Product Review

ACOM 1200S 160 – 6 Meter Linear Amplifier

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Established and new manufacturers have been introducing solid-state RF power amplifiers for HF and 6 meters with output power up to 1,500 W. The ACOM 1200S is a 1 kW output example of these new amps. (Specifications are listed in Table 1.)

Recently introduced RF transistors with built-in protection operate at 50 V or higher (the 1200S uses a single 1400-W BLF18XR LDMOS device). This reduces power supply current requirements and also makes it possible to reduce IMD (intermodulation) products generated by the transistor nonlinearities.

Regarding reliability, as a friend in the MOSFET business once said, “RF power transistors are always one-half cycle away from destruction!” The new generation of rugged transistors can withstand very high voltage standing-wave ratio (VSWR) in pulsed service at full power, but protective circuitry is still needed for the continuous duty typical of amateur use, particularly digital modes. The amplifiers are designed to reduce power output at high SWR and take themselves offline if there is too much reflected power or transistor current.

Bottom Line

The compact, attractive ACOM 1200S delivers a full kilowatt output on all modes with no duty-cycle limitations and will satisfy most operating needs. If paired with a high-power auto-tuner, the combination will deliver full auto-tune, wide-band HF and 6-meter performance.
Table 1: ACOM 1200S, serial number 190173, firmware v1.8

<table>
<thead>
<tr>
<th>Manufacturer’s Specifications</th>
<th>Measured in ARRL Lab</th>
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<tr>
<td>Frequency range: All amateur frequencies in the range of 1.8 to 29.7 MHz, 50 to 54 MHz.</td>
<td>Tested on 160, 80, 40, 30, 20, 17, 15, 12, 10, 6 meters.*</td>
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<tr>
<td>Primary power requirements: 100 to 240 V ac.</td>
<td>As specified. Tested with 240 V ac supply.</td>
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<tr>
<td>Power output: 1,000 W ± 0.5 dB PEP or continuous carrier with continuous carrier with no mode limitations (with 240 V ac supply), 500 W with &lt; 150 V ac supply.</td>
<td>As specified.</td>
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<tr>
<td>Driving power required: Typically 40 W for 1,000 W RF output.</td>
<td>Drive level for 1,000 W output: 7 MHz, 28 W; 14 MHz, 49 W; 18.1 MHz, 66 W; 21 MHz, 59 W; 24.9 MHz, 49 W; 28 MHz, 57 W; 50 MHz, 29 W. See Figure A.</td>
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<tr>
<td>Third-order intermodulation distortion (IMD): &gt; 31 dB below rated PEP.</td>
<td>14 MHz: 3rd/5th/7th/9th: At 1,000 W PEP: −34/−33/−47/−64 dB. At 500 W PEP: −33/−41/−54/−62 dB.</td>
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<tr>
<td>Keying time: Not specified.</td>
<td>Unkey to key: 15.2 ms; key to unkey: 20 ms.</td>
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<tr>
<td>Size (height, width, depth): 6.7 x 17 x 14.6 inches; weight, 32 pounds.</td>
<td>*Reminder: US amateurs must observe a limit of 200 W PEP output on the 30-meter band.</td>
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The amplifiers are discussed as being "no-tune," but band-pass filters are required to meet FCC regulations for spurious emissions. The amplifiers are really only "no-tune" within a single band, in the sense of not needing to adjust an impedance matching network inside the amplifier — there are no TUNE and LOAD controls but an appropriate output filter must be switched in for each band. With a CAT interface to the transceiver to control band selection, or using the built-in frequency counter to sense the incoming RF, you can switch bands from the front panel of the radio and go.

Installation
The 1200S weighs only 32 pounds — I have had tube amplifiers with heavier power transformers. The footprint on the tabletop is 14.6 inches wide by 16.8 inches deep. The amplifier stands 6.7 inches high, so it is of the same general size as a large transceiver. Combined with a high-efficiency, internal switch-mode power supply, this is truly a "desktop kilowatt." The amplifier can operate from 93 to 265 V ac at 50 or 60 Hz without any reconfiguration of the input power connections required. You'll have to provide your own power cord to suit the local power system. If operated from 120 V ac, the maximum power output is reduced to 500 W.

In my station, I simply swapped the 1200S for my kilowatt tube amplifier, driven by a TS-590S transceiver. The physical switch was easy because the 1200S is smaller and lighter. As far as radio cabling goes, my existing amplifier keying cable was a direct match for the amp's phono jack and the RF connections consist of one RF input and one RF output (see Figure 1). The amplifier keying line (KEY IN) connected directly to the TS-590S as a standard ground-to-key output. There is no ALC input on the 1200S, so that cable was left disconnected.

There is also a KEY OUT output from the 1200S that can be used as an "amplifier ready" line, but I used the transmit-delay function of the TS-590S to hold off the RF for the required 15 milliseconds after the amplifier keying relay closes. For transceivers with a transmit inhibit input, the KEY OUT signal can be used to prevent premature transmissions. (If the amplifier detects the RF too early, it changes to the STANDBY mode and displays a fault message.) I used the keying relay in the TS-590S to control the amplifier. Because I
was operating semi-break-in, that was not a problem (the 1200S does not support in full break-in, or QSK, operation).

Configuration
Getting the amplifier set up is straightforward. Once the power is applied and the red LED on the front-panel power switch is on, hold down the power switch until the amp sends TEST in Morse code audio. (The Morse announcements are a nice touch, especially to the sight-impaired.) Note that you have to turn on the back-panel power switch for the front-panel power switch to work. If the red LED power indicator isn’t on, the front-panel switch doesn’t turn the unit on.

The boot-up sequence for the amplifier seems to take a little time when the amplifier is new. Just be patient, and when the user screen lights up a few seconds later, you’re ready to configure the amplifier’s settings. After you’ve set everything up the first time, the power-on sequence is faster. When the amp is ready to go, it sends an R character and waits for the operator in STANDBY mode.

Figure 2 shows the MENU SELECTION screen. The next item of business is to select the CAT SETTINGS menu and follow the steps described in the manual to get the CAT interface configured. (Manual and frequency-sensing band-switching is also supported.) In the “CAT Settings Menu” section of the manual, a table shows which options to select for the type of interface needed — RS-232, TTL, BCD, or VOLTAGE. Another table shows the proper options for various models of radios from Icom, Elecraft, Kenwood, and Yaesu. You then select the data rate and polling rate to match the radio’s settings and plug in the cable. The TS-590S and the 1200S were happily communicating via RS-232 right away. At the same time, I had the TS-590S interfaced via its USB port with a PC running N1MM+ Logger software without any apparent problems. If you want to use an Icom CI-V interface, you’ll have to build or buy a cable with the ¼-inch mono phone plug on one end for the radio and a DB-9 on the other end for the amplifier. The amp is designed for use in a remote-control station, with power on/off controlled through the REMOTE interface or the CAT/AUX interface.

If you choose not to use the amplifier’s CAT interface, it can be turned off, and the amp’s internal frequency counter will determine the incoming RF frequency and switch the amplifier’s band accordingly. A single 100-millisecond dit, a short pulse of carrier, or a voice syllable or two is long enough for the amplifier to switch to the correct band. I have never been comfortable intentionally transmitting into a mistuned amplifier for any length of time, but it is nice to know that I have that option with the 1200S. Another option is to use the BAND UP/BAND DOWN switch on the front panel. I noticed that the band selection does not wrap around from 160 to 6 or from 6 to 160 — that’s a good thing in the middle of a contest.

After the radio and amplifier are talking to each other, the manual leads you through a series of careful step-by-step checks to be sure the receiving and transmitting functions are working and hooked up as you expect. The tests ensure that signals get to the radio’s receiver when the amplifier is in STANDBY or
not being keyed. Then you check the transmit functions, one by one. Finally, a low level of RF is applied, and you can check out the transmit functions using a dummy load. Only then should you try driving the amp to full power. It’s easy to disconnect a new piece of equipment, so a cautious approach is helpful. The same checkout process will also be helpful in isolating any problems during troubleshooting.

There is a full TEST menu that includes running the fan at different speeds and making sure any external relay- or switch-based BCD band-select interface is working. An AMPLIFIER MEASUREMENTS screen displays the value of major parameters, such as input and output power, SWR, transistor current and bias, and amplifier temperature. The amplifier is well-instrumented with the necessary data available to the user.

**Performance**

I gave the amp an extended test during the 2020 ARRL DX CW Contest in a Multioperator-Two Transmitter (Multi-Two) operation from my station. The amplifier was powered from 240 V ac and used pretty much continuously at full power for 48 hours without incident. I kept a sharp eye on the PA TEMPERATURE meter, and it never went into the red zone, nor did the fan have to kick into high gear. Fan noise was minimal during the contest — no louder than my tube amps. No RFI issues were experienced with the CAT connection to the transceiver for the entire contest. Figure 3 shows the LCD during typical operation.

The amplifier has 14 dB of gain, so not much power is necessary for full output. Typically, 25 to 40 W was enough to result in RF output near full power on any of the bands. The low drive requirements make this amp an excellent partner for the low-power SDR transceivers starting to appear. A 10 to 20 W transceiver can drive this amp to several hundred watts of output, where it will be coasting along. That’s just right for operation using one of the WSJT-X digital modes, PSK31, or RTTY. At reduced power, the amplifier will run cool and should be a reliable performer in a remote station, as well.

Typical of solid-state amplifiers, the 1200S is sensitive to SWR. It is specified at SWR less than 2:1, preferably 1.5:1 or less. My 40-meter, two-element beam is tuned for minimum SWR near 7.175 MHz and has an SWR of about 2.2:1 at 7.020 MHz. My tube amps are unfazed by this and tune up into the antenna anywhere in the band without complaint. The 1200S, however, was unable to develop more than about 500 W of output at the low end of 40 meters without faulting and going into standby. Luckily, I had a 1 kW antenna tuner available and put that in-line for the 40-meter beam. The antenna tuner lowered the SWR to 1:1 at 7.050 MHz, and there were no more faults due to SWR. When ACOM says 2:1, they mean it — you won’t get full output at or above an SWR of 2:1.

If your antenna system SWR is higher than 1.5:1 where you intend to operate, you should retune the antennas. If that’s not feasible and SWR is higher, you’ll have to use an antenna tuner rated for at least 1 kW. To utilize the amplifier’s full flexibility, you’ll need an automatic tuner, such as the recommended ACOM 04AT. The external tuners do add expense to the overall system, but the combination of the 1200S and 04AT gets high marks from other users, as reported online.

**Caveats**

On most of the bands, we took it easy and ran the amp with 25 to 35 W input, so the RF output stayed somewhat lower than full output. You can create problems for yourself through excess drive, however. Some transceivers can set a different power level for each band, but the TS-590S cannot. This caused a problem when we were operating on 40 meters after using the amp all night on the low bands at full power. I got a report of bad key clicks and discovered that drive was still set to the 80-meter power level — more than needed on 40 meters. (The TS-590S CW keying rise time was set to the maximum of 6 milliseconds.)
The amp wasn't faulting, but it was clearly being pushed.

Reducing drive cleared up the clicking, so after the contest, I checked it out more thoroughly. To make a long story short, without an ALC signal from the amp back to the radio, it's easy to push the amp pretty hard. The TS-590S transceivers also have a well-known leading-edge transient on the output waveform that shoots up to full power before the radio's own ALC can bring power back down to the required level. The combination of the transient and higher drive than needed was the likely culprit behind a bad signal. ALC-caused transients on other radios may cause the same problem. With the tube amps, the TS-590S runs at nearly full power output, so the transient was never an issue. (Kenwood fixed this transient in late-production TS-590S radios and in the TS-590SG. They also offered a free modification for owners of early radios, but my radio has not yet been modified.)

I learned that it's best to watch your drive level with high-gain solid-state amplifiers in general to avoid both overdriving the amp and possibly creating spurious emissions. This particular problem was a combination of the operator (me) not checking drive level and a quirk of my TS-590S (the overshoot). It wasn't a particular deficiency of the amplifier but an example of what you have to be careful about with high-gain solid-state amps.

On 6 meters, the amp performs very nicely. I hooked it up to my venerable IC-7000 transceiver, which is my go-to radio for the WSJT-X modes, primarily FT8 and MSK144. The IC-7000’s amp keying line is available on the 13-pin ACC socket, so it was easy to get that working and the necessary CAT cable was ordered with the amplifier. I was able to adjust the key-to-RF-output delay in the WSJT-X software, choosing 200 milliseconds for plenty of safety cushion beyond the 15-millisecond minimum requirement.

Because FT8 and MSK144 require long transmissions, I was interested to see whether the amp would run hot. Running 10 W from the transceiver on 50.313 and 50.260 MHz produced 370 to 400 W output. Because I was powering the amplifier from 120 V ac at the time, this was about 80% rated power.

**PA TEMPERATURE** is displayed on the front-panel screen as both a numeric value (in degrees Celsius or Fahrenheit) and as a bar graph. During the long transmissions, you can clearly see the temperature going up several degrees. The fan speed increases one level at 50 °C but is still very quiet. The long transmit periods never pushed temperature higher than 55 °C, and that was after extended periods of CQing. If I were going to do an RTTY contest at 1 kW output, I would expect much more heat from the amplifier, though.

### User Interface

As I mentioned earlier, the amp doesn't just "beep" when a function is performed or a message displayed. It sends you a Morse letter or two. When the amp powers up, you hear **TEST**, then **R** when it is ready for operation, and when you turn it off, **AR**. If a fault condition is detected, the letter **F** is sent. So even if you never operate CW, you'll learn a little bit just by using the amp.

Using intelligent annunciations is a nice touch. Every appliance and piece of equipment beeps, but very few use the controller to actually communicate with the user. I'd like to see more of that — like maybe sending **AS** when going into **STANDBY** mode.

The LCD, though not a touchscreen, is very high quality and colorful. Brightness is adjustable and the default setting was fine at normal room lighting levels. There is a lot of information on the display, but it is not that big. The designers probably assumed the amplifier will be close to and in front of the operator. Still, the labels for the selected band and the bar graphs are bright and easy to read, even off to the side of your visual field.

As shown in Figure 3, the status indicators (**OPERATE/STANDBY, TX/RX, CAT STATUS, and REMOTE**) are very small — about ¼-inch square — and don't show up well. With all that display real estate to work with, there's no reason not to make the indicators much larger so the operator is more likely to notice a change in status.

The overall design of the amplifier is very sleek, reminiscent of consumer audio equipment. The LCD is nicely placed and the black switches match the panel exactly. This is a nice-looking piece of radio gear.
User Manual
The user manual is brief but complete as far as setup and operating directions go. There does not appear to be a service manual, so there is no schematic of the amplifier available. (Check the Downloads tab on the ACOM 1200S website for a copy of the manual, as well as the latest firmware.)

The manual's English is a bit strained in places, but with careful reading and reference to the controls and screens, it gets the job done. All of the screens, controls, and drawings are accurate and clear.

Summary
After several years of anticipating kilowatt-plus solid-state amplifiers, the manufacturers have delivered. The full-kilowatt output of the 1200S is quite enough for most operating needs at a reasonable price. ACOM has done a good job with this compact amplifier. The designers have paid attention to what amateurs need in their stations, including remote control. If paired with an auto-tuner, the combination will deliver full auto-tune, wide-band HF and 6-meter performance.


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 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.

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.