



(2) 3-400 Z

TEMPO

2000

LINEAR AMPLIFIER

Handwritten signature or initials.

TABLE OF CONTENTS

SECTION 1.	Introduction.	1
SECTION 2.	Specifications and Controls.	2
SECTION 3.	Installation.	5
SECTION 4.	Operation.	8
SECTION 5.	Circuit Description.	12
SECTION 6.	Maintenance.	13
SECTION 7.	Parts List.	18

LIST OF ILLUSTRATIONS

Figure 1.	Front Panel View.	3
Figure 2.	Rear Panel View.	4
Figure 3.	Tempo One—Tempo 2000 Interconnections.	6
Figure 4.	Filament Voltage Connections.	8
Figure 5.	Power Plug Connections.	9
Figure 6.	Input Power Connections.	9
Figure 7.	Bottom View.	14
Figure 8.	Top View.	15
Table 1.	Trouble Analysis.	16
Table 2.	Typical Relay and Transformer Resistances.	16
Table 3.	Miscellaneous Resistance Measurements.	17
Schematic		22

HENRY RADIO

"World's Largest Distributors of Short Wave Equipment"

11240 W. OLYMPIC BLVD.
LOS ANGELES, CALIF. 90064
213 477-6701

BUTLER, MISSOURI, 64730
816 679-3127

931 N. EUCLID
ANAHEIM, CALIF. 92801
714 772-9200

WARNING

THE TEMPO 2000 IS EQUIPPED WITH TWO HIGH VOLTAGE INTERLOCKS. THESE INTERLOCKS ARE INCLUDED TO SAVE YOUR LIFE. YOU DEFEAT THESE INTERLOCKS ONLY AT PERIL TO YOUR OWN LIFE.

ALWAYS UNPLUG THE LINE CORD BEFORE REMOVING THE TEMPO 2000 COVERS.

ALWAYS CHECK TO BE SURE THAT THE INTERLOCKS HAVE FUNCTIONED PROPERLY AFTER YOU HAVE REMOVED THE TEMPO 2000 COVERS.

ALWAYS DISCHARGE THE TEMPO 2000 TUBE CAPS BY TOUCHING A GROUNDING STICK TO THE CHASSIS, THEN THE TUBE CAPS, AFTER CHECKING FOR INTERLOCK ACTION.

SECTION 1 INTRODUCTION

The Tempo 2000 is a full legal limit 80-10 meter grounded grid linear amplifier.

Tempo 2000 features include:

- * Power reed relays for instantaneous and silent transmit-receive (T-R) and bypass switching. The T-R switching operates from a separate receiver and transmitter even when the 2000 is turned off.
- * A self-contained solid-state power supply.
- * Grounded grid input for maximum compatibility with modern transceivers and transmitters.
- * Full legal limit power input on all modes.
- * 80-10 meter amateur band coverage. Covers many MARS (Military Amateur Radio Service) frequencies adjacent to the amateur bands.
- * An internal dummy load simplifies exciter tuneup.
- * A double interlock system helps reduce shock hazard.
- * Circuit breakers protect the power supply.
- * The relative RF output meter reads exciter or amplifier power.
- * The Tempo 2000 is operational within three seconds from turn on.
- * Black aluminum chimneys and rear panels help dissipate heat from each tube.

SECTION 2

SPECIFICATIONS AND CONTROLS

2.1 SPECIFICATIONS

BAND COVERAGE	80, 40, 20, 15 and 10 meters.
MAXIMUM POWER	SSB: 2000 watts PEP CW: 1000 watts AM: 1000 watts RTTY: 1000 watts
DRIVING POWER REQUIRED	55 watts for 1000 watts input. 85 watts PEP for 2000 watts PEP input.
DUTY CYCLE	SSB: continuous voice modulation. CW: 50% (key down time not to exceed 15 minutes.)
THIRD ORDER DISTORTION	35 db below PEP at full input on SSB.
OUTPUT IMPEDANCE	30 to 100 ohms minimum, unbalanced; Pi network, 80-10 meters.
INPUT IMPEDANCE	50 ohms nominal, unbalanced; input circuit requires no tuning.
METER FUNCTIONS	0-800 relative RF power. 0-800 mA grid current. 0-800 mA plate current. 0-3000 volts high voltage.
FRONT PANEL CONTROLS	LOADING: 0 to 50. TUNING: 0 to 50. FUNCTION: OFF, OPERATE. DRIVER TUNE. BAND: 80, 40, 20, 15, and 10 meters. MODE: CW, SSB. METER: RF Power, Grid mA, Plate mA, Plate V.
TUBE COMPLEMENT	Two 3-400Z in parallel.
POWER REQUIREMENTS	117 volts AC at 20 amperes (maximum). 234 volts AC at 10 amperes (maximum).
CABINET SIZE	15-1/2" wide x 7" high x 14" deep.
NET WEIGHT	62.4 pounds.

2.2 CONTROLS

2.2.1 FRONT PANEL CONTROLS

KENNETH V. JACKMAN, M. D.
BOX 9003 U. S. N. H. GUAM
FPO SAN FRANCISCO, 96630
WA200Q/KG6

1. TUNING Control— 0-50
2. LOADING Control— 0-50
3. FUNCTION Switch— OFF
OPERATE
DRIVER TUNE
4. BAND Switch— 80, 40, 20, 15, 10
5. MODE Switch— CW, SSB
6. METER Switch— RF POWER, GRID mA,
PLATE mA, PLATE V
7. METER

Tunes amplifier output circuit. "0" setting corresponds to the lowest frequencies. (Maximum capacitance.)

Loads amplifier output circuit. "0" setting gives minimum load. (Maximum capacitance.)

OFF position removes power from all circuits except the antenna changeover switching circuitry.

OPERATE position enables all circuits. DRIVER TUNE position switches the driver output to the 50 ohm, 100 watt continuous driver load.

Selects appropriate amounts of inductance from coils L1 and L2 for the band selected.

Switches taps on the high voltage transformer, T3, for 1800 VDC supply output in the CW position or 2500 VDC output in the SSB position.

Selects the meter functions.

Reads relative RF power, grid current, plate current or plate voltage.

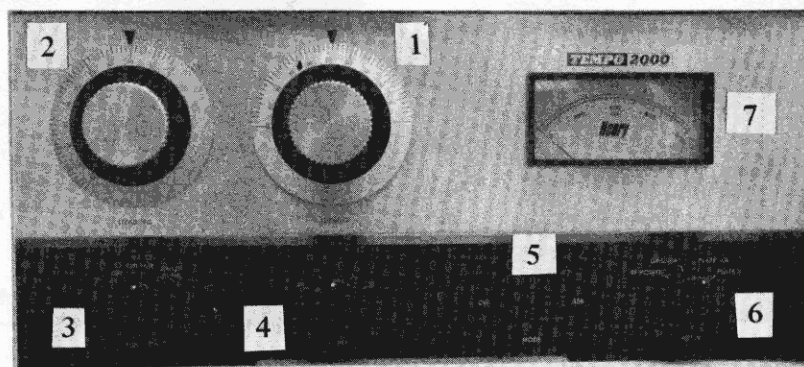


Figure 1. Front Panel View.

2.2.2 REAR PANEL CONTROLS

- | | |
|---------------------------------|--|
| 1. Relay Contacts | T-R relay connections. Connect to normally closed relay contacts. |
| 2. Circuit Breaker Reset Button | Depress momentarily to reset the circuit breaker. |
| 3. Power Connector | Connect to 234 VAC; 117 VAC acceptable if necessary; with appropriate rewiring of TS2 and the line cord. |
| 4. OUTPUT Connector | Connect to a 50 ohm antenna capable of handling one KW CW. |
| 5. Exciter Selector Switch | Rotate to XCVR for transceiver exciter; rotate to RCVR/XMTR for a receiver-transmitter combination. |
| 6. RCVR Input Connector | Connect to the receiver to use the T-R antenna changeover relays. |
| 7. INPUT Connector | Connect to the exciter output connector. |
| 8. GROUND Post | Connect to a permanent earth ground. |

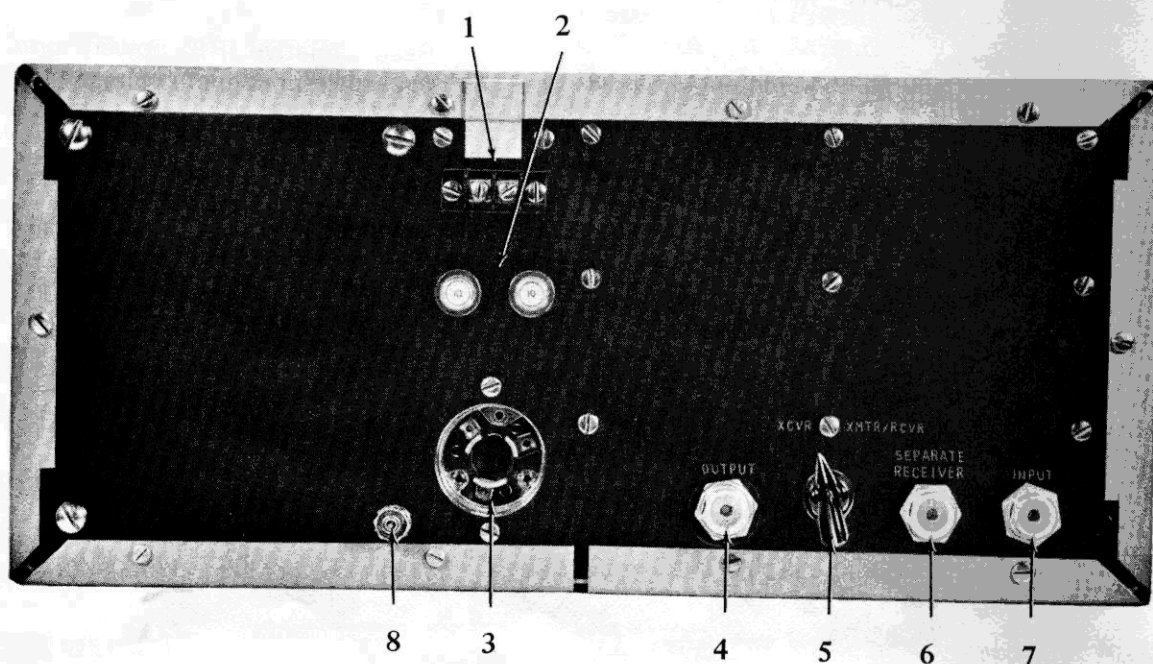


Figure 2. Rear Panel View.

SECTION 3

INSTALLATION

3.1 UNPACKING

Carefully remove your Tempo 2000 amplifier from its packing material. Examine the unit carefully for any sign of shipping damage. Report any damage immediately to the shipping company and to Henry Radio. Retain all shipping labels if damage is apparent. Retain all packing material for any future storage or shipment of the Tempo amplifier.

3.2 WRITING TO HENRY RADIO

A warranty registration card is inserted in this manual. Please fill it out and return it to Henry Radio as soon as possible to validate your warranty. If it is necessary to write concerning an equipment problem please include a complete system diagram. Especially important are accessories used and attachments and modifications made during or after installation.

For any of the above requirements contact:

Henry Radio Company
11240 W. Olympic Blvd.
Los Angeles, California 90064

3.3 STORE RETURNS

Repair service is available through Henry Radio but do not return any equipment without prior authorization.

3.4 PRE-INSTALLATION

Carefully read all of the installation section before beginning installation of the 2000. This practice familiarizes you with the requirements necessary for the Tempo 2000 installation and helps you assemble the components necessary for installation before you begin the actual installation of the unit.

3.5 AMPLIFIER LOCATION

The Tempo 2000 operates at the highest legal power input levels, so a major consideration in any installation should be to insure adequate

ventilation. Plan your operating space for log books, telephone books, etc., so that you are not tempted to place them on the 2000 during operation. Your linear amplifier is a conservatively designed unit but heat remains one of the most critical factors in determining equipment life. Under most conditions a few inches of space on all sides (including the back) with nothing placed underneath or on top of the linear will provide more than adequate ventilation.

There is a definite hazard that a loose piece of paper could fly up under the 2000 and be held there by the suction created by the fan, completely blocking all air input.

The 3-400Z tubes must be positioned vertically ± 30 degrees, or their warranty is not valid.

3.6 POWER REQUIREMENTS

The Tempo 2000 requires 10 amperes at 234 VAC or 20 amperes at 117 VAC line voltage. You should operate your linear on 234 VAC if possible, since few 117 VAC lines can reliably supply sufficient current to operate the 2000 at full output. The Tempo 2000 is shipped wired for 234 VAC. Refer to Section 3.11 for 117 VAC modification instructions.

The source should be properly fused and wired with number 14 or bigger wire for 234 volts or number 12 or larger for 117 volts. If the 2000 is operated on a 117 volts circuit it should be the only load on that circuit.

Check the open circuit wall socket voltage frequently during your usual operating times, and if it is less than 224 volts (or 112 volts if you use a 117 VAC line) consistently or more than 234 volts (117), refer to Section 3.10 for filament transformer tap changes.

The power plug must be wired following Figure 3.4. Check your wall outlet before purchasing the power plug to be sure you get the correct type.

3.7 EXCITER

The Tempo 2000 can be driven to 1000 watts DC input by any exciter capable of 55 watts

output, or to 2000 watts PEP input by exciters capable of 85 watts PEP output. Exciters of lower output will drive the 2000 to lower power levels. (Remember that single sideband transmitters are relatively inefficient, and that many transmitters and transceivers rated at quite high input levels might not maintain sufficient output levels on all frequencies.)

The Tempo One 80 to 10 meter transceiver makes an ideal exciter for the Tempo 2000. It will drive the Tempo amplifier to full legal input on CW or SSB on all bands.

3.8 ANTENNAS

The output impedance matching range of the Tempo 2000 Pi network is 30-100 ohms minimum across the 80-10 meter amateur bands. The antennas used must present a VSWR of 2:1 or less, preferably 1.5:1 or less. The antenna feedline should be RG-8/U type, or better. Other cable can be lossy, the wrong impedance or not capable of handling the power output of the Tempo 2000.

Use of a low pass filter can help maintain your good name in the non-amateur community. At kilowatt power levels television and other broadcast interference can be troublesome. Installed in the antenna feedline, the filter reduces frequencies above 54 MHz by 75 db or more.

3.9 INTERCONNECTIONS

Refer to the front and rear views, Figures 1 and 2, for the location of the controls and connections of your amplifier. Refer also to Figure 3 for Tempo 2000 station interconnections.

Prepare a short piece of RG-58A/U to connect the exciter antenna jack to the Tempo 2000 RF INPUT jack. This amplifier-input cable should be less than one-quarter wavelength at your highest operating frequency. About four feet or less is most acceptable. Now connect this cable.

Connect the RG-8/U antenna lead to the Tempo 2000 OUTPUT jack. Install the low pass filter in the antenna line close to the 2000.

If you use a receiver-transmitter combination prepare a length of 50 ohm coaxial cable, preferably RG-58A/U, and connect it between the receiver antenna jack and the RECEIVER jack of the Tempo 2000. The 2000 relay automatically switches the antenna to the receiver antenna jack during receive.

Connect a ground wire (number 14 or heavier) to the Tempo 2000 ground stud. It is a good idea not to depend upon the antenna lead shield for grounding purposes since it can inadvertently be disconnected while the Tempo 2000 is turned on. Connect the ground wire to a cold water pipe or ground rod.

Terminals 1 and 2 of TS1 must be connected together to switch the Tempo 2000 to receive. A pair of normally closed contacts on the exciter's VOX-PTT relay should be used for this function. Note that the Tempo 2000 requirements are exactly opposite of those of most other amplifiers, which usually need a pair of normally open contacts. All modern transceivers have a set of spare relay contacts available for this purpose. If you use a receiver transmitter combination with the Tempo 2000 you can obtain the same function from the push-to-talk relay in the transmitter or from an external relay used for that purpose.

The reed relays used in the Tempo 2000 require proper exciter-amplifier relay sequencing for longest reed life. These reeds can withstand high voltage when open and high currents when closed, but they can only switch a limited amount of power. So be sure that the reed relays are always in the transmit condition (no connection between terminals 1 and 2 of TS1) before RF is applied to the input circuits. When switching back to receive, RF drive must be removed before terminals 1 and 2 are connected by the exciter relay. These precautions ensure that the 2000 reed relays are not used to switch during high RF drive power conditions, resulting in a relay life expectancy of millions of operations.

Proper sequencing is automatically maintained when the terminals on TS1 are connected to a pair of normally closed contacts on a transceiver relay. When the transceiver relay is actuated, either by VOX or PTT, its coil is energized and its armature begins to move. During the first few milliseconds of actuation the armature is taking up slack in the normally closed contacts, so these do not move immediately. When the transceiver relay contacts do

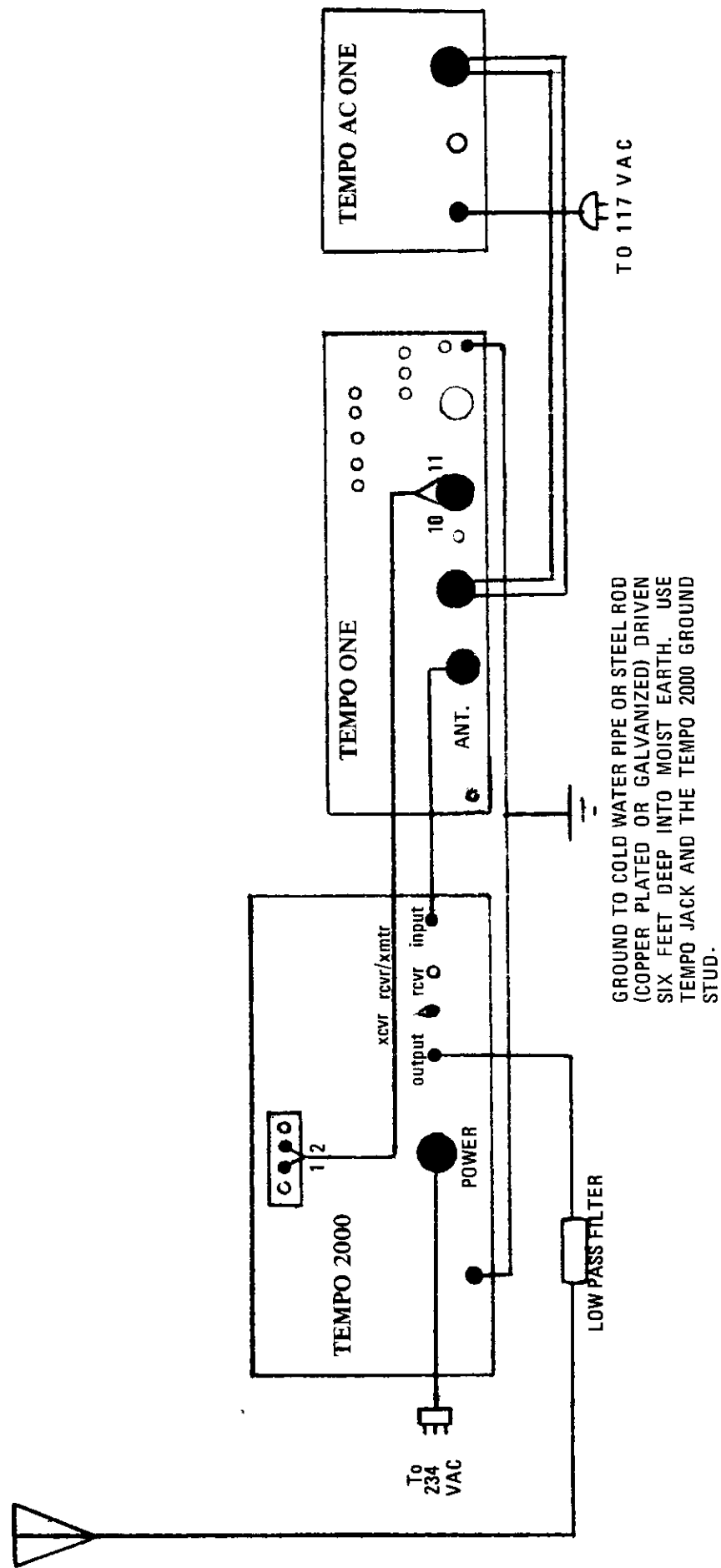


Figure 3. Tempo One-Tempo 2000 Interconnections.

break contact from the normally closed position the Tempo 2000 reed relays immediately switch to the transmit position before the exciter relay contacts can move to their normally open position. So the Tempo 2000 relay switches while the transceiver relay is between positions. The reed relays switch without power applied, resulting in a life expectancy many times greater than a conventional relay. Switching is smooth, quiet and nearly instantaneous.

Problems may arise when the Tempo is driven by a transmitter which has no built-in relay, or when it is desired to operate 100% break-in CW. Under these circumstances it may be best to provide a separate relay to key the driver and also operate the Tempo 2000. Using a single relay for both of these functions will insure proper sequencing. However, there is still some danger of damaging the reeds if there is another way to key the transmitter besides the key line such as a Tune switch, AM switch, Zero switch, etc. Actuation of such a control may put RF drive on the Tempo 2000 input while it is still in the receive state. Extreme care should be used to prevent this from occurring. Transmitters with time-sequence keying can also be a problem in this regard, because their RF output can hang on for some time after the key line is opened. Such a transmitter must be adjusted for fairly "hard" keying to keep this release time to a minimum.

3.10 HIGH OR LOW LINE VOLTAGE MODIFICATIONS

3-400Z triodes are designed to run at a filament voltage of 5.0 volts plus or minus about 5% for maximum tube life. The Tempo 2000 filament

transformer has three different voltage taps, which can be used to compensate for low or high filament voltage. Tempo 2000's are shipped with the medium (115 volt) tap connected, and may be used this way at most line voltages. However, for permanent installations, it will be best to check the line voltage and use the tap which will provide maximum tube life over a long period. Check the voltage at the wall socket to which the Tempo 2000 is to be connected during your usual operating hours. If this voltage is between 224 and 234 volts (112 to 117 volts if you are running the Tempo 2000 on a 115 VAC circuit), no change is necessary. If the line voltage is below 224 volts (112) move the black wire connected to terminal 2 of TS7 to terminal 4 of TS7. See Figure 4. If the line is above 234 VAC (117) move the black wire to terminal 1 of TS1. Note: even when using this tap, voltages over 264 VAC (132) will shorten tube life.

3.11 117 VAC OPERATION MODIFICATIONS

The Tempo 2000 is shipped wired for 234 VAC operation. To operate from 117 VAC, modify the connections to TS2 as indicated in Figure 6. Refer to Figure 8 for the location of TS2.

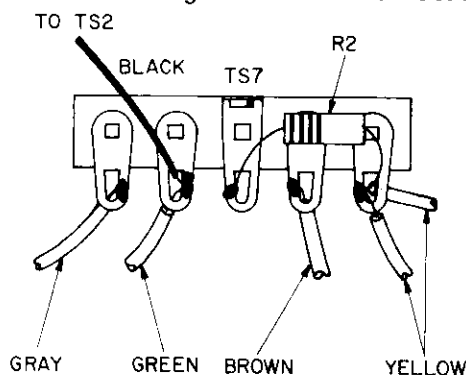


Figure 4.
Filament
Voltage
Connections

SECTION 4 OPERATION

4.1 GENERAL

Numbers in () reference the photographs of the front and back panel, Figures 1 and 2.

These operating instructions are intended to assist the operator who is familiar with the Tempo 2000 in putting it on the air quickly. We recommend that an operator who is unfamiliar with the unit refer to the notes, Section 4.6, and the Circuit Description, Section 5, before operating the Tempo 2000.

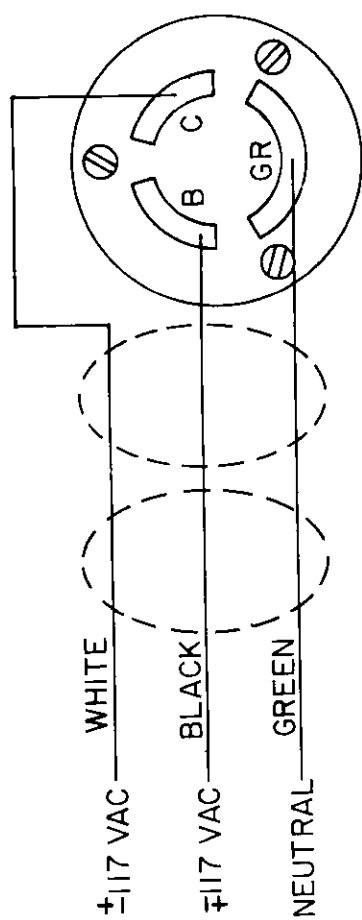
4.2 PRELIMINARY CHECKS AND CONNECTIONS

4.2.1 Checks

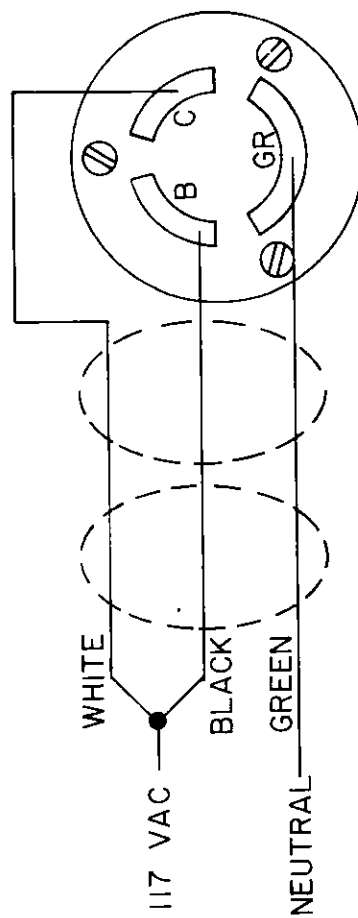
* Be sure that the Tempo 2000 is connected to a 234 VAC outlet capable of delivering 10 amperes. If you use a 117 VAC source, it should be capable of supplying 20 amperes. In either case check for adequate supply voltage at the wall outlet. (Refer to Section 3.11.)

* The exciter and Tempo 2000 should both be well grounded. (Refer to Section 4.6.5.)

* The Tempo 2000 must be connected to a properly resonated 50 ohm antenna capable of handling at least one kilowatt CW. VSWR must be 2 to 1 or less.



234 VAC POWER PLUG CONNECTIONS



117 VAC POWER PLUG CONNECTIONS

Figure 5. Power Plug Connections.

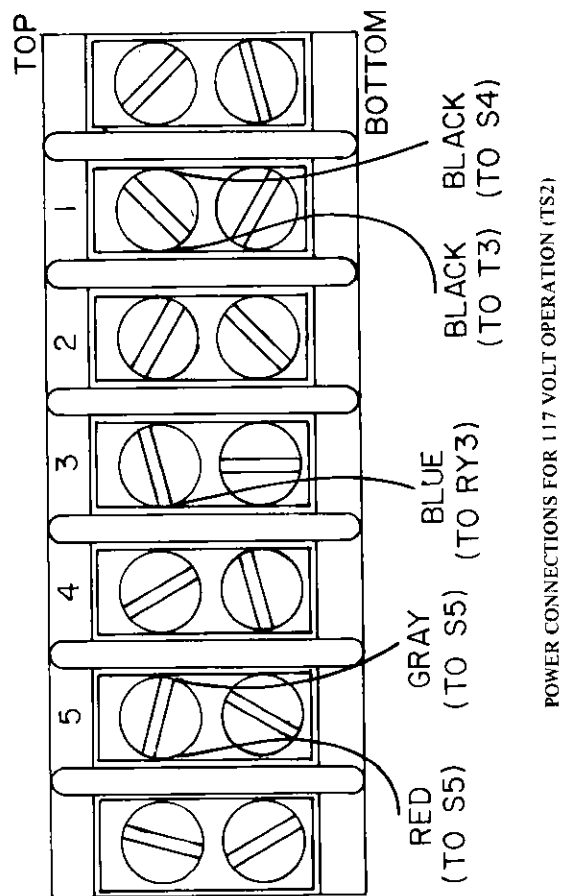
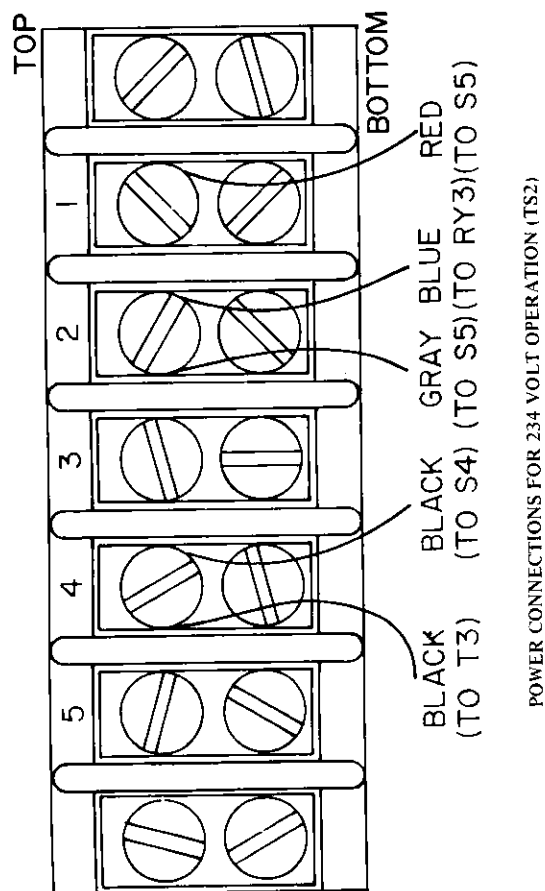


Figure 6. Input Power Connections.

4.2.2 CONNECTIONS AND SETTINGS

* Terminals 1 and 2 (1 on Figure 2) must be connected to normally closed transceiver or transmitter push-to-talk relay contacts.

* The Tempo 2000 INPUT connector (7 on Figure 2) must be connected to the transceiver or transmitter ANTENNA jack. (Refer to Section 4.6.1.)

* Connect the receiver (if used) ANTENNA connector to the Tempo 2000 RCVR connector (6 on Figure 2.)

* Rotate the rear panel switch (5 on Figure 2) to the XCVR position (for a transceiver exciter) or RCVR/XMTR (for a separate receiver and transmitter.)

4.3 DRIVER TUNEUP

* Rotate the FUNCTION switch (3 on Figure 3) to DRIVER TUNE.

* Rotate the BAND switch (4 on Figure 1) to the band to be used.

* Rotate the METER switch (6 on Figure 1) to RF POWER.

* Refer to Section 4.6.4.

* Load the driver to a Tempo 2000 meter reading of about 60-70 on the mA scale.

4.4 TEMPO 2000 TUNEUP— CW

* Rotate the Tempo 2000 FUNCTION switch to OPERATE.

* Push the Tempo MODE switch (5 on Figure 1) to CW.

* Preset the Tempo 2000 LOADING (2 on Figure 1) and TUNING (1 on Figure 1) controls as follows:

(Fill in the blanks for settings you find best if different from those listed.)

	BAND	LOADING	TUNING
800	80 CW	10 <u>34</u>	18 <u>26</u>
800	80 SSB	25 <u>27</u>	21 <u>26</u>
	40 CW	31 <u>33 1/2</u>	37 <u>40</u>
	40 SSB	25 <u>29</u>	39 <u>40</u>

500	20 CW	29 <u>31</u>	42 <u>43</u>
600	20 SSB	27 <u>29</u>	42 <u>43</u>
500	15 CW	28 <u>32</u>	43 <u>45</u>
600	15 SSB	30 <u>31</u>	44 <u>45</u>
450	10 CW	34 <u>32</u>	41 <u>43 1/2</u>
1152-575	10 SSB	31 <u>30</u>	42 <u>43 1/2</u>

* Key the exciter and peak the Tempo 2000 RF power with the Tempo TUNING control.

* Rotate the Tempo 2000 METER switch to PLATE mA.

* Load the Tempo 2000 with its TUNING and LOADING controls to 550-600 mA. (Depends on plate voltage and driver input power. Refer to Section 4.6.2.)

* Rotate the METER switch to GRID mA and check grid current. Reading should be 200-400 mA.

* If grid current is not 200-400 mA, vary the exciter output to obtain 200-400 mA and reload the Tempo 2000 to 550-600 mA.

* This completes tuneup for CW.

4.5 TEMPO 2000 TUNEUP— SSB

* Perform all of the steps for tuneup on CW.

* Rotate the FUNCTION switch to DRIVER TUNE.

* Load the Exciter to full rated output.

* Switch the exciter to SSB and the 2000 to OPERATE.

* Switch the 2000 MODE switch to SSB.

* Do not exceed 1 KW on voice peaks as observed on the plate mA and plate V meter. Refer also to Section 4.6.2.

* Reduce exciter output as necessary to obtain 1 KW input by varying the audio drive.

4.6 NOTES

4.6.1 TEMPO 2000 INPUT IMPEDANCE

The Tempo 2000 has no tuned input circuits; the driving transmitter works directly into the

3-400Z cathodes, which present a very non-linear impedance. Over a full RF cycle, this impedance averages about 50 ohms, but actually is close to 25 ohms for half a cycle and several hundred ohms for the other half. For this reason, a VSWR bridge connected between the driver and the Tempo 2000 will indicate a very high VSWR even though the average load presents a good match and easily accepts the driver power.

Because of these non-linear input characteristics it is best to keep the coax from the driver to the Tempo 2000 as short as is convenient. Lengths up to four feet are acceptable.

With an accurate wattmeter and a kilowatt dummy load, you might notice that the 2000 efficiency is slightly lower on one band than on another. This can be caused by a resonance in the input circuit and coax, and a slight change in coax length will shift the resonance away from the affected band. In any case, this problem is common to all RF amplifiers with untuned cathode input, and the loss of output is considerably less than one db.

4.6.2 METERING CIRCUITS

The Tempo 2000 metering circuits are designed to comply with FCC requirements for measuring SSB power. The meter has a 0.25 second time constant. Indicated voice peaks must not exceed one KW.

To measure input power to the final, you must add Tempo 2000 input as indicated on the meter to the exciter input as indicated on its meter. This procedure is necessary with any grounded-grid linear amplifier.

4.6.3 AMPLIFIER COOLING

The cooler the Tempo 2000 operates the longer its components will last. Be sure to maintain adequate clearance for cooling air on all sides of the unit, including the back panel.

The Tempo 2000 back panel functions, with the tube chimneys, as a partial heat sink for the tubes. Consequently it will be quite hot to the touch during operation.

Never allow the fan inlet or outlet passages to be blocked.

4.6.4 EXCITER DUMMY LOAD

The Tempo 2000 exciter tuning dummy load consists of two 100 ohm, 50 watt ceramic

encapsulated non-inductive wirewound resistors in parallel. They can be used as a 50 ohm dummy load at 100 watts continuous duty. They can handle more power for limited periods of time:

POWER LEVEL (RF)	MAXIMUM TIME
100 Watts	Continuous
150 Watts	~~Two minutes~~
200 Watts	80 seconds
250 Watts	50 seconds
300 Watts	30 seconds

The resistors should be allowed to cool for 5 minutes before applying power again. Typical transceivers are 50% to 60% efficient on CW, so a 500 watt input rig will probably not put out over 300 watts RF, and a 280 watt rig will not put out much over 170 watts.

In any case, the Tempo 2000 is not intended to be used as a dummy load for test purposes. The internal load resistors should be used only for loading up a driver transmitter in preparation for transmitting with the 2000.

4.6.5 GROUND PROTECTION

A proper ground connection to the rear panel ground lug is an absolute must, for AC protection as well as RF. The chassis of the Tempo 2000 is purposely NOT grounded through the AC neutral, to prevent shock hazard due to improper AC line voltages. Coaxial cables cannot be depended on to provide a good AC ground, because it is too easy to forget to unplug the Tempo 2000 before disconnecting coaxial cables. Without a good ground, a component failure could conceivably elevate the Tempo 2000 chassis to a hazardous voltage at any time.

SECTION 5

CIRCUIT DESCRIPTION

5.1 GENERAL

The Tempo 2000 is a 2000 watt PEP (1000 watt CW) input linear amplifier. The tubes are 3-400Z zero bias triodes in parallel grounded grid configuration.

Some of the features of the Tempo 2000 circuitry are: dual circuit breaker overload protection; transistor operated magnetic reed changeover relays; a double interlock system which opens the power supply, then shorts the residual B+ to ground; wide range pi output network that covers the complete 80 through 10 meter bands without load switching, and metering of plate voltage, plate current, grid current and relative power output.

5.2 POWER SUPPLY

5.2.1 HIGH VOLTAGE POWER SUPPLY

High voltage power transformer T3 has two tapped primary windings. The primary windings are connected in series for 234 VAC operation and in parallel for 117 VAC operation. Figure 6 illustrates the connections for 234 and 117 volt operation. Circuit breakers CB1 and CB2 protect the power supply against overload. Interlock S4 opens the line when the top cover is removed. CW/SSB MODE switch S5 switches the taps on the primary of T3. In SSB position the high voltage power supply output is 2500 VDC. In CW position the output is 1800 VDC. The secondary of T3 furnishes voltage for a full-wave voltage doubler circuit with a capacitive filter in the output. Resistors R6 through R13 equalize the voltage across each of the filter capacitors and, along with R14, form a bleeder network. The B+ output from the filter is applied to the amplifier tubes through radio frequency choke L4.

5.2.2 25 VDC POWER SUPPLY

The 25 VDC power supply circuitry consists of transformer T2, half-wave rectifier D101 and filter capacitor C101. The output from this supply is used to power the solid state switching circuitry and the power reed relays. This supply operates even with the FUNCTION switch in the

OFF position, permitting operation of the electronic switching circuitry for low power type operation.

5.2.3 FILAMENT SUPPLY

The filament supply transformer, T1, with primary taps for line voltage sources of 110, 115, and 230 volts RMS, has an output of 10 volts AC. The filament transformer is connected in series with the power amplifier tube filaments through a bifilar wound toroid filament choke. The tube filaments are designed to operate at 5.0 volts plus or minus 5% for maximum life.

5.3 OUTPUT CIRCUIT

High voltage is applied to V1 and V2 through radio frequency choke L4 and parasitic chokes E2 and E1. The plates of V1 and V2 are connected by C3 to a wide range pi network. Tuning capacitor C2 is connected to the input side of tapped inductors L2 and L3. Loading capacitor C2 is connected on the output side of L1 and L2. Band switch S1 switches the coil taps. The output of the pi network is coupled to the antenna by wafer S2A on the function switch.

5.4 CHANGEOVER SWITCHING

The terminals of TS1 are shorted together by a set of normally closed contacts in the exciter during receive condition. This puts a ground on coil of RY1. Q104 conducts and the current through the coil of RY1 closes the contacts. The closed contacts of RY1 complete the signal path in receive from J3 to J2 through C104, S3, D102 and C102, or to J1 through C104 and S3. At the same time, the base of Q102 is grounded through D104 and through L101, the contacts of RY1 and L9, turning off Q102 and de-energizing RY2. In transmit condition the normally closed relay contacts in the exciter are opened. This opens the terminals at TS1, removing the ground from RY1, allowing its contacts to open. This in turn switches Q101 and Q102 and Q103 to the conducting state. The emitter current path for Q102 is through the coil of RY2, causing this relay to energize and enable the power amplifier tubes, V1 and V2, by grounding their cathodes. The conduc-

tion of Q101 reverse biases D102 which blocks the receive path to J2.

5.5 METERING CIRCUITS

The front panel meter measures plate current, grid current, plate voltage and RF power output. The meter, M1, is switched by the front and rear wafers of meter switch, S7. The upper meter scale reads from 0 to 3. The lower scale reads from 0 to 800.

For measuring plate current and grid current, M1 is switched in parallel with a 1.2 ohm resistor, R19, which is connected between the bottom of the power supply and ground. S7 reverses the meter polarity to measure plate current. Resistor R20 is in series with the meter for all measurements. Plate voltage is measured by placing the meter in parallel with series resistors R17 and R19. The meter measures RF power output when connected in series with the power output detector.

SECTION 6 MAINTENANCE

6.1 GENERAL

Troubleshooting the Tempo 2000 is not particularly difficult. But, because this unit contains lethal voltages, special attention must be given to the cautions and warnings listed in this section. The following items briefly summarize the procedures that must be strictly observed.

- Do not remove any covers with the power cord connected to the line.
- Measure the high voltage only when absolutely necessary. Use a high voltage probe. Do not use hand held test leads.
- A grounding stick must be used to discharge the power supply whenever the cover shields are removed.

6.2 REMOVING CHASSIS ENCLOSURE

- Remove all electrical connections on the rear panel.
- Remove the eight number 6 screws that attach the enclosure to the rear panel.
- Carefully slide the enclosure away from the front panel.

6.3 REPLACING POWER AMPLIFIER TUBES

WARNING

Discharge the power supply before replacing the power amplifier tubes by touching the plate caps to the chassis with a grounding stick. Touch the chassis first.

- Remove the chassis enclosure.
- Remove the four number 6 screws from the top cover. Remove the cover.
- Remove the suppressor assemblies from the plate caps.

CAUTIONS

- Make sure the tubes are cool before removing them.
 - Do not flex the suppressor assemblies more than is necessary for removal of the tubes. They are brittle and excessive flexing can cause them to break off.
- Gently rock the tubes back and forth while pulling them out of their sockets.

6.4 CLEANING

The Tempo 2000 can be kept clean with vacuuming. The vacuum cleaner used should have a soft bristle brush.

6.5 REPLACING METER LAMPS

The meter lamps, I1 and I2, are mounted behind the meter inside the unit. The chassis enclosure and top cover must be removed to gain access to them.

6.6 BLOWER MOTOR LUBRICATION

Lubricate the blower motor at 2 to 6 month intervals, depending on frequency of use, with premium grade SAE 20 or 30 oil. The lubrication access port is located on the fan blade pedestal. Only a few drops are necessary.

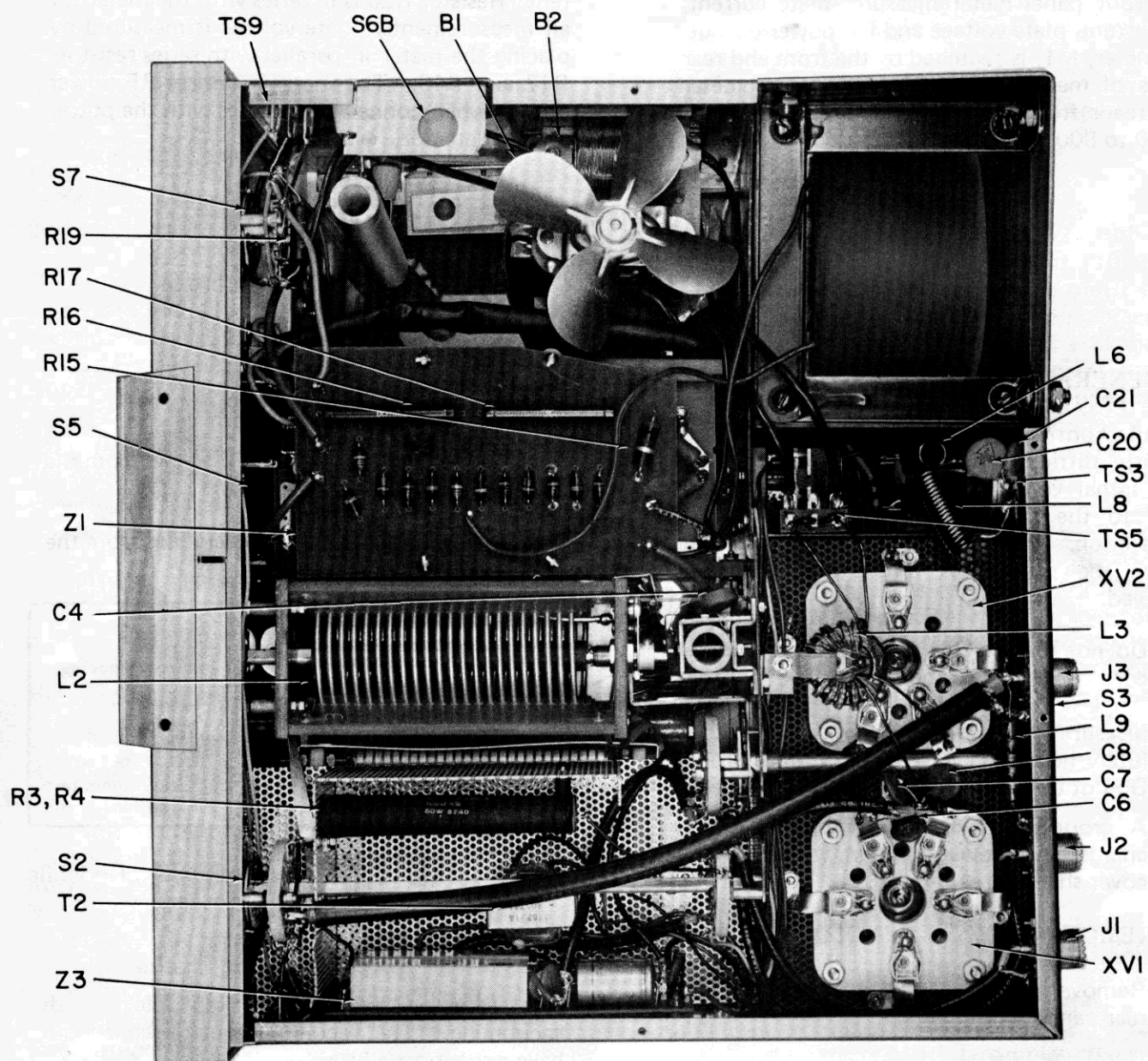


Figure 7. Bottom View.

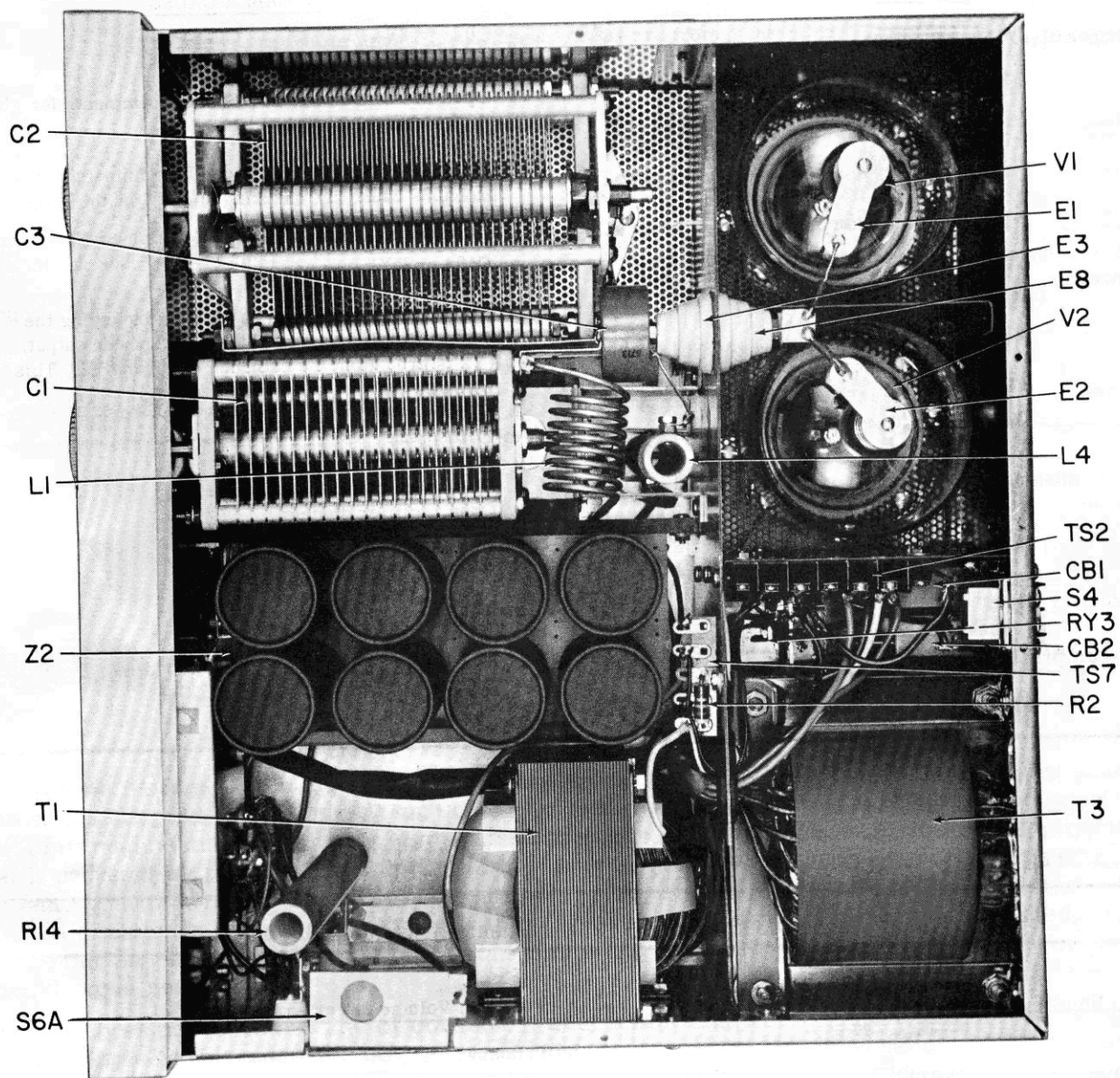


Figure 8. Top View.

Table 1.
TROUBLE ANALYSIS

<u>TROUBLE</u>	<u>PROBABLE CAUSE</u>
1. Inoperative. No RF output.	a. RY3 defective. b. T1 open. c. Open filament in V1 or V2.(Check filaments for glow) d. RY2 defective. NOTE: The high voltage and RY3 can be eliminated as a probable cause by checking the B+ on the front panel meter.
2. No receive signal getting through from antenna to receiver.	a. Q104 or RY1. NOTE: The +25 VDC power can be checked by keying the transmitter.If there is evidence of power output, RY2 is grounding the cathodes of V1 and V2. This indicates that the supply is operating. b. Q101 shorted. c. D102 open.
3. B+ is missing. No indication on the front panel meter.	a. RY3, open coil or faulty contacts. b. Open rectifier diodes. c. Series interlock switch S4 open. d. Either circuit breaker open.
4. Receiver weak.	a. RY1
5. Circuit breaker will not stay reset.	a. Shorted high voltage rectifier diodes. b. Shorted filter capacitors. c. C3 shorted.

Table 2.
TYPICAL RELAY AND TRANSFORMER RESISTANCES

<u>T1, Filament Transformer</u>			<u>T3, High Voltage Power Transformer</u>		
<u>Winding</u>	<u>Lead</u>	<u>Value</u>	Primary	Black to Orange White to Blue	0.7 ohms maximum 0.7 ohms maximum
Primary	Black to Brown	1.3 ohms	Secondary	Red to Brown	11.0 ohms maximum
	Black to Green	1.4 ohms			
	Black to Gray	1.5 ohms			
Secondary	Black to Black	0.025 ohms	<u>RY1, Receiver Antenna Switch</u>		
	Black to Yellow	0.013 ohms	Coil	1200 ohms ±10%	
<u>T2, Low Voltage Power Transformer</u>			<u>RY2, Cathode Switch</u>		
Primary	Black to Black	400 ohms maximum	Coil	600 ohms	
			<u>RY3</u>		
Secondary	Red to Red	55 ohms maximum	Coil	550 ohms ±10%	

TABLE 3
MISCELLANEOUS RESISTANCE MEASUREMENTS

Conditions: All switches maximum counterclockwise with no power applied. All measurements are from point listed to ground.

	<u>Min.</u>	<u>Max.</u>		<u>Min.</u>	<u>Max.</u>
Plate cap of either tube. Capacitive. (Momentarily open the HV interlocks, S6A & S6B, to check this).	25 K	100 K	Terminal 1 of meter switch, S7.	800 Ω	975 Ω
			Terminal 9 of meter switch, S7.	1.1 Ω	1.3 Ω
Junction of C3, L1 and C1.	800 K	1.2 MEG	Terminal 10 of function switch, S2B.	100 MEG	---
All Power terminals on TS2.	100 MEG	---	Center of J3 (output).	20 Ω	30 Ω
Junction of R2 and T1 center tap.	42 K	52 K	Center of J1 (input).	20 Ω	30 Ω

HENRY RADIO STANDARD WARRANTY

Henry Radio warrants each new radio product manufactured 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 of its manufacture which under normal installation, use, and service discloses such defect, provided the unit 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 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.

This warranty does not extend to any of our radio products which have been subjected to misuse, neglect, accident, incorrect wiring not our own, improper installation, or to use in violation of instructions furnished by us, nor does it extend to units which have been repaired or altered outside our factory, nor in cases where the serial number there of has been removed, defaced, or changed, nor to units used with accessories not manufactured or recommended by us.

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 radio products.

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

SECTION 7

PARTS LIST

SYMBOL NO.	DESCRIPTION	PART NO.	SYMBOL NO.	DESCRIPTION	PART NO.
BLOWER					
B1	Fan, blade	529-1002-001			
B2	Fan, motor	557-0001-001			
BRACKETS					
BKT	Bracket, motor mounting	017-0639-001	CH10	Includes:	
BKT	Divider, tube enclosure	017-0584-001	CH11	Cabinet shell	017-0592-002
BKT	Bracket, tube support	017-0583-001	CH12	Finger	017-0648-001
BKT	Chassis divider	017-0582-001		Bracket, cabinet support	017-1312-003
BKT	Bracket, loading capacitor	017-0638-001		Feet, rubber	574-1001-001
BKT	Strap, loading capacitor	017-0629-001		Bezel, meter	014-0641-001
BKT	Bracket, support, spotweld assembly	023-2541-001		Window, meter	018-0885-001
BKT	Bracket, mounting, toroid choke	017-0633-001		Tube enclosure	017-0561-001
BKT	Ground lug, 50 Ω load	017-0643-001	CAPACITORS		
BKT	Bracket and shield, 50 Ω load	017-0637-001	C1	Tuning, 250 pF max.	154-0009-007
BKT	Mounting bar, P.C. board	018-0880-001	C2	Loading, 1170 pF max.	153-0038-002
BKT	Bracket, bleeder resistor mounting	017-0642-001	C3	Ceramic, 0.0039 μ F, 6kV	510-3083-392
BKT	Bracket, mounting, interlock switch	017-0632-001	C4	Ceramic, 500 pF, 6kV	022-1506-001
BKT	Bracket, plate choke mounting, base	017-0634-001	C5	Ceramic, 0.01 μ F -20%, 500 V., Y5U, +80	510-3005-103
BKT	Bracket, plate choke mounting, upper	017-0635-001	C6	Same as C5	
CIRCUIT BREAKER			C7	Same as C5	
CB1	Circuit breaker, 10A	534-2004-010	C8	Same as C5	
CB2	Same as CB1		C9	Ceramic, 0.0022 μ F $\pm$ 20%, 500V., Y5U	510-3004-222
CHASSIS PARTS			C10	Same as C9	
CH1	Chassis rail	017-0567-001	C11	Mica, 220pF $\pm$ 10%, 500V., DM15	510-0005-159
CH2A	Cover, top	023-2431-001	C12	Ceramic, 0.01 μ F +80 -20%, 500V., Y5U	510-3005-103
	Includes:		C13	Mica, 220pF $\pm$ 10%, 500V., DM15	510-0005-221
	Cover, top	017-0586-001	C14	Ceramic, 0.0047 μ F +80 -10%, 500V., Y5U	510-3005-472
	Offset (top & bottom)	017-0587-001	C15	Same as C14	
	Label	559-0024-005	C16	Ceramic, 0.0047 μ F $\pm$ 20%, 125VAC	510-3001-472
	Label, high voltage warning	559-4018-001	C17	Same as C16	
CH2B	Cover, bottom	023-2431-002	C18	Same as C16	
	Includes:		C19	Same as C16	
	Offset (top & bottom)	017-0587-001	C20	Same as C16	
	Label	559-0024-005	C21	Same as C16	
	Label, high voltage warning	559-4018-001	C22	Electrolytic, 200 μ F, 450 V	510-4031-004
	Cover, bottom	017-0586-002	C23	Same as C22	
CH3	Overlay support panel assembly	023-2560-001	C24	Same as C22	
	Includes:		C25	Same as C22	
	Support panel, overlay	017-0581-001	C26	Same as C22	
	Cushion, foam	018-0889-001	C27	Same as C22	
	Cushion, foam	018-0889-002	C28	Same as C22	
CH4	Assembly, front panel	023-2556-001	C29	Same as C22	
	Includes:		C30	Ceramic, 0.005 μ F $\pm$ 20%, 50V., Y5U	510-3002-502
	Front panel	017-0576-001	C31	Same as C30	
	Captive spacer (outside)	013-0929-004	C101	Electrolytic, 400 μ F +100-10%, 40 V.	510-4009-001
	Captive spacer (inside)	013-0929-001	C102	Ceramic, 0.01 μ F, +80 -20%, 500 V, Y5U	510-3005-103
CH5	Trim, front panel	017-1303-001	C103	Ceramic, 0.0022 μ F, $\pm$ 20%, 500 V, Y5U	510-3004-222
CH6	Trim, Johnson, "Viking"	559-9001-002	C104	Ceramic, 0.01 μ F, +80 -20%, 500 V, Y5U	510-3005-103
CH7	Overlay, front panel, upper	559-2028-001	C105	Ceramic, 0.0047 μ F, +80 -20%, 500 V, Y5U	510-3005-472
CH8	Overlay, front panel, lower	559-2029-001	C106	Film, 0.15 μ F, $\pm$ 10%, 75 V	510-1001-034
CH9	Cabinet assembly	023-2545-001	DIODES		
			D1	Germanium	523-0005-001
			D2	1A, silicon	523-0003-002

PARTS LIST (cont'd)

SYMBOL NO.	DESCRIPTION	PART NO.	SYMBOL NO.	DESCRIPTION	PART NO.
D3	Same as D2		HW	Screw, 8-32 x 5/8, bd. hd.,	011-0221-020
D4	SI, 1A, controlled avalanche	523-0008-008	HW	Set screw, 6-32, hex socket	011-0112-004
D5	Same as D4		HW	Set screw, 8-32	011-0022-006
D6	Same as D4		HW	Screw, 10-32 x 1/4, rd. hd.,	011-0028-008
D7	Same as D4		HW	Screw, 10-32 x 3/8 rd. hd.,	011-0028-012
D8	Same as D4			NPB	
D9	Same as D4		HW	Screw, 1/4 - 20 x 1/2 rd. hd.,	011-0052-016
D10	Same as D4			NPB	
D11	Same as D4		HW	Screw, 1/4 - 20 x 5/8 rd. hd.,	011-0052-020
D12	Same as D4		HW	Stud, 8-32 x 2 1/2	011-0520-080
D13	Same as D4		HW	Nut, hex, 2-56	012-0038-002
D14	Same as D4		HW	Nut, hex, 4-40	012-0001-001
D15	Same as D4		HW	Nut, hex, 6-32	012-0002-001
D101	Si, 1.2 V, 1A	523-0001-002	HW	Nut, hex, 8-32	012-0006-001
D102	1N881 (selected), Si, 200 V	523-1000-881	HW	Nut, hex, 10-32	012-0109-002
	50 mA		HW	Nut, 3/8 - 32	012-0040-003
D103	Ge, 30 V, 100 mA	523-0005-001	HW	Nut, hex, 1/4 - 20	012-0011-001
D104	Same as D103		HW	Nut, hex, 5/8 - 24	012-0188-004
			HW	"U" type fastener, 6-32	012-0503-003
	ELECTRICAL PARTS		HW	Washer, flat #6	029-0002-001
E1	Assembly, plate parasitic suppressor	023-2554-001	HW	Washer, flat #8	029-0003-001
E2	Same as E1		HW	Washer, flat #1/4	029-0139-001
E3	Insulator	010-0218-002	HW	Lockwasher, #2	029-0178-001
E4	Insulator	135-0500-001	HW	Lockwasher, #4	029-0116-003
E5	Strap, ground	017-0654-001	HW	Lockwasher, #6	029-0069-003
E6	Strap, ground	017-0654-002	HW	Lockwasher, #10	029-0015-001
E7	Strap, ground	017-0654-004	HW	Lockwasher, #1/4	029-0031-003
E8	Insulator	010-0218-002	HW	Washer, 7/8, fiber	029-0025-001
E9	Insulator	135-0500-001	HW	Bearing, panel	013-0009-005
			HW	Cable clamp	572-0001-007
	GROMMET		HW	Spacer	013-0155-170
G1	Grommet, rubber	574-0002-004	HW	Spacer	013-0155-171
			HW	Spacer	013-0155-172
	HARDWARE		HW	Standoff, diode board	018-0881-001
HW	Screw, 2-56 x 1/8, rd. hd.	011-0360-004	HW	Insulating spacer, 50 Ω load	018-0882-001
HW	Screw, 1-72 x 7/32, bd. hd.,	011-0829-007	HW	Terminal, ring	586-0001-034
	CPS nylon		HW	Terminal, solder #4	586-0005-104
HW	Screw, 2-56 x 1/4 rd. hd., NPB	011-0005-008	HW	Terminal, solder #6	586-0005-106
HW	Screw, 4-40 x 3/16, bd. hd.,	011-0012-006	HW	Terminal, solder #8	586-0005-008
	NPB		HW	Terminal, solder #10	586-0005-010
HW	Screw, 4-40 x 1/4, bd. hd., NPB	011-0012-008		LAMPS	
HW	Screw, 4-40 x 5/8, bd. hd., NPB	011-0012-020	I1	Incandescent meter lamp	022-0021-001
HW	Screw, 4-40 x 1/2 bd. hd., NPB	011-0012-016	I2	Same as I1	
HW	Screw, 6-32 x 3/16, fill. hd.,	011-0116-006		JACKS	
	NPB		J1	Connector, coaxial, UHF	142-0101-002
HW	Screw, 6-32 x 1/2, fill. hd.,	011-0116-016	J2	Same as J1	
	NPB		J3	Same as J1	
HW	Screw, 6-32 x 3/16, bd. hd.,	011-0114-006	J4	Connector, power	022-1429-001
	NPB			COILS AND CHOKES	
HW	Screw, 6-32 x 1/4, bd. hd.,	011-0114-008	L1	Coil, 15 meter	023-2502-001
	NPB		L2	Inductor, tapped	023-2377-001
HW	Screw, 6-32 x 3/8, bd. hd.,	011-0114-012	L3	Choke, toroidal, bifilar, wound	023-2497-001
	NPB			Choke, high voltage	023-1085-004
HW	Screw, 6-32 x 1/2, bd. hd.,	011-0114-016	L5	Choke, line filter	016-1181-003
	NPB		L6	Choke, line filter	016-1181-005
HW	Screw, 6-32 x 7/8 rd. hd.,	011-0016-028	L7	Same as L6	
	NPB		L8	Same as L6	
HW	Screw, 8-32 x 3/16, bd. hd.,	011-0221-006	L9	Choke, RF	022-0951-011
	NPB				
HW	Screw, 8-32 x 1/4, bd. hd.,	011-0221-008			
	NPB				

PARTS LIST (cont'd)

SYMBOL NO.	DESCRIPTION	PART NO.	SYMBOL NO.	DESCRIPTION	PART NO.
METER			RELAYS		
M1	Meter assembly Includes: Meter case Meter dial Meter movement Back plate, meter Capacitor, 0.005 μ F, 50 V Shoulder bushing Screw, B.H. 4-40 UNC - 2B x 1/4, NPB Feed thru Terminal, #6 Terminal, #4 Dial light bracket Lamp Screw, B.H., #6-32, NPB Washer, flat, #6 Dial support plate Screw, 1-72 x 9/64, nylon	023-2555-001 023-2542-001 559-1004-001 554-0013-001 018-0892-001 510-3002-502 018-0036-019 011-0012-008 260-0203-001 586-0005-106 586-0005-104 147-0620-001 022-0021-001 011-0114-006 029-0002-001 016-1780-001 011-1017-004	RY1 RY2 RY3	Reed, 1.2 K Reed, 600 Ω DPST, 117 VAC	567-2001-002 567-2001-001 567-1003-001
MECHANICAL PARTS			SWITCHES		
MP	Planetary drive	526-2001-004	S2	Rotary	583-2021-001
MP	Knob, 1 1/8 dia.	013-1194-001	S3	Rotary	583-2022-001
MP	Knob	013-1193-001	S4	Pushbutton	583-4001-002
MP	Dial skirt	559-1005-001	S5	Rocker, DPDT	583-5001-001
MP	Knob	547-0003-001	S6A	Assembly, high voltage inter-lock Includes: Mounting bracket Spacer Ball, 5/8" plastic Screw, F.H. #4-40 nylon Contact, spring Nut, hex, #4-40, nylon	023-2552-001 017-0644-001 018-0884-001 574-9002-001 011-1013-016 017-0647-001 012-1001-001
MP	WARNING TAG	559-4020-001	S6B	Same as S6A	
RESISTORS			S7	Rotary	583-2020-001
R1	Composition, 1 M $\pm$ 10%, 1/2 W	569-1004-105	TRANSFORMERS		
R2	Composition, 47 K $\pm$ 10%, 1W	569-1006-473	T1	Filament	592-9006-001
R3	Wirewound, 100 Ω , 50 W	569-4010-101	T2	Power	592-3032-001
R4	Same as R3		T3	Power	592-3022-001
R5	Composition, 1.8 K $\pm$ 10%, 1/2 W	569-1004-182	TERMINALS		
R6	Film, 47 K $\pm$ 10%, 5 W	569-0003-473	TS1	Terminal block feed thru	586-2004-002
R7	Same as R6		TS2	Terminal block	586-2002-005
R8	Same as R6		TS3	Terminal strip, 2 terminal	586-1001-018
R9	Same as R6		TS4	Terminal strip, 2 terminal	586-1001-019
R10	Same as R6		TS5	Terminal strip, 3 terminal	586-1001-020
R11	Same as R6		TS6	Terminal strip, 4 terminal	586-1001-022
R12	Same as R6		TS7	Terminal strip, 5 terminal	586-1001-024
R13	Same as R6		TS8	Terminal strip, 2 terminal	586-1001-018
R14	Wirewound, 100 K, 100 W	569-2001-009	TS9	Terminal strip, 3 terminal	586-1001-020
R15	1.5M $\pm$ 1%, 2 W	022-1442-001	TS10	Terminal strip, 3 terminal	586-1001-020
R16	Same as R15		ELECTRON TUBES		
R17	Composition, 1M $\pm$ 10%, 2 W	569-1008-105	V1	Triode, high-mu power, type 3-400Z	595-2008-001
R18	Composition, 1 K $\pm$ 10%, 1/2 W	569-1004-102	V2	Same as V1	
R19	Wirewound, 1.2 Ω $\pm$ 1%	569-2212-129	WIRES		
R20	Film, 887 Ω $\pm$ 1%	569-0002-001		Cable, coax, RG-58/AU	071-0321-800
R101	Composition, 4.7 K Ω $\pm$ 10%, 1/4 W	569-1002-472		Cable, coax, RG-8/u	071-0321-700
R102	Composition, 1K Ω $\pm$ 10%, 1/4 W	569-1002-102		Cable, coax, RG-174/u	071-0321-600
R103	Composition, 1K Ω $\pm$ 10%, 1 W	569-1006-102	TUBE SOCKETS		
R104	Composition, 10K Ω $\pm$ 10%, 1/4 W	569-1002-103	XV1	Vacuum tube, 5 pin	122-0275-001
R105	Composition, 2.7K Ω $\pm$ 10%, 1/4 W	569-1002-272	XV2	Same as XV1	
R106	Composition, 220 Ω $\pm$ 10%, 1/4 W	569-1002-221	CIRCUIT BOARD ASSEMBLIES		
R107	Composition, 390 Ω $\pm$ 10%, 1/4 W	569-1002-391	Z1	Assembly, diode board Includes: PC board	023-2547-001 035-0051-001
R108	Composition, 10K Ω $\pm$ 10%, 1/4 W	569-1002-103			
R109	Composition, 47K Ω $\pm$ 10%, 1/4 W	569-1002-473			
R110	Composition, 4.7K Ω $\pm$ 10%, 1/4 W	569-1002-472			
R111	Composition, 1K Ω $\pm$ 10%, 1/4 W	569-1002-102			

PARTS LIST (cont'd)

SYMBOL NO.	DESCRIPTION	PART NO.	SYMBOL NO.	DESCRIPTION	PART NO.
D4	Diode, Si, 1A, controlled avalanche	523-0008-008	R103	Resistor, comp, 1K Ω $\pm 10\%$, 1W	569-1006-102
D5	Same as D4		R104	Resistor, comp, 10K Ω $\pm 10\%$, 1/4 W	569-1002-103
D6	Same as D4		R105	Resistor, comp, 2.7K Ω $\pm 10\%$, 1/4 W	569-1002-272
D7	Same as D4		R106	Resistor, comp, 220 Ω $\pm 10\%$, 1/4 W	569-1002-221
D8	Same as D4		R107	Resistor, comp, 390 Ω $\pm 10\%$, 1/4 W	569-1002-391
D9	Same as D4		R108	Resistor, comp, 10K Ω $\pm 10\%$, 1/4 W	569-1002-103
D10	Same as D4		R109	Resistor, comp, 47K Ω $\pm 10\%$, 1/4 W	569-1002-473
D11	Same as D4		R110	Resistor, comp, 4.7K Ω $\pm 10\%$, 1/4 W	569-1002-472
D12	Same as D4		R111	Resistor, comp, 1K Ω $\pm 10\%$, 1/4 W	569-1002-102
D13	Same as D4		RY1	Relay, reed, 1.2K	567-2001-002
D14	Same as D4		RY2	Relay, reed, 600 Ω	567-2001-001
D15	Same as D4			Contact, standoff	013-1108-001
R15	Resistor, 1.5M $\pm 1\%$, 2W	022-1442-001			
R16	Same as R15				
R17	Resistor, comp, 1M $\pm 10\%$, 2W	569-1008-105			
Z2	Assembly, capacitor board	023-2548-001			
	Includes:				
	PC board	035-0050-001			
R6	Resistor, film, 47K $\pm 10\%$, 5W	569-0003-473			
R7	Same as R6				
R8	Same as R6				
R9	Same as R6				
R10	Same as R6				
R11	Same as R6				
R12	Same as R6				
R13	Same as R6				
C22	Capacitor, electrolytic, 200 μF 450V	510-4031-004			
C23	Same as C22				
C24	Same as C22				
C25	Same as C22				
C26	Same as C22				
C27	Same as C22				
C28	Same as C22				
C29	Same as C22				
Z3	Assembly, TR switch board	023-2546-001			
	Includes:				
	PC board	035-0065-001			
C101	Capacitor, electrolytic, 400 μF , 40V	510-4009-001			
C102	Capacitor, ceramic, 0.01 μF , +80 -20%, 500 V, Y5U	510-3005-103			
C103	Capacitor, ceramic, 0.0022 μF , $\pm 20\%$, 500V, Y5U	510-3004-222			
C104	Capacitor, ceramic, 0.01 μF , +80 -20%, 500V, Y5U	510-3005-103			
C105	Capacitor, ceramic, 0.004 μF , +80 -20%, 500V, Y5U	510-3005-472			
C106	Capacitor, film, 0.15 μF , $\pm 10\%$, 75V	510-1001-034			
D101	Diode, Si, 1.2V, 1A	523-0001-002			
D102	Diode, 1N881 (selected), Si, 200V, 50 mA	523-1000-881			
D103	Diode, Ge, 30V, 100 mA	523-0005-001			
D104	Same as D103				
L101	Choke, RF	022-1193-001			
Q101	Transistor, 3011	576-0003-011			
Q102	Same as Q101				
Q103	Same as Q101				
Q104	Same as Q101				
R101	Resistor, comp, 4.7K Ω $\pm 10\%$, 1/4 W	569-1002-472			
R102	Resistor, comp, 1K Ω $\pm 10\%$, 1/4 W	569-1002-102			

NOTES:
1. SWITCHES SHOWN IN MAXIMUM COUNTERCLOCKWISE
POSITION, VIEWED FROM FRONT.

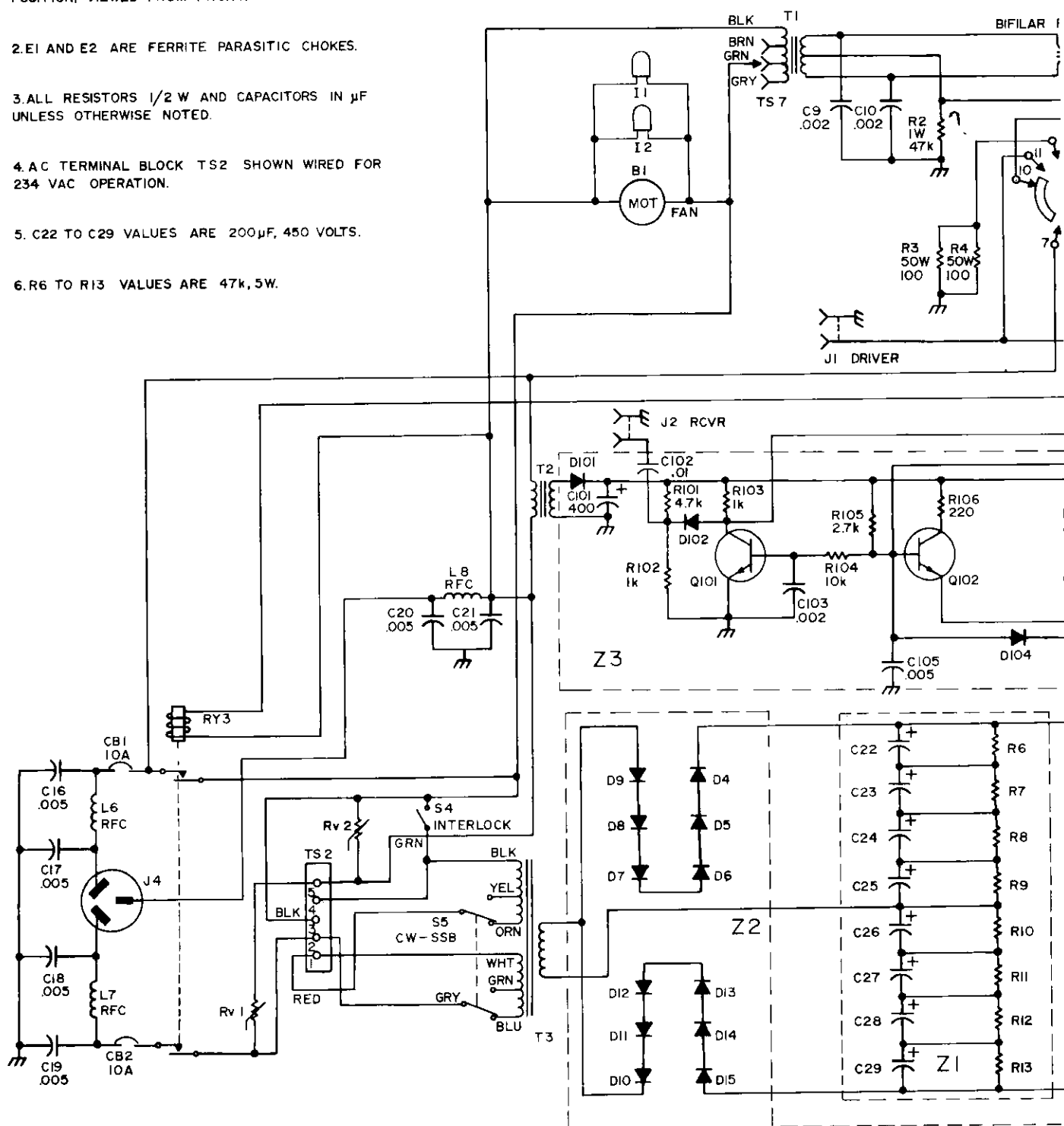
2.E1 AND E2 ARE FERRITE PARASITIC CHOKES.

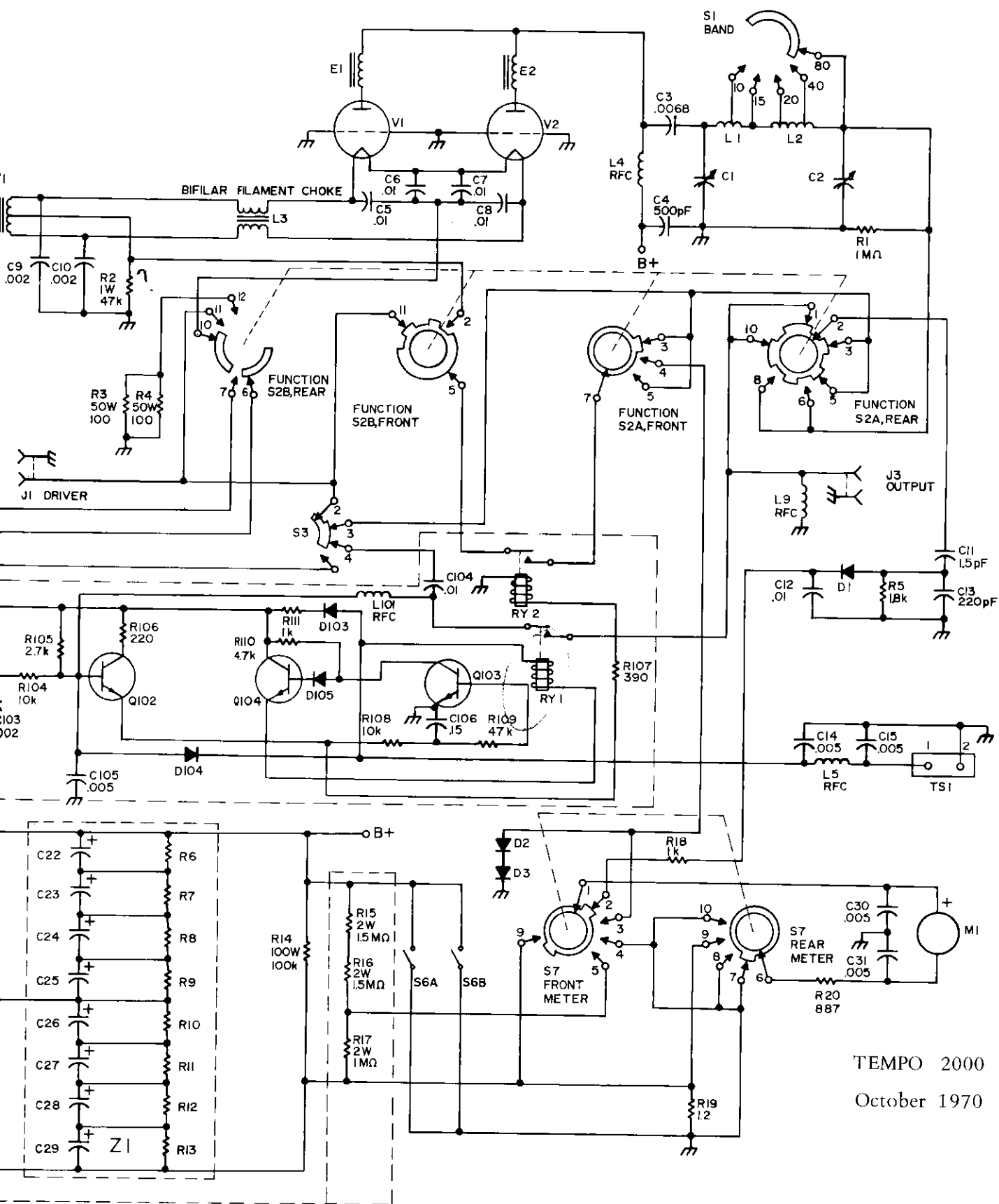
3. ALL RESISTORS 1/2 W AND CAPACITORS IN μ F
UNLESS OTHERWISE NOTED.

4. AC TERMINAL BLOCK TS2 SHOWN WIRED FOR 234 VAC OPERATION.

5. C22 TO C29 VALUES ARE 200 μ F, 450 VOLTS.

6.R6 TO R13 VALUES ARE 47k,5W.





TEMPO 2000
October 1970