

Array Solutions PowerMaster VSWR RF Power Meter

Over the last three years K9LZJ and I have been perfecting a remote control ham station located in the country, far from the reach of zoning regulations. The station is housed in a pole barn, affectionately called "the barn." We used off-the-shelf technology that anybody can duplicate, but still we needed a good remote power/VSWR monitor to complete our setup. An advertisement for the new PowerMaster from Array Solutions looked promising, and after some research and a couple of calls to Jay, WX0B, at Array Solutions, we purchased the unit and put it into play. After several weeks of both remote control and in-shack use at the barn, the PowerMaster has become an indispensable station accessory. Because most people who read this will be interested in what this device can offer for contesting or DXing, the features are described below.

Setting it Up

The PowerMaster package comes with a large sensor/coupler with a jack for connecting to the display head. This allows the coupler to be positioned right at the amplifier output while the display head rests elsewhere.

The display head is ruggedly build and stays put since there are no bulky coax connections. There are several jacks on the head including an RS232 port that can be connected to a computer COM port or to a USB port (with a suitable adapter).

Another feature on the display head is the ability to disable amplifier keying when necessary. This function is enabled by running one cable between the amplifier keying circuit of the rig to the PTT IN jack on the display head, and another between the display head's PTT OUT jack and the amplifier keying circuit. Simple cables with RCA jacks on each end work fine for this purpose.

With the display head running from our 12 volt power buss with battery backup, we loaded *PowerMaster Lite* software onto the computer from the CD and the fun began.

We selected the proper COM port for our USB-to-serial adapter and set the baud rate to 38,400 for best performance. Once the computer is communicating with the control head, the programming can be performed at the display head or through the computer. The display head has a blue florescent panel that allows easy visualization during initial programming and use. The MODE and MENU buttons allow you to set parameters in a straightforward manner. The programming description (Table 1) details this process.

The *PowerMaster Lite* software display allows text programming, setting power level scales and a number of other changes that can be implemented remotely or via the keyboard.

PowerMaster Lite

The *PowerMaster Lite* software can provide a large two-bar graph display or a half-size single bar graph within its display window. The *PowerMaster Lite* window can be dragged around on the screen and can be set to always stay on top of all other windows. The double graph offers instantaneous forward power on the top graph and reflected power on the lower graph. It also has numeric readouts for peak power, SWR and reverse power. The single bar graph displays forward power in bright blue and reflected power in bright red on the left of the bar graph as a "stacked graph," and has numeric readouts for peak power and SWR. The meter hold times can be set for 0.2, 1.0 or 2.0 seconds on all readings depending on your preference. The power scale can be set to auto adjust, or to several specific full-

scale values ranging from 10 W to 3 kW.

There are also "simulated" LEDs in the *PowerMaster Lite* window to indicate computer activity as well as the SWR and power alarm status. The alarms can be conveniently reset by clicking on the display after eliminating the problem. This is particularly helpful in remote operation.

There is a program mode to switch COM ports and baud rates, along with a meter-setting mode to adjust all of the PowerMaster parameters. You can change the meter hold times by clicking the "switches" on the right side of the window. These same switches bring up the VSWR indicator so that you can observe the changes while tuning the antenna. The only thing we didn't like about *PowerMaster Lite* was the inability to adjust the relative size of the window if the remainder of the screen had too many other things on it.

Putting the PowerMaster to Work

The equipment at the barn site consists of an ICOM 756 Pro transceiver driving either an ICOM PW1 amplifier for remote control versatility and easy operation, or a QRO 2500 for brute strength during contests and low band operation. The antenna selections include an inverted-L on 160, a 160/80-meter dual-element dipole, a quarter wave vertical on 80 meters, a 2-element shortened Yagi on 40 meters, a 4-element SteppIR Yagi on 20 through 6 meters and two Force 12 3-CS antennas. These can all be switched remotely by using *Ham Radio Deluxe* or *TRX Manager* software via remote desktop over the Internet (when in the shack we operate manually using an MFJ 8-position switch). We also have two Green Heron RT-20 antenna rotor controllers that can be remote controlled and even linked together if necessary.

I used the PowerMaster during the



Rear panel view of the PowerMaster.



Front screen of the PowerMaster.

CQWW Phone contest in October 2005 with both the PW1 and the QRO 2500 amps. The single bar graph was displayed on top of *Writelog* during the entire contest to show me what was going on. The PowerMaster's low power limit was set to 100 W for both amplifiers to warn if they weren't functioning. At the other end of the scale, the peak power limit for the PW1 was set to 1100 W and the QRO was set at 1600 W. We configured the system to initiate an amplifier shutdown if the limits were exceeded.

The SWR limit was set at 2:1 and was also configured to shut down the amplifiers if the limit was breached. I worked the first part of the contest with the PW1 and had the drive power set low enough that the high power alarm never tripped. There were no SWR problems since the amplifier automatically switched bands with the rig. When I switched to the QRO 2500, the high power alarm went off right away and I had to reset the cutoff relay and reduce the drive level accordingly.

On two occasions I switched bands, set the tune and load controls, but forgot to switch the amp bandswitch. I saw a low power indicator alarm that immediately told me how stupid I was. One time I forgot to hit the SPLIT button on 40 meters and was on the wrong part of the band with a high SWR. This immediately resulted in an amplifier shutdown, saving me some embarrassment. In another instance the SWR alarm went off because the wrong antenna was selected. Good contesters don't do this type of thing, but I sure seem to do it often.

It is certainly reassuring during the contest to see the meter display on the computer monitor and be able to glance at the peak power and SWR readings to make sure everything is okay. I am a casual contesteer and never work over half of a 48 hour contest, but I can imagine serious contesters would be happy to see the display on the computer screen and have a warning for low power, and an amplifier cutoff for high power and high SWR.

After the contest I experimented with different scenarios and found the PowerMaster to be accurate and consistent in warning about problems. The low-power alarm warns of an amplifier that is on the wrong band, out of tune, or on standby. The SWR alarm warns of feed line/antenna problems or improper antenna selection. The high power alarm/amplifier cutoff is especially helpful to avoid overdriving amplifiers such as the PW1 and blowing out its FET finals, or putting out illegal power levels on a beefy amp like the QRO 2500.

Construction

The sensor/coupler is well built with two large toroids and a cleanly laid out PC

Table 1

Normal Operation Mode: Four settings that include a display hold times of 0.2, 1.0, or 2.0 seconds, and another setting for the VSWR to be displayed on the bar graph instead of power output.

VSWR alarm mode: Settings for Off, 1.5/1, 2.0/1, 2.5/1, 3.0/1 SWR levels.

VSWR Alarm polarity mode: For setting the alarm relay to open or close for high SWR.

Low power alarm mode power: Off, 5W, 50W, 100W, 250W, 500W, 1000W, or 2000W.

High power alarm mode power: Off, 175W, 225W, 700W, 1,100W, 1.6KW, 2.6KW, 3KW.

High alarm trips amp mode: For setting *yes* or *no* to trip the alarm relay for high power.

High alarm relay polarity mode: For setting alarm relay to open or close for high power.

Show Call mode: Allows choice of *yes* and *no* for showing a text message (Call sign).

Intensity mode: Allows setting intensity of the display to one of four brightness levels.

Bar graph Ranges mode: Allows various power ranges to be set for the bar graph indicator.

Forward Power trim mode: Allows fine tuning the control head to a specific sensor.

Reverse Power trim mode: Allows fine tuning the control head to a specific sensor.

Power Display mode: Net Power (Forward - Reflected) or Forward power only.

Baud Rate mode: For setting RS232 signaling rate to 9600, 19200 or 38400 baud.



Two bar display (top) and single bar display (bottom).



PowerMaster display head and sensor/coupler.

board with discreet components. It was handy to have a jack on the coupler and the control head to allow distant remote placement with a shielded cable. The display head is laid out in a very rugged mini-rack-mount metal box that measures 8.25 inches wide, 3.5 inches high, and 4.25 inches deep. The circuit board has discreet components and several ICs. It connects to the separate display board with a ribbon connector. At its lowest brightness level, the display remains readable in average room lighting. The highest level is best for strong ambient light. The display head is heavy enough that it doesn't scoot around on the desk.

Summary

The PowerMaster is a great SWR/power measuring device that is useful dur-

ing contesting and remote control operation. For the serious HF operator or contesteer, the PowerMaster is a great station accessory. Jay, WX0B, from Array Solutions told me that sensors will soon be available for 144-220 MHz, 440 MHz, 900 MHz and 1.2 GHz, which will make this a wonderful product for serious VHF and UHF enthusiasts. The PowerMaster will be mentioned in a future *QST* article about remote control operation.

Price and Availability

The PowerMaster is priced at US\$400 and is available now. The VHF and UHF sensors will start selling soon with the price to be announced. Contact Array Solutions at www.arrayolutions.com or call 972-203-2008.

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