# Product Reviews

## May 2024

## PreciseRF HG3 QRO-B Stepper Magnetic Loop Antenna

## RigExpert Shackmaster Power 500

## Product Review

# PreciseRF HG3 QRO-B Stepper Magnetic Loop Antenna

*Reviewed by Phil Salas, AD5X*
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I've had the opportunity to review the PreciseRF HG-1 (in the June 2019 issue of *QST*) and the HG3 PRO stepper-controlled magnetic loop antenna (in the January 2021 issue of *QST*). Now that PreciseRF has released the HG3 QRO-B, I was pleased to be able to review this antenna.

## Description

The HG3 QRO-B is the high-power version of the PreciseRF HG3 Stepper Magnetic Loop Antenna series. The new HG3 plus controller is now the controller used with the HG3 EXPRESS, PRO, and QRO-B antennas. The main physical difference is that it has both an RJ45 control interface for the EXPRESS and PRO models, and a DB9 control interface for the QRO-B. The HG3 QRO-B covers 6 – 30 MHz and is rated up to 1000 W PEP depending on the band and mode. It consists of a 32.5-inch-diameter LMR-600 radiator loop; a copper tube induction loop; a high-resolution, remotely tuned, 45,000-position stepper motor-positioned large vacuum variable capacitor with a 5:1 planetary gear; the HG3 plus controller; an aluminum support mast; a dc power cable; and a 50-foot DB9-terminated weatherproof controller cable. There is also a 4-foot BNC/BNC cable that connects the remote tuner to the induction loop. Also available is an optional 80 – 30-meter add-on kit, which consists of a second loop that attaches in series with the supplied loop. When this option is installed, the antenna will not operate on 20 – 10 meters. Finally, a comprehensive illustrated user guide is included. Figure 1 shows the large vacuum variable capacitor inside of the tuning unit, and Tables 1 and 2 detail the HG3 QRO-B specifications.

## Assembling the HG3 QRO-B

The HG3 QRO-B comes in two boxes. A 37 × 3.25-inch-diameter box contains the aluminum mast, and a 31 × 18 × 6-inch box contains the rest of the parts (see Figures 2 and 3).

PreciseRF recommends the use of a RadioWavz B1:1 ISO choke balun when high power is used. Because the coupling induction loop is balanced and the coax feed is unbalanced, common-mode currents will occur without the balun. This can cause issues with the control signals, as well as distort the radiation

### Bottom Line

The HG3 QRO-B is designed for both portable and fixed station operation at up to 1000 W PEP. The remote-tuned stepper-controlled tuning results in precise, repeatable operation.

**Table 1**
**PreciseRF HG3 QRO-B Magnetic Loop Antenna**

| Manufacturer's Specifications (not tested by the ARRL Lab) | |
|---|---|
| SWR/return loss (RL) | Typically less than 1.2:1/21 dB RL at resonance |
| Impedance | 50 Ω |
| Transmit power | See Table 2 |
| Resolution bandwidth | 600 Hz |
| Continuous tuning range | 6 – 30 MHz |
| Tuning | Manual and auto |
| Tuning method | 45K-step stepper motor (NEMA 17 Unipolar) |
| Radiation loop | LMR600, 113 square inches |
| Tuning capacitor | High-voltage vacuum variable |
| Quality factor (Q) | 1765 |
| Loop radiation resistance | 0.054 Ω/14 MHz, 1.15 Ω/30 MHz |
| Vacuum capacitor equivalent | 12.5 mΩ series resistance (ESR) |
| Power loss | 1.46 dB/14 MHz, 0.14 dB/30 MHz |
| Efficiency | 84.5%/14 MHz, 98.4%/30 MHz |
| Power requirement | 12 – 14 V dc @ 2 A max; typically 1.5 A tuning, 0.2 A idle |
| Environmental | 0 – 35 °C, < 70% RH, water-resistant but not waterproof |


**Figure 1** — The HG3 QRO-B high-power tuning unit.

**Table 2**
**Maximum Power Directly Into the HG3 QRO-B**

| Manufacturer's Specifications (not tested by the ARRL Lab) | | | |
|---|---|---|---|
| **Frequency (MHz)** | **Digital/TTY** | **CW** | **SSB** |
| 7 | 400 W | 600 W | 800 W |
| 14 | 600 W | 600 W | 800 W |
| 28 | 600 W | 800 W | 1 kW |

pattern. PreciseRF has an excellent video that shows the assembly and initial setup of the antenna (**www.youtube.com/watch?v=QzqPZtdXzHA**). Assembly is quite easy and will take you less than 30 minutes. The only thing missing in the video is how to mount the recommended choke balun. The Radio-Wavz choke balun has UHF connectors. So rather than using the supplied 4-foot RG58 BNC/BNC tuner-to-loop cable with UHF adapters, I purchased an RG58 12-inch BNC/PL259 cable and an RG58 20-inch BNC/PL259 cable from Amazon. The 12-inch cable connects from the balun to the induction loop, and the 20-inch cable connects from the balun to the tuning unit. I tie-wrapped the balun to the aluminum mast just above the tuning unit, as you can see in the lead photo.

**Figure 2** — The reviewer, Phil Salas, AD5X, with the boxed-up PreciseRF HG3 QRO-B.

**Figure 3** — The PreciseRF HG3 QRO-B opened boxes.

## Installing the HG3 QRO-B

The HG3 QRO-B is easily handled by one person. It may be installed in a temporary or permanent location. Its aluminum mast can be attached to a secure support using U-bolts (not included), or to a tripod using its ½-inch pipe thread. The antenna is easily rotated with most rotators, including an inexpensive TV-type rotator or the PreciseRF VH226E programmable rotator, which is appropriate for either portable or fixed station use. The HG3 plus controller and the remote high-power tuner RF input use standard UHF SO-239 connectors.

For this review, I mounted the HG3 QRO-B to a mast attached to the side of my house at about the 15-foot level, as you can see in Figure 4. It is rotated with my Yaesu G-450ADC medium-duty rotator. Because the HG3 QRO-B is bidirectional, only a 90-degree rotation capability is needed. I shimmed up the QRO-B aluminum mast with some scrap PVC, as the QRO-B mast diameter was too small for my rotator.

**Figure 4** — The HG3 QRO-B mounted on a pole at the reviewer's house.

## Operating the HG3 QRO-B

Keep in mind that there is a very high RF field around the QRO-B, especially when running high power. PreciseRF recommends that the operator stay at least 25 feet from the antenna when transmitting.

The HG3 plus controller is powered by 12 – 14 V dc applied through the included 2.1 × 5.5-millimeter power cable. When the controller is powered on, it will ask if you want to initialize the tuner. This sets the minimum and maximum range of the vacuum variable, as well as sets the approximate capacitance for each of the ham bands. The initialization procedure takes only a minute or so. While you don't need to do this every time, you definitely want to do it your first time and any time you make changes to the antenna location. After initialization, the controller defaults to the basic operating screen and sets the band to 20 meters.

There are four soft keys labeled **F1** through **F4**. The display indicates the function of these keys, and changes when keys are pressed to indicate the necessary next functions. The **MODE** (**F3**) key changes the display to show 80 – 30-meter information if the 80 – 30-meter kit is installed. The **HELP** (**F4**) key provides tuning information. The initialization and default screens are shown in Figures 5 and 6.


**Figure 5** — The PreciseRF magnetic loop controller initialization screen.

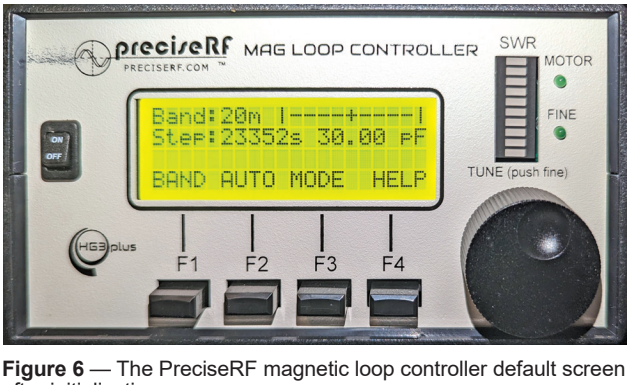


**Figure 6** — The PreciseRF magnetic loop controller default screen after initialization.

Once the default 20-meter screen is displayed, you can press the **BAND F1** key to permit decrementing (**F1**) or incrementing (**F2**) the bands. When tuning stops in the desired band, press **OK** (**F4**). Now you will normally tune for maximum noise using the **TUNE** control. Tapping the **TUNE** control enables fine-tuning. You can then transmit a low-level signal and tune for best standing wave ratio (SWR). This is quick and easy to do by observing the SWR bar graph. It is interesting to note that when you change direction during tuning, the controller takes up any backlash by tuning in the opposite direction, followed by tuning in the desired direction. This causes a momentary increase in SWR. This is normal and doesn't affect tuning, though you should hesitate momentarily when manually changing tuning direction. Also, if you record the step count for your favorite frequencies, you can re-tune the QRO-B in short order when changing frequencies and bands.

There is a very effective auto-assisted tuning feature. To enable auto-tune, tune the controller for maximum noise on your transceiver. Then press **AUTO** (**F2**). The controller will display "Transmit 2-10 watt CW." If you transmit over 10 W, the auto-tune feature may not always work. Transmit a low-power carrier and press **OK** (**F2**). The HG3 QRO-B is automatically tuned until the lowest SWR point is found. This entire process takes just a few seconds and worked very well for me. I found that I didn't even need to tune for maximum noise first. Whenever I changed bands or frequencies within a band, I just went to **AUTO** and started the auto-tune process. In most cases, it tuned perfectly on the first try. If not, I would just repeat the **AUTO** process, and it would always find the correct solution the second time. I wound up using the **AUTO** feature whenever I changed bands and/or frequencies.

## On-the-Air Operation

I made several measurements of the antenna resonance and bandwidth prior to my on-the-air tests. The results are shown in Table 3.

I operated with a transmit power up to 500 W using my K3/KPA500 setup (100 W maximum on 30 meters, of course). I operated CW (my preferred mode) on 30 meters, but focused on SSB on the other bands. I could pretty much work anyone I could hear. I also made many A/B comparisons between the HG3 QRO-B and my 43-foot vertical. On average, I found the HG3 QRO-B to be about 2 – 3 S-units below the 43-foot vertical on 40 meters, and 1 – 2 S-units below the 43-footer on 30 meters. On 20 – 10 meters, the QRO-B was often equivalent to the 43-foot vertical and sometimes would outperform it. Of course, there were situations where one antenna significantly outperformed the other, but on average I observed the results stated. The HG3 QRO-B also had a better signal-to-noise ratio on all bands when compared to the 43-foot vertical.

**Table 3**
**Antenna Parameters Measured When the HG3 QRO-B Is Fed Through About 35 Feet of LMR-400 Cable**

**The SWR was recorded from the HG3 plus controller display.**

| Band | SWR Minimum | 2:1 SWR Bandwidth |
|---|---|---|
| 40 m | 1.3:1 | 16 kHz |
| 30 m | 1.3:1 | 20 kHz |
| 20 m | 1.2:1 | 50 kHz |
| 17 m | 1.1:1 | 70 kHz |
| 15 m | 1:1 | 85 kHz |
| 12 m | 1:1 | Greater than full band |
| 10 m | 1.1:1 | 215 kHz |

## Firmware Update

While the HG3 QRO-B manual states that firmware can be upgraded by the user, no information on doing this is provided. There is a warning that damage to the unit due to a user upgrade is not covered by the warranty. So, if you need to update the firmware, you should contact PreciseRF.

## Conclusion

The PreciseRF HG3 QRO-B is an effective antenna worth considering for restricted antenna locations and portable operation at power levels up to about 1000 W PEP. Because it is remotely tuned, the high-intensity RF field can always be kept well away from the operator. You can review the HG3 QRO-B operation manual, the installation guide, and the installation video on the PreciseRF website.

*Manufacturer:* PreciseRF, 13690 Wisteria Dr. NE, Aurora, OR 97002, **www.preciserf.com**. Price: HG3 QRO-B, $3,025; VH226F programmable outdoor antenna rotator, $275; HG3 QRO 80 – 30-meter add-on kit, $355.

# Polar Electric *MRP40* Morse Code Decoder and Sender Software

*Reviewed by Charles "Chip" Veres, KM4SJN*
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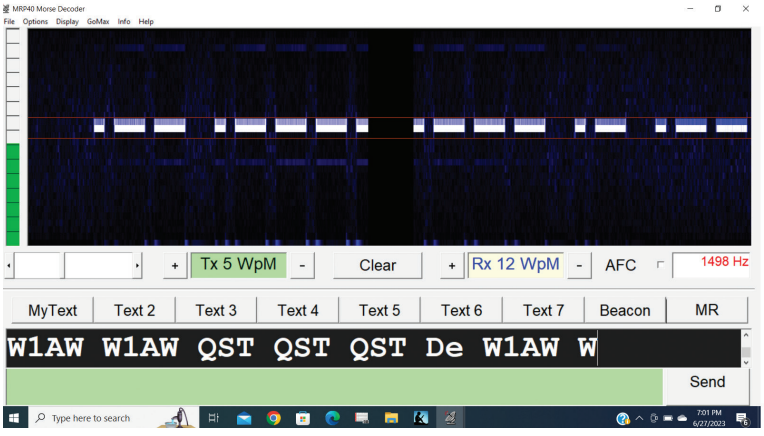
This review is an attempt to locate today's best Morse code decoder program. My motivation is to try to encourage CW (code) communications by Technician-class operators on 80, 40, or 15 meters. This seems to be a sadly underused resource. The *MRP40* is among the best programs available for automatic telegraphy. Most of today's Technicians became hams without learning code. Expecting them to turn around and learn to send by hand and receive by ear is optimistic.




## Description

The *MRP40* is a Windows software package that you can download from **www.polar-electric.com/Morse/MRP40-EN**. You will also need an SSB transceiver and an audio interface to get the signals from the radio to the computer. The lead photo is a screenshot of the *MRP40* software decoding W1AW. You may need to temporarily disable your antivirus software, although mine just asked me if I wanted to continue, and I did. The program installs itself.

## Setting Up Your Transceiver

We are going to "cheat" and send CW by applying pure tones to an upper sideband (USB) transmitter. It is important to keep the tones pure, so you transmit on only one frequency. The most likely problem here is overdriving. If your transceiver has an ALC meter, adjust the audio input until the meter just moves, no more. As a general rule, the transmitter should be putting out about half of its ALC maximum rating. Other helpful settings on the transceiver are the **USB** filter bandwidth, which should be left on, and the **AGC**, which should be shut off if possible. You may need to be persistent to turn down the audio level. On my computer I needed to go into "Advanced Sound Properties" and turn down the *MRP40* level specifically.

## The Sound Interface

This can be the hardest or the easiest part of the installation depending on luck and how much money you throw at the problem. I am in the very lucky category, as my Icom IC-7100 has a built-in computer interface — two cables and that's it. One is the USB cable that carries the audio in both directions. The other is a push-to-talk (PTT) cable from the computer to the radio. That's activated by a function of the *MRP40* under **OPTIONS**, **TX SETTINGS**, **EDIT COM PORT**. The COM port "pushes" the PTT switch so you don't have to. You will find the one-transistor schematic in Figure 7.

My friend John's, WA4PYQ, installation was of medium complexity. He likes to both save money and build ham radio projects. So, he got a KF5INZ Easy Digi kit interface from eBay and three cables from DigiKey. His total cost was about $25. The Easy Digi interface assembled by KF5INZ runs between $30 and $45. An MFJ-1205 interface costs $145, but it does all the work for you. Note that all these interfaces do exactly the same thing. It's just a matter of how much sweat equity you put into it.

## Receiving and Sending CW with the *MRP40*

In the big blue box on the screen, point at the signal you want to receive and click on it. This sets both the receive and transmit frequencies. The first station I

### Bottom Line

The *MRP40* software can decode CW signals as long as you can hear them and even after they no longer move the S-meter.

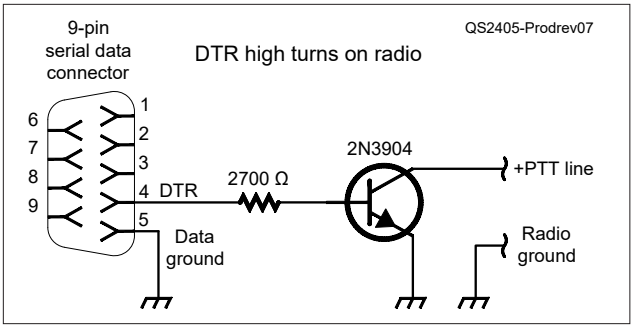



**Figure 7** — Schematic of the PTT "button pusher."

tried to receive was W1AW. In general, this was a great success. They send bulletins and code practice three times every weekday evening, and they usually put an S-9 signal on my station in south Florida. Just to try it, I mis-tuned my antenna tuner until the signals faded out. I found that the *MRP40* would continue to correctly copy them as long as I could hear them and after they no longer moved the S-meter. Receiving W1AW, I noticed one strange effect. Below 10 WPM, the *MRP40* would put a word space after each letter — still fully readable but funny to look at. On my fifth try, it finally dawned on me that it was sending with the Farnsworth method, with the letters at 13 WPM and extra-long spaces between them. The *MRP40* was faithfully printing out what it heard.

After receiving W1AW 10 times, the next step was to try other stations. Tuning around, I found several more stations. The program provided similar performance to a human operator, but its strong and weak points were different. The program is capable of 52 WPM, so most operators can't out-speed it. But in some situations, it can be intolerant of bad spacing and fading (just like humans), and of course performance is at its best when the receiving text is generated by another machine.

The *MRP40* has nine memory buttons between the frequency screen and the decoded text. Right-clicking these buttons brings up a text entry screen where you can store your name, rig, QTH, or anything you like. You can even change the name of the button to remember what's where. Once saved, left-clicking these buttons merges them into your transmitted text. The attached mini log stores the following variables: call, name, QTH, and RST. They can be merged into a memory button — for example, <CALL> de KM4SJN K.

### A Different Experience

For an old-timer like me, the *MRP40* provides a very different experience — more like FT8 than like hand-sent CW. I don't touch-type, so I found myself wanting to reach through the radio and say, "Hold your horses, Buster! I'm still typing." I'm sure younger people and touch typists will be more comfortable. I may go back to my old key and just let the *MRP40* help with reception.

### Tune Button

There is no tune button to transmit continuously for adjustments (except in the menu for WinKeyer). I found I could adequately simulate one by turning the sending speed down to 1 WPM and sending several "T"s. That permitted me to adjust my antenna tuner and transmit power.

My station consists of an Icom IC-7100, a Hustler 4-BTV vertical at roof height, and an HP 8570p laptop computer. For this review I used the *MRP40* encoder-decoder program exclusively.

John, WA4PYQ, was my partner for the local two-way tests. His station includes a Kenwood TS-570D transceiver and a Dell Latitude E5530 computer. His antenna is a 40-meter dipole laid on the tile roof about 10 feet up. Our stations are separated by about 14 miles. He also used the *MRP40* program with his homebrew audio interface.

At WA4PYQ's station, the *MRP40* wouldn't run at first. It reported the absence of Mscomm32.ocx. That is a program Windows uses to communicate with the serial port. We got a fresh copy and installed it in Windows/System/SysWoW64. That cleared the problem.

This whole process may be a bit bewildering for a new operator. If you can, find a more experienced person to help.

## Conclusion

This program and others like it can vastly extend the range of Technician-class stations.

*Manufacturer:* Polar Electric (Norbert Pieper), Max-Planck Str. 11, D-59399, Olfen, Germany, **www.polar-electric.com**. Price: $65.00 after 1-month free trial.

# RigExpert Shackmaster Power 500

*Reviewed by Harold Kramer, WJ1B*
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The Shackmaster Power 500 from RigExpert is a compact, quiet power supply with an informative LCD touch display. The rated power is 500 W, and it can provide 13.8 V dc at up to 35 A, along with 5 V dc USB outputs to charge smartphones and tablets. When connected to a computer, it has extensive monitoring and configuration capabilities.

## Description

The Power 500 arrived nicely boxed and sturdily packaged. The box includes a vertical mounting bracket and a comprehensive instruction manual. Also included is a heavy-duty ac cord and a USB-C-to-USB-A cable that is used to connect the Power 500 to a computer.

The ac input voltage is specified as anywhere from 80 V ac to 264 V ac. There are no external switches or jumpers required when the input voltage is changed. The power supply senses the ac input voltage and adjusts accordingly. It is small and compact, measuring about 6.5 inches across and deep, and 2 inches high. It weighs only about 2.4 pounds, and it can be mounted either horizontally or vertically. That could be a real space saver on a crowded operating desk. The Power 500 has a cooling fan and a fan outlet in the rear (see Figure 8), but I never heard any acoustic noise from it even after hours of operation.

I did not see any RFI on the spectrum scope of my Icom IC-7610 or hear any RF noise on the HF bands when the Power 500 was running. There is an FCC and a CE (European) certification label affixed to the box. Conducted emissions testing done by the ARRL Lab shows that the Power 500 meets FCC regulations when tested both at lower loads and with a transmitter, producing an approximate 20 A load.

## Inputs and Outputs

The Power 500 has several different dc output connectors. Please note that all the PowerPole connectors on this unit are rated for 45 A, allowing each one of them to use the full 35 A capacity. There are two Anderson PowerPole connectors on the rear. Also, on the rear is a USB-C connector that connects to a computer for monitoring the power supply. On the front of the Power 500, there are two more PowerPole connectors along with two USB-A connectors and two USB-C connectors that can be used to charge smartphones or similar USB-powered devices.

I did not want to push my luck testing this functionality, but according to RigExpert, the Power 500 features "an advanced Intelligent Protection System" that protects it from overcurrent, overvoltage, and overheating.

## Display

The Power 500 has a bright, legible display on its front with white, green, and red characters. The display's function is changed by touching and/or swiping the display panel, similar to changing the display on a smartphone. Here are the screens that are displayed (the PC software screen capture shown in Figure 9

### Bottom Line

The RigExpert Shackmaster Power 500 is a high-quality, compact, and quiet 35 A power supply with advanced capabilities.

**Figure 8** — The RigExpert Shackmaster Power 500 rear panel.

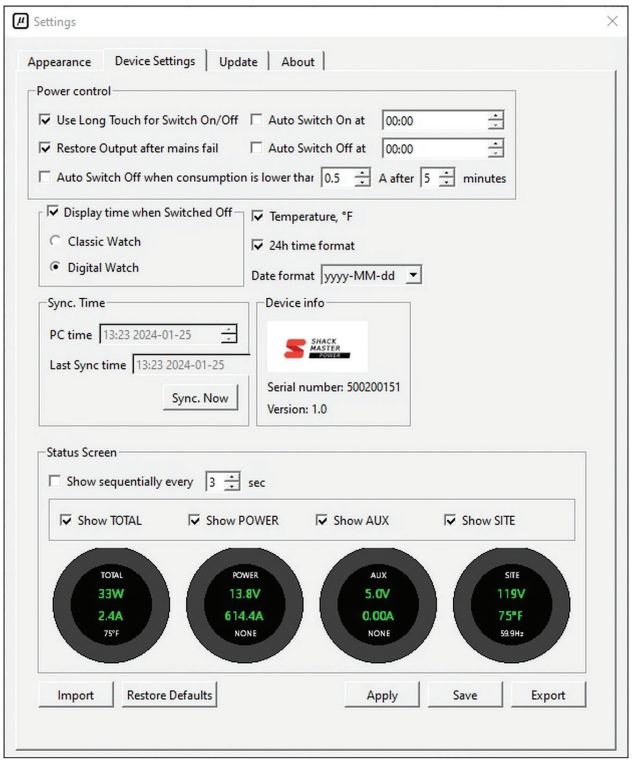


**Figure 9** — The *REAMP* (RigExpert Analyzer for Micro Power) software device settings.

shows the different available **STATUS SCREEN**s for the display):

**TOTAL** — Displays the total power consumed in watts, current consumption, and ambient temperature of the device.

**POWER** — Displays the voltage and current of the 13.8 V output.

**AUX** — Displays the USB voltage and current output.

**SITE** — Displays the ac input voltage and frequency (e.g., 59.9 Hz) and the internal temperature of the power supply (listed as "Conditions" in the manual).

When the on/off switch on the rear is on and ac power is applied, swiping the display turns on the power supply and another swipe turns it off. When the Power 500 is off but ac power is on, it displays the time in UTC.

## Computer Connection

A unique feature of the Power 500 is that RigExpert supplies free software called *REAMP* (RigExpert Analyzer for Micro Power) that is used to control the Power 500 from a computer. The software is available for Windows, macOS, and Linux. I downloaded the software to my Windows 10 computer, and it installed with no problems. The Power 500 connects to a computer through a USB-C connector on the rear of the power supply. The software graphically monitors the operation of the power supply, and it can display up to five parameters, such as 13.8 V dc output and current, on its graph display. It can measure these parameters in real time, or they can be stored files for future reference. The software worked fine on my computer, and it was interesting to see how the USB output current varied while my iPhone was charging.

The *REAMP* software can change how the input screens are displayed, adjust the time clock settings, and turn the power supply on or off at certain times. There is also a provision for remote control of the power supply. I have mentioned only a few of the features of the *REAMP* software. There are many additional capabilities for operating, monitoring, and customizing the Power 500 to your personal operating needs.

## Conclusion

While the Power 500 is somewhat expensive for an amateur radio power supply, it's worth the money if you are in the market for a compact and quiet power supply with advanced capabilities and options.

The Power 500 is a high-quality, compact 35 A power supply that can easily power a 100 W HF transceiver along with providing power for USB devices. It displays many operating parameters that can be monitored and customized to the users' needs when connected to the RigExpert software and a computer.

*Manufacturer:* Rig Expert Ukraine Ltd., Solom'yans'ka Square, 2, 03035, Kyiv, Ukraine, **www.rigexpert.com**. Available from several US dealers. Price: $360.

# DX Engineering NCC-2 Receive Antenna Phasing Systems

*Reviewed by Pascal Villeneuve, VA2PV*
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The DX Engineering NCC-2 is identified as a Receive Antenna Phasing System on the manufacturer's website, but you will find out with this review that it is way more than that. The NCC-2 is an upgraded version of the previous model, the NCC-1.

At the 2013 Hamvention, I was looking for a way to protect a second receiver using the same HF antenna system. I started asking questions to a few manufacturers, who referred me to the DX Engineering booth. So, I went, and they brought up a solution using the RTR-1A Modular Receive-Transmit Interfaces. A few days after Hamvention, I received the unit and started to figure out how to connect it. There are so many ways to connect it that you need to sit down and figure out the best setup for what you want to do. I drew a diagram and sent it to DX Engineering support; they answered promptly with a different suggestion. After I proceeded with all the connections, everything worked as expected.

I've had the RTR-1A in the shack for several years, and it serves its purpose well. I had another brand of noise canceler and an HF beam for 10, 15, and 20 meters with an inverted **V** dipole on 80 meters. The setup worked well with the second receiver, but to use the noise canceling system I needed a second receive antenna that was a long wire around 10 feet above the ground. For the receive antenna I also had an external preamp to be efficient on most bands. At some point I had the local utility resolve many interference issues. The noise cancellation system was not required anymore, so I removed everything to reduce all the cabling behind the desk, as there were many devices involved — the RTR-1A, the noise canceler, the RX antenna preamp, and a protection relay to protect the RX antenna from transmitted RF.

Remember, the NCC-2 is way more than a noise canceler. It can include all the functionalities of my previous setup in one piece of equipment, reducing considerably the cables needed for the connections and the error risk associated with too many of these.

The NCC-2 now has a built-in receive-transmit interface relay system (equivalent to the RTR-1A), and the


unit has six plug-in modular circuit board sockets (three for each receive antenna), allowing the unit to serve many purposes. By default, there are six bypass modules installed, and you will need to remove one to install any of the optional modules (more on this later). The options are the Receive Preamplifier Plug-In Module (DXE-RPA-2-PM), the Receiver Guard 5000HD Plug-In Module (DXE-RG5000HD), the 75 to 50 Ω Impedance Transformer Plug-In Module (passive) to match 75 Ω RX ANT feed lines to NCC-2 50 Ω internal impedance, and the NCC-2 Receive Filter Sets (passive, non-switchable): high-pass, band-pass, and low-pass filters.

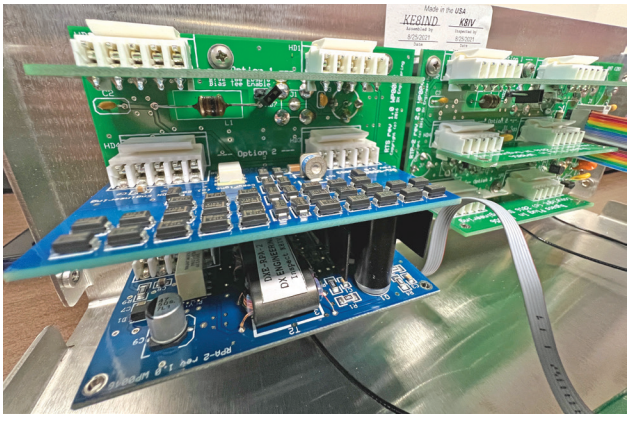

**Figure 10** — The NCC-2 internal add-on modules: the DXE-RG5000HD Receiver Guard located in option 2 (middle module on the left side) and the DXE-RPA-2-PM preamplifier module located at the bottom.

## Bottom Line

The DX Engineering NCC-2 is more than just a noise canceler. It provides an all-in-one solution for different applications while reducing the external connections.

You can also combine the NCC-2 with the DX Engineering Active Vertical Receive Antenna System. Because of my limited space (6500-square-foot lot), for this review I used a 40-meter dipole about 15 feet above the ground. I also added two optional modules for the receive antenna: the DXE-RG5000HD Receiver Guard and the DXE-RPA-2-PM preamplifier module (see Figure 10). Also, the NCC-2 can provide Bias Tee for its two receive antenna ports for coax-fed active verticals and other accessories.

## Physical Description

The first thing you will notice is the overall quality, with its steel enclosure, sturdy knobs, and weight (more than 8 pounds). Keep in mind that this unit frequency coverage is 0.3 to 30 MHz, and it cannot be used on 6 meters.

On the front panel (see the lead photo), starting from the left, you have the **POWER** switch. When the unit is off, it is bypassed with your main antenna (TX) going to your rig directly. Above the **POWER** switch, you have a three-position switch with an LED just above showing the receive/transmit relay (RTR) feature status. When in the **NORM** position, the RTR is active and the LED is blue. In the **MAIN ON** position, the RTR is off and the LED is red. The bottom **MAIN ON** position is the same as the previous top one, but it's a momentary switch to quickly monitor the main antenna while holding it down.

The next set of controls is for channel A (**CH A**). In my setup, this is for the main antenna, as I have only one receive antenna on channel B (**CH B**). There is an **A dB** rotary attenuator switch to reduce the antenna signal for **CH A** from –10 to –30 dB; this is useful to match the received antenna signal strength. Below the attenuator switch there is an **OPTION** switch for **CH A** with a yellow status LED above when it's in the **ON** position; this is used to turn on and off the optional preamplifier module, if installed for **CH A**. In my case, there is none, so switching this one has no effect. The **BALANCE** knob is for balancing the signal between **CH A** and **CH B** antennas for noise cancellation. Next is the rotary switch attenuator for **CH B**, and just below is the **CH B OPTION** switch; in my case, this switches the preamp on for my receive antenna. On your right, you have the **PHASE** knob for the noise cancellation. Below, on the left, you have the **B PHASE** switch, **NORM** and **REV** position; in some cases, you will need to switch the phase in order to null a noise. The last one on the right is the **BAND** switch; **L** position is for the low band, 40 meters and above, and **H** is for below 20 meters.

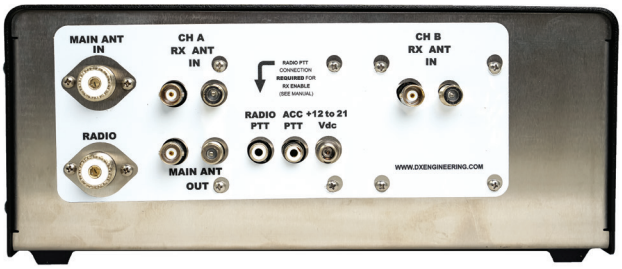


**Figure 11** — The NCC-2 rear panel.

On the rear panel (see Figure 11), you have two SO-239 antenna ports — one is to connect your main transmit antenna (**MAIN ANT IN**), and the other is for the **RADIO**. For both **CH A** and **CH B** receive antenna inputs, you have the option of using either the 50 Ω BNC or the F-style connector (you can use either of these). Using a 75 Ω input, you need the optional transformer module. When I was making the connection, I wondered why they were using these types of connectors for the receive antenna because most of us will need to use adaptors. Well, the answer is in the manual — it is to prevent any accidental connection to the transmitting equipment. I mentioned earlier the risk of my previous setup — having three different boxes to achieve the same result. This is what I was talking about, so it's a good thing they used these to reduce any risk. When the RTR is on, the receive signal from the main antenna is sent to the **MAIN ANT OUT** connector that you can use to connect a second receiver. In the middle of the rear panel, you have two RCA connectors for the **RADIO PTT** and the **ACC PTT** to connect an accessory such as an HF amplifier. Beside the RCA connectors you have the **+12 TO 21 VDC** input.

## Connecting the NCC-2

This is where the fun begins. First, you will need to figure out how to connect your antennas and equipment depending on your intended use. In the user manual, you will find six setup examples, from pages 27 to 32. You can download the manual from the following link: **www.dxengineering.com/parts/dxe-ncc-2#InstructionArea**.

There are many ways to connect the NCC-2, and you will need to identify the best way for your setup — you may plan to use the RTR feature to feed a second receiver, like a software-defined radio (SDR), or you may have one or two receive antennas. If you need to provide power via the coax to either one or two receive active antennas, you will have to open the NCC-2 cover and change the jumper of one or two

channels to enable the Bias Tee; by default, both are disabled.

My connections are a mix and match of different diagrams shown in the manual. In case of any doubt, contact the DX Engineering technical support to ensure your setup is okay, as there are many possibilities.

I have only one receive antenna, which is not active, and no Bias Tee was needed. I also have an amplifier, which is the reason I got the receiver guard module for the receive antenna. Keep in mind that if you have an amplifier, it needs to be connected after the NCC-2, as the maximum power through this unit is 200 W. All my HF transmit antennas come into the station using only one coax from a remote switch located in the tower.

I started with diagram 1 on page 27 of the manual ("Phasing a Transmit Antenna with a single Active Receive Antenna using the RTR function"). My antenna is not active, as mentioned previously, but other than the Bias Tee being disabled, the connections are the same. The NCC-2 has two receive antenna inputs for the antenna phasing system. When you have only one receive antenna and one transmit antenna, you will need to feed the **CH A ANT IN** with the **MAIN ANT OUT** using the included BNC-to-BNC jumper. If you want to feed a second SDR receiver using the RTR function, you can insert a splitter between the **CH A ANT IN** and the **MAIN ANT OUT**, as shown in diagram 4 on page 30 of the manual.

In my station, I have a coax switch to switch between the antenna to different HF radios. I also have a 1 kW amplifier and a station monitor that has two RF couplers, one before the amplifier and one after, so the coax output of the radio's coax switch connects to the input of the first RF coupler, and the output of this coupler is connected to the **RADIO** input of the NCC-2.

The **MAIN ANT IN** input on the NCC-2 is connected to my HF amplifier RF input, the amplifier RF output is connected to the second RF coupler input, and the output of this coupler is connected to the outside antenna's coax switch. The RF power going through the NCC-2 will be a maximum of 100 W.

I used the included BNC jumper to connect the **MAIN ANT OUT** to the **CH A RX ANT IN** on the NCC-2, and I connected my RX dipole antenna to the **CH B ANT IN** using an SO-239 to a BNC adapter. I hope I didn't lose you with all these connections — it's easier when you have the units in front of you.

I connected the PTT coming from the radio to the **RADIO PTT** on the NCC-2, and the **ACC PTT** on the NCC-2 to the amplifier PTT input. And I connected the dc power from one of my shack power supplies to the NCC-2. To power the NCC-2, you will need a well-filtered 2 A dc source from +13 to 21 V dc. The dc connector is included, but you will have to build your cable.

Before I made all these connections, I opened the NCC-2 and installed the optional DXE-RG5000HD-PM Receiver Guard and the DXE-RPA-2-PM Receive Preamplifier modules. This is important, as both modules can be installed on either channel A or B or even both. I have only one of each of these optional modules, and in my case, these needed to be installed in-line only on my RX antenna, channel B. There are three optional slots for each channel. From top to bottom, you have option 1, option 2, and option 3. The receiver guard goes into option 2, and the preamplifier goes in the option 3 slot. See the online manual for more details, as these have their specific positions.

## On-the-Air Operations

Before I could use the NCC-2, I had to wait for winter to arrive. I don't usually have any interference during summer, and I install my receive antenna only in winters, because it's installed low above the ground and close to the pool.

Now that everything was installed, I could try the NCC-2. The RTR feature is the best way to protect a second receiver from unwanted RF; it allows you to share your antenna and the phasing system with your main receiver. It's great that this feature is included with the NCC-2, and this works very well.

When it comes to noise cancellation, your results will vary depending on the performance of your receive antenna system. Having the preamplifier option built in is a great addition if you're using an antenna that does not perform equally on all the bands. My receive dipole antenna works best on 40 meters, and the preamplifier is needed when I want to null a noise on 80 meters, because to efficiently null a noise you will need to be able to match the signal strength of both antennas as close as possible using the **BALANCE** knob. If there's too much of a difference, you won't be able to obtain a great result. That's the reason you also have a variable attenuator for each receive antenna. As for the preamplifier, on 80 meters my radio signal meter shows a difference of +4 dB when I turned this option on, and on 40 meters it's up to 8 dB. The other bands show similar results. Keep in

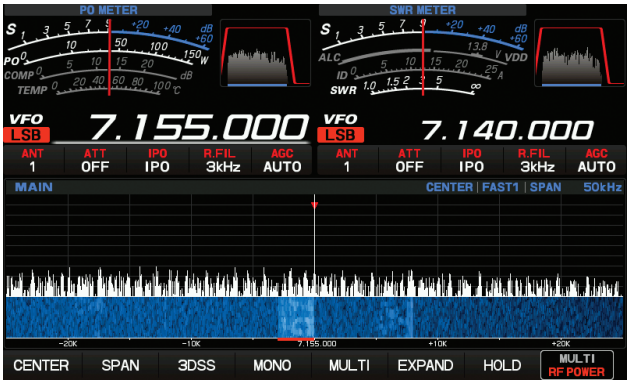


**Figure 12** — The Yaesu FTDX101D waterfall screen capture showing noise interference before using the NCC-2 noise canceler.

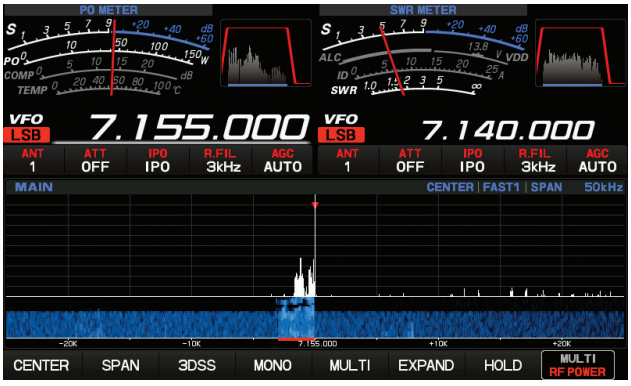


**Figure 13** — The Yaesu FTDX101D waterfall screen capture just after switching on the pre-adjusted NCC-2 noise canceler.

mind that this is not a laboratory measurement; it's just my observation with my current setup. The DXE-RPA-2-PM specifications on the manufacturer's website mentioned a gain of 16 dB, and ± 1.5 dB, from 300 kHz through 35 MHz. In my case, the preamplifier of my receive antenna was necessary, and it works very well.

My lot is small, and I didn't install an external protection relay on the receive antenna, so I was a bit worried that if I was using the amplifier, the RF picked up by the receive antenna could damage the NCC-2. That's the reason I installed the optional receiver guard module. It looks like it survives a 1 kW transmission test even with the preamp on. The preamplifier LED stays on when I transmit, but I'm pretty sure it's deactivated. This is great, as no external relay is needed when using the NCC-2 with the optional receiver guard module.

I had to wait for noise interference on a cold winter day to really test the efficiency of the noise canceling system of the NCC-2. One morning in January, it happened on 40 meters; the noise peaked up to 20 dB over S-9. Keep in mind that the NCC-2 is able to null the noise before it even gets into your receiver, which is way better, as it won't add distortion on the received strong signal audio. To null the noise, I set the **PHASE** knob in the middle (5) and started to play with the **BALANCED** knob. I was unable to null the noise right away, so I switched the **B PHASE** switch to **REV** and played with the **PHASE** knob, and the noise was almost gone. Then I fine-tuned using the **BALANCED** and **PHASE** knob. I was able to make the noise disappear completely. You will need to play with the knobs very slowly to fine-tune and achieve the best performance. The NCC-2 made the difference between turning off the radio (as I couldn't hear anything) and listening to an interference-free quality signal. You can see the signal difference in the screen captures from my Yaesu FTDX101D when I switched the NCC-2 on and off (see the transition in Figures 12 and 13). In Figure 12, the NCC-2 is off. Look at the noise on the S-meters in both VFOs. In Figure 13, we can see when the NCC-2 was turned on (it was pre-adjusted). On the main VFO (left) the desired station signal is actually stronger than before, and I can now hear it clearly. If you compare sub VFO signal in Figures 12 and 13 (right), you can actually see the noise drop to the receive signal at this frequency when the NCC-2 was in-line.

I noticed that after nulling a noise that is present on most of the band, you have to adjust the **PHASE** knob if you move more than 40 kHz from where you've made the first adjustment, but this can be achieved very quickly.

## Conclusion

If I had enough room in my backyard, I would have loved to test the NCC-2 with two of the active receive antennas from DX Engineering. The results must be astonishing with this setup. Nevertheless, using the NCC-2 with a non-active antenna combined with the preamplifier will give you the ability to null most of the noise.

The NCC-2 provides an all-in-one solution for different applications while reducing the risk by using fewer external connections.

*Manufacturer:* DX Engineering, 1200 Southeast Ave., Tallmadge, OH 44278, **www.dxengineering.com**. Price: $949.99 for the main unit, $64.99 for the optional DXE-RPA-2-PM Receive Preamplifier modules, $79.99 for the optional DXE-RG5000HD-PM Receiver Guard 5000HD module. Other options are available on the manufacturer's website.