CAT Primer

Setting up CAT / Digimode Software to work with QRPver Minion Transceivers

V0.7 - 03.12.19

Contents

Update History

Rev.	Date	Comments
0.6	28.10.2019	Initial version
0.7	03.12.2019	Chapter 2: DC-3001 CH341 replaces CH340; Minion SDR STM32 driver clarification, Ch4 HRD amended + screenshot added, Ch 6 flrig description redone, Ch 7-9 V 2.0 of WSJT-X and JS8Call considered, new chapter 10 HDSDR, Ch 12 USB Deview added. Text edited in places for improved clarity.

1. Introduction

The QRPver DC-3001 and SDR "Minion" transceivers come with a USB port for CAT (Computer Aided Tuning), which greatly adds to the comfort and possibilities of operating these tiny rigs. Additional interfaces are not required. QRPver transceiver's CAT provides only provides basic functions, but covers the essential ones: VFO frequency control and memories, mode selection, and keying the tx (PTT and CW).

If you are a newcomer to CAT software, it can be quite challenging to get CAT rig control to work correctly. The purpose of this document is to explain the first steps required for your QRPver Minion transceiver to communicate with the digimode software on your Windows 10 PC or notebook. Today not only digimode, but also logging software typically features data exchange with your transceiver via CAT.

The document cannot of course be an in-depth tutorial on digimode software in general.

# 2. USB Connection with a PC

2.1 Minion DC-3001

First the CH341 USB driver software must be installed. The recommended installation steps are:

1. download the CH341SER.exe file from the DC-3001 dropbox documents folder linked to the QRPver website /.

2. switch on your DC-3001 transceiver and connect it to a free USB port with a mini-USB cable. Connect a dummy load to the antenna jack.

3. launch the driver installation file. The follow screen will appear, after you have authorized Windows to modify your PC settings:
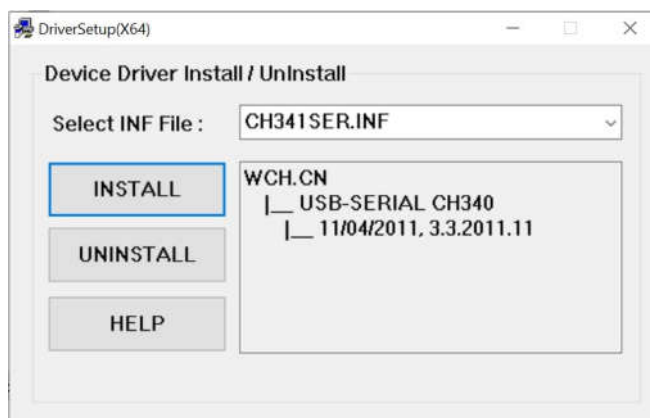
*1 CH341 Installation Message*
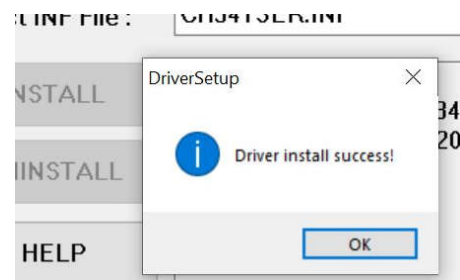
Ideally you will rapidly get an "installation success" message, preceded by a string of TX keying, while the COM port is tested and set up.

Check for the activated COM port number in the Windows device manager. This will be the port you will be communicating with this device for the current and future sessions. The driver identifies as "CH340".

2 COM3 assigned to DC-3001
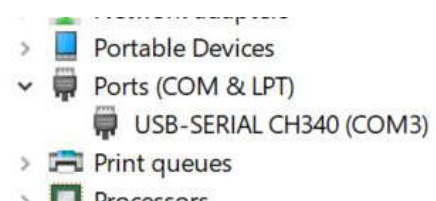
In case of difficulties, try the following

- switching the transceiver off and on, or removing and plugging in the USB cable

- reinstalling the driver

If this does not help, you can try further steps

- adjust the Windows Com port bps settings with the "properties" context function of the device manager. The speed settings should be identical with the one in your transceiver.

- try another USB port on your notebook. If it works, mark this particular USB socket for future use. Reconnect this rig to this port only. Windows tends to "remember" which ports required specific drivers. Compare the hints on organizing your COM ports in the Annex of this document

3 Windows COM port settings

- Rebooting Windows after deinstalling and before reinstalling the driver again. Disconnect the rig before installation and reconnect afterwards.
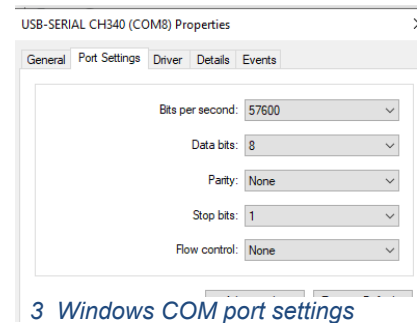
In case of *any* CAT software problem it's always a good idea to first check it a COM port connection is established. To quickly access the device manager press the Windows_X key and select the device manager with a mouse click.

Alternatively, the following two-line batch file will directly launch the device manager:
@echo off
devmgmt.msc

2.2 Minion SDR

If you use Windows 10, the Minion SDR does not require the installation of a specific USB driver. Plugging in the USB cable into a free port after switching on the transceiver should make Windows assign a COM port to the rig. You may have to plug in the cable *twice* for Windows to carry this out. Launch the device manager to find out which COM port this is.
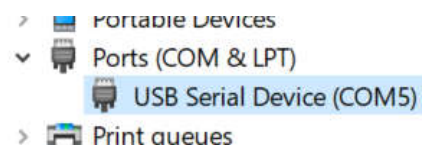
4 COM Port 5 assigned to Minion SDR

With previous releases of Windows, you may have to install the virtual STM COM port driver, downloaded from:
https://www.dropbox.com/sh/hy96p5mk4p0yh8w/AADoOHwuG9MRXFf_HjsfFdVGa?dl=0

An adjustment of the Windows COM port settings speed rate as shown above should not be necessary, but certainly cannot do any harm.

Similar to the DC-3001 it is wise to always use the same physical USB port of your PC or notebook, once a solid communication was established.

The Minion SDR does not support RTS, DTR or CTS signal lines, i.e. switching to transmit is accomplished with the "CAT" setting in your digimode SW.

3.   Line in / out connections of your transceiver

Apart from the USB CAT cable, you need to connect the PC sound card to the transceiver via the line in / out connectors. It sounds simple enough to connect 3 cables and do some adjustments, but unless you have already worked a lot with interfacing external audio devices to your PC this may require some time until everything is configured correctly. The steps to take are as follows:

3.1 Receive

In the receive mode the transceiver's audio output is routed to the PC's soundcard input.

Connect the line out socket (pink ring) of the DC-3001 with the line in connector of your PC/sound card, or – this usually isn't available – the microphone in socket with a normal 3.5mm stereo cable. Minion SDR connectors are not color-coded.

- Open the MS Windows sound settings (e.g. by right clicking the loudspeaker symbol in the task bar) and select the second "microphone" (or line in, if available) entry to switch from the internal microphone to the external cable
- In the "device properties" sub-screen set the audio level to the desired level. A level of 30dB is recommended for WSJT-X with a quiet band. If you are using a (usually very sensitive) microphone input this means the level must be turned down quite low, e.g. to 4 or 5 %.

Check that the software's input really is the cable and not mike/speaker audio. A loud cough should not move the level meter! However, speaker audio captured by the internal microphone works surprisingly well in decoding FT8 signals in WSJT-X or other digimodes in fldigi.

3.2 Transmit

In the transmit mode the soundcard-generated digimode AF signal is routed to the transceiver's line input to modulate the transceiver's RF signal.

Connect the headphone out connector of your PC/sound card (green ring) to the line in socket (blue ring) of the DC-3001, again with a normal 3.5mm stereo cable[1].

- Set "output device" to "Headphones" in the Windows sound settings.
- Set to a level >50%; usually 75% will work well

Press the "tune" button of your digimode software and adjust the "power" slider e.g. of WSTJ-X so that:

- for the DC-3001 the PWR level is within the range indicated in the manual
- for the SDR set the level is ~ 20% lower than the maximum achievable PWR level

Too high modulation levels will increase distortion and reduces your chances of successful contacts. The issue is covered in depth in the section "transmit levels" of ZL2IFB's amazing "FT8 Operating Guide" (must read).

For the DC-3001 a minimum level is required to trip the VOX to key the TX in the digimode configuration.

You are now – technically – set to run your first digital or FT8 QSOs!

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[1] A screened cable is not necessarily required but should be used if a PA is employed.

3.3 Troubleshooting

If everything works at the first go – congratulations! If not:

- If the rig fails to key: make sure the rig mode is set to "digi", as in "USB" mode the VOX is not active (DC-3001 only)

- Frequency control issues / flrig / Omnirig: check for the correct COM Port

- Audio issue, especially if there is no tx signal on the headphones out connector: go to the sound settings and play around with the settings. There are separate adjustment sliders for speaker and headphones volumes!

A very useful tool for getting things to work the first time is a small active speaker with its input crocodile clipped to the respective cable ends to check if the audio signals in both directions are actually present. Of course, a scope will do just as well.

A very good step-by-step guide how to set up audio levels is contained in the "Important – Receive Levels" chapter of ZL2IFBs FT8 Operating Guide.

If your Windows device is a notebook with a single 4 pole 3.5mm connector for mike and headphones, an adapter must be used, such as available in the QRPver webshop.
Alternatively, a home-made "Y" cable, cut to the desired length is a good idea as you only have 1 item instead of 3 to carry.

4. Connecting with Ham Radio Deluxe (HRD)

HRD is a very popular and extremely rich-featured digimode software originally written by Simon Brown HB9DRV. It has a phenomenally good user interface for frequency management and memories. Even if only the main frequency setting functions are available via the TS-440S interface, it's worth a try. The old 2012 version 5.24.0.38 is fine for this.

Switch on the transceiver, launch HRD and select TS-440S as rig. Uncheck "RTS" and "CTS" boxes. If you leave the boxes or only one of them checked, the (DC-3001) transceiver will go into TX mode after "Connect". Compare the Annex of this document for more details on these options.

In case you get an error message, check that the rig is accessible via a Windows-assigned COM port, and that port and baud rate settings are correct.

A brief "click" of the T/R relay (DC-3001 only) confirms that the rig is communicating with HRD.
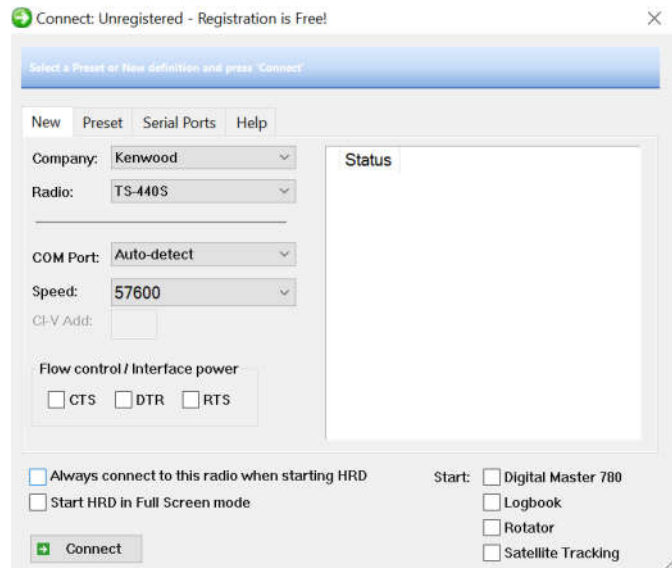
5 HRD First Connection Screen
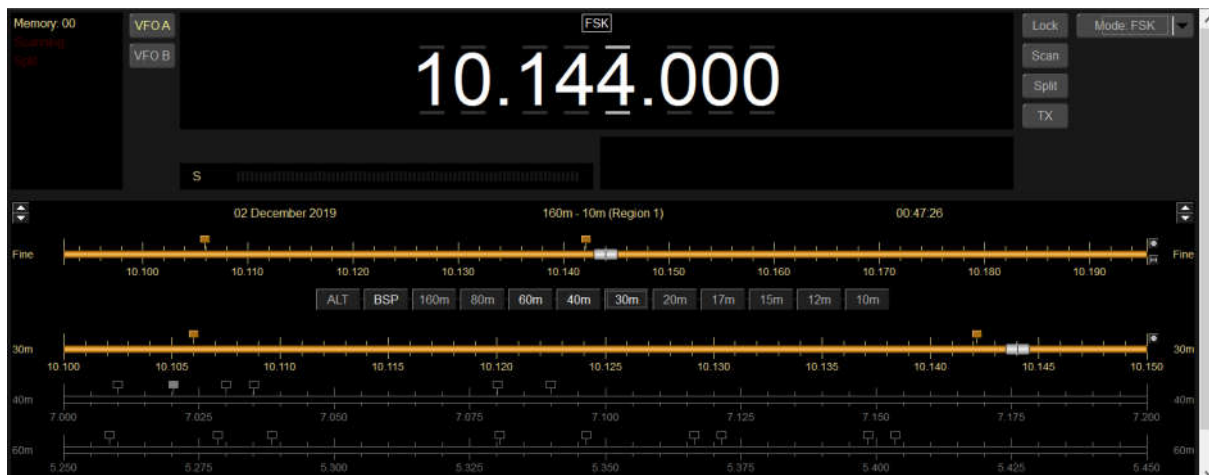

6 HRD V5 Main UI

The TS-440S has only one VFO. In order to access VFO B of the Minion SDR from HRD you need to configure this additional button via the "Customize / define button" function. Further functions such as assigning frequency spots to function keys, memory to VFO etc. can be added.

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5.   Connecting with FLdigi 4.1.08

Fldigi is a popular digital communications software offering a large number of digital operating modes e.g. PSK31, but also legacy modes such as RTTY and CW.

There are several alternatives for CAT control. Either your rig is directly configured in the "RigCat" configuration tab, or you can use flrig, described further below, to communicate with your QRPver transceiver. Yet another option is the configuration via a Hamlib configuration file.
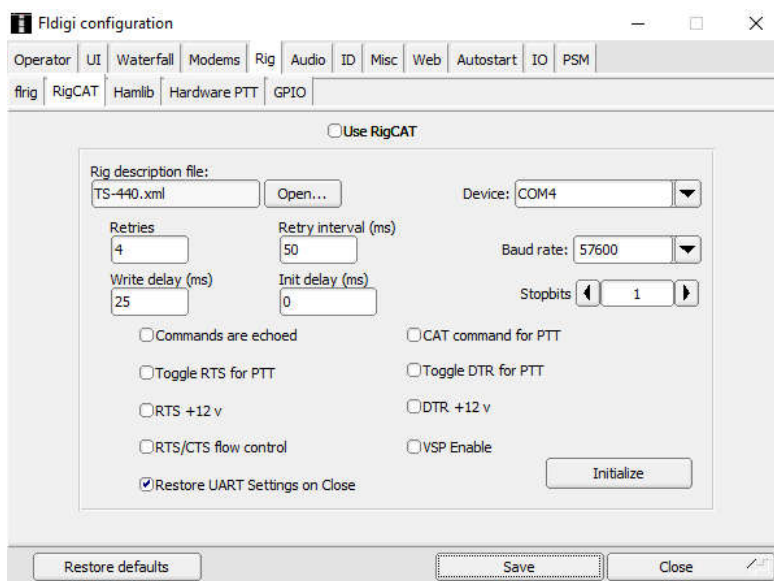
For the first option, open the "RigCAT" tab after launching FLdigi. The screen will look similar to this:
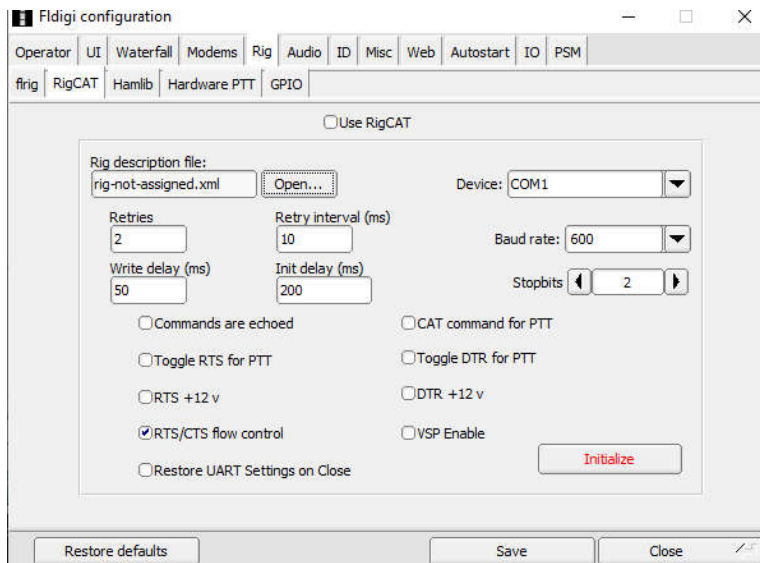
7 fldigi RigCat screen (unedited)

Download the TS-440 xml description file from
https://sourceforge.net/projects/fldigi/files/xmls/kenwood/

Copy this into your fldigi directory and set this as the rig description file
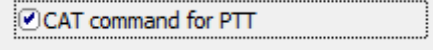

8 fldigi configuration DC-3001

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Set the COM port allocated to your rig by Windows and the transceiver baud rate as configured in the transceiver.

The above configuration works for the "Digi Vox Yes" option of the DC-3001.

For the Minion SDR, or for non-digivox operation of the DC-3001, the box "CAT command for PTT" must be checked.

Save the configuration.

6.   Connecting with FLrig 1.3.48

6.1 General

FLrig is a compact module which doesn't do much more than connect to your rig for frequency control and a few other functions as available through the CAT interface for your rig. For the QRPver transceivers, the functions are limited to tuning and mode setting. Tuning is very smooth using the mouse or cursor keys. Integration with fldigi is perfect and you can adjust the frequency in either of the two programs [2].
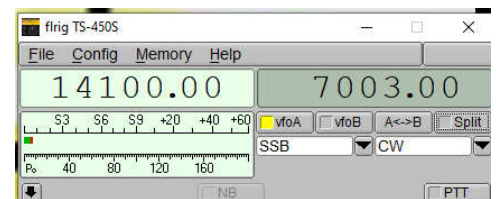
9 flrig UI

Flrig is also suited for CAT interfacing with WSJT-X and JTDX software.


6.2 Configuration

After installing flrig go to the "configuration" screen. There is no TS-440 configuration file, but fortunately, the TS-450S one will work. Select this as the rig, enter the COM port, baud settings, set stop bits to "1" and check the "PTT via CAT" box. Click on the red "Init" button which should change from red to black and you should be fully set up. Flrig remembers the settings for the next time you use it. In case of problems rebooting the rig or dis- and reconnecting the USB cable may help.
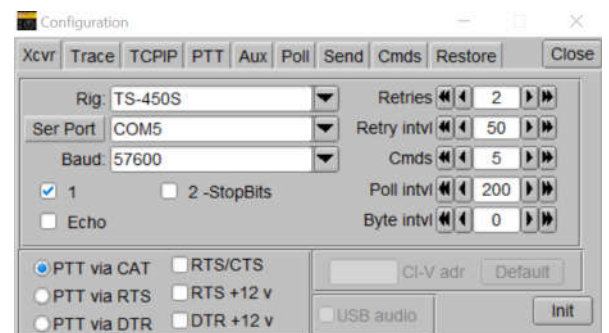
10 flrig settings for – Minion SDR

6.3 Memory Manager

As flrig on its own only tunes within the active band, you may want to try out flrig's memory manager to change bands. The function is very basic, but you will mainly be using flrig as an intermediary to a digimode client. Move to the desired band with the transceiver's "Band" function, and select "Save" in the Memory menu. Enter the "manage" subscreen. Enter a descriptive alpha tag by selecting an entry (must be marked in blue) and hitting Return.
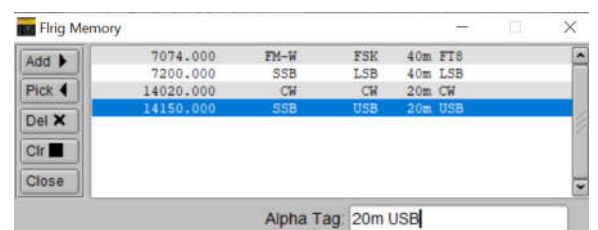
11 flrig Memory Manager

Use the *right* of the two mode selection pull-down menus for mode setting (CW, USB, LSB and FSK(=DIGI).

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[2] The SDR split function may not work

7.   Connecting with WSJT-X

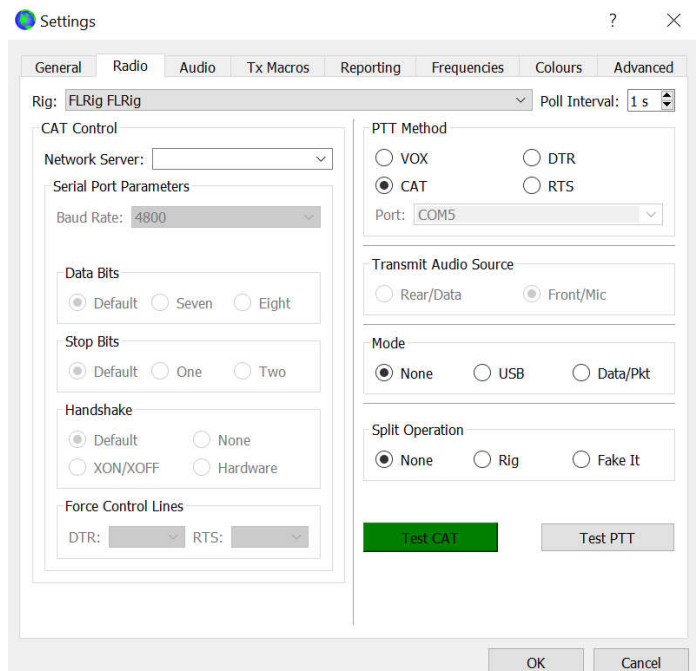WSJT-X of course gives you the wildly popular FT8 mode, but also FT4 (contest) and WSPR amongst others.

For some reason or other, even the recent V2.0 of WSJT-X (11/2019) refuses to directly connect to the DC-3001 or Minion SDR with the TS-440 setting. A rig connection error is produced instead.

Fortunately, there's a workaround to connect WSJT-X to your rig. Simply install and configure flrig, Omnirig or Ham Radio Deluxe. Launch this first and then start WSJT-X. Configure the rig settings accordingly, i.e. Instead of configuring your rig (TS-440) in WSTJ-X you select "flrig", "Omirig1" (if configured as rig#1) or "Ham Radio Deluxe".

12 WSJT-X connecting to the Minion SDR via flrig

Clicking the "Test CAT" button should change its color to green, or the Test CAT button may already be green when the tab is opened.

Check if band switching in WSJT-X will adjust the transceiver's frequency.

If you are using flrig or HRD and frequency control was working there, it should also work in WSJT-X.

8.   JTDX

JTDX provides an own user interface for digimodes including, in the more recent versions, FT8, and is preferred by some hams over WSJT-X.

JTDX reuses the code of WXJT-X for CAT interfacing, i.e. the same procedure as described for WSJT-X applies for interfacing with your transceiver.

9.   JS8Call

JS8Call is an increasingly popular weak signal digimode combining the "chat" capability of other digimodes with the efficient 15s transport protocol of FT-8. The latest V2 release features a 10s "fast" and a 6s "turbo" mode for better band conditions.
You need to run the separate JSCall software for JS8Call.

Similar to JTDX, JS8Call reuses the code of WXJT-X for CAT interfacing, i.e. the same procedure as described for WSJT-X applies for interfacing with your DC-3001.
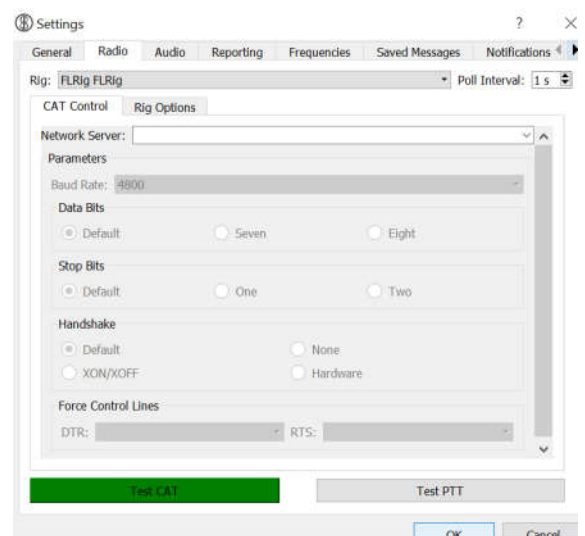

13 JS8Call Options (F2)

10.   Connecting to SDR Software (HDSDR)

Connecting your Minion (DC-3001 or SDR) transceiver to SDR software is briefly described using the example of HDSDR. Connectivity with other SDR clients should be similar, provided they have an Omnirig interface, as this is how we connect to HDSDR

Note: The waterfall display range will be limited to the audio bandwidth set in the rig, i.e. a maximum of 3.500 Hz. This means you will n o t get a full band waterfall. The main advantage of SDR software then are the good frequency management and mode switching, and for the DC-3001 there will be a 3.5 kHz spectrum display. Due to the excellent receiver and filters characteristics of the Minion transceivers, performance on the ham bands will of course be superior to any general purpose SDR dongle.

To connect the transceiver, launch Omnirig and check for the correct port settings. Then launch HDSDR. Call up the configuration menu and check the Omnirig "rig 1" box. This should be shown as "connected"
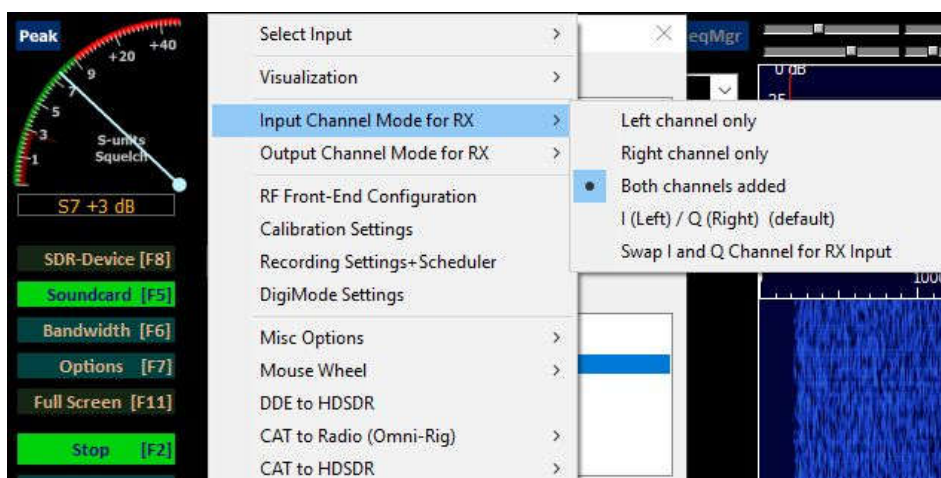

14   HDSDR Configuration (1)

The audio must be fed into HDSDR via a line in cable or microphone input. For a first check, using the microphone will be fine. In this case, the Windows sound mixer settings shown below apply.
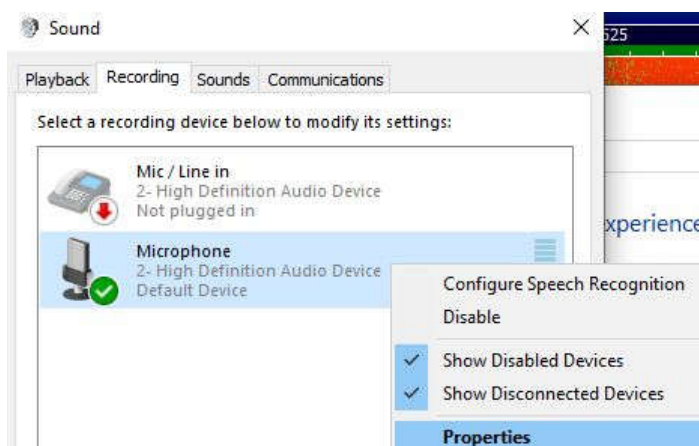
Reduce the microphone or line input level to accommodate a comfortable loudspeaker AF sound (microphone input) or to a convenient line in level. You may have to reduce the level setting to quite a low volume to achieve this.

Enter the "select input" submenu and mark "sound card" as the active input device.
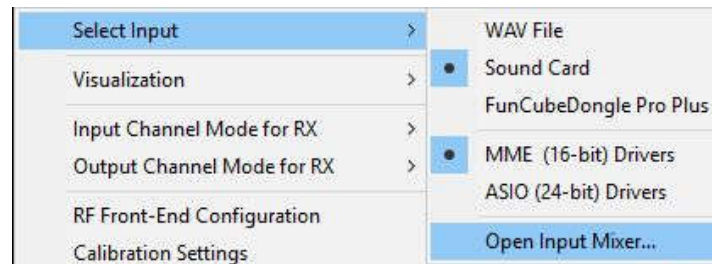
11. Omnirig

Sooner or later, several programs you have require CAT access to your rig simultaneously. In order to avoid a program exclusively "grabbing" the COM port link to your rig, you need to introduce a "separation layer" and then to specify this in the rig definition list of all CAT clients. This will sort out routing the requests and the rig responses to all your active CAT programs, keeping the frequency and mode settings in sync for all programs.

An extremely popular utility serving this purpose is "Omnirig" written by Alex VE3NEA (dxatlas.com). For software to be compatible with Omnirig, it must integrate some DLLs provided by Alex. Check out the software compatibility list on his website to find out if your SW is Omnirig-enabled.

In Omnirig you can define two separate radios, marked as "Rig 1" and "Rig 2".

17 Omnirig Setting – DC-3001

DC-3001: select "TS-440", set the COM port as shown in your device manager and the baud rate as set in your DC-3001 transceiver.
RTS may be set to "Handshake". After clicking the "ok" button you may hear a brief PTT click of your rig.

Minion SDR: download the specific Omnirig ini file from:
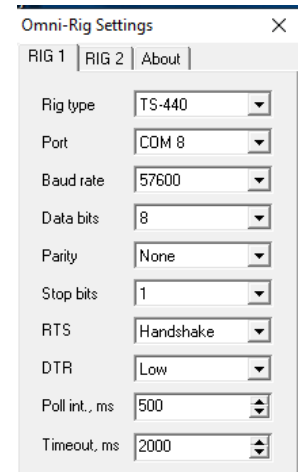https://www.dropbox.com/sh/j37z2odffuvywvk/AACsS-eL19TM83YINWwN-Bk2a?dl=0

Copy this to your C:\xxxx\Afreet\OmniRig\Rigs directory.

RTS and DTR signal lines are not used by the SDR; value can be anything.
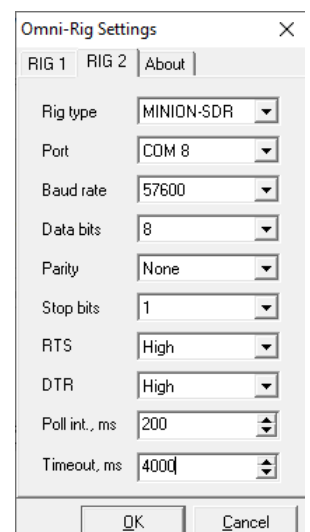
The "Poll" setting can be reduced to speed up the response time of VFO dial updates.

After launching Omnirig, start the CAT or logging SW, define "Omnirig" in the rig settings.

18 Omnirig setting - Minion SDR

In case of difficulties try running ominrig.exe with administrator privileges. This is the only way to get Omnirig working properly, if you are running logging software requiring administrator rights such as Log4OM or Swisslog. Unfortunately, all software using Omnirig must then be run with administrator rights due to the Windows security model; a serious inconvenience, to be used with caution.

12. Appendix: Organizing your COM Ports

Windows has a "life of its own" concerning devices connected to your PC. For us hams connecting many devices with many different drivers to a PC through serial COM ports this can get problematic, as Windows adds new COM devices to the end of an internal list without deleting anything. Here are three good techniques of bringing order to your COM ports:

- Windows device manager: start with administrator privileges, click "show hidden devices" in the "View" menu. One by one uninstall previous, no longer required entries in your COM port list. Don't check the box "delete driver" if you may want to connect an old device again.
 While you are at it, why not check your Audio inputs at the same time.

- A very useful tool is "COM Name Arbiter Setter";
  https://www.uwe-sieber.de/misc_tools.html

  Consult the documentation on the website - using Goole translate if necessary - to find out how to use it.

  Hat Tip to Gary, ZL2IFB for digging out this very useful utility.

- A further similar tool is "USBDeview" from NirSoft.
  Help file text: *USBDeview is a small utility that lists all USB devices currently connected to your computer, as well as all USB devices that you previously used. For each USB device, extended information is displayed: Device name/description, device type, serial number (for mass storage devices), the date/time that device was added, VendorID, ProductID, and more...*
  USBDeview also allows you to uninstall USB devices that you previously used, and disconnect USB devices that are currently connected to your computer.
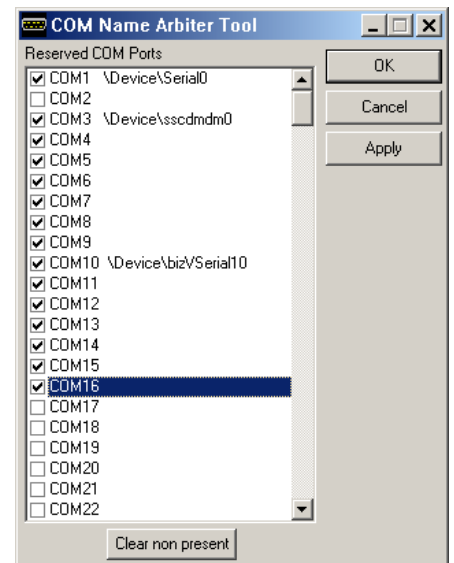
Device Name	Description	Device Type	Connected	Safe To U...	D...	US...	Driv...	Serial Number	Created Date
STM32 Virtual ComPort in FS Mode	USB Serial Device	Communication	Yes	Yes	No	No	COM5	3m6T07	01/12/2019 22:55:31
Port_#0004.Hub_#0001	USB Serial Device	Communication	No	Yes	No	No	COM6	400	29/11/2019 19:34:27
0000.0015.0000.003.000.000.000....	USB Serial Device	Communication	No	No	No	No	COM4		29/11/2019 14:44:10

18 USBDeview showing Windows native STM32 VCP Driver for Minion SDR

13. Appendix: Flow Control/CTS, DTR and RTS Lines

Usually, your CAT software will work without use of these signal lines to key the tx PTT for SSB and digimode operation.

In case of difficulties, you may experiment with these settings. Usually, RTS is used for PTT and DTR is used for keying (applies for DC-3001 only; Minion SDR does not access RTS/DTR)

This is the HRD help file text:

CTS
Enables the CTS flow control, required for Kenwood radios.

DTR
Enables the DTR line when the COM Port is opened and leaves it on, usually to provide power for an interface cable. For Yaesu CT-62 and ICOM CT-17 interfaces this can be left unchecked (off).

RTS
Enables the RTS line when the COM Port is opened and leaves it on, usually to provide power for an interface cable. For Yaesu CT-62 and ICOM CT-17 interfaces this can be left unchecked (off).