30 WATT HIGH FIDELITY INTEGRATED AMPLIFIER

MODEL

HF-32

INSTRUCTION

MANUAL

HF 32-2

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

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MODEL HF-32

30 WATT HIGH FIDELITY INTEGRATED AMPLIFIER

general description

GENERAL

The HF-32 is an excellent example of EICO's "low-silhouette" design methods, whereby compactness and richly attractive appearance are obtained without compromising good engineering practice. Power tubes are well separated from each other and heat-sensitive components, undesirable coupling are avoided, and a single horizontal chassis is used which greatly simplifies kit construction and maintenance. It is unquestionably a top value in the amplifier field.

FEATURES

1. Three low level inputs for magnetic phono, tape head, and microphone.
2. Four phono equalizations (including RIAA) and NARTB Tape Head equalization. Equalization circuit is of the extremely low distortion feedback type.
3. Three high level inputs for tv, tuner, crystal/ceramic cartridge, or tape.
4. Single switch selects any input and/or equalization. Unused inputs are shorted at every position of the input selector for zero cross-talk.
5. DC heater power supplied to preamplifier tube to insure lowest hum. DC superimposed on all other tube filaments.
6. Extremely low distortion bass and treble tone controls of the variable crossover, feedback type. Printed circuit couplate simplifies wiring.
7. Rumble and scratch filter circuits inserted by front panel slide switches.
8. A Centralab printed-circuit, prewired loudness control (compentrol) plus a separate level control, both on the front panel. By pre-setting the panel level control as instructed, the loudness control will automatically provide correct Fletcher-Munson compensation at the setting which gives the desired listening level.
9. Low impedance output to tape recorder, useful on all inputs. Affected by filter circuits and tone controls.
10. Four EL84 push-pull parallel output stage with very high quality 6 lb. output transformer having extensively interleaved windings and grain-oriented steel laminations.
11. Williamson-type power amplifier circuit consisting of a voltage amplifier direct coupled to a split-load phase inverter driving the output stage. The high power sensitivity of the output stage eliminates the necessity for additional driver stages, permitting the use of a large amount of inverse feedback with a high stability margin.
12. Two EZ81 rectifier tubes having warm-up characteristics matched to the output tubes comprise a conservatively rated rectifier section of exceptional reliability. Filter electrolytics also operate well below maximum ratings and voltage surges at starting are eliminated.
13. Switched and unswitched convenience outlets.
14. Fuse and panel mounted fuse holder, pilot lamp.
15. Hum balance control.
16. Newly designed "low-silhouette" construction, utilizing horizontal chassis to permit proper layout and component separation necessary for long component life. Extremely flexible design permits easy console installation with complete shielding and adaptability to any panel thickness.

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SPECIFICATIONS

Output Power: 30 watts continuous, 47 watts peak.

* IM Distortion (60 cps & 7 kc at 4 : 1): 2% at 30 watts; 1% at 20 watts, 0.5% at 10 watts.

* Total Harmonic Distortion: below 1% 20 cps — 20 kc within 1 db of 30 watts.

* Frequency Response: 1 w: ±0.5 db 10 cps - 50 kc, ±1.5 db 10 cps - 100 kc; 30 w: ±0.5 db 15 cps - 50 kc, ±1.5 db 15 cps - 100 kc. ±0.1 db 15 cps - 30 kc at any level from 1 mw to 30 w; no peaking or raggedness outside audio range.

Square Wave Response: 20 cps to 20 kc essentially undistorted.

Inverse Feedback: 20 db

Stability Margin: 15 db

Damping Factor: above 10, 20 cps to 20 kc.

Speaker Connections: 4, 8, and 16 ohms.

Tone Control Range: at 10 kc - 13 db boost, 15 db cut; at 50 cps - 14 db boost, 15 db cut.

Equalization: Mag Phono Input: RIAA, COLumbia (original LP), LONdon, American 78. Tape Head Input: NARTB.

Sensitivity (Input for rated output): Mag. Phono - 5 millivolts; Tape Head - 2 millivolts, Microphone - 4 millivolts; High level (TV, TUNER, AUX.) - 0.4 volt.

Hum & Noise Level (below rated output): Mag. Phono — ** 60 db down. Tape Head — ** 51 db down. Microphone — 57 db down. TV, TUNer, AUXiliary — 75 db down. (Maximum gain, tone controls set at flat positions.)

Scratch and Rumble Filters: Scratch filter introduces approximately 12 db/octave slope above 5 kc; Rumble filter introduces approximately 12 db/octave slope below 70 cps. The nominal cut-off frequencies are points at which response is 6 db down when the corresponding filter is introduced.

Power Requirements: 117 V, 60 cps; 140 watts consumption.

Tubes: 2- ECC83/12AX7, 2- EC90/6C4, 4- EL84, 2- EZ81.

Size: 15" wide, 4 3/4" high, 10 1/2" deep.

Weight:

* Measured from high level inputs with tone controls set at "flat" positions and loudness control at maximum (no effect).

** Includes effect of equalization.

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GENERAL

a) HEAT DISSIPATION (VENTILATION): In common with other electronic equipment, the HF-32 produces considerable heat in normal operation. Unless continuous and adequate air flow is obtained around the heat producing elements, these elements will over-heat and their useful life will be greatly curtailed.

It is useful to understand the process of convection whereby heat is removed in judging the suitability of a location. Air heated by the heat-producing elements expands and rises; cool air is drawn from beneath to take the place of the heated air. In this manner, a stream of air is set in motion which continually removes heat from the amplifier. (In particular, we are mainly concerned with the major heat-producing elements; the four EL84 output tubes and the two EZ81 rectifier tubes.) If there is any impediment to or constriction of the air flow, the essential process of heat removal will be adversely affected.

Adequate ventilation will be provided if the amplifier is installed in an open-back console provided that the top of the amplifier is spaced at least two inches below any shelf mounted above it. If the cabinet is enclosed at the rear, provide several large holes or slots as low down and as high up in the cabinet back as possible. As an alternate, holes may be provided in the sides, bottom, or top of the cabinet. The important thing to remember is that effective ventilation requires provision for cool air to enter at the bottom and hot air to leave at the top.

If the amplifier is not installed in a console, it may be situated on an open surface or on a shelf of a bookcase. Four rubber feet are also provided so that the amplifier will not mar the surface of furniture on which it is placed.

b) EASY ACCESS TO CONTROLS: Mount the amplifier at a height which will permit easy manipulation of the controls. Tuner controls should be located nearby.

c) ACCESSABILITY TO PARTS: Tubes are the most frequently replaced items in electronic equipment. If the amplifier is installed in a console, sufficient space should be alloted to reach and remove any tube in the amplifier. Furthermore, input and output terminals of the amplifier should be accessible to permit easy interchanging of system components for comparison, and connection or disconnection of a portable tape recorder which is stored away when not in use. If antennas are strung around the back of the console in which the amplifier is installed, arrange them so they will not interfere with access to the amplifier.

d) ACOUSTICAL ISOLATION: If amplifier and speaker are installed in the same cabinet (not recommended), provide sufficient separation to minimize mechanical speaker vibration reaching the amplifier. The minimum separation is about one foot.

CONSOLE MOUNTING

a) Operations on console front panel preliminary to amplifier mounting: (1) Tape the panel template provided to the face of the console so that the top of the mounting surface line on the template is level with the top of the amplifier mounting shelf. Note: When shelf is not available, tape the template at any convenient spot on the face of the console. (2) Use an awl or a nail to pierce the centers of the four extreme outer holes for mounting the control plate, to transfer their locations to the console panel beneath. (3) Trace out the rectangular cutout with an awl or nail and then pierce the centers of the four 1/2" holes, one in each corner of the cutout. (4) Remove the panel template. (5) Drill the four 1/2" holes in the console panel, one in each corner of the rectangular cutout area. Cut out the rectangular piece with a keyhole saw, using the four 1/2" holes as starting holes.

b) Amplifier mounting in console: (1) Pull off the control knobs. (2) Remove the four screws that fasten the bezel to the side pieces and remove the bezel. (3) Remove the two screws and nuts that fasten the control plate to the bezel. The bezel is not used in console mounting. (4) Fasten the control plate to the console panel with the two #4 x 3/8 wood screws supplied. (5) If the rubber feet have been inserted in the bottom plate, remove them. (They may be pried out with a thin screwdriver.) (6) Place the unit on the mounting shelf and slide it forward until the slide switch support brackets are up against the panel and both slide switches accessible from the front; the control shafts should be approximately centered in the corresponding holes in the control plate. (7) With a sharp pencil, draw the outline of the side and rear bottom edges on the chassis shelf. As the bottom plate falls short of the full width by 3/16" on each side, draw new side edge lines 3/16" inside the original side edge lines. (8) Now remove the knobs and take the chassis off the shelf. (9) Remove the 6 screws which fasten the bottom plate to the chassis. (10) Place the bottom plate exactly in the outline drawn on the shelf and mark the position of the center hole on the left side and the center hole on the right side. (11) Remove the bottom plate and drill each of the marked holes on the shelf to a diameter of 1/4". (12) Refasten the bottom plate to the chassis, with the four of the six #8 x 3/8 screws previously removed, using the two holes at the rear and the two holes at the front of the chassis. (13) Replace the chassis on the shelf, positioning it exactly in the outline previously drawn, and restore the knobs. This time make sure that the indicator dot on each knob agrees with the control position. (14) From the bottom side of the shelf, insert a #8 x 1" screw, with a 1/2" flat washer against the head, through both the left and right side center holes. These screw engage the stamped nut over each hole on the chassis flange and when tightened secure the chassis to the shelf.

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a) SPEAKER CONNECTIONS: To connect your speaker to the amplifier properly, you must know its rated impedance. This may be read off the speaker nameplate. Connect one speaker lead to the "G" terminal on the rear apron and the other speaker lead to the nearby terminal corresponding to the rated speaker impedance (4, 8, or 16 ohms). Plastic-covered lamp cord may be used for distances up to 50 ft. with little power loss. For shorter distances, TV antenna lead can be used, particularly if it is desired to run the sepaker lead under a rug.

If it is desired to use two similar or identical full-range speakers of the same rated impedance (either 8 or 16 ohms only) for better sound distribution, connect one speaker lead of each pair to "G" and the two remaining leads to the terminal with a number equal to half of one of the speaker's rated impedance. (It may be necessary to "phase" the two speakers by reversing both of the leads from one of the speakers.) This may not be done if each of the speakers is designed for reproduction of a different part of the audio spectrum (woofer-tweeter combinations) in which case a cross-over network is required which connects to the amplifier with only one pair of leads.

b) LO & HI MAG. PHONO INPUTS: These are intended for use with phonographs having magnetic cartridges, or with ceramic or crystal cartridges having adaptors for magnetic cartridge input (to permit choice of equalizations). The HI input provides a 3 : 1 attenuation of the input signal for very high output cartridges that might cause overloading of the preamplifier stage. Most magnetic cartridges (low to average output) should be plugged into the LO input (direct), which provides the highest gain and the best signal-to-noise ratio. Use the HI input for exceptionally high output cartridges or if you can detect distortion on peaks when the cartridge is connected to the LO input, which is eliminated when the cartridge is connected to the HI input. The loading resistance presented to the cartridge at both LO and HI inputs is 100,000 ohms (100KΩ). If a lower loading resistance is required by the particular cartridge used, connect a resistor of appropriate value across the input. The resistor should be placed across the leads coming from the cartridge at some suitable point in the phonograph (see Fig. 1). The value of this shunt resistor (R_s) can be determined from the desired loading resistance (R_l) by this formula $R_s = \frac{100,000 \times R_l}{100,000 - R_l}$ ohms, or this table: for $R_l = 50K\Omega$, use $R_s = 100K\Omega$; for $R_l = 33K$, use $R_s = 50K\Omega$; for $R_l = 25K\Omega$, use $R_s = 33K\Omega$.

c) TAPE HEAD INPUT: This input is intended for receiving the output signal directly from the playback head of a tape deck. NARTB tape head equalization for 7 1/2 and 15 ips tape speeds is applied to signals fed in at this input. The loading resistance presented to the tape head is 100,000 ohms.

d) MICROPHONE INPUT: This input is intended for receiving the output signal directly from a microphone. It is preferable that the microphone used be of the high impedance type.

e) HIGH LEVEL INPUTS: Four high level input jacks designated as Tuner, TV, Tape, and Auxiliary are provided for connection of tuners, tv receivers, tape recorder playback, and ordinary or RIAA equalizing crystal or ceramic phono cartridges without adaptor. A shielded cable with a shielded "phono-type" plug should be used to connect each of these sources to the corresponding amplifier input jack. Unless the source has a low-impedance output such as a cathode follower (with which up to 50 ft. of cable can be used), use the shortest possible connection and low capacity shielded cable (cable having as low as 25 mmfd capacitance per foot is available).

If the tuner employed has a volume control to adjust the output, set this control as follows. Turn the amplifier LEVEL control to minimum and the LOUDNESS control to maximum. Play any recording on your phonograph and turn up the level control to obtain an ordinary listening level. Without touching the LEVEL or LOUDNESS controls, turn the SELECTOR to TUNER and adjust the volume control on the tuner to obtain approximately the same loudness level as was obtained from the recording. In the case where the tuner has no output level control and also in the case

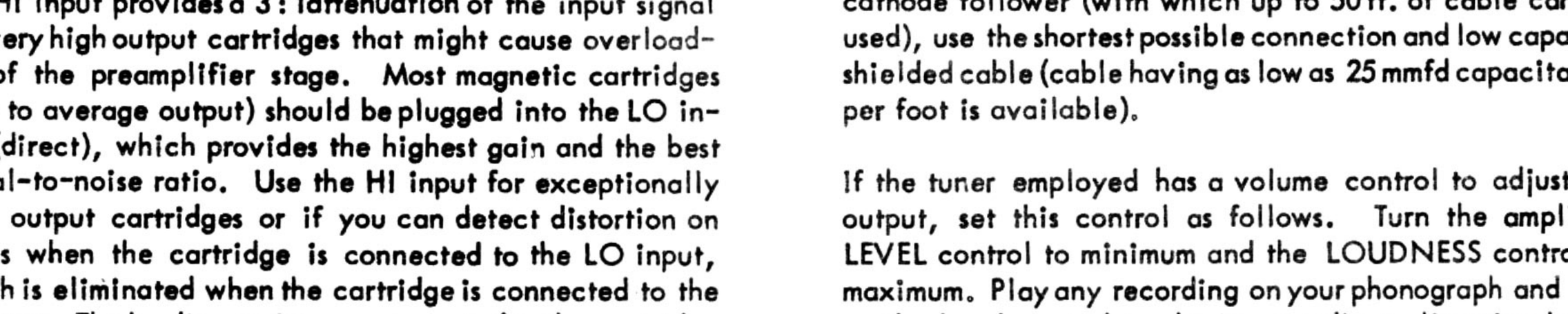

Fig. 1

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of the other high level inputs, the independent LEVEL control on the front panel of the amplifier permits adjustment of the level when changing inputs.

f) TAPE OUTPUT: A shielded cable (up to 50 ft. may be used) with a shielded "phono-type" plug should be used to connect from the TAPE OUTPUT jack to the input of the tape recorder. Any input chosen by the SELECTOR is fed out to the tape recorder through this jack. All inputs are affected by the level control, the tone controls, and the filters, but not the loudness control.

g) POWER CONNECTIONS: The power cord of the turntable and tuner may be inserted in the convenience outlets provided on the rear chassis apron. The receptacle marked 117 VAC is intended for use primarily with a phonograph and provides 117 VAC regardless of whether the power switch of the amplifier is turned on or off in order to protect the phonograph mechanism. The receptacle marked 117 VAC 150 W, SWITCHED is "live" or "dead" depending on whether the amplifier power switch is turned on or off and is intended primarily for use with tuners. Equipment drawing in excess of 150 watts should not be plugged into this outlet.

HUM ADJUSTMENT

After checking the amplifier for proper operation, remove all input cables to the amplifier and make the following control settings which hold throughout the process of hum adjustment: SELECTOR at RIAA, LEVEL & LOUDNESS to 10, TREBLE control at -5, BASS control at 0. Next procede as follows: With your ear held close to the speaker, insert the amplifier power plug into the wall outlet and listen to the hum level. Now pull out the plug and reinsert it with the prongs reversed and listen again. Choose the prong position which gives the least hum. Now connect the tuner input connector to the amplifier input jack, and with tuner set between stations and the tuner volume control set at a minimum, do the same with the power plug of the tuner, using the 117 VAC SWITCHED receptacle on the amplifier if desired. Finally connect the phono input connector to the amplifier PHONO LO or PHONO HI input as is required (turntable off and pickup arm at rest position) and do the same with the power plug of the turntable, using the 117 VAC convenience outlet on the amplifier if desired. When all of this is completed, adjust the hum balance control on top of the amplifier chassis for least hum.

operation

PRELIMINARY: Be sure all tubes are firmly seated in their sockets and that the tube shields are making good contact with their bases. As initial adjustments, set these controls as follows: LEVEL at zero, LOUDNESS at ten, BASS at zero. Turn the amplifier on by turning the TREBLE control clockwise from OFF and set it at zero initially.

LISTENING TO PHONOGRAPH: Set the SELECTOR to one of the record equalization positions on the dial. Doing so automatically selects the phonograph input plugged into the PHONO LO or PHONO HI input. For help in choosing the recording curve appropriate to any particular record, refer to the section titled "RECORD EQUALIZATION SELECTION". When in doubt as to which equalization is most appropriate, use RIAA, which is the best compromise for all records. Keep in mind that while the positions offered cover most recording curves likely to be encountered, additional separate and variable bass and treble response adjustments are necessary for fully satisfactory results. These may be necessary to compensate for the over-all characteristics of your audio system (including room acoustics), inexact matching of the actual recording characteristic by any of the equalizations provided, and above all, the particular tastes of the listener.

LISTENING TO TAPE DECK (direct connection to tape head): Set the SELECTOR to TAPE HEAD, which automatically selects the TAPE HEAD input and NARTB tape head equalization for the 7 1/2 and 15 ips speeds. This equalization is the industry standard for pre-recorded stereo and monaural tapes.

LEVEL & LOUDNESS CONTROLS: Simply stated, the purpose of the LOUDNESS control is to provide compensation for the increasing inefficiency of the human ear in hearing bass and treble with decreasing volume level. The LOUDNESS control, as it is turned counter-clockwise from maximum clockwise rotation, not only decreases the volume but increasingly emphasizes the bass and treble according to the Fletcher-Munson curves (curves developed from a statistical study of this effect). An uncompensated LEVEL control is also provided to "set" the LOUDNESS control for proper operation in any system, and also for the purpose of adjusting the listening level when going from quiet program material to loud program material or the reverse without occasioning a change in the loudness compensation. To "set" the LOUDNESS control at any time, perform these operations in the order given to avoid blasting or possible damage to speakers of low power-handling capacity: a) Turn the LEVEL control to zero; b) Turn the LOUDNESS control to ten; c) With high level orchestral program material being fed to the amplifier from your phonograph or tuner, advance the LEVEL control setting until a relatively loud listening level is obtained. d) Turn down the LOUDNESS control until your normal listening level is obtained with the LEVEL control set as just described. Proper loudness compensation should now be obtained at any listening level adjusted to with the LOUDNESS control. The same reference LEVEL control setting will be suitable for both phonograph and tuner listening if the volume control of the tuner has been adjusted as described in the "High Level Inputs" sub-section of the "Electrical Connections" section. When selecting inputs which do not have level

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adjusts, such as tv or a crystal cartridge connected to the AUX. input, it may be desirable to set the LEVEL control to zero beforehand and then bring up the LEVEL control to obtain the desired listening level to avoid blasting.

BASS CONTROL: The plus sign on the right side of the dial indicates that clockwise rotation from the mid-point (0) increases (boosts) base response; the minus sign on the left side indicate 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 setting.

TREBLE CONTROL: The plus sign on the right side of the dial indicates that clockwise rotation from the mid-point (0) increases (boosts) treble response; the minus sign on the left side 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.

RUMBLE FILTER: Rumble (low vibration) occurs at about 29 cps in 4-pole record changers and turntables. Recorded rumble will also sometimes be found in discs recorded before the development of the improved techniques in use today (transmitted program material may also include records of the latter type). Reduced rumble is one of the objectives in the design of turntables and changers for high fidelity use, but the extent to which it is eliminated depends on the quality and condition of the turntable or record changer used. That is why the rumble filter is provided. Note that whether the rumble frequency itself is audible or inaudible (depending on the extreme low frequency response of the speaker system), it may still overload the amplifier or speaker and cause distortion in the audible region. Insert the rumble filter whenever recording to tape from records played on a doubtful changer or player, in order to eliminate any trace of sub-sonic rumble from appearing at the recording head and eventually magnetizing it with increased distortion level as a result. The rumble filter also eliminates tape overload from low frequency noise components and thus provides cleaner tapes.

SCRATCH FILTER: The scratch filter is used for reduction of noise with worn or scratchy records, particularly older 78 RPM records, and for elimination of noise above 5 KC on AM broadcasts. It is particularly valuable in these cases when recording on tape.

FILTER CIRCUITS VS. TONE CONTROLS: Note that the filter circuits provide relatively sharp cut-offs, whereas the tone controls provide gradual, frequency-proportional changes in the response. One type of control is not a substitute for the other and both may be used together to achieve any desired response. It is worth noting, however, that the "variable turnover" tone controls employed in this instrument may be used to further sharpen the cut-off when desired or effectively shift the cut-off frequencies in either direction.

LISTENING TO TUNERS, TV, OR OTHER HIGH LEVEL INPUTS: With the SELECTOR switch set at TUNER, TV, or AUXILIARY, the corresponding high level input from a radio tuner, tv, tape recorder with built in preamplifier-equalizer, second tuner, or crystal cartridge will feed through the preamplifier. Adjustment of the volume control on each source is discussed in the "Electrical Connections" section under "High Level Inputs" and again under "Level & Loudness Control" in this section.

MAKING RECORDINGS: Tape, wire, or disc recordings may be made by connecting the recorder to the TAPE OUTPUT jack. See "TAPE OUTPUT" under "ELECTRICAL INSTALLATION" and the "RUMBLE FILTER" and "SCRATCH FILTER" operating instructions.

RECORD EQUALIZATION SELECTION

Records are made with boosted volume in the treble range to mask surface noise and reduced volume in the bass range to conserve groove space and reduce distortion. As there was no universally accepted standard of treble boost and bass cut in recording before Spring 1954, records of which the masters were made before this date may require any one of several different equalizations (amounts of bass boost and treble cut) by the amplifier to restore the original balance.

In the Spring 1954, the RIAA recording curve was adopted by almost all record companies. At this time, all recording companies use the RIAA recording curve. If an older LP record does not seem properly equalized at the RIAA position, try LONdon if it is a LONDON (ffrr) or L'Oiseau-Lyre record and COLumbia if it is of almost any other brand. For most 78 rpm recordings, either the AMerican 78 or the EURopean 78 equalization will be found suitable.

maintenance

TROUBLE SHOOTING AND OPERATING NOTES

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 30 watts output, as well as the corresponding 1 kc signal voltages.

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TROUBLE-SHOOTING PROCEDURES

Connect a phonograph and speaker to the amplifier as described in "Electrical Connections" and set controls for phono listening. Play a known high quality LP recording on the phonograph. If there is no output to the speaker or if the output is low or audibly distorted, procede 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.

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 speaker terminal "G" on the amplifier. Do not connect such a ground wire to other components in the system.

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 the trouble is no output or low output, check AC signal voltages and DC operating voltages starting at the input and working step-by-step toward the output. Set the VOLUME & LOUDNESS controls to maximum (10), the BASS and TREBLE controls to their mid-points (0), and the SCRATCH & RUMBLE filters to OFF. Use a 1000 cycle sinewave signal, such as supplied by the EICO 377 Sine & Square Wave Audio Generator. In addition, use a precision 100:1 attenuator to permit obtaining a level of 0.005 volt fed into MAG. PHONO from an audio generator output of 0.5 volt, 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 and a VTVM or 20,000 Ω/volt VOM for DC voltage measurements.

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

When the defective stage is localized, procede 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 EL84 output tubes. Do not turn the amplifier on with any of the output tubes removed.

CHECKING A TYPICAL TUBE STAGE

1. Check tube.
2. Check plate and cathode resistor.
3. Check coupling capacitors for leakage or short.
4. For output stage, check dc resistance of transformer windings.
5. Check grid leak resistor for open.
6. Check cathode by-pass capacitors for short.
7. If no or low B+ voltage on tube, check decoupling path for open or defective R40, R41, R42 and filter capacitor C31 or C32.
8. If wiring and circuit components including the tube check O.K. and B+ voltage is excessive, check the decoupling path for short or defective R40, R41, R42.

Suspected trouble in the equalization, tone, filter, and volume or loudness controls and networks should lead to specific resistance and capacitance checks to localize the trouble. In general, if the user suspects poor frequency response, defective equalization, or defective operation of the tone controls or filter circuits, the amplifier should be tested thoroughly with audio generator, vtvm, and scope.

SERVICE

If trouble developes in your instrument which you can not remedy yourself, write to our service department listing all possible indications that might be helpful. If desired you may return the instrument to our factory where it will be placed in operating condition for $9.50 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.

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TROUBLE-SHOOTING CHART

SYMPTOM	CAUSE	REMEDY
Amplifier causes power line fuse to blow. Power line fuse blows again with V9 & V10 out of their sockets.	Line cord, J9, J10, primary or high voltage secondary windings of T2 shorted internally or externally (wiring).	Replace or repair.
Amplifier causes power line fuse to blow. Power line fuse does not blow again with V9& V10 out of their sockets.	V9, V10, C31, V5, V6, V7, V8, or T1 primary shorted internally or externally.	Replace or repair.
Any or all tube filaments not lit. (except V1)	Open tube filament. Open lead from 6.3V winding of T2. 6.3V winding of T2 open.	Replace or repair.
V1 filament not lit.	Open V1 filament. No connection or poor connection to pin 5 (fil.) of V1 from common cathode connection of V5, V6, V7, and V8. Pin 4 (fil.) of V1 not grounded.	Replace or repair.
Output tube bias too high (resulting in distorted output waveform).	Same as above if V1 filament not lit. Open R26 if V1 filament is lit.	Replace or repair.
DC voltage at V9, V10 cathodes (pin 3) is incorrect as specified below.		
a) No voltage.	Defective V9 or V10 C31 shorted internally or externally.	Replace Replace or repair.
b) High voltage.	Connection from C31 to pin 3 of V9 & V10 broken. Connection to center tap of h.v. secondary winding of T2 open. Output tubes V5, V6, V7, V8 over-biased or not drawing current. May result from open R26, open filament or defective connection to V1 filament.	Repair Repair Replace, repair, or see trouble-shooting typical tube stage.
c) Low voltage.	Excessive current drain in amplifier. Defective V9, V10.	See trouble-shooting typical tube stage. Replace
Excessive hum on mag. phono or tape head.	V1 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 and tape head.	V1 socket and contacts dirty.	Clean throughly with carbon tetrachloride.
Sustained oscillations.	Poor dress of output transformer T1 leads	Dress all input leads and T1 leads away from each other. Keep T1 leads away from input jacks.
Sustained microphonics on mag. phono and tape head.	V1 defective.	Replace
Hum on all inputs.	V2 defective, not properly shielded, or dirty sockets and contacts. Dress of power transformer T2 leads.	Replace, correct, or clean. Correct

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VOLTAGE AND RESISTANCE CHART

TUBE	PIN#	OPERATING VOLTS AT NO SIGNAL (DC UNLESS NOTED)	OPERATING VOLTS AT 30W OUT (DC UNLESS NOTED)	SIGNAL VOLTS (1 KC) AT 30W OUT	OHMS (UNIT DISCONNECTED FROM POWER)
ECC83/12AX7	1	62	56	.012	320KΩ
	2	0	0	.0036	110KΩ
V1	3	0.6	0.65	.0034	1.2KΩ
	4	0	0	-	-
	5	12.5	14.6	-	17Ω
	6	98	92	.38	320KΩ
	7	0	0	.012	1MΩ
	8	1.35	1.35	0	4.7KΩ
	9	6.3	7.3	-	8Ω
EC90/6C4	1	141	142	1.16	125KΩ
	2	-	-	-	-
V2	3&4	filament (0VDC; 6.3VAC between pins 3 & 4)			0-50Ω
	5	141	142	1.16	125KΩ
	6	0	0	.38	500KΩ
	7	7.5	7.4	.236	5.6KΩ
ECC83/12AX7	1	95	96	8.4	340KΩ
	2	0	0	1.16	180KΩ
V3	3	.95	.95	1.05	1.65KΩ
	4&5	filament (0VDC; 6.3VAC to pin 9)			0-50Ω
	6	175	175	1.2	180KΩ
	7	0	0	.60	450KΩ
	8	2	2	0	6.8KΩ
	9	filament	-	-	-
EC90/6C4	1	195	185	7.4	92KΩ
	2	100	102	7.4	82KΩ
V4	3&4	filament (0VDC; 6.3VAC between pins 3 & 4)			0-50Ω
	5	196	190	7.7	92KΩ
	6	95	96	8.4	340KΩ
	7	100	102	7.4	82KΩ
EL84	1	0	0	7.4	330KΩ
	2	0	0	7.4	330KΩ
V5,V6	3	12.5	14.6	0	330Ω
(rear)	4&5	filament (0VDC; 6.3VAC between pins 3 & 4)			0-50Ω
	6	0	0	7.4	330KΩ
	7	340	337	200	62Ω (T1 brown lead)
	8	-	-	-	-
	9	345	342	10	0
EL84	1	0	0	7.4	330KΩ
	2	0	0	7.4	330KΩ
V7,V8	3	12.5	14.6	0	330Ω
(front)	4&5	filament (0VDC; 6.3VAC between pins 3 & 4)			0-50Ω
	6	0	0	7.4	330KΩ
	7	340	333	200	66Ω (T1 blue lead)
	8	-	-	-	-
	9	345	342	10	0
EZ81	1	290VAC (60 cps)	290VAC (60 cps)	-	45-55Ω
	2	-	-	-	-
V9,V10	3	345	342		200KΩ
	4&5	filament (345VDC; 6.3VAC between pins 4 & 5)			200KΩ
	6	-	-	-	-
	7	290VAC (60 cps)	290VAC (60 cps)	-	45-55Ω
	8	-	-	-	-
	9	-	-	-	-

All resistance measurements, except those made from pin 3 of V9 and V10 (EZ81 rectifier), are made with pin 3 of V9 and V10 grounded. All voltage and resistance measurements are measured to chassis with the controls set as follows: SELECTOR to RIAA, LEVEL & LOUDNESS both at 10, SCRATCH & RUMBLE FILTER both at OFF, BASS & TREBLE controls both at 0. For voltage measurements at 30W output, set the input selector to the RIAA position and feed a 0.005 volt (5 mv) 1 kc signal to the LO MAG. phono input jack; connect a resistive (preferably non-inductive) load of equal resistance to the tap selected (±20%) and capable of handling 60 watts. Voltage measurements are made with a VTVM. Operating line voltage at which voltage measurements are made is 117VAC, 60 cps. NOTE: ALL VOLTAGE & RESISTANCE VALUES MAY VARY NORMALLY BY ±15%.

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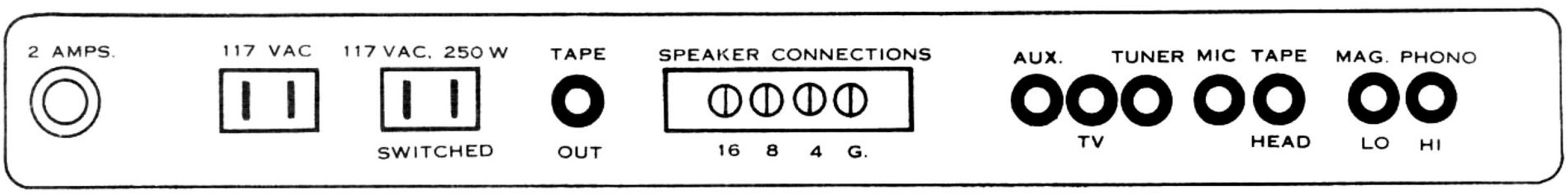
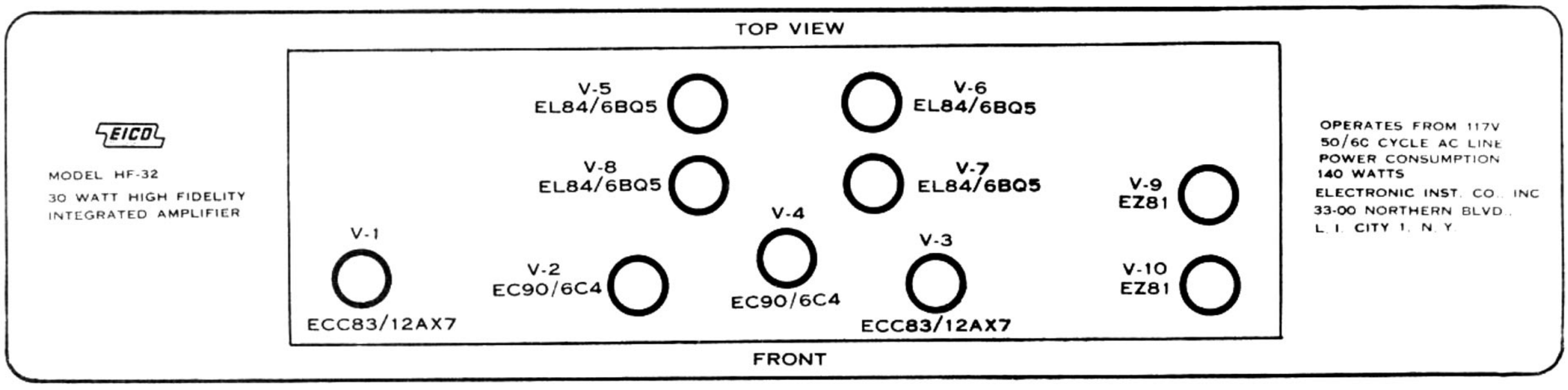
	SECTION	AUX	TV	TUNER	MIC	TAPE HEAD	78	RIAA	COL	LON
SELECTOR SWITCH	A	9-11	3-11	3-11	NC	NC	NC	NC	NC	5-9
	B	1-2-4	2-4	NC	4-12	1-4-6	2-6-7	NC	NC	NC
	C	4-5	4-5	4-7-11	4-5-7	NC	4-7	4-11	4-11	4-5
	D	2-8-9	2-3-8	3-8	8-12	6-8	2-6-8	3-8	8-9	8-9
	E	3-5-12	3-6-12	3-7-12	3-8-12	3-8	3-8	3-8	12-8	12-8
	F	4-6-7-8	4-5-7-8	4-5-6-8	4-5-6-7	4-5-6-7	4-5-6-7	4-5-6-7	4-5-6-7	4-5-6-7
	G	NC	NC	NC	5-6	5-7	5-8	5-8	5-8	5-8
	H	4-6-7-8	6-7-8	4-6-7-8	4-7-8	4-6-8	4-6-7	4-6-7	4-6-7	4-6-7

1) Entries are numbers of those switch contacts which are connected together by the rotors at the particular position. NC means no connection.
2) On schematic diagram, all switch wafers shown in the maximum counter-clockwise position (AUX) as seen from the front or shaft end.





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REPLACEMENT PARTS LIST

Stock	Sym.	Description	Am't.
22517	C1,2	cap., disc., .025 mfd (25K or 25,000 mmf), GMV	2
20039	C3,14,18,	cap., molded, .1 mfd 400 V	3
23014	C4,21	cap., elec., 10 mfd, 6 V	2
22507	C5,10	cap., disc., .0022 mfd (2.2K or 2,200 mmf), 10%	2
22508	C6	cap., disc., .0033 mfd (3.3K or 3,300 mmf), 10%	1
20048	C7	cap., molded, .033 mfd, 20%	1
22515	C8,11	cap., disc., 500 mmf, 10%	2
22518	C9	cap., disc., .0027 mfd (2.7K or 2,700 mmf), 10%	1
22514	C12	cap., disc., 850 mmf, 10%	1
22532	C13,17	cap., disc., .0015 mfd (1.5K or 1,500 mmf), 10%	2
22547	C15,19	cap., disc., .015 mfd (15K or 15,000 mmf), 20%	2
22521	C16	cap., disc., .001 mfd (1K or 1,000 mmf), 10%	1
22548	C20	cap., disc., .009 mfd (9K or 9,000 mmf), 10%	1
22536	C22, 23, 24, 28	cap., disc., 25 mmf, 10%	4
20024	C25, 26	cap., molded, .022 mfd - 600 V	2
23017	C27	cap., elec., 300 mfd, 25 V	1
22509	C29	cap., disc., 100 mmf, 10%	1
20043	C30	cap., molded, .03 mfd, 600 V, 20%	1
23016	C31, 33	cap., elec., 30 mfd, 400 V,	2
24005	C32	cap., elec., 20-40-40 mfd/400-350-350 V	1
91005	F1	fuse, 3A	1
92000	I1	pilot light	1
50014	J1,2,3,8	jack, single phono	4
50011	J4-5,6-7	jack, dual phono	2
50016	J9,10	outlet, convenience	2
29751	PC1	printed circuit	1
10435	R1,2,	res., 150KΩ (brown,green,yellow,silver) 1/2W,±10%	2
10417	R3	res., 220KΩ (red,red,yellow,silver) 1/2W,±10%	1
10407	R4,5	res., 1MΩ (brown,black,green,silver) 1/2W,±10%	2
11526	R6,7	res., 200KΩ (red,black,yellow,gold) 1/2W, ±5%	2
11533	R8	res., 1.2KΩ (brown,red,red,gold) 1/2W, ±5%	1
10430	R9	res., 4.7KΩ (yellow,violet,red,silver) 1/2W,±10%	1
11527	R10,12,14	res., 100KΩ (brown,black,yellow,gold) 1/2W,±5%	3
11525	R11	res., 150KΩ (brown,green,yellow,gold) 1/2W, ±5%	1
11511	R13	res., 560KΩ (green,blue,yellow,gold) 1/2W, ±5%	1
10410	R23	res., 100KΩ (brown,black,yellow,silver) 1/2W,±10%	1
11518	R15	res., 2.2MΩ (red,red,green,gold) 1/2W,±5%	1
10428	R16	res., 47KΩ (yellow,violet,orange,silver) 1/2W,±10%	1
10449	R17	res., 5.6KΩ (green,blue,red,silver) 1/2W,±10%	1
18038	R18	pot., 500KΩ, audio taper (volume)	1
10416	R19	res., 15KΩ (brown,green,orange,silver) 1/2W,±10%	1
18034	R20, S4	pot., 500KΩ, linear taper, CT (treble)- on-off switch	1
18033	R21	pot., 1MΩ, linear taper (bass)	1
10421	R22	res., 6.8KΩ (blue,grey,red,silver) 1/2W,±10%	1
18039	R24,PC2	pot., 500KΩ, 2 taps, linear (compentrol)	1
10400	R25, 30	res., 10KΩ (brown,black,orange,silver) 1/2W,±10%	2
10900	R26	res., 330Ω (orange,orange,brown) 2W, ±20%	1
11546	R27	res., 33KΩ (orange,orange,orange,gold) 1/2W,±5%	1
10412	R28,33,34	res., 330KΩ (orange,orange,yellow,silver) 1/2W,±10%	3
11542	R29	res., 1.6KΩ (brown,blue,red,gold) 1/2W,±5%	1
11547	R31,32	res., 82KΩ (grey,red,orange,gold) 1/2W,±5%	2
10432	R35,36 37,38	res., 1KΩ (brown,black,red,silver) 1/2W,±10%	4
19009	R39	pot., 100Ω (hum adjust)	1
10422	R40	res., 68KΩ (blue,grey,orange,silver) 1/2W,±10%	1
10447	R41	res., 39KΩ (orange,white,orange,silver) 1/2W,±10%	1
10853	R42	res., 10KΩ (brown,black,orange,silver) 1W,±10%	1
14601	R43	res., 80Ω, 5W, ±5%	1
60050	S1	switch, selector	1
62000	S2, 3	switch, slide (rumble,scratch)	2
32008	T1	transformer, output	1
30021	T2	transformer, power	1
54500	TB1	terminal board, 4 post	1
54000	TB2, 3	terminal strip, 1 post left	2
54003	TB4, 8	terminal strip, 2 post	2
54013	TB5, 6, 7	terminal strip, 1 post left w/ground	3
81134		shield, top with spade bolts	1

Stock#	Sym.	Description	Am't.
54006	TB9	terminal strip, 3 post 2 right	1
54017	TB10	terminal strip, upright 1 post right	1
54001	TB11, 12	terminal strip, 1 post right	2
90034	V1,3	tube, 12AX7	2
90051	V2,4	tube, 6C4	2
90039	V5,6,7,8	tube, EL84	4
90038	V9,10	tube, EZ81	2
97800	XF1	fuse holder	1
97712	XI1	pilot assembly	1
97027	XV1,3	socket, 9 pin min. top mount	2
97033	XV2	socket, 7 pin min. top mount	1
97024	XV4	socket, 7 pin min. bottom mount	1
97025	XV5,6, 7,8,9,10	socket, 9 pin min. bottom mount	6
40000		nut, hex, 6-32 x 1/4	48
40001		nut, hex, 3/8-32 x 1/2	6
40007		nut, hex, 4-40 x 1/4	20
40008		nut, hex, 8-32 x 1/4	14
40016		nut, hex, 1/2-24 w/slot	1
40026		nut, tinnerman, 8-32	6
40027		nut, tinnerman, angle bracket	2
41000		screw, 6-32 x 1/4 Bd. H.	46
41003		screw, 8-32 x 3/8 Bd. H.	8
41016		screw, 4-40 x 1/4 Bd. H.	22
41027		screw, #4 x 3/8 R. H. brass wood screw	2
41028		screw, 8-32 x 1 R. H.	2
41045		screw, #6 P. K. x 1/4 brown	4
41046		screw, 8-32 x 3/8 Bd. H. brown	4
41047		screw, #8 P. K. x 5/16 Bd. H.	6
42000		washer, lock, 3/8	6
42002		washer, lock, #6	48
42007		washer, lock, #4	22
42008		washer, lock, #8	14
42029		washer, rubber, 1/21D (fuseholder)	1
42032		washer, flat, #8, 7/16 O.D.	2
43000		lug, ground, #6	3
43001		lug, pot, ground, 3/8	3
43004		lug, solder, #8	4
43006		lug, ground #4	1
46000		grommet, rubber	1
46006		feet, rubber	4
50012		insulator, bakelite	2
51006		plug, phono RCA	7
53007		knob, round	5
57000		line cord	1
58004		wire, hook-up	length
58300		spaghetti	length
58301		tubing, heavy	length
58408		shielded cable, 1 cond.	length
58412		shielded cable, 3 cond.	length
58501		wire, bare, #22	length
80052		panel	1
81108		chassis	1
81109		bottom plate	1
81110		bracket, left	1
81111		bracket, right.	1
81112		perforated screen	1
81113		shield	1
81114		bracket, switch	1
81116		bezel	1
81903		cable clamp	4
89215		label, rear layout	1
89216		label, tube layout	1
97300		tube shield	2
97301		tube shield	1
97710		jewel	1
66060		manual of instruction (wired)	1
66309		manual of instruction (kit)	1

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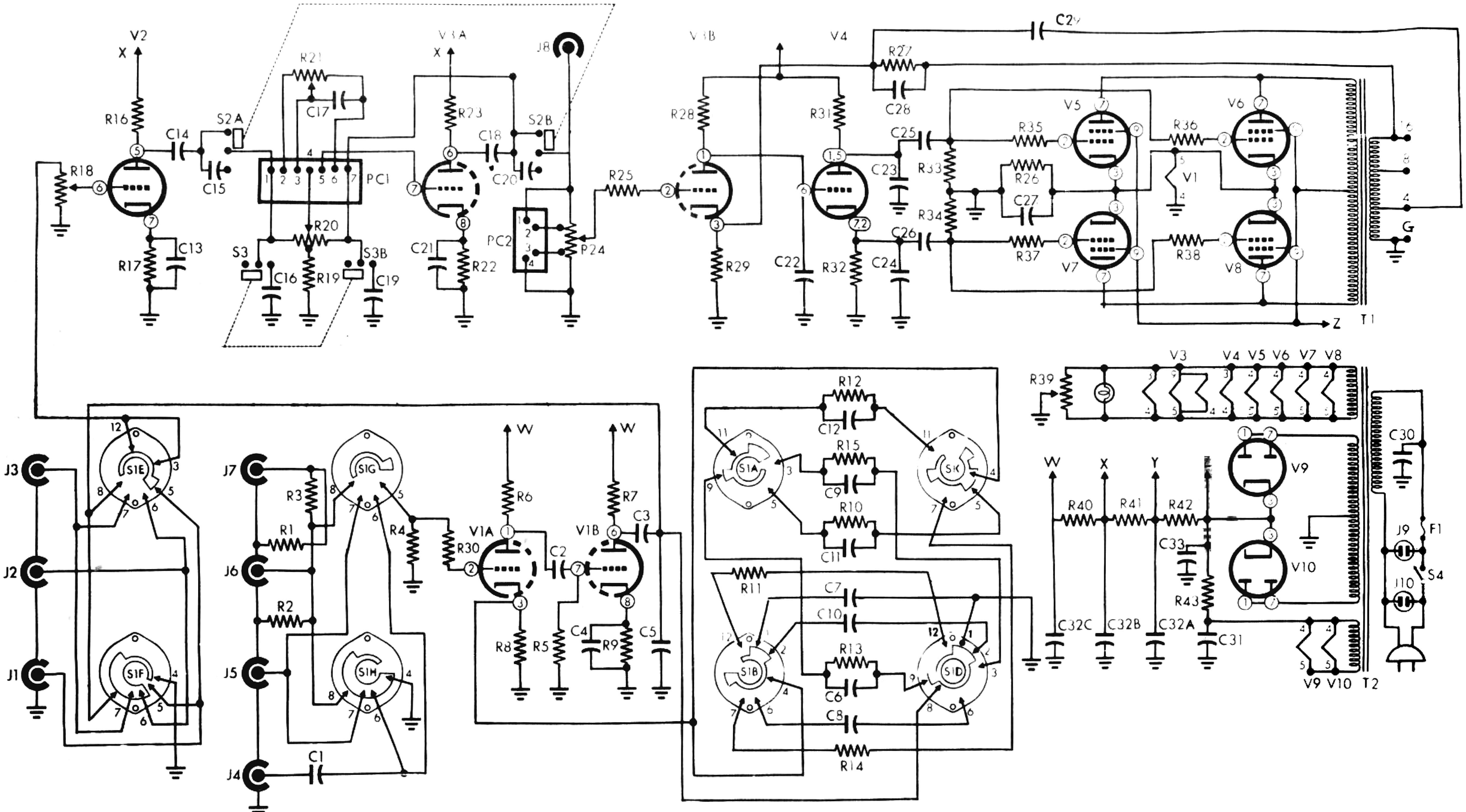

Sym.	Description	Sym.	Description	Sym.	Description	Sym.	Description	Sym.	Description	Sym.	Description
C1	cap., disc., .025 mfd, GMV	C19	cap., disc., .015 mfd, 20%	J1	jack, aux.	R7	res., 200KΩ, 1/2W, ± 5%	R24	pot., 500KΩ, 2 taps, linear (compentrol)	R42	res., 10KΩ, 1W, ±10%
C2	cap., disc., .025 mfd, GMV	C20	cap., disc., .009 mfd, 10%	J2	jack, tv	R8	res., 1.2KΩ, 1/2W, ± 5%	R25	res., 10KΩ, 1/2W, ±10%	R43	res., 80Ω, 5W, ± 5%
C3	cap., molded, .1 mfd - 400 V	C21	cap., elec., 10 mfd - 6 V	J3	jack, tuner	R9	res., 4.7KΩ, 1/2W, ±10%	R26	res., 330Ω, 2W, ±10%	S1	switch, selector
C4	cap., elec., 10 mfd, - 6 V	C22	cap., disc., 25 mmf, 10%	J4	jack, mic	R10	res., 100KΩ, 1/2W, ± 5%	R27	res., 33KΩ, 1/2W, ± 5%	S2	switch, slide (rumble)
C5	cap., disc., .0022 mfd, 10%	C23	cap., disc., 25 mmf, 10%	J5	jack, tape head	R11	res., 150KΩ, 1/2W, ± 5%	R28	res., 330KΩ, 1/2W, ±10%	S3	switch, slide (scratch)
C6	cap., disc., .0033 mfd, 10%	C24	cap., disc., 25 mmf, 10%	J6	jack, phono lo	R12	res., 100KΩ, 1/2W, ± 5%	R29	res., 1.6KΩ, 1/2W, ± 5%	S4	on-off switch (on R20)
C7	cap., molded, .033 mfd, 20%	C25	cap., molded, .022 mfd - 600V	J7	jack, phono hi	R13	res., 560KΩ, 1/2W, ± 5%	R30	res., 10KΩ, 1/2W, ±10%	T1	transformer, output
C8	cap., disc., 500 mmf, 10%	C26	cap., molded, .022 mfd - 600V	J8	jack, tape out	R14	res., 100KΩ, 1/2W, ± 5%	R31	res., 82KΩ, 1/2W, ± 5%	T2	transformer, power
C9	cap., disc., .0027 mfd, 10%	C27	cap., elec., 300 mfd - 25 V	J9	outlet, 117 VAC, 250 W	R15	res., 2.2MΩ, 1/2W, ± 5%	R32	res., 82KΩ, 1/2W, ± 5%	V1	tube, 12AX7
C10	cap., disc., .0022 mfd, 10%	C28	cap., disc., 25 mmf, 10%	J10	outlet, 117 VAC	R16	res., 47KΩ, 1/2W, ±10%	R33	res., 330KΩ, 1/2W, ±10%	V2	tube, 6C4
C11	cap., disc., 500 mmf, 10%	C29	cap., disc., 100 mmf, 10%	PC1	printed circuit	R17	res., 5.6KΩ, 1/2W, ±10%	R34	res., 330KΩ, 1/2W, ±10%	V3	tube, 12AX7
C12	cap., disc., 850 mmf, 10%	C30	cap., molded, .03 mfd - 600V	PC2	printed circuit (on R24)	R18	pot., 500KΩ, audio taper (volume)	R35	res., 1KΩ, 1/2W, ±10%	V4	tube, 6C4
C13	cap., disc., .0015 mfd, 10%	C31	cap., elec., 30 mfd - 400 V	R1	res., 150KΩ, 1/2W, ±10%	R19	res., 15KΩ, 1/2W, ±10%	R36	res., 1KΩ, 1/2W, ±10%	V5	tube, EL84
C14	cap., molded, .1 mfd - 400 V	C32	cap., elec., 20 - 40 - 40 mfd/ 400 - 350 - 350	R2	res., 150KΩ, 1/2W, ±10%	R20	pot., 500KΩ, linear taper, CT (treble) on-off switch	R37	res., 1KΩ, 1/2W, ±10%	V6	tube, EL84
C15	cap., disc., .015 mfd, 20%			R3	res., 220KΩ, 1/2W, ±10%			R38	res., 1KΩ, 1/2W, ±10%	V7	tube, EL84
C16	cap., disc., .001 mfd, 10%	C33	cap., elec., 30 mfd - 400 V	R4	res., 1MΩ, 1/2W, ±10%	R21	pot., 1MΩ, linear taper (bass)	R39	pot., 100Ω (hum adjust)	V8	tube, EL84
C17	cap., disc., .0015 mfd, 10%	F1	fuse, 3A	R5	res., 1MΩ, 1/2W, ±10%	R22	res., 6.8KΩ, 1/2W, ±10%	R40	res., 68KΩ, 1/2W, ±10%	V9	tube, EZ81
C18	cap., molded, .1 mfd - 400 V	I1	pilot light	R6	res., 200KΩ, 1/2W, ± 5%	R23	res., 100KΩ, 1/2W, ±10%	R41	res., 39KΩ, 1/2W, ±10%	V10	tube, EZ81

EICO MODEL HF-32 30 WATT HIGH FIDELITY INTEGRATED AMPLIFIER