

Noble Radio NR-PAN3K Panoramic Adapter for the Yaesu FTdx3000



Description

The NR-PAN3K is a Panadapter designed specifically to operate in conjunction with the Yaesu Ftdx3000 and 5000 transceivers to create a spectral display and rig control environment using Ham Radio Deluxe and HDSDR programs running on a Windows based PC or laptop. The combination of the NR-PAN3K and the aforementioned software will allow “point and click” frequency control of the 3000/5000 using a mouse on the HDSDR spectral display. The frequency may also be controlled by the HRD rig control interface as well as the main tuning knob of the radio. This combination creates a powerful control and logging environment for the radios.

While designed to be used with the FTdx3000, the NR-PAN3K can also be used with a Ten Tec Orion II transceiver if it has been modified to provide a tap off the 9 MHz IF stages. A suitable method for doing this is described in an online article by VE7TK. The Orion has suitable RCA connections at the back of the radio to basically plug in the adapter in a similar way that it is connect to the Ftdx3000/5000..

The PAN3K requires a 9 MHz IF input signal. It bandpass filters this signal to roughly a 1.5 MHz bandwidth. This signal is run through a high dynamic range preamp and then applied to the input of a double balanced mixer. A local oscillator signal at 38 MHz upconverts the 9 MHz to 47 MHz where it is again filtered and run through a IF amplifier stage. This amplifier has a fixed gain but it can be varied by an internal adjustment. The resulting 47 MHz signal is presented to an SDR module that is interfaced to a PC or laptop via a USB connection.

HDSDR is used for the spectral display because it is a freeware program with many features and also connects to Ham Radio Deluxe via a DDE link so that no virtual com ports are required to use a rig control / logging program as well as a spectral display program to control the same radio. This makes for a very easy setup software installation and control / logging environment .

Installation of the PAN3K is basically plug and play. The IF signal is picked up from the IF OUT RCA connector on the rear panel of the radio. There is also another RCA jack that supplies 13.8 VDC to power the adapter. A third RCA plug terminated cable goes to the TX GND connector at the rear panel. These connections are all that is required for the Panadapter to operate with the Ftdx3000/5000 or the Orion II. The SDR is connected to the PC via the USB connector on the NR-PAN3K front panel.

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Installation of the NR-PAN3K to the Ftdx3000/5000

The following items are supplied with the NR-PAN7.

- 1> NR-PAN3K unit
- 2> IF Input cable
- 4> USB Cable



NR-PAN7 MAIN UNIT

IF CABLE



USB
CABLE

Installation of the Main Unit

Installation of the Main unit is basically a plug and play operation. Plug the RCA plug with the RED heat shrink on it into the 13.8 V connector on the rear panel of the Ftdx3000/5000. Plug the RCA plug with the BLACK heat shrink on it into the TX GND connector on the rear panel of the Ftdx3000/5000. Plug the IF cable (RCA plugs on both ends with black heat shrink) into the jack marked IF OUT on the rear panel of the Ftdx3000/5000 and the other end in to the jack marked IF IN – 9 MHz on the front panel of the NR-PAN3K. Plug the USB cable provided into the SDR OUT connector on the front panel of the NR-PAN3K and the other end into an unused USB jack on your PC or laptop. This completes the physical installation of the unit. Next the software will have to be installed and setup to use the panadapter.



13.8 VDC

IF OUT

TX GND

Required Software and Installation

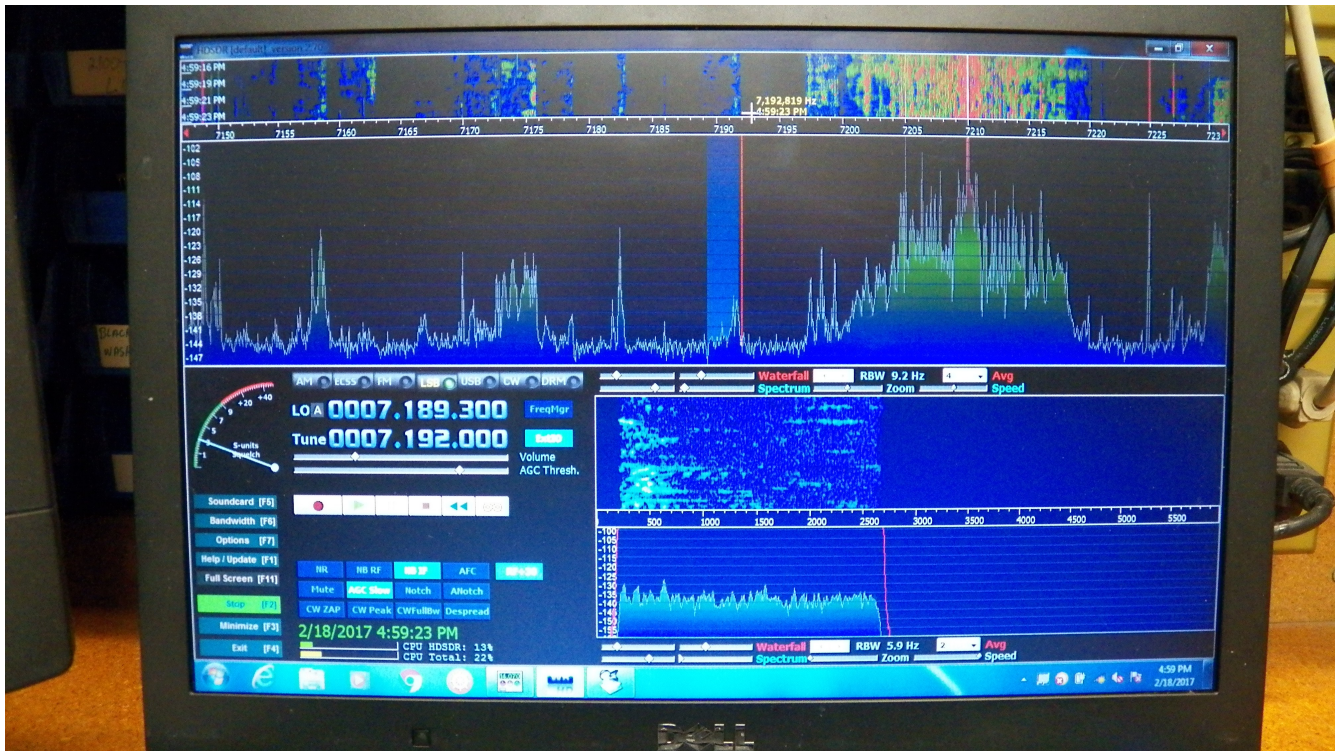
In order to use the functions of the Panadapter there must be some sort of control software setup in a PC or laptop computer. The Panadapter was designed to operate with two programs to provide a spectral display plus rig control and logging functions. Ham Radio Deluxe (HRD) and HSDR are the two applications that work well with the Ftdx3000/5000 to control the radio.

Ham Radio Deluxe 5.24 is the final free version and can be found with an internet search for download from several sites on the internet. This program may not support all of the functions of the 3000/5000. If you want complete control of the radio a paid version will have to be purchased from the vendor. That program should be downloaded and installed on the control computer. HRD will give you rig control and logging plus many other functions. That should be installed and connected to the Ftdx3000 and verified that the program is controlling the radio in terms of frequency and other items.

The next program that will need to be installed is HSDR. It is also a freeware program that can be found at www.hdsdr.de. That will provide the spectral display for the panadapater. Once both of these programs are installed the drivers for the hardware will have to be installed. To use HSDR with the PAN3K the driver for the SDR receiver must be installed. The driver to use is installed with zadig. The zadig utility can be downloaded from <http://zadig.akeo.ie>. Download the latest version that is compatible with the operating system you are using. Make sure that the USB cable is plugged into the SDR OUT connector on the NR-PAN7 with the other end into an unused USB port on the PC or Laptop. Run the zadig utility by clicking on the file and opening the dialog box. The app may need to be opened and run as an administrator. Do this by right clicking it and choosing Run As Administrator. Go to OPTIONS ---> List All devices and make sure that is checked. In the drop down box chose Bulk In, Interface (Interface 0). This can also sometimes show up as an item prefixed with **RTL28328U**. Make sure that WinUSB is selected as the target driver and click on Replace Driver. The following site will also show step by step instructions for loading the SDR driver <http://www.rtl-sdr.com/tag/zadig/>. Once the driver is installed HSDR can be started. If the driver is working properly the spectral display screen should appear. To verify that the driver is installed correctly click on the ExtIO box next to the frequency display and it should show a box with the heading **ExtIO – RTL2832.DLL**. If that is present then close the box and press F7 to bring up the **OPTIONS** Menu. Point to the **Select Input** item and then make sure that **Generic RTL2832U OEM** is selected. You may also see it listed as **RealTek**. Next go to the **RF Front End Calibration** item in the F7 menu. Click on (select) **SDR on IF output, which is controlled by** and then select **HRD (DDE)**. Under Sync mode select **Full Sync in Both Directions**. Under **IF Frequency** enter **47000000**. Leave the Offset at 0 for the moment. Click **Mirror RF Spectrum in General**. Click **APPLY** and close the window. In the F7 menu select **DDE to HSDR**. Select **HRD** in the box that pops up. Next click “Manual Connect” and you should see green text at the bottom that says “Status Connection OK :)” Click OK to close the window.

With the Ftdx3000 powered on and HRD running and connected to HSDR via the DDE link (this should show in the pop up box that was used to select HRD as the DDE link in the previous step. If it is not connected then select Manual Connect in that box) clicking the START button on HSDR should bring the spectral display alive and any signals in the passband of the 3000's IF should appear on the display. The amplitude of the display may be way off from optimal when first started and the frequency of a tuned signal on the TR7 may not be exactly lined up with the spectral display. These factors will have to be adjusted to suit your individual taste and to calibrate frequency to the FTdx3000. But a good starting point is to have the spectral display set for a 100 kHz width (this gives the best overall display bandwidth while still allowing for easy frequency selection of a signal with the mouse) and the SDR

RF Gain set to around 25. This can be set by either using the slider from the box labeled RF+N (N being the value selected) at the right side of the buttons at the bottom left corner of the screen, or by clicking the ExtIO box. The window that appears will show a slider which will also control the gain plus a few other options. The Sample Rate should be set to 2.4 Msps as a starting point. The Buffer size should be set to 64 kB. Make sure both of the AGC selections are OFF (not checked). Offset Tuning should be checked. In some PC systems the sample rate may have to be lowered to avoid excess spurs near the center of the screen. If this is what you see then start with the lowest rate (.94 Msps) and gradually increase until the problem appears then back off one step. The actual scale height and spectral width and speed of the update, etc are controlled by the sliders under the spectral display window. You will need to play with these to get the best display to suit your preferences. A typical display will look like the picture below.



Typical Spectral Display from the NR-PAN3K

You can use the position of the sliders in the picture as a starting point for setting up your display. You can see that the frequency displayed on the Tune value is set to the actual operating freq of the TR7/NRV7 and not the frequency of the IF. Use the mouse to place the red vertical cursor on one of the signals on the spectrum display and left click the mouse. The display should instantly put the selected signal at the center of the screen and the Tune frequency on HDSDR, the Ftdx3000 and HRD frequency displays should all change to the new frequency and the selected signal should be heard on the 3000. The proper way to select a signal depends on what sideband is in use. For USB the cursor should be placed to the left side (edge) of the signal passband. For LSB it should go to the right side. For CW it will also be to the left if you are using USB CW mode. The mode of the display will be changed with the Ftdx3000 or with HRD or HDSDR. To calibrate the amplitude of the screen use the Calibration Settings menu in the F7 menu. Note this is for Ver 2.76, last release in Feb 2017. Earlier versions will

use a different menu setup. The antenna should be disconnected from the radio and the “S-meter Calibration” tab should be selected. The noise floor should be about -112 to -114 dBm in the “Current Level” box. If it is much different than that enter a value of -112 in the “Correct Level” box and then hit “Calculate”

This should all be done with the RF Gain set to a value of 25 dB. Next go to the sliders under the spectrum display window. Using the slider closest to the word “Spectrum” set the minimum level on the spectrum scale to -135 dBm. Using the slider to the left of that one set the max scale value to -84 dBm. That should give a good starting point for weak signals (barely moving the S-meter on the radio) to just start to pop out of the noise floor while still keeping very strong ones from moving past the top of the display. These numbers are just a starting point and can be played with to get a display that suits your individual preference. One thing that should be noted is that the minimum of RF gain necessary should be used to prevent overload of the SDR receivers front end. Excessive gain will only result in many spurs and possible images from strong broadcast stations appearing in the spectrum. Values should be limited to between 25 and 30 dB for best results. The lower the better.

HSDR Calibration

In most instances the SDR receiver will not be exactly calibrated to the FTdx3000 VFO and will require a correction factor to be entered. The quickest way to check this is to tune in a broadcast station or a station like WWV or CHU on the 3000 using its VFO. Zero beat the station with the tuning knob (should be within 10 Hz or so of the actual broadcast station frequency). Look at the spectral display on HSDR and see where the carrier for the station appears. It should be exactly on the red line at the center of the display. If this is not the case, estimate what the error is from the freq display bar at the top of the spectral display and then pull up the RF Front End and Calibration box through the F7 menu. Go to the **Global Offset** box and enter the error value (in Hz) of the signal. Close the box and go back and recheck the signal. Do this until you match the TR7 frequency with the Spectral Display. At this point you should be able to accurately click on SSB signals and they should appear tuned properly on the FTdx3000.

Using the SDR Receiver Capability of HSDR

Since the signals from the Ftdx3000 receiver are also being received by the SDR receiver in the PAN3K they can be processed by the DSP software in the HSDR program as well. The DSP filtering and other features can be used on received signals. This mode can also be used to more accurately set the freq offset in the previous section by listening to an AM station and matching the audio from the SDR receiver to that of the 3000. The only drawback to using it this way is that there will be a noticeable latency or delay between the real time audio from the 3000 until it actually appears at the output of the HSDR audio from the PC speakers. So it is not very easy to operate in this way but could be suitable for just receiving. Operating CW with the SDR receiver would be almost impossible.

PC / Laptop Hardware Considerations

There is obviously a lot of processing going on between the HRD and HDSDR programs so to get the best results from the system it would be advisable to use a reasonably fast computer, preferably one with at least a dual core processor and it would also need at least 2 free USB ports to support the Ftdx3000 control port plus the SDR receiver data. With both HRD and HDSDR running the computer should be setup with dual monitors so that each program could have its own screen making it a lot easier to see what is going on and access all the features of both programs without having to move and shrink windows around, etc. Plus the logging windows will also need to be popped up in HRD if you use that feature so it gets crowded quickly. The photo below shows a typical setup for the TR7/NRV7/NR-PAN7 running HRD and HDSDR.



Typical setup for a dual screen PC setup

Internal IF Gain Adjustment

If the gain adjustments on the HDSDR program do not seem to be sufficient to allow low level signal operation without creating image problems with strong signals, the amplified IF signal can have its gain varied by a pot adjustment internal to the NR-PAN3K. The photo below shows the location of this adjustment.



The Gain Voltage can be monitored at TP2. The factory default setting for that point is 3.6 Volts. A higher voltage will decrease the gain while a lower voltage will increase it.

Any questions or comments about the NR-PAN7 can be directed to :

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