

How To set up the Kenwood TS-590S for Digital Data and Digital Voice Operation

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Introduction

These brief notes explain how to set up the Kenwood TS-590S transceiver for digital data and digital voice (DV) operation. The audio codec that is built into the transceiver makes this very simple to do.

The procedure described in this HOWTO has been specifically tested with Windows XP Home + SP3. The procedure for other versions of Windows should be similar.

Hardware Requirements for Digital Operation

- Kenwood TS-590S transceiver
- PC
- USB A/B cable to connect the TS-590S to the PC

Additional Hardware Requirements for Digital Voice Operation

- A (built-in) sound card for the microphone and loudspeaker/headphones (for example, SigmaTelAudio, SoundMAX, Realtek, AC97)
- Microphone and loudspeaker/headphones

Software Requirements (see References for sources)

- Virtual COM port driver (USB audio codec), from Kenwood
- (Optional) QuickMix, to save Windows audio level settings
- Digital data software (for example, Fldigi, Digipan, WSPR)
- Digital voice software (for example, FDMDV)

Connecting the TS-590S to the PC

Fig 1 shows the simplicity of connecting the TS-590S to the PC. All that is required is a standard USB A/B cable – that is, a cable with a rectangular connector at one end that plugs into a spare USB socket on the PC, and a square connector at the other end that plugs into the back of the radio.

Control of the switchover between transmit and receive is achieved by VOX. There is no hardware PTT connection between the PC and the radio. The radio has a separate set of VOX controls for data transmission – these controls are totally independent of VOX for SSB.

If CAT control of the radio is required as well, an additional RS-232 cable is required (not shown here).

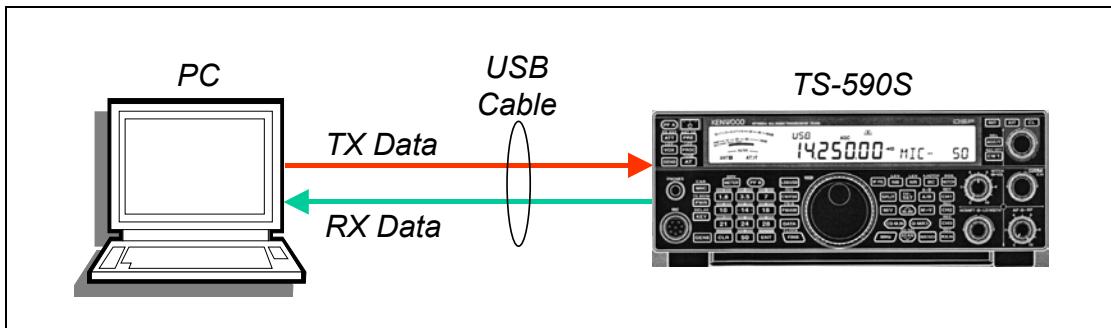


Fig 1: The PC and the radio are connected together by a single USB cable. Transmit/receive control is achieved by VOX – there is no PTT connection

This method of connection has several advantages over other methods:

- The connection uses a standard USB cable, not a custom-made radio-specific cable.
- No separate hardware interface is required to isolate the PC from the radio.
- The connection between the PC and the radio is digital, not analog, thus reducing the possibility of hum pickup.

Installing the Virtual COM Port Driver

Before the PC can communicate with the radio, you need to install the virtual COM port driver on the PC. The driver software and full instructions for installation are available for download on the Kenwood site:

http://www.kenwood.com/i/products/info/amateur/vcp_e.html

After installation, the driver should appear as a serial port, similar to Fig 2.

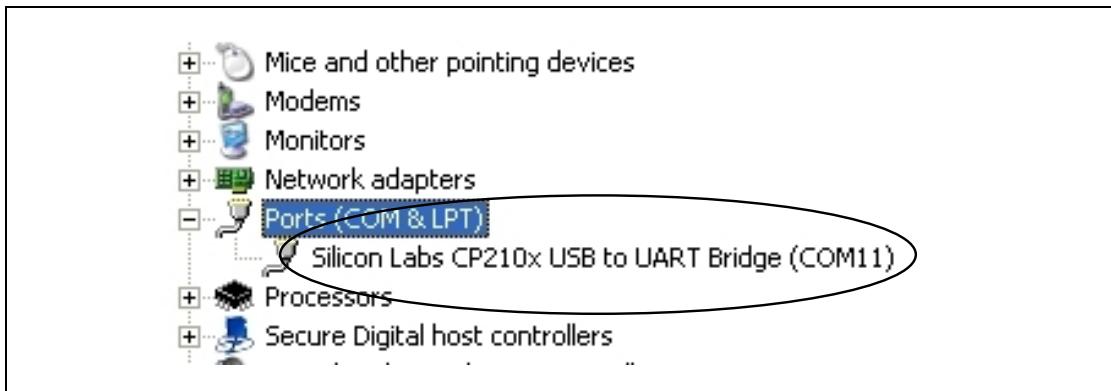


Fig 2: The Windows Device Manager ([Control Panel > System > Hardware > Device Manager](#)) confirms that the virtual COM port driver is installed

Setup for Digital Data Operation: The Big Picture

The block diagram in Fig 3 shows how the hardware and software fit together for digital data transmission and reception.

- The yellow boxes represent the PC software
- The blue box represents the Windows audio mixer control
- The RX audio level into the PC is controlled within the TS-590S
- The TX audio output level from the PC is controlled by the Windows audio mixer
- The audio mixer and the capture/playback interfaces in the digital software are set to “USB Audio CODEC”

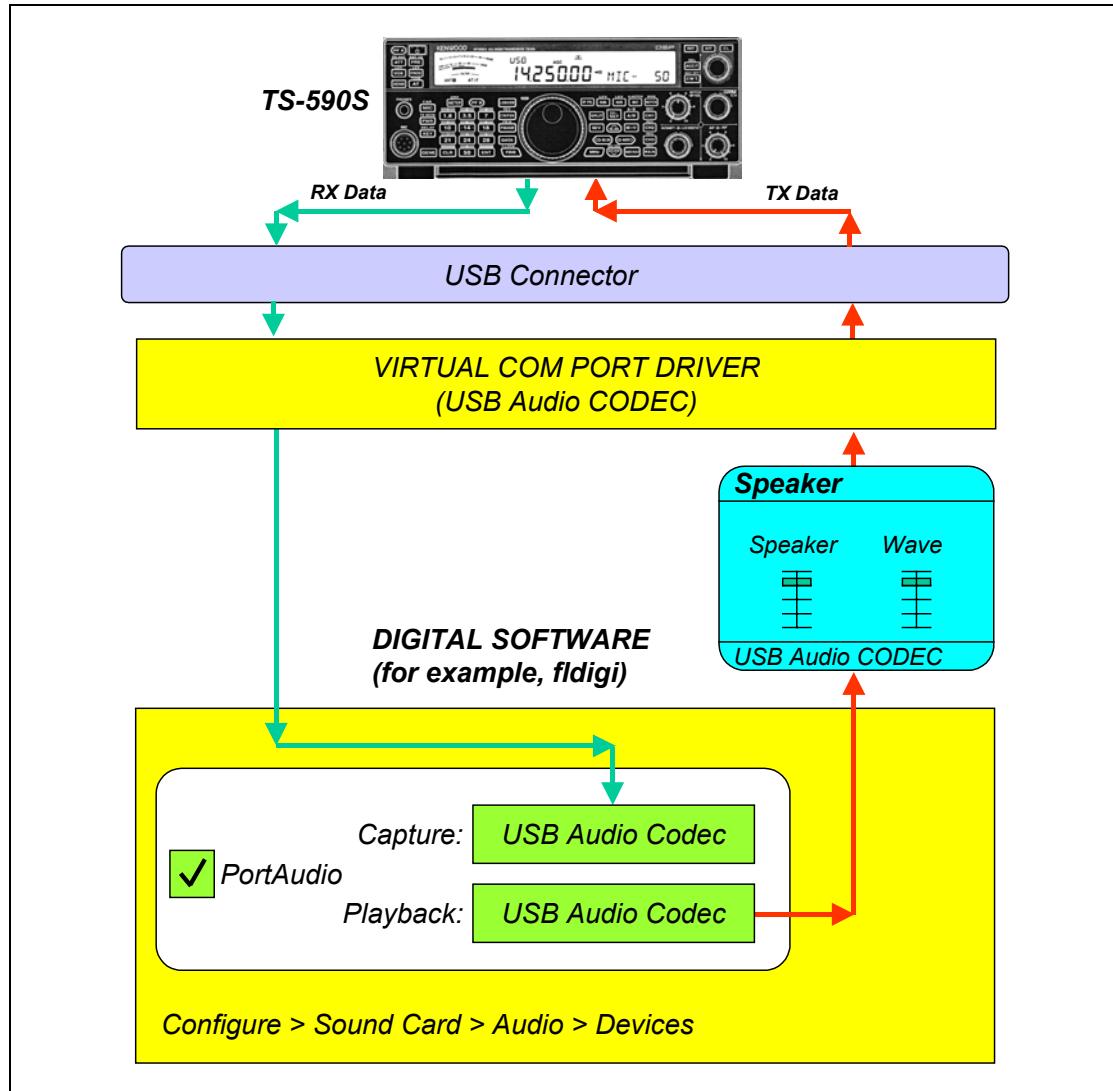


Fig 3: Transmit and receive data flow for digital operation

You may be wondering why only the Speaker audio control is configured in Windows (to control the TX audio level from the PC to the radio), where it would seem that a Recording control should also be necessary (to control the RX audio level from the radio to the PC). In fact, it turns out that the Windows XP audio mixer does not offer a separate Recording control for the USB Audio CODEC. This is why the RX audio level can only be controlled from within the TS-590S. The situation may be different for other versions of Windows.

Configuring the Windows Audio Mixer

The first step in setting up the Windows audio mixer is to make sure the Volume (loudspeaker) icon is displayed on the Windows toolbar. If it is not visible, click on Control Panel > Sounds and Audio Devices, then select Place volume icon in the taskbar. See Fig 4.

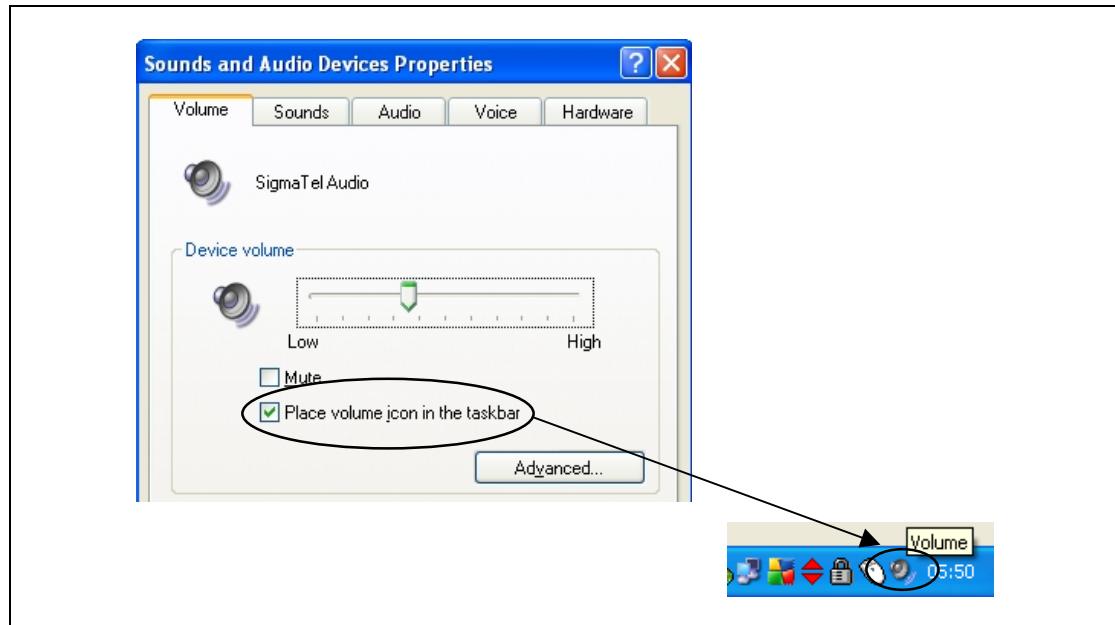


Fig 4: Placing the Volume icon in the toolbar

Next, double-click on the Volume icon in the toolbar. This will pop up the master volume control panel (Fig 5). Click on Options > Properties, then select the USB Audio CODEC as a Playback device. Finally, click on OK, and the control will appear on the screen as in Fig 3.

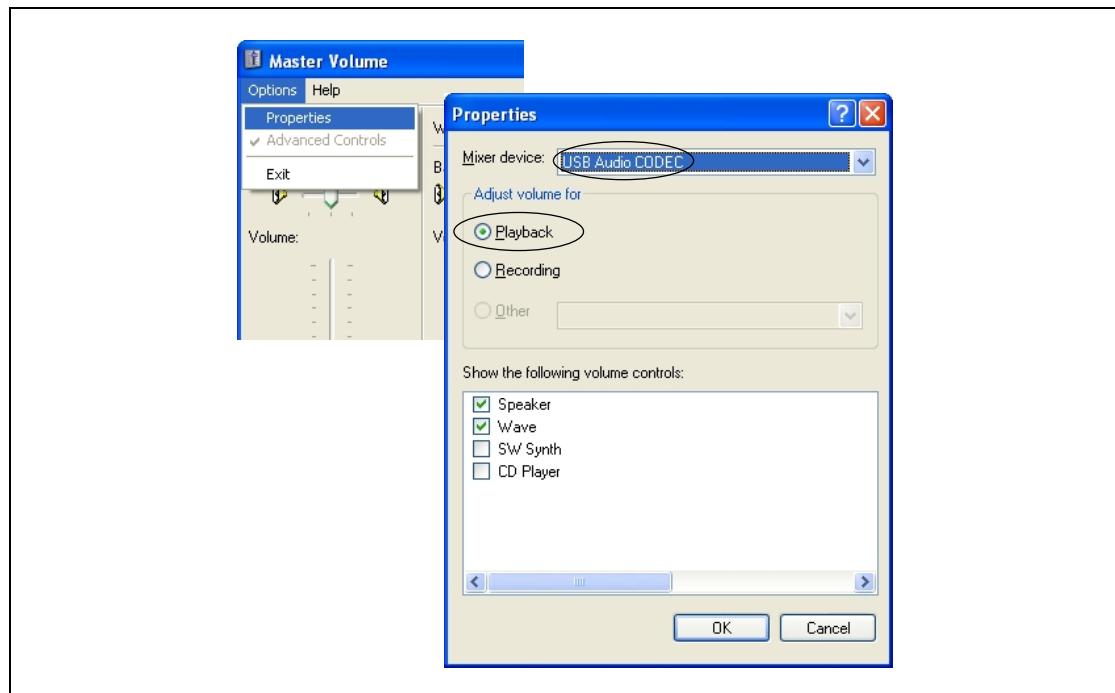


Fig 5: Selecting the USB Audio CODEC

Setting up the TS-590S Menus for Data Operation

Fig 6 shows the menus in the TS-590S that are involved in data operation via the USB connection. The Instruction Manual for the radio explains how to select these menus.

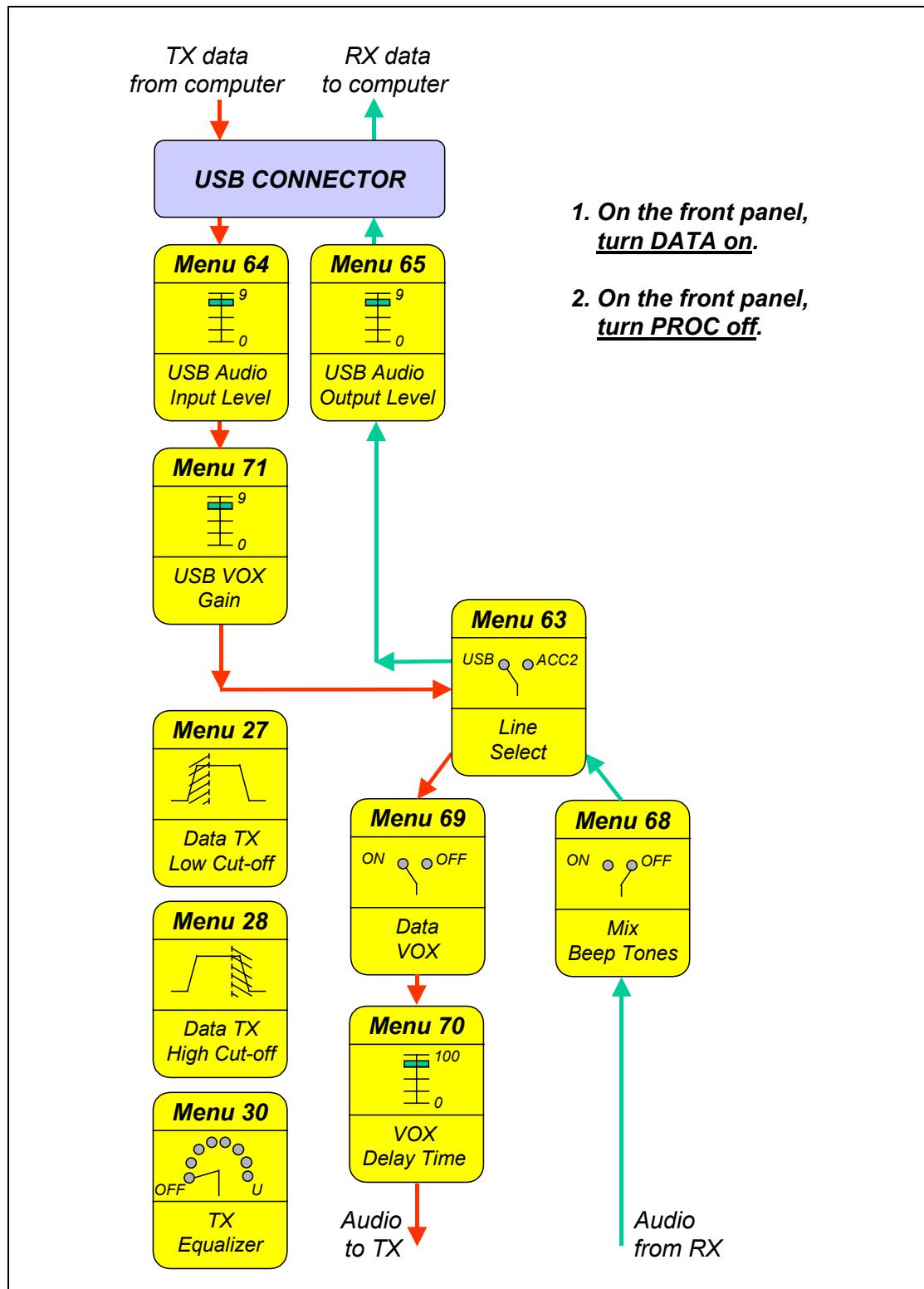


Fig 6: TS-590S menus for data operation

The table below shows the required settings for data operation.

<u>FRONT PANEL SETTINGS</u>		
Menu	Function	Setting
27	Data TX Low Cut-Off	10 Hz
28	Data TX High Cut-Off	3000 Hz
30	TX Equalizer	OFF
63	Line Select	USB
64	USB Audio Input Level	Start at 1, increase as necessary (in conjunction with the Speaker audio control in the PC) for suitable TX audio level. Note: The TX audio level must never exceed the point where ALC appears
65	USB Audio Output Level	Start at 1, increase as necessary for suitable input level to the digital program running on the PC
68	Mix Beep Tones	OFF
69	Data VOX	ON
70	VOX Delay Time	Start at 50, adjust if necessary (unlikely)
71	USB VOX Gain	Start at 5, adjust if necessary (unlikely)

Some comments on these settings:

- Remember to check that the speech processor (PROC) control is turned off at the front panel during data operation, otherwise the data signal will be severely distorted.
- Similarly, remember to turn the TX Equalizer (menu 30) off during data operation, to prevent undue distortion.
- Different digital programs running on the PC generate TX audio at different levels. To avoid having to change the USB Audio Input Level (menu 64) for each program, it is probably easier to leave menu 64 permanently set to 5, say, and adjust the output level in the PC as required by each program. The utility program QuickMix is very useful here, allowing you to save and retrieve individual levels for each program – see the References section for a link to QuickMix.
- It is imperative that the TX audio level never causes the ALC to come into operation. To minimise distortion of the transmitted signal, a simple technique is to:
 - gradually increase the TX audio level to the point where ALC just appears (one block on the ALC display on the front panel).
 - measure the transmitter output power at this point, using an external power meter.
 - reduce the TX audio level until the transmitter output power falls to about 75% of the previously measured power.

By adopting these precautions, it is easy to achieve PSK31 IMD levels of around –37dB (a very good figure).

Receiving Data Signals

When the TS-590S is set to DATA mode, the concentric HI/SHIFT and LO/WIDTH controls on the front panel let you set up a brick-wall audio DSP filter anywhere in the audio passband. See Fig 7.

- The HI/SHIFT control sets the center frequency of the filter.
- The LO/WIDTH control sets the width of the filter.

This gives an extremely flexible and effective method of removing unwanted signals.

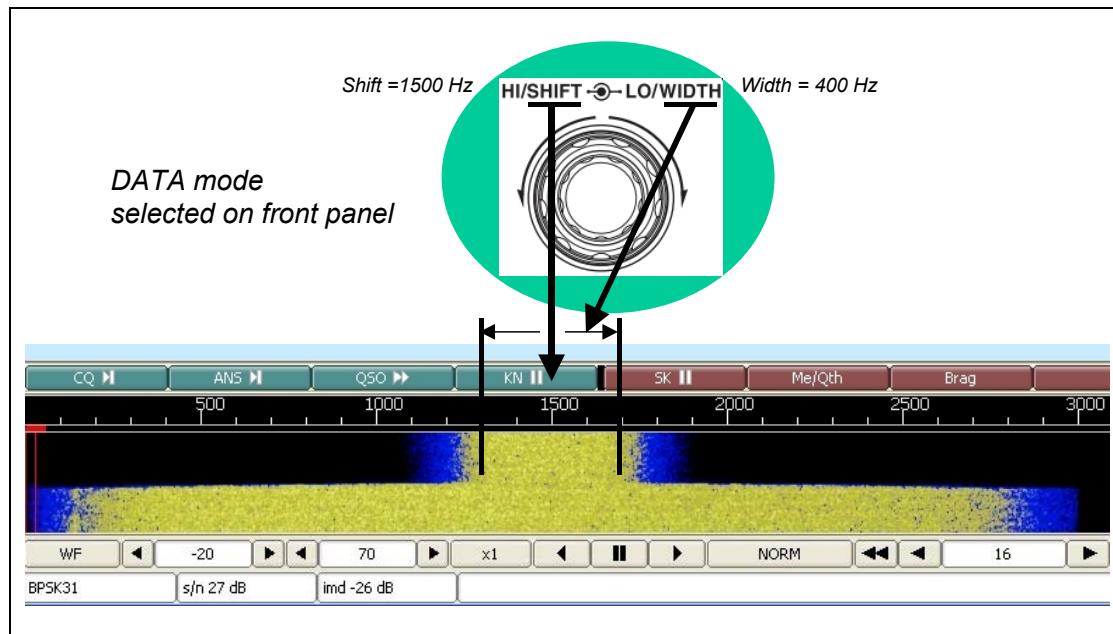


Fig 7: The audio DSP filter in operation (with Fldigi). The radio must be set to DATA mode for this filter to work

Setup for Digital Voice Operation: The Big Picture

The block diagram in Fig 8 shows how the hardware and software fit together for digital voice transmission and reception.

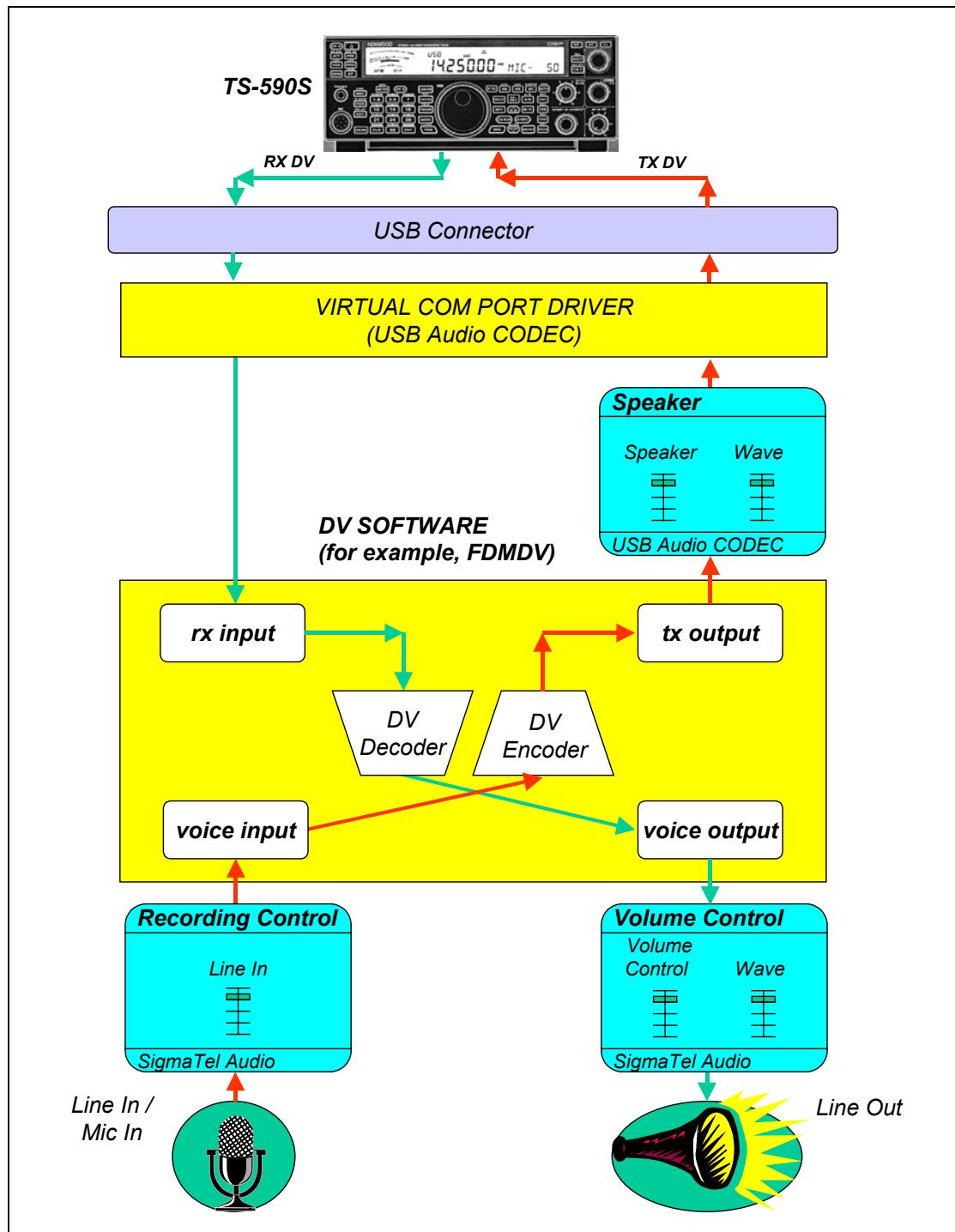


Fig 8: Transmit and receive data flow for digital voice operation

The top half of Fig 8, representing the connection between the PC and the radio, is exactly the same as for digital data operation.

The bottom half of Fig 8 shows the additional hardware and software required for digital voice operation.

- The incoming RX data from the radio is decoded in the DV software, and output as audio to the loudspeaker or headphones. The audio level is controlled by the Volume Control Windows mixer.
- The outgoing audio from the microphone passes through the Recording Control Windows mixer, and is then encoded in the DV software. The encoded audio passes to the USB Audio CODEC, and thence to the radio.

The simplest way of connecting the microphone and loudspeaker/headphones to the DV software is via the (usually) built-in soundcard in the PC. [In the examples in this HOWTO, SigmaTelAudio is used].

DV Soundcard Selection

The first step in setting up the software is to identify the ports that the DV program will use. For example, for FDMDV, click on Sound > Sound Card Selection (see Fig 9), then select the appropriate soundcards:

<i>Input/output</i>	<i>soundcard</i>
rx input	USB Audio CODEC
tx output	USB Audio Codec
voice input	SigmaTelAudio
voice output	SigmaTelAudio

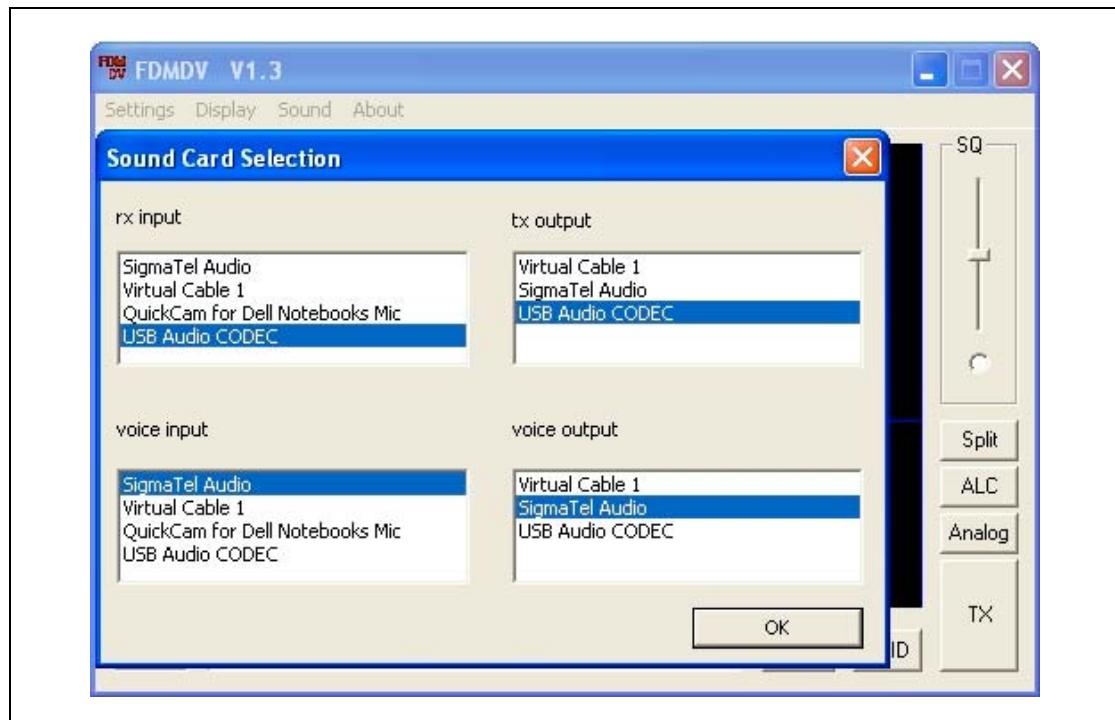


Fig 9: FDMDV soundcard selection

Configuring the Windows Audio Mixers for Digital Voice

For DV you need to configure *three* separate Windows mixers, following the procedure described earlier for the USB Audio CODEC. See Fig 10. The mixers are:

- Speaker: USB Audio CODEC (for tx output)
- Recording Control: SigmaTelAudio (for voice input)
- Volume Control: SigmaTelAudio (for voice output)

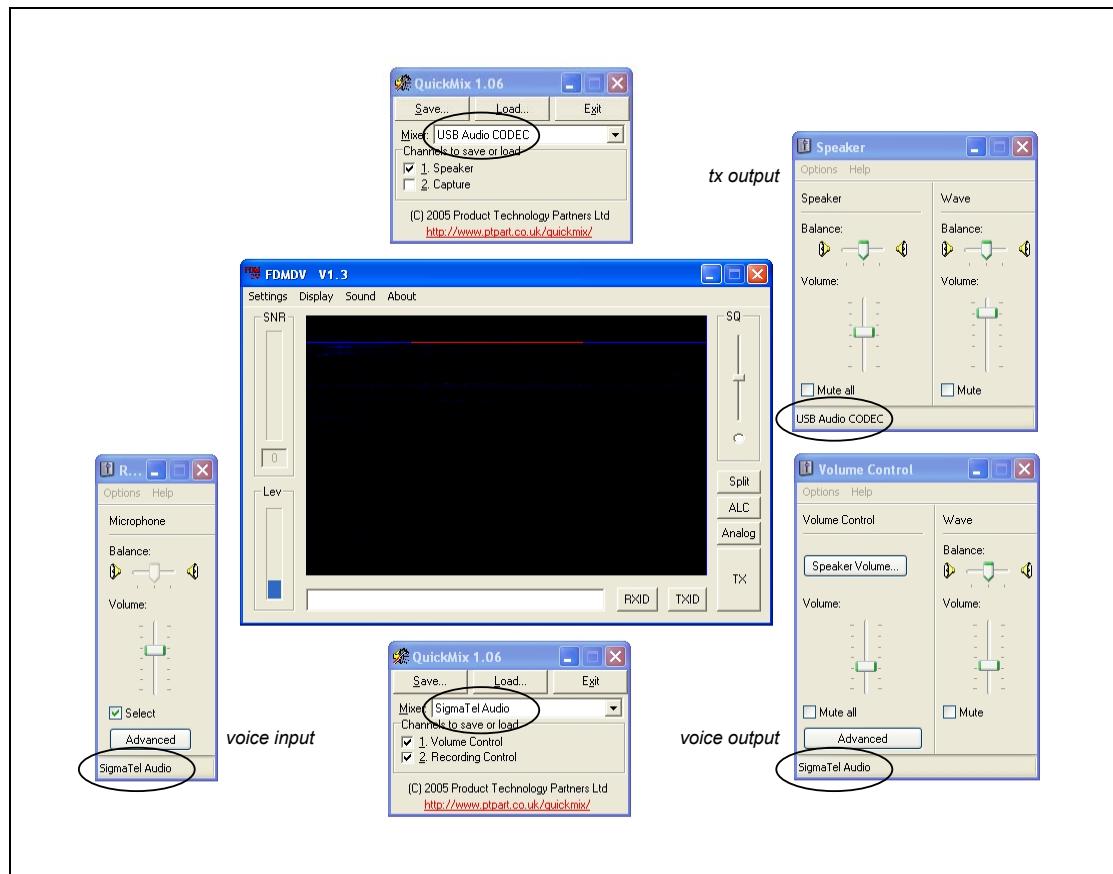


Fig 10: The three Windows mixers used with the DV program (FDMDV). It is convenient to position the mixers on the screen as shown when initially setting them up. When the correct audio levels have been set, they can be saved using QuickMix

Checking out DV operation: Step 1 – Audio input from the radio

To verify that the DV program is receiving audio from the radio, tune the radio into any strong signal and watch the DV receive display. If no signal spectrum appears there, gradually increase the USB Audio Output Level in the radio (menu 65) until the spectrum appears.

Then adjust the DV program for minimum squelch, and check that loud squawking sounds emerge from the loudspeaker/headphones. If necessary adjust the voice output Volume Control mixer for a comfortable sound level.

The system is now ready to receive DV signals.

Checking out DV operation: Step 2 – Microphone input level

Click on the TX button and speak into the microphone. Adjust the voice input Record Control mixer to the point where the voice level indicator on the DV program reaches about 90% of maximum.

The system is now ready to transmit DV signals.

Checking out DV operation: Step 3 – Saving the mixer levels

To avoid having to set the Windows mixer levels each time you start the DV program, it is a good idea to save the levels, using QuickMix. You will need to save two sets of levels: one set for the USB Audio CODEC, and the other set for the PC soundcard.

Checking out DV operation: Step 4 – More detailed instructions

The above description is necessarily brief, to explain the basic steps in setting up the PC and the radio for digital voice operation. For the finer points you will need to refer to the detailed documentation for the DV program(s) you plan to use. As a starting point, the FDMDV documentation by Mel Whitten, K0PFX, is very helpful – it is at <http://n1su.com/fdmdv/>

Making Contact on Digital Voice

The recommended way of setting up a DV sked is to register with the K3UK Digital Sked page:

<http://www.obriensweb.com/sked/index.php?page=digital>

Then post a message saying what frequency and mode you are using, and with luck someone will call you!

References

Resource	URL
Kenwood TS-590S Resources – G3NRW	http://homepage.ntlworld.com/wadei/ts-590s.htm
Virtual COM port driver	http://www.kenwood.com/i/products/info/amateur/vcp_e.html
QuickMix software	http://www.pcworld.com/downloads/file_download/fid,6486-order,4/download.html
Fldigi software	http://www.w1hkj.com/download.html
FDMDV software and user documentation	http://n1su.com/fdmdv/
Digital radio group	http://groups.yahoo.com/group/digitalradio/
Digital voice group	http://groups.google.com/group/digitalvoice
K3UK DigitalRadio Sked page	http://www.obriensweb.com/sked/index.php?page=digital

Document Version History

Version	Date	History
1.0	7 Feb 2011	First version