

By William Rynone, PhD, PE

A CW Generator and Audio Distribution System for Students



Up to eight students can copy CW at the same time with this distribution amplifier, and it even includes its own CW oscillator!

The Anne Arundel (Maryland) Amateur Radio Club president, Bob Rose, AA3RR, dedicated a significant portion of one of our meetings to a discussion of how we might encourage more young people to join the ham community. It seems that Bob had attended a meeting of another club where a junior group was “in full swing.” He was quite impressed and wanted to see if we could achieve similar results.

Of course, one of the challenges involved in developing potential new amateurs is providing educational assistance. Arranging classes is easy, even when they take place on Saturdays (Saturday classes are welcomed in the Northeast during the cold winter months!). Teaching theory in a classroom setting is straightforward, too. CW instruction in a group setting, however, is another matter. This can be a challenge to both students and teachers.

Bob determined that the best approach was to teach the receiving portion of the code lesson to all the students simultaneously. To minimize interference and to enhance concentration, the students would have to wear headphones. With these objectives in mind, he requested that volunteers design and build a combination code practice oscillator and distribution amplifier.

Meeting the Requirements

Bob specified that the system should provide headphone outputs to eight students. Each student would have the ability to adjust the audio level for his set of headphones. The club had already purchased eight identical sets of headphones at a Dollar Store, but we wanted to preserve the flexibility for each student to use his personal headphones as well.

We considered trying a basic audio power amplifier, but the students might be using low-impedance headphones. In this instance, we’d have to be careful to use coupling capacitors with high capacitance ratings (think “large”). On the other hand, the output terminals of dual power supply op-amps are almost at ground (with no applied signal). Thus, no output coupling capacitors would be required. The choice seemed obvious.

Finally, we wanted to keep the CW oscillator design as simple, yet stable, as possible. It would also be convenient if the project could include an input from an external audio source. That would give the instructor the flexibility to either generate the practice himself, with a key or keyer of his choice, or use a tape player or similar device.

Building the Distribution Amplifier

The schematic diagram is shown in Figure 1. You’ll notice right away that this project is based on the Fairchild KA334 dual op-amp IC. While this op-amp is not common, it is an excellent choice for its current handling and the fact that you can couple almost any low-impedance load directly to its output without bulky transformers or coupling capacitors. If you have difficulty finding the KA334, try obtaining them as samples directly from Fairchild. The best way to do this is on the Web at www.fairchildsemi.com/samples/index.jsp. Create an “end user account,” then request samples of the KA334. You’ll only need five to complete this project.

The power supply was designed with simplicity and cost in mind. A single transformer, a bridge rectifier (U1), a DIP socket and two filter capacitors are the only parts used. The transformer is a very common 6.3-V center-tapped filament model. The bridge rectifier used in this project is a four-pin DIP unit. This was selected for its small size. Since we’re using a socket, the rectifier is easily replaced should an inadvertent short “cook” the bridge.

To avoid the cost, weight and volume of a CW oscillator that employs a resonant L-C network, the circuit chosen was a Wein Bridge oscillator running at approximately 625 Hz with one section of a KA334 (U2). This type of oscillator only requires resistors and capacitors in the frequency-determining feedback network. A CW key plugged into the 1/8-inch jack at J1 can key the oscillator. Alternatively, you can patch the audio output of a tape player into jack J10 and feed its signal into the amplifier network. SPDT switch (S2) allows you to select either the CW key or tape player option.

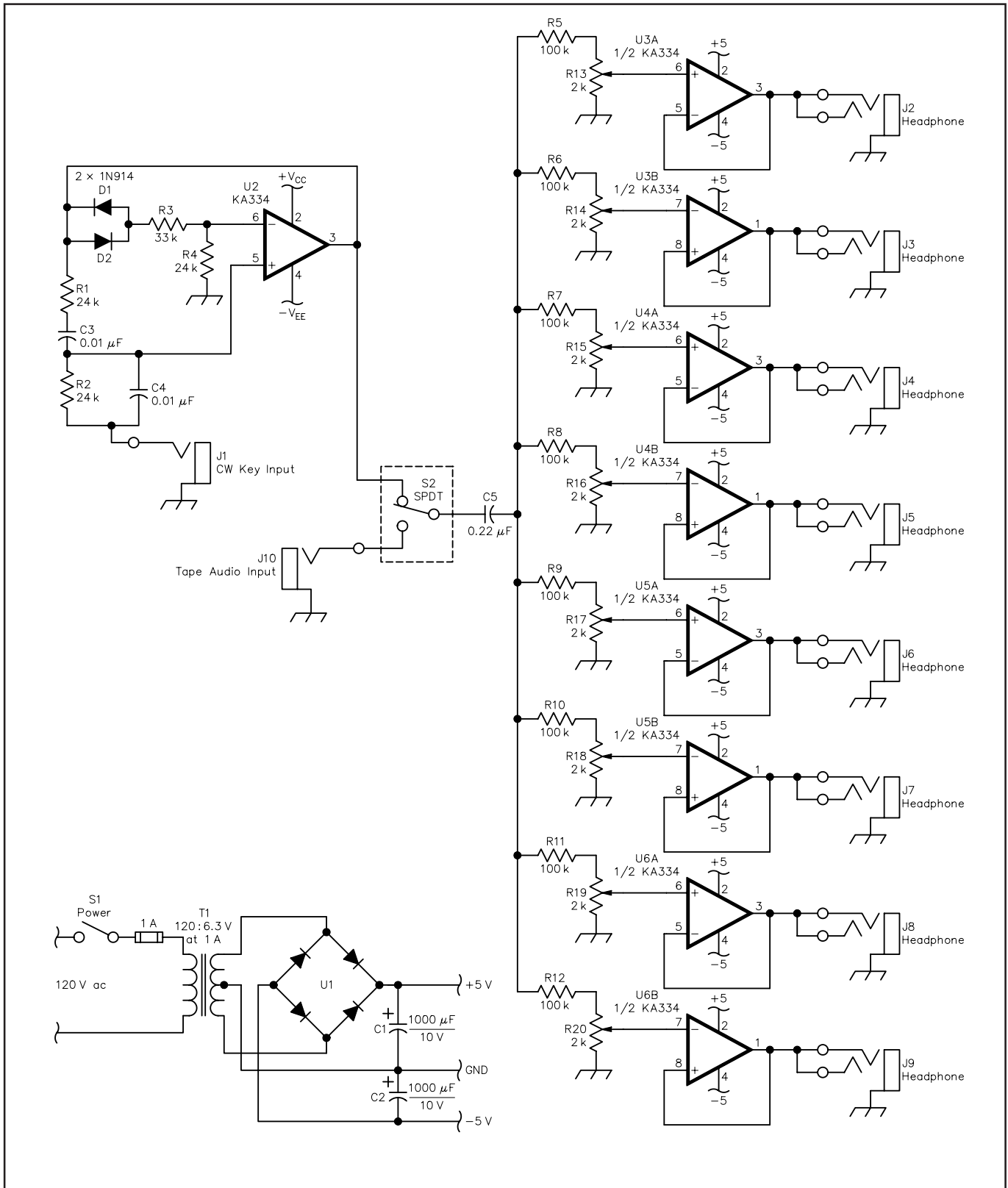


Figure 1—Schematic diagram of the distribution amplifier. RadioShack part numbers shown in parentheses unless otherwise noted.

C1, C2—Electrolytic capacitors, 1000 μF at 10 V (272-1047).

C3, C4—0.01 μF ceramic disk capacitors.

C5—0.22 μF ceramic disk capacitor.

D1, D2—1N914 diodes.

J1— $1/8$ -inch 2-conductor jack (274-251).

J2-J10— $1/8$ -inch 3-conductor jacks (274-246).

R1, R2, R4—24 $\text{k}\Omega$ $1/4$ -W resistors.

R3—33 $\text{k}\Omega$ $1/4$ -W resistors.

R5-R12—100 $\text{k}\Omega$ $1/4$ -W resistors.

R13-R20—2 $\text{k}\Omega$ potentiometers, audio taper.

S1—SPST toggle switch (275-651).

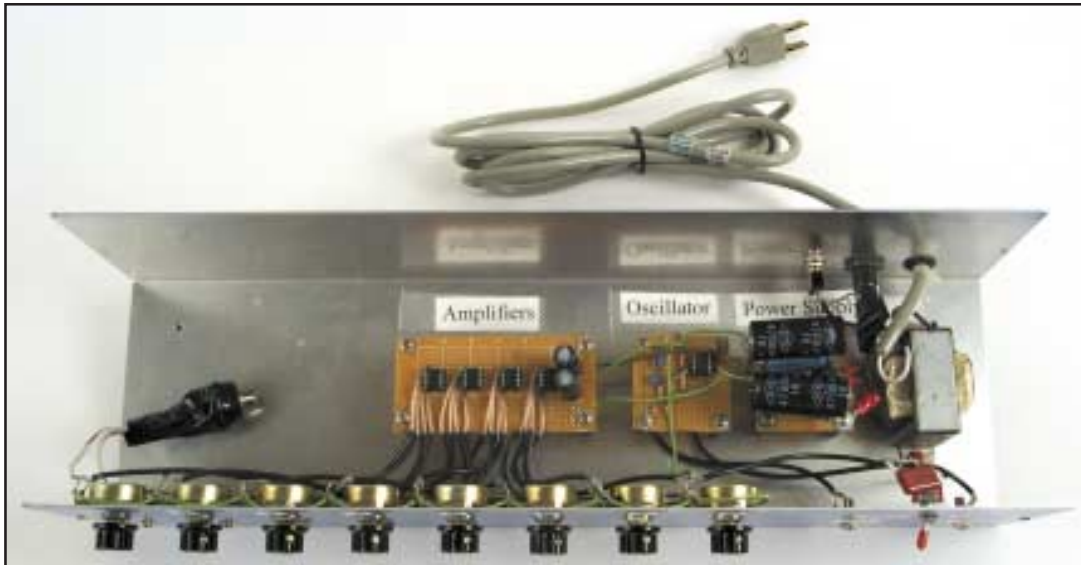
S2—SPDT toggle switch (275-603).

T1—Transformer, 120 V primary, 6.3 V center-tapped secondary at 1.2 A. Available from Mouser Electronics, part no. 553-F14X. Tel 800-346-6873; www.mouser.com.

U1—Bridge rectifier, 1 A at 200 V (276-1161).

U2-U6—Dual op-amps, Fairchild KA334 (see text).

Misc—Perfboard, knobs, enclosure.



Interior view of the distribution amplifier.

The distribution amplifier consists of four KA334s, U3-U6, each plugged-into eight-pin DIP sockets. The op-amp inputs are derived from the wipers of potentiometers (the audio level controls). The signal from the oscillator or tape player is simultaneously fed into one end of eight $100\text{ k}\Omega$ $\frac{1}{4}\text{-W}$ resistors, and then fed into each of the eight potentiometers before being applied to their respective op-amps. The output of each op-amp is directed to one of eight headphone jacks (J2-J9) that are mounted on the front control panel.

The power supply, oscillator and the amplifier parts were mounted on separate perf boards, but could be combined into a single unit. The perf boards are then mounted on standoffs on the bottom of a Bud box which functions as a chassis.

Depending on the approach you use, and how handy you

are with tools, this can be a single-evening project. The result will be most appreciated by your CW students!

Acknowledgments

Oscar Ramsey, NV3G, displayed his parts layout and wiring skills, and Norm Chipps donated parts and supplied ideas from his extensive practical knowledge. Dick Wilkinson used his beautiful Nikon camera to its best and also provided labels. Professors (Ret) Ralph Santoro and Steve Burns made valuable technical contributions.

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FEEDBACK

In Figure 1 of “A CW Generator and Audio Distribution System for Students” (Feb 2002 *QST*, p 63), the top input terminals of the eight op-amps (U3A through U6B) should be marked with a plus sign (non-inverting input terminal), and the bottom terminals should be marked with a negative sign (inverting input terminals). In addition, pins 5 and 6 are reversed in the op-amps shown in Figure 1.—*Bill Rynone*