

**Noble Radio NRV4C Remote VFO / Station Accessory
with Integrated Panadapter for the Drake R-4C/T-4X(C)
Twins**



**Noble Radio
PO Box 509
Ridge, NY 11961
USA**

NRV4C Remote VFO Overview



The NRV4C Remote VFO is designed to operate with the Drake C Line using the R-4C receiver and either the T-4X or T-4XC transmitter in a transceiver setup. The VFO is a highly stable PLL type which can be tuned in fixed steps of 100 Hz or 1 KHz or in a Variable Speed Tuning (VST) mode which changes the step size between 10 Hz and 10 kHz depending on the speed of the tuning knob. These tuning options are all selected by front panel switches. There is a SPLIT mode available which allows separating the receive and transmit frequency to any two points within a band. The front panel LCD indicates which VFO (A for receive and B for transmit) is currently controlling the frequency. A single push button can sync the two VFO's to the current receive frequency and remove the VFO from SPLIT mode. The VFO has a USB CAT port to allow control from an external PC using common rig control programs. There is a Panadapter built into the NRV4C which can be used with HDSDR to display a spectrum around the current operating frequency capable of displaying an entire ham band. Using this feature along with the CAT port allows the radios to be tuned by pointing to a frequency on the spectral display and clicking the mouse. This “point and click” feature vastly improves the operating experience of these vintage radios and gives the Drake Twins an “SDR” feel while preserving the vintage sound and operating controls of the original radios. The NRV4C VFO also allows full HF coverage (excluding the 5.000 to 6.000 Mhz range for transmitting) without any crystals. The normal band crystals in the R-4C are removed and a “Band Data” cable is plugged into the top pin of each crystal socket. This allows the NRV4C to read the band switch of the R-4C and display the position on the LCD of the VFO. The NRV4C limits the highest and lowest frequencies allowed for the current band switch position. Of course the preselector and RF tune controls on the R-4C and T-4X/C must still be adjusted manually to match the operating frequency.

In addition to the VFO and Panadapter functions the NRV4C contains an electronic keyer for CW and a speech compressor for SSB. The keyer is a Winkey 3 type by Steve, K1EL. It contains many many features which include CW memory (for messages), adjustable weighting, keyer type (Iambic A or B, Bug style, etc) and also includes a USB port to allow sending from an external PC running a program that supports Winkey operation. A sinewave sidetone generator is included. An external keyer or straight key may also be used by plugging it into the KEY jack on the back of the NRV4C and programming the Winkeyer accordingly.

The Speech Compressor is a VOGAD type which basically uses an AGC type system to keep the output level of the processor constant over a wide range of input levels. It greatly increases the average output power of the SSB signal with minimal distortion. There is an internal jumper that can be set to provide a “phantom power supply” to the mic pin on the NRV4C front panel which will allow the use of a condenser type microphone. The voltage is fixed at 7.5VDC.

The NRV4C also contains a sound card with a USB connection to allow easy operation of the various digital modes. The received audio is taken from the ANTI-VOX connection on the R-4C. Since this level varies with the volume control setting on the R-4C there is an AGC circuit in the NRV4C to maintain a constant audio level to the sound card over roughly half the range of the R-4C's volume control. In most cases the volume will be set to minimum when operating in these modes. There are additional controls for setting the receive and transmit levels to and from the sound card on the front panel of the NRV4C for easy adjustment while operating.

The NRV4C allows the R-4C to operate in two modes. There is a Ham Band mode which follows the band switch and its allowable frequencies and there is also a General Coverage mode which allows an additional tuning step of 500 Khz for rapid band changes. In the Ham band mode there are 5 memories for each band switch position. In General Coverage mode there is only one memory which acts as a "scratchpad" memory. Additional memories can be had by using the NRV4C with an external rig control program on a PC.

Several other items are included in the NRV4C as conveniences to make operating the Twins easier. There is a front panel toggle switch to put the TX into TUNE in CW mode. This eliminates the difference in power levels between using the TUNE function on the transmitter and then resetting the actual power when keying in CW. There is also a second toggle switch which comes out to a connector on the back panel and is intended to be used to control the VOX on the transmitter. A cable can be made to short the VOX adjustment pot to operate PTT on SSB and then remove the short with the switch to allow the preset VOX level to be used for CW operation. This is especially useful for the T-4X which has the VOX control on the rear of the radio.

There is a connector on the rear of the NRV4C that can be used to supply power to a 12V DC fan to cool the finals on the T-4X/C. If a 4 wire fan is connected it will be set to run at minimum speed to keep it at the minimum noise level.

There is a front firing speaker built into the NRV4C which connects to the R-4C speaker output with an RCA plug connection. There is a jack to plug in an external speaker which will disconnect the NRV4C speaker. The CW sidetone is coupled to the speaker and its level is independent of the volume control on the R-4C.

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Introduction to the NRV4C

The NRV4C is a powerful PLL based Remote VFO and Station Accessory device with an integrated Panadapter for the Drake R-4C. While it can be used with the R-4C receiver alone it is designed to be used with the R-4C and T-4X or XC transmitter in a transceive application. The VFO generates output frequencies between 7.095 MHz and 35.645 MHz to replace the first Local Oscillator in the radios. The signal is filtered and amplified and can drive a standard RG-178 coax line for interconnection to the RX and TX units through the INJ connector. Low capacitance cables do not need to be used for these connections. The NRV4C frequency display will show the actual operating frequency based upon the band switch and what frequency within the band was selected. The data to identify what position the band switch is set for is acquired by installing a “Band Data” cable into the R-4C. The cable is installed in the forward pins of the standard band crystal sockets after the crystals have been removed. It is a plug in operation and no soldering is required. An additional ground wire is also attached to the screw next to the crystal socket bank. The other end of the Band Data cable terminates in a standard RJ-45 connector which just plugs into the back of the NRV4C.

There are several other connections that must be made between the NRV4C and the R-4C and T-4X(C) to allow the entire system to work together. These include MUTE, ANTI-VOX, CW KEY, MIC and Speaker. If the Panadapter is to be used then the Antenna connection must pass through that unit. This is all done through pass through jacks on the rear panel of the NRV4C. The actual connections for these cables will be described in further detail in the following sections.

In addition to these interconnects there are several connections that are made to a PC or Laptop computer to allow the VFO (and therefore the frequency of the “transceiver”) to be controlled by a rig control application running on the computer. With the addition of the Panadapter running with HSDR and Ham Radio Deluxe (HRD) the frequency can be controlled off the HSDR spectral display by a simple click of the mouse on a signal of interest. The frequency can also be set by directly typing the number into the Direct Frequency Entry window in either HRD or HSDR. Memories may also be setup on these programs as well as the 5 hardware memories per Band Switch position in the NRV4C. Third party logging programs may also be used with HRD if so desired and may also have their own frequency control and memory applications. Additionally, the frequency may be “tuned” by rolling the mouse wheel in HSDR. Of course there is also the main tuning knob on the NRV4C which can be used to tune the radio in a conventional manner. HSDR can be setup to easily shift a signal into the proper position for correct offset in CW mode by just clicking on it in the audio spectrum window of the screen or typing a “Z”.

The NRV4C includes a Winkey3 electronic keyer for CW operation and has 5 CW memory buttons on the front panel for storing and recalling CW messages. There is also a USB port connection to the keyer so it may be used in applications such as N1MM and other loggers for contests or general CW sending allowing even more message memories to be available. Keyer speed can be set by a knob on the front panel of the NRV4C or by the PC Winkey application over the USB connection. The Winkey system contains many programmable features that are so comprehensive they will not be covered in this manual. It is suggested that the user go to the K1EL Systems web site

<https://www.k1elsystems.com/keyers.html> and look through the Winkey3 datasheet for all the details on how to get the most use out of this keyer. Check the stand alone operation section of the data sheet on: www.k1elsystems.com/files/WK3_Datasheet_v1.3.pdf

For SSB operation, the NRV4C includes a VOGAD type speech compressor to increase the average talk power of the transmit signal over a wide range of speech levels into the microphone. Separate

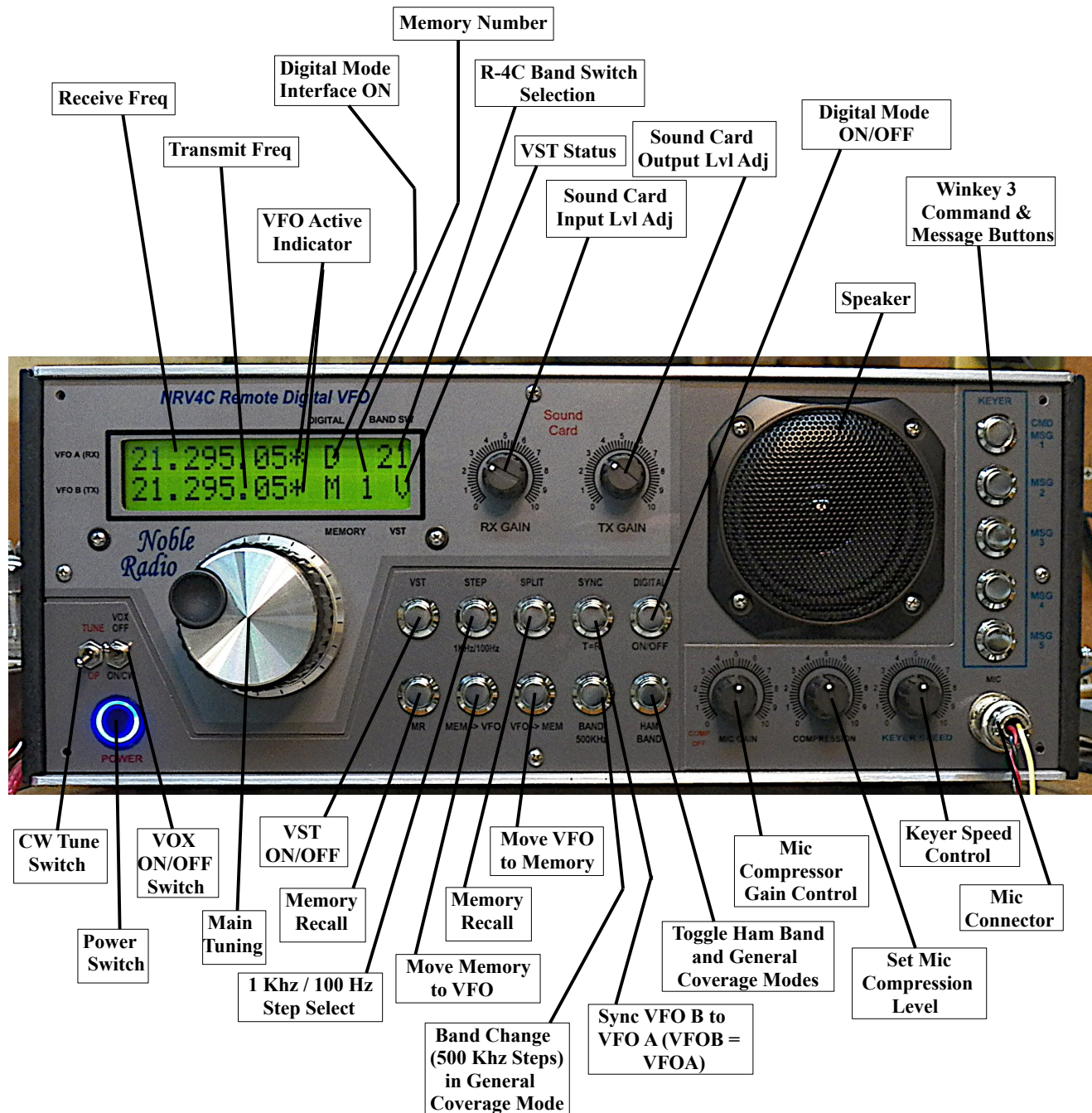
controls for Mic Gain and Compression Level are provided. The Compressor may also be turned off to allow the mic signal to pass straight through to the transmitter. An internal jumper can be set to provide a 7.5VDC “Phantom Power” source to the mic input pin for condenser type microphones. The power is sent through a 10K resistor to protect the voltage source against shorts in the microphone connection.

For digital mode operation the NRV4C includes a Sound Card with a USB interface to connect directly to a USB port on a PC or Laptop. The audio from the R-4C is fed to the NRV4C through the ANTI-VOX connection. Since this signal level varies with the main volume control setting on the R-4C there is an AGC circuit that levels the ANTI-VOX signal before presenting it to the Sound Card input. This allows the R-4C volume (AF Gain) control to be placed from minimum to about the 1 o'clock position and provide a constant signal level to the Sound Card input. There are also Receive and Transmit level controls on the front panel which can further be used to tailor the signal levels going in and coming out of the Sound Card. These along with the Sound Card sliders in the PC sound system allow total control of the audio. A PTT signal is generated by the NRV4C when it detects an audio signal from the sound card and will key the transmitter for as long as the audio is present.

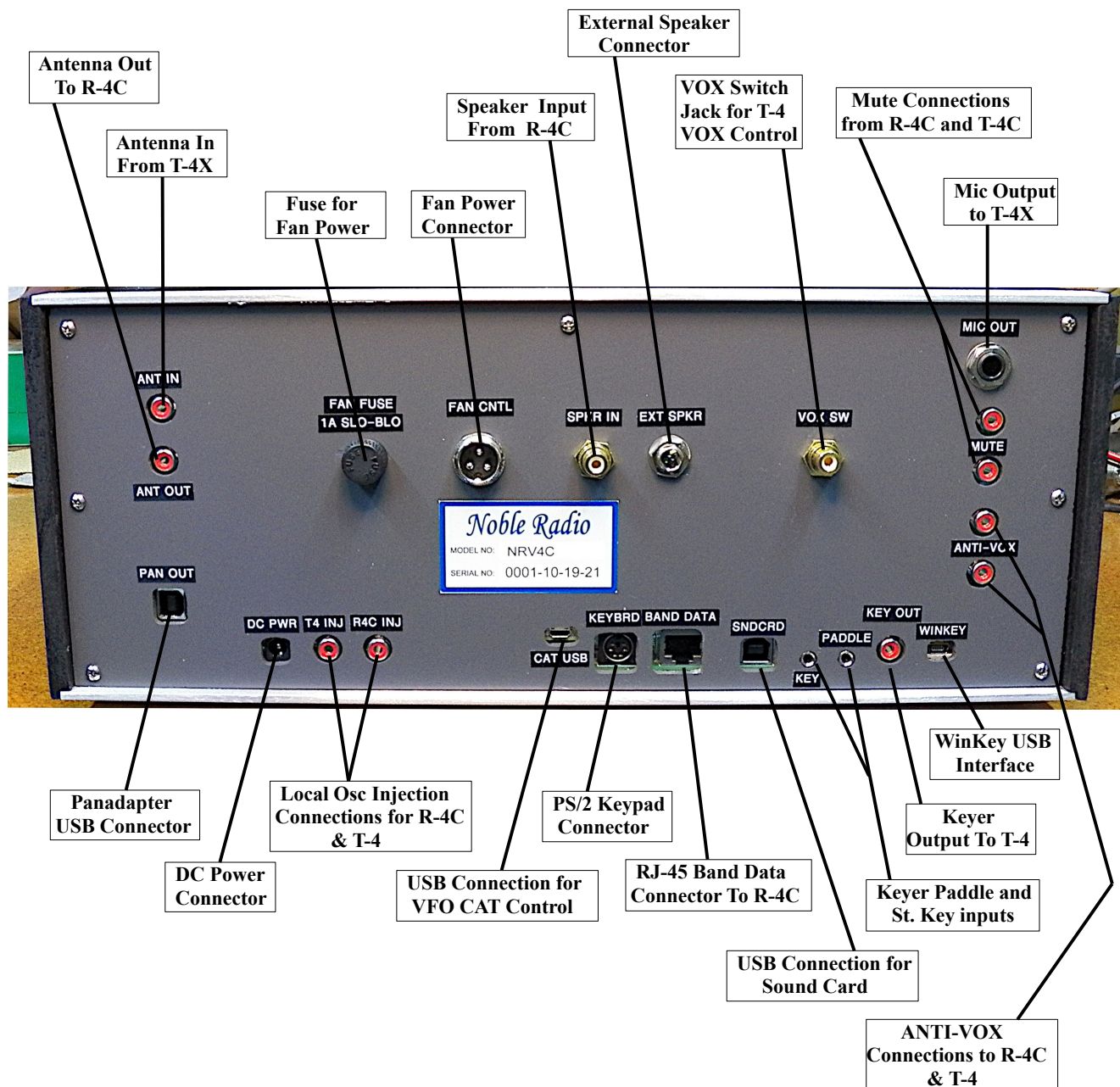
There are two front panel switches provided on the front of the NRV4C to make operation of the T-4X or XC a bit easier. One is a TUNE switch for CW tuneup operation. It keys the transmitter from the KEY jack in CW mode so once the T-4X(C) is tuned the power level will not have to be re-adjusted as it would when using the TUNE mode on the T-4X(C) itself. The second switch is intended to be use to enable and disable the VOX function on the transmitter. This is especially useful on the T-4X when switching between the SSB PTT mode and CW mode. It requires that a two wire cable with an RCA plug be made up by the user and connected across the VOX control on the rear panel of the T-4X and then plugged into the VOX Switch connector on the back of the NRV4C. With the switch in the VOX ON position the VOX control can be set for the delay required for CW operation. When the switch is set to VOX OFF the control is shorted (same as setting to minimum) and PTT operation is active.

Lastly, there is a front firing 3.5 inch high fidelity speaker on the front panel of the NRV4C. It has a power rating of 30W and a 100Hz to 20 KHz frequency response. It provides excellent reproduction of SSB signals with more than enough capability to handle the output power of the R-4C. The speaker output connection of the R-4C plugs into the SPKR connector on the back of the NRV4C. There is also a ¼ in phone jack provided on the same circuit which will disconnect the internal speaker when an external speaker is plugged into it if the user would rather use their own speaker setup.

Front Panel Display and Controls



Rear Panel Connections

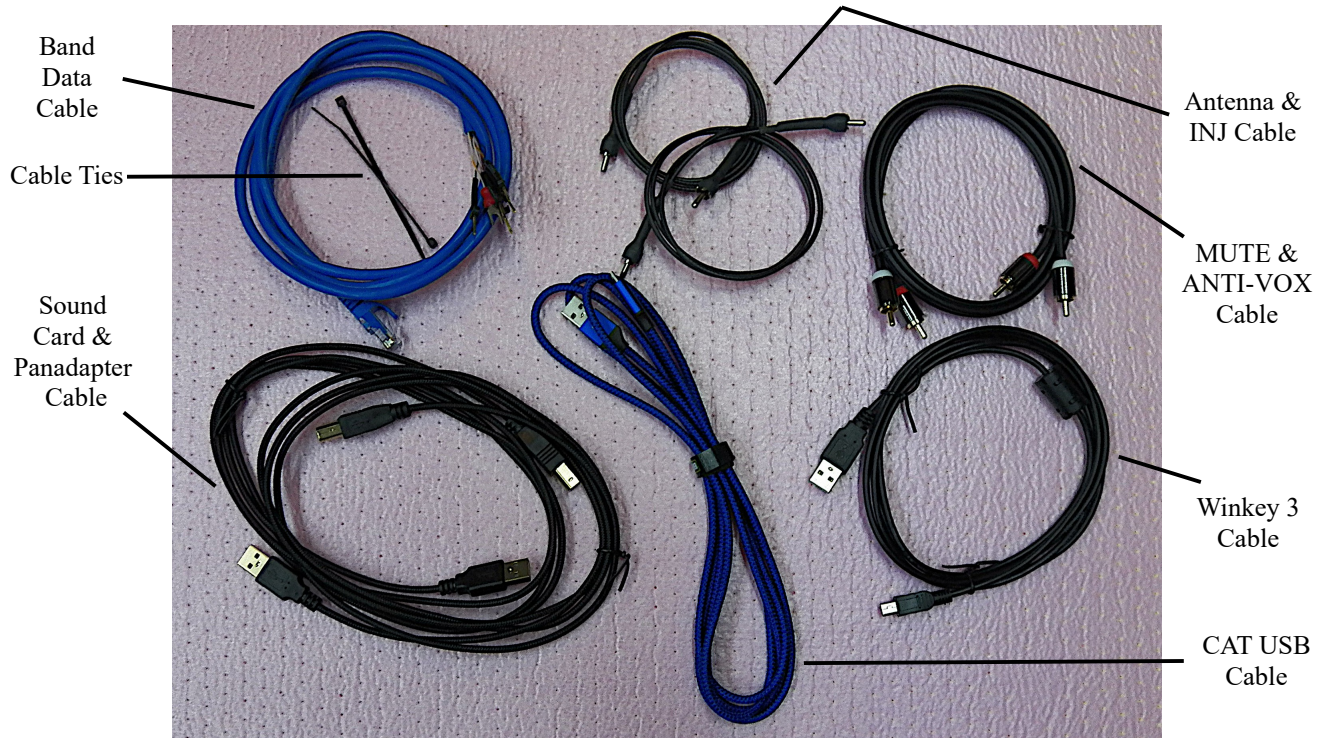


Keyer Paddle Jack: TIP = Dash Connection , RING = Dot Connection, SLEEVE = Common
This is reversible by changing settings in the Winkey chip.

Mic Out: TIP = PTT Connection, RING = Mic Audio Connection, SLEEVE = Ground

NRV4C Setup

The NRV4C is supplied with 4 RCA patch cables, the Band Data cable, 4 USB cables plus a short pigtail cable with a matching connector for the fan power connector. These along with the standard cable set to interface an R-4C with a T-4X or XC make it easy to get the VFO up and running. There is also a wall plug DC Power supply included with the NRV4C to provide power. A regulated 13.8V .5A or greater power supply with a 2.1mm coaxial power plug may also be used to run the NRV4C. A cable for connecting the Mic output on the back of the NRV4C (Standard 1/4in stereo phone plug) to the Mic Input on the T-4X or XC (.21in stereo phone plug) must be fabricated by the user in order to operate voice or digital modes. An optional cable for this is available from Noble Radio.



The RCA patch cables are used to connect one leg of the MUTE, KEY, INJECTION to R-4C and T-4X(XC) as well as the ANT IN and OUT. The ANTI-VOX and SPKR IN connections are made with the existing cables from the original R4/T4 setup. USB cables will connect the PAN OUT, CAT USB, Sound Card and WINKEY ports to the host PC or Laptop.

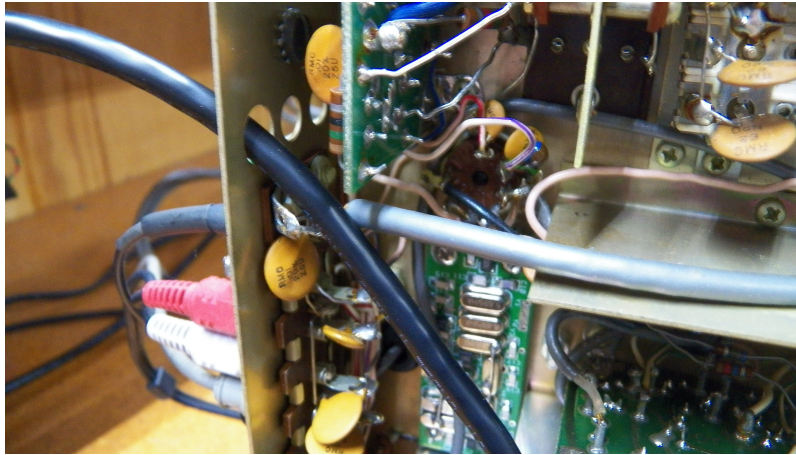
NRV4C Band Data Cable Installation

The first step in setting up the NRV4C for operation with an R-4C is to install the BAND DATA cable into the receiver. To do this the top and bottom covers will need to be removed from the R-4C.

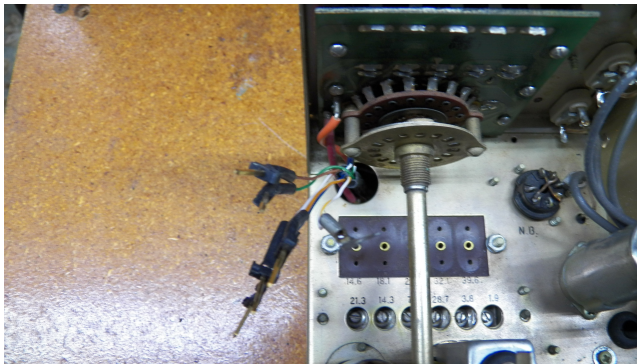
IMPORTANT: BEFORE ATTEMPTING TO INSTALL THE CABLE BE SURE TO TURN THE POWER SWITCH OFF AND UNPLUG THE RADIO FROM THE AC OUTLET.

With the covers removed unplug the 5 crystals from their sockets at the back left corner of the R-4C in front of the auxiliary crystal switch. Save the crystals in case the radio will need to be restored to its original condition in the future.

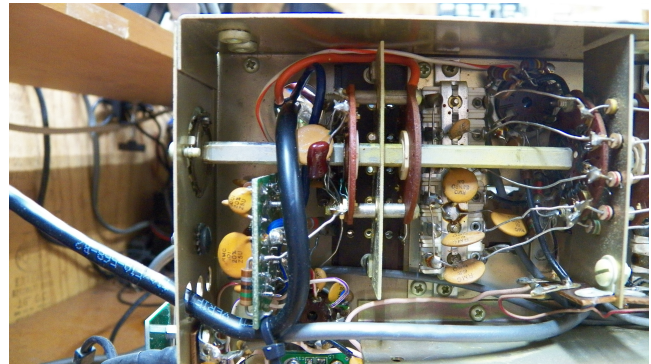
Next take the end of the band data cable with the pins at the end and route that through the large hole at the bottom of the rear panel on the left side (looking from the front of the radio) of the chassis as shown in the photo below.



Next route the pins and ground lug through the hole on the top of the chassis which is right behind the band crystal socket strip. Take your time with this and do 2 or 3 pins at a time and be careful to make sure all the wires come through in front of the three larger wires in the hole. A bit of patience is required here. When the wires are properly through the hole it should look like the photos below.



BAND DATA Cable from Top of Chassis

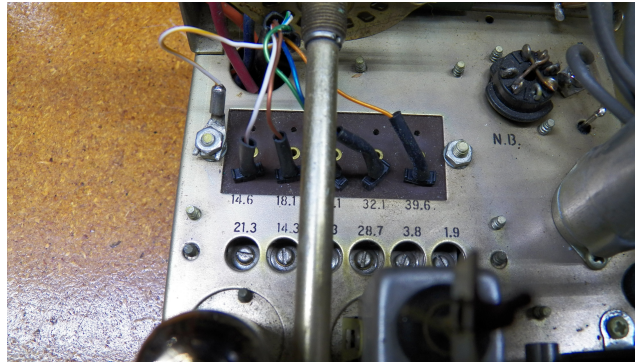


BAND DATA Cable from Bottom of Chassis

Once the cable is through the hole to the top of the chassis allow the insulated sleeve of the cable to extend approximately 1 inch above the top of the chassis. Secure the BAND DATA cable to the piece of gray coax cable on the bottom side with the provided cable tie as shown in the bottom side photo. Return to the top of the chassis and plug the pins into the front hole of the appropriate crystal sockets as outlined in the table below. Be sure that they are fully seated in the socket.

CRYSTAL POSITION	WIRE COLOR
#1 (14.6 MHz)	White/Brown stripe
#2 (18.1 MHz)	Brown
#3 (25.1 MHz)	Green
#4 (32.1 MHz)	Blue
#5 (39.6 MHz)	Orange

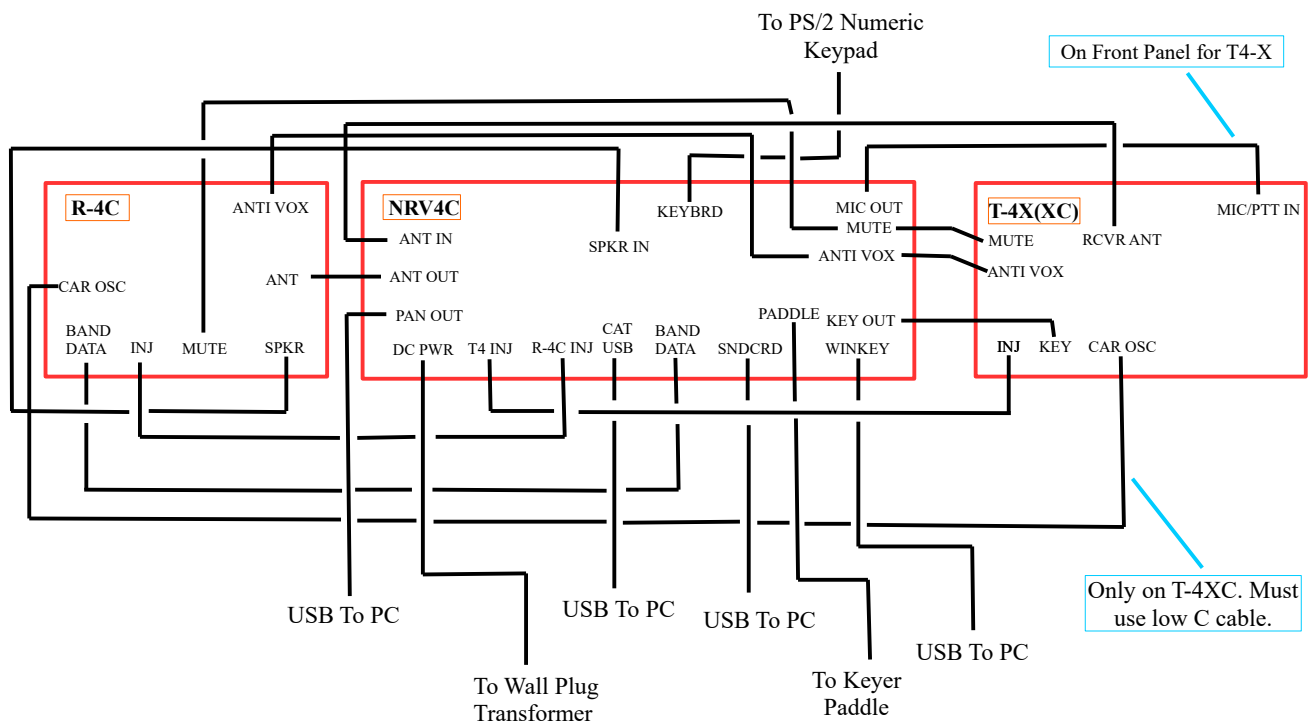
Once these are in place secure the ground wire (White/Orange stripe) with its lug to the screw on the left side of the crystal socket strip using the #4-40 supplied nut. The final installation should look like the photo below.



At this point the bottom cover can be installed but leave the top cover off until the operation of the cable is checked to make sure there are no errors in pin placement.

Connecting the NRV4C to the R-4C and T-4X(XC)

The next step in setting up the NRV4C is to make the cable interconnections between the NRV4C, R-4C and the T-4X(XC). The following diagram shows how the units interconnect.



This is the basic interconnect configuration to get the system up and running with a PC connected. Use the original interconnect cables plus the cables that are supplied with the NRV4C to make the connections as shown. Once the units are connected together the setup may be tested. Be sure to plug in

the supplied 15VDC wall transformer for the NRV4C power supply.

Before using the R-4C / T-4X (XC) with the NRV4C the XTALS switch on both the receiver and the transmitter must be in the NORM position and the R-4C should be used in the EXT MUTE position.

To power up the units the R-4C should be turned on first and wait until a hiss is heard from the speaker in the NRV4C. Then press the power switch on the NRV4C. The power switch LED should light and an “R” (dit-dah-dit) in CW should be heard from the sidetone through the speaker. That is confirming that the CW Keyer has powered up and is running. The revision message should appear on the display and after a couple of seconds that should be replaced with the standard frequency display and the R-4C should come alive because the VFO is now generating the local oscillator signal and sending it to the INJ ports. The current band switch position on the R-4C should be displayed on the right side of the top line of the display on the NRV4C. An allowed frequency within that band switch position should also be displayed on the VFO A and B lines on the display. To power everything down the T-4X transmitter should be turned off first then the NRV4C should be turned off and finally the R-4C. If the R-4C is turned off before the NRV4C it will see the bandswitch as being in the 160M position and if the VFO was in a higher band it will save the 160M memory as 3.000 MHz since it stops at the high end of the allowable frequency range for that bandswitch position.

The BAND DATA cable connections can now be checked by rotating the R-4C band switch through all of its positions and the display on the NRV4C should follow it. If this is not the case re-check the positions of the wires in the crystal socket in the R-4C and be sure that they are all securely seated in the forward pin of the crystal sockets. Also check to be sure that the RJ-45 connector on the back of the NRV4C is seated properly in its connector.

If all is well at this point the R-4C can be peaked up for the frequency set by the VFO in the usual manner. If it is not on a Ham Band, the easiest way to change to the desired frequency is by using the memory function or by use of the CAT port with a PC rig control program. The NRV4C has 5 memories for each band switch position and the first two memories have been programmed with a valid ham band frequency for each band switch position. Some positions only include one ham band while others may cover two. The following chart lists the bands that are valid for each position of the band switch.

Band Switch Position	Valid Ham Bands
1.5 – 3.0	160M (1.8 – 2.0 Mhz)
3.5	80M (3.5 – 4.0 Mhz)
3.5	60M (5.3 – 5.405 Mhz) This is for Receive Only .. Do not attempt to transmit on the 60M band !
7.0	40M (7.0 – 7.300 Mhz)
14.0	30M (10.100 – 10.150 Mhz) 20M (14.0 – 14.350 Mhz)
21.0	17M (18.068 – 18.168 Mhz) 15M (21.0 – 21.450 Mhz)
28.5	12M (24.890 – 24.990 Mhz) 10M (28.0 – 29.7 Mhz)

While these are the valid ham bands for each band switch position the R-4C / NRV4C combination can cover much greater range than just these bands. The following chart lists the total frequency range for each band switch position.

Once the R-4C and NRV4C are operating properly together the T-4X (XC) can be turned on and checked for proper operation. Once this is established the cover can be installed on the R-4C.

Band Switch Position	Allowed Frequency Range
1.5 – 3.0	1.5 – 3.000.00 Mhz
3.5	3.000.01 – 5.405 Mhz
7.0	6.000 – 10.000.00 Mhz
14.0	10.000.01 – 16.000.00 Mhz
21.0	16.000.01 – 23.000.00 Mhz
28.5	23.000.01 Mhz – 30.000.00 Mhz

When operating outside of the 160, 80, 40, 20, 15 or 10 meter ham bands care must be taken to insure that the preselector is tuned to the proper resonance point for the selected frequency or out of band operation can occur. This goes for the R-4C as well as (and especially for) the T-4 transmitter. The following chart shows the approximate preselector settings for each ham band. **Be sure that the R-4C and the T-4 transmitter are at the same settings before transmitting to prevent out of band operation.**

Ham Band	Preselector Scale Setting
160 M	As Marked (2.5 - 4)
80 M	As Marked (2.5 - 4)
60M (Receive Only)	6.5 – 7 (Receive Only)
40 M	As Marked (5 - 6)
30 M	Approximately 4.9
20 M	As Marked (7.5 - 8)
17 M	Appox 7.6 (in the 20M marking)
15 M	As Marked (8.5 - 9)
12 M	Approx 8.5 (start of 15M marking)
10 M	As Marked (9 - 10)

Connecting the NRV4C to a PC

Although the NRV4C can be used stand alone with the 4 Line Twins it is highly recommended that it be interfaced to a PC or Laptop to obtain the most benefit from its capabilities. The following descriptions will assume that the NRV4C is connected to a PC running HRD (Ham Radio Deluxe), HDSDR and either the HRD logging program or a third party logging program connected to HRD.

The NRV4C utilizes the CAT protocol for the Kenwood TS-480. Once HRD is installed and running the NRV4C can be connected by defining it as a TS-480 using a baud rate of 9600. Determine the COM port that the NRV4C has been assigned by using the Windows Device Manager. Open Device Manager and click on the COM ports item. It will list all the COM ports in the system. Unplug the USB cable from the CAT port from either the back of the NRV4C or the PC and see which port number is removed from the list. That is the COM port for the NRV4C. Replace the cable and use that port to complete the rig definition for HRD. Click on Connect in HRD, select the rig that you just defined and it should connect to the NRV4C and show the main screen with the current frequency of the VFO. The frequency can be changed by holding the cursor over one of the digits in the main frequency display and scrolling the mouse wheel. You can also click on the frequency bar below the main display to move the frequency. Turning the main tuning knob on the NRV4C should also change the frequency of the display in HRD. If this is working then there is a successful connection to HRD.

The USB port in the NRV4C should be automatically recognized and a driver installed when it is connected to a PC running Windows 10. Other versions of Windows may not automatically do this. In that case a driver will have to be installed. Use the driver installation program provided on the CD that comes with the NRV4C. Once this is done the PC should recognize the USB port which can be verified with the Windows Device Manager. Note that it may show up as a Virtual COM port.

At this point it is assumed that HSDR has been installed on the PC. This program is available for free download at www.hdsdr.de, you should use v2.80 or later. All discussions about HSDR in this document will assume v2.80.

Make sure that the USB cable is plugged into the PAN OUT connector on the back of the NRV4C and the other end to a free port on the PC. Start HSDR and it should display a spectrum on the PC display. The program needs to be linked to HRD through its DDE interface. To do this click on Options (or press F7) and in the pop up menu select DDE to HSDR. In the small window that pops up select HRD for DDE Format and TUNE for Sync Type. At the bottom of the window there should be a line that is green and says Status: connection OK. If it is not connected and red then click on the Manual Connect button and then it should connect and turn green. Once the connection is established close the window. Before the system can be used with the NRV4C a few more parameters will need to be setup. Once again pull up the Options menu and select RF Front End Configuration. When the configuration menu pops up the following items need to be set:

Select "SDR on IF output, which is controlled" and select "by HRD (DDE)" in the box at the end of the line.

Next select for the Sync Mode, Full Sync in both directions.

Next enter the IF Frequency as 43645000 Hz. Be sure to get this correct or the spectrum will not be showing what the R-4C is actually looking at.

At the end of the window check:

Mirror RF Spectrum in General

Operate CW in Lower Sideband (LSB)

Leave all the offsets at 0 for now. These will be adjusted later to get the spectrum display exactly on frequency.

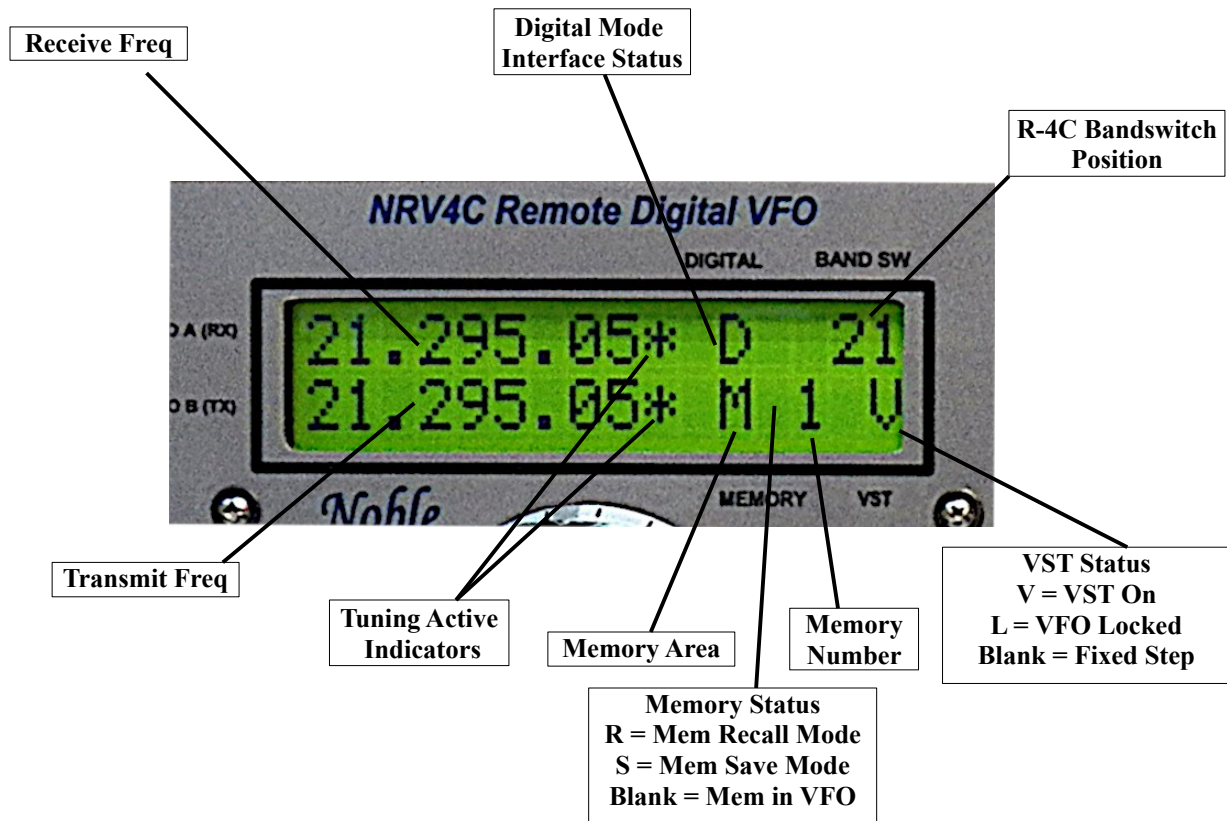
Now hit Apply and then close the window. The spectrum should now show the same frequency as the NRV4C and if an antenna is connected to the system a display of signals around the VFO freq (which will appear in the center of the screen) should be visible on the screen. Moving the tuning knob should

change the frequency in HRD and HDSDR. Place the red vertical tuning line controlled by the mouse over a signal in the spectral display and left click and the NRV4C should immediately go to that frequency and you should hear the signal you are watching on the display assuming the correct sideband is selected. To tune a signal using the mouse click on a signal in the spectrum display you need to first put the NRV4C into the correct mode. The NRV4C selects mode by looking at what controls the operator is using. If you want to go into CW mode then tap one of the paddles on the keyer and the mode in HRD and HDSDR should change to CW and the spectral display will show a narrower filter (the blue box by the red line in the center of the display is the filter area). Once the CW offset and Pitch are set in HDSDR a signal can be tuned for zero beat by placing the mouse cursor exactly over the signal and clicking. The signal should then have the same pitch as the CW offset set between the R-4C and the T-4 transmitter.

To put the NRV4C into SSB mode the PTT line on the mic needs to be enable briefly. The mode will change to USB or LSB on the HRD display and also on the HDSDR mode buttons below the spectral display. IF a logging program with a rig control window is also connected then it should also change there. The blue filter box on the HDSDR display will now get wider and show on either the left (LSB) or right (USB) side of the red center tuning line. The NRV4C determines what sideband mode to send (either USB or LSB) by looking at the frequency. If the frequency is 10.000 MHz or above then USB will be used. If it is below 10.000 MHz then LSB will be used. To tune in an SSB signal with the mouse off of the HDSDR spectral display the tuning line needs to be at the zero beat frequency when clicking the mouse. So if a USB signal is on the display the mouse should be positioned to the left side of the signal and clicked. The right side would be used for an LSB signal. Using the default settings in HDSDR the phone bands are setup for 500 Hz steps so that when you click near a signal the closest 500Hz freq to the value clicked will be set.

These are the basic steps in setting up the NRV4C and verifying the basic frequency control functions are working. More detail on other functions and advanced use of the PC controlled functions will be presented in later sections of this manual.

Display Description



Transmit & Receive Frequencies – Shows the frequency currently being received and the frequency that will be used for transmit mode.

Tuning Active Indicators (*) - If the * is on, it means that VFO will be tuned by the Main Tuning knob (and by CAT commands). If the * is off, then that VFO will not be affected by tuning.

Digital Mode Interface Status – If a D is shown in the display then the Sound Card interface is ON for transmission. The receive interface is always connected. When it is ON the Mic circuit is disconnected from the TX Audio to the transmitter. When it is OFF the Mic is connected and the Sound Card output and the Sound Card generated PTT signal is disconnected.

Memory Area, Status and Number – The M indicates the memory area on the display. The number shows which memory was selected. If an R is present between the M and the memory number (for example MR0) then the **Memory Recall** mode is on (press MR button). When in this mode turning the Main Tuning knob will scroll through the 5 memories (0 – 4) showing the memory freq on the display and tuning the radio to that frequency as well as sending the new frequency out the USB CAT port. If the user wants to go back to the original frequency that was set in the VFO before pressing the MR switch then the MR switch should be pressed again and the VFO will be restored and the R will be removed from the display.

If a frequency is to be saved in the selected memory number then the VFO → MEM switch should be

pressed which will show an S on the display between the memory number and the M. It will last for about 2 seconds before being removed and leaving a blank character again. The memory shown on the display will then contain the value of the current VFO frequency.

VST Status – If this character is a V then the VST (Variable Speed Tuning) mode is enabled. In this mode the faster the Main Tuning knob is turned the bigger the tuning steps will be. If it is OFF (character blanked) then the VFO is in a fixed step tuning mode and the step size will be either 100Hz or 1 kHz. The 100 Hz or 1 kHz digit will be underscored on the top frequency display (Receive freq) to indicate which step size is currently selected. This can be changed (toggled) by pressing the STEP switch.

If there is an L on the display in this character position then the VFO is locked and the Main Tuning knob will have no effect on the VFO frequency. The VFO will also not be changed by CAT commands over the USB port. The Lock function can only be controlled by the PS/2 keypad using the “.” key.

Front Panel Switch Functions

A) VST (Variable Speed Tuning)

The VST switch will allow you to tune with progressively larger step sizes based on the speed that the tuning knob is turned. The steps are 10 Hz, 100 Hz, 1 KHz and 10 KHz. This allows quick excursions across the larger bands while still providing fine tuning of a signal once at the desired frequency. When the VST function is active a “**V**” will appear at the end of the bottom line of the display (see photo in Display description section).

Pressing the VST button repeatedly will turn the function on then off. When the function is off then the VFO tunes in fixed 100 Hz or 1 KHz steps depending on the state of the STEP function.

B) STEP 1KHz/100Hz

This switch will toggle the fixed step size mode between 100 Hz steps and 1 KHz steps. The selected step size will be indicated by an underscore line under the digit being changed on the top line frequency display (VFO A (RX Freq)).

C) SPLIT

SPLIT Mode allows either VFO A or B to be selected for tuning. VFO A will determine the receive frequency and VFO B the transmit frequency. When SPLIT is pressed the VFO B Tuning Active indicator (“*”) will turn off indicating that any frequency changes made (by either the Tuning knob or a USB CAT port command) will only affect the VFO A (receive) frequency. VFO B will remain as it was. If the SPLIT switch is pressed again the VFO A Tuning Active indicator will turn off and the VFO B indicator will turn on indicating that any frequency changes made will only affect the VFO B (transmit) frequency. Repeated pressing of the switch will just toggle between the two VFO's. When the transmitter is activated the Tuning Active indicator position on the display next to the VFO B frequency will be replaced with a “T” for as long as the transmitter is active. When coming out of transmit, if the VFO B was left as active it will change the frequency to VFO A (receive) automatically and show the “*” next to VFO A frequency.

D) SYNC T=R

The SYNC switch should be used when the NRV4C is in SPLIT mode and you want to exit that mode. It will set the transmit frequency (VFO B) to the VFO A frequency with no split offset.

E) DIGITAL ON/OFF

The DIGITAL ON/OFF button will connect the Mic audio input connection to the T-4X (XC) to either the sound card interface or to the Mic interface (either direct Mic connection or through the Speech Compressor). When D appears in the top line of the display the Sound Card is connected. When it is off the Mic circuit is connected. When the Sound Card is connected it will also connect the digital VOX circuit to the transmitter's PTT line so whenever any tones come out of the Sound Card it will key the transmitter. This function is disabled when DIGITAL mode is off.

F) MR

The MR switch will put the NRV4C into the Memory Recall Mode. An “R” will be displayed on the bottom line of the display between the “M” and the memory number (see the photo in the Display Description section). When in this mode the Main Tuning knob is used to scroll through the memories. There are 5 memories for each band switch position on the R-4C. As the memories are scrolled the R-4C will be tuned to the displayed frequency for the selected memory. If the MR key is pressed a second time the VFO's will go back to the last frequency they were on before the MR was pressed the first time. This allows the selection of any memory that can then be used to save the original frequency using the MEM → VFO and VFO → MEM keys.

G) MEM → VFO and VFO → MEM

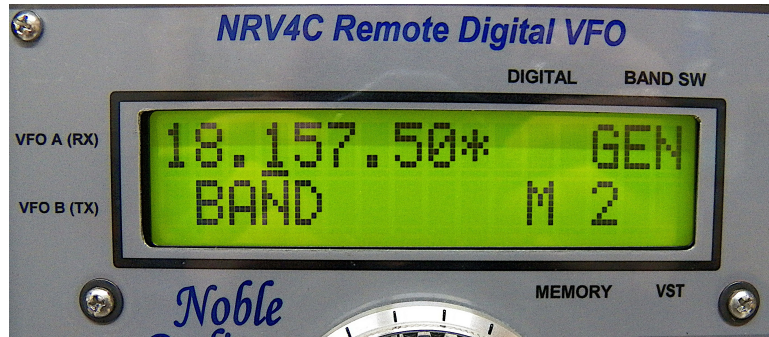
The MEM → VFO and VFO → MEM keys are used in conjunction with the MR function. To retrieve a saved frequency from one of the memories the MR function should be selected first and then use the Main Tuning knob to pick the memory you want to retrieve. Once that is selected press the MEM → VFO button and the “R” next to the “M” on the display will blank and the VFO's will be set to the frequency in the memory. The tuning knob will now act as a frequency tuning control again. To save a frequency into a memory, use the MR function to select a memory number to save to and then press MR again to come out of MR mode. Next press the VFO → MEM switch and an “S” will be displayed between the “M” and the memory number on the display for about 2 seconds before it is blanked. At that point the current VFO frequency is saved in the memory number displayed on the bottom line of the display.

HAM BAND and BAND 500 Khz

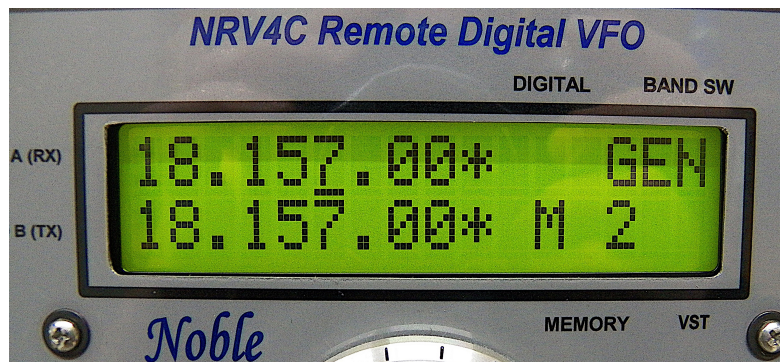
The HAM BAND switch toggles the NRV4C between Ham Band and General Coverage operation. In Ham Band operation the NRV4C limits the allowed frequencies for each band switch position of the R-4C. It also provides 5 memories for each band switch position.

In General Coverage mode The NRV4C ignores the band switch position of the R-4C and just sets the VFO to the frequency that is set by the Tuning knob or from USB CAT commands. It is up to the operator to be sure that the radios band switch and preselector are set properly for the selected

frequency of operation. There is only one memory in the General Coverage mode which is the one that holds the current frequency. If the VFO is switched back to Ham Band mode it will go to the last Ham Band frequency it was set for before General Coverage mode was selected. Switching back to General Coverage mode will set the VFO to the last General Coverage frequency that was used. While in General Coverage Mode the BAND/500KHz button can be pressed and the display will change to show it is in the band select mode as in the photo below. Note that the step size underscore line is now under the 100 KHz digit since the step size is 500 KHz. Note also that the Band Switch value has been replaced by GEN to indicate the General Coverage mode.



Turning the Main Tuning knob will now provide a 500KHz step size to get through the HF spectrum very quickly. Once the frequency is in range of the desired value the BAND/500KHz button can be pressed and it will revert to the normal General Coverage display with normal tuning rates as was previously described. The normal General Coverage display looks like the photo below.



Using the Internal Sound Card

The NRV4C contains its own sound card that is interfaced to a PC using the supplied USB cable. There are no drivers that need to be loaded into the PC. The sound card will work with programs such as WSJT-X, Digipan and Fldigi. To setup for use with a digital communication program that program must be loaded into the PC and configured to use the USB Sound Card in the NRV4C as the audio device. The device name can be found using the Device Manager in Windows. Open the Device Manager and click on "Audio inputs and outputs". Device Manager will display a list of all the audio devices in the system. The Sound Card in the NRV4B will be shown as "USB Audio Device". If there is more than one USB audio device in the system they will be numbered. To find out which is the one in the NRV4C unplug the USB cable to the Sound Card in the NRV4C and see which device is

removed from the Device Manager list. That is the one to use in any digital communications programs with the NRV4C. Plug the cable back in and configure the program for the device.

Use the RX Gain control in the sound card area on the front panel of the NRV4C to set the receive level so as not to overload the sound card input. Adjust so there is just a slight amount of background noise in the waterfall with no signals present or until the signals do not increase in amplitude on a spectral display such as the one in WSJT-X. This should provide good sensitivity without any overdriving of the sound card. This level is usually around 2 – 3 on the control scale. The NRV4C has an AGC circuit in it to keep the audio from the ANTI VOX line at a relatively constant level to the Sound Card input circuit. So the AF Gain control on the R-4C can be anywhere from minimum to around the 1 o'clock position and will not change the setting that was made with the front panel RX Gain control on the NRV4C.

To setup for making a transmission using the sound card, set the TX Gain control on the front panel of the NRV4C to minimum. Set the Mic Gain on the T-4X (XC) for a desired power level using the TUNE function on the transmitter. Set the MODE on the T-4 and the R-4C to USB. Boot the digital program on the PC. We will assume that WSJT-X is being used for FT8 and has been configured to use the NRV4C Sound Card. Press the DIGITAL ON/OFF button on the NRV4C (the D should appear in the top line of the display). Click the TUNE button in FT8 and the T-4 should go into transmit mode with almost no output power. Slowly advance the TX Gain control clockwise and the output power should start to increase. To get maximum output power advance the TX Gain control on the NRV4C until the point where the output power does not increase any further then back off until the power just starts to decrease. That is the point just below where the ALC starts to kick in. Do not operate with the ALC active, it will just create distortion products in the audio and make for a messy transmitted spectrum. Once the setting has been reached click the TUNE button again in FT8 to turn the TX off and return to the receive mode. At these settings the C Line Twins are ready to operate in Digital Mode. If a lot of digital operation is anticipated it is highly recommended that a cooling fan be used over the final amplifier tubes drawing air from the tube cage out the top. Constant FT8 operation is basically a 50% duty cycle. Modes like PSK31 or RTTY can be even higher and lower output power should be used for extended operation on these high duty cycle modes. The TX GAIN control on the NRV4C can be used to lower the output power easily.

To make sure that the VOX circuit in the NRV4C has enough signal to key the PTT line to the T-4 transmitter with its internal VOX circuit, the volume control slider for the USB card in the Windows Audio Mixer should be set to between 80% and 100%. Use the TX Gain pot on the NRV4C to reduce the level to the T-4 Mic to set the power level.

Microphone Connection and Using the Speech Compressor

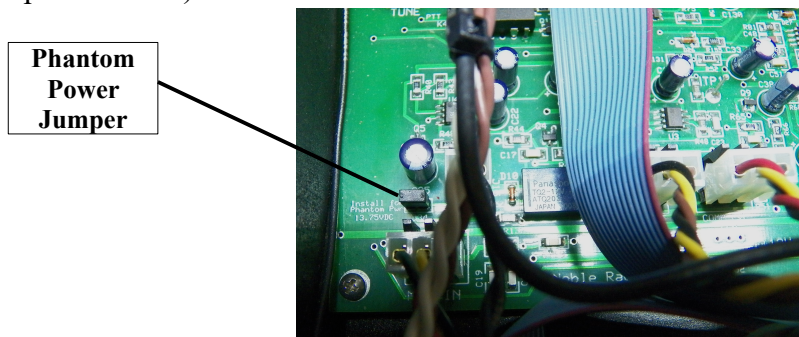
The NRV4C has a built in VOGAD (Voice Operated Gain Adjusting Device) speech compressor. It is basically a mic amplifier with an AGC system to increase the gain on lower input levels and reduce the gain for higher mic input levels. This tends to keep the average microphone input level to the transmitter at a relatively constant level and provides a higher average output power level with very low distortion. The compressor is switched on by the MIC GAIN control on the front panel of the NRV4C. The control can then be used to set the mic input level to the VOGAD circuitry.

Start by tuning the transmitter with the TUNE function in SSB mode to the proper output power. Once that is established turn on the compressor with the MIC GAIN control and advance it to between 4 and 5 on the scale. Set the COMPRESSION control to 3. Depending on the microphone used the MIC GAIN should end up between 4 and 7 to produce a leveled output with low level audio to very loud levels. Backing a couple of inches away from the mic should produce the same output power as being

right on top of the microphone. Do not advance the compression control too far or it will eventually lead to clipping of the signal and distortion. A range of 3 to 6 should be fine for most microphones. While these settings should work with most microphones some on the air tests will also give a better indication of the optimal settings to use for your particular microphone. The VOGAD compressor can be left on all the time, even when running digital modes since engaging the sound card interface for transmit will disconnect the VOGAD processor automatically. With proper setting of the compressor you should see a noticeable difference in average output power with the compressor on and off. The input to the processor has the option of providing a phantom voltage source to power condenser type microphones or electrets, etc. A 7.5 V source is supplied with a 10K series resistor as a current limiting device. The voltage is applied to the mic connector by a user configurable jumper inside the NRV4C. The jumper is disconnected when shipped from the factory so to apply the voltage the user must open the cover of the NRV4C and move the jumper. Microphone types such as high impedance crystal mics do not require any phantom voltage and the jumper should be removed when using those. Dynamic mics also do not require it but if the voltage is applied it should not damage the microphone. Note that the mic input circuits for the Drake T-4 series transmitters are designed for a high impedance microphone like a crystal type. Running a low impedance dynamic or studio type condenser microphone directly into the T-4 transmitter (compressor switched OFF) will not work. You will only get a few watts of bad audio out of the microphone this way. To use a low impedance microphone always run it through the NRV4C compressor. The compressor will act as an impedance matching device as well as a compressor and provide good audio from the T-4 series transmitters. A high impedance crystal mic can also be used with the compressor without issues but the Mic Gain would need to be lowered probably to a 2.5 to 3 on the Gain control.

To connect or disconnect the phantom voltage the top cover of the NRV4C needs to be removed. Turn off the power on the NRV4C when doing this to prevent damage if any screws fall into the unit when removing the cover and short something on the main PCB. To do this remove the 6 screws in the black top cover plate and then remove the two screws on the ends of the aluminum rail at the BACK of the unit. Remove the center screw at the top of the back panel. **DO NOT TRY TO REMOVE THE CENTER SCREW ON THE TOP OF THE ALUMINUM RAIL. ONLY REMOVE THE CENTER SCREW FROM THE TOP OF THE BACK PANEL.**

Lift the aluminum rail slowly which will also lift the top cover plate. Remove the plate and the rail and set them aside. The jumper is located at the front left corner of the Main PCB right behind the front panel (see photo below).



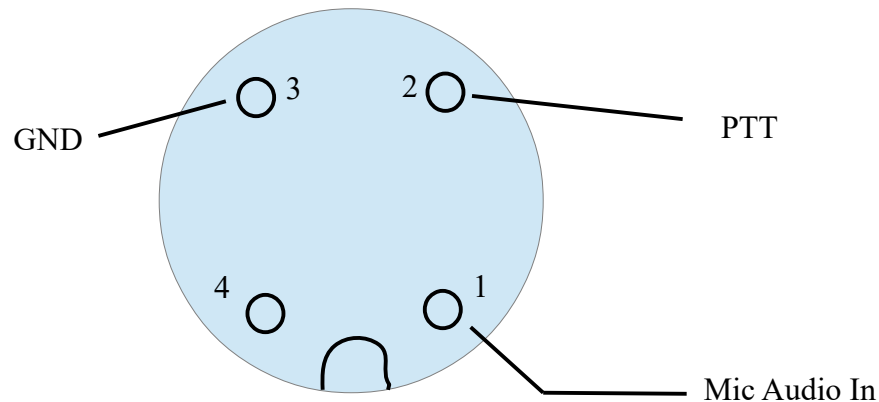
To connect Phantom power to the microphone place the jumper on the two pins as shown in the photo. To remove power either remove the jumper or just place it on one pin (leaving the second pin visible) so that it is stored in the unit for use at another time.

Once that is done the top cover and aluminum rail can be replaced. The cover plate has a small dot at

the center of one of the long edges. That should be on the inside and to the front of the enclosure so that all screw holes line up correctly. The aluminum rail should be put in place along the back edge (be sure that the center “L” bracket is on the inside of the back panel) first then the top plate set with the front edge behind the aluminum and laid down on the enclosure. A bit bit of pressure to the front may be required to allow it to drop into place in front of the back rail. Replace the screws and it is complete. Do not over tighten the screws. They should be installed using a hand screwdriver (not a screw gun or drill) and just made a tight “snug” since the side panels are made of MDF material and excessive force in tightening the screws can strip the holes.

The microphone connector pins are setup as shown in the diagram below:

Microphone wiring for NRV4C 4 pin Plug on Front Panel – Front View



The VOGAD compressor can be left on all the time, even when running digital modes since engaging the sound card interface for transmit will disconnect the VOGAD processor automatically.

Using the NRV4C with an External Keypad

The NRV4C has a PS/2 connector on the rear panel to allow the operator to control the unit with a keypad in addition to the front panel pushbutton switches. The keypad also adds a couple of extra functions that are not available from the front panel switches. The keypad is arranged so that the numeric keys 0 – 9 are defined as function keys and duplicate the 10 main front panel pushbutton switches. They are defined as follows:

1 = VST, 2 = STEP, 3 = SPLIT, 4 = SYNC, 5 = MR, 6 = BAND/500KHz, 7 = HAM BAND
8 = DIGITAL ON/OFF, 9 = VFO → MEM, 0 = MEM → VFO

In addition to these keys the “.” (Decimal Point) key will Lock and Unlock the VFO. When Locked an “L” will appear at the end of the second display line (where the V for VST goes).

The “+” and “-” keys can be used to jog the frequency +/- 500 Hz.

The keypad is not required to operate the NRV4C but the Lock and 500Hz jog functions are only available with the keypad.

Using the Winkey3

The NRV4C contains a Winkey 3 electronic keyer chip to take care of all the keyer functions. It can be

used with a paddle in various modes (Iambic A or B, Bug style, etc) and all parameters are configurable using the CMD switch on the front panel and the paddle. The keyer can also be controlled by its USB port on the back of the NRV4C. It will interface with any software that can control a Winkey chip. Some programs are N1MM, Winlog32, HRD, Winwarbler, etc. The USB port must be identified by using the Device Manager in Winodws (use the same procedure defined in the **Connecting the NRV4C to a PC** section) and then that port is used in the configuration portion of the program which will control the Winkey 3 chip.

A few of the basic commands will be reviewed here but the command set is so extensive it is not practical to include all of the details for all of the features in this document. As was stated at the beginning of this manual the full data sheet for the chip can be found on K1EL's website at:

www.k1elsystems.com/files/WK3_Datasheet_v1.3.pdf

Check the stand alone operation section of this data sheet.

The keyer can be used without any configuration leaving the default settings in tact. The keyer speed is controlled by the front panel KEYER SPEED control near the Mic Connector. The 5 push button switches arranged vertically on the right hand side of the front panel are used for entering commands and saving and retrieving stored CW messages. To enter a command press and hold the CMD/MSG1 button until the keyer responds with an "R". At that point the command would be entered using the paddles plus any other parameters required for a particular command. As an example, to set the keyer mode to Iambic A (which is the default mode) the CMD button is pressed and held until a "R" is sent. Then a "K" would be entered using the paddle (K is the keyer mode command). The keyer would respond with an "E" and then the mode code would be entered, which for Iambic A would be an "A". The keyer responds with an "R" and the command is complete. If there is an error in any of the entries the keyer responds with a "?" and the procedure must start again. The complete list of commands is in the data sheet on K1EL's web site.

To enter a message in one of the 5 memories use the following procedure:

Press and hold the CMD button until it responds with an "R"

Press the button for the memory you want to use to store the message, the keyer responds with an "E"

Enter the message at a steady rate using the paddles. If you want to leave a word space between characters just pause for a bit until the keyer responds with an "E" and that means a word space was inserted. When the message is complete enter an "AA" (dit-dah-dit-dah) and the keyer will respond with an "R" to indicate the completion of the task.

To send a message simply press the button of the message you want to send and it will start. To interrupt it just tap one of the paddles. If a message is empty when the button is pressed the keyer will respond with an "MT".

Setting up the PAN4 Panadapter

The NRV4C contains the PAN4 panadapter board which uses the PLL generated local oscillator for the INJ ports of the R-4C and T-4 series transmitter to generate its own wideband IF which is filtered, amplified and fed to an SDR module which uses a USB port to send IQ data to the PC running the

HSDR program. The panadapter requires a couple of applications to be run on a PC for everything to work properly. It is recommended that the PC have a copy of HRD (Ham Radio Deluxe), HSDR and if the logging program from HRD is not used then a third party logging program. The description in this manual assumes HRD V6.7.0.357 or later and HSDR V2.80 or later. HRD is a paid program but HSDR is free and can be downloaded from www.hdsdr.de . HRD is basically used to control the connections between the NRV4C, HSDR and a third party logging program if the logger in HRD is not used. HSDR will provide the spectral display for the panadapter. HRD links to HSDR by a DDE interface and provides a smooth, seamless connection and transfer of frequency and mode data between the two applications. See the section on **Connecting an NRV4C to a PC** to connect the USB CAT port to HRD and get the NRV4C under HRD control. Once the NRV4C can be controlled by HRD the driver for the SDR device in the PAN4 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 PAN OUT connector on the NRV4C 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. **WARNING: DO NOT select anything else or you will overwrite that device's driver! DO NOT click around randomly in Zadig. If you do you are likely to overwrite your mouse, keyboard, printer, soundcard etc drivers. Choose ONLY Bulk In, Interface (Interface 0) or an item prefixed with RTL28328U.**

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 SDR-Device box below the S-meter (or Press F8) 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.

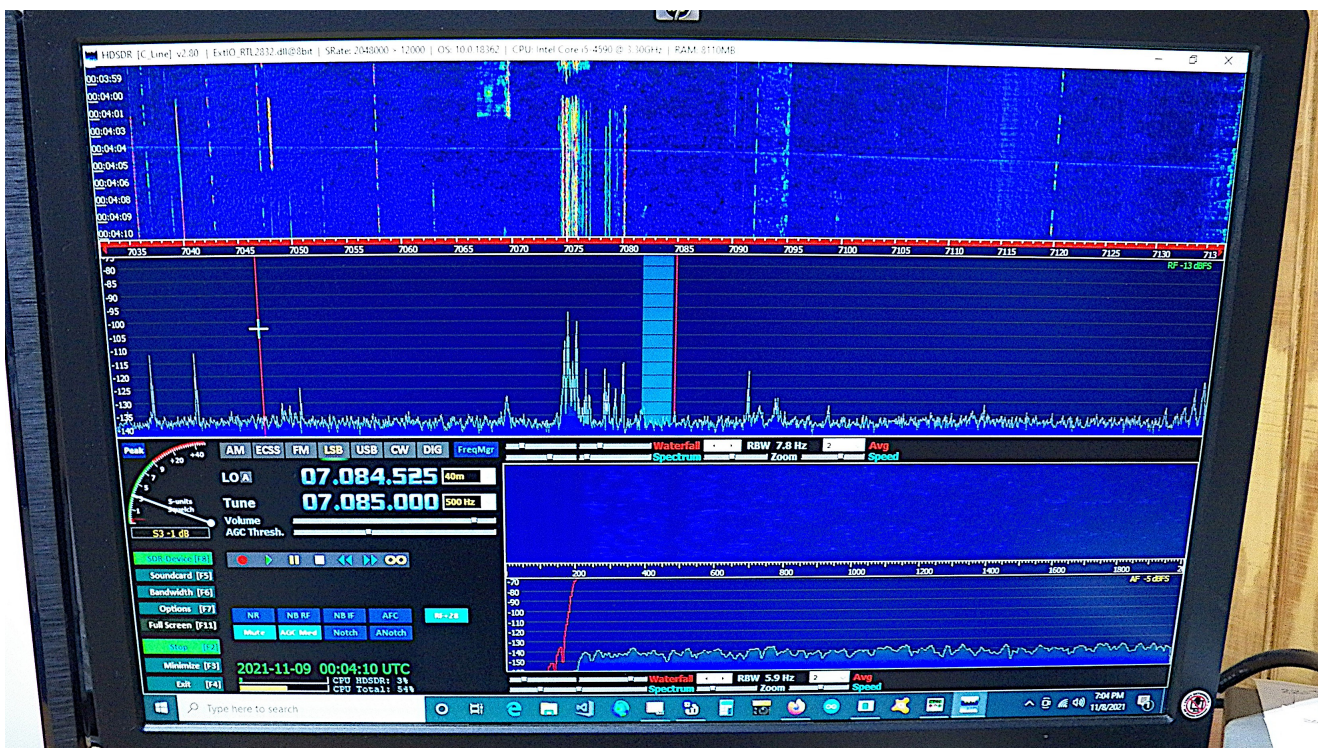
Next go to the RF Front End Calibration item in the F7 menu. Click on (select) **SDR on IF output, which is controlled by** and then select **HRD (DDE)**. Under Sync mode select **Full Sync in Both Directions**. Under **IF Frequency** enter **43645000**. Leave the Offset at 0 for the moment. Click **Mirror RF Spectrum in General** and **Operate CW in Lower Sideband (LSB)**. 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 R-4C and NRV4C 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 (if it is not already running) should bring the spectral display alive and any signals in the passband of the R-4C'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 NRV4C 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 NRV4C. But a good starting point is to have the spectral display zoom set for a 100 kHz to 150 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 28.

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 pressing F8 and using the slider in the ExtIO popup window. 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 as the default. 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 final value should be between 2.0 and 2.4 Msps.

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-PAN4

Use the position of the sliders in the picture as a starting point for setting up the display. Notice that the frequency displayed on the Tune value is set to the actual operating freq of the NRV4C 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 NRV4C and HRD frequency displays should all change to the new frequency and the selected signal should be heard on the R-4C. 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 be placed on the center of

the signal but the CW Offset must be setup to allow the received tone to match the CW offset setup between the R-4C and the T-4 series transmitter.

Before attempting to calibrate the offsets in HSDR the R-4C and T-4X/XC must be thoroughly stabilized. They should be running for at least an hour before calibration starts.

The T-4 series transmitters operate CW on LSB. So that is where the offset will be introduced. Pull up the RF Front-End Configuration Menu by pressing F7 and then selecting it from the drop down menu. The “Operate CW in Lower Sideband (LSB)” selection should be checked from the initial setup. If not do that now. Above that is a horizontal table of programmable offsets for each mode. The box labeled CW_L is where the offset correction will be made to get the HSDR spectrum to match the CW offset on the Drake Twins. To determine the actual offset that the T-4 transmitter is set for, WSJT-X should be installed on the PC and the Sound Card connected. Place WSJT-X in FT8 mode so that the audio spectral display is on the screen. Lower the output power on the T-4 with its GAIN control so that it is just enough to hold the VOX on when the TUNE switch on the NRV4C is switched on. Place the R-4C Function switch in the ON position (not EXT MUTE as it should normally be for operation with the NRV4C). Turn the RX GAIN control for the Sound Card in the NRV4C almost all the way down (CCW). This avoids overloading the Sound Card input. Key the transmitter with the TUNE switch on the NRV4C and the sidetone from the R-4C should be heard and the tone should appear on the FT8 display. Read the frequency off the FT8 display and this is the offset value that CW Offset needs to be set to in HSDR. Return the R-4C Function switch to EXT MUTE and bring the TX power back to normal. Next go to the Audio Spectral display in the bottom right side of the HSDR screen and find the **CW Pitch = XXX** line in the top left corner of that display box. Place the mouse over that line and click. A window should pop up allowing the CW Pitch to be set to the value we have determined is correct for the system offset. Type that in and then close the window.

The next step is to tune in a CW carrier and look at the audio frequency on the FT8 display. Adjust the tuning until it matches the CW offset that was determined from the previous steps. Look at the Audio Spectral display in HSDR and see if the carrier is centered on the vertical line that is at the offset that was just entered in the previous step. If it is then the alignment is done. If not then use the frequency scale at the top of that display to determine how many Hz the signal is displaced from the CW Pitch line. Go into the RF Front-End Calibration Window using F7 and then the drop down menu. Go to the Offset Table in the center of the window and enter the offset that was just read from the scale in the previous step. If it is too high use a negative value, too low a positive. Close the Window and go back to looking at the signal in the audio window in HSDR after checking the tuning to be sure it is still at the right CW pitch in the FT8 program. If the correction was good then the signal should be centered on the vertical CW Pitch line in the Audio Spectral display. If not go back and repeat the process until it is. Once this is setup, a CW signal can be tuned by clicking on the signal in the Main Spectral display. It should appear in the bottom Audio Spectral display close to the CW Pitch line. To get it exactly on frequency click at the center of it in the bottom display and it should move to the CW Pitch line and the T-4 transmitter should be zero beat with the received signal and the received audio pitch should match the CW Offset of the system. Another way to get the received signal exactly on frequency is to get it into the bottom spectrum window and then just press “Z” on the PC Keyboard. This works best if only one signal is shown in the audio pass band otherwise it could confuse the software and net the wrong signal. To complete the CW setup the sidetone for the Keyer should be changed to match the CW Pitch of the system. This can be done using the “Z” command for the Winkeyer3. Go into command mode by pressing and holding the CMD button until an “R” is heard. Immediately enter a “Z” with the paddles. The sidetone should come on and stay on. Using the paddles the sidetone can be moved up or down in frequency. One paddle moves it up and the other down. Adjust the sidetone until it matches the CW Pitch frequency of the system and then press the CMD button again and the sidetone should shut off.

The system is now ready for CW operation.

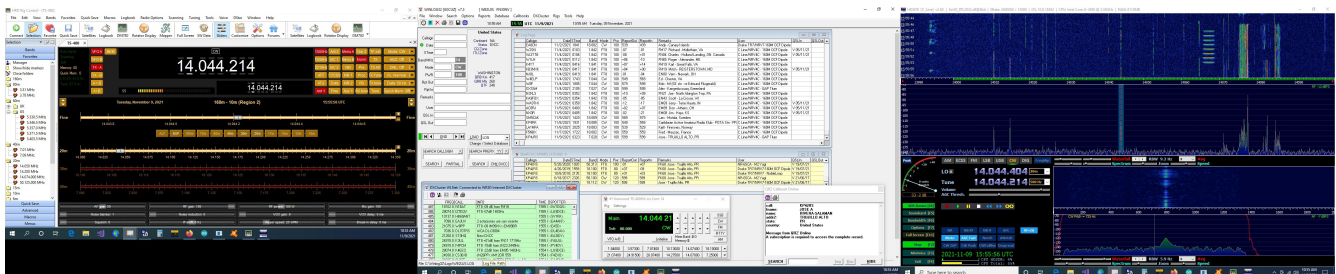
One thing to note. When using the NRV4C in CW SPLIT mode the transmit frequency shown is the unshifted (zero beat) value. When the TX is keyed it will shift lower by whatever value is set for the CW Offset.

Now that the CW frequency has been adjusted the USB and LSB modes will have to be checked and adjusted if necessary. Be sure the equipment is warmed up for at least an hour before doing this.

The best way to set the offsets for the other modes is to use a standard broadcast station or WWV / CHU etc. First set the mode with the NRV4C by pressing the PTT switch. This will send either USB or LSB to the HDSDR program. To be sure everything is in sync press the paddle first to force CW mode and be sure that HDSDR switches to CW. Then press PTT and see that HDSDR switches to either USB or LSB. The sideband selected depends on whether the tuned frequency is above or below 10.000 MHz. Tune the broadcast signal to zero beat in an SSB mode. Check to see that the spectrum display shows the tune line in the correct place on the signal. If it is too high or low go to the offset boxes in RF Front-End Calibration and enter a correction value (+ or -). Re-check and repeat until the spectrum display has the tune line in the correct place on the signal. Switch between AM and SSB on the R-4C to check that audio tones from the time stations match in pitch to assure a zero beat condition. The procedure can also be done by using the SDR receiver capability of HDSDR itself. Turn on a PC system sound card using the F5 menu and the audio of the received station on HDSDR will be heard. Use that to shift the station with the programmable offsets until it is correct. Do the same with the other modes and the calibration is complete.

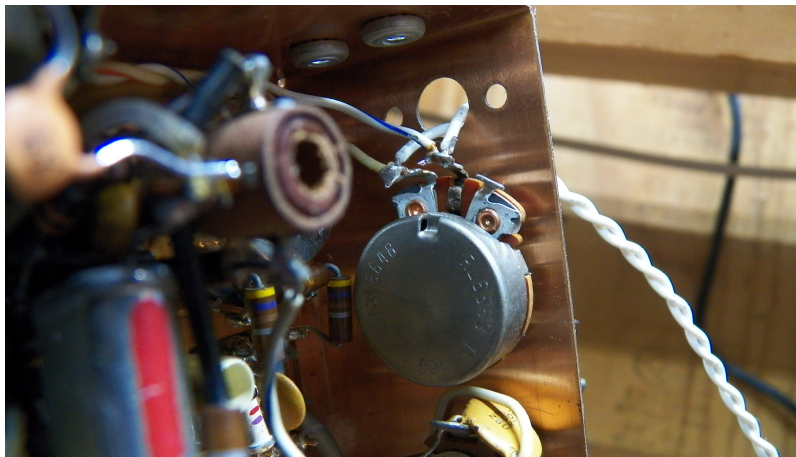
PC/Laptop Hardware Considerations

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 4 free USB ports to support the NRV4C control/CAT port plus the SDR receiver data (PAN OUT) plus the Winkey3 port and then the sound card on the NRV4C if digital modes are to be used. 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 or have a third party logger so it gets crowded quickly. The main screen of HRD could be parked to free up the monitor for a logging program which has its own rig control window and memories so frequency control could be from the logger and HDSDR. Then 2 monitors would work well. The ideal setup would be to have 3 monitors and a computer that has a dual core i5 processor or better running at 2.4 GHz or faster with as much RAM as possible, preferably more than 4GB. A typical setup like that would look like the photo below.



Connecting the VOX Switch

The NRV4C has a front panel toggle switch that can be used to switch the VOX delay on and off for the T-4X series transmitters. It is especially useful for the T-4X, XA and XB units where the only way to defeat the VOX is to reach to the back panel of the transmitter and turn the control down all the way. This becomes cumbersome if switching between modes like CW, which require the VOX delay and SSB using PTT. The switch can be wired across the VOX Delay pot in the transmitter. When in the OFF position (which is labeled ON/CW) the VOX delay is enabled. When on the ON position (which is labeled VOX OFF) the delay pot is shorted and the delay is defeated so that PTT operation is possible. To wire this for the T-4XA and B a small cable needs to be made up from a twisted pair of 22 AWG wire with an RCA plug at the end. The RCA plug will plug into the VOX SW jack on the back of the NRV4C and the other end gets soldered to the VOX DELAY pot on the underside of the T-4 chassis. The photo below shows the connections. Note how the cable is routed through the spare RCA Jack hole in the rear apron.



This is the way the RCA Plug should be connected at the other end of the cable. A standard RCA audio patch cable could also be used by cutting the plug off on one end and stripping back the cable.



Although the VOX enable switch on the T-4XC is controlled by pulling or pushing the GAIN control on the front panel the function can also be moved to the switch on the NRV4C and leave the VOX switch on the T-4XC pulled out all the time. The switch in the T-4XC is shown in the photo below.

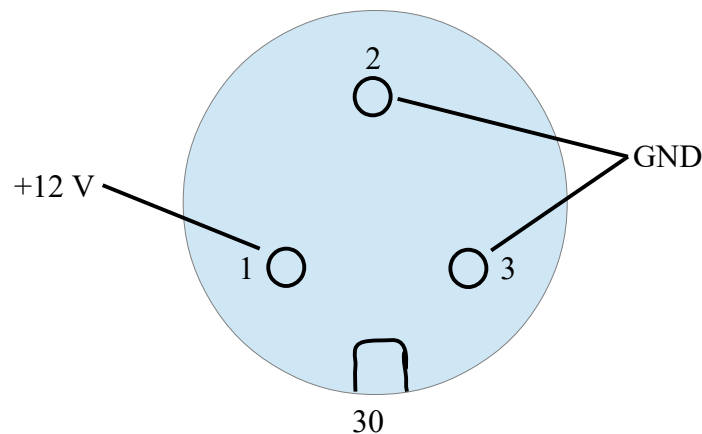


Use these pins

Fan Connections

The NRV4C has a 3 pin connector on the rear panel that can be used to run a small fan for cooling the final amplifier tubes in the T-4X series transmitter. A 12 VDC fan of approximately 3.625in or 92mm square is a good size for placing directly over the amplifier cage and drawing air out. If a 2 wire fan is used it should be rated to draw no more than 180 mA. As an alternative a 4 wire computer type fan can be used and the speed control connected to the third pin of the NRV4C connector which will run it at minimum speed for very low noise operation. Only a small amount of air needs to be moved through the cage to make a big difference in keeping the operating temperature at a safe level for the tubes. A 4 wire 92mm fan rated at 2.5 Amps running in the low speed configuration will only draw around 50 mA. This connection is fused with a 1A Slo-Blo fuse and has a 10 ohm resistor in series with the connector to limit inrush current when the fan starts up. If a high capacity fan with a higher current rating than the 180 mA spec needs to be used, the plug in wall transformer power supply that is supplied with the NRV4C should be replaced with a regulated 13.8VDC supply with 2.5A or more capacity. The pin definitions for the Fan Connector are shown below:

Fan Connector Pinout



To connect to a 4 wire fan the +12V should go to the Red wire on the fan, one ground wire should go to the Black wire on the fan and the second ground wire should go to the Blue wire on the fan. The supplied connector with pigtail wires is coded as Pin 1 = Red, Pin 2 = Yellow, Pin 3 = Black.

SPECIFICATIONS

VFO

Output Frequency: 7.145 – 35.645 MHz

Output Level: 3 Vp-p nominal (2.5Vp-p to 6p-p depending on band and preselector tuning)

PLL Generated

INTERFACE

VFO through the INJ ports of R-4C and T-4X series transmitter

Transformer Isolated Internal Sound Card with USB Interface to PC using a Type B connector

USB Rig Control Port with Micro Type B connector

PS/2 Keypad Interface

VOGAD Speech Compressor for SSB operation

Internal Winkey3 Keyer with USB interface. Paddles use 3.5mm Mini Phone Jacks

DIMENSIONS & WEIGHT

14.25 in W x 8.5 in D x 5.5 in H (36.2 cm x 21.6 cm x 13.97 cm) – Does not include Knobs and feet

6.125 lbs (2.78 Kg)