TEMPO 2001

OPERATING AND MAINTENANCE MANUAL

2000 WATT INPUT, 3.5 TO 30 MHZ,

AMATEUR BAND LINEAR AMPLIFIER

11240 West Olympic Boulevard Los Angeles, California 90064 Henry Radio

2001 SPECIFICATIONS

▪ TYPE AND FUNCTION OF EQUIPMENT — The Tempo 2001 is a 2000 watt PEP (1200 watt nominal output) one stage linear amplifier using air cooled, highly linear, grounded-grid triodes. The 2001 operates on all amateur bands between 3.5 and 30 MHz.

▪ FREQUENCY RANGE — All of the amateur bands between 3.5 and 30 MHz.

80 Meters	3.500 to 3.750 MHz
75 Meters (F)	3.750 to 4.000 MHz
40 Meters (CW)	7.000 to 7.150 MHz
40 Meters (F)	7.150 to 7.300 MHz
20 Meters	14.000 to 14.350 MHz
15 Meters	21.000 to 21.450 MHz
10 Meters	28.000 to 29.700 MHz

▪ TUBE COMPLEMENT — Two Eimac 8874 grounded grid triodes. One 6FG6 RF Output Indicator.

▪ TUBE COOLING — Forced air cooling.

▪ TYPE OF EMISSION — SSB, CW.

▪ DUTY CYCLE — 100% SSB or CW, 50% key down.

▪ POWER REQUIREMENTS — 230 VAC, 50/60 Hz 15 amps or 115 VAC, 50/60 Hz, 30 amps.

▪ DRIVE POWER REQUIRED — 75 watts.

▪ INPUT POWER — 2 kilowatts PEP SSB — 1 kilowatt CW.

▪ OUTPUT POWER — 1200 watts PEP SSB, 550 watts CW.

▪ PLATE POWER DISSIPATION — 600 watts.

▪ OUTPUT IMPEDANCE — 52 ohms unbalanced with SWR not to exceed 2:1.

▪ INPUT IMPEDANCE — 52 ohms.

▪ HARMONIC AND OTHER SPURIOUS RADIATION — Second Harmonic: —40 db. Third Order Distortion: —35 db at full power output.

▪ NOISE LEVEL — —40 db or better below one tone carrier at 1 kilowatt.

▪ ALC CIRCUIT — Prevents overdrive from today's high power amplifiers and boosts average talk power.

▪ PROTECTIVE DEVICES — High voltage shorting switch on cabinet. Other protective devices include a 15 amp circuit breaker on the AC line, a cathode fuse, a relay supply fuse, and a warmup delay relay.

▪ METERING — MULTIMETER — 0-1 amp (I_p - plate current), 0-100 ma (I_g - Grid Current), 0-5000 VDC (HV - High Voltage), Relative Power Output Indicator.

▪ DIMENSIONS — Approximately 7" high x 14" wide x 14" deep.

▪ WEIGHT — Approximately 36 pounds. Shipping weight: 41 pounds.

▪ FRONT PANEL CONTROLS — Multimeter and Multimeter Switch, Band Switch, Tune and Load controls, 2 pilot lights, relative power output indicator.

▪ REAR PANEL CONTROLS — ALC adjust and output, relay control, RF input, Cathode fuse, RF output.

WARRANTY

Henry Radio warrants each new product sold by it to be free from defective material and workmanship and agrees to remedy any such defect or to furnish a new part in exchange for any part of any unit which under normal installation, use, and service discloses such defect, provided the unit, or part, is delivered by the owner to us intact for our examination, with all transportation charges prepaid to our factory, within ninety days from the date of sale to the original purchaser and provided that such examination discloses in our judgment that it is thus defective. Should a malfunction be suspected, write in detail to our service department for suggestions concerning the operation, repair, or return of your unit if it should prove necessary.

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Any part of a unit approved for remedy or exchange hereunder will be remedied or exchanged by Henry Radio without charge to the owner. This warranty is in lieu of all other warranties expressed or implied and no representative or person is authorized to assume for us any other liability in connection with the sale of our products.

Henry Radio reserves the right to make any improvements to its products which it may deem desireable without obligation to install such improvements in its previously sold products.

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OWNER'S NOTES

TABLE 1. Calibration Table. Serial Number ______________

The figures inserted at the factory are approximate settings for a 52 ohm load with an SWR of 1:1.

FACTORY DATA		SSB			CW		
BAND	FREQUENCY	TUNE	LOAD	OUTPUT	TUNE	LOAD	OUTPUT
80 CW	3.600 MHz	+++	+++	+++	0.70	48	500
75 F	3.900 MHz	2.15	60	1200	+++	+++	+++
40 CW	7.100 MHz	+++	+++	+++	10.15	20	500
40 F	7.200 MHz	9.90	55	1200	+++	+++	+++
20	14.100 MHz	+++	+++	+++	12.20	45	500
	14.200 MHz	12.05	70	1200	+++	+++	+++
15	21.100 MHz	+++	+++	+++	13.60	35	550
	21.200 MHz	13.30	65	1200	+++	+++	+++
10	28.100 MHz	+++	+++	+++	14.70	60	550
	28.500 MHz	14.10	85	1200	+++	+++	+++

USER DATA		SSB			CW		
BAND	FREQUENCY	TUNE	LOAD	OUTPUT	TUNE	LOAD	OUTPUT
80 CW		+++	+++	+++			
		+++	+++	+++			
		+++	+++	+++			
75 F					+++	+++	+++
					+++	+++	+++
					+++	+++	+++
40 CW		+++	+++	+++			
		+++	+++	+++			
		+++	+++	+++			
40 F					+++	+++	+++
					+++	+++	+++
					+++	+++	+++
20							
15							
10							

This table has the factory calibration data for this amplifier. Note that the position of the TUNE and LOAD controls vary greatly at the same frequency of operation according to the type of emission selected. The amplifier is loaded much more heavily during SSB emission than during CW emission. There is a column in the table for TUNE and LOAD settings for SSB and for CW operation.

After you have correctly tuned the 2001 to one of your frequent operating frequencies, record the control settings in the table for future reference. These values should hold constant as long as the load does not change. The factory data is only an approximation to aid in tuning the amplifier the first time and the actual readings can vary considerably, depending on the load.

SECTION 1 INTRODUCTION

The Tempo 2001 is a sophisticated one-stage linear amplifier using two ultra-linear, hi-mu, grounded grid triodes. The 2001 is a genuine table top, 2000 watt PEP amplifier which stresses reliability and high component quality in its design. The 2001 is designed for SSB and CW emission on all amateur bands between 3.5 and 30 MHz. The amplifier comes factory wired for operation from a 230 VAC line but may be easily rewired for 115 VAC operation. Please read this manual to familiarize yourself with the 2001 before attempting operation

CAUTION

There are dangerously high voltages present inside the 2001 whenever the power switch is in the ON position. Please do not remove the top cover without exercising the utmost caution.

SECTION 2 INSTALLATION

2.1 UNPACKING

Remove the amplifier from its shipping carton and packing material and examine it carefully for visible damage. If the linear has been damaged in shipment, save the box and packing material and notify the transportation company immediately. It is a good idea to save the box and packing material in any case because the box is expensive to replace and very useful for shipping and moving the amplifier. The 2001 is shipped fully assembled, so to get on the air, simply place the amplifier in a proper location, connect the cables as described, and be sure to fully understand the operating instructions.

The following accessories should be included with the 2001.

- 1 Instruction Manual
- 1 Warranty Card
- 1 PL-259 Coaxial Connector
- 1 RF Input Cable (RG-58)
- 2 Shielded Control Cables
- 5 3 AG, 6 ampere fuses
- 5 8 AG, 1.5 ampere fuses

2.2 OPERATING LOCATION

The 2001 may be located wherever desired as long as it has an adequate air supply for its cooling system and an adequate power source for operation. If either the top of the cabinet is covered or the blower inlet on the bottom is blocked, tube damage will result. Make certain that there is always adequate airspace around the amplifier.

2.3 CABLING

All of the following cables must be connected before operation of the amplifier.

POWER CABLE

The 2001 comes from the factory wired for operation from a 230 VAC, single-phase, 50/60 Hz power source. The green wire in the power cord is neutral and should be connected to the neutral wire of the power source, or to ground. The black and the white wires should be connected to the 230 VAC line.

CAUTION

The amplifier will be damaged if the green wire is not wired correctly.

For 115 VAC operation, refer to the rewiring instructions in Section 6.6. A power plug has not been included with the amplifier because there are several different types of 230 VAC power outlets in use.

ANTENNA

Use only RG-8/U coaxial cable (or its equivalent) to connect the 2001 to the antenna. A type PL-259 coax connector is included in the accessory kit. Prepare the cable and connector as described in Figure 1. The PL-259 mates with the jack marked ANTENNA on the rear panel of the 2001.

CAUTION

Do not operate the 2001 without a load or into a load with an SWR greater than 2:1. Measure the antenna's SWR on all of the bands to be used. Measure the SWR with an SWR meter and the exciter before operating the 2001.

RF IN

The RG-58A/U input cable connects to the RF IN connector on the back of the amplifier. This connector is the BNC jack. The other end of the cable is terminated by an RCA phono plug and should be inserted in the RF output connector of the exciter. An adapter may have to be used if the exciter does not have a matching socket.

ALC (Automatic Level Control)

Plug the gray ALC cable into the ALC OUT phono socket on the back panel of the 2001 and into the ALC socket of the exciter. If the exciter does not have provision for feedback of ALC voltage from the amplifier, simply ignore the amplifier's ALC socket and cable.

RELAY

The gray relay control cable should be plugged into the RCA phono socket marked RELAY on the rear panel of the amplifier. This cable conducts the keying signal from the exciter to switch the 2001 to the transmit condition. The cable should be plugged into the phono socket marked Antenna Relay (or its equivalent) on the exciter. The exciter need only supply a shorting relay contact to ground to key the 2001.

CAUTION

Do not apply any voltage to the RELAY jack. The 2001's internal relay is activated by a self-contained relay supply.

When the 2001 is driven by an exciter without an antenna relay socket, it may be necessary to examine the circuit diagram of the exciter to find an available unused relay contact that is normally open in the receive condition. All current SSB transmitters and transceivers have a relay contact at a terminal board or jack on the back panel.

SECTION 3 OPERATING CONTROLS

3.1 FRONT PANEL CONTROLS

OFF-ON SWITCH (1 on Figure 2)

This 15 amp circuit breaker serves to protect the primary circuits of the 2001 as well as turning the primary power on and off.

MULTIMETER SWITCH (2 on Figure 2)

This four-position rotary switch selects the function of the multimeter as described below:

EXC ONLY — With the switch in this position the exciter feeds through the 2001 to the antenna. The multimeter is not connected in this position and the 2001 can not be keyed. The exciter automatically feeds straight through to the antenna when the amplifier is turned off regardless of this switch's position.

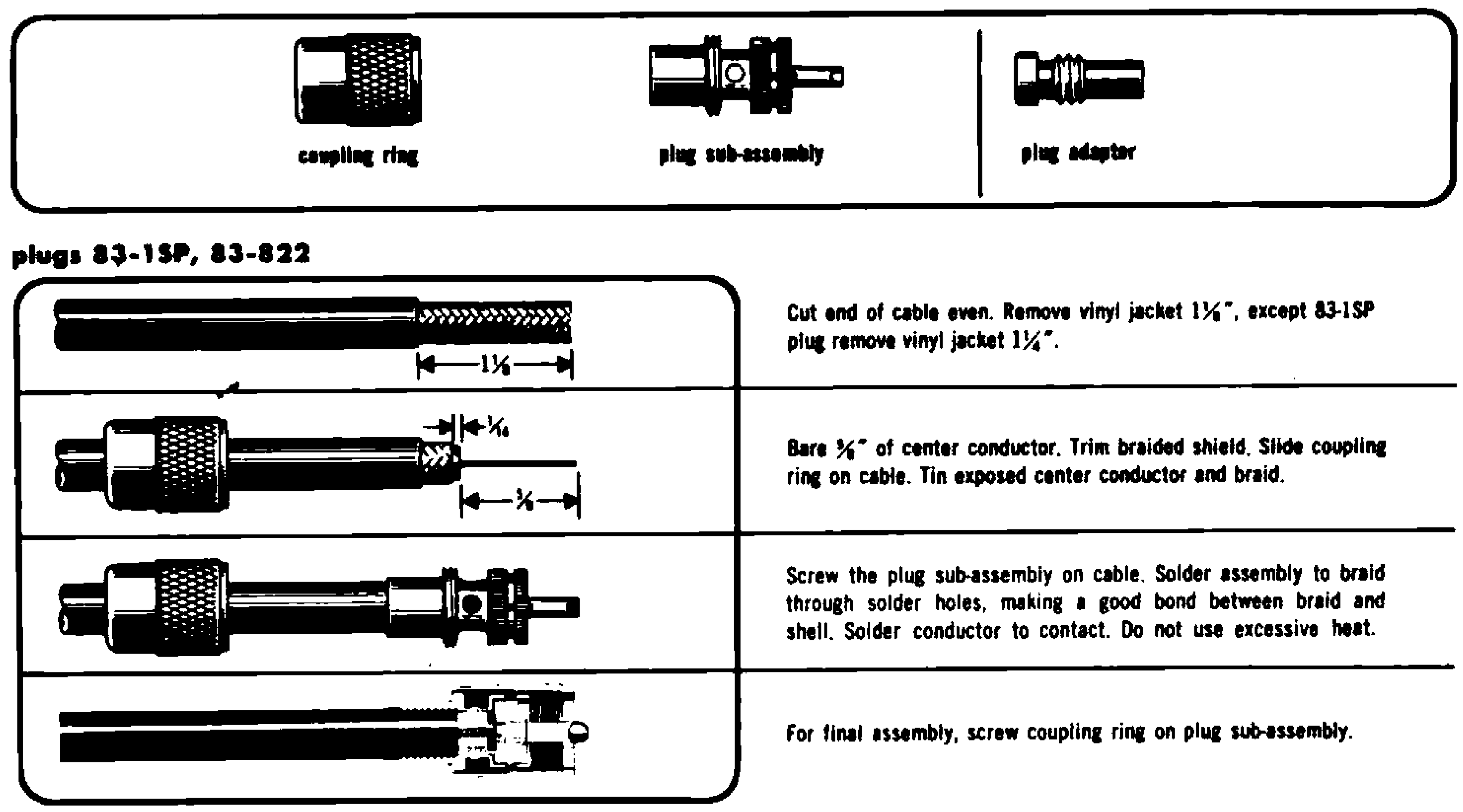
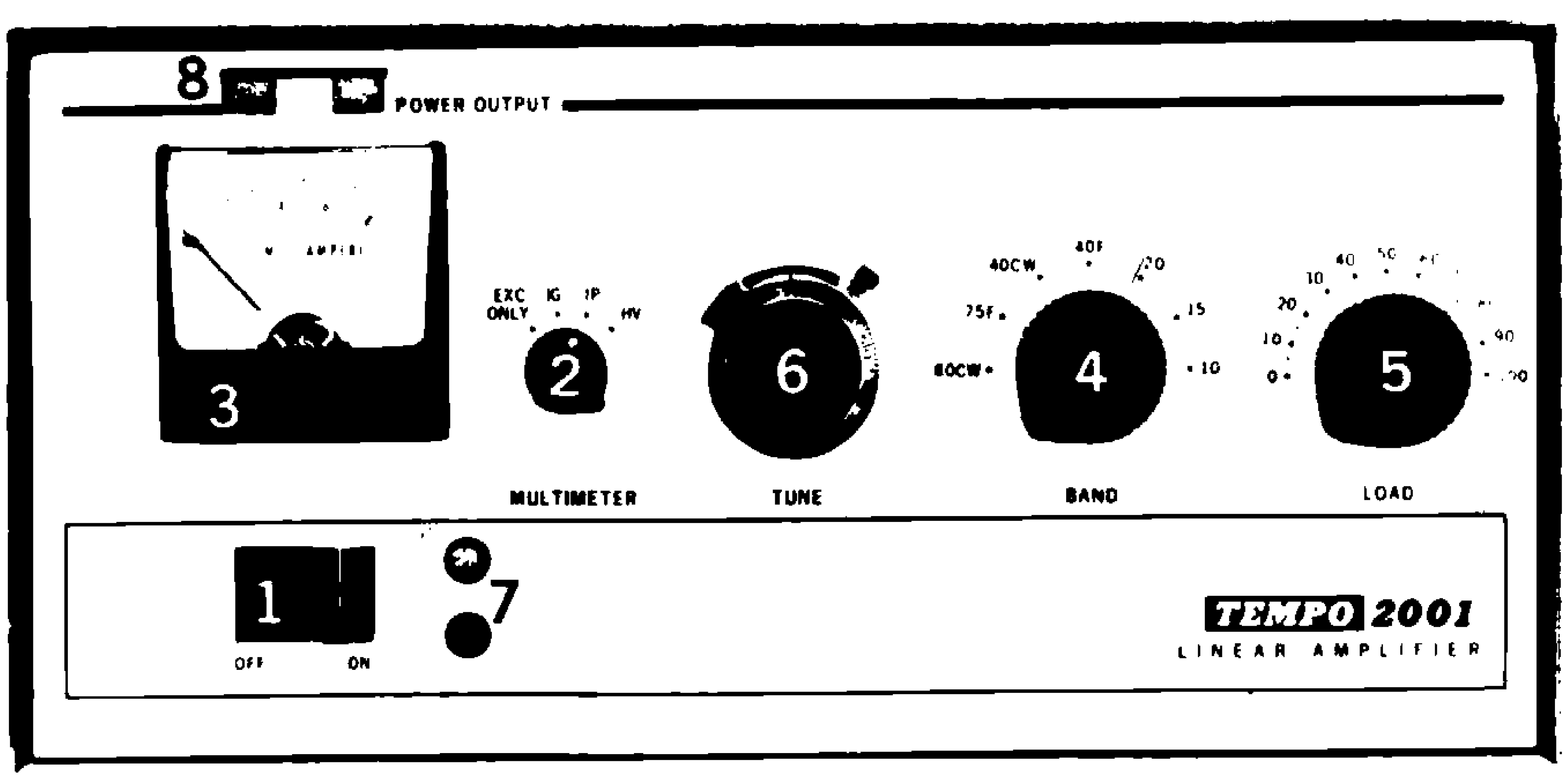


FIGURE 1. Assembly Instructions for a PL-259 Coax Connector.



1. OFF-ON Switch
2. MULTIMETER Switch
3. Multimeter
4. BAND Switch
5. LOAD Control
6. TUNE Control
7. Pilot Lights
8. Relative Power Indicator

FIGURE 2. 2001 Front Panel Controls.

IG — With the switch in this position, the meter monitors the amplifier's grid current. The full scale meter reading in this position is 100 ma DC. The 8874 tubes may be damaged if the grid current exceeds 80 ma for any length of time.

IP — With the switch in this position, the meter monitors the amplifier's plate current. The full scale meter reading in this position is 1 amp DC. Normal resting current (at zero drive) is .04 to .08 amps.

HV — With the switch in this position, the meter monitors the amplifier's high voltage. The full scale reading in this position is 5000 VDC. Normal plate voltage with the 2001 in stand-by is 2300 to 2500 volts. At full output the voltage will be between 1700 and 2000 volts. Note that line voltage variations will cause corresponding variations in the plate voltage.

MULTIMETER (3 on Figure 2)

This meter can be used to monitor several of the amplifier's operating parameters as described above. For normal operation, leave the meter in the IP position to monitor the amplifier's plate current.

BAND SWITCH (4 on Figure 2)

The BAND switch selects the necessary circuits for the amplifier to operate in any one of the following frequency ranges.

80 CW	3.500 to 4.000 MHz	CW Only
75 F	3.775 to 4.000 MHz	SSB Only
40 CW	7.000 to 7.300 MHz	CW Only
40 F	7.150 to 7.300 MHz	SSB Only
20	14.000 to 14.350 MHz	
15	21.000 to 21.450 MHz	
10	28.000 to 29.700 MHz	

Never move the BAND switch when the 2001 is in the key down, transmitting condition.

TUNE CONTROL (6 on Figure 2)

The TUNE control is a 15 turn vernier dial connected to the variable inductance tank coil. The vernier reading can be used in conjunction with the value given in the calibration table to adjust the tank coil for the approximate tuning range to be used. A vernier reading of 14.99 (maximum clockwise rotation) corresponds to minimum tank coil inductance and the highest tank circuit frequency.

LOAD CONTROL (5 on Figure 2)

This control matches the 2001's output network to the load. Refer to the calibration table for approximate initial settings for the frequency range desired. A LOAD control setting of 0 corresponds to minimum loading and maximum load capacitor mesh.

PILOT LIGHTS (7 on Figure 2)

When the 2001 is first turned on, the bottom pilot light will illuminate indicating that the power supply is on

CAUTION

Lethal high voltage is present inside the 2001 whenever the power switch is in the ON position, even when only one pilot lamp is lighted.

When only the bottom pilot light is on, the 2001 is in the warm-up mode and can not be keyed. When the 60 second warm-up period is complete, the top pilot light will illuminate to indicate that the 2001 is ready for operation and can be keyed.

RELATIVE POWER INDICATOR (8 on Figure 2)

This electron ray type indicator shows the power output of the 2001. As power output increases, the two beam halves move closer towards one another.

3.2 REAR PANEL CONTROLS

RELAY (1 on Figure 3)

This RCA phono socket is marked RELAY. When this socket is short-circuited, the 2001 antenna relay closes, unless the MULTIMETER switch is in the EXC ONLY position. Never apply any voltage to this socket.

ALC ADJ. (2 on Figure 3)

This potentiometer controls the sensitivity of the 2001's ALC circuit. Refer to Section 4.4 for the adjustment procedure.

ALC OUT (3 on Figure 3)

This socket accepts an RCA phono plug. The ALC feedback to the exciter is available here.

RF IN (4 on Figure 3)

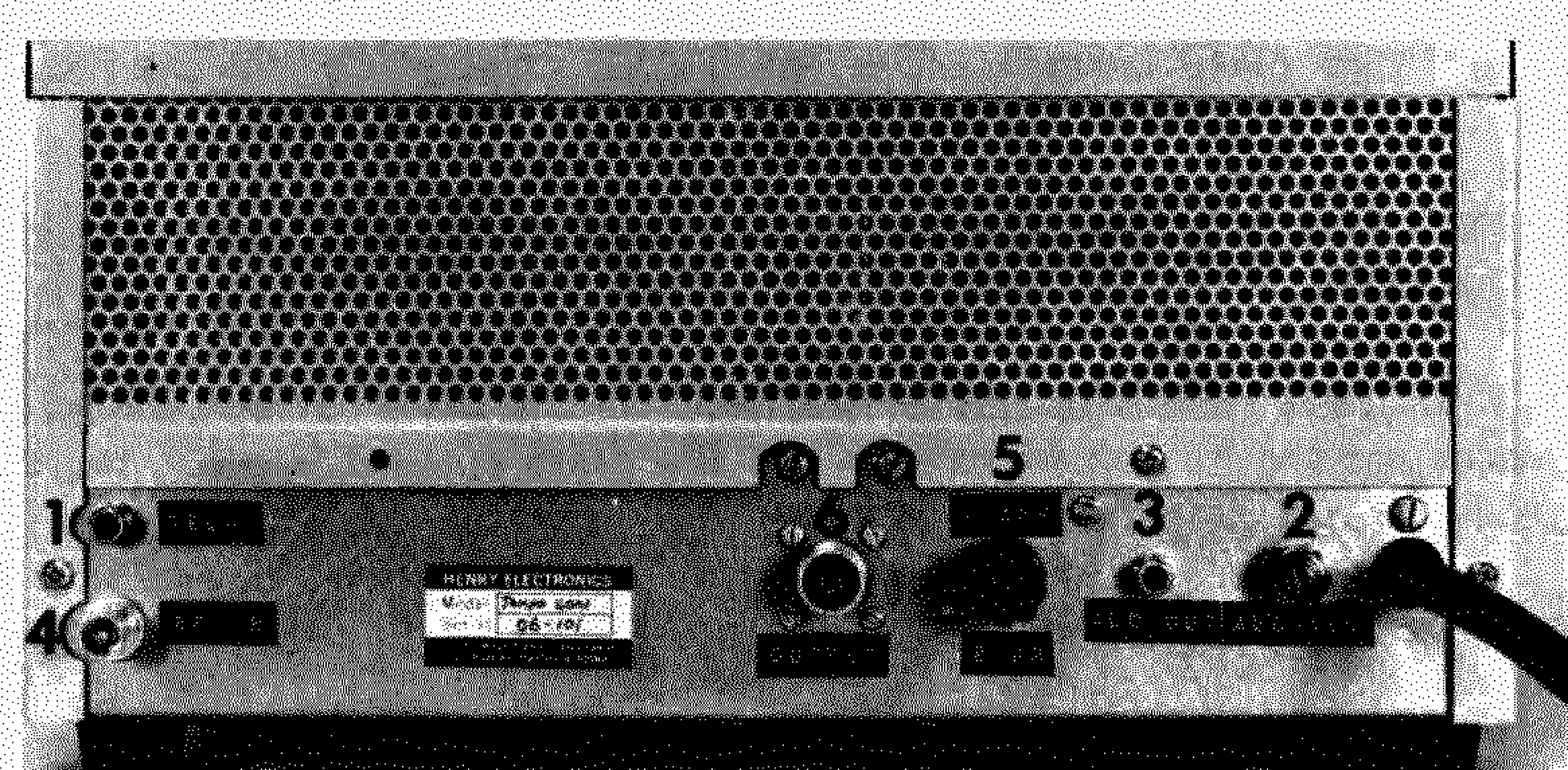
This BNC coax connector accepts the drive line from the exciter. The 2001's impedance is 50 ohms.

8 AG, 1.5 AMP (5 on Figure 3)

This is the cathode fuse. Never use a higher amperage fuse than the one specified.

ANTENNA (6 on Figure 3)

The 2001's output impedance is 50 ohms nominal. Do not operate the 2001 without a load or into a load with an SWR more than 2:1. Use only RG-8/U coax (or its equivalent) to connect this SO-239 connector to an appropriate antenna or dummy load.



1. RELAY
2. ALC ADJ.
3. ALC OUT
4. RF IN
5. 8 AG, 1.5 AMP
6. ANTENNA

FIGURE 3. 2001 Rear Panel Controls.

SECTION 4 OPERATION

4.1 PRELIMINARY SETTINGS

Tune the exciter to the desired operating frequency and then turn its drive to zero.

CAUTION
Exciter drive exceeding 100 watts may damage the 2001's 8874 tubes.
Please read all of the instructions before operating the amplifier.

Turn the MULTIMETER switch to the EXC ONLY position and then turn the power switch to ON. The lower pilot light will illuminate, indicating that the power supply is on. Please remember that the full high voltage is present inside the amplifier whenever the power switch is turned on.

Check for blower operation by feeling for the air stream coming out the top of the amplifier cabinet near the output tubes. If the blower is not operating, DO NOT ATTEMPT TO TRANSMIT. The tubes will be destroyed.

After approximately 60 seconds of warm-up, the upper pilot light will come on to show that the 2001 is ready for operation. Check for an HV multimeter reading of 2300 to 2500 VDC.

Refer to the Calibration Table. Set the TUNE and LOAD controls to the values interpolated from the factory calibration data or from your own notes for the desired frequency. Now turn each control slightly lower. This will make the tuning procedure easier.

Set the BAND switch to the desired band and turn the MULTIMETER switch to IP.

4.2 SSB OPERATION

CAUTION
During these tune-up procedures the 2001 is operated at power levels well in excess of its normal ratings. To avoid tube damage, key the amplifier for only 10 seconds MAXIMUM at a time. Allow AT LEAST 10 seconds for the tubes to cool off between each period of key down tuning.

Drive the 2001 to .3 amps of plate current. Use the TUNE control to dip the plate current (tune for minimum plate current and/or maximum closure on the relative output indicator).

Switch the MULTIMETER switch to the IG position and readjust the exciter's drive control for 60 to 70 ma of grid current in the 2001.

1— Switch the MULTIMETER switch to the IP position. If the plate current is now less than 1 amp, increase the LOAD control setting in one small step. If the plate current is more than one amp, decrease the LOAD control setting in one small step.

2— Redip the plate current with the TUNE control.

3— Switch the MULTIMETER switch to the IG position. Readjust the exciter's drive level to return the 2001's grid current to 60 to 70 ma.

Repeat steps 1 through 3 above until the following operating parameters are reached:

IG = 60 to 70 ma, IP = 1 amp, and the TUNE control is adjusted for a plate current dip.

This completes the tune-up procedure for SSB operation of the 2001. When transmitting, adjust the exciter's drive control so that voice peaks do not exceed .5 amps of plate current in the 2001. This will assure speech clarity in the transmitted signal.

4.3 CW OPERATION

First complete the procedure described in Section 4.1.

CAUTION

Remember, 10 seconds or more of tube cooling for each 10 second tune-up period.

Drive the 2001 to .3 amps of plate current. Use the TUNE control to dip the plate current (tune for minimum plate current and/or maximum closure on the relative output indicator).

Switch the MULTIMETER switch to IG and readjust the exciter's drive control for 70 to 80 ma of grid current in the 2001.

(1)— Switch the MULTIMETER switch to IP. If the plate current is less than .5 amp, increase the LOAD control in one small step. If the plate current is greater than .5 amp, decrease the LOAD control setting in one small step.

(2)— Redip the plate current using the TUNE control.

(3)— Switch the MULTIMETER switch to the IG position. Readjust the exciter's drive level to return the 2001's grid current to 70 to 80 ma.

Repeat steps 1 through 3 above until the following operating parameters are reached:

IG = 70 to 80 ma, IP = .5 amp, and the TUNE control is adjusted for a plate current dip.

This completes the tune-up procedure for CW operation of the 2001. The amplifier must not be held in a key-down condition for more than 50% of the time. If the operator exercises reasonable care, he will be able to run the 2001 in the CW mode on a continuous duty basis.

4.4 ALC ADJUSTMENT

The 2001 is shipped with the ALC ADJ. potentiometer fully clockwise (off). The ALC adjustment need only be made once unless the 2001 is going to be used with a different exciter. So after the ALC adjustment is made, use the locknut on the potentiometer shaft to lock the adjustment in place.

With the ALC ADJ. pot in the fully clockwise position, tune the 2001 for SSB operation. Drive the amplifier to 1 amp of plate current and then rotate the ALC ADJ. pot counter-clockwise until the plate current just begins to decrease. If the exciter can not drive the 2001 to 1 amp of plate current, leave the ALC ADJ. potentiometer in the fully clockwise position.

The ALC will prevent overdrive from high powered exciters when it is adjusted properly. For the cleanest, sharpest signals, avoid driving the plate current above .5 amp on voice peaks. (For sharpest adjusting accuracy, use a two tone generator and an oscilloscope.)

SECTION 5 CIRCUIT DESCRIPTION

The 2001 power transformer has two separate 115 volt primary windings which may be wired in series for 230 VAC operation or in parallel for 115 VAC operation. The 1000 volt secondary winding output is rectified in a voltage doubler circuit. Electrolytic filter capacitors with voltage equilizing bleeder resistors serve as the filtering network. Another secondary winding provides 6.3 volts for the tube filaments and 12 volts for the relay supply.

When the 2001 is first turned on, RY1, the warm-up relay, blocks the relay supply voltage preventing actuation of the transmit relay RY2. After approximately 60 seconds RY1 closes, illuminating the top pilot light and providing voltage to the transmit relay circuit. The relay supply is fuse protected.

The BAND switch selects the appropriate input coil and the correct tank circuit padding capacitor. The adjustable input network provides an optimum match between the 2001 and its exciter for each band.

The output tubes are operated in a grounded grid configuration with 10 volts positive bias on their cathodes. The 2001 utilizes a Pi-type output circuit with a variable inductance tank coil. An electron ray indicator tube serves as a relative output power indicator by sampling the 2001 output near the antenna connector.

The tubes are protected by a fast-acting 1.5 AMP cathode fuse. The transformer and primary circuits are protected by a 15 ampere double-pole circuit breaker. The relay supply is protected by a 6 ampere fuse. A shorting strap grounds the high voltage whenever the top cover is removed.

SECTION 6 MAINTENANCE AND ADJUSTMENTS

6.1 ADJUSTMENT OF THE GRID CURRENT READING

The grid current calibration potentiometer has been factory adjusted and should not require attention. If however, the operator considers the metering circuit to be out of adjustment, proceed as follows:

Remove the top cover of the amplifier.

Remove R4 from ground and insert a 0-1 ampere test meter between the resistor and ground with the negative side of the meter to ground. Note that a low impedance meter must be used if this adjustment is to be accurate.

Switch the 2001 on and turn the MULTIMETER switch to the IG position.

CAUTION
Dangerous high voltage is exposed. Proceed with extreme caution.

Tune the 2001 for SSB operation on any frequency.

Advance the exciter's drive control for a test meter reading of .08 ampere then adjust R4 as shown in Figure 4 until the MULTIMETER reading is exactly 10 times greater than the test meter reading.

Turn the 2001 off. Wait for the high voltage to bleed down and then remove the test meter and reconnect R4) to ground.

Replace the top cover.

6.2 ADJUSTMENT OF THE PLATE CURRENT READING

The plate current calibration potentiometer has been factory adjusted and should not require attention. If the operator considers the metering circuit to be out of adjustment, proceed as follows:

Remove the top cover of the 2001.

Unsolder the red high voltage lead which comes out of the wiring harness and is connected to the filtering network. See C on Figure 4.

Insert a 0-1 ampere DC test meter between the filter bank and the high voltage lead with the positive side of the meter towards the filter bank. Note that the test meter will be at approximately 2500 volts above ground. BE CAREFUL.

CAUTION
The high voltage is exposed and dangerous.

Drive the amplifier to .5 amps of plate current on the test meter.

Switch the MULTIMETER switch to the IP position and adjust R11 as shown in Figure 4 until the multimeter and test meter agree.

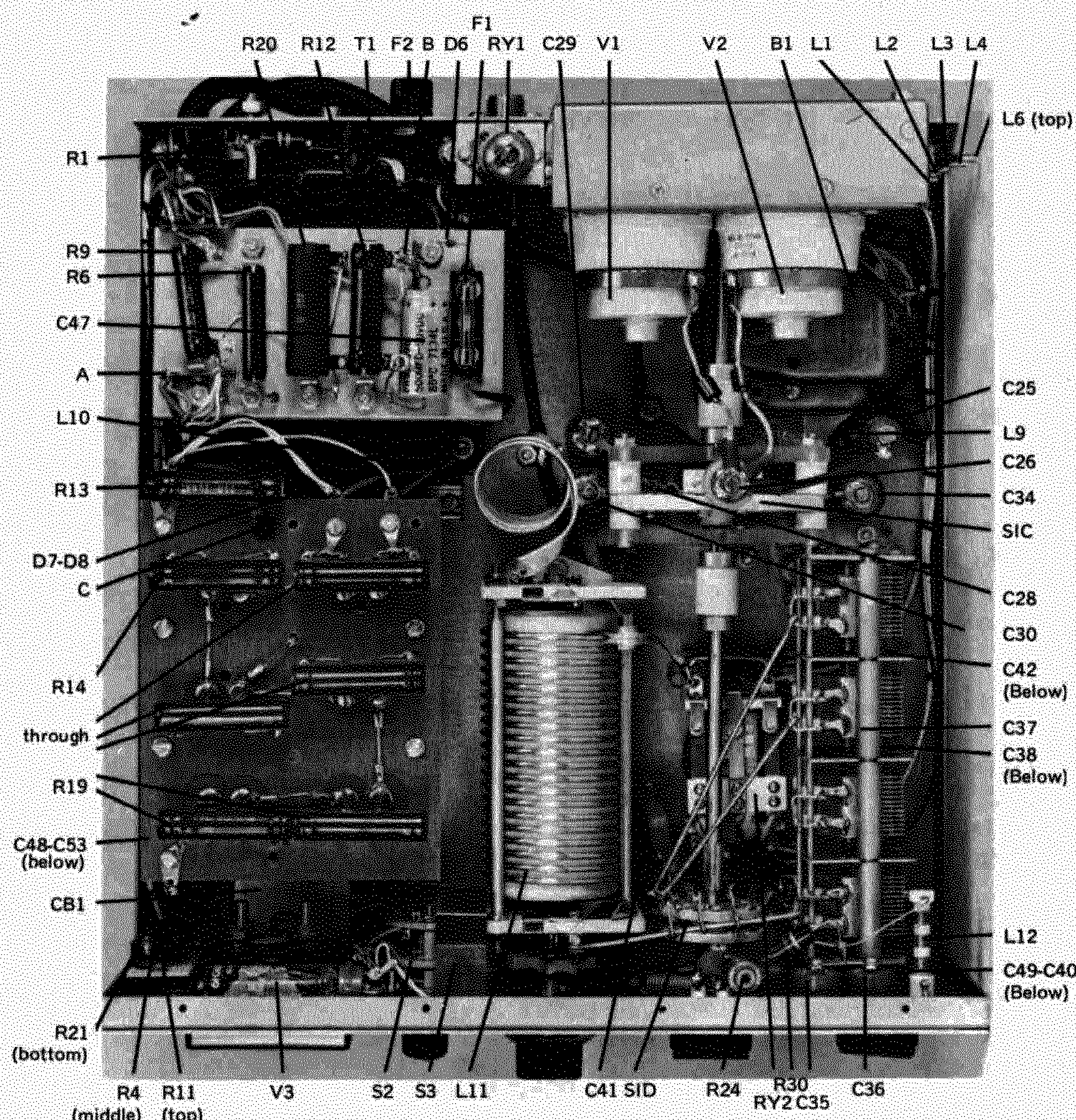
Turn the 2001 off and wait for the high voltage to bleed down. Remove the test meter and resolder the high voltage lead to the filtering network. Replace the 2001's top cover.

6.3 ADJUSTMENT OF THE PLATE VOLTAGE READING

The plate voltage calibration potentiometer has been factory adjusted and should not require attention. If the operator considers the metering circuit to be out of adjustment, proceed as follows.

Remove the top cover of the amplifier and insert a 0 to 3000 VDC (or more) test meter between the anode of an 8874 and ground. Turn the 2001 on and switch the MULTIMETER switch to HV.

CAUTION
Lethal high voltage is exposed. Exercise EXTREME caution.



Input Coil Frequencies
L1 - 10 meters (Bottom Coil)
L2 - 15 meters
L3 - 20 meters
L4 - 40 meters
L5 - 80 meters (Top Coil)

FIGURE 4. 2001 Parts Diagram.

Adjust R21 (see Figure 4) until the multimeter and the test meter readings agree. Turn off the 2001 and wait for the high voltage to bleed down. Remove the test meter and replace the top cover of the amplifier.

6.4 ADJUSTMENT OF THE RELATIVE POWER INDICATOR

The relative power indicator has been factory adjusted and should not require attention. If the operator considers the indicator to be out of adjustment, proceed as follows.

Remove the 2001's top cover, turn the amplifier on, and tune it for SSB operation on either the 10 meter band or the highest frequency band used.

CAUTION
Lethal high voltage is exposed. Exercise EXTREME caution.

Drive the amplifier to 1 amp of plate current and then adjust R24 (see Figure 4) until the two halves of the indicator just meet. Turn off the 2001 and replace the top cover.

6.5 ADJUSTMENT OF THE INPUT COILS

The input coils have been factory adjusted for the amateur bands and should not require attention. The amplifier will operate on frequencies within about ±2% of the band limits without retuning the coils. By retuning the input coils the amplifiers can be retuned for frequencies about ±5% of the band limits. Remove the top cover of the amplifier and insert an SWR bridge in the drive cable between the exciter and the 2001. Turn on the 2001 and tune it for SSB operation on the band to be adjusted. There is only one input coil for the 75 and 80 meter bands.

CAUTION
Lethal high voltage is exposed. Exercise EXTREME caution.

Drive the 2001 to 1 amp of plate current and then adjust the appropriate input coil for minimum power reflected back into the exciter (see Figure 4 for coil locations). Turn the 2001 off, replace the top cover and remove the SWR bridge from the drive line.

6.6 REWIRING THE 2001 FOR 115 VAC OPERATION

Remove the white wire from terminal 4 of the power transformer (T1) and reconnect it to terminal 1. Remove the buss-wire jumper between terminals 2 and 3. Remove the green wire and the black/white wire from the terminal strip on the relay supply plate mounted on T1. Solder both of the wires to terminal 4 of the transformer.

Use 14 guage buss wire with spaghetti insulation to jumper terminal 1 to terminal 3 on the transformer. Then jumper terminal 2 to terminal 4 in the same way. The connections to the 115 VAC line should be made in the following way. Connect the green wire to one side of the line and connect the black and the white wire together to the other side of the line.

6.7 REPLACEMENT OF TUBES, PILOT LIGHTS, AND WARM-UP RELAY

REPLACEMENT OF THE OUTPUT TUBES

Remove the stainless steel screw holding the two plate leads and the high voltage lead to the top of C26 (see Figure 4). Slide the teflon air deflector out from under the tubes and remove both plate contacting rings by sliding them off the tops of the tubes.

Rock the tubes gently out of their sockets. Note that if a chimney breaks loose it will be necessary to reattach it to the tube chassis. Instructions for reattaching the chimneys are given below. Install the new tubes and make sure that they are fully seated in their sockets. Replace the plate contacting rings, slide the air deflector back into place, and reconnect the high voltage and plate leads with the same stainless steel screw. A non-magnetic screw must be used for this connection.

REPLACEMENT OF THE PILOT LIGHTS (EFJ 147-2203-302)

If one of the pilot lights burns out, grasp the lip on the front edge of the bulb case with the thumb and fingernail and pull the case out, away from the panel. Remove the two slip-on connectors from the pins on the base of the bulb. Slide the connectors onto the new bulb and press the new bulb into the panel until it is flush.

REPLACEMENT OF THE WARM-UP RELAY (Amperite 115NO60T)

Remove the top cover of the 2001 and remove the warm-up relay from its 9-pin socket near the rear of the amplifier (see Figure 4). Install the new relay and replace the top cover.

REPLACEMENT OF THE RELATIVE OUTPUT INDICATOR TUBE

Remove the 2001's top cover and remove the old tube from its 9-pin socket behind the front panel. Install the new tube and then proceed with the relative output power indicator adjustment procedure described in Section 6.4.

REATTACHING THE OUTPUT TUBE'S CHIMNEYS

Make sure that the tube is correctly seated in its socket. Apply a liberal coating of silicone rubber sealant to the bottom edge of the chimney and slide it over the tube. Clamp the chimney in place until the sealing compound has cured. Note that excessive pressure should not be used as the tube chassis will be deformed.

SECTION 7 TROUBLESHOOTING

7.1 RESISTANCE MEASUREMENTS

Disconnect the 2001 from its power source and turn the power switch to OFF. Remove all of the cables from the rear panel and set the BAND switch to 80 CW.

MEASURING POINT	RESISTANCE
Output tube anode to ground	60 K ohms
Relay supply filter network (point B on Figure 4) to ground	15 ohms
Across the power transformer (T1) secondary	18 ohms
Depress the antenna relay manually and measure the resistance across the antenna connector.	25 ohms

7.2 VOLTAGE MEASUREMENTS

Plug the amplifier into a power source, remove all other cabling, and turn the power switch to ON. Make the voltage measurements after the amplifier has warmed up. All voltages are measured with respect to chassis ground except line voltage.

FUNCTION	MEASURING POINT	VOLTAGE
Line voltage	Power source	240 VAC
High Voltage	Output tube anode	2400 VDC
Filament Voltage	Point A on Figure 4.	6.34 VAC
Relay Supply Voltage	Point B on Figure 4.	14 VDC

7.3 TROUBLESHOOTING CHART

The following chart is designed to help the operator find and remedy possible service problems.

SYMPTOM	CAUSE	REMEDY
Power switch will not stay on.	High voltage short. D7-D8 shorted. Filter network partially or fully shorted. Short in the high voltage line. Primary circuit short. T1 wired incorrectly. T1 defective. Blower defective. Defective circuit breaker. 2001 not correctly wired to power source.	 Replace the diode. Repair the circuit. Examine for charring or other evidence of an arc. Examine T1's wiring. Replace T1. Replace blower. Replace the circuit breaker. Check power plug wiring.
Lower pilot light will not come on.	Pilot light is burned out. No relay supply voltage. F1 blown. D6 defective. T1 defective. Short circuit in the relay supply filter network.	Replace the pilot light. Replace the fuse and determine why it blew Replace the diode. Replace T1. Repair the circuit.
Upper pilot light will not come on after 60 seconds.	Pilot light is burned out. RY1 is defective.	Replace the pilot light. Replace the relay.
Low HV, high HV, or no HV reading on multimeter.	Defective meter. R21 out of adjustment. No high voltage. Defective D7-D8 Defective T1. Defective multimeter switch. Defective bleeder resistors, R14 through R20.	Replace the meter. See Section 6.3. Replace the diode. Replace T1. Replace S3. Replace the defective resistor.
High voltage arc.		Check for charring or other evidence of an arc to deter- the cause of the flash-over.
No resting current when the 2001 is keyed and the HV reading is normal.	RY2 is defective. R11 requires adjustment.	Replace the antenna relay. See Section 6.2.
Negative grid current with exciter drive.	Weak or defective 8874 tubes.	Replace tubes.
Low or no output with normal exciter drive.	Weak or defective 8874 tubes.	Replace tubes.
RF arcing.	Excessive SWR. Incorrect tuning. RF short.	Check the antenna. Read the manual. Check for charring or other evidence of an arc in the RF circuit.

SYMPTOM	CAUSE	REMEDY
Excessive plate current with a small amount of IG.	R11 is out of adjustment	See Section 6.2.
	Shorted padding capacitor C28 through C34.	Replace the capacitor.
Low or high IG reading with normal output and IP.	R4 requires adjustment.	See Section 6.1.
Low IG reading and low output.	Insufficient drive power.	Check exciter.
	Shorted drive coax.	Check drive line.
	Defective D4.	Replace ALC diode.

7.4 REPLACING FUSES

Whenever a fuse blows, make every effort to discover the cause. Never replace a fuse with a higher amperage fuse than the one specified. An improper fuse can cause extensive damage to the amplifier and will void the equipment warranty.

7.5 ORDERING SPARE PARTS OR RETURNING THE AMPLIFIER

All orders for replacement or spare parts should include the type of equipment, the serial number of the amplifier, the schematic number of the part and its part number. This information will insure quick and correct service.

The tubes' lives are warranteed for 1000 hours on a pro-rated basis. All warranty claims must be accompanied by a completed Eimac warranty claim form. All warranty claims must be filed with the company from which you purchased the tubes.

Should it ever be necessary to ship the 2001 for any reason, be sure to repack it in its original box and packing material. If the original box is not available, pack the amplifier in a box or crate strong enough to withstand the equipment's weight and large enough to allow several inches of packing protection between the side of the box and the side of the amplifier. Should it ever be necessary to return the unit to Henry Radio for any reason, be certain to return it prepaid and include a complete description of its problems.

SECTION 8. 2001 PARTS LIST

SCHEMATIC NO.	DESCRIPTION	NUMBER
	ACCESSORY KIT: Includes —	
	CABLE: 6' phono plug to phono plug, relay control and ALC feedback.	04 25025
	CABLE: RF IN, 10', RG-58/U coaxial cable, phono plug	04 00010
	Box of 5, 3AG, 6 amp fuses.	
	Box of 5, 8AG, 1½ amp fuses.	
	CONNECTOR: PL-259 coax connector.	16 00259
B1	BLOWER: 115 VAC, 60 Hz, 20 cubic feet per minute, 16 watts, 3000 rpm.	00 38529
	BOX: 2001 box and packing material.	57 20010
C1	CAPACITOR: Silver mica, 100 pf, 500 volt, 5%.	08 15101
C2 and C3	CAPACITOR: Silver mica, 100 pf, 500 volts, 5%.	08 15111
C4 and C5	CAPACITOR: Silver mica, 91 pf, 500 volts, 5%.	08 15910
C6	CAPACITOR: Silver mica, 330 pf, 500 volts, 5%.	08 15331
C7 and C8	CAPACITOR: Silver mica, 150 pf, 500 volts, 5%.	08 15151
C9	CAPACITOR: Silver mica, 470 pf, 500 volts, 5%.	08 15471
C10 and C11	CAPACITOR: Same as C6.	
C12	CAPACITOR: Same as C9.	
C13	CAPACITOR: Silver mica, 1500 pf, 500 volts, 5%.	08 19152
C14	CAPACITOR: Silver mica, 1000 pf, 500 volts, 5%.	08 15102
C15 through C17	CAPACITOR: Ceramic disc, .01 uf, 600 volts, GMV.	08 06103
C18 and C19	CAPACITOR: Silver mica, 47 pf, 500 volts, 5%.	08 15470
C20 through C24	CAPACITOR: Same as C15.	08 06103
C25	CAPACITOR: Ceramic disc, .0047 uf, 6 KV, GMV.	08 60047
C26	CAPACITOR: Ceramic transmitting, 1000 pf, 5 KV, 20%.	08 85813
C27	CAPACITOR: Same as C15.	08 06103
C28 and C29	CAPACITOR: Ceramic transmitting, 25 pf, 7.5 KV, 7 amps, 10%.	08 85025
C30	CAPACITOR: Ceramic transmitting, 50 pf, 7.5 KV, 10 amps, 10%	08 85051
C31 and C32	CAPACITOR: Ceramic transmitting, 100 pf, 5 KV, 9.8 amps, 10%	08 85012
C33	CAPACITOR: Same as C28.	08 85025
C34 and C35	CAPACITOR: Same as C31.	08 85012
C36	CAPACITOR: Same as C30.	
C37	VARIABLE CAPACITOR: LOAD control, air, 380 pf x 4 ganged.	09 40380
C38	CAPACITOR: Mica transmitting, .0002 uf, 2500 VDC.	08 24032
C39 through C42	CAPACITOR: Mica transmitting, .0005 uf, 1200 WVDC.	08 24025
C43	CAPACITOR: Same as C15.	08 06103
C44 through C46	CAPACITOR: Ceramic disc, .01 uf, 150 volts, 20%.	08 10103
C47	CAPACITOR: Electrolytic tubular, 500 uf, 50 volt, 20%.	08 01390
C48 through C53	CAPACITOR: Electrolytic, 190 uf, 450 volts.	08 19145
C54	CAPACITOR: Ceramic disc, .05 uf, 20 VDC, 20%.	08 20503
C55	CAPACITOR: Same as C44.	08 10103
CB1	CIRCUIT BREAKER: 2 pole, 50/60 Hz, 15 amp, black, 230 VAC	12 11161
	COUPLER: ¼" to ¼" shaft coupling, 1 1/8" long, flexible.	28 14250
	COUPLER: Shaft coupler, nickle plated brass, 3/4" long, 7/16" diameter, 4 set screws.	34 00138
	COUPLER: Rigid shaft coupling, 1¼" long, 11/16" diameter, ¼" shaft.	34 14252
D1	DIODE: Zener, 82 volt, 5 watt.	73 02545
D2	DIODE: Silicon rectifier, axial lead, 400 PIV, 1 amp.	73 00157
D3	DIODE: Silicon rectifier, 10 volt, 1.2 amps.	73 00010
D4	DIODE: Silicon rectifier, 1 amp, 1000 PIV.	73 00509
D7 and D8	DIODE: Silicon rectifier, 10,000 PIV, 1.2 amps.	73 10000
D9	DIODE: Germanium rectifier, 75 PIV, 500 ma peak.	73 01034
F1	FUSE: 3AG, 6 amp, 250 VAC.	24 30601
F2	FUSE: 8 AG, 1½ amp, 250 VAC.	24 80151
	FEET: Black plastic, 1" diameter, 3/8" high.	36 00103
	NYLON FOOT SPACERS: for above.	
	FERRITE BEADS: 1.25 uh ferrite inductor.	56 43801
	FUSEHOLDER: 3AG, extractor post fuse holder.	25 34204
	FUSEHOLDER: Open clip fuseholder, 3AG size.	25 99062

SCHEMATIC NO.	DESCRIPTION	NUMBER
	GEAR: Bandswitch detent gear, 96 teeth, 1.5" diameter.	28 06496
J1	JACK: RF IN, BNC coaxial chassis jack.	16 35010
J2	CONNECTOR: ANTENNA coax connector, type SO-239.	16 00239
J3 and J4	JACK: Relay and ALC OUT, RCA phono chassis jack.	16 35010
	KNOB: MULTIMETER knob, black matte, round ring skirted, ¼" shaft.	36 70220
	KNOB: LOAD and BAND switch, black matte, round ring skirted, 1.25" diameter, ¼" shaft.	36 12512
L1	INDUCTOR: 10 meter input coil, .3 uf, 5 turns.	32 20001
L2	INDUCTOR: 15 meter input coil. 30 uh, 5 turns.	32 20002
L3	INDUCTOR: 20 meter input coil, .7 uh, 6 turns.	32 20003
L4	INDUCTOR: 49 meter input coil, 1.2 uh, 10 turns.	32 20004
L5	INDUCTOR: 75 meter input coil, 15 turn.	32 20005
L6	INDUCTOR: 80 meter input coil, 14 turn.	32 20006
L7	INDUCTOR: RF choke, 2.5 uh, ferrite core, 160 ma.	85 06302
L8	INDUCTOR: Cathode choke, 18 gauge wire, ¼" diameter, 55 turns.	85 02001
L9	INDUCTOR: Plate choke, ½" diameter, 22 gauge, 110 turns.	85 02002
L10	INDUCTOR: 10 meter coil, silver flashed copper strip.	32 11112
L11	INDUCTOR: Tank coil, 0-6 uh, variable inductor.	32 22925
L12	INDUCTOR: Output choke, ceramic, 2.5 mh, 150 ma.	85 04555
M1	METER: Multimeter, 0-1 ma DC movement, 0-1 ma DC scale.	52 06175
	MANUAL: 2001 operating and maintenance manual.	92 02001
	METAL WORK: 2001 relay supply mounting bracket.	—
	METAL WORK: 2001 warm-up relay mounting bracket.	
	METAL WORK: 2001 power cord bracket.	
	METAL WORK: LOAD capacitor mounting brackets.	
	METAL WORK: 2001 POWER OUTPUT indicator mounting bracket.	
	METAL WORK: 2001 input section chassis.	
	METAL WORK: 2001 input section cover plate.	
	METAL WORK: 2001 cabinet wraparound.	
	METAL WORK: 2001 main chassis.	
	METAL WORK: 2001 front panel.	
	METAL WORK: 2001 bandswitch aluminum mounting angle.	
	METAL WORK: 2001 bandswitch, large lucite mount.	
	METAL WORK: 2001 long bandswitch shaft.	
	METAL WORK: 2001 short bandswitch shaft.	
	METAL WORK: 2001 bandswitch TUNE capacitor shaft.	
	METAL WORK: 2001 bandswitch input section shaft.	
	METAL WORK: 2001 antenna relay mounting plate.	
	METAL WORK: 2001 blower, mounting bracket.	
	METAL WORK: 2001 TUNE coil metal standoffs.	
	METAL WORK: 2001 long tube socket mounting bars.	
	METAL WORK: 2001 short tube socket mounting bars.	
	METAL WORK: 2001 high voltage diode heat sink.	
	METAL WORK: 2001 filter network angle mounts.	
	METAL WORK: 2001 aluminum filter network mounting spacers.	
	METAL WORK: 2001 calibration potentiometer board.	
	METAL WORK: 2001 bandswitch small lucite mount.	
	METAL WORK: 2001 teflon tube exhaust bracket.	
	METAL WORK: 2001 bakelite filter network mounting plate.	
PL1 and PL2	LIGHT: Warm-up and ready indicator, miniature press-in light, red, 10-16 volts.	40 22302
	POINTER: Clear plastic dial pointers.	36 20000
	POWER CORD: 14 gauge, 3 conductor, 300 volt, 7 feet.	04 00500
	POTENTIOMETER: ALC adjust, 100 K ohm, 2 watt, linear.	60 01011
R2	RESISTOR: Carbon, 1 K ohm, 1 watt, 10%.	68 20013
R3	RESISTOR: Carbon, 68 K ohm, 1 watt, 10%.	68 20683
R4	POTENTIOMETER: Grid current adjust, 500 ohms, type F.	60 20000
R5	RESISTOR: Carbon, 220 ohm, 1 watt, 10%.	68 22200

SCHEMATIC NO.	DESCRIPTION	NUMBER
R6	RESISTOR: Vitreous enamel, wirewound, 5 ohm, 10 watt, 5%.	68 80050
R7	RESISTOR: Vitreous enamel, wire wound, 10 K ohm, 10 watt, 5%, with wire leads.	68 80103
R8	RESISTOR: Carbon, 200 ohms, 2 watts, 10%.	68 62000
R9	RESISTOR: Vitreous enamel, wire wound, .5 ohm, 10 watt, 5%.	68 80052
R10	RESISTOR: Same as R5.	68 22200
R11	POTENTIOMETER: Plate current adjust, same as R4.	60 20000
R12	RESISTOR: Vitreous enamel, wire wound, 25 ohm, 20 watt, 5%.	68 02250
R13	RESISTOR: Vitreous enamel, wire wound, 25 ohm, 20 watt	68 02025
R14 through R19	RESISTOR: Vitreous enamel, wire wound, 10 K ohm, 20 watt,	68 02103
R20	RESISTOR: Vitreous enamel, wire wound, 200 ohm, 20 watt, 5%.	68 02200
R21	POTENTIOMETER: High voltage adjust, 100 K ohm, type F.	60 00104
R22 and R23	RESISTOR: Carbon, 1.5 M ohm, 1 watt, 10%.	68 20155
R24	POTENTIOMETER: Relative Power Adjust, same as R4.	60 20000
R25 and R26	RESISTOR: Carbon, 100 K ohm, 2 watt, 10%.	68 61003
R27	RESISTOR: Carbon, 1 M ohm, ½ watt, 10%.	68 40016
R28	RESISTOR: Carbon, 68 K ohm, ½ watt, 10%.	68 40683
R29	RESISTOR: Carbon, 1K ohm, ½ watt, 10%.	68 40013
R30	RESISTOR: Carbon, 10K ohm, 2 watt, 5%.	68 50103
R31	RESISTOR: Carbon, 470 K ohm, ½ watt, 10%.	68 44703
RY1	RELAY: Warm-up delay, 115 VAC, 60 volt delay, normally open.	64 11560
RY2	RELAY: 3PDT, 12 VDC, 10 amp, antenna relay,	64 01025
S1A and S1B	SWITCH: Bandswitch, input section, 5 position, non-shorting, rotary, ceramic switch section.	76 20003
S1C	SWITCH: Bandswitch, TUNE control section, 7 position, rotary, ceramic.	76 20085
S1D	SWITCH: Bandswitch, LOAD section, 7-position, rotary, miniature ceramic section.	76 00284
S2	SWITCH: High voltage shorting strap.	76 02001
S3A, S3B, S3C	SWITCH: Multiswitch, 3 pole, 4-position, rotary.	76 02002
	SPACER: Fiberspacer, ½" long, number 6 hole.	34 02132
	STANDOFF: Ceramic, 1" long, ½" diameter, 8/32 thread.	34 02609
T1	TRANSFORMER: Primary — 115 VAC, 15 amp x 2. Secondary — 900 volt at 500 VA, 6.3 volts at 3.5 amps, 15 volt relay tap.	84 00491
	TERMINAL BOARD: 12 connector, bakelite, 1" wide, 2¼" long, with type 1268 lugs, ALC board.	80 26812
	TERMINAL STRIP: Tie down phenolic strip, two-lugs.	80 00862
	TERMINAL STRIP: 5 lug, phenolic strip, center mount.	80 00866
	TUBE SOCKET: 11- pin, for 8874 tubes.	89 24311
	TUBE SOCKET: RY1 and V3 socket, 9-pin socket.	65 20009
V1 and V2	ELECTRON TUBE: Ceramic hi-mu, triode, type 8874.	88 08874
	GRID CONTACT CLIPS.	89 02001
	PLATE CAP.	89 02002
	TUBE CHIMNEYS	89 12411
V3	ELECTRON TUBE: Electron tube indicator, type 6FG6, power output indicator.	88 06006
	VERNIER: LOAD control tuning vernier.	56 11407
	VERNIER: TUNE control dial counter and vernier, 15 turn.	56 00431

NOTE

Fuse F2 is drawn incorrectly above.
It should be in series in line C.

C1	100 pf, 500 v.
C2 and C3	110 pf, 500 v.
C4 and C5	91 pf, 500 v.
C6	330 pf, 500 v.
C7 and C8	150 pf, 500 v.
C9	470 pf, 500 v.
C10 and C11	330 pf, 500 v.
C12	470 pf, 500 v.
C13	1500 pf, 500 v.
C14	1000 pf, 500 v.
C15-C17	.01 uf, 600 v.
C18 and C19	47 pf, 500 v.
C20-C24	.01 uf, 600 v.
C25	.0047 uf, 6 Kv.
C26	1000 pf, 5 Kv.
C27	.01 uf, 600 v.

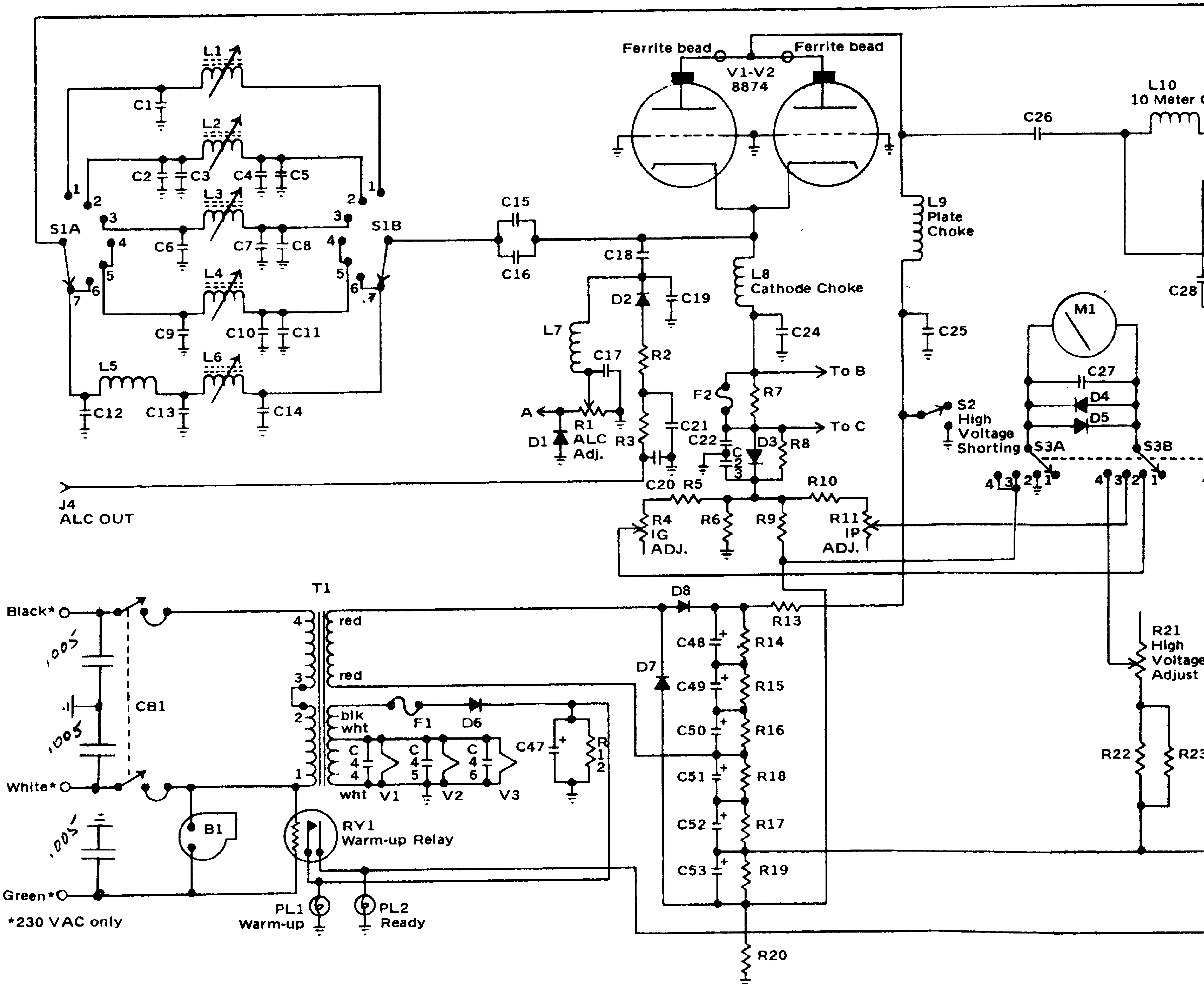
C28 and C29	25 pf, 7.5 Kv.
C30	50 pf, 7.5 Kv.
C31 and C32	100 pf, 5 Kv.
C33	25 pf, 7.5 Kv.
C34 and C35	100 pf, 5 Kv.
C36	50 pf, 7.5 Kv.
C37	380 pf x 4
C38	.0002 uf, 1 Kv.
C39-C42	.0005 uf, 1 Kv.
C43	.01 uf, 600 v.
C44-C46	.01 uf, 150 v.
C47	500 uf, 50 v.
C48-C53	190 uf, 450 v.
C54	.05 uf, 20 v.
C55	.01 uf, 150 v.

D1	HEP-Z2545
D2	HEP-157
D3	JI-Z-10
D4-D6	GE-509
D7 and D8	SDHD-10K
D9	1N34A
F1	3 AG, 6 amp
F2	8 AG, 1.5 amp
R1	100 K ohm, 2 watt.
R2	1 K ohm, 1 watt, 10%.
R3	68 K ohm, 1 watt, 10%.
R4	500 ohms.
R5	220 ohm, 1 watt, 10%.
R6	5 ohm, 10 watt, 5%.

R7	10 K ohm, 10 watt, 5%.
R8	200 ohm, 2 watt, 10%.
R9	.5 ohm, 10 watt, 5%.
R10	220 ohm, 1 watt, 10%.
R11	500 ohms.
R12 and R13	25 ohm, 20 watt, 5%.
R14-R19	10 K ohm, 20 watt, 5%.
R20	200 ohm, 20 watt, 5%.
R21	100 K ohm.
R22 and R23	1.5 M ohm, 1 watt, 10%.
R24	500 ohms.
R25 and R26	100 K ohm, 2 watt, 10%.
R27	1 M ohm, ½ watt, 10%.
R28	68 K ohm, ½ watt, 10%.
R29	1 K ohm, ½ watt, 10%.
R30	10 K ohm, 2 watt, 5%.
R31	470 K ohm, ½ watt, 10%.

TEMPO 2001

March 1973

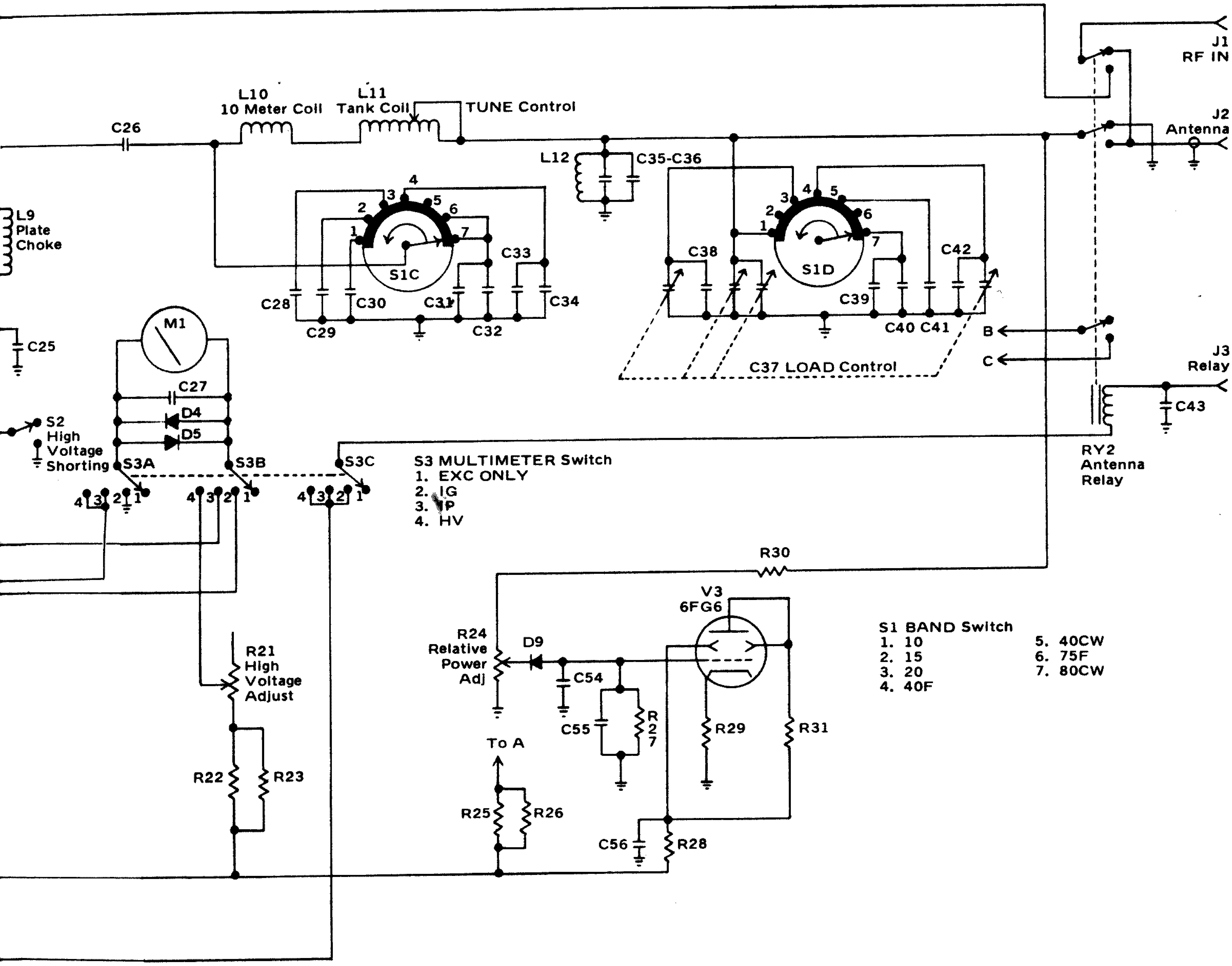


C1	100 pf, 500 v.
C2 and C3	110 pf, 500 v.
C4 and C5	91 pf, 500 v.
C6	330 pf, 500 v.
C7 and C8	150 pf, 500 v.
C9	470 pf, 500 v.
C10 and C11	330 pf, 500 v.
C12	470 pf, 500 v.
C13	1500 pf, 500 v.
C14	1000 pf, 500 v.
C15-C17	.01 uf, 600 v.
C18 and C19	47 pf, 500 v.
C20-C24	.01 uf, 600 v.
C25	.0047 uf, 6 Kv.
C26	1000 pf, 5 Kv.
C27	.01 uf, 600 v.

C28 and C29	25 pf, 7.5 Kv.
C30	50 pf, 7.5 Kv.
C31 and C32	100 pf, 5 Kv.
C33	25 pf, 7.5 Kv.
C34 and C35	100 pf, 5 Kv.
C36	50 pf, 7.5 Kv.
C37	380 pf x 4
C38	.0002 uf, 1 Kv.
C39-C42	.0005 uf, 1 Kv.
C43	.01 uf, 600 v.
C44-C46	.01 uf, 150 v.
C47	500 uf, 50 v.
C48-C53	190 uf, 450 v.
C54	.05 uf, 20 v.
C55	.01 uf, 150 v.

D1	HEP-Z2545
D2	HEP-157
D3	JI-Z-10
D4-D6	GE-509
D7 and D8	SDHD-10K
D9	1N34A
F1	3 AG, 6 amp
F2	8 AG, 1.5 amp
R1	100 K ohm, 2 watt.
R2	1 K ohm, 1 watt, 10%.
R3	68 K ohm, 1 watt, 10%.
R4	500 ohms.
R5	220 ohm, 1 watt, 10%.
R6	5 ohm, 10 watt, 5%.

R7	10 K
R8	200
R9	.5 oh
R10	220
R11	500
R12 and R13	25 o
R14-R19	10 K
R20	200
R21	100
R22 and R23	1.5 M
R24	500
R25 and R26	100
R27	1 M
R28	68 K
R29	1 K
R30	10 K
R31	470



NOTE

Fuse F2 is drawn incorrectly above. It should be in series in line C.

Z2545
157
0
)9
)-10K
A

6 amp
1.5 amp

ohm, 2 watt.
hm, 1 watt, 10%.
ohm, 1 watt, 10%.
hms.
hm, 1 watt, 10%.
ı, 10 watt, 5%.

R7	10 K ohm, 10 watt, 5%.
R8	200 ohm, 2 watt, 10%.
R9	.5 ohm, 10 watt, 5%.
R10	220 ohm, 1 watt, 10%.
R11	500 ohms.
R12 and R13	25 ohm, 20 watt, 5%.
R14-R19	10 K ohm, 20 watt, 5%.
R20	200 ohm, 20 watt, 5%.
R21	100 K ohm.
R22 and R23	1.5 M ohm, 1 watt, 10%.
R24	500 ohms.
R25 and R26	100 K ohm, 2 watt, 10%.
R27	1 M ohm, ½ watt, 10%.
R28	68 K ohm, ½ watt, 10%.
R29	1 K ohm, ½ watt, 10%.
R30	10 K ohm, 2 watt, 5%.
R31	470 K ohm, ½ watt, 10%.