

SUPER STEREO HEADPHONE AMPLIFIER KIT

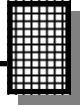


Ramsey Electronics Model No.

SHA2

Want to listen to your audio source with headphones but the manufacturer provided no headphone output? No problem; simply connect the line level output to the input on the SHA2, connect your stereo headphones, and you're all set! This is the next generation headphone amp with the ability to connect multiple outputs and with more control options than our SHA1.

- **Separate volume, treble, bass, balance and loudness**
- **Signal level clipping indicator LED**
- **Stereo loop-through for multiple feeds with separate controls**
- **CD quality audio**
- **Runs on a 9 volt battery or 12 to 20 VDC external power**



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- LEDS1 LED Strobe Light
- BE66 Blinky Eyes Animated Display
- LTS1 Laser Trip Sensor
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RAMSEY AMATEUR RADIO KITS

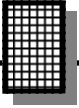
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- QRP Series HF CW Transmitters and QAMP Power Amplifiers
- CW7 CW Keyer

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SHA2 Super Stereo Headphone Amplifier
Ramsey Electronics publication No. SHA2
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INSTRUCTION MANUAL FOR

SUPER STEREO HEADPHONE AMP

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CIRCUIT DESCRIPTION

Let's take a look at the schematic diagram, we will follow through from input to output to get a general idea how this kit works, and why. We will look mainly at the left channel circuitry starting at J1. Items in parentheses , '(xx)', refer to the right channel signal path. Standard configuration settings will be assumed. See the optional configurations section for additional operation information.

The nitty-gritty of it all

A line level audio signal is connected to J1. Line level means an audio signal of around 1V peak to peak, will give a reading of 0dB on a VU meter. The audio passes through C9 (C10), a coupling capacitor. This capacitor prevents DC from entering the circuit from external components and interfering with audio quality. The capacitor lets the audio pass through to pin 19(2) of U3, an LM1036, which is the tone/volume/balance control IC.

This IC can be thought of as the heart of the SHA2. It provides control of all the major functions of the unit including volume, tone, balance and loudness. Without this IC there would be a large quantity of resistors, capacitors and amplifiers required to achieve the same functionality it provides. By the way, remember that it is actually two sets of these controls since this is a stereo system. R9, R10, R11 and R12 are the volume, tone and balance controls. These functions are controlled by U3 with a DC voltage applied to the respective control pins. This voltage is supplied by a built in reference source on pin 17 and each control varies the voltage on the control pins which is applied to its control pin. The loudness control, S1A, is used to provide a slight amount of bass boost when the volume is set to lower settings. Because your ear is less sensitive to low tones at low levels this provides a more robust sound at these levels. Capacitors C15 and C21 determine the way the treble control operates. Capacitors C19, and C20 are for the bass control while C16 and C18 are used both treble and bass.

After being processed the signal is sent from U3 pin 8(13) to the input of the output amplifier, U2(U4) pin 3 through C10(C17), another coupling capacitor like C9. U2(U4) is a fully integrated audio amplifier, capable of driving low impedance loads. It requires very few external components, runs very efficiently, and has great fidelity. U2(U4) amplifies the signal to drive a low impedance speaker like those in your headphones.

R7(R14) and C14(C27) on the output side of the LM386, U2(U4) is for preventing oscillations due to the inductive nature of a speaker coil being driven by the LM386. This makes the load of the speaker look more resistive rather than inductive which prevents "motorboating" of the audio signal.

C12(C24) is another coupling capacitor, and it serves the same purpose as C9 at the start of the circuit. This prevents the DC portion of the signal on the output of U2(U4) from being sent to the headphones.

The clipping detector circuit

The clipping detector circuit watches the headphone output signal level and flashes an LED when the output signal comes close to the maximum level available from the LM386. This level is determined by the voltage divider formed by R15 and R17.

U1C and U1D form comparator circuits for the left and right channels. The output signals from U2(U4) pin 5 is fed to U1C(U1D) pin 10(12), the '+' or non-inverting input, of the comparator. If this signal level exceeds the level on pin 9(13) the output, pin 8(14), will go to a high state about equal to the supply voltage of 9 volts. This forward biases diode D2(D5), causing it to conduct and apply a positive voltage through R16 and light the clipping LED D3. R16 is simply a current limiting resistor to prevent D3 from conducting too much current and 'burning out'. Because the outputs of the two comparators are basically at ground under non-clipping conditions D2 and D5 are needed so that if one comparator output goes high and the other is still low the current to light D3 is not grounded through the low output.

The looping buffer

The purpose of this circuit is to provide a signal which is identical to, but isolated from, the input signal to feed other devices such as additional SHA2 units, your tape recorder, etc. The isolation feature prevents the additional devices from interfering with the original input signal. For example if the other the device were to develop a short it will not affect the unit that it is being fed from.

U1A(U1B) are used as a unity gain amplifier or buffer. The input signal is feed through C1(C2), a coupling capacitor, to the buffer amplifier input pin 3(5). The output of the buffer then goes through C31(C32) to the buffered loop output. R1(R4) and R2(R3) form a voltage divider which sets a bias level on the '+' input of the amplifier which is half of the supply voltage. This allows the input signal to swing around this point and produce an output signal which is between ground and the power supply voltage. This is basically the same way the clipping detector works except the output of U1A(U1B) is made to swing between 0 and the supply voltage as long as the input level does not exceed a peak-to-peak level greater than the supply voltage. Capacitor C31 (C32) removes the DC level of the output and presents a signal which is centered around 0 volts to the loop output jack. R19(R18) Provide a path for C31(C32) to discharge and also sets the impedance of the output. This low

impedance makes it possible to connect multiple devices, like the SHA2, with high impedance to the output without having any significant effect on the quality of the signal. This is called bridging the output.

Wondering what impedance is? If you know about resistance you know, or I'll tell you, resistance is a measurement, in ohms, of the amount of resistance to current flow in a DC circuit. Like a garden hose that is crimped. There is less water (current) flowing in the hose because of the crimp (resistance)). Impedance is the same thing but is used to describe resistance to an AC current flow. Why the difference? The resistance (impedance) of an AC circuit is affected by the frequency of the AC signal but there is no frequency involved with a DC signal. The impedance of an amplifier input will be different for every signal frequency applied to it but a circuit which has only DC current will always be the same. When an impedance is specified it is usually for a frequency at the center of the range expected.

What about H1 and H2?

Notice that the input to the looping buffers have a set of jumpers, H1(H2), feeding them. These jumpers allow you to choose between the direct input feed to the SHA2 or the output of the LM1036 processor. By connecting a jumper between pins 1 and 2 of the headers the buffered output is simply whatever the input is. If the jumper is placed between pins 2 and 3 the buffered output becomes the processed signal provided to the headphone amplifiers.

Let's say that you want to use your SHA2 to listen to the record level output of your amplifier because it does not have a headphone jack but you also want to be able to record the program you are listening to. Yes you could simply connect a 'Y' adaptor to the output and plug in the recorder. But what would happen if the cables to the recorder became shorted to ground. Now you lose the signal to everything connected to the recorder output. The looping buffer in the SHA2 will prevent the recorder from affecting your headphones if the recorder is defective.

Now let's consider a situation where you have several power amplifiers that are connected to speakers in different areas. You want to control all the levels from one central location. By connecting pins 2 and 3 on the headers you can feed all the amplifiers from the SHA2 and have your monitor headphones too.

How about feeding one signal to a string of monitors for your band. Simply daisy chain the SHA2's using the looping buffers. The possibilities are nearly endless. The choice is yours.

The power supply

VR1, C29 and C28 supply the regulated DC voltage for the circuit. VR1 regulates the input, which should be around 12VDC input to J5, to a level of 10VDC for use in the unit. Yes the internal supply voltage indicates it is 9VDC and here is the reason why. You will notice that diode D1 is connected between VR1 and the power switch. This diode is to prevent voltage being applied to the output of VR1 from battery BAT1. Diodes are neat things because they will only conduct current in one direction such as in this case when a positive voltage is applied to the anode of the diode with respect to the cathode. (OK... the cathode is the side of diode to which the arrow points in the schematic or the end with a band or 'mark' on it in the actual device. The anode is the other side. The cathode likes to be negative with respect to the anode.) Anyway, you never get something for nothing and in the case of the diode when it is conducting there is about .6 volts lost across it so the voltage supplied to the circuitry is around 9.4 volts but we'll just call it 9VDC.

You will notice that the power jack, J5, has a switch contact which disconnects the battery from the circuit when external power is being used. This prevents the battery from attempting to charge when you are using an external power supply. It is not a good idea to attempt to charge a battery, in fact it can cause a battery to explode, if the battery is not designed to be charged. NEVER attempt to charge a standard alkaline or carbon/zinc battery.

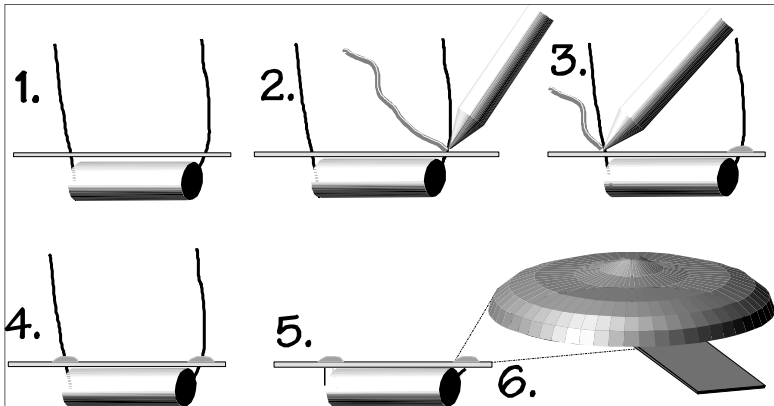
RAMSEY “LEARN-AS-YOU-BUILD” ASSEMBLY STRATEGY

Be sure to read through all of the steps and check the boxes as you go to be sure you didn't miss any important steps. Although you may be in a hurry to see results, before you switch on the power check all wiring and capacitors for proper orientation. Also check the board for any possible solder shorts and/or cold solder joints. All of these mistakes could have detrimental effects on your kit - not to mention your ego!

Kit building tips:

Use a good soldering technique - let your soldering iron tip gently heat the traces to which you are soldering, heating both wires and pads simultaneously. Apply the solder to the iron and the pad when the pad is hot enough to melt the solder. The finished joint should look like a drop of water on paper - somewhat soaked in.

Mount all electrical parts on the topside of the PC board. This is the side that has few or no traces on it, the side with the silkscreen writing. When parts are installed the part is placed flat to the board and the leads are bent on the backside of the board to prevent the part falling out before soldering (1). The part is then soldered securely to the board (2-4), and the remaining lead length is then clipped off (5). Notice how the solder joint looks close up, clean and smooth with no holes or sharp points (6).



SHA2 PARTS LIST

CAPACITORS

- 5 10 nF ceramic disc capacitors [marked 103] (C3,13,15,21,25)
- 2 100nF ceramic disc capacitors [marked 104] (C14,27)
- 2 100pF ceramic disc capacitors (marked 100, 101, or 101K) (C11,23)
- 4 220nF ceramic disc capacitors (marked) (C6,7,8,26)
- 2 390nF ceramic disc capacitors(C19,20)
- 14 10uF electrolytic (C1,2,4,9,10,16,17,18,22,28,29,30,31,32)
- 2 220uF electrolytic (C12, 24)
- 1 470uF (C33)

RESISTORS

- 2 2 ohm resistors [red-black-gold] (R7,14)
- 3 470 ohm resistors [yellow-violet-brown] (R16,18,19)
- 4 47k ohm resistors [yellow-violet-orange] (R5,6,8,13)
- 1 100k ohm resistor [brown-black-yellow] (R15)
- 1 560k ohm resistor [green-blue-yellow] (R17)
- 4 1M ohm resistors [brown-black-green] (R1,2,3,4)

SEMICONDUCTORS

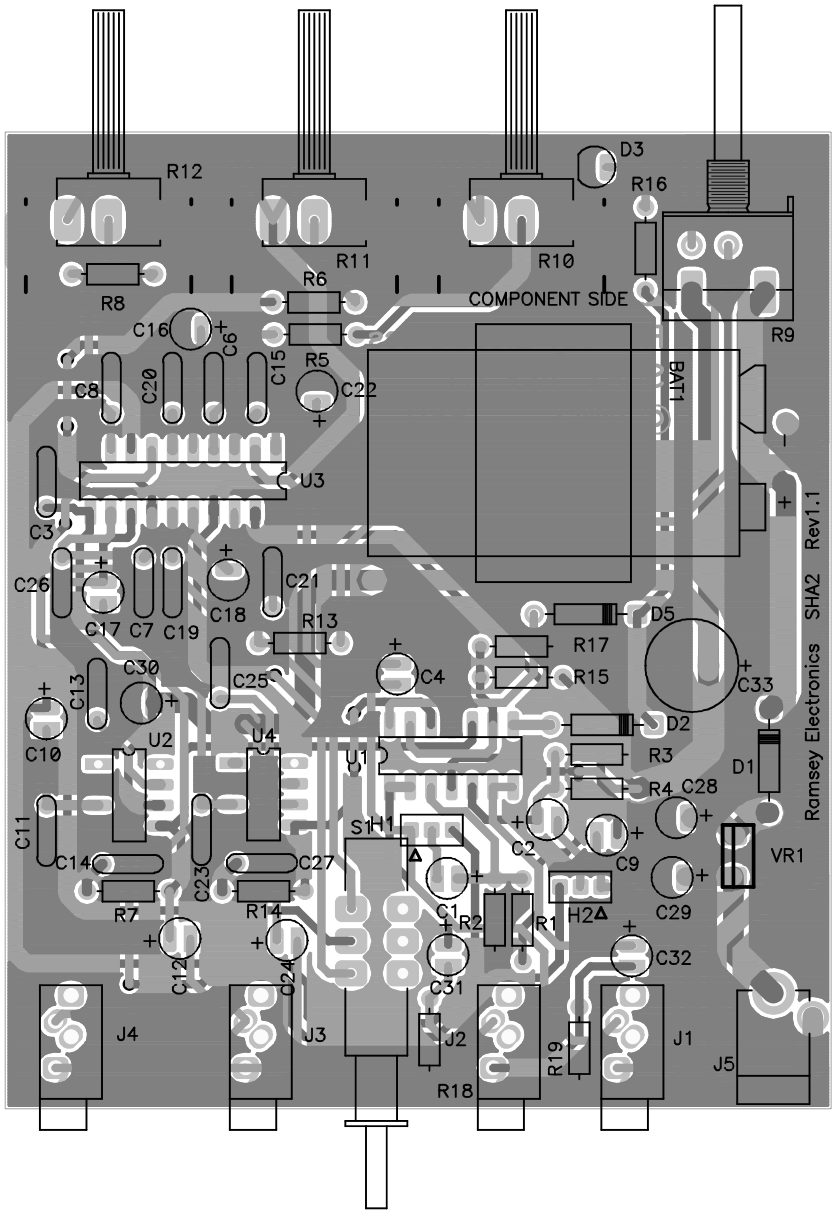
- 3 IN4000 series diodes (IN4000 to IN4004) [black body, white band] (D1,2,5)
- 1 7810 10V voltage regulator (VR1)
- 1 Red LED (D3)
- 2 LM386N low voltage audio power amplifier (U2,4)
- 1 LM1036N dual DC operated tone/volume/balance IC (U3)
- 1 LMC660AIN quad rail to rail op amp (U1)

CONTROLS, HARDWARE, AND MISCELLANEOUS

- 3 100k ohm PC mount potentiometers (R10,11,12)
- 1 100k ohm PC mount switch potentiometer (R9)
- 1 9V battery clip (BAT1)
- 1 9V battery snap
- 1 DPDT pushbutton switch (S1)
- 2 3 pin headers (H1,2)
- 2 Jumper blocks for 3 pin headers
- 4 3.5mm stereo jacks (J1,2,3,4)
- 1 2.1mm power jack (J5)

REQUIRED, NOT SUPPLIED

SHA2 PARTS LAYOUT DIAGRAM



ASSEMBLY STEPS

You've got your parts sorted, your iron is warmed up, so let's get started. We'll follow a logical order when installing the parts in your kit. Take your time and be sure to make good, solid solder connections.

Save a couple of the longer leads that you snip off the back when trimming. You need one of them for a later step.

- Install U3, LM1036N dual DC operated tone/volume/balance IC. You'll see the PC board silkscreen shows a notch on one end of the part; this corresponds to the notch on the IC and shows you which way to place the part. Line up the notches and make sure that all pins are through the board. Since no other parts have been installed, when you flip the board over to solder the part you can have it sit flat on your bench and the board will hold U3 in place. That way the part will be correctly seated on the board. That's why we're putting the ICs in first! We typically solder the two corner pins, flip the board over to check placement, then solder the rest.
- Install U1, LMC660AIN quad rail to rail op amp. Follow the notched end for placement and be sure the part is sitting flat on the board before soldering all the pins.
- In the same way, install U2 and U4, the LM386N low voltage audio power amplifiers. Orient the notched ends and check placement before soldering all 8 pins on each chip.

Ok, you're warmed up now. Let's start installing the smaller components. If you place the board so that the jacks, J1 through J4 are on the bottom and the silkscreen writing is facing you so that you can read it, we'll start at the upper right corner of the board, near R9. We'll skip the larger switches, knobs, and jacks for now and install those at the end.

- Install R16, 470 ohm resistor (yellow-violet-brown).
- Moving to your left, install R6, 47k ohms (yellow-violet-orange).
- Install R5, another 47k ohm resistor (yellow-violet-orange).



Here at the shop we typically insert a number of parts through the board, bend the leads out so that they stay put, and solder a group of parts all at one time. Now you don't want a forest of leads to have to work through but 5 - 10 part groups seem to work well.

- Install C22, the first of many 10uF electrolytic capacitors. These parts have a polarity and must be installed correctly in order to function. The PC board silkscreen shows a "+" sign next to one of the holes for the part. This corresponds to the longer of the two leads, the positive. The negative

lead is not only shorter than the other, it has a band or stripe running down the body of the part next to the short lead that shows zeros or minus signs. Be sure to install the part so that the positive lead goes into the hole marked with a “+” sign and the negative lead into the other. Push the part down until it sits on the board and solder both leads.

- Install C15, 10nF ceramic disc capacitor (marked 103).
- Install C6, 220nF ceramic disc capacitor (marked 224).
- Install C20, 390nF ceramic disc capacitor (marked 394).
- Install C8, 220nF ceramic disc capacitor (marked 224).
- Install C16, 10uF electrolytic capacitor. Remember to orient the part following the “+” sign on the silkscreen and Parts Layout Diagram.
- Install R8, 47k ohms (yellow-violet-orange).
- Install C3, 10nF ceramic disc capacitor (marked 103).
- Install C26, 220nF ceramic disc capacitor (marked 224).
- Install C17, 10uF electrolytic capacitor. Remember the polarity when installing.
- Install C7, 220nF ceramic disc capacitor (marked 224).
- Install C19, 390nF ceramic disc capacitor (marked 394).
- Install C18, 10uF electrolytic capacitor. Watch orientation!

Ok, if you haven't already done so you might consider a little break at this point. Rest your eyes, stretch, then take a look at your parts placement and solder joints to be sure they look great before moving on.

- Install C21, 10nF ceramic disc capacitor (marked 103).
- Install R13, 47k ohm resistor (yellow-violet-orange).
- Install C25, 10nF ceramic disc capacitor (marked 103).
- Install C30, 10uF electrolytic capacitor. I'd remind you to be careful how you install the part, remembering to check the polarity before soldering, but I don't want to bug you about it.
- Install C13, the last 10nF ceramic disc capacitor (marked 103).
- Install C10, 10uF electrolytic capacitor. Polarity.
- Install C11, 100pF ceramic disc capacitor (marked 100, 100K, or 101).

- Install C14, 100nF ceramic disc capacitor (marked 104).
- Install R7, a 2 ohm resistor (red-black-gold).
- Install C23, 100pF ceramic disc capacitor (marked 100, 100K, or 101). It's tucked in between U2 and U4.
- Install C27, 100nF ceramic disc capacitor (marked 104).
- Install R14, 2 ohms (red-black-gold).
- Install C12 and C24, both 220uF electrolytic capacitors. These are slightly larger than the 10uF caps you've been installing but the same rules apply as to polarity. Follow the stripe or band for the negative lead and place the longer positive lead in the hole marked with a "+" sign.

Now we'll move back up and toward the middle of the board. Hopefully you're not having too much trouble seeing where the parts are supposed to be placed.

- Install C4, 10uF electrolytic capacitor. Please orient it properly. Thanks!
- Install D5, 1N4000 series diode, another polarity sensitive component. The white band on the part and the white band shown on the silkscreen need to line up with each other. Solder as usual.
- Install R17, 560k ohms (green-blue-yellow).
- Install R15, a 100k ohm resistor (brown-black-yellow).
- Install C33, 470uF electrolytic capacitor. Remember the rules for electrolytic caps and follow the "+" sign.
- Install D1, 1N4000 series diode. The white band shows the way to place the part.



While you're clipping leads on the back side of the board you can also check the solder joints and immediately touch up any that don't look right. You're already looking at the connections closely and it's a good time to spot mistakes!

- Install VR1, the 7810 10V voltage regulator. The writing on the part should face the outside of the PC board. Bend the center lead out so that the part fits into the holes and solder it in.
- Install D2, 1N4000 series diode. Again, follow the white band on the board and on the part for orientation.
- Install R3, 1 M ohm resistor (that's a million ohms!) (brown-black-green).

- Install R4, another 1 M ohm resistor (brown-black-green).
- Install C28, 10uF electrolytic capacitor. Remember the polarity yet again.
- Install C29, 10uF electrolytic capacitor. Placement.
- Install C9, 10uF electrolytic capacitor. Watch your placement..
- Install C2, yup, another pesky 10uF electrolytic. The lead with the band goes in the hole opposite the one marked with the “+” sign, as usual.
- Install R1 and R2, both 1 M ohm resistors (brown-black-green).
- Install H2, one of the three pin headers. The long pins stick up from the board and the short pins go into the board to be soldered.
- Install C32, yet another 10uF electrolytic capacitor.
- Install R19, 470 ohm resistor (yellow-violet-brown). You’ll find it between J1 and J2.
- Install H1, the other three pin header.

We’re in the home stretch now, just a few more parts to install. Take a break when you need to and then let’s get building again.

- Install C1, 10uF electrolytic capacitor. Positive lead, “+” hole.
- Install C31, 10uF electrolytic capacitor, and this is the last time you’ll have to hear about polarity and orientation. Refreshing, isn’t it?
- Install R18, 470 ohms (yellow-violet-brown), between J2 and J3.

Jacks, pots, switches and we’re just about ready to fire up your headphone amp.

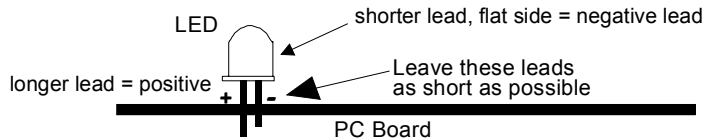
- Starting at the left and working our way to the right, let’s install J4, one of the 3.5mm stereo jacks. This part and the rest of the jacks and switches will want to sit flatly and nicely on the PC board so that the kit fits well when you go to case it up and so that you don’t have trouble plugging things in, etc. Take your time and do it right, and we’re almost finished anyway so a few extra minutes here won’t cost you much but will pay off in the end.
- In the same way, install J3, another 3.5mm stereo jack. Remember when headphone jacks were all 1/4”? Now they’ve all gone over to 3.5mm. Of course some of us remember those single ear, cream colored earphones you’d get with your transistor radio. Hmmm, kind of dating myself now, huh? Ok, let’s get back to building!
- Locate the DPDT switch and install it in the S1 position. Happily, I have no

stories about DPDT switches to bore you with.

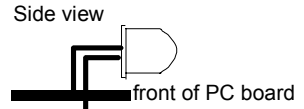
- ❑ Back to jacks, install J2 and while you're at it, let's install J1 and get it over with. Both are 3.5mm stereo jacks.
- ❑ Now install J5, the 2.1mm power jack.
- ❑ Time to install the 9V battery holder. This is where you'll need that clipped off lead from the beginning of your construction. This is bent into the shape of a staple that will fit through the holes in the battery holder and down through the top of the circuit board. Once the holder is on the board with the "staple" through it, bend the leads out on the backside of the board to hold them in place, then solder. The tighter the bend the less slop you'll have in the battery holder. If you want it perfectly tight then get it where you want it and solder the "staple" wire right to the battery clip on the topside of the board.

We still have to flip the board over a few more times so let's install the battery snap last; that way it won't flop around too much.

- ❑ Install R9, the 100k ohm PC mount switch potentiometer. It's different from the other three and easy to spot.
- ❑ Before we install R10 we'd better install D3, the mini red LED.



The part has a flat side and a flat edge is shown on the PC board for orientation. This part will be bent over and the LED will be sitting on the board when you're finished. In other words, very short lead length above the board.



- ❑ Install R10, R11, and R12, 100k ohm PC mount potentiometers. These parts will want to sit flat on the board before you solder them. They like it that way.



I like to solder the 3 center leads on the pots, then take my time and solder all the ground connections on each one. The ground connections will take a bit more time because the surface area of the ground plane is larger than the small pads you're used to. But don't worry, you won't hurt anything leaving the iron on a bit longer with these connections. In fact, you'll have to do it that way to get a solid solder joint. And soldering all the grounds together will actually make it easier since the plane will stay hotter as you keep working from one connection to another.

- ❑ The battery snap is the last part to be installed. The red lead goes into the hole marked with a “+” sign and the black goes into the “-” hole. You can tin the leads by twisting them together and melting some solder on them or you can simply twist them, put them through the board, and solder them. It’s up to you. Just don’t tin them so much that they don’t fit through the holes in the board.

That’s it! But wait, before you grab a battery and fire up your kit let’s check a few things. Mainly check the orientation of the ICs, diodes, and all those electrolytics. We don’t want anything to go “pop” when we apply power, right? Also check your solder joints for any that are less than perfect and make sure that all the solder connections you see on the back are supposed to be there. Bridges can be dangerous to your circuit. Be sure none of your clipped off wires have lodged between the connections on the back. When you’re satisfied we’ll move on and give your headphone amp a try.

SETUP AND TESTING

It's time to apply power to your SHA2 and start listening to your line level sources.

You need:

- An AC adapter or a fresh 9 volt battery
 - A line level audio source (CD player line out, etc.)
 - A cable to connect the audio source to the SHA2. Either dual RCA to 3.5mm stereo or 3.5mm stereo to 3.5mm stereo, depending on what connector(s) are on your line level source.
 - Headphones
1. Connect your audio source to J1, the line level audio input jack.
 2. Connect your headphones to either J3 or J4, the headphone outputs.
 3. Connect your DC supply or 9 volt battery.
 4. Turn on your line level source.
 5. Turn on your SHA2. The LED, D3, should light and then go out after a few seconds. Turn the volume up to a comfortable level.
 6. You should be hearing your line level audio source at this point. Now try the balance control, R12, and get the balance between left and right set where you want it.
 7. Try out the treble control, R10, and the bass control, R11, and set them for the sound you want.
 8. Next try pressing in S1, the loudness control. You should hear the difference immediately. It almost sounds like a bass boost but you'll notice that the overall loudness increases too.
 9. Plug another set of headphones into the other headphone jack and try that out too.

When you first see your LED light you may think that it's a power on indicator, and it is temporarily when you first turn on the kit. After that it's a clipping indicator, showing you when the audio level is close to the maximum output of the IC. During typical operation this LED will be off.

The buffered loop output, J2, allows you to connect the line level audio output of your SHA2 to another device. You can set the SHA2 up so that the output is directly coupled, just as if you had your line level source connected right to the other device, or you can send the line level audio to another source with the tone controls added. This is done using jumper headers H1 and H2.

You can set the left and right channels independently of each other. H1 controls the right channel of the stereo output and H2 controls the left channel. Pin 1 on both H1 and H2 is marked by a triangle. By placing a jumper block between pins 1 and 2 of H1 and H2, the buffered output follows the input exactly. Whatever you have coming in on the audio input is what will be sent out on J2. Placing the jumper block between pins 2 and 3 of H1 and H2 causes the buffered output to have the same tone controls applied to it as the headphone output. You can put the jumper block on H1 and not H2, on H2 and not H1, etc. so that one channel would have tone control applied to it and the other would exactly follow the input. It's all up to you.

Once you have the jumpers set, try plugging the buffered output into the line level input on a piece of equipment and make sure it's working correctly. If you have the tone controls set and have H1 and H2 jumpered for it you should be able to hear that the original line level source has been changed and now matches what you're hearing through the headphones.

That's about it. You're ready to start using your SHA2.

One last thought about the buffered output. You can use it to daisy chain more than one SHA2 so that all headphone outputs on the chain are hearing the same source. Simply plug the buffered output of the first SHA2 into the line level input of the second SHA2. Now you have 4 headphone jacks all on the same "channel", all hearing the same audio. Think of the possibilities for long car trips. A portable DVD player with a line level audio output, 2 to 4 children in the back of a minivan all happily listening to a movie on their own headphones, peace and quiet for the driver. Sounds lovely, doesn't it?

We're sure you'll come up with other uses for your SHA2, such as plugging the line level output of your Bose radio into it so that you can listen on headphones. Or plugging a line level audio source into your Ramsey FM transmitter through an SHA2 so that you can monitor the broadcast without having to tune in an FM radio. And there are probably many other applications that we haven't even thought of yet. Let us know if you come up with something interesting, ok?

TROUBLESHOOTING

While we hoped it wouldn't come to this, it's possible that your SHA2 didn't work as soon as you applied power. The main thing to remember in a situation like this is . . . don't panic! It's usually something simple and since you built the kit, you know the kit and you'll find it if you look carefully. Just follow a logical approach when troubleshooting.

The first thing to check is always your component placement, especially ICs, diodes, and electrolytic capacitors. Make sure that the resistors with similar color bands haven't been switched. Then flip the board over and make sure that all the solder connections look good, that none have been missed, and that there are no bridged connections that don't belong. 90% of the problems we see on kits that have been sent in for repair are construction errors of one kind or another so this really is the place to start.

Check your headphones on a different source to be sure they aren't the problem. This is also a good thing to do if the SHA2 seems noisy because it's probably not the kit but may well be a poor connection inside the headphones.

The next step may seem obvious but we'll state it anyway. Be sure you have a good 9 volt battery or a good power source if you're using a wall transformer. A multimeter is helpful here. Also be sure that the tip of the adapter is positive, especially if you didn't get it from Ramsey. A meter isn't the best way to test a battery but it will tell you if a 9 volt is beyond hope. A battery tester will put the battery or cell under a load and give you a better indication of its condition. If the input power from your regulated supply or wall transformer is good you can check your regulator to see what's coming in and if you have a good 10 volts going out. (This does not apply if you're using a 9 volt battery; the kit runs directly from the battery and bypasses the regulator.) If the output of the regulator is good then you can take a look at the schematic and note the power input pins on the ICs, then check them to be sure they're being supplied with the correct voltages.

Beyond these checks you'll need some test equipment such as an oscilloscope to follow your line level source through until you see the signal stop. You can read the warranty instructions on the inside back cover of this manual and send the kit in for repair if you get in over your head. All the information for returning a kit to Ramsey for repair is on that page.

If you need help you can call Tech Support at 585-924-4560 and speak with a technician. You can expect to be taken back over the ground covered above when you call, so be prepared. We can tell the people who read through the troubleshooting and checked their kit over from the ones who panicked and called before checking. But rest assured that one way or another you'll have a working SHA2 when all is said and done.

If you enjoyed this Ramsey product, there are plenty more to choose from in our catalog - write or call today!

CONCLUSION

We sincerely hope that you will enjoy the use of this Ramsey product. As always, we have tried to compose our manual in the easiest, most “user friendly” format possible. As our customers, we value your opinions, comments, and additions that you would like to see in future publications. Please submit comments or ideas to:

Ramsey Electronics Inc.
Attn. Hobby Kit Department
590 Fishers Station Drive
Victor, NY 14564

or email us at: techsupport@ramseymail.com

And once again, thanks from the folks at Ramsey!

The Ramsey Kit Warranty

Please read carefully BEFORE calling or writing in about your kit. Most problems can be solved without contacting the factory.

Notice that this is not a "fine print" warranty. We want you to understand your rights and ours too! All Ramsey kits will work if assembled properly. The very fact that your kit includes this new manual is your assurance that a team of knowledgeable people have field-tested several "copies" of this kit straight from the Ramsey Inventory. If you need help, please read through your manual carefully, all information required to properly build and test your kit is contained within the pages! However, customer satisfaction is our goal, so in the event that you do have a problem, take note of the following.

1. DEFECTIVE PARTS: It's always easy to blame a part for a problem in your kit. Before you conclude that a part may be bad, thoroughly check your work. Today's semiconductors and passive components have reached incredibly high reliability levels, and it's sad to say that our human construction skills have not! But on rare occasions a sour component can slip through. All our kit parts carry the Ramsey Electronics Warranty that they are free from defects for a full ninety (90) days from the date of purchase. Defective parts will be replaced promptly at our expense. If you suspect any part to be defective, please mail it to our factory for testing and replacement. Please send only the defective part (s), not the entire kit. The part(s) MUST be returned to us in suitable condition for testing. Please be aware that testing can usually determine if the part was truly defective or damaged by assembly or usage. Don't be afraid of telling us that you 'blew-it', we're all human and in most cases, replacement parts are very reasonably priced.

2. MISSING PARTS: Before assuming a part value is incorrect, check the parts listing carefully to see if it is a critical value such as a specific coil or IC, or whether a RANGE of values is suitable (such as "100 to 500 uF"). Often times, common sense will solve a mysterious missing part problem. If you're missing five 10K ohm resistors and received five extra 1K resistors, you can pretty much be assured that the '1K ohm' resistors are actually the 'missing' 10 K parts ("Hum-m-m, I guess the 'red' band really does look orange!") Ramsey Electronics project kits are packed with pride in the USA. If you believe we packed an incorrect part or omitted a part clearly indicated in your assembly manual as supplied with the basic kit by Ramsey, please write or call us with information on the part you need and proof of kit purchase.

3. FACTORY REPAIR OF ASSEMBLED KITS:

To qualify for Ramsey Electronics factory repair, kits MUST:

1. NOT be assembled with acid core solder or flux.
2. NOT be modified in any manner.
3. BE returned in fully-assembled form, not partially assembled.
4. BE accompanied by the proper repair fee. No repair will be undertaken until we have received the MINIMUM repair fee (1/2 hour labor) of \$25.00, or authorization to charge it to your credit card account.
5. INCLUDE a description of the problem and legible return address. DO NOT send a separate letter; include all correspondence with the unit. Please do not include your own hardware such as non-Ramsey cabinets, knobs, cables, external battery packs and the like. Ramsey Electronics, Inc., reserves the right to refuse repair on ANY item in which we find excessive problems or damage due to construction methods. To assist customers in such situations, Ramsey Electronics, Inc., reserves the right to solve their needs on a case-by-case basis. The repair is \$50.00 per hour, regardless of the cost of the kit. Please understand that our technicians are not volunteers and that set-up, testing, diagnosis, repair and repacking and paperwork can take nearly an hour of paid employee time on even a simple kit. Of course, if we find that a part was defective in manufacture, there will be no charge to repair your kit (But please realize that our technicians know the difference between a defective part and parts burned out or damaged through improper use or assembly).

4. REFUNDS: You are given ten (10) days to examine our products. If you are not satisfied, you may return your unassembled kit with all the parts and instructions and proof of purchase to the factory for a full refund. The return package should be packed securely. Insurance is recommended. Please do not cause needless delays, read all information carefully.

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REQUIRED TOOLS

- Soldering Iron (WLC100)
- Thin Rosin Core Solder (RTS12)
- Needle Nose Pliers (MPP4 or RTS05)
- Small Diagonal Cutters (RTS04)

TOTAL SOLDER POINTS

214

ESTIMATED ASSEMBLY

TIME

Beginner..... 3 hrs
Intermediate..... 1.5 hrs
Advanced..... 1 hr

ADDITIONAL SUGGESTED ITEMS

- Helping Hands Holder for PC Board/Parts (HH3)
- Technician’s Tool Kit (TK405)
- Desoldering Braid (RTS08)
- Digital Multimeter Ramsey M133



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Manual Price Only: \$5.00
Ramsey Publication No. SHA2
Assembly and Instruction manual for:
RAMSEY MODEL NO. SHA2
Super Stereo Headphone Amplifier