INTERFACING RADIOS TO COMPUTERS

The following guide was produced for the benefit of any radio enthusiasts who are thinking of trying out DGPS, NAVTEX, DSC, SSTV, WeFAX or one of the other radio data modes for the first time, and want a more detailed explanation about how to go about this. Interfacing the radio receiver with the computer can be one of the most confusing aspects of this if you have never done this type of listening before, but hopefully this basic guide will give you a reasonably simple explanation of what you need, and how to go about doing this for yourself. In the original version of this publication, it just covered just Windows XP, which was the main operating system in use for a good many years, but in more recent versions of Windows, such as Vista, Windows7 and Windows8, the soundcard settings now look very different, so although it was about time I updated this to reflect that fact. Because many radio enthusiasts often have an older PC in the shack, which will still run the older operating system on it (essential if you want to continue to run programs like Skysweeper, which won't run on later versions of Windows), I decided that rather than include all the various methods in just one file, it would instead be better to produce two versions. If Windows XP is what you are using, then it's the other version you want, as this one only covers Vista/Windows7 and Windows8.

Different types of Products to basically do the same thing.

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West Mountain Radio RIGblaster Plug and Play Digital Mode/Rig Control Interfaces

Not Yet Reviewed

$119.95

http://www.g4ilo.com/usblink.html

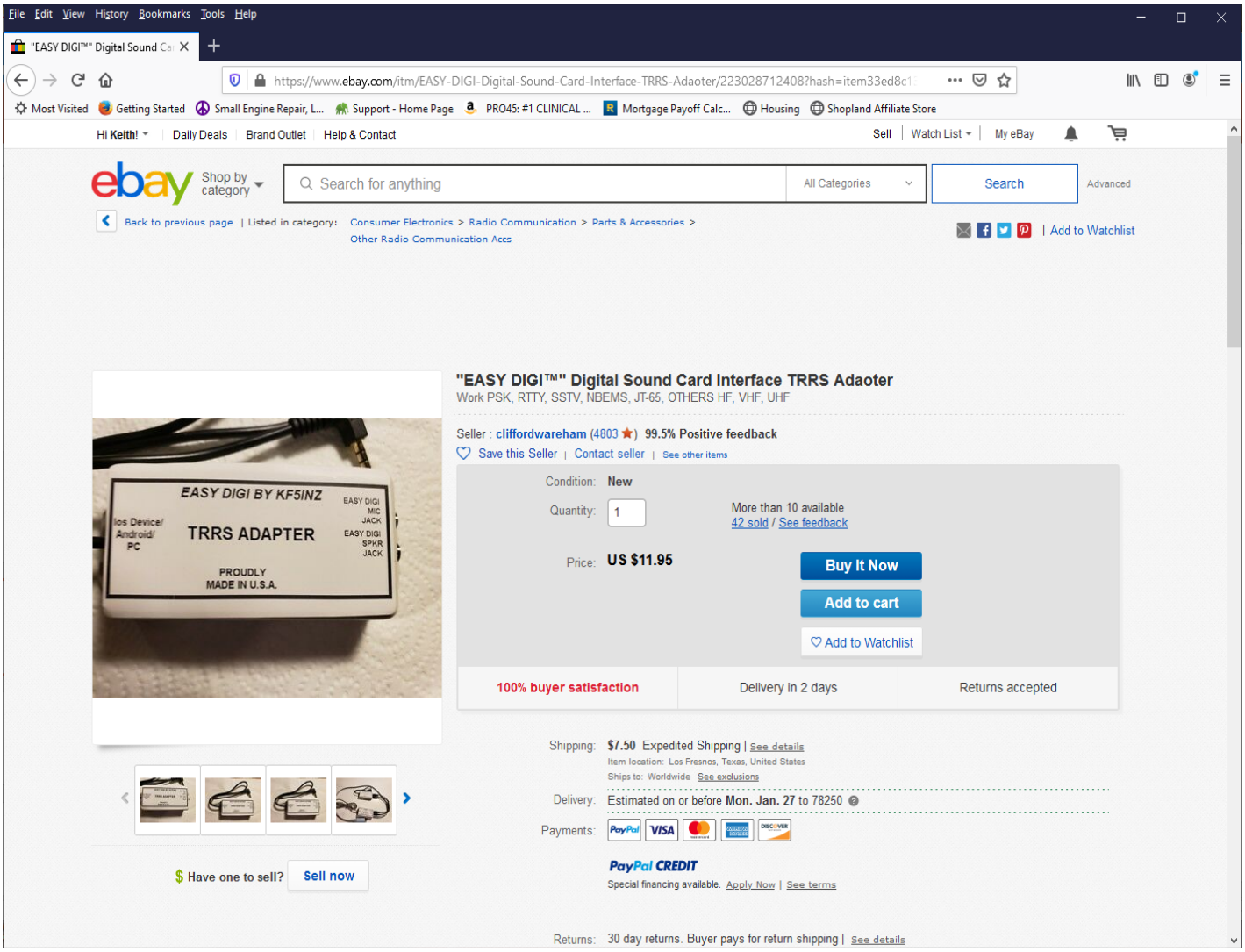
The USBlink - a home-brew digital modes interface:

- Digital modes using sound card software have become increasingly popular over the last few years. However what with YouTube ham radio videos, podcasts and other hobby-related multimedia most hams want to have sound from their computer and are unwilling to give this up to work digital modes. Many solve the problem by buying a SignaLink USB Interface. It's a fine piece of kit and I've heard nothing but good reports of it but it is quite expensive. So how would you like to build your own USB sound card interface for a fraction of the cost of a SignaLink? I did, and I called it the *USB*link. This article describes how I did it.

For Ipad and such:

"EASY DIGI™" Digital Sound Card Interface TRRS Adaoter

Work PSK, RTTY, SSTV, NBEMS, JT-65, OTHERS HF, VHF, UHF



The SignaLink USB Interface is a USB powered device that contains a sound card and VOX circuitry that keys the radio PTT whenever the digital mode software goes into transmit and produces audio. This avoids the need for a serial interface using a second USB port just to control the transceiver PTT, which is the bane of interfaces like the RigBlaster, and it works with just about any digital mode software.

The TigerTronics SignalLink has three front panel rotary controls that let you set transmit and receive audio levels plus VOX delay. It also provides full isolation between the radio and the computer. My *USB*link requires you to use the computer mixer slider controls to set the audio levels, just as you would when using a regular sound card, and the VOX delay is fixed and fast acting. I don't know of any digital modes where you would want a slow acting VOX.

No isolation:

- My USBlink also does not provide isolation. Every commercial sound card interface and just about every published sound card interface design includes transformer isolation of the audio circuits and opto-isolation of the PTT line. It's enough to make me wonder what I'm missing because in all the time I have been using sound card digital modes since the late 1990s I have never used an interface that had isolation and never found it to be necessary. The one time I used a commercial interface with isolation - to connect an Asus Eee PC to my FT-817 - I experienced bad 50Hz hum and had to solder a link between the grounds on the radio and PC sides because the netbook had no grounding through its power supply and so it was floating.
- Because my *USB*link doesn't provide many of these functions of the TigerTronics SignaLink it can't fairly be called a SignaLink clone. But omitting these components allows a big cost saving to be made, as long as you are one of the people who, like me, does not need to isolate the radio from the computer. It also lets you make the interface very small, which is a bonus for portable operation.

Choice of sound card:

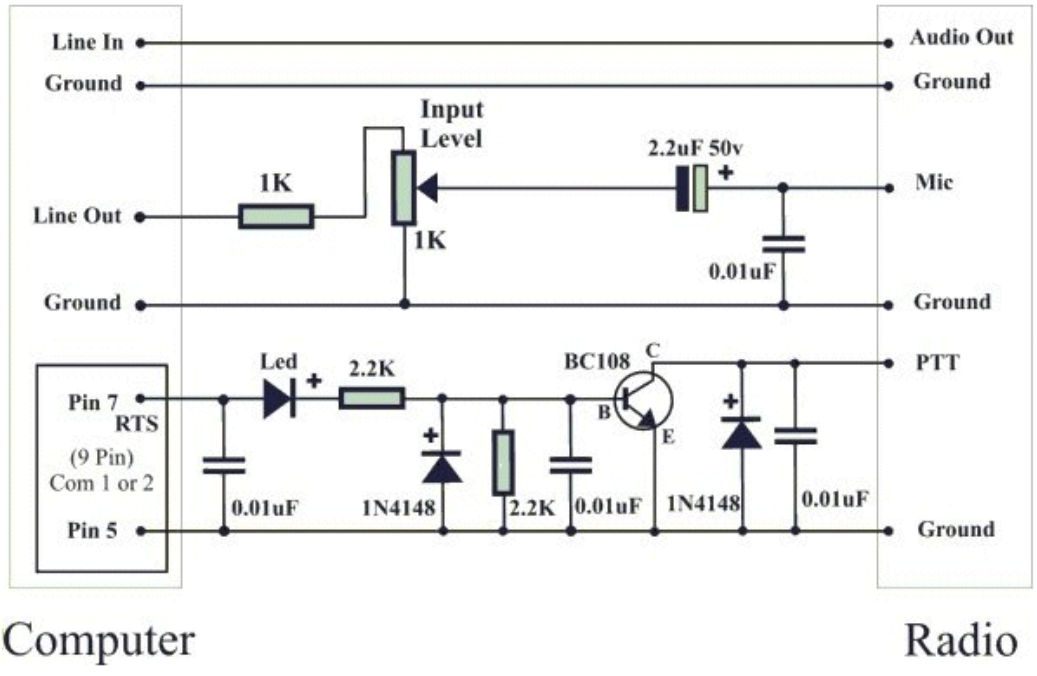
- The *USB*link comprises an inexpensive USB sound card together with a simple audio VOX circuit, housed in a small case.
- The USB sound card I used is shown on the right. At the time of writing these devices can be purchased from China on eBay for a couple of pounds if you are willing to wait a couple of weeks for delivery. Purchased from a supplier in the UK they are a bit more expensive. These sound devices are better quality and more reliable than the cheapest thumb-sized "dongles" and have controls for speaker volume and muting the mic input and speaker output.
- I must point out that in tests I made a few months ago I found this particular type of dongle to give poor results with some sound card software such as the AGW Packet Engine. When playing back recordings I made of weak EME (earth-moon-earth) signals the faint morse code could not be heard at all. I am not sure of the reason for this but it may have to do with the sample rate used.
- Most digital mode programs use a sample rate of 11,025Hz or can select the native sample rate of the sound card. I did not observe poor decoding with other programs I tried. I have switched to using TrueTTY for HF packet and it works with this USB sound device perfectly. So I decided to use this cheap USB audio device rather than a better quality one as the loss would be small if the project didn't work.

SIMPLE INTERFACE:

• This circuit, based on parts typically found in any amateur's "junk box" is an extremely cost effective solution. In this circuit, RTS (the "ready to send" line on the computer) drives an open collector for the PTT. Any general NPN transistor can be used instead of the BC108. It is very similar to the isolated circuit (below), except it does not use audio transformers or the optocoupler, but performs splendidly. (Of course, if you just happen to have a couple of audio transformers, you could add them to this circuit in the same position as in the isolated circuit).

https://www.dxmaps.com/wsjtinterface.html

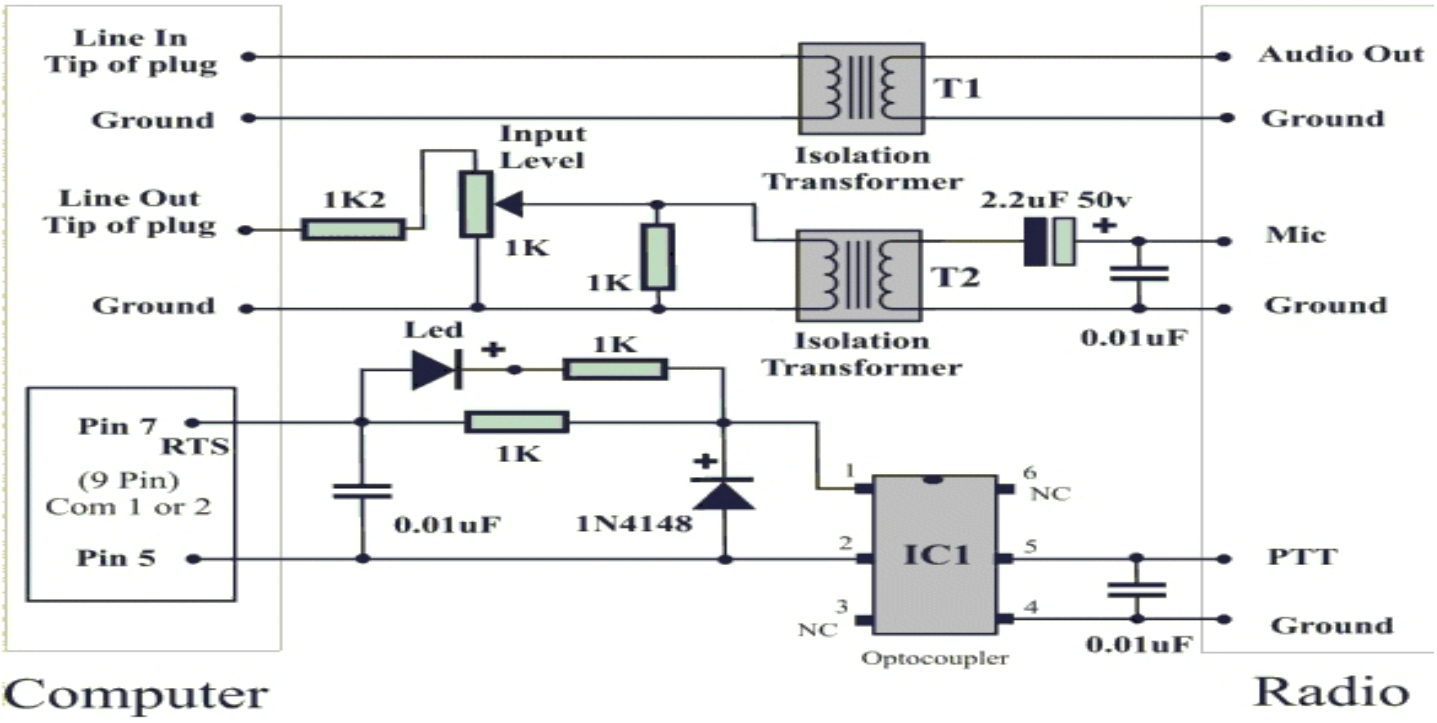
- **Components**
- 1 x 1k ? watt resistors - 2 x 2.2k ? watt resistors
- 1 x 1k Potentiometer Lin - 1 x 2.2uF 50v capacitor - 4 x 0.01uF capacitors
- 1 x Red LED (High sensitivity type) - 2 x Diode 1N4148 - 2 x 3.5mm Stereo plugs
- 1 x BC108 Transistor - 1 x 9 Pin D plug (Com port 1 or 2) & cover
- Screened cable - Project Box



ISOLATED INTERFACE:

- This circuit incorporates two 600-ohm audio transformers (T1 & T2) and an RS232 powered optocoupler IC1. Preferably use an IC socket for IC1, for possible quick replacement! The purpose of the transformers and an optocoupler is to isolate the transceiver from the computer, keeping the interference from the PC to a minimum. Ensure that the screening on the radio and the screening on the PC are not connected together.
- Stereo 3.5 mm plugs connect the line in and out on the computer soundcard. Use the tip and earth only as in this application the sleeve is not used.
- To control the radio PTT, an isolated signal from the computers RS232 (RTS) line is used. If you have an available DB9 connector on your computer, use RTS (Pin 7) and ground (Pin 5). If you have a DB25 connector on your computer, use RTS (Pin 4) and ground (pin 7).
- VR1 is a 1K linear potentiometer used to control the amount of audio going to the MIC and is adjusted for correct audio drive to the radio, usually converting line (0.5v) to MIC (10mV) levels. The 1.2k resistor (from the Line Out) can be changed to a greater value if you are troubled by the pot always being at the bottom or top of the range or alternately by adjusting the computers audio out slider till the correct level is achieved. Operationally, audio levels are adjusted by the computer level controls or are incorporated in the software you will be using.
- The LED (high sensitivity type) is used as an indicator when the interface is in the transmit mode.
- It is suggested that the finished interface is put in a metal box and that the grounding is taken from the radio side of the circuit.

https://www.dxmaps.com/wsjtinterface.html



Components

- 3 x 1k ? watt resistors - 1 x 1.2k ? watt resistors
- 1 x 1k Potentiometer (lin) ? 1 x 2.2uF 50v capacitor - 3 x 0.01uF capacitors
- 2 x (T1 & T2) 600 ohm transformers type 9000 RS Number 208-822
- 1 x IC1 optocoupler 4N25 RS Number 597-289
- 1 x Red LED (High sensitivity type) - 1 x Diode 1N4148 - 2 x 3.5mm Stereo plugs
- 1 x 9 Pin D plug (Com port 1 or 2) & cover
- Screened cable - Project Box

What is an interface?

- Well according to my copy of the Collins English Dictionary, an interface is described as "An area where two things interact or link", and "An electrical circuit linking one device, especially computer, with another". That pretty much says it all, it's a method of linking your radio with your personal computer for the purpose of transferring data between them, or in our case, an audio signal from the radio's loudspeaker socket or lineout/recorder output, to the computer's line input socket on the soundcard. In its simplest form, connecting your radio to your computer requires nothing more than using a simple cable with a plug on each end, with one plugged into the radio, and the other plugged into the computer, but as we are all too aware, real life is often anything but simple. It is possible to have issues such as interference being picked up on the connecting cable, or noise being produced by your (all to often) Chinese built computer, with its very noisy Switched Mode Power Supply, which has had all of its filtering components omitted, and replaced with nothing more than wire links. This shouldn't happen of course, and these things shouldn't carry 'CE' marks as they have to do in the European Union, if they don't meet the right EMC specifications, sadly, and all too often in my experience, importers and manufacturers will happily cut corners to save themselves the cost of such things, and after all, just how many of these will find their way into the home of a radio enthusiast (and his neighbors), and many people will be completely unaware that this is even a problem? You may be lucky though and have a well made one, or have already replaced the one that it came with due to suffering interference to your radio reception, so the simple solution maybe all that you need, and is you have a suitable cable to hand why not try it first and see how it sounds before going on to any more complex (more expensive) solutions. For the simple solution all you may need is a length of cable that is long enough to connect the two units together, and something as simple as a several meters long audio cable with a 3.5mm jack plug on each end will often suffice. These can usually be purchased from most computer or hi-fi shops, or in many of the local electronic retailers, if they still exist in your area. My preferred solution these days is to buy one on EBay, as these are usually much cheaper, will arrive very quickly, and save you from having to traipse around many stores trying to explain to blank looking salesmen what it is that you are after, and what it is for.

Building a simple Interface:

- Assuming you are running a Windows program such as YaND,MultiPSK or SeaTTY, we'll first take a look at how we might connect your radio receiver and PC in the simplest way possible, and without the need for a soldering iron or any other construction skills. On the right you can see a simple audio cable with a 3.5mm jackplug on each end, in many cases this will be all you require to interface your equipment. The leads shown here are fitted with stereo jackplugs, and in many cases this will cause no problems, but some radios may require a mono plug to be fitted on the radio side, or some type of stereo/mono adaptor plug.

Kits and Pre-assembled Interfaces:

- If you don't want to build your own computer-to-radio interface, you can purchase a pre-assembled interface .. or buy a kit with all the necessary parts.
- I haven't used interfaces from all the sources listed below, so I can't vouch for any of them. The list is merely a service for those who are shopping. I also haven't been very diligent in keeping the list current, so do a web search for others.

- **A. USB External Sound Devices**
- These devices can be of particular value for several reasons:
- They may be your only solution if your computer has no serial or parallel ports, just USB ports.
- They free up your first sound card for other applications and you won't need to reset the first sound card's mixer/volume control when you switch to and from AGWPE use.
- No external power required.
- Simplified cabling between computer and radio.

Note: For USB-attached sound card devices, use the basic setup procedures on this site, except for the COM/LPT port selection in the properties configuration, select a non-existent LPT port, e.g. LPT3. There is no need to have AGWPE tie-up a RS232 port in Windows when AGWPE doesn't need to use it. (AGWPE won't let you select a non-existent COM port, just a non-existent LPT port.)

A. USB External Sound Devices:

Tigertronics SignaLink USB - see the special AGWPE-SignaLink USB configuration and problem solving page on this website.

- Griffin iMic - us$30-35. - do a Google Search for vendors
- West Mountain Radio: The RIGBlaster Advantage has its own sound card and connects to your PC via USB cable -- no serial cable or sound card cables -- much like the Tigertronics SignaLink USB above, but it also has a serial port for rig control via the USB connection to the PC. See West Mountain Radio's web page for additional information and current pricing.

- RigExpert - several versions; see this page and look under "Interfaces": http://www.rigexpert.com
- MicroKeyer - "a powerful All-In-One multi-mode USB interface for CW, SSB, AM, FM, and digital modes (RTTY, PSK31, SSTV, APRS, PACKET, EchoLink and many others)." http://www.microham.com
- USBlink - instructions for building your own USB sound card interface by G4ILO. http://www.g4ilo.com/usblink.html

B. Kits and Pre-assembled Kits:

West Mountain Radio has several models of pre-assembled interfaces. The RigBlaster (Std, Plus and Pro models) let you keep both your microphone and sound card connections attached to the radio's microphone jack. The Nomic (No Mike) doesn't have that feature, but it is smaller in size, less expensive, and doesn't require a power connection.

MFJ also sells a pre-assembled interface in two models: the 1275 (round connector) and 1275M (modular connector).

Bux CommCo™ sells the RASCALGLX kit which has all the parts and cables you'll need to make a well-designed interface. The kits use isolation components on each line...a very nifty extra. It would be difficult to purchase all the components on your own for such a price! One nice feature is the ability to quickly change the GLX-to-radio cable. One comes free (you pick your radio model) but you can order cables for additional radios for $15. They also offer the RASCAL-II+, which requires no USB or serial port connection.

Tigertronics sells the SignaLink

Donner's - Interfaces for about $40 plus shipping http://www.donnerstore.com

KH6TY's Audio-triggered PTT Interface - information about this home-brewed interface that does not need a serial, parallel or USB port for radio PTT is at http://home.comcast.net/~kh6ty/interface/ This interface was featured in QST in June 2009 (p. 30). A $5 circuit board is also available.

WB2REM-G4CDY All Mode Interfaces - http://www.wb2rem.com/

KK7UQ's "Altoids" box interface kit: http://kk7uq.com/html/model_ii.htm. Includes a way to attenuate RX audio from the radio which might be helpful to users who are forced to use the MIC jack for input (MIC input is often to sensitive for full audio from the radio).

GD16 MI from G. Dierking http://www.gdierking.de/gd16mie/

Unified Microsystems SCI-6 - $30 kit with full isolation

DIGI-1 From WIMO http://www.wimo.de/s90_e.htm

ISOTERM-MULTI CON from G3LIV: www.g3liv.co.uk

Several from ASTRORADIO (España):

http://www.astroradio.com/t/tenda/301001.html

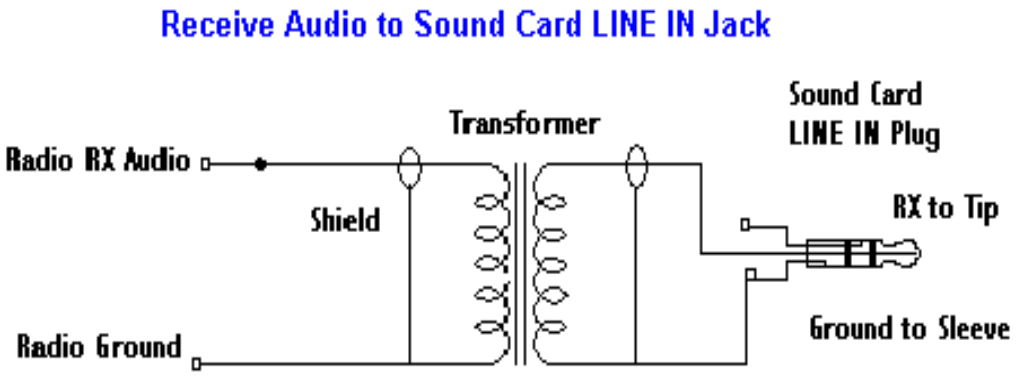
http://www.astroradio.com/t/tenda/302007.html

http://www.astroradio.com/t/tenda/302000.html

MOST IMPORTANT LOOK AT: **https://www.soundcardpacket.org/7cablerx.aspx**

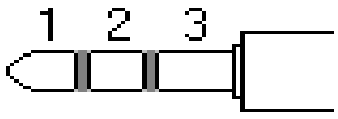
You should also use shielded cable to reduce the risk of any RFI (Radio Frequency Interference) getting on the RX signal.

Here's the schematic for an isolated RX cable:



To build your RX cable:

• **Cable material:** Use a cable with a single insulated wire and a braided shield. Small coaxial cable like RG-174U should work well; even RG-58U would work. The shield can act as ground line if you are using a transformer. If you aren't using a transformer, attach the shield at the radio ground only, and not at the computer/sound card ground.



1. Left channel +
2. Right channel +
3. Left and right channel -

• Sound card connector: You will need a plug that will fit the sound card LINE IN/Microphone jack, probably a 1/8" (3.5mm) stereo 3 conductor male mini-plug (e.g. Radio Shack part #274-284). Do not use a mono 2 conductor plug.

Connecting the radio and the computer to each other:

• Your radio will very likely have a loudspeaker socket for plugging an external speaker into, or some sort of line output/recorder socket. If none of these are fitted, then there will very likely be a headphone socket of some type, so that could be used instead. Anyone of these could be used to connect the radio to the PC, but there can be problems with certain types of sockets, and we will take a look at some of these next. The

• Loudspeaker Socket:-Most radios have one of these, and in many cases you will have some type of external speaker or audio filter connected to it. This can work very well, but you will often find that you need to use the radio's volume control to set the audio output level, and this can prove tricky. It also means that you will probably not hear any audio from the receiver when this is plugged in, and instead you will have to rely on the computer's own loudspeakers to tell what is coming out of your set, and if you are over-driving it.

• ***The Line Output/Recorder Socket:–***

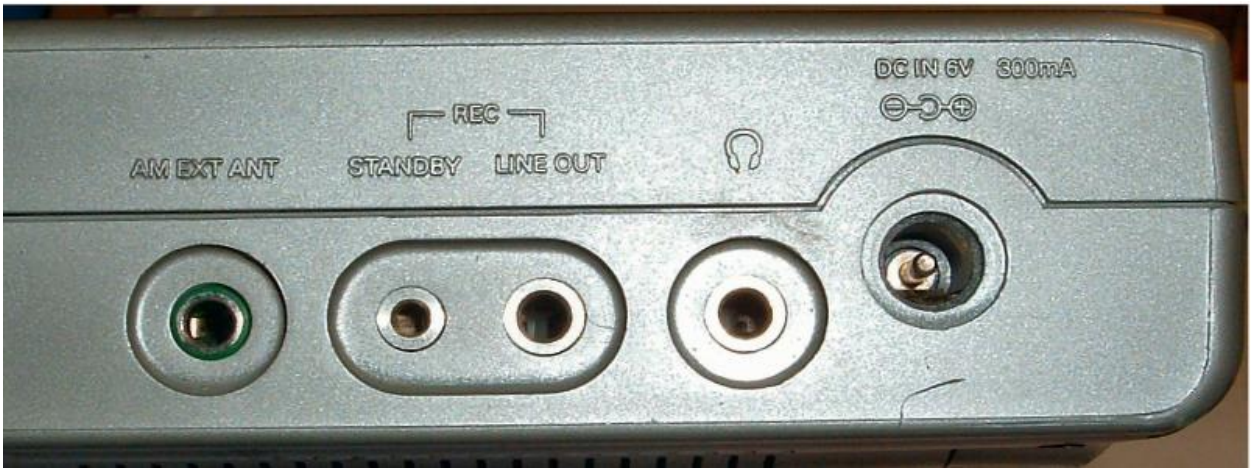
• This will generally have a fixed level of audio coming from it, with typical examples being around 100 or200mv. This is the best place to connect your cable if you have one. You will still be able to turn the volume up or down on your radio to hear what is going on, but this will not affect your radio's output level in most cases. If you have an audio filter attached here you should connect your cable to the filter's own line output socket, so that the filtered audio will reach your receiver instead of the unfiltered audio, which would be less effective.

• ***The Headphone Socket:–***

• This can also work very well ,and in many cases will have the audio level limited slightly to prevent damage to the user's hearing. In the absence of a line output socket this can often be used instead, with the cable plugged directly into it, and you can then just remove it when you need to hear the audio.

- **NOTE**-Some listeners will often employ something like a 'Y' splitter here, and then connect a pair of headphones to the other side of this, which will allow them to hear what is coming out of the radio

- Below you will see a picture of the side of my Sangean ATS909 portable receiver, which works quite well for NAVTEX decoding. As you can see from the image below, it doesn't have a loudspeaker socket, but it does have a Line Out, and a Headphone socket, either of which could be used for decoding purposes:



Soundcards come in various shapes and sizes:

- Many computers will have a sound card fitted, at least most of the modern ones that is, and un like in the old days, when you would often have to fit one yourself, now a days these are pretty much a standard item, and in many cases will be integrated not the Motherboard, and then connected by cable to sockets on the front or back of the computer's case. Some listeners often find that they need more than one sound card if their one and only Line Input socket is tied up with decoding, and in some cases, a second card could be installed in one of the spare PCI slots. Often some sort of external USB Soundcard(left) maybe used instead, and the latter may be helpful if you are having conflicts between two internal soundcards, due to it not sharing the same IRQs. Below is a shot of what a typical soundcard will look like if one is fitted to your machine, and this is the sort of thing you should be looking out for. You can see that there are four 'jack' sockets here, though some cards will often just have three. In this case the Pink socket is for a microphone, the blue one is the Line Input, and green is for the Loudspeakers/Line output.

• Again, the ‘mic’ socket could be used (laptops often only have a ‘mic’ socket for inputs) but the blue ‘Line-In’ is the one we should be using, since this will usually give the best results.‘ Mic’ sockets can be a little too sensitive, and sometimes need additional resistance to be placed before the input to prevent over load problems.

A slightly more elaborate Interface:

• Your system may work perfectly well, and give excellent decodes using the methods shown above, and you might well have tried that now and found that it gives exactly the results you wanted, so you can ignore the next bit. If your radio and PC are now talking to each other but suffering with a little mutual interference, you might then like to read on and see how you can improve things even further. Sometimes when a radio is connected directly to a PC, the ‘DC’ path created along the cable you’ve just plugged in might prove to be the ideal escape route for a lot of the PC’s nasty noises. If they make a break for your beloved radio, the results might be a lot of additional noise and even distortion on your signal, and very poor quality decodes are often the result. This is quite a common problem when transceivers are connected to PCs, since RF from the Transmitter can make its way into the PC and cause lots of nasty RF feedback problems. This is not the end of the world though, and a fairly simple method can be employed to ensure that this doesn’t happen. If you are technically proficient you might like to try it anyway, and you might find that the additional efforts were well worth it in the long run. The circuit shown below shows how we can break the ‘DC’ path of the cable by inserting a small transformer in series with the cable, and this can be done very cheaply, and without too much of a problem. The usual method is to insert a ‘line isolation filter’. These can be found on many old modem boards, which can often be picked up cheaply, or you might even have one already lying around in your junk box somewhere. I picked up a whole bunch of these for just 50 pence each at a UK Radio Rally(hamvention),and have used them to make a collection of nice and cheap filters for myself and for various friends.

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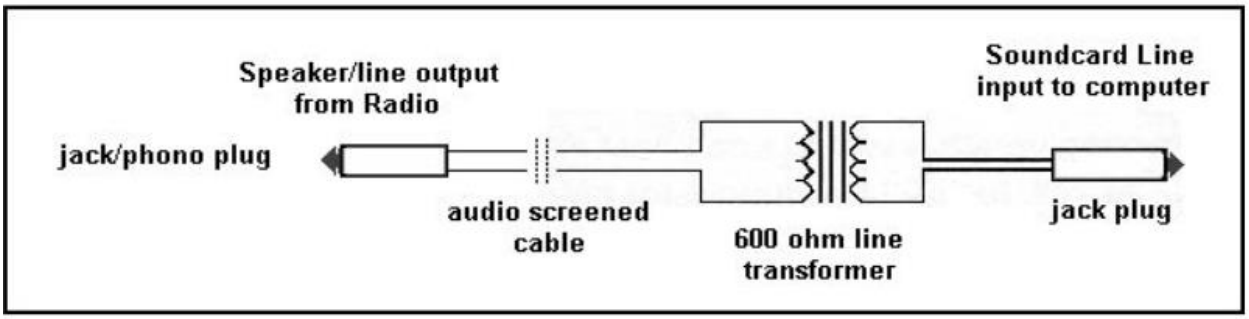


• This simple filter ensures that your PC and radio are kept physically isolated, but still allows the audio signals to pass along to their destination. Below we will see some' examples of how these often look.

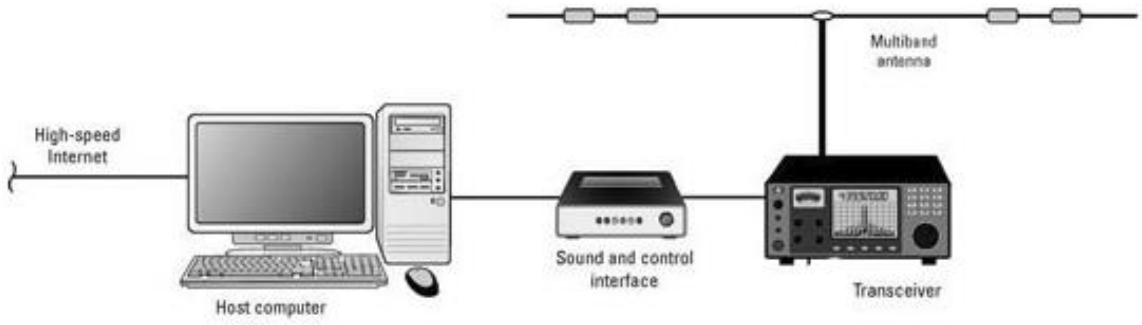
Setting the line level for the decoder you are using:

• I decode all manner of digital modes, including ones such as NAVTEX, DSC and DGPS, and I mainly use programs such as YaND, SeaTTY,Y aDD and DSC decoder for this. I also like to decode other modes as well from time to time, such as Slow Scan Television(SSTV),or very slow CW decoders (QRSS). There are all kinds of other interesting modes too, such as SELCAL, RTTY, MFSK and even CW. In the previous version of this document, many of the program examples I used belonged mainly to the Skysweeper program, sadly, since then the creator has moved on to other things, and the program won't run on later versions of Windows, which is a great shame. There are however many other excellent programs that will decode many different radio modes too, and ones like 'MultiPSK' and' Fldigi' will give you access to all kinds of digital decoding modes.

If you also happen to be a radio ham, then you may also want to transmit some of these modes as well, and in that case, using some form of line isolation as mentioned earlier, is definitely a good idea if you want to avoid any problems like RF getting into your PC from your transmitter. Once you have a working setup, pretty much any program will be available for you to play with, and since many are free ,or offer a free trial period, you can put them through their paces and decide for yourself which ones you prefer. I have had great fun in the past year decoding Slow Scan images from the Russian Astronauts on the International Space Station, and you don't even need to be a licensed ham to do that.

The Computer / Transceiver Interface:

- I'm not sure of the percentage, but I suspect that most, if not almost all, ham radio stations of 2018 include a computer, usually connected to their transceiver. A computer is mainly used for:
- Running logging, mapping, propagation, contenting, design, programming, and other sorts of software that may or may not require direct connection to the radio.
- Running rig control software – to monitor frequency, change modes, control transmission, and perhaps rotor or antenna control.
- Running SDR software.
- Running digital mode software, which included encoding and decoding via the audio interface, and usually includes some basic rig control.



CAT Rig Control:

- For modern ham transceivers (1980s and later) with microprocessor control (frequency, modes, etc.), a protocol called CAT (for Computer Aided Tuning or Computer Aided Transceiver – it is unclear which is the real term) allows a computer to remotely control various aspects of a transceiver. CAT can control frequency, transmit, modes, and other controls found on typical transceivers.
- Until fairly recently (perhaps 2010), the CAT connection to the computer was via an RS-232 serial interface cable. Sometimes a simple RS-232 cable will work, but not all radios have used standard RS-232 voltages, and level conversion hardware is often required.

- There are a number of commercially available boxes that can connect computers to radios, often including the audio connection.
- More recently it has become more and more difficult to find a Windows based PC that has an RS-232 port. There are also commercial boxes that will convert the RS-232 signals to a USB (Universal Serial Bus) connection. These conversion boxes require a PC software driver so that the PC rig control software will think it is still talking to an RS-232 port.

There are quite a few transceiver to computer interface boxes available – make a Google search to find various models. Currently, I think one of the best price for features value is with the SignaLink USB box from tigertronics.com.

SignaLink from Tigertronics.com

The most modern transceivers will skip the RS-232 connector completely, and provide a direct USB connection from transceiver to computer, along with appropriate drivers.
Rig control via CAT usually uses a different set of commands for each brand of radio. Modern software that uses rig control provide settings that can work with a very large number of radios. Some will even interface to the rig via software protocols with other software. For example, WSJT-X can communicate directly to a radio, or via the CAT interface of Ham Radio Deluxe or DXLab Suite.

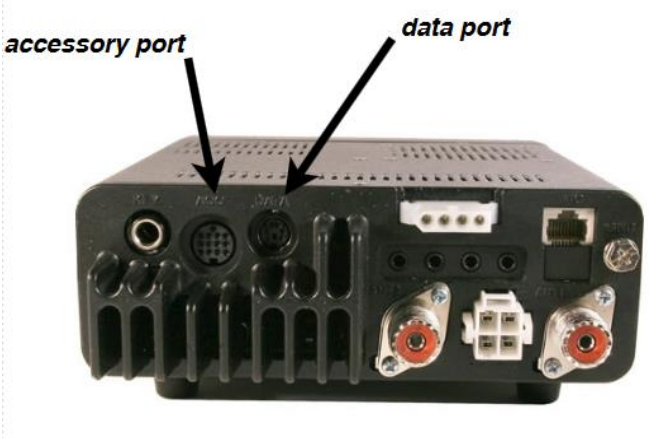
Audio Interface:

If you also want to use digital modes such as PSK31 or FT8, you also need to connect your computer to the audio input and output of your transceiver. Formerly, the audio connections were made directly from the computer's audio out and in jacks to the radio's jacks. This works, but is touchy when setting audio levels, and can make it difficult to also get the normal audio output for computer sounds or music.
The current boxes such as the SignaLink and direct USB connection include independent audio pathways, and make the whole process easier.

Modern Ham Rigs can be controlled via a CAT interface. Connecting computer to the radio can be done directly via a computer USB cable, or via one of several interface boxes. The various ham apps that provide rig control provide settings to work with different models and brands of radios.

- This time in our quest to get on the air with digital, I'll discuss station setup. For most of this article, it will be related to HF and sideband operation. I'll talk about FM near the end.
- For a Ham Radio digital setup, three things are needed: a radio, computer, and an interface to connect the two.
- First the radio. Theoretically, any radio can be put into digital service. Two things are important to consider: frequency stability and switching speed. Frequency stability is critical to digital operations because drift is deadly. Tube and older radios tend to drift in frequency as they warm up. For a mode such as PSK, drifting a few hertz puts you into someone else's conversation. Switching speed and fast turnaround times are needed. The switching speed of older radios can be hard on relays. Solid-state radios manufactured in the last two decades are recommended. Radios that cover HF/VHF/UHF all mode – open up even more operating possibilities.

- Most radios are designed with digital modes in mind. Radios with an "accessory port" or "data port" built in are ready to go, though not plug-and-play. The data port is the recommended way to connect an interface to the radio. These ports have pins for keying, transmit audio, and received audio. The audio pins have fixed audio levels and do not change based on the volume setting of the radio. If the radio doesn't have accessory or data ports, microphone and audio out can be used. It's not an ideal situation but it will work. An important thing to keep in mind, some radios mix various audio inputs. An example is an external mic connected to the accessory port maybe mixed with audio coming into the data port. This means audio generated by the computer will mix with ambient noise picked up from the microphone. You don't want this because you'll interfere with other digital exchanges. It's important to know your radio and how it operates in different configurations. Test with a buddy or Elmer first before jumping in.
- CAT (Computer Aided Transceiver) ports on the radio including RS232 (serial port) and CI-V are useful when creating your own interface. Audio cables between your radio and computer would provide transmit and receive audio but these won't key the radio. CAT ports provide a lot of functionally including the ability to change settings in the radio, update memory channels, change frequency, etc. Keying the radio via CAT is universally supported in applications. A configuration example would be using the soundcard for audio in/out to the audio out/mic-in on the radio. A separate cable between the computer and radio provides CAT commands, usually via a COM port.



Duty cycle is the amount of time the radio is generating RF. When operating SSB voice, the amount of RF the radio generates depends how loud your voice is at that moment. In CW, RF is generated with each dot and dash. In both cases, the radio is operating at less than 100% duty cycle due to pauses in between words and characters. Many digital modes operate the radio near 100% which causes a lot of heat. Heat causes components to fail. Radios are designed for SSB voice though some newer models are including 100% duty cycle. Operate the radio at a power setting of 50% or less (30% recommended) of the total output power. A 100 watt radio would be set between 30 and 50 watts. FM, by nature, is the exception because voice or digital over FM uses the same bandwidth. The typically longer key down times for digital will still generate more heat.
Radios have different operating modes: USB, LSB, FM, AM, RTTY, DATA, DIGITAL and possibly others. HF digital mostly uses Upper Sideband regardless of frequency. In most cases the USB setting is what you want. Some radios will not allow keying from a computer unless they're in a 'digital' mode setting. Check your operating manual and, again, practice and test with a buddy first. Turn off all filters, blankers, attenuation and the like or set it to the least disruptive setting. Set transmit and receive bandwidths to the full SSB bandwidth allowed (2.8 kHz). No filtering and wide bandwidths have less of a chance to distort or modify the signal. Modification of the signal affects the ability to decode a signal. Filtering can be used but after practice and understanding how they affect decoding. Contests usually warrant filtering to keep loud adjacent signals from affecting the exchange.

- The interface. It serves two main purposes: act as a modem and the device that keys the radio. It acts like a modem by taking modulated audio from the software application and sending to the radio for transmit and taking received audio from the radio and sending it to the application for demodulation. Nearly all computers and laptops in the last decade have on-board audio while older configurations utilize an add on soundcard. Most computers don't have serial ports these days. If a serial port is needed for CAT, options such as a USB (Universal Serial Bus) to serial adapter, serial port ad don cards, or cables manufactured with USB to serial adapters built in are available.

RIGblaster interface–front view.

- All-in-one interface solutions make the connection between the radio and computer easy. Solutions offer a built in sound card and fewer cables needed to make the connections. Offerings include products from West Mountain Radio, MFJ, MicroHAM, or RigExpert. These options free your on-board soundcard to listen to music or surf online minimizing the possibility of transmitting audio not suited for the airwaves. Adjustments on these interfaces are audio levels and speed (delay) at which the interfaces switches the radio from transmit to receive. Newer models include all functionality integrated into a single USB port requiring only one cable.
- Unterminated cables are available to create custom solutions. The SignaLink and cable are about $120 and available at all ham radio retailers. It is a simple VOX ("voice" operated switch) device. When sufficient audio is generated by the computer it keys the radio. It unkeys the radio when that audio has fallen below a threshold.
- If you have an interface or are setting one up for the first time, I wrote a tutorial on configuring the interface in Windows. It shows setting default devices and audio levels. These settings help avoid splattering on the bands (taking up more bandwidth than intended) due to too much audio fed into the transmitter. Again, practice with a buddy or Elmer to verify optimal audio settings. Included is a section showing how to record digital transmissions and play them back for decoding at a later time (time shift) such as a net: http://www.k8jtk.org/2015/04/16/radio-interface-setup-for-getting-started-with-ham-radio-sound-card-digital-modes/

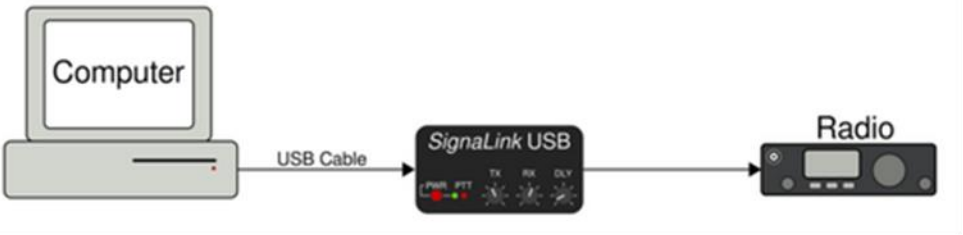
The computer:

Aside from the requirements to make connections, most computers work fine for digital operation. Ones made within the last decade seem to work without issue. Some older ones tend to have issues. A computer with a 1.5 GHz CPU and 4GB of RAM is sufficient. As always, more is better. Windows is the operating system of choice for digital programs. Mac and Linux are well represented with a program or two less viable than their Windows counterparts. Let's not forget portable devices like tablets and smartphones. Digital applications are available for those devices too. My operating has been on a Windows 7 64 bit desktop computer.

- Up to this point I've talked about operating digital on HF and Sideband. What about Technicians who don't have access to digital portions of the HF bands? All of these digital modes can be operated over FM so you Technicians can get in on the fun too. Won't be able to transmit as far as an HF station but digital can be transmitted over simplex or even a net on a repeater using an HT! On HF, audio tones are generated by Audio Frequency Shift Keying (AFSK). Audio generated by the computer is converted into RF frequencies when transmitted. Only those frequencies in use at that time are transmitted by the radio. This allows hundreds of exchanges to take place on the same frequency. FM on the other hand occupies the full 10 to 15 kHz, even though the bandwidth of the audio generated by the computer is less.

So it still stands only one transmitting station can have the frequency at a time. Yes, this defeats the purpose of narrow bandwidth modes. Someone wanting to learn and experiment with these modes may get bitten by the bug and lead to a license upgrade. I say let them have at it. That's how I did it.

- To this point, Stephen Cass – KB1WNR, Senior Editor for the IEEE magazine built a low power FM digital transmitter for just that reason, get more people interested in digital. It's a great maker project or demonstration tool for digital. I also mention it because he used my instructions to get Fl digi running on the Raspberry Pi! http://spectrum.ieee.org/geek-life/hands-on/hands-on-a-ham-radio-for-makers
- Next time, I'll start covering specific digital modes, software, and operation.
- The recommended solution for a radio without integrated USB audio is the Tigertronics SignaLink USB. Two cables are needed to make all connections. A USB cable connects the computer and SignaLink for the audio (soundcard) and a cable to the radio for audio and keying. The cable for the radio is specific to connector type or manufacturer. A list of cables is available and simple internal wiring diagram to match the cable to the radio.



SignaLink USB interface–front view.

SignaLink USB interface–rear view.

Reference Pages:

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