PRICE $2.00

HEATH COMPANY • BENTON HARBOR, MICHIGAN

HEATHKIT®
ASSEMBLY MANUAL

HEATHKIT® by DAYSTROM

STEREO AMPLIFIER

MODEL AA-100

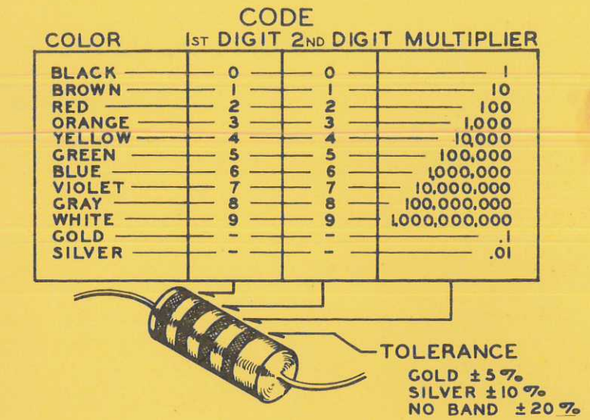
RESISTOR AND CAPACITOR COLOR CODES

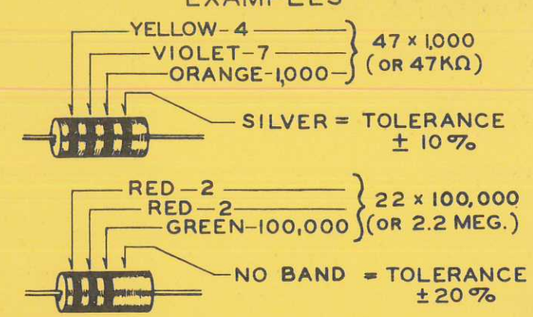
RESISTORS

The colored bands around the body of a color coded resistor represent its value in ohms. These colored bands are grouped toward one end of the resistor body. Starting with this end of the resistance value; the second band represents the second digit; the third band represents the number by which the first two digits are multiplied. A fourth band of gold or silver represents a tolerance of ±5% or ±10% respectively. The absence of a fourth band indicates a tolerance of ±20%.

The physical size of a composition resistor is related to its wattage rating. Size increases progressively as the wattage rating is increased. The diameters of 1/2 watt, 1 watt and 2 watt resistors are approximately 1/8", 1/4" and 5/16", respectively.

The color code chart and examples which follow provide the information required to identify color coded resistors.

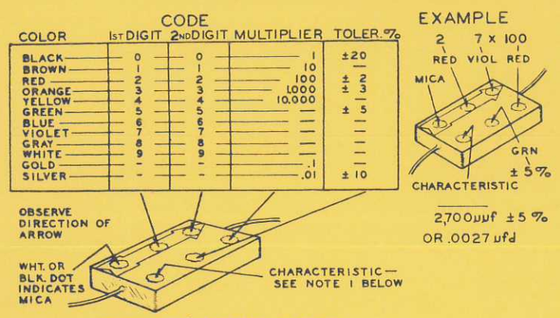




CAPACITORS

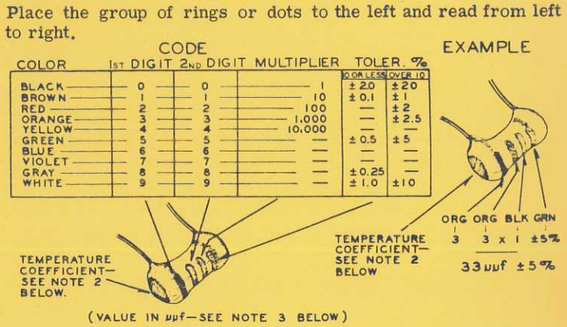
Generally, only mica and tubular ceramic capacitors, used in modern equipment, are color coded. The color codes differ somewhat among capacitor manufacturers, however the codes shown below apply to practically all of the mica and tubular ceramic capacitors that are in common use. These codes comply with EIA (Electronics Industries Association) Standards.

MICA



TUBULAR CERAMIC

Place the group of rings or dots to the left and read from left to right.



NOTES:

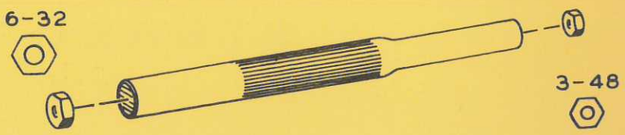
1. The characteristic of a mica capacitor is the temperature coefficient, drift capacitance and insulation resistance. This information is not usually needed to identify a capacitor but, if desired, it can be obtained by referring to EIA Standard, RS-153 (a Standard of Electronic Industries Association.)

2. The temperature coefficient of a capacitor is the predictable change in capacitance with temperature change and is expressed in parts per million per degree centigrade. Refer to EIA Standard, RS-198 (a Standard of Electronic Industries Association.)

3. The farad is the basic unit of capacitance, however capacitor values are generally expressed in terms of μfd (microfarad, .000001 farad) and μμf (micro-micro-farad, .000001 μfd); therefore, 1,000 μμf = .001 μfd, 1,000,000 μμf = 1μfd.

USING A PLASTIC NUT STARTER

A plastic nut starter offers a convenient method of starting the most used sizes: 3/16" and 1/4" (3-48 and 6-32). When the correct end is pushed down over a nut, the pliable tool conforms to the shape of the nut and the nut is gently held while it is being picked up and started on the screw. The tool should only be used to start the nut.



Assembly and Operation of the

HEATHKIT® by DAYSTROM

STEREO AMPLIFIER

MODEL AA-100

HEATH COMPANY,
BENTON HARBOR,
MICHIGAN

a subsidiary of DAYSTROM, INCORPORATED

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All prices are subject to change without notice. The Heath Company reserves the right to discontinue instruments and to change specifications at any time without incurring any obligation to incorporate new features in instruments previously sold.

12/7/62

SPECIFICATIONS

Power Output:. . . . . 25 watts Stereophonic (each channel).
50 watts Monophonic.

Music Power Rating:. . . . . 30 watts stereophonic (.7% total harmonic distortion at 1 kc.)
60 watts monophonic (.7% total harmonic distortion at 1 kc.)

Input sensitivity - volts rms
for 25 watts output per channel:

MONOphonic PHONO* (on Left Channel only):. . . . . 1.5 mv.

STEREOphonic PHONO*:. . . . . 1.5 mv.

TAPE HEAD:. . . . . 1.0 mv.

TUNER:. . . . . 0.2 V.

AUXiliary 1:. . . . . 0.2 V.

AUXiliary 2:. . . . . 0.2 V.

*For Magnetic Cartridges

Input Impedances:

PHONO:. . . . . 47 KΩ supplied; may be changed if cartridge so requires.

TAPE HEAD:. . . . . 470 KΩ.

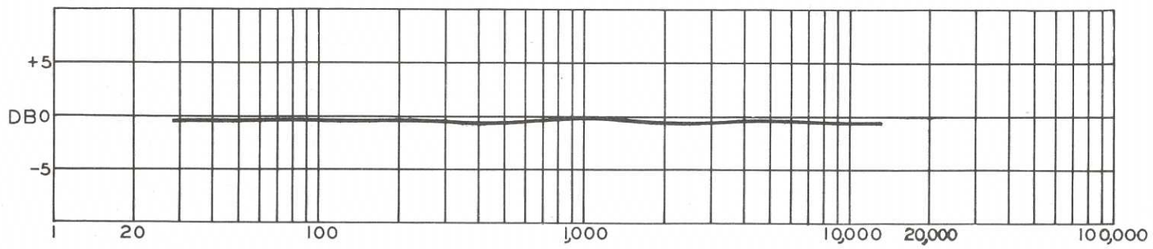
TUNER and AUXiliary:. . . . . 250 KΩ each.

Output Impedances:. . . . . 4, 8 and 16 Ω each channel.

Tape Recorder Output:. . . . . Approximately 0.5 volt maximum at source resistance of approximately 600 Ω from cathode follower. Minimum recommended load resistance: 150 KΩ.

Frequency Response:. . . . . ±1 db 30-15,000 cps at 25 watts, from auxiliary inputs. See Graph A.

GRAPH A



FREQUENCY RESPONSE AT 25 WATTS

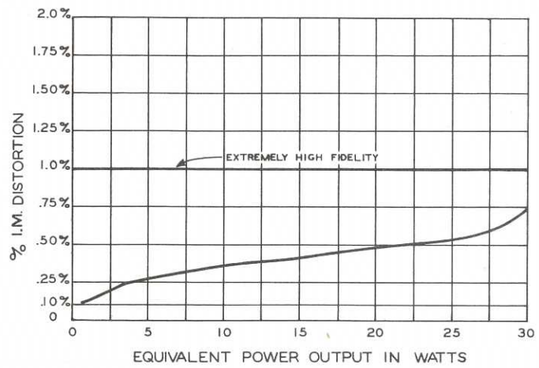
Channel Separation:. . . . . 42 db minimum at 1000 cps.

Damping Factor:. . . . . 15.

Harmonic Distortion:. . . . . Less than 0.5% at 25 watts, 1000 cps. Less than 2% at 25 watts, 30-15,000 cps.

Intermodulation Distortion:. . . . . Less than 1% at 25 watts, 60 and 6000 cps mixed 4:1. See Graph B.

GRAPH B



NOTE: Harmonic and intermodulation distortion specifications are typical for either channel operating at the stated power output. Measurements were made under the following conditions:

Signal generator fed to both channels simultaneously, using AUX 1 inputs in parallel.

Left Channel and Right Channel amplifiers both operating at equal power output, into individual resistive loads.

Line voltage constant, 117 volts.

Hum and Noise:

PHONO (with PHONO LEVEL control adjusted for sensitivity of 6.0 mv at 1000 cps):. . . . . 55 db*.

TAPE HEAD:. . . . . 35 db*.

TUNER and AUXiliary Inputs:. . . . . 70 db*.

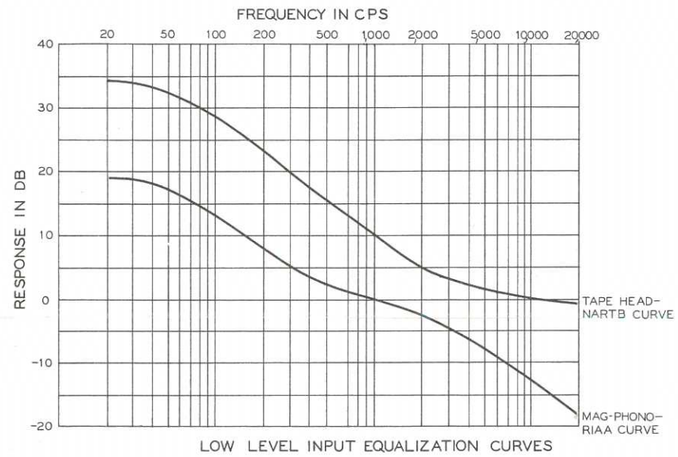
*The number of db below 25 watts output in either channel, measured under the following conditions:

PHONO and TAPE HEAD inputs shorted.
TUNER and AUXiliary inputs terminated in 600 Ω.
All INPUT LEVEL controls in maximum clockwise position, unless otherwise stated.
VOLUME control in maximum clockwise position.
BALANCE control in center position.
SEPARATION control in maximum counter-clockwise position.
TONE controls in flat positions.
POWER AMPLIFIER INPUT LEVEL controls in maximum clockwise position.
LEFT PHASE switch in NORM position.
Both SPEAKER OUTPUTS loaded with 16 Ω resistive load.

The hum and noise figures stated above are unweighted (uncorrected for hearing characteristics) and represent rms values as read on an AC vacuum tube voltmeter. (It is to be noted that the application of a "weighting characteristic" would alter the specification in a favorable direction.)

Due to the equalization present in PHONO and TAPE HEAD positions, the meter readings for these inputs contain a considerable amount of random low-frequency noise, most of which is sub-audible. (Such noise is due to thermal agitation in tubes and resistors, contact resistance effects in electrolytic capacitors, power line variations, etc.) In evaluating noise, the audibility of its various components must be considered. The extreme input sensitivity (1 millivolt) of the AA-100 TAPE HEAD input must also be borne in mind.

The actual 60 cycle hum (and harmonics) included in the readings is very small, compared to the mostly sub-audible noise components referred to above. As a matter of fact, the AA-100 is almost completely free from hum, for practical purposes.



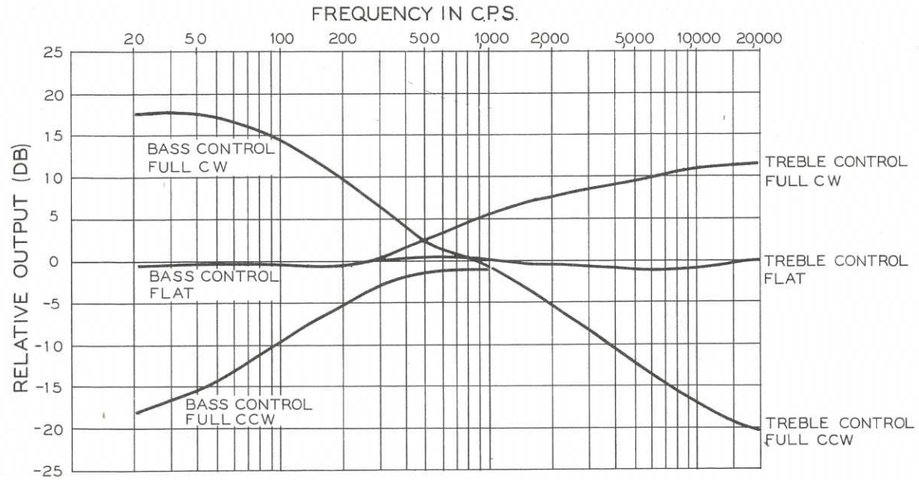
Graph C

Equalization:

PHONO:. . . . . RIAA curve.

TAPE HEAD:. . . . . NARTB tape playback curve. See Graph C.

Tone Controls:. . . . . Separate BASS and TREBLE controls in each channel. BASS control provides approximately 15 db boost and 17 db cut at 30 cps. TREBLE control provides approximately 12 db boost and 20 db cut at 15,000 cps. See Graph D for curves.



GRAPH D - TONE CONTROL CURVES

Front Panel Controls:

MODE SELECTOR Switch:. . . . . Four positions: (1) STEREO NORMAL
(2) STEREO REVERSE
(3) MONOPHONIC LEFT
(4) MONOPHONIC RIGHT

In positions (3) and (4), monophonic sources connected to either channel are fed to both channels in parallel.

SOURCE SELECTOR Switch:. . . . . Six positions: (1) MONOphonic PHONO
(2) STEREO PHONO
(3) TAPE HEAD
(4) TUNER
(5) AUXiliary 1
(6) AUXiliary 2

The inputs of both the Left Channel and the Right Channel are simultaneously switched to any of the above stereo pairs of inputs. Exception: Position (1) is a monophonic input to the Left Channel only.

BALANCE Control:. . . . . Raises volume level of either channel while lowering it in the other. Range 8 db per channel for a total balance range of 16 db.

SEPARATION Control. . . . . Mixes Left and Right Channels over a range of 0 to 100%.

(BALANCE and SEPARATION controls are concentric.)

VOLUME Control:. . . . . Dual tandem type for simultaneous level adjustment of both channels.

LEFT CHANNEL TONE:. . . . . Dual concentric bass and treble controls for Left Channel.

RIGHT CHANNEL TONE:. . . . . Dual concentric bass and treble controls for Right Channel.

POWER Switch:. . . . . OFF-ON.

INPUT LEVEL Controls:. . . . . On all inputs except TAPE HEAD. Controls are located under chassis.

POWER AMPLIFIER INPUT LEVEL Controls:. . . . . One in each channel, for adjustment of overall sensitivity. Accessible from under chassis.

HUM BALANCE Controls:. . . . . One in each channel, for balancing out 60 cps hum from heater circuits. Accessible from under chassis.

PHASE Switch:. . . . . Slide-type switch located on rear chassis apron. Reverses phase of Left Channel at loudspeaker terminals.

117 Volt Power Receptacles:. . . . . Two: one NORMAL, one SWITCHED, for powering accessory equipment. Located on rear chassis apron.

Power Requirements:. . . . . 105-125 volts, 50-60 cycles AC.
150 watts at 117 volts, with no load on AC receptacles.

Tube Complement:. . . . . 2 - EF-86
4 - 12AX7
2 - 7199
4 - 7591
1 - GZ-34

Dimensions:. . . . . 15-1/4" wide x 5" high x 13-1/2" deep (maximum). NOTE: Feet are included in height dimension.

Mounting Position:. . . . . Horizontal. A 4-3/8" x 14-7/8" opening is required for panel mounting. Vertical mounting (panel horizontal) not recommended.

Net Weight:. . . . . 28-3/4 lbs.

Shipping Weight:. . . . . 34-1/2 lbs.

The foregoing specifications are representative of the performance of the average production unit. Minor variations from the specifications are to be expected. However, such variations are held to a minimum in the Model AA-100, through the use of printed circuit boards and high quality components. Due to these factors, plus conservative design, these normal variations may be disregarded from a performance standpoint.

CIRCUIT DESCRIPTION

As shown in the block diagram of Figure 1, the AA-100 consists of two complete channels, designated Left and Right, and a power supply which is common to both channels. Inputs for magnetic phono, tape head, and three high-level sources are provided for each channel. Note that the Left Channel has an additional magnetic phono input for a monophonic cartridge.

All inputs are applied first to the SOURCE SELECTOR switch, which selects the desired pair of inputs for application to the two channels. (When the switch is in the MONO (monophonic) PHONO position, no input is applied to the Right Channel.)

In each channel the low level signals from PHONO and TAPE HEAD are amplified first by the type EF-86 tube (V-1 in the Left Channel and V-2 in the Right Channel). This is a low-hum, low-noise pentode especially designed for low level input applications.

Following amplification by this tube, the appropriate equalization (RIAA for PHONO, NARTB for TAPE HEAD) is applied by means of R-C equalizer networks. See Graph C. This equalization is necessary to compensate for the inherent characteristics of magnetic pickups and tape heads, and gives flat overall frequency response. In addition, the RIAA equalization pro-

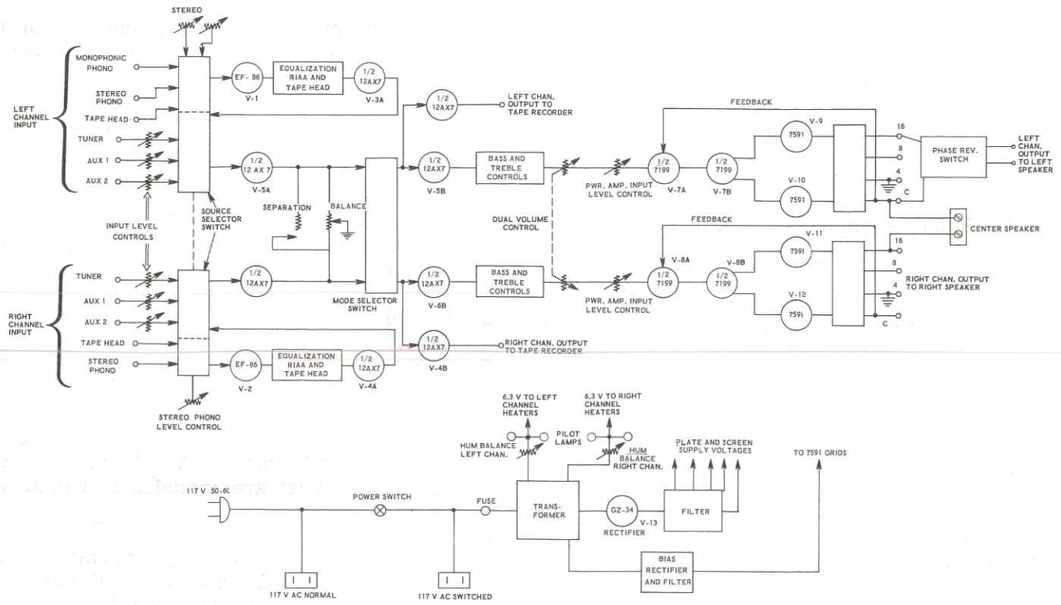


Figure 1

vides a fixed amount of high frequency roll-off (17.2 db at 15,000 cps) which exactly compensates for the high frequency pre-emphasis of the RIAA recording characteristic. This pre-emphasis helps recorded high frequency sound to override surface noise (scratch). The signal, now equalized, is further amplified by one triode section of a type 12AX7 dual triode (V-3A in the Left Channel, and V-4A in the Right Channel). At this point the signal from PHONO, in each channel, is applied to the PHONO LEVEL control (necessary for presetting volume level for a given magnetic cartridge). The Left Channel has both STEREO and MONOphonic phono level controls; the appropriate level control is switched into the circuit by the SOURCE SELECTOR switch. There is no level control for TAPE HEAD input of either channel because the signal voltage developed by a tape head will generally be lowest of all signal sources. Thus in making the initial level control adjustments after installing your AA-100, it is only necessary to adjust level controls for the remaining signal sources, until their individual levels equal that obtained from the tape head.

The three high level inputs for each channel are designated TUNER, AUX 1, and AUX 2, each of these having a level control.

Following the SOURCE SELECTOR switch the signal in each channel, regardless of source, is applied to one section of a type 12AX7 dual triode (V-5A in the Left Channel, and V-6A in the Right Channel). From this stage, in each channel, the signal is fed to the MODE SELECTOR switch. However, let us first consider the BALANCE and SEPARATION controls which are connected between the Left and Right Channels at this point in the circuit. The BALANCE control, R-38, is a potentiometer so connected that it forms a part of a voltage divider in both channels. (Refer to the schematic diagram for the circuit details.) In the Left Channel, this voltage divider consists of R-42, R-39, and half of R-38, when this control is in its center position. In the Right Channel, the divider consists of R-34, R-36, and the other half of R-38, since the arm of R-38 is grounded. Therefore, when the control is in its center position, the voltage division produced in each channel by the control and the associated resistors is equal, and the gain of both channels is also equal. If the control is now turned either side of center, the gain of one channel will increase while the gain of the other channel will decrease. Physically, the connections are arranged so that turning the control clockwise from center increases the volume level of the Left Channel, while decreasing that of the Right Channel. Of course turning the control counterclockwise from center produces the opposite effect.

The SEPARATION control, R-37, provides control over channel separation, if desired. By means of this control, any degree of mixing (i.e., reduction of channel separation) may be obtained between the two channels. A moderate degree of mixing definitely reduces the "hole-in-the-middle" effect found in some stereo program material.

When this control is turned to its extreme counterclockwise position (marked NORMAL on the panel) it is open-circuited, and there is no mixing effect whatever. As it is turned clockwise, the degree of mixing gradually increases until the two channels are completely mixed, in the extreme clockwise position.

Signals in both channels are next applied to the MODE SELECTOR switch. Figures 2A through 2D illustrate the functions of this switch in each of its four positions.

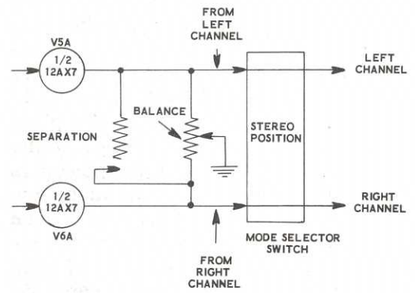


Figure 2A

STEREO NORMAL position: See Figure 2A. Signals from the Left Channel and the Right Channel inputs are fed straight through to the Left Channel output and the Right Channel output, respectively.

STEREO REVERSE position: See Figure 2B. In this position signals from the Left Channel inputs are fed to the Right Channel output, and signals from the Right Channel inputs are fed to the Left Channel output.

MONO LEFT position: See Figure 2C. In this position any input to the Left Channel may be fed simultaneously to both the Left and Right Channel outputs.

MONO RIGHT position: See Figure 2D. In this position any input to the Right Channel may be fed simultaneously to both the Right and Left Channel outputs.

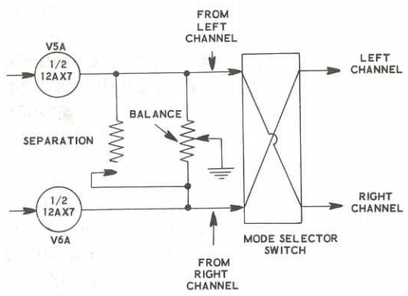


Figure 2B

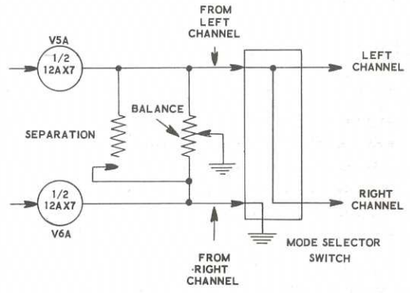


Figure 2C

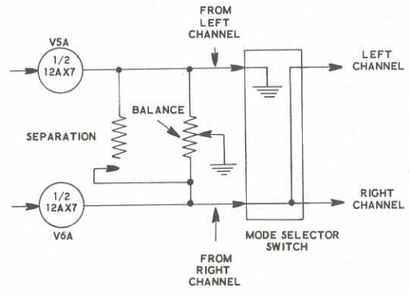


Figure 2D

The signal from the MODE SELECTOR switch feeds the remaining triode section of the 12AX7 in each channel (V-5B and V-6B). It also feeds cathode followers V-3B in the Left Channel and V-4B in the Right Channel, from which connections may be made to feed an external stereo tape recorder. Because of the low output impedance of a cathode follower, the cable(s) feeding the recorder may be any practical length without encountering high frequency loss. Also, the cathode followers give perfect circuit isolation so that the external tape recorder feed does not affect in any way the normal output of the AA-100.

Also, with respect to the tape recorder outputs it should be noted that their take-off points (in each channel) are after the BALANCE and SEPARATION controls and the MODE SELECTOR switch, but before the BASS and TREBLE controls and VOLUME control. Therefore, the tape recorder outputs will be affected by the settings of the SEPARATION and BALANCE controls and the MODE SELECTOR switch; they will not be affected by the settings of the BASS and TREBLE and VOLUME controls.

This, it is believed, is as it should be; in recording a stereo program, the SEPARATION and BALANCE controls may be adjusted as the program requires, and the effect of this adjustment will appear in the recording. The same applies to the MODE SELECTOR switch with respect to STEREO NORMAL and STEREO REVERSE positions. On the other hand, the BASS and TREBLE controls may be used to compensate for speaker effects and room acoustics, without affecting the tape being recorded. Similarly, the VOLUME control may be adjusted for any desired listening volume without affecting the recording level.

After amplification by V-5B in the Left Channel and V-6B in the Right Channel, the signal is applied to the tone control circuit. For each channel this consists of a pair of concentric BASS and TREBLE controls. The tone control circuit is conventional. Physically, the components comprising the tone control network are encased in an encapsulated circuit (#84-13) which mounts on the circuit board in virtually one operation, and saves considerable time and space.

From the tone controls, the signal in each channel is applied to its section of the dual VOLUME control, R-68 and R-60. This is the main or "master" VOLUME control, and is operated from the front panel. It is a ganged potentiometer, thus affording single-knob volume control for both channels. In the manufacture of this control, its dual elements have been matched for close tracking, so the volume change is equal - within 2 db or better - for both channels, over most of the control rotation.

From this control the signal in each channel goes to individual level controls (PWR. AMP. INPUT LEVEL CONTROLS R-70 and R-78). By means of these, the gain of either channel may be permanently reduced to correct for differences in efficiency of the two speakers used.

Signal is then applied to each power amplifier, which consists of a type 7199 pentode-triode tube (V-7 in the Left Channel and V-8 in the Right Channel) and two type 7591 power output tubes, connected in push-pull. The pentode section of the 7199 serves as a voltage amplifier. It is direct-coupled to the triode section which is connected as a phase splitter, delivering push-pull (out-of-phase) signal voltages to the control grids of the 7591 tubes (V-9 and V-10 in the Left Channel; V-11 and V-12 in the Right Channel). Output power developed in the plate circuit of each of these tubes is added in the output transformer, where the total power is coupled to the loudspeaker load. The tubes are operated as straight pentodes, with plate, screen and bias potentional chosen for maximum undistorted power output. A fixed bias of -16 volts for the control grids is derived from a separate half-wave selenium rectifier, which obtains its voltage from a tap on the high-voltage secondary winding of the power transformer.

Approximately 18 db of overall negative feedback is applied around each amplifier, from the output transformer secondary back to the cathode of the 7199 pentode section. This feedback loop reduces distortion, flattens frequency response and increases the damping factor of each power amplifier.

A pair of terminals is provided for connection to a center speaker, if desired. The amplitude of the signal obtained from these terminals is dependent upon the instantaneous phase of the signals in the Left and Right Channels, relative to each other. It is maximum when these signals happen to be in phase. If they happen to be out

of phase, and equal in amplitude, it is zero. Because this signal represents an adding of in-phase signals in the two channels, a center speaker carrying this signal tends to fill in the "hole-in-the-middle" effect present in some stereo material. In lieu of a center speaker, the SEPARATION control may be used to accomplish essentially the same effect. The CENTER SPEAKER terminals may instead be used to feed monophonic signal to a speaker in a remote location, such as another room. Satisfactory sound will be obtained from both stereo and monophonic sources.

Just ahead of the LEFT CHANNEL OUTPUT terminals is a phase-reversal switch, labelled LEFT PHASE. The switch is located on the rear chassis apron, and permits instant phase reversal if you are in doubt as to the correct phasing of speakers or stereo source material.

In the power supply section, V-13, a type GZ-34 full-wave RECTIFIER tube, supplies all plate supply voltages. Decoupling and ripple filtering is accomplished by filter capacitors C-48 and C-49, in conjunction with resistors R-99 through R-102, inclusive. Separate 6.3 volt windings on the power transformer supply heater voltages to the tubes in the two channels. Each winding has a HUM-BALANCE control, permitting each channel to be individually optimized for lowest hum. A voltage divider consisting of R-96 and R-97 places a positive DC potential on the tube heaters. This eliminates hum-producing heater-to-cathode emission in tubes.

Two 117 volt power receptacles are provided on the rear chassis apron. One of these supplies power independently of the AA-100 POWER switch; the other is switched off and on with the AA-100. The primary of the power transformer is fused with a 2-ampere slow-blow fuse.

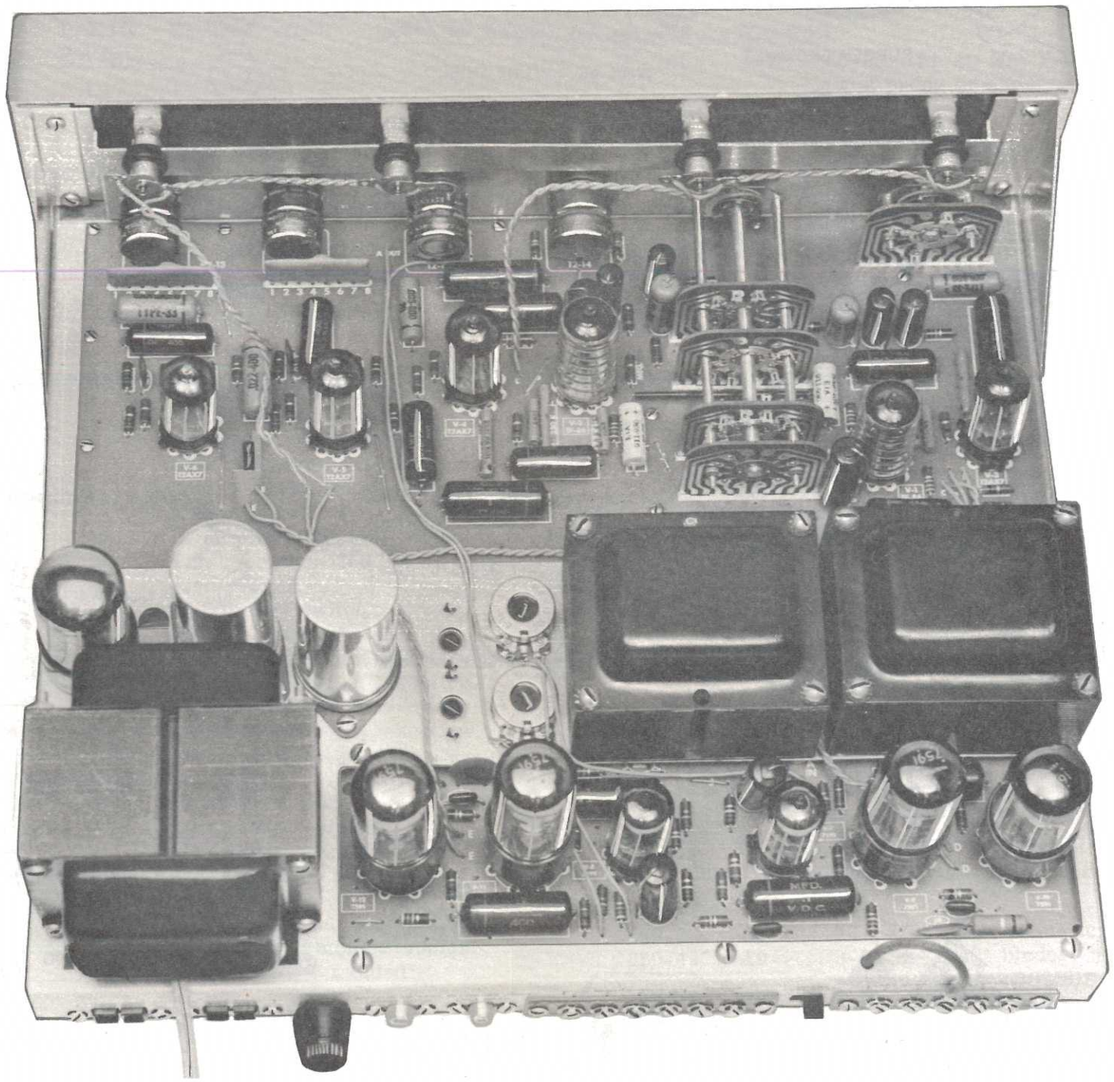
CONSTRUCTION NOTES

The HEATHKIT Model AA-100 Stereo Amplifier, when constructed in accordance with the instructions in this manual, is a high quality amplifier capable of many years of trouble-free service. We urge you to take the necessary time to assemble and wire the kit carefully. Do not hurry the work and you will be rewarded with a greater sense of confidence, both in your amplifier and in your own ability.

This manual is supplied to assist you in every way to complete your kit with the least possible chance for error. The arrangement shown is the result of extensive experimentation and trial. If followed carefully, the result will be a stable instrument, operating at a high degree of dependability. We suggest that you retain the manual in your files for future reference, both in the use of the instrument and for its maintenance.

UNPACK THE KIT CAREFULLY AND CHECK EACH PART AGAINST THE PARTS LIST. In so doing, you will become acquainted with the parts. Refer to the charts and other information on the inside covers of the manual to help you identify the components. If some shortage or parts damage is found in checking the Parts List, please read the REPLACEMENT section and supply the information called for therein. Include all inspection slips in your letter to us.

Resistors generally have a tolerance rating of 10% unless otherwise stated in the Parts List. Tolerances on capacitors are generally even greater. Limits of +100% and -20% are common for electrolytic capacitors.



( ) 3. 10 KΩ resistor (brown-black-orange).

( ) 4. 68 μμf mica capacitor.

( ) 5. 100 Ω 1 watt resistor (brown-black-brown).

( ) 6. .02 μfd ceramic disc capacitor.

( ) 7. 470 KΩ resistor (yellow-violet-yellow).

( ) 8. 1 KΩ resistor (brown-black-red).

( ) 9. .1 μfd 400 V capacitor.

( ) 10. 27 KΩ resistor (red-violet-orange).

( ) 11. 68 μμf mica capacitor.

( ) 12. 820 KΩ resistor (gray-red-yellow).

( ) 25. 22 KΩ 5% resistor (red-red-orange-gold).

( ) 26. Jumper (use excess resistor lead).

( ) 27. 220 KΩ resistor (red-red-yellow).

( ) 28. .1 μfd 400 V capacitor (upright mounting).

( ) 29. 47 KΩ resistor (yellow-violet-orange).

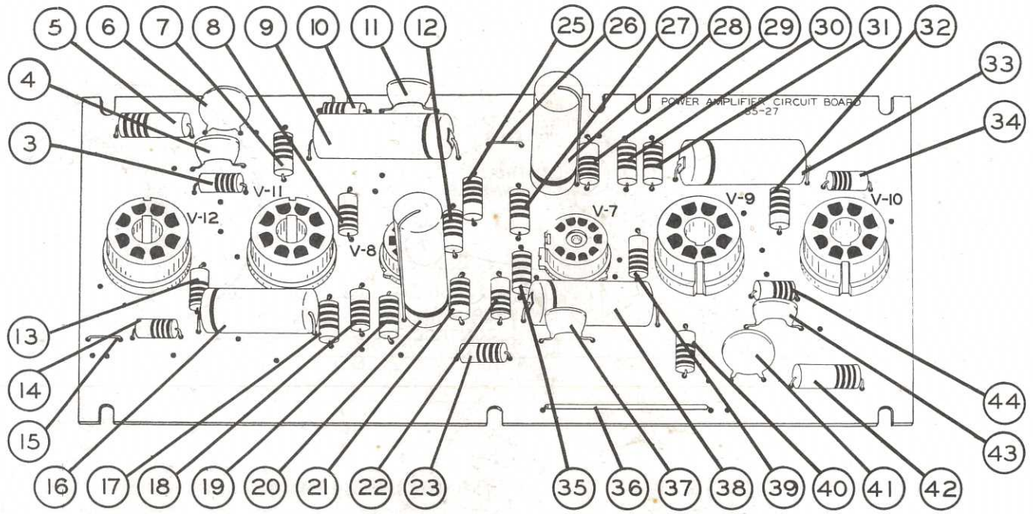
( ) 30. 22 KΩ 5% resistor (red-red-orange-gold).

( ) 31. 1 KΩ resistor (brown-black-red).

( ) 32. 1 KΩ resistor (brown-black-red).

( ) 33. .1 μfd 400 V capacitor.

( ) 34. 470 KΩ resistor (yellow-violet-yellow).



( ) 13. 1 KΩ resistor (brown-black-red).

( ) 14. 470 KΩ resistor (yellow-violet-yellow).

( ) 15. Jumper (use excess resistor lead).

( ) 16. .1 μfd 400 V capacitor.

( ) 17. 1 KΩ resistor (brown-black-red).

( ) 18. 22 KΩ 5% resistor (red-red-orange-gold).

( ) 19. 47 KΩ resistor (yellow-violet-orange).

( ) 20. .1 μfd 400 V capacitor (upright mounting).

( ) 21. 220 KΩ resistor (red-red-yellow).

( ) 22. 22 KΩ 5% resistor (red-red-orange-gold).

( ) 23. 27 KΩ resistor (red-violet-orange).

( ) 24. Solder and cut off leads of components installed so far.

( ) 35. 820 KΩ resistor (gray-red-yellow).

( ) 36. Jumper, 2 3/8" hookup wire.

( ) 37. 68 μμf mica capacitor.

( ) 38. .1 μfd 400 V capacitor.

( ) 39. 1 KΩ resistor (brown-black-red).

( ) 40. 470 KΩ resistor (yellow-violet-yellow).

( ) 41. .02 μfd ceramic disc capacitor.

( ) 42. 100 Ω 1 watt resistor (brown-black-brown).

( ) 43. 68 μμf mica capacitor.

( ) 44. 10 KΩ resistor (brown-black-orange).

( ) 45. Solder and cut off leads of the remaining components, then set the assembled board aside temporarily.

Now proceed to INSTALLATION OF PRE-AMPLIFIER CIRCUIT BOARD AND FRONT PANEL on Page 20.

Figure 7

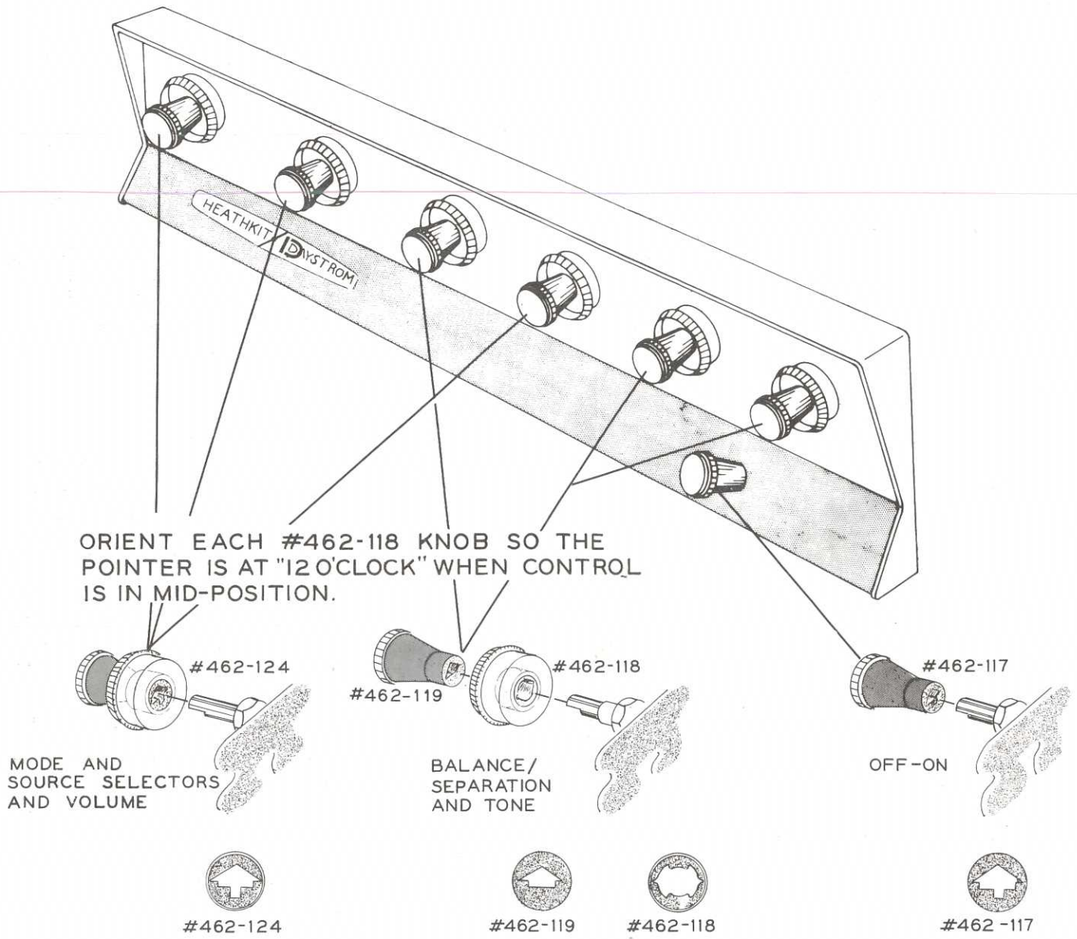


Figure 23

INITIAL TEST

In order to insure against possible serious damage which could conceivably result from a construction fault, it is recommended that the following procedure be observed in applying power to your AA-100 for the first time.

( ) Turn the front panel LEVEL control to its maximum counterclockwise position. The POWER switch should be in the OFF position. Plug the line cord into electrical outlet, 105-125 volts, 50/60 cycle AC only.

( ) Turn the POWER switch ON; the pilot lights should light. After about half a minute, the tube filaments (heaters) should be lit, and exhibit a dull red or orange glow. It is difficult to see the filaments of the EF-86 tubes; however, these tubes should become noticeably warm after a few minutes.

CAUTION: Do not touch any exposed leads on the circuit boards while power is on.

( ) Now turn the power OFF, insert the GZ-34/5AR4 tube in the octal socket (near the power transformer) and turn the power ON again. The 7591 tubes should exhibit no additional red glow than was observed prior to installing the GZ-34. The latter's filament should glow like the other tubes. However, its gray metal plates, or the plates of the 7591's, should not turn red. If they do, it is a sign of excessive current drain, probably due to a short circuit; in that event, turn power OFF immediately and do not reapply power until the trouble is found and corrected. Refer to the IN CASE OF DIFFICULTY section on Page 43.

NOTE: A blue glow (fluorescence) around the plate structure of the 7591's is NORMAL and should not be interpreted as a sign of trouble.

( ) This would be a good time to check at least the main supply voltages in the amplifier. All normal DC voltages appear on the schematic. The main supply voltages are considered to be (1) The 7591 plate supply voltage - pin 8 of V-13; (2) The 7591 screen supply voltage - present at the junction of R-101 and R-102 (also hole 42 on small circuit board); (3) The bias supply voltage - present at the junction of R-105 and R-106 (also hole 40 on small circuit board). The latter voltage is NEGATIVE with respect to chassis. Note the conditions of measurement stated on the schematic. If these voltages deviate significantly more than 10%, the associated circuits should be carefully checked. If voltages read normal, turn power OFF and install the bottom cover, as shown in Figure 22.

( ) If you are satisfied that the AA-100 is operating normally at this time, disconnect electrical power and install the cabinet shell as shown in Figure 24 (fold-out from Page 34). Be careful not to let the ventilating slots in the top of the cabinet shell snag the tops of the can-type electrolytic capacitors.

NOTE: Due to the close proximity of the power transformer to the top cover, an audible mechanical vibration may be experienced, due to the magnetic field of the transformer acting on the cover. To eliminate this, wedge a small piece of foam rubber or resilient packing material (used in packing your kit) between the top of the transformer and the cover to damp out vibration of the cover.

LOUDSPEAKER CONNECTIONS

( ) Connect the left speaker to the LEFT SPKR terminals. Depending upon the impedance of this speaker (4Ω, 8Ω or 16Ω), connect wire with spade lug to the appropriate screw terminal on the LEFT SPKR IMPEDANCE terminal strip.

( ) Connect one wire from the right speaker to the C (Common) terminal under the RIGHT SPKR terminals. Connect the other wire to the appropriate terminal (4Ω, 8Ω or 16Ω), depending upon the speaker impedance.

NOTE #1: The common (C) marked speaker terminals are not connected directly to chassis ground. Any grounding of these terminals will result in distortion and loss of power output. When measuring or installing the AA-100, the speaker leads must be ungrounded, and no connection should be made between the LEFT and RIGHT channel outputs.

NOTE #2: Normally, the output of both channels of this amplifier are connected to suitable speaker systems. If you intend to use only one speaker system, connect it to one of the channels, and connect the other channel to a resistive load. The resistive load will prevent the unused channel from "running free," which could damage the channel.

You may use a 4Ω, 8Ω, or 16Ω high wattage resistor for the resistive load. Connect this resistor to the proper terminals of the unused channel.

INITIAL HUM BALANCE ADJUSTMENT

( ) Set all controls as follows:

MODE SELECTOR switch - STEREO NORM.
SOURCE SELECTOR switch - STEREO NORM. PHONO
BALANCE control - 12 o'clock position
SEPARATION control - maximum counter-clockwise (at normal)
VOLUME control - maximum counterclock-wise

LEFT CHANNEL TONE
RIGHT CHANNEL TONE
} 12 o'clock (flat) positions

( ) Under the chassis, set all nine INPUT LEVEL controls and the two INPUT LEVELS TO POWER AMPS controls to their maximum clockwise positions.

( ) Before making any input connections, turn POWER switch ON and wait approximately one minute for the tubes to warm up. Now advance the VOLUME control until a hum is heard in both speakers. Carefully adjust the RIGHT CHAN HUM BALANCE control until the hum level is minimum, as heard from the RIGHT speaker. Now adjust the LEFT CHAN HUM BALANCE control for minimum hum, as heard from the LEFT speaker. As the hum is progressively reduced by the HUM BALANCE controls, it will probably be necessary to turn up the VOLUME control in order to better detect the condition of minimum hum, which is quite critical. The HUM BALANCE controls should be readjusted later, after the input sources have been connected to the AA-100. The minimum hum will also be much lower when the inputs are connected.

INSTALLATION

The Model AA-100 is primarily intended to set in an "open" location, such as a table top or shelf. Its decorative cabinet shell was designed for this type of installation. The unit may be panel mounted, if desired, by removing the feet and the cabinet shell. When mounted in this way, the cutout is completely covered by the front panel, resulting in a neat installation. Vertical mounting (panel horizontal) is not recommended.

VENTILATION is important for long component life in any piece of electronic equipment, due to the unavoidable generation of heat within the equipment. In the Model AA-100, ventilation is obtained by the open back and the slots in the cabinet shell and bottom cover. When operated on a shelf, the back of the cabinet should be at least an inch from the wall; also, a clearance of at least 2" above the top of the cabinet should be provided. If these precautions are followed, adequate air circulation will be promoted and the unit will run relatively cool.

Adequate ventilation will ordinarily be no problem if the unit is installed in an open-back cabinet, provided there is a small amount of clearance above the unit for hot air to escape.

IMPORTANT: BECAUSE OF THE EXTREME SENSITIVITY AND HIGH POWER OUTPUT OF THE AA-100, IT IS IMPERATIVE THAT THE FOLLOWING PRECAUTION BE OBSERVED: NEVER UNDER ANY CIRCUMSTANCES CONNECT OR DISCONNECT ANY INPUTS WHILE POWER IS ON, WITHOUT FIRST TURNING THE VOLUME CONTROL FULLY COUNTERCLOCKWISE. FAILURE TO OBSERVE THIS PRECAUTION MAY DAMAGE THE SPEAKERS OR OUTPUT TRANSFORMERS, NECESSITATING COSTLY REPAIR OR REPLACEMENT.

INPUT CONNECTIONS

Most signal sources terminate in a standard RETMA phono plug which fits the input sockets of your AA-100. Eight plugs of this type, along with a length of shielded cable, are furnished for the purpose of making up input cables for connection to the AA-100. See Figure 25.

If you are in doubt about the correct input connections for the various types of signal sources, the following information should prove helpful.

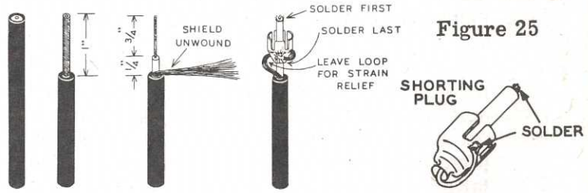


Figure 25

NOTE: The shielding of the input cable should not touch the chassis of the AA-100 at any point. Grounding to the chassis at this point could create excessive hum.

MONO PHONO:.	For monophonic magnetic or variable reluctance phono pickups.
STEREO PHONO:.	For stereophonic magnetic or variable reluctance phono pickups.
TAPE HEAD:.	For direct connection to playback heads on tape decks.
TUNER, AUX 1, or 2:.	For AM or FM tuners, complete tape recorders (having their own playback preamplification and equalization), crystal or ceramic phono pickups,* capacity (FM) phono pickups with required oscillator, and compensated phono pickup preamplifiers (all types).
OUTPUT TO TAPE RECORDER INPUT:.	For feeding signal to an external tape recorder to record from tuner, records, etc., either in stereo or monophonically. The "high level" input of the tape recorder should be used - this may be designated "high level," "radio," or "line." The input impedance should be at least 150,000 Ω.
*Crystal or ceramic pickups may also be connected to PHONO provided they are appropriately loaded (usually with a relatively low resistance) to make them "velocity responsive." Most manufacturers of these types of pickups furnish recommended termination circuits, which should be followed regardless of which input is used.	

INPUT LEVEL CONTROLS

After making all input connections, the INPUT LEVEL controls should be adjusted for approximately equal volume levels as the SOURCE SELECTOR switch is turned from one input to another.

No level controls are provided for the TAPE HEAD inputs. This is because generally the signal from the tape head will be lower in level than that from the nagnetic phono pickup. Therefore, the PHONO level controls should be adjusted so as to bring the PHONO levels down to match that of the tape head. The level controls for TUNER, AUX 1 and 2 should be adjusted to the same level. If the TAPE HEAD inputs are not used, hum may be experienced when switching through the TAPE HEAD mode of the selector switch. To eliminate this hum, construct shorting plugs as shown in Figure 25, and insert them into the TAPE HEAD inputs.

Because of the very high sensitivity (1.5 millivolts) of the PHONO inputs, audible distortion may be experienced when using higher output cartridges if the PHONO INPUT LEVEL controls are operated at their maximum settings. For this reason, the following maximum settings for these controls should be observed.

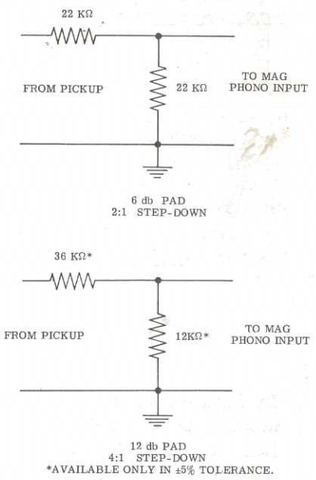


Figure 26

For cartridge output of less than 5 mv, the control may, generally, be left in the maximum clockwise position.

For cartridge output of 5 mv, turn control counterclockwise one-fifth of its rotational range below maximum clockwise position.

For cartridge output of 10 mv, turn control counterclockwise one-third of its rotational range below maximum clockwise position.

For cartridge output of 20 mv, turn control counterclockwise one-half of its rotational range below maximum clockwise position.

(These settings make allowance for high velocity recorded peaks.)

For magnetic pickups of greater output than 20 millivolts (at stylus velocity of 5 cm/sec.), an L-pad should be installed at the input socket to prevent overloading the preamplifier stages, and at the same time present the proper load to the pickup. Two L-pads are illustrated in Figure 26. They may be easily installed at the input sockets. The resistors are standard 1/2 watt values which may be secured at any radio or electronic supply store. Be sure to remove the 47 KΩ resistor already installed on each phono input socket.

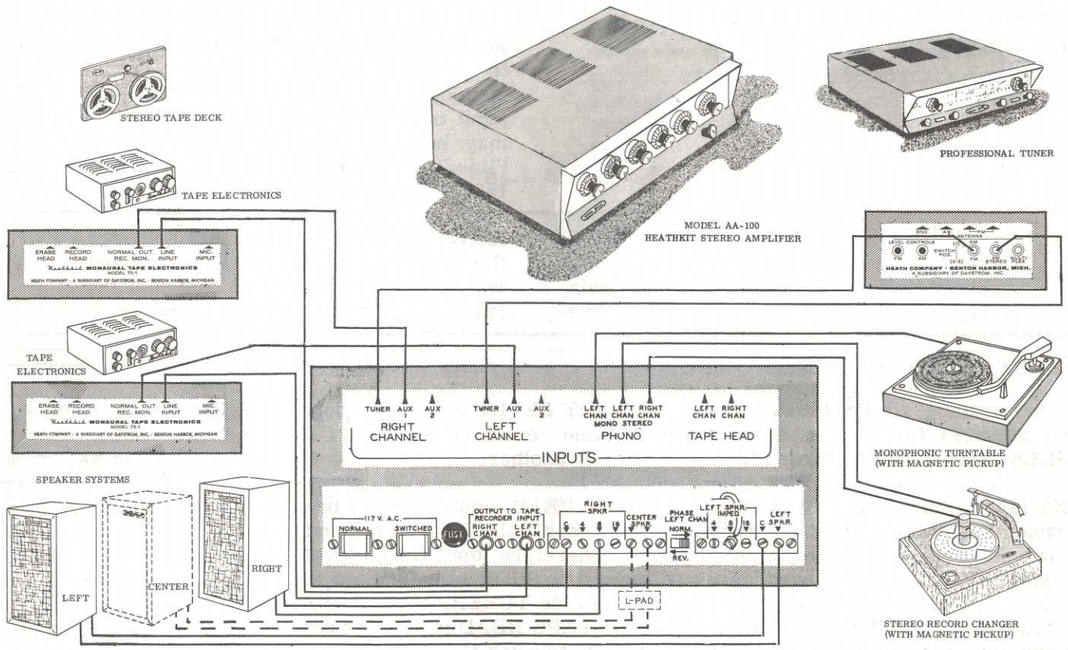


Figure 27

In addition to the INPUT LEVEL controls mentioned above, each power amplifier in the AA-100 has an INPUT LEVEL control. The normal positions of these controls are full clockwise. However, in case of a higher efficiency speaker in one channel than in the other, the gain of the first channel may be permanently reduced by means of its INPUT LEVEL control.

ACCESSORY POWER

Two outlets on the rear chassis apron may be used to supply power to accessory equipment, such as record changer, tape deck, or tuner. The SWITCHED outlet is controlled by the POWER switch on the AA-100. The NORMAL outlet supplies power as long as the AA-100 is plugged into the power source. This outlet is intended for devices such as record changers or tape decks, which may be subjected to damage if power is removed without shutting off the mechanism.

Figure 27 shows connections of a complete stereo system using the AA-100.

SPEAKER PLACEMENT

Generally, for stereo listening, the two loudspeakers should be spaced six to eight feet apart. They should be placed along a wall, either facing straight ahead or "firing in" toward each other's axis at a right angle to the wall. The optimum positions can best be determined by experiment. A great deal depends upon the size and acoustics of the room and upon the high frequency dispersion characteristics of the speakers. Identical speakers or speaker systems are recommended.

The correct speaker spacing depends to some extent upon the listener's position and distance from the speakers. In other words, if the listening position is restricted to one that is relatively close to the speakers, some improvement could probably be obtained by moving the speakers closer together.

Remember that in stereophonic reproduction we are striving to recreate not only the sounds of "right" and "left" origin but also those near the center, as accurately in position as possible. By all means, experiment with speaker and listening positions sufficiently to arrive at the best set of conditions for your particular installation.

ELIMINATING "HOLE-IN-THE MIDDLE" EFFECT

This effect is not uncommon in two-channel stereo reproduction. It may be due to microphone placement and/or acoustics at the recording (or broadcast) location, or it may be due to excessive speaker separation, or an unfavorable listening position.

Either of two methods may be used to eliminate or minimize the hole-in-the-middle effect: (1) Use of the SEPARATION control; (2) Use of a center speaker. Both of these methods are discussed under OPERATION.

OPERATION

Assuming that all input and output connections have been made and that all LEVEL controls have been adjusted, any stereo source connected to corresponding inputs of the Left and Right Channels, and selected by the SOURCE SELECTOR switch, should be heard in the speakers. The MODE SELECTOR switch should be in the STEREO NORM position. The listening levels of both channels may be adjusted simultaneously by means of the VOLUME control. When the TONE control knobs are in the vertical (12 o'clock) positions, the overall response is flat. Turning either the bass or the treble control of either channel clockwise boosts bass or treble of that channel; counterclockwise rotation cuts bass or treble.

Turning the BALANCE control either way from the 12 o'clock position increases the level of one channel, and simultaneously decreases the level of the other channel. As the markings on the front panel window indicate, turning the control toward "L" shifts the sound toward the left; turning it toward "R" shifts the sound to the right. This control should be used to keep the two channels balanced, despite any unbalance in the program material.

The normal position of the SEPARATION control (full counterclockwise) is designated on the front panel. This is the position of normally high channel separation, and maximum stero effectiveness. Turning the control clockwise gradually mixes both channels together until, in the full clockwise position, both speakers are carrying both channels, completely mixed, and the stereo source has been made completely monophonic.

The principal purpose of the SEPARATION control is to permit whatever degree of mixing is necessary to eliminate the "hole-in-the-middle" which is present in some stereo material. This control will be found extremely effective in such cases.

The following additional use of the SEPARATION control should be noted: Any normally phased stereo phono cartridge will play monophonic records successfully if its two "hot" terminals

are tied together. Since both channels are tied together when the SEPARATION control is fully clockwise, monophonic records may be played in this way with a stereo pickup.

In the Model AA-100, a pair of output terminals for a center speaker is provided. This may be used (as an alternative to the SEPARATION control) to fill the "hole-in-the-middle." The signal for the center speaker, as derived within the AA-100, is proportional to the instantaneous sum of the left and right (A and B) signals. Therefore, it is a maximum when the A and B signals are in-phase, and zero if A and B signals happen to be completely out-of-phase.

Because of these relationships, behavior of the center speaker will be correct to give center fill without sacrificing stereo effectiveness.

An adjustable L-pad is necessary to permit adjustment of volume level of the center speaker. For optimum center fill, it will be found that only a very low level is desired for the center speaker. For this reason, there is nothing critical as to the type of speaker used; almost any speaker will suffice. The speaker voice coil impedance may be from 4 to 16 ohms. Figure 28 shows proper L-pad connection in the center speaker circuit.

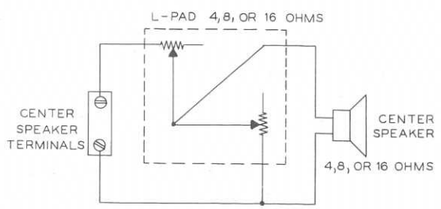


Figure 28

When the MODE SELECTOR switch is in the STEREO NORM position, the external connections should be such that the Left Channel feeds the LEFT* speaker and the Right Channel the RIGHT speaker.

*Defined as the listener's left when facing the speakers.

Turning the MODE SELECTOR switch to the STEREO REV position reverses the two channels, with respect to the speakers. This switch position serves as a convenient corrective for stereo material which might be reversed.

For example, many radio stations today broadcast stereo by means of simultaneous FM and AM transmission, but there is no set standard as to which is left and which is right. By means of the STEREO NORM and STEREO REV positions, the channels may be instantly reversed, if the situation demands. It is only necessary that the FM source be connected to one of the high-level inputs on one channel; for example, TUNER, Left Channel, and the AM source to the corresponding input of the other channel (in this example, TUNER, Right Channel).

Remember that when the MODE SELECTOR switch is in the STEREO NORM position, all monophonic sources connected to Left Channel inputs will be heard only in the LEFT speaker, and all monophonic sources connected to Right Channel inputs will be heard only in the RIGHT speaker. (Of course in the STEREO REV position, the reverse is true.) When the MODE SELECTOR switch is in the MONO LEFT position, all monophonic sources connected to MONO LEFT Channel inputs will be heard in both speakers. Similarly, when the switch is in the MONO RIGHT position, all monophonic sources connected to Right Channel inputs will be heard in both speakers. For example, MONO PHONO which connects to the input of the Left Channel preamplifier only, will be heard in both speakers only when the MODE SELECTOR switch is in the MONO LEFT position.

Monophonic sources, when reproduced in this way over both speakers, may be given a "pseudo-stereo" effect by adjusting the TONE controls so that one channel contains mostly high frequencies and the other channel contains mostly low frequencies. This will give an added dimension to orchestral music, since some instruments will seem to be located on one side, and others on the other. The overall effect bears some resemblance to true stereophonic sound, hence the term "pseudo-stereo."

SPEAKER PHASING: The two speakers should be connected so that they are "in phase" when the LEFT PHASE switch (located on the rear chassis apron) is in the NORM position. "In phase" means that both speaker cones move in the same direction at the same time. (If two-way speaker systems are used, phasing refers to the low-frequency woofers.)

Speaker phasing can be easily determined in the following manner: Disconnect one of the low level inputs and set the SOURCE SELECTOR switch to the corresponding input. Turn the MODE SELECTOR switch to MONO LEFT or MONO RIGHT, whichever channel the input was removed from. Advance the VOLUME control until a hum is heard in the speakers. (Turn the appropriate HUM BALANCE control, if necessary, to create a hum level.) Place the speakers side by side. Find the position of the LEFT PHASE switch which gives the loudest hum when you stand directly in front of the speakers. If this is the NORM position, the speakers are in phase when the switch is in NORM. If it is the REV position, reverse the wires to one of the speakers; then they will be in phase when the switch is in NORM. If the HUM BALANCE controls were turned, readjust them for minimum hum again.

The switch should normally be left in the NORM position. If you encounter stereo program material which seems to be out-of-phase, you can correct it by throwing the switch to REV.

IN CASE OF DIFFICULTY

Recheck the wiring. Trace each lead in colored pencil on the pictorial diagrams as it is checked in the amplifier. Most cases of difficulty result from wrong connections. Often having a friend check the wiring will reveal a mistake consistently overlooked.

Compare the tube socket voltages with those shown in the schematic diagram. Readings within 20% of those shown may be considered as normal. If a discrepancy is noted, check the associated circuits carefully. Any component in those circuits should be suspected until proven satisfactory.

In the case of any performance deficiency in the AA-100, it should first be noted whether the trouble is in the Left Channel, Right Channel, or both. This includes hum, noise, weak signal, distortion, or loss of signal.

Any difficulty that is common to both channels is most likely caused by a defect in the common power supply. If the difficulty is confined to one channel, tubes may be substituted from the other channel; in this way, a defective tube may be quickly isolated.

In the event that one of the circuit boards of your AA-100 has been ruined through accidental use of acid or paste fluxes, or for any other reason, a convenient repair kit is available for each of the two boards. Each kit consists of a new circuit board, new tube sockets, and all board-mounted resistors and capacitors. The #63-247 and #63-248 switches, and #212-6, #12-27, and #12-28 controls are not included since these items can probably be successfully removed from the damaged board. This can best be accomplished by cutting up the board directly underneath the switches and controls, using diagonal cutters. Then unsolder and remove the circuit board fragments from the individual switch or control prongs. Should this effort prove unsuccessful, however, new switches and controls can be ordered as required.

The repair kits may be ordered from the following information:

Kit No. AAR-100-1	Preamplifier circuit board repair kit.
Kit No. AAR-20	Power amplifier circuit board repair kit.

SPECIFIC TROUBLES

HUM: Hum in a hi-fi amplifier is usually caused by excessive heater to cathode leakage in one of the tubes, a poor ground connection, a faulty filter capacitor, or, in many cases, improperly placed leads. A faulty electrolytic filter capacitor that is responsible for hum will allow an excessive amount of AC ripple to be present in the DC B+ voltage. These capacitors can be checked either by direct substitution or with a good capacitor tester.

If hum is a problem only when using the low level inputs (PHONO and TAPE HEAD), the EF-86 and 12AX7 stages, as well as the low-level input sockets and associated wiring, should be suspected.

In many cases, hum will appear to be originating in the amplifier but is actually being picked up by the signal source, or is the result of a poor connection in the audio cable which connects the signal source to the amplifier. When considering hum, the primary concern should be with the hum heard at normal settings of the LEVEL control. It is normal to hear a very slight amount of hum and noise at the upper extreme setting of this control.

DISTORTION: Faulty tubes, a shorted coupling capacitor, or a resistor that has changed value can cause distortion. The tubes may be checked as previously suggested. An ohmmeter will prove helpful in checking for shorted capacitors and resistors that are out of tolerance.

Loss of signal: The three most common causes of signal loss are a faulty tube, a short circuit between the signal path and ground and an open coupling capacitor.

After checking the tubes, an ohmmeter can be used to check for short circuits. Most coupling capacitors have a very high leakage resistance, therefore, an ohmmeter check would not be conclusive. Coupling capacitors are best checked on a capacitor tester or by direct substitution.

Another way to check for signal loss is by signal tracing. This is done by applying an audio voltage to an appropriate input either from an audio generator or from a high fidelity signal source and then checking progressively from the input jack at various points along the signal path with a signal tracer or an oscilloscope to determine at which point the appropriate signal is lost. After obtaining this information, the associated circuitry should be checked, as previously suggested.

If test instruments are not available for signal tracing, a .01 to .05 μfd capacitor can be used to find the stage that is not passing the applied signal. By holding one lead of this capacitor and touching the other lead to the control grid pin of each tube socket, a 60 cycle hum should be heard from the output. If, upon touching a grid pin, a hum is not heard, the associated circuitry should be suspected and thoroughly checked out.

SERVICE INFORMATION

SERVICE

If, after applying the information contained in this manual and your best efforts, you are still unable to obtain proper performance, it is suggested that you take advantage of the technical facilities which the Heath Company makes available to its customers.

The Technical Consultation Department is maintained for your benefit. This service is available to you at no charge. Its primary purpose is to provide assistance for those who encounter difficulty in the construction, operation or maintenance of HEATHKIT equipment. It is not intended, and is not equipped to function as a general source of technical information involving kit modifications nor anything other than the normal and specified performance of HEATHKIT equipment.

Although the Technical Consultants are familiar with all details of this kit, the effectiveness of their advice will depend entirely upon the amount and the accuracy of the information furnished by you. In a sense, YOU MUST QUALIFY for GOOD technical advice by helping the consultants to help you. Please use this outline:

1. Before writing, fully investigate each of the hints and suggestions listed in this manual under "IN CASE OF DIFFICULTY." Possibly it will not be necessary to write.
2. When writing, clearly describe the nature of the trouble and mention all associated equipment. Specifically report operating procedures, switch positions, connections to other units and anything else that might help to isolate the cause of trouble.
3. Report fully on the results obtained when testing the unit initially and when following the suggestions under "IN CASE OF DIFFICULTY." Be as specific as possible and include voltage readings if test equipment is available.
4. Identify the kit model number and date of purchase if available. Also mention the date of the kit assembly manual. (Date at bottom of Page 1.)
5. Print or type your name and address, preferably in two places on the letter.

With the preceding information, the consultant will know exactly what kit you have, what you would like it to do for you and the difficulty you wish to correct. The date of purchase tells him whether or not engineering changes have been made since it was shipped to you. He will know what you have done in an effort to locate the cause of trouble and, thereby, avoid repetitious suggestions. In short, he will devote full time to the problem at hand, and through his familiarity with the kit, plus your accurate report, he will be able to give you a complete and helpful answer. If replacement parts are required, they will be shipped to you, subject to the terms of the Warranty.

The Factory Service facilities are also available to you, in case you are not familiar enough with electronics to provide our consultants with sufficient information on which to base a diagnosis of your difficulty, or in the event that you prefer to have the difficulty corrected in this manner. You may return the completed instrument to the Heath Company for inspection and necessary repairs and adjustments. You will be charged a minimal service fee, plus the price of any additional parts or material required. However, if the completed kit is returned within the Warranty period, parts charges will be governed by the terms of the Warranty. State the date of purchase, if possible.

Local Service by Authorized HEATHKIT Service Centers is also available in some areas and often will be your fastest, most efficient method of obtaining service for your HEATHKIT equipment. Although you may find charges for local service somewhat higher than for factory service, the amount of increase is usually offset by the transportation charge you would pay if you elected to return your kit to the Heath Company.

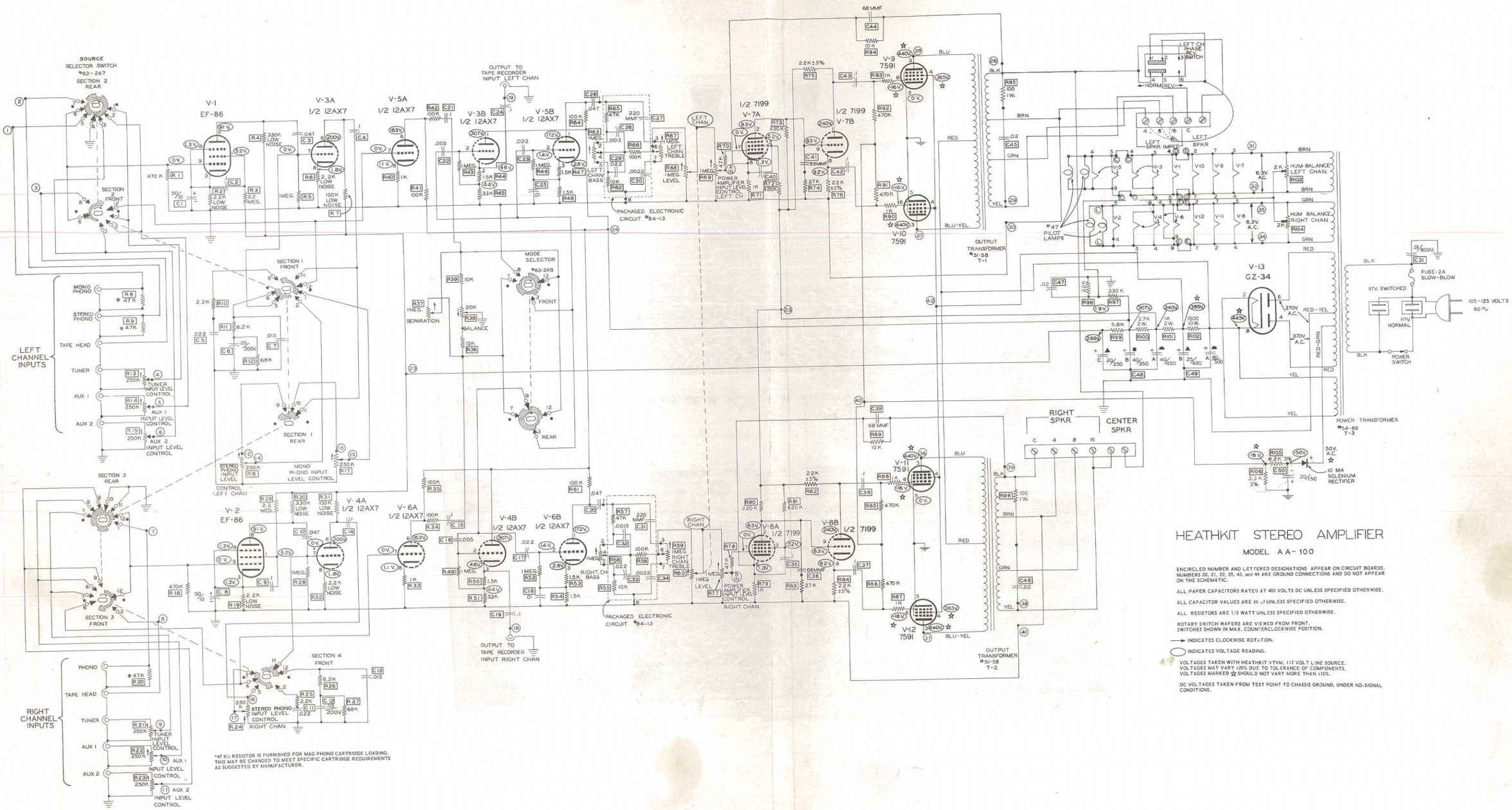
HEATHKIT Service Centers will honor the regular 90 day HEATHKIT Parts Warranty on all kits, whether purchased through a dealer or directly from Heath Company; however, it will be necessary that you verify the purchase date of your kit.

Under the conditions specified in the Warranty, replacement parts are supplied without charge; however, if the Service Center assists you in locating a defective part (or parts) in your kit, or installs a replacement part for you, you may be charged for this service.

HEATHKIT equipment purchased locally and returned to Heath Company for service must be accompanied by your copy of the dated sales receipt from your authorized HEATHKIT dealer in order to be eligible for parts replacement under the terms of the Warranty.

THIS SERVICE POLICY APPLIES ONLY TO COMPLETED EQUIPMENT CONSTRUCTED IN ACCORDANCE WITH THE INSTRUCTIONS AS STATED IN THE MANUAL. Equipment that has been modified in design will not be accepted for repair. If there is evidence of acid core solder or paste fluxes, the equipment will be returned NOT repaired.

For information regarding modification of HEATHKIT equipment for special applications, it is suggested that you refer to any one or more of the many publications that are available on all phases of electronics. They can be obtained at or through your local library, as well as at most electronic equipment stores. Although the Heath Company sincerely welcomes all comments and suggestions, it would be impossible to design, test, evaluate and assume responsibility for proposed circuit changes for special purposes. Therefore, such modifications must be made at the discretion of the kit builder, using information available from sources other than the Heath Company.



HEATHKIT STEREO AMPLIFIER

MODEL AA-100

ENCIRCLED NUMBER AND LETTERED DESIGNATIONS APPEAR ON CIRCUIT BOARDS. NUMBERS 20, 21, 22, 25, 43, and 44 ARE GROUND CONNECTIONS AND DO NOT APPEAR ON THE SCHEMATIC.

ALL PAPER CAPACITORS RATED AT 400 VOLTS DC UNLESS SPECIFIED OTHERWISE.

ALL CAPACITOR VALUES ARE IN μf UNLESS SPECIFIED OTHERWISE.

ALL RESISTORS ARE 1/2 WATT UNLESS SPECIFIED OTHERWISE.

ROTARY SWITCH WAFERS ARE VIEWED FROM FRONT. SWITCHES SHOWN IN MAX. COUNTERCLOCKWISE POSITION.

→ INDICATES CLOCKWISE ROTATION.

⬭ INDICATES VOLTAGE READING.

VOLTAGES TAKEN WITH HEATHKIT VTVM, 117 VOLT LINE SOURCE. VOLTAGES MAY VARY ±20% DUE TO TOLERANCE OF COMPONENTS. VOLTAGES MARKED ☆ SHOULD NOT VARY MORE THAN ±10%.

DC VOLTAGES TAKEN FROM TEST POINT TO CHASSIS GROUND, UNDER NO-SIGNAL CONDITIONS.