

## Optimizing the SDR-1000 for Weak Signal Operations on Two Meters

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What is needed to have an optimum two meter station? There are three major categories that need to be addressed:

- **Element 1:** One needs an excellent receiver that has a front end that won't crunch when strong adjacent signals appear on the band. Sensitive enough to detect the very weak ones, and have a noise blanker that is the best of the best. When combining a quality transverter to the SDR-1000 hardware and the PowerSDR console, you will have just that. The focus of this write up is just that.
- **Element 2:** An antenna(s) setup that hears the very weakest of signals, has the cleanest pattern, and fits the QTH profile. Many online resources, as well as printed materials are available for those that seek understanding. I will default to the extensive help, discussions, and documentation provided by the web.
- **Element 3:** Feed lines that minimize signal loss from the antenna to the radio. Many people entertain the addition of a mast mounted preamp to further enhance their receiving ability. Many online resources, as well as printed materials are available for those that seek understanding. I will default to the extensive help, discussions, and documentation provided by the web.

### Hardware Configuration – Choosing a Transverter.

Is it best to order the internal DEMI 144/28FRS transverter or one of the already available "external" transverters? The SDR-1000 provides a choice of different ways to get on two meters:

First consideration is the internal option provided by Flex Radio with the DEMI 144/28FRS transverter. While this appears to be the correct choice because of price, ease of use, and ease of hookup, please pay attention to the write-up.

The DEMI144-28FRS is an optional integrated 2 meter transverter. Designed as an IF for microwave transverters, it provides high dynamic range operation from 144-146 MHz. It provides 0dB gain and +17dBm LO drive on receive with a 3.5dB NF so that it can easily handle the output from other transverters. Power output is 50-100mW on transmit and can be reduced by the front panel power control.

It has 0dB gain on the receiver front end which means it's pretty hard of hearing unless you add a preamp. Next, the power output is around 50 mW, way less than a handheld FM

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radio. DEMI sells a small 30 watt power amplifier for a little less than \$200US. The additional cost of enhancing this transverter on transmit and receive, easily justifies exploring the purchase of an external transverter leaving the internal one as a microwave IF.

The second option is an external transverter. One that already is setup to have some receiver amplification gain and on the transmit side, 25 to 60 watts of RF output. This was the choice I took. Having said that, there are several ways to connect one of these external transverters to the SDR-1000.

### **Hardware Configuration – Connecting an External Transverter**

Making your external transverter look like the internal transverter option:

This method allows you to use either the 1 watt or 100 watt version of the SDR-1000, without any fear of damaging the transverter by “over driving” the RF power going into the transverter’s transmit stage.

#### **Benefits:**

- Allows you to use either the 1 watt or 100 watt version of the SDR-1000
- No fear of damaging the transverter by “over driving” the rf power going into the transmit stage.
- All RF and T/R control is accomplished by one small coaxial cable
- PTT control on the X2 connector can be reserved for amplifier control only.

Required modification to the external transverter to make it look electrically like the internal FRS transverter:

- to allow 1 mW of drive power power
- enable the TTL voltage to control the T/R switching by adding a blocking capacitor and switching circuit for the T/R using the TTL voltage
- PTT amplifier control (if needed) to be wired to connector X2, pin 7. (See related article, SDR-1000 Operating Manual (link below), topic Plug Pinouts, External Control Connector (X2))

I connected the external transverter to the SDR-1000 RFE board, connector J2, in exactly the same place that the internal DEMI 144/28FRS transverter would be plugged into. This is the 1 mW drive level connection that includes the TTL voltage necessary to switch the transverter T/R function (transmit and receive). This is all accomplished using just one coax cable.

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In order to enable this connection, one needs to have this external transverter modified for this 1 mW of drive and to enable the TTL voltage provided on the coax to change the transverter state from receive to transmit. This becomes very useful in the future if you are thinking about having additional transverters connected to the SDR-1000. All you will have to do is move the coax line from one transverter to another via a coaxial rf relay, and the transverter connection is simplified because the rf signal and T/R moves together as one.

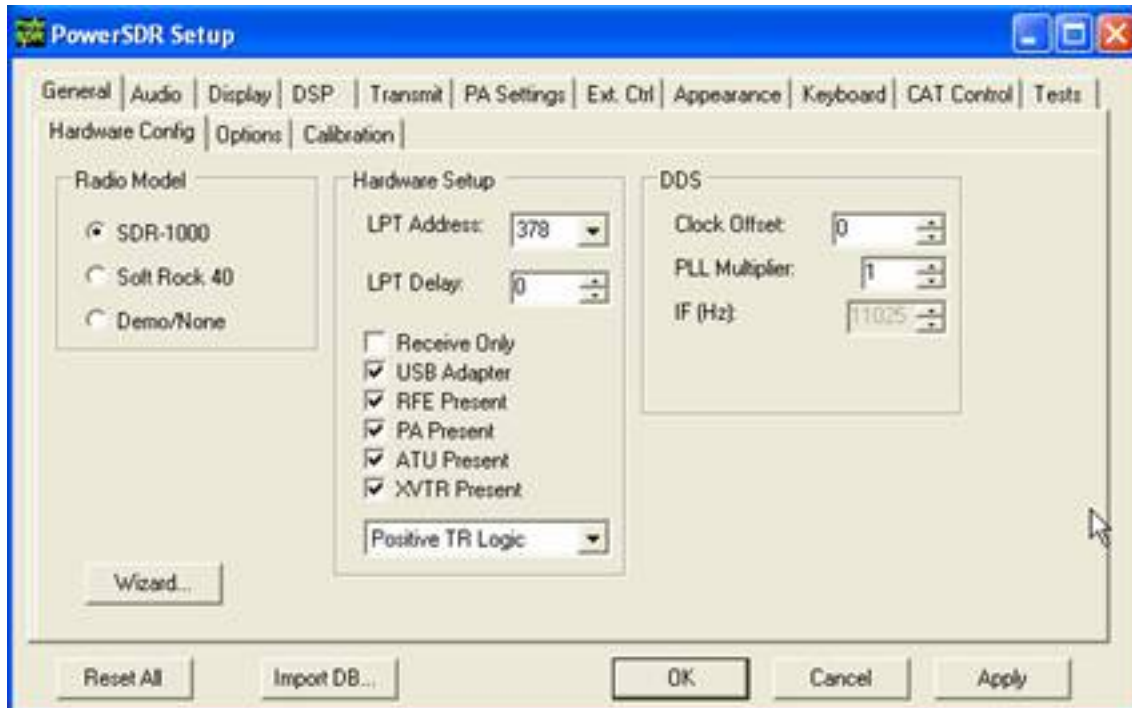
**Note: If you add the internal transverter option from Flex-Radio, or order it from DEMI, AND you want to switch seamlessly between the modified external transverter(s) as described above, one modification is required to this transverter to make it behave exactly as the external transverter(s) (described above). The two wires going to the TXON and RXON connections on the DEMI 14428FRS board need to be switched. This will change the TTL voltage to be low on receive and high on transmit, the same as all the external transverters. This allows all the transverters to remain powered on, for frequency stability, but stay in receive mode when not selected..... else the default would be transmit mode, and with no antenna connected, possible damage could occur to each transverter when not selected. On the PowerSDR console set-up screen, when using the Set-up Wizard, Figure 1a, select that you have a 2 meter transverter and then select the type as DEMI 25 watt unit. This will ensure that a "positive voltage" is used to put the transverter into a transmit state.**



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**Figure 1a PowerSDR Setup Wizard – Hardware Setup Screen**

If you miss the Wizard setup screen, then select the **Hardware Config Tab**, Figure 1b. Select the check box that's labeled "XVTR Present" followed by "Positive TR Logic" in the drop down box.



**Figure 1b Hardware Config Tab Options**

### Connecting an external transverter to SDR-1000 (1 Watt version).

#### Benefits:

- Usually no modification to the external transverter
- No hardware modifications to the SDR-1000

#### Requires:

- Coaxial cable connection to connector J3 (HF/6m QRP) on the back of the SDR-1000
- A separate connection to connector X2 Pin 7 is needed to PTT control to switch the T/R line going to the transverter

Refer to the related article, Introduction to configuring the SDR-1000 and UCB for Weak Signal Microwave Applications (link below), on how to wire up and use multiple transverters

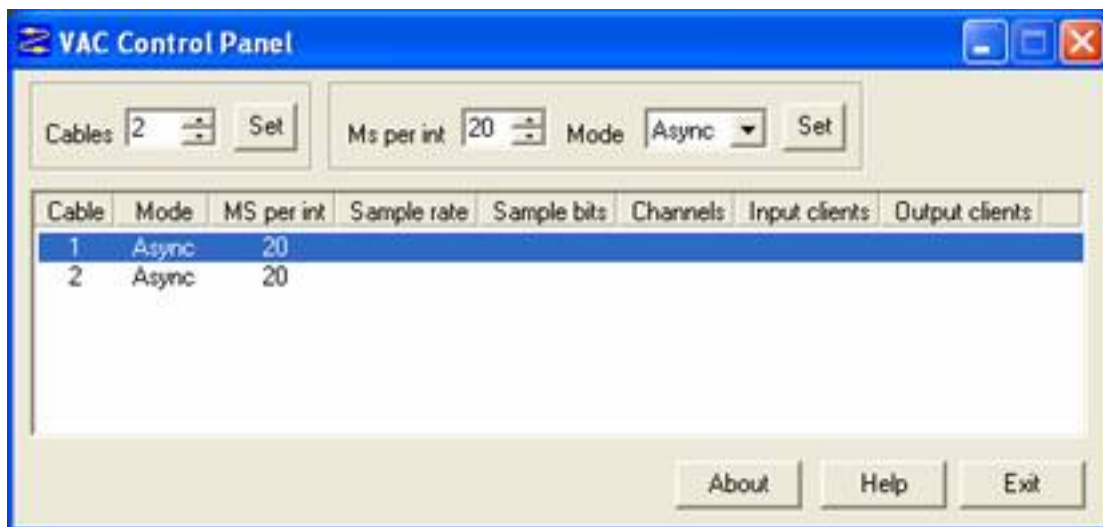
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with the SDR-1000. His setup requires the User Defined UCB (Universal Controller Board) and Xverter tab on the PowerSDR console to control all the aspects a multi-transverter setup.

### Digital Mode Setup using Virtual Audio Cable (VAC)

VAC is a third party program that enables one software application to move digital audio signals to another software application without using additional sound cards or physical cables. A sound card's function is to make analog signals from digital signals and vice versa.... VAC removes this extra transformation and yields a cleaner audio signal. There is a fee associated with securing a license for this product. One last, but not insignificant, advantage using VAC is that fewer external wires are required in the overall connection of the SDR-1000 to the computer being used for the radio.

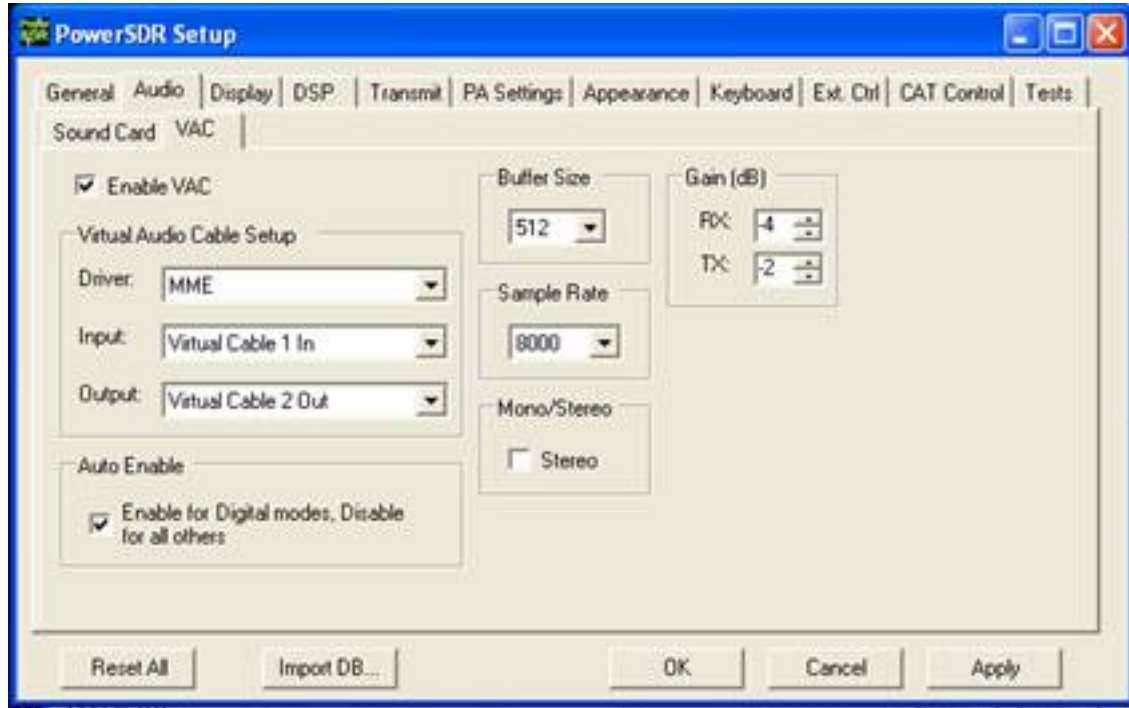
Follow the instructions on how to install and configure the VAC application. After installation you should see a screen similar to Figure 2 when executing the VAC Control Panel.



**Figure 2 VAC Control Panel**

Figure 3a below is a screen shot of the configured setup screen in the PowerSDR application. Note, as of this writing, the Sample Rate is required to be set to a value of 8000.

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**Figure 3a PowerSDR Setup Screen Showing the VAC Tab Options.**

To enable the VAC function in digital applications, one must choose either DIGL or DIGU, see Figure 3b below.



**Figure 3b - Subset of the PowerSDR Main Console Window**

Interaction occurs with the "Auto Enable" function selection above. See Figure 3b above.

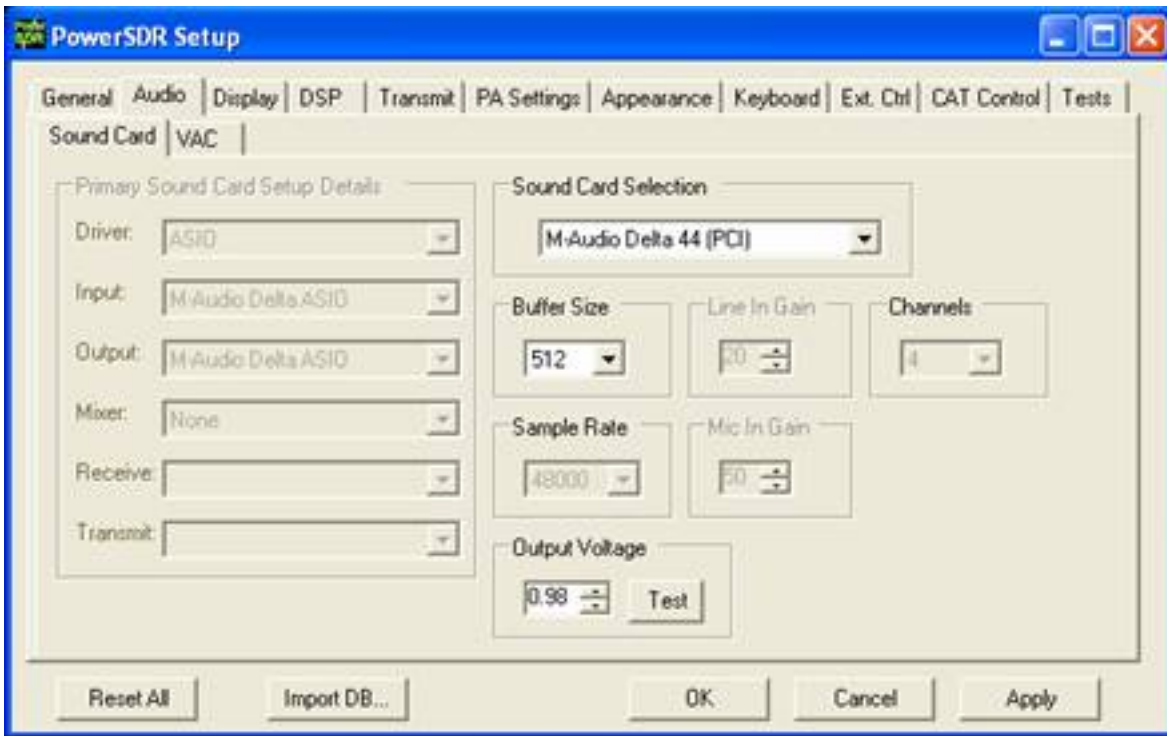
If you are using the Creative Labs Extigy USB sound card, see the section titled: **Creative Labs Extigy USB Sound Card.**

If you are using the M Audio Delta 44 sound card, see the section titled: M-Audio Delta 44 Sound card Option.

**M-Audio Delta 44 Sound card Option.**

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Figure 4 below shows the settings for the Delta 44 card and its buffer setting to work with the VAC connection.



**Figure 4 PowerSDR Console Settings for the Delta 44**

The actual M-Audio Delta 44 Card Setup. Find and click on the startup icon on your desktop for the M-Audio application – See Figure 5 below.



**Figure 5 Icon to start the M Audio application.**

Below are screen shots of my setup that is functioning at my station. Figures 6 through 8 are screen shots of the tabs in the M-Audio Delta Control Panel.

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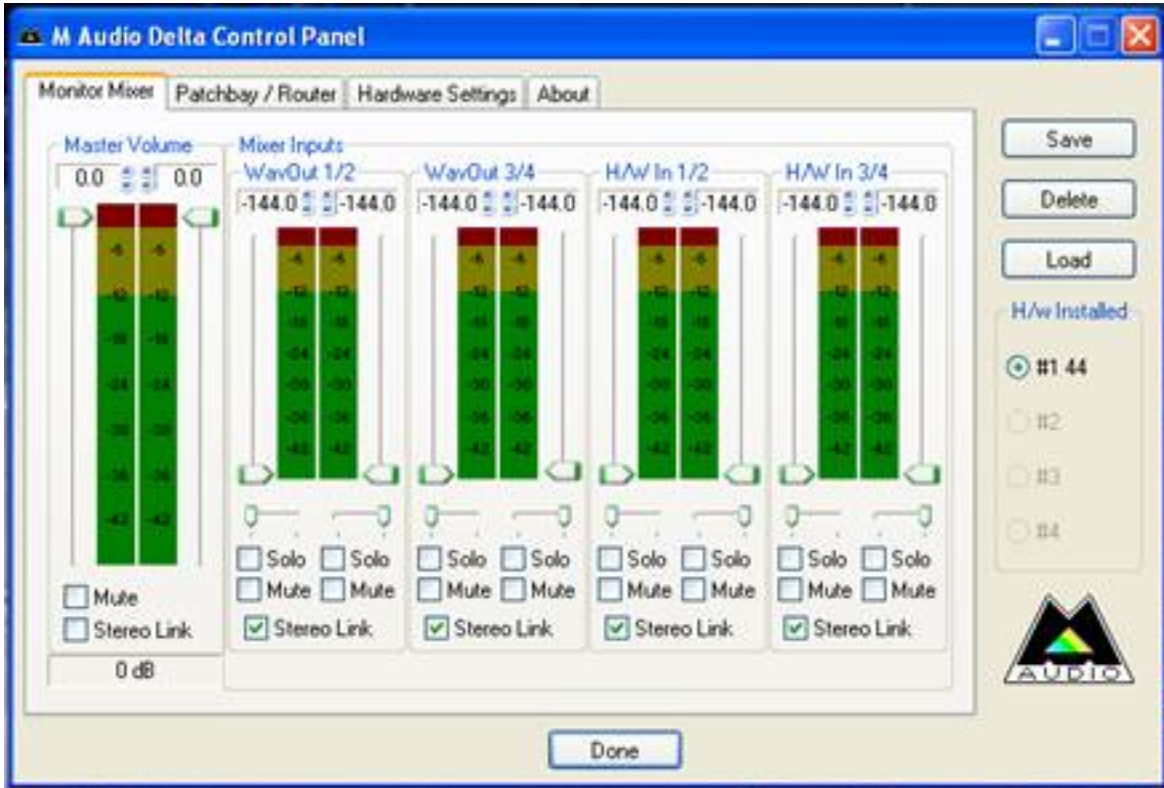
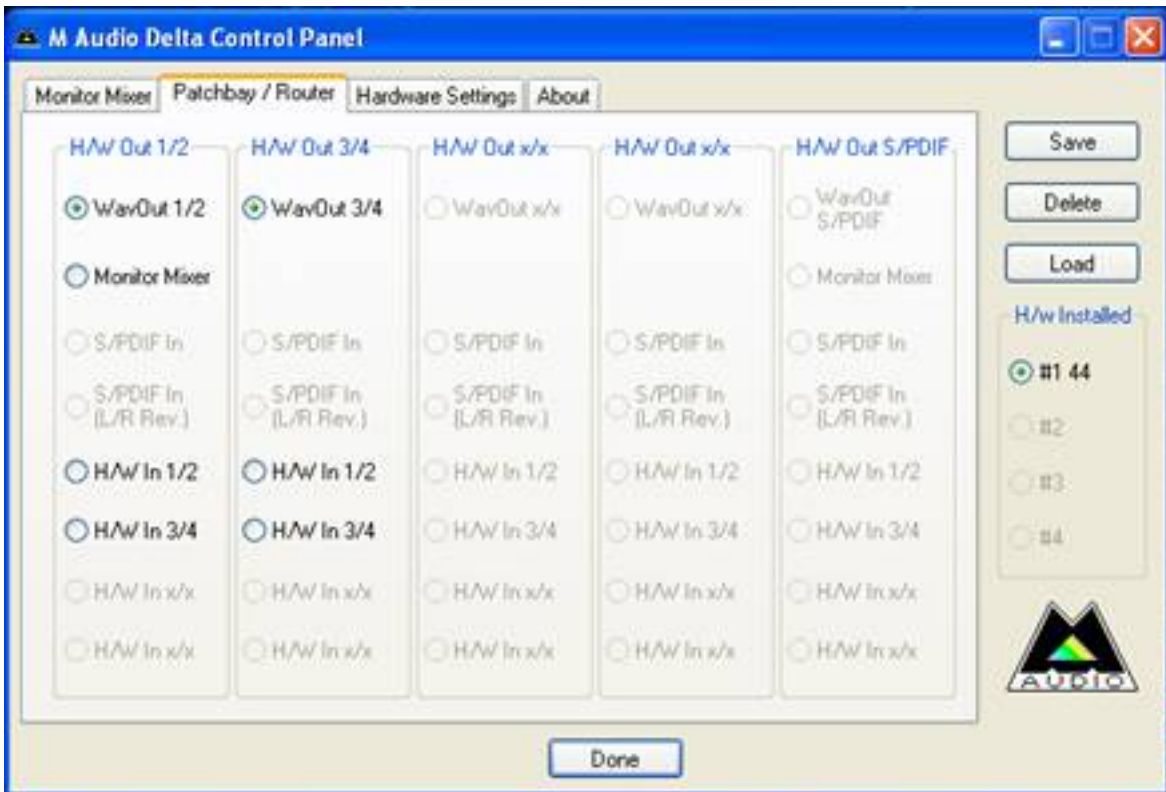
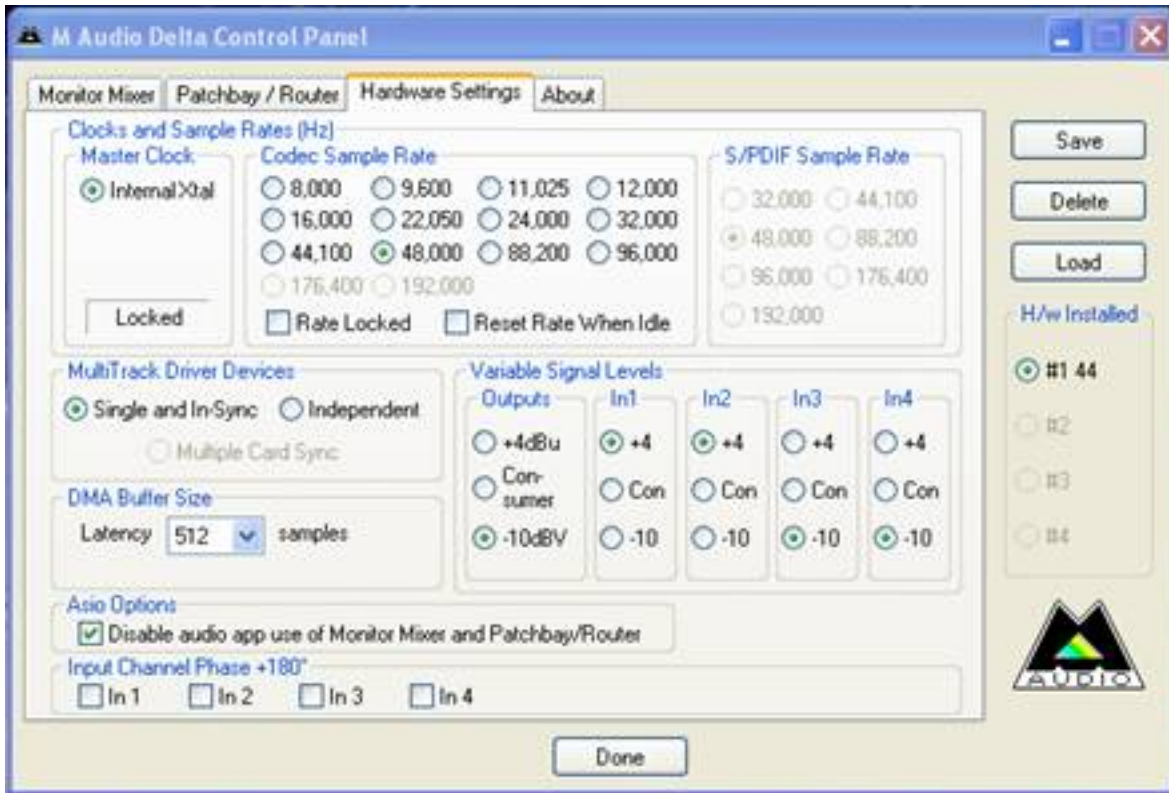


Figure 6 M Audio Delta Control Pane – Monitor Mixer





**Figure 7 M Audio Delta Control Pane – Patchbay / Router**



**Figure 8 M Audio Delta Control Pane – Hardware Settings**

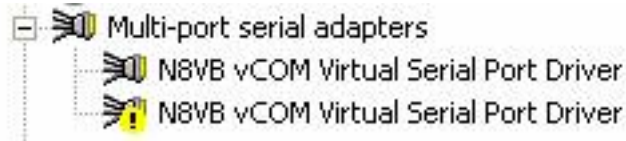
### Remote Control using the CAT and PTT setup options

CAT and PTT setup options for enabling Digital Modes on the SDR-1000. Figure 4 shows the settings that are defined for my station. I am using Virtual Serial Ports provided by N8VB's free software driver. In his driver, I have defined two pairs of serial cables defined as COM 4&5, and COM 6&7. You are free to choose whatever pair addresses on your system that prevents conflicts with existing assigned serial ports.

**NOTE: There have been problems reported using vCom with Windows Vista. The virtual com port program Com0Com is being used as a substitute for vCom and has better compatibility and has greater control over the virtual com port behavior.**

After installation of these virtual serial ports, you should see something similar to this on the Hardware Device Manager screen Figure 9 below.

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**Figure 9 Hardware Device Manager view**

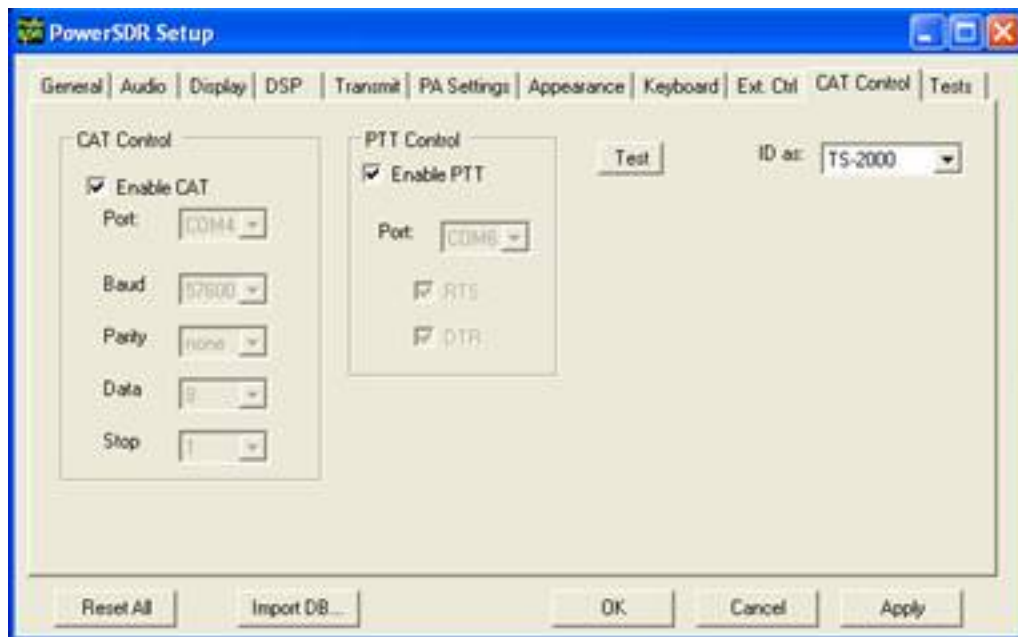
It is important that you define, and use, your set-up pairs carefully. Figure 10 shows my implementation of the following rules I set up for myself.

### **Note: Pair of ports COM4/5**

- I assign COM 4 for the SDR-1000 side of the communications for CAT control
- This requires COM 5 to be identified in any application that requires CAT control

### **Note: Pair of ports COM6/7**

- I assign COM 6 for the SDR-1000 side of the communications for PTT control
- This requires COM 7 be identified in any application that requires PTT control with the SDR-1000



**Figure 10 PowerSDR Setup – CAT Control Tab**

### **WSJT Setup**

One of the current Digital Applications being used by the VHF and above community is WSJT

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authored by Joe Taylor, K1JT. Visit his page at <http://pulsar.princeton.edu/~joe/K1JT/index.htm> .

WSJT is a computer program for VHF/UHF communication using state of the art digital techniques. It can decode fraction-of-a-second signals reflected from ionized meteor trails, as well as steady signals more than 10 dB weaker than those required for conventional CW. One of its operating modes is particularly well optimized for amateur EME (Earth-Moon-Earth) communications. WSJT is freely available to radio amateurs for non-commercial purposes.

WSJT supports five principal operating modes:

- **FSK441**: for meteor scatter
- **JT65**: for EME and extreme troposcatter
- **JT6M**: for meteor scatter (optimized for 50 MHz)
- **EME Echo**: for measuring your own echoes from the Moon
- **CW**: for EME QSOs using 15 WPM Morse code

Please note, however, that EME Echo mode is not yet supported in version 5.9.0.

There are functions being added all the time so check the web site for the latest functions. The 6 meter community has specific modes just for them.

The screens associated with WSJT Ver 5.9.0 are shown below. Three screens are shown at start up. Figure 11 is the main screen and contains the "Setup" Tab.

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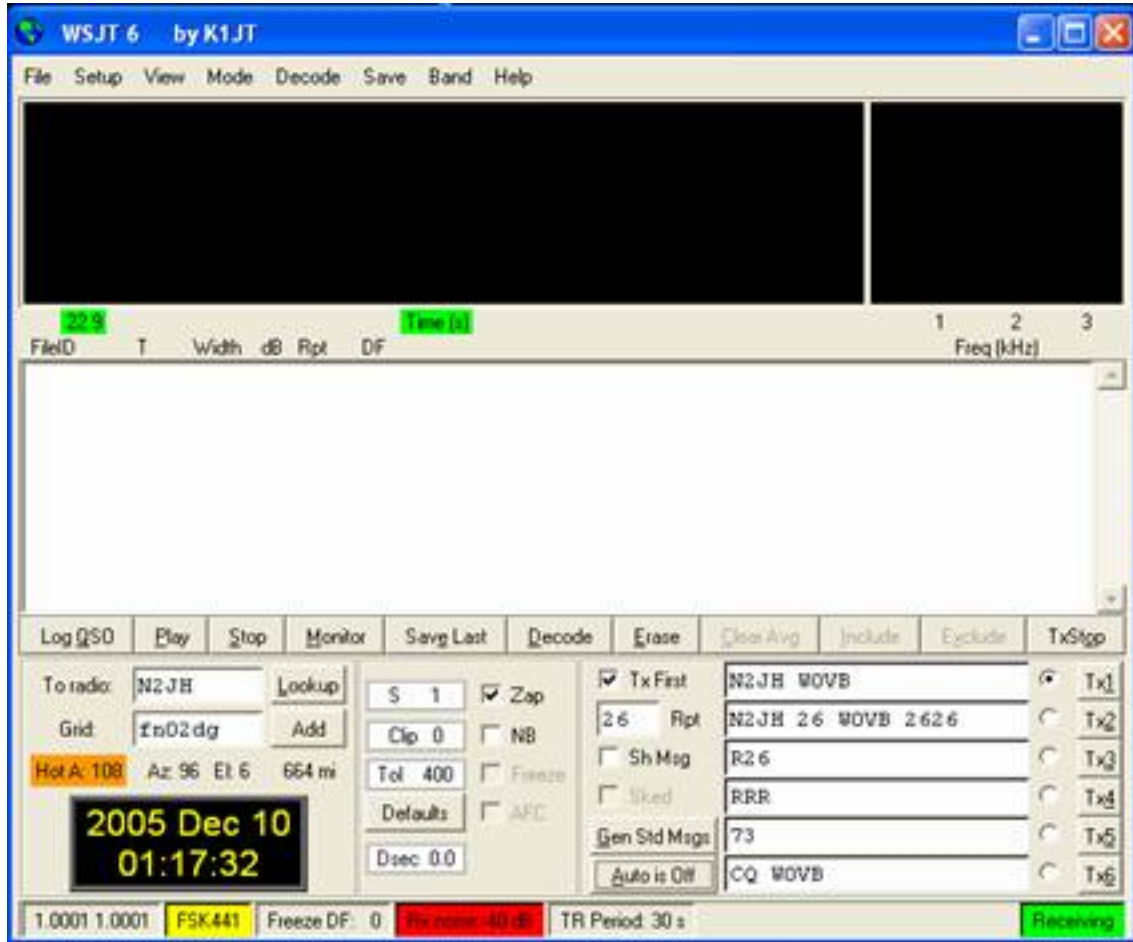


Figure 11 WSJT Main Screen

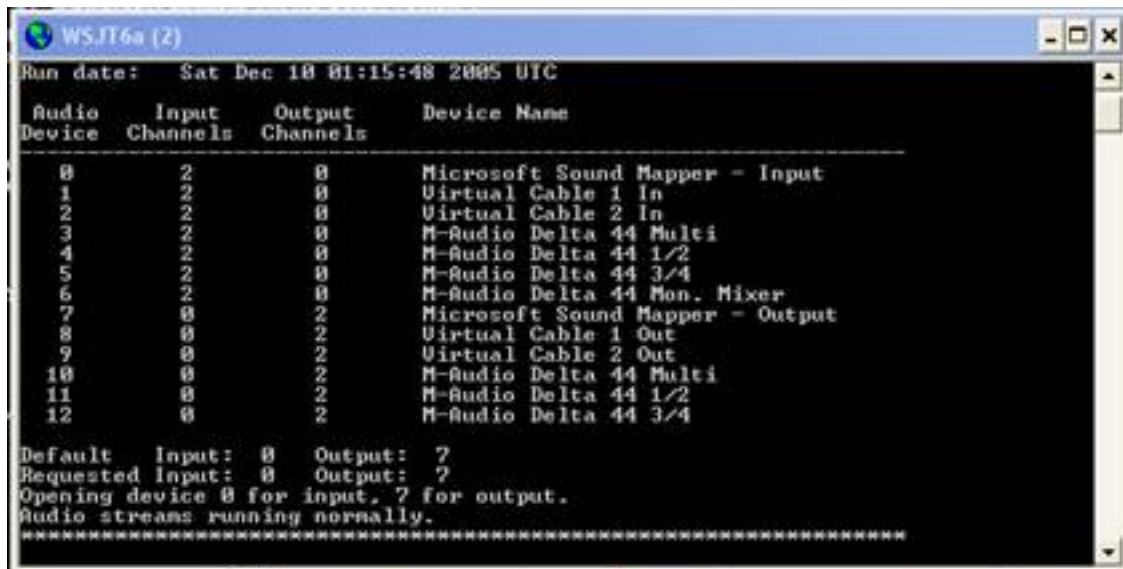


Figure 12 WSJT audio device screen showing Windows XP assignments

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Please note the input and output assignments. Each is using the Microsoft Sound Mapper.

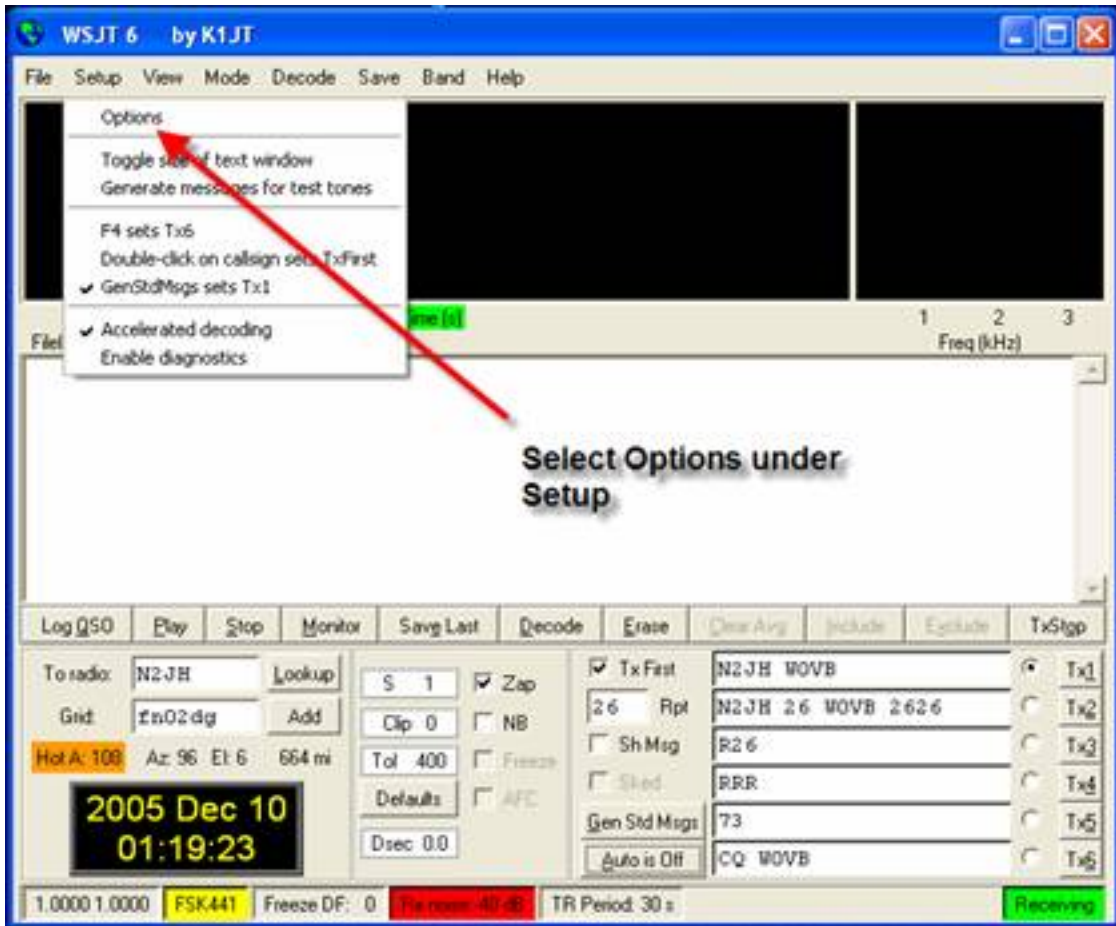
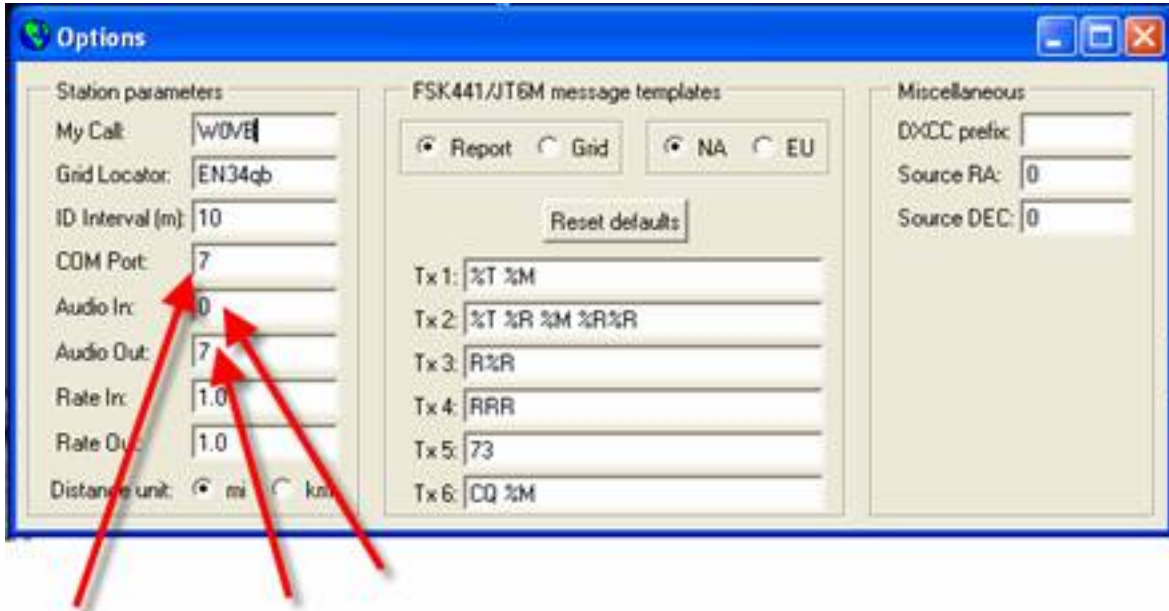


Figure 13 WSJT Main Screen showing the Setup Options control

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Verify COM Port matches PTT pair in SDR CAT Control Tab  
Match Audio In: and Audio Out:  
with Microsoft Sound Mapper - Audio Input and  
Microsoft Sound Mapper - Audio Output

**Figure 14 WSJT Setup Options pointing out the three important setup parameters**

To enable the VAC function in digital applications, one must choose either DIGL or DIGU, see Figure 15 below.

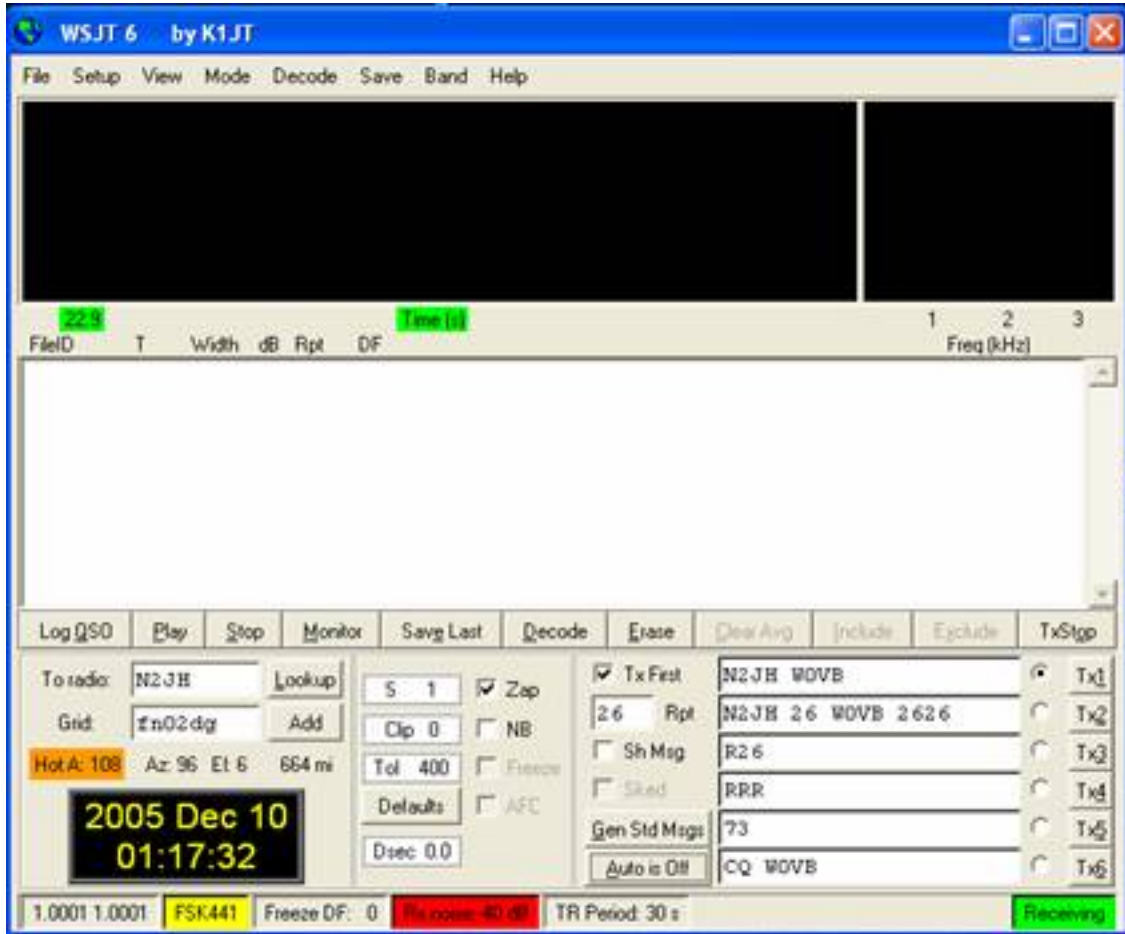


**Figure 15 subset of the PowerSDR Main Console**

Interaction occurs with the "Auto Enable" function selection above. See Figure 3a above.

The first time you run the WSJT application, you will most likely "listen" to a station transmitting signals in your direction. In order to activate the receive mode of WSJT you will need to click the "Monitor" button on the WSJT Main Screen, Figure 16.

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**Figure 16 WSJT Main Screen**

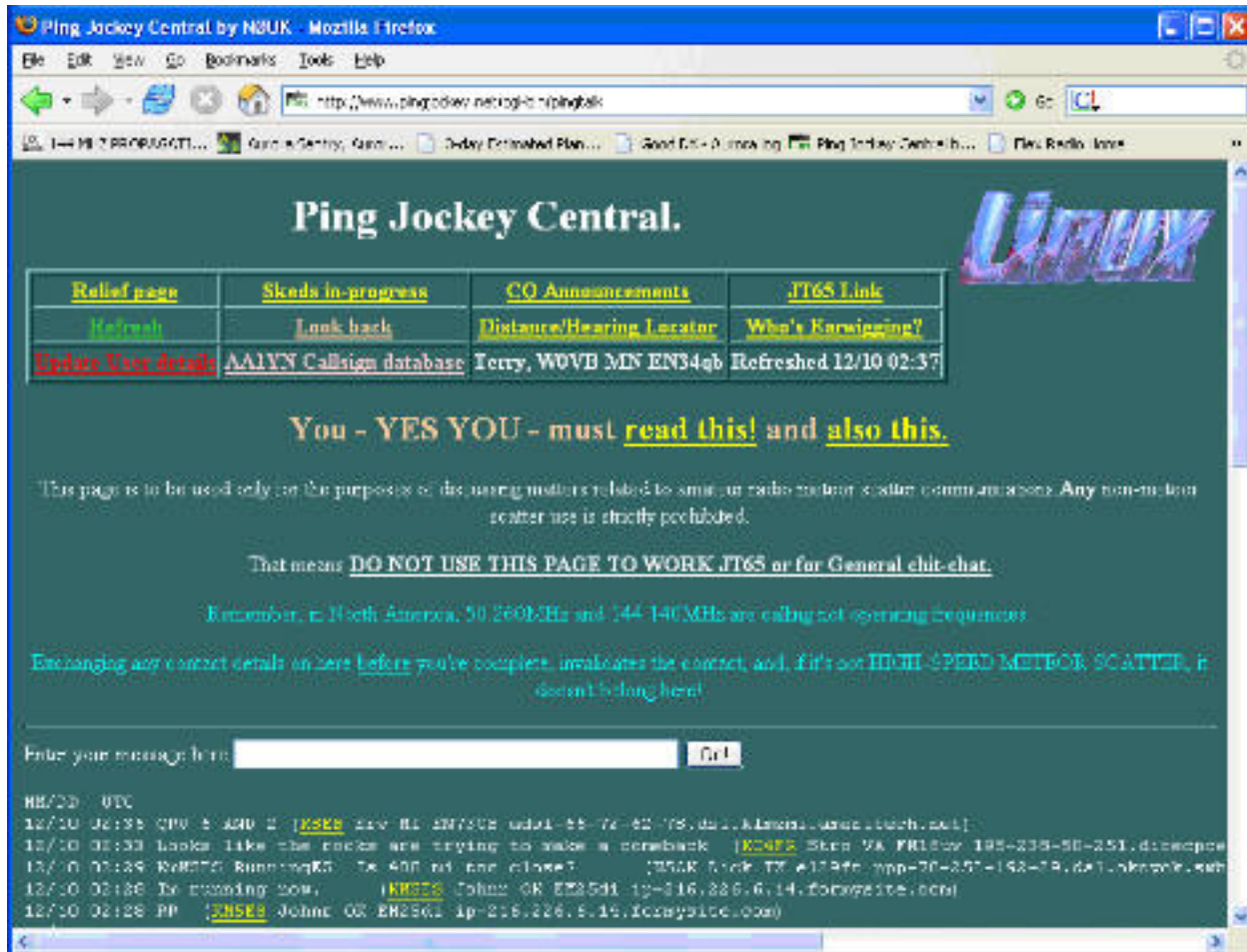
### Running WSJT for Digital VHF Plus Communications

#### Meteor Scatter

One must first complete the setup options within the PowerSDRTM screens as well as complete any hardware cabling necessary. For details, see the sections listed under Putting the SDR-1000 on Two Meters for weak signal work.

Finding people communicating via Digital Modes on VHF and above is as simple as going to this website [www.pingjockey.net/cgi-bin/pingtalk](http://www.pingjockey.net/cgi-bin/pingtalk). Below is a sample screen shot from this web site. Notice the various click boxes at the top of the screen specifying the mode being used by the users of WSJT. Figure 17 shows the main page of Ping Jockey Central used by those running PSK441A mode for 144, 222, and 432 MHz. Explore the various options behind the JT65 Link.

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**Figure 17 Ping Jockey Central – Main Web Page**

Note: When connected to the web page, clicking on a highlighted call allows you to send an email to that specific person.

### **Moonbounce (E.M.E. – Earth Moon Earth) – Digital Mode**

One must first choose the setup options within the PowerSDR screens as well as complete any hardware cabling necessary. For details, see the sections listed under Putting the SDR-1000 on Two Meters for weak signal work.

Finding people communicating via Digital Modes on EME is as simple as going to the this website [www.pingjockey.net/cgi-bin/jt65eme](http://www.pingjockey.net/cgi-bin/jt65eme) .

Here is a sample screen shot of this web site. Notice the various click boxes at the top of the screen specifying the mode being used by the users of WSJT. Figure 18 shows the main page of JT65 EME Link.



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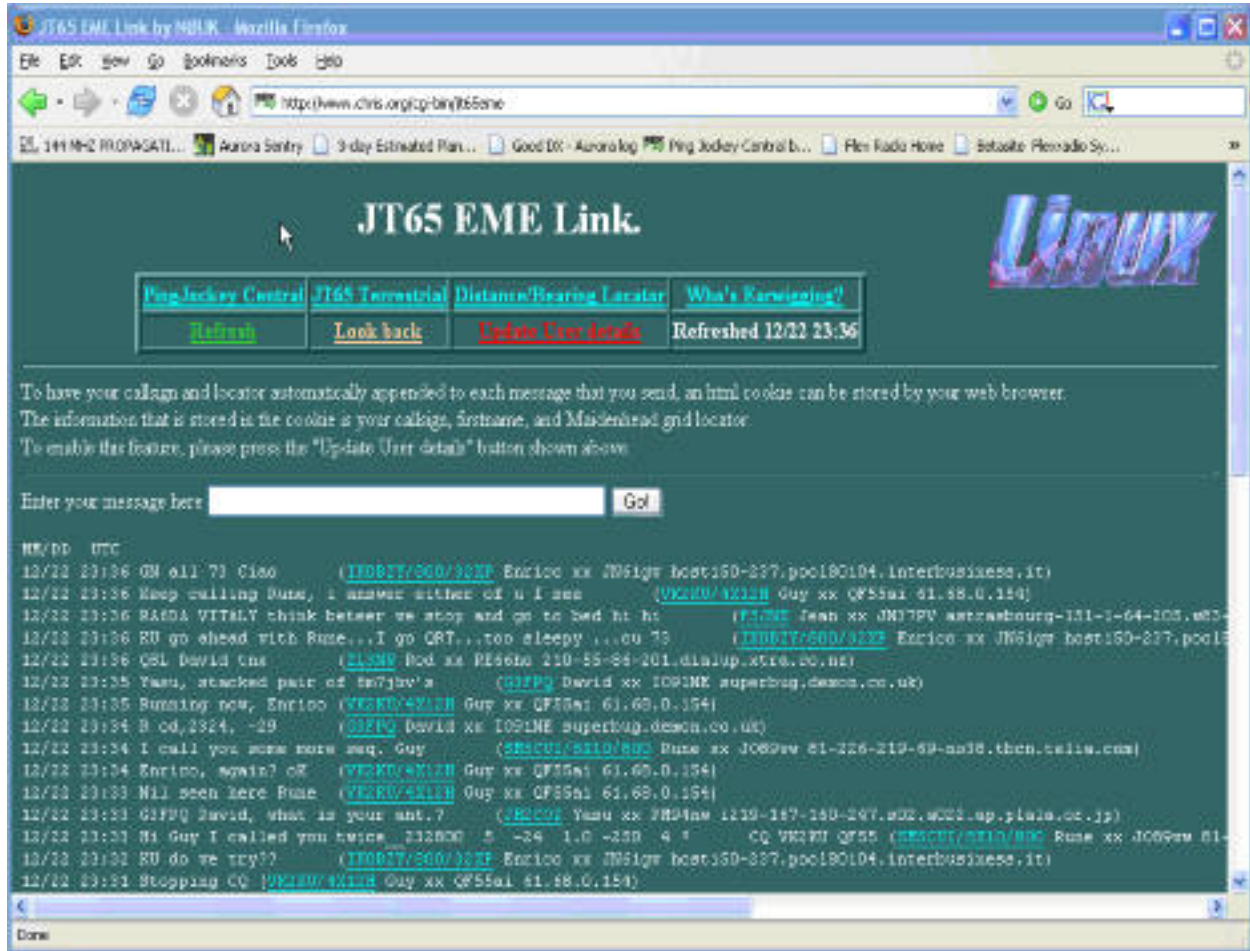


Figure 18 Ping Jockey Central – JT65 EME Link

**Note:** When connected to the web page, clicking on a highlighted call allows you to send an email to that specific person.

### Moonbounce (E.M.E. – Earth Moon Earth) – CW & SSB

The SDR-1000, when combined with a VHF, or above transverter, becomes an *awesome* combination for EME.

The filters available, the noise blankers, the waterfall display, and panadapter function make it an exciting audio and visual experience.

The panadapter function is among the most sensitive displays available. Even the smallest of signals will be visible on the panadapter!

All that is required in the shack, for listening, is the SDR-1000 and a transverter. There are

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several large stations around the world that one can listen to with a single antenna..... aimed at the rising, or setting moon. That is, no elevation is required, one aims at the moon on the horizon.

Antenna gain is compensated for you by these large stations. Many are running between 8 and 32 yagis, some even more. Chances are, if their array is that large, they also run high power, another bonus to help you hear them.

I must point out here that my personal experience over the past 6 months shows that the majority of the activity is on the digital modes. If you are just starting out, many stations can be heard and decoded off the moon if you install and enable WSJT. See the section labeled "WSJT Setup".

Many online resources are available to describe getting an EME station up and running if one will search the internet.

### **Configure VQLog with the SDR-1000**

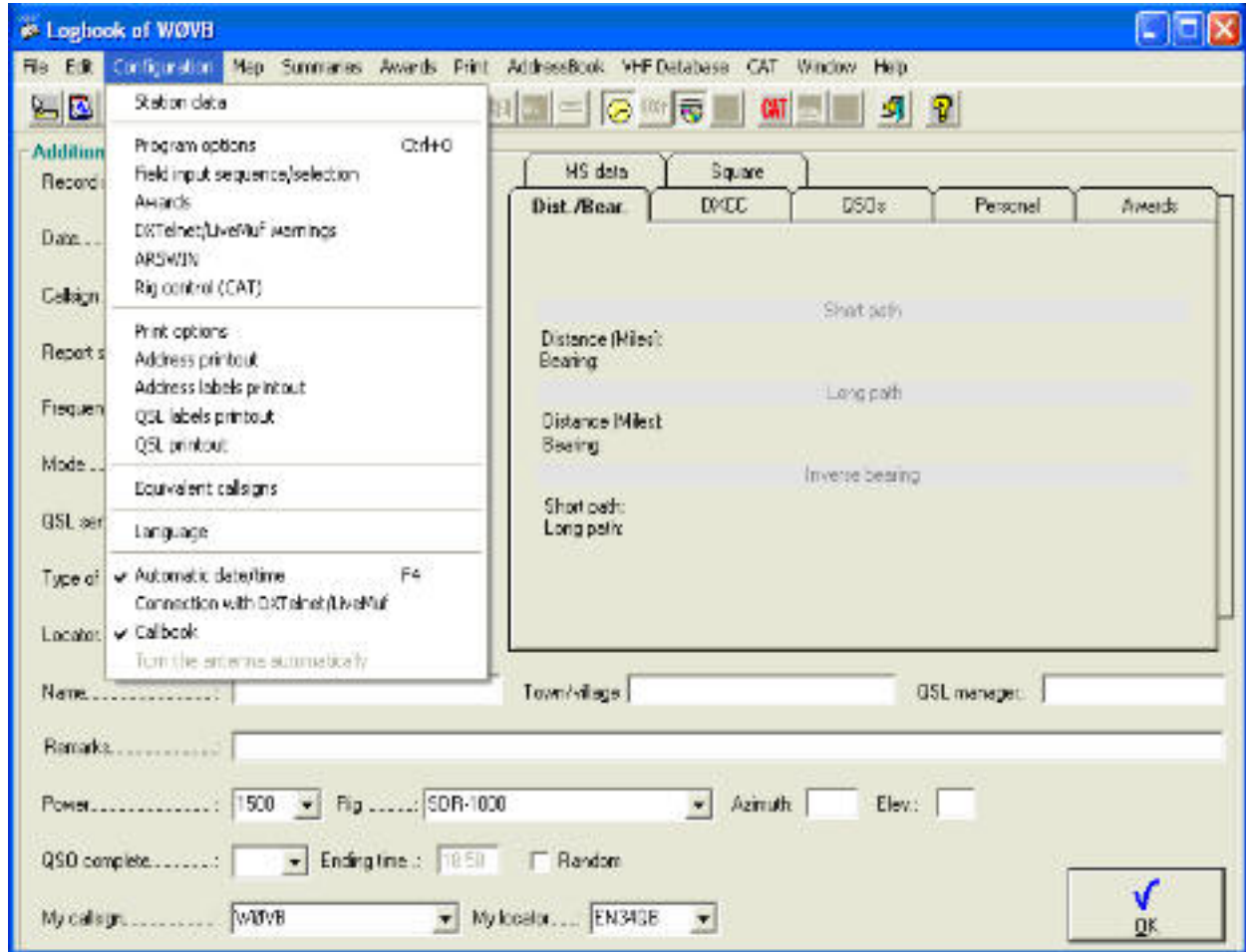
VQLog is a shareware log-book program for Windows specially intended for HF or VHF-DX'ers and Satellite enthusiasts, and it is fully usable for ALL amateur bands from 0 KHz to 99 GHz. The setup within PowerSDR is documented above.

### **Remote Control using the CAT and PTT setup options.**

Go to <http://www.vhfdx.net/vqlog.php> to download the latest version of the application.

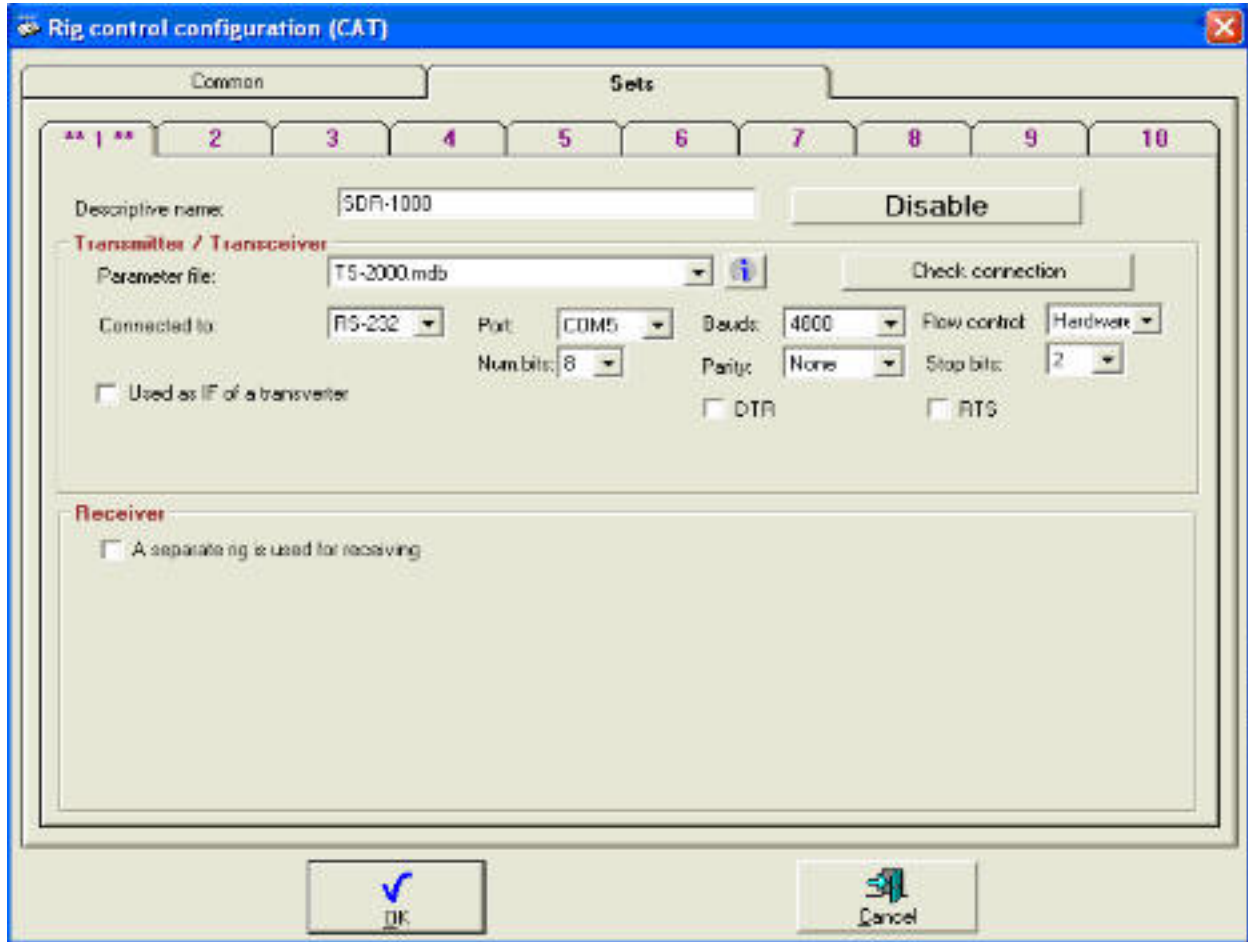
After you have the SDR-1000 setup options entered into the PowerSDR set-up screens, see Figures 19 and 20 for the data to be entered in the VQLog configuration screens.

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**Figure 19 VQLog Main Screen - Select Rig control (CAT)**

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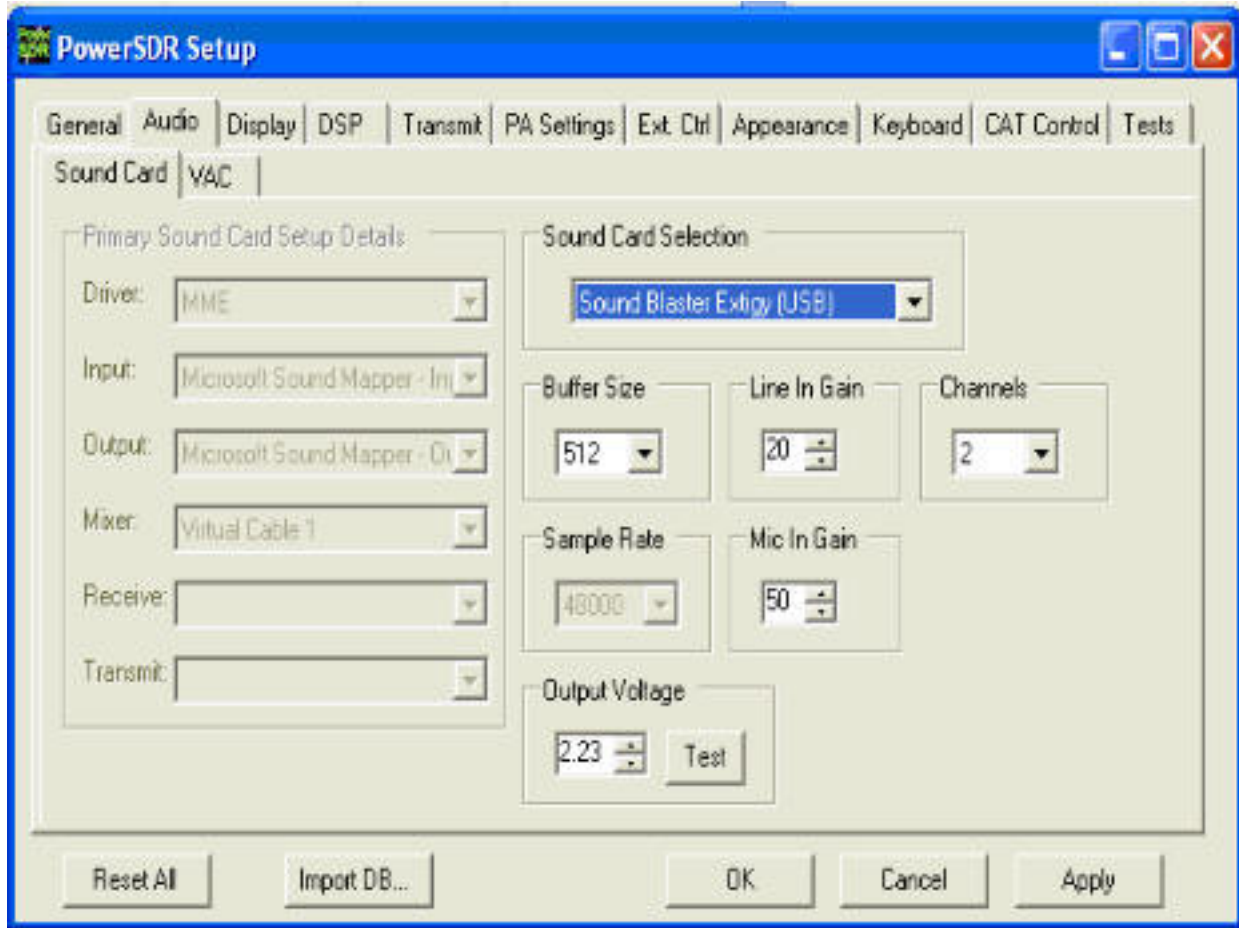


**Figure 20 VQLog Computer CAT Control Set-up Screen**

### **Creative Labs Extigy USB Sound Card**

Figure 21 below shows the settings for the Extigy card and its buffer setting to work with the VAC connection.

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**Figure 21 PowerSDR Sound Card set-up tab**

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### **KB Source Document(s):**

None Referenced

## Optimizing the SDR-1000 for Weak Signal Operations on Two Meters

FlexRadio Systems Knowledge Center

<http://kc.flex-radio.com/KnowledgebaseArticle50257.aspx>