

# AMERITRON AL-1500

## FULL POWER LINEAR AMPLIFIER INSTRUCTION MANUAL



The Ameritron AL-1500 is a 1500 watt output linear amplifier that operates from 160 through 15 meters. The Ameritron AL-1500X is the export model and covers 160 through 10 meters. The AL-1500J is the export model for Japan and covers 160 through 10 meters. The AL-1500 uses a single 3CX1500A7/8877 tube in a class AB2 grounded grid circuit. CW, FM and RTTY efficiency is improved by shifting the bias deeper into class B. The heavy duty power supply and RF components, combined with a forced air system utilizing a chimney, provide long service life for expensive components. The AL-1500 is shipped factory wired for 240 volt, 50/60 Hz power mains.

*PLEASE READ THIS MANUAL BEFORE OPERATING THIS EQUIPMENT!*

**AMERITRON**

116 Willow Rd.  
Starkville, MS 39759

## UNPACKING INSTRUCTIONS

1. Carefully remove the amplifier, transformer, and tube from their shipping cartons. Inspect each item for visible damage. If any damage occurred during shipment, notify the transportation company immediately.
2. Save all packing materials in case you need to return your AL-1500(X/J) for factory service. The cartons have been designed to give maximum protection for this amplifier. Any units returned without proper packing may be damaged and shipping claims cannot be made. Contact the factory before returning any units.
3. Remove the screws that hold the cover to the amplifier. Slide the cover back and remove it from the amplifier. There is a small bag that contains the fuses, fuse caps and the remainder of the chassis screws wrapped in the packing material around the anode connector.
4. Please read the GENERAL INFORMATION and SPECIFICATIONS sections before attempting to install the transformer and tube. Please note that the tube chimney comes factory installed around the tube socket. Go to the INSTALLATION section on page 4 to begin installing the transformer and tube.
5. This amplifier must always be disconnected from the power mains before removing the cover. See the precaution on page 10. Please read the entire manual to become familiar with the operation of the AL-1500(X/J) amplifier.

NOTE: The AL-1500J is the Japanese export version of the AL-1500 amplifier. The AL-1500J utilizes a special power transformer for use with 200V AC, 50 Hz. The AL-1500J will perform to specifications with the special transformer installed and will cover 24 and 28 MHz.

## FEATURES

1. High performance tube: the AL-1500 uses a single rugged 3CX1500A7/8877 tube.
2. High power gain: the 3CX1500A7/8877 features high power gain. As little as 65 watts of drive power will provide 1500 watts of output power.
3. SSB/CW switch: the bias voltage is switched to provide the best linearity on SSB or the lowest dissipation on CW operation.
4. ALC Indicator: the drive level is detected to provide a control voltage for the exciter. ALC prevents overdriving of the linear and reduces distortion from excessive drive power.
5. Vernier Plate and Load Adjustments: both tuning controls have vernier 6:1 reduction drives for smooth tuning.
6. Two Illuminated Panel Meters: the AL-1500 has two illuminated panel meters. The Grid Current meter provides a continuous reading of grid current and indicates proper operation of the amplifier. The other meter reads Plate Voltage (HV), Plate Current (IP), Peak RF Watts (PO) and ALC.
7. Operate/Standby Switch: filament and plate voltages are maintained while allowing the amplifier to be bypassed for "barefoot" operation.
8. 12 Volt Auxiliary Jack: 12 volts at 100 mA is provided for accessories such as the ATR-15 Antenna tuner.
9. XMT Indicator LED: provides a front panel indication of proper amplifier keying by the exciter during operation.
10. Grid Overload Circuit: this amplifier has a circuit that protects the tube from excessive grid current. If 175 mA of peak grid current is reached the "OPR" LED will no longer light and the amplifier will go into a bypass condition. This overload condition can be reset by momentarily putting the STBY/OPR switch in the STBY position.

Caution: This amplifier must be disconnected from the power mains before removing the cover. See the warning on page 10.

## TECHNICAL SPECIFICATIONS AL-1500

### Input:

Circuit type: Pi-network, slug tuned coils  
Maximum VSWR at resonance: 1.3:1  
Minimum 2:1 VSWR bandwidth: 20% of center frequency  
Maximum drive power permissible: 100 watts  
Typical drive for full power output: 65 watts

### Output:

Circuit type: Pi-L, Pi  
1/2 hour continuous carrier: 1500 watts  
30 second continuous carrier: 2500 watts  
1/2 hour PEP two-tone test: 2500 watts plus 30 second PEP two-tone test: 2500 watts plus

### Power Supply:

Circuit type: full wave bridge, capacitor input  
No load voltage: 3600 V  
Full load voltage: 3300 V  
Full load current: 1 amp  
Regulation: 10% typical  
Transformer: 34 lbs., hypersil  
Capacitors: 26 mfd total, computer grade  
Maximum draw at rated output: 15 amps at 240V AC 50/60 Hz

### Tube:

Type: (1) 3CX1500A7/8877  
Continuous dissipation: 1500 Watts  
Warm-up time: 180 seconds

### Metering:

Multimeter: Plate current, plate voltage, drive/ALC, power output (PEP watts)

Grid: Grid current

ALC: Negative going, 0-20V, adjustable, phono jack

Efficiency CW: 65% typical

Efficiency SSB (envelope crest): 62%

MARS/WARC: yes, set to nearest highest amateur band

Keying: Requires relay closure or sinking to ground of 12V DC at 100 mA, phono jack

RF Connectors: S0239

Line Connector: NEMA 6-15P, 240V style

Dimensions: 18 1/2 D x 17 W x 10 H

Weight: 77 lbs.

Frequency Coverage: (AL-1500)-1.8, 3.5, 7, 14, 18 and 21 MHz. User modified models cover 24 and 28 MHz. (AL-1500X/J) Export models-1.8, 3.5, 7, 14, 18, 21, 24 and 28 MHz.

Third Order IMD at Rated Output: -36 dB

# GENERAL INFORMATION

## SAFETY INTERLOCK

While the Amplifier's top cover is in place, the interlock switch closes to allow AC line voltage to reach the power transformer. When the top cover is removed, the interlock opens and disconnects the line voltage. This does not discharge the bank of power supply filter capacitors. Be sure to allow the filter capacitors to discharge before you touch anything inside the Amplifier. You can select the High Voltage function of the Multimeter to check the high voltage potential. Never attempt to defeat the safety interlock. **WARNING- Never remove the cover of this amplifier with the unit plugged into the power line.**

## DRIVING POWER

This Amplifier is designed to operate at full ratings when it is driven by an exciter that has approximately 65 watts of RF output. You can use an exciter that has lower output power, but the Amplifier's output will be less. If you use an exciter that delivers more than 100 watts, carefully adjust the driving power to avoid "over drive" and the creation of spurious signals, which create needless interference to other operators. We highly recommend that you use a monitor scope for continuous output monitoring. The display on an oscilloscope is the best way of determining the amplitude of the voice peaks which, if excessive, can cause "flat topping" and splatter. This amplifier has a circuit that protects the tube from excessive grid current. If 175 mA of peak grid current is reached, the "OPR" LED will no longer light and the amplifier will go into a bypass condition. This overload condition can be reset by momentarily putting the STBY/OPR switch in the STBY position.

**IMPORTANT:** In no case should you advance the power output control of your exciter beyond the point where the Amplifier's Power Output indication ceases to increase. If you turn the control past this point, nonlinear operation may occur.

## FILAMENT SUPPLY

The filament circuit of this amplifier satisfies all requirements of the tube manufacturer related to tube performance and life. Inrush current is controlled by the transformer internal resistance and impedance, filament choke resistance and filament wiring resistance. To insure maximum life of the tube never replace any circuit components or wiring with substitute parts.

The low voltage tap on the filament transformer primary provides the ability to operate the blower at slower speeds for reduced noise. Normal amateur operation in CW and SSB will not cause heat damage to components on any recommended tap. It is always advisable to use the maximum speed (air flow) that the level of noise permits to extend component life. Wiring information for the blower is shown in the "Transformer Connections" instructions.

## PLATE SUPPLY

The plate supply has a full wave bridge rectifier and a 1.8 KVA CCS rated tape wound hypersil transformer. Filtering is accomplished by a bank of high quality capacitors totaling 26 mfd (additional capacitance will not improve supply performance). The Plate Supply will not be harmed by nor

mal continuous amateur operation at 1500 watt levels. Power is applied through RLY2 when the 12V DC low voltage supply is activated. A 10 ohm resistor limits the line current during the filter capacitor charge time to lower the stress on components. When the primary voltage approaches the full line value, RLY3 shorts the 10 ohm resistor and applies the full line voltage to the plate transformer. The 10 ohm resistor acts as a fuse during start-up if the high voltage supply has a short.

## TIMER OVERLOAD BOARD

The AL-1500 has a circuit board mounted on the front panel side of the filter capacitor board that provides time delay to insure the cathode of the 3CX1500A7/8877 has reached proper operating temperature before high voltage and RF drive power can be applied. This board also samples the peak grid current and removes drive if the grid current is excessive.

The timer portion of this circuit board uses IC1A as a comparator to drive the complimentary darlington 01 and 02. When twelve (12) volts is first applied to terminal "Y" diode D3 provides a regulated 5.1 volt reference. Divider R8 and R7 reduces the reference voltage to 3.7 volts. C9 charges from current supplied by R9. After approximately three minutes, the comparator output (pin 1) goes high. Q3's collector goes low and turns on Q2 and Q1. If the 12 volt supply is momentarily interrupted diode D1 discharges C9 through R6, R7, and R8. Any interruption of more than a few seconds requires a complete timing cycle to begin again.

The grid overload circuit compares the voltage developed across the grid shunt (.3V equals 200mA) to the .256V reference provided by R5 and R11. This sets the grid trip at 175 mA. Pin 7 of IC 18 will go high and turn 04 on if the grid current reaches 175 mA. This will cause RLY 1 to latch on and remove the 12 volts from the antenna transfer relay in the amplifier. The circuit is reset by putting the amplifier on standby momentarily. This removes the voltage that holds RLY 1 locked on. **NOTE:** The grid overload circuit will respond much faster than the grid meter can indicate grid current. If the overload continuously trips, the likely cause is excessive peak grid current. This is caused by the loading control being set too low (counter-clockwise) for the peak drive power applied to the amplifier.

## EXPORT MODIFICATIONS

A simple modification will allow operation on frequencies above 15 meters. Instructions for this modification are available by sending a written request for "Export Modification Instructions" along with a copy of a valid amateur license. There is no charge for this information. Export models are shipped with this modification and have an "X or J" following the serial number. Standard frequency coverages are indicated in the chart following the tuning instructions on page 10.

## METERING FUNCTIONS

The AL-1500 has two illuminated meters. The Grid Current meter provides a continuous indication of the 3CX1500/8877 grid current. This exclusive feature of Ameritron amplifiers indicates proper amplifier operation better than any other parameter. Do not exceed 75 mA on this meter during normal operation of this amplifier. The other meter reads Plate Voltage (HV), Plate Current (IP), Peak RF Watts (PO) and ALC. These functions are selected with the Multimeter Switch.

**Plate Voltage (HV):** Read DC Plate Voltage on the 4000 volt scale. This scale is 100 volts per division. Normal voltages are 3600 volts no load, 3300 volts full load.

**Plate Current (Ip):** Read DC Plate Current on the 1000 mA scale. This scale is 25 mA per division.

**Peak RF Watts (PO):** Read Peak RF Watts on the 2000 watt scale. This scale has 50 watt divisions below 1000 watts and 100 watt divisions above 1000 watts.

**NOTE:** This circuit uses an emitter follower to charge a capacitor to the peak envelope voltage detected by the ALC/Power Board. Accurate peak envelope power readings are given when the amplifier is connected to a 50 ohm nonreactive load. If the amplifier is used with a mismatched load, the power meter will read higher or lower than normal by a ratio up to the value of the SWR. Potentiometer

R5 on the Meter Board (50-01140-1) adjusts the calibration of the power meter.

ALC: Indicates a relative drive level (average, not PEP) that can be estimated by dividing the Peak RF Watts scale by 10.

## TECHNICAL ASSISTANCE

Technical assistance is available during our normal business hours on weekdays. The following information is required to assist you with operational problems:

1. Model and Serial Number
2. Date of purchase and dealer
3. An accurate description of the problem

Meter readings at all stages of the tuning procedure are very important along with a complete description of the other equipment used with our product.

Written assistance is also available. Due to time delays in processing mail, please allow at least three weeks for a written reply.

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## PERIODIC MAINTENANCE

The high voltage present on the plate choke and air variable capacitors attracts dust and dirt out of the air stream. It is particularly important that the high voltage areas at the bottom of the plate choke and the insulators on the air variable capacitors be dust free. These areas should be inspected every few months if the amplifier is operated in a dusty environment. Unplug the line cord, and wait about 90 seconds until the power supply capacitors discharge. Check the HV scale for zero voltage before removing the cover. Remove the cover. You must first connect a jumper wire from ground or chassis to the anode connection of the tubes.

**NOTE:** This is a safety wire that must be installed when beginning service work. After service is complete, reverse the procedure to remove the safety wire. Remove the wire from the anode connection first and then from ground. Use a soft bristle brush dipped in alcohol to clean areas mentioned previously. In the event that cleaning is required at frequent intervals, place a low restriction air filter material over the air inlet holes on the left front side of the cabinet near the filter capacitors. Most hardware stores stock suitable materials that are used as replacement filters for window air conditioners.

## INSTALLATION

### TRANSFORMER INSTALLATION

Remove the cover of the amplifier. Remove the small package that is wrapped around the anode connector. This is the fuse pack and contains the fuses, fuse caps and the remainder of the chassis screws. Remove the top 7/16" nuts from the four transformer mounting bolts inside of the amplifier. Carefully remove the transformer from its shipping carton.

Place the transformer on the four 1/4-20 mounting bolts. Use care because the transformer is heavy. The side with the two high voltage secondary RED leads must be adjacent to

the center panel(see Fig. 1). Now place a 7/16" nut on each bolt (see Fig. 2). Snug the nuts down manually. Do not tighten with a ratchet wrench.

Remove the brass 1/4" hex nuts and the top flat washer from the two 6-32 screws on the rectifier board (see Fig. 1). Install the RED lead ring terminals on the screws and replace the flat washers and 1/4" hex nuts. Position the wires so that the black insulated areas are at least 1/4" from each other and any metal objects. Now tighten the 1/4" hex nuts.

## TRANSFORMER INSTALLATION Cont.

For 240V Operation (factory wired):

The four primary leads have colored plastic insulating boots over the quick disconnect terminals. Slide these back prior to installing the leads. Install the color coded boots as follows:(see Fig. 1) Note: Japanese export model (AL-1500J) should follow the 240V operation steps to properly connect their transformers. The AL-1500J is supplied with a special transformer for 200V operation.

1. BLUE (Brown wire) to the top relay terminal
2. YELLOW (Black/White) to the top terminal of terminal block
3. CLEAR (Black wire) to the second terminal of terminal block
4. RED (Brn/Wht) to the bottom terminal of terminal block

Now slide the colored insulating boots back over the terminals. Note: The green wire is not used for 240V operation. There is no green wire on the AL-1500J export model transformer.

Important: The leads must be in the positions indicated by the color coded insulating boots(see Fig. 1) for 240V operation. Or for 200V operation in Japan. Caution: Do not use the 220V wiring unless the line voltage is always below 220 VAC. The Standard USA voltage is 240 VAC, not 220.

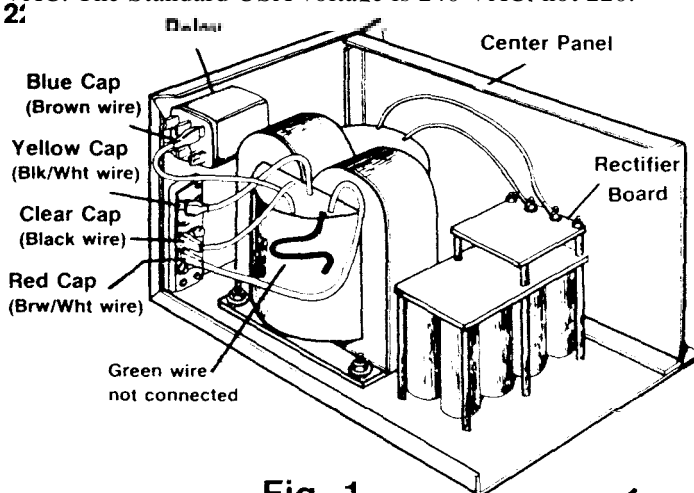
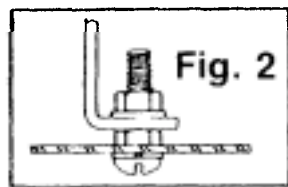


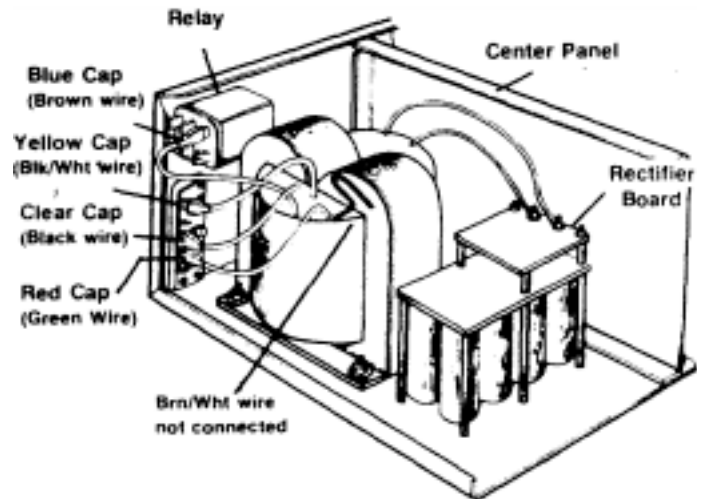
Fig. 1



For 220V operation (see Fig. 3), follow the first three steps above, then follow the steps below:

1. Slide the RED boot back on the BRN/WHT wire.
2. Clip the terminal connector off the wire and slide the RED boot off.
3. Remove the restraint from the GRN wire and slide the RED boot on to the wire.
- 4- Solder the terminal connector to the GRN wire.
5. Tape up the BRN/WHT wire because it will not be used.

Fig. 3



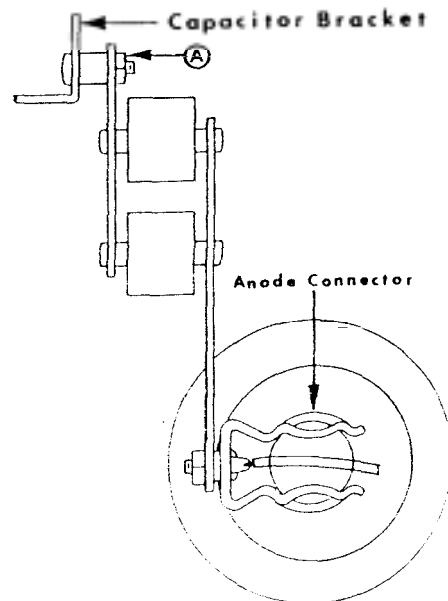
## TUBE INSTALLATION

Note that one of the tube pins is larger in diameter. This larger pin "keys" the tube base and socket. Install the tube by aligning the tube pins with the socket contact terminals, then seat the tube with vertical pressure ONLY. Do not "rock" or "twist" the tube. Also the chimney is already mounted inside the AL-1500 amplifier.

After the tube is installed, attach the anode connector as follows: (Refer to the Fig. 4)

1. Remove screw "A" that holds the anode connector to the 500pf blocking capacitors.
2. Attach the anode connector to the tube anode.
3. Insert screw "A" into the 500pf capacitors and snug it down.

Fig. 4

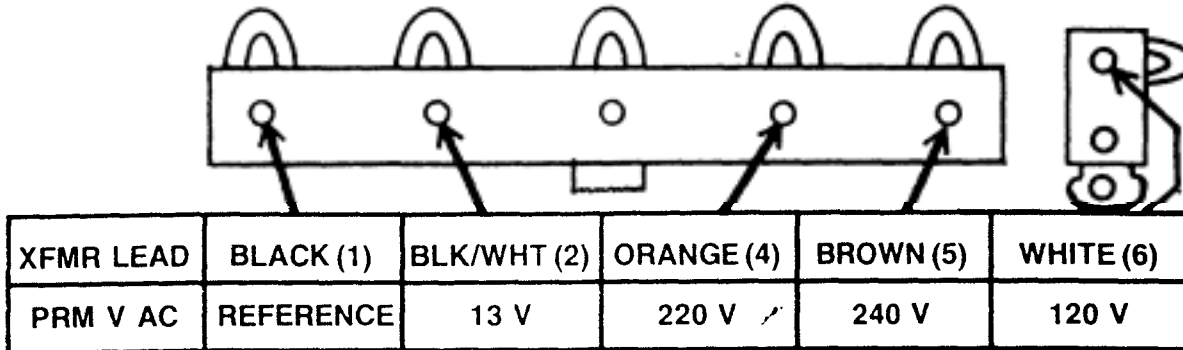


Top View of 1500 Tube

**Caution:** This page is only valid for transformers that contain these exact color codes for the primary winding. Early production units did not contain a multiple tap transformer. If the terminal strip has all these color coded wires, then the unit has the multiple tap transformer.

### FILAMENT/BLOWER WIRING INSTRUCTIONS

The AL-1500 and 1500(X) amplifiers come prewired for 240V line voltage and with the blower prewired for medium high fan speed. NOTE: The AL-1500J Japanese export model is prewired for 208V line voltage. This page gives filament transformer connection details for various line voltages and blower speeds. The five lug terminal strip and the single lug terminal strip are located immediately behind the ON/OFF rocker switch inside the unit. The drawing below shows the connection of transformer leads and their purpose.



This chart shows the color code of the transformer leads and their purpose. The number in parenthesis indicates the number of the terminal lug that the transformer lead is connected to. The number three (3) lug is not used to change the filament or blower wiring. Do not add or remove any wires from the number three (3) lug. Refer to the drawing above. Use the lug numbers above when referring to both of the Filament connection chart and the Blower connection chart below.

**FILAMENT TRANSFORMER LINE VOLTAGE** There are two wires that connect to the terminal lugs which determine the Filament Line Voltage. The BLACK wire from the power switch and WHITE wire from rear of the unit connect to different terminal lugs depending on the voltage desired. The AL-1500 and 1500(X) come prewired for 240V operation\*. AL-1500J comes prewired for 200V operation\*\*. Refer to the chart below. The voltage listed in the chart below is the maximum line voltage that should be applied to a given tap. Operation with line voltage in excess of the tap voltage selected can result in a reduction of tube life

**MAXIMUM LINE VOLTAGE**

| LUGS | 245 V* | 232 V | 220 V | 208 V** |
|------|--------|-------|-------|---------|
| 1    | BLACK  |       | BLACK |         |
| 2    |        | BLACK |       | BLACK   |
| 3    |        |       |       |         |
| 4    |        |       | WHITE | WHITE   |
| 5    | WHITE  | WHITE |       |         |
| 6    |        |       |       |         |

\* indicates factory shipped (AL-1500/X)

\*\* indicates factory shipped (AL-1500J)

### BLOWER CONNECTIONS

The GREEN and WHITE wires from the rear of the unit connect to the terminal lugs to control the air speed of the fan. The AL-1500/X/J are prewired for the medium high speed setting\*. Refer to the chart below. The blower connections can be moved to lower speed taps if air noise is excessive. Ameritron recommends using the highest speed tap that noise considerations permit. The lowest speed tap will develop sufficient air flow for standard amateur SSB and CW full power operation. The highest speed taps should be used for contest or RTTY operation.

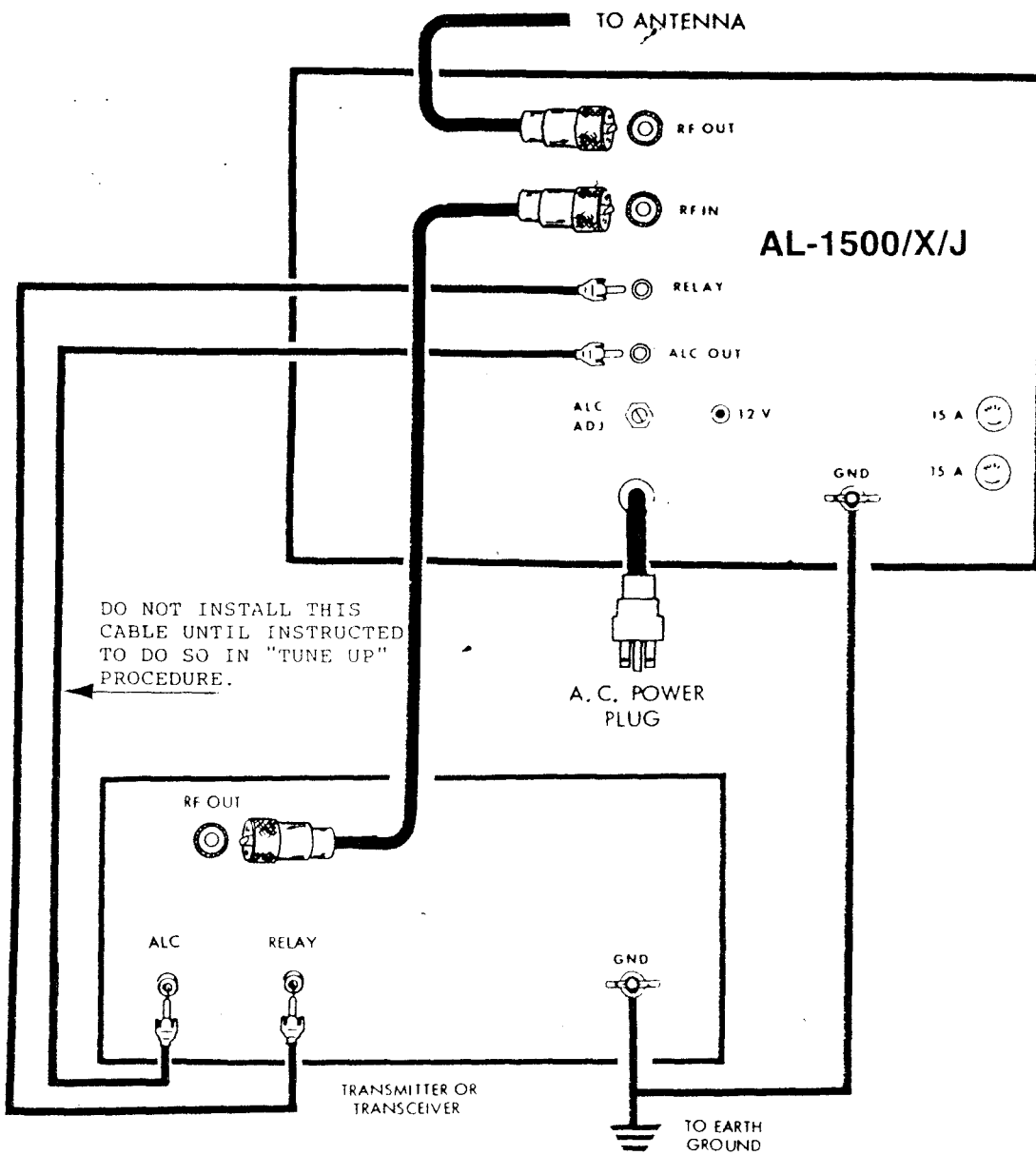
**BLOWER SPEED**

| LUGS | LOW   | M LOW | M HIGH* | HIGH  |
|------|-------|-------|---------|-------|
| 1    |       |       | BROWN   |       |
| 2    |       | BROWN |         |       |
| 3    |       |       |         |       |
| 4    | BROWN |       |         |       |
| 5    |       |       |         | BROWN |
| 6    | GREEN | GREEN | GREEN   | GREEN |

\* indicates Factory shipped

## INTERCONNECTION

1. Connect the RF output of the exciter to the RF IN connector on the rear of the AL-1500 with 50 ohm coax. Use any good quality 50 ohm cable long enough to connect the amplifier to the exciter. The amplifier uses a standard SO-239 female that will mate to a PL-259 male connector on the cable.
2. Connect the existing station antenna system to the RF OUT connector on the rear of the AL-1500 with RG-8 type coax. This connection uses PL-259 connectors.
3. Use shielded audio type cable with standard male phono plugs to connect to the RELAY jack on the AL-1500. This jack has positive 12V DC open circuit and supplies 100mA of current when pulled to ground.
4. Connect a short ground lead from a good earth and RF ground to the GND terminal.
5. The 12V connection on the rear panel provides 12V DC at 100 mA maximum to operate external dial lamps or accessories such as the ATR-15 Antenna Tuner.
6. DO NOT CONNECT THE "ALC OUT" SOCKET ON THE AMPLIFIER TO THE "ALC" SOCKET ON THE TRANSMITTER UNTIL INSTRUCTED TO DO SO IN THE TUNE UP PROCEDURE. This jack provides up to 20 Volts of negative voltage for transmitter gain control.





## INSTALLATION Cont.

### LOCATION

-Do not operate the Amplifier in excessively warm locations or near heating vents or radiators. Be sure air can circulate freely around and through the Amplifier cabinet. Provide an unobstructed air inlet for the blower. Do NOT place anything that will impede the free flow of air within 2 inches of the cabinet ventilation holes.

### VENTILATION

The AL-1500 ventilation system has been designed and tested to maintain tube seal temperature safely below the tube manufacturer's rating at 1500 watts output with a 100% duty cycle when properly tuned. The blower in the AL-1500 is a permanently lubricated type that requires no maintenance in normal operation. To insure proper ventilation in your installation, observe the following:

1. Do not block or unduly restrict the ventilation holes in the cover. Be sure that the amplifier is located in an area so the vent holes have open air circulation.
2. The exhaust air flow is over 30 CFM. Do not "assist" the air flow unless the fan exceeds the AL-1500 blower CFM by a factor of 2:1.
3. Do not mount additional fans on the AL-1500 cabinet.
4. The exhaust air will become quite warm at higher power levels. Do not place any heat sensitive objects in the exhaust air stream.

### TUNING INSTRUCTIONS

Proper tuning of a grounded grid linear amplifier is best accomplished with an understanding of what each control does and what the meters are telling the operator about the condition of TUNE.

The tuning controls function as follows:

**PLATE:** This control tunes the amplifier output circuit to the operating frequency. It should always be adjusted for maximum output power or maximum grid current. Due to interaction with the "LOAD" control, a "touch-up" should be performed after any load adjustments.

**LOAD:** This control adjusts the coupling of amplifier to the antenna or load. It should be adjusted to keep the grid current in the proper operating range. As the loading capacitance is reduced (by rotating the control to a higher front panel number), the coupling is increased. An increase in coupling will reduce grid current and increase the amount of drive the amplifier will accept without component damage.

A common mistake in tuning is to adjust the "LOAD" control at low drive powers and apply more drive dur

### POWER CONNECTIONS

The AL-1500 is supplied with a NEMA 6-15P plug for 240V AC operation. Operation with power main voltages below 200 volt is not recommended. Special transformers are required for 200V, 50/60 Hz operation (see NOTE on page 1). Refer to the "Transformer Installation" section on pages 4 and 5 for the correct wiring for 220 to 240 volt operation.

**NEVER REWIRE THE POWER SUPPLY TO BOOST THE HIGH VOLTAGE ABOVE 3700 VOLTS.**

The wiring between the fuse box and the amplifier AC outlet must be No. 12 gauge or larger in order to supply the current required (13 amperes) without a significant drop in the line voltage. The outlet should be fused for 20 amperes.

### GROUNDING

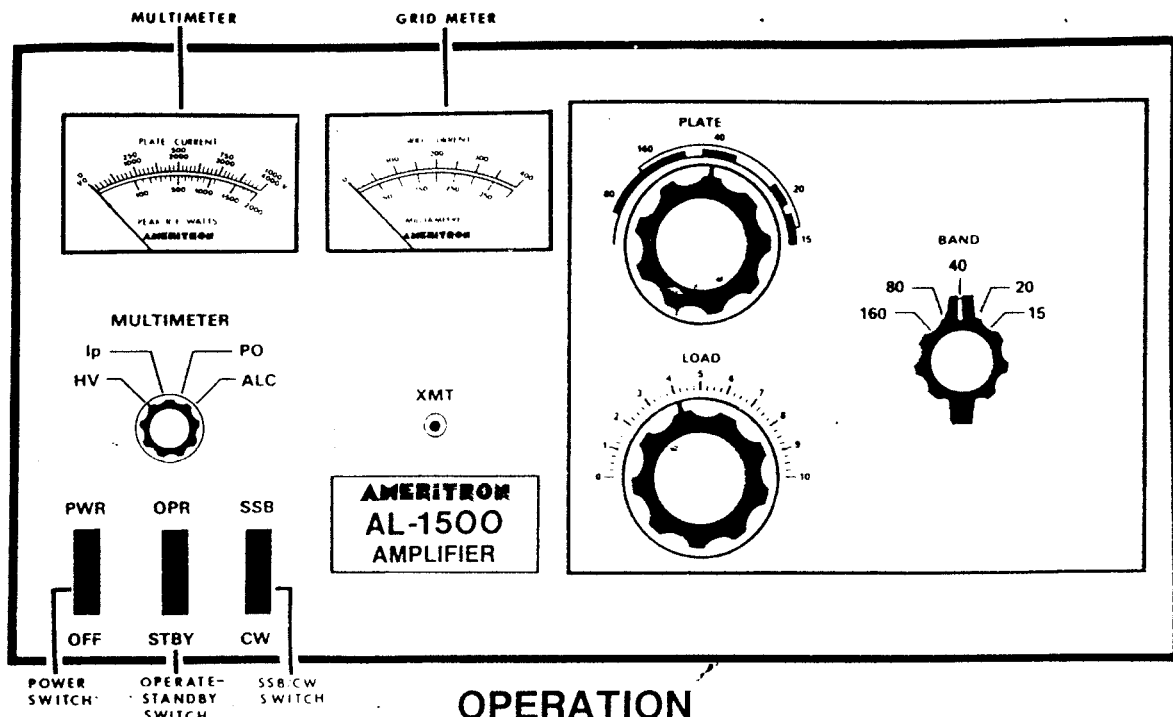
Connect a good RF and earth or water pipe ground to the ground post on the rear panel of the Amplifier. Use the heaviest and shortest connection possible.

Before you use a water pipe ground, inspect the connections around the water meter and make sure that no plastic or rubber hose connections are used. These connections interrupt electrical continuity to the water supply line. Install a jumper around any insulating water connections you may find. Use heavy copper wire and pipe clamps. It is best to ground all equipment to one point at the operating position and then ground this point as described above.

ing operation. Excessive grid current, distortion on SSB or arcing in the tank components occurs when full drive power is applied to the amplifier without the "LOAD" set for enough clockwise (higher loading).

It is important to remember the loading must be set properly for the PEAK power the amplifier is expected to develop. 50 watts PEP will be the maximum drive the amplifier will safely handle if the output of the amplifier is tuned with 50 watts of carrier drive. Any attempt to go beyond the amount of drive power the amplifier was originally tuned at will result in a rapid increase in grid current, splatter and even damage to components.

The "LOAD" control should be adjusted for maximum output power without exceeding the recommended grid current. **DO NOT USE THE LOAD CONTROL TO REDUCE POWER IN A GROUNDED GRID AMPLIFIER.** The drive from the exciter should be reduced if the amplifier plate current or output power is excessive. The "LOAD" setting should be increased if grid current is excessive. Any errors in adjusting this control should be made in favor of a higher load setting (clockwise).



## OPERATION

### CW PROCEDURE

Follow these instructions in numerical order. If the various meter readings are different than indicated, check the connections from the exciter to the amplifier and make sure they are correct. Consult the manual for the exciter.

Be sure the transformer is correctly installed and wired for your line voltage. See the "Transformer Installation" section on page 4 and 5 for wiring details.

- Set the AL-1500 front panel switches as follows:  
POWER TO OFF  
OPR-STBY TO STBY  
SSB-CW TO CW  
MULTIMETER TO HV
- Plug the AC line cord into the proper voltage outlet.
- Set the Power Switch to the ON position. The grid meter should light and the blower should start. After three minutes, the plate meter should light and the multimeter should read 3600 volts nominal and absolutely no more than 3700 volts HV.
- With the amplifier still on STANDBY, tune the exciter into a normal 50 ohm load according to the manufacturer's instructions. Turn the exciter drive fully down after tuning.
- Place the amplifier mode switch in the CW position, the bandswitch on the same band as the exciter, the PLATE control in the dial range for the band selected and the load control as indicated:

| CW        |      | PHONE (SSB) |      |
|-----------|------|-------------|------|
| Frequency | Load | Frequency   | Load |
| 1.810     | 2    | 1.850       | 3    |
| 3.600     | 3½   | 3.900       | 6    |
| 7.050     | 3    | 7.200       | 4    |
| 14.050    | 5    | 14.250      | 5    |
| 21.050    | 6    | 21.350      | 6    |
| 28.050    | 7    | 28.500      | 7    |

- With exciter drive still at zero, place the MULTIMETER switch in the Ip position. Observe the 1000 mA scale. The meter should read zero (0). Place the STBYOPR switch in the OPR position.
  - Key the exciter (no drive) and observe the plate current on the 1000 mA scale. It should be 75 mA. Place the CW-SSB switch in the SSB position. Plate current should now read 250 mA. Return the CW-SSB switch to the CW position.
- Note: The no drive currents will vary up to 25% due to component and line voltage tolerances.
- Apply only enough drive to indicate a grid current of 50 mA or an Ip of no more than 500mA. Tune the PLATE control for maximum output power or grid current. It is normal for the plate current to dip at this point. If the grid current goes over 100 mA, reduce the drive at once. Unkey the exciter. NOTE: This amplifier has a circuit that protects the tube from excessive grid current. If 175 mA of peak grid current is reached, the "OPR" LED will no longer light and the amplifier will go into a bypass condition. This overload condition can be reset by momentarily putting the STBY/OPR switch in the STBY position. Repeated tripping of the grid overload circuit usually indicates that the loading control is set too far counterclockwise for the amount of drive being applied to the amplifier or that something in the antenna system is changing impedance (arching) during
  - Place the MULTIMETER switch in the PO position and observe the 2000 Peak RF Watts scale. Increase the drive until 100 mA of grid current is indicated. Adjust the LOAD and PLATE controls for maximum output. The grid current may be lower now.

- Advance the drive to 100 mA of grid current. Adjust the LOAD and PLATE controls for maximum output power. The output should be over 1000 watts now.
- Apply full drive without exceeding 100 mA of grid current. The final grid current should be around 50 mA and the plate current below 1000 mA.

## ALC (Automatic Level Control)

The primary use of the ALC is to reduce the input drive power to a safe level for the AL-1500. The maximum drive that the AL-1500 will tolerate is approximately 100 watts. At this drive level the output of the AL-1500 may be in excess of 2000 watts when properly tuned. The ALC should be connected and adjusted after the amplifier is properly tuned on CW. Use a shielded audio-type cable with a standard male phono connector to connect the 0-20 volt negative ALC voltage to the exciter ALC input. Consult the exciter manual for proper connection details.

## Setting the ALC ADJ Control

Proper adjustment of the rear panel ALC control can be achieved by the following steps:

1. Load the amplifier according to the tune-up instructions (with the ALC disconnected from the exciter) to the desired maximum power.
2. Connect the ALC line and rotate the ALC control fully clockwise looking at the rear of the unit.
3. Set the MULTIMETER switch to the PO position or observe an external PEP meter or oscilloscope
4. Set the transmitter audio control about 20<sup>0</sup>16 higher than normal.
5. Speak in the microphone in a normal tone of voice and observe the reading on the 2000 RF Watts scale
6. Adjust the ALC ADJ control on the rear panel until the amplifier output is no more than the desired maximum power obtained in step 1.

The exciter internal ALC will maintain linearity the amplifier

ALC will prevent over-power operation.

## SSB PROCEDURE

Tune the Exciter and Amplifier as described in "TUNE-UP CW PROCEDURE".

1. Place the SSB-CW switch in the SSB position.
2. Adjust the exciter gain control to permit voice peaks to reach the same value the peak output meter read on CW when fully loaded. The plate and grid currents should remain well below 50% of the CW values during normal modulation.

## SSTV, FM, RTTY, PACKET, AMTOR:

The plate current should be limited to 800 mA maximum. The grid current should be limited to 50 mA. Tune the amplifier for peak output power with the drive reduced to the grid and plate current below the ratings given.

### NOTE:

Some exciters will put out short duration high power RF pulses when first keyed. Exciter power output peaks may reach or exceed full output level even if the exciter's power control has been adjusted to deliver reduced power under "keydown" conditions.

The amplifier loading control must be set high enough (clockwise) to prevent extremely high energy levels from developing in the plate and grid circuits of the amplifier. DO NOT "UNDERLOAD" THE AMPLIFIER TO REDUCE POWER. Never "retune" the amplifier to produce higher efficiency with reduced drive. Poor linearity, splatter or even damage to components may result from failure to follow these instructions. Repeated tripping of the grid current circuit usually indicates that the loading control is set too far counter-clockwise for the amount of drive being applied to the amplifier or that something in the antenna system is changing impedance (arcing) during peaks.

The AL-1500 will operate with full output on all WARC bands except 24.5 MHz. The AL-1500X (export model) will operate with full output on all WARC bands.

### STANDARD FREQUENCY COVERAGE

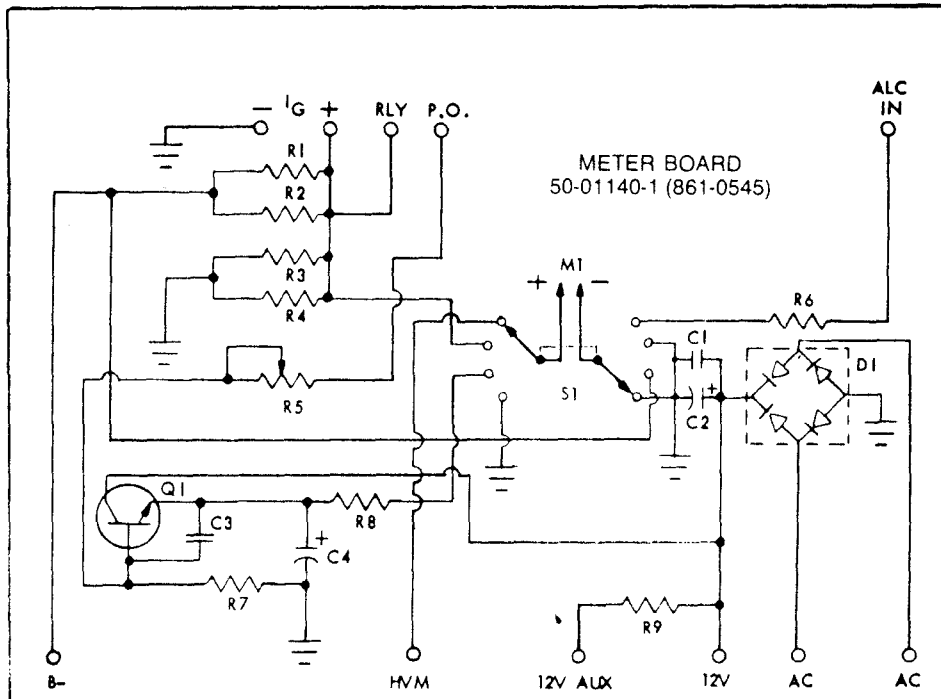
| AL-1500    |                  | AL-1500X/J |                  |
|------------|------------------|------------|------------------|
| 160 meters | 1.8 - 2.0 MHz    | 60 meters  | 1.8 - 2.0 MHz    |
| 80 meters  | 3.3 - 4.4 MHz    | 80 meters  | 3.3 - 4.4 MHz    |
| 40 meters  | 5.9 - 9.0 MHz    | 40 meters  | 5.9 - 9.0 MHz    |
| 20 meters  | 10.0 - 15.5 MHz* | 20 meters  | 10.0 - 15.5 MHz* |
| 15 meters  | 17.0 - 21.5 MHz  | 15 meters  | 17.0 - 21.5 MHz  |
|            |                  | 10 meters  | 24 - 29 MHz**    |

\* excluding 11.5 to 12.5 MHz

\*\* excluding 26 to 28 MHz

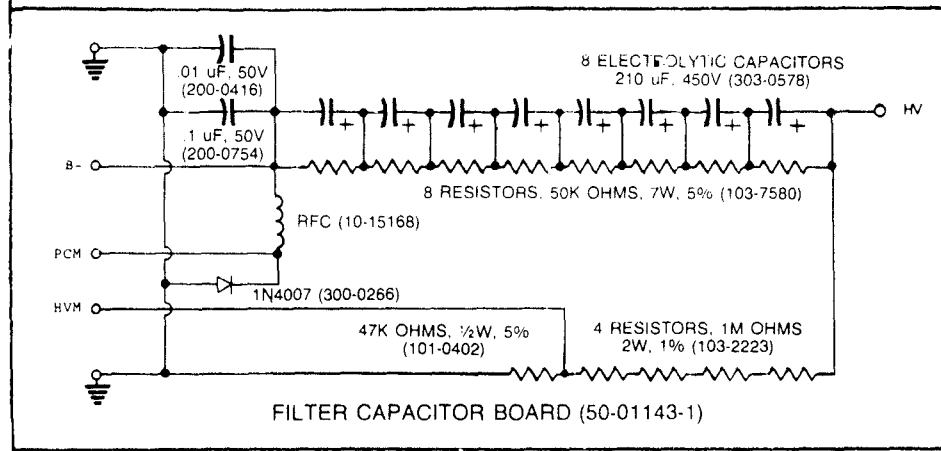
## WARNING!!

MAKE NO ATTEMPT TO PUT THIS AMPLIFIER IN SERVICE WITH THE COVER REMOVED! CONTACT WITH VOLTAGES INSIDE THIS AMPLIFIER CAN BE FATAL! ALWAYS DISCONNECT THE AMPLIFIER FROM THE POWER MAINS AND WAIT FOR THE FILTER CAPACITORS TO DISCHARGE BEFORE REMOVING THE COVER.

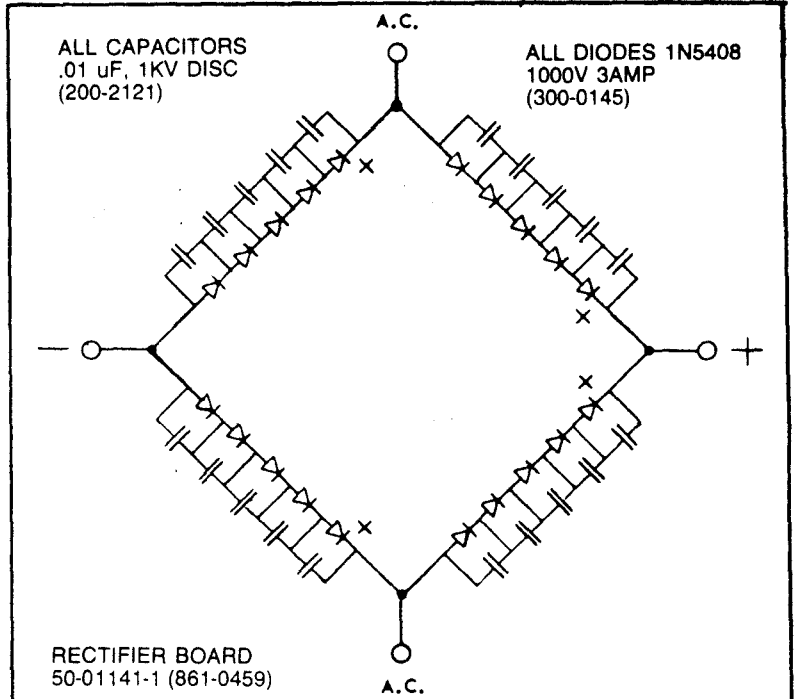


METER BOARD  
50-01140-1 (861-0545)

|        |                    |          |        |                         |          |
|--------|--------------------|----------|--------|-------------------------|----------|
| D1     | 1.5 AMP 50V bridge | 300-9646 | R1, R2 | 6 ohm, 3W, 1%           | 103-3399 |
| C1, C3 | .01 uf 50V disc    | 200-0416 | R3     | 1.5 ohm, 3W, 1%         | 103-3400 |
| C2     | 1000 uf 25V        | 203-0149 | R5     | 100K ohm trimpot        | 104-0534 |
| C4     | 10 uf 25V          | 203-0642 | R6     | 33K ohm, 1/2W, 5%       | 101-0644 |
| Q1     | 2N3904             | 305-0645 | R7     | 15K ohm, 1/2W, 5%       | 101-0273 |
|        |                    |          | R8     | 10K ohm, 1/2W, 5%       | 101-0643 |
|        |                    |          | R9     | 10 ohm, 1/2W, film type | 101-0595 |



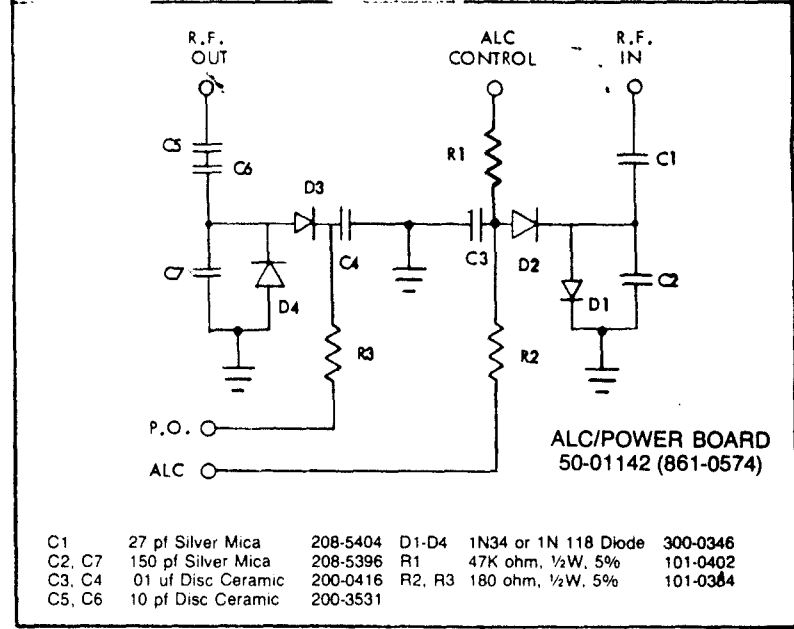
FILTER CAPACITOR BOARD (50-01143-1)



RECTIFIER BOARD  
50-01141-1 (861-0459)

ALL CAPACITORS  
.01 uF, 1KV DISC  
(200-2121)

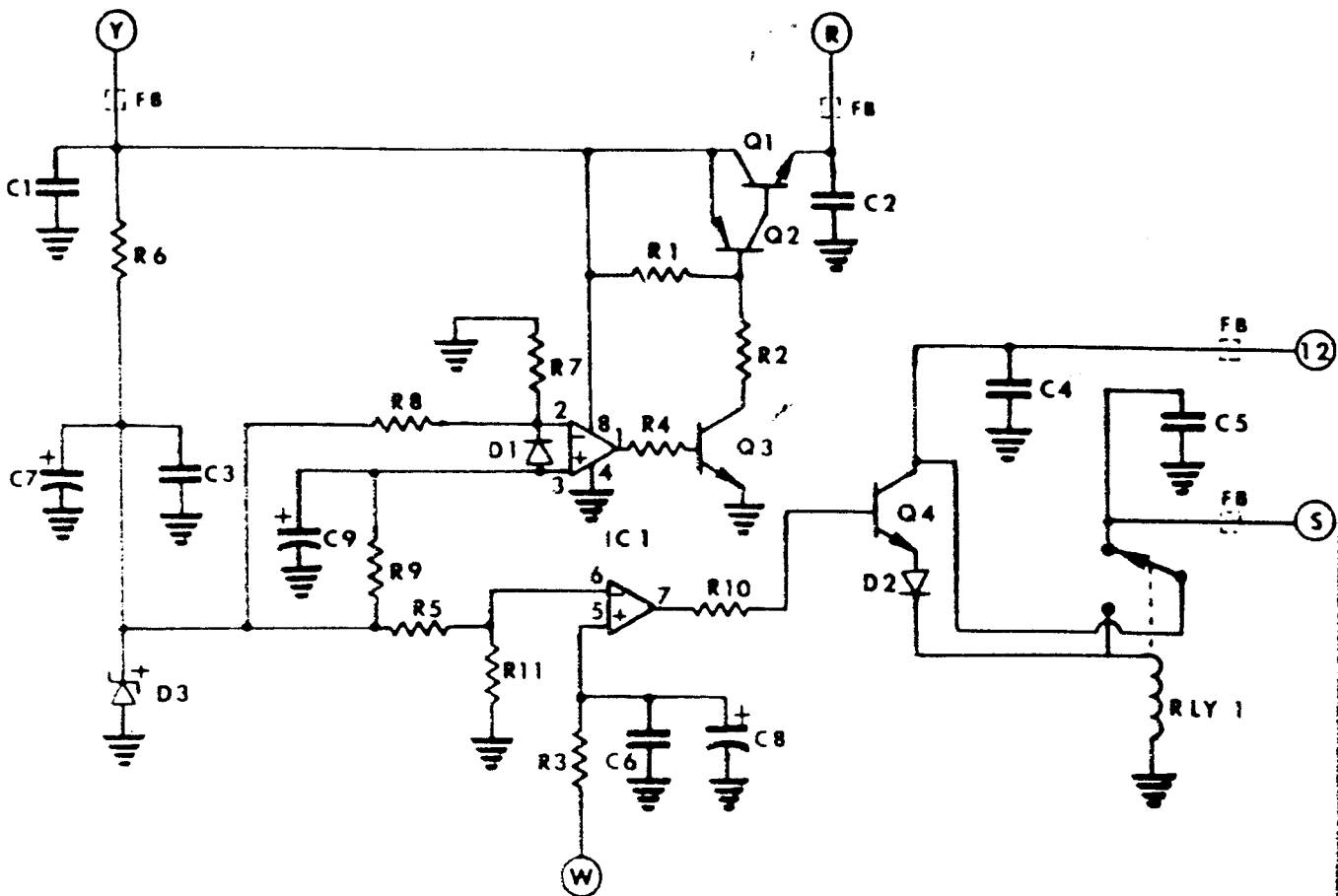
ALL DIODES 1N5408  
1000V 3AMP  
(300-0145)



ALC/POWER BOARD  
50-01142 (861-0574)

|        |                    |          |        |                      |          |
|--------|--------------------|----------|--------|----------------------|----------|
| C1     | 27 pf Silver Mica  | 208-5404 | D1-D4  | 1N34 or 1N 118 Diode | 300-0346 |
| C2, C7 | 150 pf Silver Mica | 208-5396 | R1     | 47K ohm, 1/2W, 5%    | 101-0402 |
| C3, C4 | 01 uf Disc Ceramic | 200-0416 | R2, R3 | 180 ohm, 1/2W, 5%    | 101-0384 |
| C5, C6 | 10 pf Disc Ceramic | 200-3531 |        |                      |          |

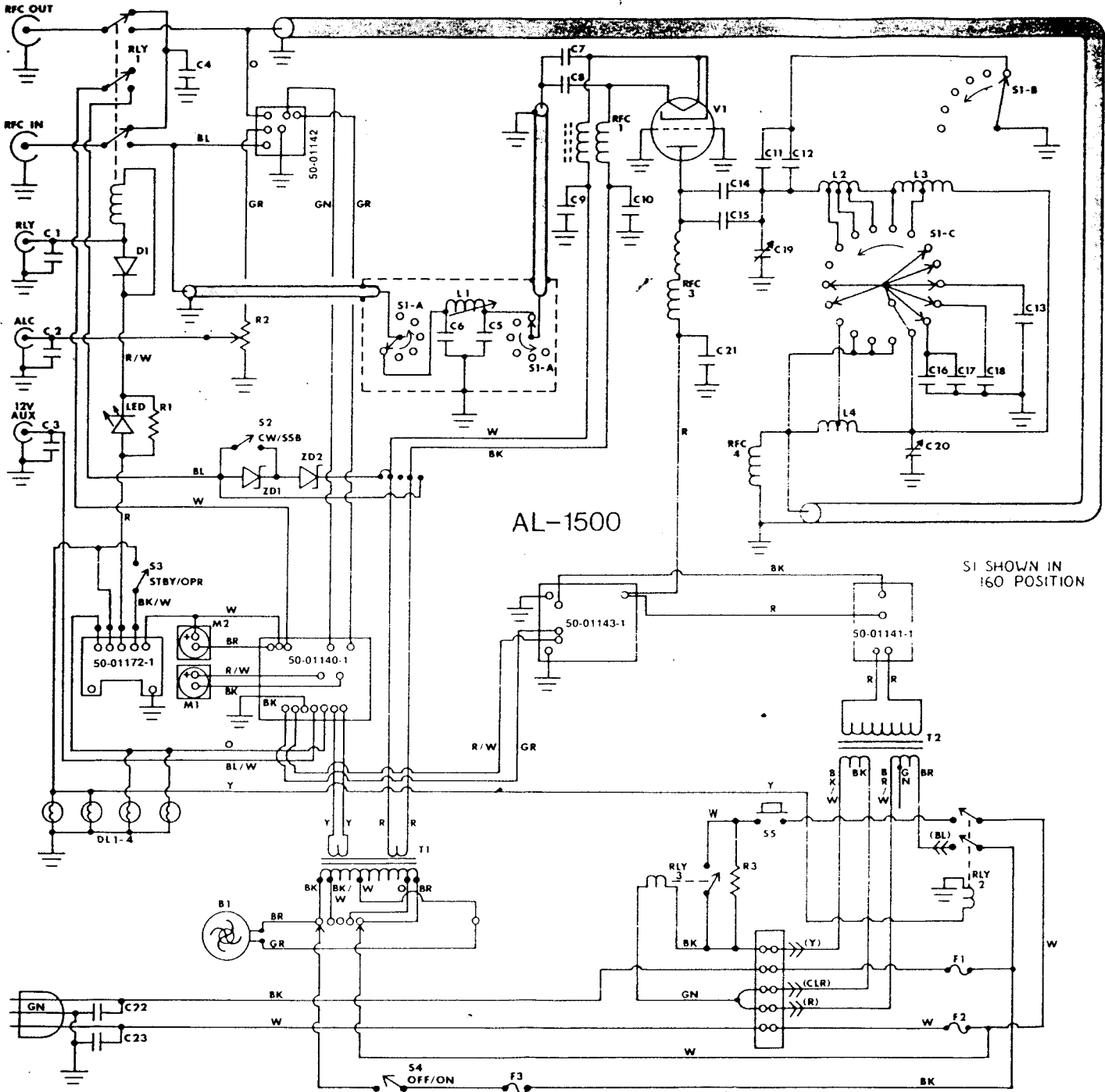
## TIMER/OVERLOAD BOARD (50-01172)



- |       |                                    |       |                                  |
|-------|------------------------------------|-------|----------------------------------|
| C 1-6 | .01 uF 50V disc (200-0416)         | Q 3,4 | NPN transistor 2N3904 (305-0645) |
| C 7,8 | .47 uF tantalum (203-0530)         | R 1-3 | 10K ohm 1/2 watt (101-0643)      |
| C 9   | 100 uF electrolytic (203-0564)     | R 4,5 | 3.3K ohm 1/4 watt (100-0729)     |
| D 1,2 | 1N4007 diode (300-0266)            | R 6,8 | 680 ohm 1/4 watt (100-0532)      |
| D 3   | 5.6V zener diode (301-0710)        | R 7   | 1.8K ohm 1/4 watt (100-0728)     |
| FB    | Ferrite beads (10-15168)           | R 9   | 1M ohm 1/4 watt (100-0730)       |
| IC 1  | LM 358 dual op amp (311-0724)      | R 10  | 1K ohm 1/4 watt (100-0727)       |
| Q 1   | NPN transistor MJE 3055 (305-1723) | R 11  | 180 ohm 1/2 watt (101-0384)      |
| Q 2   | PNP transistor 2N3906 (305-0722)   | RLY 1 | Mini relay 12V DC (408-2135)     |

# AL-1500 SCHEMATIC

## Power supply shown wired for 240V operation



| AL-1500 INPUT CHART |                 |                 |                 |
|---------------------|-----------------|-----------------|-----------------|
| BAND                | C5 (PF)         | L1              | C6 (PF)         |
| 160                 | 1300 (208-5177) | 28t (10-13149)  | 2000 (208-5608) |
| 80                  | 1000 (208-5176) | 18½t (10-13191) | 1300 (208-5177) |
| 40                  | 500 (208-5691)  | 11½t (10-13190) | 500 (208-5691)  |
| 20                  | 220 (208-5175)  | 6½t (10-13152)  | 180 (208-5605)  |
| 15                  | 150 (208-5396)  | 3½t (10-13171)  | 150 (208-5396)  |
| 10                  | 150 (208-5396)  | 3½t (10-13171)  | 150 (208-5396)  |

### PARTS LIST

| <u>Designation:</u> | <u>Description:</u>               | <u>Ameritron Part #:</u>                        |
|---------------------|-----------------------------------|---|
| B1                  | Blower                            | 410-3737  |
| C1-3                | .01 uf 50V disc                   | 200-0416  |
| C4                  | 27 pf silver mica                 | 208-5404  |
| C5-6                | See input chart                   |   |
| C7-10               | .01 uf 1KV disc                   | 200-2121  |
| C11-13              | 170 pf doorknob                   | 209-0559  |
| C14-18              | 500 pf doorknob                   | 209-0412  |
| C19                 | 190 pf 4.5KV plate tuning         | 204-2570  |
| C20                 | 800 pf 1.2KV loading              | 204-2573-1                                      |
| C21                 | .001 uf 7.5KV disc                | 200-2122  |
| C22 - 23            | .01 uf 1.4KVDC disc               | 606-1185  |
| D1                  | 1N4005 diode                      | 300-0266  |
| DL1-4               | 12V wire lead meter lamp          | 420-0164  |
| F1-2                | 15A 250V fuse                     | 755-1431  |
| F3                  | 4A 250V fuse                      | 755-1638  |
| 50-01140-1          | Meter board assembly              |   |
| 50-01141-1          | HV rectifier board assembly       |   |
| 50-01142            | PO/ALC detector board assembly    |   |
| 50-01143-1          | HV Filter cap. board assembly     |   |
| 50-01172-1          | Timer/Overload board assembly     |   |
| L1                  | See input chart                   |   |
| L2                  | High frequency coil               | 10-13147  |
| L3                  | Low frequency coil # 10 airdux    | 404-0600  |
| L4                  | "L" coil # 12 airdux              | 404-0601  |
| M1                  | Multimeter 1 mA 300 ohm           | 400-2602  |
| M2                  | Grid meter 1 mA 300 ohm           | 400-2603  |
| R1                  | 33 ohm ¼w resistor                | 100-0403  |
| R2                  | 100K ohm ½w resistor              | 105-1341  |
| R3                  | 10 ohm 12W resistor               | 103-9701  |
| RFC1                | Filament choke                    | 10-15115  |
| RFC3                | Plate choke                       | 10-15139  |
| RFC4                | 2.5 mH choke                      | 402-1162  |
| RLY1                | 3 PDT 10A 12V DC relay            | 408-6139  |
| RLY2                | SPDT 120V AC relay                | 408-4700  |
| RLY3                | 2 PST 30A 12V DC relay            | 408-2588  |
| S1                  | 6KV @ 20A bandswitch              | 500-3557  |
| S2-4                | Rocker switch                     | 503-1147  |
| S5                  | Interlock switch                  | 504-3247  |
| T1                  | 5.1V filament/control transformer | 406-1419-3J                                     |
| T2                  | HV plate transformer              | 406-1418-1D(AL-1500/X)<br>406-1418-1J(AL-1500J) |
| V1                  | 3CX1500/8877 tube                 | 350-0590  |
| ZD1-2               | 7.5V 10W zener diode              | 301-8597  |