K8JHR Computer Headset-to-Transceiver Adapter Box

OBJECTIVES / OVERVIEW:

1. Provide a conveniently located remote junction box to connect a computer gaming headset, and PTT switch, to an HF amateur radio transceiver.

2. Provide a resistive circuit to attenuate the 8-10 v bias voltage supplied by the radio to approximately 5 volts, as is standard fare on a internal computer sound card or external computer audio interface.

3. Provide a 2-resistor, 10 dB attenuator pad (L-network voltage divider) to attenuate the headset electret condenser microphone capsule's open signal voltage.

DESCRIPTION:

The adapter circuit shall be constructed in a plastic project box measuring approximately 2" W x 4" L x 1.5" T which can be mounted to the station desktop.

The adapter circuit shall be connect to the transceiver's 8-pin microphone jack with a 5-wire cable. Two wires and shield conductor shall carry the microphone audio, bias voltage, and mic ground to the adapter, while the remaining two wires shall bring the PTT open and ground to the adapter. This cable shall be terminated with a standard 8-pin round female radio microphone plug. The separate components shall be mounted to a small circuit board for convenience during construction and to organize and facilitate the internal wiring.

A separate 3-wire patch cable shall bring the headphone audio signal to the adapter and it shall be terminated with a 3.5mm 3-pole phone plug, and a 1/4 inch 3-pole phone plug, at each end, respectively.

The adapter circuit shall employ an in-line resistor to attenuate bias voltage from approximately 8-10 v DC to approximately 5 v DC.

The adapter circuit shall employ a 10 dB (+/-) 2-resistor, L-network, attenuator pad (voltage divider) to attenuate electret condenser microphone's open signal voltage.

The adapter circuit shall include three, 3.5 mm phone jacks for connecting the microphone, headphone, and PTT switch, respectively.

PARTS LIST:

Jacks	4	3-conductor stereo 1/8 inch (3.5mm) phone jacks, Radio Shack Part 274--249, two (2) jacks per package
R1	2	2.2k Ohm Resistor,, Radio Shack Part No. 271-1325
R2	1	470 Ohm Resistor, Radio Shack Part No. 271-1317
R3	1	220 Ohm Resistor, Radio Shack Part No. 271-1313
C1	1	4.7 uf Electrolytic Capacitor, Radio Shack Part No. 272-1024
Board	1	Printed Circuit Board, Radio Shack Part No. 276-148 (One half of one dual board)
Box	1	Plastic project box, (4" x 2" x 1") Radio Shack Part No 270-1802
Cable	1	MFJ-5082 Cable, 8-Pin round microphone connector, unterminated far end
Wire	3	Various lengths of 3-color, 22 gauge stranded insulated hook up wire

[**Note**: Original plans call for R2, 415 Ohm, and R3, 270 Ohm, resistors, but the local Radio Shack only carries the above-listed close substitute resistors in stock. These work fine, but your mileage may vary.]

DISCUSSION:

Audio Signal Attenuation:

Computer gaming headsets generally perform well with ham radio transceivers. The earphone receivers are typically low impedance (30-60 ohms +/-) and have sufficient output to use directly, without modification or need for an additional headphone amplifier. In contrast, many audiophile and studio grade headphones present a much higher impedance load, and cannot be used with many amateur radio transceivers without an outboard headphone amplifier.

Except most recent ICOM transceivers, many, if not most, HF transceivers are designed (or set) to be used with dynamic microphone cartridges. In contrast, computer gaming headsets usually employ electret condenser microphone capsules, which are typically produce substantially a higher open signal voltage (i.e., output signal strength.) Gaming headset electret condenser microphone capsules are generally rated with "impedance equal to load" such that microphone impedance is rarely an issue.

Sometimes, the operator can adequately adjust the radio's input settings to accommodate a computer gaming headset's inherently higher signal strength. Unfortunately, this is not always the case, and the operator finds very little latitude for adjusting the radio's AF-Gain control. In many case, the headset's condenser microphone output is so inherently "hot" there is very little latitude for adjusting the microphone input volume. In some cases, the microphone is so "hot" mic gain must be set as low as 1 or 2 percent (i.e., just above zero) AF-Gain, and if it is set any higher, AGC comes on full strength, full time, and has insufficient latitude to do its job. The mic is either off, or it is on and triggers AGC full time.

Inserting a 10 dB attenuator pad between the mic capsule and the radio's microphone input jack can obviate crowding the AGC circuit, and allows the operator to set the radio's microphone input volume much higher, perhaps, as high as 40 to 50 percent, close to, or within, the same range as a typical dynamic microphone. This, in turn, allows the operator much greater latitude when adjusting microphone input signal strength (AF-Gain) and allows the AGC substantially more room to operate as intended, so it only operates on audio peaks.

Bias Voltage Attenuation:

Microphones designed for highly intelligible communications entail different considerations form those used in hi fidelity music reproduction.

Most amateur radio transceivers produce 8-10 v DC bias voltage on one pin of a 8-pin round microphone input jack, or sometimes on one conductor of an RJ45 / 8P8C-45 jack.) In contrast, gaming headsets are generally designed to work with industry standard internal computer sound cards and external audio interface devices which supply 2.5 v to 5 v on the ring conductor of the microphone input jack. Rarely, a gaming headset microphone cable is terminated with a 2-pole 3.5 mm phone plug. (This is not industry standard, and generally appears on older microphones, or similar microphones intended for related, but different, applications.)

After two decades experience testing and sampling computer headsets, and publishing product reviews and recommendations for use with speech recognition software applications, this writer is convinced most gaming headsets work better with the lower bias voltage supplied by computer sound cards and audio interface devices. Higher voltage increases microphone sensitivity, and alters the microphone's inherent dynamic range, often emphasizing lower frequency response, which, in turn, may have a deleterious effect on clear, intelligible speech communication. Operating with lower bias voltage, tends to to reduce the microphone's output signal strength, and provides a more desirable audio frequency response curve for the intended application.

Attenuating the supplied bias voltage can be accomplished by various techniques. I chose to employ an in-line resistor. Another technique is to employ a voltage divider comprised of two or more resistors in a L, U, T

network. For this project, a single resistor was selected, notwithstanding it would be more difficult to predict the resulting voltage drop prior to construction. An L-circuit pad consisting of two equal-value resistors can provide greater predictability reducing voltage by exactly one-half or other known ratio.

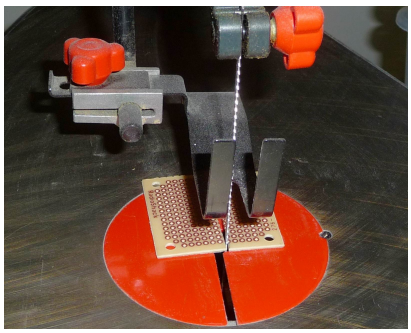
Most electret condenser capsules have two connector pins, and bias voltage must be applied to the audio signal conductor exterior to the capsule, *per se*. (Three-conductor capsules exist, but these are rarely used in this application.)

Industry standard computer sounds cards apply bias voltage to the ring on the 3.5 mm phone plug terminating the headset microphone cable. Alternatively, bias voltage can be applied ahead of this point, within the subject adapter, before the mic input jack, which accommodates both 2-pole and 3-pole phone plug cable designs. The schematic drawings, *infra*, depict two additional variations, one applying bias voltage to the ring on the 3.5 mm phone plug, as is typical of computer sound cards, and another employing an L-network voltage divider applied to the audio line.

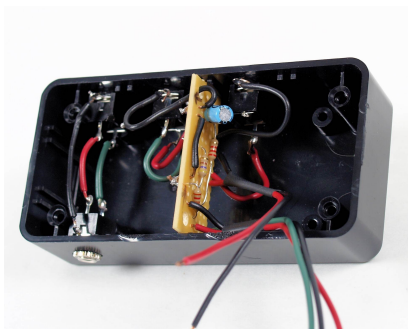
A capacitor is placed in-line between the point where bias voltage is applied, and the transceiver microphone input jack, to prevent that voltage from entering the radio audio circuit. A capacitor is often, but not always, found as part of the radio's audio input circuit for the same purpose, so this capacitor may be redundant. Considering not all transceivers employ such a protective device on the mic audio input, it is included in this project for good measure, just in case.

PHOTOS OF COMPLETED PROJECT:

Most of the parts.



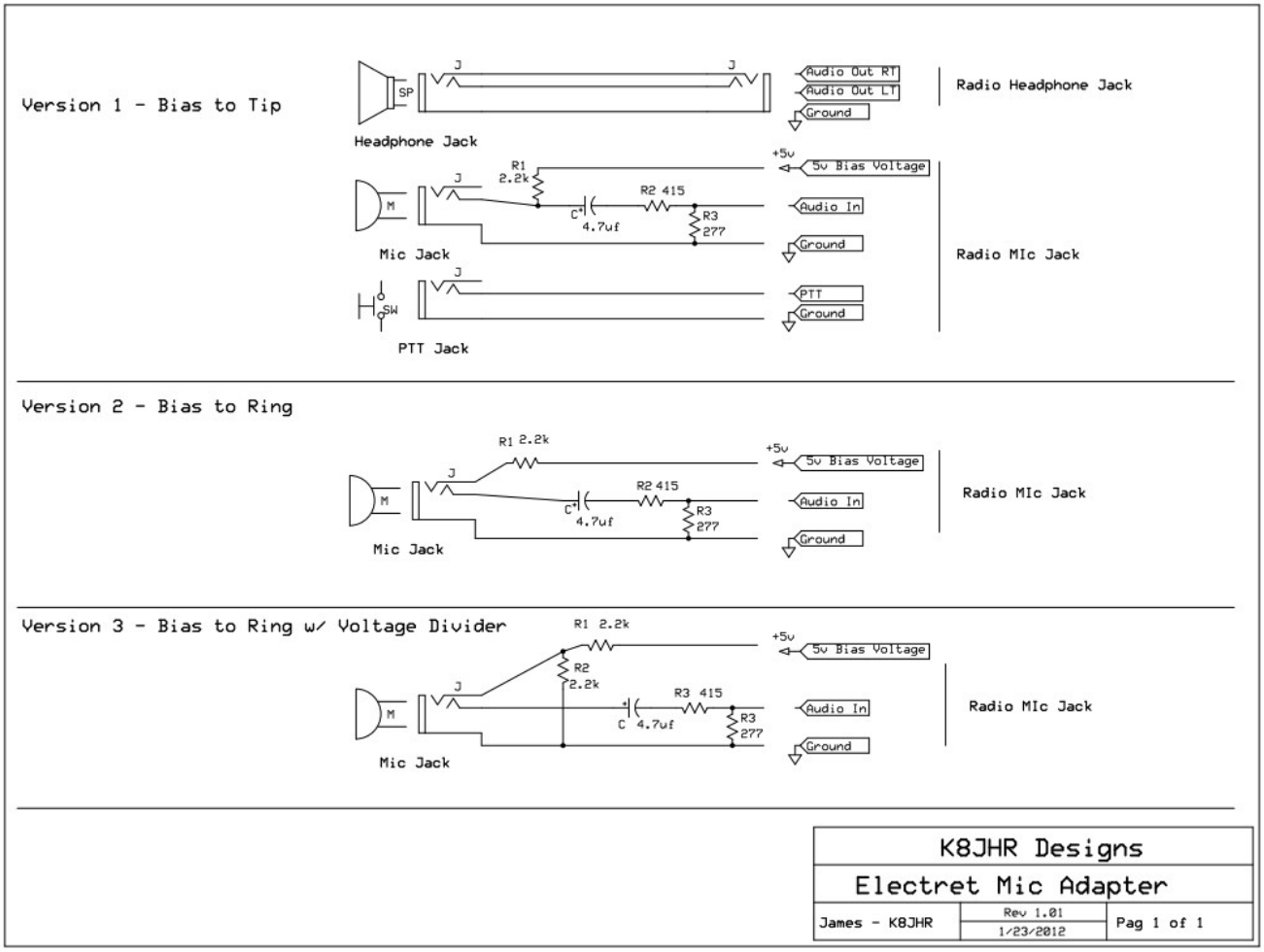
Cutting the board to size.



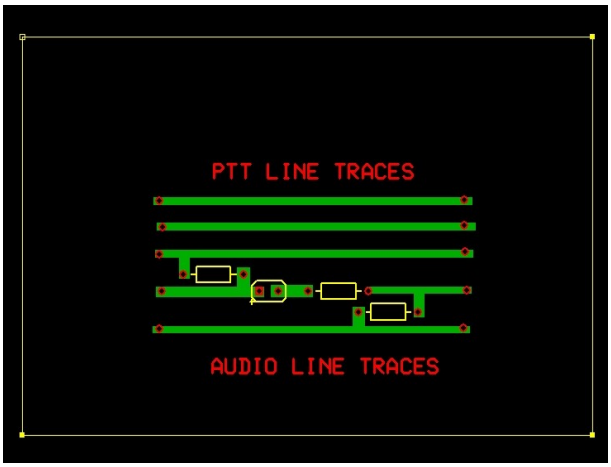
Project Box Interior View.

Finished project exterior view.

SCHEMATIC CIRCUIT DRAWING:



PARTS LAYOUT AND TRACE DIAGRAM



FINISHED PROJECT INSTALLED