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Title: An Audio Interface Unit for Field Day and Contesting
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An Audio Interface Unit for Field Day and Contesting

Let everyone in on the contest action with this flexible accessory.

John S. Raydo, KØIZ

After several Field Days it became apparent that our club needed improvements to our headphone and speaker setup. Both the operator and logger needed headphone connections. Individual volume controls would be nice. Observers couldn't hear the radio when we plugged in headphones. Sound attenuation of headsets forced operator and logger to communicate by yelling.

The Answer

This unit makes two person operation more efficient. Dual stereo headphone jacks, volume controls and external speaker jack are provided jacks are provided for both dynamic and electret microphones. Perhaps most unusual is an intercom feature for operator and logger to more easily communicate via headset mics.

There are times when the operator and logger need to talk, for example to resolve a call-sign ambiguity. With this unit the operator can initiate *two-way* intercom communication by pressing an INTERCOM switch. The logger, however, can only initiate *one-way* intercom to the operator. This is so that the logger can't inadvertently cut off the operator during a contact. To respond, the operator presses his intercom switch. In both instances radio volume is reduced for "talk-over" during intercom use.

Both operator and logger will need headsets with microphones. The unit has two intercom switches plus jacks for optional foot switches for hands-free operation. Here's how it works:

Operator Communicating with Logger:

- Operator presses and holds INTERCOM switch (on unit or foot switch).
- This disconnects the operator mic from radio. Both mics are connected via internal amplifier to both earphones.
- Radio volume is reduced (adjustable using the RADIO VOL control).
- Operator and logger can talk.

Logger Communicating with Operator

- Logger presses and holds INTERCOM switch (on unit or foot switch).
- Logger mic is connected via internal amplifier to both earphones.
- Operator mic remains connected to radio and can still transmit on the radio.
- Radio volume is reduced.
- The operator can respond to the logger by pressing the operator INTERCOM switch.

Circuit Description

The circuit diagram is shown in Figure 2. I originally designed my unit for use with dynamic microphones such as the HC4 and HC5 elements used in various Heil headsets. Then at the last contest an operator brought a Heil iC type headset that uses an electret element. So I added two more mic jacks to supply the required dc for that type microphone. Mic bias current is limited to less than 1 mA to avoid damage if a dynamic mic is accidentally plugged into the wrong jack. The higher electret output is reduced by resistors R11 and R28.

Figure 1 — Front view of the audio interface box. Operator controls are on the left and logger controls are on the right.

Both the operator and logger mics have preamplifiers with 34 dB gain set by the ratio of the resistors R4/R3 and R9/R8. The VOLUME controls, R14 and R15, allow operator and logger to individually adjust their intercom volumes. The preamps feed a single 2 W intercom amplifier.

Pressing the operator INTERCOM switch transfers the operator mic from radio to intercom preamp and amplifier via relay K1 and then to the headphones via relay K2. Pressing the logger INTERCOM switch will also activate K2 (but not K1). During intercom use audio from the radio passes through control R20 (RADIO VOL) at reduced volume. Switch S2 allows selection of both left and right sides of the headphones or only the right side, for the intercom. The operator and logger each have individual headphone VOLUME controls R24 and R25 (the operator control also has POWER switch S1).

Construction

I built my unit in a bone colored PacTec plastic box, P/N LH84-200. Mouser now only carries the black version but other distributors may have the bone version if that's your preference. Front panel controls include two headphone volume controls, two intercom volume controls, radio volume and L+R / R switch and two intercom switches.

The back panel (see Figure 3) has a multitude of connectors: ¼ inch stereo jacks for two pair of headphones, two 3.5 mm mono jacks for headset microphones, one 0.210 inch jack for an aviation type mic (if desired), 3.5 mm stereo and mono jacks for connection to the radio's headphone and mic jacks, one stereo 3.5 mm jack for a speaker, two 3.5 mm mono jacks for foot switches and a jack for a wall wart.

Power is provided by a 9 V dc wall wart reclaimed from some other use. A rating of at least 200 mA is suggested. Wall warts have various sized connectors so make sure the jack you use is compatible. Also verify the polarity (the center pin on mine is positive). A 12 V dc wall wart can be substituted

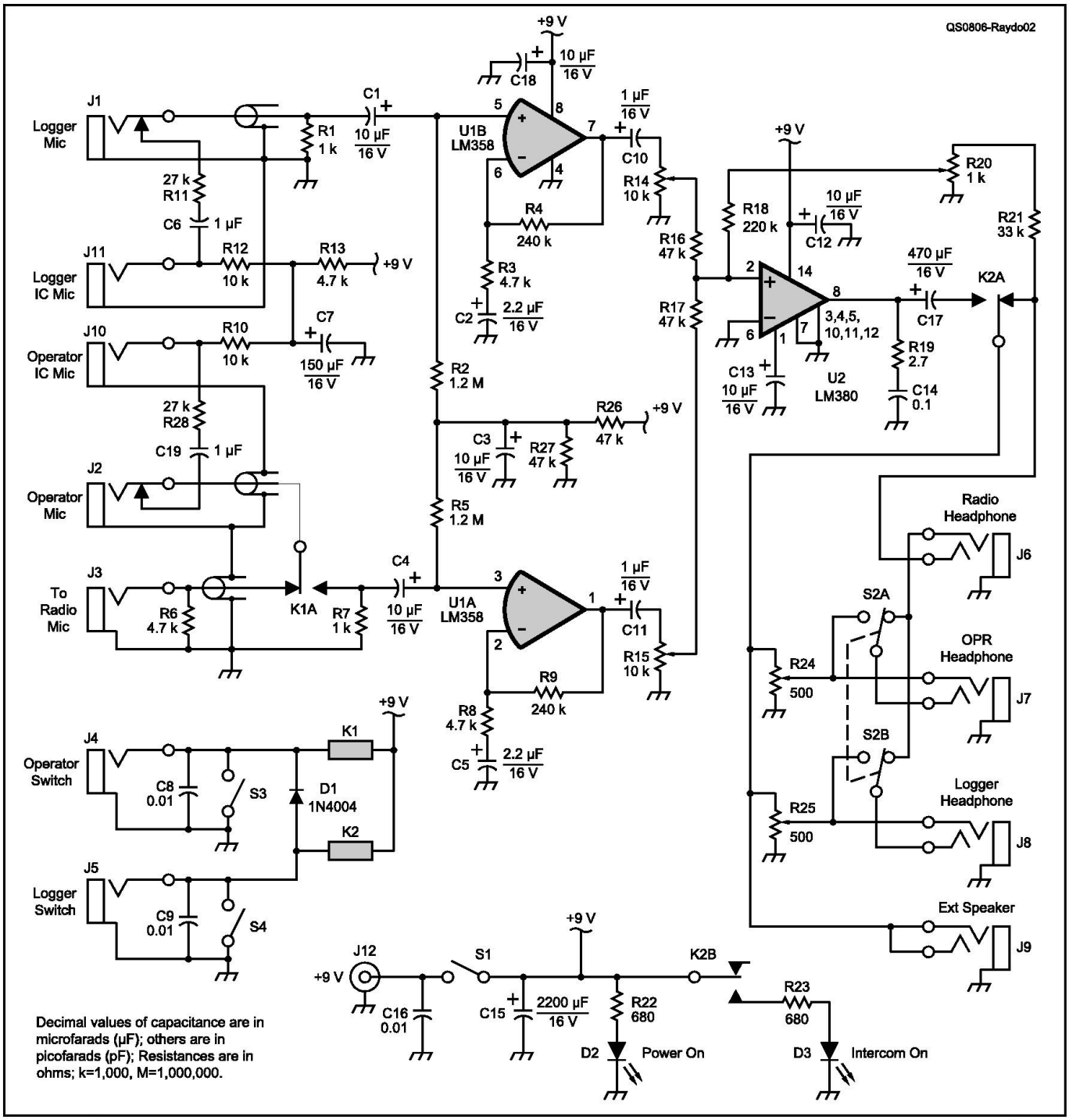

Figure 2 — Schematic diagram and parts list for the audio interface unit. Mouser parts are available at www.mouser.com, RadioShack parts at www.radioshack.com.

C1, C3, C4, C12, C13, C18 — 10 µF, 16 V electrolytic capacitor.
C2, C5 — 2.2 µF, 16 V electrolytic capacitor.
C6, C10, C11, C19 — 1 µF, 16 V electrolytic capacitor.
C7 — 150 µF, 16 V electrolytic capacitor.
C8, C9, C16 — 0.01 µF, 50 V ceramic capacitor.
C14 — 0.1 µF, 50 V ceramic capacitor.
C15 — 2200 µF, 16 V electrolytic capacitor.
C17 — 470 µF, 16 V electrolytic capacitor.
D1 — Diode, 1N4001 or 1N4004, Mouser 512-1N4004.
D2 — Red LED, Mouser 696-SSI-LCR3612ID.
D3 Yellow LED, Mouser 696-SSI-LXR3612YD.
J1-J5, J10, J11 — 3.5 mm mono jack, Mouser 16PJ135.
J6, J9 — 3.5 mm stereo jack, Mouser 16PJ136.
J7, J8 — Three conductor ¼ inch jack, Mouser 502-12B.
J12 — 2.5 mm jack for dc input, Mouser 502-712A.
K1, K2 — DPDT relay, 9 V, Mouser 653-G6A-274P40-DC9.
R1, R7 — 1 kΩ, ⅛ W resistor.
R2, R5 — 1.2 MΩ, ⅛ W resistor.
R3, R6, R8 — 4.7 kΩ, 1/8 W resistor.
R4, R9 — 240 kΩ, ⅛ W resistor.
R10, R12 — 10 kΩ, ⅛ W resistor.
R11, R28 — 27 kΩ, ⅛ W resistor.
R13 — 4.7 kΩ, ⅛ W resistor.
R14, R15 — 10 kΩ potentiometers, Mouser 31JA401-F.
R16, R17, R26, R27 — 47 kΩ, ⅛ W resistor.
R18 — 220 kΩ, ⅛ W resistor.
R19 — 2.7 Ω, ½ W resistor.
R20 — 1 kΩ potentiometer, Mouser 31JN301-F.
R21 — 33 kΩ, ⅛ W resistor.
R22, R23 — 680 Ω, ⅛ W resistor.
R24, S1 — 500 Ω potentiometer with SPST switch, Mouser 31VM205-F.
R25 — 500 Ω potentiometer, Mouser 31VA205-F.
S2 — DPDT toggle switch, Mouser 10TC260.
S3, S4 — SPDT long handle, center off, momentary contact switch, Mouser 10TA445.
U1 — Dual op amp IC, LM358, Mouser 595-LM358P.
U2 — Audio amplifier IC, LM380 or NTE740A, Mouser 526-NTE740A.
Project box, 8 × 4 ¼ × 2 ¼ (black, see text), Mouser 616-72004-510-000.
Circuit board, RadioShack 276-158.

Figure 3 — Rear view of the audio interface box. Operator jacks are on the right, logger on the left. Connections to the radio are in the center.

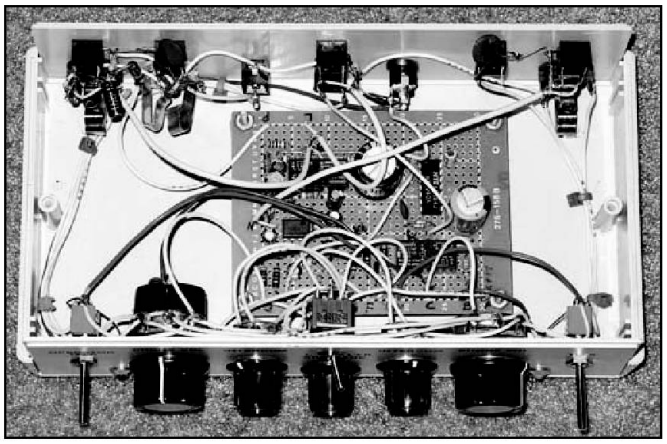

Figure 4 — Inside view of the audio interface box. A RadioShack circuit board is used for most components.

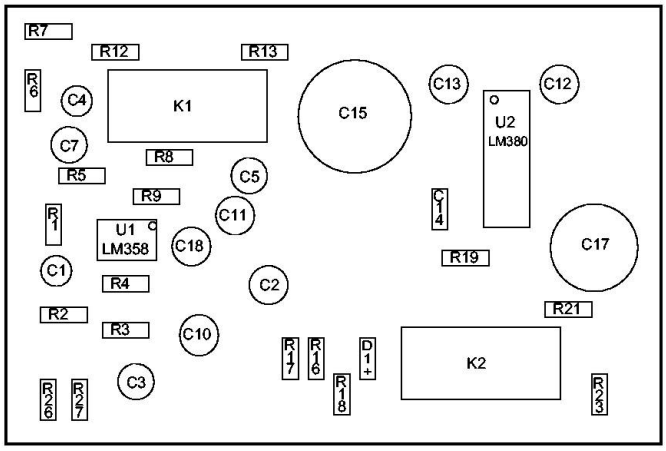

Figure 5 — Suggested parts layout for audio interface box.

John Raydo, KØIZ, received his Novice license in 1957. From early on he has enjoyed designing and building ham radio equipment and antennas and has authored a number of articles for QST *and* QEX. *He is an active member of the Johnson County (Kansas) Radio Amateur Club. John is a graduate electrical engineer with also a liberal arts degree in math and science as well as an MBA. He started his career working for TWA in the engineering department and later headed up their Information Services and Purchasing departments. He is now retired from his second career as an investment principal. John can be contacted at* **kcflyers@yahoo.com**. QST

if K1 and K2 are changed to 12 V type and the LED series resistors R22 and R23 are changed to a value of 1 kΩ.

Other than controls and jacks most components are mounted on a RadioShack prototype circuit board attached with four ½ inch spacers and shown in the box in Figure 4. A suggested parts layout is shown in Figure 5. Point to point wiring is used between circuit board pads and is not particularly critical.

Connections to both mic jacks and radio mic jack use shielded cable to reduce hum and risk of interference pick-up. Connect the shields on the operator and radio mic cables to a common ground point on the circuit board near U1. Bypass capacitors C8, C9 and C16 and resistor R6 are mounted at their respective jacks.

Rub-on lettering helps give a professional appearance. I used Helvetica medium (12 point size) from Hobby Lobby (a craft and hobby chain). Since letters vary in width (for example an "i" takes less space than an "m") I used Microsoft *Word* to first print the text on paper, selecting *Helvetica, Bold* font. This way you can see the spacing and find the center of each label. Select the center letter of your label and rub using the end of a ballpoint pen or similar rounded object. Add additional letters to the left and right of the center letter. If you make a mistake, use your fingernail to lightly scratch off the letter. Do the labeling before assembly. When finished, spray the panel with two light coats of a clear plastic spray.

Connecting an external speaker in addition to two headphones might be too much of a load for some radios and cause reduced volume and/or distortion. I use an inexpensive amplified computer speaker plugged into the audio interface external speaker jack to reduce the load.

You will need two cables to connect the unit to your radio. A 3.5 mm mono plug-to-plug shielded cable for the mic circuit is compatible with a Heil headset mic. A 3.5 mm stereo plug-to-plug cable (RadioShack 42-2387 plus 274-367 adapter) works for the earphones.

Summary

Last year's CQ WW DX Phone contest and SKYWARN event were my trial runs with the unit. In both cases my co-operator and I used VOX for radio operation and two foot switches for intercom use. The unit made it much easier on our ears and voices. Now for our club's real test: ARRL Field Day!

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