

Product Review

Midnight Design Solutions Phaser Digital Mode Transceiver Kit

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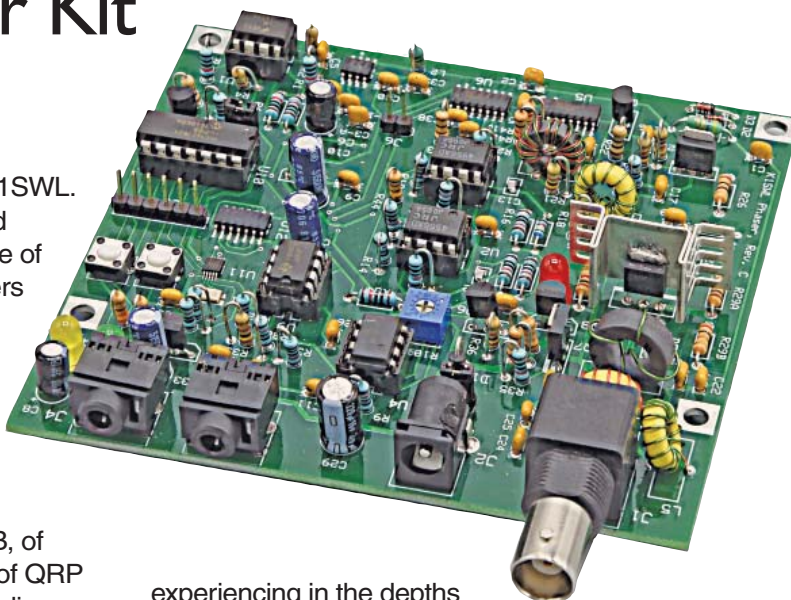
Many of you may remember Dave Benson, K1SWL. He was the designer and entrepreneur behind Small Wonder Labs, the manufacturer of some of the most popular low-power (QRP) transceivers ever created. Several years ago, Dave decided that it was time to retire and close his business, much to the disappointment of many in the QRP community.

Well, he's back!

Dave has teamed with George Heron, N2APB, of Midnight Design Solutions, to offer a new set of QRP transceivers known as Phasers. These little radios are intended for use with the wildly popular FT8 digital mode. If any communication mode was tailor made for QRP, it is FT8. With just a few watts and an antenna, you can make contacts throughout the world, even during the marginal conditions we're

Bottom Line

The Phaser Digital Mode Transceiver offers a clever and inexpensive way to get on FT8 and other digital modes with a compact, dedicated QRP transceiver that is easily used in the field.



experiencing in the depths of the solar minimum.

Phaser Flavors

Phaser transceivers are kits designed for operation on a single band. You have your choice of kits for 80, 40, 30, 20, or 17 meters. Dave designed each transceiver to be hard-coded for output on the FT8 frequency for each band. However, every transceiver is capable of operating on an alternate frequency that you can program yourself. If you want to operate another digital mode on the band, such as PSK31, for example, the frequency can be changed accordingly. So, while the Phasers are sold as "FT8 transceivers," they are actually multimode digital radios.



Figure 4 — Parts are mounted on labeled cards for easy identification.

The Phaser transceiver generates about 4 W SSB output. Because virtually all FT8 operating takes place using upper sideband (USB) transmissions, the Phaser is hardwired for that mode.

Building the Phaser

For this review, I selected the 20-meter model and ordered the optional enclosure kit. The transceiver board is just 4.125 × 3.85 × 1.2 inches and includes seven preinstalled surface-mount components.

The through-hole parts are all mounted on labeled cards (see Figure 4). No more sorting and squinting as you try to read resistor color codes or barely legible numbers on disc capacitors. I've never seen such a straightforward approach to kit building, and Midnight Design Solutions should be congratulated on going the extra mile to ensure success. All you have to do is follow the instructions and pluck the parts you need from the cards.

The downloadable assembly manuals are thorough and colorful. Someone put a lot of effort into these documents. Once again, the obvious goal is to make the assembly steps as clear as possible. The manual even has a sense of humor. I had to chuckle upon seeing a visual example of an improperly wound toroid inductor. The caption beneath the image read: "Bad Toroid! (Bad, bad, toroid!)"

The assembly steps are divided into six groups of parts. When you complete a group, the manual instructs you to run some tests to make sure that the section of the transceiver you just built is functioning normally. I'm an experienced kit builder, so I chose to skip the tests. That's not the best approach for these



Figure 5 — The Phaser enclosure front panel includes switches and LED indicators for selecting the standard FT8 frequency or alternate (user-programmed) frequency. (Note that the TRANSMIT indicator LED incorporated into the latest version could be mounted on the front panel as well.)



Figure 6 — The rear-panel connections for AUDIO IN/OUT, ANTENNA, and POWER.

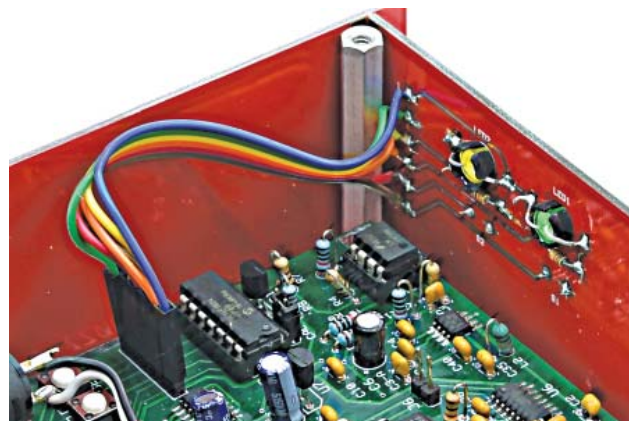


Figure 7 — The front-panel pushbutton switches and LEDs are soldered to traces on the back side of the panel and connected to the PCB board with a ribbon cable.

Table 2
Phaser Digital Mode Transceiver Specifications

Frequency coverage:
Phaser-80 board, 3.573 MHz (FT8) and 3.578 MHz (JS8/Alt)
Phaser-40 board, 7.074 MHz (FT8) and 7.078 MHz (JS8/Alt)
Phaser-30 board, 10.136 MHz (FT8) and 10.130 MHz (JS8/Alt)
Phaser-20 board, 14.074 MHz (FT8) and 14.078 MHz (JS8/Alt)
Phaser-17 board, 18.100 MHz (FT8) and 18.104 MHz (JS8/Alt)
(For each band, the FT8 frequency is hard-coded and the Alternate frequency is set for JS8 but can be reprogrammed by the user for FT4, PSK, or other frequencies.)

Transmitter operation: Phasing SSB, 4 W output (nominal).
Receiver minimum discernible signal (MDS): -109 dBm.
Power requirements: 12 V dc at 130 mA (receive) and 1 A (transmit).
Size (height, width, depth): 1.2 × 4.125 × 3.85 inches (PC board); 2 × 5 × 4.5 inches (enclosure).
Weight: 11 ounces with enclosure.

kits, though, as troubleshooting is much easier if you test as you go. The Phaser PC board is somewhat complex in terms of component density, so even with the excellent manual and the pre-labeling of parts, there is always an opportunity to make a mistake or the chance for a bad component. It's best to take your time and do the tests, just in case.

I needed about 6 hours to complete the kit PC board. Final testing is simple. You just connect the necessary audio cables to your computer, connect your antenna coax, apply transmit audio, and adjust a single potentiometer until the Phaser jumps to the transmit mode and starts generating RF output.

Note that the PC board shown here is the latest version. It incorporates a more robust bias switch than on the original and adds a current-limit function to cure an occasional issue with thermal overload when builders ran the transceiver at more than rated output. The new board also adds a transmit indicator LED to the board.

You can stop here and use the Phaser PC board without an enclosure. All connectors and controls are mounted on the board and are readily accessible. If you prefer your radio in a box, check out the optional enclosure kit, shown in Figures 5, 6, and 7. This kit uses interlocking fiberglass PC board panels designed to be soldered together along the inside mating edges, resulting in a sturdy case. The enclosure panels are finished with a smooth red solder mask, and the front and rear panels have silk-screened labels. It took me less than an hour to build the enclosure for my radio.

Phaser On the Air

You won't need an interface between your computer and the Phaser. The transceiver design includes a voice-operated switch (VOX) that keys the radio when sufficient transmit audio is present. I used my Phaser with a laptop computer that provided only a headphone output jack. That's the case with most modern laptops, but it doesn't present an impediment to using them with Phaser transceivers. All you need is an inexpensive outboard sound device that plugs into one of the laptop's USB ports. These devices are available for less than \$20 from sources such as Amazon.

I fired up my *WSJT-X* software, configured it to use the external USB audio device, and selected "None" in the dropdown transceiver-selection menu. Phasers don't provide CAT connections, so I wanted to make sure the software wouldn't throw an error message after a futile attempt to communicate with a radio that wasn't there.

The *WSJT-X* waterfall display immediately came to life with FT8 signals and the software began decoding. On 20 meters, with my Icom IC-7300 transceiver and a vertical antenna, *WSJT-X* can decode FT8 signals at my station down to about -24 dB. With the Phaser, I was decoding signals as weak as -19 dB. Considering the fact that you're running QRP, this level of sensitivity is more than adequate. After all, extremely weak stations are unlikely to hear you anyway.

As usual, the FT8 watering hole on 20 meters was packed with signals. When you're operating at QRP power levels, it can be a challenge to be heard in such crowded conditions. I chose a relatively clear spot in the waterfall display and began calling CQ in the hope that someone would decode my 4 W signal.

After a couple of attempts, I finally received a response from a station on the opposite side of the continent. He gave me a -16 dB report, and I was pleased; not bad for a few watts and a vertical antenna. After finishing the contact, I checked the PSKReporter map (pskreporter.info/pskmap.html) and found that a number of other stations had reported receiving my signal as well.

I decided to reprogram the Phaser's frequency and give WSPR a try. Reprogramming the Phaser's frequency requires some practice; it isn't as simple as spinning a VFO knob.

There is a tiny pushbutton labeled **FT8**, which you must hold down while powering up the radio. When you release it, the **FT8** LED blinks twice to let you know you're in the frequency programming mode. Next, you have to use the **FT8** and **ALT** pushbuttons to enter the frequency by sending Morse code. The **FT8** button sends dits and the **ALT** button sends dahs. As you can imagine, the odds of making mistakes are very high. I needed several tries before I finally achieved success. No matter how badly you mess up, though, rest assured that the preprogrammed FT8 frequency will remain undisturbed.

An Investment in Fun

While I would not recommend the Phaser for your first kit-building experience, it should be well within the abilities of most hams, including beginners with some guidance. Several clubs have already purchased Phaser kits for group projects, which lend themselves well to the Phaser's thorough approach to building.

The Phaser manual is available for download from the Midnight Design Solutions website, so you can see what's involved in building and using it. The kit is well supported with a very active Chat With The Designers discussion group online at groups.io/g/cwtd.

Each kit costs just \$55 and the optional enclosure is an additional \$25. So, for \$80, you can own a single-band transceiver that's perfect for portable operating. This review was written while we were waiting for Spring to arrive, but as soon as the weather warms and the COVID-19 "stay at home" rules loosen up, I'll grab my laptop and take my Phaser to a park. With just a simple portable antenna and a small battery to power the Phaser, I suspect I will be making plenty of contacts.

Manufacturer: Midnight Design Solutions, 205 Okema Trace, Loudon, TN 37774; midnightdesignsolutions.com/phaser. Price (not including shipping): Phaser transceiver: \$55; enclosure: \$25.