Bluetooth® Serial Data Interface for CI-V and CAT-62

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Here's an accessory to provide a wireless serial data link to the CAT connection of your radio. Using plug-in jumpers it can be configured to work with the CI-V bus used by Icom for many of its radios, or for the CAT-62 connection such as used on several Yaesu models. Check your radio's users manual to determine if this device would be compatible. It employs 3.3 V logic level, non-inverted, serial data, using open drain drivers for "wired OR" operation. On the computer side, it should work with just about any PC, tablet, or even Android® device that is Bluetooth® capable.



So far, the interface device has been successfully tested using a Yaesu FT-817 (CAT-62) as well as an Icom IC-706MKIIG (CI-V) with N3FJP's *Amateur Contact Log v3.4*, and with *Ham Radio Deluxe v5.22.0.02*. There have been a few occasions when HRD has decided it wanted to halt and close, but upon re-launching HRD the connection was re-established. These tests were on an older laptop running WinXP-SP3 with a USB-plugin Bluetooth® dongle. Though not in a shielded enclosure, no RFI troubles to or from noted so far using coax-fed antennas at up to100 W. Though not yet tested, other control/logging software, such as *Amateur Contact Log v4.7* and *N1MM* should also function as long as the software supports the target radio.

The interface requires about 35 to 40 mA (slightly more when in the "discoverable" mode). Battery power is possible (a few hours on a 9 V battery) but connection to a source of 8 to 14 V DC is more appropriate. Most radios have 13.8 V available somewhere on the rear panel connections. Pads are provided on the circuit board for power connection, and an ON-OFF pushbutton switch is board mounted. There is room inside the (optional) case for a set of AAA cells, or even a lithium photo battery.



Connection to the target radio is via a 3.5 mm (1/8") stereo phone jack. For a CI-V connection, only the tip and sleeve of the jack are used, so a mono plug can be used. All three conductors are employed for the CAT-62 connection.

The serial data rate is set by default at 9600 baud, but can be changed from a PC using an appropriate TTL (3.3V) serial data interface.

While the example presented was built on a custom designed two-sided printed circuit board, only a few (5 minimum) connections need be made to the 34-pin surface mount Bluetooth® module, so wire connections could be used on perfboard or Manhattan-style construction. Sufficient schematic and parts information is provided that modestly experienced builders should be able to duplicate this project.



Bluetooth serial port interface for CI-V and CAT-62				
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ID	Quantity	Description		
C1, C3, C7	3	0.1 μF 10% 50V SMT 1206		
C10, C11	2	0.001 μF 10% 50V SMT 1206		
C2	1	10 μF 10% 25V SMT 1206		
R2	1	3.9 К 5% SMT 1206		
R3, R4, R5	2	10 K Ω 5% SMT 1206 (R4 and R5 optional – see schematic)		
JP1	1	4 pin, 0.1" spaced male header strip		
U1	1	AMS1117-3.3 3.3 V series regulator, SOT-223		
U2	1	74LCX07 hex buffer/driver with open drain outputs, SOIC-16		
BT1	1	Bluetooth serial transceiver HC-06 Example: HC-06 - ebay item #130984502683		
J1	1	3.5 mm (1/8") stereo phone jack (<i>e.g.</i> eBay item 281276235578)		
SW1	1	SPST switch (DPDT used on PC board) Marlin P Jones #18017 SW		
D1	2	LED indicator, any color, blue preferred, SMT 1206		
D2	1	1N4007 diode, SMT 1206		
R1	1	100 Ω 1W, use with power source greater than 7 V – see schematic		



Top Copper, rev1.00



Bottom Copper, rev1.00

Setting up a Bluetooth® serial data interface

Example shown on a Dell 600 running WinXP SP3

If Bluetooth® is available on the PC, either by virtue of an internal Bluetooth® transceiver or an external device, the Bluetooth® icon should appear in the taskbar.



Click the Bluetooth® icon to open a pop-up menu. Select "Show Bluetooth Devices."

If this is the first time working with Bluetooth®, an empty list should appear.

Be sure that your Bluetooth® interface card is powered up and is *discoverable*. The LED should be flashing if the device is working and is discoverable.

The interface does not need to be connected to a device (such as a K2-KIO2) at this time. The *pairing* operation does not depend on the hardware connection that will be made to the interface.

Click the "add" button to open a Wizard.

The Wizard will lead you through the steps to discover and install the remote Bluetooth® device.

Check the box to indicate that your interface is powered up and ready to be discovered.

d Bluetooth Device Wiz	ard 🔼	
®	Welcome to the Add Bluetooth Device Wizard	
\mathbf{X}	Before proceeding, refer to the "Bluetooth" section of the device documentation. Then set up your device so that your computer can find it:	
	 Turn it on Make it discoverable (visible) Give it a name (optional) Press the button on the bottom of the device (keyboards and mice only) 	
	✓ My device is set up and ready to be found.	
	Add only Bluetooth <u>devices that you trust</u> .	
	< Back Next > Cancel	

After a few seconds your device should appear. Click on it to select it, then click "Next"

By default the serial interface is factory-names as "HC-06" or "HC-05"

In the example shown it has been reprogrammed by the user to better indicate the device to which it will be connected. In this case, an Elecraft K2 transceiver with the serial number shown.

You'll need to enter the passkey for the device. The manufacturer's default passkey is "1234." That also may be reprogrammed by the user if desired.

Click the button, and then enter the passkey.

Then click "Next"

dd Bluetooth Device Wizard	
Select the Bluetooth device that you want	to add.
K2-1133 New device	
If you don't see the device that you want to a turned on. Follow the setup instructions that o and then click Search Again.	
(< <u>B</u> ack <u>N</u> ext > Cancel
d Bluetooth Device Wizard Do you need a passkey to add your device To answerthis question, refer to the "Bluetooth" se	•
your device. If the documentation specifies a pass	
Use the passkey found in the documentation Let me choose my own passkey:	: 1234
 <u>D</u>on't use a passkey 	
You should always use a <u>passkey</u> , unless your recommend using a passkey that is 8 to 16 digi more secure it will be.	
[< <u>B</u> ack <u>N</u> ext > Cancel

A new window should appear for a few seconds and then disappear as the PC exchanges setup information with the Bluetooth® device.

Windows is exchanging	i passkeys.
When instructed below, ente	er the passkey using your Bluetooth device.
For more information about e device.	entering a passkey, see the documentation that came with your
Connecting	
Disease ententies seeded	ey on your Bluetooth device now.
riease enter the passke	
Please enter the passke Passkey:	1234
Passkey:	
Passkey:	
Passkey:	

In a few seconds the pairing process should complete.

Pay particular attention to the COM ports that have been assigned.

Make a special note of the "Outgoing" COM port. That is the one you will use to connect to your device.



Click "Finish" and your device should appear in the Bluetooth® Device list.

At this point you can launch an application that would normally connect to a serial port. Use the applications options menu to select the port that was assigned as "Outgoing."

However, it is possible that the Bluetooth® setup process could assign COM port numbers that are not available as options in some applications. For instance, Term232 only allows COM1 through COM4.

It is possible to change the COM port assignments using the Device Manager – accessible via the Windows Control Panel.

Open the Control Panel and launch the "System" task.





Now click the "Hardware" tab, and launch "Device Manager" A new window with a list of installed device should appear.

System Properties	? 🔀			
System Restore Automatic Updates	Remote			
General Computer Name Hardware	Advanced			
C Device Manager				
The Device Manager lists all the hardware devices installed on your computer. Use the Device Manager to change the properties of any device.				
Device N	lanager			
Drivers Driver Signing lets you make sure that installed drivers are compatible with Windows. Windows Update lets you set up how Windows connects to Windows Update for drivers.				
Driver <u>Sig</u> ning <u>W</u> indows	Update			
Hardware profiles provide a way for you to set up and store different hardware configurations.				
Hardware Profiles				
OK Cance	Apply			

Expand the "Ports" to show the installed COM and LPT ports. You should see the same COM ports that were created when the Bluetooth® device was paired.

Double click the port you wish to modify.

 Device Manager

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When the new window appears, cick the "Port Settings" tab.

Standard Serial over Bluetooth link (COM3) Properties		
General Port Settings Driver Details		
Standard Serial over Bluetooth link (COM3)		
Device type: Ports (COM & LPT)		
Manufacturer: Microsoft		
Location: on Bluetooth Device (RFCOMM Protocol TDI)		
Device status		
This device is working properly.		
If you are having problems with this device, click Troubleshoot to start the troubleshooter.		
<u><u> </u></u>		
Device usage:		
Use this device (enable)		
OK Cancel		

Don't pay any attention to the Baud Rate report. The Bluetooth® module has its data rate hard programmed and cannot be changed with Device Manager.

Then click the "Advanced" button



A new window will open that has a dropdown menu showing the ports available for assignment.

Note that many of the ports may be marked as "in use."

Most of the time these are left over assignments from previously launched applications and can usually be ignored without incident.

Click to port number you wish to reassign to your Bluetooth® device, and respond with a "Yes" or "OK" to the various dire sounding system warnings.

Your Bluetooth® COM port should be reassigned.

1 CONTRACTOR OF Advanced Settings for COM3 2 ☑ Use FIFO buffers (requires 16550 compatible UART) ОК Select lower settings to correct connection problems Cancel Select higher settings for faster performance <u>D</u>efaults Receive Buffer: Low (1) High (14) (14) Transmit Buffer: Low (1) High (16) (16) COM Port Number: COM3 COM3 COM4 (in use) COM4 (in use) ReCOM5 (in use) COM6 (in use) COM7 (in use) COM8 (in use) COM9 (in use) Advanced. Scheduled Tasks COM10 COM11 (in use) COM12 00 COM13 COM14 User Accounts COM15 nu COM16 COM17 OK COM18 Ŧ COM19

You have to close Device Manager and re-launch it in order to see that the changes have taken place.

At this point you should have a Bluetooth® serial port that can be accessed by your favorite logging or rig control application. For example, the "Rig Interface" settings for N3FJP's Amateur Contact Log look like the screen below. Just select the appropriate COM port (the outgoing one, remember), set the Baud Rate (*e.g.*, 4800 for the K2) and the rig (*e.g.*, Elecraft). No parity, 8 data bits, 1 or 2 stop bits.

Note that for Icom rigs you will have to edit the command strings to insert the proper CI-V address (*e.g.*, hex 58 for the 706Mk2G). Remember that you **<u>must</u>** select the baud rate that the Bluetooth® is configured for. The rate can only be changed bt reprogramming the module (see later in this document).

Chose "None" for "Connection Power" and select a convenient polling rate -2 s is generally adequate.

Click "Test" and you should get a response from the rig. You should also notice that the LED on the Bluetooth® module has stopped flashing and is now steadily illuminated.

Rig Interface Setup				
Select Rig:	Comm Port:			
None Elecraft Icom Icom 735 Kenwood Kenwood 2 Ten Tec Omni VI Ten Tec Orion Ten Tec Frt Pnl Ten Tec Pegasus	C 1 C 2 C 3 C 4 C 5 C 6 C 7 C 8 C 9 C 10 Baud Rate (k): C 1.2 C 2.4 C 4.8 C 9.6 C 14.4 C 19.2 C 28.8 C 38.4 C 56 Parity: Data Bits: C 7 C 8 C 1 C 2 C Odd None Even C 7 C 8 C 1 C 2 Connection Power: Radio Polling Rate: C 100 ms C 2 Sec C 10 Sec			
String to read frequency: FA; Frequency:	String to read mode: MD; Should be PH or CW 18.08427 Mode: CW			
To use the Rig Control interface, select the appropriate parameters for your radio and click test. Be sure to select the connection power option if your interface requires it. From the main form, when changing bands on your radio the band on this program should automatically change. If you need an interface for your rig, please check our website for hardware purchase options. Please consider this rig interface section of code a beta version. I have only been able to test it personally on a Kenwood radio. I have received reports of success for all the listed rigs. If you have a rig that isn't listed and would like to do some testing, you can click Other from the list above, send commands as detailed in your radio's manual and view the radio's response below. Letting me know the commands for your radio and the format of the respose will be a huge help for supporting additional rigs.				
I have added additional code so that by right clicking on a DX spot that is being displayed on the DX spotting band map, your radio will change to the spot frequency. Most Elecrafts, Icoms, Kenwoods and Yaesus are now supported. If you would like to help develop and test this feature for other rigs, please click the Change Frequency button.				
Unprocessed data returned:	Copy unprocessed data to clipboard MD3; Convert from Hex Done			

Configuring the Bluetooth® module using AT commands

When a HC-06 equipped Bluetooth® adapter is *unpaired* (the LED is flashing) the unit can accept configuration commands via the wired serial port connection. The Bluetooth® unit must be configured to employ separate TX and RX connections to a 3.3 V USB-Serial adapter. This means that R4 and R5 must be installed, and a jumper placed between JP1-1 and JP1-2.

Connect the RX line of the USB-Serial adapter to the TIP connection of J1, connect the TX line of the USB-Serial adapter to the RING connection of J1, and connect the GROUND of the USB-Serial adapter to the SLEEVE connection of J1.

The Bluetooth® unit will have to be powered by a DC source of 5 to 12 V, capable of about 40 mA. The V+ and GND pins on the 3-pin header can be used to connect a power source.

Commands must be sent at the data rate for which the Bluetooth® device is currently configured. If a command is issued that changes the data rate, subsequent commands must be sent at the new rate.

It is best to store the desired commands a short ASCII text files and use a terminal program such as Term232 to transmit the command strings. An internal time-out timer requires that the command string be transmitted within about a 2 second window, generally too quick to type commands by hand.

Each command begins with "AT" followed by additional parameters. The module will respond to indicate that the command has been received and processed.

Here are commands that are known to function with the HC-06 modules being used in this adapter:

command: AT	response: OK	communication check (ping test)
<i>command</i> : AT+version	response: OKLinvorV1.8	firmware version inquiry
n=1 for 1200 b n=2 for 2400 b n=3 for 4800 b	baud baud baud (module manufacturer's defaul baud baud 0 baud 0 baud 0 baud 00 baud 00 baud	adecimal number
<i>command</i> : AT+name<dev< b=""> <devicename></devicename></dev<>	icename> response: O	e
command: AT+PIN<4 dig	it code> response: OK<4 di	igit code> change pass key

4 digit code> is the password or *passkey* used when pairing the device (default 1234)

HC-05 modules, which can be either master or slave Bluetooth© devices, have a more extensive set of AT commands.