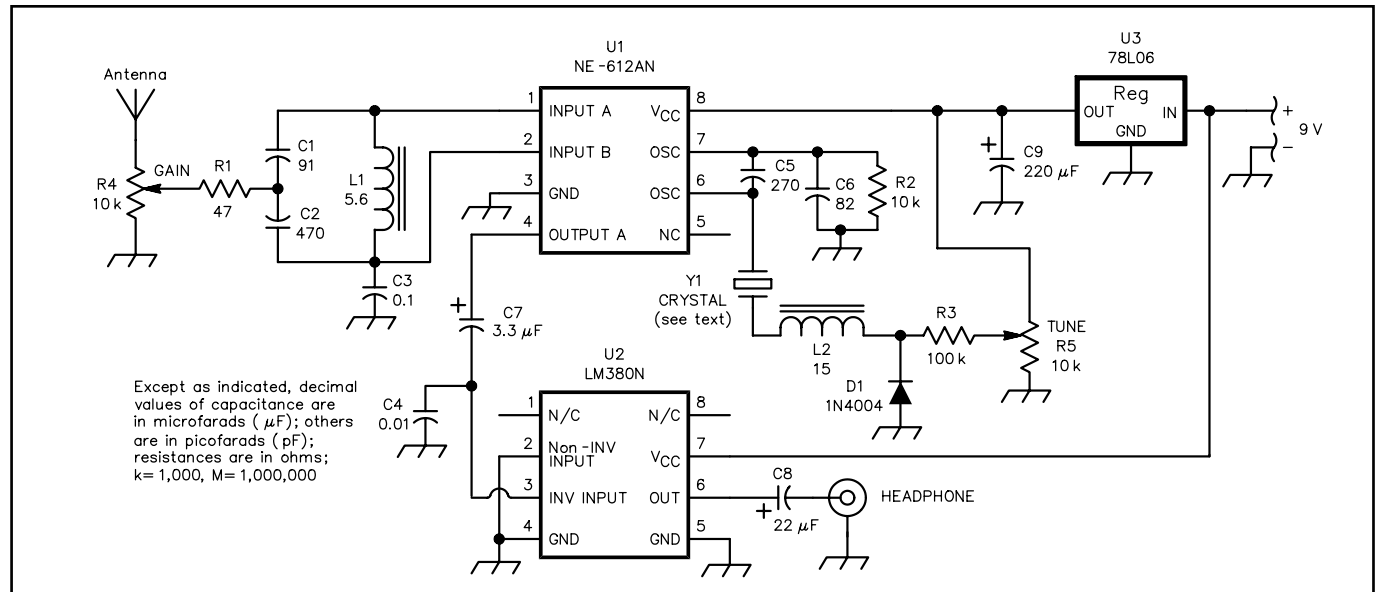
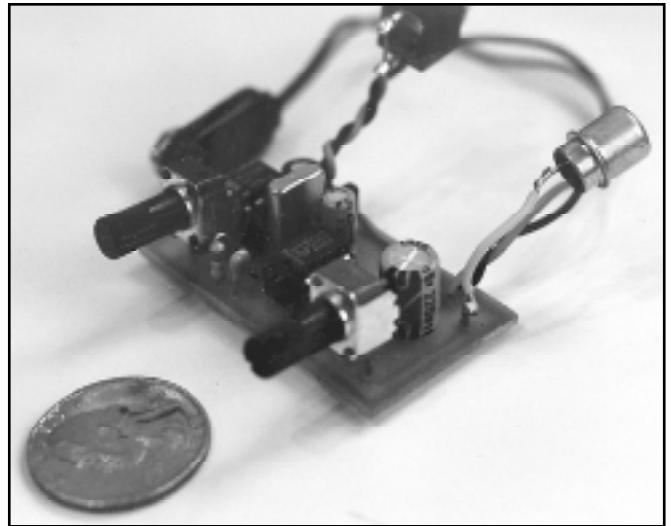
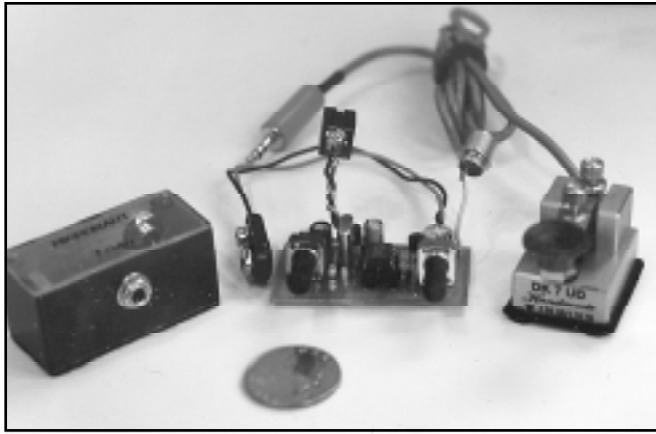


Figure 1—Schematic of the MRX-40 receiver. Equivalent parts can be substituted. With the exceptions noted below, all parts are available from Mouser Electronics, 958 N Main St, Mansfield, TX 76063-4827; tel 800-346-6873.

- C1—91 pF ceramic disc capacitor (Mouser 140-CD50S2-091J)
- C2—470 pF ceramic disc capacitor (Mouser 140-CD50P2-471K)
- C3—0.1 μF monolithic capacitor (Mouser 581-UDZ104K1)
- C4—0.01 μF monolithic capacitor (Mouser 581-UEZ103K1)
- C5—270 pF monolithic capacitor (Mouser 581-UEC271J1)
- C6—82 pF monolithic capacitor (Mouser 581-UEC820J1)
- C7—3.3 μF electrolytic capacitor (Mouser 208-50V3.3)
- C8—22 μF electrolytic capacitor (Mouser 208-50V22)
- C9—220 μF electrolytic capacitor (Mouser 208-10V220)
- D1—1N4004 (Mouser 592-1N4004A)
- L1—5.6 μH molded choke (Mouser 43LS566)

- L2—15 μH molded choke (Mouser 43LS155)
- R1—47 Ω , 1/4 W resistor (Mouser 30BJ250-47)
- R2—10 k Ω , 1/4 W resistor (Mouser 30BJ250-10K)
- R3—100 k Ω , 1/4 W resistor (Mouser 30BJ250-100K)
- R4, R5—10 k Ω potentiometers (Mouser 317-2091-10K)
- U1—NE-612AN (Dan's Small Parts, Box 3634, Missoula, MT 59806; tel 406-258-2782; <http://www.fix.net/dans.html>)
- U2—LM-380N-8 (Dan's Small Parts; see U1)
- U3—78L06ACZ voltage regulator (Mouser 511-78L06ACZ)
- Y1—Crystals in HC49U holders for 7040 or 7122 kHz are available for \$3 each from Doug Hendricks, KI6DS, 862 Frank Ave, Dos Palos, CA 93620.



From left to right, the Micronaut transmitter, MRX-40 receiver and an equally small key (made by DK7UD).

circuit board (PCB) to 1×2 inches. To accomplish that goal, I used miniature molded chokes and other small components.

The simplicity is in the circuit (see Figure 1). The MRX-40 is a crystal-controlled direct-conversion receiver consisting of an NE-612AN oscillator/mixer chip followed by an LM-380N audio amplifier.

By using a 1N4004 diode as a varicap, the receive frequency can be shifted about 1.5 kHz above or below the crystal frequency. This tuning technique eliminates the need for bulky variable capacitors. The QRP Club kit² includes a crystal for 7040 kHz, the 40 meter QRP frequency. If you're a Novice or Technician Plus, you'll want to substitute a crystal for 7122 kHz. See the parts list in Figure 1 for crystal sources.

The voltage supply to the NE-612 and tuning circuit is regulated by a 78L06 so that the 8 V limit of the NE-612 is not exceeded. On the other hand, the full battery voltage is applied to the LM-380. The audio output is more than ample for Walkman-style headphones. Instead of an audio **VOLUME** control, the MRX-40 uses a **GAIN** control at the antenna input to accomplish the same purpose.

Etching Your Own PCB

The MRX-40 can be built on a piece of perforated board, but you can also opt to etch your own printed circuit board for a neater appearance. The etching template and overlay are available from ARRL Headquarters.³

The board layout for the QRP Club kit was created on a computer using *Easytrax* and *Easyplot* software.⁴ Once the circuit board was designed and printed on paper, I transferred the pattern to TEC-200 film⁵ using a copy machine. If you've never used TEC-200, you'll find that it is quite handy for single-board pro-

duction. The image placed on the film is transferred to the circuit board using a clothes iron. The board is then etched in the conventional manner.

The *Easyplot* software can also produce the files necessary for multiboard production on a Gerber Plotter. For our project we produced four files: bottom layer, solder mask, overlay, and drill plot. With these files, a PCB production facility can produce as many boards as you desire. (If you walk into a PCB plant with just a schematic and ask them to do the layout they charge by the hole. For this project board [with its 62 holes], the charge for layout alone would have been about \$240!)

Construction

There is really nothing unusual about the construction of the MRX-40. You will be working in a very small area, so a hobby vise is recommended to hold the board steady when soldering. A good set of eyes also helps, as does a 60 W iron with a small tip. I find it best to mount the smallest components first. Sockets for ICs are optional. An enclosure can be made for the MRX-40 from circuit boards soldered together, or anything else you have available.

Operation

Connect a 9 V battery to the receiver and check the voltage at pin 8 of U3. It should be about 6 V. If you can check the current drain from the battery, you should find something in the range of 16 to 17 mA.

Assuming that the voltage and current measurements are normal, you should be home free. No alignment is necessary. You can check the local oscillator function by listening to it with another 40 meter receiver. Now fire up your 40 meter CW transmitter and enjoy!

Notes

- ¹Micronaut transmitter kits are available from Dave Ingram, K4TWJ, 4941 Scenic View Dr, Birmingham, AL 35210. They are \$15 (without crystal), plus \$2 shipping and handling.
- ²MRX-40 receiver kits are available for \$18 from Steve Bornstein, K8IDN, 475 East North Broadway, Columbus, OH 43214. The kit contains all parts, PCB with mask and overlay, jacks, controls, and a step-by-step manual.
- ³A PC-board template package is available from the ARRL, at a cost of \$2 for members, or \$4 for nonmembers. Send your request for the BORNSTEIN MRX-40 TEMPLATE along with a business-size SASE to the Technical Department Secretary, 225 Main St, Newington, CT 06111-1494.
- ⁴You'll find a demo version of *Easyplot* software on the World Wide Web at <http://www.tol.mmb.com/E147>. *EasyTrax* freeware can be downloaded at <http://www.protel.com/download.htm>.
- ⁵TEC-200 film is available from Meadow Lake Corp, 25 Blanchard Dr, Box 497, Northport, NY 11768.

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