HPSDR
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TM

Janus and Ozy
Operation with PowerSDR

FlexRadio Systems SDR-1000
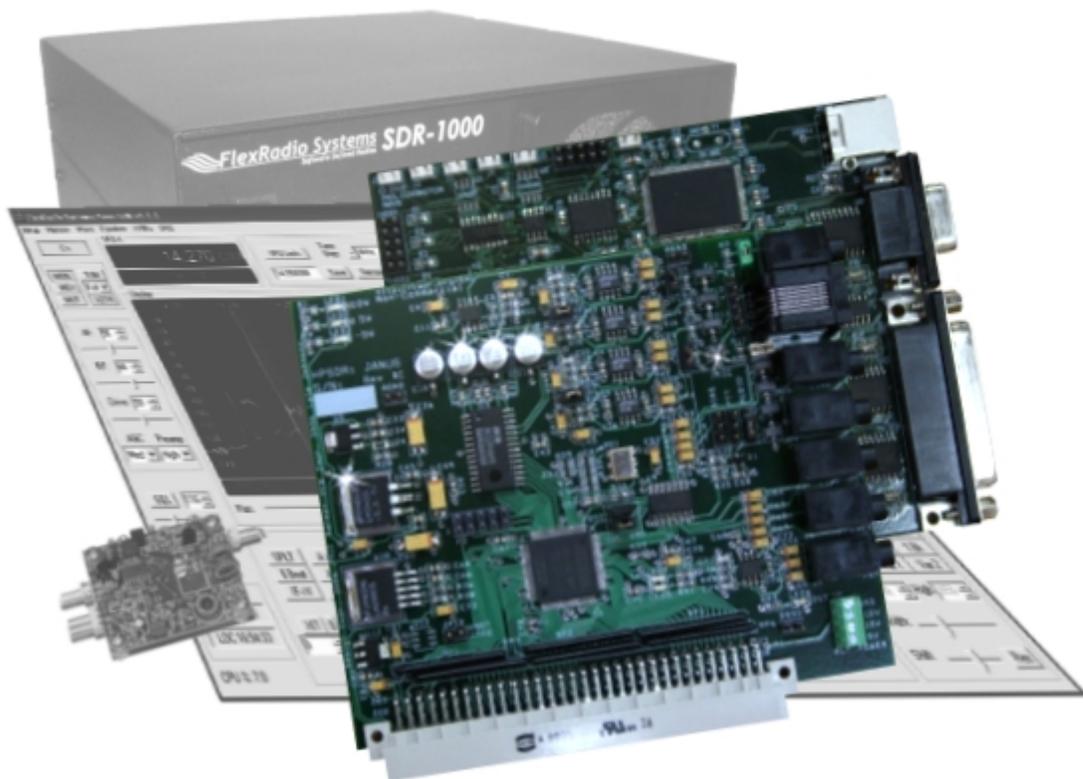
Text: Phil Harman, VK6APH
Bill Tracey, KD5TFD
Joe de Groot, AB1DO

Graphics and Layout: Joe de Groot, AB1DO

Revision 2.0

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Introduction

The HPSDR Ozy and Janus boards can be used together with PowerSDR v1.10.0 or higher to control the SDR-1000 and/or process the I/Q and audio streams of both the SDR-1000 and SoftRock[1]. 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 2 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 PowerSDR[2] v1.10.0 or higher.

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 a 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 5 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 USB Driver	USB Driver to enable the PC to communicate with Ozy, see page 11
.Net 1 Framework	Required to run PowerSDR, see page 14
.Net 2 Framework	Required to run Ozy initialization software
Power SDR v1.10.0 or later	Required to Operate PowerSDR with Janus/Ozy, see page 14 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 and after Ozy firmware being loaded, four red LEDs are lit as indicated. 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.
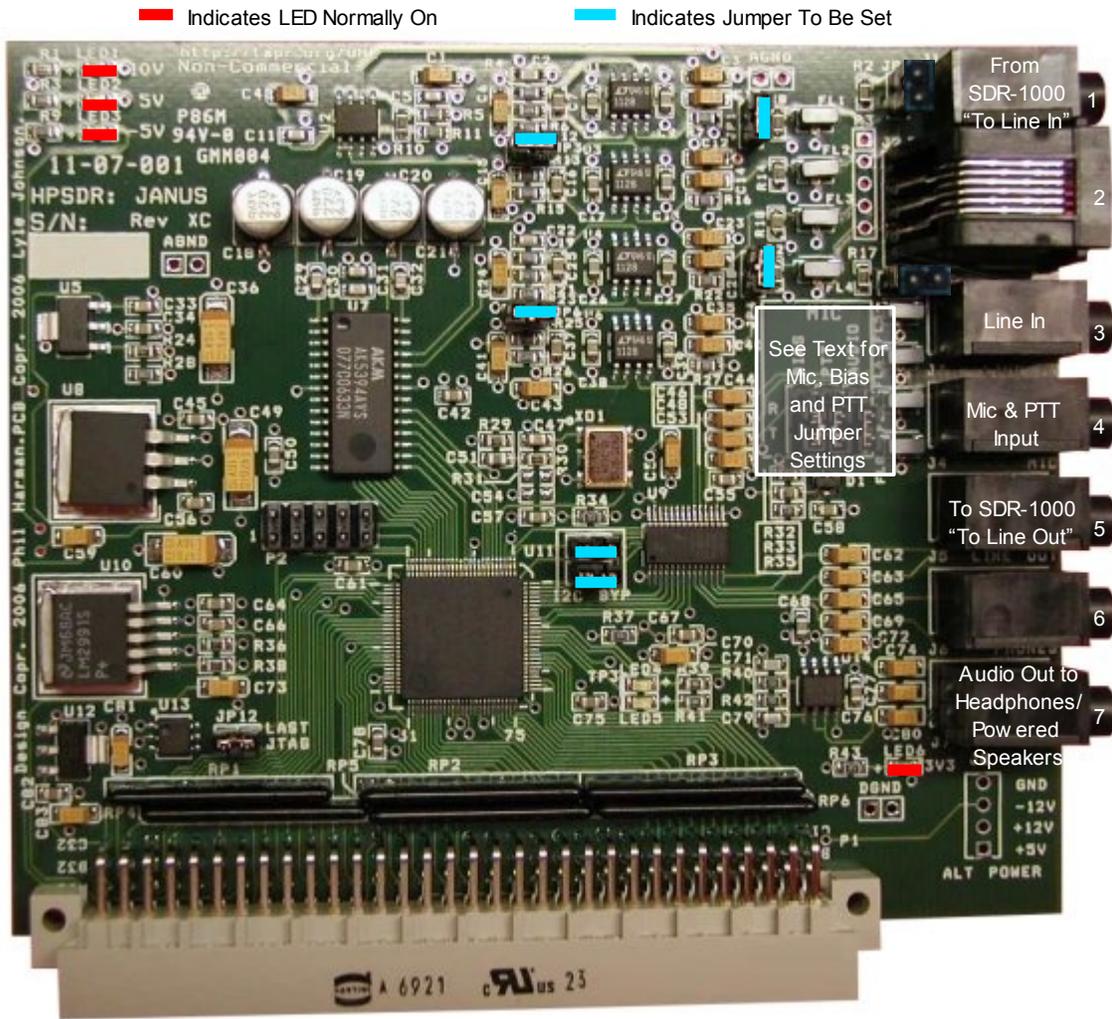
Fig 1: Janus Board Indicating Jumper Settings, Connections and LEDs

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 (⅛") 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.

Tip: Connect to PTT or Mic (See Text)
Ring: Connect to Mic or PTT (See Text)
Sleeve: Connect to Outer Braid
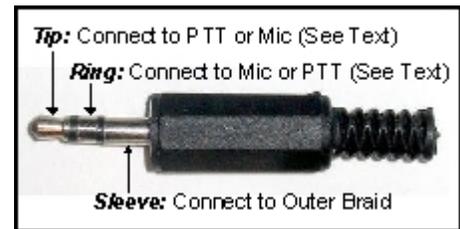
Fig 2: Microphone Plug Connections

   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 (⅛") 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).
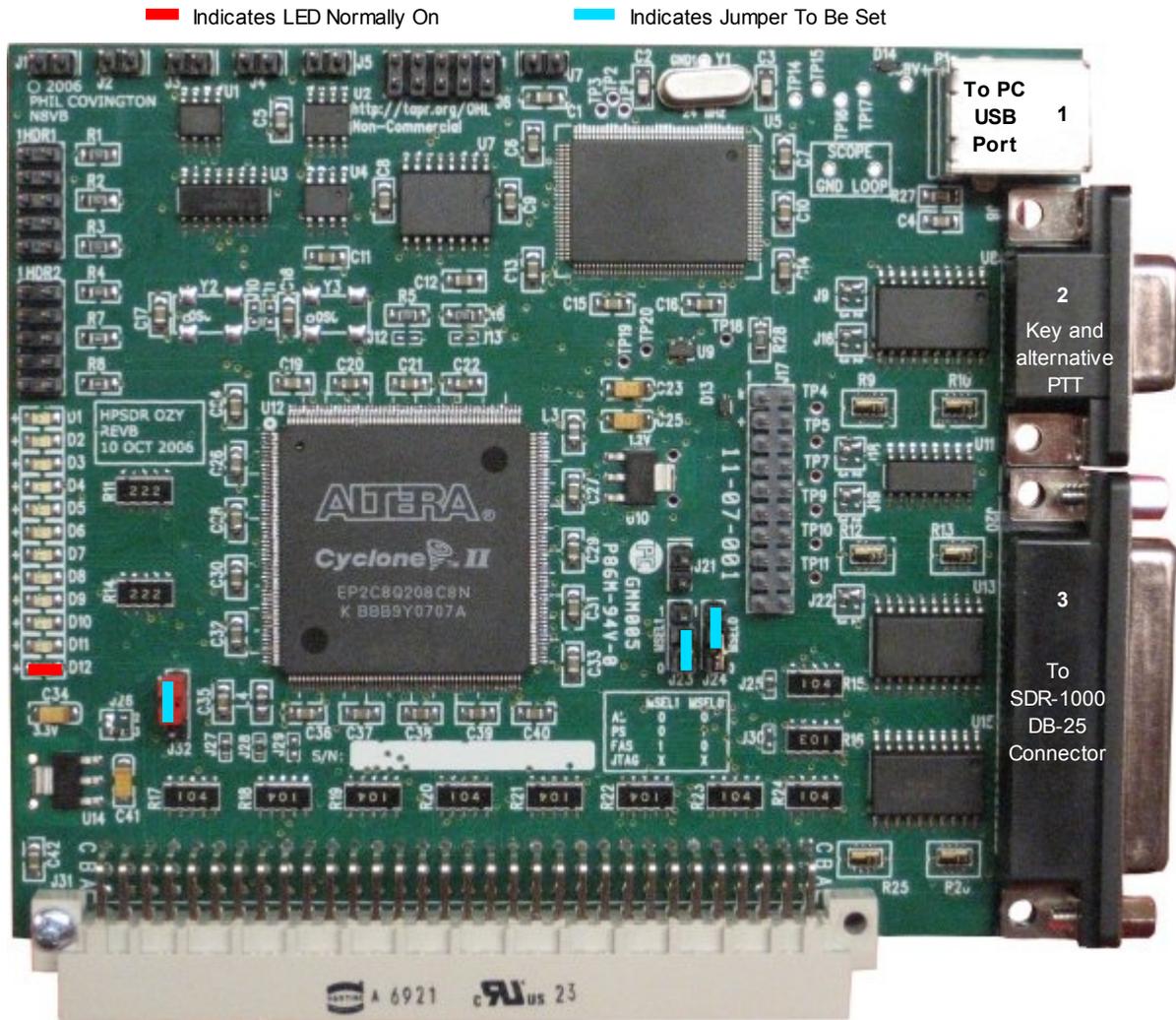
Fig 3: Ozy Board showing Connections

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.

   o 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
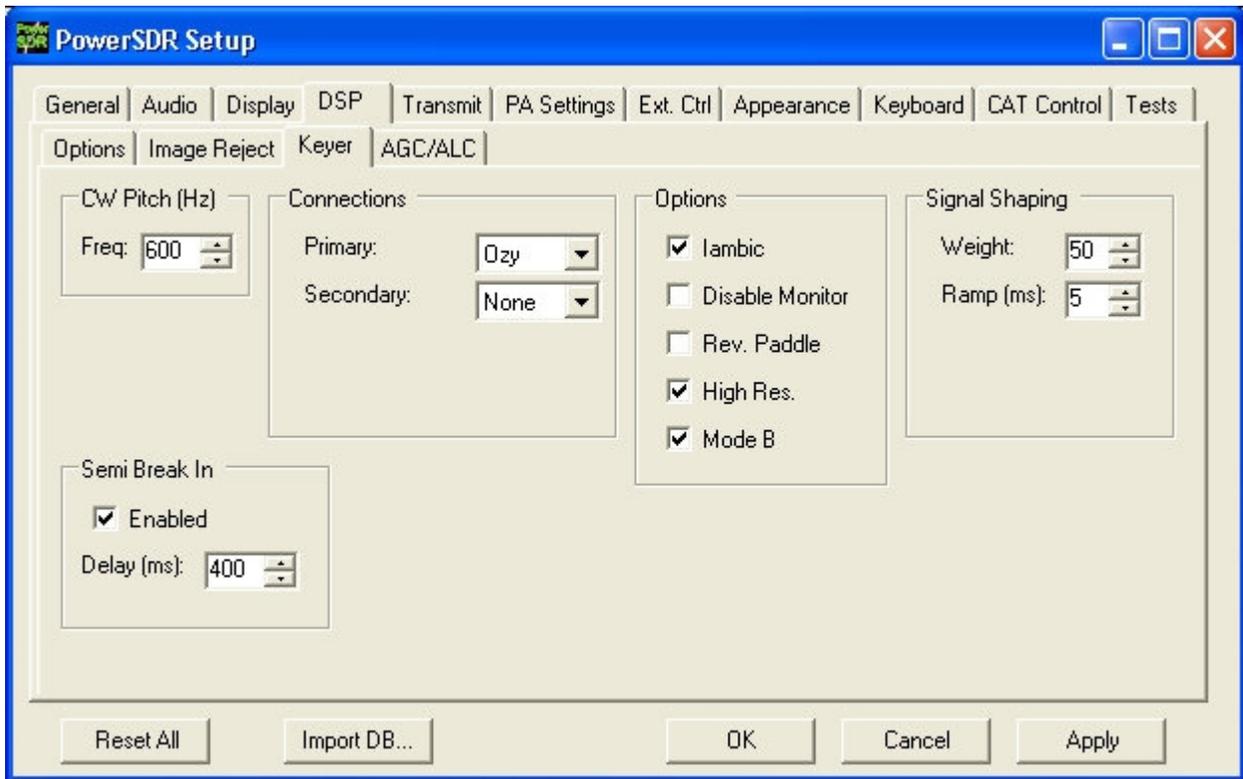
Fig 4: Selecing Ozy as the Primary Keyer Connection in PowerSDR

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. Install the USB driver (see next), if you have not previously done so

2. Power up Ozy and Janus and connect to a USB port on your PC.

3. Download PowerSDR v1.10.1 or higher from the Flex-Radio website.

4. Run PowerSDR v1.10.1 or higher. The first time you run it, configure it as explained below.

Installing the USB Driver

To enable your PC to recognize Ozy you must install the USBIO.exe driver you downloaded from the FlexRadio website.

Note: IF YOU HAVE PREVIOUSLY INSTALLED THE LIBUSB DRIVER, YOU MAY SKIP THIS STEP.

Note: IF YOU HAVE PREVIOUSLY INSTALLED THE USBIO DRIVER (USED FOR THE FLEXRADIO USB-TO-PARALLEL ADAPTER), YOU MAY SKIP THIS STEP.

1. Download the self-extracting USBIO driver installer (the driver used for FlexRadio's USB to parallel adapter) from the the FlexRadio website downloads page and save it to your Desktop.

2. Make sure Ozy is **disconnected** from the PC and run USBIO.exe. This will copy the USB driver files for Ozy to the right place in the system directory and to C:\Program Files\FlexRadio Systems\USBIO for safe keeping.

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3. **Power up** Ozy/Janus and **connect** Ozy to a USB port on the PC. Windows will find new hardware and start the wizard. Select not to search and click **Next** (see Fig 5).

Fig 5: Found New Hardware - No Search This Time

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2. Select **Install the software automatically** and click **Next.**

   Note: IF AUTOMATIC INSTALLATION DOES NOT WORK, THEN SELECT MANUAL INSTALLATION AND BROWSE TO C:\Program Files\FlexRadio Systems\USBIO, WHERE A COPY OF THE DRIVER FILES CAN BE FOUND.

3. Click **Finish** when the wizard is done installing Ozy. The updated driver can be found in the Device Manager as shown in Fig 6.
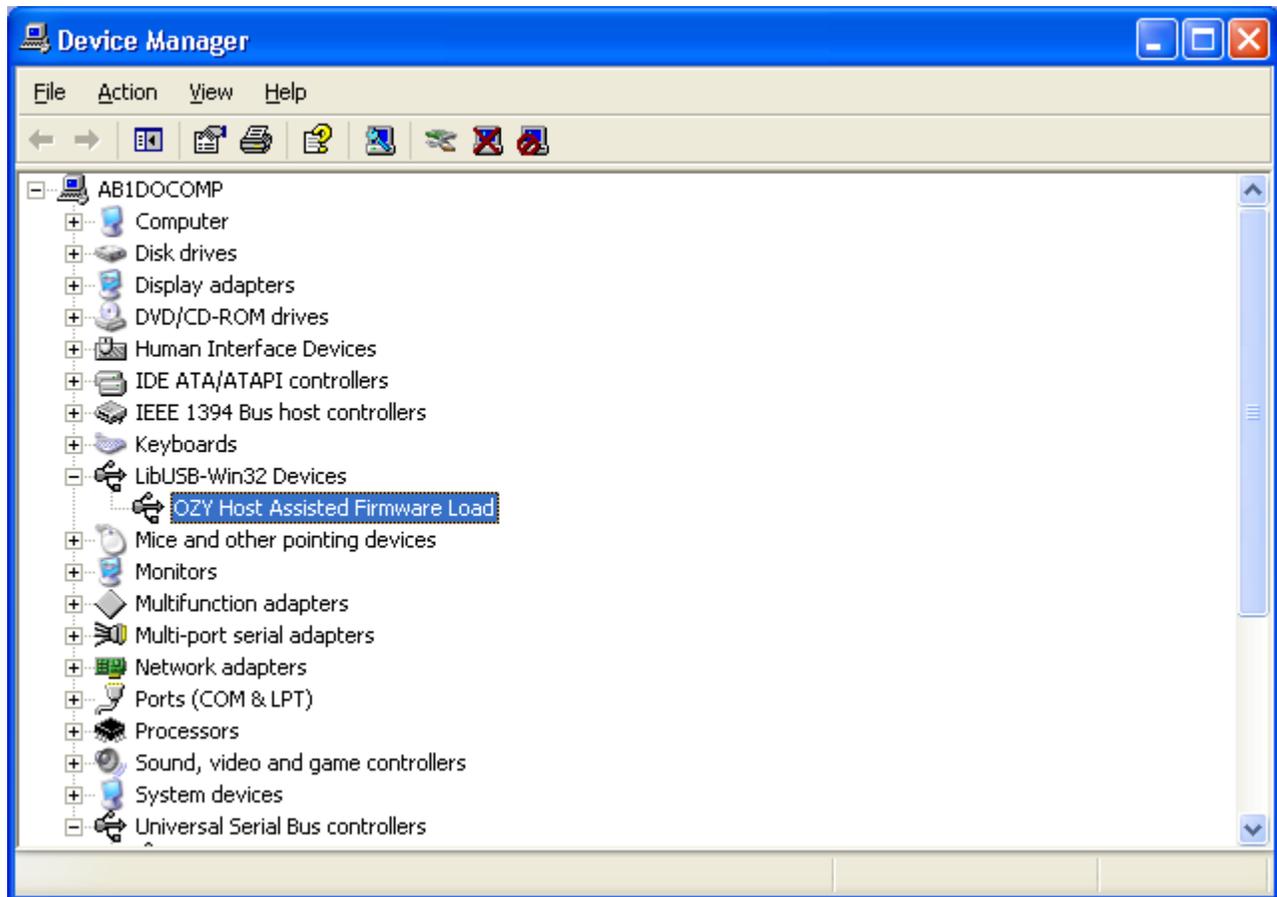
Fig 6: Device Manager Displaying Ozy Driver

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Running PowerSDR

You are now ready to run PowerSDR v1.10.1 or higher.

- When starting up for the first time, the FFTWisdom routine will run as usual.

- If you are prompted to install the .Net 1 Framework[4], do so. PowerSDR requires the .Net 1 Framework to run.

- At this stage it is prudent not to 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 also select the USB Adapter.

- Before clicking the *Start* button in PowerSDR, follow the directions 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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4 The .Net 2 and .Net 1 Frameworks will reside on your computer side-by-side without problems.

Ozy SDR-1000 Control
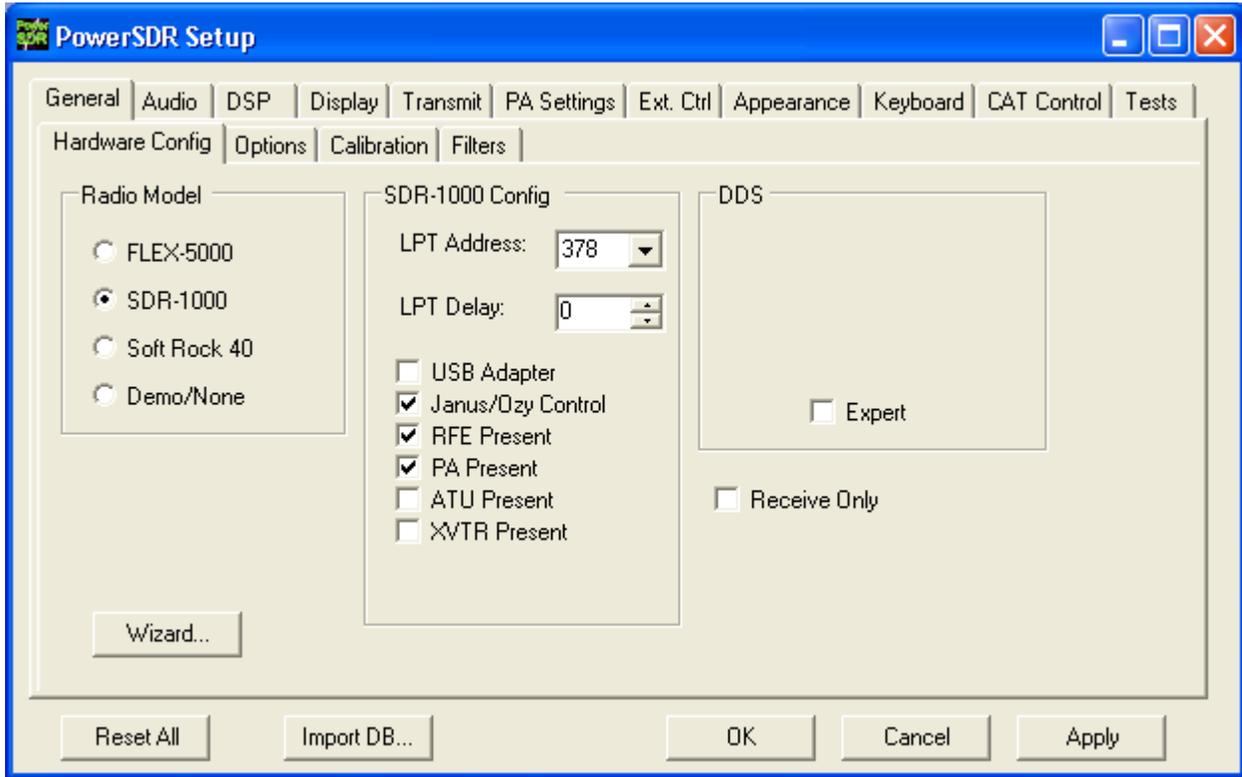
Fig 7: Selecting Ozy to Control the SDR-1000

To select Ozy SDR-1000 control, in PowerSDR click *Setup* on the Front Console to open the Setup 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 7 above.

If this is the first time you select Janus/Ozy Control after powering up Ozy, then the relevant firmware (initozy11.bat) will automatically be uploaded to the Ozy board (into the FPGA), to set Ozy to control the SDR-1000 and Janus.

Note 1: THE FIRMWARE REQUIRES THAT THE .NET 2.0 FRAMEWORK[5] 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 2: THE FIRMWARE REMAINS RESIDENT IN OZY UNTIL YOU POWER DOWN OZY. THEREFORE, IF YOU RESTART POWERSDR WITH THE FIRMWARE STILL RESIDENT IN OZY, IT WILL NOT BE RELOADED.

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

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 8 below.
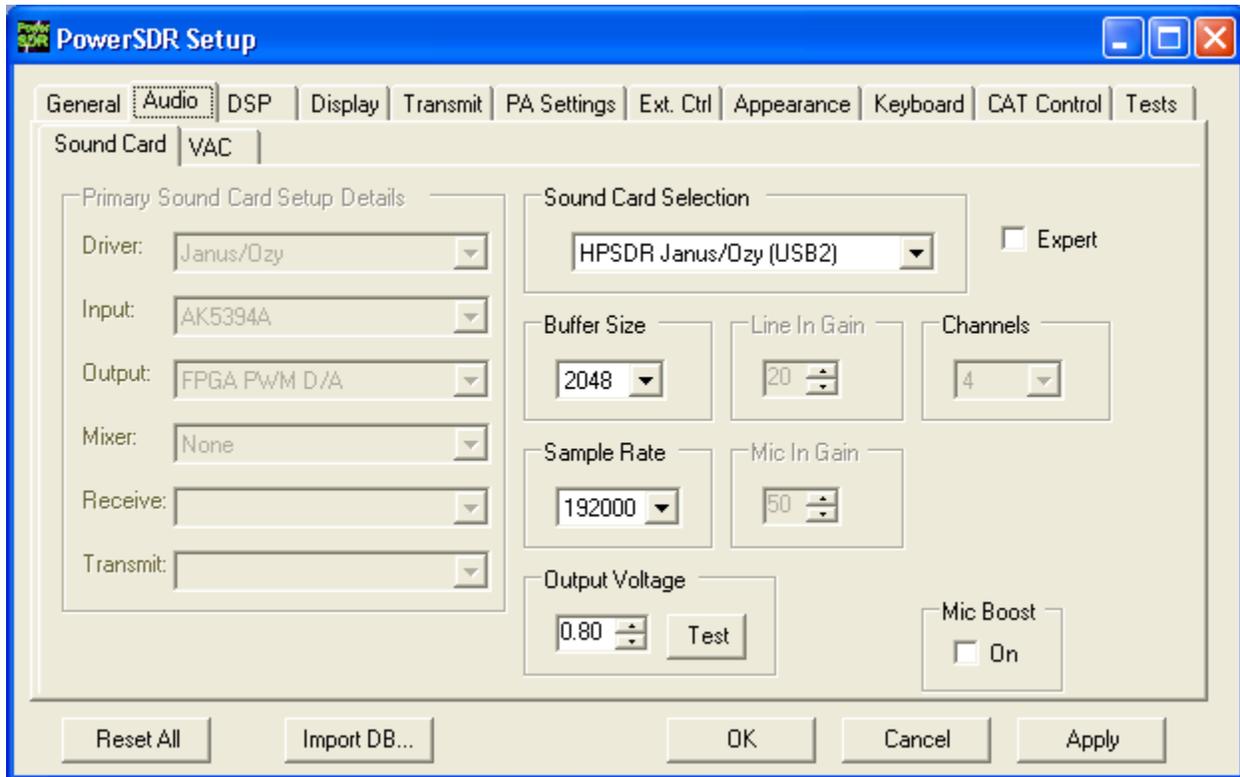
Fig 8: Selection of Janus as the Sound Card in PowerSDR

If you have not selected Janus/Ozy control (see previous section) and this is the first time you run PowerSDR after powering up Janus/Ozy, then when you click the *Standby/On* button in PowerSDR, the Ozy firmware will first load. Also see the notes on the previous page.

You are now ready to operate your SDR-1000 using Ozy and/or Janus. Before you do, you should first run through the PowerSDR calibration routines.

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A comment on the LEDs on Janus and Ozy

With Ozy and Janus powered up, but Ozy not yet initialized (firmware not yet loaded) the following LEDs will illuminate:

- Ozy: D12
- Janus D1-D6[6]

After initializing Ozy, the LEDs illuminated are:

- Ozy: D2, D3, D5-D8, D9 and D10 alternating, D12; D4 when transmitting
- Janus: D1-D3, D6

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6 At power on and firmware not loaded, Janus LEDs 4 (yellow) and 5 (green) will illuminate. These LEDs signify that there is a 10MHz reference present on Atlas C16 (LED4) and the VCXO PLL on Janus is locked (LED5). Before the firmware 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.

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
Rev 2.0	February 2008	Incorporated USBIO instead of LibUSB, automatic loading of firmware in PowerSDR 1.10.1 or higher, added complete list of illuminated Ozy and Janus LEDs

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