

40 WATT INTEGRATED STEREO AMPLIFIER

MODEL  
**ST 40**

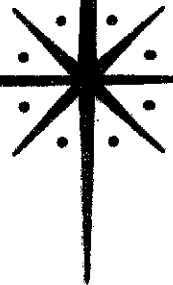


**EICO**

INSTRUCTION

MANUAL

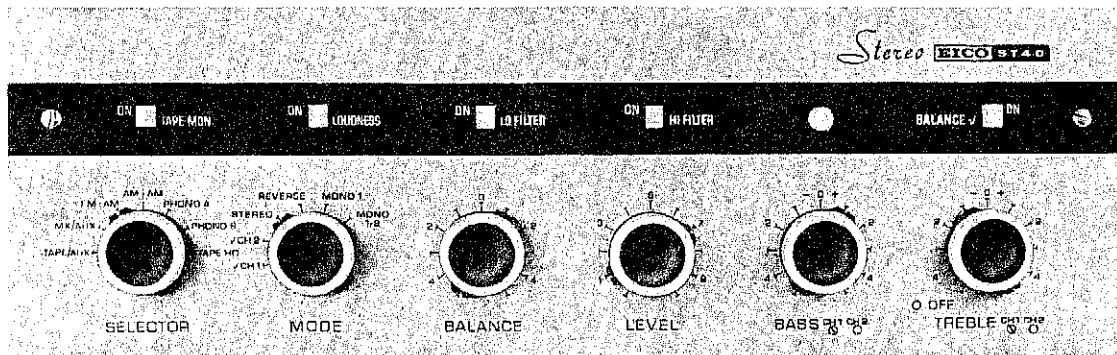
ST 40-1



ELECTRONIC INSTRUMENT CO. INC.  
3300 NORTHERN BLVD., L. I. CITY 1, N. Y.



# 40 WATT INTEGRATED STEREO AMPLIFIER



## GENERAL DESCRIPTION

The EICO Model ST-40 is a complete high fidelity stereophonic control center and a pair of 20-watt amplifiers, all on one chassis. With it, you can select, preamplify, and control any stereophonic or monophonic source and feed it through the self-contained dual 20 watt amplifiers to a stereo pair of speaker systems. Provision is made for operating a center speaker directly from the ST-40.

## FEATURES

1. Provision for two stereo phono cartridges to be connected. Permits the use of both a turntable and a record changer in the installation. One pair presents 47K $\Omega$  load and the other pair 100K $\Omega$  load, to cover most popular cartridges. RIAA equalization.
2. Provision for connecting stereo tape heads. MARTB equalization for 7 1/2 ips.
3. High level input pairs for multiplex adaptor, pre-amplified and equalized tape, FM tuner, and AM tuner.
4. Separate level and balance controls. Null-type balance checking circuit.
5. Switched high and low frequency filter circuits permit elimination of rumble problem or scratch and distortion when need be.
6. Switched loudness compensation.
7. Tape monitor switch.
8. Feedback equalization, with feedback around both preamplifier stages. High overload point.
9. Bass and treble tone controls are of the variable inflection point, feedback type for exceptionally low distortion and the most desirable control characteristics. These controls do not affect the volume or interact with each other, and boost or cut at the extremes of the audio range do not affect the mid-range.
10. Separate filament windings and hum balance controls for each channel permit an optimum hum balance for each channel, rather than a compromise for both channels.
11. Unused inputs grounded by SELECTOR switch to eliminate cross-talk — except for TAPE inputs, since some tape machines are adversely affected if playback outputs are grounded during recording.
12. Provision for feeding a center speaker directly from the ST-40.
13. Conservatively operated 7591 output tubes, and highly efficient GZ34 rectifier.

## SPECIFICATIONS

**POWER OUTPUT:** 40 watts total; 20 watts each channel continuous sine wave power

**IM DISTORTION (60 & 7000 CPS at 4:1):** 1% at 20W each channel; 0.6% at 10W; 0.16% at 1W

**HARMONIC DISTORTION:** Less than 1% 40-20,000 cps within 1db of 20 watts each channel; less than 1.5% 30-20,000 cps at half-power each channel

**FREQUENCY RESPONSE:**  $\pm 0.5$ db 40-20,000 cps at 20 watts each channel;  $\pm 1$  db 12-25,000 cps at 1 watt each channel

<u>INPUT</u>	<u>SENSITIVITY</u>	<u>INPUT IMPEDANCE</u>
Phono A	3Mv	100K $\Omega$
Phono B	3Mv	47K $\Omega$
Tape Head	1.75Mv	1M $\Omega$
FM	360Mv	500K $\Omega$
AM	360Mv	500K $\Omega$
Multiplex	360Mv	500K $\Omega$
Tape	360Mv	500K $\Omega$

**TONE CONTROL RANGE:**  $\pm 15$ db at 50 cps and 10kc

**DAMPING FACTOR:** 11

**SPEAKER CONNECTIONS:** 4, 8, 16 $\Omega$

**TAPE OUTPUT IMPEDANCE:** 400 $\Omega$  at 20kc when using low level inputs; same as the output impedance of the source when using high level inputs

**TUBES:** 2-12AX7, 4-12DW7, 4-7591, 1-GZ34 rectifier

**POWER SOURCE:** 117V, 60 cps

**POWER CONSUMPTION:** 165 watts

**CONVENIENCE OUTLETS:** 1 controlled by power switch, 1 not switched

**FUSE:** 3 amperes

**SIZE (HWD):** 5 1/8" x 15 7/8" x 13 1/8"

**WEIGHT:** 32 lbs.

## CABINET INSTALLATION

### GENERAL

1. Mount horizontally on a well-braced shelf. The stock thickness of the wood panel may not exceed 3/4".
2. Do not remove feet for mounting. Air must be allowed to enter through the perforations in the bottom plate to avoid overheating.
3. Any shelf above the unit must be spaced away at least 3 inches. Allow at least a 1 1/2" tolerance on each side of the unit.
4. Leave the back of the cabinet entirely open.

### PREPARATION OF UNIT

1. Turn unit over and loosen the front and rear pairs of screws (4 in all) that fasten the bottom plate to the side pieces. Remove the center pair entirely. Then turn the unit back right side up.
2. Remove the 6 screws, one on each side, that fasten the cover to the side pieces. Remove the cover and set aside.
3. On the top side of the chassis, loosen all 6 screws (3 on each side) that fasten the chassis to the side pieces.
4. Push both side pieces back as far as they will go. The screws that have been loosened will move from the front to the rear ends of the slots in the chassis and the bottom plate. Then re-tighten all the screws that have been loosened. Check to see that all the tubes are properly seated in their sockets and then replace and re-fasten the cover to the side extrusions.
5. Detach all the knobs from the control shafts and then remove the 4 screws, (2 previously concealed by knobs and 2 in the recessed area) that fasten the panel to the chassis. Lift the panel out over the control shafts and set it aside. The unit is now prepared for cabinet installation.

## PREPARATION OF THE CABINET

1. Two templates are provided, one for the cabinet shelf and the other for the cabinet panel. The shelf template is used to locate exactly two holes that are to be drilled in the shelf. The panel template is used to locate exactly the required rectangular cut-out. The two templates must be used together as indicated, as there is an exact relationship between the locations of the shelf holes and panel cut-out.

2. To use the shelf template, cut it or fold it back exactly along the dashed line that corresponds to the panel thickness. Remove the shelf from the cabinet and line up this dashed line on the template with the front edge of the shelf, positioning it also along the edge to leave at least 1 1/2" clearance on each side. Tape the template in position and use a center punch to mark the centers of the two holes to be drilled. If the shelf can not be removed, place the template in a similar manner on the top side of the shelf if there is room to drill from the top side, or on the under side of shelf if there is only room to drill from the under side. If the template is used on the underside of the shelf, mark the rear edge of the shelf at the points where the extended heavy lines on the template hit the rear shelf edge. After the holes are center-punched, remove the template and drill carefully through the punched centers to a diameter of 1/4". If the shelf has been removed for the drilling operation, now re-mount it. Finally, replace the shelf-template in exactly its former position on the top-side of the shelf and tape it down. If the shelf template had been used on the underside of a stationary shelf, now place it on the top-side of the shelf using the marks on the rear edge of the shelf previously made. (In the latter case, accuracy may be improved by cutting the two holes out of the shelf-template with a razor blade and then lining up the holes in the shelf template with the holes in the shelf).

3. To use the panel template, cut it or fold it back exactly along the dashed line. This dashed line corresponds to the junction of the top side of the cabinet shelf and the interior side of the wood panel. Position the panel template against the interior side of the wood panel so that the dashed line rests against the shelf and the two heavy vertical lines in the panel template meet with the two heavy horizontal lines in the shelf templates. Tape the panel template down and use a center-punch to make the centers of the four 3/8" holes in the four corners of the rectangular cut-out shown on the template. Now remove both templates and drill carefully through each of the four punched centers to a

hole diameter of 3/8". On the front side of the wood panel scribe a rectangle externally tangential to the four drilled holes. Check the height and width of the rectangle against the panel template dimensions. These dimensions should not be exceeded. Now carefully cut out the rectangle with a sabre saw, using a small blade to start accurately in the 3/8" holes. After the cutting operation, any rough spots or excess material along the edges of the cut-out may be removed with a file. Finally, brush or blow out all chips and sawdust.

## MOUNTING THE UNIT

1. Insert the unit from the rear of the cabinet, carefully guiding the controls through the panel cut-out. Center the unit in the cut-out and re-mount the panel with the four screws previously removed.

2. From the rear of the cabinet, pull the amplifier toward you gently, until the front panel is flush against the wood panel.

3. Now place 5/8" flat washers against the heads of the two #8 x 1 3/4" screws provided and insert them from the bottom side of the shelf into the two holes drilled previously. It may be necessary to shift the unit slightly to the left or right in order to afford clear access for the screws. When both screws have caught, tighten them to secure the unit to the shelf.

4. Replace the knobs previously removed on the control shafts.

## INPUT CONNECTIONS

Channel 1 has 7 inputs and channel 2 has 6 inputs, one of which there is no use for at the present time (AM 2).\*

The channel 1 inputs are identified by the suffix "1" and are as follows:

<u>CH. 1 Low Level Inputs</u>	<u>CH. 1 High Level Inputs</u>
PHONO A 1	FM 1
PHONO B 1	AM 1
TAPE HEAD 1	Multiplex 1
	TAPE 1

The channel 2 inputs are identified by the suffix "2" and are as follows:

<u>CH. 2 Low Level Inputs</u>	<u>CH. 2 High Level Inputs</u>
PHONO A2	AM 2* (See note)
PHONO B2	MultiplEX 2
TAPE HEAD 2	TAPE 2

All high level inputs provide the same gain and flat frequency response. Low level inputs provide much higher gain and the prescribed gain-frequency characteristics of RIAA for phono and NARTB for tape head.

Monophonic sources, such as FM tuner, AM tuner, or monophonic phono cartridge, are plugged into Channel 1 inputs. Stereophonic sources, such as stereo phono cartridge, stereo tape heads, or FM, Multiplex (MX) adaptor, are plugged in as follows: left channel into channel 1 inputs; right channel into channel 2 inputs.

\*Input AM 2 is provided against the possibility of AM-AM stereo. AM 1 is the normal AM tuner input.

Setting the SELECTOR switch to FM-AM and the MODE switch to STEREO or REVERSE takes care of feeding two normally monophonic channel 1 inputs (FM tuner and AM tuner) one to channel 1 and the other to channel 2 for FM-AM simulcast stereo.

## PHONO

The PH. A input jacks 1 & 2 and the PH. B input jacks 1 & 2 permit the use of two magnetic cartridges in your system. One cartridge can be a stereo type and the other monophonic or both can be stereo. One cartridge can be in a turntable, and the other in a record changer or an inexpensive phono for children's use. A monophonic cartridge is plugged into the channel 1 input only.

When playing a monophonic record with a stereo cartridge, set the MODE switch to the MONO 1-2 position, specifically intended for this purpose. In the MONO 1-2 position, the channel 1 and 2 inputs are fully blended internally, and the blend is fed to both amplifiers. The purpose here is to cancel extraneous vertical noise components in the cartridge output.

When playing a monophonic record with a monophonic cartridge, set the MODE switch to MONO 1, the normal monophonic position at which the channel 1 input is fed to both amplifiers.

The load presented to the cartridge by the PHONO A

inputs is 100K $\Omega$ . The load presented to the cartridge by the PHONO B inputs is 47K $\Omega$ . The choice of load impedance permits accommodation of most popular cartridges. Most popular cartridges, including all Shure and the Pickering 381A require 47K $\Omega$  load. The Pickering 380A, however, requires 100K $\Omega$  load.

If the Weathers C501-D cartridge is used, connect a 180K $\Omega$  resistor in series followed by a 33K $\Omega$  resistor in shunt, to each output. Plug into PHONO A inputs. This network avoids overloading the preamplifier inputs.

## X TAPE HEAD

The TAPE HEAD 1 & TAPE HEAD 2 input jacks permit the connection of a tape deck having no playback preamplifiers to the unit. The tape head should be of the conventional high impedance, high output type normally supplied in decks without playback electronics. If the head is of the stereo type, connect the upper track output to TAPE HEAD 1 and the lower track output to TAPE HEAD 2. If the head is of the monophonic type, connect the output to TAPE HEAD 1. The load presented to the tape head by each input is 1 megohm.

## FM TUNER

The FM 1 input jack is for connection of an FM tuner.

## AM TUNER

The AM 1 input jack is for connection of an AM tuner. Do not use AM 2 for this purpose.

## FM MULTIPLEX ADAPTOR

The MX 1 and MX 2 input jacks permit the connection of an FM Multiplex adaptor. Any adaptor will provide a left channel output and a right channel output. The left channel output is connected to MX 1 and the right channel output to MX 2.

## X TAPE

The TAPE 1 and TAPE 2 input jacks permits the connection of a tape machine complete with playback preamplifiers. If the machine provides stereo playback, connect the upper track output to TAPE 1, and the lower track output to TAPE 2. If the machine is of the monophonic type, connect the output to TAPE 1.

# OUTPUT CONNECTIONS

## TAPE RECORDER

The TAPE OUT 1 & TAPE OUT 2 jacks are intended for feeding signals out to the "line" recording inputs of a tape recorder. These are independent outputs for channel 1 and channel 2, respectively. They are unaffected by the LEVEL, BALANCE, BASS, TREBLE, HI FILTER, and LO FILTER controls.

## SPEAKER CONNECTIONS

**WARNING:** Do not operate the amplifier without first connecting speakers to the speaker connection terminals, exactly as described below.

Every speaker has a rated impedance, which may be 16, 8, or 4 ohms. For an amplifier to provide rated power output with rated distortion, the speaker used with it must be connected to the output transformer tap corresponding to its impedance.

On the rear apron of the unit, there are three 4-connection Terminal Boards (TB). Silk-screened on the apron is a diagram for connecting up to three speakers; one each for channels 1 and 2, and an optional center channel speaker.

To agree with the established conventions of stereo, connect the left speaker to the channel 1 output, and the right speaker to the Channel 2 output, after reading the connection information below.

The board at the left, TB1, carries the impedance taps for channel 1. The board at the lower right, TB3, carries the impedance taps for channel 2.

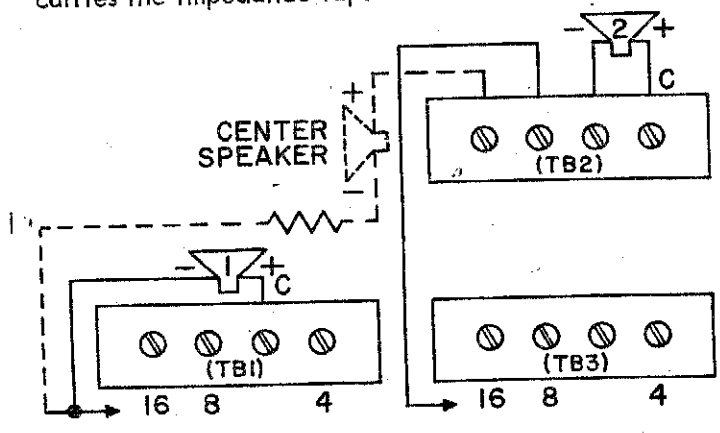
The left board, TB1, carrying the channel 1 impedance taps (16, 8, 4Ω), also includes the common terminal (C) for channel 1. The channel 1 speaker is connected to this common terminal C and the appropriate channel 1 impedance tap, as shown.

The lower right board, TB3, carrying the channel 2 impedance taps (16, 8, 4Ω), does not carry the common terminal C for channel 2. In fact, the channel 2 speaker is not to be directly connected to this board at all. The upper right board, TB2, provides the connection terminals for the channel 2 speaker. As the diagram shows, the channel 2 speaker is to be connected between the right-hand pair of terminals on board TB2. Note that the terminal at the extreme right is marked "C", this being the common terminal for channel 2.

To complete the connection of the channel 2 speaker, a jumper wire must be connected between the third terminal from the right on the upper right board, TB2, and the appropriate impedance tap on the lower right board, TB3, as shown in the diagram.

There is a third speaker shown in the diagram, labelled CENTER SPKR. (OPTIONAL). A resistance symbol is shown in series with this speaker, as well. This resistance symbol stands for an attenuator to reduce the level of the center speaker appreciably below that of the channel 1 and 2 speakers so as to produce "center fill" without markedly diminishing the stereo effect. For this purpose we recommend an adjustable 50 ohm, 25 watt wire-wound dropping resistor such as the Ohmite "Dividohm", mounted on the rear panel of the center channel speaker adjacent to the speaker terminals. Connect the sliding divider on the resistor to one of the speaker terminals, allowing enough slack to permit the slider to be moved along the body of the resistor. Now connect the other speaker terminal to the extreme left-hand terminal on the upper right board, TB2, on the amplifier, and then connect one end terminal of the dividing resistor to the same impedance tap on the left board, TB1, used for the channel 1 speaker. These connections are shown in the diagram.

The speaker connection diagram silk-screened on to the rear apron of the amplifier is reproduced in Fig. 1, with additional polarity indications which will assist in phasing the speakers properly if your speakers are marked as to polarity. A physical representation of the speaker connections is given in Fig. 2. If your speakers are not marked as to polarity, use the phasing method given below.



**SPEAKER TERMINALS FIG. 1**

Set the speakers together, including the center speaker if you are using one. Listen to a monophonic source with plenty of bass material through both channels, and all speakers, at once. Temporarily disconnect one lead going to the center speaker. Now reverse the connections to one outside speaker. If the bass is fuller, the two outside speakers are now in phase. If the bass is thinner, restore the original connections to this outside speaker. Now re-connect the lead previously removed from the center speaker. If the bass is fuller, the center speaker is in phase with the outside speakers. If the bass is thinner, reverse the connections to the center speaker.

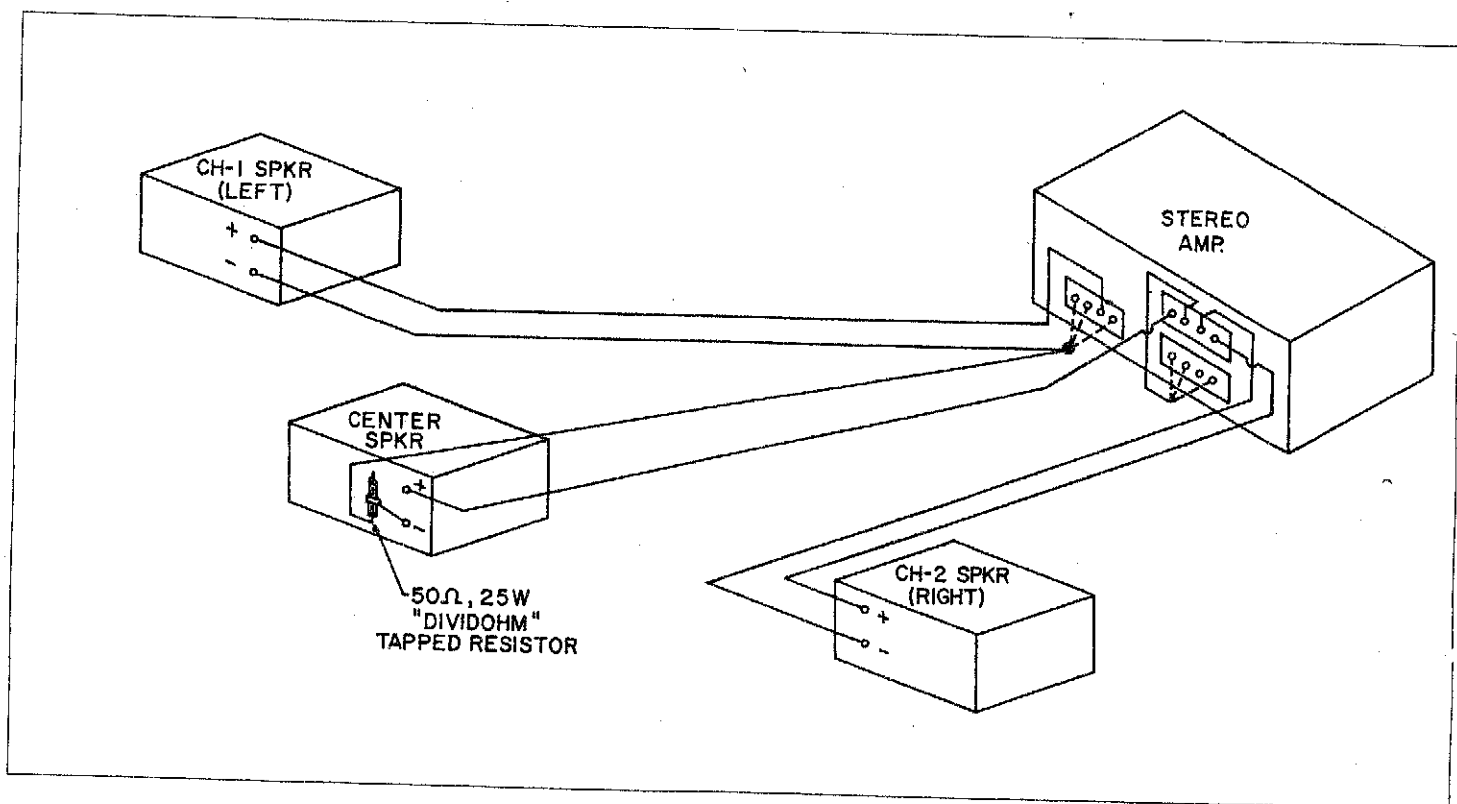
NOTE: We do not mean to give the impression that a center channel speaker is normally necessary in a stereo installation. We consider it, rather, to be a convenient facility in the case that the channel 1 and 2 speakers have to be spread apart more than the normal 8 to 10 feet, or that, with normal spacing, listening at close quarters is often necessary. Under these circumstances the sound from the channel 1 and 2 speakers may become disassociated, resulting in a phenomenon known as "hole-in-the-middle". The center channel speaker is a remedy for this situation.

## AC POWER CONNECTIONS

Plug the line cord into a 117VAC, 60 cps power line outlet only. A DC power source will cause severe damage to the unit.

Two convenience outlets are provided on the rear apron, one switched and one unswitched. The unswitched outlet should be used with record changers, turntables, or tape decks (devices which can sometimes be harmed if turned off simply by removing power) if it is not convenient to plug them directly into the power line. The switched outlet is for use with tuners. A cube tap may be used if more than one connection is to be made to an outlet.

A 3 amp fuse is provided on an extractor post mounting on the rear apron. This fuse protects only the amplifier, not any equipment plugged into the switched convenience outlet.



**SPEAKER CONNECTIONS FIGURE 2**

**OPERATION OF CONTROLS**

SELECTOR Switch: Used to select any input or pair of inputs as follows:

POSITION	SOURCE	INPUTS	COMMENTS
TAPE /AUX.	Pre-amplified tape	TAPE 1 & TAPE 2	
MX/AUX.	FM Multiplex Stereo	MX 1 & MX 2	
FM-AM	FM tuner & AM tuner	FM 1 & AM 1	FM only with MODE Sw at MONO 1
AM-AM*	AM tuner	AM 1	Set MODE Sw at MONO 1
PHONO A	Stereo mag. phono cartridge	PH. A 1 & PH. A 2	Set MODE Sw at MONO 1-2 to play mono record
PHONO B	Stereo mag. phono cartridge	PH. B 1 & PH. B 2	Set MODE Sw at MONO 1-2 to play mono record
TAPE HD.	Stereo tape head in deck without preamplifiers	TAPE HD. 1 & TAPE HD. 2	

MODE Switch: Used to select mode of operation

POSITION	OPERATION	COMMENTS
CH. 1	CH. 1 input out CH. 1 speaker	For checking left side of stereo program
CH. 2	CH. 2 input out CH. 2 speaker	For checking right side of stereo program
STEREO	CH. 1 input out CH. 1 speaker CH. 2 input out CH. 2 speaker	Should normally give left side of program out of left speaker, and right side of program out of right speaker
REVERSE	CH. 1 input out CH. 2 speaker CH. 2 input out CH. 1 speaker	Use if left side of program is coming out of right speaker when set at STEREO
MONO 1	CH. 1 input out CH. 1 & 2 speakers	Use for all mono listening except when playing mono record. Used also for checking balance in Stereo. See BALANCE ✓ operation.
MONO 1-2	CH. 1 plug CH. 2 inputs blended out CH. 1 & 2 speakers	Used only when playing mono record (with stereo cartridge)

\*See note on use of AM 2 in INPUT CONNECTIONS.



**BALANCE Control:** Used to achieve equal left and right side program levels in stereo. Effective in mono to center the apparent source between the speakers. Neither channel amplifier is favored (as to gain) at the zero setting (mid-rotation). As the control is turned clockwise from zero, the channel 2 (right) speaker is made louder and the channel 1 (left) speaker is made softer, while the overall level remains about the same. As the control is turned counter-clockwise from zero, the channel 1 (left) speaker is made louder and the channel 2 (right) speaker is made softer, while the overall level remains about the same.

**BALANCE ✓ (CHECK) Slide Switch:** If you have identical left and right speakers (or dissimilar speakers of nearly equal efficiency), the BALANCE control can be set properly by means of the BALANCE ✓ (CHECK) slide switch as follows:

1. Set BALANCE ✓ (CHECK) slide switch to ON
2. Set MODE switch to MONO 1
3. Adjust BALANCE control for minimum sound (null) from the left (CH. 1) speaker. There will be no sound from the right (CH. 2) speaker. If the BALANCE control is turned either direction from the proper setting (null), the sound level from the left speaker will increase.
4. Return the MODE switch to STEREO or REVERSE if the source is stereo.

#### NOTE:

In the "null" method of balancing just described, this is what is being done. An identical signal is fed to the channel 1 and 2 amplifiers at the high level input points (setting MODE switch to MONO 1). A dummy load is internally substituted for the channel 2 (right) speaker and the channel 2 output signal is fed back through a precision dividing network to the input of the channel 1 power amplifier (setting BALANCE ✓ switch to ON). The channel 2 output signal is out-of-phase with the input signal to channel 1 and tends to cancel or nullify it. When the BALANCE control is set so that the portion of the channel 2 output signal fed to the channel 1 power amplifier input is equal to the channel 1 signal at this point, almost complete cancellation (null) occurs and the output from the channel 1 speaker is at a minimum.

This method of balancing achieves equality of gain in the channel 1 and 2 amplifiers from the high level inputs to the speaker outputs. The preamplifiers, which are ahead of the high level input, are audibly nearly

equal in gain because of feedback. If, upon returning the MODE switch to STEREO or REVERSE after setting the BALANCE control by this method, audible balance is not achieved, the indication is that the sources feeding the amplifier are not equal. If the sources have their own level controls, such as FM or AM tuners or Multiplex adaptors, then these level controls should be set to equal output by successively setting the MODE switch at ✓CH. 1 and ✓CH. 2 while adjusting the source level controls for equal output from each speaker. Once the source levels have been adjusted, the null balancing method described previously will work effectively.

If one speaker is a little more efficient than the other, you may pad down the more efficient speaker by a series resistor up to half the rated speaker impedance (more will unduly deteriorate speaker damping), in order to make the convenient null balancing method effective. If the speakers are grossly different in efficiency, you will have to adjust the BALANCE control by successively setting the MODE switch at ✓CH. 1 and ✓CH. 2, while finding the BALANCE control setting that produces about equal output from each speaker.

If a stereo phono cartridge has a marked difference in output between the two sides, you will have to adjust the BALANCE control setting until audible balance is achieved, while successively setting the MODE switch to ✓CH. 1 and ✓CH. 1 and ✓CH. 2, when this input is selected.

**LEVEL control:** Used to adjust the listening level in both channels. The BALANCE control is adjusted after setting the LEVEL control. Substantial changes in LEVEL control setting may require re-setting the BALANCE control. Adjust the output level controls in tuners, multiplex adaptor, and tape machines with preamplifiers, to match the sound level obtained on phono, if possible. If any of the high level sources can not provide high enough output to match phono, simply set this source to maximum output.

**LOUDNESS slide switch:** A characteristic of human hearing is that sensitivity to bass tones diminishes more rapidly, as the listening level is lowered, than sensitivity to middle and high frequency tones. Many people find the audible loss of bass at low listening levels unsatisfying. Setting the LOUDNESS slide switch to ON provides a compensating amount of bass boost at low listening levels. Do not leave the LOUDNESS switch at ON when listening at normal volume, since the amount of bass boost provided will usually be excess-

ive and unmusical. Some people prefer not to use loudness compensation at all, because it does not correspond to any natural listening condition at a live performance.

**BASS CONTROL CH. 1, BASS CONTROL CH. 2 (CONCENTRIC):** The plus sign on the right side of the dial indicates that clockwise rotation from the mid-point (0) of either control increases (boosts) bass response; the minus sign on the left side indicates that counter-clockwise rotation from the mid-point decreases (cuts) bass response. There is no interaction with the TREBLE control. Start all adjustments with this control set at the mid-point (0), which is called the "flat" position since bass response is neither cut nor boosted at this position.

**TREBLE CONTROL CH. 1, TREBLE CONTROL CH. 2 (CONCENTRIC):** The plus sign on the right side of the dial indicates that clockwise rotation from the mid-point (0) of either control increases (boosts) treble response; the minus sign indicates that counter-clockwise rotation from the mid-point decreases (cuts) treble response. There is no interaction with the BASS control. Start all adjustments with this control set at the mid-point (0), which is called the "flat" position since treble response is neither cut nor boosted at this position.

The amplifier ON-OFF power switch is ganged with the CH. 2 TREBLE control. Note the word "OFF" on the panel just beyond full-counter-clockwise rotation. The plain circle symbol preceding it indicates that the power switch is ganged with the CH. 2 control. Turn the amplifier off by turning the CH. 2 TREBLE control beyond full counter-clockwise rotation until the power switch clicks to OFF. Turn the amplifier on by turning the CH. 2 TREBLE control clockwise from OFF and setting it at the mid-point (0) or some customary setting of the CH. 2 TREBLE control you may use.

**LO FILTER slide switch:** Set to ON when it is desired to cut low frequency response below 100 cps because of rumble in a phonograph or even in broadcast program material. Phonograph rumble is usually at about 29 cps and may well not be directly audible. Sometimes it can be at a much lower frequency, which is definitely not directly audible. However, the effect of rumble can be heard even the rumble itself is not. It manifests itself by using up amplifier power at low frequencies and can even overload the amplifier. If, at normal listening levels on phonograph, setting the LO FILTER to ON definitely results in "cleaner", less-distorted sound, the indication is that your phonograph

suffers from excessive rumble. Whether it is worth doing anything about it, depends on the installation. If you have inexpensive speaker systems that do not produce substantial undistorted sound below 80 cycles, you may just as well live with the rumble and eliminate its bad effects by using the LO FILTER. If you have made a considerable investment in speakers, partly in order to obtain full, undistorted response below 80 cycles, you may not want to forego full bass response. In the latter cases, have the phonograph examined by a qualified service man to see if the rumble is caused by a defect that can be remedied.

**HI FILTER slide switch:** Set to ON when it is desired to cut high frequency response above 5000 cps. Useful for minimizing extraneous noise when listening to narrow range AM broadcasting, for listening to noisy or worn records, and for reducing the annoyance of excessive distortion from any source.

**TAPE MONITOR slide switch:** Useful with complete tape machines (including record and playback electronics) that provide off-the-tape monitoring facilities while recording. In this situation, setting the TAPE MONITOR slide switch to ON permits you to hear the program being recorded directly from the tape.

## MAINTENANCE

### INSTALLATION PROCEDURES FOR MINIMUM HUM

**AC LINE CORDS:** Hum can usually be reduced by the following procedure, after all the equipment used with the amplifier is connected to it and plugged in.

1. Turn on all the equipment used.
2. Reverse the amplifier's AC line cord plug in the wall outlet to see if hum is reduced. Leave it in the position that results in least hum.
3. With the SELECTOR switch, select a particular piece of equipment, and determine the insertion position of its AC line cord plug that results in least hum.
4. Repeat step 3 for every piece of equipment used with the amplifier.

When this is done, proceed to HUM BALANCE adjustments.

**HUM BALANCE:** Separate filament windings and hum-balance controls are provided for the two channels, so that an optimum hum balance setting can be found for each channel, rather than a compromise setting for both channels. Connect the phonograph and leave it shut-off with the tone arm at rest. Set the SELECTOR to the PH. A or PH. B position depending on which inputs are used. Set the MODE switch at  $\checkmark$  CH. 1, BALANCE at 0, LEVEL at 10, BASS 1 & 2 at 0, TREBLE 1 & 2 at 0 (amplifier turned on). Set all slide switches at "off" (down). Adjust the channel 1 hum-balance control (R-77) with a screw-driver until the hum heard from the channel 1 speaker is at a minimum. Now set the MODE switch at  $\checkmark$  CH. 2 and adjust the channel 2 hum-balance control (R-78) until the hum heard from the channel 2 speaker is at a minimum. See Figure 3 for the locations of R-77 and R-78.

**GROUNDING:** The cause of phonograph hum may be a metal pick-up arm not grounded to the cable shield (try a good single ground connection to the cable shield from turntable frame, pick-up arm, and cartridge case), direct hum pick-up by the magnetic cartridge from the record player motor (try using a rubber mat on the turntable to increase the separation of the pick-up from the motor), or pick-up from a power transformer or other magnetic field in the vicinity (try moving phonograph away from suspected source). Check also that the phono input cable shielding is grounded to the amplifier chassis at one point only, through the skirt of the input connector where it plugs into the amplifier. Finally, try a good building ground, such as a connection from a cold water pipe terminated under the channel 2, 4 $\Omega$  impedance tap (ground) on the rear apron of the amplifier. Do not connect such a ground wire to other components in the system. If possible, let each channel be connected to the amplifier using a separate shielded cable to the amplifier input. It is also desirable that the ground leads on both cables not be connected together at any point — not even at the cartridge. However, with some cartridges, it will not be possible to do this. In this case, just disregard this last instruction.

## SERVICING

### GENERAL

Your amplifier should require little service except for normal tube replacement. We recommend no substitutions for the tube types used in this amplifier except as stated. All the tube types used are distributed nationally, but replacements can be obtained directly from EICO if desired.

To facilitate servicing, remedial and trouble-shooting procedures have been provided in the TROUBLE-SHOOTING CHART that follows. A VOLTAGE AND RESISTANCE CHART is also provided as an aid in locating defective components. DC operating voltages are given both at no signal and signal developing 20 watts output, as well as the corresponding 1kc signal voltages.

### TROUBLE-SHOOTING PROCEDURES

Connect a stereo phono and a pair of speakers to the amplifier as described in INPUT CONNECTIONS and OUTPUT CONNECTIONS. Do not operate the amplifier without speakers or equivalent loads connected exactly as described. Set the SELECTOR switch to the corresponding phono position (PH. A or PH. B) and the MODE switch to STEREO. Play a known high quality stereo recording on the phonograph. If there is no output to the speaker, or if the output is low or audibly distorted, proceed to the checks for those symptoms. If there is excessive hum in the output, disconnect the phono input cable from the amplifier and short the phono input jack to chassis. If the hum disappears, the trouble is not in the amplifier but in the phonograph or in the connection to the amplifier. In each case, check for the trouble in the amplifier which seems defective. If both amplifiers are defective, check the power supply.

Excessive hum on other inputs may be checked in a similar manner. Disconnect the input cable in question and short the particular input jack to the chassis. If the hum disappears, the trouble is external to the amplifier. Note that on all inputs, the braid of the input cable should connect to the amplifier only through the skirt of the input connector. The cause and remedies for the following symptoms are then based on the assumption that checks made in the manner described above have eliminated the possibility of the trouble being external to the amplifier.

If trouble is no output or low output, check AC signal voltages and DC operating voltages starting at the input, and work step-by-step toward the output in each amplifier. Set the LEVEL control to maximum (10), the BALANCE, BASS and TREBLE controls to their mid-points (0), the SELECTOR switch to PH. A or PH. B and the MODE switch to STEREO. Feed a 1000 cycle sine-wave signal from an audio signal generator through a precision 100:1 attenuator to the phono inputs selected. The attenuator permits obtaining a level of 0.003 volt fed into MAG. PHONO from an audio generator output of 0.3 volts, which can easily be measured on

the lowest AC volts range of your VTVM (also improves signal to hum from generator). Use a high input impedance VTVM for all AC signal voltage measurements; a VTVM or 20,000 $\Omega$ /v VOM for DC volts measurements.

If the trouble is an excessively distorted output, try tube replacement, signal tracing, or proceed directly to voltage and resistance measurements.

When the defective stage is localized, proceed to a resistance and voltage check of the stage, using the data in the VOLTAGE and RESISTANCE chart. Disconnect the amplifier from the power line and discharge capacitors prior to making any resistance check, and prior to removing any or all of the 7591 output tubes. Do not turn the amplifier on with any of the output tubes removed.

### TRANSFORMER TEMPERATURE

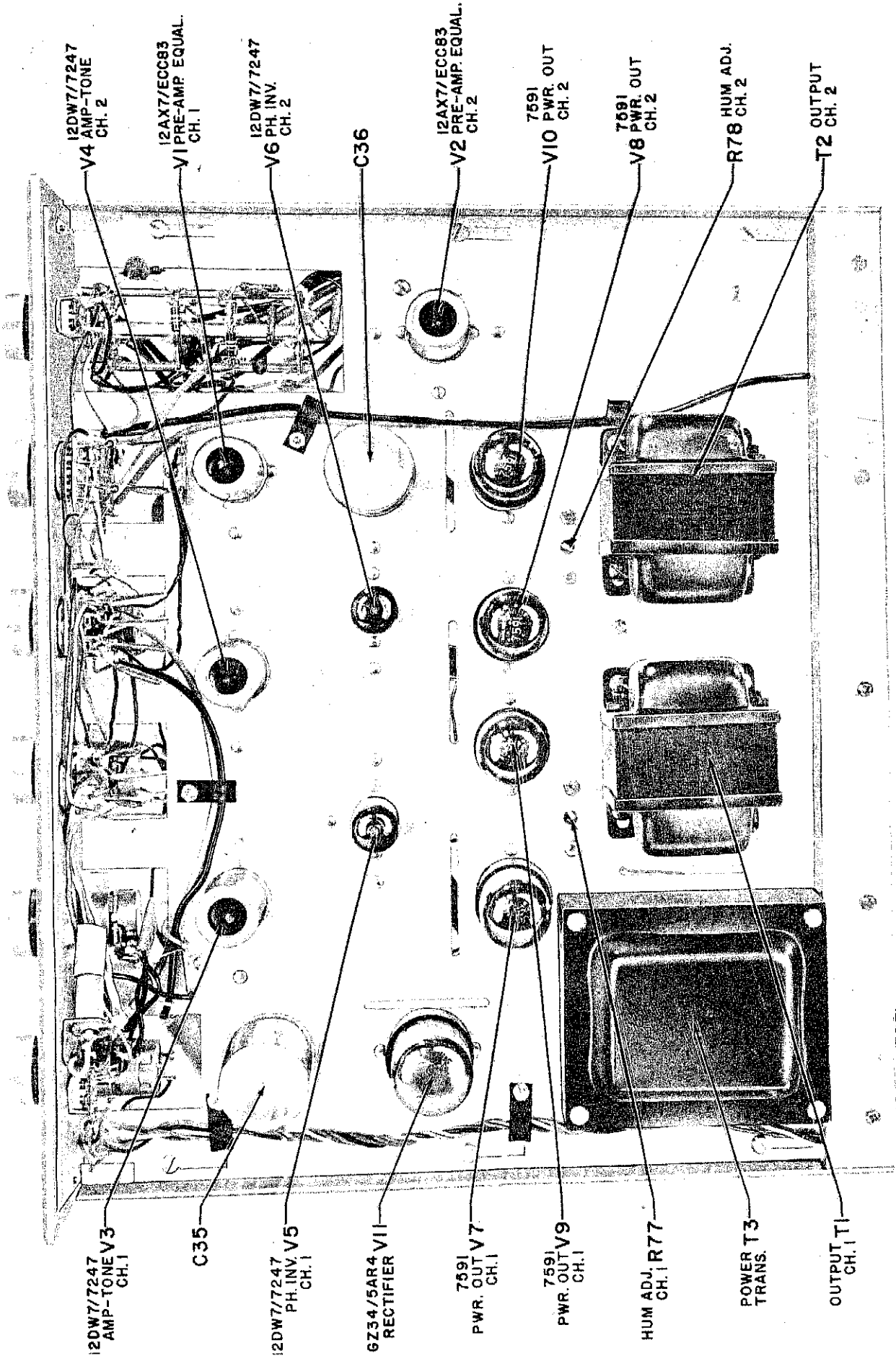
The transformers used in this unit run at a temperature less than 195°F despite the fact that the safety limit is at a much higher 221°F. Although 195°F is cool for a transformer, it is very hot to the touch. Transformers which seem too hot when touched with the hand, are usually good and are actually not overheating.

Output transformers usually run cooler than power transformers. Some output transformers may appear hotter

than others due to being located near hot components such as output and power tubes and power transformers.

### SERVICE

If trouble develops in your instrument which you cannot remedy yourself, write to our service department listing all possible indications that might be helpful. List, also, any code numbers in red under the words INSTRUCTION MANUAL on the cover. If desired, you may return the instrument to our factory where it will be placed in operating condition for \$13.50 plus the cost of parts replaced due to their being damaged in the course of construction. NOTE: Before returning this unit, be sure all parts are securely mounted. Attach a tag to the instrument, giving your home address and the trouble with the unit. Pack very carefully in a rugged container, using sufficient packing material (cotton, shredded newspaper, or excelsior), to make the unit completely immovable within the container. The original shipping carton is satisfactory, providing the original inserts are used or sufficient packing material inserted to keep the instrument immovable. Ship by prepaid Railway express, if possible, to Electronic Instrument Co., Inc., 33-00 Northern Blvd., Long Island City 1, New York. Return shipment will be made by express collect. Note that a carrier cannot be held liable for damages in transit if packing IN HIS OPINION, is insufficient.



TUBE LAYOUT FIGURE 3

**TROUBLE-SHOOTING CHART**

SYMPTOM	CAUSE	REMEDY
Amplifier causes power line fuse to blow. Power line fuse blows again with V11 out of its socket.	Line cord, J16, primary or high voltage secondary windings of T3 shorted internally or externally (wiring).	Replace or repair.
Amplifier causes power line fuse to blow. Power line fuse does not blow again with V11 out of its socket.	Defective V11, C35, V7, V8, V9, V10; T1 or T2 primary shorted internally or externally.	Replace or repair.
Any or half of tube filaments not lit.	Open tube filament. Open lead from one of the 6.3V windings of T3. One 6.3V winding of T3 open.	Replace or repair.
Output tube bias too high (resulting in distorted output waveform).	Open R73, R74.	Replace or repair.
DC voltage at V11, cathode (pin 8) is incorrect as specified below.  a) No voltage.  b) High voltage.  c) Low voltage.	Defective V11. C35 shorted internally or externally.  Connection from C35 to pin 8 of V11 is broken. Connection to center tap of h.v. secondary winding of T3 open. Output tubes, V7, V8, V9, V10 over-biased or not drawing current. May result from open R73, R74.  Excessive current drain in amplifier. Defective V11	Replace Replace or repair.  Repair Check possible causes and replace or repair. Check possible causes and repair.  See trouble-shooting typical stage. Replace
Excessive hum on mag. phono tape head or mic.	V1 or V2 defective Fil. leads dressed too close to grid lead. Tube shield not making electrical contact to base or base not making electrical contact to chassis. Shielding and grounding of wiring to input jacks not exactly as instructed and shown in drawings.	Replace Dress fil. leads away from grid lead. Check and correct.  Correct.
Excessive noise on mag. phono or tape head.	V1 and V2 and contacts dirty.	Clean thoroughly with carbon tetrachloride.
Sustained oscillations.	Poor dress of output transformer T1 or T2 leads.	Dress all input leads and T1, T2 leads away from each other. Keep T1, T2 leads away from input jacks.
Sustained microphonics on mag. phono, tape head or mic.	V1 or V2 defective.	Replace
Hum on all inputs	V3 or V4 defective, not properly shielded, or dirty sockets and contacts. Dress of power transformer T3 leads.	Replace, correct, or clean.  Correct

REPLACEMENT PARTS LIST

SYMBOL NO.	STOCK NO.	AMT.	DESCRIPTION	STOCK NO.	AMT.	DESCRIPTION
C1, 2	22538	2	cap., disc, 600mfd, 10% .4mf	40000	47	nut, hex, 6-32
C3, 4	22520	2	cap., disc, 1000mfd (1.2K or 1200mfd), 10%	40001	6	nut, hex, 3/8-32
C5, 6	22522	2	cap., disc, 360mfd, 10%	40007	48	nut, hex, 4-40
C7, 8, 9, 10	22517	4	cap., disc, .025mfd (25K or 25,000mfd), GMV	40008	12	nut, hex, 8-32
C11, 12	22534	2	cap., disc, 68mfd, 10%	40016	1	nut, 1/2" for fuseholder
C13, 14	22580	2	cap., disc, .2mfd, +80-20%	41003	8	screw, 8-32 x 3/8
C15, 16, 17, 18, 19, 20, 21, 22	20039	8	cap., molded, .1mfd, 400V	41035	5	screw, #6 x 1/4, self tapping
C23, 24	22547	2	cap., disc, .015mfd (15K or 15,000mfd), 20%	41047	7	screw, #8, self tapping
C25, 26	22532	2	cap., disc, .0015mfd (1.5K or 1500mfd), 10%	41086	47	screw, 6-32 x 5/16
C27, 28	22523	2	cap., disc, .0068mfd (6.8K or 6800mfd), 10%	41090	36	screw, 4-40 x 5/16
C29, 30	22548	2	cap., disc, .009mfd (9K or 9000mfd), 10%	41091	12	screw, 4-40 x 1/4, flat head
C31, 32	22547	2	cap., disc, .015mfd (15K or 15,000mfd), 20%	41026	2	screw, 4-40 x 1/4, brass
C33, 34	22509	2	cap., disc, 100mfd, 10%	41097	2	screw, 6-32 x 5/16, brown oxide
C35	24008	1	cap., elec., 40-20/500V	41099	18	screw, 8-32 x 3/8, Type F, brown oxide
C36	24005	1	cap., elec., 20/40/40-400/350/350V	41100	2	screw, 8-32 x 1 3/4
C37	23041	1	cap., elec., 30mfd, 400V	42000	6	washer, lock, #3/8
C38, 39	23007	2	cap., elec., 50mfd, 25V	42002	46	washer, lock, #6
C40	20043	1	cap., molded, .03mfd, 600V	42007	48	washer, lock, #4
C41, 42	22548	2	cap., disc, .009mfd (9K or 9000mfd), 10%	42005	2	washer, #6, flat
F1	91005	1	fuse, 3 amp	42008	12	washer, lock, #8
I1	92000	1	bulb, #47	42029	1	washer, rubber, 1/2" for fuseholder
J1, 2, 3; 4, 5, 6; 7, 8, 9; 10, 11, 12; 13, 14, 15	50018	5	jack, phono, triple	42055	2	washer, flat, #8, 5/8" OD
J16, 17	50016	2	A.C. receptacle	43000	1	lug, ground, #6
PC1, 2	29751	2	printed circuit	43004	5	lug, ground, #8
R1, 2	10428	2	res., 47K, 1/2W, 10% (yellow, violet, orange, silver)	46000	1	grommet, rubber, 3/8
R3, 4	10410	2	res., 100K, 1/2W, 10% (brown, black, yellow, silver)	46011	4	plastic feet
R5, 6, 7, 8	11526	4	res., 200K, 1/2W, 5% (red, black, yellow, gold)	53047	2	knob, concentric, inner
R9, 10	11532	2	res., 4M, 1/2W, 5% (yellow, black, green, gold)	53048	2	knob, concentric, outer
R11, 12	10407	2	res., 1M, 1/2W, 10% (brown, black, green, silver)	53049	4	knob, dual, split knurl
R13, 14	10424	2	res., 22K, 1/2W, 10% (red, red, orange, silver)	57000	1	line cord
R15, 16	11512	2	res., 2.4K, 1/2W, 5% (red, yellow, red, gold)	58004	length	wire, hook-up, black
R17, 18	10455	2	res., 1.5M, 1/2W, 10% (brown, green, green, silver)	58005	length	wire, hook-up, brown
R19, 20	11520	2	res., 40K, 1/2W, 5% (yellow, black, orange, gold)	58006	length	wire, hook-up, red
R21, 22	11533	2	res., 1.2K, 1/2W, 5% (brown, red, red, gold)	58007	length	wire, hook-up, orange
R23, 24, 25	10444	3	res., 120K, 1/2W, 10% (brown, red, yellow, silver)	58008	length	wire, hook-up, yellow
R26	10416	1	res., 15K, 1/2W, 10% (brown, green, orange, silver)	58009	length	wire, hook-up, green
R27, 28	11523	1	res., 68K, 1/2W, 5% (blue, grey, orange, gold)	58010	length	wire, hook-up, blue
R29, 30	10421	2	res., 6.8K, 1/2W, 10% (blue, grey, red, silver)	58012	length	wire, hook-up, grey
R31-32	18068	1	pot., 750K, dual	58013	length	wire, hook-up, white
R33-34	18069	1	pot., 250K, dual	58300	length	spaghetti, small
R35, 36	10413	2	res., 2.7K, 1/2W, 10% (red, violet, red, silver)	58303	length	spaghetti, large
R37, 38, 39, 40	11546	4	res., 33K, 1/2W, 5% (orange, orange, orange, gold)	58408	length	single conductor, black
				58412	length	cable, 3 conductor
				58414	length	cable, single conductor, grey

**REPLACEMENT PARTS LIST (CONTINUED)**

SYMBOL NO.	STOCK NO.	AMT.	DESCRIPTION	STOCK NO.	AMT.	DESCRIPTION
R41	10452	1	res., 8.2K, 1/2W, 10% (grey, red, red, silver)	58501	length	wire, bare
R42	14502	1	res., 1800Ω, 5W, 10%, W. W.	80092	1	panel
R43, 44	10442	2	res., 1.5K, 1/2W, 10% (brown, green, red, silver)	81175	2	cable clamp, plastic
R45-46	18071	1	pot., 1M, concentric	81270	1	input strip, rear panel
R47-48, 53	18070	1	pot., 500K, concentric with switch	81273	1	chassis hood
R49, 50	10431	2	res., 470K, 1/2W, 10% (yellow, violet, yellow, silver)	81275	1	bottom plate
R51, 52	10432	2	res., 1K, 1/2W, 10% (brown, red, black, silver)	81276	1	cable clamp - small
R53, 54	10431	2	res., 470K, 1/2W, 10% (yellow, violet, yellow, silver)	81920	6	clamp, cable - large
R55, 56	11510	2	res., 1.138K, 1/2W, 5%	81921	2	bracket, extrusion, left side rail
R57, 58	11556	2	res., 15K, 1/2W, 5% (brown, green, orange, gold)	81922	1	bracket, extrusion, right side rail
R59, 60, 61, 62	11547	4	res., 82K, 1/2W, 5% (grey, red, orange, gold)	81923	1	pilot light shield
R63, 64, 65, 66, 67, 68	10412	6	res., 330K, 1/2W, 10% (orange, orange, yellow, silver)	89537	1	shield for 9 pin socket
R69, 70, 71, 72	10400	4	res., 10K, 1/2W, 10% (brown, black, orange, silver)	97300	4	jewel for pilot light
R73, 74	14602	2	res., 125Ω, 5W, 5%, wire wound	97717	1	Manual of Instructions (Wired)
R75	14850	1	res., 16Ω, 20W, 5%, wire wound	66094	1	Manual of Instructions (Kit)
R76	11559	1	res., 12K, 1/2W, 5% (brown, red, orange, gold)	66347	1	
R77, 78	19016	2	pot., 100Ω, wire wound			
R79	14510	1	res., 33K, 5W, 10%			
S1	60074	1	switch, rotary, 4 sections			
S2	60083	1	switch, rotary, 1 section			
S3		1	switch, SPST mounted on R47, 48			
S4	62012	1	switch, slide, Double Pole Double Throw			
S5, 6, 7	62014	3	switch, slide, Four Pole Double Throw			
S8	62012	1	switch, slide, Double Pole Double Throw			
T1, 2	32020	2	transformer, output			
T3	30047	1	transformer, power			
TB1, 2, 3	54500	3	terminal board, 4 screw			
TB4	54002	1	terminal strip, 1P right with ground			
TB5, 6, 7, 8, 9, 10, 11, 12, 13	54003	9	terminal strip, 2 post			
TB14, 15	54006	2	terminal strip, 3 post 2 right			
TB16, 17, 18	54001	3	terminal strip, 1 post right			
TB19	54015	1	terminal strip, 3 post 2 left with ground			
TB20, 21, 22, 23, 24	54003	3	terminal strip, 2 post			
V1, 2	90034	2	tube, 12AX7/ECC83/7025			
V3, 4, 5, 6	90061	4	tube, 12DW7/7247			
V7, 8, 9, 10	90073	4	tube, 7591			
V11	90044	1	tube, GZ34			
X11	97712	1	pilot light assembly			
XF1	97800	1	fuseholder			
XV1, 2, 3, 4	97027	4	socket, 9 pin miniature with shield support			
XV5, 6	97025	2	socket, 9 pin miniature			
XV7, 8, 9, 10, 11	97032	5	socket, octal			



**VOLTAGE AND RESISTANCE CHART**

	Pin#	Column 1 DC volts at 20 watts each channel	Column 2 DC volts at no signal	Column 3 AC volts (signal) at .0023V into Mag. Phono Input	Column 4 Resistance in ohms. Pin 8 of XV11 grounded
V1,2	1	107	113	.275	75K
	2	0	0	.018	1.5Meg
	3	0.9	0.83	.01	1150
	4	15	14		125-175
	5	15	14		125-175
	6	38	41	.018	355K
	7	0	0	.0023	113K
	8	0.5	0.5	.0027	2300
	9	15	14		125-175
V3,4	1	54	50	0.86	81K
	2	0	0	0.135	250K
	3	1.75	1.83	0.058	1500
	4	15	14		125-175
	5	15	14		125-175
	6	75	78	0.73	83K
	7	0	0	0.064	320K
	8	.42	.45	0.037	1K
	9	15	14		125-175
V5,6	1	195	215	8.1	92K
	2	86	89	9.5	340K
	3	93	97	8.1	82K
	4	15	14		125-175
	5	15	14		125-175
	6	86	89	9.5	340K
	7	0	0	0.7	300K
	8	.6	.65	0.59	1.1K
	9	15	14		125-175
V7,8 V9,10	1	0	0	8.1	330K
	2	15	14		125-175
	3	395	396	220	170-210
	4	310	318	2.7	1800
	5	15	14	.05	125
	6	0	0	8.1	330K
	7	15	14		125-175
	8	310	318	.23	1800
V11	1				
	2	402	407		> 30K**
	3				
	4	335*	335*		20-35
	5				
	6	335*	335*		20-35
	7				
	8	402	407		> 30K**

\*AC 60 cycles

\*\*Short from pin 8 of XV11 to ground removed

Note: Throughout voltage checks, a dummy load must be connected across each amplifier output.

Column 1 - Feed a 1kc signal into TAPE/AUX. 1 input. Set ST-40 controls as follows: SELECTOR switch at TAPE/AUX., MODE switch at MONO 1, BALANCE control at 0, LEVEL control at 10, BASS controls at 0, TREBLE controls at 0, and all slide switches to the down (off) position. Adjust audio generator output for 20 watts output each channel.

Column 2 - Remove input signal. Use same control settings as in/Column 1.

Column 3 - AC signal voltages checked one channel at a time. To test Channel 1 amplifier, feed a .0023 volt, 1kc signal from an audio generator to the PH. A1 input. Set SELECTOR switch at PH. A, MODE switch at ✓CH. 1, and all other controls as given for Column 1. To test Channel 2 amplifier, feed a .0023 volt, 1kc signal to the PH. A2 input and set the MODE switch at ✓CH. 2.

Column 4 - Set controls as for Column 1. Disconnect unit from AC line and remove all input and output connections. Short pin 8 of XV11 to chassis ground with a jumper throughout resistance measurements, except when resistances at XV11 pins are being checked.