INTERFACING RADIOS TO COMPUTERS

By Alan Gale, G4TMV

The following guide was produced for the benefit of any radio enthusiasts who are thinking of trying out DGPS or Navtex Dxing for the first time, and want a more detailed explanation about how to do this. Interfacing the radio receiver with the Computer can be one of the most confusing things if you have never done this type of thing before, and hopefully this basic guide will give you a simple explanation of how to go about doing this for yourself.

What is an interface?

Well according to my copy of the Collins English Dictionary, this is described as "An area where two things interact or link", and "An electrical circuit linking one device, esp. a 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, in our case an audio signal from the radio's loudspeaker socket, or line/recorder output, to the computer's line input socket on the soundcard.

Depending on whether you just want receive data modes or transmit them as well, you can either make a simple interface, which will just work for receiving, or if you are a Radio Amateur, something more elaborate, which can be used for transmitting the various types of datamodes as well. The type of software and radio that you are using will dictate what you use, for example, if you are using a DOS based programme like RadioRaft, you will need a Hamcomm type interface, which will decode the incoming signal and feed it to the Computer's Serial Port (this will also be required to send a RTS/DTR signal to trigger the push to talk function on some transmitters too!). If this type of interface is what you require then details on how to build one can be found at the following site:

Hamcomm Interface: http://www.pervisell.co.uk/ham/raftaide.htm#I29

Of course if you are using a Windows only programme such as Skysweeper, or SeaTTY then things become much simpler, and at its most basic nothing more than a common audio cable with a jack plug on each end will be sufficient, and these can be purchased cheaply from most computer or hi-fi shops, or in many of the local electronic retailers.

Perhaps you would like both types, but don't want to have to go to the trouble of building them yourself, or would prefer a commercially made decoder? If so then you can by them from a number of different sources (a Google search should turn plenty of them up), though one company I would recommend is Pervisell, the UK radio software supplier, who not only sell a nice selection of interfaces, but will also ship them just about any part of the planet, and will also allow online payments for them as well. I have bought a number of items from them myself, and bought my registered copies of Skysweeper and RadioRaft from there too, so I don't have any reservations about recommending them. Many of the other dealers may be every bit as good, but as I have no personal experience of dealing with them I will leave it to the buyer to check them out.

Pervisell Demodulators/Interfaces: http://www.pervisell.co.uk/ham/hardware.html

Building a simple Interface:

Assuming you are running a Windows programme like Skysweeper or SeaTTY we'll 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 construction skills first.

On the right you can see a simple audio cable with a 3.5mm jack plug on each end, in many cases this will be all you require to interface your equipment. The leads shown here are fitted with stereo jack plugs, and in many cases this will cause no problems, some radios may require a mono plug on the radio side, or some type of adaptor though.
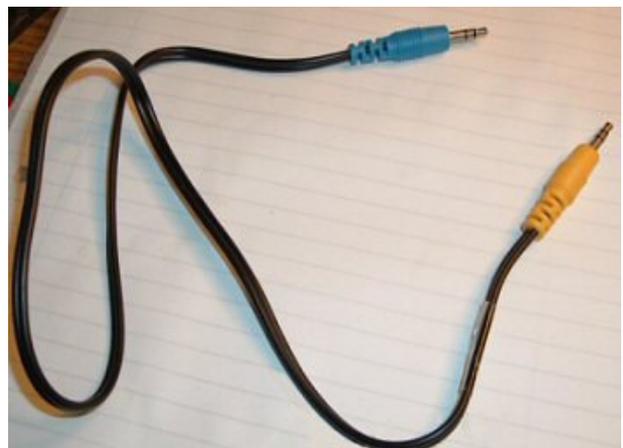
Connecting the radio and the computer to each other:

Your radio will very likely have a loudspeaker socket, a line output/recorder socket, or some type of headphone socket fitted, and either of these could be used to connect it to the PC, although there can be some problems with certain types of sockets, and we will look at 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 find that you need to use the radio's volume control to set the level, and this can prove tricky, it also means that you will probably not hear any audio from the receiver and will have to rely on the computer's own speakers to tell what is coming out of your set.

The Line Output/Recorder Socket – this will generally have a fixed level of audio coming from it, typical examples being around 100mv, and 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, and this will not affect your 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.

The Headphone Socket – this can also work very well, and in many cases will have the audio level limited slightly, and in the absence of a line output socket can be used with the cable plugged directly into it and just removed when required to hear the audio. Many listeners will employ some type of 'Y' splitter here, and connect a pair of headphones to the other side, thus avoiding being deafened by the data tones, and still able to hear what is going on.

Below you will see a picture of the side of my Sangean ATS909 portable receiver, which works quite well for Navtex decoding, and as you can see from the shot below, it has no loudspeaker socket, but does have Line Out and Headphone sockets, either of which could be used for this purpose:

Many computers will have a sound card fitted, at least most modern ones that is, though some older machines may still need to have one installed. These are fairly inexpensive though, and since many old PCs can be picked up very cheaply, can be ideal for use with many of the decoding programmes. Having a dedicated system like this in the shack might well be preferable to having your super duper, all singing, all dancing, state of the art machine tied up for hours on end. Below is a shot of what a typical sound card 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 speakers.

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 overload 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, if so, you can ignore the next bit. If your radio and PC are now talking to each other but suffering a little mutual interference you might 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 distortion on your signal, and very poor quality decodes as a result. This is quite a common problem when transceivers are connected to PCs, and 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, you might find the additional efforts 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', and 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.
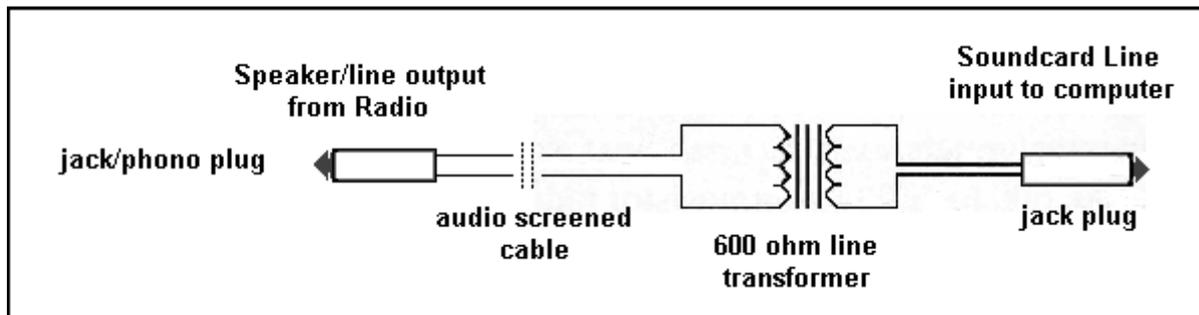

This simple filter ensures that your PC and radio are kept physically isolated, but still allows the audio signals to pass along to their destination. Below we will see some 'real' examples of how these look in reality.
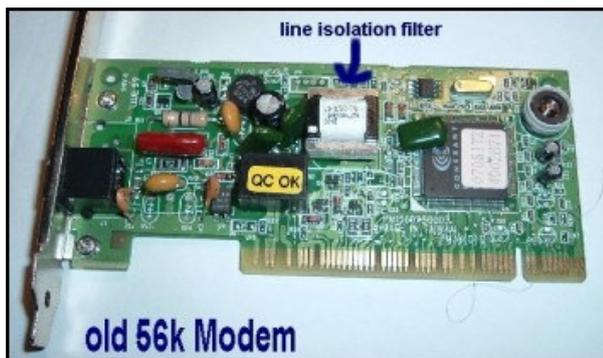
Above left is a picture of an old 56k modem showing the line isolation transformer, and above right we can see some other examples of the types of filters you might encounter on these boards. These two types are the ones I've usually encountered, but there may be other types that look slightly different on boards from other countries.

My own favoured method of using these is to take a hacksaw and to 'saw' the pcb around the transformer and then leave it attached on the bit of printed circuit board that it is soldered to. This allows me to solder the leads directly onto the transformer's pins, and also prevents damage to the internal wiring of the transformer, which can be very easily done if excessive heat is applied to the pins during attempts to remove them from the circuit board. This also makes a very sturdy base to anchor your cables too, again helping to prevent any future breaks and shorts, and giving the whole assembly some additional stability and strength.

line isolation filter
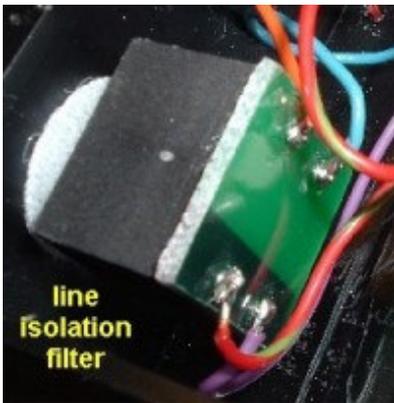
On the left is a picture of a line isolation filter already removed from the modem, and with wires already attached to it. In this case the filter was mounted in small ABS plastics box, and this was also fitted with a four way switch, and also a 50 kohm potentiometer. The idea behind this was to allow me to attach my Hi-Fi tuner (I sometimes like to record radio programmes on my PC), and also to connect my Minidisc Recorder as well whenever I need to. I could of course just unplug the lead from the sound card, but doing this repeatedly can weaken the connection, and it's also not in the most convenient of places to get access to down there on the rear of the PC. The 50 k pot allows me to control the line levels quickly and easily, and without having to keep changing the Windows level settings (which we will be taking a closer look at very shortly!). How elaborate you choose to make yours depends on how you plan to use it.

If the thought of cutting up a modem puts you off, the good news (for UK listeners at least), is that you should be able to buy them from some of the major electronics suppliers, though with the rapid demise of the old style modems they may become more scare in the near future.

### Wiring up the Transformer and cable:

Now that you've got your transformer, plugs and cable you have to put it all together, and if you already have a ready made up cable with a jack plug on each end all you might need to do is cut the cable in half, and solder the ends to your transformer. If you have bought a transformer you might like to try soldering it to a small piece of 'veroboard' for greater strength and stability, but if you have taken the fun route and 'hacksawed' one out of an old modem card you should now have something similar to the one shown below on the left hand side. The picture below right shows the underside of the printed circuit board:
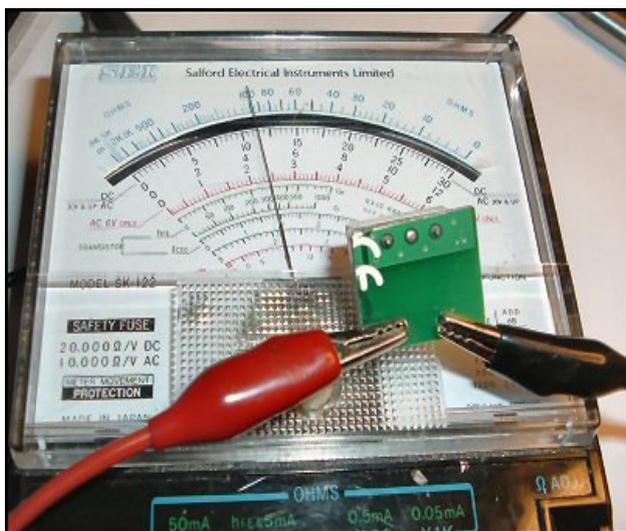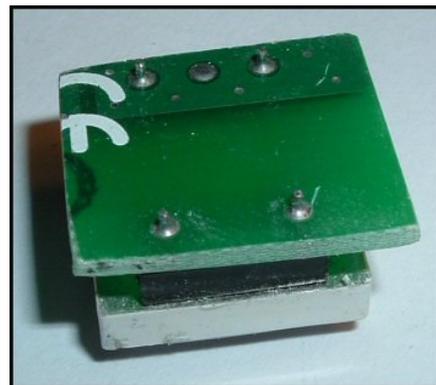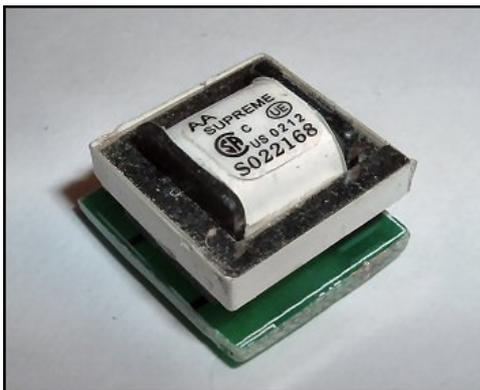

We are now ready to attach our wires to the transformer, and as can be seen from the picture above right, there are two sets of pins visible on the underside of the pcb, which can be used for this task. First though, before starting your soldering, be sure to check that the filter isn't 'open circuit', and you can do this with a simple 'multimeter set on a low range'. You should get a reading between two of the pins on one side, and two of the pins on the other side, we attach the centre and braid of our cable to these pins as can be seen on the left:

In the example here you can see that there is a resistance of around 100 ohms between the two pins at the bottom of the board, this is where we will connect our audio cables' inner core and braid.

Next job is to solder the ends of the cable to the pcb, and below we can see how this looks when they are attached in the picture below left. Please note that the braid of the two cables must be on the same side, otherwise you will be connecting the centre of one cable to the outer braid of the other!
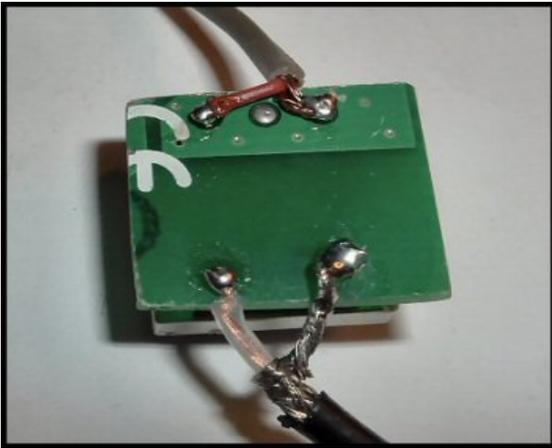
Above left: *the wires are attached to each side!*
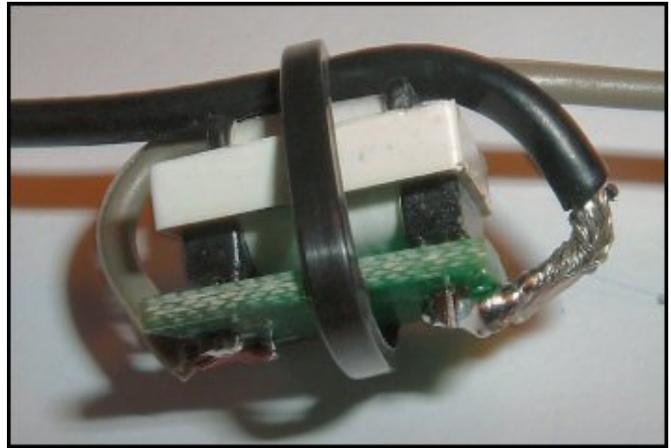
Above right: *the wires are crossed over for extra strength!*

Above: *the final assembly, wrapped in self- amalgamating tape for extra strength and insulation!*

There are various ways of ensuring that the cable will stay where it is meant to stay, and not easily pull out and cause a short circuit. I have shown examples of both methods (top right and bottom left). My own preferred method is to 'cross' the wires over each other, and then attach them using either a 'cable tie' or coating them with self-amalgamating tape. This latter method produces a very well insulated and very strong joint when the tape has moulded itself around the transformer.

This will give you a waterproof and very strong filter, which will withstand years of abuse and punishment.

The final result:

On the right you can see the finished cable connected to my old laptop and Sangean portable Receiver. I hope this now gives a clearer idea of how these devices are connected together, and where all the different bits go!

That's not the end of the story though, in the next section we need to look at how the Windows Sound settings need to be configured if we are to make the best use of our newly connected radio and PC, and it's this part of the set up process that often causes the most problems, especially for those who are newcomers to data decoding.

Right: *We are now interfaced!*

**Setting up the soundcard, and configuring the Windows settings:**

Now that you've made your interface, and connected your radio to your PC "The world is your Lobster", as Del Boy would say. Not only are you now ready to decode all of those lovely data signals, but you can also use your connection to make recordings of your catches as well. Yes, our interface will allow you to record signals using either the Windows Recorder function, or perhaps something more sophisticated like Cool Edit or Audacity, which will allow you to edit and enhance your catches too. You can even record all of your favourite radio signals as .mp3 files and listen to them on your .mp3 player or Ipod if you are really sad person (like me!) ☺

If you take a look at the 'system tray' at the bottom left hand corner of your PC you should see a small symbol that looks like a loudspeaker (see example below).

The small speaker in the centre is the icon for your soundcard, though some PCs will have their own settings (blue icon is mine!).

If you can't see the speaker icon in your system tray you can make it appear by clicking on your 'Start' button, and then going to your 'Control Panel' and clicking on the "Sound and Audio Devices" icon. You should then see something like this (in Windows XP anyway!):
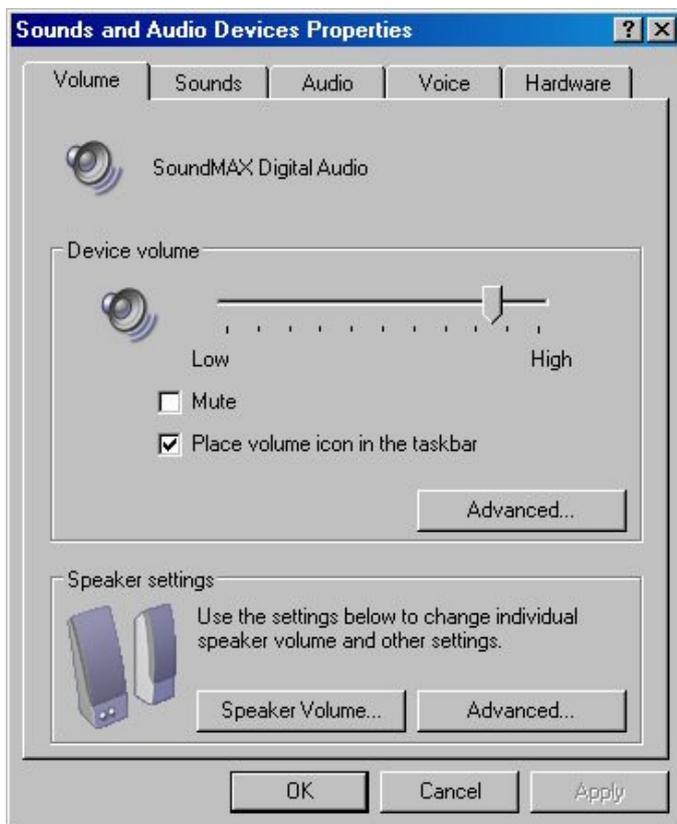

If you are now seeing a box like the one on the left, and the box marked "Place volume icon in the taskbar" is not ticked, you should add a tick there, this will then add the icon to your system tray for easy access.

If the speaker icon has now appeared you should click on it with your right hand mouse button, and a box should appear saying "Open Volume Control", and "Adjust Audio Properties". Click on "Open Volume Control" with your left hand mouse button.

You should now see a box appear like the one shown below, this controls the 'playback' or volume settings of your PC. You can then click on "Options" and then "Properties" and then click "Recording" on the box that appears to access your recorder/line input settings.

Please note that although the "Line In" setting on the image shown below from my own PC is set at "Mute", this will only be required if you don't want to hear the sounds of your received data signals coming from your PC's speakers. I mute this with some modes, but often untick it when making recordings.
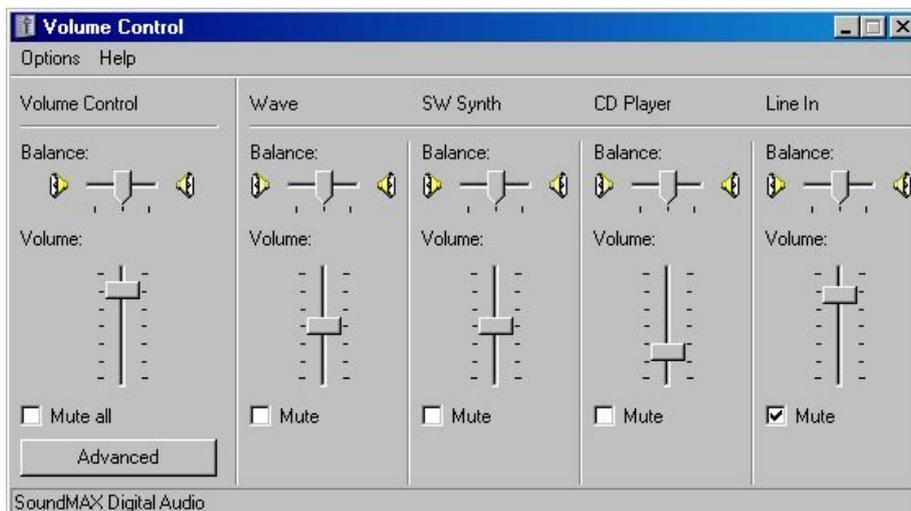

You should initially set any of the sliders at around mid-point, and then experiment with them until you find the levels that suit you.

The setting we are most interested in though is the 'Line In' on the Recording Panel, and this is probably the most important setting of all. We shall take a look at this in the next section, and find out more about setting the correct levels for the mode we are decoding.

Setting up the recording panel:

If all is well so far we should now be seeing the "Recording panel", which should look something like the one shown below:
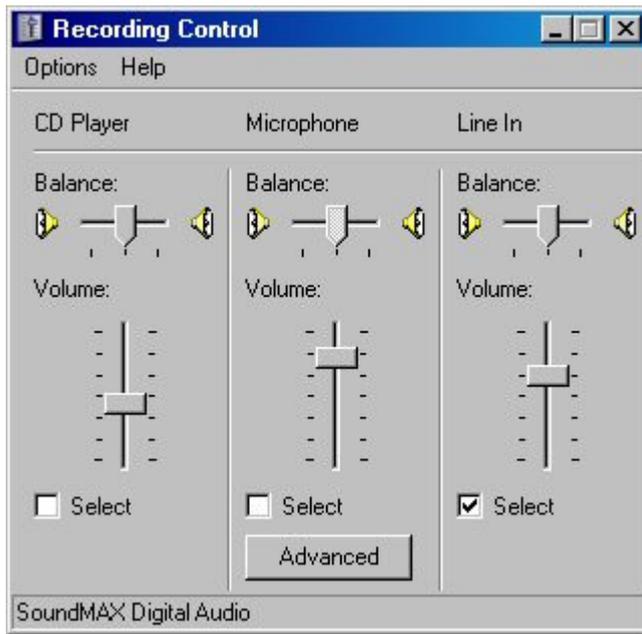
You can see from the panel on the left that I have selected the 'Line In' section, and placed a tick in the box marked "Select" (if you are using the Mic input, or a laptop which only has a Mic in, select that instead). We should now be getting sound coming into the computer's soundcard, and if you have a programme like SeaTTY or Skysweeper open, you should see the trace jumping around on the screen as we can see on the SeaTTY trace below:

With some programmes such as Skysweeper, all of the above can be avoided, because the creators of this programme have very kindly placed a couple of icons at the top of the programme interface, which allows the user just to click on them to bring up the panels above, needless to say this does make things much simpler. In the case of SeaTTY, this has the facility to allow the user to select one of several soundcards, if they have more than one fitted that is, and this can be selected from within the programme settings. Users should consult the programme's Help File for more information about this if they need this function.
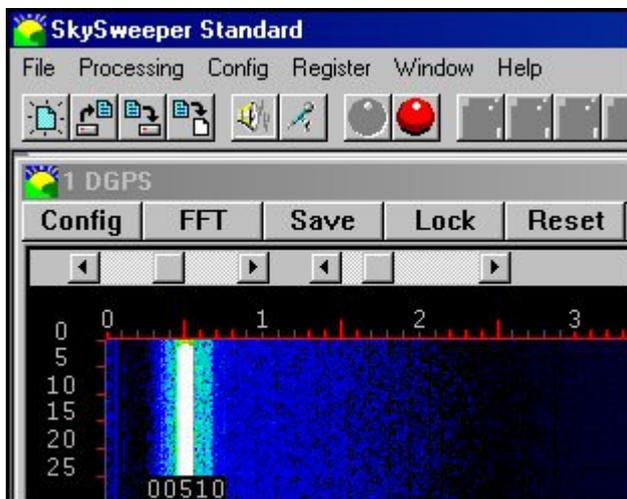
The image on the left shows part of the Skysweeper interface. The window at the bottom shows the trace produced by the incoming signal, and if your card is now set correctly it should be looking something like this. If you can see lots of extra lines to the right hand side you are probably overdriving your soundcard, and you should lower the slider on the 'Line In' on the Recording control panel. You can easily access this from Skysweeper by clicking on the 'microphone' button (under the word 'config'), this will bring the panel up for you automatically.

To go back to a comment I made on page 4 about my using an external 50 k pot to control my signal levels, you can now probably see why, it's much simpler than messing with these settings every time!

And Finally………….

Hopefully by now you have grasped what is meant by interfacing your radio to your PC, and have now done this successfully, and are busily decoding all kinds of wonderful signals. Although this article was aimed basically at helping LF Dxers to get started with Navtex and DGPS decoding, the interface you have set up will also allow you to decode many other types of data signal with some of the wide range of other decoding programmes that are also available. I like to decode aircraft SELCAL and ACARS signals, and DSC/GMDSS monitoring is also becoming very popular too, as are many other types of signals, far too numerous to mention here. You can now try your hand at many of these by using your new interface. Data decoding can be great fun once you get into it, and I hope this guide to interfacing your equipment has helped to show you the way. If you feel anything is missing, or should be included in future revisions of this publication please do let me know via the following e-mail address: navtexupdates 'at' ndblist.info (replace the 'at' with @). You can find lots of frequency databases to try your hand with at the NDB List website's NAVTEX and Datamodes Sections at: http://www.ndblist.info

Alan Gale.