

SDR Transceiver Zeus ZS-1 and FLDIGI

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This step-by-step instruction should help to set up outstanding SDR transceiver ZS-1 and also excellent software FLDIGI for smoothly operating digital modes with using just the usual USB cable between transceiver and PC.

SDR transceiver [ZS-1](#) has been one of the first real software-defined amateur radio transceivers, and is still going strong. It hit the market in early 2012, and the software has been developed continuously. The hardware delivers from nearly zero milliwatt to a maximum of 15 watt with an exceptional clear signal. Even just these features – there are many more! – make this transceiver also a first choice when it comes to digital modes. In these most efficient modes you don't need more than a dipole and five watts or so. I even worked North Korea, #1 on the Most-wanted DXCC list, with this setup in old-fashioned RTTY; see QSL on the last page, *Figure 12*.

I had tested ZS-1 right from the start, using the very first set which was sent from St. Petersburg/Russia to Germany. Since my [You Tube video](#) of April, 2012, software has been developed further. After more than four years, I did get again interest in amateur radio and digital modes. I bought the most recent hardware version, now made by [SSB Electronic](#), at a modest price. Still, I am very enthusiastic about this transceiver!

As I first struggled a bit getting it smoothly to go with digital modes, I wrote this step-by-step instruction on how to set it up. Thanks to Alexandr Gromov and Yan Alexeenko, the both parents of hardware and software, for their valuable help.

Some Software is all you need

The general idea is to connect digimode software [FLDIGI](#) with ZS-1 transceiver and to run it smoothly by controlling the transceiver via FLDIGI and, at least partly, vice versa. The solution should work just in the PC without any other connection to the transceiver just than the usual USB connection.

To make things as clear as possible, I refer to the software I used. I can recommend it, but you may have other preferences and do so in a similar way.

This is the additional software you need:

- [FLDIGI](#) as state-of-the-art digimode software
- [VAC](#), or virtual audio connector, to connect the audio output of ZS-1 to the audio input of FLDIGI (receive) and the audio output of FLDIGI to the audio input of ZS-1 (transmit)
- [VSPE](#), or virtual serials ports emulator, to do two things:
 - to switch ZS-1 via FLDIGI from receive to transmit and vice versa and
 - to exchange mainly the HF frequency between FLDIGI and ZS-1, and vice versa (via a virtual CAT interface, standing for computer-aided transceiver)

Please find a block diagram (*Figure 1*) of this setup on the next page.

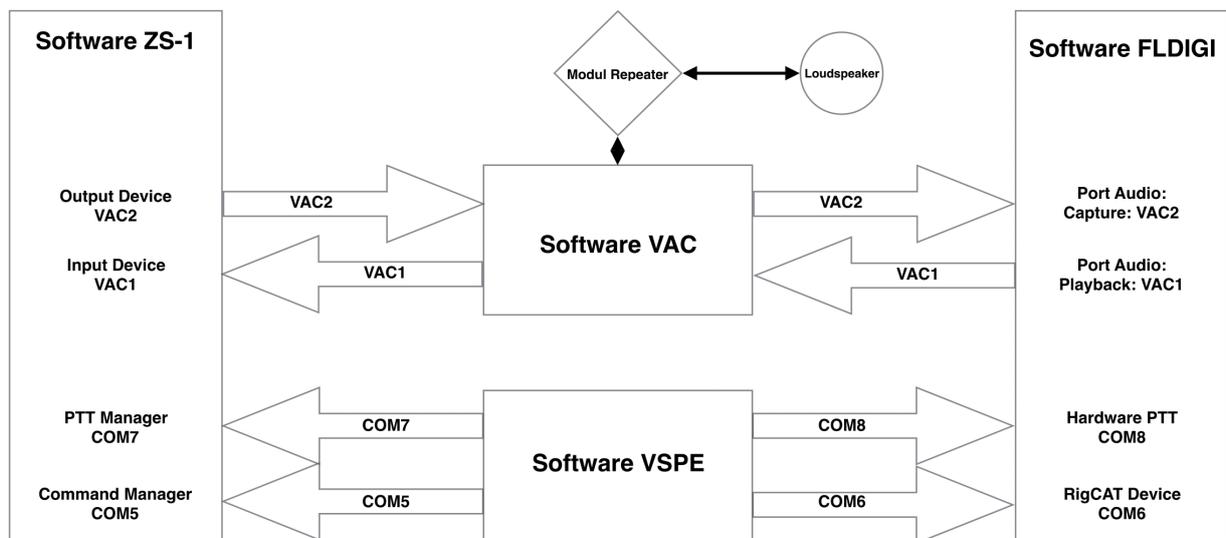


Figure 1: Block diagram showing the general setup. You should already know the software of Zeus ZS-1, left. You may know also Software FLDIGI, right. This paper explains the CAT and audio connections between those two software, by additional software VSPE (CAT) and VAC (audio). If you wherever get lost in this paper, this Figure should be your navigator.

How to set up the additional software

Please find below an example of how to first set up the additional software. You should or even must register the software which sets you back 2 x 25 US-\$. Compare this to the bunch of cables and modems you and me had needed before to connect a legacy transceiver to your PC and software – my successfully used [USB Interface II of microHAM](#) cost about 175 US-\$...

VSPE: Virtual Ports

First you have to download, install and probably register VSPE for a small fee of 25 US-\$. Then you have to set up this virtual serial ports emulator:

- Open VSPE by double-clicking the icon.
- Create two pairs of of virtual COM connections, e.g.: COM5 ↔ COM6 and COM7 ↔ COM8.
DEVICE -> CREATE -> DEVICE TYPE [choose PAIR from the drop down list]
Then “Specify device characteristics” for “Virtual serial port 1” and “Virtual serial port 2” – COM5 and COM6 for the first pair, COM7 and COM8 for the second pair. See *Figure 2*, next page.
- Save your work in a file, e.g.: FILE->SAVE AS-> ZS1

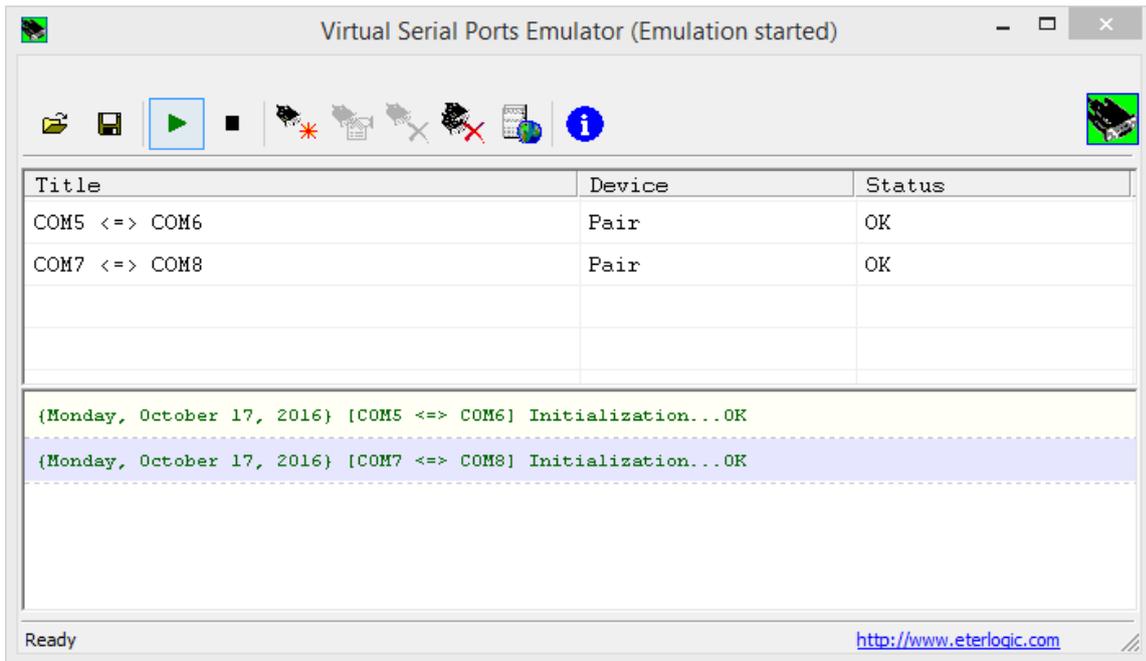


Figure 2: You need two pair virtual serial ports. VSPE window should look like this after having set up them.

VAC: Virtual Audio

First you have to download, install and register VAC for a small fee of about 25 US-\$. Then you have to set up some virtual cables:

- Open the Virtual Audio Cable Control Panel by double-clicking vcctlpan.exe.
- Specify the number of virtual cables you want: “Cables xx Set” in the upper left part under “Driver parameters”. See Figure 3 for an example with 24 cables, a number needed for other software also.

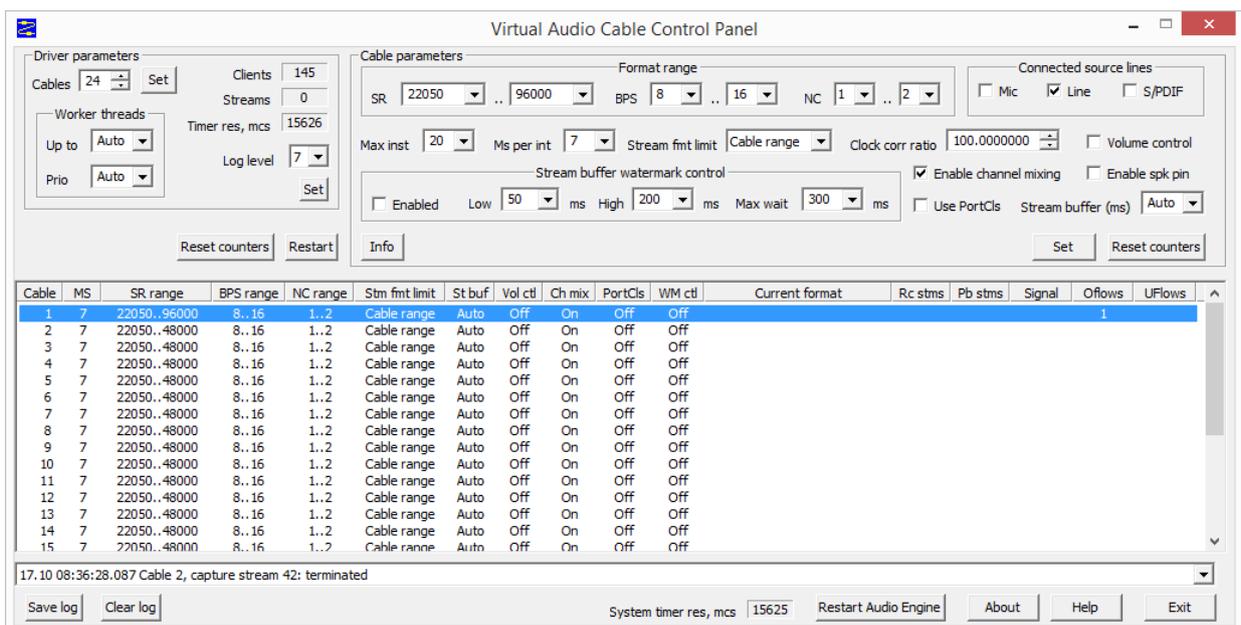


Figure 3: You need also at least two virtual audio cables, or VAC. Here 24 VACs had been made.

Putting it all together

In the next step, you have to put it all together as shown in the block diagram.

ZS-1

First step: CAT

- Open ZS-1 software.
- Click “Settings” (the gear-like icon upper right), to open the SETTINGS window.
- In this Window, click to “Server Mode”.
- Set “Command Manager” to COM5. This is one part of your first pair COM5⇔COM6 of the two VSPE cables to control the frequency and the mode (e.g. USB/LSB/CW).
- Set “PTT Manager” to COM7. This is one part of your second pair COM7⇔COM8 of the two VSPE cables to control the PTT switch (i.e. to change from receiver to transmit and vice versa).
- Click into “Management” and into “Start CAT” to connect these end of both cables to the ZS-1 software – see *Figure 4*. Close “Settings” window.

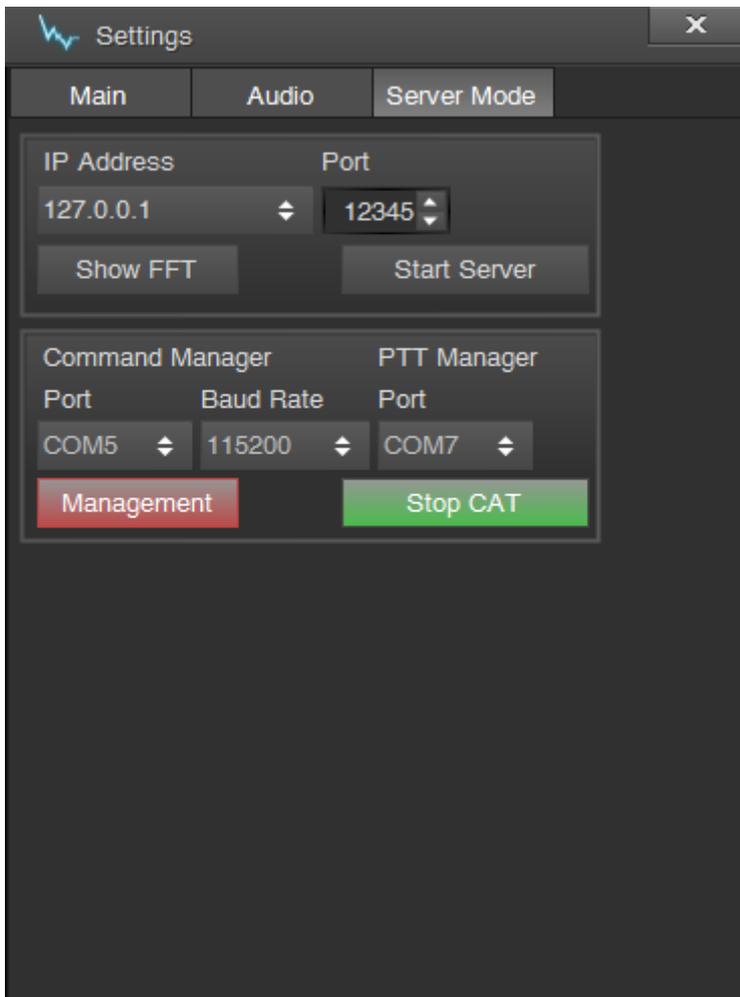


Figure 4: Here the COM settings had been made at ZS-1 software – COM5 for the Command Manager, exchanging frequencies; COM7 for the PTT Manager for keying the transceiver Both functions have to be activated – see highlighted bottoms below. “Baud Rate” may be also reduced, I kept it at default.

Second step: Soundcard

- Click “Settings” (the gear-like icon upper right), to open the SETTINGS window.
- In this Window, click to “Audio”, see Figure 5.
- Set “Output Device” to “Line 2 (Virtual Audio Cable)”. So the audio output during receive will be fed via VAC2 into the input (“Capture”) of FLDIGI.
- Set “Input Device” to “Line 1 (Virtual Audio Cable)”. So the audio input during transmit will be fed via VAC1 from the output (“Playback”) of FLDIGI to the the input (“Capture”) of FLDIGI.

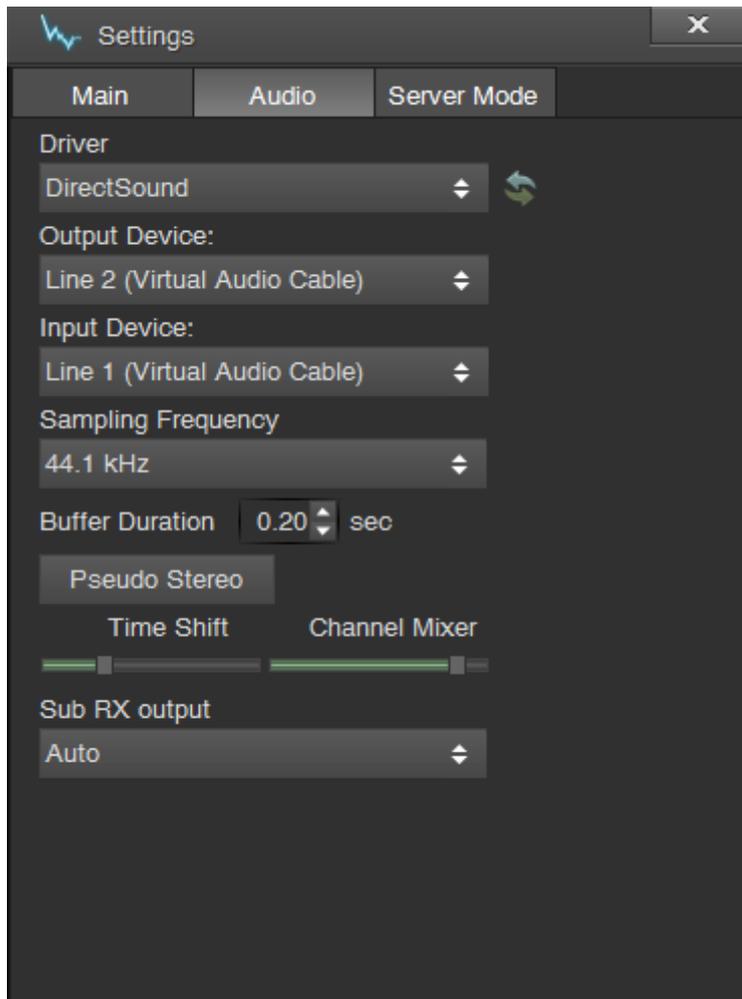


Figure 5: Here the audio settings had been made according to the above text. “Sampling frequency” may be also changed, I kept it at default.

FLDIGI

First you have to download and install free FLDIGI software, written by a team around David Free, W1HKJ, and consisting of M0GLD, F4ECW, VK2ETA, DL1SMF, WA5ZNU, KL4YFD and S57LN.

In the next step, you have to care for routing the **audio in and out** (*Figure 6*):

- Open FLDIGI by double-clicking the icon.
- Open FLDIGI Soundcard configuration: Configure -> Sound Card -> Devices.
- Choose “Line 2” for “Capture”, and choose “Line 1” for “Playback”.
- Click “PortAudio”, if not marked already.
- Save and Close.

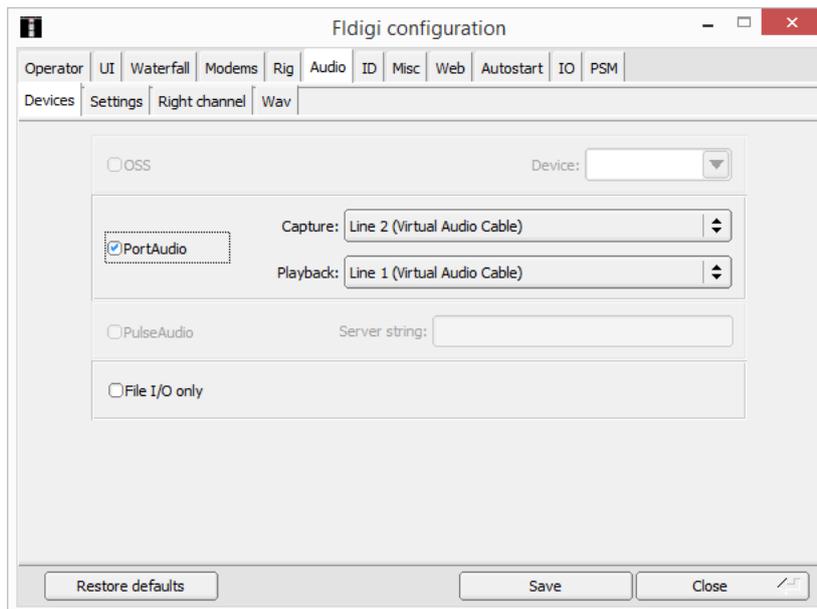


Figure 6: In the menu Soundcard -> Devices of FLDIGI, you have to set the PortAudio as given in the text.

Then you have to prepare FLDIGI to correctly interpret the **frequencies via CAT data**. With ZS-1, they follow a scheme, having been developed for transceiver TS-590S from Kenwood. The interpreter is an XML file:

- Download the file TS-590S.xml from [this source](#) [pick that out of the folder: “kenwood”].
- Save this XML file in the “rigs” folder of FLDIGI.
- Open FLDIGI by double-clicking the icon.
- Open FLDIGI RigCAT configuration: Configure -> Rig control -> RigCAT.
- Locate the “Rig description file” by clicking “Open...”.
- Locate this file, and double-click it. “TS-590s.xml” must now show up in the window “Rig description file” – see *Figure 7*, next page.

Keep the RigCAT window open to finish the CAT-connection for exchanging the frequencies between ZS-1 and FLDIGI, and vice versa:

- Enter COM6 under “Device:”
Remember: COM6 is the other part of virtual serial cable COM5↔COM6.
- Change “Baud rate:” to the same value as in ZS-1’s Settings menu [Figure 4, here 115200]
- In FLDIGI’s configuration window, tick “Using CAT”, click “Initialize”, then “Save” – see also Figure 7.

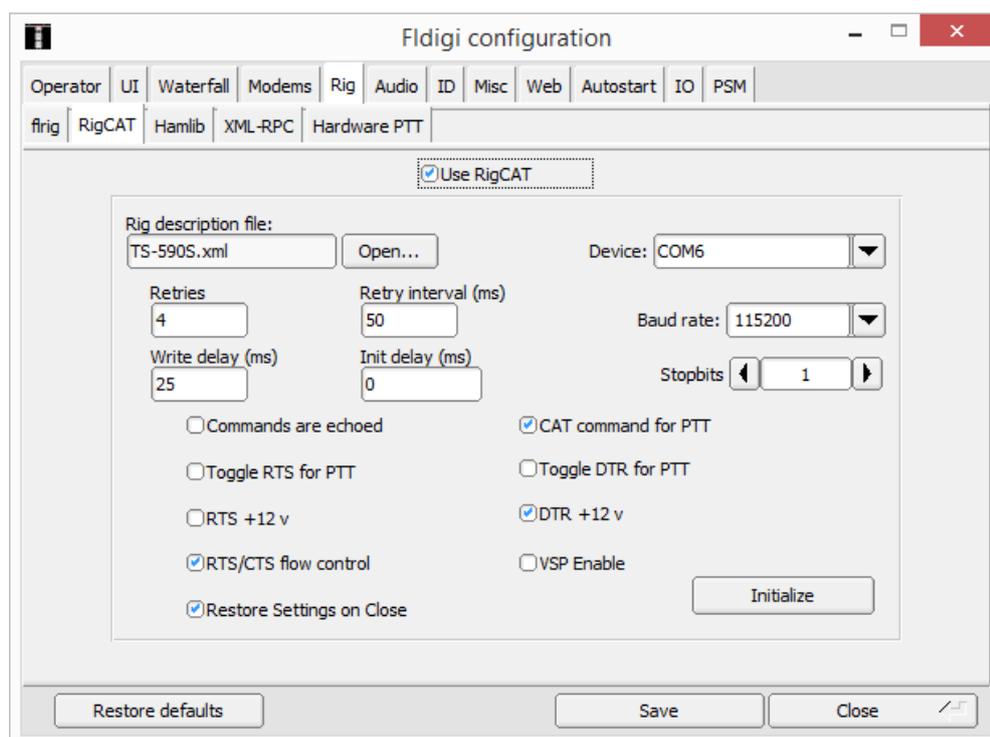


Figure 7: In the menu RigCAT of FLDIGI, you have to choose the right “Rig description file” (TS-590S.xml), as well as the matching “Device” (COM6) and the matching “Baud rate”.

In the next step, you finally have to activate COM8 of the second virtual serial cable to switch ZS-1 between receive and transmit via software:

- Open FLDIGI Hardware PTT configuration: Configure -> Rig control -> Hardware PTT.
- In FLDIGI’s configuration window, click “Initialize”, then “Save” – see Figure 8, next page.

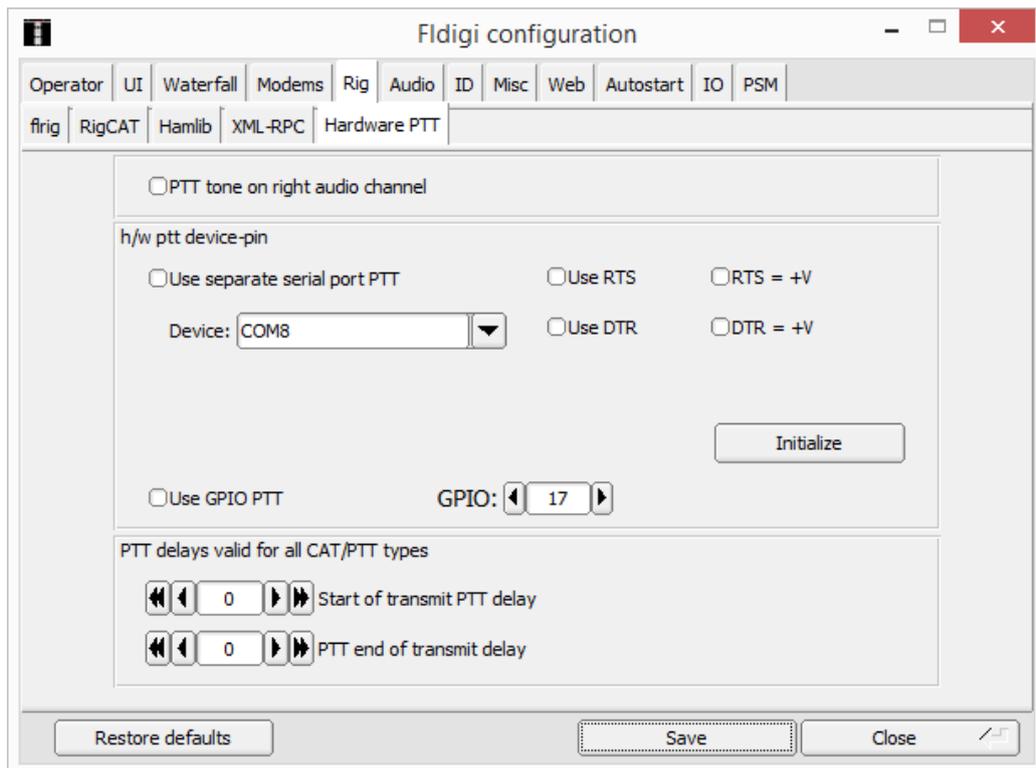


Figure 8: In the menu Hardware PTT of FLDIGI, you have to choose the matching “Device” (COM8) to key the transceiver.

A first Test

For a very first test, switch on your ZS-1 by the software button, upper left. You should now tune the ZS-1 by its own software (modes “Digi” and “USB” and frequency) or the frequency also by FLDIGI. Place a CQ call in PSK31 on 20 m, and the transceiver should switch from receive to transmit, sending out the CQ file, and automatically going back to receive again. See *Figure 9*, next page.

But “nothing heard”? Yes, still you are controlling your audio with just VAC1 and VAC2. The loudspeaker of your PC still isn’t part of the play. You can activate it by the “Audiopeater” module of your VAC software:

- Locate “Repeater.exe” in the VAC folder (default: c: -> Programmes -> Virtual Audio Cable -> audiorepeater.exe)
- Double-click “audiorepeater.exe”.
- Choose as “Wave in “ in the dropdown list “Line 2 (Virtual Audio Cable)” – the output of ZS-1 during receive.
- Choose as “Wave out” in the dropdown list e.g. “Speakers”.
- Click onto “Start” to activate the audiorepeater – see *Figure 10*, next page.

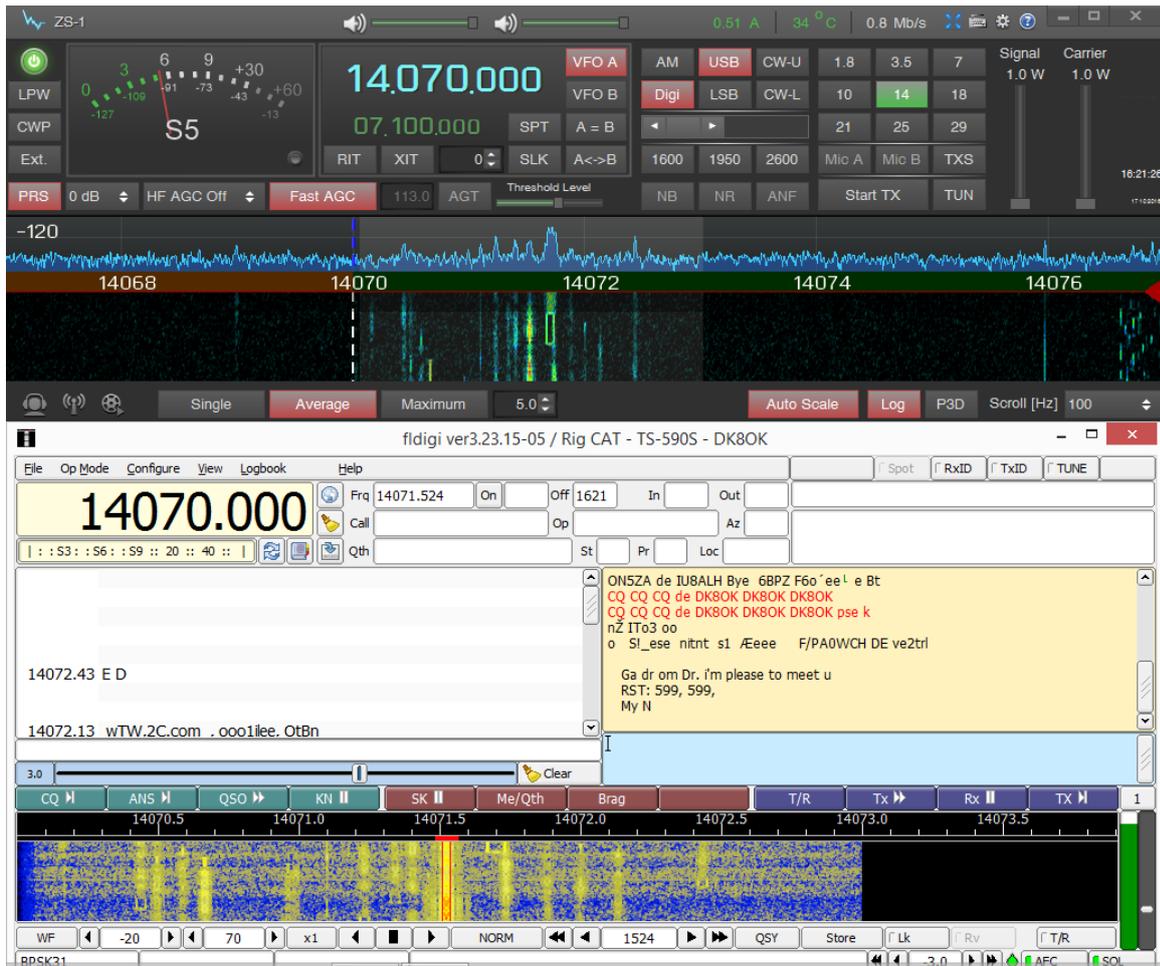


Figure 9: A first test on the laptop shows that all is working fine – swapping frequencies between the two software plus keying the transceiver from FLDIGI.

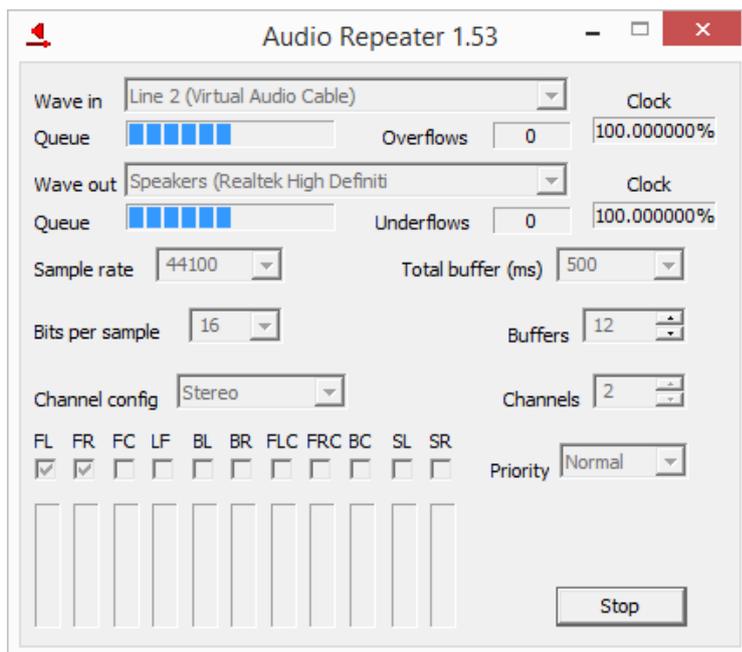


Figure 10: Here the Audio Repeater module of VAC software has been started.

Some important Hints

The above given configuration will work until you switch off your PC and on again.

The good news is that most changed entries are saved and pop up after re-booting the PC. This is true for:

- VAC cables, which are automatically started in the background
- Virtual Serial Ports Emulator, VSPE: : if you have saved all your changes, the last setup will come into action again as soon as you double-click the icon.
- ZS-1: if you have saved all your changes, they will come into action again as soon as you double-click the icon.
- FLDIGI: if you have saved all your changes, they will come into action again as soon as you double-click the icon.

For one other things you **must** care for after **each** re-boot of your PC:

- Start VSPE software, control if COMs are active, send it down to the task bar line

Recommendation

I recommend having aliases of the four software you need on the desktop. There you should place them in a row (from left to right, e.g.). You then make now mistakes **in opening each software in the right order after a re-start of the PC** – *Figure 11*. After that you can click VSPE and Audio Repeater into the task bar.

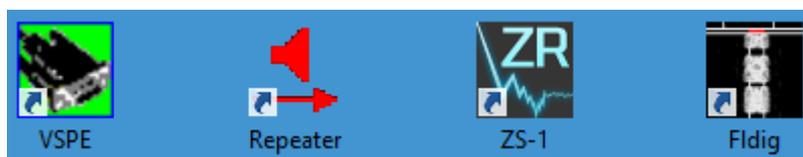


Figure 11: Just put the icons of the aliases of each of the four important software onto your desktop. So you nearly automatically open a) each software needed in b) the right order.

| Date | UTC | Band | Mode |
|-----------|-------|------|------|
| 18 Sep 02 | 12:59 | 15M | RTTY |
| VOID | VOID | VOID | VOID |
| VOID | VOID | VOID | VOID |

QSO Verified by KK5DO 73...Ed

Figure 12: With digital modes, 5 W is enough for even the Most Wanted DXCC Country, namely North Korea. QSL of P5/4F4LN, worked in QRP, RTTY mode, back in 2002 on 15 m The last one for DXCC Honor Roll ...

Appendix: Some other Software than FLDIGI

The above text should apply also for similar software. Here are examples of some other software than FLDIGI, I just had at hand which had been tried out *in praxi*. For the controls of ZS-1 software see *Figure 4* and *Figure 5*.

Generally speaking, it turned out that the easiest parts are:

- routing audio in and audio out between transceiver software and mode software
- keying the transceiver from receive to transmit and vice versa via the mode software

The more difficult part, however, seems:

- to control also the transceiver's frequency and mode via CAT

Due to time limitations, I couldn't achieved that in each case where it might be possible if you have more time to struggling through the thicket of several software menus with their often each individual wording and logic. So, see this Appendix just a starter for your own work.

I used some care to test each and every step, I have describes in this Appendix. Nevertheless, there may be hidden mistakes or newer software revisions causing the system still not working. In this case, refer to what said to FLDIG and try it in parallel with your mode software.

EasyPal

[EasyPal](#) is a fine digital SSTV mode, using a robust OFDM modulation, similar to DRM (Digital Radio Monde). Look [here](#) for an introduction. It is also one of these innovative modes which deserve more attention.

The software supports:

- Soundcard: VAC in/out
- CAT: Keying the transceiver

Soundcard: Action -> Setup -> Soundcard.

With soundcard options somewhat limited, see *Figure 13* you may have to change soundcards in ZS-1 software:

- In *Figure 13*, I choose Line 1 for receiver and Line 3 for transmit. Click "Assign", and reboot EasyPal.
- In ZS-1, this corresponds to Output Device 1 = Line 1 and Input Device = Line 3. If it is not matching, change these options.

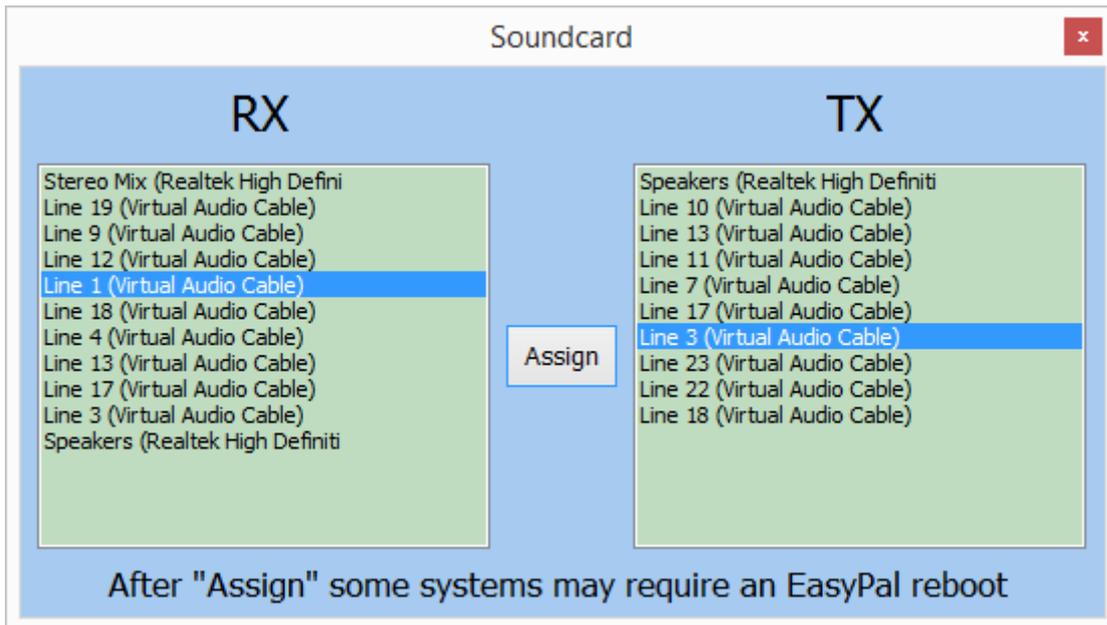


Figure 13: Choose soundcards for receive (RX) and transmit (TX), then reboot EasyPal.

CAT: Setup -> Setup c/s-soundcard-PTT -> Use CommPort (PTT rts/dtr). See Figure 14 for “PTT COMMPORT SETUP”

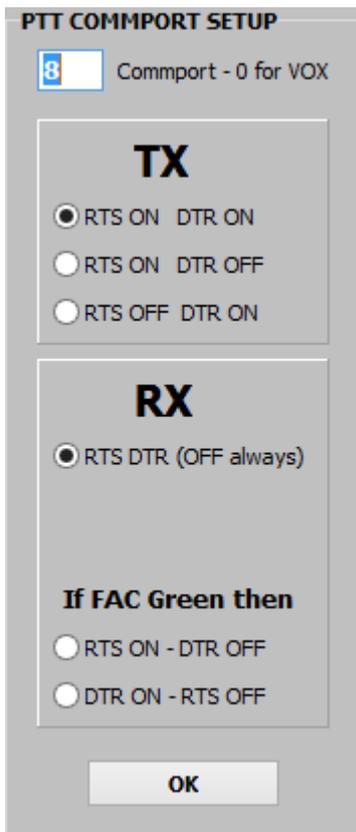


Figure 14: Keying is done via the “PTT COMMPORT SETUP” by COM8. Tick “RTS ON DTR ON” at TX and “RTS DTR (OFF always)” at RX.

FreeDV

[FreeDV](#) is a free software for digital audio on HF with a public domain speech codec. It's a clever mode with just 1,25 kHz bandwidth and 16 QPSK carriers which deserves much more activity.

The software supports:

- Soundcard Receive: VAC in/out
- Soundcard Transmit: VAC in/out
- CAT: Keying the transceiver

Setup is done via Tools -> Audio Config

Soundcard Receive: Obviously there is a built-in "Audio repeater". So, first switch off VAC's Audio Repeater module if you have activated it.

Call up "Tools -> Audio Config" menu in FreeDV, then choose (see *Figure 15*):

- Index Tab "Receive"
- From Radio: Line 2
- To Speakers/Headphones: Speakers
- Index Tab "Transmit"
- From Microphone: Line1
- To Radio: Line 1
- Click OK

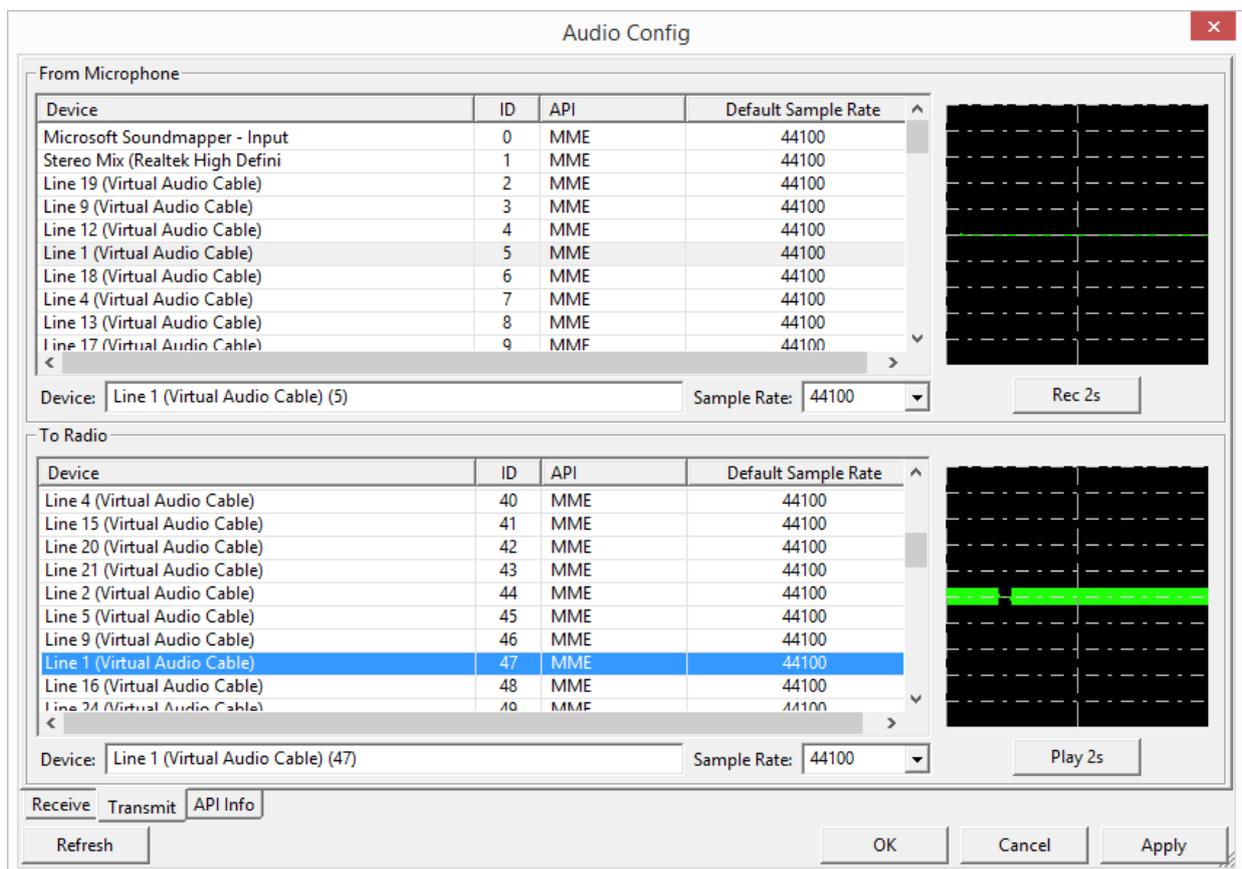


Figure 15: Choose soundcards for receive and transmit via the index tabs at the bottom (here shown: Transmit).

CAT: Call up “Tools -> PTT Config” menu in FreeDV, then choose (see *Figure 16*):

- Click “Use Serial Port PTT” under “Serial Port Settings”
- Choose COM8
- Click OK

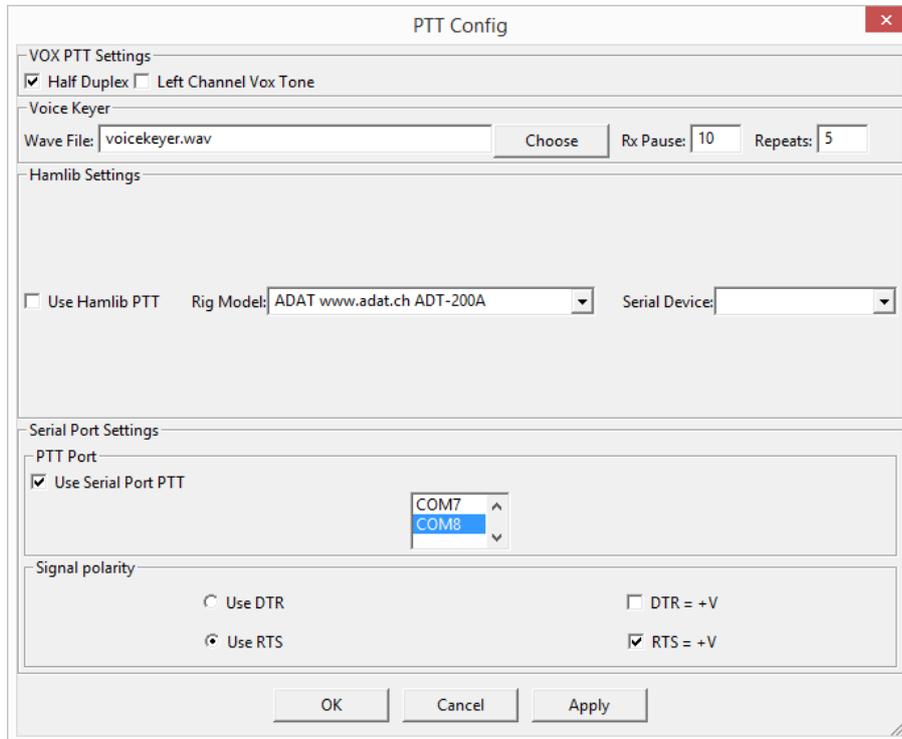


Figure 16: Tick COM8 under Serial Port Settings.

MixW 3.2

[MixW3.2](#) is a fine, versatile multi-mode software.

It supports:

- Soundcard: VAC in/out
- CAT: Frequency control , keying the transceiver plus keying CW
- PTT port settings: Keying the transceiver *plus* CW

There is also an alternative to split up CAT (just frequency control) and PTT (keying the transceiver plus keying CW). This had been also tried out and works pretty much like that in FLDIGI. As I think it more comfortable to control *all* functions via CAT (and it works ...), only this method is explained here.

CAT: call up “PTT & CAT” via Hardware -> CAT settings (see *Figure 17*), then:

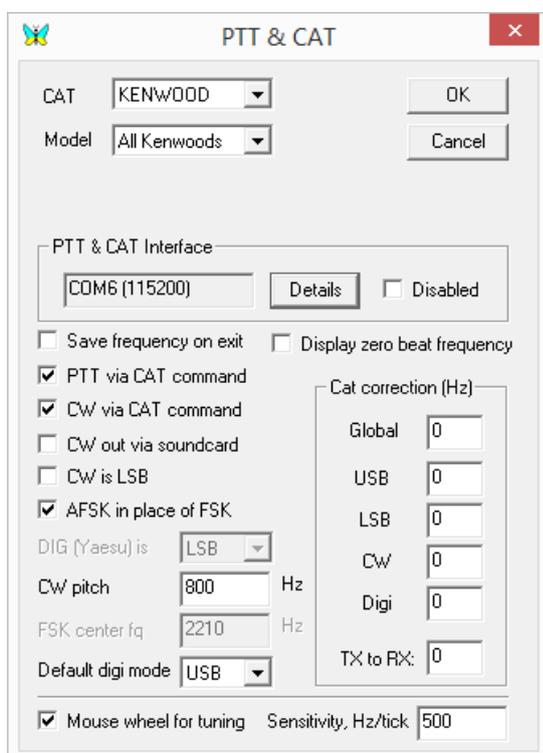


Figure 17: First part of PTT & CAT.

- CAT: Kenwood
- Model: All Kenwoods
- PTT & CAT Interface: call up” COM6 (115200)” via Details -> Serial Port which should read (*Figure 18*, next page):
 - Port: COM6
 - Baud rate: 115200
 - Data Bits 8
 - Parity None
 - Stop bits 1
 - RTS: PTT
 - DTR: CW
 - Click OK

- Tick “PTT via CAT command” if you exactly want *this* (recommended)
- Tick “CW via CAT command” if you exactly want this (it’s up to you, but I recommend key by the CW socket at the rear of ZS-1)
- Tick “AFSK in place of FSK”

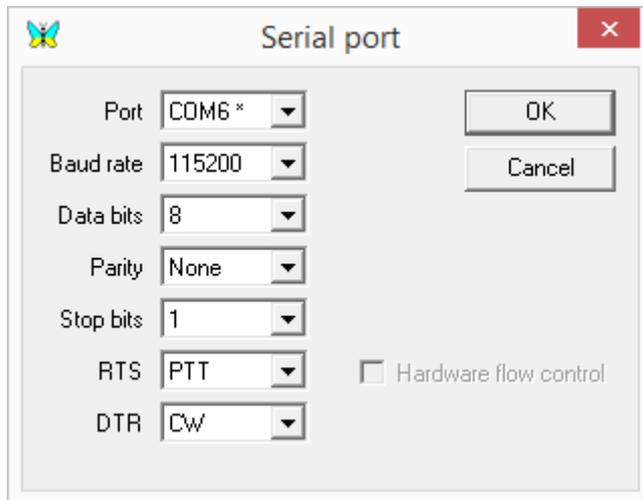


Figure 18: This is the sub-menu “Serial port” of “Details”, see Figure 17.

MMTTY/MMSSTV

[MMTTY](#) is a free software for RTTY, whereas [MMSSTV](#) covers SSTV.

Both software do support:

- Soundcard: VAC in/out
- CAT: Keying the transceiver

Setup is done via Option -> Setup.

Soundcard: If you have programmed more than 32 VACs, the software chooses a set of 2 x 16 at random for “Reception” and “Transmission”, see *Figure 19*. If you miss the VACs you had set in ZS-1 software for reception and transmitting, you have to change them, i.e.:

MMTTY/MMSSTV:

- Setup -> SoundCard
- Choose e.g. Reception Line 3, Transmission Line 4
- Then you have to choose at ZS-1:
Output Device Line 3, Input Device Line 4

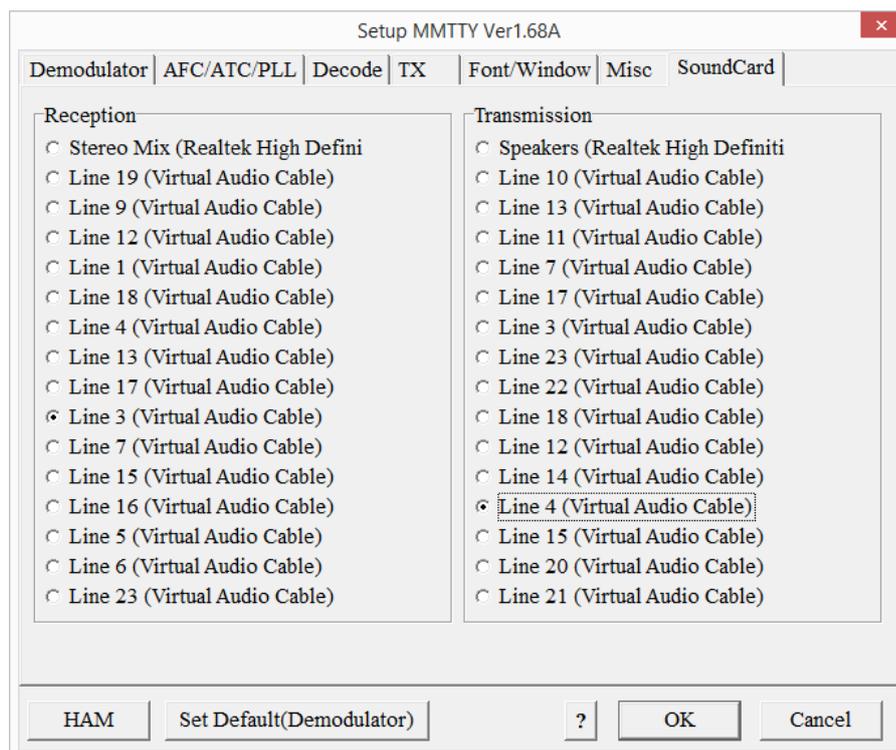


Figure 19: MMTTY (shown here) and MMSSTV do offer a just limited choice of your programmed VACs.

CAT: at MMTTY/MMSSTV, call up Setup.

- MMTTY: Under “PTT & FSK” choose COM8.
- MMSSTV: Under “PTT” choose COM8.

See *Figure 20* showing that for MMTTY, see next page.

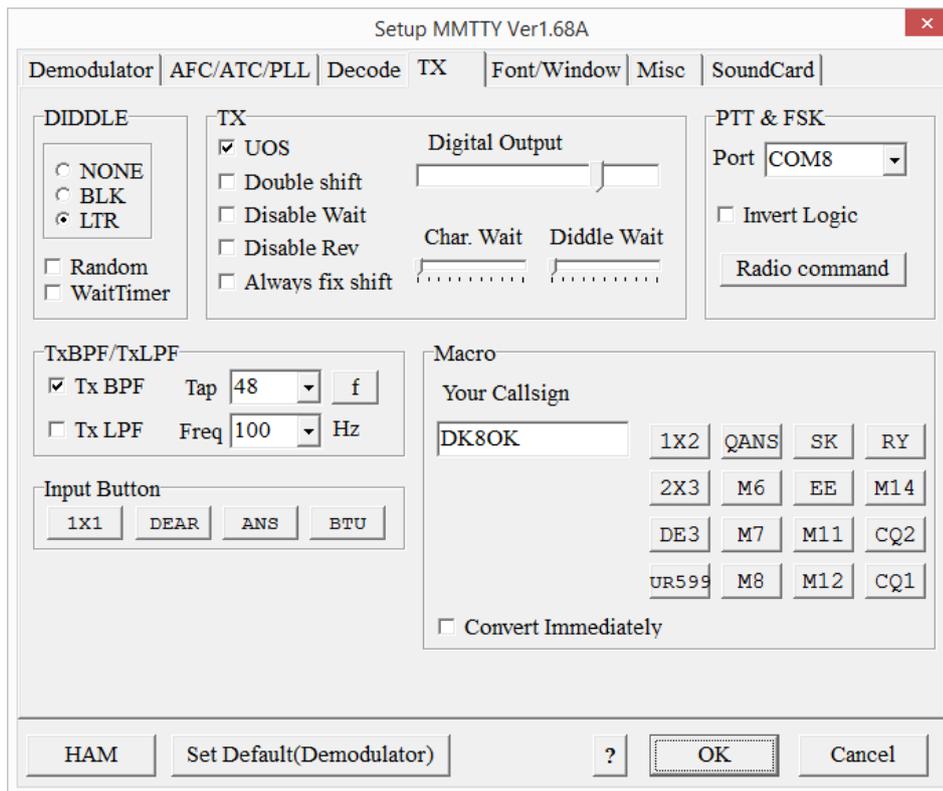


Figure 20: In MMTTY and MMSSTV, CAT controls only the keying of the transceiver.

MultiPSK

[MultiPSK](#) is a real mighty multi-mode software with some unique modes.

The software supports:

- Soundcard: VAC in/out
- PTT port settings: Keying the transceiver
- CAT: via “Commander” module of [DXLab suite](#).

Due to time limitations, I just implemented the most important two points. In the time, I had for testing, I got the “Commander” going (frequency transfer & keying the transceiver right from the Commander), but couldn’t establish communications between Commander and MultiPSK software.

Soundcard (*Figure 21*, for input; next page):

- On the configuration screen, locate “Sound Card (Input)”
- Choose soundcard for input from the list.
- On the configuration screen, locate “Sound Card (Output)”
- Choose the soundcard for input from the list.

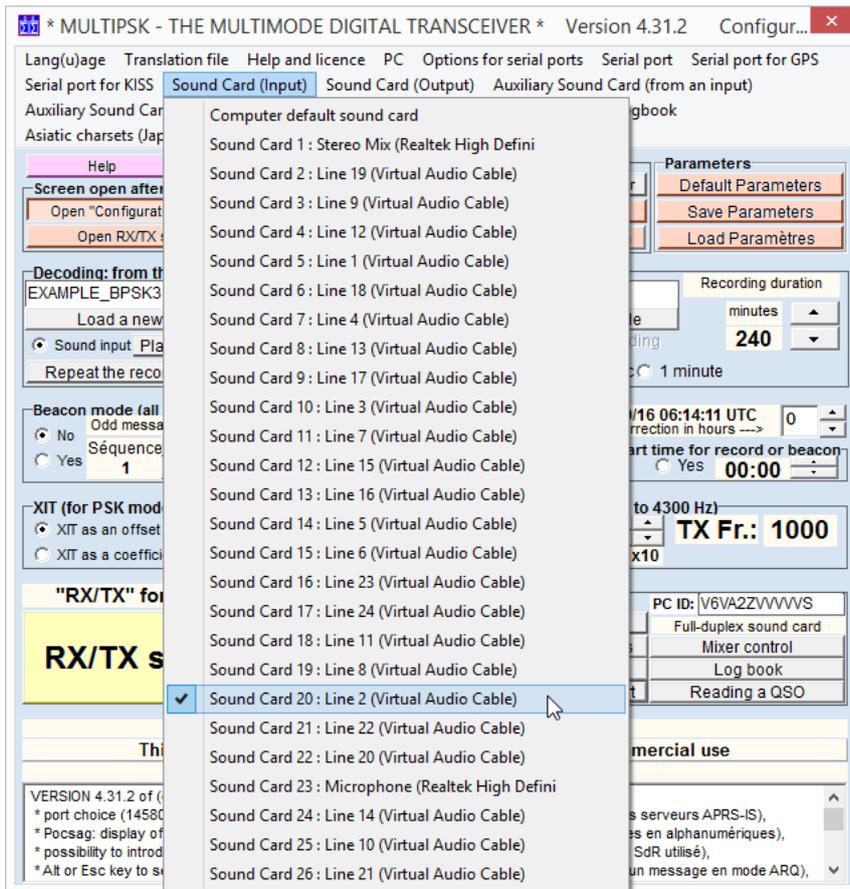


Figure 21: Locate VAC2 for audio input (shown here) and VAC1 for audio output, and tick these.

PTT port settings are done in the “Configuration screen”:

- Serial port -> COM8 (see Figure 22)
- Options for serial ports -> Activation of the RQS ... (see Figure 23)

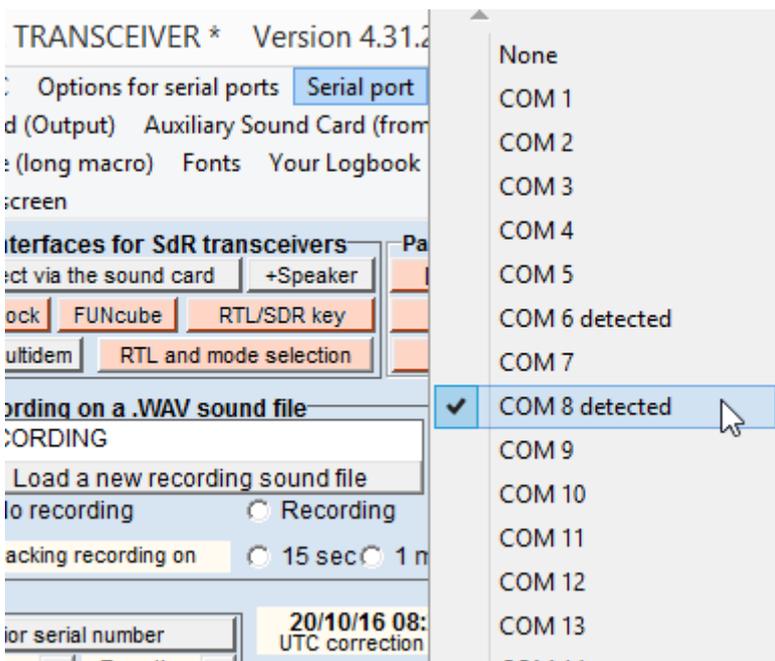


Figure 22: Setting the number of the serial port in the Configuration screen of MultiPSK.

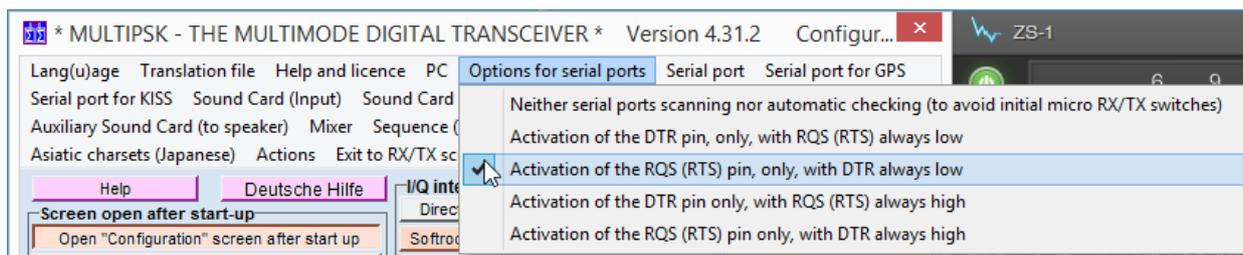


Figure 23: Setting the Options for the serial port.

WSPR

[WSPR](#) is smart software working in WSPR mode with low power and very high efficiency under even adverse HF conditions.

The software supports:

- Soundcard: VAC in/out
- PTT port settings: Keying the transceiver
- CAT: Frequency control

See [Figure 24](#) for the “Station parameters”. With this setup I can use *only* frequency control via CAT. Unfortunately, it reports *invalid audio devices* ([Figure 24](#)). There are a couple of questions in the internet addressing the same problem – alas, without an answer. Help is appreciated!

Sorry to say that the same goes for [WSJT](#) software: CAT for keying works, but couldn’t get the audio input/output working. Also here: Help is appreciated!

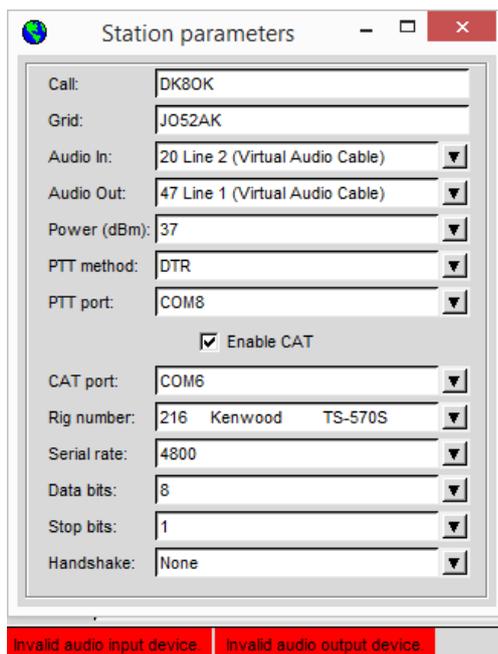


Figure 24: With WSPR, I got only CAT working. All 50+ audio channels return to be “invalid audio device” each.