

## SDR-1000/SDR-Console Troubleshooting Guide

This guide is intended as a companion to the *SDR-1000 Hardware Manual* and the *SDR-Console Installation and Quick Start Guide*. It addresses common installation and configuration problems and their possible solutions. Please read the appropriate sections of the above referenced manuals for more detail on these topics.

### **Relays Don't Click When SDR-Console Software Loads**

**Operational Description:** The SDR-1000 uses a set of four 8-bit latches for controlling the relays and DDS. When the unit is powered on, these latches are in an unknown state. The SDR-Console should be loaded after powering on the radio for the first time. This will reset all of the relays and the DDS to a known state. Pull down the bottom of the SDRConsole form to reveal a Reset button that can be used after software is loaded.

#### **Probable Causes:**

1. Parallel cable does not have 25 conductors – The cable must be a 25 conductor straight through cable with a DB-25P on each end. Some cables may have 25 pin connectors but less than 25 conductors. The cable should be the shortest available and in no case longer than 6 feet in length. **Caution: most flat cables do not work in this application.**
2. Parallel port base address not set properly – For the radio to function, the base address must be correctly set on the Setup Options/General tab under PIO Base Address. The base address may be located by finding the first (lowest) hexadecimal number under Setting column on the Resources tab under the Printer Port (LPT?) Properties, which may be found in the Windows Device Manager.
3. Shorts caused by metal spacers or washers – Do not use metal spacers or washers between the boards. They can short one of the power supplies to ground. However, you can safely use metal screws on top of the BPF board to screw into the nylon spacers below. You should place a set of four nylon washer and 3/8" nylon spacer combinations between the BPF and TRX boards, and between the TRX and PIO boards respectively.
4. Power supply does not handle sufficient current – The SDR-1000 can pull as much as 1.25A before reset and will normally draw 600-700mA in receive mode. Place a current meter in line with the power supply to see that it is drawing the 600-700mA after reset. This is a good general indicator to tell if the radio is working properly.

### **Relays Reset but Operation is Intermittent**

**Operational Description:** See the previous Operation Description. Capacitive loading on the parallel port cable as well and insufficient drive from the parallel port itself can adversely affect reliability of the signals that control the SDR-1000 latches. This can cause the DDS to tune to random frequencies and/or the relays to operate erratically.

**Probable Causes:**

1. Cable is too long – Use the shortest 25 conductor parallel port cable you can find. Under no circumstance should it be longer than 6 feet (1.8m) and less is preferable. The cable should also be shielded. **Caution: most flat cables do not work in this application.**
2. Parallel port drive insufficient – In some cases, the parallel port itself may be at fault on some of the clone chips. Check the DC voltage on the parallel port data lines (X1-1 to X1-9). Active high lines should be at +5VDC potential. Low voltage drive can cause erroneous data to be sent to the DDS so that it loses its synchronization. Try a different computer or add a new parallel port card to your system.

Note: If the DDS is running properly, the radio will draw just under 700mA (400mA with the switching regulator at IC5) in receive mode depending on the frequency of operation. With the RFE board installed, current drain will be just over 800mA. A very low current could mean that the DDS is not running. A high current, near 1A or more typically means that the radio is not being reset properly.

***The Radio Resets but I Don't Hear Any Signals***

**Operational Description:** The SDR-Console uses the Windows Multimedia Mixer to control the baseband audio input and output from and to the SDR-1000 respectively. The mixer controls may be accessed by double clicking on the speaker icon in the Windows system tray or through the Windows Control Panel. There are two control panels: normally called Volume (or Playback) Control and Recording Control. The SDR-Console uses the Recording Control to input signals through the Line In and Microphone connectors on the sound card. It then processes the signals and sends the output to the Wave control on the Volume Control panel.

Controls on the Volume Control panel connect sounds directly from their respective inputs to the Speaker output Destination through the Wave Output control. This means that signals originating from this control panel cannot be heard or processed by the SDR-Console software. They are passed directly through by the operating system to the Speaker/Line outputs. The Speaker/Line output is used by the SDR-1000 as baseband transmit signal and therefore any signal coming through the Volume Control panel will be placed directly on the air in unfiltered, double sideband suppressed carrier mode. For this reason it is important that all controls on the Volume Control panel be muted except for the Wave and Master Volume controls. If the Line In and Microphone controls are not muted here, they will cause an echo effect on receive or transmit audio respectively.

Controls on the Record Control panel route signals to the Wave Input Destination, which is used by the SDR-Console software to capture the incoming digitized signals. These signals are processed and routed to the Wave Output control on the Volume Control panel to be sent to the Speaker Destination. This is true for both receive and transmit modes. The only difference is that the Record Control Source is switched between the

Line In and Microphone for the respective TR modes. For more information on the operation of the sound card mixer read, “Making a Sound Card Work for You,” Bob Freeth, G4HFQ, *QEX*, May 2001.

There are four configurations of the Windows Multimedia Mixer for Recording: Mux, Mixer, Multiple Mute, and Multiple Select. All but Multiple Select are currently supported by SDR-Console. The software attempts to determine the mixer type and then sets most of the controls to their proper settings. Here are the characteristics of the four types:

- MUX – The input to the Recording Control allows only one input to be selected at a time usually with a pull down select box. It may also have select boxes at the bottom of each control but only one may be selected at a time. The Turtle Beach Santa Cruz card uses a MUX type Record mixer.
- Mixer – The Mixer panel may have Select check boxes at the bottom of each control. For proper operation only the desired control should be checked for the respective TR mode – line-in for receive and microphone for transmit.
- Multiple Mute – SoundBlaster AWE32 and AWE64 cards typically have this type of mixer. Each control on the Record Control has a mute checkbox. This means that for proper operation all controls must be muted except for the desired control – line in for receive and microphone for transmit.
- Multiple Select – We have not seen this type of mixer so we can’t say what it looks like. It is documented in the Microsoft mixer information. If you get the error message: “Unable to determine the Record Source Mixer type,” please report it to FlexRadio Systems.

#### **Probable Causes:**

1. **Make sure you are using one of the officially supported sound cards that are listed on the Specifications Page of the FlexRadio Systems website and in the SDRConsole Installation and Quick Start Guide. These are the ONLY cards that we guarantee will work with the SDRConsole software. Use of other cards is at your own risk.**
2. Check all cables according to the SDR-100 Hardware Manual instructions.
3. Read the SDR-Console Installation and Quick Start Guide for instructions on how to install and use the software.
4. MUX or Mixer type Record Controls not selected properly – You have not correctly set up the Input Mixer Selection on the SDR-Console Setup Options/General tab. Open the Recording Control as described above. Observe the selected input as you press the up/down arrows on the Line In Record ID control. Find the ID number of the control that corresponds to the Microphone (versions after v1.0.0 will allow you to directly set the Microphone ID with the Mic In Record ID). Once you know the Microphone ID, dial it into the Mic In Record ID using its respective up/down arrows. Next, find the Line In ID number using the Line In Record ID again and leave it with the Line In control selected. Press OK or Apply to save the settings.

5. Multiple Mute or Multiple Select – Notify FlexRadio Systems if you have a problem with these types of mixers.
6. Bad audio cable or incorrect connection – Read the installation section of the SDR-1000 Hardware Manual to determine that you have correctly installed all cables. Check continuity of cables you may have made yourself.
7. Master Mute on sound card mixer stays on – This is probably due to a problem with the PTT appearing to be engaged. This may cause the SDRConsole to cycle in and out of transmit very quickly. The software mutes the Master Volume when transitioning between RX and TX and back again. To see if this is the problem you can check the Disable PTT box on the SetupOptions>Transmit tab. If this fixes the problem refer to the topic below, “Radio stays in transmit after releasing the PTT button.” It is also a possibility that the parallel port cable is not connected properly.
8. Connectors not properly mated between boards – It is important to make sure that all connectors between the BPF, TRX and PIO boards are properly mated. *For example if J2 on the BPF board is not mated with J4 on the TRX board, signals will be very weak.*
9. Confirm that the oscillator at QG1 is fully seated in the pin socket connectors. You may also see a very high noise floor if the oscillator is not properly seated.

It is possible to confirm proper operation of the mixer setup without the SDR-1000 hardware present. Simply connect an audio signal generator to the line input of the sound card. Turn on the SDR-Console and set the mode to SPEC (Spectrum). This will display the entire 40KHz bandwidth of the receiver. If you have properly configured the mixer as described above you will be able to see and hear a 1KHz signal from the audio generator. You can move the frequency and you will see it move up and down the spectrum. It will be displayed as a double sideband suppressed carrier signal.

### ***RFE Just Installed - Now Signals Weak and Transmit Power Low***

**Operational Description:** The RFE requires the fabrication of a 10-pin extension connector to go between the BPF and RFE board. The connector is fabricated from ½ of a 20-pin wire wrap socket. The original specification was to cut the pins to ¼ inch (6.25mm). If the pins are any longer than this, they may short to the PCB below, causing the BPF relays to malfunction. It is unlikely that this will cause permanent damage but the radio will not function properly. The installation instructions have now been modified to specify a length of 3/16 inch to allow more clearance for the pins.

### ***I Am Receiving Signals But Cannot Null the Image***

**Operational Description:** The SDR-1000 and SDR-Console together use Quadrature Sampling to detect and modulate signals of all types. This means that J1 and J3 require stereo (I and Q) inputs and outputs respectively from the sound card. The signals must be of approximately equal magnitude and 90 degrees out of phase in order for the radio to function properly. If one of the channels is not operating properly or you have inadvertently connected the radio to the mono microphone input, it will be impossible to

remove the image and some modes will not operate. A further result will be a doubling of the noise power (3dB) in the receiver.

**Probable Causes:**

1. Review the Image Reject Alignment section in the SDRConsole Installation and Quick Start Guide.
2. Bad or intermittent audio cable or connector – Make sure that you have a properly shielded, stereo, cable and connector. Check continuity and short circuits, tip-to-tip, ring-to-ring, and shield-to-shield. Make sure that the plugs are FULLY engaged on both ends of the cable. If you are using the SDR1K-ENC enclosure, make sure that the back panel is seated all the way against the PC board stack. If the panel is not seated properly, it may prevent the connector from going all the way into the jack. *Note: A bad cable or a connector that is not fully engaged is the VIRTUALLY ALWAYS the cause of image rejection problems.*
3. Open the Recording Control mixer panel. Verify that the balance control is centered. Any lack of balance on this control would prevent removal of the image. Try moving the slider from side to side. If the signal goes away in one direction, this indicates a probable bad cable or connector that is not fully engaged.
4. Poor quality sound cards may allow you to null the image, only to find that the image rejection decreases only a few KHz away. This is due to amplitude variance by frequency on the sound card itself. The only solution is a better sound card.
5. J1 on the TRX board is connected to the microphone input – You cannot use a mono microphone input to properly receive signals on the SDR-1000. A stereo line input is required. With a mono input you can listen to signals but you will not be able to remove the opposite sideband image. The receive will also be much noisier than normal.
6. You have no line in – Many notebook computers today do not have a line input. In this case you will need to install a USB sound card such as the SoundBlaster Extigy or MP3+.

It is possible to test for proper operation of the SDR-1000 hardware independently. To do so you will need to power up the hardware and load the SDR-Console software. Turn the radio on with the On/Off button and set it to the desired frequency with the INA gain set to 26dB. Use a signal generator to apply a –10dBm signal near the VFO frequency and observe the baseband audio signals on the tip and ring of J1 on the TRX board. If you have tuned the radio correctly you should see audio frequency sine waves on the tip and ring that are approximately equal in magnitude and 90 degrees out of phase. This will tell you that the hardware is functioning properly.

***The Radio is Receiving but Sensitivity Seems Low***

**Operational Description:** Simply put, the SDR-1000 is dependant on having a high quality sound card in order to function properly. Many sound cards and especially those on the motherboard have low dynamic range, high noise floor, harmonic distortion, and

clock jitter. All of these limit the effective dynamic range of the SDR-1000. Just because a board is called a 16-bit board does not mean that it has 16 usable bits of dynamic range. Some cards may only have 12-14 usable bits. A true 16-bit card will have 96dB of dynamic range. You will lose 6dB of dynamic range for each bit that is not usable.

**Probable Causes:**

1. If you just installed the RFE board, read the section above titled, “RFE Just Installed - Now Signals Weak and Transmit Power Low.”
2. The sound card does not have sufficient dynamic range to support the SDR-1000. **Refer to the officially supported sound cards that are named in the SDRConsole Installation and Quick Start Guide and on the Specifications page of the FlexRadio Systems website.**
3. Some mixers have special effects (reverb, etc.) that can significantly reduce the dynamic range of the sound card. Make sure all effects are muted or turned off. You want the sound card to have a completely flat input response for best performance.

***Tuning is Off Frequency***

**Operational Description:** A 200MHz low jitter oscillator clocks the AD9854 DDS. Frequency compensation is provided in the SDR-Console software to correct for oscillator offset. A description of the procedure for offset compensation is covered under the topic of Clock Oscillator Adjustment in the SDRConsole Installation and Quick Start Guide.

***Runtime Error 13 “Type Mismatch”***

**Operational Description:** International customers may experience this error message when loading SDR-Console with the Windows operating system set for the local language. This is because the SDR-Console uses the English fractional (decimal) delimiter “.” for display and storage of frequency. Some countries use “,” or other symbols as fractional delimiters.

The current solution is to switch the OS to English using the Regional and Language Options from the Windows Control Panel when running the SDR-Console. Windows makes it fairly easy to switch back and forth between languages by placing the switch on the task bar after you use it the first time.

If for some reason you open and close the SDR-Console in a language that does not have the “.” delimiter, you will cause a very large frequency to be stored in the Windows registry. This will cause the type mismatch error when you start SDR-Console. The only solution is to delete the SDRConsole registry using regedit.exe. You will find the SDRConsole folder under HKEY\_CURRENT\_USER\Software\VB and VBA Program Settings\SDRConsole. Simply delete the folder, switch to English, and reload SDRConsole. The defaults will then be restored.

## **CPU Loading Too High – “Glitches” Heard in the Audio Output**

**Operational Description:** Not all PCs are created equal. The CPU clock rate alone does not tell the whole story. SDR-1000 performance will be directly affected by bus, video, sound card, and memory performance. Also, the number of applications running will affect the performance of the radio.

### **Probable Causes:**

1. The SDRConsole uses increasingly sophisticated DSP software to perform all of the modulation, demodulation, and filtering tasks. It is recommended that your system use at least a 600MHz CPU with 256MB or more of RAM and a high performance graphics subsystem. If you plan to run the VB6 IDE you will need at least a 1GHZ machine to run in interpreted mode.
2. One of the most likely problems is that you have a slow on-board video system. These steal CPU and memory cycles to perform graphics tasks. Try adding a high performance AGP video card such as that used by gamers. In many cases, this will improve performance more than a higher speed CPU because of the graphics overhead of the spectral display.
3. USB sound cards may add significant processor overhead as compared to PCI bus cards. If a USB sound card is required, it may be necessary to upgrade CPU speed.
4. You may not have enough memory. Try increasing memory to 256MB or even 512MB.
5. Another good idea is to NOT allow Windows to manage the swap file. Set the minimum and maximum sizes to the same number, which effectively stops Windows from resizing it on the fly. You can change this under the System control panel, under Advanced Performance Options. A reasonable value for Windows 2000 is about 128MB. If possible it should be located on the second hard drive, if fitted.
6. Remove or turn off performance hogs like high color, animations, fancy screen backgrounds, shadowed cursor, XP style borders, active desktop, etc.
7. Try removing any unnecessary applications that are running in your system tray. These eat up CPU cycles. You may also want to look at task manager to see what other applications may be “lurking” around in the background. There are nice utilities that help you manage these applications:
  - a. EndItAll - <http://www.pcmag.com/article2/0,4149,697,00.asp>
  - b. StartupRun - <http://www.webattack.com/Freeware/system/fwstartup.shtml>
8. If you find that your system is still on the borderline in executing SDR-Console you may want to try setting the OS to favor background tasks. Through the Windows Control Panel go to the Advanced tab on the System Properties form. Then select the Performance Settings and the Advanced tab. This will allow you to set the Processor Scheduling to favor background tasks. DirectX is considered by Windows to be a background task.

### ***Low or no power output on transmit***

**Operational Description:** The SDR-1000 uses a TI OPA2674 (early units used the OPA2677) Dual Wideband, High Output Current Operational Amplifier for the 1W driver stage. As stated in the SDR-1000 Hardware Manual, the user should use caution not to connect the amplifier into unknown or highly reactive loads. An open circuit or highly capacitive load can cause the circuit to oscillate, resulting in a damaged part.

Also, the circuit requires approximately 0.5V<sub>rms</sub> of baseband audio drive on J3 of the TRX board to reach the full 1W RMS output. Some sound cards may not have sufficient drive to achieve this level of RF output. The RFE board amplifier has higher gain (as well as better circuit protection) than the one on the BPF board, thereby allowing full output with lower level sound cards.

#### **Probable Causes:**

1. Low power output in voice modes – Make sure that the RF control on the SDR-Console is set to maximum (100%). If necessary, engage the Microphone Boost on the Advanced button of the mixer Record Control panel. This will significantly increase the microphone channel gain. Make sure that the Wave control on the Volume Control panel is set to maximum gain. If you still do not have enough drive, measure the true RMS voltage on the Line/Speaker out connector on the sound card. Make sure you are able to drive the ~0.5V RMS level required.
2. Low power in CW mode – The CW Controls form on the Visual Basic SDRConsole has its own “Level” control that sets the RF output in CW mode only. Its control is independent of the PWR control on the front panel of the SDRConsole. Make sure this control is set to 100% for full CW output.
3. No output – If an audio signal applied directly to J3 of the TRX board does not provide any RF output, it is likely that the OPA2674 is damaged and must be replaced.

### ***Radio Stays in Transmit After Releasing PTT Button***

**Operational Description:** Status line S6 on the parallel port is used to tell the SDR-Console software that the PTT line has been engaged. The 1K resistor, R9, is intended to pull the signal line low when the PTT switch is not engaged, sending a high signal to S6.

**Probable Causes:** The 1K resistor may not provide a low enough impedance to ground for some parallel ports. The solution is to attach another 1K resistor in parallel with R9 or replace it with a 500-ohm resistor. Newer units may have a 470 ohm resistor installed already. If you still have problems, you can parallel a 200-270 ohm resistor. The voltage at R9 should be below 0.6V when PTT is not activated.

### ***Carrier is Very High on Transmit***

**Operational Description:** The QSE, IC2 on the TRX board, provides quadrature sampling of the I and Q signals at the carrier frequency. Any DC imbalance between the four phases will cause a high level of carrier output. The QSD is biased to 2.5VDC by the voltage divider made up of R7 and R22. Worst-case carrier output with no modulation should be -25dBm (-55dBW).

**Probable Causes:** The primary cause is a failure of IC2 on the TRX board. Remove the BPF board for this test. Check the voltage at the common point between R7 and R22 in transmit mode. It should be 2.5VDC +/- 0.1V. If it is well outside of this range in transmit mode, IC2 is damaged and must be replaced.

### ***The LM7805 (IC5) Heat Sink on the PIO Board Gets Very Warm, Possibly Causing the Radio to Temperature Cycle.***

**Operational Description:** The PIO board uses LM7805 (IC5), 5V linear regulator, to generate 5VDC from the 13.8VDC supply. IC9 and IC10 regulate the 5V supply down to 3.3V for powering the AD9854 DDS, which dissipates around 2W. All relays on the BPF and TRX board are also powered from the 5V supply. Although a linear supply provides the lowest noise power solution, heat dissipation without forced air-cooling may be a problem in some installations. Outside of an enclosure at room temperature, the heat sink plate will run about 60C. The DDS chip, IC4 on the TRX board, will run over 70C under the same conditions.

**Probable Causes:**

1. Metal jackscrews on the bottom of the PIO heat sink plate should mount directly to a BARE metal on the enclosure with heat sink grease applied to the point of contact. This will help significantly in the transfer heat into the enclosure.
2. Make sure there is proper airflow across the PC board stack. It may be necessary to install forced air-cooling. The SDR1K-ENC has provisions for the installation of a 80mm fan.

### ***The LCD Fonts are not Displayed on the SDR-Console***

**Operational Description:** The SDR-Console frequency displays are best viewed with the TBLCD font that may be retrieved from the link under the Software section on the FlexRadio Systems Download page. Install the font according to the SDR-Console Installation and Quick Start Guide.

### ***Where are the SDR-Console Registry Entries?***

**Operational Description:** All Setup Options as well as the state of the radio when turned off are stored in the Windows Registry under:

HKEY\_CURRENT\_USER\Software\VB and VBA Program Settings\SDRConsole

If for some reason erroneous data gets stored in the Registry you can delete the SDRConsole folder and it will be recreated on the next startup with the default values.

### ***How to Test the Power Supply Voltages on the PIO Board?***

**Operational Description:** The PIO board contains regulators for 5VDC, two 3.3VDC sources, 12VDC, and +/-15VDC. These supplies may be tested without the PIO board attached to the TRX board. ***All measurements should be made on the bottom side of the TRX board to prevent the possibility of shorting the power supply pins and causing damage.*** The voltage measurements are as follows:

1. +12V regulated – J2 pin 9
2. +15V unregulated – J5 pin 2 (no load - approximately 18 to 21 volts) **CAUTION, DO NOT SHORT!!!**
3. -15V unregulated – J5 pin 1 (no load - approximately -18 to -21 volts) **CAUTION, DO NOT SHORT!!!**
4. +5V regulated – J5 pin 6
5. +3.3V regulated – J4 pin 9
6. +3.3V regulated – J4 pin 10