Product Reviews

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Xiegu XPA125B 1.8-50 MHz 100 W Amplifier

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Product Review

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Besides my main station Elecraft K-Line (K3/KPA500/KAT500), I also own some QRP rigs — namely Elecraft KX3, Xiegu X5105, and Xiegu G90 transceivers — which I use primarily for portable operations. The Xiegu XPA125B 100 W amplifier is an interesting addition for those who want to use their QRP radios as part of their higher-power fixed station. While the XPA125B is clearly designed to seamlessly interface with the Xiegu X108G, X5105, X6100, and G90 transceivers, it will also work with any QRP rig. And an internal wide-range automatic antenna tuner provides antenna system flexibility when necessary.

XPA125B Amplifier Technical Details

The XPA125B is powered directly from a standard 13.8 V dc power supply capable of 20 – 25 A. There is no fan (i.e., the heavy metal case provides the necessary thermal protection), and a handle on the left side provides ease of transport. The amplifier is specified to output 100 W on 160 – 10 meters, and 80 W on 6 meters, typically with less than 5 W of drive. Transmit and receive switching is provided by an internal relay. There is an amplifier bypass switch, and the XPA125B is also bypassed when it is powered off. The XPA125B provides manual band changing for non-Xiegu transceivers, and auto band switching when used with Xiegu transceivers.

The XPA125B Display and Fault System

There is significant control, monitoring, and display information available on the XPA125B's LCD front panel display. Displayed functions include input and output SWR, input and output RF power, voltage and current, PA stage temperature, and band and ATU status. Four buttons provide manual control of the amplifier: the one on the left is an **ON/OFF** power button, the **PA** is used to switch between standby and operating, the **BAND** button is for band selection, and **ATU/TUNE** enables the automatic antenna tuner. The XPA125B also monitors multiple parameters to protect it from damage. These include high SWR (>3:1), high current (≥25 A), high voltage (≥15 V dc), and high temperature (≥100 °C). A fault condition suspends normal operations, normally by bypassing the amplifier. Faults clear automatically when the amplifier is unkeyed. The full XPA125B specifications are shown in Table 1.

Setting Up the Amplifier

Begin by installing the 30 A fuse in the fuse holder if it is not pre-installed. Connect the following: a ground wire, the antenna coax into the SO-239 **ANT** con-

Figure 1 — The Xiegu XPA125B rear panel.

Bottom Line

The XPA125B is a compact 100 W amplifier that is designed to work with any QRP transceiver. The built-in automatic antenna tuner adds to its operating flexibility. However, there are technical issues that one needs to be aware of.

nector, the coax from the transceiver to the SO-239 **TRX**, and the power amplifier (PA) key cables from the **COMM** 3.5-millimeter port to your transceiver. The PA key interface is not necessarily compatible with all transceivers. A ground enables the amplifier. However, if 3.2 V dc or more is applied to the XPA125B PTT port, the internal processor will be permanently damaged. The optional CE-19 interface provides ALC, PTT, and band-changing information for the Xiegu X5105 and G90 transceivers, and the correct PTT interface for non-Xiegu transceivers. The Xiegu X108 and X6100 transceivers interface directly with the XPA125B without requiring the CE-19. If you are using Xiegu transceivers, set the input power to 5 W, as the ALC interface will adjust the driving power as required. For non-Xiegu transceivers, the input power should be initially set to 1 W. Finally, connect the 13.8 V dc into the **DC IN** port, and turn on the amplifier by pressing the power button for 2 seconds (see Figure 1 for the rear panel connection ports).

Performance Measurements

Because the XPA125B will typically be used with 5 W QRP transceivers, I tested it up to a maximum of 5 W drive, as the specifications note that this is the typical drive level needed for full power. Table 2 details the measured amplifier input versus output. The XPA125B display power readings are compared to a NIST-traceable Array Solutions PowerMaster (input), and Mini-Circuits PWR-6GHS+ sensor and calibrated attenuators (output).

The first thing I noticed was that there was about a 0.5 to 0.6 V dc voltage drop through the dc connector on the XPA125B at the higher current levels. There was another 0.3 V drop along the 3-foot dc power cable supplied with the unit. The XPA125B power connector is a six-pin Molex, but only two tin-plated pins are used for power. Also, the power cable appears to be about 16 gauge, but 14- or 12-gauge wire would be more appropriate. To keep the voltage at 13.8 V dc on the XPA125B display, I had to set my power supply to 14.6 V dc. This resulted in 100 W output on 20 meters. Setting my power supply to 13.8 V dc resulted in the maximum output on 20 meters dropping to 94 W. Also, the XPA125B internal wattmeter appears centered in accuracy on 20 meters. It reads low below 20 meters, and high above 20 meters. So, while the internal wattmeter appears to show that you are close to the typical 80 W specification on 6 meters, the actual power is 62 W with 5 W drive. Also, the input power monitor reading is significantly in error. Finally, I found that the input and output SWR and power readings do not work unless the amplifier is on-line and being keyed. Of course, when this is the case, the input SWR

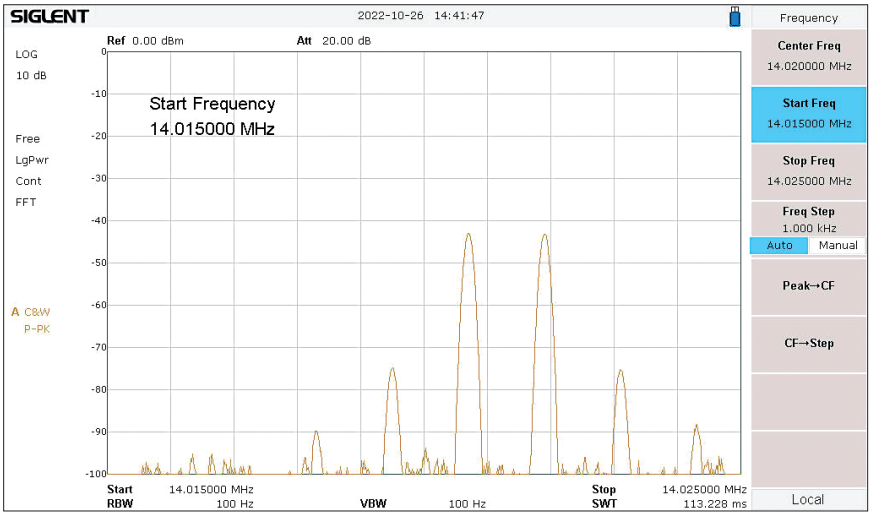

Figure 2 — The Xiegu XPA125B two-tone test with the Elecraft KX3 set at 5 W output.

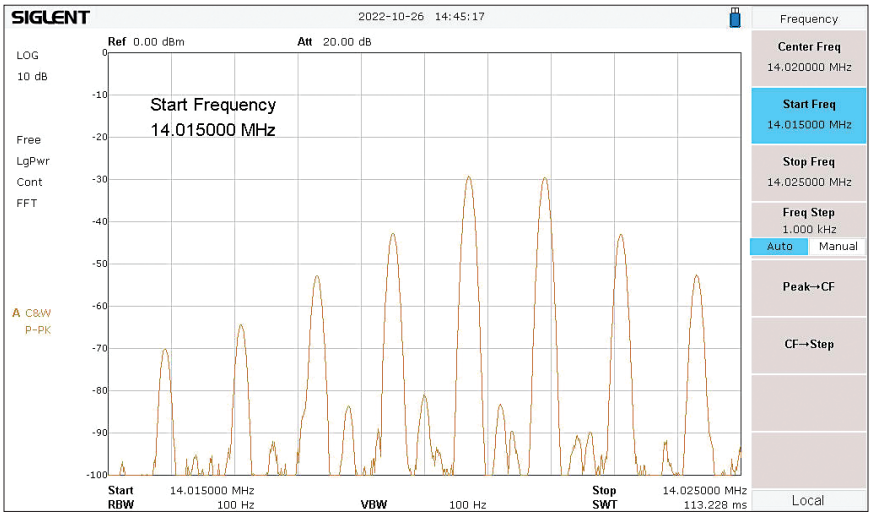

Figure 3 — The Xiegu XPA125B resultant two-tone output.

always shows 1:1, as it is looking into the input of the on-line amplifier.

Finally, the gain drops as you increase drive. This indicates that the amplifier is going into compression at the higher power levels. This implies that you are degrading IMD as you near the amplifier's rated output. My KX3 has a built-in two-tone generator, so I looked at the barefoot KX3, and then the KX3 driving the XPA125B to 94 W on 20 meters (external power supply set to 13.8 V). As you can see in Figures 2 and 3, there is significant degradation of IMD performance when the amplifier is used.

The XPA125B Automatic Antenna Tuner

The XPA125B internal ATU provides manual (user-initiated) tuning. Tuning is initiated when the **ATU/TUNE** button is pressed for several seconds, and 5 W of RF carrier is applied. The ATU can be used whether the amplifier is on-line or not. If your QRP transceiver doesn't include an ATU, the XPA125B will take care of this for you. However, as mentioned earlier, the XPA125B SWR meters do not work unless the amplifier is on-line and keyed. The automatic tuner will tune, but you have no indication of the final SWR unless your QRP transceiver has an SWR meter.

Tuner Matching and Loss Measurements

Resistive matching range and loss testing was performed with the precision setup described in the "Product Review" column in the August 2012 issue of *QST* (see **www.arrl.org/qst-in-depth** for details). Tuning power was set at 5 W, per Xiegu recommendations. All measured losses are subject to the ±3% accuracy of my NIST-traceable test equipment. The XPA125B tuning range is specified at 14 – 500 Ω resistive, though

Table 1
Xiegu XPA125B, serial number X02DG22210070
FCC ID number 2ANLH-XPA125B.

Manufacturer's Specifications	Measured in the ARRL Lab
Frequency range: 1.8 – 30 and 50 – 54 MHz.	160-, 80-, 60-, 40-, 30-, 20-, 17-, 15-, 12-, 10-, 6-meter bands, as specified.*
Power output: 100 W PEP with 12 V ~ 15 V dc on 160 – 10 meters; 80 W on 6 meters.	100 W, as specified on 160 – 12 meters, 79 W on 10 meters, 62 W on 6 meters with 13.8 V dc.
Driving power required: Max 5 W.	1.8 – 54 MHz, 0.2 – 5.0 W (see Figure A).
Spurious and harmonic suppression: >50 dB.	HF, >61 dB; 6 meters, 50 – 76 dB. All bands except 6 meters meet FCC requirements.
Third-order intermodulation distortion (IMD): Not specified.	3rd/5th/7th/9th-order products (dB below PEP at full output): 14 MHz, –20/–29/–41/–48 dB. See Figure B (dB below PEP at 80 W output): 14 MHz, –28/–39/–38/–46 dB. See Figure C.
Transmit-receive switching time: Not specified.	Key to RF output: 31 ms. Unkey to receive: 30 ms.

Power requirements: 12 – 15 V dc, 30 A max.

Size (height, width, depth, excluding knobs, handles, and connectors): 2.8 × 6.3 × 10.3 inches. Weight: 5.86 pounds.

*In the US, the legal power limit on 30 meters is 200 W PEP output, and on 60 meters it is an ERP of 100 W PEP relative to a half-wave dipole.

Table 2
Xiegu XPA125B Amplifier Measurements, 13.8 V dc amplifier display. Standby: 0.16 A, key down, no drive, 2.1 A.

Band	True Input	XPA125B Mon In	XPA125B Mon Out	True Output	Gain	DC Amps Act/Mea
160 M	1.0 W	0.1 W	61 W	62 W	17.9 dB	10/11
	2.0 W	0.3 W	86 W	89 W	16.5 dB	11.8/14
	3.0 W	0.5 W	94 W	98 W	15.1 dB	12.4/14
	4.0 W	0.7 W	98 W	103 W	14.1 dB	12.6/14
	5.0 W	0.9 W	100 W	108 W	13.3 dB	12.7/14
20 M	1.0 W	0 W	73 W	72 W	18.6 dB	7.9/8
	2.0 W	0 W	85 W	85 W	16.3 dB	8.7/9
	3.0 W	0.1 W	92 W	91 W	14.8 dB	9.3/9
	4.0 W	0.2 W	95 W	96 W	13.8 dB	9.7/10
	5.0 W	0.3 W	100 W	100 W	13.0 dB	10/10
10 M	1.0 W	0.1 W	68 W	63 W	18.0 dB	6.9/7
	2.0 W	0.1 W	86 W	82 W	16.1 dB	8/8
	3.0 W	0.2 W	91 W	87 W	14.6 dB	8.5/9
	4.0 W	0.3 W	93 W	89 W	13.5 dB	8.8/9
	5.0 W	0.4 W	97 W	94 W	12.7 dB	9.1/9
6 M	1.0 W	0.1 W	37 W	30 W	14.8 dB	7.5/8
	2.0 W	0.3 W	52 W	44 W	13.4 dB	9.3/10
	3.0 W	0.7 W	63 W	51 W	12.3 dB	10.2/11
	4.0 W	1.0 W	72 W	57 W	11.5 dB	11.1/12
	5.0 W	1.4 W	76 W	62 W	10.9 dB	11.8/13

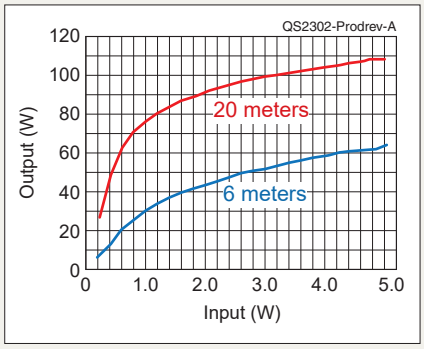

Figure A — Xiegu XPA125B amplifier input versus output power.

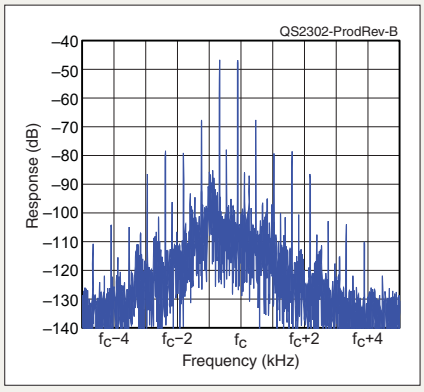

Figure B — Xiegu XPA125B amplifier transmit IMD at 100 W on 20 meters.

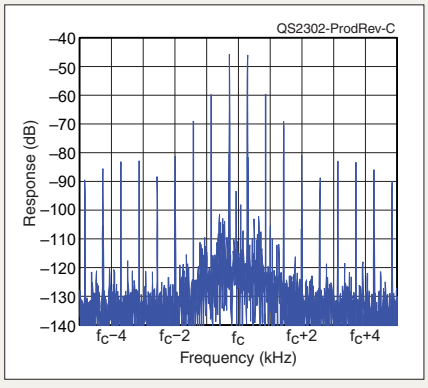

Figure C — Xiegu XPA125B 20-meter band IMD performance at 80 W. Third-order products are –28 dBc, and fifth-order products are –39 dBc. Overall, throttling back to 80 W will transmit a cleaner signal on the bands.

Lab Notes: Xiegu XPA125B 1.8 – 50 MHz 100 W Amplifier

The Xiegu XPA125B amplifier presented quite the challenge for the ARRL Lab to test. We had originally obtained a slightly older version of this amplifier. It worked well enough, except for the problem that the RF power output was low on the upper bands. This might not have been a problem in and of itself, but when we pushed it hard to get closer to the rated power, the transmit IMD performance was not good at all. We then found that Xiegu had a new and improved version of the amplifier, so the editors decided to review the new unit.

When we received the new version, we saw the same problem with power output on the 10- and 6-meter bands. Worse, this unit did not meet the FCC limits for spurious emissions on 6 meters. We had purchased the amplifier through HRO, so we contacted them. HRO immediately agreed to exchange the amplifier for us. The replacement arrived promptly. It was a bit low on power on the upper bands, but not as bad as the older version had been. But the unit would not go into transmit on 80 meters and displayed a **LOW EFFICIENCY** error message. Again, HRO immediately agreed to help, and we soon had a third unit. (Kudos to HRO for its excellent customer service!)

Like the previous two amplifiers, this amplifier, again, did not meet its power output specification on both the 10- and 6-meter bands (see Table 1). The harmonics on 6 meters did not meet the FCC limits for spurious emissions. If this amp is to be used on 6 meters, an external filter must be used.

The transmit IMD, measured at full available power on all applicable bands, was marginal, but a noticeable improvement was observed when the output power was reduced to around 80 W (see Figures B and C). If users of this amplifier want to be good neighbors on the bands, on SSB it is best to throttle the output back from full power to achieve the cleanest signal from the amplifier on any band.

The amplifier showed another unexpected anomaly. The input power was reading significantly low on the amplifier's input power meter compared to the input power measured on the Lab's wattmeter. For example, on 20 meters, the input power read 0.5 W, with an input power of 5 W measured using an external wattmeter. The amplifier is specified for an input power of 5 W, so to prevent damaging the amplifier with overdrive, note the setting of your transceiver, which produces a 5 W RF output, and be sure not to exceed that while operating with this amplifier. We did not see this problem on the other amplifiers we tested, so the unit that customers receive may or may not have this problem, but it is something that customers should look out for.

It might just be the bad luck of the draw, but the Lab found problems with each of the amplifiers it tested. It makes a good HF CW amplifier for your QRP rig. It can be used on FM, although it did get quite warm during testing, so it would be best to throttle it back a bit. It works on SSB, but it will be quite a bit cleaner if it is operated at about 80% of the power it will achieve on all bands. And on 6 meters, a low-pass or band-pass filter will be a must to avoid exceeding the FCC limits on harmonics. — *George Spatta, W1GKS, ARRL Assistant Laboratory Manager*

I went outside the low range for these tests (see the results in Table 3).

The XPA125B couldn't match extreme resistive impedances on 160 meters. However, it was able to provide matches on all other bands, though the losses could be high in some cases. Also, I often had to force a re-tune several times to achieve an SWR less than 2:1, as measured by my external SWR meter (the XPA125B internal SWR meter is inoperative). The XPA125B antenna tuner does not have any memories, so you must re-tune each time you change frequencies, depending on the mismatch. When the tuned match is greater than 2:1, there is no indication of tuning failure, though the PA will fault if the SWR is greater than 3:1.

Table 3
Xiegu XPA125B Resistive Load and Loss Testing

VS WR/Impedance		160 M	80 M	40 M	20 M	10 M	6M
10:1/5 Ω	Loss (%)	66%	28%	.20%	20%	.20%	.28%
	VSWR	2.2:1	1.6:1	1.6:1	1.4:1	1.2:1	1.5:1
8:1/6.25 Ω	Loss (%)	48%	17%	9%	9%	18%	22%
	VSWR	3.9:1	1.8:1	1.6:1	1.6:1	1.4:1	1.5:1
4:1/12.5 Ω	Loss (%)	20%	12%	9%	9%	12%	12%
	VSWR	2.2:1	1.7:1	1.4:1	1.7:1	1.8:1	1.2:1
3:1/16.7 Ω	Loss (%)	16%	12%	10%	10%	10%	10%
	VSWR	1.7:1	1.8:1	1.4:1	1.5:1	1.8:1	1.2:1
2:1/25 Ω	Loss (%)	12%	12%	12%	8%	8%	10%
	VSWR	1.7:1	1.8:1	1.8:1	1.6:1	1.5:1	1.8:1
1:1/50 Ω	Bypass Loss	0%	0%	0%	0%	0%	0%
	Bypass VSWR	<1.1:1	<1.1:1	<1.1:1	<1.1:1	<1.1:1	<1.1:1
2:1/100 Ω	Loss (%)	<5%	8%	7%	7%	6%	8%
	VSWR	1.6:1	1.6:1	1.6:1	1.7:1	1.6:1	1.6:1
3:1/150 Ω	Loss (%)	<5%	10%	10%	6%	8%	10%
	VSWR	1.2:1	1.5:1	1.7:1	1.4:1	1.6:1	1.6:1
4:1/200 Ω	Loss (%)	<5%	<5%	<5%	<5%	<5%	8%
	VSWR	1.1:1	1.4:1	1.6:1	1.5:1	1.6:1	1.2:1
8:1/400 Ω	Loss (%)	15%	6%	6%.	10%	11%	12%
	VSWR	2:1	1.5:1	1.6:1	1.6:1	1.5:1	1.1:1
10:1/500 Ω	Loss (%)	20%	<5%	<5%	12%	26%	28%
	VSWR	2.5:1	1.4:1	1.4:1	1.3:1	1.4:1	1.3:1

Operating

I was able to test the XPA125B with my Xiegu G90, Xiegu X5105, and Elecraft KX3, and a QRP Labs QCX-mini 20-meter transceiver. I used the optional CE-19 interface with the Xiegu radios, and it worked well by providing keying and automatic band changing for the XPA125B. The XPA125B control interface is a miniDIN6 connector, so I built interface cables for the KX3 and the QCX-mini using a mini-DIN6P cable. The KX3 keys the XPA125B directly. As the QCX-mini PTT output is 5 V dc on transmit, and 0 V dc on receive, I originally built a special interface for this. However, as the QCX-mini only operates full break-in, this was a problem due to the slow transmit/receive relay in the XPA125B. So, I just made a manually switched amplifier keying cable for when I used this radio.

My HF antenna is a 43-foot vertical, and the XPA125B autotuner easily handles the SWR on 60 – 10 meters. I made one SSB contact on 20 meters and received a good audio report. However, I refrained from making additional SSB contacts due to the high IMD when running full power. I felt much better using CW and made several contacts with each of my four QRP rigs on 40, 30, and 20 meters.

Conclusion

The XPA125B is a compact 100 W amplifier that integrates perfectly with Xiegu transceivers and, to a slightly lesser extent, with virtually all other QRP transceivers. The internal antenna tuner provides all the antenna system flexibility most hams will ever need. However, there are several items to consider:

The Good — The XPA125B is compact and rugged, requires no fan, monitors many parameters, and is well protected.

The Bad — The XPA125B doesn't meet its typical output power level specification on 10 and 6 meters. Also, the input voltage must be set almost 1 V dc higher in order to meet the typical power output specification on the other bands. And the input power and input SWR readings are useless.

Additionally, the XPA125B seriously degrades the IMD performance of the driving transceiver. Lastly, the XPA125B does not meet FCC spectral output requirements on 6 meters (an external low-pass filter would be needed).

Manufacturer: Xiegu. Distributed and supported in the US by select US distributors. Price: $619.95; CE-19 Expansion Port, $34.95.

Ham Radio Solutions CW Hotline

Reviewed by Sean Klechak, W9FFF
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To advance my Morse code skills, I've continuously tried different learning methods. I eventually felt I was ready to get on the air and make CW contacts. My code transmission was slow, my code reception was worse, and I barely made it through my first few contacts.

Regardless, I came out very proud of my accomplishments that day. However, I have acquired a case of "key fright" that has prevented me from getting back on the air to practice. Instead, I have been studying, and I am now at a crossroads. I feel I can only improve so much, without someone to practice with. I need to practice Morse code with others for a more real-world scenario.

Building the Kit

Recently, I was introduced to the CW Hotline from Ham Radio Solutions, a budget-friendly electronics kit that, according to their website, is "designed to provide a way to key a remote station in CW mode, but can also be used as a private Morse code link to friends." That intrigued me, as I wasn't aware it would work as a remote station key (two CW Hotline devices are required). Although my main goal was to get on the air and operate CW comfortably, I am never opposed to putting together an electronics kit to help me improve my soldering skills.

First, I proudly consider myself an amateur — in every sense of the word. I am dedicated to learning new things, experimenting with technology, and making correctable mistakes. Electronics projects and soldering are no different. I enjoy building these kits, and I always gain some knowledge when assembling them. The CW Hotline is sold in an assembling kit, and recently the manufacturer started offering a fully assembled and tested device. The kit contains all the parts to build either the straight key or the paddle version, and the instructions seem easy to follow. Many people may want to practice with their own paddle or key. For this, the CW Hotline has included a trace on the printed circuit board (PCB) to a jack input for your key.

There aren't any surface-mounted parts, which is good for new hobbyists. Altogether, there are just over 20 parts to solder in this kit, all of which attach to an included PCB and are enclosed in a plastic case. My experience of building this kit was relatively easy. The kit walks through the setup and explains the use of the CW Hotline as both a practice key and a remote key.

Much of the kit comes delivered in a ziplock baggie (see Figure 4), with most of the electrical components placed inside the black plastic electronics kit box. I removed the components from my kit and separated everything in my work area. This allowed me to visualize the kit build. I read the online instructions first while confirming I had everything I needed to complete the build. The case itself needs to be drilled. To drill for the correct hole spacing and fitting, you'll need a printer. I failed to realize this and had to go to my local library to print the template, which is readily available on the CW Hotline website. The manufacturer now offers designs for 3D-printed cases on their website for those who wish to print their own cases instead of drilling.

Otherwise, the kit was an easy build. A few tips to remember: The orientation of the resistors on the PCB doesn't matter. The placement of the resistors, however, does. There are five resistors in this kit, and the parts list clearly labels where each resistor should be placed and provides the band color codes for each. If you do not place the resistors in the correct spot, you will have issues later. Subsequently, the diodes, like the LEDs provided with the kit, have a

Bottom Line

The CW Hotline is an inexpensive and fun kit to build. It is well designed and easy to understand, and it provides an online portal that enables you to connect with other learners and instructors. This is not only an excellent way to practice CW with people online, but with two devices it's also a great tool to use with friends, or even as a remote key to activate your transceiver.

Figure 4 — The contents of the CW Hotline electronics kit.

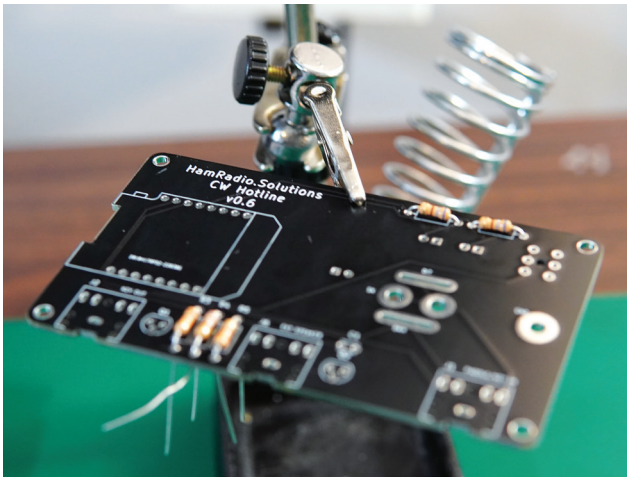

Figure 5 — Using a vice may be beneficial while assembling this kit. Here is an alligator clip holding up the PCB. The alligator clip has rigid edges that, if placed on a trace, may cause damage.

polarity, and their orientation matters. Make sure you read the instructions to determine the polarity. The instructions are not included with the kit but can easily be found on the CW Hotline website. I failed to ensure the spacing of specific electrical components from the PCB. Ensuring proper distance before soldering these components is important; without the appropriate spacing, your built kit may not fit appropriately into your freshly drilled kit box.

During my build, I used a flux pen while soldering the electrical components to the PCB. I have found flux to be critical in properly soldering components. Even with the solder-containing change, I added some via my flux pen. Finally, it could be difficult to solder components on a PCB without holding the PCB in place. I used an inexpensive soldering stand with alligator clips and a magnifying glass (see Figure 5). This allowed me to keep the PCB in place and look through the magnifying glass to confirm that my soldering joints were acceptable. Josh Nass, KI6NAZ, uses a vice grip/block and seems to have satisfactory results. I would venture to say Josh's way of securing the PCB is sturdier and easier to work with, and I will test that method in the future. After about 45 minutes, I completed the build (minus the case drilling). If you have experience in soldering, this might take you only 30 minutes, and if you are less experienced, don't worry about time. Your focus on patience and proper techniques will be most critical. In time, you'll get faster and more proficient with different techniques.

I chose to build an iambic paddle. It requires a center post so that either paddle may tap the center area, creating a short and thus activating a dit or a dah. My center post was not high enough off the PCB, and I was not making electrical contact with the paddles. Ultimately, I used an additional nut (screw) on the center post. One nut was below the PCB, and one nut was above the PCB, followed by a washer on top for grounding. I have found this solution to work efficiently and have yet to feel the need to tighten the extra nut. Additionally, I have not run into any issues with the paddles mistakenly grounding out. The best recommendation I have is to give the extra nut a try and determine if you like it or not. Part of the spirit of amateur radio is tinkering and experimenting.

Three jacks are installed on the side of the kit. These jacks are meant to hook up your own key/paddle, or use an external speaker or a key out (see Figure 6). It is nice to have the option to use my key, as there may be times when I want to learn a straight key over the paddles — not to mention the added convenience of practicing with the paddle I'll primarily be using. The key out serves as a useful tool to activate a radio to which the device is connected. Whenever I hear

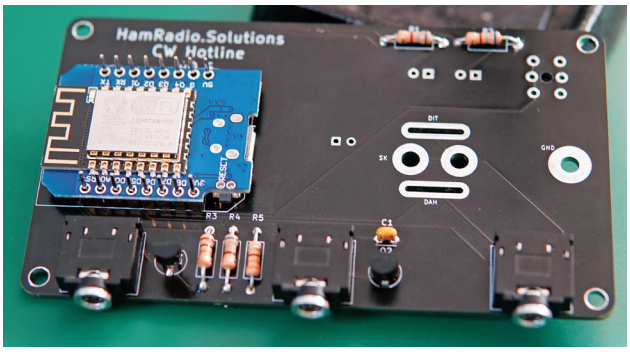

Figure 6 — A nearly assembled board ready to be soldered into place. But wait! The ESP8266 shown here is placed incorrectly. Always double-check that you have the electronics part in the correct orientation prior to soldering the components in place.

people discussing the CW Hotline, it is usually to practice code over the internet. However, having the ability to operate CW remotely with a key is intriguing. To operate remotely and drive a connected computer, two CW Hotline kits are required (more on this later).

CW Hotline Connections

After building the kit, I plugged the device in to see if I let the smoke out. The CW Hotline plugs into a micro-USB connection, which needs to have data-passing capabilities. Not all micro-USB cables are the same. I plugged my CW Hotline device into the computer and navigated through the brief configuration of settings on the CW Hotline portal (under the **CONNECT** tab at **www.hamradio.solutions/cwhotline**). You can also update the unit firmware from this web page. Although I thought I had done everything correctly, I heard "dah dit - dah dit dah dit," or NC. This error code means the device could not connect to Wi-Fi with the settings I provided. For me, the issue was the Wi-Fi name not being case-sensitive. With a quick correction, a save of the locations, and a device reboot, there it was again: "dah dah dah - dah dit dah," or OK. This means the Wi-Fi is synced correctly.

The CW Hotline user manual lists all error codes and their meanings. After a brief skim through the user manual, I was able to correct the error.

Using the CW Hotline

The next step is to go on the CW Hotline website and access their VBand (**www.hamradio.solutions/vband**), a different portal from the settings configuration. At this portal, I connected to VBand and started practicing my code in the "Practice Channel," a private channel to practice code. This is nice because I could practice on my own or practice with QSO bot, an automated bot that simulates regular contact on CW. After some practice, I tried to make contact and practice code in one of the public channels. No one was on any public channels that morning, but there I waited, practicing calling CQ and thinking of how I would respond. To my surprise, someone was on within a few moments and suggested I slow down my speed. I located the CW Hotline's Discord server and found it full of individuals willing to offer suggestions. One tip was to use the pushbutton for the speed adjustment. This easy tip had me coding at a speed I was far more comfortable with. Then, I went back into the Practice Channel to practice keying with the new speed. I found the speed to be acceptable, not only for sending but also for receiving. I chose 12 words per minute, knowing this is below the recommended standard when starting with code.

Linking Two Units for Remote Operations

The real fun began when I built a second kit (see Figure 7). I chose not to solder in a straight key or iambic paddle. This works fine if you plan on using your key or not using the critical portion of that kit. The second kit allows for multiple options. I can now go through the device configuration and set a "link key." This link key allows for multiple devices to connect directly with each other without the need for a computer. It is meant to be unique so that no one unauthorized is keying up your other devices. This is important if you use the CW Hotline as a remote key to your ham radio transceiver. I practiced sending Morse code between units and noticed a slight delay

Figure 7 — Two CW Hotline kits working together. For my second kit, I chose not to install a straight key or paddle, as it will be used with an external key.

as the signal traveled through Wi-Fi. Both units were on the same network, so I turned my phone into a hot spot and configured one of the CW Hotline devices for the phone's Wi-Fi.

Does this work over multiple computer networks? The answer is yes. After that, I didn't notice any additional delay being on the same network. This is not only an excellent key to practice with people or QSO bot on VBand, but also (with two devices) a great tool to use with friends, or even remotely as a key to activate your transceiver.

Conclusion

The CW Hotline was a great kit to build. It provided me with hours of educational value — from building out the kit, configuring the ESP8266 to work with VBand, and directly communicating with other CW Hotline kits for the purpose of practicing Morse code, to utilizing it to work as a key while operating away from my station. At $50 per kit, it is well designed and easy to understand, and it provides an online portal that enables you to connect with other learners and instructors. I highly recommend this kit to clubs looking for a build with a purpose. After building, club members can practice together until they feel more proficient in getting on the air. Plus, this kit is entry-level, so it should be straightforward for beginners to learn a variety of tasks, including soldering and Morse code. Since building this kit and using it in different ways, my Morse code proficiency has improved, and I expect it to continue to improve as I keep practicing and testing myself online against others in the VBand.

Manufacturer: Ham Radio Solutions, **www.hamradio.solutions**. Price: kit version: $50 each, plus shipping; assembled version: $100 each, plus shipping.

microHAM ARCO Smart Antenna Rotator Controller

Reviewed by Pascal Villeneuve, VA2PV
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A rotator controller is an essential accessory in an amateur radio station that uses a directional Yagi antenna. Most controllers are basic, and some enable you to operate remotely. The microHAM Antenna Rotator Controller (ARCO) is different. First, this is an eye-catching unit, and I must admit that this is the best-looking rotator controller I have ever seen. It almost looks like another radio on the shelf. It's bigger than the Icom IC-7300 and has a large color touchscreen. It also has many cool features, and operating an antenna rotator has never been easier than with this controller.

According to the manufacturer, the ARCO controller was created to replace all other rotator control units, and is supposed to work with virtually any rotator. Although I was unable to test an azi-muth/elevation type of rotator, according to the manufacturer it features several ways of controlling azimuth or elevation heading. While this controller is compatible with most rotators, double-check with your local dealer to ensure full compatibility before buying.

Bottom Line

The microHAM ARCO with the 7-inch color touchscreen is an eye-catching antenna rotator controller, but it's not only a good-looking controller for the station; it's one of the most advanced controllers. Its fully customizable configurations can ease the operations of any complex antenna setup.

The unit is standalone, but it can be operated remotely via a computer, tablet, or phone (more on this later).

Description

There are two versions of this controller. The 200 W unit is the standard version, and the 400 W unit is meant to be used with larger rotators. I have the Yaesu G-450A, and the 200 W version (the reviewed unit) is more than enough.

This rotator controller is huge, at 10.4 × 4.9 × 5.9 inches (without protrusions). It's slightly taller than my Icom IC-7610. On the front panel, it has a 7-inch color touchscreen with intuitive functions. With a touch on the map, it turns. It has an infinite rotary knob to select an exact bearing by turning in either direction. After 3 seconds, the rotator moves to the desired bearing. You can cancel the rotation just by pushing the rotary knob. Under the rotary knob, there are traditional direction buttons — CCW and CW — for each direction to manually turn the rotator holding the selected pushbutton.

There are three LED indications on the front panel: **POWER** (amber when on), **FAULT** (normally off, red when a fault is detected), **MOTOR** (turns green when it's moving), and an on/off switch.

What makes this unit different is that there are rack-mount-style handles on each side of the front panel. It's useful when you need to transport it, because the ARCO weighs 6.28 pounds.

There are many ports on the rear panel (see Figure 8). This controller can be plugged into a standard ac outlet using the included standard power cord. If you order from the US, you will get the 115 V ac unit. It's internally switchable to 240 V ac, and you can confirm your pre-wired version by looking at the rear panel. Above the AC **LINE** connection is a 3.5-millimeter (⅛-inch) stereo jack, which can be used to link multiple ARCO controllers together. There's a legacy DB9 **SERIAL** RS-232 computer control port, a **LAN** Ethernet RJ-45 port to control the unit over IP, a USB B port (**USB**) for computer control, a USB A port (**FW**) for keypad connection or local firmware update, and a DB15 female (**D-SENSOR**) socket for digital position sensors. There are two different types of rotator connector, a 10-position removable terminal, and a rotator connection port connected in parallel with six conductors to connect directly to a Yaesu rotator. There's also a ground (**GND**) terminal bonded to the chassis, a fuse holder, and the cooling fan that I never heard running. The unit is always on, but goes into standby after a while.

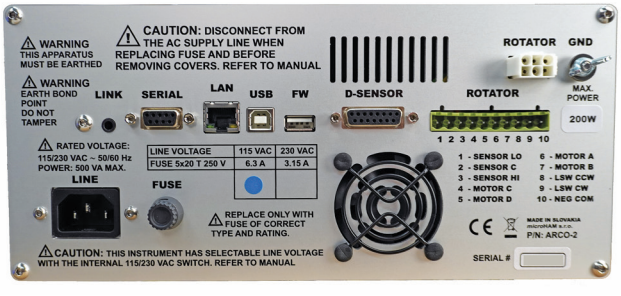

Figure 8 — The microHAM ARCO Smart Antenna Rotator Controller rear panel.

Optional Accessories

While I was writing this review, microHAM launched three optional ARCO External Control (ARXC) accessories for the ARCO controller. These options appeared in the **SYSTEM** menu after upgrading the controller to the latest firmware (reviewed version 3.1.E). The three optional accessories are: the ARXC RELAY, which adds a user-programmable relay output for antenna and polarization switches control, or mast preamplifier bypass control; the ARXC MAGNETIC, which adds an antenna slippage watchdog and electronic compass sensor function to ARCO; and the ARXC LoRa, which consists of two LoRA communication modules paired for a wireless link between ARCO and ARXC modules (the operating frequency is 868 MHz). Note that this information was taken from the manufacturer's website, and none of the listed accessories were tested in this review.

Rotator Connections and Setup

In the manual setup section, the first thing mentioned is "Do not connect any rotator cables to the ARCO and make sure the power is switched to off." They also ask you to check that your unit is wired for your region AC voltage. After confirming the voltage, you can connect the power cord into the **LINE** socket.

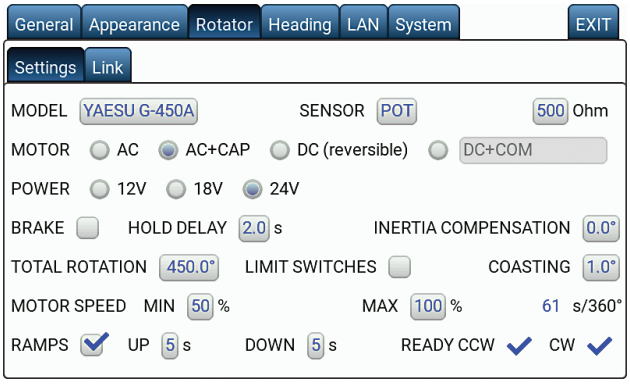

Figure 9 — The ARCO Rotator settings menu tab.

Before connecting your rotator to the controller, ensure you have the correct pinout for your specific model. If you've just installed a new rotator, you will need to do a rotator centering. Everything is well explained in the manual. If you're just swapping a controller of an existing rotator, you can skip the centering procedure. The next step is the calibration procedure. This is to ensure that the controller knows where the limits are for each direction.

After turning on the ARCO, it may take a few moments to boot. It's less than 10 seconds when a rotator is connected. At the bottom left of the screen, there's a gear logo that you just touch to enter the settings menu. To set up your rotator, you will need to go to the **ROTATOR** tab. You can see my settings in Figure 9.

The settings menu has six tabs. The first one (**GENERAL**) is for setting up your location with your grid square, the distance unit (kilometers or miles), time and date, the screensaver, the park position, and a few control options (see Figure 10).

The second tab is **APPEARANCE**, which has five sub-tabs (see Figure 11). In the first sub-tab (**GLOBAL**), you can set your preferred look of the display. You have a day and night brightness adjustment, two background settings (light and dark — I prefer the dark look), and a few heading settings. The four other sub-tabs are for the map customizable presets (more on this later).

In the **HEADING** tab, you will find two sub-tabs, one for the calibration and the other to define three individual antennas installed on the same rotator (see Figure 12). You can also set the mounting offset of the additional antennas versus the main antenna (antenna #1).

The **LAN** tab is for setting your IP network. You can remotely control this unit via any VNC software. You will find VNC software for free on any platform, including Windows, macOS, Linux, iOS, and Android, so you can remotely control the ARCO on any smart device. In my opinion, the VNC solution is the best for remote operations, as it doesn't require any proprietary software. Note that all the screen captures used in this review were taken from my MacBook using free VNC software. With the VNC software, you see the same thing as the ARCO touchscreen simultaneously with the unit.

The last tab is **SYSTEM**, with six sub-tabs. The first one is **SYSTEM** (see Figure 13), and the five others are to set up the optional accessories (not tested in this review). In the **SYSTEM** sub-tab, you can upgrade the ARCO firmware directly if the unit is connected to the internet. From there you touch the **LOAD** button to see if there's new firmware available. A pop-up screen will open and show you the currently running and latest available versions. To upgrade, there will be another **LOAD** button beside the version. Touching it will automatically download the new version and upgrade the device.

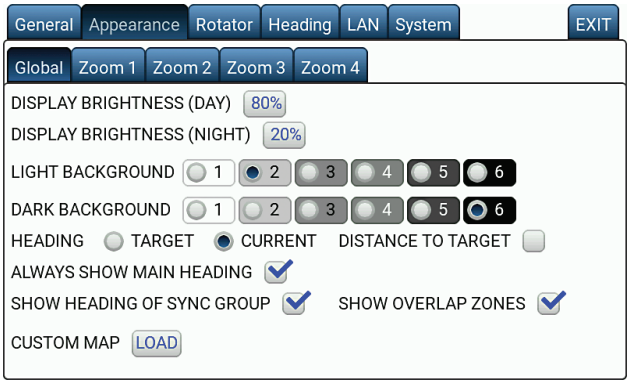

Figure 11 — The ARCO **APPEARANCE** settings menu tab.

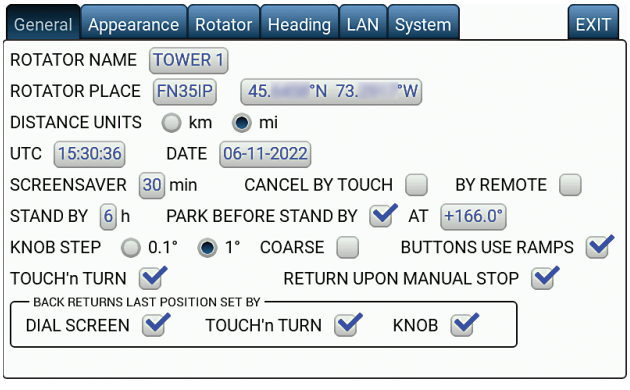

Figure 10 — The ARCO **GENERAL** settings menu tab.

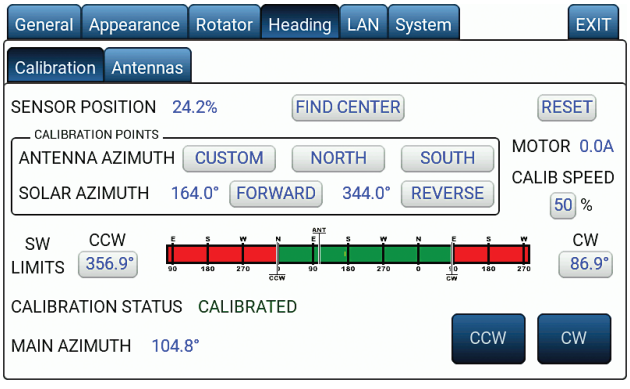

Figure 12 — The ARCO **HEADING** (calibration) settings menu tab.

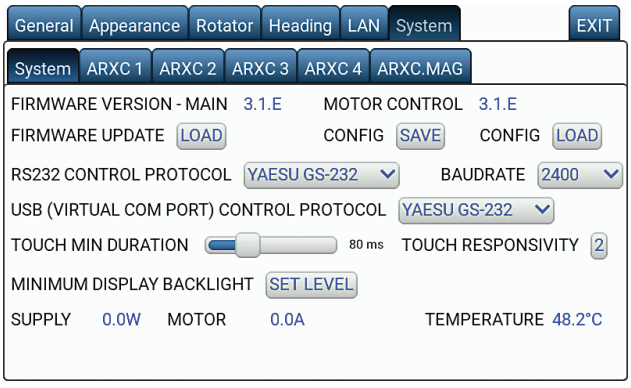

Figure 13 — The ARCO **SYSTEM** settings menu tab.

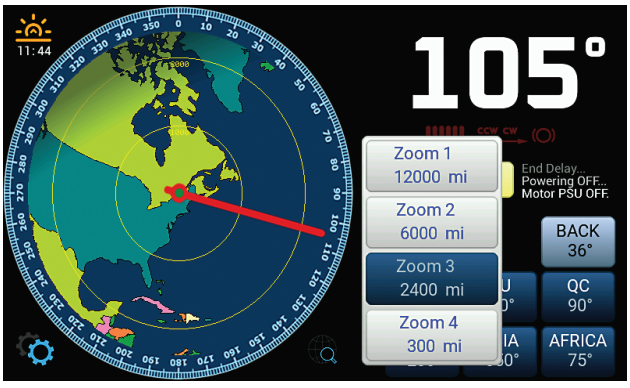

Figure 14 — The main screen map recall for different customizable altitude views.

Operating the ARCO Controller

The front panel touchscreen is very intuitive. Just touch somewhere on the map, and 3 seconds later it will turn. You can configure up to four different customizable maps in the **APPEARANCE** setting tab. Having different maps depending on your operation is very useful. With the different altitude views, you can see the full world map (at 12,000 miles altitude) for chasing DX on 20 meters, but you may want to see only the North American continent while operating on 6 meters (2,400 miles altitude), or a low altitude view for 2 meters operation (300 miles altitude). The altitude is completely customizable. You can toggle between your customized maps by touching the **MAP ZOOM** on the touchscreen (see Figure 14). It's better to set up the four presets in advance, as they will be recalled instantaneously, because generating a new map can take about 1 minute.

You can use the infinite rotary knob to select an exact bearing manually by turning in either direction. After 3 seconds, the rotator will move in the desired direction to the selected bearing. You can cancel the rotation by pushing the rotary knob. Under the rotary knob, there are traditional direction buttons — CCW and CW — for each direction to manually turn the rotator.

Touching the azimuth number on the top right of the screen will bring you to the **HEADING DIAL SCREEN**, which allows you to enter the desired heading with the large on-screen keypad (see Figure 15). It also allows you to set the heading based on your location to a specific DXCC country or prefix, or particular WAZ or ITU zone, to turn your antenna in the proper direction. Touching the **NEW** azimuth will toggle between the short and long path bearing. It shows that this controller was designed with the DXers in mind, as it's complete and easy to operate.

You can program six memory presets that can be recalled just by touching them on the touchscreen.

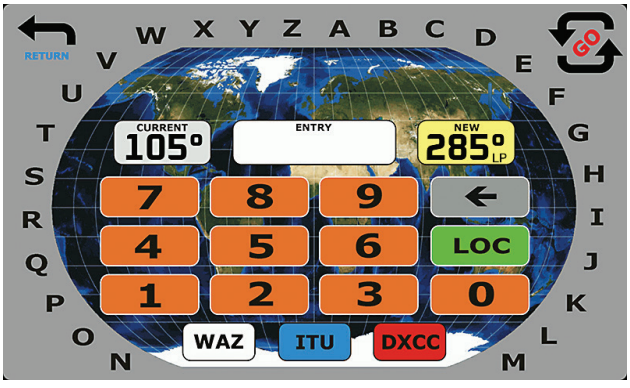

Figure 15 — The **HEADING DIAL SCREEN** allows you to enter the desired heading with the large on-screen keypad. It also allows you to set the heading for the QRA locator by specific DXCC country or prefix, or particular WAZ or ITU zone, to turn your antenna in the proper direction.

You also personalize the memory name. For example, I have one named "PARK," which I use to place my antenna so it will be best positioned for the lesser wind load against my QTH-predominant wind direction. But even if I forget to park my antenna manually, I programmed the controller to automatically park to the correct bearing after a certain time (programmable between 1 and 99 hours; see Figure 10).

In Conclusion

This may seem like a long review for an antenna rotator controller, and I didn't cover everything the ARCO controller can do. This is a complex unit, but it makes your operations very simple, and I just love it. I have used this unit for the past 7 months without any issues or bugs, so this one is a keeper for me.

Manufacturer: microHAM, Maticna 28, Galanta, 92401, Slovak Republic, **www.microham.com**. Price: $799.99 for the 200 W version (as reviewed), $899 for the 400 W version. Available for purchase in the US via DX Engineering, **www.dxengineering.com**.