

# **Advanced Repeater Systems USB Radio Interface Adapter Installation and Operation Instructions**

## **Overview**

The Advanced Repeater Systems USB Radio Interface Adapter (“Adapter”) provides the computer to radio interface required for EchoLink®, and a variety of digital applications such as Winlink 2000. The Adapter utilizes a high-performance, full-duplex, 7.1 CH USB soundcard for excellent audio, transmit and receive level controls, optional adjustable transmitter key delay, and a Voice Operated Switch (VOX) Push-to-Talk (PTT) circuit. There is no need to open the radio for access to a Carrier Operated Switch (COS). The Adapter has 3 status LEDs for computer communication, Tx modulation and Tx Key.

The USB Radio Interface Adapter is available in two versions- with speaker microphone cable and plug for most handheld radios with preset audio levels; and a Universal Version with either an interface cable for direct solder connection to any radio or repeater, or a mobile radio adapter cable. The Adapter can be used as a standalone station, as a half duplex link to a repeater, or connected to a repeater.

The USB Radio Interface Adapter has been tested and is compliant with the USB 2.0 Full-Speed (12 Mbps) Specification, USB Audio Device Class Specification 1.0 and USB HID Class Specification 1.1.

## **Features & Specifications**

- Small Size (40 x 80 mm)
- Completely USB powered
- Easy Installation and Set-up
- Adjustable Rx and Tx Levels
- VOX generated PTT
- Optional Adjustable Delay for Digital Modes
- Green Power and Computer Communications Status LED
- Blue Tx Modulation LED
- Red Tx Key LED
- High Fidelity 7.1 Channel Sound Card
- Driverless for Windows 8, 7, 98E, ME, 2000, XP, SERVER 2003, Vista, Linux & MacOS

## **Digital Operation**

Reference the Radio Interface Adapter Layout on page 3. Remove the cover and set the Tx and Rx Levels, and the Tx Delay in accordance with your system’s requirements.

## **EchoLink Operation**

Receiver audio is processed through the Adapter to the computer where the EchoLink software (in the VOX mode) passes the audio to the EchoLink network. Likewise audio from the EchoLink network is passed from the computer USB port to the Adapter’s VOX which keys and applies audio to the transmitter. EchoLink only versions have a fixed 1.5 second transmitter delay.

Your Amateur Radio Callsign must be registered as a Sysop with EchoLink system (as a –L or –R for a link or repeater) and you must have EchoLink Software running on your computer. Usually Echolink will validate your Sysop Callsign within an hour. Without your Sysop Callsign, you cannot set up a radio link or repeater connection in the EchoLink software. If used as an EchoLink radio link to a repeater, EchoLink prefers that the repeater be modified to pass or transmit an encoded sub-audible CTCSS tone only when a user is on the input and have the link radio in CTCSS decode mode to prevent the repeater hang time and identification from being broadcast over the EchoLink network.

## **Ground Loop Hum, Isolation and Single Point Ground Systems**

The ARS USB Radio Interface Adapter utilizes a common ground design for use in a Single Point Ground System (SPGS). These are the safest, most effective ground and equipment protection method for radio and repeater systems. A SPGS requires all equipment grounds to be tied to a single common point. Some computer to radio interface devices avoid ground-loop audio hum by isolating grounds with transformers and optic isolators which is unnecessary with a properly designed and installed SPGS.

If you are experiencing audio hum, you likely have a ground-loop. Reverse the computer and/or radio power plug polarity or use a 3 to 2 prong adapter to open the ground loop between the equipment. Multiple equipment ground returns, through audio cables, data lines, power supplies and even antenna systems, are often the cause of ground-loop related audio hum and lightning related equipment damage.

## **Universal Version Interconnect Wiring**

The Universal Version has a 4 conductor; Tip, Ring1, Ring2, Shield (TRRS) jack and is supplied with a Radio Interface Cable suitable for solder installation with virtually any radio or repeater. The Tx Key is an open collector 2N2222 capable of 500 mA current sink. Tx Audio is sufficient to drive most microphone inputs and has about 5 K ohms output impedance. It may be necessary to install between a 10K to 100K series resistor with the microphone input to prevent overdrive and hum. Receive audio must be de-emphasized, and squelch or CTCSS gated. Low volume speaker audio is generally used for the Rx Audio input.

The following is the interface cable color code. (bare wire is not connected)

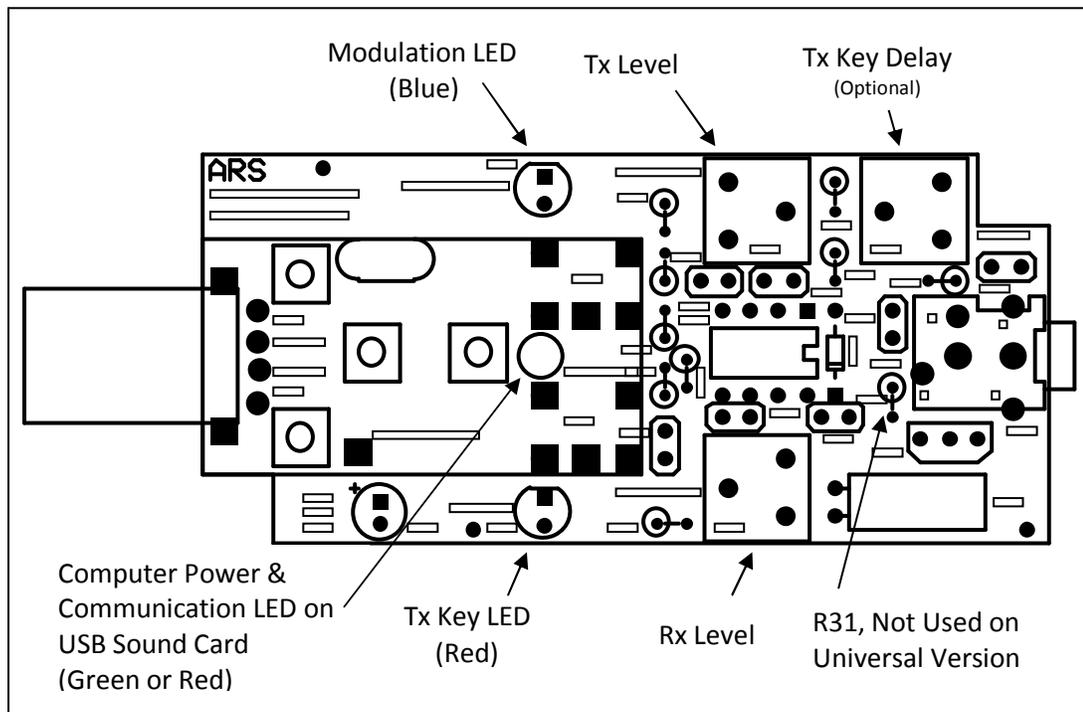
<u>Connector</u>	<u>Signal</u>	<u>Wire Color</u>
Tip	Rx Audio	Red
R1	Tx Key	Black
R2	Tx Audio	Yellow
Shield	Ground	Green

## **EchoLink Set-up and Installation**

1. Plug the Adapter into one of your computer's USB ports, the computer should recognize and respond with "New Hardware" found and proceed to load the USB driver, if required.
2. Load and Run the EchoLink software.
3. Using a RF radio Link or Repeater requires the user to register as a Sysop under the Tools, System Set-up, My Station, and Mode. Sysop requires your Callsign have a -L or -R suffix.
4. Under Set-up, Audio, set the input and output device to (generic) USB audio device.
5. If using CTCSS tone, check the 300 Hz High-Pass Filter.
6. Under Tools, Sysop Settings, set both receive and transmit controls to VOX.
7. Under Signals, set Tone Burst, at beginning of each Tx, 50 mS and select one of the four tones.
8. For now, leave other settings to default as fine tuning of values and other features can be added after the Adapter is operational.
9. Open the computer Control Panel, Sound file; verify that the USB device is listed and active. Check the USB device box for both Playback (Tx audio) and Recording (Rx audio).
10. Set the computer Playback level maximum for maximum VOX sensitivity (If the transmit audio is too high, reduce the level with the Tx Level potentiometer in the Adapter)
11. Initially set the Recording (Rx) level to half to three quarter scale.
12. Set the radio that will be used for the EchoLink Interface and a test radio on a simplex test channel. Verify that the two radios communication with each other.

13. Plug the Adapter into the speaker microphone jack of the EchoLink Interface radio.
14. Initially set the EchoLink Interface radio volume to one-third. (lower volume may result in poor signal to noise and higher volume may result in distorted receive audio)
15. Go to the EchoLink Test Server. Verify that the blue LED flashes with the announcement voice and the red Tx Key LED is lit, radio is keyed, and the test audio is clear and of nominal level.
16. If the audio sounds over driven and distorted, or low in level, adjust Tx Level potentiometer by removing the Adapter cover (by removing the two Phillips screws). Reference the picture below for the location of the Tx Level potentiometer.
17. Reconnect to the Test Server. Adjust the transmit audio level to a clear and sufficient level of the EchoLink announcement voice.
18. Key the test radio and adjust the EchoLink Interface radio's volume control using the EchoLink Audio Adjustment Bar on the computer. Loud audio peaks should enter the yellow bar.
19. Verify clear and undistorted audio on playback. If necessary, adjust the Rx Level potentiometer for best audio level for a one third volume setting on the radio.
20. Disconnect from the Test Server.
21. Install the Adapter cover and screws (do not over tighten).
22. The basic EchoLink Set-up is now complete.
23. The EchoLink software has many features that you can set such as automatic identification, DTMF remote control, station short cuts, preferences, messages, etc.
24. Set your Callsign and identification time; FCC Rules require that your EchoLink station be identified at least every ten minutes while transmitting with a final ID in either voice or CW at a maximum rate of 20 words per minute.
25. Remote control features are under the Sysop Settings, DTMF. Select the internal DTMF decoder, set your control codes and your Station Shortcuts to your favorite stations.

### USB Radio Interface Adapter Circuit Board Layout



## **Troubleshooting**

EchoLink is a peer-to-peer program. It utilizes ports 5198 and 5199 for UDP packets and port 5200 for TCP packets. The modem and router (if used) must be configured for port forwarding. Opening modems and routers vary depending on the manufacturer. DSL and cable modems may have to operate in bridge mode. Firewalls in the modem, router and computer may have to be disabled or you must set up an exception for EchoLink. Internet security software may have to be disabled or configured for these ports. Contact your Internet provider for information on opening your modem. Information on opening a port or port forwarding of your router is usually available on the Internet or at [portforward.com](http://portforward.com).

EchoLink has an excellent Firewall and Router test routine found under Tools, Firewall/Router Test. By clicking on this test, EchoLink tests and verifies both TCP and UDP packet connections.

When running set-up, the EchoLink software may set the currently used USB port as the default. Switching to another port may result in the audio being re-routed back to the computer's default. To avoid this problem use the same USB port for EchoLink.

It is best to dedicate a computer to avoid audio routing problems with your computer's default audio settings and conflicts with other audio related programs. For example, running Skype or a MP3 player may cause the default input/output audio device to change which may result in the Adapter audio to route to a different port and/or cause random keying.

If your Adapter fails to either have Receive or Transmit Audio, the problem is likely with the Computer's Audio Settings found under the Control Panel in the "Sound" file. Make sure that the USB device is listed which may require going to the Device Manager and that both Transmit and Receive Levels are on.

If the Adapter keys then un-keys this is likely caused by the computer's audio mixer setting the microphone input (which is the receiver audio) being fed directly back to the speaker output (which is the transmitter audio) causing the Adapter to go immediately into transmit. This setting is used to generate sidetone audio so that the user can hear his/her voice similar to a telephone when using a headset for applications such as Skype. To rectify this condition, set the receive level to transmit level to zero. Note that sometimes this setting is hidden.

Some computers default to internal audio output devices such as the internal speakers and microphone, and drivers which may have to be disabled.

Turn the computer's power saving or power management system OFF. The power management system can cause the USB Adapter to randomly key with power cycling.

Keep the radio antenna as far as possible from the computer and the Adapter to minimize potential RF interference. Use only high-quality USB extension cables with Adapter.