Icom CAT and Digi-Mode Interface Guide

First of all, thank you for purchasing my Icom CAT and Digimode Interface Cable. Hopefully, this guide will allow you to get your PC connected to your Icom Radio with the minimum of effort. Your Interface comes with a full 12 Month warrantee against material failure.

Please note: Although I have never had any interface damage a Radio or associated Computer, you use this item entirely at your own risk. I will not be responsible for any damage caused to your equipment through use of this product. You should always follow the manufacturer's instructions when connecting items to your equipment.

This unit is compatible with the CI-V Interface on the following radios

Icom Radio's With 8 Pin Din Accessory Connector

IC-275 #	IC-375 #	IC-575 #	IC-707 #	IC-725 #	IC-726 #
IC-728 #	IC-729 #	IC-735 #	IC-736 #	IC-737 #	IC-738 #
IC-746	IC-746Pro	IC-756 #	IC-756Pro	IC-756Pro 2	IC-756Pro 3
IC-761 #	IC-765 #	IC-775 #	IC-775DSP #	IC-7800 #	IC-781 #
IC-820 #	IC-821 #	IC-910 #	IC-970 #	IC-7400	

Icom Radio's With 13 Pin Din Accessory Connector

IC-78 #	IC703	IC-706 #	IC-718 #	IC-7000	

Note: The Radios marked "#" do not allow for PTT keying via the CI-V/CAT command set. However, to provide full compatibility the interface is also wired for Hardware PTT keying via the "Send" pin of the accessory connectors. In this mode, the PTT function is controlled by the RS-232 "RTS" signal.

So what does the interface do for me?
The interface allows your PC or Laptop to remotely control the functions of your Icom Transceiver via its CAT/CI-V interface when using suitable software. The interface also routes the transmit/receive audio from your radio to your PC's soundcard allowing you to operate modes such as PSK31, SSTV, WEFAX or just about any mode that requires an audio interfacing to and from your PC.

How does it work?
Built into the 9-pin D-Type RS-232 shell is a level shifter which converts the RS-232 signal into the TTL levels compatible with the CAT/CI-V port on your radio. The audio to and from your PC's soundcard is also routed via the D-type connector. This is done for 2 reasons. To attenuate the transmit audio so that you do not over-drive the modulator circuit in your radio and to provide a convenient wiring termination to get both the CAT and audio signals down the common multi-core cable to minimise the possibility of ground loops.

At the Radio end of the interface cable, you will find an 8 pin or 13 pin Din connector. The connector type will depend on the version of the interface that you have purchased. The DIN connector carries the PTT and the Audio signals in/out of your radio. Also from the DIN connector is a short CAT/CI-V interface tail terminated in a 3.5mm mono jack which plugs into the CAT/CI-V socket on the rear panel of your radio.

Connecting it all up

1. Before connecting the interface, I suggest you turn both your PC and Radio off.
2. Plug the 9 Pin D-Type into a free RS-232 port on your PC. If your PC does not have an RS-232 port then the interface works well when used in conjunction with USB to RS-232 adapters.
3. From the rear of the 9-Pin D-Type are 2 tails terminated in 3.5mm stereo jacks. These jacks will either be colour coded or have a label.
   The jack with the **Blue identifying band** or "Line In" label connects to the soundcard Line Input of your PC. You can also use the Microphone input but be aware that the Microphone input on soundcards can have a "boost function". If you do decide to use the Microphone input, I suggest that you turn any "boost" option to minimum until you have checked the levels into your preferred decoding software.
   The jack marked with the **Green identifying Band** or "Line-Out" label plugs into the soundcard Line Output or Speaker Output. If in doing this, you need to unplug your existing speaker jack, you can make or purchase a "Y" splitter so that you can have both devices plugged in at the same time.
4. At the other end of the interface cable you will find an 8 or 13 pin Din plug. This plugs this into the Accessory 1 socket on the rear of your radio.
5. Finally the Din connector has a short Tail terminated in a mono 3.5mm jack plug with a **Yellow identifying band** or "CI-V" label. This plugs into the CAT/CI-V socket on the rear of your radio.
6. Once you are happy that all the connections are secure, turn your equipment back on.

Software

There is plenty of suitable software available on The Net, some being free and others paid for. To get maximum benefit from this interface, you need software that combines the remote control ability of your radio via the CAT/CI-V interface and the Coding and Decoding of the Digital Mode audio to and from you radio. The most popular software is:

- Ham Radio Deluxe   http://hrd.ham-radio.ch/
- MixW   http://www.mixw.net/
- N1MM (via MMVari)   http://pages.cthome.net/n1mm/
- MMVari   http://mmhamsoft.amateur-radio.ca/MMvari/
- MultiPSK   http://multipsk.eqth.info/

Software Configuration (CAT Interface)

1. If your PC has an RS-232 port, ensure it has been turned on in the BIOS
2. You may run into connection problems if you have another application running that requires access your serial port. Ensure these applications are closed when using this interface.
3. Ensure the CI-V address of your radio is set to the factory default otherwise your chosen software will not communicate with your radio. Refer to your radio's manual on how to do this.
4. The interface is designed to work at all baud rates supported by your radio. For best performance, I suggest you use the highest speed available.
5. **Important:** When configuring your software of choice, ensure that the option to provide interface power via the "DTR" signal **IS** enabled. Some software will also give you the option to power the interface from the "RTS" signal. Ensure that the "RTS" option **IS-NOT** selected. This interface uses the "RTS" line to operate the Hardware PTT line and if your software raises the "RTS" signal permanently, your radio will be PTT keyed all of the time.
6. Ensure your software of choice is set for the correct Com Port, Radio Manufacturer/Type and that the Baud Rate matches that pre-configured on your radio. (If you are having problems, some software allows you to "Auto Detect" the Com Port and Baud Rate settings and so it will do the searching for you)

PTT Set Up

Early Icom Radio's do not allow for PTT via the CAT commands and so the operation of the PTT needs to done in hardware. If you refer to the compatibility table at the top of this document, you will notice that some radios are identified by a "#" symbol. If you radio is not identified by a "#" symbol, the PTT is done via the CAT command and you can ignore this PTT Set Up Section. If your radio is identified by a "#", then read on…..

- **For Ham Radio Deluxe**, press F8 which will bring up the program options screen. From here you can select the "COM Port TX" tab. Select the "RTS" button in the "COM Port Pin" section and hit apply and OK out.
- **For MixW,** under the Configuration Menu, select the TRCVR CAT/PTT Submenu. In here is a "PTT& CAT Interface" box with a "Details" button. When you hit the "Details" button, you can set "RTS" to control PTT in a drop down box.

For any other software, just find the section in the program configuration where it allows you to control PTT of your radio via the "RTS" line of the RS-232 port.

Audio Set Up

Most Digi-Mode software comes with set-up instructions for transmit and receive audio levels and so you will need to refer to the instructions that came with your software of choice. However, I will offer some pointers.

Receive Audio Level

Icom have chosen to standardize the Audio levels (AF detector output) from the accessory sockets on their radios. On radios with the 8 pin Din Accessory connector, the detected audio output is on Pin 5 and on radios with the 13 pin accessory connector, it is on pin 12. The detected audio level on these pins will be between 100mv to 300mv and will be unaffected by the volume control on the front of the radio. This level is more than adequate to drive the "Line Input" or "Microphone Input" of your soundcard.

At this point I am assuming you use Microsoft Windows. To enable the input feature of your soundcard, run up the "Sound" application from "Control Panel" and ensure that the Line or Microphone inputs are enabled and the audio levels set accordingly. There are so many variations of audio drivers and applications, it would be impossible to cover all aspects in this set-up document. However, many PC audio applications have an input level meter and you need to adjust the Line in or Microphone input level such that your decoding application has enough received audio level to operate without clipping the audio input. If you choose to use the Microphone input, you may need turn off any "boost" or "gain" function.

Transmit Audio Level

Again, Icom have standardized the audio level to apply to the Modulator input pin on the radio accessory sockets. (Pin 4 on the 8 pin Din connector and Pin 11 on the 13 Pin Din connector). The level required is approximately 100mv with an input impedance of 10kOhms.

Your average PC sound card is quite capable of delivering over 1v on the line output and so some audio attenuation needs to be done. I have included an attenuator circuit in the D-Type shell which drops the level by approximately 15dB to avoid over driving the modulator input of the radio.

Now let us consider the PSK31 mode. It is effectively a 2-tone signal which in theory occupies 31.25kHz worth of bandwidth. However, because it is a 2 tone signal you need your transmitter output stage to be operating in a linear mode to limit the possibility of inter-modulation distortion. I suggest that you set the Mic gain mid-way and turn off any audio/speech processing if your radio has this feature.

I have done a fair bit of experimentation and research into the optimum drive level and came across a truly excellent article by N1NKM. Have a look at the following web-link and it explains very well the pitfalls of getting the modulation and power levels wrong. (http://www.mymorninglight.org/ham/psk.htm).

If you follow this procedure from N1NKM, you should produce a nice clean signal.

1. Set the Line output level of your soundcard to zero.
2. Put your preferred PSK or Digi-Mode application to transmit mode.
3. Raise the line output audio level of your soundcard so that you start to produce output power and your transmitter ALC meter is "just" moving off the bottom of the scale. At this point, make a note the transmitter output power.
4. Now turn down the line output level from your soundcard to reduce the transmitter output power by 20%

This will ensure that your transmitter is not crushing the signal and that the ALC is not having any effect.

On my Icom IC-718, this gives me approximate 40w of output which is more than adequate for PSK. You need to bear in mind that PSK is a very narrow band mode and by using the DSP functionality of a modern PC and soundcard, it is the equivalent of having a VERY narrow filter in your receiver. This means that even the lowest output powers can result in very useable PSK communication.

Ground Loops

The reason why Rig-Blaster and Signal Link Interfaces are expensive in comparison to this product is that they offer either total or partial isolation of the audio and PTT paths between your PC and Radio to remove all possibility of ground loops. However, in my experience, as long as you keep cabling to a minimum, use good quality cable with appropriately short lengths between your Radio, PSU, PC and Mains supply then ground loops are not generally an issue.

How do I recognize it I have a ground loop problem?

Well, if you have a ground loop issue, it will most likely be also present in receive mode as well as transmit. Whilst in receive mode, if you look at the waterfall image in your favoured digi-mode application, you will see solid vertical lines appearing at 60Hz, 120hz, 180 Hz and so on across the display. (These will be 50Hz, 100Hz, 150Hz etc if you use 50Hz a.c power). When you transmit, these 60/50Hz products will also mix with your outgoing PSK signal causing potential signal errors and undesired increase to your radiated signal bandwidth. If you do see these products in receive mode, try a different grounding strategy between your PC, Radio and PSU.

For more products, contact details or Help, please visit www.xggcomms.com