

# ***IsoCat***

## ***Isolated USB Transceiver Control***

***Plus***

## ***Sound Card Interface***



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# Introduction

Digital communication using the frequencies between 3 and 30 MHz is an interesting and dynamic activity on the ham bands today. Modestly priced computers equipped with sound cards have brought about both non-traditional means to use traditional modes and the development of extremely effective new modes that would have been impossible 10 years ago. Transceivers available today are equipped to facilitate these operating modes. All that is necessary to add digital communications capability is an efficient means of connecting the station transceiver to the station computer. For best results and fewest connection issues, this interface should match signal levels between the two and provide ground path isolation.

# Interface

IsoCat is a fully isolated interface between a transceiver and computer. It comprises a complete USB interface and a bi-directional audio link between the sound card and the transceiver. The USB control interface supports both Icom CI-V and many Yaesu CAT control ports on current transceivers. The USB interface can also be configured to support transceivers that require separate input and output control signals.

The sound card interface is compatible with any transceiver. The interface provides complete isolation between the transceiver and the computer, as well as complete isolation between both functions of the interface. Either side of the interface can be operated independently of the other.

The USB port provides power for the USB interface. The USB interface IC, switch-mode transformer driver, and opto-isolators are powered from the computer. The miniature switching power supply provides 5V DC to power the transceiver side of the interface through an isolation transformer and full-wave bridge rectifier. Power requirements fall well under the 100 millampere limit of USB 1.1.

The transceiver supplies power for the transceiver side of the sound card interface. Power requirements are very low, less than 10 milliamperes. Voltage should be between 8 and 15 volts. No power is required for the computer side of the sound card interface.

# Transceiver

Virtually any of the last three generations of ham transceivers on the market will work very well with digital communications modes. The two main requirements are stability and access to the transceiver transmit-receive control circuitry. Even some older transceivers are usable, depending on their stability. Desirable features include adjustable power output and direct access to the modulating circuitry instead of through the microphone.

High power capability is not a requirement. If the band is marginally open, communication is often possible. In some cases, communication is possible even when the voice segments appear dead. Some of the newer modes will reliably track signals up to 15 db below the noise level.

# Computer

Most ham shack computers are capable of digital mode operation. Often it is a last-generation family computer or one picked up at a hamfest. The requirements for effective digital mode operation are not particularly difficult to satisfy. A basic system consists of 400 MHz or faster processor, 32-mb memory, 5-GB hard drive, a USB port, and a sound card. Some programs will run on slower systems than this. If you have such a system, try it! You may not be able to receive and type at the same time, but at least you will get on the air!

# Operating system

Windows 98 is the minimum recommended Microsoft Windows OS. Older versions are difficult to set up and do not provide USB support. Linux support is provided in kernel 2.6.9 or later. Drivers are available for all three flavors of Mac OS. The latest drivers for all three operating systems are available on the supplied diskettes. You can also find the drivers or on the web at <http://www.ftdichip.com/Drivers/VCP.htm>.

**IMPORTANT:** Install only the Virtual Com Port (VCP) drivers if you get the drivers from the web.

# Software

A wide variety of freeware, shareware, and commercial digital mode software is available for you to choose from. This is a partial listing to get you started. It is by no means comprehensive and includes only HF digital communications packages. Not all have been tested with this interface but there is no reason to believe that they will not work.

Search for the listed name on the web to get the latest version and for more information.

## ***Windows***

Ham Radio Deluxe by HB9DRV - logging, PSK31, PSK63

TrueTTY - teletype

MMTTY - teletype

MMSSTV - slow-scan television

MixW - PSK31, Olivia

DigiPan - PSK31, PSK63

DX4WIN - PSK31

Hamcom 3.1 - CW, RTTY, AMTOR

HamScope - PSK31

Hellschreiber - Hellschreiber

WinWarbler - PSK

## ***Linux***

lpsk31 - console PSK31

xfhell - GTK Hellschreiber application

xdemorse - GTK Morse code application

gMFSK - MFSK16, MFSK8, RTTY, THROB (1, 2, and 4), MT63, Feldhell, Olivia-2, dominoEX, and others

QSSTV - SSTV application for the KDE desktop

G-PSK31 - PSK31 application

xpsk31 - PSK31 application

## ***Mac OS***

atv\_fax - ATV and fax application

bcast - packet application

Mac MultiMode - RTTY, FAX, SSTV, Packet, ACARS, PSK31, ALE

## Cables

Five cables are required to connect the IsoCat to the computer and transceiver. Length is not critical – other length cables (within reason) may be substituted to suit station requirements. Cable sets packed with the IsoCat are all 6 feet in length. The cable set includes:

- Two 1/8 in stereo audio patch cables to connect the computer and transceiver audio
- One USB type B connector for interface to computer
- One miniature DIN connector to transceiver accessory connector

The cable is cable is wired to provide transmitter keying using either CI-V commands or RTS hardware keying. You choose the keying method through the application software you use. You may need to supply a custom cable, depending on your transceiver.

- One 1/8" stereo audio cable to connect the IsoCat to the transceiver control port

IsoCat is configured to provide both send and receive signals on the tip. The ring connection is not used. You may need to provide an adapter or custom cable, depending on your transceiver.

## Testing

I have installed the IsoCat on Windows 98, 2000, and XP. Centos and Suse Linux recognize the USB section of IsoCat as a standard TTY port, but I have not installed any of the Ham-related software on the Linux desktop (so many things to do, so little time....). Unfortunately, I do not have access to a Mac to test with. There are drivers built into the operating system or available on the FTDI site ([www.ftdichip.com](http://www.ftdichip.com)) for all of these operating systems, along with instructions for installing on each OS.

The alignment procedure outlined below is deliberately generic because of the differences in each OS and OS version. I document only the PSK31 procedure, but other modes follow similar setup and alignment procedures. The goal is to drive the transmitter with as high a level signal from the computer as possible without distorting the signal from the computer or overdriving the transmitter. Sound card digital communications modes depend on linear transmitter operation; *any* ALC activity is undesirable for PSK31 operation.

The same principle applies to the signal from the transceiver to the sound card - you want as high a signal level as possible without distortion from the transceiver and without overdriving the sound card input. All transceiver signal processing should be turned off - the demodulation software for your chosen operating mode takes care signal processing.

## ***Preparation***

Before starting testing, connect the transceiver output to a dummy load and turn the power down to 1 to 5 watts. Digital modes place high duty cycle loads on the transmitter. No point stressing the transceiver while testing.

## ***Transceiver control***

To begin testing, connect the IsoCat to your computer system using the USB cable and install the appropriate drivers. Do not connect the interface to the transceiver. For Windows systems, you should have the VCP driver install package on the hard drive or on a diskette. The latest VCP drivers are on the FTDI website, <http://www.ftdichip.com/Drivers/VCP.htm>

After the IsoCat is installed on the computer, connect the control port on the radio to the control connector. Launch your rig control program and configure appropriately for the transceiver and control port. Accept the changes and let the program establish a connection with the transceiver. I have used this interface with Scott Davis' (N3FJP) programs, with Simon Brown's (HB9DRV) programs, as well as several freeware RTTY programs, all with equal success.

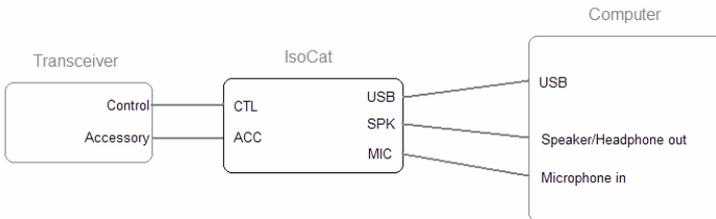
Most programs expect the serial port to be numbered between COM1 and COM8. Because of the way Microsoft Window XP installs additional serial ports, the VCP driver may install the IsoCat driver as COM9 or above. A possible workaround is to change the port number to a lower number that does not conflict with other devices installed at the same time. See the Windows documentation for details.

Verify that the control program responds to changes initiated at the transceiver. Verify that the transceiver reliably switches from receive to transmit and back.

## ***Sound card interface***

When the transceiver and computer are communicating reliably, continue with the sound card testing and calibration. Complete the following additional connections:

- Connect the sound card headphone or speaker output to the modulation input connector on the interface with a 1/8" stereo audio cable.
- Connect the sound card microphone input to the modulation output connector on the interface with a 1/8" stereo audio cable.
- Connect the signal connector to the transceiver accessory connector with the accessory cable.



## ***Adjustment***

- Turn the TX level and RX level pots on the circuit board fully CCW.
- Start the computer.
- Set the sound card input (microphone or line in) gain and the audio output level to 75% using the control panel.
- Connect the transceiver to a dummy load.
- Power up the transceiver. NOTE: during computer startup, be sure the transceiver is off - some OSs may toggle the control lines, keying the transceiver. Not good!
- Launch the digital mode application of choice.
- Set the transmitter to 50% rated power output (or less).
- Turn off compression, notch filtering, and DSP, if available.
- Initiate a test transmission.
- Turn the TX level clockwise until the ALC level begins to increase, then counterclockwise until the ALC level is 0.
- Unkey the transceiver.
- Disconnect the dummy load and connect an antenna to the transceiver. Locate a station that is transmitting a signal using the desired mode.
- Slowly turn the RX level clockwise until the signal peaks at about 70% to 80% of maximum on an input amplitude display. In most cases, this will be optimum and still allow a bit of headroom for louder signals.

Congratulations, now you are ready for some operating time! This I will leave, as a former teacher was prone to saying, as an exercise for the student. Hope to hear you on the air.

## **Conclusion**

This is an interesting and educational project. It opens the door experimenting with sound card modes, such as Pactor, TTY, Hellschreiber, and SSTV just to name a few. It is also useful for recording QSOs or voice contest calls.



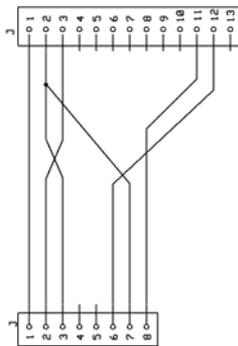




P7

Plug-rear view

- 1 RTS+
- 2 RTS-
- 3 RTS+
- 4 DTR+
- 5 Signal in
- 6 Signal in
- 7 COMMON
- 8 Signal out



ICON 783, 786, 788



Plug-rear view

- 1 BU (L 818 A)
- 2 CND
- 3 VSEND (HF 58 MHz)
- 4 BDI
- 5 BEND (783, 786) (788 optional)
- 6 RLC
- 7 VSEND (788)
- 8 13.BV (L A)
- 9 KEY
- 10 FSK
- 11 MOD
- 12 AF
- 13 SALS

<b>NSBIA</b>	
<b>IsoCat Signal Cables</b>	
B111 - NSBIA	Rev. 1.0
	5/7/886
	Cable Diagrams

## Parts List

Reference	Title	Detail
R3	Resistor, 1/8w, 5%, 1500 ohm	axial lead
R22	Resistor, 1/8w, 5%, 100 ohm	axial lead
R32	Resistor, 1/8W, 5%, 100K	axial lead
R12, R25, R38	Resistor, 1/8w, 5%, 10 ohm	axial lead
R15, R29, R34	Resistor, 1/8w, 5%, 10000 ohm	axial lead
R13, R39	Resistor, 1/8w, 5%, 110 ohm	axial lead
D7, D8	Diode, light emitting, yellow. Diffused	
D4	Diode, light emitting, green, diffused	
D3	Diode, light emitting, red, diffused	
R33	Resistor, 1/8w, 5%, 1000 ohm	axial lead
D1, D2, D5, D6	Diode, small signal, 1N914	
R28	Resistor, 1/8w, 5%, 2200 ohm	axial lead
L1	Inductor, ferrite bead	axial lead
R5, R6	Resistor, 1/8w, 5%, 270 ohm	axial lead
R1, R2	Resistor, 1/8w, 5% 27 ohm	axial lead
Q1, Q4, Q5, Q6	Transistor, NPN, 2N3904, TO-92	
Q2, Q3	Transistor, PNP, 2N3906, TO-92	
R20	Resistor, 1/8w, 5%, 3300 ohm	axial lead
R14, R19	Resistor, 1/8w, 5%, 300 ohm	axial lead
R21	Resistor, 1/8w, 5%, 33000 ohm	axial lead
R7, R8, R9, R15, R16, R35, R40	Resistor, 1/8w, 5%, 4300 ohm	axial lead
R11	Resistor, 1/8w, 5%, 47 ohm	axial lead
R4, R10	Resistor, 1/8w, 5%, 470 ohm	axial lead
X1	Crystal, oscillator, 6-mHz	

R27	Potentiometer, 12-turn, 1K ohm	
R26	Potentiometer, 12-turn, 10K ohm	
U2, U3	IC, optoisolator, 4N33	6-pin DIP
R23	Resistor, 1/8w, 5%, 560 ohm	axial lead
R24	Resistor, 1/8w, 5%, 6.2 ohm	axial lead
U7	IC, memory	93C46
J7	Connector, DIN	CP-2280
U6	IC, DC-DC converter, surface mount	MAX253
C11, C13	Capacitor, polyester, 0.01uf, 50v	
C4, C6, C8, C15	Capacitor, polyester, 0.1uf, 50v	
C1, C3, C9, C10, C12	Capacitor, stacked metal film, 1uf, 50v	
C7	Capacitor, electrolytic, 22 uF, 16V	
C2, C5	Capacitor, electrolytic, 33 uF, 16V	
C14	Capacitor, electrolytic, 100 uF, 16V	
	Board, printed circuit	
J2, J3, J4, J5, J6	Connector, 1/8 phone,	
T2, T3	Transformer, audio	1:1, 600 ohm
U4, U5	Relay, solid state. 400V, .15A	PS1741E-1A-A
J1	Connector, USB	7877801
T1	Transformer, power, switching	7825355
U1	IC, USB-serial converter	FT-232-BL



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