

The Simple Digital Interface

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Virtually all digital mode operation these days uses the PC sound card to generate the signal on transmit, and to process, decode and display the data on receive. The PC also turns the transmitter on and off, usually via a serial port. The same arrangement applies to non-digital modes such as SSTV, Hellschreiber, Spectrogram signal monitoring and so on. In connecting the computer to the radio transceiver there are a few traps that can snare the first-time user, and will occasionally catch the experienced as well!

Transmit Audio

The computer sound card LINE OUT connection is usually intended for a stereo mini-plug (3.5mm). Since we don't transmit stereo, just connect to the tip and sleeve, leaving the ring floating. The software usually drives both left and right channels. The trouble starts at the transmitter end, where the soldering iron is required. You need of course to have the correct plug for the rig. On simpler rigs you have no choice but to connect to the microphone socket, and it's also often the simplest approach no matter how fancy your rig is, especially if you wish to use digital VOX. On some rigs there is a rear panel auxiliary connection for transmit audio, but there are several points that need to be considered. Does the transmitter VOX work with audio fed in this way? Does the microphone stay connected while using the auxiliary input, so receiving stations will hear your keystrokes and any unguarded remarks? Are unwanted computer noises transmitted via this input, even when you expect to use only the microphone? Read the rig manual carefully and make careful dummy load tests using an independent monitor receiver before venturing on air.

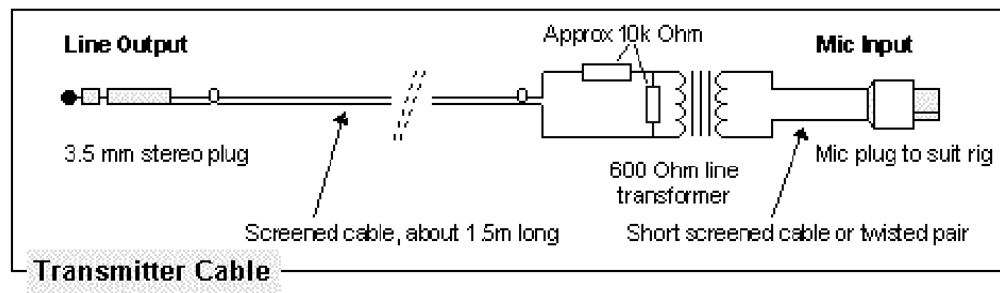


Fig. 1. The simplest transmitter cable

It is very important to use an isolating transformer in the TX audio line (see Fig. 1). This reduces the chance of RF getting into the computer, and computer noise getting into the receiver. However, the main purpose of isolation is to prevent high DC currents from 12V operated rigs returning to the power supply partially via the sound card cables and computer power cord. I have heard first-hand several horror stories about blown-up microphone circuits and melted tracks on sound cards.

The best transformer to use is a small high quality line transformer. You can recycle these from old phones, or you can buy them from DSE, Jaycar etc. The two resistors provide the correct termination to the computer and transformer. Adjust the value of the 10k resistor to give an appropriate audio level. If driving an auxiliary input, the value may need to be as low as 100 Ohm.

Receive Audio

To receive via the computer sound card, the receiver audio output is connected to the computer sound card LINE IN socket, again using a 3.5mm stereo plug. On simpler rigs you will need to use the headphone socket (although sometimes receive audio is also on the mic socket), but a special auxiliary connection is better for several reasons. The level is usually independent of the volume control, and the speaker is not shut off when you connect to it. It is

important to be able to hear what you are receiving, even if once you have made contact you turn down the volume.

It's not wise to rely on the computer speakers to hear the incoming signal, as doing this tends to be a source of stability problems. Remember that you use the speaker audio output on transmit, and since the sound card is full-duplex, with LINE IN enabled to LINE OUT, the receiver noises will be routed through the sound card and back to the transmitter, tripping the VOX and transmitting strange noises. Make sure the LINE IN is disabled as a LINE OUT source.

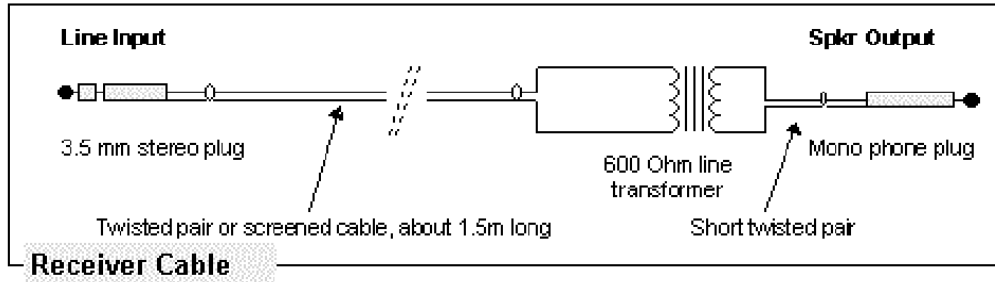


Fig. 2. The simple receiver cable

As you see in Figure 2, the receiver cable is also isolated by a line transformer. The main reason is to prevent destructive power supply return current paths, as previously explained, but it also helps remove interference and reduce hum loops. Once you have all your connections made, and the power cord temporarily removed from the computer, check with a multimeter that there is no DC connection between the frame of the rig (antenna socket for example) and the frame of the computer. The only DC connection should be that via the safety earth (once the computer is plugged in again). Just because you intend to use a laptop doesn't excuse you from using transformers, as laptop power supplies are notoriously noisy, and generally have very poor high frequency isolation from the mains supply. Without the recommended transformers, you are guaranteed to have hum and buzz trouble with a laptop.

Press-to-Talk

The simple interface described above requires VOX to be enabled on the rig for automatic transmit operation. Manual transmit operation is possible, usually gives better results, and may be your only choice on simpler rigs. You could rig up a switch on the microphone plug if necessary, but a simple computer operated PTT circuit is best. Unfortunately this also needs to be DC isolated to prevent dangerous current loops and hum, and in this case, since no audio path is required, the most convenient method is to use an opto-coupler or relay. See Figure 3.

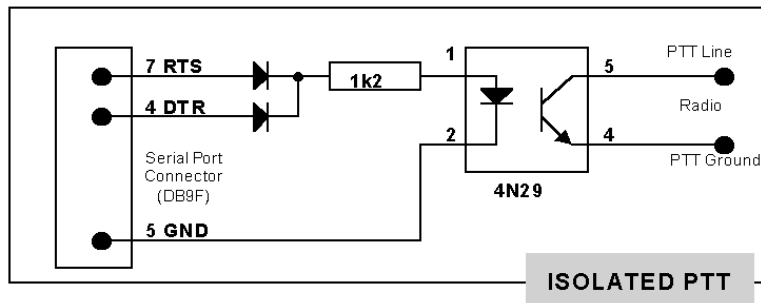


Fig. 3. The isolated PTT circuit

Most PC software operates the transmitter by asserting a handshake line on a spare RS232 serial port (COM Port). There are two output lines available on each port, RTS and DTR, and in some software this setting is configurable. It's much simpler to just wire the two options

together in an OR fashion, as is achieved in this design by the two diodes, which can be any silicon signal diode, such as a 1N4148. Since the source voltage is typically 5 – 10V, and the opto diode is a current operated device requiring several milliamps, a series resistor is used. When the opto diode conducts and thus glows, the opto transistor turns on, and operates the PTT.

Some older rigs use relays, or otherwise draw more current in the PTT circuit that the opto-coupled device in Figure 3 can handle. In such cases use a darlington coupled transistor (BC337 etc) to beef the PTT circuit up. I can also recommend another really beautiful and simple design which I've used several times. This is especially suited to rigs with difficult PTT circuits, such as ones which are operated by pulling the input high rather than pulling to ground, or use a higher voltage unsuited to an opto-coupler. This method uses a small 5V operated reed relay. Just use the same two diodes shown in Figure 3, and replace the resistor and opto diode with the reed relay coil and a parallel catch diode (wired with its cathode to the other diode cathodes). A conventional relay won't do – it must be a low power sensitive type such as a reed relay (5V, 10mA).

Whether you build the opto or reed relay design, either one can be squeezed into the housing of an RS232 D connector. By the way, if you don't have a spare serial port, the USB adaptor type work equally well with either of the designs described. It's more a matter of whether the software will work with the adaptor.

All this and SSB Too!

It is possible to put all the circuits described above into one neat little package, perhaps mounted in a small plastic box. There's a further advantage if you do – you can automate the reconnection of the microphone when you need it, and very often in digital mode contacts (and especially SSTV of course) you wish to alternate voice with digital. It's highly inconvenient to have to plug in and unplug the microphone all the time.

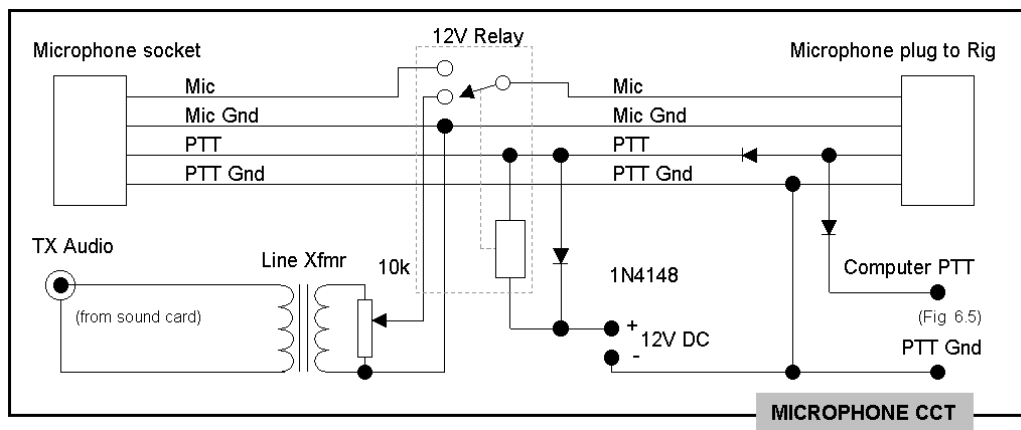


Fig. 4. Combining the interface and microphone

Not everything is shown in Figure 4. You have to imagine that you have also included the components shown in the previous drawings, such as the receive cable and the PTT circuit, although they can also be built separately. The relay shown in Fig. 4 is a conventional small type, operated by the PTT switch on the microphone, which you unplug from the rig and connect to your new box. The box then connects into the microphone socket of the rig. Now, when you press the microphone PTT switch, the relay pulls in and connects the microphone audio, and when you release it, the digital mode audio is connected. The operation is very simple, and feels completely natural to the user.

You will notice the two diodes on the PTT line. These allow the microphone OR the computer PTT circuit to activate the rig. In this way you can pick up the microphone and operate it normally for SSB, even when the computer is off or disconnected. You can also over-ride the digital mode while transmitting. The third diode across the relay coil is to suppress the

inductive spike caused as the relay is released, and might otherwise damage the equipment. By the way, the 12V supply to this circuit must also be isolated from the computer. If the rig runs off a 12V supply, then this may be suitable, although watch for problems with ground loops. If you use the rig's supply, just connect the +12V, and let the relay supply return via the microphone socket ground.