

WaveNode WN-2d Station Monitoring System

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The WN-2d is the third iteration of WaveNode's Station Monitoring System that we've reviewed in *QST*.^{2,3} As you might expect, each builds on the earlier versions with the addition of new features or capabilities. All share the architecture of a single processing unit supporting up to four inline forward and reflected power sensors. While the WN-1 provided all processed data via software running on a PC, the WN-2, added a monochrome LCD screen that showed peak and average power and SWR along with an output power bargraph. The WN-2 used the same software suite as the WN-1, but now the unit could function without a PC.

²J. Hallas, W1ZR, "WaveNode WN-1 Station Monitoring System," Product Review, *QST*, Oct 2004, pp 71-74. Product Reviews mentioned here are available to ARRL members online at www.arrrl.org/product-review.

³J. Hallas, W1ZR, "WaveNode WN-2 Station Monitoring System," Product Review, *QST*, Aug 2007, pp 71-73.

The WN-2d Standalone Display

The WN-2d carries the independence theme a bit further with an enhanced display that adds two rows of brightly colored tuning bars extending across the width of the control unit above an LCD screen similar to the one on the earlier WN-2.

The top display (see lead photo) provides a relative forward power indication over 16 green segments with full scale shown as 100%. Left to its own devices, 100% corresponds to 2000 W, changeable only by using the PC software. The next row is 16 segments that show SWR ranging from 1:1 to 10:1. Segments below 2:1 are green, while above they are bright red. The LCD has a row of legends followed by an indication of forward peak and average power, SWR and an indicator of which of up to four sensors is being monitored. Each sensor is monitored every 50 ms, so results can usually follow a quick CW dit, or two.

Pushing the SELECT button cycles the display through each of up to four sensors. Each sensor can monitor different parts of a single RF chain (transceiver and amplifier output, for example) or different radio systems

operating on different antennas or different bands. For this review, we used two sensors — the HF-1 (0-2 kW, 1.8-60 MHz) and UHF-1 (140-460 MHz) shown in Figure 1. The website lists conflicting power ratings for the UHF-1, but WaveNode confirmed that this sensor is rated for 300 W continuous at 144 MHz and 150 W at 222 and 440 MHz. Other sensors are rated for various power levels and frequency ranges from HF through 1.3 GHz, including 2 kW single band sensors for 2 meters and 70 cm. See the WaveNode website for details.

The SELECT button also goes through two positions in which each display shows the values of two of the four auxiliary (AUX) inputs. The AUX inputs can monitor any function that can output a dc voltage between

Bottom Line

The WaveNode WN-2d provides useful accuracy and a lot of flexibility in terms of what you can measure and how you can display it. I found it a useful tool and a good adjunct to equipment in my station.



0 and 20 V. This could be used to monitor your dc power system, for example, or could be scaled through a divider from some higher voltage signal to monitor anything in the shack that can be represented by a voltage. The AUX inputs are accessible via a rear panel (see Figure 2) ribbon cable connection, along with four LOGIC outputs (more later).

In addition, the SWR is monitored to alarm at a default level of 3:1. Upon exceeding that

level, a relay is set and held. Both normally open and closed relay contacts are available on a rear panel connector. These contacts can be used to keep a power amplifier from keying if the SWR is too high, for example. The front panel RESET button restores normal operation.

The rear panel also has jacks for an optional interface for one or two Yaesu DXA series antenna rotators. Antenna position indication

Figure 1 — The two remote sensors we tested. Up to four can be monitored simultaneously. The HF-1 (left) covers 1.8 to 60 MHz at up to 2 kW peak and is equipped with UHF connectors. The UHF-1 (right) covers 140 to 460 MHz (see text) and has Type-N connectors. Connector type may be specified at time of order.



Figure 2 — Rear panel of the WaveNode WN-2d stand-alone unit. Up to four power sensors can be plugged in at once, along with auxiliary inputs and logic outputs.

and rotator control are handled from a screen in the WaveNode software.

The WN-2d PC Software

While the standalone version is certainly a useful device, the power and versatility of the package really comes through after setting up the supplied *Windows* software on a PC. The software installs easily from the supplied CD. The standalone unit connects to the PC via a standard USB cable. The one supplied included ferrite cores at each end for RFI suppression, but it was too short for my installation. I used a standard USB printer cable without RFI suppression and had no problems. There are two USB driver versions included — one for *Windows 2000*, *Windows XP* and *Windows Vista*, and the other for *Windows 7*. As noted in the manual, the correct driver should be specified at the time of installation.

The TOP SCREEN

The TOP SCREEN (see Figure 3) comes up as soon as the software starts. It provides all the basic real time (as opposed to statistically collected) information from up to four sensors and the auxiliary inputs, AUX 1 to AUX 4. Power and SWR data are displayed graphically as well as numerically, while the four aux levels are shown numerically. The full scale value of each of the sensor power graphs on the top screen can be cycled through 20 W, 200 W, 2000 W, USER or AUTO. The AUTO selection picks among the 20 W, 200 W, 2000 W full scale range depending on the power detected. The full scale value of each sensor's power graphic can be set using the CONFIGURATION menu and that becomes the USER setting.

The TOP SCREEN is used to set the SWR alarm threshold (see upper right), as well as to declare which of the four sensors will be monitored for the SWR alarm. One sensor choice is NO, useful for taking untuned antenna data, for example. The length of time the SWR must exceed the threshold before triggering an alarm is also selectable on this screen, presumably in seconds. Note that after making a change, you must click on the number window so it changes back to blue before the change takes effect.

Setting the Values

A wide range of options can be selected using the CONFIGURATION FILE EDITOR menu (see Figure 4), found under the FILE tab on the TOP SCREEN. Here you can set the display to show your call letters (who can resist that, even though my call letters are one of the few things I can still always remember), set the full scale of each of the sensor bars, set the power level that will be 100% on the stand-

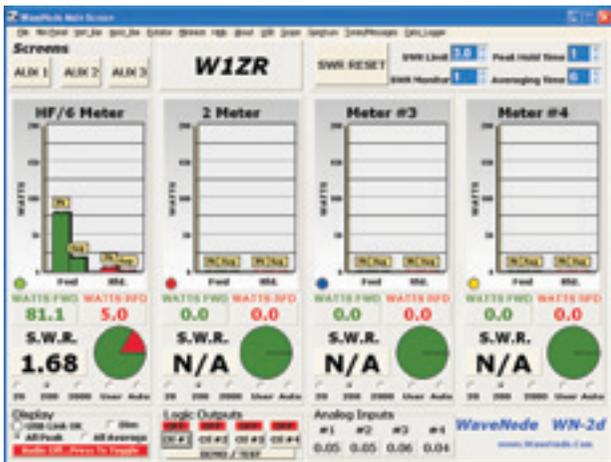


Figure 3 — This is the TOP SCREEN that comes up as soon as the software starts. It provides numerical and graphical indication of both peak and average forward and reflected power for all four sensor inputs. In addition, it provides the data for the four AUX inputs and the switches for the logic outputs. The SWR threshold is set in the upper right.

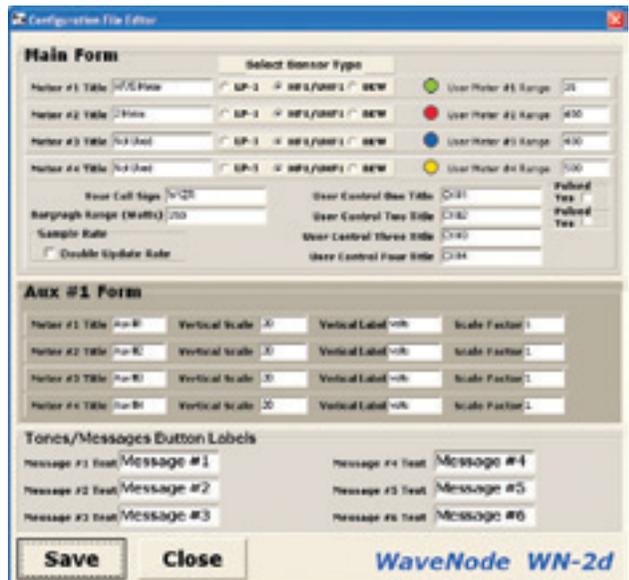


Figure 4 — The CONFIGURATION FILE EDITOR menu, found under the FILE tab on the TOP SCREEN. Here you can set the display to show your call letters, and set the scale ranges for each of the graphs, including the POWER bar on the stand-alone console.

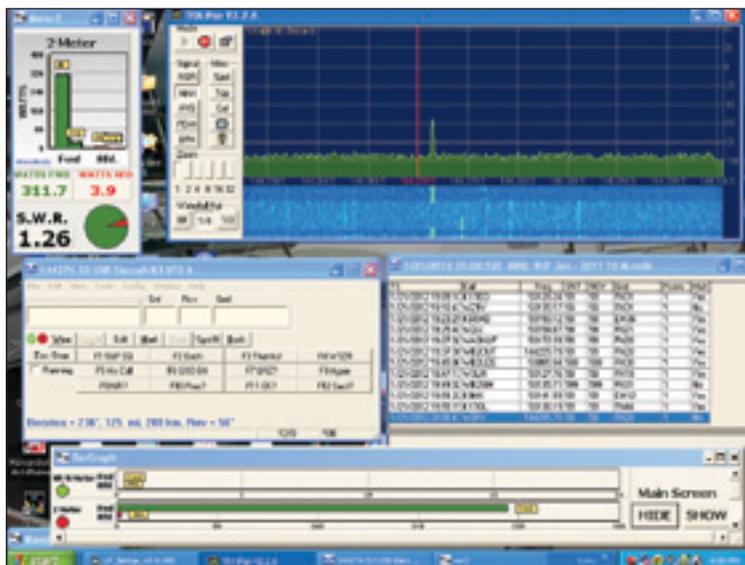


Figure 5 — The W1ZR computer desktop during the January ARRL VHF Contest. In addition to the two logging screens from the *N1MM Contest Logger* and the *TRXPAN* panadapter screen, I have a small *WaveNode* single panel screen in the upper left, and two of the four bargraphs from the horizontal display along the bottom.

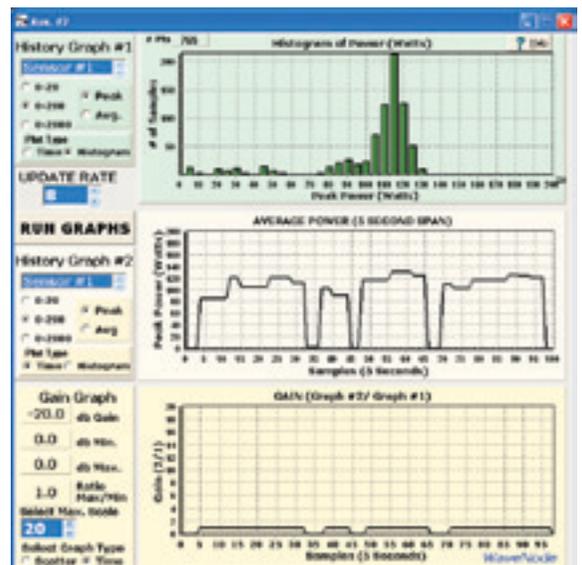


Figure 6 — The display provided after clicking AUX 2 offers some interesting data.

alone display and set any scale factors for the aux inputs.

Cutting Back on Real Estate

While the full size TOP SCREEN is useful for getting used to the program features or for making specific measurements, it is probably more than you want open during other operations while you have logging, rig control or DX spotting software windows open on your PC desktop. *WaveNode* has

provided a number of smaller screens that can be called upon to allow you to keep track of your power readings without taking up a lot of screen space.

If you click on the panel associated with a particular sensor on the TOP SCREEN, just that panel becomes available and it can be moved to a convenient location on your desktop. Want it smaller? Just click again and it gets smaller. In addition, there are a

number of special compact screens — a numerical summary and horizontal or vertical bar graphs showing each power measurement. Figure 5 shows my computer desktop during the January 2012 ARRL VHF Sweepstakes. In addition to the two logging screens from the *N1MM Contest Logger* and the *TRXPAN* panadapter screen showing the output of the Telepost LP-PAN panadapter, I have a small *WaveNode* single panel screen in the upper left, and two of the four bar-

Table 2
WaveNode WN-2d Station Monitoring System

Manufacturer's Specifications

Frequency range	1.8-60 MHz, 140-460 MHz with HF-1 and UHF-1 sensors; other frequency ranges available.
Power range	0-2000 W (HF-1 sensor, s/n 101098); 144 MHz, 0-300 W, 222 and 440 MHz, 150 W (UHF-1 sensor, s/n 100761). Other power levels available.
Accuracy	±5% from 5-2000 W; ±1 W below 5 W input.
Power requirement	11-16 V dc, (wall supply provided).
Current consumption	127 mA (idle, no measurement), 290 mA (maximum) at 13.8 V dc.
PEP measurement	Active.

Measured in ARRL Lab

Actual Forward Power	Indicated Power					
Frequency (MHz)	2	14	28	50	144	432
5 W CW	4.1	4.7	4.8	5.2	4.6	5.8
5 W 50%	4.3	4.8	5.0	5.2	4.6	5.8
100 W CW	93	103	108	116	100	—
50 W CW	—	—	—	—	—	58
100 W 50%	95	107	112	120	100	—
50 W 50%	—	—	—	—	—	58
100 W Two-Tone	—	102	—	—	—	—
300 W CW	—	—	—	—	278	—
300 W 50%	—	—	—	—	278	—
1 kW CW	940	1001	—	1150	—	—
700 W CW	—	—	770	—	—	—
1 kW 50%	1010	1010	1000	1179	—	—
1 kW Two-Tone	—	1040	—	—	—	—

Actual SWR	Indicated SWR					
1:1 SWR	1.0:1	1.0:1	1.0:1	1.1:1	1.1:1	1.1:1
2:1 SWR	2.0:1	2.0:1	2.1:1	2.1:1	2.1:1	2.1:1
Insertion loss (dB)	<0.1	<0.1	<0.1	<0.1	0.1	0.4

Price: WN-2d with one sensor, USB cable and wall power supply: \$450.

graphs from the horizontal display along the bottom.⁴ The vertical display is similar.

Computed and Statistical Data Displays

In addition to the real time data displayed on the TOP SCREEN and its derivatives, there are quite a few screens that can be used to make statistical and other calculations based on the accumulated data.

In the upper left of the TOP SCREEN display are buttons that get you to the AUX 1, AUX2 and AUX3 screens. Each of these gets you to a display of processed data that you may find useful. The AUX 1 button gets you to a screen that provides a running display of transmitted energy in watt-hours. This may be important for power management at a broadcast station, but I'm not sure it will be of particular interest to amateurs.

The AUX 2 screen, on the other hand, pro-

vides a number of useful outputs. Figure 6 shows this screen with its three graphs. The first provides a histogram showing the number of samples taken of peak power (average power can also be selected) during,

for example, a speech transmission. This can be helpful in determining the effect of speech compression. The second graph shows a similar plot but of average power readings over a 5 second span. A comparison of the two shows why the usual average power meter doesn't tell the story of the output of an SSB transmitter. The third screen can show the gain of an amplifier in the system, but requires two sensors in the same frequency range, which we didn't have. If an amplifier is linear, the samples should all result in the same gain. Any compression, due to over-drive perhaps, will result in samples showing lower gain.

The AUX 3 screen makes it possible to generate a semi-automatic plot of the SWR as seen by one or more sensors. If you select a frequency range and the increment, the WaveNode software will prompt you with a frequency. You manually set your transmitter there (listening first, and making sure it is in a range you are allowed to transmit on, of course) hit the key and the SWR is recorded. Then it gives you the next prompt. Note that this shows the results from a single sensor. If you had the sensors on the input and output of your linear, the single screen could show plots of both the input SWR of your amplifier over the band as well as the SWR response of your antenna system, for example.

There are other screens available from the top bar of the TOP SCREEN. One is a time domain oscilloscope-like display of the RF envelope, while another displays the actual spectrum of the detected modulating frequencies.

Manufacturer: WaveNode, PO Box 111404, Campbell, CA 95011; tel 408-933-8059; www.wavenode.com.

See your July edition of digital QST for a video overview of the WaveNode WN-2d.



⁴J. Hallas, W1ZR, "TelePost LP-PAN Software Defined IQ Panadapter," Product Review, QST, Feb 2009, pp 44-47.