

PRICE \$1.00



**Assembling
and Using Your...**

Heathkit

PREAMPLIFIER

MODEL WA-P2

HEATH COMPANY

A Subsidiary of Daystrom Inc.

BENTON HARBOR, MICHIGAN

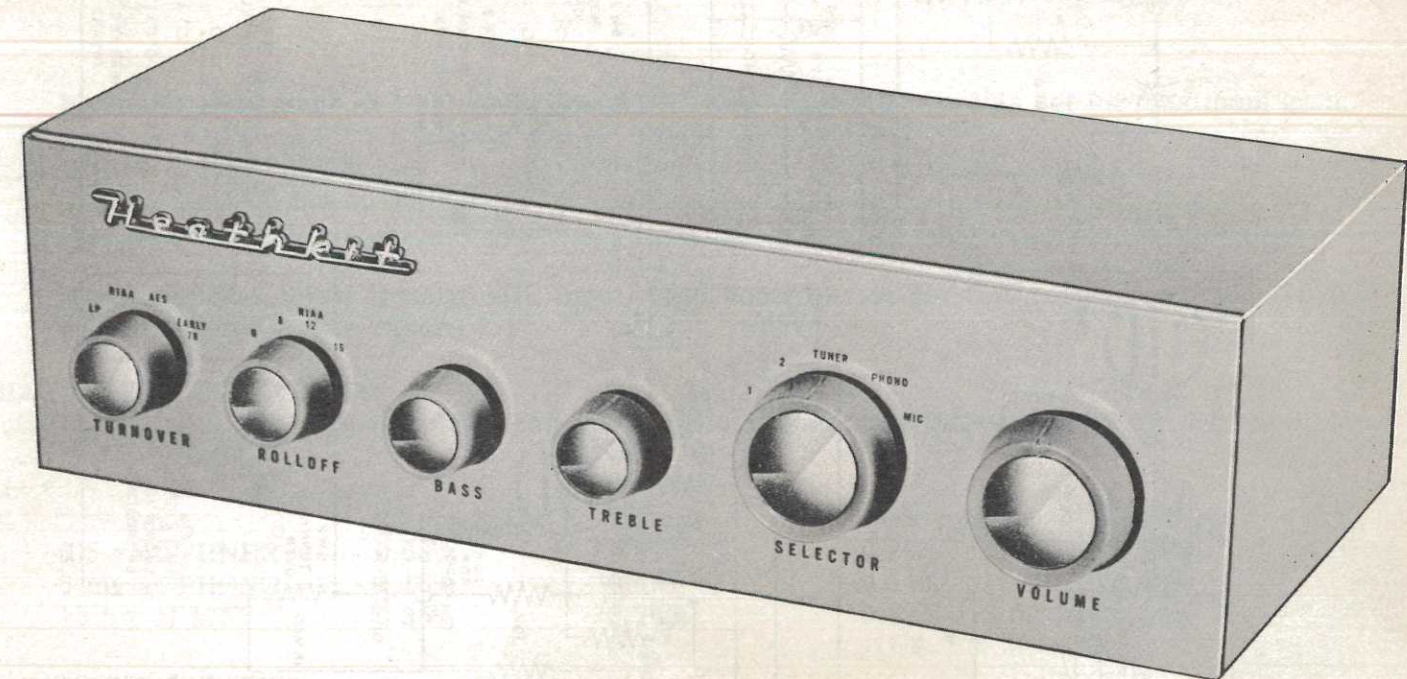
STANDARD COLOR CODE — RESISTORS AND CAPACITORS

INSULATED UNINSULATED Color	FIRST RING BODY COLOR First Figure	SECOND RING END COLOR Second Figure	THIRD RING DOT COLOR Multiplier
BLACK	0	0	None
BROWN	1	1	0
RED	2	2	00
ORANGE	3	3	,000
YELLOW	4	4	0,000
GREEN	5	5	00,000
BLUE	6	6	000,000
VIOLET	7	7	0,000,000
GRAY	8	8	00,000,000
WHITE	9	9	000,000,000

AXIAL LEAD RESISTOR	DISC CERAMIC RMA CODE

ASSEMBLY AND OPERATION OF THE HEATHKIT PREAMPLIFIER

MODEL WA-P2



SPECIFICATIONS

INPUTS:

Three high-level and two low-level inputs; individual level controls for each.

High-level inputs, 1, 2 and TUNER, for 0.1 volts or higher; 0.5 megohm input impedance.

Low-level inputs, PHONO and MIC, for 0.1 volts or lower; phono input impedance normally 22 K Ω for magnetic phono pickup; microphone input impedance 2.2 megohms.

OUTPUTS:

Two: Output to main amplifier variable 0 to at least 2.5 volts RMS from any normal program source; full control of input selection, volume, phono compensation and tone balance, cathode follower output; recommended load impedance 200 K Ω or higher shunted by .007 μ fd or less; up to 100 feet of shielded microphone cable, or up to 200 feet of RG-58-AU coaxial cable, may be used between preamplifier and main amplifier with not more than 3 db loss at 10,000 cps.

Output to recorder input providing minimum of 0.25 volts RMS from any normal program source; full control of input selection, phono compensation and individual input level, but independent of volume control or tone controls; cathode follower output with same characteristics as output to main amplifier input.

The standard color code provides all necessary information required to properly identify color coded resistors and capacitors. Refer to the color code for numerical values and the zeroes or multipliers assigned to the colors used. A fourth color band on resistors determines tolerance rating as follows: Gold = 5%, silver = 10%. Absence of the fourth band indicates a 20% tolerance rating.

The physical size of carbon resistors is determined by their wattage rating. Carbon resistors most commonly used in Heathkits are 1/2 watt. Higher wattage rated resistors when specified are progressively larger in physical size. Small wire wound resistors 1/2 watt, 1 or 2 watt may be color coded but the first band will be double width.

MOLDED MICA TYPE CAPACITORS

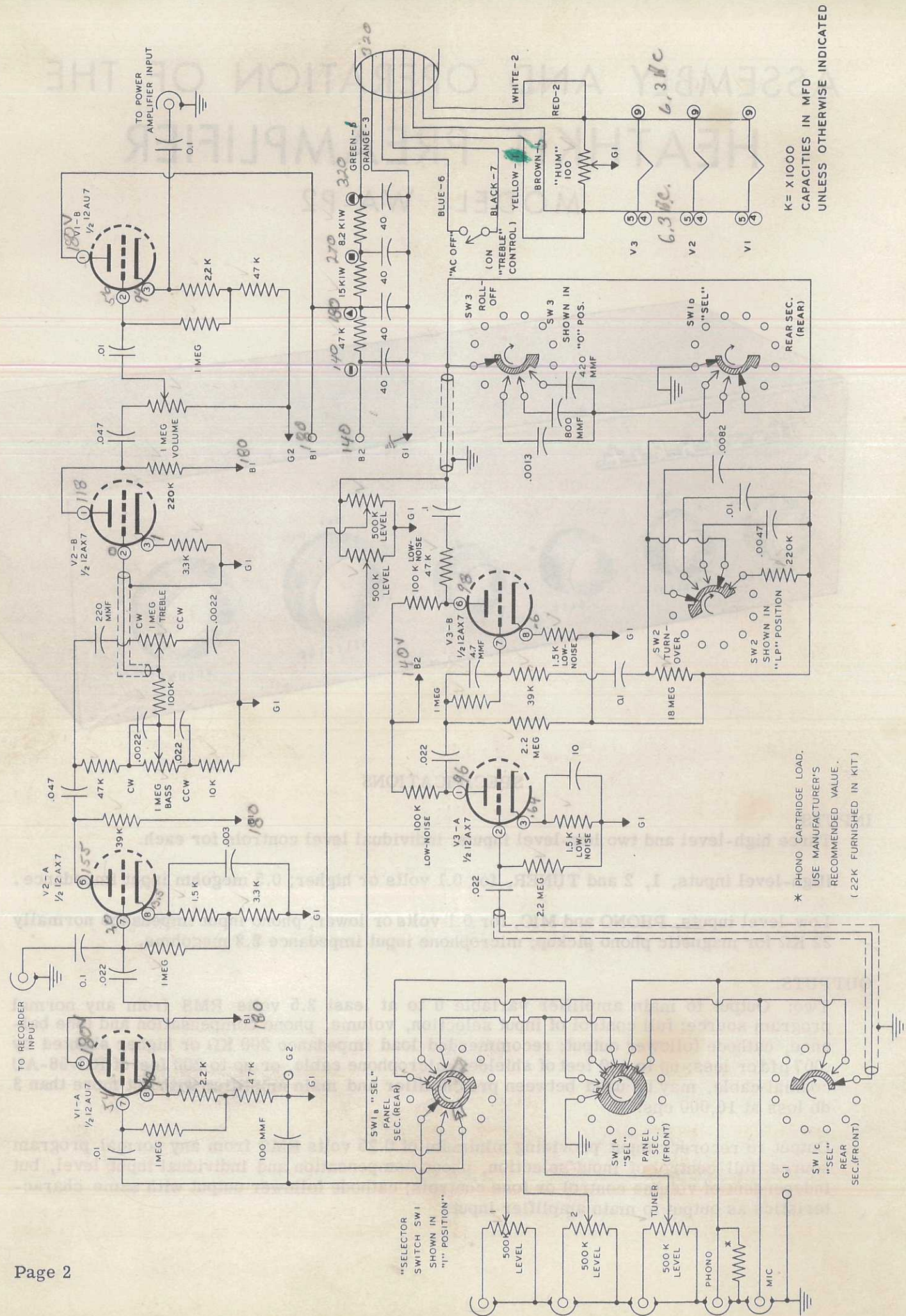
CURRENT STANDARD CODE	RMA 3-DOT (OBSOLETE) RATED 500 W.V.D.C. \pm 20% TOL.	BUTTON SILVER MICA CAPACITOR

MOLDED PAPER TYPE CAPACITORS

TUBULAR CAPACITOR	MOLDED FLAT CAPACITOR Commercial Code	JAN. CODE CAPACITOR

The tolerance rating of capacitors is determined by the color code. For example: red = 2%, green = 5%, etc. The voltage rating of capacitors is obtained by multiplying the color value by 100. For example: orange = 3 \times 100 or 300 volts. Blue = 6 \times 100 or 600 volts.

In the design of Heathkits, the temperature coefficient of ceramic or mica capacitors is not generally a critical factor and therefore Heathkit manuals avoid reference to temperature coefficient specifications.



GAIN:

High-level inputs:

0.05 volt input produces 0.5 volt RMS output	
0.09 " " " "	1.0 " "
0.14 " " " "	1.5 " "
0.18 " " " "	2.0 " "
0.23 " " " "	2.5 " "

Low-level inputs:

1.4 millivolts input produces 0.5 volt RMS output	
2.5 " " " "	1.0 " "
3.6 " " " "	1.5 " "
4.9 " " " "	2.0 " "
6.2 " " " "	2.5 " "

Measurements made at 1000 cps with LEVEL and VOLUME controls set for maximum gain.

FREQUENCY RESPONSE:

- 1.0 db from 25 cps to 30,000 cps
- 1.5 db from 15 cps to 35,000 cps

Measurements made through MIC input, tone controls set for flat response at 100, 1000 and 10,000 cps. (See Figure 2.)

HARMONIC DISTORTION:

At 2.5 volts RMS output, total measured harmonic distortion (not corrected for source distortion) is:

Input	20 cps	1000 cps	10,000 cps	20,000 cps
0.5 v at TUNER	0.63%	0.17%	0.33%	0.47%
6 mv at PHONO	1.15%	0.46%	0.54%	0.66%
15 mv at MIC	0.35%	0.26%	0.42%	0.48%

Source distortion from generator	0.74%	0.22%	0.22%	0.24%
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NOTE: Where source distortion is greater than measured distortion, it is assumed that certain cancellation effects are responsible.

INTERMODULATION DISTORTION:

Measured at 60 and 7000 cps with 4:1 ratio; tone controls at flat, volume at maximum, output level controlled by adjusting LEVEL control.

Output Voltage (RMS)	MIC Input	TUNER Input
0.5	0.48%	0.2%
1.0	0.50	0.3
1.5	0.50	0.4
2.0	0.55	0.59
3.0	0.70	0.77
4.0	0.88	0.98
5.0	1.1	1.2

HUM AND NOISE:

- 0.5 volt at TUNER input 72 db below 2.5 volts RMS
- 6 mv at PHONO input 62 db below 2.5 volts RMS
- 15 mv at MIC input 70 db below 2.5 volts RMS

Measured with tone controls set for flat response at 100, 1000 and 10,000 cps; volume control at maximum gain; turnover control at LP; rolloff control at 0; power cord polarized

for minimum hum; hum balance control set for minimum hum in PHONO input position; LEVEL control adjusted for 2.5 volts RMS output at input voltage shown.

PHONOGRAPH:

COMPENSATION: Low-frequency compensation provided by four-position TURNOVER control. See Figure 1 for curves.

High-frequency compensation provided by four-position ROLLOFF control. See Figure 1 for curves.

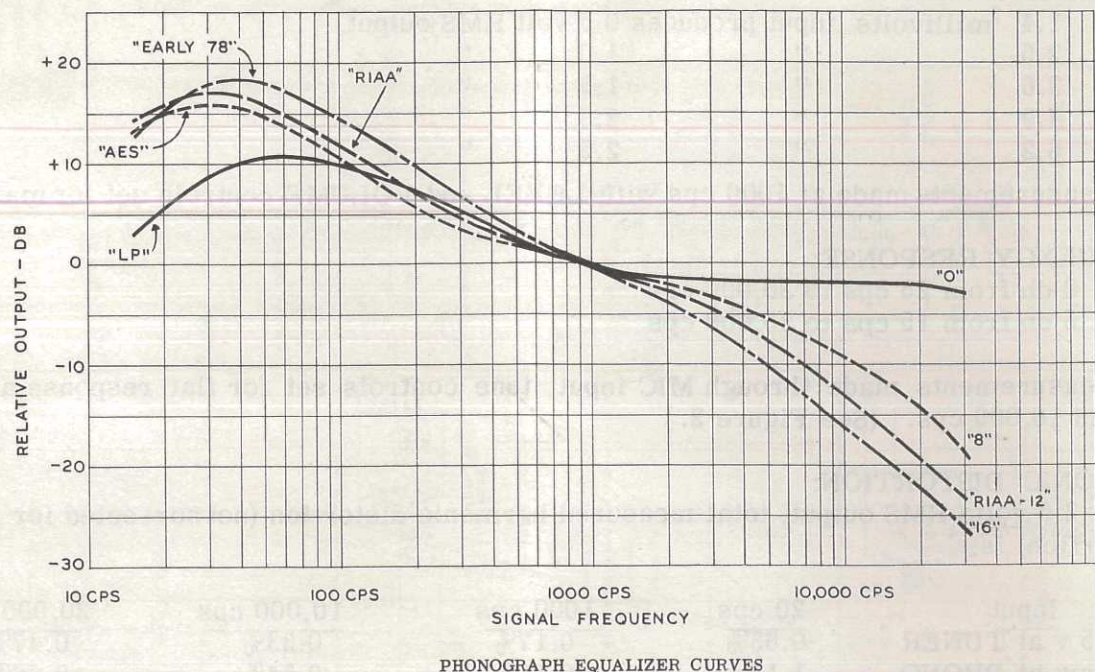


Figure 1
(TURNOVER CURVES TAKEN WITH ROLLOFF SET AT 0)
(ROLLOFF CURVES TAKEN WITH TURNOVER SET AT LP)

TONE CONTROL:

Separate bass and treble tone controls. Bass control provides approximately 18 db boost and 12 db cut at 50 cps. Treble control provides approximately 15DB boost and 20 db cut at 15,000 cps. See Figure 2 for curves.

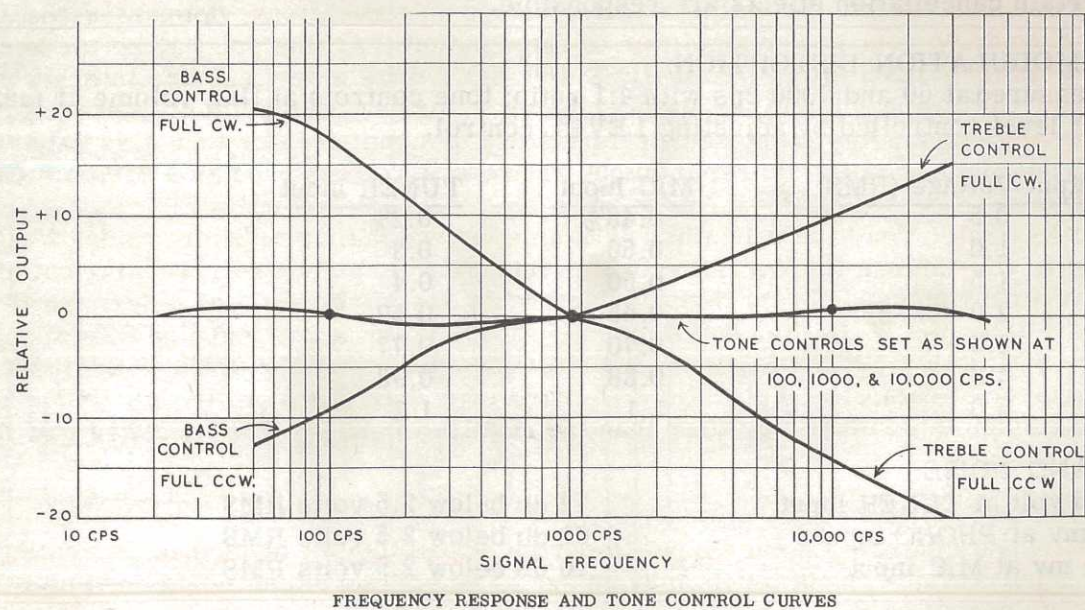


Figure 2
FREQUENCY RESPONSE AND TONE CONTROL CURVES
(BASS CURVES TAKEN WITH TREBLE CONTROL AT FLAT)
(TREBLE CURVES TAKEN WITH BASS CONTROL AT FLAT)

VOLUME CONTROL:

Conventional uncompensated voltage divider type at grid of main amplifier cathode follower output stage. Space is provided to mount a "loudness control" where program source outputs and main amplifier sensitivity permits. See Figure 3 for further information.

INPUT SENSITIVITY FOR "MIC" AND "PHONO" INPUTS OF HEATHKIT WA-P2 PREAMPLIFIER.

Curve marked "MIC INPUT (VOLUME CONTROL)" represents input-output characteristic for WA-P2 Preamplifier with conventional volume control through "MIC" channel.

Curve marked "PHONO INPUT (VOLUME CONTROL)" same as above except for "PHONO" channel.

Curve marked "PHONO INPUT (LOUDNESS CONTROL)" represents input-output characteristic when using loudness control in place of conventional volume control, through "PHONO" channel.

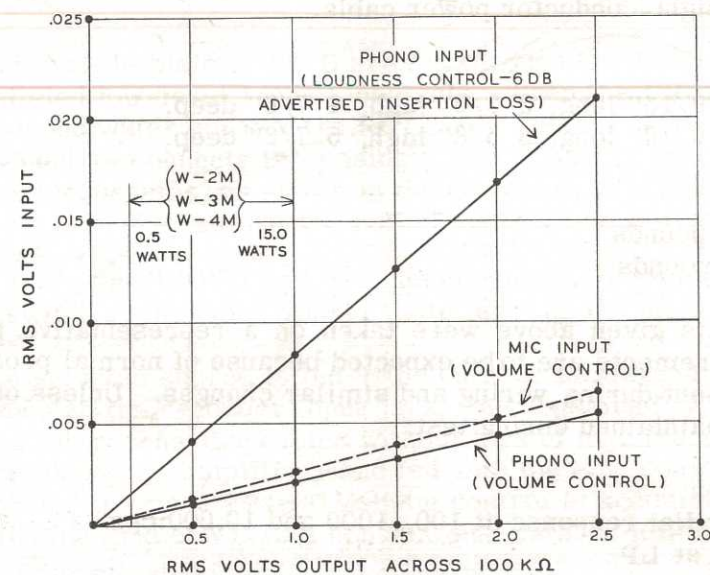


Figure 3

1. VOLUME OR LOUDNESS CONTROL AT FULL CLOCKWISE.
2. TONE CONTROLS SET AT FLAT.
3. TURNOVER CONTROL AT "LP."
4. ROLLOFF CONTROL AT "0."
5. LEVEL CONTROL FULL CLOCKWISE.
6. 1 KC SIGNAL.

To Use This Chart: From the manufacturer's specifications, determine the input voltage required to drive your power amplifier to rated output. At this point along the horizontal axis, marked "RMS VOLTS OUTPUT ACROSS 100 KΩ", draw a vertical line intersecting the three curves of the graph. Using the applicable curve, project this point of intersection to the left-hand vertical axis. Any input source furnishing a signal greater than this value is capable of driving the main amplifier to rated output when the WA-P2 is used as a preamplifier.

For Example: You have a Heathkit Williamson-type main amplifier, model W-2M. You wish to know if you can use the WA-P2 with conventional volume control, working out of a Fairchild 215 phonograph pickup. From the manufacturer's specifications, you determine that 0.75 volts input will drive the W-2M to 5 watts output. At this point, a vertical line intersects the PHONO INPUT (VOLUME CONTROL) curve at a value of approximately 0.002 volts input. From the manufacturer's data, the Fairchild 215 cartridge delivers 3 millivolts (0.003 volts) at 7.5 cm/sec. Since this value is greater than the required input, you are assured that the combination is satisfactory.

LEVEL CONTROLS:

Individual controls for each input to permit adjustment of level thus preventing overloading of input circuits. Input levels may be set so no volume adjustments need be made when selector switch is operated.

POWER SUPPLY:

Requires power from external source, as follows:

6.3 v AC at 1.0 amp.

300 v DC at 10 ma.

These voltages are available from any Heathkit Williamson-Type amplifier, models WA-1, W-2M, W-3M or W-4M. One additional resistor is required; this resistor is supplied with the WA-P2 kit. An eight-conductor cable terminating in an octal plug is supplied with the kit. This plug makes all required power connections to Heathkit main amplifiers.

POWER SWITCHING:

AC on-off switch on treble tone control, rated at 3 amperes, 125 volt AC. Switch leads are brought out through eight-conductor power cable.

DIMENSIONS:

Cabinet only: 12 9/16" long, 3 3/8" high, 4 7/8" deep.

Overall: 12 9/16" long, 3 5/8" high, 5 7/8" deep.

WEIGHT:

Net weight: 3 1/2 pounds

Shipping weight: 7 pounds

NOTE: The measurements given above were taken on a representative preamplifier. Variations from these measurements are to be expected because of normal production deviations in components, lead placement during wiring and similar changes. Unless otherwise stated, the following settings were maintained during test:

Volume control full on

Tone controls set for flat response at 100, 1000 and 10,000 cps

Turnover control set at LP

Rolloff control set at 0

Level controls adjusted for output voltage indicated:

2.5 volts RMS at 1000 cps if not otherwise stated

Output measurements were taken at the end of a four-foot length of shielded cable, with a capacity of 55 μf per foot. Power supply was taken from a W-2M Heathkit Williamson-type Amplifier, modified in accordance with the instruction manual and operated at 117 volts 60 cycles.

INTRODUCTION

The Heathkit model WA-P2 was designed to fulfill the performance requirements of the most critical audiophile, at the lowest possible cost. It is truly a worthy companion for the Heathkit Williamson-type main amplifiers with which it was designed to be used. Where sufficient filament and plate power is available, it may also be used to great advantage with any other true high-fidelity amplifier.

To our knowledge, the WA-P2 meets or exceeds the specifications for preamplifiers for the most rigorous high-fidelity applications. It will do justice to the finest available program sources whether they be phonograph pickups, tuners, microphones or recorders. But no preamplifier can correct for serious distortion in the following power amplifier or reproducer system. It can only deliver to these units program material conveniently selected, properly compensated and free of contributed distortion or extraneous noise. When constructed and adjusted in accordance with instructions, the WA-P2 is fully capable of meeting these requirements.

CIRCUIT DESCRIPTION

In addition to the data presented in the specifications, the following brief circuit description may be of interest to the technically inclined constructor.

High-level inputs are adjusted to equal and suitable volume levels by the LEVEL controls. The desired input is selected by means of the back contacts of the first wafer of the selector switch. Low-level inputs are selected by the front contacts of the second wafer of the selector switch. (Idle input channels are grounded through the front contacts of the first wafer.) Low-level signals are fed through triode V-3A and passed to the grid of triode V-3B through the .022 coupling condenser and the 1 megohm series resistor, by-passed by the 4.7 μf condenser. When the input switch is in the PHONO position, signal voltage is also fed through the 39 K Ω resistor and the 0.1 μf coupling condenser to the TURNOVER control switch and to ground through the back contacts of the second wafer of the selector switch. This shunt network produces the rising low-frequency characteristics required for proper equalization of phonograph recordings. Variations of this response curve are controlled by the condenser-resistor combinations selected by the turnover control. In the MIC input position, the entire TURNOVER control is shorted to ground.

Audio voltages appearing at the plate of V3-B are fed through the 47 K Ω resistor and the .01 μf condenser to the paralleled low-level LEVEL controls. When the PHONO input is selected, the back contacts of the second wafer connect the ROLLOFF control between this point and ground. Rotation of the rolloff control connects increasingly larger shunt capacities to ground, thus de-emphasizing the higher frequencies, as shown in the equalization curves. In the MIC input position, the ground return is broken so that the rolloff control is deactivated.

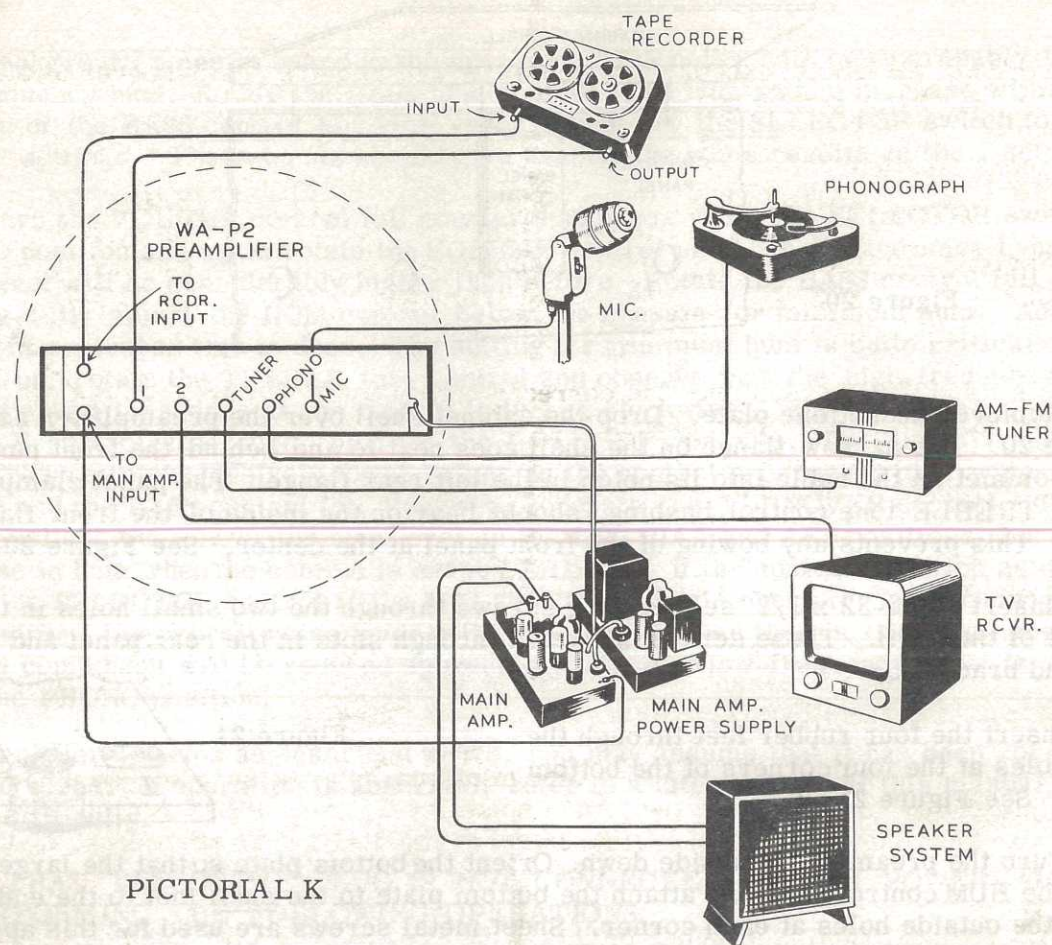
The adjusted outputs from the PHONO and MIC level controls appear at the back of the first wafer of the selector switch at the same approximate level as the high-level inputs.

Audio voltage from the selected source is fed to the cathode follower stage V1-A and appears at a much lower impedance at the recorder input jack. As explained in the specifications, this permits the use of long interconnecting cables without loss of high frequencies. This voltage is also applied to the grid of V2-A, amplified, and fed into the tone control circuits. The signal voltage is then reamplified in triode V2-B. Volume control is accomplished between the plate circuit of this stage and the grid of V1-B, a conventional cathode follower triode with the characteristics outlined previously under SPECIFICATIONS.

Plate supply voltages are developed at the output of the three-section RC filter whose parameters have been established for maximum rejection of very low frequencies as well as reduction in 60 and 120 cycle ripple. This filter system provides a high degree of decoupling and so stabilizes the performance of the preamplifier when powered from a following main amplifier where plate supply coupling might cause motor-boating.

Filament supply is line-frequency AC obtained from an external filament winding. No ground to any portion of the filament winding is used except through the hum-balance control in the pre-amplifier. By this means, a very substantial reduction in hum level is accomplished.

A great deal of experimentation resulted in the system of shielding and grounding used in the WA-P2 preamplifier. Use of large diameter spiraled conduit reduces the shunting effect of shields at higher audio frequencies. All current-carrying grounds for a particular stage are returned to a common insulated point and individual ground leads are brought to chassis ground near the physical center of the chassis. In this way, chassis currents are reduced to a minimum and coupling in ground returns becomes a minor problem.



PICTORIAL K

HOW TO USE THE TURNOVER AND ROLLOFF CONTROLS

These controls compensate the response of the preamplifier to correct for the recording characteristic used by the various manufacturers. A committee of the Record Industry Association of America has recently approved a standard curve, to be known as the "RIAA Standard Recording and Reproducing Characteristic." This committee is composed of representatives of Capitol, Columbia, Decca, Mercury and RCA Victor. It may be assumed that the use of the curve will become widespread in the future. **THIS CHARACTERISTIC MAY BE MATCHED BY SETTING THE TURNOVER AND ROLLOFF CONTROLS TO THE "RIAA" POSITIONS.**

For recordings released prior to 1954, use the following table as a guide for setting these controls:

LP Records labelled	TURNOVER	ROLLOFF	LP Records labelled	TURNOVER	ROLLOFF
Atlantic	RIAA	16	London	LP	8
Bartok	AES	16	Lyricord	AES	16
Blue Note Jazz	AES	RIAA-12	Mercury	AES	RIAA-12
Caedmon	AES	RIAA-12	M-G-M	RIAA	RIAA-12
Canyon	AES	RIAA-12	Oceanic	LP	16
Capitol	AES	RIAA-12	Philharmonia	AES	RIAA-12
Capitol-Cetra	AES	RIAA-12	Polymusic	RIAA	16
Cetra-Soria	AES	RIAA-12	RCA-Victor	RIAA	RIAA-12
Columbia	LP	16	Remington	RIAA	16
Cook Laboratories	RIAA	RIAA-12	Tempo	RIAA	RIAA-12
Decca	AES	RIAA-12	Urania	LP	16
Electra	AES	16	Vanguard-Bach Guild	LP	16
EMS	AES	RIAA-12	Vox	LP	16
Esoteric	RIAA	RIAA-12	Westminster	RIAA	16
Haydn Society	LP	16			

45 RPM records of all labels, except RCA, generally will require AES turnover and 12 db roll-off. For RCA, use RIAA settings.

78 RPM records labelled:

Brunswick	EARLY 78	0	EMI	EARLY 78	0
Capitol	AES	RIAA-12	HMV	EARLY 78	0
Columbia (English)	EARLY 78	0	London	EARLY 78	8
Columbia (USA)	AES	16	Parlophone	EARLY 78	0
Decca	AES	RIAA-12	RCA-Victor	RIAA	RIAA-12

Please bear in mind that there is only one correct combination of turnover and rolloff for a given recording and that is the one which sounds best to you. Do not hesitate to experiment until you find the settings you prefer. Additional information concerning equalization of recordings appears in technical literature. "High Fidelity" magazine publishes an extensive tabulation at intervals and portions of the above list were compiled from this source, with permission of the publishers.

NOTES ON USING THE WA-P2 PREAMPLIFIER

With the BASS and TREBLE control indicators in the vertical, or 12 o'clock position, the response of the preamplifier is essentially flat except for compensation supplied by the turnover and rolloff circuits in the PHONO position.

Be sure to reverse the line plug in the outlet for minimum hum. Also, after all connections are made, readjust the HUM control for the lowest noise level, using PHONO input. Set the BASS control at full clockwise and the ROLLOFF control to the EARLY 78 position so that maximum bass boost is used. As mentioned before, the setting of the HUM control is rather critical.

Occasionally, residual hum of a higher pitch will be evident even with the VOLUME control at minimum. If this occurs, try disconnecting the shield of the output cable at the point where it is connected to the main amplifier plug.

As explained in the Specifications (Page 5), no "loudness control" circuit is incorporated in the WA-P2. Space is provided for these controls if you should desire to use one of them. If a 3-section control is used, it may be necessary to clip off a corner of the chassis flange directly behind the control. This may be done easily with a pair of diagonal cutting pliers. Follow the manufacturer's recommendations for installing and using loudness controls.

SELECTION OF ACCESSORY COMPONENTS

The range of accessory components for use in high-fidelity systems continues to expand. Every attempt has been made to provide in the WA-P2, sufficient flexibility to utilize future as well as current equipment of this kind. Remember that the preamplifier is only one important link in the chain. It cannot eliminate distortion or noise from other parts of the system.

For phonograph reproduction, we seriously recommend the purchase of a cartridge with a replaceable diamond stylus despite the higher first cost. Reduction in damage to records, better tracking and longer life will more than repay the extra original outlay.

Magnetic or reluctance types of cartridges are generally susceptible to external magnetic fields and they should be used only with turntables or changers equipped with motors designed to have very weak external fields. Ceramic and crystal cartridges are not affected in this way and great improvements have been made in the performance of this group of pickups.

In the speaker-enclosure field, a tremendous range in price (and performance) exists. Generally speaking, the performance can be predicted more from the size of the speaker enclosure than from the size of the speaker cone. Good bass reflex baffles, properly designed and adjusted, are probably the best low-cost enclosures available at present. Many of the Helmholtz-resonator types of enclosures are excellent but they are more critical as to driver units, construction and other variables. Most speaker manufacturers supply excellent data on enclosure design.

Further discussion of the accessory problem is outside the scope of this manual. We recommend, for a serious and comprehensive review of the subject, any of the books mentioned in the bibliography. "Audio Engineering," "High-Fidelity," "Radio and Television News" and "Radio-Electronics" are publications which regularly feature articles on this subject.

IN CASE OF DIFFICULTY

Recheck the wiring. Trace each lead in colored pencil on the pictorial 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 voltage table below. 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 proved satisfactory.

If voltages and tubes are normal, try the following procedure:

With the VOLUME control about half on and LEVEL control full on, touch terminal V1-3 with one lead of a .01 μ fd condenser, hold the other lead in your hand. (CAUTION: Do not touch the chassis or any other metallic body with your other hand while making this test.) This should cause a decided increase in hum level at the speaker, if the circuit from this point is normal. Work back through the circuit, touching terminals V1-2, V2-1, V2-2, V2-6, V2-7, V1-8, V1-7, V3-6, V3-7, V3-1 and V3-2. The hum increase should be noticed at each point and will generally become greater as you work back. At some point, the circuit will appear to be dead and all circuitry following that stage may be disregarded in your trouble shooting. In this way, you can easily locate the source of the trouble and expedite its correction.

VOLTAGE CHART

SOCKET	Pin 1	Pin 2	Pin 3	Pin 4 and 5	Pin 6	Pin 7	Pin 8	Pin 9
V1	180	56	94	H	180	54	90	H
V2	118	0	1	H	155	2.0	3.5	H
V3	96	NS	.64	H	98	NS	0.6	H
Filter Condenser	Terminal \blacktriangle	320	Terminal \blacksquare	270	Terminal \blacktriangle	180	Terminal \blacksquare	140

All voltages are positive DC to chassis, measured with Heathkit V-6 Vacuum Tube Voltmeter with 11 megohm input resistance. Voltage between points marked H is 6.3 volts AC. NS indicates reading not significant. Measurements made with 320 volts DC input to filter system.

BIBLIOGRAPHY

"The Saturday Review Home Book of Recorded Music and Sound Reproduction," Prentice Hall, Inc., New York

Read, O.; "The Recording and Reproduction of Sound," Howard W. Sams and Company, Inc. Indianapolis

Newitt, John H.; "High Fidelity Techniques," Rinehart Books, Inc., New York

REPLACEMENTS

Material supplied with Heathkits has been carefully selected to meet design requirements and ordinarily will fulfill its function without difficulty. Occasionally improper instrument operation can be traced to a faulty tube or component. Should inspection reveal the necessity for replacement, write to the Heath Company and supply all of the following information:

- Thoroughly identify the part in question by using the part number and description found in the manual parts list.
- Identify the type and model number of kit in which it is used.
- Mention the order number and date of purchase.
- Describe the nature of defect or reason for requesting replacement.

The Heath Company will promptly supply the necessary replacement. Please do not return the original component until specifically requested to do so. Do not dismantle the component in question as this will void the guarantee. If tubes are to be returned, pack them carefully to prevent breakage in shipment as broken tubes are not eligible for replacement. This replacement policy does not cover the free replacement of parts that may have been broken or damaged through carelessness on the part of the kit builder.

SERVICE

In event continued operational difficulties of the completed instrument are experienced, the facilities of the Heath Company Service Department are at your disposal. Your instrument may be returned for inspection and repair for a service charge of \$5.00 plus the cost of any additional material that may be required. THIS SERVICE POLICY APPLIES ONLY TO COMPLETED INSTRUMENTS CONSTRUCTED IN ACCORDANCE WITH THE INSTRUCTIONS AS STATED IN THE MANUAL. Instruments that are not entirely completed or instruments that are modified in design will not be accepted for repair. Instruments showing evidence of acid core solder or paste fluxes will be returned not repaired.

The Heath Company is willing to offer its full cooperation to assist you in obtaining the specified performance level in your instrument. Factory repair service is available for a period of one year from the date of purchase or you may contact the Engineering Consultation Department by mail. For information regarding possible modification of existing kits, 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 any electronic outlet store. 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 specific purposes. Therefore, such modifications must be made at the discretion of the kit builder according to information which will be much more readily available from some local source.

SHIPPING INSTRUCTIONS

Before returning a unit for service, be sure that all parts are securely mounted.

ATTACH A TAG TO THE INSTRUMENT GIVING NAME, ADDRESS AND TROUBLE EXPERIENCED.

Pack in a rugged container, preferably wood, using at least three inches of shredded newspaper or excelsior on all sides. DO NOT SHIP IN THE ORIGINAL KIT CARTON AS THIS CARTON IS NOT CONSIDERED ADEQUATE FOR SAFE SHIPMENT OF THE COMPLETED INSTRUMENT. Ship by prepaid express if possible. Return shipment will be made by express collect. Note that a carrier cannot be held liable for damage in transit if packing, in HIS OPINION, is insufficient.

SPECIFICATIONS

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.

WARRANTY

The Heath Company limits its warranty of parts supplied with any kit to a period of three (3) months from the date of purchase. Replacement will be made only when said part is returned postpaid, with prior permission and in the judgment of the Heath Company was defective at the time of sale. This warranty does not extend to any Heathkits which have been subjected to misuse, neglect, accident and improper installation or applications. Material supplied with a kit shall not be considered as defective, even though not in exact accordance with specifications, if it substantially fulfills performance requirements. This warranty is not transferable and applies only to the original purchaser. This warranty is in lieu of all other warranties and the Heath Company neither assumes nor authorizes any other person to assume for them any other liability in connection with the sale of Heathkits.

The assembler is urged to follow the instructions exactly as provided. The Heath Company assumes no responsibility or liability for any damages or injuries sustained in the assembly of the device or in the operation of the completed instrument.

HEATH COMPANY
Benton Harbor, Michigan

PARTS LIST

PART No.	PARTS Per Kit	DESCRIPTION	PART No.	PARTS Per Kit	DESCRIPTION
Composition Resistors			Sockets-Plugs-Terminal Strips-Knobs		
✓ 1-11	1	1.5 KΩ 1/2 watt	✓ 434-16	1	9-pin tube socket
✓ 1-44	2	2.2 KΩ 1/2 watt	✓ 434-43	2	9-pin tube socket, shielded
✓ 1-14	2	3.3 KΩ 1/2 watt	✓ 434-42	7	Phono input socket
✓ 1-20	1	10 KΩ 1/2 watt	✓ 438-6	1	Octal plug and cap
✓ 1-22	1	22 KΩ 1/2 watt	✓ 438-4	4	Phono plug
✓ 1-67	2	39 KΩ 1/2 watt	✓ 431-11	4	5-lug terminal strip
✓ 1-25	5	47 KΩ 1/2 watt	✓ 431-12	1	4-lug terminal strip
✓ 1-26	1	100 KΩ 1/2 watt	✓ 431-16	1	2-lug terminal strip
✓ 1-29	2	220 KΩ 1/2 watt	✓ 462-27	4	Knob, small
✓ 1-35	4	1 megohm 1/2 watt	✓ 462-28	2	Knob, large
✓ 1-37	2	2.2 megohm 1/2 watt			
✓ 1-74	1	18 megohm 1/2 watt	Metal Parts		
✓ 1-4A	1	8.2 KΩ 1 watt	✓ 200-M64	1	Chassis
✓ 1-26A	2	15 KΩ 1 watt	✓ 204-M65	1	Bracket, left-end
✓ 2-84	2	1.5 KΩ 1/2 watt low-noise	✓ 204-M66	1	Bracket, right-end
✓ 2-85	2	100 KΩ 1/2 watt low noise	✓ 90-M29F	1	Cabinet shell
Controls-Switches			✓ 203-M58F76	1	Control panel
✓ 11-17	1	100 Ω ww control HUM	✓ 203-M59F79	1	Rear panel
✓ 10-35	5	500 KΩ comp. control LEVEL	✓ 205-M34F	1	Bottom plate
✓ 10-37	2	1 megohm comp. control VOLUME and BASS	✓ 207-M7	1	Panel clamp
✓ 19-21	1	1 megohm comp. control w/switch TREBLE	✓ 206-3	2	Tube shield
✓ 63-75	1	Single-section rotary switch TURNOVER	✓ 206-23	1	Switch shield
✓ 63-76	1	Single-section rotary switch ROLLOFF	Wire-Cable-Shielding		
✓ 63-74	1	Double-section rotary switch SELECTOR	✓ 344-1	1	length Hookup wire
			✓ 344-1	8	lengths Hookup wire (8 colors)
			✓ 340-2	1	length Bare wire
			✓ 343-3	1	length Shielded cable
			✓ 346-1	1	length Sleeving, 1/16"
			✓ 346-5	1	length Sleeving, 1/4"
			✓ 347-1	1	length 8-conductor cable
			✓ 206-24	1	length Shielding, 3/16"
Condensers			Hardware		
✓ 21-29	1	4.7 μμf ceramic (.0000047 μfd)	✓ 73-1	2	3/8" grommet
✓ 21-9	1	100 μμf ceramic (.0001 μfd)	✓ 73-4	2	3/16" grommet
✓ 21-22	1	220 μμf ceramic (.00022 μfd)	✓ 73-6	4	7/16" grommet
✓ 21-23	1	420 μμf ceramic (.00042 μfd)	✓ 207-5	1	Cable clamp
✓ 21-24	1	800 μμf ceramic (.0008 μfd)	✓ 250-2	6	3-48 machine screw
✓ 21-25	1	.0013 μfd ceramic (1300 μμf)	✓ 250-8	4	#6 sheet metal screw
✓ 21-26	1	.003 μfd ceramic (3000 μμf)	✓ 250-9	2	6-32 x 3/8" machine screw
✓ 23-37	2	.0022 μfd molded paper	✓ 250-31	20	6-32 machine screw
✓ 23-39	1	.0047 μfd molded paper	✓ 250-46	12	6-32 self-tapping screw
✓ 23-54	1	.0082 μfd molded paper	✓ 252-1	6	3-48 hex nut
✓ 23-34	3	.01 μfd molded paper	✓ 252-3	22	6-32 hex nut
✓ 23-50	4	.022 μfd molded paper	✓ 252-7	12	Control nut
✓ 23-52	2	.047 μfd molded paper	✓ 253-10	12	Flat metal washer, control
✓ 23-53	4	.1 μfd molded paper	✓ 253-21	4	Flat metal washer, 9/16"
✓ 25-4	1	10 μfd 25 volt elec.	✓ 253-15	1	Flat fiber washer
✓ 25-48	1	40 μfd 350 v., 40 μfd 300 v., 40-40 at 250 v. electrolytic	✓ 253-16	1	Shoulder fiber washer
			✓ 254-1	20	#6 lockwasher
			✓ 254-4	15	Control lockwasher
			✓ 255-2	4	#6 spacer, 3/16"
			✓ 259-1	2	#6 solder lug
			✓ 261-4	4	Rubber mounting feet
Miscellaneous					
✓ 411-25	1	12AU7 tube			
✓ 411-26	2	12AX7 tube			
✓ 391-1	1	Nameplate			
✓ 481-3	1	Condenser mounting wafer			
✓ 595-89	1	Instruction manual			

