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My Journey to Remote Operation: Station in a Box!

A remotely controlled operating setup with one transceiver.

Dave Ingebright, WB7ELY

For the last couple of years, I have been tantalized by all the available equipment for remote-controlling a ham station. Operating my home station in rural Washington while on vacation or from my winter home in Arizona sounded intriguing. I've tried various stealth, attic, balcony, and temporary antennas, but with poor grounds, high noise levels, and HOA restrictions, I've never had much luck.

Recently, I thought about an unused S-0 station sitting out in the countryside and began wondering if I no longer needed a shack full of radio equipment. I thought, "Why not control my entire home station with one good remote-controlled radio setup?" The station could be in my detached garage, closer to the antennas, and be controlled over the home local area network (LAN) from the desk in my office. Running one full-function radio would certainly declutter my office. This way, I could have a reliable radio system at home and the opportunity to hit the **ON** button and operate 80 to 6 meters using any mode wherever there is internet access.

My shack PC could run the rest of my ham applications and any other networked remote controls I wanted to add. Plus, my coaxial cable antenna runs would be shorter and give my station better performance. A major reconfiguration would simplify my operating position and still allow me to experiment with remote amplifiers, remote relays, multiple antennas, and even beams and rotors.

The Right Equipment

After researching remote-controlled radio systems and available software schemes, I decided on the Remoterig RRC-1258MkIIs from Microbit. The Remoterig was specially developed to remote-control amateur radio stations via the internet in a user-friendly and cost-effective way. The Remoterig units are normally used in pairs. One is connected to the radio, and the other is connected to the control panel. This system is unique because a PC is not needed. The microphone, speaker, internal keyer, and a couple of COM ports are all handled by the two units, each one connected to a network.

The front of the remote station in a box as it was being wired. Note the small fuse block to power the RRC box. From top to bottom: the 12 V power supply, RRC radio unit, and TS-480SAT transceiver in a mobile mount bracket. The top interior shelf shows the holes for flow-through cooling.

The 1258 model can be configured to work with most amateur radios available from Icom, Kenwood, Yaesu, and Elecraft. The RRC system requires a radio transceiver with a detachable front panel or a network jack. The radio control panel connects to the control unit, and the radio connects to the radio unit. Jumpers need to be hooked inside the RRCs to correspond to your radio's make and model.

Each RRC system runs on 10 to 18 V dc and has an ethernet jack to connect your network. I bought the optional Wi-Fi board and installed it in the control RRC unit for extra flexibility. I followed the owner's manual and configured the boxes to work with my Icom IC-706 transceiver. The system's menus allow adjusting for

The back of the station in a box as it was being wired.

varying internet quality connections, including cell-phone connections.

Because my Icom IC-706 transceiver has a detachable front panel, it was a good candidate for the system's first test. The only problem was that the separation cable had to be modified and fitted with RJ45 plugs. I carefully cut and spliced the cable and held my breath as I powered things up for the first time. It worked well. I liked that the control panel acted like it was directly connected to the radio, but the radio was 100 feet away, located in the garage, and now closer to the antennas.

I wouldn't say it's all plug-and-play, but I had the system working over my home LAN without much trouble. I even set up a temporary 2.4 GHz radio link and ran the radio at my neighbor's house, which was on the hill behind my house. When I tried to get the outside internet access working through my home router and firewalls, it wouldn't work. I got on the RRC forum and met Mitch, DJØQN (SK), who was happy to help me configure the detailed menus, my firewalls, and the port forwarding settings on my home router.

For this project I chose to use the Kenwood TS-480 (**www.kenwood.com/usa/com/amateur/ts-480sat**), as it has all the latest features and fit into my budget. It is a solid 100 W radio with a good-looking, elegant stand-alone control panel.

The Build

The next step was to design and build the permanent radio portion of the remote system. Good practice dictates that the whole radio installation should emphasize attention to detail and safety.

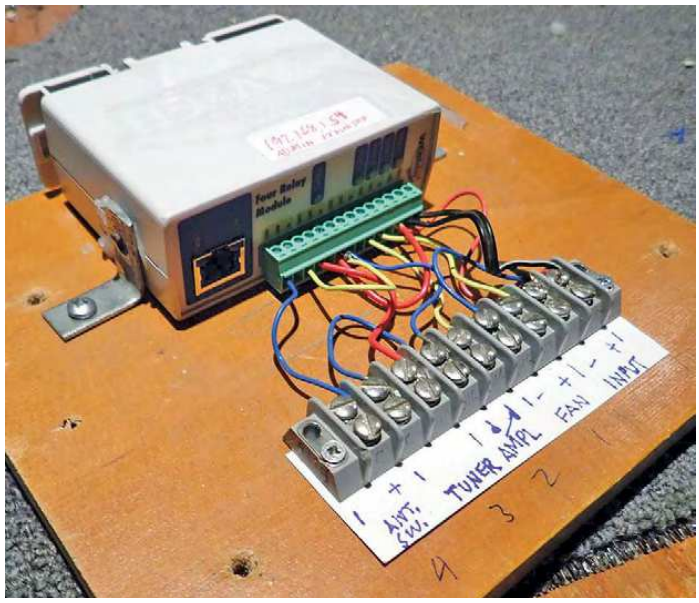
For my operational needs, the remote system should be in a safe, secure, and well-ventilated box containing the power supply, transceiver, RRC, and a muffin fan. All the dc wiring needed to be short, fused correctly, and the right gauge of wire for a permanent, trouble-free installation. The different signal paths, such as the network, audio, data, and other signal wiring inside the box, were separated and tied off with zip ties. I wanted the configuration of the main part of the remote station to be as stable as I could make it.

On the outside, the coax runs, grounding, and antennas needed to be installed so there would be little or no maintenance. Eventually, I installed the antenna coaxial cables in underground conduits and ran them to my three antennas.

I built the box from plywood and cut three interior shelves sized for the main modules (power supply, RRC, and transceiver). I drilled 2-inch holes for draw-through airflow around the main parts and through the shelves. Removable smoked Plexiglas covers were used to close off the front and rear of the box.

The completed station in a box with Plexiglas. Note the coax antenna plugs, ground wire, network, and power cables.

The Elecraft amplifier and antenna tuner are on the right. Dave Ingebright, WB7ELY, used the remote clients downloaded from the manufacturer's website to monitor the other equipment.



The web relay and terminal strip mounted to a scrap piece of wood for testing.

Seven 1-inch air-intake holes on the bottom of the covers provided enough capacity for the 4-inch muffin fan to pull cooling air up through the shelves and out of the box. A pair of handles finished the top because the box weighed about 20 pounds and would be difficult to move otherwise. I felt that air filtering was not needed but certainly could be added later.

The station in a box worked well and looked good, but I soon realized I needed a web relay to control the fan, operate a coax relay, and switch power on the antenna tuner and amplifier. I decided on a WebRelayQuad by ControlByWeb (**www.controlbyweb.com**). This remote-controlled four-relay switch came with four hefty relay outputs controlled independently by any computer connected to the network. This was the piece I needed to expand the remote station's capabilities.

For the initial test, I mounted the switch on a scrap piece of wood with a terminal strip. Setting up the web relay was simple, and I was able to build a custom menu within a few minutes. It connected to my network using its own IP address without any trouble. For outside internet access, I had to subscribe to a dynamic domain name system. I chose **www.dyndns.org**, but there are many providers out there. I bookmarked the web relay on the station PC, and during operating sessions, I would turn on the fan and control the other equipment as needed.

Everything worked as expected, and I was happy to have a solid station configuration and be able to concentrate on operating and making contacts. My station in a box ended up sitting on a shelf under my workbench in the garage. Because the transceiver was now in another place, I had to pay more attention to the metering on the control panel, as this was my only indication of power output, standing wave ratio, and quality of my signal.

This project forced me to look at my amateur station differently. The station components and wiring had to be more permanent than my usual "hook it up and try it out" method. I am very satisfied with this durable station, and I've learned a lot about internet networking, TCP/IP protocols, and, most of all, having patience while working through networking difficulties. In the end, I have an extraordinary station that I can operate from anywhere in the world and one that will grow with my future equipment and operating skills.

All photos by the author.

Dave Ingebright, WB7ELY, has been a ham since 1976. He holds a General-class license and is active on the HF+6 bands. Dave holds an Electronics Technician certificate from DeVry University, an Electronics Technology degree from Shoreline Community College, and an FCC General Radiotelephone license. Dave spent 15 years as an electronics technician and retired as a flightline manager with Boeing Co. In his spare time, he is a tireless designer and builder of electronic gadgets. Dave holds a patent on an optically isolated intercom system for flight test aircraft. You can reach him at **daveingeb@comcast.net**.

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