

## SA-16-AR ASSEMBLY AND INSTALLATION GUIDE

Thank you for choosing the SA-16-AR Stepped Attenuator Kit, a replacement for the 16 Ohm pots used in many Acoustic Research loudspeakers. I would like to thank many of the people who post on the Acoustic Research forum at The Classic Speaker Pages, <http://www.classicspeakerpages.net/> , for advice and encouragement for this project. The AR forum at classicspeakers is an unending source of great information about AR speakers and the library at classicspeakers is the first place to look for technical information about AR speakers. Thanks also go to Mark Spencer (the admin and owner) who has done a wonderful job. If you are interested in classic speakers, then <http://www.classicspeakerpages.net/> is THE place to be.

Following are the assembly instructions for your new SA-16-ARs.

Note: The SA-16-AR is a fairly simple assembly project for anyone with even a little experience soldering. Disassembling the speaker and removing the pots and replacing them with SA-16-ARs is more difficult, but still well within the capabilities of most people.

If, after reading through these instructions, you feel uncomfortable with proceeding with the building and installation of the SA-16-ARs and would rather have a professional speaker repair service repair your speakers, under the terms of our "SA-16-AR 30 Day Fail-Safe Guarantee" you can return the kit(s) within 30 days of receipt for a full refund of the cost of the attenuators and the shipping we charged you. You will be responsible only for the cost of returning the kits.

### **Tools Needed:**

Soldering Iron or Gun (Radio Shack Model: 64-2071 or equivalent).

Damp sponge for tip cleaning is a nice accessory. A damp folded paper towel also works.

Solder (Tin-Lead 60-40 rosin core solder or equivalent) (Radio Shack 64-009 or equivalent). **DO NOT USE "ACID CORE" OR "ORGANIC CORE" SOLDER.**

Diagonal Cutting Pliers

Safety Glasses for use when cutting resistor leads and soldering.

Magnifying glass – for inspection

Volt -Ohmmeter with resistance measuring capability (for testing)

The following are useful for removing the pots and installing the attenuators in the speaker:

Needle Nose Pliers

Wire Strippers

Small screw driver (for knobs)

Pliers (or suitable socket driver, 9/16” for pot, will also fit 14mm for new nut)

Dust mask (for protection against the fiberglass stuffing used in the speakers)

Disposable gloves (for handling fiberglass)

**Parts Included (per kit):**

1 ea. SA-16-AR Printed Circuit Board

1 ea. Switch (Lorlin CK1054) Nylon Rotary Switch Mouser P/N 10WA344

(Stock Switch Shaft is cut to size and index pin is filed, includes mounting hardware)

Following are 2W resistors:

2 ea.	0.5 Ohm	R14 R15;	Mouser P/N 262-0.5-RC
4 ea.	1.0 Ohm	R4 R5 R16 R17;	Mouser P/N 262-1.0-RC
11 ea.	1.5 Ohm	R1, R2, R3, R6 thru R13;	Mouser P/N 262-1.5-RC
1 ea.	2.4 Ohm	R18;	Mouser P/N 283-2.4-RC
1 ea.	3.0 Ohm	R19;	Mouser P/N 262-3.0-RC
1 ea.	3.6 Ohm	R20;	Mouser P/N 262-3.6-RC

**Getting Started:**

Note: We recommend you build and test one attenuator at a time.

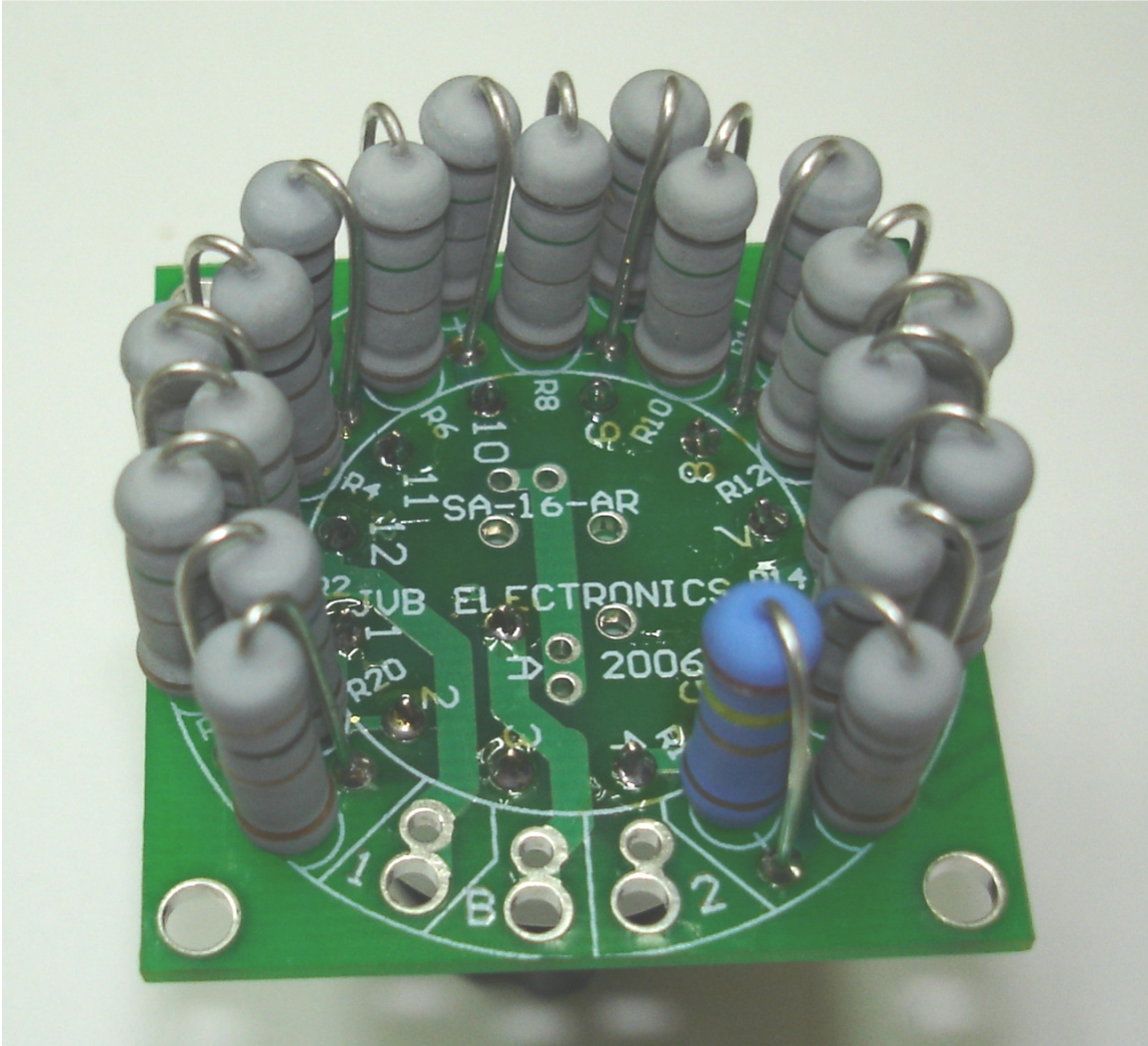
**Step 1.** Open the resistor packages and verify each resistor by the color code. Tape or glue the template below to a piece of styrofoam or cardboard and punch a small hole in the middle of each circle. The resistors may then be separated by value by sticking one lead in the hole. The count of resistors per value per attenuator is below the values. The colors of the 3 color code bands is below the count.

For reference: The color code for the value of these resistors is contained in the 3 colored bands near one end. The gold band on the other end indicates the resistor tolerance of 5%. The first 2 bands are coded as: 0=Black, 1=Brown, 2=Red, 3=Orange, 4=Yellow, 5=Green, 6=Blue, 7=Violet, 8=Gray, 9=White. The third band is the multiplier and, for resistors less than 10 Ohms, is either Silver (multiply by 0.01) or Gold (multiply by 0.1). An example: The three bands are Red-Yellow-Gold which would be 2(Red) 4(Yellow) multiplied by 0.1(Gold) , 24 times 0.1 = 2.4 Ohms.

					
0.5 Ohms	1.0 Ohms	1.5 Ohms	2.4 Ohms	3.0 Ohms	3.6 Ohms
2	4	11	1	1	1
Green	Brown	Brown	Red	Orange	Orange
Black	Black	Green	Yellow	Black	Blue
Gold	Silver	Silver	Silver	Silver	Silver

Resistor Separator Template (Use to Group Resistors by Values)

**Notes on Installing Resistors.** Each resistor will be installed “standing up” (See Figure 1.) Prepare the resistor for installation by gently bending one lead 180 degrees so that both leads are parallel and close together



**Figure 1. Completed SA-16-AR**

Resistors will be installed on the silkscreened side of the printed circuit (the side with white printing on it). The circle printed on the board surrounds the hole in the board that the body side of the resistor will be mounted in. The short white line from the circle to another hole indicates where the other lead (the bent-over) lead will mount. The identifier (R1, R2, etc.) is printed near the circle in each case.

When mounting the resistor, allow about 1/8 inch of clearance between the body and the board. This makes inspecting the solder joint easier and looks neat.

**Notes on Soldering:** Wear safety glasses when soldering or cutting. Heat the joint and feed in solder as needed. If you really don't know anything at all about soldering see one of the many excellent websites about soldering electronic components such as <http://www.mtechnologies.com/building/atoz.htm> and <http://et.nmsu.edu/~etti/fall97/electronics/solder.html> .

- Step 2.** Install R20 (3.6 Ohms) on the top of the board and solder both leads. After soldering, cut off the leads about 1/16 inch from the bottom of the board using diagonal cutters.
- Step 3.** Install R19 (3.0 Ohms) on the top of the board and solder both leads. After soldering, cut off the leads as before.
- Step 4.** Install R18 (2.4 Ohms) on the top of the board and solder both leads. After soldering, cut off the leads as before.
- Step 5.** Install R14 (0.5 Ohms) on the top of the board and solder both leads. After soldering, cut off the leads as before.
- Step 6.** Install R15 (0.5 Ohms) on the top of the board and solder both leads. After soldering, cut off the leads as before.
- Step 7.** Install 4 resistors, R4, R5, R16 and R17 (each is 1.0 Ohms) on the top of the board and solder both leads. After soldering, cut off the leads of all 4 resistors as before. **Note:** You should have installed all resistors except the eleven 1.5 Ohm resistors at this point.
- Step 8.** Install 11 resistors, R1, R2, R3, R6, R7, R8, R9, R10, R11, R12, and R13 (each is 1.5 Ohms) on the top of the board and solder both leads. After soldering, cut off the leads of all 11 resistors as before.
- Step 9.** Install the switch **ON THE BOTTOM** of the board (the side of the board without white printing on it, opposite the side the resistors are sticking up from). Pin A on the switch **Must** go in the hole marked "A" on the board. **Double-check this before soldering.** Solder the 12 outer pins and pin 'A' of the switch.
- Step 10.** Inspect your work. Use a magnifying glass. Check especially for unsoldered leads, 'cold' solder joints (grainy looking, not shiny), or joints where the solder didn't flow (balled up).

Your Attenuator is complete! Now to test it.

Using the multimeter on the lowest Ohms setting-

Note: Some digital meters won't go to 0 Ohms because they measure the lead and internal resistance of the meter. In this case your readings may be offset by the meter's built-in resistance. Simply subtract the shorted lead value from the measured value.

Meter inaccuracy and contact resistance (of the leads to the pads) will cause the values read to vary slightly.

- Measure from Pad 1 (Large hole marked '1') to Pad 2. Should be 16 Ohms.
- Rotate switch fully clockwise. Measure from Pad 1 to Pad 'B'. Should be 0 Ohms.
- Rotate switch 1 click CCW (counterclockwise). Measure from Pad 1 to Pad 'B'. Should be 0.5 Ohms.
- Rotate switch 1 click CCW. Measure from Pad 1 to Pad 'B'. Should be 1.0 Ohms.
- Rotate switch 1 click CCW. Measure from Pad 1 to Pad 'B'. Should be 1.75 Ohms.
- Rotate switch 1 click CCW. Measure from Pad 1 to Pad 'B'. Should be 2.5 Ohms.
- Rotate switch 1 click CCW. Measure from Pad 1 to Pad 'B'. Should be 3.25 Ohms.
- Rotate switch 1 click CCW. Measure from Pad 1 to Pad 'B'. Should be 4.0 Ohms.
- Rotate switch 1 click CCW. Measure from Pad 1 to Pad 'B'. Should be 5.0 Ohms.
- Rotate switch 1 click CCW. Measure from Pad 1 to Pad 'B'. Should be 7.0 Ohms.
- Rotate switch 1 click CCW. Measure from Pad 1 to Pad 'B'. Should be 9.4 Ohms.
- Rotate switch 1 click CCW. Measure from Pad 1 to Pad 'B'. Should be 12.4 Ohms.
- Rotate switch 1 click CCW, this should bring you to the stop. This is the last switch position. Measure from Pad 1 to Pad 'B'. Should be 16 Ohms.

Congratulations, you are finished building and testing the attenuator.

## Notes on Installation (AR-3a)

In order to replace the pots it is necessary to remove the woofer from the speaker. Some suggestions follow that may make the job of disassembling and reassembling an AR-3a speaker easier. This is not a complete how-to on speaker repair. Other models of speakers will be different. There is a lot of collected wisdom available at <http://www.classicspeakerpages.net/> both in the library and the Acoustic Research forum on classic speakers.

1. It may be necessary to pry the woofer out because of the putty used to seal it (some later versions used gaskets). If you need to pry, do it gently. Use more than 1 flat-bladed screwdriver and loosen the woofer gradually all the way around the edge. The putty may need a little time to give. The speaker should not be very cold when removing the woofer (stiff putty), room temperature is OK. You can save the putty for reuse if it isn't too stiff. We have used Thermwell Frost King (Mortite is another Thermwell brand) rope caulk (from Lowes) to replace the original putty. We use 2 strands of the 3/16" rope caulk for the woofer.

2. Desoldering and soldering the woofer generally requires 2 people, one to hold the woofer and one to desolder or solder the wires.
3. Mark the wire colors directly on the metal speaker basket near the connections BEFORE removing the wires.
4. Note how the brown porous fiber paper holds the fiberglass away from the woofer. You should try to replace the paper in approximately the same position when finished. Remove the paper and the fiberglass stuffing. Use a dust mask and disposable gloves and work outside when removing or replacing the fiberglass stuffing. Save the stuffing in a separate plastic bag for each speaker. If rock wool (instead of fiberglass) was used (some very old speakers used rock wool) consider replacing it with an equal weight of fiberglass (see the forums on classic-speaker-pages for pros and cons on replacement). We do not recommend replacing with fiberfill or any polyester stuffing or other flammable material.
5. Store the woofer carefully while removed from the speaker.
6. If a digital camera is available, consider taking photos of the pots and crossover wiring for reference.

In theory, the installation is very simple. Remove the wires from pin 1, pin 2, and pin B of a potentiometer and install the wire removed from pin 1 on the pot to pad 1 on the attenuator, install the wire removed from pin 2 on the pot to pad 2 on the attenuator, and install the wire removed from pin B on the pot to pad B on the attenuator. Note: For convenience there are 2 holes for each pad (1, 2, and B). Remove the knob from the pot, unscrew the mounting nut and remove the pot. Mount the attenuator in the hole the pot was removed from and replace the knob. In practice there are several pitfalls to be aware of. The following suggestions apply primarily to the AR-3a speaker.

Suggestion 1. On the AR-3a, the midrange control has the magnet wire from L-1001#1 soldered directly to pin 1 of the potentiometer. This is difficult to remove without cutting and difficult to connect. Solution: If you are unable to desolder and remove the wire, cut it very close to the solder joint and strip the insulating coating off the end (1/4 to 1/2 inch or so) by scraping with a sharp knife all the way around it. The insulation is very tough so make sure you are down to shiny metal. Connect a short (6 inches or less) wire to the end of the magnet wire by wrapping the tinned end of the stranded wire around the stripped end of the magnet wire and soldering it. Cover the joint with a short piece of heat shrink tubing. This will give you a manageable wire to connect.

Suggestion 2. Solder a short piece of insulated wire from the small hole on pad 2 on the tweeter attenuator to the small hole on the mid attenuator. You can do this before you install the attenuators. This will allow you to only connect 1 yellow wire inside the speaker to either of the large pad 2 holes on the attenuators.

Suggestion 3. If any wire seems too short, it's OK to solder an extension wire and insulate the joint with shrink tubing. A good mechanical joint (i.e. wire ends wrapped well) leads to a good solder joint.

Suggestion 4. It may be helpful to install the wires on the attenuators before fastening them in place. Do not overtighten the switches when installing them.

Suggestion 5. Do not tighten one screw at a time when reinstalling the woofers. Instead, gradually tighten the screws. It's best to go back and forth across the speaker so adjacent screws are not tightened at the same time. Several passes tightening all the screws will avoid any tendency to warp the speaker basket and will allow the putty to flow evenly. Do not overtighten.

Suggestion 6. If you run into a problem, ask for help. Email me at [jvbreen@aol.com](mailto:jvbreen@aol.com) for questions about the SA-16-AR or post on the AR forum at <http://www.classicspeakerpages.net/> for any questions about AR speakers.

## Operation

The factory setting for the tweeter control on the AR-3a was 1.75 Ohms. This is matched exactly by setting the SA-16-AR three clicks back from the full clockwise position.

The factory setting for the mid-range control on the AR-3a was 3.25 Ohms. This is matched exactly by setting the SA-16-AR five clicks back from the full clockwise position.

You may want to start out with the factory settings and then change them to suit your listening environment and personal taste.

## SA-16-AR 30 Day Failsafe Guarantee

**For the first 30 days after you receive the kit(s) (applies only to kits purchased directly from JVB Electronics): You may return the kit(s) for any reason for a full refund, including any shipping we charged you to send the kit(s) to you, even if the kit is partially assembled or damaged during assembly beyond repair. You will be responsible only for shipping charges back to us in Carmichael, CA. Also if, during the 30-day Failsafe Guarantee, during assembly you damage a part or parts, we will send replacement parts at no charge to you, upon request.**

### LIMITED ONE YEAR WARRANTY

JVB ELECTRONICS warrants this product (SA-16-AR Stepped Attenuator Kit) against defects in material and workmanship to the original purchaser for a period of one year from the date of purchase, subject to the following terms and conditions.

JVB ELECTRONICS (the Seller) will repair or, at Sellers option, replace the product or any part or parts thereof, which prove defective within one year of receipt by the purchaser provided that the product is returned to the Seller transportation prepaid.

This warranty does not apply if the defect is the result of accident, misuse, neglect, alteration, improper installation, unauthorized repair, improper testing, or damage during shipping.

The buyer will be responsible for providing proof of the date of purchase in the case of products purchased from or through authorized dealers or agents of the Seller.

This warranty is in lieu of all other warranties express or implied including any warranty of merchantability or fitness for a particular purpose, and the Seller neither assumes, nor authorizes any person or firm to assume for it, any other or further obligation or liability in connection with the sales, installation or use of any product.

**UNDER NO CIRCUMSTANCES SHALL SELLER OR ANY AFFILIATE OF SELLER HAVE ANY LIABILITY WHATSOEVER FOR LOSS OF USE OR FOR ANY INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES.**