

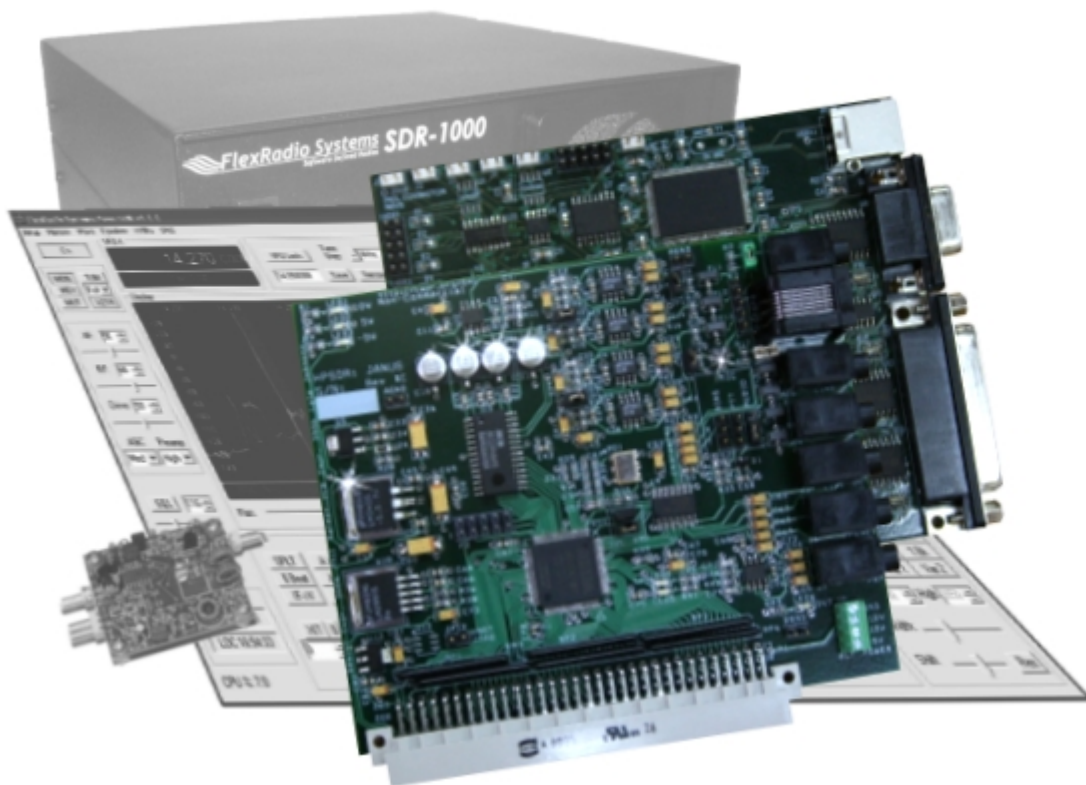


High Performance Software Defined Radio

Open Source Hardware and Software Project

Project Description: <http://hpsdr.org>

Janus and Ozy *Operation with PowerSDR*



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Introduction

The HPSDR Ozy and Janus boards can be used together with a modified version of PowerSDR to control the SDR-1000 and/or process the I/Q and audio streams of both the SDR-1000 and SoftRock¹. This manual describes the connections to be made between Janus and the SDR-1000 or SoftRock, Ozy and the SDR-1000 (for control) and Ozy and the PC. Subsequently it describes how to setup PowerSDR to invoke Ozy control and/or use Janus for the audio processing.

What you will Need

Table 1 and Table 7 below summarize the hardware and software you will require to operate the SDR-1000 or SoftRock using the Janus and Ozy boards and PowerSDR.

Janus is not a sound card in the traditional sense and it will not be recognized as such by Windows. In fact the I/Q data are transmitted via Ozy over the USB connection to the PC. The use of Janus and Ozy requires a modified version of PowerSDR².

Table 1: Hardware Requirements

Hardware	Comment
Atlas board ³	Backplane for all HPSDR boards
Ozy board	Control data and digital I/Q streams to/from PC
Janus board	AD/DA between PC and SDR-1000 or SoftRock, PTT and audio in/out
Atlas Power Supply	PC ATX type or equivalent (Alternatively, power can be fed through Janus board, see Fig 1 on page 5 and page 8)
SDR-1000 or SoftRock	RF front end recognized by PowerSDR
Microphone cable	To connect microphone (incl PTT) to Janus, see Fig 1 on page 5 and page 6
1/8" stereo audio cables	I/Q connections between Janus and SDR-1000/SoftRock, see Fig 1 on page 5 and pages 6 and 8
USB cable	Connection between Ozy and PC, see Fig 3 and text on page 9
25-pin control cable	Between Ozy and SDR-1000 DB-25 connectors to enable Ozy to control the SDR-1000, see Fig 3 on page 9 and page 10
Key and/or PTT	Key and/or alternative PTT connection through Ozy DB-9 connector, see Fig 3 on page 9 and page 10

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¹ Any other associated SDR that will work with PowerSDR can also be used.

² Currently PowerSDR is the only known SDR software that has been modified to work with Janus and Ozy. We expect that in time, other software may also be modified, or newly created.

³ At the time of this writing WB2ZXJ is developing an Atlas Lite, which only has 2 Euro-connectors.



Table 2: Software Requirements

Software	Comment
Ozy Driver S/W	USB Driver to enable the PC to communicate with Ozy, see page 12
.Net 1 Framework	Required to run PowerSDR, see page 21
.Net 2 Framework	Required to run Ozy initialization software, see page 20
Ozy Initialization S/W	Software to initialize the FPGA of Ozy, see page 20
Modified Power SDR	Required to Operate PowerSDR with Janus/Ozy, see page 21 and following

In the following, the set-up of and connections to Janus and Ozy will be explained in detail, followed by the PowerSDR settings.

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Janus Set-up

During normal operation, four red LEDs are lit as indicated⁴ To use the Janus board with the SDR-1000 nine jumpers must be set. Six of these are indicated in light blue in Fig 1 below. The remaining three relate to microphone and PTT connections and to the microphone bias. These are explained in detail below. For ease of reference, the i/o jacks in Fig 1 have been enumerated and each will now be dealt with in turn.

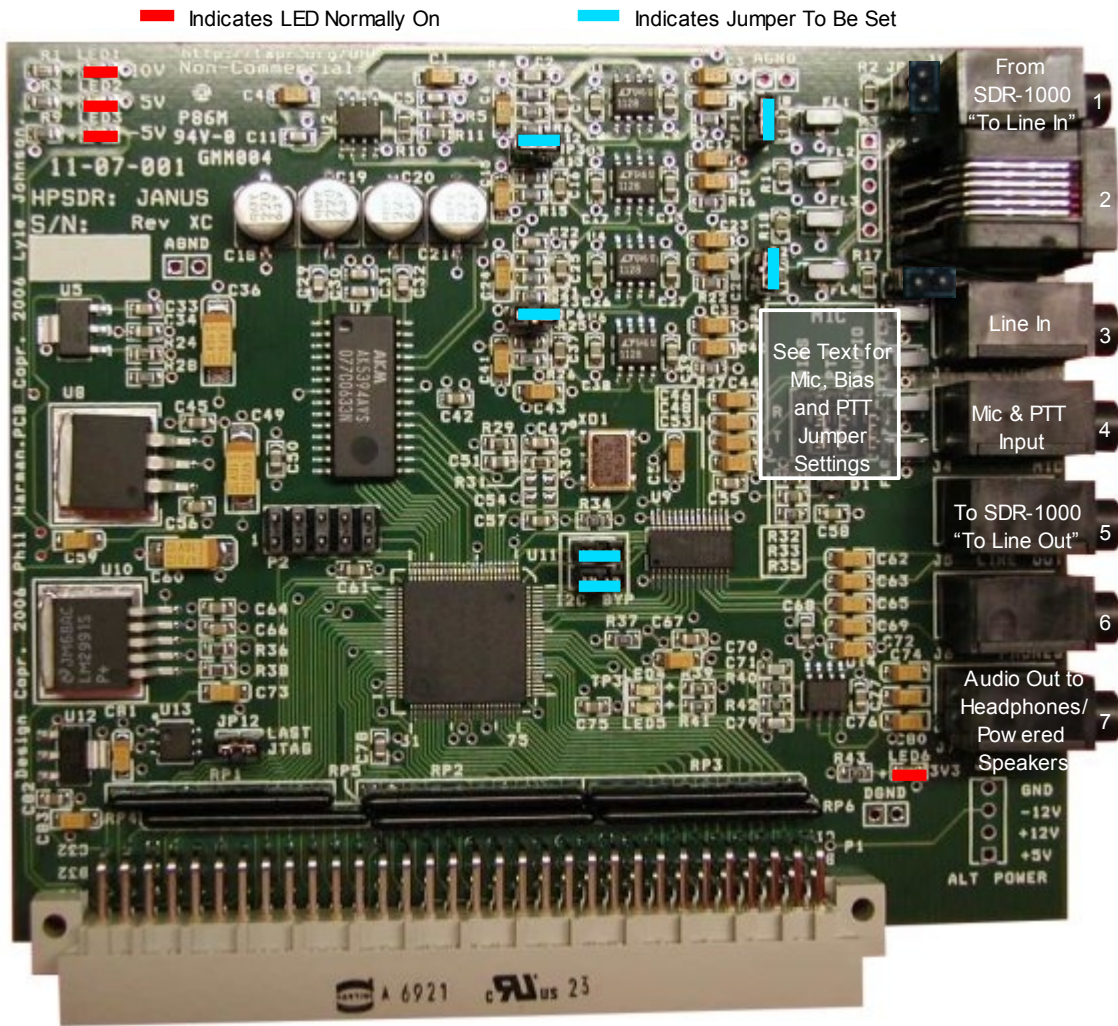


Fig 1: Janus Board Indicating Jumper Settings, Connections and LEDs

⁴ At power on and initozy.bat not loaded, LEDs 4 (yellow) and 5 (green) will also light. These LEDs signify that there is a 10MHz reference present on Atlas C16 (LED4) and the VCXO PLL on Janus is locked (LED5). Before initozy.bat is loaded there is no clock into the CPLD on Janus. The CPLD defaults to light LEDs 4 and 5. Once Ozy is running the detector in Janus works and the LEDs dim. If you feed 10MHz over Atlas pin C16 (i.e. an external reference or Gibraltar later on) then Janus will detect it and try and phase lock the 12.288MHz VCXO to it.

The reference clock is actually on Janus and gets fed to Ozy over the Atlas bus and then back to Janus via the bus! That needs to be done since when Penelope and/or Mercury are fitted later on one of them will provide the master clock.



1 I/Q Input Connection

This is the I/Q connection to the associated SDR's receiver. For the SDR-1000, connect to the jack labeled "To Line In" with a 3.5mm (1/8") stereo audio cable.

2 Balanced I/Q Input Connection

Not used with the SDR-1000 or SoftRock, nor any other associated SDR receiver that does not deliver it's I/Q signals in balanced audio format.

3 Line In Connection

Connect to an audio source (such as the playback of a recording) with a 3.5mm audio cable. This connection bypasses the microphone preamp. Do not confuse this jack with the I/Q Input jack (#1) above.

4 Microphone and PTT Connections

Connect the microphone and any PTT connection from the microphone through a 3.5mm tip-ring-sleeve audio plug.

3.5mm Plug Connections

Connect the Sleeve to the outer braid of the coaxial microphone cable (see Fig 2).

Since there is no standard relating to the wiring of microphone plugs Janus allows several options:

- The microphone may be connected to either the tip or the ring (see Fig 2).
- If the microphone has a PTT button, this can be connected to the opposite terminal (ring or tip) to where the microphone signal is connected.



Fig 2: Microphone Plug Connections

Note: THE PTT BUTTON SHOULD PRESENT A VOLTAGE FREE CONTACT THAT CONNECTS ITS ASSOCIATED PIN TO THE OUTER SLEEVE OF THE COAXIAL MICROPHONE CABLE WHEN PRESSED. THIS IS THE MOST COMMON WIRING FOR A PTT BUTTON, BUT USERS ARE ADVISED TO CHECK THE CONNECTIONS WITH A MULTIMETER IF UNSURE OF THE EXACT CONFIGURATION.

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Microphone Jumper Settings

Janus has three jumpers, just behind the microphone and PTT jack (#4), which need to be set in accordance with the connections chosen above (see the "gray box" in Fig 1) . These are identified on the board as Audio, PTT and Bias respectively and together grouped as Mic. Additionally the R (ring) and T (tip) positions are identified (see Table 3).

- Set the *AUDIO* jumper to identify the terminal (tip or ring) that the microphone is connected to.
- Janus can provide DC bias for use with Electret microphones. If your microphone requires a DC bias, set the *BIAS* jumper to the same terminal (tip or ring) the microphone is connected to.

Note: IF YOUR MICROPHONE DOES NOT REQUIRE A DC BIAS THEN DO NOT FIT A JUMPER.

Table 3: Microphone and Jumper Settings

Bias	Microphone	
	Tip	Ring
No		
Yes		

PTT Jumper Settings

If your microphone is fitted with a PTT switch, then set the PTT jumper to identify the terminal (ring or tip) that this PTT switch is connected to (see Table 4).

Note: MAKE SURE THIS IS NOT THE SAME TERMINAL YOUR MICROPHONE IS CONNECTED TO.

Note: DO NOT SET THIS JUMPER IF YOUR MICROPHONE HAS NO PTT SWITCH OR YOU DO NOT CONNECT IT.

WARNING: IF YOUR MICROPHONE PLUG USES TIP AND SLEEVE CONNECTIONS ONLY AND YOU SET THE PTT JUMPER TO THE RING SETTING, THE PTT ON THE ASSOCIATED SDR WILL BE PERMANENTLY ACTIVATED.

If you wish to connect an external PTT switch connect it between the sleeve terminal of the plug and which ever terminal is not being used by the microphone. Set the PTT jumper accordingly.

Note: AN ALTERNATIVE PTT INPUT IS AVAILABLE THROUGH THE DB-9 CONNECTOR ON THE OZY BOARD - SEE PAGE 10 FOR MORE DETAILS.

Note: PTT AND CW MUST BE CONNECTED TO OZY/JANUS AND NOT TO THE SDR-1000 JACKS. THIS MAY CHANGE IN FUTURE AS THE SOFTWARE GETS UPDATED.

Table 4: PTT Jumper Settings

PTT	
Ring	Tip



5 I/Q Output Connection

This is the I/Q connection to the associated SDR's exciter. For the SDR-1000, connect to the jack labeled "To Line Out" with a 3.5mm (1/8") stereo audio cable.

6 Not Used

Note: EVEN THOUGH THIS CONNECTOR IS IDENTIFIED ON YOUR BOARD (SILK SCREEN) AS THE PHONES CONNECTOR, IT IS **NOT** USED AS SUCH WHEN USED WITH POWERSDR. THE BOARD INDICATIONS ARE ONLY GENERIC. THE INPUTS AND OUTPUTS ON JANUS CAN BE RE-CONFIGURED BY THE SOFTWARE LOADED INTO ITS CPLD.

7 Audio Out

Connect to either a set of headphones or powered speakers using a stereo 3.5mm plug. Connect the right channel to the Tip and the left channel to the Ring.

Note: EVEN THOUGH THIS JACK IS IDENTIFIED AS PWM ON YOUR BOARD, IT IS INDEED USED AS THE AUDIO OUT JACK IN THIS APPLICATION. SEE THE PREVIOUS NOTE.

Alternative Power Connector

On the Janus board, just beneath the Audio Out connector (#7) are four terminals that can be used to feed power to Janus, and via the Atlas backplane, to Ozy. These terminals may be used instead of the Molex power connector on the Atlas board.

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Ozy Setup

To use the Ozy board with the SDR-1000, 3 jumpers need to be set, indicated in light blue in Fig 3. One LED is lit indicating the +5V power supply. (All other LEDs are under software control).

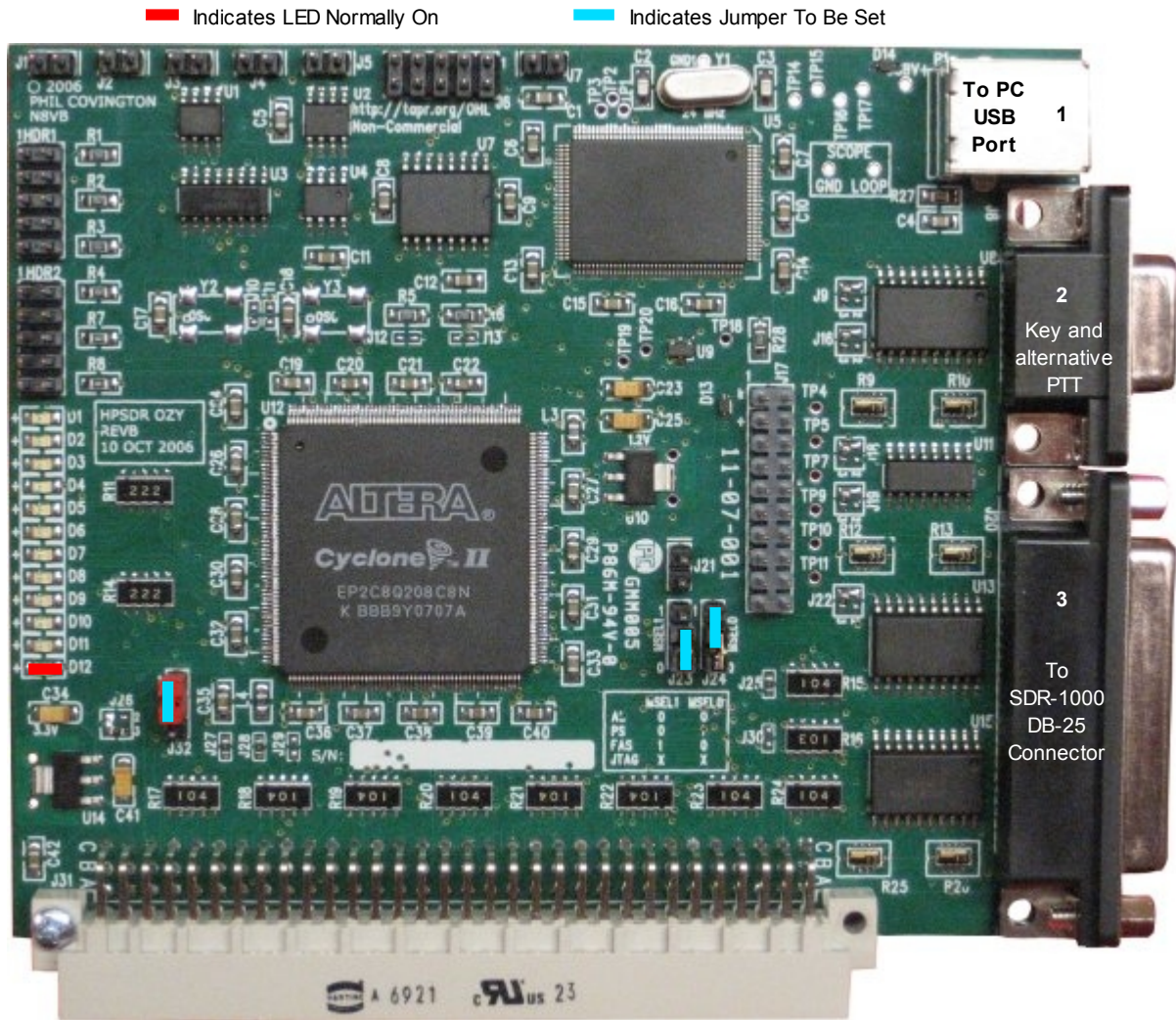


Fig 3: Ozy Board showing Connections

For ease of reference, the i/o jacks in Fig 3 have been enumerated and each will now be dealt with in turn.

1 USB Connection

Connect the USB port (1) to a USB2 port on your PC. No power is drawn from the PC USB port so a powered hub etc. is not required. It is best to use the type of USB lead that has a ferrite bead built into it, if available, and connect the bead end into Ozy.



2 DB-9 Connection

The DB-9 jack (2) can be used to connect a PTT and/or a key.

- The PTT is connected to pin 7 and needs to be grounded to transmit. The ground available on pin 5 can be used for this.
- To connect a key, connect the dash to pin 6 and the dot to pin 7 as shown in Table 5.
- These pins need to be grounded to activate them, for which pin 5 should be used.
 - To use this key, you will need to enable it in PowerSDR. To do so, click on Setup and then select the DSP tab followed by the Keyer Sub-tab. In the Connections section, select Ozy as shown in Fig 4 below.

Table 5: Connecting a Key to Ozy

Ozy DB-9 Pin	Key
5	Common
6	Dash
7	Dot

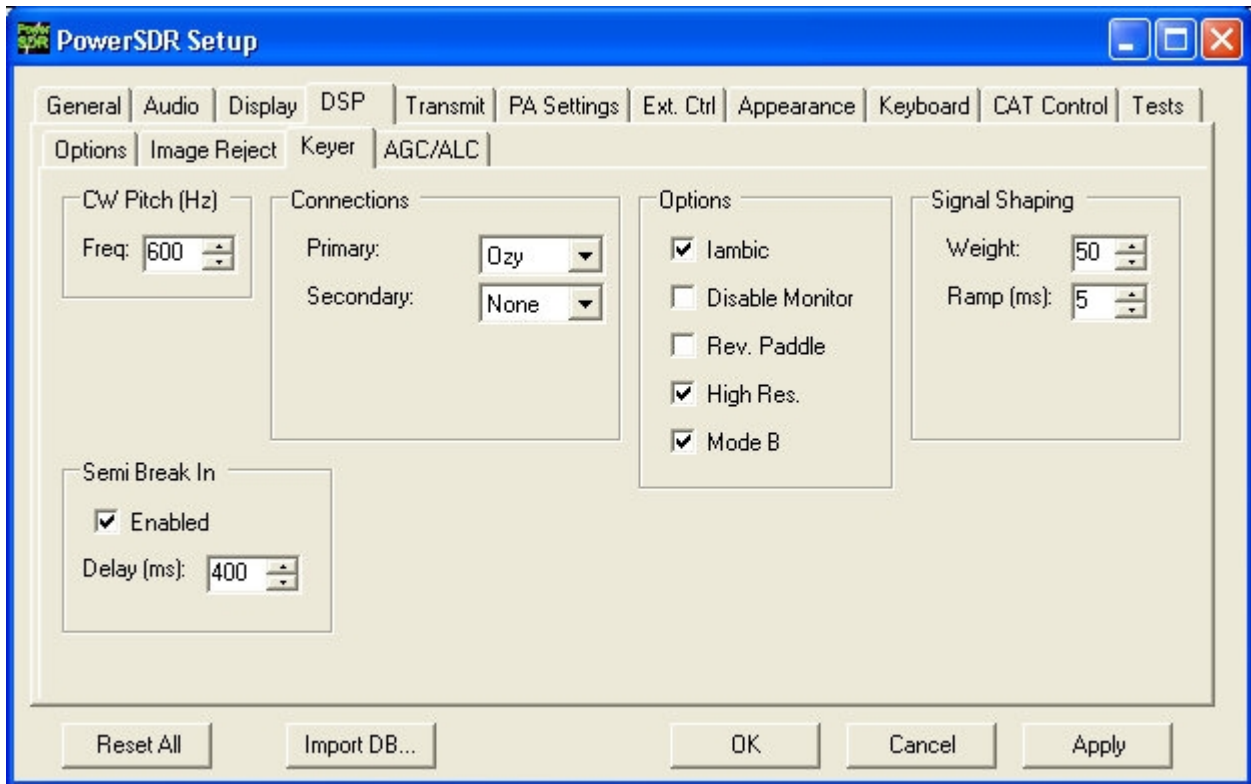


Fig 4: Selecting Ozy as the Primary Keyer Connection in PowerSDR

3 DB-25 Connection

If you are using Ozy to control the SDR-1000, connect the DB-25 jack (3) to the DB-25 jack on the SDR-1000, marked "To Parallel Port". Use a shielded male-to-male lead with all 25 pins connected of the shortest practical length. If a lead with an integral ferrite bead is available, use that and connect the bead end into Ozy. A short ribbon cable has been successfully tested. However, such a cable may have a (very) high sensitivity to RF so it is not recommended.



Software

To run PowerSDR with Ozy/Janus you will need to:

1. Download, using e.g. TortoiseSVN (<http://tortoisesvn.net/>), the LibUSB driver package from the HPSDR SVN system (see Fig 5) at:

svn://206.216.146.154/svn/repos_sdr_hpsdr/trunk/PowerSDR-ForJanusOzy-LatestReleasedBinaries/libusb-driver-package

2. Download the PowerSDR package from the HPSDR SVN system (see Fig 5) at⁵:

svn://206.216.146.154/svn/repos_sdr_hpsdr/trunk/KD5TFD/PowerSDR/HPSDR-1.6.3/bin/Release

3. Install the LibUSB driver (see below)
4. Connect and power up Ozy and Janus
5. Run initozy.bat, which is part of the PowerSDR package you downloaded. This will initialize Ozy and Janus
6. Run PowerSDR you just downloaded. The first time you run it, configure it as explained below.

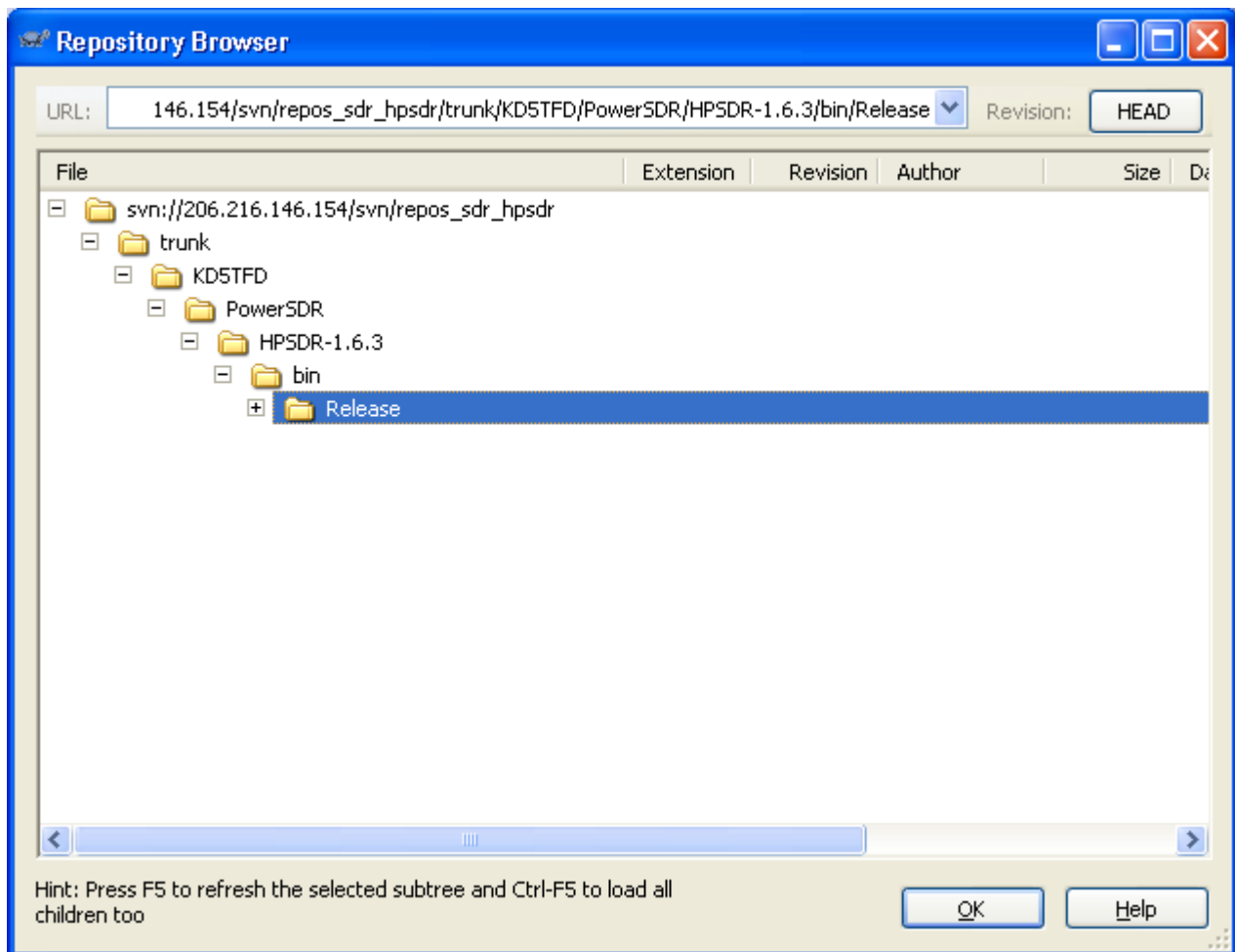


Fig 5: Tortoise SVN Repo-Browser Displaying Folders Containing LibUSB and PowerSDR Binaries

⁵ This address includes an updated initozy.bat file to speed up control of SDR-1000 using Ozy.



Installing the USB Driver

To enable your PC to recognize Ozy you must install the LibUSB driver you downloaded from the HPSDR SVN system.

Important: THE PROCEDURE FOR INSTALLING LIBUSB IS SLIGHTLY DIFFERENT FOR THOSE WHO USE OR HAVE USED THE FLEX-RADIO USB ADAPTER AND THOSE THAT NEVER HAVE

If You Have Previously Installed Flex-Radio USB Adapter Driver

If you have previously installed the Flex-Radio USB Adapter Driver (USBIO.exe), or an older version of the Ozy USB driver, you must update the driver. To do so:

1. Plug in the Flex-Radio USB Adapter, but do not run PowerSDR.
2. In Windows, open the **Control Panel**, double-click on **System**, select the **Hardware** tab and click the **Device Manager** button. Select the **Cypress EZ-USB FX** driver, right click and select **Update Driver...** (see Fig 6).

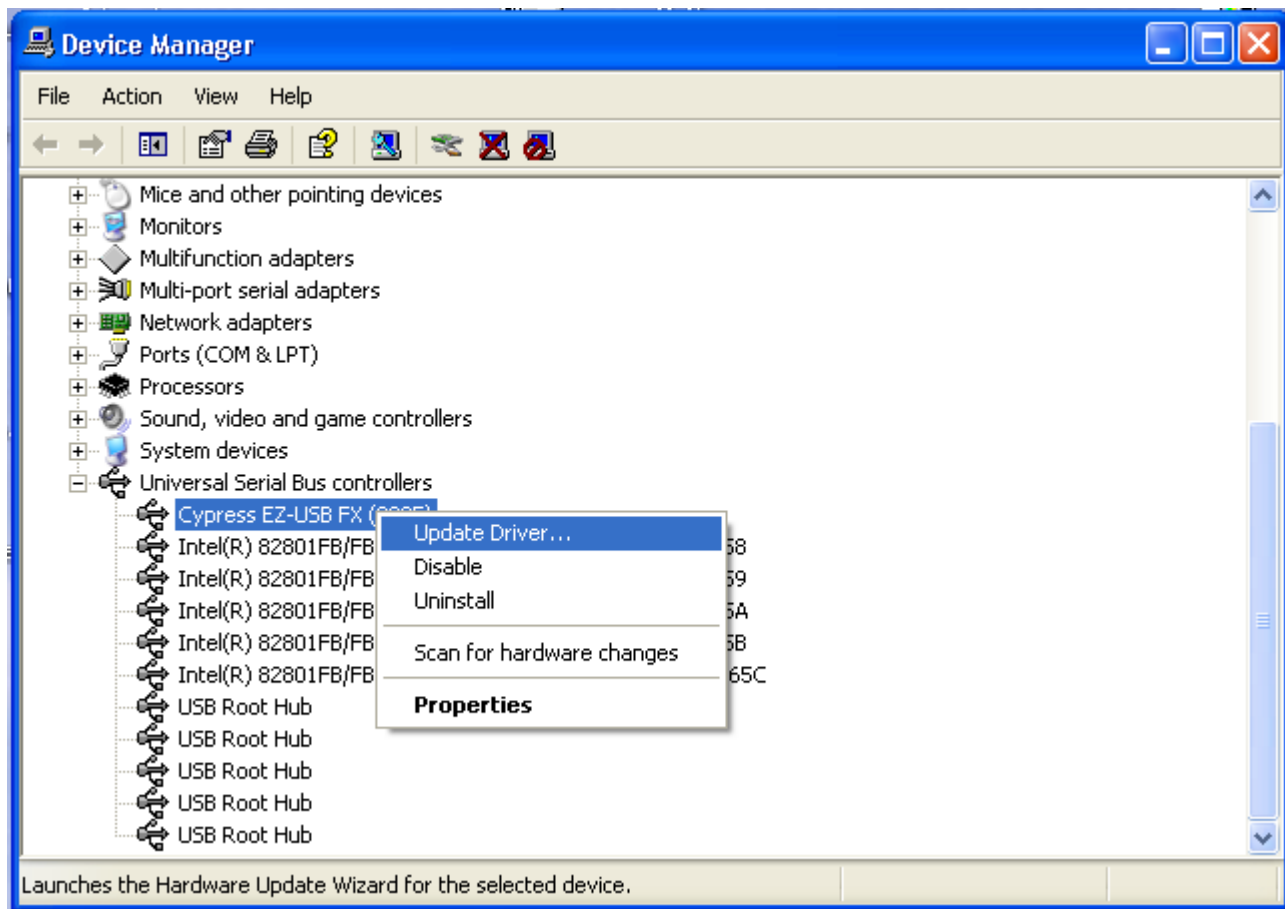


Fig 6: Updating the Flex-Radio Adapter Driver from the Device Manager

3. This will start the Hardware Update Wizard. Select **No, not this time** and click **Next** (see Fig 7).

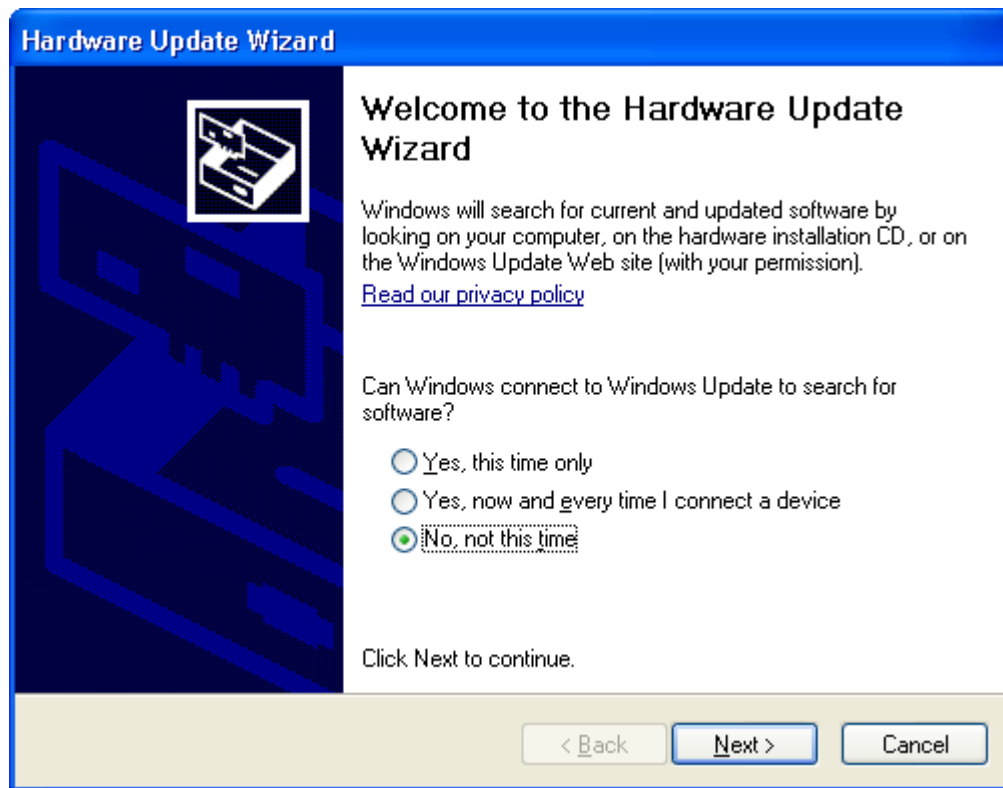


Fig 7: Hardware Update Wizard - Do Not Connect to Windows Update

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4. Select **Install from a specific location** and click **Next** (see Fig 8).

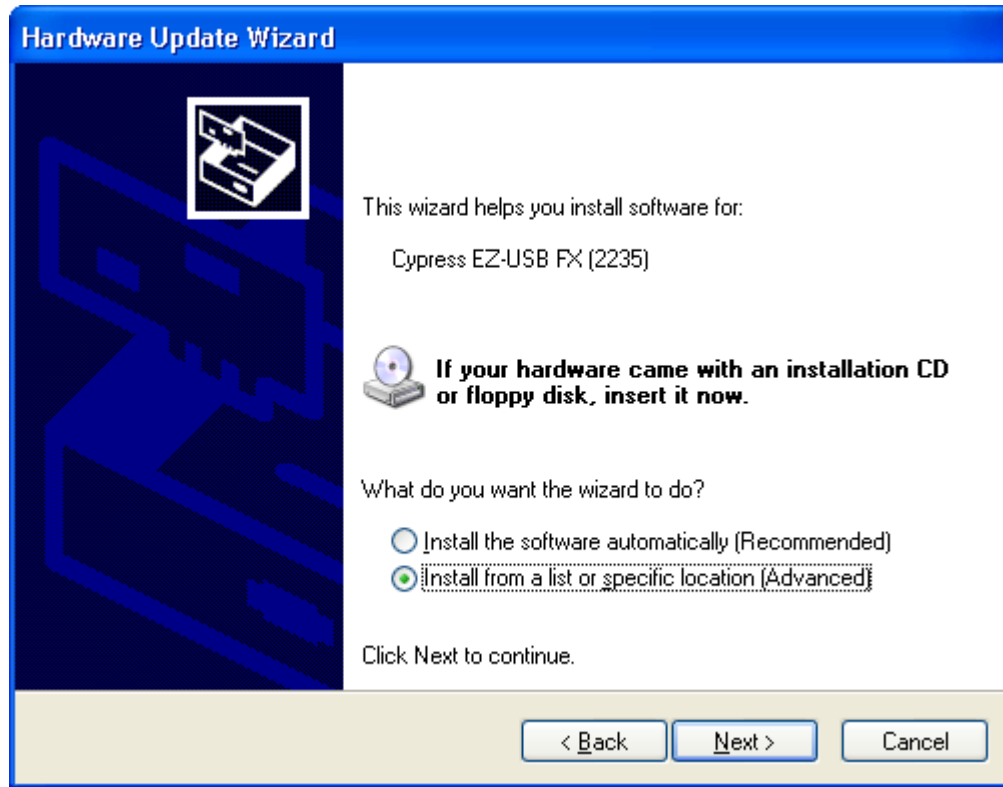


Fig 8: Hardware Update Wizard - Install From a Specific Location

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5. Browse to the folder you downloaded the LibUSB driver to and click **Next** (see Fig 9).

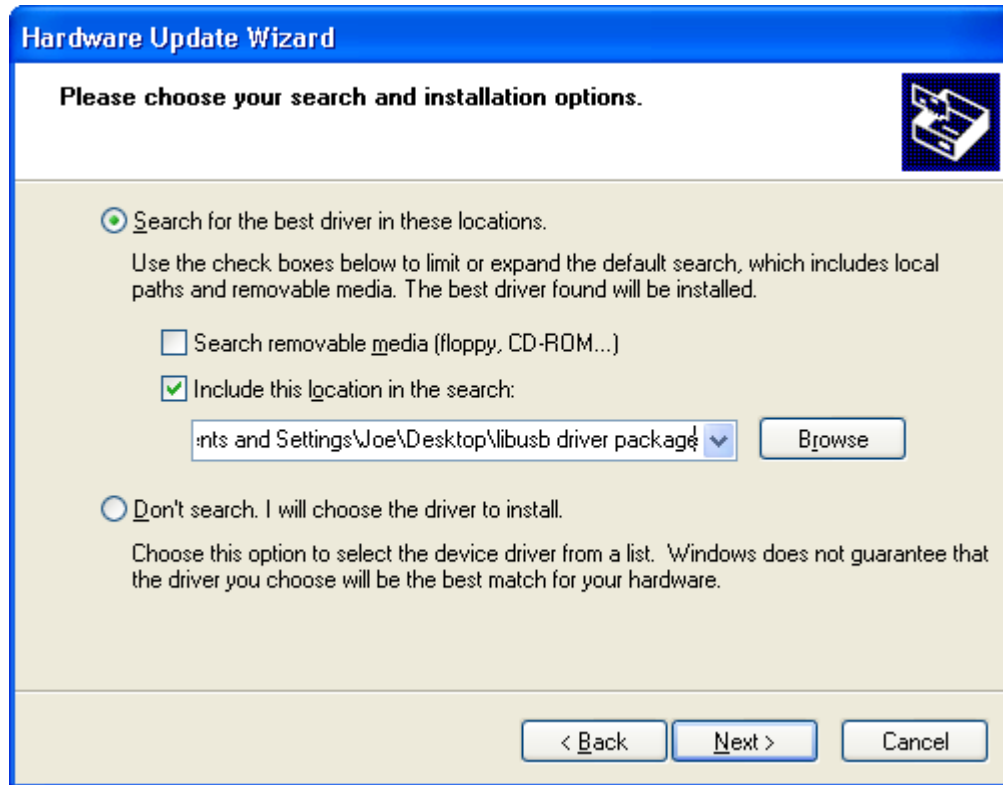


Fig 9: Hardware Update Wizard - Browse to Location of LibUSB

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- The Hardware will display the new driver, EZ-USB FX (LibUsb). Click **Finish**. The updated driver will be found in the Device Manager under **LibUSB-Win32 Devices** (see Fig 10).

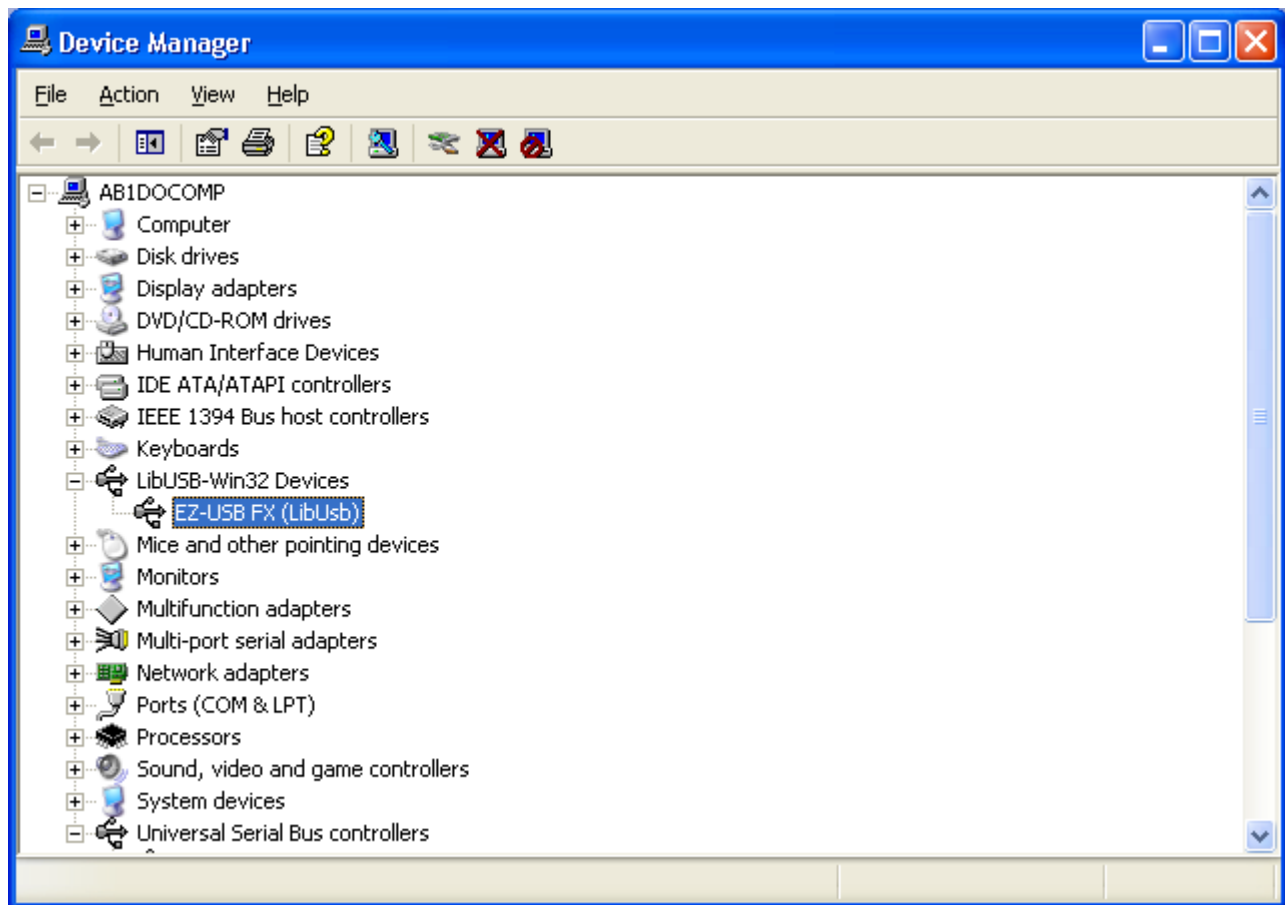


Fig 10: Device Manager Displaying Updated Driver

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If You Have Never Installed the Flex-Radio USB Adapter Driver

If you have never before installed either the Flex-Radio USB Adapter Driver (USBIO.exe) or a previous version of the Ozy USB driver, you will need to install the LibUSB driver you downloaded using Windows Found New Hardware Wizard.

1. Power up Ozy/Janus and connect Ozy to the PC. Windows will find new hardware and start the wizard. Select not to search and click **Next** (see Fig 11).



Fig 11: Found New Hardware - No Search This Time

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2. Select **Install from a specific location** and click **Next** (see Fig 12).

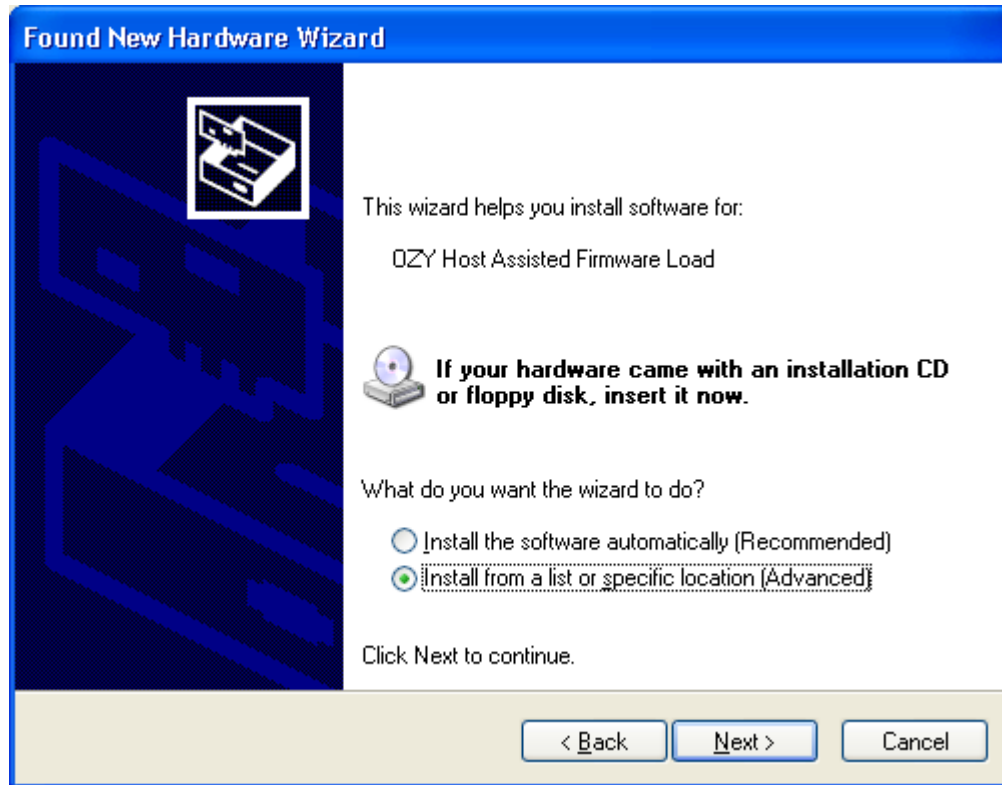


Fig 12: Found New Hardware - Install From a List or Specific Location

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3. Browse to the folder you downloaded the LibUSB driver to and click **Next** (see Fig 13).

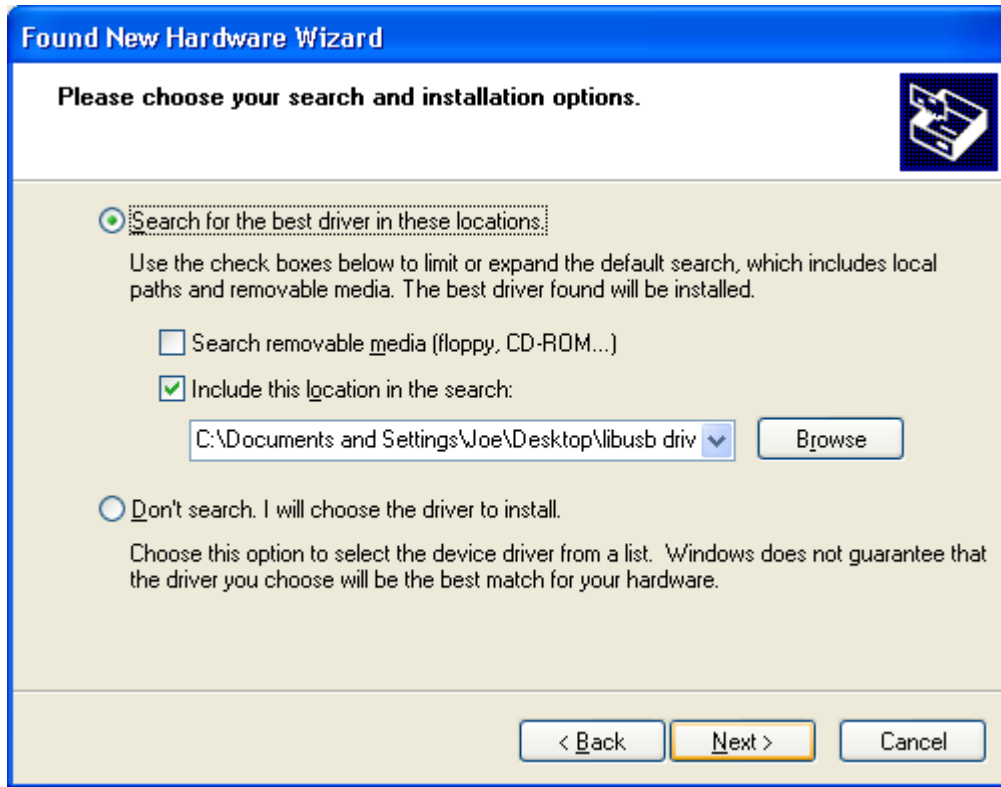


Fig 13: Found New Hardware - Browse to Folder Containing LibUSB

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- The Hardware will display the new driver, Ozy Host Assisted Firmware Load. Click **Finish**. The updated driver will be found in the Device Manager under **LibUSB-Win32 Devices** (see Fig 14).

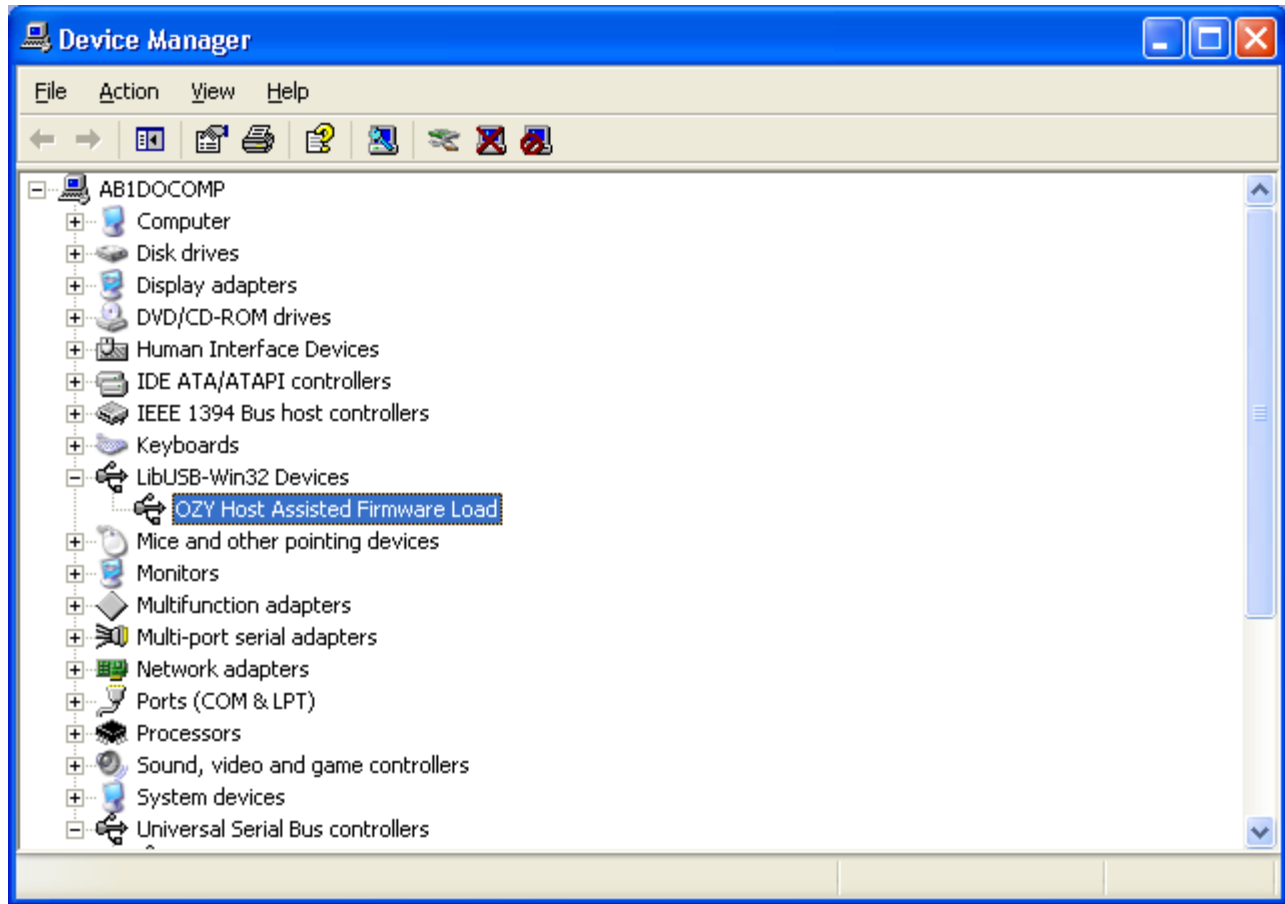


Fig 14: Device Manager Displaying Ozy Driver

Initializing Ozy

Before being able to use Ozy/Janus with the modified PowerSDR, Ozy (and Janus) will need to be initialized with the correct firmware. To do so, locate the file **initozy.bat** in the folder containing all the PowerSDR files you downloaded from the HPSDR SVN system. Double click on **initozy.bat**. This will open a command window, displaying the various routines as they run. On completion, press any key to continue. When completed, LEDs D5 through D8 on the Ozy board will light up and LEDs D9 and D10 will alternate.

Note: THE FILE **INITOZY.BAT** REQUIRES THAT THE .NET 2.0 FRAMEWORK⁶ BE INSTALLED ON YOUR COMPUTER. FAILING TO DO SO WILL WILL RESULT IN MULTIPLE ERROR MESSAGES AND AN INCOMPLETE INITIALIZATION. YOU CAN DOWNLOAD THE .NET 2.0 FRAMEWORK FROM [HERE](#).

Note: **INITOZY.BAT** MUST BE RUN EVERY TIME YOU POWER-UP OZY.

⁶ The .Net 2 and .Net 1 Frameworks will reside on your computer side-by-side without problems.



Running PowerSDR

You are now ready to run the modified version of PowerSDR that you downloaded from the HPSDR SVN system.

- When starting up for the first time, the FFTWisdom routine will run as usual.
- If you are prompted to install the .Net 1 Framework⁷, do so. PowerSDR requires the .Net 1 Framework to run.
- At this stage it is prudent to not use an existing database, but to start with a clean install.
- Make the various selections according to your hardware setup. If you are using Ozy for control, do NOT select the USB Adapter and from the sound card list select either the sound card that you will be using, or if you will use Janus, select any sound card that you have on your system.
- Before clicking the *Standby* button in PowerSDR, follow the directions explained below.

PowerSDR Settings

Ozy and Janus may be used with the SDR-1000 to control and/or process the audio and I/Q streams by selecting the corresponding settings in PowerSDR. Four combinations are possible as shown in Table 6.

Table 6: Overview of Ozy/Janus Interaction with SDR-1000

Ozy	Janus	SDR-1000 Control	Audio/IQ Processing
		PC Parallel Port or Flex-Radio USB Adapter	Third Party Sound Card (Delta-44 or Edirol FA-66)
✓		Ozy	Third Party Sound Card (Delta-44 or Edirol FA-66)
✓	✓	PC Parallel Port or Flex-Radio USB Adapter	Janus
✓	✓	Ozy	Janus

Note: IF JANUS IS USED FOR AUDIO AND I/Q PROCESSING, BUT OZY IS NOT USED TO CONTROL THE SDR-1000, THEN OZY IS STILL REQUIRED TO CONTROL JANUS AND ROUTE THE DIGITIZED AUDIO AND I/Q STREAMS OVER THE USB CONNECTION TO THE PC.

Note: BY SELECTING BOTH OZY FOR CONTROL AND JANUS FOR AUDIO, THERE IS ONLY ONE CONNECTION BETWEEN THE SDR-1000 AND THE PC, BEING OZY'S USB CONNECTION.

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⁷ The .Net 2 and .Net 1 Frameworks will reside on your computer side-by-side without problems.



Ozy SDR-1000 Control

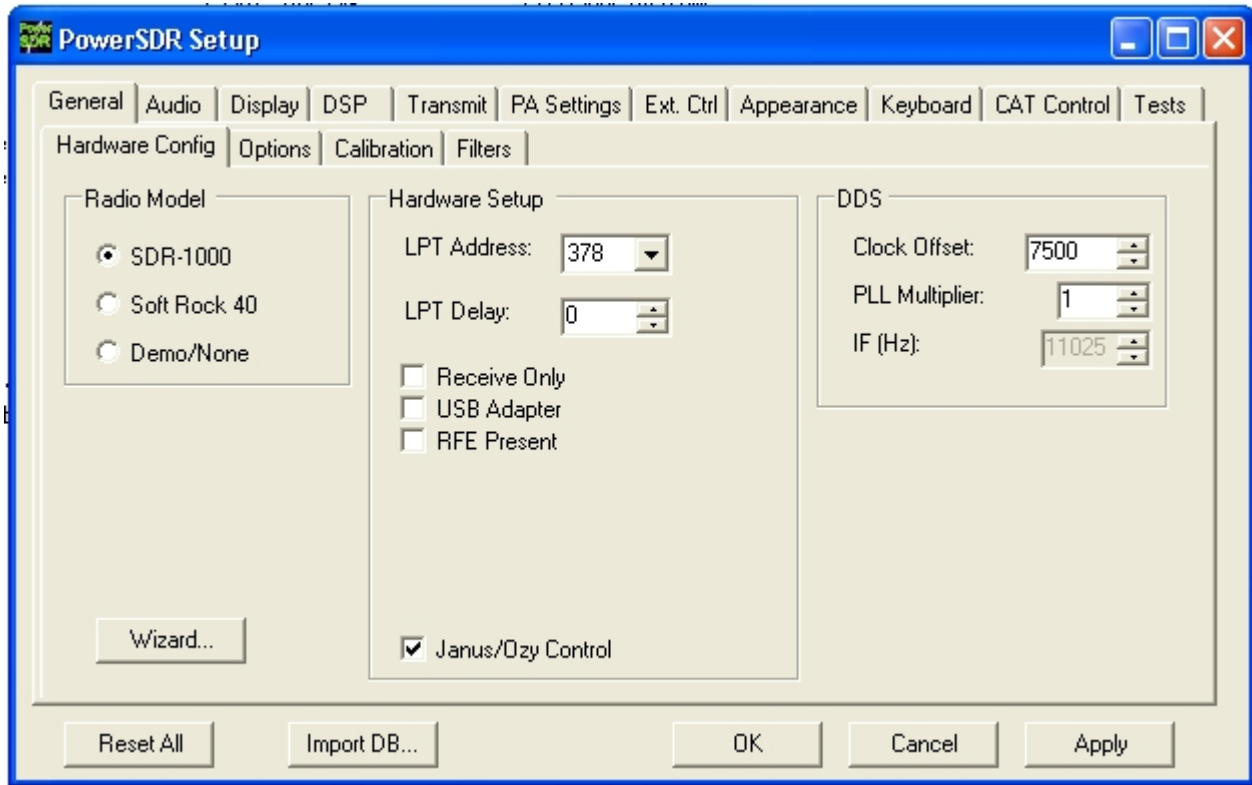


Fig 15: Selecting Ozy to Control the SDR-1000

To select Ozy SDR-1000 control, in PowerSDR click *Set-up* on the Front Console to open the Set-up Form. Click on the *General* Tab and then on the *Hardware Config* Sub-Tab. In the section labeled *Hardware Setup*, select *Janus/Ozy Control*, as shown in Fig 15 above. When you do this, the relevant firmware is uploaded to the Ozy board (into the FPGA), to set Ozy to control the SDR-1000 and Janus.

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Janus Audio and I/Q Processing

To select Janus to process the audio and I/Q streams, go to the *Set-up Form, Audio Tab* and select the *Sound Card Sub-Tab*. In the *Sound Card Selection* section, select *HPSDR Janus/Ozy (USB2)* from the drop down list, just like you would any other sound card. See Fig 16 below.

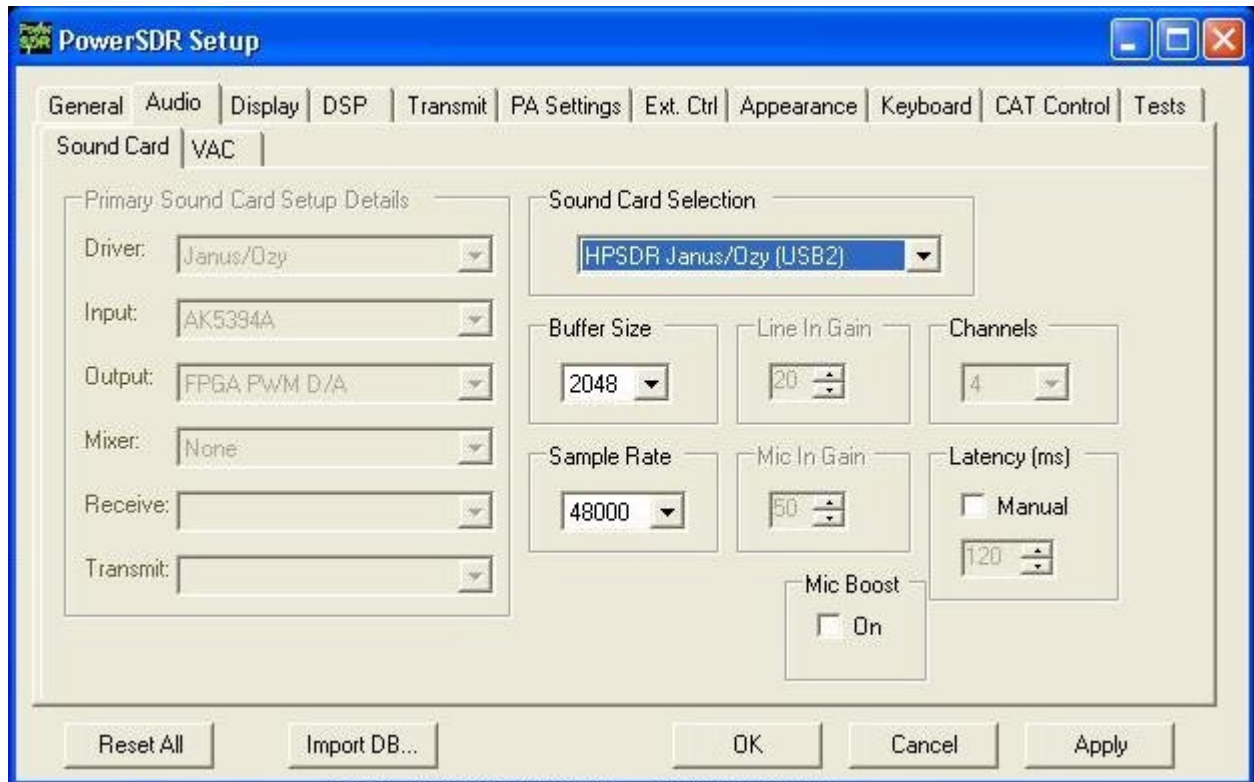


Fig 16: Selection of Janus as the Sound Card in PowerSDR

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Table of Revisions

Table 7: Revisions to this Document

Revision	Date	Comment
Rev 1.0	May 2007	Initial Publication
Rev 1.1	June 2007	Corrected typos, added more detailed information on .Net v1 and v2 Frameworks, corrected Ozy DB9 keyer connections
Rev 1.2	June 2007	Added information on Janus LEDs 4 and 5, updated PowerSDR SVN address