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A30 POWER AMPLIFIER

SERVICE MANUAL



Phase Linear PROFESSIONAL SERIES

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CAUTION: THIS MANUAL IS INTENDED FOR USE ONLY BY QUALIFIED SERVICE PERSONNEL. HAZARDOUS VOLTAGES MAY BE ENCOUNTERED IN THE SERVICING OF THE A30 AMPLIFIER. USE EXTREME CAUTION AND READ ALL INSTRUCTIONS CAREFULLY.

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prepared 10-80

1-0. SPECIFICATIONS

ELECTRICAL PERFORMANCE

POWER OUTPUT

120 watts output power minimum RMS per channel both channels driven into 8 ohms with no more than .05% total harmonic distortion.

180 watts RMS per channel into 4 ohms

300 watts RMS mono mode into 8 ohms

FREQUENCY RESPONSE

11Hz to 190kHz +0, -1dB

INTERMODULATION DISTORTION (60Hz:
7kHz @ 4:1)

Less than .005% at rated power into 8 ohms

Less than .005% at rated power into 4 ohms

SIGNAL-TO-NOISE RATIO

100dB (IHF A Weighted)

PROPAGATION DELAY: 440 nanoseconds

DAMPING FACTOR: 330:1 @ 1,000 Hz

INPUT IMPEDANCE: 49k ohms minimum

INPUT SENSITIVITY

.775 VRMS (0dBm) at Maximum level for 120 watts output

SPEAKER IMPEDANCE

No less than 4 ohms in stereo

No less than 8 ohms in mono

SLEW RATE

100 volts per microsecond

RISE TIME

Less than 1.0 microsecond

PHASE SHIFT

0° at 20Hz

-3.1° @ 20kHz

PROTECTION:

Output transistor protection: Electronic limiters together with power supply fuses prevent excursions into unsafe operating areas, regardless of load impedance.

Speaker Protection: This amplifier does not provide speaker protection from very high power levels. The user must make sure that all speakers to be connected to this amplifier can safely handle a minimum of 120 watts. Separate fusing of speakers is highly recommended. An electronically activated relay disconnects the amplifier's output from the speakers:

1. For approximately five seconds after turn-on.
2. Immediately after turn-off.
3. In the presence of DC output voltage or high level subsonic signals.

GENERAL

POWER REQUIREMENTS:

- a. 120 VAC $\pm 10\%$, 50/60Hz (USA & selected export markets)
- b. 240 VAC $\pm 10\%$, 50/60Hz (General export models)

POWER CONSUMPTION: 600 watts

LINE CORD:

Three-conductor, grounded, removable type.

MECHANICAL

UNIT: Dimensions: 19"w × 3½"h × 12"d
(rack depth) (48.3cm ×
8.9cm × 30.5cm)
(Standard EIA rack-
mountable)

Weight: 26 lbs (11.8 kgs)

SHIPPING:

Dimensions: 23"w × 8"h × 17"d (58.4cm ×
20.3cm × 43.2cm)

Weight: 32 lbs (14.5 kgs)

Specifications are subject to change without
notice due to design improvements.

2-0. PANEL FUNCTIONS

2-1. FRONT PANEL DESCRIPTION

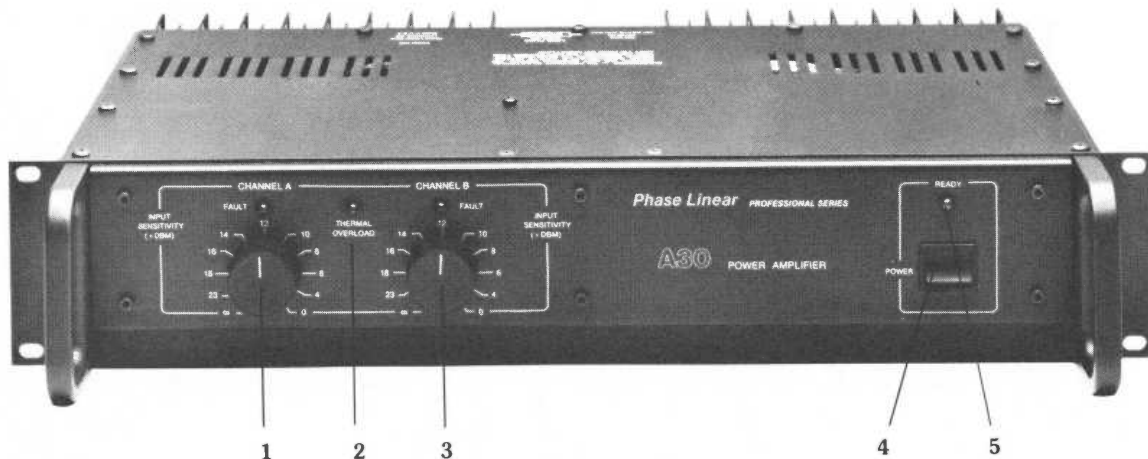


Illustration 1

- 1. INPUT SENSITIVITY CONTROL:** Stepped attenuators for each channel allow the input sensitivity of the A30 to be matched for optimum performance to any source input. These attenuators are calibrated in "dBm" required at the input for rated output. For example, when the attenuator is set at 0 dBm, an output from the mixing board or electronic crossover of .775 volts will result in full output.
- 2. THERMAL OVERLOAD INDICATOR:** This red LED will light any time the temperature of either heatsink exceeds its thermal limit. All AC power will be removed from the power transformer during the overload condition (as long as the overload indicator is lit) allowing the amplifier to cool. When the amplifier has cooled sufficiently power will be restored and the overload indicator will extinguish.
- 3. FAULT INDICATOR:** The red LED fault indicators will light up whenever the amplifier is clipping, current limiting, the supply fuse is blown, or for any reason the output of the amplifier does not precisely follow the input. Refer to OPERATING INSTRUCTIONS section for further details.
- 4. POWER SWITCH:** Allows independent switching of the amplifier.
- 5. READY INDICATOR:** This green LED will light up approximately five (5) seconds after the power switch is turned on to indicate that the output relay is closed and the amplifier is ready for operation.

2-2. REAR PANEL DESCRIPTION

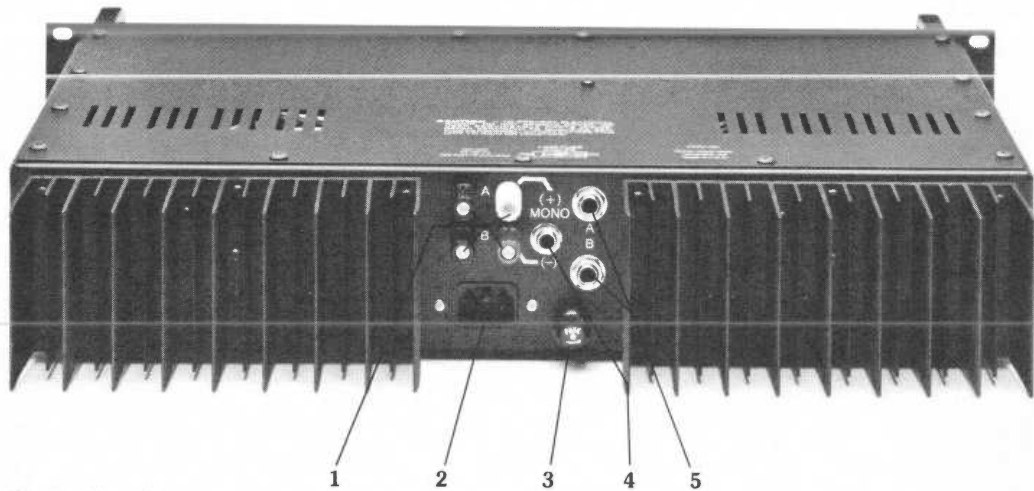


Illustration 2

- 1. OUTPUT TERMINALS:** For stereo operation, connect each speaker line so that the plus terminal of the speaker is connected to the positive terminal of the amplifier (red, white) and the common or ground of the speaker is connected to the black or ground terminal of the amplifier. For mono (bridged) operation, connect the plus terminal of the speaker to Channel A positive terminal (white) and the common or ground terminal of the speaker to the positive (red) terminal of Channel B.
- 2. POWER CORD:** Power is supplied to the A30 via the detachable line cord supplied with the amplifier. The line cord is of the three conductor variety, the third prong being a safety ground. (CAUTION. Do not cut the third grounding prong from the plug.)
- 3. LINE FUSE:** Fuseholder for the primary fuse of the transformer; required to ensure the transformer does not exceed its safe operating limits.
- 4. MONO (Bridged) INPUT:** Inserting an input plug into the MONO input *automatically* places the amplifier in its bridged mode. (See Mono Operation in the TECHNICAL INFORMATION section for further details.)
- 5. STEREO INPUT:** These inputs will accept standard 1/4" phone plugs carrying line level unbalanced signals.

3-0. INSTALLATION

POWER CONNECTION

Power is supplied to the A30 via the detachable line cord supplied with the unit. The line cord is of the three conductor variety, the third prong being a safety ground. The AC voltage source should be capable of supplying at least 10 amps to the amplifier to insure proper transient power capability. If an extension cord is required, be sure to use the heavy-duty variety (16 gauge or larger) and keep the length short to prevent power loss. **CAUTION:** Be sure the amplifier is plugged into the proper power source. Operation of a 120 volt version on a 240 volt line will cause certain damage. For voltage conversion, refer to SECTION 10-0 on page 28.

GROUNDING

Input and output grounds are internally connected to the chassis of the A30 in such a fashion (inputs grounded; outputs floating) to minimize the possible ground loops that result in hum when units are rack mounted. Grounding of the power amplifier to the preceding line level components is accomplished through the shielded input cable. No further grounding of the A30 should be necessary.

VENTILATION

The A30 Power Amplifier requires a generous supply of cooling air to dissipate the relatively large amounts of heat generated by any high power amplifier. The amplifier must be installed allowing unrestricted ventilation with adequate clearance for the heatsinks to breathe. In rack installations involving several high power amplifiers or other equipment which restricts normal convection air flow through the rack, forced air ventilation must be provided by the

installation of an exhaust fan in the rack to provide a minimum of 60 cubic feet per minute air exchange to avoid overheating of all the equipment in the rack.

INPUT/OUTPUT CONNECTIONS

Stereo Operation: To connect the input of the A30 to a line source, such as a mixer or electronic crossover, always use shielded wire with ¼" phone plugs — ground being applied to the sleeve and signal connected to the tip. The inputs to the A30 are unbalanced high impedance (49K ohms). For balanced low impedance operation, use an in-line matching transformer of the locking type (e.g., Shure A95A or equivalent). The jacks of the A30 provide sufficient exposed thread to accommodate the locking type.

Low impedance speaker wires should be connected between the A30 and the speakers. Due to the high output capability of the A30 the speakers should be fused. Please refer to the section entitled Speaker Fusing. A large wire gauge is necessary to handle the potentially high output current of the amplifier and not reduce the damping factor significantly. 16 gauge wire or larger is recommended for this purpose.

Care should be taken to insure all speaker connections are made properly. Dual banana plugs are recommended to minimize the chance of short circuiting the output of the amplifier.

CAUTION: NEVER CONNECT THE OUTPUTS OF THE TWO CHANNELS TOGETHER OR WITH ANOTHER AMPLIFIER'S OUTPUT AS THIS WILL LEAD TO POSSIBLE AMPLIFIER DAMAGE. BE CERTAIN THAT THE POWER IS OFF WHEN HOOKING UP ANY SPEAKERS TO THE AMPLIFIER.

Correct phasing of the speakers should be maintained when connecting them to the amplifier. If the speakers are connected out of phase, sound cancellations will occur at some frequencies. Proper phasing can be assured by connecting the "Hot" and "Common" terminals of the amplifier to the corresponding terminals on the speakers.

Mono (Bridged) Operation: The mono or bridged mode of the A30 allows the amplifier to deliver 300 watts power capability into a single speaker load of 8 ohms connected across the hot terminals of Channel A and B. Should mono operations be desired, one cable carrying the desired audio should be connected to the mono input which will *automatically place the amplifier in the bridged mode*. The input sensitivity is then controlled for both halves of the mono output signal by *Channel A level control only*. The mono speaker is connected between the plus terminal of Channel A, and the plus terminal of Channel B. *Do not make any connection to the minus or ground terminals when the A30 is in mono operation.* Note: If the speakers are connected in the normal stereo configuration and signal is improperly applied to the Channel A or B inputs and not the mono input, no damage will occur but the silence will be obvious.

SPEAKER FUSING

The fuses in the amplifier are primarily to protect the amplifier. The speakers connected to the amplifier should be fused, especially in the case of compression drivers. No matter how much care is taken in the design of a good sound reinforcement system, accidents can occur due to feedback, microphones dropping to the floor or connecting cables being torn loose by drug crazed throngs. All of these can cause system overdrives which may destroy expensive drivers unless precautions are taken during installation. Determine from the speaker manufacturer the correct protection fuse for your specific model. Install a fuse socket in the speaker line where it will be easily accessible. If the fuse opens repeatedly, it indicates that the desired listening level is not safely obtainable with the present speaker system. **DO NOT OVERFUSE.**

If fusing information is not available from the manufacturer or if the speaker system is a home-built type, the following equation is recommended for determining the correct speaker protection fuse:

$$I = \sqrt{\frac{P}{4R}}$$

where I is the current rating of the fuse in amperes, P is the maximum *peak* power handling capability in watts, and R is the value of the speaker impedance in ohms. For example, an 8 ohm speaker capable of handling 125 watts of peak power should be protected with a 2 amp fast acting fuse.

4-0. OPERATING INSTRUCTIONS

INITIAL USE

Before turning the A30 on for the first time, double check to see that all connections are made according to the "Installation" section. The A30 may be switched on by means of the Power switch located on the front panel. The "fault" lights may flash very briefly as the power comes on, however they should not remain on. Power on indication is provided by the green "Ready" led which will illuminate only after the five second period has elapsed during which the amplifier's output relay is open. If, at any time while the amplifier is being operated the output relay should open, the ready light will extinguish to indicate the amplifier's refusal to pass nastiness on to the speakers.

INPUT SENSITIVITY CONTROLS

The input attenuators are calibrated in dBm — 0 dBm being the most sensitive position. At this fully clockwise position, an input level of .775 VRMS (0dBm) will result in an output voltage of 31 VRMS. This is the voltage required to produce 120 watts in an 8 ohm load. The counter-clockwise positions of the attenuators reduce the input sensitivity by the indicated amounts.

FAULT INDICATORS

The Channel A and B fault indicators will illuminate for the duration of any of the following conditions:

1. Clipping
2. Current limiting
3. Blown power supply fuses
4. Slew Rate limiting
5. Anytime the output of the amplifier does not precisely follow the input.

THERMAL OVERLOAD INDICATOR

The thermal overload light will illuminate anytime the temperature of either heatsink

exceeds its thermal limit. All AC Power will be removed from the power transformer during the overload condition allowing the amplifier to cool, and the thermal overload indicator will serve to verify this condition.

READY INDICATOR

The Ready light will illuminate anytime the speaker relay is closed indicating the amplifier's willingness to faithfully serve in the quest for elevated sound pressure levels.

AMPLIFIER FUSING

The A30 contains internal "melt-down" only (10A) fuses which are not easily replaceable and provide two important functions: 1. These fuses will only blow in case of definite failure which, by definition, requires servicing before the fuses can be replaced. This protects internal components from further damage possible from a catastrophic output failure. 2. Separate fusing of Channel A and B provides a means of disconnecting one channel from the power supply in the event of a failure so that the remaining channel may still be used until repairs can be made to the faulty channel.

OPERATING CHARACTERISTICS

When operating at or near maximum power output, the amplifier will be warm to the touch. This is quite normal, and will not cause damage. The output transistors in the amplifier are rated to run at a maximum temperature of 150°C (302°F). They will never get that warm due to thermal safeguards employed internally. To keep the amplifier within its safe operating temperature, proper ventilation must be maintained and speaker impedance limits observed. (4 ohms or greater in Stereo and 8 ohms or greater in bridged mode.)

5-0. TECHNICAL CIRCUIT DESCRIPTION

CIRCUIT DESCRIPTIONS

The Phase Linear A30 consists of two independent direct-coupled analog power amplifiers combined to form one stereo unit capable of very high power output, with extremely low distortion and noise. Refer to the schematic diagram and following description for a brief explanation of the technical aspects of this amplifier.

The low-level input section employs a wide-band FET input differential control amplifier. This amplifier performs all of the linearizing functions required to correct for the small irregularities found in a high gain, high current power amplifier. The input signal applied to this stage is processed and modified to obtain the properly processed input signal for the first stage of voltage amplification.

The voltage amplifier (Q101 & Q103) between the control amplifier and the current amplifiers is a common base type, performing both level shifting and voltage gain to supply the proper level and drive currents for the final stage of voltage gain.

Transistors Q102 and Q104 provide the final voltage and current gain necessary to drive the two pairs of paralleled output transistors.

R113, R103, C105 and C101 provide level and frequency scaling of the negative feedback which is applied to the inverting port of the control amplifier to set the overall system gain and closed loop frequency response of the amplifier. This negative feedback also reduces any open loop nonlinearities, which may exist, to virtually unmeasurable amounts.

The speaker relay is driven by the series combination of Q4 and Q5 and is pulled low to its "on" state only when there is no DC voltage present on the bases of either Q3 or Q4. Any AC appearing on the input to this circuit is shunted to ground by either C3 or C4. The series combination of R21 and C4 provide the approximately 5 second turn-on delay of the relay system when power is first applied to the unit. D7 and D8 in conjunction with filter capacitor C9 provide power to this circuit.

The inverter which is used to drive Channel B during mono operations is comprised of two operational amplifiers, one of which is a unity gain non-inverting buffer which drives an inverting amplifier from a constant impedance which delivers the proper polarity for bridged operation.

MODULE REPLACEMENT

The Phase Linear A30 was designed with ease of service as a prime design consideration. The amplifier is modular which lends itself to replacement of a damaged channel. Replacement modules are available from the factory and replacement involves only four screws and a few push-on connectors. If module replacement is attempted great care must be exercised in the process to ensure every connection is properly made prior to applying power. See Section 9-0, page 25.

MONO OPERATION

Operating a stereo amplifier in the mono mode (sometimes known as bridging or strapping) is achieved by inverting the signal polarity of one channel and connecting the speaker load from the hot side of one channel to the hot side of the other. The result, then, is that when one channel is driven to a certain amplitude, the other channel is driven to the exact same level, but the polarity is reversed. This exactly doubles the voltage applied to the loudspeaker for any given input. Since the power applied to the load = $\frac{E^2}{R}$, then it follows that $\frac{(2E)^2}{R}$ = four times the power in that load.

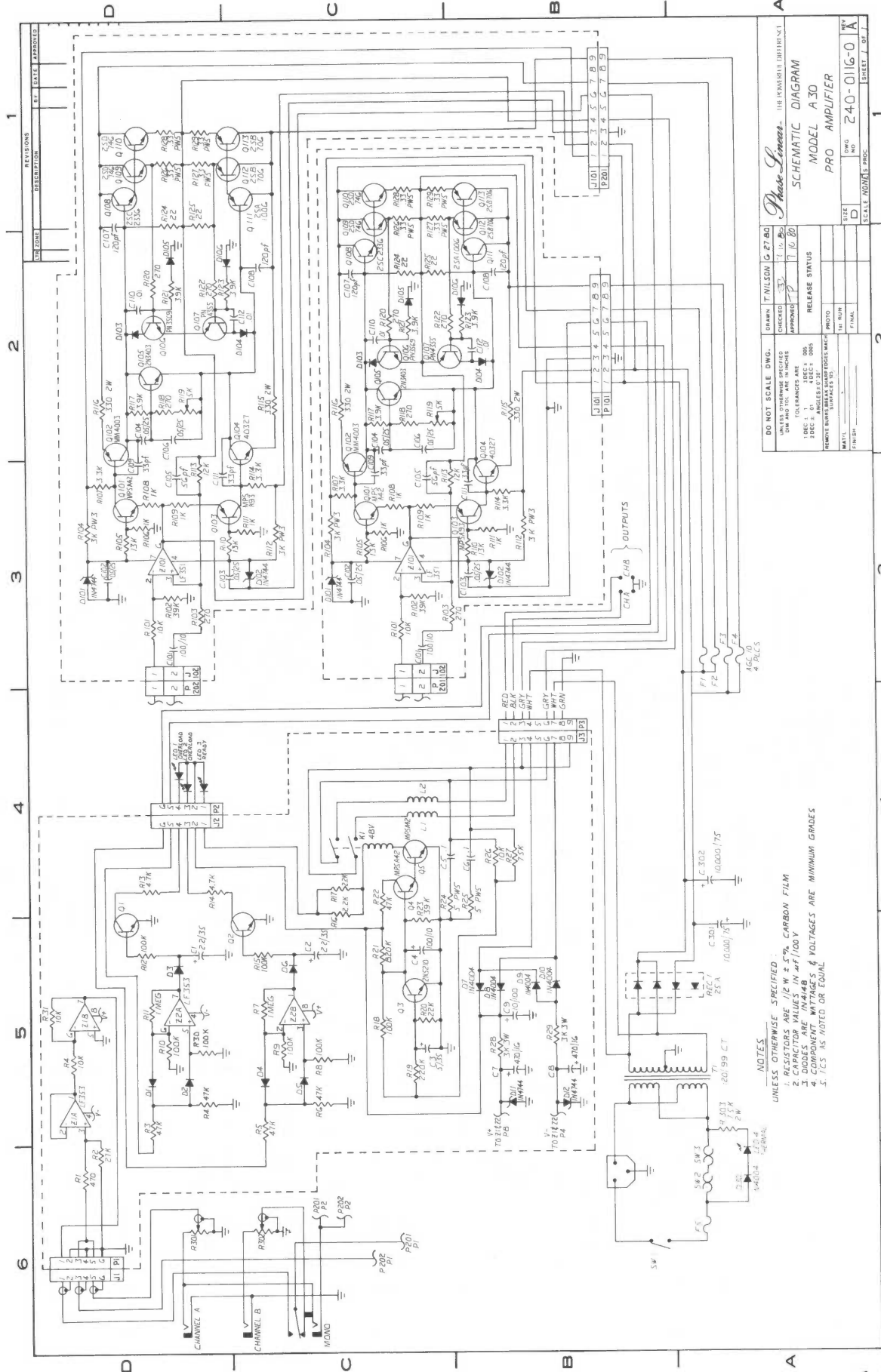
For example, assume the output voltage of the A30 = 24.5 VRMS then $\frac{(24.5)^2}{8} = \frac{600}{8}$ or 75 watts.

If we double the voltage we then have $\frac{(49)^2}{8}$ or $\frac{2401}{8} = 300$ watts. As you can see from this example, a speaker of less than 8 ohms would be asking the amplifier for an enormous amount of power.

Of course all of this power does not come free of charge. When driving a load in the mono mode, each channel of the amplifier is actually driving only one half of the total load impedance. Therefore thermal loading on the heat-sinks will be greater due to higher current flow in the output devices. (When the two channels each drive the load from different ends and at opposite polarity, there is an effective ground placed at the center of the load, thus one half of the impedance is seen by each channel.)

6-0. SCHEMATIC AND ASSEMBLY DIAGRAMS

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| 6-3b. Foil Pattern, A30 Relay PCB | 16 |



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| DO NOT SCALE DWG. | | DRAWN | T. NILSON | DATE | 6-27-60 |
| UNLESS OTHERWISE SPECIFIED | 1/16" | CHECKED | | APPROVED | |
| DIM AND TOL ARE IN INCHES | | | | | |
| 1. RESISTORS ARE 1/2 W ± 5% CARBON FILM | | | | | |
| 2. CAPACITORS ARE MALLORY 544B .001/100V | | | | | |
| 3. DIODES ARE 1N4001 | | | | | |
| 4. COMPONENT WATTAGES & VOLTAGES ARE MINIMUM GRADES | | | | | |
| 5. T/CS AS NOTED OR EQUAL | | | | | |
| REWORK NUMBER (SEE PART PROCESS MACH. SURFACE) | | | | | |
| MATERIAL | | | | | |
| PREPARED BY | | | | | |
| DATE | | | | | |
| SCALE | | | | | |

Phase Linear - THE PIONEER DESIGN UNIT
 SCHEMATIC DIAGRAM
 MODEL A30
 PRO AMPLIFIER

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| 595 | 596 | 597 | 598 | 599 | 600 |

Fig. 6-1. Schematic Diagram, Model A30

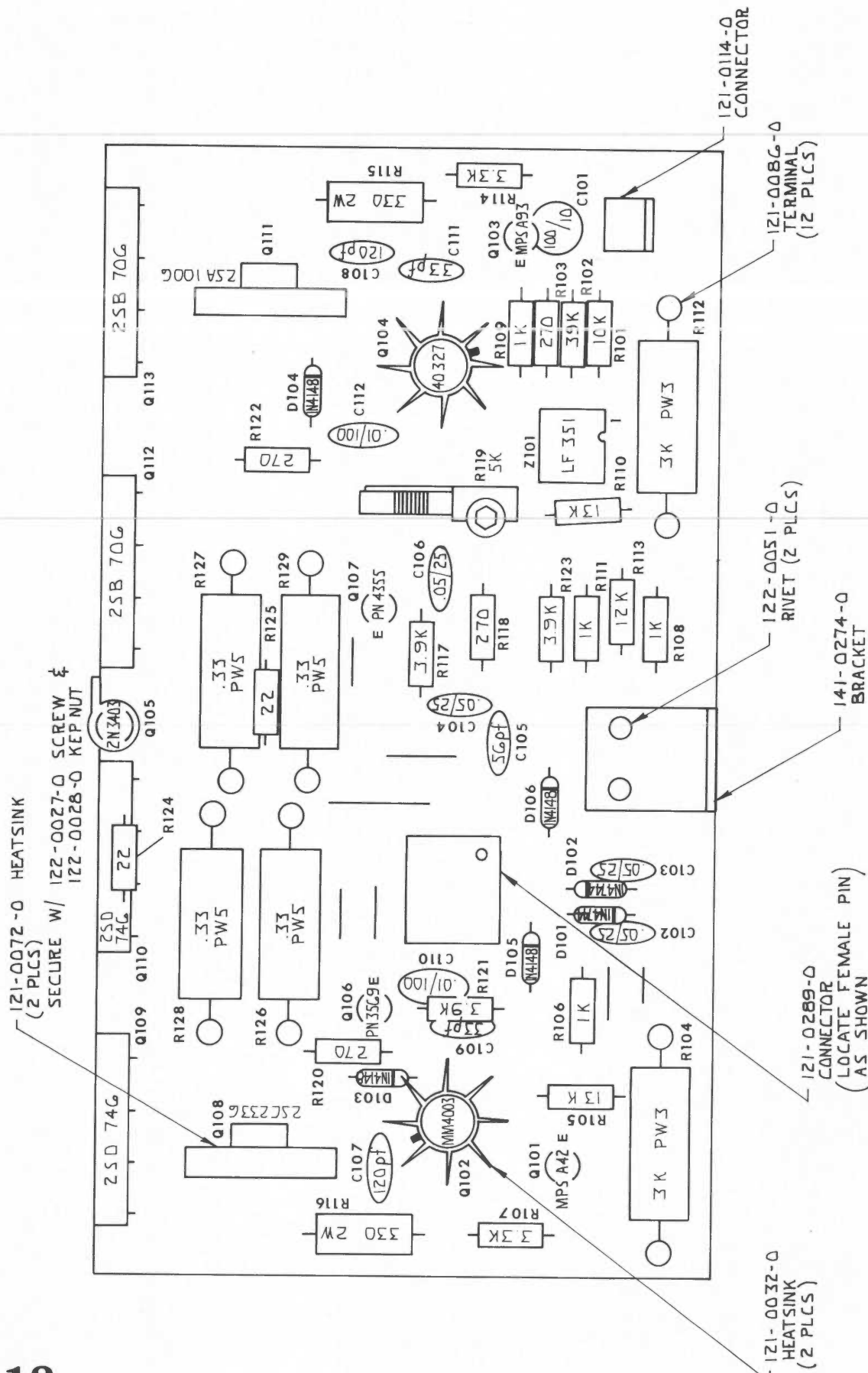


Fig. 6-2a. Assembly Diagram, A30 Drive PCB

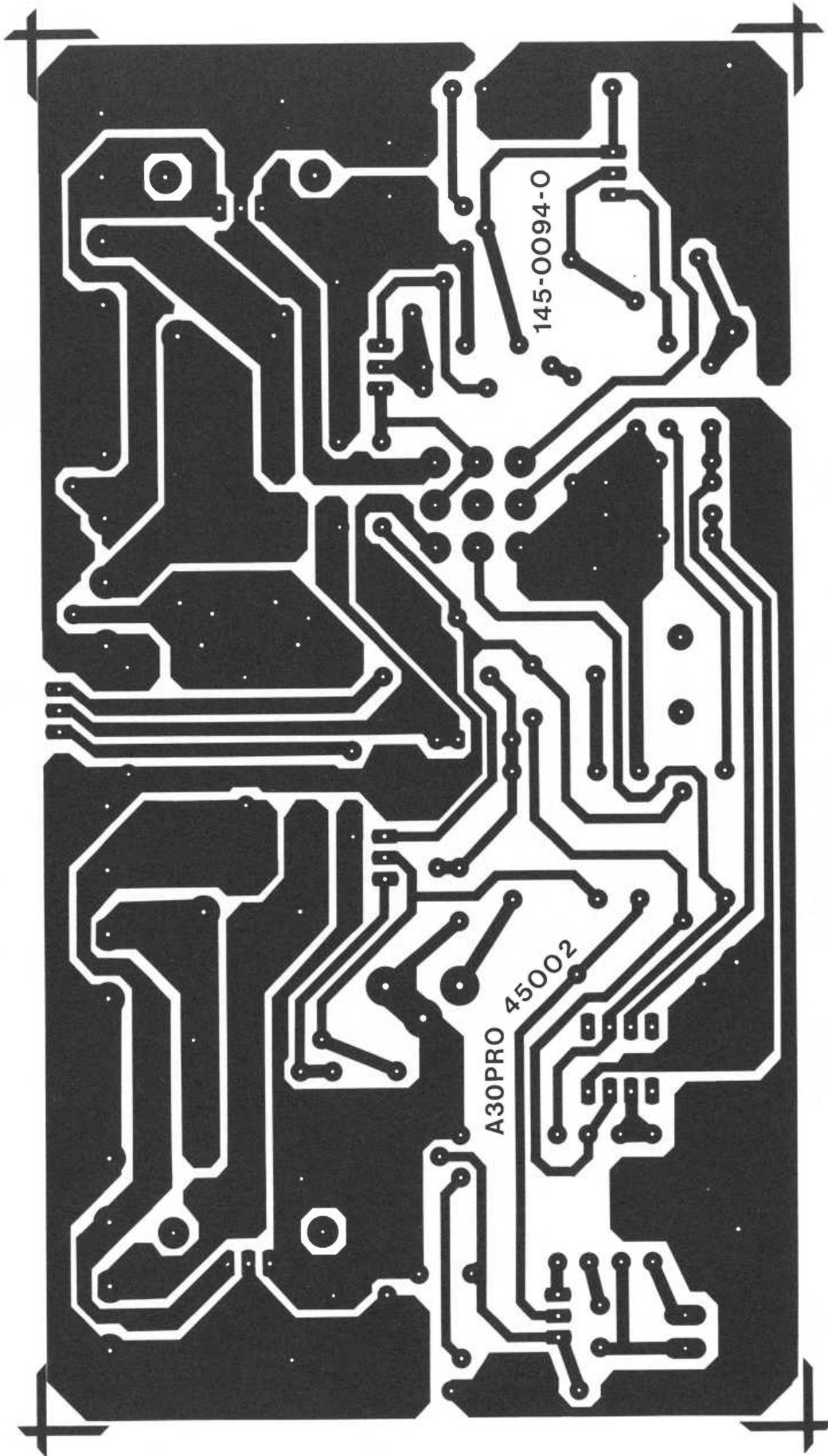


Fig. 6-2b. Foil Pattern, A30 Drive PCB

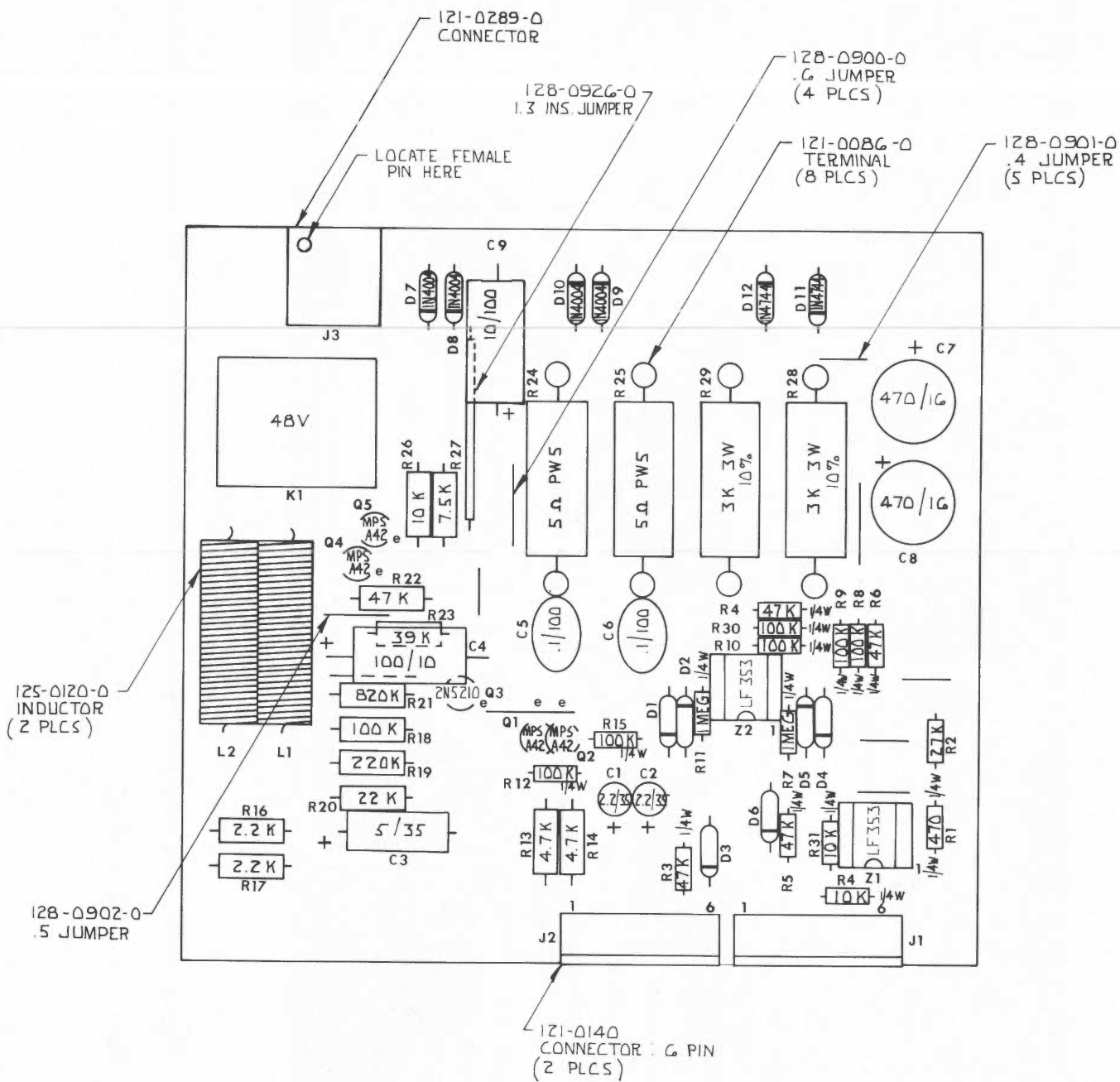


Fig. 6-3a. Assembly Diagram, A30 Relay PCB

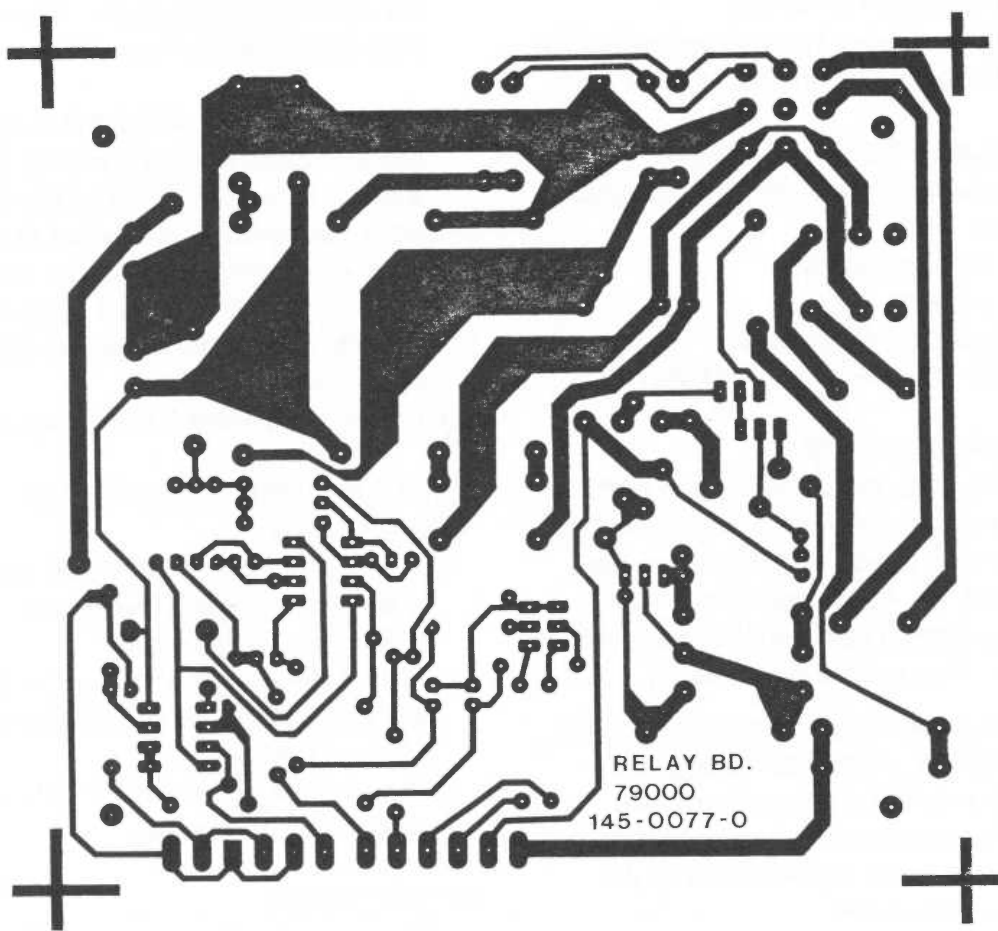


Fig. 6-3b. Foil Pattern, A30 Relay PCB

7-0. TEST PROCEDURE

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- 7-1. Power Supply
- 7-2. Energizing the Unit
- 7-3. Output Signal without Load
- 7-4. Output Signal with 8-ohm Test Load
- 7-5. Distortion
- 7-6. Offset Voltage
- 7-7. Protection Circuit Test
- 7-8. Output Relay Test (DC and Subsonics)
- 7-9. Bridge Mode Test (Mono Mode Test)

NECESSARY TEST EQUIPMENT:

- Ultra-low distortion audio signal generator
- VOM or DVM
- Dual-trace oscilloscope
- THD analyzer
- 250-watt 8-ohm load resistor
- Variable line transformer (VARIAC)

7-1. POWER SUPPLY.

Before plugging in the AC line cord on the A30 check the line fuse on the back of the chassis. Verify MDX-4 slo-blo (3AG 4A slo-blo) fuse for the AC line. (For 220-240 volt operation verify AGC-3 fast-blow or 3AG 3A fast-blow.)

CAUTION!! SAFETY CRITICAL COMPONENT. REPLACE FUSES ONLY WITH SAME TYPE AND RATING. REMPLACER UNIQUEMENT PAR UN FUSIBLE DE MEME TYPE AT CALIBRATION.

NOTE: if the fuse is discovered blown do not energize the unit, even after replacing the blown fuse. Follow the procedure in TROUBLESHOOTING, Section 8-1 to properly energize the unit without causing possible further damage to the unit's output stage.

7-2. ENERGIZING THE UNIT

Plug the line cord into a variable line transformer (VARIAC) and slowly turn it up to 117VAC (or 220VAC as required). If a line transformer is not available, plug the line cord directly into a working AC outlet of proper line voltage. Verify that the LED READY indicator illuminates after approximately 5 seconds.

7-3. OUTPUT SIGNAL WITHOUT A LOAD.

1. Monitor channel A output with the scope and AC voltmeter. DO NOT connect any other load to the outputs at this time.
2. Drive channel input with a 2kHz sine wave signal until the output wave form is well into clipping. Verify that the clipping is symmetrical.
3. Repeat steps 1 and 2 for channel B.

7-4. OUTPUT SIGNAL WITH 8-OHM TEST LOAD.

1. Connect a 8-ohm/250-watt load resistor to channel A output terminals and monitor channel A output.
2. Apply a 2kHz signal to channel A input and verify at least 31 volts RMS output before clipping.
3. Repeat the above at 20Hz, 200Hz and 20kHz for both channels.

7.5 DISTORTION

1. Monitor channel A output with a THD analyzer.
2. With an 8-ohm load also connected to channel A output, drive channel A to an output of 31 volts RMS and verify a THD plus noise of 0.05% or less.
3. Repeat this procedure with channel B.

This same procedure may also be used to test for IM distortion of 0.005% or less.

Note: It may be necessary to use the high filter in the THD analyzer if so equipped.

7-6. OFFSET VOLTAGE

Measure across the output terminals of each channel for presence of DC voltage and verify $\pm 10\text{mV}$ or less with *no inputs* connected to the amplifier.

7-7. PROTECTION CIRCUIT TEST.

1. Drive channel A with a 200Hz signal to an output level of 31 volts RMS.
2. Short the output terminals of channel A together with a jumper wire for 1 to 4 seconds. Remove the jumper and verify that the amplifier resumes normal operation.
3. Repeat this test for channel B.

7-8. OUTPUT RELAY TEST (DC AND SUBSONICS).

1. Drive channel A into clipping with a 1Hz-10Hz signal (with or without a load resistor connected to the output terminals) and verify that the output signal is removed almost immediately. This should be accompanied by a distinct clicking sound as the output relay opens.
2. Turn down or remove the input signal and verify that the output relay closes within 2-4 seconds, restoring signal to the output terminals.
3. Repeat this procedure with channel B.

7-10. BRIDGE MODE TEST (MONO MODE TEST).

1. Monitor the MONO output (red and white output terminal connections) with scope and AC voltmeter and with *8-ohm* test load connected to the output terminals.

Note: Do not connect any load to the MONO output terminals less than 8 ohms since damage to the output circuitry can result.

2. Drive the MONO input with a 2kHz sine wave and verify at least 49 volts RMS output before clipping.
3. For MONO distortion test use the same procedure as in Section 7-5, except drive the output to 49 VRMS.

8-0. TROUBLESHOOTING AND ALIGNMENT

CONTENTS:

8-1. Power Supply Malfunction

- 8-1a. Blown line fuse.
- 8-1b. Blown supply fuses(s).
- 8-1c. Checking for shorted output transistors.
- 8-1d. Isolating the defective output transistor(s).
- 8-13. Output transistor current sharing test.

8-2. Output Malfunction — No Load Connected

- 8-2a. No output, one or both channels.
- 8-2b. Asymmetrical waveform clipping.
- 8-2c. Truncated or asymmetrical waveform output.
- 8-2d. Waveform oscillations.
- 8-2e. Excessive current draw when turning up variable line transformer.

8-3. Output Malfunction into a Test Load

- 8-3a. Unit delivers less than rated output.
- 8-3b. Asymmetrical clipping or truncated waveform.

8-4. Excessive Distortion/Bias Adjustment

- 8-4a. Bias adjustment.
- 8-4b. Unit overheats.
- 8-4c. Excessive THD

8-5. Excessive Offset Voltage

8-6. Protection Circuit Malfunction

- 8-6a. Supply fuses open during protection circuit test

8-7. Output Relay Malfunction

- 8-7a. Output relay will not open with subsonic or DC signal.
- 8-7b. Output relay opens prematurely or intermittently.

8-7c. Output relay will not close after unit is energized.

8-8. MONO Mode Malfunction.

- 8-8a. No output in MONO mode.

NOTE: Most transistors and diodes in the model A30 can be checked in circuit using an ohmmeter on the Rx1, Rx10 or 2K scale. With the A30 line cord *disconnected from the AC line source* measure the forward-biased junction and verify a reading of 400-700 ohms typically on a DVM for a good device. Actual readings on good devices will vary from meter to meter, and some meters do not have sufficient test voltages to turn on a semiconductor. Nevertheless, the shorted or open device is usually revealed quickly using this in-circuit method.

CAUTION: Before making any measurements internal to the A30, unless otherwise specified, be sure that the line cord is unplugged and the power supply capacitors are discharged. Wait at least five minutes after unplugging the amplifier to insure that these capacitors are fully discharged, or discharge each capacitor by shorting a low value (5-25 ohms) resistor with at least a 5-watt rating across the two terminals of each capacitor after the unit is unplugged.

Use extreme caution when taking any measurements internal to the A30 with the power on — hazardous voltages are present. Only qualified personnel with properly insulated and protected equipment should attempt servicing of the A30 with the power on.

Most components and sub-assemblies can be made accessible by removing the top and bottom covers of the amplifier. For module replacement, front panel removal or further component access see Section 9-0, pages 26-28.

8-1. POWER SUPPLY MALFUNCTION.

8-1a. Blown line fuse.

- 1) Disconnect positive and negative wires from the bridge rectifier and measure for shorted diodes in the bridge.
- 2) Measure for shorted power transformer.
- 3) Disconnect wiring at the power supply filter capacitors and measure for shorted capacitor(s).

8-1b. Blown supply fuse(s).

If any of the supply fuses are found blown there is a high probability that one or more of the output transistors is defective, especially if the blown fuse(s) appear vaporized black or silver indicating a large current surge.

CAUTION: Do not replace fuse(s) and energize the unit at this time since this may cause further damage to the output stage. First perform the follow-in test to check for defective output transistors:

8-1c. Checking for shorted output transistors.

Be sure that the AC line cord of the A30 is unplugged, then follow the disassembly procedure in Section 9-0. The output transistors can be checked by either removing the top and bottom covers of the amplifier or by removing only the power module.

For the NPN output transistors (D746A) place the negative probe of an ohmmeter on the collector bus of the output transistors. Touch the positive probe to either one of the output emitters in that bank. If any one of the output transistors in that bank are shorted the meter will display a very low reading, usually less than one ohm. If none of the outputs are shorted the meter will display a typical reading for a forward biased junction, usually 400-700 ohms depending on the meter used.

The above applies equally to the PNP (B706A) output transistors except that the positive probe is placed on the collector bus and the negative probe is touched to either one of the outputs in that bank.

Refer to the following Section 8-1d for isolation of a defective output transistor:

8-1d. Isolating defective output transistors.

To isolate the defective output(s) in a bank which indicates a short (see above procedure 8-1c) switch the ohmmeter to the lowest scale (Rx1, Rx200, etc.). Touch the proper probe (negative for NPN, positive for PNP) to the collector bus as in 8-1c above and touch the other probe to either output transistor emitter lead in that bank. One reading will be significantly lower (about 0.6 ohm) than the other, which indicates that the lower reading output is shorted.

Remove the defective output transistor(s) and check each one individually as verification that it is indeed shorted. Replace the defective output transistor(s) and repeat the above procedure until no short is indicated.

NOTE: Whenever any output transistor has been replaced it is necessary to perform the following step to verify proper and equal current sharing of all output transistors:

8-1e. Output transistor current sharing test.

This test is necessary to verify that all output transistors are operating properly by equally sharing current. Although the amplifier will probably meet all specifications without all outputs operational, increased loading of the remaining outputs will result in a significant reduction of operational reliability.

1) With an 8-ohm test load resistor connected to the output terminals of channel A, drive the channel A input with a 200Hz sine wave signal to obtain 31 volts RMS output.

2) Turn down the variable line voltage transformer (VARIAC) to about 75-80 volts. Monitoring the output signal on an oscilloscope will reveal a waveform which is clipping very hard.

3) Using a DC voltmeter measure the voltage drop across the emitter resistors in each bank. Verify that there is between 240-300 mV DC across each resistor.

Replace any output transistor whose emitter resistor voltage drop varies more than $\pm 10\%$ from the average reading in that bank. Before replacing, however, measure the emitter resistor to insure that it is not defective.

Repeat the above test for channel B.

8-2. OUTPUT MALFUNCTION — NO LOAD CONNECTED.

8-2a. No output, one or both channels.

1) Check for blown supply fuses(s) or line fuse. Refer to Section 8-1a or 8-1b.

2) With power off, check all transistors and diodes in circuit as described in Section 8-0 NOTE on p. 19.

3) Drive the inputs with a 1-volt signal at 2kHz. Energize the unit and check for signal at pin 6 of Z100/Z200 for each channel. If either Z100 or Z200 has latched up to the front end supply voltage ($\pm 15V$), replace the respective IC.

3) Isolate the protection circuit as outlined in Section 8-2c and retest.

4) Check for loose, worn, or dirty input jacks.

8-2b. Asymmetrical waveform clipping.

1) Verify matched power supply + and - voltage readings at the power supply filter capacitors. There should be no more than 2 volts difference between the positive and negative supply readings (typically 70 volts).

2) Possible defective driver Q108 or Q111; replace as necessary.

3) See following Section 8-2c.

8-2c. Truncated or asymmetrical waveform output.

1) Possible defective protection circuit. Disconnect either leg of D103 and D104, then recheck the output waveform. If the problem is now removed check and

replace D103, D104, Q106 or Q107 as necessary.

2) Possible defective output driver. Check/replace Q108 or Q111 as necessary.

3) Possible defective level shift. Check/replace Q101 and Q103 as necessary.

4) Possible defective voltage amp. Check/replace Q102 and Q104 as necessary.

8-2d. Waveform oscillations.

1) Check output RC network poles R24/C5 and R25/C6 for the respective channel. These are located on the relay PCB.

2) Replace front end IC Z101.

3) Check all grounding points for weak or broken solder joints. Also check drive PC board for broken or weak solder joints.

8-2e. Excessive current draw from variable line transformer when turned up.

1) Isolate the protection circuit as outlined in Section 8-2c above and retest.

2) Check the bias transistor (Q105) carefully for open junctions and replace as necessary. If the bias transistor measures good but the amp still draws current, then short the bias transistor emitter to collector with a jumper wire. If the amp now ceases to draw excessive line current, replace the bias transistor.

3) Check the output and output driver transistors.

8-3. OUTPUT MALFUNCTION INTO A TEST LOAD.

8-3a. Unit delivers less than rated output.

Check for line or VARIAC voltage sag. Voltage at the line plug *must* be at least 117 VAC *while delivering full output*.

8-3b. Asymmetrical clipping or truncated waveform.

1) Check the protection circuit as outlined in Section 8-2c above and retest.

2) Possible defective driver Q108 or Q111. Check/replace as necessary.

3) Check for balanced power supply at the filter capacitors while driving a load. If the voltages differ by more than 2 volts, replace the capacitor which reads lower.

4) Check for defective (or burned) emitter resistors in the output stage. Perform step 8-1e.

8-4. EXCESSIVE DISTORTION/BIAS ADJUSTMENT.

8-4a. Bias adjustment.

Check and adjust as follows:

1) Remove all input and output connections, then measure the DC voltage drop across R124 and R125 with the unit powered up but cold.

2) Verify .35–.45VDC across these resistors in each channel.

3) Adjust bias trim pot R119 to obtain correct voltage drop.

8-4b. Unit overheats.

If the unit develops excessive operating temperatures check that the load impedance being driven (actual speaker load) is not less than 4-ohms per channel, or less than 8-ohms in the mono bridged mode. Also insure that in normal operation there is sufficient area for air circulation around the heatsinks.

If the unit develops excessive heatsink temperatures while at idle, or during low power usage the following steps should be taken:

- 1) Adjust pre-driver bias current as described in step 8-4a.
- 2) Check and replace pre-drivers Q102 and Q104.
- 3) Perform output transistor current sharing test as described in step 8-1e.

8-4c. Excessive THD.

- 1) Excessive crossover distortion: possible shorted bias transistor (Q105). Check/replace as necessary.
- 2) Defective protection circuit. See Section 8-2c.
- 3) THD analyzer interface problem:
 - a) activate the high filter on the analyzer if it is so equipped; repeat the THD measurement.
 - b) examine the test bench grounding system for possible ground loops. Ground the analyzer *directly* to the A30 output ground, not to the load or scope.

8-5. EXCESSIVE OFFSET VOLTAGE.

- 1) Replace Z101 front end IC.
- 2) Verify + and -15 volts DC across D101 and D102. Replace either if necessary.
- 3) Replace C101.

8-6. PROTECTION CIRCUIT MALFUNCTION.

8-6a. Supply fuses open when amplifier output terminals are shorted.

This drive indicates that the protection circuit is not shunting drive current properly.

- 1) Check and replace as necessary Q106, Q107, D103 and D104.
- 2) Check and replace as necessary R120-R129.
- 3) Perform current sharing test 8-1e on page 21 to determine if the current sensing output transistors for the protection circuit (Q109, Q112) are defective.

8-7. OUTPUT RELAY MALFUNCTION.

8-7a. Output relay will not open with subsonic or DC signal.

- 1) Check Q3-Q5 on the relay control PC board.
- 2) Check wiring and solder connections on relay control PC board.

8-7b. Output relay opens prematurely or intermittently.

- 1) Check for excess offset voltage as per Section 8-5, page 23.

2) Check Q3-Q5 on the relay control PC board.

8-7c. Output relay will not close after unit is energized.

- 1) Check for defective output transistors as described in Sections 8-1c, d, and e.
- 2) Check Q3-Q5 on the relay control PC board.
- 3) Check for excessive offset voltage at the relay terminals. See Section 8-5.

8-8. MONO MODE MALFUNCTION.

8-8a. No output in MONO mode.

- 1) Check MONO input jack for proper switching and solder connections.
- 2) Check channel A and channel B independently (not in the MONO mode) for proper operation.
- 3) Check channel A level control such that it is not fully attenuated or defective. See Mono Operation, Section 3-0, page 7.
- 4) Check/replace Z1 on the relay control PC board.

9-0. DISASSEMBLY

9-1. POWER MODULE REPLACEMENT

NOTE: The power module for each channel can be removed without removal of the top or bottom cover of the A30. However, if the power module must be removed or replaced then there is a high probability that the power supply fuse(s) inside the unit are open and must be replaced.

The supply fuses can be made accessible by removal of only the top cover (13 phillips screws).

1) Remove the four #6-32 phillips head machine screws located between the cooling fins at each corner of the heatsink (see fig. 9-1).

2) Turn the amplifier upside down and pull the power module a slight distance away from the chassis. Disconnect the 7-wire connector socket and the 2-wire signal input connector (see fig. 9-1b).

3) Turn the amplifier right side up and remove the two spade lug terminals on the thermal cut-out switch.

The module assembly can now be completely removed from the amplifier.

NOTE: On some earlier production A30's the thermal cut-out switch has soldered wire connections instead of spade lug terminals. On these units either the two wires must be de-soldered, or the two

mounting screws which attach the thermal switch to the heatsink must be removed.

4) For module installation simply attach the plugs and terminals to their respective sockets and slide the module into the chassis.

IMPORTANT: During installation of the module into the chassis be sure that the assembly guides are aligned to insure proper positioning of the module (see fig. 9-1c).

9-2. COMPONENT AND SUB-ASSEMBLY ACCESS.

For access to the power supply, relay control PC board, power drive circuit components and circuit board foil patterns simply remove the top and bottom covers of the A30 (13 phillips screws each).

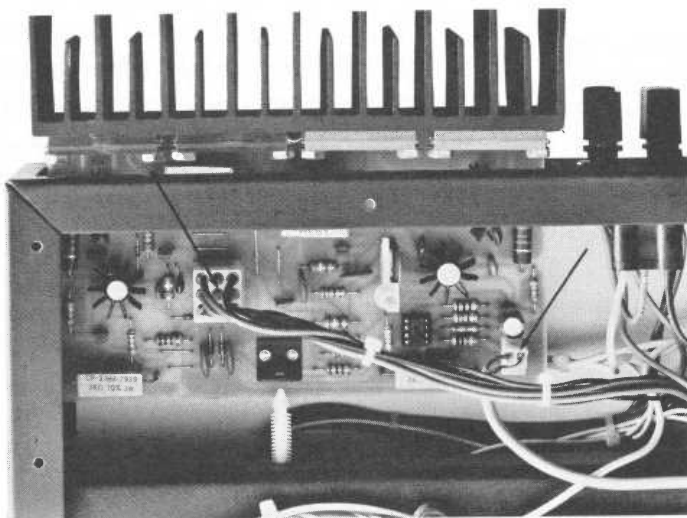


Figure 9-1b.

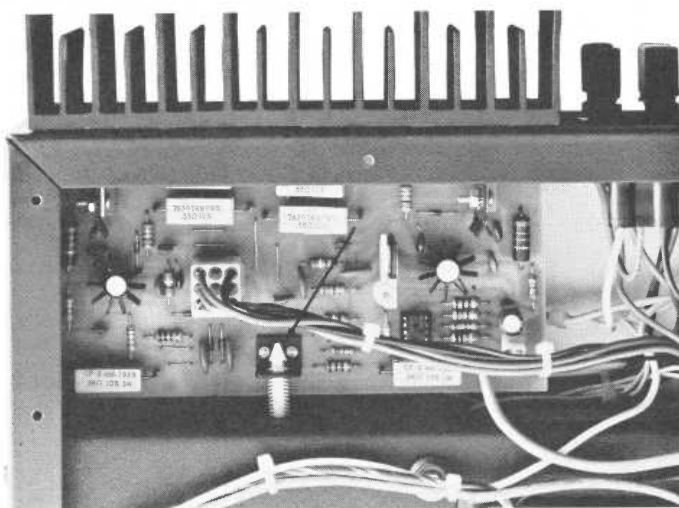


Figure 9-1c.

9-3. FRONT PANEL REMOVAL

- 1) Remove the two input level knobs; pull straight off.
- 3) Remove the six 7/64" allen head screws which attach the front panel to the sub-front panel. The front panel can now be pulled away only slightly from the unit.
- 3) Remove the terminal connectors to the POWER switch.
- 4) For final removal of the front panel the various indicator LED's must be removed. With a small blade screwdriver pry off the LED bezel retaining collar from the back side of the front panel (some LED collars may be heat glued but this should present no problem). Push the LED out of the bezel from the front side of the front panel and then push out the bezel from the back side of the front panel.
- 5) Push out the POWER switch from the back side of the front panel. The front panel can be replaced by reverse order of the above steps.

9-4. SUB-FRONT PANEL REMOVAL/ HANDLE REMOVAL.

- 1) Remove the front panel as per Section 9-2.
- 2) Remove the rack-mount handle bolts with a 3/16" allen wrench. The sub-front panel can now be slightly moved away from the chassis.
- 3) Remove the input control pot shaft nuts (11mm; 7/16" wrench or nutdriver will do in a pinch). The sub-front panel can now be completely removed from the chassis. Take care sliding the LED and associated wiring through the sub-front panel access holes.
- 4) If installing a new sub-front panel it will be necessary to remove the top/bottom cover support bracket from the existing sub-front panel (2 #6-32 machine screws and kep nuts).

10-0. LINE VOLTAGE SELECTION

The model A30 is equipped with a dual-primary power transformer which can be wired for either 110-120VAC or 220-240VAC, 50/60 50/60Hz line voltage operation.

The unit can be wired for either line voltage operation by changing the spade lug connections on the power transformer primary wires as per the following diagram:

After wiring the unit for selected line voltage operation the line fuse must be changed accordingly:

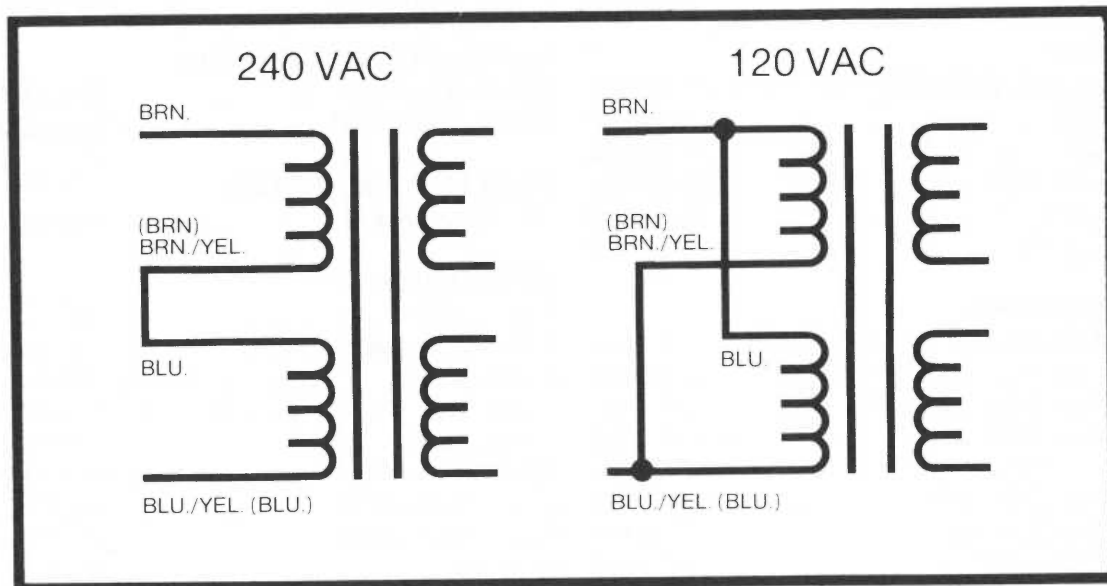
FOR 110-120VAC operation use only MDX-4 slow-blow or 3AG 4A slow-blow type fuse.

FOR 220-240VAC operation use only 3AG 3A fast-blow or AGC-3 fast-blow type fuse.

CAUTION!! SAFETY CRITICAL COMPONENT; REPLACE FUSES ONLY WITH THE SAME TYPE AND RATING.

ATTENTION!! REMPLACER UNIQUEMENT PAR US FUSIBLE DE MEME TYPE AT CALIBRATION.

It is not necessary to replace the supply fuses with a different value. No other changes or alterations are necessary for line voltage conversion.



11-0. PARTS LIST — A30

TRANSISTORS:

| | |
|--------------------------|----------|
| 2SB706A | 126-0093 |
| 2SD746A | 126-0092 |
| 2SA1006 | 126-0094 |
| 2SC2336 | 126-0095 |
| 40327 | 126-0007 |
| MM4003 | 126-0006 |
| 2N3403 | 126-0016 |
| MPS A93 | 126-0028 |
| MPS A42 | 126-0052 |
| 4355 | 126-0045 |
| 3569 | 126-0044 |
| 2N5210 | 126-0127 |
| TIS 97 | 126-0020 |
| Insulator: output trans. | 121-0066 |

INTEGRATED CIRCUITS:

| | |
|-------|----------|
| LF351 | 126-0114 |
| LF353 | 126-0124 |

DIODES:

| | |
|-----------------------|----------|
| Bridge rect: 20Z/200V | 126-0001 |
| 1N4148 | 126-0002 |
| 1N4004 | 126-0003 |
| 1N4744 (15v) | 126-0064 |
| LED: red | 126-0125 |
| LED: green | 126-0126 |

CAPACITORS:

| | |
|---------------------|----------|
| 10,000/75v: lytic | 127-0147 |
| 470/10v: lytic: rad | 127-0125 |
| 100/16v: lytic: ax | 127-0022 |
| 10/100v: lytic: ax | 127-0093 |
| 5/35v: lytic: ax | 127-0037 |
| 100/10v: lytic: rad | 127-0033 |
| 2.2/50v: lytic: rad | 127-0119 |
| .1/100v: mylar | 127-0015 |
| .01/100v: mylar | 127-0063 |
| .05/25v: disc | 127-0007 |
| .0027/150v: disc | 127-0049 |
| 120pF/100v: disc | 127-0020 |
| 56pF/100v: disc | 127-0044 |
| 33pF/100v: disc | 127-0002 |

RESISTORS:

| | |
|------------|----------|
| 5/5watt | 128-0381 |
| .33/5watt | 128-0344 |
| 3k/3watt | 128-0380 |
| 330/2watt | 128-0379 |
| 7.5k/1watt | 128-0366 |

SWITCHES:

| | |
|-----------------|----------|
| Power | 129-0151 |
| Thermal cut-out | 129-0163 |
| Relay: HL2P:48v | 129-0116 |

POTENTIOMETERS:

| | |
|------------------------|----------|
| 5k trim: multi-turn | 129-0046 |
| Input attenuator: 50kB | 129-0153 |

TRANSFORMER/INDUCTORS:

| | |
|--------------------------|----------|
| Coil: L1, L2: signal out | 125-0120 |
| Power transformer | 125-0040 |

PRINTED CIRCUIT BOARDS:

| | |
|-------------------|----------|
| Power drive PCB | 210-0306 |
| Relay control PCB | 210-0271 |

POWER DRIVE MODULE:

| | |
|-------------------|----------|
| Drive module assy | 210-0305 |
|-------------------|----------|

METALWORK:

| | |
|-------------------------|----------|
| Front panel | 220-0102 |
| Sub-front panel | 141-0242 |
| Chassis | 220-0127 |
| Cover: top | 220-0103 |
| Cover: bottom | 141-0241 |
| Handle: rack-mount | 142-0062 |
| Knob: input control | 142-0061 |
| Pan: x-fmr support | 141-0240 |
| Heatsink | 142-0042 |
| Clamp: power supply cap | 141-0184 |
| Bracket: cover support | 141-0238 |

HARDWARE:

| | |
|---------------------------|----------|
| Handle bolt: allen: 3/16" | 122-0150 |
| Front panel bolt: allen | 122-0146 |
| Module screw; 6-32×1/2 | 122-0004 |
| Top-bottom cover screw | 122-0123 |
| Transformer bolt | 122-0128 |

MISCELLANEOUS:

| | |
|---------------------------------|----------|
| Fuse: 3AB/10A: supply | 121-0253 |
| Fuse: 3AB/4ASB: line | 121-0248 |
| Fuseholder block: supply | 121-0284 |
| Fuseholder: line | 121-0298 |
| Jack: 1/4": channel input | 121-0205 |
| Jack: 1/4": mono input | 121-0124 |
| LED bezel | 121-0255 |
| LED bezel collar | 121-0287 |
| Binding post: white | 121-0006 |
| Binding post: red | 121-0007 |
| Binding post: black | 121-0008 |
| Line cord: 18/3 | 121-0262 |
| Line cord receptacle | 121-0252 |
| Insulator: output trans | 121-0066 |

NOTE: When ordering replacement parts please specify *model* and *serial number(s)* of unit(s).

Phase Linear

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