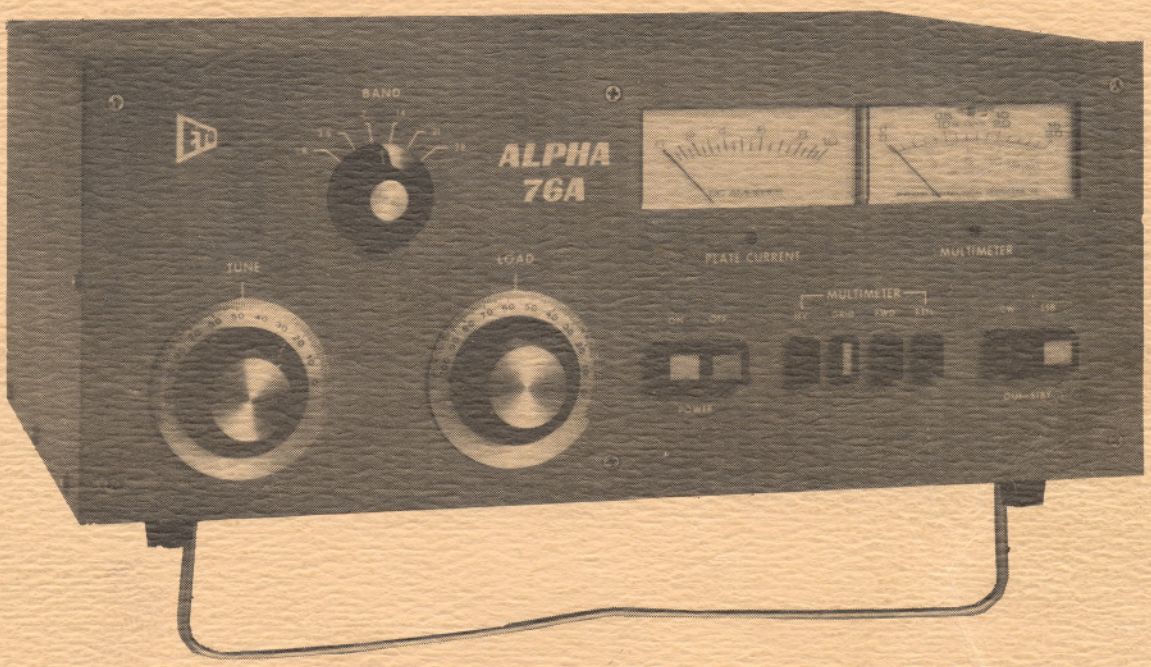
PRICE: $5.00

W2PV
MASTER

OPERATING AND TECHNICAL MANUAL

HIGH FREQUENCY LINEAR POWER AMPLIFIERS

ALPHA 76A, 76PA, and 76CA



EHRHORN TECHNOLOGICAL OPERATIONS, INC.

CAÑON CITY, COLORADO 81212

Revised November, 1978

(Applies to all ALPHA 76A series units built after April, 1978)

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1-719-260-0395 FAX AS OF 10/93

EHRHORN TECHNOLOGICAL OPERATIONS, INC.

CAÑON CITY, COLORADO 81212

11/78 U.S.A.

SECTION 1

GENERAL DESCRIPTION

The ALPHA 76A is a self-contained high frequency linear power amplifier capable of continuous operation at d-c plate input powers in excess of two kilowatts PEP for SSB voice and one kilowatt average or continuous carrier, with no time limit (NTL). The ALPHA 76A is tunable over the range 1.8 - 2.0 plus 3 - 24 MHz, optimized for convenience in the five amateur bands 15 through 160 meters. (Export-only models with "E" suffix have six bands extending to 30 MHz, including the amateur 10 meter band.)

SPECIFICATIONS: Model PA-76AF (U.S.) & PA-76AE (Export only)

Frequency Coverage: 1.8-2.0 and 3-24 MHz (including 15-160 meters). Model PA-76AE: 1.8-2.0 and 3-30 MHz.

Plate Power Input: To 2.5 KW PEP/SSB, 1 KW average or carrier, CCS.

Typical Efficiency: 60% (RF output/d-c input).

Drive Power: Nominal 100-120 watts PEP, 60-80 watts carrier.

Input & Output Impedances: Nominal 50 ohms resistive, unbalanced; load VSWR 2:1 or less.

Distortion: Third order IM more than 30 dB below 1 KW PEP output.

Harmonics: 50 dB or more below mean fundamental frequency output.

Tube Complement: Two Eimac 8874 ceramic triodes in grounded-grid.

Cooling: Full-cabinet, ducted forced air; centrifugal blower.

ALC: Negative-going, adjustable threshold. (Amplifier ALC not normally used with broadband, solid state transceivers.)

HV/LV Tap Change: Internal relay standard.

Protection: Primary fuses, plate overcurrent relay, AC and HV interlocks.

Primary Power: 220-250V/10A or 110-130V/20A, 50-60 Hz, 1 phase.

Size: 7.5" h x 17" w x 14.75" d (19 x 43 x 38 cm).

Weight: 65 lb (30 kg) net; 75 lb (34 kg) shipping, two cartons.

Options and Model Variations Available:

Option "L" -- Lightweight Hipersil® power transformer reduces weight by approximately 20 lb; ratings unchanged.

ALPHA 76PA -- Model PA-76PA is identical with PA-76A above except tube complement is three 8874's. Increased (continuous) tube cathode current rating provides very long tube life ; especially attractive for extended RATT, SSTV, or AØ operation at 1 KW input on low voltage, instant switchover to 2+ KW PEP without retuning.

ALPHA 76CA -- Model PA-76PA with alternate extra-duty, epoxy-encapsulated Hipersil® power transformer. Reduces weight by 10 lb while providing extra margin for extended duty and/or unfavorable environments.

SECTION 2

INSTALLATION

1. Unpacking: Carefully remove amplifier and transformer from cartons; SAVE PACKING MATERIAL FOR RE-USE -- SHIPMENT OF YOUR ALPHA IN OTHER THAN FACTORY PACKING MAY RESULT IN DAMAGE NOT COVERED UNDER WARRANTY.

   Inspect closely for evidence of shipping damage; if found, notify delivering carrier and seller at once. Complete warranty registration form and mail to ETO at once.

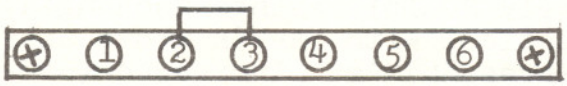
2. Transformer Installation: The cover of the amplifier is easily removed. Remove the three flat head Phillips screws from the front edge on top, two pan head screws from the rear flange of the top cover, and five pan head screws from each end of the cover -- then lift it carefully off. (If your amplifier has a flat head screw in the center of the top surface of the cover, REMOVE IT ONLY IF THE SLOTS ARE CLEAR AND THE SCREW UNPAINTED.)

   Orient the transformer so that both multi-pin, molded plugs on the transformer harness point toward the front of the amplifier; move the corresponding mating connectors in the amplifier itself temporarily out of the way. Carefully lower the transformer into position so that the $\frac{1}{4}$-20 tapped mounting holes in its base line up with corresponding holes in the amplifier base plate. Install the $\frac{1}{4}$-20 bolts and washers provided, and tighten.

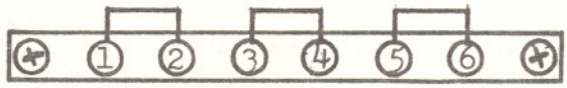
   Check both pairs of connectors visually for proper mating orientation (avoid excessive harness bending or twisting, as it may cause damage to wires or connector pins) and mate them firmly, pushing until the integral latches engage.

3. Electrical Installation: The amplifier is normally shipped from the factory wired for 220-250V operation. If it is to be operated instead on 110-130V lines, change over the connections as described below before replacing the cabinet cover.

   Changeover to 110-125V Operation - Locate the six-terminal barrier strip on the right side of the center chassis partition, above and to the left of the transformer. With short jumper wires only between lugs #2 and #3, the amplifier is connected for 240V power supply. Substituting instead a jumper between terminal #1 and #2, another between #3 and #4, and a third between #5 and #6, reconnects for 120V power source. (See sketches below.)



CONNECTIONS FOR 240V



CONNECTIONS FOR 120V

   Power Cable Connection - The green wire of the amplifier power cable is a chassis safety ground, and must always (and only) be connected to the safety ground of the a-c mains -- NEVER to one of the "hot" power wires. The black and white wires are interchangeable and connect to the two "hot" service conductors.

4. Physical Location: Your ALPHA must be located so that intake of cool air through the rear panel, and exhaust of warm air through the top cover perforations, is not impeded in any way. A minimum of 4 to 6 inches of clearance should be allowed behind and above the amplifier for air circulation. Be careful not to block the top-cover exhaust openings with log books or equipment.

5. RF And Control Connections: Interconnection of the ALPHA for operation with any popular transceiver or exciter is extremely simple. Connect the rear panel jacks as follows:

   RF INPUT - Use an appropriate plug and RG-58C/U or similar small 50 ohm coaxial cable to connect to transceiver or exciter "rf output" or "antenna" connector. KEEP CABLE AS SHORT AS POSSIBLE -- PREFERABLY NOT LONGER THAN 2½ TO 3 FEET.

   RF OUTPUT - Use a standard PL-259 ("UHF" type) plug and RG-8A/U or similar coaxial cable (50 ohm) to connect to antenna system.

   RELAY - Use a standard "phono-type" patch cable to connect this jack to transceiver or exciter contacts which are "open" on receive and "shorted" on transmit ("N.O." = "normally open"). Nearly all transceivers provide such contacts via either phono-type jacks or other accessory connector on the rear panel.

   NOTE: When the amplifier is OFF, or in the RECEIVE condition with no short across its RELAY line, the RF OUTPUT connector is internally connected directly to the RF INPUT, providing normal "transceive-type" antenna input to the receiver.

   ALC - For use with tube-type transceivers having negative-going ALC systems with external input jacks, simply patch this jack to the mating one on the transceiver or exciter with a standard "phono"-type cable. Nearly all modern solid state (broadband) transceivers utilize positive-going internal ALC, with a detector at the rf output point. This internal system normally functions adequately to control SSB drive power to the amplifier; in fact, most such exciter/transceivers provide no external ALC input jack and it is entirely unnecessary to make any ALC connection.

6. Blower: The cooling blower is mounted on a new "absorbent foam" cushion pad which dramatically reduces transmission of mechanical noise and vibration. Two 10-32 Phillips head screws secure the blower motor to the amplifier rear panel for safety during shipment, and must be removed for quietest operation. These two screws are identified with arrows in FIGURE 2 on page 11 of this manual. Remove both screws, and the rubber strips wedged between the rear panel and the blower motor bearing housing (between and slightly above the screws); save for future shipping. SERIOUS PHYSICAL DAMAGE TO AMPLIFIER AND BLOWER MAY RESULT IF SCREWS AND SHIM STRIPS ARE NOT PROPERLY RE-INSTALLED BEFORE SHIPPING AMPLIFIER!

SECTION 3

OPERATION

1. Control Functions:

BAND - Selects tuning range of amplifier, indicating the nominal center of the band in MHz.

TUNE - Controls operating frequency. In general, higher frequency bands (14 & 21 MHz, etc.) tune toward the "0" end of the vernier dial scale, lower frequencies tune toward 50-100.

LOAD - Controls amplifier loading ... the power input level at which best efficiency and linearity is achieved. Higher bands load normally toward the 70-100 end of the vernier scale, lower bands typically vary across most of the dial depending on frequency and load impedance or VSWR. In general, higher dial numbers result in heavier loading.

PUSH BUTTONS -

ON: Depressing momentarily applies a-c power to amplifier. Also press to restore power after overcurrent relay has tripped, interrupting main a-c power.

OFF: Depress momentarily to remove a-c power from amplifier.

HV: Multimeter monitors high voltage - 3000V full scale.

GRID: Multimeter monitors grid current - 150 mA full scale.

FWD: Multimeter monitors forward RF power - 2000W full scale.

REFL: Multimeter monitors reflected RF power - 200W full scale.

CW: Selects lower plate voltage for CW/FSK/SSTV and other types of emission, including SSB, up to 1 KW d-c input.

SSB: Selects high plate voltage for 2+ KW PEP SSB input.

OUT = STBY: When both the CW and SSB buttons are out (as evidenced by black color windows), the amplifier is placed in the STANDBY condition. Antenna changeover relay is disabled, permitting "straight-through" operation of exciter/transceiver while amplifier remains ready for immediate use if desired.

ALC - Rear panel screwdriver adjustment sets the drive power level at which ALC voltage begins to rise from zero. Use a small insulated screwdriver to avoid accidentally shorting circuit.

2. Tune-Up Procedure:

(a) GENERAL - The objective of tune-up is to adjust the amplifier to deliver maximum power output at the desired level of plate d-c power input, or at the available level of rf drive power, whichever is lower.

When the amplifier is adjusted for maximum attainable rf power output with a specific, fixed level of rf carrier drive power, it is automatically set up properly for the best combination of efficiency and linearity possible at that drive level.

If the drive power is increased beyond the tune-up level after the final TUNE/LOAD adjustments, flattopping and undesirable distortion (on SSB) will result, along with grid current greatly in excess of normal.

If drive power is reduced below the tune-up level without further adjustment of TUNE and LOAD controls, amplifier efficiency will be reduced. Both of these statements are applicable to any linear amplifier of the types used for high power amateur and similar service.

It is therefore essential that the amplifier be adjusted for maximum rf output at the drive and d-c input powers which are to be employed in normal operation, WITH ONE IMPORTANT EXCEPTION: if the plate voltage is changed without changing also the TUNE and LOAD adjustments, the resulting power level which will yield optimum performance at the new plate voltage will vary in proportion to the square of the plate voltage change. For example, if the ALPHA 76Ais tuned up for maximum output with 1400 VDC plate voltage and with the drive level set so that the resultant maximum output is about 700 watts (equivalent to a d-c input of roughly 1000 watts), THEN if the plate voltage is increased to 2000 VDC the amplifier will automatically perform optimally at about 700 X $(2000/1400)^2$ = 1400 watts rf output, corresponding to approximately 2000 watts d-c input.

In general, the final operating adjustment after basic tune-up should be to adjust excitation (drive) from the exciter or transceiver so that the GRID current meter indication just reaches about 50 madc (1/3 scale) key-down or on voice peaks.

(b) INITIAL TUNE-UP - Place amplifier in STANDBY (both CW and SSB buttons out: if one is already depressed, partially depress the other one and release, so that both pop out and show black).

(1) Press HV button and watch MULTIMETER HV scale (0-3 KV).

(2) Press ON button and release. Panel meters should immediately illuminate red or amber and the MULTIMETER should swing promptly to indicate 1.5 KV ± 100V (mid-scale). (If this does not occur, press OFF immediately and locate problem.) The blower should also start immediately and exhaust air should be detectable flowing from cover vents.

(3) When tube warm-up delay is completed in 45-90 seconds, the meters will change to pale blue or green, indicating "ready" to transmit. Set controls to the preliminary points indicated in Table I below, depending on the desired operating frequency.

TABLE I -- PRELIMINARY SETTINGS FOR INITIAL TUNE-UP

FREQ. MHZ	BAND	TUNE	LOAD	FREQ.	BAND	TUNE	LOAD
1.8	1.8	84	30	7.1	7	50	45
2.0	1.8	75	25	14.15	14	20	70
3.6	3.5	53	38	21.20	21	10	82
3.9	3.5	42	48	28.70*	28*	08*	90*

(*"E" suffix models only.)

(4) Press CW button and switch exciter to CW or TUNE; the ALPHA panel meters should turn amber, indicating 'transmit.'

(5) Very slowly increase exciter carrier output until the amplifier PLATE CURRENT meter indicates half-scale -- about 0.5 ampere. Press FWD and carefully adjust LOAD for maximum RF WATTS meter reading. Then adjust TUNE for maximum indication on the meter (FWD RF WATTS). Repeat the process of alternately peaking first LOAD, then TUNE, until no further increase in FWD RF WATTS can be achieved.

(6) Note PLATE CURRENT meter indication; the desired reading for one kilowatt d-c input is approximately 0.7 amp (since 0.7 amp X 1400 volts = 980 watts input).

(7) If the plate current in step (6) was less than 0.7 amp, increase exciter carrier output slightly and repeat the LOAD-TUNE adjustment process of steps (5) and (6) again. If the plate current in step (6) was greater than 0.7 amp, decrease exciter output slightly and repeat the process.

(8) Continue the process outlined in step (7) until, after the final LOAD-TUNE adjustments, the PLATE CURRENT meter indication is as desired.

The ALPHA is now correctly adjusted for operation at one kilowatt DC input using the "CW" (low) plate voltage tap.

(c) OPERATION AT 1 KW INPUT (KEY-DOWN OR PEP/SSB) - Tune up as in (b) above. Leave amplifier in CW mode. No further adjustment is required for CW-FSK-SSTV operation except to check exciter rf output under operating conditions to insure that plate current is as desired. Also press GRID and check that grid current does not exceed about 50-75 ma (1/3 to 1/2 scale).

For SSB to approximately 1 KW PEP input, set mike gain or equivalent exciter rf output control so that amplifier GRID current meter does not swing above about 30-50 ma on speech peaks (less than 1/3 scale).

(d) OPERATION ON SSB AT 2+ KW PEP INPUT (1 KW AVERAGE) -Tune up exactly as in (b) above. Remove excitation and press SSB button.

Switch exciter to normal SSB and, while speaking normally into the mike, adjust mike gain until EITHER (1) amplifier PLATE CURRENT meter swings just reach approximately 0.45 amp (just under half-scale) on highest speech peaks, OR (2) amplifier GRID current meter swings just reach 50 ma (one-third scale), whichever occurs first.

Maximum legal (U.S.) amateur power input of one kilowatt average corresponds to the condition described, assuming that plate voltage (HV) is approximately 2.2 KV on speech peaks (i.e., 0.45 amp X 2200 volts = 990 watts average). A slight increase in loading will reduce grid current peaks, if necessary to achieve desired plate current swings.

3. Operating Notes:

(a) TUBES - The 8874 ceramic triodes are extremely rugged and normally operate with a large margin of safety. They will deliver outstanding service life IF not damaged by grossly excessive grid dissipation or airflow blockage (keep the intake and exhaust vent areas clear!) Do not allow average plate current per tube to exceed 0.35 amp for more than 15-30 seconds, nor ever to exceed 0.5 amp. Do not allow grid current to ever exceed full scale (150 ma); normal operation requires only 50-60 ma.

(b) INTERLOCKS - The ALPHA 76A(all versions) is equipped with switches which shut off a-c power and short out the high voltage power supply when the cover is not securely fastened in place. THESE PROTECTIVE INTERLOCKS ARE PROVIDED TO PROTECT YOU AGAINST POTENTIALLY FATAL ELECTRIC SHOCK RESULTING FROM CONTACT WITH OPERATING VOLTAGES INSIDE THE AMPLIFIER. THE AMPLIFIER SHOULD NEVER BE ENERGIZED WITH THE COVER REMOVED AND INTERLOCKS DEFEATED EXCEPT BY THOROUGHLY TRAINED AND KNOWLEDGABLE SERVICE PERSONNEL!

(c) FUSES - Except in rare instances of component failure, the blowing of one or both primary line fuses indicates that the maximum safe average power input capability of the amplifier has been substantially exceeded. USE ONLY 10A CERAMIC FUSES, EXCEPT 15A for 76CA option, up to 20A for 120V operation.

The slo-blo fuse F3 located just behind the front panel prevents burn-out of the step-start resistors and HV rectifiers in the event of abnormal turn-on conditions or HV faults. DO NOT SUBSTITUTE a fuse of different type or rating.

(d) PLATE OVERCURRENT RELAY - This relay functions primarily to de-energize the primary power quickly in the event of a fault in the HV circuitry or grossly excessive drive conditions. The relay should not be relied on to prevent either short- or long-term overdrive; that is the operator's responsibility. Should the overcurrent relay trip, removing all a-c power from the amplifier, it is essential to determine and correct the cause before re-applying power by actuating the ON button.

(e) MAINTENANCE AND TROUBLESHOOTING - Most apparent failures and problems with the ALPHA 76Aseries result from operators' failure to read and thoroughly understand the contents of this manual, as well as basic linear amplifier principles -- rather than from actual equipment defects.

Amplifier interiors, particularly the high voltage d-c areas of the power supply and rf compartment, should be cleaned frequently enough (with a soft brush and a vacuum cleaner) to prevent visible accumulation of dust. If extremely dusty conditions prevail, it may be advisable to secure a thin plastic air filter, of the type used in window air conditioners, across the air intake area.

TABLE II -- TROUBLESHOOTING HINTS

SYMPTOMS	POSSIBLE CAUSE/CURE
1. Won't turn on; nothing happens when ON button pushed.	a) External a-c wire, fuse, or breaker open or missing. b) Cover a-c interlock open. c) Fuse F1 or F2 blown or missing.
2. Relay closes (and blower may start) but no HV or meter illumination at turn-on.	a) Step-start relay K2 not closing; possible blown fuse F3, defective +28V supply (D13-D-14 or C7?), or HV fault.
3. Blower starts, HV normal, but meters do not switch to green and amplifier will not switch to transmit.	a) Defective reed relay K6. b) Defective Q1, C8, or R29.
4. Grid meter "pins" at low drive levels.	a) R28 open or damaged.
5. Low grid current, excessive input VSWR (abnormal exciter loading), low rf output.	a) Bias zener D8 damaged or open. b) R28 damaged or open (but grid current will read very high).
6. Plate current flows in receive or STBY conditions. See also no. 9 below.	a) 8874 tube leak or short, cathode to grid or heater. b) D7 defective or damaged.
7. Low drive and output power; cannot drive exciter to normal input or output levels.	a) ALC sensitivity control R40 set improperly; unplug ALC to check. See note bottom of pg.
8. Flashover in RF compartment, usually between load capacitor plates.	a) Excessive load VSWR; mismatch or wrong antenna; defective rf cables or connectors. b) Insufficiently heavy loading and/or excessive drive power. c) Dirt or other contaminant in capacitor plates. d) If chronic, capacitor plates damaged by previous arcing.
9. Plate current flows in receive or STBY and cannot drive amplifier; abnormal exciter loading.	a) 8874 tube short, cathode-to-grid or cathode-to-heater.
10. Distorted SSB output signal; possibly severe TVI.	a) Excessive drive power and/or inadequately-heavy loading. b) Flashover of variable capacitor on voice peaks. c) Antenna or feedline arcing on peaks. d) RF feedback from antenna into exciter or microphone line.

NOTE: If exciter manufacturer does not provide instructions for adjustment of ALC, set pot R40 for desired amplifier plate current swings on peaks and adjust mike gain for degree of ALC action desired for normal exciter operation.

SECTION 4

THEORY OF OPERATION

1. RF Amplifier Section: Tubes V1 and V2 (and V3 in models 76PA and 76CA) are parallel-connected in a grounded grid configuration. +28 volts of cathode bias is applied via R7 and L7 to cut off plate current during non-transmit periods; bias is reduced to an operating level of 5.1 volts when the antenna relay is actuated.

   RF excitation is applied to the cathodes via an input network, including a broadband, toroidal ferrite input matching transformer, which is carefully designed to present to the exciter a nominal 50 ohm load with linear characteristics. Changing this input network may result in excessive input VSWR.

   The plate output circuit is a full pi-L network consisting of C16, L1-L2-L3, C17, and L4. The pi-L provides harmonic suppression substantially better than a simple pi network, as well as somewhat better efficiency in this application.

   An rf directional wattmeter, consisting of L9 and associated components, senses forward and reflected power in the rf output line for display on the panel meter when selected by push-buttons FWD and REFL, respectively.

   Excitation voltage is detected and filtered by ALC rectifier C23-C24, D15, and associated components. The drive level at which negative-going ALC is generated (i.e., the threshold level) is set by rear-panel potentiometer R40 which back-biases D15.

   Relay K4 switches the antenna straight through to the exciter when the amplifier is OFF or in STBY or receive conditions, permitting normal transceive operation. K4 switches the ALPHA 76 A into the transmit configuration when an external short is placed across RELAY control jack, J3.

2. Power Supply: Transformer T1 is a 1.5 KVA continuous-service unit (2.4 KVA Hipersil®-core for 76CA only) which supplies all required a-c operating voltages for the amplifier.

   High voltage d-c for the tube anodes is rectified by a full-wave bridge, D1-D4, and filtered by a 30 mfd., 2.7 KV capacitor consisting of C1-C6 in series. These computer-grade electrolytic capacitors are factory capacitance-matched to insure uniform a-c ripple voltage distribution and long service life.

   High voltage tap-change relay K3 selects high or low transformer voltage taps, as controlled by the front panel CW/SSB push button switches.

   Cover interlock switch S4 prevents actuation of the main power relay K1 unless the cover is secured in place. Safety "crowbar" S5 places a low-resistance short across the HV supply (and discharges the filter capacitor bank) whenever the cover is opened.

FWCT rectifier D13-D14, and filter capacitor C7, provide +28 V for bias and control circuitry. A 25 VAC transformer winding is "bucking" connected to provide approximately 95 VAC for the blower, resulting in a reduced noise level but virtually the same air delivery as at full voltage.

Dual primary windings on T1 permit connection for either 110-125 V or 220-250 V operation, as described in the Installation section of this manual. No wiring change is necessary for operation from either U.S. standard 120-N-120 or from typical overseas 220-250 V without "central" neutral -- two-wire systems. The third power cable (green) wire is simply a chassis safety ground.

3. Control And Metering Circuits: ON/OFF push buttons S2 control self-latching main power relay K1. Resistors R1 and R2 limit the initial current inrush to 12 amperes maximum, and are shorted by relay K2 when the HV filter capacitor approaches full charge (the delay is only a few tens of milliseconds). Fuse F3 protects against burn-out of R1 and/or R2 in the event of mistakes or faults which prevent K2 from closing properly.

During the required heater warm-up period, the 8874 tubes are protected against plate current flow by a 60-second (nominal) time delay circuit consisting of MOSFET Q1 and associated components. Until C8 reaches sufficient voltage to close K6 via Q1, T/R relay K4 is prevented from closing regardless of external RELAY line conditions. Hence, standby (cut-off) tube bias is maintained and rf drive cannot be applied to the tubes.

After time delay K6 closes, an external short placed across J3 (the RELAY jack) closes T/R relay K4, provided that either the CW or the SSB switch is depressed (if both are "out," the T/R relay is locked out, leaving the amplifier in standby condition). Actuating K4 reduces the cathode bias applied via R7 to the +5.1 volts determined by zener D8. This operating bias level permits slight plate current flow under idling conditions in the SSB (high voltage) mode; with lower voltage applied for CW, idling plate current is close to cut off.

Plate current is metered directly by M2. Grid current is measured across R28 in the grid return circuit and high voltage is metered directly via precision multiplier resistors R13-R15.

Excessive plate current (as evidenced by abnormal voltage drop across R6) actuates overcurrent relay K7, which trips out K1. Status-indicating meter lamps I1 through I4, which are controlled by Q2 and Q3, illuminate the meters amber when K6 is open (during the time-delay interval) and when the external RELAY line is shorted so that the T/R relay is in the transmit condition. When the time delay relay is closed but the T/R relay is not actuated (amplifier in STANDBY and/or external RELAY line open), the green lamps illuminate the meters, signifying "ready."

SECTION 5 -- ILLUSTRATIONS

FIGURE 1 - Transformer Access & Location

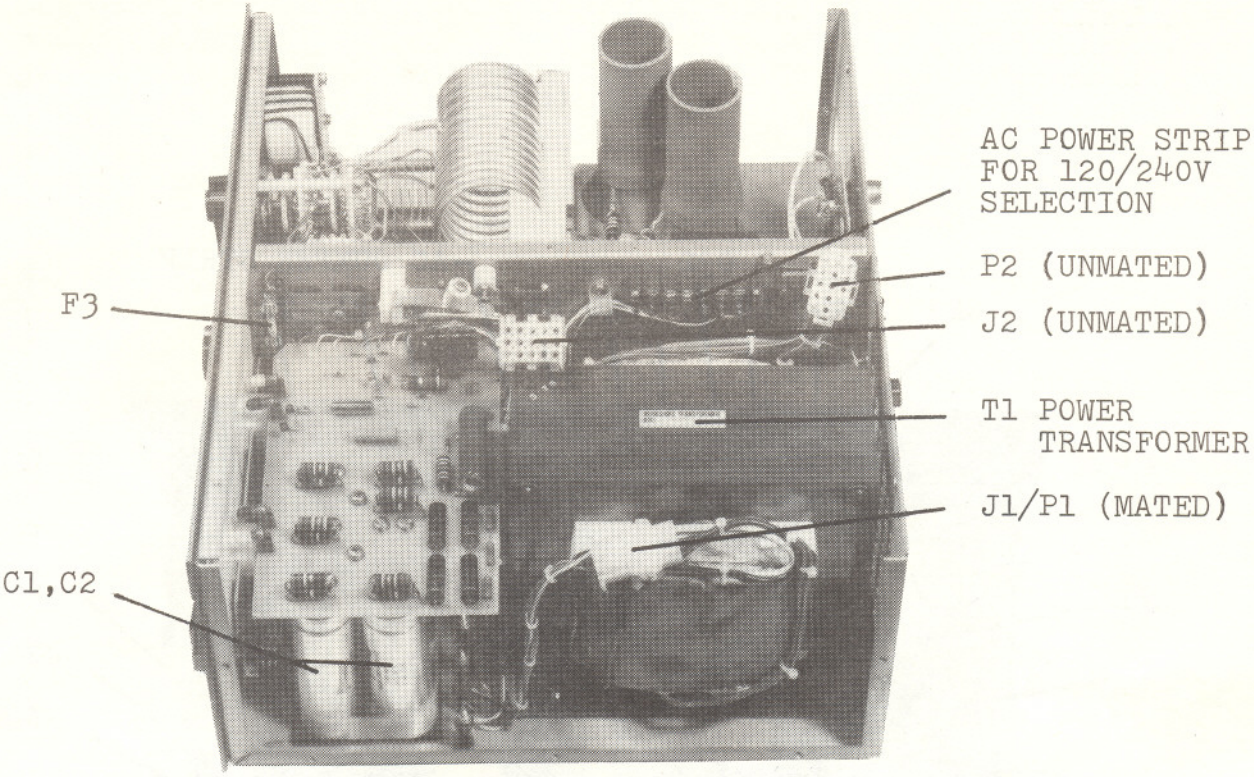


FIGURE 2 - Rear View

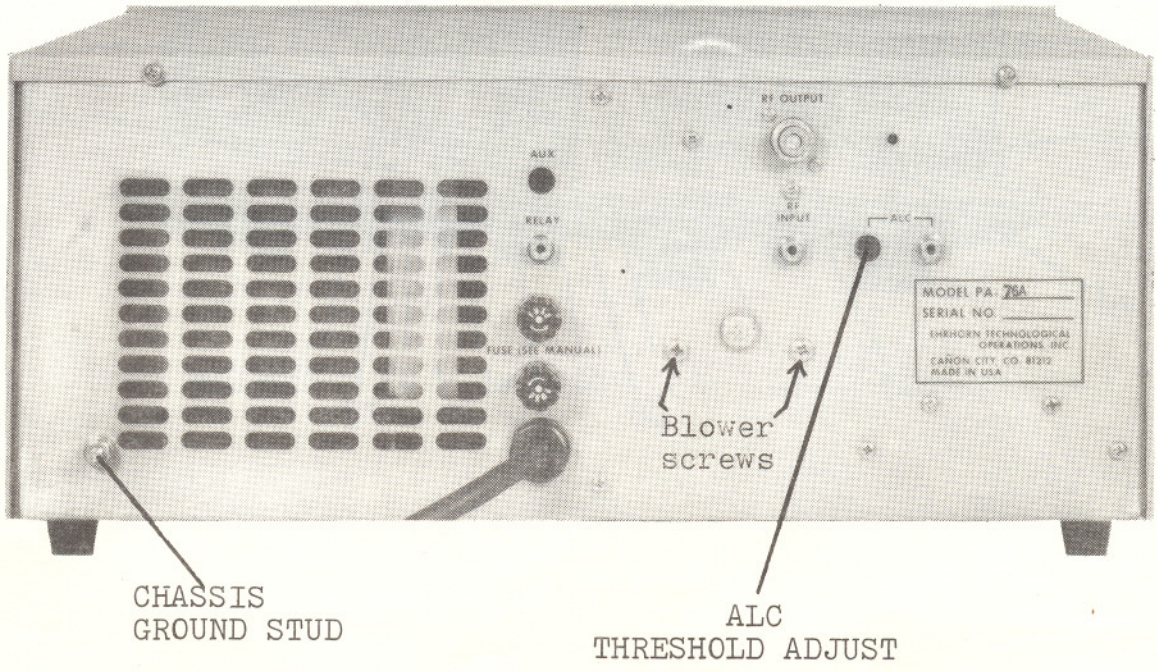
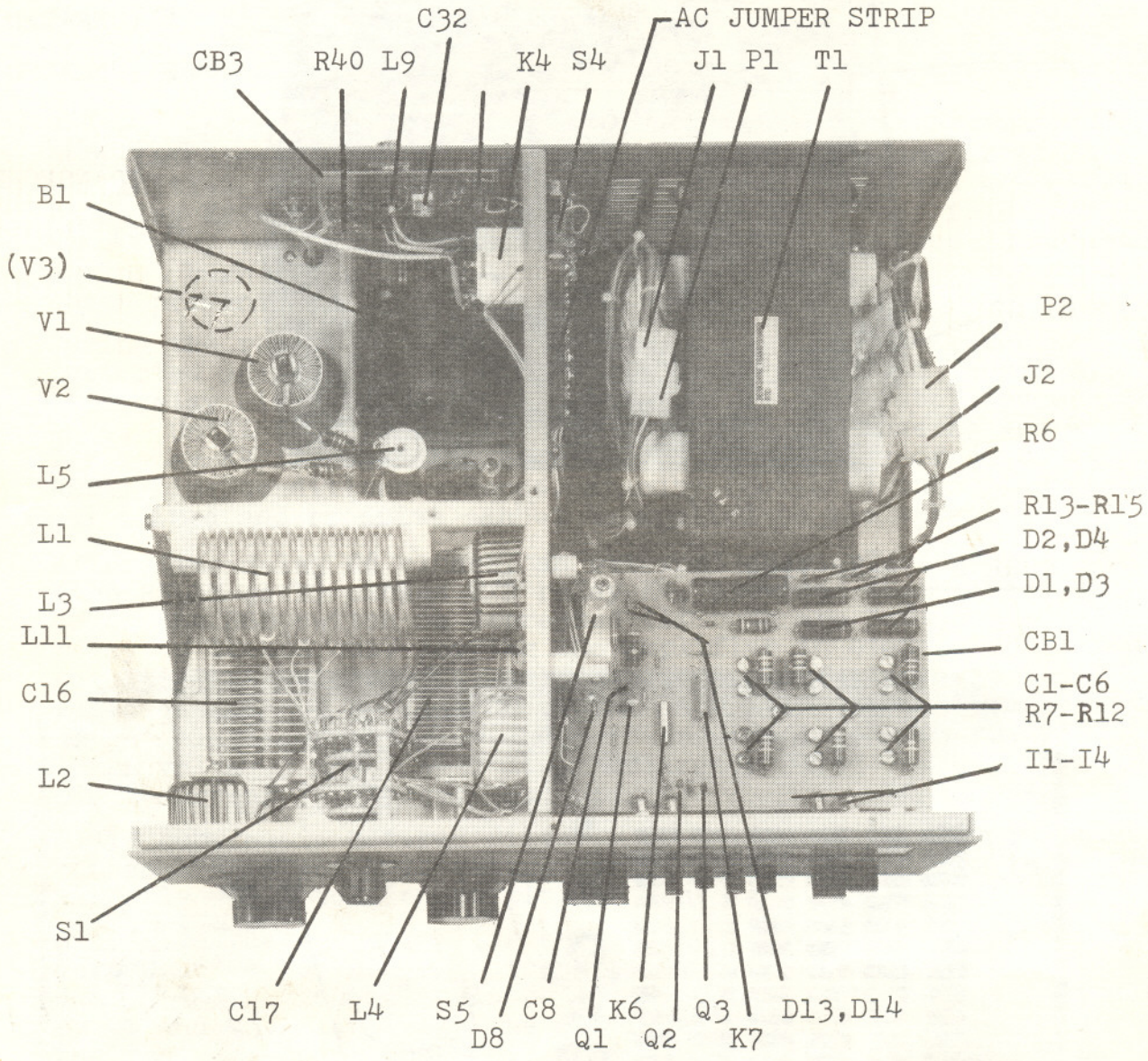


FIGURE 3 - Top View Showing Major Component Locations

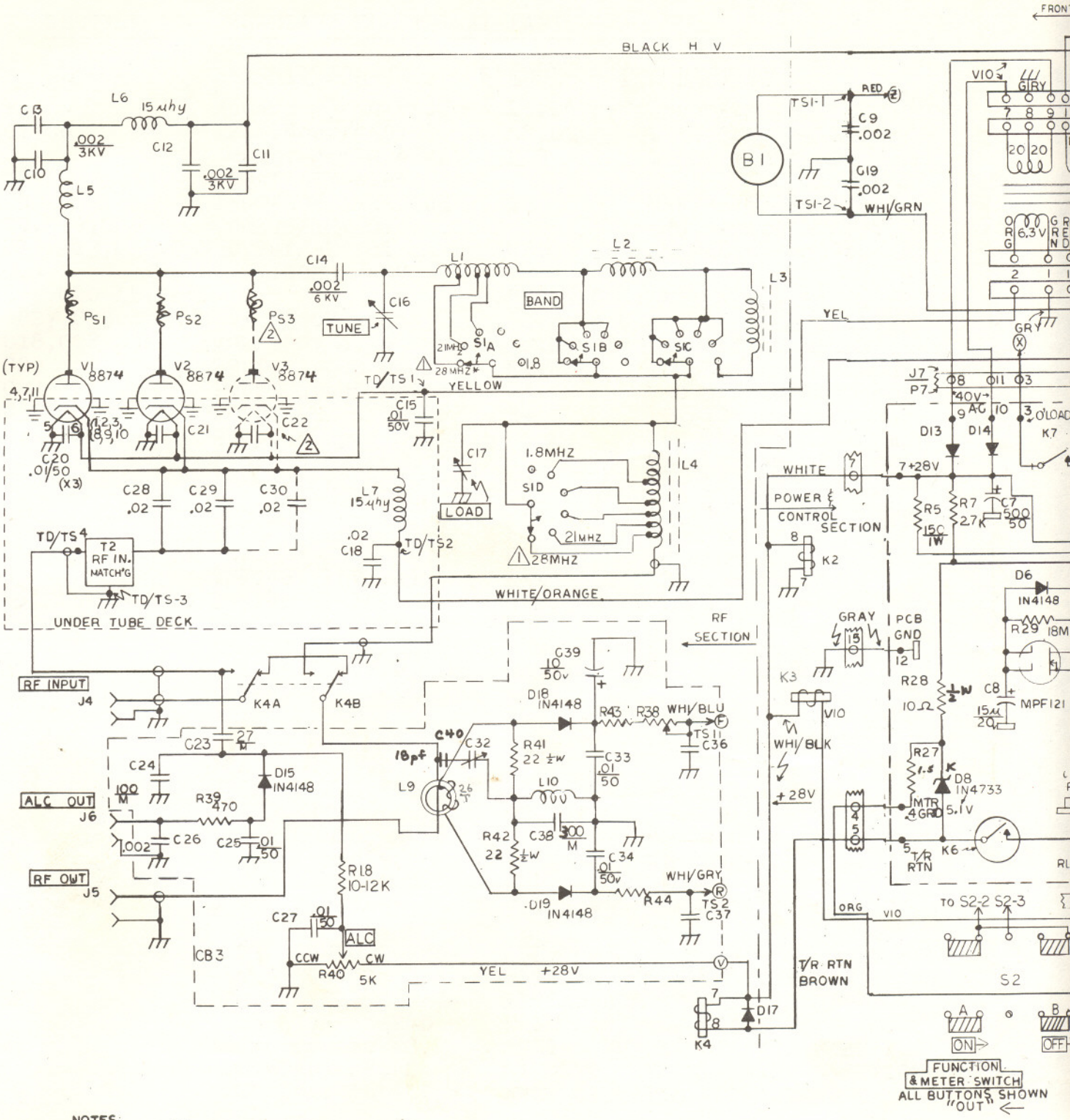


SECTION 6 -- STANDARD ELECTRICAL PARTS

SYMBOL	DESCRIPTION
B1	Howard #3-90-8507
C1-C6	120-180uf/450V comp. grade elec.
C7	500uf/50V elect.
C8	15uf/20V tantalum
C9,C19,C26	.002uf/1KV disc
C10-C13,C36,C37	.002uf/3KV disc
C14	2 x .002uf/6KV
C15,C20-22,C25, C27,C33,C34,C41	.01uf/50V disc
C18,C28-C30	.02/500V disc
C23	27pf dipped mica
C24	100pf dipped mica
C32	2-8pf air trimmer
C38	300pf dipped S.M.
C39	10uf/50V elect.
C40	18 pf/1 KV disc
D1-D4	3KV PIV/.5A CCS, RCC 1733
D5	1N4746 (18V/1W)
D6,D15,D18,D19	1N4148 or 1N914B
D7	1N4722 or 1N5404
D8	1N4733 (5.1V/1W)
D9	1N4757 (51V/1W)
D10-D14,D17	1N4004 (400V/1A)
D20	
F1, F2	10A/250V, type 3AB or ABC (76CA only, 15A)
F3	1½A slo-blo, type MDL or equiv.
I1-I4	#387, 28V lamp
K1	DPST/120VAC, Guardian 1390-2C-120A
K2	DPST/24VDC, Guardian 1395-2C-24D
K3	HV relay, 24VDC, PB #PRD11DY0-24
K4	DPDT/10A, Phillips 39C11D24
K6	5 VDC coil, SPST N.O. 500 Ω DC.
K7	24 VDC coil, SPST N.O. 1800 Ω DC

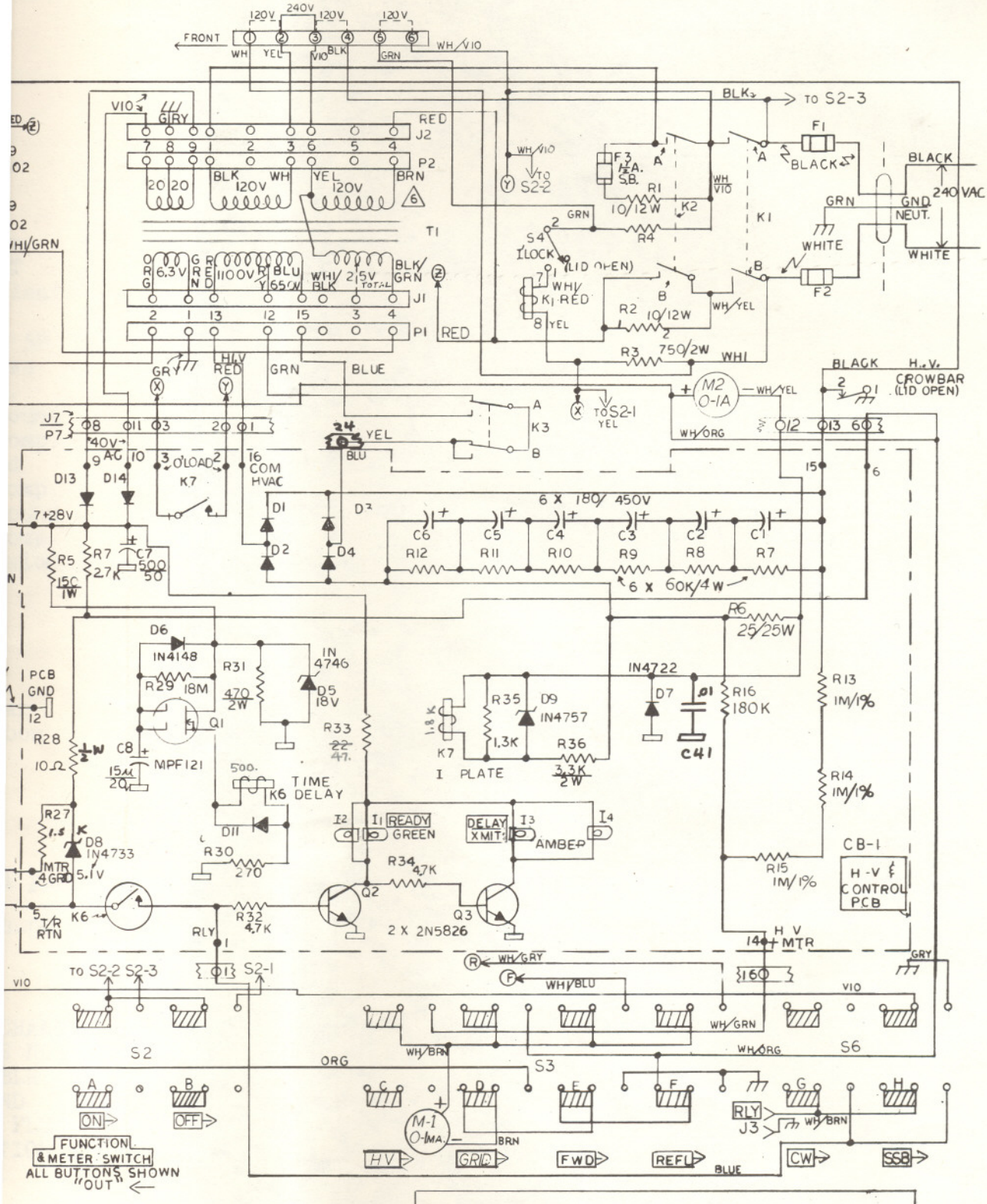
SYMBOL	DESCRIPTION
L5,L6,L7	15uhy/1A RFC
L8,L11	1 to 2.5 mhy RFC
L10	1 mhy miniature
Q1	MPF121 or similar dual-gate MOSFET
Q2,Q3	2N5826 or equivalent
RESISTORS: All are ¼ watt, 5% carbon comp. or film unless otherwise specified below.	
R1,R2	10 ohm/12W wirewound
R3	750 ohm/2W 10% comp.
R4	10K/12W wirewound
R5	150 ohm/1W 10% comp.
R6	25 ohm/25W wirewound
R7-R12	2 x 120K/2W 5% comp.
R13-R15	1M/1% 3/4W precision
R16	180K/¼w
R18	10-15K
R31	470 ohm/2W comp.
R32,R34	4.7K
R36	3.3K/2W 10% comp.
R38,R40	5K trimpot, linear
R41,R42	22 ohm/½W 5% carbon
R43	
R44	1.8K
R28	10 ohm/½ watt/5%
S1	Centralab JV9034
S2,S3,S6	8 station special push button assembly
S4	Microswitch V3L-4-D8
V1,V2,V3	Eimac type 8874

ALL COMPONENTS SUBJECT TO CHANGE WITHOUT NOTICE. COMPONENTS NOT LISTED ARE SPECIALS AVAILABLE FROM ETO. SPECIFY MODEL AND SERIAL NUMBER OF AMPLIFIER PLUS CIRCUIT SYMBOL OR DESCRIPTION WHEN ORDERING REPLACEMENTS.



NOTES:

1. 28 MHZ "E" SUFFIX ONLY
2. PA-76 PA (&"C") ONLY
3. ALL D's IN4004 UNLESS NOTED
4.
5.
6. XFMR LEAD COLORS APPLY TO STD PA-76 XFMR ONLY; HIPERSIL XFMR WIRE COLORS VARY
7. ALL CAPACITORS 1KV UNLESS NOTED
8. ALL RESISTORS 5 or 10% 1/4W UNLESS NOTED



EHRHORN TECHNOLOGICAL OPERATIONS, INC.
CAÑON CITY, CO. 81212

9/1/76 ROLE
11/14/78 ROLE
11/78 ROLE

MODELS PA-76A AND 76RA & "C" OPTION
DWG NO: SCHEMATIC